

The pill millipedes of Vietnam: a key to genera and descriptions of five new species (Diplopoda: Glomerida: Glomeridae)

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Abstract. A new genus and five new species of glomerid millipedes are described from Vietnam: *Tonkinomeris napoensis*, new genus & new species, from Ha Giang Province; *Hyleoglomeris coloratoides*, new species from Huong Son District, Ha Tinh Province; *Hyleoglomeris lobus*, new species from Cuc Phuong National Park, Ninh Binh Province; *Hyperglomeris simplex*, new species from Vinh Phuc Province; and *Rhopalomeris sauda*, new species from Bac Kan and Vinh Phuc Provinces. New distributional records and detailed morphological data are provided for *Peplomeris magna* Golovatch, 1983. A key to the genera of the family Glomeridae is provided for the Vietnamese fauna. The current status of glomerid systematics is discussed.

Key words. Diplopoda, Glomeridae, millipede, new species, identification key, Vietnam

INTRODUCTION

Vietnam is located in a tropical biodiversity hotspot and known to harbour rich biodiversity (Sterling et al., 2006). Of this biodiversity, millipedes are important as decomposers, and yet they remain inadequately studied at a basic alpha-taxonomic level. To date, 20 species in five genera of the millipede family Glomeridae have been recorded from Vietnam, of which half have been described within the past 13 years (Verhoeff, 1915, 1921; Silvestri, 1917; Attems, 1938; Enghoff et al., 2004; Golovatch et al., 2006; Golovatch et al., 2013; Golovatch & Semenyuk, 2016; Golovatch, 2017). Most species are known only from their type localities, and their distributional patterns are, therefore, still unexplored. The number of glomerid millipedes is likely higher than these 20 species because the country is situated in a diverse tropical region, and the historically limited field collecting has woefully underestimated true diversity. This work contributes to our knowledge of the glomerid fauna of Vietnam through the descriptions of a new genus and five new species. We review the Vietnamese glomerid fauna and provide keys to the genera and species.

MATERIAL AND METHODS

Material was collected during field expeditions in Vietnam organised by the Institute of Ecology and Biological Resources, Vietnam Academy of Sciences and Technology (Hanoi, Vietnam); the Field Museum of Natural History (Chicago, USA); and Department of Entomology, Virginia Tech (Virginia, USA). Specimens were collected by visual searches of forest leaf litter and tree trunks by hand and by sifting with 0.5 cm mesh litter sifter. Specimens were preserved in 99% ethanol.

Specimen morphology was examined with a Leica MZ125 or Olympus SZX10 microscope. Numerous morphological characters including the gnathochilarium, mandible, female vulvae, and telopods were dissected for morphological study. Digital images were taken using a Nikon D5100 camera and a DinoLite flash with normal light and UV light using focus-stacking (see Sierwald et al. in press, for description of method). Digital images were focal-stacked with *Helicon Focus* ver. 6.0. For scanning electron microscopy, we used a Leo Scanning Electron Microscope (Carl Zeiss SMT, Peabody, MA) at the FMNH with specimens that were dissected, mounted on SEM stubs on carbon tabs and sputter-coated with gold. After SEM imaging, telopods and other body parts were placed in glass microvials and returned to their original specimens.

Holotypes and paratypes are deposited in the Field Museum of Natural History (FMNH, Chicago, USA), and the Institute of Ecology and Biological Resources (IEBR, Hanoi, Vietnam).

Abbreviations:

FMNH Field Museum of Natural History, Chicago, USA
HNHM Hungarian Natural History Museum, Budapest, Hungary

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IEBR	Institute of Ecology and Biological Resources, Hanoi, Vietnam
IZW	Institute of Zoology, Warszawa, Poland
MNHN	Musée National d'Histoire Naturelle, Paris, France
ZIN	Russian Academy of Sciences, Zoological Institute, St. Petersburg, Russia
ZMHB	Museum für Naturkunde der Humboldt-Universität (Zoologisches Museum), Berlin, Germany
ZMUC	Zoological Museum, University of Kobenhavn, Denmark
ZMUM	Zoological Museum, State University of Moscow, Russia
ZSM	Zoologische Staatssammlung München, Germany

pref	= prefemur
pret	= prefemoral trichostele of telopod
sch	= schisma of thoracic shield
sc	= apical sensory cones on 7 th antennomere
sp	= stipites of gnathochilarium
str	= striae
stu	= setose tubercule on podomere 3 of leg 18
syh	= syncoxite horn of telopod
syl	= syncoxite lobe (=central lobe in Wesener, 2010) of telopods
ta	= tarsus
tho	= thoracic shield
ti	= tibia
TO	= Tömösváry organ
tp	= tibial process of telopod

Morphological terminology. The terminology for morphological features employed in this paper follows largely the recent use by Oeyen & Wesener (2015). The glomerid telopods carry a variety of processes and so-called trichosteles (slender protuberances carrying a single long seta at the distal tip) on either the telopod prefemur, femur, and/or tibia. Although the presence and/or absence of particular processes are cited as identifying characters for subfamilies and tribes (e.g., Wesener, 2015: 379), homology-hypotheses for these processes and trichosteles have not been advanced. This paper considers the terms used for telopod processes as purely descriptive, and identical terms do not necessarily imply primary homology.

The abbreviations listed below are used as labels in the figures:

an1, an2, an3, an4, an5, an6	= antennomeres 1–6
ca	= cardines of gnathochilarium
co	= collum
col	= coxal lobe of leg 17
dfp	= distal femoral process of telopod
ed	= sparsely setose edge on mesal side of podomere 2, leg 18
ex	= external tooth of mandible
fe	= femur
fet	= femoral trichostele of telopod
gu	= gula
hs	= hyposchism of thoracic shield
ia	= intermediate area between molar plate and pectinate lamella of mandible
in	= internal tooth of mandible
ip	= inner palp of stipites of gnathochilarium
ll	= fused lamellae lingualis of gnathochilarium
lv	= lateral valve of vulva
me	= mentum of gnathochilarium
mp	= molar plate of mandible
mv	= mesal valve of vulva
oc	= ocelli; as traditionally used in Diplopoda, we continue to employ the term ocellus/ocelli in this work.
ov	= operculum of vulva
op	= outer palp of stipites of gnathochilarium (also called lateral palp)
pl	= pectinate lamella(e) of mandible
po1, po2, po3, po4	= podomeres 1–4

RESULTS

Order Glomerida

Family Glomeridae Leach, 1815

A list of glomerid species reported from Vietnam. L= name listed; R= revision; D= diagnostic description; ST= syntypes; HT= holotype; PT= paratype; T= type, specific status uncertain.

1. *Annameris curvimana* Verhoeff, 1915

Annameris curvimana Verhoeff, 1915. Zoologischer Anzeiger 46(1): 50, figs. 17 (telopod), 19 (2nd tergite), ST ZSM; from central Vietnam.

Annameris curvimana: -- Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

2. *Annameris robusta* Verhoeff, 1921

Annameris robusta Verhoeff, 1921. Archiv für Naturgeschichte 86A(12): 35; T 2 females (ZMHB 5762 1 female syntype), cited locality: Tonkin (= northern Vietnam).

Annameris robusta: – Moritz & Fischer, 1978. Mitteilungen aus dem Zoologischen Museum in Berlin, 54(2): 342 (listing female syntype specimen)

Annameris robusta: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L)

Note: The species is known from a female only.

3. *Hyleoglomeris cattienensis* Golovatch & Semenyuk, 2016

Hyleoglomeris sp. Golovatch, et al., 2011: 80

Hyleoglomeris cattienensis Golovatch & Semenyuk, 2016. Russian Entomological Journal 25(4): 414, figs. 8–13; HT male (ZMUM p3487), PT 6 females (ZMUM p3488), from Cat Tien National Park, southern Vietnam.

4. *Hyleoglomeris cavernicola* Golovatch, Geoffroy & VandenSpiegel, 2013

Hyleoglomeris cavernicola Golovatch, Geoffroy & VandenSpiegel, 2013. Arthropoda Selecta 22(3): 202, figs. 1A–C; HT male (MNHN CC 182); PT female (MNHN CC 182), from Cat Ba National Park, northern Vietnam.

5. *Hyleoglomeris colorata* Golovatch, Geoffroy & VandenSpiegel, 2013

Hyleoglomeris colorata Golovatch, Geoffroy & VandenSpiegel, 2013. Arthropoda Selecta 22(3): 204, figs. 3–4; HT male (MNHN CC 184), PT female (MNHN CC 184), from Phong Nha–Ke Bang National Park, central Vietnam.

6. *Hyleoglomeris fedorenkoi* Golovatch, 2017

Hyleoglomeris fedorenkoi Golovatch, 2017. Russian Entomological Journal 26(2): 197, figs. 10–18; HT male (ZMUM), from Chu Yan Sinh National Park, Dak Lak Province, Highlands of Vietnam.

7. *Hyleoglomeris robusta* Attems, 1938

Hyleoglomeris robusta Attems, 1938. Mémoires du Muséum national d'Histoire naturelle n.s. 6(2): 205, no images; HT female (MNHN), male unknown, Pic de Lang Biang from Dalat, Highlands of Vietnam.

Hyleoglomeris robusta: – Golovatch, Geoffroy & Mauriès, 2006: 891, 894, fig. 3 (R); topotypic material of a male, and a female (largely consistent with the female holotype, MNHN, CC161).

Hyleoglomeris robusta: – Golovatch, 1983a: 180 (L); Golovatch, 1983b: 116, in key as *H. robustus*; Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

Hyleoglomeris electa (Silvestri, 1917)

Apiomeris (Hyleoglomeris) electa Silvestri, 1917. Records of the Indian Museum 13(3,9)119, fig. XIV (3 images), described from female specimen; Museum/Types unknown; India.

Hyleoglomeris electa: – Attems, 1938. Mémoires du Muséum national d'Histoire naturelle n.s. 6(2): 206, figs. 20–22, (D, male specimen in MNHN) from Lamdong Province, Dalat, Mt. Langbiang (Pic de Lang Biang), Vietnam.

Note: Golovatch (1987: 219) discussed doubts regarding the conspecificity of the Indian specimens Silvestri (1917) had when describing the new species *electa*, and the Vietnamese specimens identified as *H. electa* by Attems in 1938.

Hyleoglomeris electa: – Attems, 1953. Mémoires du Muséum national d'Histoire naturelle n.s. Ser. A, Zoologie, 5(3): 158; Xien Kuang, Plateau de Boloven, Laos; listed only, neither image nor description, female specimen in MNHN.

Hyleoglomeris electa: – Golovatch, 1983a: 180 (L); Golovatch, 1983b: 116, in key; Enghoff, Golovatch & Nguyen, 2004: 31 (L).

Hyleoglomeris electa: – Golovatch, Geoffroy & Mauriès, 2006: 890, 896: list *electa* as a tentative junior subjective synonym of *H. robusta*; Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

Hyleoglomeris maior Attems, 1938

Hyleoglomeris maior Attems, 1938. Mémoires du Muséum national d'Histoire naturelle n.s. 6(2): 206, figs. 23–24; T male (MNHN),

cited locality: Phanrang, Hon Ba (S. Annam); Ninh Thuan Province, southcentral Vietnam.

Hyleoglomeris maior: – Golovatch, 1983a: 180 (L); Golovatch, 1983b: 116, in key; Enghoff, Golovatch & Nguyen, 2004: 31 (L). Golovatch, Geoffroy & Mauriès, 2006: 891, 896: list *maior* as a tentative junior subjective synonym of *H. robusta*; Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

Note: Figures of the telopods of *electa* and *maior* are distinctly different. The tentative synonymy of these two species under *H. robusta* needs to be substantiated by examination of the type material and topotype material.

8. *Hyleoglomeris spelaea* Golovatch, Geoffroy & VandenSpiegel, 2013

Hyleoglomeris spelaea Golovatch, Geoffroy & VandenSpiegel, 2013. Arthropoda Selecta 22(3): 202, figs. 2A–C; HT male (MNHN CC183), from Phong Nha–Ke Bang National Park, central Vietnam.

9. *Hyleoglomeris speophila* Golovatch, Geoffroy & Mauriès, 2006

Hyleoglomeris speophila Golovatch, Geoffroy & Mauriès, 2006. Zoosystema 28(4): 902, fig 5; HT male (MNHN CC157), from Cat Ba National Park, northern Vietnam.

Hyleoglomeris speophila: – Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

10. *Hyleoglomeris triangulifera* Attems, 1938

Hyleoglomeris triangulifera Attems, 1938. Mémoires du Muséum national d'Histoire naturelle n.s. 6(2): 204, T female (in MNHN?), no images, cited locality: Cauda (S. Annam); Nhatrang from Khanh Hoa Province, southcentral Vietnam.

Hyleoglomeris triangulifera: – Golovatch, 1983a: 180 (L); Golovatch, 1983b: 115, in key; Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & Mauriès, 2006: 892 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

Note: The species is known from a female only.

11. *Hyperglomeris conspicua* Golovatch, 1983

Hyperglomeris conspicua Golovatch, 1983. Annales Historico–Naturales Musei Nationalis Hungarici 75: 110, figs. 11–14; HT male and several PT (ZIN), male and female (HNHM), male and female (ZMUC), from Hoa Binh Province, northern Vietnam.

Hyperglomeris conspicua: – Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L); Golovatch, 2017: 197, in key.

12. *Hyperglomeris depigmentata* Golovatch, Geoffroy & VandenSpiegel, 2013

Hyperglomeris depigmentata Golovatch, Geoffroy & VandenSpiegel, 2013. Arthropoda Selecta 22(3): 206, fig. 5; HT male (MNHN CC 185), PT 1 male, 2 females (MNHN CC 185), PT male (ZMUM), from Thanh Hoa Province, northcentral Vietnam; Golovatch, 2017: 197, in key.

13. *Hyperglomeris dirupta* (Silvestri, 1917)

Dinoglomeris dirupta Silvestri, 1917. Records of the Indian Museum 13(3,9): 147, figs. 34 (2 images), 35 (11 images), T male, juv. (museum deposition unknown), cited locality: Tonkin, Montes Mauson; from Lang Son Province, northern Vietnam.

Hyperglomeris dirupta: – Golovatch, 1983a: 180 (L), new combination.

Hyperglomeris dirupta: – Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L); Golovatch, 2017: 197, in key.

14. *Hyperglomeris lamellosa* Silvestri, 1917

Hyperglomeris lamellosa Silvestri, 1917. Records of the Indian Museum 13(3, 9): 146, figs. 32 (2 images), 33 (10 images), T male (museum deposition unknown), cited locality: Tonkin, Montes Mauson; from Lang Son Province, northern Vietnam.

Hyperglomeris lamellosa: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L); Golovatch, 2017: 197, in key.

15. *Hyperglomeris maxima* Golovatch, 1983

Hyperglomeris maxima Golovatch, 1983. Annales Historico–Naturales Musei Nationalis Hungarici 75: 108, figs. 6–10; HT male, PT female (ZIN), PT male (ZMUM), PT male (HNHM), from Hoa Binh Province, northern Vietnam.

Hyperglomeris maxima: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L); Golovatch, 2017: 197, in key.

16. *Hyperglomeris nigra* Golovatch, 2017

Hyperglomeris nigra Golovatch, 2017. Russian Entomological Journal 26(2): 195, figs. 1–9; HT male (ZMUM), from Xuan Son National Park, Phu Tho Province, northern Vietnam.

