FOOD GRADE MINERAL OIL-THYMOL WIDEN ALTERNATIVES FOR HONEY BEE PARASITE CONTROL

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by DR. PEDRO P. RODRIGUEZ
2133 Wolfsnare Road, Virginia Beach, VA 23454
email: DronebeeR@netscape.net

C.E. HARRIS
321 London Bridge Road, Virginia Beach, VA 23454

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You must give some time to your fellow men. Even if it is a little thing do something for others - something for which you get no pay but the privilege of doing it.
Albert Schweitzer

Introduction

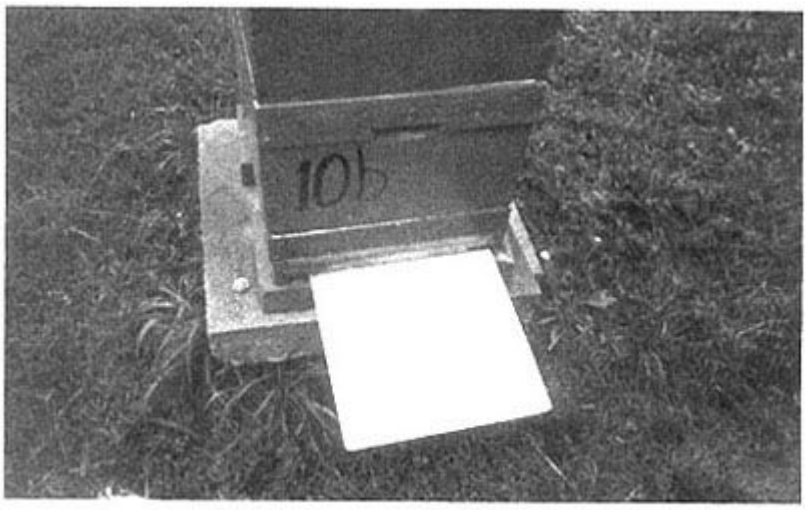
Having lost all my research hives due to aerial pesticide spray for the control of the West Nile Mosquito in the Tidewater area of Virginia, I was inclined to give up food grade mineral oil research in this area. However, continued success with food grade mineral oil (FGMO) in Spain and the added threat of yet another honey bee parasite in the United States, Small Hive Beetles, restored my desire to renew my research efforts in the Tidewater area. This trial was designed for the purposes of testing the effect of thymol, an organic plant extract, when added to FGMO in small doses. Although my own experience and anecdotal testimony from beekeepers worldwide indicate that FGMO is effective for the control of honey bee mites, my desire to use thymol comes from the fact that I continue to look for ways that will make FGMO more cost-effective and, if possible, strengthen its capacity in the control of honey bees parasites. Increased development of resistance by varroa mites to synthetic pesticides and contamination of hive products with pesticides remain a formidable challenge for investigators in search of alternative means to control honey bee parasites. Although a new substance is being introduced (thymol), it is fair to assure those who have been having success with FGMO that it continues to be as effective and the form of application remains as previously explained. To accommodate the use of thymol, slight changes have been made in the emulsion formula. (See new FGMO-Thymol formula).

FGMO stand alone fogging colonies

Because Small Hive Beetles (SHB) have a reproduction phase outside the hive, in addition to the use of thymol-FGMO formulation, I think that it might be possible to lessen their damage potential by trapping their larvae or adults during this phase. It was reasoned that reducing their numbers mechanically would contribute to managing them by effectively reducing their numbers. Trapping SHB's in their non-hive phase would reduce their numbers, lessen the cost of their management and lessen potential contamination of hive products with foreign materials utilized for treatment. Adding thymol to the FGMO formula in doses not toxic to honey bees is intended to simultaneously assay the effect of thymol, if any, on the properties of FGMO and its potential for treatment of parasitic mites and Small Hive Beetles.

Materials and Methods

Food Grade Mineral Oil (USP White mineral oil, 0.86 density), beeswax; Burgess Portable Propane Insect Fogger; honey; 6132 inch upholster's welt cord; granular thymol; 90 degrees or higher ethyl alcohol.; standard 10-frame deep hives, medium honey supers, granular sugar; 6 sugar syrup feeding glass jars; 12 screened bottom traps; field folding table; smoker; hive tool; waxed paper; beetle collection bottles; alcohol; beetle traps; bungee straps, plastic bottles, sawdust, hand-held magnifying glass; tweezers; camera; recording notebook and pencils.



