

New species of the millipede genus *Glyphiulus* Gervais, 1847
from the *granulatus*-group
(Diplopoda: Spirostreptida: Cambalopsidae)

НОВЫЕ ВИДЫ ДИПЛОПОД РОДА *Glyphiulus* Gervais, 1847
из группы *granulatus* (Diplopoda: Spirostreptida: Cambalopsidae)

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КЛЮЧЕВЫЕ СЛОВА: Diplopoda, *Glyphiulus*, таксономия, новый вид, пещера, Вьетнам, Китай, Таиланд.

ABSTRACT. The *granulatus*-group of the basically southeast Asian genus *Glyphiulus* is shown to currently comprise 33 species, of which 13 are new: *G. grandis* sp.n. and *G. totalis* sp.n. from southern Vietnam, *G. difficilis* sp.n., *G. mulunensis* sp.n., *G. tiani* sp.n., *G. acutus* sp.n., *G. paramulunensis* sp.n., *G. proximus* sp.n. and *G. speobius* sp.n., all seven from the Mulun karst, Guangxi Province, southern China, all specially keyed and mapped because of mostly being very similar to one another, as well as *G. sattaana* sp.n., *G. duangdee* sp.n., *G. mongkon* sp.n. and *G. maidtreejit* sp.n., all four from Thailand.

РЕЗЮМЕ. Группа видов *granulatus* исконно юго-восточноазиатского рода *Glyphiulus* теперь содержит 33 вида, включая 13 новых: *G. grandis* sp.n. и *G. totalis* sp.n. из Южного Вьетнама, *G. difficilis* sp.n., *G. mulunensis* sp.n., *G. tiani* sp.n., *G. acutus* sp.n., *G. paramulunensis* sp.n., *G. proximus* sp.n. и *G. speobius* sp.n., все семь из карстового массива Мулун (пров. Гуанси, южный Китай), причем для всех семерых специально составлены ключ и карта их распространения из-за их большого сходства между собой, а также *G. sattaana* sp.n., *G. duangdee* sp.n., *G. mongkon* sp.n. и *G. maidtreejit* sp.n., все четыре вида из Таиланда.

Introduction

The millipede genus *Glyphiulus* Gervais, 1847 has recently been redefined, reviewed and shown to comprise 39 species in two groups, the *granulatus*- and the *javanicus*-group [Golovatch et al., 2007a, b]. The *granulatus*-group alone encompasses 20 species, all keyed, ranging from southern China and northern Laos in the north to southern Vietnam in the south [Golovatch et al., 2007a]. Only one species, *G. granulatus* (Gervais, 1847), has attained a vast, pantropical distribution through human agency, whereas the remaining species tend to be local to very local. The ranges of both species groups are parapatric, vastly overlapping across much of southern China and peninsular Indochina [Golovatch et al., 2007a, b].

The *granulatus*-group of *Glyphiulus* is characterized by the following features [Golovatch et al., 2007a]:

(1) ♂ legs 1 are usually very strongly reduced, represented solely or mainly by a sternum lacking any median structures, but bearing strongly separated, evidently curved prongs with a leg vestige on each side at base (usually represented by just a few setae, more seldom also 1–2 rudimentary segments). Very seldom, a nearly complete telopodite persists, but the sternum still supports a pair of widely separated and curved

prongs. [σ legs 1 with central structures on the sternum in other groups].

(2) Other σ legs normal or nearly so, not enlarged. [σ legs 2 sometimes incrassate in other groups].

(3) A typical carinotaxy pattern of the collum is I–VI+7a+pc+ma. Quite often the pattern is different, either due to crest reduction (especially anteriorly) or hypertrophy, but a median crest is always traceable, at least near the caudal margin. [Usually typical carinotaxy formulae of the collum are different in other groups].

(4) A typical carinotaxy pattern of the metaterga is 3(2)+I+3+I+3(2). The crests usually being divided transversely into two halves, while the median crest is often doubled anteriorly, the formula becomes 3(2)+I+4+I+3(2) and 3(2)+i+3+i+3(2). If the pattern is different, it is usually readily derived from the typical one (or vice versa), i.e. the lateral crests are reduced to two or the crests are undivided, or some of the crests are divided into three, rather than two, transverse rows of tubercles (see also below), etc. A median crest, even when strongly reduced, is always present as well. [Usually typical carinotaxy formulae of the metaterga are different in other groups].

(5) The anterior gonopods are reduced to a plate-like coxosternum with moveable, lateral, 1-segmented telopodites. [Shared with some other species groups].

(6) The posterior gonopods are highly compressed, showing a subflagelliform (rarely subspatuliform), often plumose, distal process. [Shared with some other species groups].

(7) The pleural flaps behind the gonopod opening on σ segment 7 usually do not form an apparent transverse ventral ridge. [Shared with some other species groups].

Prompted by the discovery of numerous and diverse Cambalopsidae, mainly collected in caves in southeast Asia since 1986, at present we are able to add another 13 new species to the *granulatus*-group of *Glyphiulus* alone. Our paper focuses on their descriptions, including the first representatives of the group found in Thailand.

Abbreviations used: IZAS — Institute of Zoology, Academia Sinica, Beijing, China; MNHN — Muséum national d'Histoire naturelle, Paris, France; MZCU — Museum of Zoology, Chulalongkorn University, Bangkok, Thailand; NMNHS — National Museum of Natural History, Sofia, Bulgaria; SCAU — South China Agricultural University, Guangzhou, China; SEM — Scanning electron microscopy; ZMUC — Natural History Museum, University of Copenhagen, Copenhagen, Denmark; ZMUM — Zoological Museum, State University of Moscow, Moscow, Russia;

Material and methods

The material serving as the basis for the present contribution derives from the predominantly subterranean collections made in Vietnam, China and Thailand by Anne Bedos and Louis Deharveng (MNHN), in

Thailand by Philippe Leclerc (France), in China by Franck Brehier (France) and Tian Mingyi and his collaborators (SCAU), as well as in Thailand by Somsak Panha and his collaborators from the Animal Systematics Research Unit, MZCU: Chirasak Sutcharit, Natdanai Likhitrakarn, Piyatida Pimvichai and some others (MZCU). The field trips of 2009 and 2010 across Thailand, organized by Somsak Panha, were also attended by the first author. Much of this material, including many of the holotypes, has been deposited in MNHN, with several paratypes shared between the collections of MZCU, ZMUM, ZMUC and NMNHS, as indicated hereafter.

SEM micrographs were taken using a JEOL JSM-6480LV scanning electron microscope. After examination, SEM material was removed from stubs and returned to alcohol, all such samples being kept at MNHN.

Carinotaxy formulas are basically those developed by Golovatch et al. [2007a, b]. In addition, the abundant illustrations aid immensely in properly interpreting the formulas and in comparing the species.

Given so many new species yielded, only a regional key has been attempted here, because many more *Glyphiulus* can definitely be expected to be collected and become available for study in future.

Taxonomic part

Glyphiulus grandis sp.n.

Figs 1–2.

MATERIAL. Holotype σ (MNHN GA 076), Vietnam, Lam Dong Prov., Dalat, Bidoup National Park, Hon Giao, forest litter, 12.1864°N, 108.714817°E, 1,630 m a.s.l., hand collection, 12.06.2008, leg. L. Deharveng & A. Bedos (Vn08-139).

NAME. To emphasize the very large size of the animal.

DIAGNOSIS. Differs from congeners, including the even larger *G. superbus* Silvestri, 1923, also from Dalat [Silvestri, 1923], by the unusually large size, the special carinotaxy pattern of the collum, the absence of anterior doubling of the median crest on the metaterga, and the highly peculiar shape of the anterior gonopods.

DESCRIPTION. Length ca 65 mm, midbody segments round in cross-section, their width (horizontal diameter) and height (vertical diameter) similar, 4.9 mm. Coloration variegated red and dark grey-brown (Fig. 1).

Body robust, with 67p+3a+T. Eye patches transversely ovoid, each composed of about 45 blackish, rather flat ocelli in 10–11 irregular longitudinal rows (Figs 1A–C). Antennae short and moderately clavate (Figs 1B, C, 2A), extending to beyond segment 3 laterally, antennomeres 6 and 7 each with a small distodorsal field of bacilliform sensilla. Gnathochilarium with a separate promentum, polytrichous (Fig. 2B).

Postcollar constriction moderate. Crests on collum evident, only mid-dorsally slightly flattened (Figs 1A–C). Carinotaxy formula of collum, I+2p+III+IV+5p+6a+pc+ma.

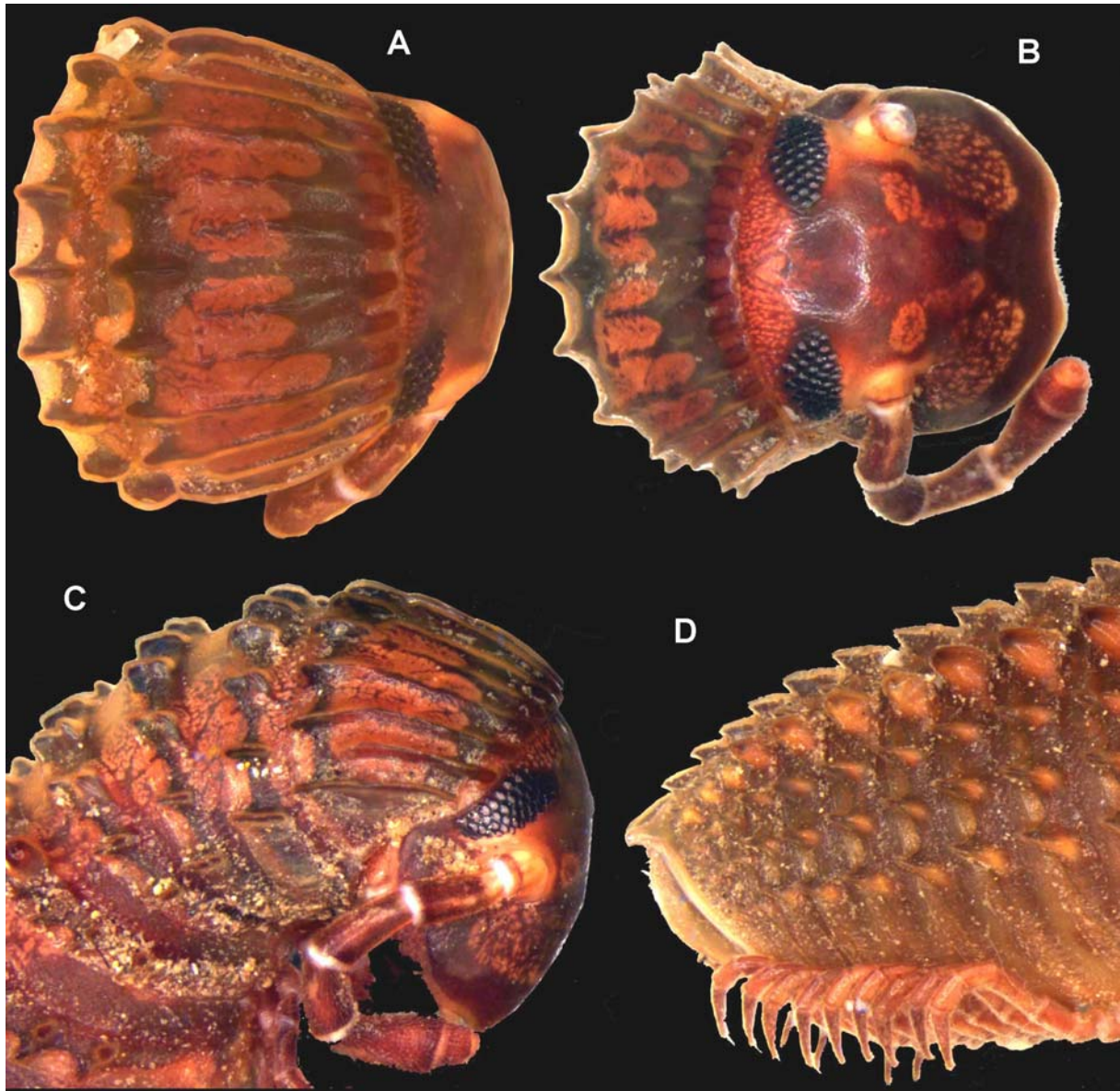


Fig. 1. *Glyphiulus grandis* sp.n., ♂ holotype: A–C — anterior part of body, dorsal, frontodorsal and lateral views, respectively; D — posterior part of body, lateral view. Pictures not taken to scale.

Рис. 1. *Glyphiulus grandis* sp.n., голотип ♂: А–С — передняя часть тела, соответственно сверху, сверху и спереди и сбоку; D — задняя часть тела, сбоку. Фотографии без масштаба.

Subsequent metaterga strongly crested (Fig. 1C, D); carinotaxy formula, 3/3+I/i+3/3+I/i+3/3. Ozoporiferous tubercles especially large, conical, directed caudolaterad (like all others), elongated on top, higher than wide; midbody metatergal crests divided into two about midway, caudal half especially high and sharp.

Tegument finely alveolate-areolate, dull throughout. Fine longitudinal striations in front of stricture between pro- and metazona, remaining surface of prozona very delicately shagreened. Segments 2 and 3 with long pleural flaps. Limbus extremely finely and regularly denticulate/spiculate. Epiproct (Fig. 1D) simple, subtriangular, narrowly rounded caudally, with a

faint axial elevation dorsally. Paraprocts rather regularly convex (Fig. 1D), median margins only slightly elevated due to premarginal sulci. Hypoproct transversely lanceolate, paramedian setigerous pits (setae abraded) nearly contiguous.

Ventral flaps behind gonopod opening on segment 7 barely distinguishable as low swellings, not forming a marked transverse ridge.

Legs rather short (Figs 1D, 2F), on midbody segments about 2/3 length of segment height. Claw at base usually with a strong accessory spine almost half as long as claw itself (Fig. 2F).

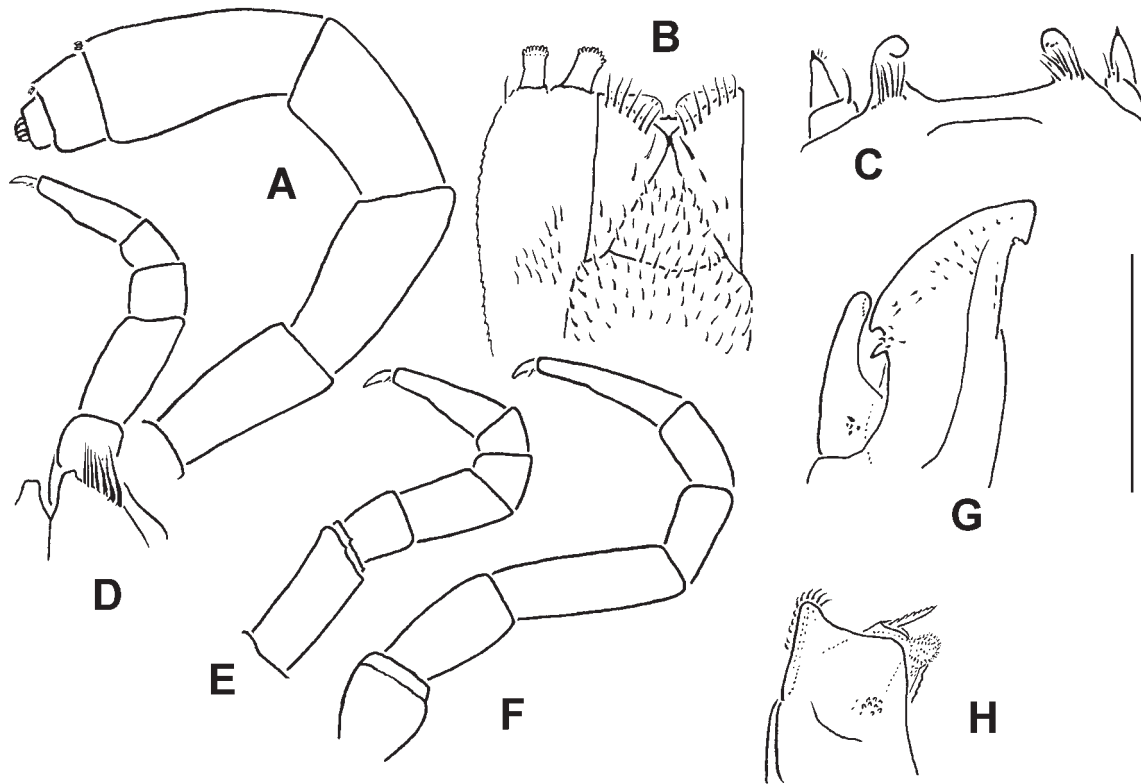


Fig. 2. *Glyphiulus grandis* sp.n., ♂ holotype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — leg 3, caudal view; F — midbody leg, lateral view; G — right anterior gonopod, caudal view; H — left posterior gonopod, front view. Scale bar: 1.0 mm.

Рис. 2. *Glyphiulus grandis* sp.n., голотип ♂: А — антенна, сбоку; В — гнатохиларий, снизу; С — ноги 1, сзади; D — нога 2, сзади; E — нога 3, сзади; F — среднетеловишная нога, сбоку; G — правый передний гонопод, вид сзади; H — левый задний гонопод, вид спереди. Масштаб: 1,0 мм.

♂ legs 1 (Fig. 2C) represented only by a sternum devoid of any median or paramedian structures, but carrying 1+1 strongly separated prongs, both evidently curved forward and bearing several strong setae and rudimentary, 2-segmented leg vestiges at base. ♂ legs 2 only very slightly hypertrophied, only claw and, anteriorly, coxa somewhat reduced; penes broad, oblong-subtrapeziform, each with seven strong setae distolaterally (Fig. 2D). ♂ legs 3 modified in having coxa especially slender and elongate (Fig. 2E).

Anterior gonopods (Fig. 2G) with a typical shield-like coxosternum, this being high, rather abundantly microsetose on caudal face, provided with a conspicuous, high, terminally axe-shaped, mesal process and a pair of sharp teeth laterally. Telopodite small but movable, 1-segmented, lateral in position, with a strong apical seta and a field of microscopic setae/cones at base, only slightly longer than adjacent lateral corner of coxosternum. Posterior gonopods (Fig. 2H) very compact, coxite medio-apically with a plumose distal process (= flagellum) and a hyaline apicolateral lobe clothed with microscopic spikes.

Glyphiulus totalis sp.n.

Figs 3–5.

MATERIAL. Holotype ♂ (MNHN GA 077), Vietnam, Lam Dong Prov., Dalat, Peak Lang Bian, below summit, 12.044330°N, 108.445452°E, rainforest litter, litter, 2,030 m a.s.l., sifting & Berlese extraction, 08.12.2006, leg. L. Deharveng & A. Bedos (Vn06-170). Paratype: 1 juv. ♂ (SEM), same locality, together with holotype.

NAME. To emphasize that most of the crests on the collum and metazona are undivided, complete.

DIAGNOSIS. Differs from congeners in the especially complete carinotaxy of the collum and metaterga, coupled with the oligotrichous gnathochilarium, the anteriorly non-doubled median crests, the peculiar, subtriangular anterior gonopods, and the virtually bare and bifid flagella of the posterior gonopods.

DESCRIPTION. Length of holotype about 13 mm, width 0.9 mm, midbody segments being broadest. Coloration uniformly yellow-brown; head light, yellow with a brown tint.

Body with 35p+4a+T (holotype) or 32p+4a+T (juvenile paratype).

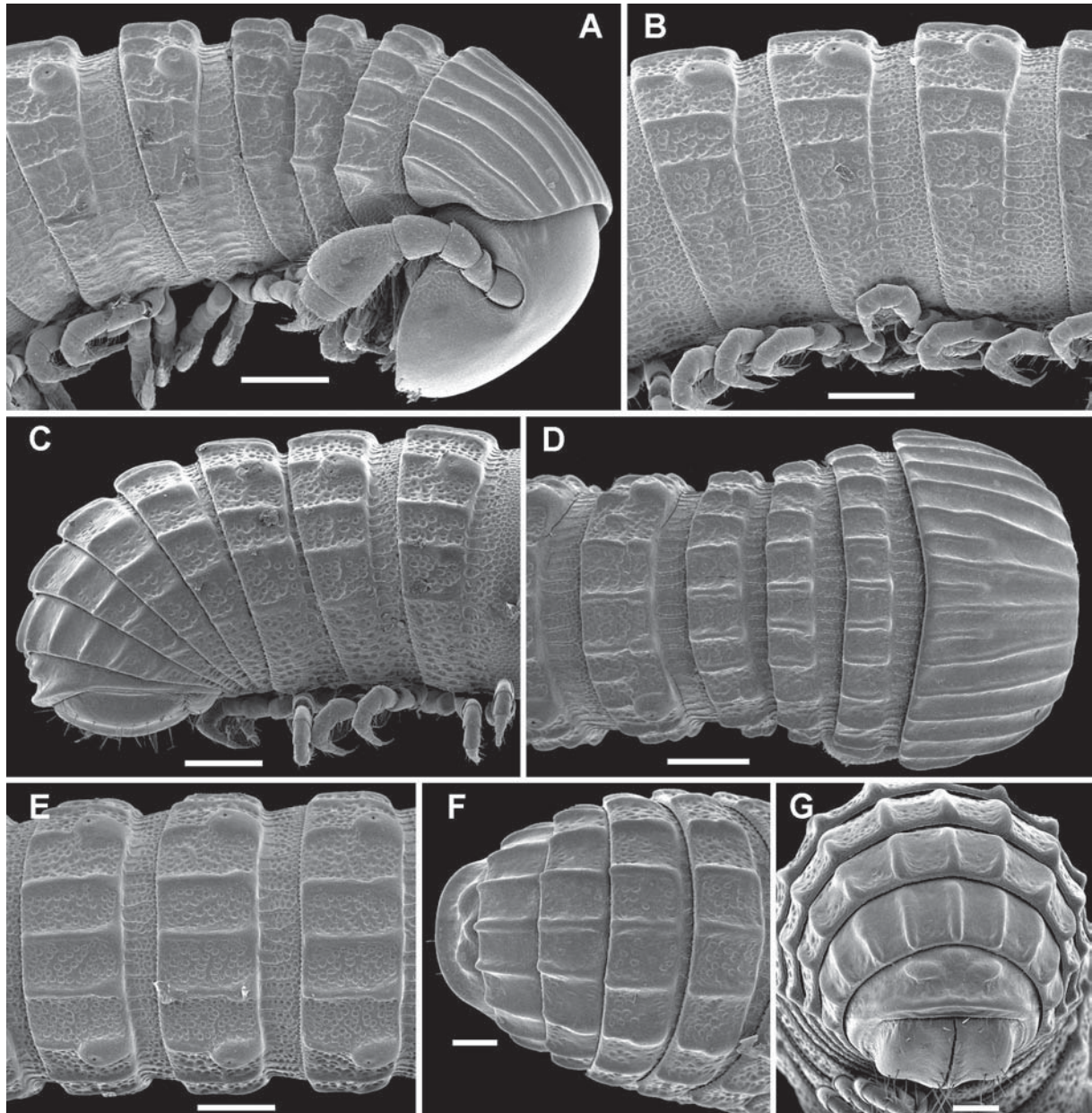


Fig. 3. *Glyphiulus totalis* sp.n., ♂ paratype: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C, F & G — caudal part of body, lateral, dorsal and caudal views, respectively. Scale bars: A–E — 0.2 mm; F & G — 0.1 mm.

Рис. 3. *Glyphiulus totalis* sp.n., паратип ♂: А, D — передняя часть тела, соответственно сбоку и сверху; В, Е — среднетелувищные сегменты, соответственно сбоку и сверху; С, F, G — задняя часть тела, соответственно сбоку, сверху и сзади. Масштаб: А–Е — 0,2 мм; F, G — 0,1 мм.

All characters as in *G. grandis* sp.n. (Figs 3–5), except as follows. Ocellaria like small, rather vaguely outlined, roundly-subtriangular spots bearing three distinct, blackish ocelli on each side. Gnathochilarium (Fig. 5B) oligotrichous, with a separate promentum ($n=2$).

Carinotaxy formula of collum: I–VI+7a+P+ma (Figs 3A, D).

Subsequent metaterga moderately strongly crested (Figs 3, 4D); carinotaxy formula, 3+I/i+3+I/i+3 (Figs

3B, E, 4D), meaning that most of crests remain undivided. Ozoporiferous tubercles enlarged, conical, low, much wider than high (Fig. 4D).

Limbus extremely finely and regularly plicate (Fig. 4F). Epiproct (Figs 3F, G) simple, regularly rounded caudally, with 1+1 evident tubercles dorsally. Hypoproct (Fig. 4C) transversely bean-shaped, slightly concave caudally, paramedian setigerous setae rather well separated.

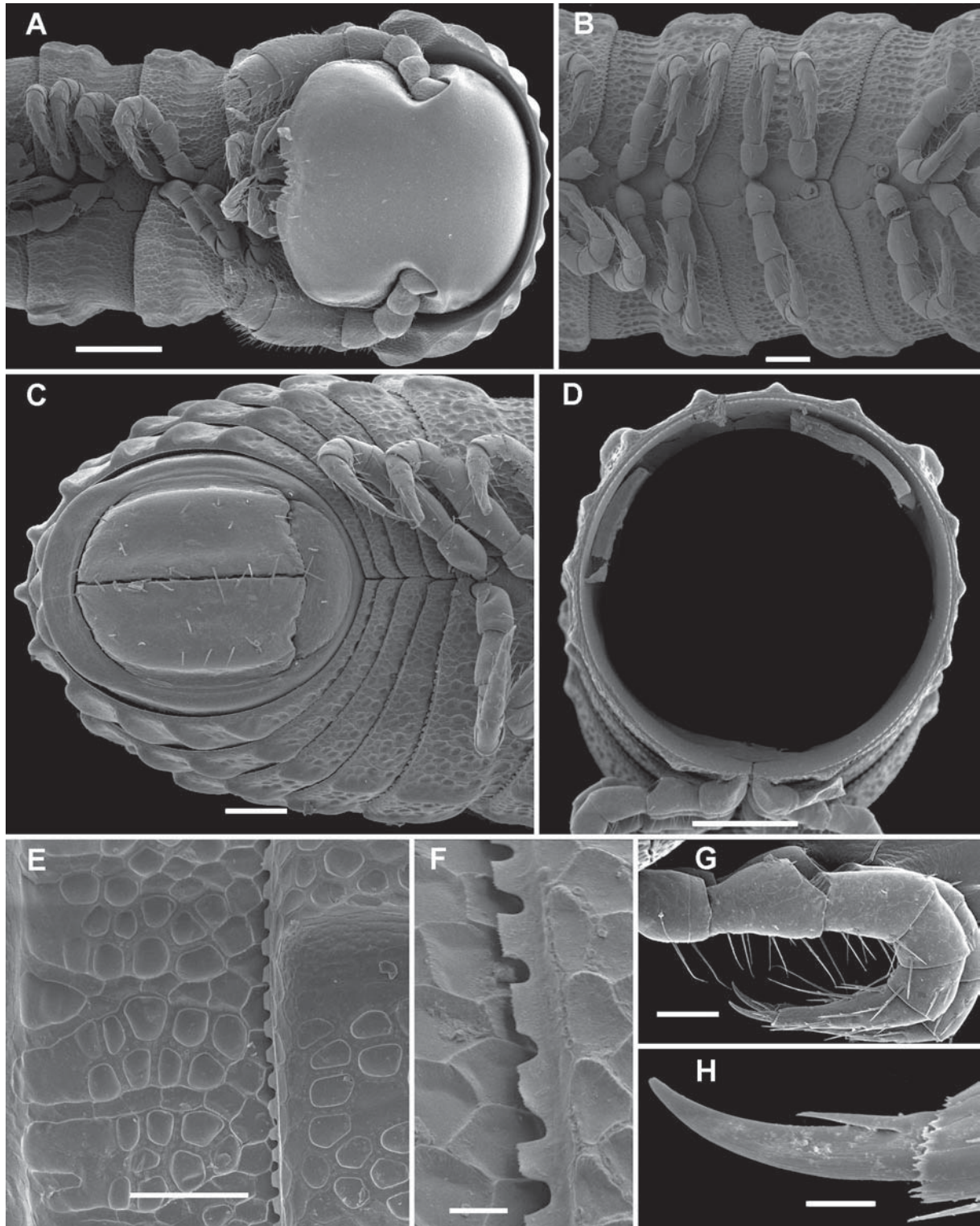


Fig. 4. *Glyphiulus totalis* sp.n., ♂ paratype: A — anterior part of body, ventral view; B — midbody segments, ventral view; C — caudal part of body, ventral view; D — cross-section of a midbody segment, caudal view; E — tegument texture, lateral view; F — limb, lateral view; G — midbody legs, front view; H — enlarged claw. Scale bars: A & D — 0.2 mm; B & C — 0.1 mm; E & G — 0.05 mm; F & H — 0.01 mm.

Рис. 4. *Glyphiulus totalis* sp.n., паратип ♂: А — передняя часть тела, снизу; В — среднетуловищные сегменты, снизу; С — задняя часть тела, снизу; D — поперечный D — разрез через среднетуловищный сегмент, сзади; E — текстура покровов, сбоку; F — лимбус, сбоку; G — среднетуловищные ноги, спереди; H — увеличенный коготок, сбоку. Масштаб: А, D — 0,2 мм; В, С — 0,1 мм; E, G — 0,05 мм; F, H — 0,01 мм.

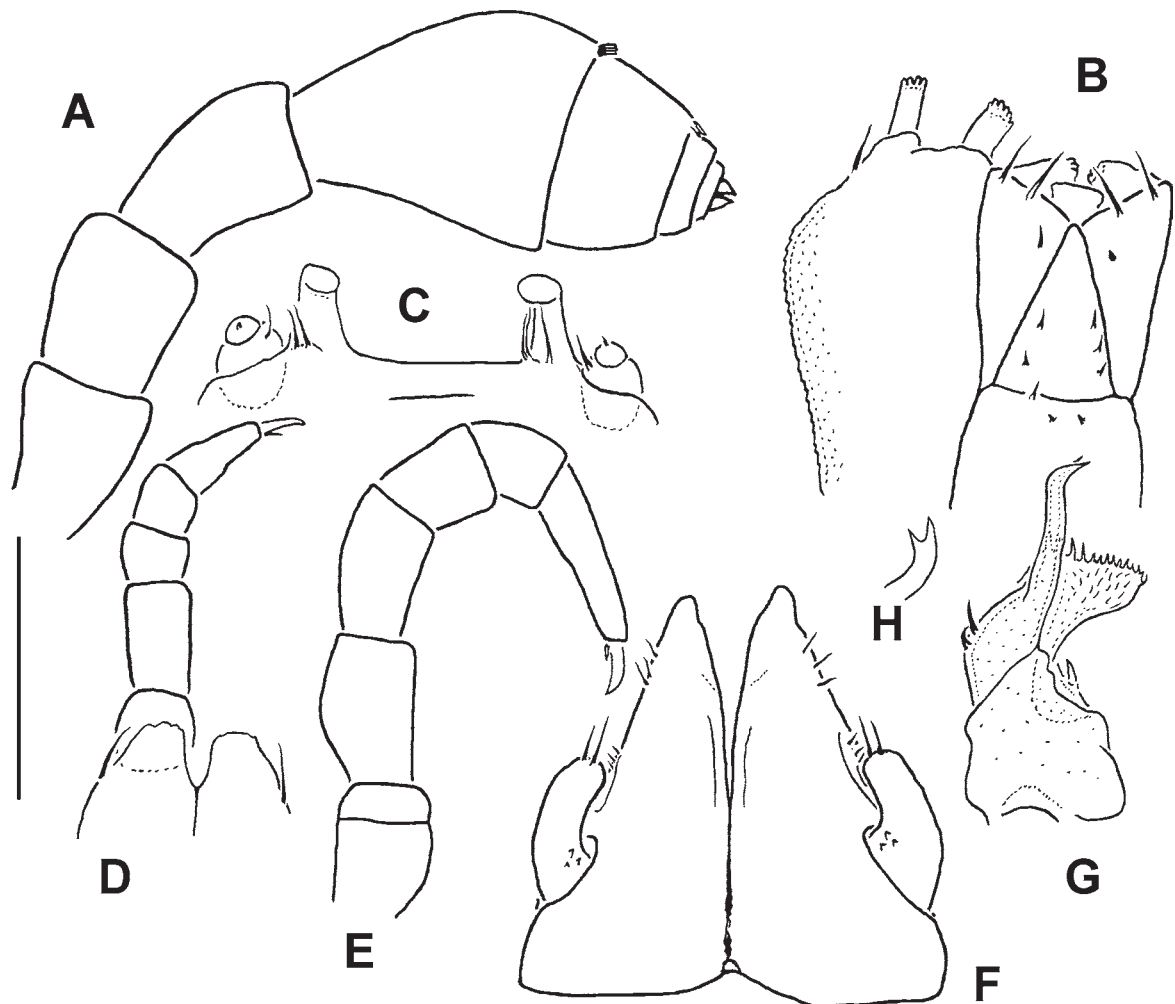


Fig. 5. *Glyphiulus totalis* sp.n., ♂ holotype: A — antenna, lateral view. B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view. E — midbody leg, lateral view; F — anterior gonopods, caudal view; G — right posterior gonopod, subfront view; H — tip of flagellum of posterior gonopod. Scale bar: 0.2 mm.

