**FES 2022 Annual Meeting**

**Abstracts of Symposiums, Student Competition Papers and Posters, and Submitted Papers**

**Symposium 1 – Thrips of Economic Importance: Taxonomic, Regulatory and Management Challenges**

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**Using DNA to identify thrips** - The author provides a general overview of non–destructive DNA extraction and PCR to identify thrips. Advantages and disadvantages of molecular identification are discussed and examples of thrips phenotypes vs. genotypes are presented.

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**Thrips-field identification resources and guides** – Thrips are an important direct pest and disease vector for many agricultural, ornamental, and native landscape plants. Despite the importance of thrips from a pest and beneficial insect perspective, limited field level resources exist for identification. The original development of the "Pest Thrips of the United States: Field Identification Guide" will be reviewed. Also, other resources, for thrips identification, and plans to update thrips field-level educational materials will be presented.

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**To be or not to be?: Invasive thrips and regulatory action in Florida** – The regulatory significance of a newly detected exotic thrips is open to evaluation. The decision to regulate or not regulate an introduced species depends on factors such as its importance as a pest in its region of origin, its vector capacity and Florida distribution at the time of discovery, among others. In this presentation I discuss the conditions leading to regulatory action.

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**Chilli thrips, South Asia 1 dominates *Scirtothrips dorsalis* cryptic species complex in the United States** – Tomato chlorotic spot virus (TCSV) is an orthotospovirus that causes a devastating disease in tomato (*Lycopersicon esculentum* Miller). TCSV appeared recently in South Florida. Studies were conducted in the fields, ornamental nurseries, and greenhouses in Miami-Dade County, Florida during the vegetable growing seasons from October to April in 2017 through 2020. Based on the three years total samples, three species of thrips were commonly seen with melon thrips, *Thrips palmi* Karny (62.16 + 0.79%), being the most abundant species followed by common blossom thrips, *Frankliniella schultzei* Trybom (21.55 + 0.66%), and western flower thrips, *Frankliniella occidentalis* (Pergande) (16.26 + 0.61%). Abundance of all thrips and TCSV infected plants was high at the edge of the tomato fields 3 weeks after transplanting with significantly fewer infected plants toward the center of the field. Various ornamental plants, weeds, and vegetable plants were recorded as host of TCSV and vector thrips. We also addressed effectiveness of various chemical insecticides, placement of reflective plastic mulch, barrier plants, biocontrol agents and various tomato cultivars. All these techniques together provided suppression of TCSV and vector thrips.

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***Franklinothrips vespiformis* a potential biological control agent for mites, thrips, and whiteflies in greenhouses** – We will discuss *Franklinothrips vespiformis* as a potential biological control agent for mites, thrips and whiteflies in greenhouses. We will concentrate on our research managing *Echinothrips americanus*, a pest thrips that destabilizes IPM programs for many important ornamental, vegetable and specialty crops in Florida greenhouses.

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**Managing chilli thrips in Florida strawberry** – The invasive chilli thrips, *Scirtothrips dorsalis* Hood, has been an economically important pest of strawberry in Florida since 2015. Resistance to insecticides has already been documented in *S. dorsalis* infesting strawberry, leading to an urgent need for developing non-chemical control options to manage this pest. In fact, field populations of *S. dorsalis* collected during November (early-season) were found to be 30% more susceptible to the same insecticides when compared to late-season population collected in February from same strawberry fields. Augmentative biological control using predatory mites, *Amblyseius swirskii* and *Neoseiulus cucumeris* was found to be effective in greenhouse and field studies in organic strawberry, respectively. In our field studies during the strawberry field season of 2021-2022, strawberry fruit yield on reflective mulch (metallic and white reflective mulch) was found to be 3-times the black mulch, S. dorsalis population was 1/3rd that of black mulch, and thrips related plant damage was negligible on reflective mulch. Therefore, our research indicates that biological and cultural control using reflective mulch are reliable integrated pest management techniques to manage S. dorsalis in strawberry in Florida.

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**Thrips release and persistence as biological control agents of the weed Brazilian peppertree** - Brazilian peppertree, *Schinus terebinthifolia* (Anacardiaceae), is an invasive weed of natural and agricultural areas of California, Florida, Hawaii, and Texas, USA. A thrips, *Pseudophilothrips ichini* (Hood) (Thysanoptera: Phlaeothripidae), was permitted and released in 2019 as the first biological control agent for this invasive weed in Florida, USA. The thrips feeds on flushing leaves that are produced during the vegetative season of the host. Together, the USDA–ARS, University of Florida, and Florida Department of Food and Consumer Services combined efforts to mass produce and release *P. ichini* throughout the Brazilian peppertree-invaded range in Florida. Between May 2019 and Dec 2021, more than 2 million *P. ichini* were released at 567 sites in Florida. Over this period, *P. ichini* persisted at up to 60% of the survey sites for at least 1 generation as indicated by recovery of thrips adults at least 60 d after release. These results indicate that this thrips, a classical biological control agent, has persisted in the invaded range of Brazilian peppertree in Florida with populations evident at many release sites. This biological control agent will provide land managers with a safe and cost-effective means of controlling Brazilian peppertree.

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**Development of a management program for controlling thrips and thrips transmitted tospovirus (TCSV) in tomato** – Tomato chlorotic spot virus (TCSV) is an orthotospovirus that causes a devastating disease in tomato (*Lycopersicon esculentum* Miller). TCSV appeared recently in South Florida. Studies were conducted in the fields, ornamental nurseries, and greenhouses in Miami-Dade County, Florida during the vegetable growing seasons from October to April in 2017 through 2020. Based on the three years total samples, three species of thrips were commonly seen with melon thrips, *Thrips palmi* Karny (62.16 + 0.79%), being the most abundant species followed by common blossom thrips, *Frankliniella schultzei* Trybom (21.55 + 0.66%), and western flower thrips, *Frankliniella occidentalis* (Pergande) (16.26 + 0.61%). Abundance of all thrips and TCSV infected plants was high at the edge of the tomato fields 3 weeks after transplanting with significantly fewer infected plants toward the center of the field. Various ornamental plants, weeds, and vegetable plants were recorded as host of TCSV and vector thrips. We also addressed effectiveness of various chemical insecticides, placement of reflective plastic mulch, barrier plants, biocontrol agents and various tomato cultivars. All these techniques together provided suppression of TCSV and vector thrips.

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**Research and extension efforts for *Megalurothrips usitatus* (Bagnall) management following its first detection in Florida** - The Asian bean thrips, *Megalurothrips usitatus* (Bagnall) (Thysanoptera: Thripidae), is native to tropical Asia and is a pest of leguminous crops (Fabales: Fabaceae). Since its first detection in Florida in early 2020, *M. usitatus* has been a threat to more than 28,000 acres of snap bean production in the southern region of the state. Larvae and adults feed on all parts of leguminous plants, causing leaf, flower, and fruit malformation. Research conducted in the laboratory and in the field determined the efficacy of insecticides for *M. usitatus* control. Laboratory bioassays indicated that methomyl and spinetoram are effective against adults. However, in a field evaluation in Palm Beach County, two foliar applications of spinetoram, methomyl, or a cyantraniliprole+abamectin premix were not associated with a detectable decrease in infestations of *M. usitatus* adults, which occurred at low levels in experimental plots. An extension program led by University of Florida personnel was developed in response to the detection of *M. usitatus* in Florida snap beans. This program has aimed to assist extension agents, crop consultants, and producers in identifying *M. usitatus* and implementing effective management practices. A key component of this program is an areawide scouting system for monitoring of *M. usitatus* population dynamics to assist stakeholders with management decisions.

**Symposium 2 – Landscape Ecology of Medically Important Insect Vectors**

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**Trends and opportunities in tick-borne disease mapping** - Tick-borne diseases are a growing problem in many parts of the world, and their surveillance and control touch on challenging issues across the fields of public health, medical entomology, and veterinary medicine. Spatial approaches can be used to synthesize the data generated by integrative surveillance systems and help stakeholders understand the distribution of risk. We present results from a systematic review of over 8,000 studies and identified a total of 303 scientific publications that map tick-borne diseases using data on vectors, pathogens, and hosts. We find tremendous diversity of methods in tick-borne disease mapping, but also find major gaps: data on enzootic cycles are severely underutilized, and mapping efforts are mostly limited to Europe and North America. We illustrate the value of incorporating pathogen surveillance information into landscape risk estimates with an exploratory niche modeling study on the American dog tick, *Dermacentor variabilis* (Say) (Acari: Ixodidae), and understudied spotted fever group rickettsiae (SFGR) infection caused by *Rickettsia montanensis*. We compared geospatial predictions from five species distribution modeling frameworks, and found that the distribution of ticks infected with *R. montanensis* is nested within a larger overall D. variabilis distribution. Risk is often described in terms of vector distribution, but it is also important for public health planning to understand the distribution of pathogen exposure. We suggest that future work focus not only on tick surveillance, but also pathogen and host distributions following a One Health approach that combines medical and veterinary surveillance for maximum impact.

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**Correlations between landcover and mosquito community composition and potential implications for West Nile virus transmission risk in Manatee County, FL** – Land use and land cover (LULC) change has been identified as an important driver of emerging vector-borne zoonotic diseases, including mosquito-borne diseases. Quantifying correlations between landcover and mosquito community composition and abundances is a crucial first step toward understanding potential impacts of LULC change on transmission risk. Although most studies investigating environmental drivers of mosquito abundances and distributions focus on individual vector species, interspecific variations in vector competency within mosquito communities across different landscapes have potential to affect transmission outcomes. Here, we utilized joint species distribution models to quantify effects of landscape composition on mosquito community diversity, expecting a decrease in species richness and an increase in proportion of West Nile virus (WNV) vector species with urban landcover. Species presence/absence across 60 sites in Manatee County, FL, sampled in 2016, 2017, 2019, and 2020, served as response variables; percent landcover for developed, cropland, herbaceous wetland, and woody wetland within 5 km of trap sites served as environmental variables. Community weighted mean values were calculated from a binary matrix of WNV vector competency to predict proportions of WNV vectors across the study area. Results indicated that proportions of variance explained by percent landcover for individual species coincided with known habitat associations for most species. Maps visualizing spatial predictions proportions of WNV competent vector species predicted the highest proportions in urbanized areas. Quantifying baseline effects of landscape on mosquito community distributions can provide insights relevant to understanding potential LULC impacts and improve prevention and management of mosquito-borne disease.

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**Spatiotemporal distributions of West Nile virus in Florida using 2018 mosquito control and public health surveillance data -** West Nile virus (WNV) is a mosquito-borne pathogen that circulates naturally within mosquito vectors and avian amplifying hosts in the wild. Since WNV was first introduced to Florida in 2001, consistently occurring spillover events to humans and equines have been causing substantial public and veterinary health concern. Florida Department of Health (FDOH) and the Florida Mosquito Control Districts (FMCD) combine efforts to implement the Florida arboviral surveillance program which uses sentinel chickens as guidance to track WNV activity across the state on a weekly basis. Despite robust mosquito control and public health surveillance, very little is known about landscape associations with WNV transmission in Florida. The objective of this study was to quantify the underlying spatiotemporal structure of WNV in Florida at 187 sentinel chicken coop sites across 36 weeks during the 2018 sampling season as a first step toward additional landscape and climate analyses. Here, we generated spatiotemporal Gaussian Markov Random Fields (GMRFs) executed in the R-INLA package and plotted the weekly spatiotemporal structure of WNV seroconversion across participating sites. Results indicated that WNV seroconverted chickens occurred in distinct foci in the Panhandle and northeastern Florida in the second week of July. Peak activity occurred in October throughout the entire state, which may be correlated to peak abundances of *Culex nigripalpus mosquito vectors. Additional analyses, incorporating landscape and climate variables in conjunction* with weekly GMRFs, have the potential to provide new insight into the WNV disease system in Florida and improve public health and vector surveillance strategies.

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**Biotic and abiotic factors influencing the transmission of West Nile virus in Florida** - In the US, most cases of mosquito-borne neurological disease are caused by West Nile virus (WNV). WNV is most often vectored by mosquitoes in the genus Culex. WNV incidence in humans in the southeastern US is lower compared to other areas, and the causes of this variation are not well understood. Insect-specific viruses (ISV) have been observed to modulate arboviruses, and *Culex flavivirus* (CxFV) that has had impacts on WNV within the mosquito. This study aims to identify potential factors impacting mosquito diversity and CxFV prevalence in north-central Florida. In forested, suburban, and urban sites, mosquitoes have been trapped monthly, with known WNV vector species tested for CxFV. The highest abundance of mosquitoes has been observed in forested sites (n = 11079 mosquitoes), but the highest species richness is seen in suburban sites (n = 26 species). This is concerning, as a higher degree of mosquito diversity introduces a greater risk of mosquito-borne disease due to the varying biology and ecologies of different mosquito species. Infection rates from published accounts of CxFV detection have been used to calculate potential sample sizes needed to confidently detect infection, and screening these pools for CxFV will provide valuable information regarding potential trends of WNV incidence in the US.

**Symposium 3 – Detection, Mitigation, Compliance: The Regulatory Perspective of Pest Management**

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**The role of entomology in safeguarding Florida agriculture: A regulatory perspective** - Florida is a state rich in agriculture with over 47,000 active farm operations that total 10 million acres. Our range of growing regions spans from temperate to sub-tropical to tropical and this allows for a wide array of agricultural commodities to be grown in our state. Because of our favorable climate, Florida is also rich in arthropod diversity and unfortunately, rich in opportunities to have invasive arthropods enter and establish in the state. Entomology has played a vital role in safeguarding Florida agriculture with humble beginnings of a visionary Entomologist from the University of Florida establishing parameters for nursery stock movement to where we are today with entomologists from several universities, USDA and FDACS conducting research, extension and regulatory activities that support the safeguarding of both Florida agriculture and our natural resources.

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**Challenges associated with regulating vectored plant pathogens** – Some insects pose risks to plants primarily because they transmit plant pathogens. There are inherent challenges associated with regulating those insect species and the pathogens they potentially carry. Three situations follow. 1. An insect vector might be established in the USA (without the pathogen it vectors), and thus not subject to regulations. However, if that same insect arrives from another country where the pathogen it transmits occurs, it could pose a serious risk by arriving with the pathogen. 2. Sometimes a vector is morphologically difficult or impossible to separate from a non-vector that already occurs in the USA. In these cases, insects that pose significant risks could escape regulations. 3. If an insect and the pathogen it transmits are present in a nursery setting, but plants are asymptomatic due to a lengthy latent period, it is not possible to regulate the disease complex based on presence of the pathogen (no observable disease). Only the insects can be regulated, and if they are controlled, no further quarantine applies, even though plants for sale already are infected. Further discussion is needed at local and national levels about these and related issues.

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**Plant and Apiary Inspection: protecting Florida from unwanted plant and apiary pests** – The Bureau of Plant and Apiary Inspection is the regulatory section of the Division of Plant Industry which enforces Florida Statutes and rules specific to the movement of plants, plant products, and managed honey bee colonies, as well as conducts surveys for the early detection of plant and honey bee pests that pose a threat to Florida’s agriculture industry. Regulatory inspections are conducted annually on all registered nurseries and routine inspections of all beekeepers and managed honey bee colonies within the states to help ensure freedom from exotic pests. The Bureau also conducts import inspections on all high-risk products entering the state with inspection staff and canine teams at parcel facilities and agricultural interdiction stations. Early Detection is key with the Bureau, monitoring fruit fly and other exotic pest traps throughout the State. Furthermore, the Bureau is the first responder to the interception of exotic plant pest and fruit flies by conducting emergency programs that involve expanded trapping, bait treatments, regulatory actions, and public outreach to prevent the establishment of these pests that are major threats to Florida agriculture. The Bureau assists industry in conducting inspections and certifications to allow the movement of Florida produced plants, plant products, and honey bee colonies in meeting destination regulatory requirements. These inspections allow the movement of agriculture products that may be restricted or require additional treatments by the producer.

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**Bureau of Pest Eradication and Control (PE&C) – Detect and Protect** – PE&C functions to assist in the detection, control and eradication of harmful pests and diseases, particularly involving citrus, as it administers the Citrus Health Response Program, a cooperative program by FDACS, USDA and industry to protect Florida's citrus. The bureau accomplishes its mission through a comprehensive program of multiple types of commercial survey and through regulatory inspection and oversight with detailed data recording and mapping of all activities which is available to inform growers, address their concerns, increase public awareness, and support the industry overall. The bureau is tasked with responding immediately to emergency actions upon the detection, identification and verification of invasive pests and/or diseases, and will mobilize the necessary equipment, supplies and personnel for these special programs. Personnel are trained in survey and detection, and to carry out the protocols established by the Division labs to address the specific pest. There are assigned personnel trained in the use and application of pesticides when it is required. Examples of special programs are the Citrus Canker Eradication Program, Giant African Land Snail Eradication, Mediterranean and Oriental Fruit Flies control programs, Horntail Snails, and Citrus Leprosis. CHRP is authorized under Sec. 581 (FS) and Rule 5B-63. The regulatory section of the bureau advises and enforces the decontamination and quarantine protocols with growers, harvesters/haulers and processors in the industry ensuring their current registrations with the state. They inspect packinghouses and processors, trailers, monitors all movement of citrus fruit from quarantined areas all of which helps to protect domestic and foreign markets.

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**ENPP: an overview of the bureau activities** – The Bureau of Entomology, Nematology, and Plant Pathology (ENPP of FDACS-DPI) is more that it appears. This talk briefly discusses activities of our many sections: Botany, CAPS, Entomology with the Florida State Collection of Arthropods, Nematology, Plant Pathology, Molecular Diagnostics Lab, Permit Unit, and the new Honey Bee Diagnostic Lab.

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**Protecting Florida from Tephritid fruit fly pests** – Florida is under constant threat of incursion by exotic tephritid fruit fly species. Their large host range includes an abundance of commodities produced within the state. Florida maintains an effective pre-emptive fruit fly program utilizing several key components. Sterile insect preventative release relies on the mass release of irradiated adult flies. Detection through trapping is another key control activity. Much of peninsular Florida is monitored year-round using various traps. Approximately 56,000 traps are deployed over 8,000 square miles. When invasive flies are found, control programs are quickly initiated. Methods development to improve current techniques or investigate new ways of monitoring, controlling or eradicating fruit flies is perpetual. An overview of the state's fruit fly program will be presented.

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**The regulatory authority and responsibilities of the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Permit Section** – The Division of Plant Industry Permit Section upholds the mission of Florida Department of Agriculture and Consumer Services “to safeguard the public and support Florida's agricultural economy”. The Permit Section strives to protect stakeholders from incurring potential losses caused by the unintentional spread of plant pests and diseases. The Permit Section operates under statutory authority to ensure the movement and possession of any regulated organisms adheres to all conditions outlined in the various permits issued by FDACS-DPI. Consisting of 10 biological scientists and administrative personnel the Permit Section collaborates with over a dozen of the Division’s taxonomists and regulatory specialists as well as other state and federal government agencies. Each year the Permit Section reviews over 2500 applications involving educational demonstrations, research, cultivation, sale, or harvest of regulated organisms. More than 100 facilities will be inspected annually as part of a state-wide risk assessment program to stimulate proactive regulatory action, improve public perception of permit processes, and enhance response time in the event of a natural disaster.

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**Snail invasions: a story of success** –Due to its subtropical climate, multiple international shipping ports, and its allure as a tourist destination, the state of Florida is under the persistent threat of invasive species introductions which imperil the state’s agriculture, unique and fragile ecosystems, and human health. Two such invading species are the giant African land snail (GALS), native to east Africa, and the horntail snail (HTS), which is native to India. GALS is well-known to be a highly damaging pest of Florida’s agricultural, ornamental, and native plants. GALS also poses a risk to human health, harboring the causative agent of rat lungworm disease. Such attributes were cause for concern upon the snail’s first introduction to Florida from Hawaii in the 1960s. Similar concerns have recently been raised about HTS. Though both species pose similar risks, each species has unique life history traits which demonstrate their distinct nature, and thus, the need for specialized tactics essential for their eradication. Through the collaborative efforts of the United States Department of Agriculture (USDA) and the Florida Department of Agriculture and Consumer Services – Division of Plant Industry (FDACS-DPI), GALS has been eradicated twice, first in 1975 and again in 2021 after its reintroduction in 2011. Such success emphasizes the importance of thoroughly applied eradication and control programs informed by scientific research. Thus, the Bureau of Methods Development and Biological Control of FDACS-DPI is currently responsible for researching HTS life history traits, molluscicide efficacy, and trapping methods.

