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DELOVANJE ZDRAVILA VARROMED® ZA ZATIRANJE VAROJ (*Varroa destructor*) POZIMI OB UMETNI PREKINITVI ZALEGANJA V JUŽNI EVROPI

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Izvleček

Zajedavec *Varroa destructor* je eden od najpomembnejših povzročiteljev bolezni čebel (*Apis Mellifera* Linnaeus). Za njegovo zatiranje je na voljo veliko različnih učinkovin in načinov, nobeden pa ni popoln in si zato neprestano prizadevamo za učinkovitejše in za človeka, čebele ter okolje tem bolj sprejemljive načine zatiranja. Akaricide delimo v dve skupini: sintetične in akaricide na osnovi naravnih kislin ter eteričnih olj. Prvi so običajno zelo učinkoviti, vendar puščajo ostanke v vosku in medu, zajedavci pa postajajo nanje odporni. Na drugi strani pa so akaricidi, ki vsebujejo substance, ki se lahko uporabljajo v ekološkem čebelarstvu, za okolje sprejemljivejše in je tveganje za njihove ostanke manjše, vendar pa je njihova učinkovitost nižja in med čebeljimi družinami neizenačena. Od leta 2017 je v ES registrirano zdravilo VarroMed®, v katerem sta aktivni učinkovini oksalna in mravljinčna kislina. V raziskavi smo proučevali učinek zdravila VarroMed® za zimsko zatiranje varoj v Južni Evropi. Poskus smo izpeljali ob umetni prekinitvi zaleganja s priprtjem matice. Srednja vrednost učinkovitosti v skupini zdravljeni z zdravilom VarroMed® je bila 95.6%±3.5%, v kontrolni skupini pa je odpad varoj znašal 8.6%±7.3%. Rezultati kažejo visoko učinkovitost zdravila VarroMed®, ko v čebelji družini ni zalege. V nadaljevanju bo potrebno podobne študije opraviti v različnih klimatskih pogojih.

Ključne besede: zimsko zatiranje varoj, učinkovitost, VarroMed®, prekinitev zaleganja, zapiranje matice

VarroMed® PERFORMANCES IN SOUTHERN EUROPE FOR *Varroa destructor* CONTROL IN HONEYBEE (*Apis mellifera*) COLONIES DURING WINTER WITH ARTIFICIAL BROOD INTERRUPTION

Abstract

Varroa destructor is one of the most important pathogens of honeybee (*Apis Mellifera* Linnaeus). Many different compounds and techniques are used in order to control this parasite. Even though the perfect acaricide does not exist, continuative efforts are done towards more sustainable and respectful (for human, bees and the environment) products. Acaricides can be divided in two groups: synthetic acaricides and organic acaricides. Usually the first ones have a high and homogenous efficacy, but residues can be found in wax and honey. Furthermore, mite population is acquiring resistance to these chemicals. Organic compounds, on the other hand, are more environment friendly and present a low risk of residues, but their efficacy is frequently lower and more variable among colonies. VarroMed® is a varroacide product authorized in EU since 2017. The active principles are oxalic and formic acid. In this study, performances of VarroMed® were evaluated against *V. destructor* in Southern Europe. The trial was carried out in colonies after an artificial brood interruption period induced by queen caging. The mean acaricidal efficacy in the group treated with VarroMed® was 95.6%±3.5%, while the mite fall in the control group was 8.6%±7.3%. The results showed a high efficacy of VarroMed® in absence of brood. Further studies should be carried out in order to evaluate the VarroMed® performances in different climatic conditions.

Key words: winter treatment, efficacy, VarroMed®, brood interruption, queen caging

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INTRODUCTION

Varroa destructor is one of the most important pathogens of honeybee (*Apis Mellifera* Linnaeus). Many different acaricide compounds and techniques are used in order to control this parasite.

Even though the perfect acaricide does not exist, continuative efforts are done towards always more sustainable and respectful (for human, bees and the environment) products. Acaricides can be divided in two main groups: synthetic acaricides and organic acaricides (Rosenkranz et al., 2010). Usually the first have a high and homogenous efficacy, but residues can be found in wax and honey. Furthermore, resistance of the mite population to these chemicals has been reported (Milani, 1995). Organic acaricides, on the other hand, are more environmentally friendly and have a low risk of residues, but frequently their efficacy is lower and more variable among colonies.

VarroMed® (BeeVital GmbH) is a varroacide product authorized in EU since 2017. It is based on organic acids and can be used during the whole year in presence or absence of brood.

