MONITORING THE NATURAL FALL OF VARROA MITES IN HONEYBEE COLONIES WITH THE USE OF STICKY BOARDS IN CLAY COUNTY, WEST VIRGINIA

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INTRODUCTION

The Varroa mite (*Varroa destructor)* is one of the most destructive pests of the honeybee (*Apis mellifera)* in the United States. Originating in Asia, the mite has now spread to most areas of the world through bee shipment (migratory colonies, package bees, and queen shipment). Colonies containing varroa mites will eventually die if mite levels are not controlled. The introduction of this pest in the United States has led to a decrease in honeybees nationwide. In the United States, approximately 130 agricultural crops rely on the honeybee for pollination producing over $9 billion in added value to these crops (http://interests.caes.uga.edu/insectlab/agimpact.html).

Beekeepers across the nation have come to rely on pesticides for mite control. Because pesticides were initially effective, beekeepers began using them habitually in colonies at the end of every production season. This method of varroa treatment was conducted with little knowledge about the actual mite levels of each colony. Colonies were treated regardless of the infestation level. At times this gave varroa mites unnecessary exposure to pesticides leading to pesticide resistance while increasing production costs to beekeepers.

Two chemical controls that have been used by beekeepers over the last decade are tau-fluvalinate and coumaphos. With reports of varroa mites developing resistance to these two chemicals nationwide, the WVU Clay County Extension Office conducted resistance assays for these two products for members of the Clay County Beekeepers Association. Our results indicated that there was widespread resistance to tau-fluvalinate and sporadic resistance to coumaphos in colonies tested.

Although other controls have now become available, it is evident that beekeepers must stop the habitual use of chemical treatments in order to prevent further buildup of resistance by varroa mites. Producers need to adopt integrated pest management (IPM) strategies in order to manage varroa mites successfully. After identifying the pest and setting action thresholds, monitoring the pest population is the next step in any IPM program.

Several methods exist for monitoring varroa mite populations in honeybee colonies. Methods include visual inspection, drone sampling, powder sugar shakes, ether roll, wash methods and sticky boards. These methods are not meant to quantify the total number of mites in a colony, but to give an estimate of the mite load within a hive.

Of mite sampling methods, the sticky board method is a more accurate, passive way to determine mite levels in colonies. Varroa mites naturally fall from bees within a hive to the bottom of the colony. A study at the University of Delaware determined that natural mite fall onto sticky boards was an effective way to monitor mite populations in honeybee colonies (http://ag.udel.edu/enwc/faculty/dmcaron/Apiology/mitesampling.htm). Sticky boards are easy to use; you simply place them beneath the screen bottom board in the hive and count the number of mites on the sticky board after a 24-hour period.

The purposes of this demonstration were:

- to monitor mite population levels over the course of a production season by using sticky boards to assess the change in the varroa mite population in colonies in Clay County, West Virginia.
- to educate beekeepers to recognize colonies that do not need treatment against varroa mites and thus reduce pesticide use, thereby reducing production costs.

METHODS

Hives were identified by 5 beekeepers for varroa mite monitoring. Sticky boards were provided to each beekeeper to sample up to 5 hives. Sticky boards were placed in hives on the Monday prior to Clay County Beekeepers meetings and were removed 24 hours later. The sticky boards were placed in the same hives for monitoring each month.

Month of application, hive number and beekeeper were recorded on the sticky boards. The boards were analyzed for number of varroa mites. Monthly mite counts were recorded for each hive. Beekeepers were instructed to treat hives when a threshold level of 50 mites per sticky board was reached.

A regression analysis was performed for month of application and number of varroa mites in hives that were not treated for varroa mites and in hives that were treated for varroa mites. Correlation coefficients were calculated for the number of varroa mites in treated and non-treated hives.

RESULTS

The number of hives monitored for varroa mites with sticky boards varied from month to month. The number of beekeepers using the sticky boards also varied. Some participants did not have 5 colonies to sample initially, so as additions were made to their bee yard in May and June, these colonies were also sampled.

The use of pesticides by beekeepers accounted for the diminishing sample size, namely, the number of beekeepers with monitored colonies in August and September. In some cases, the threshold number of varroa mites was reached. In other cases, beekeepers resorted to the habitual use of pesticides, even while sampling varroa mites with sticky boards and knowing the recommended threshold for treatment had not been met. In August, 1 beekeeper had treated all of their colonies. By September, 2 of 5 had treated all colonies. Once all colonies were treated in a yard, sampling stopped. See Table 1.

