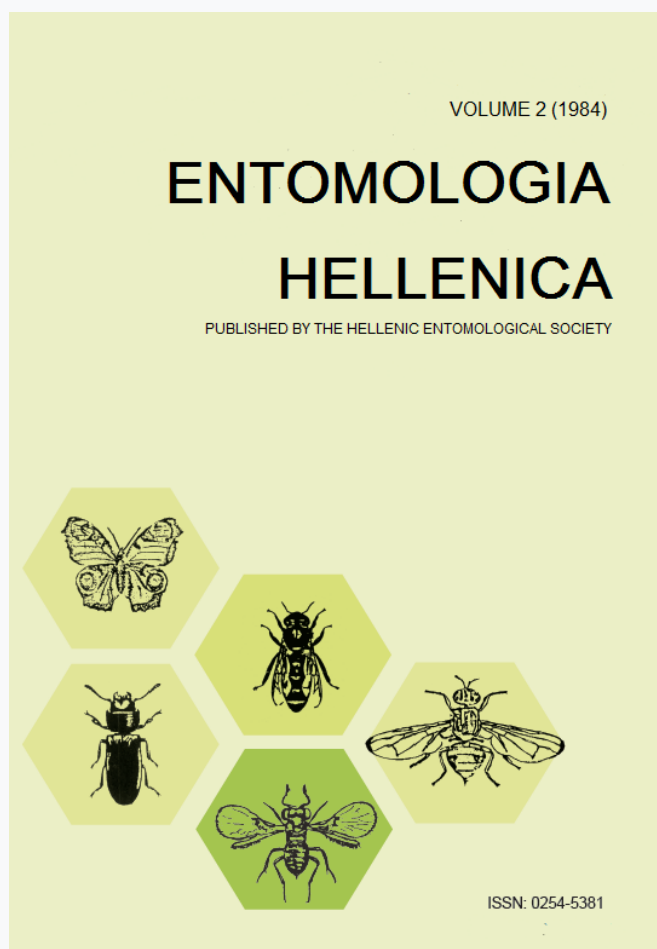


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Using Drone Brood in the Control of the Varroa Disease of Bees in Greece¹

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ABSTRACT

The use of drone brood to control the Varroa disease (*Varroa jacobsoni* Ouds) was tested in twenty bee colonies (ten as control) which had a very low *Varroa* mite infestation. The experiment started in winter 1981-82. Early in spring 1983 the brood was removed from ten hives and later during April, May and June it was replaced by drone combs (trap combs) which were also removed when drone cells were capped. The same treatment was repeated during spring 1984.

In July 31, 1984, the adult bee infestation was 0 to 7%, while the worker brood's infestation was 0 to 17%. The data show that, after two and half years without any acaricidal treatment, six out of the ten bee colonies continued to have a very low mite infestation, while three showed high infestation and had to be treated with acaricide. One of the three colonies was treated by acaricide in the winter 1983-84, that is two years from the beginning of this experiment. On the contrary, in the ten control colonies (with the same low infestation in spring 1982) the mite infestation reached catastrophic levels by August 1983.

Introduction

The possibility of using biological control agents such as parasites, viruses, bacteria and others, against the destructive mite of bees *Varroa jacobsoni* Ouds (Acarina: Varroidae) is restricted. On the other hand, biological control by means of mite predators may have little chance of success (Griffiths et al. 1984). Attempts to use other means for the suppression of the Varroa pest population have been undertaken, and in certain cases those means along with the use of chemicals gave promising results justifying future research (Grobov 1977). Thus, there have been attempts to create conditions for attracting and trapping *Varroa* mites and to establish artificially broodless periods (Grobov 1977, Toshkoff et al. 1979). These manipulations in combination with acaricidal treatment could re-

sult in a good control of the mite (Santas and Lazarakis 1984).

The mite *V. jacobsoni* reproduces exclusively on the capped brood and it prefers drone over worker brood for reproduction (Grobov 1977, Toshkoff et al. 1979). Ruttner and Koeniger (1979), and later other research workers, took this fact into consideration on their efforts to control the Varroa disease.

