

APILIFEVAR AND APIGUARD: EVALUATION OF TWO ORGANIC TREATMENTS AGAINST VARROASIS AND ACARIOSIS OF THE HONEYBEE

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Abstract

The experiment was carried out in 2 apiaries of Havana province, with the objective of proving the effectiveness of two natural medications in the fight against bee varroasis and acariosis, illnesses caused by acari. The used products were ApiLifeVar and ApiGuard, which have their base in essential oils of grateful acaricidal effect. We had ApiLifeVar to treat 21 beehives and ApiGuard for 4, representing a total of 25 colonies. Both products were used according to the producer orientations and with an ambient temperature of 28 °C as average during the days in that it was carried out the study. We made an initial sampling and a final one (before and after the treatment) of mature bees and breeding honeycombs to determine the parasitological indexes Invasion Extensity, Infestation Rate and Invasion Intensity, this last one only in the case of Acarapis. The obtained results showed a great variation in the reductions for beehive of both products and in all the indicators, so much for Varroa as for Acarapis. When comparing the results among the apiaries for ApiLifeVar didn't found significant differences among them in the reductions of none of the indicators with a 95% trust level. The effectiveness obtained with this product for Varroa and Acarapis was 65.54% and 77.97% respectively. In ApiGuard the results showed effectiveness against Varroa of 56.33%, the one that is considered low, and against Acarapis of 27.91% what tells us that practically it didn't have effect on this agent. When comparing the two products among them, there were found significant differences for all the reductions with a 94% trust level, except in the reduction of the positive cells in Varroa, where there were no differences.

Keywords: Varroa / Acarapis / organic treatments

Introduction

Many are the illnesses that affect the honeybee *Apis mellifera* L., and nowadays the parasitic ones provoked by mites have particular importance. Among these we can find the varroasis and the acariosis, caused by the mite *Varroa* sp. (ectoparasite) and the *Acarapis woodi* Rennie (endoparasite) respectively, both very important due to their characteristics and damages incided to the inhabitants of the beehive (GONZÁLEZ et al., 1995). A lot of fighting methods have been used: chemicals, zootechnicals, biologicals and lastly under the concept of integrated fight (SAMMATARO et al., 1996). Chemicals have been, up to now, the most potent tool used, but they have inconveniences because of the residues in the apicultural products and also because mite get resistant to them (FAUCON et al., 1996). For these reasons, the use of organic compounds offers a valid option because their presence is normal in the environment of the beehive, it is harmless for human health and also doesn't leave appreciable residues, being able to integrate harmoniously with other fight means (BOGDANOV et al., 1997). The essential oils are organic compounds that have been increasing in the fight against these parasites, and for the reason that in our country the Bayvarol (flumetrina), a synthesis chemical product, has been the only one used until now, we intended as objective of this work to prove the effectiveness of the organic products APILIFEVAR and APIGUARD against the varroasis and the acariosis of the honeybees under our field conditions.

Materials and Methods

To carry out the experiment, two medications of natural origin based on essential oils were used: APILIFEVAR, an Italian product composed by Thymol, Menthol, Camphor and Eucalyptol, and the British product APIGUARD only made up by Thymol, both volatile products. We had treatment for 4 beehives with APIGUARD and for 21 beehives with APILIFEVAR.

Two apiaries of Havana province were used on the experiment, one with 16 beehives and the other one with 9 beehives. The treatment was applied in the month of April of the 2002 with an average temperature of 27.5°C following the manufacturer's instruction of using for each one, not being able to fulfill a requirement of APIGUARD that consisted in separating APIGUARD tray of the cover of the beehive at least 5 cm to guaranteeing the good volatilization of the Thymol from the gel. The samples were taken from worker's brood (of the beehives that presented breeding) and of mature bees, before and after the treatment, according to the National Veterinary Medical Institute (IMV) norms for their laboratories net. To diagnose the presence of *Varroa* in the brood, approximately 100 cells of each beehive with worker's brood were inspected by means of opening. By means of the DE JONG et al., (1982) method for the diagnosis of *Varroa* the mature bees were examined. For the diagnosis of *Acarapis* was used as method the cut of the head with exhibition of the tracheal trunks and clarification with KOH. The studied indicators were: Infestation Rate (T.I.) and Invasion Extensity (E.I.) for both parasites and Invasion Intensity (I.I.) only for *Acarapis*. To the obtained results in each indicator for each parasite the reduction percent by the following formula was calculated:

Reduction Indicator = (Initial Indicator-Final Indicator) / Initial Indicator *100

The reduction in the Infestation Rate (T.I.) represents the effectiveness of the product.

