

# PHILIPPINE AGRICULTURAL BIBLIOGRAPHY

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USER'S GUIDE

Consecutively numbered, the bibliographic entries are classified according to subject category.

SAMPLE ENTRIES

- 1 MONOGRAPH
- 2 C10
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- Enhancement of the forest genetics laboratory of the College of Forestry and Natural Resources (CFNR) University of the Philippines Los Baños (UPLB) [Laguna, Philippines]. Tolentino, E.L., Jr. Department of Science and Technology, Bicutan, Taguig City (Philippines). Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development. TR-1826. 2016.
- Laboratory mass rearing of the five lepidopteran pests of corn namely the...
- FORESTS; LABORATORY EQUIPMENT; FORESTRY EQUIPMENT; UNIVERSITIES;
- 1 SERIAL ARTICLE
- 2 E16 Production economics
- 3
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- Enhancing soybean productivity and local availability in Region 2 [Cagayan Valley, Philippines]. Calderon, V.J.F., Aquino, R.M.G., Olinares, R.B., dela Cruz, C.G., Batang, E.F. Jr., Atalin, V.U., de Guzman, S. 48. Crop Science Society of the Philippines Scientific Conference : Proceedings, Legaspi City, Albay (Philippines), 2-7 Jul 2018. Philippine Journal of Crop Science (Philippines) . v.43 (Supplement no. 1) p. 43-44 (Jul-2018).
- The program created awareness on the importance of soybean for human, livestock and soil health in Cagayan Valley [Philippines] through promotion of soybean production, food utilization ...
- GLYCINE MAX; SOYBEANS; PLANT PRODUCTION; PRODUCTIVITY; FOOD TECHNOLOGY; HEALTH FOODS; HOUSEHOLDS; DOMESTIC CONSUMPTION; PHILIPPINES

1	BOOK CHAPTER	
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9	<b>Fernandez, P.R., Jr, Geganzo, L.G.L., Subade, R.F., Napilan-Espectato. L.</b> Bioethanol production from macroalgae and socio-ecological implications. Fernandez, P.R. Demafelis, R.B. Geganzo, L.G.L. Subade, R.F. Napilan-Espectato, L. Santiago, D.E.O. Movillon, J.L. Hourani, K. Gatdula, / K.M. Magadia, R.V. Jr.- College, Laguna (Philippines), <u>2016. TR-1732. p. 1-71 .</u>	11 12
10	IPB Var 6 is a white-flint open pollinated variety. It is a quality protein maize (QPM) that is high yielding and	6 5
	ZEA MAYS; MAIZE; VARIETIES; SEED; PROTEINS; PROCESSED PRODUCTS; FOODS; TECHNOLOGY; TECHNOLOGY	

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| 1. Subject category | 7. Conference title, place, and date                           |
| 2. Title            | 8. Journal title, volume, number, page and date of publication |
| 3. Author (s)       | 9. Abstract  |
| 4. Corporate author | 10. AGROVOC DESCRIPTORS  |
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## **A - AGRICULTURE IN GENERAL**

### **A50 – AGRICULTURAL RESEARCH**

Review of Dr. Adelina A. Barrion's contributions to Asian corn borer studies. **Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 196. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Archived in old folders at the Entomology Laboratory of the Institute of Plant Breeding [University of the Philippines Los Baños, College, Laguna, Philippines] the previous works of the late Dr. Adelina A. Barrion, a distinguished Filipino insect geneticist, were retrieved. These works were cited in relation to the recently funded project entitled 'Basic studies on the Asian corn borer, *Ostrinia furnacalis* (Guenee)' funded by Biotechnology Coalition of the Philippines in collaboration with different players of the corn seed industry. The unpublished papers of Dr. Barrion from the 1981 PCARR project entitled 'Breeding for Corn Borer Resistance' had been important milestones in basic studies on Asian corn borer (ACB). Several studies conducted by her team on larval morphology, chaetotaxy, head capsule, heterovoltinicity, and life cycle were discussed. Based on the breadth of research work of the ACB that Dr. Barrion and her team had accomplished, there is need to compile and publish these works in their original form. This paper, therefore, aims to: 1) revisit and review the works of Dr. A. A. Barrion which will significantly contribute to the local references on the ACB; 2) consider these old works for possible publication in a local journal or as a book of collected works; and 3) pay tribute to an outstanding entomologist recognizing her pioneering works on the ACB.

OSTRINIA FURNACALIS; ZEA MAYS; MAIZE; GENETICISTS; RESEARCH; EVALUATION; RESEARCH PROJECTS

## **C – EDUCATION, EXTENSION AND INFORMATION**

### **C10 - EDUCATION**

2018 revised terminal report: impact assessment of the program on enhancing the demand for Agriculture, Forestry, and Natural Resources (AFNR) graduates through Science and Technology-components 2 and 3: consortium and individual SUC [State Universities and colleges] reports. *Department of Science and Technology, Bicutan, Taguig City (Philippines).*

*Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development; Philippines Univ. Los Baños, College, Laguna (Philippines); Bicol Univ., Guinobatan, Albay (Philippines); Cavite State Univ., Indang, Cavite (Philippines). TR-1909. College, Laguna (Philippines). 2018.*

UNIVERSITIES; TRAINING COURSES; EDUCATIONAL GRANTS; EDUCATIONAL INSTITUTIONS; FORESTRY; AGRICULTURE; NATURAL RESOURCES; PHILIPPINES

## **E - AGRICULTURAL ECONOMICS, DEVELOPMENT AND RURAL SOCIOLOGY**

### **E10 - AGRICULTURAL ECONOMICS AND POLICIES**

Accelerating and sustaining irrigation development in the Philippines: a key to food security and inclusive economic growth. **Ella, V.B.** *Philippines Univ. Los Baños, College Laguna (Philippines). Land Resources Div. UPLB Centennial Professorial Chair Lecture. College, Laguna (Philippines). 28 Jun 2019.*

This paper generally aims to demonstrate the importance of accelerating and sustaining irrigation development in attaining food security and inclusive economic growth in the Philippines. The average actual rate of irrigation development of 2.75% per year or about 47,000 hectares of new irrigated areas per year would never lead to rice self-sufficiency in the Philippines and will make the country always dependent on other countries to fill the deficit in local rice production. A simple rice supply and demand analysis shows the accelerating and sustaining irrigation development by 1.5 times, 1.75 times, 2 times and 2.5 times the current rate would enable satisfaction of the local rice demand in only about 22 years, 18 years, 14 years and 8 years, respectively for better food security through self-sufficiency. Accelerated and sustained irrigation development could also result to more inclusive economic growth due to increased economic activities and employment opportunities in the marginalized rural sector with the outpouring of massive investments on irrigation development. The provision of irrigation facilities would also enable farmers to shift to diversified high value crop production to augment their income. However, there are numerous issues and constraints besetting irrigation development in the country ranging from engineering and technical to institutional, economic, environmental, social, legal and even to such contemporary issues such as unregulated land conversion, watershed denudation, climate change and climate variability, competing water uses among others. Most of these issues could be addressed through the provision of enabling policies. The enactment of legislations such as National Land Use Act should be expedited to address rapid and unregulated conversion of prime irrigable and irrigated agricultural lands into non-agricultural uses. The Rice Tariffication Act, enacted in early 2019 may have to be

revisited and amended if necessary to prevent its potential inhibitory effects on irrigation development in the country in anticipation of the potential decrease in the selling price of palay by the local farmers due to the liberalization of rice importation triggered by this law. Accelerated and sustained irrigation development would also call for massive irrigation investments and proper irrigation system planning, design, operation and maintenance, which in turn would require updated land and water resources database system, sustained research, development and extension and adoption of water saving and water use efficient technologies. These massive irrigation investments should be used and allocated optimally in order to maximize the benefits that could be derived from these government investments. Overall, this lecture has demonstrated that accelerated and sustained irrigation development may be a key or an option in achieving both food security through self-sufficiency and inclusive economic growth. Results generated in this paper could serve as basis for additional studies to further prove the merits of this option and to serve as basis for future policy formulation on food security and economic growth inclusivity in the Philippines.

ORYZA SATIVA; PLANT PRODUCTION; IRRIGATION; IRRIGATION SYSTEMS; FOOD SECURITY; ECONOMIC GROWTH; PHILIPPINES

### **E90 - AGRARIAN STRUCTURE**

Progress and process monitoring services in Laguna [Philippines] (Lot. No. PPMS-4A-B2-03 terminal report). Pantoja, B.R., Evangelista, G.B., Desamero, J.J.M., Alvarez, J.V., Tan, Ma .F.O., Umali, M.E., Ledesma, N.M., Velasco, R.L. Department Of Agrarian Reform, Elliptical Road, Diliman, Quezon City (Philippines); University of the Philippines Los Baños Foundation, Inc., 4030, College, Laguna (Philippines). TR-1750. College, Laguna (Philippines). Dec 2016.

The Progress and Process Monitoring project aims to determine the effectiveness and efficiency of the delivery of the Agri-extension and Business Development Services relative to the achievement of the improved farm productivity, viable agri-enterprises and increased income of the ARBs and ARBOs. Under the Agrarian Reform Community Connectivity and Economic Support Services (ARCESS), the Rice Productivity Enhancement sub-project is being implemented specifically by three ARBOs, namely: Maria Rosario Isidro Lalig Multi-Purpose Cooperative (MARILA MPC) is San Pablo Cluster ARC; Coralan MPC in Coralan ARC; and Buklod Kaunlaran in Barangay [Village] Balubad (BKBB) MPC in BKBB ARC. Activities undertaken in implementing the sub-projects are the subjects for the Progress and Process Monitoring services. This Draft Terminal report monitored AES and BDS activities from November 1, 2015 to February 29, 2016. Moreover, issues and concerns and lessons learned from the May 2015 are also discussed as well as recommendation on possible

courses of action to enhance project implementation. This report also presents the results of the baseline survey of intended farmer-scientists of the three cooperatives. Progress and process monitoring employed both quantitative and qualitative design/methods and developed appropriate monitoring tools.

AGRARIAN REFORM; MONITORING; TRAINING PROGRAMMES; EXTENSION ACTIVITIES; EXTENSION PROGRAMMES; ENTERPRISES; PHILIPPINES

## F - PLANT SCIENCE AND PRODUCTION

### F04 - FERTILIZING

Effect of nitrogen fertilizer on nymphal development of the brown planthopper, *Nilaparvata lugens* (Stal). **Marquez, N., Bacolod, K.A., Vidaure, S.M.P., Santos, J.P. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Univ. Science High School.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 171. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The effect of nitrogen (N) fertilizer on the nymphal development of the brown planthopper (BPH), *Nilaparvata lugens* (Stal) was studied from November, 2017 to February, 2018 to help farmers determine optimum N fertilizers rate, considering BPH management. Four treatments, each replicated six times, consisting of different N fertilizer rates applied at 15 and 36 days after sowing (DAS) were used. Data such as plant height, greenness of plants using Leaf Color Chart, and number of tillers were monitored at 15, 21, 29, 36, and 42 DAS. BPH individuals were introduced at 47 DAS to the rice plants for them to lay eggs. Hatched nymphs were collected 14 days after. After another 12 days, all the plants were already dried up, and BPH were collected from each replicate. BPH individuals were sorted to brachypterous (short-winged), macropterous (long-winged) and nymphs. Rice plants applied with N fertilizer became greener and taller, and produced with more tillers. However, BPH also reproduced and developed on, and colonized these rice plants. Regulating N fertilizer application can help minimize *lugens*, nitrogen fertilizer, nymphal development.

NILAPARVATA LUGENS; NYMPHS; NITROGEN FERTILIZERS; FERTILIZER APPLICATION; PEST CONTROL; APPLICATION RATES



## F06 - IRRIGATION

Accelerating and sustaining irrigation development in the Philippines: a key to food security and inclusive economic growth. **Ella, V.B.** *Philippines Univ. Los Baños, College Laguna (Philippines). Land Resources Div. UPLB Centennial Professorial Chair Lecture. College, Laguna (Philippines). 28 Jun 2019.*

This paper generally aims to demonstrate the importance of accelerating and sustaining irrigation development in attaining food security and inclusive economic growth in the Philippines. The average actual rate of irrigation development of 2.75% per year or about 47,000 hectares of new irrigated areas per year would never lead to rice self-sufficiency in the Philippines and will make the country always dependent on other countries to fill the deficit in local rice production. A simple rice supply and demand analysis shows the accelerating and sustaining irrigation development by 1.5 times, 1.75 times, 2 times and 2.5 times the current rate would enable satisfaction of the local rice demand in only about 22 years, 18 years, 14 years and 8 years, respectively for better food security through self-sufficiency. Accelerated and sustained irrigation development could also result to more inclusive economic growth due to increased economic activities and employment opportunities in the marginalized rural sector with the outpouring of massive investments on irrigation development. The provision of irrigation facilities would also enable farmers to shift to diversified high value crop production to augment their income. However, there are numerous issues and constraints besetting irrigation development in the country ranging from engineering and technical to institutional, economic, environmental, social, legal and even to such contemporary issues such as unregulated land conversion, watershed denudation, climate change and climate variability, competing water uses among others. Most of these issues could be addressed through the provision of enabling policies. The enactment of legislations such as National Land Use Act should be expedited to address rapid and unregulated conversion of prime irrigable and irrigated agricultural lands into non-agricultural uses. The Rice Tariffication Act, enacted in early 2019 may have to be revisited and amended if necessary to prevent its potential inhibitory effects on irrigation development in the country in anticipation of the potential decrease in the selling price of palay by the local farmers due to the liberalization of rice importation triggered by this law. Accelerated and sustained irrigation development would also call for massive irrigation investments and proper irrigation system planning, design, operation and maintenance, which in turn would require updated land and water resources database system, sustained research, development and extension and adoption of water saving and water use efficient technologies. These massive irrigation investments should be used and allocated optimally in order to maximize the benefits that could be derived from these government investments. Overall, this lecture has demonstrated that accelerated and sustained

irrigation development may be a key or an option in achieving both food security through self-sufficiency and inclusive economic growth. Results generated in this paper could serve as basis for additional studies to further prove the merits of this option and to serve as basis for future policy formulation on food security and economic growth inclusivity in the Philippines.

ORYZA SATIVA; PLANT PRODUCTION; IRRIGATION; IRRIGATION SYSTEMS; FOOD SECURITY; ECONOMIC GROWTH; PHILIPPINES

### F30 - PLANT GENETICS AND BREEDING

Natural introgression of Bt genes from Bt corn to traditional maize: the case of Silangan variety from San Carlos, Pangasinan, Philippines. **Caasi-Lit, M.T. mclit@up.edu.ph. Novio, B.A., Salazar, A.M., Paril, J.P., Cuizon, R.P., Macasaet, J.P.A., Panabang, B.B., Alvarez, A.M., Marmeto, A.D., Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 185. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee), became effectively managed when Bt corn was introduced in 2003 in the Philippines. However, ACB remains a serious problem for open pollinated varieties (OPV). The search for alternative and safe control measures continues especially for the latter. The Corn Germplasm Utilization through Advanced Research and Development (CGUARD) program of the Department of Agriculture initiated the collection of our traditional maize varieties from all over the country as sources of traits for tolerance or resistance to biotic and abiotic stresses. Field performance and status of these genetic resources were initially assessed for ACB resistance vis-a-vis the last 15 years of Bt corn planting. The screening efforts partly aim to determine the presence of Bt genes (Cry1Ab) in the collection. Field visits were done in several towns of San Carlos, Pangasinan, [Philippines] to interview the original Silangan corn farmers. This traditional corn has been planted since the 1930's by their parents and they continue to grow the said variety despite the availability of Bt corn in the surrounding field. This study discussed the case of Silangan variety from Pangasinan which has been naturally introgressed with Bt Cry1Ab genes. This traditional maize had good agronomic/consumer qualities and observed tolerance to drought.

OSTRINIA FURNACALIS; ZEA MAYS; MAIZE; VARIETIES; GENES; OPEN POLLINATION; GENETIC RESISTANCE; BACILLUS THURINGIENSIS; INTROGRESSION; INDIGENOUS ORGANISMS; PHILIPPINES

## H - PLANT PROTECTION

### H10 - PESTS OF PLANTS

Assessment of non-target contact toxicity of dinotefuran and thiamethoxam on adult *Comperiella calauanica* Barrion et al. (Hymenoptera:Encyrtidae). **Almarinez, B.J.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit. Pacheco, P.R.D.C. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biology Dept. Roa, E.L.Q., Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 32 (2) p. 185-186. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Neonicotinoids are known for very high neurotoxicity to insects and relative safety to mammals, including humans. However, being broad-spectrum and reportedly highly toxic to bees, these insecticides have been implicated in decline of populations of beneficial insects, particularly honey bees. Their toxicity to non-target species, especially *Comperiella calauanica* Barrion et al., the highly specific and very efficient parasitoid of coconut scale insects, *Aspidiotus rigidus* Reyne, should be assessed. Contact toxicity of two locally utilized neonicotinoids, dinotefuran and thiamethoxam, on adult female *C. calauanica* was determined using leaf disk and whole leaf uptake assays. Concentrations including upper and lower limits of recommended dosages for field use of these neonicotinoids were applied as treatments, with water as negative control. Both dinotefuran and thiamethoxam were highly toxic to adult *C. calauanica*, even at the lowest recommended dosage. Complete mortality was observed within 2-3 hours from exposure in the leaf disk assay, and within four hours for dinotefuran, and between 4-5 hours for thiamethoxam in the whole leaf uptake assay. Twitching and other responses associated with impaired nervous function were observed in *C. calauanica* exposed to either neonicotinoid, suggesting neurotoxic effects. These findings strongly point to the incompatibility between *C. calauanica* and the use of neonicotinoids to control *A. rigidus*. Safer alternatives must be studied should chemical control be deemed necessary.

COMPERIELLA; SPECIES; ADULTS; COCCOIDEA; APIDAE; PESTICIDES; PEST CONTROL; TOXICITY

Assessment protocol for field bioefficacy evaluation of insecticides against onion armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera:Noctuidae). **Ardez, K.P., Navasero, M.V., Bato, M.B. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop**

**Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 196-197. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Field bioefficacy evaluation of some insecticides against onion armyworm (OAW), *Spodoptera exigua* (Hubner), was conducted in Muñoz, Nueva Ecija [Philippines] during the 2017-2018 onion cropping season. Three indicators of level of infestation/degree of damage were used, namely: counting of larvae per instar outside and inside leaves, damage severity rating, and visual damage rating. Number of OAW larvae found outside of leaves is not a reliable indicator of infestation level because it accounts only for 20% of all larvae counted; the rest recommended. However, first instars should be excluded considering its clumped distribution in the field. Severity rating provides better estimates of level of damage but visual damage rating may suffice for purposes of comparison between treatments.

SPODOPTERA EXIGUA; ONIONS; INSECTICIDES; INFESTATION; ANIMAL DEVELOPMENTAL STAGES; CROP LOSSES

Association of silicon content with yellow stem borer, *Scripophaga incertulas* (Walker), tolerance in indica rice cultivars. **Fernando, T.C., Ordonio, R.L., Miranda, R.T., Castillo, M.P. Philippine Rice Research Inst., Maligaya, Science City of Muñoz, Nueva Ecija (Philippines). Whitehead, C., Gomez, L., McQueen-Mason, S. University of York, Heslington, York YO10 5DD, (United Kingdom). Dept. of Biology.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 32 (2) p. 202-203. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Yellow stem borers (YSB), *Scripophaga incertulas* (Walker), are major pests in rice agriculture. Hence, there have been numerous studies on pest management involving them. Improving stem composition is seen as a way to promote YSB tolerant in rice. Silica (SiO<sub>2</sub>) is known to contribute to normal growth and development in rice and is also linked to resistance to pathogen and other environment factors by affecting physical traits of the stem. Here, Silicon content in rice is shown to positively influence YSB tolerance. In 2017 dry season, YSB occurrence was observed in field planted to exactly 215 indica rice cultivars varying in terms of maturity and other traits. This allowed evaluation of the relationship of rice straw Silicon content with YSB tolerance. YSB incidence was diagnosed by counting whiteheads during the reproductive stage. Incidence reaching 20% meant significant yield loss. In addition, 25 primary tillers each from individual plants per entry were collected during maturity and sent to the University of York for high-throughput rice straw Silicon content analysis. Out of 185 early maturing rice cultivars attacked by YSB, 45 were found to be tolerant. Person's correlation showed positive relationship between Silicon content and

YSB tolerance, i.e., higher silicon levels can lead to better tolerance. These rice cultivars with higher silicon content can be utilized in breeding programs as sources of tolerance or resistance to YSB.

ORYZA SATIVA; RICE; VARIETIES; SCIRPOPHAGA INCERTULAS; STEM EATING INSECTS; SPECIES; SILICON; PEST RESISTANCE

Bio-ecology of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith): available knowledge. Navasero, M.M. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Philippine Entomologists. 0048-3753. (Jul-Dec 2019). v.32 (2) p. 199. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.

This paper briefly described each of the developmental stages of a new invasive pest in the country, *Spodoptera frugiperda* (J.E. Smith), along with its haplotypes and host range, based on data available in the literature, for wider information dissemination among fellow researchers. The egg hatches in 2-3 days. Mean development time (in days) of the sixth 3.7, instars are as follows: first 3.3., second 1.7, third 1.5, fourth 1.5, fifth 2.0, and sixth 3.7, when reared on corn at 25 deg C. Total larval duration is about 14 days during warm months and 30 days in cooler months. The pupal duration is about 8-9 days during summer, reaching 20-30 days during cooler weather but they cannot withstand long periods of cold weather. The adult stage is nocturnal, active during warm humid evenings. After a preoviposition period of 3-4 days, the female moth normally deposits most of her eggs during the first 4-5 days but maybe extended for up to three weeks. Mean duration of adult life is estimated at 10 days. Two haplotypes or strains determined through DNA barcoding have been reported: the corn strain which feeds predominantly on maize, cotton, and sorghum; and the rice strain which feeds on rice are also present in our country, which makes it a potential pest of concern to many of our economically important crops.

SPODOPTERA FRUGIPERDA; DNA; NUCLEOTIDE SEQUENCE; ANIMAL DEVELOPMENTAL STAGES; PEST INSECTS; CROP LOSSES

Biological control of coffee berry borer [*Hypothenemus hampei* (Ferrari)] and green scale insect (*Coccus viridis* Green) infesting organically grown arabica coffee in Benguet [Philippines]. Das-Ilen, G., Ligat, B.S., Dacus, W.A., Eladjoe, K.J.P. Benguet State Univ., La Trinidad, Benguet (Philippines). Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 186-187. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.

