SUCCESSFUL BEEKEEPING

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CAN YOU MAKE VARROA SICK?

Abstract:
It is not necessary eliminate 100% of the varroa mites in your hives. If you can make them sick or infertile, their population will slowly die. This method will keep your varroa level and the damage that the varroa mite can do at a threshold that will not negatively impact your hives. Biopesticides and Formic acid in low dose continuous method by MiteGone can achieve this.

BIOPESTICIDES
Biopesticides are organisms that have the ability to affect pests. The most common of these organisms are fungi. Most scientists believed that fungi can kill mites on plants only.
I hold the US 6,277,371B1 patent to using the fungus *Hirsutella thompsonii* to kill varroa mites on bees. How this fungus was discovered is an interesting story. My co-inventor, a Czech honey bee researcher Oldrich Haradzim was working in southern Slovakia on varroa infested hives in 1982. By a series of interesting coincidences. Dr. McCoy of the Citrus Research Centre in Florida developed a method of attacking the Citrus Rust Mite on orange groves using the *H. thompsonii* fungus and passed his research on to Abbott Laboratories in Chicago. Abbott Laboratories developed it into a biopesticide called MYCAR. In 1981 Abbot Labs then sent MYCAR to Dr. Veiser at the Czech Academy of Science. Dr Veiser was, at that time, considered a leading worldwide authority on insect pathology. Dr. Veiser was going to test MYCAR on mites that were damaging cherry orchards.

Before Dr. Veiser ran any tests in the Cherry Orchards, he gave a sample of MYCAR to O. Haradzim to verify that MYCAR would not harm bees as they are important pollinators of cherries. O. Haradzim took the MYCAR dust with him to Slovakia where he was working on varroa infested hives. He applied the MYCAR dust to the brood of varroa infested hives. While observing the effect of MYCAR on bees and brood in the cells (which were dusted by MYCAR before capping), he was surprised to find no mortality or damage either to brood or bees. More interestingly, he observed that in 18-day old larva infected with varroa he found only founder varroa mites but no young varroa of any kind. He repeated his tests several times and determined that something in the MYCAR dust made varroa mites infertile an unable to reproduce.

He brought his discoveries forward to the appropriate authorities, but it was 1982 and the middle of the Cold War. At the time, Czechoslovakia was under an American embargo. It was decided that while his discovery was important, buying MYCAR would be a drain on the limited amount of US dollars the country had, and the funds must be used to buy more important things.

In 1992, 10 years later, varroa mites were approaching the valley where O Haradzim had his summer home and his own bees. He told me about his discovery, and asked me to get him some MYCAR and send it to him. (As an interesting side note, it took varroa mites 10 years to migrate naturally a distance of 300 km in a country where there are no natural barriers to the varroa nor does migratory beekeeping take place. Additionally, there are villages roughly three miles apart in every direction each with honey bee hives.)

As my bees are packed for the winter by end of September, I always drove south to spend the fall in Florida. Not only did I get to enjoy the Florida sunshine but I was also able to investigate what beekeepers were doing with mites there. In 1992, on my way to Florida, armed with O. Haradzim' s story, I drove to Abbott Laboratories and found that they had discontinued their Agriculture section and had stopped making MYCAR. It took another 5 years to find the people involved in the original research and find Dr. Clay McCoy. Fortunately, Dr. McCoy found some *H. thompsonii* spores stored in his freezer and

he give them to me in 1997. I spent the eight years from 1992 to 2000 researching and documenting patentable proof that *H. thompsonii* is effective in reducing varroa mite populations in bee hives. In 1997 I established my research in Florida, and then State Apiarist Laurence Cuts arranged to have Gainesville Labs to produce *H. thompsonii* spore wash that we sprayed into the brood. While driving each fall to and from Florida, I visited research centers in Weslaco Texas, Batton Rouge Louisiana, and Tucson Arizona. The scientists in those centers became my mentors. I learned how to scientifically and statistically conduct tests, how to judge the reproduction rate of varroa, and learned many other strategies for future research. In 1999 in Florida, with David Westervelt, we for many hours were examining 18-day old honey bee larva. In our control hives, we found that 80% of the adult varroa reproduced. In the hives applied with *H. thompsonii* spore wash, only 20% of the adult varroa reproduced. You can read how to evaluate reproduction rates at:
http://www.mitegone.com/pdfpages/Varroa%20Reproductions%20Guideline.pdf

VARROA MITE REPRODUCTION GUIDELINES
Courtesy of Jeff Harris & Robert Danka USDA Honey Bee Breeding, Genetics and Physiology Lab
1157 Ben Hur Road, Baton Rouge, LA 70820

ABSTRACT: The foundress mite is reproductive if she produces 1 adult daughter and 1 adult son before the bee emerges. A mite is infertile if she produces no offspring. Adult male tan color, body is longer than wide; lower left of Picture #14. Adult female tan or light brown, body is wider than long; lower right of Picture #14. At 18 days old (black eyes), a bee pupae should have one adult daughter varroa mite if things are on schedule. You can tell the daughter is an adult if you can find her shed skin, which is triangular and mostly transparent (but with one white point, more or less).

