

Four new Chordeumatida (Diplopoda) from caves in China

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ABSTRACT

Four new chordeumatid millipedes are described from southern Chinese caves. Two of these, *Nepalella grandis* n. sp. (troglobite) and *N. marmorata* n. sp. (troglophile), belong to the Oriental genus *Nepalella* Shear, 1979 (Megalotyliidae). They differ from congeners and each other in leg and gonopod structure, as well as the very large body size (*N. grandis* n. sp.) and male leg papillation (*N. marmorata* n. sp.). A key is given to all 22 currently known species of this genus. A further two are troglobites, placed in the new genus *Lipseuma* n. gen. (Kashmireumatidae): *Lipseuma josianae* n. gen., n. sp. (type species) and *Lipseuma bernardi* n. gen., n. sp. Both differ in body size, as well as certain details of leg and gonopod structure. Although the new genus shows particularly simple anterior and posterior gonopods, it is considered more advanced than the remaining two kashmireumatid genera, *Kashmireuma* Mauriès, 1982 and *Vieteuma* Golovatch, 1984.

KEY WORDS

Diplopoda,
Chordeumatida,
subterranean biology,
cave,
China,
new genus,
new species.

RÉSUMÉ

Quatre nouveaux Chordeumatida (Diplopoda) de grottes de Chine.

Quatre nouvelles espèces de diplopes chordeumatides sont décrites de grottes du sud de la Chine. Deux d'entre elles, *Nepalella grandis* n. sp. (troglobie) et *N. marmorata* n. sp. (troglophile), appartiennent au genre oriental *Nepalella* Shear, 1979 (Megalotyridae). Elles diffèrent entre elles et de leurs congénères par la structure morpho-anatomique des pattes et des gonopodes, ainsi que, pour l'une, par la très grande taille (*N. grandis* n. sp.) et, pour l'autre, par la présence de papilles sur les pattes des mâles (*N. marmorata* n. sp.). La description des nouvelles espèces est accompagnée d'une clé d'identification des 22 espèces constituant actuellement le genre. Deux autres espèces troglobies sont placées dans un genre nouveau, *Lipseuma* n. gen. (Kashmireumatidae): *Lipseuma josianae* n. gen., n. sp. (espèce type) et *L. bernardi* n. gen., n. sp. Toutes les deux se distinguent par la taille du corps, de même que par certains détails structuraux des pattes et des gonopodes. Bien que le nouveau genre soit caractérisé par des gonopodes antérieurs et postérieurs particulièrement simples, il est ici considéré comme plus évolué que les deux autres genres de la famille Kashmireumatidae, *Kashmireuma* Mauriès, 1982 and *Vieteuma* Golovatch, 1984.

MOTS CLÉS

Diplopoda,
Chordeumatida,
biologie souterraine,
grotte,
Chine,
nouveau genre,
espèces nouvelles.

INTRODUCTION

As noted recently elsewhere (Geoffroy & Golovatch 2004), China is perhaps the last great *terra incognita* for millipedes. The Chinese diplopod fauna as currently known comprises only 160 species (Wang & Mauriès 1996), whereas at least several times as many can be expected to occur there.

Because collections of cavernicolous Diplopoda from China have only relatively recently become available for study, only a small number of cave-dwelling millipede species have hitherto been recorded there. Although a fresh, but brief, review of the Chinese cavernicolous millipedes is available (Chen *et al.* 2003), it does not emphasize that the limited number of such diplopods known include some very unusual higher taxa. These are especially remarkable in the order Callipodida. Firstly, Zhang (1993) described *Sinocallipus simplipodicus* from a cave in Yunnan, and proposed the monobasic family Sinocallipodidae. A very similar species, if not the same, has since been encountered epigeically in Laos and is now considered to represent a suborder of its own, Sinocallipodidea, the basalmost in the order (Shear *et al.* 2003; Stoev unpubl. data).

Secondly, Wang & Zhang (1993a) described seven species in four genera, all from Yunnan caves, and all placed in a new family, Paracortinidae. This family continues to be recognized as valid, but the number of genera has since been reduced to one (Shear *et al.* 2003). Stoev (2004) has described a new troglobitic species of *Paracortina* Wang & Zhang, 1993 from two adjacent caves in southern Yunnan. Even more recently, the family Paracortinidae has been reviewed (Stoev & Geoffroy 2004), including the description of two cave-dwelling species from Yunnan, China and Thanh Hoa, Vietnam.

As regards the Polydesmida in Chinese caves, these concern three families, namely Polydesmidae, Doratodesmidae and Paradoxosomatidae, although the existing collections also contain several species of Opisotretidae. Loksa (1960) described not only two new monotypic genera of Cambalopsidae (order Spirostreptida) – although both were later synonymized (Mauriès & Nguyen Duy-Jacquemin 1997) – but also two polydesmidan species. One of these is currently referred to as *Pacidesmus sinensis* (Golovatch & Hoffman, 1989) (Polydesmidae) (Golovatch & Hoffman 1989; Golovatch 1991) and the other as *Desmoxytes longispina* (Loksa, 1960)

(Paradoxosomatidae) (Golovatch & Enghoff 1994), both from Guizhou Province and both troglophilic. More recently, Zhang & Chen (1983) then Chen & Zhang (1990) described two new species of the genus *Epanerchodus* Attems, 1901 (Polydesmidae), each from a cave in Guizhou and Zhejiang provinces. Three remarkable new monotypic genera of the family Doratodesmidae have been obtained from Yunnan caves (Wang & Zhang 1993b). Finally, three new *Epanerchodus*, including two presumed troglobites, and one new, presumably troglophilic species of *Usbekodesmus* Lohmander, 1933, have just been described from caves in southern China by Geoffroy & Golovatch (2004).

The first representatives of the millipede order Chordeumatida have only recently been recorded in China, with two of the seven currently known species being cavernicoles in the southern part of the country (Mauriès & Nguyen Duy-Jacquemin 1997; Shear 1999, 2002). These are *Vieteuma hubeiense* (nom. emend. pro *hubeiensis*) Mauriès & Nguyen Duy-Jacquemin, 1997 and *Nepalella caeca* Shear, 1999, both presumed troglobites (Chen *et al.* 2003).

ABBREVIATIONS

CIX	macrochaetal index (distance between exterior and median macrochaetae divided by distance between interior and median macrochaetae);
MA	macrochaetal angle (formed between the arm from the median and exterior macrochaetae and that between the median and interior macrochaetae);
MIX	median index (distance between interior macrochaeta and axial suture divided by distance between interior and median macrochaetae);
MNHN	Muséum national d'Histoire naturelle, Paris;
PIX	paratergal index;
ZMUM	Zoological Museum, State University of Moscow.

MATERIAL AND METHODS

The present paper treats the collection of Chordeumatida taken by Josiane and Bernard Lips (Villeurbanne, France) and their collaborators in 1999, during one of their numerous speleological

expeditions to southern China. Four new species have been found, all of which are described below. Furthermore, because two of these species prove to represent a new genus in a family which is among the basalmost in the Chordeumatida, this invites some evolutionary considerations.

Nearly all type material is housed in the MNHN, Collection Myriapodes (MNHN, with respective entry number); a single paratype has been deposited in the ZMUM.

The descriptions below follow the format recently proposed by Spelda (2001), with slight modifications by Golovatch & Wytwer (2003).

SYSTEMATICS

Family MEGALOTYLIDAE Golovatch
in Golovatch & Mikhajlova, 1978
Genus *Nepalella* Shear, 1979

Nepalella marmorata n. sp.
(Figs 1A-C; 2; 3A, B)

TYPE MATERIAL. — Holotype: China, Sichuan Prov., Xin Long County, Snake Mouth Cave, No. 389, 5.VIII.1999, leg. J. & B. Lips, ♂ (MNHN DB21). Paratypes: same locality, 1 ♂ (MNHN DB21); 1 ♂ (ZMUM).

ETYMOLOGY. — To emphasize the prevailing marbled, brown coloration.

DIAGNOSIS. — Differs from congeners by peculiar male tarsal papillation, as well as certain details of leg and gonopod structure.