Coffee berry borer, *Hypothenemus hampei* (Ferrari), infestation ranged from 28-90% on arabica coffee plantations in the different municipalities of Benguet while green scale, *Coccus viridis* Green, had no injury arabica leaves and stems. The lady beetle, *Chilocorus circumdatus* Gyllenhal (Coleoptera: Coccinellidae) was identified as a natural enemy of *C. viridis*. The lady beetles were present in six municipalities of Benguet province, namely: La Trinidad, Kapangan, Kibungan, Mankayan, Atok, and Banguias. Lady beetle eggs are white, laid in clusters (6-25 eggs), and banana-shaped. Larvae have four instars which are alligator-like. Pupae are capsule-like, orange in the center, and are surrounded by hair-like structures. Adults are convex, white upon emerging, but turns predominantly orange after a few minutes. First instar larvae consumed an average of nine green scale insects per day occupying a length of approximately 1.19 mm on the shoots of coffee plants and the second instar consumed an average of seven green scale insects per day occupying a length of 1.98 mm. The third instar larvae consumed an average of five scale insects per day occupying a length of approximately 2.38 mm. The fourth instar and adult predator consumed an average of seven and six scale insects per day, respectively, occupying a length of approximately 2.78 mm on the shoots of coffee plants. The natural enemy of coffee berry borer was *Beauveria bassiana* (Bals.) Vuill., an entomopathogenic fungi.

ARABICA COFFEE; HYPOTHENEMUS HAMPEI; COCCUS; SPECIES; COLEOPTERA; BIOLOGICAL CONTROL; NATURAL ENEMIES; LARVAE; PUPAE; INFESTATION

Biology of a spider mite, *Tetranychus urticae* Koch, and a phytoseiid predator, *Proprioseiopsis lenis* (Corpuz and Rimado), and its biological control potential. **Salinas-Labe, M.D. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Dept. of Pest Crop Protection. [mdslabe@gmail.com](mailto:mdslabe@gmail.com). Sumalde, A.C., Corpuz-Raros, L.A., Ocampo, V.R. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 97-111.**

The life histories of the spider mite, *Tetranychus urticae* Koch, on *Rosa* sp. 'Bravo', and of the phytoseiid predator, *Proprioseiopsis lenis* (Corpuz and Rimando), were studied under ambient laboratory conditions, together with the biocontrol potential of *p. lenis*, using *T. urticae* larvae as prey. The mites underwent egg, larval, protonymphal, and deutonymphal stages before reaching the adult stage. For *T. urticae*, average durations (days) of life stages for female and male were: incubation,  $3.43 \pm 0.11$  and  $3.63 \pm 0.11$ ; larva,  $1.70 \pm 0.24$  and  $1.68 \pm 0.09$ ; protonymph,  $1.63 \pm 0.07$  and  $1.72 \pm 0.12$ ; and deutonymph,  $1.83 \pm 0.09$  and  $2.23 \pm 0.29$ , respectively. The female completed development within  $8.60 \pm 0.24$ , and the male,  $9.22 \pm 0.35$  days. Adult males live longer ( $16.31 \pm 1.34$  days) than females ( $14.83 \pm 0.59$  days). Arrhenotokous parthenogenesis and sexual reproduction were observed. Pre-

oviposition, oviposition, and post-oviposition period were:  $1.06 \pm 0.14$ ,  $10.08 \pm 0.72$ , and  $3.70 \pm 0.14$  days, respectively. Fecundity ranged from 11.126 eggs, and hatchability, 85.11-100%. Sex ratio was 2.13 females: 1 male. For *P. lenis*, all progenies were females; hence, it showed thelytokous parthenogenesis. Average durations (days) of stages were: incubation,  $1.37 \pm 0.07$ ; larva,  $0.89 \pm 0.04$ ; protonymph,  $1.03 \pm 0.05$ ; and deutonymph,  $1.20 \pm 0.08$ . Development was completed within  $4.50 \pm 0.12$  days. Mean adult longevity was  $20.45 \pm 1.50$  days. Pre-oviposition, oviposition, and post-oviposition periods were:  $1.95 \pm 0.22$ ,  $16.20 \pm 1.31$ , and  $2.67 \pm 0.51$  days, respectively. Fecundity ranged from 7-74 eggs and hatchability, 98-100%. *P. lenis* prefers *T. urticae* larvae as prey and could be satiated at 30 larvae per day. *P. lenis* has shorter developmental period, longer life span, longer oviposition period, and high egg hatchability relative to its prey – desirable features of effective predators.

#### TETRANYCHUS URTICAE; PREDATORS; BIOLOGICAL CONTROL; LIFE CYCLE; DEVELOPMENTAL STAGES

Biology of Black soldier fly, *Hermetia illucens* (L.) under Davao RCPC [Regional Crop Protection Center] laboratory conditions. Huelar, M.G., Velasco, C.J., Infante, M.N., Vito, Ma, M.M., Razo, S.T. Department of Agriculture Regional Field Office 11, F. Bangoy St., Agdao, Davao City (Philippines). Regional Crop Protection Center. Maulit, R.T., Jr. Davao Commercial Agriculture Research Station, Mati, Davao Oriental (Philippines). Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 175. 50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.

The biology of Black soldier fly, *Hermetia illucens* (L.) was studied under laboratory conditions at room temperature (28-32 deg C) using 1 kg of chicken pellets as diet. Female *H. illucens* laid an average of 988.70 eggs per egg mass. Eggs were 1.01 mm long, creamy white when freshly laid, and turned creamy yellow before hatching. Incubation period ranged from 3-5 days. Larvae underwent five instars, were creamy white then turned brownish on entering the pre-pupal stage. Matured larvae were 27 mm long. Pre-pupae were brownish and turned black for population. Body size ranged from 20-27 mm long and 5-7 mm wide. Pre-pupal stage took 7-15 days. Pupae were hook-like, black and 19-24 mm long. Total larval development and population periods ranged from 14-18 and 9-14 days, respectively. *H. illucens* adults are wasp-like, with generally black body, 15-23 mm long and can live 5-10 days. The total life cycle from eggs to adult took 38-62 days. Salient data gathered of life history of *H. illucens* under local conditions and capability to be mass produced using chicken pellets indicate its potential as natural decomposer for animal waste.

DIPTERA; SPECIES; LIFE CYCLE; BIOLOGY; CHICKENS; PELLETS; TEMPERATURE

Biology of the predatory water bug, *Diplonychus rusticus* (Fabricius) (Hemiptera:Belostomatidae), on prey *Aedes aegypti* L. (Diptera:Culicidae) wigglers. **Millanes, J.M. Bureau of Plant Industry, 692, San Andres Street, Malate, Manila (Philippines). National Plant Quarantine Services Div. Javier, P.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 113-128.**

The biology of the predatory water bug, *Diplonychus rusticus* (Fabricius) (Hemiptera: Belostomatidae), was studied under laboratory conditions using *Aedes aegypti* (L.) (Diptera:Culicidae) wigglers as prey. *D. rusticus* exhibits paurometabolous type of development passing through egg, nymph, and adult stages. An adult female laid about 6-14 egg batches with an average of  $55.95 \pm 2.36$  eggs per batch. Incubation period ranges from 8-11 days with a mean of  $9.28 \pm 0.06$  days and 79.63 % hatchability. The nymph passed through five instars before reaching the adult stage. The mean durations of the different instars were:  $4.62 \pm 0.16$ ,  $4.22 \pm 0.15$ ,  $5.24 \pm 0.24$ ,  $8.06 \pm 0.58$ , and  $15.86 \pm 0.61$  days, respectively. The developmental period was 28-54 days ( $\bar{x} = 38.14 \pm 0.85$  days). Longevity of females ranged from 110-283 days ( $\bar{x} = 196.76 \pm 12.53$  days) while that of males was from 115-282 days ( $\bar{x} = 212.38 \pm 14.04$  days). *D. rusticus* was found to be voracious predator of *A. aegypti* in the laboratory. The mean consumption rates for the respective instars were  $10.0 \pm 0.35$ ,  $17.22 \pm 0.31$ ,  $36.48 \pm 0.73$ ,  $98.18 \pm 2.89$ , and  $171.88 \pm 4.23$  individual wigglers per day. On the other hand, adult *D. rusticus* can consume 112-300 wigglers per day or an average of  $206.54 \pm 6.66$  individuals.

AEDES AEGYPTI; HEMIPTERA; CULICIDAE; DEVELOPMENTAL STAGES; HETEROPTERA; LIFE CYCLE; PREDATION

Brine shrimp lethality test as biological model for preliminary screening of insecticidal activity from secondary metabolites isolated from Philippine actinomycetes. **Mendoza, J.P., Sumang, F.A.M., Baterina, S.J.S., Alcantara, E.P. Philippines Univ. Los Baños, College, Laguna (Philippines). National Inst. of Molecular Biology and Biotechnology. *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 176. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines)*. 8-11 May 2018.**



Actinomycetes are the most abundant source of many types of bioactive secondary metabolites including natural organic insecticides. A screening program of currently underway to evaluate the insecticidal potential of actinomycete accession in the laboratory. The applicability of brine shrimp lethality assay, considered useful for preliminary screening of insecticidal compounds of microbial origin, was tested to identify isolates of actinomycetes with potential insecticidal activity. Solution of crude extracts prepared from fermentation broths of several actinomycetes isolated from soil samples were separately dispensed in drum glass vials containing saline suspension of brine shrimp. *Artemia salina* (L.). Crude extracts showing high toxicity to brine were selected as candidates for secondary screening. Mortality data obtained from insect artificial diet surface overlay assay suggest correlation of brine shrimp lethality assay with insecticidal activity.

ACTINOMYCETALES; BRINES; ARTEMIA SALINA; PESTICIDAL PROPERTIES; INSECTICIDES; SECONDARY METABOLITES; MORBIDITY

Chemical control for rice grain bug (*Paraeucosmetus pallicornis* Dallas (Hemiptera:Lygaeidae) under screenhouse conditions. **Estoy, G.F., Jr. Philippine Rice Research Inst., Basilisa, RT. Romualdez 8611, Agusan del Norte (Philippines); Montilla, S.B. Caraga State Univ., Ampayon, Butuan City (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 168-169. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Four commonly used synthetic insecticides in Agusan del Norte, Philippines were evaluated and compared with two organic insecticides for the control of the rice grain bug (RGB), *Paraeucosmetus pallicornis* Dallas under screenhouse conditions. RGB mortality were recorded at 15, 30, 45, 60, 1,440 and 2,880 min after post treatment application, respectively. All synthetic insecticides gave 100% mortality after 15 min after post treatment application. However, the organic insecticides gave delayed responses (1,440 and 2,880 min after post treatments).

ORYZA SATIVA; RICE; HETEROPTERA; LYGAEIDAE; SPECIES; CHEMICAL CONTROL; INSECTICIDES; MORTALITY; PHILIPPINES

Classical non-chemical control: sharing experiences with the common cutworm, black armyworm, and onion armyworm. **Navasero, M.M. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 200. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron,*

*Palawan (Philippines). 2-5 Jul 2019.*

The National Crop Protection Center-UPLB [University of the Philippines Los Baños] Quick Response Team had encountered in recent years three cases of cutworm and armyworm outbreaks in Luzon Island, Philippines. The outbreak of the common cutworm, *Spodoptera litura* (Fabricius) in Pangasinan was successfully abated with the use of Nucleopolyhedrosis virus (NPV). This case also was instrumental in the development of the village-level mass production of NPV, the first for a biological control agent in the Philippines. For the black armyworm, *S. exempta* (Walker). Several parasitoids, predators, and entomopathogens were documented associated with this species during its outbreak in CALABARZON [Cavite, Batangas, Rizal, Quezon] in 2010. However, cessation of the outbreak was attributed to the obligatory migration behavior of adults that forces them to spread and the succeeding generation reverting back to solitary phase. The most recent was the outbreak of the onion armyworm, *S. exigua* (Hubner), in 2016 in onion-growing areas of Regions 1 [Ilocos Region] and 3 [Central Luzon]. SeMNPV and *Metarhizium rileyi* from infected *S. exigua* larvae had been cultured and their high efficacy to *S. exigua* had been established under laboratory conditions. Preliminary field trials for SeMNPV showed promising results.

SPODOPTERA LITURA; METARHIZIUM; SPODOPTERA; SPECIES; BIOLOGICAL CONTROL AGENTS; MIGRATORY PESTS; PREDATORS; PARASITISM; PHILIPPINES

Collection, characterization and identification of parasitoids and predators of major insect pests of Arabica coffee. **Das-Ilen, G., Ligat, B.S., Tad-awan, B.S., Basalong, A.A., Evasco, N.H.G., Catchero, D.M., Balanban, O.D., Abdelkawi, M.L. Benguet State Univ., La Trinidad, Benguet (Philippines).** *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 186. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The major insect pests of arabica coffee were coffee berry borer (CBB), scale insects, aphids, mealybugs, snout beetle, and stem borer. The scale insects, aphids, mealybugs, snout beetle, and stem borer infest Arabica coffee from seedling stage until maturity while CBB infests berries. Potential biological control agents associated with these major insect pests were also collected. Potential predators feeding on aphids, scale insects, and mealybugs were lady beetles (Coleoptera: Coccinellidae), namely: black lady beetle [*Chilocorus nigritus* (Fabricius)], orange lady beetle [*C. circumdatus* (Gyllenhal)], 16-spotted lady beetle [*Tytthas pis sedecimpunctata* (L.)], yellow spotless lady beetle (*Illeis koebelei* Timberlake); ant beetle (Coleoptera:Anthicidae):*Anthicus* sp.; brown lacewings (Neuroptera:Hemerobiidae):*Hemerobius* spp.; green lacewings (Neuroptera:Chrysopidae):*Chrysoperla rufilabris* sp. The Assassin bug

(Hemiptera:Reduviidae) Zelus sp. Feeds on adult CBB. Potential parasitoids that emerged from scale insects were small wasps (Hymenoptera: Eulophidae): (Hemiptarsenus sp.);Encyrtidae (Anagyrus sp., Copidosoma sp., Chrysocharis sp., and Microterys sp.). No parasitoids emerged from aphids, mealybugs, snout beetles, stem borer, and CBB.

ARABICA COFFEE; HYPOTHENEMUS HAMPEI; APHIDOIDEA; PSEUDOCOCCIDAE; STEM EATING INSECTS; BIOLOGICAL CONTROL; PEST CONTROL; IDENTIFICATION; PARASITIDS; PREDATORS

Comparative performance of entomopathogens against the rice bug *Leptocorisa oratoria* (Fabricius), in Eastern Visayas [Philippines] I. laboratory efficacy. **Almeroda, B.B., Dela Cruz, C.S. Department of Agriculture-Regional Field Office 8, Tacloboan Leyte (Philippine).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 186. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Two entomopathogens were tested as possible alternative strategies to insecticides against rice bug, *Leptocorisa oratoria* (fabricius). Three days after application, rice bugs treated *Metarhizium anisopliae* (Metsch.) Sorok.SPW isolate and *Beauveria bassiana* (Bals.) Vuill. Showed 75.83% and 55% infection, respectively, under laboratory conditions using 1x10<sup>8</sup> spore count. Increasing the spore concentration from 1x10<sup>6</sup> to 1x10<sup>8</sup> directly increased the effectiveness of both entomopathogens in the pot experiment. However, their effectiveness is affected by heavy rains (615-788.6 mm) when applied in the field. Only *B. bassiana* showed highest infection of 44.26% in all treatments. *M. anisopliae* SPW showed 29.83% infection, and *B. bassiana*, 12.1%. Infection occurrence can last up to harvesting. *M. anisopliae* SPW isolate is currently being mass-produced in a cost-effective medium at the Pest Management Laboratory, AES, Abuyog, Leyte [Philippines].

BEAVERIA BASSIANA; LEPTOCORISA; SPECIES; RICE; INSECTICIDES; PEST CONTROL; METARHIZIUM ANISOPLIAE; ENTOMOGENOUS FUNGI; PHILIPPINES

Comparative performance of entomopathogens against the rice bug, *Leptocorisa oratoria* (Fabricius), in Eastern Visayas [Philippines]. 2. field efficacy and cost-and-return analysis. **Almeroda,B.B., Dela Cruz, C.S. Department of Agriculture-Regional Field Office 8, Tacloban Leyte (Philippine).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 193-194. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Metarhizium anisopliae (Metsch.) Sorok.SPW isolate and Beauveria bassiana (Bals.) Vuill. were evaluated under field conditions against the rice bug, Leptocorisa oratoria (Fabricius). Cost and return analysis of the production of the two entomopathogens was also conducted. M. anisopliae SPW and B. bassiana isolates infect both nymphal and adult stages of rice bug. Infected rice bug exhibited whitish mycelial growths in the ventral portion of thorax and on the bases of the legs, 3-7 days after application. Highest observed nymphal infection in the laboratory of B. bassiana and M. anisopliae were 88.33 and 96.67% respectively, seven days after application. On the other hand, under greenhouse conditions, adult rice bugs succumbed to 85% infection by B. bassiana but only 57.50% infection by M. anisopliae SPW. Using palay as substrate for the two entomopathogens lowered production cost per bag of PhP 18.59 and was more economical than cracked corn i.e., PhP 21.59 per bag. In the field, use of entomopathogens significant reduced rice bug population. However, its efficacy was hampered when applied during rainy season. Pesticide application done by farmers incurred 115.16% higher cost compared with the production cost per bag when using Metarhizium.

LEPTOCORISA; SPECIES; HETEROPTERA; RICE; METARHIZIUM ANISOPLIAE; BEAUVERIA BASSIANA; PEST CONTROL; BIOLOGICAL CONTROL AGENTS; ENTOMOGENOUS FUNGI; PHILIPPINES

Comparison of the strip type and rubber septa traps with sex pheromone lure of onion armyworm, Spodoptera exigua (Hubner) (Lepidoptera:Noctuidae) in Sto. Domingo, Nueva Ecija [Philippines]. Cayabyab, B.A.G., Manaday, S.J.B., Gonzales, P.G., Burgonio, G.A.S. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 204. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.

The strip type and rubber septa carriers for sex pheromone lures were compared during an 80-day trapping study onion armyworm, Spodoptera exigua (Hubner), from January 13-April 13, 2019 in Dolores Sto. Domingo, Nueva Ecija [Philippines]. Six traps were used for each type of pheromone carrier. The sex pheromone was tethered at the center of five-gallon container with water and soap. Male moth catches were counted and recorded daily between 0600 and 0800H. Locations were selected based on the damage assessment observed last onion-growing season. The rubber septa had higher daily catches than the strip type. Moreover, the former had a total, (cumulative) male catch of 41,165 while the latter had 6,880. The rubber septa containing sex pheromone can be used for detection, population forecasting, and mass trapping of male moths.

SPODOPTERA EXIGUA; SEX PHEROMONES; ONIONS; ATTRACTANTS; TRAPPING; PEST INSECTS; PHILIPPINES

Construction and analysis of the transcriptome of the white stemborer, *Scripophaga innotata* (Walker). **Mascareñas-Bautista, Ma.A., Lao, A.G.dJ. Philippines Univ. Diliman, Diliman, Quezon City (Philippines). National Inst. of Molecular Biology and Biotechnology. Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. Estoy, G.F., Jr. Philippine Rice Research Inst., Basilisa, RT. Romualdez 8611, Agusan del Norte (Philippines).** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 181. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Rice stemborers are considered one of the most destructive pests of rice in Asia. Among the stemborers, *Scripophaga innotata* (Walker) or the White stemborer (WSB) is known exclusively feed on rice stems in Mindanao [Philippines]. Since minimal genetic information on WSB is currently available, our group works on generating a molecular toolbox through global profiling of expressed genes. The transcriptome dataset or the 'toolbox' may provide better insight into the genetic makeup and expression patterns of WSB, as well as insight into the infestation behavior and resistance mechanisms utilized by the insects. Transcriptomics started with Illumina technology-based sequencing of RNAs from WSB. The sequences were then assembled and annotated using multiple databases including Nr/Nt, GO, InterPro, COG, and KEGG. Bioinformatics analysis of the constructed transcriptome yielded molecular markers, including 1,183,579 single nucleotide polymorphisms and 18,666 microsatellites. This and additional data from further analysis of the transcriptome will be used in downstream assays.

SCIRPOPHAGA; STEM EATING INSECTS; POLYMORPHISM; RICE; PESTS OF PLANTS; INFESTATION; NUCLEOTIDE SEQUENCE; GENETIC MARKERS; GENE EXPRESSION

Copulation and oviposition behavior of *Helopeltis bakeri* Poppius under laboratory conditions. **Ormenita, L.A.C., Amalin, D.M., De La Salle Univ., 2401 Taft Ave., Manila (Philippines).** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 173. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Cacao, *Theobroma cacao* L., is susceptible to a number of insect pests and pathogens which could hinder the country's campaign on production boost. One of the major insect pests of cacao in the Philippines is the cacao mirid bug (CMB), *Helopeltis bakeri* Poppius. CMB feeds

on the cacao pods as well on young shoots manifested by black lesions, which progress into dieback symptom. One of the control measures being investigated is the use of sex pheromone. In identifying the sex pheromone of CBM, 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 in developing the sex pheromone trap for the monitoring and management of CBM.

THEOBROMA CACAO; HELOPELTIS; SPECIES; OVIPOSITION; SEX PHEROMONES; REPRODUCTIVE BEHAVIOUR; SEXUAL MATURITY

Damage incidence of coconut leaf beetle *Brontispa longissima* Gestro on seedlings of selected coconut varieties. **Rosales, G. Bohol Island State Univ., Bilar, Bohol (Philippines). Coll. of Agriculture and Natural Sciences. Ceniza, J.C. Visayas State Univ., ViSCA, Baybay, Lete (Philippines). Dept. of Plant Protection.** *Philippine Entomologist (Philippines).* 0048-3753. (Oct 2018). v. 32 (2) p. 182. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The degree of damage of *Brontispa longissima* Gestro infestations was assessed in 10 selected and recommended tall and dwarf coconut varieties at seedling stage in the NCRC-VSU [National Coconut Research Center-Visayas State University] nursery. Among the selected coconut varieties, tall and dwarf seedlings of BAYT (Baybay Tall green and brown) and Albuera Dwarf (ALD) varieties succumbed to more damage to *Brontispa* beetles compared with the other varieties, i.e., 4.67, 4.433, and 3.33, respectively. Seedlings of dwarf varieties, Malayan Yellow Dwarf (MYD) and Malayan Red Dwarf (MRD) gave the least damage (1.0 damage rating). High damage ratings of the BAYT and ALD were shorter (mean 44 and 45 days, respectively) than in other varieties, an indication of being suitable and preferred, and MYD and MRD slightly non-preferred by the beetles compared for other varieties.

