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Two new species of the millipede genus *Desmoxytes* Chamberlin, 1923 (Diplopoda: Polydesmida: Paradoxosomatidae) from caves in southern China

Два новых вида многоножек-диплопод рода *Desmoxytes* Chamberlin, 1923 (Diplopoda: Polydesmida: Paradoxosomatidae) из пещер Южного Китая

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KEY WORDS: *Desmoxytes*, new species, cave, China.
КЛЮЧЕВЫЕ СЛОВА: *Desmoxytes*, новый вид, пещера, Китай.

ABSTRACT. Two new parapatric species of *Desmoxytes* are described from caves in a karst area in Guangxi Province, southern China: *D. scutigeroides* sp.n. and *D. scolopendroides* sp.n. Both are possibly troglobites, this being especially true of *D. scutigeroides* sp.n., in which the legs, antennae and paratergal spines are particularly long, the body is loose while the tegument often pallid. Both the species differ well from each other and the remaining, known congeners, all in Southeast Asia and southern China, chiefly by the length of the legs and antennae, as well as in certain details of tergal and male leg ornamentation, and in gonopod structure.

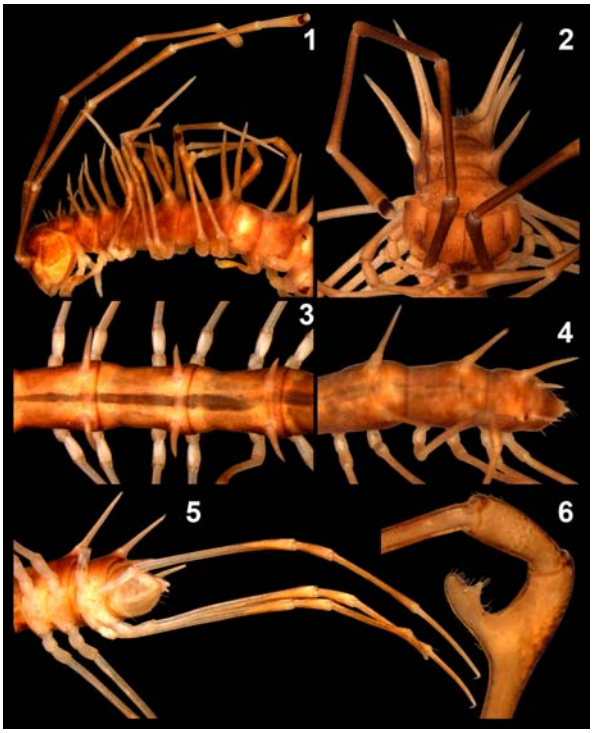
РЕЗЮМЕ. Из пещер одного из карстовых районов в провинции Гуанси (Южный Китай) описаны два новых парапатрических вида рода *Desmoxytes*: *D. scutigeroides* sp.n. и *D. scolopendroides* sp.n. Возможно, оба они троглобионты, но это особенно очевидно для *D. scutigeroides* sp.n., у которого ноги, антенны и паратергальные шипы чрезвычайно длинные, тело хрупкое, а покровы часто бесцветные. Оба эти вида хорошо отличаются как друг от друга, так и от прочих, уже известных видов рода (все из Юго-Восточной Азии и Южного Китая) прежде всего длиной ног и антенн, некоторыми деталями вооружения тергитов, а также строением ног самца и гоноподий.

Introduction

The dragon millipedes, or the genus *Desmoxytes* Chamberlin, 1923, form a highly characteristic element in the paradoxosomatid faunas of Southeast Asia and southern China, with 24 species currently described (see reviews in Golovatch & Enghoff [1994], Nguyen Duc et al. [2006] and Enghoff et al. [2007]). Only one of the species, *D. planata* (Pocock, 1895), has attained a vast distribution in the tropics (in addition to Southeast Asia, also Sri Lanka, Java, the Andaman, Seychelles, Comoros and Fiji islands) which is certainly due to anthropochorism, whereas the remaining congeners are mostly very local.

