AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2014 – 2016

TITLE: Evaluating potential of a predatory mite as a biological control agent for honey bee ectoparasite, *Varroa* mite and testing efficacy of a new miticide (amitraz)

RESEARCH LEADER: Ramesh Sagili

COOPERATORS: Oregon Beekeepers and Oregon State Beekeepers Association (OSBA).

SUMMARY: Varroa mite is a parasitic mite that is a major threat to the beekeeping industry in the US and across the world. Beekeepers do not have many effective mite control options. Amitraz is an important Varroa mite control product currently available for use by beekeepers and there is concern that the efficacy of this product is decreasing and mite populations are developing resistance against this product. In this study we tested the efficacy of amitraz (Apivar) in mite control and possible mite resistance to this product. We also evaluated the potential of a predatory mite for biological control of Varroa. Apivar efficacy was 88.7% which suggests that this product was providing adequate mite control. Our amitraz resistance study results suggest that some mite populations might have developed resistance against amitraz. Predatory mites were not found to be effective in biological control of Varroa mites.

OBJECTIVES: The objectives of this proposal are**:** 1) Determine the potential of predatory mites (*Stratiolaelaps scimitus*) as biological control agents for *Varroa* mites and 2) Evaluate efficacy of amitraz (Apivar) and mite resistance to amitraz.

PROCEDURES:

Experiment 1: Twenty colonies headed by sister queens with similar mite infestation levels were used for this study. Mite populations were estimated in each of these experimental colonies before initiation of the experiment. Treatments were assigned randomly to these experimental colonies. Ten colonies received predatory mite treatment and ten served as controls. Predatory mites were obtained from Evergreen Growers Supply, Clackamas, Oregon. Predatory mites (*Stratiolealaps scimitus*) were supplied in a vermiculite base by this supplier. This vermiculite based product with predatory mites was sprinkled on a paper placed on top bars beneath the hive cover such that the mites in the vermiculite would crawl on to the frames and also on to the bees when bees start removing the vermiculite from the hive.

Each of the experimental hives designated to receive predatory mite treatment received approximately 25,000 predatory mites. The colonies designated as control received peat moss without any predatory mites instead of vermiculite with predatory mites. *Varroa* mite levels were monitored each week by alcohol wash method. Sticky mite boards stayed on the hives throughout the experimental period of 6 weeks. These mite boards were used for monitoring mite drops throughout the experimental period and also to observe any possible physical damage done to *Varroa* mites by the predatory mites. Colony evaluations (bees, brood and food resources) for all experimental

colonies were done at the start and end of the experiment. In addition we also observed bee behaviors periodically in the experimental hives to document any unusual bee behaviors in the presence of predatory mites.

Results / Discussion

There were no significant differences between mite populations between treatment and control colonies at the beginning of the experiment (ANOVA: $F_{1, 18} = 2.51$, $P=0.15$). The mite populations were also not significantly different between predatory mite treatment and controls after 6 weeks of treatment (ANOVA: $F_{1, 18} = 1.42$, $P=0.26$). We did not observe any significant differences in total number of *Varroa* mites with chewed/damaged appendages (Fig. 4) between treatment and control colonies. Our results suggest that predatory mites (*Stratiolaelaps scimitus*) do not provide effective control for *Varroa* mites in honey bee colonies.

Experiment 2 (Estimation of Apivar efficacy): Twenty established homogeneous colonies with sister queens and similar mite infestation levels were used for this study. Ten out of these twenty colonies received Apivar and the other ten colonies served as controls. Treatments were assigned randomly to these experimental colonies. Mite populations were recorded at the start of the experiment and then periodically throughout the experimental period by both alcohol wash method and sticky mite board counts. Each colony designated as treatment received two strips of Apivar per brood chamber and the strips remained in the colonies for a period of seven weeks (July 24 to September 11). We used three different methods to estimate the efficacy of Apivar.

Results / Discussion

The estimated efficacy of Apivar using method one (alcohol wash) was 88.7%, whereas the Apivar efficacies obtained using method 2 and 3 were 96.8% and 78% respectively. These results suggest that Apivar appears to be providing effective *Varroa* mite control, but not to the extent (greater than 95%) that has been reported in other countries such as Canada.

Experiment 3 (Apivar Resistance Study): For this study we used colonies from 7 commercial beekeeping operations and 14 backyard beekeeper apiaries for monitoring mite resistance in 2014. We repeated this study again in 2015. The mite resistance to Apivar was monitored using a method similar to Pettis et al. (1998). For commercial beekeeping operations, five colonies were randomly selected within a single apiary where miticide treatment was not applied within a minimum of 3 months. Colonies were assessed for *Varroa* mite infestation via sugar roll method of approximately 150 bees. Colonies were selected for the study if they had over a 3% mite infestation from the sugar roll test.

Approximately 4 oz. of bees were sampled from a brood frame in each colony and placed into a 400ml cage with a mesh lid (Fig. 6). Each cage contained a treatment strip of 3.33% Amitraz (1.3 X 4 cm) stapled to a piece of cardstock for optimum mite contact. A small piece of sugar fondant was placed on the top of the cage until bees could be transferred to an incubator, where they received 50% sucrose solution and water top feeders. The cages remained in the incubator (33ºC, 55% RH) until 24 hours of treatment exposure has lapsed. After 24 hours, total mite fall was counted by shaking the cages through its mesh opening. The mites that remained on the bees were counted via 50% ethanol wash.

Results/Discussion

The analysis of this data is still in progress. Following are the preliminary results from 2014 study. Average percentage mite mortality from Apivar exposure in commercial beekeeping operations was

83%. Average percentage mite mortality from Apivar in backyard beekeeper colonies was 96%. These preliminary results suggest that mite populations in Oregon commercial beekeeping operations might be developing resistance to Amitraz. We will be able to arrive at a more definitive conclusion after analyzing the 2015 data.

SIGNIFICANT ACCOMPLISHMENTS: Research findings from this study have been disseminated to Oregon beekeepers at Oregon State Beekeepers annual meetings during 2014 and 2015. Manuscript pertaining to this research is under preparation for publishing in a peer refereed journal.

BENEFITS & IMPACT: Results from this study have provided new insights to beekeepers regarding the efficacy and resistance of amitraz (Apivar) which is a primary mite control product available for beekeepers. Information gleaned from this study will help beekeepers formulate their mite management strategies for effective Varroa mite control and reduce their colony losses.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM: Additional funding was received from the National Honey Board during the project term.