



Contribution to the knowledge of trombiculid mites (Acari, Trombiculidae) and their hosts in Türkiye, with a comprehensive species checklist

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Received:

18 May, 2026

Accepted:

10 September, 2026

Published:

15 October, 2026

Subject Editor:

A. Saboori



ABSTRACT

Knowledge of host associations in trombiculid mites recorded from Türkiye remains incomplete, and the host range of several species is still insufficiently known. To address this gap, the present study investigates four trombiculid species, *Hirsutiella llogorensis* (Daniel, 1960), *Leptotrombidium europaeum* (Daniel & Brelih, 1959), *Neotrombicula sympatrica* Stekolnikov, 2001, and *N. vulgaris* (Schluger, 1955), collected as ectoparasitic larvae from various rodent hosts. To minimize taxonomic uncertainty, *Apodemus* hosts (except one species) were confirmed molecularly using the mitochondrial cytb gene region. The principal finding of the study is the documentation of new host records for these species, thereby expanding their known host range. In addition, distributional data, brief morphological notes, comparisons with previous records from Türkiye, aberrations observed in *N. sympatrica*, and an updated checklist of trombiculid species recorded from Türkiye are provided. These findings contribute to a better understanding of host associations of trombiculid mites in Türkiye and provide a basis for future faunistic and ecological studies.

KEYWORDS

Anatolia, *Apodemus*, chiggers, distribution, host-parasite relationships

CITE:

Karağaç, R., Selçuk, A.Y. & Sevsay, S. (2026) Contribution to the knowledge of trombiculid mites (Acari, Trombiculidae) and their hosts in Türkiye, with a comprehensive species checklist. *Persian Journal of Acarology*, 15(4): 150406. <https://doi.org/10.22073/pja.150406>

INTRODUCTION

Acariform mites of the family Trombiculidae are well known ectoparasites from the cohort Parasitengona (Shatrov and Kudryashova 2008). The larvae of the family Trombiculidae, commonly referred to as chiggers, parasitize terrestrial vertebrates, including humans. Several species of Trombiculidae are of medical importance as vectors of chigger-borne rickettsial diseases, particularly scrub typhus (Nielsen *et al.* 2021). Trombiculidae is a highly diverse family within Parasitengona and traditionally includes four subfamilies: Trombiculinae, Leeuwenhoeckinae, Gahrlepiinae and Apoloniinae (Kudryashova 1998; Shatrov and Kudryashova 2008; Stekolnikov 2013, 2018, 2021). This classification reflects the widely accepted framework used in modern trombiculid systematics, although the boundaries and phylogenetic relationships among these subfamilies have been the subject of ongoing debate. In particular, the status of Gahrlepiinae and Apoloniinae has been discussed by several authors, with some treatments recognizing them as distinct lineages or even elevating certain groups to family level based on morphological characters. Despite these discussions, the sensu lato concept proposed by Kudryashova (1998) remains the most widely used in recent taxonomic works (Costa *et al.* 2024).



Trombiculid mites occur worldwide and display remarkable ecological and morphological diversity. According to the most recent checklist by Nielsen *et al.* (2021), the family currently comprises 3013 species belonging to 188 genera, making it one of the largest and most speciose lineages of Parasitengona. Their larvae are ectoparasitic on a wide range of vertebrates and, more rarely, invertebrates, whereas deutonymphs and adults are free-living predators (Shatrov and Kudryashova 2008; Nielsen *et al.* 2021).

The host spectrum of chiggers is broad and includes mammals, birds, amphibians, reptiles, and rodents (Goff 1979, 1982; Arnold 1986). They primarily parasitize small mammals (especially rodents), birds and reptiles (Li *et al.* 1997; Wohltmann *et al.* 2007; Daniel *et al.* 2010). A few species of chigger mites have also been recorded parasitizing invertebrates (Vercammen-Grandjean *et al.* 1970). Larvae of Trombiculidae are considered habitat-specific rather than host-specific (Goff 1979).

To date, 53 species of Trombiculidae have been reported from Türkiye. The genus *Hirsutiella* consists of 11 species (Zajkowska *et al.* 2026). Only three species of the genus have been recorded from Türkiye; *Hirsutiella alpina*, *H. llogorensis*, *H. steineri* (Kepka 1966; Stekolnikov and Daniel 2012). The genus *Leptotrombidium* consists of 372 known species. Only two species of the genus have been recorded from Türkiye; *Leptotrombidium europaeum* and *L. miniopteri* (Kepka 1962, 1966; Stekolnikov and Daniel 2012; Stekolnikov *et al.* 2025). The genus *Neotrombicula* consists of 196 known species. Fourteen species of the genus have been recorded from Türkiye; *Neotrombicula autumnalis*, *N. bolkarensis*, *N. delijani*, *N. heptneri*, *N. kızılarsivrisiensis*, *N. kolebinovae*, *N. lazistanica*, *N. palestinensis*, *N. scrupulosa*, *N. sympatrica*, *N. tragardhiana*, *N. turkestanica*, *N. vernalis*, *N. vulgaris* (Kepka 1962, 1966; Stekolnikov 2000, 2001b, 2019; Çakıroğlu *et al.* 2008; Stekolnikov and Klimov 2010; Kalúz 2011; Kalúz and Kováčik 2012; Stekolnikov and Daniel 2012; Stekolnikov and Kar 2015; Jabbarpour 2016; Açıcı *et al.* 2021; Eren *et al.* 2021; Nielsen *et al.* 2021; Eren and Açıcı 2025).

The present study aims to document new host records and additional distributional data for *Hirsutiella llogorensis*, *Leptotrombidium europaeum*, *Neotrombicula sympatrica*, and *N. vulgaris* in Türkiye. Particular attention was given to host identification at the species level, since accurate determination of rodent hosts is essential for establishing reliable host associations and avoiding erroneous conclusions about the host range of trombiculid mites. This is especially important in morphologically similar host groups such as *Apodemus*, in which misidentifications may affect the interpretation of host-parasite relationships. Accurate identification of the mites themselves is equally important for establishing reliable host-parasite associations. In the present study, mite identification was based on detailed morphological examination using established diagnostic characters and comparison with the original and subsequent descriptions of these morphologically well-characterized species; molecular characterization was beyond the scope of the present study. The examined material is also compared with previous descriptions, and an updated checklist of trombiculid species recorded from Türkiye to date, together with their host associations, is presented.

MATERIAL AND METHODS

Larvae were collected from a total of 34 host individuals; these included 7 *Apodemus* spp., 1 *A. cf. ponticus*, 3 *A. mystacinus*, 15 *A. uralensis*, 3 *Chionomys nivalis*, 1 *Microtus obscurus*, 1 *Mus macedonicus* and 3 *Rattus rattus*. Fieldwork for small mammals was conducted in Çoruh University Seyitler Campus (Artvin) (N 41° 11' 43", E 41° 50' 57"), Hatila (Artvin) (N 41° 11' 22", E 41° 44' 27"), Kafkasör Plateau (Artvin) (N 41° 10' 12", E 41° 48' 17"), Engiz (Samsun) (N 41° 28' 46", E 36° 02' 22") and Kars (N 40° 36' 06", E 43° 07' 29"). Small mammals were captured using high-sensitivity Sherman live traps.

Because species of the genus *Apodemus* (*Apodemus flavicollis*, *Apodemus witherbyi*, *Apodemus uralensis*, *Apodemus mystacinus*) show high morphological similarity, the host specimens identified as belonging to the genus *Apodemus* were examined at the molecular level using the partial mitochondrial cytb gene region to avoid possible taxonomic misidentification (Kryštufek and Vohralík 2009; Korkmaz *et al.* 2025). The partial cytb region was amplified using the primers L7 (5-ACCAATGACATGAAAAATCATCGTT-3) and H6 (5-TCTCCATTTCTGGTTTACAAGAC-3) primers (Montgelard *et al.* 2002). The raw cytb

sequences obtained were aligned using MAFFT implemented in Geneious Prime (version 2023.1.2) (Kato *et al.* 2002). For other mammal species, species identification was performed based on morphometric and morphological characteristics (Kefelioglu 1995; Kryštufek and Vohralík 2001, 2005, 2009).

Apodemus sp. samples were collected from Samsun (Engiz) on 5 December 2022 and Artvin on 27 February 2024; *Apodemus cf. ponticus* samples were collected from Samsun (Engiz) on 5 December 2022; *Apodemus mystacinus* samples were collected from Artvin (Hatila) on 13 April 2024; *Apodemus uralensis* samples were collected from Artvin (Kafkasör Plateau) on 30 November, 1 and 2 December 2022, from Samsun (Engiz) on 5 December 2022, from Artvin (Hatila) 13 April 2024; *Chionomys nivalis* samples were collected from Kars on 25 September 2024; *Microtus obscurus* samples were collected from Kars on 26 September 2024; *Mus macedonicus* samples were collected from Kafkasör Plateau on 1 December 2022; *Rattus rattus* samples were collected from Artvin (Çoruh University Seyitler Campus) between 7 and 28 March 2023. coll. A.Y. Selçuk. The tissue samples of mammalian specimens whose cytb gene sequences were examined are stored in the Hunting and Wildlife Program Laboratory of Artvin Çoruh University.

A total of 1934 larvae were extracted: 173 larvae from the ears of *Apodemus* sp.; 1 larva from the ears of *A. cf. ponticus*; 39 larvae from the ears of *A. mystacinus*; 1247 larvae from the ears of *A. uralensis* (Fig. 1A, B), 103 larvae from the ears of *Chionomys nivalis*; 44 larvae from the ears of *Microtus obscurus*; 130 larvae from the ears *Mus macedonicus*; and 197 larvae from the ears of *Rattus rattus* (Fig. 1C, D).



