The Honey Bees Next Door

Backyard Beekeeping as a Means to Monitor Pesticides in Urban Environments

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Objectives

Test the use of honey bees as a sentential species to monitor pesticides in three locations in each of two urban centers.

Determine if pesticide residue data collected from honey bees in urban population centers can be used to educate residents about their community's use of pesticides and perhaps influence residents to reduce future pesticide use.

Share this study and its outcome with other communities and beekeeping organizations in the hopes that others might be interested in using honey bees to assess pesticide use in their communities.

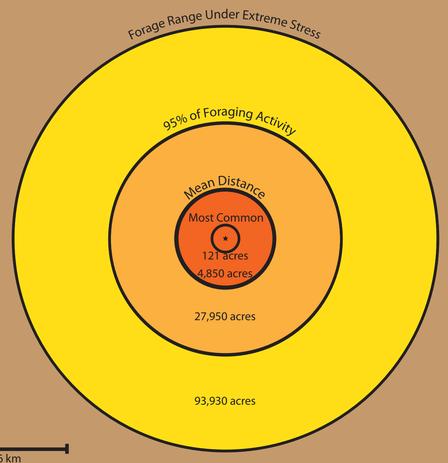
Significance

Human exposure to pesticides in our environment is receiving increasing attention in both scientific and popular literature. Likewise, an international dialogue has developed around the phenomenon known as Colony Collapse Disorder (CCD) and the potential role of pesticides.

The ability of a honey bee colony to cover a defined geographic area and collect pesticide residues in the course of the their normal pollen and nectar gathering is well documented. Monitoring honey bee colonies inhabiting urban environments could provide valuable insight into the pesticides and relative amounts that are present in densely populated community centers.

Pesticides are known to present negative health effects to both humans and honey bees, and in studying this shared urban environment, we stand to learn more about our personal health and how we are affecting pollinator health.

Relative Honey Bee Foraging Ranges



The rings represent the varying distances a honey bee will travel under different conditions, with the star representing the colony location.

Relative Honey Bee Foraging Distances

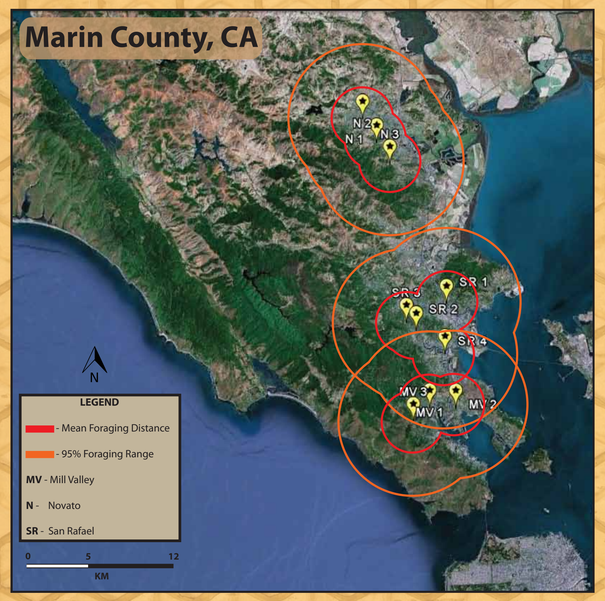
Most Common Foraging Distance [600-800 meters]

