Journal of Apicultural Research 26(1) : 64–67 (1987)

INFESTATION OF HONEYBEE (*APIS MELLIFERA*) COLONIES BY THE PARASITIC MITES *VARROA JACOBSONI* AND *TROPILAELAPS CLAREAE* IN SOUTH VIETNAM AND RESULTS OF CHEMICAL TREATMENT

J. WOYKE

FAO Representation, Hanoi, Vietnam

Revised typescript received for publication 20 May 1986

Summary

In honeybee (*Apis mellifera*) colonies examined in South Vietnam an average of 4·9% of brood cells were infested by *Varroa jacobsoni* and 46·2% by *Tropilaelaps clareae*. Average rates of infestation of adult workers were 6·3 per 100 for *V. jacobsoni* and 3·4 per 100 for *T. clareae*. Thus, despite a tenfold higher infestation of brood by *T. clareae*, infestation of adults by *V. jacobsoni* was twice as high. Amitraz was more effective than phenotiazine against both mite species, killing 95·7% of *V. jacobsoni* and 79·2% of *T. clareae* mites whereas phenotiazine killed only 57·7% of *V. jacobsoni* mites and 56·4% of *T. clareae*. Because of the low incidence of *V. jacobsoni*, mite treatment in Vietnam should be concentrated on *T. clareae* which can be controlled without medication.

Introduction

The parasitic bee mites *V. jacobsoni* and *T. clareae* are both serious problems in beekeeping with *A. mellifera* in south-east Asia (Crane, 1968). The extent of the respective losses to each of the two species is not known. *A. cerana* is the original host for *V. jacobsoni* and *A. dorsata* for *T. clareae*. After the introduction into south-east Asia of *A. mellifera*, both mite species invaded that bee (Crane, 1968). Stephen (1968) reported the presence of both in Vietnam. *V. jacobsoni* does not cause heavy losses there, but has been reported by a number of authors to do so in parts of south-east Asia. The biology and control of both mites have been reviewed by De Jong et al. (1982). In Europe various drugs are used to control *V. jacobsoni*. Satisfactory control of *T. clareae* in the presence of brood using sulphur (Atwal & Goyal, 1971), or formic acid (Rajesh et al., 1984) has been reported. Chlorbenzilate was reported by Burgett et al. (1983) to be unreliable. Woyke (1984, 1985*a*, *b*) controlled *T. clareae* without medication by depriving colonies of all brood. This procedure is not effective against *V. jacobsoni*, however. Nyein and Zmarlicki (1982) applied phenotiazine successfully against both mite species in the absence of brood. Fumigation of colonies with amitraz has been used with success for several years against *V. jacobsoni* in Poland (Romaniuk, 1982).

In the present investigation phenotiazine and amitraz were compared for their effectiveness against the two species of mite in Vietnam.

Materials and Methods

The investigation was carried out from 26 January to 2 February in the south of Vietnam, in Dong Nai province near the town of Xuan Loc, 80 km NE of Ho-Chi-Minh City.

Infestation of brood and adult bees by both species of mites was examined in six *A. mellifera* colonies. The extent of the invasion of brood was determined by removing about 150–300 sealed worker brood-cells in each colony, pulling out each larva or pupa and recording the presence or absence of mites on it and in the cell. Infestation of adult bees was determined by brushing about 250–350 bees from the brood combs of each colony into a white porcelain bowl containing hot water. The bees were stirred in the water for a while, then shaken out individually beneath the surface with the aid of forceps. The numbers of bees removed and of mites left behind in the bowl were recorded.

The six colonies used were selected at random. All occupied one-storey hives, were of similar strength and had about seven brood combs. None had received prior chemical treatment. Brood combs were removed before treating one colony (No. 57) and replaced by empty combs, but as this appeared to provide no advantage the brood was left behind during treatment of all the other colonies.

Permanent address: Bee Culture Division, Agricultural University, 02-766 Warszawa, Nowoursynowska 166, Poland.

Three colonies were treated in the daytime with phenotiazine and three with amitraz. For the former, 1·5 g of phenotiazine were placed on glowing charcoals in a smoker and the smoke was first directed into the extended spaces between the combs and beneath the partly raised top of the hive and then 30 puffs were applied through the opening (there was no inner cover). The hive was kept closed for 5 min afterwards, then the procedure was repeated twice. For the amitraz treatment 0·1 ml Taktic liquid containing 12·5% amitraz was put on a dry strip of filter paper impregnated with sodium nitrate. The strip was lit and slipped through the entrance beneath the combs. Afterwards the entrance was kept closed for 20 min.

The effectiveness of the treatments was assessed in two ways: (1) before each treatment a piece of cardboard was placed on the hive bottom beneath the combs and the mites falling on it immediately after treatment were counted and (2) numbers of mites remaining on the adult workers were determined when the treatment was finished.

