**Abstracts**

**FES Presidential Address**

**Heather McAuslane** - Department of Entomology and Nematology, Box 110620, Gainesville, FL 32611; hjmca@ufl.edu; 352-392-1963

The Role of the Florida Entomological Society in Science Communication

**PIONEER LECTURE**

**Howard Frank** - Department of Entomology and Nematology, Box 110620, Gainesville, FL 32611; jhfrank@ufl.edu; 352-505-6056

Frederick Douglas Bennett, A Legend in Biological Control - Fred Bennett was a legend in biological control before he was hired by the University of Florida, which surely was the reason he was snapped up. The position he was offered was that of Graduate Research Professor made available by retirement of Reece Sailer in 1985. Fred had been Director of the Commonwealth Institute of Biological Control, based in Trinidad, West Indies but also with units at that time in England, India, Kenya, Malaysia, Pakistan, and Switzerland. Established to mitigate pest problems in Commonwealth countries, it now worked also under contract in non-Commonwealth countries. That caused Fred to travel widely for research projects and to attend scientific meetings. Although biological control calls for expertise in applied ecology and ethology, knowledge of various taxonomic groups helps very much. Fred’s taxonomic interests are in bees, Sphingidae, and in scale insects and their chalcidoid parasitoids (Aphelinidae, Encyrtidae and Eulophidae). Fred was born and educated in Canada, performed PhD research in California, was employed briefly in Bermuda, then Trinidad, and finally Florida. But when he retired with his wife Betty in 1993, this was to the Isle of Man in the Irish Sea, where he continued entomologizing and publishing. Why there? Because it was close to England where his daughter and two sons live. As Graduate Research Professor at the University of Florida he was popular, mentored graduate students, and worked with faculty members of the Entomology and Nematology Department in Gainesville and at various Research Stations in Florida.

**PhD oral paper competition**

1. **Jayshree S Patel**, Thomas Chouvenc and Nan-Yao Su - Entomology and Nematology Department, Ft. Lauderdale Research and Education Center, University of Florida, FL 33314-3205; Jayshree.patel@ufl.edu; 201-993-0727

Temperature Preference of Two Invasive Coptotermes Species and their Hybrids (Blattodea: Rhinotermitidae) - Temperature preference of two invasive subterranean termite species, *Coptotermes gestroi* (Wasmann) and *Coptotermes formosanus* Shiraki and their hybrids were determined in a horizontal thermal gradient. The activity of workers of four mating combinations : ♀*C. gestroi* × ♂*C. gestroi* (*C. gestroi*), ♀*C. formosanus* × ♂*C. formosanus* (*C. formosanus*), ♀*C. gestroi* × ♂*C. formosanus* (Hybrid G), ♀*C. formosanus* × ♂*C. gestroi* (Hybrid F), when placed on the temperature gradients were videotaped and analyzed to determine the mean temperature preference values (mTPV). The temperature ranges for active termites were 21.9 - 39.5 °C for *C. gestroi,* 11.1 - 39.5 °C for *C. formosanus*, 25.3 - 38.2 °C for Hybrid G and 24.9 - 39.3 °C for Hybrid F. There was no significant difference in the mTPV among two parental species and Hybrid G. The mTPV of Hybrid F was significantly higher than both parental species. Our results indicate that hybrid populations of *C. formosanus* and *C. gestroi* might be more active in tropical than temperate regions, and if established in temperate regions, they will be more active in summer months when the mean temperature exceeds 25 °C.

1. **Sang-Bin Lee** and Nan-Yao Su - Entomology and Nematology Department, Ft. Lauderdale Research and Education Center, University of Florida, FL 33314-3205; lsb5162@ufl.edu; 754-465-4019

Foraging Proportion of *Coptotermes formosanus* Shiraki (Blattodea: Rhinotermitidae) in Sand and Organic Soil - A colony of the Formosan subterranean termite is composed of different castes and may contain millions of individuals. Recent studies have shown that 10 – 20 % of the colony forage out and return to share acquired food with nestmates. In this study, we measured foraging proportions and wood consumption of *C. formosanus* in different nitrogen richness (organic soil vs sand) in the central nest and foraging site. Two containers (central nest and foraging site) were connected to each other by an acryl tube (1 m length) and the container was filled with either organic soil (OS) and/or sand (S), yielding 4 different combinations. A piece of spruce wood was placed at the foraging site then a 2 yr-old incipient colony was introduced into the central nest. Number of termites at foraging site and total number of termites were counted and proportion of termites at foraging site was calculated. Substrates in foraging site, central nest, and its interaction had significant impacts on the foraging proportion of workers, but not on soldiers. The highest foraging proportion and wood consumption were observed when both central nest and foraging site was filled with sand, whereas the lowest foraging proportion and wood consumption was recorded in the case of organic soil in central nest and sand in foraging site.

1. **Joseph F. Velenovsky**, Daniel E. Jasso-Selles, Francesca De Martini, Thomas Chouvenc, Nan-Yao Su and Gillian H. Gile - Entomology and Nematology Department, Ft. Lauderdale Research and Education Center, University of Florida, FL 33314-3205; jvelen10@ufl.edu; 410-726-0560

Examination of the Parabasalian Symbiont Community of *Coptotermes gestroi* (Wasmann) and *Coptotermes formosanus* Shiraki (Blattodea: Rhinotermitidae) through Morphological and Molecular Techniques - The relationship between subterranean termites and their hindgut protozoa is a well-known example of an obligate mutualism. Three parabasalians within *Coptotermes formosanus* Shiraki have been described: *Holomastigotoides hartmanni* Koidzumi, *Spirotrichonympha* (*Cononympha*) *leidyi* Koidzumi, and *Pseudotrichonympha grassii* Koidzumi. Recently, one parabasalian was described from *Coptotermes gestroi* (Wasmann): *Pseudotrichonympha leei* del Campo and Keeling. Despite the classification of *C. formosanus* and *C. gestroi* as major structural pests, and the abundant attention that has been given to protozoa within other subterranean termite genera such as *Reticulitermes*, the complete diversity of the protozoan community of *C. formosanus* and *C. gestroi* was only recently revealed. This study used microscopy, single cell isolation, and phylogenetic tree construction to further investigate the protozoan community of *C. formosanus* and *C. gestroi*.In addition to *H. hartmanni*, *S.* *leidyi*, and *P. grassii*, the hindgut of *C. formosanus* harbors an undescribed *Holomastigotoides* species and an undescribed species from the recently reestablished genus *Cononympha*. The hindgut of *C. gestroi* also harbors five parabasalians: *P. leei*, two undescribed *Holomastigotoides* species, and two undescribed *Cononympha* species. The protozoan community of *C. formosanus* and *C. gestroi* is similar to the community present within *Heterotermes aureus* (Snyder).

1. **Emilie P. Demard**, Ismail Doker, Rhuanito Soranz Ferrarezi and Jawwad A. Qureshi - Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; edemard@ufl.edu; 772-801-1430

Pest and Predacious Mite Complex of Citrus Under Protective Screen (CUPS) **-** Citrus Under Protective Screen (CUPS) exclude Huanglongbing (HLB) or citrus greening disease mainly by not allowing the vector Asian citrus psyllid. However, several other pests and small beneficial organisms including mites are able to enter through the screen. Pest mite feeding causes damage to leaves and fruit and reduces the marketability of fruits. Two rootstocks of ‘Ray Ruby’ grapefruit (Citrus paradisi) planted in ground and pots were investigated for diversity and abundance of phytophagous and phytoseiid mites in CUPS and control. Leaves and fruits were examined for pest mites using a 10X hand lens and canopies tap sampled for pest and predacious mites. Phytophagous mites, *Phyllocoptruta oleivora* (Ashmead) (Acari: Eriophyidae) and *Panonychus citri* (McGregor) (Acari: Tetranychidae) were abundant in CUPS and control. *Phyllocoptruta oleivora* in CUPS and control averaged 0.73 ± 0.08 and 1.03 ± 0.10 per lens field on leaves, respectively. *Panonychus citri* averaged 1.01 ± 0.16 and 0.12 ± 0.02 per tap sample in CUPS and control, respectively. Phytoseiid mites were significantly more in CUPS compared to control (15.07 ± 0.82 and 5.06 ± 0.40 per tap samples, respectively) and more in the in-ground trees compared to potted trees (14.57 ± 0.83 and 5.56 ± 0.41, respectively). *Amblyseius tamatavensis* was 68% of the predatory complex followed by *Typhlodromalus peregrinus* at 27%. *Amblyseius tamatavensis* was dominant in CUPS (76%) and *T. peregrinus* in control (41%). *Proprioseiopsis mexicanus* and *Typhlodromips dentilis* were present at lower abundance. These pytoseiids will be useful for managing pest mites in CUPS.

1. **Kelly Carruthers,** Eutychus Kariuki, and Carey Minteer - Entomology and Nematology Department, Indian River Research and Education Center, University of Florida, FL 34945; Kelly.carruthers@ufl.edu; 281-928-2297

Invasive Species Outreach Education in the K-12 Classroom - Managing invasive species is costly, particularly in Florida. Management of invasive plants alone in Florida is estimated to cost roughly $45 million annually. Several different methods are employed to control invasive species, including mechanical, chemical, and biological controls. Information about the relative safety and cost of each method is available and accessible to the public, but it is not routinely accessed in school classrooms. Public K-12 classrooms are sometimes the only formal science training the general public receives, which makes them an important venue for science outreach. Over the course of six weeks, we worked with a local STEM K-8 school, Samuel Gaines Academy of Emerging Technologies (Fort Pierce, FL), to teach students concepts that are important in invasion science. Lessons included an interactive invasion game, an experiment to test fertilizer effects on *Liliocerus cheni* (a biological control agent) production, invasive species presentations, and a game-show style quiz game. Student knowledge was assessed by pre- and post-tests, showing that students’ knowledge of invasive species increased over the 6-week unit. Student test scores increased in the post-test by 38% on average. Our goal is to increase school participation throughout the state to facilitate awareness and contribute to public knowledge about the control of invasive species with an emphasis on biological control.

1. **Reina L. Tong** and Nan-Yao Su – Entomology and Nematology Department, Ft. Lauderdale Research and Education Center, University of Florida, FL 33314-3205; reinat@ufl.edu; 808-253-1182

Trophic Path of Exuviae within Colonies of *Coptotermes gestroi* (Wasmann)**-** The observation that workers of *Coptotermes formosanus* Shiraki always molt at the central nest led to the hypothesis that exuviae, a possible nitrogen source, are fed to the queen for more egg production, or to the growing brood. To find the trophic path of exuviae in *C. gestroi* (Wasmann) colonies, 20 exuviae marked with a rabbit immunoglobulin marker were fed to subsets (queen, king, 5 first instar larvae, 10 second instar larvae, 20 first instar workers, 35 second and older instar workers, and 5 soldiers) of four colonies. Two days later, an enzyme-linked immunosorbent assay was used to detect the marker in each caste. The percent of each caste that was positive for the marker was arcsine transformed and subjected to an analysis of variance. The concentration of marker by caste was also analyzed. Percent positive with marker varied among castes, with the highest percentage positive in the queen (100 ± 0% positive) and king (75 ± 50% positive). Among recipients, the queen had a significantly higher concentration than eggs and first instar larvae (*p* = 0.0039). Donors (first and second and higher instar workers) did not differ in percent positive, but did differ in concentration of marker (*p* = 0.0181), with second and higher instar workers having higher concentration than first instar workers. Based on these results, we concluded that most exuviae were consumed by the second and higher instar workers and passed on to the queen.

1. **Olayinka David,** Andre Luis Costa-Da-Silva and Matthew Degennaro- Florida International University, 11200 SW 8th street, Miami, FL 33199; odavi022@fiu.edu; 305-946-9197

Roles of Olfactory Receptors in *Aedes aegypti* Reproduction - Olfaction is the capacity to smell. Animals use olfactory receptors (ORs) to detect and decipher chemical molecules in their surroundings. Although, usually a peripheral chemosensory phenomenon, ORs are, in fact, expressed and stimulated within the female reproductive tract of many animals including the competent vectors of arboviral diseases and malaria, *Aedes aegypti* and *Anopheles gambiae* respectively. Mosquito ORs are typically heterodimeric complexes composed of one invariant odorant receptor co-receptor (Orco) and one variant odor specific receptor. Whereas it is largely unknown how ORs exert their function in facilitating mosquito reproduction, *A. aegypti* and An. gambiae sperm have previously been shown to respond to Orco agonists (VUAA1 and VUAA4) in vitro, in a manner that suggests their activation. Here, we report a reproductive defect in the previously characterized Orco mutant (orco-/-) *A. aegypti* compared to Orlando strain wild type over two gonotrophic cycles. Although, orco-/- female mosquitoes laid as many eggs as wild type, there is however a significant reduction in egg hatch rate when compared to wild type. Whereas the mutant hatching defect was rescued when wildtype males were crossed with mutant females, this rescue was not sustainable in the second gonotrophic cycle. Our results suggest that orco-/- female Aedes aegypti may be deficient in an important chemosensory machinery possibly required for stimulating sperm expulsion out of storage for fertilization. Understanding the molecular and biochemical role of reproductive tissue expressed ORs in mosquito may hold the key to a new vector population control.

1. **Joshua I. Raji,** Nadia Melo, John Castillo, Sheyla Gonzalez, Valeria Saldana, Marcus Stensmyr and Matthew DeGennaro - Florida International University, 11200 SW 8th street, Miami, FL 33199; jraji001@fiu.edu; 78645186553

Ir8a Mutant Mosquitoes Lose Strong Attraction to Humans *-* Mosquitoes use olfaction as a primary means of detecting their hosts. Previously, the genetic ablation of a family of Aedes aegypti olfactory receptors, the Odorant Receptors (ORs), was not sufficient to reduce host-seeking in the presence of carbon dioxide (CO2). This suggests the olfactory receptors that remain, such as the Ionotropic Receptors (IRs), could play a significant role in host detection. To test this, we disrupted the Ir8a co-receptor in Aedes aegypti using CRISPR/Cas9. Ir8a mutant female mosquitoes are not attracted to lactic acid, a behaviorally active component of human odor, and lack odor-evoked responses to acidic volatiles found in human odor. The loss of Ir8a reduces mosquito attraction to humans and their odor. We show that the CO2-detection pathway is necessary but not sufficient for IR8a to detect human odor. Our study reveals that the IR8a pathway is crucial for an anthropophilic vector mosquito to effectively host seek.

**M.S. oral paper competition**

1. **Wilfrid Calvin,** Julien Beuzelin, Oscar Liburd, Marc Branham and Ludger Jean Simon - Entomology and Nematology Department, University of Florida, Belle Glade, FL 33430; wilfrid.calvin@ufl.edu; 239-384-1441

Evaluation of Intercropping and Biological Insecticides on Sugarcane Aphid (Hemiptera: Aphididae) Infestations in Sorghum - The sugarcane aphid (*Melanaphis sacchari*) emerged as a new sorghum (*Sorghum bicolor*) pest in North America in 2013 and became a concern in sorghum production in Haiti in 2015. The development of resistant sorghum varieties has been the main approach for sugarcane aphid management in Haiti; however, additional management tactics have been studied to potentially provide a comprehensive management strategy. Field experiments were conducted in Jonc-Labeille, Chantal, Haiti in Fall 2018 and Spring 2019 to determine the effect of intercropping sorghum with maize (*Zea mays*) or pigeon pea (*Cajanus cajan*) compared to a sorghum monoculture on sugarcane aphid infestations. In both years, infestation levels were substantially lower in sorghum-maize than in sorghum-pigeon pea or sorghum alone. Relatively small sorghum plant size due to competition with maize plants likely contributed to the decrease in sugarcane aphid infestations in sorghum-maize. Laboratory, greenhouse, and field experiments were conducted to determine the effects of biological insecticides on sugarcane aphid infestations. Azadirachtin, pyrethrins, *Beauveria bassiana* strain GHA, *Isaria fumosorosea* Apopka strain 97, *Chromobacterium subtsugae* strain PRAA4-1, and *Burkholderia* spp. strain A396 were compared to a conventional insecticide, flupyradifurone. Azadirachtin, pyrethrins, *B. bassiana*, and *C. subtsugae* negatively impacted sugarcane aphid infestations in the laboratory, whereas only azadirachtin and pyrethrins had impacts in the greenhouse. The biological insecticides did not provide satisfactory control in the field. Therefore, further research should determine potential factors that may alter the efficacy of biological insecticides under field conditions.

