THREE NEW SPECIES AND NEW RECORDS OF CHIGGER MITES (ACARI: TROMBICULIDAE) FROM EAST HINDUKUSH, PAKISTAN

BY M. DANIEL [1] and A. A. STEKOL'NIKOV [2]

(Accepted October 2005)

ACARI
CHIGGERS
TAXONOMY
FAUNA
PARASITES
HINDUKUSH
PAKISTAN

SUMMARY: Three new species, *Trombicula stoliczkai* n. sp., *Microtrombicula humeroventrala* n. sp., and *M. tirichmirensis* n. sp. are described from murid rodents collected in East Hindukush, Pakistan. Five species are recorded for the first time in Pakistan.

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RÉSUMÉ : Trois espèces nouvelles, *Trombicula stoliczkai* n. sp., *Microtrombicula humeroventrala* n. sp. et *M. tirichmirensis* n. sp. sont décrites de rongeurs muridés recueillis en Hindukush Est, Pakistan. Cinq especes inedites sont signalees du Pakistan.

INTRODUCTION

Results of the chiggers collection in the First Czechoslovak Expedition to Hindukush (1965) were briefly characterized more than 30 years ago (DANIEL 1973). The Expedition visited the Afghan part of the East Hindukush (Vakhan region), where 11 chigger species were collected. This was the first chigger fauna evidence in this Afghan part of the Hindukush range. To the time only findings of *Microtrombicula gratiosa* Schluger & Kudryashova, 1969 and *Montivagum dihumerale* (Traub & Nadchatram, 1967) were published (DANIEL 1973). The present paper covers results of chigger mites fauna investigations carried out in Tirich Mir region by the Second Czechoslovak Expedition to Hindukush in 1967 (DANIEL 1969).

MATERIAL AND METHODS

All chiggers were collected by M. DANIEL in Pakistan, East Hindukush, Tirich Mir mountains massif in June-August 1967. The collections were realized in two areas including a mosaic of dispersed sampling sites (slightly differing in habitat conditions). In the text these areas are designated as follows. A) "Shekhniyak" — local name of a part of Tirich Gol Valley close to the head of the Tirich Glacier, 3650 m above sea level (36° 14' N; 72°00' E). This part was covered with numerous islets of bushy willow and birch forming isolated impermeable patches divided from one another by narrow strips of stone debris fields. B) "Basecamp" — Tirich Glacier Valley, the environment at the confluence of the Upper and Lower Tirich Glacier, 4000-4100 m

1. School of Public Health, Institute for Postgraduate Medical Education, Ruska 85, 100 05 Prague 10, Czech Republic; e-mail: daniel@ipvz.cz

2. Zoological Institute, Russian Academy of Sciences, Universitetskaya 1, Saint-Petersburg 199034, Russia; e-mail: acari@zin.ru

Acarologia, 2004 [2005], XLV, 4 : 273-285.

(36°18' N; 71°56' E). On the slopes opposite the mountain range leading to the East of the Tirich Mir Massif there were three grass strips winding through rock and stone debris. Small brooks fed from the higher situated snow field were flowing through two of these grass strips, the third one was waterlogged in its upper reaches. The vegetation was favourably influenced by the south exposition of this site.

Chiggers were found on the following species of mammal hosts: *Alticola roylei* (Gray, 1842), *A. argentatus* (Severtzov, 1879), *Cricetulus migratorius* (Pallas, 1773), and *Apodemus (Sylvaemus)* sp. The specimens of *Apodemus* originally were identified as *A. sylvaticus* L. However it is probably *Apodemus wardi* (Wroughton, 1908), judging from the data on distribution of different *Apodemus* species in Asia (WILSON & REEDER 1993). Mites were mounted in Swann's medium. All measurements are given in micrometres (mm). Terminology follows GOFF et al. (1982), with some adaptation: "ventral setae" (V) — setae on the ventral surface of idiosoma excluding coxal and sternal setae; VS — number of ventral setae; D — dorsal idiosomal setae; DS — number of dorsal idiosomal and humeral setae; TaIII — length of leg III tarsus; TaW — width of leg III tarsus; m-t ratio between distance from mastitarsala to the base of leg III tarsus and length of leg III tarsus. Type specimens are deposited in the acarological collections of the Zoological Institute of the Russian Academy of Sciences, Saint-Petersburg (ZIN), the Institute of Parasitology, Academy of Sciences of the Czech Republic, Ceske Budejovice (PaU) and in the collection of the senior author.

RESULTS AND DISCUSSION

More than 1000 chiggers specimens were collected during the expedition. Their identification revealed 10 species including three new to science. Five species are recorded in Pakistan for the first time. *Montivagum dihumerale* was the most abundant species in this collection (824 specimens), as well as in the material collected in the Vakhan region. Full data on the field ecology of this and other recorded species will be published later.

TROMBICULA STOLICZKAI n. sp.
(FIGS. 1-9; TABLE 1)

DIAGNOSIS: SIF = 7B-B-3-2100.3100; fPp = B/B/BNB; fCx = 1.1.4(3-6); fSt = 2.2; fSc: PL > AL >= AM; Ip = 816; fD = 2H-8-6-8-6-2; DS = 33; VS = 26; NDV = 58.