COCOS NUCIFERA; VARIETIES; COLEOPTERA; SPECIES; LEAVES; LEAF EATING INSECTS; SEEDLINGS; ADULTS; EGGS; LARVAE; DAMAGE; INFESTATION

Detection of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera:Noctuidae) using larval morphological characters, and observations on its current local distribution in the Philippines. **Navasero, M.V., Navasero, M.M. marnavasero@yahoo.com. Burgonio, G.A.S., Ardez, K.P., Ebuenga, M.D., Beltran, M.J.B., Bato, M.B., Gonzales, P.G., Magsino, G.L. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. Barrion-Dupo, A.L.A. Philippines Univ.**

**Los Baños, College, Laguna (Philippines). Inst. of Biological Sciences. Aquino, M.F.G.M. Department of Agriculture-Regional Crop Protection Center II, Ilagan, Isabela (Philippines). da\_cvialrcpc02@yahoo.cm. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 171-184.**

Detection surveys and identification using larval morphological characters of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith), were conducted in several provinces in the Philippines from June to October 2019. The smooth body texture and presence of conspicuous black pinaculae on the dorsal body segments of larvae distinguished *S. frugiperda* from the other species of the genus and three other common noctuid pests of corn in the Philippines, namely; *S. exempta* (Walker), *S. Exigua* (Hubner), *Mythimna separate* (Walker), and *Chrysodeixis eriosoma* (Doubleday). The markings along the inverted Y-shaped frontoclypeal suture and ecdysial line, except for *C. eriosoma*, is common to all species but differ in breadth and color. Incidence of fall armyworm was recorded in 17 municipalities in 10 provinces. Preliminary observations indicated that the pest is damaging only to non-Bt corn. It infests all growth stages of corn but showed apparent preference for earlier growth stages of the host.

SPODOPTERA FRUGIPERDA; LARVAE; MIGRATION; ZEA MAYS; ANIMAL MORPHOLOGY; IDENTIFICATION; PHILIPPINES

DNA barcode for the lanzones scale, *Unaspis mabilis* Lit and Barbecho (Hemiptera:Diaspididae). **Alvarez, V.K.I., Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Ecology Lab. Lit, I., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Lucañas, C.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Cave Ecology Lab. Abenis, K.O., Latina, R.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 187-188. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines)*. 2-5 Jul 2019.**

The mitochondrial cytochrome c oxidase subunit 1 (COI) nucleotide sequences of *Unaspis mabilis* Lit and Barbecho (Hemiptera:Diaspididae), infesting lanzones leaves are provided for the first time. The total genomic DNA of each mussel scale insect was extracted from individuals infesting lanzones leaves from selected sites in Los Banos, Laguna [Philippines]. A COI gene amplicon with approximately 700 bp was obtained using the primer pair PcoF1 and LepR1. Nucleotide sequence alignment showed no variation among the COI sequences from all the samples, indicating a single haplotype. BLASTn search yielded no significant hit nor match with any of the available sequences for *Unaspis* species. The closet hit was

*Aulacaspis tubercularis* Newstead (GenBank Accession No. HM474091) with only 87.4% nucleotide similarity DNA barcode generated from this study (GenBank Acc. Nos. MN114099, MN14101, and MN114102), could be used to verify the species identity of other lanzones scale accessions, and monitor the distribution and spread of *U. mabilis* which would greatly influence possible pest management options.

UNASPIS; SPECIES; INFESTATION; LANSIUM DOMESTICUM; DNA; PEST CONTROL; NUCLEOTIDE SEQUENCE

DNA barcoding of onion armyworm, *Spodoptera exigua* (Hubner), in Nueva Ecija and Benguet [Philippines]. Guerrero, M.S., Laquinta, J.F., Alforja, L.M., Aquino, A.G., Perez, E.A., Gaylon, M.P. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Ligat, B.S. Benguet State Univ., La Trinidad, Benguet (Philippines). Cayabyab, B.F. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 204-205. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.

In early 2016, a pest outbreak was reported in large areas of onion farms in Nueva Ecija, causing damage in 14 municipalities involving 5,330 hectares and 4,089 farmers. The pest was identified as the Onion armyworm (OAW), *Spodoptera exigua* (Hubner). The outbreak was suspected to have resulted from long distance mass migration triggered during the previous El Niño event, although the pest had been recorded already in the Philippines, since the late 1970s. Three years hence, OAW still brings severe damage in Nueva Ecija, forcing farmers to intensify spraying synthetic chemical insecticides to secure their harvest. Continuous monitoring and integrated pest management methods were done through collaboration of units in UPLB [University of the Philippines Los Baños] and CLSU [Central Luzon State University], LGUs [local government units], farmers associations, and DA-BAR [Department of Agriculture-Bureau of Agricultural Research]. To provide a quick and accurate identification during monitoring and for future reference, molecular methods were optimized to have DNA barcodes of this pest. Field-collected OAW adults and larvae from Dolores, Sto. Domingo, Nueva Ecija were processed to genomic DNA extraction and PCR amplification of COI gene. Samples were successfully sequenced and results deposited in the GenBank database as partial COI sequences of OAW Nueva Ecija population. In November 2018, OAW adults were also collected through the pheromone traps in Benguet State University, La Trinidad Benguet from farms with onion and other highland vegetables. Comparison of partial COI sequence of OAW population from Benguet and Nueva Ecija through multiple sequence alignment showed no nucleotide polymorphism.



SPODOPTERA EXIGUA; ONIONS; DNA; NUCLEOTIDE SEQUENCE; PEST INSECTS; GENETIC POLYMORPHISM; INTEGRATED PEST MANAGEMENT; CROP LOSSES; MONITORING; PHILIPPINES

Durability of resistance of popular high-yielding varieties to major insect pests and diseases of rice. **Santiago, G.dC., Dunca, Ma.S.V., Valdez, E.M. Philippine Rice Research Inst. Central Experiment Station, Maligaya, Muñoz, Nueva Ecija (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 169-170. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

To combat pest problems, many breeding programs emphasize the development of varieties with multiple resistance. Sources of resistance have been identified, breeding methodologies have been refined, and many varieties with multiple resistance are widely grown. However, the stability of resistance of a particular variety depends on the genetic interaction between the host plant and the pest. 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. Re-evaluation for the resistance stability of 43 popular/high yielding rice varieties to major insect pest and disease resistance stability of 43 popular/high-yielding rice varieties to major insect pests and diseases started during the dry season of 2016 under field and greenhouse conditions. Although the resistance of some varieties was unstable, majority had maintained their reactions against the major insects pests and diseases as during the time of their reactions against the major insect pests and diseases as during the time of their release.

ORYZA SATIVA; RICE; HIGH YIELDING VARIETIES; PESTS OF PLANTS; PEST RESISTANCE; PEST CONTROL; PLANT DISEASES; DISEASE CONTROL; DISEASE RESISTANCE

Ecology of insects and other arthropods of Rafflesia consueloae Galindo et al. **John Sy, E.P., Ong, P.S. Philippines Univ. Diliman, Diliman, Quezon City (Philippines). Ecology and Taxonomy Academic Group. Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 192. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Studying the ecology of insect and other arthropods visitors of Rafflesia is important in understanding their roles on its life history and propagation such as through pollination. This pioneering study documented 19 flowers of the most recently discovered Rafflesia consueloae Galindon et al. in five sites in Mt. Balukbok, Nueva Ecija, Philippines using video

cameras to determine visitor species diversities, assemblages, behaviors, and interactions with the flower. Visitation of various insects and other arthropods (grouped into morphospecies) were captured through video footage and the assessed using Cowlog 3.0.2 by recording durations of visits, tallying behaviors exhibited from a user-made behavior classification system, and comparing species diversity between specimens collected from field sampling and from videos. Sixteen morphospecies were identified from the videos in interaction with the flower. Of these, only one did not belong to insect. An additional nine morphospecies were collected during field sampling, all of which were dipterans, bringing to 25 the potential arthropod assemblage in Mt. Balukbok. Of those interacting with the flower, Diptera sp. 1, Sarcophagidae sp. 1, Calliphoridae sp. 1, and Conopidae sp. 1 were the most abundant. Calliphoridae sp. 1 and Sarcophagidae sp. 1 were observed to exhibit 'landing' behaviors most frequently. These carrion flies were also the only morphospecies observed to carry pollen out of the flower. Conopidae sp. 1 was consistently observed to oviposit on the perigone lobes and diaphragm. *R. consueloae* follows a low-level of sapromyophily as its pollination syndrome, while also being capable of brood-site deception.

ARTHROPODA; DIPTERA; ANIMAL ECOLOGY; BEHAVIOUR; FLOWERS; POLLINATION; RAFFLESIAACEAE

Effects of coffee grounds mixed in soil on soil arthropod diversity and growth of pechay (*Brassica rapa* L.). **Tambaoan, F.G.S., Lit, I. L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 190. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Consumption of brewed coffee is increasing, generating more wastes from coffee grounds (used ground coffee). Establishments and groups have encouraged the use of coffee grounds as soil additives or amendments for home gardens, or for use in growing vegetables, to prevent coffee grounds from going to landfills. As part of on-going studies on effects of soil amendments on the abundance and diversity of soil arthropods, we performed preliminary potted experiments and monitored the initial and final arthropod composition and abundance in the two treatments – soil only and soil mixed with fresh coffee grounds. Numerically, more arthropods, especially collembolans and mites were observed in soil only, than in soil mixed with coffee grounds. Diversity was also higher without coffee grounds. Pechay plants used as indicators were stunted in potted soil with coffee grounds. However, statistically, the two treatments did not differ significantly in terms of soil arthropod diversity. It is believed that caffeine residues possibly caused poor

growth of pechay in the potted soil. Coffee grounds should be composted first before using them as soil additives or amendments. The use of fresh coffee grounds as soil amendments should be avoided, especially when growing plants from seed. Further studies using garden plots instead of pots as well as comparison with conventional gardening practices are recommended.

BRASSICA CAMPESTRIS; COFFEA; COFFEE; CAFFEINE; ARTHROPODA; SOIL; PEST CONTROL; WASTE MANAGEMENT; SOIL AMENDMENTS

Effect of increasing temperature on Nilaparvata lugens (Stal) and its predator Cyrtorhinus lividipennis Reuter. **Encarnacion, C.C.B., Rillon, G.S. Philippine Rice Research Inst., Maligaya, Science City of Muñoz, Nueva Ecija (Philippines). Crop Protection Div.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 175. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

With the expected climate change in the near future, it has been estimated that there will be an increase in temperature that could influence behavior, that there will be an increase in temperature that could influence behavior, development, and interaction of insect pests and natural enemies. Hence, a study was conducted to determine the effect of increasing temperature on rice brown planthopper (BPH) Nilaparvata lugens (Stal) and its predator Cyrtorhinus lividipennis Reuter. Higher temperature killed 100% of BPH and 70% of C. lividepennis after seven days. This confirms that exposure to higher temperature will have lethal effects on both BPH and its important predator C. lividipennis.

NILAPARVATA LUGENS; CYRTORHINUS LIVIDIPENNIS; PREDATORS; TEMPERATURE; CLIMATIC CHANGE

Effect of nitrogen fertilizer on nymphal development of the brown planthopper, Nilaparvata lugens (Stal). **Marquez, N., Bacolod, K.A., Vidaure, S.M.P., Santos, J.P. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Univ. Science High School.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 171. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The effect of nitrogen (N) fertilizer on the nymphal development of the brown planthopper (BPH), Nilaparvata lugens (Stal) was studied from November, 2017 to February, 2018 to help farmers determine optimum N fertilizers rate, considering BPH management. Four treatments, each replicated six times, consisting of different N fertilizer rates applied at 15

and 36 days after sowing (DAS) were used. Data such as plant height, greenness of plants using Leaf Color Chart, and number of tillers were monitored at 15, 21, 29, 36, and 42 DAS. BPH individuals were introduced at 47 DAS to the rice plants for them to lay eggs. Hatched nymphs were collected 14 days after. After another 12 days, all the plants were already dried up, and BPH were collected from each replicate. BPH individuals were sorted to brachypterous (short-winged), macropterous (long-winged) and nymphs. Rice plants applied with N fertilizer became greener and taller, and produced with more tillers. However, BPH also reproduced and developed on, and colonized these rice plants. Regulating N fertilizer application can help minimize lugs, nitrogen fertilizer, nymphal development.

NILAPARVATA LUGENS; NYMPHS; NITROGEN FERTILIZERS; FERTILIZER APPLICATION; PEST CONTROL; APPLICATION RATES

Effects of weeding practices on the soil and litter arthropod diversity in corn (*Zea mays* L.). **Tambaoan, F.G.S., Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Caasi-Lit, M.T., Barrion-Dupo, A.L.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Panabang, B.B., Laude, R.A.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 191. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.**

The diversity of soil and litter arthropod in plots field of corn (*Zea mays* L.) was determined at different crop phenological stages (seed/seedling, vegetative, and reproductively) under two weeding treatments, namely: (1) regulated weeding, i.e. weeding during the early vegetative and at 30-40 days after planting; and (2) no weeding, each with three replications. A susceptible traditional open-pollinated white corn variety, IPB Var 6, was planted. Soil and little samples were gathered before planting and every other week thereafter, and were run through Berlese-Tullgren funnels for atleast 48 hours to extract the arthropods. Arthropods were sorted, preserved, processed, and identified. Individuals per morphospecies were counted and diversity indices computed. Insects and other arthropods belong to 14 insect orders/arthropod classes, most notably mites and collembolans. Treatments did not differ significantly until the pollen shed/reproductive stage. Removal of weeds decreased soil arthropods populations. There was higher soil arthropod diversity in unweeded (control) plots. Regulated weeding probably promoted plant diversity in the experimental plots and, in turn, encouraged soil arthropod diversity. Previous studies abroad have suggested that in supporting soil food webs, weed

rhizospheres may be more important than crop rhizospheres since crops tend to maximize their aboveground net primary productivity. Hence, weeds are significant in protecting soil biodiversity, especially in conventionally tilled agroecosystems. Conserving soil biodiversity is part of the pursuit for sustainable and environmentally sound agricultural practices.

ZEA MAYS; MAIZE; VARIETIES; ARTHROPODA; WEEDING; SOIL; BIODIVERSITY

Effects of weeding processes on the population of corn pests. Parakikay, T.P., Lit, I.L., Jr., Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Barrion-Dupo, A.L.A., Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Panabang, B.B., Laude, R.A.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 189-190. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Corn or maize is the second most important crop in the Philippines. Two main factors that reduce corn crop yield are insect pests and weeds. Weeds also include what are generally considered as alternate hosts of insect pests. Along this line, knowledge of weeds as alternate host of pests is also important in integrated pest management. We aimed to determine the effects of weeding practices on the population of pests and other arthropods associated with corn. A susceptible traditional open-pollinated white corn variety, IPB Var 6, was used with two treatments, namely: (1) regulated weeding, or weeding during the early vegetative and at 30-40 days after planting, and (2) unweeded plots, each with three replications. Insects and other arthropods were visually counted (non-destructive sampling) on selected plants at the inner rows. There were more major pests among weeded plots. Arthropods observed were predominantly pest species, and among the major pests, the Asian corn borer, *Ostrinia furnacalis* (Guenee), was the most recorded species. T-test showed no significant difference between the treatments ( $p$ -value= 0.93), probably because the available area cannot accommodate an experimental design that considers interplot migration of insects.

ZEA MAYS; MAIZE; OSTRINIA FURNACALIS; ARTHROPODA; WEEDING; MIGRATION; WEEDS; HOST PLANTS

Efficacy of corn event TC1507 and the hybrid stacked product TC1507XMON810XNK603 against secondary lepidopteran pests of corn in the Philippines. Caasi-Lit, M.T. [mclit@up.edu.ph](mailto:mclit@up.edu.ph). Lontoc, M.B.T.. Benigno, E.A. Philippines Univ. Los Baños, College

**Laguna (Philippines). Inst. of Plant Breeding. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 129-141.**

Field efficacy of transgenic maize event TC1507 expressing the Cry1F protein (containing event DAS-slashed zero 15 slashed zero7-1), event MON-slashed zero slashed zero 81slashed zero-6 and the stacked hybrid expressing Cry1F and Cry1Ab proteins (containing event DAS-slashed zero 15 slashed zero 7-1xMON-slashed zero slashed zero 81 slashed zero-6xMON-slashed zero slashed zero 6 slashed zero 3-6) against the four secondary lepidopteran pests, namely: common cutworm (CCW) *Spodoptera litura* (Fabricius), true armyworm (TAW) *Mythimna separate* (Walker), corn earworm (CEW), *Helicoverpa armigera* (Hubner), and corn semi-looper (CSL) *Chrysodeixis eriosoma* (Doubleday) was evaluated during the 2012 dry season in two regulated filed trials in Cauayan, Isabela and Alcala, Pangasinan [Philippines]. TC1507 provided effective control against CCW, CEW and CSL, and presented a new mode of action against the primary pest, the Asian corn borer (ACB) *Ostrinia furnacalis* (Guenee). On the other hand, the triple stacked hybrid (TC1507xMON810xNK603) provided effective control against all four secondary lepidopteran pests. The combined trait product offers broader spectrum for lepidopteran pest control aside from its excellent performance against ACB.

ZEA MAYS; HYBRIDS; SPODOPTERA LITURA; MYTHIMNA SEPARATA; HELICOVERPA ARMIGERA; CHRYSODEIXIS; OSTRINIA FURNACALIS; PEST CONTROL; TRANSGENIC PLANTS

Exploring soil mesofaunal diversity in cassava plantations. **de Roxas, M.C.dL., Cayabyab, B.F., Guerrero, M.S., Ardez, K.P. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 182-183. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines)*. 8-11 May 2018.

Cassava is one of staple or staple supplement foods for more than 15M Filipinos. This root crop is also use as raw material in the production for feeds, and other industrial products, and also as feed-stock for bio-ethanol production. Due to changing climate and developments in trade and economy, pest introduction and outbreak of endemic pests is highly possible. In combating these problems, one aspect of the agroecosystems often being disregarded is the soil and its role in pest and disease proliferation or suppression. To identify and determine status of soil micro-arthropod communities associated with cassava plantations as indicators for soil health and biodiversity, an initial survey and monitoring of soil micro-arthropod communities was done near Cagayan Valley Integrated Agricultural Research Center (CVIARC) in Ilagan and Naguilian, Isabela. Soil samples from cassava plantations in CVIARC, Brgy. [village] Camunatan and San Felipe in Iligan, and Brgy.

Cabaruan, Naguilian, all in Isabela, were randomly collected. Microarthropods from the soil samples were extracted using Berlese funnel. Collected samples were preserved, documented and preliminarily identified. Initial processed data show interesting view on soil faunal diversity indicating presence of predators and parasitoids. Data gathered from this study will be used as baseline information on the cassava microarthropod community. In the future, further studies could be explored on the dynamics of these organisms and their role on cassava plantations.

CASSAVA; PLANTATIONS; ARTHROPODA; FAUNA; PESTS OF PLANTS; SOIL; PREDATORS; PARASITIDS

Evaluation of local clay particles as coating agent and carrier of entomopathogen against cacao mirid bug, *Helopeltis bakeri* Poppius. **Albacete, S.C., Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 174-175. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Clay particles were compared with commercially available film as coating agent and carrier of the entomopathogen, *Metarhizium anisopliae* (Metch.) Sorok, to control cacao mirid bug (CMB), *Helopeltis bakeri* Poppius, using choice and no-choice tests. Cacao pods were coated separately with local clay particles (kaolin, zeolite, bentonite), and the commercially available US kaolin. Water and commercial insecticide served as negative and positive controls, respectively. US kaolin had the fewest feeding punctures but not significantly different from zeolite based on post hoc analysis and comparable to that of the insecticide treatment. Pods sprayed with water had the most feeding punctures. All insects died when exposed to cacao sprayed with insecticides. Since US kaolin and zeolite were efficient in protecting pods from CBM feeding, they were tested as carrier of *M. anisopliae*. Three checks were included: positive control (insecticide), negative control (water only), water as carrier of *M. anisopliae* infection 24 hours after exposure to cacao pods, as confirmed by positive *M. anisopliae* extraction from dead *H. bakeri* died from *M. anisopliae* infection in 24 hours after exposure to cacao pods, as confirmed by positive *M. anisopliae* extraction from dead *H. bakeri* through potato dextrose agar (PDA) plating, CMB exposed to water with *M. anisopliae* remained alive after 48 hours and not all PDA plates showed fungal growth. All *H. bakeri* died after exposure to pesticide, whereas with water only, all *H. bakeri* remained alive throughout the experiment. Hence, zeolite has the potential as effective biocoating agent for cacao pods and carrier of entomopathogen.

THEOBROMA CACAO; HELOPELTIS; SPECIES; HETEROPTERA; METARHIZIUM ANISOPLIAE; CLAY; COATING

Fall armyworm, Spodoptera frugiperda (J.E. Smith) (Lepidoptera:Noctuidae): biogeographical origin, distribution and spread. **Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith), had not been reported to occur in the Philippines based on pest records for the last 100 years or so. Recently, however, it is being monitored as it threatens to invade the Philippines, having been reported quite recently in Taiwan and in other neighboring Asian countries, most notably Indonesia (Sumatra) and Thailand. FAW is known to have originated from and is widely distributed in the Americas, but in 2016, it arrived and invaded Africa, and from there, it spread quickly in 2018 to India, and in 2019 to Sri Lanka and other Asian countries. The patterns of spread and colonization are similar to the trends observed for the *Erythrina* gall wasp, *Quadrastichus erythrinae* Kim which reached the Philippines around 2005 and killed coral trees up to 2012. Other invasive species that apparently show the same routes are the coconut leaf beetle, *Brontispa longissimi* Gestro, and possibly also, the spread of the rigid coconut scale, *Aspidiotus rigidus* Reyne from Indonesia and the Philippines to Vietnam. Extreme weather events attributed to the current climate change as well as inevitable consequences of global trade and international travel are among the suspected contributory factors in these current aggressive spread of invasive species like the FAW.

SPODOPTERA FRUGIPERDA; ASPIDIOTUS; GEOGRAPHICAL DISTRIBUTION; CLIMATIC CHANGE; WEATHER

Field parasitism of *Marietta carnesi* (Howard) (Hymenoptera:Aphelinidae) on *Comperiella calauanica* Barrion et al. (Hymenoptera:Encyrtidae) in Orani, Bataan, Philippines. **Amarinez, B.J.M., Arce, S.N.S. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit. Busmente, E.A.B., Labios, M.E.P. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biology Dept. Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 195. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

*Comperiella calauanica* Barrion et al. is a native, highly specific encyrtid endoparasitoid that is effective and efficient against the coconut scale insect, *Aspidiotus rigidus* Reyne. The



aphelinid *Marietta carnesi* (Howard) and its hyperparasitism on *C. calauanica* has been reported earlier. So far, *M. carnesi* has been the only confirmed natural enemy of the aforementioned encyrtid in the field. The hyperparasitism of *M. carnesi* on *C. calauanica* is here reported from samples collected in Orani, Bataan. Very low degrees of hyperparasitism were observed, with mean average values of 3.66%, 2.10%, and 1.70% recorded for three sampling periods. Correlation and regression analyses on the number of hyperparasitized scales against the number of parasitized scales seem to show a much lower degree of host density-dependence of hyperparasitism of *M. carnesi* compared to primary parasitism of *C. calauanica* on *A. rigidus*. These findings appear to strongly support the view that the occurrence of *M. carnesi* as hyperparasitoid would not have much implication on the efficacy of *C. calauanica* as biological control agent of *A. rigidus*.