In 1998, I was able to give vials of *H. thompsonii* and to pass on our discovery to other scientists for research. Brenda Ball in England, and Dr. Peng in California both researched and wrote papers on *H. thompsonii* In Weslaco Texas, Bill Wilson introduced me to Rosalind James who confirmed Gainesville's Nabih E El Gholl's Laboratory proofs that *H. thompsonii* will kill varroa. She also involved Lambert Kanga in the project. They all wrote papers proving that the fungi will kill the varroa. During the 1999 Apimondia Conference in Vancouver, Robert Danka arranged for me to present a slide of a varroa mite being consumed by *H. thompsonii* to the rest of the scientists.

In 2000, after 120 hive field tests in Kelowna and all of the associated costs, I had to give up. I left the research to Rosalind James and Lambert Kanga. You can read about it at:
http://www.mitegone.com/pdfpages/2002%20Kanga%20James%20Boucias%20Fungi%20Pdf%20A.pdf

Unfortunately, the manufacturing of spores and making them stable to produce a marketable and inexpensive medicine for beekeepers to use is still being worked on. In the meantime, beekeepers need to look at other alternatives.

USING LOW DOSE CONTINUOUSE RELEASE OF FORMIC ACID BY MITEGONE METHOD AND DISPENSER. US 6,837,700, B2 Patent.

Fact: Formic acid on its own does not do anything. Depending on the concentration of formic acid and the dispenser's method used, you will get either beneficial or negative side effects.

I started my battle against the mites like all others in early 1990s with the same question. What have the Europeans done to treat hives since they have had Trachea and varroa mites for so many years? Being Czech by birth I turned to my friend Oldrich Haradzim. At that time, he was the head of Bee Pathology at the Czech Bee Research Institute. He provided all literature I needed to start.

Concentration of Formic Acid - Europeans use 85% concentration of formic acid to treat their hives. Thanks to Carry Clark at the Bee Research Center in Dawson Creek Canada who researched what concentration is most effective and least harmful to honey bees. Here is what he found:

We use 65% formic acid for a number of reasons. At 72%, the molecules of water and acid evaporate at same rate. With higher concentrations, acid molecules have to evaporate first until the surface concentration reaches 72%. This high rate of acid evaporation causes harmful blasts of acid to the bees. At 65%, the molecules of water must evaporate first until the evaporating surface reaches 72%. This is gentler on the bees and does not cause harmful side effects. In the USA 95% acid is a common concentration to purchase. It needs to be diluted when treating honey bees. Stronger is not better in this case.

THERE ARE TWO BASIC DISTRIBUTION METHODS FOR FORMIC ACID.

Blast /Flash Methods - The only European dispenser to work in North American beekeeping methods was the Kramer plate. Dr. Nasr converted this product into the commercially available Miteaway. Many homemade applicators are used including folded blue shop towels, or butcher pads called mite wipes. Other flash methods spraying 30 cc or 1 oz. of acid on the bottom board were also used. All of these methods overdose the hives and rely on the bees to ventilate the hive and lower the concentration of fumes so it kills the mites but not the adult bees. These methods are outside-weather dependent and cause all of the negative side effects that you hear about.

Low Dose Continuous Release Methods - Dispensers like the Nsenhider, Propodi, and Burmister emit a steady but low dose flow of formic acid for 21 days or more and do not cause any damage to bees, brood, or queens. They are very effective at controlling mites. Unfortunately, they were all little plastic gadgets judged unusable in North American commercial beekeeping.

After researching a variety of treatment methods, I decided that I did not like the side effects of blast method treatments. I really liked how gentle low dose continuous methods were on the bees, but I could not use any of the existing dispensers in my 500-hive operation. It took two years of development to come up with dispenser that I could use in my operation. My dispenser would have to be adaptable to any size and strength of colony and not susceptible to outside weather conditions. The dispensing pads I developed do all of this because they fit vertically in bee space of the brood box where bees maintain constant brood temperature and humidity. The pad's capillary tubes hold in the liquid without dripping and gravity pulls the acid down to the evaporating surface ensuring steady evaporation. For details and answers to any question visit www.mitegone.com/ click on FAQ.

