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Mites and Ticks (Acari) of Bats (Chiroptera) collected from Bursa and Kütahya Provinces, North-Western of Türkiye

Türkiye'nin Kuzeybatısındaki Bursa ve Kütahya İllerinden Toplanan Yarasaların (Chiroptera) Akarları ve Keneleri

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ABSTRACT

Objective: A total of 357 specimens belonging to nineteen species of bats collected from Bursa and Kütahya Provinces, Türkiye, were examined for mite ectoparasites.
Methods: Related bat species were collected and studied about ectoparasitologically. For this purpose stereo and light microscopic methods used. Bat species, bat number, acari species, acari number and their gender, infected numbers were determined.
Results: The bats were found to harbour nine acarid species: *Eyndhovenia euryalis*, *E. myoti*, *Steatonyssus noctulus*, *Steatonyssus* sp., *Ixodes vespertilionis*, *Dermanyssus* sp., *Ornithonyssus desultarius*, *Anchystropus zelebarii* and *Macronyssus aristippe*.
Conclusion: To the best of our knowledge, this is the first report of acarids on *Rhinolophus euryale* and *Myotis daubentoni*. New area and host records are reported.
Keywords: Bat, biodiversity, mesostigmata, metastigmata, Türkiye

ÖZ

Amaç: Bursa ve Kütahya illerinden toplanan 19 yarasa türüne ait toplam 357 örnek akar ektoparazitleri açısından incelenmiştir.
Yöntemler: İlgili yarasa türleri toplanmış ve ektoparazitolojik olarak incelenmiştir. Bu amaçla stereo ve ışık mikroskobi yöntemler kullanılmıştır. Yarasa türü, yarasa sayısı, akar türü, akar sayısı ve cinsiyeti, enfekte sayıları belirlenmiştir.
Bulgular: Yarasaların dokuz akar türünü barındırdığı tespit edildi: *Eyndhovenia euryalis, E. myoti, Steatonyssus noctulus, Steatonyssus* sp., *Ixodes vespertilionis, Dermanyssus* sp., *Ornithonyssus desultarius, Anchystropus zelebarii* ve *Macronyssus aristippe.*
Sonuç: Bildiğimiz kadarıyla bu, *Rhinolophus euryale* ve *Myotis daubentoni*'nin ilk incelemesidir. Yeni lokalite ve konak kayıtları raporlanmıştır.
Anahtar kelimeler: Yarasa, biyoçeşitlilik, mesostigmata, metastigmata, Türkiye

INTRODUCTION

There are few studies about acari on bats in Türkiye, studies of these ectoparasites are important because of their ability to transmit diseases such as rabies, inflammation of the brain, painful and feverish febrile, typhus, syphilis, encephalitis etc. to people and animals (1-5).

Members of the *Spinturnicidae* live as a colony (5) generally on the back, abdomen, in skin and armpits as well as the tail and wing membranes of bats; additionally, they may live separately from hosts for various periods of time (6). Species of the Spinturnicidae are typically found on vespertilionid, phyllostomid and mormoopid bats in Türkiye (5).

Species of *Macronyssidae* like the *Spinturnicidae* are always parasitic on bats. But Ixodidae have possibilities of many other vertebrate hosts.

The aims of this study are to determine the acari of bats in the *Vespertilionidae* and *Rhinolophidae families*,

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determine acari fauna of Türkiye, and list new host records and locations.

METHODS

Between July 2011-October 2018 from different localities and time periods bat species (Table 1) were collected by mist net from forested areas and caves in Bursa and Kütahya Provinces, Türkiye and returned to Uludağ University, Faculty of Science and Literature, Department of Biology, Parasitology Laboratory for study. They were sexed, body length measured and identified based upon the keys of (7).