17. *Peplomeris demangei* Silvestri, 1917

Rhopalomeris (Peplomeris) demangei Silvestri, 1917. Records of the Indian Museum 13(3, 9): 145, fig. 31 (10 images), T male (museum deposition unknown), cited locality: Tonkin; from Hanoi, northern Vietnam.

Peplomeris demangei: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 201 (L).

18. *Peplomeris magna* Golovatch, 1983

Peplomeris magna Golovatch, 1983. Annales Historico–Naturales Musei Nationalis Hungarici 75: 107, figs. 1–5; HT male (HMNH), from Cuc Phuong National Park, northern Vietnam.

Peplomeris magna: – Korsos & Golovatch, 1989. Acta Zoologica Hungarica, 35(3–4): 1 male, 1 female (HNHM), 1 male (ZMUM) 2 males, 1 female (IZW), Cuc Phuong National Park.

Peplomeris magna: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 202 (L).

19. *Rhopalomeris tonkinensis* Silvestri, 1917

Rhopalomeris tonkinensis Silvestri, 1917. Records of the Indian Museum 13(3,9): 133, fig. 30 (4 images), T female or juv.

(museum deposition unknown), cited locality: Tonkin, Montes Mauson; from Lang Son Province, northern Vietnam.

Rhopalomeris tonkinensis: – Golovatch, 1983a: 180 (L); Enghoff, Golovatch & Nguyen, 2004: 31 (L); Golovatch, Geoffroy & VandenSpiegel, 2013: 202 (L).

Note: The species is known from female only.

20. *Rhopalomeris variegata* Golovatch & Semenyuk, 2016

Rhopalomeris variegata Golovatch & Semenyuk, 2016. Russian Entomological Journal 25(4): 411, figs. 1–7; HT male (ZMUM p3485), PT 3 females (ZMUM p3486) from Gia Lai Province, Highlands of Vietnam.

Rhopalomeris variegata: – Golovatch, 2017. Russian Entomological Journal 26(2): 200, figs. 19–33; 2 males, 4 females (ZMUM), Kon Tum Province, Kon Plong District, tropical rain forest.

Vietnamese glomerid species are assigned to five genera: *Annameris*, *Hyleoglomeris*, *Hyperglomeris*, *Peplomeris*, and *Rhopalomeris*. While currently close to 100 species of *Hyleoglomeris* range from the Balkans to Indonesia, members of the genera *Annameris* (2 species), *Hyperglomeris* (7 species), and *Peplomeris* (2 species) are known only from Vietnam. The three species in the genus *Rhopalomeris* range from Malaysia to northern Vietnam. Three Vietnamese glomerid species are known from females only: *R. tonkinensis*, *A. robusta*, and *H. triangulifera*. Eight species described in the last century (by Verhoeff, Attems, and Silvestri) are known from their type specimen only, and have never been re-collected. Species distributions for these glomerids are unexplored. For the 12 more recently described species, only *Peplomeris magna* has been recollected twice (see below) in the same geographic region as the original type material. Thus, the current distribution patterns are strongly biased and reflect the limited collecting effort. Due to the lack of specimens for most Vietnamese glomerid species, morphological intra-specific variability cannot be ascertained. Furthermore, the type specimens of the species described by Silvestri, Verhoeff, and Attems have never been examined during more recent work on the group, allowing at most tentative synonymy suggestions (for *H. electa* and *H. maior*). Providing a basis for future research with comparative material, numerous illustrations of somatic characters, as well as telopods and vulval features are given here for *P. magna*, and *Hyleoglomeris lobus*, new species.

TAXONOMY**Subfamily Haploglomerinae Mauriès, 1971****Genus *Tonkinomeris*, new genus**

Type species. *Tonkinomeris napoensis*, new species by original designation.

Diagnosis. The new genus is similar to *Peplomeris* Silvestri, 1917 from Vietnam by having elongated telopods with femoral and tibial processes. The genus is differentiated from other genera by the leg-pair 18 being very stout, with

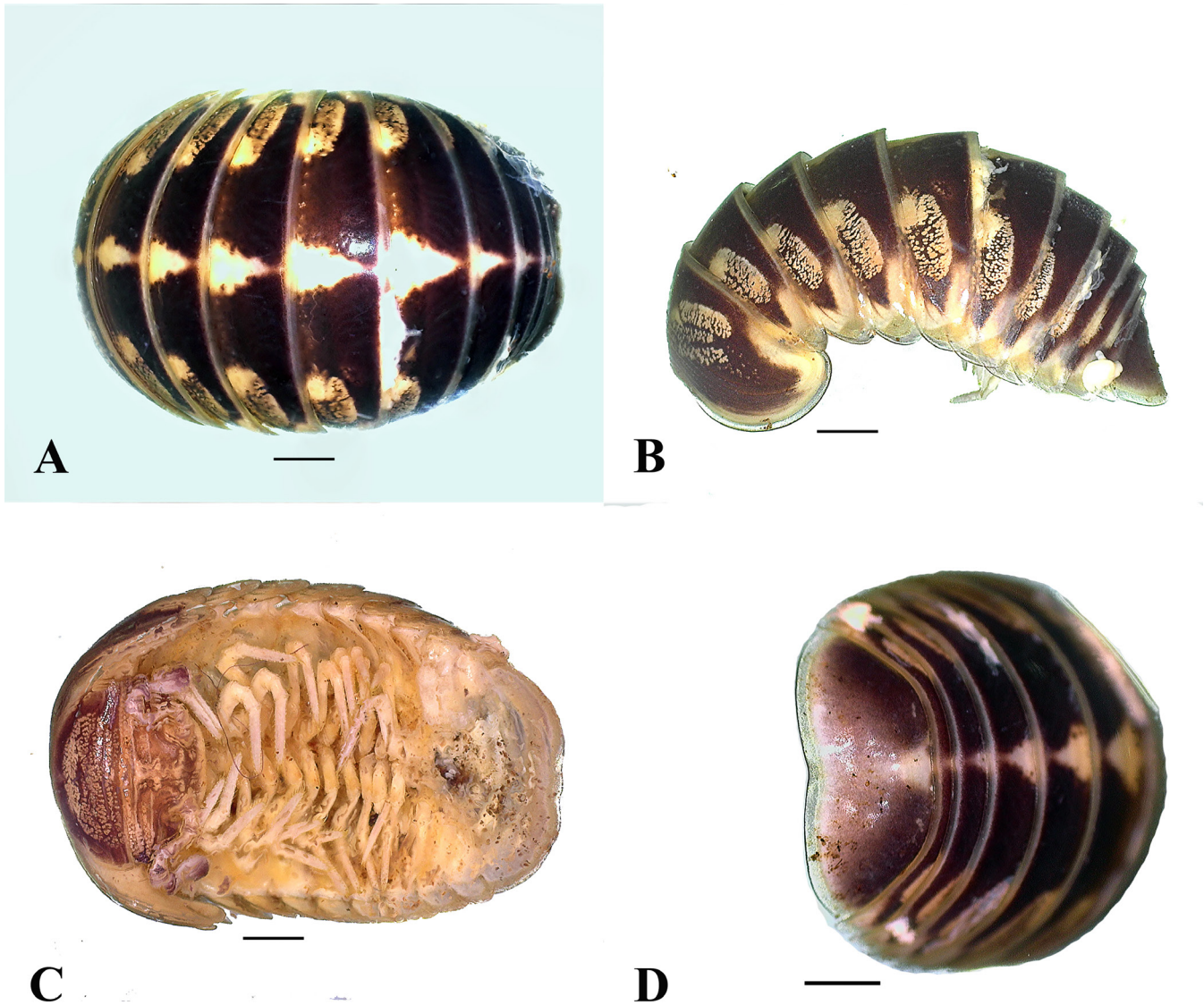


Fig. 1. *Tonkinomeris napoensis* new species, holotype (IEBR–Myr 657H), Na Po village (Ha Giang Prov.). A, whole body, dorsal view; B, lateral view; C, ventral view. D, anal shield, posterior view. Scale bar = 1 mm.

a short, stout, sparsely setose tubercle on podomere 3. In contrast, *Peplomeris* possesses a normally reduced leg-pair 18 and lacks the tubercle. Telopods elongate, without femoral trichosteles, but with a short, stout tuberculiform trichostele on the telepodal prefemur. Telopod femur straight. Distal outgrowth of telepodal tibia a large lamelliform process—absent in *Peplomeris*. Telepodal syncoxial lobe rounded trapeziform—not emarginated medially as in *Peplomeris*.

The new genus is tentatively assigned to the subfamily Haploglomerinae Mauriès, 1971 based on the simple, elongate telopods and lack of a femoral trichostele. See discussion of the current glomerid classification below.

***Tonkinomeris napoensis*, new species**
(Figs. 1–4)

Material examined. Holotype: male (IEBR–Myr 657H) Vietnam, Ha Giang Province, Bac Quang District, Duc Xuan Commune, Na Po Village, forest on limestone, 14–15 April 2014, coll. A. D. Nguyen.

Paratypes: 3 males, 5 females (IEBR–Myr 657P) same data as for holotype.

Etymology. Named after the Na Po Village where type specimens were collected, (feminine adjective).

Diagnosis. The species is differentiated by characters in the genus diagnosis above.

Description. Holotype male (IEBR–Myr 657H). Width of 2nd tergum 5.0 mm; body length 9.6 mm.

Exoskeleton (Fig. 1): Terga black with median line of yellow triangular spots longitudinally, and two paramedial marbled transverse oval spots (Fig. 1A, B). Lateral margins light yellow. Anal shield black with a light brown, triangular spot medially (Fig. 1D). **Head:** Ocelli 5+1, lenses convex, contrasting black against light brown background of head. Tömösváry organs transverse oval, margins slightly concave, ca. 2× wider than long. Antenna clavate apically; antennomere 6 large, ca. 2× longer than wide. Antennal tip with four

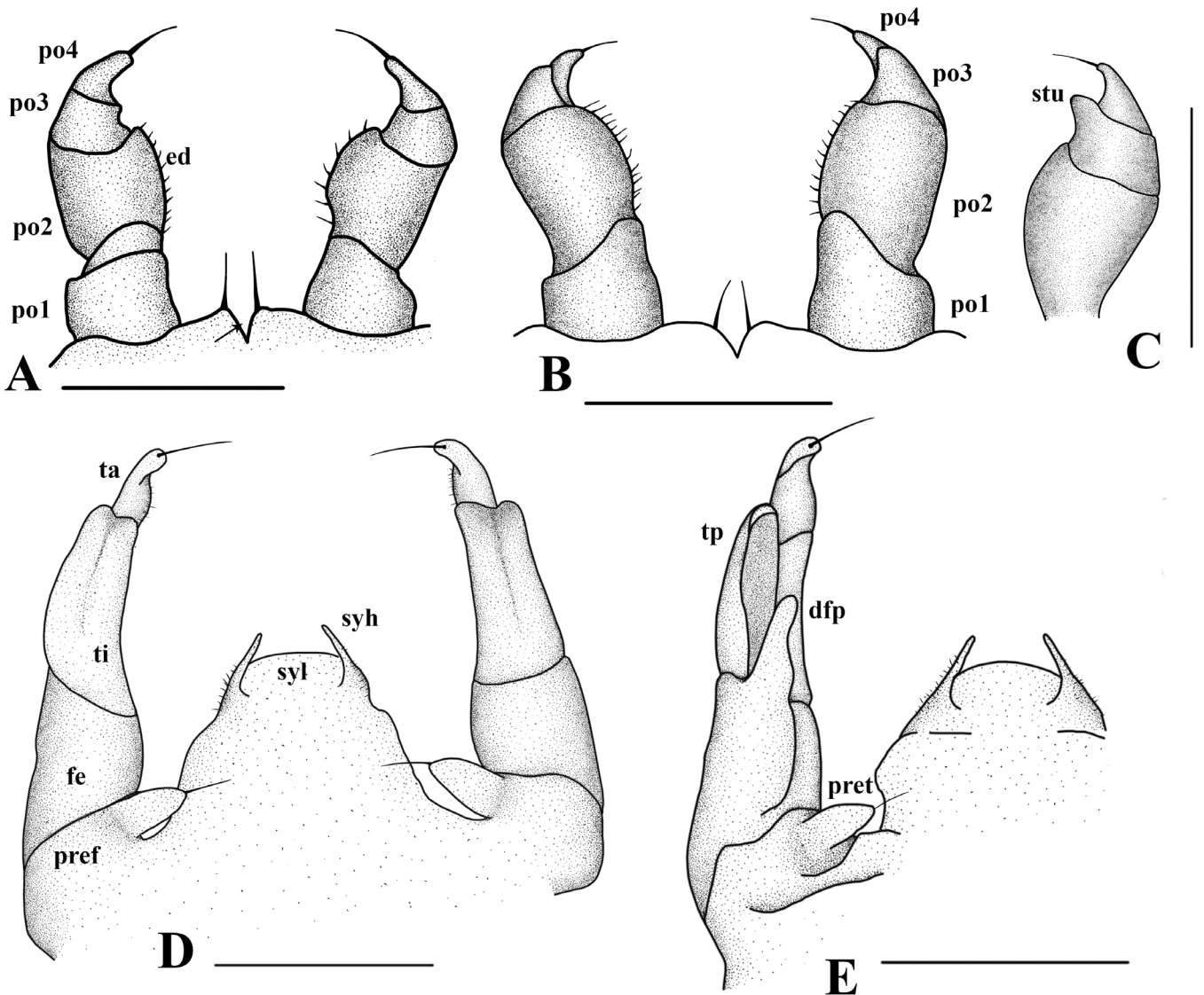


Fig. 2. *Tonkinomeris napoensis* new species, holotype (IEBR–Myr 657H), Na Po village (Ha Giang Prov.). A, legs 18, anterior view; B, posterior view; C, lateral view. D, telopods, anterior view; E, posterior view. Scale bar = 1 mm.

large, apical sensory cones. *Tergites*: Collum semi-circular, with a very large marbled yellow-brown spot medially (Fig. 1C). Second tergum (=thoracic shield, tho) with a narrow hyposchism (hs), reaching to caudal margin; dorsal surface with 6–7 distinct transverse striae, all crossing dorsum. Anal shield strongly rounded, emarginated mediocaudally (Fig. 1D). Other tergites each with 3–4 superficial striae. *Legs*: Leg-pair 17 strongly reduced, 3-segmented: coxa with a regular outer lobe, and a setiferous tubercle distomesally; podomere 1 with a small distomesal setiferous knob. Leg-pair 18 (Figs. 2A, C, 3A, B), robust, stout, 4-segmented: coxa with syncoxial notch (arrow); podomere 2 large, with sparsely setose edge (ed) mesally; podomere 3 with a short, stout, sparsely setose tubercle (stu) on posterior side (Fig. 2C); podomere 4 with apical seta.

Telopods (Figs. 2D, E, 3D, E, 4): Telopods with a rounded trapeziform, central syncoxial lobe (syl) with two setose horns (syh) paramedially, each projected mesoventrad above syncoxial lobe. Prefemur broadened basally, carrying a short, stout tuberculiform trichostele (pret). Femur with a straight,

distal process (dfp), without femoral trichosteles. Tibia with a large, densely microgranulated, lamelliform process (tp). Tarsus rounded apically, and not sigmoid, carrying a seta; mesal side sparsely setose.

Variation. Width of 2nd tergum 3.8–5.0 mm (males), 5.2–6.5 mm (females); body length 5.3–9.6 mm (males), 6.9–9.6 mm (females). A particular big female 12.6 mm long, width 10 mm at tergum 2.

Remarks. *Tonkinomeris napoensis*, new species is only known from its type locality.