My original intent was to create a spring varroa and Tracheal mite treatment as a companion treatment to Fluvalinate in the late summer. In 1994 we made our first batch of pads and used them successfully. In 1995 a few more beekeeper friends joined me in making more pads by hand in my workshop. In 2000, our British Columbia Apiary Technician convinced me to go commercial. The method and dispenser were patented and we named it MiteGone.

By 2002, varroa mites resistant to Fluvalinate started spreading throughout British Columbia and reached my area by the summer of 2005. Knowing the origins of the other harsh chemicals used to treat the varroa, I decided to use my MiteGone treatment in late summer as well. I monitored the success of this fall treatment using drop testing before, at the first 24-48 hours, and after the treatment. For details of testing efficacy and resistance see: http://www.mitegone.com/pdfpages/Methods%20of%20Testing.pdf I used 20 hives, brought from different bee yards, into a test circle in my home wintering yard. We used the 3-5-day natural drop count using a full bottom size sticky board, covered by 1/8" screen raised 3/8" above the sticky board, and prorated this count to 24 hours. Our before treatment test drops were 10-15 mites per day. After the first 24 to 48 hours of acid treatment the drops were 20 times higher. These results were great. Our after treatment test a month later was 15-20 mites per day. This result was higher than our before treatment results. These results did not seem right. We tested the hives again before our mid-April formic treatment, using the same method, and the drops were 5 mites per day. I repeated the test for several years with the natural drop before the treatment in the spring decreasing each year. I was starting to think that the MiteGone treatment was making mites sick and then they were dying in large numbers long after treatment.

To answer my questions, I arranged for a 30-hive treatment test to be completed in Brandon Florida in October of 2007. We were recording the effects of the MiteGone treatment on varroa mites, and its reproduction, but also its effect on the small hive beetle. In this test, we placed the pads in various places in the hive. The test was scientifically and statistically correct, as treatments and controls were assigned by using a drop test counts.

After setting up the test, we went to the beekeeper's home location where he asked if we had extra pads to treat his few remaining hives. He had an extra 6 hives, 3 boxes high to treat. With so many bees per hive, I decided to use 4 MiteGone pads on each hive. When we first opened these hives, the top covers were black with beetles. When I returned 7 days later to proceed with examining 18-day old larvae that had been caped before MiteGone treatment, I found that 80% of the mites reproduced. A week later I examined another 500 cells that were caped 5 days after the MiteGone treatment was applied. I found only 20% of the mites reproduced.

Most interestingly, there were beetles in the control hives. I found only a few living beetles in the test hives after the treatment. They were hiding under the horizontally laid pads on skewers on bottom boards. To our surprise the six hives in the beekeeper's home yard had no beetles at all! The beetles had left the hives as no beetles were found. I began to wonder if MiteGone repelled the small hive beetle. Unfortunately, 2007 was the last year of testing in Florida.

During 2009 and 2010 we completed two MiteGone treatment tests each year and all of our drop tests were supervised by our local bee inspector. We tested 20 hives each year. In our August test, the mite count before treatment was 10-15 mites per day. We stopped testing after the treatment as tests in mid-April were steadily decreasing in mites found. In the spring of 2009 and 2010 our inspector found on all 20 drop boards, in the hives for 3-day drop a total of 2 mites. Statistically, this is a result of zero mites in spring. Treatment in spring even with zero mites prevents reinfestation during pollination, and keeps mites in manageable level.
Details:http://www.mitegone.com/pdfpages/HOW%20WE%20GOT%20TO%20ZERO%20MITES%20Jan.2015%20D-1%20doc.pdf

In 2011, I sold the bulk of my beekeeping operation to a young beekeeper but I kept 50 hives in my ownership, operated by the buyer in exchange for teaching him my way of beekeeping for 2 years.
In 2013, these 50 hives were returned back to me. Heading to my high 70s, I sold half of these hives to various new beekeepers and kept 24 hives. I use these remaining 24 hives as breeders of Vernon stock to keep reproducing this line of locally improved honeybees. I use these hives to run practical beekeeping courses and for queen production. From these hives I also create 120 mating nuks each year from which 24 are again selected and wintered as future breeders.

This allowed me, in 2019, to select 4 hives in late summer with highest mite drop of 15-20 mites per day to test. We did not treat these four hives with MiteGone in the fall and by the spring of 2020 they were in 20-25 mites per day range. We treated these hives with MiteGone in mid-April and I followed the test routine that was used in Brandon Florida in 2007. I was able to reproduce the results with 80% of mites reproducing before the treatment and then only 20% reproducing after the treatment was applied.

I am now 80 years old and do not have the ability to complete large scientifically and statistically correct tests and trials. I'm hopeful that a USDA Lab or University may choose to continue to study these topics. Please contact me if you would like any more information about these topics.