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Several new or poorly-known cavernicolous millipedes (Diplopoda) from southern China

Несколько новых и малоизвестных пещерных диплопод (Diplopoda) из Южного Китая

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КЛЮЧЕВЫЕ СЛОВА. Diplopoda, новый вид, пещера, Китай.

ABSTRACT. Two new troglobitic diplopods are described from southern China: *Nepalella grandoides* sp.n. (Chordeumatida: Megalotylidae) and *Pacidesmus superdraco* sp.n. (Polydesmida: Polydesmidae). Further three species of Polydesmidae are recorded in caves of Sichuan or Guizhou Province, China.

РЕЗЮМЕ. Из Южного Китая описаны два новых троглобионтных вида: *Nepalella grandoides* sp.n. (Chordeumatida: Megalotylidae) и *Pacidesmus superdraco* sp.n. (Polydesmida: Polydesmidae). Еще три вида Polydesmidae отмечены в пещерах провинции Сычуань или Гижоу.

Introduction

Since the recent treatment of the rich subterranean collections of the millipede families Megalotylidae and Polydesmidae from southern China [Geoffroy & Golovatch, 2004; Golovatch et al., 2006; Golovatch & Geoffroy, 2006], fresh material representing two new species from these groups has been amassed in the Muséum national d'Histoire naturelle, Paris, France. This paper is devoted to their description.

The indices used below in the description of the new chordeumatidan are those adopted after Spelda [2001].

Abbreviations used:

CIX: Macrochaetal Index
MA: Macrochaetal Angle
MIX: Median Index
MNHN: Muséum national d'Histoire naturelle, Paris, France
PIX: Paratergal Index
ZMUM: Zoological Museum, State University of Moscow, Russia

Species descriptions

Order Chordeumatida
Family Megalotylidae

Nepalella grandoides **sp.n.**
Figs 1–13.

HOLOTYPE ♂ (MNHN DB043), China, Sichuan Prov., Beichuan County, Cave Yuan Dong, No. 1566, 17.08.2004, leg. J. Lips.

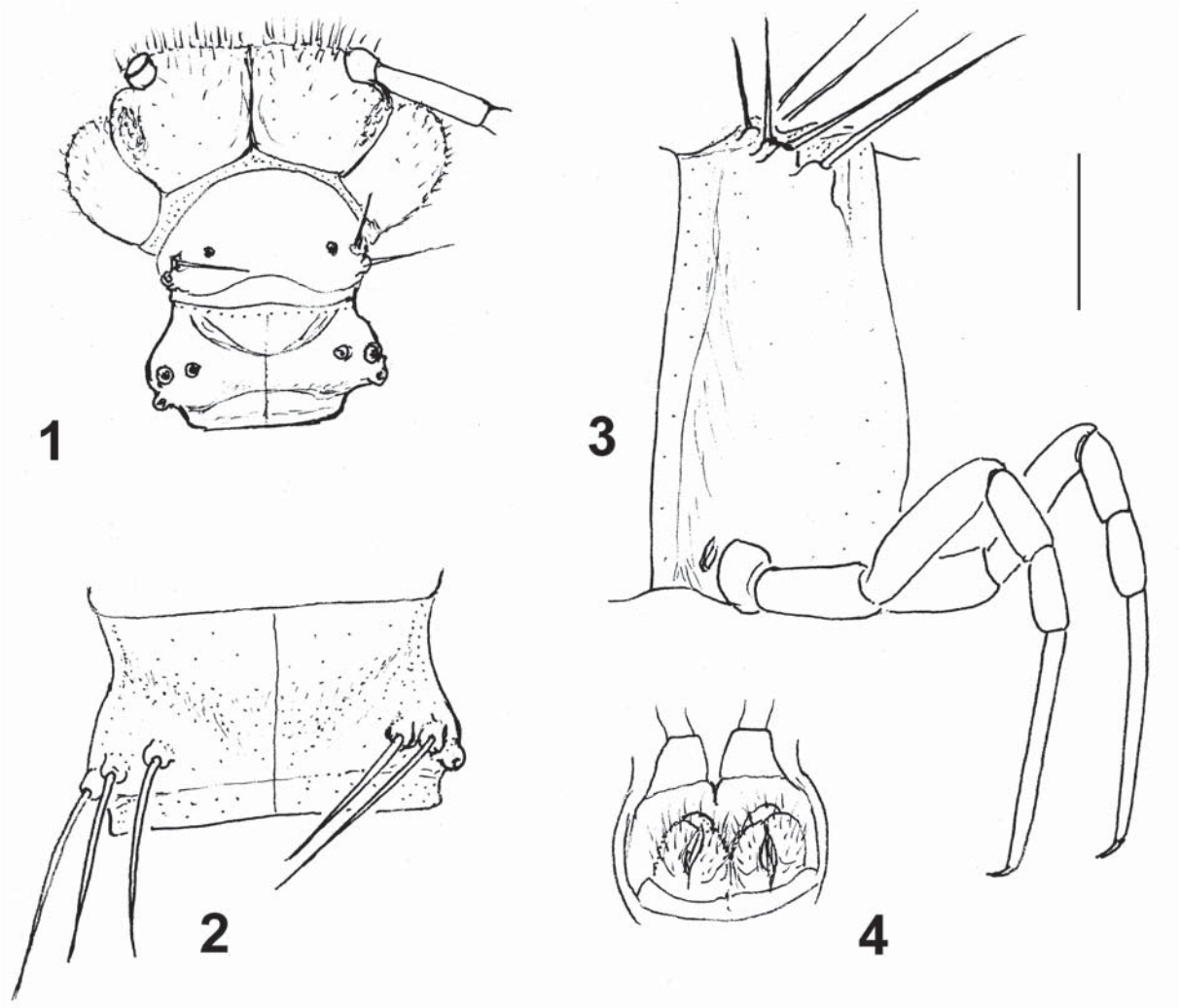
PARATYPES: 1 ♀, 1 juv. (28 segm.) (MNHN DB043), same data, together with holotype, 17.08.2004; 1 ♂, 1 ♀, 1 juv. (28 segm.) (MNHN DB043), same cave, No. 1591, 18.08.2006; 1 ♂, 2 ♀♀ (ZMUM), same cave, No. 1583, 18.08.2004; 1 ♀ (MNHN DB043), same cave, No. 1593, 18.08.2004; 1 juv. (28 segm.) (MNHN DB043), same county, Cave Black Wind, No. 1565, 16.08.2004, all leg. J. Lips.

