

VARROA MITE INFESTATION IN APIARIES OF DUHOK PROVINCE, KURDISTAN REGION, IRAQ

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ABSTRACT: Although *Varroa* mite infestation of honey bee is widespread throughout the world but data about the level of infestation in the bees of our area are inadequate. Therefore the present study was carried out to determine *Varroa* mite infestation level in the apiaries of Duhok Province, Kurdistan Region of Iraq. A total of 500 samples of adult honey bee workers from more than twenty separated apiaries were collected from August to the end of October, 2013. Capped brood from five apiaries were examined in which drone pupae were collected in early summer, 2013, while worker pupae samples were collected from August to the end of October, 2013. Sticky Boards without acaricide and with three different acaricides namely Apistan, Chekmite + and Wangs were used in three apiaries. *Varroa* mite infestation level was 33% in adult workers. High levels of *Varroa* mite infestation were recorded in drone pupae samples in which the highest level was 65% in apiary A3, while the lowest level was 36% in apiary A4. *Varroa* mite infestation occurred in the worker pupae from all tested apiaries in which the highest level was 34% in apiary A5 and the lowest level was 20% in apiary A3. The number of naturally felled down mites were low in the first week in all apiaries but increased after six weeks of the study. The number of felled down mites in the first week was the highest 220 felled down female mites per colony with acaricide Wangs.

KEY WORDS: *Varroa* mite, honey bees

INTRODUCTION

The mite *Varroa destructor* Anderson is the species of ecto-parasitic mites (Acari: Varroidae) that causes serious disease (Varroosis) of larvae, pupae and adults of honey bee *Apis mellifera* L. The mite is also known to transfer pathogenic viruses into the bee (Allen et al. 1986) and is suspected to be one of the agents causing colony collapse disorder (Borrello et al. 2009). Currently, the disease represents one of the most important problems of the world beekeeping and is attributed by the International Epizootic Bureau to the list 'B' of quarantine diseases of bees along with American foulbrood and Acariosis. Therefore, Varroosis must be regularly controlled to predict colony loss (Dobrynin et al. 2013). The hemophagous honey bee mite *Varroa destructor* is still the greatest threat for apiculture. No other pathogen has had a comparable impact on both beekeeping and honey bee research during the long history of apiculture. *Varroa* mites have affected the apiculture industry negatively in every country that it has been introduced. Accurate estimates of the effect of *Varroa* on the apiculture industry are hard to find, but is safe to assume that the mites have killed thousands of colonies worldwide; *Varroa* mites also have affected the feral (wild) population of bees in many areas. Since feral colonies were not managed for *Varroa* mites and the colonies were left unprotected, the loss of feral colonies quickly resulted as *Varroa* continued to spread. This external parasite feeds on the hemolymph of adult bees, larvae, and

pupae. Heavy parasitism results in heavy bee mortality and subsequent weakening of the colony and can lead to colony death (Webster and Delaplane 2001).

The mite *Varroa destructor* can be found on adult bees, on the brood, and in hive debris. The adult female mite is oval and flat, about 1.1 mm long, 1.5 mm wide, and pale to reddish brown; it can easily be seen with the unaided eye. Because the mites attach to the adult bee between the abdominal segments or between body regions (head, thorax, abdomen), they are difficult to detect. However, they can be easily seen against the white surface of pupae. Male mites are considerably smaller, are pale to light tan, and are rarely encountered (Delfinado-Baker 1984).

Varroa mite infestation was first detected in Iraq in the mid 1980s (FAO). Many beekeepers, particularly those with traditional hives lost almost all their colonies. In 1990, *Varroa* mite was reported in all Arab countries (Haddad 2011). Although different kinds of acaricides from various sources were used by beekeepers but still remains threat to the bee hives of the area. Domestic apiculture industry was destroyed during gulf war only feral colonies existed in the mountains. After 1991 beekeeping process began again and a large number of infested honey bee colonies were illegally imported from neighboring countries.

Identification of the agent can be made by the clinical signs of Varroosis which can only be rec-

ognized at a late stage of infestation, so that diagnosis entails the examination of the hive debris. The earliest and most precise diagnosis can be made only after the application of a medication that forces the mites to drop off from the bees or to kill them directly. Larger amounts of debris can be examined using a flotation procedure. Bees are washed in petroleum spirit, alcohol or detergent solution. However, this method is less accurate due to the unequal distribution of mites and the usually small sample sizes (OIE Terrestrial Manual, 2008). *Varroa* mites are difficult to detect within a colony, because mites either are hidden within capped cells or difficult to detect between overlapping sternites on the abdomen of adult bees. Thus beekeepers and scientists have been working to develop accurate and easy methods of predicting mite levels in colonies using various sampling techniques.

