

## FACTORS CAUSING SUPPRESSION OF VARROA MITES POPULATION DEVELOPMENT IN THE "SUNNY HIVE" OF APIVOX PROJECT

In this article we examine the factors, which provide suppression of the development of Varroa mites population in a honey bee hive, at temperatures below critical for mites. Using a hive which will create conditions for the occurrence of such a factors, in particular the Solar Hive, will significantly reduce the mite load on bees, which in turn will contribute to a radical reduction in the death of bee colonies in professional and amateur apiaries.

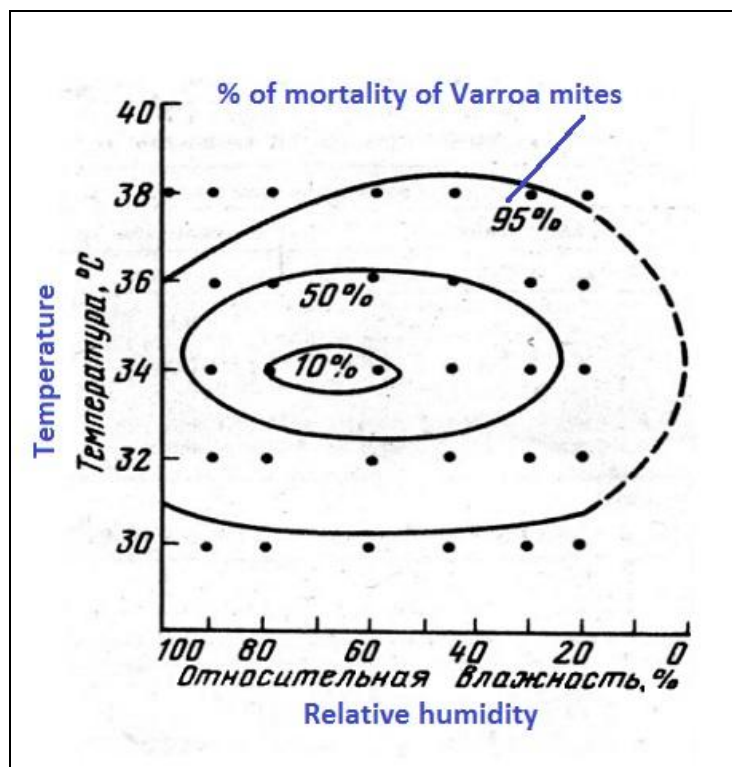
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The fight against Varroa mites is currently acquiring great importance, due to the mass death of bees in the apiaries of professionals and especially amateur beekeepers. The hive, which we present and call the Sunny Hive, bases its action on the effect of temperature impact on Varroa mites and their brood. But what is the basis of the negative impact on them? We say - temperature. But on what exactly and how does it affect? Let's consider the main factors of the effect of increased air temperature in the hive on Varroa mites and their brood.

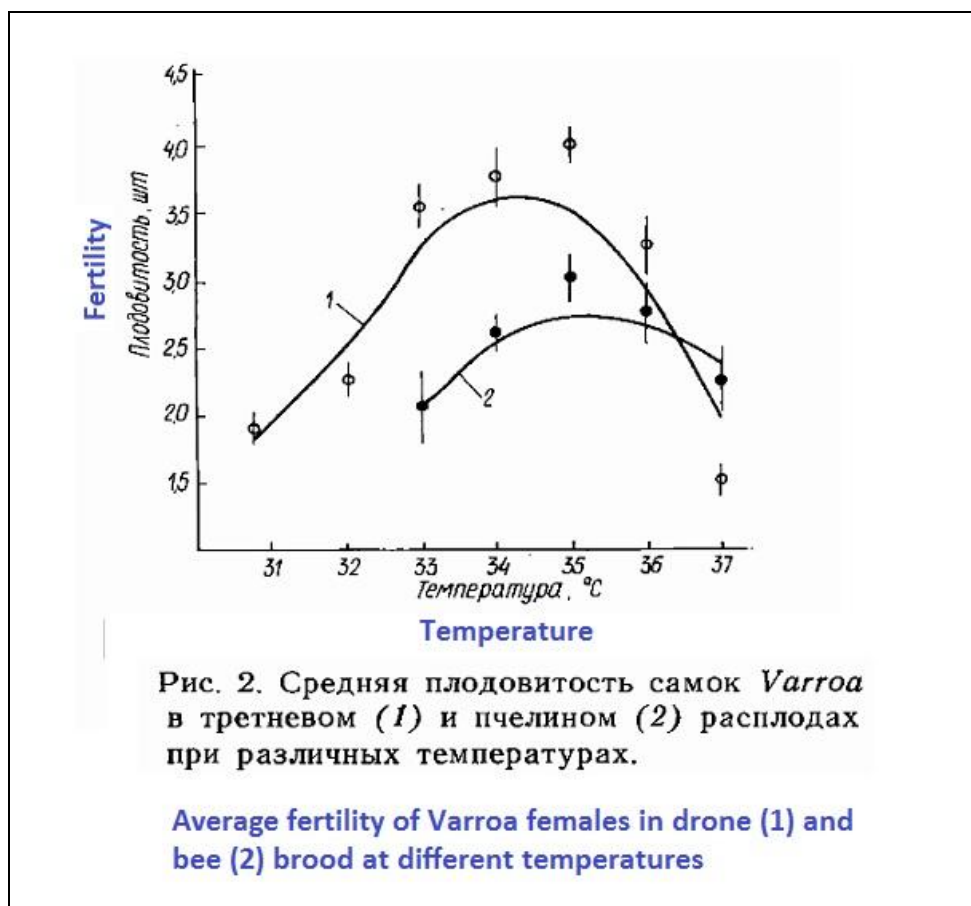
Soviet scientists Akimov and Piletskaya wrote in their work "The Effect of Temperature on the Laying and Development of Varroa Jacobsoni Eggs" (Bulletin of Zoology 1985), that an increase in temperature above the optimum for the development of Varroa mites, that is, above +36C, caused a sharp increase in the duration of the development of mite brood from eggs, and when the temperature reached +38C, the mortality rate of eggs was such high, that it was impossible to continue the experiments.