COMPERIELLA; SPECIES; HYMENOPTERA; APHELINIDAE; ASPIDIOTUS; BIOLOGICAL CONTROL; HYPERPARASITISM; PARASITOID; PHILIPPINES

First record of *Verticillium epiphytum* Hansf. and *Fusarium* cf. *incarnatum-equiseti* species complex as entomopathogens of *Aspidiotus* spp. [Hemiptera:Diaspididae]. **Alforja, S.I.R. Zara, I.J.G., Cea, T.M., Latina, R.A., Magsino, E.A., Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 190. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The pathogenicity of putative entomopathogenic fungi collected from collected coconut scale insects (*Aspidiotus* spp.) cadavers were investigated in this study. The identities of these isolates were confirmed through nucleotide sequencing. ITS-primers were used for general identification of the isolates and those that were identified as *Lecanicillium* and *Fusarium* species were selected for further species identification using other markers. For the *Lecanicillium* species, large subunit (LSU) and small subunit (SSU) rRNA primers were used and through this the identity of the isolates were confirmed to be *Verticillium epiphytum* Hansf. Instead. On the other hand, using TEF-1 primers, it was found that the *Fusarium* species belong to any one of the following three species complexes: *F. incarnatum-equiseti* complex, *F. concolor* complex, and *F. fujikuroi* complex. Greenhouse bioassays studies were conducted using the identified isolates against the *Fusarium* sp. and *V. epiphytum* isolates are pathogenic against *A. destructor* and *A. rigidus*. Furthermore, this is the first record of its pathogenicity to both *Aspidiotus* spp.

VERTICILLIUM; SPECIES; FUSARIUM; ASPIDIOTUS; ENTOMOGENOUS FUNGI; NUCLEOTIDE SEQUENCE; NEW SPECIES; PATHOGENICITY

First report of the lanzones scale, Unaspis mabilis Lit and Barbecho (Hemiptera:Diaspididae), as a pest of cacao. Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). **Environmental Biology Div. Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Lucañas, C.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Alvarez, V.K.I., Latina, R.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 191. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The lanzones scale, *Unaspis mabilis* Lit and Barbecho (Hemiptera:Diaspididae), has been known since 2008 to infest lanzones leaves exclusively. It has demonstrated aggressive spread throughout almost all lanzones plantations from North Cotabato and Davao in Mindanao [Philippines] to various provinces in Luzon and, more recently, in Mindoro and Panay Islands. In 2017, mussel scales collected from cacao trees in Caticlan, Aklan, showed field characteristics that were quite similar to lanzones scales. Examination of slide-mounted specimens showed that they were indeed conspecific with those infesting lanzones. DNA extracted from the cacao-infesting scale insects matched the DNA barcode generated from a complementary study (GenBank Acc. Nos. MN114099, MN14101, and MN114102), and hence, supported the species identity based on morphological characters. The need for pest management R and D for *U. mabilis* is emphasized considering that cacao is a high value crop.

THEOBROMA CACAO; UNASPIS; SPECIES; COCCOIDEA; HEMIPTERA; DIASPIDIDAE; LANSIUM DOMESTICUM; DNA; CYTOCHROME C OXIDASE; PEST CONTROL

Household ants (Hymenoptera:Formicidae) of Tangub, Misamis Occidental [Philippines]. **Pancho, U.Z., Lit, I.L., Jr., General, D.E.M. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 191-192. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Tangub is the smallest city in northern Mindanao [Philippines] where majority of the population are farmers and like in other urban areas, ants are common pests in households. Protein (canned plain tuna flakes) and concentrated sugar solution baits were used to

determine appropriate baiting methods for an ant pest control. Collected ants were preserved in 95% ethanol, examined in the laboratory, and identified at least up to genus level. Six genera were identified, namely: *Monomorium*, *Paratrechina*, *Pheidole*, *Solenopsis*, *Tapinoma*, and *Tetramorium*. The average numbers of species and of individuals attracted were not significantly different between the two baits. The most abundant species was *Solenopsis geminate* (Fabricius), which was apparently more attracted to the tuna baits. The other species baited from various households were *Monomorium pharaonic* (L.), *Paratrechina longicornis* (Latreille), *Pheidole* sp., and *Tapinoma melanocephalum* (Fabricius). *Tetramorium* sp. was only encountered once. Based on Simpson's Index of Diversity, sugar baits attracted more species.

FORMICIDAE; HOUSEHOLDS; HYMENOPTERA; SUGAR; TUNA; MONOMORIUM; PHEIDOLE; TETRAMORIUM; PEST CONTROL; PHILIPPINES

Identification of bacterial entomopathogens of *Spodoptera exigua* (Hubner) (Lepidoptera:Noctuidae). Navasero, M.M., Mendoza, M.J.C. **Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 203-204. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

*Spodoptera exigua* (Hubner) is devastating insect pest of onion that causes economic losses in major-onion producing areas in the country. In search for options in managing the insect pest, entomopathogens that could serve as biocontrol agents against the insect pest were identified. Isolation of the potential entomopathogens were obtained from the gut portion of dead *S. exigua* larvae. The isolates were identified through colony morphology in potato dextrose peptone agar growth media and molecular characterization. Out of 12 isolates, there were only four distinct colonies identified based on morphological characteristics. Of these, one distinctly belongs to *Enterobacter cloacae* (Jordan) Hormaeche and Edwards (100%) while the other three were close to *Cronobacter sakazakii* (Farmer et al.). other three were close to *Cronobacter sakazakii* (Farmer et al.) Iverson et al. (90%), *E. cloacae* (92%), and *Serratia marcescens* Bizio (85%) but were suggestive of novel species based on molecular identification.

SPODOPTERA EXIGUA; IDENTIFICATION; BIOLOGICAL CONTROL; ONIONS; PLANT PRODUCTION; PEST INSECTS; ENTOMOGENOUS FUNGI

Induction of sterility on coconut leaf beetle, *Brontispa longissima* Gestro (Coleoptera:Chrysomelidae) through gamma radiation. Javier, A.M.V., Obra, G.B. **Philippine**

**Nuclear Research Inst.-Dept. of Science and Technology. Commonwealth Avenue, Diliman, Quezon City (Philippines). Gallego, Ma.C.E. Philippine Coconut Authority, PCA Complex, Bago-Oshiro, Turbok District, Davao City, Davao del Sur (Philippines). Zipagan, M.B. Philippine Coconut Authority, Rizal St, Legazpi City, Albay (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 173-174. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The sterilizing effect of irradiation on *Brontispa longissima* Gestro was studied using different doses of gamma radiation. Tests showed that the pupal stage was more radiosensitive than adults, while females were more radiosensitive than males. Validation trials showed that there is need to increase the dose from 40 to 45 Gy and using different ratios involving unirradiated females and males, and irradiated males. The relative sterility index (RSI) values of the irradiated males obtained ranged from 0.17 to 0.39. Increasing the number of irradiated males increased their competitiveness. A ratio of 1:1:15 was the most competitive with a RSI of 0.39 under laboratory conditions, indicating that unirradiated females mated indiscriminately with unirradiated and irradiated males. Hence, the use of radiation-induced sterility for sterile insect technique may be possible for the management of *B. longissima*.

COLEOPTERA; SPECIES; COCONUTS; GAMMA IRRADIATION; ANIMAL DEVELOPMENTAL STAGES

Influence of fruit physico-biochemical properties of Philippine 'Carabao' mango cultivars on the ovipositional preference and insect development of oriental fruit fly, *Bactrocera dorsalis* (Hendel). **Sison, M.L.J., Cortaga, C.Q., Barcos, A.K.S., Laurel, N.R., Javier, R.D., Mateo, J.M.C. Philippines Univ. Los Baños, College Laguna (Philippines). Inst. of Plant Breeding.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 197. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Philippines is regarded as a major world exporter of 'Carabao' mango. This mango variety is also reputed internationally as among the world's sweetest. However, the export potential of this variety cannot be maximized due to insect pests such as the Oriental fruit fly, *Bactrocera dorsalis* (Hendel), which are most often difficult to control. To address this concern, the Institute of Plant Breeding-UPLB [University of the Philippines Los Baños], with support from DOST-PCAARRD [Department of Science and Technology-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development], continuously identifies and evaluates putative fruit fly-resistant mango accessions. In this study, five least

and five most preferred 'Carabao' mango accessions were correlated with different fruit physico-biochemical characteristics, to understand their influence on the ovipositional preference and development of *B. dorsalis*, and to elucidate possible physico-biochemical bases of resistance/susceptibility of mango fruits. Pearson correlation analysis of least and most preferred accessions showed that ovipositional preference was positively correlated to adult emergence ( $r=0.840$ ), flesh % protein ( $r=0.662$ ), peel % protein ( $r=0.760$ ), flesh total flavonoids ( $r=0.953$ ) and peel total flavonoids ( $r=0.694$ ) while peel firmness ( $r=0.594$ ), flesh % fat ( $r=0.756$ ), peel % fat ( $r=0.644$ ) and pH ( $r=0.591$ ) showed a negative correlation. For adult emergence, there was a positive correlation with ovipositional preference ( $r=0.840$ ), peel % moisture ( $r=0.561$ ), flesh % fat ( $r=0.553$ ) and peel % relative scavenging activity ( $r=0.813$ ) showed a negative correlation. The results can help in selecting and improving Philippine 'Carabao' mango with resistance to *B. dorsalis*.

MANGIFERA INDICA; VARIETIES; BACTROCERA DORSALIS; CHEMICOPHYSICAL PROPERTIES; OVIPOSITION; HOST PLANTS; PEST RESISTANCE; PEST CONTROL

Insect pest and natural enemies of processing tomato in Ilocos Provinces [Philippines].  
**Cayabyab, B.F., Gonzales, P.G., Padilla, J.dG., Benigno, M.P. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Mendoza, N.D., Dela Cruz, R.G. Northern Foods Corp., Sarrat, Ilocos Norte (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 183. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The succession of insect pests in the production of processing tomato in Ilocos Region [Philippines] was studied. Processing tomato is planted after rice in Ilocos Region was studied. Processing tomato is planted after rice in Ilocos region where the only operational processing plant in the Philippines is located (Northern Foods Corporation). The processing tomato is grown in a total area of 800 ha involving about 2,000 contract growers, each with an average of 0.40 ha landholdings. Tomato growing barangays [villages] representing the agro-ecology of the province were selected randomly. Fields of farmers that grow the most popular tomato variety of the region were selected, assigned and utilized from first observation until the end of planting season. In each field, five spots were selected randomly, and in each spot, arthropods were counted of five random plants and recorded. Preliminary results showed high incidence of leafminer *Liriomyza sativae* Blanchard, whiteflies (*Bemisia tabaci* (Gennadius)), hoppers, tomato fruit worm *Helicovera armigera* (Hubner), and black winged aphids. The 28-spotted lady beetle *Epilachna vigintioctopunctata philippinensis* (Dieke), cutworm *Spodoptera litura* (Fabricius), mealybugs, and dipterans were also observed. Meanwhile, together with the predatory bug

Cyrtopeltis tenuis Reuter, coccinellid beetles, parasitoids, and different season will be done to fully characterize the succession of insect pest in processing tomato production.

LYCOPERSICON ESCULENTUM; LIRIOMYZA SATIVAE; RICE; BEMISIA TABACI; HELICOVERPA ARMIGERA; APHIDOIDEA; EPILACHNA VIGINTIOCTOPUNCTATA; SPODOPTERA LITURA; PSEUDOCOCCIDAE; NATURAL ENEMIES

Insect pests and their associated natural enemies on lowland potato grown in Batac, Ilocos Norte [Philippines]. Legaspi, N.B., Atis, M.I., Sagsagat, F.C., Lucas, M.P. Mariano Marcos State Univ., Roosevelt Avenue Brgy. 12 San Blas, Paoay, 2902 Ilocos Norte (Philippines). Reyes, C.P. Cagayan State Univ., Tuguegarao, Cagayan (Philippines). Barrion, A.T., Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 201. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Previous researches confirmed that potato can be cultivated in the warm Ilocos [Philippines] lowlands. Hence, the Lowland Potato Production Technology was developed to increase potato production where it proved feasible, profitable and socially acceptable. The diversity of cropping in the region, however, encourages built-up of insect pests. The abundance of insect pests and their associated natural enemies was documented to assess the sustainability of lowland potato production under a bio-based pest management strategy. Fifteen heat-tolerant potato varieties were planted in Batac, Ilocos Norte in November 2018. To obtain natural pest pressure and biological control occurrence in the test field, no chemical was sprayed throughout the growing period. Monitoring was done through beating and pitfall methods at vegetative and mature crop stages. Insect count, sorting and identification was done in the laboratory and yielded eight orders of insect pests dominated by thrips. Among potato varieties, Bengueta was the most susceptible to thrips infestation. Six species of natural enemies were identified including ants and spiders. The performance of potato varieties was also assessed in terms of yield. Of the 15, three performed the best: Gloria (8.89 t/ha, Raniag (8.19 t/ha), and Meva (6.24 t/ha). Successful growing of lowland potato is possible without chemical spraying. This could be used as springboard in developing a sustainable lowland potato farming system with biological control as one of the measures in its pest management program.

POTATOES; SOLANUM TUBEROSUM; VARIETIES; LOWLAND; NATURAL ENEMIES; PEST INSECTS; PEST CONTROL; PHILIPPINES

Inter-and intra-specific competition among gregarious and solitary endoparasitoid wasps and the phenomenon of 'resource sharing'. **Magdarog, P.M., Tanaka, T. Nagoya Univ., Furocho, Chikusa Ward, Nagoya, Aichi 464-8601 (Japan). Lab. of Applied Entomology Div. of Biofunctions Development.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 172. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Inter- and intra-specific competitions occur naturally between two or more female parasitoids foraging for hosts (=extrinsic) and multiple larvae competing for host resources within the same individual host (=intrinsic). Understanding these interactions is important in biocontrol for selecting effective agents and management strategy to avoid conflict among exotic and native natural enemies. Authors evaluated foraging strategies and intrinsic competitive interactions among three endoparasitoids, the solitary *Meteorus pulchricornis* (Wesmael), and the gregarious *Cotesia kariyai* (Watanabe) and *C. ruficrus* (Haliday) in their common host, *Mythimna separata* (Walker). During foraging, both *M. pulchricornis* and *C. kariyai* discriminated between unparasitized and 4-7 day-old host larvae post-oviposited by conspecific and heterospecific wasps. However, super- and multiparasitism occurred even when host larvae were 2-day post-parasitized. Also, once parasitoid larvae within hosts were at 1st-2nd instar, super- and multiparasitism were avoided. Host discrimination abilities may have been occurred from volatiles of damaged plants and internal mechanism from 4-7 post parasitized hosts. Outcome of intrinsic competition was affected by host stage when multiparasitism occurred and time interval of oviposition *M. pulchricornis* and *C. kariyai* were both generally superior to *C. ruficrus*, although occasionally and latter outcompeted *C. kariyai* in multiparasitized host. Competitive advantage of superior species maybe due to their mandibles. Remarkably, gregarious parasitoids were able to share host resources enabling them to occasionally emerge from multiparasitized host especially with short interval between attacks. However, cumulative brood sizes of both species were generally less than when either *Cotesia* species developed alone.

COTESIA; METEORUS; SPECIES; MYTHIMNA SEPARATA; VESPIDAE; FEMALES; PARASITIDS; PARASITOSSES; NATURAL ENEMIES

Invasive fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera:Noctuidae): distinguishing characteristics. **Barrion-Dupo, A.L.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 198-199. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith), is a pest known to subsist and inflict damage to economically important grasses like corn and rice. The lepidopteran has been recorded to have moved from its South American origin to Africa in 2016. From Africa, FAW has made its way to Asia; larvae attacking inside the whorls and destroying developing corn tassel. Hence, it is important to farmers to properly identify this pest before initiating pest control measures. At present, there are five species of *Spodoptera* that are known to occur in the Philippines: 1) beet or onion armyworm, *S. exigua* (Hubner); 2) African armyworm, *S. exempta* (Walker); 3) common cutworm, *S. litura* (Fabricius); 4) lily caterpillar, *S. picta* (Guerin-Meneville); and 5) lawn armyworm, *S. Mauritia* (Boisduval). FAW larvae can upside-down Y pattern in the frontal aspect of the larval head. In addition, four large dots arranged as a square mark the dorsal side of the last larval body segment. Meanwhile, the dots on the other larval body segments are arranged in a trapezoid.

SPODOPTERA FRUGIPERDA; MAIZE; RICE; PEST INSECTS; IDENTIFICATION; LARVAE; CROP LOSSES

Invasive thrips injurious to garlic (*Allium sativum* L.) in Ilocos Norte, Philippines. **Reyes, C.P. Cagayan State Univ., Tuguegarao, Cagayan (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 196. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

'Ilocos White' is the most common variety planted for commercial garlic production in the Philippines. Thrips or 'kulisipsip' are associated with this variety in the Experimental Area of Mariano Marcos State University, Batac, Ilocos Norte. Accurate identification of thrips infesting garlic is crucial in designing appropriate pest management strategies. Thrips samples were collected at random in about 200-m plot planted to 'Ilocos White' in the said area in January-February 2019, at late vegetative stage by shaking and beating plants on white board. Specimens were sorted under a light microscope. Two species of thrips are infesting garlic plants in the study area, namely: *Thrips tabaci* Lindeman, an invasive terebrantian known as pest of onion and confirmed as vector of viral and bacterial pathogens in other countries, and *Haplothrips gowdeyi* Franklin, an invasive tubuliferan associated with flowers of Poaceae and Asteraceae plants. Females and larvae of *T. tabaci* were found on almost all samples while the population of *H. gowdeyi* was low, probably due to the absence of garlic flowers. There was no male *T. tabaci* in the collection which could mean that the thrips population on garlic maybe parthenogenetic. Based on these findings, detection of viral and bacterial pathogens in *T. tabaci* and garlic tissues, and



monitoring of *H. gowdeyi* population on flowering garlic are recommended.

ALLIUM SATIVUM; GARLIC; VARIETIES; THRIPS TABACI; HAPLOTHRIPS; PEST CONTROL; IDENTIFICATION; PATHOGENS; INFESTATION

Larval antibiosis to yellow stem borer, *Scripophaga, incertulas* (Walker), among traditional rice varieties. **Rillon, G.S., Encarnacion, C.C.B., Dela Cruz, M.B., Santiago, G.C., Parcada, I.G. Philippine Rice Research Inst. Central Experiment Station, Maligaya, Muñoz, Nueva Ecija (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 202. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Philippines is home to various kinds of microflora. A large portion of the Philippine microflora includes actinomycetes (Actinomycetales). They are Gram-negative bacteria that are prolific producers of various natural products. However, actinomycetes remain unexplored especially in the search for different insecticidal natural products. Production of natural insecticides in actinomycetes is typically low such that an effective elicitation method is required to increase in microbial production of the insecticidal compounds. One hundred fifty-six BIOTECH actinomycete strains were screened for insecticidal activity against neonate larvae of Asian corn borer (ACB), *Ostrinia furnacalis* (Guenee). Seven out of 156 strains were found to have moderate insecticidal activity against ACB. Addition of rare earth elements (REE) Lanthanum (La) and Scandium (Sc) in culture media enhanced the insecticidal activity of three out of seven actinomycetes strains by up to two-fold. Despite the less dramatic effect of REE treatment on insecticidal activity, the appearance of potentially novel compounds in REE-treated strains might provide a new mode of action insecticide. Thus, REE proved to be an effective method in eliciting insecticidal compounds from actinomycetes.

ORYZA SATIVA; RICE; VARIETIES; INDIGENOUS ORGANISMS; STEM EATING INSECTS; SPECIES; LARVAE; DEFENCE MECHANISMS; ACTINOMYCETALES; OSTRINIA FURNACALIS

Larval ecology of *Anopheles* mosquitoes in Kudat, Sabah, Malaysia. **Aure, W., Chua, T.H. Research Inst. for Tropical Medicine, Filinvest Corporate City, 9002 Research Dr, Alabang, Muntinlupa (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 195. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Malaria remains one of the most important mosquito-borne diseases in Malaysia. Knowledge on vector ecology is needed for suitable disease management. Data are still

limited on Anopheles larval ecology in Kudat, Sabah, Malaysian Borneo, one of the main endemic areas for malaria particularly Plasmodium knowlesi Sinton and Mulligan (Pk). The contribution of land use types and physicochemical characteristics of aquatic habitats to conditions favorable for vector larval development and density, was investigated, especially Anopheles. A longitudinal survey of mosquito larval abundance, diversity, and habitat types. GLMM predicted mean value of Anopheles larvae were highest in rubber tree (1.66, SE 0.40) followed by coconut (0.91, SE 0.40), clearing sites (0.81, SE 0.36) oil palm (0.62, SE 0.42), settlement (0.56, SE 0.41), and least, in forested areas (0.46, SE 0.42). In terms of abundance, An. Balabacensis Baisas (75.7%) > An. Barbirostris van der Wulp (1.9%) = An. Lesteri de Meillon (1.9%) = An. Borneensis MacArthur (1.9%) > Aedes albopictus (Skuse) (17.7%) > Cx. Gelidus Theobald (0.9%). Important breeding sites of An. Balabacensis larvae were artificial containers (21%), puddles (21%), and intermittent streams (58%). Larval densities vary with land use types. Human activities promoted proliferation of breeding habitats for Anopheles mosquitoes, particularly An. Balabacensis. Thus incorporating the aspect of deforestation in health policy and malaria research is recommended for better insights and understanding effects of ecological changes in Pk malaria transmission.

ANOPHELES; CULICIDAE; LARVAE; ECOLOGY; PLASMODIUM KNOWLESI; MALARIA; DISEASE TRANSMISSION; MALAYSIA

Lepidopteran pests of corn in the Philippines vis-a-vis the imminent invasion by the fall armyworm, Spodoptera frugiperda (J.E. Smith) (Lepidoptera:Noctuidae): quick review and nature of damage. **Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 199. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

A quick review of the field characteristics of lepidopteran pest of field corn already known to occur in the Philippines as well as their nature of damage is provided. This aims to provide field technicians, research entomologists, and other workers a working familiarity, especially of species closely related to the fall armyworm (FAW), Spodoptera frugiperda (J.E. Smith). Diagnostic notes and photographs of the following are provided: the Asian corn borer, Ostrinia furnacalis (Guenée) (Crambidae) and the species of Noctuidae, namely: the corn earworm Helicoverpa armigera (Hubner); true armyworm, Mythimna separata (Walker); common cutworm, S. litura (Fabricius); and the corn semi-looper, Chrysodeixis eriosoma (Doubleday). Aside from the morphological characteristics enumerated for the larvae of these species, their damage to field corn is nowhere similar to what is known in other countries for FAW. Characteristic larval features and damages to corn that differentiate each of these lepidopterous species are discussed.

