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The millipede genus *Nepalmatoiulus* Mauriès, 1983 (Diplopoda, Julidae) in Nepal, with descriptions of two new species

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Abstract

Two new species of the genus are described from Nepal: *Nepalmatoiulus karnaliensis* **sp. nov.** and *Nepalmatoiulus humlaensis* **sp. nov.** A brief overview of the *Nepalmatoiulus* species of Nepal is provided. A key is given to all *Nepalmatoiulus* species presently known from Nepal. Taxonomic and distributional remarks are provided for all the species.

Key words: taxonomy, distribution, review, key

Introduction

The present work is a continuation of the study of a collection of *Nepalmatoiulus* specimens stored in the Zoological Museum, State University of Moscow, Russia. Previously, materials from China were studied (Mikhaljova 2020a, 2020b, 2023a, 2023b, 2024). This time, the material on this genus from Nepal was examined.

The genus *Nepalmatoiulus* Mauriès, 1983 has hitherto been known from Myanmar, India, Thailand, Malaysia, Vietnam, Nepal, Bhutan, Japan and China including Taiwan. Overviews of this genus and descriptions of new species and reports of some species in the individual territories can be found in publications of Mauriès (1983), Enghoff (1987), Wang & Mauriès (1996), Zhang *et al*. (1997), Korsós & Lazányi (2013), Golovatch & Liu (2020) and Mikhaljova (2020a, 2020b, 2023a, 2023b, 2024).

This genus was originally described as a subgenus of *Chromatojulus* Verhoeff, 1894 (Mauriès 1983), and then elevated to the full genus status by Enghoff (1987). To date, *Nepalmatoiulus* includes 84 species (including the two new species described herein). In Nepal, this genus has until now been known to be represented by 13 species (Enghoff 1987). With the two new species described here, the number of *Nepalmatoiulus* species of Nepal is increased to 15.

Material and methods

The material treated here is deposited in the collection of the Zoological Museum, State University of Moscow, Russia (ZMUM). Specimens were kept in 70–75% ethanol. During the study, the gonopods and some other parts were dissected from a limited number of specimens and mounted in glycerin as temporary micro-preparations. Specimens were studied using standard stereomicroscopic equipment: MC–2–Zoom Digital. SEM micrographs were prepared at the Centre for Collective Use "Biotechnology and Gene Engineering" of the Federal Scientific Center of the East Asia Terrestrial Biodiversity, Far Eastern Branch of the Russian Academy of Sciences (FSCB) in Vladivostok, Russia, using a Merlin 62–15 ZEISS scanning electron microscope. Mounts for SEM were made by air-drying after transfer to acetone from 96% alcohol, mounting on stubs, and coating with chromium. After examination, SEM material was removed from stubs and returned to alcohol. SEM images were edited in Adobe Photoshop Elements 9.

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A "body ring formula" indicates the number of podous (including gonopod ring and collum) and apodous rings before the telson in an individual. This formula is x (-y) where x = sum of podous and apodous body rings including collum but excluding telson and y = number of apodous body rings before telson.

The following terms used here are defined as:

"Nonapical stipital setae of gnathochilarium" is the field of setae level with or slightly basal to prementum (after Enghoff 1987, fig. 9).

"Limbus" is the hyaline posterior edge of metazonite (after Enghoff 1987, figs 15–21).

"Coxa 2 with one mesapical oral seta" refers to the seta directed to the body front (after Enghoff 1987, fig. 30).

"Coloration of the usual julid type" means a colour pattern of dark/light spots and stripes similar to that of many other Julidae (after Enghoff 1982) such pattern is described for *Cylindroiulus* by Enghoff (1982, figs 11–12, 20–22).

Taxonomic part

Order Julida Brandt, 1833

Family Julidae Leach, 1814

Genus *Nepalmatoiulus* Mauriès, 1983

The main distinguishing characters of the genus: eyes present; stipites of male gnathochilarium with a group of short setae (nonapical setae) in the middle part; preanal ring with a caudal, prominent dorsal process; male legs of most species with adhesive pads; male leg pair 1 hook-shaped; male leg pair 2 with oral, coxal gland opening; ventral margin of male ring VII with ventrad lobes; anterior gonopod in posterior view with a telopodite remnant and an excavation for accommodation of mesomeral process; flagellum whip-shape; posterior gonopod includes an anterior mesomeral process connected through a membranous velum to a posterior solenomere; vulva with apically excavated operculum.

