The Effects of Clothianidin, Propiconazole, and Amitraz on Apis mellifera Behavior

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Beekeepers across North America lose their beehives at alarming rates to factors like pesticides. The direct exposure to neonicotinoids, fungicides, and miticides that Apis mellifera, honey bees, experienced while in commercial fields could cause honeybee death. In this two-part study of the synergistic effects of three common agricultural chemicals were studied; Clothianidin is a neonicotinoid insecticide that is coated on the plant seed to prevent pests. Propiconazole is a fungicide applied as a seed coating to protect plants from diseases. Amitraz is a miticide used by beekeepers. The first phase of the experiment tested the sublethal behavioral effects of neonicotinoids, fungicides, and miticides on Apis mellifera. With behavior observations, high rates of leg spasm, trembling, and tumbling trauma were connected to honeybees that have pesticide applications. Life survivability percentage decreased when certain pesticides like Clothainidin were applied but, life survivability percentage remains 100% in Propiconazole, Clothianidin+Propiconazole, and Propiconazole+Amitraz. The second phase tested the cognitive learning ability of honeybees exposed to Clothianidin, Propiconazole, and Amitraz in a pass/fail test. Honeybees not exposed to pesticides had a higher percent of learned success compared to honeybees exposed to pesticides. Of the eight combinations tested, Propiconazole+Amitraz and Acetone had the highest success percentage at 100% and 88% while Propiconazole and Clothianidin+Propiconazole had the lowest success percentage at 22% and 33%. This work highlights the importance of the need for investigation of sublethal impacts of single and combination pesticides used at field relevant concentrations on bee behavior.

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