Рис. 5. *Glyphiulus totalis* sp.n., голотип ♂: А — антенна, вид сбоку; В — гнатохиларий, вид снизу; С — ноги 1, спереди; D — нога 2, сзади; E — среднетуловищная нога, сбоку; F — передние гоноподы, сзади; G — правый задний гонопод, вид почти спереди; H — вершина жгутика заднего гонопода. Масштаб: 0,2 мм.

Legs short (Figs 3A, B, 4G, 5E), on midbody segments about 2/3 length of segment height. Claw at base with a strong accessory spine, latter usually about half as long as claw itself or nearly so (Fig. 4H).

♂ legs 1 (Fig. 5C) with rudimentary, 2-segmented leg vestiges. ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with a strong seta distolaterally (Fig. 5D).

Anterior gonopods (Fig. 5F) with a subtriangular coxosternum about 2 times as high as telopodites, rather poorly microsetose on caudal face. Posterior gonopods (Fig. 5G, H) very compact, flagellum bare and bifid, lateral lobe clothed with microscopic spikes.

Glyphiulus difficilis sp.n.

Figs 6–9.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Yachang County, Huaping, Cave She Dong, 24.823875°N, 106.285873°E, 450 m a.s.l., hand collection, 30.05.2007, leg. F. Brehier (CHlgx07-30-08). Paratypes: 1 ♂, 1 ♀ (SCAU), 2 ♂♂, 1 ♀ (MNH GA 078), 1 ♂, 1 ♀ (ZMUM), 1 ♂ (ZMUC), 1 ♂ (SEM), same locality, together with holotype. Non-types: 1 ♂, 1 ♀ (MNH GA 078), 1 ♀ (SCAU), 1 ♀ (SEM), same province and county, Huaping, Cave Xia Yan Dong, 24.792083°N, 106.371389°E, hand collection, 28.05.2007, leg. L. Deharveng & A. Bedos (CHlgx07-28-01).

NAME. To emphasize the difficulties in distinguishing this new species from the next ones from the Mulun karst.

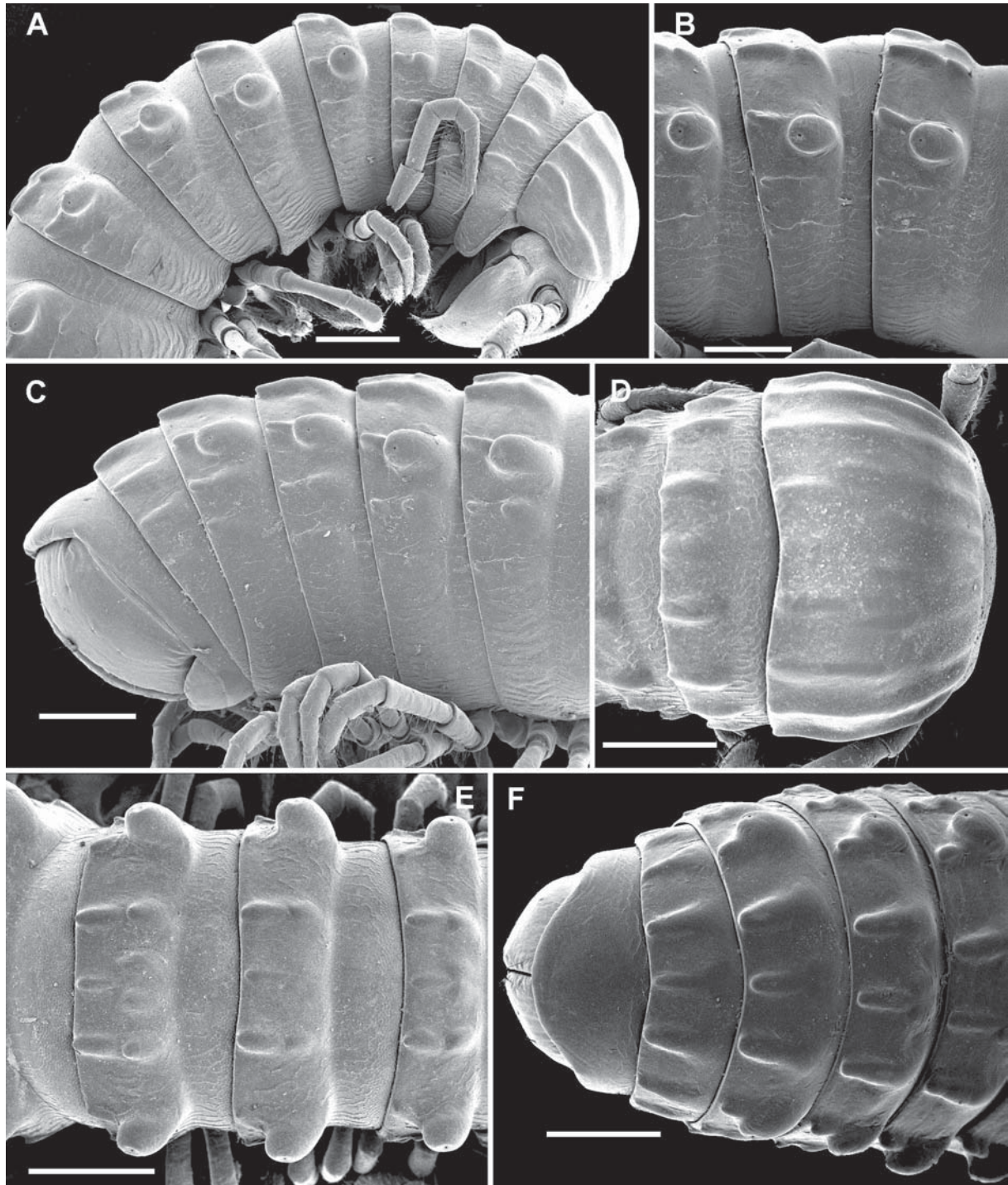


Fig. 6. *Glyphiulus difficilis* sp.n., ♂ paratype: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and dorsal views, respectively. Scale bars: 0.5 mm.

Рис. 6. *Glyphiulus difficilis* sp.n., паратип ♂: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетеловишние сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сверху. Масштаб: 0,5 мм.

DIAGNOSIS. Differs from congeners in the relatively poorly developed crests on the collum and metaterga, in particular the strongly obliterated paramedians and median on the collum, coupled with the polytrichous gnathochilarium, the very long legs, the

absence of a premarginal groove on the paraprocts, the presence of anteriorly doubled median crests, and certain details of gonopod structure. This new species seems to be especially similar to *G. adeloglyphus* Zhang et Li, 1982, and *G. anophthalmus* (Loksa, 1960), also

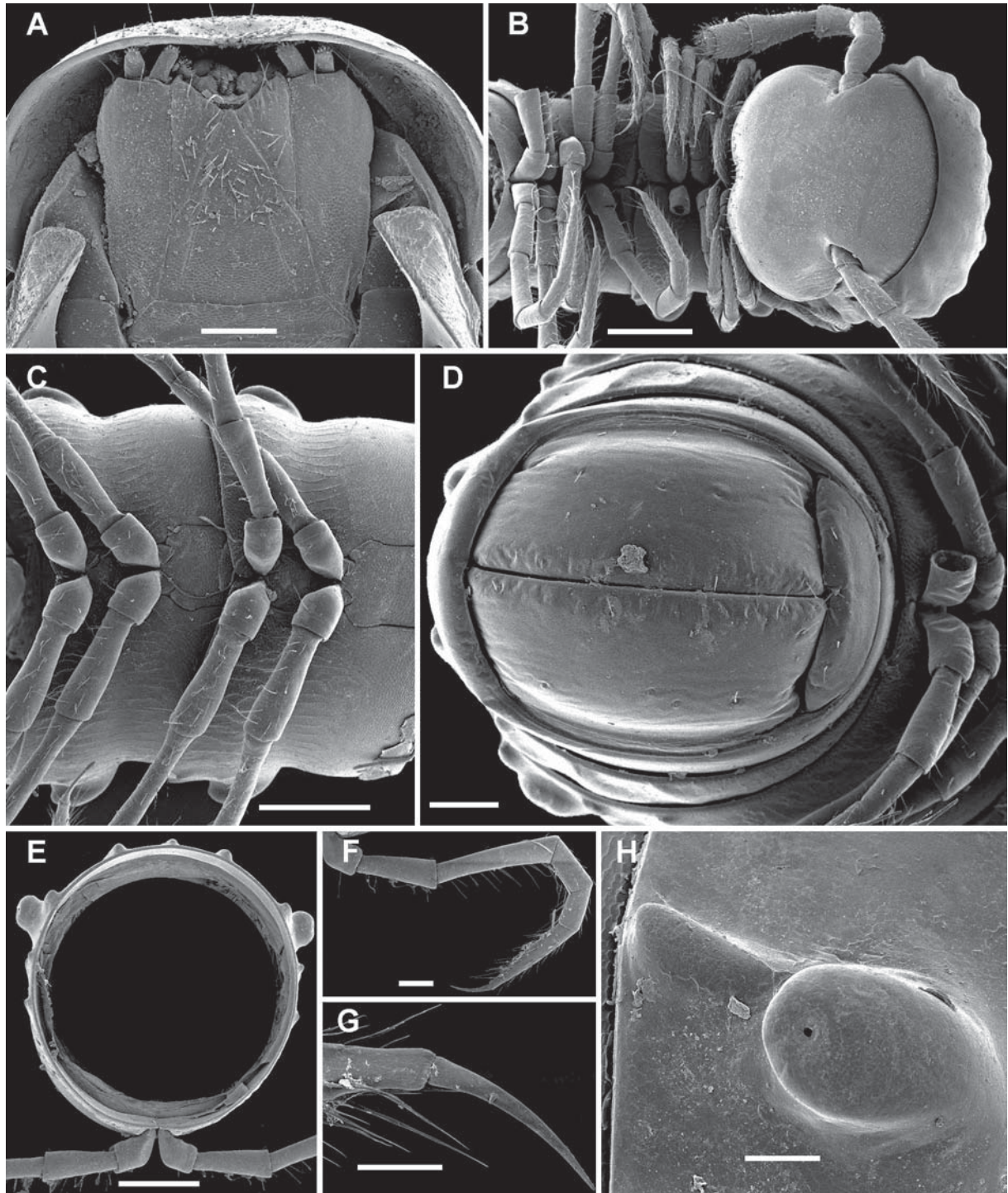


Fig. 7. *Glyphiulus difficilis* sp.n., ♂ paratype: A — gnathochilarium, ventral view; B — anterior part of body, ventral view; C — midbody segments, ventral view; D — posterior part of body, caudal view; E — cross-section of a midbody segment, caudal view; F — midbody leg, lateral view; G — enlarged claw, lateral view; H — enlarged ozopore region. Scale bars: A, D & F — 0.2 mm; B, C & E — 0.5 mm; G & H — 0.1 mm.

Рис. 7. *Glyphiulus difficilis* sp.n., паратип ♂: А — гнатохиларий, вид снизу; В — передняя часть тела, вид снизу; С — среднетуловищные сегменты, вид снизу; D — задняя часть тела, вид сзади; E — поперечный разрез через среднетуловищный сегмент, сзади; F — среднетуловищная нога, вид сбоку; G — увеличенный коготок, сбоку; H — увеличенный район озопоры. Масштаб: А, D, F — 0,2 мм; В, С, E — 0,5 мм; G, H — 0,05 мм; F, H — 0,1 мм.

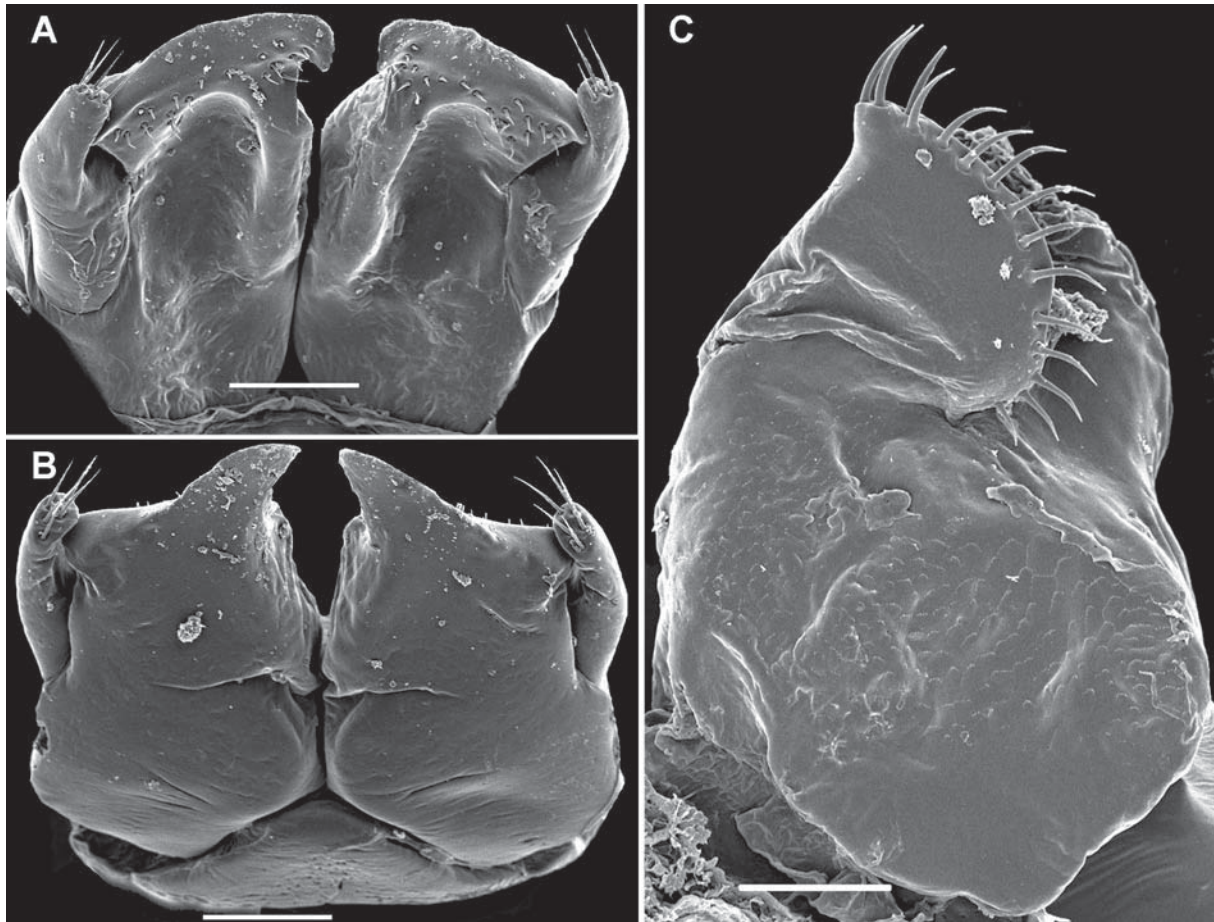


Fig. 8. *Glyphiulus difficilis* sp.n., ♂ paratype: A & B — anterior gonopods, caudal and front views, respectively; C — right posterior gonopod, mesal view (a short plumose flagellum broken off). Scale bars: A & B — 0.1 mm; C — 0.05 mm.

Рис. 8. *Glyphiulus difficilis* sp.n., паратип ♂: А, В — передние гоноподы, соответственно сзади и спереди; С — правый задний гонопод, вид изнутри (короткий перистый жгутик обломан). Масштаб: А, В — 0,1 мм; С — 0,05 мм.

from Guangxi Province, as well as to *G. balazsi* (Loksa, 1960), *G. quadrohamatus* Chen et Meng, 1991 and *G. pergranulatus* Golovatch et al., 2007, all from Guizhou Province, especially as regards the strongly reduced crests on the collum [Loksa, 1960; Zhang & Li, 1982; Chen & Meng, 1991; Golovatch et al., 2007a], but differs in there retaining three lateralmost carinae complete, the ornamentation patterns of body segments, in gonopod conformation etc. (see also Key below).

DESCRIPTION. Length 35–46 mm, width 1.9–2.1 mm, midbody segments being broadest. Holotype about 37 mm long, 2.0 mm wide. Coloration rather uniformly light yellow-brown to brown, only some crests and ozoporiferous tubercles often infuscate, dark castaneous brown.

Body with 49–64p+3–1a+T, holotype with 51p+2a+T.

All characters as in *G. grandis* sp.n. (Figs 6–8), except as follows. Antennae slightly longer and slenderer, extending beyond segment 4 laterally (Fig. 7B). Ocellaria invisible. Gnathochilarium (Fig. 7A) polytrichous, with a separate promentum (n=2).

Carinotaxy formula of collum: I–III+4p+5a+pc+ma (Figs 6A, D), but mid-dorsal crests very low and poorly traceable.

Subsequent metaterga relatively moderately strongly crested (Fig. 6); carinotaxy formula, 2/2+I/i+4/3+I/i+2/2 (Figs 6B, E, 7E). Ozoporiferous tubercles enlarged, conical, low, wider than high, subtruncate apically (Fig. 7E), with adjacent crests/tubercles on metaterga usually being much smaller and not sharp.

Epiproct (Figs 6C, F) simple, regularly rounded caudally, with neither tubercles nor crests dorsally. Paraprocts regularly convex, devoid of premarginal sulci medially (Figs 6C, 7D). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 7D).

Legs very long and slender (Figs 7C, E, F), on midbody segments their length about 1.5–1.6 times greater than segment height. Claw very long, usually without accessory spine at base (Fig. 7G).

♂ legs 1 as usual, with rudimentary, 2-segmented leg vestiges. ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with two strong setae distolaterally.

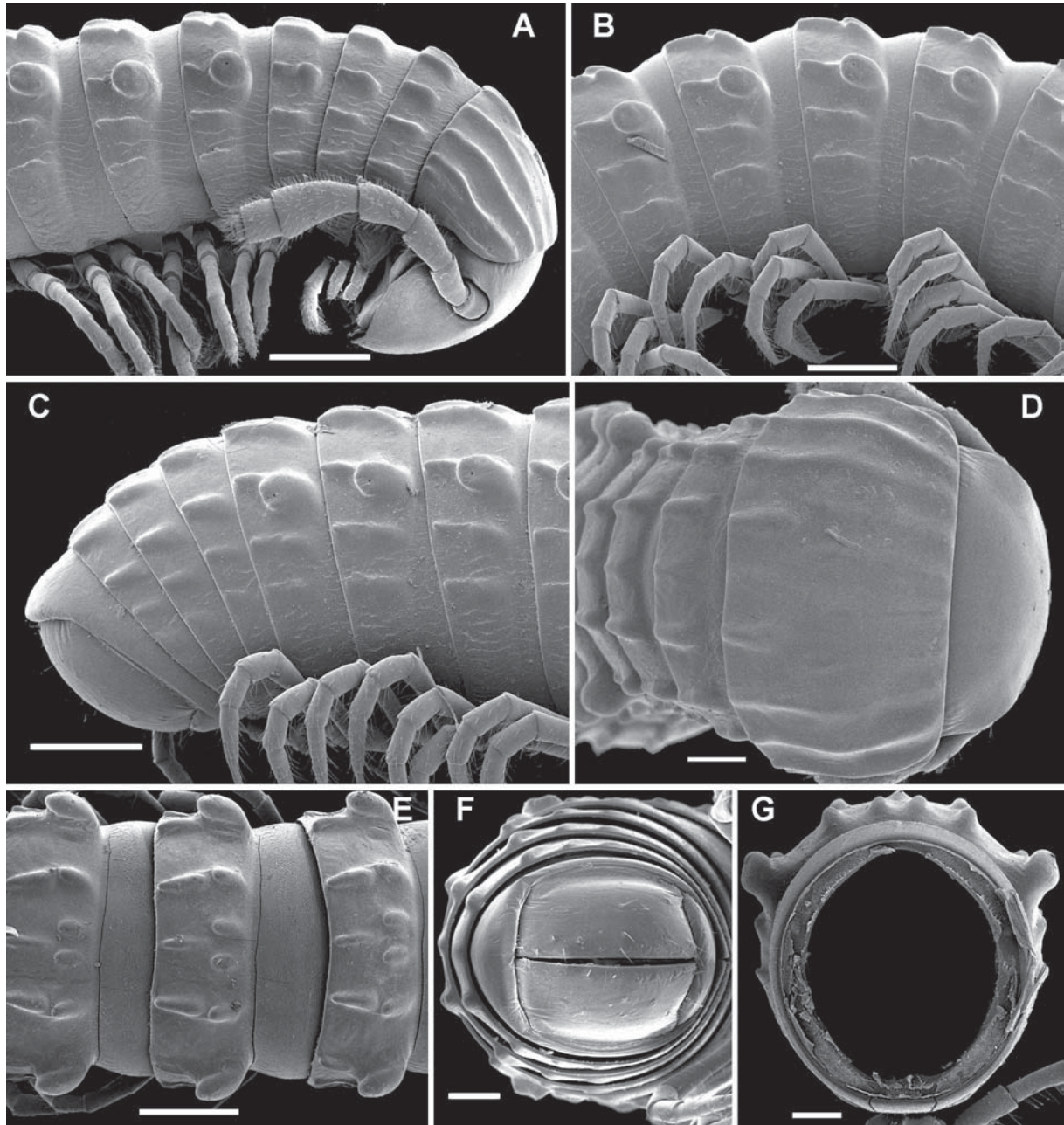


Fig. 9. *Glyphiulus difficilis* sp.n., ♀ non-type from Cave Xia Yan Dong: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — caudal part of body, lateral and caudal views, respectively; G — cross-section of a midbody segment, front view. Scale bars: A–C & E — 0.5 mm; D, F & G — 0.2 mm.

Рис. 9. *Glyphiulus difficilis* sp.n., нетиповая ♀ из пещеры Xia Yan Dong: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелувищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сзади; G — поперечный разрез через среднетелувищный сегмент, спереди. Масштаб: A–C, E — 0,5 мм; D, F, G — 0,2 мм.

Anterior gonopods (Figs 8A, B) with a plate-like coxosternum showing its inner, axe-shaped tips only slightly higher than telopodites, rather densely microsetose on caudal face. Posterior gonopods (Fig. 8C) as usual, very compact, flagellum rather short and plumose.

REMARKS. The non-type series from Cave Xia

Yan Dong (Fig. 9) shows the following characteristics that make it a little distinguished from the types: (1) body somewhat smaller, ♂ ca 34 mm long and 1.7 mm wide, with 48p+2a+T, ♀ ca 29 or 33 mm long, 1.5 or 1.8 mm wide, with 43p+4+T or 48p+2a+T; and, (2) crests on collum and metazona slightly more strongly developed.

Glyphiulus mulunensis sp.n.

Figs 10–12.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huangjiang County, Mulun Nature Reserve, Cave Mashan Dong, 25.15855°N, 108.05865°E, 335 m a.s.l., hand collection, 19.05.2007, leg. F. Brehier (CHIGx07-19-02). Paratypes: 1 ♂ (MNHN GA 079), 1 ♂, 1 ♀, 3 juv., 1 fragm. (SCAU), 1 ♂ (SEM), same locality, together with holotype; 1 ♂, 1 ♀ (MNHN GA 079), 1 ♂, 1 ♀ (ZMUM), same cave, 19.05.2007, leg. L. Deharveng, A. Bedos & Li Youbang (CHIGx07-19-01). Non-types: 2 ♂♂, 1 ♀ (MNHN GA 079), 1 ♂, 1 ♀ (SCAU), 1 ♂, 1 ♀ (ZMUC), Mulun Nature Reserve, Cave Gang Lai Dong 2, 25.11177°N, 108.00172°E, hand collection, 13.03.2005, leg. L. Deharveng, Chen & A. Bedos (CHIGx05-085).

NAME. To emphasize the Mulun karst which is known to support the richest cave fauna in China [Deharveng et al., 2008].

DIAGNOSIS. Differs from congeners by the polytrichous gnathochilarium, coupled with the peculiar carinotaxy patterns, in particular an incomplete formula of the collum due to strongly obliterated central crests (much like in the above *G. adeloglyphus*, *G. balazsi* and *G. anophthalmus*), as well as by a visible premarginal sulcus on each paraproct, the caudad increasingly acute metatergal crests, and the special shapes and armature of both gonopod pairs (see also Key below).

DESCRIPTION. Length of adults 43–48 mm, width 2.0–2.1 mm, midbody segments being broadest. Holotype about 48 mm long, 2.0 mm wide, with 67p+2a+T. Coloration rather uniformly light yellow-brown to (castaneous) brown, only some crests and ozoporiferous tubercles often infuscate, dark brown. Juveniles uniformly yellow.

Body with 61–68p+2–1a+T.

All characters as in *G. grandis* sp.n. (Figs 10–12), except as follows. Antennae long and slender, extending to end of segment 5 laterally (Figs 10A, 11A, 12A). Ocellaria invisible. Gnathochilarium (Figs 11C, 12B) less strongly polytrichous, with a separate promentum (n=3).

Carinotaxy formula of collum complete: I–III+4p+5a+pc+ma (Figs 10A, D), but mid-dorsal crests very low and poorly traceable.

Subsequent metaterga relatively strongly crested (Figs 10, 11D); carinotaxy formula, 2/2+I/i+4/3+I/i+2/2 (Figs 10B, E, 11D). Ozoporiferous tubercles enlarged, oblong-conical, higher than wide, rather narrowly rounded apically (Fig. 11D), on midbody and, especially, posterior segments with similarly high, caudad growing increasingly high and sharp tubercles/teeth around (Figs 10B, C).

Epiproct simple, regularly rounded caudally, with a faint axial ridge dorsally (Figs 10C, F, G). Paraprocts regularly convex, with premarginal sulci medially (Fig. 10G). Hypoproct transversely bean-shaped, slightly concave caudally.

Legs long and slender (Figs 11D, E, 12F), on midbody segments their length about 1.2–1.4 times greater than segment height. Claw long, usually with only a highly rudimentary accessory spine at base (Fig. 11F).

♂ legs 1 as usual, with rudimentary, 1-segmented leg vestiges (Figs 11C, 12C). ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with two strong setae distolaterally (Fig. 12D).

Anterior gonopods (Figs 11G, 12G) with a plate-like coxosternum showing its inner, axe-shaped tips considerably higher than telopodites, rather densely microsetose on caudal face. Posterior gonopods (Figs 11H, 12H) as usual, very compact, flagellum rather short and plumose.

REMARKS. The non-type series from Cave Gang Lai Dong 2, consisting of only fragmented specimens, agrees in every detail with the types, but shows the following minor deviations: (1) width of midbody segments 1.8–2.1 mm, and (2) penes with four strong setae on each side (n=1).

Glyphiulus tiani sp.n.

Figs 13–15.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huangjiang County, Mulun Nature Reserve, Cave Dong Zai Dong, 25.13783°N, 108.03508°E, 308 m a.s.l., hand collection, 20.05.2007, leg. L. Deharveng, F. Brehier, A. Bedos & Tian Mingyi (CHIGx07-20-01). Paratypes: 1 juv., 1 juv. fragm. (SCAU), 1 ♀ (MNHN GA 080), 1 juv. (SEM), same locality, together with holotype.

NAME. Honours Tian Mingyi, Guangzhou, China, one of the most active collectors of cave fauna in the Mulun region.

DIAGNOSIS. Very similar to the previous species, as well as to *G. adeloglyphus*, *G. balazsi* and *G. anophthalmus*, but differs from them and other congeners in the rather polytrichous gnathochilarium, coupled with the peculiar carinotaxy patterns, and the special shapes and armature of both gonopod pairs (see also Key below).

DESCRIPTION. Length of adults: 33 (holotype) or 36 mm (paratype), width 1.8–1.85 mm, midbody segments being broadest. Adult body with 50p+4a+T (holotype) or 53p+3a+T (paratype). Coloration uniformly pallid to very light brown, only some ozoporiferous cones contrastingly infuscate, brown.

All characters as in *G. grandis* sp.n. (Figs 13–15), except as follows. Antennae rather long but clavate, extending beyond segment 4 laterally (Figs 13A, 15A). Ocellaria invisible. Gnathochilarium (Figs 14A, 15B) less strongly polytrichous, with a separate promentum (n=2).

Carinotaxy formula of collum complete, pattern discernible: I–III+4p+5a+pc+ma, but mid-dorsal crests very flat (Figs 13A, D).

Subsequent metaterga relatively strongly crested (Figs 13, 14E); carinotaxy formula, 2/2+I/i+4/3+I/i+2/2 (Figs 13B, E, 14E). Ozoporiferous tubercles enlarged, oblong-conical, about as high as wide at base, rather narrowly rounded and subtruncate apically (Fig. 14E), on midbody and, especially, posterior segments with much lower, mainly strongly rounded tubercles/crests around (Figs 13B, C), only in rear 1/5 body these crests slightly more elevated and more narrowly rounded.

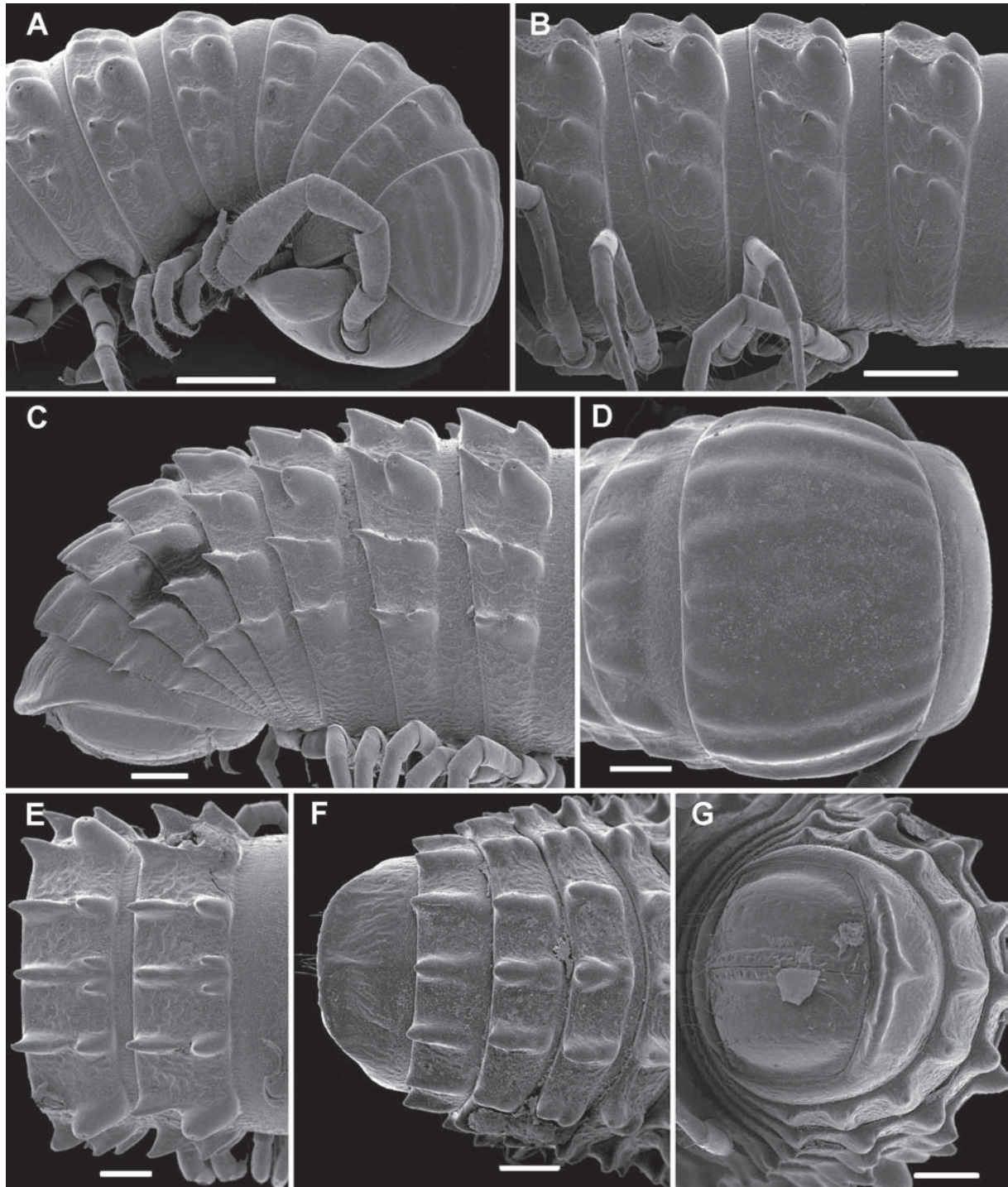


Fig. 10. *Glyphiulus mulunensis* sp.n., ♂ paratype from Cave Mashan Dong: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C, F & G — posterior part of body, lateral, dorsal and caudal views, respectively. Scale bars: A & B — 0.5 mm; C–G — 0.2 mm.