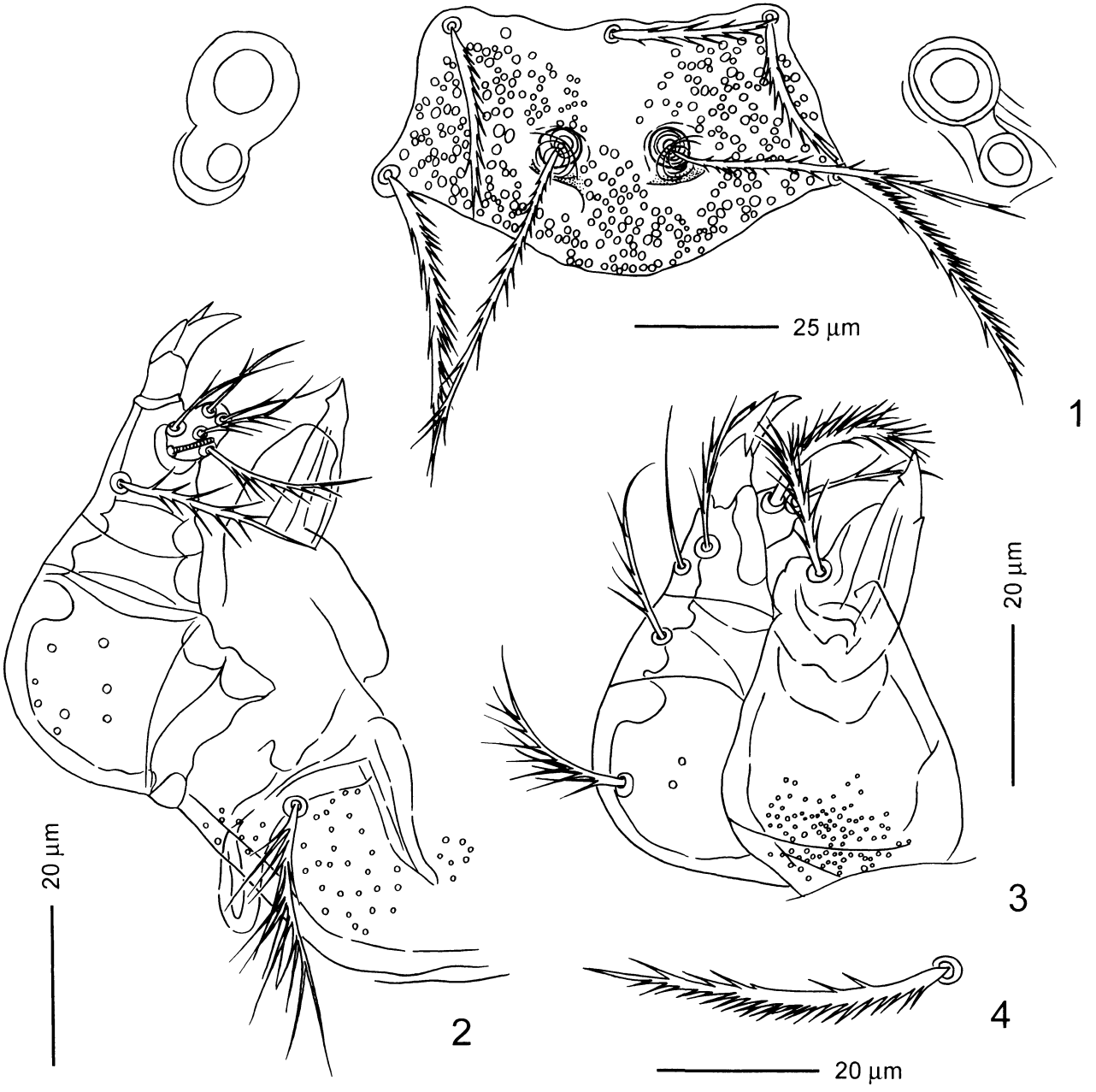
DESCRIPTION: *Larva*. Idiosoma. Eyes 2 + 2, anterior 16-19 in diameter, posterior smaller. One pair of humeral setae; 30-33 dorsal idiosomal setae, arranged 8-6-(8-10)-..., with pointed tips, heavily feathered with thin barbs; two pairs of sternal setae and 22-28 ventral setae; total idiosomal setae 54-63.

Gnathosoma. Gnathobase, cheliceral base, and palpal femur sparsely punctate; cheliceral blade with tricuspid cap; gnathobase with a pair of branched setae; galeala heavily branched; palpal claw 3-pronged; setae on palpal femur and genu branched, dorsal and ventral setae on palpal tibia branched, lateral palpal tibial seta nude; palpal tarsus with 7 branched setae and tarsala.

