

**FLORIDA ENTOMOLOGY SOCIETY ANNUAL MEETING,  
AUGUST 2-5, 2015 – SANIBEL HARBOUR RESORT & SPA, FT. MYERS FLORIDA  
DAILY SCHEDULE OF MEETINGS AND FUNTIONS**

<b>SUNDAY, AUGUST 2<sup>nd</sup></b>		
<b>Meeting/Function</b>	<b>Time</b>	<b>Room / Location</b>
Office	3:00 PM – 6:00 PM	Cypress
Registration	3:00 PM – 6:00 PM	Registration Desk
Presentation Collection – Slide Preview	3:00 PM – 6:00 PM	Jasmine
Poster Display Set-UP	3:00 PM – 6:00 PM	Caloosa B
Executive Board Meeting	6:00 PM – 7:00 PM	Orchid
<b>MONDAY, AUGUST 3<sup>rd</sup></b>		
<b>Meeting/Function</b>	<b>Time</b>	<b>Room / Location</b>
Continental Breakfast	7:00 AM – 7:55 AM	Everglades Foyer
Registration Continued	8:00 AM – 5:00 PM	Registration Desk
Presentation Collection – Slide Preview	8:00 AM – 5:00 PM	Jasmine
Welcoming Remarks / Cindy McKenzie	8:00 AM – 8:10 AM	Everglades A&B
Presidential Address / Cindy McKinzie	8:10 AM – 8:30 AM	Everglades A&B
International Congress of Entomology 2016 / Alvin Simmons	8:30 AM - 8:40 AM	Everglades A&B
2015 Pioneer Lecture	8:40 AM – 9:20 AM	Everglades A&B
FES Business Meeting	9:25 AM – 10:25 AM	Everglades A&B
Coffee Break	10:30 AM –10:55 AM	Everglades Foyer
Graduate Student Luncheon – with Pioneer Lecturer	12:15 PM -1:15 PM	Island Room
Student Competition: Ph.D.	1:30 PM -3:45 PM	Everglades A
Coffee break	3:00 PM-3:15 PM	Everglades Foyer
Student Competition: M.Sc.	3:45 PM-4:45 PM	Everglades B
Poster Session – Authors present 4:45 PM to 5:45 PM	1:30 AM – 5:45 PM	Caloosa B
Mixer Social	6:30 PM – 8:30 PM	Island Room & Terrace
<b>TUESDAY, AUGUST 4<sup>th</sup></b>		
<b>Meeting/Function</b>	<b>Time</b>	<b>Room / Location</b>
Past President's Breakfast	7:00 AM	Restaurant
Continental Breakfast	7:30 AM – 8:25 AM	Everglades Foyer
Registration Continued	8:00 AM – 5:00 PM	Registration Desk
Presentation Collection – Slide Preview	8:00 AM – 5:00 PM	Jasmine
Poster Session – Authors present 4:30 PM to 5:30 PM	11:00 AM – 5:30 PM	Caloosa B
Symposium: <b>Management of Thrips and Tospoviruses in Florida: Emerging and Long Term Concerns</b>	8:10 AM – 12:00 PM	Everglades A
Symposium: <b>Unique Application Methods to Control Insect Pests</b>	8:25 AM – 11:45 AM	Everglades C
Submitted Papers Session 1	8:30 AM – 11:45 PM	Caloosa A
Coffee Break	10:05 AM –10:25 AM	Everglades Foyer
Awards Luncheon	12:00 PM – 2:00 PM	Island Room
Nan-Yao Su Symposium: <b>Accomplishments and Impact of Nan-Yao Su on Termite Research and Control: Celebrating the 20th Anniversary of the Commercial Launch of the Sentricon® Termite Colony Elimination System</b>	2:05 PM – 4:30 PM	Everglades A
Symposium: <b>Mosquito Control in Florida</b>	2:05 PM – 5:00 PM	Everglades C
Submitted Papers Session 2	2:05 PM – 4:10 PM	Caloosa A
Coffee Break	3:00 PM – 3:20 PM	Everglades Foyer
<b>WEDNESDAY, AUGUST 6<sup>th</sup></b>		
<b>Meeting/Function</b>	<b>Time</b>	<b>Room / Location</b>
Registration Continued	8:00 AM – 9:00 AM	Registration Desk

Continental Breakfast	7:30 AM – 8:25 AM	Everglades Foyer
Symposium: <b>Management of Fall Armyworm</b>	8:55 AM – 11:45 PM	Everglades A
Symposium: <b>Whiteflies: Developing Management Solutions for Globally Invasive Pests</b>	8:55 AM – 11:45 PM	Everglades C
Poster Session – Continued	8:00 AM – 12:00 PM	Caloosa B
Coffee Break	10:05 AM - 10:25 AM	Everglades Foyer
Whitefly In-Service Training	1:30 PM - 5:00 PM	Orchid/Caloosa A

**PROGRAM**  
**98th ANNUAL MEETING of the**  
**FLORIDA ENTOMOLOGICAL SOCIETY**  
**August 2- 5, 2015 – Ft. Myers, FL**

<b>SUNDAY, AUGUST 2<sup>nd</sup></b>		
<b>Time</b>	<b>Meeting/Function</b>	<b>Room / Location</b>
3:00 PM – 6:00 PM	Office	Cypress
3:00 PM – 6:00 PM	Registration	Registration Desk
3:00 PM – 6:00 PM	Presentation Collection – Slide Preview	Jasmine
3:00 PM – 6:00 PM	Poster Display Set-UP	Caloosa B
6:00 PM – 7:00 PM	Executive Board Meeting	Orchid
<b>MONDAY, AUGUST 3<sup>rd</sup></b>		
<b>Time</b>	<b>Meeting/Function</b>	<b>Room / Location</b>
7:00 AM – 7:55 AM	Continental Breakfast	Everglades Foyer
8:00 AM – 5:00 PM	Registration Continued	Registration Desk
8:00 AM – 5:00 PM	Presentation Collection – Slide Preview	Jasmine
8:00 AM – 8:10 AM	<b>Welcoming Remarks</b> / Cindy McKenzie	Everglades A&B
8:10 AM – 8:30 AM	<b>Presidential Address</b> / Cindy McKenzie	Everglades A&B
8:30 AM - 8:40 AM	<b>International Congress of Entomology 2016</b> / Alvin Simmons	Everglades A&B
8:40 AM – 9:20 AM	2015 Pioneer Lecture: <b>Professor Margaret Collins, 2015 Pioneer Awardee</b> Vernard Lewis, University of California Berkeley, College of Natural Resources, Richmond, CA 94804	Everglades A&B
9:25 AM – 10:25 AM	<b>FES Business Meeting</b>	Everglades A&B
10:30 AM – 10:55 AM	<b>Coffee Break</b>	Everglades Foyer
1:30 AM – 5:45 PM	<b>Poster Session 1</b> – Authors present 4:45 PM to 5:45 PM	Caloosa B
<b>DSP-1</b>	<b>Genetic Assay for Distinguishing Native and Imported Fire Ant Species</b> David C. Cross and Michael A. Caprio Dept. of Biochemistry, Mol. Biol, Entomology and Plant Pathology, Mississippi State Univ. 100 Old Hwy 12, Miss. State, MS 39762; <a href="mailto:dcc6@msstate.edu">dcc6@msstate.edu</a>	
<b>DSP-2</b>	<b>Evaluating mustard and arugula plant volatiles and refuge plants for sustainable control of insect pests</b> Jesusa C. Legaspi, Neil Miller, Lambert Kanga, Muhammad Haseeb USDA-Agricultural Research Service-CMAVE /Florida A&M University-Center for Biological Control 6383 Mahan Dr., Tallahassee, FL 32308; <a href="mailto:Jesusa.Legaspi@ars.usda.gov">Jesusa.Legaspi@ars.usda.gov</a>	
<b>DSP-3</b>	<b><i>Nesidiocoris tenuis</i> (Heteroptera: Miridae) for Control Silverleaf Whitefly in Tomato</b> Jose A. Castillo, Amy Roda and Philip A. Stansly University of Florida – IFAS-SWFREC, Immokalee, Florida 34142; <a href="mailto:jacastil@ufl.edu">jacastil@ufl.edu</a>	
<b>DSP-4</b>	<b>Morphology and Sexual Dimorphism of the Weevil <i>Myloccerus undecimpustulatus undatus</i> (Coleoptera: Curculionidae)</b> Justin George and Stephen L. Lapointe USDA-ARS, USHRL, 2001 South Rock Road, Fort Pierce 34953; <a href="mailto:justin.george@ars.usda.gov">justin.george@ars.usda.gov</a>	
<b>DSP-5</b>	<b>Variability in leaf damage among cultivars of lychee, host of <i>Myloccerus undecimpustulatus undatus</i> Marshall adults</b> Nancy D. Epsky, Jerome Niogret, Micah A. Gill and Paul E. Kendra	

	USDA/ARS, SHRS, 13601 Old Cutler Rd. Miami, FL 33158; <a href="mailto:Epsky@ars.usda.gov">Epsky@ars.usda.gov</a>	
<b>DSP-6</b>	<b>Enrichment Of A-Copaene Content Results in Improved Lure for Redbay Ambrosia Beetle, <i>Xyleborus glabratus</i> (Coleoptera: Curculionidae: Scolytinae)</b> <u>Paul E. Kendra</u> , Wayne S. Montgomery, Mark A. Deyrup, and David Wakarchuk USDA-ARS, SHRS, 13601 Old Cutler Rd., Miami, FL 33158; <a href="mailto:paul.kendra@ars.usda.gov">paul.kendra@ars.usda.gov</a>	
<b>DSP-7</b>	<b>Silk Fly Electroantennography, A Crucial Step For Semiochemical Investigations</b> <u>David Owens</u> , Gregg Nuessly, Paul Kendra, Dfkshina Seal, Thomas Colquhoun, and Daniel Hahn University of Florida - IFAS, Everglades Research and Education Center, 3200 E. Palm Beach Rd, Belle Glade, FL 33430 <a href="mailto:owensd119@ufl.edu">owensd119@ufl.edu</a>	
<b>DSP-8</b>	<b>Stink Bugs in Florida Rice</b> Ron Cherry and <u>Mike Karounos</u> . Everglades Research & Education Center, 3200 E Palm Beach Rd., Belle Glade, FL 33430-4702; <a href="mailto:wompum@ufl.edu">wompum@ufl.edu</a>	
<b>DSP-9</b>	<b>Dose-responses of the citrus leaf miner to several insecticides commonly applied in Florida</b> <u>James A. Tansey</u> , Moneen M. Jones, Pilar Vanaclocha, and Philip A. Stansly University of Florida, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 <a href="mailto:jtansej@ufl.edu">jtansej@ufl.edu</a>	
12:15 PM -1:15 PM	<b>Graduate Student Luncheon – with Pioneer Lecturer</b>	Island Room
<b>Student Competition: Ph.D.</b>		Everglades A&B
<b>1</b> 1:30 PM	<b>Transmission of <i>Squash Vein Yellowing Virus</i> to and from Cucurbit Weeds and Effects on Whitefly Behavior</b> <u>Deepak Shrestha</u> , Susan Webb, Heather McAuslane, and Scott Adkins Dept. Entomology and Nematology, UF; PO Box 110620, 1881 Natural Area Drive, Steinmetz Hall, Gainesville, FL 32611; <a href="mailto:dshrestha@ufl.edu">dshrestha@ufl.edu</a>	
<b>2</b> 1:45 PM	<b>Optimizing Host: Parasitoid Ratios and Photoperiod for Efficient Mass Rearing of <i>Tamarixia Radiata</i> (Hymenoptera: Eulophidae), A Parasitoid of The Citrus Greening Disease Vector <i>Diaphorina Citri</i> (Hemiptera: Psyllidae)</b> <u>Xulin Chen</u> , Monica Triana and Philip A. Stansly University of Florida IFAS, Southwest Florida Research and Education Center 2685 State Road 29 N. Immokalee, FL. 34142; <a href="mailto:xulin527@ufl.edu">xulin527@ufl.edu</a>	
<b>3</b> 2:00 PM	<b>Systemic Insecticides and Reflective Mulch for Asian Citrus Psyllid (<i>Diaphorina Citri</i>) Control in New Citrus Plantings</b> <u>Scott Croxton</u> and Phil Stansly University of Florida IFAS, Southwest Florida Research and Education Center 2685 State Road 29 N. Immokalee, FL. 34142; <a href="mailto:croxtsd@ufl.edu">croxtsd@ufl.edu</a>	
<b>4</b> 2:15 PM	<b>Susceptibility of Strawberry Varieties to <i>Tetranychus Urticae</i> (Koch) and Establishment of <i>Neoseiulus Californicus</i> (Mcgregor) in Organic Open-Field and High Tunnel Systems</b> <u>Omotola Dosunmu</u> and Oscar Liburd University of Florida Entomology and Nematology Dept. Bldg. 970, Natural Area Dr., Gainesville, FL 32611-0620 <a href="mailto:toladosunmu@ufl.edu">toladosunmu@ufl.edu</a>	
<b>5</b> 2:30	<b>New Organic Tools, Border Sprays, and Cultivation Tactics for Control of <i>Drosophila suzukii</i></b> <u>Lindsay E. Iglesias</u> , Oscar E. Liburd University of Florida, Entomology & Nematology Dept., 1881 Natural Area Dr., Gainesville, FL 3261 <a href="mailto:lignlesias@ufl.edu">lignlesias@ufl.edu</a>	
<b>6</b> 2:45	<b>The Dose-Independent Lethal Time of 20-Hydroxyedysone Ingested by Formosan Subterranean Termites</b> <u>Lucas P. Carnohan</u> , Nan-Yao Su, and Salvador Gezan University of Florida- IFAS, Fort Lauderdale Research and Education Center, 3205 College Ave. Davie, FL 33314 <a href="mailto:carnohanl@ufl.edu">carnohanl@ufl.edu</a>	
3:00-3:15 PM	<b>Coffee Break</b>	
<b>7</b>	<b>Field Host Specificity of a Potential Hydrilla Biological Control Agent, <i>Cricotopus Lebetis</i> Sublette</b>	

3:15 PM	<b>(Diptera: Chironomidae).</b> Eutyclus Kariuki, James Cuda, Jennifer Gillett-Kaufman, Stephen Hight, and Raymond Hix Dept. of Entomology & Nematology, University of Florida, Bldg 970 Natural Area Dr. Gainesville, FL 32611, <a href="mailto:Eutyclus.kariuki@ufl.edu">Eutyclus.kariuki@ufl.edu</a>	
<b>8</b> 3:30 PM	<b>Development of Silk Fly Olfactory Bioassays</b> <u>David Owens</u> , Gregg Nuessly, Thomas Colquhoun and Dakshina Seal University of Florida - IFAS, Everglades Research and Education Center, Belle Glade, FL 33430; <a href="mailto:owensd119@ufl.edu">owensd119@ufl.edu</a>	
<b>Student Competition: M.Sc.</b>		Everglades B
<b>9</b> 3:45 PM	<b>Evaluation of Monitoring, Biorational Insecticides and Pruning for Integrated Management of Chilli Thrips, <i>Scirtothrips Dorsalis</i> Hood (Thysanoptera: Thripidae) On Roses</b> <u>Luis F. Aristizábal</u> , Yan Chen, Ron H. Cherry, Ron D. Cave, and Steven P. Arthurs Mid-Florida Research and Education Center, 2725 Binion Rd, Apopka, FL 32703, <a href="mailto:larist@ufl.edu">larist@ufl.edu</a>	
<b>10</b> 4:00 PM	<b>Effect of <i>Diaphorina citri</i> (Homoptera: Psyllidae) instar on level of parasitism, sex ratio, and size of <i>Tamarixia radiata</i> (Hymenoptera: Eulophidae)</b> <u>Christopher R. Kerr</u> , Norman C. Leppla, Eric A. Rohrig University of Florida – IFAS, Dep’t of Entomology and Nematology, 1881 Natural Area Drive, Gainesville, FL 32611 <a href="mailto:Ishbua@ufl.edu">Ishbua@ufl.edu</a>	
<b>11</b> 4:15 PM	<b>Florida Host Plant Suitability and Preference for the Brown Marmorated Stink Bug: <i>Halyomorpha halys</i> (Stål)</b> <b>Hemiptera: Pentatomidae</b> <u>Eric G. LeVeen</u> , Amanda Hodges, PhD University of Florida, Department of Entomology and Nematology/Doctor of Plant Medicine Program <a href="mailto:eleveen@ufl.edu">eleveen@ufl.edu</a>	
<b>12</b> 4:30 PM	<b>Biology of <i>Thalassa Montezumae</i> (Coleoptera: Coccinellidae) A Predaceous Beetle of the Invasive Soft Scale <i>Phalacroccoccus Howertoni</i> (Hemiptera: Coccidae) n South Florida</b> <u>Netalie Francis</u> , Lambert Kanga, Muhammad Haseeb, Catharine Mannion Florida Agricultural and mechanical University, Tallahassee FL, 32307 <a href="mailto:nfrancis232@gmail.com">nfrancis232@gmail.com</a>	
6:30 PM – 8:30 PM	Mixer Social	Island Room & Terrace
<b>TUESDAY, AUGUST 4<sup>th</sup></b>		
<b>Time</b>	<b>Meeting/Function</b>	<b>Room / Location</b>
7:00 AM	Past President’s Breakfast	Restaurant
7:30 AM – 8:25 AM	Continental Breakfast	Everglades Foyer
8:00 AM – 5:00 PM	Registration Continued	Registration Desk
8:00 AM – 5:00 PM	Presentation Collection – Slide Preview	Jasmine
11:00 AM – 5:30 PM	<b>Poster Session</b>	Caloosa B
<b>Submitted Paper Session 1</b>		Caloosa A
<b>13</b> 8:30 PM	<b>An Overview of Mosquito Control Programs in Florida</b> <u>Adriane Rogers</u> Florida Department of Agriculture and Consumer Services Division of Agricultural Environmental Services Bureau of Scientific Evaluation and Technical Assistance, Tallahassee, FL 32399 <a href="mailto:Adriane.Tambasco@FreshFromFlorida.com">Adriane.Tambasco@FreshFromFlorida.com</a>	
<b>14</b> 8:45 PM	<b>Development of a Smart Mosquito Counter Device &amp; Its Newly Updated Capability for Mosquito Identification</b> <u>Hoonbok Yi</u> , Jae-seung Yu, Sangae Kim, Hyunjung Kim, Wookgyo Lee, Young Ran Ju, Mi-Yeoun Park, and E-hyun Shin Department of Bio & Environmental Technology, Seoul Women's University, Seoul, Korea 139-774 <a href="mailto:yihoonbok@gmail.com">yihoonbok@gmail.com</a>	
<b>15</b> 9:00 PM	<b>Creating a field environment in a tent: Do simulations really work?</b> <u>Phillip E. Kaufman</u> Entomology and Nematology Dept., University of Florida, Gainesville, FL 32611 <a href="mailto:pkaufman@ufl.edu">pkaufman@ufl.edu</a>	