Рис. 10. *Glyphiulus mulunensis* sp.n., паратип ♂ из пещеры Mashan Dong: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелушные сегменты, соответственно сбоку и сверху; C, F, G — задняя часть тела, соответственно сбоку, сверху и сзади. Масштаб: A, B — 0,5 мм; C–G — 0,2 мм.

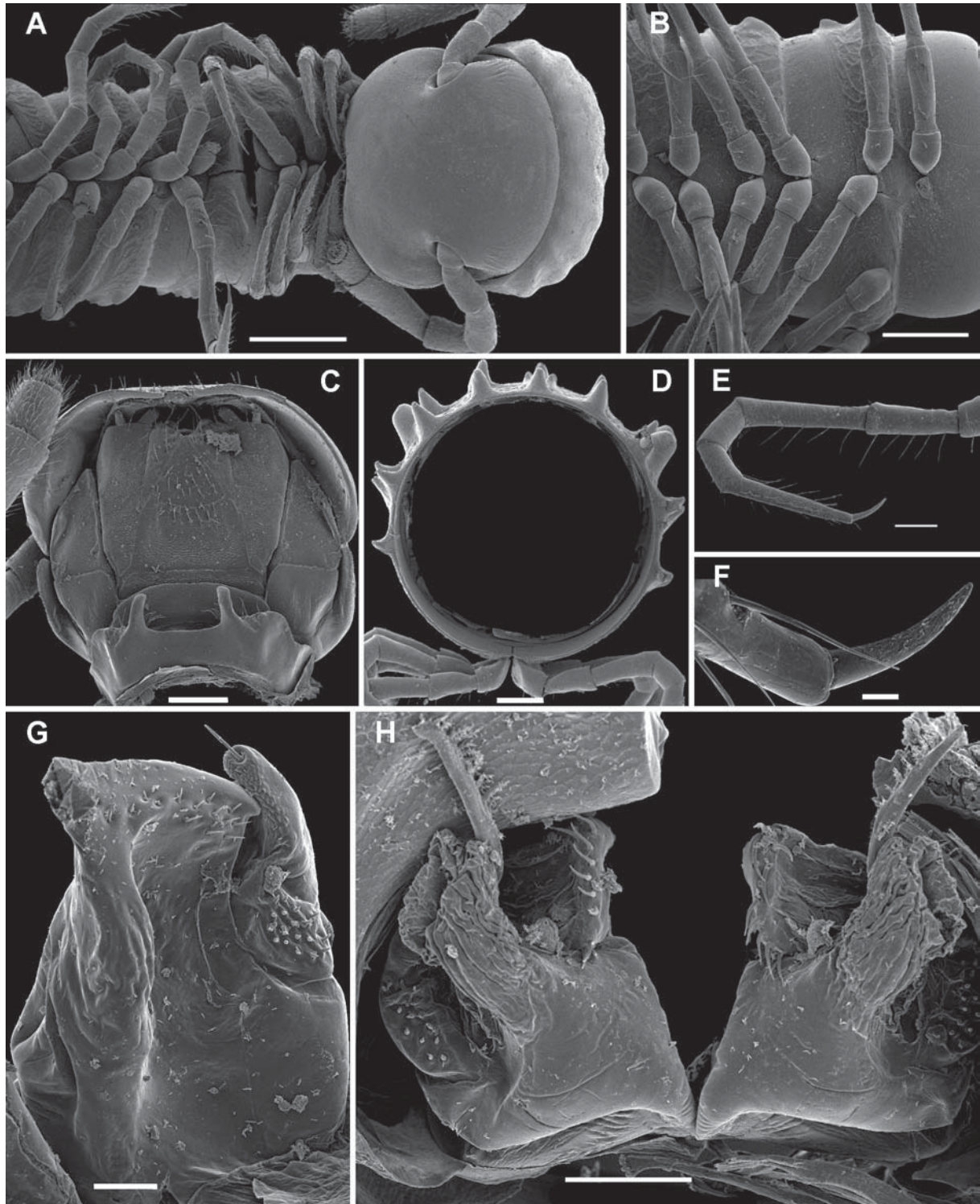


Fig. 11. *Glyphiulus mulunensis* sp.n., ♂ paratype from Cave Mashan Dong: A — anterior part of body, ventral view; B — midbody segments, ventral view; C — gnathochilarium and legs 1, ventral view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view; G — left anterior gonopod, caudal view; H — both posterior gonopods, front view. Scale bars: A & B — 0.5 mm; C–E — 0.2 mm; F — 0.1 mm; G — 0.05 mm; H — 0.02 mm.

Рис. 11. *Glyphiulus mulunensis* sp.n., паратип ♂ из пещеры Mashan Dong: A — передняя часть тела, снизу; B — среднетуловищные сегменты, снизу; C — гнатохиларий и ноги 1, сзади; D — поперечный разрез через среднетуловищный сегмент, сзади; E — среднетуловищная нога, сбоку; F — увеличенный коготок, сбоку; G — левый передний гонопод, сзади; H — оба задних гонопода, спереди. Масштаб: A, B — 0,5 мм; C–E — 0,2 мм; F — 0,1 мм; G — 0,05 мм; H — 0,02 мм.

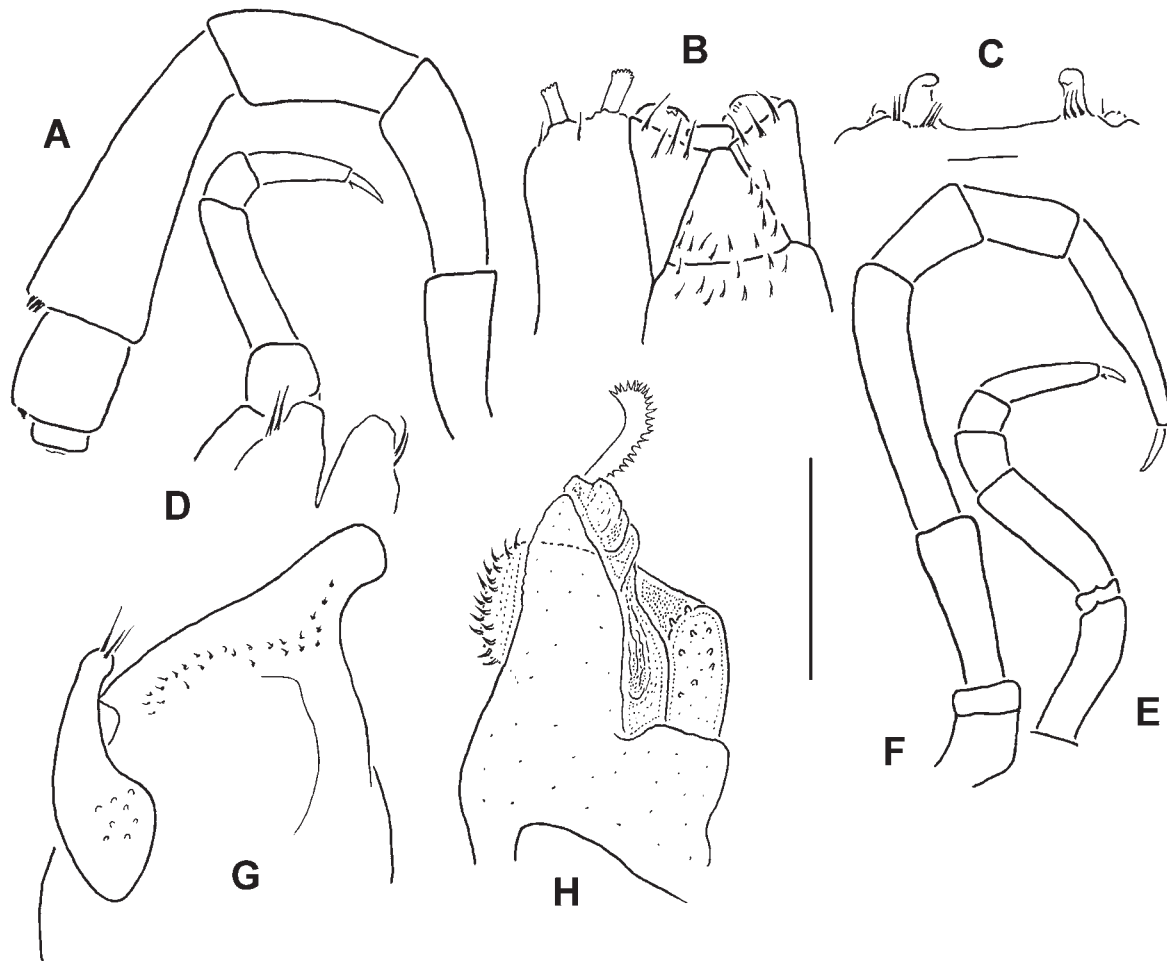


Fig. 12. *Glyphiulus mulunensis* sp.n., ♂ paratype from Cave Mashan Dong: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — leg 3, caudal view; F — midbody leg, caudal view; G — left anterior gonopod, caudal view; H — left posterior gonopod, front view. Scale bar: A–F — 0.5 mm; G & H — 0.2 mm.

Рис. 12. *Glyphiulus mulunensis* sp.n., паратип ♂ из пещеры Mashan Dong: A — антенна, сбоку; B — гнатохиларий, снизу; C — ноги 1, спереди; D — нога 2, сзади; E — нога 3, сзади; F — среднетелувищная нога, сбоку; G — левый передний гонопод, сзади; H — правый задний гонопод, спереди. Масштаб: A–F — 0,5 мм; G, H — 0,2 мм.

Epiproct simple, regularly rounded caudally, with a faint transverse impression dorsally (Figs 13C, F, 14D). Paraprocts regularly convex, with premarginal sulci medially (Fig. 14D). Hypoproct transversely bean-shaped, slightly concave caudally.

Legs long and slender (Fig. 14E), on midbody segments their length about 1.0–1.1 times greater than segment height. Claw long, mostly without accessory spine at base (Fig. 14G).

♂ legs 1 as usual, with rudimentary, 1-segmented leg vestiges (Fig. 15C). ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with two strong setae distolaterally (Fig. 15D).

Anterior gonopods (Fig. 15E) with a plate-like coxosternum showing its inner, axe-shaped tips considerably higher than telopodites, rather moderately microsetose on caudal face. Posterior gonopods (Fig. 15F)

as usual, very compact, flagellum rather short and plumose.

Glyphiulus acutus sp.n.

Figs 16–20.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huangjiang County, Mulun Nature Reserve, Cave Gang Lai Dong, 25.11278°N, 107.98309°E, hand collection, 12.03.2005, leg. L. Deharveng & A. Bedos (CHIgx05-075). Paratypes: 1 ♀ (SCAU), 1 juv. ♂ (SEM), same locality, together with holotype. Non-types: 1 ♂ (IZAS), 1 ♀ (SCAU), 2 ♂♂ (MNHN GA 081), 1 ♂ (SEM), western part of Mulun Nature Reserve, Cave Huo Bayun Dong, 25.157778°N, 107.910556°E, 860 m a.s.l., hand collection, 09.11.2009, leg. Tian Mingyi et al. (CHIgx09-093).

NAME. To emphasize the tubercles/crests other than ozoporiferous cones on the metazona being mostly acute caudo-apically.

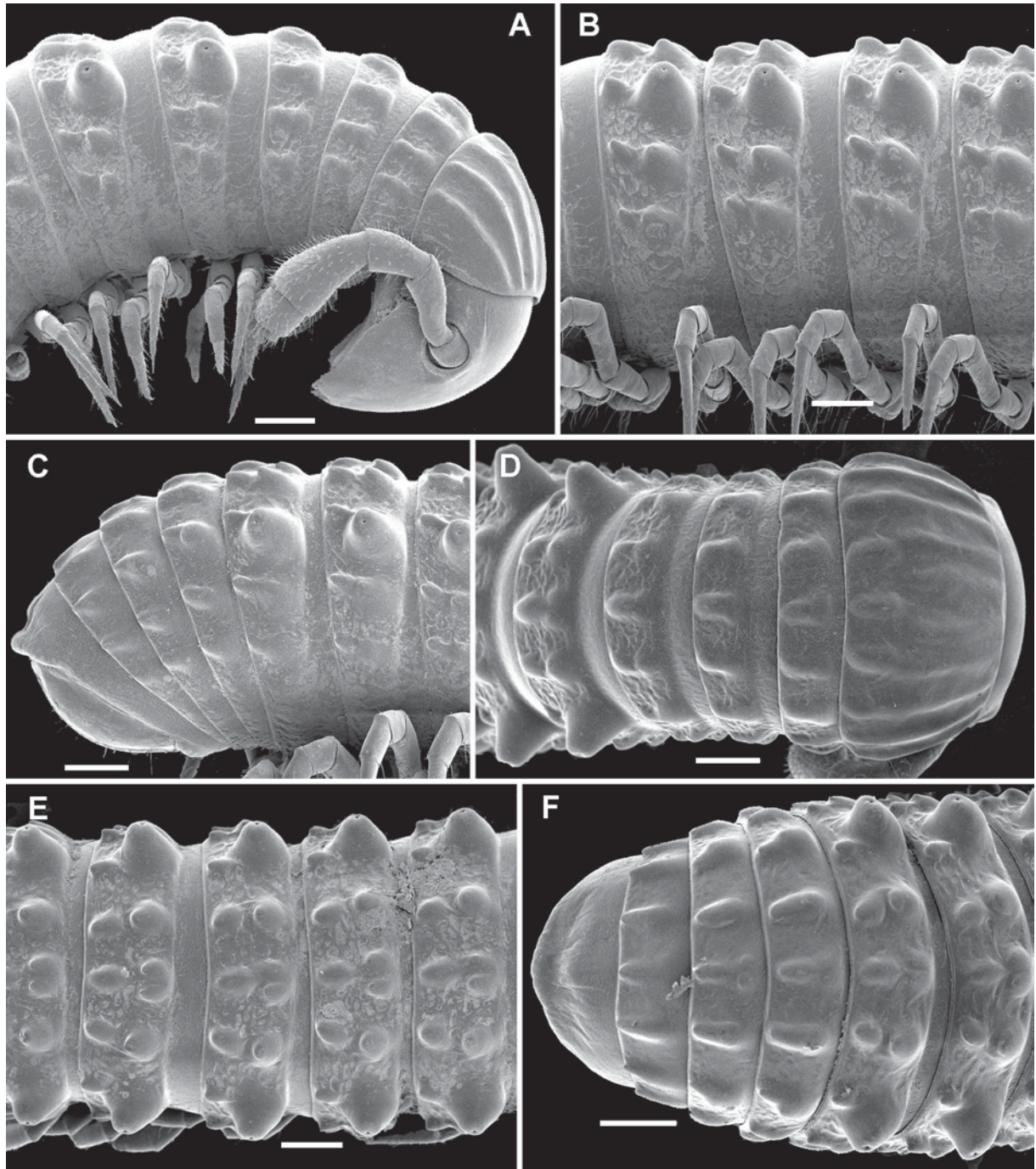


Fig. 13. *Glyphiulus tiani* sp.n., juvenile paratype from Cave Mashan Dong: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and dorsal caudal views, respectively. Scale bars: 0.2 mm.

Рис. 13. *Glyphiulus tiani* sp.n., паратип-личинка из пещеры Dong Zai Dong: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелувищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сверху. Масштаб: 0,2 мм.

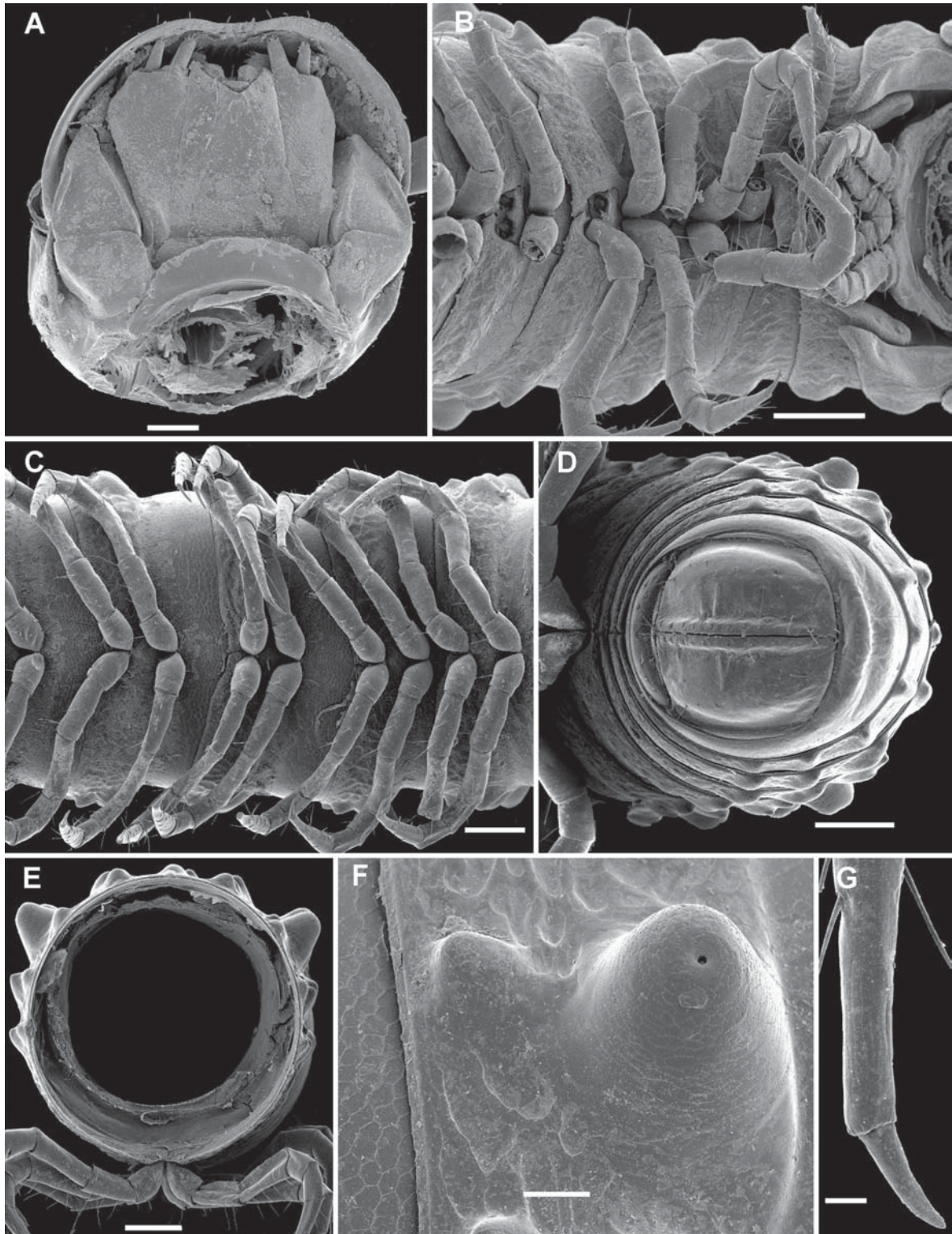


Fig. 14. *Glyphiulus tiani* sp.n., juvenile paratype from Cave Dong Zai Dong: A — gnathochilarium, caudal view; B — anterior part of body (head removed), ventral view; C — midbody segments, ventral view; D — caudal part of body, caudal view; E — cross-section of a midbody segment, caudal view; F — enlarged ozopore region, lateral view; G — enlarged claw, lateral view. Scale bars: A — 0.1 mm; B–E — 0.2 mm; F — 0.05 mm; G — 0.02 mm.

Рис. 14. *Glyphiulus tiani* sp.n., паратип-личинка из пещеры Dong Zai Dong: А — гнатохиларий, снизу; В — передняя часть тела (голова удалена), снизу; С — среднетуловищные сегменты, снизу; D — задняя часть тела, сзади; E — поперечный разрез через среднетуловищный сегмент, сзади; F — увеличенный район озопоры, сбоку; G — увеличенный коготок, сбоку. Масштаб: А — 0,1 мм; В–Е — 0,2 мм; F — 0,05 мм; G — 0,02 мм.

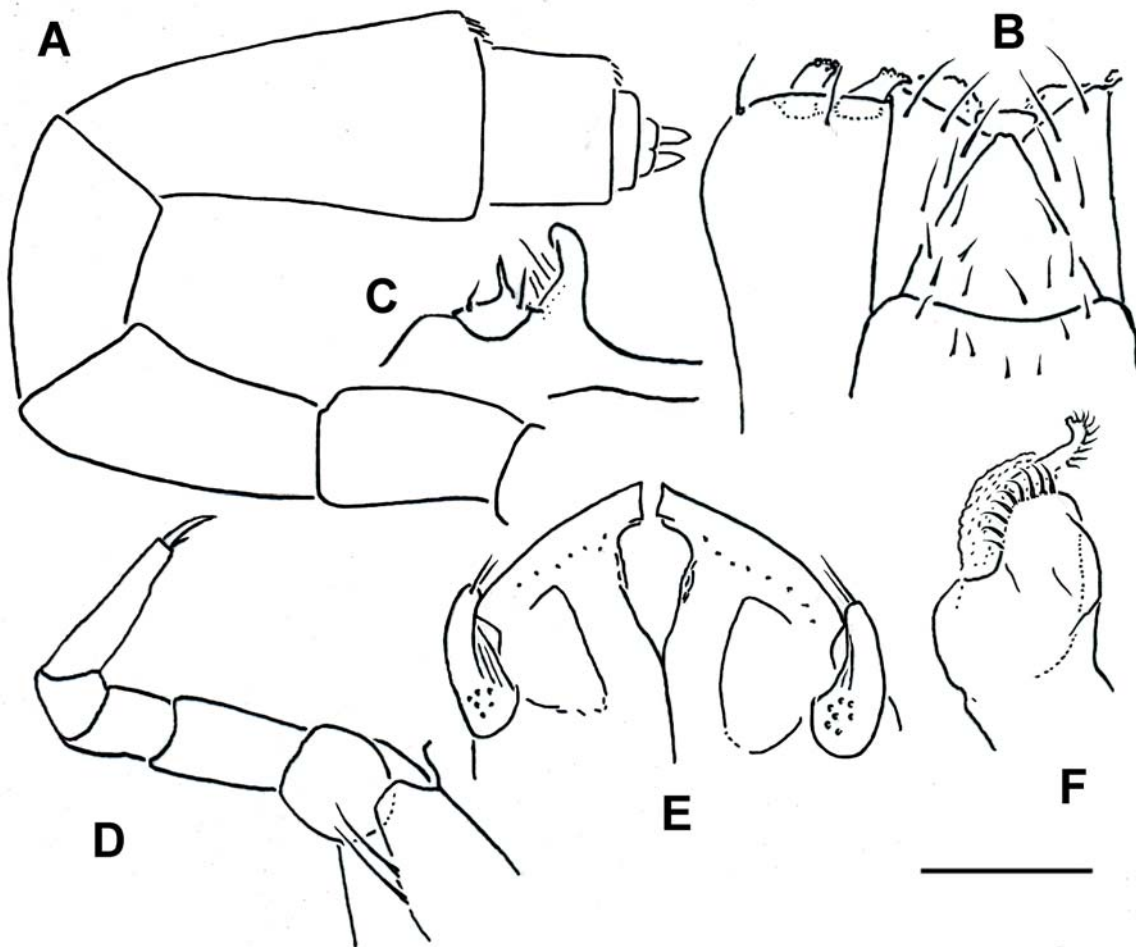


Fig. 15. *Glyphiulus tiani* sp.n., holotype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — anterior gonopods, caudal view; G — left posterior gonopod, mediocaudal view. Scale bar: 0.2 mm.

Рис. 15. *Glyphiulus tiani* sp.n., голотип: А — антенна, сбоку; В — гнатохилиарий, снизу; С — ноги 1, спереди; D — нога 2, сзади; E — передние гоноподы; F — левый задний гонопод, изнутри и сзади. Масштаб: 0,2 мм.

DIAGNOSIS. Very similar to the previous species, as well as to *G. adeloglyphus*, *G. balazsi* and *G. anophthalmus*, but differs from them and other congeners in the peculiar, mostly high and acute tubercles/crests around only slightly higher ozoporiferous cones on metazona, the moderately setose gnathochilarium, coupled with the peculiar carinotaxy patterns, and the special shapes and armature of both gonopod pairs (see also Key below).

DESCRIPTION. Length of adults: 31 (holotype) or 33 mm (paratype), width 1.5–1.6 mm, midbody segments being broadest. Adult body with 51p+2a+T (holotype) or 58p+2a+T (paratype). Coloration uniformly pallid to very light brown, only some ozoporiferous cones contrastingly infusate, brown.

All characters as in *G. grandis* sp.n. (Figs 16–18), except as follows. Antennae shorter and stouter, extending to about end of segment 3 laterally (Figs 16A, 18A). Ocellaria invisible. Gnathochilarium (Figs 17A,

18B) far less strongly polytrichous, with a separate promentum (n=2).

Carinotaxy formula of collum complete, pattern discernible: I–IV+4p+5a+pc+ma, but mid-dorsal crests flat (Figs 16A, D).

Subsequent metaterga relatively strongly crested (Figs 16, 17E); carinotaxy formula, 2/2+I/i+4/3+I/i+2/2 (Figs 16B, E, 17E). Ozoporiferous tubercles enlarged, oblong-conical, usually higher than wide at base, rather narrowly rounded and subtruncate apically (Fig. 17E), on nearly all segments with only somewhat lower, usually sharp tubercles/crests around (Figs 16B, C).

Epiproct simple, regularly rounded caudally, slightly flattened dorsally along caudal margin (Figs 16C, F). Paraproct convex, with premarginal sulci medially (Fig. 17D). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 17B).

Legs shorter but slender (Figs 17E, G), on midbody segments about 0.8–0.9 length of segment height. Claw

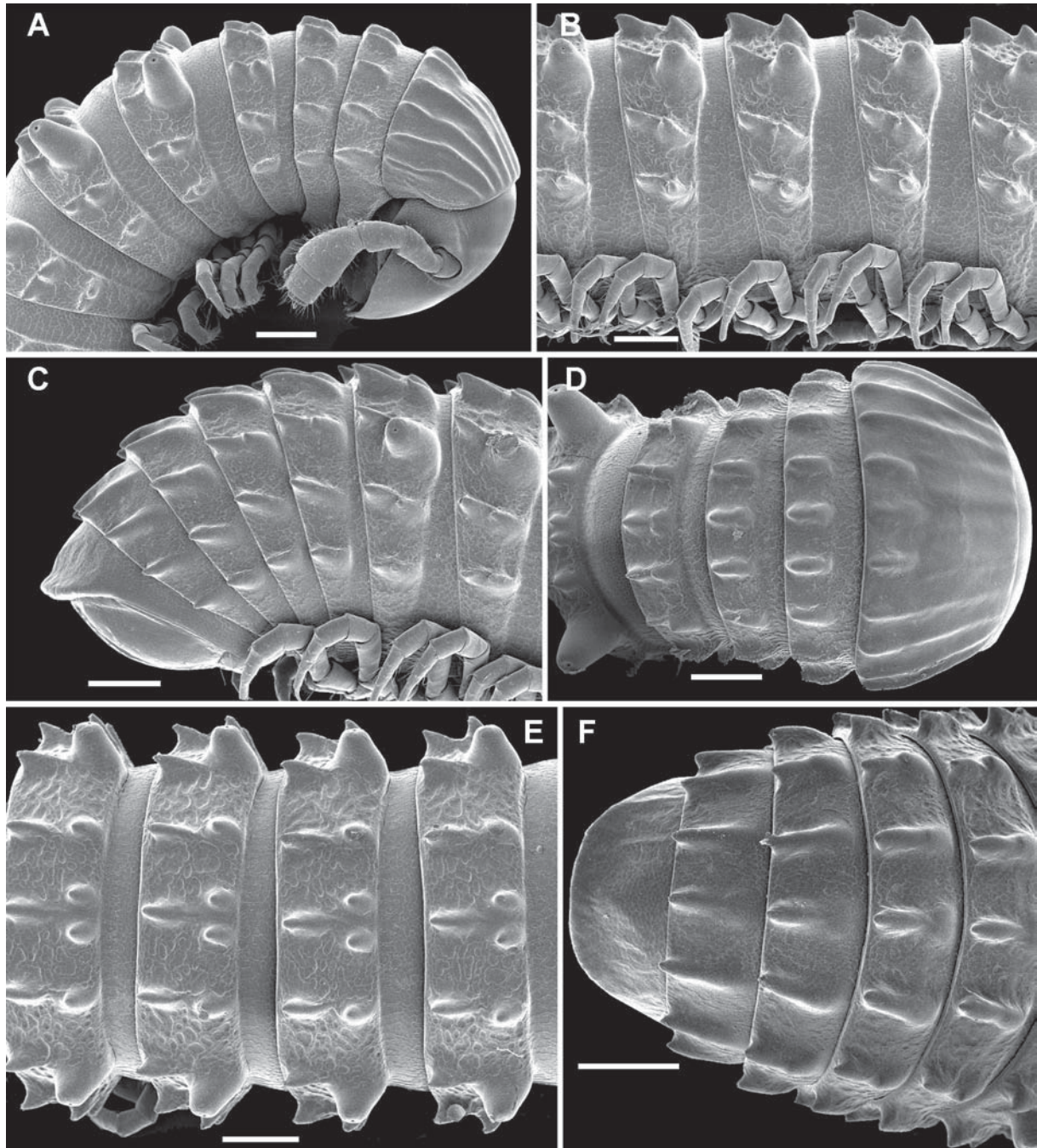


Fig. 16. *Glyphiulus acutus* sp.n., juvenile paratype from Cave Gang Lai Dong: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and dorsal caudal views, respectively. Scale bars: 0.2 mm.

Рис. 16. *Glyphiulus acutus* sp.n., паратип-личинка из пещеры Gang Lai Dong: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелувищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сверху. Масштаб: 0,2 мм.

long, often with a short but distinct accessory spine at base (Fig. 17H).

♂ legs 1 as usual, with rudimentary, 1-segmented leg vestiges (Fig. 18C). ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with two strong setae distolaterally (Fig. 18D).

Anterior gonopods (Fig. 18E) with a plate-like coxosternum showing its inner, axe-shaped tips considerably higher than telopodites, rather moderately microsetose on caudal face. Posterior gonopods (Fig. 18F) as usual, very compact, flagellum rather short and plumose.

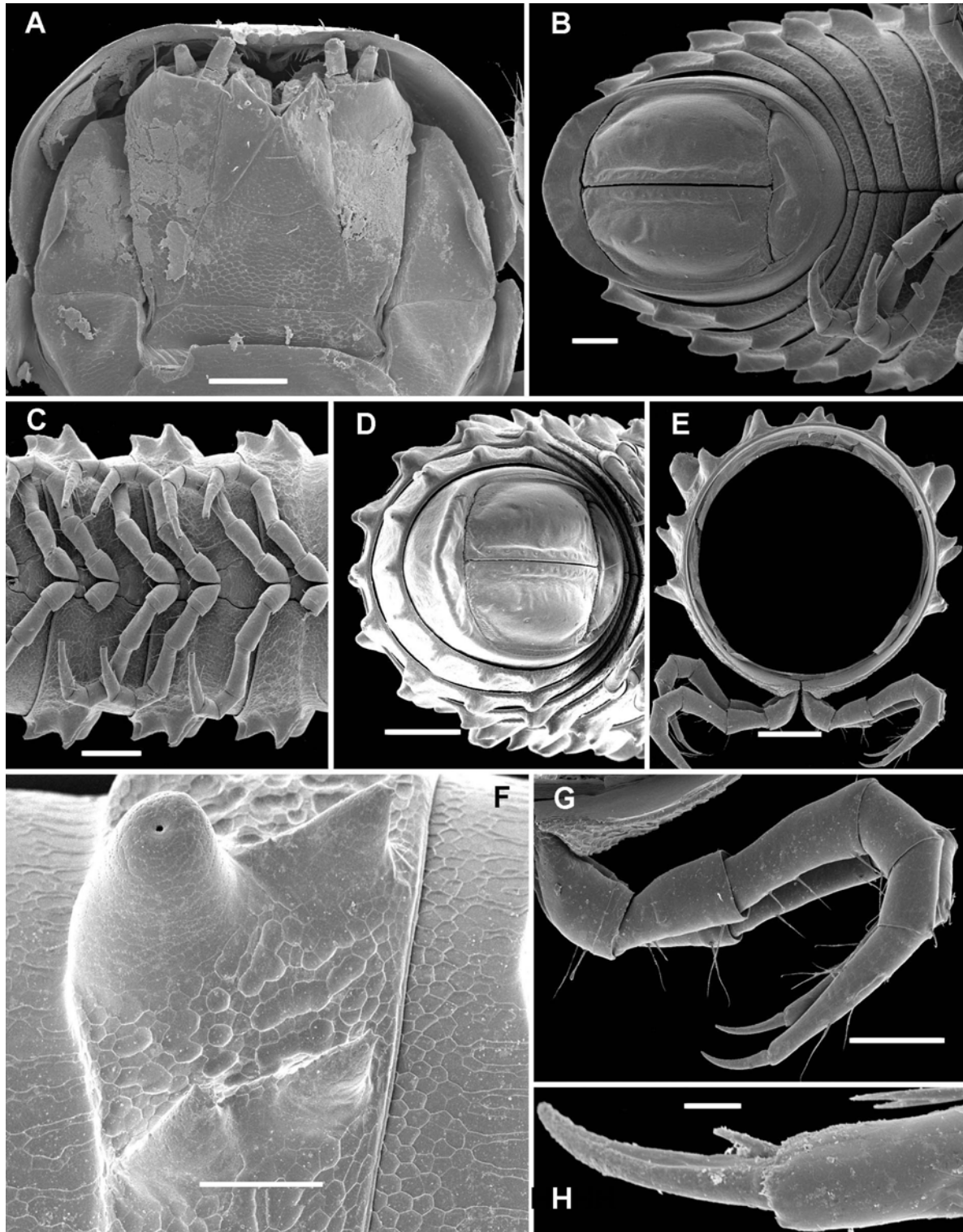


Fig. 17. *Glyphiulus acutus* sp.n., juvenile paratype from Cave Gang Lai Dong: A — gnathochilarium, caudal view; B & D — caudal part of body, ventral and caudal views, respectively; C — midbody segments, ventral view; E — cross-section of a midbody segment, caudal view; F — enlarged ozopore region, lateral view; G — midbody legs, lateral view; H — enlarged claw, lateral view. Scale bars: A, B, F & G — 0.1 mm; C–E — 0.2 mm; H — 0.01 mm.