Three basic methods have been developed for detection of *Varroa* mite infestation level in honey bee colonies. The first method is wash technique by using different solutions like ether (Shabanov et al. 1980), ethanol (De Jong et al. 1982) after collecting of adult bees from a colony then removal of the mites. The second method of sampling is the direct examination of brood (Fries et al. 1991). The third most commonly used method of sampling is the examination of hive debris for mites on the bottom boards (Tewarson et al. 1992). A sticky adhesive is applied to the cardboard to prevent living mites from leaving the debris and re-connecting to a passing bee. These "sticky boards" can be enhanced by adding acaricides to the colonies to increase the number of mites that fall down from the bees (Devlin 2001).

In spite of widespread of *Varroa* mite in the bees of the area but data are poor about the level of infestation in the apiaries of the region, therefore the aim of the present study is to determine the level of *Varroa* mite infestation in the apiaries of Duhok Province, Northern of Iraq.

MATERIALS AND METHODS

Adult worker collection

A total of 500 samples (adult workers) from twenty separated apiaries of Duhok Province were collected from August to the end of October, 2013. Adult bees (samples) were taken from both sides of three uncapped brood combs of five colonies in each apiary. Collected bee samples were kept individually in eppendorf tubes containing 30% ethanol then the number of mites on the individual worker was counted.

Brood Sampling

Drone brood and worker brood

To obtain the level of infection, drone brood collected in early summer were examined, otherwise worker brood collected during August, September and October were examined. In each apiary, sealed brood combs (15 cm × 10 cm pieces) were collected from August to the end of October, 2013 from five separated apiaries. All brood samples were individually kept in eppendorf tubes containing 30% alcohol then carefully examined under binocular microscope. Empty brood cells (after brood removing) were observed using an appropriate source of light and the numbers of mites were counted. It is worth to mention that honey bee brood production in our area starts from the beginning of April to the end of October.

Sticky-Board without acaricides (natural fall down of the mites)

Naturally felled down *Varroa* mites were recorded for six weeks using IPM sticky board with five colonies in three separated apiaries (A1, A2, and A3). The distance among these apiaries was not less than fifteen kilometers. In each apiary five untreated colonies were tested weekly for six weeks starting from the last week of September. A sticky board is placed below a screen mesh (3 mm × 3 mm) allowing for daily or weekly counting of *Varroa* mite.

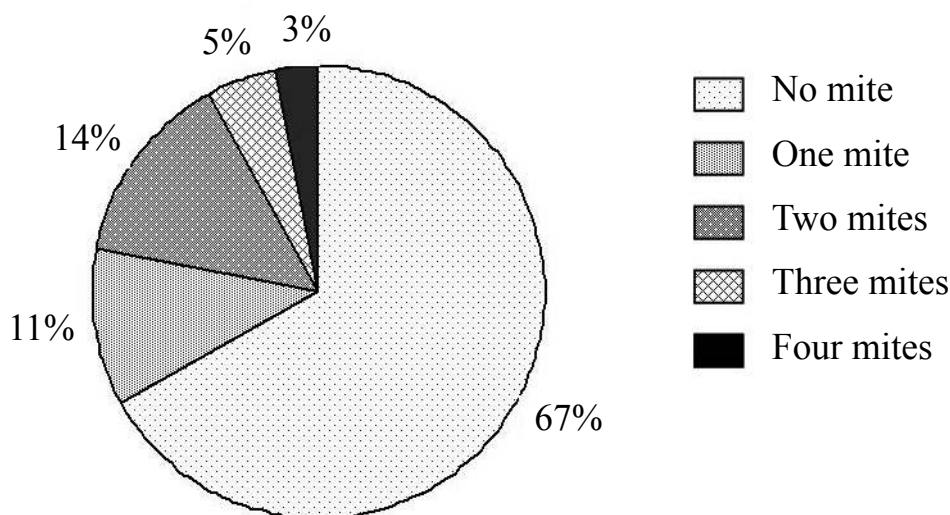
Sticky-Board with acaricides

Five colonies from three separated apiaries were treated with Apistan strips, Check mite+ strips and Wangs (Ziyang Bee medicine Factory, Sichuan, China) for six weeks. Dropped mites were recorded daily as a method of predicting the mite population.