Genus *Peplomeris* Silvestri, 1917

Type species. *Peplomeris demangei* Silvestri, 1917: 144, by original designation.

Remarks. The genus *Peplomeris* was established by Silvestri (1917) as a subgenus to *Rhopalomeris* Verhoeff, 1906, and was placed in the subfamily Doderiinae. Mauriès (1971)

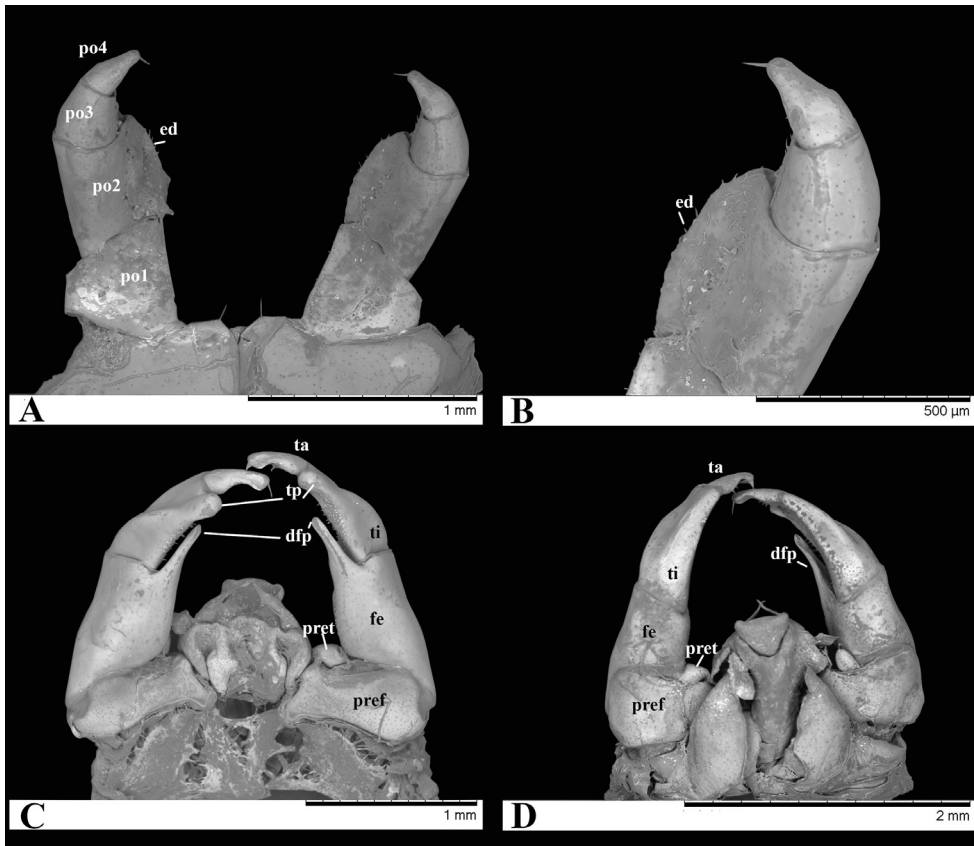


Fig. 3. *Tonkinomeris napoensis* new species, holotype (IEBR–Myr 657H), Na Po village (Ha Giang Prov.). A, legs 18, anterior view; B, right leg 18, anterior view; C, telopods, anterior view; D, posterior view. Scale bar = 1 mm (A, C); 0.5 mm (B); 2 mm (D).

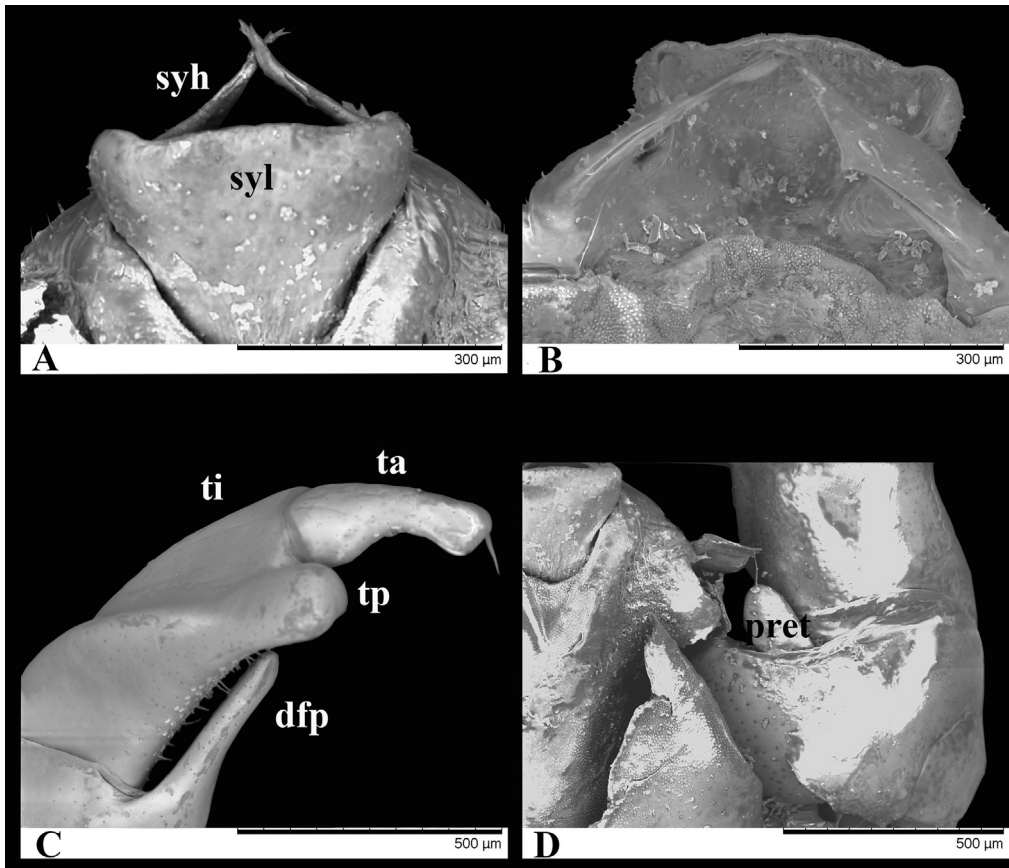


Fig. 4. *Tonkinomeris napoensis* new species, holotype (IEBR–Myr 657H), Na Po village (Ha Giang Prov.). A, telopods: syncoxial lobe and horns, posterior view; B, anterior view; C, left telopod, distal part, anterior view; D, basal part, anterior view. Scale bar = 0.3 mm (A, B); 0.5 mm (C, D).

assigned this genus to the tribe Haploglomerini. The genus *Peplomeris* is currently in the subfamily Haploglomerinae due to their simple, elongated telopods, presence of a prefemoral trichostele, and femoral trichostele strongly reduced or absent (Wesener, 2015: 379)

The genus *Peplomeris* was known from two species: *P. magna* Golovatch, 1983 and *P. demangei* Silvestri, 1917 from northern Vietnam. The two species can be distinguished by the number of setae in podomere 4 of leg 17 (two in *P. magna*, one in *P. demangei*) and the direction of syncoxial horns (mesoventrad, and slightly above syncoxial lobe in *P. magna* versus ventrad, noticeably above syncoxial lobe in *P. demangei*).

***Peplomeris magna* Golovatch, 1983**
(Figs. 5–18)

Material examined. 1 male, 3 females, 1 juvenile (FMNH INS 3716068) Vietnam, Ninh Binh Province, Nho Quan District, Cuc Phuong National Park, Bong, botanical garden, trail starting at restaurant, 20.3483°N, 105.5979°E, collected in the morning, 22 September 2016, coll. Petra Sierwald et al.; 3 females, 1 juvenile (FMNH INS 3716014) Ninh Binh



Fig. 5. *Peplomeris magna* Golovatch, 1983 from Cuc Phuong National Park, habitus. Photo by: Anh D. Nguyen, image not to scale.

Province, Nho Quan District, Cuc Phuong National Park, 20.3167°N, 105.6081°E, in the afternoon, 22 September 2016, coll. Petra Sierwald et al.; 1 male, 3 females (FMNH INS 3716128) Vietnam, Hanoi, Ba Vi District, Ba Vi National Park, road to the temples, midway point, 21.0753°N, 105.3661°E, naturally protected forests, in the morning,

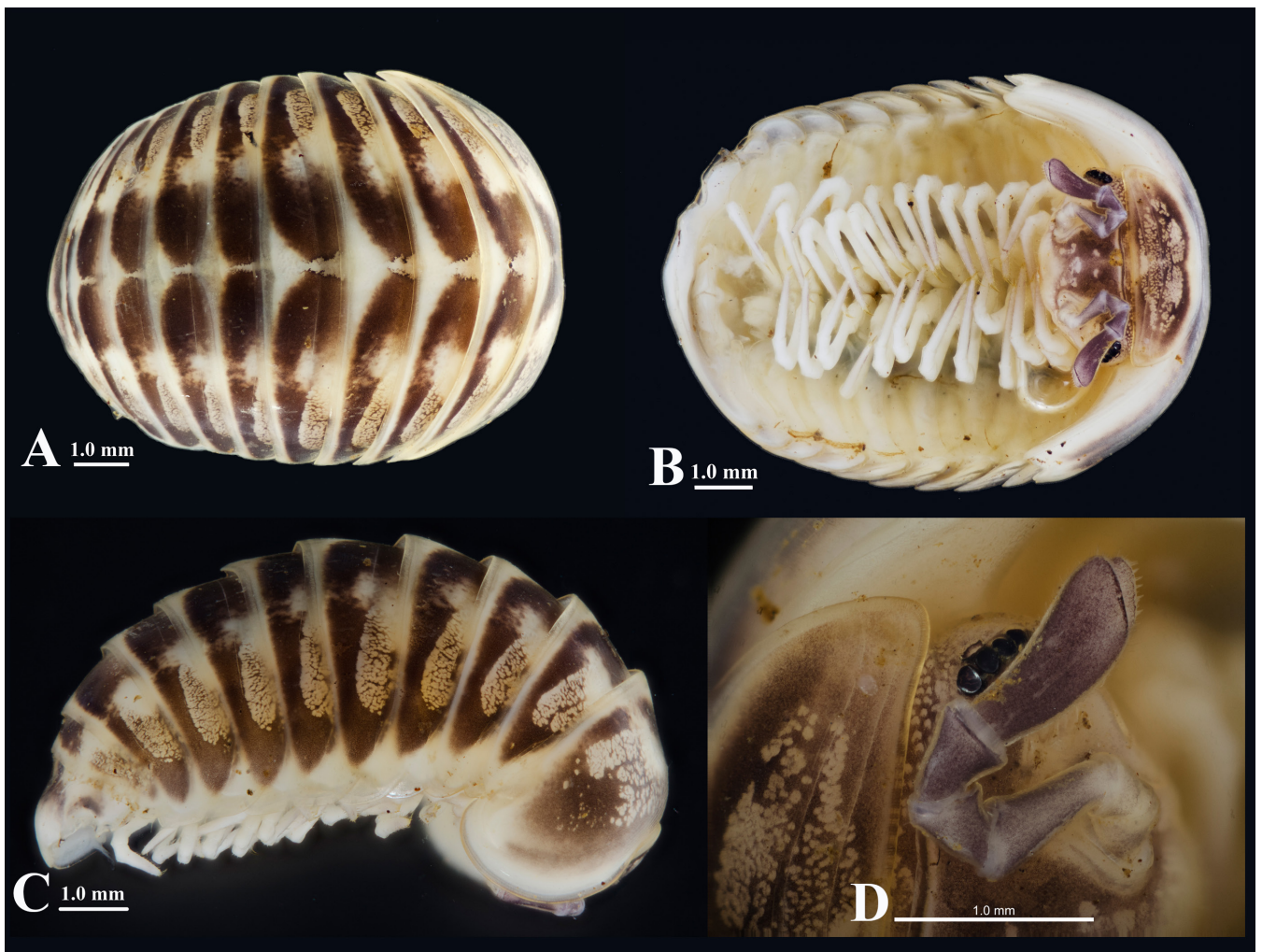


Fig. 6. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, whole body, dorsal view; B, ventral view; C, lateral view; D, antenna, subdorsal view. Scale bar = 1 mm.

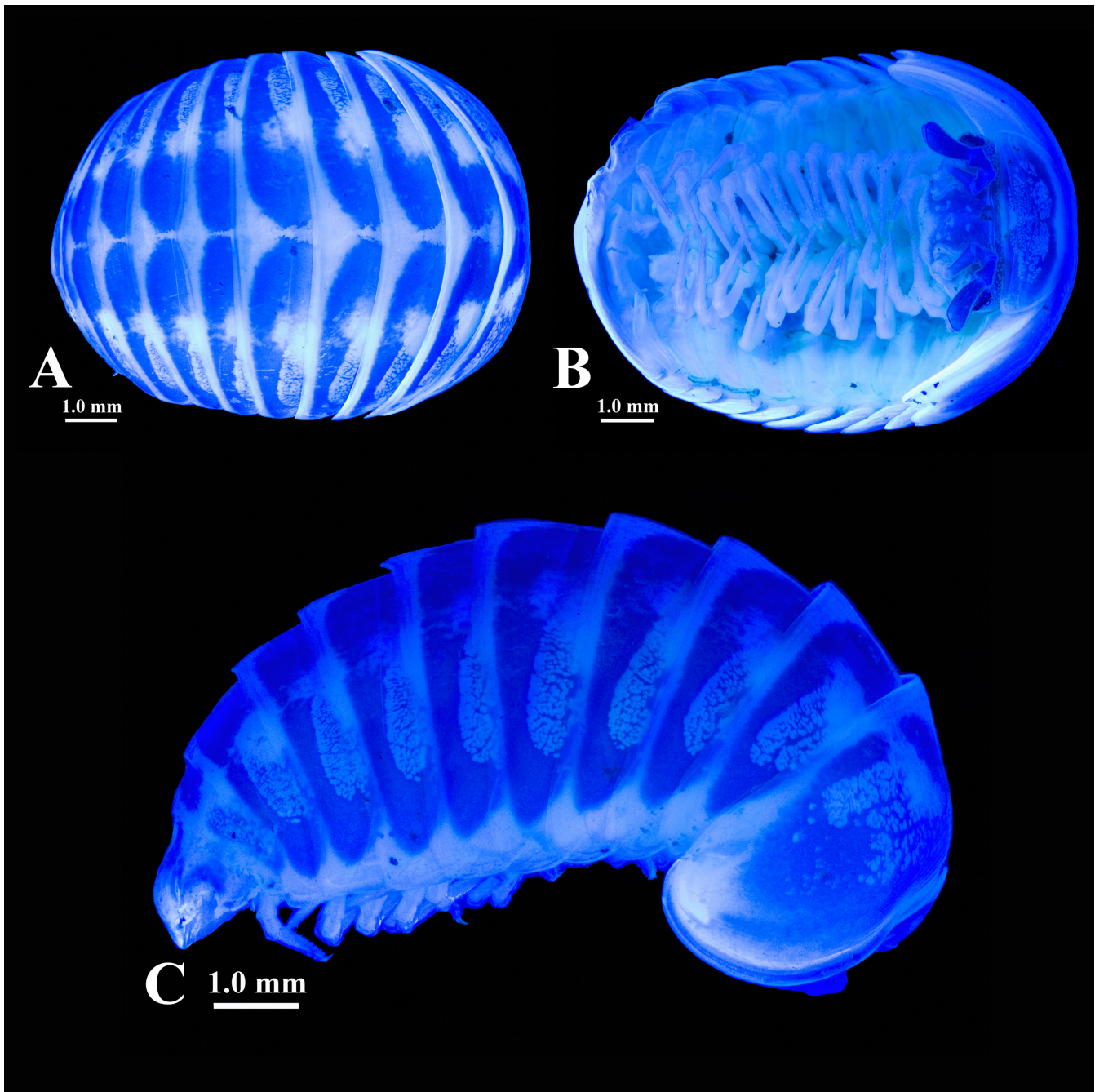


Fig. 7. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, whole body under UV light, dorsal view; B, ventral view; C, lateral view. Scale bar = 1 mm.

