



Organic Agriculture Research in Protected Structures

Jesusa C. Legaspi, Ph.D.

Sweetpotato whitefly and aphids are major insect pests in horticultural crops in north Florida. Cultural control of these invasive insects is a sustainable management tool to mitigate the damage to organic vegetable crops in high tunnels. In collaboration with Dr. A. Bolques (FAMU), attractive refuge plants such as marigold, basil, dill and sweet alyssum were planted in a “tropical screenhouse” at the FAMU Research and Extension Center, Quincy FL, in summer 2018. These plants will enhance populations of beneficial insects that may reduce the numbers of whiteflies and aphids. Buckwheat cover crop was also planted in the screenhouse to reduce soil nematodes, increase fertility of the soil and improve biological control in the system [continued on page 2].

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Buckwheat cover crop in high tunnel (Picture by Susie Legaspi)



Dr. Alex Bolques at the FAMU Research and Extension Center (Picture by Susie Legaspi)



2018 CBC Advisory Council Retreat
Center of Biological Control Faculty, Staff, Students, and Advisory Council members at the August 2018 CBC Advisory Council Meeting at Wakulla Springs Lodge in Wakulla Springs, FL. Pictured from left to right; back row: Dr. Norm Leppla, Dr. Raymond Hix, Dr. Stephen Hight, Dr. Ben Hottel, Jermaine Perier, Worrel Diedrick, Dr. Alex Bolques, Dr. Paul Shirk, front row: Dr. Jennifer Taylor, Dr. Lambert Kanga, Dr. Susie Legaspi, Albertha Parkins, Sabrina Hayes, and Walker Marechal.

Research & Outreach News

Organic Agriculture Research in Protected Structures (continued from page 1)

Population densities of insects throughout the season were monitored by taking weekly samples of sticky traps, pitfall traps (for soil insects) and leaf counts. Data from the latter sampling methods continue to be processed and recorded. Preliminary results indicated that sweetpotato whiteflies, aphids and thrips were the common insect pests in mustard and buckwheat plants. The beneficial insects or natural enemies of the insect pests collected were mainly big-eyed bugs and ladybeetles. In addition, attractive refuge flowering



Sweet Potato Whitefly, *Bemisia tabaci*, (Picture by Scott Bauer)

plants were also planted outside the screenhouse (marigold, milkweed, sunflower, commercial mix of flowering plants) to attract natural insect enemies and pollinators. Funded by: USDA-Na-

tional Institute for Food and Agriculture-Organic Research and Extension Initiative and USDA-ARS-Collaborators: Univ. of Florida, Univ. of Georgia and Florida A&M University; submitted by: Dr. Jesusa C. Legaspi, USDA-ARS-CMAVE

Exchange Scholar – Oceana O’Dean

Oceana O’Dean, a researcher at the National Agricultural Research and Extension Institute, Georgetown, Guyana completed her one month training in the summer of 2018 on the identification of insect pests and beneficial species in the agriculturally important crops. She focused on the vegetable and fruit crops in the high tunnels, greenhouses, and open fields. Her mentors were Dr. Muhammad Haseeb, Dr. Jesusa Legaspi, Dr. Lambert Kanga, and Dr. Alejandro Bolques. Her training program was coordinated by Dr. Verian Thomas in the CAFS.



Graduate student, Jessica Jinadu, helping at the Florida State University School STEM day in Winter 2017.



Dr. Robert Nowierski (National Program Leader, Division of Plant System-Protection, USDA, NIFA) visited the Center of Biological Control



Dr. Muhammad Haseeb, Ms. Oceana O’Dean, Chris, and Dr. Jesusa Legaspi

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Entomology Insect Science Summer Camp (EISSC)

The Entomology Insect Science Summer Camp in the College of Agriculture and Food Sciences, through its Extension Program, was established in 2016. Throughout the course of the week, students learned about insect biodiversity, insect anatomy, insect ecology and conservation. Students made their own insect collections and learned about invasive species and how to prevent the spread of invasive pests. During the last day of camp students and parents explored insects in other cultures and have the opportunity to try entomophagy, eating insects.