16 9:15	<b>Milkweed Watch: The Search for Invertebrate Diversity Through Citizen Science</b> Thomas Weissling and Louise Lynch Department of Entomology, 103 Entomology Hall, University of Nebraska, Lincoln, NE 68583-0816 <a href="mailto:tweissling@unl.edu">tweissling@unl.edu</a>
17 9:30 PM	<b>Biological and economical evaluation of an integrated pest management of coffee berry borer, <i>Hypothenemus hampei</i> (Coleoptera: Curculionidae) on large coffee farm in Colombia through participatory research</b> Luis F. <a href="mailto:larist@ufl.edu">Aristizábal</a> <sup>1</sup> , Hector I. Trujillo <sup>2</sup> , Alex E. Bustillo <sup>3</sup> , Mauricio Jiménez <sup>4</sup> , and Steven P. Arthurs <sup>1</sup> . Mid-Florida Research and Education Center, 2725 Binion Rd, Apopka, FL 32703, <a href="mailto:larist@ufl.edu">larist@ufl.edu</a>
9:45 PM	<b>Coffee Break</b>
18 10:00	<b>A Trap and Lure for Monitoring Blueberry Gall Midge (<i>Dasineura Oxycoccana</i> Johnson) in Florida Blueberries</b> Elena M. Rhodes, Shweta Sharma, Hans Alborn, Nicole Benda, and Oscar E. Liburd Entomology and Nematology Dept., University of Florida, Gainesville, FL 32611 <a href="mailto:erhodes@ufl.edu">erhodes@ufl.edu</a>
19 10:15	<b>The Fungus, <i>Raffaelea Lauricola</i>, Manipulates Release of Host Plant Odors Causing Initial Repellency and Subsequent Attraction to Trees by its Vector, the Redbay Ambrosia Beetle</b> Xavier Martini, Marc A. Hughes, Jason A. Smith, Lukasz L. Stelinski University of Florida, CREC, 700 experimental Station road, Lake Alfred, FL 33850 <a href="mailto:smartini@ufl.edu">smartini@ufl.edu</a>
20 10:30	<b>The Rise and Fall of Formosan Subterranean Termite Colonies in Louis Armstrong Park, New Orleans, 2004 – 2014</b> Nan-Yao Su, Eric Guidry, and Carrie Cottone Ft. Lauderdale Research and Education Center, University of Florida <a href="mailto:nysu@ufl.edu">nysu@ufl.edu</a>
21 10:45	<b>Laboratory Host-Specificity Tests with the Kudzu Bug, <i>Megacopta cribraria</i> (Hemiptera: Plataspidae) A New Invader in Florida</b> Julio Medal, Susan Halbert and Andrew Santa Cruz Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 1911 SW 34th Street. Gainesville, FL 32608 <a href="mailto:Julio.medal@freshfromflorida.com">Julio.medal@freshfromflorida.com</a>
22 11:00	<b>Biology of a stem boring weevil <i>Apocnemidophorus pipitzi</i> (Faust) (Coleoptera: Curculionidae) And its impact on Brazilian peppertree, <i>Schinus terebinthifolia</i></b> J. P. Cuda, J. L. Gillmore, J. C. Medal, J. Bricker, and B. R. Garcete-Barrett Entomology & Nematology Dept., Charles Steinmetz Hall, PO Box 110620, Gainesville, FL 32611-0620 <a href="mailto:jcuda@ufl.edu">jcuda@ufl.edu</a>
23 11:15	<b>Effect of environmental variables on Coffee berry borer (<i>Hypothenemus hampei</i>) in Puerto Rico</b> Jose M. Garcia, Yobana A. Marino, Paul Bayman, and Jose C. V. Rodrigues University of Puerto Rico-AES, 1193 Calle Guayacan St, San Juan PR 00926 <a href="mailto:jose_carlos@mac.com">jose_carlos@mac.com</a>
24 11:30	<b>Do-It-Yourself Insect Pest Traps</b> Adrian Hunsberger <sup>1</sup> and Steven Arthurs <sup>2</sup> . <sup>1</sup> UF/Miami-Dade County Extension 18710 SW 288 <sup>th</sup> Street, Homestead, FL 33030 <a href="mailto:aghu@ufl.edu">aghu@ufl.edu</a>
<b>2015 Industry Symposium</b> <b>Unique Application Methods to Control Insect Pests</b> Organizers: Catherine Long (Syngenta Crop Protection, Vero Beach, FL) Craig Heim (FMC, Savannah, GA), Bruce Ryser (FMC, Tampa, FL) and Scott Ferguson (Atlantic Turf & Ornamental Consulting, Vero Beach, FL) <a href="mailto:scott@atoconsult.com">scott@atoconsult.com</a>	
8:25 AM	<b>Welcome Introduction</b> Scott Ferguson
25 8:30 AM	<b>Sentricon® Termite Colony Elimination System: An Innovative Approach to Termite Control Born of Collaboration Between Industry and Academia.</b> Joe Eger, Dow AgroSciences, 2606 S. Dundee St. Tampa, FL 33629 <a href="mailto:jeeger@dow.com">jeeger@dow.com</a>
26 8:50 AM	<b>Citrus Trunk and Citrus Root Injection Techniques for the Treatment of Citrus “Greening” Disease.</b> Tom Minter, Florida Pesticide Research, Inc. 1810 Deleon Street, Oviedo, FL 32765; <a href="mailto:FLPESTTOM@bellsouth.net">FLPESTTOM@bellsouth.net</a>
27 9:10 AM	<b>End Zone Fly Sticker Bait, A New Method For Control of Filth Flies.</b> Dina Richman, & Bruce Ryser, FMC Corp., 9703 Cypress Pond Avenue, Tampa, FL 33647; Dina Richman, FMC

Everglades C

	Global Specialty Solutions, 9703 Cypress Pond Avenue, Tampa, FL. 33647; <a href="tel:813-361-2393">813-361-2393</a> ; <a href="mailto:bruce.ryser@fmc.com">bruce.ryser@fmc.com</a>	
<b>28</b> 9:30 AM	<b>Worldwide Status on the Use of Mating Disruption.</b> <u>Jack W. Jenkins</u> and Donald Thomson, Pacific Biocontrol Corp, 620 E. Bird Lane, Litchfield Park, AZ 85340; <a href="mailto:jjenkins@pacificbiocontrol.com">jjenkins@pacificbiocontrol.com</a>	
9:50 AM	<b>Coffee Break</b>	
<b>29</b> 10:10 AM	<b>A Progressive Approach To Baiting When Managing the Invasive Tawny Crazy Ant, <i>Nylanderia fulva</i> (Hymenoptera: Formicidae).</b> Michael Bentley, University of Florida, Department of Entomology and Nematology, P.O. Box 110620, Gainesville, FL, 32611 <a href="mailto:MTBentley@ifas.ufl.edu">MTBentley@ifas.ufl.edu</a>	
<b>30</b> 10:30 PM	<b>Effective Pest Control Through Trunk Injection Technology.</b> JB Toorish, Arborjet, Inc., 5860 Ansley Way, Mount Dora, FL 32757; <a href="mailto:jbtoorish@arborjet.com">jbtoorish@arborjet.com</a>	
<b>31</b> 10:50 PM	<b>Seed Treatments for Control of Insects in Vegetables</b> David Belles Syngenta Crop Protection, Chandler AZ; <a href="mailto:David.Belles@syngenta.com">David.Belles@syngenta.com</a>	
<b>32</b> 11:10	<b>Utilization of biotech sweetcorn products for pest management.</b> Roberto Cordero, Seminis Vegetable Seeds Co., 2700 Camino Del Sol, Oxnard, CA 93030	
11:30 AM	<b>Discussion and Wrap Up:</b> Scott Ferguson	
<b>Symposium</b>		
<b>Management of Thrips and Tospoviruses in Florida: Emerging and Long Term Concerns</b>		
Organizer: Hugh A. Smith, Ph. D. Assistant Professor, Vegetable Entomology Univ. Florida/IFAS/Gulf Coast REC, 14625 CR 672, Wimauma, FL, 33598 <a href="mailto:hughasmith@ufl.edu">hughasmith@ufl.edu</a>		Everglades A
8:10 AM	<b>Welcome Introduction</b> Hugh Smith	
<b>33</b> 8:15 AM	<b>Challenges and Opportunities in the Management of Thrips and Thrips-Vectored Viruses in Florida</b> Joe Funderburk University of Florida-IFAS, 155 Research Road, Quincy, FL 32351; <a href="mailto:jef@ufl.edu">jef@ufl.edu</a>	
<b>34</b> 8:30 AM	<b>Transmission of Tospoviruses and Ilarviruses by Thrips</b> <u>Ismael E. Badillo-Vargas</u> , Joseph E. Funderburk & Scott Adkins University of Florida, Quincy, Florida; <a href="mailto:ismael.badillo@ars.usda.gov">ismael.badillo@ars.usda.gov</a>	
<b>35</b> 8:45 AM	<b>The Role of The IR-4 Project In Helping to Manage Thrips Across Commodities in FL Agriculture.</b> Michelle Samuel-Foo IR-4 Southern Region Field Coordinator   Associate Research Scientist University of Florida   Food and Environmental Toxicology Lab , 1642 SW 23rd Drive PO Box 110720, Gainesville, FL 32611 – 0720 <a href="mailto:mfoo@ufl.edu">mfoo@ufl.edu</a>	
<b>36</b> 9:00 AM	<b>Predator in First: A Prophylactic Biological Control Strategy for Management of Multiple Pests of Pepper</b> <u>Cindy L. McKenzie</u> , Vivek Kumar, Yingfang Xiao, Lance S. Osborne US Horticultural Research Laboratory, ARS-USDA 2001, S. Rock Road, Fort Pierce, FL 34947, <a href="mailto:cindy.mckenzie@ars.usda.gov">cindy.mckenzie@ars.usda.gov</a>	
<b>37</b> 9:15 AM	<b>Thrips in the South Florida Landscape</b> Catharine Mannion Associate Professor of Entomology, Tropical Research and Education Center, 18905 SW 280 <sup>th</sup> Street, Homestead, FL 33031, <a href="mailto:cmannion@ufl.edu">cmannion@ufl.edu</a>	
<b>38</b> 9:30 AM	<b>Thrips Species, Seasonal Abundance And Their Management to Suppress Tomato Chlorotic Spot Virus In Homestead Tomato.</b> Dak Seal Associate Scientist, IPM, Insect Pest of Vegetables, Tropical Research and Education Center UF/IFAS, 18905 SW 280 <sup>th</sup> St., Homestead, FL 33031, <a href="mailto:dseal3@ufl.edu">dseal3@ufl.edu</a>	
<b>39</b> 9:45 AM	<b>Biology and Management of Flower Thrips in Berry Crops</b> <u>Oscar Liburd</u> and Elena M. Rhodes Professor of Fruit and Vegetable Entomology, Entomology and Nematology Dept., Bldg. 970, Natural Area Dr., University of Florida, Gainesville, FL 32611-0620, <a href="mailto:oeliburd@ufl.edu">oeliburd@ufl.edu</a>	
<b>40</b> 10:00 AM	<b>Toward the Identification Of Thrips Larvae Found With Cultivated Crops And Ornamentals In Florida.</b> <u>Thomas Skarlinsky</u> and Joe Funderburk , USDA, APHIS, PPQ, P.O. Box 660520, Miami, Florida 33266; <a href="mailto:Thomas.L.Skarlinsky@aphis.usda.gov">Thomas.L.Skarlinsky@aphis.usda.gov</a> ,	

10:15 AM	<b>41</b> <b>Recent Developments in Managing Thrips in Florida Fruit and Vegetable Crops: A Practitioner's Perspective.</b> Galen Frantz, Glades Crop Care Inc. 949 Turner Qua , Jupiter, FL 33458, <a href="mailto:gfrantz@gladescropcare.com">gfrantz@gladescropcare.com</a>	
10:30 AM	<b>Coffee Break</b>	
10:45 AM	<b>42</b> <b>Tolfenpyrad: A New Insecticide for Thrips Control in Florida</b> Botond Balogh Nichino America, 124 Star Shell Drive, Apollo Beach FL 33572, <a href="mailto:bbalogh@nichino.net">bbalogh@nichino.net</a>	
11:00 AM	<b>43</b> <b>Optimizing thrips control in Florida crops with Radiant and Closer</b> Alejandro A. Calixto, Melissa Siebert, Luis Gomez, Linda Lindenberg and Scott Houk Dow AgroSciences, 33245 Mandrake Rd, Wesley Chapel, FL 33543, <a href="mailto:aacalixto@dow.com">aacalixto@dow.com</a>	
11:15 AM	<b>44</b> <b>Managing Thrips in Florida Strawberry</b> Hugh A. Smith	
11:30 AM	<b>45</b> <b>Discussion: Priorities for Thrips Management in Florida</b> Dr. Norman C. Leppla, Professor & Program Director, IPM'University of Florida, IFAS Entomology and Nematology Department, 1881 Natural Area Drive, Gainesville, FL 32611-0620 <a href="mailto:ncleppla@ufl.edu">ncleppla@ufl.edu</a>	
12:00 PM – 2:00 PM	<b>Awards Luncheon</b>	Island Room
<b>Submitted Paper Session 2</b>		Caloosa A
2:05	<b>46</b> <b>Asian citrus psyllid control and foliar nutrition improve productivity of HLB-infected citrus trees</b> James A. Tansey, Pilar Vanaclocha, Moneen M. Jones, Cesar Monzo, and Philip A. Stansly University of Florida, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 (USA) <a href="mailto:jtansey@ufl.edu">jtansey@ufl.edu</a>	
2:20	<b>47</b> <b>Huanglongbing in China: History, Distribution and Current Status</b> Yijing Cen, Xiaoling Deng, Philip A. Stansly University of Florida-IFAS, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 <a href="mailto:cenyj@ufl.edu">cenyj@ufl.edu</a>	
2:35	<b>48</b> <b>Ultrastructure of the salivary glands and bacteria-like structures in the gut and other organs Of the Asian citrus psyllid <i>Diaphorina citri</i> (Hemiptera: Liviidae), vector of huanglongbing disease bacteria</b> El-Desouky Ammar, David G. Hall and Robert G. Shatters Jr USDA-ARS, US Horticultural Research Laboratory, Fort Pierce, FL 34945 <a href="mailto:desoukyammar@gmail.com">desoukyammar@gmail.com</a>	
2:50	<b>49</b> <b>Infection of The Asian Citrus Psyllid, <i>Diaphorina Citri</i> Kuwayama (Hemiptera: Liviidae) with <i>Candidatus Liberibacter Asiaticus</i> Increases its Propensity For Dispersal</b> Kirsten Pelz-Stelinski, Mark Hoffman, Xavier Martini, Lukas Stelinski Citrus Research and Education Center, University of Florida-IFAS, 700 Experiment Station Rd, Lake Alfred, FL 33850 <a href="mailto:pelzstelinski@ufl.edu">pelzstelinski@ufl.edu</a>	
3:05	<b>Coffee Break</b>	
3:20	<b>50</b> <b>A Comparison of Plant Species for Rearing Asian Citrus Psyllid</b> David G. Hall and Matthew G. Hentz USDA-ARS, Fort Pierce, FL <a href="mailto:David.Hall@ARS.USDA.GOV">David.Hall@ARS.USDA.GOV</a>	
3:35	<b>51</b> <b>Why is <i>Poncirus Trifoliata</i> Resistant to Colonization by Asian Citrus Psyllid?</b> Justin George, Stephen L. Lapointe, David G. Hall USDA-ARS, Fort Pierce <a href="mailto:justin.george@ars.usda.gov">justin.george@ars.usda.gov</a>	
3:50	<b>52</b> <b>Asian Citrus Psyllid Control and Foliar Nutrition Improve Productivity of HLB-Infected Citrus Trees</b> James A. Tansey, Pilar Vanaclocha, Moneen M. Jones, Cesar Monzo, and Philip A. Stansly University of Florida-IFAS, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 <a href="mailto:jtansey@ufl.edu">jtansey@ufl.edu</a>	
4:05	<b>53</b> <b>Use of synthetic mating-duet vibrations to disrupt <i>Diaphorina citri</i> (Hemiptera: Liviidae) mating behavior</b> Richard Mankin, Sylvia Lujo, Emily Pregmon, Kayla Norton, Ethan Hartman, and Nina Zagvazdina USDA-ARS-CMAVE, Gainesville, FL 32608 <a href="mailto:Richard.Mankin@ars.usda.gov">Richard.Mankin@ars.usda.gov</a>	
<b>Nan-Yao Su Symposium</b> <b>Accomplishments and Impact of Nan-Yao Su on Termite Research and Control: Celebrating the 20th</b>		Everglades A

<b>Anniversary of the Commercial Launch of the Sentricon® Termite Colony Elimination System</b>		
Organizers, Ellen Thoms, Douglas Products, Gainesville, FL and Joe Eger, Dow AgroSciences, 2606 S. Dundee St. Tampa, FL 33629 <a href="mailto:jeeger@dow.com">jeeger@dow.com</a>		
2:05 PM	<b>Introduction</b> Joe Eger	
<b>54</b> 2:20 PM	<b>Impact of The Sentricon® Termite Colony Elimination System on the termite control market</b> Dave Maurer Dow AgroSciences, Indianapolis, IN	
<b>55</b> 2:40 PM	<b>Formosan Subterranean Termites from Discovery to Control.</b> Ed Bordes New Orleans Mosquito, Termite and Rodent Control Board (Retired) 2100 Leon C. Simon Blvd. New Orleans, LA 70122; 504-442-5331 <a href="mailto:Edbordes@usa.net">Edbordes@usa.net</a>	
<b>56</b> 3:00 PM	<b>Professor's Nan-Yao's Su Contributions to Termite Science and Outreach</b> Vernard Lewis Berkeley Global Campus, 1301 South 46th St., Richmond, CA 94804; <a href="mailto:urbanpests@berkeley.edu">urbanpests@berkeley.edu</a>	
3:20 PM	<b>Coffee Break</b>	
<b>57</b> 3:40 PM	<b>Sentricon® Above-Ground Bait Stations for Termite Management In New 510-665-6724Orleans</b> Carrie Cotone New Orleans Mosquito, Termite and Rodent Control Board, New Orleans, LA 70122; <a href="mailto:cbcottone@nola.gov">cbcottone@nola.gov</a>	
<b>58</b> 4:00 PM	<b>Hybridization of Two Termite Invaders in Florida</b> Thomas Chouvenc University of Florida, Davie, FL	
4:20 PM	<b>Wrap-up and Discussion</b> Ellen Thoms and Joe Eger	
<b>Symposium</b> <b>Mosquito Control in Florida</b>		
Organizer: Dr. Rui-De Xue: Director: The Anastasia Mosquito Control District of St. Johns County 500 Old Beach Rd, St Augustine, FL 32080 <a href="mailto:xueamcd@gmail.com">xueamcd@gmail.com</a>		Everglades C
2:05 PM	<b>Welcome Introduction</b> Rui-De Xue	
<b>59</b> 2:20 PM	<b>An overview of mosquito control programs in Florida</b> Adriane Tambasco, Fla Dept. of Agricultural and Consumer Service, Tallahassee, FL 32399 <a href="mailto:Adriane.Tambasco@FreshFromFlorida.com">Adriane.Tambasco@FreshFromFlorida.com</a>	
<b>60</b> 2:35 PM	<b>Aerial applications to control mosquitoes in Florida</b> Mark Latham, Manatee County Mosquito Control District, Palmetto, FL 34221, <a href="mailto:manateemcd@aol.com">manateemcd@aol.com</a>	
<b>61</b> 2:50 PM	<b>Lee County mosquito control district operations</b> T. Wayne Gale, Lee County Mosquito Control District, Lehigh Acres, FL 33971, <a href="mailto:gale@lcmcd.org">gale@lcmcd.org</a>	
<b>62</b> 3:05PM	<b>Aedes mosquito control response to suspect dengue and chikungunya cases</b> Rui-De Xue, Anastasia Mosquito Control District, St. Augustine, FL 32080, <a href="mailto:xueamcd@gmail.com">xueamcd@gmail.com</a>	
<b>63</b> 3:20 PM	<b>The Lee County Mosquito Control District's comprehensive education outreach program</b> Neil Wilkinson, Florida Gulf Coast University, Fort Myers, FL 33965, <a href="mailto:nwilkins@fgcu.edu">nwilkins@fgcu.edu</a>	
3:35 PM	<b>Coffee Break</b>	
<b>64</b> 3:50 PM	<b>Trapping studies on Florida Tabanidae, a largely neglected biting fly family in the state</b> Daniel L. Kline, USDA/CMAVE, Gainesville, FL 32608, <a href="mailto:Dan.Kline@ARS.USDA.GOV">Dan.Kline@ARS.USDA.GOV</a>	
<b>65</b> 4:05 PM	<b>Development of the smart mosquito counter device and its newly updated capability for mosquito identification</b> Hoonbok Yi et al, Department of Biol & Environmental Technol., Seoul Women's University, Seoul, Korea 139-174. <a href="mailto:yihoonbok@gmail.com">yihoonbok@gmail.com</a>	
<b>66</b> 4:20 PM	<b>Data review of a multi-state and multi-district research and development program with DeltaGard adulticide</b> John Paige, Bayer Environmental Science, Vero Beach, FL, <a href="mailto:John.Paige@Bayer.com">John.Paige@Bayer.com</a>	

