

The wing mites (Acari: Spinturnicidae) of the Turkish bats, including new records

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Abstract

This study is based on 93 Spinturnicidae specimens collected on 312 bat specimens obtained from various parts of Turkey. As a result of the study, six mite species were identified: *Eyndhovenia euryalis* (Canestrini, 1884), *Spinturnix acuminatus* (Koch, 1836), *S. myoti* (Kolenati, 1856), *S. psi* (Kolenati, 1856), *S. plecotinus* (Koch, 1839), and *S. punctata* (Sundevall, 1833). Of these species, *S. plecotinus* and *S. punctata* are new records for the Turkish fauna.

Keywords: Chiroptera; Eyndhovenia; Mesostigmata; Spinturnix; Turkey.

1. Introduction

The mites of the family Spinturnicidae Oudemans, 1902 (Acari: Mesostigmata) are highly specialised obligatory ectoparasites that are found only on bats, in the families Pteropodidae, Rhinolophidae, Hipposideridae, Rhinopomatidae, Megadermatidae, Emballonuridae, Phyllostomidae, Mormoopidae, Noctilionidae, Nycteridae, Natalidae, Molossidae, Miniopteridae, and Vespertilionidae. They complete their entire life cycle on membranous regions, e.g. wing and tail membranes, of their host's body, and feed on the host's blood (Till, 1958; Rudnick, 1960; Herrin & Tipton, 1975; Uchikawa *et al.*, 1994). 15 spinturnicid species have been recognized in Europe, being 13 species of the type genus *Spinturnix* von Heyden, 1826, one species of *Paraperiglischrus* Rudnick, 1960, and one species with two subspecies of *Eyndhovenia* Rudnick, 1960 (Rudnick, 1960; Deunff, 1977; Deunff *et al.*, 1986, 1997, 2004; Estrada-Peña *et al.*, 1989; Krištofík *et al.*, 2012; Sachanowicz *et al.*, 2014). In the Palearctic Region, they display different levels of host specificity, ranging from one to several host species (Deunff, 1977; Baker & Craven, 2003; Bruyndonckx *et al.*, 2009). More than one spinturnicid species can be found on single bat host (Rudnick, 1960; Dusbábek, 1962, 1970; Deunff, 1977; Deunff & Beaucournu, 1981; Deunff *et al.*, 1986; Uchikawa *et al.*, 1994). As mites cannot live away from their host for more than a few hours, mite transmission and dispersal strongly depends on host body contacts (Deunff, 1977; Bruyndonckx *et al.*, 2009).

The first information about the family Spinturnicidae in Turkey was given by Beron (1974). He recorded three mite species belonging to two genera from Yarımburgaz Cave (İstanbul): *Eyndhovenia euryalis* (Canestrini, 1884) ex *Miniopterus schreibersii* (Kuhl, 1817), *Spinturnix psi* (Kolenati, 1856) and *S. myoti* (Kolenati, 1856) ex *Myotis myotis* (Borkhausen, 1797) and *M. blythii* (Tomes, 1857). 20 years later, Uchikawa *et al.* (1994) included a record of *S. psi* ex *Myotis nattereri* (Kuhl, 1817) obtained from Turkey, without giving the locality (but it was from Antalya Province; since Kock (1974) gave details of same material). A third study (Karataş & Çakır, 2004) reported *Spinturnix acuminata* (Koch, 1836) ex *Pipistrellus pipistrellus* (Schreber, 1774) from İzmir as a forth species. Lastly, Çiçek *et al.* (2007) added an undetermined species of *Ancystropus* Kolenati, 1856 ex *M. emarginatus* (Geoffroy Saint-Hilaire, 1806) from İzmir, in addition to *S. myoti* ex *M. nattereri* from Denizli.

The aim of this study is to contribute to the knowledge of the mite family Spinturnicidae in Turkey and to add new records to the fauna list of the country.

2. Materials and methods

The mites were obtained from the bats in the collections at the Zoology Department of Niğde University (ZDNU), Niğde, Turkey.

