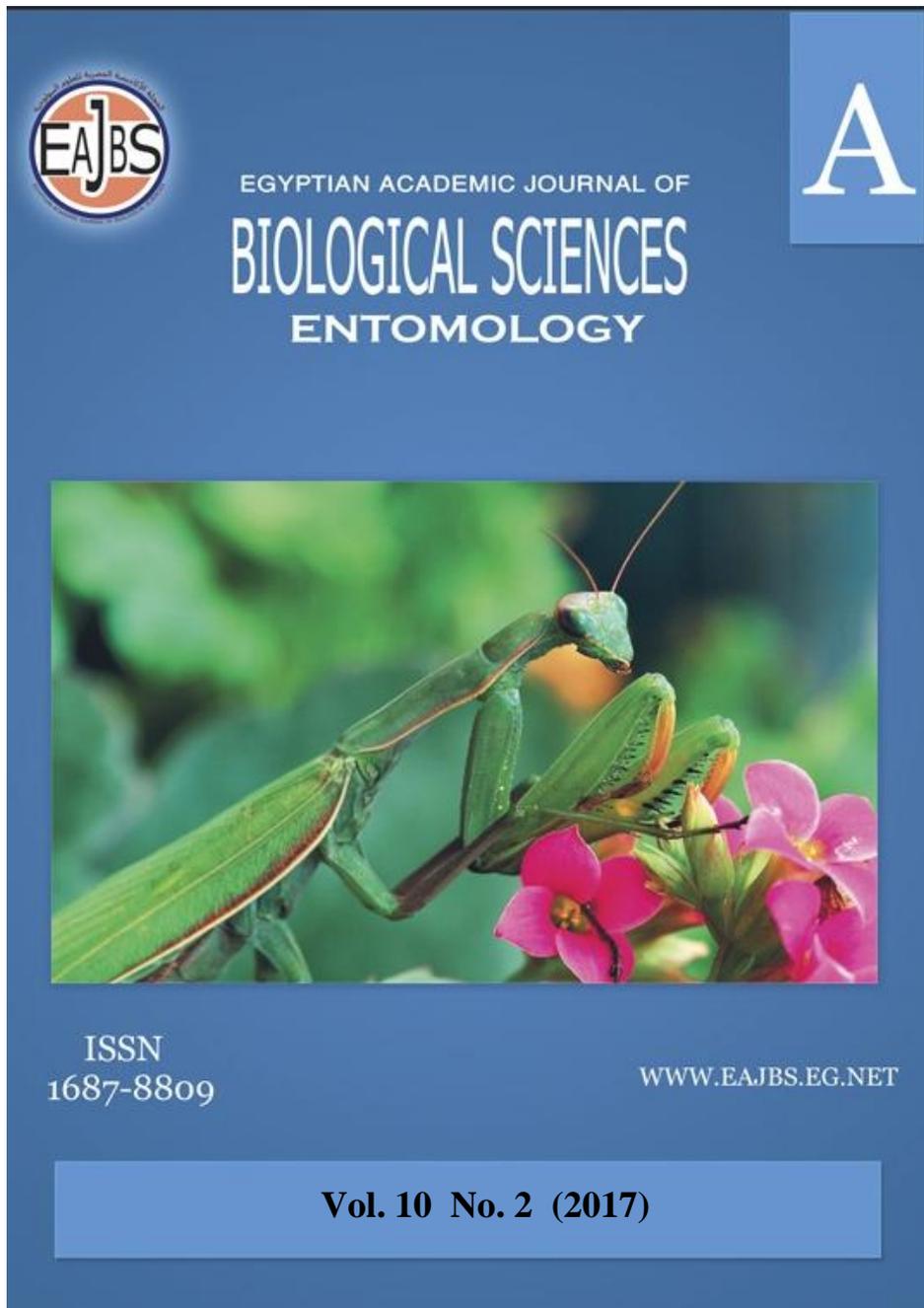


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**Occurrence of the Ectoparasites Infesting *Rattus rattus* and *R. norvegicus* at El-Menofia Governorate, Egypt**

**Younis A. E. Eisa, A. M. Rizk and E.M.A. Yassin**

Plant Protection Research Institute, A.R.C., Dokki, Giza, Egypt.