Screened bottom board tray

Location

321 London Bridge Road, Virginia Beach, VA 23454

The experimental hives were arranged in two parallel rows. Six hives (Buckfast lineage) provided by my friend and research collaborator, C. E. Harris, and six hives (Italian lineage) established from new packages. The bees were housed in standard hives in a combination of six deep and medium honey supers from last year and six standard hives installed on March 29, 2003. The packages were installed with wired-frames with fresh foundation, and fed 2 quarts each of sugar syrup. Six hives were provided with permanent screened bottom boards and six hives with removable screened bottom boards. All 12 hives were provided with waxed-paper smeared with FGMO as mite traps.

Six hives were provided with six SHB traps hung from the landing board and filled with FGMO-soaked sawdust.

FGMO-soaked sawdust
small hive beetle front trap

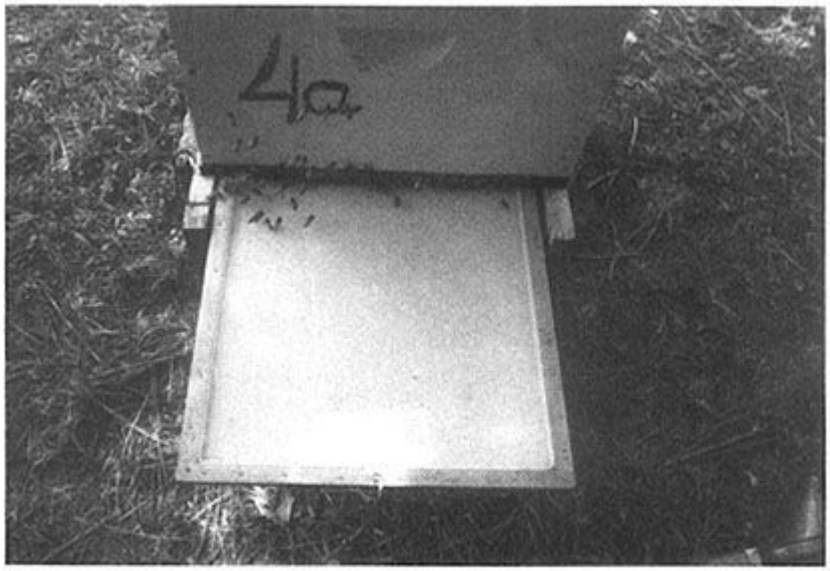
Results

a. Mites

Colonies under treatment were divided in two groups.

(1) One group with five colonies treated with FGMO fog once a week and one colony used as control.

In this group, mite drop counts have remained low (39 high; 6 low) and decreased except one colony which is queenless and has developed a very high drone population. The control colony has shown a relatively low mite drop count compared to her sisters. Higher mite drop count in treated colonies is attributed to FGMO effect.



Removable screened bottom tray

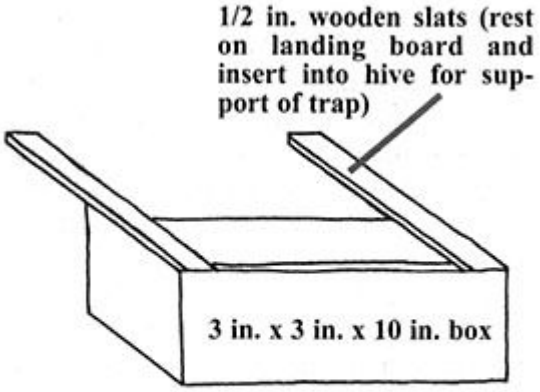
(2) Second group. Six colonies treated with FGMO/Thymol emulsion soaked cords replaced every two weeks. FGMO fog once a week. These packages arrived infested with mites and small hive beetles. After six weeks of treatment, tests have shown one mite in the mite drop
count trap. No phoretic mites and no mites in uncapped bee larvae. The colonies have rapidly developed perfect brood frames, large bee populations and are storing honey. No signs of other bee diseases have been detected during the ongoing test trial.

b. Beetles.

This experiment was designed with the expectation that the packages might be infested with small hive beetles based on information about this parasite in the region of origin of the packages.

