MITES ASSOCIATED WITH HONEYBEE, *APIS MELLIFERA* IN EGYPT

GHADA S. REFAEI AND M. E. EL-NAGGAR

Plant Protection Research Institute, ARC, Dokki, Giza

(Manuscript received 1st January 2008)

Abstract

In the present study, an intensive survey of hive debris, honeybee brood combs, bee-collected pollen, live and dead adult bees was carried out during two successive years 2005-2006, throughout Egyptian Governorates. For determining the incidence, diversity, host associations and ecological distribution of mites associated with honeybees. Data proved the occurrence of 42 mite species belonging to 4 suborders: Mesostigmata, Prostigmata, Astigmata and Cryptostigmata and 19 families associated with honeybees in Egypt, including house guests, phoretic, and parasitic. *Varroa destructor* and *Acarapis woodi* are the most important parasitic species. A list of all recorded species is given with their geographic distribution and information on economic importance and type of association is provided. The majority of these species were rarely collected from hives, hives products and honey combs, as well as plant and soil mites and incidental visitors.

INTRODUCTION

Honeybees are considered the most important beneficial insects which have direct and indirect roles in agricultural production. Honey is the main product of this insect besides additional products such as: royal jelly, pollen, wax, propolis and poison. The roles of honeybees in the pollinator of flowering plants lead to an increase in agricultural products and improvements in the product quality (Allam, 1994).

The honeybee, *Apis mellifera* is accompanied by numerous arthropods, a great number of which belong to mites. Relationships between mites and bees are of diverse characters. These mites may be parasitic, phoretic or house guests. Many species of parasitic mites are the cause of economic important diseases to bees. The parasitic mite, *Varroa destructor* previously named *Varroa jacobsoni* Oud. is considered the most widespread ectoparasite of the honeybee, *Apis mellifera* and it causes serious problems in the world of beekeeping due to its parasitic relationship with bees (Ritter, 1981; Donze and Guerin, 1994; Anderson and Trueman, 2000). The literature on these species is very rich but the knowledge on other mite species associated with bees, their nests and stored hive products is rather poor (Chmielewski, 1989). So, the objective of the present work is to investigate the prevalence, host associations and diversity of mites associated with honeybees in Egypt.

MATERIALS AND METHODS

A survey of mites associated with the honeybee, *Apis mellifera* was carried out during two successive (2005-2006) throughout most Egyptian Governorates. Several methods have been used during the period of the study: A sheet of strong white paper or plastic with a screen can be placed under the brood combs to continuously monitor colonies in the areas of suspected infestations. The screen prevents the bees from removing the dead mites falling on the paper (Mautz, 1979; De Jong, 1980; De Jong *et al.,* 1982). 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). Adult bees can be sampled directly by brushing them from the brood combs into jars filled with alcohol and shaked for one to thirty minutes. The bees were strained out and the filtrate passed through a white cloth where mites can be examined. For collecting *Acarapis woodi,* bee's prothoracic collar was removed to expose the two largest tracheae in the body, and then examined by a stereo microscope. Adult mites or their developmental stages were collected by a fine camel hair brush no. "00" (De Jong *et al.*, 1982). Mites from random samples of hive debris, pollen, dead bees and brood combs can be extracted also, using the modified Tullgren funnels for 24 hours. The mites were received in Petri-dishes filled with water.

Adult mites and their developmental stages were picked up, cleared in Nesbitt's solution or lactic acid, then mounted in Hoyer's medium on glass slides and examined by stereo microscope for identification. Directories of Acarologists of the World (Hughes, 1961; Chant, 1965; Lindquist & Evans, 1965; Summers & Price, 1970; Hughes, 1976; Krantz, 1978; Zaher, 1984; Zaher, 1986; Smiley, 1992; Lindqvist, 1998) were used.

RESULTS AND DISCUSSION

The honeybee, *Apis mellifera* is considered one of the most important and beneficial insects, whose damage has serious negative economic implications for both beekeeping industry and agriculture (Melathopoulos *et al.*, 2000). The study of prevalence, diversity, host associations and distribution of mites associated with honeybee is necessary to monitor the economically important species, and manage their effects on beehives.

In the present study it is clear that the Acarofauna associated with honeybee, *Apis mellifera* L. in Egypt is numerous and comparatively rich in its species. A survey of hive debris, honeybee brood combs, bee-collected pollen, live and dead adult bees, during the period of the study shows that 42 species of mites are commonly

associated with honeybees in Egypt. Most of these mites have been rarely collected, and are of no ecological concern. Mites that are found in beehives may be house guests, phoretic or parasitic. *Varroa destructor* and *Acarapis woodi* are the most important parasitic species. Phoretic mites are flower or leaf feeding mites that use honeybees just for transport from one plant to another and arrive to beehives accidentally. Among the many house guests are those mite species that feed on old provisions and others that are predators on other mites. It was noticed that mites are rarely fed on stored pollen; however, large numbers of pollen-feeding mites are found in stored combs (De Jong *et al.*, 1982; Sammataro *et al.*, 2000; Refaei, 2001).

