Winter Colony Health Assessment After Using Mite Away™ Quick Strip (MAQS™) as a Control for Varroa Mites in the Fall of 2009

Ontario Beekeepers' Association Tech-Transfer Program
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Beekeepers struggle to manage colonies efficiently under the influence of the aggressive parasite, *Varroa destructor*. The development of resistance to the active ingredients in varroacides and the potential negative influence of environmental conditions on treatment efficacy make the available options unreliable. The MAQS™ is a single application, formic acid based treatment that does not require additional equipment for proper use. Results from a MAQS™ field test conducted by the University of Hawaii in the summer of 2009 documented a large initial kill of phoretic varroa and high mite mortality in capped brood.

MAQS™ efficacy was tested in Ontario in the fall of 2009. The health of the colonies in the spring of 2010 was documented to determine overall treatment effects on wintering colonies.

Protocol

Thirty-six colonies in three bee yards near Stirling, Ontario were surveyed on October 2 (day -3) to determine colony strength and varroa mite levels using an alcohol wash of approximately 300 bees. Five colonies in each of the three yards were randomly selected to check pre-treatment nosema spore levels. Twenty-five bees per sample were analyzed. Colonies were randomly divided into three treatment groups, control (n=12), 150 g MAQS™ (n=12) and 300 g MAQS™ (n=12). Twenty-seven colonies in the trial were 1.5 brood chambers. The remaining nine colonies were single brood chambers.

Colonies were treated on October 5 (day 0). Control colonies received two Apistan® strips. The low (150 g) and high (300 g) doses of MAQS™ treatment were placed directly on the top bars under the inner cover for single brood chambers. For 1.5 brood chambers, the MAQS™ was placed between the brood chambers regardless of the half box being in the upper or lower position. Chemical resistant gloves were used when handling the MAQS™.

On October 8 (day 3) frames of capped brood were selected from thirteen colonies in one of the yards and brought to the lab. One hundred worker cells from each frame were uncapped. Each cell was examined with a light source directed into the cell. A dissecting microscope was used when necessary. The numbers of live and dead varroa mites were recorded based on mite age and gender using the following categories: mature male, mature female and immature female.

Varroa mite levels were determined on October 8 (day 3), 13 (day 7) and 19 (day 14) using an alcohol wash of approximately 300 bees. On October 13 and 19 queen presence and the health of the brood was recorded.

All colonies had supplemental feeding where required of 2:1 sucrose to meet overwintering feed reserve needs. No additional medications (eg. Fumagilin-B, oxytetracycline) were used. Apistan® strips were removed on December 5. All colonies were wrapped for winter in the middle of January.

On April 21, 2010 colonies were assessed for varroa levels, winter mortality and queen status.

Results

Nosema spores were detected in two of the 15 colonies sampled. Both colonies were from the same yard. Detected spore levels were low (25,000 and 200,000 spores per bee).

Pre-treatment varroa levels were above 20 varroa per 100 bees for all treatment groups (Figure 1). Colonies which received two Apistan® strips (control) experienced a drop in varroa in the first three days to just over ten varroa per 100 bees. The low MAQS™ dose reduced varroa levels to five varroa per 100 bees after day three. There was no further reduction in varroa levels for the remainder of the trial for the control and the low MAQS™ dose treatments. The high MAQS™ dose decreased varroa levels to less than one varroa per 100 bees and maintained that level two weeks after treatment.

In April, 2010, varroa levels were 5.0, 2.9 and 1.3 varroa per 100 bees for control colonies (Apistan®), 150 g MAQS™ treated colonies and 300 g MAQS™ treated colonies, respectively.

Thirteen frames of capped brood were inspected in the lab to determine the effect of the treatments on varroa mortality in the capped brood. The varroa infestations ranged from 13% to 87%. Control colonies, 150 g MAQS™ treated colonies and 300 g MAQS™ treated colonies had average brood varroa infestations of 51%, 39% and 56%, respectively. Varroa treated with 300 g MAQS™ had noticeably fewer live varroa mites for all three of the age and gender categories (Figure 2). Ninety-seven to 98% of the varroa in the capped brood were dead after three days of treatment.

In April, 2010 three of the twelve colonies in the control group (Apistan®) were dead. An additional two colonies were drone layers and were included in the mortality rate of 42%. Colonies receiving the 150 g MAQS™ treatment had a mortality rate of 33% including two dead colonies, one drone layer and one queenless colony. One colony died in the 300 g MAQS™ treatment group resulting in a mortality rate of 9%. One colony was removed from this treatment group in the fall due to American Foulbrood.