67 4:35 PM	<b>Mosquito research foundation, free research money!!</b> James Clauson, Beach Mosquito Control District, Panama City Beach, FL, <a href="mailto:jamesclauson@comcast.net">jamesclauson@comcast.net</a>	
4:50 PM	<b>Discussion and Wrap-Up</b> Rui-De Xue	
<b>Wednesday, August 5<sup>th</sup></b>		
<b>Meeting/Function</b>	<b>Time</b>	<b>Room / Location</b>
7:30 AM – 12:00 PM	Registration Continued	Registration Desk
8:00 AM – 12:00 PM	Presentation Collection – Slide Preview	Jasmine
8:00 AM – 12:00 PM	<b>Poster Session</b>	Caloosa B
<b>Symposium</b> <b>Management of Fall Armyworm</b> Organizers: Jawwad Qureshi and Robert Meagher University of Florida, Southwest Florida Research and Education Center, Immokalee, FL 34142 239-658-3451 <a href="mailto:jawwadq@ufl.edu">jawwadq@ufl.edu</a>		Everglades A
8:55 AM	Welcome Introduction: <b>Jawwad Qureshi</b>	
68 9:00 AM	<b>Insecticidal control of fall armyworm in sweet corn</b> <u>Barry Kostyk</u> and Phil Stansly, University of Florida, SWFREC, 2685 SR 29 N, Immokalee, FL. <a href="mailto:bkostyk@ufl.edu">bkostyk@ufl.edu</a>	
69 9:20 AM	<b>Field Evaluation of Bt Maize Hybrids Against Fall Armyworm, <i>Spodoptera frugiperda</i></b> <u>Jawwad A. Qureshi</u> and Fangneng Huang	
70 9:40 AM	<b>Bt Resistance in Fall Armyworm in The Americas: What We Know and What We Think it Means</b> <u>Graham Head</u> , Renato Carvalho, Samuel Martinelli, and Dan Pitts Monsanto Company, 800 North Lindbergh, St Louis, MO 63167	
71 10:00 AM	<b>Inheritance, Fitness Costs, and Cross-Resistance of Cry1F Resistance in Fall Armyworm</b> <u>Fangneng Huang</u> , LSU AgCenter, Baton Rouge, LA	
10:20 AM	<b>Coffee Break</b>	
72 10:40 AM	<b>New insights for Biological Control of Fall Armyworm in Florida</b> <u>Mirian M. Hay-Roe</u> <sup>1</sup> , Robert Meagher <sup>2</sup> and Rodney Nagoshi University of Florida, Everglades Research and Education Center, 1700 SW 23 <sup>rd</sup> Dr. Gainesville, FL 32608	
73 11:00 AM	<b>Replacing a Common Ground Cover Plant with Sunn Hemp to Reduce Migrating Populations Of Fall Armyworm</b> <u>Robert Meagher</u> , Rod Nagoshi, Shelby Fleischer, and John Westbrook USDA-ARS CMAVE, 1700 SW 23 <sup>rd</sup> Dr., Gainesville, FL 32608	
74 11:20 AM	<b>Using genetic markers to assess fall armyworm distribution patterns and migration.</b> <u>Rod Nagoshi</u> <sup>1</sup> , Shelby Fleischer, John Westbrook, Robert Meagher, Mirian Hay-Roe CMAVE USDA-ARS, 1600 SW 23 <sup>rd</sup> Dr. Gainesville, FL 32608	
11:40 AM	<b>Discussion and Conclusions:</b> Jawwad Qureshi and Robert Meagher	
<b>Symposium</b> <b>Whiteflies: Developing Management Solutions for Globally Invasive Pests</b> Organizers: Vivek Kumar, Post-Doctoral Associate, Mid-Florida Research & Education Center, University of Florida-IFAS & Muhammad Z. Ahmed, Post-Doctoral Associate, Tropical Research & Education Center, University of Florida		Everglades C
8:55 AM	<b>Symposium introduction:</b> Muhammad Z. Ahmed	
75 9:00 AM	<b>What happens in greenhouses doesn't stay in greenhouses</b> <u>Lance S. Osborne</u> , Vivek Kumar, Cindy L. McKenzie University of Florida, IFAS, Mid-Florida Research and Education Center. 2725 Binion Road Apopka, Florida <a href="mailto:lsosborn@ufl.edu">lsosborn@ufl.edu</a>	
76 9:20 AM	<b>Determining the feeding cessation of <i>Bemisia tabaci</i> adults and nymphs after the application of Cyazypyr® and other insecticides.</b> <u>Juan M. Alvarez</u> , Rachel A. Cameron, Edward B. Lang and Hector E. Portillo DuPont Crop Protection, Stine-Haskell Research Center, 1090 Elkton Rd. Newark, DE 19711 <a href="mailto:juan.m.alvarez@dupont.com">juan.m.alvarez@dupont.com</a>	
77 9:40 AM	<b>Parasitoids of Rugose Spiraling and Ficus Whitefly</b> <u>Catharine Mannon</u> , Lance Osborne, Anthony Boughton, Muhammed Z Ahmed, Trevor Smith, Antonio Francis, Vivek	

	Cindy McKenzie UF/IFAS, Tropical Research and Education Center, 18905 SW 280 <sup>th</sup> Street, Homestead, FL 33031 <a href="mailto:cmannion@ufl.edu">cmannion@ufl.edu</a>
10:00 AM	<b>Coffee Break</b>
<b>78</b> 10:20 AM	<b>Uncovering an unintended negative impact of parasitoids in biological control of whitefly</b> Muhammad Z. Ahmed. 18905 SW 280 <sup>th</sup> street, Homestead, FL33031. <a href="mailto:zaheerento@ufl.edu">zaheerento@ufl.edu</a>
<b>79</b> 10:40 AM	<b>Current status of silverleaf whitefly, <i>Bemisia argentifolii</i> (Bellows and Perring) in south Florida vegetable crops</b> Dakshina R. Seal
<b>80</b> 11:00 AM	<b>A review of fortuitous biological control of invasive whiteflies</b> Antonio W. Francis. 2725 S. Binion Road, Apopka, FL 32703. <a href="mailto:Antonio.Francis@FreshFromFlorida.com">Antonio.Francis@FreshFromFlorida.com</a>
11:20 AM	<b>Discussion and Conclusions:</b> Vivek Kumar
1:30 PM	<b>Whitefly In-Service Training. Catharine Mannion</b>
	Orchid

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***End of 2015 Florida Entomological  
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Thanks for your participation!***

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**BOOK OF ABSTRACTS**  
**98th ANNUAL MEETING of the**  
**FLORIDA ENTOMOLOGICAL SOCIETY**  
**August 2 - 5, 2015 – Ft. Myers, FL**

**[President's Address]**

**How does the Florida Entomological Society Measure Up to other State/Regional Entomological Societies in the US? ,**  
Cindy McKenzie

**[International Congress of Entomology 2016]**

Alvin Simmons

**[2015 FES Pioneer Lecture]**

**Professor Margaret Collins, 2015 Pioneer Awardee**

Vernard Lewis, University of California Berkeley, College of Natural Resources, Richmond, CA 94804

Margaret James Strickland Collins was born in Institute, West Virginia, in 1922. She was the fourth of five children of Rollins James and Luella (Bolling) James. Her parents were collegiately trained and instilled the importance of education. Reading and playing in the woods and a nearby barn were also Margaret's early passions.

Margaret Collins was a prodigy while in school. Because of her voracious reading habits, she received praise and was awarded access to the West Virginia State College library to check out books at six years old. She continued her academic excellence through high school, being skipped two grade levels before graduating in 1937. She later was awarded an undergraduate scholarship to West Virginia State College and completed her B. S. degree in 1943 majoring in Biology with minors in Physics and German. As a graduate student, she was admitted to the University of Chicago and completed her Ph.D. in Zoology in 1949. Dr. Collins was one of the first African American females to be awarded a doctorate in a biological science from a major United States university. Her mentor and thesis advisor was Professor Alfred E. Emerson, the legendary termite expert, who at that time maintained the largest termite collection anywhere in the world.

During the next thirty years, Professor Collins would hold professorial titles with tenure at three universities that included Howard University in Washington, D.C., Florida A and M University and Federal City College in Washington, D.C. She also held university administrative titles that included Department Head and Dean, as well as being the President of the Entomological Society of Washington. Dr. Collins retired from Howard University 1983, but went on to accept an unpaid research position at the Smithsonian Institution National Museum of Natural History in Washington, D.C. that same year. She held this position until her passing in 1996 while conducting field research in the Little Cayman, Cayman Islands. She was first author or co-authored on 40 research publications that included the biogeography, physiology, chemical defenses and taxonomy of termites. She is best known as a world authority on the termite diversity in the Cayman Islands, and this collection maintained in the Smithsonian Institution still bears her name.

For those of us who have collegiate degrees, you are well aware of the challenges and obstacles that present themselves. Margaret had more challenges and obstacles than most of us. She grew up and attended classes during an era when, because of her color and race, she was unwelcomed or denied admission. Worst yet, she had to endure racist epithets and even a bomb threat, all because she was supportive of equal rights that included driving African Americans less fortunate than her to work during a bus boycott in Tallahassee. She was an amazing individual, raising two sons as a single parent during a time when neither women nor African Americans were welcomed in many institutions of higher education. Her life's passions were her children and her passions for termites. After an illustrious 35 year professional career, we celebrate Professor Collin's life, academic and personal achievements, as well as her being selected the 2015 Pioneer's awardee from the Florida Entomological Society.

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**Poster Session**

**[DSP 1] Genetic Assay for Distinguishing Native and Imported Fire Ant Species**

Imported fire ants, particularly *Solenopsis invicta*, are expanding into western regions of the United States and increasingly into habitats occupied by many native *Solenopsis* species of similar size and general appearance. By preserving populations of the less aggressive, non-invasive native species, *S. invicta* should have more difficulty becoming established and expanding its range. Consequently, there would be fewer negative human-ant interactions. Unfortunately, as notoriety of the imported fire ants spreads, it is likely home owners, grounds managers, and others are targeting both native and non-native species with pesticide treatments. The development of a genetic assay that determines which fire ant species is present can serve as a tool for local professionals that are in a position to dispense advice. We sequenced a gene region known to have high interspecific variation and designed oligo-primers that amplify that region for multiple *Solenopsis* species, including *S. xyloni*, *S. geminata*, *S. geminata* x *S. xyloni*, *S. richteri*, *S. invicta* and *S. aurea*. Simple restriction digests of the amplicon, when separated on an agarose gel, indicate which species is present.

**[DSP 2] Evaluating mustard and arugula plant volatiles and refuge plants for sustainable control of insect pests**

Jesusa C. Legaspi, Neil Miller, Lambert Kanga, Muhammad Haseeb. USDA-Agricultural Research Service-CMAVE /Florida A&M University-Center for Biological Control 6383 Mahan Dr., Tallahassee, FL 32308; [Jesusa.Legaspi@ars.usda.gov](mailto:Jesusa.Legaspi@ars.usda.gov)

Whiteflies and aphids are important insect pests in vegetable crops. To mitigate the use of chemical insecticides, “push-pull” strategies can be used as components of sustainable or cultural pest management. We conducted laboratory olfactometer or odor detecting tests to measure the effects of arugula (*Eruca sativa* cv. Nemat), and 2 mustard variety plants, *Brassica juncea* cv. Caliente 19 and giant red mustard, as whitefly repellents. Preliminary results showed that mustard and arugula plants are promising repellent plants against the sweetpotato whitefly, *Bemisia tabaci*, comprising a potential “push” component. Preliminary analysis of a field study on annual ornamental plants, sweet alyssum, *Lobularia maritima*, intercropped with kale (*Brassica oleracea*) revealed the most abundant predatory hoverflies to be *Toxomerus marginatus*, followed by *Allograpta oblique*, *Eupeodes americanus*, *Ocyrtamus fuscipennis*, *Toxomerus geminatus*, *Toxomerus bosci*, and *Pseudodoros clavata*. Hoverflies are important generalist predators of aphids such as the green peach aphid, *Myzus persicae*. “Push-pull” strategies can be complemented with natural enemy refuges as cultural management techniques in farmscaping towards sustainable management of whiteflies and aphids.

**[DSP 3] *Nesidiocoris tenuis* (Heteroptera: Miridae) for Control Silverleaf Whitefly in Tomato**

Jose A. Castillo, Amy Roda and Philip A. Stansly. <sup>1</sup>University of Florida – IFAS-SWFREC, Immokalee, Florida 34142; [jacastil@ufl.edu](mailto:jacastil@ufl.edu)

Three species of Miridae: *Nesidiocoris tenuis* Reuter, *Macrolophus separatus* Uhler and *Engytatus modestus* Distant are currently being reared on *Nicotiana tabacum* L at our Center. Macroscopic morphological characteristics of adult mirid females and males as well genitalia of some dissected males were used to distinguish the 3 species. *N. tenuis* was evaluated to control whitefly on tomato in field and laboratory experiments. Seedling tomato plants were caged with whiteflies and *N. tenuis* or with only whiteflies. After a week, seedlings were transplanted into the field and some left in cages in the greenhouse. In both cases, seedlings were distributed in a randomized block design with 4 replications and 3 treatments: predator release, pesticide application and untreated plots. Whitefly populations were monitored weekly. Fewer whitefly eggs were seen with the predator and pesticide treatments in both, field and caged plants although the effect of the mirid was clearer on caged plants. In laboratory experiments, the feeding behavior of *N. tenuis* and plant damage were compared in tomato as follow: plants plus: (*N. tenuis*), (*B. tabaci* + *N. tenuis*), (*Ephestia* eggs + *N. tenuis*), (*B. tabaci* + *Ephestia* eggs + *N. tenuis*), (*B. tabaci*) and plants alone. Better whitefly control was seen when mirids had access to only whitefly than when *Ephestia* eggs were also available. No *N. tenuis* damage (necrotic rings) was observed whereas whitefly damage (curly leaves) was seen on plants with subjected to whitefly along or to whitefly + *Ephestia* eggs + *N. tenuis*.

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**[DSP 4] Morphology and Sexual Dimorphism of the Weevil *Myloccerus undecimpustulatus undatus* (Coleoptera: Curculionidae)**

Justin George and Stephen L. Lapointe USDA-ARS, USHRL, 2001 South Rock Road, Fort Pierce 34953; [justin.george@ars.usda.gov](mailto:justin.george@ars.usda.gov)

Developing effective management strategies based on host plant resistance is of critical importance for managing Asian citrus psyllid (ACP). *Poncirus trifoliata* is a trifoliolate species that is graft-compatible with *Citrus* spp., and used as a rootstock in many citrus growing regions. *Poncirus* has several valuable traits including its apparent antixenotic and antibiotic resistance to ACP that may delay or reduce development, longevity and reproduction. Oviposition, nymphal development and adult emergence of ACP were studied on four trifoliolate accessions, trifoliolate hybrid Troyer and *Citrus macrophylla* using no-choice and choice assays. Oviposition was reduced and nymphal development was delayed on trifoliolate accessions compared with Troyer and *C. macrophylla*. Significantly fewer ACP adults emerged from trifoliolate accessions (mean=21±3.3) compared with *C. macrophylla* (mean=47±19.3) and Troyer (mean=46±13.8). Time to adult emergence under no-choice conditions on trifoliolate accessions were 25 days compared with 17 days for *C. macrophylla*. ACP survived and oviposited on trifoliolate accessions even though survival and development were compromised (antibiosis effect). Under choice conditions, adult ACP showed significantly higher preference for *C. macrophylla* (mean=47±8.5) and Troyer (mean= 26±7.7) compared with the trifoliolate accessions (mean=12±3.3). Significantly more adults emerged from *C. macrophylla* accessions by day 15; few adults emerged from the trifoliolate accessions. This reduction in host preference and oviposition, and delayed nymphal development on trifoliolates is characteristic of non-preference (antixenosis). The traits responsible for antixenotic resistance may be valuable for incorporation into citrus scion breeding programs.

**[DSP 5] Variability in leaf damage among cultivars of lychee, host of *Myloccerus undecimpustulatus undatus* Marshall adults**

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The Sri Lankan weevil has imposed heavy damage on the canopy of various ornamental and fruit trees since it was first detected in South Florida in 2000. One of the more heavily damaged fruit trees is lychee, *Litchi chinensis* (Sapindales: Sapindaceae). As part of a study to better understand host choice by adult weevils, we quantified level of foliar damage to trees in the lychee germplasm collection at the Miami ARS station.

**[DSP 6] Enrichment Of A-Copaene Content Results in Improved Lure for Redbay Ambrosia Beetle, *Xyleborus glabratus* (Coleoptera: Curculionidae: Scolytinae)**

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The exotic redbay ambrosia beetle, *Xyleborus glabratus* Eichhoff, has become a serious invasive pest in the USA, now established in seven southeastern states. Females are the primary vectors of a fungal pathogen, *Raffaelea lauricola*, that causes laurel wilt. This vascular disease has caused extensive mortality in native *Persea* species, including redbay (*P. borbonia*), swampbay (*P. palustris*), and silkbay (*P. humilis*), and currently threatens avocado (*P. americana*) in south Florida. With continued spread, laurel wilt may impact additional Lauraceae throughout the Americas. The most effective lures for *X. glabratus* contain cubeb oil, an essential oil composed of a complex mixture of terpenoids. To elucidate the primary attractants of *X. glabratus*, fractional distillation was used to separate whole cubeb oil into 17 fractions (based on chemical boiling point), which were then used as substrates in binary-choice bioassays. Fractions were also analyzed by GC-MS to determine terpenoid composition. Significant attraction of *X. glabratus* was observed only with fractions that contained high percentages of the sesquiterpenes  $\alpha$ -copaene and  $\alpha$ -cubebene. This information was used to prepare two prototype lures, one of which contained copaiba oil, and the other a proprietary essential oil product enriched to contain 50%  $\alpha$ -copaene. In field trials, the copaiba and commercial cubeb lures captured equal

numbers of *X. glabratus*, but the 50% copaene lure captured significantly more beetles and had field longevity of three months.