The present paper puts on record two further new *Desmoxytes*, both taken in caves in the globe's largest karst region, southern China, more precisely in the Mulun Karst, in Guangxi Province, China [Deharveng et al., 2008]. This karst is known to host the richest cave fauna in China. One of the species which shows especially long extremities and tergal spines, as well as a loose body and often a pallid tegument, is an undisputed troglobite, already referred to as *Desmoxytes* sp. in Deharveng et al. [2008]. The second species, albeit more strongly pigmented but also demonstrating quite long legs and antennae, might prove to be a troglophile or even a troglobite as well; it was collected in another karst unit, about 60 air-km southeast of Mulun. These are likely to be true cavernicoles amongst *Desmoxytes* species, a genus whose members regularly show aposematic, unusually bright colour patterns and only rarely occur in caves. Only one congener has hitherto been considered as a likely troglobite, *D. longispina* (Loksa, 1960), also from southern China [Loksa, 1960][1] . Speak-

[1] This species was described as *Centrodesmus longispinus* from material taken in "a cave near the village of Pien-Ja in central Kulouі" (see also Golovatch & Enghoff [1994]). This locality seems to presently lie at Guilin, Guangxi Province, again a region in southern China known to be very rich in karst.



Figs 1–6. *Desmoxytes scutigeroides* sp.n., ♂ paratype from Cave Gang Lai Dong 2: 1 — anterior body portion, lateral view; 2 — same, front view; 3 — middle body portion, dorsal view; 4 — caudal body portion, dorsal view; 5 — same, ventral view; 6 — distal part of femur 6, front view. Photographs by Louis Deharveng (taken not to scale).

Рис. 1–6. *Desmoxytes scutigeroides* sp.n., паратип ♂ из пещеры Ганг-Лаи Донг 2: 1 — передняя часть тела, вид сбоку; 2 — то же, вид снизу; 3 — средняя часть тела, вид сверху; 4 — каудальная часть тела, вид сверху; 5 — то же, вид снизу; 6 — дистальная часть фемура 6, вид спереди. Фотографии Louis Deharveng (снято без масштаба).

ing even more generally, the Paradoxosomatidae, a family dominating the diplopod faunas of entire Australasia, appears to contain surprisingly few troglomorphic species. The more so important is the present discovery of two new parapatric and cavernicolous *Desmoxytes* in southern China.

The material has been shared between the collections of the following institutions, as indicated thereafter: IZB — Institute of Zoology of the Chinese Academy of Sciences, Beijing, China; MNHN — Muséum national d'Histoire naturelle, Paris, France; SCAU — South China Agricultural University, Guangzhou, China; ZMUM — Zoological Museum, University of Moscow, Russia.

Taxonomic part

Desmoxytes scutigeroides **sp.n.**
Figs 1–14.

HOLOTYPE ♂ (SCAU), China, Guangxi Province, Huanjiang, Mulun Nature Reserve, Cave Gang Lai Dong 2, by hand, 13.03.2005, leg. L. Deharveng & A. Bedos (CHIgx05-085). PARATYPES: 1 ♂ (IZB), 1 ♂ (MNHN JA 128), same data, together with holotype. 1 ♀ (SCAU), 1 ♂ (ZMUM), Mulun Nature Reserve, Cave Mashan Dong, by hand, 19.05.2007, leg. L. Deharveng, A. Bedos & Li Youbang (CHIgx07-19-01). 1 ♂, 2 ♀♀ (IZB), Guangnan, Cave Gonglu Dong, by hand, 7.11.2009, leg. L. Deharveng & A. Bedos (CHIgx09-082). 4 ♂♂ juv. (19 segments) (SCAU), Shui Yuan, Cave Shui Yuan Dong, by hand, 11.11.2009, leg. L. Deharveng & A. Bedos (CHIgx09-118).