Figure 1. Larvae infesting the inner and surrounding areas of host ears. Hosts: *Apodemus uralensis* (A–B), *Rattus rattus* (C–D).

Larvae-bearing ears and leg parts of captured host specimens were placed in separate Eppendorf tubes. Mites were then detached using an entomological pin and preserved in 75% ethanol, cleared in Nesbitt's solution, and mounted on glass microscope slides using Hoyer's medium. Measurements (in micrometers) were taken, and photographs were captured using a BX63 phase-contrast Olympus microscope. Photographs of hosts infected with larvae were taken using a Nikon SMZ25 stereo-microscope.

Terminology – Terminology follows Kepka (1962, 1966), Goff *et al.* (1982), and Stekolnikov and Daniel (2012). The specimens are deposited in the Acarology Laboratory of Erzincan Binali Yıldırım University, Erzincan, Türkiye (EBYU).

RESULTS

Host species: Seven *Apodemus* species are distributed in Türkiye: *Apodemus agrarius*, *A. sylvaticus*, *A. flavicollis*, *A. cf. ponticus*, *A. mystacinus*, *A. uralensis*, and *A. witherbyi* (Kryštufek and Vohralík 2009; Çetintürk *et al.* 2025). Of these, *A. flavicollis*, *A. cf. ponticus*, *A. mystacinus*, *A. witherbyi*, and *A. uralensis* occur in similar habitats in Anatolia (Kryštufek and Vohralík 2009). These five species are highly similar in their karyological (Doğramacı and Kefelioğlu 1991; Arslan and Zima 2014), morphological, and morphometric characteristics (Kryštufek and Vohralík 2009; Korkmaz *et al.* 2025), making species identification difficult (Korkmaz *et al.* 2025). Therefore, molecular methods were used in this study to minimize possible taxonomic misidentifications of *Apodemus* host species and thereby improve the reliability of the recorded host–larva associations.

According to the molecular analyses, 15 specimens were identified as *Apodemus uralensis*, three as *A. mystacinus*, and one as *A. cf. ponticus*. The obtained sequences were deposited in GenBank under accession numbers PZ660283–PZ660300.

In addition to *Apodemus uralensis*, *A. mystacinus*, and *A. cf. ponticus*, the following species were identified based on their morphological characteristics: *Apodemus* sp. (7 specimens), *Chionomys nivalis* (3 specimens), *Microtus obscurus* (1 specimen), *Mus macedonicus* (1 specimen), and *Rattus rattus* (3 specimens).

The supplementary morphological descriptions provided below are intended to complement, rather than replace, the existing species descriptions. To avoid repeating characters that have been adequately documented in previous studies, we focus on morphological characters observed in the examined material that provide additional information or revise previously published observations. The original and subsequent descriptions are cited under each species.

Trombiculid species

Hirsutiella llogorensis (Daniel, 1960)

Syn.: *Trombicula* (*Neotrombicula*) *llogorensis* Daniel, 1960

Supplementary morphological description of the specimens examined in the present study (n = 10) – SIF = 7BS-B-3-2111.1000; fsp = 7.7.7; fPp = B/B/BBB; fCx = 1.1.1; fSt = 2.2; fSc = PL > AL > AM; DS = 62–82; VS = 58–82; NDV = 134–150; Ip = 717–830. Scutum subpentagonal to nearly hexagonal, with a rounded posterior margin; AM situated distinctly posterior to AL and SB posterior to PL. Sensilla flagelliform and usually nude, occasionally with a few branches in the middle portion. Scutum densely punctate and bearing two pairs of oval eyes on ocular plates. PW > AW > SD; ASB ≥ SB > PSB. Dorsum with one pair (2H) of humeral setae; dorsal idiosomal setae thickly barbed and mostly arranged in regular rows (Fig. 2), with the first three rows doubled. Venter with two pairs of sternal setae; each coxa bears one seta, and ventral setae are finely barbed, with posterior setae generally longer than anterior ones. Galeala usually branched; palptibial claw slender and three-pronged; chelicerae long and robust, with a tricuspid cheliceral blade. All legs seven-segmented, with barbed ordinary setae; specialized leg setation corresponds to SIF given above. For detailed previous descriptions, see Kepka (1966) and Stekolnikov and Daniel (2012).

For *Hirsutiella llogorensis*, 24 host individuals belonging to *Apodemus cf. ponticus*, *Apodemus* sp., *A. mystacinus*, *A. uralensis*, *Mus macedonicus*, and *Rattus rattus* were examined. All larvae were collected from the ear margin and inner surface of the ear. The morphological characters and most scutal measurements of the specimens examined in the present study are consistent with previous descriptions of *H. llogorensis*. However, some differences were observed in certain morphometric characters. Compared with the specimens reported by Stekolnikov and Daniel (2012), the present material showed lower values for

several leg measurements (pa = 233–284 vs. 308–335, pm = 208–247 vs. 274–317, pp = 262–299 vs. 324–364, TaIII = 62–85 vs. 94–104) and for DS (62–82 vs. 80–104). Although NDV in the present material (134–150) does not overlap with the range reported by Stekolnikov and Daniel (2012) (152–182), it falls within the range reported by Kepka (1966) (123–160). In the absence of corresponding differences in the principal qualitative diagnostic characters, we do not consider these morphometric differences alone sufficient to separate the present material from *H. llogorensis*. Accordingly, the identification of the present specimens as *H. llogorensis* is retained, while the observed morphometric differences are explicitly documented here. A detailed comparison of the morphological measurements is presented in Table 1.

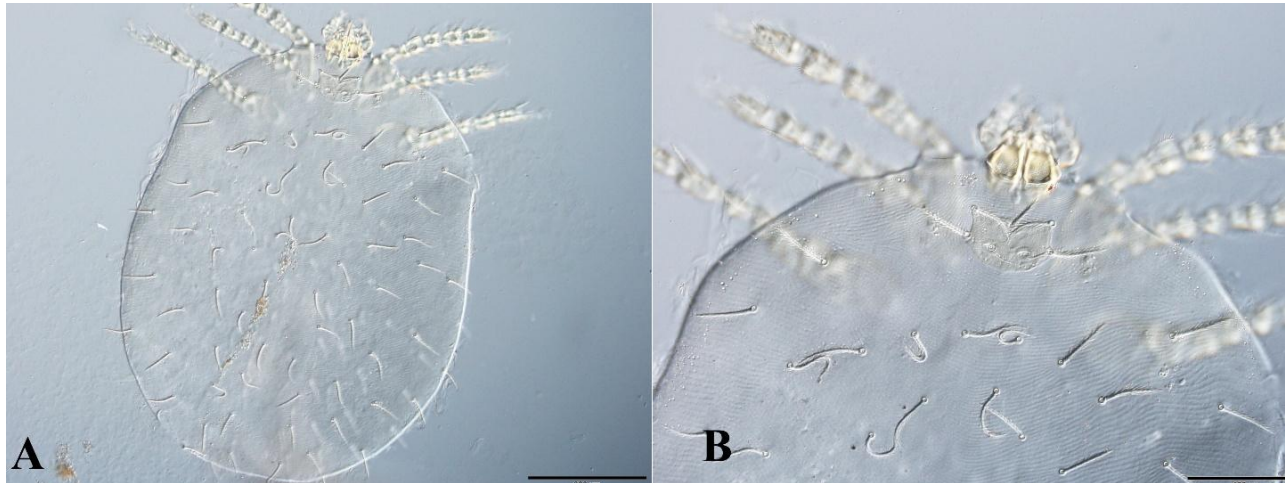


Figure 2. *Hirsutiella llogorensis* (larva) – **A.** Dorsal aspect of idiosoma; **B.** scutum and eyes.

Previously recorded hosts – *A. sylvaticus*, *Microtus majori*, *M. (Chionomys) roberti*, and *Rattus rattus* (Kepka 1966); *Apodemus* sp., *A. agrarius*, *A. ponticus*, *Microtus daghestanicus*, and *M. majori* (Stekolnikov 2001a); *Apodemus* sp., *Chionomys gud*, *Ch. roberti*, *Cricetulus migratorius*, *Microtus agrestis*, and *M. daghestanicus* (Shatrov 1988); *Apodemus* sp. (Neronov 1969); *Apodemus* spp., *A. agrarius*, *A. ponticus*, *A. uralensis*, *Chionomys* sp., and *Microtus majori* (Stekolnikov 2003); and *Apodemus agrarius*, *A. flavicollis*, *A. ponticus*, *A. uralensis*, *Chionomys gud*, *Ch. roberti*, *Cricetulus migratorius*, *Garrulus glandarius*, *Microtus agrestis*, *M. daghestanicus*, and *M. majori* (Stekolnikov and Daniel 2012).

New host records in the present study – *Apodemus mystacinus* and *Mus macedonicus*.

Distribution – Albania, Armenia, Azerbaijan, Bulgaria, France, Georgia, Iran, Kosovo, Russia, Türkiye. Hosts and distribution locations of *Hirsutiella llogorensis* in Türkiye based on the present study and previous records are given in Table 5.

Table 1. Comparison of the morphological data of *Hirsutiella llogorensis* with the previously given examples in Türkiye.