#### **[DSP 7] Silk Fly Electroantennography, A Crucial Step For Semiochemical Investigations**

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Silk flies (*Euxesta* and *Chaetopsis* spp., Diptera: Ulidiidae) are severe pests of sweet corn in Florida, Central, and South America. Identification of attractive semiochemicals may facilitate development of improved monitoring and management strategies for these pests. To this end, an electroantennography (EAG) method was devised to identify raw materials that elicit strong olfactory responses from which volatiles can be collected and identified. Whole silk fly heads were mounted on micropipette electrodes filled with 0.1 M KCL solution using a salt free electrode gel. Antennal responses to corn tassel, corn silk, and armyworm frass collected from tassel-fed worms (tassel frass) and from silk-fed worms (silk frass) were recorded using a Syntech EAG system. Dose response curves to headspace frass volatiles were constructed for mature and immature *Euxesta eluta* females. Of the substrates evaluated, corn silk elicited the lowest antennal responses and silk frass elicited the strongest responses among the three species tested. Therefore, silk frass volatiles are being investigated further. This is the first time that electroantennography has been reported for species of silk fly.

#### **[DSP 8] Stink Bugs in Florida Rice**

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The stink bug complex attacking Florida rice is the most diversified and unique stink bug complex in US rice production. In Florida, stink bugs are currently considered the most important pest. Planting date could be used to move rice heading from the period of greatest flight activity, thus reducing stink bug populations and damage in the rice. Fall panicum, *Panicum dichotomiflorum*, was the most common grassy weed found in weedy areas of rice fields, and significantly more rice stink bugs were found in these weedy areas than were found in non-weedy areas in the fields. A 2014 study showed no significant effect of water or flooding depth on stink bug abundance in sweep net catches.

#### **[DSP 9] Dose-Responses of the Citrus Leaf Miner to Several Insecticides Commonly Applied to Citrus in Florida**

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The citrus leafminer (CLM), *Phyllocnistis citrella* Stainton (Lepidoptera: Gracillariidae), was first detected in Florida in 1993 and quickly spread throughout the state. CLM oviposit on young citrus shoots. Damage by mining larvae reduces photosynthesis, causes leaf malformation, and increases susceptibility to canker. Although effectiveness of several reduced-risk and broad-spectrum chemical insecticide formulations has been confirmed in field trials, dose-response relationships have not been studied in detail. The reliance on chemicals to control CLM populations has certainly increased selective pressures that may lead to resistance. However, resistance evaluation relies on initial quantification of baseline responses of susceptible populations.

Here, we present results of laboratory bioassays conducted to evaluate baseline susceptibilities using individuals from a susceptible laboratory colony. Tested insecticides included the commercial reduced-risk formulations: Micromite (diflubenzuron), Intrepid (methoxyfenozide), and Delegate (spinetoram). Other formulations tested included some that may be applied to CLM populations as part of control efforts for these insects and other citrus pests. These include: Agri-Mek (abamectin), Actara (thiamethoxam), Exirel (cyantraniliprole), and the broad-spectrum insecticides Danitol (fenpropathrin), and the organophosphate, Dimethoate. We estimated the concentration-response relationships for CLM adults and larvae to these insecticides using probit analysis. Results indicated excellent efficacies for Actara, Delegate, Agri-Mek, Danitol and Dimethoate for CLM adults and Actara, Agri-Mek, Delegate, Dimethoate, and Intrepid

for CLM larvae. Relatively poor efficacy for CLM larvae was achieved with Danitol. Baseline susceptibilities of CLM to these compounds will form the basis for future resistance evaluation work.

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## Student Competition: Ph.D.

### [1] Transmission of *Squash Vein Yellowing Virus* to and from Cucurbit Weeds and Effects on Whitefly Behavior

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Florida ranks first in the production of watermelon (*Citrullus lanatus*) in the United States. Since 2003-2004, growers have periodically suffered large losses from a disease caused by *Squash vein yellowing virus* (SqVYV). Under field conditions, cucurbit weeds such as *Momordica charantia* (balsam apple) and *Cucumis melo* var. *dudaim* (smellmelon) were found to be infected with SqVYV and, in the laboratory, *Melothria pendula* (creeping cucumber) was easily mechanically inoculated. These weeds are commonly found in Florida and have been important in the spread of aphid-transmitted cucurbit viruses. The objectives of this study were to i) compare these weeds and watermelon cv. Mickylee as sources of inoculum, ii) compare their susceptibility to SqVYV, and, iii) compare the whitefly behaviors of settling and ovipositing on infected versus mock-inoculated creeping cucumber leaves. Results from the transmission test showed that the lowest percentage of infection occurred when balsam apple was used as a source of inoculum. Watermelon was more susceptible to SqVYV than balsam apple. Creeping cucumber was equally susceptible and as good a source of SqVYV as watermelon. There were more eggs laid on mock-inoculated leaves than on SqVYV-inoculated leaves. In the first few hours after release, whiteflies did not preferentially settle on infected versus mock-inoculated creeping cucumber leaves. After 24 h, however, whiteflies preferred to settle on mock-inoculated leaves. The observed level of transmission, settling, and oviposition behavior could lead to the rapid spread of SqVYV.

### [2] Optimizing Host: Parasitoid Ratios and Photoperiod for Efficient Mass Rearing of *Tamarixia Radiata* (Hymenoptera: Eulophidae), A Parasitoid of The Citrus Greening Disease Vector *Diaphorina Citri* (Hemiptera: Psyllidae)

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*Tamarixia radiata* is an ectoparasitoid of *Diaphorina citri* and it is being used as an augmentative biological control agent in Florida which requires mass rearing. However, there is a lack of information efficiency of the current rearing methods. In order to improve the efficiency of mass rearing *T. radiata* in the colony, three releasing rates of *D. citri* per shoot were tested to obtain the optimal psyllids production, four host: *T. radiata* ratios were tested for the optimal wasp production, and five photoperiods were tested for the most efficient production. Results showed that 20 psyllid adults per flush was adequate for psyllids infestation while avoiding the stickiness on shoots, and 60 *T. radiata* females per cage (approximately 4800 nymphs) was most economically efficient for mass rearing. Progeny sex ratio was not influenced by the parental sex ratio. A photoperiod of 12 hours was most efficient to maintain high fecundity. These modifications improved the parasitoid production three-fold compared to the same effort and materials with our previous procedures.

### [3] Systemic Insecticides and Reflective Mulch for Asian Citrus Psyllid (*Diaphorina Citri*) Control in New Citrus Plantings

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Greening or huanglongbing (HLB) is a devastating disease of citrus caused by *Candidatus Liberibacter asiaticus* and transmitted by the Asian citrus psyllid (ACP), *Diaphorina citri*. HLB now occurs worldwide in most citrus growing regions except the Mediterranean and Australia. Management relies principally on insecticidal control of ACP which is insufficient, even for young trees which are most susceptible to the disease. We tested the ability of metalized polyethylene mulch to repel adult ACP as well as effects on incidence of HLB and early tree growth with and without

insecticide treatments as well as with and without foliar nutrition. The experimental design is a 3-way factorial randomized complete split block design with 4 replications of 4 main plot treatments : (1) supplementary foliar nutrients only, (2) insecticides only, (3) nutrients plus insecticides, and (4) neither nutrients nor insecticides (control). Each main plot was split with half being planted on metalized UV reflective mulch. Evaluations of all treatments include ACP populations on flush and sticky cards, trunk growth measurements, and leaf samples tested for the presence of HLB.

#### **[4] Susceptibility of Strawberry Varieties to *Tetranychus Urticae* (Koch) and Establishment of *Neoseiulus Californicus* (McGregor) in Organic Open-Field and High Tunnel Systems**

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Strawberry is an economically important small fruit crop in the United States with yields exceeding 36 billion pounds during 2012. Florida is the second highest producing state in the country. Organic strawberry production is increasing in the southeastern states and strawberry varieties need to be identified for use in this type of production system. The study was conducted to evaluate the susceptibility of commercial strawberry varieties to twospotted spider mites (TSSM), and to assess the performance of *Neoseiulus californicus* (McGregor) on the strawberry varieties to control TSSM population. In 2013-2014 growing season, eight and eleven varieties were planted in a randomized complete block with 4 replicates in the open field and high tunnel system respectively. Sampling was done weekly. In the open field, Albion, Proprietary 1 and Camarosa had numerically higher population of TSSM, but there was no significant difference among strawberry varieties. High tunnel system favored high densities of TSSM and other insect pests. In 2014-2015 growing season, three varieties were planted in the open field, in a randomized complete block design with four replicates. Festival had the highest number of TSSM. High yielding varieties that harbor fewer TSSM and have a high number of *N. californicus* may be well suited for use in an integrated organic system. High tunnel system will be more practicable in North Florida and other southeastern states, where the climate is relatively too cool for production in the early season.

#### **[5] New Organic Tools, Border Sprays, and Cultivation Tactics for Control of *Drosophila suzukii***

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*Drosophila suzukii*, an invasive fruit fly pest (Diptera: Drosophilidae) from Southeast Asia, attacks healthy small and stone fruits. Estimated losses are >27 mil USD in the eastern U.S., partly due to increased insecticide use. Organic growers have been particularly affected due to limited tools, and therefore, require new tactics for *D. suzukii* management. Our first study screened organic insecticides for *D. suzukii* management in southern highbush blueberries. The experiment was a RCBD with 12 treatments and 4 replicates. Compounds were applied at 7-d intervals with an air-assist sprayer. Adult flies were monitored weekly using clear, 1-L plastic traps baited with a yeast sugar mixture and hung in the bush center. Larvae were monitored by collecting berry samples weekly and rearing them in cups at 23°C, 16:8 light:dark and ~65% RH for two weeks. In another study conducted in organic blackberries, border sprays and between-row cultivation were evaluated for their potential to suppress *D. suzukii* populations. Entrust® (spinosad) was applied on both experimental plantings prior to treatment applications. One planting received a border spray of Azera® (azadirachtin + pyrethrins) at 7-d intervals. Aisles were clean cultivated in half of each planting. Adult *D. suzukii* were monitored weekly using the above procedures. Results from the blueberry study identified potential tools for integration into a *D. suzukii* IPM program. Findings from the blackberry study showed that border sprays suppressed *D. suzukii* populations and the addition of cultivation tactics further reduced *D. suzukii* population, suggesting the potential of cultivation tactics for *D. suzukii* management.

#### **[6] The Dose-Independent Lethal Time of 20-Hydroxyedysone Ingested by Formosan Subterranean Termites**

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Subterranean termite baiting systems containing chitin synthesis inhibitors (CSI), such as noviflumuron, can provide colony elimination. Commercial baits contain 0.5% noviflumuron, which is lethal, non-deterrent, slow-acting, and has a dose-independent lethal time. The dose-independent lethal time allows large numbers of termites that have ingested a

range of lethal doses to continue with normal behavior for several weeks before exhibiting mortality. This dose-independent lethal time is unique to CSIs, and may be partly responsible for the colony elimination that is achieved using these compounds. However, the time required for colony elimination is relatively long, and there is potential to improve baiting systems by shortening the lethal time. The insect molting hormone, 20-hydroxyecdysone (20E), causes subterranean termite mortality within 12 days of exposure. Using 20E in place of, or in combination with noviflumuron may result in a shortened lethal time. The focus of this study was to evaluate the dose-independent lethal time of several concentrations of 20E and noviflumuron, alone and combined. Groups of 30 workers and 3 soldiers were placed into Petri dishes containing a paper disk containing one of the aforementioned treatments. Survivorship was monitored daily for 14 days. The results of the study showed that termites ingesting 20E survived for around 6 days before exhibiting mortality, whereas termites ingesting only noviflumuron survived to the end of the experiment. 20E does seem to have a brief dose-independent lethal time, but additional studies involving whole colonies will be necessary to determine if 20E can eliminate colonies.

**[7] Field Host Specificity of a Potential Hydrilla Biological Control Agent, *Cricotopus Lebetis* Sublette (Diptera: Chironomidae).**

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Hydrilla, *Hydrilla verticillata* (L.f.) Royle (Hydrocharitaceae), is one of the most destructive aquatic weed species in the United States. Since its introduction into Florida in 1950s, the management of hydrilla has remained challenging. Mechanical harvesting creates stem fragments that furthers the spread of hydrilla. Furthermore, some hydrilla biotypes have developed herbicide resistance. To date, released insect biological control agents have failed to achieve sufficient control of hydrilla. In 1991, a stem mining midge *Cricotopus lebetis* Sublette (Diptera: Chironomidae), was discovered attacking the apical meristem of hydrilla in Kings Bay, Florida. Subsequent laboratory studies confirmed *C. lebetis* was able to suppress hydrilla growth, but also revealed *C. lebetis* can complete development on some native plants. Many studies of biocontrol agent host specificity have revealed a large disconnect between the results of laboratory and field tests. The objective of this study was to determine the field host specificity of *C. lebetis*. Five commonly found submersed aquatic plants were sampled from Lake Rowell and Lake Istokpoga in spring 2014 and 2015. *Cricotopus lebetis* adults emerged from all sampled plants, but stem dissections revealed the presence of *C. lebetis* larvae within hydrilla stems only. Since no larvae were found attacking the stems of non-target species, it is possible that the emergence of adults from non-targets was due to pupae contaminating the non-target plant samples. These results confirm the hypothesis that hydrilla is the only known field host of *C. lebetis* and further demonstrate the necessity of field host specificity studies for biocontrol agent assessment.

**[8] Development of Silk Fly Olfactory Bioassays**

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Several species of silk flies (Diptera: Ulidiidae) are extremely destructive sweet corn pests in southern Florida. They are currently managed with multiple insecticide applications. Studies were initiated to examine their chemical ecology in hopes that information gleaned could lead to additional management tactics. Silk flies have been observed to be attracted to noctuid-damaged plants as well as developing from damaged solanaceous crops. Ovipositional choice assays were conducted consisting of ten pairs of silk flies held over partitioned dishes containing sweet corn silks, frass, pepper and tomato slices to determine which material silk flies preferred to oviposit on. Still-air olfactory bioassays consisting of snap cap vials attached to bamboo poles were conducted with silk flies to determine if frass was as attractive as or more attractive than corn. In general, frass was the most attractive material for oviposition and to locomotion. There were differences in ovipositional preference among the tested species and in degree of oviposition, with frass and silks preferred. The volatile components of frass, silks, and tassels are being investigated.

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**Student Competition: M.Sc.**

**[9] Evaluation of Monitoring, Biorational Insecticides and Pruning for Integrated Management of Chilli Thrips, *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) On Roses**

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Chilli thrips is an invasive pest affecting vegetables, fruits, and ornamentals. We studied three aspects of an integrated pest management program against chilli thrips on Knock Out roses. First, we developed an injury severity index to correlate visual damage caused by chilli thrips and the estimated population size of this pest on roses. Visual damage was then used as a predictor for population density. Second, applications of bio-rational insecticides and their rotations with spinosad reduced chilli thrips populations significantly under conditions simulating nursery production. The entomopathogenic fungi *Metarhizium brunneum* and *Beauveria bassiana*, a botanical insecticide (azadirachtin), and horticultural oils reduced chilli thrips populations by an average of 72%, 55%, 67%, and 58%, respectively. Pruning significantly reduced but did not eliminate an established chilli thrips infestation without insecticide sprays. Our results suggest that the use of eco-friendly insecticides in rotation programs with spinosad and pruning can provide effective control of chilli thrips in the nursery industry and also for roses planted in landscapes.

**[10] Effect of *Diaphorina citri* (Homoptera: Psyllidae) instar on level of parasitism, sex ratio, and size of *Tamarixia radiata* (Hymenoptera: Eulophidae)**

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*Tamarixia radiata* Waterston (Hymenoptera: Eulophidae) is being mass reared by the Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Florida Biological Control Laboratory and Dundee Biological Control Laboratory, and other states and countries for biological control of the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Homoptera: Psyllidae). In an effort to improve the rearing system used in Florida, experiments were conducted to evaluate the effects of host *D. citri* nymph instar on the level of parasitism by *T. radiata*, and sex ratio and size of the progeny. Significantly different parasitism levels of 16.53, 58.49, and 79.96% occurred when *T. radiata* females parasitized third, fourth and fifth instar nymphs, respectively. The percentage of female progeny also increased significantly when the parasitoids developed on larger hosts with 0, 12.48, and 63.78% of the emerging adults being females from third, fourth and fifth instar nymphs. Mean left hind tibia lengths for parasitoids increased with later host nymph instars with 0 produced, 0.25 and 0.31 mm for females and 0.20, 0.24, and 0.29 mm for males from third, fourth, and fifth instars. There was no significant difference in the mean left hind tibia length between males and females developing on hosts of a similar instar. Thus, since fifth instar *D. citri* nymphs yielded the highest level of parasitism, percentage of female progeny, and the largest parasitoids, this host size is recommended for mass-rearing *T. radiata*.

**[11] Florida Host Plant Suitability and Preference for the Brown Marmorated Stink Bug: *Halyomorpha halys* (Stål) Hemiptera: Pentatomidae**

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*Halyomorpha halys* was first detected in the U.S. in Pennsylvania, in 2001. Currently a pest of fruit and vegetable crops in the mid-Atlantic and northeastern states, as well as an urban nuisance, *H. halys* is considered to be an invasive species. Interceptions have occurred in Florida, but no established populations have been recorded in Florida. Many host plants are documented in the literature, and *H. halys* is highly polyphagous; however, little information exists regarding developmental hosts. Research objectives focus on identifying developmental hosts and preferences for plants commonly found in Florida. Plant species evaluated in a no-choice, balanced incomplete block design include *Calamintha georgiana*, *Camelia japonica*, *Citrus x sinensis*, *Citrus aurantiifolia*, *Citrus paradise*, *Elaeagnus ebbingii*, *Fragaria x ananassa*, *Hamelia patens*, *Hibiscus coccineus*, *Hibiscus mutabilis*, *Hibiscus rosa-sinensis*, *Ligustrum japonicum*, *Malus domestica*, *Passiflora coccinea*, *Persea americana*, *Prunus persica*, *Ruellia brittoniana*, *Smilax rotundifolia*, *Thunbergia battiscombei*, *Vaccinium corymbosum*, *Vitex agnus-castus*, and *Vitis riparia*. Results demonstrate *Hibiscus rosa-sinensis* and *Malus domestica* are developmental hosts, but not *Citrus* species; however, survival to third instar was observed on *Citrus aurantiifolia*. In choice tests, adult specimens were present and feeding respectively more often on *Hibiscus rosa-sinensis*, *Elaeagnus ebbingii*, and *Ligustrum japonicum* than other plant species.

**[12] Biology of *Thalassa Montezumae* (Coleoptera: Coccinellidae) A Predaceous Beetle of the Invasive Soft Scale *Phalacrocooccus Howertoni* (Hemiptera: Coccidae) in South Florida**

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A new species of soft scale, *Phalacrocooccus howertoni* (Hemiptera: Coccidae), was first reported in South Florida in 2008. *Phalacrocooccus howertoni* is problematic on croton plants in production and in the landscape, and has also been reported on approximately 100 host plants. Due to its polyphagous nature and high reproduction, it is potentially a serious pest of numerous tropical and subtropical ornamentals, fruit plants and environmentally important mangroves. In this study a predatory beetle, *Thalassa montezumae* (Coleoptera: Coccinellidae) was identified feeding on the *P. howertoni*. Laboratory studies determined the life cycle, longevity, survival rate, and fecundity of *T. montezumae*. The life cycle was classified as holometabolous consisting of four instars. Adult females are larger than males with an average length of  $4.79 \pm 0.083$ mm and  $4.60 \pm 0.09$ mm respectively. Average developmental time from egg to adult was  $33.95 \pm 0.73$  days; the survival rate from egg to adult was 71.9 %. Lifetime fecundity was  $306.11 \pm 6.70$  eggs per female with average oviposition days of  $17.92 \pm 1.79$ . These findings provide useful insights about the biology of this predatory beetle which will aid in future studies, rearing and releasing as a biological control agent of *P. howertoni*.