ZEA MAYS; MAIZE; SPODOPTERA FRUGIPERDA; PEST CONTROL; PEST INSECTS; CROP LOSSES; PHILIPPINES

Management of onion armyworm, Spodoptera exigua (Hubner) through the use of Spodoptera exigua nucleopolyhedrovirus (NPV). Guerrero, M.S., Cayabyab, B.F., Alforja, L.M., Perez, E.A., Aquino, A.G., Sagado, W.S., Valdez, R.B. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 169. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Onion, *Allium cepa* L., is a high value crop in the Philippines and in 2016, approximately 20M dollars were lost due to the infestation of onion armyworm (OAW), *Spodoptera exigua* (Hubner). Significant losses resulted from that insect outbreak exacerbated by climate change. To address the use of nucleopolyhedrovirus (NPV), being highly specific, environmentally safe and effective, is an ideal part of IPM strategy. Efficacy of NPV against AOW was evaluated through laboratory and potted experiments. Local strains of OAW NPV were collected and isolated from field collected and laboratory reared larvae. NPV were collected and isolated from field collected and laboratory reared larvae. NPV infected larvae were placed in microcentrifuge tubes and stored in the refrigerator until use. Two treatments, one with NPV infection and other control, replicated three times for three trials were conducted at the NCPC, UPLB [National Crop Protection Center, University of the Philippines Los Baños]. Field application of NPV for efficacy tests showed promising results. NPV infected larvae were already observed in the field. NPV infected larvae apparently stopped feeding, were soft, shiny, and fragile. Upon death, larval bodies liquefy and disintegrate having characteristically foul odor. Microscopy of NPV infected larvae showed polyhedra appearing as irregular, thickened particles enveloped in a cell. Laboratory and potted experiments resulted to 72 and 62.5 percent mortality, respectively. Hence, NPV was effective in killing OAW larvae indicating high potential for use in biocontrol as part of an IPM strategy.

ALLIUM CEPA; ONIONS; SPODOPTERA EXIGUA; VIROSES; LARVAE; PEST CONTROL; INTEGRATED PEST MANAGEMENT

Mapping the potential geographic distribution of the coconut scale insect *Aspidiotus rigidus* Reyne using maximum entropy (MaxENT) modelling in the Philippines. Panga, I.B. [ibapanga@gmail.com](mailto:ibapanga@gmail.com), Hamor, N.H., Diño, J.U., Caoili, B.L., Laquinta, J.F., Sapin, G.D., Yap, S.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science,

**Entomology and Plant Pathology.** msayap3@up.edu.ph. Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 181. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The recent coconut scale insect outbreaks in CALABARZON [Cavite, Laguna, Batangas, Rizal, and Quezon, Philippines] in Luzon, and Basilan and Zamboanga in Mindanao have threatened the Philippine coconut industry. The rapid progression of the outbreaks was due to the introduction of a foreign invasive coconut scale species, *Aspidiotus rigidus* Reyne as confirmed by molecular analysis. In this study, Maximum Entropy (MaxEnt) Modelling was used to map the potential geographic distribution of *A. rigidus* Reyne as confirmed by molecular analysis. In this study, Maximum Entropy (MaxEnt) Modelling was used to map the potential geographic distribution of *A. rigidus* in the Philippines based on associations between known occurrence records and a set of environmental variables. Model performance was evaluated by area under the curve (AUC) which showed high values for training and test data indicating a high level of discriminatory power of the MaxEnt prediction. Variable such as annual range and seasonality of temperature had the highest contributions to the prediction. Highly suitable areas for *A. rigidus* are CALABARZON, Basilan, and southern part of Zamboanga Sibugay, while moderately suitable areas include Camarines Norte, Marinduque, Palawan (central), Negros, and Misamis Oriental, and South Cotabato in Mindanao.

ASPIDIOTUS; SPECIES; GEOGRAPHICAL DISTRIBUTION; MODELS; EVALUATION; PHILIPPINES

Mark-recapture method: a new dimension in managing the rice black bug, *Scotinophara sorsogonensis* Barrion et al. (Hemiptera:Pentatomidae) in Bicol Region, the Philippines. **Mostoles, M.D.J. Central Bicol State Univ. of Agriculture, Pili, Camarines Sur (Philippines). Crop Protection. Barrion-Dupo, A.L.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Capricho, M.A.A., Barrion, A.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Section. albertobarrion1114@gmail.com. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 143-158.**

A new mark-recapture technique for adult rice black bugs (RBB), *Scotinophara sorsogonensis* Barrion et al. (Hemiptera:Pentatomidae), successfully determined for the first time, the mode of migration, flight dispersal pattern, and distance traveled by RBBs. The water resistant, luminous Aervoe Glo sup TM paint was placed as small dots on the pronotum and scutellum, each dot representing the specific date of field release during full moon (FM) and non-full moon (NFM) periods. Altogether, 27,000 (13,000 for FM and 14,000

for NFM) RBB adults were marked and released in the farmer's field between 1800 and 1830H in Mabca, Sagnay, Camarines Sur. More RBBs migrated during NFM (5,566) coupled with calm weather. NFM recovery of marked adults was highest (93.8%) in July and lowest (21%) in August, whereas recoveries were only 65% in June and 32% in September for FM period. Catch patterns in order of preponderance were W-N-NW-NW for NFM and SE-N-W-E for FM. Marked bugs traveled short (0.1m-30m) and long (2- >30km) distance modes depending on weather patterns. About 27% of marked RBBs were unaccounted for and presumed to have migrated over long distances beyond monitoring points. Results challenged previous RBB management recommendations and new ones are enumerated. The mark-recapture method applied nocturnally for monitoring RBB migration facilitated identification of species of predators in the field such as earwigs (four), carabids (11), anthicid (one), reduviids (three), and spiders (eight). Further, the generalist *Rhinella marina* (L.) was observed to consume 808-1, 214 adult RBBs per predation activity.

SCOTINOPHARA; SPECIES; RICE; PEST CONTROL; MIGRATION; NATURAL ENEMIES; PHILIPPINES

Molecular identification and preliminary genetic diversity analysis of tobacco stemborer, *Scrobipalpa aptatella* (Walker) (Lepidoptera:Gelechiidae) from Northern Mindanao [Philippines] using cytochrome c oxidase I. Ogot, A.V., Latina, R.A., Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. blcaoili@up.edu.ph. *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 159-170.

*Scrobipalpa aptatella* (Walker) or tobacco stemborer (TSB) is a reported pest of tobacco worldwide. Its damage is characterized by stem tunnels created by larval feeding that consequently result to stem galling and wilting as the infestation progresses. Proper identification of TSB is crucial in establishing effective control measures to prevent serious infestation. DNA barcoding was used to establish the identity of TSB infesting tobacco plantations. Using cytochrome c oxidase I (COI) gene as the molecular marker, TSB samples collected from Claveria, Misamis Oriental and Bukidnon [Philippines] revealed 99.0% nucleotide similarity to *S. aptatella* (Walker) COI sequence (GenBank Acc. No. KF388766). Multiple alignments of the COI sequences showed single nucleotide polymorphism within and between the collected populations. Haplotype and nucleotide diversity analyses resulted to values of 0.2584 and 0.00074, respectively that revealed five haplotypes. These haplotypes showed distinct separation in the phylogenetic tree constructed. Evidence of TSB population expansion was also observed based on Tajima's D and Fu's tests of neutrality. The occurrence of *S. aptatella* in these production areas calls for the development of control measures against TSB infestation.

SCROBIPALPA; SPECIES; STEM EATING INSECTS; TOBACCO; DNA; INFESTATION; GENETIC MARKERS; PHILIPPINES

Molecular identification of nucleopolyhedrovirus (NPV) isolated from onion armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera:Noctuidae). **Cayabyab, B.F., Guerrero, M.S., Laquinta, J.F., Alforja, L.M., Aquino, A.G., Perez, E.A., Gaylon, M.P. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 204. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

A nucleopolyhedrovirus (NPV) sample from Onion armyworm (OAW), *Spodoptera exigua* (Hubner) was collected in a spring onion field at Sitio Tanibong Abar 1st San Jose City, Nueva Ecija on 25 August 2017. Filtered and crude NPV extracts were both tested in the field and laboratory. Preliminary laboratory tested resulted to 62.5% and 72% mortality for filtered and crude extracts, respectively. Laboratory rearing of OAW ensured continuous supply of infected larvae. Molecular characterization of the NPV using Polh and Lep 9 genes resulted to 99% nucleotide identity with *S. exigua* multiple nucleopolyhedrovirus (SeMNPV). The outcome suggests that this NPV indeed came from OAW and can be used as an sequenced with both forward and respective reactions.

SPODOPTERA EXIGUA; ONIONS; LARVAE; IDENTIFICATION; PEST CONTROL; PEST INSECTS; PHILIPPINES

Molecular identification of the coconut scale insects *Aspidiotus rigidus* Reyne and *Aspidiotus destructor* Signoret in the Philippines. **Ishitani, N., Watanabe, K. Ehime Univ., 10-13 Dogohimata, Matsuyama, Ehime 790-8577 (Japan). Dept. of Civil and Environmental Engineering.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 178-179. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The Philippines faced a devastating coconut scale insect (CSI) outbreak damaging 2.7 million coconut palms in the provinces of Batangas, Cavite, Laguna and Quezon [Philippines] in 2009-2014, and in Basilan and Zamboanga until recently. Severely infested coconut palms dry up and die within six months. The invasive CSI species was initially identified as *Aspidiotus destructor* Signoret, but further morphological analysis pointed *A. rigidus* Reyne as the correct identification. *A. destructor* has been documented since 1905 with no serious infestation reports, possibly due to effective natural enemies. On the other hand, *A. rigidus*

is believed to have been introduced to the Philippine either by wind or accidental importation of infested coconut palms. *A. destructor* and *A. rigidus* are difficult to separate morphologically. Both species have pyriform bodies, without stigmatic pores and prepygidial ducts, and indistinguishable pygidial characteristics. However, some features of live specimens and biology of the two species can facilitate identification. Samples collected from laboratory reared and field populations were preliminary identified based on host specificity, and egg-skin arrangement. Authors sequenced the mitochondrial cytochrome c oxidase subunit I (COI) gene (barcoding region) and the nucleotide elongation factor 1a (EF-1a) gene. Sequence data from both genes distinguished *A. rigidus* from *A. destructor*. Variation was also observed on both markers between Northern and Southern *A. rigidus* populations in the country.

ASPIDIOTUS; SPECIES; COCONUTS; NUCLEOTIDES; IDENTIFICATION; INFESTATION

Morphometric analysis of antenna, rostrum, and forewing of *Proutista moesta* (Westwood) (Hemiptera:Derbidae) in different populations and host plants. **Hamor, N.H., Yap, S.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology.** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 176-177. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Antennae, rostrum and forewings of *Proutista moesta* (Westwood) collected from citronella (Agronomy medicinal garden, UPLB [University of the Philippines Los Baños, Laguna, Philippines], coconut (Aborlan, Palawan, corn (Aborlan, Palawan; Pangpang, Sorsogon; Pili Drive, UPLB; Kabacan, North Cotabato), sugarcane (Pili Drive, UPLB), and banana (Odiongan, Romblon) were illustrated and measured. Character variations among populations were analyzed using traditional and geometric morphometric analyses. Stylet of rostrum and flagellum of antenna have significant variation ( $p$  value  $<0.05$ ). Rostrum-stylet in sugarcane is significantly different from rostrum-stylet in corn-Kabacan (Adjusted  $p$ -value= $0.012 < \alpha=0.05$ ) and in corn-Palawan (Adj.  $p$ -value= $0.000 < \alpha=0.05$ , corn-Pili drive (Adj.  $p$ -value= $0.005 < \alpha=0.05$ ), and sugarcane (Adj.  $p$  value= $0.000 \alpha=0.05$ ). Canonical Variate Analysis showed that wing shape varies across host plants. Bivariate plot showed significant forewing shape varies across host plants. Bivariate plot showed significant forewing shape differences across hosts plants and between populations (Mahalanobis distance  $p<0.05$ ).

HEMIPTERA; SPECIES; DRUG PLANTS; COCONUTS; MAIZE; SUGARCANE; BANANAS; POPULATION GENETICS; HOST PLANTS; ANIMAL MORPHOLOGY

Morphometric analysis of wing elements of the genus *Cleora* (Lepidoptera:Geometridae) in Mts. [Mounts] Guiting-Guiting and Makiling, Philippines. **Huet, A.M.O., Lit, I.L., Jr., Barrion-Dupo, A.L.A., De Chavez, E.R.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Biological Sciences.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 188. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

*Cleora curtis* is a common genus of Geometridae in lowland forests. Its species delineation relies on careful examination in genitalia. This study used morphometric analysis of wing pattern elements in an attempt to distinguish *Cleora* species collected from Mts. Guiting-guiting and Makiling [Philippines]. There are four new records from Mt. Guiting-guiting, namely: *C. injectaria*, *C. propulsaria*, *C. pupillata luzonensis*, and *C. onycha onycha*. *C. onycha onycha* is also a new record for the Philippines. In Mt. Makiling, there are six species, namely; *C. batillata*, *C. contiguata bigladiata*, *C. determinate*, *C. decisaria*, *C. inoffensa*, and *C. lacteata*. Linear measurements of meristic elements of the *Cleora* wings as well as geometric analysis were done. In the linear character analysis of forewing and hindwing species are not distinguished. In contrast, shape analysis of forewing successfully discriminated the species as indicated by the significant Mahalanobis distance. However, for hindwing, the species clumped together indicating that the shapes are closely similar. Overall, results of the linear and geometric analysis of these wing elements were subjected to principal component analysis (PCA). PCA showed overlaps between species. Meanwhile, canonical variance analysis (CVA) revealed that although clustering was observed on wing shape, there were only minimal differences. Therefore, among the characters analyzed, only geometric morphometrics of the forewing, particularly the shape, can be used as a tool to differentiate *Cleora* species.

LEPIDOPTERA; SPECIES; GENERA; IDENTIFICATION; WINGS; HIGHLANDS; PHILIPPINES

New coleopteran pest record on mango in Ilocos Norte [Philippines]. **Cayabyab, B.F., Magsino, G.L., Ebuenga, M.D., De Roxas, M.C.dL., Alforja, L.M. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 188-189. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Four samples of a coleopteran pest on mango from Ilocos Norte, Philippines were forwarded by Chief Marivic Begonia of the RCPC [Regional Crop Protection Center] 1, San Fernando, La Union Center on February 13, 2019 to the UPLB-NCPC [University of the Philippines-National Crop Protection Center]– Quick Response Team. The pest, identified as



Deporaus sp. (Mango leaf-cutting beetle) (Coleoptera:Rhynchitidae), is a new record. The characteristic damage of the mango leaf-cutting weevil as observed in the field on March 28, 2019 are cut young leaves. Infestation is characterized by 'window panes' (scraping adaxial leaf epidermis) on young leaves by adult weevils. It attacks new flushes of leaves, turning the affected leaves brown, curly, and crumpled. A similar pest on mango was recorded in nearby countries such as India , Thailand, Malaysia, Bangladesh, and China. Reports on the genus Deporaus in the Philippines do not include its historical infestation on mango. A collaborative research, development, and capacity-building will be conducted shortly with the concerned farmers, LGUs, [local government unit] RCPC 1 and the project staff.

COLEOPTERA; LEAF EATING INSECTS; NEW SPECIES; IDENTIFICATION; MANGOES; PHILIPPINES

Non-host status of Philippine 'Hass' avocados (Persea Americana Mill.) to fruit flies Bactrocera dorsalis (Hendel) and B. occipitalis (Bezzi) (Diptera:Tephritidae). **Lantican, G.A. Dole Philippines, Inc., Davao City (Philippines).** Philippine Entomologists. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 197. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The host status of 'Hass' avocados (Persea americana Mill.) to two fruit fly species Bactrocera dorsalis (Hendel) and B. occipitalis (Bezzi) was studied in Dole Philippines orchards from 2009 to the present. The procedure and this report adapts the ISPM 37 protocols as of April 2016. The two fruit fly species are found in the avocado orchards. Of the 79,404 commercially mature fruits harvested hard green and collected from the field and from the packing house, zero fruit was found with any fruit fly infestation. Different field caging test under semi-natural field conditions were carried out in Tupi, South Cotabato; Calinan, Davao City; and Malaybalay, Bukidnon orchards. The 560 fruit attached to trees and introduced with gravid fruit flies were not infested with either species, while the host fruit (Carica papaya L.) exhibited 80-100% infestation. We conclude the non-host status of 'Hass' avocados to fruit flies, B. dorsalis and B. occipitalis in the Philippines.

PERSEA AMERICANA; AVOCADOS; CARICA PAPAYA; BACTROCERA; BACTROCERA DORSALIS; TEPHRITIDAE; INFESTATION; HOST PLANTS; PEST RESISTANCE

Occurrence and identification of insect pests and diseases on different white potato varieties grown at low elevation in VSU [Visayas State University] Baybay City, Leyte, Philippines. **Gapasin, Ruben M., Carpentero, E. Visayas State Univ., Baybay, Lete (Philippines).** **Reyes, C.P., Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila**

**(Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 32 (2) p. 201. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Potato (*Solanum tuberosum* L.) locally known as 'patatas' is a cold loving plant widely grown at high elevation areas in which temperature favors its growth. Fifteen different varieties/selections were planted at low elevation in Baybay City, Leyte [Philippines] to determine their adaptability or performance under this condition. The occurrence and identities of insect pests and diseases attacking potato were investigated. Four collecting methods were employed such as beat tray, pitfall, light trap, and vial tapping. Identification was done under the stereomicroscope, referred to published guides and brochures, and confirmed by authority on the groups. The following insect pests occurred in the potato field: *Elipachna* larvae and adult, aphids, leaf miner, thrips, pachyrhynchid beetle, green leafhopper, immature Pseudococcidae, mirid bug (*Halticus* nr. *minutus* Reuter), and orthopteran species. White grubs were also collected from plots where damaged tubers were observed. In addition, several natural enemies were also collected and identified, such as spiders under the families Formicidae (ants) and Scelionidae. The main disease observed was bacterial wilt which caused high mortality of early-stage potato plants. Tuber rot was also observed in tubers with holes in some varieties. The identification of insect pests and diseases attacking potato is necessary in developing IPM program for promising potato varieties across areas in the Philippines.

SOLANUM TUBEROSUM; POTATOES; VARIETIES; WILTS; ROTS; EPILACHNA; LARVAE; PEST CONTROL; PEST INSECTS; NATURAL ENEMIES; IDENTIFICATION; PHILIPPINES

Ornamental and cultivated aroid host plants of *Hippotion celerio* (L.) (Lepidoptera:Sphingidae). **Supetran, A.U., Barrion-Dupo, A.L.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 182. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The family Araceae, also known as aroids, is known for the high ornamental and economic value of many included species. One of the persisting pests of this family is *Hippotion celerio* L. (Sphingidae), or the Taro Hornworm. The larva feeds on the leaf blades of aroids, leaving only the primary and secondary veins. It is also capable of withstanding the presence of calcium oxalates that are supposed to deter herbivores. There are no data on aroid host plants recorded to provide baseline data and updated checklist of host plants for *H. celerio*.

ARACEAE; ORNAMENTAL PLANTS; LEPIDOPTERA; SPECIES; HOST PLANTS

Parallel genetic divergence of the coconut scale insect *Aspidiotus rigidus* Reyne (Hemiptera:Diaspididae) and its host-specific parasitoid *Comperiella calauanica* Barrion et al. (Hymenoptera:Encyrtidae) in the Philippines. **Ishitani, N., Serrana, J., Carvajal, T.M. Ehime Univ., 10-13 Dogohimata, Matsuyama, Ehime 790-8577 (Japan). Almarinez, B.J.M., Barrion, A.T., Amalin, D.M. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Coll. of Science. Watanabe, K. Ehime Univ., 10-13 Dogohimata, Matsuyama, Ehime 790-8577 (Japan).** *Philippine Entomologist (Philippines).* 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 194. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Philippines faced coconut scale insect (CSI), *Aspidiotus rigidus* Reyne, outbreaks in CALABARZON [Cavite, Laguna, Rizal, Quezon, Philippines] from 2009-2014, and in Basilan and Zamboanga recently. From 2009, infestation only reached manageable status in early 2017 mainly due to the parasitoid *Comperiella calauanica* Barrion et al. this encyrtid was discovered during the outbreak in Calauan, Laguna, with a highly successful 80% parasitization specific to CSI. The introduction of CSI into the Philippines was believed to be either by wind or accidentally through imported infested palms. However, inferring from the source population, the route and mechanism of spread of CSI need further evidence. The history of geographic origin of an invading population can be traced by characterizing genetic variation using molecular markers. Sequences of cytochrome oxidase (COI) gene and the nuclear protein encoding gene – elongation factor 1a (EF-1a) were utilized to investigate the genetic structure and diversity of CSI from localities with documented outbreaks from 2014-2017. Both COI and Ef-1a markers and all approaches revealed two distinct genetic groups, separating the Luzon outbreak population from those in Mindanao. Two mitochondrial, and four nuclear haplotypes (one from Luzon, and three from Mindanao) exists. In addition, parallel genetic divergence among *C. calauanica* populations was observed, with two distinct populations from Luzon and Mindanao. These could provide critical information for designing and implementing quarantine strategies, and defining and testing ecological and evolutionary studies to understand the invasion success and decline of outbreak populations.

ASPIDIOTUS; SPECIES; COMPERIELLA; HYMENOPTERA; COCONUTS; GENETIC DISTANCE; PARASITIDS; CYTOCHROME C OXIDASE; INFESTATION; GENETIC MARKERS; NUCLEOTIDE SEQUENCE; PHILIPPINES

Pathogenicity of *Metarhizium anisopliae* (Metch.) Sorok. as biological control agent of banana pseudostem weevil, *Odioporus longicollis* (Oliver). **Yebes, A.G., Orboc, E.V.E., Simpao, J.T., Herradura, L.E., Arcelo, M.M. Bureau of Plant Industry-Davao National Crop Research Development and Production Support Center, Bago-Oshiro, Davao City (Philippines).** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 175-176. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The banana pseudostem weevil (BPW), *Odioporus longicollis* (Olivier) affects and cause decline of banana production particularly in small banana farms in Region 11 [Davao Region, Philippines]. The naturally occurring entomopathogenic fungus, *Metarhizium anisopliae* (Metch.) Sorok. is a potential biocontrol agent against many pests including banana weevils. The study aimed to asses the efficacy of three isolates of *Metarhizium* from field-infected Rice black bug (RBB) *Scotinophara* sp., Coconut leaf beetle *Brontispa longissima* Gestro, and BPW against BPW. Under laboratory conditions, the three isolates caused infection and death of BPW at varying spore concentrations. *M. anisopliae* isolated from RBB exhibited the highest mortality rate on BPW with 35.71, 50.00, and 64.29% at  $1 \times 10^7$ ,  $1 \times 10^8$ , and  $1 \times 10^9$  spores/ml significantly reduced BPW population and caused 65.86% infection on trapped weevils.

