FLORIDA ENTOMOLOGICAL SOCIETY

96TH ANNUAL MEETING PRESENTATION ABSTRACT

Naples, Florida July 14 – 17, 2013

Monday, July 15

8:00 AM – Orchid 3-4

General Session

8:00 - 8:10 AM

Welcoming remarks: Clark Lovelady, President, Florida Entomological Society

8:10 - 8:30 AM

President's Address: Going Forward with the FES. Clark Lovelady. Syngenta Crop Protection, 7145 58th Ave., Vero Beach, FL 32967

As an organization, the Florida Entomological Society, where are we going? What are the strategies we need to employ in the next several years to remain a vibrant scientific society? How can we effectively manage increasing costs to operate as a non-profit organization? What methods should be used to increase our membership and visibility in the Entomology and natural history communities? I offer up some collective ideas for these important questions.

8:30 - 9:20 AM

FES Pioneer Lecture Honoring Dr. John A. Mulrennan, Sr.: Dr. John A. Mulrennan, Sr.: An Entomology Pioneer of Florida. John A. Mulrennan, Jr. 8523 Goldeneye Lane Jacksonville, FL 32217. mulrennan9@comcast.net

Drs. John A. Mulrennan, Sr. and John A. Mulrennan, Jr. developed and nurtured mosquito control operations in Florida for more than 50 years. The most significant mosquito control event in Florida was the creation of State funds in 1949 through the efforts of John, Sr. This legislatively established program was designated for permanent control work. Later his efforts resulted in establishing the Entomological Research Center in 1953 (now the Florida Medical Entomology Laboratory (FMEL)) in Vero Beach. John A. Mulrennan, Sr. was awarded an honorary Doctor of Science degree in 1972 by the University of Florida in recognition of his high distinction in public service which exemplified the ideals of the University of Florida.

Monday, 10:00 AM- 6:00 PM – Orchid 2

Posters Session 1

[DSP 1] **The Citrus greening bibliographical database.** P. Vanaclocha and P. A. Stansly. South West Florida Research and Education Center, 2685 State Road 29 North, Immokalee, Florida 34142. pvanaclocha@ad.ufl.edu

In 2009 the Citrus greening bibliographical database, http://swfrec.ifas.ufl.edu/entomology/extension/hlb/, was created by the entomology group at the Southwest Florida Research and Education Center (SWFREC-IFAS) in collaboration with the Florida Center for Library Automation at the University of Florida. The objective of the database is to centralize information related to the most devastating disease affecting citrus groves, huanglongbing (HLB) (citrus greening disease), and the vectors of *Candidatus* Liberibacter species that cause this disease, *Diaphorina citri* Kuwayama and *Trioza erytreae* (Del Guercio). Funding was initially provided by the Citrus Research and Development Foundation. The database is continually updated and currently includes more than 3,000 entries which include refereed and non-refereed publications, proceedings, presentations, reports, extension publications, periodicals, dissertations, book chapters and abstracts. More than 90% of these references are linked to the original sources, thus facilitating bibliographical research tasks to any person or entity interested on finding information on this topic.

[DSP 2] **Foiling the yellow dragon**. Scott Croxton and Phil A. Stansly. South West Florida Research and Education Center, 2685 State Road 29 North, Immokalee, Florida 34142. croxtsd@ufl.edu

Polyethylene mulch was evaluated for deterring colonization by Asian citrus psyllid (ACP) *Diaphorina citri*, reducing incidence of huanglongbing (HLB) or citrus greening disease and accelerating growth of young citrus. UV reflective low density polyethylene mulch metalized with aluminum, low density whitefaced polyethylene mulch and bare ground all using drip irrigation in a randomized complete block design were tested and compared to the current grower standard using micro-sprinkler irrigation with four replications located at the Southwest Florida Research and Education Center in Immokalee, FL. Populations of ACP and other arthropods were monitored on new flush while ACP movement was monitored using yellow sticky cards. Incidence of HLB was evaluated twice during the 20 month study period using qPCR. Trunk cross sectional area, soil moisture, and surrounding weed biomass were also monitored. Metalized mulch reduced pest populations and HLB incidence compared to all tested alternatives. In addition, metalized mulch increased tree growth and soil moisture while reducing weed pressure. Results of this study present a good case for the use of metalized plastic mulch for young citrus plantings.

[DSP 3] **Plant resistance within the Rutaceae to Asian citrus psyllid.** David G. Hall, Ed Stover and Matthew Richardson. USDA-ARS, 2001 S. Rock Road, Fort Pierce, FL 34945. David.Hall@ars.usda.gov

Within the Aurantioideae, the only major groups of germplasm with pronounced resistance to the Asian citrus psyllid are the Trifoliates (cultivars of *Poncirus trifoliata*) and Trifoliate hybrids. Within these groups, two types of resistance to Asian citrus psyllid have been observed: antixenosis and antibiosis. Traits conferring resistance could be exploited in a conventional or transgenic breeding program for commercial citrus. Traits conferring antixenosis may likely hold promise as attractants or repellents for the psyllid.

[DSP 4] **Control of *Brevipalpus phoenicis* (Acari: Tenuipalpidae) with hot water treatments.** Katia Santos, I. Baez, M. Hennessey and J. E. Peña. Tropical Research and Education Center, 18905 SW 280th Street, Homestead, FL 33031. katiasantos@ufl.edu

Brevipalpus phoenicis is considered one of the most important vectors of citrus leprosis. Due to the recent reports of citrus leprosis in South, Central America and Mexico, major emphasis has been placed on developing quarantine methods against this mite. Citrus fruits can be immersed in water heated to control pests without inacceptable loss of market quality. Then, we tested different water temperature regimes to determine if hot water treatment is efficient to dislodge *B. phoenicis* from lemons. Sets of lemons were immersed in water baths at 53- 63^{0}C and mite survival compared with lemons held in a water bath at normal temperature (22°C). Hot water treatments were efficient dislodging immature mite and adult stages, but failed to dislodge the egg stage.

[DSP 5] **Attraction of a native Florida leafminer, *Phyllocnistis insignis*, to pheromone of an invasive citrus leafminer, *P. citrella*.** Craig P. Keathley, Lukasz L. Stelinski, and Stephen L. Lapointe. USDA-ARS-U.S. Horticultural Research Laboratory, 2001 South Rock Road, Fort Pierce, FL 34945-3030. craig.keathley@ars.usda.gov

We collected a native North American species, *Phyllocnistis insignis* (Frey & Boll) (Lepidoptera: Gracillariidae), in traps baited with a 3:1 blend of (*Z,Z,E*)-7,11,13-hexadecatrienal (triene) and (*Z,Z*)-7,11-hexadecadienal (diene), 2 components of the sex pheromone of the invasive citrus leafminer, *P. citrella* Stainton. No moths were caught in unbaited traps. *Phyllocnistis insignis* moths were found in pheromone-baited traps year round with a peak flight in May. In 3 trials designed to evaluate mating disruption of *P. citrella*, application of triene and/or a 3:1 blend of triene and diene disrupted catch of male *P. insignis.* These data suggest that efforts to disrupt mating of *P. citrella* may influence non-target populations of the congeneric leafminer species, *P. insignis.*

[DSP 6] **Preliminary surveys in east Africa for natural enemies of the invasive Cogongrass, *Imperata cylindrica* (Poaceae).** James P. Cuda, William A. Overholt, and Bruno P. Le Ru. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. jcuda@ufl.edu

Cogongrass, *Imperata cylindrica* (L.) Beauv, is an aggressive, rapidly colonizing invasive grass of pine plantations, livestock pastures, roadsides, railways, reclamation areas, and natural communities in the Florida. Once established, this federal noxious weed quickly displaces the native or planted vegetation, often forming dense monocultures that reduce the productivity and biodiversity in the invaded area and creating a fire hazard. Herbicides and mechanical/physical control practices are routinely used for controlling existing Cogongrass stands, but these conventional methods are expensive, labor intensive and not sustainable due to the weed's regenerative capacity from its extensive rhizomes. In February 2013, Cogongrass was surveyed at 13 localities in the vicinity of Njombe, Tanzania, where the plant is endemic. In total, 572 larvae of an undescribed stem boring moth of the genus *Acrapex* (Lepidoptera: Noctuidae) were collected and transported under permit to containment laboratories in Nairobi, Kenya and Ft. Pierce, Florida. From these field-collected larvae, 26 adults emerged and mated. Female

fecundity (total egg production) and fertility (number of viable eggs) were 582 and 191, respectively. Because previous studies have shown that *Acrapex* spp. are Cogongrass specialists, laboratory colonies will be established in Kenya and the USA in order to conduct biological and host range studies.

Monday, 10:00 AM – 12:00 PM – Orchid 1

Workshop: Removing Honey Bees from Structures (2 CEUs in GHP will be available)

Organizer: William H. Kern, Jr. Ft. Lauderdale Research and Education Center, IFAS, University of Florida, 3205 College Ave., Davie, FL 33314. whk@ufl.edu

Swarming Honey bees, *Apis mellifera*, invading structure to establish colonies has become an increasing problem in Florida, Louisiana, and several western States. This workshop will discuss honey bee biology and how to remove honey bee colonies from structures. Both lethal pest control techniques and non-lethal beekeeper techniques will be discussed and demonstrated. The target audience includes pest control professionals and beekeepers interested in doing live bee removals.

Monday, 10:10 – 11:51 AM – Orchid 3-4

Master's Student Competition

Dan Hahn, Student Activities Committee Chair, Department of Entomology and Nematology, College of Agriculture and Life Sciences. dahahn@ufl.edu.

10:10 – Introduction

10:15

[1] **Influence of varietal planting on the abundance and distribution of *Frankliniella bispinosa* in southern highbush blueberries in Florida**. Tamika Garrick and Oscar E. Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. tgarrick09@ufl.edu

Blueberry varieties are usually grown in mixed stands to encourage pollination or in a pure stand where only one variety is grown in a small block. The use of mixed plots is an IPM cultural tactic that can be used to reduce the abundance of some pests. We evaluated varietal planting patterns of southern highbush (SHB) blueberry (*Vaccinium corymbosum* L. × *V. darrowi* Camp) varieties to determine its effect on the abundance of *Frankliniella bispinosa* (Morgan) during two field seasons in Central Florida. A RBD with 3 treatments was used: treatments 1 and 2 consisted of a single variety of SHB (Emerald or Jewel) and treatment 3 was a mixed planting of these two blueberry varieties (Emerald and Jewel). Thrips population was monitored by inspecting flower clusters. Approximately 5 flower clusters were collected randomly from each plot on a weekly basis. Thrips found in flower clusters were counted using the 'shake and rinse'

method. The number of thrips collected from flower and trap counts were recorded and analyzed using Repeated measures ANOVA. The results showed that planting SHB blueberries in a mixed stand or as single stands in small blocks does not have an effect on thrips population early in the season; however differences were observed later in the season during the peak flowering period. Therefore, growers who plant small blocks of SHB cannot depend on this method to control thrips in blueberries.

10:27

[2] **Effect of soil temperature on survival and wood-consumption rate of four subterranean termite species (Isoptera: Rhinotermitidae).** Runxin Cao and Nan-Yao Su. Ft. Lauderdale Research and Education Center, University of Florida, 3205 College Ave, Davie, FL33314. caorunxin@ufl.edu

Survivorship and wood-consumption rate are two variables to measure the fitness and activity of subterranean termites. This study examined the effect of soil temperature on survival and wood-consumption rate of four economic important species of subterranean termite, *Coptotermes formosanus, C. gestroi, Reticulitermes virginicus* and *R. flavipes*. The experiment was conducted in incubators at 10, 15, 20, 25, 30, 35°C under ≈99% relative humidity in constant darkness. Survival and wood-consumption rate were analyzed using two-way ANOVA with species and temperature as independent variables. The result showed that in the medium temperatures of 20 and 25°C, the survival and wood-consumption rate were not significantly different among four species, while at the extreme temperature of 10, 15, 35°C, both variables were significantly different. *Reticulitermes flavipes* survived at 10°C but not at 35°C. The activity of *C. gestroi* was high at 35°C but did not survive at 10°C. The result may be used to explain the geographic distribution patterns of these four subterranean termite species and to predict the potential areas of their invasions.

10:39

[3] **Purification and characterization of acetylcholinesterase from *Drosophila suzukii.*** Valeria S. M. Valbuena, Katherine M. Walstrom, and Elzie McCord, Jr. New College of Florida, 5800 Bay Shore Rd, Sarasota, FL 34243. valeria.valbuena@ncf.edu

Drosophila suzukii (Matsumura) is an invasive fly species and a current agricultural threat to soft peel fruit, such as strawberries and cherries, in the United States. Native to South East Asia, *D. suzukii* females have a serrated ovipositor that enables them to pierce the skin of ripening fruit to lay their eggs inside, which leads to the eventual decay of the fruit. *D. suzukii* has been exposed to pesticides throughout Asia, which may have conferred resistance via a mutated form of the enzyme acetylcholinesterase (AChE). AChE carries out a key step in the termination of synaptic transmission by hydrolyzing the neurotransmitter acetylcholine. AChE is the target of many current pesticides because its inhibition leads to ataxia, convulsions, and eventual death in the insects. In this study, AChE was purified from the heads of 5 day old *D. suzukii* flies by sequential extraction procedures followed by size exclusion chromatography. The partially purified AChE was used to optimize the pH and temperature of the reaction. Protein concentration assays were completed to calculate specific activity, and kinetic assays were

performed. A K_m value of 27 +/- 2 μM and a specific activity of 0.23 units/mg of protein were determined.

