

Gamasine Mite (Parasitiformes: Mesostigmata) Infestations of Small Mammals (Mammalia: Rodentia, Insectivora) in Turkey

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SUMMARY: The present study was conducted on small mammals from different locations in Turkey. One hundred twenty- three individuals representing 11 species of rodents and insectivora were investigated for mite ectoparasites. A total of 126 gamasine mites were collected from 96 individuals (78.1%) of 6 species of small mammals. Five gamasine families were recorded: Laelapidae, Hirstionyssidae, Haemogamasidae, Macronyssidae and Macrochelidae. *Laelaps jettmari* Vitzthum (72 species) was predominant and found mainly on *Mus musculus* (Linnaeus) and *Cricetulus migratorius* (Pallas). New species of gamasine mites and host records for Turkey are given.

Key words: Gamasine mites, Rodentia, Insectivora, Turkey

Türkiye’de Küçük Memelilerin (Mammalia: Rodentia, Insectivora) Gamasine Akar (Parasitiformes: Mesostigmata) İnfestasyonları

ÖZET: Bu çalışma Türkiye’nin farklı bölgelerindeki küçük memeliler üzerinde yürütüldü. Onbir türden oluşan 123 kemirici ve insectivor akar ektoparazitleri yönünden incelendi. Toplam 126 gamasine akar 6 küçük memeli türünün 96 (%78,1)’sından toplandı. *Laelaps jettmari* Vitzthum (72 tür) yoğunlu ve özellikle *Mus musculus* (Linnaeus) and *Cricetulus migratorius* (Pallas) üzerinde bulundu. Türkiye için yeni gamasine akar türleri ve konakları verildi.

Anahtar Sözcükler: Gamasine akarları, Rodentia, Insectivora, Türkiye

INTRODUCTION

Some small mammals populations are wild but others are commensal and live in close association with man. They act as carriers, reservoirs, or both of a number of disease agents that infect humans and domestic animals. These disease agents, including bacteria, spirochetes, rickettsiae, viruses, protozoa, and helminths, are often transmitted by ectoparasites. Numerous species of mites occasionally infest man and they transmit several diseases as rickettsia tsutsugamushi fever, epidemic haemorrhagic fever, and cause severe allergic reaction (4, 29). There is little information on the gamasine mites infesting rodents (10, 12, 13, 14) in Turkey. Here, we document new geographical and host records for gamasine mites of rodents in Turkey.

MATERIALS AND METHODS

Small mammals were live-trapped from July 1996 to July 1997 in Ankara (39° 57’ N and 32° 53’ E), Bursa (40° 11’ N and 29° 04’ E), Siirt (37° 55’ N and 41° 57’ E), Diyarbakır (37° 55’ N and 40° 14’ E) and Şanlı Urfa (37° 08’ N and 38° 46’ E) province. Tomahawk® (Tomahawk Live Trap Co., Tomahawk, Wisconsin) and large Sherman® (H. B. Sherman Traps, Inc., Tallahassee, Florida) live-traps baited with sunflower seed, oatmeal, and peanut butter. Live-traps were set overnight either in grids, close to rodent nests, or randomly from woodland transects, woodland, old fields, refuse heaps, beside dump, in and around demolished buildings at different localities. Traps were checked each morning and captured animals were removed. The animals were placed in plastic bags with a cotton ball soaked with ethyl ether until they became unconscious, after which they were removed from the bag, identified, and marked, and the entire body was brushed with a toothbrush over a white tray. Most small mammals were released after examination, with the exception of representative vouchers of each species. The tray was washed with 70 % ethyl alcohol and all the contents (alcohol and ectoparasites) were transferred with

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a pipette to a vial and labeled by host number, date, and location of capture. The plastic etherization bag also was visually searched for ectoparasites. A unique toothbrush and plastic bag were reserved for each host species, and after the sample was processed, all instruments were dried with disposable paper towels to reduce the chance of contamination. At all times, great care was taken to avoid cross-host contamination of ectoparasites. In the laboratory, vial contents were examined under a stereoscope and gamasine mites were identified using keys from Baker *et al.* (4), Strandtmann and Wharton (20), Allred (1), Garrett and Allred (10) and Krantz (11). Specimens of gamasine mites mounted on permanent slides (in Berlese's fluid). Representative specimens of host and gamasine mites were housed in the Department of Biology, Gazi University of Art and Science Faculty, Turkey.

