MYRMECOPHILE INSECTA ASSOCIATED WITH SOME ANT SPECIES (HYMENOPTERA-FORMICIDAE) IN EGYPT

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ABSTRACT

Studies of myrcmcophile insects associated with the Egyptian ant fauna indicate considerable diversity and variability. Thirteen insect orders have been recorded, Coleoptera, Homoptera, Heteroptera, Collembola, Isoptera, Diptera, Thysanura, Psocoptera, Lepidoptera, Dermaptera, Blattoidea, Hymenoptera, Embioptera. Thirty families have been recorded, Lyctidae, Lathridiidae, Anthicidae, Carabidae, Chrysomelidae, Coccinellidae, Cryptophagidae, Cucujidae, Curculionidae, Dermestidae, Elateridae, Histeridae, Mycetophagidae, Nitidulidae, Staphylinidae, Tenebrionidae, Lepismatidae, Labiduridae, Sminthuridae, Entomobryidae, Hodotermitidae, Aphididae, Coccidae, Jassidae, Membracidae, Anthocoridae, Cydinidae, Lygaeidae, Miridae, Polyphagidae.

INTRODUCTION

In spite of the aggressive behavior of ants, they are hostile to many organisms that can live in or near their nests and create symbiotic association with them; these organisms are termed as "Myrmecophiles". Many of them depending to a great degree on the ant society during a part or all of their life cycle. These myrmecophiles include a great diversity of arthropod groups like beetles, mites, springtails, flies, bugs, wasps, spiders, pseudoscorpionds, woodlice, booklice, cockroaches and others.

Wherever ants are found, intimate symbiotic relationships are established with most sap-sucking insects including aphids, mealybugs, scale insects, treehoppers, and some lepidopterous larvae. Sugary materials secreted by these creatures are taken by the ants to feed on them while the latter provide protection to these insects. Study of these myrmecophiles will help in understanding the relationships among the invertebrates in the terrestrial ecosystem and can help in discovering new taxa. Myrmecophiles are arthropods that live in or near the ant nests and evolved different levels of association with ants.

Donisthorpe is on of the first pioneer myrmecologists who write on the

issue of myrmecophiles living with ants. In (1923a) this author gave notes and observations on many myrmecophilous groups which included beetles, flies, aphids, mealybugs, spiders, springtails and woodlice. In (1923b) he continued his myrmecophilous observations on the previous arthropod groups plus notes on bugs and wasps. While in (1924) this author presented another series of his myrmecophilous notes including the pervious arthropods.

A detailed study of the guests of the British ants explaining their habitats and life histories were given by the previous author, Donisthorpe (1927). This work was the most comprehensive review of the myrmecophiles at all. Another comperhensive review of the relationships between ants and their guests were given by Hölldobler and Wilson (1990). They discussed in detail the symbiotic interactions between ants and other arthropods and they revised most literature concerned with this subject. The relationship between ants and their ecto- and endo-parasitic arthropods, including species of Acarina, Strepsiptera, Hymenoptera and Diptera were reviewed by Wojcik (1989). He mentioned that detailed studies of the biology and behavior of such parasites may contribute in understanding the actual relationships between them and ants. Skaife (1961) gave a general account on several ant guests including flies, beetles, butterflies, wasps, antlions and mites. He presented some notes about the relationships of these guests with their hosts. A general background about the symbiotic interactions between some myrmecophiles and ants was presented by Dumpert (1978). He explained the behavior of such myrmecophiles which included spiders, beetles and coleopterous larvae. An overview about the interactions of ants with other organisms including plants, animals, insects and fungi was presented by Schultz & Mc Glymn (2000). In addition, they gave a revision of the most important works carried out on this topic.

The phenomenon of myrmecoidy is the morphological or behavioral resemblance to ants without living in their nests or being myrmecophiles and may prey on them. Myers and Salt (1926) studied this phenomenon in Cuba describing and figuring the spiders and other insects that mimic ants.

Ant nests may contribute in the discovery of new species of different groups as done by Cushing (1995).

On the other hand, Ants were found to mimic other groups of insects such as termites. In a study involving this topic, Hölldobler and Wilson (1992) described a new species of ants *Pheidole nasutoides* from Costa Rica whose major workers mimic those of *Nasutitermes* sp. present in the same habitat. Termitophiles associated with sand termite Psammotermes hypostoma Desn. were studied in

Assiut governorate in Egypt by Abd el-Galil (1986). The author recorded three species of ants associated with that termite; *Monomorium pharaonis* L.; *Cataglyphis bicolor* Fabr.; and *Camponotus maculatus* v.*aegyptiacus* Emery.

Most of the myrmecophilous mites are phoretic, scavengers, parasites or predator organisms other than the host ant. Some ants feed on these mites, the specialized predation of oribatid mites by two species of the genus *Myrmecina* in Japan, *M.graminicola japonica* Wheeler & *M.flava* Terayama was discussed by Masuko (1994). The author described the morphological and behavioral adaptations that developed for the preying process.