Рис. 17. *Glyphiulus acutus* sp.n., паратип-личинка из пещеры Gang Lai Dong: А — гнатохиларий, снизу; В, D — передняя часть тела, соответственно снизу и сзади; С — среднетуловищные сегменты, снизу; Е — поперечный разрез через среднетуловищный сегмент, сзади; F — увеличенный район озопоры, сбоку; G — среднетуловищные ноги, сбоку; H — увеличенный коготок, сбоку. Масштаб: А, В, F, G — 0,1 мм; С–Е — 0,2 мм; H — 0,01 мм.

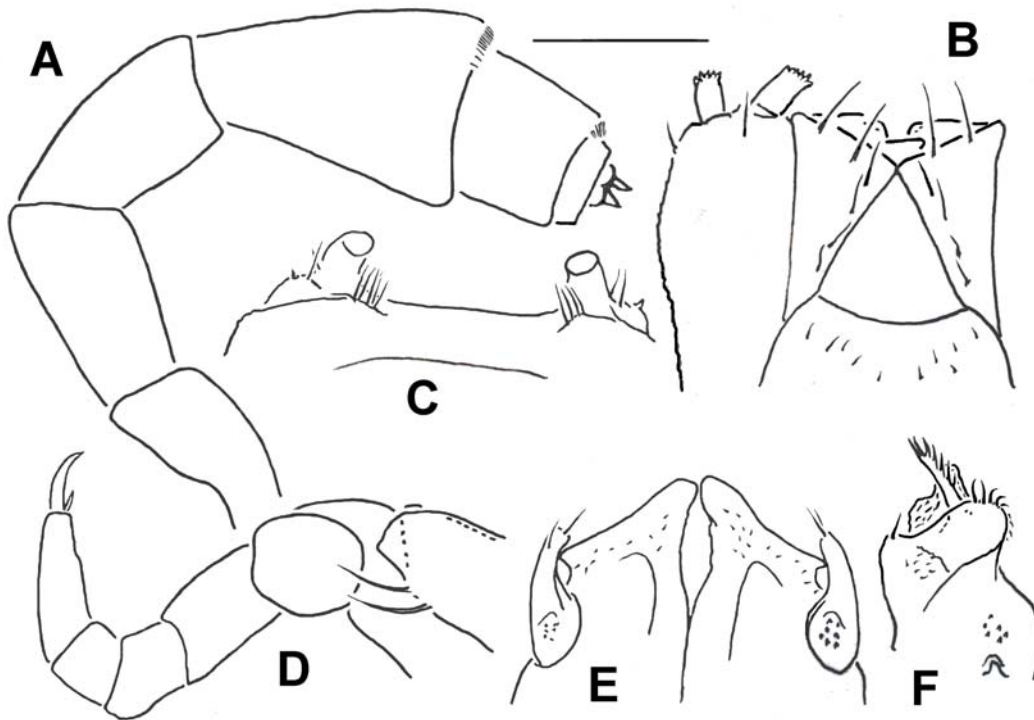


Fig. 18. *Glyphiulus acutus* sp.n., holotype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — anterior gonopods, caudal view; G — left posterior gonopod, front view. Scale bar: 0.2 mm.

Рис. 18. *Glyphiulus acutus* sp.n., голотип: А — антенна, сбоку; В — гнатохиларий, снизу; С — ноги 1, спереди; D — нога 2, сзади; E — передние гоноподы; F — левый задний гонопод, спереди. Масштаб: 0,2 мм.

REMARKS. The non-type series from Cave Huo Bayun Dong (Figs 19 & 20) generally agrees very well with the types, but shows the following minor deviations: (1) coloration uniformly brown to brown castaneous dark, with distal halves of antennae light brown; (2) body 30–33 mm long, 1.5–1.6 mm wide, with 56–60p+3–2a+T; (3) antennae and legs slightly longer, the former extending to end segment 4 laterally, the latter 1.1–1.2 length of midbody height (Figs 19A, G, 20E); (4) ozoporiferous cones usually a little higher, while crests/tubercles around a little lower (Figs 20D); (5) epipect with a faint axial ridge dorsally (Figs 19C, F, 20A).

Glyphiulus paramulunensis sp.n.

Figs 21–24.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huanjiang County, Huanjiang, Cave Shui Dong Mulun, 24.7485°N, 108.27191°E, 332 m, hand collection, 23.05.2007, leg. F. Brehier (CHlgx07-23-06). Paratypes: 1 ♂, 2 ♀♀, 5 juv. (SCAU), 4 ♀♀, 2 juv., 4 fragm. (IZAS), 2 ♂♂, 2 ♀♀ (MNHN GA 082), 1 ♂, 1 ♀ (ZMUM), 1 ♂, 1 ♀ (ZMUC), 1 ♂, 1 ♀ (NMNHS), 1 ♀ (SEM), same locality, together with holotype. Non-types: 1 ♂, 5 ♀♀, 7 juv. (IZAS), 2 ♂♂, 4 ♀♀, 7 juv. (SCAU), 2 ♂♂, 2 ♀♀, 2 juv. (MNHN GA 082), 1 ♂, 1 ♀ (ZMUM), 1 ♂, 1 ♀ (ZMUC), 1 ♂, 1 ♀

(NMNHS), 1 ♂ (SEM), Huanjiang, Cave Xia Lan Dong, 24.80708°N, 108.28354°E, 356 m a.s.l., hand collection, 22.05.2007, leg. L. Deharveng, A. Bedos, Li Youbang & Tian Mingyi (CHlgx07-22-01).

NAME. To emphasize the particular similarity to, and parapatry with, *G. mulunensis* sp.n.

DIAGNOSIS. Very similar to *G. mulunensis* sp.n., as well as to *G. adeloglyphus*, *G. balazsi* and *G. anophthalmus*, in showing deficient carinotaxy on the collum, but differs from them and other congeners in the peculiar, low, flattened tubercles/crests dorsal to only slightly higher ozoporiferous cones on metaterga, the polytrichous gnathochilarium, coupled with the special shapes of the anterior gonopods (see also Key below).

DESCRIPTION. Length of adults: 18–35 mm, width 1.0–1.7 mm, midbody segments being broadest. Adult body with 37–57p+5–1a+T. Holotype ca 35 mm long, 1.7 mm wide, with 57p+1a+T. Coloration uniformly pallid to light brown, often with a slightly stripy pattern when some ozoporiferous cones and crests/tubercles, including crest remnants on collum, somewhat infuscate, usually light brown.

All characters as in *G. grandis* sp.n. (Figs 21–23), except as follows. Antennae long and moderately clavate, extending beyond segment 4 laterally (Figs 21A, 22B, 23A). Ocellaria invisible. Gnathochilarium (Fig.

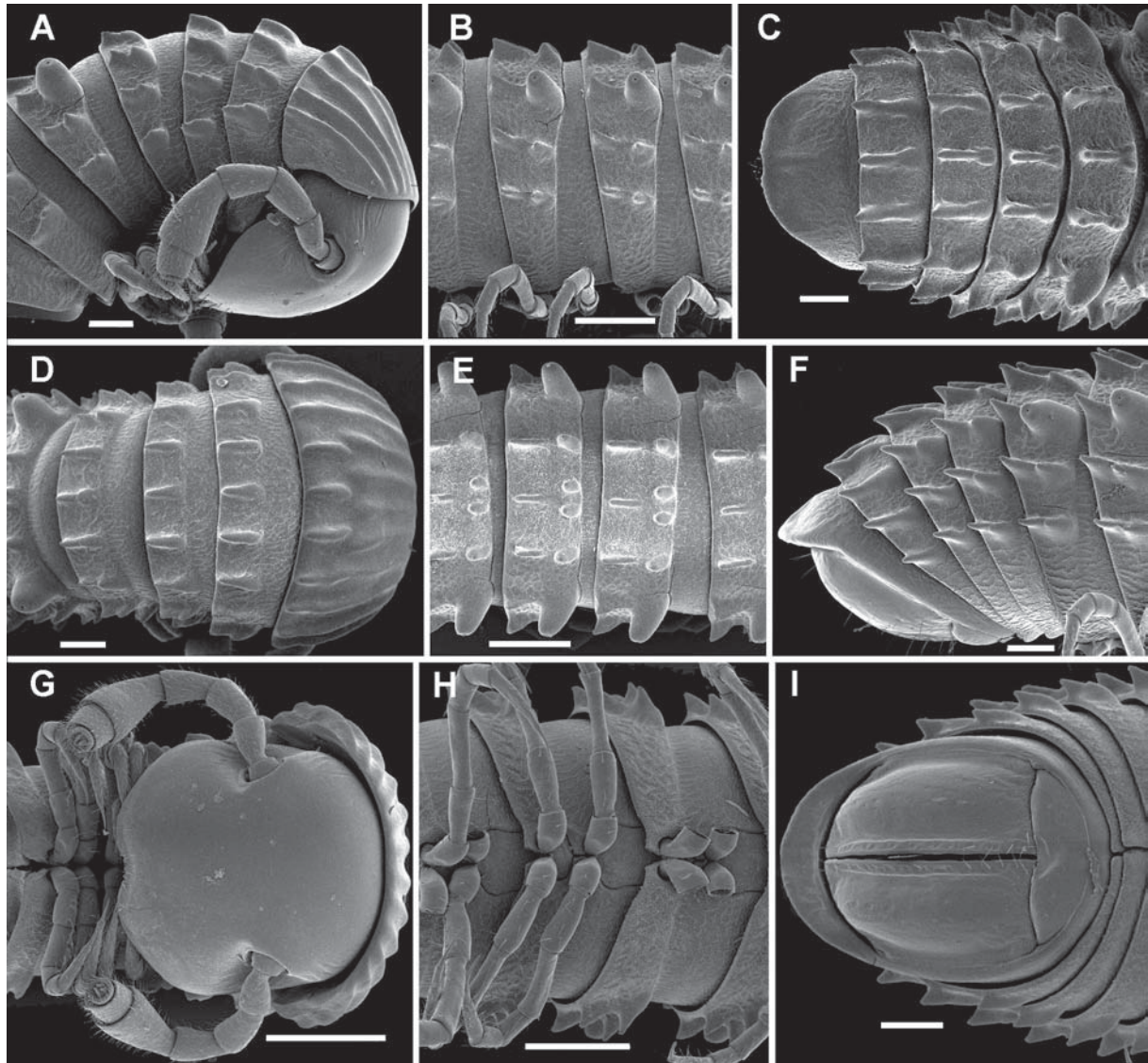


Fig. 19. *Glyphiulus acutus* sp.n., ♂ non-type from Cave Huo Bayun Dong: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: A, C, F & I — 0.2 mm; B, D, E, G & H — 0.5 mm.

Рис. 19. *Glyphiulus acutus* sp.n., нетиповой ♂ из пещеры Ную Байун Дунг: А, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетуловищные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: А, С, F, I — 0,2 мм; B, D, E, G, H — 0,5 мм.

23B) strongly polytrichous, with a separate promentum ($n=2$).

Carinotaxy formula of collum highly incomplete, barely discernible (usually through light brown stripes) only as I, I-II or, more rarely, I-III, all crests being very flat, while mid-dorsal ones fully obliterated (Figs 21A, D).

Subsequent metaterga moderately strongly crested (Figs 21, 22E); carinotaxy formula, $2/2+I/i+4/3+I/i+2/2$ (Figs 21B, E, 22E). Ozoporiferous tubercles enlarged, oblong-conical, broader than high at base, subtruncate apically (Fig. 22E), on nearly all segments

with considerably lower, usually strongly flattened, never acute tubercles/crests around (Figs 21B, C).

Epiproct simple, regularly rounded caudally, very faintly flattened dorsally on both sides of a very poorly developed axial ridge (Figs 21F, 22A). Paraprocts convex, with premarginal sulci medially (Figs 21C, 22A). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 22D).

Legs long and slender (Figs 22E, F), on midbody segments about 1.2–1.4 length of segment height. Claw long, usually without accessory spine at base (Fig. 22G).

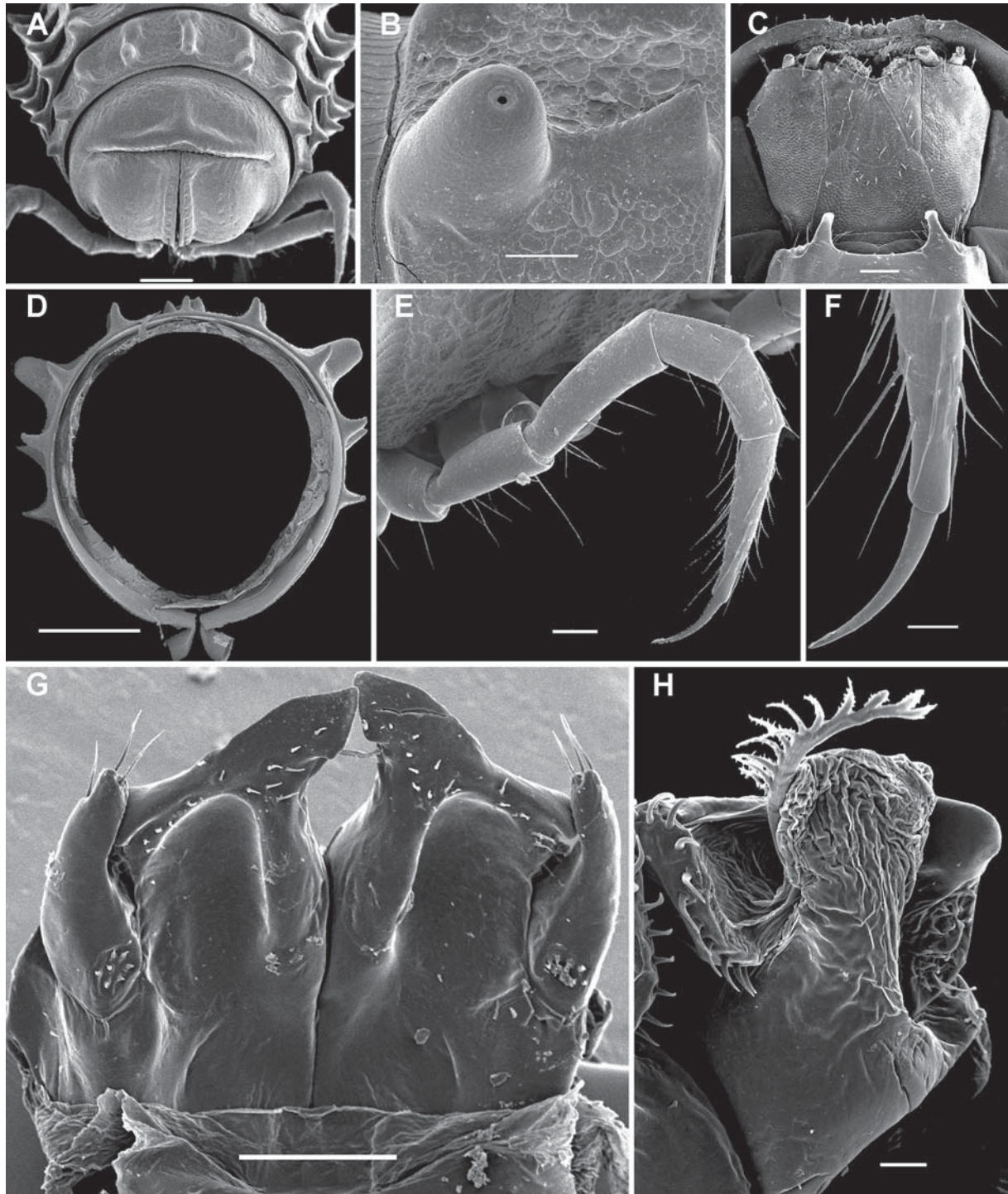


Fig. 20. *Glyphiulus acutus* sp.n., ♂ non-type from Cave Huo Bayun Dong: A — caudal part of body, caudal view; B — enlarged ozopore region, lateral view; C — gnathochilarium and legs 1, caudal view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view; G — anterior gonopods, caudal view; H — left posterior gonopod, front view. Scale bars: A & C — 0.2 mm; B, E & G — 0.1 mm; D — 0.5 mm; F — 0.05 mm; H — 0.02 mm.

Рис. 20. *Glyphiulus acutus* sp.n., нетиповой ♂ из пещеры Huo Bayun Dong: А — задняя часть тела, сзади; В — увеличенный район озопоры, сбоку; С — гнатохиларий и ноги 1, сзади; D — поперечный разрез через среднетуловищный сегмент, сзади; E — среднетуловищная нога, сбоку; F — увеличенный коготок, сбоку; G — передние гоноподы, сзади; H — левый задний гонопод, спереди. Масштаб: А, С — 0,2 мм; В, E, G — 0,1 мм; D — 0,5 мм; F — 0,05 мм; H — 0,02 мм.

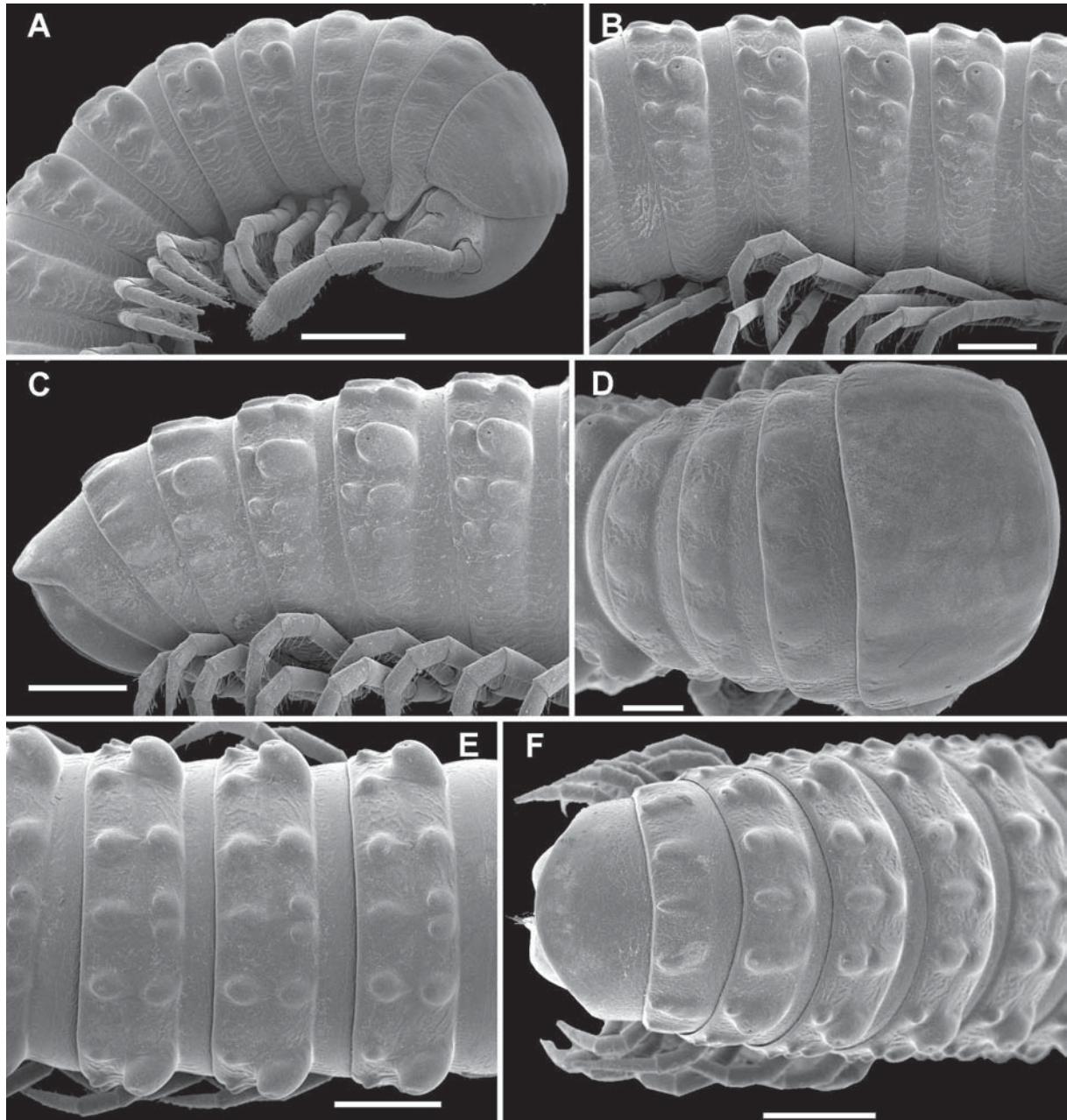


Fig. 21. *Glyphiulus paramulunensis* sp.n., ♀ paratype from Cave Shui Dong Mulun: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and dorsal caudal views, respectively. Scale bars: A–C, E & F — 0.5 mm; D — 0.2 mm.

Рис. 21. *Glyphiulus paramulunensis* sp.n., паратип ♀ из пещеры Shui Dong Mulun: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелувищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сверху. Масштаб: A–C, E, F — 0,5 мм; D — 0,2 мм.

♂ legs 1 as usual, leg vestiges virtually absent (Fig. 23C). ♂ legs 2 only very slightly hypertrophied; penes broad, oblong-subtrapeziform, each with two strong setae distolaterally (Fig. 23D).

Anterior gonopods (Fig. 23E) with a plate-like coxosternum showing its inner, distinctly upturned, elevated, axe-shaped tips only moderately higher than telopodites, rather modestly microsetose on caudal face.

Posterior gonopods (Fig. 23F) as usual, very compact, flagellum rather short and plumose.

REMARKS. The large non-type series from Cave Xia Lan Dong (Fig. 24) shows (1) a coloration ranging from uniformly light yellow to dark brown, stripy pattern also being less distinct, while distal halves of antennae often nearly pallid as well; (2) body of adults 20–31 mm long, 1.0–1.3 mm wide, with 39–51p+4–

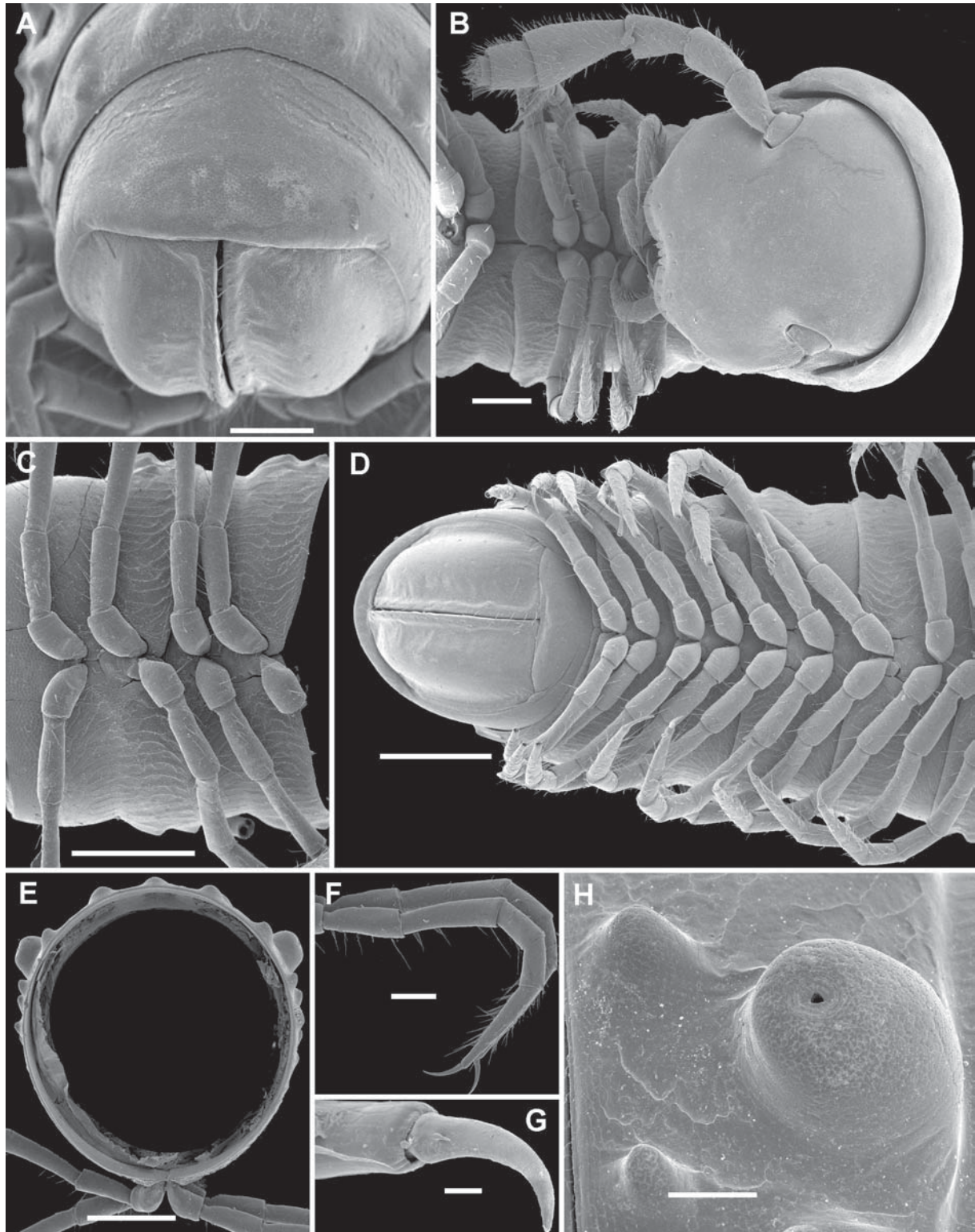


Fig. 22. *Glyphiulus paramulunensis* sp.n., ♀ paratype from Cave Shui Dong Mulun: A & D — caudal part of body, caudal and ventral views, respectively; B — anterior part of body, ventral view; C — midbody segments, ventral view; E — cross-section of a midbody segment, caudal view; F — midbody legs, lateral view; G — enlarged claw, lateral view; H — enlarged ozopore region, lateral view. Scale bars: A & C — 0.2 mm; B, E & G — 0.1 mm; D — 0.5 mm; F — 0.05 mm; H — 0.02 mm.

Рис. 22. *Glyphiulus paramulunensis* sp.n., паратип ♀ из пещеры Shui Dong Mulun: A, D — задняя часть тела, соответственно сзади и снизу; B — передняя часть тела, снизу; C — среднетелувищные сегменты, снизу; E — поперечный разрез через среднетелувищный сегмент, сзади; F — среднетелувищные ноги, сбоку; G — увеличенный коготок, сбоку; H — увеличенный район озопоры, сбоку. Масштаб: A, C — 0,2 мм; B, E, G — 0,1 мм; D — 0,5 мм; F — 0,05 мм; H — 0,02 мм.

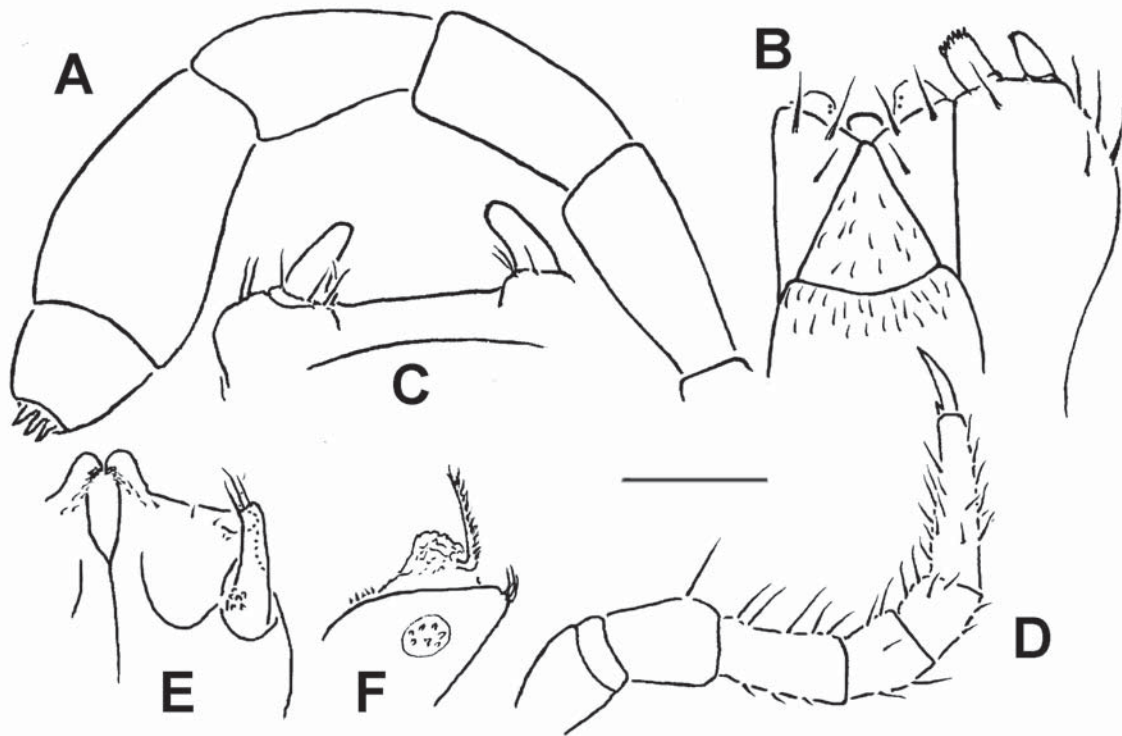


Fig. 23. *Glyphiulus paramulunensis* sp.n., ♂ paratype from Cave Shui Dong Mulun: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — anterior gonopods, caudal view; G — left posterior gonopod, caudal view. Scale bar: 0.2 mm.

Рис. 23. *Glyphiulus paramulunensis* sp.n., паратип ♂ из пещеры Shui Dong Mulun: A — антенна, сбоку; B — гнатохиларий, снизу; C — ноги 1, спереди; D — нога 2, сзади; E — передние гоноподы, сзади; F — левый задний гонопод, сзади. Масштаб: 0,2 мм.

1a+T; (3) collum with mostly complete but indistinct crests I–III, plus barely discernible mid-dorsal ones (Fig. 24C); (4) most of mid-dorsal crests/tubercles on metaterga subacute caudally (Fig. 24B); (5) gnathochilarium very abundantly setose (Fig. 24E). This variety seems to slightly bridge the gap between this and the next species.

At this purely descriptive taxonomic level it appears impossible to reliably appreciate the above degrees of variation in these two populations currently deemed to represent only a single polymorphous species. Genetic analyses, bar-coding in particular, are necessary to verify this impression. The same actually concerns the entire set of new species and varieties described here from the Mulun region.

Glyphiulus proximus sp.n.

Figs 25–27.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huajiang County, Mulun Nature Reserve, Cave Ganxiao Dong, 25.182633°N, 108.031839°E, 650 m a.s.l., hand collection, 07.11.2009, leg. Tian Mingyi et al. (CHlgx09-087). Paratype: 1 ♂ (SEM), same locality, together with holotype. Non-types: 1 ♂ (MNHN GA 083), 1 ♂ fragm. (SCAU), 1 ♂ (SEM), Mulun Nature Reserve, Cave Dong Tu Dong, 25.164444°N, 108.049167°E, 360

m a.s.l., hand collection, 28.10.2009, leg. Tian Mingyi et al. (CHlgx09-019).

NAME. To emphasize the proximity, both structural and geographical, to *G. paramulunensis* sp.n.

DIAGNOSIS. Very similar to *G. paramulunensis* sp.n., but differs by the virtually complete carinotaxy formula on the collum and, above all, by the considerably larger size (see also Key below).