DESCRIPTION

Length *c.* 32 mm, maximum width 2.8 mm. Coloration rather pale brown, largely marbled; head, antennae (except for a pallid tip), dorsum and metazona below paraterga being slightly darker brown, pattern becoming somewhat annulate. Legs usually paler. Eye patches blackish.

Head width = segment 4 >> collum > segment 2 > 3 < 5 < 6 = 20 < 7; after segment 20 or 21, body very gradually tapering toward telson.

Body with 30 segments (29 pleurotergites, or rings, in terms of Enghoff *et al.* 1993). Head densely setose, clypeolabral region slightly convex. Eye patches

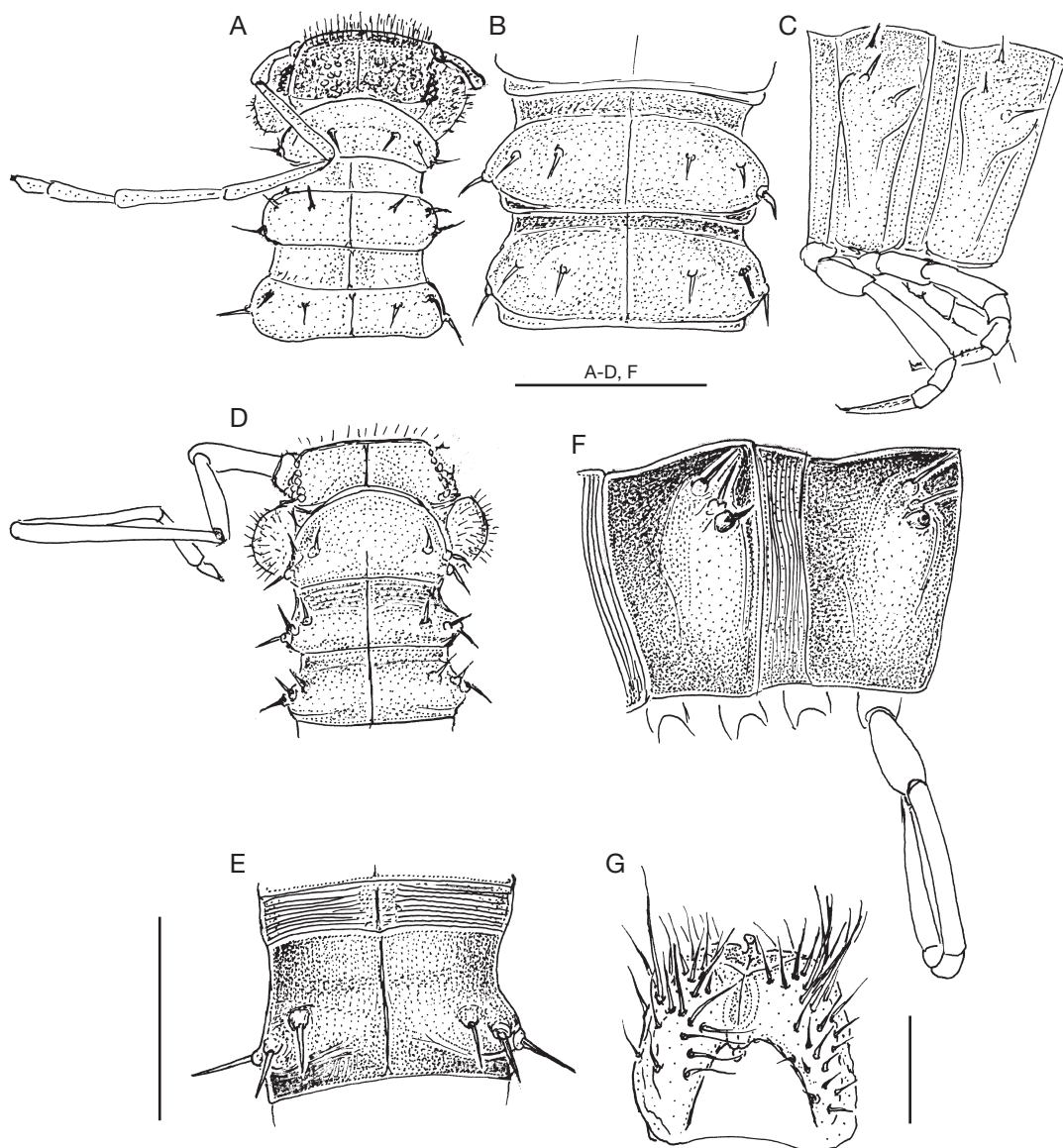


FIG. 1. — **A-C**, *Nepalella marmorata* n. sp., paratype ♂; **D-F**, *N. grandis* n. sp., paratype ♂; **G**, *N. grandis* n. sp., paratype ♀; **A, D**, anterior body end, dorsal view; **B, E**, midbody segments, dorsal view; **C, F**, same, lateral view; **G**, vulva, front view. Scale bars: A-F, 2.0 mm; G, 0.4 mm.

triangular, each composed of 15-17 convex ocelli. Antennae very long and slender (Figs 1A; 2A), reaching beyond body segment 5 dorsally; antennomere 7 with a peculiar flattened seta dorsally in distal third. Gnathochilarium without promentum (Fig. 2B).

Collum usual, obcordate in shape, with rudimentary paraterga (Fig. 1A). Tegument smooth, shining, only prozona distinctly and densely striolate transversely. Metatergal setation 3 + 3, typical, macrochaetae short, rather thick but pointed, positioned on