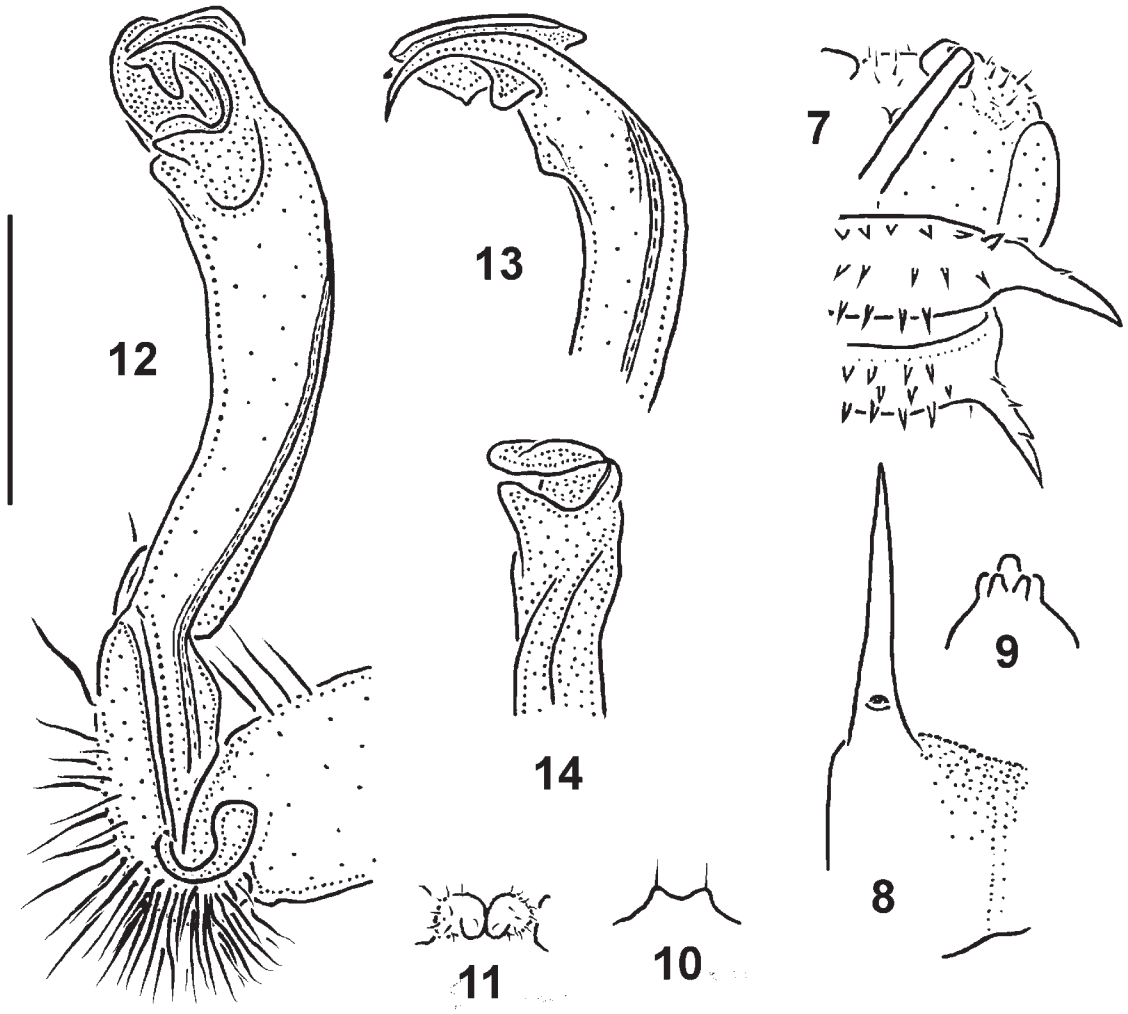
NAME. To emphasize the extremely long legs, antennae and paraterga, thus somewhat resembling Scutigeromorpha species.

DIAGNOSIS. Differs from congeners in the spiniform and mostly extremely long paraterga, coupled with the unusually moniliform body, the extremely long antennae and legs, the humped ♂ femora 6 and the strongly condensed gonopods. Superficially, this new species seems to be especially similar to *D. longispina* (Loksa, 1960), also a cavernicole in southern China [Loksa, 1960], but it differs clearly in the larger body (length ≥ 28 mm, versus 24 mm), in the humped ♂ femora 6 (not 7), in a simpler epiproct (versus much more elaborate), in the armoured, spiniferous segments 2–4 (versus bare), in the dentate paraterga 1–5 (versus 1–6), in the shape of the solenophore etc.

DESCRIPTION. Length ca 28–30 (♂) or 33–34 mm (♀), width of midbody pro- and metazona 1.4–1.5 and 1.5–1.6 mm (♂), 1.9–2.0 and 2.0–2.1 mm (♀), respectively. Holotype ca 28 mm long and 1.5 mm wide. Penultimate ♂♂ ca 20–22 mm long and 1.0–1.1 mm wide. Head broadest, 1.7–1.8 (♂), 2.3–2.4 (♀) or 1.5 mm (♂ juv.) wide. Colour of alcohol material pallid (including penultimate ♂♂) to rather uniformly beige grey-brown, only antennomere 7 and often border region between vertex and labrum dark brown, while venter, antennomere 8 and often a few basal podomeres pallid to light beige (legs slightly infuscate distad).