Coleoptera is one of the most important insect orders that have many myrmecophiles. The latter are distributed along several families as Staphylinidae, Histeridae, Coccinellidae, Tenebrionidae....etc. Akre and Rettenmeyer (1966) described species of Staphylinid beetles that show varying degrees of association with army ants. They mentioned that some species live around the edges of the bivouacs or in the refuse pile without any integration into the colony, others are found running along edges or within the emigration columns of ants while others can live under specific conditions inside the colony and die after removal from the colony. The beetles associated with fungus growing ants of the genera *Atta* and *Acromyrmex* were studied giving 411 species belonging to 25 families (Navarette-Heredia, 2001). The authors presented a check list of these beetle species and mentioned that perminant beetles are associated with ant debris and/or in fungus chamber and finally noted that there is no evidence of direct interactions with the host.

The trophobiotic associations between ants and Homoptera including aphids, scale insects, coccids and mealybugs are very common. In the majority of cases the ants seek out and attend these insects on their proper food-plants and protect them and in return the homopterans produce considerable quantities of a sweet saccharine liquid which is much valued by the ants. The history of the symbiotic association between ants and mealybugs was studied by Johnson *et.al.* (2001). They reported a new record of *Acropyga* gyne carrying mealybug from French Guiana in several pieces of Dominican amber that contain *Acropyga* gyne with mealybugs. They estimated the age of this association to be at least 15-20 million years. The discovered mealybugs represented three new species belonging to a new genus.

Numerous species of Diptera are found with ants, and in the near neighbourhood of ant nests and these associations comprise different degrees of closeness. Some are truely parasitic, being ecto- or ento-parasites on their hosts (Donisthorpe, 1927). In a study concerning ectosymbiosis between phorid flies and

army ants, Rettenmeyer and Akre (1968) confirmed that most species of the phorid flies living with army ants in central America are scavengers and feed on dead ants and booty refuse deposited by the ants outside their bivouacs. So they cause no harm to the colonies and might be beneficial by eliminating refuse.

Myrmecophiles of army ants of West Africa were studied by Mann (1921-1922). The author reported four insect families living within ant nests, Paussidae, Staphylinidae, Syrphidae and Coccidae. In addition, a new species and a new subspecies were described.

Akre and Rettenmeyer (1968) investigated the phenomenon of trail-following by guests of army ants by exposing a large variety of these guests to natural odor trails laid over the floor of the laboratory arena. The authors found that nearly all the species tested, including species of Staphylinidae, Histridae, Limulodidae, Phoridae, Thysanura and Diplopoda were able to orient accurately by means of trail alone and by varying degrees.

Some diplopod species were found living with ants. A new species of myrmecophilous diplopod *Yncodesmus dampfi* from Mexico was described by Chamberlin (1947). The species was seen marching with the columns of the migratory army ant *Eciton praedator* (Smith).

No previous studies on the myrmecophiles of Egypt were carried out. This study provides the first estimate of the Egyptian ant myrmecophiles. Therefore, the aim of the present study is to Study the myrmecophilous arthropod fauna that are associated with some Egyptian ant species.

MATERIAL AND METHODS

In all the previous techniques ants were collected in the field and then put into vials filled with 95% ethanol and tight-fitting caps to retard the evaporation of alcohol. All the myrmecophiles of a certain ant colony were taken and put with their ant guest in the same vial. Every sample receptacle (vial) was clearly labeled with a code number written on a thick paper using a good quality pencil and then placed inside the vials. The code number refers to the location, date, habitat ....etc.

The first step in ants and myrmecophiles specimens preparation was the sorting of the material collected from the field. After field work, specimens were usually contained in vials and jars and were mixed with soil, other organisms and miscellaneous matter. It was important to remove the ants and their myrmecophiles from other

materials as soon as possible in order to prevent damage to specimens by abrasive particles and to avoid the formation of coating of clay and mineral salts on specimens. Salt-water extraction technique was used as described by Agosti *et.al* (2000).

Several microhabitats in which different kinds of ant nests and forage were surveyed and observed in all the studied localities. Searching for ants and their myrmecophiles was carried out on bare ground, in leaf litter, on twigs, shrubs and trees, under stones and in decaying logs. Rotting twigs and small tree branches buried within the litter were broken up to search for ants which were then picked up by the aspirator.