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**Surveying for pests of regulatory significance in Florida: Cooperative Agricultural Pest Survey (CAPS) Program** – The Florida Cooperative Agricultural Pest Survey (CAPS) program is a combined effort by state and federal agricultural agencies to conduct surveillance, early detection, and rapid response to exotic plant pests of agricultural and natural plant resources. Florida serves as the principle port of entry into the United States for nearly all imported plant material and is at an elevated risk year-round for invasion by exotic species. Pest surveys are conducted using approved survey methods such as visual techniques, and/or lures and trapping developed by the USDA APHIS PPQ CPHST and include pest such as giant African land snail, Asian long-horned beetle, old world bollworm, spotted lanternfly, and cotton seed bug. Surveys are conducted by the CAPS team and several cooperators throughout the state including university extension specialists, scientist, industry personnel, Customs and Border Protection, and Parks and Recreation personnel. The CAPS program surveyed for more than 70 pest species of regulatory significance and reported over 14,579 negative data points, two (2) US records and two (2) State records in 2021. The program continues to survey for pests of regulatory significance on a yearly basis.

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**Technique development: rearing, research, and 3D printing** – The Technique Development section conducts research for the Division of Plant Industry surrounding the management of new and invasive pests in Florida. Research includes assessment of pesticides and other control and monitoring techniques and learning more about a particular pest through literature review and biological studies. Most research involves maintaining pest colonies and creating rearing protocols. Our current projects include *Bulimulus sporadicus*, an invasive snail established throughout Florida, and the black bean bug, *Brachyplatys subaeneus*, a Plataspid recently established along Miami Beach, Florida. Our goal is to determine the most cost-effective management plans for Florida, because both species are spreading rapidly. Other projects involving bait stations and traps are developed by the section’s 3D printing laboratory. Customized objects are designed using computer software and printed using a 3D printer, which deposits successive layers of heated plastic until the object is created. The lab has produced insect traps for psyllids, moths, beetles, and mollusks. Specifically, we’ve had major success creating a trap for the Asian citrus psyllid, which is also successful at catching at least two other psyllid species and their associated parasitoids. This trap is an important monitoring tool being used to survey for exotic psyllids that could harm Florida agriculture. The lab is used for in-house prototype production and is also used in conjunction with collaborative research agreements with collaborators throughout the U.S. Future projects include developing a fruit fly bait station with collaborators in Hawaii.

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**Reporting a pest or disease to FDACS-**DPI - FDACS-DPI monitors the movement of agricultural products to prevent, mitigate, control, or eradicate plant and honeybee pests and diseases. Additionally, DPI is the definitive and comprehensive repository for Florida agricultural pest and disease records. To prevent pest introduction and movement, DPI conducts surveys, sets up trapping arrays for known pests, inspects agricultural products as they enter Florida, inspect nurseries and distribution centers, and inspect plants and honeybees before they leave the state. Timely communication of new finds provides DPI the ability to respond quickly to emerging issues. The relationships and cooperation of researchers, Florida universities, educators, and students with DPI are integral to safeguarding Florida’s natural and agricultural resources.

**Symposium 4 - Microbial-based Pest Control**

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**Efficacy of entomopathogenic fungus-based products applied against the citrus red mite, *Panonychus citri* (Acari: Tetranychidae), under laboratory conditions** - The use of entomopathogenic fungus (EPF)-based products is an environmentally friendly pest management strategy for pests that have become resistant to chemical insecticide applications including mites. This experiment determined which EPF-based product was most efficacious against a Florida citrus pest, the citrus red mite, *Panonychus citri*, under laboratory conditions. EPF-based products were evaluated against the mites using a novel bioassay apparatus. Bioassays consisted of a cell culture well plate with solidified water agar (1 ml) in specific wells with a treated leaf disk placed on top of the agar. Treated disks were sprayed with 106 spores/ml of *Cordyceps javanica* from PFR-97 20% WDG and NoFly WP, *Beauveria bassiana* from Velifer ES and Botanigard MAXX ES, or water only (control) and allowed to air dry. One female citrus red mite was carefully placed on top of each disk per well and sealed with Parafilm. Mites were monitored daily until death. Dead mites were removed, placed into a separate moisture Petri dish chamber, and transferred to a growth chamber (25⁰C, 14-hour photophase) until mycosis occurred. All EPF-based products were more efficacious in killing citrus red mites compared to controls. Median survival time for 50% (ST50) of the mites exposed to Velifer, PFR-97, and NoFly was ~4 days. BotaniGard MAXX, containing the strain *B. bassiana*, induced 90% mycosis with a ST50 of ~2 days. Mycosis in mites exposed to EPF-based products was ≥60%; no mycosis occurred in the control. BotaniGard MAXX provided the highest mortality and percentage mycosis of all EPF-based products tested.

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**Measuring the response to *Drosophila suzukii* to yeast baited Scentry lures** - *Drosophila suzukii* (Matsumura) is a significant pest for blueberry growers in North Central Florida. These pest are responsible for an estimated $1 billion dollars in economic losses annually and left un-managed, infestations can reduce a grower’s marketable fruit yield by as much as 80%. The first step for blueberry growers focused on protecting their crop from infestations is monitoring for the arrival of *D. suzukii* in their field. The Scentry® SWD Trap and Lure System is often deployed by pest mmanagers to monitor for the arrival and abundance of *D. suzukii* in blueberry fields. Unfortunately, this trap system captures too few *D. suzukii* and too many non-target drosophilids. Fruit-associated microbes have been implicated as an important factor for host fruit foraging, however, knowledge regarding the use of microbes as monitoring tools for *D. suzukii* is limited. In this study, we investigate the response of *D. suzukii* to Scentry® traps baited with commercial lures, *Candida asparagi*, and *Hanseniaspora uvarum* in the field and in the lab. Here, we demonstrate that *D. suzukii* prefers Scentry® traps system augmented with yeast in the field and in the lab. These findings inform our understanding of how yeast influence *D. suzukii* preferences and potentially provides additional monitoring tools for pest managers.

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**Utilization of entomopathogens for the suppression of invasive ants** - Red imported fire ants, *Solenopsis invicta*, and tawny crazy ants, *Nylanderia fulva*, are well established invasive ants in the southern USA. Biological control is perhaps the only self-sustaining approach for the regional suppression of these invasive social insects. The discovery of pathogens in red imported fire ants and tawny crazy ants have sparked efforts to utilize pathogens to augment traditional chemical controls for ants. The utilization of *Solenopsis invicta* virus 3 against fire ants and the microsporidian pathogen *Myrmecomorba nylanderiae* against tawny crazy ants will be reviewed. Introductions of these pathogens into colonies of their host species have resulted in field infections of these invasive ants.

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**Development of microbial-based tools to improve management of *Drosophila suzukii*** *- Drosophila suzukii* is a global pest of small fruits. It was first detected in the US (California) in 2008, has since swept across states and become major concerns for growers and stakeholders. Despite decades of research and pest management on *D. suzukii*, current controls rely exclusively on chemical insecticides, which are not effective against larvae feeding inside fruits and are not environmentally sustainable. Robust baits and trapping systems are also urgently needed to optimize *D. suzukii* monitoring. Drosophilid flies are frequently associated with symbiotic bacteria and yeasts in the gut, some of which can also be found on their host plants. We are interested in the extent to which the fly- and fruit-associated bacteria impact *D. suzukii* colonization of host fruits. We discover that *D. suzukii* interacts with host fruits by manipulating the fruit bacteriome. Fruits that were foraged by *D. suzukii* became more attractive to the flies. Surprisingly, our GC/MS data suggested that the increased attractiveness was not due to volatiles released by the bacteria introduced by the flies, but rather, increased production of specific fruit volatiles and flavor compounds in the foraged fruits. Through culturing, we have also isolated >50 bacterial species from *D. suzukii* and their target berry crops collected from the field. After testing 12 of these isolates, we identified a few potential fly attractant and repellent bacteria and had their volatile profiles revealed by GC/MS. Future work will include testing different candidate volatiles in isolation or mixtures in their attractiveness or repellency to *D. suzukii.*

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**Targeting *Candidatus Liberibacter asiaticus* and endosymbionts of the Aisan citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Liviidae), using antisense oligonucleotides** - Citrus greening, caused by the bacterial pathogen *Candidatus Liberibacter asiaticus* (CLas), has decimated the Florida citrus industry since its discovery in 2005. CLas is an obligate bacterial pathogen that multiplies in citrus trees and in the insect vector, the Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama. It is currently not possible to treat trees infected with CLas. Management of citrus greening disease, or Huanglongbing (HLB), has relied heavily on infected tree removal, insecticidal management of the ACP vector, and broad-spectrum antibiotic treatments. These inputs are not sustainable, due to the large number of infected trees, high costs of replanting and insecticides, and the development of insecticide resistance. Antibacterial FANA oligonucleotides are chemically modified synthetic single-stranded nucleic acid analogs, that can modulate gene expression by enzymatic degradation or steric blocking of an RNA target. This study investigated the use of FANA oligonucleotides to reduce ACP symbionts and to prevent CLas transmission. We found that silencing CLas and endosymbiont genes using FANA oligonucleotides significantly reduced bacterial titers in ACP and in citrus trees. The implications of these findings are discussed with respect to improving tree health in citrus groves and providing a more sustainable approach for management of HLB.

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***Parasitoid plays as Trojan horse in the horizontal transmission of Wolbachia***- Facultative bacterial endosymbionts are associated with many arthropods and can benefit hosts by increasing their fitness and providing protection from pathogens and natural enemies. Maternal transmission of endosymbionts has been shown to be the main transmission pathway, while horizontal transmission is considered rare and has been challenging to document outside of laboratory settings. Wolbachia is one of the most common endosymbionts infecting arthropods and is found in several species belonging to the *Bemisia tabaci* cryptic species complex. The most abundantly expressed protein of Wolbachia in arthropods is Wolbachia surface protein (wsp). An extensive wsp sequence dataset is available from across the cryptic species complex. We analyzed our wsp gene sequences and all possible available datasets of wsp from *Bemisia* cryptic species to study the evolutionary history of this gene. We found identical wsp genotypes between indigenous and invasive *B. tabaci* members. Since the invader and indigenous individuals cannot copulate, we assumed that some nonsexual means of transmission, such as natural enemies, especially parasitoids, may have played a role in this inter-species horizontal transmission of Wolbachia. Our previous experiments revealed that by allowing horizontal transmission of Wolbachia, parasitoids could inadvertently enhance the fitness of the targeted pest species. Our finding presents a significant challenge to the practice of biological control.

**Symposium 5 - Management of Invasive Pest Insects of Specialty Crops and Community Gardens**

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**Use of machine learning to assist in design of improved methods to disrupt mating behavior of *Diaphorina citri*** *- Diaphorina citri* is an invasive pest that vectors a bacterium causing a disease that kills citrus trees, resulting in greatly decreased juice production in Florida since 2005. Currently this insect is treated with insecticides to reduce spread of the vector, but resistance to some of the commonly used treatments has been increasing. Attempts to develop alternative methods to control *D. citri* include disruption of its mating behavior, which incorporates wing-fanning duets of males and females singing to each other to identify the locations of potential mates. The songs are carried as vibrations along the tree branches. Disruption of mating by synthetic broadcasts of song vibrations has been demonstrated in the laboratory. Here we discuss results of machine learning analyses (automated methods of identifying calling song features) in progress to identify and inexpensively disrupt the features of calling duets that are most important for mating and thereby improve the benefit/cost ratio of disruption methods.

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**Eco-based pest management of specialty crops in high tunnels** - A dual strategy of using “push-pull” technology and companion planting was tested in high tunnels and a screened enclosure in north Florida. The specialty crops were tomato, leafy greens and strawberry. The “push” component consisted of repellent plants such as 2 varieties of mustard and arugula. The “pull” component tested the use of green leaf volatiles. A commercial beneficial insect attractant, “preda-lure” was included. We found a relatively low population of insect pests such as whiteflies, thrips and aphids throughout the growing season. The “pull” component continue to be studied. The use of green volatiles in laboratory and greenhouse tests showed promising results but more studies are needed to be conducted in high tunnels. The main beneficial natural enemies were the minute pirate bug and whitefly parasites. The dual strategy of the “push-pull” technology and companion planting may be a low-cost, sustainable eco-based pest management tool to control insect pests in high tunnels and enclosed screened structures.

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**Are predatory mites effective as biological agents to suppress the Southern Red Mite, *Oligonychus ilicis* in blueberry plants?** - Southern Red Mite (SRM), *Oligonychus ilicis* McGregor (Acari: Tetranychidae), is an important spider mite pest that feeds on more than 34 host plants and causes economic damage to many ornamentals and fruit crops. Florida blueberry growers have experienced severe losses due to the outbreaks of SRM, and a series of research has been conducted, using a few miticides to suppress SRM population. Predatory mites are an important management tool used for controlling spider mites; however, predators have not been successfully evaluated in blueberry systems. *Amblyseius swirskii*, *Phytoseiulus persimilis* and, *Neoseiulus californicus* (Acari: Phytoseidae) are among the most economically important arthropod biological control agents used in augmentative biological control. The three species of predatory mites have different food habits, which can affect the predator’s efficiency. *Amblyseius swirskii* are used to control mite pests and small insects (thrips and whiteflies) and are able to develop from pollen. *Neoseiulus californicus* can feed on tetranychid mites, small arthropods, and plant-derived food (i.e., pollen). Alternatively, *Phytoseiulus persimilis* is a specialist. In preliminary laboratory experiments, *P. persimilis* and *N. californicus* reduced SRM motiles (all life stages except eggs). We will be discussing these results and additional experiments with predatory mites and their effects on the SRM population in blueberry pest management.

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**Management of melon thrips, *Thrips palmi* Karny, an invasive pest of specialty crops in South** **Florida** - Melon thips, *Thrips palmi* Karny, is an important pest of all vegetable crops in the South Florida. This thrips arrived in Miami-Dade County in 1990 and caused serious feeding damage to its host crops. Population abundance increased rapidly resulting in complete defoliation of the host crop in a few days of its arrival. At the beginning of invasion, very little was known about its management program. Insecticides of all known chemistry were evaluated in the laboratory and field against melon thrips adults and larvae, but nothing was found effective. In our first small plot field trials, we used 15 insecticide treatments belonging to major insecticide classes, where formetanate hydrochloride, a miticide, provided significant reduction of thrips (15.0/bean leaf) when compared with the untreated check (1,100/bean leaf). Later, the discovery of Spinosad, which is more effective than formetanate hydrochloride, in 1995 was helpful to commercial growers to control melon thrips. Melon thrips infestation occurs on the abaxial surface of host leaf. Top young leaves are preferable to the older leaves at the middle and bottom of a plant. Melon thrips arrive at the edge of a young crop field and then disperse inwardly with the increase in population. Melon thrips distribution was aggregated in eggplant fields irrespective of plot sizes.

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**Status and management of *Tuta absoluta* (Lepidoptera: Gelechiidae)** –
Tomato (*Solanum lycopersicum*) is the second most important vegetable crop next to potato. South American tomato leaf miner (*Tuta absoluta*) (Lepidoptera: Gelechiidae) can cause a yield loss of 100%. Other than tomato it also feeds on other crops belonging to Solanaceae. This pest started spreading in 2006 and as of today has spread to Europe, Africa, western Asia, and South and Central America and still spreading on the American continent. In 2014, it is reported in Costa Rica, and in 2018 in Haiti. Currently, pheromone traps are effective in detecting and monitoring this pest. Significant advances have been made in the field of semiochemicals to cope with *T. absoluta*, especially sex pheromones that are important male attractants. Management strategies include cultural (sanitation, isolation), biological (egg and larval parasitoids, predators, entomopathogenic nematodes, and viruses), and chemical (pyrethroids) methods. Predatory natural enemies are available commercially and parasitoids are being identified and reared at various locations. Quarantine facilities are most important to contain and avoid this pest. Computer modeling has enabled tracking of the movement of *Tuta absoluta* trade routes through domestic markets. Improved modeling efforts will allow an understanding of its movement.

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**Management of chilli thrips in southern highbush blueberries** – Chili thrips, *Scirtothrips dorsalis* Hood, are multivoltine pests of southern highbush blueberries in Florida. Females can lay up to 200 eggs and have four to eight generations in the late spring and summer months. The use of reduced-risk insecticides with different modes of action has the potential to reduce resistance development while targeting the different life stages of chilli thrips. We evaluated the performance of six insecticides on a population of chilli thrips in a conventional southern highbush blueberry farm in the summer of 2020 in Clermont, Florida. The experiment was set up as a completely randomized block design with each insecticide replicated four times. The insecticides included tolfenpyrad (Apta® 15 SC), acetamiprid (Assail® 30 SC), spinetoram (Delegate® WG), flupyradifurone (Sivanto Prime®), flupyradifurone Sivanto Prime® with Induce® adjuvant, sulfoxaflor (Transform® WG), and water control. Leaves were sampled weekly where the average number of adults and immatures were counted, and an arbitrary index of leaf damage was assessed. Results demonstrated that Apta and Assail performed the best at reducing chilli thrips populations. In addition, severe damage of blueberry leaves was observed four weeks after the first insecticide application. Finally, we hypothesize that severe infestations in untreated bushes may have contributed to increased injury in treatments.

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**Integrated Pest Management (IPM) tactics for control of Asian citrus psyllid and citrus pest complex** - Asian citrus psyllid (ACP) *Diaphorina citri* is the vector of *Candidatus Liberibacter asiaticus* (CLas) responsible for causing huanglongbing (HLB) or citrus greening disease. Both vector and disease are established in Florida and devastating citrus industry. Cultural, biological, and chemical pest control methods have shown reductions of 80-100% in ACP populations in traditional open orchards but not enough to reduce the spread of the disease. In contrast, advanced production systems providing a physical barrier against vector colonization in individual trees and large acreage have shown protection from ACP-HLB and improved plant health and yield. However, other pests such as citrus leafminer, thrips, scales, mealybugs, and mites are reported from these structures. Pest management in traditional and advanced systems will be discussed.

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**Spotted Lanternflies (*Lycorma delicatula*) are attracted to 60-Hz vibrational stimuli** - The spotted lanternfly, *Lycorma delicatula* White (Hemiptera: Fulgoridae), is a polyphagous insect pest native to China that invaded the United States in 2014, in Berks County, Pennsylvania. It has since spread to other states and as of 2021, become established in portions of Connecticut, Maryland, Massachusetts, Delaware, New Jersey, New York, Ohio, Indiana, Virginia, and West Virginia. Spotted lanternfly is both an agricultural and forest pest, with over 170 known hosts worldwide, including grape vines, fruit trees, and ornamentals. Most studied species of Hemiptera are known to communicate using some form of substrate-borne or airborne vibration, and it was anticipated that vibrational communications would be demonstrated in *L. delicatula*. This report provides the first evidence that spotted lanternflies sense and respond to vibrational stimuli. In laboratory studies, adult and 4th-instar nymphs of *L. delicatula* were attracted towards broadcasts of 60-Hz acoustic/vibrational stimuli. These results identify a potential avenue for development of detection and control methods for this major invasive pest.

