Florida Citrus Advanced Technology Program

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

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2009-2010 REPORT	CATEGORY (drop-down)	TODAY'S DATE (m/d/yr)
(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*	Psyllid	1/1/10

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

Insect growth regulators negatively impact ACP, imidacloprid has strong sub-lethal effects, pymetrozine inhibits feeding

TITLE and CONTACT INFORMATION

Proposal Title Development and optimization of biorational tactics for Asian citrus psyllid control and decreasing huanglongbing incidence.

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

The purpose of this investigation has been to develop, evaluate, and optimize biorational management tools for Asian citrus psyllid (ACP) including insect growth regulators and antifeedants. In our first set of laboratory studies with insect growth regulators, we investigated the activity of the insect growth regulators pyriproxyfen (Knack), buprofezin (Applaud) and diflubenzuron (Micromite) on ACP eggs, nymphs and adults to evaluate its potential usefulness as a biorational insecticide for inclusion into an integrated pest management (IPM) strategy for ACP control. All three chemicals exhibited strong ovicidal and larvicidal activity against ACP eggs and nymphs, respectively, in age- and concentration-dependent manners. Fewer eggs hatched into nymphs at the higher concentrations tested (80-160 µg mL-1). A significantly lower percentage of early instar nymphs (first, second and third) survived and emerged into adults at the higher concentrations tested (80-160 µg mL-1) compared with late instar nymphs (fourth and fifth). Furthermore, all three chemicals exhibited transovarial activity by significantly reducing the fecundity of females and viability of eggs deposited by females that emerged from treated fifth instar nymphs. Topical application of each chemical to adults also significantly reduced fecundity and egg viability. Application of each chemical at 160 µg mL-1 resulted in the highest inhibition of egg hatch in younger eggs (0-48 h old) laid before or after treatment and strongest suppression of adult emergence from early instar nymphs compared with other rates tested. Each chemical also markedly reduced female fecundity and egg viability for adults that were exposed either directly or indirectly. Also adults emerging from nymphs treated with pyriproxyfen were deformed and died soon after emergence. The direct (ovicidal and larvicidal) and indirect (transovarial) effects of the IGRs against immature and adult ACP, respectively, suggest that integration of these insecticides as part of an IPM strategy should negatively impact ACP populations over time. In a separate investigation, we have been studying the sub-lethal effects of various insecticides. Given the broad use of imidacloprid for management of ACP, particularly on young trees, we investigated it's possible sub-lethal effects first. Because of the variation in spatial and temporal uptake and systemic distribution of imidacloprid applied to citrus trees and its degradation over time in citrus trees, ACP adults and nymphs are exposed to concentrations that may not cause immediate mortality but rather sublethal effects. Our objective was to determine the effects of sublethal concentrations of imidacloprid on ACP life stages. Feeding by ACP adults and nymphs on plants treated daily with a sublethal concentration (0.1 µg mL-1) of imidacloprid significantly decreased adult longevity (8 d), fecundity (33%), and fertility (6%) as well as nymph survival (12%) and developmental rate compared with untreated controls. The magnitude of these negative effects was directly related to exposure duration and concentration. Furthermore, ACP adults that fed on citrus leaves treated systemically with lethal and sublethal concentrations of imidacloprid excreted significantly less honeydew (7-94%) compared with controls in a concentration-dependent manner suggesting antifeedant activity of imidacloprid. Sublethal concentrations of imidacloprid negatively affect development, reproduction, survival, and longevity of ACP which likely contributes to population reductions over time. Also, reduced feeding by ACP adults on plants treated with sublethal concentrations of imidacloprid may potentially decrease the capacity of ACP to successfully acquire and transmit the HLB causal pathogen. Pymetrozine is a chemical that is known to paralyze the muscles involved in plant probing in plant-sap sucking insects such as aphids and is known to prevent transmission of aphid and whitefly transmitted viruses. In our initial investigations, we found that at a 100 ppm dosage applied to citrus plants, pymetrozine inhibits acquisition of Liberibacter by psyllids on Valencia, Clepatra Mandarin, and Persian lime by approximately 50%.