RESULTS

One hundred twenty-three small mammals belonging to four families, eighth genera and eleven species were examined (number of specimens in parentheses) as follows. Muridae: *Mus musculus* (Linnaeus) (56), *Apodemus sylvaticus* (Linnaeus) (2); Sciuridae: *Citellus citellus* (Linnaeus) (9); Cricetidae: *Cricetulus migratorius* (Pallas) (34), *Microtus arvalis* (Pallas) (7), *Mesocricetus auratus* (4) (Waterhouse), *Mesocricetus brandti* (Nehring) (2), *Meriones tristrami* (Thomas) (4), *Meriones persicus* (Blanford) (1), *Microtus guentheri* (Danford and Alston) (2); Soricidae: *Crocidura suaveolans* (Pallas) (2). Of the 123 small mammals examined, 96 (78.1 %) were infested with mites. The number of investigated small mammals is not sufficient for deep analyse of rodents and insectivora infestation but very useful on the way of knowledge parasites fauna of Turkish rodents. The literature data concerning some species of rodents from another regions show that absence of gamasine mites on some hosts may be by chance.

In total 126 mites were collected from all host species, except *A. sylvaticus*, *M. guentheri*, *M. brandti*, *M. tristrami* and *M. persicus*. Species, number and stages of gamasine mites for each host and localities of collection for Turkey are shown in Table 1.

Laelaps jettmari (Vitzthum), *Laelaps hilaris* (Koch), *Haemolaelaps androgynus* (Bregetova), *Haemolaelaps glasgowi* (Ewing), *Hirstionyssus isabellinus* (Oudemans), *Hirstionyssus eversmani* (Zemskaja), *Haemogamasus zachvatkini* (Bregetova) and *Haemogamasus horridus* (Michael) are new to the Turkish fauna. *Laelaps algericus* (Hirst), *Laelaps kochi* (Oudemans) and *Haemogamasus nidiformes* (Bregetova) are reported in Ankara province for the first time. The presence of *Eulaelaps stabularis* (Koch) on *C. migratorius*, *M. auratus* and *C. citellus* is a new host record for Turkey. Also, this is the first time that this mite species is recorded from Ankara province. The presence of the genera *Hypoaspis* on *C. suaveolans* is a new host record for Turkey. Also, this is the first time that this genera is recorded from Diyarbakır province. *Ornithonyssus bacoti* Hirst, although cosmopolitan, is recorded for the first time on *C. migratorius* and *M. arvalis* in Turkey.

Seven species of gamasines were found on *M. arvalis* (Table 2), 74.8% of the sampled individuals were infested with at least one mite. *L. jettmari* was the most common species, occurring on *M. musculus* (71.43%) and *C. migratorius* (64.71%) (Table 2). The remaining mite species exhibited low prevalence levels (1.8-50.0%) (Table 2).

Prevalence and mean intensity for each mite species are reported in Table 2.

DISCUSSION

The mites infesting small mammals have been scarcely studied and very little is known about the distribution and host associations in Turkey.

Laelaps jettmari has been reported from Manchuria, Korea, and Japan as a parasite on rodents of several genera, particularly *Apodemus* (4). But the main host for these mites on the territory of ex-USSR was *C. migratorius* (3). *L. jettmari* (72) was the only dominant mite species that infested *M. musculus* and *C. migratorius* in our study.

Mašan and Stanko (16) reported that *L. algericus*, a specific fur ectoparasite dominated in the nests of mound-building mouse *Mus spicilegus*. Uchikawa and Suzuki (26) found it on the ground squirrel, *Menetes berdmore* in Thailand. On data of Bregetova (3) these mites typical for *M. musculus*. Specimens of *L. algericus* were previously reported in different localities of Turkey from *Apodemus mysticanus*, *A. sylvaticus*, *C. migratorius*, *M. musculus* and *Microtus* (10), but were collected only from *C. migratorius* in our study.

Laelaps hilaris (Koch) was found on *Microtus agrestis* in southern Scandinavia by Nilsson (17). To Ambros *et al.* (2), this mite species found mainly on *M. agrestis* and *M. arvalis* in Slovakia, and we have found the mites of this species on *M. arvalis*.

Whitaker and Wilson (28) stated that *L. kochi* is found on *Microtus californicus*, *M. chrotorrhinus*, *M. longicaudus*, *M. montanus*, *M. ochrogaster*, *M. oeconomicus*, *M. pennsylvanicus*, *M. pinetorum*, and also with other wild rodent species in north America and north of Mexico. According to results from Garrett and Allred (10) *L. kochi* was associated with *Apodemus mysticanus*, *A. sylvaticus*, *M. musculus* and *Microtus* in Turkey and, also was predominant on *Microtus*. To our knowledge, *L. kochi* was found only on *M. arvalis*.