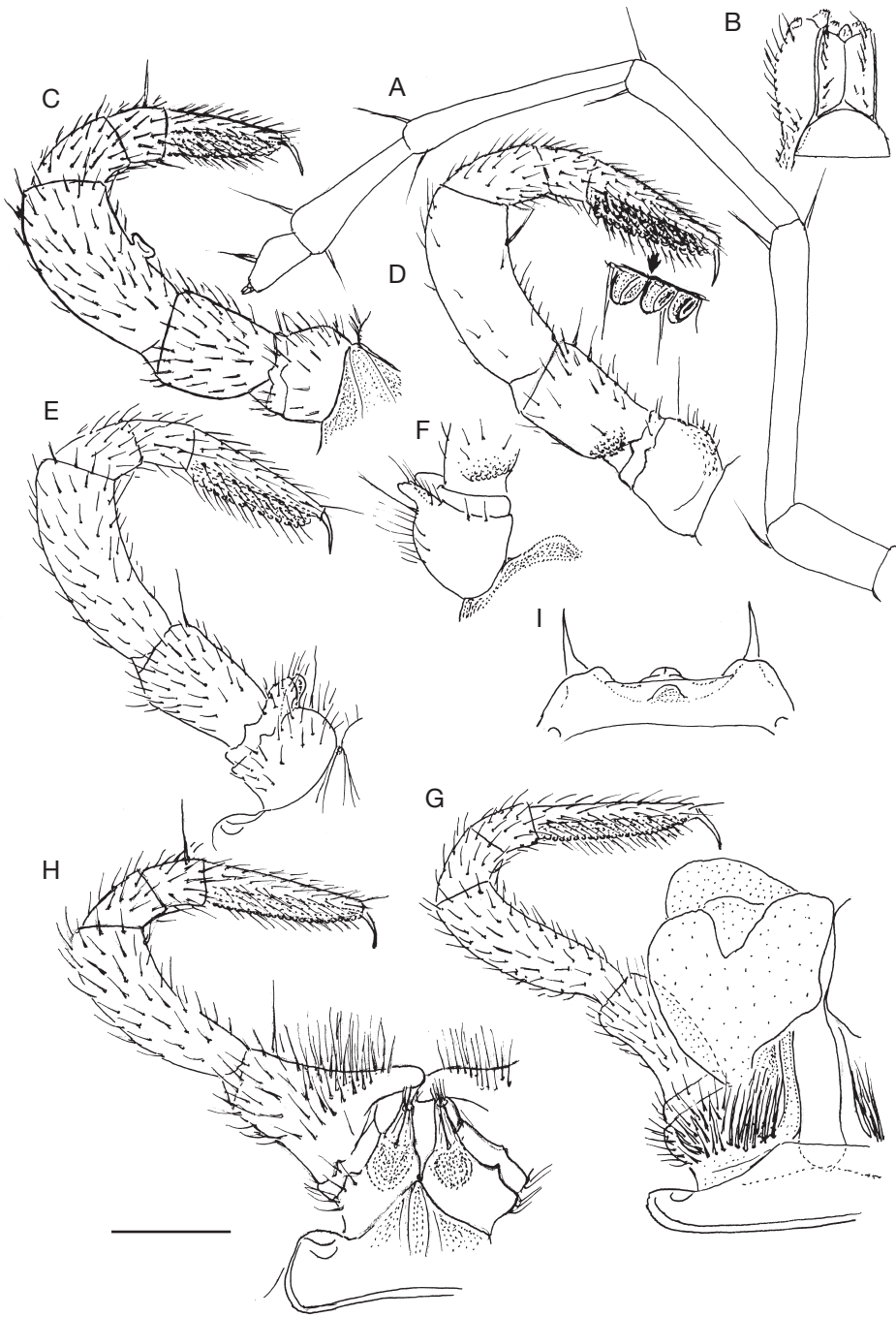


FIG. 2. — *Nepalella marmorata* n. sp., paratype ♂: **A**, antenna; **B**, gnathochilarium, ventral view; **C**, leg 4, front view; **D**, leg 5, caudal view; **E**, leg 7, front view; **F**, coxa 7, caudal view; **G**, leg 10, front view; **H**, leg 11, front view; **I**, anterior gonopods (leg-pair 8), front view. Scale bar: 0.8 mm.

minute knobs; stricture between pro- and metazona shallow, inconspicuous (Fig. 1A-C).

Paraterga small dorsolateral swellings/shoulders, not set off by peritremata, rather regularly rounded in dorsal view (Fig. 1A-C).

CIX (15) = 0.58; MIX (15) = 1.26; MA (15) \approx 160°; PIX (15) impossible to evaluate due to insufficiently developed paraterga.

Axial suture distinct, pallid, usual; segment 7 only very slightly broader than adjacent ones, conspicuous due to slightly upturned, ridge-like pleural arches, without ventral apophyses. Limbus regularly microdentate, quite distinct ventrolaterally; similar minute denticles covering entire surface of pleural ridges.

Legs long and slender, slightly longer in male, *c.* 1.4 times as long as midbody height. Legs 1 and 2 slightly reduced as usual, tarsi with usual brushes but without papillae; coxa 2 perforated by gonopore orifice. All subsequent legs conspicuously papillate over caudal face of ventral half (Fig. 2C-E, G, H). Legs 3-7 distinctly incrassate, pairs 3 and 4 particularly so. Femora 3 and 4 each with a small but evident mushroom-like protuberance at midway ventrally (Fig. 2C). Coxae 5-7 microgranulate ventrally, prefemora 5-7 each with a microgranulate bulge dorso-parabasally (Fig. 2D). Coxa 7 and trochanter 7 with a distoventral digitiform outgrowth (Fig. 2E, F). Legs 10 and 11 with coxal glands; coxae 10 conspicuously enlarged and setose (Fig. 2G); each coxa 11 with a large, apically pilose, coniform funnel with a long parabasal seta on front face; prefemur 11 with a strong parabasal process ventrally (Fig. 1H). Claws invariably long, sabre-shaped, simple.

Anterior gonopods (leg-pair 8) as usual very strongly reduced, sternum with a median and a lateral lobule, coxites spike-like (Fig. 2I).

Posterior gonopods (leg-pair 9) hypertrophied (Fig. 3A, B), with two ear-shaped folds at base on front face of colpocoxites and two highly conspicuous, extremely ramified, plumose, fimbriate, bush-like structures at base on caudal face; colpocoxites prominent, about as high as telopodites, with three longitudinal lamellae on caudal face, median lamella micropilose; telopoditome 1 particularly strongly setose on posterior face,

telopoditome 2 infusate and with a vestigial segment apically.

REMARKS

Nepalella marmorata n. sp. differs from the similarly large and brown *N. magna* Shear, 2002 – the only congener based on females (Shear 2002), and also coming from southern China (Yunnan) – primarily in the lesser number of ocelli per eye patch (15-17 versus 25). Regrettably, no material of the opposite sex of either species is available to reveal further differences (see also Key below).

Based on the clearly pigmented body and ocelli, *N. marmorata* n. sp. seems to be only a troglophile.

Nepalella grandis n. sp. (Figs 1D-G; 4)

TYPE MATERIAL. — Holotype: China, Yunnan Prov., Zheng Xiong County, Cave Bai Yin Dong, Nos. 523 & 524, 18.VIII.1999, leg. J. & B. Lips, ♂ (MNHN DB42). Paratypes: same locality, 1 ♂ (MNHN DB42); 1 ♀ (MNHN DB42); 1 ♀ (MNHN DB42); 6 juvs (MNHN DB42).

ETYMOLOGY. — To emphasize the particularly large size.

DIAGNOSIS. — Differs from congeners by the particularly large size, as well as certain details of leg and gonopod structure. The unusually strong colpocoxites, surmounted by a pseudosegmented head-like structure, also make *N. grandis* n. sp. easily distinguishable.

DESCRIPTION

Length *c.* 40 (♂) to 42 mm (♀), maximum width 2.8 (♂) to 2.9-3.0 mm (♀). Coloration entirely pallid.

Head width = segment 6 = 20 >> collum > segment 2 > 3 > 5 < 7; after segment 20 or 21, body very gradually tapering toward telson.

Body with 30 segments. Head densely setose, clypeolabral region slightly convex. Eye patches triangular, each composed of 10 (♀) or 15 (♂) rather convex ocelli. Antennae extremely long and slender (Figs 1D; 4A), reaching beyond body segment 8 dorsally; antennomere 7 with a peculiar flattened seta dorsally in distal third. Gnathochilarium without promentum.