20 September 2016, coll. Petra Sierwald et al.; 4 females (IEBR–Myr 656) Vietnam, Ninh Binh Province, Nho Quan District, Cuc Phuong National Park, Bong station, forests, 20.3483°N, 105.5979°E, 28 July–2 August 2017, coll. Anh D. Nguyen.

Remarks. The species was previously known from only its type locality, Cuc Phuong National Park (Golovatch, 1983b). New records expand its distribution northward by about 150 km.

With several specimens available, *P. magna* is illustrated here in detail. In most respects, the morphological details correspond well to the general bauplan of the order Glomerida (Wesener in Minelli, 2015: 377). Head with horseshoe-shaped

Tömösváry organ, row of 7 ocelli and a single ocellus above as common in the order (7+1 pattern) (Figs. 8A, D, 13A, B). Antennae laterally flattened, consisting of 7 antennomeres, the 6th being the longest, with numerous apical sensory cones as specific for the genus *Peplomeris* (Figs. 6B, D, 8A–F, 13A, C, D) on antennomere 7. Gnathochilarium (Figs. 9A, B, 14A–D) with wide gula, large cardines and stipites, large fused lamellae lingualis, mentum knob-shaped, subdivided longitudinally, in *Peplomeris* larger than in other Glomerida (compare with *Eupeyerimhoffia*, fig. 3H in Oeyen & Wesener, 2015). Stipites with larger inner and smaller outer palps, each palp with numerous sense cones (Figs. 14C, D). Mandible (Figs. 12A, B) agrees with the bauplan for the order: gnathal lobe with a single external tooth (ex), four inner teeth (in), 7–8 pectinate lamellae (pl); folded intermediate area (ia), and

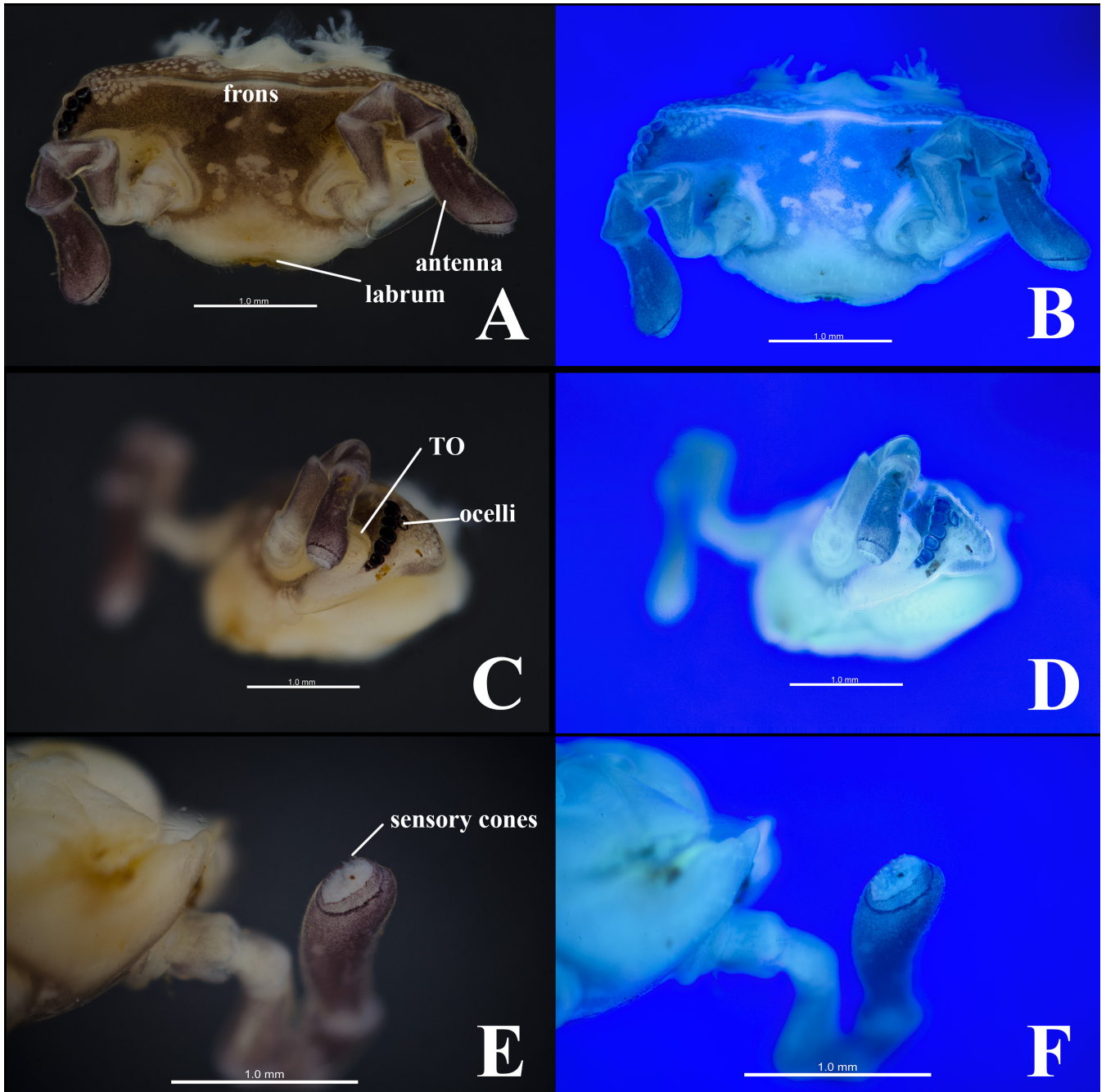


Fig. 8. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, head, anterior view, normal light; B, UV light; C, head, sublateral view, normal light; D, UV light; E, tip of left antenna, normal light; F, UV light. Scale bar = 1 mm.

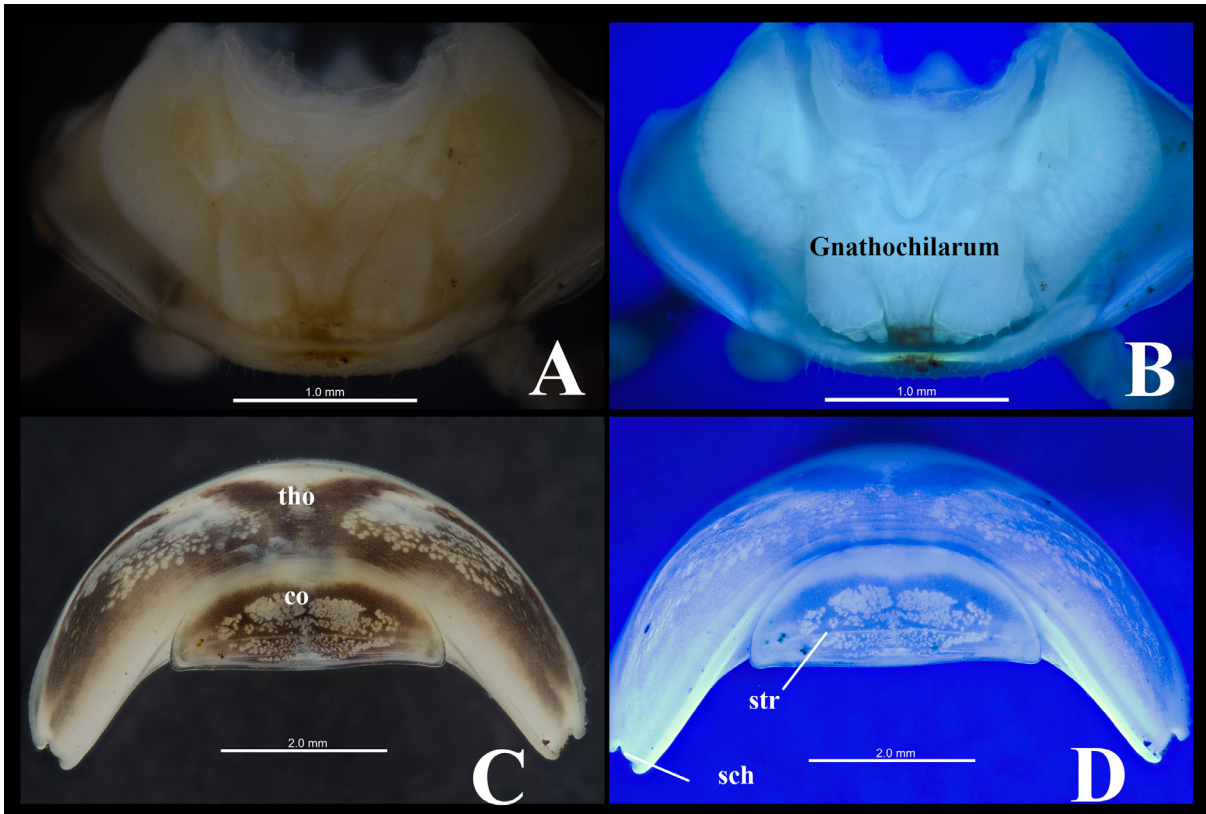


Fig. 9. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, gnathochilarum, ventral view, normal light; B, UV light; C, thoracic shield and collum, anterior view, normal light; D, UV light. Scale bar = 1 mm (A, B); 2 mm (C, D).

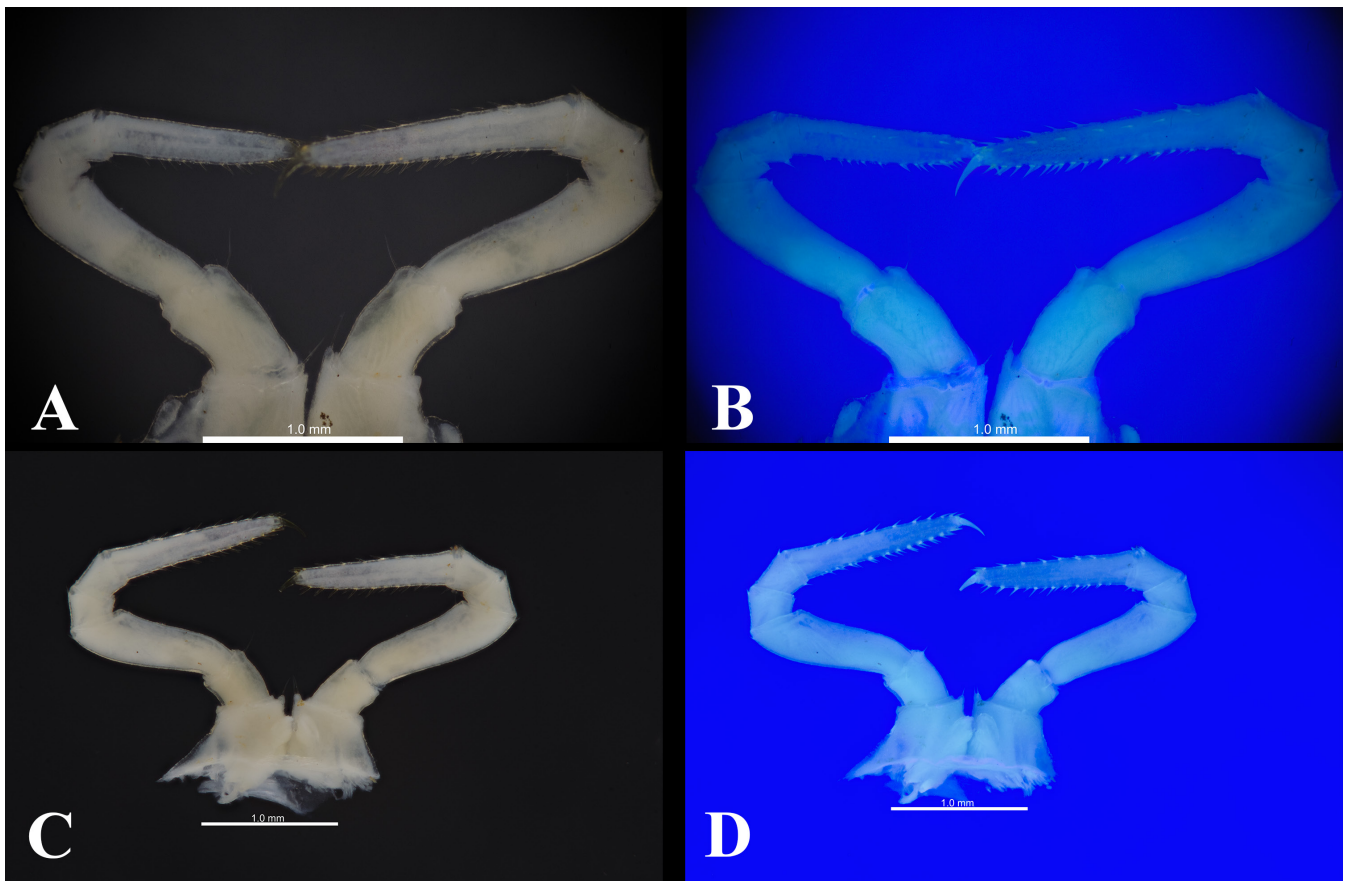


Fig. 10. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, male first legs, normal light; B, UV light; C, male second legs, posterior view, normal light; D, UV light. Scale bar = 1 mm.