An effective way of increasing the efficacy of acaricide products is their use during a broodless period, that can be induced artificially. A summary of different techniques to have broodless colonies can be found in Box 1.

The goals of our field trial was to evaluate the performance of VarroMed® during winter in a temperate area in combination with an artificial brood interruption period.

Materials and methods

The active principles of VarroMed® are oxalic dihydrate (44mg/ml) and formic acid (5mg/ml).

In this study, performances of VarroMed® were evaluated against V. destructor in Italy, Southern Europe during January and February 2018 in central Italy.

Due to the absence of broodless conditions during winter in central Italy, an artificial brood interruption was provided by caging all the queens in VAR-CONTROL® cages 21 days before the VarroMed® treatment was performed.

We assessed the variation in colony strength in both groups by using the Liebefeld method (Delaplane et al., 2013). One group was treated with VarroMed® following the indications of the producer for winter treatment (Figure 3), and the other one was left untreated following the protocol reported in Figure 4.

The mite fall was quantified by changing the sticky sheets in the bottom board every 2-3 days during the whole period of the trial. The residual amount of mites was evaluated with a follow up treatment combining a single dose of both amitraz and fluvalinate.

Results and discussion

The mean acaricide efficacy in the treated group with VarroMed® was 96.6%±3.5% (n=9), while the mite fall in the control group was 8.6%±7.3% (n=9). There was a significant statistically difference between both groups ($p<0.0001$). The mean amount of varroa mites at the end of the treatment was 408 mites/colony.

There was no significant variation in the colony strength of the colonies (p-value (Two-tailed) = 0.689).

Temperature ranged from 0°C to 12°C and relative humidity ranged from 22% to 100%. As VarroMed® is advised at any time of the year, these conditions should be valid for the use of the product.

The high acaricidal efficacy observed in our trial (95.6%±3.5%) was similar to other acaricidal treatments in absence of brood (Rosenkranz et al., 2010). This fact could be attributed to the presence of oxalic acid in the

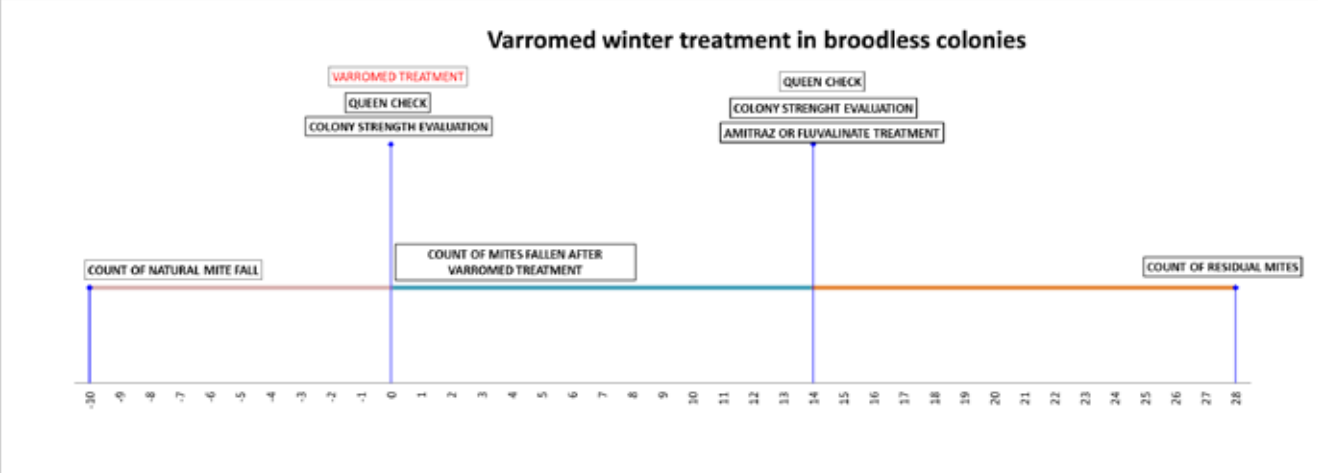

Figure 3- Protocol for the treated group

Inducing a brood interruption period into honeybee colonies forces the varroa mites to stay in the phoretic phase. This condition rends all varroa mites vulnerable to treatments with acaricide products like oxalic acid and thymol. Therefore, combining a brood interruption period with an acaricidal treatment boosts the acaricidal efficacy (until around 90% efficacy) (Rosenkranz et al., 2010; Giacomelli et al., 2016), protecting our bees from the effects of the varroa mite infestation. The brood interruption alone, as beekeeping technique, has an acaricidal efficacy that is around 40% (Giacomelli et al., 2016).