The use of drone brood to control the *Varroa* mite was considered important to be studied under our country's conditions also. Our research started during winter 1981 and the results of the period 1982 to August 1983 have been already published (Santas and Lazarakis 1984). In the present paper the data of 1983-84 and the conclusions of the whole experiment are given.

Materials and Methods

The experiment started in the winter of 1981-82 with twenty bee colonies (ten as control). Due to previous

¹ Received for publication December 28, 1984.

	April		May		June		July			
Bee colony	1	2	3	4	5	6	7	8	9	10
Number of drone combs in 1983	3	2	3	3	3	4	4	2	3	2
Number of drone combs in 1984	1,5	2	1,5	1	2	1	1,5	1,5	2	2

treatments with malathion dust the *Varroa* mite infestation was very low (Santas 1984, Santas and Lazarakis 1984). In December 1982, without any other treatment, nine out of the ten bee colonies (used for brood trap test) had a small rate of adult bee infestation ranging from 0.4-2.7% and only one showed a relatively high infestation of about 8.2% (Santas and Lazarakis 1984). Early in spring 1983, all drone brood from those ten bee colonies was removed and destroyed. Later on, during April, May and June,

In those periods, that is during spring and early summer 1983 and 1984, 1, 1.5, 2, 3, or 4 drone combs were used as traps as shown above.

Two methods were used for the formation of drone combs. Either an entirely empty frame was used (without any artificial comb), or a small sheet of artificial comb 1-2 cm in width had been placed through the top bar of the frame (Fig. 2). It has been observed that the combs in the second case were formed earlier than those in the first case. However,

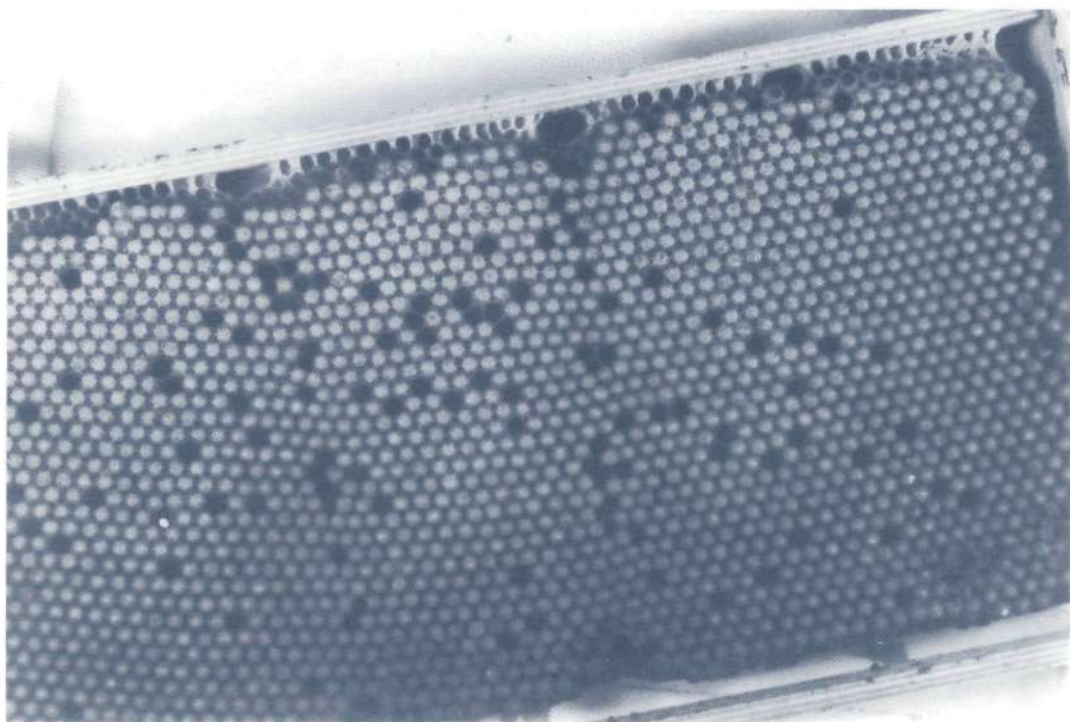


FIG. 1. Frame with capped drone brood.

drone combs (trap combs) were used. They were removed when drone cells were capped. The same treatment was repeated during spring 1984 (Fig. 1).

the section of the comb that corresponded to the sheet of the artificial comb and a little below consisted of worker cells (Fig. 3).