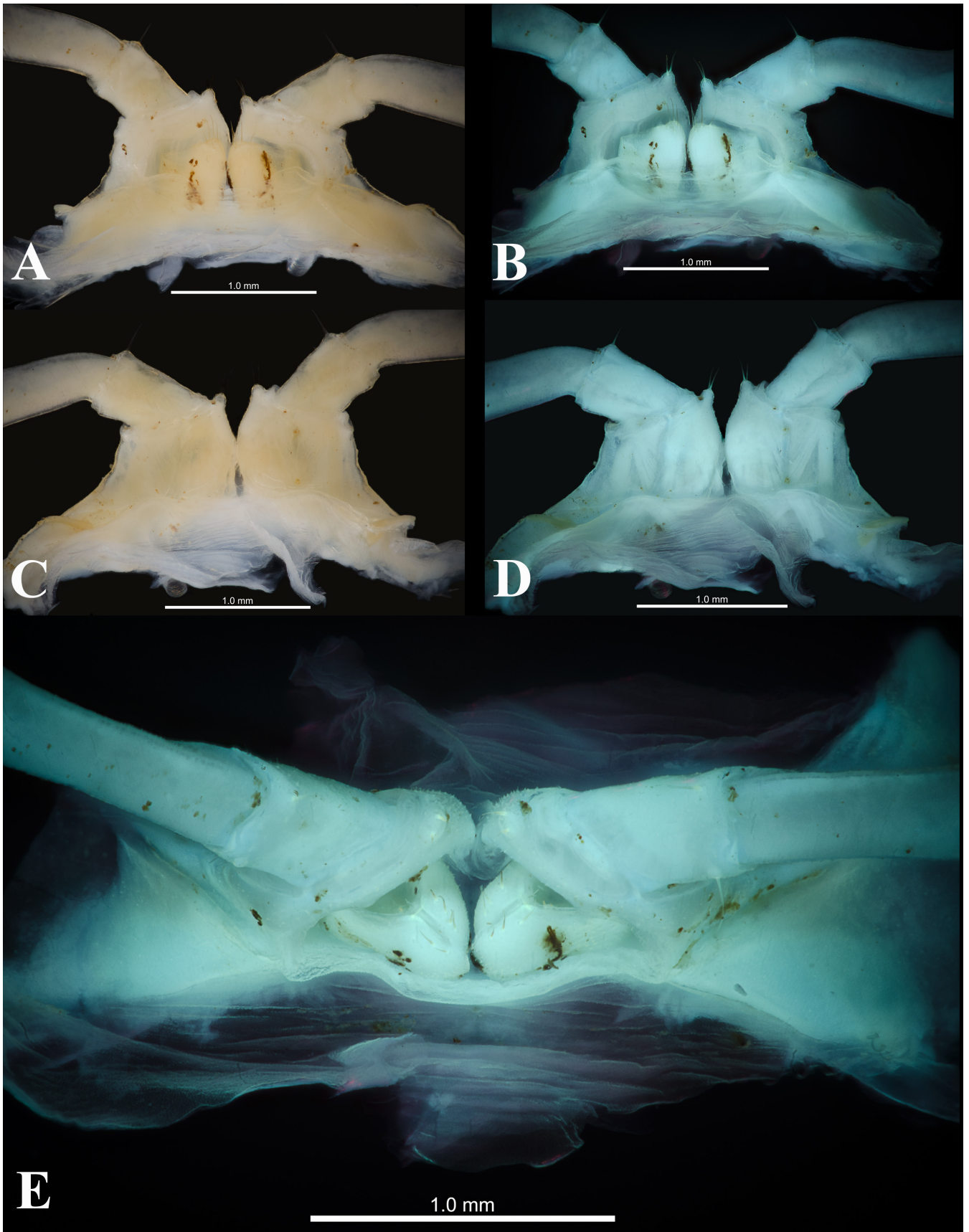


Fig. 11. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, female second legs, posterior view, normal light; B, UV light; C, anterior view, normal light; D, UV light; E, subventral view, normal light; F, UV light. Scale bar = 1 mm.

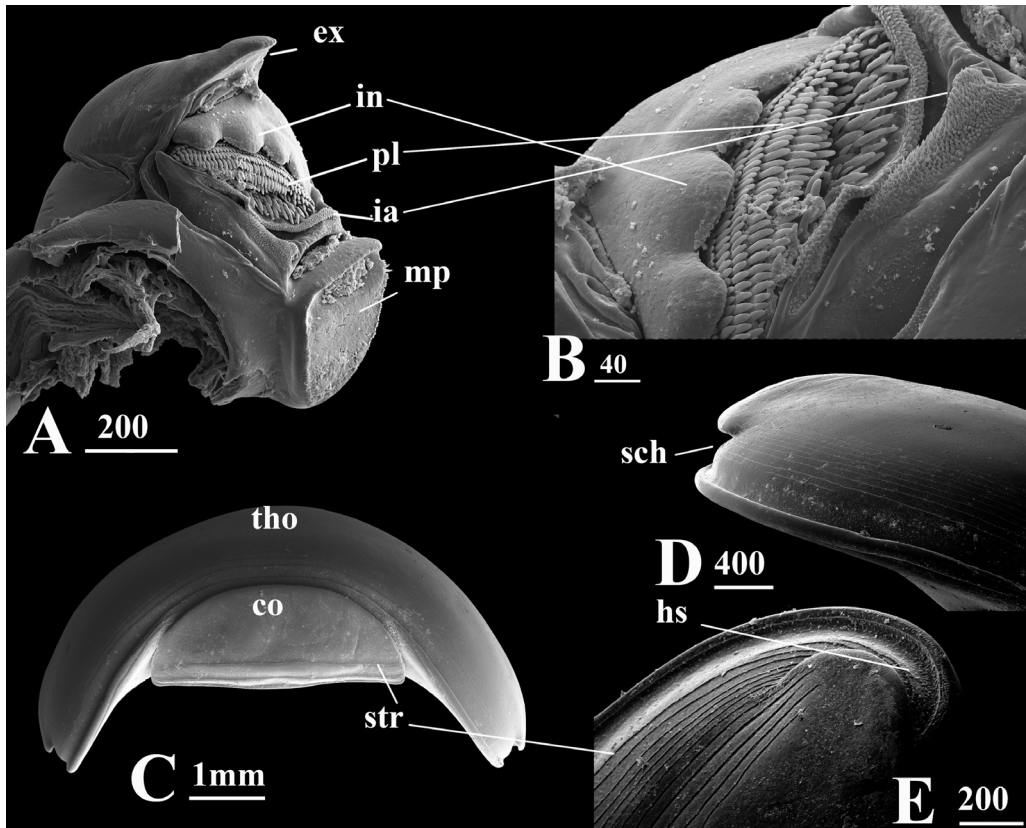


Fig. 12. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, B, mandible, internal view; C, thoracic shield and collum, anterior view; D, lateral part of thoracic shield, anterior view; E, dorsal view. Scale bar in μm .

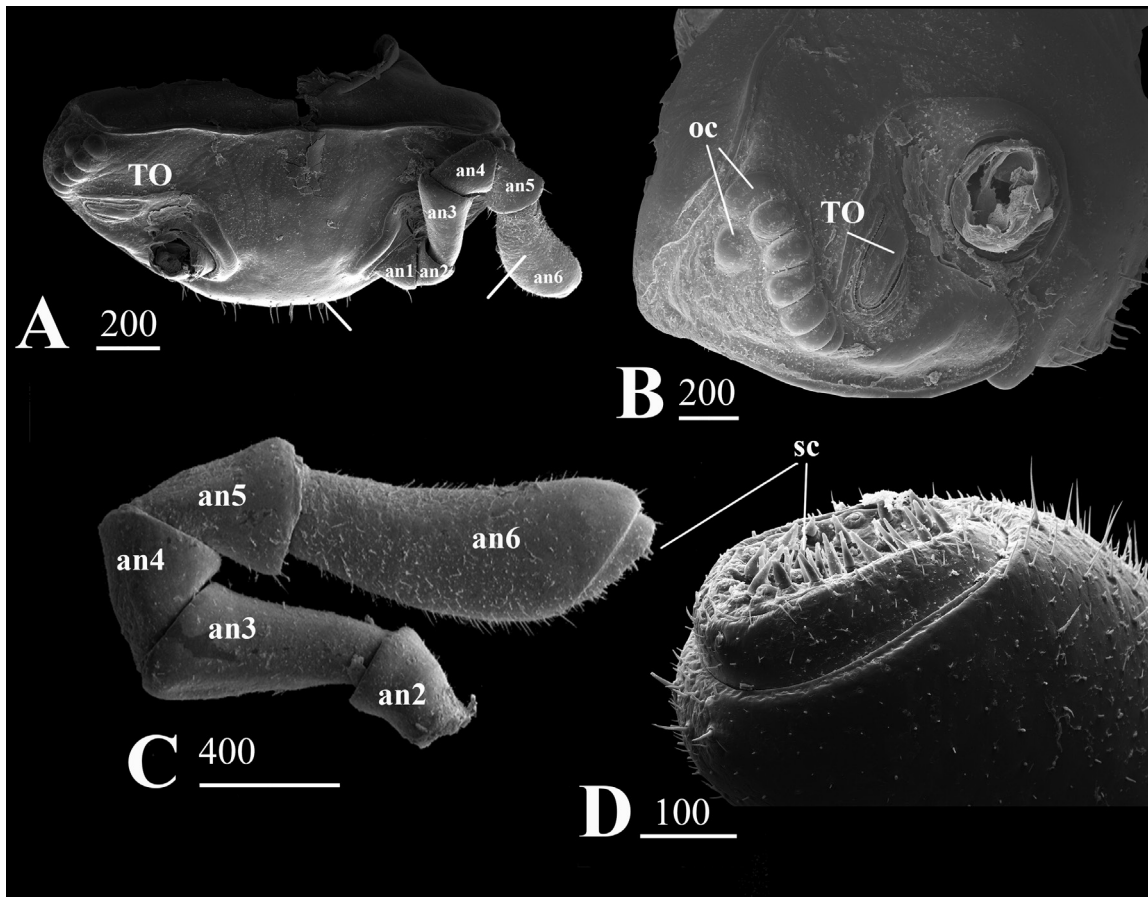


Fig. 13. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, head, anterior view; B, lateral view; C, D, antenna and antennal tip. TO = Tömösváry organ; an = antennomere. Scale bar in μm .

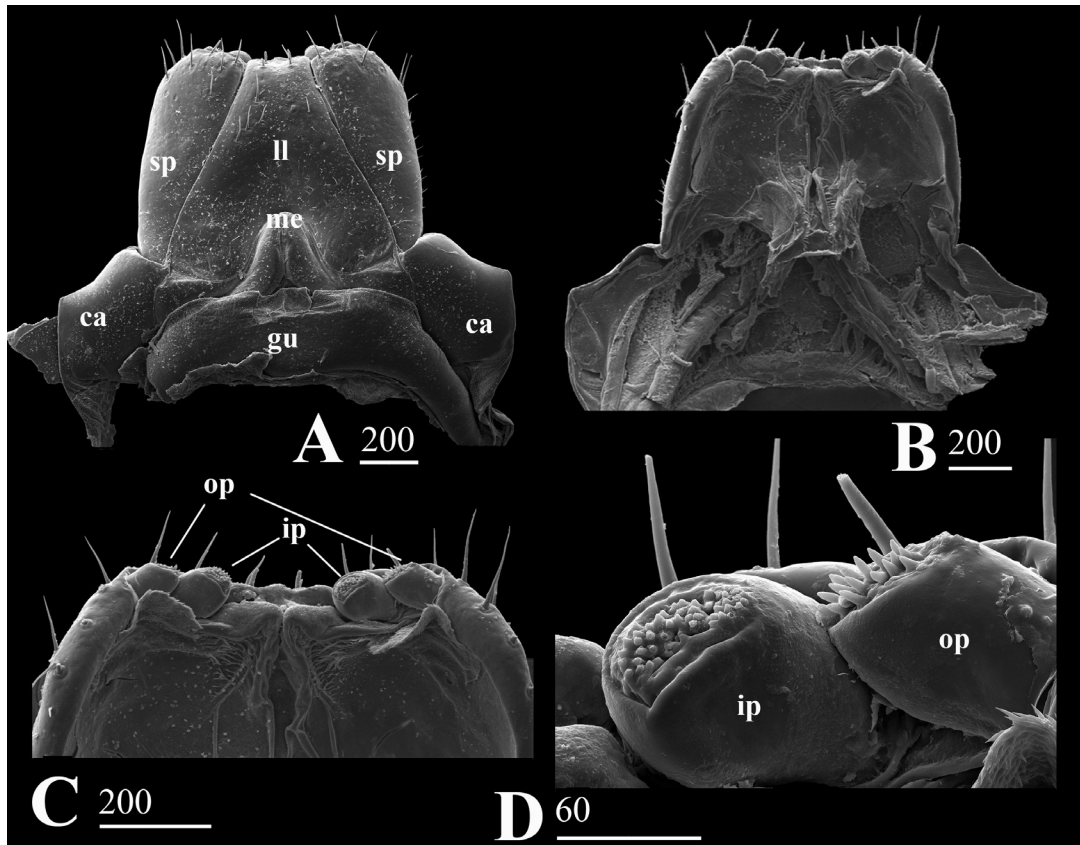


Fig. 14. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, B, gnathochilarum, external and internal view; C, D, palps. Scale bar in μm .

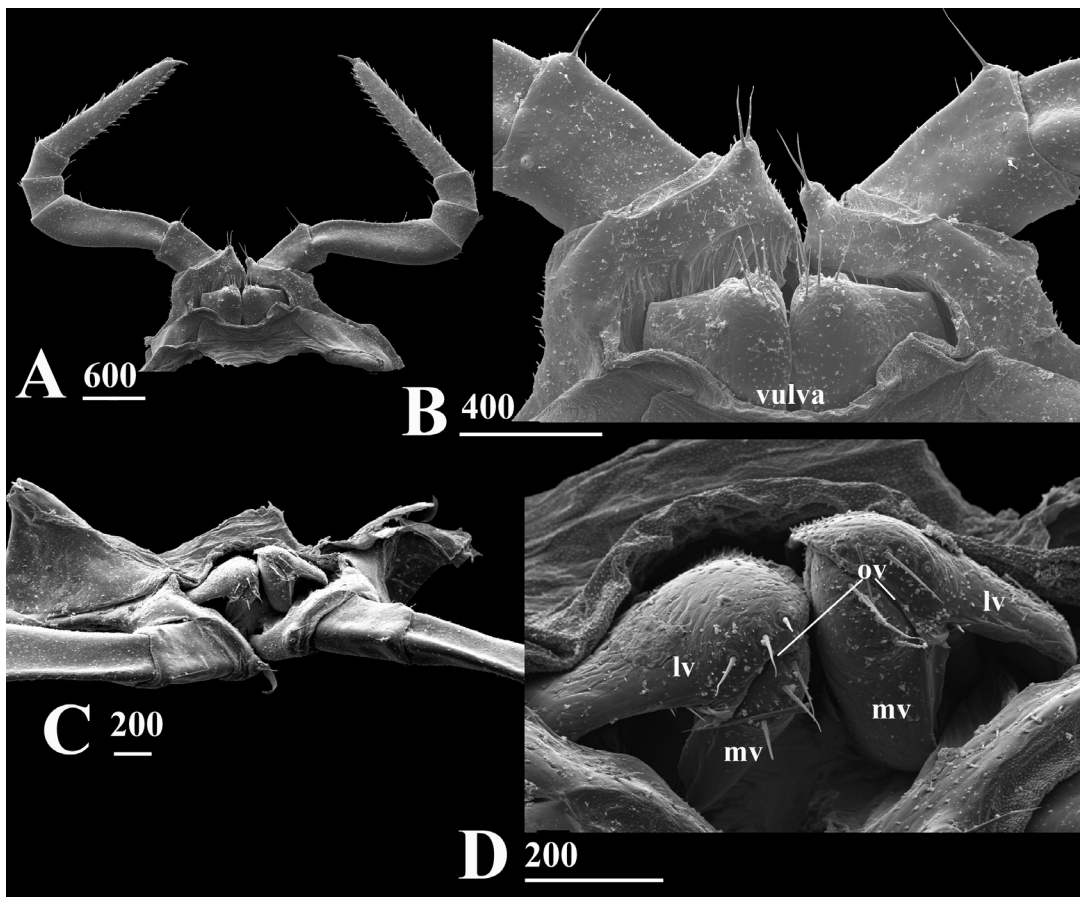


Fig. 15. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, B, female second legs and vulva, posterior view; C, D, ventral view. Scale bar in μm .