1. **Jessica Awad,** Amanda Hodges, Elijah Talamas, and Ronald D. Cave- Entomology and Nematology Department, University of Florida, Gainesville, FL 32608; jessica.awad@ufl.edu; 352-395-4665

Building a Diagnostic Framework for the Genus Synopeas (Hymenoptera: Platygastridae)- Taxonomic preparedness for the agricultural problems of the future begins with the systematic treatment of herbivores and their natural enemies. Parasitoids in the genus *Synopeas* Förster (Hymenoptera: Platygastridae: Platygastrinae) attack gall midges (Diptera: Cecidomyiidae) of economic importance. Hosts include invasive species such as the swede midge *Contarinia nasturtii* (Kieffer) and mango midge *Procontarinia mangiferae* (Felt), as well as native North American pests like the blueberry midge *Dasineura oxycoccana* (Johnson). The genus *Synopeas* has been somewhat neglected by modern professional systematics, and the lack of a diagnostic framework constitutes a serious taxonomic impediment to future development of gall midge biological control programs. The project utilizes a set of reared specimens from Papua New Guinea to elucidate the morphological and molecular bases for species delimitation in *Synopeas*.

1. **Johnalyn Gordon** and Thomas Chouvenc – Fort Lauderdale Research and Education Center, University of Florida, Davie, FL 33314; johnalynmgordon@ufl.edu; 727-417-1905

Colony-age-dependent Variation in Cuticular Hydrocarbon Profiles in *Coptotermes gestroi* - Cuticular hydrocarbons have important physiological and ecological functions for insects, such for protection against desiccation and as semiochemicals in eusocial taxa, including termites. Such alkanes and alkenes are known to vary, both qualitatively and quantitatively, among species populations, castes within a colony, and due to changes in seasonality and diet. Changes to hydrocarbon composition have been linked to varying degrees of aggression between termite colonies, although the variability of results among various studies suggests that additional factors may be involved. The age of a termite colony could a relevant factor in cuticular hydrocarbons (CHCs) profiles and has not been previously investigated. In this study, CHCs were identified and quantified using gas chromatography-mass spectroscopy. We identified CHC profiles of castes from *Coptotermes gestroi* colonies of four different age classes to determine if intercaste, intracolonial variation was dependent on colony age. Young colonies were found to have significantly higher intercaste variability in comparison to older colonies. This study demonstrated that the CHC profile within termite a colony changes over the lifetime of the colony and may play a role in colony recognition cues over time.

1. **Matthew T. Pileggi**, John R. Chase, and Adam C.N. Wong - Entomology and Nematology Department, University of Florida, Gainesville, FL 32608; mpileggi@ufl.edu; 772-708-5565

Influence of Host Parameters on Prevalence and Co-Occurrence of Antibiotic Resistant Bacteria in Livestock Associated Flies in Florida - Antibiotic use in livestock accounts for 80% of total antibiotic use in the USA and has been described as the main driver for resistant evolution and spread. However, there remains a missing link between agricultural antibiotic use and its impact on human and animal infections. In this study, two common species of filth flies from a livestock farm were collected over the course of 11 months: house flies Musca domestica, representing a generalist feeder, and stable flies Stomoxys calcitrans, representing a specialist (blood) feeder. The abundance and prevalence of ARBs in individual whole body and gut samples were assayed by culturing on selective antibiotic media, with morphologically-distinct colonies identified by Sanger sequencing of the 16S rRNA gene. Of the 149 total filth flies processed, which included 81 house flies and 68 stable flies, 12 different antibiotic-resistant bacteria (ARB) species were recovered from 6 (4.0%) samples. The identities of ARBs encompassed both enteric pathogens and commensals, but shared no overlap between house flies and stable flies, which could be attributed to their different dietary lifestyles. Nearly all the ARB-positive flies were isolated from females that bear 2 or more ARB species at total CFU reaching up to 5.2 x 104 per fly. An exception was a male house fly bearing a single species of ARB. The majority of ARB species was specifically isolated from the guts, contrary to the expectation that pathogens were more often associated with the body surfaces. Together, we conclude that both house flies and stable flies have the capacity to carry ARB and the fly gut may serve as a potential reservoir for the acquisition and dissemination of resistance genes.

1. **Roxie White**, Christopher Geden, and Phillip Kaufman –Entomology and Nematology Department, University of Florida, Gainesville, FL 32614; RXYWHITE@ufl.edu; 321-698-4442

Assessing Virulence of *Beauveria bassiana* against House Fly Adults -Resistance to chemical insecticides has fueled investigation of alternative control strategies for many insect species including the house fly (*Musca domestica* L.*)*. Entomopathogenic fungi have shown promising results for managing house fly populations while being safe for humans and other animals. The purpose of this study was to analyze the effectiveness of four strains of the entomopathogen *Beauveria bassiana* against adult house flies. The strains included two commercially available strains (GHA and HF23) and two strains that were isolated from flies on dairy farms (NFH10 and L90). Our hypothesis was that strains that had been isolated from house flies would have higher virulence against house flies than strains isolated from other hosts. Female flies were exposed to filter paper treated with liquid suspensions of conidia using a forced contact assay for two hours. Flies were transferred to observation containers and mortality was recorded daily for nine days. All strains except L90 induced >98% mortality at the highest concentration (1x109 conidia/ml). Strain L90 resulted in 91.1% mortality and took the longest time to cause 50% mortality (LT50=5.5 days). In contrast the LT50s for GHA, HF23 and NFH10 were 3.8, 4.5, and 4.3 days, respectively. On day eight post exposure the most virulent strains were GHA and NFH10 followed by HF23 and L90 (LC50=6.9, 6.8, 7.4, 7.8, respectively). Overall, the house fly-derived strain NFH10 was as effective as the leading commercialized strain GHA, (present in BotaniGard® and Mycotrol®) and may have the advantage of being adapted to environmental conditions on livestock farms.

1. **Hannah R. Talton** and Oscar E. Liburd- Department of Entomology and Nematology, University of Florida, Gainesville, FL 32607; htalton@ufl.edu; 336-340-7257

Assessing Cultural Practices, Injury and Susceptibility of Selected Strawberry Cultivars to the Seed bug (*Neopamera bilobata*) in Organic Strawberry Production - Strawberry seed bug, *Neopamera bilobata* (Say), is an emerging pest of organic and conventional strawberries in Florida. The rhyparochromidae species has been collected in a wide range of habitats across the world, including South and Central America, and many states in the southeastern United States. There is limited information on this pest. Thus, the type of injury caused, and management recommendations are unproperly documented. Strawberry seed bugs are suspected of injuring ripe strawberries; consequently, decreasing growers’ profits. In this study, we evaluated the susceptibility of three strawberry cultivars ‘Winterstar™’, ‘FL-127’ Sensation®, and ‘Strawberry Festival’ to strawberry seed bugs. The study was designed to assess plants growing with and without runners, and their effects on strawberry seed bug populations and yields throughout the growing season. The experimental design was a randomized complete block design with split plot restrictions and 3 replications. The main plot treatment: with and without runners and subplots were the three different cultivars. It was determined that plots with runners contained higher seed bug populations than those without runners where adult infestation was significantly higher than nymphs. From harvest samples, it was determined that ‘FL-127’ Sensation® and ‘Winterstar’ produced higher yields than ‘Strawberry Festival.’ ‘FL-127’ Sensation® berries showed significantly higher seed bug injury than other cultivars. Field plots without runners produced higher marketable yield than field plots with runners. These findings will help to develop a more effective integrated pest management (IPM) program that growers can use to manage seed bug populations.

1. **Victoria Adeleye** and Dakshina Seal- Tropical Research and Education Center, University of Florida, Homestead, FL. 33031; vadeleye@ufl.edu; 706-461-4905

Management of the Pepper Weevil, *Anthonomus eugenii* Cano Using Aggregation Pheromone and Biorational Insecticides - Pepper, *Capsicum annum* L. is an important crop in Florida and several other states in the southern region of USA. Pepper weevil, *Anthonomus eugenii* Cano (Coleoptera: Curculionidae), is the most harmful insect pests of pepper in Florida and other tropical and subtropical regions of North, Central and South America. High population of this pest cause destruction in fruits and flower buds. All immature life stages develop within the fruit thus making control difficult. Manual collection, elimination of fallen fruits, use of conventional insecticides have been used to control this pest. The repeated use of broad spectrum insecticides has led to the development of resistance and elimination or population reduction of pepper weevil´s natural enemies. However, to reduce insecticide resistance, there is an immediate need to develop a sustainable strategy to control pepper weevil. For this reason, this research aims at conducting experiments to evaluate the effect of aggregation pheromone and bio-rational insecticides with botanicals and micro-organisms as active ingredients against pepper weevils under field conditions. Parameters to evaluate efficacy will include: no. of infested flowers, no. of adults, no. of infested buds, no. of infested fruits, no. of fallen fruits, weight and no. of marketable fruits. The results obtained from this study will help to understand pepper weevil population abundance at a certain field condition, address management program accurately, and to predict initiation of pepper weevil infestation.

**Symposium 1 - Laying the Foundations for Citrus and Vegetable Pest Management in Florida: A Man, a Mission, and a Legacy (10)**

1. **Alberto Urbaneja,** Meritxell Pérez-Hedo, Javier Calvo, Karel Bolckmans, amd Phil A. Stansly - Instituto Valenciano de Investigaciones Agrarias (IVIA). Centro de Protección Vegetal y biotecnología. CV-315, Km. 10,7 – 46113 Moncada (Valencia), Spain; aurbaneja@ivia.es; +34659463921

The Unforgettable Sabbatical Year of Phil Stansly in Spain: His Contribution to the Advance of Biological Control in Greenhouse Vegetables of Southern Europe - In Europe, biological control in protected crops is widely adopted for pest management. The case of sweet peppers and tomatoes in South-eastern Spain could be a paradigmatic example of how biological control based on the use of natural enemies has environmentally, socially and economically transformed an entire region of more than 30,000 ha of protected crops. In this area, crop protection in greenhouse has evolved from a reductionist approach which was based entirely on chemical treatments to an integrated approach based on the use on natural enemies and preventive and sustainable control methods. In this presentation, we will present the invaluable contribution of Phil A. Stansly in this biocontrol success. In just one sabbatical year in Spain back in 2001, Phil promoted the use of whitefly parasitoids, especially the indigenous parasitoid *Eretmocerus mundus* and participated in the commercial development of the zoophytophagous predator *Nesidiocoris tenuis*. More than 30 publications were written from that period, which gives an idea of the relevance of the work developed by Phil in Spain. After the sabbatical, the collaboration continued. Several research projects have been conducted together since that period and some that have unfortunately fallen halfway. Phil's loss leaves an indelible mark for entomology in Florida but also in Spain, where he leaves a large number of colleagues and friends. In Spain Phil will always be remembered as he was: a great entomologist, an inspiring man and a great person.

1. **Amy Roda** and Jose Castillo - United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Center for Plant Health Science and Technology, Miami, FL; Amy.L.Roda@usda.gov; 305-213-4236

Control of whitefly *Bemisia tabaci* (Hemiptera: Aleyrodidae) in Open Field Tomato Crops in Florida Using Zoophytophagous Mirid Predators: A Characteristically Thorough Phil Stansly Study - Miridae of the tribe Dicyphini are important plant-feeding predators used to control pest arthropods such as whiteflies, leafminers, aphids and spider mites in vegetable crops. In cage studies, one exotic, *Nesidiocoris tenuis* (Reuter) (Hemiptera: Miridae), and one native, *Macrolophus praeclarus* (Distant) (Hemiptera: Miridae), Florida mirid species were found to significantly reduced the number of whiteflies (*Bemisia tabaci*) on tomatoes compared tomato plants without mirids. These mirids may offer a mitigation strategy to control whiteflies as well as for pests not established in Florida like the tomato leafminer, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) and the old world bollworm, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae). We investigated the ability of N. tenuis and *M. praeclarus* to control B. tabaci on tomato in seven open field tomato trials conducted at the South West Florida Research and Education Center in Immokalee, Florida. Fewer whitefly eggs and nymphs were seen in the mirid and pesticide treatments compared to the no treatment controls. *Nesidiocoris tenuis* was found to establish, while *M. praeclarus* was observed only during the first weeks of the studies. Field trials that included sesame plants with tomatoes plants increased the numbers of *N. tenuis* when prey was scarce and allowed sustained whitefly control. Florida’s native and fortuitously established mirids may prove to be immediately available biological agents for the management of present and future tomato pests.

1. **Barry Kostyk,** Phil Stansly, and Jose Castillo – Southwest Florida Research and Education Center, University of Florida, Immokalee, FL 34142; bkostyk@ufl.edu; 239-503-0724

Biological Control of Insect Pests in Field Grown Eggplant- The two spotted spider mite, *Tetranychus urticae*, the sweetpotato whitefly (SWF), *Bemisia tabaci* (Gennadius) and melon thrips *Thrips palmi* Karny feeding can all reduce overall plant health and reduce yield and quality of eggplant grown in Florida. Studies by Stansly and Castillo (2009/2012) have shown the potential for biological control of these pests in eggplant using the commercially available predatory mites and a preliminary study (Stansly and Kostyk) in 2013 has shown the Metarhizium (Met 52 – Novozymes) reduces spider mite populations on eggplant. The objective was to compare control of pests on eggplant using pesticides or predatory mites with and without applications of *Metarhizium anisopliae*. An untreated control was compared to a weekly application of pesticides, weekly applications of *Metarhizium anisopliae*, alternate applications of *M. anisopliae* and releases of the predatory mites *A. swirskii, N. californicus*, and *Neoseiulus longispinosus* (Evans), and predatory mites alone. Reduction in numbers of whitefly were greatest when the phytoseiid mites were included in the system while the greatest reduction in number of spidermites was observed in those plots with *Metarhizium anisoplia*. Control of thrips was inconsistent throughout the trial with the greatest reductions observed in plots using the combination of the two biological control agents.

1. **Dakshina R. Seal -** Tropical Research and Education Center, University of Florida, Homestead, FL 33031; dseal3@ufl.edu; 786-217-9269

Potentials of Biocontrol Practices in Managing Pepper Weevil, *Anthonomus ugenii* Cano (Coleoptera: Curculionidae) - The Anastasia Mosquito Control District (AMCD) uses multiple methods for the surveillance of arboviruses in Saint Johns County. The primary method for disease surveillance is the Sentinel Chicken program. Ten sites dispersed throughout the county are monitored weekly and blood samples are submitted for analysis of arboviral titers. To monitor arboviruses vectored by container-inhabiting mosquitoes, 12 Biogents Sentinel Traps are dispersed throughout urban areas. Any *Aedes aegypti* or *Aedes albopictus* collected in these traps are tested for the presence of Dengue, Chickungunya, and Zika viruses via PCR at the Bronson Animal Disease Diagnostics Laboratory. Last, gravid traps are set to collect Culex mosquitoes for in-house West Nile Virus testing via endpoint PCR, the RAMP assay, and LAMP assay using the Genie III. Ultimately, these methods are used collectively to monitor for the presence of arboviruses and protect the citizens of Saint Johns County.