Nepalmatoiulus karnaliensis new species

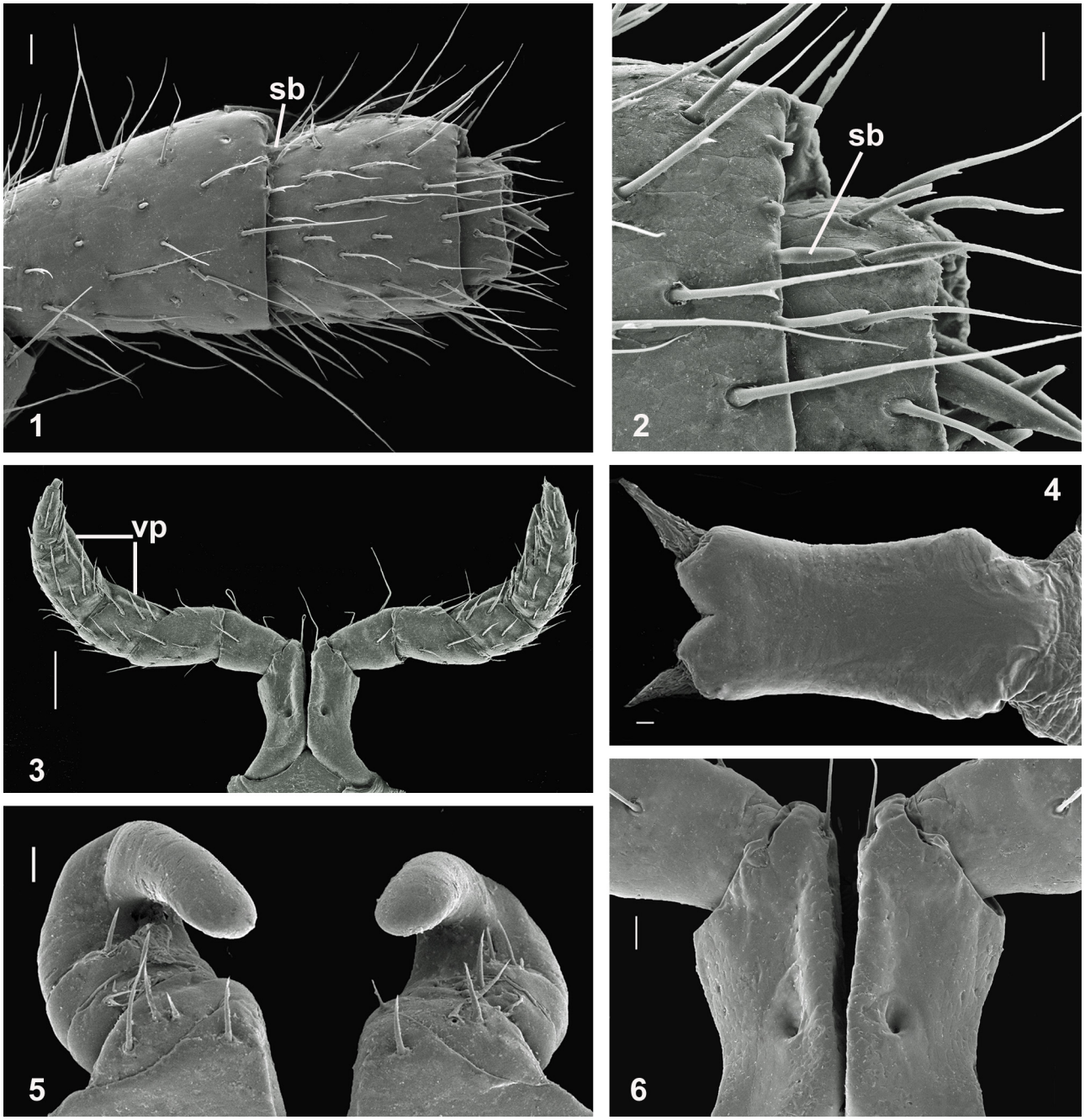
Figs 1–23

Material examined. *Holotype*: male (ZMUM), Western Nepal, Karnali Province, Humla District, 12–13.5 km SE of Simikot, Ghatte, Yanchu Khola to Simikot, N 29˚54′23″–29˚53′37″, E 81˚55′7″–81˚55′36″, 2920–3490 m, pasture and disturbed mixed forest, 18.VI.2022, leg. D. Telnov; *paratypes*: 3 males, 2 females, 1 juvenile (ZMUM), same data as for holotype; 2 males, 3 juveniles (among them 1 subadult male with 5 apodous body rings) (ZMUM), Western Nepal, Karnali Province, Humla District, ca 12–13 km SE of Simikot, N 29˚54′23″–29˚54′00″, E 81˚55′7″–81˚55′11″, 2990–3310 m, disturbed mixed forest, 17–18.VI.2022, leg. D. Telnov.

Diagnosis. Differs from congeners mainly by the apex of the solenomere densely spinose, with anteromesal flagellate spines, by the straight margin of velum, by a deep notch of the velar margin near the mesomeral process.

Description. *Males*. Length in alcohol 12.0–18.0 mm, midbody vertical diameter 0.9–1.2 mm, with 42(–4), 42(–4), 44(–3), 47(–2), 48(–2), 48(–1) rings. Coloration (in alcohol) marbled dark brown, colour pattern of entire rings of the usual julid type (description of the pattern of the julid type see Enghoff 1982). Eyes black, antennae dark brown. Legs light marbled brown.

Head smooth, 2 epicranial setae, 4 supralabral setae; at least 16 labral setae. Eye patch subtriangular; one of the paratypes had at least 30 ommatidia. Antennae medium-sized, rather slender and clavate. Antennomeres 5 and 6 with incomplete distodorsal corolla of sensilla basiconica (**sb**) (Figs 1, 2; in the figs almost all **sb** are broken off). Mandibular stipites with large, evenly rounded, slightly swollen lobes. Gnathochilarium with small group of nonapical stipital setae; lamellae linguales each with 5 setae arranged longitudinally. Collum with striae at posterior margin. A transverse row of relatively long or short setae (short setae—in males from 2990–3310 m a.s.l.) at hind edge of collum mainly dorsally.