RESULTS

From the total number of examined adult workers 33% were infested while 67% were non-infested with *Varroa* mites. Among the infested workers the number of *Varroa* mites on their bodies was 4, 3, 2 and 1 in 3%, 5%, 14% and 11% respectively (Fig. 1).

Table 1 shows the percentage of drone pupae infested with *Varroa* mites collected in early summer from five different apiaries. All apiaries were infested with *Varroa* mite in which the highest percentage (65%) was found in samples collected from Apiary A3 followed by Apiary (A5) with 60%, while the lowest percentage was 36% in apiary A4.

Fig. 1. *Varroa* mite infestation in adult bee workers.Table 1.
Varroa mite infestation in drone pupae.

Apiaries	% of drone pupae infested with mites					% of infested brood
	No mite	1 mite	2 mites	3 mites	4 mites	
A1	56	15	7	14	8	44
A2	42	3	28	17	0	48
A3	35	10	23	10	22	65
A4	66	7	0	22	5	36
A5	40	24	18	7	11	60

Table 2.
Varroa mite infestation in worker pupae.

Apiaries	% of worker pupae infested with mites					% of infested brood
	No mite	1 mite	2 mites	3 mites	4 mites	
A1	67	6	15	12	0.00	33
A2	72	15	0	9	4	28
A3	80	6	14	0	0	20
A4	75	0	11	14	0	25
A5	66	8	13	7	6	34

Table 2 shows the percentage of worker pupae infested with *Varroa* mites collected from August to the end of October, 2013 from five different apiaries. *Varroa* mites were found in all apiaries with highest percentage 34% in apiary A5 and the lowest percentage 20% in apiary A3.

The rate of naturally felled down *Varroa* mites was low in the first week of the study in three apiaries and increased after six weeks in which 65 *Varroa* mites per colony were felled down in apiary A3, 54 in A2 and 42 in A1 (Fig. 2).

The mortality rate of *Varroa* mites was high in the first week of the treatment then lowered af-

ter six weeks with three used acaricides as shown in Figure 3. The highest rate of felled down *Varroa* mite was recorded with acaricide Wangs in the first week after treatment which was 220 mites per colony while with Apistan and Chekmite was 106 and 99 mites per colony respectively.

DISCUSSION

Bee population witnessed dramatic decreases at the late of 1980s due to the wide spread of *Varroa* mite infestation according to the interviews made with local beekeepers. Moreover, war conditions led to the migration from the rural areas to

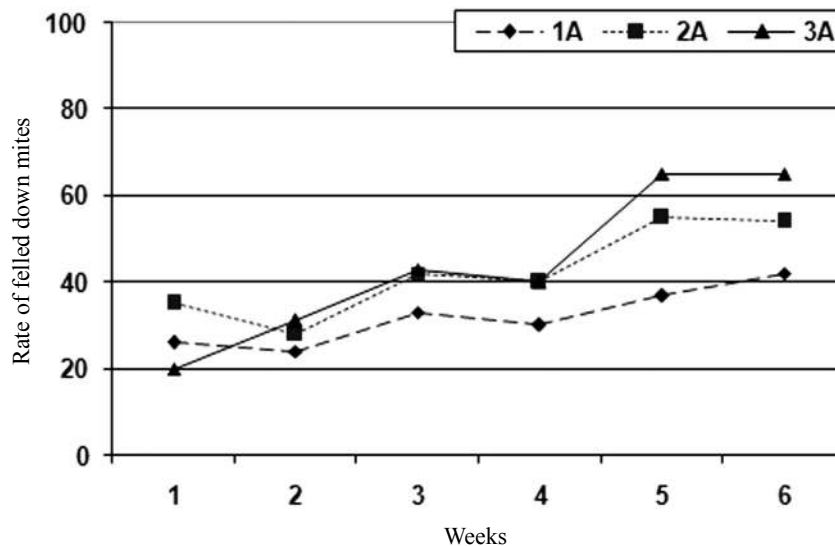


Fig. 2. Naturally fall down of *Varroa* mites in three apiaries A1, A2 and A3.

