DESCRIPTION OF MALES OF TWO MACRONYSSID MITE SPECIES (MESOSTIGMATA: GAMASINA: MACRONYSSIDAE) PARASITIZING THE SIBERIAN TUBE-NOSE BAT *MURINA HILGENDORFI* (CHIROPTERA: VESPERTILIONIDAE)

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ABSTRACT: Descriptions of males of two parasitic mite species (Mesostigmata: Gamasina: Macronyssidae) from the Siberian tube-nose bat *Murina hilgendorfi* (Chiroptera: Vespertilionidae), along with a key to males of the genus *Macronyssus* in the Palaearctic Region are presented.

KEY WORDS: Bat gamasid mite, *Macronyssus*, the Siberian tube-nose bat, *Murina hilgendorfi,* key to males.

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INTRODUCTION

Macronyssid mites (Mesostigmata: Gamasina: Macronyssidae) form a vesper bat ectoparasite fauna core (Chiroptera: Vespertilionidae) (Orlova *et al.* 2016). Little data are available on the medical significance of the macronyssid mites (Gamasina, Macronyssidae) associated with the Palaearctic bats (two cases of separating *Bartonella* sp. from mites belonging to the genus *Steatonyssus*: Reeves *et al.* 2006; Hornok *et al.* 2012). Meanwhile, many species belonging to this family whose hosts are rodents (*Ornithonyssus bacoti* (Hirst, 1913), *O. bursa* (Berlese, 1888), *O. sylviarum* (G. Canestrini *et* Fanzago, 1877) and others) are involved in transmission of dangerous natural focal infections, such as lymphocytic choriomeningitis, rickettsial pox, Q-fever, and tularemia (Zemskaya 1973).

Two years after the first description of females of the macronyssid mites *Macronyssus stanyukovichi* Orlova, Zhigalin, 2015 and *Macronyssus tigirecus* Orlova, Zhigalin, 2015, males of these species were found. This was due to the current extensive investigation of bats on the territory of Western and Eastern Siberia, especially of under-studied species, such as the Siberian tube-nose bat *Murina hilgendorfi* Peters, 1880 (Chiroptera: Vespertilionidae).

MATERIAL AND METHODS

In the summer, the bats were caught using both mist-nets and mobile traps. During the hibernation period, animals were picked from the winter roost walls. After the examination, all bats were returned to shelters or released. Ectoparasites were removed with a preparatory needle and forceps, after which the specimens were fixed in 70% ethanol. Mites were mounted on permanent slides using Faure–Berlese's mounting medium (Whitaker 1988). Drawings were made using camera lucida and the "Leica DM 2500" transmission light microscope. Chaetotaxy of the specimens was determined according to Lindquist and Evans (1965). Measurements (in µm) were taken from the allotype and paratypes (presented in parentheses in the descriptions below).

SYSTEMATICS

Macronyssus stanyukovichi Orlova et Zhigalin, 2015

Diagnosis. *Male*. Idiosoma oval 530 (506–549, n=3) × 270 (262–305, n=5). Dorsal plate with 26 setal pairs.

Description. *Dorsal idiosoma* (Fig.1). Dorsal plate obovate, weakly reticulated, 501 (489–547, n=3) long and 280 (244–294, n=3) wide, bearing 26 pairs of smooth setae (their location shown in Fig. 1). Podonotal setae (16 pairs): 5 pairs long (z2, z3, s3, s4, s6; length about 48–55), 6 pairs moderately long (j1, j2, j3, s1, s2, r2; length about 23–28) and 5 pairs short (j4, j5, j6, z5, z6; length about 12–15); z3–z5 ratio about 4.5: 1. Opisthonotal setae (10 pairs): 4 pairs long (J5, Z4, S1, S3, length about 40–48), 2 pairs moderately long (Z3, S4, 26–32), 3 pairs short (J1, J2, J3, length about 12–19), J5—microseta. Posterior margin of dorsal plate straightened. Unsclerotized integument of dorsal opisthosoma bearing 13–15 pairs smooth sharp setae approximately equal lengths (20–25). Peritreme long (including stigma 270–290) reaching middle of bases of first legs.