The collected mite species in this work were belonged to four suborders: Mesostigmata (Gamasida), Prostigmata (Actinedida), Astigmata (Acaridida), and Cryptostigmata (Oribatida) (tables 1-3).

A- Suborder: Mesostigmata

16 mesostigmatid mite species from 6 families were collected from beehives (table 1).

1- Family Varroidae:

This family was represented by only one species *V. destructor* (Anderson and Trueman, 2000) which is considered as the most serious known ectoparasitic mite of the honeybee, *Apis mellifera*. It was first described in 1904 from *A. cerana* in Indonesia and Later on, it was found distributed worldwide in several countries (Grobov, 1976; De Jong *et al.*, 1982; Chmielewski, 1989; Bailey and Ball, 1991; Hussein, 1991).

Varroa mite is believed to arrive to South America on queens of *A. mellifera* that were taken to Paraguay by Japanese beekeepers (De Jong *et al.*, 1984). Female mites of *V. destructor* deposit their eggs in cells containing late instars honeybee larvae. In their nymphal stages, mites attach to bees and feed on the haemolymph. Not all infested broods are killed but adult infested bees have deformed wings as a result of heavy parasitism in colonies. Mites are most commonly attached to the thorax and can be easily seen with unaided eye as they are larger than most other mites Akratanakul and Burgett (1975).

In the present study, *Varroa* mites were normally distributed throughout most of Egyptian apiaries visited and the average number of mites in infested colonies was quite high.

2- Family Ascidae:

The ascid mites are mostly predators and occur in soil, humus, moss, stored products, bee nests and plants. They prey on acarid mites, eggs of insects and also can feed on fungi, saprophytic arthropods and pollen. Some species of this family are

parasitic (Egan and Moss, 1969).

Several ascid mites were recorded in association with honeybees in Egypt. *Blattisocius keegani, B. tarsalis* and *Lasioseius* sp were found associated with dead bees and hive debris. The genera *Lasioseius* and *Blattisocius* were recorded from beehives allover the world (Brgetova, 1977; Haragsim *et al.*, 1978; De Jong *et al.*, 1982; Crozier, 1989; Chinniah and Mohanasundaram, 1995). On the other hand, *Protogamasellus mintus*, *Proctolaelaps orientalis* and *Proctolaelaps* sp were found associated with dead bees and brood combs. Similarly, several *Proctolaelaps* species were recorded in bee nests feeding on small arthropods, fungi, pollen or phoretic on adult bees without causing any harmful effects (El-Banhawy and Nasr, 1984; Davydova, 1988; Klimov, 1998; OConnor and Klimov, 2004).

3- Family Laelapidae:

This family contains a diverse assemblage of free living and insect associated mites (Eickwort, 1990). Species belonging to this family are partially cleptoparasitic through predation on astigmatid mites. These mites feed on provisions in beehives without harming the brood they also feed on injured bees and on pollen (Eickwort, 1979). However, the genus *Tropilaelaps* includes mites that are obligatory parasites on different species of *Apis* inflicting significant damage to apiculture (Eickwort, 1993).

The present results showed that five laelapid species were found associated with beehives in Egypt. Likewise, numerous genera of laelapid mites were found associated with bees allover the world (De Jong *et al.*, 1982; Eickwort, 1994; OConnor and Klimov, 2004).

4- Family Parasitidae:

The parasitid mites occur in a wide range of habitats including soil, humus and various organic debris where they feed on eggs, immature microarthropods and nematodes (Zaher, 1986). In addition, parasitid deutonymphs are often phoretic on insects and they also utilize them for transport from one feeding locals to another (Krantz, 1978). The members of the genus *Parasitus* are phoretic on adult bees feed on other arthropods and wax (Richards and Richards, 1976). *Parasitus* species occur in 96% of bumblebee nests in Canada and 25-28% in overwintering queens in Denmark (Schousboe, 1987).

In the present work, *Parasitus consanguineus* was rarely collected from samples of hive debris.

Similarly, many authors recorded this genus from bees in different countries including Europe, North America (Hyatt, 1980; De Jong *et al.*, 1982; Davis and McRoy, 1987; OConnor and Klimov, 2004) and Egypt (Refaei, 2001). The nature of associations between these mites and bees is uncertain, although predatory behaviour

towards acarid mites and microarthropods was suggested by Richards and Richards (1976) and this may be beneficial to the colonies.

5- Family Phytoseiidae:

The members of this family are widely distributed predators inhabiting a variety of plants and prey on phytophagous mites, insects and pollen grains (Zaher, 1986). Two phytoseiid species were recorded from Egyptian beehives with a low abundance. These were *Euseius scutalis* and *Typhlodromus athiasae*. Likewise, El-Banhawy and Nasr (1984) collected the phytoseiid mite, *Amblyseius okanagensis* from beehives in the state of New York. All previous studies and the present study revealed that this family is not bee associated; however, it may be transported to beehives by bees visiting plants and flowers causing no harm to bees (Chmielewski, 1991).