10:51

[4] **Evaluation of baits and trap designs for monitoring spotted wing drosophila, *Drosophila suzukii* (Matsumura) in Florida blueberries.** Lindsy E. Iglesias and Oscar E. Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. liglesias@ufl.edu

The spotted wing drosophila (SWD) *Drosophila suzukii* (Matsumura) has become a serious threat to Florida's blueberry industry. Females oviposit under the skin of ripening fruit where larvae develop, rendering the fruit unmarketable. Effective monitoring for SWD is necessary to anticipate outbreaks and guide control actions. A field trapping study was conducted to evaluate the effectiveness of different trap designs baited with apple cider vinegar (ACV) with dish detergent. These designs were compared with the commonly recommended yeast baited trap design. A total of 4 treatments were evaluated. Experimental designs were RCBD with 4 replicates. The basic plastic cup trap baited with ACV and dish detergent served as the control. Other treatments were modifications of the basic trap; treatment 2 had a yellow visual stimulus and treatment 3 had a yellow sticky card placed inside. The fourth used the same trap design as treatment 3; however, the commonly recommended yeast mixture was used as bait. A second study evaluated the attractiveness of different industry recommended baits to SWD in the field. The standard plastic cup design was used as the trap. Treatments included ACV, yeast-sugar mixture, a yeast-flour-ACV mixture, and rice vinegar-red grape wine mixture, all with dish detergent added as a surfactant. Results from the trapping study show little difference between the ACV trap designs. The yeast-baited trap performed much better at capturing SWD in the field. Our results from the bait study suggest that traps baited with yeast perform better than the ACV or wine-vinegar mixture when serviced weekly.

11:03

[5] **Evaluation of trap types and attractants for large scale monitoring of bark and ambrosia beetles (Curculionidea: Scolytinae & Platypodinae).** Sedonia Steininger, Andrea Lucky and Jiri Hulcr. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. m.sedonia@ufl.edu

Trapping studies show that bark and ambrosia beetles (Curculionidea: Scolytinae & Platypodinae) are abundant and diverse in Florida, with several introduced species of economic importance, and new introductions increasing in frequency. Future monitoring efforts can be aided by wider availability of traps, however, traps and attractants that are typically used are unavailable to the general public. The goal of this study was to develop a simple, effective trap using easily obtained materials that can be made and deployed by anyone interested in monitoring or collecting these insects, including forest managers, parks personnel and citizen scientists. We compared the effectiveness of three different trap types and, separately, four different attractants. In comparing three different configurations of window traps made from plastic 2-litre soda bottles, we found that simple, one-window traps captured the greatest number of species whereas

one-window traps painted brown captured the most individuals. Two-window traps captured neither the most, nor the fewest, individuals or species. A comparison of attractants in two-window traps found that 95% ethanol, which is not readily available to the public, attracted the highest number of species but that Purell hand sanitizer (70% ethanol) and then Germ-X hand sanitizer (63% ethanol) were also reasonably effective. A lure of Purell hanging over a trap filled with Prestone low-tox antifreeze attracted the fewest species and individuals. In conclusion, we suggest that simple one-window soda bottle traps baited with ethanol-based hand sanitizer will be simple, effective and inexpensive tools for large scale monitoring of bark and ambrosia beetles.

11:15

[6] **Control twospotted spider mites with your smartphone.** Ruohan Liu, Menghan Wang and Oscar Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. ruohan@ufl.edu

We developed a smartphone based application to visualize twospotted spider mite (*Tetranychus urticae* Koch) damage on strawberries and provide control suggestion in real-time. Twospottd spider mites (TSSM) feed on strawberry leaves results in a reduction in chlorophyll, which causes a discoloration effect that can be detected by analyzing the image taken by the cameras. This application supports the growers in detecting the infestation of TSSM before the population exceeds economic threshold, and gives control suggestion to optimize the control effectiveness. This application was trained though machine learning process. Support vector machine is used as the classification algorithm, and two feature vector collecting methods were involved in this study. One is averaging R, G and B value of all pixels for each photo, another one is calibrating the ratios of pixels falling in each class. During 2012 to 2013 field season, 500 strawberries foliar samples with different amount of TSSM were selected for the training process and 500 leaves were randomly taken for practice process. Both front side and back side of the leaves were taken for comparison. We found classification using the back side gives better results than those using the front side. By using the threshold of 30 mites per leaf, the judgment ratio of using average R, G, and B value performance % accuracy, which is significantly higher than classifying the ratios of pixels.

11:27

[7] **The Influence of diet on egg formation in *Tamarixia radiata* (Waterston) (Hymenoptera: Eulophidae), a parasitoid of *Diaphorina citri* (Kuwayama) (Hemiptera: Psyllidae).** Xulin Chen and Phil Stansly. South West Florida Research and Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142. xulin527@ufl.edu

Tamarixia radiata, is an arrhenotokous ectoparasite of *Diaphorina citri*, vector of citrus greening disease or huanglongbing. The incidence of parasitism was generally low in the early growing season, suggesting a need for mass-rearing parasitoids for release, requiring temporary storage. During the holding period, food provided to females may affect the number of eggs formed in ovaries, which may influence their efficiency as a biocontrol agent upon release. In this experiment, each pair of newly emerged *T. radiata* was placed in a 50 ml centrifuge tube and

stored in a growth chamber at 17°C. Wasps were provided with 8 different diet treatments: water, honey, Nu-Lure, host nymphs, honey+ Nu-Lure, honey+ host nymphs, Nu-Lure+ host nymphs, and honey+ Nu-Lure + host nymphs. *T. radiata* females under each different treatment were dissected after 5, 10, 15, and 20 d. Results showed that, an average of 4.6 eggs were observed in ovaries of newly emerged female *T. radiata*, so they may use reserve nutrition from larval stages to form the first clutch of eggs. Honey alone was enough to keep wasps females alive, but egg resorption took place within 5 days after emergence. The combination of honey + Nu-Lure resulted in female survivorship similar to a diet of host nymphs, but egg formation was still less with nymphs provided. *T. radiata* formed more eggs feeding on mixed diets (Nu-Lure+ honey+ nymphs or Nu-Lure+ nymphs) compared to nymphs alone. Until now, no diet has been found as a complete substitute for nymphal hemolymph.

11:39

[8] (cancelled)

11:51 - *End of Master's Competition*

1:30 – 5:00 PM – Orchid 3-4

Symposium: Exotic Whitefly (2 CEUs in L&O will be available)

Organizer: Cindy McKenzie, US Horticultural Research Laboratory, ARS-USDA, 2001 South Rock Road, Fort Pierce, FL 34945.

1:30 Introduction

1:35

[9] **Past, present and possible future: The history of whiteflies in Florida as a taste of things to come?** Ian Stocks. Division of Plant Industry, Florida Dept. Agriculture & Consumer Services, 1911 SW 34th St., Gainesville, Florida 32608. ian.stocks@freshfromflorida.com

Historical reports indicate that >75 species of whiteflies have been recorded in Florida since ~1900. Some became major pests, many did not, and many of the major pests were eventually controlled using chemical, biological, cultural or integrated management techniques, or for reasons that are unknown. Adventive species routinely appear, such as Rugose Spiraling whitefly, Bondar's Nesting whitefly and Ficus whitefly, and require that management programs be developed. This trend is likely to continue, as several species in the genus *Aleurodicus* alone are 'knocking on the door'.

1:55

[10] **Whitefly outreach-updates from collaborative efforts**. Amanda Hodges. Department of Entomology and Nematology, University of Florida, IFAS, Steinmetz Building., 970 Natural Area Drive, P.O. Box 110620, Gainesville, FL 32611. achodges@ufl.edu

During 2012, the University of Florida, IFAS extension partnered with several counties, FDACS-DPI, and the USDA-APHIS-PPQ to launch the Florida Whitefly website (http://flwhitefly.org/). Specifically, a need was expressed to provide online certification for Florida's landscape professionals due to urgent and pending whitefly management issues in south Florida. To date, almost 300 learners have completed the online module for landscape professionals. The scripted PowerPoint presentation for educators of landscape professionals has been downloaded over 43,000 times. The Florida whitefly website and educational materials have been promoted at various extension conferences and professional training events. Landscape professionals and homeowners continue to request and demand information on Florida whiteflies as these invasive species continue to spread.

2:15

[11] **Responding to an invasive species at the community level.** Lance S. Osborne and the Palm Beach Whitefly Task Force. Mid-Florida Research and Education Center, University of Florida, 2725 Binion Road, Apopka, FL 32703-8504. lsosborn@ufl.edu

A local task force was organized in the city of Palm Beach to address issues with invasive whiteflies. We wanted to develop a system for addressing not just one specific invasive species but a system that could be used in the future of other pests threatening the community. The three major guiding principles were: be as inclusive as possible, work with those impacted to achieve a reasonable outcome and develop the framework for addressing future invasive species.

2:35

[12] **Biology and population dynamics of ficus whitefly, *Singiella simplex*.** Catharine Mannion and Holly Glenn. Tropical Research and Education Center, University of Florida, 18905 SW 280th Street, Homestead, FL 33031. cmannion@ufl.edu

The ficus whitefly, *Singiella simplex*, is an invasive pest first observed in 2007 and is known to only attack ficus species. The whitefly life cycle is approximately one month and remains somewhat cyclical with monthly peak populations of adults. Adults were monitored using yellow sticky traps for 4 years. The influence of direction and temperature/season will be discussed.

Break 2:55 - 3:15 – Orchid Foyer

Symposium: Exotic Whitefly (continue)

3:15

[13] **Collaborative efforts to develop a biological control program for the rugose spiraling whitefly.** A. Francis, K. Hibbard, and T. Smith. Florida Dept. of Agriculture and Consumer Services – Division of Plant Industry, 45 Virginia Park Blvd, Fort Pierce, FL 34947. Antonio.Francis@FreshFromFlorida.com

Florida Department of Agriculture and Consumer Services – Division of Plant Industry is engaged in mitigation efforts along with key partners to combat several exotic whitefly pests damaging landscape and ornamental plants in Florida. One of the principal species is the rugose spiraling whitefly, *Aleurodicus rugioperculatus* Martin. Present activities include surveys to collect, identify, and document natural enemies found attacking this species and the evaluation of associated parasitoid and predator species. *Encarsia guadeloupae* Viggiani, an aphelinid parasitoid recovered from the rugose spiraling whitefly, is being evaluated to determine its efficacy as a control agent. Additionally, several tropical plants are undergoing host preference testing, with the objective of mass rearing the whitefly for natural enemy production and release.

3:35

[14] **Host plant preference and oviposition characteristics of the rugose spiraling whitefly (*Aleurodicus rugioperculatus*)**. Siavash Taravati and Catharine Mannion, Tropical Research and Education Center, University of Florida, 18905 SW 280th st., Homestead, FL 33031. siavashtaravati@ufl.edu
Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* Martin, is an invasive species in South Florida which was first found in 2009. It feeds on over 60 plant species including avocado (*Persea americana*), black olive (*Bucida buceras*), *Calophyllum* spp., coconut (*Cocos nucifera*) and gumbo limbo (*Bursera simaruba*). In order to better understand the biology of this pest, two experiments were conducted to study its oviposition characteristics. First, the correlation between leaf size, spiral size and number of eggs per spiral was measured on a common host plant (gumbo limbo). The mean and 95% CI for number of eggs per spiral was 22.8 ± 1.6 and a modest positive correlation was found between the spiral area and number of eggs. However, no significant difference was found between the number of eggs laid on fresh versus non-fresh leaves 2) The ovipositional preference of RSW was studied by exposing the whiteflies to five different host plants. No significant difference was found among the number of eggs laid on each plant species.

3:55

[15] **Rugose spiraling whitefly and prospects for biological control by parasitoids.** Anthony Boughton, Siavash Taravati, Catharine Mannion and Lance Osborne. Tropical Research and Education Center, University of Florida, 18905 SW 280th st., Homestead, FL 33031. aboughton@ufl.edu

Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* (Homoptera; Aleyrodidae), is an exotic whitefly that recently invaded south Florida and has become a serious pest on landscape plants in urban communities. Whitefly nymphs excrete large quantities of sticky honeydew as they feed. When infestations occur on trees or palms in urban areas, and honeydew falls on sidewalks, patios and cars, RSW can become a serious nuisance pest. Current management is based on chemical insecticides, but treatments are expensive and typically don't remove whiteflies from all infested plants in an area. Various natural enemies, including several parasitoid species are known to attack RSW in south Florida and are thought to have potential for suppressing whitefly populations. We present what is known about parasitoids attacking RSW in south Florida, including preliminary life history information on one species, *Encarsia noyesi*

(Hymenoptera: Aphelinidae), and discuss prospects for the use of these species in a biological control program against RSW.

4:15

[16] **Giant whitefly (Aleurodicus dugesii) as a surrogate for evaluating the parasitoid wasp (*Encarsiella noysei*) for potential biological control of Rugose Spiraling Whitefly (*Aleurodicus rugioperculatus*).** Yingfang Xiao, Lance Osborne, Cindy McKenzie, Vivek Kumar, Junjian Chen, and Siavash Taravati. Mid-Florida Research and Education Center, University of Florida, 2725 Binion Road, Apopka, FL 32703-8504. yfxiao@ufl.edu

Both Giant whitefly (GW), *Aleurodicus dugesii* and Rugose Spiraling Whitefly (RSWF), *Aleurodicus rugioperculatus*, are whitefly pests in Florida landscapes. Giant whitefly was first discovered in Florida in 1996 while Rugose Spiraling Whitefly was discovered in March 2009. To develop a rearing system for the parasitoid *(Encarsiella noysei)* for release against the RSWF, we needed to know more about the biology of the GW and this parasitoid. The experiments we have conducted include: (a) life cycle studies of GW whitefly (non-parasitized and parasitized) on major host plants; (b) evaluated parasitism and determined host stage or preference of the parasitoid on various host plants grown under greenhouse conditions.

4:35 –Discussion

5:00 – *End of Symposium*

Monday, 3:15 – 4:56 PM – Orchid 1

Ph.D. Student Competition

Dan Hahn, Student Activities Committee Chair, Department of Entomology and Nematology**,** College of Agriculture and Life Sciences**.** dahahn@ufl.edu

3:15 Introduction

3:20

[17] **Asian citrus psyllid seasonal movement and spatial distribution patterns.** Scott Croxton and Phil Stansly. South West Florida Research and Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142. croxtsd@ufl.edu

Asian citrus psyllid movement was monitored as several scales in Florida citrus groves to determine movement patterns. Movement was monitored from the individual tree level up to between block movement using yellow sticky traps collected at 14 day intervals for 26 months. ACP movements were tracked into and out of citrus blocks for migration patterns using sticky traps. These sticky traps were placed in a perimeter 30 feet outside of citrus blocks and in surrounding unmanaged areas on wooden stakes at heights of 3 and 6 ft. Two-sided sticky traps attached to wooden stakes provide the additional benefit of indicating direction of psyllid

movement when captured. In addition within canopy movements were monitored by placing sticky cards in the canopy of individual trees at 4, 8, and 12 ft heights on both the east and west sides of the trees. Finally sticky cards were placed on tomato stakes between areas of high management low ACP populations and low management high ACP populations to determine movement between the two practices of citrus management. These cards were marked so that direction of ACP movement could be monitored. Monitoring ACP movement at these levels allows characterization of distinct patterns to emerge. Groves being monitored were all located in Hendry and Collier County.