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**Submitted Paper Session 1**

**[13] An Overview of Mosquito Control Programs in Florida**

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The state of Florida currently has 62 state approved mosquito control programs. The criteria for establishing a state approved mosquito control program can be found in section 5E-13.030 of the Florida Administrative Code (F.A.C.). Every county or district budgeting local funds to be used exclusively for the control of mosquitoes is eligible to receive state aid on a dollar-for-dollar matching basis, which is distributed by the Florida Department of Agriculture and Consumer Services (FDACS), provided the program provides the required documentation each month. FDACS is the regulatory authority governing mosquito control in the state.

Of the 62 state approved programs, 15 are independent districts while 47 are county run programs. 21 programs throughout the state perform aerial mosquito control operations. The manner in which mosquito control programs operate throughout the state varies widely, from small programs performing strictly mosquito adulticiding using ultra low volume (ULV) truck spraying, to larger programs with a fully comprehensive program performing integrated mosquito management. Integrated mosquito management uses a variety of methods to combat mosquitoes, including premise sanitation, land and water management (such as mosquito ditches and impoundments), chemical control (both larviciding and adulticiding), biological control, surveillance, and public education.

For some counties with no mosquito control programs, the department has established a memorandum of understanding in which participating counties set traps to collect adult mosquito specimens and then send the trap contents out for identification in order to establish base line population data for those regions of the state.

**[14] Development of a Smart Mosquito Counter Device & Its Newly Updated Capability for Mosquito Identification**

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We developed the smart mosquito counter device (height 1080mm × width 560mm × diameter 320mm, 220V 60Hz 30W), which could attract the female mosquito by emitting CO<sub>2</sub> gas (300ml/min), could count the number of the captured mosquitoes by an infra-red beam area sensor, and could send the captured mosquitoes' number through the CDMA module at real time. We operated the 8 – 16 devices with sensor networks and a server at the Youngdeungpo areas in Seoul city of south Korea for three years (2011-2013) and we could efficiently control mosquitoes at the high mosquito density area based on the mosquito data. We found that the accuracy of the device was about over 93% compared the real mosquito data and transmitted data by CDMA. We also found the water reservoir areas to control

floods in Seoul city had relatively higher mosquito density than other normal areas, because those flat water areas were preferred by mosquitoes. Because we knew the mosquito occurrence peak times and areas from mosquito data transmitted by the mosquito devices, we could efficiently control mosquito larva and adults at the right time. We could accomplish very systematic mosquito control policy and we had the high credibility with the results. Based on the mosquito occurrence data, we selectively and scientifically controlled mosquitoes. Therefore, we reduced pesticide usage and saved pesticide expenses about to half during the study periods. We also developed a new updated technology for the device for mosquito identification and it is a renovation.

#### **[15] Creating a field environment in a tent: Do simulations really work?**

Phillip E. Kaufman. Entomology and Nematology Dept., University of Florida, Gainesville, FL 32611 [pkaufman@ufl.edu](mailto:pkaufman@ufl.edu)

When evaluating insecticides under field conditions, particularly under livestock settings, considerable variability enters experimental models. To overcome this, a simulated field trial was conducted that allowed for insect recruitment and replacement, while balancing environmental and farm management parameters that are so often confounding. On a typical livestock farm house flies are ubiquitous, occurring in overlapping generations with immature development in a variety of habitats. Insecticides targeting house flies on livestock farms occurs through several methods, but most often are residual applications to structures and sugar-baits dispersed in the environment or placed in bait stations. Residual applications tend to quickly reduce adult fly populations, while bait applications require several days to reduce populations. Residual insecticide studies are quite easy to evaluate, while bait studies are notoriously difficult to evaluate. In this study, a new house fly insecticide bait, Zyrox (cyantraniliprole), was evaluated for its ability to kill house flies prior to their capacity to reproduce in provided substrate. Fly abundance over time was evaluated under one of six conditions that included a sugar-only control, a Zyrox-only, and a sugar + Zyrox treatment that each included either a larval source replenishment or no replenishment. Larval source replenishment consisted of larval developmental media into which adult house flies were permitted to oviposit. Each treatment was supplied with 1,000 adult house flies and 1,000 late-instar larvae. Fly abundance was evaluated over a 20-day period and the study was replicated 3 times using 12 screened tents. Results will be presented and implications discussed.

#### **[16] Milkweed Watch: The Search for Invertebrate Diversity Through Citizen Science**

Thomas Weisling and Louise Lynch. Department of Entomology, 103 Entomology Hall, University of Nebraska, Lincoln, NE 68583-0816 [twaisling@unl.edu](mailto:tweisling@unl.edu)

In response to a national decrease in milkweed populations, numerous private and government programs have implemented various activities to draw attention to the issue. These programs often focus on monarchs and the impacts of declining host plants. Here at UNL, we created a conservation program called Milkweed Watch. Milkweed Watch is a citizen science project designed to explore and document the diversity of insects and other arthropods that use milkweed plants either as food or for shelter. The goals of this project are to further document the various arthropod species found on milkweed plants, to determine the diversity and distribution of milkweed plants in the plains, and to promote awareness about and appreciation of milkweeds, a plant considered by many to be a weed. We are relying on citizens to share which arthropod species they observe on milkweeds. With each observation and each report, we gain a clearer picture of milkweed's significance. Together, we can support not only monarch conservation efforts, but also the stewardship of all those animals that rely on these critical plants.

#### **[17] Biological and economical evaluation of an integrated pest management of coffee berry borer, *Hypothenemus hampei* (Coleoptera: Curculionidae) on large coffee farm in Colombia through participatory research**

Luis F. Aristizábal<sup>1</sup>, Hector I. Trujillo<sup>2</sup>, Alex E. Bustillo<sup>3</sup>, Mauricio Jiménez<sup>4</sup>, and Steven P. Arthurs<sup>1</sup>. Mid-Florida Research and Education Center, 2725 Binion Rd, Apopka, FL 32703, [larist@ufl.edu](mailto:larist@ufl.edu)

The coffee berry borer (CBB), *Hypothenemus hampei* is the most serious insect pest on coffee plantations worldwide. In the municipality of Risaralda, Caldas, Colombia, large coffee farms located at lower attitude (<1250 masl) have environmental conditions that make the control of this pest challenging. Coffee producers and technicians from Cenicafé, evaluated an integrated pest management (IPM) program that include monitoring, cultural practices, and biological and chemical insecticides through a participatory research project. Three large coffee farms (20, 42 and 82 ha) were receiving IPM practices were evaluated for infestation by CBB on field and parchment (processed) coffee over 18

months. Results showed that two farm sold parchment coffee with >8% CBB damage and one farm produced parchment coffee < 5% (economical threshold). Despite *Beauveria bassiana* and chemical insecticides being applied several times and the efficacy of harvest being improved, infestations of CBB in the field were high reaching (>35%) in two farms but lower in the last one (5.6%). The reasons for the different results and additional comments of IPM of CBB conducted under operational conditions are discussed. The cost for control of CBB averaged 7.5% of total production cost across all three coffee farms. A successful IPM for CBB depends of supervision in the farm and knowledge of the farmer regarding this insect pest.

**[18] A Trap and Lure for Monitoring Blueberry Gall Midge (*Dasineura Oxycoccana* Johnson) in Florida Blueberries**  
Elena M. Rhodes, Shweta Sharma, Hans Alborn, Nicole Benda, and Oscar E. Liburd. Entomology and Nematology Dept., University of Florida, Gainesville, FL 32611 [erhodes@ufl.edu](mailto:erhodes@ufl.edu)

Blueberry gall midge (BGM), *Dasineura oxycoccana* Johnson, is a major pest of Rabbiteye blueberries and has recently begun to emerge as a serious pest of Southern Highbush blueberries. In Rabbiteye, BGM larvae infest developing leaf and flower buds, whereas they mainly infest leaf buds of Southern Highbush. Mature larvae fall to the ground and pupate in the soil. Therefore, proper monitoring is essential to ensure that insecticides are applied when adults are emerging from the soil. Our previous research has demonstrated that bucket emergence traps and clear sticky sheets are effective monitoring tools. The objective of this study was to determine if it is possible to improve the effectiveness of clear sticky sheets by investigating trap height and the addition of an attractant. Clear sticky sheets were hung at low, medium, and high heights within the bush. Bucket and panel traps were also included as controls. Clear sticky sheets hung the lowest within the bushes caught the most midges and behaved similarly to bucket traps. The attractant was a blend of camphene, hexanal, ocimene, and ylang ylang oils. There were 5 replicates of 5 treatments: 300 ul concentration, 200 ul concentration, 10X and 100X dilutions of the 200 ul concentration, and control (pentene only). Mostly female midges were caught on the traps and the 10X dilution of the 200 ul concentration caught the most midges ( $31.5 \pm 6.2$ ), twice as many as the control ( $13.7 \pm 2.8$ ). The findings indicate that clear sticky sheets are a viable monitoring tool if they are hung low in the bushes and the attractant blend enhances their effectiveness.

**[19] The Fungus, *Raffaelea Lauricola*, Manipulates Release of Host Plant Odors Causing Initial Repellency and Subsequent Attraction to Trees by its Vector, the Redbay Ambrosia Beetle**  
Xavier Martini, Marc A. Hughes, Jason A. Smith, Lukasz L. Stelinski. University of Florida, CREC, 700 experimental Station road, Lake Alfred, FL 33850 [xmartini@ufl.edu](mailto:xmartini@ufl.edu)

**[20] The Rise and Fall of Formosan Subterranean Termite Colonies in Louis Armstrong Park, New Orleans, 2004 – 2014**  
Nan-Yao Su, Eric Guidry, and Carrie Cottone. Ft. Lauderdale Research and Education Center, University of Florida [nysu@ufl.edu](mailto:nysu@ufl.edu)

Population dynamics of the Formosan subterranean termite, *Coptotermes formosanus* Shiraki, in the 32-acre Armstrong Park adjacent to French Quarter, New Orleans have been monitored since 1998. Following the total elimination of all detectable colonies of *C. formosanus* with hexaflumuron and noviflumuron baits in 2003, the site was left un-baited to monitor the population recovery in the Park. *C. formosanus* activities in the Park began to increase in 2004 with a classic Sigmoid curve and by 2008, the activity level reached a plateau. The results suggest that even with an aggressive baiting program to eliminate all detectable *C. formosanus* populations in an area-wide program, the population can recover in 5 years if baiting program stop and the target area is surrounded by *C. formosanus* populations. As the final phase of the project, “always active” durable baits, Recruit HD, were applied in 2010, and since 2013 *C. formosanus* population has been kept at near zero level.

**[21] Laboratory Host-Specificity Tests with the Kudzu Bug, *Megacopta cribraria* (Hemiptera: Plataspidae) A New Invader in Florida**  
Julio Medal, Susan Halbert and Andrew Santa Cruz. Florida Department of Agriculture and Consumer Services, Division of Plant Industry. 1911 SW 34th Street. Gainesville, FL 32608 [Julio.medal@freshfromflorida.com](mailto:Julio.medal@freshfromflorida.com)

The Kudzu Bug, *Megacopta cribraria* (Heteroptera: Plataspidae), was first reported in Georgia in fall 2009, and since then it has been spreading through Georgia, North Carolina, South Carolina, Alabama, Virginia, Mississippi, Maryland, Delaware, Tennessee, Kentucky, Louisiana and Florida. The kudzu bug was initially found in March 2012 on kudzu plants in north Florida, and it is currently reported in 29 counties. In its native to Asia, one of the kudzu bug's preferred hosts is kudzu, *Pueraria montana*. This insect also is an agricultural pest of soybean, *Glycine max*, and other legume plants. The kudzu bug adults were exposed during 5-6 weeks to thirty-five potted plant species in a greenhouse. Egg masses were deposited and nymphs completed development to adult stage on kudzu, soybean, pigeon pea, *Cajanus cajan*; white clover, *Trifolium repens*; white sweetclover, *Melilotus alba*; alfalfa, *Medicago sativa*; black-eye pea, *Vigna radiata*; red clover, *Trifolium pratense*; lima bean, *Phaseolus lunatus*; Perennial peanut, *Arachis glabrata*; American jointvetch, *Aeschynomene americana*; and pinto bean, *Phaseolus vulgaris*. However, sweet orange, *Citrus sinensis*; peanut, *Arachis hypogaea*; chickpea, *Cicer arietinum*; lentil, *Lens culinaris*; mungbean, *Vigna radiata*; corn, *Zea mays*; sorghum, *Sorghum bicolor*; tomato, *Lycopersicon esculentum*; bell-pepper, *Capsicum annum*; Florida beggarweed, *Desmodium tortuosum* and jicama, *Pachyrhizus erosus* were not utilized as reproductive hosts. Implications and potential damage to Florida commercial crops is reviewed.

**[22] Biology of a stem boring weevil *Apocnemidophorus pipitzi* (Faust) (Coleoptera: Curculionidae) And its impact on Brazilian peppertree, *Schinus terebinthifolia***

J. P. Cuda, J. L. Gillmore, J. C. Medal, J. Bricker, and B. R. Garcete-Barrett. Entomology & Nematology Dept., Charles Steinmetz Hall, PO Box 110620, Gainesville, FL 32611-0620 [jcuda@ufl.edu](mailto:jcuda@ufl.edu)

Brazilian peppertree (BP), *Schinus terebinthifolia* Raddi (Anacardiaceae), was introduced into Florida, USA, from South America as an ornamental in the late 19th and early 20th centuries. In the 1980s, BP was targeted for classical biological control because it is invasive and there are no native congeners in the continental USA. In March 2006, a survey for natural enemies of BP was conducted in southeastern Paraguay. A stem boring weevil identified as *Apocnemidophorus pipitzi* (Faust) was collected from the plant at several locations. The insect also has been reported from Argentina, Brazil and Uruguay. Weevils were transported under permit to the Florida Biological Control Laboratory in Gainesville, FL. A laboratory colony of *A. pipitzi* was established in April 2007 by caging the adults on cut branches of BP supplemented with leaf bouquets. This insect is the first stem borer of BP successfully reared under laboratory conditions. To date, over 19 generations of the weevil have been produced in the laboratory. Adults are defoliators and feed mainly on the upper surface of subterminal leaflets, where they produce a characteristic notching pattern. Females deposit eggs singly inside the stems and larvae feed under the bark where they damage the vascular cambium. There are five instars, pupation also occurs inside the stem, and a new generation is produced in 3-4 months. Comparing growth of potted plants with and without exposure to weevil herbivory revealed that feeding damage by the adults and larvae caused significant leaf abscission and a reduction in biomass accumulation.

**[23] Effect of environmental variables on Coffee berry borer (*Hypothenemus hampei*) in Puerto Rico**

Jose M. Garcia, Yobana A. Marino, Paul Bayman, and Jose C. V. Rodrigues. University of Puerto Rico-AES, 1193 Calle Guayacan St, San Juan PR 00926 [jose\\_carlos@mac.com](mailto:jose_carlos@mac.com)

Coffee berry borer (CBB), *Hypothenemus hampei*, was reported in Puerto Rico in 2007 and is extremely difficult to control with chemicals and biological methods, means, as it spends most of its life cycle inside the coffee berry. A geographic information system (GIS) database relating the incidence of CBB and biocontrol organisms to climate data, elevation and other available variables have been developed for Puerto Rico. An initial island-wide survey was conducted throughout the different coffee growing areas to determine pest infestation levels and estimate coffee damage. Using BioClim database and georeferential information analyzed with MaxEnt software package 19 environmental variables plus altitude that could explain the reported occurrence of the pest. The variable precipitation of wettest quarter, min temperature of coldest month and precipitation seasonality explained 62% of the predicted occurrence of the pest. These initial results are directing a more specific local integrated pest control approach for coffee areas that present different probabilities and pressure of the pest.

**[24] Do-It-Yourself Insect Pest Traps**

Adrian Hunsberger<sup>1</sup> and Steven Arthurs<sup>2</sup>. <sup>1</sup>UF/Miami-Dade County Extension. 18710 SW 288<sup>th</sup> Street, Homestead, FL 33030 [aghu@ufl.edu](mailto:aghu@ufl.edu)

Several types of commercial traps used to monitor or control insects or other arthropods are marketed. However, many traps are not readily available to the homeowner or may need to be ordered and therefore involve an unacceptable cost or waiting period. Here we discuss easy to make, DIY indoor and outdoor insect traps for commonly encountered pests in the home, garden or landscape. We focus on traps that can be made using common household materials. Traps to capture insects vary greatly, depending on the target, location and purpose. Traps may be simple interception devices that passively capture insects, contain lures or baits or have specific designs and colors to attract particular type of pest. Traps may be inexpensive and disposable, more complex, or require periodic servicing to maintain their effectiveness. In some cases, it may be less expensive to make your own traps compared to purchasing commercial traps. Moreover, commercial traps are not available for many of the pests found in Florida, but ideas for future development can be gleaned from some of the DIY traps.

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### **2015 Industry Symposium: Unique Application Methods to Control Insect Pests**

Organizers: Catherine Long (Syngenta Crop Protection, Vero Beach, FL) Craig Heim (FMC, Savannah, GA), Bruce Ryser (FMC, Tampa, FL) and Scott Ferguson (Atlantic Turf & Ornamental Consulting, Vero Beach, FL) [scott@atoconsult.com](mailto:scott@atoconsult.com)

### **[25] Sentricon® Termite Colony Elimination System: An Innovative Approach to Termite Control Born of Collaboration Between Industry and Academia.**

Joe Eger, Dow AgroSciences, 2606 S. Dundee St. Tampa, FL 33629 [jeeger@dow.com](mailto:jeeger@dow.com)

The first commercial termite bait product, The Sentricon Termite Colony Elimination System, was launched by Dow AgroSciences in 1995. This year marks the 20<sup>th</sup> anniversary of the launch. Collaboration between Dow AgroSciences and the University of Florida matched an effective active ingredient (hexaflumuron) with a baiting concept that uses workers attracted to wood monitors to recruit additional termites to baits. The system has continued to add innovations to improve efficacy and increase intervals between station monitoring. These innovations will be covered in the talk.

### **[26] Citrus Trunk and Citrus Root Injection Techniques for the Treatment of Citrus “Greening” Disease.**

Tom Minter, Florida Pesticide Research, Inc. 1810 Deleon Street, Oviedo, FL 32765; [FLPESTTOM@bellsouth.net](mailto:FLPESTTOM@bellsouth.net)

Citrus “greening” or Huanglongbing disease is a devastating disease of citrus which affects nearly 100% of trees in Florida. It is a worldwide problem. The Candidatus Liberibacter bacteria is vectored by the Asian citrus psyllid. Over time, the bacteria plugs the vascular system of the tree, concentrating in the trunk and roots. This plugging causes a severe decline in tree health and eventually death.