The bats were collected during faunistic and ecological studies related with the bats of Turkey before this study. These are preserved in 70% ethanol for later evaluation. Mite specimens were cleared with potassium hydroxide (KOH) or lactophenol, and then mounted on permanent glass slides in Hoyer's medium. The localities of the samples obtained between 1995 and 2003 are shown in **Fig. 1**. The mites were identified under an Olympus SZ61 microscope, using various keys and other taxonomic literatures (Deunff, 1977; Deunff *et al.*, 1986, 1997; Rudnick, 1960; Uchikawa & Wada, 1979; Uchikawa *et al.*, 1994; Stanyukovich, 1997; Ferenc *et al.*, 2003; Orlova *et al.*, 2016, 2017). Identification of some specimens was confirmed by Prof. Dr. Jean Deunff (France). The material is deposited at ZDNU.

3. Results and discussion

We found some ectoparasites such as fleas (Siphonaptera), bat flies (Streblidae, Hippoboscidae), ticks (Ixodida), bedbugs (Cimicidae) and mites (Acari) on bats. Among the parasite samples, 93 wing mites (Spinturnicidae) were determined.

3.1. *Eyndhovenia euryalis* (Canestrini, 1884)

Type locality: Toscana, Italy

Type host: *Rhinolophus euryale* Blasius, 1853 (Rhinolophidae)

Examined Materials: Hatay: Hassa, Turkish-Syrian border (cave), 27.VII.1998: 2 ♂♂ ex *Rhinolophus euryale*. Karabük: Yenice, Büyük Cave, 16.IX.2001: 3 ♀♀ ex *R. ferrumequinum*.

Trabzon: Maçka, Çatak Vil. (cave), 22.VIII.2001: 1 ♂, 4 ♀♀ ex *R. euryale*. Zonguldak: Sofular Vil. (cave), 13.IX.2001: 1 ♂ ex *R. cf. mehelyi*.

Female: Idiosoma length: 0.36-0.66 mm, width: 0.35-0.50 mm. Peritreme entirely located on dorsal side, legs I with pulvillus. 1 seta on dorsal shield and 12 podosomal setae surrounding that shield. 23 pairs of setae between epigynal and anal plates.

Male: Idiosoma length: 0.36-0.56 mm, width: 0.36-0.49 mm. Peritreme located on the dorsal side, legs I with pulvillus. 1 seta on dorsal shield and 12 podosomal setae.

Remarks: *E. euryalis* ranges in the Palaearctic Region, from North Africa, Spain, France, the Netherlands, Poland, and Slovakia throughout Crimea (Ukraine) and the Caucasus to Kazakhstan, Uzbekistan, Tajikistan, Kirghizstan, and Japan (Rudnick, 1960; Estrada-Peña *et al.*, 1989; Stanyukovich, 1997; Krištofík *et al.*, 2012). It is usually associated with bats of the genus *Rhinolophus* Lacépède, 1799, including *R. euryale* and *R. ferrumequinum* (Schreber, 1774) (Rudnick, 1960). Although Beron (1974) reported this mite on *Miniopterus schreibersii* (Kuhl, 1817) from İstanbul, he stated that this mite may have passed from other hosts in same colony to *Miniopterus*. Therefore, the host was likely to be *R. euryale* (or *R. blasii* Peters, 1867), which was observed living in the same place but was not examined for ectoparasites. In this study, *E. euryalis* was found on *R. ferrumequinum*, *R. euryale*, and on *R. cf. mehelyi*.

3.2. *Spinturnix acuminatus* (Koch, 1836)

Type locality: Germany.