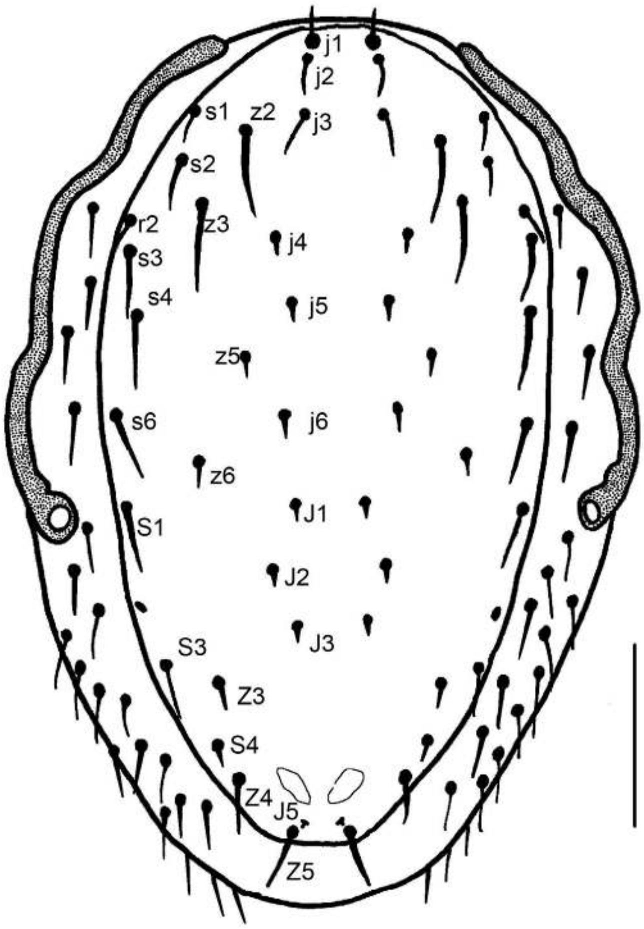

Fig. 1. *Macronyssus stanyukovichi* Orlova et Zhigalin, 2015, male, dorsal idiosoma. Scale bar 100 µm.

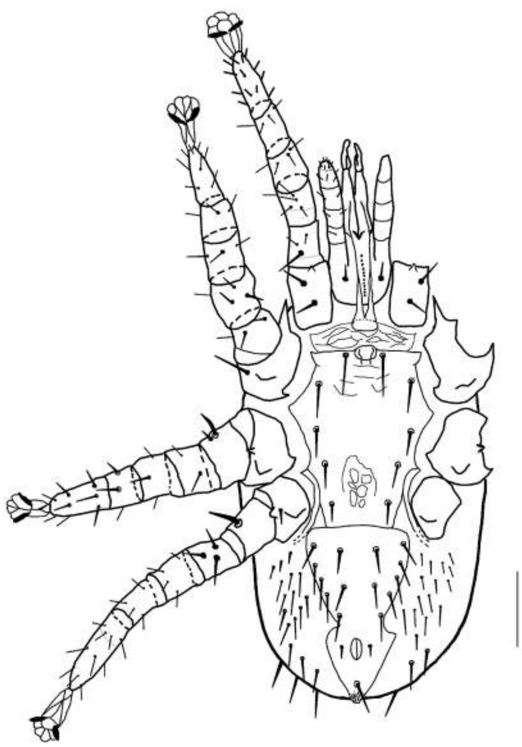

Fig. 2. *Macronyssus stanyukovichi*, male, ventral idiosoma. Scale bar 100 µm.

Fig. 3. *Macronyssus stanyukovichi*, male, chelicera. Scale bar 50 µm.

