



Determining the effectiveness of various Varroa mite treatments on honey bee populations

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Introduction

Since 2006, honey bee colony losses throughout Europe and North America have been reported. These losses can be attributed to the presence of Colony Collapse Disorder. Varroa mites (*Varroa destructor*) are one of the causes of Colony Collapse Disorder which involves rapid loss of adult worker bees (vanEngelsdorp, 2009). The Varroa mite has moved west from its original host the Asian honey bee (*Apis cerana*) and is now infesting the European honey bee (*Apis mellifera*) which was a far less resistant source for the Varroa mite. Varroa populations often kill their host. When Varroa mites were first introduced in Europe and America they were easily controlled with one or two treatments, however colony losses have now increased even with the new control methods. Varroa in every colony causes an enormous pressure on bee health (Yves Le Conte, 2010). If Varroa is left untreated, the infested colonies could die within six months to two years of the initial mite infestation (Yves Le Conte, 2010). There are many treatments available. Hogguard is a miticide that is made from natural hop compounds. It promotes bee health and survivability, however when brood is seen many treatments are needed (Products, 2018). Mite Away Quick Strips are formic acid polysaccharide gel strips for the treatment of Varroa mites in a certain temperature range (Products N.A., 2018). However, if the temperatures are not in this range then it can lead to queen loss and adult bee and brood mortality (Jadczak, 2018). The purpose of this experiment was to assess which Varroa mite treatment was most effective at managing mite populations. It was hypothesized that the strongest chemical treatment would control the mites best, the more natural treatment would have moderate control of mite's infestation, and the control or untreated hive would have the most mites.

Methods

To determine proper treatment for Varroa destructor infestation, three honey bee hives in Joppa, MD were evaluated using a sugar roll technique. A one-fourth measuring cup was used to transfer bees from each hive into a mason jar along with two tablespoons of powdered sugar. The jar was sealed with a screen and the bees were gently rolled until fully coated in powdered sugar. The jar was shaken onto a white surface. The mites were then counted. This process was continued once in the months June and July to obtain baseline data and to determine which hive received which treatment method. The hive with the highest amount of Varroa mites was treated with the Mite Away Quick Strips®, a chemical treatment, because it has 90-95% success rate. The hive that had the second most Varroa mites was treated with Hogguard II®, an herbal treatment. The hive that had the least Varroa mites was left as a control and not treated. The Mite Away Strips were applied between the top hive body and the inner cover. They were left for seven days then removed and safely disposed of according to the instructions given by Mite Away. The Hogguard II® treatment, two strips were applied for every ten frames according to the manufacturer's instructions. The strips had to be hung between two brood frames and left on for a minimum of 14 days. After the treatments were completed a sugar roll was done to assess the success of each treatment. The data was then compiled and graphed to show the relationship between number of Varroa mites and treatment. A one-way Anova evaluated the statistical significance of the treatment methods.

Research Question

To what extent does Varroa mite treatments affect the infestation rate of Varroa mites in honey bee populations in Harford County, Maryland?

Results

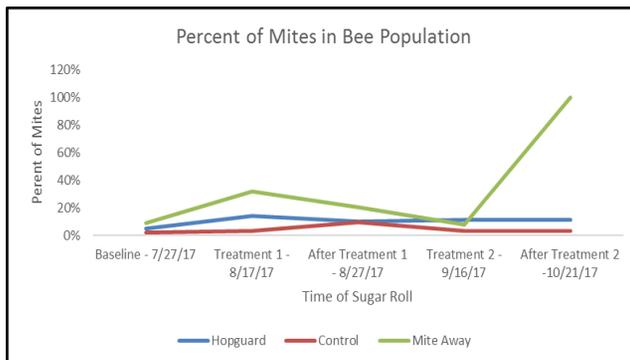


Figure 1: represents the average percent of mites in bee population per 200 bees, showed through the different times a sugar roll was taken. The trend shows that the control hive had the least mite infestation and the mite away had the most mite infestation.

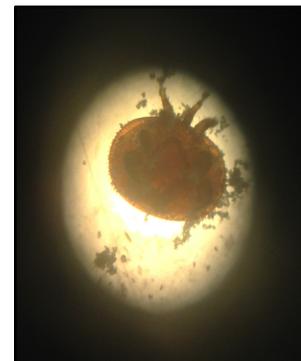


Figure 2: is a Varroa mite that was shaken out during the sugar roll test.