I designed a rudimentary trap filled with sawdust soaked with FGMO to catch SHBs should they be present in the packages. The trap was hung off the landing board of the hives with the intention to catch female beetles dropping off to lay on the ground and or beetle larvae born inside the hive and headed for the ground to pupate.

As assumed, female beetles were caught in the trap in four out of the six hives fitted with the trap. Although some adult beetles were found inside the hives, frequent inspection of brood frames and inside the hives revealed a total absence of beetle larvae, contrary to reports from regions where SHB are found infesting hives. It is thought that this procedure may have removed all the beetles that came in the packages before they had time to reproduce, precluding development of beetle larvae in the hives.



FGMO soaked sawdust small hive beetle trap suspended from landing board

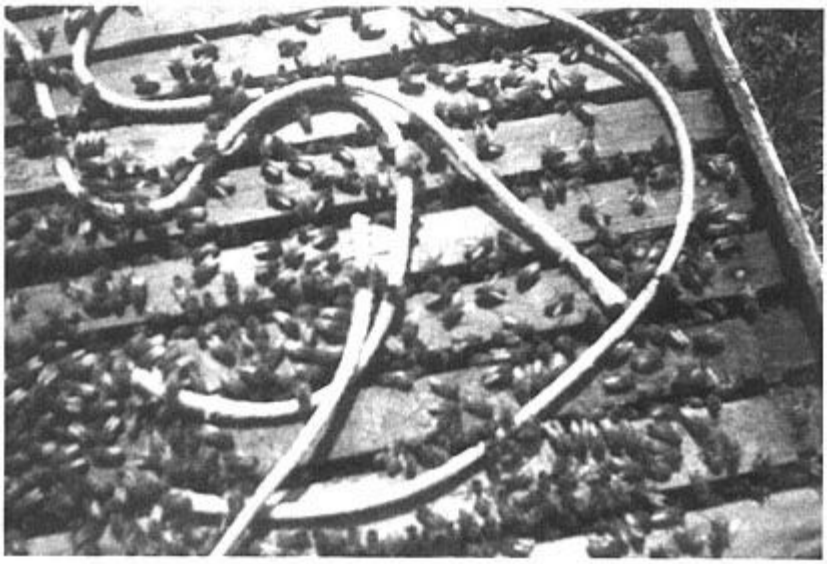
Installation of aerial traps designed for trapping yellow jackets by an FGMO collaborator in Spain yielded a very pleasant surprise, trapping hundreds of beetles. I have made slight modifications to this trap to adapt it to areas with heavy rainfall and added drone brood comb as an attractant to beetles. See accompanying diagrams of traps.

Although this trial is ongoing, findings tend to indicate that the use of thymol may have been effective in driving off the beetles and preventing them from multiplying within the hive, hence my reason for writing this article prior to finalizing the trial. If thymol is indeed effective against small hive beetles, this knowledge may be useful during this season for others who may wish to duplicate this procedure in other regions where beetles are present. Also, it may be beneficial for individual beekeepers who may wish to install these types of traps around their bee yards at a time when beetles might be abundant in their vicinity.

Discussion

Continued development of resistance of honey bee mites to synthetic pesticides, contamination of hive products with synthetic pesticides and spread of the small hive beetle in a similar pattern as varroa mites did on their arrival, has given investigators additional reasons for continued studies in search of safe, non-toxic means to add to existing tools for integrated pest management of honey bees. Most beekeepers accept with resignation that honey bee mites will be a permanent resident of our hives due to a variety of reasons (development of resistance by the mites to treatment, improper or no treatment procedures on the part of some beekeepers, repopulation via feral colonies, robbing of disease-weakened colonies at times of dearth of nectar, mite-infested worker and drone drifting, treatment failures, lowering of the bee's natural