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**Pepper Weevil (Coleoptera: Curculionidae) oviposition and feeding behaviors in wild, ornamental and consumable peppers in Florida** - Due to current climate vulnerabilities of the production systems and habitat characterization, Florida’s pepper growers face challenges to understand why pepper weevil, *Anthonomus eugenii* (Coleoptera: Curculionidae) is becoming more problematic in recent years. It causes serious damage to varieties selected for consumption. However, the incidence of this pest on wild and ornamental peppers remains unknown. This study investigated the consequences of chili domestication on the feeding and oviposition of *A. eugenii*. We used plants of one wild accession, Bird Eye Pepper, five ornamental varieties (Pops Yellow, Black Pearl, Sedona Sun, Chilli Chilli and Salsa Deep) and two domesticated varieties selected for consumption (Scotch Bonnet and Jalapeno). First, we characterized the plants according to their fruit and flower sizes, pericarp thickness, capsaicin level, fruit position, and flower color. Then, the susceptibility of fruits and flowers to *A. eugenii* was evaluated. Overall, domestication increased fruit and flower sizes and pericarp thickness, altered capsaicin levels, and altered fruit position and flower color. Weevils laid more eggs and fed more on varieties selected for consumption than on wild and ornamental plants. The fruit wall thickness and fruit weight were negatively correlated with the infestation levels. This study determined that chili domestication has altered morphological and chemical (capsaicin) traits in pepper fruits with direct consequences for the feeding and oviposition. A better understanding of the natural resistant traits of wild plants that have been altered due to domestication could help in the development of new pepper varieties resistant to the pepper weevil.

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**Toxicity of some ready-to-use and common garden pesticides to blue orchard bees and leafcutter bees** - Non-Apis bees such as the blue orchard bees (*Osmia lignaria*) and leafcutter bees (*Megachile rotundata*) are important pollinators of numerous wild and cultivated crops. In commercial crop production systems, they are often exposed to various agricultural chemicals that pose serious threats to their survival, and over a period, such regular exposure may subsequently affect abundance and overall health of these bees. In other settings (such as backyard gardens, community garden and urban landscapes) these bees are also regularly exposed to numerous toxic pesticides used for management of various pests, including invasive species, and impact of such exposure often goes unnoticed. In this study, we examined direct exposure effects of six commonly used garden pesticides and ready-to-use (RTU) formulations to the blue orchard bees and leafcutter bees that are commonly found in community gardens and backyard agriculture. We assessed the toxicity in terms of bee mortality at 24, 48, 72, and 96-hours after the exposure. The results of these bioassays will be presented and discussed.

Symposia 6: Industry Updates

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**Is a career in industry right for you?** - The goal of this talk is to help students determine if a career in industry is a good fit for their personality.

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**The Power of Botanical Insecticides** - Kemin Crop Technologies presents an update on our product portfolio. Two new botanical oil based insecticides will be presented and reviewed. TetraCURB MAX, a reformulation of our flagship rosemary oil product, will be presented with field data followed by GEMSEI. GEMSEI is a new EPA registered garlic oil based insecticide with excellent efficacy on lepidopteran pests. Both products are OMRI listed and will be new tools for Florida growers to use against multiple different pests.

**Student Competition: M.S. Oral Presentations**

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**Beetle herding: development of strategies to optimize biological control of air potato using attractants** - *Dioscorea bulbifera* is an invasive plant species able to grow up into forest canopies and cover forest floors with no known natural predators outside its native range of Asia and Africa. *Lilioceris cheni*, the air potato beetle, is a Chrysomelidae specialized in eating its host *D. bulbifera*. In this study, we investigated attraction of *L. cheni* to its host plant volatiles in the presence and absence of wind using a wind tunnel as well as conspecific damage volatiles. Using a wind tunnel and freshly cut leaves from *D. bulbifera* beetles were tested on their choice of leaves or no leaves in the presence or absence of wind. Our research on L. cheni shows a significant response to the presence of a *D. bulbifera* leaf placed upwind, with the presence of wind. In the absence of wind and/or leaves, *L. cheni* was shown to disperse randomly between the upwind and downwind targets suggesting *L. cheni* uses volatiles from *D. bulbifera* in proper host selection. Further tests show *L. cheni* displayed positive chemotaxis towards host plants with conspecific damage more than nondamaged host plants in the wind tunnel. The information gathered through this study further adds to the discussion of Chrysomelidae as an agent in integrated pest management and suggests lures could be created to attract *L. cheni* to *D. bulbifera* sites. Further investigation of *L. cheni* and its host selection cues are needed to further understand how *L. cheni* identifies *D. bulbifera*.

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**Influence of *Brassica* variety on numbers of larval and pupal diamondback moth (*Plutella xylostella*) (Lepidoptera: Plutellidae)** - The diamondback moth (DBM), *Plutella xylostella* (Lepidoptera: Plutellidae), is a key pest of the Brassicaceae. DBM preference for feeding and oviposition varies among different host crops, and can be influenced by leaf characteristics and plant architecture. During spring 2022 we investigated the effect of four host types - green cabbage, red cabbage, Napa cabbage and collards – on numbers of DBM larvae and pupae using a randomized complete block design in three distinct brassica production regions in Florida (Hillsborough County, Palm Beach County and St John’s County). Plants were grown without the application of insecticides, and whole plant samples were collected three, six and nine weeks after transplanting. Plants were weighed and number of larvae and pupae per plant was recorded. Napa produced significantly more biomass than other hosts at each site. Other hosts were not different with regard to biomass except at the Hillsborough County site, where red cabbage weighed less than green cabbage and collards. When analyzed on both a per plant and per gram basis, infestations tended to be highest in green cabbage and collards and lowest in Napa.

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**Use of conventional and organic insecticides to control rice stink bugs in Florida** – Two species of stink bugs, *Oebalus pugnax* and *Oebalus insularis*, are considered major pests in rice in Florida. Pyrethroids are used to manage stink bugs in conventional rice; however, there is limited information available on the relative efficacy of conventional and organic insecticides. In 2020, a first field experiment compared the efficacy of one application of a pre-mix of pyrethroid+neonicotinoid (lambda-cyhalothrin+thiamethoxam) and a pyrethroid (zeta-cypermethrin) alone. In 2021, a second field experiment compared the efficacy of repeated applications of azadirachtin, pyrethrins, a pre-mix of azadirachtin+pyrethrins, and a pyrethroid (lambda-cyhalothrin). In the laboratory, an experiment using a research spray booth was conducted to compare the effect of pyrethrins and lambda-cyhalothrin on adult rice stink bug mortality. *Oebalus insularis* and *O. pugnax* were effectively controlled by pyrethroids under field conditions whereas azadirachtin and pyrethrins suppressed stink bug infestations. Under laboratory conditions, lambda-cyhalothrin caused high mortality whereas the pyrethrins caused low mortality.

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**Predation efficacy of commercially available *Amblyseius swirskii* Athias-Henriot (Mesostigmata: Phytoseiidae) on strawberry pest *Tetranychus urticae* Koch (Trombidiformes: Tetranychidae)** - Florida is the second largest producer of strawberries (Fragaria x ananassa) particularly winter strawberries in the United States, with a total contribution of over $399 million dollars to a $2.23 billion dollar industry. Currently, the major economic pests of strawberries in Florida include phytophagous thrips particularly *Scirtothrips dorsalis* Hood, and spider mites especially *Tetranychus urticae* Koch. Growers rely on insecticides as a management strategy for these pests, an approach that has accelerated the development of insecticide resistance among pest populations. As a result, many growers are adopting the use of biological control agents, particularly the generalist predatory mite, *Amblyseius swirskii* to manage these pests. Nevertheless, the predatory efficacy of commercial *A. swirskii* with no previous exposure to *T. urticae*, for suppressing *T. urticae* in strawberries remains to be established. To determine the predatory efficacy, *A. swirskii* was purchased from commercial suppliers, starved for 48 hours and presented with five adult female *T. urticae*, fifty *T. urticae* eggs, ten *T. urticae* deutonymphs and five adult female, Acarus spp. (control). The total number of *T. urticae* adults, eggs, deutonymphs, and Acarus spp. consumed by *A. swirskii* were recorded at 12, 24, 36, and 48 hours and percentage mortality determined. Our results indicate that commercially available *A. swirskii* requires at least 48 h of exposure to various life stages of *T. urticae* in order to attain an efficacy of at least 80%.

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**Can *Apis mellifera* be reared in vitro on irradiated royal jelly?** - The ability to rear *Apis mellifera* workers in vitro is an important method used to study the effects of pesticides, nutrition, hormones, etc. on bee development. In this assay, bee larvae feed on an artificial diet that includes royal jelly (RJ) that is often sourced internationally, raising concerns about pathogen spread. These concerns may be mitigated by irradiating the RJ prior to use, though this could affect its value in an artificial diet. The purpose of our study was to determine if A. mellifera can be reared in vitro on a diet containing RJ irradiated at 25 kGy. Twelve-hour-old larvae were collected from eleven colonies and fed a diet containing untreated RJ, irradiated RJ, or an irradiation control (untreated RJ left at room temperature for 3 days). Statistically fewer larvae survived to adulthood when fed irradiated RJ (71%) than when fed untreated RJ (85%) or the irradiation control (78%). Feeding on irradiated RJ did not affect bee developmental time, though bee weight at emergence was reduced over that of bees fed the untreated RJ. Our data demonstrate that *A. mellifera* workers can be reared on a diet that includes irradiated RJ, but that additional diet refinements may be necessary to improve survival of these individuals to levels experienced by larvae feeding on untreated diet. Ongoing projects with RJ include determining microorganism presence in RJ and the ability of treatment with radiation to sterilize RJ.

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**Abundance of adult corn silk flies (Diptera: Ulidiidae) in sweet corn fields and adjacent habitats during the 2021-2022 growing season** – Corn silk flies (Diptera: Ulidiidae) are major insect pests of sweet corn in Florida, with three species, *Euxesta stigmatias, Euxesta eluta*, and *Chaetopsis massyla*, causing the damage. Habitats surrounding sweet corn fields harbor corn silk fly adults before they lay eggs on sweet corn ears. However, studies determining adult relative abundance as affected by habitat have only been initiated recently. Commercial farms in the Everglades Agricultural Area were sampled in fall 2021, winter 2022, and spring 2022 for corn silk fly adults in sweet corn fields, sugarcane fields, and non-crop habitats. For each season, eight sites with the three habitats were sampled using Multilure traps. In each habitat of each site, five traps were deployed for two to four weeks, and the number of corn silk fly adults captured in traps was recorded weekly. Adults of the three fly species were present in all habitats from the fall to the spring. During the fall and the winter, the highest numbers of adults were observed in non-crop habitats although differences among habitats were not detected (P>0.05). In the spring, corn silk fly adults were 2.7-fold more abundant (P<0.05) in non-crop habitats than in sweet corn fields. This study showed that the number of corn silk fly adults can be nearly three times higher in non-crop habitats than in sweet corn fields, suggesting that these habitats are a substantial source of pest populations. Results emphasize the potential importance of habitats other than sweet corn fields in corn silk fly management.

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**Insect herbivore functional traits change across a disturbance gradient** - Disturbance events regulate community structure and are often a necessary process for maintaining some ecosystems. For example, fire has been shown to influence assemblages of insect herbivores, but the underlying mechanisms driving these changes are poorly understood. Fire might directly impact insect communities by influencing some species more than others or indirectly by influencing the composition of plant communities upon which they feed. Approaches that use trait values of insect herbivore communities, for example traits related to dispersal such as wing length or traits related to their feeding niche such as incisor strength, provide a powerful way to infer mechanisms structuring insect communities. Specifically, if herbivores respond indirectly to fire through changes in the plant community, functional traits related to their feeding niche should correlate with time since fire. However, if herbivore communities respond directly to fire through disturbance and recolonization, functional traits related to dispersal should correlate with time since fire. To test these hypotheses, we sampled grasshopper assemblages at various sites along a gradient of time since last fire in longleaf pine savannahs. We then measured a variety of functional traits on individual grasshoppers and calculated the community weighted means of the trait values at each site. We then used linear models to evaluate how grasshopper traits change across a disturbance gradient. Evaluating how these trait values change across a disturbance gradient will elucidate the underlying mechanisms driving community assembly, ultimately allowing for better management and conservation of these communities.

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**Leveraging lawn plant communities for arthropod conservation in urban landscapes** - Global urbanization is a major driver for arthropod biodiversity declines. Urban greenspaces have potential to help mitigate the effects of urbanization if managed with the goal of conservation. Turfgrass lawns are ubiquitous in urban landscapes, covering three times the area of any crop in the United States. Simplified lawn plant communities tend to support less diverse arthropod communities than natural areas. The pervasiveness of lawns in urban environments and their familiarity to the public makes them an ideal system to begin to address the effects of urbanization on biodiversity loss and to educate homeowners on environmentally sound management practices. While lawns typically receive various inputs to reduce plant and arthropod biodiversity, lawn plant communities range from turfgrass monocultures to various degrees of succession. This study investigated the impact of lawn plant diversity on the urban arthropod community. Our sites were chosen across a gradient of weed presence and diversity, and take place in both St. Augustinegrass and bahiagrass, the two most common grasses in the southeast. To capture a comprehensive view of the target trophic groups, pitfall traps were deployed to collect predators and herbivores. We found that the effect of plant diversity within lawns on predator diversity was highly dependent on the grass type of the lawn, while the increase plant richness and cover increased predator and herbivore activity density regardless of grass type. Ultimately, the results of this study offer a low-effort, low-cost way for homeowners to conserve urban arthropod biodiversity.

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**Ethovision: Video analysis of efficacy of potential biocontrol agents for Diaphorina citri***-* Citrus greening is a devastating disease vectored *by Diaphorina citri*, (Hemiptera: Psyllidae) Asian citrus psyllid (ACP), which has caused an almost 80% reduction in citrus yield in Florida since its discovery in 1998. Preservation of Florida's citrus industry warrants continued research of Asian citrus psyllid control methods as pesticide tolerance may result in population resurgence. Approved biological control agents include the parasitoid wasps*Tamarixia radiata* and *Diaphorenc*y*rtus aligarhensis*. The predatory beetle Hippodamia convergen is also a known predator of ACP. To determine which species has the most efficient short-range host-tracking patterns when presented with host and non-host stimuli, 120 10-minute videos recorded the natural enemies with different stimuli in a small, ventilated petri dish arena. The stimuli included: 1) D. citri nymph (host) on citrus leaf disc, 2) infested citrus leaf disc without nymph, 3) uninfested citrus leaf disc, 4) leaf disc of a non-host plant (cotton), and 5) empty petri dish (negative control). Video analysis was completed using EthovisionXT Behavior Tracking software. Comparison of the latency to first stimulus sector interaction and arrestment time are factors in determining which species is more efficient in finding the host, supported by visual tracking patterns and heatmap. Results indicate that there are differences among foraging/host finding behaviors of the natural enemies we tested.

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**Assessment of *Diaphorina citri* populations and its control in high-density citrus plantings** – The Asian citrus psyllid (ACP) *Diaphorina citri* is the vector of huanglongbing (HLB) or citrus greening associated with phloem-limited bacteria in the genus *Candidatus Liberibacter*. Infected trees start to decline and produce poor-quality fruits, which drop prematurely. Consequently, citrus production has decreased by more than 70% since the advent of HLB in Florida in 2005. There is no cure for the disease yet. Several strategies, including high-density plantings, are being tested to increase profits in the early years of tree production. There are several unknowns for this new concept, including a lack of knowledge to understand the response of arthropods to these increasing plant densities and pest management. We conducted experiments to investigate the influence of different planting densities on ACP populations and their natural enemies. The experiments were conducted at the Southwest Florida Research and Education Center, Immokalee, Florida, USA, on four-year-old ’Valencia’ sweet orange (*Citrus sinensis*) trees budded on ‘US-897’ (*C. reticulata* × *Poncirus trifoliata*) rootstock. Six planting densities were investigated at 447, 512, 598, 717, 745, and 897 trees per hectare. We assessed the incidence of ACP and natural enemies, biotic mortality in ACP populations, and the effect of insecticides on arthropods. So far, the results have not revealed consistent significant differences in ACP distribution or its natural enemies among the different planting densities. Additional studies and analyses are in progress.

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**The effect of temperature on larval development of *Calomela intemer*ata Lea (Coleoptera: Chrysomelidae), a potential biological control agent for *Acacia auriculiformis*** - *Acacia auriculiformis* is a fast-growing tree that is native to Australia. This species has invaded pinelands, hammocks, and scrub habitats in Florida. Efforts to control the tree using biocontrol began in 2016, when two biotypes (Queensland and Northern Territory) of *Calomela intemerata* were imported into FL to undergo testing. To determine climate suitability with Florida, immature survival and developmental times of the two *C. intemerata* biotypes were evaluated at ten constant temperatures (10, 15, 17.5, 20, 25, 27.5, 30, 32.5, 34, and 35C) in environmental chambers with 60–70% RH and a photoperiod of 14:10 (L:D). Groups of three adults (2 females and 1 male) were set up within Petri dishes and held at the assigned temperature. To ensure eggs and beetles acclimated to the temperature for sufficient time, all eggs laid within the first 24 hours of exposure were excluded from the experiment. After that time, eggs were collected daily, counted, and placed inside petri dishes within the same chamber. Upon hatching, the first instars were placed singly inside new Petri dishes containing an *Acacia auriculiformis* leaf and moist filter paper. All dishes were monitored daily. Development times were recorded by tracking molted larval head capsules. Analyses of variance were used to compare survival and developmental times between biotypes for each temperature. Results indicated a significant difference in development and survival among the temperatures, but not between the biotypes.

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**Host range testing of *Calomela intemerata* (Coleoptera: Chrysomelidae) – a potential biological control agent of earleaf acacia (*Acacia auriculiformis*)** – *Acacia auriculiformis* (earleaf acacia) is a fast growing, evergreen tree belonging to the family Fabaceae. It is native to Australia and was introduced to the United States as an ornamental plant in 1932. Earleaf acacia is listed as a category I invasive plant by the Florida Invasive Species Council, indicating that this species is spreading rapidly and altering native plant communities and ecosystem functions. In 2019, *Calomela intemerata* (Coleoptera: Chrysomelidae) was imported into containment laboratories in Florida from Australia to assess its potential for biological control of earleaf acacia. Host specificity tests are underway at the UF/IFAS Hayslip Biological Control and Containment Laboratory in Fort Pierce, Florida. No choice larval development and adult feeding tests were conducted, leaf tissue placed in 100 mm diameter petri dishes using 46 plants species across 11 families. Feeding by *C. intemerata* larvae and adults were observed on four and two closely related Acacia spp., respectively. None of these acacia species are native or economically important in Florida. No larvae completed development on any species other than *A. auriculiformis*. Further testing is needed to determine if this insect will be safe to release in Florida for control of earleaf acacia. However, current results are promising.

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**Ecological host range and potential non-target impacts of *Pseudophilothrips ichini* (Thysanoptera: Phlaeothripidae), a biological control agent of Brazilian peppertree, on plants native to Australia and the United States** - Pre-release quarantine testing of weed biological control agents is frequently done using simple no-choice tests. However, these fundamental host range tests are very conservative and do not realistically depict how potential biological control agents might interact with surrounding non-target plant species. This can cause the rejection of a safe agent. Ecological host range studies in areas where the biological control agent is native or already present can test the validity of laboratory findings with the advantage of allowing the agent to use host-seeking behaviors or other cues. A weed biological control program targeting *Schinus terebinthifolia* Raddi (Anacardiaceae) was given permission to release *Pseudophilothrips ichini* (Hood) (Thysanoptera: Phlaeothripidae) in Florida, USA in 2019. Information from Florida’s program has provided insight for other countries with invasive Brazilian peppertree, such as Australia, which has several culturally and ecologically important non-target species that are closely related to *S. terebinthifolia*. To evaluate the risk for non-target attack by *P. ichini* on these non-target species, we performed an open field experiment to simulate the spillover risk of these insects in both the presence and absence of their preferred host, *S. terebinthifolia*. The results suggest that *P. ichini* populations may spill over onto two non-target plants in the absence of their preferred host and could pose a risk to non-targets in Australia.

