THE VARROA DESTRUCTOR CONTROL USING A SHORT TIME TREATMENT BY BRUSHING THE CAPPED BROOD WITH VOLATILE ORGANIC ACIDS

FREQUENTLY ASKED QUESTIONS!

1) ***What is formic acid?***

Is an organic acid which is highly volatile, produced naturally by ants, *Urtica dioica*, and biodegradation processes etc.

The concentrated formic acid (usually found on market in concentrations of 65% or 85%) is a synthetic product obtained by methanol (https://fr.wikipedia.org/wiki/Acide_m%C3%A9thano%C3%AFque). It is a substance allowed, recommended and widely used in organic beekeeping in many countries. The European legislation (Council Regulation 834/2007, Regulation (EU) 2018/848 of the European Parliament) recommend the use of formic acid and some others acaricide substances without pollutant effect in varroa control.

2) ***How long does it take to treat a hive? I've got 150 hives, is this method reasonable in terms of time needed?***

Using manual brushing it takes around few minutes for a hive, depending on the quantity of brood. But we recommend to do this treatment when the beekeeper do different inspections or interventions in the brood nest. To be more efficient and to reduce strongly the mite population and the workload is important to treat only the frames with big surfaces of capped brood.

3) ***When are the best period of the season to treat?***

The treatment can be done during any intervention in the hive nest, for example:

1. Early in the spring when there are small areas of capped brood, when there are some inspections or operations for reorganizing the nest (reducing or enlargement). Preferable the treatment should be done before the beginning of drone rearing if the weather permits the interventions into the hive. From the scientific literature is known that drone brood increase faster the number of varroa population as the rate of varroa breeding is around 2.2–2.6 (the adult mated females resulted from one mother) as compared with 1.3–1.45 in worker brood.

Mention! The external temperature and humidity are not important in the treatment administration by brushing. These parameters are important when the classical treatment with formic acid are performed as they are based by evaporation of formic acid **into whole the bee colony** for a longer period (usually several days until 7-10 days). But in our case the treatment is a short treatment and focused only on bee brood – capped stage. After around 10 minutes from the moment of administration the surplus of

brushed formic acid will be evaporated and the dose of formic acid for treatment is already absorbed (evaporated) inside the cell. So, for honeybees/queen or larval brood the brushed formic acid is not harmful.
2. When the artificial swarms are established using capped brood, usually 1-3 frames of capped brood. This is important to give a clean start to the new colony, as usually a lot of varroa are taken together with this capped brood.
3. In summer, just before rearing the wintering bees, to produce winter bees under a very low infestation of varroa. This depends on region, country etc. Sometimes is good to take advantage of a honey flow (as it happens in sunflower in Romania) when the brood surface is reduced because the bees block the nest with honey and usually the beekeepers needs to create space for egg laying to obtain bees for wintering.
4. In any moment in the active season, when it is an intervention in the brood nest, even just before honey flows, as the formic acid does not contaminate the honey as well as all the other bee products.
5. Taking into consideration the 8–10-fold higher infestation rates of drone brood compared to worker brood (Rosenkrantz, 2010, Boot et al., 1995b; Calderone and Kuenen, 2001; Fuchs 1990) it is very important that treatment to be mandatory applied on all drone brood surfaces, which highly increase the efficiency of the treatment.

Being organic, the treatment does not give resistance to varroa and does not contaminate the bee products. However, to diminish the workload, the treatment decision can be done after monitoring the infestation degree at the level of apiary in a certain percentage of colonies.

To improve the time of treatment administration we developed in the last months an installation based on 2 different technical solutions to reduce the time of application, and to simplify this work. They will be published in the next period.

VERY IMPORTANT!
THE TREATED COMBS HAVE TO BE SEPARATED BY ORIGIN COLONY, FOR AROUND 10 MINUTES, IN A SEPARATED BOX, WELL VENTILATED BY SCREENED TOP AND BOTTOM BOARDS TO LET THE SURPLUS OF FORMIC ACID TO EVAPORATE. IF WE PUT THEM IMMEDIATELY INTO A HIVE, THE EVAPORATED FORMIC ACID CAN KILL BEES AND QUEENS, ESPECIALLY IF THE SURFACE OF TREATED BROOD IS HIGH.
Exceptionally, in lower concentrations and only if the treated brood surface is small and if is absolutely necessary (for example in the cases of robbing), the brushed combs can be introduced immediately in the nest, but all the bees from the nearby combs have to be shaken down inside the hive and the entrance should be opened at maximum. If the hive is equipped with varroa control bottom board it can be open around 50% to facilitate the ventilation.