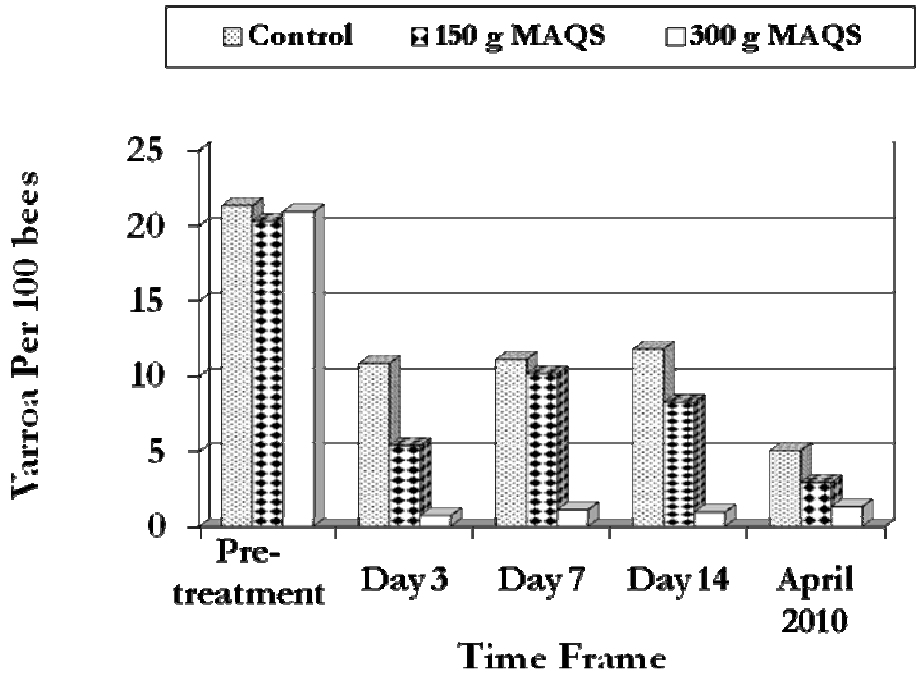

Figure 1. Varroa mites per 100 bees during Mite Away™ Quick Strip (MAQS™) treatment trial, fall 2009 and April, 2010.

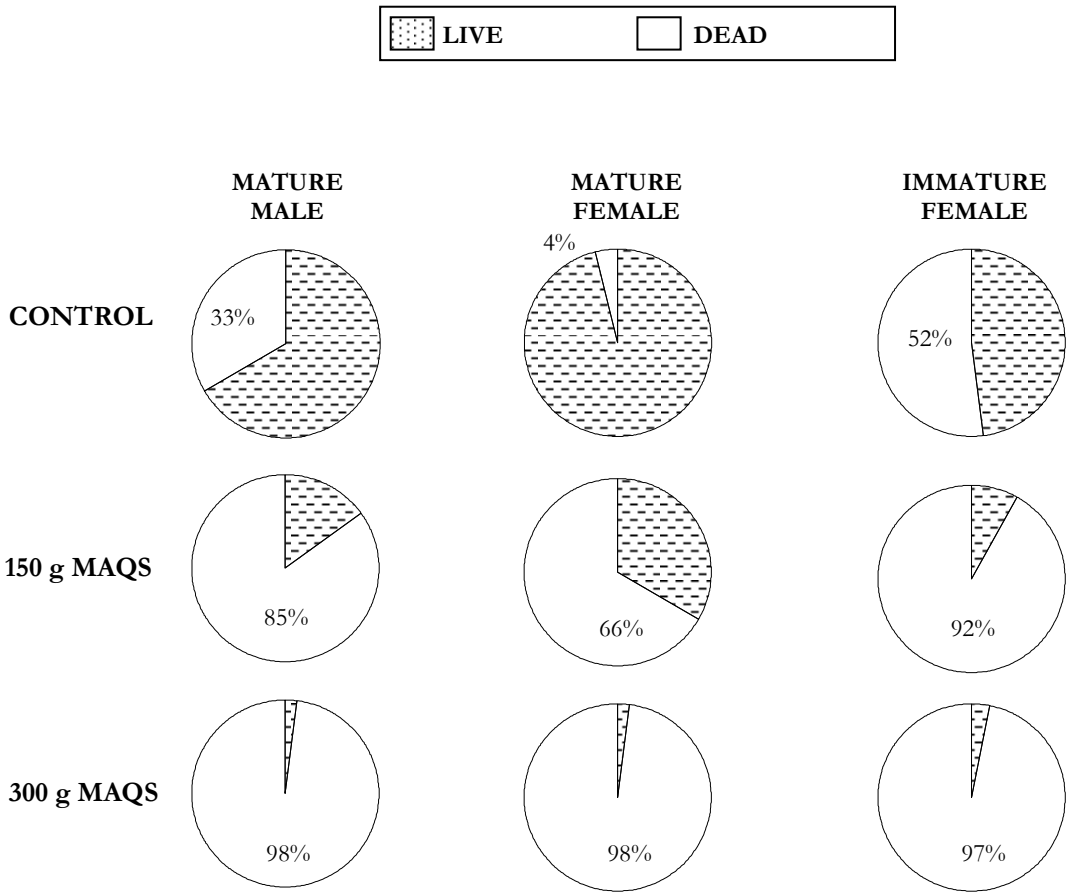

Figure 2. Portion of live versus dead mature male varroa, mature female varroa and immature female varroa in capped brood for control colonies (two Apistan® strips) and colonies treated with 150 g MAQS™ and 300 g MAQS™. The portion of dead varroa is given as a percent for each category.