**Student Competition: Ph.D. Oral Presentations 1**

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**Specificity of pathogen-induced plant volatiles from two viruses to vectoring and non-vectoring species of flower thrips** - Insect-vectored plant pathogens are known to alter host-plant quality and associated cues, subsequently affecting the frequency of interactions with the vector and influencing pathogen transmission. Following infection, pathogen-induced changes in the host plant may result in direct effects on the vector such as increased survivability, fecundity, and altering feeding behaviors or indirect effects through host-mediated cues including changes in plant nutrients and morphology and the release of pathogen-induced plant volatiles (PIPVs). It is unknown if PIPVs deliver information specific to the vector and have evolved as a result of host manipulation, or if they are a more generalist indicator of plant status. We investigated the response of the vector of tomato spotted wilt virus (TSWV), *Frankliniella occidentalis* Pergande, and a non-vectoring species, *F. tritici* Fitch. Both species compete within the same flower but may respond differently to PIPVs. Additionally, both species were exposed to PIPVs of tomato yellow leaf curl virus (TYLCV) transmitted by *Bemisia tabaci* Gennadius to determine how specific these responses are. *Frankliniella tritici* did not respond to PIPVs. *Frankliniella occidentalis*, however, was attracted to both TSWV and TYLCV-infected plants. Volatiles from TSWV- and TYLCV-infected plants were collected and identified using GC-MS. Principal component analysis of the volatiles showed a clear differentiation between the volatiles of the uninfected and infected tomatoes. There was, however, no differentiation between the two virus-infected tomatoes, suggesting that PIPVs from both viruses elicit a generalist response in *F. occidentalis* absent in *F. tritici* and are likely not the result of host-plant manipulation.

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**Seasonal phenology of hibiscus mealybugs, *Nipaecoccus viridis* (Newstead), in central Florida citrus -** *Nipaecoccus viridis* (Newstead) (Hemiptera: Pseudococcidae) is an invasive pest known to cause devastating damage to citrus in regions where it establishes. It causes deformation and premature abortion of developing fruit leading to high yield loss. In the three years since it was found in Florida, *N. viridis* has been reported causing damage in commercial citrus groves in the central and southern part of the state. As a recent invader, there is no information available on the seasonal phenology of *N. viridis* on citrus in Florida. Due to the ideal Florida climate and multivoltine nature of *N. viridis*, we expect multiple *N. viridis* generations throughout the year. The main objective of this study was to describe the seasonal phenology of *N. viridis* populations with biweekly monitoring, using a combination of sampling techniques in six commercial citrus groves in central Florida throughout 2021. Results showed that *N. viridis* completes multiple generations per year, two of them being clearly defined and resulting in high populations. *N. viridis* populations peak between May and July, damaging fruit set and developing fruit, and between October and December. Seasonal phenology information obtained from this study will be used to develop an effective management strategy for *N. viridis* in Florida citrus.

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**How Do Flies Sense Their Protein Stores? : Hexamerin Proteins and Reproductive Behavior in the Caribfly, Anastrepha suspensa** - Surviving winter is a severe challenge for many insects. Diapause allows insects to become dormant during harsh seasonal conditions like winter, thus synchronizing their growth, development, and reproduction with favorable seasonal conditions. Diapause may last many months and is often accompanied by the cessation of feeding, representing a substantial nutrient cost. However, many insects live in nutrient limited or risky foraging environments, so may struggle to obtain the nutrients needed for diapause. How might nutrient intake affect an insect's likelihood of diapause? Furthermore, how might an insect's feeding preferences change if it is destined for the resource intensive diapause program? We are investigating these questions in the corn earworm, *Helicoverpa zea*, using the geometric framework for nutrition to examine the relative roles of carbohydrate and protein nutrition. Overall, diapause and nutrition are mutually linked. Our experiments lay the groundwork for future studies to test the relative importance of nutrient intake and nutrient stores, or test the extent to which nutritional differences in agricultural crops may delay diapause and affect overwintering survival in the field. Our findings may contribute to IPM recommendations in agriculture landscapes with host plants predicted to cause different diapause incidence and overwintering survival in *H. zea*.

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**Evaluation of biopesticides for management of *Megalurothrips usitatus* (Bagnall)** - *Megalurothrips usitatus*, an invasive thrips pest of legumes is an important pest of snap beans (*Phaseolus vulgaris*) in south Florida. The presence of *M. usitatus* has resulted in growers initiating insecticide applications earlier than prior to the establishment of the pest and applying insecticides more frequently. Furthermore, snap bean growers in south Florida have shared an interest in potential management alternatives to their current reliance on conventional insecticides. The efficacy of biopesticides for management of adult *M. usitatus,* including BotaniGard (*Beauveria bassiana*), Pyganic (pyrethrin), M-Pede (potassium salts and fatty acids), Suffoil-X (mineral oil), Aza-Direct (azadirachtin), and Trilogy (neem oil) were evaluated using a Potter Spray Tower. Exposed *M. usitatus* were observed after 72 hours and mortality was recorded.

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**Susceptibility of *Aedes aegypti* to Mayaro virus infection under different environmental temperatures** - Mayaro virus (MAYV) is an emerging mosquito-borne arbovirus and public health concern. We evaluated the influence of temperature on *Aedes aegypti* responses to MAYV oral infection and transmission at two constant temperatures (20 °C and 30 °C). Infection of mosquito tissues (bodies and legs) and salivary secretions with MAYV was determined at 3, 9, 15, 21, and 27 days post-ingestion. At both temperatures, we observed a trend of increase in progression of MAYV infection and replication over time, followed by a decline during later periods. Peaks of MAYV infection, titer, and dissemination from the midgut were detected at 15 and 21 days post-ingestion at 30 °C and 20 °C, respectively. Mosquitoes were able to transmit MAYV as early as day 3 at 30 °C, but MAYV was not detectable in salivary secretions until day 15 at 20 °C. Low rates of MAYV in salivary secretions collected from infected mosquitoes provided evidence supporting the notion that a substantial salivary gland barrier(s) in Florida Ae. aegypti can limit the risk of MAYV transmission. Our results provide insights into the effects of temperature and time on the progression of infection and replication of MAYV in *Ae. aegypti* vectors.

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**Evaluation of visual based trapping methods for ambrosia beetles associated with laurel wilt** - Laurel wilt is a vascular disease caused by *Raffaelea lauricola* that infects trees in the Family Lauraceae, mainly vectored by the redbay ambrosia beetle (Coleoptera: Scolytinae, *Xyleborus glabratus*). In avocado, in the absence of the main vector, laurel wilt is vectored by multiple species of ambrosia beetles. The first experiment evaluated *X. glabratus* responses to different color materials wrapped around the trunk of redbay trees. We then tested the effect of visual cues to trap ambrosia beetle vectors in avocado groves and redbay forest systems. Cylindrical shaped sticky traps of different colors (White, Black, Silver) baited with ethanol lures were placed in avocado groves with a history of Laurel Wilt to evaluate landing rates on both the traps and the adjacent avocado trees. Later the impact of ultra-violet (UV) light emitted from the traps would be tested by measuring ambrosia beetle behavior in response to various light regimes created by different UV manipulating materials (ultraviolet block, titanium dioxide and non-nano zinc oxide and a multiple chemicals-based, light absorbent, sunscreen SPF 50, equate). In all three experiments silver and or UV reflective material had the highest landing rates of ambrosia beetle species. For most ambrosia beetle species captured in our study, the combination silver cover/ ethanol lures attracted the greatest number of beetles. UV manipulation indicated that ambrosia beetles are more influence by the intensity of full spectrum light emitted by the trap rather than the specific UV wavelength.

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**Determining *Pseudophilothrips ichini* preference between Brazilian peppertree plants exhibiting a hypersensitive response and plants susceptible to *Calophya* spp. for integrating biological control agents** - Insect herbivores and plants have a long history of coevolution, where insects become better at attacking plants and plants become better able to defend against the pest insects. The hypersensitive response (HR) is a plant defense characterized by localized necrosis in areas under attack by pathogens or arthropods. The only published reports of a hypersensitive response to arthropod biological control agents is in Brazilian peppertree, *Schinus terebinthifolia*. Some S. terebinthifolia plants demonstrated HR to a potential biological control agent, *Calophya* spp (Hemiptera: Calophyidae), which are gall forming and non-mobile as nymphs. Previous research with *Pseudophilothrips ichini* (Thysanoptera: Phlaeothripidae), the biocontrol agent currently being released for *S. terebinthifolia*, has been conducted on HR plants. Data suggests that feeding and development of *Pseudophilothrips ichini* are not impacted by placement on HR and susceptible plants (plants that support the complete development of the *Calophya* spp.). However, previous experiments were conducted without the ability of *P. ichini* to choose between the HR and susceptible plants. The goal of this study was to determine if *P. ichini* show a preference for *Calophya* spp. susceptible plants, because if both insects provided a selective pressure against susceptible plants, then the population of *S. terebinthifolia* may be pushed more toward well defended plants, making biocontrol efforts more difficult. We found that *P. ichini* do not demonstrate a preference between HR and susceptible plants, ensuring that these two insects are compatible for control of *S. terebinthifolia* in the field.

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**Antibiotic treatment reduces *Candidatus Liberibacter asiaticus* abundance and acquisition by the Asian citrus psyllid, *Diaphorina citri* (Hemiptera: Liviidae)** - Huanglongbing (HLB), or citrus greening disease, is the most destructive citrus disease worldwide. *Candidatus Liberibacter asiaticus* (CLas), the putative causal agent of HLB, is transmitted by the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Liviidae). Management of HLB relies on the use of insecticides to reduce vector populations. In 2016, antibiotics were approved for citrus to manage CLas infection. Reducing endosymbiont abundance is known to cause corresponding reduction in host fitness among insects. We hypothesized that applications of oxytetracycline or streptomycin would reduce CLas populations in young and mature citrus trees, CLas acquisition by *D. citri*, and *D. citri* abundance. Our results indicate that treatment of citrus with oxytetracycline or streptomycin reduced acquisition of CLas *by D. citri* adults and emerging F1 nymphs as compared with that observed in trees treated with insecticides, but with no antibiotics. However, under field conditions, neither antibiotic treatment prevented infection of young or mature trees with CLas as compared with insecticide treatment negative controls; whereas, trees enveloped with mesh screening that excluded vectors prevented bacterial infection. Populations of *D. citri* were not consistently affected by antibiotic treatment under field conditions, as compared with an insecticide only comparison. Collectively, our results suggest that while drench application of oxytetracycline or streptomycin to citrus can affect CLas populations within phloem sufficiently to demonstrate reduced acquisition of bacteria under controlled conditions, even high frequency applications of these formulations under field conditions were ineffective in preventing spread of pathogen under conditions where HLB incidence is high, such as Florida.

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**Management and population dynamics of pepper weevil *Anthonomus eugenii* Cano (Coleoptera: Curculionidae) in South Florida** - Pepper weevil is an economic important pest of pepper. Pepper weevil infestation is one of the major constraints of growing pepper at the level of production. We determined pepper weevil population abundance (using aggregation pheromone lures placed on a yellow sticky traps) in Spring 2022 season and weevil density in infested jalapeño fruits across production seasons. We measured the fruit length (cm) to correlate between pepper weevil density and fruit length. We determined fruit size preference. The result shows that there is not really any kind of pattern to the size of fruit the pepper weevil prefers under field conditions and does not discriminate in choosing fruits of any size. There was little or no correlation between fruit length and pepper weevil density. There is a need to protect fruits from pepper weevil damage at all stages until they are harvested. Pepper weevil population increases as temperature increases. The result of these studies will help make adequate management decisions and understand pepper weevil abundance across production seasons. Actara (Thiamethoxam) and Vydate (Oxamyl) are the two major insecticides growers use for pepper weevil management in South Florida. As an integrated approach, we evaluated the efficacy of reflective plastic mulch and two standard insecticides for managing pepper weevil on Jalapeño peppers in Spring 2021. The three mulch treatments evaluated were: Can-Shine (Metalized top and white bottom), white on black (Can-Grow XSB) and bare soil with no mulch. Result shows that there is a potential increase in marketable yield when reflective silver on white mulch is combined with insecticides.

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**Citrus leafminer populations, its natural enemies, and biotic mortality during spring and summer in Southwest Florida** – The citrus leafminer (CLM), *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae), is a significant pest of Florida's nurseries and young plantations of citrus. CLM larva damages the citrus leaf cuticle and enhances the vulnerability to citrus canker disease. Natural enemies are a key factor in reducing the CLM populations. We monitored populations of CLM and natural enemies in the spring and summer 2022. Exclusion experiments to determine the impact of natural mortality on CLM were also conducted. CLM larvae or mines per leaf per shoot increased from 0.2 in March to 0.82 in May in Valencia trees and 0.2 in March to 0.73 in May in Hamlin trees. Overall, an average of 0.49 and 0.52 larvae or mines per leaf per shoot were observed between the two varieties. The incidence of natural mortality based on the larvae consumed by the predators from fresh mines averaged 23-36% between March and May. In the cohort experiments, natural mortality averaged 20-40%. Ants, spiders, and lacewings were the important predators observed during these experiments. The parasitism rate averaged less than 6.4% and was contributed mainly by the *Pnigalio* spp. and *Ageniaspis citricola*.

**Student Competition: Ph.D. Oral Presentations 2**

**\**Adhikary, L.*** *and S. Lahiri*, Gulf Coast Research and Education Center, Entomology and Nematology Department, IFAS, University of Florida, 14625 County Road 672, Wimauma, FL 33598 USA

**Evaluation of strawberry cultivars for host plant resistance against chilli thrips** - Strawberry, Fragaria x ananassa (Rosaceae) is an important specialty crop in Florida worth ~$399 million. Many insect pests attack strawberry in the field. Among them, an invasive insect, chilli thrips, *Scirtothrips dorsalis* Hood is becoming a major pest, causing considerable yield and revenue loss in recent years. Being an invasive and highly polyphagous species, *S. dorsalis* is now expanding its range to other southeastern states. Chemical control is no longer reliable due to resistance development. To manage *S. dorsalis* sustainably, host plant resistance (HPR) is a novel option. Host plant resistance is a technology that relies on the intrinsic ability of plants to defend against pest attacks. Four commercial cultivars namely, ‘Florida Brilliance’, Florida MedallionTM FL16.30-128, Sweet Sensation® ‘Florida127’, and Florida PearlTMFL16.78-109 were evaluated during the field season of 2021-2022 at Gulf Coast Research and Education Center. Twenty bare root strawberry transplants were planted in each field plot, and each cultivar was replicated five times in a randomized complete block design. Damage rating on leaves, *S. dorsalis* adult and larval count on trifoliates, and marketable fruit yield were assessed for each cultivar. Results indicate that, ‘Florida Brilliance and Sweet Sensation®‘Florida127’ had a significantly lower number of *S. dorsalis* and lower damage rating per trifoliate when compared to Florida MedallionTM FL16.30-128 and Florida PearlTM FL16.78-109. Also, ‘Florida Brilliance’ produced the highest marketable fruit yield (5.42gm/plant) followed by Sensation (3.313gm/plant), Medallion (2.16gm/plant), and Pearl (1.16gm/plant). Therefore, there is potential for HPR in the management of *S. dorsalis*.

***\*Kleckner, K.****, A. De Carolis, C. Jack, C. Stuhl, G. Formato, J.D. Ellis,* Honey Bee Research and Extension Lab, Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Drive, Gainesville, FL 32611-0620 USA

**Screening new compounds against small hive beetles (*Aethina tumida*) with a novel acute toxicity bioassay and field trial** - Beekeepers need new registered products to use as control methods for the small hive beetle (SHB), *Aethina tumida*, a significant pest of western honey bee (*Apis mellifera*) colonies. Few approved chemical control options exist and those available are often not effective. Here, we developed a novel acute laboratory bioassay that delivers compounds of interest to SHBs via pollen. Additionally, we conducted a field trial through which we deliver treated pollen to SHBs in traps made from modified compact disc (CD) cases. We assessed the efficacy of coumaphos (only approved in-hive treatment available in the U.S.), acetamiprid (frequently used to control beetles), and fipronil (commonly used in baits for urban pests and used by beekeepers to control SHBs) as SHB control agents. Adopting our laboratory bioassay, we found acetamiprid (LC50 = 41 ng/µl) to be more toxic to SHBs than was coumaphos (LC50 = 2501 ng/µl), yet less toxic to SHBs than was fipronil (LC50 = 3.561 ng/µl). In our field trial, colonies treated with acetamiprid and fipronil reduced live SHB populations over those of control colonies to comparable levels. Traps containing acetamiprid treated pollen retained significantly higher numbers of dead SHBs than did traps containing fipronil treated pollen. From our results, we consider acetamiprid to be a promising control agent against SHBs. Future research is needed to assess the effects of acetamiprid on honey bee health, hive products, and surrounding environments.

***\*Campos, J.N.D.****, S.V. Paula-Moraes, M.M. Rabelo, and B. Unruh,* West Florida Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, 4253 Experiment Dr., Hwy 182, Jay, FL 32565 USA

**Validated rearing and toxicological bioassay methods to tropical sod webworm, *Herpetogramma phaeopteralis* Guenée (Lepidoptera: Crambidae)** - Tropical sod webworm (TSWW) *Herpetogramma phaeopteralis* Guenée (Lepidoptera: Crambidae) is a pest in warm-season turfgrass species in the southeastern U.S. Outbreaks during the summer/fall cause economic impact on sod production, lawns, and golf courses due to the grass blade larval feeding. The objectives of this study were to validate the rearing method to keep field-derived colony of TSWW and document the susceptibility to insecticides commonly adopted in turfgrass systems. This study was performed in 2021 at the West Florida Research and Education Center/UF, Jay, FL. The rearing method used a multispecies larval diet and adult diet solution containing yeast and vitamins. In addition, a novel toxicological bioassay method was developed using a 5-cm stolon of St. Augustinegrass (*Stenotaphrum secundatum*) in containers with fine layer of agar. Concentration‐mortality bioassays used third instar larvae, with five replications, and 20 larvae per concentration. Chlorantraniliprole (Acelepryn), indoxacarb (Advion), clothianidin (Arena), and bifenthrin (Talstar) insecticides were tested using seven concentrations of each insecticide, including a control (water). Larval mortality was recorded after 48h, and data were analyzed using probit regression in Polo Plus v1.0. TSWW was high susceptible to chlorantraniliprole, indoxacarb, and clothianidin. A low susceptibility was detected to bifenthrin. The TSWW rearing method indicated overall larval, pupal, and adult survival at around 80%, 60%, and 85%, respectively. The overall production of insects was around 1,000 individuals/generation. The validation of rearing method of TSWW and documentation of insecticide performance were critical aspects a program of insect resistance management in high input turfgrass systems.

***\*Barbosa dos Santos, I.****, S.V. Paula-Moraes, J. Beuzelin, D. Hahn, C. Fraisse,* West Florida Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, 4253 Experiment Dr., Hwy 182, Jay, FL 32565 USA

**Phenology of occurrence of *Helicoverpa zea* Boddie (Lepidoptera: Noctuidae) in the Florida Panhandle: weather association and host plant origin** - *Helicoverpa zea* is a polyphagous pest of C3 and C4 plants cultivated in the Florida Panhandle, which is an overwintering region for this species. The objectives of this study were to: (i) document the annual phenology of flight of *H. zea*, (ii) estimate the effect of weather variables on *H. zea* densities, and (iii) determine the host origin of H. zea populations based on isotopic carbon analysis. Year-round trapping of *H. zea* moths was conducted for two years in 16 commercial fields, in Escambia/Santa Rosa, and Jackson counties, using Trécé Inc Pherocon® VI delta traps baited with Zealure sex pheromone lure. Trapped *H. zea* moths collected biweekly were identified using morphological wing patterns. The association between moth catches and temperature, wind speed, rainfall, and relative humidity were tested using generalized mixed models in R software. The highest and lowest *H. zea* abundance in both locations was from July to September, and from November to March, respectively. Escambia /Santa Rosa Counties had the higher *H. zea* catches, and the weather explained 64% of moth catches, with a significant effect of temperature, relative humidity, rainfall, and wind speed. In Jackson County, weather explained 49% of *H. zea* catch, with a significant effect on temperature, rainfall, and wind speed . Overall, plants with C3 photosynthetic pathways were the main *H. zea* hosts throughout the year. This study contributes to the pest management in a migratory intersection region, which is a source of *H. zea* that annually migrates northward in the U.S and Canada.