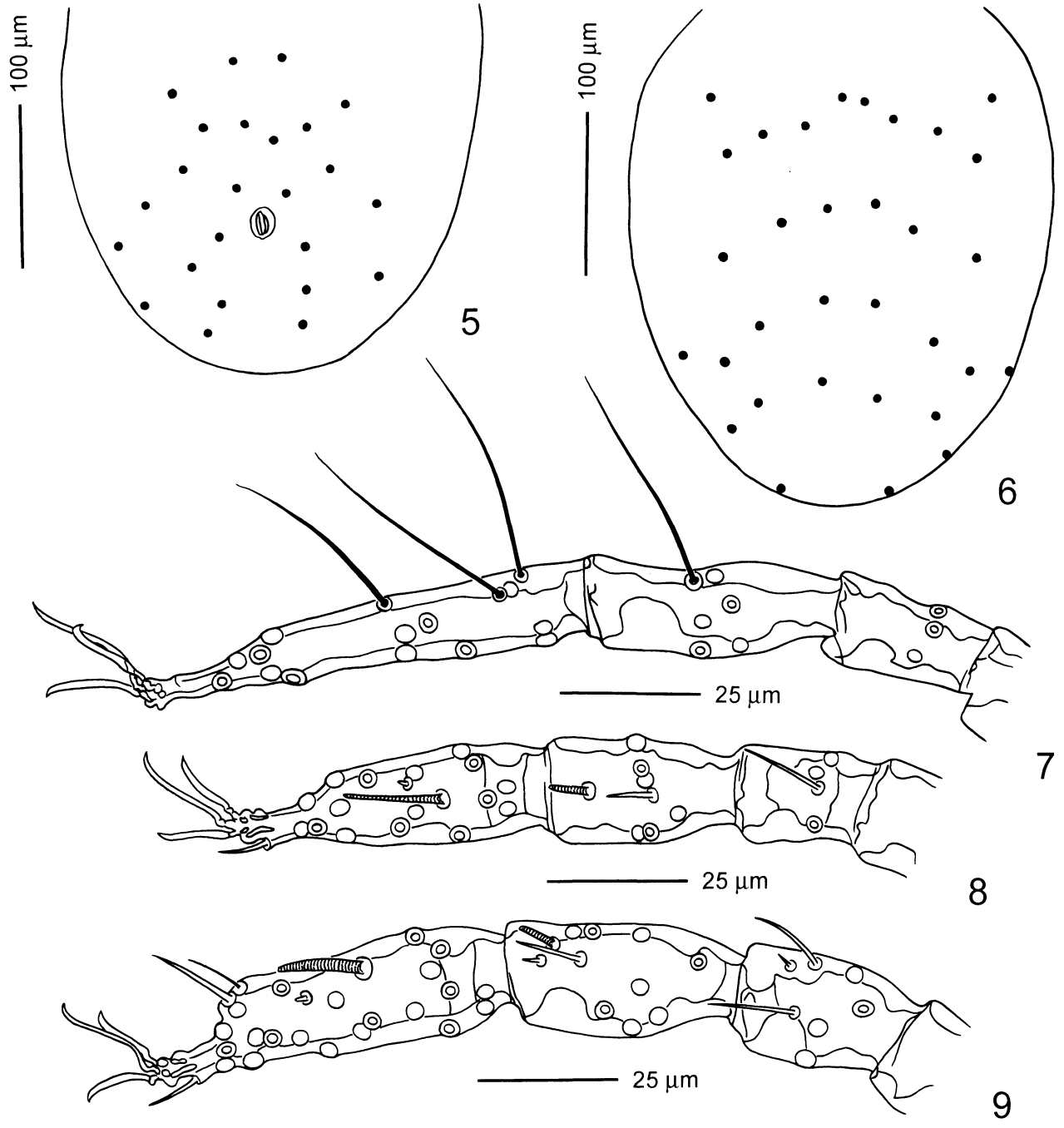
Scutum. Densely punctate with very large puncta (scrobiculate), nearly pentagonal, with rounded posterior margin; scutal setae similar to dorsal idiosomal setae; PL > AL >= AM; AM base on level of ALs; SB anterior to level of PLs and somewhat close together; sensilla flagelliform, barbed from their bases, distal barbs longer.

Legs. 7-segmented, terminating in a pair of claws and clawlike empodium. Leg I: coxa with 1 non-specialized branched seta (1B); trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 2 genualae, microgenuala; tibia 8B, 2 tibialae, microtibiala; tarsus 22B, tarsala 15 long, microtarsala, subterminala, parasubterminala, pretarsala. Leg II: coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala 18 long, microtarsala distal to tarsala, pretarsala. Leg III: coxa 4(3-6)B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala absent; tibia 5B, tibiala replaced with mastitibiala; tarsus 13B, 3 mastitarsalae, distal mastitarsala sometimes with few cilia.

HOSTS: *Alticola roylei, Apodemus (Sylvaemus)* sp.



Figs. 1-4. — *Trombicula stoliczkai n.* sp., larva.
1. — Scutum and eyes. 2. — Ventral aspect of gnathosoma. 3. — Dorsal aspect of gnathosoma. 4. — Dorsal idiosomal seta of 1st row.



FIGS. 5-9. — *Trombicula stoliczkai* n. sp., larva.
5. — Arrangement of ventral idiosomal setae. 6. — Arrangement of dorsal idiosomal setae. 7. — Leg III. 8. — Leg II. 9. — Leg I.

	AW	PW	SB	ASB	PSB	SD	PPL	AP	AM	AL	PL	S	H
Holotype	56	81	19	26	23	49	20	28	26	27	47	64	45
Minimum	53	77	18	23	20	45	17	26	25	25	43	61	43
Maximum	59	83	22	27	27	53	23	31	32	34	53	66	52
Mean	57	80	20	25	23	48	20	28	27	30	48	63	46

	D	V	pa	pm	pp	Ip	DS	VS	NDV	TaIII	TaW
Holotype	34-48	33-45	277	245	306	828	34	24	58	83	13
Minimum	33-42	27-41	266	236	283	788	32	22	54	76	12
Maximum	39-52	34-49	284	252	308	841	35	28	63	83	13
Mean	35-47	31-45	274	246	296	816	33	26	58	78	13

TABLE 1. — *Trombicula stoliczkai* n. sp.: Standard measurements of the type series (N = 10)

TYPE DATA: holotype larva (No. T.-Tr.-27, P-44/4) from *Alticola roylei,* Shekhniyak, 3 August. 65 paratypes larvae from *Alticola roylei,* and 1 from *Apodemus (Sylvaemus)* sp., 3, 8-9 August, other data same. The holotype and 30 paratypes are deposited in ZIN; 20 paratypes are deposited in PaÚ; 15 paratypes are deposited in the collection of the senior author.

ETYMOLOGY: The species is named after a famous Czech scientist FERDINAND STOLICZKA, who made a valuable contribution to the exploration of Asian mountains in nineteenth century.

DIFFERENTIAL DIAGNOSIS: The new species differs from all other *Trombicula* in having 7B on palpal tarsus (5B in *Trombicula* s.s., 6B in *Cotrombicula),* coxa III being multisetose, absence of genuala III, and the presence of multiple mastitarsalae on leg III (in *Trombicula* s.l. only one mastitarsala is rarely present).

REMARKS: Mastitibiala III in the new species may be a transformed tibiala. There is a tendency in *Trombicula* to the elongation of specialized leg setae, and sometimes tibiala and genuala III are so elongate, that they look like mastisetae, for example, in *Cotrombicula mitchellensis* Goff, 1983. A study by the electon microscope is need to reveal the true nature of this seta.

The presence of very large puncta on the scutum is one of the main characters of *Trombicula* s.l. These puncta are named "scrobiculae" (GOFF et al. 1982) or "areolae" (DOMROW & LESTER 1985). Previously such scuta were defined as "verrucose" or "reticulate" (VERCAMMEN-GRANDJEAN 1968), but modern authors suppose these terms to be incorrect.