A χ^2 analysis was used to determine the effect of amitraz treatment on the respective percentages of *V. jacobsoni* and *T. clareae* mites killed after applying the Bliss (arcsin) transformation. The transformed values for the two species were compared with a 1 : 1 distribution.

Results

Infestation of colonies

Examination of brood cells in the six colonies revealed only 1·4–7·2% of cells infested by *V. jacobsoni* mites, but as many as 21·1–62·0% by *T. clareae* mites (Table 1). Only in two colonies were both species of mites found together in the same cells. On the average, 0·6% of cells were invaded by both mites.

Out of the total of 1190 brood cells investigated, *V. jacobsoni* mites were found, on average, only in 4·9% of brood cells and *T. clareae* in as many as 46·2% in every colony. Thus *T. clareae* invaded almost 10 times more brood cells than *V. jacobsoni*.

According to the local beekeepers *V. jacobsoni* has been present in *A. mellifera* colonies in Vietnam for 20 years and *T. clareae* for many years in almost every colony. Similar percentages of infestation were found in 1985 in many other colonies besides the experimental ones. It can therefore be assumed that the larger differential between the two species in degree of infestation of the experimental colonies was not caused by a difference in the time of invasion.

Examination of adult bees showed an incidence of 1·3–9·5 *V. jacobsoni* mites and 0·7–6·8 *T. clareae* mites per 100 bees. Infestation of bees in individual colonies was always higher by *V. jacobsoni* than by *T. clareae* mites (Table 1). Among a total of 1755 adult bees examined, the mean infestation rate was 6·3 *V. jacobsoni* and 3·4 *T. clareae* per 100 bees.

Thus despite a rate of infestation of brood by *T. clareae* that was 10 times as high, the *V. jacobsoni* mite infested almost twice as many adult bees as *T. clareae*.

Results of treatment with chemicals

Unfortunately, the degree of infestation, before treatment, of workers in colonies treated with phenotiazine and amitraz was not uniform, although the colonies were of similar size. Adult worker infestation by *V. jacobsoni* was 2·15 times as high in colonies treated subsequently by amitraz as in those treated by phenotiazine, and infestation by *T. clareae* 3·5 times as high (Table 1).

After the colonies were treated with phenotiazine, only single mites of both species were found on the bottom board of the hive, but after amitraz treatment, about 100–300 mites of each species were found there (Table 1).

On average, 45·2 times more *V. jacobsoni* mites were found on the bottom board when amitraz was used and 17·9 times more *T. clareae* mites. Thus in ratio to infestation, 21·0 times more *V. jacobsoni* (45·2 : 2·15) were found on the bottom board after amitraz treatment than after phenotiazine treatment and 5·1 times more *T. clareae* (17·9 : 3·5).

Since the colonies were not exactly of the same size, re-examination of degree of worker infestation after treatment should be a better criterion of the effectiveness of the chemicals than the absolute number of mites fallen to the bottom of the hive.

Re-examination of the infestation of worker bees by the mites after treatment with phenotiazine showed a considerable decrease, except in one case (colony No. 57, infestation rate of 7·7 *V. jacobsoni* mites per 100 bees after treatment). It was concluded that this was

TABLE 1. Infestation of *A. mellifera* colonies in Vietnam in 1985 by *V. jacobsoni* (V) and *T. clareae* (T) mites and the results of treatment with phenotiozine (PH) and amitraz (AM). NE = numbers of brood cells or worker adults examined; infestation of brood is expressed as a percentage and infestation of adults as average number of mites found per 100 individuals sampled.

			Infestation before treatment									*Results of treatment*				
			Brood				*Adult workers*			*Mites killed*		*workers*			*% killed*	
Treatment	*Date*	*Colony no.*	*No. examined*	*V*	*T*	*V+T*	*No. examined*	*V*	*T*	*V*	*T*	*No. examined*	*V*	*T*	*V*	*T*
PH	26 Jan	57	250	6·8	62·0	0·4	336	8·0	3·0	10	12	336	7·7	1·2	3·8	60·0
	3 Feb	34	143	1·4	51·7	0	310	1·3	0·7	3	8	306	0·7	0·3	46·2	57·1
	3 Feb	44	142	5·6	21·1	0	230	2·6	0·9	2	2	246	0·8	0·4	69·2	55·6
	Total or mean		535	4·6	44·9	0·1	876	4·0	1·5	5·0	7·3	888	0·75*	0·35*	57·7*	56·4*
AM	25 Jan	25	210	5·7	48·6	0	322	7·1	4·7	120	82	284	0·4	1·1	94·4	76·6
	26 Jan	49	290	7·2	40·0	3·4	295	9·5	6·8	266	123	418	0·7	2·2	92·6	67·6
	3 Feb	21	155	2·5	53·5	0	262	9·2	4·5	292	188	364	0	0·3	100	93·3
	Total or mean		655	5·1	47·4	1·1	879	8·6	5·3	226	131	1066	0·37	1·2	95·7	79·2
	Overall total or mean		1190	4·9	46·2	0·6	1755	6·3	3·4							

*Mean of colonies 34 and 44.

owing to the different preparation of that colony before the treatment, *viz.*, that all brood combs were replaced by empty combs. This resulted in workers clustering during the treatment beneath the roof and walls of the hive. Since this result differed so much from the others, it was not included in the calculation of the averages. On average, 0·75 *V. jacobsoni* mites and 0·35 *T. clareae* mites per 100 bees were found after phenotiazine treatment and 0·37 and 1·20 respectively per 100 bees after amitraz treatment.

