Investigation of the Impact of Fungicides and Adjuvants on Bee Health, Behavior, and Development

Project Leaders: Diana Cox-Foster and Theresa Pitts-Singer
USDA-ARS-PWA Pollinating Insect Research Unit, Old Main Hill UMC 5310, USU- BNR 261, Logan UT 84322
(435) 797-0530, Diana.Cox-Foster@ars.usda.gov

PROJECT SUMMARY

Objectives for current year:

- Evaluate impact of fungicides, organosilicone adjuvants, and combination on bee survival and reproduction
- Determine if fungicide and organosilicone elevate viral titers in individual bees to alter behavior
- Evaluate the impact of fungicides and organosilicones on overall pathology of bees

Background and Discussion:

Success in almonds depends upon pollination. For honey bees, four factors interact to cause losses: varroa parasitization, pathogens, lack of good nutrition (pollen availability) and finally pesticide exposure. Some of the factors that may be common to many crops are fungicides and adjuvants. In pollen collections, fungicides rank in the top pesticides detected in incoming pollen; besides these compounds, adjuvants may be an issue. The amount of organosilicones applied to almonds was approximately 10% the poundage of all active ingredients applied as reported in the Summary of Pesticide Use Report Data by the California Department of Pesticide Regulation for 2013. Added research is needed to understand the impacts of pesticides on bee behavior, health, and development when fed to colonies. Potentially the interaction of pathogen infections and fungicides could be altered when combined with adjuvants.

In this research, we asked about the impacts of a fungicide/insecticide mixture of Propiconazole (Tilt) at 150 ppb a.i. and chlorantraniliprole (Altacor) at 3 ppm a.i. and the commonly used adjuvant organosilicone, at 40 ppb. The four treatments consisted of:1) untreated; 2) fungicide/insecticide-treated (F/I); 3) organosilicone-treated (OSS); and 4) fungicide/insecticide/ organosilicone-treated (ALL). The pesticides were delivered to micro colonies using UltraBee pollen substitute (Mann Lake); we monitored the behavior of foragers and brood development and will determine pathogen levels (with focus on viruses). Micro-colonies were used to create colonies with similar pathogen loads. In order to test the “worst case scenario”, our assumption was that any impacts on behavior, health, and development would occur in the micro colonies, since they lacked the overall resilience of the large workforce of normal colonies. Colonies were begun with sister queens and the same number of workers; but the workers reasserted themselves amongst the hives. Three size classes were randomly assigned to the treatments and the hives randomly laid out in the apiary to avoid bias versus environment.

Both starting, colony size and treatment had impacts on colony survival. The smallest colonies had the greatest mortality overall and the mortality in the F/I and OSS tended to be higher and these colonies did not grow as fast as the control or the ALL treatments. Among the treatments, marked bees from F/I and OSS were more apt to be found in other colonies besides their own following consumption of the treatments. Swarming/ absconding occurred more often in the treated colonies versus the controls; all bees left the colonies (queens were clipped and marked, so the colonies were found nearby). Pathogen analyses are progressing to determine how the infection levels were impacted. Colony survival will be followed over the winter.

Project Cooperators and Personnel: Ellen Klinger, USDA-ARS-PWA PIRU; Craig Huntzinger, USDA-ARS-PWA PIRU

For More Details, Visit

- Poster location 118, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at Almonds.com/ResearchDatabase
- Related project: 16-POLL16-J. Johnson/Pettis; 16-POLL17-R Johnson; 16-POLL18-Berenbaum