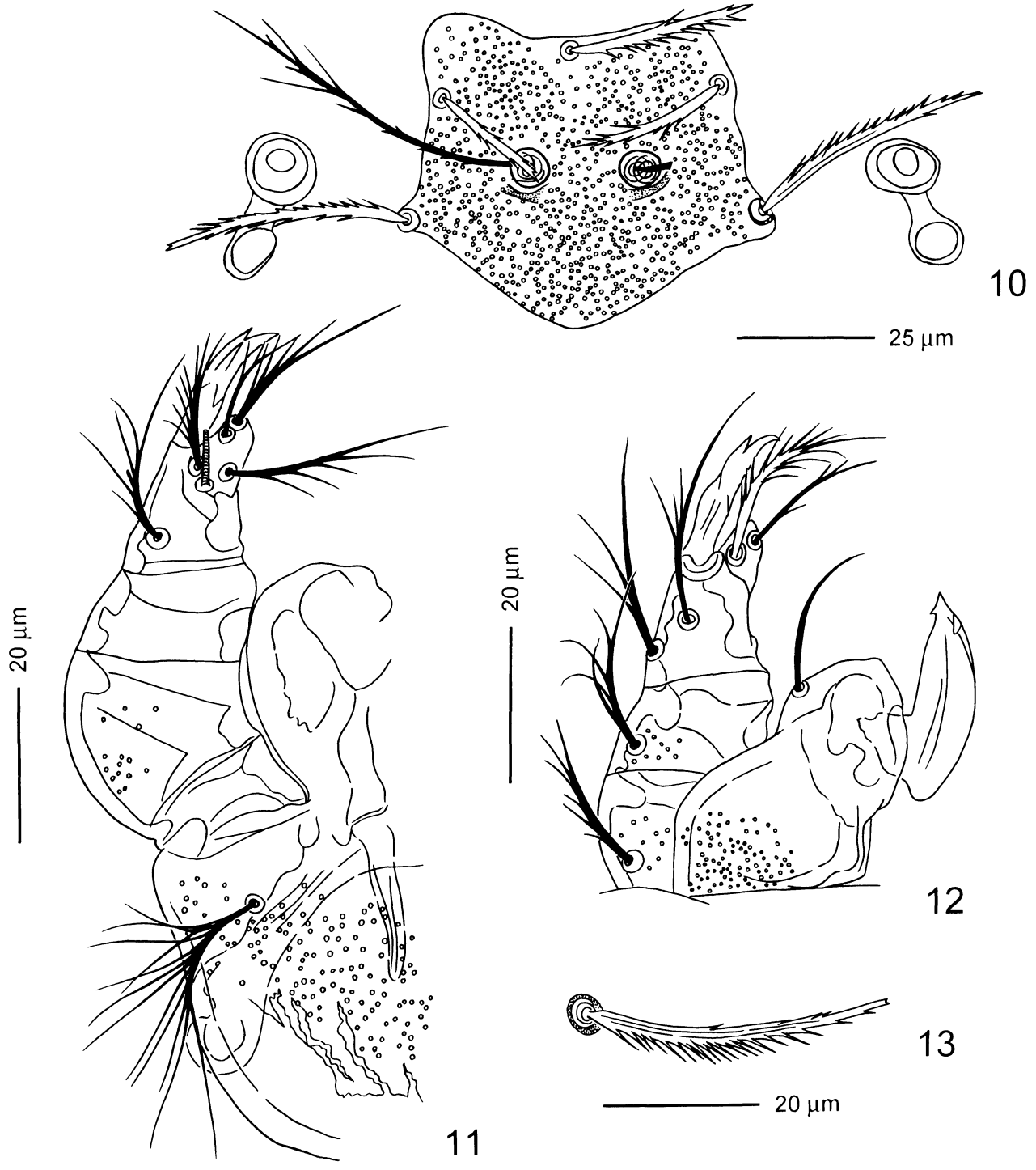
Cotrombicula Vercammen-Grandjean, 1960 is considered to be a synonym of *Trombicula* Berlese, 1905 by DOMROW & LESTER (1985), since these genera differ only in their palpal tarsal setation. Our finding of a new species having palpal tarsus 7B confirms the opinion of these authors, that palpal tarsal setation has a limited taxonomic value in this case. The form of scutum and sensilla in the new species, as well as heavily branched galeala, presence of two genualae I, and large eyes are characteristic for the majority of *Trombicula* s.l.

A variation in the numbers of coxal setae III is recorded. 32% of 66 type specimens have 4 setae on coxa III (fCx=1.1.4), 29% 4 and 3 setae (as in the holotype), 20% 4 and 5 setae. Other variants are rare: 3 setae (8%), 3 and 5 setae (6%), 5 setae (3%). One specimen has 6 and 4 setae.