The inaugural program in 2016 enrolled 16 campers, the camp has steadily grown in popularity since then. The Entomology Insect Science Summer Camp (EISSC) enrolled 23 students in 2017 from Tallahassee and its surrounding areas as well as Panama City, Fort Walton Beach, North Carolina, and São Paulo, Brazil. The 2018 program hosted 25 students in grades 2 to 6 and in 2019 there were 35 applicants.



A EISSC student examines a live insect

In 2019 the first Entomology Internship Summer Program for high school students was held. Students were able to gain hands-on experience in Entomology through mini research projects focused around economically important insects.

Insect Science was featured in every camp held in the College of Agriculture and Food Sciences in 2019 and was also featured in a few community camps as well. Entomology was featured in The Food Science Enrichment Summer Program (FSSEP), Raising Agriculturally and Technically Literate Rattlers (RATLR Camp) and Ag-Discovery and Vet-Tech Camp, 4-H Cloverbud camp, Orange Avenue Public Housing Summer Camp, The Wewahitchika Home School Summer Program and the AGRI-STEM Residential Summer Program [Source: S. Hayes].

Do you know someone who will be interested next year, or do you have children you would like to participate?

Contact Sabrina Hayes: Sabrina.hayes@fam.u.edu



A EISSC student holding a lubber grasshopper

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USDA, AFRI, iPiPE Project Summer Interns

In the fall of 2018, Dr. Muhammad Haseeb hosted three Borlaug Research Fellows from Africa (two from South Africa and one from Zambia). They were trained to control the fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae) using effective pest management strategies. Dr. Lambert Kanga, Dr. Susie Legaspi, and Dr. Rodney Nagoshi were the mentors of these fellows. The project was funded by the USDA, FAS and coordinated by Ms. Karen Utrecht.



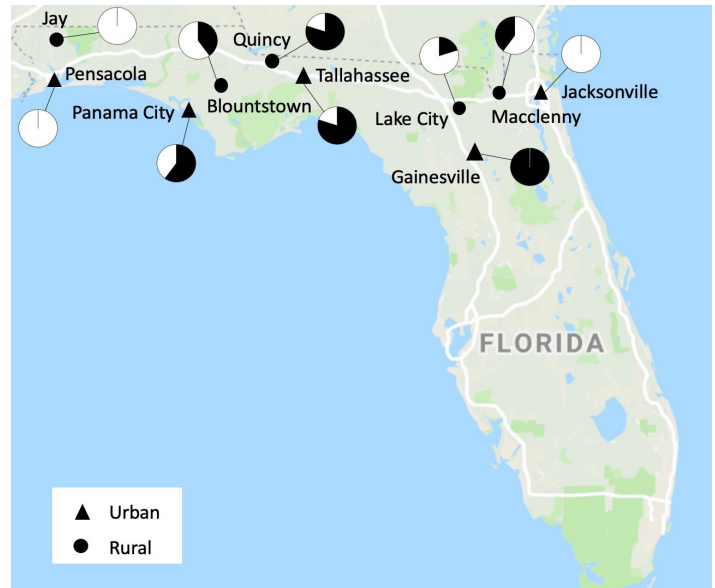
Collaborators and Borlaug Research Fellows presenting summer research projects at the FAMU College of Agriculture and Food Sciences

Examining the Prevalence of *Solenopsis Invicta* Virus 3 in *Solenopsis Invicta* (Hymenoptera: Formicidae) Alates Collected in North Florida

Red imported fire ants, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), are originally from South America but now infest over 128 million hectares of land in the United States. Their presence has caused social, environmental, and economic impacts. Over the decades, chemicals have successfully controlled these pests.



Dr. Ben Hottel and graduate student Donna Arnold collect Red Imported Fire Ants, *Solenopsis invicta*, from an ant mound in North Florida



Map of Florida illustrating the distribution of SINV-3 infection rate of *Solenopsis invicta* colonies in urban and rural cities of North Florida. Black portions of the pie charts represent the proportion of infected colonies and white represents the proportion of uninfected colonies.