3:32

[18] **Morphometric analysis of the Asian citrus psyllid, *Diaphorina citri* in Alachua and Collier counties.** Thomson M. Paris, Scott D. Croxton, Philip A. Stansly and Sandra A. Allan. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. thomsonparis@ufl.edu

Several psyllid species such as the pear psyllid have different seasonal form characterized by different wing shape and length. Longer wing length in insects may enhance dispersal capacity, while at the same time decreasing reproductive capacity. Preliminary observations have been made of different seasonal forms, however, they have not been well documented. Asian citrus psyllids were obtained from citrus orchards from monthly aspirator collections in Alachua and Collier Co. and weekly from suction traps in Collier Co. High resolution digital photographs were obtained using a Keyence observation system with a high performance zoom lens. Using computer software, seven measurements from the wings and tibia were obtained. Principal component analysis of the measurement data was conducted to examine the effect of time of year. Additionally, location with respect to groves and height of suction trap were considered.

3:44

[19] **Termite molting: a spatial and temporal assessment**. Garima Kakkar, Thomas Chouvenc and Nan-Yao Su. Ft. Lauderdale Research and Education Center, IFAS, University of Florida, 3205 College Avenue, Davie, FL 33314. garimaiari@ufl.edu

Chitin synthesis inhibitor (CSI)-based baiting programs have been successful in eliminating subterranean termite field colonies. In *Coptotermes formosanus* Shiraki, it takes around 3 months to eliminate a colony with noviflumuron (CSI) bait. Although the slow acting CSIs allow the toxicant to spread in a colony of millions of individuals, there is an incentive to reduce the duration of the treatment for economic purpose. CSI's are insect growth regulators that affect the molting process of workers in lower termites. Thus, for accelerating the activity of CSI baits, it is crucial to determine the molting process of workers in a colony. This study provides information on the time and site of *C. formosanus* workers molting in a colony. Results will help determine how long it may take for an individual to be affected by CSI and its site of mortality which may be useful in avoiding any secondary repellency.

3:56

[20] **Regulation of relative humidity through evaporative water loss in termites.** John Zukowski and Nan-Yao Su. Ft. Lauderdale Research and Education Center, IFAS, University of Florida, 3205 College Avenue, Davie, FL 33314. jzukows2@ufl.edu

As a group, termites are considered to be one of the more desiccation prone insects. This is mostly attributed to their soft bodies and small size. Termites address the problem of desiccation through behavioral and physiological means, both as individuals and as a group. One way appears to be through the regulation of relative humidity in the immediate environment of the nest and adjoining tunnels and tubes. This regulation is accomplished through the release and uptake of water vapor through the cuticle. Here we evaluated the amount of water lost (as a function of weight) and its use in the regulation of humidity levels in an experimental chamber by four species of termite. *Cryptotermes brevis* (Walker), *Cryptotermes cavifrons* Banks, *Coptotermes formosanus* Shiraki, and *Neotermes jouteli* (Banks) were collected and placed in a chamber where humidity levels were monitored for two days. Lacking food and free water, the termites were able to regulate the relative humidity level of the chamber for some time, albeit at different percentages. *Cryptotermes brevis* had the lowest relative humidity plateau of the four, reflecting its tolerance to dry conditions such as those found in the structural timber they infest.

4:08

[21] **Effect of cultural practices on *Blissus insularis* densities in St. Augustinegrass**. Navneet Kaur and Eileen A. Buss. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. nkaur8@ufl.edu

The southern chinch bug, *Blissus insularis* (Barber) is a major insect pest of St. Augustinegrass. Feeding damage stunts plant growth and kills entire lawn, often requiring new sod and frequent insecticide applications in Florida. Because of the repeated development of insecticide resistance, cultural practices that maintain quality turf grass and reduce insect abundance are needed. Thus, we sought to determine the impact of nitrogen fertilization and mowing height) on turf health and subsequent *B. insularis* densities. St. Augustinegrass cultivars 'Floratam' and 'Captiva' were treated with 100-300 kg nitrogen/ha/yr using soluble and slow release sources in 2011. Significantly more *B. insularis* were collected from Floratam plots that received the highest N rate (300 kg/ha/yr), regardless of the source, in contrast to Captiva which contained few *B. insularis*. However, no significant differences existed among the two cultivars as measured by *B. insularis* survival, development rate, and fecundity in a previous laboratory bioassay. In a field study in 2012, N fertilizer rate (100 and 200 kg/ha/yr) and mowing height (5 and 10 cm) did not interact, but plots with taller mow turf (10 cm) contained more *B. insularis* than plots with shorter turf (5 cm). Higher densities in the taller turf can be explained by the differences in the microclimate within the grass canopy providing protection from the temperature extremes. Based on the results of this study, we recommend modifying the cultural practices in St. Augustinegrass lawns to reduce the requisite of insecticides for *B. insularis* management.

4:20

[22] **Insecticide bioassays against corn-infesting Ulidiidae.** David Owens, Gregg Nuessly, and Nick Larsen. Everglades Research and Education Center, University of Florida, 3200 E. Palm Beach Rd, Belle Glade, FL 33430. owensd119@ufl.edu

Sweet corn scouts have reported difficulty in managing the "corn silk fly" species complex. Current management options for controlling these flies are limited to pyrethroid sprays and a couple of organophosphate applications during the ear formation stages. Contact insecticide tests using several pyrethroids indicate that *Euxesta stigmatias* are becoming resistant to several pyrethroids. Piperonyl butoxide restored treatment efficacy. Tests with *E. eluta* indicate that this species is more sensitive to pyrethroids than *E. stigmatias*.

4:32

[23] **Susceptibility of tropical sod webworm (Lepidoptera: Crambidae) to entomopathogenic nematodes (Rhabditida: Steinernematidae and Heterorhabditidae): Effect of nematode species and larval size.** Nastaran Tofangsazi, Ron Cherry and Steven Arthurs. Mid Florida Research and Education Center, University of Florida, Apopka, FL 32703. ntsazi@ufl.edu

We evaluated the pathogenicity of *Steinernema carpocapsae, S. feltiae, Heterorhabditis bacteriophora, H. megidis* and *H. indica* against different larval size of *Herpetogramma phaeopteralis*. All tested EPN species were pathogenic to *H. phaeopteralis* in the laboratory, but *S. carpocapsae* was the most effective. The mean lethal concentration was not significantly different for three different larval size, (based on overlap 95% CL) with the exception of *H. indica*. The mean number of IJs produced per White trap was significantly higher by larvae infected by *H. bacteriophora*. "Millenium(R), a proprietary formulation of *S. carpocapsae* for Turfgrass, was chosen for further experiments in greenhouse. Overall the neonicotinoid, clothianidin, provided the best *H. phaeopteralis* control but greenhouse experiments also revealed that the label rate (10^6 IJ/liter) of *S. carpocapsae* reduced webworm populations by 83-93%, and was as effective as clothianidin against larger size larvae. Our data suggest that *S.carpocapsae* can be a good option for *H. phaeopteralis* biocontrol but further field studies for its potential to manage *H. phaeopteralis* under different environmental conditions are advisable.

4:44

[24] **Evaluation of OMRI approved insecticides for control of silverleaf whitefly and conservation of beneficial insects in organic squash.** Janine Razze and Oscar E. Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. jrazze@ufl.edu

Organic zucchini squash is a high value vegetable crop in Florida and potential exists to expand its production throughout the state. A lack of knowledge on the effectiveness of OMRI approved products is one of the constraints to organic squash production in Florida. Research on the effectiveness of OMRI approved insecticides for managing whitefly populations in squash as

well as their effects on natural enemies will provide additional information on how these insecticides can be used to regulate pest populations. The objectives of this study were to evaluate the effect of OMRI approved insecticides that can be used to control the silverleaf whitefly, *Bemisia tabaci* B biotype, on organically grown squash; and to determine the effect of selected insecticides on a key natural enemy, *Delphastus catalinae*. The first experiment compared the effects of four OMRI approved insecticides and an untreated control on whitefly densities. Insecticides include 1)Aza-Sol, 2)PyGanic EC 1.4, 3)M-Pede, 4)Entrust, and 5)untreated control. The second experiment investigated the effect of OMRI approved insecticides on *D. catalinae*. Treatment effectiveness was evaluated 1, 3 and 5 days post-treatment. Based on the findings from the first experiment, PyGanic and M-Pede were highly effective at controlling whitefly populations on squash. This study will be important for providing information on how insecticides can be used in combination with natural enemies to regulate pest populations in organic crop systems.

4:56 - End of Ph.D. Student Competition

Tuesday Morning, July 16

8:00 AM– 12:00 PM

REGISTRATION – *Meeting Planner Office*

8:00 AM – 5:00 PM – Sea Grape

OFFICE/PRESENTATION PREVIEW - Collection of Presentations –

Tuesday, 8:30 – 11:30 AM – Orchid 3-4

Submitted Papers Session 1

8:30 Introduction

8:35

[25] **A vector-focused method for evaluating weeds as hosts of tomato yellow leaf curl virus.** Hugh A. Smith, Gary E. Vallad, and Keri L. Druffel. Gulf Coast Research and Education Center, University of Florida 14625 CR 672, Wimauma, FL, 33598. hughasmith@ufl.edu

Twelve weeds common to Florida farms were evaluated as hosts of Tomato Yellow Leaf Curl virus, a geminivirus vectored by the silverleaf whitefly, *Bemisia tabaci* biotype B. Weeds evaluated were known whitefly hosts, and were evaluated in cages containing only one weed species. Whitefly adults reared on tomato infected with TYLCV and therefore putatively viruliferous were introduced into cages containing test plants in week 1. New weeds were added to cages over an 8 week period to allow subsequent generations of whitefly to develop on fresh plants. At 10 weeks, tomato plants susceptible to TYLCV were placed in each cage as indicator plants to determine if viruliferous whiteflies were present in the cage. Susceptible tomato was used as a positive control, and cotton, a confirmed non-host of TYLCV, was used as a negative

control. Whitefly adults were collected from each cage periodically and tested for TYLCV using PCR. Tissue from weed and control plants was tested periodically for TYLCV, as were tissue and whitefly from the indicator tomatoes in the last weeks of the trial. Whiteflies tested at week 1 were consistently viruliferous, indicating that all weed species were exposed to high numbers of viruliferous whiteflies. No weeds tested positive for virus, and over time whiteflies established on weeds consistently tested negative for TYLCV. The positive control and whiteflies associated with it were consistently positive for TYLCV. Only indicator tomatoes in the positive control tested positive for TYLCV.

8:47

[26] **Growth and development of *Metamasius callizona* on different host Bromeliads.** Teresa M. Cooper, Ronald D. Cave and J. Howard Frank. Indian River Research and Education Center, University of Florida, 2199 South Rock Rd., Ft. Pierce, Florida 34945. tmcooper@ufl.edu

Metamasius callizona is an invasive bromeliad-eating weevil that is destroying native bromeliad populations in Florida. The weevil is from Mexico, Guatemala, and Belize. We have searched in Central America for a classical biological control agent to control the weevil. We found a parasitoid fly on a related species of bromeliad-eating weevil in Honduras, but we have never found a parasitoid or specialist natural enemy associated with *M. callizona* populations in Central America. Florida has 12 species of bromeliads that are susceptible to attack by the weevil. Weevil infestations on two of these species, *Tillandsia utriculata* and *T. fasciculata*, have been monitored. The weevil has greater abundance on *T .utriculata* than on *T. fasciculata*. In Central America, *T. utriculata* grows in the presence of the weevil without the devastation experienced in Florida. We have begun preliminary studies to understand the differences between host species (*T. fasciculata* versus *T. utriculata* in Florida) and varieties (*T. utriculata* in Florida versus *T. utriculata* in Central America) and how these differences affect the weevil's demographics. Such research may lead to the development of a variety of *T. utriculata* in Florida that is more resistant to the weevil.

8:59

[27] **Risk Assessment of the egg parasitoid *Trissolcus halyomorphae* (Scelionidae) for biocontrol of the brown marmorated stink bug, *Halyomorpha halys* (Pentatomidae) in the USA.** Julio Medal, Trevor Smith, Andrew Santa Cruz, Kim Hoelmer, Christine Dieckoff, Katherine Tatman, and Jones Walker. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 1911 SW 34th St. Gainesville, FL 32614. Julio.Medal@freshfromflorida.com

Host-specificity tests were conducted February 2012- May 2013 at the FDACS-DPI quarantine facility in Gainesville, Florida. The egg-parasitoid *Trissolcus halyomorphae* (Scelionidae), introduced from China, was exposed to egg masses of the brown marmorated stink bug, *Halyomorpha halys* (Pentatomidae). This stink bug was found in Pennsylvania, USA in 1998, probably introduced in packing material. In 2013, it was reported in 38 states and is causing significant damage to tree fruit, legumes and vegetables. This stink bug has been intercepted several times in Florida during the last few years, but apparently is not yet established. As part

of the risk-assessment to release the egg parasitoid, choice and no-choice oviposition tests were conducted with twenty species of phytophagous and predatory stink bugs. Results indicated that the egg-parasitoid prefers the target pest, and most of the non targets tested (11) showed no parasitoid development and 8 had a low to moderate level of parasitoid emergence.