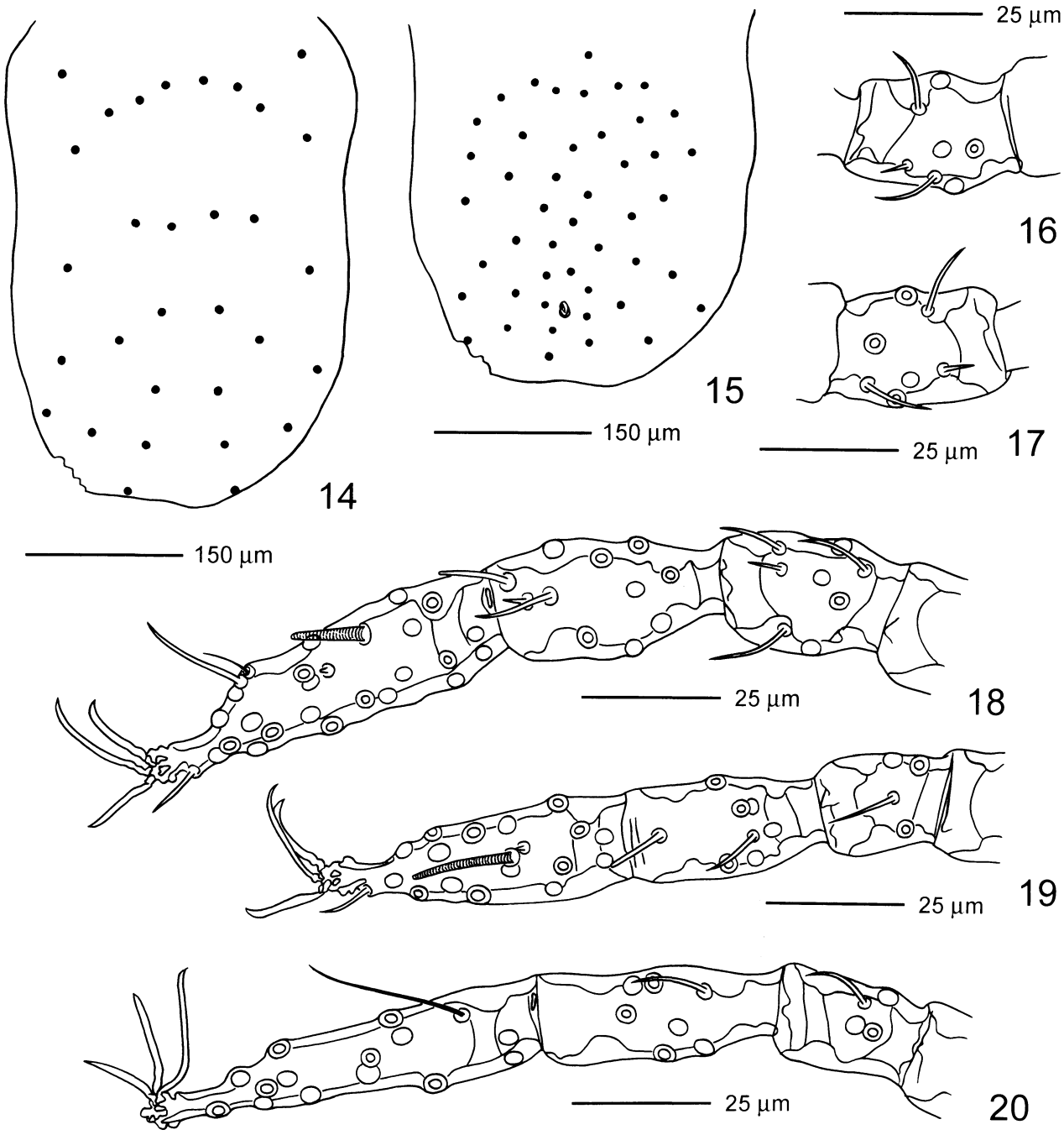
MICROTROMBICULA HUMEROVENTRALA n. sp.
(FIGS. 10-20; Table 2)

DIAGNOSIS: SIF = 6B-N-3-(3-2)111.1000; fPp = B/B/BBB; fCx = 1.1.2; fSt = 2.2; fSc: PL > AM > AL; Ip = 834; fD = 2H-8-6-6-2-4-4; DS = 30; VS = 43; NDV = 74.

DESCRIPTION: *Larva.* Idiosoma. Eyes 2 + 2, anterior 12-13 in diameter, posterior smaller. One pair of humeral setae; 2 or 3 pairs of humeroventral setae between coxae II and III; 25-33 dorsal idiosomal setae, arranged 8(7-9)-6-6-2-..., heavily feathered with



FIGS. 10-13. — *Microtrombicula humeroventrala* n. sp., larva.
10. — Scutum and eyes. 11. — Ventral aspect of gnathosoma. 12. — Dorsal aspect of gnathosoma. 13. — Dorsal idiosomal seta of 1st row.



FIGS. 14-20: *Microtrombicula humeroventrala* n. sp., larva.
14. — Arrangement of dorsal idiosomal setae. 15. — Arrangement of ventral idiosomal setae. 16, 17. — Variants of the setation of genu I. 18. — Leg I. 19. — Leg II. 20. — Leg III.

	AW	PW	SB	ASB	PSB	SD	PPL	AP	AM	AL	PL	S	H
Holotype	55	63	21	28	28	57	18	22	34	27	45	-	47
Minimum	50	59	19	25	27	54	18	20	34	23	40	61	43
Maximum	56	67	21	29	31	60	20	27	37	29	47	61	49
Mean	53	64	20	28	29	56	19	24	36	27	42	61	46

	D	V	pa	pm	pp	Ip	DS	VS	NDV	TaIII	TaW	m-t
Holotype	34-41	27-40	297	250	292	839	27	42	69	74	14	0.201
Minimum	32-39	25-38	275	229	277	781	27	39	68	72	14	0.167
Maximum	34-46	27-41	315	259	308	882	35	48	78	79	15	0.264
Mean	33-41	26-40	295	246	292	834	30	43	74	75	14	0.208

TABLE *2: Microtrombicula humeroventrala* n. sp. Standard measurements of the type series (N = 10)

thin barbs; two pairs of sternal setae and 39-48 ventral setae; total idiosomal setae except sternal and humeroventral 68-78.

Gnathosoma. Gnathobase, cheliceral base, palpal femur and genu moderately punctate; cheliceral blade with tricuspid cap; gnathobase with a pair of branched setae; galeala nude; palpal claw 3-pronged; setae on palpal femur, genu and tibia branched; palpal tarsus with 6 branched setae and tarsala.

Scutum. Densely punctate, nearly pentagonal, with angulate posterior margin and anterolateral shoulders; scutal setae similar to dorsal idiosomal setae; PL > AM > AL; AM base anterior to level of ALs; SB anterior to level of PLs; sensilla flagelliform, with long branches in distal part and short barbs in proximal part.

Legs. 7-segmented, terminating in a pair of claws and clawlike empodium. Leg I: coxa 1B; trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 or 2 genualae, long microgenuala; tibia 8B, 2 tibialae, long microtibiala; tarsus 22B, tarsala 14-15 long, microtarsala, subterminala, parasubterminala, pretarsala. Leg II: coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala 17-18 long, microtarsala, pretarsala. Leg III: coxa 2B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus 14B, mastitarsala.