1. **Jawwad Qureshi** – Southwest Florida Research and Education Center, University of Florida, Immokalee, FL 34142, jawwadq@ufl.edu; 239-658-3458

Management of Asian Citrus Psyllid, *Diaphorina citri* - The Asian citrus psyllid (ACP), *Diaphorina citri* (Hemiptera: Liviidae), vector pathogens of huanglongbing (HLB) or citrus greening disease. Currently, there is no cure for HLB and management of ACP focuses on conventional practices. Nevertheless, HLB continues to spread. Limited effectiveness of conventional chemical control, negative effects on biological control and environment, secondary pest outbreaks, increased production costs and ACP resistance warrant integrative and sustainable strategies for psyllid control*.* Investigations and improvement of ACP control using biological and chemical methods toward integrated and sustainable pest management will be discussed.

1. **Xulin Chen** – Bayer Crop Science, 5000 Centregreen Way, Cary, NC 27513; xulin.chen1@bayer.com; 916-214-5150

A Molecular Study I Conducted with Dr. Phil Stansly-- Molecular Detection of Endosymbionts in *Tamarixia radiata* - The differences of *Tamarixia radiata* fitness have been observed between the colonies in DPI Gainesville and in UF Immokalee. Our objective was to survey eubacteria species present in *T. radiata* from both colonies, and more importantly, confirm the absence of Ca. L. asiaticus in the two T. radiata populations. In order to do so, we sequenced a single copy gene from *T. radiata* DNA for quantification in order to confirm an equal bacterial infection level in the two populations, and also estimated genome size of *T. radiata*, which has not been reported previously. It was suggested that insect genome size was related to parasitism and development, and estimation of insect genome size is of great importance in understanding insect evolution.

1. **Scott Croxton** - Nichino America, Labelle, FL 33935; scroxton@nichino.net; 803-334-2301

Reflecting on Reflective Mulch My Work with Phil Stansly **-** Polyethylene mulch was evaluated in multiple trials for deterring colonization by Asian citrus psyllid (ACP) *Diaphorina citri*, reducing incidence of huanglongbing (HLB) or citrus greening disease, and accelerating growth of young citrus trees. Populations of ACP and other arthropods were monitored on new flush while ACP movement was monitored using yellow sticky cards in all the trials. Incidence of HLB was evaluated twice per year during the studies using qPCR. Trunk cross sectional area, soil moisture, and surrounding weed biomass were also monitored in these trials. Metalized mulch reduced pest populations and HLB incidence compared to all tested alternatives. In addition, metalized mulch increased tree growth and soil moisture while reducing weed pressure. When combined with standard insecticide applications metalized mulch provided the stronger results than either alone. Results of these studies present a good case for the use of metalized plastic mulch for young citrus plantings

1. **Ralf Dujardin** and Gerry Phelps - Imaflex USA Inc., 1201 Unity Street, Thomasville, NC 27360; rdujardin@imaflex.com; 941-284-6334

High-Reflective Metalized Crop Protection Films - High-reflective metalized mulch films are surface-modified with a thin aluminum metallic mirror layer. Only an aluminum mirror is capable to reflect more than 90% of infrared, visible and ultraviolet solar radiation. Metalized mulches are used mostly by tomato producers in the Southeast to repel daylight active sap-sucking insects of the orders Hemiptera that transmit viral diseases. The effectiveness of solar light reflection from high-reflective mulches in repelling insects has been proven and reported in research literature for various crops. A widespread use of high-reflective films in horticulture did not take place until today when the increasing development of insecticide resistance and the need for low or pesticide free cultivation require alternatives in insect and diseases management. Results will be reviewed from field trials performed for newly designed high-reflective films in cooperation with Prof. Phil Stansly, which indicates statistically equivalent insect control like insecticides and in addition significantly earlier crop maturation, increased crop yields and enhanced fruit quality in pepper, strawberry and citrus production.

1. **Joseph M Cicero**, Nicholas Tucker and Emma N.I. Weeks **-** Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; jcicero@ufl.edu; 520-404-0045

Three Solutions to Simplifying the Complexity of Anatomical Research - A blast of major publication databases such as EBSCO, Agricola, or PubMed, using the keywords (Diaphorina) AND (citri), yields about 400 to 500 hits. These mostly consist of studies in IPM, ecology and the molecular. Amidst these counts are a mere ten monographic hits elucidating external anatomy, five of which are morphometric, and eight monographic hits elucidating internal anatomy. From this it is clear that anatomy lags far behind in attention by the entomological theater dedicated to solving the citrus greening problem. There are several reasons for this. To mention a few- the 3D complexity is staggering, and yet attempts at histological and ultrastructural elucidations use labor intense means to obtain 2D cross-sections; developmental and nutritional changes occur within individuals which generate a high sampling error; modern publication format is dense and concise with micrographs limited in number and magnification. Three solutions are available. The first is a mantra of working up the basics of the anatomy of interest first, before its need becomes critical for molecular studies. For many structures, modern anatomical workups have not commenced, and the only basics available are found in archival literature. These did not have the advantage of our modern instrumentation, and they are replete with misinterpretation and teleology. The second solution involves using generic terminology in place of homological terminology. The third is to compose animated tutorials of the anatomy using graphics software such as Adobe Illustrator, Corel Draw, and Adobe Animate. These latter solutions allow accessibility of the information to broader audiences.

1. **Nicholas Johnston,** Lukasz L. Stelinski and Philip A. Stansly– North Florida Research and Education Center, University of Florida, Quincy, FL 32351; njohnston8979@ufl.edu; 210-788-9326

Dispersal Patterns of Asian citrus psyllid (*Diaphorina citri* Kuwayama) and Secondary-Host Interactions **-** The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama, remains the most economically important and difficult to manage pest in citrus throughout Florida. To better understand ACP’s physiological response to secondary hosts and how these factors affect dispersal in the absence of a true reproductive host, potential secondary host plants *Bidens alba*, *Ludwigia octovalvis*, and *Eupatorium capillifolium* were investigated. Survivorship under “no choice” conditions was evaluated on secondary hosts compared to a reproductive host as well as fat body content and chemical signature of honeydew using gas chromatography mass spectrometry (GC-MS). To determine behavioral factors relating to dispersal, a series of “choice” trials was also conducted. In field trials, yellow sticky-card traps were placed along the border of a citrus grove to measure movement before and after insecticide applications. Both *Bidens alba* and *Eupatorium capillifolium* increased ACP survivorship by 2-fold compared to starvation conditions. Honeydew of ACP feeding on B. alba had high amounts of fatty acids indicative of triglyceride breakdown. However, fat body content of ACP feeding on secondary hosts decreased at a slower rate compared with starvation. In field trials, sticky card traps caught significantly higher numbers of ACP after insecticide spray, indicating at least a temporary increase in dispersal behavior conducive to re-infestation. While secondary hosts were not shown to support reproduction and long-term survival, these findings support the hypothesis that ACP can use secondary hosts such as B. alba as temporary reservoirs when ideal host conditions are unfavorable, returning to previous or neighboring groves after dispersal.

**Symposium 2 – Uncharted Territory: Entomology in Support of Florida’s Emerging Crops and Production (7)**

1. **Cory Penca** and Amanda Hodges - USDA-APHIS-PPQ CPHST, 13601 Old Cutler Rd., Miami, FL 33158; corypenca@gmail.com; 954-815-2796

Characterizing the Heteropteran Pest Complex in Florida Peaches with a Focus on the Establishment of the Brown Marmorated Stink Bug **-** The catfacing pest complex can cause significant economic losses to peach producers in the southeastern United States. While this pest complex has been well-studied in the southeastern United States, there is currently no Florida-specific information appropriate for the nascent subtropical peach industry in the southern half of the state. In an effort to fill this knowledge gap, a multi-year survey at several orchards representing the primary peach growing areas in the state was conducted. Surveys employed both trap-based and visual methods, and provided insights into the species composition, relative abundances, population dynamics, and regional differences. Our results suggest that the brown stink bug, *Euschistus servus*, and the leaffotted bug, Leptoglossus phyllopus, are the primary catfacing pests in Florida peaches. The brown marmorated stink bug, *Halymorpha halys*, was detected in four consecutive survey years, indicating potential establishment of this exotic species in Florida. Implications of these findings on management of catfacing pests in Florida peaches, including the potential impact of *Halyomorpha halys* are discussed.

1. **Babu Panthi,** Oscar Liburd, Justin Renkema, and Sriyanka Lahiri- Gulf Coast Research and Education Center, University of Florida, Wimauma, FL 33598; panthibabu@ufl.edu; 765-430-6864

Determining when to Spray Reduced-risk insecticides After Scouting for *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in Florida Strawberry **-** *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) is an invasive thrips species in Florida and an increasingly important pest of Florida strawberry. Control decisions in strawberry are made when visible chilli thrips injuries are seen in strawberry fields. A field study arranged as a factorial RCBD with two factors (spray timing and S. dorsalis density) and four replicates, was conducted in Balm, Florida to determine the optimum spray timing for S. dorsalis in strawberry. Small plots of six young strawberry plants (cv: Radiance) with 4-5 new leaves were infested with 0, 5, 10 or 20 S. dorsalis adults. Some plots were treated with Radiant® SC (spinetoram) after 4 or 14 days and others were left untreated. The timing of reduced-risk insecticides was assessed by the number of thrips-injured leaves, a plant damage rating, damaged and marketable yield, plant biomass, and canopy cover. There were no significant differences between 4- and 14-day applications of Radiant® SC for any of the parameters assessed. Marketable yield was not significantly different between treated and non-treated plots when initial S. dorsalis density was five adults per plant, but the yield in untreated plots was reduced by 41 and 49% compared with 4- and 14- day applications respectively, when initial *S. dorsalis* density was 10 or 20 adults per plant. In conclusion, five *S. dorsalis* adults per plant does not warrant the use of a reduced-risk insecticide; however, when the population exceeds 10 adults per plant, insecticides can be applied up to two weeks after scouting without compromising yield.

1. **Eric Rohrig** - Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608; Eric.Rohrig@FreshfromFlorida.com; 352-395-4744

Florida Hemp Production: Regulatory and Pest Challenges for an Emerging Crop **-** The recent emergence of hemp, Cannabis sativa L., cultivation in Florida as a cash crop brings much excitement for growers and industry alike. It will also bring with it new regulatory and pest challenges which must be overcome if the industry is to grow and be profitable. Hundreds of pests impacting hemp cultivation have been identified worldwide, the majority of which are insects. The absence of pesticides labeled for use in hemp will make pest control difficult and could set up a system for misuse of chemicals. Preventing new pests from entering the state, rapidly identifying pests impacting Florida crops and providing effective control options will require a collaborative effort between researchers, regulators and growers. Current hemp regulations, pests of concern and control options are presented.

1. **Hugh A. Smith** - Gulf Coast Research and Education Center, University of Florida, Wimauma, FL 33598; hughasmith@ufl.edu; 813-419-6588

Managing Spider Mites in Florida Hops - Hops (*Humulus lupulus*) has been evaluated as a commercial crop for Florida since 2016 at GCREC, where it is cultivated from February through June. Several pest species have been found feeding on hops, but so far only spider mites (Tetranychus spp.) have reached damaging levels each season. In addition, spider mites are the only pest consistently reported by Florida’s new hops growers. Several miticides are registered for use on hops, and in 2018 an on-farm miticide trial near Brooksville successfully reduced a spider mite infestation that was impacting cone quality. In 2019 two releases of the predatory mite *Phytoseiulus persimilis* were made in response to a spider mite infestation in the hop yard at GCREC. This was sufficient to contain the infestation season long, and no insecticides were applied to the crop that season. Naturally occurring predators joined *P. persimilis* in suppressing spider mite populations.

1. **Eleanor F. Phillips,** Sandra A. Allan, and Jennifer L. Gillett-Kaufman- Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; eleanorphillips@ufl.edu; 615-337-6037

Entomological Survey of North Central Florida Olive Groves: A Potential New Specialty Crop in Florida - Invasive pests and climate change pose a serious and ongoing threat to well-established tree fruit production systems in Florida. In the last ten years innovative growers in the north central region of Florida have begun planting olive trees, *Olea europaea*, a new potential fruit tree crop for the state. To evaluate the potential risk posed by arthropods to Florida olive production, a two-year extensive survey of arthropods in four olive groves in north central Florida was conducted. From the utilization of seven different sampling methods, the most abundant pest of concern encountered was black scale insects, *Saissetia oleae*. A potential pest that may warrant additional study in future years of more flowering and fruiting are *Frankliniella bispinosa*, Florida flower thrips. Recently, the native *Manduca rustica*, the rustic sphinx moth, has been recorded as a new pest on olives. Two of the most damaging invasive olive-specific pests known in all other olive growing areas of the world (*Euphyllura olivina*, the olive psyllid, and *Bactrocera oleae*, the olive fruit fly) were not found in this survey. Continued monitoring for olive-specific and native pests is recommended to prevent high economic loss and pest establishment. Taxonomic identifications to the species level of pest arthropods, and family level identifications of beneficial arthropods are presented. Abiotic and biotic characteristics of each grove were examined in relation to pest abundance. The results of this study will help inform growers on when and where potential arthropod pests may be present in Florida olive agroecosystems.

1. **Adam G. Dale,** and Matthew A. Borden- Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; agdale@ufl.edu; 352-273-3976

Emerging Tea Crops in Florida: Pest Observations and Future Work - There are two emerging crops in Florida grown for tea production. The first is the true tea plant, *Camellia sinensis*, while the other is the native yaupon holly shrub, Ilex vomitoria. These species have a long history for the beverages produced from their foliage – infusions which are both caffeinated and highly regarded for their healthful benefits. However, pest management information for both crops is lacking. The pest complex of *Camellia sinensis* is well documented in major tea-producing regions, but not in the southeastern United States. Similarly, several minor arthropod pests of Ilex vomitoria are documented in the region, but it is unknown if they will become problematic in the context of commercial production. Here, we present what we have observed thus far about existing and potential pests of these emerging crops.

1. **Jawwad Qureshi,** Salman Al-Shami, Emilie Demard and Rhuanito Soranz Ferrarezi – Southwest Florida Research and Education Center, University of Florida, Immokalee, FL 34142; jawwadq@ufl.edu; 239-658-3458

Pest Management in Citrus Under Protective Screen (CUPS) – Citrus production in Florida is reduced by more than 70% since the advent of huanglongbing (HLB) or citrus greening disease in Florida. The pathogen of this disease is spread by the vector Asian citrus psyllid, *Diaphorina citri*. Citrus Under Protective Screen remains free of HLB due to the protection provided by these structures against psyllid. However, other small pest insects can enter through the screens and attack citrus. Incidence and management of pests in the CUPS will be discussed.

**Symposium 3 - Invasive Scales and Mealybugs in Florida (7)**

1. **Greg Hodges -** Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608; greg.hodges@freshfromflorida.com; 352-395-4627

A Brief History of the Importance and Impact of Scale Insects in Florida **-** The impact of scale insects in Florida agriculture and regulatory activities dates back to the cottony cushion scale and the release of vedalia beetle. Since that time, many scale insects have had an impact in Florida with recent examples including black parlatoria scale, cycad Aulacaspis scale, pink hibiscus mealybug, lobate lac scale and howerton’s scale just to name a few. In as such, Florida has also had a deep history of successful researchers and taxonomists that have been at the forefront of helping devise control strategies for these insects as well as providing identification trainings to university and regulatory personnel from around the world.

1. **Muhammad Z. Ahmed,** and Douglas R. Miller - Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608; Muhammad.Ahmed@freshfromflorida.com; 352-273-4677

Current Role and Future Potential of Florida State Collection of Arthropods in Scale Insects Regulation and Management - Florida receives 2–3 new invasive arthropod species each month, and many of them have potential to establish and cause damage to Florida agriculture. Scale insects are one of the most diverse pest groups with over 380 species in Florida, of which, almost half of them are global pests. The scale insect collection at the Florida State Collection of Arthropods (FSCA) plays an important role in scale insect diagnostics that leads to proper regulation and management of scale insects in Florida. Until recently, the scale insect collection was separated into three parts. In the past two years these collections have been merged, unlabeled slides have been labelled, and the entire collection has been documented and curated. The FSCA is the largest collection of scale insect slides in the southeastern United States and the third largest in the country, based on the number of specimens and species. We give this presentation to draw attention to this collection so that others can benefit from it.