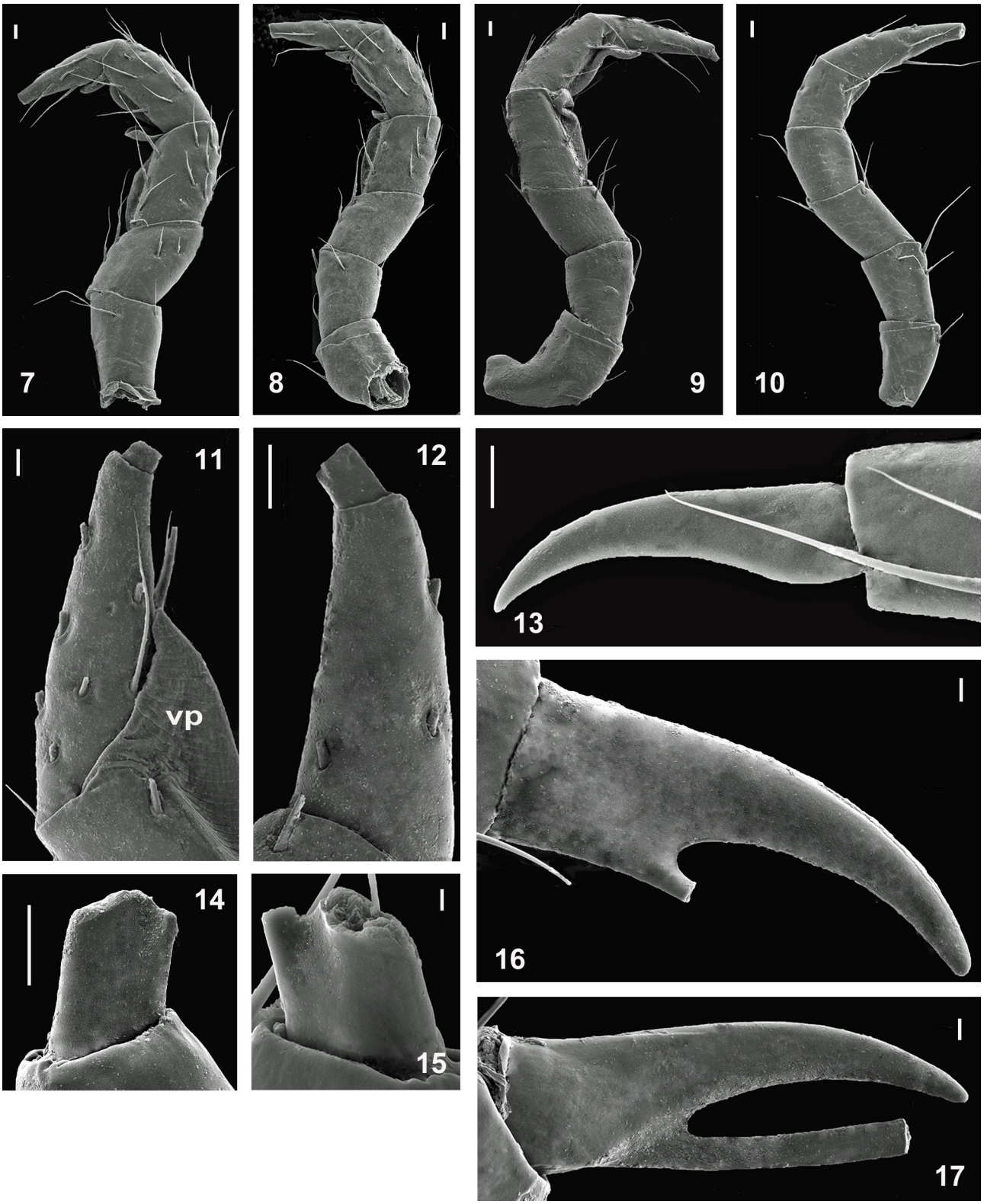


FIGURES 1–6. *Nepalmatoiulus karnaliensis* **sp. nov.**, male paratype (**ZMUM**). **1**. Distal part of antenna. **2**. Apex of antenna. **3**. Leg pair 2, anterior view. **4**. Penis, posterior view. **5**. Leg pair 1, anterior view. **6**. Coxae 2, anterior view. **Abbreviations: sb**, sensilla basiconica; **vp**, ventral pads. Scales: 10 μm (Figs 2, 4), 20 μm (Figs 1, 5–6), 100 μm (Fig. 3).

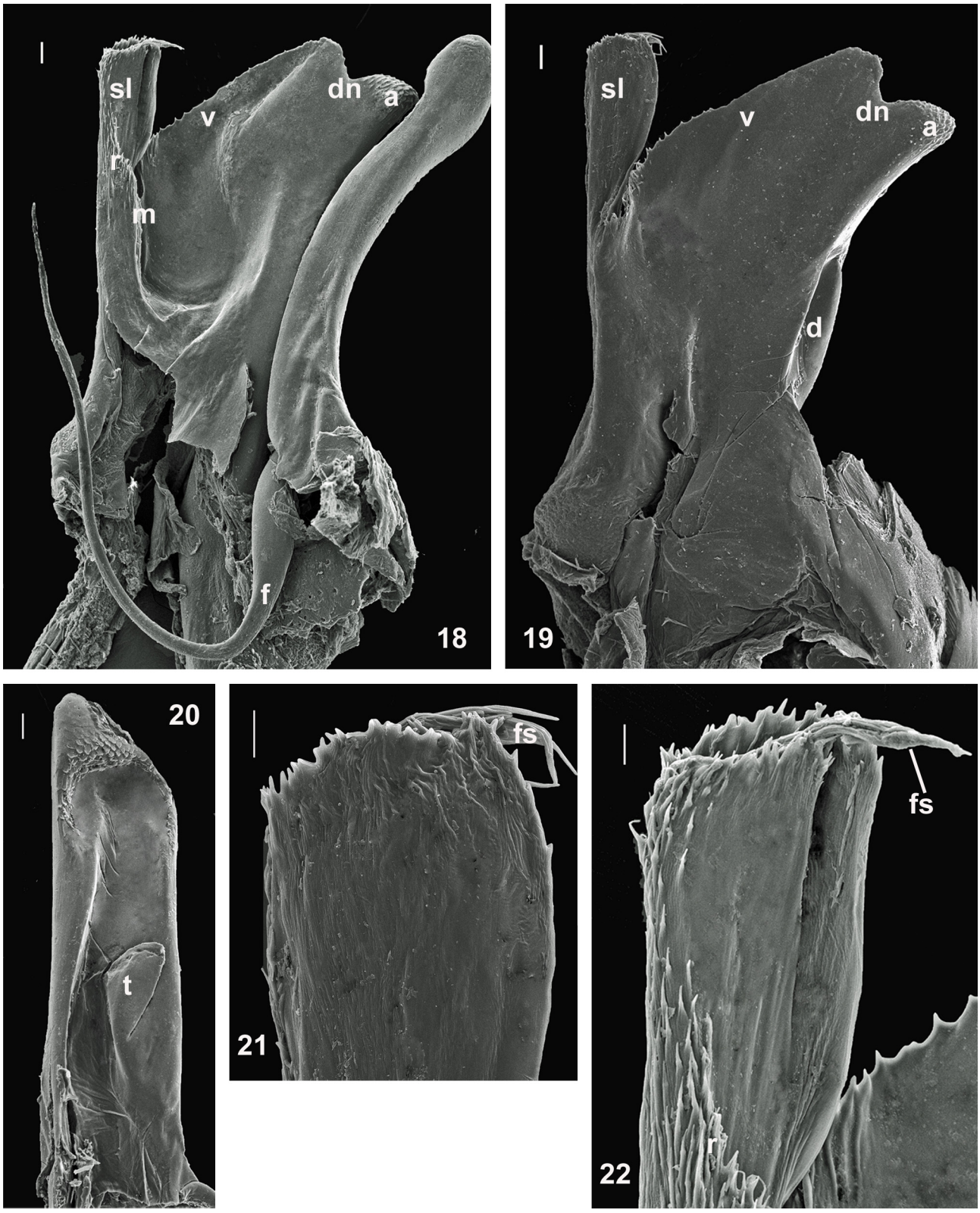
Body rings circular. Metazona with dense, regular, longitudinal striae reaching hind margin (12–13 striae in an approximate square with sides equal to metazonital length of a dorsal side of a midbody ring). Limbus straight, smooth (of Type 1 in Enghoff 1987). A transverse row of thin and sparse setae (sparse setae in males from 2990–3310 m a.s.l.) at hind edge of metazonites, setae gradually growing denser toward telson. Ozopores very small, lying behind suture dividing pro- and metazona touching the suture. Telson with caudal dorsal projection straight and long, covered with setae and carrying at tip a claw-shaped process curved dorsad. Preanal ring, anal valves, and subanal scale covered with setae.