TYPE DATA: holotype larva (No. T.-Tr.-28, P-7/15) from *Alticola roylei,* Basecamp, 10 July. 11 paratypes: 9 larvae, 29-30 June, 2, 4, 10 July, other data same; 2 larvae, Shekhniyak, 8 August, other data same. The holotype and 5 paratypes are deposited in ZIN; 4 paratypes are deposited in PaÚ; 2 paratypes are deposited in the collection of the senior author.

HOST: *Alticola roylei.*

ETYMOLOGY: Specific epithet refers to the presence of humeroventral setae.

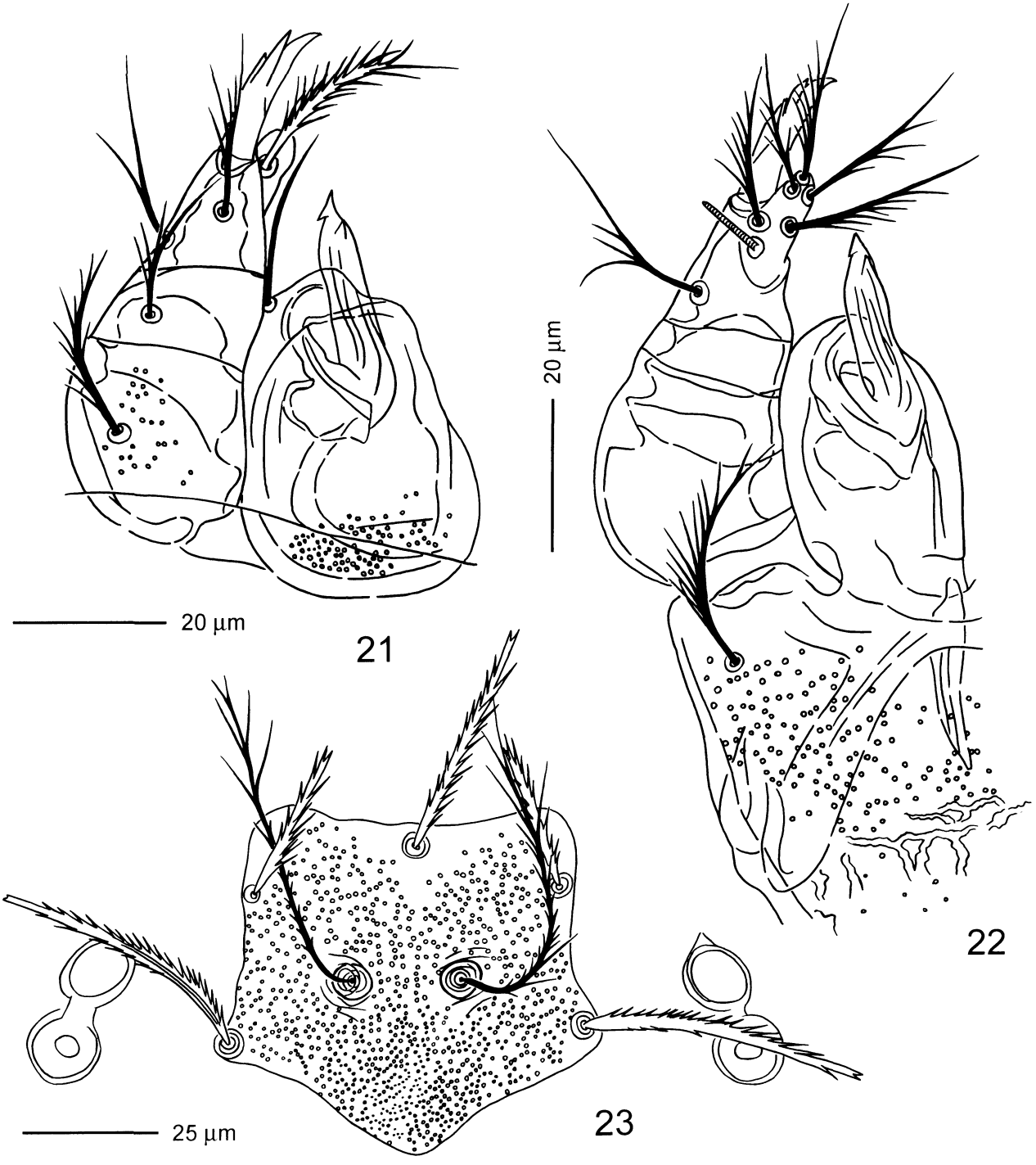
DIFFERENTIAL DIAGNOSIS: The new species is similar to *Microtrombicula latens* Traub & Nadchatram, 1966 and differs from this species in the presence of the humeroventral setae, posterior scutal margin angulate versus broadly rounded, scutum is relatively broader (PW = 59-67 versus 50-54) and with more prominent posterior margin (PSB = 27-31 versus 22-26, SD = 54-60 versus 49-54, P-PL = 18-20 versus 14-15).

REMARKS: TWO specimens have 3 pairs of humeroventral setae and one has 3 + 2 Hv. A half of type specimens have 2 genualae I at least on one genu, other specimens have 3 genualae 1. Coxal setal formula is rather constant (1.1.2), only one specimen has 3 and 2 setae on coxae III.