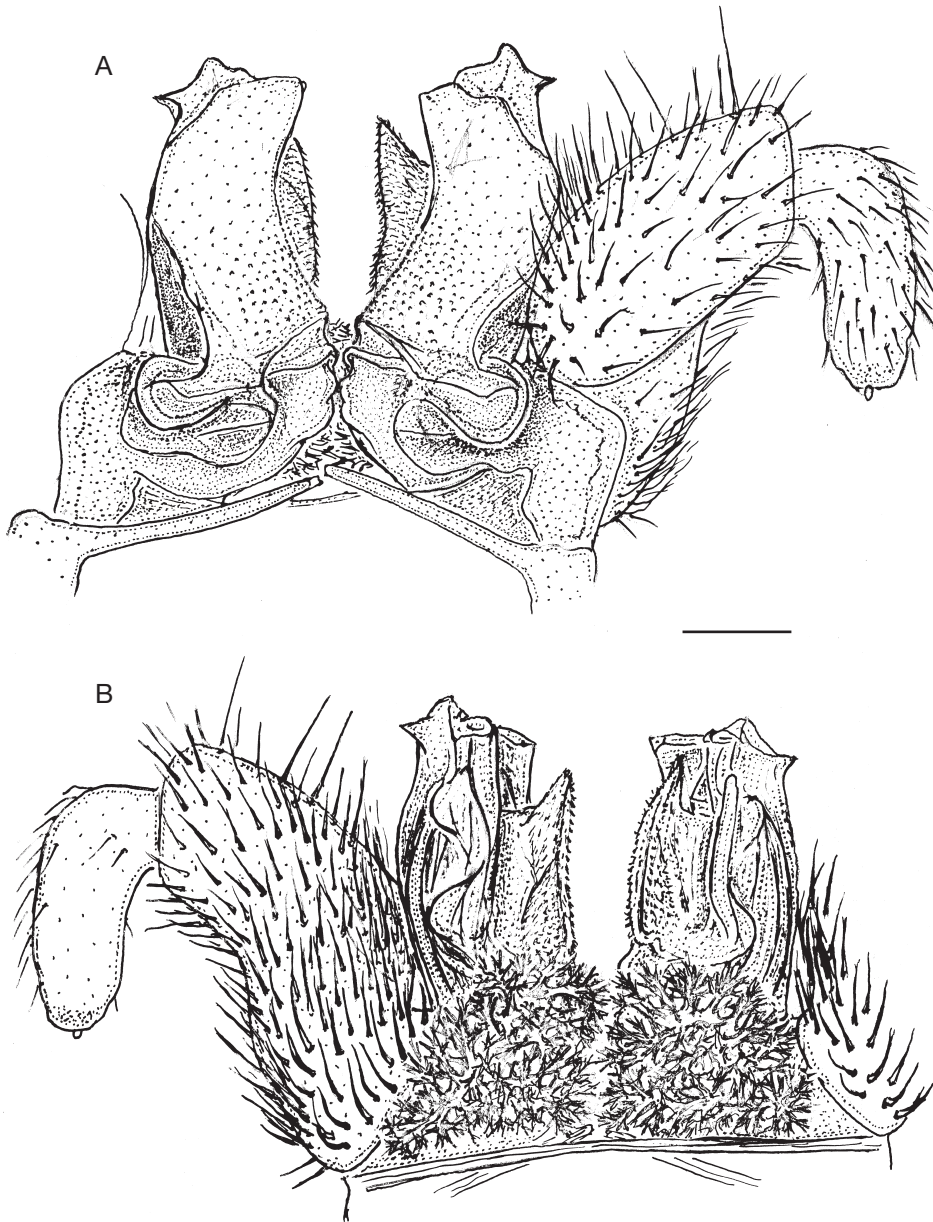


FIG. 3. — *Nepalella marmorata* n. sp., paratype ♂, posterior gonopods (leg-pair 9), front (A) and caudal (B) views, respectively. Scale bar: 0.4 mm.

Collum usual, obcordate in shape, with rudimentary paraterga (Fig. 1A). Tegument smooth, shining, translucent, only prozona distinctly and densely striolate transversely. Metatergal setation

3 + 3, typical, macrochaetae medium-sized, rather thick but pointed, positioned on minute knobs; stricture between pro- and metazona very shallow, inconspicuous (Fig. 1D-F).

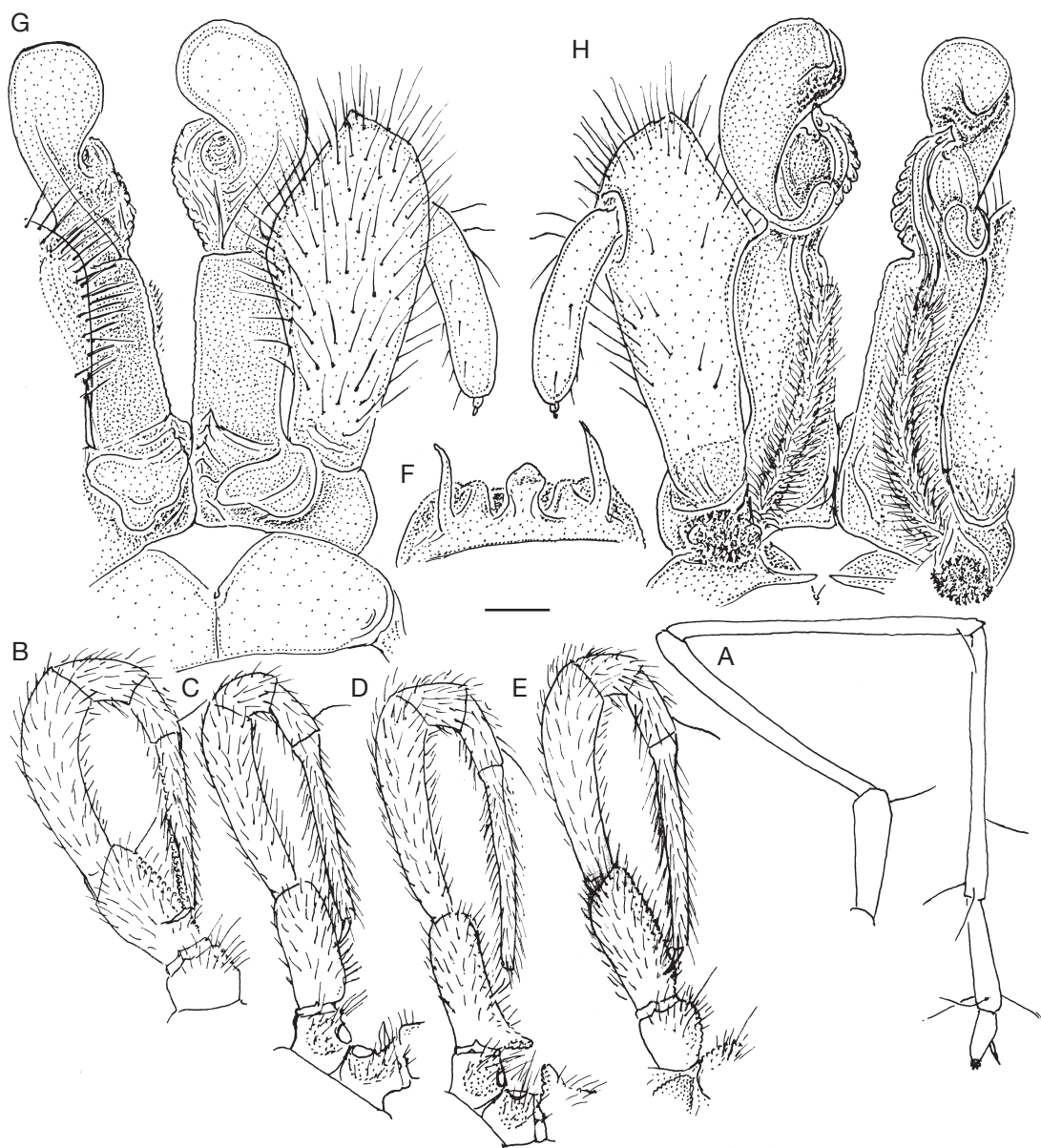


FIG. 4. — *Nepalella grandis* n. sp., paratype ♂: **A**, antenna; **B**, leg 7, caudal view; **C**, leg 10, front view; **D**, leg 11, front view; **E**, leg 12, front view; **F**, anterior gonopods (leg-pair 8), caudal view; **G**, **H**, posterior gonopods (leg-pair 9), front and caudal views, respectively. Scale bar: A-E, 0.8 mm; F-H, 0.4 mm.

Paraterga small dorsolateral swellings/shoulders, not set off by peritremata, rather regularly rounded in dorsal view, only more abruptly so after caudal corner (Fig. 1D-F).

CIX (15) = 0.46; MIX (15) = 2.08; MA (15) ≈ 165°; PIX impossible to evaluate as paraterga too poorly developed.

Axial suture distinct, usual; segment 7 only very

slightly broader than adjacent ones, conspicuous due to a clearly visible and frontally projecting anterior lobe of pleurite, latter without ventral apophyses. Limbus barely visible, microdentate, traceable only near pleurites ventrolaterally.

Legs very long and slender, slightly longer in males than in females, *c.* 1.8 times as long as midbody height. Legs 1 and 2 slightly reduced as usual, tarsi with usual ventral brushes, but without papillae; male coxa 2 perforated by gonopore orifice. All tarsi slightly bulging immediately at base, male prefemora microgranulate ventrally (Fig. 4E). Male legs 3-7 somewhat incrassate, pairs 3 and 4 especially so, each conspicuously papillate over caudal face of disto-ventral third (Fig. 4B). Male legs 10 and 11 with coxal glands; prefemur 10 conspicuously enlarged at base (Fig. 4C); prefemur 11 with a strong, microgranulate, parabasal process ventrally (Fig. 4D). Claws invariably long, sabre-shaped, simple.

Anterior gonopods (leg-pair 8) as usual very strongly reduced, sternum with a median protuberance and two lateral lobules, coxites spike-like (Fig. 4F).

Posterior gonopods (leg-pair 9) hypertrophied (Fig. 4G, H), with two ear-shaped folds at base on anterior face of colpocoxites and two large flagella beset with simple pilosity. Bases of coxite with two small, roundish bulges beset with minute plumose setae on caudal face. Colpocoxites especially prominent, higher than telopodites, distal one-third gently curved and directed distocaudally, delimited at base by a transverse sulcus on front face, with a relatively small, recurved, spoon-shaped process at base of caudal face, and an inner, gently ribbed lobe with a minute solenomere at tip. Telopoditomere 1

more strongly setose on front face, telopoditomere 2 with two vestigial segments apically.

