

## Species composition and diversity of mites associated with honeybees *Apis mellifera* L in the Egyptian apiaries

Abd El Hady M. A. H.<sup>a\*</sup>, Mahfouz H. M.<sup>b</sup>

<sup>a</sup>Department of Agriculture Zoology and Nematology, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt

<sup>b</sup>Department of Plant Production, Faculty of Environmental Agricultural Sciences, Arish University, Arish, Egypt

### Abstract

Honeybees are social insects that live in colonies and play an important role in agricultural production. These insects are the main source of honey in addition to other products such as: royal jelly, wax and pollen, as well some other products like propolis and poison that can be used as a treatment for certain human diseases. However, the important role of that bees play in pollinating crops cannot be overlooked, as bees are the most common insect species. Also, one third of the food consumed daily depends on the role of bees in pollination crops. On the other hand, a lot of mites take honeybees as a suitable habitat including nonparasitic, omnivorous, and pollen-feeding species, and parasites. The latter may cause severe diseases for bees. The bio-relationships between mites and bees have been attracted the attention of many researchers, they concluded that the association between mites and bees could be ecto or endo parasites, phoretic, exudate feeders, predaceous and fungivorous. So, it was necessary to throw more light on mites in honeybees' colonies and apiaries. From the following data it can be announced that, a total of 30 species of mites belonging to 15 families have been recorded from different governorates of Egypt. Some collected mites were predators on other mites and small arthropods, while others feed on pollen, old provisions or use the honeybees just for transport from a place to another. The *Varroa destructor* was the most collected and the most dangerous parasitic mite of the honeybee, *A. mellifera* L worldwide collected from all the studied governorates of Egypt.

**Keywords:** honeybees, parasites, relationships, mites, incidence, *Apis mellifera*.

\*Corresponding author: Abd El Hady M. A. H.,  
E-mail address: [mohamed\\_abdelhady.5@azhar.edu.eg](mailto:mohamed_abdelhady.5@azhar.edu.eg)

## 1. Introduction

Honeybee (*Apis mellifera* L.) is considered as one of the most important insects all over the world including Egypt, that lives in a society and show some degrees of social behavior and cannot survive as individually but require the social setting of a colony. Mankind has benefited from honeybees for thousands of years as food and medicinal purposes, in addition to other products. Also, one of the most important roles of that honeybees pollinating of the plants. Recently under Egyptian conditions beehives are infected with many pests including the *Acarapis woodi*, *Varroa jacobsoni* and *Tropilaelaps clareae* are known the honeybee's main pests (Neumann and Carreck, 2010; Wakhil *et al.*, 1999; Ward *et al.*, 2008). However, about 100 mite species mostly harmless are associated with honeybees (Eickwort 1988). Those mites affect honeybee hives may be divided into three groups: parasites, phoretic mites, and house guests. As for species may be relatively few, but some cause many serious diseases to bees (Ahn *et al.*, 2015; Diana-Sammataro, *et al.*, 2000; Mordecai *et al.*, 2016). Several authors have studied the incidence of the mites associated with honeybees in different countries around the world. The current study focused on surveying and studying mite species that associated with honeybees and their economic importance in honeybee hives in several Egyptian governorates.

## 2. Materials and methods

### 2.1 Areas of study

The current study was conducted in 9 regions from three Egyptian governorates (three regions for each governorate), during the two successive years (2019 and 2020), to study the prevalence and diversity of mite species associated with honeybee (*A. mellifera* L.) hives. These governorates are Giza (El-Aiat, El-Saf and Atfeeh), Sharkeia (Belbes, Hihya and Faqous) and Faiyum (Faiyum, Tamiya and Ibsheaway).

### 2.2 Methods of samples

Different methods were used in order to collect mite species associated with honeybee during this study, either from the bodies of honeybee workers or from hives floor. The bee workers, adult bee, were brushing from the brood combs into jar containing 75% ethyl alcohol, then shacked out for a few minutes until the bees strained out. The jar contents were filtered by using a piece of white cloth. The yielded materials were examine under a stereo-binocular microscope, and to continuously monitor the level of mite infestations in hives, a sheet of white paper or plastic sheet can be placed on the bottom boards under a wire frame, where falling mites were trapped and wire kept

bees from removing mites (De Jong *et al.*, 1982). On the other side brood combs of infested bees were banged on a table covered with a piece of dark paper. Dislodged mites may be seen running over the paper and picked up with a fine brush wetted with alcohol (Morse, 1978). Also modified Tullgren's funnels were used to extract different mite species from the hive debris, pollen, dead bees and brood combs, by using 40-Watt bulb for 6 h. The mites were received in Petri-dishes filled with water. Most of mite species were individually mounted directly in Hoyer's medium, on glass slide, dried in an oven at 50–55°C to stretch the mites and rendering them clear and transparent labels including the necessary information were stuck to the slides then examined under a research microscope.

### 2.3 Identification of mite species

The identification of mite species associated with honeybee was based on illustrated keys of Lindquist and Evans (1965), Summers and Price (1970), Balogh (1976), Hughes (1976), Krantz (1978), Evans and Till (1979), Zaher (1984) and Zaher (1986).