1. **Ronald D. Cave** - Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; rcave@ufl.edu; 772-577-7378

Biological Control of the Cycad Aulacaspis Scale - The cycad aulacaspis scale, *Aulacaspis yasumatsui*, is an invasive armored scale of cycads in many areas of the world. Natural enemies were introduced into Florida during biological control projects. After the scale invaded Guam, exploration in Asia was conducted and numerous parasitoids and a new species of lady beetle were discovered. Attempts were made to introduce some of these natural enemies into Florida, but none were successful. However, one parasitoid, *Arrhenophagus* cf. *chionaspidis*, was eventually detected in Florida and may be having an impact on scale populations.

1. **Amy Roda,** Cindy McKenzie, Eric Rohrig, Lance Osborne and Muhammad Z Ahmed- USDA-ARS, Subtropical Horticulture Research Station, 13601 Old Cutler Road, Miami, FL 33158; Amy.L.Roda@usda.gov; 305-213-4236

Developing Strategies to Manage a New Invasive Pest Species, the Phantasma Scale (*Fiorinia phantasma* Hemiptera: Diaspididae) ***-*** The phantasma scale (*Fiorinia phantasm*a Cockerell & Robinson, Diaspididae: Hemiptera) is a significant pest of at least 24 families and 44 genera of nursery and ornamental plants, as well as several fruit crops. The scale was first detected in Miami-Dade County March 1, 2018 and recently in nurseries in West Palm Beach County. An immediate mitigation strategy is needed to help contain the spread of the pest and protect landscape and native plants as well as high value nursery stock. In Miami, the scale has been found on 16 palm and 5 ornamental plant species, with the highest populations occurring on Phoenix palms. Monthly evaluations of phantasma scale populations on Tahina palms (*Tahina spectabilis*) located in a planting in Coral Gables, FL showed that the mean percentage of canopy infestation increased from 12% to 25% in 6 months. Natural enemies have been found to attack the scale, including Cecidomyiidae, Syrphidae, Chrysopidae, Coccinellidae, and Phytoseiidae predators as well as parasitoids. Current efforts are focused on finding immediate solutions for growers by testing labeled insecticides as well as possible landscape level solutions by determining the impact of the local natural enemies. Additionally, taxonomic keys are being developed for timely and accurate insect identification.

1. **Adam Dale,** Travis Birdsell, and Jill Sidebottom- Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; agdale@ufl.edu; 352-273-3976

Evaluating the Invasive Potential of Elongate Hemlock Scale on Florida Tree Species - Hundreds of thousands of cut Fraser fir Christmas trees are imported into Florida annually during the Christmas holiday season. Since these trees have been growing outdoors for the previous 6-9 years, they are frequently infested with a diversity of arthropods, most of which do no harm. However, in the eastern and northeastern U.S., an exotic armored scale insect, elongate hemlock scale, is a key pest of Fraser fir. Although growers actively and aggressively control for these pests, it is difficult and often unsuccessful. As such, many cut trees that are originate from EHS-infested locations are have live scale on them. Since this insect is not established in Florida, there are concerns that it may disperse from Christmas tree onto trees in Florida’s forests and landscapes. To address this concern, we conducted a host evaluation study of 16 tree species that are potential hosts of this scale insect. We found that EHS produced active crawlers over a 40 day period after cutting Fraser fir averaging around 600 crawlers per 6-inch twig. After allowing for three full generations, we evaluated all plant species to determine if EHS successfully established and reproduced on them. Encouragingly, only 4 of 16 species appear to be viable hosts for EHS. Of the four confirmed hosts, none are native to Florida and two are occasionally used as ornamental species in north Florida. This study provides important information to help inform regulatory decisions for a frequently encountered scale insect pest.

1. **Salman Al-Shami,** and Jawwad Qureshi - Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; salshami@ufl.edu; 772-577-7339

Predatory Behavior of *Curinus coeruleus* (Mulsant) Adults and Larvae on Florida Red Scale (FRS) *Chrysomphalus aonidum* (L.) - Scale insects are important pests of citrus. Florida red scale (FRS), *Chrysomphalus aonidum* (L.) is a serious problem in citrus grown in Florida. In the present study, female FRS with armor, without armor and combination of armor and no armor were presented to adult and larvae of the predatory ladybeetle, *Curinus coeruleus*. Scales were recorded as damaged or consumed after 24, 48 and 72 hours of exposure. Adults exhibited strong predation activities in all three treatments. Adult consumption of FRSs with shells from 10 individuals averaged 7 and 9 after 24 and 48 hours, respectively. Larvae responded more to scales without armor followed by combination treatment containing scales with and without armor and treatment containing scales with armor. Survival of ladybeetle larvae and adult averaged more than 90% across treatments. Findings suggest that C. coeruleus has the potential to be an effective biological control agent against FRS.

1. Patricia Caligari, Michael J West, Yorelyz Rodriguez Reys, and **Jose C Verle Rodrigues** - University of Puerto Rico, 1193 Guayacan St, San Juan PR 00926; jose\_carlos@mac.com; 787-767-9705

Multitrophic Interactions with Harrisia cactus Mealybug (HCM) and their Parasitoids in Puerto Rico Cacti Dry Forest **-** The mealybug *Harrisia*cactus mealybug (HCM) invaded Puerto Rico before 2000 and is causing extreme damage and death to native cactus in the dry forests of southern Puerto Rico. It was initially identified as *Hypogeococcus pungens*, but is now an unnamed and probably new-to-science species of *Hypogeococcus.*If effective control options are not identified (i.e., biocontrol agents) it will be a major threat to native cactus in SW and SE United States, Mexico, and other Caribbean islands. We identified several natural enemies occurring in Puerto Rico and verified their limited efficiency controlling HCM. A new species of parasitoid, *Leptomastidea hypogeococci,*was described associated with HCM in the island. The parasitoid was reported as the most frequent natural enemy associated to the pest and recently was confirmed that is also associated to a species of hyperparasitoid, identified as *Chartocerus niger*, which may be playing a role on the efficiency of the natural control. So far, two species of promising parasitoids identified in South America were introduced to quarantine (*Anagyrus cachamai* and *A. lapachosus*) and are under evaluation.

**Symposium 4 - Biological Control of Weeds in Florida (7)**

1. **Ellen C. Lake**, Matthew Purcell, and Elizabeth Mattison, USDA ARS Invasive Plant Research Laboratory, 3225 College Avenue, Fort Lauderdale, FL 33314; ellen.lake@ars.usda.gov; 954-475-6547

Biological control of *Lygodium microphyllum*, Old World Climbing Fern: Foreign Exploration and Host Range Testing - *Lygodium microphyllum*, Old World climbing fern, is expanding its range in Florida and negatively impacting native flora and fauna. Three biological control agents have been approved and two have established on the weed but additional agents are needed to achieve desired levels of control. Exploration for arthropods feeding on *L. microphyllum* is ongoing in its native range, particularly in Australia and southeast Asia.Host-range testing is in progress with two moths and a sawfly at the USDA ARS Invasive Plant Research Laboratory quarantine facility in Fort Lauderdale, FL. No-choice testing has been completed with the moth *Lygomusotima stria* (Lepidoptera: Crambidae). This moth can complete development on several lygodium species and multigeneration tests are ongoing. Cold-tolerance testing for *L. stria* indicates that this species is unlikely to fully colonize Florida or overlap in range with the southernmost populations of the native species *Lygodium palmatum*. Herbaria records of *L. palmatum* are being compiled to delineate the range of this species for comparison to CLIMEX mapping of the projected range of *L. stria*. A sawfly, *Neostrombocerus albicomus* (Hymenoptera: Tenthredinidae), can reach outbreak densities on *L. microphyllum* in the native range. Multigeneration testing is ongoing with this insect and three lygodium species. The moth *Callopistria exotica* (Lepidoptera: Noctuidae) feeds very heavily on *L. microphyllum* foliage creating “fish-boning” damage. Rearing methods have been developed for *C. exotica* and host-range tests completed to date indicate that *C. exotica* is a lygodium specialist.

1. **Dale A. Halbritter**, Gregory S. Wheeler, and Min B. Rayamajhi **-** USDA ARS Invasive Plant Research Laboratory, 3225 College Avenue, Fort Lauderdale, FL 33314; dale.halbritter@usda.gov; 661-406-8932

Life history Trade-offs of Thrips Reared on Brazilian peppertree with Respect to Fertilization and Plant Terpenoid Profiles - *Pseudophilothrips ichini* Hood (Thysanoptera: Phlaeothripidae) has recently been approved for field release to control the highly invasive Brazilian peppertree, *Schinus terebinthifolia* Raddi. Optimal host plant material is essential to insect production and colony viability. We investigated how fertilizing plants impacts thrips development, survival, and fecundity. Cohorts of 20 thrips eggs were reared on cuttings from saplings in 3.8-L pots. Plants were fertilized every 2 weeks (24N-8P-16K) at one of three concentrations: low (0 g/L water), medium (1.8 g/L water), or high (3.6 g/L water). To identify terpenoids that may be involved in plant defense, we used gas chromatography-mass spectroscopy. Among a subset of the 3.8-L potted plants, half of the plants were each infested with 40 adult thrips for 48 hours and uninfested plants served as the control. After 48 hours, all plants were destructively sampled. Thrips life history trade-offs and projected population growth will be discussed with respect to the terpenoid profiles at the different fertilizer levels, as well as nitrogen content determined in a previous study. The outcome of this study will inform mass rearing protocol to optimize production for field release.

1. **James P. Cuda**, Purnama Hidayat, and William A. Overholt - Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; jcuda@ufl.edu; 352-273-3921

*Orseolia javanica* (Diptera: Cecidomyiidae) a Potential Biological Control Agent for the Invasive Cogongrass, *Imperata cylindrica* **-** Cogongrass (*Imperata cylindrica* (L.) P. Beauv.: Poaceae) is a federal listed noxious weed that is invasive in Florida and other southeastern states (e.g., Alabama, Georgia, Louisiana, Mississippi, North and South Carolina). This perennial rhizomatous grass was introduced into the USA initially as packing material from Japan, and then as a forage crop from the Philippines in the early 1920s. Native to Africa and Asia, cogongrass is listed among the top ten worst weeds in the world because it crowds out native plants, provides poor forage to animals, and reduces pine forest productivity. Chemical control costs can exceed $400 per hectare; in 2009, Alabama spent $6.3 million of federal stimulus funds exclusively for control with herbicides. Biological control using natural enemies from the native range of cogongrass has received little attention and no biocontrol agents have been introduced anywhere in the world. A potential biocontrol agent is an Indonesian gall midge *Orseolia javanica* Kieffer and van Leeuwen-Reijinvaan (Diptera: Cecidomyiidae).

1. **Carey R. Minteer,** Eutychus Kariuki and Patricia Prade **-** Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; c.minteerkillian@ufl.edu; 772-577-7379

Hypersensitive Response of Brazilian Peppertree: Potential Impacts on New Biological Control Agents **-** Brazilian peppertree (BP) is an invasive shrub that currently infests over 700,000 acres in Florida. Two species of biological control agents are approved and will be released in Florida by the end of 2019. One agent, *Calophya latiforceps* (Hemiptera: Calophyidae), is a leaf-galling species that can elicit a hypersensitive response in some BP individuals. This response involves the production of salicylic acid by the plant, the rapid death of cells surrounding *C. latiforceps* nymphs, and the death of the nymphs. This produces a visible spot of necrotic cells on the leaf surface. Not all individuals of BP produce this response (susceptible plants) and nymphs of *C. latiforceps* develop normally. *Pseudophilothrips ichini* (Thysanoptera: Phlaeothripidae), another biological control agent for BP, does not elicit the same, visible response upon feeding on the plants. We conducted tests to determine if the reproduction or impact of *P. ichini* was different between hypersensitive and susceptible BP plants. There was no difference in the reproductive capacity of *P. ichini* on hypersensitive or susceptible plants; however, *P. ichini* feeding had less of an impact on the height of hypersensitive plants.

1. **Greg Wheeler** - USDA ARS Invasive Plant Research Laboratory, 3225 College Avenue, Fort Lauderdale, FL 33314; greg.wheeler@ars.usda.gov; 954-475-6546

Biological Control of Chinese tallowtree, *Triadica sebifera*: Overseas Exploration, Host Testing, and Plans for Release **-** Classical biological control can provide an ecologically sound, cost-effective, and sustainable management solution to protect diverse habitats. Chinese tallowtree, *Triadica sebifera* (Euphorbiaceae), is one of the most damaging invasive weeds in the southeastern USA. Overseas and quarantine research has developed two species, a flea beetle *Bikasha collaris* (Coleoptera: Chrysomelidae) and a defoliating moth, *Gadirtha fusca* (Lepidoptera: Nolidae), as potential biological control agents of Chinese tallowtree. Host range testing of both has been completed and this included no-choice, dual-choice and multi-generation tests. The results indicated that both species have very narrow host ranges. Details of these tests will be presented but in summary, they indicate that although a small amount of feeding may occur in no-choice conditions on a few species of non-targets, the larvae will not be able to maintain a population for more than two generations on any species except the target weed Chinese tallowtree. Once released, these species may play an important role and contribute to the integrated control of this invasive weed.

1. **Aaron S. David,** and Ellen C. Lake**-** USDA ARS Invasive Plant Research Laboratory, 3225 College Avenue, Fort Lauderdale, FL 33020; aaron.david@ars.usda.gov; 954-475-6564

Biological Control of Old World Climbing Fern (*Lygodium microphyllum*): Population Dynamics and Impacts of two Established Agents - *Lygodium microphyllum* (Lygodiaceae) is an introduced vine that is rapidly invading Florida’s natural areas. The plant forms dense mats that smother native vegetation, alter fire behavior, and climb into the tree canopy, killing mature trees. Currently, the USDA-ARS Invasive Plant Research Laboratory rears and releases two biological control agents to help manage *L. microphyllum* infestations, the moth *Neomusotima conspurcatalis* (Lepitoptera: Crambidae) and the mite *Floracarus perrepae* (Acariformes: Eriophyidae). Since 2014, we have released >3.5 million of these agents across south and central Florida, and, currently, we work to (1) monitor populations of released agents and (2) quantify their impacts on *L. microphyllum* growth. Our monitoring efforts have documented highly seasonal dynamics of populations of both agents. Field surveys revealed that, in several *L. microphyllum* infestations, >40% of leaflets exhibited *F. perrepae* galls. Results from a 2-yr sampling of mite-colony plants showed that mite density within galls exhibited two population cycles per year: a strong cycle that boomed in spring and busted in summer, and a weak cycle that moderately increased mite density in fall and declined in winter. Furthermore, potted plant experiments showed that *F. perrepae* damage substantially reduced the growth rate of individual *L. microphyllum* rachises by 4x, in many cases halting rachis growth entirely and damaging new rachises emerging from the rhizome before any leaflets formed. Overall, the establishment, production, and effects of the two biological control agents are encouraging and support their continued use as an important component of *L. microphyllum* management.

1. **Eutychus Kariuki,** James Cuda, Stephen Hight, Raymond Hix, Jennifer Gillett-Kaufman, Lyn Gettys, and Carey Minteer **-** Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; Eutychus.kariuki@ufl.edu; 772-577-7388

Impact of an Adventive Stem-mining Midge on the Invasive Aquatic Plant Hydrilla verticillate - *Hydrilla verticillata* (L.f.) Royle is among the most invasive aquatic plants in the United States. Management of the plant is complicated by challenges that include development of herbicide-resistant biotypes and non-selectivity and prohibitive costs of mechanical harvesters. Scientists have proposed exploration for new biological control agents to complement the existing management tools. A stem-mining midge (*Cricotopus lebetis* Sublette) discovered in 1992 attacking the apical meristems of *H. verticillata* in Kings Bay, Florida, has been identified as a potential biological control agent for the plant. Previous studies showed the damage caused by larvae of *C. lebetis* suppressed *H. verticillata* infestations and reported the insect may have value as an augmentative biological control agent for the plant. However, more information is needed to better predict the efficacy of *C. lebetis* as a biological control agent for *H. verticillata*. Thus, this study investigated the impact of *C. lebetis* herbivory on the competitive ability of *H. verticillata* and the foraging depth of the insect. The results showed larvae of *C. lebetis* significantly reduced biomass production, turion production, and competitiveness of *H. verticillata*. In addition, the larvae of *C. lebetis* was able to attack *H. verticillata* at depths ranging from 0 m to at least 2.7 m, providing evidence that *H. verticillata* in Florida’s shallow waterbodies grows within the vertical foraging range of the insect.

