CITRUS ADVANCED TECHNOLOGY PROGRAM

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

▶ INSTRUCTIONS

(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*

Required: What is the "headline" for this report (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Levels of ACP insecticide resistance depend on color morph

Proposal Title

Maintaining the effectiveness of our current and most important psyllid management tools (insecticides) by preventing insecticide resistance

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
10/6/11	Citrus Research and Development Foundation	Vector Management

REPORT UPDATE (500 words; summarize your accomplishments)

We have been investigating levels of insecticide resistance in populations of Asian citrus psyllid (ACP) in Florida. There are three distinct color morphs of ACP. In other words, ACP adults in the field are either gray/brown, blue/green or red/orange, based on their abdominal color. Over the course of an annual season, the proportions of ACP representing a particular color morph change. For example, gray/brown psyllids may be more abundant in the summer than winter, while blue/green ACP may be more abundant in the winter than summer. In insects, variation in body color among individuals of a species is a common phenomenon. These color variations play an important role in mate selection, keeping predators away, body temperature regulation, and habitat selection. Color variations in individuals of a species are possibly the result of phenotypic plasticity, nutritional status, bacterial symbionts, infection status, genetic factors or combinations of two or more factors. We noticed that certain color morphs may be more suspectable to insecticides than others in experiments in which resistance levels of FL ACP populations were being evaluated. Our hypothesis is that factors such as nutritional status and bacterial symbionts dictate the abdominal color of ACP, which in turn influences levels of insecticide resistance in corresponding color morphs of ACP. Previous studies with other insect species have shown that nutritional status and bacterial symbionts influence insecticide susceptibility.

Insecticide susceptibility for three insecticides was compared among gray/brown, blue/green and red/orange color morphs of field-collected ACP. ACP from the red/orange morph were significantly more susceptible to fenpropathrin than ACP of the blue/green morph. Imidacloprid caused higher mortality of red/orange than blue/green and gray/brown morphs. Likewise, chlorpyriphos caused significantly higher mortality in red/orange than in blue/green and gray/brown morphs. To confirm the genetic basis of variable susceptibility levels among the three color morphs, relative expression of five CYP4 genes (CYP4C67, CYP4DA1, CYP4C68, CYP4DB1 and CYP4G70) was compared among the color morphs. These genes regulate expression of the specific enzymes that degrade the insecticide imidacloprid (and certain other insecticides/toxins). Expression of all five CYP4 genes was significantly different among the various color morphs tested. CYP4C67 was expressed at significantly higher levels in blue/green than in red/orange and gray/brown morphs. CYP4DA1, CYP4C68, CYP4G70, and CYP4DB1 were expressed at significantly higher levels in blue/green and gray/brown than red/orange morphs. These results suggest that expression levels of five CYP4 genes are highly specific to the color morph of ACP tested. Red/orange ACP color morphs are characterized by lower levels of CYP4 genes, indicating lower levels of cytochrome P450 monooxygenases. Lower levels of CYP4 genes in red/orange morphs suggest that decreased expression of such genes might be responsible for higher susceptibility to the three insecticides tested in ACP. These CYP4 genes may serve as DNA-based screening markers for cytochrome P450-mediated insecticide resistance in field populations of ACP. In addition, these results will be useful for insecticide resistance monitoring, since we know that certain morphs are more susceptible than others. This will allow us to standardize our tests during various points in the season. Finally, during the times when red/orange ACP are most prevalent, ACP populations may be most susceptible to several currently used insecticides.

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SUBMIT REPORT

CITRUS RESEARCH AND DEVELOPMENT FOUNDATION, INC.