Turk (24) and Allred (1) described *E. stabularis* (Koch) as the most common mite to be found in the nests and on the bodies of rodents and insectivores. According to results from Nilsson (17) this mite species is nest parasite which usually occur on *Apodemus flavicollis* in southern Scandinavia. Ambros *et al.* (2) reported that *E. stabularis* was found in high numbers on

Table 1. Species of gamasine mites collected from the small mammals at different regions of Turkey

Mite species	Total Number of mites	Host species (stages of mites)	Localities
Laelapidae			
<i>Laelaps jettmari</i> Vitzthum ^a	72	<i>M.musculus</i> (10 M, 34 F) <i>C.citellus</i> (1 F) <i>C.migratorius</i> (6 M, 21 F)	A
<i>Laelaps algericus</i> Hirst	2	<i>C.migratorius</i> (2 F)	A ^c
<i>Laelaps hilaris</i> Koch ^a	2	<i>M.arvalis</i> (2 F)	A
<i>Laelaps kochi</i> Oudemans	1	<i>M.arvalis</i> (1 F)	A ^c
<i>Eulaelaps stabularis</i> Koch	7	<i>C.migratorius</i> ^b (4 F) <i>C.citellus</i> ^b (2 F) <i>M.auratus</i> ^b (1 F)	A ^c
<i>Haemolaelaps</i> sp.	5	<i>M.musculus</i> (1 M, 2 PN) <i>M.arvalis</i> (1 PN) <i>C.suaveolans</i> (1 F)	A, B
<i>Haemolaelaps androgynus</i> ^a Bregetova	5	<i>C.migratorius</i> (1 F) <i>C.suaveolans</i> (4 F)	A, B
<i>Haemolaelaps glasgowi</i> Ewing ^a	2	<i>M.arvalis</i> (1 F) <i>C.citellus</i> (1 F)	A
<i>Hypoaspis</i> sp.	2	<i>C.suaveolans</i> ^b (2 F)	D ^c
Hirstionyssidae			
<i>Hirstionyssus isabellinus</i> Oudemans ^a	8	<i>M.musculus</i> (1 M, 7 F)	A
<i>Hirstionyssus</i> sp.	3	<i>M.musculus</i> (1F) <i>C.migratorius</i> (2 F)	A
<i>Hirstionyssus eversmani</i> Zemska ^a	1	<i>C.migratorius</i> (1 F)	A
Haemogamasidae			
<i>Haemogamasus nidiformes</i> Bregetova	6	<i>M.arvalis</i> (1 M, 5 F)	A ^c
<i>Haemogamasus zachvatkini</i> ^a Bregetova	1	<i>M.arvalis</i> (1 F)	A
<i>Haemogamasus horridus</i> ^a Michael	1	<i>M.arvalis</i> (1 F)	A
Macronyssidae			
<i>Ornithonyssus bacoti</i> Hirst	5	<i>C.migratorius</i> ^b (1 F, 1 M) <i>M.arvalis</i> ^b (3 F)	A ^c
Macrochelidae			
<i>Macrocheles muscaedomestica</i> Scopoli	3	<i>C.citellus</i> (3 F)	A

M: Male, F: Female, PN: Protonymph, DN: Deutonymph, ^aNew country record, ^bNew host record for Turkey, ^cNew geographical record for Turkey, A: Ankara.; B: Bursa.; D: Diyarbakir.

A. flavicollis in Slovakia. Mašan and Stanko (2005) reported the most frequent species were *E. stabularis* Koch and *Proctolaelaps pygmaeus* Müller in the nests of mound-building Mouse *Mus spicilegus* in Slovakia. This mite species recovered from the eastern woodrat *Neotoma floridana* by Durden et al. (6) in the southeastern United States and mean intensity was 1.0. Species of *E. stabularis* was previously reported in Turkey from guinea pig (14), *Apodemus*, *A. mysticanus*, *A. sylvaticus*, *M. musculus* and *Microtus* (10), but was collected only from *C. migratorius*, *M. auratus* and *C. citellus*, and also mean intensity for this mite recovered from these rodents was 1.0 in this study. In Brazil, the genus *Haemolaelaps* was associated with the rice rat *Oryzomys russatus* (5), the water rat *Nectomys squamipes*, *Oxymycterus dasytrichus* and the spiny rat *Trinomys dimidiatus* (15). Adult and protonymphs of *Haemolaelaps* were collected almost

exclusively on *M. musculus*, although the sample size was very low in this study. It is reported that *Haemolaelaps glasgowi* (Ewing) is common on *Rattus rattus*, *R. norvegicus*, and *M.musculus*, as well as on many wild rodents (4). Nelder and Reeves (18) stated that it was found on the eastern chipmunk, *Tamias striatus* in USA.