**Symposium 5 – Molecular Ecology and Medical Entomology: Tools for Revealing Ecological Interactions Between Insects and Other Organisms (6)**

1. **Lindsay P. Campbell,** and Alana M. Alexander - Florida Medical Entomology Laboratory, 200 9th St SE, Vero Beach, FL 32962; lcampbell2@ufl.edu; 772-226-6666

Landscape Genetics of Medically Important Arthropod Species - Landscape genetics is a multidisciplinary approach, combining methods from landscape ecology, spatial analytics, and population genetics to study distributions, connectivity, and drivers of species population structures across an area. Landscape genetic approaches applied to medically important arthropod species provide new avenues to investigate impacts of landscape factors on genetic diversity and differentiation of vector populations and to observe how species use their local environments, providing valuable information toward prevention and control strategies. Here, we present an example of a landscape genetics approach focused on the mosquito species *Aedes mcintoshi* (subgenus *Neomelaniconion*), an important primary vector for Rift Valley fever virus in Kenya. Genetic diversity and differentiation were characterized across seven locations within one regional subclade of *Ae. mcintoshi* in Northeastern Kenya, using CO1 (cytochrome oxidase subunit 1) sequence data deposited in GenBank. Associations between diversity and differentiation and environmental variables were quantified using a multivariate statistical approach. Results indicated no evidence of isolation by distance across the study area, but we found significant CO1 subpopulation structure and associations with recent mean precipitation values. Percentage clay in the soil and precipitation were associated with variations in genetic diversity across the study locations. The data revealed a large number of haplotypes, indicating a need for additional sampling across a larger geographic area, and future incorporation of next generation sequencing approaches will provide an opportunity to obtain a greater amount of information from which to better characterize the genome.

1. **Carrie De Jesus,** Samantha Wisely, Coleman Sheehy, and David Blackburn - Department of Wildlife Ecology and Conservation, University of Florida, 110 Newins-Ziegler Hall, Gainesville, FL 32611; carriedejesus@ufl.edu; 949-680-7510

Investigating the Prevalence of Ixodes scapularis on Reptile Hosts in Florida - In Florida, only a few cases of Lyme disease are acquired in state. In the southeastern US, reptiles are important hosts for *Ix. scapularis* that vector *Borrelia burgdorferi*. Previous studies have implied that large numbers of available reptile host in Florida could be diluting *Borrelia burgdorferi* transmission; however, the prevalence of *Ix. scapularis* on reptiles has not been well investigated in Florida. The objective of this investigation was to determine how *Ix. scapularis* utilizes reptile hosts in Florida. In order to look at host utilization, I examined reptiles for ticks from the Florida Museum of Natural History Herpetology collection. Four species of lizards were examined for ticks: *Plestiodon laticeps* (Broadhead skink), *Plestiodon fasciatus* (common five lined skink), *Plestiodon inexpectatus* (south eastern five lined skink) and *Sceloporus undulates* (Eastern fence lizard). I examined 1,948 reptiles, collected from 1902 to 2018, which came from 60 counties. Ticks were present on reptiles from the Pan-handle to the southern tip of Florida. Wakulla County, located in northern Florida had the greatest number of reptiles infested with ticks (85/238). The majority of reptiles infested with ticks were found in the Pan-handle and north-central Florida and 14.5% (282/1,948) of all specimens examined were infested with ticks*. Plestiodon latieps* had the highest prevalence of ticks 29.7% (114/383). Nymphal and larval ticks were the most common life stages found on reptiles. This investigation found a higher prevalence of infected reptiles than previous studies conducted in southeastern US.

1. **Isaiah J. Hoyer,** Erik M. Blosser, Carolina Acevedo, Anna Carels Thompson, Lawrence E. Reeves and Nathan D. Burkett-Cadena **-** Florida Medical Entomology Laboratory, 200 9th St SE, Vero Beach, FL 32962; ihoyer820@gmail.com; 208-215-8841

Mammal Decline, Linked to Invasive Burmese Python, Shifts Host Use of Vector Mosquito Towards Reservoir Hosts of A Zoonotic Disease - Invasive apex predators have profound impacts on natural communities, yet the consequences of these impacts on the transmission of zoonotic pathogens are unexplored. Collapse of large- and medium-sized mammal populations in the Florida Everglades has been linked to the invasive Burmese python, *Python bivittatus* Kuhl. We used historic and current data to investigate potential impacts of these community effects on contact between the reservoir hosts (certain rodents) and vectors of Everglades virus, a zoonotic mosquito-borne pathogen that circulates in southern Florida. The percentage of blood meals taken from the primary reservoir host, the hispid cotton rat, *Sigmodon hispidus* Say and Ord, increased dramatically (422.2%) from 1979 (14.7%) to 2016 (76.8%), while blood meals from deer, raccoons and opossums decreased by 98.2%, reflecting precipitous declines in relative abundance of these larger mammals, attributed to python predation. Overall species diversity of hosts detected in *Culex cedecei* blood meals from the Everglades declined by 40.2% over the same period (H(1979) ¼ 1.68, H(2016) ¼ 1.01). Predictions based upon the dilution effect theory suggest that increased relative feedings upon reservoir hosts translate into increased abundance of infectious vectors, and a corresponding upsurge of Everglades virus occurrence and risk of human exposure, although this was not tested in the current study. This work constitutes the first indication that an invasive predator can increase contact between vectors and reservoirs of a human pathogen and highlights unrecognized indirect impacts of invasive predators.

1. **Craig Bateman** - Florida Museum of Natural History, University of Florida, Gainesville, FL 32601; batemanc@gmail.com; 248-891-2199

Total Ecological Communities in the Ambrosia Symbiosis - Advances in sequencing technology have revolutionized biology. It is now possible to identify entire communities of individuals with unprecedented depth, resulting in a proliferation of community association studies. Still, the technology has been under- or inappropriately used, with one example being the ambrosia symbiosis between beetles and fungi. The ambrosia symbiosis contains important invasive and plant-pathogenic species, but the symbiosis remains poorly characterized due to its impressive diversity. Of more than 3,000 beetle species, fungal symbionts have only been identified from less than a percent of known beetle species. We characterized a more appropriate depth and breadth of the symbiosis by sampling communities of ten independently evolved origins of the symbiosis across beetles. We discuss how complex interactions between beetles, fungi, trees, bacteria, and other organisms interact to mediate associations and functions. These results provide information on potential invasion risk and management tactics for pestiferous ambrosia symbioses. The depth of these interactions also suggests a restructuring of how we interpret the impact of interactions on evolutionary processes.

1. **Caroline Efstathion,** Nathan D. Burkett-Cadena, and William H. Kern Jr. - Anastasia Mosquito Control District 120 EOC Drive St. Augustine, FL 32092; cefstathionamcd@gmail.com; 904-471-3107 ext.336

Prefledging Mortality and the Abundance of Mosquitoes Biting Nestling Barn Owls **-** Mosquito-borne diseases can have disastrous effects on avian populations; therefore, most studies of bird and mosquito interactions have focused on the mortality and morbidity associated with the diseases. However, the effect of mosquitoes feeding on birds, independent of disease, has not been well studied. We studied Barn Owls nesting in artificial nest boxes in sugarcane fields in Florida. To reduce mosquito effects on nestlings, we used an insecticide spray in half of the nest boxes. Mosquito suction traps were fixed to the outside of eight nest boxes to collect mosquitoes over a 24-h period weekly. Collected mosquitoes were counted, sorted into blood-fed and unfed females, and identified to species when possible. The dominant mosquito species captured was *Culex nigripalpus*. The highest total number of mosquitoes and blood-fed mosquitoes captured in a suction trap in one trap night was 3,193 and 379, respectively. Significantly fewer mosquitoes were captured from treated nest boxes compared to untreated boxes. Nestling age influenced the total number of mosquitoes captured, with the highest numbers associated with fledglings 22–42 d old. The highest numbers of blood-fed mosquitoes were captured when nestlings were 22–28 d old. Nestlings in insecticide-treated boxes had higher survival rates compared to those in untreated boxes during months with high mosquito numbers. Mosquitoes can impose energetic costs on nestlings by causing stress from irritation, dehydration, and the constant regeneration of blood cells. These costs, in addition to other factors can contribute to higher mortality rates during nesting periods with high mosquito numbers.

1. **Dongmin Kim,** Tawni L. Crippen, Heather R. Jordan and Jeffery K. Tomberlin - Department of Entomology, Texas A&M University, College Station, Texas, 77843; dongminkimkorea@gmail.com; 979-422-4144

Quorum Sensing Inhibitor Approaches to Unravel the Biological Function of Interkingdom Signaling Molecule in *Staphylococcus epidermidis* **-** *Aedes aegypti*, is a vector of pathogens transmitting many infectious diseases such as Zika, Dengue, and Yellow Fever. Skin-inhabiting bacteria, such as *Staphylococcus epidermidis*, produce specific volatile organic compounds (VOCs) which participate in attracting mosquitoes to human hosts. Several studies have investigated microbial VOCs enroot to developing mosquito control methods; however, information about bacterial ecology and its role in mosquito behavior is lacking, specifically, whether bacterial communication through quorum sensing (QS) modulates VOCs production that affects mosquito behavior. This study demonstrated disrupting QS by *S. epidermidis* with a quorum sensing inhibitor reduced the VOCs composition by 35.0% and suppressed mosquito attraction by 55.1%. RNASeq data underscored the regulation of metabolism and stress response of *S. epidermidis* and resulting protein transport of secondary metabolites potentially leading to altered VOCs production. This interdisciplinary study provides the first evidence of interkingdom cross-talk between bacteria and eukaryotic organisms that can be altered by QS manipulation.

**Symposium 6 – Pest Control Challenges in the Southeastern United States (4)**

1. **Scott Ferguson** - Atlantic Turf & Ornamental Consulting, 2940 3rd Street SW, Vero Beach, FL 32968; Scott@atoconsult.com (772) 643-5658

Why is the American Serpentine Leafminer, *Liriomyza trifolii*, such a Problem to Control? - The American serpentine leafminer, *Liriomyza trifolii* (Diptera: Agromyzidae) is a major pest of many vegetable and ornamental crops in the field and greenhouse throughout the world, and especially in Florida. Biological factors that make leafminers a problem include: a high reproductive rate (females can lay up to 600 eggs in their short life); short generation time; overlapping generations; a very wide host range that includes vegetable crops, some field crops (cotton and soybeans, for example), ornamentals and some broadleaf weeds; and a tremendous ability to develop insecticide resistance to virtually any class of chemistry applied. Operational factors that can make leafminers a problem include: low damage thresholds, especially in leafy vegetables and ornamentals requiring insecticide applications; long season crops requiring multiple insecticide applications; and leafminer population upsets caused by the application of insecticides to control other pests.

1. **Muhammad Haseeb,** Lambert H.B. Kanga, Albertha J. Parkins, Pengxiang Wu, Jesusa C. Legaspi and Oscar E. Liburd; Center for Biological Control, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee, FL32307; muhammad.haseeb@famu.edu; 850-412-7060

Developing and Implementing Effective IPM Strategies in Specialty Crops in North Florida - Several pest insects cause serious challenges to specialty crops in north Florida. Growers and industry need effective pest management solutions to control these economically important pest insects in conventional and organic cropping systems. FAMU’s IPM Program has been developing and implementing effective IPM strategies in specialty crops since 2010. For example, to manage *Nezara viridula* in tomatoes, the use of trap crops (sorghum, sunflower and millet) and refuge crops (three varieties of sweet alyssum) were evaluated during 2014- 2015 for their potential use in a ‘push-pull’ strategy to manage this serious pest effectively. Sorghum was found to be effective in attracting *N. viridula* adults and reducing their numbers in tomato crop. *Geocoris punctipes* was the most abundant natural enemy of *N. viridula* found on all three varieties of sweet alyssum. In addition to *G. punctipes, Orius insidiosus* and other parasitoids and predators were recorded from all three varieties of sweet alyssum. For small fruit crop protection (blueberries and blackberries), we evaluated several traps and bait systems in 2016 and 2017 to properly monitor and manage *Drosophila suzukii*. Based on the preliminary findings of this study, the use of pine bark mulch maybe a possibility to manage *D. suzukii* in open field conditions. During 2017-2018, a study on the pepper weevil, *Anthonomus eugenii* was carried out to find its distribution within the pepper plants. Based on these findings, small scale growers are being trained to sustain crop productivity and profitability of their farms in north Florida.

1. **Xavier Martini** and Lukasz Stelinski **-** North Florida Research and Education Center, University of Florida, Quincy, FL 32351; xmartini@ufl.edu; 850-875-7160

*Development of a Push-pull System for the Redbay Ambrosia beetle Xyleborus glabratus, Vector of the Laurel Wilt Pathogen* - Laurel wilt is a vascular disease that has caused extensive mortality of trees and shrubs in the Lauraceae family, which include many commercially, ecologically and culturally important species such as Redbay, Persea borbonia. and avocado P. americana. Laurel wilt is caused by the fungus Raffaelea lauricola that is vectored by the exotic redbay ambrosia beetle, Xyleborus glabratus. We discovered that levels of methyl salicylate (MeSA) significantly increased in redbay three days post inoculation with R. lauricola, and that X. glabratus was significantly repelled by MeSA in olfactometer bioassays. These findings are consistent with observations that pioneer beetles abandon host trees shortly after attempting initial colonization. We decided to test MeSA in field condition, as well as verbenone, an anti-aggregation pheromone that has been found to repel a wide diversity of bark beetles. During the experiment conducted on cut redbay bolts, we observed a decrease in terms of arrivals to the bolts as well as number of boring holes found in the bolts at the end of the study for both MeSA and verbenone treatments. However, on subsequent experiments conducted on whole trees on a larger scale only verbenone significantly repelled redbay ambrosia beetles. In a final step, we included verbenone in a push-pull system in forest and avocado grove settings. In redbay, the attractant used was α-copaene a sesquiterpenes known to attract X. glabratus, while ethanol was used in avocado orchards. In both situations, we were able to significantly reduce the number of beetles attacking redbay and avocado. In redbay, we were able to reduce beetle populations by nine fold as compared with untreated controls.

1. **Dakshina R. Seal** - Tropical Research and Education Center, University of Florida, Homestead, FL 33031; dseal3@ufl.edu; 786-217-9269

Chemical and Nonchemical Approaches for Controlling Pepper Weevil *Anthonomus eugenii* Cano (Coleoptera: Curculionidae) - Pepper weevil (PW), *Anthonomus eugenii* Cano is a serious pest of pepper. PW infestation causes significant economic yield loss. Current knowledge to control PW is insufficient. Proper timing of applying insecticides is an important consideration in achieving successful control of PW. Among chemical insecticides, oxamyl (Vydate®) and thiamethoxam (Actara®) are effective in significantly reducing PW abundance. PW pheromone trap alone or pheromone in combination with yellow sticky tubes (PWACT) are effective in attracting and reducing PW adults. Chromobacterium subtsugae (Grandevo®) and Beauveria bassiana (BotaniGard®) show moderate effectiveness in causing mortality of pepper weevil adults. These products can be used in rotation with effective chemical insecticides to manage pepper weevil.