6- Family Uropodidae:

The members of this family are free-living mites inhabiting soil, debris, moss, organic manures, nests of insects, and they feed on fungi, housefly larvae and free living nematodes. Of special interest is the discovery of uropodid mites in Egyptian beehives.

Trichouropoda sp. was rarely collected from hive debris and adult bee samples without causing any damage to beehives (table, 1). The phoretic association between uropodid mites and bees is presumed to be transitory because both happen to be migrants and both are exploiting the same temporary habitat (Rubink *et al.*, 1991). Similarly, Chmielewski (1989) recorded uropodid mite, *Urobovella marginata* from Polish beehives and El-Erksousy (1996) collected *Trichouropoda* sp. from Egyptian beehives.

B- Suborder: Prostigmata

The prostigmatid mites vary greatly in their biology, structures and habitats. This diverse suborder has evolved an important relationship with bees.

Table (2) shows 13 prostigmatid mite species belonging to seven families were found associated with honeybees in Egypt.

1- Families Cheyletidae and Cunaxidae:

These families are considered as predaceous Prostigmata and may be facultatively occuring in beehives where they feed predominantly on Astigmata (Eickwort, 1994). Several cheyletid genera were recorded as phoretic on bees (OConnor and Klimov, 2004); *Cheyletophyes* species were restricted with large carpenter bees (Putatunda and Kapil, 1988; Walter *et al.*, 2002). While species of the genera *Hemicheyletia, Cheyletus* and *Cunaxa* (Cunaxidae) were recorded associated with honeybees worldwide (De Jong *et al.*, 1982; El-Naggar, 1982; Davis and McRoy, 1987; El-Erksousy, 1996), but the levels of associations were unknown.

The work presented herein recorded six prostigmatid mite species belonging to the families Cheyletidae and Cunaxidae from beehives in Egypt. These species included. *Cheletogenes ornatus* and *C. lepidopterorum* were found associated with adult bees and hive debris. *C. eruditus* and *C. malaccensis* and *Hemicheyletia bakeri* were recorded from hive debris. Finally, *Cunaxa* sp was found attached to the thorax of honeybee workers. These mites can prey on other mites and small arthropods without conspicuous damage or harm to bees or broods; so they may be useful to the colonies.

2- Family Tarsonemidae:

This family was represented in the present study by three species, *Acarapis woodi, Tarsonemus granaries and T. apis*. The most serious one is the parasitic mite, *A. woodi* which completes its life cycle within the prothoracic tracheae of the honeybee. *A. woodi* has been detected in several countries allover the world (Delfinado-Baker *et al.*, 1989 Lozano *et al.*, 1989; Gerson *et al.* 1994). It feeds on the haemolymph of their host by piercing the tracheal walls with their mouthparts (Õrösi-Pal, 1934). . This mite is posing a serious threat to honeybee health and also affects foraging and survivorship of honeybees (Gary and Page, 1989).

In the present study, few numbers of *A. woodi* were detected in the tracheae of the worker honeybee. Species of *Tarsonemus* sp was rarely collected from hive debris. Similary, several species of the genus *Tarsonemus* were recorded previously from honeybees [De Jong *et al.* (1982, Europe); Senna (1997, Egypt)]. The structure of their mouth parts suggested that these mites are not parasites but possibly feeding commensally on pollen and they are of little or no adverse effects on bees (Lindquist, 1968).

3- Family Scutacaridae:

Several members of this large family are associated with insects or their nests including bees and wasps (Delfinado *et al.,* 1976). All scutacarid mites have been observed feeding on fungi (OConnor and Klimov, 2004). Both. *Imparipes* and *Scutacarus* genera include fungivores species that are closely associated with bees and may introduce fungi to beehives (Delfinado and Baker, 1976; De Jong *et al.,* 1982). Only *S.* sp. was recorded from beehives in Egypt where it was collected from hive debris in very few numbers (table, 2).

4- Families Raphignathidae, Eupodidae and Bdellidae:

These three prostigmatid families are not bee associated; however, their species frequently invade beehives (El-Naggar, 1982). Most of these mites are predators as they may feed on other mites and small insects in beehives without harming bees or broods.

The family Raphignathidae was represented by two species, *R. bakeri* and *R.* sp. collected from dead workers. Also, family Eupodidae represented by *Eupodes* sp. which was found associated with brood combs and adult bees.

Members of the family Bdellidae are common predators in the soil. One species *Spinibdella bifurcata* was rarely collected from hive debris herein (Table, 2). Most of the above mentioned mite genera of the families Raphignathidae, Eupodidae and Bdellidae were collected previously from Egyptian beehives where El-Naggar (1977 & 1982) collected *Raphignathus* sp. and *S. bifurcata* from honeybee colonies at Sohag and Gharbia Governorates, respectively.

C- Suborder: Astigmata

Astigmata is represented in the present study by 10 species of the families Acaridae, Chaetodactylidae, Glycyphagidae and Hemisarcoptidae (Table 3). Astigmata are typically the most abundant obligate bee-associate mites in nests of bees (Eickwort, 1990; OConnor and Klimov, 2004).

