

Investigating Navel Orangeworm (NOW) Resistance to Pyrethroid Insecticides through Neonate Larval and Adult Bioassays

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PROJECT SUMMARY

Objectives:

- Determine whether navel orangeworm resistance to bifenthrin is maintained in the absence of selection pressure.
- Examine neonate larval survivorship in contact toxicity assays involving filter papers sprayed with bifenthrin at a range of concentrations in a resistant and a susceptible colony.
- Assess survivorship differences in resistant and susceptible adults sprayed with bifenthrin at multiple concentrations with two insecticide carriers.

Background and Discussion:

This research effort continued our investigations of a recently wild-caught strain of navel orangeworm, *Amyelois transitella*, resistant to pyrethroid insecticides. Previous research with feeding assays determined that resistance was likely occurring through enhanced detoxification by cytochrome P450 monooxygenase (P450) and esterase enzymes. Our current research incorporates two additional assay systems that allow us to examine survivorship differences with the pyrethroid-resistant colony (R347) and a susceptible laboratory colony (CPQ) at the neonate larval and adult life stages.

Results from bifenthrin median-lethal concentration (LC_{50}) assays have shown that resistance was maintained through the first nine generations. A recent decline in median-lethal concentration values from generation ten through twelve suggests that the R347 colony

may be losing its resistance to pyrethroids in the absence of selection pressure.

Although resistance may be declining in the R347 colony, results from contact toxicity assays show a significant difference in survivorship between R347 and CPQ colonies on filter papers sprayed with 30 ppm and 300 ppm bifenthrin. A 300 ppm dose of bifenthrin is equal to the maximum field application. At the 300 ppm dose, 22% of resistant R347 neonate larvae survived for the duration of the assay compared to 1% of the neonate larvae from the susceptible CPQ colony.

In adult spray assays, low concentrations of bifenthrin killed both resistant and susceptible adults in trials with both a highly penetrating organic carrier and a water carrier. Doses at 30 ppm and 10 ppm resulted in 100% kill of resistant and susceptible adults after 48 hours. However, survivorship was significantly greater in the resistant colony when bifenthrin was applied at a 3 ppm dose using both insecticide carriers.

Ultimately, this research may generate insights that improve pesticide choice and management strategies for navel orangeworm. A possible loss in resistance over time suggests that a reduction in pyrethroid pressure could restore effective use of the chemical class if resistance emerges. The decreased susceptibility of resistant neonate larvae and adults toward bifenthrin in contact toxicity assays and spray trials accentuates the importance of improving coverage efficacy in field applications.

Project Cooperators and Personnel: Joel Siegel, USDA/ARS, Parlier; Brad Higbee, Paramount Farming Co.

For More Details, Visit

- Poster location 17, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2015) at Almonds.com/ResearchDatabase
- 2013-2014 Annual Reports CD (13-ENTO1-Berenbaum); or on the web (after January 2015) at Almonds.com/ResearchDatabase
- Related project: 14-ENTO11-Siegel/Walse