Head rather densely setose, vertex densely pilose (Fig. 7). Epicranial suture distinct (Figs 2 & 7). Antennae extremely long and slender (Figs 1 & 2), reaching back to body segment 8 or 9 (♂), 6 or 7 (♀, juv.) dorsally. Collum (Figs 2 & 7) about as broad as segment 2, with three transverse rows of needle-shaped spines: 4+4 anterior, 3+3 intermediate and 2+2 posterior; paraterga spiniform, directed dorsolaterad, with a spine anteriorly at base and a spinicle/denticle at distal 1/3.

Body parallel-sided from segment 6(7) to 17, strongly moniliform due to elongated metazona (twice as long as prozona) and a narrow but shallow and simple stricture (Fig. 3). Surface of prozona and paraterga finely shagreened, of metazona finely granular, dull. Ozopores visible only laterally (Fig. 8). Transverse sulcus on metaterga very faint, shallow, traceable on metaterga 5(6)–17(18). Metaterga 2 and 3 each with three transverse rows of setiferous needle-shaped spines: 2+2 anterior, 3+3 intermediate and 3+3 posterior; paraterga with two denticles, one each at basal and distal 1/3 (Fig. 7). Metaterga 4 and 5 each with both anterior and intermediate rows of spinules strongly reduced, but posterior row of 3+3 spines remaining readily visible; paraterga 5 already without denticles, but laterally with a small parabasal bulge carrying a



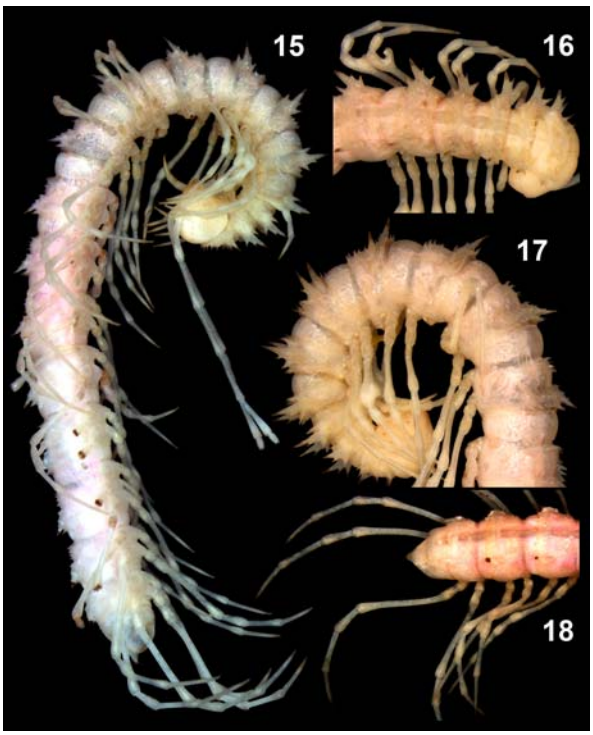
Figs 7–14. *Desmoxytes scutigeroides* sp.n., ♂ paratype from Cave Gang Lai Dong 2: 7 — head, collum and segment 2, right half, dorsal view; 8 — segment 7, lateral view; 9 — epiproct, dorsal view; 10 — hypoproct, ventral view; 11 — sternal cones between coxae 4, ventrocaudal view; 12 — right gonopod, mesal view; 13 & 14 — distal part of gonopod, dorsal and subventral view, respectively. Scale bar: 1.0 (7–11) & 0.3 mm (12–14).

Рис. 7–14. *Desmoxytes scutigeroides* sp.n., паратип ♂ из пещеры Ганг-Лаи Донг 2: 7 — голова, коллум и сегмент 2, правая половина, вид сверху; 8 — сегмент 7, вид сбоку; 9 — эпипрокт, вид сверху; 10 — гипопрокт, вид снизу; 11 — стернальные бугорки между коксами 4, вид снизу и сзади; 12 — правый гонопод, вид изнутри; 13 и 14 — дистальная часть гонопода, соответственно сверху и почти снизу. Масштаб: 1,0 (7–11) и 0,3 мм (12–14).

