

Research on the Use of Herbal Products in the Treatment of Varroa Infestation

Dragoş Moraru¹, Adrian Răşinar¹, Lazăr Roxana Nicoleta¹, Cimpoica Denis¹,
Silvia Pătruică¹

¹Banat's University of Agricultural Sciences and Veterinary Medicine, Faculty of Animal Science and Biotechnologies, 119, Calea Aradului, 300645, Timisoara, Romania

Abstract

Varroa destructor is a parasite that affects all stages of development of the bee colony, and currently represents one of the greatest dangers in the loss of colonies worldwide. Currently, different types of treatments have been researched and administered, both synthetic products and based on natural substances. As a result, in this study, we made a comparison between the effectiveness of two natural treatments. As a result, in this study we made a comparison between the effectiveness of two natural treatments (Thymo Varo San and Herba Strip) compared to the same number of synthetic treatments (Varachet Forte and Scabatox), all of which are used by beekeepers to control bee infestation with the mite *Varroa destructor*. The experiment was carried out in August 2021 in Caransebeş, Romania, on a number of 40 bee colonies, distributed in batches of 10 colonies for each treatment used. The results were evaluated at an interval of 1 day, respectively 7 days after administration, and the best results were recorded in the case of the treatment with Thymo Varo San.

Keywords: bees, treatment, *Varroa destructor*, varroa tester.

1. Introduction

Bees have a major role in pollination [1-3], but also in the wide variety of products used for nutritional and medicinal purposes by humans [4,5].

Currently, the increasing mortality of bee families in the European Union, but also worldwide, have resulted in increased concern of specialists to find solutions to reduce or at least stop this upward trend of loss of bee colonies, having in view the special importance of bees in the continuity of life on Earth.

In addition to the other known mortality factors of bee colonies (industrial pollution, pesticides and various types of diseases), the greatest threat is represented by the infestation with the parasitic mite *Varroa destructor* [1,6,7].

The first description of the *Varroa* mite was made in 1904 when it was described as an external parasite found on *Apis cerana* (Oudemans, 1904) [5,8]. At the beginning of the 19th century, when the productive colonies of *Apis mellifera* were brought to Asia, it marked the moment of the change of host [9], because it took advantage of the low resistance of this breed and through the increased virulence of the parasite managed to contaminate the new host [9,10]. The main factor in changing the host was the lack of a host-parasite relationship, and *Apis mellifera* bees were unable to defend, unable to take action against it [11].

After the 2000s it was proved that *Varroa* is much more than a species, being revealed different haplotypes by studying the mtDNA sequences of *Varroa*.

Other haplotypes of *Varroa destructor* and *Varroa jacobsoni* were reported in 2004 [12-14], which are directly dependent on the exposure time [15].

* Corresponding author: Moraru Dragoş,
moraru.dragos96@yahoo.com

Varroa destructor is about 1.6 mm long and has a disc-like shape (oval) and has a brown-copper or red-brown coloration [7,8,16].

Adults and young mites feed on bee haemolymph (their blood) and can survive even during the cold seasons, either on bees or brood if it exists in the bee family [7].

The reproduction of *Varroa destructor* mites takes place only at the level of the brood and prefers cells that are capped for a longer time, namely drone cells, and most of the time even two female mites emerge from these cells instead of one, as in the case of a cell of working bee brood [7,8].

As a negative effect on *Apis mellifera* it is known that *Varroa* does not intend to kill his own host but it was observed a decrease in performance during flight [17] by reducing flight period [18]; bees have an affected immune system, resulting in a shorter lifespan [19-21]. Bee colonies parasitized by *Varroa destructor* become weaker, agitated and can leave the honeycombs with brood and even the hive in case of hyperparasitism [8].

During the winter, the worker bee brood is particularly affected, and the bees in it fail to develop specific characteristics of this difficult season for the life of the colony, thus resulting in a depopulation of the bee colony due to the existence of a high percentage of mites, being a risk for its death in winter [16,19,22].

The destructive *Varroa* parasite acts as a vector and can transform and spread over 18 different types of bee colony viruses, resulting in various outbreaks that can be managed on their own by a healthy bee family, sometimes even going unnoticed by the beekeeper [17,20].

Other negative effects that have been observed at the colony level are represented by: the decrease

of the swarm production and the reduction of the population increase percentage [20].

At the level of the brood, the death of the larvae could be noticed inside the capped brood cell or after the hatching period, the deformed wing syndrome was visibly found [16]. Both conditions have as one of the main causes the contamination of bee families with *Varroa destructor*.

An anti-varroa treatment administrated in time can save the lives of thousands of bees in an infested colony, and the use of herbal or volatile herbal products [16] in the treatment of the parasite *Varroa destructor* as well as biotechnical processes can offer, in addition to their effectiveness, many other advantages, including the lack of residues in bee products after administration [23] compared to their existence in the case of chemicals [24].

2. Materials and methods

The experiments were performed in August 2021 in Caransebeş, Caraş Severin (Romania) on a number of 40 bee colonies distributed in 4 batches, of 10 bee colonies each. For each batch, the initial degree of *Varroa* mite infestation was determined using a *Varroa* tester, also called the powdered sugar test applied to a sample of 300 bees [16] and additional polypropylene textile material was placed on the bottom of the hive in order to be able to highlight the presence of the destroyed mites after the treatments.

The bee colonies were treated with two synthetic treatments (Varachet Forte and Scabatox) and with two natural products-based treatments (Thymo Varo San and Herba Strip), according to Table 1.