**\**Salgado, S.****, E. Le Falchier, and C. Minteer,* Indian River Research and Education Center, Entomology & Nematology, IFAS, University of Florida, 2199 South Rock Road, Fort Pierce, FL 34945 USA

**Diversity and impact of local herbivorous insects on earleaf acacia in** Florida - Earleaf acacia (*Acacia auriculiformis*A.Cunn. ex Benth) is a non-native, perennial tree species native to Australia. Earleaf acacia was introduced into the United States as an ornamental plant in the early 1900s. Since then, earleaf acacia has been spreading rapidly throughout Florida. The impact of insect herbivores on the development of earleaf acacia was evaluated in the Indian River Research and Education Center, Fort Pierce, Florida from 2020 to 2022 using an open field insecticide exclusion method. The impact of herbivores was evaluated every three months, the variables measured were plant height, basal diameter, plant width, and presence of flowers and seed pods. Seeds were quantified to estimate seed production. The insect damage was estimated from 20 leaves randomly selected. The diversity of herbivores was collected every three months using beat sheet samples.  This study reveals that natural enemies present in Florida have no measurable impact on the growth of earleaf acacia. Most of the insect species collected from this study were generalists, and some of them are serious agricultural pests.  Many insect herbivore species have been collected from this study, however, there are no differences in growth between insecticide-protected and unprotected trees. As natural enemies do not have an impact on earleaf acacia, *Calomela intemerata*Lea (Coleoptera: Chrysomelidae) and *Trichilogaster sp. nov*. (Hymenoptera: Pteromalidae), two biological control candidates imported from the plant’s native range, are being studied under quarantine facilities at the University of Florida’s Hayslip Biological Control Research and Containment Laboratory for testing and potential application.

***\*Berto, M.M.*** *and D. Carrillo,* Tropical Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, 18905 SW 280th Street, Homestead, FL 33031 USA

**Phoretic mites associated with ambrosia beetles in Florida avocados** - We report several phoretic mites associated with ambrosia beetles for the first time. Ambrosia beetles spend most of their life inside galleries built on host trees. They use the xylem as a substrate for farming symbiotic fungi. Some of these symbionts are plant pathogens that infect avocado (*Persea americana*) trees in South Florida, such as *Raffaelea lauricola* and *Fusarium* sp. A few other organisms inhabit ambrosia beetle galleries, including phoretic mites. Little is known about the ecology of phoretic mites and their potential application in pest management. A survey was conducted in eight avocado orchards and swampbay (*Persea palustris*) stands in Florida. Ambrosia beetles were captured in flight using modified Lindgren traps, as they emerged from infested logs placed in emergence chambers, and were also physically excavated from infested logs. Nine mite species in five families were collected from nine beetle hosts, including *Asca* sp. (Ascidae), *Proctolaelaps bickleyi* and *Proctolaelaps* sp. (Melicharidae), *Acarothorectes curculionium*, *Elattoma* sp., *Brazilopsis floridensis*, and *Pediculaster* sp. (Pygmephoridae), *Tarsonemus* sp. (Tarsonemidae), and *Histiogaster arborsignis* (Acaridae). The mite family Pygmephoridae was the most abundant group. *Acarothorectes curculionium* and *Elattoma* sp. were the most common phoretic mite species, and B. floridensis is a new mite species found in this study. The phoretic associations were not specific to a particular ambrosia beetle species. The cryptic living habits of ambrosia beetles make their management challenging. Future studies will evaluate the potential of phoretic mites to be incorporated into innovative IPM practices for managing ambrosia beetles and other wood-boring pests.

***\*Perry, C.****, M. Gireesh, and S. Lahiri*, Gulf Coast Research and Education Center, Entomology & Nematology Department, IFAS, University of Florida, 14625 County Road 672, Wimauma, FL 33598 USA

**Understanding the efficacy of hexythiazox for managing twospotted spider mites in strawberry** *–* Twospotted spider mite, *Tetranychus urticae* Koch is a common arthropod pest of strawberry crops in Florida. *T. urticae* cause considerable stippling and scarring damage to strawberry plants that can result in significant yield loss. The objective of this study was to compare the efficacy of hexythiazox (Onager Optek®) with cyflumetofen (Nealta®) and abamectin (Agri-Mek® SC) against different life stages of *T. urticae*. The field study was conducted in 2022 at the Gulf Coast Research and Education Centre (GCREC), University of Florida. The treatments were hexythiazox, cyflumetofen, abamectin, and a combination of hexythiazox and abamectin and each treatment was replicated four times in a randomized complete block design. Each plot contained twenty strawberry ‘Florida Brilliance’ plants. Treatments were applied using back-pack sprayer set at 40 psi. Flower and leaf samples were collected at three, ten, and twenty days after the initial application and counts of *T. urticae* eggs, nymphs, and adults were done using microscope. Based on the results, hexythiazox outperformed cyflumetofen in controlling *T. urticae* eggs, nymphs, and adults. While comparing with non-treated control plots, hexythiazox treated plots reduced the mite population by ~ 3 times. Moreover, no significant difference in mite suppression was found while adding abamectin to hexythiazox compared to hexythiazox-only treatment. These results indicate that hexythiazox could significantly reduce *T. urticae* populations in strawberry crops. These findings will help the growers utilize a more effective miticide for *T. urticae* management in strawberry.

***\*Kaur, J.****, E. Kraus, E. Clifton, and P. Hahn,* Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Examining the role of environmental variation in mediating plant defense traits and the effectiveness of biocontrol agents** *-* Classical biological control is widely accepted as an efficient strategy to manage invasive plants. However, the effectiveness of biocontrol agents can be highly variable, where an agent may be efficient under certain environmental contexts but ineffective under others. Florida harbors a highly problematic invasive weed: air potato (*Dioscorea bulbifera* L.). The *beetle Lilioceris cheni* (Coleoptera), a specialist on air potato, has been successfully established as its biocontrol agent although its effectiveness varies across the latitudinal gradient in Florida. Since the plant reproduces asexually, environmental variation across Florida may alter plant defense chemistry, which may determine differences in the beetle’s effectiveness. Hence, we first surveyed beetle damage on air potato populations across Florida and then investigated the role of plant defense chemistry on beetle performance through a series of lab-based chemical and feeding assays. We found that beetle damage is inversely related to cover of the plant population. Consequently, to enhance the beetle effectiveness, we tested the effects of synthetic application of phytohormones salicylic acid (SA), methyl jasmonate (MeJA), and a control on beetle herbivory and plant defenses (C:N ratio and saponins). Beetle herbivory was higher on SA treated plants than MeJA, but they did not vary for C:N ratio. However, C:N ratio gradually decreased towards North, in natural populations. We expect to find higher saponins in SA treated plants and in populations from South Florida, due to higher resources. These results will provide a foundational understanding of the ecological factors that influence effectiveness of biocontrol agents and help improve future biocontrol programs.

**\**Ali, M.,*** *and J. Qureshi,* Southwest Florida Research and Education Center, IFAS, University of Florida, 2685, SR 29 N, Immokalee, FL, USA

**Distribution of *Diaphorina citri* (Hemiptera: Liviidae), its natural enemies, and biotic mortality between the border and interior of commercial citrus blocks** - *Diphorina citri*, also known as Asian Citrus Psyllid (ACP), is a vector of the devastating huanglongbing (HLB) disease pathogen. Therefore, psyllid management is critical. ACP adults flying into citrus blocks are likely to colonize the perimeter's trees before further spreading into the block. Therefore, block perimeters could serve as a breeding ground for ACP compared to trees in the interior. Trees in the block perimeter and interior were investigated for ACP, natural enemies, and biotic mortality in ACP populations in commercial citrus groves. Psyllid infestation was high in the block perimeter than in the interior. The natural enemies and biotic mortality of ACP were also relatively high in the perimeter but common throughout the blocks. In such a scenario, block perimeters can be treated with sprays of insecticides more often than the rest of the block for greater ACP suppression and to conserve beneficial insects. Spraying the entire citrus block may not be cost-effective and cause more harm to beneficial organisms such as predators and parasitoids, much needed for biological control of ACP and other pests.

***\*Lopez, M****. and O.E. Liburd,* Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Assessing diurnal emergence and response of blueberry gall midge (Diptera: Cecidomyiidae) to various classes of insecticides** -The blueberry gall midge (BGM), *Dasineura oxycoccana* Johnson (Diptera: Cecidomyiidae), is one the most destructive blueberry pests in Florida. Approximately 58% of blueberry farms have reported reduced yields linked to BGM infestations. This study evaluated emergence times of BGM in a Southern Highbush blueberry planting during peak infestation. Bucket emergence traps were set up in a randomized complete block design. Traps were interchanged every three hours from 6 AM – 6 PM and replicated on four separate days. Results indicated that 67% of adults emerged from 9 AM – 3 PM. Complimentary benchtop bioassays evaluated the toxicity of commonly used insecticides on adult stage BGM. Insecticides included imidacloprid, acetamiprid, malathion, flupyradifurone, spinetoram, tolfenpyrad, spirotetramat, and cyantraniliprole. Water was used as the control. Mortality was assessed after 1, 3, and 6 hours of residual exposure with an arbitrary index (AI) of 2 = uninhibited mobility; 1 = decreased mobility; and 0 = death. While all insecticides had significantly lower average AI than the control, malathion performed best at increasing adult mortality at 1, 3, and 6 hours post application. Three and six hours post application, acetamiprid, flupyradifurone, and cyantraniliprole had superior performance at reducing BGM. These findings inform growers on which insecticides to apply during an optimum time frame to reduce BGM pressure, and ultimately, reducing the cost and ecological impact.

**Posters**

**Student Poster Competition**

**Masters of Science:**

***1.\*Muthomi, P.K****., O.E. Liburd, D. Seal, J. Beuzelin, and T. Morawo,* Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Behavioral management of diamondback moth (*Plutella xylostella*), using specialized pheromone and lure application technology (SPLAT) in cabbage** - Behavioral manipulation of insects utilizing semiochemicals has great potential in reducing the risk of resistance to the active ingredient (AI) by the target pest. The diamondback moth, *Plutella xylostella* (DBM) ranks among the top 20 resistant arthropods, exhibiting resistance to >95 active ingredients. DBM is the most important pest of cabbage globally, and it is attracted to its host plants by chemical and/or physical stimuli. Most semiochemical controlled-release formulations are dispensed using devices, such as aerosol dispensers and polyethylene tubes but recent developments have shown that a versatile innovative pheromone dispensing technology, SPLAT (Specialized Pheromone Lure Application Technology), has great management potential when used as an ‘attract and kill’ tactic. One formulation of SPLAT for DBM is Acttra®Plutella. The goal of this study was to conduct laboratory studies to determine the attractiveness of Acttra®Plutella for the control of DBM and field trials. The hypothesis is that the lure has a strong attraction to draw the insect directly to the source of stimuli and induce contact which eventually kills the adults if a toxicant is used. The innate behavioral responses were tested in a Four-choice olfactometer bioassay chamber and field trials were conducted. Results obtained showed that Entrust® (Spinosad) mixed with Acttra®Plutella provided the most consistent and effective control of DBM in the field, while DBM chose cabbage disks with Acttra®Plutella as the first choice implicating attraction, in the laboratory.

***2.\*Taylor, C.E.****, J.R. Bloomquist, C.J. Geden, and E.R. Burgess IV.* Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Bioaccumulation of brevetoxin in two filth fly families and transstadial presence** - *Karenia brevis* is a marine dinoflagellate responsible for harmful algal blooms (HABs) in the Gulf of Mexico. These HABs are commonly referred to as red tides and are responsible for the mass mortality of marine and terrestrial fauna. *Karenia brevis* produces a neuroactive phycotoxin called brevetoxin (PbTx). The mass mortality events produced from red tides attract many shoreline scavengers who can then become poisoned with PbTx through multi-trophic interactions. To date, research has been focused on vertebrate scavengers. This study focuses on the first major colonizers of carcasses, filth flies. Using a commercially available enzyme-linked immunosorbent assay (ELISA) kit, larvae and adult filth flies collected from the carcasses of two separate red tide events were examined for the presence of PbTx. Transstadial persistence of PbTx was also examined by investigating the larvae, pupae, and adult flies from families Calliphoridae and Sarcophagidae. The calliphorids were identified to species using a key whereas sarcophagids required molecular barcoding via Cytochrome Oxidase I (COI) sequencing. Flies collected from the beaches were also examined for brevetoxin presence. All of the collected flies tested positive for brevetoxin presence. Brevetoxin transstadially persisted from larval, pupal, and adult life stages. This is the first study to confirm bioaccumulation of brevetoxins in invertebrates during red tide events and it foreshadows potential trophic effects at the interface of the marine and terrestrial ecosystems.

**3.\**McDuffie****, D., D. Kline, O. Baker, W. Piwowarek, and E.R. Burgess IV*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Mosquito fauna in high floral and low floral microhabitats at a North Florida botanical garden, with special focus on the sugar meal ecology of *Coquilletidia perturbans*** - Mosquitoes consume plant nectars to gain sugar for key biological processes. Sugar-feeding patterns tend to be quite variable among mosquito species, and especially vary based on factors such as sex, habitat, geography, and season. This study will involve the collection of mosquitoes at Kanapaha Botanical Gardens in Gainesville, FL, a location with high diversity in mosquito species and floral sugar sources (i.e., nectar). Eight CDC light traps will be placed around the study site every two weeks for a total of fifteen trapping events. There will be one trap placed within eight microhabitats that were chosen based on unique plant compositions and potential for mosquito resting/breeding sites. Species richness, evenness, and diversity will be tracked temporally. To gain insights into the sugar feeding ecology of a prolific species at this site, adult *Coquilletidia perturbans*, a competent vector of Eastern Equine Encephalitis (EEE) and West Nile virus, will undergo analysis of fructose and total sugar content using a modified anthrone assay, a commonly used assay to measure sugar content in mosquito samples. Wing measurements will be used as a proxy of body size and used to normalize sugar readings from the anthrone assay. Gaining insight into the temporal makeup of mosquito populations in microhabitats with varying degrees of floral sugar availability will have the potential to improve targeting adult mosquitoes with control measures such as attractive toxic sugar baits (ATSBs) or through the modification of plant communities much like pollinator ecology has successfully done for the past 30 years.

***4.\*Lambert, A.*** *and O.E. Liburd*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Comparison of commercial lures for *Drosophila suzukii* (Diptera: Drosophilidae) in Florida blueberry plantings** - *Drosophila suzukii* (Diptera: Drosophilidae) is a fruit fly that has invaded Europe and the Americas in the late 2000s. It is a major insect pest of small and stone fruit and has made a significant impact to the Florida blueberry industry. To manage these pests, it is important for farmers to be able to monitor the population. We compared two *D. suzukii* traps and lures, Scentry and Trécé, to see which was more effective at targeting *Drosophila suzukii*. There are many different species of *Drosophila* and it is important to easily monitor specifically *Drosophila suzukii*, since that is what is affecting these crops. Data was taken in 7 trapping periods from early to late season. Berries were harvested in 4 periods and monitored for *Drosophila suzukii*. Both traps and lures were effective at capturing *Drosophila*, but the Trécé trap and lure was more effective at targeting specifically *D. suzukii*. This would make it easier for a farmer to monitor *D. suzukii* populations. Something else to note is that the Trécé trap were simpler to set up and handle than the Scentry trap.

**Ph.D.**

***5.****\*****Kaur, G.****, L. Stelinski, X. Martini, R. Mallinger, N. Boyd, and S. Lahiri*. Gulf Coast Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, Wimauma, FL

**Identification of plant volatiles for integrated pest management of chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in strawberry in Florida** - Current thrips management practices in strawberry rely on foliar application of synthetic insecticides and evolution of resistance is an on-going problem. Several studies have examined application of herbivore induced plant volatiles (HIPVs) for management of *Frankliniella occidentalis* Pergande (Thysanoptera: Thripidae). However, this is not well explored for the management of chilli thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) in open-field strawberry production. Therefore, the objectives of this study are to: 1) assess the response of *S. dorsalis* to uninfested and infested strawberry plants by olfactometer assays; and 2) identify HIPVs released in response to *S. dorsalis* infestation. The volatiles from plants of two commonly grown strawberry cultivars will be collected from: 1) clean plants; 2) plants infested with *S. dorsalis* only; 3) plants with mechanical injury. The head space volatiles will be collected from plants using a push and pull collection system. Furthermore, three dual-choice experiments with *S. dorsalis* will be conducted: 1) clean air vs. uninfested plants; 2) clean air vs. plants infested by *S. dorsalis*; and 3) control plants vs. plants infested by *S. dorsalis*. This study will describe the role of strawberry HIPVs in host selection preference by *S. dorsalis*. The results of this study will enable identification of potential plant volatiles that may be used for integrated pest management of *S. dorsalis* in strawberry.

***6.****\*****Blore, K****., R. Baldwin, C. Batich, P. Koehler, R. Pereira, C. Jack, W. Qualls, and R. Xue*. Anastasia Mosquito Control District, 120 EOC Drive, St. Augustine, FL 32092 USA

**Evaluation of silver nanoparticle as a control tool against adult mosquito vectors** - Insecticides remain an integral component of mosquito control operations but sustained use of a limited number of active ingredients (AI) has led to the widespread development of resistance. New types of insecticides will be necessary in maintaining control efficacy. Toxicity screening of metal nanoparticles was conducted via topical applications to assess their viability as potential insecticides and for possible synergism with existing AI. Nanoparticles were synthesized from silver nitrate (AgNO3) using essential oils from different plants. Essential oils contain bioactive compounds and metabolites that can act as both a reducing and capping agent to stabilize the AgNP molecule. The resultant AgNP are to be characterized by spectrophotometer, FTIR and electron microscopy analysis. Nanoparticles were screened to determine LC50 and LC90 values against adult females of *Aedes aegypti*, *Culex quinquefasciatus* and *Anopheles quadrimaculatus*. Nanoparticles were also conjugated with permethrin during synthesis and assessed for toxicity comparison with permethrin alone and with PBO.

***7.\*De Giosa M.****, L. Ataide, R. Ochoa, and A.M. Revynthi*. Tropical Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, Homestead, FL USA

**Eriophyid mites as pests of tropical and subtropical plants in south Florida** - Eriophyid mites are highly specialized pests that cause important damage to fruit, vegetable, forest, and ornamental plants all over the world. Eriophyids are classified as vagrant, gall-making, refuge-seeking and bud inhabiting species based on their intimate relationships with their hosts. Vagrant eriophyid species cause nonspecific symptoms such as russeting, bronzing. Gall-making eriophyid species cause symptoms, such as closed galls (i.e., pouch galls) and open galls (i.e., erinea), witches’ brooms. Refuge-seeking eriophyid species cause rosetting, while bud inhabiting eriophyid species cause fruit distortion. Eriophyid mites are emerging as important agricultural pests also in south Florida. Some of the most common species that have been found are *Aculops lycopersici, Aculops cannabicola, Phyllocoptruta oleivora* (rust mites), *Aceria litchii* and *Acalitus simplex* (erinose mites), *Eriophyes cynodoniensis, Paracalacarus podocarpi, Aceria guerreronis* (rosette mites), and *Tegolophus perseaflorae* (bud mite). It is still unknown how the different symptoms develop. International literature suggests that the mite saliva may be responsible for alternating the host plant physiology. In the past, researchers have provided a protocol to extract saliva from eriophyids. Here we provide an overview of the most common eriophyid mites in south Florida and their associated symptoms. We also present a short description of the saliva extraction protocol and how this can be optimized to obtain qualitative and quantitative saliva from different eriophyid mites.