Traits	This study n = 10	Kepka (1966) n = 12	Stekolnikov and Daniel (2012) n = 10 (For S n = 2, for V _{min} and V _{max} n = 7)
SIF	7BS-B-3-2111.1000	7BS-B-3-2111.1000	7BS-B-3-2111.1000
Eyes	2+2	-	2+2
fPp	B-B-BBB	B-B-BBB	B-B-BBB
Pc	3	3	3
Gn	2	2	2
fSc	PL>AL>AM	PL>AL>AM	PL>AL>AM
	PL \ SB	-	-
fCx	1.1.1	-	1.1.1
fSt	2.2	-	2.2
fsp	7.7.7	-	-

Table 1. Continued.

Traits	This study n = 10	Kepka (1966) n = 12	Stekolnikov and Daniel (2012) n = 10 (For S n = 2, for V _{min} and V _{max} n = 7)
SIF	7BS-B-3-2111.1000	7BS-B-3-2111.1000	7BS-B-3-2111.1000
Eyes	2+2	-	2+2
fPp	B-B-BBB	B-B-BBB	B-B-BBB
Pc	3	3	3
Gn	2	2	2
fSc	PL>AL>AM	PL>AL>AM	PL>AL>AM
	PL \ SB	-	-
fCx	1.1.1	-	1.1.1
fSt	2.2	-	2.2
fsp	7.7.7	-	-
AW	52–67	56–76	53–60
PW	64–74	66–92	61–68
SB	26–32	26–39	24–28
ASB	29–36	30–42	33–36
PSB	12–19	12–20	14–17
P-PL	17–28	-	22–25
SD	44–52	44–60	47–52
AP	23–29	20–32	23–26
AM	29–42	36–52	38–43
AL	37–50	42–60	36–45
PL	49–56	50–72	49–58
S	43–76	50–80	63–76
H	48–62	-	53–61
D _{min}	31–47	-	36–47
D _{max}	49–61	-	55–68
V _{min}	16–24	-	25–29
V _{max}	45–55	-	53–59
pa	233–284	-	308–335
pm	208–247	-	274–317
pp	262–299	-	324–364
lp	717–830	-	906–1016
TaIII	62–85	-	94–104
S ₁	17–21	-	-
S ₂	16–19	-	-
MTa	20–33	-	-
DS	62–82	-	80–104
VS	58–82	-	53–80
NDV	134–150	123–160	152–182
m-t	0.247–0.289	-	0.215–0.288

***Leptotrombidium europaeum* (Daniel & Brelih, 1959)**

Syn.: *Trombicula* (*Leptotrombidium*) *intermedia europaea* Daniel & Brelih, 1959

Supplementary morphological description of the specimen examined in the present study (n = 1) – SIF = 7B-B-3-2111.0000; fsp = 7.7.7; fPp = N/N/BNN; fCx = 1.1.1; fSt = 2.2; fSc = PL > AM > AL; DS = 38; VS = 36; NDV = 74; Ip = 748. Scutum subrectangular, with a straight to slightly convex posterior margin; sensilla flagelliform and branched. Scutum densely punctate and bearing two pairs of oval eyes on ocular plates. PW > AW > SD; SB > ASB > PSB. Dorsum with one pair of humeral

setae (2H); dorsal idiosomal setae thickly barbed and mostly arranged in regular rows (Fig. 3). Venter with two pairs of sternal setae; each coxa bears one seta, and ventral setae are finely barbed, with posterior setae generally longer than anterior ones. Galeal seta barbed; palptibial claw slender and three-pronged; chelicerae long and robust, with a tricuspid cheliceral blade. All legs are seven-segmented and bear barbed ordinary setae; specialized leg setation corresponds to the SIF given above. For detailed previous descriptions, see Kepka (1966) and Stekolnikov and Daniel (2012).

The morphological characters and most morphometric measurements of the examined specimen are consistent with previous descriptions of *L. europaeum*. Most scutal measurements, the lengths of the AM, AL, and PL setae, and the numbers of dorsal and ventral idiosomal setae fall within or close to the ranges previously reported by Kepka (1966) and Stekolnikov and Daniel (2012). Some morphometric differences were nevertheless observed. In particular, the leg measurements of the present specimen are lower than those reported by Stekolnikov and Daniel (2012): pa = 251 vs. 297–331, pm = 236 vs. 261–297, pp = 261 vs. 297–329, lp = 748 vs. 855–941, and TaIII = 67 vs. 72–83. Vmax is also higher in the present specimen (58 vs. 46–48). A detailed morphometric comparison is provided in Table 2.

Table 2. Comparison of the morphological data of *Leptotrombidium europaeum* with the previously given examples in Türkiye.

Traits	This study n = 1	Kepka (1966) n = 13	Stekolnikov and Daniel (2012) n = 39 (For S n = 10, for V _{min} and V _{max} n = 2)
SIF	7B-B-3-2111.0000	7BS-B-3-2111.0000	7B-B-3-2111.0000
Eyes	2+2	-	2+2
fPp	N-N-BNN	N-N-BNN	N-N-BNN
Pc	3	3	3
Gn	2	2	2
fSc	PL>AM>AL SB - PL	PL>AM>AL SB - PL	PL>AM>AL SB - PL
fCx	1.1.1	1.1.1	1.1.1
fSt	2.2	-	2.2
fsp	7.7.7	7.7.7	-
AW	82	72–86	72–85
PW	87	84–96	81–97
SB	38	34–40	34–43
ASB	27	26–32	27–35
PSB	14	10–20	16–21
P-PL	14	-	15–23
SD	41	40–50	44–55
AP	27	26–32	23–32
AM	62	46–60	50–64
AL	43	32–44	36–46
PL	64	52–70	55–70
S	-	60–78	68–82
H	62	-	53–72
D _{min}	48	-	40–52
D _{max}	65	-	52–69
V _{min}	31	-	30–34
V _{max}	58	-	46–48
pa	251	-	297–331
pm	236	-	261–297
pp	261	-	297–329
lp	748	-	855–941

Table 2. Continued.

Traits	This study n = 1	Kepka (1966) n = 13	Stekolnikov and Daniel (2012) n = 39 (For S n = 10, for V _{min} and V _{max} n = 2)
TaIII	67	-	72–83
S ₁	23	-	-
S ₂	17	-	-
DS	38	34–41	35–47
VS	36	-	29–43
NDV	74	74–91	69–89

For *Leptotrombidium europaeum*, two host individuals of *Apodemus uralensis* were examined. The larva used for the morphological examination was removed from the ear of one host.

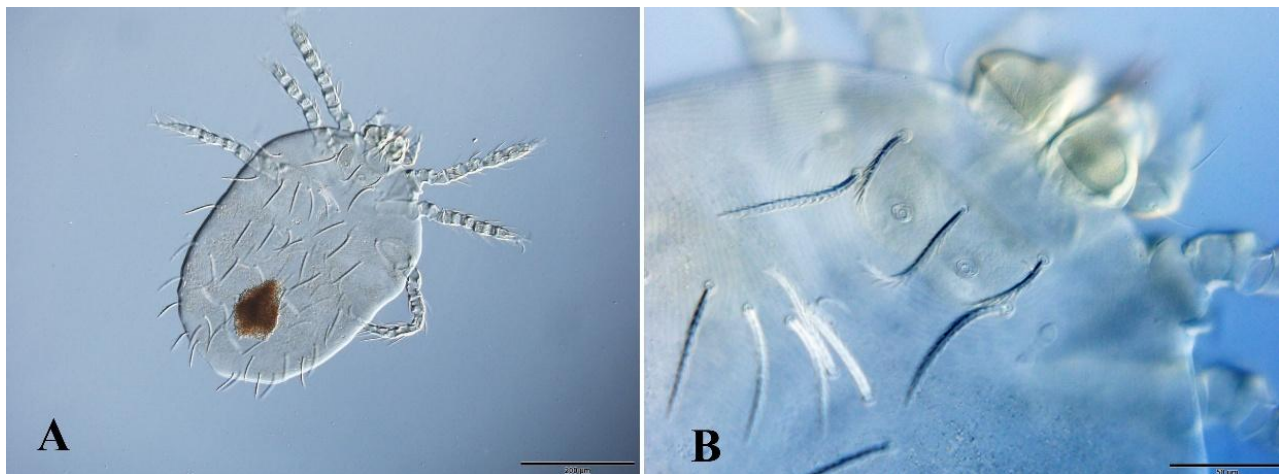


Figure 3. *Leptotrombidium europaeum* – A. dorsal aspect of idiosoma; B. scutum and eyes.

Previously recorded hosts – *Microtus multiplex*; *Apodemus sylvaticus*, *A. mystacinus*, *Microtus majori*, and *M. (Chionomys) roberti* (Kepka 1966); *Sorex minutus* (Haitlinger 1980a); *Myodes glareolus* and *Microtus agrestis* (Haitlinger 1980b); *Microtus subterraneus* (Kovačik 1984); *Apodemus (Sylvaemus)* sp., *A. fulvipectus*, *A. mystacinus*, *A. ponticus*, *A. uralensis*, *Chionomys nivalis*, *Ch. gud*, *Cricetulus migratorius*, *Crocidura leucodon*, *Microtus* sp., and *M. majori* (Stekolnikov 2004); *Apodemus sylvaticus* (Imaz et al. 2006); *Apodemus flavicollis*, *A. mystacinus*, *A. ponticus*, *A. uralensis*, *A. witherbyi*, *Apodemus* sp., *A. (Sylvaemus)* sp., *Chionomys nivalis*, *Cricetulus migratorius*, *Crocidura leucodon*, and *Microtus majori* (Stekolnikov and Daniel 2012); *Apodemus agrarius*, *A. flavicollis*, *A. sylvaticus*, *A. uralensis*, *Crocidura suaveolens*, *Microtus agrestis*, *M. arvalis*, *M. subterraneus*, *Muscardinus avellanarius*, *Myodes glareolus*, *Neomys anomalus*, *N. fodiens*, *Sorex araneus*, and *S. minutus* (Moniuszko and Małol 2014); *Lepus europaeus*, *Parus major* and *Eptesicus serotinus* (Stekolnikov et al. 2022).