**ARTICLE INFO**

**Article History**

Received:20/2/2017

Accepted:28/3/2017

**Keywords:**

Rodent  
Ectoparasites  
Mites  
lice and ticks

**ABSTRACT**

The ectoparasites arthropods of rodent infesting animals and human have gained much attention in Egypt. The most important rodents in Egypt are Roof rate, *Rattus rattus* and Norway rate, *Rattus norvegicus*. Parasitological survey of these rodent species in El-Menofia Governorate (different regions) during summer season, 2016 was infested with various species from arthropods such as 6 mite species, 2 tick species and one lice species. The collected mites were *Dermanyssus sanguineus* (Dermanyssidae), *Orithonysus bacoti* (Macronyssidae), *Haemolaelaps glasgowi*, *Laelaps nuttalli* (Laelapidae); *Radfordia* sp. and *Myobia* sp. (Myobiidae). In this study, the ectoparasitic ticks were represented by two species i.e. *Rhipicephalus sanguineus* and *Hyalomma dromedarii* (Ixodidae). On the other hand, the ectoparasitic lice on *R. rattus* and *R. norvegicus* at El-Menofia Governorate were represented by one species, *Polyplax spinulosa* (Polyplacidae). The present study showed that the lowest number of trapped rats was 15 rats at El-Bagour district with 71 parasitic mites, 61 lice individuals and 25 tick members but the highest number of trapped rats was recorded at Menouf region (51 rates) infested with 262 different mite numbers, 23 lices and 40 tick individuals. The lowest number of parasitic mites was 69 members at Ashmoun district and the highest lice number was found at Ashmoun (943 lices) but the lowest number was recorded at Menouf (23 lices), while El-Bagour region included the lowest number of ticks (15 individuals) and the highest number was found in Quesna (125 individuals). The current study indicated that Ashmoun district had the highest number of collected rat ectoparasites (1028 individuals), but the lowest region was El-Bagour, as, it included 147 ectoparasites individuals (mites, lice and ticks).

**INTRODUCTION**

Domestic rodents (rats and mice) are closely associated with man and his food and can play either direct or indirect role in vectors of pathogens of human, Zahedi *et al.*, (1996). *Rattus rattus* is a pest and dangerous to humans in several ways, as these animals are severely destructive to crops, farms and fruit trees. Not only, they feed on these but they destroy what they are unable to consume. Also, these domestic rodents play an important role in the transmission of diseases of public health in urban and semi-urban environment (Brooks and Rowe, 1987). Many rodents are implicated in the spread of diseases to humans and domestic animals, and must be controlled (Brouqui and Raoult, 2006). The causative organisms of many diseases are carried in the blood of rodents and need an arthropod vector to act as an intermediary in the transmission of the diseases to man (Azad, 1986).

The rodents are reservoir hosts for a number of parasites, plague and other pathogens (Paramasvaran *et al.*, 2009). Rodent ectoparasitic mites can be found in homes where rats or mice are abundant or where rodents have recently died. Several common rodent mites have been known to occasionally bite humans. The tropical rat mite, *Ornithonyssus bacoti* is neither truly tropical nor exclusively feeds on rats and can live for up to 10 days off its host and is capable of traveling great distances to find new food sources (Hahn and Averbeck, 2017). In habitats where rodents have been killed, the mites will leave their dead hosts, congregate around heat sources, such as hot pipes and stoves and seek alternative food sources including humans (Hahn and Averbeck, 2017) and the bite of these mites often causes tiny, clear blisters which is accompanied by a rash. The fleas that and ticks live on rat, *R. rattus* which carry a number of diseases that can seriously harm humans, livestock, and other animals (Allen, 1938; Corbet and Southern, 1977; Grzimek, 2003; Singleton *et al.*, 2003 and Jongejan and Uilenberg, 2004). The present study aims to elucidate the ectoparasites fauna of the rats, *Rattus rattus* and *R. norvegicus* in El-Menofia Governorate during summer season, 2016.

## MATERIALS AND METHODS

All captured rats were transported to the laboratory, and then, exposed to Ether to avoid killing and escaping the ectoparasitic mites, lice and ticks by using tooth brush to extract the individuals which cleared in Nesbit' agent (40 gm of chloral hydrate, 25 ml distilled water and 25 ml of concentrated hydrochloric acid for 24-72 hours depending upon the amount of sclerotization of the specimens. The cleared specimens were mounted in Hoyer's medium (50 ml distilled water, 30 gm of gum Arabic, 200 gm of chloral hydrate and 20 ml of glycerin) (Krantz and Wharton, 2009). The identification of mites was done according to Evans (1982), Krantz and Walter (2009) and Mathison and Pritt (2014). Identification of tick and lice were done according to Mathison and Pritt (2014), Soulsby (1978), Imms (1934) and Hogstraal (1956), was followed frequency and index number of mite/number of animals and lice index (number of lice/number of animals) and tick index (number of tick/number of animals) were recorded. The study was conducted all over summer season, 2016. One hundred and fifty wire box traps were baited and distributed in some selected residential houses at sunset in two villages for each of 9 districts in El-Menofia Governorate (El-Sadat, Tala, Berket El-Sabaa, Ashmoun, El-Bagour, Quiesna, Shebien El-Koom, El-Shohadaa and Menouf during summer season, 2016). Distributed traps will be collected next morning and the positive ones enclosed in separated white bag to avoid escape ectoparasites and transported to the laboratory. In laboratory, each animal was identified. The average number of rodents per traps was counted.