Figure 3 is of the mason jar being rolled to allow all the bees to be fully coated in the sugar.



Figure 4 is the action of shaking powdered sugar out of the mason jar to reveal the Varroa mites that were on the bees.

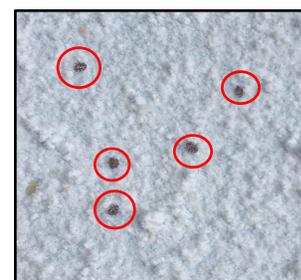


Figure 5 is the Varroa mites in the powdered sugar after being shaken out of the mason jar.

Results Analysis

The results of the study showed that the control hive with no mite treatment had the least mite after completion of the study. The hive with the Hogguard or natural treatment had the intermediate amount of mites, and the hive with the Mite Away Strips or the chemical treatment had the most mites. Figure 1 displays the three-hives tested with the percentage of Varroa mite infestation in each one. The trend showed that the control hive had less mites compared to the Hogguard Hive and Mite Away Strip Hive. The Control Hive started off with a 2.3% infestation of mites and ended with a 5% mite takeover. The Control Hive peaked after treatment one at 14.9%. The Hogguard Hive started off with a 5% infestation of mites and ended with a 17.5% infestation of mites. The Hogguard Hive peaked at 21% before treatment 1. The Mite Away Strip Hive started off with a 9% infestation of mites and with a 100.0% infestation of mites. The Mite Away Strip Hive peaked before treatment 1 at 48.5% and then after treatment 2 when there was a total mite infestation of 100%. When a One-Way ANOVA conducted it showed that differences between the hives was not significant. (p value was 0.593).

Conclusions

The results of this study do not support the hypothesis that type of mite treatment affects abundance of Varroa mites. The control or untreated hive had the least number of mites 5% out of 200 bees. The Hogguard or natural hive had 17.50% out of 200 bees. The Mite Away Strips or chemical treatment had 100% mite/bee ratio. This hive died. The hives were managed based on the baseline mite counts. The control hive had the least number of mites and the chemically treated hive had the most mites. The Mite Away Strips and other chemical treatments do not have 100% effectiveness. The Mite Away Strips and other chemical treatments leave the stronger mites to reproduce the next generation and eventually become resistant to the treatment. The natural substances such as Hogguard have not yet resulted in resistance (Yves Le Conte, 2010). It is possible that the Mite Away Hive died because the hive was not treated at the correct temperature range causing the hive to weaken and the mites to become resistant. (Jadczak, 2018). However Colony Collapse Disorder can be linked to the bee high mortality because when the treatments are applied the bees are already weakened so the treatments do not work as well. The results of other studies agree that hives need to be treated (Yves Le Conte, 2010). However in the experiment done on the Harford County hives survival rates were better without treatment.

Further Implementation

Because the three hives had different concentrations of mites and were treated commensurate with their level of infestation, it was difficult to draw conclusions about the effectiveness of the different treatment methods. Further experiments need to be conducted in a more controlled way to assess the effectiveness of oxalic acid because it has been said to be 90-99% effective at killing Varroa mites with little injury to the bees and brood (Berry, 2015). Hives should be sampled for mites and chosen for similar mite concentrations and tested using the latest oxalic acid treatment. Another question that arose from this study was how easily the mites can spread through an apiary. A study could be done in different apiary locations to test the proximity of bee hives and mite counts.

Literature Cited

- Berry, J. (2015, May 25). *OXALIC ACID: Effective & Easy On Bees*. Retrieved from Bee Culture: <http://www.bee-culture.com/oxalic-acid-effective-easy-on-bees-but/>
- Products, B. H. (2018). *Bee Health*. Retrieved from Beta Tec: <https://betatec.com/bee-health/>
- Products, N. A. (2018). *Mite Away Quick Strips*. Retrieved from NOD Apiary Products: <http://nodglobal.com/mite-away-quick-strips/>
- Strips, M. A. (2018). *NOD Products*. Retrieved from Mite Away Quick Strips: <http://nodglobal.com/wp-content/uploads/2016/03/US-M-PL-003.pdf>
- vanEngelsdorp, D. (2009). *Colony Collapse Disorder: A Descriptive Study*. PLOS one 4(8)
- Yves Le Conte, M. E. (2010). Varroa mites and honey bee health: can Varroa explain part of the colony losses. *Apidologie*, 11.

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