

Citrus Industry Update

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Published by the University of Florida, Institute of Food and Agricultural Sciences, with the mission of keeping the Florida Citrus Industry informed of current research concerning canker and greening.

During November, the UF, IFAS Citrus Research and Education Center at Lake Alfred celebrated its 90th anniversary of support to the Florida citrus industry with the grand opening of the new Plant Pathology Building and re-dedication of Ben Hill Griffin Jr. Citrus Hall. With important challenges to the well-being of Florida's premier agriculture industry, the addition of capability at CREC to address greening, canker and other citrus issues comes at a critical time. IFAS is proud to have new and improved facilities to go along with new faculty who have been recruited to address citrus industry challenges.

Greening Transmission and Spread

New Post Doc Entomologist at CREC

Dr. Timothy A. Ebert, a new post-doctoral entomologist, began work at the Citrus Research & Education Center in Lake Alfred on Nov. 5. Dr. Ebert's research will involve field studies examining the spread of the citrus greening pathogen by the Asian citrus psyllid in addition to other work focused on biology and management of the psyllid. Dr. Ebert will work under the direction of Drs. Michael Rogers and Ron Brlansky. (Michael Rogers, mrgrs@ufl.edu)

Biology of the Greening Pathogen

Cell Line Presentation held in Gainesville

As part of an IFAS project to develop a citrus psyllid cell line, a specialist in insect cell line establishment, Dr. Dwight Lynn (USDA), was invited to the UF Gainesville campus, Department of Microbiology and Cell Science, to collaborate in developing the cell line. His visit included the presentation of a week-long workshop on insect cell lines (establishment, maintenance, storage, etc.) in conjunction with Faculty at Entomology & Nematology and participants from other units. The workshop was held Nov. 7 - 14. (Nemat Keyhani, keyhani@ufl.edu).

Psyllid Management

Aerial Pesticide Application Under Evaluation

A large-scale trial is underway to evaluate the effectiveness of aerial pesticide applications for reducing psyllid populations. Monitoring of the adult psyllid population began in early October at the study site with pesticide applications made in the later part of the month. Three treatments are being compared in this trial including 1) aerial applications of dimethoate, 2) carbaryl applied aerially and 3) dimethoate applied using a conventional airblast sprayer. Several blocks of trees were left untreated as a control. At the time applications were made, the majority of trees were (and continue) to produce little if any new flush needed for psyllid reproduction. Thus psyllids were located deeper in the canopy at the time of application. Thus, the results of this trial will provide insight as to the effectiveness of aerial applications for targeting adult psyllids when the majority of trees are not flushing. (Michael E. Rogers, mrgrs@ufl.edu)

Psyllid Management

Asian Citrus Psyllid Biology

In collaboration with David Hall's group, specifically his post-doc Erik Wenninger (USDA, ARS, Ft. Pierce), Dr. Lukasz Stelinski has been working toward identification of psyllid attractants. The ultimate goal of this work is isolation and identification of the active compounds. Synthetic copies of these compounds will then be developed into effective lures for monitoring this pest. The first step in this work is to determine the role pheromones and kairomones may play in the mate finding and host plant finding behavior of the psyllid. Our initial work suggests that male psyllids respond to a volatile female-produced pheromone that may be involved in long range mate finding. An abstract of a paper that currently is in pre-submission review on this topic is attached. The role plant volatiles play in psyllid host finding behavior also is being investigated. We are finding that psyllids are attracted to citrus flush plant volatiles. Females appear more attracted than males, but the results are preliminary to date. The next step will be isolation and identification of the active plant compounds followed by confirmation of their behavioral activity. We hope this will lead to the development of a more effective monitoring lure in the near future.

Behavioral evidence for a female-produced sex attractant in *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae). Erik J. Wenninger, Lukasz L. Stelinski & David G. Hall. Abstract *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae) is an important worldwide pest of citrus. It vectors three phloem-restricted bacteria in the genus *Candidatus Liberibacter* that cause huanglongbing (citrus greening disease). Studies were

conducted to examine the behavioral responses of male and female *D. citri* to conspecifics of the same and opposite sex, with and without associated citrus host plants, in both open-air arena choice assays and Y-tube olfactometer assays. Virgin and mated male *D. citri* preferentially colonized citrus plants that were currently or had been previously colonized by virgin or mated female *D. citri* compared with control plants without females. However, males or females did not preferentially accumulate on plants colonized by conspecifics of the same sex compared with uninfested plants and females showed no preference for plants pre-infested with males compared with uninfested controls. In complementary Y-tube assays, virgin and mated males showed preference for arms with odor sources from mated females compared with blank controls in the absence of associated citrus host plant volatiles. In both behavioral assays mated female *D. citri* appeared more attractive compared with virgin females. The vibrational calling behavior of male *D. citri* was reduced when males were challenged by the odors of conspecific mated females relative to when males were challenged by the odor of other males. Collectively, our results provide behavioral evidence for a female-produced volatile sex attractant pheromone in *D. citri*. Future identification and synthesis of a sex attractant pheromone will be an important contribution to current monitoring and management practices for *D. citri*. (Lukasz Stelinski, stelinski@ufl.edu).