RESULTS AND DISCUSSION

The present study provides the first estimates of myrmecophiles associated with the Egyptian Formicidae; the collected taxa are as follow:

Thirteen orders of different insect groups have been recorded associated with the ant species studied (table 1), these are: order Coleoptera with fourteen families: Staphylinidae (8 species), Curculionidae (2), Anthicidae (9), Tenebrionidae (8), Nitidulidae (1), Dermstidae (1), Elateridae (3), Coccinellidae (2), Cryptophagidae (1), Chrysomelidae (1), Carabidae (4), Mycetophagidae (1), Histeridae (1), Cucujidae (2); Order Heteroptera with four families: Anthocoridae (1), Lygaeidae (6), Cydinidae (1), Miridae (1); Order Homoptera with three families: Membracidae (1), Jassidae (1), Coccidae (1); Order Isoptera with a single family Hodotermitidae (2); Collembolla (2); Order Thysanura with a single family Lepismatidae (1); Order Psocoptera with unidentified family (1); Order Dictyoptera with a single family Polyphagidae (1); Order Dermaptera with a single family Labiduridae (1); Diptera, Hymenoptera, Embioptera & Lepidoptera with unidentified families

Many arthropods have evolved symbiotic relationships with ants. Some are found at the periphery of the nest, either near the entrances or on refuse piles; others are found within the chambers of the nests, either in the peripheral chambers or deeper in the nest in the brood and storage chambers (Hölldobler & Wilson, 1990). They range from tiny collembolans to beetles and caterpillars many times the size of their hosts. Many thousands of these arthropods species mentioned make their homes and/or earn their livings in the stable environment afforded in or near ant nests, including insects of orders Blattaria, Coleoptera, Diptera, Homoptera, Hymenoptera, Lepidoptera, Neuroptera, Orthoptera, Psocoptera and Thysanura (Agosti et. al., 2000), they are called "myrmecophiles". These myrmecophiles have evolved various

adaptations enabling them to exist in this hostile environment. Many of them acquired cuticular hydrocarbons similar or identical to those of their hosts.

Donisthorpe (1927) wrote a book concerned with the guests of the British ants and contains a great deal of fascinating information about this issue and is well worth reading by anyone interested in myrmecophiles or interspecies relationships. A more recent revision of all literature concerned with myrmecophiles is presented by Hölldobler and Wilson (1990). This revision involves a table containing all invertebrate taxa that are known to be associated with the ant societies.

The myrmecophilous groups recorded in the present work are the following:

Order: Coleoptera

Coleoptera is one of the most important insect orders that have a great diversity of myrmecophiles. Many families have been recorded associated with ants. In the present study, thirteen families are recorded from this order which are quite common in the ant communities, these include:

Family: Anthicidae: Nine species of this family have been recorded. The beetles of this family are quite similar to ants in their morphology and therefore they take the name "the ant-like beetles". It is believed that these myrmecophilous Coleoptera may gain protection against predators due to this similarity.

Family: Carabidae: This family is represented by four species. The ants have adopted numerous defenses, including repellent chemicals and soldier castes to discourage predators, while predators have acquired methods of overcoming such defenses, becoming increasingly specialized in the process of predation (Agosti *et. al.* 2000). Carabid beetles are one of the most specialized predators and their relationships with ants could be a predation one.

Family: Chrysomelidae: Only a single unidentified species is recorded from this family. The larvae of the chrysomelid beetles feed on vegetable materials in host ant nests (Jolivet, 1952).

Family: Coccinellidae: This family is represented by two species. The relationship of these beetles with ants is indirect one; larvae and adults feed on aphids which are attended by ants.

Family: Cryptophagidae: Only one species is recorded from this family. Nothing is known about the relationship of these myrmecophiles and ants.

Family: Cucujidae: A single unidentified species is recorded. Nothing is known about the relationship of this group and ants.

Family: Curculionidae: Only two species are recorded from this family. Nothing is known about the relationships of these myrmecophilous beetles with ants.

Family: Dermestidae: Only One species is recorded, it is believed that members of this group of beetles may be scavengers and feed on the refuse piles of ant nests.

Family: Elateridae: This family is represented three species. Nothing is known about the relationship of these Myrmecophilous beetles and ants.

Family: Histeridae: Only a single unidentified species is recorded. This group of beetles steals or successfully solicits regurgitated food; this fact is obtained from an observation of the hysterid beetle *Hetaerius brunneipennis* (Wheeler, 1908). Some feed on detritus, others feed on hosts and on prey captured by ants; some solicit regurgitated food (Hölldobler & Wilson, 1990).

Family: Mycetophagidae: Only one species is recorded from this family. Nothing is known about the relationship of this group and ants.

Family: Nitidulidae: Only two species are recorded. These beetles solicit regurgitated food from ants (Hölldobler & Wilson, 1990).

Family: Staphylinidae: This family is represented by eight species. The relationship of this group of beetles and ants depends on the species; some are predators on the host or some are scavengers; at least some also groom the host while others feed by soliciting the regurgitated food by the ants and in some species, the larvae of Staphylinidae feed on the ant larvae (Hölldobler & Wilson, 1990).