BANANAS; PRODUCTION; METARHIZIUM ANISOPLIAE; CURCULIONIDAE; SPECIES; SMALL FARMS; BIOLOGICAL CONTROL AGENTS; PATHOGENICITY; INFECTION; MORBIDITY; PHILIPPINES

Perspectives on management of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in the Philippines. **Parimi, S. Bayer Crop Science, Mumbai, Maharashtra 400076 (India).** *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v.32 (2) p. 200. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Corn production in the Philippines is affected by biotic and abiotic factors. Biotic factors include weeds, diseases like stalk rot, insect pests like aphids and lepidopterans viz., Asian corn borer *Ostrinia funacalis* (Guenee), corn earworm *Helicoverpa armigera* (Hubner), and common cutworm *Spodoptera litura* (Fabricius). In recent months, an invasive polyphagous species, the fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith), attacked corn in parts of Asia. It also feeds on other crops like sorghum, pearl millet, sugarcane, and cotton. Hitherto, it has been reported from 15 other Asian countries. Chemicals belonging to five or more modes for action (MoA) and Bt corn hybrids are being registered or given conditional approval for management of the pest. However, Bt corn in the Philippines is facing several

challenges that may limit sustainability which include poor or no refuge compliance, use of single gene-based technologies, delay in shift to pyramided products during the long years of use leading to potential resistance and cross resistance issues. The use of Bt corn against FAW needs 'Functionally effective pyramided products with two or more genes of different MoAs' deployed in a seed blend (RIB – refuge in a bag) model. One Bt corn hybrid, MON89034, has proven efficacy against FAW globally, likewise demonstrated in Vietnam. Bayer's corn hybrids DK6919S and DK9955S, and other crop protection products offer dual or different MoAs against FAW offering flexibility and benefit to farmers, following resistance management guidelines fitting into IPM plans.

ZEA MAYS; MAIZE; VARIETIES; SPODOPTERA FRUGIPERDA; OSTRINIA FURNACALIS; HELICOVERPA ARMIGERA; PEST CONTROL; BACILLUS THURINGIENSIS; PEST RESISTANCE; PHILIPPINES

Pest of Philippine stingless bees. **Baroga-Barbecho, J.B., Cervancia, C.R. Philippines Univ. Los Baños, College, Laguna (Philippines). Bee Program.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 189. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Many pests attack hives of *Tetragonula biroi* (Friese) but these can be managed. A 10-year monitoring project was conducted by the team of the UPLB [University of the Philippines Los Baños Bee Program from 2010 to the present in selected meliponaries in the Philippines to identify the different pests of *T. biroi*. The species of pests we have identified were: (1) hive syrphid fly, *Ceriana* sp.; (2) hive phorid fly; (3) small hive beetle, *Aethina tumida*; (4) a beetle under the Family Nitidulidae; (5) and another under Histeridae; (6) soldier fly, *Hermetia* sp., and (7) some species of pollen mites. Majority of these pests are destructive found inside the nest or hive feeding on honey and/or pollen. Managed colonies of *T. biroi* can be protected from these pests by maintaining strong colonies, by performing proper beekeeping practices, and through quarantine.

APIDAE; COLEOPTERA; DIPTERA; HIVES; PEST CONTROL; PESTS; PHILIPPINES

Population dynamics of insects associated with dragon fruit (*Hylocereus* sp.). **Estigoy, J.H. jphestigoy@yahoo.com. Estigoy, M.A.S. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Agricultural Science and Technology. mariaadrielleestigoy@gmail.com.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 194-195. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Population dynamics include seasonal occurrence, diversity, and estimated damage assessment of major insect pests. Insect monitoring methods were visual count, use of yellow and blue sticky boards, and commercial methyl eugenol sprayed on PET bottles. In particular, insects associated with dragon fruit production indicated predominance of tachinid fly, all three species of ants (*Paratrechina* sp., *Solenopsis* sp., and *Tapinoma* sp.) and aphids during the vegetative stage, only three species of ants and fruit fly (*Bactrocera* sp.) were observed during the flowering stage, and ants again at the fruiting stage. Insect diversity index on dragon fruit was low attributable to only a few insect species noted and was only for one site in Batac City, Ilocos Norte [Philippines]. Similarly, diversity index was low when superficially taken at the three crop stages. An in-vivo experiment showed that the rate of damage of fruit fly on the fruit was 25% and described as having numerous exit holes, very soft to touch and with oozing sap from the holes. The injury caused by the red ants was 30% of the total number of collected fruits described as having numerous white, pin-sized pricks on the skin with few coalescing scab-like lesions.

HYLOCEREUS; SPECIES; TROPICAL FRUITS; FRUIT DAMAGING INSECTS; POPULATION DYNAMICS; DAMAGE

Population dynamics of major insect pest of rice at the PhilRice [Philippine Rice Research Institute] Central Experiment Station [Nueva Ecija, Philippines]. **Valdez, M.E., Santiago, G.dC. Philippine Rice Research Inst., Muñoz, Nueva Ecija (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 184. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Management strategies differ from one pest to another and with the different growth stages of the insect. Oftentimes their populations are overlapping, making management difficult. Timely and correct intervention is necessary to better manage a particular pest. One tool used to determine the population dynamics of the different insect pests is through light trapping. Light traps provide a significant clue to the diversity of insects active at night and can aid in predicting how population fluctuate during a particular period in relation to prevailing weather conditions. Although several light traps are widely used in monitoring different insects, no scientific data on trap diversity, number, and its efficacy are readily available. Such data could shed light on the insects attracted to specific range of light sources was done. Two type of light traps, the JICA-type and KOPIA-type, were installed at the PhilRice CES [Philippine Rice Research Institute Central Experiment Station, Nueva Ecija, Philippines] to have knowledge of the population dynamics of the major insect pests, to aid in decision-making in insect pest management. The weekly catches from the two types of

light trap from January to December 2017 were brought to the laboratory for sorting, identification, and counting. Arthropod catches varied with the different types of light trap although the population peak of the major pests were comparable. Insect population correlates with weather data.

PEST INSECTS; ARTHROPODA; RICE; POPULATION DYNAMICS; LIGHT TRAPS; PEST CONTROL

Preliminary assessment of fish flakes as a potential artificial feeding medium for *Euborellia annulata* (Fabr.). **Ceballo, F.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology; Ayen, C.J.A., Ciriaco, F.M. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School; de Roxas, M.C.dL. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center; Jatico, W.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School; Masanit, J.R.A. Don Mariano Marcos Memorial State Univ.--North La Union Campus, Sapilang, Bacnotan, 2515 La Union (Philippines); Matalog, R.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School; Novenario, M.B. Tarlac Agricultural Univ., Malacampa, Camiling, Tarlac (Philippines); Romero, E.T.A. Isabela State Univ., Echague, Isabela, (Philippines).** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 171-172. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Insect rearing for biological control is an old solution to agronomic pest problems, and due to increasing demand for safe produce, studies on biocontrol continue to advance. The use of the predatory black earwig, *Euborellia annulata* (Fabricus), to control Asian corn borer, *Ostrinia furnacalis* (Guenee), is one of the options in IPM for corn. The potential of mass rearing the predatory earwigs with fish flakes was tested versus fish meal in 12 weeks. After approximately three generations, male to female ratio changed drastically from 33% down to 17%, with rations from 12:36 to 7:41. Population data and dissection results suggest that the predatory earwigs can still reproduce using fish flakes as an alternate diet. However, it also suggests that it could only be a temporary option and not entirely recommended for use in mass production as compared to fish meal. While the provision of artificial diet is already convenient and cost-effective, studies could be continued to assess reproductive potential earwigs to other diets as compared to natural diet. Assessment of nutritive value of fish flakes in comparison with other diets could also be done in the future.

OSTRINIA FURNACALIS; DERMAPTERA; SPECIES; BIOLOGICAL CONTROL; MAIZE; FEEDING; FEEDS

Preliminary findings of molecular variation in brown planthopper, *Nilaparvata lugens* (Stal), among populations from Isabela and Laguna [Philippines]. **Laquinta, J.F., Ardez, K.P., Guerrero, M.S. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Caoli, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. Navasero, M.V. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 190-191. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Brown planthopper (BPH), *Nilaparvata lugens* (Stal), is the most destructive rice pest in Asia. It causes severe damage to rice, resulting to great losses to farmers. Since its first record of infestation in the Philippines in 1954, BPH still persists causing resurgence outbreaks in different provinces that imply more complex approaches to manage its population. Using 850-bp cytochrome oxidase I (COI) sequences, three BPH haplotypes were reported in the Philippines, with one dominating just like in other Asian countries. A preliminary analysis of molecular variation among and within BPH populations from Roxas City, Isabela and Calauan, Laguna was conducted. After having the genomic DNA isolation and gene amplification optimized, amplicons were sent for sequencing. Molecular variations were analyzed using the aligned partial nucleotide sequences coding for the COI of BPH. Two haplotypes from 581-bp partial sequences were recognized. Through BLAST, the dominant haplotype showed 100% nucleotide identity while the other showed 99.83% with *N. lugens* MK032794.1. Polymorphism was found at the 370th nucleotide position showing transversion of A-T.

NILAPARVATA LUGENS; SPECIES; CYTOCHROME C OXIDASE; MITOCHONDRIAL GENETICS; PLANTATIONS; PHILIPPINES; PEST INSECTS; NUCLEOTIDE SEQUENCE; GENES; GENETIC POLYMORPHISM

Preliminary study of the effects of microplastics on soil arthropod ecology. **Lit, I.L., Jr., Bariring, A.A.T., Huet, A.M.O., Jimenez, J.R.D., Pancho, U.Z. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 192. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Microplastics are small pieces of plastics 0.33-5.00 mm long. They range from micro beads used in personal care products and pre-production pellets and powders to fibers from synthetic clothing and fragments degraded from larger plastic products. They have become



ubiquitous in environment today, but most studies on them tend to focus on marine ecosystems, their effects on marine organisms, and how plastic pollution in marine environments eventually lead back to humans. Only a few have studied their presence and distribution in terrestrial ecosystems and their effect on the soil and soil organisms. Preliminary study gathered 1-liter soil samples from selected areas on the lower slopes of Mount Makiling and in UPLB [University of the Philippines Los Baños] Campus. Each soil sample was dissolved in a gallon of tap water and the resulting floating debris after settling were examined and sorted. Microplastics from the rural site (near households) accounted for 96.15% of the total samples found, of which 69.23% were from synthetic textile fibers, 15.38% from beads or Styrofoam, and 11.54% assorted plastic fragments. Initial dissections also showed the presence of microplastics in guts of cockroaches, earthworms, beetles, and maggots.

ARTHROPODA; SPECIES; OLIGOCHAETA; PLASTICS; FOREST SOILS; POLLUTION; ANIMAL ECOLOGY

Preliminary study on the use of Beauveria spp. for the control of rice grain bug, Paraeucosmetus pollicornis Dallas (Hemiptera:Lygaeidae) in the laboratory. **Estoy, G.F., Jr., Israel, V.A.I. Philippine Rice Research Inst., Basilisa, RT. Romualdez 8611, Agusan del Norte (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 172-172. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Beauveria spp. were isolated from the rice grain bug (RGB), Paraeucosmetus pollicornis Dallas. Infected adults were collected from Maragusan, Compostela Valley [Philippines]. The fungus was mass produced and evaluated against laboratory reared RGB adults through insect dipping method under laboratory conditions. RGB mortality was recorded at 100% and 95% after three and two days post treatment application, respectively. Beauveria spp. as a biological control agent can be incorporated in the management of RGB in the field.

BEAUVERIA; HETEROPTERA; SPECIES; RICE; MORTALITY; BIOLOGICAL CONTROL AGENTS; LABORATORY EXPERIMENTATION; BIOLOGICAL CONTROL

Preliminary survey of arthropods in forage and pasture crops. **Ceballo, F.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology. Ayen, C.J.A., Ciriaco, F.M. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School. de Roxas, M.C.dL. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Jatico, W.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School. Masanit, J.R.A. Don Mariano**

**Marcos Memorial State Univ., Bacnotan, 2515 La Union (Philippines). Matalog, R.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Graduate School. Novenario, M.B. Tarlac Agricultural Univ., Malacampa, Camiling, Tarlac (Philippines). Romero, E.T.A. Isabela State Univ., Echague, Isabela, (Philippines).** *Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 183-184. 50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Pasture and forage crops are integral part of Philippine agriculture when viewed from the livestock industry. Being undervalued, arthropod diversity related to these crops is also disregarded. Preliminary data on arthropod composition of these crops were collected for nine weeks between August 14, and October 9, 2017 at the Dairy Training and Research Institute, UPLB [University of the Philippines Los Baños] through sweep net method and pitfall trapping. A total of 4, 442 arthropods belonging to 87 families were grouped based on functional groups. Arthropods from pasture and forage crops were equally diverse but have different skews on functional group rations. As follow-up study on different pasture communities for a whole year duration employing different collection methods is recommended to comprehensively capture arthropod population data. This will also confirm which factors in pasture communities are the driving force for the variety of arthropod taxonomic and functional composition.

#### ARTHROPODA; FORAGE; FEED CROPS; SURVEYS

Preliminary survey of insect pests and natural enemies in a potato production area under high hills zone. **Masangcay, T.D., Pinon, A.F., Tad-awan, B.A., Pablo, J.P. Batangas State Univ., Rizal Ave, Extension, Batangas, 4200 Batangas (Philippines). Amalin, D.M., Barrion, A.T., Carlos, C.C.C. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit.** *Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 32 (2) p. 201-202. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Preliminary survey and identification of arthropod pests, both harmful and beneficial to potato, was conducted in Kapangan, Benguet (600 m asl). Fifteen potato varieties were planted using generation zero seeds. No synthetic pesticide was applied to encourage arthropod population in the area. Regardless of variety, monitoring at one and two months after planting revealed leaf miner infestation on the leaves as shown by whitish tunnels on the leaf surfaces. The infestation was very evident in the second month with typical deformation and scaly underside on the leaves. Results of the monitoring/collection one

month before harvest gathered from pitfall traps and through plant beating revealed nine different harmful insect species. These were aphids, potato hoppers, thrips, mirid bugs, flea beetles, flea hoppers, and leafminers. These insects outnumbered the tuber moths and whiteflies. During harvest, a few cutworm, white grub, and wireworms were observed from the soil. As to natural enemies, three species of spiders, ants, and one of wasp were observed. These are: *Atypena formosana* (Oi) (Araneae:Linyphiidae), *Cheirachantium* sp., *Oxyopes javanus* Thorell (Araneae:Oxyopidae), *Solenopsis* sp. (Hymenoptera:Formicidae), and *Platygaster* sp. (Hymenoptera:Platygasteridae).

POTATOES; SOLANUM TUBEROSUM; PRODUCTION; PESTS OF PLANTS; ARANEAE; LINYPHIIDAE; OXYOPES; SOLENOPSIS; HYMENOPTERA; FORMICIDAE; PLATYGASTER; PLATYGASTERIDAE; PEST INSECTS; USEFUL ARTHROPODS; INFESTATION; IDENTIFICATION; MONITORING; NATURAL ENEMIES

Reconsideration of the biogeography of the Luzon-Endemic genus *Psithyristria* (Hemiptera:Cicadidae): parallelism to mammalian distribution patterns in Luzon, Philippines. **Lit, I, Jr., L. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The genus *Psithyristria* is so far as known endemic to Luzon Island [Philippines] and is composed of relatively small cicadas occurring generally at 1,000 m asl. A previous study focusing on the systematics and evolution of the group pointed mainly to the adaptation of the group to high elevations as the major factor to explain its distribution in the mountains of Luzon. Recent studies showed the complex geological origins of Luzon islands as well as patterns of mammalian diversity in Luzon that follow biogeographical sky islands. The phylogeny of *Psithyristria* was reviewed and the inferred possible affinities of more recently described species were incorporated into the cladograms. The distributions of all known *Psithyristria* species were mapped. In turn, the redrawn cladograms were diagrammed onto the distribution maps. The resulted show parallels of sky island distribution patterns seen among Luzon mammals as well as possible adaptive radiation after the initial colonization by the ancestor of *Psithyristriini*.

HEMIPTERA; CICADIDAE; GENERA; ENDEMIC; BIOGEOGRAPHY; PHYLOGENY; ADAPTATION; GEOGRAPHICAL DISTRIBUTION; PHILIPPINES

Review of Dr. Adelina A. Barrion's contributions to Asian corn borer studies. **Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab.** Philippine

Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 196. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Archived in old folders at the Entomology Laboratory of the Institute of Plant Breeding [University of the Philippines Los Baños, College, Laguna, Philippines] the previous works of the late Dr. Adelina A. Barrion, a distinguished Filipino insect geneticist, were retrieved. These works were cited in relation to the recently funded project entitled 'Basic studies on the Asian corn borer, *Ostrinia furnacalis* (Guenee)' funded by Biotechnology Coalition of the Philippines in collaboration with different players of the corn seed industry. The unpublished papers of Dr. Barrion from the 1981 PCARR project entitled 'Breeding for Corn Borer Resistance' had been important milestones in basic studies on Asian corn borer (ACB). Several studies conducted by her team on larval morphology, chaetotaxy, head capsule, heterovoltinicity, and life cycle were discussed. Based on the breadth of research work of the ACB that Dr. Barrion and her team had accomplished, there is need to compile and publish these works in their original form. This paper, therefore, aims to: 1) revisit and review the works of Dr. A. A. Barrion which will significantly contribute to the local references on the ACB; 2) consider these old works for possible publication in a local journal or as a book of collected works; and 3) pay tribute to an outstanding entomologist recognizing her pioneering works on the ACB.

OSTRINIA FURNACALIS; ZEA MAYS; MAIZE; GENETICISTS; RESEARCH; EVALUATION; RESEARCH PROJECTS

Revision of the ant genus *Tetheamyra* Bolton, 1991 (Formicidae:Myrmicinae:Crematogastrini). **General, D.E.M. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Section.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 188. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The crematogastrine ant genus *Tetheamyra* Bolton, 1991 is revised, with the description of a new species, *Tetheamyra bidentate* General and Buenavente, 2018. The worker and queen castes are described.

FORMICIDAE; GENERA; NEW SPECIES; IDENTIFICATION; TAXA; INSECTA

Seasonal fluctuation of yellow stem borer and other arthropods at PhilRice [Philippine Rice Research] Central Experiment Station [Nueva Ecija, Philippines]. **Santiago, G.C., Valdez,**

**E.M. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Univ. Science High School.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 203. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Insect pest management employs several tactics compatible with each other to become effective. Generally, insect pests are widely distributed and oftentimes their populations overlap. Hence, management is difficult and strategies differ from one pest to another and with different insect growth stages. Knowing the right time to apply intervention is necessary for better pest management. One tool to determine population fluctuations of different arthropods is through light trapping as it provides significant clues to the diversity of insects active at prevailing water conditions. Light trap collections showed that adult yellow stem borer (YSB) population peaked in March (dry season) with 232 moths and in September (wet season) with 48. The highest number of brown planthoppers was in March (2,328) and August (4,552). The trend was similar for other hoppers: zigzag (ZLH) and green leaf hoppers, and white-backed planthopper. Among pests, ZLH was the highest among with 12,692 individual trapped in populations were comparatively low. The mirid bug predominated among natural enemies and its populations were comparatively low. The mirid bug predominated among natural enemies and were very low in all crop growth stages. This was due to the low YSB population throughout the study. Weather the data was also correlated to the number of arthropods collected the study.

SCIRPOPHAGA INCERTULAS; STEM EATING INSECTS; SPECIES; ARTHROPODA; PEST CONTROL; LIGHT TRAPS; NATURAL ENEMIES; PHILIPPINES

Sex pheromone an effective monitoring tool in the management of onion armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera:Noctuidae). **Ebuenga, M.D., Gonzales, P.G., Manaday, S.J.B., Cayabyab, B.F., Cayabyab, B.A.G., Burgonio, G.A.S. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v.32 (2) p. 170. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Among the various pest monitoring tools and techniques, trapping light and pheromone lures are more commonly used. The advantage of pheromone lure over light is its specifically and coverage. Virgin females, crude pheromone extracts, and synthetic sex pheromones were used as baits for mass trapping and population monitoring of *Spodoptera exigua* (Hubner) moths in Nueva Ecija [Philippines] Live virgen female baits reared in the laboratory lasted 3-5 days in the field. Rubber septa infused with crude pheromone extract

attracted male moths for at least 14 days. Finally, commercial synthetic pheromone preparation with active ingredients (Z, E)-9, 12-tetradecadienol and (Z)-9-tetradecenol remained effective in the field for at least 40 days. Trapping data from January 6- to February 3, 2018 in Sto. Domingo, Nueva Ecija revealed an increasing number of male moths. Highest number of catches per trap per night reached 300 individuals. Daily counts are also entered as initial values in a dynamic population model with degree-days controlling the maturation rate.

SPODOPTERA EXIGUA; MONITORING; SEX PHEROMONES; PEST CONTROL; FEMALES; PHEROMONES; ONIONS; TRAPS

Smarter pest identification technology (SPIdTech): a digital platform to identify, manage, report, and monitor insect pest and crop disease occurrence. **Guiam, A.C., Ebuenga, M.D., de Panis, W.N., Gamba, K.E. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 197-198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Crop pest and disease occurrences, aggravated by climate, greatly affect global food production. To address this issue, a system named SPIdTech (Smarter Pest Identification Technology) was developed to educate and help farmers and other agricultural workers in identifying, managing, and reporting major pest and disease in rice, corn, coffee, cacao, banana, coconut, sugarcane, soybean and tomato in the Philippines. It provides two major features: Pest and Disease Identification that uses machine learning technology to identify as a virtual encyclopedia containing data on identification signs, life stages, management practices, and other pertinent information about a pest or disease. Data such as GPS location to map and tag the data, top three identification results to monitor the occurrence of pest and disease in the area, and image data to record and verify the results were collected from the users for faster and remote monitoring. An offline version was also developed to extend the capacity of the application to areas with minimal internet connectivity. More than being a system for monitoring, SPIdTech is an educational platform that will raise familiarization with common pests and diseases in the Philippines.

INSECTA; PLANT DISEASES; PEST CONTROL; TECHNOLOGY TRANSFER; IDENTIFICATION; ARTIFICIAL INTELLIGENCE; PEST CONTROL EQUIPMENT; TECHNOLOGY; REMOTE SENSING; MONITORING

Some botanicals and microbials against onion armyworm, *Spodoptera exigua* (Hubner) (Lepidoptera:Noctuidae) at Sto. Domingo, Nueva Ecija [Philippines]. **Cayabyab, B.F.,**

**Guerrero, M.S., Alforja, L.M., Aquino, A.G., Perez, E.A., Gaylon, M.P., Obozo, R.J.L., Perfecto, M.J.B. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Ramos, R. Onion Growers Association of Sto. Domingo, Nueva Ecija (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 203. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Onion, *Allium cepa* L., is one of the high value crops in the Philippines. In 2016, the onion industry lost approximately 20M dollars due to infestation of the onion armyworm (OAW), *Spodoptera exigua* (Hubner). Significant production losses resulted from the insect population outbreak at Dolores, Sto. Domingo, Nueva Ecija [Philippines] exacerbated by excessive use of pesticides, and climate change. The research evaluated the efficacy of botanicals and microbials against OAW through field experimentation from December 2018-April 2019. Nine treatments namely; NPV crude extract, fungi (*Metarhizium anisopliae* (Metsch.) Sorok., AzTron sup R (bacterial insecticide), botanicals neem and wood vinegar, synthetic insecticide chlorfenaphyr (Kotetsu sup R), farmers' fields with pheromone traps. The control had no pheromone traps and the pest management decrease in larval counts at fourth and fifth applications. Yield of treated plots were statistically higher as compared to the untreated control. The efficacy of botanicals, pheromones and microbials against OAW was affirmed.