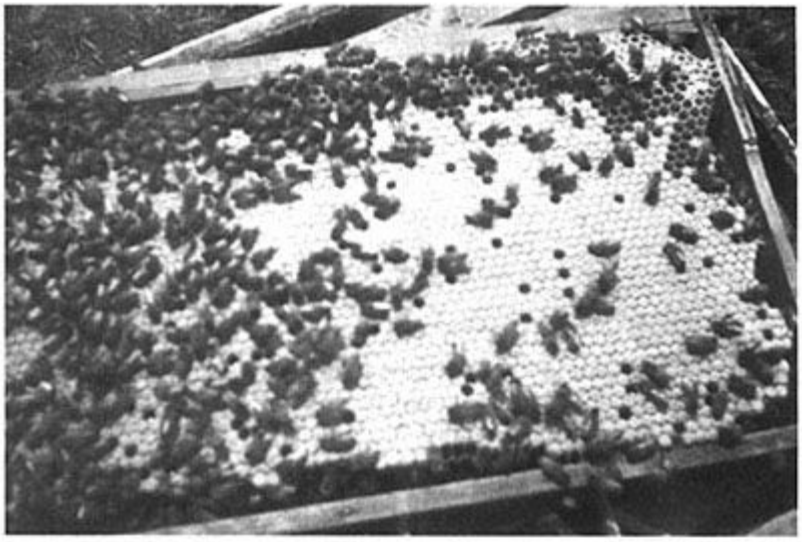
resistance due to combined affliction with other parasites and/or illnesses).



FGMO/Thymol emulsion-soaked cords

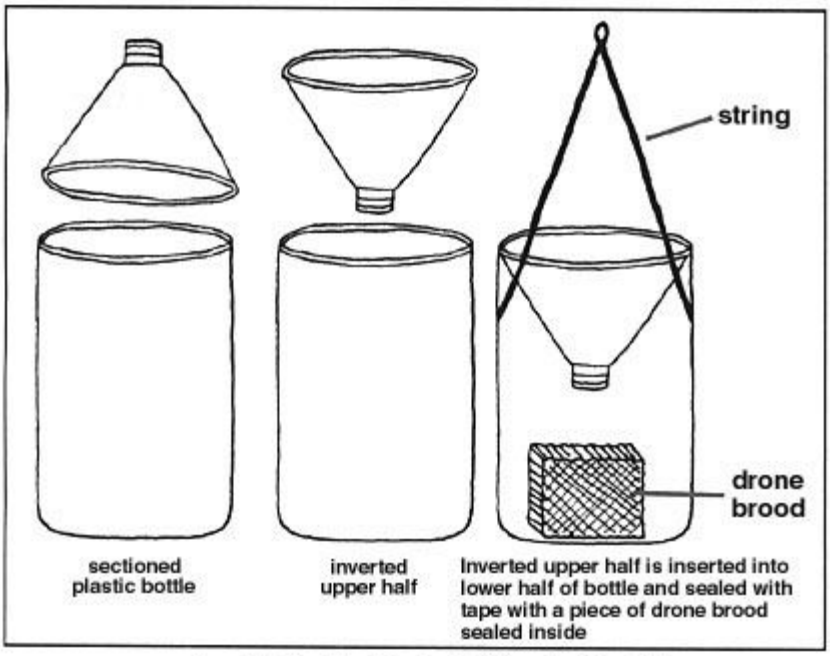
This tendency is most unfortunate because parasites stress honey bees making them dedicate more time to other functions that are not conducive to their well being and dramatically reducing their production. On the contrary, disease and parasite-free colonies thrive and harvest much higher volumes of honey as demonstrated in the experiments with FGMO previously reported. One can draw a similar pattern in beekeeping to that in animal husbandry. Contented cows produce more milk. There is no doubt that "contented" honey bees will produce more honey. Healthy honey bees react differently than if they are afflicted by illness. Hence, the reason for searching for additional ways and means to find more economic and effective means to maintain our bees in a disease-free state.

There is a common street saying, 'If it aint broke, don't fix it." FGMO is not broken. We are merely looking for ways to improve its efficacy, especially at times when new threats are lurking among our hives and there is a growing tendency to accept the practice of "management" of disease conditions as opposed to "control" of disease conditions. Management practices guarantee continuance of disease-producing factors in our hives, while control practices offer the option of maintaining a pest-free environment in our bee yards.



