Urban Vs Rural Bee Hives; How Water Resources May Affect Success Rate of Hive Growth

Introduction: Colony Collapse Disorder (CCD) is defined by 1) rapid loss of adult worker bees in a hive coupled with excess brood populations, 2) lack of bee corpses within or surrounding hive, and 3) lack of or delayed invasion of typical pests (e.g. mites, wax moths, or hive beetles). It has been reported that if CCD colonies had any living adults, there were too few to care for the larvae and no living adults that could fly. Further, researchers have described a lack of robbing by stronger hives despite there being a clear lack of resources in the environment. Even after taking apart the hives that had fallen prey to CCD, with supplies of honey and bee bread for the taking, ancillary species were not taking advantage of the easy resources as expected [7].

Those in agronomy use a variety of crop security methods that may have adverse effects on these key pollinators (i.e. honey bees). Many studies have stated that pollinators have been variably effected by neonicotinoids in agricultural, urban or rural areas. Bayer CropScience released data stating that max dose of these applicants (e.g. imidacloprid) with no adverse effects on bees were at levels of 20 ppb. Reassuringly, many studies have only found approximately 4 ppb in wax and bee bread [6]. Some reported that the amount found in treated seeds were only as high as 10 ppb, but this still shows a lack of evidence for these applications being the largest contributor to CCD [4].

Although pesticides are an issue, they do not appear to be the main cause of the disappearance of so many hives. The next best resource I can look to for harmful contaminants, in my opinion, is the bee's water sources. Surprisingly there are only a handful of papers (e.g. [1],[2],[3],[5]) published on either acute metal toxicity from water sources or any of the polyaromatichydrocarbons (PAHs) that wash into local waterways. I hypothesize that the toxicity in local waterways, both urban and rural, will be significant to understanding the mortality and behavior alterations of bees when exposed to local water stable contaminants. The goal is to contribute and add a new perspective to the researching community for probable contributors of hive death.

Methods

Bee Hives: I have previously established two hives in a Stillwater urban area with plenty of neighborhood and road run off into a retention pond where I have observed the bees gathering their water. There is a larger operation of bee hives set up in an organic rural location in Sperry, OK from which the hives set up in Stillwater came from. The rural hives were very healthy and strong. The goal is to test the difference in contaminants based on location, not on genetic resistance.

Water Samples: Water samples will be collected through the spring and summer of 2017. I will test the water for contaminants (e.g. metals and PAHs) and collect data from those results. Results from these samples will then be used as a model for the contaminant exposure that can occur to bees consuming water from these urban sources. Further, this data can be compared to laboratory derived toxicity data for bees exposed to selected metals or PAHs to estimate potential for exposure and effects.

Bees from hives in both locations will then be collected in groups of five or ten and placed containment chambers. Some of the experiments will be run with the applicant being sprayed on the bottom of the chamber where the bees will walk on it periodically. Others will be given to the bees through a drinking straw where they will directly ingest the compounds. Any change in behavior or mortality will be recorded in detail and reported.

Conclusion: I will establish a baseline for the toxicity based on the data I collect which will then, in trial, include acute toxicity (i.e. mortality) and sub lethal toxicity (i.e. behavior). These end results are expected to follow repeated contact or oral exposure to the selected metal(s) and/or PAHs. Following exposure trials on the bees, I will compare toxicity data results to the previously recorded environmental sample data. This will allow me to begin assessing the effects of exposure and risk associated with consuming water from urban environments compared to rural environments.

References:

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