Discussion

The MAQS™ treatment is easy to apply. Chemical resistant gloves are required to handle the strips and place them on the top bars for single brood chambers and between the boxes for double brood chamber colonies. No extra equipment is needed to accommodate the MAQS™. The ease of treatment application would be considered an advantage for commercial beekeeping.

The fall trial was not conducted at an ideal time due to the lateness of the season. High varroa levels in October have the potential to cause irreversible brood damage that could affect wintering success in all treatment groups. An effective treatment, which kills the majority of the varroa in a colony, cannot repair damaged brood nor restore the health of young bees with physical deformities caused by high varroa infestations.

The high MAQS™ dose (300 g) reduced varroa from 21 to less than one mite per 100 bees in the first three days of the treatment period. This reduction was maintained for two weeks, until the end of the monitoring period.

This result is incredibly promising for an effective varroa treatment. Impressively, the treatment was effective at killing 97% to 98% of the varroa in the capped brood within the first three days of treatment.

The low MAQS™ dose (150 g) had some effect on varroa levels after day three but levels were too high to classify the dosage as a stand alone treatment. The increase in varroa over the next 11 days and the results of the live verses dead varroa in the capped brood indicates that the increase in varroa was the result of emerging varroa, unaffected by the treatment.

Colonies that received the Apistan® treatment were assessed at three, seven and fourteen days after treatment. This is a 42 day treatment and therefore should not be evaluated after such a short exposure time. However, it was monitored as a comparison to the MAQS™ treatments. Spring varroa levels reflect infestation after the proper application time for all treatment groups. April varroa levels were the lowest in the 300 g MAQS™ treatment group which averaged 1.3 varroa per 100 bees. This level is below the spring threshold guidelines for Ontario signifying that a spring treatment is not warranted. In comparison, the Apistan® treatment group averaged 5.0 varroa per 100 bees in the spring. This level is more than twice the threshold guideline for Ontario and would warrant a treatment.

Results of resistance testing (Appendix A) indicated that Apistan® was the most effective conventional treatment option available for use as the control. Colonies in the test yards were last exposed to Apistan® in 2002. The brood comb had since been replaced.

Post-treatment (days 7 and 14), one queen in each treatment group was not seen and eggs and young brood were absent. There were no indications that queen loss was attributed to the treatments. There was brood damage but high varroa levels would have contributed to this and thus complicated determining the cause of the damage. Brood damage was noted in colonies in all treatment groups. Repeating the trial earlier in the fall, before excessive varroa cause brood damage, would provide further insight in this area.

The wintering success of all colonies in the trial was determined in April 2010. Colonies from the 300 g MAQS™ treatment group, with the lowest varroa levels, also had the lowest winter mortality of 9%. Forty-two percent of the control colonies (Apistan®) died or were drone layers in the spring.

APPENDIX A

RESISTANCE TESTING 2009 - PETTIS TEST

Beekeeper: NOD **Sample Date:** July 28th, 2009

Yard	Colony	Treatment	Avg Total Mite Counts	Average Efficacy	Standard Error
Hilltop	33	Apistan®	26.8	94.78%	3.79
		Bayvarol®	21.0	96.67%	5.77
		No Treatment	26.0	15.74%	6.56
		CheckMite+™	21.0	81.62%	9.68
Hilltop	21	Apistan®	36.0	90.42%	1.52
		No Treatment	42.5	32.91%	36.43
		CheckMite+™	41.5	79.94%	10.10
Swamp	41	Apistan®	25.8	97.02%	1.90
		Bayvarol®	26.5	96.48%	3.74
		No Treatment	26.0	21.75%	14.13
		CheckMite+™	20.5	93.99%	4.59
Swamp	74	Apistan®	4.5	92.26%	7.78
		No Treatment	7.3	25.00%	43.30
		CheckMite+™	5.3	85.18%	9.36
Tall Trees	75	Apistan®	4.0	97.50%	4.33
		Bayvarol®	6.3	87.71%	7.58
		No Treatment	6.0	0.00%	0.00
		CheckMite+™	4.3	33.33%	26.35

Note: The average total mite counts for Colonies 74 and 75 were below 10, which is not high enough to provide reliable information in regards to resistance. Therefore, the information should be treated with caution.
Also, the no treatment percentage mortality for colony 21 is high. One rep out of the four dropped 29/31 mites within the 24 hour time period. This is irregular, and may have been caused by the travel from the yards to the office. This also happened with colony 74.