## 3. Results and Discussion

The current study showed that, presence of 30 mite species belonged to 15 families

extracted from beehive debris, pollen, dead and active bees and brood combs are commonly associated with honeybee in three Egyptian governorates (Giza, Sharkeia and Faiyum) these mites may be divided into: ecto or endo parasites, phoretic, exudate feeders, predaceous and fungivorous. The collected mites are belonging two orders [parasitiformes including suborder Gamasida (Mesostigmata), and order Acariformes including three suborders Actinedida (Prostigmata), Acaridida (Astigmata) and Oribatida (Cryptostigmata)]. Suborder Gamasida (Mesostigmata) was represented by seven families and fourteen species [Ascidae (5 species), Rhodacaridae (one species), Parasitidae (one species), Laelapidae (3 species), Amerosiidae (two species), Uropodidae (one species) and Varroidae (one species)]. The Mesostigmata mites composed mostly of predaceous or parasitic species, (Ghada-Refaei, 2001). Suborder Actinedida (prostigmata) was represented by four families and eight species [Tydeidae (two species), Pygmoformidae (one species), Scutacaridae (one species) and Cheyletidae (four species)]. Then suborder Acaridida was represented by two families [Acaridae (four species), Glycyphagidae (two species)]. Also, suborder Oribatida was represented by two families [Oppidae (one species) and Oribatulidae (one species)] (Table 1).

Table (1): Species composition and diversity of mites inhabiting honeybee hives in three Egyptian governorates.

Family	Mite species	Locality	Abundance
Suborder: Gamasida			
Ascidae	<i>Blatosciocius tarsalis</i> (Berlese)	G	+
	<i>Blattisocius mali</i> (Oudemans)	S	+
	<i>Blattisocius</i> sp	G & S	+
	<i>Proctolaelaps peygmaeus</i> (Muller)	F	+
	<i>Proctolaelaps orientalis</i> Nasr	S	+
Rhodacaridae	<i>Rhodacarus roseus</i> Oudemans	F & G	+
Parasitidae	<i>Parasitus consanguineus</i> Oudemans and Voigts	S	+
Laelapidae	<i>Androlaelaps kifli</i> Metwally and Ibrahim	G & F	+
	<i>Hypoaspis whabi</i> Metwally and Ibrahim	G & F	+
	<i>Ololaelaps brevetova</i> Shreef and Soliman	F	++
Ameroseiidae	<i>Kleemannia plumosus</i> Oudemans	S	+
	<i>Ameroseius aegypticus</i> El Badry, Nasr and Hafiz	G	++
Uropodidae	<i>Urobovella</i> sp	G	+
Varroidae	<i>Varroa destructor</i> Anderson & Trueman	All studied Gov	+++
Suborder: Actinedida			
Tydeidae	<i>Paralorryia wooleyi</i> Baker	F	+
	<i>Tydeus kochi</i> Oudemans	G	++
Pygmoformidae	<i>Pediculaster</i> sp	S	+
Scutacaridae	<i>Scutacarus evansi</i> Soliman & Kandil	S	+
Cheyletidae	<i>Acaropsella notchii</i> Volgin	F	++
	<i>Cheletomorpha lapidopterus</i> (Shaw)	G	+
	<i>Cheyletus malaccensis</i> Oudemans	S	++
	<i>Hemechyletia bakeri</i> (Ehara)	F	++
Suborder: Acaridida			
Acaridae	<i>Acarus farris</i> Oudemans	G & S	++
	<i>Caloglyphus mycophagus</i> (Megnin)	F	+
	<i>Caloglyphus rhizoglyphoides</i> (Zacbvatkin)	All studied Gov	+++
	<i>Thyreophagus entomophagus</i> (Laboulbene)	All studied Gov	++
Glycyphagidae	<i>Glycyphagous ornatus</i> Kramer	G & F	++
	<i>Lapidoglyphus michaeli</i> (Oudemans)	G & F	++
Suborder: Oribatida			
Oppidae	<i>Oppia bayoumi</i> Shreef & Zaher	G & S	+
Oribatulidae	<i>Zygoribatulo tameyai</i> El-Badry and Nasr	G & S	+

Signs: +: rare (1-3 mites), ++: moderate (3-9 mites), +++: high (more than 9 mites), G= Giza governorate, F= Faiyum governorate, S= Sharkeia governorate.