Family: Tenebrionidae: This family is represented by eight species. These beetles are quite common in many ant nests and can be considered as ideal myrmecophilous species.

These myrmecophilous beetles are probably seed predators in storagechambers of the host ants nests (Hölldobler & Wilson, 1990).

Order: Hymenoptera

This order is represented my some parasitic species collected from the nests of many ant species from different localities but none of them has been identified.

Order: Homoptera

Beneficial interactions between homopterans and ants have been recorded for aphids, coccids, mealy bugs and membracids. Homopterans excrete honeydew that serves as food for ants. Ants also prey upon myrmecophilous Homoptera to supplement their protein requirements, and in doing so, they regulate populations of attended homopterans, preventing possible overpopulation and death of the host plant (Way 1963 & Fritz 1983).

In the majority of cases the ants seek out, and attend the scale insects on their proper food-plants, whether close at hand, or at some distance from the nest. Coccids protect their bodies with a covering of a white, powdery, wax-like substance; or with a tough scale. They produce considerable quantities of a sweet saccharine liquid which is excreted from the anus, and is much valued by the ants (Donisthorpe, 1927).

Family: Aphididae: Only a single unidentified species was collected. These insects which have been called "plant lice" play a very important role in the economy of Formicidae. The ants breed and "milk" them; keep them in herds, both underground and on plants; build "cattle-sheds" and walls of earth mixed with the secretion from their mandibular glands to protect them and keep away enemies. The ants also attend plant-lice on trees and bushes at long distances from their nests. Aphids produce, in return, vast quantities of excreta, which constitute a very considerable proportion of the food of many ants (Donisthorpe, 1927).

Family: Coccidae: An unidentified species of mealy bugs was collected the association between coccids or scale-insects and ants is very similar to that between ants and aphids. This association is much older; fossils alates of the ant genus *Acropyga* were discovered attending mealy bugs in Dominican amber dated to the Miocene (Johnson et. al. 2001). The discovery indicated that this intimate association has existed for at least 15-20 million years.

Family: Jassidae: A single unidentified species of the genus *Deltocephalus* was collected. The relationship between ants and Jassids is quite similar to that between ants and Aphids.

Family: Membracidae: This family is represented by a single species. The ant is observed attending the nymphs of membracids on *Tamarix nilotica* trees. The relationship between membracids and ants is similar to that between ants and aphids. The membracids excrete sugary materials which are taken by ants, and in return ants provide care and protection for them.

Order: Heteroptera

A diversity of insect predators settles near ant trails and prey on the ants.

Some of the most specialized predators occur among the Hemiptera (Hölldobler & Wilson, 1990). It is thought that the members of this order have a predatory relationship with ants. This order is represented by the following families:

Family: Anthocoridae: A single species is recorded.

Family: Cydinidae: Only a single species also is recorded.

Family: Lygaeidae: Five genera and five species are recorded.

Family: Miridae: A single unidentified genus and species is recorded. These myrmecophiles are probably predacious on ants (Hölldobler & Wilson, 1990).

Order: Collembola

This order is a common nest associate which has been taken, often in large series, from nests of many ant species from different localities. None of the collected species has been identified. The collembolans living inside the ant nests are mostly scavengers (Hölldobler & Wilson, 1990).

Order: Isoptera

Two genera and species are associated with ants, the major workers of the *Pheidole sinaitica* is similar to the soldiers of the termite *Anacanthotermes* sp. in size and shape. This may give advantages to both ants and termites. This result agrees with that given by (Hölldobler & Wilson, 1992) in which the authors described a new species of ants *Pheidole nasutoides* whose major workers mimic those of the termite *Nasutitermes* sp.

However, to our knowledge no ant or other social Hymenoptera have been recorded that mimic termites, despite the fact that many termite species have formidable defences against both vertebrates and invertebrates that would seemingly make them ideal models (Hölldobler & Wilson, 1992). But these authors imagine that ants may prey on termites.

Order: Diptera

This order is represented my some larvae collected from the nests of many ant species from different localities but none of them has been identified.

Order: Thysanura

Two species of this order are recorded. It is well known that thysanurans can be considered parasitic symbionts, simply stealing food from ant foragers during the trophollaxis phenomenon or by actively soliciting food droplets by mimicking

the tactile signals used by ants for this purpose (Wheeler, 1910). The silverfish *Trichatelura manni* has been observed to scrap and lick the body secretions of its ant host *Eciton* spp. (Wilson, 1971)

Order: Psocoptera

Two unidentified species are recorded. Nothing is known about the accurate relationship of these insects with ants.

Order: Lepidoptera

Several larvae of this order are recorded from the nests of many ant species from different localities, but it seems that the relationship is much more strong with the ant species *Tetramorium shirlae* because lepidopterous larvae are recorded associated with this species in three localities, and it is thought that Lepidoptera has more or less relationships with the mentioned ant species differing in its strength.