9:11

[28] **Monitoring blueberry gall midge (*Dasineura oxycoccana* Johnson) and mapping the distribution of the midge and its parasitoids in rabbiteye blueberries.** Elena M. Rhodes and Oscar E. Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. erhodes@ufl.edu

As much as 80% of a rabbiteye blueberry planting can be injured by blueberry gall midge (BGM), *Dasineura oxycoccana* Johnson larvae feeding in developing buds. Emergence and panel traps are both effective monitoring tools for BGM, but no comparisons between them have been made. Surveys for natural enemies conducted in north-central Florida from 2007 to 2010 found numerous platygastrids and eulophids active in blueberry plantings. The objectives of this study were to 1) compare the effectiveness of emergence and panel traps for monitoring BGM and 2) to model the distribution of BGM and its parasitoids in a rabbiteye blueberry field. Experiments were conducted at an organic rabbiteye blueberry farm in Gainesville, FL in 2012 and 2013. Emergence traps, panel traps, and modified panel traps were compared in a RCBD with 4 replicates at 3 field sites, 2 in 2012 and 1 in 2013. Bud samples were also collected to determine how well the traps predicted larval numbers. To model the distribution of BGM and its parasitoids, a grid of 25 sample points was setup in both years. Emergence and yellow sticky traps were used to monitor BGM and parasitoid adults, respectively. Bud samples were collected to monitor BGM and parasitoid larvae. Emergence traps were more effective at low population densities. Panel traps were as effective as emergence traps at higher population densities. Both BGM and its parasitoids tend to be randomly distributed in the blueberry planting.

9:23

[29] **Mass rearing and release of *Lilioceris cheni* (Coleoptera: Chrysomelidae), biological control agent of air potato, *Dioscorea bulbifera,* in Florida.** Eric Rohrig, Trevor Smith, Ken Hibbard and Min Rayamajhi. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 1911 SW 34th Street, Gainesville, Florida 32608. Eric.Rohrig@freshfromflorida.com

Air potato, *Dioscorea bulbifera*, is an invasive, aggressive, high climbing vine which forms dense blankets smothering native trees and understory plant species. It is considered one of the more common natural area weeds in Florida with infestations recorded from over 30 counties. Air potato is listed as a noxious weed by the Florida Department of Agriculture and a Category I invasive plant by the Florida Exotic Pest Plant Council. A biological control program was initiated at the USDA-ARS-IPRL after discovering *Lilioceris cheni* attacking *Dioscorea bulbifera* in the Katmandu Valley of Nepal in 2002. Both larvae and adults are voracious feeders. A single individual is capable of consuming approximately 30 square feet of leaf tissue in its lifetime. After extensive host range testing was complete, a permit to release *L. cheni* was issued

in 2011. FDACS-DPI, in collaboration with USDA-ARS-IPRL, began limited releases of *L. cheni* in central and south Florida in summer of 2012. Beetle populations increased at release sites inducing varying levels of damage and successfully overwintered into 2013. Mass rearing and release of *L. cheni* will distribute beetles to public and private lands throughout Florida to combat *D. bulbifera* and reduce herbicide use.

9:35

[30] **Is *Litchi chinensis* a potential host for redbay ambrosia beetle, *Xyleborus glabratus*?** Jerome Niogret, Paul E. Kendra, Randy C. Ploetz, Wayne S. Montgomery, Jorge E. Peña, Gurpreet S. Brar and Nancy D. Epsky. USDA-ARS, 13601 Old Cutler Rd., Miami, FL 33158-1857. jerome.niogret@ars.usda.gov

Redbay ambrosia beetle (RAB), *Xyleborus glabratus* Eichhoff, is an exotic wood-borer that vectors the fungal agent (*Raffaelea lauricola*) responsible for laurel wilt disease. To date, all known hosts of RAB are trees within the family Lauraceae. However, our previous research indicated that female RAB are highly attracted to freshly-cut wood from lychee, *Litchi chinensis* Sonn. (Sapindaceae) in field tests, and will bore into lychee wood in lab bioassays. Those initial tests were done with an unknown cultivar; therefore, we investigated the potential host status of a commercial lychee, 'Brewster', one of the most extensively planted varieties in south Florida. Lab and field experiments were conducted to determine if 'Brewster' (1) is susceptible to attack by RAB, (2) exhibits symptoms of laurel wilt disease, and (3) is capable of supporting reproduction of RAB. In addition, we performed chemical analysis of the volatile emissions from 'Brewster' to compare its profile to that of known hosts.

9:47 - 10:10 - Break – Orchid Foyer

10:10

[31] **Evaluation of insect repellents to manage the redbay ambrosia beetle, vector of laurel wilt, a lethal disease affecting avocados in Florida.** D. Carrillo, P.E. Kendra, R. E. Duncan, W.S. Montgomery and J.E. Peña. Tropical Research and Education Center, University of Florida, 18905 SW 280th Street, Homestead, FL 33031. ritad@ufl.edu

Production of avocado in Florida is valued at $30 million a year, accounting for twelve percent of the national production. Over 90 percent of avocado in Florida is grown in the southern tip of the peninsula, and avocado is considered Florida's second most important fruit crop after citrus. The redbay ambrosia beetle (RAB), *Xyleborus glabratus* Eichhoff (Coleoptera: Curculionidae: Scolytinae) vectors the fungal pathogen, *Raffaelea lauricola*, T.C. Harr., which causes laurel wilt, a lethal disease of trees in the family Lauraceae that includes avocado, *Persea americana* Mill. No sexual or aggregation pheromones have been identified from RAB or any other ambrosia beetle. Thus, in this study we evaluate repellent substances in an effort to disrupt the host location behavior, and therefore attack by RAB. Thirteen molecular formulas obtained from Bedoukian Research Inc., classified as "biopesticides" by EPA that are in the process of obtaining registration, were tested. The materials closely resemble naturally occurring molecules, have very low toxicity, and have

proven effective repelling insects from different orders. Results of laboratory bioassays and field trials will be presented.

10:22

[32] **Forest entomology for the new century: bark and ambrosia beetles in research, education, and citizen engagement in Florida.** Jiri Hulcr, Sedonia Steininger, Caroline Storer and Andrea Lucky. School of Forest Resources and Conservation, University of Florida, PO Box 110410, Gainesville, FL 32611. hulcr@ufl.edu

Current forest entomology is facing new challenges. The role of historically important pests is diminishing, but the pressure of exotic species is increasing. While the need for new research on forest pest is greater than ever before, traditional sources of research support are dwindling. Further, the public is increasingly separated from the natural environment, leaving issues such as forest health out of societal focus.

If forest entomology is to thrive in the upcoming decades, it needs to make itself more popular. Here we introduce two projects, the goals of which are to strengthen the appreciation of forest entomology in contemporary academia and society as a whole.

The Bark & Ambrosia Beetle Academy (www.ambrosiasymbiosis.org/academy) is a week-long "boot camp" providing hands-on training in scolytine identification, ecology and management for students, researchers, professionals, and landowners. Instruction will be provided by leading experts through lectures, microscope lab identification sessions, and field trips. This will be the most networking-oriented event in the history of bark beetle research.

Backyard Bark Beetles is a citizen science program designed to improve public understanding of forest insects, especially in youth. Participants are guided by an attractive website, and by educational networks such as 4-H or Extension, to deploy a simple soda-bottle trap in their backyards. The catch is sent to the UF Forest Entomology team, and the information returned to participants through an interactive website: www.backyardbarkbeetles.org. Our previous program on ants attracted >10,000 participants.

10:34

[33] **Resource opportunities from the nest of a dying subterranean termite colony: a laboratory case of ecological succession.** Thomas Chouvenc, Paul Bardunias and Nan-Yao Su**.** Ft. Lauderdale Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, 3205 College Avenue, Ft. Lauderdale, Florida 33314. tomchouv@ufl.edu

Subterranean termites such as *Coptotermes formosanus* Shiraki possess underground nests made out of a complex network of galleries resulting in a highly modified environment in comparison to the surrounding soils. A healthy colony can maintain homeostatic environmental conditions within the nest, limiting opportunities for pathogens, parasites and predators to exploit the termite colony as a resource. However, a stressed or senile colony can display a lack of nest maintenance, leading to the colonization of the nest as an opportunistic niche by alien organisms. In this study, we described the nest colonization by microbes and arthropods during the collapse of senile *C. formosanus* laboratory colonies. The carton nest and the tunnel lining which are mostly made out of termite fecal material were invaded by a variety of fungi, and Acari and

Collembolan populations quickly increased during the senescence phase of the termite colony, presumably scavenging on the fungal material. Finally, the carton colonized by fungal mycelia hosted numerous larvae of a Sciarid fly, *Bradysia sp*. (Diptera). This fungus gnat used the decomposing carton material as a breeding site, and numerous adults of this fly were found hovering above the dying termite colony. *Bradysia* larvae also showed infestation of parasitic nematodes, suggesting the presence of multiple trophic levels in the resource utilization of the nest of a declining termite colony. We concluded that a dying subterranean colony represents a resource opportunity for scavenging organisms and that the nest structure represents an opening niche that initiates an ecological succession.

10:46

[34] **Preliminary investigations into soldier mandibular asymmetry in the Isoptera.** A. J. Mullins, P. M. Bardunias and N.-Y. Su. Ft. Lauderdale Research and Education Center, University of Florida, Institute of Food and Agricultural Sciences, 3205 College Avenue, Ft. Lauderdale, Florida 33314. amull81@ufl.edu

This paper proposes a re-description of the functional morphology of soldier mandibles in the Capritermes complex of the Termitidae. Evidence is provided based on field/video documentation of defensive behavior, as well as laboratory experimentation on the physical properties of defensive mandibles. An evolutionary analogy to ancient human warfare, specifically the Mongolian composite bow lends to the description of this unique morphology.

10:58

[35] **The School of Ants: using citizen scientist data to map urban biodiversity patterns in Florida.** Andrea Lucky, Lauren M. Nichols, Amy M. Savage, Cristina Castracani, Leonora Shell and Rob R. Dunn. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. alucky@ufl.edu

The School of Ants is a citizen science project that maps ant distribution across the United States with the help of local participants in cities and towns. This project showcases how researchers and educators can partner successfully in offering public education about scientific methods and local biology while also providing scientists with reliable data. As of Summer 2013 the School of Ants is focusing on Florida. The scientific goals of the project are to 1) assess the diversity of ground-foraging ants that live near humans and 2) map geographic ranges of both native and exotic ant species. The simple collecting protocol maximizes accessibility to a broad range of participants, while addressing published concerns related to the use of citizen-generated data in scientific inquiry. Educationally, the project 1) provides opportunities for people to learn about the organisms around them using hands-on methods and 2) creates opportunities for professional researchers to interact with citizens, both indirectly (through the School of Ants website) and directly (through public outreach activities). Citizen Scientist participants have already documented new state records of introduced species, and more such discoveries are expected in Florida.

11:10

[36] **Update on use of ProFume® (sulfuryl fluoride) as a post-harvest fumigant in the United States.** Ellen Thoms. Dow AgroSciences, 7257 NW 4th Blvd, #20, Gainesville, FL 32607. emthoms@dow.com

Presentation will review current uses of ProFume® gas fumigant (sulfuryl fluoride) for treatment of food commodities and food processing facilities, and ongoing activities to challenge the proposal by the US EPA to remove food tolerances for sulfuryl fluoride.

11:22 – Discussion

11:30 – *End of Submitted Papers Session 1*

Tuesday, 8:30 – 11: 45AM – Orchid 1

Symposium: Thrips – small players with big damages

Organizers: Vivek Kumar (Mid-Florida Research and Education Center, IFAS-UF), and Garima Kakkar (Ft. Lauderdale Research & Education Center, IFAS-UF)

8:30 Introduction

8:35

[37] **Prey preference of phytoseiid mites, *Amblyseius swirskii* (Athias-Henriot) and *A. cucumeris* (Oudemans) on two important thrips pest of field cucumber in south Florida.** Garima Kakkar, Dakshina R. Seal and Vivek Kumar. Mid-Florida Research and Education Center, University of Florida, IFAS, 2725 Binion Road, Apopka, FL 32703. vivekuf@gmail.com

The melon thrips, *Thrips palmi* Karny (Thysanoptera: Thripidae), is an economically important pest of various greenhouse and field crops in south Florida. It is a pest of Southeast Asian origin, and in Florida it was first observed in 1990. *T. palmi* has a wide host range and prefers plants in the family Cucurbitaceae and Solanaceae. Heavy infestation of *T. palmi* on cucumber may lead to production of scarred, damaged or deformed fruit with no marketable value. In Homestead, *T. palmi* is one the major pests of field cucumbers and is a challenge to cucumber growers in the area. In recent years, invasion by a new adventive thrips species, *Frankliniella schultzei* (Trybom) has further aggravated the damage to field cucumbers. *F. schultzei* has been reported as a key pest in tomato and cucumber fields of several parts of South America. Earlier known to make few encounters in flowers of ornamental plants in southern and central Florida, *F. schultzei* has now established in southern Florida. In past few years, predatory mite, *Amblyseius swirskii* (Athias-Henriot) and *A. cucumeris* (Oudemans) has received much attention and these have been documented as a potential biological control agent of whiteflies and thrips. Considering the success of phytoseiid mites in regulating various thrips species, we evaluated the role of *A. swirskii* and *A. cucumeris* as a potential predator of *F. schultzei* and *T. palmi* inhabiting different microhabitats of the same crop. Presence of two thrips species on cucumber plants may affect the

predatory behavior of the two mite species. Thus, we also investigated the persistence of predacious mites on leaves and flowers of cucumber in the presence of two thrips species.

8:53

[38] ***Frankliniella occidentalis* (Pergande) integrated pest management programs for fruiting vegetables in Florida**. Joe Funderburk. North Florida Research and Education Center, University of Florida, 155 Research Road, Quincy, FL 32351. jef@ufl.edu

The spread of the western flower thrips *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) resulted in the worldwide destabilization of established integrated pest management programs for many crops. Efforts to control the pest and the thrips-vectored tospoviruses with calendar applications of broad-spectrum insecticides have been unsuccessful. The result has been a classic 3-R situation: resistance to numerous insecticides, resurgence of the western flower thrips populations as a result of natural predators and native competitor thrips being eliminated, and replacement by various other pests. Integrated pest management programs for fruiting vegetables have been developed and implemented that are effective, economical, ecologically sound, and sustainable. The components include the following: define pest status (economic thresholds), increase biotic resistance (natural enemies and competition), integrate preventive and therapeutic tactics (scouting, ultraviolet-reflective technologies, biological control, compatible insecticides, companion plants, and fertility), vertically integrate the programs with other pests, and continuously communicate with end-users. The programs have been widely implemented in Florida, and have significantly improved management of western flower thrips and thrips-transmitted viruses.