Legs short and very slender. Very delicately serrate ventral pads (**vp**) present on postfemur and tibia, starting from legs 2 (Figs 3, 7–11, **vp** is not indicated in Figs 7–10). The claws have a traditional hooked shape with a

ribbon-shaped accessory claw at the base (Fig. 17); accessory claw probably longer than claw. However, only two claws of this shape were found among the male paratypes. There are a lot of legs in all paratypes with claws in the form of a cylinder with a slightly expanded base and a subbasal projection (Figs 9, 11–12, 14–15) or legs without claws at all (Figs 7–8, 10). This variation in the claws is the same in the holotype. This is most likely the result of



FIGURES 7–17. *Nepalmatoiulus karnaliensis* **sp. nov.**, male, female and juvenile paratypes (**ZMUM**). **7**. Male paratype from 2920–3490 m a.s.l., mid-body leg. **8**, **9**, **10**. Male, back-body leg. **11**. Male, apex of leg 5. **12**. Subadult male, apex of leg 1. **13**. Female, apex of leg 4. **14**. Subadult male, apex of leg 2. **15**. Male, apex of leg 2. **16**. Female, claw of hind leg. **17**. Male, claw of leg 2. Scales: 2 μm (Figs 15–17), 10 μm (Figs 11, 13–14), 20 μm (Figs 7–10, 12), 100 μm (Fig. 3).



FIGURES 18–22. *Nepalmatoiulus karnaliensis* **sp. nov.**, male paratipe (**ZMUM**). **18**. Gonopods, mesal view. **19**. Opisthomere, lateral view. **20**. Promere, posterior view. **21**. Apex of solenomere, lateral view. **22**. Apex of solenomere, mesal view. **Abbreviations:** **a**, apex of mesomeral process; **d**, concavity; **dn**, notch; **f**, flagellum, **fs**, flagellate spines; **m**, additional membrane; **r**, ridge; **sl**, solenomere; **t**, rudimentary telopodite; **v**, velum. Scales: 10 μm (Figs 21–22), 20 μm (Figs 18–20).

any damage (see remarks below). Leg pair 1 forming hook, the distal podomere not coming into close contact with the basal podomeres ("open hook" type in Enghoff 1987); postfemur with indistinct scaly-rugose ventral surface, coxa with one seta, distal podomere without seta (Fig. 5). Coxa 2 with one long mesapical oral seta anteriorly, gland opening positioned in central and axial position *sensu* Enghoff (1987) (Figs 3, 6). Penis subrectangular, about 1.9 times longer than wide (Fig. 4).

Gonopods slightly protruding from ring 7. Promere flattened, with parallel margins, apically strongly obliquely rounded, in posterior view apically excavated for accommodation of mesomeral process, distal margins of the excavation sparingly papillate (the papillary field is not very extensive), rudimentary telopodite (**t**) without seta (Fig. 20). Flagellum (**f**) slender, of medium length; its basal part covered with cuticular conical spikes on the caudal side; its distal part completely covered with cuticular conical spikes (Fig. 18). Mesomeral process of the opisthomere moderately thick, with rounded, strongly papillate apex (**a**) (Figs 18–19). Velum (**v**) with straight margin, tiny denticles posteriorly and a deep notch (**dn**) near the mesomeral process (Figs 18–19). Anterior surface of the mesomeral process with longitudinal concavity (**d**) (Fig. 19). Additional membrane (**m**) with a smooth edge anteriorly (Fig. 18). Solenomere (**sl**) moderately stout, apically concave, caudally densely spinose, basally with an obliquely ascending spinose ridge (**r**); apex of the solenomere densely spinose, with anteromesal long flagellate spines (**fs**) (Figs 18–19, 21–22, **fs** is not indicated in Figs 18–19).

Females. Length in alcohol 18.0–20.0 mm, midbody vertical diameter 1.4–1.5 mm, with 46(–2), 47(–1) rings. The claws with a basal setiform accessory claw ventrally (Figs 13, 16) (see remarks below). Vulva: operculum somewhat higher than bursa, apically with excavation. Posterior median plate with two rows of setae (at least 6 setae in each), apical setae longest (Fig. 23).

Juveniles. Length in alcohol 11.0–12.0 mm, midbody vertical diameter 0.9 mm, with 40(–3), 40(–3), 42(–3), 42(–5) rings. Coloration as in males.

Etymology. The specific epithet refers to the type locality, Karnali Province. Adjective.

Remarks. The large number of non-standard claws in all paratypes and the holotype is worthy of more consideration. The shape of the claws of *N. karnaliensis* **sp. nov.** was studied in the holotype and all paratypes (5 males, 2 females, and 4 juveniles) from two biotopes at different altitudes, one at 2920–3490 m and the other at an altitude of 2990–3310 m.

In males, traditional hooked claws are more common on pregonopodal legs (Fig. 17). In addition, males have many legs with claws in the shape of a cylinder with a slightly expanded base and with or without a subbasal projection (Figs 9, 11, 15). There are also many legs with no claws at all (Figs 7–8, 10). These claws are likely either broken off and torn off or damaged in some other way. All legs, both with and without claws, are equipped with ventral pads.

FIGURE 23. *Nepalmatoiulus karnaliensis* **sp. nov.**, female paratype (**ZMUM**). Vulva, posterior view. Scale: 20 μm.

Females have quite a lot of legs with traditional hooked claws, which are equipped with either broken off accessory claws (Fig. 16) or are devoid of them (the basal projection is smoothed) (Fig. 13). Females also have legs without claws, which are probably torn off.

In juveniles, most of the legs are either without claws or with claws in the form of a cylinder with or without a subbasal projection (Figs 12, 14). Only one juvenile with 3 legless rings before telson (from a biotope at an altitude of 2990–3310 m) was found to have formed hooked claws on the 3rd and 4th pairs of legs; however, these claws were without a ventral subbasal accessory claw, but with a projection in its place (the ventral subbasal accessory claws were probably broken off). Ventral tarsal pads are either present or absent, regardless of the presence or absence of a claw. The legs of juvenile males have ventral tarsal pads (for example a subadult male from a biotope at an altitude of 2990–3310 m).

The described condition of the claws was noted in paratypes from two different biotopes at different altitudes. However, since the material was collected by the same collector, it is assumed that it is caused by the damage of the claws during collection, fixation or drying of the material.