However, this method is costly and red imported fire ants establish colonies quickly after chemical application. Because of this, it is important to create additional strategies for managing fire ants. Surveys were conducted by FAMU student Donna Arnold to determine the prevalence of the *Solenopsis invicta* virus 3 (SINV-3) in alates of *S. invicta* collected from five urban areas (Tallahassee, Pensacola, Jacksonville, Gainesville and Panama City) and five adjacent rural areas (Quincy, Jay, Macclenny, Lake City, and Blountstown) of north Florida. The quantity of SINV-3 in the alates was established using Real Time Polymerase Chain Reaction (RT-PCR) techniques. The prevalence of the SINV-3 varied widely from city to city; however, no statistically significant difference in infection rate was found between urban and rural cities sampled. Cities that had no infections of SINV-3 are good candidates for the introduction of this virus as a biological control agent to help manage these pests locally. This project was done in collaboration with Dr. Subramani Balasubramani at the FAMU and Dr. Steven Valles at USDA-ARS. Funding was provided by USDA-APHIS [Source Ben Hottel].

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Visit to Chinese Academy of Sciences

In summer 2017 Dean Taylor and Haseeb visited Institute of Zoology, Chinese Academy of Sciences (IOZ-CAS) to discuss ongoing progress of exchange training of graduate students and ongoing research work on the invasive insect pests and to discuss the MOU with the leadership team. Dean Taylor presented his talk in the IOZ-CAS on the opportunities for collaborative research and academic works in the CAFS. Dr. Haseeb presented his talk on the ongoing research and academic works on the invasive pest insects. During the visit both visited Beijing Forestry University.



Dean Taylor and Dr. Haseeb in China

Borlaug Research Fellow - Mohunnad Massmi

Mohunnad Massmi (Agronomist and Extension Specialist, National Agriculture and Extension Center, Zarqa, Jordan) completed his three months exchange training successfully under the USDA, FAS project in the spring of 2017. His major interest was on the hybrid seeds influence, seedling vigor, irrigation modeling in forage sorghum and corn.



Borlaug Research Fellow Mohunnad Massmi

Few investigations were reported on the hybrid effect on vigor for irrigation conditions in Jordan. A new investigation conducted under the Norman Borlaug fellowship during 2017 demonstrated a suitable simulation for growers. The first step required the identification of drought-tolerant seeds. Five commercial seed lots (three of corn and two of sorghum) were used. The second involved planting seeds under controlled and field conditions in the Florida A&M University and then evaluating the vigor by measuring emergence, fresh weight, and water use efficiency. Corn (6640VT3P) had significantly higher fresh weight and vigor. However, it was significantly the highest with water use efficiency in the greenhouse. The superiority of corn (6640VT3P) may be attributed to increased seed weight. Thus, results suggested that corn (6640VT3P) had a high impact on the seedling establishment that could be grown under extreme drought conditions. The project was coordinated by Ms. Karen Uetrecht from the USDA, FAS and the fellow was hosted by Dr. Muhammad Haseeb, Dr. Anandhi Swamy, Dr. Jesusa Legaspi, and Dr. Alfredo Lorenzo.



Yasmine Moffett and Dr. Hottel at Gilchrist Elementary School STEM Night Winter 2019

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Ed Freytag from the City of New Orleans Mosquito, Termite, and Rodent Control Board gives a hands-on demonstration at the 42nd Annual FAMU Field Day and Workshop on how to inject insecticidal foam into a tree infested with Formosan subterranean termites. Picture by B. Hottel

Annual Famu Field Day and Workshop (2017-2019)

Florida A&M University Entomology has continued to have its annual pest control focused conference each fall. It is hard to believe but we just hosted the 43rd conference this year on October 29th and 30th, 2019 with over 100 participants registered. There has been a few changes to the conference that have been made over the past three years.