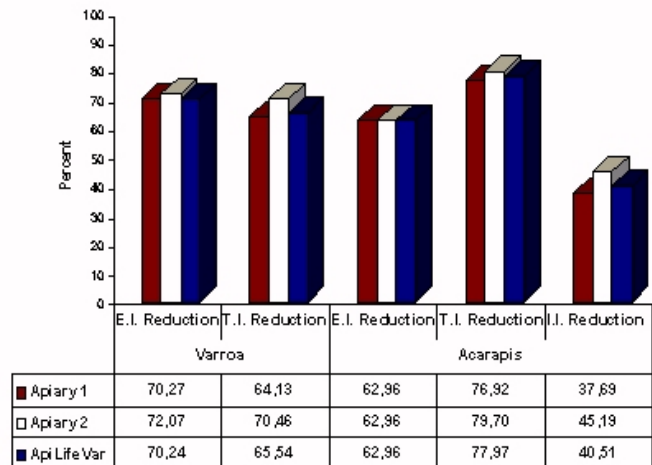
The reductions of interest obtained were compared among apiaries and among products for non parametric test with the statistical package statgraphics 3.1. The test used was Wilcoxon for comparison of means.

Results

As first result, a great variation in the reductions by beehive of all the indicators for both parasites and products was obtained.

APILIFEVAR

In Chart 1, the reduction in the different indicators is appreciated for both parasites after the employment of APILIFEVAR. On it the effects of the product in each one of the apiaries and the general effect of the treatment can be observed.



As it can be observed, the general effectiveness obtained by the product for *Varroa* was of 65.54% and for *Acarapis* of 77.97%. All the studied indicators were reduced as average in more than 60% except the Invasion Intensity that hardly surpassed their decrease a 40%. When comparing among apiaries for this product related to *Varroa*, no significant differences were found in any of the evaluated indicators with a confidence level of 95%, and with probabilities of $p = 0.721$ (E.I.) and $p = 0.928$ (T.I.). In *Acarapis* it was also determined that the significant differences didn't exist between apiaries for the studied parameters, with probability of $p = 0.825$ for the E.I., $p = 0.971$ for the T.I. and $p = 0.885$ for the I.I.

APIGUARD

Varroa destructor Anderson and Trueman

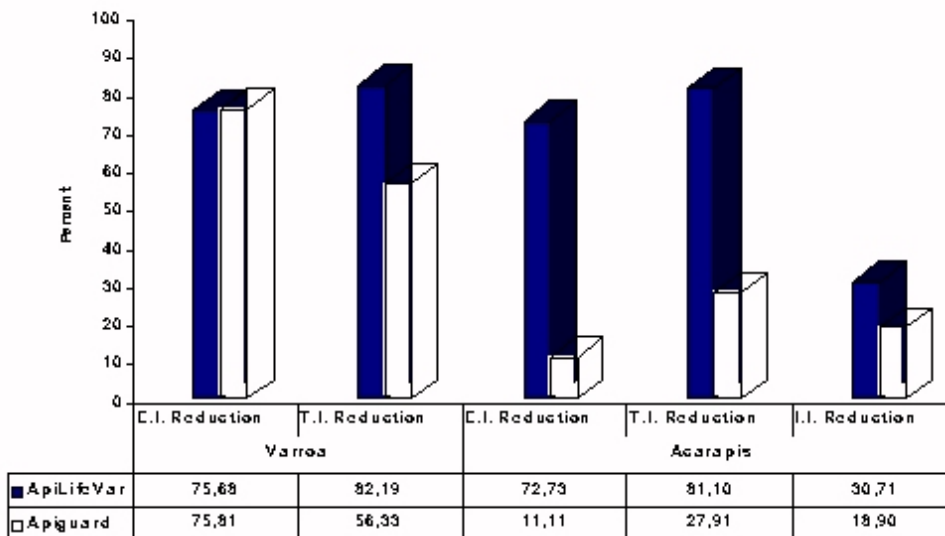
The results observed in Table I are the reductions of the different indicators obtained for APIGUARD in both parasites. In this it is possible to notice an effectiveness against *Varroa* of 56.33% and against *Acarapis* only of 27.91%. When observing these results we perceive that the indicators of *Varroa* were much more reduced than those of *Acarapis*, upon which apparently the product didn't achieve a significant effect.

Something important to keep in mind is that when returning to the beehive for the renovation of the treatment we could observe that the content of some trays remained almost intact.

	APIGUARD				
	Varroa		Acarapis		
	E.I. Reduction	T.I. Reduction	E.I. Reduction	T.I. Reduction	I.I. Reduction
Beehive 1	75,68	72,02	0,00	20,00	20,00
Beehive 2	50,00	32,50	0,00	25,00	25,00
Beehive 3	100,00	47,10	0,00	29,41	29,41
Beehive 4	71,43	53,52	33,33	33,33	0,00
APIGUARD	75,81	56,33	11,11	27,91	18,90

Comparison Between APILIFEVAR And APIGUARD

The comparison was settled down among eight beehives, four tried with APILIFEVAR and four with APIGUARD. The selection was made based on similar characteristics as quantity of storey, strength and others. The reductions of the indicators were summarized for each parasite and product in Chart 2 that it is presented next.