ALLIUM CEPA; ONIONS; CROP YIELD; SPODOPTERA EXIGUA; METARHIZIUM ANISOPLIAE; BIOPESTICIDES; PHEROMONES; PEST INSECTS; PEST CONTROL; PHILIPPINES

Stingless bees (Hymenoptera:Apidae:Meliponni) under the genus Tetragonula Moure in the Philippines. **Baja, S., Mostoles, M.D.J. Central Bicol State Univ. of Agriculture, Pili, Camarines Sur (Philippines).** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 192-193. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The nesting habits, morphological and genetic structure of stingless bees were assessed using the traditional taxonomic characters and BLAST analysis results in 18 populations of *Tetragonula* in the Philippines. Different structures, shapes and color of stingless bee nest entrances were recorded. Dendrograms were drawn using measurement from morphometric characters. Most species build their nests in tree cavities, cemented walls, and rocks with circular shape of entrances. Irregular shapes of nests from Ogbong (Catanduanes), Calapan (Oriental, Mindoro), Alabat and Perez (Quezon) [Philippines] were observed. Most colony entrances are hard and dark in color, facing east with 3-15 guard bees. Light colored entrances were observed in colonies from Cacilles (Hernani, Samar) and

Pangi (Gasán, Marinduque). Nesting habits of stingless bees were not species-specific. Only amplicon from 16S rRNA genes were reproducible in 12 colonies analyzed. No hits found in sample specimens from Panim-an, Caramoan, Camarines Sur and Oriental, and Oriental Mindoro (Calapan and Naujan). However, samples from Tagbilaran, Bohol and Tagum, Davao were confirmed. In Luzon, the identified species were: *Tetragonula iridipennis* (Smith) from Alabat and Perez (Quezon), Gasán (Marinduque), Garchitor ena (Camarines Sur), Viga, (Catanduanes), Placer (Masbate) and Naujan ( Mindoro), and *T. laeviceps* (Smith) from Calapan (Mindoro), and Caramoan (Camarines Sur). In the Visayas, *T. laeviceps* was also found in Hernani (Samar), Marbuena and Nasidman (Iloilo) and *T. sapiens* (Cockerrell) in Tagbilaran (Bohol). In Mindanao, *T. sapiens* was also identified from Tagum (Davao). An unidentified species was found in Paniki (Aroroy, Masbate).

APIDAE; SPECIES; IDENTIFICATION; TAXONOMY; GENES; GENERA; NESTING; PHILIPPINES

Strategies on managing rice planthoppers. **Rillon, G.S., Encarnacion, C.C.B. Philippine Rice Research Inst., Maligaya, Science City of Muñoz, Nueva Ecija (Philippines). Crop Protection Div., Hae-Ryun Kwak National Academy of Agricultural Sciences, Jeollabuk-do, Wanju-gun (South Korea). Crop Protection Div.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 170-171. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Planthoppers have lately been reported as potential constraints in rice production in the Philippines. Data from light trapping in Nueva Ecija showed an increasing trend of planthopper populations. The planthopper field population was also determined using sticky trap in two sites located in Ricefields with hopperburn were observed in many towns in Nueva Ecija and some fields in Tarlac and Pampanga [Philippines] during the monitoring period. Incidence of damage ranged from 5-50%. As there was an increasing trend in the planthopper populations and it is associated hopperburn damage, current strategies to prevent pest outbreaks were presented such as planting of resistant varieties, synchronous planting to avoid overlapping populations, conservation of beneficial organisms to maximize natural biological control, and proper use of chemicals as when needed.

ORYZA SATIVA; RICE; PLANT PRODUCTION; FULGOROIDEA; POPULATION DENSITY; LIGHT TRAPS; STICKY TRAPS; PEST CONTROL

Surface characterization and wetting properties of coconut scale insects, *Aspidiotus destructor* Signoret and *Aspidiotus rigidus* Reyne (Hemiptera:Diaspididae) from the Philippines. **Mariano, M.K., Amalin, D.M., Almarinez, B.J.M., Janairo, J.I. De La Salle Univ., 2401 Taft Ave., Manila (Philippines). Biological Control Research Unit.** Philippine



Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 187. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Biological surfaces are important in the interaction of organisms with their environment. Such surfaces are composed of micro-hierarchical structures that are products of evolution and functional for the organism to thrive. Biomimetics revolves around the idea that evolution produces the most resilient design fitted for a specific environment. Thus, technology could be inspired from nature itself. Coconut scale insects (CSI) such as *Aspidiotus destructor* Signoret and *A. rigidus* Reyné are major pests of coconut in the Philippines. These species are interesting because their wax scale cover protects the organism from water loss and wetting, and enables it to attach to the substrate using secretions. The hierarchical micro- and nano-structures and wetting properties of the scale covers of CSIs were described and compared. Scanning electron microscopy revealed that *A. destructor* and *A. rigidus* could be differentiated using the micro-structures on their scale covers. The scale cover of *A. destructor* has overlapping wax layers while that of *A. rigidus* has a uniformly layered structure. Wettability test by way of contact angle measurement showed the CSI scale cover's hydrophobicity (>90° contact angle), which may be attributed to its surface topology, wherein the wax protrusions inhibit the water from spreading fluidly. These findings on the scale cover of the two *Aspidiotus* spp. may have implications on morphological characterization for taxonomic studies, as well as future applications for biomimetic design of hydrophobic materials.

ASPIDIOTUS; SPECIES; COCONUTS; PEST INSECTS; ANIMAL MORPHOLOGY; PHILIPPINES

Taxonomy and nest structure of hover wasps (Hymenoptera:Vespidae:Stenogastrinae) in Mt. Makiling, Philippines. **Jimenez, J.R.D., Lit, I.L., Jr., Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 188. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Five species of hover wasps (Hymenoptera:Vespidae:F) are included in the faunal list for Mount Makiling, Laguna, Philippines. They are *Eustenogaster luzonensis* (Rohwer), *Liostenogaster varipicta* (Rohwer), *Parischnogaster depressigaster* (Rohwer), *P. nigricans* (Cameron), and *P. timida* (Williams). *E. Luzonensis* was not recovered or collected during this study. On the other hand, *P. nigricans*, known to occur in Luzon but was not included in the previous works, is now confirmed to be present in the mountain, particularly in the lower and middle slopes. The nests of the four species collected were also studied,

photographed, and described. Each nest exhibits differences in architecture, which may also be reflective of other characteristics such as morphology. The mandibles of the wasps were dissected and photographed, and their length, width, and height were measured. Additional variations in characters were added in each description. The nests can be differentiated from one species to another, with those of *P. nigricans* being the most flexible. Hence, nest structure may also be identified according to the wasp species that constructed them. *L. varipicta* which uses mud, has longer and thinner mandibles compared to vegetable material users like *Parischnogaster* spp.

VESPIDAE; SPECIES; TAXONOMY; NESTING; HIGHLANDS; PHILIPPINES

Temporal patterns of the pit-building activity of antlion larvae (*Myrmeleon angustipennis* Banks). Parakikay, T.P., Lit, I.L., Jr., Dupo, A.L.B. **Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 189. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Antlion larvae are known to be a 'sit-and-wait' type of predator. They constructed conical pits in sandy soil that serve as traps. Thus it has become a model organism commonly used for behavioral ecology studies. The authors determined whether antlion larvae are nocturnal or not, by observing the relationship between the number of pits created and the time of the day. The experiment followed a factorial repeated measure design, with times set up in the morning, noon, and evening. Time had a significant influence on the activity of antlion larvae, i.e., they were more active at night, and therefore, antlion larvae can be considered nocturnal.

LARVAE; BEHAVIOUR; ECOLOGY; PREDATORS; TIME

Transcriptome analysis of Philippine *Comperiella* sp. from coconut scale insect, *Aspidiotus rigidus* Reyne. Mascareñas-Bautista, Ma.A., Camposano, J.M.T., Saldajeno, D.P.B. **Philippines Univ. Diliman, Diliman, Quezon City (Philippines). National Inst. of Molecular Biology and Biotechnology.** Navasero, M.M., Navasero, M.V. **Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32(2) p. 180. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Recently, *Comperiella* sp. (Hymenoptera), a known endoparasitoid of diaspine or armored scale insects, was reported in some parts of Laguna, Quezon, and Batangas province in the Philippines. Because of its importance and potential as a biological control agent against coconut scale insects, particularly *Aspidiotus rigidus* Reyne, information on the biology of the insect is necessary for monitoring and assessment of its efficiency. This study aimed to provide pioneering studies on the molecular knowledge of Philippine *Comperiella* sp. Transcriptome analysis was employed to create a molecular toolbox that can be used to study its movement within populations, insecticide resistance, and other traits. Total RNA sequencing using Illumina MiSeq produced a total of 20.84 M reads and 6.36 Gb read length. De novo assembly was performed using Trinity RNA-Seq v2.3.2 followed by bioinformatics analysis using Blast2GO PRO. Trinotate 3.0.1 was used for further analysis to generate annotations against PFAM, COG, and EggNOG databases.

ASPIDIOTUS; SPECIES; COMPERIELLA; COCONUTS; INSECTICIDES; PESTICIDE RESISTANCE; BIOLOGICAL CONTROL AGENTS; ZOOLOGY; NUCLEOTIDE SEQUENCE

Updates from recently conducted detection survey for fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in Region 2 [Cagayan Valley], Philippines. Navasero, M.V., Magsino, G.L. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 199-200. 51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.

Detection of the fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith), in Taiwan was reported on June 10, 2019, and because of its proximity to the Philippines, this prompted the local and national concerned agencies to intensify their detection and surveillance activities. Initial effort was focused in Cagayan Valley, being the largest corn-producing region in the country. The Regional Crop Protection Center 2, through the Bureau of Plant Industry, sent to the National Crop Protection Center, UPLB [University of the Philippines Los Baños, for identification, seven noctuid larvae with collection date June 7, 2019 from a Bt corn field in Piat, Cagayan [Philippines]. One of the larvae was positively identified as that of FAW. A picture of another larva from the same site conspicuously showing the distinctive features of FAW was also provided. Immediate follows-up detection survey failed to produce additional specimens of FAW. Since Bt corn was found still working against FAW in new territories of invasion, those found in Piat could have been from non-Bt corn refuge. Bt-corn accounts for about 50% of total plantings of corn in the country and Region 2 has the highest 90% which could have slowed down its spread. Detection surveys focusing on non-Bt corn should be done especially in areas with lower percentages of Bt-corn plantings.

ZEA MAYS; SPODOPTERA FRUGIPERDA; PEST SURVEYS; IDENTIFICATION; PEST INSECTS; LARVAE; PHILIPPINES

Use of unmanned aerial vehicle (UAV) and Pix4D-Mapper in monitoring and mapping or armyworm infested onion areas in Bongabon, Nueva Ecija [Philippines]. **Tagaca, R.V., Alberto, R.T. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Alejandro, K.T.F., Manipon, K.C.C. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Inst. for Climate Change and Environmental Management.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 193. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Remote sensing is one of the advanced technologies that can be used in early detection, mapping, and spatial tracking of plant pests and diseases. This technology can give updated data on the geoinformation and plant health status of the areas by conducting image analysis and classification processes using images captured by satellites and unmanned Aerial Vehicles (UAV). Onion armyworm (OAW), *Spodoptera exigua* (Hübner), is the most destructive insect pest of onion today, as it attacked onion plants in the field in huge numbers and can destroy entire onion fields in one night. It leaves whitish appearance of onion leaves and damaged bulbs which are no longer fit for human consumption. Damage manifestations are very visible in aerial images captured by UAVs. Thus, these imageries were utilized to detect, monitor and mapped the infested onion fields in Bongabon, Nueva Ecija [Philippines]. Orthophotos of UAV-captured imageries were processed using Pix4D-Mapper. Also, the Normalized Difference Vegetation Index (NDVI) and orthomosaics of captured images were produced and analyzed using the same software and ArcGIS to generate geo-entomological maps showing the point of infestation, actual health status of the area by extracting the infested and the non-infested onion fields. These maps were later turned over to the decision-makers and extension workers to raise the level of awareness on the infestation and use as monitoring tool in OAW prevention and spread as well as in planning for pesticide management and environmental protection.

SPODOPTERA EXIGUA; ONIONS; REMOTE SENSING; TECHNOLOGY TRANSFER; FARM EQUIPMENT

Validation of potential bioinformatically-derived SNP markers for future population genetic studies in coconut scale insects *Aspidiotus* sp. (Hemiptera:Diaspididae). **Beringuela, D.N.A., Mascarenas-Bautista, Ma.A. Philippines Univ. Diliman, Diliman, Quezon City (Philippines). National Inst. of Molecular Biology and Biotechnology. Caoili, B.L. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant**

**Pathology.** *Philippine Entomologist (Philippines)*. 0048-3753. (Oct 2018). v. 32 (2) p. 178-179. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The Philippine is the second largest coconut producer as as such, depends highly on the coconut industry. A decline in coconut production was reported in 2009 due to infestation by an insect that came to be locally known as cocolisap. Several pest control methods have been employed, most of which have not been proven effective. The cocolisap was first identified to be *Aspidiotus destructor* Signoret; but was later determined as *A. rigidus* Reyne in 2014. The ability to control insect pests requires the understanding of its fundamental biology. However, only a very limited grasp of the biology, as well as genetics and population structure, is available for *Aspidiotus* species. DNA molecular markers such as SNPs are often used as tools to provide knowledge on the biology of a pest particularly its genetic diversity which determines susceptibility to different control strategies. The study at hand aimed to develop molecular markers of single nucleotide polymorphisms (SNPs) for future population genetic studies of this coconut pest. To achieve this, SNPs were mined from unpublished transcriptome sequences of *Aspidiotus* species. Eighteen SNP loci involved in insecticide resistance were chosen for validation through amplification and agarose gelelectrophoresis. Results will be included in an initial list of SNP markers for population genetic analysis in coconut armored scale insects, *Aspidiotus* spp.

ASPIDIOTUS; SPECIES; COCONUTS; PESTICIDE RESISTANCE; GENETIC VARIATION; PEST CONTROL; ZOOLOGY; GENETIC MARKERS; INFESTATION

What's for dinner? documenting insect prey diversity through bat fecal analysis. **Gustilo, W.O., Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Cave Ecology Lab. De Guai, A.P.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Animal Biology Div.** *Philippine Entomologist (Philippines)*. 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 195-196. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Insect diversity in front of bat-inhabited caves in Putting Bato, Polillo Island [Philippines] was recorded and compared to the contents of fecal pellets from insectivorous bats inhabiting those caves. UV-light trap was used to sample the insects along a 2-km transect with three plots. Altogether, five insect orders were noticeably abundant – Coleoptera, Hymenoptera, Hemiptera, Lepidoptera, and Diptera (the most abundant). Fecal pellets from 45 individuals belonging to nine species under three families of insectivorous bats were collected. Distribution of Coleoptera, Lepidoptera, Hemiptera, and Hymenoptera showed significant differences across bat species ( $\rho < 0.05$ ). The diversity of prey consumed

reflected the diversity of insects as food sources for the bats. However, data on prey consumption and prey availability showed no evidence of correlation ( $\rho < 0.05$ ). This suggests that bats could prey on insects which are hard to detect morphologically in fecal samples due to their relative digestibility. Molecular techniques are recommended for more accurate data on insect prey diversity through fecal analysis.

CHIROPTERA; SPECIES; CAVES; COLEOPTERA; HYMENOPTERA; HEMIPTERA; LEPIDOPTERA; DIPTERA; PREDATION; FAECES; BIODIVERSITY

## H60 - WEEDS AND WEED CONTROL

Effects of weeding practices on the soil and litter arthropod diversity in corn (*Zea mays* L.).  
**Tambaoan, F.G.S., Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Caasi-Lit, M.T., Barrion-Dupo, A.L.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Panabang, B.B., Laude, R.A.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 191. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The diversity of soil and litter arthropod in plots field of corn (*Zea mays* L.) was determined at different crop phenological stages (seed/seedling, vegetative, and reproductively) under two weeding treatments, namely: (1) regulated weeding, i.e. weeding during the early vegetative and at 30-40 days after planting; and (2) no weeding, each with three replications. A susceptible traditional open-pollinated white corn variety, IPB Var 6, was planted. Soil and litter samples were gathered before planting and every other week thereafter, and were run through Berlese-Tullgren funnels for at least 48 hours to extract the arthropods. Arthropods were sorted, preserved, processed, and identified. Individuals per morphospecies were counted and diversity indices computed. Insects and other arthropods belong to 14 insect orders/arthropod classes, most notably mites and collembolans. Treatments did not differ significantly until the pollen shed/reproductive stage. Removal of weeds decreased soil arthropods populations. There was higher soil arthropod diversity in unweeded (control) plots. Regulated weeding probably promoted plant diversity in the experimental plots and, in turn, encouraged soil arthropod diversity. Previous studies abroad have suggested that in supporting soil food webs, weed rhizospheres may be more important than crop rhizospheres since crops tend to maximize their aboveground net primary productivity. Hence, weeds are significant in protecting soil

biodiversity, especially in conventionally tilled agroecosystems. Conserving soil biodiversity is part of the pursuit for sustainable and environmentally sound agricultural practices.

ZEA MAYS; MAIZE; VARIETIES; ARTHROPODA; WEEDING; SOIL; BIODIVERSITY

Effects of weeding processes on the population of corn pests. Parakikay, T.P., Lit, I.L., Jr., Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Caasi-Lit, M.T. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Barrion-Dupo, A.L.A., Abenis, K.O. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div. Panabang, B.B., Laude, R.A.P. Philippines Univ. Los Baños, College, Laguna (Philippines). Entomology Lab. Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 189-190. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Corn or maize is the second most important crop in the Philippines. Two main factors that reduce corn crop yield are insect pests and weeds. Weeds also include what are generally considered as alternate hosts of insect pests. Along this line, knowledge of weeds as alternate host of pests is also important in integrated pest management. We aimed to determine the effects of weeding practices on the population of pests and other arthropods associated with corn. A susceptible traditional open-pollinated white corn variety, IPB Var 6, was used with two treatments, namely: (1) regulated weeding, or weeding during the early vegetative and at 30-40 days after planting, and (2) unweeded plots, each with three replications. Insects and other arthropods were visually counted (non-destructive sampling) on selected plants at the inner rows. There were more major pests among weeded plots. Arthropods observed were predominantly pest species, and among the major pests, the Asian corn borer, *Ostrinia furnacalis* (Guenee), was the most recorded species. T-test showed no significant difference between the treatments ( $p$ -value= 0.93), probably because the available area cannot accommodate an experimental design that considers interplot migration of insects.

ZEA MAYS; MAIZE; OSTRINIA FURNACALIS; ARTHROPODA; WEEDING; MIGRATION; WEEDS; HOST PLANTS

## K - FORESTRY

### K50 - PROCESSING OF FOREST PRODUCTS

Waste of tobacco stalk particles as additive in wood-based composite. **Acda, M.N.** *Philippines Univ. Los Baños, College, Laguna (Philippines). Dept. of Forest Products and Paper Science. UPLB Centennial Professorial Chair Awardee. College, Laguna (Philippines). 27 Feb 2019.*

In general, the lecture showed that waste tobacco stalks can be used as an alternative material either alone or in combination with wood particles for the manufacture of particleboard. Laboratory no choice feeding against *C. gestroi* and underground ground field exposure test showed that boards containing at least 25-50% tobacco stalk had good resistance against Philippine subterranean termites. Average weight loss of samples exposed to subterranean termites indicated less than 10% and 20% in laboratory and field exposure tests, respectively. Termite resistance of particle boards containing tobacco stalks could most likely be attributed to the presence of nicotine in the samples. Internal bond, stiffness and strength properties of boards containing tobacco stalks were above the minimum requirements for general use particleboard set by EN and PNS standards. However, boards containing 50-100% tobacco stalk showed high water absorption and thickness and swelling after 24 h soaking in water. The high levels of TS and WA could be due to poor bonding of UF resin due to the presence of heavy wax on tobacco stalks and wide cell lumen width providing large empty spaces for moisture absorption. Potential use of waste tobacco stalk as raw material in particleboard manufacture could benefit the tobacco industry by alleviating solid waste disposal problems, pollution and efficient utilization of the biomass material. Tobacco stalk particles from 4 to 8% by mass of urea formaldehyde adhesive mix blended well and resulted in satisfactory working property. Addition of tobacco particles at 4% and 8% by mass had increased or no significant effect on shear strength and cohesive wood failure of plywood using *P. falcata* veneers, respectively. Based on shear strength and wood failure, panels containing 4 to 8% tobacco stalk particles would pass the requirements of ISO 12466-2 or the PNS standards. Examination of limited adhesive penetration and improved plywood strength suggest that tobacco particles could function as both filler and extender in adhesive formulation. Although further research is needed, tobacco stalk offers an alternative to traditional fibers used as filler in plywood production. Its low cost, strength, low density and non-abrasiveness could potentially improve working properties and performance of urea formaldehyde bonded plywood.

TOBACCO; WASTES; WASTE UTILIZATION; PLYWOOD; PARTICLE BOARDS



## L - ANIMAL SCIENCE, PRODUCTION AND PROTECTION

### L40 - ANIMAL STRUCTURE

Metagenomic analysis of stingless bees in the Philippines. Mascareñas-Bautista, Ma.A., Ballesteros, J.T. Philippines Univ. Diliman, Diliman, Quezon City (Philippines). National Inst. of Molecular Biology and Biotechnology. Mostoles, D.J. Central Bicol State Univ. of Agriculture, Pili, Camarines Sur (Philippines). Coll. of Agriculture and Natural Sciences. Manuel, Ma.C.C. Philippines Univ. Los Baños, College, Laguna (Philippines). Genetics and Molecular Biology Div. Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 179-180. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Stingless bees, *Tetragonula* sp. (HYmenoptera:Apidae), are native to the Philippines and are key pollinators that remote sustainability in agroecology. Along with *Apis* sp. and *Bombus* sp., they are described as eusocial corbiculates with highly specialized gut microbial communities attributed to their social behavior. These gut microbiomes influence the development immunity, nutrition, and overall health status to their hosts and are able to subsist long-term as host-adapted symbiont lineages. Metagenomics with the aid of next-generation sequencing, provides an efficient and high-throughput method to catalog the entire composition of gut microbial communities and elucidate their relative function in the host. Gut microbiome of stingless bees, *Tetragonula* sp., from Bicol region, the Philippines were analyzed using metagenomics. For library preparation, the DNA samples were amplified using Illumina MiSeq-specific 16S V3V4 primers, then libraries were normalized and sequenced in a 2x300 cycle run. 16S rRNA sequencing reads were processed and analyzed using QIIME taxonomic units and predominant microbial phylotypes like Proteobacteria, Firmicutes, and Bacteroidetes across different colonies, and among closely related genera *Apis* and *Bombus*. Similarities among gut microbiomes of stingless bees from different colonies at different locations imply persistence of conserved microbial phylotypes. Variations on other phylotypes across colonies suggest how differences in external factors, like food source and climate, may influence gut microbiome diversity. Future directions include validating data using other metagenomic analysis software and databases.