Vulva (Fig. 1G) rather short, densely pilose, receptacle process on operculum small but evident, curved, digitiform, slender.

REMARKS

Nepalella grandis n. sp. is amongst the largest species in the order Chordeumatida, and certainly the largest in *Nepalella*. This can also be associated with cave gigantism, as this animal is definitely troglomorphic, showing such typical troglomorphisms as unpigmented ocelli and tegument, extremely long legs and antennae. The number of ocelli per eye patch is also reduced, especially in the female. 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 (Shear 2002) and has hitherto been known to comprise 20 species or subspecies from Nepal (10), Thailand (2), Myanmar (2), Vietnam (1) and southern China (5). The only previous key dealt with 14 of these (Mauriès 1988). With the addition of a further two congeners from Chinese caves, *Nepalella* can now be regarded as one of the most speciose genera among the oriental Chordeumatida. Considering all available descriptions (Shear 1979, 1987, 1999, 2002; Golovatch 1983; Mauriès 1988), the following refined and updated key to *Nepalella* species is proposed. This will hopefully encourage further work on this remarkable genus, in which many other new species undoubtedly remain to be discovered.

KEY TO THE SPECIES OF *NEPALELLA* SHEAR, 1979

1. Adults with 28 body segments (27 pleurotergites in terms of Enghoff *et al.* 1993)
 *N. phulcokia* Mauriès, 1988
- Adults with 30 body segments 2
2. Body length \geq 30 mm, width 2.8-3.0 mm 3
- Body length \leq 25 mm 5
3. Body particularly large, \geq 40 mm long; tegument and ocelli pallid; tergal macrochaetae medium-sized (Fig. 1D-F); troglomite from Yunnan Prov., China *N. grandis* n. sp.
- Body 30-33 mm long, tegument and ocelli distinctly pigmented; macrochaetae short (Fig. 1A-C) 4

4. Each eye patch with 15-17 ocelli; troglophile from Sichuan, China *N. marmorata* n. sp.
— Each eye patch with 25 ocelli; epigean in Yunnan, China *N. magna* Shear, 2002
5. Body tegument pallid, but eye patches and antennae pigmented; body 21-23 mm long, 2.6-2.7 mm wide due to paraterga being well developed, in the form of distinct dorsolateral keels; tergal setae long; male legs 3-7 not enlarged; Myanmar ... *N. pallida* Mauriès, 1988
— Body either entirely pallid (cavernicole) or distinctly pigmented; body width ≤ 2.3 mm, paraterga largely poorly developed, like indistinct dorsolateral swellings; tergal setae medium-sized at most; male legs 3-7 very often crassate 6
6. Body length ≥ 18 mm, width ≥ 1.9 mm; coloration uniformly brown, male coxa 10 without distinct processes 7
— Never all these three characters combined 8
7. Posterior gonopods (male legs 9) with colpocoxites divided distally into three branches; only male femur 4 with a rounded gibbosity ventrally; Thailand
..... *N. taiensis* Mauriès, 1988 (*N. t. taiensis* and *N. t. inthanonae* Mauriès, 1988)
— Posterior gonopods (male legs 9) with colpocoxites not divided distally; male femora 3 and 4 each with a fungiform protuberance ventrally; Nepal *N. gunsa* Shear, 1987
8. Body entirely pallid; ocelli 9, reduced, only slightly pigmented and widely separated; male legs 3-7 not modified; cave in Guizhou Prov., China *N. caeca* Shear, 1999
— Body pigmented, ocelli dark and never reduced, > 20 in number, always forming a compact triangular eye patch on each side of head; male legs 3-7 most often crassate 9
9. Body *c.* 16 mm long and 2.2 mm wide due to relatively well developed, shoulder-shaped paraterga; male femur 4 with a distal knob subtending a distal depression on ventral side; Yunnan *N. griswoldi* Shear, 2002
— Body width usually ≤ 1.9 mm; paraterga modestly to poorly developed; male femur 4 either unmodified or otherwise modified 10
10. Tergal setae short and blunt; male legs 3-7 crassate, but without further modifications; posterior gonopod telopodite relatively strongly reduced, much shorter than colpocoxites; Yunnan *N. pianma* Shear, 2002
— Tergal setae short to medium-sized, but always acute; at least some of male legs 3-7 usually with modifications; telopodite of posterior gonopods hypertrophied, (sub)equal in height to colpocoxite 11
11. Body width 1.8-2.0 mm; male legs 3-7 with tarsal papillae and dorsally inflated prefemora; Yunnan *N. kavanaughii* Shear, 2002
— Body width usually ≤ 1.9 mm; tarsal papillae largely absent; male prefemora 3-7 not enlarged dorsally 12
12. Tarsal papillae present on most of male legs; male prefemur 11 with a long, digitiform, parabasal process; Vietnam *N. vietnamica* Golovatch, 1983
— Tarsal papillae absent; male prefemur 11 devoid of processes 13
13. Claw simple; male coxa 10 with a long process distoventrally; male 11 coxa at most with one small process distoventrally, usually devoid of any; Nepal 14
— Claw complex, with both a minute accessory claw dorsally and a long setoid filament ventrally at base; male coxae devoid of processes, somewhat reduced and fused with sternite into a coxosternum subtending voluminous coxal glands, male coxa 11 with two small processes distoventrally; Myanmar *N. birmanica* Mauriès, 1988

14. Coloration ochraceous, with four dark, brown, longitudinal stripes 15
 — General coloration ochraceous to brownish, with spots, or metazona dark 18
15. Colpocoxites of posterior gonopods divided into three branches or lobes 16
 — Colpocoxites of posterior gonopods poorly divided distally into only two short branches 17
16. Larger: 16-17 mm long, 1.8-1.9 mm wide; colpocoxite of posterior gonopods divided into three lobes; male coxa 10 with a C-shaped process ... *N. tragsindola* Mauriès, 1988
 — Smaller: 10-12 mm long, 1.0-1.3 mm wide; colpocoxite of posterior gonopods divided into two lobes and a slender acuminate branch (solenomere?); male coxa 10 with a coniform process topped by a rounded, microgranulate bulge ... *N. gairiensis* Mauriès, 1988
17. Larger: 17 mm long, 1.6 mm wide (♂); both branches of colpocoxite very short and erect; male coxa 10 with a bifid process *N. ringmoensis* Mauriès, 1988
 — Smaller: 11-14 mm long, 1.3-1.5 mm wide (♂, ♀); internal branch of colpocoxite directed medially; male coxa 10 with a subtruncate process *N. deharvengi* Mauriès, 1988
18. Male coxa 10 with a straight, apically truncate process; male prefemora 3-7 each with a distoventral knob; male coxa 11 without gland, but with a small distomedial process
 *N. thodunga* Shear, 1979
 — Male coxa 10 with a curved, apically acuminate process; male prefemora 3-7 either unmodified or only third and fourth with distoventral knobs; male coxa 11 at most with a small gland, devoid of any processes 19
19. Male coxa 10 with a strong unciform process directed caudally; male femora 3-7 each with a fungiform protuberance at midway ventrally *N. taplejunga* Shear, 1987
 — Male coxa 10 with process directed laterad; male femora 3-7 unmodified 20
20. Larger: *c.* 14 mm long, 1.4-1.5 mm wide; tergal setae medium-sized; male prefemora 3 and 4 with distoventral knobs *N. khumbua* Shear, 1979 (type species)
 — Smaller: *c.* 10 mm long, 1.0 mm wide; tergal setae short; male legs 3 and 4 without such modifications *N. jaljalae* Mauriès, 1988

Family KASHMIREUMATIDAE Mauriès, 1982

Genus *Lipseuma* n. gen.

TYPE SPECIES. — *Lipseuma josianae* n. sp.

ETYMOLOGY. — Dedicated to Josiane et Bernard Lips, -euma being a common generic end suffix in Chordeumatida. Gender neuter.

OTHER SPECIES INCLUDED. — *Lipseuma bernardi* n. sp.