9:11

[39] **Current status of thrips in tomato and onions fields of Georgia**. David G. Riley**.** Department of Entomology, University of Georgia, 122 S. Entomology Dr., Tifton, GA 31793. dgr@uga.edu

Thrips continue to be important pests in tomato and onions in Georgia even though recent advances in management have greatly reduced the impact in both of these crops. In tomato, *Tomato spotted wilt virus* is managed mainly by host plant resistance to the virus, but western flower thrips (*Frankliniella occidentalis*) can still pose problems through direct feeding damage or late season transmission to virus resistant fruit. Possible negative interactions with insecticide combinations have been observed relative to thrips control. Late season applications of imidacloprid insecticide should be avoided because it increases the probing behavior of western flower thrips. In onion, *Iris yellow spot virus* transmission by thrips has not become an economically important problem in the Vidalia onion region. However, thrips control does improve onion yields in some years. There are three species of thrips that are prevalent on onions in the Vidalia region: tobacco thrips (*Frankliniella fusca*), onion thrips (*Thrips tabaci*), and western flower thrips. In recent years, the tobacco thrips has dominated in the Vidalia production region, but flower thrips (*Frankliniella tritici*) were found in significant numbers in 2013. Insecticide resistance in thrips populations from excessive use of insecticides is being avoided by rotating modes of action (MOA) or IRAC groups per thrips generation. In 2013, the Radiant-

Benevia-Lannate rotation provided the lowest thrips count over all followed by Benevia alone, Karate alone, and the other rotation. The untreated check was highest throughout, but the counts, thrips, were all quite low, likely due to heavy February rains.

9:29

[40] **Haplotype analysis of global chilli thrips (*Scirtothrips dorsalis*) populations using the metazoan barcode.** Cindy L. McKenzie, Aaron Dickey, Lance S. Osborne, Vivek Kumar and Robert G. Shatters Jr. USDA-ARS, U.S. Horticultural Research Laboratory, 2001 South Rock Rd, Ft Pierce, FL 34945. cindy.mckenzie@ars.usda.gov.

Scirtothirps dorsalis is a globally invasive polyphagous crop pest infesting several major field and ornamental crops. Established in Florida since 2005, it had spread to Texas within one year. Establishing a putative source locality of the US population would help stakeholders target effective control and quarantine strategies for this pest. But this effort is complicated by phylogenetic and morphological evidence suggesting that *S. dorsalis* may be a cryptic species complex. In an attempt to overcome these challenges, the metazoan barcode region of the mitochondrial CO1 gene of chili thrips populations from Israel, China, Singapore, India, and the US was sequenced, aligned, and analyzed using statistical parsimony. We report the patterns of diversity found within this species including particularly high haplotype diversity in Indian populations. We discuss the implications of our results for the phylogenetics of *S. dorsalis* and the origin of the US population.

9:47

[41] **Next generation DNA sequencing of the globally invasive plant pest, *Scirtothrips dorsalis*.** Aaron M. Dickey, J. Kent Morgan, Cindy L. McKenzie, Robert G. Shatters, Jr. and Lance S. Osborne. Mid-Florida Research and Education Center, University of Florida, 2725 Binion Road, Apopka, FL 32703. aaron.dickey@ars.usda.gov

One of the highest profile thrips species to invade the U.S. in the last ten years is the chilli thrips. This thrips is difficult to identify due to few distinct morphological characters and molecular data suggest that it is actually a complex containing multiple, morphologically indistinguishable, species. Here we present the latest in next-generation DNA sequencing results from chilli thrips including an initial characterization of a thrips microbiome. We discuss how these data can be used to support ongoing efforts to construct a robust chilli thrips phylogeny and to identify the site of origin of the U.S. population. Metagenomics discoveries made as a result of this project may also provide critical insights into biotic interactions relevant to all thrips species and facilitate the emergence of new control strategies for these important pests.

10:05 - 10:20 - Break – Orchid Foyer

10:20

[42] **Management strategies for *Frankliniella schultzei* on tomato: a principal vector of Groundnut Ring Spot Virus.** D. R. Seal, V. Kumar and G. Kakkar. Tropical Research and

Education Center, University of Florida, 18905 SW 280th St., Homestead, FL 33031. dseal3@ufl.edu

Tomato is an important crop to the state of Florida. In 2007-08 seasons, Florida generated $622 million by harvesting 31,500 acres of tomatoes. In order to maintain sustainability of this high value crop it is important to regulate pests affecting its yield. Among various important pest of tomato, *Frankliniella* thrips (*F. schultzei* Trybom and *F.occidentalis* Pergande) are the most serious pests inflicting significant yield loss due to their ability to transmit viral pathogens. *F. schultzei* is commonly known as common blossom thrips or tomato thrips. It is an efficient vector of Groundnut Ring Spot Virus (GRSV), which affects all the above ground parts of its host plant. In this study we investigated distribution pattern of *F.schultzei* and the corresponding virus infected plants. Distribution of *F. schultzei* was random on leaves and aggregated on flowers. We also evaluated various insecticide treatments on the control of thrips and reduction of GSRV on tomatoes which includes: soil application of imidacloprid followed by foliar application of cyazypyr, and imidacloprid at planting followed by foliar application of dinotefuran in rotation with spinetoram. Imidacloprid, dinotefuran and spinetoram program, and cyazypyr by itself significantly reduced *F. schultzei*. In these two studies, rate of viral infection was slow although number of plants infected with virus did not differ from the nontreated control. The similar treatements were also evaluated on pepper where effectiveness of insecticides followed the same pattern as the tomato study.

10:38

[43] **Using IPM tactics to manage flower thrips in southern highbush blueberries.** Oscar E. Liburd, Elena M. Rhodes and Hector A. Arévalo. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 32611. oeliburd@ufl.edu

Flower thrips, *Frankliniella* spp. are a key pest in southern highbush and Rabbitteye blueberries. In previous studies we showed that 70 and 90% of the thrips recorded in blueberries on flowers and sticky traps respectively were *Frankliniella bispinosa* (Morgan). These thrips prefer to feed on blueberry petals that result in scars on ripening berries rendering the fruit unmarketable. Additionally, we found that as the number of thrips increased fruit injury became more apparent and fruit dehydration was recorded when individual flowers are exposed to 20 or more thrips. To develop an integrated management program to manage thrips populations in blueberries we studied the influence of flowering weeds on thrips population. In addition, we investigated how blueberry cultivars, Emerald, Jewel, Star and Millenia, influenced thrips population within a planting. Our flowering plant surveys revealed several reproductive hosts of *F. bispinosa*, including: Carolina geranium (*Geranium carolinianum* L.), white clover (*Trifolium repens* L.), and wild radish (*Raphanus raphanistum* L.). White clover was the dominant host growing adjacent to the blueberry planting at the study site and our findings indicate that clover does not appear to be a significant source for thrips inoculation for southern highbush blueberry plantings. The variety Emerald frequently had significantly more thrips than other cultivars evaluated due to its early and more uniform flowering characteristics. Therefore, interplanting early and late season flowering cultivars could be used as a tactic to suppress thrips activites. Finally, we studied reduced-risk insecticides including, Delegate (Spinetoram), Requiem, Rynaxypyr and conventional pesticides, Malathion for potential control of thrips population in blueberries. All of

the insecticides suppressed thrips activity below control and there were no differences between reduced-risk and conventional insecticides.

10:56

[44] **Lessons learned from a distant land: Onion thrips and their management in the Pacific Northwest.** Stuart Reitz. Department of Crop and Soil Sciences, Oregon State University, 710 SW 5th Ave., Ontario, OR 97914. stuart.reitz@oregonstate.edu

The Treasure Valley of eastern Oregon and southwestern Idaho accounts for over 25% of the onion production in the US. Over 20,000 acres of onions are produced in an intensively farmed area within a 30-mile radius of Ontario, Oregon. Onion thrips and *Iris yellow spot virus* that these thrips vector are the major constraints on onion production in the Treasure Valley. This cropping system poses unique challenges for the management of these pests, and these will be discussed in this presentation. Some of the challenges stem from the hot, dry growing season, which allows for large populations of thrips to develop rapidly. The high concentration of onion fields then fosters movement of thrips, and the concomitant spread of iris yellow spot. To date, growers in the Treasure Valley have relied on insecticides to attempt to manage thrips, but onion thrips reproductive modes and their short generation time has led to rapid development of resistance to indiscriminately used insecticides. This has led to the evolution of more effective insecticide use programs. These programs include the rotation of insecticides to delay the development of resistance to insecticides. Other crop management tactics to help reduce plant stress and exposure to thrips have been developed to build more robust IPM programs for these pests, and these will be discussed, especially in comparison with other IPM programs for thrips.

11:14

[45] **A novel biocontrol strategy for managing thrips and other key pests in pepper crops.** Lance S. Osborne, Cindy L. McKenzie, Steven Arthurs, Yingfang Xiao, Vivek Kumar, Christian Miller and Jianjun Chen . Mid-Florida Research and Education Center, University of Florida, 2725 Binion Road, Apopka, FL 32703. lsosborn@ufl.edu

Pest management in the vegetable and ornamental plant industries in Florida is facing great challenges due to the recent introduction of several invasive pests. Among them**,** chilli thrips is causing major problems due to its polyphagous nature, lack of effective residual insecticides, and limited availability of known resistant plant varieties. To address this issue, we developed a novel biological-based '*Predator-In-First'* approach for sustainable control of thrips and other key pests that threaten pepper production in protected and outdoor culture. The key component of this method involves the release of specific predatory mites on uninfested seedlings before transplanting. The *Predator-In-First* approach aims to establish biological control in the critical post-transplanting period. This is significant because natural enemies generally do not establish until later in the season when thrips numbers have built up. It exploits the characteristics of type III generalist predatory mites which can feed and reproduce on host plant pollen/nectar in the absence of their prey.

11:32 – Discussion

11:45 – *End of symposium*

Tuesday, 10:00 AM – 6:00 PM – Orchid 2

Poster Session 2

[DSP 7] **Smart aerial release machine for sterile insect technique under the chilled adult method.** Cano Rene, Leal Ruben and Angulo Roberto. Servicios Aereos Biologicos y Forestales Mubarqui, Enrique Cardenas 1356 fraccionamiento los Arcos Ciudad Victoria Tamaulipas Mexico. rlmubarqui@yahoo.com.mx

New design machine uses vibrating conveyors to avoid 100 percent the damages in insects and calibrate by means of the computer and software GIS in a precision way.
Methods: The use of tablet computer devises and android operative systems, beside GIS software allow us to create a software that interact with the release machine means Bluetooth communication ports, sending instructions to start, calibrate in real time turn off open and close the gates.

[DSP 8] **Use of chlorine dioxide gas to control bed bug (Hempitera: Cimicidae).** Christopher Tipping. Delaware Valley College, 700 E. Butler Ave, Doylestown, PA 18901. Christopher.tipping@delval.edu

Bed bug, *Cimex lectularius* L. (Hemiptera: Cimicidae), have been reported in nearly every major city in the US. Although bed bugs have not been shown to vector disease organisms, their bites can be painful and cause significant discomfort as well as serious anxiety. Chemical control has not provided adequate measures and these insect have demonstrated resistance to a variety of chemistries. The use of ClO_2 to kill bedbugs has been shown to be effective; however, on-site production of this fumigant is expensive. Use of a simple, inexpensive device to produce ClO_2 has been shown to be effective in laboratory tests against adult, larval, and egg stages providing 100% mortality after an average exposure of 2737 ppm-hours.

[DSP 9] (moved to #55)

[DSP 10] **Cubeb oil identified as an improved attractant for redbay ambrosia beetle, *Xyleborus glabratus* (Coleoptera: Curculionidae: Scolytinae).** Paul E. Kendra, Wayne S. Montgomery, Jerome Niogret, Elena Q. Schnell, Mark A. Deyrup, and Nancy D. Epsky. USDA-ARS, 13601 Old Cutler Rd., Miami, FL 33158-1857. paul.kendra@ars.usda.gov

Redbay ambrosia beetle (RAB), *Xyleborus glabratus* Eichhoff, is an exotic wood-borer that vectors the fungal agent (*Raffaelea lauricola*) responsible for laurel wilt disease. Since its introduction into Georgia in 2002, RAB has spread throughout the southeastern USA, and laurel wilt has decimated large populations of native *Persea* trees, particularly redbay (*P. borbonia*) and swampbay (*P. palustris*). Currently the lethal vascular disease threatens avocado (*P. americana*) in south Florida. To control the spread of laurel wilt, effective attractants are needed for early detection of RAB. Phoebe oil lures are the best known attractant for RAB, but they are

no longer available. Current detection systems use commercial manuka oil lures, but our research indicated that manuka lures have a field life of only 2-3 weeks in Florida. Therefore, we evaluated seven essential oils as attractants for female RAB. Several field tests were conducted in Highlands County, FL to compare efficacy of manuka, phoebe, cubeb, ginger root, angelica seed, tea tree, and orange oils (all as whole oil preparations in membrane-based dispensers). Tea tree and orange oils were not attractive to RAB; ginger root and angelica seed oil were intermediate in attraction; and cubeb oil was found to be just as attractive as fresh manuka and phoebe oils. Subsequent tests with commercial lure formulations indicated that cubeb lures enriched in sesquiterpenes captured significantly more RAB than manuka lures and had increased longevity. Therefore, cubeb lures are recommended for improved detection and monitoring of RAB.

[DSP 11] **An integrated pest management scheme to protect nest cavities from invasive Africanized honey bees**. Caroline Efstathion, Paul M. Bardunias, and William H. Kern **.** Ft. Lauderdale Research and Education Center, IFAS, University of Florida, 3205, College Avenue, Davie, FL 33314. whk@ufl.edu

The introduction of the invasive Africanized honey bees (*Apis mellifera scutellata*) into the Neotropics is a serious problem for many cavity nesting birds, specifically parrots. These invasive bee swarms reproduce by fission, with swarms of bees moving away from natal colonies to form new hives within cavities. Unfortunately, swarms select cavities, natural and artificial, that are also suitable nest sites for cavity nesting parrots. This competition results in birds being unable to establish nests for lack of suitable cavities. When cavities containing established parrot nests are usurped by bees, nestlings are stung to death or starve when their parents cannot access the nests to feed them.