Treatment options have been limited. Foliar sprays or soil drench through the microjet irrigation system are being used. To date, we have no treatment to reduce the concentration of the bacteria in the trunk or root system.

For several years, I’ve been making applications with some experimental treatments using Arbor Jet tree plugs inserted into the trunk. The plugs are inserted into the rootstock or the scion. Treatments have either been non-effective or would not meet regulatory approval. I am currently evaluating injection equipment that would allow treatments to be injected into the root zone as a possible technique for the treatment of the disease, as well as *Phytophthora*, root weevils and nematodes.

Treatments into the trunk or root system with traditional chemistry that requires the establishment of a crop tolerance may trigger further residue testing. Biological treatments that do not require the establishment of a crop tolerance may fit this type of application. Developing cost analysis for this labor intensive work plus material costs are part of the ongoing work.

### **[27] End Zone Fly Sticker Bait, A New Method For Control of Filth Flies.**

Dina Richman, & Bruce Ryser, FMC Corp., 9703 Cypress Pond Avenue, Tampa, FL 33647; Dina Richman, FMC Global Specialty Solutions, 9703 Cypress Pond Avenue, Tampa, FL 33647; [813-361-2393](tel:813-361-2393) [bruce.ryser@fmc.com](mailto:bruce.ryser@fmc.com)

End Zone Insecticide Stickers target adult filth flies. They are packaged as an insecticide bait formulated on a plastic polymer film. Each sticker is coated with acephamiprid. Filth flies are controlled after landing and feeding on the surface of the plastic film. End Zone stickers are effective for up to seven months indoors and four months outdoors. They may be used in either residential or commercial locations. End Zone stickers offer discreet low profile control of filth flies. Proper installation, where & how to properly apply End Zone stickers will be discussed.

**[28] Worldwide Status on the Use of Mating Disruption.**

Jack W. Jenkins and Donald Thomson, Pacific Biocontrol Corp, 620 E. Bird Lane, Litchfield Park, AZ 85340; [jjenkins@pacificbiocontrol.com](mailto:jjenkins@pacificbiocontrol.com)

The deployment of insect pheromones to control pest populations by disrupting mating behavior, started 38 years ago when the EPA registered the pink bollworm, *Pectinophera gossypiella* pheromone. The commercial use of pheromone-mediated mating disruption has grown substantially with products for dozens of pests, predominantly Lepidopteran species.

Pheromone active ingredients are relatively expensive to produce and commercial success of mating disruption products has depended on cost effective controlled-release technologies. Mating disruption products have evolved in an attempt to improve efficacy, ease-of-use and economics. Passive pheromone dispensers that can be applied by hand or specialized application equipment are still the most widely used. Some pheromone formulations are used in conjunction with insecticides to control targeted pest via "attract and kill" mode-of-action. Microencapsulated pheromone formulations have also been developed for application with standard spray equipment. Most recently, aerosol formulations have been successfully developed for several important pests.

Mating disruption has been especially successful when combined with other management techniques and used in organized area-wide programs. Some area-wide programs have reduced populations to very low levels (tomato pinworm, codling moth) or even eradicated the target insect from specific areas (pink bollworm, Oriental fruit moth).

Currently mating disruption is used to manage more than 40 species worldwide. An estimated 750,000 hectares are treated.

Various factors (regulatory, technical, economical) influencing the use of mating disruption will be discussed.

**[29] A Progressive Approach To Baiting When Managing the Invasive Tawny Crazy Ant, *Nylanderia fulva* (Hymenoptera: Formicidae).**

Michael Bentley, University of Florida, Department of Entomology and Nematology, P.O. Box 110620, Gainesville, FL, 32611 [MTBentley@ifas.ufl.edu](mailto:MTBentley@ifas.ufl.edu)

*Nylanderia fulva* is an invasive pest ant found in several counties in Florida and other Gulf Coast states. In non-native ranges, large *N. fulva* populations have damaged electrical equipment, reduced arthropod abundance, and have even displaced another invasive ant in the U.S., *Solenopsis invicta*. Like many other invasive ants, *N. fulva* colonies are polydomous and polygynous, capable of generating dense foraging populations. As a result, contact insecticide sprays are commonly used as a first line of defense to temporarily reduce worker populations, but fail to eliminate enough of the colony, including the reproductives, to achieve long term management success. Insecticidal baits offer an advantage over contact insecticides because foraging workers transport the toxicant to reproductives, breaking the colony lifecycle. Recent field trials in North Florida utilized a progressive approach to managing *N. fulva* populations with insecticidal baits at two locations. Positive results in bait acceptance, consumption rate, and colony management were observed at both sites, suggesting that insecticidal baits may provide a solution to managing invasive *N. fulva* populations.

**[30] Effective Pest Control Through Trunk Injection Technology.**

JB Toorish, Arborjet, Inc., 5860 Ansley Way, Mount Dora, FL 32757; [jbtoorish@arborjet.com](mailto:jbtoorish@arborjet.com)

I will cover trunk injection methodology and current products. I will also explain how small doses of product can achieve effective, long term control of insect pests in trees and palms with little to no exposure to the environment, people, pets or wildlife.

**[31] Seed Treatments for Control of Insects in Vegetables**

David Belles, Syngenta Crop Protection, Chandler AZ; [David.Belles@syngenta.com](mailto:David.Belles@syngenta.com)

Insect control by seed treatments has been a fairly recent development in the history of seed treatments. Fungicides were the first use of seed treatment beginning in X with the use of X. The first registration of an insecticide as a seed treatment was lindane in X. The first insecticide seed treatments were non-systemic contact insecticides for soil insects such as wireworms and seed corn maggot. In X lindane was removed from the market and alternatives were sought. At about the same time a new class of systemic insecticides was registered the neonicotinoids. These new insecticides which included, thiamethoxam, clothianidin, and imidicloprid were ideal for use as seed treatments. Active against many sucking and chewing pests they were able to control both soil and foliar insects at early stages of crop development. The first registrations were in field crops but the benefits to vegetables were soon recognized. Minor crop registrations were obtained for imidicloprid (199X), thiamethoxam (199x), and clothianidin (199x). Examples of effective control by neonicotinoid seed treatments include: cucumber beetle, seed corn maggot, onion maggot, and aphid. Crop safety, an important consideration with valuable vegetable seed, was a concern and early barrier to use, but with new technologies such as pelleting and polymers and careful selection of seed lots risks can be mitigated. Recently, this class of chemistry has come under scrutiny for their effect on bee health. The amount of product in plants after use at flowering is lowest when applied as a seed treatment. The main concern in field crops is due to dust exposure at planting and is being addressed. Currently, there are no restrictions for use in vegetable crops.

### **[32] Utilization of biotech sweetcorn products for pest management.**

**Roberto Cordero, Seminis Vegetable Seeds Co., 2700 Camino Del Sol, Oxnard, CA 93030**

[roberto.cordero@seminis.com](mailto:roberto.cordero@seminis.com)

**No abstract**

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### **Symposium: Management of Thrips and Tospoviruses in Florida: Emerging and Long Term Concerns**

Organizer: Hugh A. Smith, Ph. D. Assistant Professor, Vegetable Entomology Univ. Florida/IFAS/Gulf Coast REC, 14625 CR 672, Wimauma, FL, 33598 [hughasmith@ufl.edu](mailto:hughasmith@ufl.edu)

### **[33] Challenges and Opportunities in the Management of Thrips and Thrips-Vectored Viruses in Florida**

Joe Funderburk, University of Florida-IFAS, 155 Research Road, Quincy, FL 32351; [jef@ufl.edu](mailto:jef@ufl.edu)

The establishment of invasive Thysanoptera, such as the western flower thrips (*Frankliniella occidentalis*) and the melon thrips (*Thrips palmi*), in Florida has resulted in the destabilization of established integrated pest management programs for many crops. Efforts to control thrips pests and thrips-vectored viruses with calendar applications of broad-spectrum insecticides have been unsuccessful. The result has been a classic '3-R' situation: resistance of pests to numerous insecticides, resurgence of pest thrips populations as a result of natural predators and native competitor thrips being eliminated, and replacement of minor pests by more damaging species. Further, insecticides are ineffective in preventing spread of tospoviruses. This paper updates information on efforts in Florida to develop and implement integrated pest management programs that are effective, economical, ecologically sound, and sustainable.

### **[34] Transmission of Tospoviruses and Iilarviruses by Thrips**

Ismael E. Badillo-Vargas, Joseph E. Funderburk & Scott Adkins. University of Florida, Quincy, Florida;

[ismael.badillo@ars.usda.gov](mailto:ismael.badillo@ars.usda.gov)

Thrips are economically important pests of several agricultural crops not only for the direct damage they cause by feeding but also indirectly by transmitting plant viruses such as tospoviruses and ilarviruses. Tospoviruses are transmitted efficiently and specifically by a few thrips species in a persistent propagative fashion. Acquisition of tospoviruses is restricted to the larval stages with the virus replicating and spreading throughout the thrips' body for transmission to occur during adulthood. *Tomato spotted wilt virus* (TSWV), *Groundnut ringspot virus* (GRSV), and *Tomato chlorotic spot virus* (TCSV) are three tospoviruses occurring sympatrically in vegetables, ornamentals and several weed species in peninsular Florida. On the other hand, a few ilarviruses, including *Tobacco streak virus* (TSV) causing red node on beans in Florida, have been shown to be transmitted via pollen with thrips mediating the process in a non-specific manner. TSV and a new ilarvirus identified in 2013 infecting tomatoes in Florida, for which the name Tomato necrotic streak virus (TomNSV) is proposed, is being investigated for its potential mechanism of transmission including

thrips as possible vectors. This paper will contrast the mode of transmission by thrips of these two groups of plant viruses.

**[35] The Role of The IR-4 Project In Helping to Manage Thrips Across Commodities in FL Agriculture.**

Michelle Samuel-Foo, IR-4 Southern Region Field Coordinator | Associate Research Scientist. University of Florida | Food and Environmental Toxicology Lab, 1642 SW 23rd Drive. PO Box 110720, Gainesville, FL 32611 – 0720 [mfoo@ufl.edu](mailto:mfoo@ufl.edu)

Florida fruit and vegetable growers annually produce about \$3 billion worth of crops for US and international markets. Healthy crops where pests and diseases are effectively managed are critically important to growers everywhere. The IR-4 project is a cooperative USDA-NIFA funded program that aids specialty crop growers in managing pests. The unique nature of Florida's agriculture necessitates the development of new pest management products. The program's mission is to provide sustainable pest management technologies (chemical and biological) to growers of specialty crops across the nation. The IR-4 Southern Region, which is domiciled at the University of Florida in Gainesville, has facilitated in excess of 750 requests from Florida stakeholders including growers and those with an interest in specialty crop agriculture across the state for registration of pest management products on fruit and vegetable crops. By developing the required residue chemistry data to support new and extended registrations, hundreds of new product uses get registered that support Florida specialty crop producers. This presentation will highlight the specialty crop pesticide registration process and will also focus on the critical role that IR-4 plays in helping to manage thrips, which are pests of increasing significance across the state in FL specialty crops.

**[36] Predator in First: A Prophylactic Biological Control Strategy for Management of Multiple Pests of Pepper**

Cindy L. McKenzie, Vivek Kumar, Yingfang Xiao, Lance S. Osborne. US Horticultural Research Laboratory, ARS-USDA 2001, S. Rock Road, Fort Pierce, FL 34947, [cindy.mckenzie@ars.usda.gov](mailto:cindy.mckenzie@ars.usda.gov)

The establishment of biocontrol agents is critical for the success of biological control strategies. *Predator-In-First* (PIF) is a prophylactic control strategy that aims to establish predators before the appearance of pests in an agro-ecosystem. PIF uses the characteristics of generalist phytoseiid mites to survive, develop and reproduce on pollen and thus establish in the absence of prey. The early establishment of the proactive population of natural enemies helps target the pests at their incipient stage of infestation. In the present study, we evaluated the practical application of PIF approach in greenhouse and commercial field production conditions using pepper as a model crop. Results showed that predatory mite *Amblyseius swirskii* established on pepper seedlings, provided effective suppression of multiple pests in controlled greenhouse conditions. In field conditions, since weather was a challenge affecting predatory mite activities, an augmentative release of mite was warranted to receive significant reduction in pest populations. We discuss the implications and limitations of this pest management approach.

**[37] Thrips in the South Florida Landscape**

Catharine Mannion. Associate Professor of Entomology, Tropical Research and Education Center, 18905 SW 280<sup>th</sup> Street, Homestead, FL 33031, [cmannion@ufl.edu](mailto:cmannion@ufl.edu)

A review of some of the key invasive thrips in the south Florida landscape attacking ornamental plants will be reviewed. Identification and management of these thrips will be discussed. Focus will be on two invasive thrips: ficus thrips and *Holopothrips* attacking *Tabebuia*.

**[38] Thrips Species, Seasonal Abundance And Their Management to Suppress Tomato Chlorotic Spot Virus In Homestead Tomato.**

Dak Seal Associate Scientist, IPM, Insect Pest of Vegetables, Tropical Research and Education Center. UF/IFAS, 18905 SW 280<sup>th</sup> St., Homestead, FL 33031, [dseal3@ufl.edu](mailto:dseal3@ufl.edu)

Tomato, *Lycopersicon esculentum* Miller, is an important vegetable crop in Florida. Miami-Dade County contributes about 8% of the total Florida tomato production. Insect pests are an important limiting factor throughout the tomato production season for causing economic damage by feeding and transmitting viral diseases. Miami-Dade tomato growers are experiencing economic yield loss due to Tospovirus (GRSV and TCSV) infection transmitted by thrips. In a recent survey, we recorded three different species of thrips- melon thrips (*Thrips palmi* Karny), common blossom thrips (*Frankliniella schultzei* Trybom) and western flower thrips (*F. occidentalis* (Pergande) associated with tospovirus infected

tomatoes. Melon thrips invasion has been documented first in the current year in all commercial production acreages. Other three species occur occasionally on tomato in Homestead. In the present study, we will investigate abundance of these thrips on vegetable and weed hosts and their seasonal abundance and management.

### **[39] Biology and Management of Flower Thrips in Berry Crops**

Oscar Liburd and Elena M. Rhodes. Professor of Fruit and Vegetable Entomology, Entomology and Nematology Dept., Bldg. 970, Natural Area Dr., University of Florida, Gainesville, FL 32611-0620, [oeliburd@ufl.edu](mailto:oeliburd@ufl.edu)

Flower thrips, *Frankliniella* spp. are a key pest in berry crops in North-central Florida. They are common from December until May depending on the crop genera and species grown. In previous studies, we found that > than 70% of the thrips recorded in blueberries (*Vaccinium*) spp. and blackberries (*Rubus* spp.) in north-central Florida were *Frankliniella bispinosa* (Morgan). These thrips are responsive to trap colors and feed primarily on flower petals. In blueberries we found a direct correlation between thrips numbers, fruit injury and fruit dehydration. For instance, as thrips numbers increase, fruit injury and dehydration becomes more apparent. Furthermore, a high population (> 4 per flower) results in several ovipositional scars on ripening berries. Surveys of flowering plants adjacent to berry crops revealed several reproductive hosts of *F. bispinosa*, including Carolina geranium (*Geranium carolinianum* L.), white clover (*Trifolium repens* L.), and wild radish (*Raphanus raphanistrum* L.). Although white clover was the dominant host growing adjacent to berry plantings our findings indicate that clover does not appear to be a significant source for thrips inoculation. The crop variety grown and management tactics are important factors that influence the abundance of thrips within plantings. Biorational pesticides provide various levels of efficacy and should be integrated with monitoring tools to provide effective management for flower thrips in berry crops.

### **[40] Toward the Identification Of Thrips Larvae Found With Cultivated Crops And Ornamentals In Florida.**

Thomas Skarlinsky and Joe Funderburk, USDA, APHIS, PPQ, P.O. Box 660520, Miami, Florida 33266; [Thomas.L.Skarlinsky@aphis.usda.gov](mailto:Thomas.L.Skarlinsky@aphis.usda.gov)

The majority of thrips identification is based on adult female morphology, but few publications exist toward the identification of larval thrips. As a result, USDA regulatory entomologists often can make only higher taxa determinations of larval Thysanoptera. However, recent thrips larvae identification research and developments in non-destructive DNA extraction have augmented our knowledge toward accurate morphological identification of thrips larvae. To extend these recent advances to researchers, crop consultants and growers in Florida, a larval identification key to some common thrips pest species is presented.

### **[41] Recent Developments in Managing Thrips in Florida Fruit and Vegetable Crops: A Practitioner's Perspective.**

Galen Frantz, Glades Crop Care Inc. 949 Turner Qua, Jupiter, FL 33458, [gfrantz@gladescropcare.com](mailto:gfrantz@gladescropcare.com)

Significant challenges have recently emerged in managing melon thrips, *Thrips palmi* Karny, and western flower thrips, *Frankliniella occidentalis* Pergande, in fruiting vegetables and cucurbit crops. Geographic expansion of the common blossom thrips, *Frankliniella schultzei* Trybom, into central Florida has led to concerns about managing tospoviruses, notably Tomato Chlorotic Spot Virus, in solanaceous crops. We report on field level pest management issues encountered during recent seasons and present potential improvements in management practices to implement in future seasons.

### **[42] Tolfenpyrad: A New Insecticide for Thrips Control in Florida**

Botond Balogh. Nichino America, 124 Star Shell Drive, Apollo Beach FL 33572, [bbalogh@nichino.net](mailto:bbalogh@nichino.net)

### **[43] Optimizing thrips control in Florida crops with Radiant and Closer**

Alejandro A. Calixto, Melissa Siebert, Luis Gomez, Linda Lindenberg and Scott Houk. Dow AgroSciences, 33245 Mandrake Rd, Wesley Chapel, FL 33543, [aacalixto@dow.com](mailto:aacalixto@dow.com)

Multiple thrips species have become major pests in Florida crops. Thrips populations can build up on a number of crops with a few species of economic significance. Several chemical control strategies have been developed over the years, with spinosyns (spinosad and spinetoram) being one of the most effective against several thrips species and compatible

with important natural enemies. A multi-faceted approach is required to manage thrips and to preserve the longevity of all chemical controls, which include proper species identification, adherence to economic threshold, and enhancement/preservation of natural enemies). The paper will reinforce best practices to preserving Radiant insecticide (spinetoram) and incorporation of a new insecticide tool Closer (sulfoxaflor), for thrips management programs in different crops and geographies across Florida.

#### **[44] Managing Thrips in Florida Strawberry**

Hugh A. Smith

#### **[45] Discussion: Priorities for Thrips Management in Florida**

Dr. Norman C. Leppla, Professor & Program Director, IPM/University of Florida, IFAS. Entomology and Nematology Department, 1881 Natural Area Drive, Gainesville, FL 32611-0620 [ncleppla@ufl.edu](mailto:ncleppla@ufl.edu)

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### **Submitted Paper Session 2**

#### **[46] Asian citrus psyllid control and foliar nutrition improve productivity of HLB-infected citrus trees**

James A. Tansey, Pilar Vanaclocha, Moneen M. Jones, Cesar Monzo, and Philip A. Stansly. University of Florida, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 (USA). [jtansey@ufl.edu](mailto:jtansey@ufl.edu)

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), vectors *Candidatus Liberibacter asiaticus* that causes Huanglongbing (HLB) throughout commercial citrus-growing regions worldwide. In Florida, HLB incidence is approaching 100% statewide. Yields have decreased and production costs have increased since 2005. The continued profitability of some groves is attributed to aggressive psyllid control with insecticides and foliar nutritional sprays that may compensate for reduced translocation. However, the value of these practices is debated. A replicated field study employing a factorial design was initiated in 2008 in a 5.4 ha commercial block of 'Valencia' sweet orange trees to evaluate individual and combined effects of foliar nutrition and ACP control with threshold-driven insecticide treatments and dormant sprays. The current work summarizes results of the last three growing seasons (2012-2015).