## RESULTS AND DISCUSSION

### **Ectoparasitic organisms on *Rattus rattus* and *R. norvegicus*.**

The parasitic species of mites and Ticks (Acari), lice (Insects) were found on rats, *Rattus rattus* and *R. norvegicus* encountered during the course of the present study. The ectoparasites were collected from the trapped rats at El-Menofia Governorate. Data on Table (1) revealed that rodent species were infested with various species from arthropods such as mites, ticks and lice. From the tabulated data, it was found that six species of mites, *Dermanyssus (Liponyssoides) sanguineus*

(Dermanyssidae), *Orithonysus bacoti* (Macronyssidae), *Haemolaelaps glasgowi* (Ewing), *Laelaps nuttalli* Hirst (Laelapidae), *Radfordia* sp. and *Myobia* sp. (Myobiidae). The ectoparasitic ticks in this study were represented by two species, *Rhipicephalus sanguineus* and *Hyalomma dromedarii* (Ixodidae). On the other hand, the ectoparasitic lice on *R. rattus* and *R. norvegicus* at El-Menofia Governorate was represented by one species, *Polyplax spinulosa* (Polyplacidae) (Table, 1). The behaviour of the collected mites, ticks and lice in this study was demonstrated in Table (1).

**Table 1: List of Ectoparasites mites, ticks and lice on *Rattus rattus* and *R. norvegicus* at El-Menofia Governorate.**

Family	Species	Behavior	Reference
<b>Ectoparasitic mites (Mesostigmata)</b>			
Dermanyssidae	<i>Dermanyssus Liponyssoides sanguineus</i>	Ectoparasites on the rat, mouse and other domestic rodents, and also can bite humans	Brouqui and Raoult, 2006
Macronyssidae	<i>Orithonysus bacoti</i>	Attacks people living in rat-infested buildings. Persons working in granaries and food supply houses frequented by rats may be greatly annoyed by this mite.	Azad, 1986.
Laelapidae	<i>Haemolaelaps glasgowi</i> (Ewing)	Starved adult females appeared to feed on a mouse	Lang, 1942
	<i>Laelaps nuttalli</i> Hirst	Adult and 1 <sup>st</sup> and 2 <sup>nd</sup> nymphs of this species fed well on blood cake (human, rat and chicken)	Ikuzawa <i>et al.</i> , 1967
Myobiidae	<i>Radfordia</i> sp.	Parallelism exists between the evolution of these mites and mammalian hosts.	Fain, 1975
	<i>Myobia</i> sp.	All stages fed on extra cellular fluids of house mouse	Wall and Shearer, 2001
<b>Ectoparasitic ticks (Metastigmata)</b>			
Ixodidae	<i>Rhipicephalus sanguineus</i> (Latreille)	This tick responsible for the maintenance and transmission of many pathogens affecting domestic animals and humans.	Jongejan and Uilenberg, 2004
Ixodidae	<i>Hyalomma dromedarii</i> Koch	This tick eliminated excess fluid to concentrate the blood meal	Tatchell, 1967
<b>Ectoparasitic lice (Phthiraptera)</b>			
Polyplacidae	<i>Polyplax spinulosa</i> (Burmeister)	This lice is a blood sucking and can transmit a number of infectious agents	Koyee <i>et al.</i> , 2011