To prevent bees from usurping nests, we developed a protocol for the application of a Push-Pull, IPM strategy. This will deter bees from selecting bird's nest cavities by treating them with permethrin, while simultaneously attracting them to pheromone-baited swarm traps will reduce honey bee usurpation in nest cavities while decreasing the amount of toxin applied and reducing the ecological impact of insecticide application.

This study will describe the effectiveness of a push-pull strategy to reduce competition for nest cavities with honey bees in field sites located in Brazil and Florida, USA. Data generated from these studies will be used for implementation of this protocol throughout the Neotropics, where parrots are threatened by honey bee competition for nest cavities.

[DSP 12] **Attractancy of lovebugs (diptera: bibionidae) to visual and olfactory stimuli.** Steven Arthurs, Nastaran Tofangsazi and Ron Cherry. Mid Florida Research and Education Center, University of Florida, Apopka, FL 32703. ntsazi@ufl.edu

We evaluated various volatile organic compounds and, separately, colors for attractancy to adult *P. nearctica* under field conditions in central and southern Florida. In olfactory tests, sticky traps placed at 10m intervals (1 m height) and baited with the floral compound phenylacetaldehyde (PAA), essential oil anethole and anisldehyde were highly attractive to both sexes of lovebugs during spring and fall flights. However PAA was superior, capturing at least 3 times as many lovebugs in direct comparisons. Methyl salicylate, eugenol and benzaldehyde were weak attractants, with a small (50–80%) but significant increase in lovebugs in traps baited with these

compounds, while geraniol and citrus oil were not attractive. Heptaldehyde, 1-phenylethanol and acetophenone were also not attractive in tests that included PAA. In visual studies with unbaited sticky cards, lovebugs were most attracted to different hues of yellow and white at both high population densities (spring flight) and low population densities (fall flight). There was little statistical difference among the remaining colors (green, blue, red and black), although black cards were consistently the least attractive. We hypothesize that the mechanism of attraction in our studies, to both volatiles and colors, might relate to feeding behavior in this insect.

Tuesday, 12:00 - 2:30 PM – Vista Ballroom

Awards Luncheon

2:30 - 5:20 PM – Orchid 1

Symposium: New Developments in Insect and Mite Control Products

Organizers: Joe Eger (Dow AgroSciences, Tampa, FL) and Scott Ferguson (Atlantic Turf and Ornamental Consulting, Vero Beach, FL)

2:30 PM Introduction

2:35

[46] **New uses for PFR-97 20 % WDG from Certis USA to control insect pests of vegetables and fruit in the US.** H. Brett Highland, Certis USA, 1069 Eisenhower Dr, Nokomis, FL 34275. bhighland@certisusa.com

PFR-97 microbial insecticide was registered by the Federal Environmental Protection Agency (EPA) in November of 2011 to control thrips, psyllids, whiteflies, mealybugs and spider mites on fruit and vegetable crops. The registration of PFR-97 gives U.S. growers access to a product that has been widely available to growers in Europe where it is a popular control material for whiteflies and thrips. The introduction of PFR-97 in the U.S. coincides with growers' needs worldwide to effectively control invasive pest species, insects that have become resistant to currently available pesticides, and to effectively manage residue limits and worker reentry intervals.

The active component in PFR-97 is a naturally occurring fungus (*Isaria fumosorosea*). The fungus infects and kills all phases of the target pest—eggs, nymphs and adults—by two routes of infection. The fungus can penetrate the host through direct contact with germinating spores applied to the crop or soil. It can also grow on plant surfaces or in the soil and parasitize hosts that come into contact with it. Regardless of the entry mode, infected insects soon stop feeding and die as the fungus completely fills their bodies, eventually emerging from the dead host to release more infective spores.

The Apopka 97 strain of *I. fumosorosea* was discovered by University of Florida researchers and licensed by WR Grace Biopesticides, a predecessor of Certis USA. It has long

been used in Japan, Korea and Europe to control difficult pests in IPM systems that require products that are soft on beneficial insects and mites.

2:53

[47] **Venerate™, a new bacterial species of *Burkholderia*, a new bio-pesticide tool for citrus and vegetables.** Tim Johnson, Guy Wilson, Steven Whitesides and Luis Solari. Marrone Bio Innovations,1721 NE 49th Avenue, Ocala, FL 34470. gwilson@marronebio.com

Venerate is the first product slated for commercialization from a novel species of *Burkholderia* designated as *Burkholderia* sp. strain A396. This isolate has no genetic relationship to known pathogenic *Burkholderia* species. *Burkholderia* sp. strain A396 was isolated from a soil sample collected by an MBI employee. It has shown to be active through ingestion and contact of a broad range of insects and certain phytophagous mites. It is non-toxic and non-pathogenic to rats, fish, birds and most beneficial insects. Venerate has shown to offer control on several key pests affecting citrus and vegetable crops. Its efficacy on insect populations resistant to a variety of other insecticides suggests it will have an excellent fit in IPM/IRM programs. Field studies were conducted from 2010 to present on several vegetable and citrus commodities to evaluate Venerate as a foliar spray for efficacy against aphids, whiteflies, twospotted spider mites, citrus rust mites, Asian citrus psyllid and pepper weevils. Venerate applied at rates from 1 to 2 gallons/acre provided encouraging control of whitefly nymphs and adults and Asian citrus psyllid nymphs and adults. These results demonstrate that Venerate will be an important new tool for Asian citrus psyllid and whitefly management on citrus and vegetable crops.

Disclaimer: Venerate, (*Burkholderia*) is not registered for use with the U.S. Environmental Protection Agency or any other agency at the time of publication of this Abstract. Registration is pending and is expected fall 2013. This Abstract is intended to provide technical information and is not an offer for sale of product.

3:11

[48] **Triple Crown™: 3-way turf pest control.** Brian Mount and Dina Richman, FMC Corp, 1735 Market Street, 18th Floor, Philadelphia, PA 19103. brian.mount@fmc.com

Triple Crown™ is a new combination insecticide for the control of both surface and subsurface turf pests. The combination of active ingredients provides both speed of control as well as long residual control of many turf pests such as; chinch bugs (both pyrethroid resistant and susceptible), mole crickets, and ants. Grubs (masked chaffer and Japanese beetle) are also controlled with this new combination product.

3:29

[49] **Verifi bed bug detection: New data from the field.** Dina Richman, FMC Corp, 1735 Market Street, 18th Floor, Philadelphia, PA 19103. dina.richman@fmc.com

The Verifi bed bug detector is the first active monitoring device on the market that can be serviced quarterly. Researchers and end-users have had success detecting low-level infestations

that were missed upon visual inspection. New field data will be presented, along with an explanation of how the Verifi detector works.

3:47 - 4:15 Break – Orchid Foyer

4:15

[50] **DuPont™ Exirel™ and Verimark™ insect control: Novel insecticides for crop protection and optimizing yield on vegetables in the Southeast**. James "Shine" Taylor, Stanley S. Royal, Glenn Hammes, Robert W. Williams, Hector E. Portillo, I. Billy Annan and Juan M. Alvarez. DuPont Crop Protection, 510 25th Ave. North, St. Petersburg, FL. james.e.taylor-1@dupont.com

Exirel™ and Verimark™ insect control are novel insecticides based on the active ingredient Cyazypyr™ (DPX-HGW86, cyantraniliprole) that belong to the second anthranilic diamide insecticides discovered by DuPont™ . Exirel™ and Verimark™ are the first products in its class of chemistry that control a cross-spectrum of insect pests including Lepidoptera, Dipteran leafminers, fruit flies, beetles, whiteflies, thrips, aphids, leafhoppers, psyllids and weevils, while conserving key predators and parasitoids. Exirel™ and Verimark™ selectively activate the ryanodine receptor in insect muscles resulting in paralysis and rapid inhibition of feeding. Exirel™ has been optimized for foliar use, demonstrating excellent translaminar movement. Verimark™ has been optimized for soil applications to deliver consistent upward root systemicity. Data on the efficacy of Exirel™ and Verimark™ on key vegetable pests, including suppression of disease transmission and other crop benefits will be discussed.

4:33

[51] **Sulfoxaflor (Closer™ SC): a new chemical class for the control of sap-feeding insects in citrus and vegetables.** Alejandro A. Calixto, Dow AgroSciences, 33245 Mandrake Rd., Wesley Chapel, FL 33543. aacalixto@dow.com

Sulfoxaflor is a new and unique chemical class (4C sulfoxamines) that lacks of cross resistance to neonicotinoids, provides fast knockdown and extended control of selected sap-feeding insects and quickly inhibits feeding. Given its unique characteristics we expect Closer™ to play a significant role in the control of the Asian Citrus Psyllid, reduction in the risk of acquisition and transmission of the Huanglongbing (HLB; citrus greening) and the prevention and/or management of insecticide resistance. Closer™ was granted federal registration in May 2013 and state registration in June 2013.

4:51

[52] **Harmonix Insect Spray*:* Bayer's first botanical product for PMPs, is definitely worth the wait.** John Paige III, Bayer Environmental Science, 328 Indian Lilac Road, Vero Beach, FL 32963. John.Paige@Bayer.com

Harmonix Insect Spray is a non-synthetic, effective product developed by Bayer in response to the demand from "green" customers. Compared to other botanical insecticides, this product is much more effective, offering very quick knockdown and residual control which can last 28 days or longer. Containing the active ingredient pyrethrum, Bayer chemists have been able to formulate this product without the use of synergists so that the product is an almost perfect choice for PMPs to use in sensitive accounts such as School IPM, L.E.E.D. facilities and health care facilities. Efficacy has been proven on many important pests including mosquitoes, cockroaches, fleas, flies and bed bugs.

5:09 - Discussion

5:20 - *End of Symposium*

Tuesday, 2:30 - 5:30 PM – Orchid 3-4

Submitted Papers Session 2

2:30 Introduction

2:35

[53] **South Florida landscapes under attack! How the public deals with whiteflies on ornamentals.** Adrian G.B. Hunsberger. Miami-Dade Extension, University of Florida, IFAS, 18710 SW 288th Street, Homestead, FL 33030. aghu@ufl.edu

Southeast Florida is ground zero for the introduction of new species into the U.S. Over the past 10 years, several new insect species have caused significant damage, both economically and aesthetically, to landscape plants and natural areas. Many of these pests have now spread throughout south Florida and elsewhere.

All too often the public overreacts, including professional landscape pest management personnel. The public's perception of insect pests is that they all cause property damage or are a threat to plant, animal or human health. One of most serious overreactions is the removal of trees that are infested with whiteflies. People view all whiteflies as capable of killing plants and will treat infestations with whatever chemical that is available, even those that are illegal to use in landscapes or fruit trees. There is little patience when cars and plants are covered in honeydew and sooty mold, and swimming pools covered in whitefly flocculence.

Another issue is the overuse and inappropriate use of pesticides which can cause environmental damage as well increasing the risk of insecticide resistance. The lay audience is easily confused with pesticide information, are unable to distinguish the difference between serious pests and minor pests, and often seek guidance from non-research based sources of information or from untrained "experts."

2:47

[54] **Pre shipping dip treatments using soap, natural oils, and *Isaria fumosorosea*: potential biopesticides for mitigating the spread of whitefly *Bemisia tabaci* (Hemiptera: Aleyrodidae)**

invasive insects on ornamental plants. Luis F. Aristizábal, Pasco B. Avery, Vivek Kumar, Jean H. Caldwell, and Lance S. Osborne. Mid-Florida Research and Education Center, University of Florida, IFAS, 2725 Binion Road, Apopka, FL 32703. larist@ufl.edu

The whitefly *Bemisia tabaci* (Hemiptera: Aleyodidae) is an invasive insect pest affecting different crops including vegetables, fruits, cereals, and ornamentals. The efficacy of some products such as commercial soap, natural oils and Preferal® (based on the entomopathogenic fungus *Isaria fumosorosea* Apopka Strain 97) are being evaluated as potential biopesticides in order to prevent the spread of the whitefly on ornamental shipments from nurseries in Florida to others states. Clean *Mentha* sp. (Lamiales: Lamiaceae) are infested by exposure to whitefly adults during a 24 h period. Then, adult whiteflies are removed and the number of eggs counted on individual cutting terminals. The cuttings are submerged in a solution (dip application) for 60 seconds with different products and maintained under a mist bed for 8-10 days for rooting. Next, the plants are placed into a shipping environment inside boxes (darkness for 24 or 48 h at 20 °C) (15 individual plants/box) used by commercial nurseries. Insect assessments are conducted at 1, 7, and 14 days after shipping in order to count the whitefly population (eggs, immature stages, and adults). Each treatment has 6 repetitions and the experiment is has 4 replications. Preferal® appears to be a promising treatment based on high mortality and low survival of whitefly populations. Pre-shipping dip application of cuttings has a high potential to mitigate the spread of the whitefly on ornamental plants shipped to different places.

2:59

[55] **Update on bait stations for Tephritid fruit fly control.** Nancy D. Epsky, Micah A. Gill, and Jonathan Crane. USDA-ARS, 13601 Old Cutler Rd., Miami, FL 33158-1857**.** nancy.epsky@ars.usda.gov

Attract-and-kill devices, otherwise known as bait stations, are being developed and tested as alternatives to broadcast pesticide application for control of a number of pest insects. With the development of female-targeted food-based synthetic attractants for tephritid fruit flies, a number of bait stations have been developed and tested for fruit fly population suppression. We conducted small-scale field tests in guava, a preferred host for the Caribbean fruit fly, *Anastrepha suspensa*, to evaluate several types of bait stations. Results of these studies will be presented.