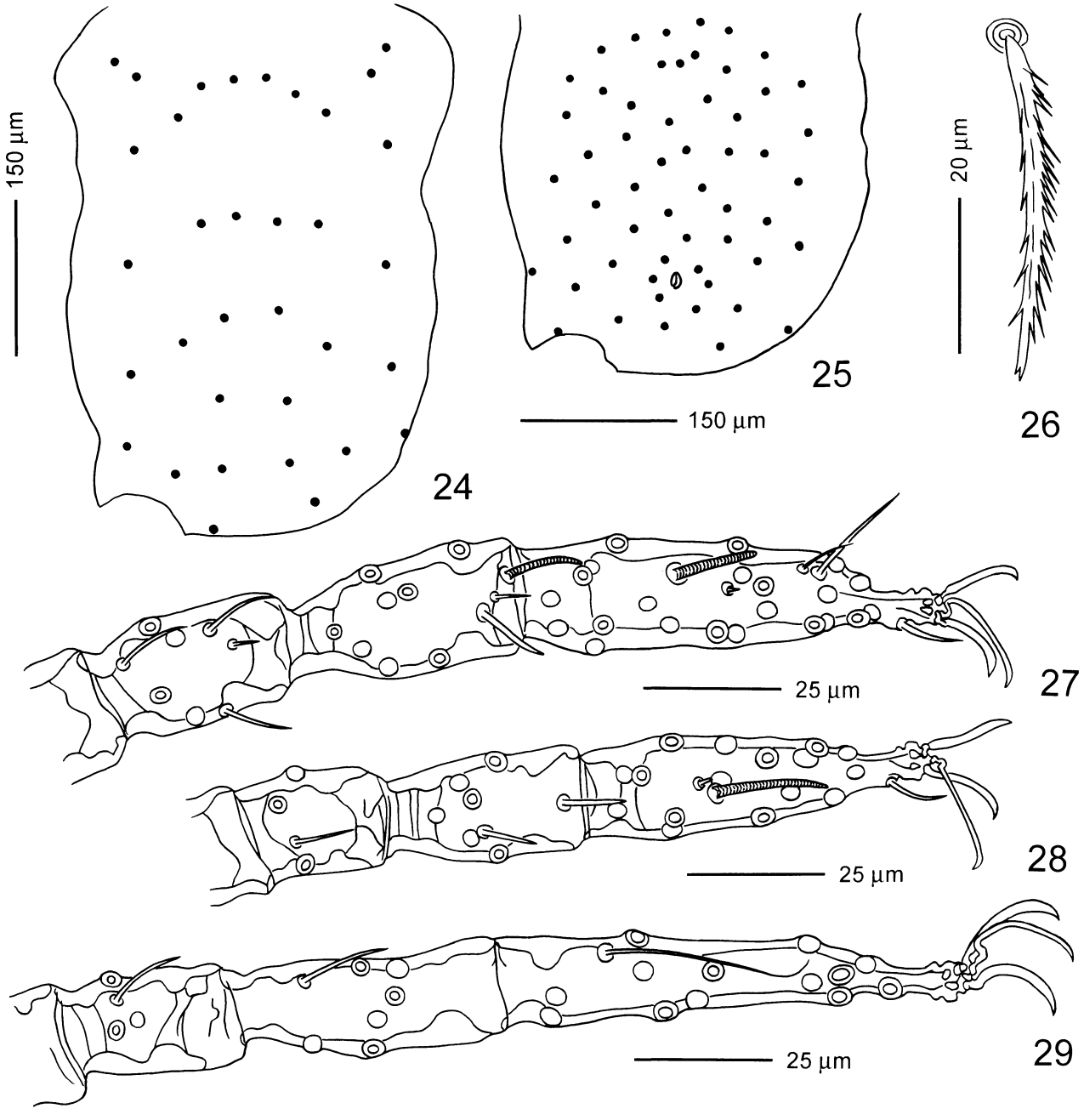
MICROTROMBICULA TIRICHMIRENSIS n. sp.

(Figs. 21-29; Table 3)

DIAGNOSIS: SIF = 6B-N-3-3111.1000; fPp = B/B/BBB; fCx =1.1.3(2-3); fSt = 2.2; fSc: PL > AM > AL; Ip = 877; fD = 4H-8-6-6-2-6-4; DS = 34; VS = 51; NDV = 85.



FIGS. 21-23: *Microtrombicula tirichmirensis* n. sp., larva.
21. — Dorsal aspect of gnathosoma. 22. — Ventral aspect of gnathosoma. 23. — Scutum and eyes.



FIGS. 24-29: *Microtrombicula tirichmirensis* n. sp., larva.
24. — Arrangement of dorsal idiosomal setae. 25. — Arrangement of ventral idiosomal setae. 26. — Dorsal idiosomal seta of 1st row. 27. — Leg I. 28. — Leg II. 29. — Leg III.

	AW	PW	SB	ASB	PSB	SD	PPL	AP	AM	AL	PL	S	H
Holotype	57	66	21	32	32	65	22	28	43	30	52	61	55
Minimum	51	64	18	29	29	58	20	24	36	25	44	61	43
Maximum	58	68	21	32	32	65	23	29	43	32	52	61	57
Mean	55	66	20	31	31	62	22	26	39	30	49	61	49

	D	V	pa	pm	pp	Ip	DS	VS	NDV	TaIII	TaW	m-t
Holotype	36-45	27-41	317	266	319	902	38	50	88	87	15	0.247
Minimum	34-42	26-39	295	250	288	833	29	47	78	77	13	0.187
Maximum	38-47	29-41	317	272	319	905	38	54	90	87	15	0.247
Mean	36-44	28-40	308	260	308	877	34	51	85	82	14	0.219

TABLE 3: *Microtrombicula tirichmirensis* n. sp. Standard measurements of the type series (N = 7)

DESCRIPTION: *Larva.* Idiosoma. Eyes 2 + 2, 12-13 in diameter. Two pairs of humeral setae; one pair of humeroventral setae between coxae II and III; 27-36 dorsal idiosomal setae, arranged 8(8-9)-6-6-2-..., heavily feathered with thin barbs; two pairs of sternal setae and 47-54 ventral setae; total idiosomal setae except sternal and humeroventral 78-90.

Gnathosoma. Gnathobase, cheliceral base, and palpal femur moderately punctate; cheliceral blade with tricuspid cap; gnathobase with a pair of branched setae; galeala nude; palpal claw 3-pronged; setae on palpal femur, genu and tibia branched; palpal tarsus with 6 branched setae and tarsala.