### **Infestation level of ectoparasites on *R. rattus* and *R. norvegicus*.**

The tabulated data in Table (2) showed that the lowest number of trapped rats was observed (15 rats) at El-Bagour district with 71 parasitic mites, 61 lice individuals and 25 tick members. On the other hand, the highest number of trapped rats was recorded at Menouf (51 rat members) which harboured 262 different mite individuals, 23 lices and 40 tick individuals. The obtained data also denoted that the lowest number of parasitic mites was 69 members at Ashmoun district, also the highest abundant lice was found at Ashmoun (943 lice individuals) and the lowest number was recorded at Menouf (23 lice members), while El-Bagour region included the lowest number of ticks (15 individuals) and the highest number was found at Quiesna (125 tick individuals). The current study indicated that Ashmoun district had the highest number of collected rat ectoparasites (1028 individuals), but the lowest region was El-Bagour being 147 ectoparasite individuals. As shown in Table (2), the highest abundance of mites and lice were noticed at El-Sadat region, and then recorded calculated index (9.06, 44.71), respectively, but the highest abundance of ticks was recorded at Quiesna district (the tick index = 4.81). However, the lowest abundant of ectoparasites on the trapped rodents were 2.51 for mites at Tala district, 0.45 for lice at Menouf district and 0.57 for ticks at Shebien El-Koom district.

**Table 2: The numbers of ectoparasite indices of *Rattus rattus* and *R. norvigicus* at El-Menofia Governorate.**

Study region	Numbers of rodents	Ectoparasites						Total numbers of ectoparasites
		Mites		Lice		Tick		
		Number	index	Number	index	Number	index	
El-Sadat	17	154.0	9.06	760.0	44.71	24.0	1.41	938
Tala	41	103.0	2.51	60.0	1.46	38.0	0.93	201.0
Berket El-Sabaa	44	99.0	2.25	195.0	4.43	57.0	1.30	351.0
Ashmoun	25	69.0	2.76	943.0	37.72	16.0	0.64	1028.0
El-Shohadaa	18	134.0	7.44	130.0	7.22	23.0	1.28	287.0
El-Bagour	15	71.0	4.73	61.0	4.07	15.0	1.0	147.0
Quiesna	26	89.0	3.42	196.0	7.54	125.0	4.81	410.0
Shebien El-Koom	47	306.0	6.51	198.0	4.21	27.0	0.57	531.0
Menouf	51	262.0	5.14	23.0	0.45	40.0	0.78	325.0
Mean	31.56	143.0		285.77		40.56		

**Infestation levels of parasitic ticks on domestic rats.**

As shown in Table (3), the lowest trapped numbers of *R. rattus* was occurred at El-Sadat district (8 rats) as free from different ectoparasitic ticks, and at Ashmoun district (8 rats) infested with 6 tick individuals, while the highest numbers of trapped rats was recorded at Shebin El-Koom (22 trapped *R. rattus*) infested with 15 tick individuals. On the other hand, the lowest trapped *R. norvegicus* numbers was recorded at El-Bagour district (4 individuals) which harboured 10 tick individuals, while, the highest trapped rats were noticed at Menouf district (30 rat individuals) infested with 25 individuals of *Rhipicephalus* sp. and free from *Hyalomma* sp. Generally, the obtained results showed that the infestation rate of the recorded parasitic ticks was a high on *R. norvegicus* at Quiesna district (125 tick individuals, i.e. 83 of *Rhipicephalus* sp. and 42 of *Hyalomma* sp.).

**Table 3: The abundance of ectoparasitic ticks infested *R. rattus* and *R. norvegicus* at El-Menofia Governorate**

Study area	Numbers of animals	Animal species	No. of tick	Tick index	No. of <i>Rhipicephalus</i> sp.	No. of <i>Hyalomma</i> sp.
El-Sadat	8	<i>R. rattus</i>	0.0	0	0	0
	9	<i>R.norvigicus</i>	24	1	17	7
Tala	22	<i>R. rattus</i>	27	1.3	22	5
	19	<i>R.norvigicus</i>	11	1.2	6	5
Berket El-Sabaa	20	<i>R. rattus</i>	31	18	17	14
	24	<i>R.norvigicus</i>	26	2.75	19	7
Ashmoun	8	<i>R. rattus</i>	6.0	2.25	4	2
	17	<i>R.norvigicus</i>	10.0	0.54	7	3
El-Bagour	11	<i>R. rattus</i>	5.0	0.5	3	2
	4	<i>R.norvigicus</i>	10.0	0.71	7	3
Quiesna	14	<i>R. rattus</i>	20.0	0.9	11	9
	12	<i>R.norvigicus</i>	105.0	5	72	33
Shebien El-Koom	22	<i>R. rattus</i>	15	0.5	8	7
	25	<i>R.norvigicus</i>	12	122	7	5
Menouf	21	<i>R. rattus</i>	15	1.66	9	6
	30	<i>R.norvigicus</i>	25	1	25	0
El-Shohadaa	9	<i>R. rattus</i>	1	0.5	1	0
	9	<i>R.norvigicus</i>	22	0.84	14	8

**Infestation levels of parasitic mites on domestic rats.**

Regarding infestation rates of ectoparasitic mites in the different localities, Table (4) showed that the highest infestation on *R. rattus* was noticed at Shebien El-Koom region (224 mite individuals), but the infestation rate was absent during the studied period at Quiesna district, as, the rats were free from any parasitic mites. On

the other hand, the lowest number of collected parasitic mites on *R. norvegicus* was noticed at Tala district with 4 mite individuals, while the largest number was 139 mites at Menouf region.