FIG. 2. Frame with a small piece of comb on the top bar.

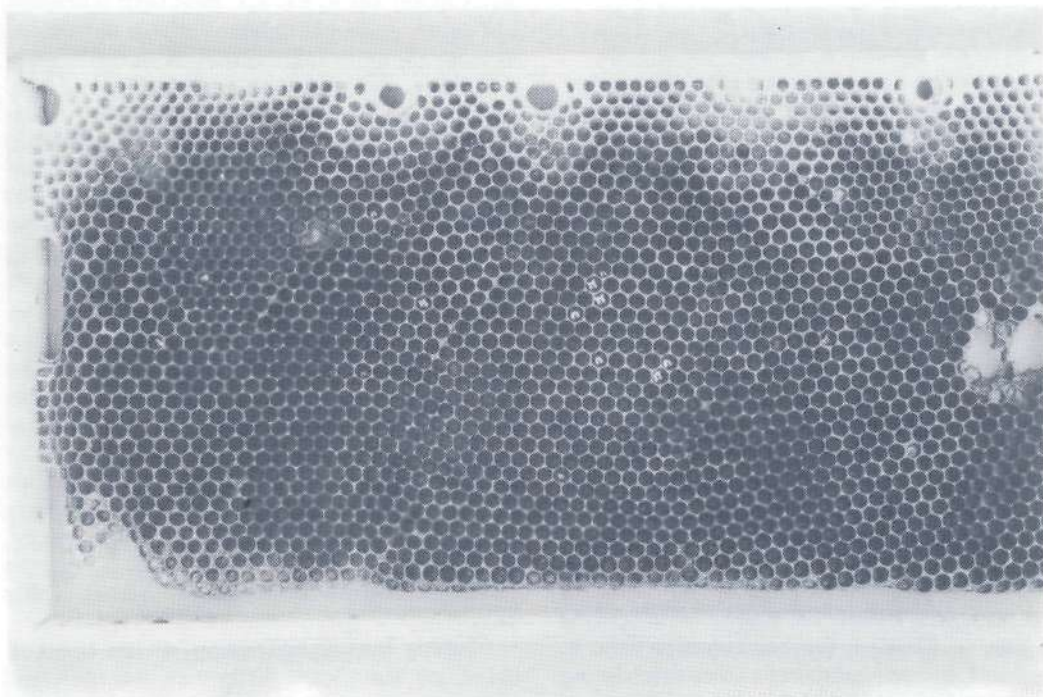


FIG. 3. A drone comb with a small area of worker comb on the top.

Results and Discussion

In July 31, 1984, the infestation by the *Varroa* mite appeared as follows: in five of the colonies (1, 2, 3, 5, 10) it was less or equal to that of August 1983, in four of them (4, 6, 8, 9) a small or large increase appeared during the same period (Table 1) and in colony 7 the infestation was so high in August 1983 that it had to be

were soon filled up with honey (4 and 6), or b) the drone combs (trap combs) worked defectively because during that period there was always scattered drone brood into the hives (Schulz et al. 1983). The second has been also observed previously (Santas and Lazarakis 1984). In addition, the bee colonies 4, 6, 8 had old queens, and bee colonies with old queens accept the drones driven out earlier in the fall

TABLE 1. Percent of *Varroa* mite infestation following drone brood removal (spring 1983 and 1984). Analysis of variance showed no significant difference in the successive dates.