Nepalmatoiulus humlaensis new species

Figs 24–37

Material examined. *Holotype*: male (ZMUM), Western Nepal, Humla District, 34.5 km SE to 41 km E of Simikot, N 29°?45?′(Unfortunately, the numbers on the label are illegible)10″–29°41′47″, E 82°4′26″–82°6′4″, 1655–2625 m, disturbed montane forest, 23.VI.2022, leg. D. Telnov.

Diagnosis. Differs from congeners (except *N. uncus* Enghoff, 1987) mainly by the velum margin with a very deep notch near the mesomeral process of gonopod, by the solenomere apex densely spinose, with anterolateral flagellate spines, by the margin of apical excavation of the promere strongly produced caudad. Differs from *N. uncus* mainly by the moderately slender, but not long, mesomeral process, by the stout solenomere which is not spinose throughout and by the promere without large apical hook.

Description. *Male*. Length in alcohol about 17.0 mm, midbody vertical diameter 1.3 mm, with 44(–2) rings, excluding telson. Coloration (in alcohol) marbled brown with light brown venter, colour pattern of entire rings of the usual julid type (description of the pattern of the julid type see Enghoff 1982). Eyes black, antennae brown. Legs light brown.

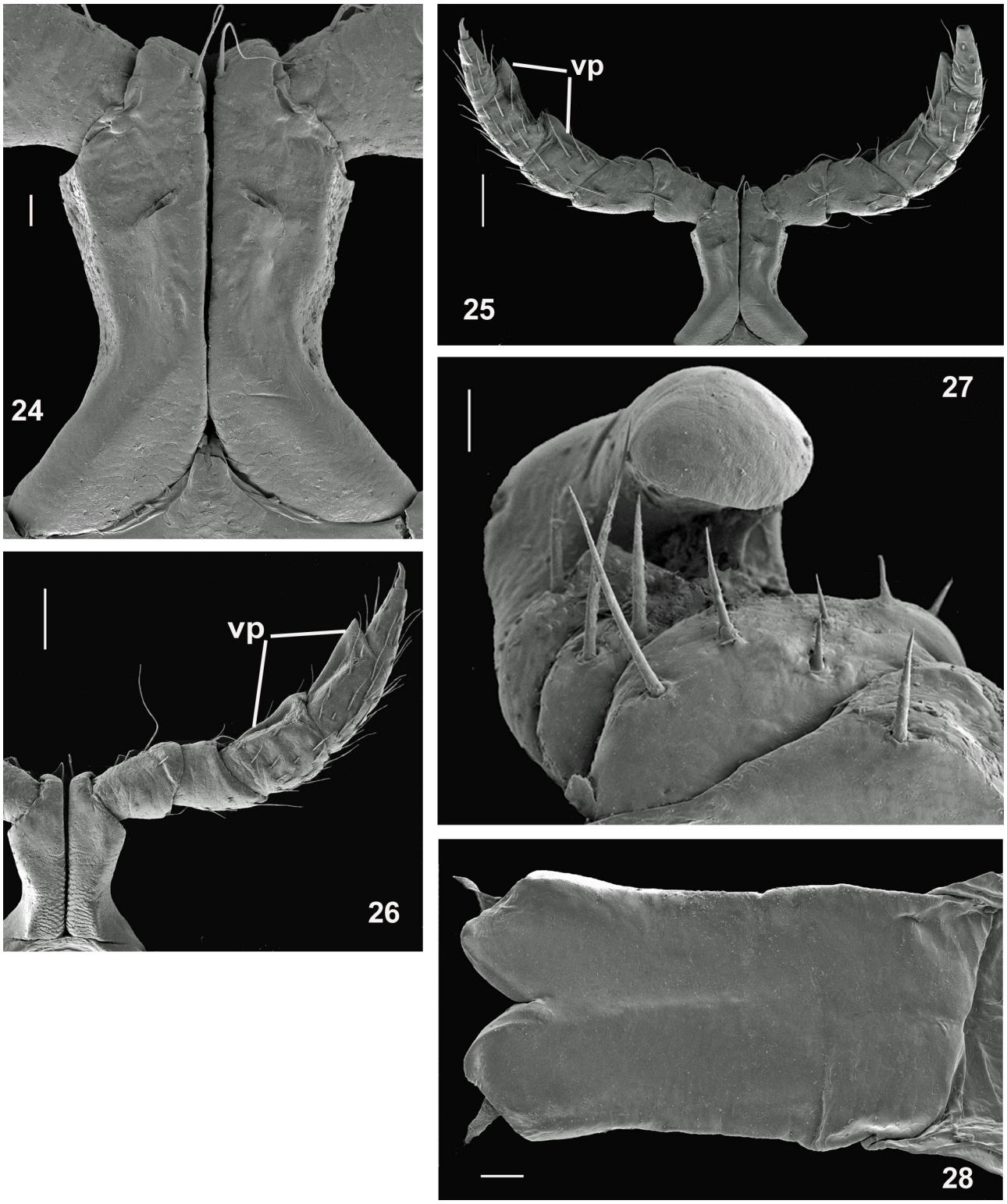
Head smooth, 2 epicranial setae, 4 supralabral setae. Eye patch subtriangular, composed of at least 40 ommatidia. Antennae short, slender and clavate. Antennomeres 5 and 6 with incomplete distodorsal corolla of sensilla basiconica. Mandibular stipites with large, evenly rounded, slightly swollen lobes. Gnathochilarium with group of dense nonapical stipital setae; lamellae linguales each with 5 setae arranged longitudinally. Collum with striae at posterior margin. A transverse row of very sparse short setae at hind edge of collum.

Body rings circular. Metazona with dense, regular, longitudinal striae reaching hind margin (12–13 striae in an approximate square with sides equal to metazonital length of a dorsal side of a midbody ring). Limbus straight, smooth (of Type 1 in Enghoff 1987). A transverse row of thin and very sparse setae at hind edge of metazonites. Ozopores very small, lying behind suture dividing pro- and metazona in touch with suture. Telson with caudal dorsal projection straight and long, covered with setae and carrying at tip a claw-shaped process curved dorsad. Preanal ring, anal valves, and subanal scale covered with setae.