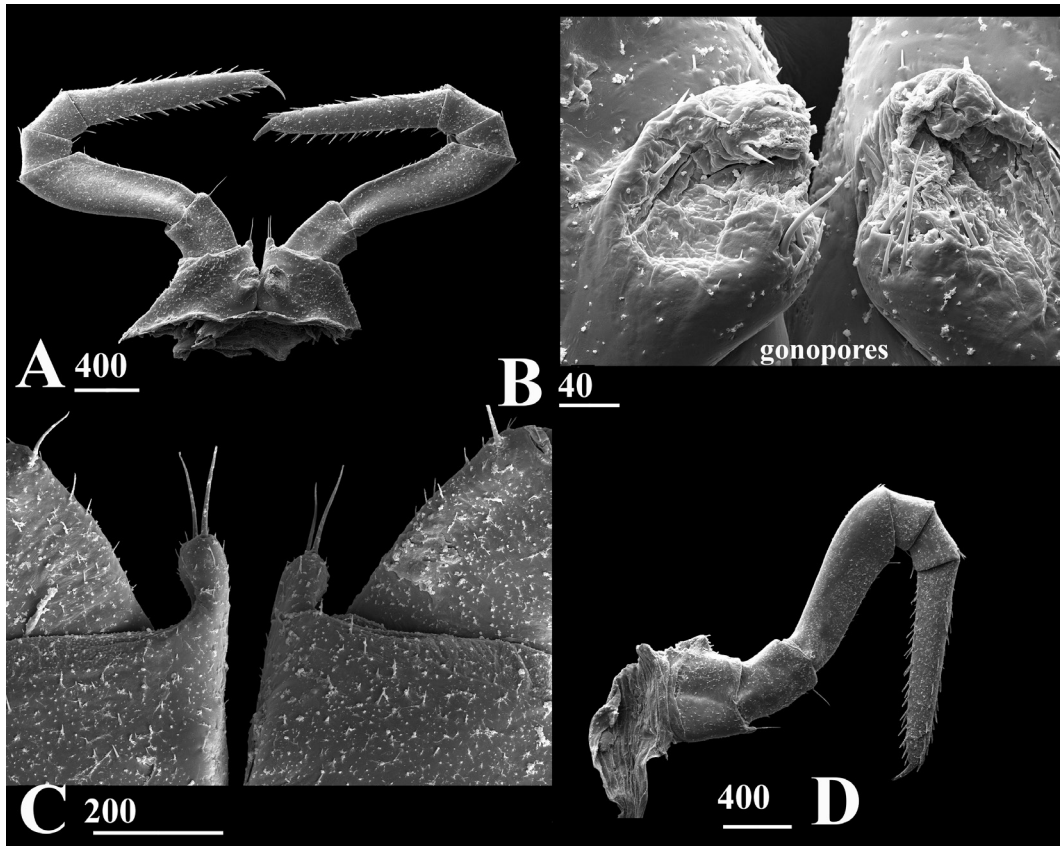


Fig. 16. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park. Ninh Binh Prov., northern Vietnam. A, B, male second legs and gonopores, posterior view; C, coxial cones of male first legs; D, male leg 3. Scale bar in μm .

a molar plate (mp) with a single transverse groove. Collum (co) with two striae (Figs. 9D, 12C), thoracic shield (tho) (Figs. 9D, 12C–E) with striae and well-developed schism (sch) and hyposchism (hs). Leg-pair 1 in males (Figs. 10A, B) with two rows of setae. Leg-pair 2 in males (Figs. 10C, D, 16A–C) with a coxal setiferous tubercle (occurring also in females) and the gonopore opening produced on a broad, mesally located knob on the posterior side of the 2nd leg coxa. Leg-pair 2 in females (Figs. 11A–E, 15A–D) with mesal coxal setiferous tubercle and posteriorly located vulva embedded on the posterior side in the 2nd leg-pair coxae. Vulva consists of a mesal plate and a lateral plate, with an operculum above. The vulval structure is strikingly similar to the vulva in *Eupeyerimhoffia* (Oeyen & Wesener, 2015, figs. 5D, E).

Leg-pair 17 in males (Figs. 17E, F) with four podomeres and a large coxal lobe (col). Male telopods (Figs. 17A–C, 18A–D) with a medially notched syncoxial lobe (syl) (termed median lingual lamina in Golovatch, 1983b), erect setose lateral syncoxial horns (syh), and a telopod with a small apical mesal prefemoral trichostele (pret) (Fig. 18D), a large projecting mesal distal femoral process (dfp), and a

stout distal tibial process (tp) on the caudal side. Telopod tarsus hook-shaped. Description and illustration given in the original description of this species by Golovatch (1983) matches the telopod found in these specimens.

Genus *Hyperglomeris* Silvestri, 1917

Type species. *Hyperglomeris lamellosa* Silvestri, 1917: 146, by original designation.

Remarks. The Vietnamese endemic genus *Hyperglomeris* Silvestri, 1917 is restricted to northern Vietnam, with seven species. All *Hyperglomeris* species are known exclusively from their type localities, and the distribution of the genus is still poorly known. There are no species that have been recorded in central and southern parts of the country. The genus is very similar to *Peplomeris* in having only prefemoral trichosteles, and femoral trichosteles strongly reduced or absent on telopods. *Hyperglomeris* differs from *Peplomeris* by having antennae with four large, apical sensory cones.

A key to identify *Hyperglomeris* species was recently provided by Golovatch (2017).

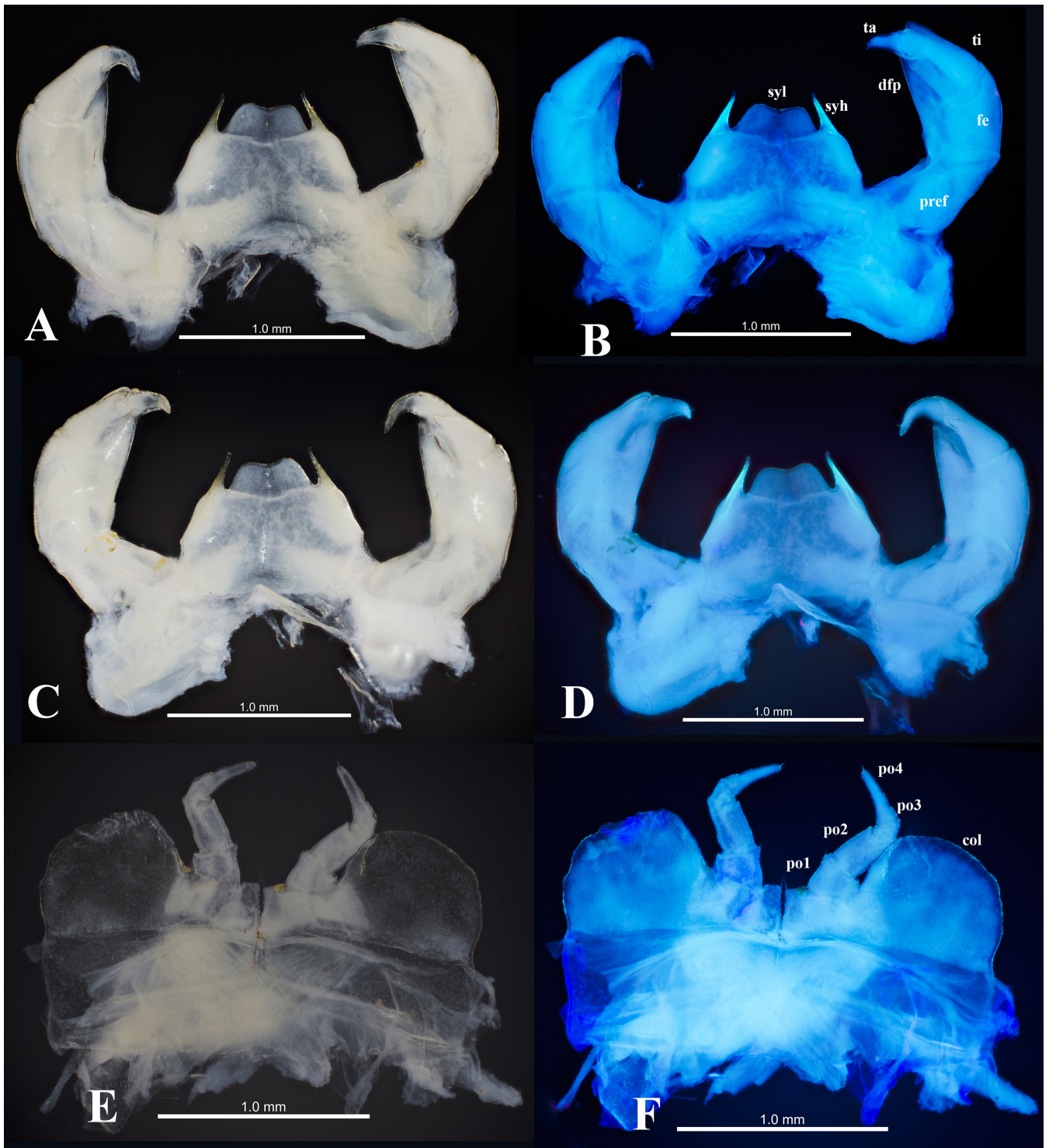


Fig. 17. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, telopods, posterior view, normal light; B, UV light; C, telopods, anterior view, normal light; D, UV light; E, legs 17, normal light; F, UV light. Scale bar = 1 mm.

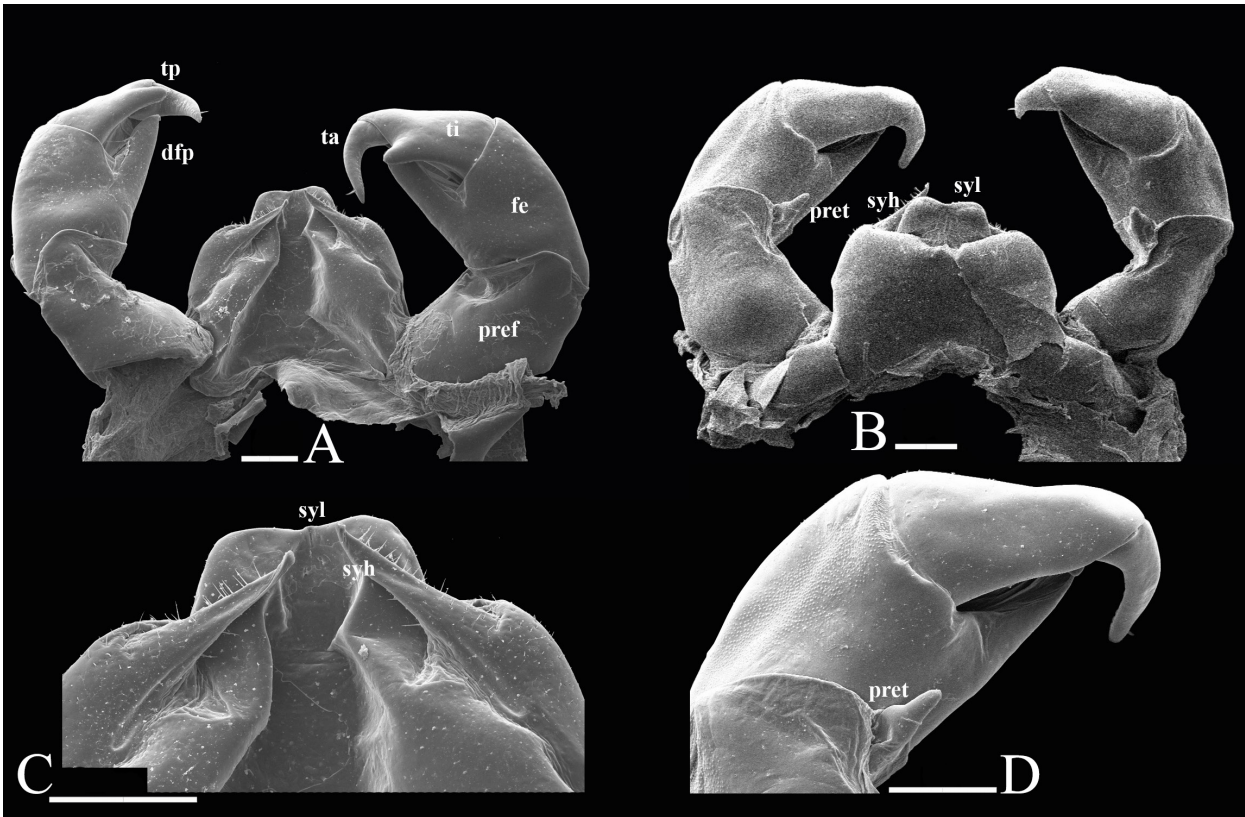


Fig. 18. *Peplomeris magna* Golovatch, 1983, male (FMNH INS 3716068) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, telopods, anterior view; B, posterior view; C, syncoxial lobe and horns, anterior view; D, right telopod, posterior view. Scale bar = 200 μ m.

***Hyperglomeris simplex*, new species**
(Figs. 19–23)

Material examined. Holotype: male (FMNH INS 3716071) Vietnam, Vinh Phuc Province, Phuc Yen Town, Ngoc Thanh Commune, Me Linh Station for Biodiversity, 21.3850°N, 105.7119°E, regenerated forest, 10–16 September 2016, coll. Petra Sierwald et al.

Paratypes: 1 male, 1 female (FMNH INS 3716070) same as for holotype; 2 females (IEBR–Myr 605) same locality, but on the way to Tam Dao 2, natural forests, 1,100 m, 25 February 2017, leg. Anh D. Nguyen; 1 female (IEBR–Myr 655) same data as for IEBR–Myr 605, but 2–4 August 2017.

Etymology. Named after the simple tibial knob of the male telopods (feminine adjective).

Diagnosis. The species is differentiated by the following character combination: Terga black with median line of yellow spots longitudinally, and two paramedial marbled transverse oval spots. Femoral trichostele absent, femur with mesoanteriorly oriented lamella. Tibial process a simple knob, tibia with mesoposteriorly oriented lamella. Tarsus hooked distally. The new species differs from *H. nigra* Golovatch, 2017, *H. depigmentata* Golovatch, Geoffroy & VandenSpiegel, 2013 in colouration pattern: body entirely unpigmented in *H. depigmentata*, and dorsa entirely black in *H. nigra* vs. terga with two lateral marbled yellowish brown



Fig. 19. *Hyperglomeris simplex* new species from Tam Dao National Park, habitus. Photo by: Anh D. Nguyen, image not to scale.

spots and a medioposterior, brownish yellow, triangular spot in *H. simplex*, new species. It can also be distinguished from *H. maxima* Golovatch, 1983, *H. conspicua* Golovatch, 1983, *H. dirupta* (Silvestri, 1917) and *H. lamellosa* Silvestri, 1917 in telopod conformation. *Hyperglomeris maxima* and *H. dirupta* have a very short, tiny, femoral trichostele which is absent in *H. simplex*, new species, *H. conspicua* and *H. lamellosa*. The latter three species are distinguished by the tibial structure: *H. simplex* has a simple knob whereas *H. conspicua* has a conspicuous, serrate, long process and a small, setiferous knob; *H. lamellosa* has two different processes.



Fig. 20. *Hyperglomeris simplex* new species, holotype (FMNH INS 3716071) from Vinh Phuc Prov., northern Vietnam. A, whole body, dorsal view; B, lateral view; C, ventral view; D, head, subventral view. Scale bar = 1 mm.