On other hand seven families of mesostigamid mites were recorded in association with honeybee, including, Ascidae Voigts and Oudemans which was represented by five species belonging to two genera *Blatosciocius tarsalis* (Berlese) from Giza governorate, *Blattisocius mali* (Oudemans) from Sharkeia and *Blattisocius* sp from Giza and Sharkeia governorates, in addition to

*Proctolaelaps peygmaeus* (Muller) and *Proctolaelaps orientalis* Nasr recorded from Faiyum and Sharkeia governorates. These mites were found in scarce numbers feeding on dead bees, brood comb and hive debris, in agreement with data obtained by O'connor and Klimov (2004), Ghada- Refaei *et al.* (2018). The family Rhodacaridae Oudemans was represented by a single species *Rhodacarus roseus*

Oudemans, which was collected from beehive debris with rare numbers at Giza and Faiyum governorates, in agreement with Sammataro *et al.* (2000). The parasitic mite *Parasitus consanguineus* Oudemans and Voigts which was found phoretic on adult bees and feed on other small arthropods and rarely recorded from samples of hive debris in Giza and Sharkeia governorates (Ghada- Refaei, 2001; Oconnor, 2004; Oconnor and Klimov, 2004). *Androlaelaps kifli* Metwally and Ibrahim, *Hypoaspis whabi* Metwally and Ibrahim and *Ololaelaps brevetova* Shreef and Soliman were collected from beehive debris in scare numbers from Giza and Faiyum governorates. While, the *O. brevetova* was collected in moderate numbers from Faiyum governorate. In general, laelapid mite species doesn't cause any significant damage in spite of being collected from bees worldwide because, most of them feed on old provisions, small arthropods, pollen or phoretic on bees (O'Connor and Klimov, 2004). The family Amerosiidae Evans was represented by two species *Kleemannia plumosus* Oudemans which was rarely recorded from samples of hive debris at Sharkeia governorate, and *Ameroseuis aegypticus* El Badry, Nasr and Hafiz which was recorded in moderate numbers from samples of hive debris in Faiyum governorate. Members of family Uropodidae Berles are free-living mites inhabiting debris, organic manures, insect nests feed on fungi. Only a single species, *Uroobovella* sp was rarely collected from bees and hive debris

at Giza governorate without any damage to beehives as reconfirmed by Refaei (2005). The most serious ectoparasitic mites to *A. mellifera* L are belonging to family: Varroidae Delfinado & Baker, (*Varroa jacobsoni*) and (*Varroa destructor* Anderson & Trueman) the *Varroa* mites were found in most of the studied hives, feeding on the internal tissue of all developmental stages of honey bee, causing a severe damage often leading to the loss of colonies and is considered as one of the reasons for transmitting certain virus diseases (Mordecai *et al.*, 2016). Also, the Actinedida is represented by four families and eight species association with honeybee. The family Tydeidae Kramer is represented by two species (*Paralorryia wooleyi* Baker and *Tydeus kochi* Oudemans). The first one was recorded in Faiyum in low numbers, while the second one was recorded from Giza in a moderate number. Both are phoretic on honeybees as previously noticed by Ghada-Refaei *et al.* (2018). The families Pygmoformidae Cross and Scutacaridae Oudemans both are represented by a single species, feeding on hive debris or fungi. These two species are *Pediculaster* sp and *Scutacarus evansi* Soliman and Kandil at Sharkeia in agreement with Ghada-Refaei (2005). Four species of predaceous are pertaining to the family Cheyletidae Leach, were recorded in association with bees feeding on acarid mite species in beehives [*i.e.*, *Acaropsella notchi* Volgin, *Cheletomorpha lapidopterus*, *Cheyletus malaccensis* Oudemans and *Hemichyletia*

*bakeri* (Ehara)]. The number and localities of occurrence of these four species are recorded in Table (1). These results are similar to those obtained by O'Connor and Klimov (2004). Two families of the Acaridida mites were recorded [Acaridae Ewing and Nesbitt (four species) and Glycyphagidae Berlese (two species)]. Most of these mites are scavengers and cleptoparasites in beehives feeding on fungi, honey, pollen or debris and dead bees. The acarid species were *Acarus farris* Oudemans, *Caloglyphus mycophagus* (Megnin), *Caloglyphus rhizoglyphoides* (Zachvatkin) and *Thyreophagus entomophagus* (Laboulbene), while the glycyphagid mite species were *Glycyphagous ornatus* Kramer and *Lapidoglyphus michaeli* (Oudemans) with moderate numbers at Giza and Faiyum governorates. The number and localities of occurrence of acarid and glycyphagid mite species are recorded in Table (1). The oribatid mites were represented by two species belonging two families [(*Oppia bayoumi* Shreef & Zaher (Oppidae) and *Zygoribatulo tameyai* El-Badry and Nasr (Oribatulidae)]. These species were collected from the abdomen of dead bees and brood comb samples with a very few numbers at Giza and Sharkeia governorates, wholly in agreement with Ghada-Refaei (2005).

#### 4. Conclusion

From the results obtained in the current study it can be concluded that, the

occurrence of mites in honey bee may be very dangerous, such as parasitic one, *Varroa destructor* Anderson and Trueman this species is the most dangerous to bees worldwide and causes severe damage, that may destroy the bees colony. Therefore it is necessary to combat the individuals of the species by using the recommended control methods. While many other species of mites are either predators to the other mites and small arthropods, or they clean the beehives from debris and the bodies of dead bees, which may attract many fungi and other harmful organisms. Therefore, it is necessary to pay attention to these species that are not harmful to beehives and to contact those that may prove to cause harm.

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