Legs medium sized, slender. Very delicately serrate ventral pads (**vp**) present on postfemur and tibia, starting from legs 2 (Figs 25–26). Claw of all legs at base with a setiform accessory claw ventrally; accessory claw of unknown length, as no whole (unbroken) accessory claws were found (Figs 25–26, 29–31). Leg pair 1 forming hook, the distal podomere not coming into close contact with the basal podomeres (“open hook” type in Enghoff 1987); postfemur with indistinct scaly-rugose ventral surface, coxa with one seta, distal podomere without seta (Fig. 27). Coxa 2 with one long mesapical oral seta anteriorly, gland opening positioned in central and axial position *sensu* Enghoff (1987) (Figs 24–25). Penis subrectangular, about 1.8 times longer than wide (Fig. 28).

Gonopods slightly protruding. Promere (**p**) flattened, with parallel margins, apically obliquely rounded, in posterior view apically excavated for accommodation of mesomeral process, margin of apical excavation strongly produced caudad, papillate (in mesal and lateral views promere apex resembles a hook with an elongated tip), posterior surface subcentrally with small flattened rudimentary telopodite (**t**) (Figs 32–34). Flagellum slender, of

medium length (Fig. 36); its basal part covered with cuticular conical spikes on the caudal side; its distal part completely covered with cuticular conical spikes (Fig. 37). Mesomeral process of the opisthomere moderately slender, with rounded, strongly papillate apex (**a**) (Figs 32, 34). Velum with arcuate margin and a very deep notch (**dn**) near the mesomeral process (Figs 32, 34). Solenomere (**sl**) moderately stout, almost parallel-sided; apex with concavity, densely spinose, anterolateral flagellate spines (**fs**) long (Figs 34–35). Additional membrane (not visible in Fig. 34) with an uneven edge. Acicular process (**ap**) of a flagellum-guiding flap short (Fig. 34).



FIGURES 24–28. *Nepalmatoiulus humlaensis* **sp. nov.**, male holotype (**ZMUM**). **24**. Coxae 2, anterior view. **25**. Leg pair 2, anterior view. **26**. Leg pair 2 without left telopodite, posterior view. **27**. Leg 1, anterior view. **28**. Penis, posterior view. **Abbreviation: vp**, ventral pads. Scales: 20 μm (Figs 24, 27–28), 100 μm (Figs 25–26).

Female. Unknown.

Etymology. The specific epithet refers to the type locality, Humla District. Adjective.

All fifteen species of *Nepalmatoiulus* known from Nepal are presented in Table 1.

TABLE 1. List of *Nepalmatoiulus* species occurring in Nepal, with data on distributions and basic literature sources.

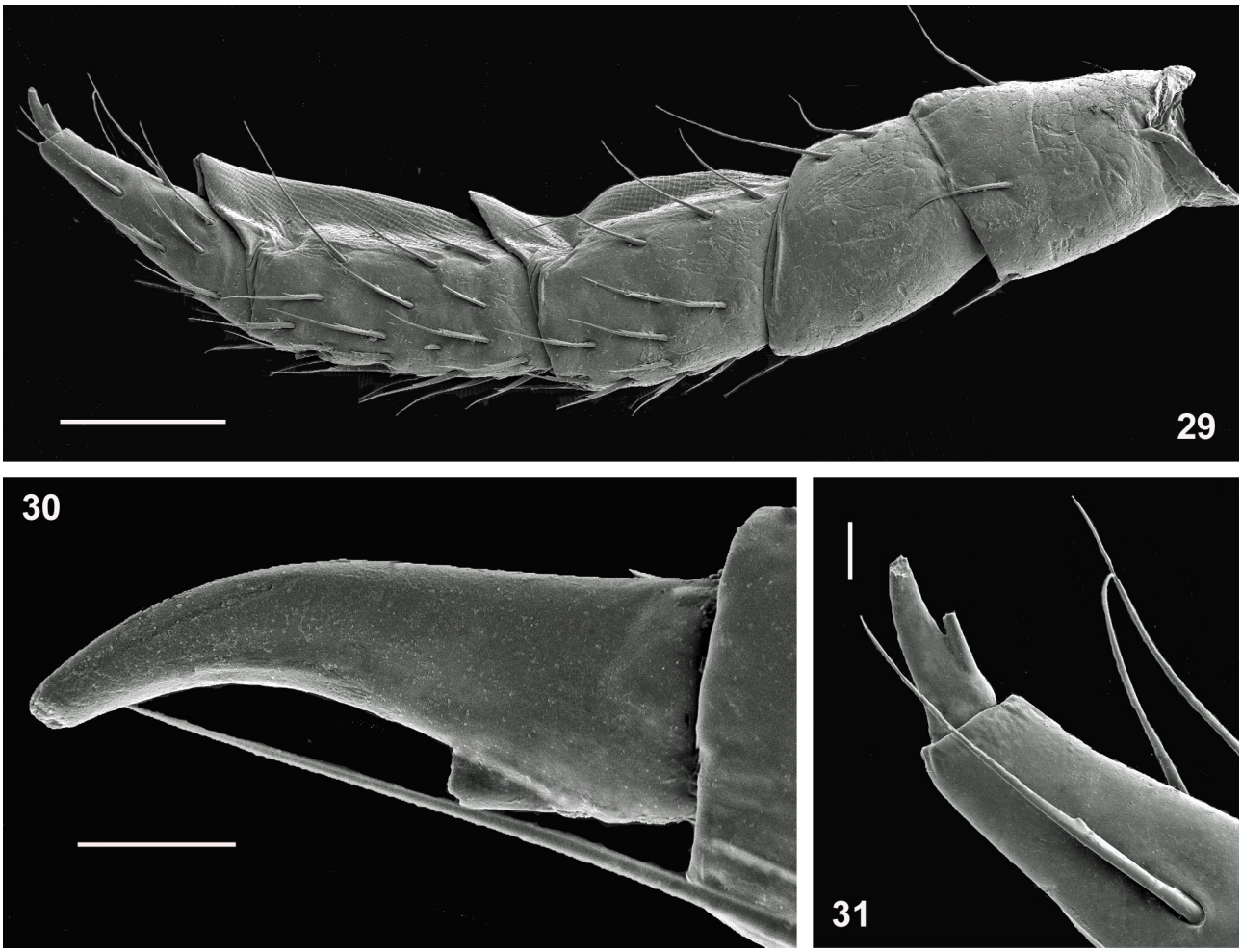
Nepalmatoiulus species	Distribution, Province, District	Main reference/s
N. deharvengi (Mauriès, 1983) *Chromatoiulus (Nepalmatoiulus) deharvengi* Mauriès, 1983	Nepal (Gandaki Province: Manang District, Pisang, North of Annapurna Himal)	Mauriès 1983, Enghoff 1987
N. generalis Enghoff, 1987	Nepal (Gandaki Province: Mustang, Myagdi, Parbat, Kaski districts; Koshi Province: Terhathum District; Bagmati Province: Rasuwa District)	Enghoff 1987
N. ghaulagiri Enghoff, 1987	Nepal (Gandaki Province: Myagdi District)	Enghoff 1987
N. humlaensis **new species**	Nepal (Karnali Provice: Humla District)	
N. hyalilobus Enghoff, 1987	Nepal (Karnali Province: Dolpo District; Gandaki Province: Myagdi District)	Enghoff 1987
N. ivanloebli (Mauriès, 1983); *Chromatoiulus (Nepalmatoiulus) loebli* Mauriès, 1983; *Chromatoiulus* (*Cyphobrachyiulus*) *loebli* Strasser, 1974	Nepal (environs of Kathmandu, Bagmati Province: Rasuwa District)	Strasser 1974, Mauriès 1983, Enghoff 1987
N. juxtapositus Enghoff, 1987	Nepal (Gandaki Province: Parbat District)	Enghoff 1987
N. karnaliensis **new species**	Nepal (Karnali Province: Humla District)	
N. martensi Enghoff, 1987	Nepal (Koshi Province: Solukhumbu District)	Enghoff 1987
N. mauriesi Enghoff, 1987	Nepal (Gandaki Province: Gorkha District)	Enghoff 1987
N. pineti Enghoff, 1987	Nepal (Gandaki Province: Mustang District)	Enghoff 1987
N. smetanai (Mauriès, 1983); *Chromatoiulus (Nepalmatoiulus) smetanai* Mauriès, 1983	Nepal (Bagmati Province: Kathmandu, Lalitpur District)	Mauriès 1983, Enghoff 1987
N. sympatricus Enghoff, 1987	Nepal (Gandaki Province: Myagdi District, Dhorpatan)	Enghoff 1987
N. uncus Enghoff, 1987	Nepal (Koshi Province: Ilam and Panchthar districts)	Enghoff 1987
N. zachonoides Enghoff, 1987	Nepal (Gandaki Province: Mustang District)	Enghoff 1987