Paul Mitola from the Florida Department of Agriculture and Consumer Services gives a regulatory talk to pest management professionals at the 43rd Annual Field Day and Workshop on October 29th, 2019

The location of the conference was moved from the Civic Center to Tallahassee Community College in the fall of 2017. This new location has better audio/visual equipment and more flexibility with catering options. The three-day conference was also changed to a two day conference for the first time in the fall of 2019. The conferences have continued to cover updated information on fumigation, mosquito control, general household pest issues, wood destroying organisms, and lawn and ornamental pests. CEU's were given for these topics for Florida and many of the states in the Southeast. The conferences included both seminars and small group hands-on workshops. [Source: B.A. Hottel]

Southeast Bed Bugs in Public Housing Meeting

In collaboration with Cornell University, we hosted the first Southeast Bed Bugs in Public Housing meeting at Tallahassee Community College on June 29th, 2017. Presenters from academia, pest control industries, and individuals representing public housing talked about the ongoing issues associated with bed bugs in low- income multi-unit housing, Section 8 housing and other temporary housing facilities. A total of 67 individuals from public housing attended the conference. The conference was funded by the U.S. Department of Housing and Urban Development. [Source: B.A. Hottel]



Brittany Campbell from the National Pest Management Association constructs a bed bug heat chamber at the Southeast Bed Bugs in Public Housing Meeting on June 29th, 2017.



Matt Lollar from UF/IFAS gives a talk on turf pests of North Florida at the Northwest Florida Pest Management Conference

First FAMU-UF Northwest Florida Pest Management Conference

In collaboration with the University of Florida, Florida A&M University co-hosted the first ever Northwest Florida Pest Management Conference in Milton, FL on April 17, 2019. The meeting educated pest management professionals on a wide range of topics including ants, bed bugs, termites, and turf pests. Due to the positive reception from industry in the area, the conference will be held again next year in March 2020.



Graduate student Tashani Brown presenting her research at the 2019 University of Florida Southeast Pest Management Conference in Gainesville, FL. Picture by B. Hottel



Dr. Muhammad Haseeb received the 2019 FAMU researcher excellence award.. Dean Robert Taylor (left), Dr. Haseeb (center), and President Rob Robinson (right)



Dr. Haseeb and Dr. Legaspi received the 2019 Teacher and Extension of the year awards, respectively from the Florida Entomological Society

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Dr. Legaspi (right) and Dr. Amalin (left) collecting pheromone traps to monitor cacao pod borer, a major insect pest in cacao (or cocoa) tree orchards in Isabela State Univ., Echague, Philippines- July 2017.



Dr. Legaspi (left) working with a faculty from Sultan Kudarat State Univ., and R. Castillo (right) in the Philippines on developing an artificial diet to rear cacao pod borer in the laboratory at De La Salle University for research purposes, July 2017.



Dr. Susie Legaspi speaks at the 2019 Vineyard Management, IPM and Pesticide Safety Workshop, 13 Feb 2019, FAMU-Center for Viticulture and Small Fruit Research, Tallahassee, FL



2019 Grape Harvest Festival Volunteers. From left to right and front to back: Dr. Oghenekome Onokpise, Dr. Lambert Kanga, Dr. Muhammad Haseeb, Dr. Susie Legaspi, Chichi Okoroji, and Almando Morain



AGRI-STEM CAMP in Tallahassee, FL July 31, 2019



Jan Peters showing AGRI-STEM participants insect collections



Field demonstrations for participants at AGRI-STEM Camp



Dr. Muhammad Haseeb, Almando Morain, and Worrel Diedrick help students with lab demonstration at AGRI-STEM Camp

Development of a Biologically Based Integrated Pest Management for Oriental Vegetable Production

The Dominican Republic is the major exporter of fresh fruits and vegetables for the European Union (EU), the United States of America (USA), neighboring South American countries and other nations around the world. However, pest loads and illegal pesticide residue levels in vegetable samples for the fresh market have been detected and continue to plague DR exports to the US and EU. Therefore, Dr. Lambert Kanga and his team developed and successfully implemented a biologically based integrated pest management (IPM) approach which reduces use of chemicals and minimizes pest damage through the careful integration of traps crops and refuge crops along with augmentative biological control (Fig. 1). This IPM strategy has increased productivity and sales for domestic and export markets of high-value fruit and vegetable global value chains. It reduces the use of chemical controls and maximizes the use of the biological and cultural components to provide an environmentally sound means of pest management for oriental and greenhouse vegetables (Fig. 2). In addition the use of this IPM program generates earnings from RD\$61,570 to RD\$139,750 in net value income



Figure 1: Monitoring for beneficial insects and pests on oriental vegetable farm with Dr. Lambert Kanga

for 10 acre farms. As a result, this successful conservation biological control strategy was decreed in 2019 by the Ministry of Agriculture as a national model for the production of oriental vegetables in the Dominican Republic.