rounded ozopore. Following metaterga smooth, with only slight traces of 3+3 knobs near posterior margin; paraterga very high, simple, spiniform (Figs 1, 3 & 8), ca 1.3–1.4 (♂), 1.1–1.2 (♀) or 0.9–1.1 (juv.) times as long as midbody height, only on segments 15–18 increasingly shortened and inclined caudad, on 19th like stout spines directed caudad (Figs 4 & 5). Axial line missing. Pleurosternal carinae poorly developed, present on segments 2 and 3, absent from others. Epiproct (Figs 4, 5 & 9) flattened dorsoventrally, relatively broad, tip like a rounded flap flanked by two pairs of evident pre-apical papillae. Hypoproct (Figs 5 & 10) subtrapeziform with a broadly concave caudal margin.

Legs 1 short; following ones increasingly longer and slenderer towards telson (Figs 1–5), extremely long and a little incrassate in ♂ compared to ♀ or juvenile (ca 7 times versus ca 4–5 times as long as midbody height without paraterga). ♂ femur 6 with a very evident, rounded, mesal, distodorsally densely pilose apophysis at distal 1/5 (Fig. 6). Sterna without modifications (Figs 2–5), rather densely pilose, cross-impressions very week; a pair of setose paramedian cones between ♂ coxae 4 (Fig. 11).

Gonopods (Figs 12–14) strongly elongated and subfalcate, their distal parts directed mesally. Femorite long and uniformly slender; lateral postfemoral sulcus very evident, postfemoral part strongly condensed; solenomere short, flagelliform, sheathed distally and only a little by a similarly short solenophore (= lamina lateralis) consisting of several small lobes.



Figs 15–18. *Desmoxytes scolopendroides* sp.n., ♂ paratype: 15 — habitus, lateral view; 16 & 17 — anterior body portion, dorsal and lateral views, respectively; 18 — caudal body portion, dorsal view. Photographs by Louis Deharveng (taken not to scale).

Рис. 15–18. *Desmoxytes scolopendroides* sp.n., паратип ♂: 15 — габитус, вид сбоку; 16 и 17 — передняя часть тела, соответственно виды сверху и сбоку; 18 — каудальная часть тела, вид верху. Фотографии Louis Deharveng (снято без масштаба).

Desmoxytes scolopendroides **sp.n.**
Figs 15–26.

HOLOTYPE ♂ (SCAU), China, Guangxi Province, Huanjiang, Cave Sheng Long Dong, by hand, 31.10.2009, leg. Tian Mingyi & Mulun Nature Reserve staff (CHIgx09-022). PARATYPES: 1 ♂ (IZB), 1 ♂ (MNHN JA 129), 1 ♂ (ZMUM), same data, together with holotype.

NAME. To emphasize the relatively long legs, antennae and paraterga, thus somewhat resembling some of the Scolopendromorpha species.

DIAGNOSIS. Differs from congeners in the wing-shaped and mostly rather long paraterga, coupled with the slightly moniliform body, the long antennae and legs, the humped ♂ femora 6 and 7, and the strongly condensed gonopods.

DESCRIPTION. Length of all ♂♂ ca 25–27 mm, width of midbody pro- and metazona 1.8 and 2.0 mm, respectively. Head broadest, 2.2 mm wide. Colour of alcohol material pallid to uniformly pinkish yellow. Live coloration obviously considerably darker, pink brown (based on some photos taken shortly after capture).

Head densely setose, vertex more sparsely pilose (Fig. 19). Epicranial suture distinct. Antennae very long and slender, reaching back to body segment 6 or 7 dorsally (Fig. 15). Collum (Figs 16 & 19) with paraterga slightly broader than head and about as broad as segment 2, with three transverse rows of setiferous spines: 4+4 anterior, 3+3 intermediate and 2+2 posterior; paraterga wing-shaped, directed dorsolaterad, with a spine anteriorly at base and a tooth at about midway.

