Determining the Effects of Fungicide Contamination of Nectar and Pollen on Honey Bee Colony Health

Project No.: **08-POLL10-DeGrandi-Hoffman**

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Objectives:

1) Determine the effects of Pristine (pyraclostobin/boscalid) fungicide on the nutritional components in bee bread.
2) Determine the effects of Pristine on the presence of fungi in pollen and bee bread.
3) Determine the effects of Pristine on brood survival and queen rearing.

Interpretive Summary:

Honey bees often are exposed to fungicides when pollinating almonds. Fungicides are probably not toxic to bees. However, symbiotic fungi live in honey bee colonies, and play a vital role in food processing, digestion, and storage. These fungi might be affected by the fungicides that are present in pollen that bees collect, and this might compromise the ability of bees to obtain nutrients from their food. We collected pollen in three different orchards and found Pristine and other fungicides in the samples. We also determined that Pristine either kills or severely limits the growth of fungi we isolated from stored pollen in honey bee colonies. We will determine the effects of Pristine on the diversity of fungi in stored pollen by feeding the pollen we collected from the almond orchards to honey bee colonies. The effects on honey bee physiology and queen rearing also will be determined in upcoming studies.

Materials and Methods:

Objective 1. : Determine the effects of Pristine on the nutritional components in bee bread.

Pollen was collected in traps on commercial colonies placed in almond orchards for pollination. The colonies belonged to Eric Olson who is a cooperator on this project. Collection began prior to the application of Pristine and then for subsequent days after application. Pollen was analyzed for the presence of Pristine and other fungicides and pesticides. The pollen collected before and after Pristine application is being fed back to colonies inside our enclosed flight area at the Carl Hayden Bee Research Center.

Objective 2. Determine the effects of Pristine on the presence of fungi in pollen and bee bread.

The effect of Pristine on the growth rates of twelve fungal species isolated from bee bread was evaluated in the laboratory. These 12 species are the most frequent isolates from bee bread and also include two fungal pathogens of bees. The fungi were cultured at 30^{o}C using a bee bread-supplemented nonnutritive agar to reflect colony conditions and standard potato dextrose agar. Pristine was added to the growth media at dilutions comparable to those found in field applications (i.e., 0.1 mg/ml, 1.0 mg/ml, 10.0 mg/ml and 100.0 mg/ml).

Objective 3. Determine the effects of Pristine on brood survival and queen rearing.

Study has not yet been conducted.

Results and Discussion:

Exposure to Pristine in growth media resulted in a marked reduction in growth rates of all 12 fungi isolated from bee bread, varying 12% - 80% depending on species and concentration of fungicide. Results were the same for the two types of media. Percentage reduction in growth rate did not correlate with fungus being a slow/moderate or fast-grower. Consistently, only *Rhizopus* sp., *Mucor* sp., and *Absidia* sp., known for their explosive growth on agar, tolerated the fungicide despite severely inhibited growth with increasing fungicide concentration. The remaining nine species were killed. *Penicillium* sp. and *Aspergillus niger* were unusually sensitive to fungicide, displaying pronounced stunted growth and quick death.

We conclude that bee bread fungi feature differential growth rates that translate into differential responses toward Pristine. Also, killing by the fungicide occurs more readily for moderate/slow growing fungi. Studies to examine the effects of other fungicides on fungal species isolated from bee bread are underway. Exposure to fungicides could disrupt the compositional balance of the colony microflora because of the large number of species potentially affected. We are currently feeding the pollen collected during almond bloom that contains fungicides to colonies in our enclosed flight area. The effects of the fungicides on the microbial community in the bee bread, the nutritional content, and the health of the colony (including the ability to construct queen cells) are being evaluated.

Recent Publications:

Yoder, J., Hedges, B.Z.., Heydinger, D.J. , Sammataro, D., DeGrandi-Hoffman, G. 2009. Differential Growth Response to a Commercial Fungicide by Fungi Associated with Honey Bee, *Apis mellifera* L. (Hymenoptera: Apidae), Colonies and Bee Bread Provisions. J. Econ. Entomol. (submitted).