After examination under a stereomicroscope, any individuals collected were fixed in 70% ethanol with glycerin. Mesostigmata samples were stained with Hoyer medium (50 cc distilled water, 30 gr crystal gum arabic, 200 gr chloral hydrate, 20 gr glycerin). Acari were examined with a light microscope and identification was based on the morphological and anatomical descriptions given by (2,8-18). The number and location of individuals of each species were recorded.

Acari specimens were deposited in the collection of Uludağ University Museum of Zoology, Bursa, Türkiye.

Aims of science collection and animal use permits are as follow: Uludağ University, Animal Experiments Local Ethics Committe number: B.30.2.ULU.0.8Z.00.00/53, decision number: 2011-05/06 and Forest and Water Affairs Ministry number: B.23.0.DMP.0.15.01.-510-29610 from Türkiye.

Statistical Analysis

Of the 357 bats examined, 213 (59.7%) had ectoparasites, but only 24 (6.7%) had acari species. Bat species, bat number, acari species, acari number and their gender, infected numbers were given in Table 1 and Table 2.

Table 1. Bats and Acari species that captured Bursa and Kütahya Provinces in T**ürkiye**

	Bat species	Bat number	Acari species
1	*Eptesicus serotinus* (Schreber, 1774)	3 (1♀♀,2♂♂)	-
2	*Miniopterus schreibersii* (Kuhl, 1819)	26 (4♀♀,22♂♂)	-
3	*Myotis alcothea* Helversen&Heller 2001	3 ♂♂	-
4	*Myotis aurescens* (Kuzyakin, 1935)	15 (6 ♀♀, 9 ♂♂)	*Eyndhovenia euryalis*, 1♀♀, 1 Nymph
5	*Myotis blythii* (Tomes, 1857)	2 (2 ♂♂)	-
6	*Myotis capaccini* (Bonaparte, 1837)	34 (17♀♀,17♂♂)	-
7	*Myotis daubentoni* (Kuhl, 1819)	23 (3 ♀♀,20♂♂)	*Steatonyssus* sp.
8	*Myotis emerginatus* (Geoffroy, 1806)	5 (3♀♀, 2♂♂)	*Eyndhovenia miyoti*, 1 ♂♂
9	*Myotis myotis* (Borkhausen, 1797)	20 (8♀♀,12 ♂♂)	-
10	*Myotis mystacinus* (Kuhl, 1819)	8 (2♀♀,6♂♂)	-
11	*Nyctalus leisleri* (Kuhl, 1818)	10 (3♀♀,7♂♂)	-
12	*Pipistrellus nathusi* Keyserling&Blasius 1839	31 (16♀♀,15♂♂)	-
13	*Pipistrellus pipistrellus* (Schreber, 1774)	73 (43♀♀,30♂♂)	*Ixodes vespertilionis*, 5 Larvae *Ixodes vespertilionis*, 2 Larvae *Ixodes vespertilionis*, 1 Larvae *Ixodes vespertilionis*, 1 Larvae *Dermanyssus* sp. *Steatonyssus noctula*, 1 ♀♀ *Ornithonyssus desultarius*, 1 ♀♀ *Steatonyssus* sp., 1 Nymph *Ixodes vespertilionis*, 7 Larvae
14	*Pipistrellus pygmaeus* (Leach, 1825)	22 (17♀♀,5 ♂♂)	-
15	*Rhinolophus blasii* Peters, 1866	21 (11♀♀,10♂♂)	-
16	*Rhinolophus euryale* Blasius, 1853	28 (10♀♀,18♂♂)	*Anchystropus zelebarii*, 1 ♀♀ *Macronyssus aristippe*, 1♀♀ *Eyndhovenia euryalis*, 1 ♀♀ *Eyndhovenia euryalis*, 2 ♀♀ *Dermanyssus* sp., 1 ♀♀ *Ixodes vespertilionis*, 1 ♀♀ *Eyndhovenia euryalis*, 1 ♀♀ *Eyndhovenia euryalis*, 3♂♂ *Eyndhovenia euryalis*, 1 Nymph, 1♀♀
17	*Rhinolophus ferrumequinum* (Schreber, 1774)	15 (7♀♀,8♂♂)	*Eyndhovenia euryalis*, 1♀♀ *Eyndhovenia euryalis*, 5♀♀, 2 Nymphs *Ixodes vespertilionis*, 1 Nymph
18	*Rhinophus hipposideros* (Bechstein, 1800)	14 (7♀♀,7♂♂)	-
19	*Rhinophus mehelyi* Matschie, 1901	4 (1♀♀,3♂♂)	-