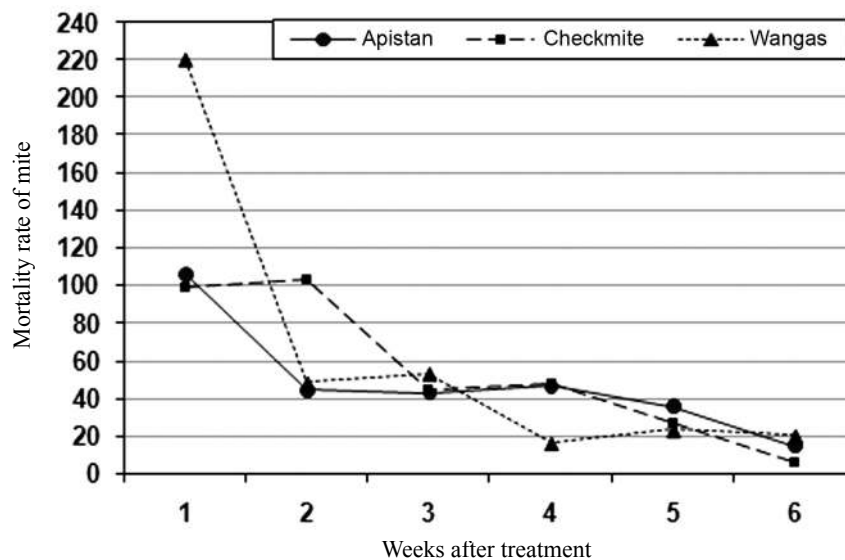


Fig. 3. *Varroa* mite mortality rates in colonies treated with Apistan, Checkmite and Wangas.

the urban areas and economic sanction imposed by United Nation on Iraq all these participated in the heavily loss of bee industry in the area. Other factors that encourage spread of many bee infections including *Varroa* mites are using traditional style of bee hives, depending mainly on natural swarming to obtain new colonies, poor knowledge of the beekeepers on using pesticides and illegal entrance of bee colonies from the neighboring countries. The results showed high level of *Varroa* mite infestation in 33% of examined adult workers collected from separated apiaries. The results of the study are similar to that of Moshavirinia et al. (2013) who found that the level of *Varroa* mite infestation was 31.5% in the apiaries of the northern regions of Iran. Jamshidi et al. (2009) found that

Varroa mite infestation rate of honeybee colonies in apiaries of Eastern Azerbaijan province in Iran was 37.33% in winter, 25.33% in autumn, 23.17% in summer and 7.72% in spring. The present findings were differ from those of many researchers like Bokaie et al. (2010) who found that 92% of apiaries of Golestan province in Iran were infested with *Varroa* mites. Cakmak et al. (2003) and Balint et al. (2011) found that 100% of the studied apiaries of Turkey and Romania were infested with *Varroa* mites respectively. The present findings are higher than those recorded by Ghoniemy et al. (2009) who found that the infestation with *Varroa* mite in 2nd year of their study in Egypt was high in winter and autumn which was 16.1% and 12.9% respectively, while low in spring and sum-

mer which was 3.3% and 3.3% respectively. These discrepancies in the rates of *Varroa* mite infestation levels in the different countries or even in the same region of the country could be attributed to many factors such as temperature, humidity, availability of pollen, numbers of apiaries and density of honey bee colonies, genotype of *Varroa* mite (Rozenecraz et al. 2010).

The levels of infestation were higher in drone pupae compared to worker pupae. Female mites prefer to enter cells and oviposit on drone pupae over worker pupae (Ritter and Ruttner 1980) possibly due to the longer time drone pupae take to develop. In 1981, Ritter described uncapping individual brood cells and examining the brood for mites. He also described the dumping of *Varroa* in different areas of the brood nest and their preference mainly for drone brood.

The levels of infestation varied among apiaries of the same region in both drone and worker pupae. As expected that the results differed with some researches and similar to others carried out in different countries. These variations in the results could be attributed to several factors such as colony population, availability of nutritional resources, using of supplemental diets, beekeeper experience in the apiary management and differences in the age of queens of investigated colonies. Akyol et al. (2007) found that colonies with young queens had a lower *Varroa* infestation level in comparison to colonies with old queens.

Data also indicated that the simple method of counting mites in hive debris is a useful parameter for monitoring the population development of *Varroa* in colonies with hatching brood (Fries et al. 1991).

Based on the results of the present study high level of *Varroa* mite infestation found in all apiaries of the region and may act as a risk factor on the health of bees.

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