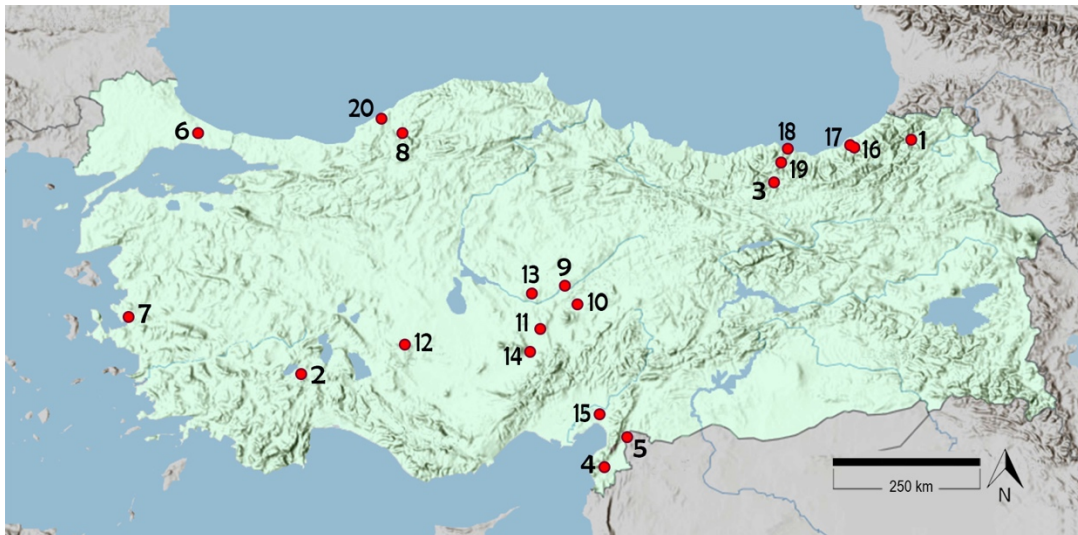


Fig. 1. The localities of spinturnicid mites collected in Turkey: 1. Ardanuç (Artvin), 2. Burdur, 3. Gümüşhane, 4. Harbiye (Hatay), 5. Hassa (Hatay), 6. Çatalca (İstanbul), 7. Karşıyaka (İzmir), 8. Yenice (Karabük), 9. Kocasinan (Kayseri), 10. Talas (Kayseri), 11. Yeşilhisar (Kayseri), 12. Selçuklu (Konya), 13. Avanos (Nevşehir), 14. Niğde, 15. Toprakkale (Osmaniye), 16. Çamlıhemşin (Rize), 17. Hemşin (Rize), 18. Trabzon, 19. Maçka (Trabzon), 20. Zonguldak.

Type host: *Nyctalus noctula* (Schreber, 1774) (Vespertilionidae).

Examined Materials: İzmir: Karşıyaka, Yamanlar (abandoned tuberculosis dispensary), 17.VII.1995: 2 ♂♂, 3 ♀♀ ex *Pipistrellus pipistrellus*.

Female: Idiosoma length: 1.00-1.22 mm, width: 0.82-0.98 mm. 3 pairs of sternal setae; number of opisthodorsal setae 24-46 (average 34); scaly dorsal shield with two large rounded projections at both front and back; podosomal setae about two times shorter than opisthosomal ones. Leg setae smooth.

Male: Idiosoma length: 0.9-1.0 mm, width: 0.7-0.8 mm. Dorsal shield with punctiform sculpture. 18-23 opisthodorsal setae and 14-46 setae on end of opisthosoma. Sternogenital shield with 6 setae, bottle-shaped.

Remarks: *S. acuminatus* has a wide distribution in the Palaearctic and Oriental regions (Rudnick, 1960; Dusbábek, 1962, 1970; Uchikawa & Wada, 1979; Deunff *et al.*, 1986; Uchikawa *et al.*, 1994; Haitlinger & Walter, 1997). It is a parasite of *Nyctalus noctula* and *Pipistrellus pipistrellus* in the British Isles (Baker & Craven, 2003). Bruyndonckx *et al.* (2009) reported this species on *N. noctula* and *N. lasiopterus* (Schreber, 1780). Frank *et al.* (2015) also reported this mite on *Myotis blythii* (Tomes, 1857), *M. dasycneme* (Boie, 1825), and *M. daubentonii* (Kuhl, 1817). The first record of this species in Turkey was provided by Karataş & Çakır (2004), on *P. pipistrellus* from İzmir.

3.3. *Spinturnix myoti* (Kolenati, 1856)

Type locality: Europe.

Type host: *Myotis myotis myotis* (Borkhausen, 1797) (Vespertilionidae).