Table 4: Mites indices of the rodent during summer, 2016 at El-Menofia Governorate.

Study regions	Rodent species	Number of rodents	Number of mites	Mite index	<i>Dermanyssus (Liponyssoides) sanguineus</i>	<i>Orithonyssus bacoti</i>	<i>Haemolaelaps glassgowi</i>	<i>Laelaps nuttalli</i>	<i>Radfordia</i> sp.	<i>Myobia</i> sp.
El-Sadat	<i>R. rattus</i>	7	97	13.86	35	30	3	0	11	18
	<i>R. norvegicus</i>	9	57	6.33	24	17	16	0	0	0
Tala	<i>R. rattus</i>	18	97	5.39	71	20	6	0	0	0
	<i>R. norvegicus</i>	17	6	0.35	4	0	2	0	0	0
Berket El-Sabaa	<i>R. rattus</i>	24	31	1.29	16	8	7	0	0	0
	<i>R. norvegicus</i>	10	68	6.8	29	22	17	0	0	0
Ashmoun	<i>R. rattus</i>	19	65	3.47	29	21	15	0	0	0
	<i>R. norvegicus</i>	13	4	0.31	4	0	0	0	0	0
El-Bagour	<i>R. rattus</i>	10	14	1.1	8	4	2	0	0	0
	<i>R. norvegicus</i>	20	57	3.05	45.0	12	0	0	0	0
Quiesna	<i>R. rattus</i>	1	0	0	0	0	0	0	0	0
	<i>R. norvegicus</i>	30	89	3.0	50	21	18	0	0	0
Shebien El-Koom	<i>R. rattus</i>	28	224	8.57	85	60	76	0	3	0
	<i>R. norvegicus</i>	7	82	2.57	11	70	1	0	0	0
Menouf	<i>R. rattus</i>	9	123	13.89	67	33	23	0	0	0

Similarly, results were obtained when the commensally rodents (*Rattus norvegicus*, *R. rattus alexandrinus* and *R. rattus frugivorus*) were surveyed by El-Kady *et al.* (1995) in the Suez Canal zone for their Acari ectoparasites. Four species of mites were recovered. In a descending order of mite indices, there were *Eulaelaps stabularis* (4.83 on 6 rats), *Laelaps nuttalli* (3.11 on 27 rats), *Ornithonyssus bacoti* (1.66 on 9 rats) and *Dermanyssus gallinae* (0.66 on 24 rats). The overall mite indices in the three governorates were 3.66 in Suez, 2.82 in Ismailia and zero in Port Said. The house mouse mite, *Liponyssides sanguineus* has a worldwide distribution but it is more common in the U.S. in the northeastern states, Hahn and Averbeck (2017). This mite attack human if rodent hosts are not available and regard as vector of *Rickettsia akari*, the rickettsial pox in humans.

Similarly results were also obtained by Mikhail *et al.* (2010) in El-Menofia Governorate. The main species of rodent was Norway rat, *Rattus norvegicus*, the grey-bellied rat, *Rattus rattus alexandrinus*, the white-bellied rat, *Rattus rattus frugivorus* and the house mouse, *Mus musculus*. The common tick species attacking rodents were: *Rhipicephalus* sp. and *Hyalomma* sp. The common mite species attacking rodents were: *Dermanyssus sanguineus*, *Orithonyssus bacoti*, *Haemolaelaps glasgowi*, *Laelaps nuttalli*, *Radfordia* sp. and *Myobia* sp. The only common lice species was *Polyplax spinulosa*. The fur mites *Radfordia* sp. and *Myobia* sp. were recorded on *R. norvegicus* for the first time at Menoufia Governorate.