In another work on the same topic, "On the Viability of Varroa Mites", Akimov and Piletskaya found a relationship between temperature and the death of Varroa mite eggs, and displayed this relationship in the form of a perfectly understandable graph. It also clearly confirmed that when the temperature rises above +36C, the mite eggs die in ever-increasing quantities.



All this is great, but the fact is that a hive with a real bee family living in it, and especially a strong family, is very different from the laboratory conditions in which experiments are conducted. Firstly, it is not at all easy to heat the hive so that the temperature in it approaches +38C. Secondly, the process of heating is indirect - at first the air heats up and only through it the heat is transferred to the honeycombs with bee brood and mites breeding in it. This means that the heating must be long and active enough in order to warm up the honeycombs and maintain such a temperature for several hours. This is why it is so important to understand how exactly affect on Varroa mites and Varroa mites brood elevated, but not critical, temperatures during the process of warming up of the hive.

The first possible factor of temperature influence is the influence of elevated temperature on mite eggs in drone brood. As it turns out, Varroa mites that reproduce in drone brood, which they love so much, are less tolerant of high temperatures than those that reproduce in worker bee brood. High temperatures are especially destructive for mite eggs that develop in drone brood. I.V. Piletskaya in her work "Features of Varroa Jacobsoni Mite Development in Bee and Drone Brood" shows that already at a temperature of +37C, the mortality rate of viable mite eggs in drone brood is 5 times higher than in bee brood. This means that the main "accelerator" of mite population development during swarming time and after it becomes a deadly trap for them.



The second factor is that in addition to the death of eggs, the elevated temperature in drone brood is unacceptable for the female mites themselves. The same work shows that when the temperature in the brood cells approaches +37C, the fertility of the female mites drops sharply. Almost 2.5 times compared to the fertility at the optimal temperature of +34-35C.

The third factor we observed in our experimental apiary. At high temperatures in the hive, bees stop laying drone brood on the whole separate frames, as well as in the center and on the sides of the combs with worker bee brood, and lay drone cells in a thin line along the lower bar of the frames -

that is, again in the coolest place. Especially opposite the entrance. This means that mites are deprived of reproductive prospects in such a family, because drone brood is the basis for the explosive growth of the mite population, and its quantity in such a hive decreases sharply.

The fourth factor is related to the foundress females themselves. Piletskaya's research is confirmed by another Soviet scientist, A. I. Muravskaya, in her work "The Effect of Temperature and Humidity on the Mite." (Beekeeping 1984, No. 8). She shows that at a temperature of only +37C, female mites begin to have problems - egg-laying is delayed, the eggs die, but most importantly, the temperature negatively affects the foundress females in the cells of the honeycombs, especially at the beginning of reproduction. Such females died en masse already at +37C. And this mass death rate reached 85%. According to the scientist, the reason for this was a lower threshold of sensitivity to the temperature factor in female mites ready to lay an egg. This means that heating the hive and honeycombs to high temperatures actively kills female mites in the process of laying eggs. And the more often we have such an opportunity, the more the mite population in the bee colony will be suppressed.

And finally, the fifth factor that influences the suppression of Varroa mite population when warming up the hive - is one of their biological features. This feature was noted by Muravskaya in her work "Biology of Varroa Mites" (Beekeeping 1979 No. 12). This feature is that each female mite lays her first egg in the upper part of the brood cell. That is, directly under the lid. As a rule, this is an unfertilized egg from which a male should emerge. Each egg develops for about five days. And it is at this time it is mostly vulnerable. What is the secret? It is that the heating of combs occurs, as we have already said, through the air in the hive. And the first place that heats up is the lids of the cells and what is underneath them. The entire comb heats up less and longer, but the eggs of the males should perish first in such conditions. This in its turn should lead to an increase in the number of unfertilized females among those who survive and hatch from eggs after exposure to high temperatures. Naturally, this will lead to a serious failure in the reproductive process of Varroa mites, and the result of this failure will be the suppression of the development of the mite population in the bee family.

So, we have considered five factors of the effect of elevated temperature on Varroa mites in the hive, which is not absolutely critical for them, and at the same time, is quite easily achievable with a certain hive design. This suggests that the Sunny Hive has enough opportunities to actively suppress the development of Varroa mites population in a bee family living in such a hive.



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