Examined Materials: Artvin: Ardanuç, Cehennemdere, 26.VIII.2001: 2 ♂♂, 4 ♀♀ ex *Myotis myotis*. Burdur: 13 km S, İnsuyu Cave, 10.VI.2000: 1 deutonymph ex *M. myotis*. Gümüşhane: Mescitli Vil. (cave), 23.VIII.2001: 5 ♂♂, 5 ♀♀ ex *M. myotis*. Hatay: Harbiye, Narlıca Vil., Karanlık Cave, 26.VII.1998: 1 ♂, 1 ♀ ex *M. blythii*. Kayseri: Kocasinan, Kuşçu, Sariağıl Cave, 12.VII.2001: 4 ♂♂, 2 ♀♀ ex *M. blythii*. Konya: Selçuklu, Küçükobruk Cave, 10.VIII.1999: 1 ♂ ex *M. myotis*. Nevşehir: Avanos, Sarılar, Hemido's Cave, 19.IX.2001: 3 ♂♂, 3 ♀♀ ex *M. myotis*. Osmaniye: Toprakkale, Büyüktüysüz Vil. (cave), 27.VI.2001: 1 nymph ex *M. myotis*. Trabzon: Beştaş Vil. (cave), 22.VII.2001: 1 ♀ ex *M. myotis*.

Female: Idiosoma length: 1.2-1.7 mm, width: 0.9-1.3 mm. Tritosternum very small, piriform sternal shield with 6 setae. Front edge of sternal shield rounded; number of opisthodorsal setae 90-130. Shield with scalloped edges. 10 propodosomal setae between peritremes and genital shield. Genital setae off genital shield.

Male: Idiosoma length: 1-1.6 mm, width: 0.8-0.9 mm. Dorsal shield covers most of idiosoma. Tritosternum small and rounded. 8 setae on a sternogenital shield; 33-46 opisthodorsal setae; 22-30 short setae between sternogenital shield and anal plate.

Remarks: *S. myoti* may be the most widely distributed species of the genus *Spinturnix* von Heyden, 1826, ranging in Palaearctic (Europe, North Africa) and Nearctic (USA) regions; since it has a very low host specificity. It is found on *Myotis myotis*, *M. blythii*, *M. punicus* Felten,

1977, *M. emarginatus*, *M. daubentonii*, *M. dasyncneme*, *M. brandtii* (Eversmann, 1845), *M. mystacinus* (Kuhl, 1817), and *M. nattereri* (Kuhl, 1817) in Europe (Estrada-Peña *et al.*, 1989; Baker & Craven, 2003; Frank *et al.*, 2015). In Spain, Estrada-Peña *et al.* (1989) reported it on species of *Myotis* Kaup, 1829, *Hypsugo savii* (Bonaparte, 1837), and *Miniopterus schreibersii*. It was collected on the bats *Myotis myotis* and *M. blythii* by Beron (1974) and also *M. nattereri* by Çiçek *et al.* (2007), in Turkey. In our research, it was found on *M. myotis* and *M. blythii*.

3.4. *Spinturnix plecotinus* (Koch, 1839)

Type locality: Europe

Type host: *Plecotus auritus* (Linnaeus, 1758) (Vespertilionidae).

Examined Materials: Kayseri: Talas, Başakpınar (cave), 13.VII.2001: 2 ♂♂, 2 ♀♀ ex *Plecotus macrobullaris*. Kayseri: Yeşilhisar, Soğanlı Vil., 06.VII.2001: 3 ♂♂ ex *P. macrobullaris*. Rize: Hemşin, Akyamaç Vil., 25.VIII.2001: 3 ♂♂, 1 ♀ ex *P. auritus*.

Female: Idiosoma length: 0.95-0.98 mm, width: 0.7-0.75 mm. 5 pairs of podosomal setae, 4 pairs of setae in front of peritremes; 6-7 pairs of opisthodorsal setae. Lanceolate setae on dorsal tip of tarsi II-IV. First pair the longest one. Tritosternum very small. Sternal shield pointed. About 17-22 short setae between epigynal and anal plates.

Male: Idiosoma length: 0.85 mm, width: 0.7 mm. 10 podosomal setae and 2 setae on end of opisthosoma. Lanceolate setae on dorsal tip of tarsi II-IV.