Ventral idiosoma (Fig.2). Sternogenital plate 219 (200–236, n=3) long, 149 (140–150, n=3) wide, with four clear projections, bearing 5 pairs of long, smooth, sharp setae. Transverse lines between setae st1 and st2. Pair st1 47 (35–50, n=3) long, setal pair st2 45 (44–47, n=4) long, st3 39 (42–45, n=3) long, st4 32 (26–42, n=3) long, st5 22 (22–33, n=2) long. Ventroanal plate with a constriction between the ventral and anal parts, 196 (189–206, n=3) long, 110 (110–137, n=3) wide, bearing 7 pairs of sharp setae in ventral part. Ventral opisthosoma with about 16–19 pairs of smooth sharp setae 29–41 long. Adanal setae 13 (15–18, n=3) long; postanal seta 25(17–29, n=3) long.

Gnathosoma. Total length (including palps) 191 (184–199, n=5). Length without palps 94 (111–141, n=3), wide 75 (74–82, n=3) bearing 4 pairs of setae 13–17 long. Deutosternal groove with the single row of 12 denticles. Tritosternum pronounced, with a wide base, lacinia elongated. Chelicera (Fig. 3) 122 (119–123, n=4) long, spermatodactyl enlarged 47 (46–47, n=4) long with two small denticle. Movable digit almost twice larger than immovable, weakly curved.

Leg. Legs brawny and long. Tibia I length–width ratio about 1.2:1, coxa II with strong spur. Coxae II, III and IV have ventral ridges. Chaetotaxy of legs is normal for the genus. Tarsus I setation is typical for the *Macronyssus crosbyi* spp. group (Radovsky, 1967; Stanyukovich, 1997).

Protonymphs and larvae were not found.

Type material. ♂ allotype and 4 ♂♂ paratype from Barsukovskaya cave (Novosibirsk province; 54°22′ N, 83°58′ E; 26/III/2014; leg. O.L. Orlov, A.V. Zhigalin), other specimens were collected in the territory of Tigirekskiy reserve (Altai Region; 51°16′ N 83°02′ E; 4/XII/2012; leg. O.L. Orlov, A.P. Golovanova), in the vicinity of the settlement Verkhniaya Bazaikha (Krasnoyarsk Region; 55° 41′ N 93° 22′ E; leg. A.M. Khritankov) and Dolganskaya Yama cave (Buriatiya Republic; 54°28′ N 113°47′ E; 20/VIII/2016; leg. D.V. Kazakov). All individuals have been collected from the Siberian tube-nose bat *Murina hilgendorfi*. Allotype, paratype and other specimens are deposited in the Museum of Zoology of Tyumen State University (Tyumen, Russia), except for the specimen from Verkhniaya Bazaikha, which is deposed in the collection of parasitic arthropods of the Zoological Institute of the RAS (Saint Petersburg, Russia).

Distribution. It can be assumed that the range of this ectoparasite coincides with the area of its principal host, the Siberian tube-nose bat, and covers Western Siberia, Eastern Siberia and the Far East of Russia.

Macronyssus tigirecus Orlova et Zhigalin, 2015

Diagnosis: *Male*. Idiosoma oval 504 (467–525, n=3) × 295 (290–326, n=3). Dorsal plate with 27 setal pairs. Ventral part of ventroanal plate with 28–30 setae. Spermatodactyl greatly enlarged, its length about the same as of the second segment of chelicerae.

Description. *Dorsal idiosoma* (Fig. 4). Dorsal plate 482 (465–499, n=3) long and 282 (236–261, n=3) wide, with reticulate pattern, bearing 27 pairs of smooth setae (their location is shown in Fig. 4). Podonotal setae (16 pairs): 10 pairs long (j1, j2, j3, z2, z3, s1, s2, s3, s5, s6; length about 23–35), one pair moderately long (r2; length about 15–17) and 5 pairs short (j4, j5, j6, z5, z6; length about 8–10); z3–z5 ratio about 4:1. Opisthonotal setae (11 pairs): 6 pairs long (S1, S3, S4, S5, Z4, Z5; length about 16–23), 4 pairs short (J1, J2, J3, J4; length about 9–10), J5—microseta. Posterior margin of dorsal plate straightening. Unsclerotized integument of dorsal opisthosoma bearing 15–17 pairs sharp approximately equal length (15–18) setae. Peritreme long (including stigma 250–260), reaching middle of bases of first legs.