1- Families Acaridae and Glycyphagidae:

The Acaridae and Glycyphagidae include numerous mites that occur as scavengers and cleptoparasites in hives of bees feeding on fungi, honey, pollen and other detritus (Veitch, 1936; Grobov, 1979; Baker *et al.*, 1983; Chmielewski, 1989). Many of these are stored-product pests but can become the most numerous mites in the beehives (Eickwort, 1993). In the present study, the genera *Acarus, Caloglyphus, Glycyphagus, Rhizoglyphus* and *Tyrophagus* were the most common mites collected from hives of honeybees in different localities in Egypt.

2- Family Chaetodactylidae and Hemisarcoptidae:

Members of this family are restricting to associate with bees (Eickwort, 1994), their species are primary obligate cleptoparasites (OConnor and Klimov, 2004). The chaetodactylid mite, *Sennertia* was found in the cell of *Xylocopa* apparently feeding on pollen (Skaife, 1952). Hypopus of this genus was collected from the abdominal pouch of the carpenter bee, *Xylocopa aestuans* (El-Badry, 1971) and from the honeybee, *A. mellifera* samples (Baker *et al.*, 1983). At the same time, Lombert *et al.* (1987) hypothesized that this mite may kill the brood, while others mentioned that it may develop without killing the brood (Skaife, 1952; OConnor, 1988). In the present study, the hypopus of *Sennertia egyptiaca* and *Hemisarcoptes* sp were rarely collected from abdomen of dead bees.

Generally, several investigators recorded astigmatid mites associated with bees (El-Duweini, 1978; OConnor, 1982; Baker *et al.*, 1983; Chmielewski, 1989 & 1991; Abrol *et al.*, 1994; Abrol and Kakroo, 1997; Senna, 1997; OConnor and Klimov, 2004).

Most astigmatid mites are scavengers and cleptoparasites. In the present study, high abundance of these mites was collected from hive debris, where they may feed on fungi, pollen, stored pollen and honey and may introduce fungi to colonies which become harmful.

D- Suborder: Cryptostigmata

This suborder is cosmopolitan and inhabits a variety of habitats including forest, litter, humus and soil surface (Krantz, 1978). These mites are primary fungivorous or saprophagous and also can feed on algae, bacteria and higher plants (Luxton, 1972). In the present study, three species from two families of this suborder were recorded from Egyptian beehives (Table 3), whereas the honeybee is considered a new host record for this suborder herein.

1- Family Oppiidae:

Members of this family are considered to be microphytophagous and commonly inhabitat moss, humus and litter. In the present study, only *Oppia sticta* was rarely collected from Egyptian beehives debris at Giza Governorate.

2- Family Oribatulidae:

Members of this family are diverse and feed on a variety of microbial fauna, fungi and old provisions and in organic layers of the forest floor (Luxton, 1972; Krantz, 1978). In the present survey, *Scheloribates laevigatus* and *Scheloribates* sp were rarely collected from the abdomen of dead bees and brood comb samples surveyed from different apiaries Giza and Menofia Governorates, respectively. Similarly, Chmielewski (1989) collected *Scheloribates* (Oribatida) from Polish beehives.

In general, cryptostigmatid mites were rarely collected from bee samples worldwide and their significance in the beehives is still unknown. But it could be suggested that these mites can enter the hives from the soil or plants attached to the bodies of bees and/or other insects visiting hives.

Table 1. Prevalence of mesostigmatid mites associated with the honeybee *Apis mellifera*

Family	Mite species	Locality	Abundance
Varroidae	*Varroa destructor* Anderson & Trueman	All studied Governorates	+++
Ascidae	*Blattisocius keegani* Fox	Giza,	++
	Blattisocius tarsalis (Berlese)	Giza	++
	Lasioseius sp	Giza, Beni-Suef	++
	Protogamasellus mintus Nasr	Giza	+
	Proctolaelaps orientalis Nasr	Fayoum	++
	Proctolaelaps sp	Beni-Suef	++
Laelapidae	*Androlaelaps casalis* (Berlese)	Giza	++
	Androlaelaps aegypticus Hafez, El-Badry & Nasr	Dakahlia	+++
	Dinogamasus sp	Fayoum	+
	Hypoaspis Koseii Hafez, El-Badry & Nasr	Fayoum	+
	Ololaelaps sp.	Sharkia	+
Parasitidae	*Parasitus Consanguineus* Odumans& Viogts	Giza	+
Phytoseiidae	*Euseius scutalis* (Athias-Henriot)	Giza	+
	Typhlodromus athiasae Porath & Swirski	Giza	+
Uropodidae	*Trichouropoda* sp	Dakahlia	+

+: rare (1-3 mites)
++: moderate (3-9 mites)
+++: high (more than 9 mites)

Table 2. prevalence of prostigmatid mites associated with the honeybee *Apis mellifera*