3:11

[56] **Management of spotted wing drosophila (*Drosophila suzukii*) in southern highbush blueberries.** Nyoike, T. W. and O. E. Liburd. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 3261. nyoiket@ufl.edu

Spotted wing drosophila (SWD), *Drosophila suzukii* (Matsumura), is an invasive pest of small fruits that has been spreading fast across the state of Florida since 2009. Potential damage due to this pest is high because unlike other Drosophilids, SWD is able to oviposit on ripening berries. We conducted studies to determine the source of SWD infesting blueberries. In addition, to develop a management plan we investigated cultural techniques involving the use of weed fabric

versus pine bark mulch in blueberry plantings and identified effective insecticides for use in organic and conventional blueberry farming systems. To study the source of SWD, monitoring traps baited with apple cider vinegar were set out in the field in late February and changed once every week. Traps were hung within the blueberry field, on the perimeter of the blueberry field and in the uncultivated field adjacent to the blueberry plantings. Results showed that SWD adults were already present in the woods by late February, when the berries were still in early developing stages. SWD population in the woods decreased when most of the berries were ripe (late March). More SWD were caught in traps on plots treated with pine bark mulch than those with weed fabric. Laboratory fruit bioassay identified two pyrethroids and Cyazypyr to be effective in controlling SWD and killing the females before they could oviposit eggs. These compounds were also used in a spray rotation program in the field and were equally effective in controlling SWD.

3:23

[57] **Mechanisms for making macho males: antioxidants boost the sexual performance of sterile male caribflies and improve the efficacy of the sterile insect technique.** Giancarlo Lopez-Martinez and Daniel A. Hahn. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 3261. dahahn@ufl.edu

Most organisms are repeatedly exposed to oxidative stress from multiple sources throughout their lifetimes, potentially affecting all aspects of organismal performance. Here we test whether exposure to a conditioning bout of anoxia early in adulthood induces a hormetic response that confers resistance to oxidative stress and enhances male sexual performance later in life in the Caribbean fruit fly, *Anastrepha suspensa*. Anoxic conditioning of adults prior to emergence led to an increase in antioxidant capacity driven by mitochondrial superoxide dismutase and glutathione peroxidase. When exposed to gamma irradiation, a strong oxidative stressor, males that received anoxic conditioning had lower lipid and protein oxidative damage at sexual maturity. Anoxia conditioning led to greater male sexual competitiveness compared with unconditioned males when both were irradiated, although there was no effect of anoxia conditioning on mating competitiveness in unirradiated males. Anoxia also led to higher adult emergence rates and greater flight ability in irradiation-stressed flies while preserving sterility. Thus, hormetic treatments that increased antioxidant enzyme activity also improved male performance after irradiation, suggesting that antioxidant enzymes play an important role in mediating the relationship between oxidative stress and sexual selection. Furthermore, our work has important applied implications for the sterile insect technique (SIT), an environmentally friendly method of insect pest control where males are sterilized by irradiation and deployed in the field to disrupt pest populations via mating. We suggest that hormetic treatments specifically designed to enhance antioxidant activity may produce more sexually competitive sterile males, thus improving the efficacy and economy of SIT programs.

3:35

[58] **Low-oxygen hormesis improves survival and rescues sterility during phytosanitary treatments in the cabbage looper, *Trichoplusia ni*.** Giancarlo Lopez-Martinez, Woodward D.

Bailey and Daniel A. Hahn. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 3261. gc.lopez@ufl.edu

Ionizing radiation used for phytosanitary treatments is a very efficient way to disinfect agricultural commodities that are destined for shipment to quarantined areas. Ionizing radiation is the pesticide-free treatment of choice because is thoroughly kills insect pests by affecting cellular components directly from energy transfer during irradiation, but the treatment continues to damage the insect long after irradiation is over. Oxygen radicals, formed during irradiation, damage DNA/RNA, lipids and proteins and lead to decreases survivorship. Commodities destined for phytosanitary irradiation are normally kept in modified atmospheres to delay ripening and increase the shelf-life of the produce. These modified atmospheres are usually created by manipulation oxygen concentration. However, low oxygen has the potential to provide a protective effect to insects when combined with irradiation due to the hypoxia reperfusion response. Antioxidants and other cellular defenses are increased during periods of low oxygen and these protective compounds can reduce post-irradiation oxidative damage. We have previously reported how low oxygen can improve survival of flies (*Anastrepha suspensa)* and moths (*Cactoblastis cactorum)* in a sterile insect technique (STI) context. Here we present data showing that low-oxygen hormesis can improve organismal survival, fecundity, and fertility in the cabbage looper, *Trichoplusia ni.* Larvae, pupae, and pharate adults irradiated in anoxia had higher survival and emergence rates than those irradiated in oxygen. Because of this the need to understand the effects that low-oxygen can have on the efficacy of these quarantine treatments is crucial in order to develop modified atmospheres that are efficacious at disinfestation.

3:47 - 4:10 - Break - Gallery

4:10

[59] **Thrips integrated pest management in snap beans.** Nicholas A. Larsen and Gregg S. Nuessly. Everglades Research and Education Center, University of Florida, IFAS, 3200 E. Palm Beach Rd.,Belle Glade, FL 33430. larsnick@ufl.edu

Thrips can be a troublesome pest to manage in snap beans (*Phaseolus vulgaris*). Thrips numbers can exceed 30 thrips per flower in the spring in Belle Glade. Yield losses can occur due to reduced pod-set, pod blemishes, and virus transmission. This presentation summarizes 3 years of research examining the impact of planting date, spray frequency, and varietal selection.

4:22

[60] **Woody host plants of the sugarcane root weevil (Coleoptera: Curculionidae) in Florida sugarcane.** D. Odero, R. Cherry. A. Wright, H. Sandhu and Y. Luo. Everglades Research and Education Center, University of Florida, 3200 East Palm Beach Road, Belle Glade, FL 33430. rcherry@ufl.edu

Laboratory and greenhouse studies were conducted to evaluate adult sugarcane root weevil responses to sugarcane and woody plants proximal to Florida sugarcane. Our results show that

prevention of encroachment of Brazilian peppertree near sugarcane fields should be a front line defense against the weevil in Florida.

4:34

[61] **Boric acid sugar baits mixed with pyriproxyfen sprayed on plants against adult and larval *Aedes albopictus* (Diptera: Culicidae).** Rui-De Xue, Jodi M. Scott, Ali Fulcher and Whitney A. Qualls. Anastasia Mosquito Control District, 500 Old Beach Road, St. Augustine, FL 32080. xueamcd@gmail.com

Boric acid (1%) sugar baits mixed with the insect growth regulator, pyriproxyfen (0.01%) sprayed on plants were evaluated against container-inhabiting mosquito *Aedes albopictus* Skuse in the laboratory. The treated plants by the mixture resulted in 80-100% mortality of laboratory-reared adult mosquitoes for 2 weeks. The water contained pyriproxyfen collected from washing treated plants resulted in 80-100% emerging inhibition for 4 weeks after the late 3rd and early 4th instar mosquito larvae were exposed once a week in the laboratory, compared with untreated control. The boric acid sugar baits mixed with pyriproxyfen not only provide effective control of adult mosquitoes, but also provide additional control of larval mosquitoes.

4:46

[62] **Non-target insecticide impacts on green lacewings, *Chrysoperla rufilabris*.** Steven Arthurs, Luis Aristizabal and Norm Leppla. Mid Florida Research and Education Center, University of Florida, Apopka, FL 32703. spa@ufl.edu

The ability to implement biologically based pest management programs for ornamental plants may be compromised by unintended effects of insecticides used by nursery and landscape industries. Non-target effects of group 4A (neonicotinoids) and other insecticides were evaluated against green lacewings *Chrysoperla rufilabris* in the laboratory. Three concentrations of insecticides were tested: (1/10 label rate, lowest label rate and highest label rate). Second instar larvae were exposed to glass surfaces previously treated with insecticides and reared at 25 °C, 80% RH, and 16:8 h L: D photoperiod. Fecundity and egg hatch were evaluated from individuals in treatments where >30% of individuals survived to adults. Results showed high toxicity (mortality > 80%) of lacewings exposed to dinotefuran, thiamethoxam, clothianidin, and bifenthrin even at 1/10th label rate. Imidacloprid and acetamiprid had intermediate toxicity, while spinosad was non-toxic. Sub-lethal effects (reduced egg production and viability) was observed from adult lacewings surviving low rate imidacloprid treatments. Further work is needed to understand insecticide compatibility with beneficial species under operational conditions.

4:58

[63] **Habitat manipulation for augmentation of ecosystem services.** Russell F. Mizell, III. North Florida Research and Education Center, University of Florida, 155 Research Rd, Quincy, FL 32351. rfmizell@ufl.edu

Practical IPM is now focusing away from the individual field and turning toward a landscape level perspective. Pest suppression strategies and tactics at the landscape level rely more on spatiotemporal relationships among vegetation, its structure and the biology, ecology and behavior of pests. Regulatory ecosystem services such as biological controls, pollination, trap cropping, etc., can be augmented to manipulate habitats to better suppress pests or augment other functions. These concepts and examples will be discussed.

5:10 – Discussion

5:30 - *End of Submitted Papers Session 2*

Wednesday, July 17

8:00 – 9:30 AM – Sea Grape

OFFICE/PRESENTATION PREVIEW - Collection of Presentations

8:00 – 10:00 AM – Meeting Planner Office

REGISTRATION

Registration Desk

Wednesday, 8:00 – 11:20 AM

Symposium: Dale Habeck – Orchid 3-4

Organizer: Howard Frank, Center for Systematic Entomology

8:00 Introduction and memories of Dale Habeck

8:05

[64] **How did Alexander von Humboldt survive? The inconveniences of modern travel to tropical America.** Rudolph H. Scheffrahn. Fort Lauderdale Research and Education Center, University of Florida, 3205 College Avenue, Davie, Florida 33314. rhsc@ufl.edu

During von Humboldt's expedition to South America over two hundred years ago, the German naturalist endured great hardships unimaginable to modern biologists. I will review the perils of his epic journey and compare von Humboldt's remarkable challenges with the mere inconveniences encountered during modern biological expeditions.

8:25

[65] **What can we learn from Lepidoptera larvae?** Andrei Sourakov. McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, Powell Hall, University of Florida, 32611. asourakov@flmnh.ufl.edu

The life histories of the erythrina leafroller, *Agathodes designalis*, and the erythrina stem-borer, *Terastia meticulosalis* from north central Florida are described. Competition among larvae of these crambid moths led to ecological niche partitioning. Both species feed on the coral bean, *Erythrina herbacea*, and each species occupies different parts of the plant and different plants in the ecosystem. Oviposition, larval behavior and morphology are consistent with adaptation for resource partitioning. Both species are multivoltine and their life history varies between generations, suggesting adaptation to environmental conditions. The co-evolution of these moths with the genus *Erythrina* is proposed. Another moth - erythrina leafminer, *Leucoptera erythrinella* (Lyonetiidae) - also uses coral bean as its hostplant, utilizing it so that interspecific competition with the abovementioned crambids is minimal.

8:45

[66] **Collaborative Biological Control Efforts in Florida.** Trevor Smith. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608. trevor.smith@freshfromflorida.com

Due to the increase in pest introductions in Florida, a growing number of collaborative biological control programs are being developed. An overview of past and present Division of Plant Industry biological control projects will be presented. Challenges associated with the increasing number of invasive species detected each year will be reviewed. Future biological control programs in Florida will also be discussed.

9: 05

[67] **Temporal changes in the scale and whitefly fauna in Florida and the role of biological control programs**. Ian C. Stocks**.** Division of Plant Industry, Florida Department of Agriculture and Consumer Services, 1911 SW 34th Street, PO Box 147100, Gainesville, Florida 32614-7100. Ian.Stocks@FreshFromFlorida.com

For nearly a century, checklists of the scale and whitefly fauna of Florida have been published and updated. The lists have grown extensively as both presumably native and presumably adventive species have been discovered, and much of the growth can be attributed to expanded international trade relationships. Trends in the prevalence of many species suggest that the typical course is for a subset of adventive species to be initially highly pestiferous, and then decline in prevalence over time to low levels. This seems to occur even though a targeted biological control program may not been implemented, possibly suggesting that an increasingly complex ecological interaction between biocontrol agents and hosts is occurring.

9:25- 9:40 - Break – Orchid Foyer

9:40

[68] **Remembering a great entomologist and personal mentor: Dale Habeck as a weed biocontrol pioneer.** Julio Medal. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608. Julio Medal. Julio.Medal@freshfromflorida.com

This presentation is dedicated in the memory of Dr. Dale Habeck (1931-2010), a great American entomologist that left a rich legacy of contributions in the area of invasive plants in Florida and as a lepidopteran taxonomist. The main objectives of this talk is to give brief insights into Dr. Habeck's main contributions in the area of biological control of invasive aquatic and terrestrial plants in Florida and as a mentor of several dozen undergraduates, graduates and post-doctoral students in the area of classical biological control. An overview will be made on Dr Habeck's extensive collaborative efforts that inspired Brazilian agricultural researchers to initiate biological control efforts to solve invasive plant problems affecting Brazil and other countries.

10:00

[69] **Beneficial connections: Dale Habeck, flowers, and bugs.** Eric Rohrig. Florida Department of Agriculture and Consumer Services, Division of Plant Industry, 1911 SW 34th Street, Gainesville, FL 32608. Eric.Rohrig@freshfromflorida.com

Dale Habeck was well known for his research focusing on Lepidopteran insects and biological control of invasive weeds. Perhaps less known, is his work with flowering plants and their role in insect ecology. From what to plant in your backyard to attract beneficial insects to statewide surveys of flower visitors, Dale increased both the public and scientific communities' awareness. His mention of a common Florida weed indirectly led to an interesting fortuitous discovery more than 20 years later.

10:20

[70] **Brazilian pepper biological control research; The contributions of Dale Habeck and where they led.** Gregory Wheeler**.** USDA/ARS Invasive Plant Research Lab, 3225 College Ave, Ft Lauderdale, FL 33314. Greg.wheeler@ars.usda.gov

From faculty member in Entomology and Nematology to colleague in biological control of weeds, Dale Habeck had an evolving impact on me and other members of the community. From my arrival in Entomology at UF in 1985 to my current occupation, Dale's influence has gone from wise professor to esteemed colleague. In the beginning of our overlapping lives, we occupied opposite ends of a research Lab in Gainesville where we interacted on a daily basis. Then upon graduation I ended up in one of many fields that Dale worked in, biological control of weeds. Specifically, I worked in systems that he initiated including waterlettuce and Brazilian pepper. Discoveries that he made in these fields paved the way for developments that I and others pursued.