Table 2. Infected sample and acari numbers

Bat species	Sample number	Infected numbers	Acari species number
Myotis aurescens	15	1	2
Myotis daubentoni	23	1	1
Myotis emerginatus	5	1	1
Pipistrellus pipistrellus	73	9	5
Rhinolophus euryale	28	9	5
Rhinolophus ferrumequinum	15	3	2

RESULTS

In this study, a total of 357 specimens of bats belonging to nineteen species captured from Bursa and Kütahya Provinces was examined for ectoparasitic mites and from them six species (31.57%) were found to harbour species of acari (Table 1). These mite species belonged to the families Ixodidae Koch (Metastigmata), Spinturnicidae Oudemans and Macronyssidae Oudemans (Gamasina).

While *Eyndhovenia euryalis* (Canestrini, 1885) (19) and *Ixodes vespertilionis* Koch, 1844 (18) are the dominant acari species, *Steatonyssus* sp. Kolenati, 1858 (2), *Dermanyssus* sp. (2), *Eyndhovenia myoti* (1), *Steatonyssus noctulus* Rybin, 1992 (1), *Ornithonyssus desultarius* Radovsky 1966 (1), *Anchystropus zelebarii* (1) and *Macronyssus aristippe* (Domrow, 1959) (1) are the rare acari species on Turkish Vespertilionid and Rhinolophid bats. Larva and female acari were the most abundant individuals collected in this study. *Myotis aurescens*, *Myotis daubentoni*, *Myotis emerginatus* and *Pipistrellus pipistrellus* collected from a few different riverine forested areas had 24 samples of 7 acari species. *Rhinolophus euryale* and *Rhinolophus ferrumequinum* collected from a few different caves had 22 samples of 5 acari species. So we can say forested areas have more acari species (7) than caves (5). However, some acari species were found in both forested areas and caves.

DISCUSSION

Of the 19 species of bats studied, only 6 species from Bursa and Kütahya Provinces were found to harbour acari ectoparasites. These bat species are: *Rhinolophus euryale*, *Rhinolophus ferrumequinum, Pipistrellus pipistrellus*, *Myotis emerginatus*, *Myotis daubentoni* and *Myotis aurescens*. Belonging to Metastigmata (Ixodidae: 34.7%) and Mesostigmata (Gamasina: Spinturnidae, Macronyssidae 65.3%) 46 acari specimens were collected (2,5,8-22) were used for diagnosing of acari species.

It is stated that there is no previous record about collecting acari of *Rhinolophus euryale* and *Myotis daubentoni* in Türkiye(5). In this study *Rhinolophus euryale* was found to harbour five species of acari; *Anchystropus zelebarii* Kolenati 1856, *Macronyssus aristippe* Domrow 1961, *Eyndhovenia euryalis* Canestrini 1884, *Dermanyssus* sp. and *Ixodes vespertilionis* Koch 1844.

Myotis daubentoni was found to harbour one species of acari; *Steatonyssus* sp., *Rhinolophus euryale* and *Myotis daubentoni* first studied in Türkiye represent new host-parasite and new geographical records.