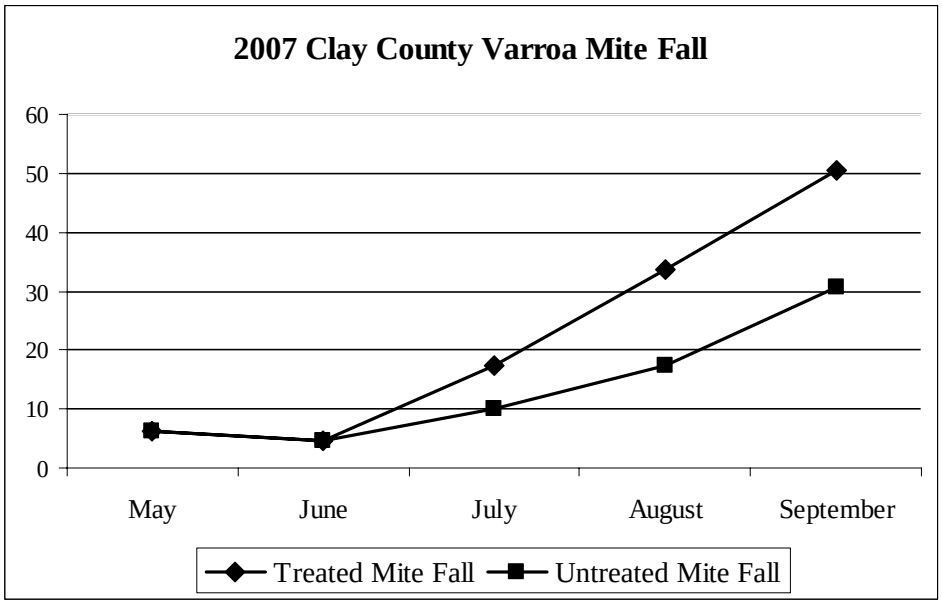
Table 1. Number of beekeepers, and colonies monitored by month.

Month	Number of Beekeepers with Monitored Colonies	Number of Colonies Monitored
May	5	16
June	5	21
July	5	22
August	4	20
September	3	16

Varroa mites were detected in each hive in at least one of the months that hives were monitored. The average number of mites increased as the summer months progressed. Because this project was designed to monitor natural mite fall, producers were encouraged to treat their colonies for varroa mite infestations as necessary. Some of the mite counts were artificially inflated because a pesticide was applied near the monitoring date. Average number of varroa mites per hive is depicted in Figure 1. The “Mite Fall from All Colonies” line includes the mite

count from all the hives, including treated colonies while "Untreated Mite Fall" includes only the hives that received no treatment during the month.

Figure 1. Average number of mites counted on sticky boards by month.



The regression coefficient (R^2) for month and number of varroa mites counted for all colonies is .91 and for the untreated hives is .84. These high regression coefficients indicate a very strong relationship between the month the hives were monitored and the number of mites counted. The correlation coefficient between all colonies and untreated varroa mite counts is .99 ($P<0.05$) which indicates that although the numbers are not the same, they are increasing at very similar rates. So, while all colonies had a greater mite fall and therefore higher numbers of mites on the sticky boards, the treatment did not trigger the increasing mite numbers as the summer progressed. Mite numbers increased regardless of treatment.

DISCUSSION

There were two expected outcomes from this project: 1) mites were found in each colony at least once during the summer months and 2) the varroa mite population in colonies increased during the summer months. Population of mites increased through the season, with some colonies reaching threshold mite levels by August and September. These months are critical times for beekeepers since brood rearing will end in mid to late October. Mite levels during these months should be monitored carefully to ensure adequate time for mite control and additional brood cycles before winter.

An unexpected observation from this study was the tremendous variation in the rate at which individual colonies develop mite populations. Some colonies developed mite levels at much slower rates than others and had essentially flat lines. These colonies may have a hygienic behavior or other characteristic that prevents mite buildup. Monitoring with sticky boards will aid beekeepers in this county in identifying those colonies that exhibit mite inhibiting behavior.

While conducting this project, beekeepers continued their habitual use of pesticide to control varroa mites. Fortunately, with this project they were able to detect threshold levels well in advance of fall, thus not treating too late for winter. However, hives that had not reached a threshold level of varroa mite infestation were also treated. Before hives with natural resistance to varroa mite can be determined, habitual treatment with pesticides must end.

One challenge in getting beekeepers to adopt an IPM program for varroa mites is the “zero tolerance” mentality. For example, beekeepers routinely treat their hives against American Foulbrood. A bi-annual treatment of oxytetracycline is used as a preventative for the disease. As a result, beekeepers treated for varroa mites in a similar manner. The early response of beekeepers to varroa mites was an attempt at complete eradication with pesticides through routine calendar applications; beekeepers failed to understand that small mite loads could be present within a healthy colony, unlike the disease, American Foulbrood. Now that it appears that varroa mites will be present in hives in spite of treatment, learning to manage the population rather than attempting to eliminate it with chemical treatments is a key point for beekeepers to adopt.

The data from this demonstration has been included in educational programs for the Clay County Beekeepers Association. The goal is to encourage the adoption of an IPM program that will monitor varroa mite populations and treat only those hives that reach a threshold level of infestation. Beekeepers will continue monitoring their hives. The difficulty comes in persuading beekeepers to withhold treatment until threshold levels of varroa mites are reached.

When treating pests, their presence in damaging numbers is necessary for their control. As ironic as it may seem, many beekeepers continue to treat for an undetected pest. Their lack of understanding on how to identify threshold levels of varroa mites in their colonies exacerbates their misuse of pesticides. As a result, resistance of varroa mites to these control products will only increase. There is a great need in the beekeeping community for further education and research on the identification of threshold levels of varroa mites in honey bee colonies. This effort would reduce honey bee losses, reduce resistance to miticides and will also save beekeepers additional production costs.