Host recorded in the present study – *Apodemus uralensis*.

Distribution – Albania, Austria, Azerbaijan, Bulgaria, Czech Republic, France, Kosovo, Macedonia, Moldova, Montenegro, Poland, Romania, Russia, Slovakia, Spain, Türkiye, Ukraine. Hosts and distribution locations of *Leptotrombidium europaeum* in Türkiye based on the present study and previous records are given in Table 5.

Neotrombicula sympatrica Stekolnikov, 2001

Syn.: *Neotrombicula sympatrica* Stekolnikov, 2001

Supplementary morphological description of the specimens examined in the present study (n = 4) – SIF = 7BS-B-3(4)-3111.1000; fsp = 7.7.7; fPp = B/B/NBB; fCx = 1.1.1; fSt = 2.2; fSc = PL > AL > AM; DS = 24–38; VS = 36–58; NDV = 60–82; Ip = 852–882. Scutum nearly pentagonal, rarely hexagonal, with a consistently rounded posterior margin and without anterolateral shoulders; sensilla

unexpanded and flagelliform. Scutum densely punctate, bearing two pairs of oval eyes on ocular plates. $PW > AW > SD$; $ASB \geq SB > PSB$. The scutum normally bears a single AM seta; however, this seta was absent in three of the four examined specimens (see Aberrations below). Dorsum with one pair of humeral setae (2H); dorsal idiosomal setae thickly barbed and mostly arranged in regular rows. Venter with two pairs of sternal setae; each coxa bears one seta, and ventral setae are finely barbed, with posterior setae generally longer than anterior ones. Galeala usually branched; palptibial claw slender and three-pronged; chelicerae long and robust, with a tricuspid cheliceral blade. For detailed previous descriptions, see Stekolnikov and Daniel (2012). All legs seven segmented, with barbed ordinary setae; specialized leg setation corresponds to the SIF given above. A detailed comparison of the morphometric measurements is provided in Table 3.

Table 3. Comparison of the morphological data of *Neotrombicula sympatrica* with the previously given examples in Türkiye.

Traits	This study n = 4	Stekolnikov and Daniel (2012) n = 8 (For S n = 4, for V _{min} and V _{max} n = 0)	Açııcı <i>et al.</i> (2021)*
SIF	7BS-B-3(4)-3111.1000	7BS-B-3-3111.1000	7BS-B-3-3111.1000
Eyes	2+2	2+2	-
fPp	B/B/NBB	B/B/NBB- B/B/BBB	-
Pc	3(4)	3	-
Gn	3	3	-
fSc	PL>AL; PL>AL>AM PL\SB; PL- SB	PL> AM> AL	PL> AM> AL
fCx	1.1.1	1.1.1	1.1.1
fSt	2.2	2.2	2.2
fsp	7.7.7	-	-
AW	65–86	77–85	79
PW	80–120	90–98	96
SB	26–39	33–39	35
ASB	32–37	33–36	21
PSB	19–27	23–30	23
P-PL	24–30	27–32	-
SD	51–64	57–66	-
AP	26–35	25–32	20
AM	47	52–59	46
AL	44–49	46–53	44
PL	49–65	72–86	84
S	75	86–95	-
D _{min}	39–57	53–59	-
D _{max}	54–80	68–79	-
V _{min}	21–41	-	-
V _{max}	49–57	-	-
pa	293–312	322–344	-
pm	263–268	275–299	-
pp	288–310	322–346	-
lp	852–882	921–989	864
TaIII	82–92	77–85	-
S ₁	18–21	-	-
S ₂	15–18	-	-
MTa	56–73	-	-
DS	24–38	33–39	34
VS	36–58	32–41	26
NDV	60–82	67–78	-
m-t	0.163–0.225	0.129–0.196	-

* According to Açııcı *et al.* (2021), morphometric measurements were obtained from 10 specimens of each species, and the results were presented as mean values. However, the total number of individuals identified as *N. sympatrica* was not specified.

Aberrations included in this species: The scutum normally bears a single AM seta (Fig. 4A); however, the AM seta was absent in three of the examined specimens (Fig. 4B).

Aberrations included in this species: The scutum normally bears a single AM seta (Fig. 4A); however, the AM seta was absent in three of the examined specimens (Fig. 4B).

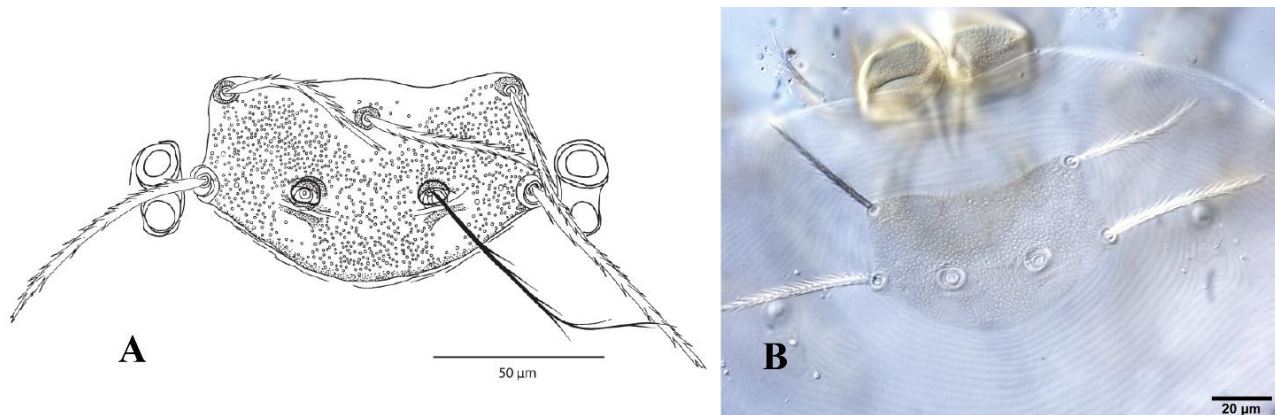


Figure 4. *Neotrombicula sympatrica* – **A.** Scutum and eyes (Stekolnikov 2001b); **B.** Morphological abnormality in which the AM seta is absent.

Previously recorded hosts – *Apodemus* sp., *A. ponticus*, *A. uralensis*, and *Microtus daghestanicus* (Stekolnikov 2001b); *Apodemus agrarius*, *A. sylvaticus*, *Alticola argentatus*, *Cricetulus migratorius*, *Lepus capensis*, *Microtus arvalis*, *M. kirgisorum*, *Mus musculus*, and *Sciurus vulgaris* (Kharadov 2002); *Apodemus* spp. and *Microtus* spp. (Stekolnikov 2002); *Apodemus sylvaticus*, *Alticola argentatus*, *Cricetulus migratorius*, *Mus musculus*, and *Rattus turkestanicus* (Shatrov and Grigorjeva 2008); *Alticola argentatus*, *Apodemus agrarius*, *A. flavicollis*, *A. ponticus*, *A. uralensis*, *Apodemus* sp., *Chionomys gud*, *C. nivalis*, *Microtus daghestanicus*, and *M. majori* (Stekolnikov and Daniel 2012); *Alticola argentatus* and *Apodemus sylvaticus* (Mamutbekova 2014); *Alticola argentatus* (Kharadov et al. 2016); and *Rattus rattus* (Açııcı et al. 2021).

New host record in the present study – *Microtus obscurus*. Previously recorded host also found in the present study: *Chionomys nivalis*.

Distribution – Armenia, Kyrgyzstan, Russia, Türkiye. Hosts and distribution locations of *Neotrombicula sympatrica* in Türkiye based on the present study and previous records are given in Table 5.

Neotrombicula vulgaris (Schluger, 1955)

Syn.: *Trombicula vulgaris* Schluger, 1955

Supplementary morphological description of the specimens examined in the present study (n = 10) – SIF = 7BS-N-3-3111.1000; fsp = 7.7.7; fPp = B/B/NNB; fCx = 1.1.1; fSt = 2.2; fSc = PL > AM > AL; DS = 44–48; VS = 30–32; NDV = 76–80; Ip = 737–775. Scutum nearly pentagonal, rarely hexagonal, with a rounded posterior margin, lacking anterolateral shoulders and densely covered with small puncta. Sensilla flagelliform and usually branched distally; scutal setae are barbed similarly to the dorsal idiosomal setae. Two pairs of eyes (2 + 2) are present. Dorsum with two pairs of humeral setae (4H); double rows of dorsal idiosomal setae are usually absent, and the 44–48 dorsal idiosomal setae bear moderately dense, thick, long barbs (Fig. 5). Venter with two pairs of sternal setae and 30–32 ventral setae; each coxa bears one seta, and ventral setae are finely barbed, with posterior setae generally longer than anterior ones. Galeal seta nude; palptibial claw slender and three-pronged; chelicerae long and robust, with a tricuspid cheliceral blade. All legs seven-segmented, with barbed ordinary setae; specialized leg setation corresponds to the SIF given above. Detailed previous descriptions are provided by Kepka (1966) and Stekolnikov and Daniel (2012), while a detailed morphometric comparison is presented in Table 4.

For *Neotrombicula vulgaris*, nine host individuals of *Apodemus* sp., *A. uralensis*, and *Rattus rattus* were examined. Larvae were collected from both the ear and leg regions.