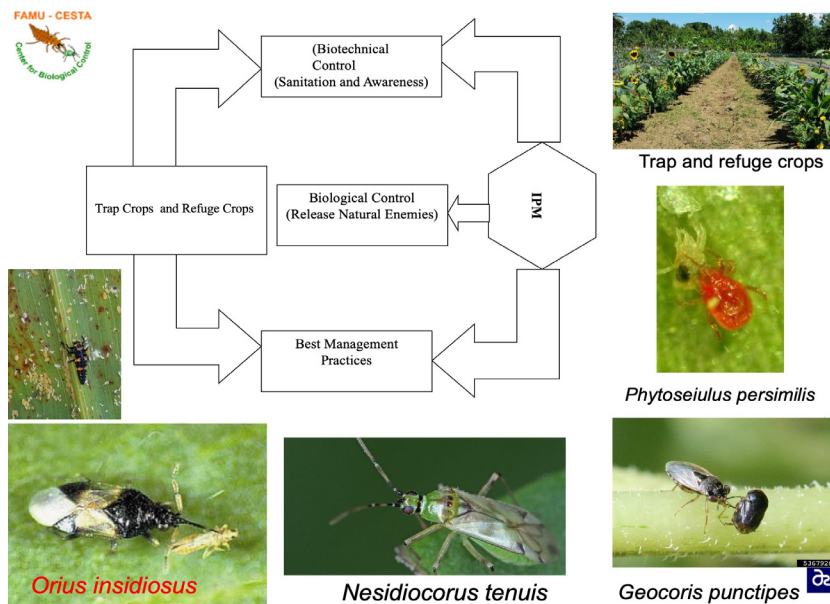


Figure 2: Components of the biologically based integrated pest management strategy

Student News

Albertha Parkins Graduates with an MS Degree

Albertha Parkins graduated in the fall of 2018. The focus of her MS research work was on the Spotted-wing drosophila (SWD), *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae), which is a non-native in the United States from the Southeast Asia. The fruit crops susceptible to SWD include blueberry, blackberry, cherry, raspberry and strawberry. Larvae of the pest develop within the fruit making it unmarketable and can cause great economic losses. Currently, there are limited options available for growers to control SWD so they rely on repeated insecticide applications. This study focuses on developing strategies to manage SWD effectively using cultural practices. The study was conducted at the University of Florida, North Florida Research and Education Center, Quincy, Florida in the summer of 2017 and 2018. The experimental design was a single unit experiment with two organic mulches pine bark (PBM), shortleaf pine needles (SPN) and one inorganic weed fabric mulch (WFM); in the control no mulch was applied. Adult flies were collected weekly (May-July) using 'Scentry Traps' and 'Suzukii Bait Traps'. For Suzukii Trap the mean density of SWD was highest in SPN and PBM had the lowest numbers in 2017. In 2018, SPN had the highest mean density, while WFM had the lowest mean density. For Scentry Trap in 2017, SPN had the highest mean density and PBM had the lowest mean density. Similarly, in 2018, SPN had the highest mean density and PBM had the lowest mean density. Overall SPN accounted for the highest number of flies and PBM had the lowest number of flies captured.



Dr. Haseeb and Albertha Parkins at graduation

all SPN accounted for the highest number of flies and PBM had the lowest number of flies captured. These preliminary results indicated that mulch type affects the density of SWD in open blueberry fields. Earlier, she presented her research findings in the Southeastern Branch of Entomological Society of America and Association of Research Directors Meetings. Her major professor was Dr. Muhammad Haseeb and committee members were Dr. Lambert Kanga, Dr. Oscar Liburd, and Dr. Anthony Ananga [Source Muhammad Haseeb].