NAME. To emphasize the similarities with *N. grandis* Golovatch, Geoffroy & Mauriès, 2006.

DIAGNOSIS. Differs from most congeners by the particularly large size, as well as certain details of leg and gonopod structure. The new species seems to be particularly similar to *N. grandis*, but differs well in the strong colpocoxites lacking both psedosegmented head-like structures on top and flagella with simple pilosity.

DESCRIPTION. Length of adults *ca* 38–40 mm (♂, ♀), maximum width 3.0 (♂) to 3.1 mm (♀). Holotype ca 40 mm long and 3.0 mm wide. Subadults *ca* 30 mm long and 2.7 mm wide. Coloration entirely pallid to light yellowish (Figs 11–13).

Head width = segment 6 = 22 >> collum > segment 2 > 3 > 5 < 7; after segment 22 or 23, body very gradually tapering toward telson.



Figs 1–4. *Nepalella grandoides* sp.n., ♂ (1–3) & ♀ (4) paratypes: 1 — anterior body portion, dorsal view; 2 & 3 — segment 15, dorsal and lateral views, respectively; 4 — vulvae behind coxae 2 *in situ*, ventral view. Scale bar: 1.0 mm.

Рис. 1–4. *Nepalella grandoides* sp.n., паратипы ♂ (1–3) и ♀ (4): 1 — передняя часть тела, вид сверху; 2 и 3 — сегмент 15, соответственно сверху и сбоку; 4 — вульвы позади тазиков 2 *in situ*, вид снизу. Масштаб: 1,0 мм.

Body with 30 segments. Head densely setose, clypeolabral region slightly convex, relatively narrow, with three usual anteromedian teeth. Eye patches subtriangular, each composed of *ca* 10–15 rather convex but entirely pallid ocelli (up to 1+3+3+4+3+2 in five rows from below toward vertex in ♂). Antennae extremely long and slender (Fig. 5), reaching beyond (♂) or midway (♀, subadult) body segment 5 dorsally. Gnathochilarium without promentum.

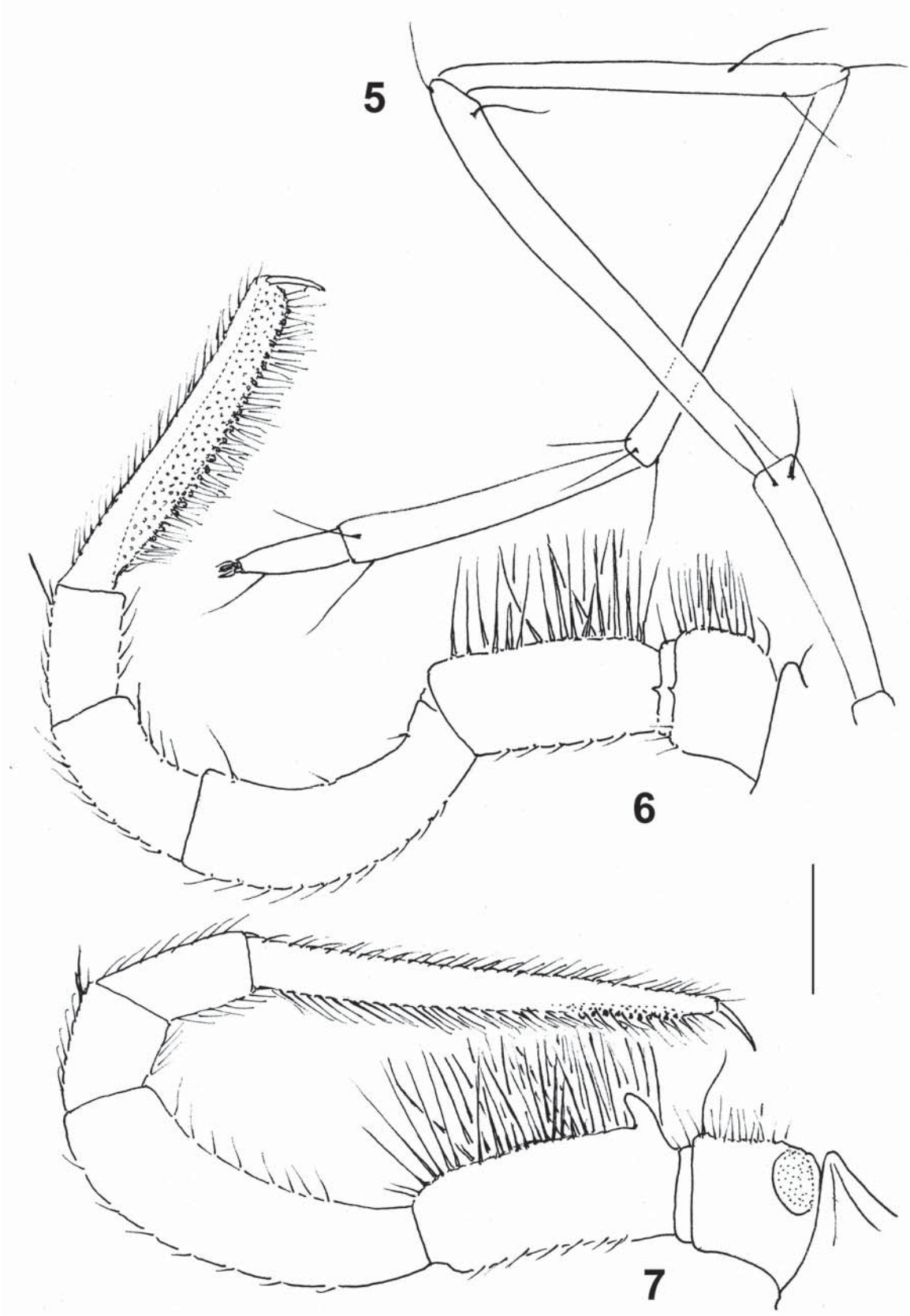
Collum usual, obcordate in shape, with rudimentary paraterga (Fig. 1). Tegument smooth, shining, translucid, only prozona distinctly and densely striolate transversely. Metatergal setation 3+3, typical, macrochaetae very long, rather thick but pointed, positioned on clear knobs; stricture between pro- and metazona very shallow, inconspicuous (Figs 2 & 3).

