Effects of Insecticide-Fungicide-Adjuvant Combinations Commonly Applied to Almonds During Bloom to Honey Bee Development and Survival

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PROJECT SUMMARY

Objectives and activities for current year:

- Identified trends in use of insecticide and insecticide/fungicide combinations applied to almonds during bloom
- Tested the effects of the most common insecticide/fungicide combinations, administered in larval diet, on worker honey bee development in a laboratory bioassay
- Tested the effects of the most common insecticide/fungicide combinations, plus a spray adjuvant, administered in pollen, on adult honey bee survival in a laboratory bioassay
- Tested the effects the insecticide chlorantraniliprole combined with the fungicide propiconazole on honey bee development using honey bee queen development as a model.

Background and Discussion:

The California Pesticide Use Reporting Database (http://calpip.cdpr.ca.gov/main.cfm) provides information on the pesticides applied to almonds during the blooming period (Feb. 15-Mar. 15). From 2014 to 2015 the number of acres to which insecticides were applied during this period dropped from 178,000 to 91,000 and the prevalence of insecticide-fungicide tank-mixes dropped from 91% to 79% of insecticide applications. These statistics are evidence that the BMPs produced by the Almond Board of California are affecting pesticide use. While the prevalence of insecticide use and tank-mixes with insecticides and fungicides are declining, over 140,000 colonies may have been exposed to pesticide combinations in almonds in 2015 and the effects of these mixtures on bees are not well understood.

The effects of insecticide, fungicide and adjuvant combinations were first tested using young adult honey bees. Newly emerged bees were placed in cups with pollen artificially contaminated with a formulated insecticide (chlorantraniliprole, diflubenzuron or methoxyfenozide), fungicide (propiconazole, iprodione or boscalid + pyraclostrobin) and/or an adjuvant (Dyne-Amic) at the maximum label rate combination. The combination of chlorantraniliprole and propiconazole, with or without the adjuvant, significantly reduced adult bee longevity over the subsequent 10 days.

In vitro rearing of honey bee larvae was performed to test the effect of the same combinations on larval development. Newly hatched (~24 hr old) larvae were fed with diets artificially contaminated with active ingredients from the above combinations at maximum label rate. Overall, larvae receiving insecticide and insecticide-fungicide combination treatments were less likely to survive and develop into adult bees compared to the control and fungicide-only treatments. Chlorantraniliprole insecticide significantly increased larval mortality and the negative effect was amplified when the insecticide was combined with fungicides propiconazole or iprodione. Diets containing insecticide diflubenzuron generally increased larval mortality and, diflubenzuron-fungicide combinations showed similar effects as this insecticide alone. No significant effect on larval mortality was detected in methoxyfenozide and any of the methoxyfenozide-fungicide combination treatments.

The effects of the chlorantranilioprole-propiconazole combination were also tested on honey bee queen development. Queen rearing boxes were provisioned with contaminated pollen and queen rearing success was assessed 4 days later. Queen larvae in all pesticide treatments survived similarly to capping, but reduced survival of queens exposed to either diflubenzuron insecticide or the combination of chlorantraniliprole insecticide and propiconazole fungicide was observed in subsequent weeks.

Project Cooperators and Personnel: Chia-Hua Lin, Colin Kurkul, and Ashley Cordle, Dept. of Entomology, Ohio State University; Andrea Wade, Bridget Gross and Emily Walker, Dept. of Biology, College of Wooster

For More Details, Visit

- Poster location 117, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2018) at Almonds.com/ResearchDatabase
- 2016 - 2017 Annual Reports (16-POLL17-R Johnson) on the web at Almonds.com/ResearchDaCtabase
- Related project: 17-POLL19-Cox-Foster