In Turkey, 18 Gamasina species that were previously collected from the other four species of bats have been reported: *Rhinolophus ferrumequinum* was found to harbour eight species of acari; *Paraperiglischrus rhinolophus, Eyndhovenia euryalis euryalis, Eyndhovenia euryalis ahi, Spinturnix psi, Macronyssus rhinolophi, Macronyssus* sp., *Steatonyssus spinosus, Steatonyssus* sp. *Pipistrellus pipistrellus* was found to harbour four species of acari; *Steatonyssus periblepharus, Steatonyssus* sp., *Macronyssus* sp. and *Ichoronyssus scutatus*. *Myotis emerginatus* was found to harbour five species of acari; *Spinturnix emerginatus*, *Macronyssus granulosus*, *Macronyssus rhinolophi, Ichoronyssus scutatus* and *Ancystropus* sp. *Myotis aurescens* was found to harbour one species of acari; *Steatonyssus periblepharus* (4,5).

In our study, *Rhinolophus ferrumequinum* was found to harbour two species of acari; Mesostigmata *Eyndhovenia euryalis* and Metastigmata *Ixodes vespertilionis*.

Pipistrellus pipistrellus was found to harbour five species of acari; *Ixodes vespertilionis, Dermanyssus* sp., *Steatonyssus noctula*, *Ornithonyssus desultarius* and *Steatonyssus* sp. *Myotis emerginatus* was found to harbour one species of acari; *Eynhovenia myoti*. *Myotis aurescens* was found to harbour one species of acari; *Eyndhovenia euryalis* (Table 1).

Based on our study, *Rhinolophus ferrumequinum* represents a new host record for *Ixodes vespertilionis*. With the exception of *Steatonyssus* sp., the other four acari species on *Pipistrellus pipistrellus* represent new host records. Also, *Myotis emerginatus* represents a new host record for *Eyndhovenia myoti* and *Myotis aurescens* represents a new host record for *Eyndhovenia euryalis*. This situation, between bat species and the acari species that feed on them determines host-parasite relationship. While the rhinolophidae and vespertilionidae carry a lot of Ixodidae, *Ixodes vespertilionis* is recorded as one of the most abundant acari species from, European, Asian, African, and Australian bat species (23-26), reported *Eyndhovenia euryalis oudemansi* (Eyndhoven 1941) and *Spinturnix emerginata* (Kolenati 1856) (Acari: Mesostigmata: Spinturnicidae) from *Myotis emerginatus* in the Polish fauna, (25) recorded from the family Argasidae *Carios vespertilionis* in *Pipistrellus pygmaeus*, from the family Ixodidae *Ixodes simplex* in *Miniopterus schreibersii* and *Myotis alcathoe*, *Ixodes vespertilionis* in *Rhinolophus euryale, Rhinolophus ferrumequinum, Rhinolophus hipposideros* and *Miniopterus schreibersii* in Slovakia.

CONCLUSION

Acari species of bats were determined that captured different localities (cave and forest areas in Osmangazi, Yıldırım, Nilüfer, İnegöl, Keles, Kestel, Uluabat districts) from Türkiye. New records are presented to this area of subject. *Rhinolophus euryale* represents a new host records of *Anchystropus zelebarii*, *Macronyssus aristippe*, *Eyndhovenia euryalis*, *Dermanyssus* spp. and *Ixodes vespertilionis*. *Myotis daubentoni* represents a new host record of *Steatonyssus* spp.

*** Ethics**

Ethics Committee Approval: Uludağ University, Animal Experiments Local Ethics Committe number: B.30.2.ULU.0.8Z.00.00/53, decision number: 2011-05/06 and Forest and Water Affairs Ministry number: B.23.0.DMP.0.15.01.-510-29610 from Türkiye.

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*** Authorship Contributions**

Concept: M.Ö., N.S., H.S.Y.; Design: M.Ö., N.S., H.S.Y Data Collection or Processing: M.Ö., N.S., H.S.Y Analysis or Interpretation: M.Ö., N.S.; Literature Search: M.Ö., N.S.; Writing: M.Ö., N.S., H.S.Y

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