Effects of Varroa Mite Treatments on Bee Memory and Learning

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Honeybees apis mellifera are an essential part of global crop production and are responsible for $200 B annually, but honeybee colonies are suffering major losses. Varroa mites (varroa destructor), is a honeybee parasite linked to this decline. To mitigate Varroa mites, beekeepers are fighting back using a range of treatments including oxalic acid and formic acid, determined to be safe for honeybees, but may have side effects. In this study, two Varroa mite treatments, oxalic and formic acid were tested to determine their effects on honeybee memory. Three groups of honeybees, positively conditioned using PER assay, were randomly assigned to groups and tested: Control (exposed to water vapor), OA (exposed to oxalic acid sublimation), MAQS (exposed to formic acid polysaccharide gel strips). Results indicate mite treatments have negative effects on bee memory and learning. Bees exposed to mite treatments had fewer positive PER responses than control group. One-tailed T-tests suggest that treatment groups vs control are statistically different. Control vs. (MAQS) p-value < 0.000491 and Control vs. (OA) p-value < 0.00001. Comparing treatments (MAQS) and (OA) showed differences in performance (p-value of < 0.000491) with (OA) as the lower scoring treatment. In addition, the treatment groups changed over time (measured at one hour intervals for 3 hours post treatment). This study provides information about IPM “soft treatments” for Varroa mites, underscoring the importance of testing of chemicals on honeybee memory. Impairment to honeybee’s memory is a key factor in honeybee’s foraging and homing behavior, and may have negative implications in overall health of honeybee colony.

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