Family	Mite species	Locality	Abundance
Bdellidae	*Spinibdella bifurcata* Atyeo	Sharkia	+
Cheyletidae	*Cheletogenes ornatus* (Can. & Fanz.)	Giza	+
	Cheletomorpha lepidopterorum (Shaw)	Dakahlia	++
	Cheyletus eruditus (Schrank)	Kafr El-Sheikh	++
	Cheyletus malaccensis Oudemans	Giza	++
	Hemicheyletia bakeri (Ehara)	Menofia	+
Cunaxidae	*Cunaxa* sp	Giza	+
Eupodidae	*Eupodes* sp	Dakahlia	+
Raphignathidae	*Raphignathus bakeri* Zaher & Gomaa	Giza	+
	Raphignathus sp.	Menofia	+
Scutacaridae	*Scutacarus* sp.	Ismailia	+
Tarsonemidae	*Acarapis woodi*	Gharbia	+
	Tarsonemus granaries	Giza	+
	Tarsonemus apis	Giza	+

+: rare (1-3 mites) ++: moderate (3-9 mites) +++: high (more than 9 mites)

Table 3. prevalence of astigmatid and cryptostigamatid mites associated with the honeybee *Apis mellifera*

Family	Mite species	Locality	Abundance
Suborder: Astigmata			
Acaridae	*Acarus siro* L.	Fayoum	+
	Caloglyphus mycophagus (Mégnin)	Fayoum	+++
	Caloglyphus sp.	Beni-Suef	+
	Rhizoglypus robini Claparede	Menofia	+++
	Tyrophagus. putrescentia (Schrank)	Giza	+
Chaetodactylidae	*Sennertia egyptiaca* El-Badry	Dakahlia	+
Glycyphagidae	*Glycyphagus domesticus* (DeGeer)	Menofia	++
	Glycyphagus ornatus Kramer	Giza, Fayoum	++
	Glycyphagus sp.	Giza	+
Hemisarcoptidae	*Hemisarcoptes sp*	Giza	+
Suborder: Cryptostigmata			
Oppiidae	*Oppia sticta* Popp	Giza	+
Oribatulidae	*Scheloribates laevigatus* Koch	Giza	+
	Scheloribates sp	Menofia	+

+: rare (1-3 mites) ++: moderate (3-9 mites) +++: high (more than 9 mites)

REFERENCES

1. Abrol, D.P. and S.K. Kakroo. 1997. Observations on concurrent parasitism by mites on four honeybee species in India. Tropical Agric., 74 (2): 150-156.
2. Abrol, D.P., S.K. Kakroo and B.N. Putatunda. 1994. Stored product mite *Tyrophagus longior* (Gervais) (Astigmata: Acaridae) with beehives in India. Current-Science, 66 (2): 105.
3. Akratanakul, P. and M. Burgett. 1975. *Varroa jacobsoni:* a prospective pest of honeybees in many parts of the world. Bee World. 56: 119-121.
4. Allam, M.F.S. 1994. Ecological, biological and control studies on *Varroa Jacobsoni* a parasitic mite of honeybees in Egypt. M.Sc. Thesis, Fac. of Agric., Cairo Univ., Giza, Egypt., pp. 142.
5. Anderson, D.L. and J.W.H. Trueman. 2000. *Varroa jacobsoni* (Acari: Varroidae) is more than one species. Exp. & Appl. Acarol., 24 (3): 165-189.
6. Bailey, L. and B.V. Ball. 1991. Honeybee Pathology. 2*nd* ed. Academic Press, San Diego, CA., 193 pp.
7. Baker, E.W., M. Delfinado-Baker and M. Baker-Delfinado. 1983. New mites (*Sennertia:* Chaetodactylidae) phoretic on honeybees (*Apis mellifera* L.) in Guatemala. Int. J. Acarol., 9 (3): 117-121.
8. Bregetova, N.G. 1977. Family Aceosejidae. In: M.S. Gilarov and N.G. Bregetova (Eds.). Opredelitel' obytayschchikh pochve kleshchey Mesostigmata (Identification key to soil-inhabiting mites Mesostigmata). Nauka, Leningrad, pp. 169-226.
9. Chant, D.A. 1965. Generic concepts in the family Phytoseiidae (Acarina : Mesostigmata). Can. Entomol. 97: 351-374.
10. Chinniah, C. and M. Mohanasundaram. 1995. Record of new ascid mites (Ascidae : Acari) infesting insects in Tamil Nadu, India. Entomon., 20 (3-4) : 233-236.
11. Chmielewski, W. 1989. Mites (Acarida) associated with honeybee (*Apis mellifica*) in Poland. Proc. XXX*Ist* International Congress of Apiculture, Warsaw, Poland, Aug. 19-25, 1987-1989, pp. 205-208.
12. Chmielewski, W. 1991. Mites (Acarida) of honeybees (*Apis mellifera* L.) in Poland. Wiadomosci Parazytologiczne, 37 (1) : 91-94.
13. Crozier, L. 1989. *Melittiphis alvearius* (Berlese) and other mites found in honeybee colonies in Nova Scotia. J. Apic. Res., 28 (3) : 166-168.
14. Davis, A. and D. McRoy. 1987. Various mites from Ontario beehives. Canadian Beekeeping, 13 (9): 209.
15. Davydova, M.S. 1988. New species of gamasid mites associated with bumble bees. Novye i Maloizvestnye Vidy Fauny Sibiri, 20: 18-32.
16. De Jong, D. 1980. *Varroa jacobsoni*, a parasitic mite of honeybees: Survey Techniques. Univ. Md. Entomol., Leafl. No. 109.