Insecticide applications consistently reduced ACP populations on insecticide-treated trees in addition to a site-wide reduction. However, neither insecticide nor nutrition applications significantly influenced HLB incidence nor titer in mature trees. In reset trees, foliar nutrition initially reduced both HLB incidence and titer relative to controls. However, infection continued to build and was 100% in all treatments by October 2013. Greatest yields (kg fruit/ ha) and production (kg s/ ha) were obtained from trees receiving both insecticides and foliar nutrition. All treatments except foliar nutrition applied alone in 2013 resulted in production and financial gains relative to controls in all years. However, the material and application costs associated with the nutrition component offset gains resulting in lower profits than insecticide applied alone.

#### **[47] Huanglongbing in China: History, Distribution and Current Status**

Yijing Cen, Xiaoling Deng, Philip A. Stansly. University of Florida-IFAS, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 [cenyj@ufl.edu](mailto:cenyj@ufl.edu)

Citrus is the most important fruit in South China. Huanglongbing (HLB), first reported in Guangdong Province in 1919, is the most devastating citrus disease. A dispute persisted over the cause of HLB between Horticulturists and Plant Pathologists until Prof. Kongxiang Lin published his 2 papers on demonstrating that it was an infectious disease. Although the Asian citrus psyllid (ACP) *Diaphorina citri* was first found in 1934 in Guangzhou, little attention was paid until 1953 when Prof. Bangkan Huang published results of his biological studies. HLB was proved to be the vector of HLB by the Research Team of Guangdong Province and Guangxi Province in 1977. Disease and vector are now widely distributed in 11 of the 18 citrus plantation provinces. Although greatly impacted by HLB, citrus production has been increasing in China since 1980s. One objective is to develop citrus in areas where HLB and ACP are absent. In regions where HLB is present, HLB-free nursery stock, sanitation of the planting environment, improvement of tolerance in infected trees and effective vector management are key strategies. Sanitation is essential because it has never been possible to grow young plants beside an infected orchard. Current research on HLB control includes use of antibiotics,

heat treatment, nutritional programs and vector control. Applying of organic fertilizers is believed to improve citrus tolerance to HLB and ACP. However, nutritional programs aiming at the infected trees have not been as effective as reported from Florida.

**[48] Ultrastructure of the salivary glands and bacteria-like structures in the gut and other organs Of the Asian citrus psyllid *Diaphorina citri* (Hemiptera: Liviidae), vector of huanglongbing disease bacteria**

El-Desouky Ammar, David G. Hall and Robert G. Shatters Jr. USDA-ARS, US Horticultural Research Laboratory, Fort Pierce, FL 34945 [desoukyammar@gmail.com](mailto:desoukyammar@gmail.com)

The Asian citrus psyllid (ACP, *Diaphorina citri*, Hemiptera, Liviidae) is the principal vector of *Candidatus Liberibacter asiaticus* (Las), the bacterium associated with huanglongbing (HLB) or citrus greening, currently the most serious citrus disease worldwide. Las is transmitted in a persistent circulative manner by ACP, and the salivary glands and alimentary canal have been suggested as 'transmission barriers' that can affect the translocation of Las within ACP. However, no detailed ultrastructural studies have been done on these important organs although some early investigations reported bacteria-like structures found in them as the causal agents of HLB. In this study, we examined the ultrastructure of the salivary glands, filter chamber and other parts of the alimentary canal, as well as other organs of healthy (non-infected) and Las-infected nymphs and adults of ACP. In addition to two ultrastructurally different symbiotic bacteria found in the bacteriome of both nymphs and adults, other morphological types of bacteria were found in the midgut epithelial cells of both infected and non-infected ACP. This shows the importance of immunolabeling, fluorescent *in situ* hybridization (FISH) or other molecular techniques that must be used before identifying any bacteria-like structures in ACP as Las or other possible agents of HLB.

**[49] Infection of The Asian Citrus Psyllid, *Diaphorina Citri* Kuwayama (Hemiptera: Liviidae) with *Candidatus Liberibacter Asiaticus* Increases its Propensity For Dispersal**

Kirsten Pelz-Stelinski, Mark Hoffman, Xavier Martini, Lukas Stelinski. Citrus Research and Education Center, University of Florida-IFAS, 700 Experiment Station Rd, Lake Alfred, FL 33850 [pelzstelinski@ufl.edu](mailto:pelzstelinski@ufl.edu)

The spread of vector-transmitted pathogens relies on complex tripartite interactions between host, vector, and pathogen. In sessile plant pathosystems, the spread of a pathogen highly depends on the movement and mobility of the vector. However, questions remain as to whether and how pathogen-induced vector manipulations may affect the spread of a plantpathogen. We demonstrate here that infection with a bacterial plant pathogen, *Candidatus Liberibacter asiaticus* (CLas), increases the probability of dispersal by its vector, the Asian citrus psyllid (*Diaphorina citri* Kuwayama). Dispersal behavior, flight capacity increased, and sexual attraction of *D. citri* are evidently manipulated by CLas. Infected psyllids initiated flight earlier, and flew for longer durations than did their uninfected counterparts. In addition, attractiveness of female to male *D. citri* increased in proportion to the CLas titer of females. Our study indicates that the phytopathogen, CLas, may manipulate movement and mate selection behavior of their vectors, which possibly an evolved mechanism to promote their own spread. These results have global implications for both current HLB models of disease spread and management strategies.

**[50] A Comparison of Plant Species for Rearing Asian Citrus Psyllid**

David G. Hall and Matthew G. Hentz\_ USDA-ARS, Fort Pierce, FL [David.Hall@ARS.USDA.GOV](mailto:David.Hall@ARS.USDA.GOV)

Five plant genotypes were compared with respect to Asian citrus psyllid (ACP) reproduction potential: *Berberis koenigii*, *Citrus aurantiifolia*, *C. macrophylla*, *C. taiwanica* and *Murraya paniculata*. ACP reproduction is dependent on young flush and thus ACP production potential on a plant is related to the quantity of young flush present. We assessed flush production potential of each genotype, first among young plants trimmed one time at 200 days after planting to stimulate new growth and then among young plants trimmed once or twice during early growth to stimulate branching and finally at 200 days after planting to stimulate new growth. ACP production per flush shoot of each genotype was then assessed by introducing ACP onto individual plants with three flush shoots and recording numbers of F<sub>1</sub> adults emerging overtime.

**[51] Why is *Poncirus Trifoliata* Resistant to Colonization by Asian Citrus Psyllid?**

Justin George, Stephen L. Lapointe, David G. Hall. USDA-ARS, Fort Pierce [justin.george@ars.usda.gov](mailto:justin.george@ars.usda.gov)

Developing effective management strategies based on host plant resistance is of critical importance for managing Asian citrus psyllid (ACP). *Poncirus trifoliata* is a trifoliolate species that is graft-compatible with *Citrus* spp., and used as a rootstock in many citrus growing regions. *Poncirus* has several valuable traits including its apparent antixenotic and antibiotic resistance to ACP that may delay or reduce development, longevity and reproduction. Oviposition, nymphal development and adult emergence of ACP were studied on four trifoliolate accessions, trifoliolate hybrid Troyer and *Citrus macrophylla* using no-choice and choice assays. Oviposition was reduced and nymphal development was delayed on trifoliolate accessions compared with Troyer and *C. macrophylla*. Significantly fewer ACP adults emerged from trifoliolate accessions (mean=21±3.3) compared with *C. macrophylla* (mean=47±19.3) and Troyer (mean=46±13.8). Time to adult emergence under no-choice conditions on trifoliolate accessions were 25 days compared with 17 days for *C. macrophylla*. ACP survived and oviposited on trifoliolate accessions even though survival and development were compromised (antibiosis effect). Under choice conditions, adult ACP showed significantly higher preference for *C. macrophylla* (mean=47±8.5) and Troyer (mean= 26±7.7) compared with the trifoliolate accessions (mean=12±3.3). Significantly more adults emerged from *C. macrophylla* accessions by day 15; few adults emerged from the trifoliolate accessions. This reduction in host preference and oviposition, and delayed nymphal development on trifoliolates is characteristic of non-preference (antixenosis). The traits responsible for antixenotic resistance may be valuable for incorporation into citrus scion breeding programs.

#### [52] Asian Citrus Psyllid Control and Foliar Nutrition Improve Productivity of HLB-Infected Citrus Trees

James A. Tansey, Pilar Vanaclocha, Moneen M. Jones, Cesar Monzo, and Philip A. Stansly. University of Florida-IFAS, Southwest Florida Research and Education Center, 2685 SR 29 N., Immokalee, FL 34142 [jtansey@ufl.edu](mailto:jtansey@ufl.edu)

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae), vectors *Candidatus Liberibacter asiaticus* that causes huanglongbing (HLB) throughout commercial citrus-growing regions worldwide. In Florida, HLB incidence is approaching 100% statewide. Yields have decreased and production costs have increased since 2005. The continued profitability of some groves is attributed to aggressive psyllid control with insecticides and foliar nutritional sprays that may compensate for reduced translocation. However, the value of these practices is debated. A replicated field study employing a factorial design was initiated in 2008 in a 5.4 ha commercial block of 'Valencia' sweet orange trees to evaluate individual and combined effects of foliar nutrition and ACP control with threshold-driven insecticide treatments and dormant sprays. The current work summarizes results of the last three growing seasons (2012-2015).

Insecticide applications consistently reduced ACP populations on insecticide-treated trees in addition to a site-wide reduction. However, neither insecticide nor nutrition applications significantly influenced HLB incidence nor titer in mature trees. In reset trees, foliar nutrition initially reduced both HLB incidence and titer relative to controls. However, infection continued to build and was 100% in all treatments by October 2013. Greatest yields (kg fruit/ ha) and production (kg s/ ha) were obtained from trees receiving both insecticides and foliar nutrition. All treatments except foliar nutrition applied alone in 2013 resulted in production and financial gains relative to controls in all years. However, the material and application costs associated with the nutrition component offset gains resulting in lower profits than insecticide applied alone.

#### [53] Use of synthetic mating-duet vibrations to disrupt *Diaphorina citri* (Hemiptera: Liviidae) mating behavior

Richard Mankin, Sylvia Lujó, Emily Pregmon, Kayla Norton, Ethan Hartman, and Nina Zagvazdina  
USDA-ARS-CMAVE, Gainesville, FL 32608 [Richard.Mankin@ars.usda.gov](mailto:Richard.Mankin@ars.usda.gov)

The mating process in the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Hemiptera: Liviidae) begins when a male buzzes his wings briefly on a host tree and then listens for a quick reply from any receptive female who detects the buzz vibrations. He searches towards the direction of her reply and they continue with duetting calls and replies until he finds her or one of them ceases duetting. We hypothesized this process might be disrupted if we attached a piezoelectric buzzer to the tree and synthetically produced an immediate loud reply buzz whenever the male called. The interfering synthetic reply would direct the searching male towards the buzzer and mask the female reply. In laboratory tests of this hypothesis, we attached a buzzer to a small citrus tree and placed a male and female on separate branches. Their behaviors were recorded on audio and video. Comparisons were made of percentages mating and the numbers and time patterns of calls when tests with different male-female pairs were conducted with or without interfering synthetic

mating replies. Mating was significantly reduced in tests with interfering replies. The observations provide insight for development of methods to disrupt *D. citri* mating in field environments.

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**Nan-Yao Su Symposium: Accomplishments and Impact of Nan-Yao Su on Termite Research and Control: Celebrating the 20th Anniversary of the Commercial Launch of the Sentricon® Termite Colony Elimination System**

Organizers, Ellen Thoms, Douglas Products, Gainesville, FL and Joe Eger, Dow AgroSciences, 2606 S. Dundee St. Tampa, FL 33629 [jeeger@dow.com](mailto:jeeger@dow.com)

**[54] Impact of The Sentricon® Termite Colony Elimination System on the termite control market**

Dave Maurer. Dow AgroSciences, Indianapolis, IN

(no abstract)

**[55] Formosan Subterranean Termites from Discovery to Control.**

Ed Bordes. New Orleans Mosquito, Termite and Rodent Control Board (Retired). 2100 Leon C. Simon Blvd. New Orleans, LA 70122; [Edbordes@usa.net](mailto:Edbordes@usa.net)

The introduction of the Formosan Subterranean Termite began in New Orleans during WWII as materials and equipment were shipped from Hawaii to Camp Leroy Johnson, the Industrial Canal, the port of Embarkation and the Eighth Naval District.

LSU and Dr. Spink became involved in the early 1960s and introduced the Pest Control industry to the problem in 1966. Early research by Ed King confirmed the presence of FST in New Orleans and in Lake Charles.

Dr. Jeff LaFage succeeded Dr Spink and hired Dr. Nan Yao Su as a post doc in 1982 and I was recording more FST swarmers than mosquitoes in selected lights throughout the City. After contacting Jeff LaFage I was introduced to the termite baiting concepts of both Jeff and Nan Yao and was in complete agreement with their termite baiting research.

Mirex was the AI of choice and was working but was eventually banned by EPA. Nan Yao moved on to Hawaii and then to Florida. Jeff Died and Nan Yao continued his quest to develop the termite baiting concept with Dow's Hexaflumuron and this chitin synthesis inhibitor was field tested and developed into the Sentricon Baiting System.

**[56] Professor's Nan-Yao's Su Contributions to Termite Science and Outreach**

Vernard Lewis. Berkeley Global Campus, 1301 South 46th St., Richmond, CA 94804; [urbanpests@berkeley.edu](mailto:urbanpests@berkeley.edu)

The contributions to the fundamental biology of termites by Professor Su have been pioneering. Starting in the early 1980s, when he was a graduate student, he first developed the methods to access, characterize, and assess field foraging populations of subterranean termites. In the years after that ground-breaking research, a cavalcade of studies followed from his lab and other labs throughout the world involving termites that included the evolution, chemical ecology, host-microbial interactions, kinship, development of molecular markers for nestmate recognition, genomic biogeography, invasive species, improved methods of termite detection, and of course colony elimination using Sentricon. His innovative research in termite biology, detection, and control has also gained him several hundred published papers and many patents and copyrights.

As further evidence of his excellence, Professor Su has received many prestigious awards that include International Fellow UF, Fellow of the ESA, Distinguished Achievement Award in Urban Entomology, Medal of Honor ESA and most recently he was selected into the University of Florida's Inventors Hall of fame. During my presentation, I will review the numerous contributions and awards that Dr. Su has achieved.

**[57] Sentricon® Above-Ground Bait Stations for Termite Management In New 510-665-6724Orleans**

Carrie Cotone. New Orleans Mosquito, Termite and Rodent Control Board, New Orleans, LA 70122; [cbcottone@nola.gov](mailto:cbcottone@nola.gov)

Above-ground bait stations have been used as part of the Sentricon® System to protect historic structures in New Orleans, Louisiana for almost two decades. Their ease of use in areas with complicated construction and little soil access has helped facilitate termite area-wide management in areas of the French Quarter. We have been given the opportunity to perform efficacy testing on above-ground stations since their inception. Most recently, we have tested the new Sentricon above-ground flexible station. This is the newest above-ground station design on the market today. A history of above-ground bait station use and efficacy testing in New Orleans will be presented.

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**[58] Hybridization of Two Termite Invaders in Florida**

Thomas Chouvinc. University of Florida, Davie, FL

The Asian and Formosan subterranean termites are two invasive species in South Florida. Over the past 3 years, the swarming seasons of the two species overlapped in April-May and mating behavior between the two species was readily observed in the field. Heterospecific colonies were established in the lab and incipient colonies showed high hybrid vigor. It is currently unknown if hybrid colonies can reach maturity and produce alates for a possible hybrid introgression. However hybrid colonies grew faster than the parental species, implying that such colonies in the field may be of concern for homeowners.

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**Symposium Mosquito Control in Florida**

Organizer: Dr. Rui-De Xue:

Director: The Anastasia Mosquito Control District of St. Johns County. 500 Old Beach Rd, St Augustine, FL 32080  
[xueamcd@gmail.com](mailto:xueamcd@gmail.com)

**[59] An overview of mosquito control programs in Florida**

Adriane Tambasco, Fla Dept. of Agricultural and Consumer Service, Tallahassee, FL 32399  
[Adriane.Tambasco@FreshFromFlorida.com](mailto:Adriane.Tambasco@FreshFromFlorida.com)

The state of Florida currently has 62 state approved mosquito control programs. The criteria for establishing a state approved mosquito control program can be found in section 5E-13.030 of the Florida Administrative Code (F.A.C.). Every county or district budgeting local funds to be used exclusively for the control of mosquitoes is eligible to receive state aid on a dollar-for-dollar matching basis, which is distributed by the Florida Department of Agriculture and Consumer Services (FDACS), provided the program provides the required documentation each month. FDACS is the regulatory authority governing mosquito control in the state.

Of the 62 state approved programs, 15 are independent districts while 47 are county run programs. 21 programs throughout the state perform aerial mosquito control operations. The manner in which mosquito control programs operate throughout the state varies widely, from small programs performing strictly mosquito adulticiding using ultra low volume (ULV) truck spraying, to larger programs with a fully comprehensive program performing integrated mosquito management. Integrated mosquito management uses a variety of methods to combat mosquitoes, including premise sanitation, land and water management (such as mosquito ditches and impoundments), chemical control (both larviciding and adulticiding), biological control, surveillance, and public education.

For some counties with no mosquito control programs, the department has established a memorandum of understanding in which participating counties set traps to collect adult mosquito specimens and then send the trap contents out for identification in order to establish base line population data for those regions of the state.

**[60] Aerial applications to control mosquitoes in Florida**

Mark Latham, Manatee County Mosquito Control District, Palmetto, FL 34221, [manateemcd@aol.com](mailto:manateemcd@aol.com)

Aerial application to control mosquitoes is an important tool to many of the larger mosquito control programs in Florida. Of the approximately 60 State Approved mosquito control programs in Florida, 16 own their own aircraft and a further 6 or 7 maintain annual contracts with private aerial applicators for regular aerial mosquito control services.

Aerial mosquito control applications can be divided into two basic operations, larviciding or adulticiding.

Larviciding is the targeting of mosquito larvae in known and highly productive habitats, usually by the application of either a large droplet spray of an aqueous formulation specific to mosquitoes or a solid granular formulation containing a similar active.

Adulticiding is the targeting of actively flying adult mosquitoes with a space spray of aerosol-sized droplets containing a broad-spectrum insecticide, either an organophosphate or a synthetic pyrethroid.

While larviciding is always the method of choice based on the targeting of the mosquito population while concentrated in larval habitats with highly mosquito-specific microbial pesticides, it is not always possible or practical to achieve a high enough level of control to remove the need to adulticide.

And although adulticiding is used to treat very large areas with a broad-spectrum pesticide, a moderate degree of specificity towards mosquitoes over non-target organisms (such as honey bees) is achieved through accurate droplet-size selection, low doses and timing of the application. State-funded research projects, including two in the past year, have demonstrated the relatively low risk of aerial adulticiding applications to non-target organisms.

