Quantifying Varroa Resistance to Miticides in US Honey Bee Colonies

Project No.: **14-POLL6-vanEngelsdorp**

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Objectives:

1) To survey the susceptibility of the US Varroa mite population to both registered and unregistered mite control products.
2) To rapidly communicate mite susceptibility and resistance levels to US beekeepers so they can make informed mite control decisions.
3) Provide mites with known susceptibilities to varroacides to other academic or corporate researchers.

Interpretive Summary:

While many factors contribute to honey bee declines, there is consensus that the single most important contributing factor is Varroa mite. To control Varroa mite, beekeepers rely on a handful of mite control products. Unfortunately, mites have developed resistance to many of these products, and/or the product's efficacy is questionable. This is of serious concern, as beekeepers need to be aware of which products will be effective in controlling the mite population in their operation. With some assurance as to which products will work, beekeepers can avoid unnecessary chemotherapy treatments, reduce unexpected losses, and improve the general welfare of their colonies.

Our survey of 365 beekeeping operations allowed for testing 219 operations (those having sufficient mites for testing) revealed that 12% of successfully tested mite populations were resistant (that is less than 20% of mites were killed in 6 hours of exposure) to coumaphos, 72% of mite populations were resistant to fluvalinate, none were resistant to amitraz, and 3% were resistant to flumethrin. Conversely, 21% of tested mite populations were susceptible (more than 80% of mites killed after 6 hour exposure) to coumaphos, 0% to fluvalinate, 20% to amitraz, and 47% to flumethrin. These preliminary results reaffirm the urgent need for additional mite control products for the bee industry.

Materials and Methods:

We began preforming resistance assays on live bees collected for National Honey Bee disease survey in April 7, 2014 and for the Bee Informed Partnership (BIP) tech teams collected samples beginning August 2014. In all, samples from 365 operations were received with sufficient bees to perform a resistance assay using one or more mite control products. The resistance assay involves placing approximately 300 bees in a cage along with a small strip of miticides (after Pettis et al. 1998). Mites that fell from the bees after 6 hours exposure were counted. Sugar powder was used to remove and quantify any mites remaining on the caged bees. When the total number of mites removed from caged bees was less than 5, the assay was not considered for further analysis. Samples from 219 different operations were collected that has sufficient mites to perform at least one successful assay.

Results and Discussion:

A total of 4 different products were tested for resistance (**Table 1**), all but flumethrin are labeled for use by beekeepers in the US. A population of mites was considered resistant, if it failed to kill less than 20% of the mites in the assay and was considered susceptible if it killed 80% or more of the mites in a sample.

There was no evidence of amitraz resistance in tested colonies, but only 20% of populations were considered truly susceptible (**Table 1**). Comaphos resistance was evidenced in 12% of tested populations, while 21% of the mite population was considered susceptible. Fluvalinate resistance was wide spread with 72% of tested populations being resistant and no population being susceptible. 3% of flumethrin tested mite populations were resistant while 47% of populations were susceptible.

Table 1: Percentage of Mite populations with sufficient mites to permit testing that was resistant or susceptible to miticides.

Product	n	Resistant (%)	Susceptible (%)
Amitraz	176	0	20
Coumaphos	169	12	21
Flumethrin	114	3	47
Fluvalinate	174	72	0

Research Effort Recent Publications:

None

References Cited:

JS Pettis, H Shimanuki, and MF Feldlaufer. 1998. An assay to detect fluvalinate resistance in varroa mites. American Bee Journal, 138 (7).