17. De Jong, D., R.A. Morse and G.C. Eickwort. 1982. Mite pests of honeybees. Ann. Rev. Entomol., 27: 229-252.
18. De Jong, D., L.S. Goncalves and R.A. Morse. 1984. Dependence on climate of the virulence of *Varroa jacobsoni*. Bee World, 65: 117-121.
19. Delfinado, M.D. and E.W. Baker. 1976. New species of Scutacaridae (Acarina) associated with insects. Acarologia, 18 (2): 264-301.
20. Delfinado, M.D., E.W. Baker and M.J. Abbatiello. 1976. Terrestrial mites of New York. III- The family Scutacaridae. J. New York Ent. Soc., 84 (2): 106-145.
21. Delfinado-Baker, M., E.W. Baker and A.C.G. Phoon. 1989. Mites (Acari) associated with bees (Apidae) in Asia, with description of a new species. American Bee J., 129 (9) : 609-613.
22. Donze, G. and P.M. Guerin. 1994. Behavioural attributes and parental care of *Varroa* mites parasitizing honeybee brood. Behav. Ecol. Sociobiol., 34 (5): 305-319.
23. Egan, M.E. and W.W. Moss. 1969. The life cycle and behaviour of a cockroach mite, *Proctolaelaps nauphoetae* (Acari : Mesostigmata : Ascidae). Notulae Naturae, 420: 1-9.
24. Eickwort, G.C. 1979. Mites Associated with Sweat Bees (Halictidae). In: Recent Advances in Acarology, Vol. I, J.G. Rodriguez ed., Academic Press, NY, pp. 575-581.
25. Eickwort, G.C. 1990. Associations of mites with social insects. Ann. Rev. Entomol., 35: 469-488.
26. Eickwort, G.C. 1993. The origin of mites associated with honeybees. In: G.R. Needham, R.E. Page Jr., M. Delfinado-Baker and C. Bowman (Eds.). Africanized Honeybees and Bee Mites. Ellis-Horwood, Ltd.: Chichester, England, pp. 327-338.
27. Eickwort, G.C. 1994. Evolution and life history patterns of mites associated with bees, In: M.A. Houck (Ed.). Mites: Ecological and Evolutionary Analyses of Life History Patterns. Chapman & Hall One Penn Plaza, New York, pp. 218-251.
28. El-Badry, E.A. 1971. *Sennertia egyptiaca* sp.n. (Acari: Chaetodactylidae), a phoretic mite associated with the carpenter bee *Xylocopa aestuana* Linn. Sonderdruck aus Bd., 69 (1971), H.I.S. 87-90.
29. El-Banhawy, E.M. and A.K. Nasr. 1984. Incidence of mites in beehives in the state of New York with descriptions of two new species. Bull. Zool. Soc. Egypt, 34: 76-80.
30. El-Duweini, F.K. 1978. Studies on mites associated with hymenopterous insects. M.Sc. Thesis, Fac. of Agric., Cairo Univ., 116 p.
31. El-Erksousy, M.H. 1996. Studies on some mites associated with hymenopterous insects. M.Sc. Thesis, Fac. of Agric., Al-Azhar Univ., 88 p.