Paraterga rather small dorsolateral swellings/shoulders, not set off by peritremata, rather regularly rounded in dorsal view, only more abruptly so after caudal corner (Fig. 2).

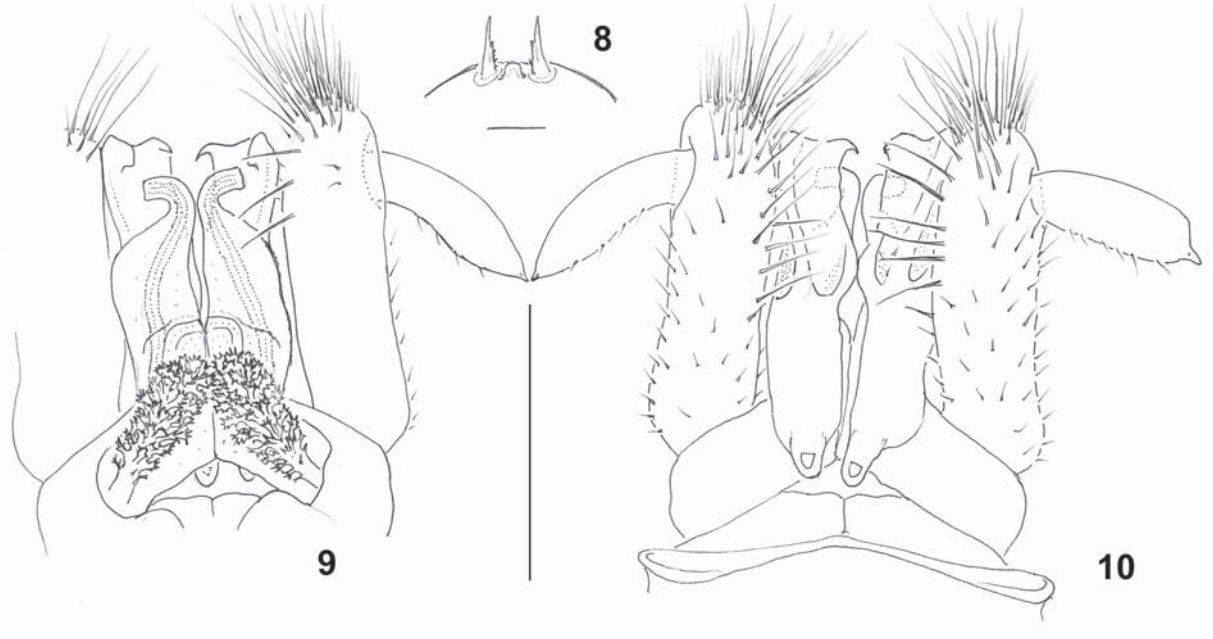
Macrochaetal index CIX (15) (i.e. distance between exterior and median macrochaetae divided by distance between interior and median macrochaetae) = 0.67. Median index MIX (15) (i.e. distance between interior macrochaeta and axial suture divided by distance between interior and median macrochaetae) = 2.44. The macrochaetal angle formed between the arm from the median and exterior macrochaetae and that between the median and interior macrochaetae, MA (15) = *ca* 165°. Paratergal index PIX impossible to evaluate as paraterga too poorly developed.

Axial suture lineiform, rather indistinct; ♂ segment 7 only very slightly broader than adjacent ones, pleurite evenly rounded, without ventral apophyses. Limbus barely visible, microdentate, traceable only near pleurites ventrolaterally.

Legs very long and slender, slightly longer in ♂ than in ♀ or subadult, *ca* 1.8 times as long as midbody height. Legs 1 and 2 slightly reduced as usual, tarsi with usual ventral brushes, but without papillae; ♂ coxa 2 with a distomediocaudal cone perforated by gonopore orifice. All tarsi very slightly bulging immediately at base (Figs 6 & 7). ♂ legs 3–7 increasingly incrassate, each conspicuously pilose and



Figs 5–7. *Nepalella grandoides* sp.n., ♂ paratype: 5 — antenna; 6 — leg 7; 7 — leg 10. Scale bar: 0.5 mm.
Рис. 5–7. *Nepalella grandoides* sp.n., паратип ♂: 5 — антенна; 6 — нога 7; 7 — нога 10. Масштаб: 0,5 мм.



