Detection and Removal of Dinotefuran from the Environment: A Multi-Year HPLC-MS Analysis

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Maintaining a healthy bee population is of vital importance to the sustainability of our planet, as bees are essential for the future of agriculture and the stability of the Earth's food supply. With a growing number of bee species protected under the Endangered Species Act, the urgency for action to halt the disappearance of these insects is paramount. One theory for the reduction in bee population relates to the increased use of insecticides globally, especially the increased use of neonicotinoid insecticides. Neonicotinoids, which are chemically related to nicotine, are lethal to bees. The present study concludes a multi-year HPLC-MS analysis of the neonicotinoid dinotefuran to examine the effects of insecticide applications at Oregon sites where mass bee deaths occurred in 2013. This longitudinal study is unique in the literature, as it is the only study to explore the detection of dinotefuran in local honeys collected prior to and following Oregon's 2015 permanent ban on dinotefuran. Results reveal that it is possible for dinotefuran to linger in honey and soil samples 3 years following neonicotinoid insecticide application. More importantly, the inclusion of a new experimental paradigm provides the first documented evidence addressing the effectiveness of phytoremediation and mycoremediation, the in situ cultivations of greenery and bacteria respectively, towards the removal of dinotefuran from the environment. As the bee population continues to decline, the sequestration, degradation, and removal of neonicotinoids from the environment should be at the forefront of future research.

Awards Won:

Drexel University: Full tuition scholarship $194,000