

Prevalence of acariosis in honeybee colonies of *Apis mellifera intermissa* in Algeria

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ABSTRACT

This study was aimed to investigate the prevalence of acariosis in honeybee colonies of *Apis mellifera intermissa* in Algeria. To this end, samples of bee colonies of the *Apis mellifera intermissa* race were taken from the brood frames for assessment of acariosis induced by *Acarapis woodi* in five provinces in Algeria viz., Tizi Ouzou, Blida, Boumerdès, Algiers, and Bouira. A sample of 100 to 150 bees spread over three to five colonies for each apiary was observed. Presence of this parasite was examined using laboratory and microscopic methods that entailed dissecting the thoraxes of the bees to expose their tracheas. Each trachea was examined under a microscope. In the case of the infected bees, the mites appear as small oval bodies attached to the transparent walls of the tracheas. According to the examination and analysis results, two cases of acariosis were observed in two colonies in the same apiary in the province of Boumerdès. In Bouira province, only one colony infested by the mite was found. Meantime, no single case of acariosis was detected in the provinces of Blida, Algiers, and Tizi Ouzou. These results indicate low prevalence of this disease in Algeria. For the infected apiaries, there is so far no 100% effective treatment for acariosis. Once this disease is present in the apiary, the beekeeper must control its development at a level that will not affect the health of the colony.

Key words : *Acarapis woodi*, *Apis mellifera intermissa*, Algeria, honey bee, prevalence, mite.

INTRODUCTION

Acariosis is a contagious parasitic disease that affects the respiratory system of the adult bee. It is caused by a microscopic tracheal mite known as *Acarapis woodi* (Rennie, 1921). This tracheal mite was first associated with a condition that caused considerable colony mortality in *Apis mellifera* in the Isle of Wight (England) in the early 1900s (Rennie, 1921). Both the larval and adult mites feed on bee hemolymph in the tracheal tubes of adult bees (Pettis and Wilson, 1996). The mated females leave the trachea and move to new callow bees to begin a new infestation (Sammataro and Needham, 1996).

Acarapis woodi is an arthropod of the class of Arachnids of the order of mites that belong to the family Tarsonemidae. It was in 1921, in England, that this disease was first identified. The male mite measures 96 to 102 μm long by 60 to 63 μm wide and the female mite ranges from 123 to 180 μm in length and 76 to 100 μm in width. The eggs are very

large; they are 110 to 128 μm long and 54 to 67 μm wide. *Acarapis woodi* infests three bee groups: the workers, drones, and queens (Bailey, 1985). This mite is an internal parasite that lives, feeds, and reproduces in the respiratory systems of bees. At all stages of its development, it mainly occupies and inhabits the first pair of thoracic tracheas (Bailey and Lee, 1959). The pathogenic effects of this mite on the infected bees depend on the number of parasites in the trachea and they are attributed to mechanical damage and physiological disorders resulting from airway obstruction, tracheal wall injury, and hemolymph (Otis and Scott-Dupree, 1992). In 1961, Bailey showed that parasitism reduces lifespan of the bee. The particular bees that are parasitized will die before those who are not, or will have a significant drop in production. Moreover, the ravage action of the mite paves the way for secondary infections (Bailey and Perry, 1982) and leads to a loss of nutrients for the bee (Eischen, 1987).

Acariosis has been declared as an alarming bee disease in Algeria where presence of its pathogenic mite, namely, *Acarapis woodi*, was first reported in Algeria in 2001 (Hussein, 2001). However, it is

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attracting attention that no information on prevalence of this epidemic in Algeria has been available in recent years. Therefore, this study aimed at investigating the prevalence of this disease in the center of Algeria. To the researchers' best knowledge, this investigation is the first study that addresses this kind of bee diseases at the Algerian national scale.

MATERIALS AND METHODS

Confirmation of a diagnosis of acariosis can only be obtained in the laboratory following a microscopic examination of a bee sample. In the present study, samples of bee colonies of the *Apis mellifera intermissa* race were collected from the brood frames in five provinces in Algeria, that is, Tizi Ouzou, Blida, Boumerdès, Algiers, and Bouira. Using a brush, the bees were collected directly and placed in a storage box which was immediately closed. The bee sample collected from every apiary consisted of 100 to 150 bees, originally preading over three to five colonies. Twelve apiaries were included in this study: three each in the provinces of Boumerdes, Bouira, and Blida; two in the area of Algiers; and only one in the region of Tizi Ouzou. Presence of the pathogenic parasite was examined using laboratory and microscopic methods that entailed dissecting the thoraxes of the bees to expose their tracheas. Each trachea was examined under a microscope. In the case of the infected bees, the mites appear as small oval bodies attached to the transparent walls of the tracheas (Peng and Nasr, 1985).

RESULTS AND DISCUSSION

Prevalence of acariosis in the central region of Algeria in 2017 is shown in Table 1. Two cases of acariosis were detected in two colonies in the same apiary in Boumerdès province. As regards Bouira province, there was only one colony infested by this mite. In the apiaries taken from the provinces of Blida, Algiers, and **Tizi Ouzou**, no acariosis case has been detected. These results confirm the low presence of this epidemic in Algeria. Such low prevalence was reported earlier in most African countries (Bradbear, 1988; Hussein, 2001; Matheson, 1993; Swart *et al.*, 2001).