	Dec. 9, 1982*	August 31, 1983*		July 31, 1984	
Bee colony	Infestation %	Infestation %	Worker brood infestation %	Infestation %	Worker brood infestation %
1	0.5	0.0(0/309)**	1.0	0.0(0/226)	0.5
2	1.4	0.4(1/274)	1.0	0.0(0/223)	0.0
3	2.7	1.6(4/258)	1.0	0.4(1/265)	0.0
4	1.8	0.0(0/312)	0.0	7.0(28/398)	17.0
5	2.4	0.0(0/295)	0.0	0.0(0/291)	0.0
6	2.1	0.0(0/246)	1.3	4.3(14/327)	9.0
7	8.2	2.9(10/345)	14.7	0.9(3/331)	0.0
8	0.4	0.6(2/355)	0.6	4.9(15/304)	12.0
9	2.2	0.0(0/209)	1.1	2.0(8/391)	1.0
10	1.2	2.8(9/320)	2.8	0.0(0/330)	0.0

* Data from Santas and Lazarakis (1984).

** In parenthesis, mites/bees in the sample.

treated with Asuntol during winter 1983-84 (Santas and Lazarakis 1984, Santas et al. 1984). In three out of the four bee colonies where increase of infestation was observed (4, 6, 8), the infestation was so high (Table 1) that had to be treated with acaricide. On the contrary, the bee colony 9 had a low bee and brood infestation (2 and 1%, respectively) and it would be active and reproductive for a long time.

The small or large increase of infestation which was observed in the four colonies could be attributed to factors probably connected to the physical condition of the queens, as it has been noted previously (Santas and Lazarakis 1984), or to random distribution of mites. It could be also attributed to the fact that some drone comb traps were used by the bees for other purposes, mainly for storing honey during that period. Thus, in the bee colonies 4, 6, 8, only 1 to 1.5 drone comb traps were used during spring 1984. This could be attributed to two causes: a) either in this period the drone combs

from bee colonies with young queens. Thus, in those colonies an increased *Varroa* mite infestation would be justified in that period (Knobelspies 1984). This proved to be true because in a check made in winter 1984 (24.2.84) an increased infestation was observed in the bee colonies 4, 6 and 8.

Moreover the degree of the mite preference to drone over worker brood is not always the same, and this of course influences the success of the drone brood trap method. According to our observations during 1983, this degree of mite preference was so high that in one bee colony no infestation in worker brood but 11% in drone brood was observed. On the average, however, the preference was 2.1-5.7. It seems that the season influences this preference (Table 2).

Taking into consideration all ten bee colonies, no significant difference was detected after treatment until July 31, 1984 (Table 1). In July 31, 1984, the adult bee infestation in the ten

TABLE 2. Percentage of *Varroa* mite infestation on worker and drone brood during spring and summer 1983.

Bee colony	April 4, 1983		May 20, 1983		June 20, 1983	
	Worker brood	Drone brood	Worker brood	Drone brood	Worker brood	Drone brood
1	0.0	1.0	0.5	3.0	0.0	1.0
2	3.0	2.0	0.0	1.5	0.0	2.0
3	2.0	6.0	2.0	8.7	0.5	3.5
4	1.0	4.0	1.0	2.0	0.0	0.0
5	5.0	6.0	0.0	0.0	—*	—
6	1.0	4.3	1.0	5.0	0.0	0.9
7	6.0	9.0	1.0	6.0	4.2	8.5
8	4.0	5.0	0.0	1.0	—	—
9	0.0	8.0	—	—	0.0	11.0
10	3.0	6.7	0.0	1.0	—	—
Mean	2.5	5.2	0.6	3.1	0.7	3.8
$5.2/2.5 = 2.1$ $3.1/0.6 = 5.2$ $3.8/0.7 = 5.4$						

* No brood was found.

colonies was 0 to 7%, while the worker brood's infestation was 0 to 17% (Table 1). The data show that, after two and half years without any acaricidal treatment, six out of the ten bee colonies, that is 60%, continued having a very low mite infestation. Three bee colonies showed high infestation and were treated by acaricide in winter 1984-85, that is three years from the beginning of this experiment (winter 1981-82). On the contrary, in the ten control bee colonies, with the same initial infestation in spring 1982, the mite infestation reached a catastrophic level in August 1983.

