CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

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Project Number

S2299

Project Title

Effects of Varroa Mite Treatments on Bee Memory

Abstract

Objectives/Goals

The goal of this project was to investigate the effects of recommended treatments of oxalic acid or formic acid for Varroa mite on honeybee memory. This project is the first of its kind to test IPM (integrated pest management) soft treatments on honeybee memory, contributing to the larger body of research to resolve the honeybee decline crisis.

Methods/Materials

Forager bees were captured, frozen, harnessed into restraints and revived in an 90 F incubator. Bees were conditioned to respond to a 1-Nonanol scent (orange oil) with 40% sucrose:water reward using PER assay. A standardized ISI (interstimulus interval) was performed with 4 second odor stimulation, followed by 3 second feeding with 1 second overlap. 27 trained bees with positive conditioning were randomly assigned to groups (Control, MAQS, OXA). Bees were exposed to their treatment conditions. Bees were then tested again for conditioned response in random order. Results recorded. Procedure was repeated for 5 trials total with a total of 135 bees.

Results

The control group responses were significantly more consistent when compared to treatment 1(MAQS) and treatment 2 (OXA) tests. Analysis using box plots show both treatment groups are unlikely ($P < .05$) to be drawn from the control group. Preliminary analysis using T-tests suggest mite treatments vs. control are statistically significant. Control vs. treatment 1 (MAQS) has p-value .003471 and control vs. treatment 2 (OXA) has p-value .018549. But comparison between the two treatments is not statistically significant p-value .339367.

Conclusions/Discussion

Testing and analysis indicates that mite treatments have negative effects on bee memory and learning. Bees exposed to mite treatments have increased levels of negative PER assay responses. The control group, when compared to MAQS group and OA group had more positive PER assay responses. The comparison between OA and MAQS mite treatments is less clear. While both had strong impacts on bee memory, more testing is required to conclude if one is more or less effective. This project is the first of its kind to investigate IPM soft treatments for mites and underscores the importance of further testing of chemicals on honeybee memory to prevent the harmful effects to colonies. Because Varroa mites are one of the causes of CCD leading hive death at a rapid rate, it is urgent research be used to help protect these pollinators.

Summary Statement

We found that "soft" varroa mite treatments have a negative effect on honeybee learning and memory.

Help Received

Patty Freedman helped with data collection. Josh Freedman assisted with data analysis tools.