Most of the damage attributed to these mites is commonly associated with the European subspecies of wintering bees. This mite usually causes low honey production, increased mortality, and reduced bee lifespan (Sammataro *et al.*, 2013). Wintering does not normally occur at the same

Table 1. Result of laboratory diagnosis of bee colonies for acariosis.

Study area	Apiary	No. of colonies examined	Presence of the mite
Algiers	Apiary 1	3	-
	Apiary 2	4	-
Boumerdes	Apiary 1	3	-
	Apiary 2	3	+
	Apiary 3	5	-
Bouira	Apiary 1	4	+
	Apiary 2	5	-
	Apiary 3	4	-
Tizi Ouzou	Apiary 1	5	-
Blida	Apiary 1	3	-
	Apiary 2	3	-
	Apiary 3	3	-

scale in Algeria and other African countries. For this reason, mite infestations in Africa may not result in the same aforementioned damage. However, limited data exist on the prevalence of this mite in African bee colonies and on its effects on bees. The environment does play a role in determining the growth of tracheal mite populations in honey bee colonies. In this context, parasitism by tracheal mites has been thought to have minimal consequences to honey bee colonies in regions where winter is mild (De Guzman *et al.*, 2005).

Acarapis woodi has been reported in many European countries, e.g., Scotland, France, Spain, and Greece (Ragsdale and Furgala, 1987; Evans *et al.*, 2007; Garrido-Bailón *et al.*, 2012). The mite then reached to the American continent, first to Argentina, Colombia, and Mexico, and then to the United States of America. Outside the European and American continents, it has been reported in Iran, Turkey, China, Argentina, and Japan (Delfinado-Baker and Baker, 1982; Kojima *et al.*, 2011; Yang *et al.*, 2013; Maeda, 2015; Ahn *et al.*, 2015; Szawarski *et al.*, 2017). In Japan, infestations of the tracheal mite *Acarapis woodi* of the Japanese honey bee *Apis cerana japonica* have spread rapidly over the mainland, causing damage and the collapse of colonies (Sakamoto *et al.*, 2017). In Spain, in a total of 635 apiaries analyzed, prevalence of *Acarapis woodi* was 8.3% in 2010 and 4% in 2011. The mite penetrates the bee colonies over time and, hence, it should not be overlooked as a possible cofactor in the collapse of bee colonies (Cepero *et al.*, 2015). In Korea, Ahn *et al.* (2015) explored prevalence of three *Acarapis woodi* species (*Acarapis dorsalis*, *Acarapis*

externus, and *Acarapis woodi*) using Polymerase Chain Reaction (PCR) and subsequent sequencing. Molecular analysis of bee DNA extracts using PCR and alignment uncovered that the three examined species of *Acarapis* were present in Korea and that 32.3% (32/99) of the sample colonies were infected with *Acarapis dorsalis*, 9.1% (9/99) of the samples were infected with *Acarapis externus*, and 1.0% (1/99) of the samples were infected with *Acarapis woodi* (Ahn *et al.*, 2015). Casanova and Perruolo (1992) reported a prevalence of *Acarapis woodi* amounting to 2.7% in apiaries in Tachira State (Venezuela). In Kurdistan region, prevalence of *Acarapis woodi* infestation was 1% in apiaries and 0.26% in hives (Khezri *et al.*, 2017). In the apiaries of the Japanese honey bee *Apis cerana japonica*, infestations of *Acarapis woodi* have spread rapidly over the mainland of Japan, causing damage and collapse of colonies (Sakamoto *et al.*, 2017). According to Eischen *et al.* (1989), honey production correlates negatively with the rate of acaparis parasitism in the heavily-infested colonies, but not in the low-, and moderately-infested colonies.

The most important parasitism for a colony is that of the worker bees because of the large number of individuals involved and their roles in the survival and production of the colony (Royce and Rossignol, 1991). The drones are the preferred hosts of mites (Dawicke *et al.*, 1992). The queens too can be infested with mites (Pettis *et al.*, 1989). The sizes of the tracheas of the workers are larger than those of the queens and this may be one of the main reasons why the workers are more frequently infected than the queens. As for the queens, they have a longer life and can constitute an important reservoir for mites. The possibility for swarming and parasitism in the production of queens can allow for spread of the disease to far distances. Transmission of the acariosis disease takes place directly from bee to bee. It can also be brought about by purchase of colonies or queens and the looting of bees. The grooming behavior of the honey bee *Apis mellifera* plays an important role in controlling the infection by the *Acarapis woodi* tracheal mite.

The frequency of autogrooming (self-grooming) on the thorax is lower in *Apis cerana* than in *Apis mellifera*. The difference in susceptibility to this mite between these two species may be due to the difference between them in the frequency of the grooming behavior (Sakamoto *et al.*, 2017). The selection work of brother Adam of Buckfast Abbey in England in the early 20th century led to production of the Buckfast lineage, which has a certain level of resistance to acariosis (*Acarapis woodi*). The

prevalence of this pathology in Algeria is low. However, the results of this study trigger further studies at the national level to accurately determine the infestation rate of this mite. For the infected apiaries, there is so far no 100% effective treatment for acariosis. Consequently, once the disease is present in the apiary, the beekeeper must control its development at a level that will not affect the health of the colony.

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