32. El-Naggar, M.E. 1977. Survey and biological studies on some mites associated with hymenopterous insects. M.Sc. Thesis, Fac. of Agric., Al-Azhar Univ., 83 p.
33. El-Naggar, M.E. 1982. Ecological and biological studies on some mites associated with insects. Ph.D. Thesis, Fac. of Agric., Al-Azhar Univ., 175 p.
34. Gary, N.E. and R.E. Page. 1989. Tracheal mite (Acari : Tarsonemidae) infestation effects on foraging and survivorship of honeybees (Hymenoptera : Apidae). J. Econ. Entomol., 82 : 734-739.
35. Gerson, U., A. Dag, C. Efrat, Y. Slabezki and Y. Stern. 1994. Tracheal mite, *Acarapis woodi* comes to Israel. Amer. Bee J., 134 (7): 486.
36. Grobov, O.F. 1976. *Varroa* disease in honeybees. Apiacta, 11: 145-148.
37. Grobov, O.F. 1979. The mite *Carpoglyphus lactis* and its role in bee's nests. In: Arakhnozy, Protozoinye bolenzi Sel' Shokhozyais-tvennykh Zhivotnykh, Moscow, USSR "Kolos" (1977, reed. 1979), 83 (RU) Viev, USSR. (C.f. R.A.E., S.A. 2670, 1979).
38. Haragsim, O., K. Samsinak and E. Vobrazkova. 1978. The mites inhabiting the beehives in CSR. Zeitschrift fur Angewandte Entomologie, 87: 52-56.
39. Hughes, A.M. 1961. The mites of stored food. Min. of Agric. Fisheries and Food Tech. Bull., 9: 1-287 pp., London, First Edition.
40. Hughes, A.M. 1976. The mites of stored food and houses. Min. Agric., Fisheries & Food-Tech. Bull., No. 9. Her Majesty's Stationery Office, 400 pp., London, Second Edition.
41. Hussein, M.H. 1991. *Varroa jacobsoni* Oud. the most recent pest of honeybee colonies in Egypt. A Report. Fac. Agric., Assiut Univ., in Arabic. 47 p.
42. Hyatt, K.H. 1980. Mites of the subfamily Parasitinae (Mesostigmata : Parasitidae) in the British Isles. Bull of the British Museum (Natural History) Zoology, 38 (5): 237-378.
43. Klimov, P.B. 1998. To the knowledge of mites and ticks (Acari) of Kuril Islands. Far Eastern Entomologist, 63: 1-36.
44. Krantz, G.W. 1978. A Manual of Acarology. Second edition, Oregon State Univ. Book Stores, Inc., Corvallis, 509 pp.
45. Lindquist, E.E. 1968. An unusual new species of *Tarsonemus* (Acarina: Tarsonemidae) associated with the Indian honeybee. Can. Entomol., 100 (9) : 1002-1006.
46. Lindquist, E.E. and G.O. Evans. 1965. Taxonomic concepts in the Ascidae, with a modified setal nomenclature for the idiosoma of the Gamasina (Acarina: Mesostigmata). Mem. Ent. Soc. Can., 47: 1-64.
47. Lindqvist, L. 1998. Taxonomic revision of the genus *Dinogamasus* Kramer (Acari: Mesostigmata : laelapidae). Entomologica Scandinavica, 54: 1-109.

48. Lombert, H.A.P.M., B.M.OConnor, F.S. Lukoschus and J.O. Jr. Whitaker. 1987. Ontogeny, systematics and ecology of *Sennertia* (*Amsennertia*) *americana* Delfinado & Baker, 1976 (Acari: Chaetodactylidae) from the nest of the carpernter bee, *Xylocopa virginica* (Hymenoptera: Anthophoridae). Int. J. Acarol., 13 : 113-129.

49. Lozano, L.G. 1989. Tracheal mite, *Acarapis woodi* (Rennie) (Acari : Tarsonemidae) infestations in the honeybee, *Apis mellifera* L. (Hymenoptera : Apidae) in Tamaulipas, Mexico. J. Ent. Sci., 24: 40-46.

50. Luxton, M. 1972. Studies on oribatid mites of a Danish beech wood soil. 1-Nutritional biology. Pedobiol. 12: 434-463.

51. Mautz, D. 1979. Gemulluntersuchung zur fruhzeitigen Erkennung. Imkerfreund, 34: 332-334.

52. Melathopoulos, A.P., M.L. Winston, R. Whittington, T. Smith, C. Lindberg, A. Mukai and M. Moore. 2000. Comparative laboratory toxicity of neem pesticides to honeybees (Hymenoptera: Apidae), their mite parasites *Varroa jacobsoni* (Acari: Varroidae) and *Acarapis woodi* (Acari : Tarsonemidae), and brood pathogens *Paenibacillus* larvae and *Ascophaera apis*. J. Econ. Entomol., 93 (2) : 199-209.

53. Morse, R.A. 1978. Honeybee pests, predators and diseases. Cornell Univ. Press, Ithaca, New York, 430 pp.

54. OConnor, B.M. 1982. Evolutionary ecology of astigmatid mites. Ann. Rev. Entomol., 27: 385-409.

55. OConnor, B.M. 1988. Coevolution in astigmatid mite-bee associations. In : Africanized Honeybees and Bee Mites. G.R. Needham; R.E. Page, Jr.; M. Delfinado-Baker and C. Bowman eds., Ellis-Horwood Ltd., Chichester, England, pp. 339-346.

56. OConnor, B.M. and P. Klimov. 2004. Systematics and ecology of North American bee-associated mites: Potential threats to native and introduced pollinators. Miscellaneous Publications of the University of Michigan Museum of Zoology, USA. (http :// insects. Ummz. Isq. Umich. edu. : 16080/bee mites/objectives. htm).

57. Örösi-Pal, Z. 1934. Experiments on the feeding habits of the *Acarapis* mites. Bee World, 15: 93-94.

58. Putatunda, B.N. and R.P. Kapil. 1988. Seven new species of *Cheletophyes* (Acari: Prostigmata : Cheyletidae) associated with carpenter bees in India. In Progress in Acarology, Vol. I (G.P. Channabasavanna and C.A. Viraktamath eds.), Oxford and IBH Publ. Co. Pvt. Ltd., New Delhi, pp. 317-328.