**Submitted papers**

1. **Oscar E. Liburd,** Lorena Lopez, and Daniel Carrillo **-** Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; oeliburd@ufl.edu; 352-273-3918

Effect of Bio-rational Insecticide on *Amblyseius swirskii* in Organic Squash - Recently, there has been a lot of focus on the predatory mite, *Amblyseius swirskii* Athias-Henriot as a bio-control agent for organic vegetable systems for management of key pests including thrips (Thripidae), and whiteflies (Aleyrodidae). We investigated the compatibility of *A. swirskii* with standard insecticide tools used by organic growers in vegetable production. Using a randomized design with incomplete blocks and three replications we conducted laboratory and greenhouse experiments to evaluate 9 treatment combinations including: M-Pede® (Gowan Company, Yuma, AZ) and *A. swirskii* released 1,3 and 5 days after insecticide application; Azera® (Valent BioSciences LLC, Raleigh, NC) and *A. swirskii* released 1,3 and 5 days after insecticide application; water and *A. swirskii* released 1 3 and 5 days after application. Overall, predatory mite larvae exposed to Azera® residues showed the highest initial mortality when released 1-day after treatment. The highest number of predatory mite nymphs were recorded in the squash from the control treatment when mites were released 3-days after treatment followed by the squash treated with Azera when *A. swirskii* was released 5-days after insecticide application. If it is strictly necessary to use Azera before *A. swirskii* releases, predatory mites should not be released 1- nor 3-days after treatment with the insecticide to avoid predatory mite mortality as precaution. Based on the insecticide classification scheme, M-Pede can be considered harmless to all stages of *A. swirskii*.

1. **Deepak Shrestha**, Marice Lopez, and Oscar E. Liburd - Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; dshrestha@ufl.edu; 352-281-1834

Evaluation of Different Release Methods and Cultivars with the Predatory mite, *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) to Manage the Whitefly [*Bemisia tabaci* (Gennadius) MEAM1] in Organic Squash - Squash (*Cucurbit pepo* L.) is a high value crop grown in Florida. The sweetpotato whitefly [*Bemisia tabaci* (Gennadius) MEAM1] also known as biotype B, is one of the damaging pests of squash in Florida. The predatory mite, *Amblyseius swirskii* can be an effective control method for whiteflies especially in organic fields. An experiment was developed to evaluate the effectiveness of different release methods of *A*. *swirskii* and squash cultivars. Following four release methods were used for *A*. *swirskii* i) *A*. *swirskii* sprinkled on top of leaves, ii) *A*. *swirskii* placed on base of the stem, iii) sachets placed on alternative plant, and iv) control (without *A*. *swirskii*) on three different cultivars Zephyr, Sunburst and Eightball. Overall, a higher number of whiteflies were found on Zephyr and Sunburst than Eight ball. Sprinkle release method had a higher number of *A*. *swirskii* on leaf than by sachet and stem methods. The control had the lowest number of *A*. *swirskii*. Higher number of eggs and nymphs of whitefly were found on Zephyr and Sunburst than on Eight ball. A higher number of plants showing virus symptoms and silverleaf disorders were found on Zephyr followed by Sunburst and then Eight ball. Zephyr also had higher yield than Sunburst and Eight ball. In conclusion, releasing *A*. *swirskii* on leaves gave better results for increasing the number of *A*. *swirskii*, however, it was not enough to control whitefly populations. Cultivar was also an important factor in determining *A*. *swirskii* and whitefly densities in an organic field.

1. **Elena M. Rhodes,** Carlene A. Chase, Xin Zhao, and Oscar E. Liburd - Entomology and Nematology Department, University of Florida, Gainesville, FL, 32611; erhodes@ufl.edu; 352- 273-3925

Movement and Spatial Distribution of Spotted Wing Drosophila, *Drosophila suzukii*, in Organic Strawberries in Florida - The invasive *Drosophila suzukii* has become serious pests of fruit crops throughout the America’s and Europe because females possess a serrated ovipositor that allows them to lay their eggs in ripening and ripe fruit. One larva can cause an entire shipment of berries to be rejected. In blueberries, *D. suzukii* are often caught on the edge of woody areas adjacent to blueberry fields and in blueberry border rows. It is not known whether this edge effect occurs in strawberry fields. The specific objective of this study was to examine the spatial distribution and movement of adult SWD on an organic strawberry farm. During the 2017/18 and 2018/19 strawberry seasons, adults were monitored weekly using Scentry traps baited with Scentry lures replaced every 4 weeks. Three traps were placed next to the bordering wooded area and 3 were placed 5 m outside of the border of the plot. The remaining traps were placed 5, 10, 20, and 40 m into the plot. In both years, higher numbers of *D. suzukii* were caught in the woods. Females were spread randomly throughout the strawberry field while males tended to cluster in the woods and on the border of the strawberry field.

1. **Bruno R. De Marchi,** and Hugh A. Smith - Gulf Coast Research and Education Center, University of Florida, Wimauma, FL 33598; bruno.rossittode@ufl.edu; 813-419-6587

Bacterial Endosymbiont Diversity among *Bemisia tabaci* (Hemiptera: Aleyrodidae) Populations in Florida **-** *Bemisia tabaci* MEAM1, also known as the sweetpotato whitefly, is a pest of many agricultural crops and an important vector of economically important plant viruses. *Bemisia tabaci* populations carry a primary endosymbiotic bacterium called *Candidatus Portiera aleyrodidarum*, which is essential for host survival. In addition to the primary endosymbiont, different facultative endosymbionts including *Arsenophonus*, *Hamiltonella*, *Wolbachia*, *Cardinium*, *Fritschea* and *Rickettsia* have been reported fromwhitefly populations around the world. These facultative endosymbionts may influence with host reproduction, host fitness, thermotolerance, tolerance to insecticides and virus transmission efficiency. We collected whitefly populations from weed and crop hosts in south Florida and identified the whitefly species as well as the facultative endosymbionts present in these populations by molecular analysis. The endosymbiont analysis found variability of facultative endosymbionts among the *B. tabaci* populations collected. Studies are being carried out to evaluate the potential association between the incidence of facultative endosymbionts and insecticide resistance in *B. tabaci* in Florida.

1. **Robert L. Meagher, Jr.** – USDA-ARS CMAVE, 1700 SW 23rd Dr., Gainesville, FL 32608; rob.meagher@ars.usda.gov; 352-374-5756

The Noctuid Egg Parasitoid *Telenomus remus* (Hymenoptera: Platygastridae) in Florida - *Telenomus remus* is a solitary parasitoid that attacks eggs of various noctuid moths, especially *Spodoptera* species. It was first released in south Florida in 1975 but was not thought to have become established. Recoveries of this parasitoid were found in north-central Florida in 2009, 2013, and since 2017 in north and southwest Florida using sentinel egg masses of *S. frugiperda*. Experiments are being conducted to determine how sentinel egg mass age and length of time spent in the field influence parasitism.

1. Esmaeil Saberi, Mohamed Ali*,* and **Jawwad Qureshi** – UF/IFAS Ft. Lauderdale Research and Education Center, 3205 College Ave., Davie, FL 33314; daguilera@ufl.edu; (863) 210-3781

Survival and Development of *Spodoptera latifascia* (Lepidoptera: Noctuidae) in Citrus - *Spodoptera latifascia* (Lepidoptera: Noctuidae), commonly known as garden armyworm is a widespread pest of various cultivated plants including citrus. Recently, it was observed infesting young ‘Valencia’ sweet orange plants in southwest Florida. Host suitability is important for the growth and development of phytophagous insects and for the establishment of a pest population on a crop. Larvae of *S. latifascia* were able to feed on a wide range of citrus cultivars. Successful development from first instar larvae through adulthood and reproduction was observed on ‘Valencia’ and ‘Hamlin’ oranges and on Lisbon lemon.

1. Alejandro Tena, José Catalán, Estrella Hernández, Kerstin Krüger, Meritxell Pérez-Hedo, Jesica Pérez-Rodríguez, Pablo Urbaneja-Bernat, and **Alberto Urbaneja** **-** Instituto Valenciano de Investigaciones Agrarias (IVIA). Centro de Protección Vegetal y biotecnología. CV-315, Km. 10,7 – 46113 Moncada (Valencia), Spain; aurbaneja@ivia.es; +34659463921

Biological Control and Confinement Strategies for African Citrus Psyllid *Trioza erytreae* (Del Guercio) (Hemiptera: Psyllidae), Vector of Citrus Huanglongbing - The African citrus psyllid *Trioza erytreae* (Del Guercio) (Hemiptera: Psyllidae) was recently (fall 2014) detected in the northwest of the Iberian Peninsula. *T. erytreae* and *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) are considered the main threat to citrus industry worldwide since both are vectors of the "huanglongbing" (HLB), an incurable citrus disease that causes large economic losses. The containment of the vectors is key to reduce the risk of HLB establishment in those areas where vectors are present without the disease (as Mediterranean citrus). In this context, a classical biological control program has been initiated in continental Europe. For this, the main citrus producing areas of South Africa were sampled during 2017. *Tamarixia dryi* was the most abundant parasitoid followed by another species of genus *Tamarixia* that had not been described so far. The host specificity of *T. dryi* was evaluated using 11 non-target psyllid species, including five species of the genus *Trioza*. Our results demonstrate that *T. dryi* is a highly specific parasitoid and its introduction, release and establishment in Europe within the classical biological control program of *T. erytreae* should not affect other psyllid species. In this work, we also present the effectiveness of containment of four commercial anti-insect netting on *T. erytreae*.

1. **Pasco B. Avery**, Jessamyn Adorada, Emily B. Duren, Alejandra V. Chavez, Ronald D. Cave, and Jawwad Qureshi- Indian River Research and Education Center, University of Florida, Fort Pierce, 34945, FL; pbavery@ufl.edu; 979-422-4144

Compatibility of Entomopathogenic Fungus, *Isaria fumosorosea* and Ladybeetle *Curinus coeruleus* for Managing the Florida Red Scale - The compatibility of *Isaria fumosorosea* with the ladybeetle, *Curinus coeruleus* for management of the Florida red scale (FRS) was determined. Citrus leaves infested with ~10 FRS were sprayed with either water or entomopathogenic fungus and allowed to air dry and then placed into an eppendorf tube filled with water secured with parafilm. Treatments were 1) leaves with FRS sprayed with water only 2) leaves with FRS sprayed with water only and provided with a single adult *Curinus coeruleus*; 3) leaves with FRS sprayed with PFR-97 and provided with a single adult *C. coeruleus*. Single leaves secured in eppendorf tubes were placed into a 30-dram vial covered with mesh and secured with a rubber band. Experimental arenas were placed into the growth chamber at 25 C under a 14:10 h L:D with ~60% RH. Mortality of ladybeetle and scale consumption were assessed after 7 days. Comparisons of percent mortality and number of scales consumed per treatment was conducted using an ANOVA and Tukey’s HSD test (α = 0.05). *Curinus coeruleus* exposed to leaves sprayed with *I. fumosorosea* were not affected in their consumption of the FRS compared to the control. The mean percent consumption was 60% and 67% in the *I. fumosorosea* treatment and the control, respectively. There was no mortality of the beetle adults after exposure to leaves sprayed with the fungus or water for 7 days.

1. **Julien Beuzelin,** Dak Seal, Carolina Tieppo Camarozano, Donna Larsen, Sandy Allan, and Gregg Nuessly – Everglades Research and Education Center, Belle Glade, FL 33430; jbeuzelin@ufl.edu; 561-993-1559

Silk Fly Management Advances in Florida Sweet Corn - Three species of picture-winged flies (Diptera: Ulidiidae) referred to as corn silk flies in southern Florida are severe sweet corn insect pests: *Euxesta stigmatias*, *Euxesta eluta*, and *Chaetopsis massyla*. Silk fly management relies on frequent pyrethroid applications. Field experiments were conducted to determine whether traps baited with synthetic lures could be used to monitor silk fly adults to assist with pest management decisions. Additional experiments addressed the effect of time of the day on the efficacy of pyrethroid applications, the efficacy of baits co-applied with spinosad, and the efficacy of biological insecticides.

1. **Brian W. Bahder,** De-Fen Mou, Noemi Soto, and Ericka Helmick - Fort Lauderdale Research and Education Center, University of Florida, Davie, FL 33314; bbahder@ufl.edu; 954-577-6305

Improved Diagnostic Tools for Palm-infecting Phytoplasmas: Applications in Extension and Vector Ecology **-** Palm-infecting phytoplasmas present a persistent and significant threat to sustainable palm production in the state of Florida. Historically, lethal yellowing (LY) has killed countless palms throughout the state and recently, lethal bronzing disease (LBD) has emerged as a major threat to the nursery and landscaping industry in the state. Due to the rapid spread of the disease throughout the state, rapid and sensitive detection techniques are needed as a foundation for management and research. Current research efforts have developed a rapid extraction protocol from palm samples that yield high total DNA with optimal purity ratios that allow for accurate results. In addition, quantitative PCR (qPCR) and melt curve analysis have been adapted to detect and differentiate between LY and LBD in a single reaction, thus eliminating post PCR handling. Digital PCR has also recently been adapted for utility in detecting palm-infecting phytoplasmas and was demonstrated to be 100x more sensitive than qPCR and nested PCR. These protocols allow us to address the needs of stakeholders in a more rapid manner than previously possible and with increased sensitivity, isolation of the phytoplasma from organs such as salivary glands can be done with greater confidence and shed light on the pathogen-vector interaction in this system.

1. **Michael Karounos,** Ron Cherry, Mabry McCray, and Shangning Ji - Everglades Research and Education Center, Belle Glade, FL 33430; wompum@ufl.edu; 859-312-6450

Survival and Behavior of *Melanotus communis* (Coleoptera: Elateridae) in Florida Sugarcane Soils - Click beetle larvae, known as wireworms, are major economic pests of southern Florida sugarcane. *Melanotus communis* wireworms were tested in both muck and sand soils found in the Everglades Agricultural Area in three tests. There were no significant differences in starved wireworms’ survival or weight change between the soils. Wireworms dispersed at similar rates towards oat baits in both soil types. Interestingly, in free choice tests, wireworms showed a high preference to reside in muck versus sandy soil.

1. **Thomas Chouvenc,** Nan-Yao Su, and Caroline Efstathion - Fort Lauderdale Research and Education Center, University of Florida, Davie, FL 33314; tomchouv@ufl.edu; 954-577-6320

The Termite Fecal Nest: A Framework for the Opportunistic Acquisition of Beneficial Soil Streptomyces- Mutualistic associations between insects and microorganisms must imply gains for both partners and the emphasis has mostly focused on coevolved host-symbiont systems. However, some insect hosts may have evolved traits that allow for various means of association with opportunistic microbial communities, especially when the microbes are omnipresent in their environment. It was previously shown that colonies of the subterranean termite *Coptotermes formosanus* Shiraki build nests out of fecal material which host a community of Streptomyces. These Actinobacteria produce an array of bioactive metabolites that provides a level of protection for termites against certain entomopathogenic fungi. How *C. formosanus* acquires and maintains this association remains unknown. This study shows that the majority of the *Streptomyces* isolates found in field termite fecal nest materials are identical to Streptomyces isolates from soils surrounding the nests, and were not vertically inherited. A survey of Streptomyces communities from *C. formosanus* fecal nest materials sampled at 20 locations around the world revealed that all nests are reliably associated with a diverse Streptomyces community. The *C. formosanus* fecal nest material therefore provides a nutritional framework that can recruit beneficial Streptomyces from the soil environment, in the absence of long-term co-evolutionary processes. A diverse *Streptomyces* community is reliably present in soils and subterranean termite colonies can acquire such facultative symbionts each social cycle into their fecal nest. This association likely emerged as an exaptation from the existing termite nest structure and benefits both the termite and the opportunistic colonizing bacteria.