Ph.D. Student Alex Orfinger

New Ph.D. Student - Alex Orfinger

Mr. Alex Orfinger is working on a Ph.D. in the FAMU-UF cooperative Ph.D. program. His co-major advisors are Drs. Raymond L. Hix, and Andrew Rasmussen. Drs. Heather McAuslane (Entomology, UF), Marc A. Branham (Entomology, UF), Charles E. Cichra (UF, Fisheries), and John C. Morse (Entomology, Clemson). His dissertation proposal is titled "Phylogenetic Systematics and Ecology of Eastern North American *Polycentropus Sensu Stricto* (Trichoptera: Polycentropodidae)." His work is part of a Biodiversity Assessment of Horn Springs and Related Springs and Spring Runs on the St. Marks River, Florida. [Source: R. Hix]

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Dr. Eutyechus Kariuki Graduated from FAMU-UF Cooperative Ph.D. program

Eutyechus M. Kariuki successfully completed the cooperative Ph.D. program in Entomology at the Florida A&M University and University of Florida in Dec 2017. The title of his dissertation was “Impact, Field Host Range, and Vertical Foraging Range of *Cricotopus lebetis* Sublette (Diptera: Chironomidae), a Biological Control Agent of *Hydrilla verticillata* [L.F] Royle (Hydrocharitaceae).” His dissertation committee consisted of Dr. Raymond Hix (FAMU), chair, Dr. Jim Cuda (Entomology, UF) co-chair, Dr. Jennifer Gillette-Kaufman (Entomology-UF), Dr. Stephen Hight (FAMU CBC/USDA-ARS), and Dr. Lyn Gettys, (Botany, UF). He is currently a post-doctoral researcher in Dr. Carey Minter’s weed biological control lab at the UF Indian River Research and Education Center in Ft. Pierce, Florida. Dr. Kariuki’s previous M.S. work was related to the biological control of tropical soda apple with Drs. Hix and Hight at the FAMU CBC.



Dr. Eutyechus Kariuki

Walker Marechal completed his research on a thesis titled “Management of the small hive beetle, *Aethina tumida* Murray (Coleoptera: Nitidulidae) in Honey Bee, *Apis mellifera* L. (Hymenoptera: Apidae) colonies.” He is currently a Ph.D. student at the Florida A&M University School of Environment. He is conducting his dissertation project titled as “Identify and Visualize the Mercury Bioremediation.”



Donna Arnold (second from left), Jermaine Perier (third from left), and Walker Marechal (third from right) at Summer Graduation 2019

Donna Arnold, Jermaine Perier, and Walker Marechal Graduated with M.S. Entomology Degrees in Summer 2019

Donna Arnold completed her thesis titled “Examining the Prevalence of *Solenopsis invicta* Virus 3 in *Solenopsis invicta* (Hymenoptera: Formicidae) Alates Collected in North Florida” (See page 3 for more information). She is currently employed as a Horticultural Instructor at the Gadsden Correctional Facility in Quincy, FL.

Jermaine Perier finished his thesis project titled “Integration of two predaceous stinkbugs and a larval parasitoid to manage the fall armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae).” He is continuing to work with Dr. Muhammad Haseeb on ongoing research projects.



Jermaine Perier (center) with collaborators and M.S. thesis committee at exit seminar in the summer of 2019

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USDA, AFRI, iPiPE Project Summer Interns

Two paid internships were provided in the summer of 2018 to Tashani Brown and Chinemenma Okoroji to obtain training on the vegetable pest insect identification and monitoring. Ms. Brown worked on the insect pests and beneficial species in tomatoes while Ms. Okoroji worked on the pepper insect pests and beneficial species. Both students presented their respective studies in the iPiPE (Integrated Pest Information Platform for Extension and Education) annual meeting in Raleigh, NC in the spring 2018 and earned the certificates of excellence.