***8.\*Zhao, D.*** *and A.C.N. Wong*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Chironomid as a new model to study *Vibrio cholerae* colonization in aquatic invertebrates** - Diarrheal disease caused by *Vibrio cholerae* is a global public health challenge. Cholera is a water-borne disease and *V. cholerae’s* persistence in the aquatic ecosystem determines its ability to infect human. Current studies showed that non-biting midge (chironomid) in water can serve as a *V. cholerae’s* reservoir. In this research, we used chironomid as a model to test how different *V. cholerae* strains persist in the chironomid larvae and the effects of *V. cholerae* exposure on chironomid survival and the composition of insect-associated microbiome. Our results show that the exposure to *V. cholerae* does not affect chironomid survival until reaching a high cell density threshold. And the colonization of V. cholerae in chironomid is dominated by pathogen load in water, with some *V. cholerae* strains more superior than others to persist in the larvae. On the other hand, *V. cholerae* exposure induces subtle changes in the chironomid microbiome. No drastic turbulation in insect-associated bacterial community is observed during the challenge of *V. cholerae*. While Shannon indices are reduced in chironomids when exposing to *V. cholerae* at high dose. Together, our research shows the potential to utilize chironomid as a model to study host-pathogen interaction and the importance of different bacterial and host factors in the colonization of *V. cholerae*.

***9.\*Boothroyd, J. C.****, S.M. Smit, S. Zlotnik, and C.W. Miller*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Weaponless males have larger testes** - Over evolutionary time, animals have been selected to invest optimally in traits for both survival and reproduction. Yet, they are unable to invest maximally in all areas, as investing heavily in one trait may compromise investment in other traits. These resource allocation trade-offs are often most apparent in energetically expensive traits, such as muscle and gonads. Yet, we still know little about how traits involved in reproduction may trade-off with others, such as those involved in dispersal, especially in males. We capitalize on a known trade-off between testes and muscular hind-leg weapons in the leaf-footed cactus bug, *Narnia femorata* (Hemiptera: Coreidae), to understand the extent to which trade-offs manifest between reproductive traits and dispersal. We induced natural limb loss, prohibiting investment in weapons beyond the penultimate instar to then determine whether other traits received increased investment. We measured testes mass and, as a dispersal trait, flight muscle mass. Controlling for body size, we found greater testes mass in males missing a leg compared with intact males. We also found a size dependent relationship with flight muscle mass, where males with no hind-leg weapons invested more heavily in those muscles, but only at small body sizes. Further investigation in this vein should examine the long-term effect of this phenomenon, and its relation to natural seasonal variation in testes mass, to better understand the impact on lifetime reproductive success.

***10.\*Tavares, C.****, R. Mishra, P. Ghobrial, and B. Bonning*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Difference in abundance of gut surface proteins between nymphs and adults of the Asian citrus psyllid, *Diaphorina citri*** - The Asian citrus psyllid (ACP), *Diaphorina citri*, is the most important pest of citrus worldwide. ACP transmits the pathogenic bacterium *Candidatus Liberibacter asiaticus* (CLas), the causative agent of huanglongbing (HLB) also known as citrus greening disease. HLB has caused severe economic losses in the global citrus industry. CLas is transmitted in a circulative and propagative manner by ACP nymphs and adults although nymphs are more susceptible to CLas infection. As circulative plant pathogens exploit proteins on the gut surface for entry, differences in relative abundance of gut surface proteins may contribute to differential CLas infection between nymphs and adults. Here, we conducted proteomic analysis and compared the relative abundance of gut surface proteins between adults and nymphs. Brush border membrane vesicles (BBMV) were prepared from dissected guts of both nymphs and adults, and samples run in triplicate on a timsTOF mass spectrometer. A total of 1516 and 1219 proteins were identified in BBMV from ACP adults and nymphs, respectively. Bioinformatics analysis software and manual curation predicted that 112 adult and 87 nymph proteins localize to the surface of the microvilli. After data normalization using the normalized spectrum abundance factor (dNSAF) method followed by Student t test, we found that the relative abundance of 26 proteins significantly differed between nymphs and adults. Knowledge of the ACP gut surface proteome, particularly proteins that are more abundant in nymphs, provides insight for potential interdiction of CLas interaction with the psyllid gut toward management of citrus greening disease.

***11.\*Iredale, M.E.****, P.H.O. Viadanna, K. Subramaniam, E. Tardif, B. Bonning, and J. Ellis*. Entomology & Nematology Dept, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA

**Characterization of Amoebic Disease in a Colony of Western Honey Bees (*Apis mellifera***) - Protozoal diseases are one of the least investigated pathogens of western honey bees (*Apis mellifera*). The amoebae, gregarines, and flagellates are within this group, but only the amoeba *Malpighamoeba mellificae* (Rhizopoda) has been associated with clinical disease (amoebic or amoeba disease). This organism was first discovered in the Malpighian tubules of honey bees in 1916. Since its discovery, *M. mellificae* has been shown to damage the Malpighian tubules, thus interfering with metabolic waste excretion and solute exchange with the hemolymph. This damage ultimately weakens and may kill the host bee. The disease has also been associated with spring dwindling of bee colonies, dysentery symptoms in adult bees, and a tendency of infected bees to disappear from the hive. Until recently, no genetic markers were available to aid in the diagnostics for and characterization of *M. mellificae*. Herein, we describe the detection and characterization of a protozoal organism in a colony of honey bees in the Yukon Territory, Canada, using PCR assay, light microscopy, histopathology, and next-generation sequencing. This work provides a foundation for further investigation into the distribution, prevalence, and pathology associated with *M. mellificae* infection in honey bees.

**Submitted Posters**

***12****.Dahmane, M., Urbaneja, A., Ruíz-Rivero, O., Alonso-Valiente, M., and* ***\*M. Pérez-Hedo***. Instituto Valenciano de Investigaciones Agrarias (IVIA). Centro de Protección Vegetal y Biotecnología, (IVIA), CV-315, Km 10.7, 46113 Moncada, Valencia, Spain,

**The zoophytophagous predator *Pilophorus clavatus* (Hemiptera: Miridae) induces plant defenses in citrus plants** - The generalist predator *Pilophorus clavatus* (L.) (Hemiptera: Miridae) inhabits citrus orchards in the Mediterranean region where preys on several important citrus pests. This predator has zoophytophagous habits, hence a part of feeding on prey, it can obtain food resources from the citrus plant. In this work, we investigated whether the plant feeding by *P. clavatus* could induce defensive responses in citrus plants (*Citrus sinensis* L. Osbeck cv. Pineapple) and whether these induced defenses could affect the plant host selection of the citrus key pest, *Tetranychus urticae* Koch (Acari: Tetranychidae) and two predatory mites, *Phytoseilus persimilis* Athias-Henriot and *Neouseiulus californicus* McGregor (Acari: Phytoseiidae). Here, we show that the jasmonic and salicylic acid pathways were upregulated on *P. clavatus*-punctured plants when compared to intact control plants. Neither *T. urticae* nor *N. californicus* showed preference for the odor source emitted by *P. clavatus*-punctured plants or intact plants in a Y-tube olfactometer test. However, *P. persimilis* resulted significantly attracted to *P. clavatus*-induced plants. The performance of *T. urticae* was also compared when mites were released on previously *P. clavatus*-induced plants or on intact plants. The infestation of *T. urticae* was significantly reduced by 70 % on those citrus plants previously activated by *P. clavatus* when compared to the control. Our results show for the first time how the beneficial role of *P. clavatus* in citrus can be two-fold, on the one hand due to its known predatory action and on the other as an inducer of the citrus plant immune system.

***13.****Cloonan, K.R.,* ***\*A. Vázquez****, M.A. Gill, L.K. Mosser, J.H. Crane, D. Carrillo, and P.E. Kendra*. Subtropical Insects and Horticulture Research, Agricultural Research Service, U.S. Department of Agriculture, 13601 Old Cutler Rd, Miami, FL 33158 USA, kevin.cloonan@usda.gov

**Field attraction and aging study of 2- and 3- component food-based lures for the Caribbean fruit fly, *Anastrepha suspensa* (Diptera: Tephritidae) in south Florida** - The Caribbean fruit fly, *Anastrepha suspensa* (Loew) (Diptera: Tephritidae), is well established in Florida as a pest of citrus, guava and other specialty fruits. To date, the most effective monitoring tools for Caribbean fruit fly include food-based baits and lures deployed in multilure traps. As part of a continued effort to identify attractive synthetic lures for the Caribbean fruit fly, we conducted field tests in Homestead, Florida to compare the efficacy and longevity of commercial 2- and 3-component cone lures (2C [ammonium acetate and putrescine], 3C [ammonium acetate, putrescine, and trimethylamine]) versus the traditional liquid protein bait consisting of hydrolyzed torula yeast and borax. Tests were conducted in guava, Surinam cherry, and loquat during the peak fruiting season (March-May). These 2- and 3- component cone lures are the current standards used by regulatory agencies. Additional lures were field-aged and analyzed in the laboratory to quantify residual chemical contents. The torula yeast-borax mixture captured the highest mean number of Caribbean fruit flies in all three hosts and the commercial 2C lures captured more flies than the 3C lures, apparently due to a repellent effect of trimethylamine. Captures with all three treatments were significantly biased toward females. Attractiveness of the 2C lure began to drop after 6-8 weeks, and the 3C lure after 5-6 weeks. Chemical analysis indicated that emissions of attractive chemicals from 2C and 3C lures decreased exponentially over time. This information will benefit regulatory agencies in designing appropriate monitoring programs for the Caribbean fruit fly in Florida.

***14.\*Tassi, A.D.****, R. Ochoa, and D. Carrillo*. Tropical Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, 18905 SW 280th Street, Homestead, FL 33031 USA, aline.tassi@ufl.edu

**Review of *Brevipalpus californicus* species complex and its association with transmission of dichorhaviruses** - The correct taxonomic identification of economically important pests is essential to developing control strategies that mitigate the damage they cause. *Brevipalpus californicus* is an important phytophagous mite responsible for direct damage and transmission of plant viruses. There is a degree of morphological variation reported for the taxon, indicating the possible existence of a species complex. These mites are present in several countries in association with many different hosts, acting as vectors of orchid fleck dichorhaviruses, which cause localized lesions and economic losses in ornamental and citrus plants. Historical data suggests that members of this complex were the vectors of citrus leprosis in Florida in the late 1800’s and early 1900’s, but the disease suddenly disappeared during the 1960’s. Presently, *Brevipalpus* transmitted viruses affecting citrus groves are reported in Mexico, Central, and South America. Moreover, several *Brevipalpus* transmitted viruses were recently reported in the United States associated with ornamentals, which also pose a threat to citrus. We studied the type material, examined over 3000 *Brevipalpus* collected from across the world, and found that *B. californicus* represent a complex of at least seven species. The misinterpretation of morphological differences amongst this complex is the result of poor taxonomy and misidentified specimens. Here, we redescribe *Brevipalpus californicus* s.s., report three new species, and resurrect three wrongly synonymized species. The next objective of the project is to conduct a survey in south Florida for new host associations, identify possible *Brevipalpus* transmitted viruses associated with them, and identify which species are responsible for virus transmission.

***15.\*Ascunce****, M.S., K. Carroll, P. Perez, P., A. Nisip, J.A. Qureshi, and E.M. Goss*. Center for Medical, Agricultural, and Veterinary Entomology, USDA-ARS, 1600 SW 23rd Drive, Gainesville, FL 32608 USA, marina.ascunce@usda.gov

**Ant community composition in a citrus grove in Florida reveals southern expansion of exotic ant *Pheidole obscurithorax*** - Native ants represent up to 25% of the animal biomass in an ecosystem and are key ecological drivers in below-ground processes through the alteration of the physical and chemical environment and their effects on plants, microorganisms, and other soil organisms. Although modern agriculture is affected by declining soil nutrients, the use of beneficial arthropods such as ants can help in its mitigation. Because most agricultural lands are highly disturbed settings, they tend to be affected by invasive species, which can competitively exclude native species. In this study, we measured the ant diversity in a citrus grove in south Florida. During the summer of 2018, we sampled 3 transects separated by 25 meters. Within each transect a total of 10 pitfall traps were placed at 5 meters intervals. Traps were collected after 48 hours, ants were sorted and identified. All the pitfall traps (100%) contained *Solenopsis invicta* (Red Imported Fire Ant), one of the worst invasive species of ants. In 15 traps (50%), we found *Dorymyrmex bureni*, the pyramide ant, which is native to the Southeast United States and known as a predator of small arthropods in citrus and soybeans, as well as honeydew tender. Two tramp species: *Monomorium floricola* and *Cardiocondyla wroughtonii* were found in 1 and 2 traps, respectively. Finally, *Pheidole obscurithorax*, a native species South America, was found in 3 traps, this species is thought to successfully compete and/or co-exist with RIFA and to our knowledge, this is the first report of its presence in South Florida.

**16.**Jarrett, B.J.M., **\**K. Sherman****, M. Graham, C. Parker, J.C. Boothroyd, and C.W. Miller*. Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA*,* benjamin.jarrett@ufl.edu

**The evolution of mouthpart plasticity in leaf-footed cactus bugs** - The ability of an organism to express different phenotypes in different environments—termed phenotypic plasticity—allows populations to persist in new environments and may enable adaptive evolution to subsequently occur. The degree of plasticity is known to evolve, but how the speed to which plasticity might evolve to increase, or decrease, is unknown. *Narnia femorata* (Hemiptera: Coreidae) provides an excellent system in which to address this question. *N. femorata* feed on a wide variety of *Opuntia* cactus fruit with fruit walls of varying thickness. Across *N. femorata* populations the mean mouthpart length is distinct, indicating genetic differentiation, but mouthpart length is also a plastic trait that can change depending on the *Opuntia* species on which they feed during development. Here we tested how quickly mouthparts, and their plasticity, can evolve by rearing replicate populations on two *Opuntia* species: *O. stricta* and *O. mesacantha*. A third treatment involved alternating the two *Opuntia* species every generation, mimicking a fluctuating environment. In this ongoing study, we predict mouthpart size will evolve to differ in the two uniform host plant treatments, and that we will see greater levels of plasticity in the alternating treatment.

***17.\*Palmer, J.*** *and P. Hahn* Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA, jakobpalmer@ufl.edu

**Variation in chemical defense among closely related species** - Chemical compounds such as phenols, polyphenol oxidase, and protease inhibitors represent some of the main ways that plants defend themselves from insect herbivores. Because these chemical defenses are costly to produce, they are either constitutive (always expressed) or induced (upregulated in response to herbivory). Here we look at chemical defense in closely related plant species from the Asteraceae family: *Solidago altissima, Gaillardia pulchella* and *Achillea millefolium*. We conducted herbivory surveys to assess damage on *Solidago altissima* and *Gaillardia pulchella* in the field. We collected leaves from twenty plants of each species with varying levels of herbivore damage. We tested three methods of preparing leaves from these species for extraction of chemical defense compounds: placing leaves on dry ice in the field, placing leaves in liquid nitrogen in the field, and freeze-drying leaves in the lab. Chemical defense compounds were extracted from the dried leaf tissue and analyzed for total phenolics, polyphenol oxidase, and protease inhibitors using a spectrometer. For *Achillea millefolium*, we analyzed plants of different genotypes collected over a moisture gradient to test if resource availability affects chemical defense. In the absence of herbivory, *Solidago altissima* was more chemically defended than *Gaillardia pulchella* and that *Solidago altissima* induced more chemical defense in response to herbivory. For *Achillea millefolium* we found that genotypes from more productive environments produced more chemical defense compounds compared to arid genotypes. This study adds predictive power to explain variation in chemical defense among closely related species and within the same species over environmental gradients.

***18.****\*****Liesenfelt, T.****, A. Chuang, and L. Diepenbrock*. Citrus Research and Education Center, Entomology and Nematology Dept., IFAS, University of Florida, 700 Experimental Station Road, Lake Alfred, FL 33850, USA, tliesenfelt@ufl.edu

**Seasonal occurrence of Chilli thrips (*Scirtothrips dorsalis*) in citrus** - Chilli thrips (*Scirtothrips dorsalis*) is an invasive thrips species in the US which was first found in Florida on roses in Palm Beach County in 2005. This pest has a large host range, small body size, and short life cycle with rapid reproduction which allows for them to quickly adapt to new environments. Chilli thrips have recently become problematic is screened citrus production systems, both in greenhouses and CUPS (citrus under protective screening) houses. Symptoms of feeding damage on leaves include including curling and deformation of young leaves. In CUPS production houses, they damage the rind of fresh fruit, making these fruit unmarketable for sale on the fresh market which can caus economic losses. In both greenhouses and CUPS, Chilli thrips cause death of growth terminals, which will stunt growth and development of trees. The goals of the project are: (1) evaluate sampling methods for Chilli thrips in screened citrus production systems, and (2) describe adult Chilli thrips seasonal occurrence in screened production systems. To do so, data collection is done within greenhouse and screenhouse house environments. Data collected is done using a combination of sticky traps, alcohol washes of leaf samples, and tap counts conducted in two-week intervals.

***19.****\*****Li, Y.,*** *G. Raina, B. Jarrett, and C. Miller*. Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA, yli10@ufl.edu

**The effect of male-male competition on female injury** -Sexual selection has driven the evolution of weapons across many species that are used by males to compete for access to females. Contests between males can be violent, as males’ weapons have evolved to be used in combat. An unintended consequence of these contests could be damaging to the females both males are fighting over. However, very few studies have examined the cost and consequence of male-male competition for females. Here, we investigate how male-male competition can result in damage to females using the leaf-footed cactus bug, *Narnia femorata* (Hemiptera: Coreidae). We will manipulate the strength of male-male competition with two contrasting sex ratios: male-biased and female-biased. We predict that females will incur more damage in the male-biased treatment. Furthermore, we will manipulate the nutrition of the female. Previous work has shown that males on a high-quality diet develop thicker cuticles. Based on this evidence, we predict that females reared on high-quality diets will also have more robust cuticle and will be better at resisting damage incurred through male-male competition. This study would provide the first evidence about female injury associated with male-male competition, and how adult nutrition might minimize or exacerbate these costs.

***20.\*Della Vechia, J.A.****, D.J. Andrade, A.L. Roda, and D. Carrillo*. Tropical Research and Education Center, Entomology & Nematology Dept, IFAS, University of Florida, 18905 SW 280th Street, Homestead, FL 33031 USA, franciosidella.j@ufl.edu

**Selectivity of acaricides administered via different routes to the predatory mite *Amblyseius largoensis***- *Amblyseius largoensis* (Acari: Phytoseiidae) is a cosmopolitan species and a common predator inhabiting citrus orchards and other fruit crops in Florida. It has been reported as an efficient biological control agent of citrus leprosis mite *Brevipalpus yothersi* (Acari: Tenuipalpidae). For the success of IPM, it is imperative to determine the selectivity of acaricides to predatory mites. We studied the ecological selectivity of four acaricides to *A. largoensis*: abamectin, cyflumetofen, fenpyroximate, and spirodiclofen. The survival and fecundity of *A. largoensis* were assessed following acaricide administration via different exposure routes: residual contact, direct contact, ingestion of pesticide-laced prey (*B. yothersi*), or a combination of these three exposure routes. The route of exposure significantly affected the survival and fecundity of *A. largoensis*. The fecundity of *A. largoensis* was reduced when the different exposure routes were combined compared to each exposure route alone. Selectivity of abamectin and spirodiclofen was relatively high for all the exposure routes. Cyflumetofen showed the lowest selectivity via direct and residual contact. Fenpyroximate showed low selectivity via direct contact, acaricide-laced prey and combined exposure routes. However, the selectivity of fenpyroximate via residual contact was high. Our results show that the selectivity of the tested acaricides to *A. largoensis* can be enhanced by restricting exposure to a single route.