10:40

[71] **Metamorphosis in Lepidoptera.** James L. Nation. Department of Entomology and Nematology, University of Florida, Bldg. 970 Natural Area Drive, Gainesville, FL 3261. JLN@ufl.edu

Dale Habeck's favorite group of insects was Lepidoptera, and I am sure he was interested in all aspects of their biology and behavior, including the physiology of development. So to honor his memory and his devotion to entomology, I have chosen to review and summarize some of the major aspects of the transition of moths and butterflies from egg, to larva, to pupa, to adult. Complete metamorphosis provides moths and butterflies with three different lives – as larva, pupa, and finally adult. Developmental changes starting with growth of the embryo within the egg, hatching, larval development, pupation, and successful adult mating and reproduction are orchestrated by a number of hormones, and the nervous system is in charge of regulating these hormones. I will review the major nervous and hormonal controls in the development of Lepidoptera.

11:00 – Discussion

11:20 – *End of Symposium*

Wednesday, 8:30 – 11:00 AM – Orchid 1

Submitted Papers Session 3

8:30 Introduction

8:35

[72] **Ultrastructural and chemical studies on integument wax and wax-producing structures in the melaleuca psyllid *Boreioglycaspis melaleucae* (Hemiptera: Psyllidae)**. El-Desouky Ammar, Rocco Alessandro, Matthew Hentz, David G. Hall and Robert G. Shatters Jr. USDA-ARS, USHRL, 2001 S. Rock Rd., Fort Pierce, FL 34945. eldammar@hotmail.com

The melaleuca psyllid, *Boreioglycaspis melaleucae* (Hemiptera: Psyllidae), has been introduced to Florida as a biological control agent against *Melaleuca quinquenervia*, an invasive evergreen tree that has invaded large areas of Florida wetland since its introduction earlier from Australia as an ornamental plant. Colonies of *B. melaleucae* on young shoots and leaves of melaleuca are normally covered by white waxy material, and nymphs of various instars produce long bundles of white waxy filaments extending laterally and posteriorly from their abdomens. A scanning electron microscopy study of 'naturally waxed' and 'dewaxed' nymphs (cleaned from wax) revealed two types of wax pore plates located dorsally and laterally on the integument of the abdominal segments starting with the 5th segment. Type-1 wax pore plates, with raised rim, slits and pits, produce long ribbons and filaments of waxy secretions that wound together forming very long wax bundles, whereas type-2 wax pore plates, with slits only, produce shorter curls of wax. Additionally, in both nymphs and adult females, the circumanal ring (around the anus)

contained ornate rows of smaller wax pores that produce wax filaments covering their honeydew excretions. Infra-red spectroscopy of waxy secretions by the melaleuca psyllid nymphs indicated that they have spectra similar to those of ester wax. The role(s) of waxy secretions by *B. melaleucae*, in avoiding contamination with their honeydew among other possibilities, are discussed.

8:47

[73] **Antennal response of Asian citrus psyllid, *Diaphorina citri*, to degradation products of citrus volatiles.** Stephen L. Lapointe and Paul S. Robbins, USDA-ARS, U.S. Horticultural Research Laboratory, 2001 South Rock Road, Fort Pierce, FL 34945. Stephen.lapointe@ars.usda.gov

Asian citrus psyllid antennae reacted strongly when stimulated with citral and ocimene that had been aged for 3-5 d in glass stimulus tubes. When neat ocimene or citral were aged on filter paper strips in sealed Pasteur pipettes for 6 d, voltage changes were observed in both male and female antennae when a 1 ml air puff was applied through the pipette into the humidified airstream flowing past the antenna. This voltage change was not seen in newly prepared (0 day) stimulus tubes. Gas chromatography-mass spectrometry analyses of headspace volatiles of stimulus tubes loaded with 20 µl of citral or ocimene indicated that the compounds were present at 0 days but could no longer be found at 6 days. Coupled gas chromatograph-electroantennogram analyses documented two peaks from extracts of aged filter papers from ocimene and citral tubes that were stimulatory to psyllid antennae. Gas chromatography-mass spectrometry analysis determined the peaks to be acetic and formic acid. Acetic acid elicited greater responses from female antennae than from male antennae. There were no statistical differences noted between male and female antennae in response to formic acid. This is the first observation of antennally detectable volatiles resulting from degradation products of constitutive plant volatiles and may contribute to the development of effective attractants for the Asian citrus psyllid.

8:59

[74] **Performance of predatory beetle *Cryptolaemus montrouzieri* on diets of Asian citrus psyllid *Diaphorina citri*, citrus mealybug *Planococcus citri*, green citrus aphid *Aphis spiraecola*, corn leaf aphid *Rhopalosiphum maidis* and flour moth *Ephestia kuehniella*.** Jawwad A. Qureshi and Philip A. Stansly. South West Florida Research and Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142. jawwadq@ufl.edu

Management of the Asian citrus psyllid (ACP) *Diaphorina citri* is critical to reduce the incidence of its vectored huanglongbing or citrus greening disease in regions where both are established. Florida citrus industry faces serious challenge from this pest disease complex. Both biological and chemical control tactics are required for sustainable management of *D. citri* and other pests such as aphids and mealybugs which colonize citrus. Naturally occurring populations of lady beetle species known to be effective against *D. citri* and several other pests of Florida citrus are being decimated through wide spread use of broad spectrum insecticides targeted against *D. citri*. None of these species are commercially available for mass release to augment biological control.

Very few species are commercially available that could be potential predators of psyllids and additional pests. *Cryptolaemus montrouzieri* commonly known as an efficient predator of mealybugs was never tested against *D. citri*. Here we report results of our experiments designed to study survival, development and reproduction of *C. montrouzieri* on diets of *D. citri* and some other pests such as citrus mealybug *Planococcus citri*, green citrus aphid or spirea aphid *Aphis spiraecola*, corn leaf aphid *Rhopalosiphum maidis* and flour moth *Ephestia kuehniella* which could be useful to help support its survival in citrus and other agro-ecosystems and to maintain its colonies in the laboratory.

9:11

[75] **Replication of *Candidatus* Liberibacter asiaticus in its psyllid vector *Diaphorina citri* (Hemiptera: Psyllidae).** El-Desouky Ammar, Robert G. Shatters and David G. Hall. USDA-ARS, USHRL, 2001 S. Rock Rd., Fort Pierce, FL 34945. eldammar@hotmail.com

The Asian citrus psyllid, *Diaphorina citri* (Hemiptera: Psyllidae), is the primary vector of *Candidatus* Liberibacter asiaticus (CLas) implicated as causative agent of citrus huanglongbing (citrus greening), currently the most serious citrus disease worldwide. CLas is transmitted by *D. citri* in a persistent circulative manner, but the question of replication of this bacterium in its vector has not been resolved so far. Thus, we conducted two large experiments to study the effects of various acquisition access periods (AAP) on infected citrus plants by nymphs and adults of *D. citri* on CLas acquisition and transmission as well as on CLas replication in this vector. RT-PCR analysis indicated that following 1-7-day acquisition access period (AAP) by nymphs 34-52% of *D. citri* became infected, whereas only 11-23% were infected after 1-7 day AAP by adults. Also, the CLas titer in *D. citri* (relative to that of psyllid S20 ribosomal protein gene) was: 1) generally higher in nymphs than in adults, 2) higher with longer AAP, and 3) higher as post-acquisition time increased between 1 and 21 days. These experiments are being repeated and further analyzed for confirmation of these results.

9:23- 9:40 - Break – Orchid Foyer

9:40

[76] **Transcriptome analysis of RNAi induced Asian citrus psyllid using quantitative real-time PCR and next generation sequencing**. John Ramos, Robert Shatters, Charles Powell, Dov Borovsky and Ritesh Jain. USDA-ARS 2001 S. Rock Road Fort Pierce, FL 34945. john.ramos@ars.usda.gov

The Asian Citrus Psyllid (Diaphorina citri Kuwayama) is an invasive Homopteran that has crippled citrus production in Florida spreading Huanglongbing (Citrus Greening) disease, causing small discolored and bitter fruit. The disease is associated with the bacterium '*Candidatus*' Liberibacter and is rapidly spreading to other citrus producing states. RNAi studies of targeted Genes were based upon a competitive Innocentive challenge among experts from diverse fields funded by the Citrus Research and Development Foundation. Seven of the fifty genes tested caused significantly high mortality and showed dose response to dsRNA containing diets. Transcriptome analysis performed using qRT-PCR and Ion Torrent Sequencing quantified

changes in the expression profile of gut tissue resulting from dsRNA containing diets. Most of these genes share similar cellular function and mode of action. These results support a systems-based approach to targeting the GI tract of Psyllids using RNAi.

9:52

[77] **Response of Asian citrus psylla, *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) to selected organic insecticides.** Jawwad A. Qureshi, Azhar A. Khan and Philip A. Stansly. South West Florida Research and Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142. jawwadq@ufl.edu

The Asian citrus psyllid (ACP) vectors causal pathogen of the huanglongbing or citrus greening disease a serious threat to citrus in Florida and other regions. Vector control is critical to reduce disease spread. Significant progress has been made in optimizing insecticide use to control ACP in conventional citrus. However, there is not enough information on the efficacy of the products that organic citrus growers could use to develop effective plans to manage vector psyllid. We used sprays and leaf dip bioassays to evaluate some Organic Materials Review Institute approved products and a dish-washing detergent Dawn against ACP. When sprayed in the laboratory, cumulative mortality of adults with insecticidal soap M-Pede® and detergent averaged 91% and 93%, respectively, within 72 hours after application. Organic JMS Stylet Oil® alone killed 80% whereas the combination of M-Pede® + Organic JMS Stylet Oil® provided 97% mortality, which was better than either product alone. Entrust® (spinosad) provided 87% mortality whereas Microthiol 80 DF® and Aza-Direct® provided only up to 25% mortality. When shoots infested with nymphs were dipped in the spray solutions mortality averaged between 90-100% in all treatments. Under field conditions, we observed significant reduction of nymphs and adults of ACP for up to 24 days using Grandevo® applied with Hyper-Active or FL 435-66 oil. FL 435-66 oil by itself, Sil-Matrix and M-Pede + Addit (a vegetable oil adjuvant) suppressed ACP for 10 to 17 days. Large scale field studies are designed for testing more products and development of ACP management plans for organic citrus.

10: 04

[78] **The latest buzz on Asian citrus psyllid vibration traps.** R. W. Mankin, S. McNeill and T. Paris. USDA-ARS-CMAVE, 1700 SW 23rd Dr., Gainesville, FL 32608. Richard.Mankin@ars.usda.gov

Efforts are in progress to develop alternative methods for monitoring the Asian Citrus Psyllid (ACP). One potential method is to trap males with attractive vibrational communication signals. A battery-powered microcontroller platform was programmed to detect signals of male ACP searching for females on tree branches and produce synchronized, attractive replies. The system has been placed in field traps, and evaluations of efficacy are being conducted.

10: 16

[79] **Extension model to improve Asian citrus psyllid control in Citrus Health Management Areas (CHMAs).** Moneen M. Jones and Philip A. Stansly**.** South West Florida Research and

Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142.
mmjones2@ufl.edu

Citrus health management areas (CHMAs) have been implemented throughout Florida to provide regional coordination to manage Asian citrus psyllid (ACP) and spread of HLB. The Gulf CHMA is going into its 5th season of cooperative action toward these goals. During the fourth (2011-2012) season we began providing GULF CHMA updates and interactive maps from CHRP data available on the CHMA website www.flchma.com, showing ACP levels and 'hot spots' (i.e. tap samples > 21 ACP for 3 consecutive cycles) on our website, www.imok.ufl.edu. The ring color of the proportional circle map designates the cycle, and the ring size the number of ACP adults per 50 taps. The largest ring represents psyllid numbers of 21 or greater. The map is readable by anyone with Adobe Reader, and it allows you to click on and off different cycle layers and view data for Cycle #, Cycle Date, County Name, and ACP # thus allowing comparison between two or more sets of data simultaneously and spatially. This project includes development and testing of a smart phone spray app for use by growers and consultants. The insecticide spray data will be converted to a map layer that overlays the Gulf CHMA psyllid counts to determine which growers may need help and what chemicals appear to be failing -- a precursor to predicting ACP resistance. We expect to build better working relationships with the growers by offering individual support of their economic efforts, ACP management, and HLB control.

10:28

[80] **Economic Injury Level model for Asian citrus psyllid control in citrus groves with high incidence of HLB.** Monzó, C. and P. A. Stansly. South West Florida Research and Education Center, University of Florida, 2685 SR 29 N, Immokalee, FL 34142. cmonzo@ufl.edu

Two 3-year field experiments were conducted in two commercial orange blocks in southwest Florida. One of the groves was planted with ‘EarlyGold’ and the other with ‘Valencia’ oranges. Average HLB incidence at the beginning of the experiment based on PCR analysis was 98% for ‘Earlygold’ and 42% for ‘Valencia’.

Experimental design was RCB with 4 replicates and 4 treatments: (1) no insecticide, (2) monthly applications (3) a nominal threshold of 0.2 psyllids per tap, and (4) a nominal threshold of 0.7 psyllids per tap. Treatment (2) was sprayed twice during the (winter) dormant season and treatment (3) spayed once, regardless of whether threshold was reached. Broad spectrum insecticides were used in winter and at the end of the growing season. More selective products were chosen during the growing season to conserve natural enemies.
Asian citrus psyllid (ACP) adult populations as well as beneficial arthropod faunal abundance were monitored every 2 weeks by tap sampling. Yield from each plot were estimated by counting full and partially full tubs in the harvest.

A cost-benefit analysis using the hyperbolic equation was conducted to determine which ACP densities were able to balance the additional ACP application costs to the losses due to ACP. This analysis indicated that mean ACP adults per tap throughout the season required to optimizing the insecticide program ranged between 0.001 and 0.33 per fortnightly tap sample, depending on market juice prices, juice quality and insecticide application costs.

Indirect costs derived from ACP biological control loses were also estimated with the proposed model.

10:40 - Discussion

11:00 - *End of Submitted Paper Section 3*

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