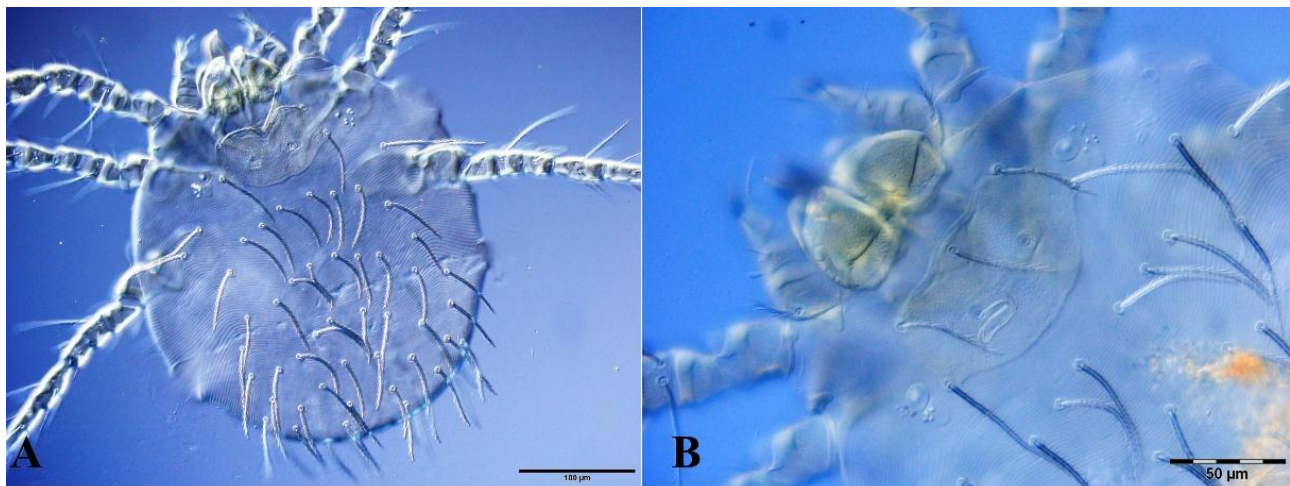


Figure 5. *Neotrombicula vulgaris* – **A.** dorsal aspect of idiosoma; **B.** Scutum and eyes.

Table 4. Comparison of the morphological data of *Neotrombicula vulgaris* with the previously given examples in Türkiye.

Traits	This study n = 10	Kepka (1966) n = 5	Stekolnikov and Daniel (2012) n = 2	Açııcı <i>et al.</i> (2021)
SIF	7BS-N-3-3111.1000	7BS-N-3-3111.1000	7BS-N-3-3111.1000	7BS-N-3-3111.1000
Eyes	2+2	-	2+2	-
fPp	B-B-NNB	B-B-NNB	B-B-NNB	-
Pc	3	3	3	3
Gn	2	2	2	2
fSc	PL>AM>AL SB \ PL	PL>AM>AL	PL>AM>AL SB \ PL	PL>AM>AL
fCx	1.1.1	1.1.1	1.1.1	1.1.1
fSt	2.2	-	2.2	2.2
fsp	7.7.7	7.7.7	-	-
AW	79–87	71–81	72–76	72
PW	98–107	88–96	88–89	90
SB	37–38	31–34	31–32	33
ASB	32–34	23–28	27	13
PSB	24–31	24–26	26–27	16
P-PL	21–28	-	25–26	-
SD	59–63	48–54	53–54	-
AP	27–34	24–32	25–27	26
AM	44–47	50–52	50	47
AL	44–48	40–42	40–41	42
PL	56–63	57–61	53	58
S	72	64	-	-
H	59–63	-	49–52	-
D _{min}	41–49	-	40	-
D _{max}	57–80	-	50–52	-
V _{min}	30–41	-	31–33	-
V _{max}	51–61	-	44–45	-
pa	243–262	-	265–266	-
pm	224–232	-	241–243	-
pp	270–281	-	274–275	-
lp	737–775	-	725–916	726
TaIII	68–71	-	65–68	-
S ₁	18–20	-	-	-

Table 4. Continued.

Traits	This study n = 10	Kepka (1966) n = 5	Stekolnikov and Daniel (2012) n = 2	Açııcı et al. (2021)
S ₂	14–16	-	-	-
MTa	70–76	-	-	-
DS	44–48	46	43–63	44
VS	30–32	32	24–37	26
NDV	76–80	78	72–95	70
m-t	0.162–0.184	-	0.208–0.211	-

* According to Açııcı et al. (2021), morphometric measurements were obtained from 10 specimens of each species, and the results were presented as mean values. However, the total number of individuals identified as *N. vulgaris* was not specified.

Previously recorded hosts – *Apodemus flavicollis*, *A. sylvaticus*, *Mus musculus*, *Chionomys nivalis*, and *Rattus turkestanicus* (Schluger 1955); *Acomys cabirinus* (Radford 1957); *Apodemus flavicollis*, *A. mystacinus*, *A. sylvaticus*, *Microtus* sp., and *Rattus rattus* (Kepka 1966); *Microtus arvalis* (Kudryashova 1979); *Apodemus agrarius*, *A. flavicollis*, *A. sylvaticus*, *Microtus oeconomus*, *Myodes glareolus*, and *Sorex araneus* (Haitlinger 1981); *Apodemus agrarius*, *A. flavicollis*, *A. sylvaticus*, *Arvicola amphibius*, *Chionomys gud*, *Myodes glareolus*, *M. rutilus*, *Cricetulus migratorius*, *Microtus arvalis*, *M. majori*, *M. oeconomus*, and *Mus musculus* (Stekolnikov 1999); *Acomys cabirinus*, *Apodemus agrarius*, *A. flavicollis*, *A. mystacinus*, *A. sylvaticus*, *Arvicola amphibius*, *Chionomys gud*, *Cricetulus migratorius*, *Microtus arvalis*, *M. majori*, *M. oeconomus*, *Myodes glareolus*, *M. rutilus*, and *Rattus rattus* (Stekolnikov and Daniel 2012); *Apodemus agrarius*, *A. flavicollis*, *Microtus oeconomus*, *Myodes glareolus*, *Neomys fodiens*, *Sorex araneus*, and *Talpa europaea* (Moniuszko and Małol 2014); *Apodemus mystacinus*, *Crocidura suaveolens*, and *Mus macedonicus* (Açııcı et al. 2021); and *Glis glis* (Zajkowska et al. 2023).

New host record in the present study – *Apodemus uralensis*. Previously recorded host also found in the present study: *Rattus rattus*. An unidentified *Apodemus* sp. was also collected in the present study.

Distribution – Azerbaijan, Bulgaria, China, Georgia, Hungary, Moldova, Poland, Russia, Turkmenistan, Türkiye, Ukraine, Israel. Hosts and distribution locations of *Neotrombicula vulgaris* in Türkiye based on the present study and previous records are given in Table 5.

Table 5. Updated checklist of Trombiculidae species in Türkiye (revised from Eren et al. 2021).

Family	Genus	Species	Host	Location	References
Trombiculidae	<i>Ascoschoengastia</i> Ewing, 1946	<i>A. latyshevi</i> (Schluger, 1955)	<i>Apodemus mystacinus</i>	Gümüşhane	Stekolnikov and Daniel (2012)
	<i>Brunebaldia</i> Vercammen-Grandjean, 1960	<i>B. brunebaldi</i> (Vercammen-Grandjean, 1956)	<i>Apodemus flavicollis</i>	Adana	Stekolnikov and Daniel (2012);
			<i>A. mystacinus</i>	Ankara	Açııcı <i>et al.</i> (2021)
			<i>A. witherbyi</i>	Antalya	
			<i>Chionomys nivalis</i>	Çanakkale	
			<i>Meriones tristrami</i>	Çorum	
			<i>Mus macedonicus</i>	Manisa	
				Mersin	
		<i>B. bulgarica</i> (Vercammen-Grandjean and Kolebinova, 1966)	<i>Apodemus witherbyi</i>	Antalya	Kepka (1966);
			<i>A. flavicollis</i>	Çanakkale	Stekolnikov and Daniel (2012);
			<i>A. sylvaticus</i>	İzmir	Açııcı <i>et al.</i> (2021)
			<i>Microtus</i> sp.	İstanbul	
			<i>Mus musculus</i>		
	<i>Brunebaldia curtinae</i> (Kepka, 1966)	<i>Apodemus (Sylvaemus)</i> sp.	Erzurum	Kepka (1966);	
		<i>Sorex raddei</i>	Trabzon	Stekolnikov and Daniel (2012)	
	<i>Cheladonta</i> Lipovsky, 1955	<i>Cheladonta</i> sp.	<i>Microtus guentheri</i>	Konya	Açııcı <i>et al.</i> (2021)
		<i>Cheladonta</i> sp. 1	<i>Mus musculus</i>	Gümüşhane	Stekolnikov and Daniel (2012)
		<i>Cheladonta</i> sp. 2	<i>Chionomys nivalis</i>	Erzurum	Stekolnikov and Daniel (2012)

Table 5. Continued.