1. **Janine Spies** – University of Florida, IR-4 Southern Region, Gainesville, FL 32611; jrazze@ufl.edu; 352-294-3991

Advocate for Specialty Crops: The role of IR-4 in Pest Management - Many of the food crops we consume, e.g. fruits, vegetables, nuts, and herbs as well as non-food crops such as landscape plants are considered specialty crops. Specialty crops are grown on limited acreage and often have a high economic value. The agrochemical industry often lacks the financial incentives to expand registration for their products to specialty crops. Since 1963, the IR-4 Project has been the primary resource for facilitating registrations of conventional chemical pesticides and biopesticides for specialty crops and other minor uses in the United States. The mission of IR-4 is to provide safe and effective pest management solutions for specialty crop growers. The IR-4 Project is federally funded through USDA & Land Grant Universities; the program’s research efforts have yielded over 45,000 use registrations in the past 50 years for food uses, ornamental and organic production. Research efforts are focused on reduced risk pesticide registrations to ensure that specialty crop growers gain registered uses that are critically important to modern Integrated Pest Management Systems.

1. **Kate Fairbanks,** Antonio Francis, and Eric Rohrig **-** Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608; Katherine.fairbanks@freshfromflorida.com; 352-395-4698

Florida Department of Agriculture and Consumer Services, Division of Plant Industry’s Ongoing Research into Methods of Control and Eradication of Exotic Tephritid Fruit Flies **-** Tropical Tephritid fruit flies represent a major threat to US agriculture, threatening production and control losses of millions of dollars. Florida’s subtropical climate, a highly mobile and cosmopolitan human population, and an abundance of cultivated and indigenous hosts make this state extremely vulnerable to fruit fly infestation. Because fruit flies can reproduce rapidly and infest over 400 species of fruits and vegetables, they have potential to spread quickly. Therefore, they must be eradicated as quickly as possible. Left uncontrolled, infestations will quickly spread throughout the State of Florida. It is the responsibility of the Florida Department of Agriculture and Consumer Services, Division of Plant Industry to monitor for, control, and eradicate these flies. To further that goal, we are conducting research such as evaluating bait and lure efficacy, studying pesticide resistance in some Hawaiian melon fly populations, and working to identify alternative chemistries to avoid pesticide resistance. In general, the projects’ methods development work will support state and federal fruit fly programs and are expected to provide enhanced methods to Florida and other states, and further protect the agricultural resources of the United States.

1. **Marina S Ascunce,** Henri Herrera, Yesenia Campaña, Robert Vander Meer, and Sanford Porter – Emerging Pathogens Institute, Department of Plant Pathology, University of Florida, Gainesville, FL 32611; ascunce@ufl.edu; 352-273-8463

Invasive Tropical Fire Ants, *Solenopsis geminata*, in the Galapagos islands - Invasive species pose major threats to public health, natural and agriculture environments resulting in billions of dollars in economic losses annually and are a major concern for oceanic archipelagos, such as the Galapagos. This World Heritage site has been affected by >1,579 alien terrestrial and marine species, including 545 terrestrial insects. The tropical fire ant (*Solenopsis geminata*), one of the most invasive insects, has reached these enchanted Islands. Thus, our goal, it is to use genetic data to pinpoint putative source populations that will then help develop biological control agents against the tropical fire ant in the Galapagos. To start addressing this question, we collected ants from 50 *S. geminata* nests from three islands in the Galapagos: San Cristobal (25 nests), Isabella (21 nests) and Santa Cruz (4 nests). First, we determined the microsatellite genotype based on 43 loci of one worker from each nest. Then we sampled 45 *S. geminata* nests from several sites in continental Ecuador and obtained their genotypic profile. We combined this newly generated data with a database previously obtained in our lab that includes genotypic information from almost 200 tropical fire ants from around the world. Preliminary analysis suggests that Ecuador is the source of the nests found in the Galapagos. More detailed analyses are needed to narrow the geographic origin of the tropical fire ants from the Galapagos within Ecuador. Future sampling is also planned in the Galapagos islands of Floreana and Santa Cruz.

**Submitted Posters**

1. **Jessica Moreno,** Poliane Sá Argolo, Daniel Carrillo, Ismail Döker, Carina Allen, Alexandra M. Revynthi, and Amy Roda - USDA-APHIS-PPQ CPHST, 13601 Old Cutler Rd., Miami, FL 33158; Jessica.moreno@ufl.edu; 305-926-5119

Spatial and Temporal Distribution of Predatory Mites Associated with Brevipalpus on Hibiscus Plants in South Florida - Predatory mites are important biological control agents of hibiscus insect and mite plant pests. Recently, predatory mites have been found to feed on the eggs and mobile stages of *Brevipalpus yothersi* (Baker, 1949) (Acari: Tenuipalpidae), the known vectors of the *Citrus leprosis virus-C* and -*C2* (CiLVs). Citrus leprosis is considered one of the most destructive diseases of citrus. In Colombia, CiLVs infected *B. yothersi* taken from hibiscus were able to transmit the virus to citrus. There are no reports of CiLVs in the U.S.A., but the vector is present in all citrus producing states. Fortunately, the disease can be controlled by managing the vector flat mite. Locally established predatory mites may be able to control *B. yothersi* populations on hibiscus, thereby help control the spread of the virus in the landscape. We collected samples from three hibiscus hedges located in South Florida for 16 months to determine seasonal and spatial changes of the predatory mite community. Predatory mites associated with *Brevipalpus* spp. on hibiscus plants belonged to the families Phytoseiidae, Bdellidae, and Cheyletidae. The phytoseiid *Amblyseius largoensis* was the most commonly found predator and was present on all sample dates and located in all sections of the hibiscus canopy (top, middle and bottom). These predatory mites could be a key factor in the development of an integrated pest management programs if citrus leprosis arrives in the U.S.A.

1. **Dena Autry,** Rui-De Xue, and Daniel Dixon - Anastasia Mosquito Control District 120 EOC Drive St. Augustine, FL 32145; Dautryamcd@gmail.com; 904-484-7339

Effect of Mass Deployment of Autocidal Gravid Ovitraps on Populations of *Aedes aegypti* and *Aedes albopictus* in St. John’s County, Florida - Anastasia Mosquito Control District (AMCD) participated in a study to evaluate the impact of massive deployment of Springstar’s Autocidal Gravid Ovitrap (AGO). The goal of this study was to determine the effectiveness of the AGO traps on populations of *Aedes* *aegypti* and *Ae. albopictus* in St. John’s County, Florida. The first year of the study, 2017, AGOs collected an abundant number of non-targets, raising questions about the impact they may be having on Aedes populations. Therefore, in 2018, AMCD continued the study in other areas of the county which were more heavily populated with the target *Aedes* species, deploying 1,600 AGO traps. Six sites were used, three experimental sites, each had 533 AGO traps and 24 sentinel autocidal gravid ovitraps (SAGO). Each control site had only 24 SAGO traps. *Aedes* *aegypti* and *Ae. albopictus* populations were monitored at all sites with SAGO and BG Sentinel traps. Once a week three BG traps were deployed and collected for identification and counted in each site and SAGO sticky cards were collected, identified, and replaced each week for every site. AGO traps are a leave and forget trap requiring minimal maintenance, but they captured predominately non-targets and comparatively few *Ae. aepypti* and *Ae. albopictus*. AGO traps, however, were highly liked and accepted by the citizens in the areas.

1. **C. Teri Allen,** Jessica Moreno, Silvia Durand, and Amy Roda - USDA-APHIS-PPQ CPHST, 13601 Old Cutler Rd., Miami, FL 33158; Carina.L.Allen@USDA.GOV; 786-831-8398

Monitoring Phantasma scale (*Fiorinia phantasma*, Diaspididae: Hemiptera) Populations on Tahina palms -*Phantasma* scale (*Fiorinia phantasm*a Cockerell & Robinson, Diaspididae: Hemiptera), known from Asia and the Oceania region, has expanded globally and was recently discovered in South Florida. Because the scale poses a major threat to nursery and landscape industries as well as to homeowners, it is considered a quarantine pest. We studied the temporal and spatial changes of *Phantasma* scale populations on the gigantic palm, *Tahina spectabilis* (Arecaceae: Arecales). The palm is endemic to Madagascar and is listed as a critically endangered species. To limit damage, two nondestructive sampling methods were developed to determine the distribution of the scale in the palm canopy and its corresponding damage. Monthly, a visual rating (0-100%) was made to evaluate the level of infestation and damage of every frond (top and bottom) from 10 randomly selected palms found in a 20 palm ex situ planting in Coral Gables, FL. Additionally, the changes in 5 individual populations of *Phantasma* scale were recorded using digital imagery. Since December 2018 the infestation has increased from 12% to 25%. More scales were found on the bottom of the fronds and populations were highest on the lower fronds. The digital images of individual populations showed a similar trend of increasing numbers of scales. The amount of damaged, evaluated by the percentage of the frond with chlorotic patches, did not show a corresponding increase to increased populations. While the overall infestation and damage is low, this study indicates that scale numbers are increasing and mitigation strategies should be explored.

1. **Paul E. Kendra,** Wayne S. Montgomery, Teresa I. Narvaez, Elena Q. Schnell, Aime Vázquez, Nurhayat Tabanca, and Daniel Carrillo - USDA-ARS, Subtropical Horticulture Research Station, 13601 Old Cutler Road, Miami, FL 33158; paul.kendra@ars.usda.gov; 786-573-7090

Comparison of Piperitone, Verbenone, and Α-Farnesene as Repellents for Euwallacea Nr. Fornicatus, Vector of Fusarium Dieback in Florida Avocado - In recent years, beetles morphologically identical to tea shot-hole borer, *Euwallacea* *fornicatus* Eichhoff (Coleoptera: Curculionidae: Scolytinae), have become established in Florida and California. These invasive beetles (collectively *E*. near *fornicatus*) are highly polyphagous and vector fungal pathogens that cause *Fusarium* dieback, a vascular disease of avocado (*Persea americana* Miller), woody ornamentals, and native forest trees. Previously, we identified piperitone (*p*-menth-1-en-3-one) as a new repellent for host-seeking *E*. nr. *fornicatus* in Florida. In this study, we compare efficacy of piperitone to two other repellents, verbenone and α-farnesene, all formulated in plastic bubble dispensers. Two replicate field tests were conducted in commercial avocado groves. Each test was run for 12 weeks and compared captures of beetles in baited traps (quercivorol and α-copaene lures) versus captures in traps containing lures plus repellent. To complement field tests, SuperQ collections followed by GC analyses were performed to quantify emissions from repellent dispensers over a 12-week period. In addition, electroantennography (EAG) was used to measure beetle olfactory response to each repellent. Overall, repellency was comparable with piperitone and verbenone, resulting in 50-70% decrease in beetle captures, with longevity of 10-12 weeks. No significant decrease in captures was observed with α-farnesene. EAG responses to piperitone and verbenone were equivalent, and significantly greater than response to α-farnesene. Since piperitone is less expensive than verbenone, this study identifies an economical alternative repellent for incorporation into pest management programs for *E.* nr. *fornicatus*.

1. **Wayne S. Montgomery,** Nurhayat Tabanca, Marco Masi, Nancy D. Epsky, Paola Nocera, Alessio Cimmino, Paul E. Kendra, Jerome Niogret, and Antonio Evidente- USDA-ARS, Subtropical Horticulture Research Station, 13601 Old Cutler Road, Miami, FL 33158; wayne.montgomery@ars.usda.gov; 786-573-7067

Potential New Attractants for Mediterranean Fruit Fly (Diptera: Tephritidae) - *Ceratitis capitata*, the Mediterranean fruit fly, is one of the most serious agricultural pests worldwide, responsible for substantial reduction in fruit and vegetable yields, resulting in billions of dollars of economic loss. The aim of this study was to identify effective attractants for *C. capitata* and disrupt the ‘disadvantage matrix’ associated with conventional insecticide control: expense, pesticide resistance, and harm to the environment and non-target beneficial insects. A series of 29 structurally-related natural and synthetic aromatic compounds were screened for bioactivity using lab bioassays and electroantennography (EAG). No-choice bioassays identified phenyllactic acid, estragole, *o*-eugenol, and 2-allylphenol as promising attractants for males. Binary choice bioassays showed *o*-eugenol to be the most attractive. In general, strong EAG responses were elicited by the same compounds that were observed to be attractive in the bioassays. Additionally, EAG analysis identified 2 compounds that elicited higher than expected olfactory responses; these require further study to determine their biological relevance. This study demonstrated that there are key structural features (specific functional groups attached to the aromatic ring) associated with attraction, information that will help direct future research on development of improved lures for Mediterranean fruit fly.

1. **Silvia R. Durand,** Jessica Moreno, and Amy Roda - USDA-APHIS-Science and Technology, 13601 Old Cutler Road, Miami, FL 33158; Silvia.R.Durand@usda.gov; 786-387-7893

Does the Florida Harrisia Cactus Mealybug (*Hypogeococcus pungens*) Attack Cactus? - *Hypogeococcus pungens* Granara de Willink (Hemiptera: Pseudococcidae), commonly known as the Harrisia Cactus Mealybug (HCM), is a scale insect that has a wide plant host range and is currently decimating endangered cactus species native to Puerto Rico. However, significant pest populations of HCM rarely occur in Florida and recent genetic studies suggest that HCM is a species complex. We tested whether the Florida population of HCM would infest and establish on known cactus hosts. Two species of cactus, *Leptocerus quadricostatus* and *Melocactus neomontanus* and two ornamental plants, *Portulaca grandiflora* and *Alternanthera ficoidea* were infested with all life stages by securing infested *A. ficoidea* stems to each plant. Weekly for two months, the plants were inspected visually for HCM establishment and plant damage assessment. By week 4, all *P. grandiflora* plants were 100% infested and by week 6 they all had died. All the *A. ficoidea* plants were 100% infested by week 6. No establishment was found on either cactus species despite numerous crawlers being found on the plants the first 3 weeks of the study. Although *H. pungens* is known to kill cacti in Puerto Rico, the Florida HCM did not infest either cactus species. This study supports the genetic evidence that the Florida HCM may be a morphologically similar but different species than the Puerto Rico HCM.

1. **Albertha J. Parkins**, Muhammad Haseeb, Oscar E. Liburd and Lambert. H.B Kanga - Center for Biological Control, College of Agriculture and Food Sciences, Florida A&M University, Tallahassee FL 32307; albertha1.parkins@famu.edu; 561-282-8985

Effects of Three Mulching Practices on the Density of Spotted-wing Drosophila (Diptera: Drosophilidae) in Open Blueberry Field in North Florida - Spotted-wing Drosophila (SWD), *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae), is a native species 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. These preliminary results indicate that mulch type affects the density of SWD in open blueberry fields.

1. **Meritxell Pérez-Hedo,** Miquel Alonso-Valiente, Carolina Gallego, Sandra Vacas, Vicente Navarro, and Alberto Urbaneja - Instituto Valenciano de Investigaciones Agrarias (IVIA). Centro de Protección Vegetal y biotecnología. CV-315, Km. 10,7 – 46113 Moncada (Valencia), Spain; aurbaneja@ivia.es; +34655484849

Tomatoes Exposed to Selected Herbivore Induced Plant Volatiles are More Robust Against Pests - It is well known that the plants are able to communicate with each other, mainly to send warning signals, when they are attacked by external agents. Plants that receive these signals (HIPVs-herbivore induced plant volatiles) are able to activate their defensive mechanisms, and thus, enter in a state of alert that makes them more robust against such kind of aggression. In this work, we have demonstrated how exposure of HIPVs to tomato plants, upregulated the jasmonate acid and salicylic acid signaling pathways throughout the season crop. In commercial tomato greenhouses and using dispensers primed with a HIPV, the infestation of the South American tomato pinworm, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechidae), a key pest for this crop, was reduced in 60%. This work opens the doors to new ways of sustainable pest management through understanding of the plant defense mechanisms.