Ants tend caterpillars in the butterfly family Lycaenidae, nourishment is provided to the ants via specialized glands, and, as in the homopteran case, protection from predation and parasitism is provided by the ants (Agosti *et. al.* 2000). More than 50% of the Lycaenid butterflies have an ant-associated lifestyle (Myrmecophily) which may very from coexistence to specific mutualistic or even parasitic interactions (Dyck *et. al.*, 2000)

Order: Dermaptera

This order is represented by few species associated with ant nests. Nothing is known about their relationship with ants.

Order: Plattodea

Family: Polyphagidae: Only one species of cockroaches is recorded. The relationship of members of this family is not known.

Finally, very little information is known about the Egyptian myrmecophiles. No studies have investigated aspects of myrmecophiles-ant associations in any depth. Therefore, much more work must be done to determine how myrmecophiles become integrated into host colonies, how the ants react to these guests, what adaptations enable myrmecophiles to live inside the nests, and to what extent myrmecophiles affect the life of the host colony.

It is thought that this preliminary contribution gives a fresh approach to the subject of myrmecophiles of the Egyptian ants and helps newcomers to renew interest in this subject.

At the end, it is our hope that others will continue their search in the field of Egyptian myrmecophiles and can study them in more depth.

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TABLE (I)

The collected myrmecophiles

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Coleoptera				
Curculionidae	Sp.	*Pheidole sinaitica*	Arish zoo	17.3.2002
	Apion sp.	*Monomorium mayri*		
		Monomorium destructor		
		Monomorium nitidiventre		
		Camponotus aegyptiacus		
		Paratrechina jaegerskioeldi		
		Monomorium bicolor		
	Coleopterous larva	*pheidole sinaitica*		
	Apion sp.	*Solenopsis lou*		
		Solenopsis bakri n.sp.		
Staphylinidae	*Platistethus cornutus*	*Cardiocondyla mauritanica*	El-Aish zoo	17.3.2002
	Aleochara verna	*Cardiocondyla mauritanica*		
Anthicidae	*Ochtonomus bivittatus*	*Monomorium destructor*	50 km Ismailia- Arish road	14.3.2002
Tenebrionidae	*Gonocephalus rusticum*	*Monomorium salomonis*	Abuzabal(under leaves)	30.9.2001
		Monomorium salomonis sommieri		
	Opatroides punctulatus	*Monomorium subopacum*		
	Coleopterous larva	*Cataglyphis savignyi*		
		Camponotus aegyptiacus		
Nitidulidae	*Carpophilus hemipterus*	*Pheidole teneriffana*	Abuzabal(betn.fig.)	1.1.2002
Elateridae	*Drasterius bimaculatus* v.*variegatulus*	*Cardiocondyla emeryi*	Hawamdyia	2.11.2000

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Cardiocondyla minutior		
Anthicidae	*Anthicus crinitus?*	*Monomorium salomonis*		
	Formicomus weruleipennis cyanopterus	*Monomorium destructor*		
	*Anthicus*sp.	*Tetramorium shirlae*		
Tenebrionidae	*Zophosis* abbreviata	*Pheidole teneriffana*		
Anthicidae	. sp.1			
	.sp.2			
	.sp.3			
	Ochteronomus bivittatus	*Cardiocondyla emeryi*	Hawamdyia	10.1.1998
Tenebrionidae	*Gonocephalum rusticum*	*Cardiocondyla minutior*		
		Monomorium salomonis		
		Monomorium destructor		
		Tetramorium shirlae		
		Pheidole teneriffana		
		Monomorium bicolor	Elqasmia,Belbis	21.2.2003
Elateridae	.sp.1	*Pheidole teneriffana*		
	.sp.2	*Tetramorium shirlae*		
coccinellidae	*Scymnus* sp.	*Cardiocondyla mauritanica*		
Staphylinidae	*.sp.*	*Tapinoma simrothi*		
Cryptophagidae	*Cryptophagus affinis*	*Monomorium bicolor*		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Anthicidae	*Octonomus bivittatus*	*Monomorium salomonis*	Alag	27.2.2003
		Monomorium exiguum		
		Pheidole teneriffana		
		Paratrechina longicornis		
		Tetramorium shirlae		
		Cardiocondyla emeryi		
Anthicidae	.sp1	*Monomorium destructor*	Nag El-shadeed,W.Aswan	8.3.2003
		Pheidole fadli n.sp.		
		Paratrechina longicornis		
		Cardiocondyla minutior		
	.sp2	*Monomorium destructor*	Luxor temple	4.3.2003
Tenebrionidae	Sp	*Monomorium exiguum*		
	Goncephalum rusticum	*Cardiocondyla emeryi*		
Coccinellidae	*Scymnus* sp.	*Cardiocondyla minutior*	Nag a El-Ghallalab,Asswan	8.3.2003
	sp.1	*Cataglyphis savignyi*		
Staphylinidae	*Paederus alferii*	*Monomorium bicolor*		
		Pheidole teneriffana		
Lathridiidae	*Corticaria rugipennis*	*Monomorium destructor*	Abuzabal	4.4.2003
Staphylinidae	sp.	*Monomorium jizane*		
Nitidulidae	Carpophilus immaculatus	*Monomorium exiguum*		
Chrysomelidae	sp.	*Pheidole teneriffana*		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Lyctidae	Sp.	*Pheidole teneriffana*	G.Asfar	29.4.2003
	Coleoptera G.sp.	*Tetramorium shirlae*		
		Cardiocondyla emeryi		
		Crematogaster inermis		
Curculonidae	*Sitona* sp.	*Cardiocondyla emeryi*	Shrinkash (El-Mansoura)	13.5.2003
		Tetramorium shirlae		
		Monomorium exiguum		
Carabidae	*Pterostichus* sp.			
Coccinellidae	*Scymnus sp.*			
Staphylinidae	Sp1.			
	Sp2.			
Anthicidae	Sp.	*Pheidole teneriffana*		
		Pheidole megacephela		
	.sp.1	*Camponotus xerxes*	zaranik	5.5.2003
Mycetophagidae	*Typhaea stercorea*	*Pheidole sinaitica*		
Staphylinidae	Sp.3			
	Sp.4			
	Sp.5			