The formic acid has a repellent effect and bees will run out and will come back on combs usually in the next 30 minutes after the evaporation of formic acid from the capped brood, but when putting the treated combs in contact with bees the evaporated formic acid could kill bees. The risk is greater for the nearest bees.

4) What is the exact dosage?

Being a brushing method there is no exact dosage, but we can make a similarity with painting the wood.
In our formulas, which are registered, we use especially formic acid of 65-75%, acetic acid and plants extracts in order to diminish the repellent effect, but you can use only formic acid between 65-75% with very good results. In our researches we try to reduce and test the efficiency of lower concentrations for new formulae treatment.

5) What is the impact on the colony or on the queen?

If is correctly done the treatment has no negative impact on honeybees and queens because the evaporation of the most part of formic acid is done outside the colony. When brushing the capped combs, the emerging honeybees from brood, if are directly brushed, could die. The direct contact of formic acid with any individual (bees or queen) can kill them, this is the reason why we recommend to keep the treated combs after brushing into separately boxes for around 10 minutes. Being a short time treatment, neither larval brood is affected by evaporated acid.

6) What is the ideal temperature / humidity to treat using this method?

When the temperature allows the work in the brood nest.

7) Is it necessary to treat also with oxalic acid for phoretic varroa?

To reduce the most part of the varroa population into a hive, including the phoretic mites, the beekeeper can apply a classical treatment in the same time, before, or after brushing, with a rapid effect, depending on the used product.
I order to kill also the phoretic varroa mites, a second treatment using brushing method with formic acid can be applied after 9 -12 days from the first treatment. This period is a necessary interval of time to allow entering into larval brood (before capping) the most part of phoretic varroa (foundress females).

8) How long can the brood stay apart from the hive to not be damaged?

The scientific literature (for example Ruttner F. 1980, Queen Rearing, Chapter V, subchapters 1.2.1 -1.2.2, (published by Apimondia in 6 languages, but probably it is found only in libraries or in private beekeepers collections) show a high resistance of both larval and capped brood if put outside the hive (a generally term) for a couple of hours or even more.

From our practice, to keep frames with brood in all stages for 25-30 minutes outside (not in direct sun) do not affect at all the brood.

9) More explanations can be found on the following links:

9.1. Research study on combating the Varroa destructor mite in capped brood of honeybees (*Apis mellifera*), a scientific and technic film (22 min.) in Romanian language, being also subtitled in English. The film includes a synthesis of our researches, regarding the development of new procedures for the application of new treatment formulae, to control varroosis, by interrupting the reproductive cycle of the mite in the capped brood. The film shows, beside brushing method, other 2 different treatment application procedures, as well as a series of scientific explanations, illustrated by images recorded in the apiaries and laboratory, made in full HD system and on stereo-microscope: https://www.youtube.com/watch?v=eptG6T4QnbA&t=359s

9.2. The artificial decapping of the honeybee brood in order to control the specific diseases, a scientific and technical film (23 min.) in English, performed in 1996: https://www.youtube.com/watch?v=qHq2woncbN4

Other published info, including scientific papers can be found on: http://www.icdapicultura.ro/film-cercetari-privind-combaterea-acarianului-varroa-destructor-in-puietul-capacit-la-albina-melifera-apis-mellifera/

VERY IMPORTANT!
ALL THE OPERATIONS WITH FORMIC ACID NEED SPECIFIC PROTECTION EQUIPMENT (SPECIAL MASK WITH FILTERS FOR VOLATILE ACIDS, PROTECTION GLASSES, AND GLOVES).
WE RECOMMEND ALSO TO HAVE NEARBY A RECIPIENT WITH CLEAN WATER TO WASH QUICKLY IN CASE OF DIRECT CONTACT WITH ACID.
IN ANY CASE, THE WORK PROTECTION REGULATIONS SHOULD BE KNOWN AND RESPECTED!

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