APIDAE; SPECIES; APIS; BOMBUS; POLLINATORS; RNA; GENOMES; DIGESTIVE SYSTEM; MICROBIAL FLORA; PHILIPPINES

## L60 - ANIMAL TAXONOMY AND GEOGRAPHY

Diversity of cockroaches (Diptoptera:Blattodea) in Mt. Guiting-guiting, Sibuyan Island [Philippines]. **Lucañas, C.C. Philippines Univ. Los Baños, College Laguna (Philippines). Museum of Natural History.** Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 178. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Cockroaches collected during a protracted series of fieldwork in the Magdiwang side at Mt. Guiting-guiting were taxonomically studied. A total of 23 species from 18 genera and four families were recorded. Two species, *Periplaneta australasiae* Fabricius and *Pyconoscelus indicus* (Fabricius), were associated with human habitations. On the other hand, three represent unknown genera, nine are possibly new species, while four are now country records. This account includes only species from the soil and understory strata.

BLATTARIA; DICTYOPTERA; PERIPLANETA; SPECIES; GENERA; TAXONOMY; PHILIPPINES

Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera:Noctuidae): biogeographical origin, distribution and spread. **Lit, I.L., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith), had not been reported to occur in the Philippines based on pest records for the last 100 years or so. Recently, however, it is being monitored as it threatens to invade the Philippines, having been reported quite recently in Taiwan and in other neighboring Asian countries, most notably Indonesia (Sumatra) and Thailand. FAW is known to have originated from and is widely distributed in the Americas, but in 2016, it arrived and invaded Africa, and from there, it spread quickly in 2018 to India, and in 2019 to Sri Lanka and other Asian countries. The patterns of spread and colonization are similar to the trends observed for the *Erythrina* gall wasp, *Quadrastichus erythrinae* Kim which reached the Philippines around 2005 and killed coral trees up to 2012. Other invasive species that apparently show the same routes are the coconut leaf beetle, *Brontispa longissimi* Gestro, and possibly also, the spread of the rigid coconut scale, *Aspidiotus rigidus* Reyne from Indonesia and the Philippines to Vietnam. Extreme weather events attributed to the current climate change as well as inevitable consequences of global trade and international travel are among the suspected

contributory factors in these current aggressive spread of invasive species like the FAW.

SPODOPTERA FRUGIPERDA; ASPIDIOTUS; GEOGRAPHICAL DISTRIBUTION; CLIMATIC CHANGE; WEATHER

Reconsideration of the biogeography of the Luzon-Endemic genus Psithyristria (Hemiptera:Cicadidae): parallelism to mammalian distribution patterns in Luzon, Philippines. Lit, I, Jr., L. **Philippines Univ. Los Baños, College, Laguna (Philippines). Environmental Biology Div.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

The genus Psithyristria is so far as known endemic to Luzon Island [Philippines] and is composed of relatively small cicadas occurring generally at 1,000 m asl. A previous study focusing on the systematics and evolution of the group pointed mainly to the adaptation of the group to high elevations as the major factor to explain its distribution in the mountains of Luzon. Recent studies showed the complex geological origins of Luzon islands as well as patterns of mammalian diversity in Luzon that follow biogeographical sky islands. The phylogeny of Psithyristria was reviewed and the inferred possible affinities of more recently described species were incorporated into the cladograms. The distributions of all known Psithyristria species were mapped. In turn, the redrawn cladograms were diagrammed onto the distribution maps. The resulted show parallels of sky island distribution patterns seen among Luzon mammals as well as possible adaptive radiation after the initial colonization by the ancestor of Psithyristriini.

HEMIPTERA; CICADIDAE; GENERA; ENDEMIC; BIOGEOGRAPHY; PHYLOGENY; ADAPTATION; GEOGRAPHICAL DISTRIBUTION; PHILIPPINES

### **L73 - ANIMAL DISEASES**

Biology of the predatory water bug, Diplonychus rusticus (Fabricius) (Hemiptera:Belostomatidae), on prey Aedes aegypti L. (Diptera:Culicidae) wrigglers. Millanes, J.M. **Bureau of Plant Industry, 692, San Andres Street, Malate, Manila (Philippines). National Plant Quarantine Services Div. Javier, P.A. Philippines Univ. Los Baños, College, Laguna (Philippines). Inst. of Weed Science, Entomology and Plant Pathology.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 113-128.

The biology of the predatory water bug, *Diplonychus rusticus* (Fabricius) (Hemiptera: Belostomatidae), was studied under laboratory conditions using *Aedes aegypti* (L.) (Diptera:Culicidae) wrigglers as prey. *D. rusticus* exhibits paurometabolous type of development passing through egg, nymph, and adult stages. An adult female laid about 6-14 egg batches with an average of  $55.95 \pm 2.36$  eggs per batch. Incubation period ranges from 8-11 days with a mean of  $9.28 \pm 0.06$  days and 79.63 % hatchability. The nymph passed through five instars before reaching the adult stage. The mean durations of the different instars were:  $4.62 \pm 0.16$ ,  $4.22 \pm 0.15$ ,  $5.24 \pm 0.24$ ,  $8.06 \pm 0.58$ , and  $15.86 \pm 0.61$  days, respectively. The developmental period was 28-54 days ( $\bar{x} = 38.14 \pm 0.85$  days). Longevity of females ranged from 110-283 days ( $\bar{x} = 196.76 \pm 12.53$  days) while that of males was from 115-282 days ( $\bar{x} = 212.38 \pm 14.04$  days). *D. rusticus* was found to be voracious predator of *A. aegypti* in the laboratory. The mean consumption rates for the respective instars were  $10.0 \pm 0.35$ ,  $17.22 \pm 0.31$ ,  $36.48 \pm 0.73$ ,  $98.18 \pm 2.89$ , and  $171.88 \pm 4.23$  individual wrigglers per day. On the other hand, adult *D. rusticus* can consume 112-300 wrigglers per day or an average of  $206.54 \pm 6.66$  individuals.

AEDES AEGYPTI; HEMIPTERA; CULICIDAE; DEVELOPMENTAL STAGES; HETEROPTERA; LIFE CYCLE; PREDATION

Colony establishment and population monitoring of dengue mosquito vector, *Aedes aegypti* (L.) for the development of sterile insect technique in the Philippines. **Javier, A.M.V., Obra, G.B., Resilva, S.S., Dimaano, A.O.** Philippine Nuclear Research Inst., Commonwealth Avenue, Diliman, Quezon City (Philippines). Atomic Research Inst. Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 174. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

The stock colony of *Aedes aegypti* (L.) was established at the Philippine Nuclear Research Institute from collections made in Quezon City [Philippines]. Quality control tests were conducted per generation of *A. aegypti*. Larvae were reared using the IAEA diet. Blood feeding of adult females was done using the live mice. Methods to improve artificial feeding system was also explored. Three trapping devices such as BG sentinel, vacuum aspirator, and ovitrap were used in monitoring population of *A. aegypti* in a selected pilot site in Quezon City. Vacuum aspirator trapped more adult dengue mosquitoes than BG sentinel in a selected pilot site. Using the ovitrap, similar proportions and patterns of dengue mosquito population were observed in both pilot and control site. The ovitrap proved to be reliable and a more specific method for surveillance and long-term monitoring of dengue mosquito population density in real life conditions in urbanized areas. These results will serve as

baseline information for sterile mosquito releases for the planned sterile insect technique program.

AEDES AEGYPTI; CULICIDAE; VECTORS; STERILE INSECT RELEASE; POPULATION ECOLOGY; PHILIPPINES

Diversity and distribution of mosquitoes (Diptera:Culicidae) in the Philippines.  
**Ammuguan, M.A.T., Aguila, A.M.A., Angeles, J., Salazar, F.V. Research Inst. for Tropical Medicine, Filinvest Corporate City, 9002 Research Dr, Alabang, Muntinlupa (Philippines).**  
Philippine Entomologist (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 177. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Publications and other documentation of Philippine mosquito diversity and distribution in the past decades are limited. The last published material with nationwide coverage was Cagampang-Ramos and Darsie's dichotomous key entitled. 'Illustrated Keys to the Anopheles Mosquitoes of the Philippine Islands' in 1970. Studies on the diversity of other mosquito genera were site-specific and focused on other aspects of the Culicidae. Initial collections to re-map the diversity and distribution of Philippine mosquitoes were conducted by the Department of Medical Entomology, Research Institute for Tropical Medicine (RITM) in April 2007. The collections are continuing and in 2017, evaluation had been done in selected provinces. RITM and regional entomologists performed adult mosquito collection using carabao-baited trap in 38 provinces year-round in 2017. All mosquitoes present in traps at the time of collection were gathered using a manual aspirator. The mosquitoes were identified using a stereomicroscope. Twelve genera were identified namely: Aedes (Subgenera Aedimorphus, Finlaya, Neomelaniconion, Ochlerotatus, Paraedes), Anopheles, Armigeres, Coquillettia, Culex, Lutzia, Mansonia, Mimomyia, Taxorhynchites, Tripteroides, Uranotaenia, and Verallina, altogether with 59 species. Fourteen of these species, under Anopheles, Culex, Aedes, and Mansania, are widely distributed vectors of the six mosquito-borne diseases in the country. This study gives an overview on current diversity of mosquitoes and their distribution in the Philippines. The presence and abundance of mosquito vectors in an area have implications on the introduction and transmission of mosquito-borne diseases which will aid in decision-making and implementation of appropriate vector control strategies.

DIPTERA; CULICIDAE; SPECIES; GEOGRAPHICAL DISTRIBUTION; HUMAN DISEASES; HEALTH; DISEASE CONTROL; FEVER; DISEASE TRANSMISSION; PHILIPPINES

Fine spatial genetic analysis of dengue vector, *Aedes aegypti* (L.) in metropolitan Manila, Philippines. **Carvajal, T.M. Ehime Univ., 10-13 Dogohimata, Matsuyama, Ehime 790-8577 (Japan).** *Philippine Entomologist* (Philippines). 0048-3753. (Oct 2018). v. 32 (2) p. 178. *50th Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines, Inc. Iloilo City (Philippines). 8-11 May 2018.*

Dengue fever is an important public health concern in endemic areas of the Philippines. Even with an available vaccine in the country, control programs still rely heavily on targeting the mosquito vector, *Aedes aegypti* (L.), in stopping the transmission cycle. Hence, the main purpose of this study is to assess the spatial population genetic structure of *A. aegypti* in Metro Manila [Philippines]. Altogether, 527 *A. aegypti* adult individuals were collected around Metro Manila from May 2014 - January 2015. Eleven microsatellite markers were genotyped and subjected to population genetic analysis. Overall FsT in very low spatial area. This indicates that such observations may be facilitated by major human transportation routes.

AEDES AEGYPTI; CULICIDAE; EPIDEMICS; MICROSATELLITES; VECTORS; FEVER; DISEASE TRANSMISSION; POPULATION STRUCTURE; PHILIPPINES

Larval ecology of *Anopheles* mosquitoes in Kudat, Sabah, Malaysia. **Aure, W., Chua, T.H. Research Inst. for Tropical Medicine, Filinvest Corporate City, 9002 Research Dr, Alabang, Muntinlupa (Philippines).** *Philippine Entomologist* (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 195. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Malaria remains one of the most important mosquito-borne diseases in Malaysia. Knowledge on vector ecology is needed for suitable disease management. Data are still limited on *Anopheles* larval ecology in Kudat, Sabah, Malaysian Borneo, one of the main endemic areas for malaria particularly *Plasmodium knowlesi* Sinton and Mulligan (Pk). The contribution of land use types and physicochemical characteristics of aquatic habitats to conditions favorable for vector larval development and density, was investigated, especially *Anopheles*. A longitudinal survey of mosquito larval abundance, diversity, and habitat types. GLMM predicted mean value of *Anopheles* larvae were highest in rubber tree (1.66, SE 0.40) followed by coconut (0.91, SE 0.40), clearing sites (0.81, SE 0.36) oil palm (0.62, SE 0.42), settlement (0.56, SE 0.41), and least, in forested areas (0.46, SE 0.42). in terms of abundance, *An. Balabacensis* Baisas (75.7%) > *An. Barbirostris* van der Wulp (1.9%) = *An. Lesteri* de Meillon (1.9%) = *An. Borneensis* MacArthur (1.9%) > *Aedes albopictus* (Skuse) (17.7%) > *Cx. Gelidus* Theobald (0.9%). Important breeding sites of *An. Balabacensis* larvae were artificial containers (21%), puddles (21%), and intermittent streams (58%). Larval

densities vary with land use types. Human activities promoted proliferation of breeding habitats for Anopheles mosquitoes, particularly An. Balabacensis. Thus incorporating the aspect of deforestation in health policy and malaria research is recommended for better insights and understanding effects of ecological changes in Pk malaria transmission.

ANOPHELES; CULICIDAE; LARVAE; ECOLOGY; PLASMODIUM KNOWLESII; MALARIA; DISEASE TRANSMISSION; MALAYSIA

## **N - AGRICULTURAL MACHINERY AND ENGINEERING**

### **N20 - AGRICULTURAL MACHINERY AND EQUIPMENT**

Smarter pest identification technology (SPIdTech): a digital platform to identify, manage, report, and monitor insect pest and crop disease occurrence. **Guam, A.C., Ebuenga, M.D., de Panis, W.N., Gamba, K.E. Philippines Univ. Los Baños, College, Laguna (Philippines). National Crop Protection Center.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v.32 (2) p. 197-198. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Crop pest and disease occurrences, aggravated by climate, greatly affect global food production. To address this issue, a system named SPIdTech (Smarter Pest Identification Technology) was developed to educate and help farmers and other agricultural workers in identifying, managing, and reporting major pest and disease in rice, corn, coffee, cacao, banana, coconut, sugarcane, soybean and tomato in the Philippines. It provides two major features: Pest and Disease Identification that uses machine learning technology to identify as a virtual encyclopedia containing data on identification signs, life stages, management practices, and other pertinent information about a pest or disease. Data such as GPS location to map and tag the data, top three identification results to monitor the occurrence of pest and disease in the area, and image data to record and verify the results were collected from the users for faster and remote monitoring. An offline version was also developed to extend the capacity of the application to areas with minimal internet connectivity. More than being a system for monitoring, SPIdTech is an educational platform that will raise familiarization with common pests and diseases in the Philippines.

INSECTA; PLANT DISEASES; PEST CONTROL; TECHNOLOGY TRANSFER; IDENTIFICATION; ARTIFICIAL INTELLIGENCE; PEST CONTROL EQUIPMENT; TECHNOLOGY; REMOTE SENSING; MONITORING

Use of unmanned aerial vehicle (UAV) and Pix4D-Mapper in monitoring and mapping or armyworm infested onion areas in Bongabon, Nueva Ecija [Philippines]. **Tagaca, R.V., Alberto, R.T. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Alejandro, K.T.F., Manipon, K.C.C. Central Luzon State Univ., 3120 Science City of Munoz, Nueva Ecija (Philippines). Inst. for Climate Change and Environmental Management.** Philippine Entomologist (Philippines). 0048-3753. (Jul-Dec 2019). v. 33 (2) p. 193. *51st Anniversary and Annual Scientific Conference of the Pest Management Council of the Philippines., Inc. Coron, Palawan (Philippines). 2-5 Jul 2019.*

Remote sensing is one of the advanced technologies that can be used in early detection, mapping, and spatial tracking of plant pests and diseases. This technology can give updated data on the geoinformation and plant health status of the areas by conducting image analysis and classification processes using images captured by satellites and unmanned Aerial Vehicles (UAV). Onion armyworm (OAW), *Spodoptera exigua* (Hübner), is the most destructive insect pest of onion today, as it attacked onion plants in the field in huge numbers and can destroy entire onion fields in one night. It leaves whitish appearance of onion leaves and damaged bulbs which are no longer fit for human consumption. Damage manifestations are very visible in aerial images captured by UAVs. Thus, these imageries were utilized to detect, monitor and mapped the infested onion fields in Bongabon, Nueva Ecija [Philippines]. Orthophotos of UAV-captured imageries were processed using Pix4D-Mapper. Also, the Normalized Difference Vegetation Index (NDVI) and orthomosaics of captured images were produced and analyzed using the same software and ArcGIS to generate geo-entomological maps showing the point of infestation, actual health status of the area by extracting the infested and the non-infested onion fields. These maps were later turned over to the decision-makers and extension workers to raise the level of awareness on the infestation and use as monitoring tool in OAW prevention and spread as well as in planning for pesticide management and environmental protection.

SPODOPTERA EXIGUA; ONIONS; REMOTE SENSING; TECHNOLOGY TRANSFER; FARM EQUIPMENT

## **P - NATURAL RESOURCES AND ENVIRONMENT**

### **P10 - WATER RESOURCES AND MANAGEMENT**

Environmental risks and their impacts on food and health security in Laguna Lake Watershed, Philippines. **Rañola, R.F., Jr. Philippines Univ. Los Baños, College, Laguna (Philippines). Coll. of Economics and Management. mrdranola@up.edu.ph.** *Lake Ecosystem Assessment in the Philippines: a Science and Policy Forum for Sustainable Laguna*



*Lake Management. Tagaytay City (Philippines). 22-23 Nov 2016. TR-1863. College, Laguna (Philippines). 2018.*

The presentation deals with environmental risks emanating from the economic and the ecological changes in the Laguna Lake Watershed, especially the Silang-Sta. Rosa watershed and the proposals for addressing them. The basic framework is based on a watershed concept which shows the interactions of activities in the upstream areas with those of the downstream land and water resources. These interactions put pressure on future ecosystems and people dependent on these resources. At the heart of these environmental issues are stakeholders whose vulnerability to the environmental risks from floods/natural calamities as well as the current production and waste management practices is influenced by their biophysical and socio-economic circumstances. These risks affect not only the environment and biodiversity but also the food security and health of the affected communities. The households however are resilient and have learned to cope with these situations. Their degree of resiliency is influenced by three important factors, namely, their earning capacity, family assets and asset management and strong support from relatives. There are 3 major programs proposed to address some of these issues. These include the Payment for Environmental Services Programs, namely, the agroforestry program to mitigate the affects of heavy rains and flooding and the willingness of households to pay for garbage collection services. Another is the program we called the 'Yaman ng Lawa' literally meaning the 'Treasures of the Lake' which is an adaptive co-management approach with communities and other stakeholders to find solutions to major issues confronting the lake. The third are initiatives related to eco-restoration of the lake, waste management and health. These are 4 important lessons learned from the study. First is that there is no free lunch, that economic growth and development has a cost to the environment in terms of food insecurity and adverse health consequences. Second, a transdisciplinary approach is important for addressing the complex and interrelated environmental issues and developing the appropriate approaches and strategies to address them. Third, market-based instruments can be useful companion tools for regulatory measures for addressing environmental issues. Lastly, there should always be a major effort to share the findings of research with the communities who would benefit from the information and if time and resources permit, help them to come up with strategies to address the environmental issues.

LAKES; WATER RESOURCES; WATERSHEDS; WATERSHED MANAGEMENT; RISK ASSESSMENT; RISK MANAGEMENT; HEALTH; FOOD SECURITY; PHILIPPINES

## Q - PROCESSING OF AGRICULTURAL PRODUCTS

### Q70 - PROCESSING OF AGRICULTURAL WASTES

Waste of tobacco stalk particles as additive in wood-based composite. **Acda, M.N.** *Philippines Univ. Los Baños, College, Laguna (Philippines). Dept. of Forest Products and Paper Science. UPLB Centennial Professorial Chair Awardee. College, Laguna (Philippines). 27 Feb 2019.*

In general, the lecture showed that waste tobacco stalks can be used as an alternative material either alone or in combination with wood particles for the manufacture of particleboard. Laboratory no choice feeding against *C. gestroi* and underground ground field exposure test showed that boards containing at least 25-50% tobacco stalk had good resistance against Philippine subterranean termites. Average weight loss of samples exposed to subterranean termites indicated less than 10% and 20% in laboratory and field exposure tests, respectively. Termite resistance of particle boards containing tobacco stalks could most likely be attributed to the presence of nicotine in the samples. Internal bond, stiffness and strength properties of boards containing tobacco stalks were above the minimum requirements for general use particleboard set by EN and PNS standards. However, boards containing 50-100% tobacco stalk showed high water absorption and thickness and swelling after 24 h soaking in water. The high levels of TS and WA could be due to poor bonding of UF resin due to the presence of heavy wax on tobacco stalks and wide cell lumen width providing large empty spaces for moisture absorption. Potential use of waste tobacco stalk as raw material in particleboard manufacture could benefit the tobacco industry by alleviating solid waste disposal problems, pollution and efficient utilization of the biomass material. Tobacco stalk particles from 4 to 8% by mass of urea formaldehyde adhesive mix blended well and resulted in satisfactory working property. Addition of tobacco particles at 4% and 8% by mass had increased or no significant effect on shear strength and cohesive wood failure of plywood using *P. falcataria* veneers, respectively. Based on shear strength and wood failure, panels containing 4 to 8% tobacco stalk particles would pass the requirements of ISO 12466-2 or the PNS standards. Examination of limited adhesive penetration and improved plywood strength suggest that tobacco particles could function as both filler and extender in adhesive formulation. Although further research is needed, tobacco stalk offers an alternative to traditional fibers used as filler in plywood production. Its low cost, strength, low density and non-abrasiveness could potentially improve working properties and performance of urea formaldehyde bonded plywood.

TOBACCO; WASTES; WASTE UTILIZATION; PLYWOOD; PARTICLE BO

## U - METHODOLOGY

### U10 - MATHEMATICAL AND STATISTICAL METHODS

Microhabitat locality and the modeling of coexistence in plant communities. **Tubay, J.M.** *Philippines Univ. Los Baños, College Laguna (Philippines). Mathematics Div. UPLB Centennial Professorial Chair Lecture. College, Laguna (Philippines). 19 Mar 2019.*

The proposed lecture provides an overview of the study of coexistence using mathematical modeling. Coexistence of several species is theoretically impossible if they compete for the same resources according to Gause's Law. Many studies have been proposed to answer this puzzle of coexistence but most of the theoretical studies are complex and complicated. The lecture proposes a much simpler theory of coexistence based on a discrete, dynamic and spatial model of a terrestrial plant community with microhabitat locality. This model can maintain coexistence of more than 10 different species which is very hard to achieve using other coexistence models. This model were also used to explain other phenomena related to coexistence in plant communities that includes disturbance such as a changing environment, grazing and human intervention.

PLANTS; SPECIES; HABITATS; MATHEMATICAL MODELS; SPATIAL DISTRIBUTION