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Tenebrionidae	*Stenosis* sp.	*Plagiolepis pallescense*		
Staphylinidae	sp.	*Plagiolepis pallescense*		
	Sp1.	*Monomorium salomonis sommieri*	Abumadi, zaranik	6.3.2003
	Sp2.			
Staphylinidae	sp. larva			
	sp.	*Plagiolepis pallescense*		
Anthicidae	.sp.			
Carabidae	*Aephnidius* sp.	*Camponotus fellah*		
Anthicidae	*Octonomus bivittatus*	*Monomorium exiguum*	Abuzabal	13.6.2003
Curculionidae	sp.	*Paratrechina jaegerskioeldi*		
		Tetramorium shirlae		
Tenebrionidae	sp.1	*Monomorium jizane*		
	sp.2	*Tetramorium shirlae*		
Carabidae	*Tachys lucasi*	*Pheidole sinaitica*		
	Gnathonarium dentatum (Wider.1834) 5j			
Anthicidae	sp.1			
	sp.2			
	sp.3			
	sp.4			
Staphylinidae	sp.			

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Carabidae	sp.			
Tenebrionidae	*Gonocephalum rusticum*			
Histeridae	sp.			
Anthicidae	sp.5	*Monomorium dentatum*m.sp.		21.6.2003
	sp.6	*Tetramorium shirlae* n.sp.		
Coccinellidae	S1p.	Monomoium sp.1		
		Monomorium sp.2		
		Pheidole sp.	Naser,benisuef	29.6.2003
		Monomorium destructor		
		Monomorium bicolor		
		Pheidole sp.	El-minia	29.6.2003
		Crematogaster sp.		
		Cardiocondyla minutior		
		Cardiocondyla emeryi		
		Monomorium destructor		
		Solenopsis bakri n.sp.		
Carabidae	*Tachys lucasi*	*Monomorium dentatum* n.sp.	Abu swelam,El-minia	29.6.2003
		Paratrechina vividula		
		Pheidole sp.		
		Cardiocondyla minutior		
		Strumigenys sp.	Abu swelam,El-minia	29.6.2003
Dermstidae	*Lasioderma serricorne*	*Leptothorax angulatus*	Naser,benisuef	29.6.2003