Family	Genus	Species	Host	Location	References
Trombiculidae	<i>Cheladonta</i> Lipovsky, 1955	<i>C. deserticola</i>	<i>Microtus schidlovskii</i>	Antalya	Stekolnikov and Daniel (2012)
	Crossley & Loomis, 1955	Stekolnikov & Daniel, 2012	<i>Spalax nebringi</i>	Mersin	
		<i>C. flava</i> (Schluger, 1955)	<i>Chionomys nivalis</i> <i>Microtus schidlovskii</i>	Adana Antalya Mersin	Stekolnikov and Daniel (2012)
		<i>C. ikaoensis</i> (Sasa, Sawada, Kano, Hayashi & Kumada, 1951)	<i>Apodemus flavicollis</i>	İzmir	
	<i>Ericotrombidium</i> Vercammen-Grandjean & André, 1966	<i>E. basei</i> (Feider, 1958)	<i>Crociodura russula</i>	İzmir	Kepka (1962); Stekolnikov and Daniel (2012)
	<i>Hirsutiella</i> Schluger & Vysotzkaya, 1970	<i>H. alpina</i> Stekolnikov, 2001	<i>Apodemus mystacinus</i>	Gümüşhane	Stekolnikov and Daniel (2012)
		<i>H. llogorensis</i> (Daniel, 1960)	<i>Apodemus cf. ponticus</i> <i>A. flavicollis</i> <i>A. mystacinus</i> <i>A. sylvaticus</i> <i>A. uralensis</i> <i>Microtus majori</i> <i>M. (Chionomys) roberti</i> <i>Mus macedonicus</i> <i>Rattus rattus</i>	Antalya Artvin İzmir Samsun	
		<i>H. steineri</i> (Kepka, 1966)	<i>Apodemus mystacinus</i> <i>A. ponticus</i> <i>A. sylvaticus</i> <i>A. wiberbyi</i> <i>A. (Sylvaemus) sp.</i> <i>Chionomys nivalis</i> <i>Cricetulus migratorius</i> <i>Microtus majori</i>	Adana Antalya Artvin Erzurum Giresun Gümüşhane Rize Trabzon	Kepka (1966); Stekolnikov and Daniel (2012)
	<i>Kepkatrombicula</i> Kudryashova & Sekolnikov, 2010	<i>K. ciliciensis</i> Stekolnikov & Daniel, 2012	<i>Microtus schidlovskii</i>	Adana	Stekolnikov and Daniel (2012)
		<i>K. crinita</i> (Schluger, 1966)	<i>Apodemus wiberbyi</i> <i>A. flavicollis</i> <i>Chionomys nivalis</i>	Adana Mersin Trabzon	
		<i>K. kudryashovae</i> (Stekolnikov, 2001)	<i>Apodemus mystacinus</i> <i>Microtus guentheri</i>	Gümüşhane Tekirdağ	Stekolnikov (2001b); Stekolnikov and Daniel (2012)
		<i>K. odessana</i> (Simonovich, 1958)	<i>Oris aries</i>	Samsun	
		<i>K. serbovae</i> (Kolebinova, 1972)	<i>Apodemus flavicollis</i> <i>A. mystacinus</i> <i>A. wiberbyi</i> <i>Chionomys nivalis</i> <i>Microtus guentheri</i> <i>M. schidlovskii</i>	Adana Antalya Çorum Mersin	Stekolnikov and Daniel (2012); Açıcı <i>et al.</i> (2021)
		<i>K. taurensis</i> Stekolnikov & Daniel, 2012	<i>Chionomys nivalis</i> <i>Microtus schidlovskii</i>	Antalya Mersin	

Table 5. Continued.

Family	Genus	Species	Host	Location	References
Trombiculidae	<i>Lacertacarus</i> Schluger & Vasilieva, 1977	<i>L. callosus</i> (Schluger, 1966)	<i>Anatololacerta pelasgiana</i>	Antalya	Jabbarpour (2016);
			<i>Darevskia adjarica</i>	Artvin	Eren and Açıcı (2025)
			<i>D. clarkorum</i>	Kahramanmaraş	
			<i>D. derjugini</i>	Kilis	
			<i>D. obscura</i>	Muğla	
			<i>D. parvula</i>	Rize	
			<i>Lacerta trilineata</i>	Sakarya	
			<i>L. viridis</i>	Zonguldak	
			<i>Phoenicolacerta laevis</i>		
			<i>Podarcis muralis</i>		
			<i>P. siculus</i>		
			<i>Stenodactylus grandiceps</i>		
		<i>Lacertacarus similis</i> Schluger & Vasilieva (1977)	<i>Darevskia adjarica</i>	Artvin	Eren <i>et al.</i> (2021);
			<i>D. bithynica</i>	Sakarya	Eren and Açıcı (2025)
			<i>D. clarkorum</i>		
			<i>D. derjugini</i>		
			<i>D. obscura</i>		
		<i>Lacertacarus turcicus</i> Kalúz, 2011	<i>Podarcis muralis</i>		
			Pitfall trap	Hatay	Kalúz (2011);
					Stekolnikov and Daniel (2012)
	<i>Leptotrombidium</i> Nagayo, Miyagawa, Mitamura & Imamura, 1916	<i>Leptotrombidium europaeum</i> (Daniel & Brelih, 1959)	<i>Apodemus</i> sp.	Adana	Kepka (1966);
			<i>Apodemus flavicollis</i>	Antalya	Stekolnikov and Daniel (2012)
			<i>A. mystacinus</i>	Ardahan	
			<i>A. ponticus</i>	Artvin	New host record
			<i>A. sylvaticus</i>	Çanakkale	
			<i>A. uralensis</i>	Çorum	
			<i>A. wiberbyi</i>	Erzurum	
			<i>A. (Sylvaeus) sp.</i>	Gümüşhane	
			<i>Chionomys nivalis</i>	İzmir	
			<i>Cricetulus migratorius</i>	Mersin	
			<i>Crocidura leucodon</i>	Rize	
			<i>Microtus majori</i>	Trabzon	
			<i>M. roberti</i>		
		<i>Leptotrombidium miniopteri</i> Feider, 1966	Cave dark zone	Konya	Stekolnikov <i>et al.</i> (2025)
	<i>Miyatrombicula</i> Sasa, Kawashima & Egashira, 1952	<i>Miyatrombicula attaliaensis</i> Stekolnikov & Daniel, 2012	<i>Apodemus wiberbyi</i>	Antalya	Stekolnikov and Daniel (2012)
			<i>Microtus schidlovskii</i>		
	<i>Neotrombicula</i> Hirst, 1925	<i>Neotrombicula autumnalis</i> (Shaw, 1790)	<i>Apodemus flavicollis</i>	Bolu	Kepka (1962);
			<i>A. mystacinus</i>	İstanbul	Kepka (1966);
			<i>A. sylvaticus</i>	İzmir	Çakıroğlu <i>et al.</i> (2008);
			<i>Citellus citellus</i>	Kayseri	Stekolnikov and Daniel (2012)
			<i>Cricetus</i> sp.	Samsun	
			<i>Crocidura</i> sp.		
			<i>Hemidactylus turcicus</i>		
			<i>Ixobrychus minutus</i>		
			<i>Microtus majori</i>		
			<i>M. roberti</i>		
			<i>Microtus</i> sp.		
			<i>Mus musculus</i>		
			<i>Rattus rattus</i>		
			<i>Sorex raddei</i>		
		<i>Neotrombicula bolkarensis</i> Stekolnikov & Daniel, 2012	<i>Apodemus wiberbyi</i>	Mersin	Stekolnikov and Daniel (2012)
			<i>Microtus schidlovskii</i>		

Table 5. Continued.

Family	Genus	Species	Host	Location	References
Trombiculidae	<i>Neotrombicula</i> Hirst, 1925	<i>Neotrombicula delijani</i> Kudryashova, 1977	<i>Apodemus (Sylvaemus)</i> sp. <i>Chionomys nivalis</i> <i>Cricetulus migratorius</i> <i>Microtus</i> sp.	Erzurum	Stekolnikov and Daniel (2012)
		<i>N. heptneri</i> Kudryashova, 1973	<i>Capra hircus</i>	Osmaniye	Stekolnikov and Kar 2015
		<i>N. kızılarsivriensis</i> Stekolnikov and Daniel, 2012	<i>Chionomys nivalis</i>	Adana Antalya	Stekolnikov and Daniel (2012)
		<i>N. kolebinovae</i> Stekolnikov & Daniel, 2012	<i>Chionomys nivalis</i> <i>Microtus schidlovskii</i>	Antalya	Stekolnikov and Daniel (2012)
		<i>N. lazistanica</i> Stekolnikov, 2000	<i>Apodemus (Sylvaemus)</i> sp. <i>A. fulvipectus</i> <i>Microtus majori</i>	Artvin Trabzon	Stekolnikov (2000); Stekolnikov and Daniel (2012)
		<i>N. palestinensis</i> (Radford, 1957)	<i>Apodemus flavicollis</i> <i>A. mystacinus</i> <i>A. sylvaticus</i>	İzmir	Kepka (1966); Stekolnikov and Daniel (2012)
		<i>N. scrupulosa</i> Kudryashova, 1993	<i>Apodemus fulvipectus</i> <i>A. mystacinus</i> <i>A. (Sylvaemus)</i> sp. <i>A. witherbyi</i> <i>Chionomys nivalis</i> <i>Microtus majori</i>	Antalya Artvin Rize	Stekolnikov and Klimov (2010); Stekolnikov and Daniel (2012)
		<i>N. sympatrica</i> Stekolnikov, 2001	<i>Apodemus flavicollis</i> <i>A. (Sylvaemus)</i> sp. <i>Chionomys nivalis</i> <i>Microtus majori</i> <i>M. obscurus</i> <i>Rattus rattus</i>	Çanakkale Kars Rize Ordu	Stekolnikov and Daniel (2012); Açııcı <i>et al.</i> (2021) New host record
		<i>N. turkestanica</i> Kudryashova, 1993	<i>Chionomys nivalis</i> <i>Microtus schidlovskii</i>	Adana Antalya	Stekolnikov and Daniel (2012)
		<i>N. tragardhiana</i> (Feider, 1953)	<i>Apodemus mystacinus</i> <i>Apodemus (Sylvaemus)</i> sp. <i>Crocidura russula</i> <i>Mus musculus</i>	Balıkesir Erzurum Gümüşhane	Kepka (1962); Stekolnikov and Daniel (2012)
		<i>N. vernalis</i> (Willmann, 1942)	<i>Apodemus flavicollis</i> <i>Chionomys nivalis</i> <i>Cricetulus migratorius</i> <i>Microtus majori</i> <i>M. (Ch.) roberti</i> <i>Microtus</i> sp. <i>Spalax leucodon</i>	Ardahan Artvin Bolu Erzurum İzmir Mersin Rize Trabzon	Kepka (1966); Stekolnikov and Daniel (2012)
		<i>N. vulgaris</i> (Schluger, 1955)	<i>Apodemus flavicollis</i> <i>A. mystacinus</i> <i>A. sylvaticus</i> <i>A. uralensis</i> <i>Crocidura suaviolens</i> <i>Microtus</i> sp. <i>Mus macedonicus</i> <i>Rattus rattus</i>	Artvin Aydın Çanakkale Çorum İzmir Manisa Samsun Tokat	Kepka (1966); Stekolnikov and Daniel (2012); Açııcı <i>et al.</i> (2021) New host record

Table 5. Continued.

