Chapter 17

Preliminary Data on Control of *Varroa jacobsoni* in the Philippines

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In the Philippines, spraying of DDT and other pesticides, heavy typhoons, the endemic mites *Varroa jacobsoni* and *Tropilaelaps clareae*, predatory birds, and lack of knowledge and training have hindered the establishment of a beekeeping industry (Cervancia, 1998). The ectoparasitic mites, *V. jacobsoni* and *T. clareae*, create difficulties in keeping *Apis mellifera*; the original hosts, *A. cerana* and *A. dorsata*, have developed a balanced host-parasite interrelation. *Varroa* mite is perceived as the most critical pest, but *T. clareae* is the more destructive. In most cases, bee diseases such as infestations with *V. jacobsoni* or *T. clareae* are first detected by the beekeeper when infestation rates have already reached destructive levels. Infested colonies show clinical symptoms of secondary infections and cause problems seen in other countries (Boecking, 1996). The impact on the growing bee industry is amplified because of lack of knowledge of control methods for most diseases.

A survey on currently existing *Varroa* control methods revealed that there is an urgent need to establish new methods, since the only available acaricide, Apistan, can only be obtained by a few beekeepers. Some beekeepers use botanicals such as leaves of neem (*Azadirachta indica*), alagaw (*Premnia odovata*), cogon (*Cylindrica emperata*) or

Biological control of *Varroa jacobsoni* in Pakistan

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The *Varroa* mite (*Varroa jacobsoni*) has long been associated with *Apis cerana* in Pakistan. However, its incidence has been negligible possibly because of natural enemies. With the introduction of *A. mellifera* in 1977, this mite became a serious pest of the newly introduced honeybee and destroyed a large number of colonies.

As a result of a survey, an anthocorid, a mirid, a reduviid and a pentatomid were found to prey on *Varroa*. Symptoms of a virus that infected this mite were also observed. However, a lack of equipment made it difficult to isolate this virus and release it on mites attacking *A. mellifera* colonies. Therefore, efforts were made to transfer the natural enemies (diseases) of this mite directly from *A. cerana* colonies to *A. mellifera* hives by keeping both honeybee species colonies side-by-side and by introducing *A. mellifera* sealed queen cells into *A. cerana* colonies in spring. Thereafter, the mite population declined to such an extent in 5–6 months that it was difficult to collect a sample of 20–30 mites in 3–5 hours. This mite, at present, is not a pest of considerable importance in Pakistan.

It seems that some natural enemies have kept the *Varroa* mite population under control in Pakistan. If potential natural enemies of the mite are isolated, evaluated, multiplied and released in *Varroa*-infested colonies of *A. mellifera* in climatically similar areas, some might prove useful.

lemon grass (*Andropogon citratus*) claiming to control mites during heavy infestation; however, their efficacy still needs to be tested (Boecking, 1996). The objective of this research is to protect the beekeeping industry from new problems that will arise from the presently used chemical control methods. Moreover, adaptation of methods originally established in other countries can only be done in the Philippines by research under local conditions.

Materials and Methods

Twenty *A. mellifera* colonies of the same size were randomly selected and grouped for replication. Initially, *Varroa* mites that fell naturally on to the bottom boards of infested hives were collected and counted over a period of 13 days at two-day intervals. Specially constructed inserts covered with a plastic screen were placed under each colony to prevent mites being cleaned out by bees. Treatments of freshly collected leaves from neem, alagaw, and cogon, and formic acid (60 %, 2 ml per comb carried on pasteboard plates), and Apistan (Fluvalinate strips) were applied twice over 23 days in February 1996. Plastic screens were fitted to the top of the frames to prevent bees from gnawing the pasteboard plates or leaves. The indigenous materials were applied following usual farmers' practice. Since formic acid should only be used below temperatures of 25°C and day temperatures reached 34°C, short-time interval treatments were tested twice during the night. Capped brood cells were opened after the second application to assess the impact of treatments. A final treatment of all colonies with Apistan was made to kill any remaining mites.

Results

The average number of dropping mites was 12 mites per day per colony (min.= 1.1 and max. = 58.2) indicating that some colonies were highly infested (Table 1). Of these dropping mites, 23.2% (n=3752) were still alive when collected.

The number of falling mites increased after the first application in colonies treated with Apistan (143.4 mites/day) and formic acid (71.8 mites/day). The results show that formic acid and Apistan affected the *Varroa* mite population. A slight increase of dropping mites can be seen after the first treatment with alagaw. Since the infestation level of experimental colonies was generally high this slight increase might range within normal variance. Therefore, indigenous materials, in the way they were applied, showed no impact on natural death rates of *Varroa*.

The final treatment of all colonies with Apistan showed the effectiveness of this acaricide. The total number of mites collected ranged from a minimum of 26 to a maximum of 2538. This experiment did not allow distinct evaluation of effectiveness of treatments used, however, the impact of formic acid is obvious. Moreover, short-time treatment of formic acid seems to be useful under local conditions in the Philippines since no queen losses or damage to brood were observed.

Large numbers of dead *T. clareae* mites were found only under colonies treated with formic acid indicating that Apistan and indigenous materials did not effect this mite. Analysing capped brood cells (n=760) in these colonies revealed that on average 12.3% of the *Varroa* mites were dead compared to 92.2% of the

Table 1. Average number of mites falling on to bottom boards before and after treatment (mites/day)

No. of colonies	3	3	3	6	2	3
Natural mite fall	6.6	24.1	22.2	11.3	14.7	2.7
Treatment	Cogon	Neem	Alagao	Formic acid	Apistan	Control
After first treatment	5.6	19.8	43.1	71.8	143.4	13.3
After second treatment	7.1	14.4	38.8	140.9	93.2	4.8
After Apistan treatment	111.7	135.0	242.7	91.1	89.7	64.4

Tropilaelaps mites. Only 3.2% of the *Varroa* mites were dead in Apistan-treated colonies, which corresponds to known natural death rates of mites in capped brood cells and shows that this chemical had no impact.

Discussion

Chemical treatments (acaricide) are used extensively in honeybee colonies to reduce damage caused by *Varroa* mite. As a consequence, sublethal residues can accumulate in beeswax and form the basis for development of resistance to these chemicals. Short-time treatments with formic acid during the night revealed promising results and correspond well with data already published (Garg *et al.*, 1984; Hoppe *et al.*, 1989). Moreover, the investigations showed that formic acid treatments against *V. jacobsoni* are also effective against *T. clareae*. Long (1998) applied 15% formic acid combined with 3 ml of oil of marjoram under Vietnamese tropical climate conditions in a long-time treatment with an average *Varroa* mite mortality of 97.98 ± 1.18 %.

These investigations using formic acid should be understood to be a first step. However, the results fit well with the demands of beekeepers in the Philippines: independence from outside resources; no residues in honey and wax; low cost; and practicality. Bee products must be of high quality without chemical residues, as a consequence any treatment must be applied during times without honey flow.

The number of mites falling from colonies treated with indigenous materials showed no differences to natural mite fall. Obviously either the indigenous material itself or the way it was applied had no impact on natural death rates of *Varroa*. Further investigations with different methods of application should follow.

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