DESCRIPTION. Length of holotype ca 54 mm, width 2.0 mm, midbody segments being broadest. Body with 75p+1a+T. Coloration uniformly dark brown, only antennae paler, light yellow-brown.

All characters as in *G. paramulunensis* sp.n. (Figs 25, 26), except as follows. Antennae long and slender, extending beyond segment 5 laterally (Figs 25A, G). Ocellaria invisible. Gnathochilarium (Fig. 26C) strongly polytrichous, with a separate promentum (n=1).

Carinotaxy formula of collum virtually complete: I–III+4p+5a+pc+ma, but mid-dorsal crests very flat, barely discernible (Figs 25A, D), much like, e.g., in *G. tiani* sp.n.

Crests and tubercles on metaterga mostly low, flattened and rounded (Figs 25A–F, 26D).

Legs long and slender (Figs 25H, 26E), on midbody segments about 1.4–1.5 length of segment height.

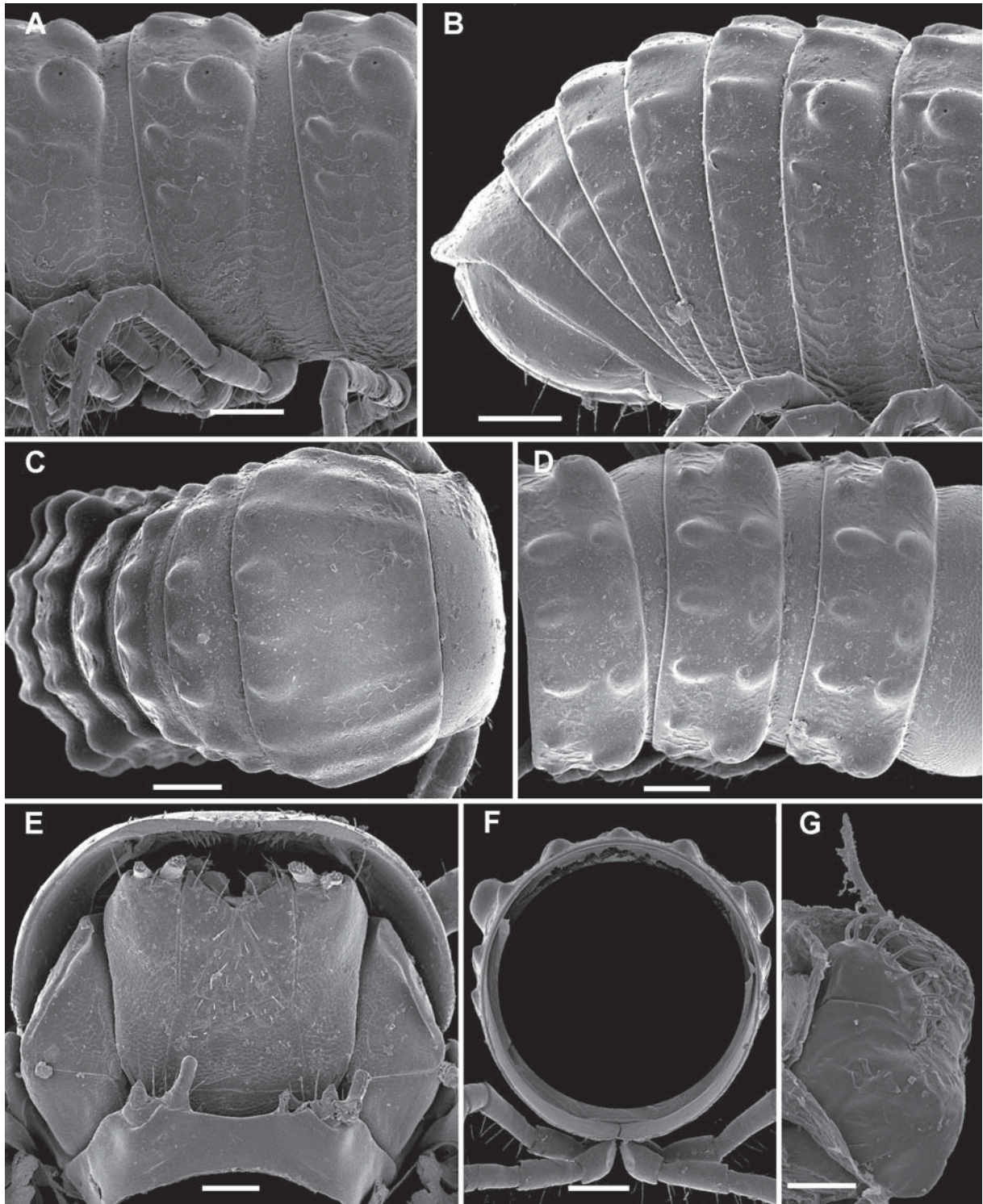


Fig. 24. *Glyphiulus paramulunensis* sp.n., ♂ non-type from Cave Xia Lan Dong: A & D — midbody segments, lateral and dorsal views, respectively; B — posterior part of body, lateral view; C — anterior part of body, dorsal view; E — gnathochilarium and legs I, ventral view; F — cross-section of a midbody segment, caudal view; G — right posterior gonopod, caudal view. Scale bars: A–D & F — 0.2 mm; E — 0.1 mm; G — 0.05 mm.

Рис. 24. *Glyphiulus paramulunensis* sp.n., нетиповой ♂ из пещеры Xia Lan Dong: A, D — среднетуловищные сегменты, соответственно сбоку и сверху; B — задняя часть тела, сбоку; C — передняя часть тела, сверху; E — гнатохиларий и ноги I, снизу; F — поперечный разрез через среднетуловищный сегмент; G — правый задний гонопод, сзади. Масштаб: A–D, F — 0,2 мм; E — 0,1 мм; G — 0,05 мм.

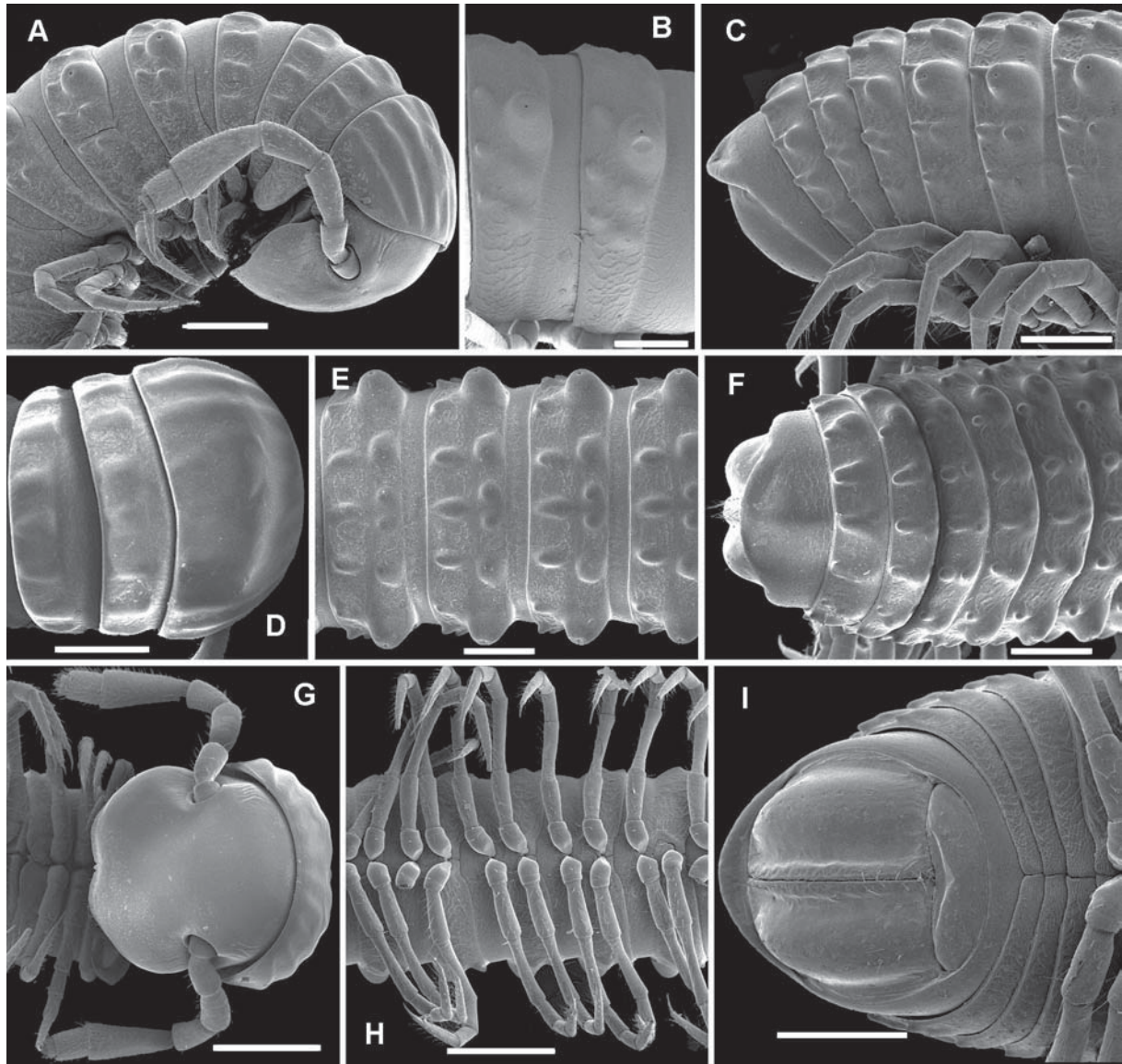


Fig. 25. *Glyphiulus proximus* sp.n., ♂ paratype from Cave Ganxiao Dong: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: A–G & I — 0.5 mm; H — 1.0 mm.

Рис. 25. *Glyphiulus proximus* sp.n., паратип ♂ из пещеры Ganxiao Dong: A, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетелувищные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: A–G, I — 0,5 мм; H — 1,0 мм.

Anterior gonopods (Fig. 26G) with a plate-like coxosternum showing its inner, somewhat elevated, axe-shaped tips only moderately higher than telopodites, rather modestly microsetose on caudal face. Posterior gonopods (Figs 26H, I) as usual, very compact, flagellum rather long and plumose.

REMARKS. If it were not for the considerably larger body and the almost complete carinotaxy of the collum, this species could easily be treated as another variety of *G. paramulunensis* sp.n.

The non-types from Cave Dong Tu Dong (Fig. 27) agree with the holotype in every detail, differing only

in coloration (pallid to very light brownish, with only some ozopirefous cones being infuscate, dark brown) and a somewhat smaller size (length ca 40 mm, width 2.0 mm, with 58p+2a+T).

Glyphiulus speobius sp.n.

Figs 28–30.

MATERIAL. Holotype ♂ (IZAS), China, Guangxi Prov., Huajiang County, Cave Xia Lan Dong, 24.80708°N, 108.28354°E, 356 m, hand collection, 21.10.2009, leg. Tian Mingyi et al. (CHIgx09-016). Paratypes: 1 ♂, 3 ♀♀ (SCAU), 2 ♂♂, 1 ♀ (MNHN

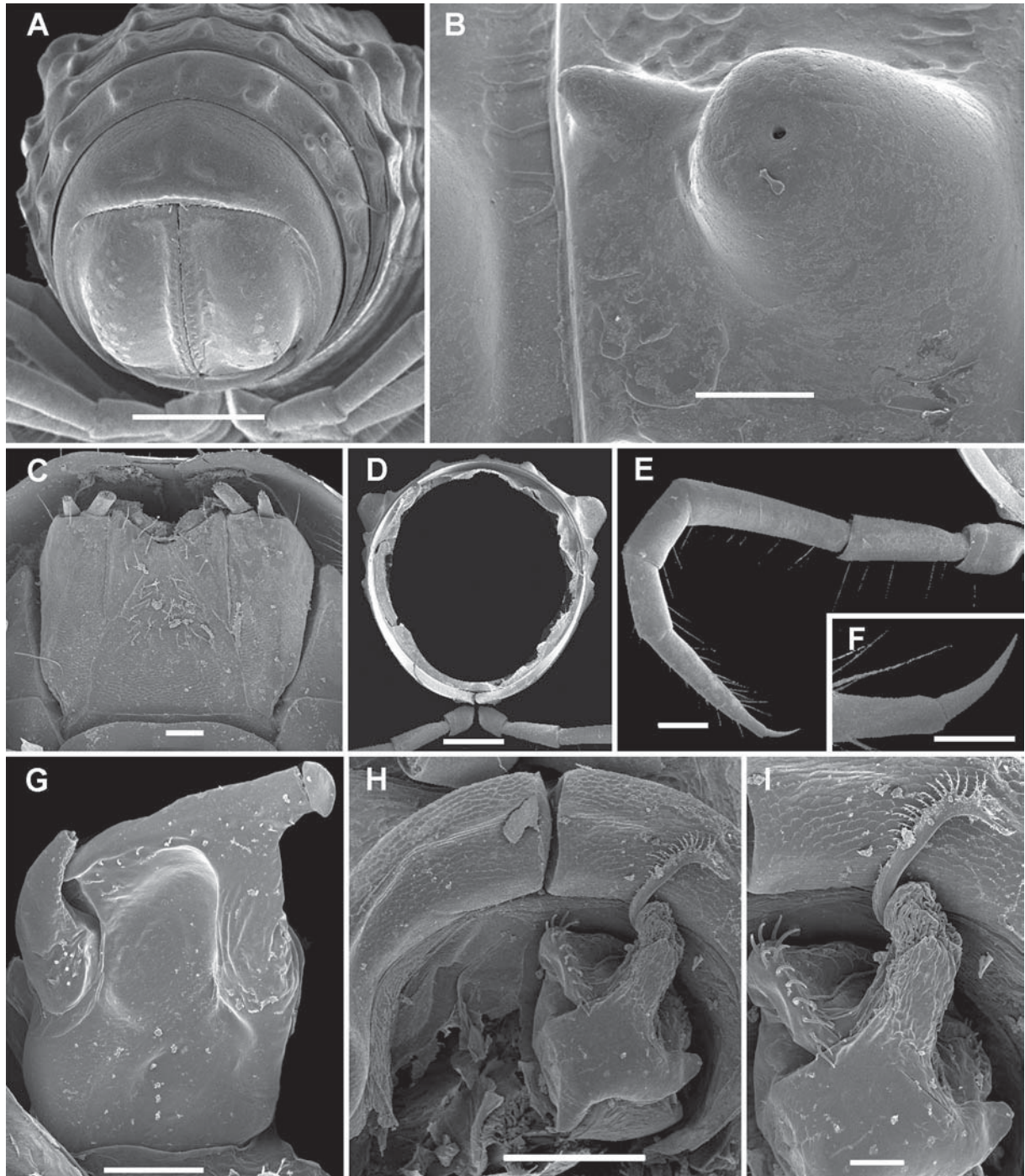


Fig. 26. *Glyphiulus proximus* sp.n., ♂ paratype from Cave Ganxiao Dong: A — caudal part of body, caudal view; B — enlarged ozopore region, lateral view; C — gnathochilarium, ventral view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view; G — left anterior gonopod, caudal view; H — right posterior gonopod, front view; I — same enlarged. Scale bars: A & D — 0.5 mm; B, C, F & G — 0.1 mm; E & H — 0.2 mm; I — 0.05 mm.

Рис. 26. *Glyphiulus proximus* sp.n., паратип ♂ из пещеры Ganxiao Dong: А — задняя часть тела, сзади; В — увеличенный район озопоры, сбоку; С — гнатохиларий, снизу; D — поперечный разрез через среднетуловищный сегмент, сзади; E — среднетуловищная нога, сбоку; F — увеличенный коготок, сбоку; G — левый передний гонопод, сзади; H — правый передний гонопод, сзади; I — то же увеличено. Масштаб: А, D — 0,5 мм; В, С, F, G — 0,1 мм; E, H — 0,2 мм; I — 0,05 мм.

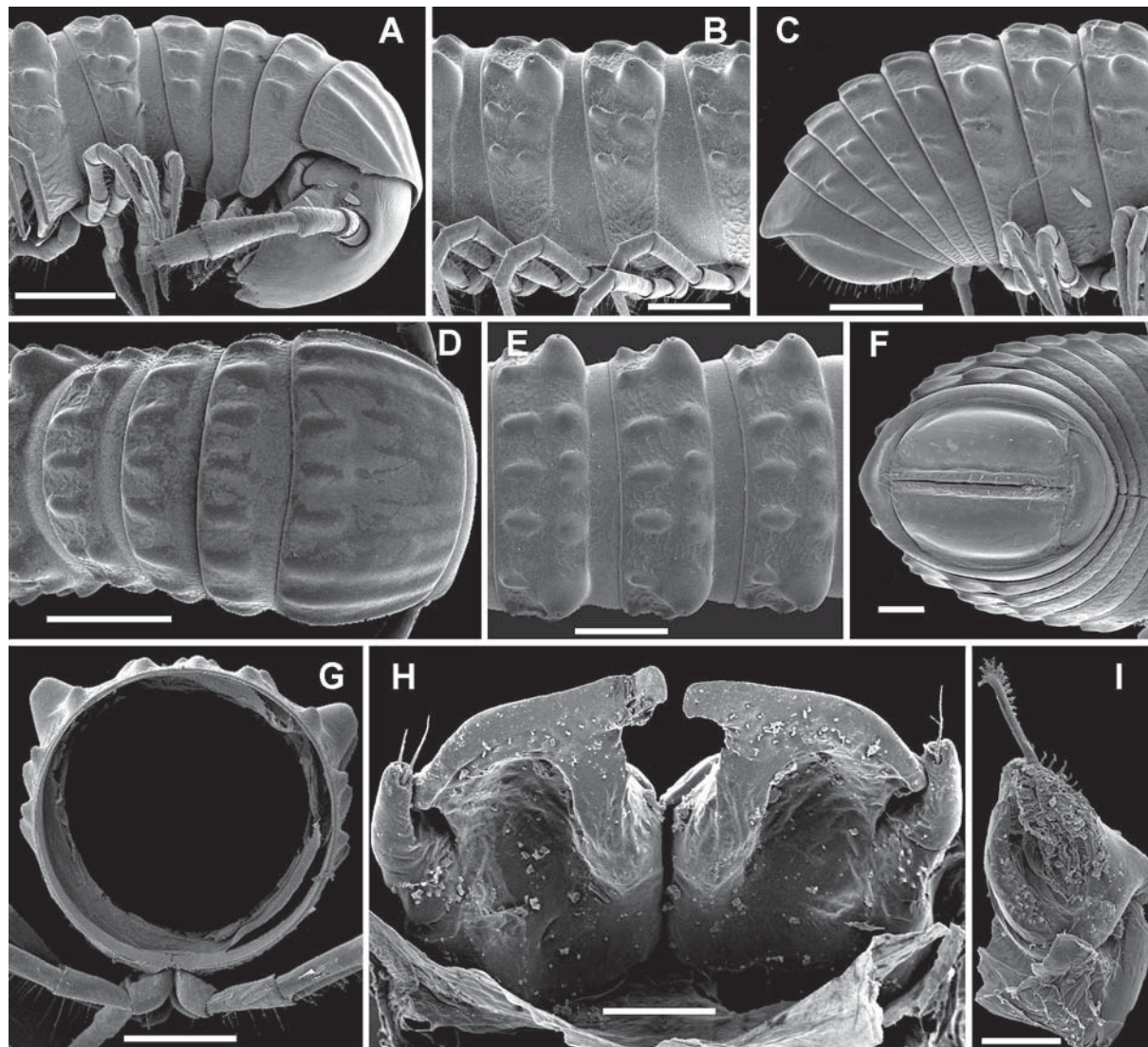


Fig. 27. *Glyphiulus proximus* sp.n., ♂ non-type from Cave Dong Tu Dong: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and ventrocaudal views, respectively; G — cross-section of a midbody segment, caudal view; H — anterior gonopods, ventrocaudal view; I — left posterior gonopod, caudal view. Scale bars: A–E & G — 0.5 mm; F — 0.2 mm; H & I — 0.1 mm.

Рис. 27. *Glyphiulus proximus* sp.n., нетиповой ♂ из пещеры Dong Tu Dong: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетуловищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку, а также снизу и сзади; G — поперечный разрез через среднетуловищный сегмент; H — передние гоноподы, снизу и сзади; H — левый задний гонопод, сзади. Масштаб: A–E, G — 0,5 мм; F — 0,2 мм; H, I — 0,1 мм.

GA 084), 1 ♂, 1 ♀ (ZMUM), 1 ♂ (ZMUC), 1 ♂ (SEM), same locality, together with holotype. Non-types: 1 ♀ fragm., 1 juv. (SCAU), 1 ♂ (MNHN GA 084), 1 ♀ (SEM), same county, Cave Shen Long Dong, 24.778249°N, 108.389836°E, hand collection, 31.10.2009, leg. Tian Mingyi et al. (CH1gx09-022).

NAME. To reflect cave-dwelling.

DIAGNOSIS. Very similar to some of the parapatric new species described above, but differs by the complete and clear carinotaxy formula on the collum in combination with low, mostly non-acute tubercles/crests dorsal to only slightly higher ozoporiferous cones on metaterga, as well as in the oligotrichous gnathochilarium and the special shape of the anterior gonopods (see also Key below).

DESCRIPTION. Length 20–31 mm, width 1.0–1.3 mm, midbody segments being broadest. Adult body with 44–58p+3–1a+T. Holotype ca 31 mm long, 1.3 mm wide, with 58p+1a+T. Coloration uniformly pallid to light brown.

All characters as in *G. grandis* sp.n. (Figs 28, 29), except as follows. Antennae long and moderately clavate, extending beyond segment 4 laterally (Figs 28A, G). Ocellaria invisible. Gnathochilarium (Fig. 29C) rather oligotrichous, with a separate promentum ($n=2$).

Carinotaxy formula of collum complete: I–III+4p+5a+pc+ma, but mid-dorsal crests very flat, barely discernible (Figs 28A, D), much like, e.g., in *G. tiani* sp.n.

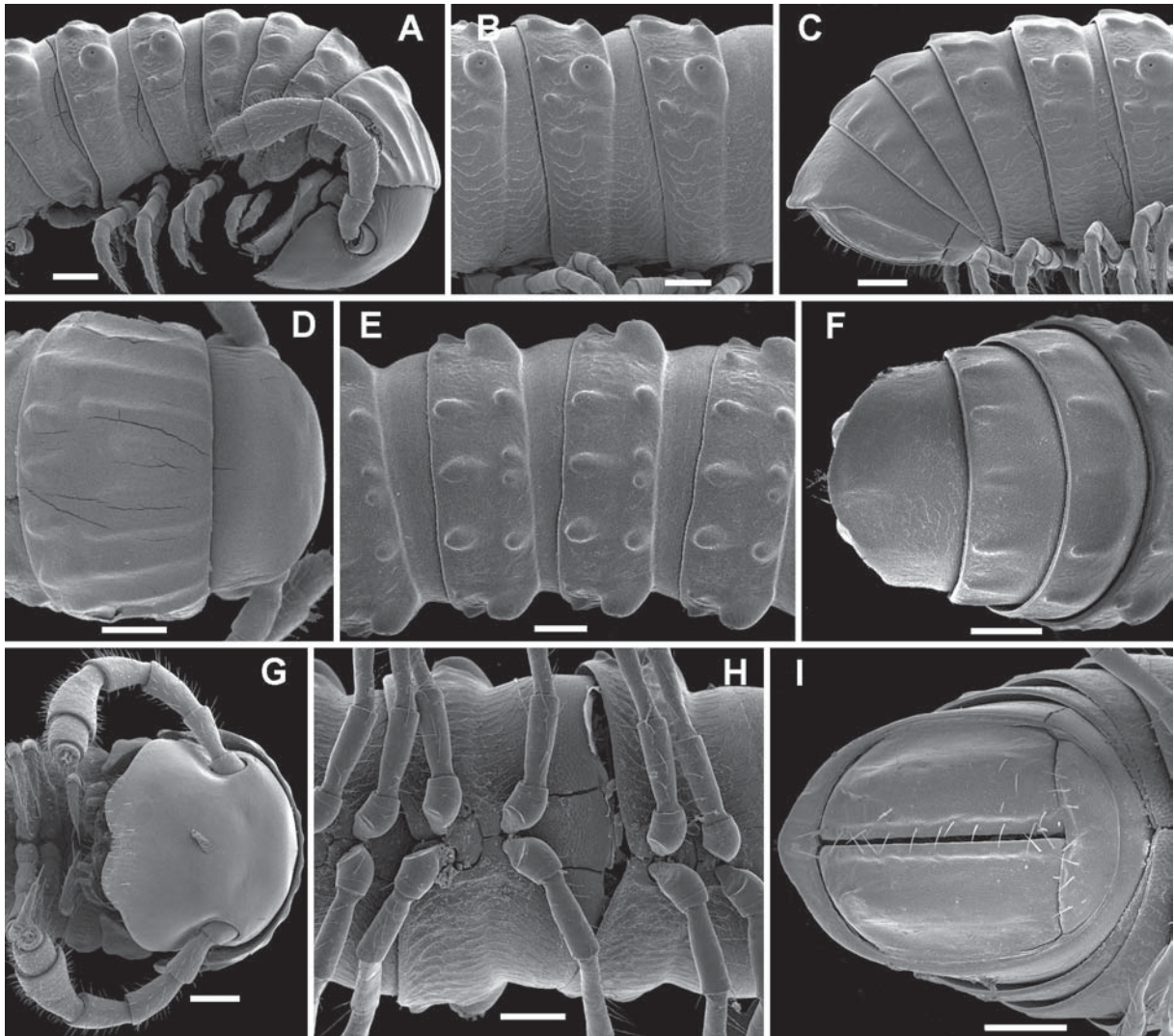


Fig. 28. *Glyphiulus speobius* sp.n., ♂ paratype from Cave Xia Lan Dong: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: 0.2 mm.

Рис. 28. *Glyphiulus speobius* sp.n., паратип ♂ из пещеры Xia Lan Dong: A, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетеловищные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: 0,2 мм.

Subsequent metaterga rather strongly crested (Figs 28A–F, 29D); carinotaxy formula, 2/2+I/i+4/3+I/i+2/2 (Figs 28B, C, 29D). Ozoporiferous tubercles enlarged, oblong-conical, broader than high at base, subtruncate apically (Fig. 29D), on nearly all segments with considerably lower, usually strongly flattened tubercles/crests around, latter growing increasingly acute towards telson (Figs 28B, C).

Epiproct simple, regularly rounded caudally, with a faint axial ridge dorsally (Figs 29F, 30A). Paraprocts convex, with premarginal sulci medially (Fig. 29A). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 28I).

Legs long and slender (Figs 29D, E), on midbody segments about 1.2–1.3 length of segment height. Claw

long, usually without accessory spine at base (Fig. 29F).

♂ legs 1 as usual, leg vestiges nearly absent (Fig. 29C).

Anterior gonopods (Figs 29G, H) with a plate-like coxosternum showing its inner, indistinctly upturned, elevated, axe-shaped tips only moderately higher than telopodites, rather modestly microsetose on caudal face. Posterior gonopods (Fig. 29I) as usual, very compact, flagellum rather short and plumose.

REMARKS. The non-types from Cave Shen Long Dong (Fig. 30) agree in nearly every detail with the types, differing only in coloration (adults light brown to brown with nearly pallid antennae and legs), size (the single complete ♂ ca 30 mm long, 1.1 mm wide,

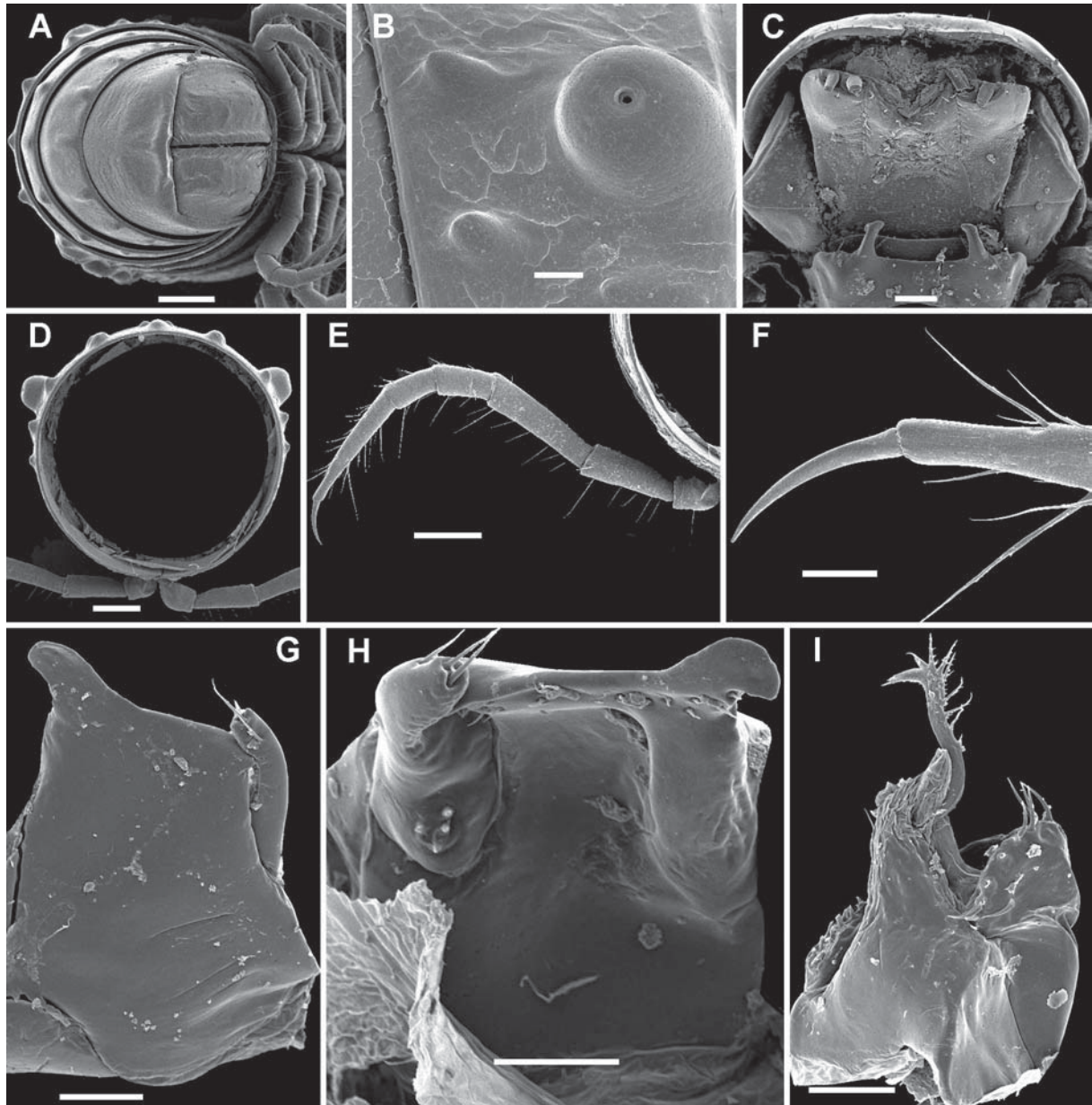


Fig. 29. *Glyphiulus speobius* sp.n., ♂ paratype from Cave Xia Lan Dong: A — caudal part of body, caudal view; B — enlarged ozopore region, lateral view; C — gnathochilarium and legs 1, ventral view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view; G & H — right anterior gonopod, front and ventrocaudal views, respectively; I — right posterior gonopod, front view. Scale bars: A, D & E — 0.2 mm; B, F–I — 0.05 mm; C — 0.1 mm.

Рис. 29. *Glyphiulus speobius* sp.n., паратип ♂ из пещеры Xia Lan Dong: A — задняя часть тела, сзади; B — увеличенный район озопоры, сбоку; C — гнатохиларий и ноги 1, снизу; D — поперечный разрез через среднетеловищный сегмент, сзади; E — среднетеловищная нога, сбоку; F — увеличенный коготок, сбоку; G, H — правый передний гонопод, соответственно спереди, а также сзади и снизу; I — правый передний гонопод, спереди; I — то же увеличено. Масштаб: A, D, E — 0,2 мм; B, F–I — 0,05 мм; C — 0,1 мм.

with 55p+2a+T; the incomplete adult ♀ ca 1.9 mm wide).

Cave Xia Lan Dong appears to be the only one in the Mulun karst currently known to support two *Glyphiulus* species, both very similar: *G. paramulunensis* sp.n. and *G. speobius* sp.n.

To give a better idea of the species of the *granulatus*-group currently known not only from the Mulun karst, but in the entire Guangxi Province, the following key can serve for their separation. Their distributions have also been mapped (Map).