Chinemenma Okoroji, Dr. Muhammad Haseeb, and Tashani Brown at the iPiPE annual meeting in Raleigh, NC Spring 2018 with certificates of excellence

Past Student Update on Edidiong Inyang

Dr. Edidiong Inyang completed his Ph.D. at the University of Texas-Arlington in the field of biological engineering in August 2019 in Dr. Shih-Ho (Simon) Chao's lab. His dissertation title was "Engineering of Nano Delivery for Diagnosis and Restoration of Disrupted Brain Endothelium Post Blast Induced Traumatic Brain Injury (TBI)." Edy completed his M.S. in Entomology at the FAMU CBC in August 2013 working with Drs. Raymond L. Hix and Richard Mankin (ARS CMAVE) using acoustic detection methods of the grape root borer. [Source: R. Hix]



Dr. Edidiong Inyang Completed at Summer 2019 Graduation



Jermaine Perier was awarded first place for the poster presentation at the 2019 ARD Symposium

Peer-reviewed Publications and Book Chapter:

- Dasia S. Harmon, Muhammad Haseeb, Lambert H. B. Kanga, and Oscar E. Liburd. 2019. Evaluation of Monitoring Traps and Lures for *Drosophila suzukii* (Diptera: Drosophilidae) in Berry Plantings in Florida. *Insects* 2019, 10, 313; doi:10.3390/insects10100313
- de Castro, A. A., J. C. Legaspi, W. de S. Tavares, R. L. Meagher, Jr., N. Miller, L. Kanga, M. Haseeb, J. E. Serrao, C. F. Wilcken, and J. C. Zaniccio. 2018. Lethal and behavioral effects of synthetic and organic insecticides on *Spodoptera exigua* and its predator *Podisus maculiventris*. *PLoS One*. 13(11):e0206789. <https://doi.org/10.1371/journal.pone.0206789>.
- Eason, J., L. K. Kanga, M. Haseeb, J. A. Qureshi and J. C. Legaspi. 2018. Mechanisms of resistance to organophosphorus and pyrethroid insecticides in Asian Citrus Psyllid populations in Florida. *Currents Investigations in Agricultural Current Research*. 1(2)-2018.CIACR.MS.ID000111.
- Eddy Inyang, Raymond L. Hix, Violeta Tsoleva, Barukh B. Rohde, Omotola Dosunmu and R. W. Mankin. 2019. Subterranean Acoustic Activity Patterns of *Vitacea polistiformis* (Lepidoptera: Sesiiidae) in Relation to Abiotic and Biotic Factors. *Insects*: 10:2-16.
- Eutyclus M. Kariuki, James P. Cuda, Stephen D. Hight, Raymond L. Hix, Lyn A. Gettys, and Jennifer L. Gillett-Kaufman. 2019. Foraging depth of *Cricotopus lebetis* larvae. *J. Aquat. Plant Manage.* 57: 000–000.
- Eutyclus M. Kariuki, Raymond L. Hix, Stephen D. Hight, Stuart R. Reitz, and Moses T. K. Kairo. 2016. Influence of sun and shade conditions on *Gratiana boliviana* (Coleoptera: Chrysomelidae) abundance and feeding activity on tropical soda apple (Solanaceae) under field conditions. *Florida Entomologist* 99(3):552-554.
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- Mankin R.W., D. Stanaland, M. Haseeb, B. Rohde, O. Menocal and D. Carrillo. 2018. Assessment of plant structural characteristics, health, and ecology using bioacoustic tools. In: *Proceedings of Meetings of Acoustics*. 175th Meeting of the Acoustic Society of America, Minneapolis, Minnesota 33: 1-12.
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- Muhammad Haseeb, Omotola G. Dosunmu, Lambert H. B. Kanga, Charles W. O'Brien and Runzhi Zhang. 2019 Development of a training program to identify invasive weevils in the Caribbean basin and the United States. *Florida Entomologist*. 102: 469-474
- Pengxiang Wu, Muhammad Haseeb, Worrel Diedrick, Haoyong Ouyang, Runzhi Zhang, Lambert H. B. Kanga, and Jesusa C. Legaspi. 2019. Influence of plant direction, layer, and spacing on the infestation levels of *Anthonomus eugenii* (Coleoptera: Curculionidae) in open jalapeño pepper fields in North Florida. *Florida Entomologist*. 102: 501-508.
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