Ventral idiosoma (Fig 5). Sternogenital plate 193 (184–200, n=3) long, 134 (139–149, n=3) wide, with four clear projection, bearing 5 pairs of long, smooth, sharp setae. Pairs st1 40 (39–41, n=3) long, setae st2 36 (34–51, n=3), setae st3 44 (38–41, n=4) long, setae st4 28 (30–38, n=3) long, setae st5 29 (28–32, n=2) long. Ventroanal plate clearly enlarged in ventral part, 195 (193–216, n=3) long, 123 (110–155, n=3) wide, bearing 14–15 pairs of long (25–31) sharp setae. Ventral opisthosoma bearing about 17–19 pairs of long (18–28) sharp setae. Adanal setae 18 (16–21, n=3) long; postanal seta 24 (21–25, n=3) long.

Gnathosoma. Total length (including palps) 172 (169–185, n=3), length without palps 80 (74–85, n=3), width 75 (74–82, n=3), bearing 4 pairs of setae 12–18 long. Deutosternal groove with the single row of 12 denticles. Tritosternum pronounced, with a wide base, 80–85 long, lacinia 23–26 long. Chelicera (Fig. 6) 162 (164–166, n=3) long, spermatodactyl greatly enlarged, about the same length as the second segment of chelicera 75 (74–75, n=3) with two small denticles. Fixed and movable fingers of chelicera are of approximately equal length 28 (27–30, n=4), straight.

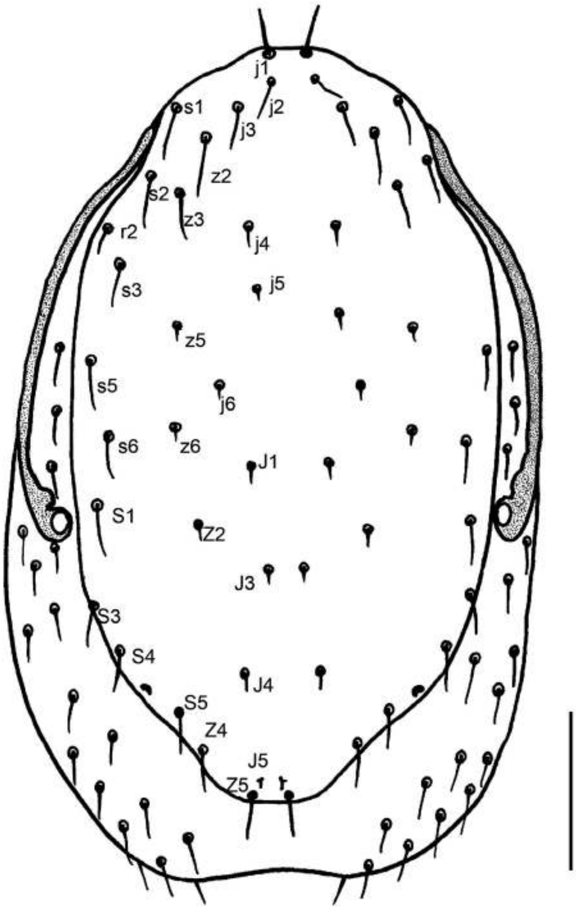

Fig. 4. *Macronyssus tigirecus* Orlova et Zhigalin, 2015, male, dorsal idiosoma. Scale bar 100 µm.