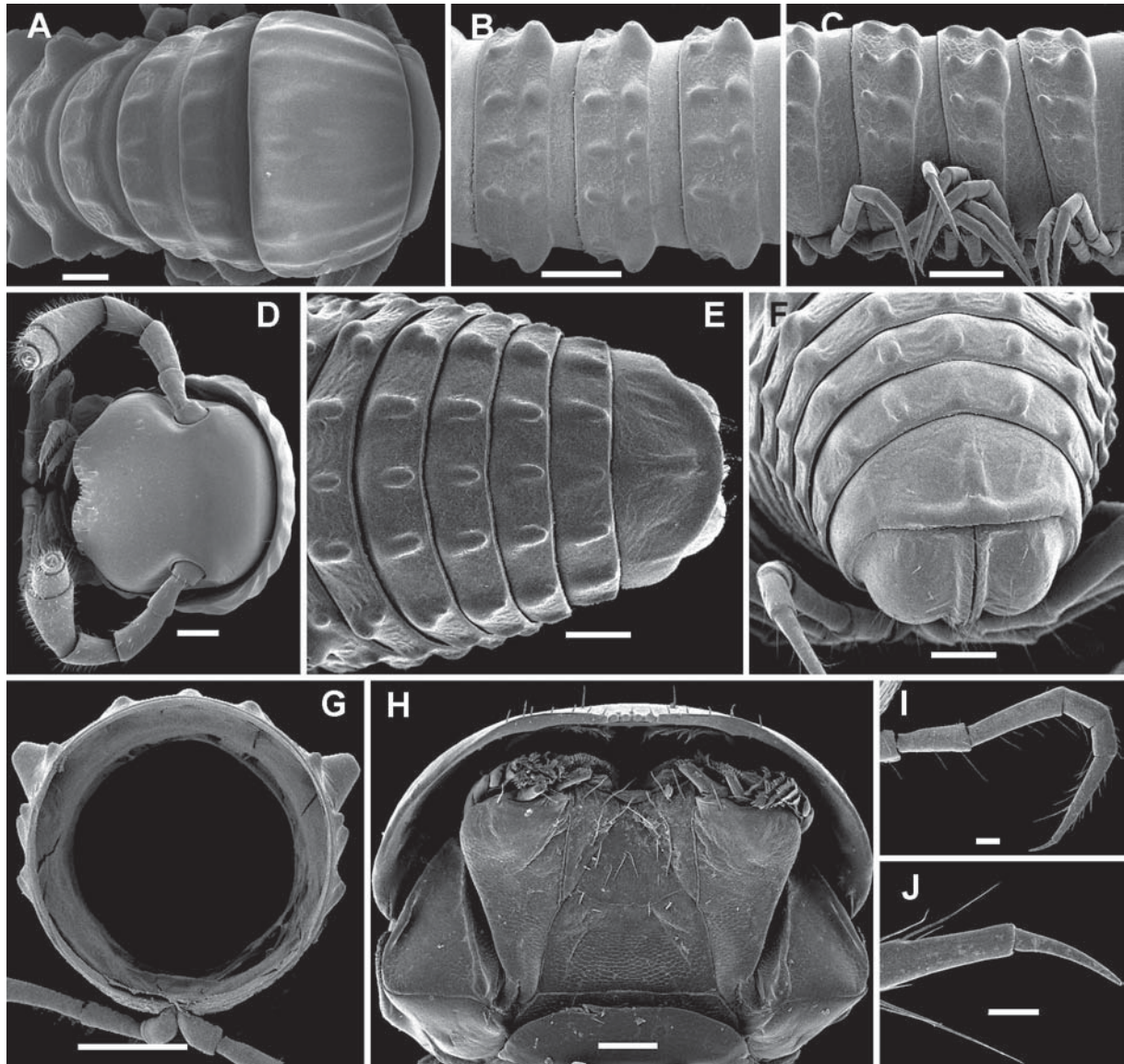
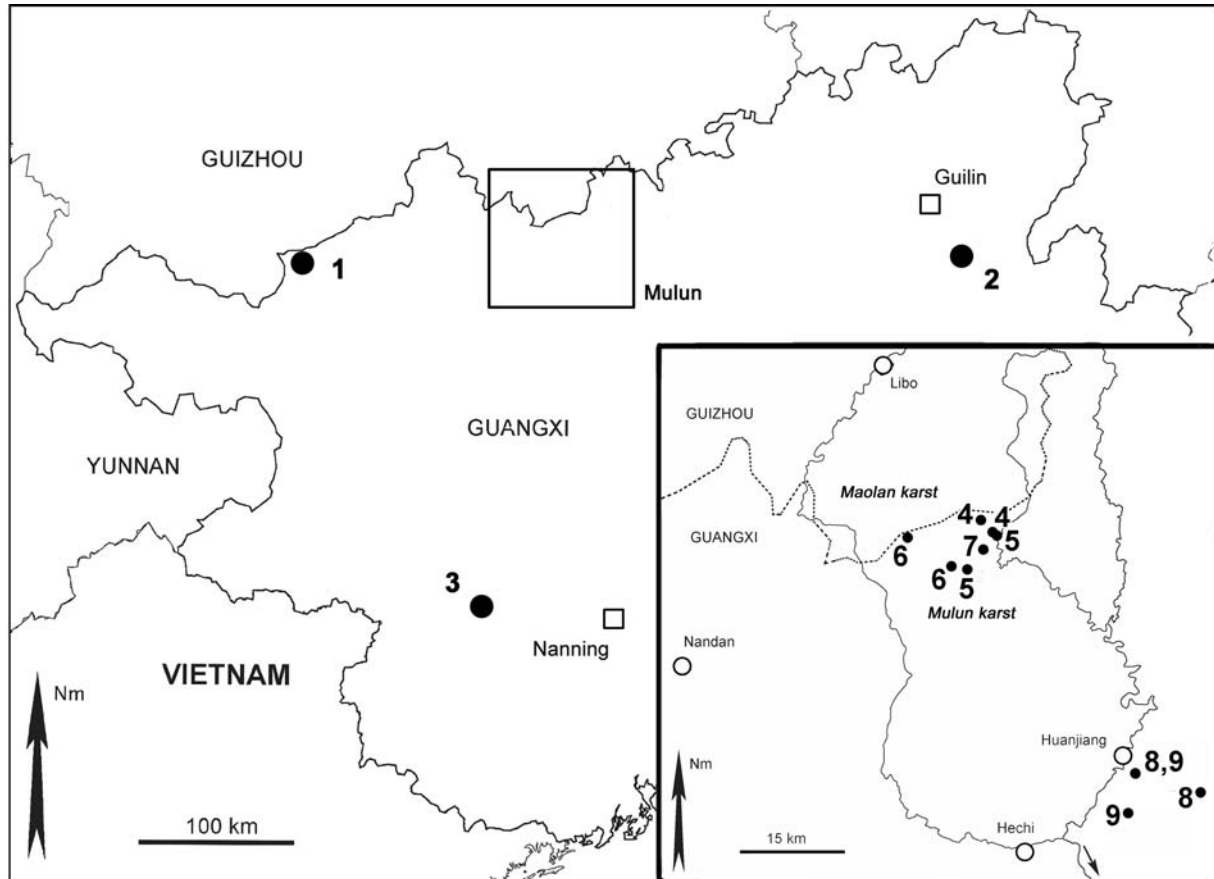


Fig. 30. *Glyphiulus speobius* sp.n., ♀ non-type from Cave Shen Long Dong: A & D — anterior part of body, dorsal and ventral views, respectively; B & C — midbody segments, dorsal and lateral views, respectively; E & F — posterior part of body, dorsal and caudal views, respectively; G — cross-section of a midbody segment, caudal view; H — gnathochilarium, ventral view; I — midbody leg, lateral view; J — enlarged claw, lateral view. Scale bars: A, D–F — 0.2 mm; B, C & G — 0.5 mm; H & I — 0.1 mm; J — 0.05 mm.

Рис. 30. *Glyphiulus speobius* sp.n., нетиповая ♀ из пещеры Shen Long Dong: A, D — передняя часть тела, соответственно сверху и снизу; B, C — среднетуловищные сегменты, соответственно сверху и сбоку; E, F — задняя часть тела, соответственно сверху и сзади; G — поперечный разрез через среднетуловищный сегмент, сзади; H — гнатохиларий, снизу; I — среднетуловищная нога, сбоку; J — увеличенный коготок, сбоку. Масштаб: A, D–F — 0,2 мм; B, C, G — 0,5 мм; H, I — 0,1 мм; J — 0,05 мм.

1. Dark subtriangular ocellaria of 10–13 ocelli on each side of head. Dorsally between ozoporiferous cones on metaterga only 1/1+1/1 tubercles. Xingping County *G. adeloglyphus*
- Ocellaria unpigmented, invisible. Dorsally between ozoporiferous cones on metaterga 1/1+2/1+1/1 tubercles (Figs 6B, E, 10B, E, 13B, E) 2
2. Carinotaxy formula of collum: 1a–4a+pa+ma, meaning that all crests on front half of collum completely obliterated. A cave near Fulong, southern Guangxi .. *G. anophthalmus*
- Carinotaxy formula of collum different, mostly complete: I–III+4p+5a+pc+ma; even when incomplete, 1–3 lateralmost crests full, extending from front to caudal margin of collum. Mulun karst 3
3. Epiproct devoid of ridges, tubercles or impressions dorsally (Figs 6C, F). Paraprocts devoid of pre-marginal sulci (Figs 6C, F, 9C, F) *G. difficilis* sp.n.
- Epiprocts with an axial ridge and/or a transverse pre-marginal impression. Paraprocts with evident pre-marginal sulci (Figs 10F, G, 13F, 14D, 17D) 4



Map. Distribution of *Glyphiulus* species from the *granulatus*-group in Guangxi Province, southern China, more or less from north to south.

Карта. Распространение видов *Glyphiulus* из группы *granulatus* в провинции Гуньси, более или менее с севера на юг:

1 — *G. difficilis* sp.n.; 2 — *G. adeloglyphus*; 3 — *G. anophthalmus*; 4 — *G. proximus* sp.n.; 5 — *G. mulunensis* sp.n.; 6 — *G. acutus* sp.n.; 7 — *G. tiani* sp.n.; 8 — *G. speobius* sp.n.; 9 — *G. paramulunensis* sp.n.

- 4. Ozoporiferous cones on metaterga mostly higher than broad at base, while adjacent crests/tubercles relatively high as well, at least on segments of posterior body third usually considerably elevated and sharp (Figs 10B, C, E, 11D, 16B, C, E, 17E, 19B, E, F) 5
- Ozoporiferous cones on metaterga at most about as high as broad at base, usually shorter, while adjacent crests/tubercles relatively low, usually rounded and never considerably elevated (Figs 13B, C, E, 14E, 25C, E, 26D, 27B, C, E, G) 6
- 5. Adults larger: width 2.0–2.1 mm. Antennae longer, extending behind segment 5 laterally (Figs 10A, 12A). Epiproct with an axial ridge dorsally (Figs 10F, G) *G. mulunensis* sp.n.
- Adults smaller: width 1.5–1.6 mm. Antennae shorter, extending only behind segment 3 laterally (Figs 16A, 18A, 19A, G). Epiproct with a transverse impression dorsally (Figs 16F, 17D, 19C, F, 20A) *G. acutus* sp.n.
- 6. Epiproct with a transverse impression dorsally (Figs 13F, 14D) *G. tiani* sp.n.
- Epiproct with an axial ridge dorsally (Figs 21C, F, 22A, 24B, 25C, F, 26A, 27C) 7
- 7. Adults larger: width ca 2.0 mm. Anterior gonopods with less strongly elevated caudomedian tips (Figs 26G, 27H) *G. proximus* sp.n.
- Adults smaller: width ? 1.7 mm. Anterior gonopods with more evidently elevated caudomedian tips (Figs 23E, 29G, H) 8
- 8. Central part of collum with completely obliterated crests, carinotaxy formula thus remaining incomplete, represented by I–II(III) laterals alone (Figs 21A, D) *G. paramulunensis* sp.n.
- Central part of collum with flattened but fully visible crests, carinotaxy formula being complete (Figs 28A, D, 30A) *G. speobius* sp.n.

***Glyphiulus sattaa* sp.n.**
Figs 31–39.

MATERIAL. Holotype ♂ (MNHN GA 085), Thailand, Chiang Rai Prov., Mae Sai Distr., Cave Tham Ku Kan (Ban Tham), hand collection, 24.06.1986, leg. P. Leclerc (THA-CR-005). Paratypes: 1 juv. (MNHN GA 085), 1 juv. (SEM); 1 ♂ (MNHN GA 085), 1 juv. (SEM), same district, Cave Tham Nam Cham, hand collection, 25.06.1986, leg. P. Leclerc (THA-CR-007); 3 ♂♂, 8 ♀♀, 8 juv. (MNHN GA 085), 1 ♂, 1 ♀ (ZMUM), 1 ♂, 1 ♀ (ZMUC), 1 ♂, 1 ♀ (MZCU), 1 ♂, 1 ♀ (NMNHS), 1 ♀ (SEM), same district, Cave Tham Prah, 360 m a.s.l., 28.11.2009, leg. C. Sutcharit et al.

NAME. To emphasize “sattaa”, in Thai meaning “faith, trust or belief”, a noun in apposition.

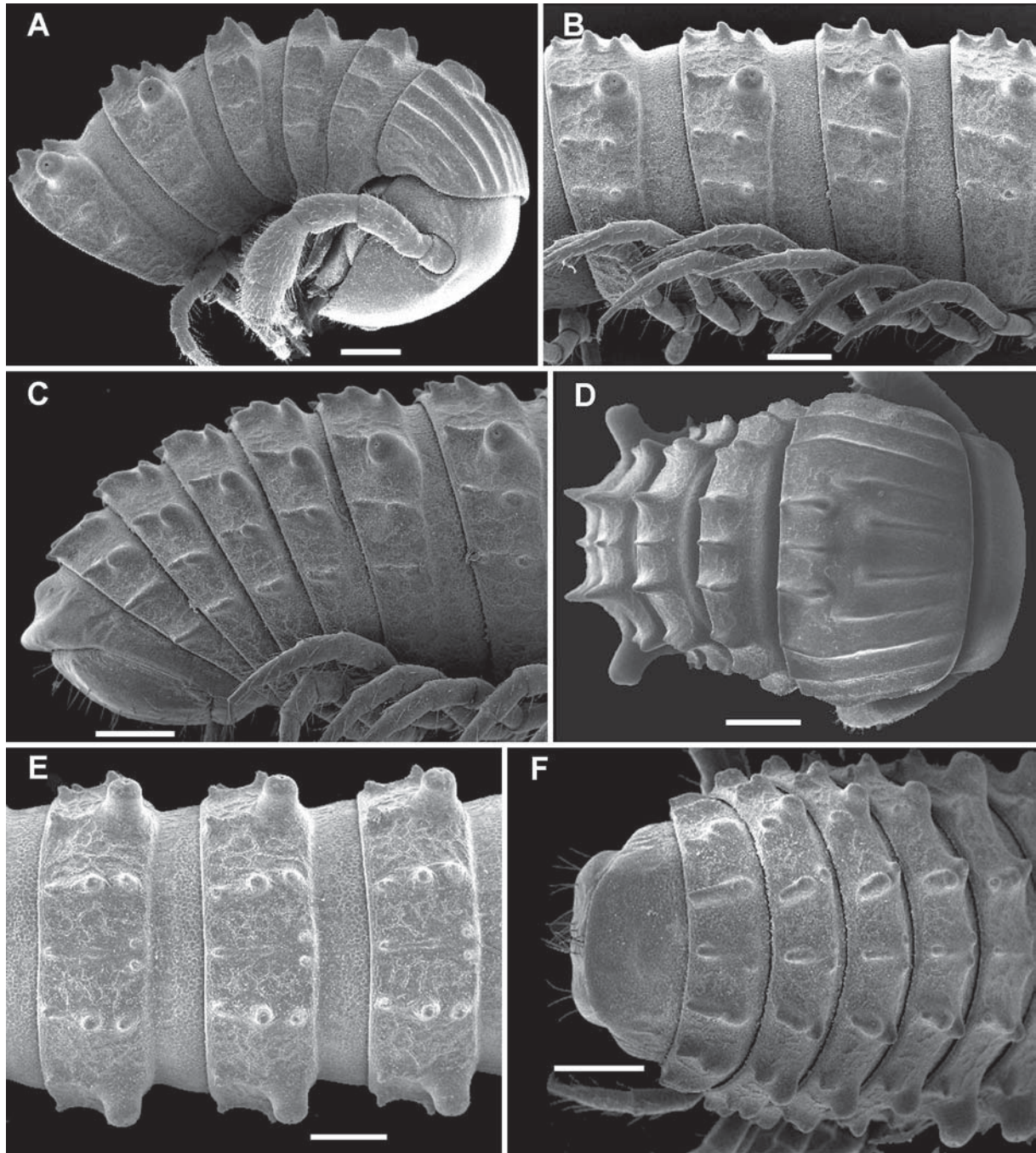


Fig. 31. *Glyphiulus satta* sp.n., juvenile paratype from Cave Tham Ku Kan: A & D — anterior part of body, lateral and dorsal views, respectively; B & E — midbody segments, lateral and dorsal views, respectively; C & F — posterior part of body, lateral and dorsal views, respectively. Scale bars: 0.2 mm.

Рис. 31. *Glyphiulus satta* sp.n., ювенильный паратип из пещеры Tham Ku Kan: A, D — передняя часть тела, соответственно сбоку и сверху; B, E — среднетелувищные сегменты, соответственно сбоку и сверху; C, F — задняя часть тела, соответственно сбоку и сверху. Масштаб: 0,2 мм.

DIAGNOSIS. Distinguished by the nearly complete and clear carinotaxy formula on the collum, combined with the peculiar carinotaxy formula of the following segments, when paramedians and, often, medians are divided into three, not the usual two, transverse rows.

In the latter character, *G. satta* sp.n. strongly resembles *G. beroni* Golovatch et al., 2007, from Yunnan Prov., China [Golovatch et al., 2007a], but differs readily in the laterals on metazona remaining divided into two.

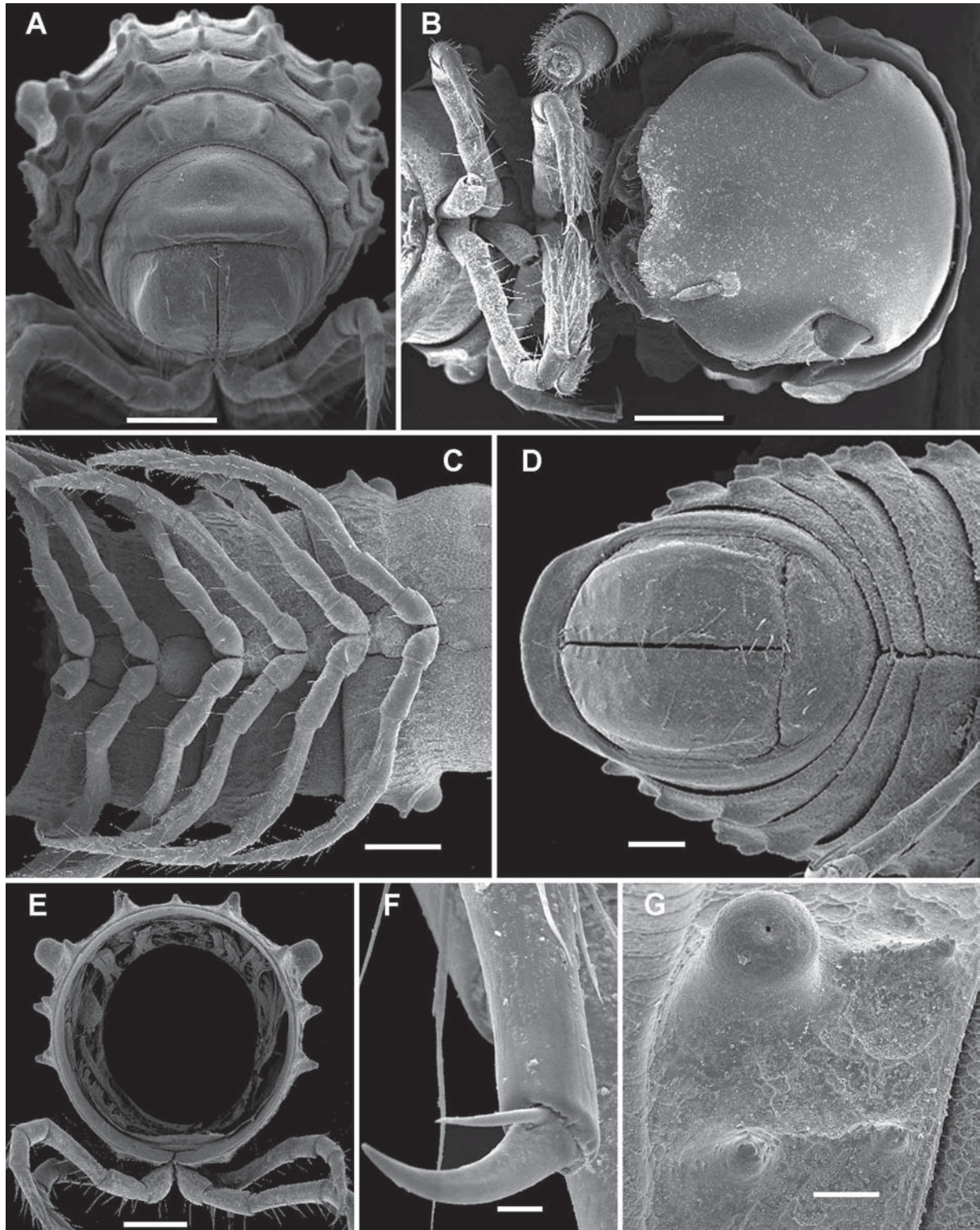


Fig. 32. *Glyphiulus satta* sp.n., juvenile paratype from Cave Tham Ku Kan: A & D — caudal part of body, caudal and ventral views, respectively; B — anterior part of body, ventral view; C — midbody segments, ventral view; E — cross-section of a midbody segment, caudal view; F — enlarged claw, ventrolateral view; G — enlarged ozopore region, lateral view. Scale bars: A–E — 0.2 mm; D — 0.1 mm; F — 0.01 mm; G — 0.05 mm.

Рис. 32. *Glyphiulus satta* sp.n., ювенильный паратип из пещеры Tham Ku Kan: A, D — задняя часть тела, соответственно сзади и снизу; B — передняя часть тела, снизу; C — среднетелувищные сегменты, снизу; E — поперечный разрез через среднетелувищный сегмент, сзади; F — увеличенный коготок, сбоку; G — увеличенный район озопоры, сбоку. Масштаб: A–C, E — 0,2 мм; D — 0,1 мм; F — 0,01 мм; G — 0,05 мм.

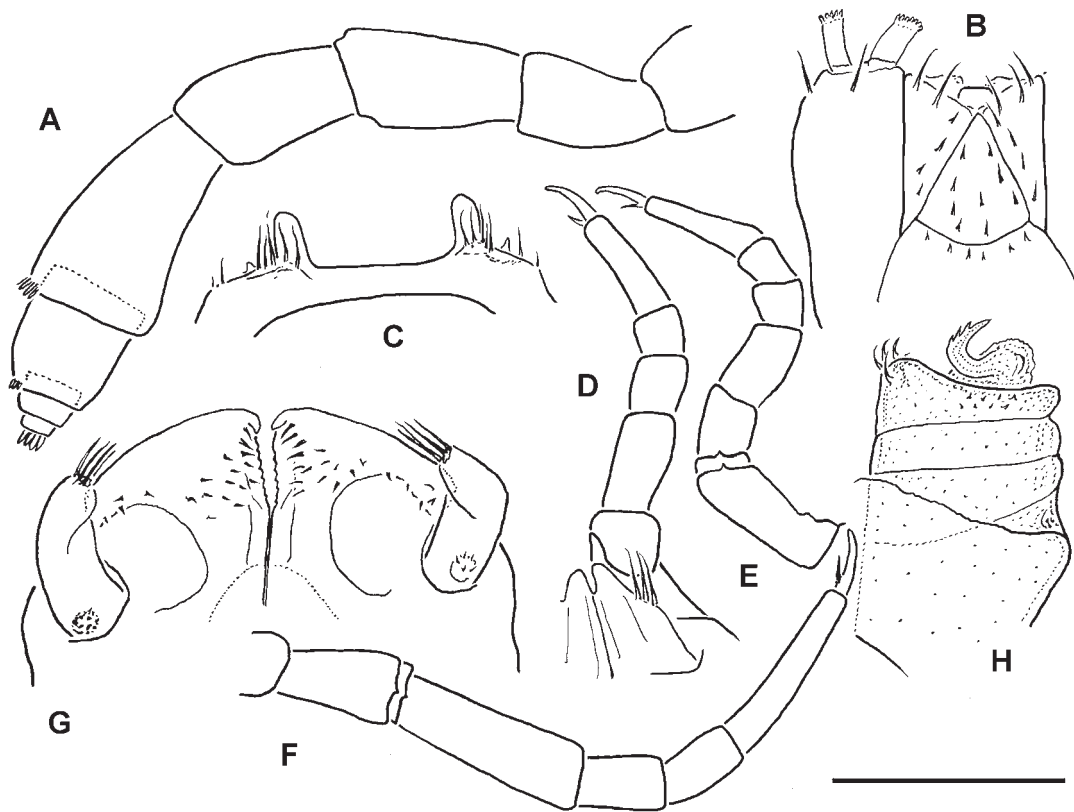


Fig. 33. *Glyphiulus satta* sp.n., holotype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — leg 3, caudal view; F — midbody leg, lateral view; G — anterior gonopods, caudal view; H — left posterior gonopod, caudal view. Scale bar: A–F — 0.4 mm; G & H — 0.2 mm.

Рис. 33. *Glyphiulus satta* sp.n., голотип: А — антенна, сбоку; В — гнатохиларий, снизу; С — ноги 1, спереди; D — нога 2, сзади; E — нога 3, сзади; F — среднетеловишная нога, сбоку; G — передние гоноподы, сзади; H — левый задний гонопод, сзади. Масштаб: А–F — 0,4 мм; G, H — 0,2 мм.

DESCRIPTION. Length of holotype 37 mm, width 1.5 mm, with 58p+1a+T, midbody segments being broadest. Paratype ♂ from Tham Nam Cham, ca 40 mm long, 1.55 mm wide, with 72p+2a+T. Paratypes from Tham Prah, 23–40 mm long, 1.0–1.7 mm wide, with 44–72p+5–1a+T. Coloration of holotype and some paratypes, including juveniles, uniformly light brown, legs a little lighter, yellow-brown, antennae light yellowish; sometimes (paratypes) brown, with some or most of tergal crests/tubercles and ozoporiferous cones infuscate, dark brown.)

All characters as in *G. grandis* sp.n. (Figs 31–39), except as follows. Antennae long and moderately clavate, extending beyond segment 4 laterally (Figs 31A, 33A, 34A, 35A, 36A, 37A, 39A). Ocellaria transversely-oval, brown, composed of 9–13 ocelli. Gnathochilarium (Figs 33B, 36B, 38B, 39B) moderately polytrichous, with a separate promentum (n=4).

Carinotaxy formula of collum complete: I–IV+5p+6a+pc+ma, all crests except lateralmost being fully developed and distinct (Figs 31A, D, 34A, D, 37A, D).

Subsequent metaterga moderately strongly crested (Figs 31, 32E, 34A–E, 35D, 37A–F); carinotaxy formula, 2/2+I/i+4/3(2)/3+I/i+2/2 (Figs 31B, C, 32E, 34B,

C, 35D, 37B, C, 38D), this being observed already from the earliest juvenile instars (with 32p+5p+T). Ozoporiferous tubercles enlarged, oblong-conical, higher than broad at base, subtruncate apically (Figs 32E, 35D, 38D), paramedians nearly as high, but medians very considerably lower, yet all these and other tubercles/crests around mostly acute.

Epiproct simple, regularly rounded to subtriangular caudally, with an evident centrobasal hump dorsally (Figs 31C, F, 32A, 34C, E, F, 37C, F). Paraprocts regularly convex, without premarginal sulci medially (Figs 31C, 32A, 34C, F, 37C, F, 38A). Hypoproct transversely bean-shaped, slightly concave caudally (Figs 32D, 35C, 37I).

Legs long and slender (Figs 32C, E, 33F, 35D, E, 36F, 37H, 38D, E, 39F), on midbody segments about 1.0–1.1 length of segment height. Claw long, usually with a strong accessory spine at base, the latter about half length of claw proper (Figs 32F, 35F, 38F).

♂ legs 1 as usual, leg vestiges nearly absent to 1-segmented (Figs 33C, 36C, 39C). ♂ legs 2 as usual, penes with three strong setae on both sides (Figs 33D, 36D, 39D). ♂ legs 3 also as usual, coxa not particularly long (Figs 33E, 36E, 39E).

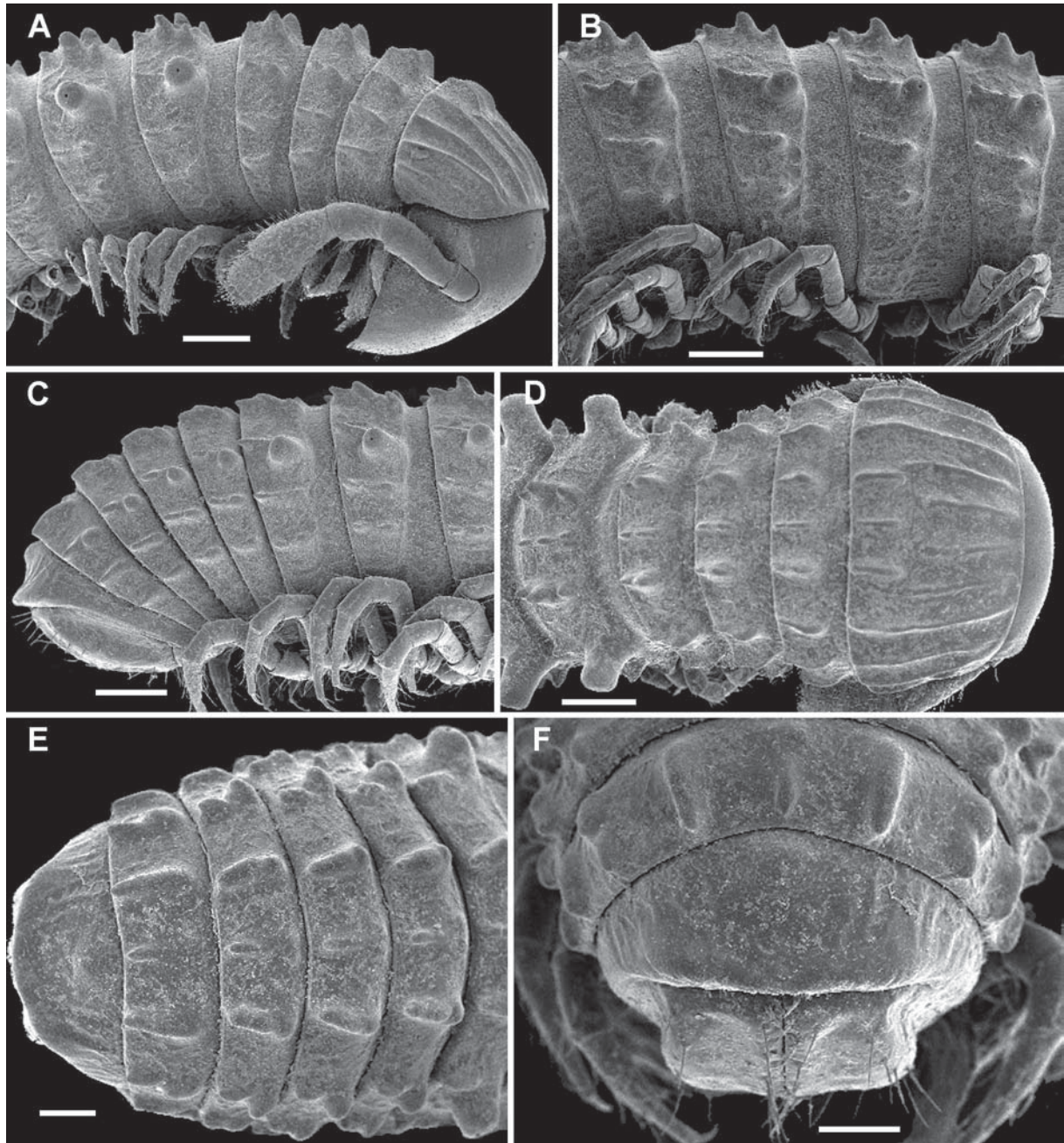


Fig. 34. *Glyphiulus satta* sp.n., juvenile paratype from Cave Tham Ku Kan: A & D — anterior part of body, lateral and dorsal views, respectively; B — midbody segments, lateral view; C, E & F — posterior part of body, lateral and dorsal and caudal views, respectively. Scale bars: A–D — 0.2 mm; E & F — 0.1 mm.

Рис. 34. *Glyphiulus satta* sp.n., ювенильный паратип из пещеры Tham Nam Cham: A, D — передняя часть тела, соответственно сбоку и сверху; B — среднетеловишние сегменты, сбоку; C, E, F — задняя часть тела, соответственно сбоку, сверху и сзади. Масштаб: A–D — 0,2 мм; E, F — 0,1 мм.