Remarks: *S. plecotinus* is a single species in Europe that bore only 4 pairs of proteronotal setae (as like *S. novaehollandiae* Hirst, 1931 from Australia and *S. nudatus* Allred, 1969 from Pakistan). Its redescription has been properly made by Rudnick (1960) and Dusbábek (1962). The specific characters were supplemented by Uchikawa *et al.* (1994). In Central Europe, *S. plecotinus* occurs on *Plecotus auritus* (Linnaeus, 1758) and *P. austriacus* (Fischer, 1829). Except these both long-eared bat species, Estrada-Peña *et al.* (1989), Stanyukovich (1997), Baker and Craven (2003) and Scheffler *et al.* (2010) gave *Rhinolophus* spp., *Myotis daubentonii*, *M. nattereri* (Kuhl, 1817), *M. mystacinus* (Kuhl, 1817), *M. brandtii*, *P. austriacus wardi* Thomas, 1911, *Barbastella leucomelas* (Cretzschmar, 1826) [s. l.], *Nyctalus noctula*, *Eptesicus nilsoni* (Keyserling et Blasius, 1839), and *E. serotinus* (Schreber, 1774) as additional hosts. This mite was also collected on *Plecotus ognevi* Kishida, 1927 in Mongolia (Scheffler *et al.*, 2010) and Baikal Region of Siberia (Orlova *et al.*, 2016), and on *P. macrobullaris* Kuzyakin, 1965 in Albania (Sachanowicz *et al.*, 2014). It was found on *P. auritus* and *P. macrobullaris* in Kayseri and Rize provinces. The ectoparasite species was new to Turkey's fauna.

3.5. *Spinturnix psi* (Kolenati, 1856)

Type locality: Serbia.

Type host: *Miniopterus schreibersi schreibersi* (Kuhl, 1817) (Miniopteridae).

Examined Materials: Artvin: Ardanuç, Cehennemdere (cave), 26.VIII.2001: 1 ♂, 1 ♀ ex *Miniopterus schreibersii*. Gümüşhane: Mescitli Vil. (cave), 23.VIII.2001: 1 ♂ ex *Myotis myotis*. Kayseri: Kocasinan, Kuşçu, Sariağıl Cave, 12.VII.2001: 4 ♂♂ ex *M. schreibersii*. Karabük:

Yenice, Saray Vil., 16.IX.2001: 1 ♂, 1 ♀ ex *M. schreibersii*. Kırklareli: Demirköy, Sarpdere Vil., Dupnisa Cave, 22.IX.2001: 1 ♂ ex *Myotis capaccinii*. Niğde: Gümüşler, Epçik Cave, 12.VIII.1999: 2 ♀♀ ex *M. schreibersii*. Trabzon: Beştaş Vil., 22.VIII.2001: 1 ♂ ex *M. schreibersii*.

Female: Idiosoma length: 0.79-1.06 mm, width: 0.63-0.82 mm. Tritosternum large and mushroom-shaped. At least 1 pair out of 3 pairs of sternal setae outside sternal shield; 37-47 opisthodorsal setae. Shield with quadrate or square plates. Genital shield narrow in front. 4-5 pairs of short setae between epigynal and anal plates. Very long lanceolate shaped setae on tarsi II, III and IV. The longest ones pilose. Some of dorsal setae on I-II legs serrated.

Male: Idiosoma length: 0.6-0.8 mm, width: 0.5-0.6 mm. Tritosternum short and wide; peritremal shield triangular, covering entirely area between coxa II and III. 4-8 setae on propodosoma, 10 short setae on sternogenital shield at edge and 16 setae on dorsal surface of opisthosoma.

Remarks: *Spinturnix psi* is thought to be host-specific for *Miniopterus schreibersii*, although Stanyukovich (1997) and some authors (Deunff, 1977; Uchikawa *et al.*, 1994; Bruyndonckx *et al.*, 2009; Sachanowicz *et al.*, 2014) described many other hosts for it, such as *Miniopterus majori* Thomas, 1906, *M. fuliginosus* Hodgson, 1835, *Rhinolophus ferrumequinum* (Schreber, 1774), *Myotis myotis*, *M. blythii*, *M. capaccinii* (Bonaparte, 1837), *Hypsugo savii*, and *Eptesicus serotinus*. Additionally, Rudnick (1960) mentions several samples taken from the genus *Vespertilio* Linnaeus, 1758 and the now-defunct genus *Vesperugo* Keyserling et Blasius, 1839 as wrongly identified hosts (Estrada-Peña *et al.*, 1989). Its distribution ranges widely in Eurasia and Africa (Beron, 1974; Estrada-Peña *et al.*, 1989; Uchikawa & Wada, 1979; Stanyukovich, 1997; Frank *et al.*, 2015). This species is the parasite of four bat species in Turkey. Beron (1974) recorded it on *M. schreibersii* in İstanbul and Uchikawa *et al.* (1994) informed it on *Myotis nattereri* (Kuhl, 1817) from Turkey (possibly from Antalya). We found it on *M. myotis* and *M. capaccinii* as the new hosts in Turkey.