Figs 8–10. *Nepalella grandoides* sp.n., ♂ paratype: 8 — anterior gonopods; 9 & 10 — posterior gonopods, caudal and front views, respectively. Scale bar: 0.5 mm.

Рис. 8–10. *Nepalella grandoides* sp.n., паратип ♂: 8 — передние гоноподы; 9 и 10 — задние гоноподы, соответственно сзади и спереди. Масштаб: 0,5 мм.

papillate over caudal face of distoventral third (Fig. 6). ♂ legs 10 and 11 subequal, each with coxal glands and tarsal papillae, latter barely traceable in distal part; prefemur conspicuously setose medially and with a small but evident process medially at base (Fig. 7). Claws invariably long, sabre-shaped, simple.

Anterior gonopods (leg-pair 8) as usual very strongly reduced, sternum with a median protuberance, coxites spike-like, very delicately serrate medially (Fig. 8).

Posterior gonopods (leg-pair 9) hypertrophied (Figs 9 & 10). Coxite bases on caudal face with two large and elongate bulges on stalks, beset with minute plumose setae. Colpocoxites prominent, about as high as telopodites, not pseudosegmented; front face basally with a pair of socket-shaped structures for anterior gonopod coxites to hinge into; distal part plate-shaped, terminally equipped with a median tooth and a lateral lobule, delimited from sigmoid solenomeres at about distal 1/3 on caudal face, at midway by the onset of two ridges on front face; caudal face devoid of flagella with simple pilosity. Telopoditomere 1 more strongly setose on front face, telopoditomere 2 with a vestigial segment apically.

Vulva (Fig. 4) rather short, simple, roundish in shape, densely pilose; operculum rounded at tip, a little higher than bursa, devoid of a receptacle outgrowth.

REMARKS. *N. grandoides* sp.n. is amongst the largest species in the order Chordeumatida, and certainly one of the largest in *Nepalella*. This can also be associated with cave gigantism, as this animal is definitely troglobitic, showing such typical troglomorphisms as unpigmented ocelli and tegument, extremely long legs and antennae (Figs 11–13). The number of ocelli per eye patch seems also to be reduced. However, because very long and slender antennae are characteristic of many, often definitely epigeic congeners, their value as a troglomorphic trait is highly limited.

This genus is well-defined and has hitherto been known to comprise 22 species or subspecies from Nepal (10), Thailand (2), Myanmar (2), Vietnam (1) and southern China (7), all keyed [Golovatch et al., 2006]. With the addition of another new congener from Chinese caves, *Nepalella* can well be regarded as one of the most species-rich diplopod genera in the entire Oriental realm.

Nepalella marmorata Golovatch, Geoffroy & Mauriès, 2006

MATERIAL. 1 ♂ (MNHN DB21), China, Sichuan Prov., Xin Long County, Cave Three Eyes (Trois Yeux) (AKL), No. 1406, 29.07.2004, leg. J. Lips.

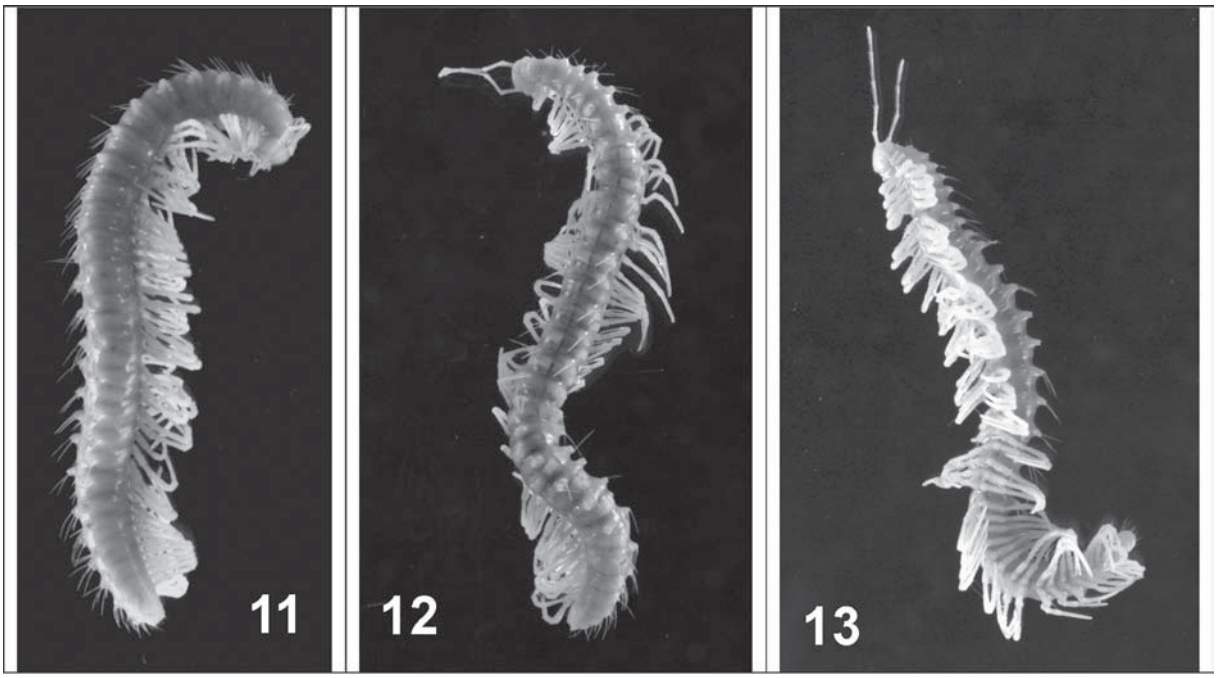
REMARKS. This apparently troglophilic species has been described from a neighbouring cave in the same county [Golovatch et al., 2006]. The male at hand is slightly less strongly pigmented than the types, its body being pale yellow, but the ocelli black, and the vertex marbled pinkish.