When carrying out the comparison significant differences were found among the products for *Varroa* for the effectiveness or T.I. but not for the E.I. with a confidence level of 94%, with probabilities of $p = 0.054$ and $p = 0.665$ respectively. As for *Acarapis* significant differences were found for the deflations in all their indicators with a 95% confidence and probabilities of $p = 0.025$ (E.I.), $p = 0.029$ (T.I.) and $p = 0.029$ (I.I.).

Discussion

The great variation of the results for beehive was observed clearly by several authors in studies made with different organic products, due to the so many factors that mediate in its detachment and dispersion in the beehive (FRILLI et al., 1992; IMDORF et al., 1995; GREGORC and JELENK, 1996, HIGES et al., 1996; CALDERONE et al., 1997). This difference it attributed to the physical conditions of the beehives where the size, the number of bodies, the integrity of the construction and the whether conditions had priority, since due to the nature of the product, it volatilizes with more or smaller speed and it can or not escape from the beehive.

In our experiment, the causes of these variations were clear due to the differences as for the conditions of the beehives and quantity of bodies in both apiaries, as well as the management conditions. In Apiary 1 the beehives were in good conditions, but they were manipulated with certain frequency because of their condition of maternal and paternal beehives of a queens' breeding centre and not being able to interrupt the work during the application of the treatment. In Apiary 2 the beehives were in not well constructive state, with holes that allowed the escape of the product and it presented beehives of two bodies that only filled with bees the inferior one, increasing the free space where the product gets lost because it doesn't get contact with the bees.

As for the effectiveness of the products we can say that the obtained values of 75.88% and 65.54% of the APILIFEVAR for *Varroa* and *Acarapis* respectively are acceptable values taking into account that they are organic products, however the obtained values for APIGUARD of 56.33% and 27.91% shows the little activity of this product for the second parasite and half effectiveness for the first one. On it several factors like the environment temperature might have influenced. According to ELLIS (2001) the range in which APILIFEVAR and APIGUARD have a good effect is among 15°C - 20°C, losing effectiveness when the external temperatures are cold since they don't allow the volatilization of the product. In our experiment the temperature was not a restrictive factor because the mean value of this parameter in the days in which the study was developed was of 27.5°C, which guarantees a good detachment of the product of the womb of the gel.

However, we find that APIGUARD didn't volatilize completely in the time of permanency inside the beehive contrary to APILIFEVAR, but not due to the temperature. This product, for the container type that contained it, should separate from the cover of the beehive at least 5 cm to allow the detachment of the product and this could not achieve. As consequence, when carrying out the change of trays at the 11th days, the content of this container remained almost intact, as a proof of the little volatilization inside the beehive. This diminished the effectiveness largely with this product so much for *Varroa* as for *Acarapis*.

Another one of the factors that might have influenced in the poor reductions found for these products was the drop initial infestation that presented the beehives since, when carrying out the final sampling, with the appearance of only a mite, the indicators were shot and they diminished the reduction percent and the effectiveness of the product.

When comparing the products significant differences were found in the effectiveness against *Varroa* with 94% confidential in favour of APILIFEVAR. This can be due to the presence of other essential oils of grateful acaricidal action like active ingredients in the product (Camphor, Menthol and Eucalyptol). The restrictive of the non separation of the cover of the beehive of APIGUARD also avoided a good volatilization of the product and was fundamental in these results. In *Acarapis*, when comparing the effectiveness, there were also significant differences among the products. These differences were in favour of the APILIFEVAR because this product presents in its womb menthol, essential oil of grateful effect against *Acarapis* (ELLIS and BAXENDALE, 1997), while the Thymol has shown diverse results in the control of this mite sometimes achieving the decrease of the infestation (MATTILA and OTIS, 1999; WHITTINGTON et al., 2000), and other times, increasing the same one (MATTILA and OTIS, 2000).

Conclusions

- The organic product APILIFEVAR is effective against *Varroa sp.* and against *Acarapis woodi* Rennie achieving values of 75.88% and 65.54% respectively that can be considered acceptable.
- The organic product APIGUARD was not effective against *Acarapis woodi* Rennie (27.91% of effectiveness) and against *Varroa sp.* it was but their effectiveness is considered low (56.33%).
- Big variations were observed among beehives as for the results of the different evaluated indicators.
- APILIFEVAR is simpler of applying than APIGUARD thus being a more advisable option that this one for the treatment of these two entities in our country.