Family	Genus	Species	Host	Location	References
Trombiculidae	<i>Schoutedenichia</i> Jadin & Vercammen-Grandjean, 1954	<i>S. anatolica</i> Kepka, 1962	<i>Crocidura russula</i>	İzmir	Kepka, (1962); Stekolnikov and Daniel (2012)
		<i>S. krampitzji</i> (Willmann, 1955)	<i>Apodemus flavicollis</i> <i>A. sylvaticus</i> <i>A. mystacinus</i>	Ankara Bursa Çanakkale	Kepka (1966); Stekolnikov and Daniel (2012);
			<i>Microtus guentheri</i>	İzmir	Açııcı et al. (2021)
		<i>S. thracica</i> Kolebinova, 1966	<i>Apodemus flavicollis</i> <i>A. mystacinus</i> <i>A. witberbyi</i> <i>Chionomys nivalis</i> <i>Microtus schidlovskii</i> <i>Rattus rattus</i>	Adana Antalya Artvin Çorum	Stekolnikov and Daniel (2012); Karağaç et al. (2025)
	<i>Walchia</i> Ewing, 1931	<i>Walchia cognata</i> Schluger & Amanguliev, 1975	<i>Crocidura russula</i>	İzmir	Kepka (1962); Stekolnikov and Daniel (2012)
	<i>Xinjiangsha</i> Wen & Shao, 1984	<i>Xinjiangsha lyciaensis</i> Stekolnikov and Daniel, 2012	<i>Chionomys nivalis</i>	Antalya	Stekolnikov and Daniel (2012)
		<i>Xinjiangsha montana</i> (Kudryashova, 1965)	<i>Apodemus ponticus</i> <i>A. (Sylvaemus) sp.</i> <i>Microtus majori</i>	Rize	Stekolnikov and Daniel (2012)
		<i>Xinjiangsha rychliki</i> Kalúz & Kováčik, 2012	Not known	Sakarya	Kalúz and Kováčik (2012)
		<i>Xinjiangsha tarda</i> (Schluger, 1957)	<i>Apodemus (Sylvaemus) sp.</i> <i>Microtus majori</i>	Artvin	Stekolnikov and Daniel (2012)
	<i>Matacarus</i> Vercammen-Grandjean, 1956	<i>Matacarus demrei</i> (Kepka, 1962)	<i>Ophisops elegans</i>	Antalya	Kepka (1962); Stekolnikov and Daniel (2012)
	<i>Odontacarus</i> Ewing, 1929	<i>Odontacarus efferus</i> Kudryashova, 1976	<i>Coronella austriaca</i>	Artvin	Eren and Açııcı (2025)
			<i>Darevskia adjarica</i>	Sakarya	
			<i>D. derjugini</i>	Samsun	
			<i>D. obscura</i>		
			<i>D. bithynica</i>		
			<i>Platyceps najadum</i>		
			<i>Podarcis muralis</i>		
			<i>P. tauricus</i>		
			<i>Telescopus fallax</i>		
			<i>Zamenis longissimus</i>		
		<i>Odontacarus hushchai</i> Kudryashova, 1994	<i>Darevskia adjarica</i> <i>D. clarkorum</i> <i>D. obscura</i>	Artvin	
		<i>Odontacarus naumovi</i> Kudryashova & Rybin, 1974	<i>Darevskia adjarica</i> <i>D. clarkorum</i> <i>D. obscura</i>	Artvin	
			<i>Darevskia adjarica</i> <i>D. clarkorum</i> <i>D. obscura</i>	Artvin	
		<i>Odontacarus saxicolis</i> Schluger, Hushcha & Kudryashova, 1965	<i>Darevskia adjarica</i> <i>D. clarkorum</i> <i>D. obscura</i>	Artvin	

DISCUSSION

The present study was conducted in Artvin, Samsun, and Kars provinces, which differ in their ecological and biogeographical characteristics within Türkiye. Artvin is characterized by the humid forest ecosystems of the Eastern Black Sea region and its Caucasus-associated biodiversity, whereas Samsun

represents the milder and more transitional habitats of the Black Sea coastal zone. Kars, in contrast, is characterized by high-altitude continental conditions within the Eastern Anatolia–Caucasus transition zone. These differences illustrate the ecological heterogeneity of the areas included in the present survey.

This study contributes new information on the host associations and distribution of trombiculid mites in Türkiye. The new host and locality records reported for *Hirsutiella llogorensis*, *Neotrombicula sympatrica*, and *N. vulgaris* expand the known host range and distributional limits of these species. By contrast, no new host or locality records were obtained for *Leptotrombidium europaeum*. The chaetotactic aberrations observed in *N. sympatrica*, including the absence of the AM seta in three specimens and the presence of an additional AM seta in one specimen, provide additional information on morphological abnormalities occurring in this species. Recording such aberrations is relevant because the number and arrangement of setae are commonly used in the identification and comparison of trombiculid taxa, and anomalous states may otherwise be misinterpreted as diagnostic characters.

Overall, the findings indicate that the host associations and distribution patterns of trombiculid mites in Türkiye are still not completely documented. Therefore, further field-based studies across different host taxa, localities, and habitat types are needed to improve species-level ecological knowledge and to better understand the diversity and biogeographical patterns of trombiculids in the country. The use of species-level host identification is especially important in this context. In morphologically similar rodent groups, particularly within *Apodemus*, imprecise host determination may easily lead to misleading conclusions about host range and host preference. Accurate host identification therefore increases the reliability of host association data and allows a more robust interpretation of host–parasite relationships. This study emphasizes the importance of carefully verifying host taxonomy when evaluating the host associations and ecological distribution of trombiculid mites. Mite identification in the present study was based on detailed morphological examination and comparison with previous taxonomic descriptions.

Although the examined specimens of *Hirsutiella llogorensis* showed some differences in morphometric values compared with previously published material from Türkiye, particularly in leg measurements, their diagnostic morphological characters are consistent with those given in previous descriptions. The scutal measurements, the lengths of the AM, AL, and PL setae, and the dorsal and ventral idiosomal setation largely correspond to those previously reported for the species. No distinct morphological characters supporting separation of the present material from *H. llogorensis* were observed. Accordingly, the identification of the examined specimens as *H. llogorensis* is retained, while the observed morphometric differences are documented and compared with previously published material.

In *Neotrombicula sympatrica*, the scutum normally bears a single AM seta. However, in the material examined in this study ($n = 4$), the AM seta was absent in three specimens (Fig. 6), whereas one specimen possessed two pairs of AM setae (Fig. 7A). Variation in the AM seta was observed in the specimens examined, with the seta being absent in three specimens and duplicated in one specimen. These conditions are regarded as individual chaetotactic aberrations. Similar aberrations were documented by Stekolnikov (2001a) and Kharadov (2002) in their studies of *Neotrombicula sympatrica*. They reported the absence of the AM seta in most aberrant specimens, as well as cases of duplication and positional displacement. In their examined material, morphological aberrations occurred in 17.2% of 3,308 specimens, with abnormalities involving the AM seta being among the most frequently recorded chaetotactic aberrations (Stekolnikov 2001a; Kharadov 2002). These previous observations are consistent with the abnormalities recorded in the present material, particularly the absence and duplication of the AM seta, and therefore support their interpretation as individual chaetotactic aberrations rather than typical character states of *N. sympatrica*. On coxa III, a single seta was present on the left side, whereas two setae were observed on the right side. Furthermore, the posterior sternal seta was represented by a single seta instead of the typical paired condition (Fig. 7B).

Eren *et al.* (2021) presented a checklist of trombiculid species recorded from Türkiye. Since then, five additional species have been reported from the country (Stekolnikov *et al.* 2025). In the present study, the checklist of Eren *et al.* (2021) was revised based on a re-examination of the taxonomic and distributional information associated with the listed species. Three records were corrected.

Hypotrombidium meleagridae was excluded from the Turkish fauna because the species was described from South Africa and no valid record from Türkiye could be confirmed. *Lacertacarus graecus*, which had been erroneously included in the checklist of Eren *et al.* (2021), was also excluded because the record on which its inclusion was based refers to Greece rather than Türkiye.