Anterior gonopods (Figs 33G, 36G, 39G) with a plate-like coxosternum showing its inner, small, unciform tips only moderately higher than telopodites, rather densely microsetose on caudal face. Posterior gonopods (Figs 33H, 36H, 39H) as usual, very compact, flagellum short, curved and plumose.

REMARKS. This is the first species of the *granulatus*-group to formally be reported from Thailand. In fact, Thailand since long could soundly be expected to support a good number of species from this group as well [Golovatch et al., 2007a].

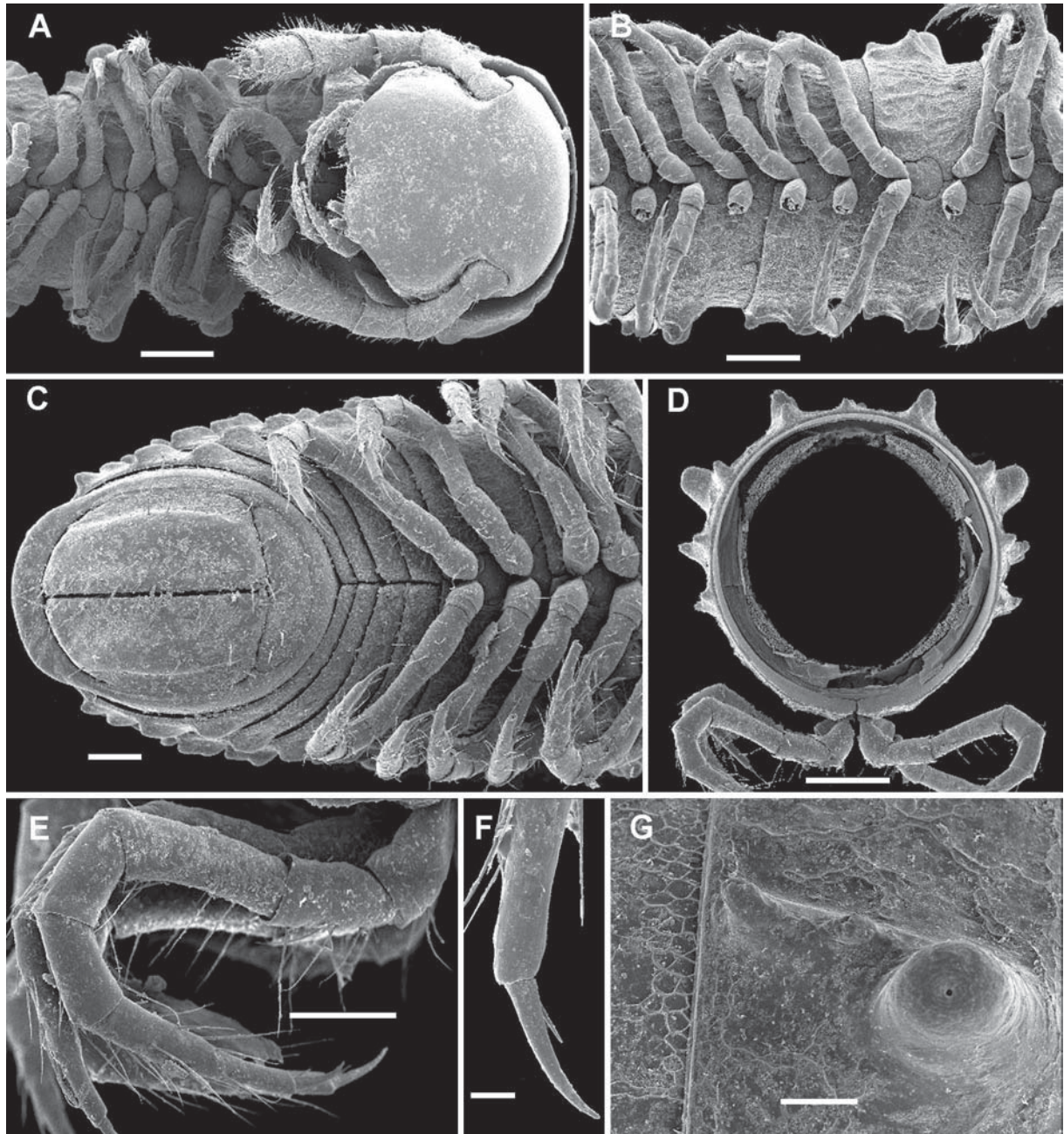


Fig. 35. *Glyphiulus satta* sp.n., juvenile paratype from Cave Tham Nam Cham: A — anterior part of body, ventral view; B — midbody segments, ventral view; C — caudal part of body, ventral view; D — cross-section of a midbody segment, caudal view; E — midbody legs, lateral view; F — enlarged claw, lateral view; G — enlarged ozopore region, lateral view. Scale bars: A, B & D — 0.2 mm; C & E — 0.1 mm; F — 0.02 mm; G — 0.05 mm.

Рис. 35. *Glyphiulus satta* sp.n., ювенильный паратип из пещеры Tham Nam Cham: А — передняя часть тела, снизу; В — среднетеловишские сегменты, снизу; С — задняя часть тела, снизу; D — поперечный разрез через среднетеловишский сегмент, сзади; E — среднетеловишские ноги, сбоку; F — увеличенный коготок, сбоку; G — увеличенный район озопоры, сбоку. Масштаб: А, В, D — 0,2 мм; С, E — 0,1 мм; F — 0,02 мм; G — 0,05 мм.

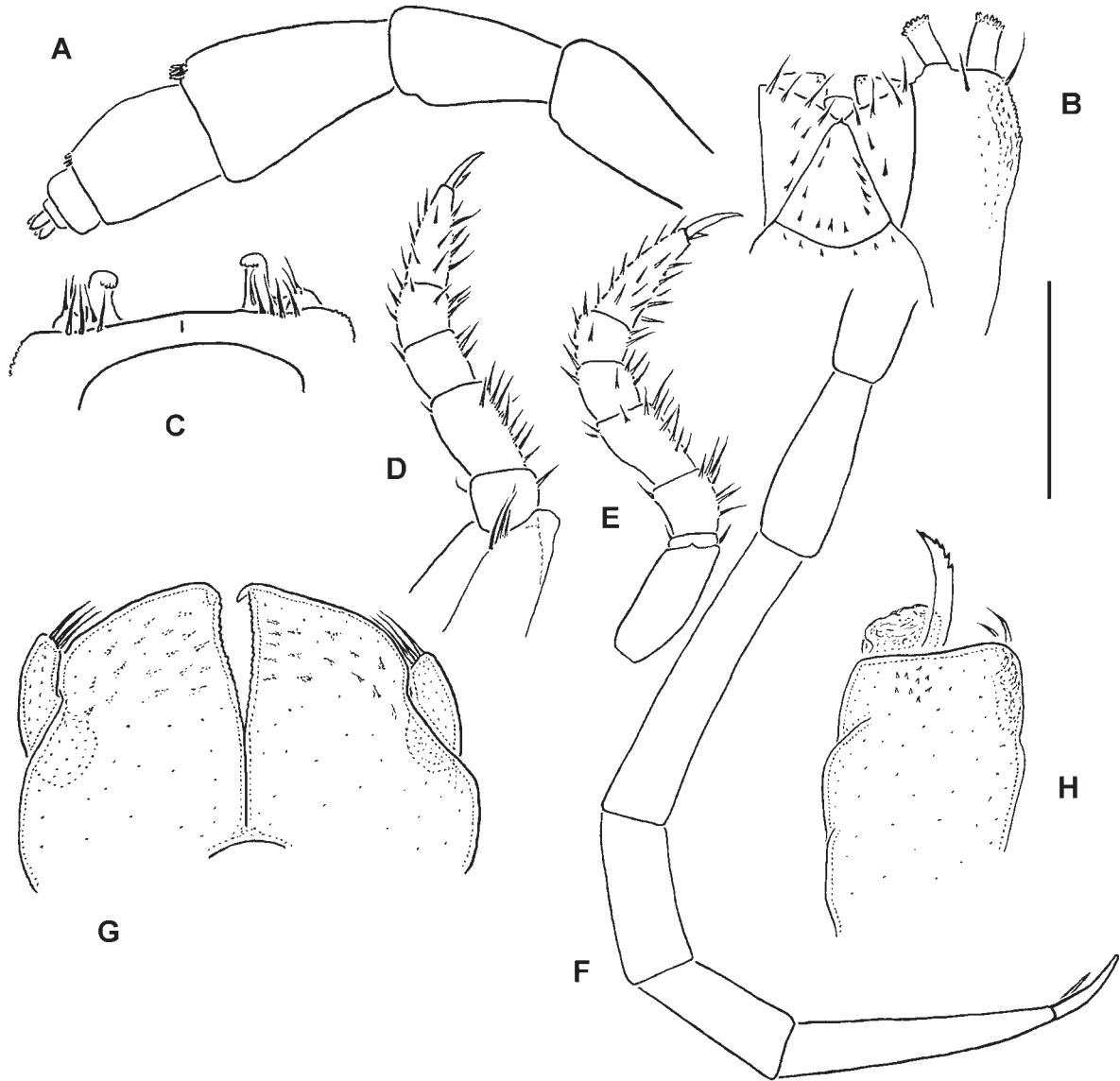


Fig. 36. *Glyphiulus satta* sp.n., ♂ paratype from Cave Tham Nam Cham: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — leg 3, caudal view; F — midbody leg, lateral view; G — anterior gonopods, front view; H — left posterior gonopod, front view. Scale bars: A–F — 0.4 mm; G & H — 0.2 mm.

Рис. 36. *Glyphiulus satta* sp.n., паратип ♂ из пещеры Tham Nam Cham: A — антенна, сбоку; B — гнатохиларий, снизу; C — ноги 1, спереди; D — нога 2, сзади; E — нога 3, сзади; F — среднетеловишная нога, сбоку; G — передние гоноподы, спереди; H — левый задний гонопод, спереди. Масштаб: A–F — 0,4 мм; G, H — 0,2 мм.

Glyphiulus duangdee sp.n.

Figs 40–42.

MATERIAL. Holotype ♂ (MNH GA 086), Thailand, Uttaradit Prov., Tong Saen Khan Distr., Khlong Trong National Park, Cave Tham Chan, 150 m a.s.l., 30.11.2009, leg. C. Sutcharit et al. Paratypes: 4 ♂♂, 4 ♀♀, 1 juv. (MNH GA 086), 2 ♂♂, 2 ♀♀ (ZMUM), 1 ♂, 1 ♀ (ZMUC), 1 ♂, 1 ♀ (MZCU), 1 ♂, 1 ♀ (NMNHS), 1 ♂ (SEM), same locality, together with holotype.

NAME. To emphasize “duangdee”, in Thai meaning “good fortune, good luck”, a noun in apposition.

DIAGNOSIS. Distinguished by the nearly complete carinotaxy formula on the collum, combined with the peculiar carinotaxy formula of the following segments, as well as by the very low ozoporiferous cones, the peculiar shapes of the epiproct, paraprocts, anterior gonopods etc.

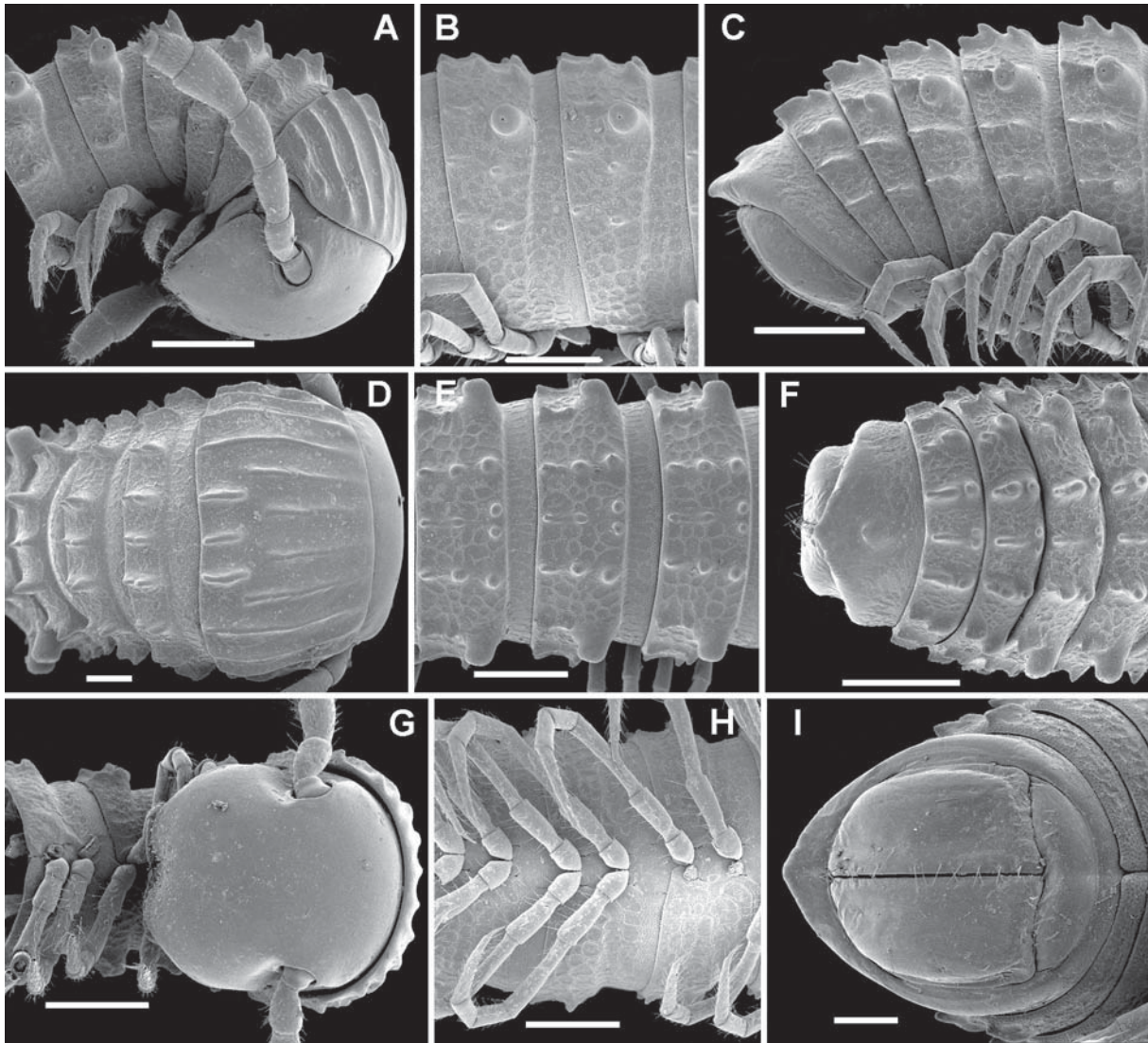


Fig. 37. *Glyphiulus satta* sp.n., ♂ paratype from Cave Tham Prah: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: A–C, E–H — 0.5 mm; D & I — 0.2 mm.

Рис. 37. *Glyphiulus satta* sp.n., паратип ♂ из пещеры Tham Prah: A, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетуловищные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: A–C, E–H — 0,5 мм; D, I — 0,2 мм.

DESCRIPTION. Length 14–22 mm, width 0.85–0.95 mm, with 40–56p+4–2a+T, midbody segments being broadest. Holotype ca 16 mm long, 0.9 mm wide, with 52p+2a+T. Coloration uniformly brown to dark brown; head, collum and legs often a little lighter, yellow-brown; antennae usually light yellowish; sometimes most of tergal crests/tubercles and ozoporiferous cones infusate, very dark brown.

All characters as in *G. grandis* sp.n. (Figs 40–42), except as follows. Antennae long and moderately clavate, extending beyond segment 4 laterally (Figs 40A, G, 42A). Ocellaria transversely-oval, blackish, composed of 8–13 ocelli in 3–4 irregular transverse rows.

Gnathochilarium (Figs 41B, 42B) moderately polytrichous, with a separate promentum ($n=2$).

Carinotaxy formula of collum nearly complete: 1a+II–V+pc+ma, both paramedians being nearly fully obliterated near front margin (Figs 40A, D).

Subsequent metaterga strongly crested (Figs 40A–C, 41C); carinotaxy formula, 3/3+I/i+4//3+I/i+3/3 (Figs 40B, E, 41C). Ozoporiferous tubercles enlarged, oblong-conical, strongly flattened, much broader at base than high, subtruncate apically (Fig. 41C), paramedians and medians about as high, these and other tubercles/crests around mostly narrowly rounded caudally (Figs 40A–C).

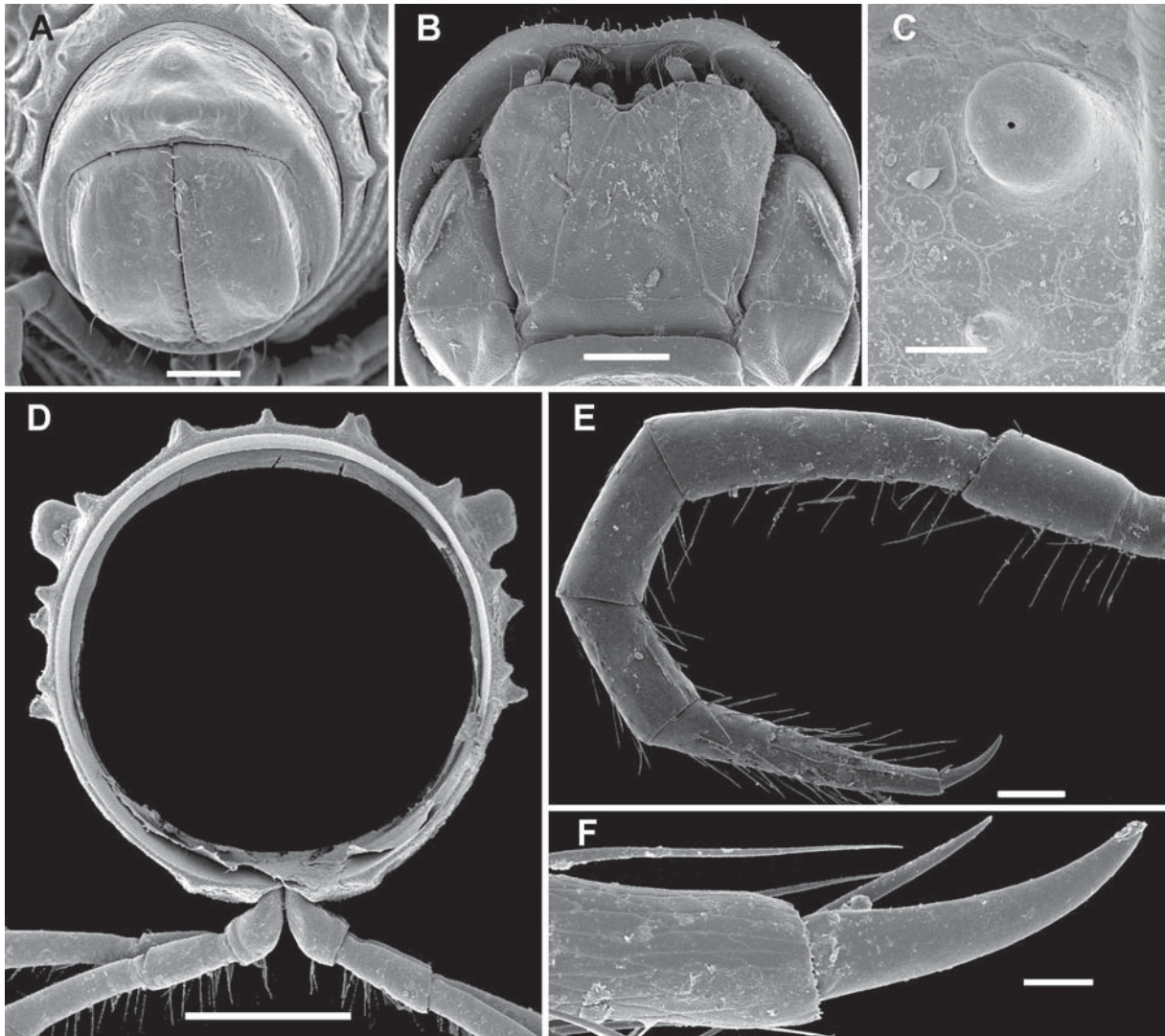


Fig. 38. *Glyphiulus satta* sp.n., ♂ paratype from Cave Tham Prah: A — caudal part of body, caudal view; B — gnathochilarium, ventral view; C — enlarged ozopore region, lateral view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view. Scale bars: A & B — 0.2 mm; C & E — 0.1 mm; D — 0.5 mm; F — 0.02 mm.

Рис. 38. *Glyphiulus satta* sp.n., паратип ♂ из пещеры Tham Prah: А — задняя часть тела, сзади; В — гнатохиларий, снизу; С — увеличенный район озопоры, сбоку; D — поперечный разрез через среднетеловишный сегмент, сзади; E — среднетеловишная нога, сбоку; F — увеличенный коготок, сбоку. Масштаб: А и В — 0,2 мм; С и E — 0,1 мм; D — 0,5 мм; F — 0,02 мм.

Epiproct simple, regularly rounded caudally, without structures dorsally (Figs 40C, F). Paraprocts regularly convex, with premarginal sulci medially (Fig. 41A). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 40I).

Legs short and slender (Fig. 41C), on midbody segments about 0.7–0.8 length of segment height (Fig. 42C). Claw long, usually with a strong accessory spine at base, the latter about half length of claw proper (Fig. 41E).

♂ legs 1 as usual, leg vestiges 2-segmented (Fig. 41F). ♂ legs 2 and 3 as usual.

Anterior gonopods (Figs 41G, 42D) with a plate-like coxosternum showing its inner, axe-shaped tips

considerably higher than telopodites, rather poorly microsetose on caudal face. Posterior gonopods (Figs 41H, 42E) as usual, very compact, flagellum rather short and plumose.

Glyphiulus mongkon sp.n.

Figs 43–45.

MATERIAL. Holotype ♂ (MNHN GA 087), Thailand, Loei Prov., Ban Non Hin Distr., Cave Tham Maho Lan, 17°06'N, 101°53'E, 575 m a.s.l., hand collection, 3.01.1992, leg. A. Bedos & L. Deharveng (THA-LO-001). Paratypes: 1 ♂, 4 ♀♀ (MNHN GA 087), 1 ♀ (ZMUM), 1 ♀ (SEM), same locality, together with holotype; 1 ♂, 1 ♀, 1 juv. (MNHN GA 087), 1 ♂ (ZMUM), 1 ♂ (ZMUC), 1 ♂ (MZCU), 1 ♂ (SEM), same cave, guano, Berlese extraction, 3.01.1992, leg. A. Bedos & L. Deharveng (THA-LO-3).

Fig. 39. *Glyphiulus satta* sp.n., ♂ paratype from Cave Tham Prah: A — antenna, lateral view; B — gnathochilarium, ventral view; C — leg 1, front view; D — leg 2, caudal view; E — leg 3, front view; F — midbody leg, lateral view; G — anterior gonopods, caudal view; H — left posterior gonopod, caudal view. Scale bar: A–F — 0.4 mm; G & H — 0.2 mm.

Рис. 39. *Glyphiulus satta* sp.n., паратип ♂ из пещеры Tham Prah: А — антенна, сбоку; В — гнатохиларий, снизу; С — ноги 1, спереди; D — нога 2, сзади; E — нога 3, спереди; F — среднетеловишная нога, сбоку; G — передние гоноподы, сзади; H — левый задний гонопод, сзади. Масштаб: А–F — 0,4 мм; G, H — 0,2 мм.

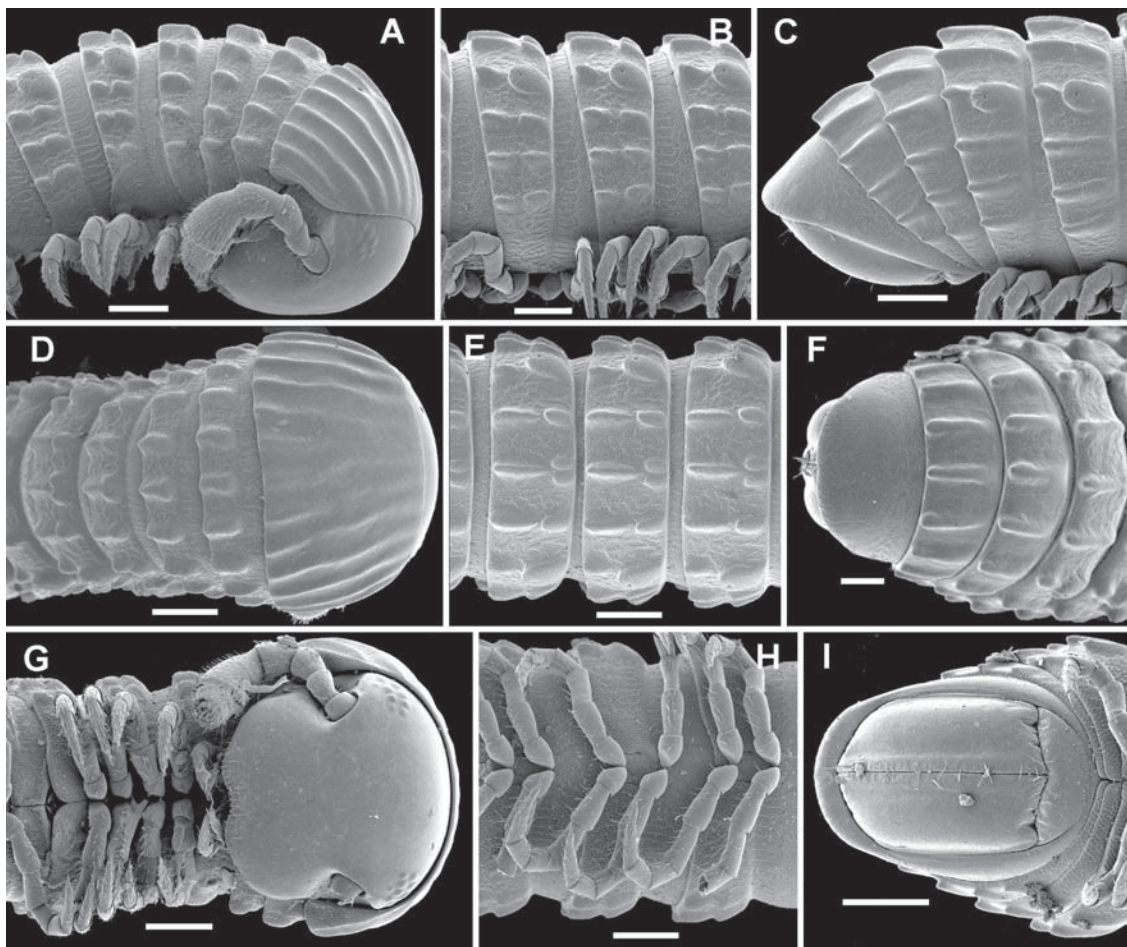
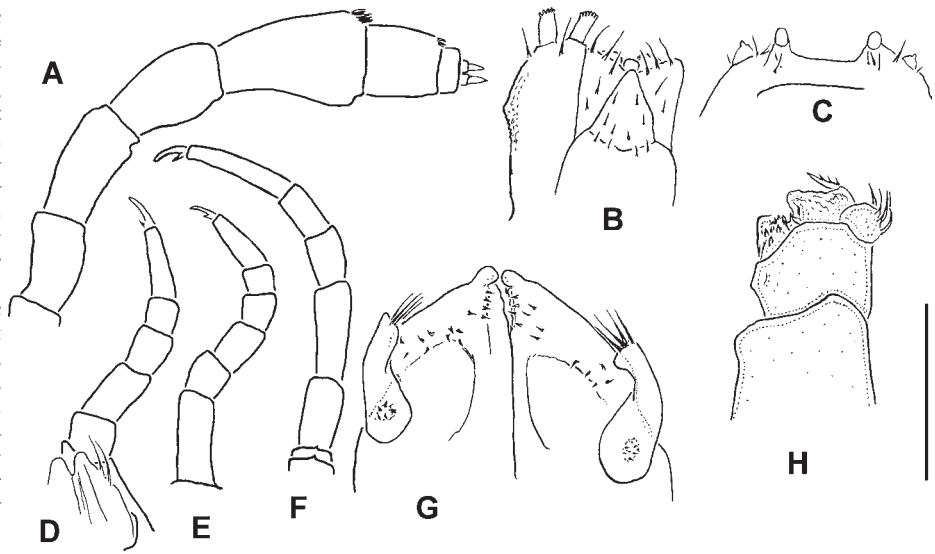


Fig. 40. *Glyphiulus duangdee* sp.n., ♂ paratype: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bars: A–E, G–I — 0.2 mm; F — 0.1 mm.

Рис. 40. *Glyphiulus duangdee* sp.n., паратип ♂: А, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетеловишные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: А–E, G–I — 0,2 мм; F — 0,1 мм.

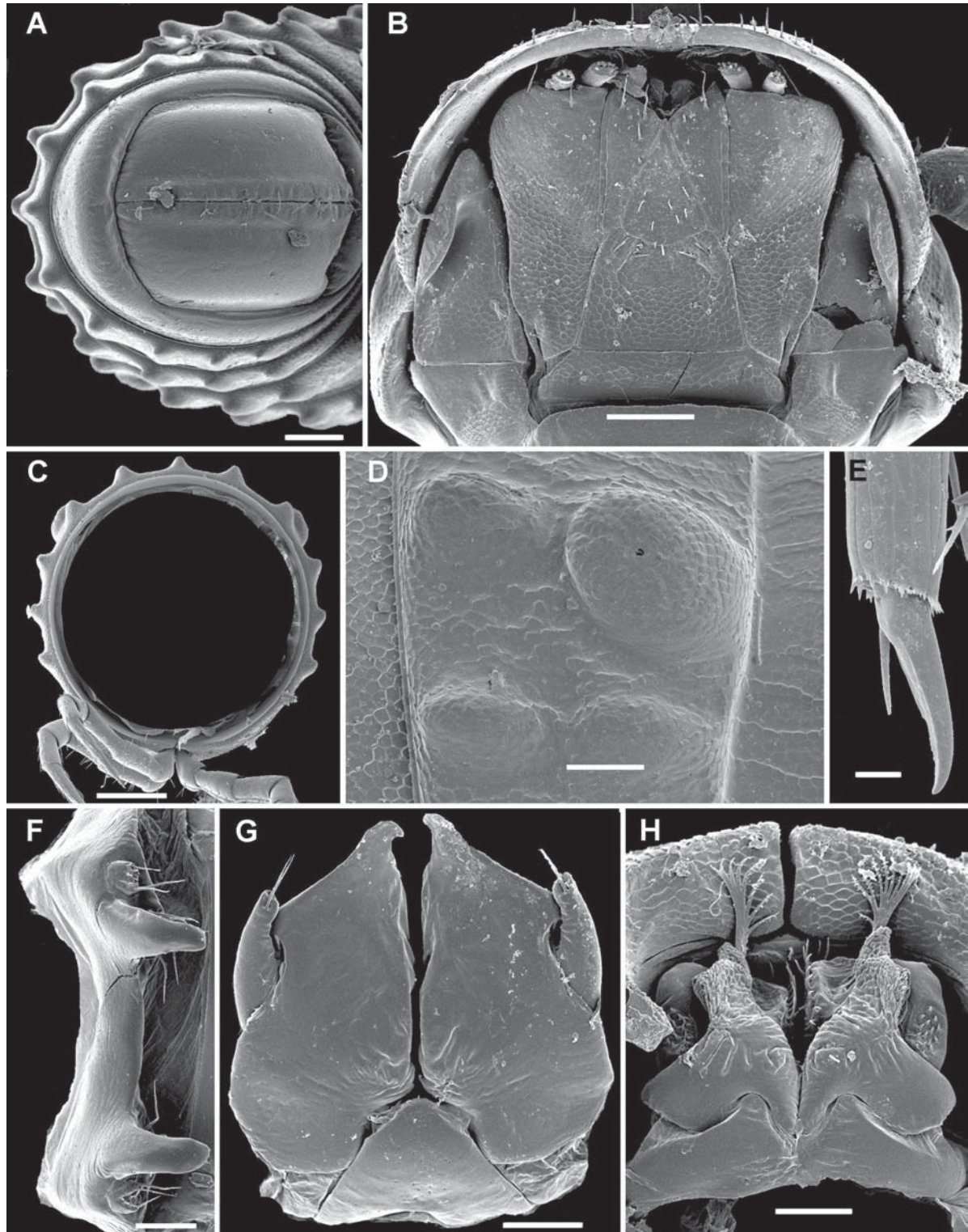


Fig. 41. *Glyphiulus duangdee* sp.n., ♂ paratype: A — caudal part of body, caudal view; B — gnathochilarium, ventral view; C — cross-section of a midbody segment, caudal view; D — enlarged ozopore region, lateral view; E — enlarged claw, lateral view; F — legs I, ventrocaudal view; G — anterior gonopods, front view; H — posterior gonopods, front view. Scale bars: A & B — 0.1 mm; C — 0.2 mm; D, F, G, H — 0.05 mm; E — 0.01 mm.