Family Kashmireumatidae

Lipseuma bernardi Golovatch, Geoffroy & Mauriès, 2006

MATERIAL. 2 ♂♂, 1 ♀ (MNHN DB21), 1 ♂, 1 ♀ (ZMUM), China, Sichuan Prov., Xin Long County, Cave Three Eyes (Trois Yeux) (AKL), No. 1406, 29.07.2004, leg. J. Lips.

REMARKS. Eventually this material is strictly topotypic, while the species is certainly troglobitic [Golovatch et al., 2006].



Figs 11–13. Habitus of *Nepalella grandoides* sp.n., ♀, ♀ & ♂ paratypes, respectively. Without scale.
Рис. 11–13. Внешний вид *Nepalella grandoides* sp.n., соответственно паратипы ♀, ♀ & ♂. Без масштаба.

Order Polydesmida
Family Polydesmidae

Pacidesmus superdraco **sp.n.**
Figs 14–26.

HOLOTYPE ♂ (MNHN JC307), China, southern Guizhou Prov., Libo County, Jia Ban, Cave Lai Tai Dong, 16.05.1995, leg. P. Trontelj.

PARATYPES: 2 ♀♀, 2 juv. (19 segm.) (MNHN JC307), same data, together with holotype, 16.05.1995, leg. P. Trontelj.

NAME. To emphasize the especially large and strongly elevated paraterga, coupled with the particularly evident troglomorphic traits, all resembling those of a Chinese mythic dragon.

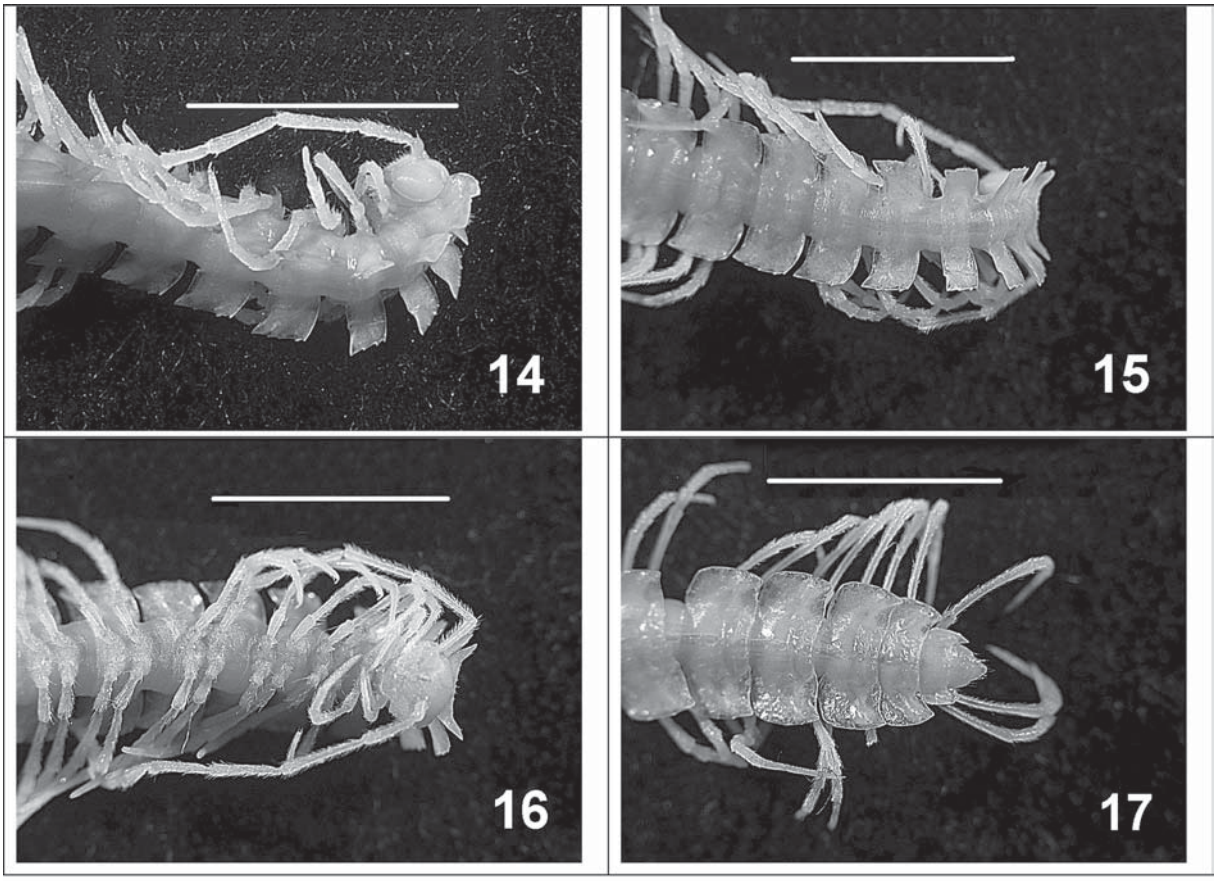
DIAGNOSIS. Differs from congeners by the especially large and strongly elevated paraterga with pointed caudal corners, the extremely long appendages, and the shape of the gonopod acropodite.

DESCRIPTION. Length of holotype about 28 mm, width of midbody pro- and metazona 1.4 and 2.8 mm, respectively. Paratypes *ca* 18 (subadults) to 30 mm long (adult ♀♀), width of midbody metazona in subadults 2.5 mm, of midbody pro- and metazona 1.6–1.7 and 3.1–3.2 mm, respectively (♀). Coloration entirely pallid.