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Attraction and Oviposition Responses of Female Oriental Fruit Fly to Host Fruit vs Torula Yeast Volatiles **-** The objective of this study is to identify new attractants for female oriental fruit fly (OFF). In recent years, incursions of OFF have increased in South Florida, threatening production of avocado, mango and many specialty crops. In August 2015, establishment of a breeding population in Miami-Dade County triggered a multimillion dollar quarantine and eradication program. Methyl eugenol (ME) is a powerful attractant for male OFF but does not intercept invading female OFF. Hydrolyzed torula yeast/borax (TY) solution is used currently for detection of females, but it is a weak attractant with a short field life. Thus, we are developing new and more potent female OFF attractants for improved OFF detection to prevent pest establishment. Here we report our first bioassay results to develop female lures based on attractive volatiles emitted from most attractive host plant materials.

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Screening of Potential Oviposition Deterrents for Oriental Fruit Fly - The oriental fruit fly, *Bactrocera dorsalis*, is an economically damaging, polyphagous pest of fruit crops. It is native to Southeast Asia, but there have been multiple invasions to Florida and California that result in large economic damage due to loss of agricultural crops and expensive quarantine treatments. Gravid females oviposit in mature fruit while they are still on the trees, and immature flies (larvae) feed on the fruit, making it unmarketable. Preventing oviposition by *B. dorsalis* females in host fruit may assist in mitigating the impact of this pest. Thus, we are screening multiple potential oviposition deterrents for *B. dorsalis*. In initial laboratory bioassays, some of the screened chemicals and their derivatives were effective in significantly reducing oviposition from gravid female flies, suggesting that these putative oviposition deterrents can be useful to reduce oviposition, thus managing the impact of *B. dorsalis*. These deterrents could be helpful tools in areas where *B. dorsalis* is established and perhaps for limiting the impact of incursions.

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Thrips and Orius Responses to Pathogen-induced Volatiles in Tomatoes - It is well-known that natural enemies are attracted to herbivory-induced plant volatiles (HIPVs). Similarly, previous research demonstrated that vectors of plant pathogens are attracted to plant volatiles induced by the pathogen that they transmit. The specificity of this response, however, is not well-known. We investigated the response of two thrips species, the western flower thrips,*Frankliniella occidentalis*Pergande, vectoring tospoviruses such as *tomato spotted wilt virus*(TSWV) and a non-vectoring species, the eastern flower thrips, *F. tritici*Fitch. Both species compete within the same flower in tomatoes, but they may respond differently to plant pathogen-induced volatiles. In addition, these thrips may respond to other viruses, including the Begomovirus *tomato yellow leaf curl*virus (TYLCV) transmitted by the sweet potato whitefly, *Bemisia tabaci*Gennadius. The minute pirate bug, *Orius insidiosus* Say, is a predator of both thrips and whiteflies and may “eavesdrop” on these pathogen-induced volatiles that may attract its prey. We investigated the response of 1) *F. triciti*(non-vectoring thrips species), 2) *F. occidentalis*(vectoring thrips species), and 3) *O. insidiosus*to TSWV- and/or TYLCV-infected hosts in choice tests using an olfactometer. We found that *F. tritici*did not respond to pathogen-induced volatiles. *F. occidentalis,*however, was attracted to both TSWV and TYLCV-infected hosts. This indicated that the vectoring thrips species had a generalist response to virus-induced volatiles absent in the non-vectoring species. *Orius* *insidiosus* was also attracted to both pathogen-induced volatiles, indicating a potential for a pest management approach.

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First Report of *Bemisia tabaci* MED (Q biotype) (Hemiptera: Aleyrodidae) in the Dominican Republic - *Bemisia tabaci* (Gennadius) is a large cryptic species complex of whitefly whose members are particularly invasive pests of hundreds of economically important commodities worldwide including cotton, vegetables and ornamental crops. When widespread control failures and resistance to insecticides were reported, a whitefly survey was conducted in 2018 to determine the distribution and composition of *B. tabaci* cryptic species populations in the Dominican Republic (DR). *B. tabaci* cryptic species detected in the DR were Middle Eastern Asia Minor 1 (MEAM1 or biotype B), Mediterranean (MED or biotype Q) and New World (NW or biotype A). Sixteen samples were collected from 11 crops across 11 Provinces in the DR. Provinces included Azua, Distrito Nacional (2), Espaillat, Independencia, La Vega, Monseñor Nouel, San Juan (2), Santiago (2), Santo Domingo, Samaná, and Peravia (3). Overall, squash was the most heavily sampled commodity (4) followed by two samples each of eggplant, and Asian spiderflower. Other host plants sampled included mint, tomato, bean, tobacco, sesame, spurge, turkey berry, and Mexican prickly poppy. MED was detected for the first time in the DR from two different Provinces (Santo Domingo and Santiago) and host plants (tomato and tobacco) and environments (greenhouse and open field). All MED sequences were identical and determined to be of Eastern Mediterranean origin. MEAM1 was the predominate *B. tabaci* cryptic species present and was detected in all but one sample which was 100% MED. NW was detected twice on eggplant in different geographical regions and once on Mexican prickly poppy in a native habitat, but always with MEAM1. Widespread difficulties managing whitefly populations efficiently make additional confirmatory cryptic species detections necessary to determine the extent of the MED invasion in the country, especially where control failures have been reported.

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Effects of Reduced-risk Pesticides on *Aphis illinoisensis* and its Natural Enemies, *Lysiphlebus testaceipes* and *Orius insidiosus* in Muscadine Grapes - The grapevine aphid, *Aphis illinoisensis* Shimer is an invasive pest that feeds on young leaves, buds and shoots of grape vines eventually reducing the number of berries produced. Conventional pesticides are currently being used to manage the grapevine aphid population, but this approach is unsustainable due to the potential for resistance development and the negative effects of these pesticides on beneficial insects including pollinators. The objectives of this study were to investigate the effects reduced-risk pesticides (environmentally safe) on *A. illinoisensis*, and its biological agents for management of aphid population in Florida vineyards. A field-based bioassay was set up as a randomized complete block with 5 treatments and 5 replicates at the University of Florida research plot in Citra, Florida. Treatments were 1) Exirel (Cyazypyr®), 2) Delegate® (Spinetoram) 3) Movento® (Spirotetramat), 4) Malathion (positive control) and 5) untreated plots (negative control). These pesticides were also exposed to two biological control agents, *Lysiphlebus testaceipes*  and *Orius insidiosus* initially obtained from Koppert Biological Systems and maintained in a laboratory. Field efficacy trial revealed Spirotetramat (Movento®) provided effective control of grapevine aphid population. The residual activity was sustained up to two weeks post application. All of the ‘reduced-risk appeared to be toxic to the biological control agentsin the laboratory bioassays, except Cyazypyr® (Exirel); therefore, extra caution should be taken when using these pesticides.

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Integration of Biocontrol Agents to Manage the Fall Armyworm, *Spodoptera frugiperda* (Lepidoptera: Noctuidae), an Economically Important Pest Insect of Corn in Florida - Larvae of the fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) cause 20-54 % reduction in corn yields annually from the United States to Brazil. The FAW is distributed to the tropical climate regions of the western hemisphere and displays a seasonal migratory pattern within the United States. Numerous biological control agents feed on the larval stages of the FAW. A large number of parasitic Hymenoptera (larval parasitoids) have been reared from the FAW. Also, many predators are recorded. Indeed, biocontrol of the FAW is of considerable importance and natural level of larval parasitism are often very high (20-70%). However, the use of simultaneous biocontrol agents at different temperature ranges were not clearly explained by previous studies. Analyzing the tri-trophic relationship between the predators and the parasitoids of the FAW could explain the influence of biocontrol agents on the pest and each other. We investigated the expressed relationship amongst early nymph stages of two of Florida’s native pentatomid predators, *Podisus maculiventris* and *Euthyrhynchus floridanus*, and a larval hymenopteran parasitoid, *Cotesia marginiventris* of the FAW at the temperatures 15, 20, 25, 30oC. Predation rates on the FAW varied with temperature. Prey consumption was recorded at all temperature ranges tested for both predator species. Colonies of the FAW and biocontrol agents were maintained under the incubator conditions at 50-60% RH and photophase of 14L:10D for all experiments. The results of this research highlight the need for tri-trophic and intraguild studies that will benefit corn Integrated Pest Management in Florida.

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Incidence and Feeding of *Spodoptera latifascia* (Lepidoptera: Noctuidae) on Citrus - *Spodoptera latifascia* (Lepidoptera: Noctuidae), commonly known as garden armyworm is a widespread pest of various cultivated plants including citrus. Recently, it was observed infesting young ‘Valencia’ sweet orange plants in southwest Florida. Host suitability is important for the growth and development of phytophagous insects and for the establishment of a pest population on a crop. Feeding potential and host suitability of *S. latifascia* mature larvae obtained from ‘Valencia’ orange was evaluated on different commercial citrus cultivars including 'Valencia' orange, 'Hamlin' orange, Lisbon lemon, Clementine, Minneola tangelo, Sugar belle, and a citrus relative orange jasmine. Most leaf consumption and larval weight was observed on Sugar belle, Minneola and Hamlin orange. Larval survival averaged between 90-100% on citrus and 50% on orange jasmine. Pupal survival averaged 25% on orange jasmine and 56% Lisbon lemon (56%) compared with all the other cultivars averaging 70-89%. Pupal stage averaged 7-9 days on the Orange jasmine, Clementine, Lisbon Lemon, Hamlin orange and Valencia orange and 5-6 days on Sugar belle and Minneola tangelo. Findings improve our understanding of *S. latifascia* as a new potential threat to citrus in Florida and for citrus pest management strategies.

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Influence of Host Age on Parasitism and Sex Ratio of *Apanteles opuntiarum* (Hymenoptera: Braconidae), a Parasitoid of Argentine cactus moth *Cactoblastis cactorum* (Lepidoptera: Pyralidae) - *Apanteles opuntiarum*Martínez & Berta is a recently discovered koinobiont larval parasitoid currently being evaluated for biological control against the invasive Argentine cactus moth in the United States. To aid in the development of laboratory rearing protocols, we assessed the influence of *C*. *cactorum* larval age on parasitism and sex ratio of *A. opuntiarum.* We exposed six female and nine male parasitoids to cactus moth larvae of various ages (1, 2, 3, and 4 weeks post-egg hatch) that were mass-reared in house on artificial diet. The results showed that the number of parasitized larvae and the number of parasitoid progeny increased with host larval age until the hosts reach three weeks old. Three-week-old *C. cactorum* larvae produced higher numbers of parasitoids than two-week-old larvae, however, the sex ratio was more female-biased in two-week-old *C. cactorum* larvae. This biological information is critical to evaluating the potential of *A. opuntiarum* for the classical biological control of *C*. *cactorum*.

1. **Yuexun Tian,** Cynthia C. Lord, and Phillip E. Kaufman -Florida Medical Entomology Laboratory, University of Florida, Vero Beach, FL; yuexun.tian@ufl.edu; 334-444-5069

Chronology of Molting in two *Rhipicephalus sanguineus* Colonies under Multiple Environmental Conditions - The brown dog tick, *Rhipicephalus sanguineus* Laterille, is unique among ticks in that it can complete its life cycle both indoors and outdoors. This ability can lead to severe residential infestations. Homeowners may not recognize an initial infestation because of tick cryptobiotic behavior, hiding in refugia between blood-feeding sessions. This often leads to a suddenly large population in a home. To improve our understanding of brown dog tick development and how environmental factors affect development, we evaluated the time-to-molt events for larvae and nymphs from two tick strains, a laboratory colony from Oklahoma State University (OSU) and a newly established colony collected in Port St. Lucie, Florida (PSL), under combinations of five temperatures (20, 23, 27, 30, and 35 °C) and four humidities (33, 52, 75, and 92% RH). We found that the molting time of larvae and nymphs from both colonies were sensitive to temperatures, but not to humidity. The lower the temperature, the longer the molting time. Nymphs took a longer time to molt than larvae for both colonies. The difference in molting time between larvae and nymphs increased as the temperature decreased. PSL larvae took longer to molt than OSU larvae under all conditions. However, PSL nymphs took more time to molt than OSU nymphs only at 35 °C.

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Transmission Potential of Zika Virus by Mosquito Vector Populations from Florida - The Asian lineage of Zika virus (ZIKV), a mosquito-borne pathogen originating from Africa, first spread into Brazil in 2015 and is now present throughout the Americas. The continental U.S. observed the first imported case of ZIKV infection in December 2015 and later Florida experienced the first locally acquired ZIKV infection in July 2016. Local transmission in the U.S. is a major public health risk, especially for Florida where vectors are abundant and there is a high potential for virus introduction. Although most often asymptomatic, ZIKV infection may be associated with severe illness including microcephaly and Guillain-Barré syndrome. Concerns about these potential risks from ZIKV infection have increased the need to investigate the interactions between potential vectors and ZIKV. The purpose of this project is to predict the emergence potential and improve risk prediction for ZIKV in Florida by characterizing transmission efficiency of local populations of the expected vector species, Ae. aegypti and Ae. albopictus, using ZIKV from Puerto Rico. Both mosquito species have been implicated as ZIKV vectors elsewhere, but both virus and vector genotype are known to influence transmission capacities and, hence, the risk of outbreaks. To test the hypothesis that Ae. aegypti and Ae. albopictus show geographic differences in midgut escape and salivary gland barriers that limits ZIKV transmission, susceptibility to ZIKV infection, disseminated infection, and transmission potential of local populations of the two vector species recently colonized from regions of Florida were compared. Results of this study will be discussed.

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Phytoplasma, The Causal Agent of Lethal Bronzing Disease of Palm In Florida and Its Vectors - Phytoplasmas cause lethal yellowing-like diseases of palms that result in yellowing, wilting and death of palms causing major outbreaks that led to the losses of millions of coconut and other palm species. They are transmitted primarily by phloem-feeding hemipteran insects, including leafhoppers, plant hoppers and psyllids.  In Florida, two phytoplasma diseases have been reported the Lethal Yellowing (LY) caused by 16SrIV-A phytoplasma and affecting mostly coconut palms, and the Lethal Bronzing (LB) caused by 16SrIV-D phytoplasma and found in date palms and native palms such as the sabal palm. Our overarching goals are to describe the diversity of phytoplasmas in Florida and the Caribbean that cause LB and LY in palms, identify their vectors, and study host-vector-pathogen interactions to help in managing the disease.  To start addressing those goals, we are working on identifying insect vectors. Thus, we conducted surveys of auchenorrhynchan insects in palm canopies at the Fort Lauderdale Research and Education Center, where the disease is actively spreading using yellow sticky traps placed on the palms. Collected insects (3,734) that included four families of auchenorrhynchans were tested for phytoplasma by PCR. The cixiid planthopper, *Haplaxius crudus*, was the most abundant (2829) with 0.78% of tested positive for phytoplasma. Suggesting that *H. crudus* is a potential vector of the LB phytoplasma. Ongoing sampling is being conducted throughout Florida to assess the disease and vector/s in other sites.

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Developing the Chironomid Midges as a Natural Host Model to Study Host-microbe Interactions - Chironomids are ubiquitous in aquatic environments, and they play an important role in the ecosystem as a primary food source for birds, amphibians, fishes and other aquatic invertebrates. The goal of this project is to develop the chironomid midges as a natural host model to study host-microbe interactions. We have developed a novel method to manipulate the microbiome of the chironomid larvae. Using this method, we found that axenic (microbe-free) chironomids did not develop to adulthood, compared with the non-sterilized counterpart. We transplanted the microbiome using homogenate of conventional chironomids, fruit flies, and mosquitoes, all of which were able to rescue axenic chironomid development. Strikingly, we were able to rescue axenic chironomid development by inoculating with a single strain of an aquatic bacterium *Vibrio cholerae,* also notorious as a human diarrheal pathogen. Our results suggest that the chironomids rely on microbes to complete the life cycle, but such host-microbe relationship appears to be flexible in the context of microbial identity. With this method, we will be able to manipulate the chironomid microbiome to study the host-microbial interaction. We are also looking into targeting the chironomid and its documented, natural association with *V. cholera*e to develop management strategies to control the transmission of cholera.