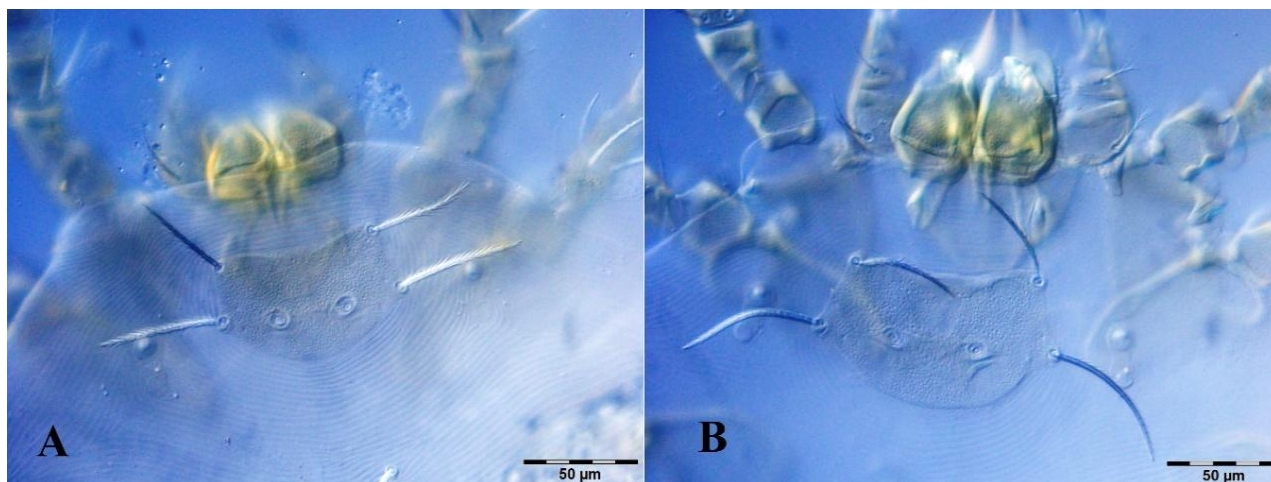


Figure 6. *Neotrombicula sympatrica* – Scutum lacking the AM seta.

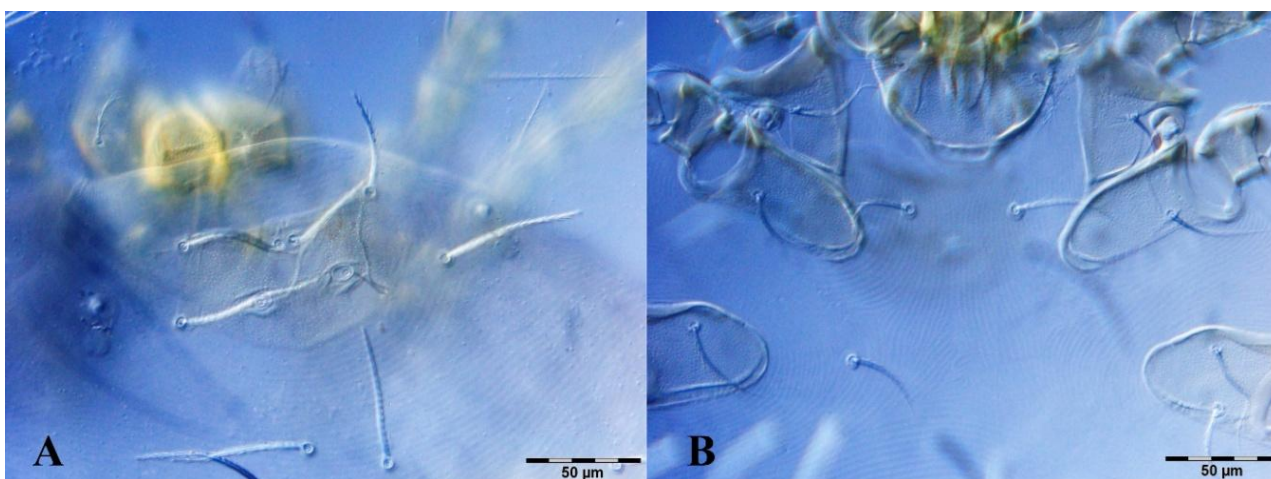


Figure 7. *Neotrombicula sympatrica* – **A.** Scutum with an additional AM seta (two AM setae in total); **B.** chaetotactic aberrations.

In addition, *Kepkatrombicula sayini* was removed as a separate species entry because this name represents a nomen nudum and refers to *Kepkatrombicula serbovae*. Following these corrections and the incorporation of the newly reported species, the updated checklist comprises 53 valid trombiculid species recorded from Türkiye (Table 5). The updated checklist also has significance beyond the addition of numerical records. By incorporating recently reported species together with their distributional data, it provides a more current overview of the trombiculid fauna of Türkiye and highlights the continuing expansion of knowledge in this group. At the same time, the checklist emphasizes that the trombiculid fauna of the country is still incompletely known, particularly with regard to host associations and regional sampling coverage. Taken together, these results demonstrate that continued integrative faunistic research, combining reliable host identification, morphological evaluation, and distributional documentation, is necessary for a more complete understanding of trombiculid diversity in Türkiye.

ACKNOWLEDGEMENTS

This study forms a part of the first author's ongoing doctoral dissertation. We thank Dr. Alexandr A. Stekolnikov (Zoological Institute of the Russian Academy of Sciences, Saint Petersburg, Russia) for his assistance in the identification of *Neotrombicula sympatrica*. We also thank Prof. Dr. Joanna Małol and

Dr. Paula Zajkowska (Wrocław University of Environmental and Life Sciences Wrocław, Poland) for their support regarding the 2023 Erasmus + Short-Term Doctoral Internship Mobility and the internship in Poland. We are grateful to the TÜBİTAK BİDEB 2211-A program for providing a scholarship to the researcher. Also, we are very grateful to the two anonymous referees for their valuable comments, which also contributed significantly to the improvement of the manuscript.

Author contributions: Sampling, collection and preparation of specimens: RK, AYS; Analyses and data curation: RK, AYS, SS; Illustration and photography: RK, AYS; writing – original draft preparation: RK, AYS, SS; writing – revisions and editing: RK, AYS, SS; supervision: SS. All authors have read and agreed to the published version of the manuscript.

Funding: The authors gratefully acknowledge the financial support provided by the Erzincan Binali Yıldırım University Scientific Research Projects Coordination Office under project number FBA2024-965.

Availability of data and materials: Data are available upon request from the authors.

Ethics approval and consent to participate: This study was conducted under research permit No. E-21264211-288.04-10822834 issued by the General Directorate of Nature Conservation and National Parks. No human participants were involved in any studies conducted by the authors for this article.

Consent for publication: Not applicable. The necessary permission for the collection of small rodents was obtained from the relevant Ministry.

Competing interests: The authors declare no conflict of interest.

Generative AI statement: The authors declare that generative artificial intelligence (AI) and AI-assisted technologies were not used in the writing of this manuscript or in the preparation of figures.

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اطلاعاتی در مورد شناخت هرناهای ترومبیکولید (Acari, Trombiculidae) و میزبان‌های آنها در ترکیه، به همراه فهرست جامع گونه‌ها

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چکیده

اطلاعات مربوط به ارتباط با میزبان در کنه‌های ترومبیکولید ثبت شده در ترکیه همچنان ناقص است و دامنه میزبانی چندین گونه به اندازه کافی شناخته نشده باقی مانده است. برای رفع این خلأ، مطالعه حاضر چهار گونه ترومبیکولید شامل *Leptotrombidium europaeum* (Daniel & Brelih, 1959)، *Hirsutiella llogorensis* (Daniel, 1960)، *Neotrombicula sympatrica* Stekolnikov, 2001 و *N. vulgaris* (Schluger, 1955) را بررسی می‌کند که به صورت لاروهای انگل بیرونی از میزبان‌های جوندگان مختلف جمع‌آوری شده‌اند. به منظور به کمینه رساندن ابهام‌های آرایه‌شناختی، هویت میزبان‌های جنس *Apodemus* (به جز یک مورد) با استفاده از ناحیه ژنی میتوکندریایی cyt b روش مولکولی تأیید شد. یافته اصلی این مطالعه، ثبت میزبان‌های جدید برای این گونه‌ها و در نتیجه گسترش دامنه میزبانی شناخته شده آن‌هاست. افزون بر این، داده‌های مربوط به پراکنش، نکات مختصر ریخت‌شناسی، مقایسه با گزارش‌های پیشین از ترکیه، ناهنجاری‌های مشاهده شده در گونه *N. sympatrica* و فهرست به‌روزرسانی شده‌ای از گونه‌های ترومبیکولید ثبت شده در ترکیه ارائه شده است. این یافته‌ها به درک بهتر ارتباط هرناهای ترومبیکولید با میزبان‌هایشان در ترکیه کمک کرده و مبنایی برای مطالعات زیان‌گشایی و بوم‌شناختی آینده فراهم می‌آورند.

واژگان کلیدی: آناتولی، *Apodemus*، چیگرها، پراکنش، روابط میزبان-انگل

دریافت

۲۸ اردیبهشت ۱۴۰۵

پذیرش

۱۹ شهریور ۱۴۰۵

انتشار

۲۳ مهر ۱۴۰۵

دبیر تخصصی

ع. صبوری

CITE: Karağaç, R., Selçuk, A.Y. & Sevsay, S. (2026) Contribution to the knowledge of trombiculid mites (Acari, Trombiculidae) and their hosts in Türkiye, with a comprehensive species checklist. *Persian Journal of Acarology*, 15(4): 150406.
<https://doi.org/10.22073/pja.150406>