Specimens of *H. glasgowi* were reported in Iran from *R. rattus*, *M. musculus*, *Meriones persicus*, *A. sylvaticus*, *Microtus socialis*, *C. migratorius* and *Ellobius fuscocapillus* (23), but were collected only from *M. arvalis* and *C. citellus* in Turkey. To Bregetova (3) and Volianskii (27), *H. glasgowi* is the most abundant mite for the nests of the many species of rodents on the territory of ex-USSR. Shayan and Rafinejad (23) reported that this mite species is the most common ectoparasite of rodents in Iran, however in this study, it was found in low numbers.

Table 2. Gamasine mites from the Turkey small mammals with values for prevalence and mean intensity

Host species (sample size)	Mite species (sample size)	Number of infested hosts and prevalence (%)	Mean intensity
Mus musculus (56)	<i>Laelaps jettmari</i> (44)	40 (71.43)	1.10
	<i>Hirstionyssus isabellinus</i> (8)	8 (14.29)	1.00
	<i>Hirstionyssus</i> sp. (1)	1 (1.79)	1.00
	<i>Haemolaelaps</i> sp. (3)	3 (5.36)	1.00
Cricetulus migratorius (34)	<i>Laelaps jettmari</i> (27)	22 (64.71)	1.28
	<i>Laelaps algericus</i> (2)	1 (2.94)	2.00
	<i>Hirstionyssus</i> sp. (2)	2 (5.88)	1.00
	<i>Hirstionyssus eversmani</i> (1)	1 (2.94)	1.00
	<i>Eulaelaps stabularis</i> (4)	4 (11.76)	1.00
	<i>Ornithonyssus bacoti</i> (2)	2 (5.88)	1.00
	<i>Haemolaelaps androgynus</i> (1)	1 (2.94)	1.00
	<i>Haemolaelaps androgynus</i> (1)	1 (2.94)	1.00
Microtus arvalis (7)	<i>Laelaps hilaris</i> (2)	1 (14.29)	2.00
	<i>Laelaps kochi</i> (1)	1 (14.29)	1.00
	<i>Haemogamasus nidiformes</i> (6)	1 (14.29)	6.00
	<i>Haemogamasus zachvatkini</i> (1)	1 (14.29)	1.00
	<i>Haemogamasus horridus</i> (1)	1 (14.29)	1.00
	<i>Ornithonyssus bacoti</i> (3)	1 (14.29)	3.00
	<i>Haemolaelaps</i> sp. (1)	1 (14.29)	1.00
	<i>Haemolaelaps glasgowi</i> (1)	1 (14.29)	1.00
Mesocricetus auratus (4)	<i>Eulaelaps stabularis</i> (1)	1 (25.00)	1.00
Citellus citellus (9)	<i>Laelaps jettmari</i> (1)	1 (11.11)	1.00
	<i>Eulaelaps stabularis</i> (2)	2 (22.22)	1.00
	<i>Haemolaelaps glasgowi</i> (1)	1 (11.11)	1.00
	<i>Macrocheles muscaedomestica</i> (3)	3 (33.33)	1.00
Crocidura suaveolans (2)	<i>Haemolaelaps</i> sp. (1)	1 (50.00)	1.00
	<i>Haemolaelaps androgynus</i> (4)	1 (50.00)	4.00
	<i>Hypoaspis</i> sp. (2)	1 (50.00)	2.00

Hirstionyssus isabellinus Oudemans has been taken from small rodents, weaseles and moles in Europe, and from meadow mice in the United States and Canada (4). Shoukry et al. (21) reported *H. isabellinus* infesting *Acomys C. dimidiatus* and *Meriones sacramenti* in Egypt. Ambros et al. (2) indicated that this mite species was associated with *Neomys fodiens*, *Clethrionomys glareolus* and *Pitymys subterraneus* in Slovakia. According to results from Whitaker and Wilson (28) *H. isabellinus* is associated with *M. musculus*, and also with other wild rodent species in north America and north of Mexico, but it was collected only on *M. musculus* in the current study.