Head usual, densely setose; genae roundly subquadrate; epicranial groove evident but shallow. Antennae (Figs 14–16 & 22) extremely long and slender, reaching beyond segment 5 dorsally; antennomeres 5 and 6 each with a distodorsal field of minute bacilliform sensilla; antennomere 7 dorsally with a small, but evident, claviform, transparent tubercle at base.

Body polydesmoid, with 20 segments. Collum considerably broader than head but narrower than increasingly broad segments 2–(5)6; with three indistinct transverse rows of very flat setigerous bosses; setae of front row slightly longer than others; paraterga broadly rounded anterolaterally, but pointed and acutangular posterolaterally, very strongly elevated above dorsum, devoid of evident indentations. Body parallel-sided on segments 6(7)–(16)17, thereafter abruptly tapering caudally. Paraterga of segment 2 likewise very strongly elevated and pointed posterolaterally, well surpassing rear tergal contour. Subsequent paraterga mostly also directed dorsolaterad, at least slightly projecting caudad beyond rear tergal contour, better so on pregonopodial and a few posteriormost segments, invariably pointed or nearly so posterolaterally, evidently elevated above dorsum until about segment 17 (♂) or 14(15) (♀), onward about level to dorsum until segment 18, subhorizontal and slightly below level of dorsum only on segment 19 (Figs 14–17). Tergal surface smooth, with three transverse setigerous rows of very flat bosses, forming a typical pattern (Figs 15 & 17); setae minute, very short, largely abraded. Prozona very finely shagreened, metazona below paraterga microgranulate. Stricture between pro- and metazona nearly smooth, only sides with extremely faint transverse striolations. Limbus microdenticulate. Pore-bearing paraterga with four, poreless paraterga with three, minute lateral incisions. Pore formula normal, ozopores lying entirely dorsally, at bottom of a lanceolate groove near lateral margin between two caudolateral incisions (Figs 20 & 21). Epiproct coniform (Figs 17–19), barely surpassing paraprocts caudally. Hypoproct semicircular, with a paramedian pair of long setae on distinct stalks caudomedially (Fig. 23).

A distinct pleurosternal flap-shaped crest present only on segment 2, thereafter totally wanting. Sterna evidently setose, but without modifications. Gonopod aperture obcordate, with a small rounded shelf caudomedially.



Figs 14–17. *Pacidesmus superdraco* sp.n., ♀ paratype: 14–16 — anterior body portion, lateral, dorsal and ventral views, respectively; 17 — caudal body portion, dorsal view. Scale bars: 5.0 mm.

Рис. 14–17. *Pacidesmus superdraco* sp.n., паратип ♀: 14–16 — передняя часть тела, соответственно виды сбоку, сверху и снизу; 17 — задняя часть тела, вид сверху. Масштаб: 5,0 мм.

Legs extremely long and slender (Figs 14–21 & 24), especially so in ♂ and towards caudal body end, even in ♀ at least 3 times as long as body height; telopodite devoid of sphaerotrichomes; claw rather long and slender, slightly curved (Fig. 24).

Gonopods (Figs 25 & 26) with typical, enlarged, subtriangular, medially fully coalesced coxae, each coxa bearing two macrosetae ventrally and a cannula dorsomedially. Telopodite elongate, relatively simple; acropodite (= branch lying distally of recurvature point of seminal groove) split into two unequal parts: a longer but rather stout, distally bifid endomere (**a**) and a shorter, lobuliform, laterally densely pilose exomere (**l**) crowned with a minute uncus. Accessory seminal chamber rather small, inconspicuous. Orifice of accessory seminal chamber placed on an inconspicuous pulvillus surrounded by dense pilosity.

Epigynal ridge low, slightly elevated and rounded only laterally. Vulvae usual, elongate, densely setose, with spiral canals at bottom of gutter.

REMARKS. The small Oriental genus *Pacidesmus* Golovatch, 1991 has only recently been reviewed [Golovatch & Geoffroy, 2006], and all three of its hitherto known species keyed: *P. shelleyi* Golovatch, 1991 (the type species, found epigeically in northern Thailand), *P. sinensis* (Golovatch & Hoffman, 1989) and *P. martensi* Golovatch & Geoffroy, 2006 (both latter species troglobitic in Guizhou Province, southern China). The fourth congener described here is also an undisputed troglobite from the very same Guizhou Province. All three cavernicoles from southern China form a distinct cluster of particularly closely related species differing mainly in the degree of development of paraterga and of troglomorphic traits, as well as in some minor details of gonopod structure. Since the new species seems to show a whole set of highly extreme adaptations to cavernicoly, at the moment it can be assumed as perhaps the most advanced member of *Pacidesmus*.

