

## Mite infestation of honeybee (*Apis mellifera*) in apiaries of North East of Iran

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**Abstract.** *Varroa destructor*, *Acarapis woodi* and *Tropilaelaps* spp. are the main parasitic honeybee mites. The present study was carried out to determine the situation of parasitic honeybee mite infestation in the apiaries of North East of Iran. A total of 54 apiaries were sampled from April to July 2011 and April to July 2012. Five colonies were randomly selected in each apiary (overall 270 colonies) and 50 adult honeybees and a piece of sealed brood cells were taken from each colony. Parasitological examinations showed that prevalence of *Varroa* infestation in apiaries of this region was 31.5%. Likewise, the *Varroa* infestation rate of honeybee colonies was 7.40% in the spring. The measured morphometrical characteristics showed that *Varroa* infestative species in this region was *V. destructor*. In this study, infestation with *A. woodi* and *Tropilaelaps* spp. were not observed. In conclusion, *Varroa* is the main parasitic mite of honey bees in the study area. It is recommended that infested colonies be monitored and mite population level in the hives be determined and based on economic threshold treatment started.

**Keywords:** *Varroa destructor*; *Acarapis woodi*; *Tropilaelaps* spp; Iran.

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### Introduction

*Varroa destructor* Anderson and Trueman, 2000, *Acarapis woodi* Rennie, 1921 and *Tropilaelaps* spp. Delfinado and Baker, 1961 are the main parasitic honeybee mites. Among them, *V. destructor* is more prevalent throughout the world (Baker, 2010; Rosenkranz et al., 2010). This mite is an ectoparasite and infests all developmental stages of bees including larvae, pupae and adults (Garedew et al., 2004; Rosenkranz et al., 2010). Decreasing

the body weight and shortening the lifespan of adult bees are the results of heavy infestation in a colony (Rosenkranz et al., 2010). The mite also is a vector for some honey bee viruses such as Kashmir bee virus (KBV), Sac brood virus (SBV), Acute bee paralysis virus (ABPV), Israeli acute paralysis virus (IAPV), and Deformed wing virus (DWV) (Boecking and Genersch, 2008). Untreated colonies usually die within six months to two years (Ritter et al., 1984).

*A. woodi* is an endoparasite of the respiratory system of honeybee. These mites infest only adult bees and their predilection sites are large tracheae of bees especially the first pair of trachea in the thorax. Acarapisosis shortens the bee lifespan and increases colonies winter losses (Frazier et al., 1994; McMullan and Brown, 2009).

*Tropilaelaps* mites like *Varroa* are ectoparasites of honeybee. Their lifecycle and pathogenesis are almost similar to *Varroa* (Coffey, 2007). These mites morphologically are distinguishable from *Varroa* spp. The body length of adult female *Tropilaelaps* mite is more than its width and in adult female *Varroa* is vice versa (Coffey, 2007). Unlike *Varroa*, they infest only broods of honeybee and phoretic survival on adult bees is 1-2 days (Coffey, 2007).

According to statistics of Iranian veterinary organization reports (2008) there are 3,778,044 honeybee colonies in Iran. Approximately 81.5% of them are located in the northern half of the country.

Komeili et al. (1986) estimated that in 1985 approximately 413,056 of 1,000,000 bee colonies in Iran vanished due to varroosis. Since then, limited studies have been conducted on prevalence, pathogenesis and economic losses caused by parasitic bee mites in Iran and its neighboring countries (Mossadegh and Bahreini, 1994; Jamshidi et al., 2009; Bokaie et al., 2010; Cakmak et al., 2003).

Despite the presence of beekeeping industry in North East of Iran, there is not any published information about parasitic bee mites in this region. In addition, in 2010 there were some complaints about hive decline and low productivity in honeybee colonies of this area. The aim of the present study was to determine the situation of parasitic honey bee mite infestation in the apiaries of this region of Iran.

## Materials and methods

### Study area

This study was carried out in North East of Iran. This area is located between 36°37'-38°17' N latitudes and 55°53'-58°20' E

longitudes with an area of more than 28,400 km<sup>2</sup>. It has common border with Turkmenistan. This region is a mountainous area and has average annual rainfall about 250 mm. There were 50 migratory bee farms in this area. The average number of colonies per apiary is 50 colonies.

In the study area, a total of 54 apiaries were sampled from April to July 2011 and April to July 2012. Of these, 30 apiaries were sampled in spring 2011 and the rest of them in spring 2012. Sampling was done in the spring because the hives are accessible only in this season. With the arrival of the summer they are moved into mountains and impassable areas. Five colonies were randomly selected in each apiary (overall 270 colonies) and 50 adult honeybees were taken from each colony. Also, from each colony a 5cm\*5cm piece of sealed brood cells was cut and placed in a polyethylene bag. These specimens and samples of adult honeybees were put in deep freezer (-20°C).

### Parasitological examinations

For the diagnosis of *Varroa* infestation in adult bees the dead bees were placed in liquid soap solution and shaken for 15 minutes. Then the bees were removed by forceps and the rest of contents were filtered. Brown mites were visible on the white background.

Frozen pieces of capped brood cells were studied under stereomicroscope. First, the capped brood cells were unsealed and then the broods were withdrawn from the cells. The body surfaces of broods and inside the cells were inspected for *Varroa* and *Tropilaelaps* infestations.

For precise identification of *Varroa* species and distinguishing of *V. destructor* and *V. jacobsoni* morphometric characteristics (including body length and width) of 45 collected adult female *Varroa* were measured. Then, the mean and standard deviation for width and length were calculated.