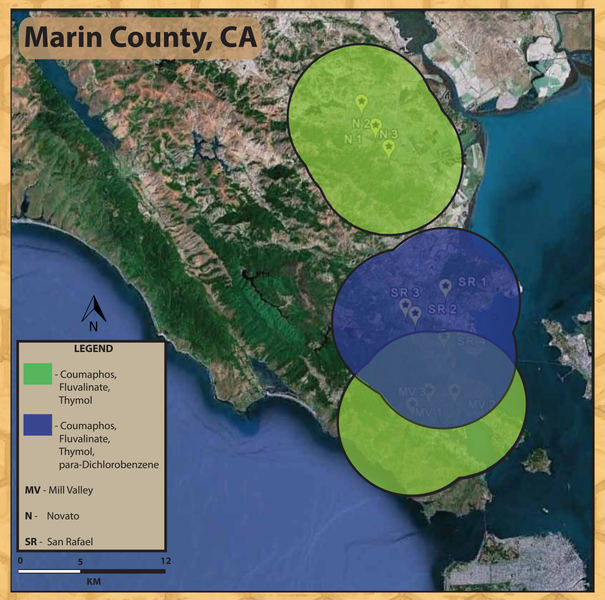
Mean Foraging Distance [2-3 kilometers]

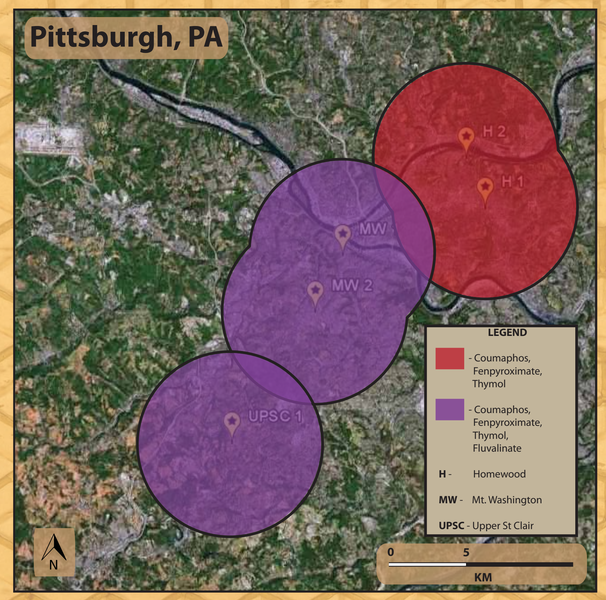
Foraging Distance of 95% of Colonies [6 kilometers]

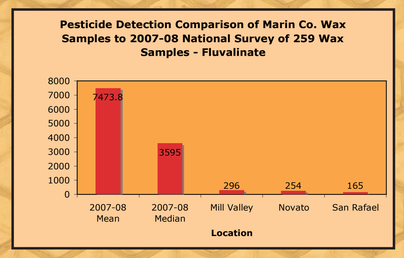
Foraging Distance of Colonies Under Extreme Stress (>5% colonies) [10-12 kilometers]

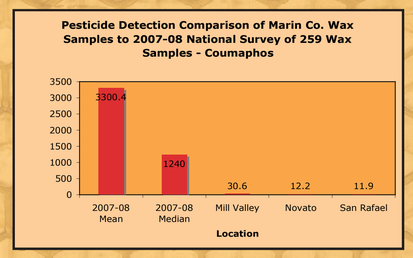
Actual distances vary, but research suggests most foraging activity could be grouped into these four categories and the respective distances traveled from the hive.