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Tenebrionidae	Tribolium sp.	*Monomorium destructor*		
Cucujidae	sp.1	*Crematogaster sp.*		
		Pheidole sp.		
		Tetramorium shirlae		
	sp.2	*Leptothorax angulatus*	El-bremble,Atfeeh	23.7.2003
		Monomorium salomoonis		
		Pheidole teneriffana		
		Cardiocondyla emeryi		
		Paratrechina jaegerkioeldi		
		Monomorium exiguum		
carabidae	*Tachys lucasi*	*Tetramorium bicarinatum*	El-koraymat,giza	23.7.2003
		Paratrechina jaegerskioeldi		
		Leptothorax angulatus	Talkha,El-Mansoura	31.7.2003
		Paratrechina longicornis		
		Cardiocondyla emeryi		
Diptera				
	sp.1	*Monomorium bicolor*	Saloga Island (Aswan)	2.5.2002
		Monomorium mayri		
		Monomorium destructor		
		Monomorium nitidiventre		
		Monomorium subopacum		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Cataglyphis savignyi		
	sp.2	*Monomorium destructor*	Fiala temple (Aswan)	7.3.2003
		Pheidole fadli n.sp.		
	Sp.3	*Pheidole teneriffana*	Abuzabal(betn.fig.)	1.1.2002
	sp.4	*Messor aegyptiacus*	G.Asfar	29.4.2003
	sp.5	*Pheidole sinaitica*	zaranik	4.5.2003
		Monomorium salomonis sonmieri		
Hodotermitidae	*Anacanthotermes* sp.	*pheidole sinaitica*	Ghazal Island (Aswan),Aswan	2.5.2002
	Amitermes desertorum (all castes)	*Solenopsis bakri* n.sp.	Saloga Island (Aswan)	2.5.2002
		Solenopsis lou		
		Pheidole sinaitica	Abumadi,zaranik	5.5.2003
		Monomorium dentatum n.sp.	Abu zabal	21.6.2003
		Tetramorium shirlae		
		Tetramorium bicarinatum	El-koraymat,giza	23.7.2003
		Paratrechina jaegerskioeldi		
		Cardiocondyla emeryi	Hawamdyia	10.1.1998
		Cardiocondyla minutior		
		Monomorium salomonis		
Collembola				
Entomobryidae	Sp.	*Monomorium destructor*		
		Tetramorium shirlae		

TABLE (l) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Pheidole teneriffana		
		Cardiocondyla mauritanica	El-Aish zoo	17.3.2002
		Monomorium bicolor	Elqasmia,Belbis	21.2.2003
		Pheidole teneriffana		
		Tetramorium shirlae		
		Cardiocondyla mauritanica		
		Tapinoma simrothi		
		Monomorium bicolor	High dam,Asswan	7.3.2003
		Pheidole sinaitica		
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae		
		Cardiocondyla emeryi		
		Monomorium exiguum		
		Monomorium destructor	Luxor temple	4.3.2003
		Monomorium exiguum		
		Cardiocondyla emeryi		
		Monomorium destructor	Fiala temple (Aswan)	7.3.2003
		Pheidole fadli n.sp.		
		Monomorium exiguum	luxor temple	4.3.2003
		Pheidole sinaitica		
		Pheidole teneriffana	G.Asfar	29.4.2003
		Tetramorium shirlae		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Cardiocondyla emeryi		
		Crematogaster inermis		
		Cardiocondyla emeryi	Shrinkash (El-Mansoura)	13.5.2003
		Tetramorium shirlae		
		Monomorium exiguum		
		Monomorium exiguum	Abuzabal	13.6.2003
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae		
		Monomorium jizane		
		Tetramorium shirlae		
		Monomorium dentatum n.sp.		
		Tetramorium shirlae		
Sminthuridae		*Monomorium dentatum* n.sp.	Abu swelam.El-minia	29.6.2003
		Paratrechina jaegerskioeldi		
		Monomorium dentatum		
		Paratrechina vividula		
		Pheidole sp.		
		Cardiocondyla minutior		
		Strumigenys sp.		
		Leptothorax angulatus	El-bremble,Atfeeh	23.7.2003
		Monomorium salomoonis		
		Pheidole teneriffana		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Cardiocondyla emeryi		
		Paratrechina jaegerkioeldi		
		Monomorium exiguum		
Heteroptera				
anthocoridae	*Triphleps laevigatus*	*Pheidole teneriffana*	Abuzabal(betn.fig.)	1.1.2002
		Monomorium bicolor	Elqasmia,Belbis	21.2.2003
		Pheidole teneriffana		
		Tetramorium shirlae		
		Cardiocondyla mauritanica		
		Tapinoma simrothi		
Lygaeidae	*Pachybrocus annulipes*	*Monomorium bicolor*		
Anthocoridae	*Triphleps laevigatus*	*Monomorium exiguum*		
Cydinidae	*Cydnus hispidulus*	*Pheidole teneriffana*		
		Tetramorium shirlae		
		Cardiocondyla emeryi		
		Cataglyphis savignyi		
Lygaeidae	*Geocoris acuticeps*	*Monomorium salomonis*	Alag	27.2.2003
		Pheidole teneriffana		
Anthocoridae	*Triphleps laevigatus*	*Pheidole fadli n.sp.*	Nag El-shadeed, W.Aswan	8.3.2003
		Paratrechina longicornis		
		Cardiocondyla minutior		
		Monomorium destructor		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Pheidole sp.		
		Lepisiota sp.		
	Hetroptera nymph G.sp.	*Monomorium destructor*	Luxor temple	4.3.2003
		Monomorium exiguum		
		Cardiocondyla emeryi		
Lygaeidae	*Cymophyes ochroleuca*	*Monomorium destructor*	Fiala temple (Aswan)	7.3.2003
	sp.	*Pheidole fadli* n.sp.		
Miridae	sp.	*Monomorium bicolor*	Kom Ombo (Aswan)	5.3.2003
		Monomorium destructor		
		Cardiocondyla minutior		
	Heteropterous nymphs 1	*Cardiocondyla emeryi*	Shrinkash (El-Mansoura)	13.5.2003
	Heteropterous nymphs 2	*Tetramorium shirlae*		
		Monomorium exiguum		
Lygaeidae	*Geocoris* sp.(nymph)	*Pheidole teneriffana*		
		Pheidole megacephela		
	Nysius cymoides	*Paratrechina longicornis*		
	sp	*Monomorium exiguum*		
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae		
Homoptera				
Membracidae	*Oxyrrhachis tarandus*	*Camponotus oasium*	Ebn Salam	7.11.2002
coccidae	mealy bugs sp.	*Monomorium bicolor*	Elqasmia,Belbis	21.2.2003