Infestation with *A. woodi* was investigated using dissection and maceration methodology (OIE, 2008). Briefly, two transverse cuttings were made behind the forelegs and in front of

the middle pair of legs, respectively. The sections obtained by this methodology were macerated by heating in 8% solution of potassium hydroxide for 20 minutes. Finally, the first pair of tracheae were studied under the stereomicroscope.

## Results

During the study, a total of 54 apiaries were sampled and studied. *Varroa* was found in 17 of the 54 apiaries sampled and prevalence of *Varroa* infestation in apiaries of this region

31.5% (95% CI, 19.1-43.9) was calculated. Likewise, the *Varroa* infestation rate of honeybee colonies was 7.40% (95% CI, 4.3-10.5) in the spring. The measured morphometrical characteristics showed that *Varroa* infestative species in this region was *V. destructor* (table 1).

Infestation with *A. woodi* and *Tropilaelaps* spp. were not observed in sampled apiaries of this study.

**Table 1.** Mean body length and width (in  $\mu\text{m}$ ) of adult female *Varroa* mites in the current study in comparison with obtained measurements by mentioned researchers

Species	Body length		Body width		No. of measured specimens
	Mean	SD	Mean	SD	
<i>V. destructor</i> (Anderson and Trueman, 2000)	1167.3	26.8	1708.9	41.2	42
<i>V. jacobsoni</i> (Anderson and Trueman, 2000)	1063.0	26.4	1506.8	36.0	73
<i>V. destructor</i> (Zhang, 2000)	1159.0	21.6	1700.0	46.5	5
<i>V. destructor</i> (Rahmani et al., 2006)	1198.4	?	1781.4	?	180
<i>V. destructor</i> (Current study)	1142.5	26.41	1725	42.63	45

## Discussion

After the first report of *Varroa* infestation in North West of Iran (Ruttner and Maul, 1983), in a short period of time, the mite spread throughout the country (Mossadegh and Komeili, 1991). The rapid spread of *Varroa* spp. among bee colonies is due to a number of factors such as drifting of sick bees, movement of bee swarms, robbing of weakened colonies by other bees and migration activities (Rosenkranz et al., 2010).

The study on the prevalence of *V. destructor* infestation in apiaries of Golestan province in Iran showed that 92% of beekeeping centers were infested (Bokaie et al., 2010). Despite the vicinity of the mentioned province with the current study area, the prevalence of *Varroa* infestation was relatively low in the current study area in comparison with Golestan province. The difference in the rate of prevalence of infestation in two neighboring areas with this mite might be attributed to different climatic conditions. The present study area has cold semi-arid climate while Golestan province has humid subtropical climate. According to Rosenkranz et al. (2010)

environmental factors like temperature, humidity or the availability of pollen and nectar can indirectly influence parasite population. Two studies in two countries with humid subtropical climate including Romania and Turkey showed that all sampled apiaries were infested with *V. destructor* (Balint et al., 2011; Cakmak et al., 2003). Also, the number of apiaries and density of honey bee colonies in a region can influence the mite population dynamics (Rosenkranz et al., 2010).

Jamshidi et al. (2009) conducted a survey on *Varroa* infestation rate of honeybee colonies in apiaries of Eastern Azerbaijan province in Iran. They also studied the seasonal frequencies of *Varroa* infestation and concluded that highest rate of infestation was in winter (37.33%) followed by autumn (25.33%), summer (23.17%) and spring (7.72%). In the present study sampling was done in the spring, and results showed that *Varroa* infestation rate of honeybee colonies in the spring was very close to the results of the study conducted by Jamshidi et al. (2009). Interestingly these two areas have similar climatic conditions. Regarding the similarities between *Varroa* infestation rates of these two areas in the

spring, probably annual average of infestation rate in these two areas are similar.

Anderson and Trueman (2000) studied mtDNA Co-I gene sequences and morphometrical characteristics including the length and width of many *Varroa* mites from different parts of the world. They concluded that *V. destructor* is the main species of *Varroa* that infests the European honeybee (*Apis mellifera*) worldwide.

Rahmani et al. (2006) collected 180 adult female *Varroa* mites from apiaries around Tehran, Iran. Based on morphometrical characteristics they identified these mites as *V. destructor*. In the current study results obtained from morphometrical measurements were in agreement with results obtained from two studies mentioned before.

*A. woodi* infestation was not observed in the study area. Mossadegh and Bahreini (1994) reported *A. woodi* infestation from 7 provinces of Iran for the first time. One of the infested provinces was Khorasan that was located in the current study area. Since 1994, there has not been any published data about *A. woodi* infestation in Iran. Muzaffar and Ahmad (1991) reported that 44% of *Apis cerana* colonies were infested with *A. woodi* in Pakistan. Gerson et al. (1994) reported this mite from Israel. Cakmak et al. (2003) did not find *A. woodi* in sampled colonies in Turkey. It is possible that heavy usage of various acaricides for *Varroa* control has affected the population of *A. woodi*.

*Tropilaelaps* was not found in the present study. This mite has not been reported from Iran yet. Regarding the presence of this parasite in Eastern neighboring countries of Iran such as Afghanistan and Pakistan (Mahmood et al., 2011) it seems that monitoring of apiaries in this respect is logical.

In conclusion, based on the results of this study, *Varroa* is the main parasitic mite of honey bees in the study area. It is recommended that infested colonies be monitored and mite population level in the hives be determined and based on economic threshold treatment be started.

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