The haemogamasid mites occur occasionally on rodents and probably are abundant in the nests of their hosts (20). It is reported that *Haemogamasus nidiformes* Bregetova appears to

be typical for red-backed mouse and rat (20, 25). According to results from Allred (1) this mite species is associated with *Crocidura lasiura*, *Mus* sp., *Ochotona roylei*, *Rattus culturatus*, *R. coxinga*, *R. fulvescens*, and also with *Microtus kikuchii* in the eastern Asia and the western Pacific. Ambros et al. (2) stated that it is found only on *A. flavicollis* in Slovakia. Garrett and Allred (10) indicated that this mite species was associated with *A. mysticanus*, *M. musculus* and *Microtus* in different localities of Turkey and, also was dominant on *Microtus*. In the current study, *H. nidiformes* was collected only on *M. arvalis*.

Previous studies (20, 25) reported *Haemogamasus zachvatkini* Bregetova infesting *Mustela putorius* and *Myospalax* sp. in China and Russia, and we have found it on *M. arvalis*.

Strandtmann and Wharton (20) recorded the haemogamasid *Haemogamasus horridus* Michael from *Apodemus* spp., *Arvicola arvalis*, *Clethrionomys glareolus*, *Mus* spp., *Sorex araneus*, *R. rattus* and *Talpa* sp. in Russia. Ambros et al. (2) stated that it is found on *C. glareolus*, *Pitymys subterraneus* and *A. flavicollis* in Slovakia, but it was collected only on *M. arvalis* in the current study. Allred (1) reported that species of *Apodemus* possessed the greatest number of the haemogamasid mites (11), whereas *Rattus* had 10, *Clethrionomys* 9, and *Microtus* 6. In our study, haemogamasid mites were found only on *M. arvalis*.

Mašan and Stanko (16) indicated that the fur ectoparasites (*Laelaps* and *Hirstionyssus*) are often specialised to a concrete host species or genus and their occurrence in the nests is relatively low. Also, according to these authors (16) the host specialisation of the nest ectoparasites (*Haemolaelaps*, *Eulaelaps* and *Haemogamasus*) is low and they occur as on the mammals body as in their nests. In the present study, the most common mite on Turkish rodents was the fur mite *L. jettmari*, but the genera *Haemolaelaps*, *Eulaelaps* and *Haemogamasus* were found in low numbers.

Ornithonyssus bacoti Hirst was recovered from *R. norvegicus* and *R. rattus* by Soliman et al. (22) in a rural area of Egypt. Younis et al. (29) stated that this mite species was collected from commensal rodents particularly *R. norvegicus* in Suez Governorate of Egypt, but it was collected only from *M. musculus* in South Sinai Governorate of Egypt (21). Radovsky et al. (19) reported *O. bacoti* infesting only *M. musculus* in Hawaii. This mite species was recovered from the eastern woodrat *Neotoma floridana* in the southeastern United States (6). According to Baker et al. (4) *O. bacoti* has a cosmopolitan distribution and occurs, associated with rats and other rodents, in both tropical and temperate of the world. Merdivenci (13) reported it was associated with *R. rattus* and *R. norvegicus* in İstanbul province of Turkey. Garrett and Allred (10) reported *O. bacoti* infesting *R. rattus* and *M. musculus* in İzmir province of Turkey. In the present study, this mite species was found only on *C. migratorius* and *M. arvalis* in Ankara province of Turkey.

Free-living mites *Macrocheles muscaedomestica* Scopoli is most often found in soil and litter such as manure and compost heaps but also occur in leaf and nests of vertebrates and social insects (7). To Emberson (8), it has been seen from nests of *Porzana tabuensis Plumbea*, the spotless crane, and *Turdus merula*, the blackbird, and also from a decayed bird carcass. *M. muscaedomestica* was reported in Thailand from the rodent, *Eothenomys melanogaster* (26), but was collected only from *C. citellus* in Turkey. So far this mite species has been recorded from the house fly *M. domestica* Linnaeus and the blue bottle fly *Calliphora erythrocephala* Meigen in Turkey (9). According to Uchikawa and Suzuki (26) it is a common predacious mite phoretic on the flies and becomes associated with mammals quite accidentally, agreeing with our findings.

In Turkey, so far free-living *Hypoaspis miles* (Berlese) and *H. vacua* (Michael) have been recorded on *Microtus* and *Apodemus mysticanus*, respectively. Uchikawa and Suzuki (26) stated that the genera *Hypoaspis* is found on the mole shrew, *Anourosorex squamipes*, but it was collected only on the lesser shrew *C. suaveolens* in the current study.

Although the host sample size was rather small, several new records of gamasine mites on small mammals for Turkey are presented in our study. Further studies are useful for knowledge of gamasine fauna of Turkey and necessary to clarify the kind of relationship between gamasine mites and their hosts in Turkey.

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