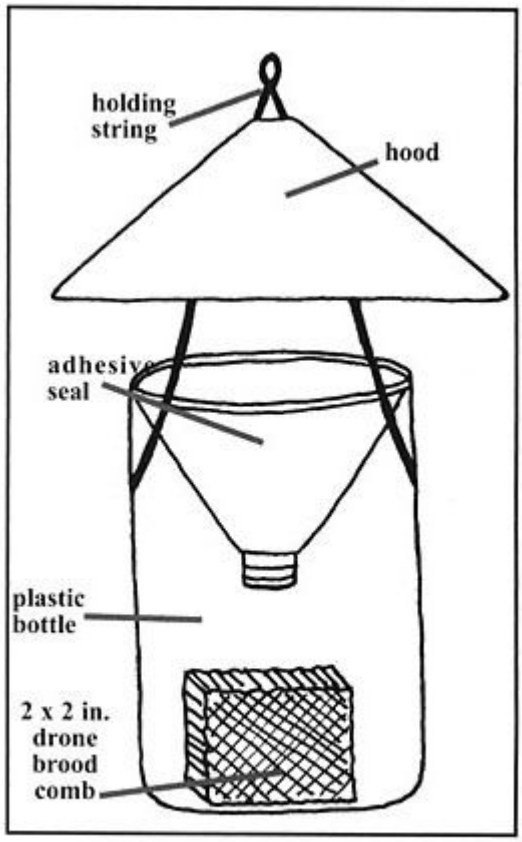
FGMO/Thymol: Varroa-free brood frame

Beekeepers need to find alternative treatments to maintain control of the diseases affecting our bees. One such new alternative is the utilization of non-synthetic miticides such as mineral oil. FGMO has three definite modes of action. It interferes with the mite's ability to breathe; it interferes with the mite's ability to cling to their meal ticket, the honey bee host; and FGMO activates the hygienic behavior of the bees soon after the bees get FGMO on their legs. When the bees' hygienic behavior is activated, the bees spread FGMO over their bodies. All races of honey bees have hygienic behavior, some more than others. It is very important to stimulate their hygienic behavior because bees with
highly developed hygienic behavior pick off mites and remove them off their bodies. Many of these mites are injured by the bees and drop off to die, while others that drop to the bottom board climb back on to the bees. Mites lose the ability to climb back on bees treated with FGMO. Mites that fall due to the action of FGMO become disabled and die before they can renew their relationship with their host. In addition, in hives provided with screened bottom boards, mites that drop off become food for ants.



Small Hive Beetle Aerial Trap built with a common plastic bottle to be hung at the bee yard.

In the new FGMO emulsion formula, there is an added bonus, the release of thymol into the hive environment. Treatments with thymol-based commercial products have resulted in variable efficacy degrees both in Europe and North America. I think that the observed variability may not be due to the properties of thymol. I tend to think that the variability may be due to the method of application, to the fact that thymol in high doses is toxic to honey bees and may cause deaths of larvae and queens. Distribution of commercial thymol-based preparations within the hive is limited by environmental conditions and bees seem reluctant to come in contact with the thymol medication dispensers. I reasoned that the bees need an enhancing mechanism, an attractant for them to visit the source of thymol and engage in the dispersion of the medication. On the contrary, I believed that adding thymol to the FGMO existing emulsion formula would not prevent honey bees from coming in contact with the medication. My experiments performed in Spain and this experiment in the USA demonstrate that bees promptly become actively engaged in removing the emulsion soaked cords because they are attracted by the honey in the formula.



Small Hive Beetle Trap to be placed in beeyard.

The concentration of thymol in the FGMO formula is a mere 3.49 per cent, a strength well tolerated by the bee population as demonstrated by perfectly uniform brood frames and rapid colony growth.

Conclusion.

As reported by several investigators, these trials demonstrate that thymol has a highly effective knock-down effect on mites. This preparation promptly reduced the mite population that came with the packages to nearly non-existent. (One dead mite in the bottom tray in one colony and zero mites in bee larvae inspected every 15 days.) In the new formulation, an enhancing effect has been added to the known properties of FGMO, while simultaneously lowering thymol's toxic potential. Utilization of beetle traps (landing board and aerial) may provide safe, economic and effective controls for small hive beetles. (See diagrams).

FGMO/thymol Formula Ingredients
1 liter FGMO
1 kilo honey
1 kilo beeswax
100 grams thymol

100 sections one meter long x 5mm each cotton cords (or 6/32 in. welt cords)
50 mls 90 degrees or higher ethyl alcohol

Preparation Instructions
- Heat FGMO in a metal or ceramic container.
- Add beeswax and stir well until wax melts.
- Remove from heat source and add honey.
- Dissolve 100 grams thymol in 50 mls of 90 or higher degree ethyl alcohol.
- Add diluted thymol to FGMO-wax-honey mixture and stir well.
- Add cotton cords, stir well, store cords in a sealed container in a cool place.