Discussion

In his revision of the *Nepalmatoiulus* genus, Enghoff grouped all the species of this genus into six species groups (Enghoff 1987). Almost all (with the exception of *N. uncus*) of the 13 Nepalese species known at that time were grouped into the *ivanloebli*-group. The main distinguishing characters of the species in this group are: the ozopores are located immediately behind the suture dividing pro- and metazona; limbus straight, smooth (of Type 1 in Enghoff 1987); mandibular stipites with large, evenly rounded lobe; leg pair 1 with indistinct postfemoral rugosities; coxa 2 with one mesapical oral seta; gland opening of the coxae 2 positioned in central and axial position *sensu* Enghoff (1987); ventral pads present from second legs to near hind end; posterior gonopods with mesomeral process moderately set apart from velum; solenomere with apical excavation and basal obliquely ascending ridge; accessory membrane present; solenomere spinose to one degree or another (Enghoff 1987).

All 12 species of the *ivanloebli*-group are very similar and differ mainly in the details of the structure of the solenomere (Enghoff 1987), so the key below to Nepalese *Nepalmatoiulus* species is based only on the structure

of the gonopods. The main morphological characters of *N. karnaliensis* **sp. nov.** (see diagnosis) make it possible to classify it as an *ivanloebli*-group member. *N. humlaensis* **sp. nov.** is slightly different, in particular, the mesomeral process broadly set apart from velum and apparently by the absence of a basal obliquely ascending ridge of solenomere. However, even with these rather minor differences it fits perfectly into the definition of this group, so *N. humlaensis* **sp. nov.** should also be included in the *ivanloebli*-group.