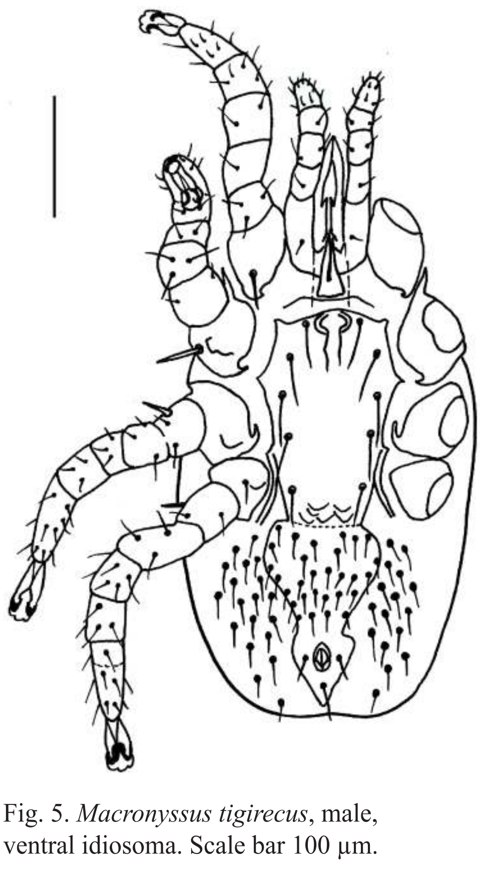

Fig. 5. *Macronyssus tigirecus*, male, ventral idiosoma. Scale bar 100 µm.

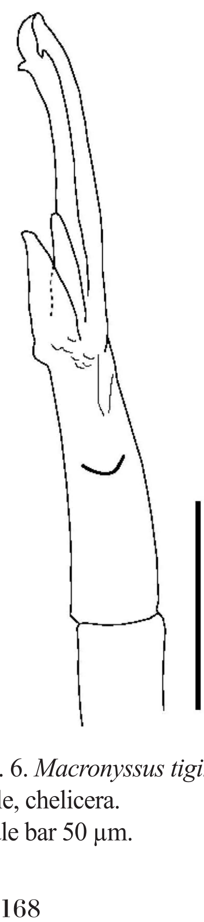

Fig. 6. *Macronyssus tigirecus*, male, chelicera. Scale bar 50 µm.

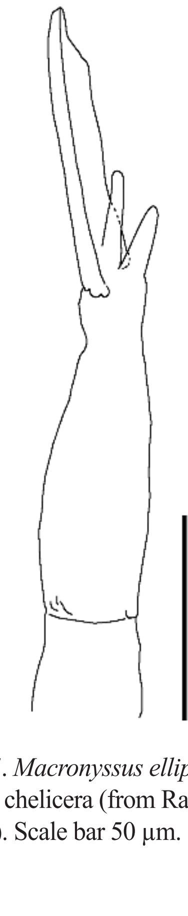

Fig. 7. *Macronyssus ellipticus*, male, chelicera (from Radovsky 1967). Scale bar 50 µm.

Leg. Legs brawny and long. Tibia I length–width ratio about 1.1: 1, coxa II with strong spur. Coxae II, III and IV have ventral ridges. Chaetotaxy of legs is normal for the genus. Tarsus I setation is typical for the *Macronyssus crosbyi* spp. group (Radovsky, 1967; Stanyukovich, 1997).

Protonymphs and larvae were not found.

Differential diagnosis. *Macronyssus tigirecus* differs from most of the palaearctic macronyssid mite species by greatly enlarged spermatodactyl like in *Macronyssus ellipticus* (Kolenati, 1956) (Fig. 7), but the two species can be easily distinguished from each other as follows: *M. tigirecus* has a smaller body size, longer peritreme reaching the coxae I (in *M. ellipticus,* peritreme reaches the coxae II) and a greater number of setae on the ventral part of the ventroanal plate (28–30 vs 10–11). The dorsal plate in *M. tigirecus* bears 27 setal pairs (vs 26 in *M. ellipticus*).

