Impacts of Insecticides and Fungicides Found in Migratory Honey Bee Colonies on Immune Function and *Varroa* Population Levels

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PROJECT SUMMARY

Objectives:

- The primary focus of this project is to determine if the pesticide loads typically found in pollen and wax of migratory colonies reduces their fitness based on a number of different criteria.

Background and Discussion:

Sub-lethal impacts of pesticides were determined through altered colony functioning during and after Megabee dietary exposure with increasing impacts seen when dietary exposure was combined with contaminated wax comb. Partial mitigation of these impacts was observed by feeding colonies on a high protein diet supplement.

Queen egg laying rate and first instar larval survival were significantly reduced more than 50% after two weeks of feeding on the fungicide contaminated diet in combination with treated wax, while only insecticide diet plus contaminated wax give less, but significant reduction in queen egg laying. This is a major sub-lethal impact on the colony for fungicide contaminated diet, and to a lesser degree insecticide contaminated diet in combination with pesticide contaminated wax, and indicates that fungicide sprayed pollen brought back to the colony is likely to have negative impacts on the colony within two weeks of exposure. Similar potential is indicated for insecticide contaminated pollen as well.

Colony impacts from treated diets and wax combinations varied by treatment and by dates across the remainder of the field season. Pollen consumption was significantly reduced in colonies with dimethoate insecticide treatment as a positive control. Honey collection was significantly reduced in colonies fed only insecticide diet or dimethoate diet. Insecticide diet only resulted in a loss of honey collection and colony weights throughout the season. Brood to adult ratio and foraging frequency were unchanged for all treatments except the dimethoate positive control. Varroa levels were consistently low among all treatments throughout the season except for the insecticide diet feeding in the 4th week of the season.

Following the removal of capped brood from the treated colonies after three weeks; colonies were allowed to forage naturally and were also given supplemental feeding with a beekeeper-produced proprietary high protein diet mixture. This feeding regime produced rapid increases in brood rearing and colony weights within two weeks, even for the dimethoate positive control, suggesting that increased nutrition can provide some rapid recovery to sub-lethal impacts of pesticides at the colony level. These results should be studied further with the potential to develop improved management strategies to minimize pesticide impacts following pollination events or for use during resting periods to rejuvenate colony health.

Colonies fed diets with insecticide contamination resulted in an increased titer of DWV (deformed wing virus) in bees over time as compared to control or fungicide treatments. The combination of exposure routes (wax treatment plus exposure through the diet) could not be evaluated given that the treated brood had limited survival. Our plans to measure adult longevity and hypopharyngeal gland development could not be completed during this season due to high levels of disease throughout the colonies and the failure of control colonies to survive normally.

Project Cooperators and Personnel: Wanyi Zhu, Maryann Frazier, Diana Cox-Foster, and Chris Mullin, Penn State University

For More Details, Visit

- 2012.2013 Annual Report CD (12-POLL9-Frazier); or on the web (after January 2014) at www.almondboard.com/researchreports
- Related Project: 13-POLL12-Hooven