Body parallel-sided from segment 5(6) to 17, only slightly moniliform due to modestly elongated metazona (ca 1.5 times as long as prozona) and a narrow, rather deep and simple stricture (Figs 15–17, 20 & 21). Paraterga smooth, surface of prozona finely shagreened, of metazona finely granular, dull. Ozopores visible dorsolaterally (Fig. 21). Transverse sulcus on metaterga faint, shallow, visible on metaterga 5–17 (Figs 16–18 & 20). Metaterga 2 and 3 each with three transverse rows of setiferous spines: 3+3 anterior, 2+2 intermediate and 3+3 posterior; paraterga with two strong teeth, one each anteroparabasally (especially strong tooth) and at distal 1/3 (Figs 16 & 19). Metaterga 4–6 each with 3+3 anterior, 2+2 intermediate (behind sulcus) and 4+4 posterior spines, lateralmost spine in posterior row (just behind paratergum) increasingly stronger. Starting from segment 7, anterior row gradually developing another row of spines immediately in front of sulcus (Fig. 20), so that metaterga 9–19 supporting already four transverse rows of usually 3(4)+3(4), 3(4)+3(4), 3(4)+3(4) and 4+4 spines/spinules, two rows each in front of and behind sulcus; these spinules gradually reduced in size towards segment 19. Paraterga directed dorsolaterad, clearly elevated above dorsum until segment 11 or 12 (Fig. 17), thereafter first level to and then increasingly below dorsum, also increasingly poorly dentate to finally become lateral and spiniform on segment 19 (Fig. 18). Axial line missing. Pleurosternal carinae poorly developed, present on segments 2 and 3, absent from others. Epiproct much like in *D. scutigeroides* sp.n., but a little narrower. Hypoproct like in *D. scutigeroides* sp.n.

Legs 1 short; following ones increasingly longer and slenderer towards telson (Figs 15–18), likely longer and a little incrassate in ♂ compared to ♀ (> 3 times as long as midbody height with paraterga). ♂ femur 6 with a very evident, rounded, mesal, densely pilose apophysis at distal 1/3 (Figs 16 & 22), ♂ femur 7 distally strongly inflated medially and pilose (Figs 16 & 23). Sterna without modifications, densely setose, cross-impressions modest; a pair of setose paramedian cones between ♂ coxae 4 like in *D. scutigeroides* sp.n.

Gonopods (Figs 24–26) strongly elongated and subfalcate, their distal parts directed mesally. Femorite long and uniformly slender; lateral postfemoral sulcus very evident, postfemoral part strongly condensed; solenomere short, flagelliform, sheathed distally and only a little by a similarly short solenophore (= lamina lateralis), latter pointed apically and consisting of a few small lobes.

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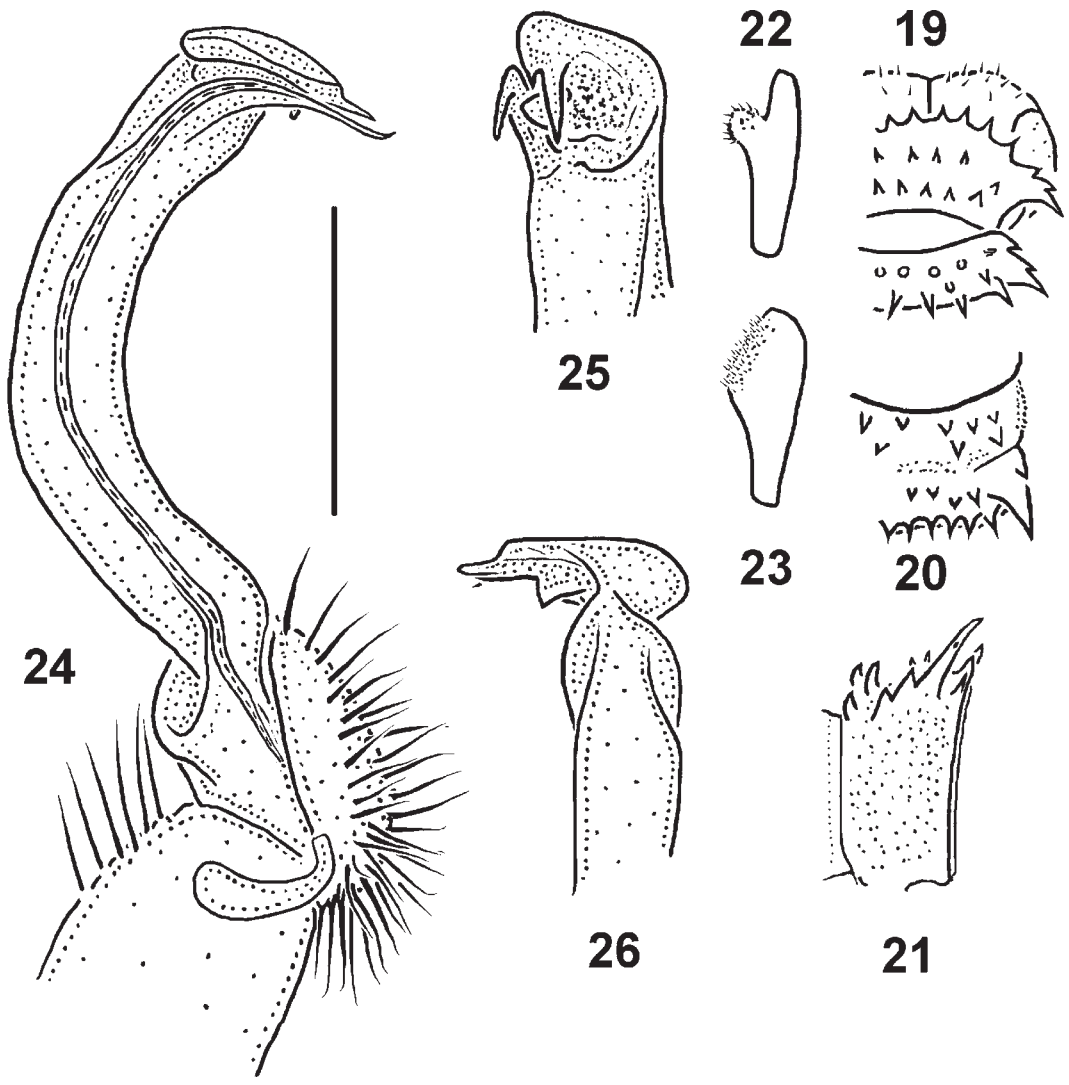