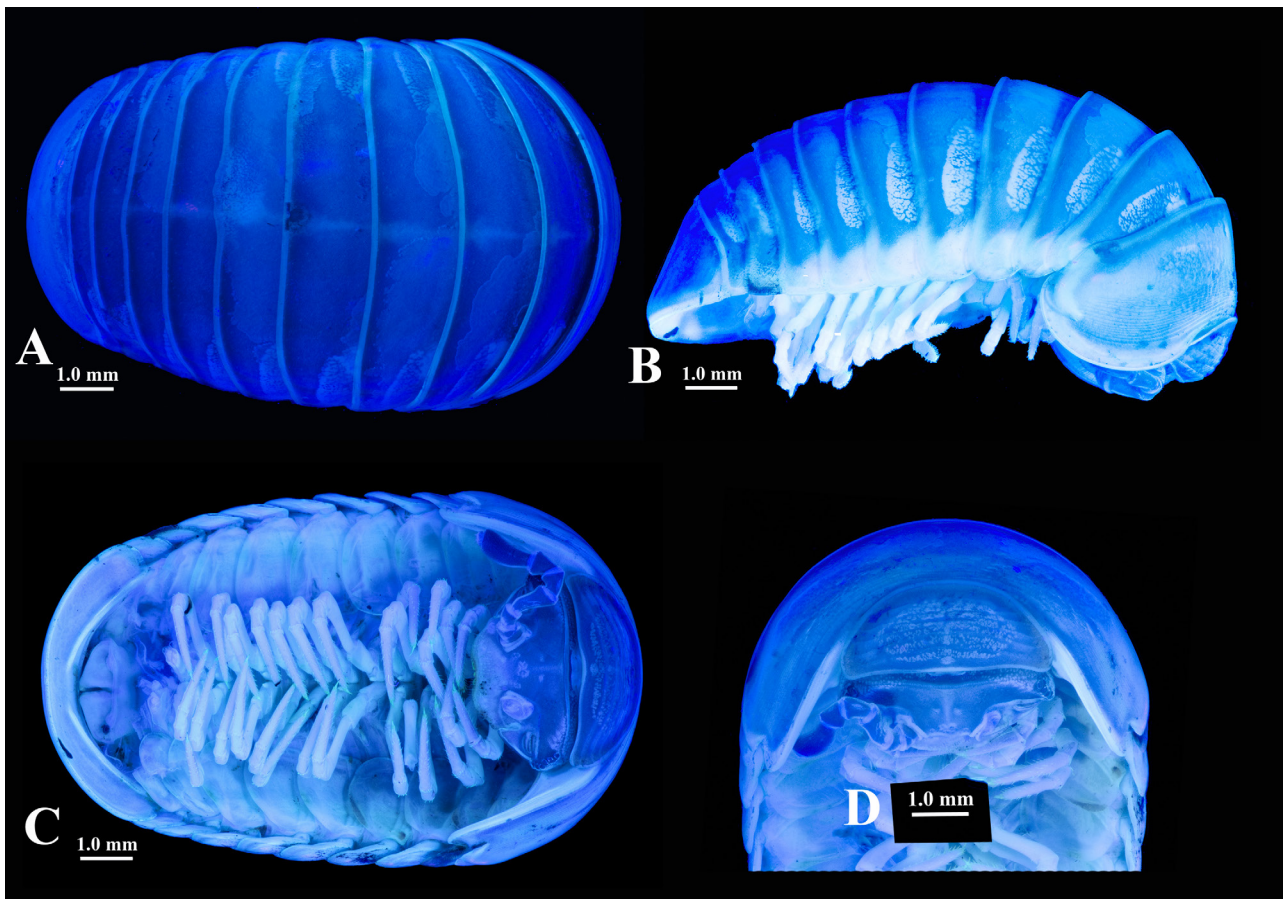


Fig. 21. *Hyperglomeris simplex* new species, holotype (FMNH INS 3716071) from Vinh Phuc Prov., northern Vietnam. A, whole body, under UV light, dorsal view; B, lateral view; C, ventral view; D, head, subventral view. Scale bar = 1 mm.

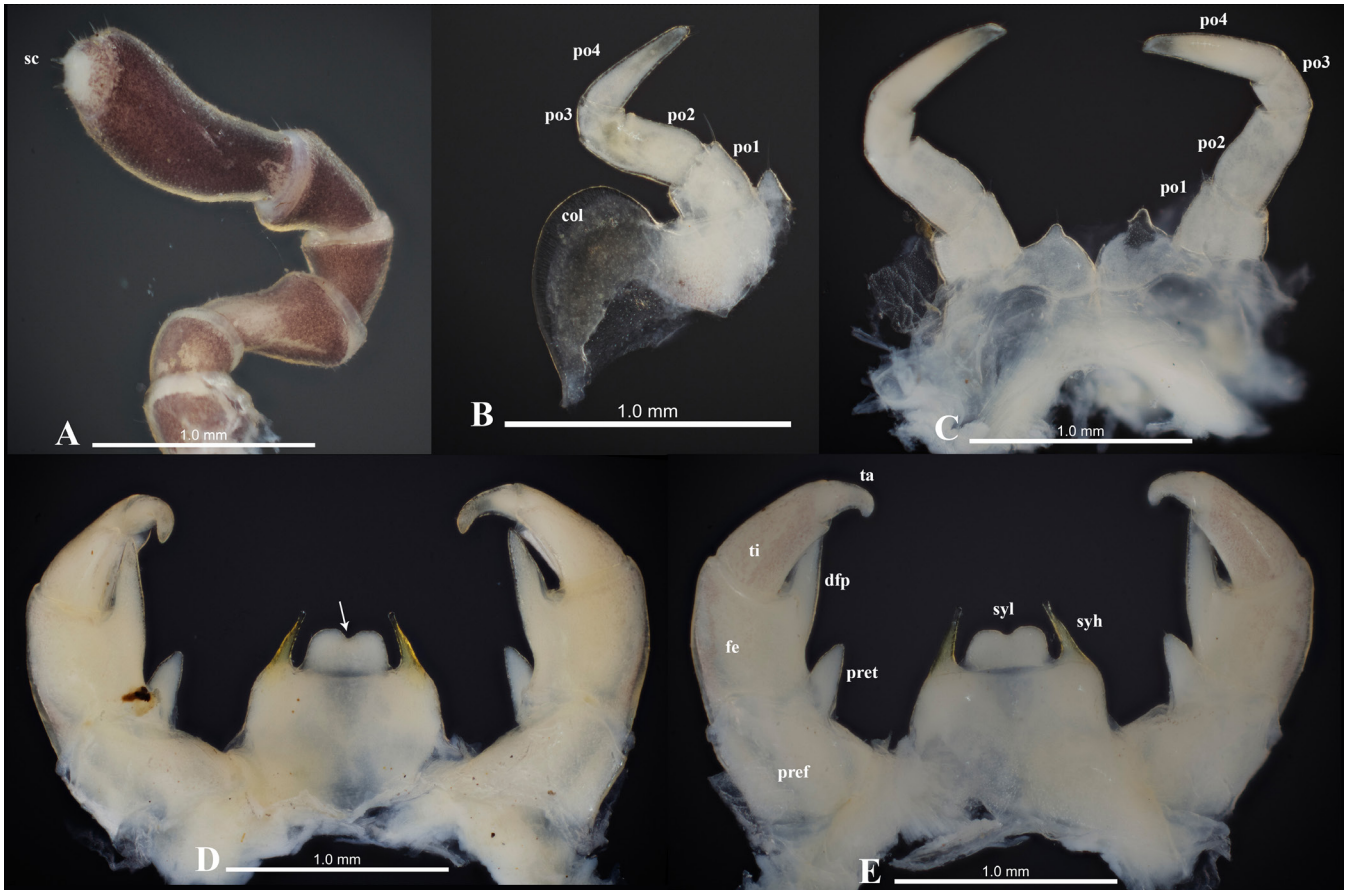


Fig. 22. *Hyperglomeris simplex* new species, holotype (FMNH INS 3716071) from Vinh Phuc Prov., northern Vietnam. A, antenna; B, leg 17; C, legs 18; D, telopods, anterior view; E, posterior view. Scale bar = 1 mm.

Description. Holotype male (FMNH INS 3716071). Width of 2nd tergum 7.0 mm, body length 12 mm. *Exoskeleton:* Terga blackish brown, shiny and smooth. Each tergum with two lateral light-brown marbled, transverse oval spots, and a medio-posterior, light-brown triangular spot. Caudal and lateral tergal margins light-yellow (Figs. 19–21). *Head:* Ocelli 7+1, lenses convex, black contrasting against brown background of head. Tömösváry organ transverse oval, margins not concave, ca. 1.6× wider than long (Figs. 20C, 21C). Antennomere 6 bean-shaped (Fig. 22A), not clavate, longer than antennomeres 4+5 combined. Antennal tip with four large apical sensory cones (sc). *Tergites:* Collum with a large oval marbled spot centrally, brown background, with 5 transverse striae (Figs. 20D, 21D). Second tergum with a narrow hyposchism reaching caudal margin, with 13 superficial transverse striae. Anal shield broadly rounded at caudal margin (Figs. 20C, 21C).

Legs: Leg-pair 17 strongly reduced in size, with 4 podomeres: coxa with a rounded outer lobe (col), and with a setiferous tubercle distomesally; podomere 1 with a small distomesal setiferous knob. Leg-pair 18 (Fig. 22C) almost normal size, with 4 podomeres with a simple syncoxial notch, and pronounced syncoxial tubercles.

Telopods (Figs. 22D, E, 23A–D) with a trapeziform, medially notched (arrow), sparsely setose, central syncoxial lobe (syl) with two setose horns (syh) paramedially, each directed

mesoventrad. Prefemur (Fig. 22E) somewhat broadened basally, carrying a tuberculiform trichostele distomesally (pret); lateroanterior side with dense micropapillae (visible on Fig. 23B). Femur simple, without trichosteles, with a large, straight, tuberculiform distal process (dfp). Tibia membranous mesally, with a short, stout knob distomesally on anterior side (Fig. 23A, tp). Tarsus apically acuminate, hooked distally.

Variation. Width of second tergum 7.0–7.2 mm (males), 9.2 mm (female); body length 12.0–13.2 mm (males), 14.6 mm (female).

Subfamily Doderiinae Silvestri, 1904

Genus *Hyleglomeris* Verhoeff, 1910

Type species. *Hyleglomeris multilineata* Verhoeff, 1910: 248, by subsequent designation.

Remarks. *Hyleglomeris* is a species-rich genus with ca. 100 species widely distributed from Europe to East Asia (Golovatch et al., 2006). Only eight species have been recorded from Vietnam, three from the southern part, two from the central region, and three from northern part of the country (see the list above). Of these, three are troglobiotic, and live in caves (Golovatch et al., 2006; Golovatch et al., 2013).

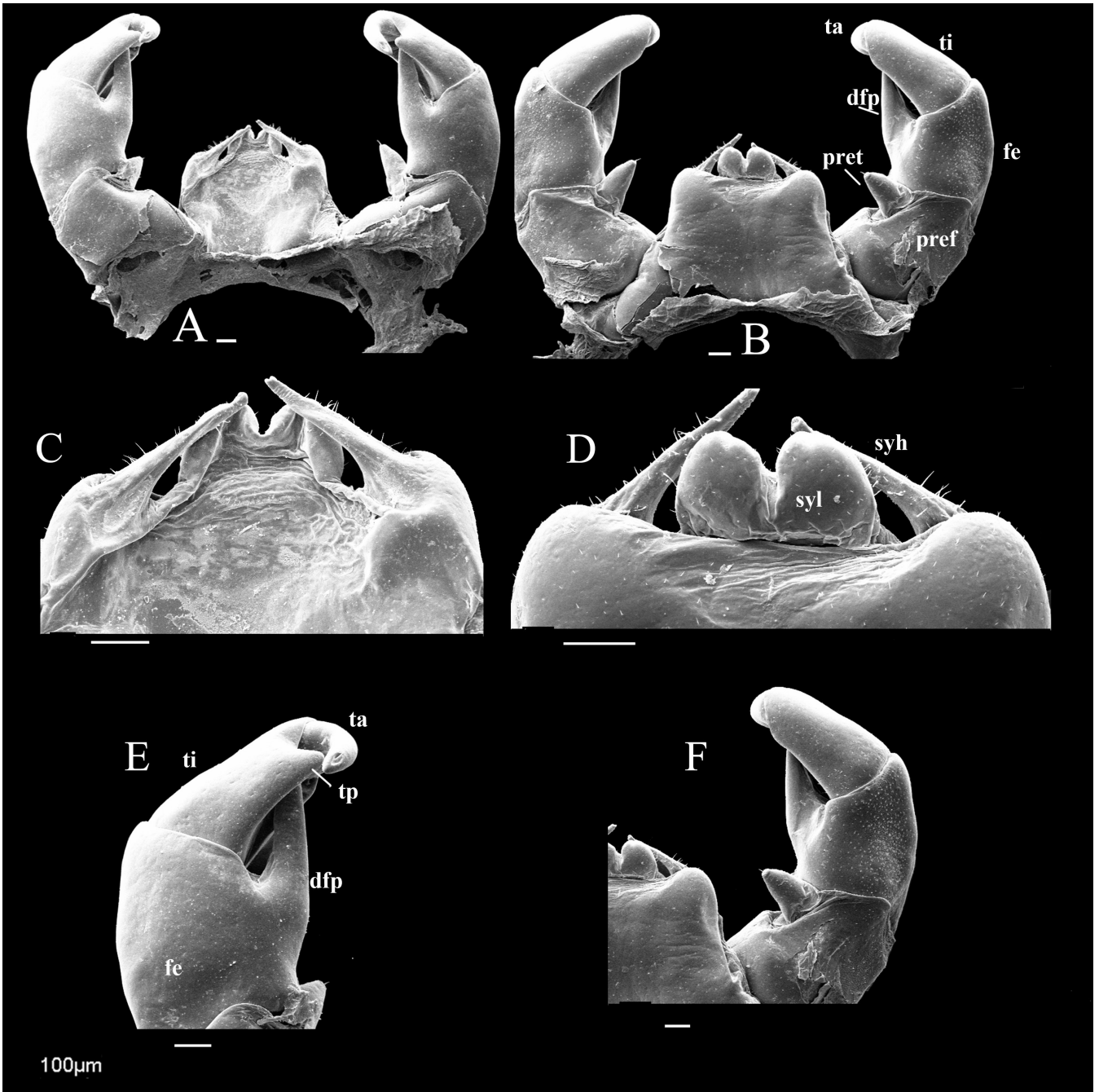


Fig. 23. *Hyperglomeris simplex* new species, holotype (FMNH INS 3716071) from Vinh Phuc Prov., northern Vietnam. A, telopods, anterior view; B, posterior view; C, syncoxial lobe and horns, anterior view; D, posterior view; E, left telopod, anterior view; F, posterior view. Scale bar = 100 µm.

The genus *Hyleoglomeris* Verhoeff, 1910 was not originally assigned to a tribe, but Mauriès (1971) then placed it into Trachysphaerini Mauriès, 1971. Currently, this taxon is in the subfamily Doderiinae (Wesener, 2015: 380).

***Hyleoglomeris lobus*, new species**
(Figs. 24–35)

Material examined. Holotype: 1 male (FMNH INS 3716132) Vietnam, Ninh Binh Province, Nho Quan District, Cuc Phuong National Park, Bong, botanic garden, trail starting from restaurant, 20.3483°N, 105.5979°E, 22 September 2016, coll. P. Sierwald et al.

Paratypes: 2 males, 4 females (FMNH INS 3716064) same as holotype; 2 males, 14 females (IEBR–Myr 653) same as for holotype, but 28 July–2 August 2017, coll. Anh D. Nguyen.

Etymology. Named after a strongly bilobed syncoxial lobe of the telopod (feminine adjective).

Diagnosis. The new species is differentiated by the following character combination: Telopods with strongly bilobed syncoxial lobe; femoral process directed caudo-mesad, tip strongly hooked with a large tubercle at 2/3 length.