Table 1. Experiment organization scheme

No	Treatment type	No of bee families	Dose administrated / bee colonies
1.	Varachet Forte	10	3 drops
2.	Scabatox	10	1 ml solution
3.	Thymo Varo San	10	smoke administration for 60 seconds
4.	Herba Strip	10	1 strip

Batch 1 was administered, on a strip of paper, a solution of Varachet Forte 3 drops / bee colony with the help of a pipette, which was subsequently

ignited in the flame and introduced into a manual smoke sprayer until the strip was completely

burned. After administration, the hive was kept closed for 20 minutes.

In batch 2, each bee colony was administrated, on two strips of textile material (cotton), 7 cm long and 0.5 cm wide, soaked in 1 ml of cooking oil, 1 ml of Scabatox solution, with the help of a pipette. After application, the strips were placed above the bee colony nest and fixed with two thumbtacks. We checked that, after closing the lid, the bees had body contact with them.

Batch 3 was administered, to each bee colony, smoke, using an automatic sprayer for 60 seconds. The smoke was the result of a process of burning of a tablet of Thymo Varo San. Such a tablet can be used for about 15 bee colonies. Like the treatment applied in batch 1, the hive was kept closed for 20 minutes to increase the efficiency of the treatment.

Batch 4 was given, to each bee colony, a strip of Herba Strip strictly above the frames that made up the bee colony's nest (to provide the body-substance contact, necessary to streamline treatment). After application, it was stabilized with a thumbtack.

All products used were purchased sealed from authorized stores.

For the evaluation of the results, the *Varroa* tester was used again one day after the application of the treatments, respectively the next evaluation took place seven days after the administration.

The results obtained were statistically processed with the help of the software Minitab 21 Statistical Software.

3. Results and discussion

At the beginning of the experiment, the degree of infestation of bee colonies from the 4 batches examined by individual samples of 300 bees / colony was identified with the help of *Varroa* tester.

The data in Table 2 show the existence of a very large number of *Varroa destructor* mites, the average parasitism on each of the 4 lots exceeds 3 times the value of the maximum limit of a bee colony.

Table 2. Evolution of the number of *Varroa destructor* parasites during the experimental period (compared to 300 worker bees/test)

No.	Statistical indices	Experimental variants											
		At the beginning of the experiment				At 24 hours				At 7 days			
		L1	L2	L3	L4	L1	L2	L3	L4	L1	L2	L3	L4
1	\bar{x}	12.90	13.20	12.70	12.00	1.00	7.50	-	8.30	1.70	1.80	0.60	3.00
2	S _x	±0.433	±0.512	±0.396	±0.471	±0.365	±0.224	-	±0.153	±0.335	±0.249	±0.163	±0.258
3	s	1.370	1.619	1.252	1.491	1.155	0.707	-	0.483	1.059	0.789	0.516	0.816

- hours after administration, we found that the average of mites identified at the resumption of testing with the *Varroa* tester, was as follows:

- in batch 1, after the administration of Varachet Forte, the average parasitism was reduced from 12.9 to 1.0;
- in the case of the batch number 2, after the administration of the Scabatox product, the average parasitism was reduced from 13.3 to 7.5;
- in batch number 3, after the administration of the Thymo Varo San product, the value of the average parasitism was reduced from 12.7 to 0.0,

practically the *Varroa destructor* mites were 100% destroyed;

- in the case of the batch number 4, after the administration of the Herba Strip product, the average parasitism was reduced from 12.00 to 8.3. At 7 days after administration, we can see, in Table 2, the average of mites identified when resuming the test with the *Varroa* tester device, as follows:

- in the case of the batch number 1, there is a slight increase compared to the previous examination, respectively from the average of 1.00 (24 hours) to 1.70 (7 days), due to the only

short-time effect of the administration of treatment by smoke vapours;

- in batch number 2, after the administration of the Scabatox product, the average parasitism was reduced from 7.50 (average at 24 hours after administration) to 1.80 (average of the batch at 7 days after administration), thus being able to observe an accelerated decrease since the last test;

- in the case of the batch number 3 (lot in which the product of Thymo Varo San was administered), there was a slight increase in the degree of infestation with *Varroa destructor* mites, from 0.00 (average of the batch at 24 hours) to 0.60 (average of the batch at 7 days), due to the short-term effect of the treatment given by smoke vapours;

- in batch number 4, after the administration of Herba Strip, the average parasitism was reduced from 12.00 (average at 24 hours after administration) to 3.0 (average at 7 days after administration), due to the longer-term effect of the long strips with solutions applied to their surface.

Similar results, visible on various experimental groups, were obtained in other researches, as follows: the very good effect in destroying *Varroa* parasites obtained by the product Varachet Forte [25], and regarding the Thymo Varo San product, its profitability was mentioned in terms of the low-cost price in purchasing the treatment compared to the very good effect of destroying mites. At the same time, the emphasis is on the Thymo Varo San product, as a possible treatment option in reducing the number of mites in organic apiaries [25].

4. Conclusions

The most effective short-term treatment (24 hours) was with the product Thymo Varo San, of 100% natural plants (pine oil, thymol, eucalyptus, incense, lavender, as well as other aromatic and medicinal plants) which was effective in combating *Varroa destructor* mites in a percentage of 100%. The synthetic veterinary medical product Varachet Forte also had a very good effect, reducing the degree of parasitism from 12.90 to 1.00 within 24 hours.

During a period of 7 days, we found out the effectiveness of products with impregnated substances, applied inside the bee family, having a longer effect.

In order to treat bee families of *Varroa destructor* mite with herbal products, with maximum efficiency, it is necessary to use a treatment protocol that combines products with immediate effect together with products with a longer effect. Therefore, successive to the present experiment, the administration of Thymo Varo San with Herba Strip can be a successful 100% natural treatment.

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