DIAGNOSIS. — Differing from both other genera of Kashmireumatidae, *Kashmireuma* Mauriès, 1982 and *Vieteuma* Golovatch, 1984, as follows:

– a completely unpaired, undivided colpocoxite of anterior gonopods (male leg-pair 9) (versus paired, fully or partly independent in the other two genera);
 – posterior gonopods (male leg-pair 9) unusually simple, telopodite voluminous but 1-segmented (versus strongly

differentiated and 2-segmented, regardless of a vestigial segment 3 sometimes visible in the other two genera);
 – male legs 6 particularly strongly hypertrophied in relation to any other leg-pair (versus normal to moderately incrassate male legs 3-6(7) in the other two genera);
 – normal female legs 2 (versus normal or vestigial in the other two genera);
 – bursa of vulva particularly short and wide (versus elongate in the other two genera).

REMARKS

The small Oriental family Kashmireumatidae has hitherto been known from six species, three each in *Kashmireuma* (Himalayas of India and Nepal) and *Vieteuma* (Vietnam and southern China). With the addition of two species of *Lipseuma* n. gen., it becomes possible to better outline the genera included in the family.

Shear (2002) has recently provided a brief summary concerning the main traits distinguishing all six kashmireumatid species known to date. These are *Kashmireuma nielseni* Mauriès, 1982, from Kashmir, India; *K. schawalleri* Shear, 1987 and *K. nepalense* Mauriès, 1988 (nom. emend. pro *nepalensis*), both from Nepal; *Vieteuma topali* Golovatch, 1984, from North Vietnam; *V. hubeiense* Mauriès & Nguyen Duy-Jacquemin, 1997 (nom. emend. pro *hubeiensis*), a troglobite from Hubei Prov., China; and *V. longi* Shear, 2002, from Yunnan Prov., China (Mauriès 1982, 1988; Golovatch 1984; Shear 1987, 2002; Mauriès & Nguyen Duy-Jacquemin 1997). The main differences between *Kashmireuma* and *Vieteuma* are as follows:

- *Vieteuma* has the posterior gonopods placed on a thick plate-like sternum, but telopoditomere 1 is very strongly modified, supplied with conspicuous lobes/outgrowths, versus sternite almost absent medially, but telopoditomere 1 only slightly modified in *Kashmireuma*;
- *Vieteuma* has 26 or 28 body segments, versus 28 in *Kashmireuma*;
- *Vieteuma* has female legs 2 normal or vestigial, versus vestigial in *Kashmireuma*.

As one can see, the above distinctions are relatively shaky, with only the posterior gonopod structure so far serving to reliably separate these still oligotypic genera. When more kashmireumatids become known, it is possible that *Vieteuma* will have to be sunk as a synonym of *Kashmireuma*.

The characters distinguishing *Lipseuma* n. gen. appear to be much stronger, especially the unusually simple anterior and posterior gonopods. In fact these are the simplest among the Chordeumatida. However, in no way can *Lipseuma* n. gen. be regarded as basal within the family in relation to *Kashmireuma* and *Vieteuma*. The gonopods of *Lipseuma* n. gen. species are simple, but the new genus itself is evolutionarily advanced. This situation resembles that observed in the North American genus *Pseudotremia* Cope, 1869, in which several species highly troglomorphic in body form show strongly simplified gonopods. The simplification results most probably because of isolation in caves, which removes any selective pressure. Indeed, the anterior gonopods of *Lipseuma* n. gen. species show a

complete fusion of the colpocoxites, these being fused only partly (parabasally) in *Kashmireuma nepalense* and entirely free in the other species of the family. Further apomorphies of *Lipseuma* n. gen. include telopoditomere 2 of the posterior gonopods being totally suppressed, and the vulvae very strongly transverse. The same holds for the hypertrophied and very special male legs 6, which apparently serve the male as claspers during copulation.

Lipseuma josianae n. sp.
(Figs 5; 6)

TYPE MATERIAL. — Holotype: China, Hubei Prov., Bangqiao County, Cave Chuan Dong Zi, Nos. 482, 485, 494, 9.VIII.1999, leg. J. & B. Lips, ♂ (MNHN DA155). Paratypes: same locality, 1 ♂ (MNHN DA155); 1 ♂, 2 juvs (MNHN DA155); ♀ (MNHN DA155); 2 juvs (MNHN DA155).

ETYMOLOGY. — To honour Josiane Lips.

DIAGNOSIS. — Differs from the only congener (*L. bernardi* n. gen., n. sp.) by the slightly larger size, as well as in certain details of leg and gonopod structure.

DESCRIPTION

Length 9.3–9.8 (♂) to 10.1 mm (♀); width of midbody segments, 0.75–0.8 (♂) to 0.9 mm (♀), maximum width of head, 0.95 mm (holotype). Vertical diameter of midbody segments, 0.75 (♂) to 0.88 mm (♀). Coloration entirely pallid.

Head width \gg collum $>$ segment 2 $>$ 3 $>$ 4 $>$ 5 $>$ 6 $>$ 7 $>$ 8 $>$ segment 9 = 18; thereafter body very gradually tapering toward telson.

Body with 28 segments (46 leg-pairs). Head sparsely setose, clypeolabral region slightly convex. Eyes completely reduced. Antennae very long and slender (Figs 5A; 6C), reaching beyond body segment 6 (♂) or 5 (♀) dorsally; antennomere 7 with a peculiar flattened seta dorsally in distal third; antennomere 8 with four unusually long and slender sensory cones. Gnathochilarium without pronotum.

Collum usual, obcordate in shape, with rudimentary paraterga. Tegument smooth, modestly shining, non-areolated, translucent. Metatergal setation 3 + 3, typical, macrochaetae very long, pointed,