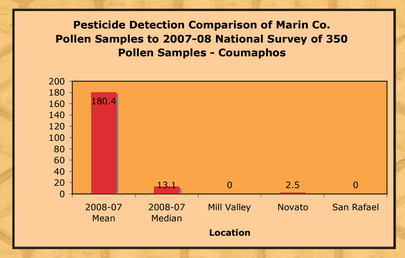


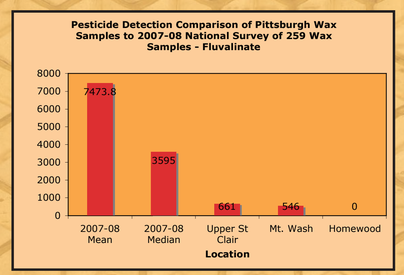


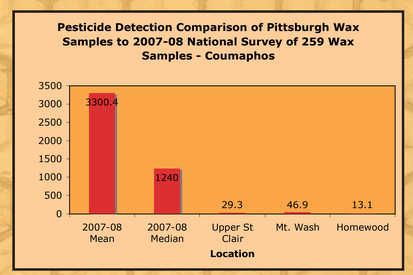


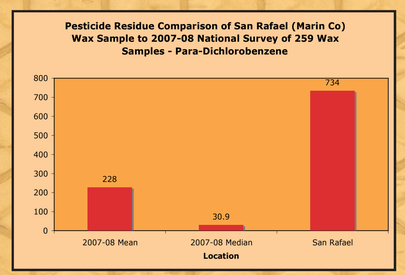












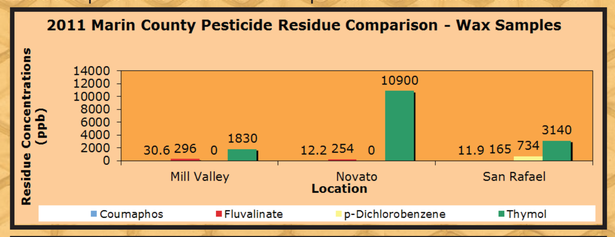
Methods

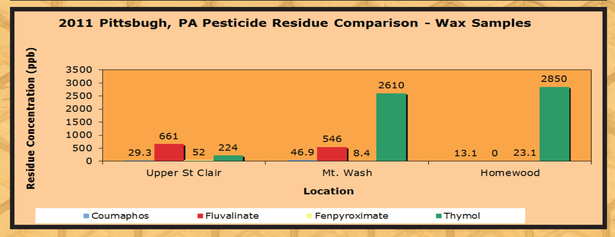
Based on established research, we know that honey bees collect pesticide residues wherever they forage. We also know that 95% of a colony's foraging occurs within a 6-km radius (27,947 acres), with a mean forage distance of 2-3 km.

Whereas comb wax is shown to accumulate pesticides over time, bee bread (pollen) represents a "snapshot" of what pesticides are present at any given time.

Because of these accumulation characteristics, this study uses citizen-collected wax and pollen samples from honey bee colonies in Marin County, CA and Pittsburgh, PA to assess pesticide concentrations in those environments.

A total of 12 samples (6 wax/6 pollen) were sent for pesticide residue analysis to the USDA-ARS National Science Laboratory in Gastonia, NC. These samples were screened for 174 pesticides and toxic metabolites.





Results

The results of this urban pesticide assessment were significantly different than anticipated, mostly due to the lack of pesticides detected in the wax and pollen samples. Though some concentrations of six different pesticides were detected, only one of these was a non-hive management pesticide and it was present in "trace" amounts (~1 ppb).

Of the five beekeeper-applied pesticides, only one pesticide (para-Dichlorobenzene) at one site (San Rafael) was detected at levels above a 2007-08 national survey of 887 wax, pollen, and bee samples (Mullin et al. 2010), while coumaphos and fluvalinate were magnitudes (100x and 10x respectively) below the mean detections of that same study.

Compared to the 121 different pesticides found within the 887 hive samples analyzed by Mullin et al. 2010, this study's findings offer encouraging news to backyard beekeepers in urban areas on both sides of the country. This data bodes well for the health of the people and pollinators where these colonies are located and for the cleanliness of the honey produced in these areas.

Future Research

At the time of sampling in this study (October), most crops had been harvested, most residences winterized, and most flowers done blooming, therefore reducing the chance a honeybee may pick up any pesticides that had been applied to these urban environments over the course of the growing season.

In addition, although many pesticides are lipophilic and tend to accumulate in beeswax, some others are water-soluble and would not show up in these wax and pollen samples. Therefore a yearlong sampling regime of pollen and nectar may more accurately reflect seasonal application of pesticides found in the non-hive environment.

References

Mullin CA, Frazier M, Frazier JL, Ashcraft S, Simonds R, et al. (2010) High Levels of Miticides and Agrochemicals in North Ame rican ApiariesL Implications for Honey Bee Health. PLos ONE 5(3): e9754