TABLE (1) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
		Pheidole teneriffana		
		Tetramorium shirlae		
		Cardiocondyla mauritanica		
		Tapinoma simrothi		
Jassidae	*Deltocephalus* sp.	*Monomorium salomonis*	Alag	27.2.2003
		Pheidole teneriffana		
		Monomorium destructor	Luxor temple	4.3.2003
		Monomorium exiguum		
		Cardiocondyla emeryi		
coccidae	Mealy bugs sp.	*Pheidole teneriffana*	G.Asfar	29.4.2003
		Tetramorium shirlae		
		Cardiocondyla emeryi		
		Crematogaster inermis		
Aphididae	sp.	*Plagiolepis pallescense*	Zaranik	5.5.2003
coccidae	mealy bug sp.	*Monomorium exiguum*	Abuzabal	13.6.2003
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae		
		Monomorium dentatum n.sp.	Abu swelam,El-minia	29.6.2003
		Paratrechina jaegerskioeldi		
Hymenoptera				
	Parasitic hymenoptera sp.1	*Pheidole teneriffana*	Abuzabal(betn.fig.)	1.1.2002

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
	Parasitic hymenoptera sp.2	*Monomorium destructor*	Abuzabal	4.4.2003
		Monomorium fizane		
		Monomorium exiguum		
		Pheidole teneriffana		
	Parasitic hymenoptera sp.1	*Cardiocondyla emeryi*	Shrinkash (El-Mansoura)	13.5.2003
		Tetramorium shirlae		
		Monomorium exiguum		
		Monomorium dentatum n.sp.	Abu zabal	21.6.2003
		Monomorium shirlae n.sp.		
Lepidoptera				
	Lepidopterous pupa	*Cardiocondyla emeryi*	Hawamdyia	10.1.1998
		Cardiocondyla minutior		
		Monomorium salomonis		
		Monomorium destructor		
		Tetramorium shirlae		
		Pheidole teneriffana		
		Tetramorium shirlae	Shrinkash (El-Mansoura)	13.5.2003
	Lepidopterous larvae	*Monomorium exiguum*		
		Cardiocondyla emeryi		
	Lepidopterous pupa	*Monomorium exiguum*	Abuzabal	13.6.2003
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Thysanura				
Lepismatidae	*Lepisma myrmecophila*	*Cardiocondyla minutior*	Nag a El-Ghallalab,Asswan	8.3.2003
		Cataglyphis savignyi		
	sp.1	*Monomorium dentatum n.sp.*	Abu zabal	21.6.2003
		Tetramorium shirlae		
Dermaptera				
labiduridae	*Euborellia annulipes*	*Plagiolepis pallescense*	Zaranik	5.5.2003
		Plagiolepis pallescense		
		Monomorium dentatum n.sp.	Abu zabal	21.6.2003
		Tetramorium shirlae		
Psocoptera				
	sp.1	*Pheidole teneriffana*	G.Asfar	29.4.2003
		Tetramorium shirlae		
		Cardiocondyla emeryi		
		Crematogaster inermis		
		Monomorium exiguum	Abuzabal	13.6.2003
		Paratrechina jaegerskioeldi		
		Tetramorium shirlae n.sp.		
Blattodea				
Polyphagidae	*Polyphaga* sp.	*Monomorium dentatum n.sp.*	Abu zabal	21.6.2003
		Tetramorium shirlae		

TABLE (I) continued

ORDER FAMILY	SPECIES	HOST (ANT SPECIES)	LOCALITY	DATE
Embioptera				
	sp.1	Monomorium sp.2		
		Monomoium sp.1		
		Cardiocondyla emeryi	Hawamdyia	2.11.2000
		Cardiocondyla minutior		
		Monomorium salomonis		
		Monomorium destructor		
		Tetramorium shirlae		
	Sp.2	*Pheidole teneriffana*		
		Monomorium destructor	El-karnak temple.Luxor	4.3.2003
		Monomorium salomonis		
		Pheidole sinaitica		

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