From the data obtained in this work, it seems that the Varroa disease may be kept under control by means of drone brood trap in colonies with low initial infestation. This agrees with the results of a similar research carried out in W. Germany (Schulz et al. 1983). Summarising, it appears that in bee colonies with low initial infestation (either because the disease is at an early stage or because of intensive treatment by acaricide), the drone comb trap method can delay the progress of the Varroa disease.

Acknowledgment

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KEY WORDS: Honeybee, *Apis mellifera*, *Varroa jacobsoni*, Varroa disease, Worker brood, Drone brood, Broodless period, Bee colony, Drone comb

Η Χρησιμοποίηση του Κηφηνογόνου στον Έλεγχο της Βαρροϊκής Ακαρίωσης των Μελισσών στην Ελλάδα

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ΠΕΡΙΛΗΨΗ

Η εργασία αυτή άρχισε το χειμώνα του 1981-82 και χρησιμοποιήθηκαν για το σκοπό αυτό είκοσι μελισσοσμήνη (δέκα σαν μάρτυρας). Στα μελισσοσμήνη αυτά έγινε μια εντατική θεραπεία με σκονίσματα μαλαθείου στη διάρκεια του ανωτέρω χειμώνα, με αποτέλεσμα η προσβολή των από το άκαρι σχεδόν να μηδενισθεί. Το Δεκέμβριο του 1982, χωρίς να μεσολαβήσει κάποια άλλη θεραπευτική αγωγή, τα δέκα μελισσοσμήνη που θα γινόταν ο πειραματισμός παρουσίαζαν μια μικρή προσβολή στις μέλισσες σε ποσοστό που κυμαίνονταν από 0,4-2,7% και μόνο μια κυψέλη είχε μια σχετικά μεγάλη προσβολή 8,2%.

Την άνοιξη του 1983 κατ' αρχάς αφαιρέθηκε και καταστράφηκε ο φυσικός κηφηνογόνος και στη συνέχεια στους μήνες Απρίλιο, Μάιο, Ιούνιο αφαιρούνταν μετά από 20-25 ημέρες οι κηφηνοκηρήθρες που κτίστηκαν ή οι κτισμένες οι οποίες και ξανατοποθετούνταν. Το ίδιο επαναλήφθηκε και την άνοιξη του 1984. Στο χρονικό διάστημα που κάλυπτε την άνοιξη και μέρος του θέρους του 1983 και 1984 χρησιμοποιήθηκαν από τα μελισσοσμήνη και συνεπώς λειτούργησαν σαν παγίδες, σε μερικά 1, σ' άλλα 1,5 ή 2 ή 3 και σε ορισμένα 4 κηφηνοκηρήθρες.

Στις 31.7.84 η προσβολή στις μέλισσες κυμαίνονταν από 0-7% ενώ στον εργατικό γόνο από 0-17%. Από τις ενδείξεις αυτές διαφαίνεται ότι από τα 10 μελισσοσμήνη που χρησιμοποιήθηκαν στην ερευνητική αυτή εργασία και πού άρχισε τον χειμώνα του 1981-82, τα 6, δηλαδή το 60%, ύστερα από 2½ σχεδόν χρόνια από την καταπολέμηση παρουσίαζαν ακόμη μια πολύ χαμηλή προσβολή έτσι ώστε αυτά να είναι παραγωγικά ακόμη για μεγάλο χρονικό διάστημα. Στο ένα χρειάστηκε να γίνει καταπολέμηση το χειμώνα 1983-84, δηλαδή μετά από 2 χρόνια, και στα υπόλοιπα 3 το χειμώνα 1984-85, δηλαδή μετά από 3 χρόνια. Αντίθετα, τα δέκα μελισσοσμήνη που χρησιμοποιήθηκαν σαν μάρτυρας και στα οποία δεν έγινε καμιά θεραπευτική αγωγή, η προσβολή τους από το άκαρι τον Αύγουστο του 1983 έφθασε στα όρια της καταστροφής.

Από τα ερευνητικά δεδομένα αυτής της εργασίας διαφαίνεται ότι μπορεί να γίνει έλεγχος της Βαρροϊκής ακαρίωσης με τη χρησιμοποίηση του κηφηνογόνου σε μελισσοσμήνη με μικρή αρχική προσβολή.