

Treatment against *Varroa destructor* combining thymol-based products and queen caging technique

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The pathogenic action of the honey bee parasite *Varroa destructor* is a major issue in beekeeping worldwide. Since varroa mite has tendency to develop resistance to chemical compounds, it is important to verify efficacy of existing products and to find new treatment alternatives.

Guaranteeing high efficacy of treatments to control *Varroa destructor* population is essential for colony survival. Organic acids based acaricides (as oxalic acid) or essential oils (as thymol) have a low risk of residues and accumulation in bee products and do not lead to mite resistance (Imdorf et al. 1999; Rosenkranz et al. 2010).

As most of the available acaricide products, thymol is ineffective on mites in their reproductive phase within brood cells. However, an artificial brood interruption period in the colony can be obtained by caging the queen preventing the egg laying. Since mites rely on honey bee brood to reproduce, any break in the brood cycle would interrupt *V. destructor* population growth. This means that all the varroa mites present in the colony will be on the adult bees, without the protection of the capped brood cells, and they can be easily reached by the thymol vapours released by an acaricide product. Therefore, the combination of commercial thymol-based veterinary products with the biotechnical method of caging the queens is a highly effective acaricide treatment.

A recent study (Giacomelli et al., 2015) evaluated the efficacy and impact of the thymol veterinary product Apiguard[®] (Fig. 1) on honey bee populations when used alone or combined with an artificial brood interruption obtained by caging the queen. Apiguard[®] killed 76.1% of the mites while queen caging killed 40.6% of the mites. The combination of Apiguard[®] administration with queen caging killed 96.8% of the mites. Comparing the amount of bees before and after treatment, Apiguard[®] treated colonies with caged queens had 48.7% fewer bees compared to before treatment, while Apiguard[®] alone reduced the

number of adult bees by 13.6%. None of the treatments in the different groups resulted in elevated queen mortality.



Figure 1. Apiguard® treatment placed on the top of brood combs, in central position.

It is important to take in account some considerations when applying these techniques:

1. to cage the queen in the lower part of the comb, distant part to the acaricide product (Fig. 2), in order to avoid queen mortality due to thymol toxicity;
2. treatment instructions should be always followed carefully in order to avoid honey bee mortality and decrease of acaricide efficacy related to temperatures. Thymol-based products have a concrete range of temperature that varies from 15°C to 30°C, with a maximum activity between 20°C and 25°C.



Figure 2. VAR-CONTROL® cage positioned in the lower part of the frame to reduce contact of the queen with the thymol vapours

References:

Giacomelli, A., Pietropaoli, M., Carvelli, A., Iaconi, F., & Formato, G. (2016). Combination of thymol treatment (Apiguard®) and caging the queen technique to fight *Varroa destructor*. *Apidologie*, 47(4):606-616.

Imdorf, A., Bogdanov, S., Ibanez, O.R., Calderone, N.W. (1999) Use of essential oils for the control of *Varroa jacobsoni* Oud. in honey bee colonies. *Apidologie* 30:209–228.

Rosenkranz, P., Aumeier, P., Ziegelmann, B. (2010) Biology and control of *Varroa destructor*. *Journal of Invertebrate Pathology* 103:96–119.