Type material. ♂ allotype and 3 ♂♂ paratypes were found in Okhotnichya cave (Irkutsk Pronince; 52°08′ N 105°27′ E; 12/IX/2016; leg. D.V. Kazakov), other specimens were found in the Tunkinskiy Nature park (Khongor–Uula ravine; Republic of Buriatiya; 51°40′ N 102°15′ E; 08/VIII/2016; leg. D.V. Kazakov), Argaleyskaya cave (Irkutsk Province; 53°25′ N 103°06′ E; 18/IX/2015; leg. D.V. Kazakov) and Tigirekskiy reserve (Altai Region; 51°16′ N 83°02′ E; 4/XII/2012; leg. O.L. Orlov, A.P. Golovanova). All individuals were collected from the Siberian tube-nose bat *Murina hilgendorfi*. The allotype, paratypes, and other specimens are deposited in the collection of the Tyumen State University Museum of Zoology (Tyumen, Russia).

Distribution. It can be assumed that the range of this ectoparasite, as in the previous species (*M. stanyukovichi*), coincides with the area of the principal host—the Siberian tube-nose bat—and covers Western Siberia, Eastern Siberia and the Far East of Russia.

Key to the males of the genus *Macronyssus* Kolenati, 1858, of the Palaearctic Region

1. Dorsal plate with 29 setal pairs of almost equal lengths, z3–z5 ratio about 1.2: 1 ....*M. hosonoi* Uchikawa, 1979
— Dorsal plate with 26–29 setal pairs, j-J setae short, z3–z5 ratio about 3–4.5: 1........................2
2. Spermatodactyl greatly enlarged, its length is about the same length as the second segment of chelicerae 3
— Spermatodactyl is clearly shorter than the second the second segment of chelicerae.................4
3. Peritreme reaching coxae II, 26 setal pairs on dorsal plate, ventral part of ventroanal plate with 10–11 setae........... *M. ellipticus* (Kolenatii, 1856)
— Peritreme reaching coxae I, 27 setal pairs on dorsal plate, ventral part of ventroanal plate with 28–30 setae ....*M. tigirecus* Orlova et Zhigalin, 2015
4. Three very long and spur-like setal pairs flanking dorsal plate about middle of idiosoma ....*M. rhinolophi* (Oudemans, 1902)
— Setae near middle of idiosoma are usual........5
5. Dorsal setae S5 and Z5 on four cylindrical processes; opisthosoma invaginated posteriorly, with 2 clusters of thick caudal setae............................ .... *M. corethroproctus* (Oudemans, 1902)
— Cylindrical processes absent; opisthosoma without invagination of posterior margin, caudal setae usual 6
6. Dorsal plate with 26–27 setal pairs................7
— Dorsal plate with 28–29 setal pairs................8
7. Peritreme ends over coxae II; ventroanal plate narrows between ventral and anal parts .... *M. granulosus* (Kolenatii, 1856)
— Peritreme reaching posterior half of coxae II; dorsal plate without narrowing ....*M. cyclaspis* (Oudemans, 1906)
8. Peritreme reaching anterior margin or middle of coxae I..9
— Peritreme reaching anterior margin or middle of coxae II 11
9. Ventral part of ventroanal plate without pronounced expansion, with 13–15 setae.................. ....*M. flavus* (Kolenati, 1856)
— Ventral part of ventroanal plate markedly expanded 9
10. Ventral setae (13–22) markedly expanded near basis....................*M. kolenatii* (Oudemans, 1902)
— Ventral setae (14), without expansion nearbasis ......*M. stanyukovichi* Orlova et Zhigalin, 2015
11. Dorsal plate with 28 setal pairs..................12
— Dorsal plate with 27 setal pairs...................13
12. Ten pairs of long, thick setae on opisthosoma, which invaginated posteriorly; basis of trirosternum expanded ...... *M. charusnurensis* Dusbabek, 1966
— Opisthosoma without invagination, with usual setae; basis of trirosternum not expanded............ .... *M. diversipilis* (Vitzthum, 1920)
13. Three pairs of long spike-like setae on posterior margin of dorsal... .....*M. heteromorphus* Dusbabek and Radovsky, 1972
— Setae on dorsal plate usual.............................. ....*M. barbastellinus* Dusbabek, Pinchuk, 1971

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