***21.****\*****Pérez Cordero, L.,*** *X. Martini, A. Chuang, L. Stelinski, and L. Diepenbrock*. Highlands County Extension, IFAS, University of Florida, Sebring, FL USA, lperezcordero@ufl.edu

**Evaluation of novel release device of repellents for the Asian Citrus Psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae)** - The Asian Citrus Psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) is the vector for the bacteria which causes citrus greening/Huanglongbing (HLB). Adults and nymphs can transmit ‘C.Las’ during feeding. Citrus greening has severe impacts on citrus tree productivity and fruit quality, eventually leading to death of trees. HLB management consists primarily of insecticide applications for the psyllid vector. However, this strategy is not a sustainable long-term solution. Environmental contamination, mortality of beneficial organisms, and the development of insecticide resistance by populations of psyllids are current challenges facing psyllid management. Volatiles from botanical oils have been found to discourage *D. citri* feeding on citrus. The goal of this project is to develop and evaluate a cost-effective odorant delivery device for botanical oil volatiles, such as lavender, citronella, thyme, and fir, to repel *D. citri*. Laboratory olfactometer tests were conducted to evaluate devices and initial results indicate that delivery of fir oil effectively repelled *D. citri.*

***22.****\*****Vázquez, A.,*** *N. Tabanca, and P.E. Kendra*. Subtropical Insects and Horticulture Research, Agricultural Research Service, U.S. Department of Agriculture, 13601 Old Cutler Rd, Miami, FL 33158 USA, aimevazquez@yahoo.com

**High performance thin layer chromatography to identify components of tea tree oil attractive to male Mediterranean Fruit Flies (Diptera: Tephritidae)** - The Mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann) is one of the most destructive pests of fruits and vegetables worldwide. Trimedlure (TML), a synthetic male attractant parapheromone, is currently used for field monitoring and detection of Medfly populations. However, TML is expensive and limited to a single supplier, making identification of alternative attractants a high priority need for APHIS-PPQ. Our previous research discovered that male Medflies are attracted to tea tree oil (TTO), an essential oil derived from *Melaleuca alternifolia*, under controlled bioassays. Preliminary separation of TTO on a preparative thin layer chromatography (TLC) plate generated five major fractions of TTO, two of which were attractive to male Medflies. Since TTO is available from multiple manufacturers, there is considerable variation in its chemical composition, necessitating screening methods to determine purity and approved variants of the oil. In this study, we used high performance TLC (HPTLC) to evaluate the variations in chemical composition of TTO obtained from different sources, featuring the chemical complexity and quality issues of TTO. HPTLC protocols were developed to improve the separation, resolution, and isolation of the individual chemical components found in TTO. This research will lead to identification of novel, alternative attractants for male Medfly, with potential applications for improvement of detection and management programs for this major agricultural pest.

***23.Hayden, J.E.*** Florida State Collection of Arthropods, Florida Dept. of Agricultural and Consumer Services, Division of Plant Industry, 1911 SW 34th St., Gainesville, FL 32608 USA, James.Hayden@FDACS.gov

**A new *Mimorista* species in Florida and cladistics of Nomophilini (Lepidoptera: Crambidae)** - The tribe Nomophilini includes 24 genera of crambid moths whose larvae feed primitively on Rubiaceae. An undescribed species of *Mimorista* Warren from Central America has been established in Florida since 2011. *Mimorista* "botydalisDHJ01" has been collected in five counties, and it feeds on *Psychotria nervosa* Sw. Cladistic analysis of the "core" of the tribe finds two major clades, one persisting on Rubiaceae, and the other having polyphagous and/or aquatic larvae. Mimorista and Samea Guenée are both polyphyletic, being catch-all genera for nomophilines with checkered maculation. The new species belongs to *Mimorista* sensu stricto, which is diagnosed from its closest relative Mecyna Doubleday by several, mostly genitalic apomorphies. The undescribed species is diagnosed from *M. botydalis* Guenée by a broader second fibula, shorter cornuti, and laterally projected antrum lobes. It is predicted to become established wherever *Psychotria* grows in Florida.

***24.****\*****Yang, X.,*** *N. Tabanca, and P.E. Kendra*. Subtropical Insects and Horticulture Research, Agricultural Research Service, U.S. Department of Agriculture, 13601 Old Cutler Rd, Miami, FL 33158 USA, xiangbing.yang@usda.gov

**Insecticide resistance detection and management of Caribbean fruit fly, *Anastrepha suspensa* using plant essential oils** - The Caribbean fruit fly*, Anastrepha suspensa*, is a major pest to over 100 host species in Florida, the Caribbean islands and countries in Central America. Currently, conventional insecticidal bait sprays are commonly used in commercial groves for control of this pest. However, extensive insecticide applications can lead to development of insecticide resistance. To evaluate the resistance level of *A. suspensa* in South Florida, field collected flies were evaluated by topical bioassays using insecticide (i.e. methomyl) to determine the median lethal dose (LD50), which was then compared to the LD50 obtained with a susceptible lab colony to determine the resistance ratio. The results showed that both female and male *A. suspensa* had a resistance ratio < 6, indicating development of mild resistance to methomyl. To manage further development of resistance, research has focused on plant extracted essential oils (EO) with demonstrated insecticidal effects as a safer alternative to conventional synthetic insecticides. We evaluated nine EOs extracted from Cupressaceae, Zygophyllaceae, Myrtaceae, Lamiaceae, Asteraceae, and Apiaceae to determine the contact toxicity against female *A. suspensa* under laboratory conditions. The results showed that six EOs were effective against *A. suspensa*, with varied LD50 levels. Results also showed that anisole (EO extracted from Apiaceae) was not only effective against *A. suspensa* via contact, but also showed strong fumigation and residue effects. Our study showed that the tested EOs have potential to be used as environmentally-friendly alternatives to conventional insecticides for control of Caribbean fruit fly.

***25.\*Gayatri, R.****, L. Yichen, J. Benjamin, and C. Miller*. Entomology & Nematology Department, IFAS, University of Florida, 1881 Natural Area Dr, Steinmetz Hall, Gainesville, FL 32611 USA, gayatriraina@ufl.edu

**Nutrition quality may affect competitive injuries in leaf-footed cactus bugs** -Males across the animal kingdom fight for resources and mating opportunities, a phenomenon known as male-male competition. These fights often come with fitness costs like physical injuries. For example, 82% of tule elk and 50% of river shrimp males show injury resulting from male-male contests. For these contests, animals use weapons like horns and spines, specially evolved for fighting and defense. However, sometimes their weapons fail them. Why is it that in the same species, weapons of some males hold vigorous battles while weapons of some snap? The answer to this is virtually unknown. To answer this question, we will be measuring the effect of early adult nutrition on the extent of injuries suffered by fighting males. For this study, we will be using the leaf-footed cactus bug, *Narnia femorata* (Hemiptera: Coreidae), a population known for aggressive male-male competition and weapon autonomy. Previous work has shown that altering the diet of these insects affects the puncture resistance of their cuticle. In this ongoing project, we investigate how dietary changes affect injury resistance in living insects kept in mixed-sex groups. This will be one of the first studies to investigate the effects of adult diet on the insect cuticle and the consequences in the context of male-male competition.

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***Listronotus sparsus* (Say), an emerging weevil pest of celery and parsley in southern Florida** - An increase in unusual insect injury has been observed in Apiaceae crops produced organically and conventionally in southern Florida. This injury consists of weevil larval tunneling through the petioles, crowns, and roots. Weevil adults collected in celery fields, as well as adults reared from larvae infesting celery plants were identified *as Listronotus sparsus* (Say), which is a relatively widespread species that has not been reported as a crop pest. Our observations suggest that this weevil exhibits behavior comparable to that of carrot weevils, *L. oregonensis* and *L. texanus*, which are serious pests of Apiaceae crops in the Great Lakes region and Texas, respectively. Thus, this weevil might represent a significant threat to celery, parsley, cilantro, and carrot production in Florida. A celery field experiment compared the efficacy of oxamyl, cyantraniliprole, chlorantraniliprole, clothianidin, and novaluron for weevil control. Posttreatment evaluations suggest that oxamyl suppresses weevil infestations. In addition, celery sentinel plots were established to study the biology of the weevil and its seasonal dynamics. Weekly samplings showed that weevils started laying eggs three weeks after transplanting. The observation of eggs and larvae suggests that the weevil infests plants throughout the crop season. Scouting efforts in southern Florida are continuing to identify weevil infestations in crops in the Apiaceae family such as celery, parsley, carrot, cilantro, and dill. This work was the first effort to identify this emerging weevil pest, study its biology, provide management information, and involve stakeholders in an educational program.

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**Thrips species in pepper relay-cropped after strawberry (Fragaria x ananassa) in Florida** - Since 2015, chilli thrips, *Scirtothrips dorsalis* Hood has emerged as an economically damaging pest of strawberry, Fragaria x ananassa (Rosaceae) in Florida. Since then, many strategies have been developed to manage them. One of the current methods of their management is the use of insecticides. Pepper, *Capsicum annuum* L. (Solanaceae) is often relay-cropped after strawberry on the same bed in Florida. However, it is not clear if S. dorsalis continues as the predominant thrips pest on the relay-cropped pepper. Pepper is a known host of *S. dorsalis*. This information is crucial for thrips management in relay-cropped pepper. Therefore, the objective of this study was to determine the thrips pest complex in the relay-cropped pepper. In the Plant City, Hillsborough Co. area, three 25-30 A fields were sampled biweekly, for two months in summer of 2021 using pan-trap (blue and yellow) in eight locations per field. Twenty-four hours after pan-trap placement, samples were collected. Results indicate that *Frankliniella bispinosa* Morgan was the predominant thrips species present in relay-cropped pepper. There was no *S. dorsalis* collected during the field season. The color of the pan made a difference in thrips collected. Blue traps had twice the number of thrips captured compared to yellow. Therefore, the thrips management program in relay-cropped pepper should target *F. bispinosa* and not *S. dorsalis*.​

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**Pesticide degradation rates influenced by growing citrus under a protective screen** *-* Currently, Huanglongbing is the most devastating disease of citrus in the United States and globally. Huanglongbing reduces yields, reduces internal and external fruit quality, and eventually kills the tree. There is no cure, and insecticides have proven ineffective at stopping the vector of the disease. Currently, the only proven technique for preventing Huanglongbing is to exclude the disease vector, the Asian citrus psyllid (*Diaphorina citri*), from trees by growing citrus under a protective screen. However, small arthropods and some diseases can penetrate the screen. Pest management is performed through the application of pesticides. However, the screen alters the enclosed environment resulting in increased temperature, humidity, and reduced UV radiation relative to open conditions. These conditions could affect pesticide degradation rates thereby changing product efficacy, reentry intervals, and post-harvest intervals. We looked at the decay rates of malathion, acetamiprid, fenpropathrin, and abamectin deposits on glass slides at 0, 0.5, 1, 1.5, 2, and 4 times the label reentry interval. The degradation rate of malathion was higher in the screen-enclosed space while the degradation rates of acetamiprid, abamectin, and fenpropathrin were reduced in the screen-enclosed space. The results are discussed in relation to the effect of the screen on the enclosed environment.

**Submitted papers 1**

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**The Asian citrus psyllid *Diaphorina citri*: the greatest threat to Mediterranean citriculture** - The psyllids *Trioza erytreae* and *Diaphorina citri* are vectors of the bacterium *Candidatus Liberibacter*. This bacterium is the causal agent of huanglongbing (HLB), an incurable and devastating citrus disease. *Trioza erytreae* invaded the northwest of the Iberian Peninsula in 2014. Between 2017 and 2018, the psyllid moved more than 200 km south along the west coast of Portugal. In 2020, the distribution of *T. erytreae* on the west coast of the Iberian Peninsula covered an uninterrupted straight line of 600 km from Cedeira (A Coruña, Spain) to Setúbal (Portugal). In 2021, its presence was confirmed in Aljezur (Algarve), an area already a few kilometers from the largest citrus area in Portugal. In Spain, the distribution of *T. erytreae* has expanded northeastward to the Cantabrian coast, and specific outbreaks have recently been reported in Asturias, Cantabria, and the Basque Country. The HLB threat for Mediterranean citrus has increased in recent months with the arrival of the Asian citrus psyllid *D. citri* in Israel. Compared to *T. erytreae, D. citri* has higher biotic potential, greater adaptability to Mediterranean climates, and, above all, a higher ability to vector the Asian HLB strain (much more aggressive than the African). This worrying situation makes any contingency measure a challenging endeavor. This work will summarize the main achievements in the management of both vectors and the lines of research focused not only on vector management but also on HLB in Spain.

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**Vacuolar ATPases gene targets of RNAi to control Asian citrus psyllid, *Diaphorina citri*** - RNA-interference (RNAi) offers a lucrative biopesticide solution for controlling insect pests and vectors of plant pathogens. There is great interest in developing dsRNA biopesticides to control the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) infestations in citrus to reduce spread of “*Candidatus Liberibacter asiaticus*” (CLas), the causal agent of citrus greening disease. In this study, genes encoding subunits of *D. citri* Vacuolar ATPase (vATPase)-A, -B, -D, and -E were evaluated as targets for knockdown and mortality of teneral adult (≤7-d-old) *D. citri*. Experiments were conducted to investigate extent of RNAi penetrance using oral delivery of four dsRNAs, individually, and stacked as a group. Psyllids were given a 10-day ingestion-access period on dsRNAs presented in a 20% sucrose solution. Significant knockdown, at 29-48% and 22-29%, was documented for all four target genes following ingestion of single and stacked dsRNAs, respectively, compared with the dsRNA luciferase control. Gene silencing resulted in significant mortality of *D. citri* adults with dsRNA targeting individual vATPase-A at 37%, -B at 35%, -D at 44%, -E at 44%, and 52% for the four stacked dsRNAs. The percent mortality for psyllids receiving stacked dsRNA was significantly higher than for those that ingested vATPase-A or vATPase-B dsRNA alone. No significant difference was observed between psyllids post-ingestion of only the vATPase-D or vATPase-E dsRNAs, and the four stacked dsRNAs. Overall, these results demonstrate that greater impact of vATPases gene targets can be achieved by presenting dsRNAs stacked, compared to that following ingestion of dsRNAs for individual vATPases gene targets.

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**Surveillance of *Diaphorina citri* populations from Florida reveals reduced susceptibility to cyantraniliprole and thiamethoxam** – The Asian citrus psyllid, *Diaphorina citri*, is an important insect pest that transmits the causal pathogens of huanglongbing (HLB) in citrus. In Florida, HLB threatens citrus production and insecticide overuse for the vector has resulted in the evolution of resistance among populations of *D. citri* to commonly used insecticides. Cyantraniliprole is effective against nymphal and adult *D. citri*. However, since the introduction of cyantraniliprole use in Florida, observations have suggested that the duration of population suppression following foliar sprays against *D. citri* has decreased from 60 to 28 d between 2012 and 2020. Here, we sampled populations of *D. citri* from four locations in FL and measured their susceptibility to cyantraniliprole as compared with a laboratory susceptible culture. A bottle bioassay method was used to measure the direct toxicity of insecticides to *D. citri*. For bifenthrin, cyantraniliprole, dimethoate, and thiamethoxam, the resistance ratios were 6.67-11.33, 3.20-36.37, 12.50-82.50, and 4.60-10.08, respectively. Our field survey revealed that susceptibility levels of *D. citri* populations to cyantraniliprole have decreased over 10-fold at three separate citrus growing locations in Florida. Although some shifts in the resistance ratio of cyantraniliprole appear to have occurred since its use began in FL citrus, the resistance ratios are congruent with field observations indicating that *D. citri* should remain susceptible to label rate applications of this mode of action without control failure. However, our results indicate that sufficient field variation exists in susceptibility to cyantraniliprole among populations of *D. citri* to justify careful management of this insecticide for the prevention of insecticide resistance development.

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**Assessment of *Amblyseius swirskii* for suppressing *Diaphorina citri*** - *Amblyseius swirskii* Athias-Henriot (Acari: Phytoseiidae) is a commercially available predatory mite that has been released in several countries and crops around the world to control pests such as thrips, whiteflies, and mites. We investigated its potential to control Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Liviidae), which is an important pest of citrus and vector of huanglongbing or citrus greening disease. These experiments were performed in the laboratory, greenhouse, and field using different release rates. In the laboratory tests, the best density was 1:1 (mite: ACP eggs), followed by 1:2, and 1:4. The most effective density for control of ACP in the greenhouse was 2:1 (mite: ACP eggs), which reduced the pest by about 50%. In the field, we released the mites on citrus trees under five different ACP management programs and evaluated their persistence after three days. We observed predatory mites on 40% of the trees in the program relying only on biological control. Biological control was also a component of IPM programs using conventional or organic insecticides. The percentage of trees in those programs with predatory mites ranged from 20 to 35%, with the lowest percentage found in the program that integrated conventional pesticides with biological control.

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**Predation of *Adalia bipunctata* (Coleoptera: Coccinellidae) on *Diaphornia citri* and *Leuronota fagarae* (Hemiptera: Psylloidea) psyllids** - *Diaphorina citri* Kuwayama is a devastating pest of citrus and vector of ‘*Candidatus Liberibacter* spp.’ the causal agent of huanglongbing (HLB) or citrus greening disease. While wild lime psyllid; Leuronota fagarae Burckhardt is native to South America and has been reported in South Florida in 2001 attacking citrus relative *Zanthoxylum fagara* (L.) Sarg. (Sapindales: Rutaceae). Biological control is needed for managing these psyllid species. The two-spotted ladybeetle, *Adalia bipunctata* (Coleoptera: Coccinellidae) is naturally found in North America and available commercially. It is a promising biological control agent and was reported preying on psyllids, aphids, and mealybugs. We evaluated *A. bipunctata* larvae and adults against nymphs of *D. citri* and *L. fagarae* in choice and no-choice tests and the suitability of these psyllids for the development of this ladybeetle. In both choice and no-choice tests, *A. bipunctata* larvae and adults consumed more *D. citri* nymphs. The development time of the larval instars did not differ between the two psyllids except the second instar which was shorter on *D. citri*. There was no difference in the adult weight or longevity of *A. bipunctata* between the two psyllids but more fertile eggs were produced in the D. citri.

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**The lychee erinose mite: pest status in Florida and management** - The lychee erinose mite (LEM) (*Aceria litchii*) is an important pest of lychee. This minute mite prefers to feed on young, new flush causing the formation of hypertrophic trichomes, known as erinea. Its recent interception in Lee County, Florida, triggered a quarantine and a subsequent eradication program. We correlated erinea development with the mite population levels and developed a method to evaluate acaricidal efficacy. Using this method, we tested ten acaricides for efficacy as prophylactic treatments to protect the new flush. We also evaluated the response of LEM to different temperatures. Additionally, we developed a postharvest treatment using a paraffinic oil that can disinfest the fruit of LEM, thereby allowing the growers to ship outside the quarantine area. Little information is available regarding the ecology of this pest and how it locates the new flush while being hidden inside the erinea. Therefore, current research focuses on the chemical ecology of LEM. Plant volatiles collected from different plant structures revealed that the ratio of three sesquiterpenes (ar-curcumene, zingiberene and β-caryophyllene) is different in the new flush compared with other plant structures, which could be associated with the preference of LEM for the new flush. Presently we are testing the attraction of LEM to two ginger oils containing these three compounds. Results of this study can serve as the basis for development of a lure that can be used to control this pest in the field.

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**Potential natural enemies of the Lychee Erinose Mite (*Aceria lichii*), an invasive pest of lychee plants in Florida -** The lychee Erinose Mite (LEM) (*Aceria lichii*) is a major pest of lychee in Asia, Australia, Brazil, and Hawaii that was recently found in Florida. LEM has rapidly spread throughout Florida’s lychee growing areas, indicating the urgent need to develop management strategies for this new invasive pest. To identify potential biocontrol agents we sampled local natural enemies in areas recently colonized by this mite. Two predatory mites were identified: *Amblyseius largoensis* and *Amblyseius woodbury*. We have successfully established colonies of *A. largoensis* in the laboratory and conducted no-choice bioassays to determine its predation rates on LEM. We offered *A. largoensis* groups of 40 LEM adults on small leaf discs placed on 1% agar and recorded the number of prey consumed and predator eggs produced in 48h. In addition, predators were offered three other potential food sources: 60 eggs of *Tetranychus urticae*, 100 eggs of *Brevipalpus yorthersi* and pollen. *Amblyseius largoensis* preyed on average, 26.5 ± 1.9 adult LEM in 48h. Predation on LEM adults by *A. largoensis* was significantly higher than on eggs of *T. urticae* (17.9 ± 1.9/ 48 hr) and *B. yorthersi* (12.1± 2.0/ 48 hr). In addition, predator mortality and oviposition were very low and similar across the treatments, including pollen. These results show the potential of *A. largoensis* as a biological control agent of LEM. The life history parameters of *A. largoensis* preying on LEM will be evaluated in subsequent studies.