From the difference in the degree of infestation by mites before and after treatment in relation to the original infestation of worker bees, the effectiveness of the treatment (% of mites killed) can be obtained. Table 1 shows that on average 57·7% of *V. jacobsoni* and 56·4% of *T. clareae* mites were killed after phenotiazine treatment. Thus about 60% of the mites of both species were killed, a rather low efficiency.

Following treatment with amitraz, on average 95·7% of the *V. jacobsoni* mites and 79·2% of the *T. clarea* mites were killed. As the percentages of both mites killed by phenotiazine in each colony did not overlap with those for amitraz, significantly more mites were killed by amitraz than by phenotiazine.

The calculated χ^2 value for the comparison of transformed values of the percentages of *V. jacobsoni* and *T. clareae* killed with the 1 : 1 distribution was 5·58, whereas the tabular value was 3·84. Thus amitraz killed a significantly higher percentage of *V. jacobsoni* than of *T. clareae* mites, suggesting greater resistance of *T. clareae* to amitraz.

Discussion and Conclusions

The above results show that amitraz is more effective than phenotiazine against both species of mites.

Of course, a single treatment in the presence of brood cannot cure the colony, because it does not kill mites inside brood cells. For this the colony must be deprived of all brood, by removing it, or caging the queen for at least 21–24 days until all bees emerge (Woyke, 1985*b*).

Another consideration is the low extent of the invasion of brood by the *V. jacobsoni* mite, despite the fact that *A. mellifera* was introduced into Vietnam 24 years ago. According to other reports, invasion of *V. jacobsoni* in honeybee colonies does not increase above a few percentage points in some tropical countries (Ruttner & Marx 1984, De Jong et al., 1984). Thus in combatting mites in Vietnam attention should be concentrated on *T. clareae*. The population of that mite can be controlled without the use of any medicine (Woyke, 1984, 1985*b*).

References

Atwal, A. S.; Goyal, N. P. (1971) Infestation of honeybee colonies with *Tropilaelaps*, and its control. *J. apic. Res.* 10 : 137–142

Burgett, M.; Akratanakul, P.; Morse, R. A. (1983) *Tropilaelaps clareae*: a parasite of honeybees in south-east Asia. *Bee Wld* 64 : 25–28

Crane, E. (1968) Mites infesting honeybees in Asia. *Bee Wld* 49 : 113–114

De Jong, D.; Gonçalves, L. S.; Morse, R. A. (1984) Dependence on climate of the virulence of *Varroa jacobsoni*. Bee Wld 65 : 117–121

De Jong, D.; Morse, R. A.; Eickwort, G. C. (1982) Mite pests of honey bees. *A. Rev. Ent.* 27 : 229–252

Nyein, M. M.; Zmarlicki, C. (1982) Control of mites in European bees in Burma. *Am. Bee J.* 122 : 638–639

Rajesh, G.; Sharma, O. P.; Dogra, G. S. (1984) Formic acid: an effective acaricide against *Tropilaelaps clareae* Delfinado and Baker (Laelaptidae: Acarina) and its effect on the brood and longevity of honey bees. *Am. Bee J.* 124 : 736–738

Romaniuk, K. (1982) [Fumilat A in the control of varroasis in honeybees.] *Medycyna wet.* 39 : 340–343 *In Polish*

Ruttner, F.; Marx, H.; Marx, G. (1984) Beobachtungen über eine mogliche Anpassung von *Varroa jacobsoni* an *Apis mellifera* L. in Uruguay. *Apidologie* 15 : 43–62

Stephen, W. A. (1968) Mites: a beekeeping problem in Vietnam and India. *Bee Wld* 49 : 119–120

Woyke, J. (1984) Survival and prophylactic control of *Tropilaelaps clareae* infesting *Apis mellifera* colonies in Afghanistan. *Apidologie* 15 : 421–434

———(1985*a*) *Tropilaelaps clareae*, a serious pest of *Apis mellifera* in the tropics, but not dangerous for apiculture in temperate zones. *Am. Bee J.* 125 : 497–499

———(1985*b*) Further investigations into control of the parasitic bee mite *Tropilaelaps clareae* without medication. *J. apic. Res.* 24 : 250–254