Also, Abd El-Halim *et al.* (2009) identified four species of mites (*Ornithonyssus bacoti*, *Haemolaelaps glasgowi*, *Echinolaelaps echinolelaps* and *Dermanyssus gallinae*), two species of ticks (*Rhipicephalus sanguineus* and *Hyalomma dromedarrii*) and one species of lice (*Polyplax spinulosa*) on rodents trapped in five Egyptian governorates (Suez, Menoufia, Giza, Damietta and Beni-Sewaf). The rodents were *Rattus norvegicus*, *Rattus rattus alexandrinus*, *Rattus rattus frugivorus*, *Acomys cahirinus* and *Mus musculus*. The authors noticed also that rodents in Suez Governorate were the highly ectoparasites infested ones. The result of the occurrence of *P. spinulosa* in rat colonies in two selected animal houses is in agreement with the study done by Koyee *et al.* (2011), in which, they mentioned that the distribution of lice on the rats was very irregular, even when rats were caught at the same time and on the same premises. According to the study of Abo-Elmaged

and Desoky (2013), the relation of inter-specific between the rodent species and their ectoparasites showed that not specific relationship between the rodent species and ectoparasites species, and the population fluctuation of rodent ectoparasites took the same trend of the population fluctuation of the rodent species. Examination of 165 rodents trapped in domestic, peridomestic and feral biotopes of central and southern India by Saxena (1999) which revealed the presence of 1,359 mesostigmatid mites. Rodents in central India were infested with 1 species of mite, *Laelaps nuttalli*; 98% of these mites were recovered from the peridomestic rodent *Bandicota bengalensis*. Also, Fain *et al.* (1980) recorded 9 myobiids mite species from Malaysian rodents

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## ARABIC SUMMERY

تواجد المتطفلات الخارجية التي تصيب الفأر *Rattus rattus* والفأر *R. norvegicus* في محافظة المنوفية

– مصر –

يونس احمد السيد عيسى – احمد محمد رزق- عصام محمد عبدالسلام ياسين

معهد بحوث وقاية النباتات- الدقى – جيزة – مصر

أجريت هذه الدراسة لمعرفة لتواجد المتطفلات الخارجية (أكاروس – قراد – قمل) والتي تصيب كلا من الفأر المتسلق *Rattus rattus* و الفأر النرويجي *R. norvegicus* في الموسم الصيفي ٢٠١٦ في مراكز محافظة المنوفية (السادات – تلا – بركة السبع – أشمون – الشهداء – الباجور- قويسنا - شبين الكوم- منوف) حيث أسفرت الدراسة عن تواجد ٦ أنواع أكاروسية مختلفة وهي النوع *Dermanyssus sanguineus* التابع لعائلة Dermanssidae و النوع *Orithonyssus bacoti* التابع لعائلة Macronyssidae والنوعان *Haemolaelaps glasgowi* و *Laelaps nuttalli* التابعان لعائلة Laelapidae والنوعان *Radfordia sp.* و *Myobia sp.* التابعان لعائلة Myobiidae أما مجموعة القراد فقد مثلت في هذه الدراسة بنوعان وهما *Rhipicephalus sanguineus* و *Hyalomma dromedarii* داخل عائلة Ixodidae. من ناحية أخرى فقد سجلت الدراسة تواجد نوع واحد من القمل متطفلا على هذه الفئران وهو النوع *Polyplax spinulosa* المنتمى لعائلة Polyplacidae. ولقد إتضح من الدراسة أن أقل عدد من الفئران التي تم صيدها كان ١٥ فأرا في منطقة الباجور وشملت ٧١ فردا أكاروسى و ٦١ فردا من القمل و ٢٥ من القراد وأعلى عدد من الفئران تم الحصول عليه كان في منطقة منوف والتي أصيبت بعدد ٢٦٢ أكاروس و ٢٣ من القمل و ٤٠ فردا من القراد. وأن اقل عدد من المتطفلات الأكاروسية بوجه عام تم جمعه من على الفئران كان ٦٩ فردا في منطقة أشمون وأعلى عدد من القمل كان في هذه المنطقة (٩٤٣) فردا وأقلها بمنطقة منوف ٢٣ فردا بينما شملت منطقة الباجور على أقل عدد من القراد ١٥ فردا وأكبر عدد منها سجل بمنطقة قويسنا (١٢٥ فرد). وبوجه عام إتضح من الدراسة أن منطقة أشمون قد اشتملت على أكبر عدد من المتطفلات الخارجية حيث تم جمع ١٠٢٨ فردا متطفل من كل من المتطفلات الخارجية ( الأكاروسات والقراد والقمل) بينما كانت منطقة الباجور أقل المناطق إحتواء على هذه المتطفلات وشملت ١٤٧ فردا.