Brood interruption can be obtained by different techniques:

-Brood removal: You can remove all frames with brood making sure that the queen remains in the beehive with the majority of adult bees, then you can treat with an acaricidal product. You can form nucs with the brood frames removed and treat them with a product effective on the varroa inside the brood (e.g. formic acid based products), or you can wait until a new queen emerges and perform another treatment in absence of brood, before receptive brood is present in the nuc.

-Queen caging on a comb (Figure 1): Caging the queen on a comb will allow the queen to continue laying eggs (but only in that comb), while the rest of the brood will emerge. You should remove that comb the 20th day after the queen caging, and you should treat the

Figure 1- Queen caging in a comb with possibility of laying eggs

Figure 2- Cage with queen caged inside without possibility of laying eggs

day 21st (if there was no drone brood the 1st day) or the day 25th (if drone brood was present the 1st day) with an acaricidal product.

-Queen caging on a cage without possibility of laying eggs: Caging the queen in a cage that do not allow to lay eggs totally interrupts the presence of brood in the hive, leaving the varroa mites without a shelter and vulnerable to an acaricidal treatment. The cages used for this purpose are similar to that shown in Figure 2, that have small entrances that allow the worker bees to come and go but do not allow the queen to get out. The queen should be freed the 21st day of caging if there was no drone brood the 1st day and the 25th if there was drone brood. The acaricidal treatment should be applied the same day that the queen is freed.

Box 1- Brood interruption techniques

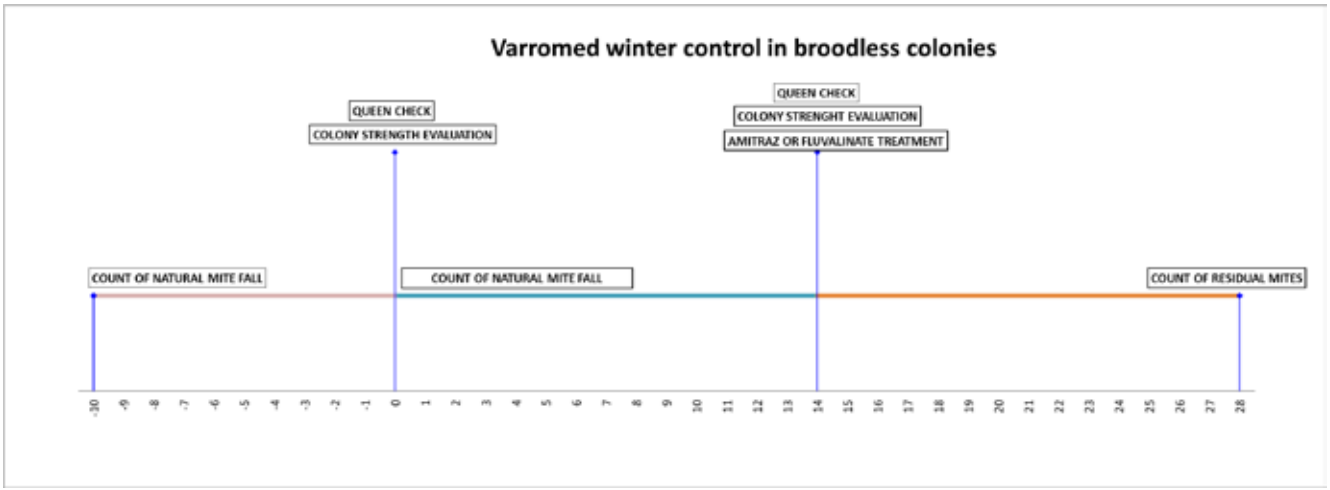

Figure 4- Protocol for the control group

product, that has been proven as an effective acaricide in absence of brood, having an efficacy above 90% (Rosenkranz et al., 2010). However, different results should be expected in a different season of the year due to the presence of brood, which is known to decrease the efficacy of oxalic acid based acaricidal treatments (Rosenkranz et al., 2010).

CONCLUSIONS

VarroMed® treatment in absence of brood is an effective acaricide against V. destructor. Broodless conditions can be naturally present in different climatic areas of Europe, and this condition could be valid to decrease the infestation level of varroa into the colonies and arrive with an acceptable amount of mites to the next productive season. Even if this condition cannot be naturally present, we verified that adopting the queen caging technique is a valid and effective way to boost the efficacy, ensuring the survival of the colonies.

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