Scutum. Densely punctate, nearly pentagonal, with angulate posterior margin and anterolateral shoulders; scutal setae similar to dorsal idiosomal setae; PL > AM > AL; AM base anterior to level of ALs; SB anterior to level of PLs; sensilla flagelliform, with long branches mainly in distal part and short barbs in proximal part.

Legs. 7-segmented, terminating in a pair of claws and clawlike empodium. Leg I: coxa 1B; trochanter 1B; basifemur 1B; telofemur 5B; genu 4B, 3 genualae, long microgenuala; tibia 8B, 2 tibialae, long microtibiala; tarsus 22B, tarsala 14-15 long, microtarsala, subterminala, parasubterminala, pretarsala. Leg II: coxa 1B; trochanter 1B; basifemur 2B; telofemur 4B; genu 3B, genuala; tibia 6B, 2 tibialae; tarsus 16B, tarsala 18-19 long, microtarsala, pretarsala. Leg III: coxa 3B or 2B; trochanter 1B; basifemur 2B; telofemur 3B; genu 3B, genuala; tibia 6B, tibiala; tarsus 14B (13B in holotype), mastitarsala.

HOSTS: *Alticola roylei, Apodemus (Sylvaemus)* sp.

TYPE DATA: holotype larva (No. T.-Tr.-29, P-1/4) from *Alticola roylei,* Basecamp, 30 June. 10 paratypes: 7 larvae, 30 June, 10, 14 July, other data same; 2 larvae from *Alticola roylei* and 1 from *Apodemus (Sylvaemus)* sp., Shekhniyak, 3, 9 August, other data same. The holotype and 5 paratypes are deposited in ZIN; 3 paratypes are deposited in PaÚ; 2 paratypes are deposited in the collection of the senior author.

ETYMOLOGY: Specific epithet refers to the type locality (Tirich Mir mountains massif).

DIFFERENTIAL DIAGNOSIS: The new species is similar to *Microtrombicula altens* Fernandes & Kulkarni, 2003, but differs from this species in the presence of the humeroventral setae, palpal claw 3-pronged versus 2-pronged, usually 3 setae on coxa III versus 2 (fCx = 1.1.3), and scutum relatively broader (PW = 64-68 versus 54-60).

REMARKS: Three specimens have 3 and 2 setae on coxa III, one specimen has 2 setae, and 7 specimens have 3 setae. A variation in the number of humeral setae takes place: one specimen has 5 and one 6 humeral setae, other specimens have 4H. In contrast to the previous species, no variation in the numbers of humeroventral setae and genualae I is recorded.

NEOTROMBICULA MONTICOLA Schluger & Davidov, 1967

MATERIAL EXAMINED: 29 larvae, *Alticola roylei,* Basecamp, 29 June-22 July.

DISTRIBUTION: Tadjikistan, Kyrgyzstan. Recorded in Pakistan for the first time.

NEOTROMBICULA TIANSHANA Shao & Wen, 1984

MATERIAL EXAMINED: 13 larvae, *Alticola roylei, A. argentatus,* Shekhniyak, 8-12 August.

DISTRIBUTION: China (Xinjiang Uygur Autonomous Region, Xizang Autonomous Region), Tadjikistan (Western Pamirs), Kyrgyzstan, Kazakhstan, Azerbaijan, Russia (Krasnoyarsk Territory, Khakasia, Altai Territory, Tuva Republic, Kirov Region, Bashkortostan, North Ossetia, Stavropol Territory, Karachay-Cherkess Republic, Krasnodar Territory), Ukraine (Eastern Carpathians), Moldova (STEKOLNIKOV 1999). Recorded in Pakistan for the first time.

NEOTROMBICULA LUBRICA Kudryashova, 1993

MATERIAL EXAMINED: 11 larvae, *Apodemus (Sylvaemus)* sp., *Alticola roylei, Cricetulus migratorius,* Shekhniyak, 9-12 August.

DISTRIBUTION: Tadjikistan (Western Pamirs). Recorded in Pakistan for the first time.

REMARKS: *Neotrombicula lubrica* is closely related to *N. anax* Audy & Womersley, 1957, but the latter species has fD = 2H-6-6-6-4-... (judging from the figure in the original description), while in *N. lubrica* fD = 2H-6-6-6-2-... So, the question whether *N. lubrica* is a synonym of *N. anax* remain undecided.

SHUNSENNIA OUDEMANSI (Schluger, 1955)

MATERIAL EXAMINED: 29 larvae, *Alticola roylei, Cricetulus migratorius,* Basecamp, 30 June-22 July; 5 larvae, *A. roylei, A. argentatus,* Shekhniyak, 29 July, 10-11 August.

DISTRIBUTION: Tadjikistan, Kyrgyzstan. Recorded in Pakistan for the first time.

REMARKS: *Shunsennia wissemani* (Traub & Nadchatram, 1966), which was described from Pakistan, is a probable synonym of this species (KUDRYASHOVA 1998).

CHELADONTA IKAOENSIS
(Sasa, Sawada, Kano et al., 1951)

MATERIAL EXAMINED: 4 larvae: 1 from *Alticola roylei* and 1 from *Apodemus (Sylvaemus)* sp., Shekhniyak, 9 August: 1 from *Cricetulus migratorius,* Shekhniyak, 30 July; 1 from *A. roylei,* Basecamp, 30 June.

DISTRIBUTION: Japan, South Korea, Russia (Primorskij Territory), Armenia (KUDRYASHOVA 1998). Recorded in Pakistan for the first time.

BRUNEHALDIA sp.

MATERIAL EXAMINED: 1 larva in bad condition, *Alticola roylei,* Shekhniyak, 11 August.

REMARKS: Judging from fPp=B/B/BNB and fCx = 1.1.1, it may be *Brunehaldia lucida* (Schluger, 1966) previously recorded in Kyrgyzstan by KHARADOV (1996).

ACKNOWLEDGEMENTS

This work was supported in part by the Grant of the Ministry of Science of the Russian Federation for State Support of Leading Scientific Schools (no. SS-1664.2003.4).

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