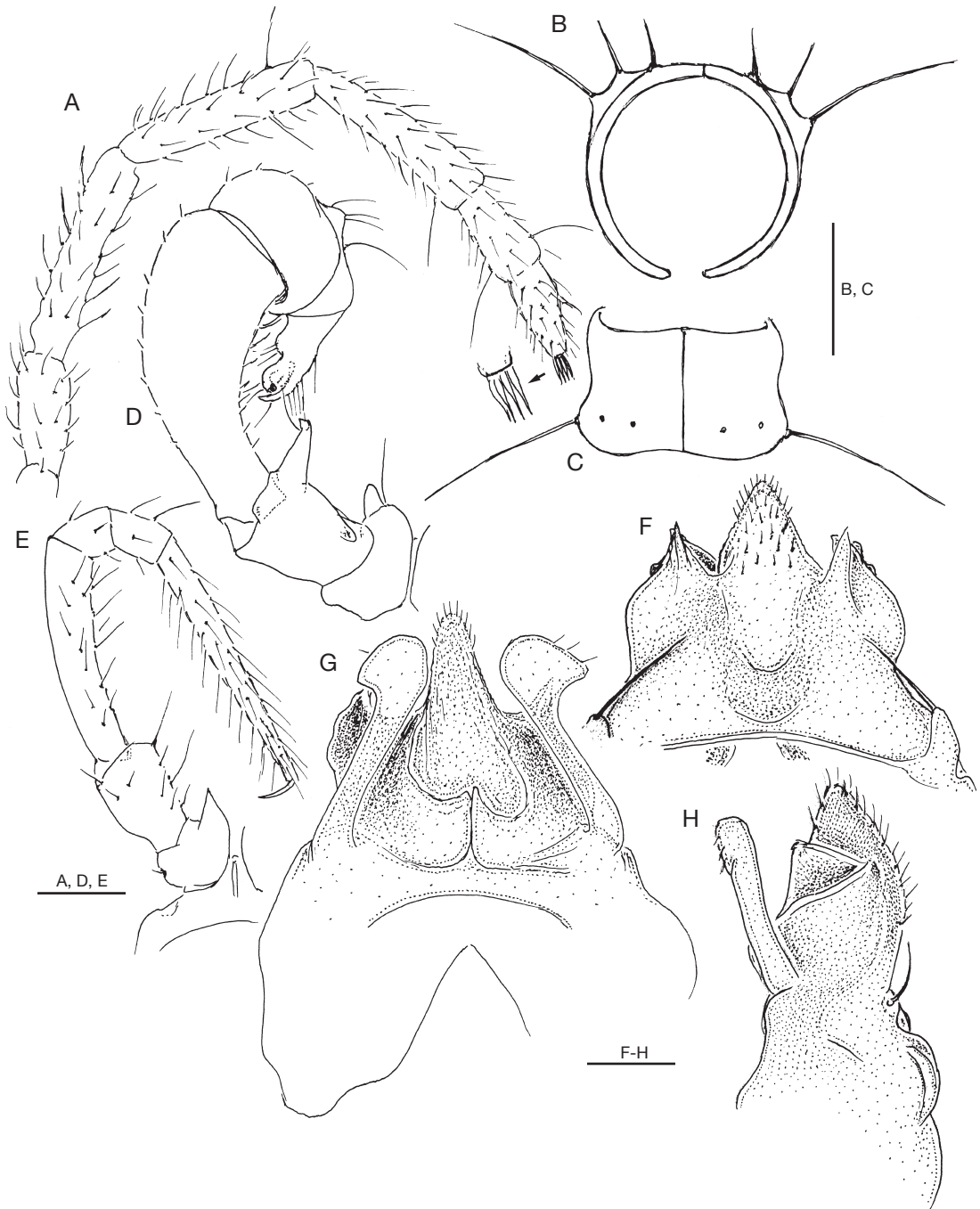


FIG. 5. — *Lipseuma josianae* n. gen., n. sp., paratype ♂: **A**, antenna; **B**, **C**, body segment 15, front and dorsal views, respectively; **D**, leg 6, front view; **E**, leg 7, front view; **F-H**, anterior gonopods (leg-pair 8), front, caudal and lateral views, respectively. Scale bars: A, D, E, 0.2 mm; B, C, 0.5 mm; F-H, 0.1 mm.

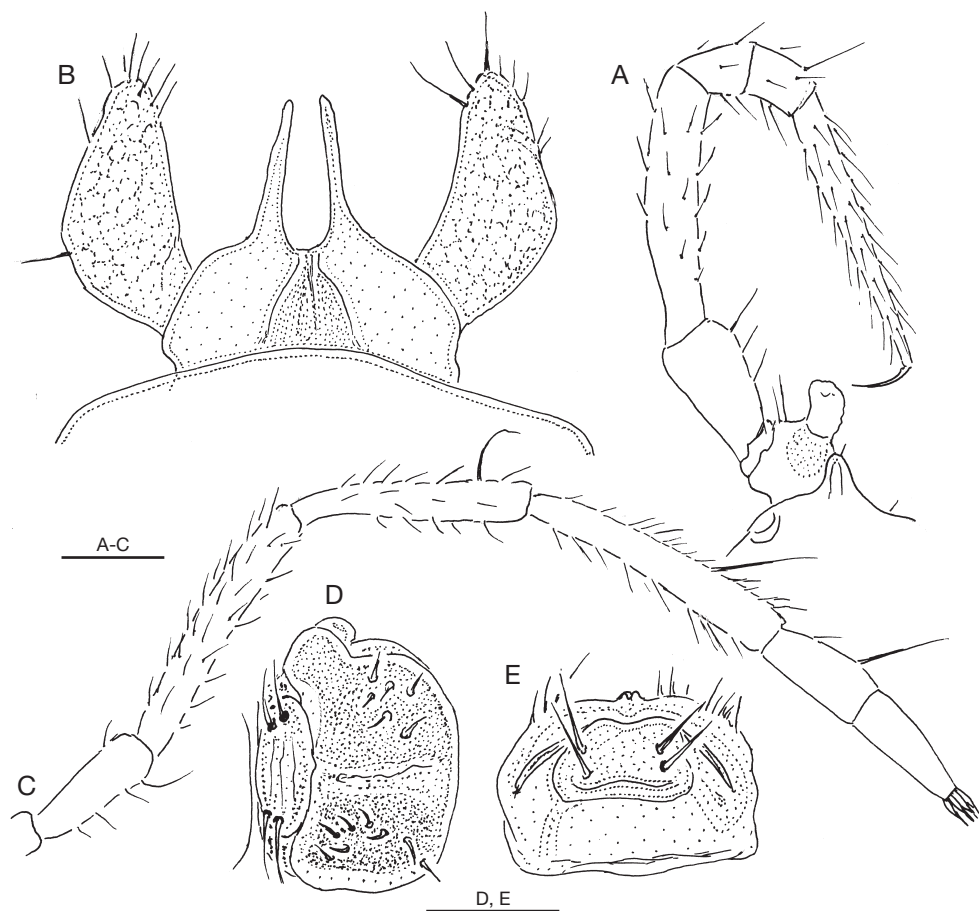


FIG. 6. — *Lipseuma josianae* n. gen., n. sp.: **A, B**, paratype ♂; **C-E**, paratype ♀; **A**, leg 10, front view; **B**, posterior gonopods, caudal view; **C**, antenna; **D, E**, vulva, ventral and caudal view. Scale bars: A, 0.2 mm; B-E, 0.1 mm.

positioned on minute knobs; exterior macrochaeta longest, *c.* 0.7 times as short as body width and nearly three times longer than median or interior one; stricture between pro- and metazona very shallow, inconspicuous (Fig. 5B, C).

Paraterga very small dorsolateral shoulders, rather regularly rounded in dorsal view (Fig. 5C), slightly better developed on anterior body third.

CIX (15) \approx 0.9; MIX (15) = 1.25; MA (15) \approx 175°; PIX impossible to evaluate as paraterga too poorly developed.

Axial suture distinct, usual; segment 7 inconspicuous, pleurite without ventral apophyses. Pleural crests evident. Limbus invisible.

Legs generally very long and slender, *c.* 1.8 times as long as midbody height. Legs 1 and 2 slightly reduced as usual, tarsi with usual ventral brushes, but without papillae; male coxa 2 perforated by gonopore orifice. Tarsal papillae absent. Male legs 3-5 unmodified. Male legs 6 (Fig. 5D) exceptionally incrassate, with a distoventral process both on coxa and prefemur; acropodite strongly clasper-like, tarsus with two bulges subventrally and a modified claw. Male legs 7 (Fig. 5E) slightly incrassate, with evidently enlarged coxa and prefemur; coxa with a pointed lobe ventrally. Male legs 10 (Fig. 6A) and 11 normal, both pairs with coxal glands. Claws very long, sabre-shaped, simple.