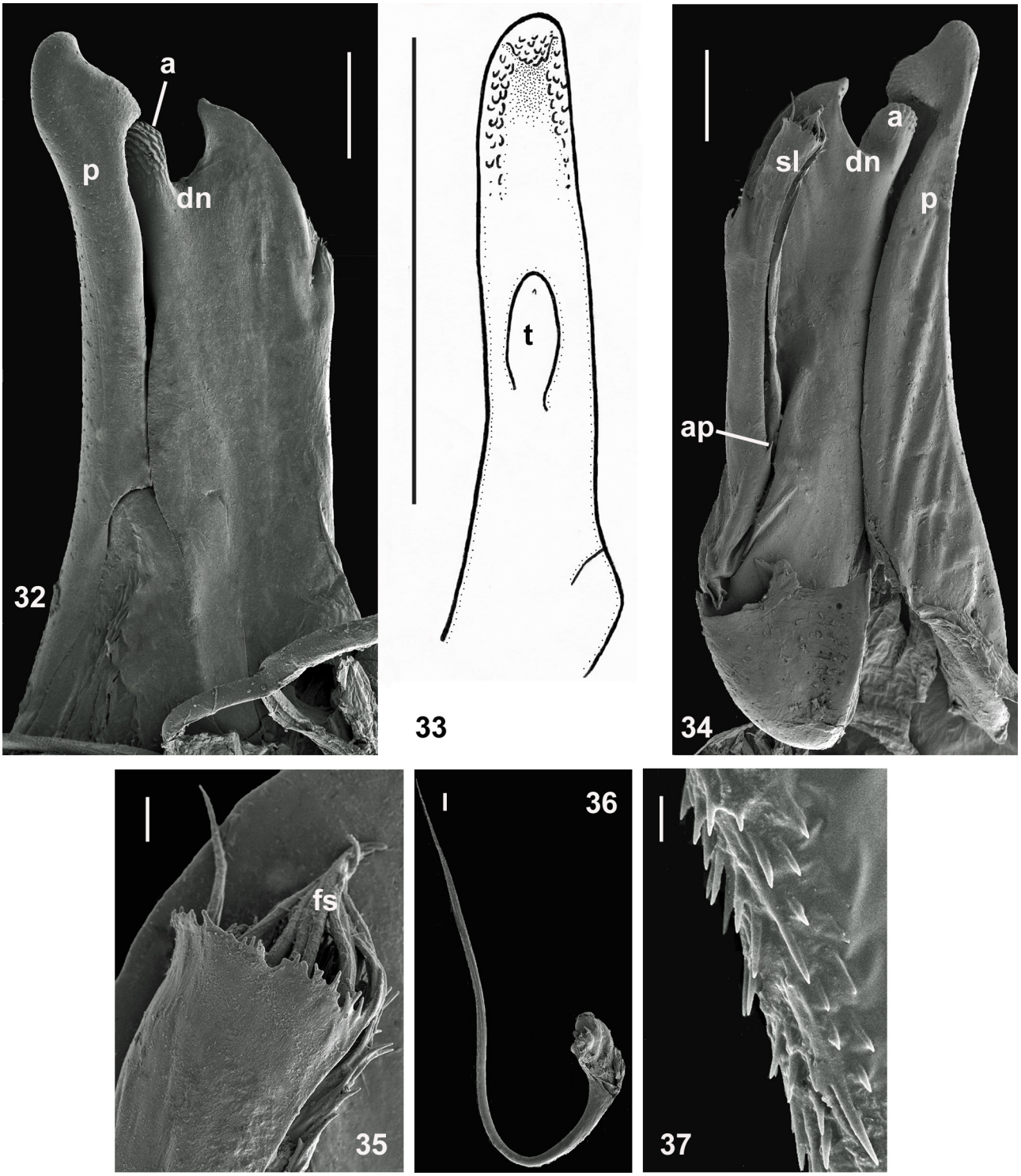


FIGURES 29–31. *Nepalmatoiulus humlaensis* **sp. nov.**, male holotype (**ZMUM**). **29**. Mid-body leg. **30**. Claw 2. **31**. Claw of mid-body leg. Scales: 10 μm (Figs 30–31), 100 μm (Fig. 29).

Conclusion

At present, 15 species of *Nepalmatoiulus* (including the two new species described above) have been recorded from Nepal (Table 1). This is somewhat less than half of the *Nepalmatoiulus* fauna of China including Taiwan, which is currently the most studied and includes 36 species (Enghoff 1987; Zhang *et al*. 1997; Korsós & Lazányi 2013; Mikhaljova 2020a; 2020b; 2023a; 2023b; 2024). However, in general, the *Nepalmatoiulus* fauna remains poorly studied, both in China and Nepal, as well as in other countries within the range of the genus, where species diversity is even lower. As for the *Nepalmatoiulus* fauna of Nepal, only 4 administrative provinces (Bagmati, Gandaki, Karnali and Koshi provinces) out of 7, and 16 administrative districts out of 77 have recorded species of this genus (Table 1). Today, all species of *Nepalmatoiulus* recorded from Nepal are considered to be endemic to this country.

The distribution of *Nepalmatoiulus* within Nepal shows only one species, *N. generalis*, being relatively widespread, being known from 6 administrative districts. Only four species were recorded in two districts, while the remaining congeners are recorded only from a single one. All currently known Nepalese species of *Nepalmatoiulus* are alpine, they have been collected at an altitude of 1655 to 4800 m above sea level.



FIGURES 32–37. *Nepalmatoiulus humlaensis* **sp. nov.**, male holotype (**ZMUM**). **32**. Gonopods, lateral view. **33**. Promere, posterior view. **34**. Gonopods, mesal view. **35**. Apex of solenomere. **36**. Flagellum. **37**. Fragment of flagellum distal part. **Abbreviations: a**, apex of mesomeral process; **ap**, acicular process; **dn**, notch; **fs**, flagellate spines; **p**, promere; **sl**, solenomere. Scales: 2 μm (Fig. 37), 10 μm (Fig. 35), 20 μm (Fig. 36), 100 μm (Figs 32, 34), 0.5 mm (Fig. 33).

Key to *Nepalmatoiulus* species occurring in Nepal (based only on gonopods of males)

1(2) Solenomere spinose throughout. Mesomeral process very long and slender . . . . . *N. uncus*
2(1) Solenomere partially covered with spines or bare. Mesomeral process not very long and slender 3
3(4) Solenomere extremely slender . . . . . *N. ivanloebli*

4(3) Solenomere stout 5
5(6) Solenomere short, not reaching the middle of the velum in length 7
6(5) Solenomere longer, reaching or exceeding the middle of the velum in length 13
7(8) Velum with a very deep notch near the mesomeral process. Margin of apical excavation of the promere strongly produced caudad (in mesal and lateral views promere apex resembles a hook with an elongated tip) (Fig. 32) . . . *N. humlaensis* **sp. nov.**
8(7) Velum with a shallow notch near the mesomeral process. Margin of apical excavation of the promere different 9
9(10) Promere apically strongly obliquely rounded. Margin of the velum with or without denticles. 11
10(9) Promere apically very slightly obliquely rounded. Margin of the velum without denticles . . . . . *N. smetanai*
11(12) Margin of apical excavation of the solenomere serrate, solenomere strongly expanded toward apex . . . . . *N. zachonoides*
12(11) Margin of apical excavation of the solenomere smooth, solenomere basally slightly constricted . . . . . *N. juxtapositus*
13(14) Margin of the velum straight, with tiny denticles posteriorly (Figs 18–19). . . . . *N. karnaliensis* **sp. nov.**
14(13) Margin of the velum rounded to some extent, with or without tiny denticles posteriorly 15
15(16) Solenomere with an anterior hyaline lobe 17
16(15) Solenomere without an anterior hyaline lobe. 19
17(18) Mesomeral process almost semicircular. Solenomere apex obliquely cut off . . . . . *N. sympatricus*
18(17) Mesomeral process slender. Solenomere apex not obliquely cut off . . . . . *N. hyalilobus*
19(20) Promere stout, with parallel margins 21
20(19) Promere slender or moderately stout, with converging margins to some extent 23
21(22) Solenomere very broad, funnel-like . . . . . *N. pineti*
22(21) Solenomere slender, not funnel-like. . . . . *N. deharvengi*
23(24) Solenomere apically strongly expanded, walls of the apical excavation striate. . . . . *N. martensi*
24(23) Solenomere apically not strongly expanded, walls of the apical excavation not striate 25
25(26) Solenomere constricted subapically, apically somewhat funnel-like. . . . . *N. ghaulagiri*
26(25) Solenomere not constricted subapically, apically not somewhat funnel-like. 27
27(28) Solenomere apex obliquely cut off, margin of the velum posteriorly with numerous long denticles . . . . . *N. mauriesi*
28(27) Solenomere not obliquely cut-off, margin of the velum posteriorly smooth or with several coarse denticles . . . . . *N. generalis*

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