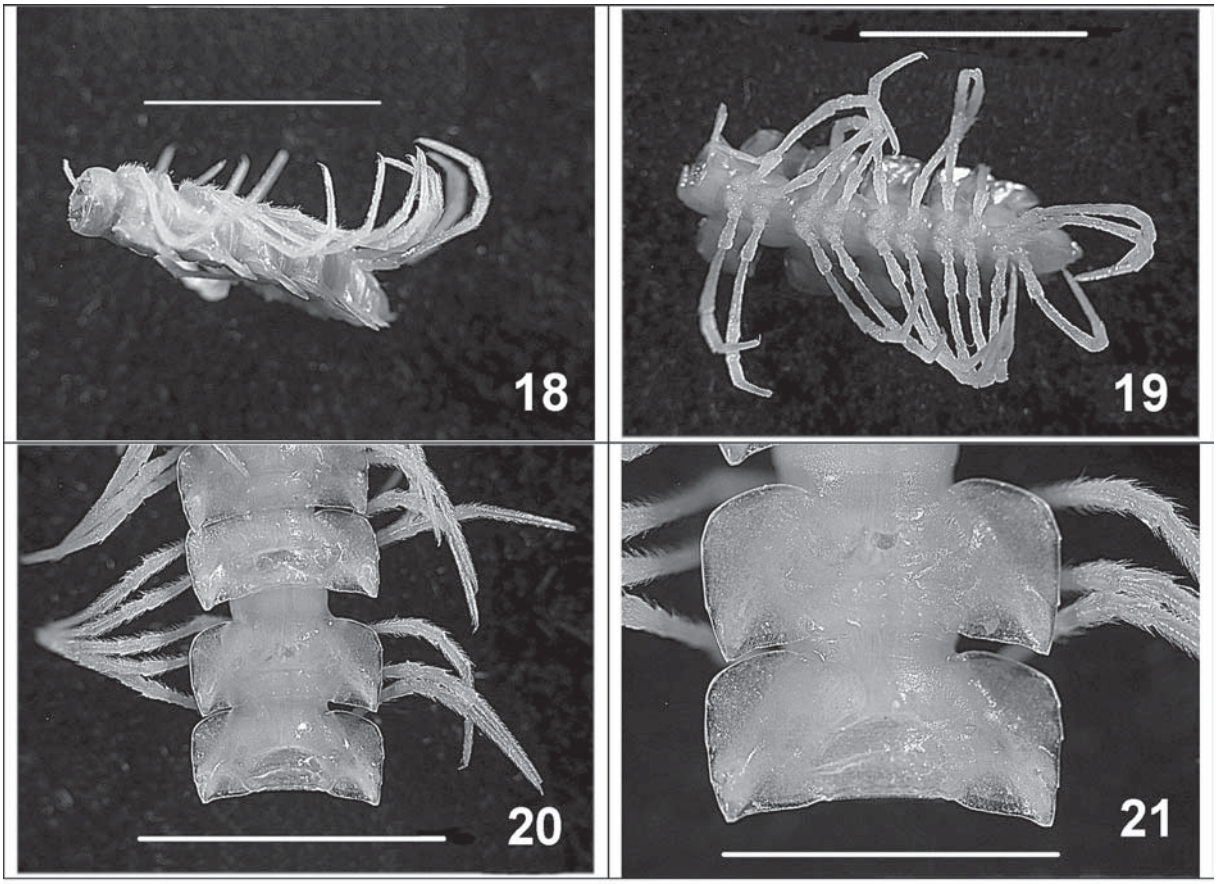
Pacidesmus martensi Golovatch & Geoffroy, 2006

MATERIAL. 1 ♂, 1 ♀ (MNHN JC306), China, Guizhou Prov., Qianxi County, town of Hong Lin, Cave Luo Sai Dong, 22.11.2003, leg. L. Latella & D. Avesani.

REMARKS. This likely troglobitic species has recently been described from two caves in Guizhou Province, China, including one in the environs of the town of Hong Lin [Golovatch & Geoffroy, 2006]. So the above sample can be regarded as near-topotypic.

Usbekodesmus varius Geoffroy & Golovatch, 2004

MATERIAL. 1 ♂ (MNHN JC302), China, Sichuan Prov., Xin Long County, Cave Monkey Kid, No. 380,



Figs 18–21. *Pacidesmus superdraco* sp.n., ♀ paratype: 18 — caudal body portion, lateral and ventral views, respectively; 20 & 21 — midbody segments, dorsal view. Scale bars: 5.0 (18–20) & 3.0 mm (21).

Рис. 18–21. *Pacidesmus superdraco* sp.n., паратип ♀: 18 — задняя часть тела, соответственно виды сбоку и снизу; 20 и 21 — среднетуловищные сегменты, вид сверху. Масштаб: 5,0 (18–20) и 3,0 мм (21).

04.08.1999; 1 ♂, 4 ♀, 2 juv. (MNHN JC302), same county, Cave Three Eyes (Trois Yeux) (AKL), No. 1406, 29.07.2004; 1 ♂, 1 ♀ (MNHN JC302), same cave, No. 1414, 29.07.2004; 2 ♂♂ (MNHN JC302), Cave Poisson à moustaches, No. 1471, 02.08.2004; 3 juv. (MNHN JC302), same cave, No. 1459, 02.08.2004; 2 ♂♂, 3 ♀♀, 6 juv. (MNHN JC302), same county, Cave Qiao Ping Dong, No. 1496, 03.08.2004; 1 ♀ (MNHN JC302), same county, Cave An Shui Ping 2, No. 1498, 04.08.2004; 2 ♀♀ (MNHN JC302), same cave, No. 1501, 04.08.2004; 1 ♀ (MNHN JC302), same county, Cave Yong Huo Xiao Dong, No. 1522, 04.08.2004, all leg. J. Lips.

REMARKS. The above material is in complete agreement with the original description [Geoffroy & Golovatch, 2004]. All of these samples can be considered as near-topotypic, with a few additional caves involved. The species seems to be troglophilic.

Epanerchodus stylotarseus Chen & Zhang, 1990
Fig. 27.

MATERIAL. 2 ♂♂, 1 ♀ (MNHN JC308), China, Guizhou Prov., Guanling County, town of Guajiang, Cave Yin Jia Dong 2 (Silver Armour Cave 2), upper fossil entrance, 04.08.2005, leg. D. Avesani & L. Latella. 1 ♀, 2 juv. (MNHN JC308), same locality, Cave San Ge Dong, 28.07.2005, leg. L. Latella & D. Avesani.