59. Refaei, G.S.M. 2001. Studies on some mites associated with honeybees in Egypt. M.Sc. Thesis, Fac. Sci., Cairo Univ., 99 p.

60. Richards, L.A. and K.W. Richards. 1976. Parasitid mites associated with bumblebees in Alberta, Canada (Acarina : Parasitidae; Hymenoptera : Apidae). II-Biology. Univ. Kans. Sci. Bull., 51: 1-18.
61. Ritter, W. 1981. *Varroa* disease of the honeybee *Apis mellifera*. Bee World, 62 (4): 141-153.
62. Rubink, W.L., M. Delfinado-Baker, W.T.Wilson, M.L. Gonzalez-Garcia and S. Gonzalez-Cortes. 1991. A phoretic uropodid mite associated with honeybee swarms of northeastern Mexico. Int. J. Acarol., 17 (4) : 259-264.
63. Sammataro, D., U. Gerson and G. Needham. 2000. Parasitic mites of honeybees : life history, implications and impact. Ann. Rev. Ent., 45: 519-548.
64. Schousboe, C. 1987. Deutonymphs of *Parasitellus* phoretic on Danish bumblebees (Parasitidae, Mesostigmata; Apidae, Hymenoptera). Acarologia, 28: 37-41.
65. Senna, F.M.A. 1997. A new record of phoretic mites on honeybee *Apis mellifera* L. in Egypt. J. Egypt. Soc. Parasitol., 27 (3) : 667-680.
66. Skaife, S.H. 1952. The yellow-banded carpenter bee, *Mesotrichia caffra* Linn., and its symbiotic mite, *Dinogamasus braunsi* Vitzthum. J. Ent. Soc. S.Afr., 15 : 63-76.
67. Smiley, R.L. 1992. The predatory mite family Cunaxidae (Acari) of the world, with a new classification. India Publishing House, West Bloom Field, Michigan, USA, 355 pp.
68. Summers, F.M. and D.W. Price, 1970. Review of the mite family Cheyletidae. Univ. Calif. Publ. Entomol., 61 : 153 pp.
69. Veitch, R. 1936. Report of the chief entomologists. Annual Report of the Department of Agriculture and Stock, Queensland, for the year 1935-1936.
70. Walter, D.E., J.J. Beard, K.L. Walker and K.S. Sparks. 2002. Of mites and bees: A review of mite-bee associations in Australia and a revision of *Raymentia* Womersley (Acari : Mesostigmata : Laelapidae), with the description of two new species of mites from *Lasioglossum* (*Parasphecodes*) spp. (Hymenoptera : Halictidae). Aust. J. Entomol., 41 (2): 128-148.
71. Zaher, M.A. 1984. Survey and ecological studies on phytophagous, predaceous and soil mites in Egypt. I- Phytophagous mites in Egypt (Nile valley and Delta). PL-480 Programme, USA, Project No. EG-ARS 30, Grant no. FG-EG-139, 228 pp.
72. Zaher, M.A. 1986. Survey and ecological studies on phytophagous, predaceous and soil mites in Egypt. II- Predaceous and non-phytophagous mites (Nile valley and Delta), PL-480 Programme, USA, Project No. EG-ARS 30, Grant no. FG-EG-139, 567 pp.

حصر الأكاروسات المرتبطة بنحل العسل في مصر

غادة رفاعي ، محمود النجار

معهد بحوث وقاية النباتات– مركز البحوث الزراعية – دقى – جيزه

تعتبر حشرة نحل العسل من أقدم الحشرات وأوسعها انتشاراً فهي تعيش معيشة اجتماعية في بيئة غنية بالمادة الغذائية ويصاحب هذا تعرضها للعديد من الآفات والأمراض والأكاروسات .. وغيرها.

ونظرا لأهمية هذه الحشرة في عملية تلقيح أزهار المحاصيل الزراعية الحقلية كانت أو بستانية مؤثرة بذلك على كمية وحجم الإنتاج وبالتالي الدخل القومي، بالإضافة إلى أهمية منتجاتها من عسل، وشمع، وغذاء ملكي، وحبوب لقاح، وسموم.

أجرى هذا البحث لدراسة الاتـــــى :

(١) حصر الأكاروسات المرتبطة بنحل العسل في مصر :

أسفرت عملية الحصر في معظم محافظات مصر على مدار سنتين متتاليتين ٢٠٠٥، ٢٠٠٦ عن وجود ٤٢ نوع من الأكاروسات مرتبطة بنحل العسل في مصر منها ما هو متطفل (داخلياً أو خارجياً)، مفترس، مترمم أو مستخدماً الحشرة كوسيلة انتقال من مكان لأخر. هذا وقد أظهرت عملية الفحص والتصنيف أن هذه الأكاروسات تنتمي لتحت رتبة الحلم ذات الثغر المتوسط، الحلم ذات الثغر الأمامي، الحلم عديم الثغر، والحلم الخنفسى. وكان أهمهما على الإطلاق وأكثرها انتشارا كلا من طفيل *Varroa destructor* و*Acarapis woodi* .