#### **[61] Lee County mosquito control district operations**

T. Wayne Gale, Lee County Mosquito Control District, Lehigh Acres, FL 33971, [gale@lcmcd.org](mailto:gale@lcmcd.org)

Lee County Mosquito Control District is one of the largest single county mosquito control districts in the United States. Thousands of acres of protected salt marsh and mangrove habitats provide an abundance of salt water mosquitoes which can cause significant disruption of normal outdoor activities. In addition, many acres of flat woodland habitats inundated with rains in the spring and summer generate many pestiferous fresh water mosquitoes, some of which are capable of transmitting diseases such as West Nile Virus, Dengue fever and Chikungunya. Lee County Mosquito Control District uses eleven helicopters and four airplanes to control mosquitoes in the immature and adult stages. Additionally, the district conducts arbovirus surveillance using sentinel chickens and mosquito pools which are tested at the District. The District is the only one in Florida to have an in-house arbovirus surveillance laboratory.

#### **[62] Aedes mosquito control response to suspect dengue and chikungunya cases**

Rui-De Xue, Anastasia Mosquito Control District, St. Augustine, FL 32080, [xueamcd@gmail.com](mailto:xueamcd@gmail.com)

Anastasia Mosquito Control District (AMCD) has promoted Best Management Practice (BMP) for Integrated Mosquito Management (IMM) and response to suspect Dengue / Chikungunya cases in St. Johns County. AMCD cooperated with St. Johns County's Department of Health to follow Florida State Department Health's mosquito-borne disease response level to conduct surveillance and control of vector Aedes mosquitoes. AMCD responded to suspect human cases through Aedes mosquito management by increasing mosquito population surveillance, eliminating oviposition sites, conducting ULV spraying and thermal fogging, and barrier spraying, and promoting public education about personal protection and prevention. These measures limited the spreading of imported dengue and chikungunya in St. Johns County, Florida.

#### **[63] The Lee County Mosquito Control District's comprehensive education outreach program**

Neil Wilkinson, Florida Gulf Coast University, Fort Myers, FL 33965, [nwilkins@fgcu.edu](mailto:nwilkins@fgcu.edu)

The Lee County Mosquito Control District educational outreach program is designed to teach school age children about mosquitoes and the role that mosquito control plays in the local community. Each educational program is conducted in collaboration with classroom teachers. Programs are designed for grades five, seven, and high school chemistry and biology classes and support Florida's Sunshine State Standards in a variety of areas. Films, readings, PowerPoint presentations, discussions, art activities, and lab experiences are utilized to teach the objectives of each five-day unit. These hands-on learning experiences are offered county-wide to public and private schools. Students learn to identify different kinds of mosquitoes, their habitats and life cycles, and are familiarized with the techniques currently being used to control mosquitoes. This is a high impact learning experience many will never forget.

#### **[64] Trapping studies on Florida Tabanidae, a largely neglected biting fly family in the state** Daniel L. Kline,

USDA/CMAVE, Gainesville, FL 32608, [Dan.Kline@ARS.USDA.GOV](mailto:Dan.Kline@ARS.USDA.GOV)

Trapping studies on Florida Tabanidae, a largely neglected biting fly family in the state. Despite their importance as very annoying nuisance pests and potential vectors of pathogens to humans, livestock and wildlife, few research studies have been conducted on the Tabanidae of Florida. This presentation will report on the results of several ongoing studies on tabanid behavior and several comparative trapping studies being conducted at a horse boarding facility and at the Lower Suwannee Wildlife Refuge located near Cedar Key, Florida. Various trap designs (shapes, size, colors) and other sampling methods are being evaluated. Based on the results obtained so far, it appears as if not all species respond in the same way to the various sampling techniques.

**[65] Development of the smart mosquito counter device and its newly updated capability for mosquito identification**  
Hoonbok Yi et al, Department of Biol & Environmental Technol., Seoul Women's University, Seoul, Korea 139-174.  
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We developed the smart mosquito counter device (height 1080mm × width 560mm × diameter 320mm, 220V 60Hz 30W), which could attract the female mosquito by emitting CO<sub>2</sub> gas (300ml/min), could count the number of the captured mosquitoes by an infra-red beam area sensor, and could send the captured mosquitoes' number through the CDMA module at real time. We operated the 8 – 16 devices with sensor networks and a server at the Youngdeungpo areas in Seoul city of south Korea for three years (2011-2013) and we could efficiently control mosquitoes at the high mosquito density area based on the mosquito data. We found that the accuracy of the device was about over 93% compared the real mosquito data and transmitted data by CDMA. We also found the water reservoir areas to control floods in Seoul city had relatively higher mosquito density than other normal areas, because those flat water areas were preferred by mosquitoes. Because we knew the mosquito occurrence peak times and areas from mosquito data transmitted by the mosquito devices, we could efficiently control mosquito larva and adults at the right time. We could accomplish very systematic mosquito control policy and we had the high credibility with the results. Based on the mosquito occurrence data, we selectively and scientifically controlled mosquitoes. Therefore, we reduced pesticide usage and saved pesticide expenses about to half during the study periods. We also developed a new updated technology for the device for mosquito identification and it is a renovation.

**[66] Data review of a multi-state and multi-district research and development program with DeltaGard adulticide**  
John Paige, Bayer Environmental Science, Vero Beach, FL, [John.Paige@Bayer.com](mailto:John.Paige@Bayer.com)

DeltaGard Insecticide, a newly registered adulticide for mosquito control is a water based formulation (FFAST) containing 20 grams of deltamethrin per liter of product. It was registered earlier this year by the US EPA and is now registered in Florida.

This presentation focuses on the efficacy data generated by a research and development program on deltamethrin insecticide applied by ground equipment as an ultra-low volume application. A very robust dataset was generated, particularly in 2014, with trials in 19 states, 28 cooperating mosquito control districts and against over two dozen mosquito species, many with documented levels of insecticide resistance.

DeltaGard efficacy trials were benchmarked against the 8 major active ingredients in the marketplace, and overall efficacy of DeltaGard, even applied at the low rate of 0.5g of active ingredient/ha, was higher than the competitive products applied at their highest labeled rates.

**[67] Mosquito research foundation, free research money!!**

James Clauson, Beach Mosquito Control District, Panama City Beach, FL, [jamesclauson@comcast.net](mailto:jamesclauson@comcast.net)

The mosquito research foundation (MRF) is a non-profit organization that is dedicated to providing research money for relevant mosquito research. Originally founded in California, the Foundation is now a nationwide organization dedicated to raising monies for mosquito research. The RFP (request for Proposal) is open to any entity around the globe that conducts mosquito research.

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**Symposium: Management of Fall Armyworm**

**Organizers:** Jawwad Qureshi and Robert Meagher. University of Florida, Southwest Florida Research and Education Center, Immokalee, FL 34142 239-658-3451 [jawwadq@ufl.edu](mailto:jawwadq@ufl.edu)

**[68] Insecticidal control of fall armyworm in sweet corn**

Barry Kostyk and Phil Stansly, University of Florida, SWFREC, 2685 SR 29 N, Immokalee, FL. [bkostyk@ufl.edu](mailto:bkostyk@ufl.edu)

Fall armyworm (FAW) is the principal pest of sweet corn in southern Florida. Populations tend to build up in summer on wild grasses during summer, moving into corn in fall. Broad spectrum insecticides are widely used to control FAW although more selective materials could provide advantages of better control with less impact on non-target organisms, as well as more rotation partners to reduce selection for resistance. Evaluations are conducted on replicated single row plots with plastic mulch raised beds with drip irrigation and fertigation. Applications are made with John Deere hi-clearance sprayer operating at spray volumes ranging from 20 to 80 GPA. While this system is different in many ways from huge commercial cropping systems on bare ground and sprayed by air, results are usually comparable. Products tested encompass several insecticide classes and range from OMRI listed products such as spinosad to new class 28 insecticides such as flubindiamide. These products have shown varying degrees of efficacy compared to broad spectrum standards such as lambda cyhalothrin and methomyl. Phytotoxic effects with inclusion of non-ionic surfactants have been observed.

**[69] Field Evaluation of Bt Maize Hybrids Against Fall Armyworm, *Spodoptera frugiperda***

Jawwad A. Qureshi and Fangneng Huang

Fall armyworm (*Spodoptera frugiperda*) is major target of Bt (*Bacillus thuringiensis*) -maize and Bt-cotton planted in Americas. Evolution of insect resistance to transgenic crops containing Bt genes is a serious threat to the sustainability of this technology. In recent years, survival of *S. frugiperda* on Cry1F maize has been reported on several occasions in the southeastern U.S. and in Brazil but was only documented from Puerto Rico. Field tests were conducted in the southwest Florida to evaluate performance of transgenic maize hybrids expressing Cry1F protein or pyramided Bt-maize traits. Significant damage by *S. frugiperda* to Cry1F maize (Herculex I) was observed suggesting resistance to Cry1F protein also confirmed in the laboratory and greenhouse tests. Very limited leaf injury and survival of *S. frugiperda* larvae was observed on pyramided Bt-maize plants expressing two, three or more proteins indicating their effectiveness against *S. frugiperda* and low level of cross-resistance to Cry1A.105 and related products. *Spodoptera frugiperda* resistant to Bt-maize in regions where it is not planted most likely represents migration from other regions. Effective plans are warranted to manage *S. frugiperda* and its resistance to Bt-crops.

**[70] Bt Resistance in Fall Armyworm in The Americas: What We Know and What We Think it Means**

Graham Head, Renato Carvalho, Samuel Martinelli, and Dan Pitts. Monsanto Company, 800 North Lindbergh, St Louis, MO 63167

Fall armyworm (FAW) is the primary target pest of transgenic Bt corn in Latin America. FAW resistance to Cry1F-containing Bt corn was first detected in Puerto Rico and subsequently has been found in the mainland US, Brazil and Argentina. The resistance has been extensively characterized and appears to have the same phenotype, and the same or a similar genotype, in all cases. The resistance seems to fit the "mode 1" model, with high level resistance to Cry1F and some cross-resistance to structurally similar Bt proteins controlled by one or a few genes, largely recessive genetics, and a resistance mechanism related to altered Bt receptor binding. Factors responsible for these cases of Bt resistance evolution in FAW likely include poor structured refuge compliance in the affected areas and less than high dose Bt corn products, and speak to the need for improved refuge compliance and more effective IPM programs for control of this pest.

**[71] Inheritance, Fitness Costs, and Cross-Resistance of Cry1F Resistance in Fall Armyworm**

Fangneng Huang, LSU AgCenter, Baton Rouge, LA

Evolution of insect resistance to transgenic Bt crops is a serious threat to the sustainability of this technology. Fall armyworm (FAW) is a target of Bt corn and Bt cotton in both North and South America, as well as a target of Bt soybean in Brazil. It is the first and the only target pest that has developed high levels of field resistance to commercial single-

gene Bt crops at multiple locations across different countries and continents. To date, field resistance of FAW to single-gene Cry1F corn has been documented in Puerto Rico, Brazil, and the southeast coastal region of the U.S. mainland including Florida. To understand more details of the resistance, several studies have been conducted to characterize the inheritance, fitness costs, and cross-resistance of the Cry1F resistance in FAW. The results showed that Cry1F-resistant FAW is also cross-resistant to Cry1A.105, but not cross-resistant to Cry2Ab2 and Vip3A. In some cases, the resistance is likely controlled by a single autosomal recessive gene and not associated with fitness costs. However, variations in the inheritance and significant fitness costs were also observed in some populations, suggesting that a diversified genetic basis may exist for the resistance. The information generated from these studies should be valuable in understanding the resistance mechanisms and developing effective strategies for the resistance management.

**[72] New insights for Biological Control of Fall Armyworm in Florida**

Mirian M. Hay-Roe<sup>1</sup>, Robert Meagher<sup>2</sup> and Rodney Nagoshi. University of Florida, Everglades Research and Education Center, 1700 SW 23<sup>rd</sup> Dr. Gainesville, FL 32608

Implementing an augmentative biological control method for a particular pest requires that one learn not only which parasitoids attack the host, but also their habitat preferences and distribution throughout the year. This makes the control release more effective and lowers its cost and the necessary release effort. We are presenting an update on our latest efforts for the biological control of the two strains of the fall armyworm (*Spodoptera frugiperda*) in Florida.

**[73] Replacing a Common Ground Cover Plant with Sunn Hemp to Reduce Migrating Populations Of Fall Armyworm**

Robert Meagher, Rod Nagoshi, Shelby Fleischer, and John Westbrook. USDA-ARS CMAVE, 1700 SW 23rd Dr., Gainesville, FL 32608

Fall armyworm (FAW) (*Spodoptera frugiperda*) is a migratory noctuid pest that overwinters in the southern parts of Florida and Texas. After their crop is harvested in the spring, vegetable growers often plant a summer ground cover crop to improve soil conditions. Many growers cultivate sorghum sudangrass (SSG), a plant that is a very good host for FAW. Our research shows that replacing SSG with an alternative plant such as sunn hemp (*Crotalaria juncea*) can reduce migrating populations of FAW. Sunn hemp provides large amounts of nitrogen to the soil and can reduce weed and nematode populations.

**[74] Using genetic markers to assess fall armyworm distribution patterns and migration.**

Rod Nagoshi<sup>1</sup>, Shelby Fleischer, John Westbrook, Robert Meagher, Mirian Hay-Roe. CMAVE USDA-ARS, 1600 SW 23<sup>rd</sup> Dr. Gainesville, FL 32608

Climate change is projected to expand the range of warm-climate agricultural pests, with adverse consequences to U.S. agriculture. Improved monitoring of pest movements and the ability to model climate-induced changes in pest distribution will facilitate adaptation to this threat. We are developing fall armyworm as a model system to address these objectives. In addition to being a major agricultural pest in the Western Hemisphere, fall armyworm migratory behavior is representative of many other moths of agricultural importance that are important pests of corn and vegetable crops. Therefore, fall armyworm studies will produce information of broad applicability while providing unique technical advantages important to the development of forecasting models of migratory movements. These will be used to identify regions at risk for climate-induced changes in fall armyworm infestations and the establishment of invasive moth pests that exhibit similar migratory capability.

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**Symposium: Whiteflies: Developing Management Solutions for Globally Invasive Pests**

**Organizers:** Vivek Kumar, Post-Doctoral Associate, Mid-Florida Research & Education Center, University of Florida-IFAS & Muhammad Z. Ahmed, Post-Doctoral Associate, Tropical Research & Education Center, University of Florida

**[75] What happens in greenhouses doesn't stay in greenhouses**

Lance S. Osborne, Vivek Kumar, Cindy L. McKenzie. University of Florida, IFAS, Mid-Florida Research and Education Center. 2725 Binion Road Apopka, Florida [lsosborn@ufl.edu](mailto:lsosborn@ufl.edu)

The movement of pests as a result of mans activities has always been a problem but it is becoming much more significant as we increase global trade. Of greatest concern is the movement of new species as well as the movement of resistant strains of known pests. The issue is demonstrated with a number of invasive species and will be discussed using *Bemisia* sp. as examples.

**[76] Determining the feeding cessation of *Bemisia tabaci* adults and nymphs after the application of Cyazypyr® and other insecticides.**

Juan M. Alvarez, Rachel A. Cameron, Edward B. Lang and Hector E. Portillo. DuPont Crop Protection, Stine-Haskell Research Center, 1090 Elkton Rd. Newark, DE 19711

Most growers rely on the use of insecticides to decrease populations of *Bemisia tabaci*. However, insecticides may take a few days to cause insect mortality and some do not reduce feeding. Reducing feeding of whiteflies would decrease the physiological effects on plants as well as the sooty mold and potentially the transmission of viruses. Measuring the reduction in feeding after the exposure of *B. tabaci* to an insecticide has proven difficult. A novel technique with a fluorescein sodium salt was developed to assess the effect of insecticides in the feeding of *B. tabaci*. With the use of this technique, it was determined that *B. tabaci* nymphs feeding on a plant treated with Cyazypyr® have a significant reduction of feeding when compared to nymphs feeding on plants treated with other insecticides with different modes of action (imidacloprid and spirotetramat).

Water sensitive paper was used to determine whitefly adult feeding, indirectly through honeydew production, when insects were placed on insecticide treated and untreated plants. Plant treatments with two formulations of Cyazypyr® showed a reduction in the amount of honeydew produced by *B. tabaci* adults equivalent to imidacloprid. The reduction in the amount of honeydew produced indicates reduced insect feeding and the possibility for a reduction in virus transmission. Plant treatments with two formulations of Cyazypyr® also resulted in higher mortality than imidacloprid. These techniques could prove useful evaluating insecticides used for managing insect vectors. The reduction in both feeding and disease transmission produced by Cyazypyr® has been demonstrated in the field.

**[77] Parasitoids of Rugose Spiraling and Ficus Whitefly**

Catharine Mannion, Lance Osborne, Anthony Boughton, Muhammed Z Ahmed, Trevor Smith, Antonio Francis, Vivek Kumar and Cindy McKenzie. UF/IFAS, Tropical Research and Education Center, 18905 SW 280<sup>th</sup> Street, Homestead, FL 33031 [cmannion@ufl.edu](mailto:cmannion@ufl.edu)

Parasitoids attacking two invasive whiteflies in south Florida, Rugose spiraling whitefly (*Aleurodicus rugioperculatus*) and ficus whitefly (*Singhiella simplex*) will be discussed. Shifts in populations of different parasitoids have occurred. The parasitoid that has had the most impact on Rugose spiraling whitefly was identified as *Encarsia noyesi* but has some behavioral and morphological differences and is currently identified as *E. near noyesi*. Parasitoids previously attacking ficus whitefly do not seem to have significant impact on population levels, however, a new parasitoid has been identified that may offer new potential.

**[78] Uncovering an unintended negative impact of parasitoids in biological control of whitefly**

Muhammad Z. Ahmed. 18905 SW 280<sup>th</sup> street, Homestead, FL33031. [zaheerento@ufl.edu](mailto:zaheerento@ufl.edu)

Vertically-transmitted facultative bacterial endosymbionts are common in invertebrates, and affect traits as diverse as the mode of sexual reproduction, speciation, and susceptibility to pathogens. Horizontal transmission of endosymbionts is thought to be infrequent in most species, and not to contribute to their spread through populations. Here we demonstrate that parasitoid wasps can act as vectors, transmitting the endosymbiont *Wolbachia* between whitefly hosts at a high rate. The ovipositors and mandibles of parasitoids can be contaminated with *Wolbachia* when probing infected whitefly. If these parasitoids then probe *Wolbachia*-free hosts and the whitefly survive, it will result in a stably infected line with increased fitness. Overall, our study provides evidence for the horizontal transmission of *Wolbachia* between insect hosts by parasitic wasps, and the enhanced survival and reproductive abilities of insect hosts may adversely affect biological control programs.

**[79] Current status of silverleaf whitefly, *Bemisia argentifolii* (Bellows and Perring) in south Florida vegetable crops**

Dakshina R. Seal

(no abstract)

**[80] A review of fortuitous biological control of invasive whiteflies**

Antonio W. Francis. 2725 S. Binion Road, Apopka, FL 32703. [Antonio.Francis@FreshFromFlorida.com](mailto:Antonio.Francis@FreshFromFlorida.com)

A significant number of exotic biological control agents documented throughout the world are fortuitously introduced, providing excellent control of numerous pests of economic importance with no environmental consequences. This review specifically addresses recorded fortuitous introductions that contributed significantly to biological control of economically important whitefly pests, with a special emphasis on the US and Caribbean region.