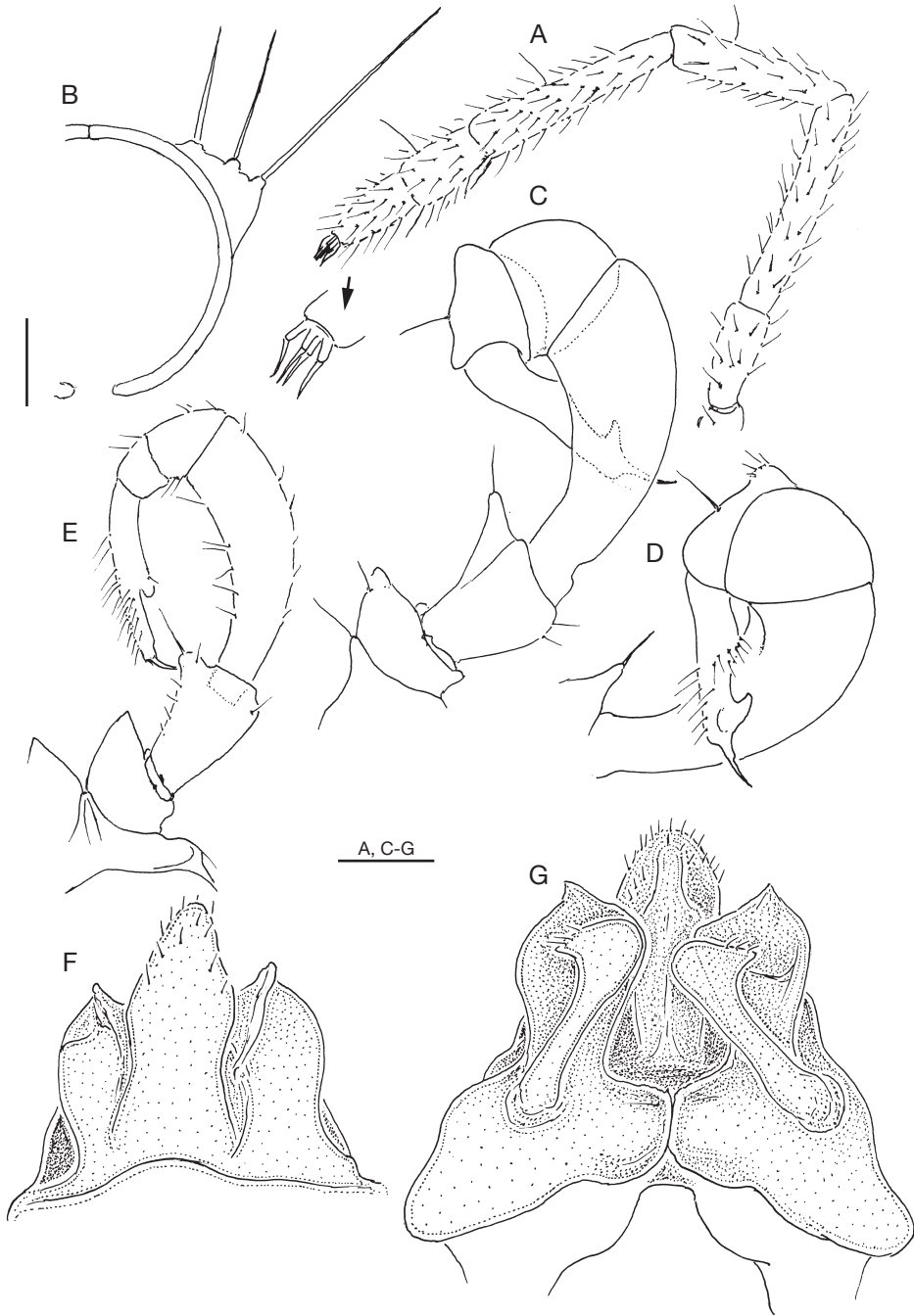


FIG. 7. — *Lipseuma bernardi* n. gen., n. sp., paratype ♂: **A**, antenna; **B**, left half of body segment 7, front view; **C**, **D**, leg 6, front and caudal views, respectively; **E**, leg 7, front view; **F-H**, anterior gonopods (leg-pair 8), front and caudal views, respectively. Scale bars: A-E, 0.2 mm; F, G, 0.1 mm.

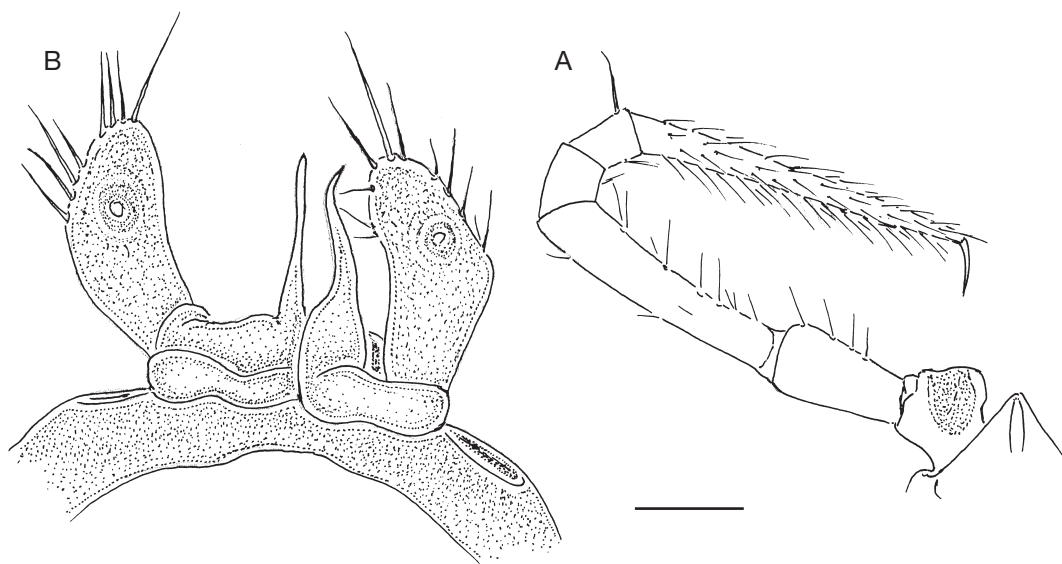


FIG. 8. — *Lipseuma bernardi* n. gen., n. sp., paratype ♂: **A**, leg 10, front view; **B**, posterior gonopods, caudal view. Scale bar: **A**, 0.2 mm; **B**, 0.1 mm.

Anterior gonopods (leg-pair 8) unusually simple, small; coxites with traces of median division basally on caudal face, completely fused on front face; distally subsecuriform telopodites laterocaudal, with a few setae distally, nearly as high as the unpaired, linguiform, distally pilose syncolpocoxite, but somewhat higher than the voluminous angiocoxal sacs with a ridge on top; sternum plate-like, with each lateral bulge on front face supporting a strong seta (Fig. 5F-H).

Posterior gonopods (leg-pair 9) also very simple (Fig. 6B), placed on a plate-like sternum; coxae contiguous medially, each crowned with a simple, long, slender, erect process ventrally; telopodite reduced to a single voluminous segment filled with glandular material.

Female legs 2 normal. Vulva (Fig. 6D, E) very broad; operculum small, devoid of outgrowths.

REMARKS

In one of the male paratypes, leg 6 is normal, not modified, whereas the anterior gonopod syncolpocoxite shows a small median notch apically, but there are no lateral setae on the coxite. Some of these traits are probably anomalous, likely neotenic.

Lipseuma bernardi n. sp. (Figs 7; 8)

TYPE MATERIAL. — Holotype: China, Sichuan Prov., Xin Long County, Three Eyes Cave, No. 438, 7.VIII.1999, leg. B. & J. Lips, ♂ (MNHN DA156). Paratypes: same locality, 1 ♂, incomplete (MNHN DA156); 1 ♂, subadult (MNHN DA156).

ETYMOLOGY. — To honour Bernard Lips.

DIAGNOSIS. — Differs from the only congener (*L. josianae* n. gen., n. sp.) by the slightly smaller size, as well as minor details of leg and gonopod structure.

DESCRIPTION

Length 7.2 (holotype) or 6.8 mm (subadult ♀); width of body segment 6, 0.72 mm, of midbody segments, 0.78 mm, maximum breadth of head, 0.9 mm (holotype).

Antennae (Fig. 7A) with even more exposed, highly elongate, pointed apical cones on stalks.

All peripheral characters like in *L. josianae* n. gen., n. sp. except as follows: exterior macrochaetae on midbody segments 0.6 mm long, i.e. nearly as wide as segment itself (Fig. 7B).

Male legs 6 (Fig. 7C, D), 10 (Fig. 8A) and 11 virtually the same as in *L. josianae* n. gen., n. sp., but male legs 7 (Fig. 7E) with a characteristic protuberance on tarsus ventrally at about midway.

Anterior gonopods (Fig. 7F, G) also virtually the same as in *L. josianae* n. gen., n. sp., but posterior gonopods (Fig. 8B) with traces of a second telopoditome distally on caudal face.

Subadult male (26 body segments) with small but evident gonopod promordia, legs 7 almost as strongly incrassate as in adult male, legs 7 also slightly enlarged.

REMARKS

Both *Lipseuma* n. gen. species are remarkable in being completely unpigmented and eyeless, as well as in bearing strongly elongated antennae, legs (especially tarsi) and exterior macrochaetae. All these features leave no doubt that we are dealing with troglodites.

It is noteworthy that interspecific variation in *Lipseuma* n. gen. is very modest, in contrast to that observed in the other two kashmireumatid genera. In fact, *L. josianae* n. gen., n. sp. and *L. bernardi* n. gen., n. sp. are barely distinguishable. The very small differences noted between them suggest either a quite recent colonization of caves by their common ancestor or a fairly recent vicariance event with speciation within their respective cave systems. The latter scenario seems more plausible, given the profound troglomorphism of both species, which would require a geological time-scale to develop, along with the geographical proximity of Chuan Dong Zi and Three Eyes caves (both situated in the Xin Long geographical zone just at the border between Hubei and Sichuan provinces [Degouve *et al.* 1997]). In other words, the old geological age of the genus *Lipseuma* n. gen. seems unquestionable, whereas the isolation of both hitherto known congeners probably occurred only relatively recently.

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