Figs 19–26. *Desmoxytes scolopendroides* sp.n., ♂ paratype: 19 — head, collum and segment 2, right half, dorsal view; 20 & 21 — segment 7, dorsal and lateral views, respectively; 22 — femur 6, front view; 23 — femur 7, front view; 24 — left gonopod, mesal view; 25 & 26 — distal part of gonopod, ventral and lateral views, respectively. Scale bar: 1.0 (19–23) & 0.3 mm (24–26).

Рис. 19–26. *Desmoxytes scolopendroides* sp.n., паратип ♂: 19 — голова, коллум и сегмент 2, правая половина, вид сверху; 20 и 21 — сегмент 7, соответственно виды сверху и сбоку; 22 — фемур 6, вид спереди; 23 — фемур 7, вид спереди; 24 — левый гонопод, вид изнутри; 25 и 26 — дистальная часть гонопода, соответственно виды снизу и сбоку. Масштаб: 1,0 (19–23) и 0,3 мм (24–26).

some of his photographs. Thanks are expressed to Liu Jin and Anthony Whitten for facilitating the biological surveys project and to the Biodiversity Office of the Guangxi Forestry Bureau and the staff of the Mulun Nature Reserve for organizing the field trip. The first author wishes to again thank the MNHN for the financial support rendered to accomplish this project in 2010.

References

Deharveng L., Bréhier F., Bedos A., Mingyi Tian, Youbang Li, Feng Zhang, Wengeng Qin, Xuefeng Tan. 2008. Mulun and surrounding karsts (Guangxi) host the richest cave fauna of China // Subterranean Biology. No.6. P.75–79.

Enghoff H., Sutcharit C., Panha S. 2007. The shocking pink dragon millipede, *Desmoxytes purpurosea*, a colourful species from Thailand (Diplopoda: Polydesmida: Paradoxosomatidae) // Zootaxa. No.1563. P.31–36.

Golovatch S.I., Enghoff H. 1994. Review of the dragon millipedes, genus *Desmoxytes* Chamberlin, 1923 (Diplopoda, Polydesmida, Paradoxosomatidae) // Steenstrupia. Vol.2. No.2. P.45–71.

Loksa I. 1960. Einige neue Diplopoden- und Chilopodenarten aus chinesischen Höhlen // Acta Zool. Acad. Sci. Hung. T.6. Fasc.1–2. P.135–148.

Nguyen Duc A., Golovatch S.I., Anichkin A. 2006. The dragon millipedes in Vietnam (Polydesmida: Paradoxosomatidae, genus *Desmoxytes* Chamberlin, 1923) // Arthropoda Selecta. Vol.14 (for 2005). No.3. P.251–257.