Рис. 41. *Glyphiulus duangdee* sp.n., паратип ♂: А — задняя часть тела, снизу; В — гнатохиларий, снизу; С — поперечный разрез через среднетуловищный сегмент, сзади; D — увеличенный район озопоры, сбоку; E — увеличенный коготок, сбоку; F — ноги I, снизу и сзади; G — передние гоноподы, спереди; H — задние гоноподы, спереди. Масштаб: А и В — 0,1 мм; С — 0,2 мм; D, F, G, H — 0,05 мм; E — 0,01 мм.

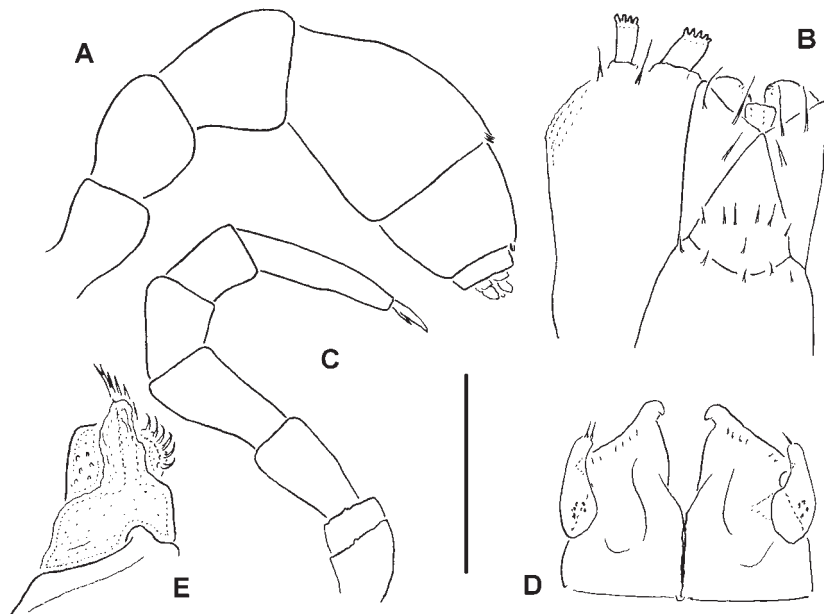


Fig. 42. *Glyphiulus duangdee* sp.n., ♂ paratype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — midbody leg, lateral view; D — anterior gonopods, caudal view; E — right posterior gonopod, front view. Scale bar: 0.2 mm.

Рис. 42. *Glyphiulus duangdee* sp.n., паратип ♂: А — антенна, сбоку; В — гнатохиларий, снизу; С — среднетуловищная нога, сбоку; D — передние гоноподы, сзади; E — правый задний гонопод, спереди. Масштаб: 0,2 мм.

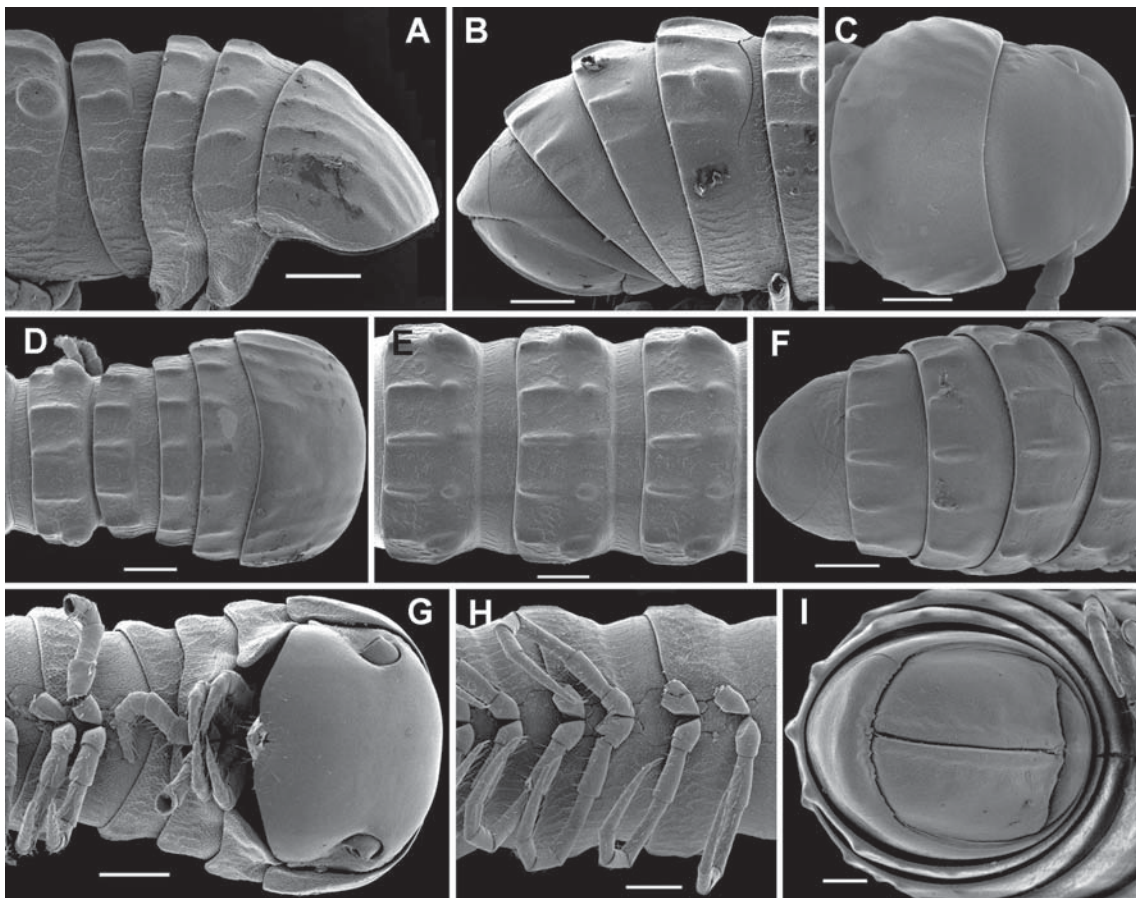


Fig. 43. *Glyphiulus mongkon* sp.n., ♂ paratype: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, F & I — posterior part of body, lateral, dorsal and ventral views, respectively; C — collum, dorsal view; E & H — midbody segments, dorsal and ventral views, respectively. Scale bars: A–H — 0.2 mm; I — 0.1 mm.

Рис. 43. *Glyphiulus mongkon* sp.n., паратип ♂: А, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, F, I — задняя часть тела, соответственно сбоку, сверху и снизу; C — коллум, сверху; E, H — среднетуловищные сегменты, соответственно сверху и снизу. Масштаб: А–H — 0,2 мм; I — 0,1 мм.

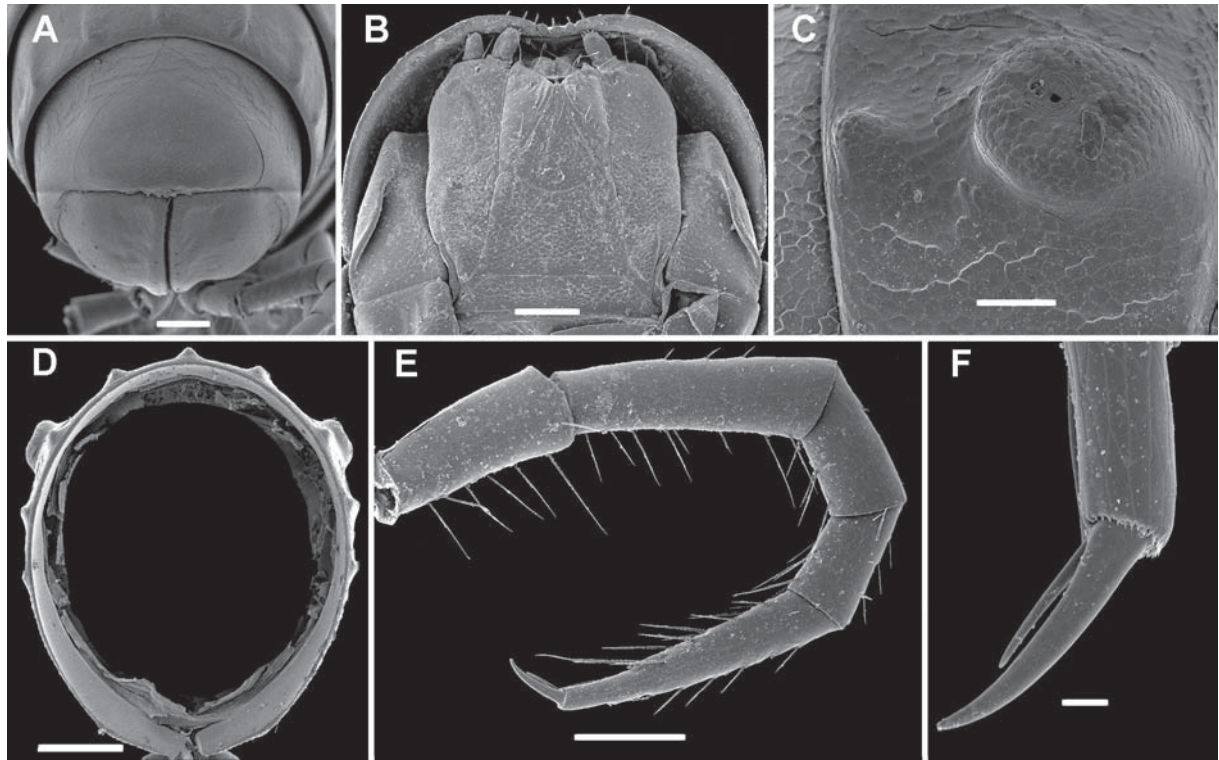


Fig. 44. *Glyphiulus mongkon* sp.n., ♂ paratype: A — caudal part of body, caudal view; B — gnathochilarium, ventral view; C — enlarged ozopore region, lateral view; D — cross-section of a midbody segment, caudal view; E — midbody leg, lateral view; F — enlarged claw, lateral view. Scale bars: A, B & E — 0.1 mm; C — 0.05 mm; D — 0.2 mm; F — 0.01 mm.

Рис. 44. *Glyphiulus mongkon* sp.n., паратип ♂: А — задняя часть тела, сзади; В — среднетуловищные сегменты, снизу; С — увеличенный район озопоры, сбоку; D — поперечный разрез через среднетуловищный сегмент, сзади; E — среднетуловищная нога, сбоку; F — увеличенный коготок, сбоку. Масштаб: А, В, E — 0,1 мм; С — 0,05 мм; D — 0,2 мм; F — 0,01 мм.

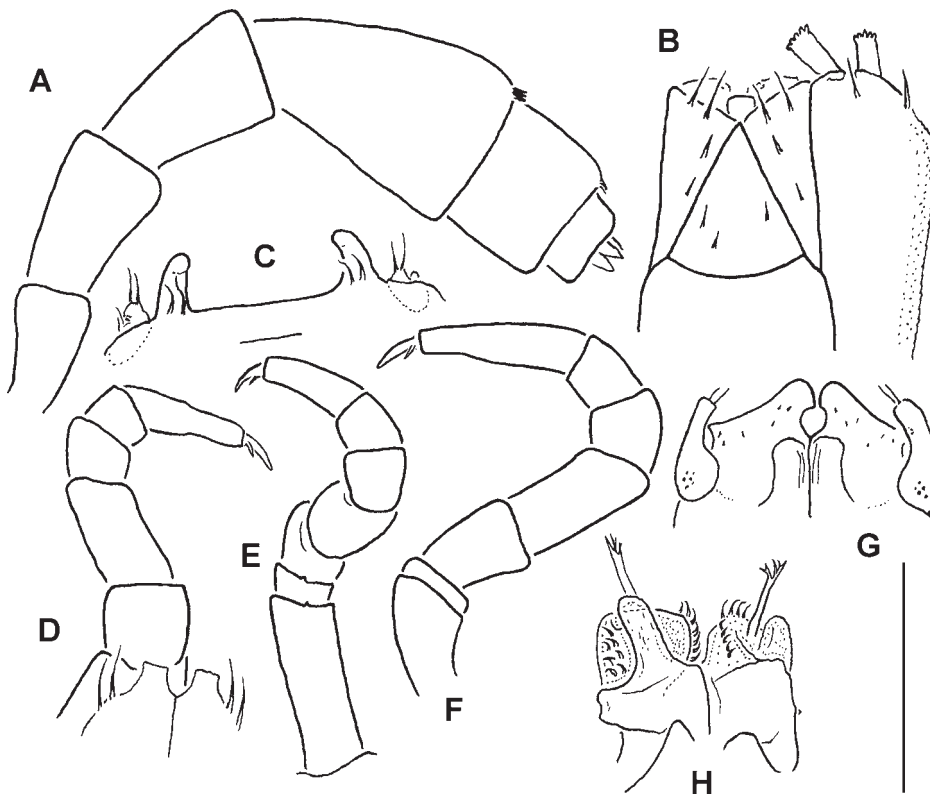


Fig. 45. *Glyphiulus mongkon* sp.n., ♂ paratype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — legs 1, front view; D — leg 2, caudal view; E — leg 3, front view; F — midbody leg, lateral view; G — anterior gonopods, caudal view; H — posterior gonopods, front view. Scale bar: 0.2 mm.

Рис. 45. *Glyphiulus mongkon* sp.n., паратип ♂: А — антенна, сбоку; В — гнатохилирий, снизу; С — ноги 1, сзади; D — нога 2, сзади; E — нога 3, спереди; F — среднетуловищная нога, сбоку; G — передние гоноподы, сзади; H — задние гоноподы, спереди. Масштаб: 0,2 мм.

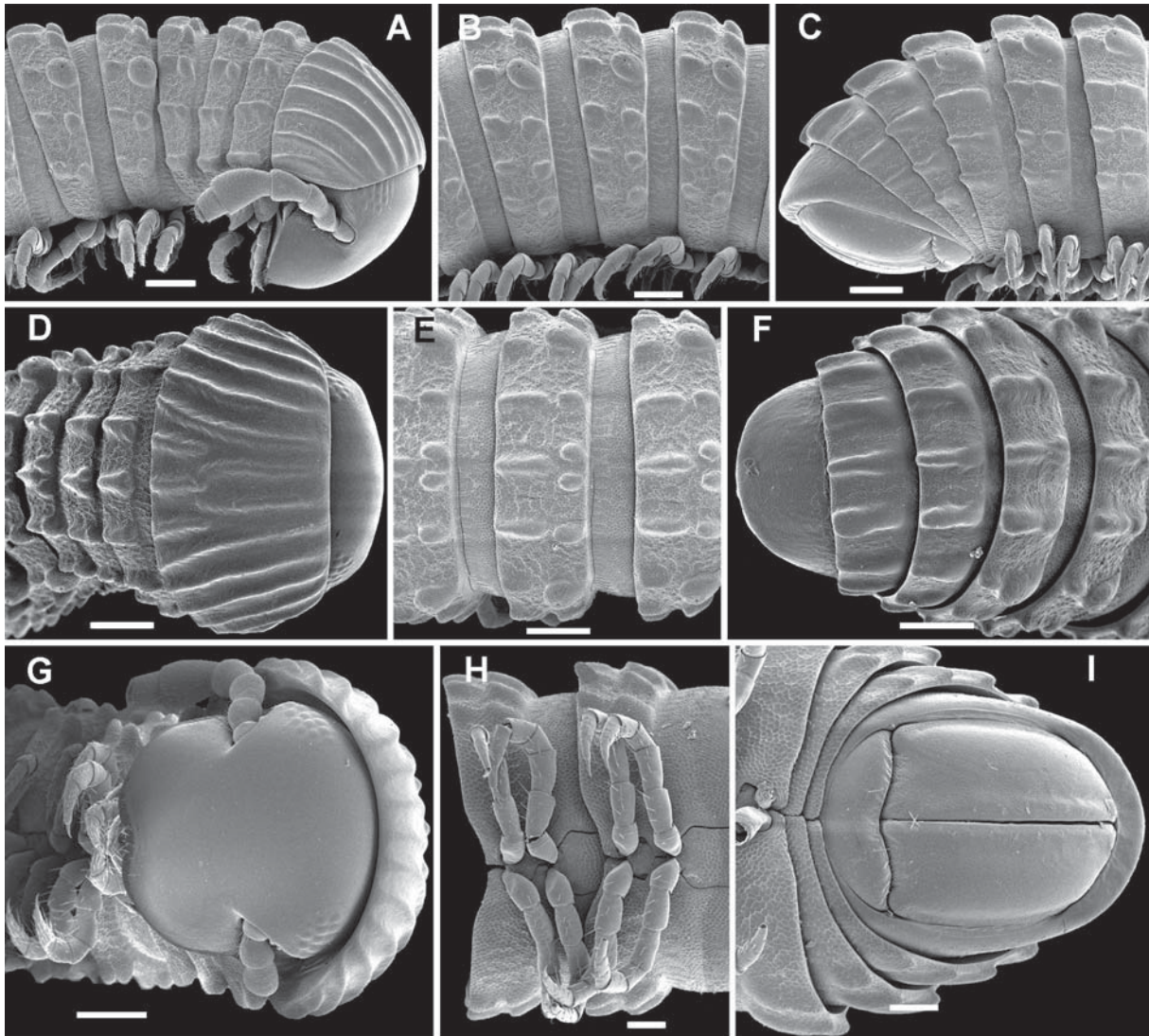


Fig. 46. *Glyphiulus maidtreejit* sp.n., ♂ paratype: A, D & G — anterior part of body, lateral, dorsal and ventral views, respectively; B, E & H — midbody segments, lateral, dorsal and ventral views, respectively; C, F & I — posterior part of body, lateral, dorsal and ventral views, respectively. Scale bar: A–G — 0.2 mm; H & I — 0.1 mm.

Рис. 46. *Glyphiulus maidtreejit* sp.n., паратип ♂: A, D, G — передняя часть тела, соответственно сбоку, сверху и снизу; B, E, H — среднетуловищные сегменты, соответственно сбоку, сверху и снизу; C, F, I — задняя часть тела, соответственно сбоку, сверху и снизу. Масштаб: A–G — 0,2 мм; H, I — 0,1 мм.

NAME. To emphasize “mongkon”, in Thai meaning “auspicious, favourable, propitious”, a noun in apposition.

DIAGNOSIS. Keys out as *G. subgranulatus* Golovatch et al., 2007, a troglobite from Yunnan, but differs in two, not three, crests present below ozoporiferous cones, by the much lower plates of the anterior gonopods etc. Distinguished from other species also by the rather small size, a slightly laterally compressed body, a nearly complete carinotaxy on the collum, combined with the anteriorly very indistinctly doubled medians on the following segments, as well as by the very low ozoporiferous cones and even lower adjacent crests/

tubercles, the peculiar shapes of the epiproct and paraprocts, etc.

DESCRIPTION. Length 12–20 mm, width 0.9–1.0 mm, with 31–43p+2a+T, midbody segments being broadest. Holotype ca 12 mm long, 0.9 mm wide, with 31p+2a+T. Coloration uniformly light yellow-brown, smaller adults and juvenile nearly pallid.

All characters as in *G. grandis* sp.n. (Figs 43–45), except as follows. Antennae short and evidently clavate (Fig. 45A), extending beyond segment 3 laterally. Ocellaria mostly invisible, only sometimes traceable as light greyish, ovoid blotches with 6–8 translucent ocelli on each side of head. Gnathochilarium (Figs

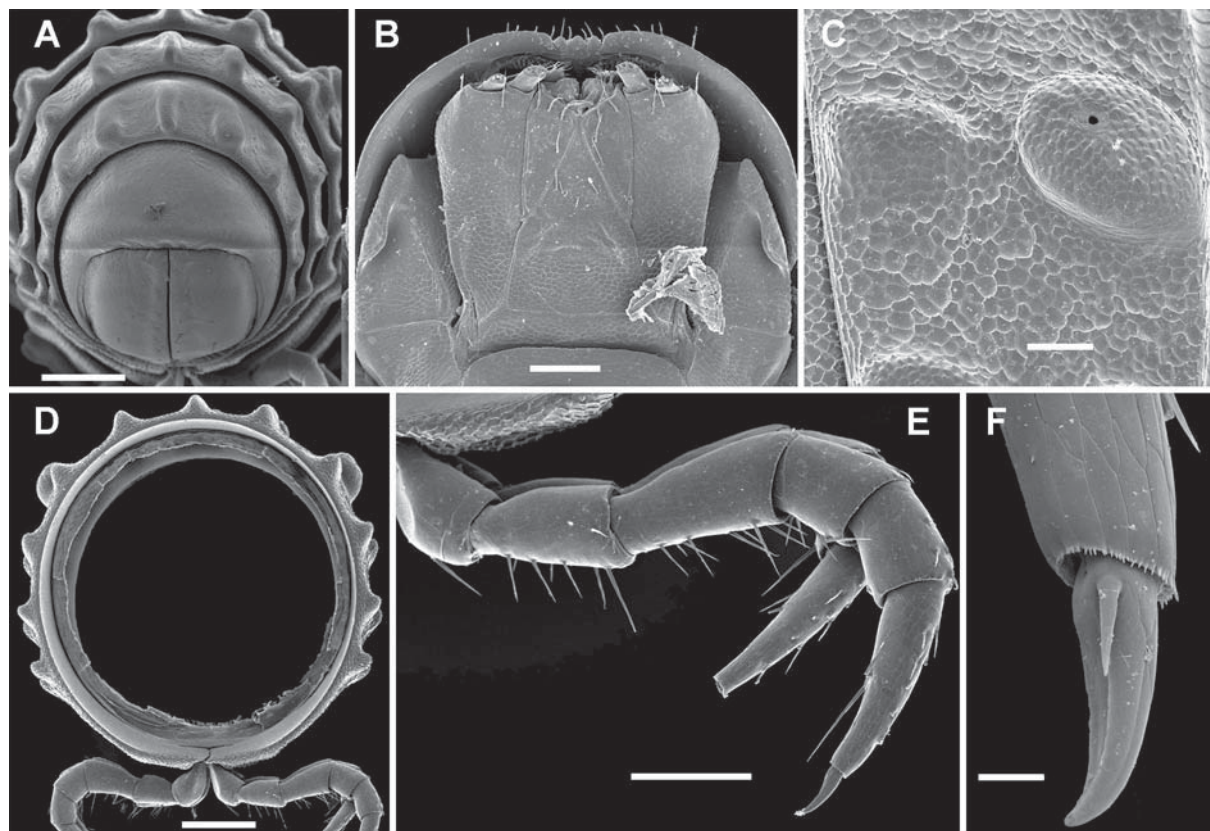


Fig. 47. *Glyphiulus maidtreejit* sp.n., ♂ paratype: A — caudal part of body, caudal view; B — gnathochilarium, ventral view; C — enlarged ozopore region, lateral view; D — cross-section of a midbody segment, caudal view; E — midbody legs, lateral view; F — enlarged claw, subventral view. Scale bars: A & D — 0.2 mm; B & E — 0.1 mm; C — 0.05 mm; F — 0.01 mm.

Рис. 47. *Glyphiulus maidtreejit* sp.n., паратип ♂: А — задняя часть тела, сзади; В — среднетуловищные сегменты, снизу; С — увеличенный район озопоры, сбоку; D — поперечный разрез через среднетуловищный сегмент, сзади; E — среднетуловищная нога, сбоку; F — увеличенный коготок, почти снизу. Масштаб: А, D — 0,2 мм; В, E — 0,05 мм; F — 0,01 мм.

44B, 45B) oligotrichous, with a separate promentum ($n=2$).

Carinotaxy formula of collum nearly complete: I–IV+5a+pc+ma, both paramedians and median being nearly fully obliterated near front margin (Figs 43A, C, D).

Subsequent metaterga strongly crested (Figs 43A, B, 44D); carinotaxy formula, 3/3+I/i+4//3+I/i+3/3 (Figs 43E, 44D), but anterior doubling of medians very poorly developed. Ozoporiferous tubercles enlarged, conical, strongly flattened, low, much broader at base than high, subtruncate apically (Fig. 44D); laterals, paramedians and medians being much lower and mostly narrowly rounded caudally (Figs 43B, E). Segments slightly compressed laterally.

Epiproct simple, regularly rounded caudally, without structures dorsally (Figs 43B, F). Paraprocts regularly convex, with premarginal sulci medially (Figs 43B, I, 44A). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 43I).

Legs rather long and slender (Figs 44E, 45F), on midbody segments about 1.1–1.2 length of segment height. Claw long, usually with a strong accessory spine

at base, the latter more than half length of claw proper (Fig. 44F).

♂ legs 1 as usual, leg vestiges 1-segmented (Figs 45C). ♂ legs 2 and 3 as usual (Figs 45D, E).

Anterior gonopods (Fig. 45G) with a plate-like coxosternum showing its inner, axe-shaped tips considerably rather moderately higher than telopodites, rather poorly microsetose on caudal face. Posterior gonopods (Fig. 45H) as usual, very compact, flagellum rather long, slender and plumose.

Glyphiulus maidtreejit sp.n.

Figs 46–48.

MATERIAL. Holotype ♂ (MNHN GA 088), Thailand, Phetchabun Prov., Lom Sak Distr., Cave Tham Pha Hong, hand collection, 1.01.1992, leg. A. Bedos & L. Deharveng (THA-PTH-004). Paratypes: 1 ♂, 1 fragm., 1 juv. (MNHN GA 088), 1 ♀ (SEM), same locality, together with holotype.

NAME. To emphasize “maidtreejit”, in Thai meaning “goodwill, sympathy, friendship”, a noun in apposition.

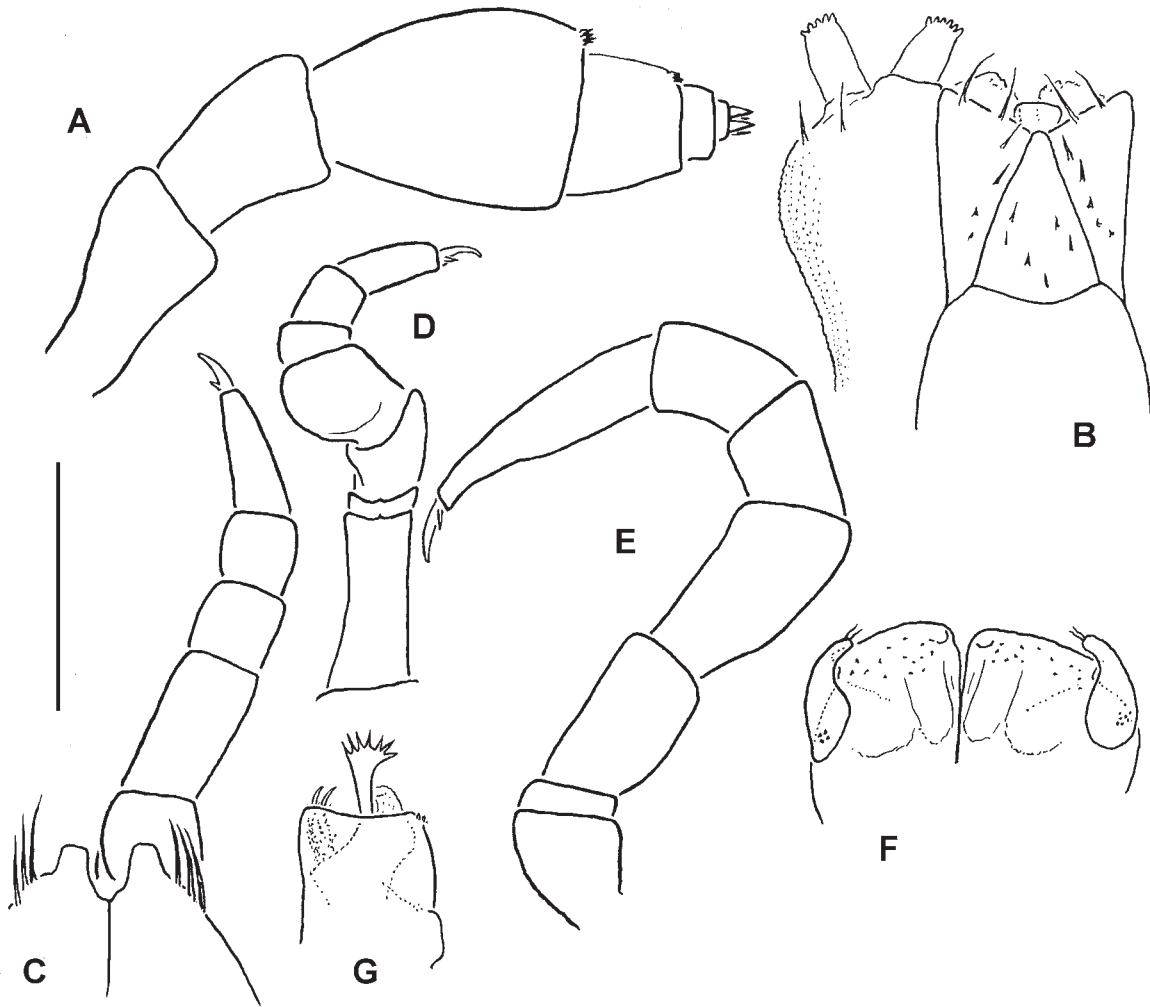


Fig. 48. *Glyphiulus maidtreejit* sp.n., ♂ paratype: A — antenna, lateral view; B — gnathochilarium, ventral view; C — leg 2, caudal view; D — leg 3, caudal view; E — midbody leg, lateral view; F — anterior gonopods, caudal view; G — right posterior gonopod, caudal view. Scale bar: 0.2 mm.

Рис. 48. *Glyphiulus maidtreejit* sp.n., паратип ♂: А — антенна, сбоку; В — гнатохиларий, снизу; С — нога 2, сзади; D — нога 3, сзади; E — среднетелувищная нога, сбоку; F — передние гоноподы, сзади; G — правый задний гонопод, сзади. Масштаб: 0,2 мм.

DIAGNOSIS. Distinguished by the complete carinotaxy formula of the collum, combined with the peculiar carinotaxy formula of the following segments, as well as by the very low ozoporiferous cones, the peculiar shapes of the epiproct, paraprocts, anterior gonopods etc.

DESCRIPTION. Length of holotype 24 mm, width 1.0 mm, with 52p+2a+T, midbody segments being broadest. Paratype ♂ ca 22 mm long, 1.0 mm wide, with 46p+2a+T. Coloration mostly dark grey-brown to dark brown; clypeus, antennae, legs and light (yellow-brown); most of tergal crests/tubercles and ozoporiferous cones infuscate, very dark brown.

All characters as in *G. grandis* sp.n. (Figs 46–48), except as follows. Antennae short and moderately clavate, extending beyond segment 3 laterally (Figs 46A, G, 48A). Ocellaria transversely-oval, blackish, com-

posed of 14–16 ocelli in 3–4 irregular transverse rows. Gnathochilarium (Figs 47B, 48B) rather oligotrichous, with a separate promentum (n=2).

Carinotaxy formula of collum complete: I–VI+7a+pc+ma, all crests being fully developed and clear (Figs 46A, D).

Subsequent metaterga strongly crested (Figs 46A–C, 47D); carinotaxy formula, (2)3/(2)3+I/i+4//3+I/i+3/3 (Figs 46B, E, 47D). Ozoporiferous tubercles enlarged, oblong-conical, strongly flattened, considerably broader at base than high, subtruncate apically (Fig. 47D), paramedians and medians nearly as high, these and other tubercles/crests around mostly narrowly rounded caudally (Figs 46B, C). Segments round in cross-section (Fig. 47D).

Epiproct simple, regularly rounded caudally, without structures dorsally (Figs 46C, F). Paraprocts regu-

larly convex, with only faint premarginal sulci medially (Figs 46I, 47A). Hypoproct transversely bean-shaped, slightly concave caudally (Fig. 46I).

Legs short and slender (Figs 47D, E, 48E), on mid-body segments about 0.9–1.0 length of segment height. Claw long, usually with a strong accessory spine at base, the latter less than half length of claw proper (Fig. 47F).

♂ legs 1 as usual, leg vestiges 1-segmented. ♂ legs 2 and 3 as usual (Figs 48C, D).

Anterior gonopods (Fig. 48F) with a plate-like coxosternum showing its inner, rounded tips about as high as telopodites, rather abundantly microsetose on caudal face. Posterior gonopods (Fig. 48G) as usual, very compact, flagellum rather short and plumose.

Conclusions

Even though most of the species described here have been taken from caves, it still remains to verify if at least some of them are indeed troglobites. Several troglomorphic traits combined, such as unpigmented tegument and ocellaria, and elongated antennae and legs, as observed, for example, in most of the new congeners from the Mulun karst, do suggest true cavernicolity. This karst is currently believed to host the richest cave fauna in China [Deharveng et al., 2008], with numerous troglobites revealed in various groups of terrestrial and freshwater invertebrates. In contrast, trogliphily at most seems to be true of the new species from Thailand.

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