REMARKS. The above material is in good agreement with the original description by Chen & Zhang [1990]. This species has only been known from Cave Gan-zi in the Guanling Bouyeizu Miazu Autonomous County, Guizhou Province, China, while the new samples come from another two caves in the same county. A gonopod drawing is given here (Fig. 27) for comparative purposes.

Being pallid to slightly pigmented (yellowish to light brown), this species seems to only represent a troglophile.

ACKNOWLEDGEMENTS. This work only became possible through the support provided to the first author by the Muséum national d'Histoire naturelle, Paris. Josiane Lips (Villeurbanne, France), Leonardo Latella (Verona, Italy) and Boris Sket (Ljubljana, Slovenia) are deeply thanked for the precious material they offered for study and for donating it to the MNHN. Igor Muratov (Moscow) and Laurent Albenga (Paris) provided logistic help by taking the pictures.

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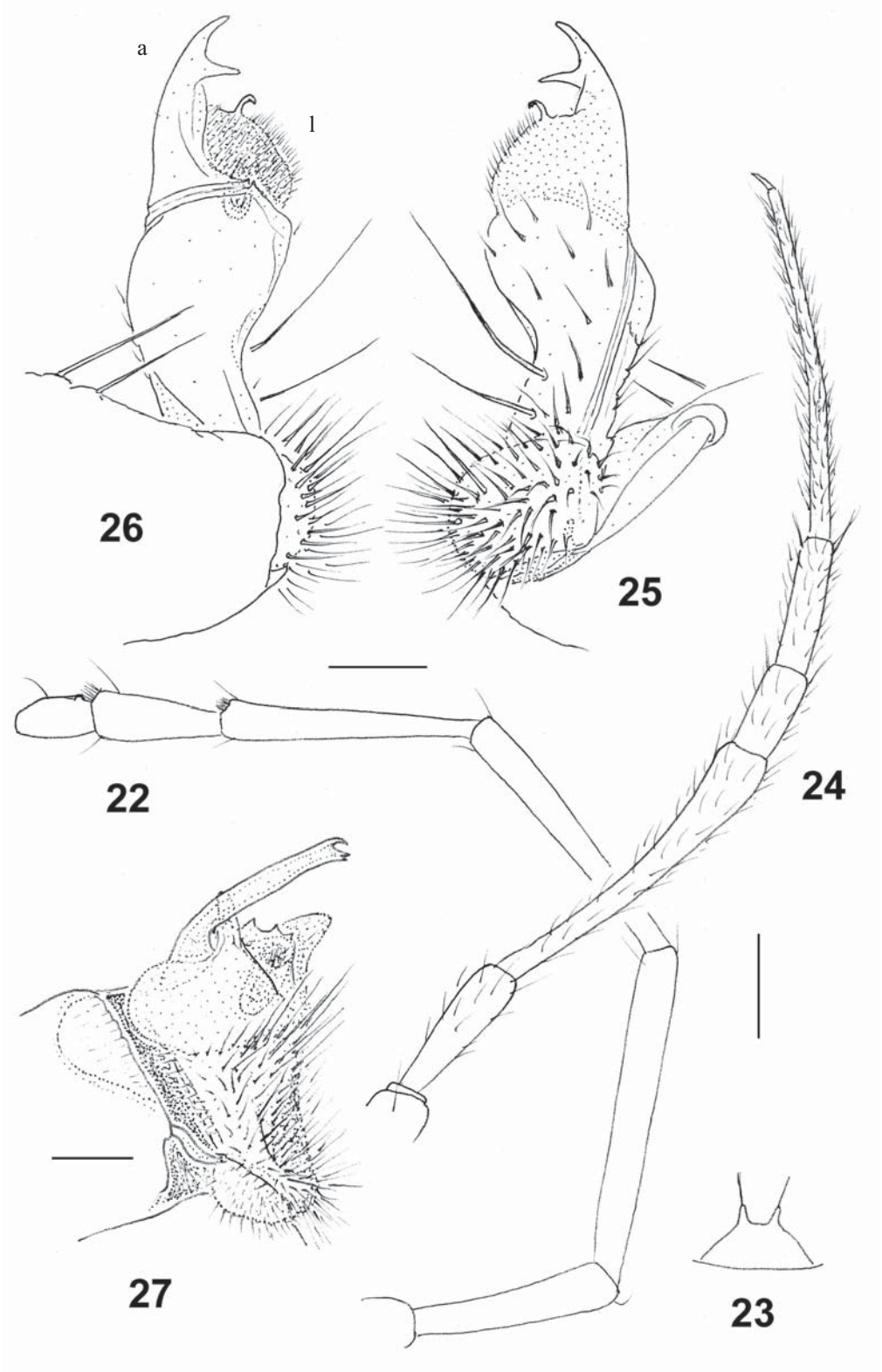

Figs 22–27. *Pacidesmus superdraco* sp.n., ♂ paratype (22–26) & *Epanerchodus stylotarseus* Chen & Zhang, 1990, ♂ (27): 22 — antenna; 23 — hypoproct, ventral view; 24 — leg 13; 25–27 — gonopod, mesal, lateral and mesal views, respectively. Scale bars: 0.5 (22 & 24), 0.2 (27) & 0.1 mm (23, 25 & 26).

Рис. 22–27. *Pacidesmus superdraco* sp.n., паратип ♂ (22–26) и *Epanerchodus stylotarseus* Chen & Zhang, 1990, ♂ (27): 22 — антенна; 23 — гипопрокт, вид снизу; 24 — нога 13; 25–27 — гонопод, соответственно изнутри, сбоку и изнутри. Масштаб: 0,5 (22 и 24), 0,2 (27) и 0,1 мм (23, 25 и 26).

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