Citrus Canker

Update of Trials on Control of Canker with Copper and Novel Compounds

In Florida, fresh and processing citrus are heavily based on canker susceptible grapefruit and Hamlin orange, respectively. This makes it necessary to rely on the use of IPM measures including windbreaks and bactericidal copper sprays to suppress the pathogen, *Xanthomonas axonopodis* pv. *citri*. Observations of late season infection of grapefruit even after season-long copper sprays confirms that windbreaks will be mandatory for production of blemish-free fresh market grapefruit in Florida.

We determined from trials conducted in southern Brazil on moderately susceptible orange varieties, that copper sprayed at 21 day intervals at rates from 0.5 to 1 lb. metallic copper per acre substantially reduces fruit disease and yield loss due to premature fruit drop. We also completed trials in Brazil to confirm that the antibiotic streptomycin, a well-known crop bactericide, controls canker alone and in combinations and rotations with copper.

Young trees of all citrus varieties are susceptible to canker because of the greater frequency of leaf flushes compared to mature, fruiting trees. For young trees up to 3 years old, imidacloprid (Admire Pro) applied as a soil drench has a well-known canker disease management use by controlling citrus leafminer to reduce wounding and exacerbation of the disease. In trials in Florida and Brazil, we have discovered that soil applications of imidacloprid also have a direct activity against canker in the field. The mode of action against canker is induction of innate citrus host resistance. The leafminer and disease control activities of imidacloprid are high enough that its use on young trees might preclude the need for copper sprays except for highly susceptible grapefruit and certain varieties of early oranges. (Jim Graham, jhg@ufl.edu)

Collaborations from Outside of Florida

During November, 2007, three groups of visiting scientists were hosted by IFAS. This is part of an ongoing effort to bring experts from outside of Florida to share information on citrus diseases and other topics, to discuss collaborations, and to forge partnerships. During this period the following collaboration events occurred:

Dr. John da Graca, Plant Pathologist and Director of the Texas A & M University Citrus Center, Weslaco, and Dr. Mamoudou Seatmou, Assistant Professor of Entomology, visited CREC on Nov. 8. A seminar was presented by Dr. da Graca. John shared information on current efforts in Texas to track the movement of Asian citrus psyllid in the state's commercial and residential trees, as well as efforts to scout for and run diagnostics against Huanglongbin. He also spoke briefly about his previous work in South Africa on citrus greening. Dr. DaGraca is one of the most experienced greening researchers in the world. Dr. Seatmou presented an overview of his work on citrus psyllid in Texas. Mr. Ray Prewett of Texas Citrus Mutual accompanied the Texas A&M scientists and participated in discussions related to citrus greening during the two-day visit.

A scientific exchange between USDA-ARS, Ft. Pierce scientists and Dr. Nguyen Minh Chau, Director of the Southern Fruit Research Institute, Ministry of Agriculture and Rural Development, Viet Nam and Dr. Katsuya Ichinose, an entomologist in the Laboratory of Plant Protection, Okinawa Subtropical Station, Japan International Research Center for Agricultural Sciences provided an opportunity for discussion at CREC on Friday, Nov. 9. Dr. Ichinose is the entomologist who first recognized

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an interaction between guava and citrus psyllids when guava is planted close to citrus. Informal discussions with the visitors and Dr. David Hall, USDA-ARS, Ft. Pierce, allowed IFAS scientists to learn more about the observations of guava-citrus interactions in Viet Nam and research projects that have ensued to determine the nature of the reported interaction. Research is ongoing at USDA-ARS, Ft. Pierce to further investigate this phenomenon.

Finally, during the period Nov. 27 to Dec. 7, CREC is hosting a group of citrus scientists from Brazil. The group of scientists from San Paulo and Bahia, Brazil are part of a USDA, Foreign Agriculture Service, Cochran Fellows Training Program, and are currently involved in citrus greening, citrus canker and other disease research and management in Brazil. In addition to several days at CREC, where each Fellow presented an overview of their work and engaged in extensive discussions on research issues, the Fellows are visiting other programs and areas of the state. They are meeting in Gainesville with the Plant Pathology Department, Microbiology and Cell Science Department, and with Florida Department of Agriculture staff involved in citrus disease issues. They also are visiting the USDA, ARS Laboratory in Fort Pierce, and will be visiting field citrus operations in East Coast, Southwest and Central Ridge locations.

Through national and international visits, seminars and other programs, we plan to continue to build collaborations that will strengthen research capability in Florida and will increase communication with other industries and regions of the world where citrus greening and canker are being addressed.

Upcoming Events

Dec. 6-7, 2007

Florida Ag Expo
University of Florida/IFAS Gulf Coast
Research and Education Center
Balm, Florida
For more information or to register,
please visit [http://www.floridagrower.net/
flgevents/](http://www.floridagrower.net/flgevents/)

Jan. 23-24, 2008

Indian River Citrus Seminar
St. Lucie County Fairgrounds
Fort Pierce, Florida
For more information or to register,
please visit [http://www.floridagrower.net/
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