3.6. *Spinturnix punctata* (Sundevall, 1833)

Type locality: Germany.

Type host: *Barbastella barbastellus* (Schreber, 1774) (Vespertilionidae).

Examined Materials: Rize: Çamlıhemşin, Ülkü Vil., 25.VIII.2001: 1 ♂, 2 ♀♀ ex *B. barbastellus*.

Female: Idiosoma length: 1.02-1.15 mm, width: 0.7-0.8 mm. 1 or 2 pairs of 3 pairs of sternal setae outside the piriform shaped sternal shield. 36-41 opisthodorsal, 8 propodosomal, 2 short metapodosomal and 30 setae between sternal shield and anal plate. 41 opisthosomal setae along body edge.

Male: Idiosoma length: 0.99 mm, width: 0.73 mm. Dorsal shield smooth and covers most of idiosoma; 8 propodosomal, 2 short metapodosomal and 21 opisthosomal setae present. Sternogenital shield narrow at the front. 3 lateral pairs of setae on the shield and 30 setae between sternogenital shield and anal plate present.

Remarks: The mite is associated with bats of the genus *Barbastella* Gray, 1821 in the Palaearctic Region, from Western and Northern Europe throughout the Caucasus to Central Asia (Kyrgyzstan), and the Russian Far East (Rudnick, 1960; Deunff *et al.*, 1997; Orlova & Kazakov, 2016). This species is herein reported for the first time in Turkey.

4. Conclusions

Herein we report six species of the family Spinturnicidae, belonging to two genera (*Eyndhovenia* and *Spinturnix*) on 12 of 39 bat species in Turkey (Karataş, in press). Of these, *S. plecotinus*, and *S. punctata*, are new records for the fauna of Turkey.

The species and their hosts of the identified mites are given in **Table 1**, according to the literature and the findings in this study. Of these, *S. myoti* and *S. psi* are parasites on four bat species, *E. euryalis* on three species, *S. plecotinus* on two species, and *S. acuminatus* and *S. punctata* on a single bat species in Turkey. According to the bat species, the most parasitized hosts are *Myotis myotis* (Borkhausen, 1797), *M. nattereri* (Kuhl, 1817), and *Miniopterus schreibersii* with two spinturnicid species. Each of the other bat species was a host of one mite species (**Table 1**).

The conclusions of the study show that it is likely to find new records of species and even to describe new species with additional researches for the fauna Spinturnicidae in Turkey.

Table 1. The mite species of the family Spinturnicidae found on the Turkish bats according to the literature (+) and present study. New records and/or host records for the Turkish fauna are denoted by asterisk (*). Uncertain host species is indicated by question mark (?) after Beron (1974)

Mites	Hosts (bats)											
	<i>Rhinolophus</i>	<i>Rhinolophus euryale</i>	<i>Rhinolophus cf. mehelyi</i>	<i>Myotis myotis</i>	<i>Myotis blythii</i>	<i>Myotis capaccinii</i>	<i>Myotis nattereri</i>	<i>Pipistrellus pipistrellus</i>	<i>Plecotus auritus</i>	<i>Plecotus macrobullaris</i>	<i>Barbastella barbastellus</i>	<i>Miniopterus schreibersii</i>
<i>Eyndhovenia euryalis</i>	*	?	*	-	-	-	-	-	-	-	-	+?
<i>Spinturnix acuminatus</i>	-	-	-	-	-	-	-	+	-	-	-	-
<i>Spinturnix myoti</i>	-	-	-	+	+	-	+	-	-	-	-	*
<i>Spinturnix plecotinus</i> *	-	-	-	-	-	-	-	-	*	*	-	-
<i>Spinturnix psi</i>	-	-	-	*	-	*	+	-	-	-	-	+
<i>Spinturnix punctata</i> *	-	-	-	-	-	-	-	-	-	-	*	-

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