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**Implications of the Brown Marmorated Stink Bug on specialty crops in Florida** - Brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål) is an economically important pest worldwide. It has spread to at least 42 states in the United States, and in 2018, BSMB was determined to have been established in Lake County, Florida. The Florida Department of Agriculture and Consumer Services, Division of Plant Industry presently classifies it as a pest with restricted distribution (FDACS-DPI). Monitoring for BMSB populations in Lake County and across Florida, in a broader range of specialty crops such as peach and tomato, is critical for developing integrated pest management strategies. Year-round monitoring of BMSB began in Lake County in 2019, and more counties were added in 2021 to monitor stink bug abundance, population dynamics, and distribution in commercial tomatoes. From 2019 to 2021, the overall catch of economically important stink bug species grew by 31.3 %. *Nezara viridula* is the most abundant pest in fruits (peach and grapes) and fruiting vegetables, followed by *Euschistus servus* and BMSB. Notably, there was a 30.7 % increase in *N. viridula*, 15 % in *E. servus*, and 13% in BMSB trapping in 2021 over 2020 in Lake County. Monitoring efforts for commercial tomatoes revealed a similar pattern, with more BMSB reports coming from counties where the pest was not previously documented. The detection of BMSB in commercial tomato production, a major component of Florida agriculture, necessitates more intensive monitoring and scouting to better understand population dynamics and timing of intervention.

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**Developing management options for Lebbeck mealybug (*Nipaecoccus viridis* Newstead), a polyphagous invasive mealybug in Florida citrus** - *Nipaecoccus viridis*, also called Lebbeck or Hibiscus mealybug, has had severe impacts on citrus groves in central and southern Florida where it has established. Impacts include fruit drop, malformed fruit and leaves, death of leaves, fruit, and limbs, and even death of young trees. Management for this pest is tricky as there are a many unknown factors- what is their seasonal phenology relative to citrus, what chemistries work best for this pest, are there predators that can be incorporated into the management program? To date, we have evaluated commonly used insecticides for use against *N. viridis*, discovered naturally occurring predators, evaluated commercially available predators, and evaluated methods to support predators in the production habitat. Each of these tools is a step towards building IPM programs for citrus and other impacted crops. Insecticide evaluations have revealed potential chemistries that could be used for the management of lebbeck mealybug, however most are broad spectrum materials known to exacerbate the challenge of managing this mealybug. Through field observations and trials, we have found chemistries that can be used to minimize population growth early in fruit production. Additionally, we have discovered naturally occurring predators and have evaluated fire ant management as a method to support predators in groves.

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**Determination of the discriminating concentration towards permethrin for surveying resistance in *Amblyomma americanum*** - *Amblyomma americanum* is ubiquitously present throughout the southeastern United States and is capable of vectoring several pathogens. White-tailed deer are the main host for adult *A. americanum*, however, they are a generalist species that will feed on most vertebrates, including humans, deer, livestock and pets. Management of this species can be challenging due to a lack of cost-effective strategies. Acaricides are often utilized, however, this may lead to pesticide resistance. The Food and Agriculture Organization of the United Nations (FAO) larval packet test (LPT) was performed on susceptible *A. americanum* to determine the lethal concentration (LC) and discriminating concentration (DC) values for permethrin. The FAO LPT was used at these pre-established values to compare levels of resistance in ticks collected from a captive deer farm and from unmanaged habitat representing high and low permethrin exposure settings. Resistance ratios (RR) calculated, from the LC values, for the ticks collected from farmed and wild deer ranged between 1 and 2. *Amblyomma americanum* collected from farmed and wild deer were not found to be resistant, however slightly elevated RRs as compared to the susceptible laboratory strain may suggest tolerance development. Although the *A. americanum* sampled in this study were not resistant to permethrin, the DC allows for a rapid evaluation of resistance in a permethrin resistance monitoring program such that alternate management strategies can be adopted if resistance is detected.

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**Utilizing reflective mulch for chilli thrips management in strawberry** - *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae), is an invasive pest in the southeastern U.S.A with a wide host range of plants including vegetable, ornamental, and fruit crops. In Florida, *S. dorsalis* has developed into a significant economic pest of strawberry since 2015. In strawberries, *S. dorsalis* feeding damage results in significant yield loss. Currently, growers in Florida use black plastic mulch in their fields which helps with root growth of transplants during winter. However, black plastic mulch can elevate heat stress in plants especially if the growers prepone the planting date. On the contrary, reflective mulch has been found effective in managing thrips pests in various crops. Hence, the objective of the study was to understand the differences in chilli thrips infestation and fruit yield in three strawberry cultivars planted on white and metalized reflective mulches vs. black plastic mulch. The study was conducted in 2021- 2022 at the Gulf Coast Research and Education Centre, University of Florida. Tissue samples were collected biweekly and marketable fruit yield was collected weekly. Five random plants were visually rated to assess leaf damage index, biweekly. Results indicate that fruit yield was 3 times higher in reflective mulches compared to black plastic mulch. Chilli thrips infestation and leaf damage index was ~ 2 times higher in black plastic mulch compared to reflective mulches. However, among cultivars, there was no significant difference in fruit yield, chilli thrips number and damage index. These findings will help growers reduce the reliance on chemical pesticides for thrips management.

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**Assessing larval pupation success of *Pseudophilothrips ichini* (Hood) under different soil moisture contents, and water treatments** - *Pseudophilothrips ichini* (Thysanoptera: Phlaeothripidae), a newly introduced biological control agent, is used to control Brazilian peppertree, *Schinus terebinthifolia* Raddi, in Florida. The Brazilian peppertree is an invasive weed that threatens natural and agricultural environments, including sensitive environments such as mangrove swamps. Because *P. ichini* larvae pupate in the soil as part of their life cycle, it is crucial to understand the effects of soil moisture content, salinity, and immersion survival time, which are unknown. The survival of the *P. ichini* larvae was investigated using fine sand at five moisture contents of water and brackish (10 ppt) saturations (0%, 25%, 50%, 75%, and 100%). We also evaluated the ability of larvae to survive after being immersed in both water treatments for 0, 1, 2, 3, 5, 8, 16, and 32 hours. The results of the study showed that water and brackish treatments significantly hindered *P. ichini* emergence at 100% in saturated soil. To avoid excessive moisture, larvae gathered in the arena's aperture cover or the upper leaves of Brazilian peppertree in 100% saturated treatments, displaying behavioral avoidance. However, no significant differences were observed in other soil moisture levels. The maximum survival time for larvae immersed in brackish treatment was 16 hours, and only one larva survived during that time for water immersion. The outcome of this study contributes to our understanding of *P. ichini* ecology and the estimation of thrips establishment success in a variety of habitats infested by Brazilian peppertree.

**Submitted papers 2**

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**Classical biocontrol of the cactus moth: an update on host range testing of a braconid parasitoid** - The Argentine cactus moth, *Cactoblastis cactorum*, is native to South America. It has been an effective biocontrol agent of prickly pear cactus (*Opuntia* sp.) in places where the plant was introduced, such as Australia and Africa. Its invasion into North America threatens native Opuntia, an important component of the desert ecosystem. First found in Florida, *C. cactorum* has moved as far west as mid-Texas, and as far north as North Carolina. Initial efforts focused on SIT and sanitation, but these techniques proved insufficient due to cost and difficulty accessing infested areas. A braconid wasp that attacks *C. cactorum* in Argentina, *Apanteles opuntiarum*, was differentiated from another wasp with a broader host range, *Apanteles alexanderi*. We are now completing host range testing of *Apanteles opuntiarum* in quarantine. It has continued to demonstrate a narrow host range when tested on native North American cactophagous and non-cactophagous caterpillars. These are promising results for the potential release of this wasp as a biocontrol agent for *Cactoblastis cactorum*.

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**Advances in the Systematics of Platygastridae** - Platygastridae (Platygastroidea) is a family of paraitoid wasps that attack immature gall midges (Diptera: Cecidomyiidae), arthropod eggs, and Sternorrhynca. The taxonomy and systematics of this family are the subjects of a renewed interest in the family and the application of new and classical methods. Recent advances, ongoing efforts, and future challenges for classification will be discussed.

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**Role of DNA barcoding in solving species complex: *Olepa* a classical example** - *Olepa* (Watson,1980) is a genus of moths which causes damages to crops like castor etc. In India recently 3 species and 2 subspecies of this genus is described with the help of integrated taxonomy. The genus is a complex and is in a strong need to revise its taxonomy. With the use of integrated approach a palearctic species of *Olepa* is reported from India by the author recently. In the presentation the complete journey of describing the species and the reporting of new record is given.

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**Parasitic personalities: consistent individual differences in behavior in a facultatively parasitic mite** - Host attachment is a necessary behavior in the evolution of parasitism. It is hypothesized that populations pass through a stage of facultative parasitism before the evolution of obligate parasitism. Previous research has revealed the impact of extrinsic factors on the expression of parasitic tendencies, but to our knowledge, the role of individual behavioral variation driving parasitic tendencies remains to be tested. Here, we used repeated behavioral assays to quantify attachment propensity and activity level of individual *Macrocheles muscaedomesticae*, facultatively parasitic mites of flies, from two different populations. Mites from both populations exhibited repeatability in attachment propensity and mites from one population exhibited repeatability in activity level. We did not find a relationship between an individual’s activity level and attachment propensity. Our data suggest that facultative parasitism may not simply describe a phenotypically plastic strategy that responds to environmental cues, but perhaps that individual differences in parasitic tendencies may appear like facultative parasitism at the population or species level.

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**The Broward College Insect Collection (BROW:BCIC): A tool to support NSF s-STEM scholars and a possible new collaborator for you in South Florida!** - The Broward College Insect Collection (BROW:BCIC) is a small collection in Ft. Lauderdale that is focused on south Florida and the greater Everglades Ecosystem. We will present how we used the collection to support students in our NSF s-STEM grant for the past 5 years, our current resources/holdings and how you may collaborate with us.

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**Organizing a statewide initiative on beekeeping: The UF/IFAS Honey Bee Extension and Education Team (HBEET)** - The University of Florida (UF), Institute of Food and Agricultural Resources (IFAS), Honey Bee Research and Extension Laboratory (HBREL) strives to offer valuable education and training to beekeepers and beekeeping educators. The Honey Bee Extension and Education Team (HBEET) is a statewide train-the-trainer initiative that was created in 2020 to develop and conduct programs that target Florida’s commercial beekeepers. The key personnel include ten UF/IFAS county faculty represented in each district across the state, one State Specialized Program Extension Agent, and one professor of entomology. Together, the group meets monthly to identify beekeeper needs, create objectives, and help with program development and evaluation. Agents also develop their own knowledge of the industry, while serving as a source of honey bee education for other agents in their districts. Some examples of projects include: creating a district beekeeping training for other UF/IFAS Extension agents, creating a honey bee pest and disease guide, translating Electronic Document Information System (EDIS) documents into Spanish, providing innovative tools and resources for beekeepers to improve business success, and creating best management practices related to honey bee health. This session will provide an overview of how this team was created, workshop content for agents, and ideas for how Florida faculty, staff, and/or students can collaborate with extension personnel throughout the state. This initiative allows a broader audience for in-person programs at the local level, leading to better management of honey bees throughout Florida and beyond.

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**Traumatic mating in the Galerucini (Coleoptera: Chrysomelidae: Galerucinae)** -
Copulatory damage during mating (termed traumatic mating) has been found in nine different phyla, and in nine orders of Arthropoda. Among arthropods, the best-known cases are the bedbugs (Siphonaptera) and some of their relatives, and the well-known fruit fly (*Drosophila melanogaster*). In Coleoptera, traumatic mating has been observed only in the Chrysomelidae subfamilies Bruchinae and Galerucinae. Traumatic mating has been intensively studied in the genus *Callisobruchus* Pic (Bruchinae), in which *Callisobruchus* males have sharp spines that have been shown to damage the female bursa. A single instance of traumatic mating has also been demonstrated in the subfamily Galerucinae, in *Metrioidea elongata* (Jac.) from Costa Rica, in which the male has long needle-like spines that penetrate the female bursa. Similar needles or very sharp spines have been found on endophalli of other Costa Rican *Metrioidea*. In this study I examined the endophalli, and the bursae of associated females, of 41 genera across all five subtribes of the Galerucini. Species in which the male endophalli have spines that could potentially damage the females were encountered across three of the largest subtribes, as were females showing puncture scars on their bursae. However, cases were also found in which males had dangerous-appearing endophalli, but females had no corresponding damage. These new data will affect evolutionary explanations of traumatic mating in Coleoptera.

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**The chemical landscape of *Phragmites australis*** *- Phragmites australis*, a wetland grass that is important for stabilizing the Louisiana coastline, has been undergoing a major die-off over the past five years. This die-off event is contributing to land loss along the Louisiana coastline, which is threatening ecosystems and commercial infrastructure critical for the function of the Mississippi River Delta. The Phragmites die-off is a multi-faceted problem and the invasive scale insect, *Nipponaclerda biwakoensis*, and microbial community are suspected to be the central causes of the die-off. Furthermore, there are different lineages of Phragmites – invasive European, introduced Delta, and introduced Gulf – that exhibit a gradient of resistance to susceptibility against the impacts from the scale insect and soil microbes and thus demonstrate differences in mortality. We used a full factorial design where we manipulated soil type from healthy and die-off soils and the presence or absence of the scale insect from three different populations of *Phragmites* within each of the three lineages – European, Delta, and Gulf. We quantified the volatiles to determine the degree to which soil, scales, and lineage influence plant odors. Preliminary results show important differences in terpene compounds, and these were associated with soil type and insect induction. Overall, these results will contribute to how the odor cues of different lineages of *Phragmites* are changing due to above-ground biotic and below-ground soil interactions and will expand our understanding of plant traits that are resistant to die-off in certain lineages.

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**Behavioral response of the hibiscus bud weevil, *Anthonomus testaceosquamosus* Linell (Coleoptera: Curculionidae) to hibiscus buds and *Anthonomus* spp. male pheromone lures** - In 2017, the hibiscus bud weevil (HBW), *Anthonomus testaceosquamosus* Linell (Coeloptera: Curculionidae) was intercepted in Florida infesting China rose hibiscus, *Hibiscus rosa-sinensis* L. Hibiscus buds fed upon and oviposited within by HBW may be aborted from plants, thus decreasing the marketability of the crop. To mitigate HBW-induced financial loss to the south Florida hibiscus industry, the development of monitoring strategies used to guide management tactics as part of an integrated pest management program for this invasive pest must be prioritized. Therefore, we sought to identify an appropriate bioassay method to study the chemical and behavioral ecology of the HBW. In doing so, we used five olfactometer types (glass y-tube, four-arm, arena, linear track, and acrylic cage) to assess the response of HBW to hibiscus buds and congeneric pheromone lures (*A. eugenii* Cano, *A. grandis* Boheman, *A. musculus* Say). In all bioassay types except the acrylic cage, restrictions in HBW movement and behavior prevented adequate response to hibiscus buds. In acrylic cage olfactometers, HBW groups containing only females, only males, and half females/half males chose hibiscus buds over empty petri dishes (control). While more HBW responded to congeneric *A. musculus* male pheromone lures than to *A. eugenii* or *A. grandis* male pheromone lures, HBW was not significantly attracted to any congeneric male pheromone lure in acrylic cage experiments. Subsequent experiments will be conducted to identify an appropriate trapping system for this pest, and to further address the behavioral responses of HBW to hibiscus volatiles and congeneric male pheromone lures.

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**Survey of potential pest and beneficial arthropods in chickpea in Florida -** Chickpea is annual legume grown commonly in the Middle East, Southern Europe, and Africa, and South America. Common chickpea pests in its Old-World range include beet armyworm, *Spodoptera exigua*; chickpea leafminer, *Liriomyza cicerina*; cowpea aphid, *Aphis craccivora*; and pod borers, *Helicoverpa armigera*. While *S. exigua* and *A. craccivora* are common in Florida, *L. cicerina* and *H. armigera* are not found in North America. The corn earworm, *H. zea*, is a potential pest of chickpea in Florida and there are three other species of *Liriomyza* found in Florida. The purpose of this study was to survey for potential pest arthropods in chickpea grown in Florida as well as for predators and parasitoids that may be involved in regulating pest populations. Wing traps baited with pheromones were used to monitor for *S. exigua* and *H. zea* adults. Yellow sticky traps were used to sample for aphids, *Liriomyza* spp., other pests, predators, and parasitoids. In situ counts were conducted bi-weekly. The presence of adults in traps and exit holes in pods indicate that *H. zea* is a pest of chickpeas in Florida. Aphids, *Liriomyza* spp., and thrips were commonly seen on yellow sticky traps. Parasitoids were the most common natural enemies counted on traps. Spiders, coccinellids, and staphylinids were the most common predators counted on traps.

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**Non-target impact of CDC-autocidal gravid traps (AGO) for control of container-inhabiting mosquitoes** *–* More than 1,600 CDC-autocidal gravid traps (AGO) were deployed in several residential subdivisions, St. Augustine, Florida for evaluation of control efficacy against container-inhabiting Aedes mosquitoes. The traps collected a few hundred mosquitoes and numerous number of non-target organisms, such as lizards, spiders, ants, beetles, roaches, flies, and other insects. The mass deployment of AGO traps reduced certain number of Aedes mosquitoes in some spots. However, the methods were highly liked and accepted by the citizens in the areas even if a high number of non-targets were collected.

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**Potential of entomopathogenic nematodes to control the Hibiscus Bud Weevil *Anthonomus testaceosquamosus* (Coleoptera: Curculionidae)** - The Hibiscus Bud Weevil (HBW) is a new and important pest for hibiscus in Florida. The state leads hibiscus production nationally and currently HBW management relies mainly on insecticides, so more environmentally sustainable alternatives are needed. Even though several biological control options have been tested against similar pests of economic importance, no biocontrol alternatives have been reported against the HBW thus far. We tested five species of entomopathogenic nematodes (EPNs) (*Heterorhabditis bacteriophora, Steinernema carpocapsae, S. kraussei, S. feltiae, S. riobrave) in comparison to a water control under laboratory conditions (27°C; 75% RH; 12:12 h L:D). Artifici*ally infested flower buds, containing larvae of different developmental stages (buds were infested with adults 4, 8 and 12 days prior to EPNs application), were individually applied with approximately 500 infective juveniles (IJ). After 4 days of applying the EPNs, observations were made on the number of surviving larvae and the number of larvae killed by EPNs per bud. The number of surviving larvae was lower in *S. carpocapsae, S. feltiae* and *S. riobrave* in comparison to water control. *Steinernema carpocapsae* and S. feltiae had greater proportion of larvae killed by EPNs. Larvae treated in earlier developmental stages (buds infested 4 and 8 days prior to application) were more susceptible than those from more advanced stages (12 days prior to application). Future experiments will evaluate *S. carpocapsae* and *S. feltiae* under greenhouse conditions, where rates of IJ and use of coadjutants will be evaluated to propose EPNs as a component of a HBW IPM program.

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**Integrated pest & pollinator management strategies for ornamental plant production** - Insecticides used during plant production can pose significant risks to adult and larval pollinators. Most pollinator toxicological data focus on bee species, but lepidopterans are also pollinators and can respond in markedly different ways than bees to the same insecticide. Consequently, many products compatible with bee conservation pose an unknown risk to larval pollinators. Using the monarch butterfly-milkweed-oleander aphid system, we conducted leaf and whole-plant feeding assays to evaluate acute toxicity and chronic effects of insecticides to monarch caterpillars.