# Florida Citrus Advanced Technology Program

## QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

**Instructions** Complete the fields based on your project specs. When finished, save the form to your local disk using a unique name. Then, go to **http://research.fcprac.com**, and log in with your user name and password using Researcher Login in the lower left. Find this project title and click on **Submit a Report**. Update your profile information if needed, then upload this report as directed.

| 2009-2010 REPORT | CATEGORY (drop-down) | TODAY'S DATE (m/d/yr) |
|---|---|---|
| ◉ *Quarterly Report* ○ *Annual Report* ○ *Final* | Leafminer | 6/25/09 |

**WHAT IS THE "HEADLINE" FOR THIS REPORT (e.g. a one-sentence "newspaper headline" describing what you accomplished)**

An attract-and-kill device for citrus leafminer has been developed and mating disruption is being optimized

**TITLE and CONTACT INFORMATION**

*Proposal Title* Development of effective citrus leafminer control with pheromone mating disruption

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| *Phone* 863-956-1151 ext. 1281 | *Project Duration (years)* 2 *Year of Project* 1 |
| *Organization* University of Florida/IFAS | *Total Direct Funds (current year)* 38245 |

**REPORT UPDATE (650 words; provide details about your headline)**

The citrus leafminer, (CLM), is a worldwide pest of citrus crops and is responsible for proliferation of citrus bacterial canker, Xanthomonas axonopodis pv. citri. The purpose of this project is to develop pheromone based control strategies for this pest that will serve as alternatives to insecticides and that should be comparable or better than insecticides in terms of efficacy and cost. Most recently, we developed and evaluated an attracticide formulation, termed MalEx, for control of CLM. MalEx is a viscous paste with UV-protective properties that is dispensed as 50 µl droplets using custom-made calibrated pumps. A formulation containing 0.016% CLM pheromone (3 : 1 blend of (Z,Z,E)-7,11,13-hexadecatrienal and (Z,Z)-7,11-hexadecadienal) and 6% permethrin was found to suppress male response to pheromone in the field superior to formulations containing 10 fold less pheromone. Although formulations without permethrin showed some suppression of male activity due to mating disruption, addition of 6% permethrin was required for optimal efficacy. When MalEx, containing 0.016% pheromone and 6% permethrin, was applied as 3,000 point sources per ha, the height of application did not influence efficacy of male CLM suppression within mature 4 m tall citrus trees. Decreasing the rate of MalEx from 3,000 to 1,500 droplets per ha reduced efficacy as measured by both male CLM activity and larval infestation. Although 4,500 droplets per ha did not result in statistically better efficacy than 3,000 droplets per ha, there was a noticeable trend for higher efficacy as droplet density was increased. Continuous treatment of 0.5 ha blocks of citrus with MalEx over the course of 112 d reduced larval infestation of new leaf flush by 3.6-7.2 fold, depending on droplet application density. In laboratory behavioral bioassays, we determined that attractiveness of MalEx droplets to male CLM was drastically reduced after 21 d of field aging. However, our laboratory investigation confirmed that 100% of males contacting MalEx droplets, aged up to 35 d in the field, were killed within 24 h. Direct observation of male CLM behavior in the field confirmed that attracted males made contact with droplets. Control of CLM with MalEx should reduce the number of required broad spectrum sprays for leafminer management in both field and citrus nursery settings. For our ongoing mating disruption studies, we have employed geometric designs to systematically and efficiently determine the most effective dosage of pheromone and blend of pheromone components for CLM control. This work has been conducted with an industry collaborator (ISCA Technologies, Inc.) who is developing and registering a pheromone product named SPLAT™ for CLM management in Florida. We have recently determined that deployment of single pheromone components, either (Z,Z,E)-7,11,13-hexadecatrienal or (Z,Z)-7,11-hexadecadienal in SPLAT™ (ISCA Technologies, Inc.) in citrus groves resulted in a high degree of disruption of male CLM's ability to find and mate with females. While either individual component was effective at disrupting mating in field trials, (Z,Z,E)-7,11,13-hexadecatrienal was approximately 13 times more effective compared with (Z,Z)-7,11-hexadecadienal alone. Application in SPLAT of a third component isolated from the pheromone glands of CLM, (Z)-7-hexadecenal, did not affect male CLM's ability to find females. Collectively, our results demonstrate that an attracticide formulation combining pheromone and permethrin robustly suppressed flight activity of male CLM to synthetic point sources of pheromone and reduced larval infestation of leaves. Highly effective mating disruption of male CLM (98 %) and associated reduction of leaf infestation has been documented for up to 221 days with two deployments of 1.5 g pheromone AI / ha. A single deployment of 3,000 droplets of MalEx, containing 0.016% pheromone by weight, amounts to deploying approximately 24 mg of pheromone per ha. To achieve 221 d of comparable efficacy, approximately 10.5 deployments of this MalEx formulation would be required. Our ongoing investigations will continue to optimize both technologies and develop mechanized sprayers.