Description. Holotype male (FMNH INS 3716132). Width of 2nd tergum 5.3 mm. Body length 7.5 mm.

Exoskeleton: Terga black with two paramedian triangular yellow spots anteriorly (Fig. 24). Collum uniformly darkish brown with a large, marbled yellowish-brown, transverse oval spot (Figs. 25C, D). Second tergum black with a broad M-shaped yellow pattern anteriorly (Fig. 24). Terga 3–11 black with two paramedian yellow spots, two small lateral yellow oval spots (Fig. 25A). Lateral and caudal tergal margins whitish yellow. Antennae brown. Anal shield black with yellow paramedian semi-elliptical spots anteriorly (Fig. 25B). Terga smooth, glossy.

Head: Ocelli 8+1 (Figs. 27E, F, 31B), lenses convex, black contrasting against to brownish background of head. Tömösváry organs transverse oval, paler than brownish background of head, ca. 1.5× wider than long, margins regular, not concave (Figs. 27D, 31A, B). Antennomere 6 largest, clavate, longer than antennomeres 4+5 combined (Figs. 27B, C, 31A, C, D). Antennal tip with four large apical sensory cones. **Gnathochilarium:** well developed cardines (ca), gula (gu) and triangular stipites (sp), fused lamellae lingualis (ll) and a small mentum (me) (Figs. 28A, B, 32A, B). **Mandible** (Figs. 32C, D): with external, internal teeth (ex & in), 10 rows of pectinate lamellae (pl), folded intermediate area (ia) (Fig. 32D), single transverse groove on molar plate (mp) shallow and narrow. **Tergites:** Collum



Fig. 24. *Hyleoglomeris lobus* new species from Cuc Phuong National Park, habitus. Photo by: Anh D. Nguyen, image not to scale.

semicircular (Figs. 28C, D), dark brown, with a very large marbled yellowish-brown, transverse oval spot, and two transverse striae (Figs. 25C, D, 26B, 28D). Second tergum with a small, narrow hyposchism reaching beyond caudal tergal margin – appearing as a posteriorly directed nubbin like lobe – with 11 superficial striae and complete, regular transverse striae laterally and dorsally (Figs. 28C–E, 33A–C).

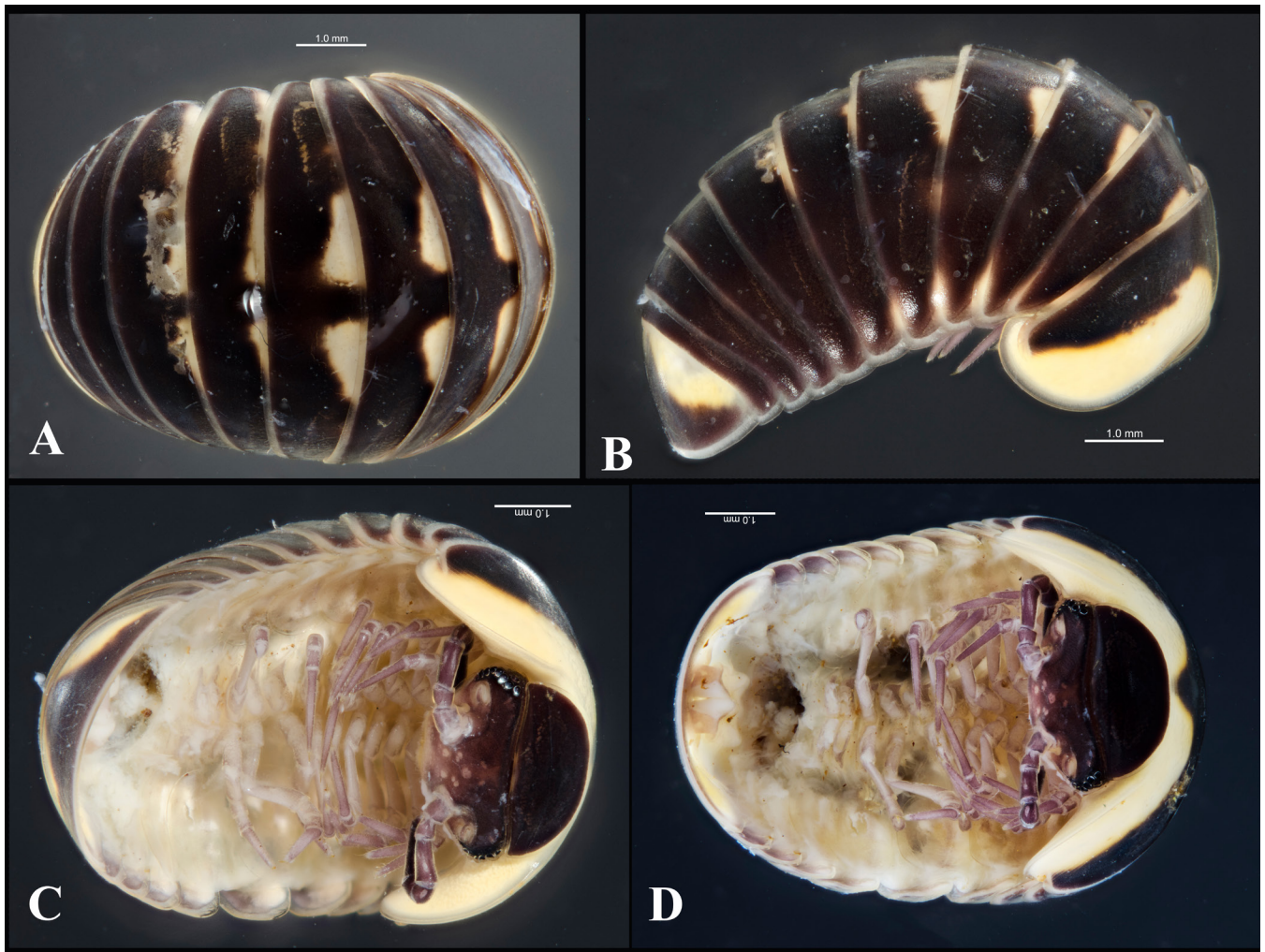


Fig. 25. *Hyleoglomeris lobus* new species, holotype (FMNH INS 3716132) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, whole body, dorsal view; B, lateral view; C, lateroventral view; D, ventral view. Scale bar = 1 mm.

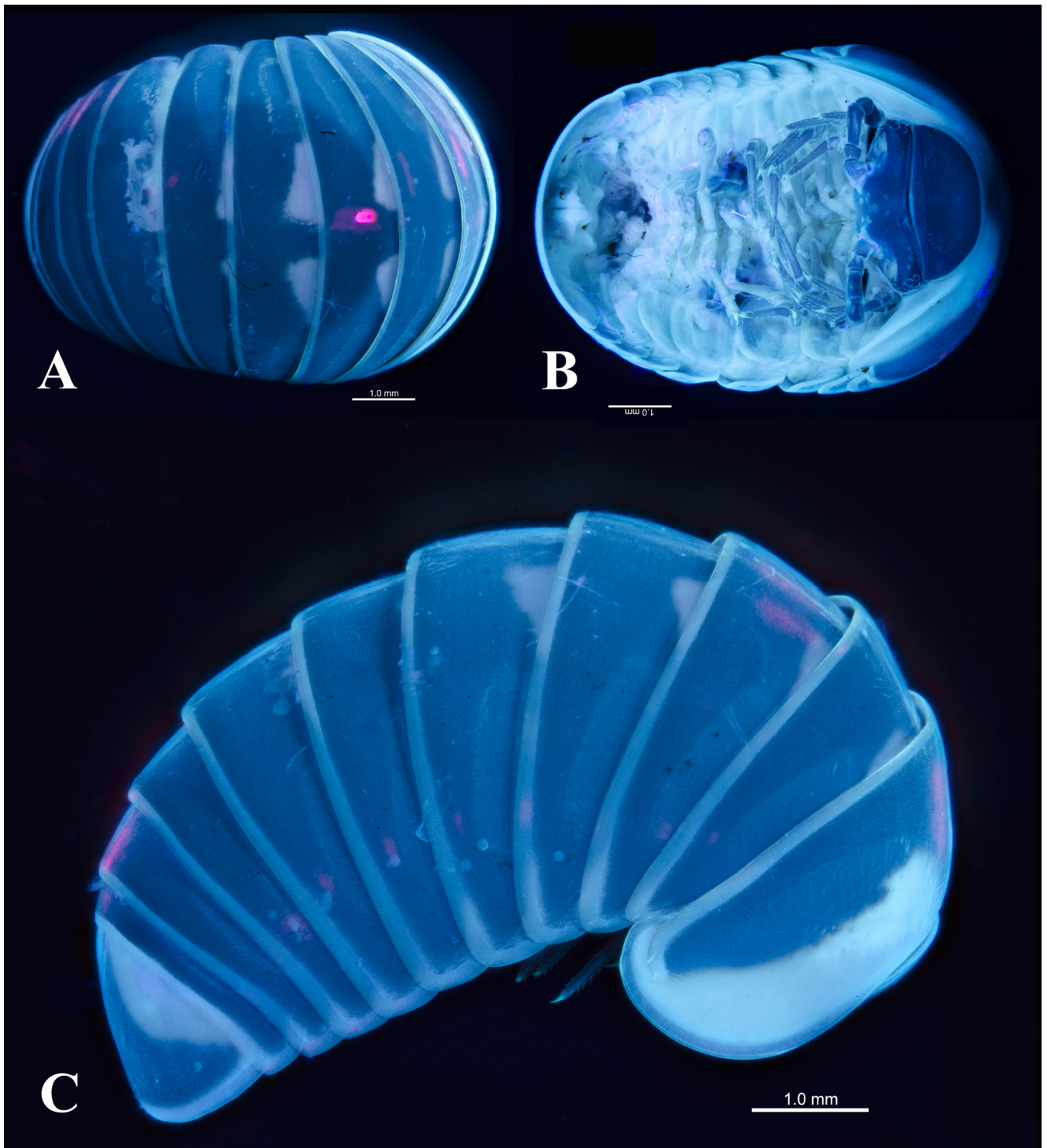


Fig. 26. *Hyleoglomeris lobus* new species, holotype (FMNH INS 3716132) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, whole body, under UV light, dorsal view; B, ventral view; C, lateral view. Scale bar = 1 mm.

Other terga without striae. Anal shield rounded at caudal margin (Figs. 25D, 26B). *Legs*: Leg-pair 1 in males (Figs. 29A, B) and females (Figs. 29C, D, 33D) with pronounced mesal setiferous coxal tubercle. Leg-pair 2 in females with vulva located within the coxae, on the posterior side, mesal plate visible (Figs. 30C, D, 33E).

Leg-pair 17 in males (Fig. 34A) strongly reduced, with 4 podomeres (podomere 3 very short), with a rounded, outer coxal lobe, coxae with an apical setiferous spine. Leg-pair

18 (Fig. 34B) less strongly reduced (podomere 3 very small) with a syncoxial notch, coxae with an apical setiferous spine. Telopods (Figs. 34C–E, 35): stout; syncoxial lobe strongly concave medially, forming two paramedial tubercles (Figs. 35B, E, see arrow). Syncoxial horns highly elevated, directed ventrally, tips broadly truncated, and bearing a spine. Prefemur micropapillate laterally and posterolaterally (Fig. 35F). Prefemoral trichostele (pret) long, prominent, finger-shaped whereas femoral trichostele (fet) slightly smaller and posterolaterally (Figs. 34C–E, 35A–D). Femoral process

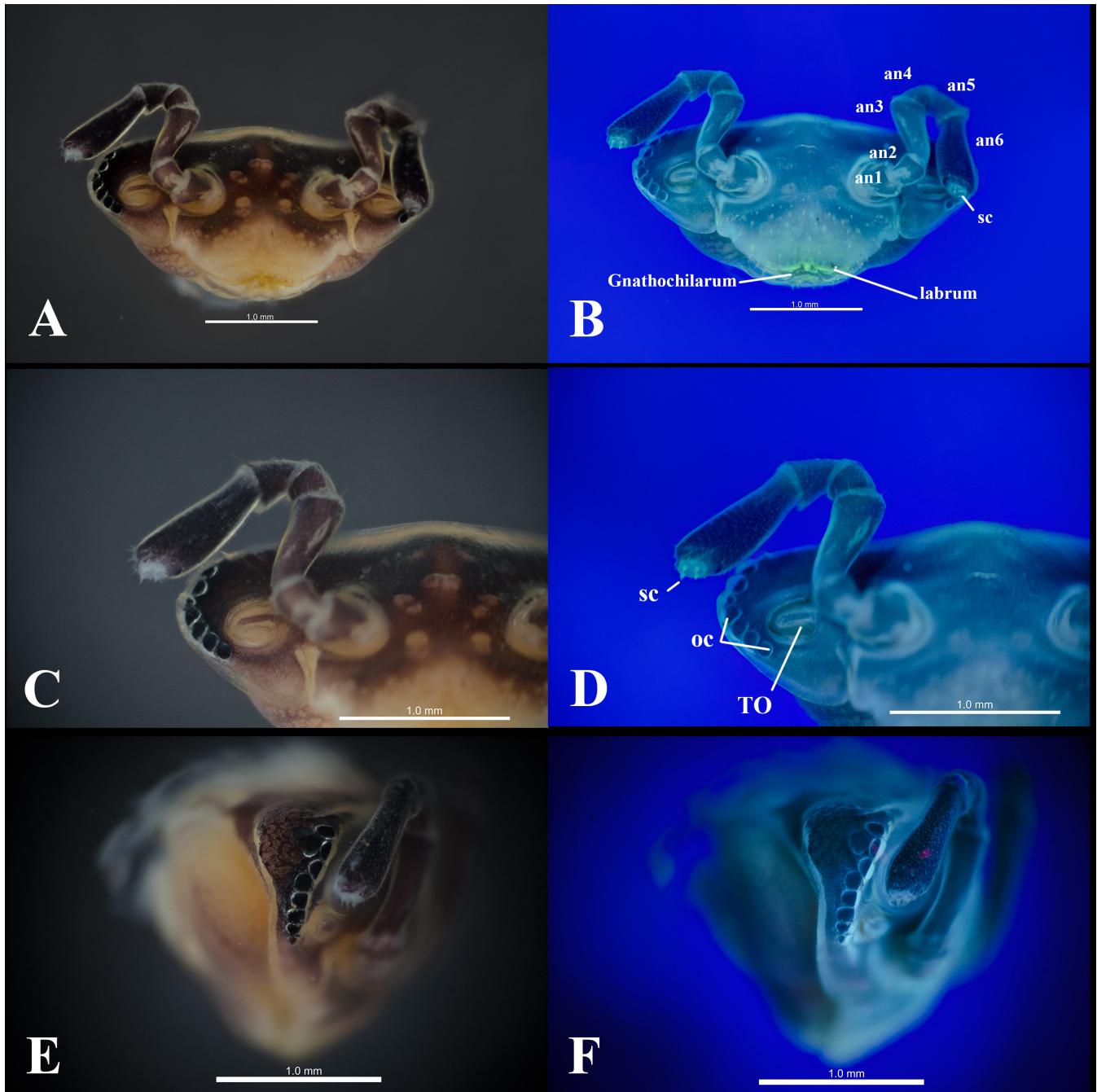


Fig. 27. *Hyleoglomeris lobus* new species, paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, C, head, anterior view, normal light; B, D, UV light; E, lateral view, normal light; F, UV light. Scale bar = 1 mm.

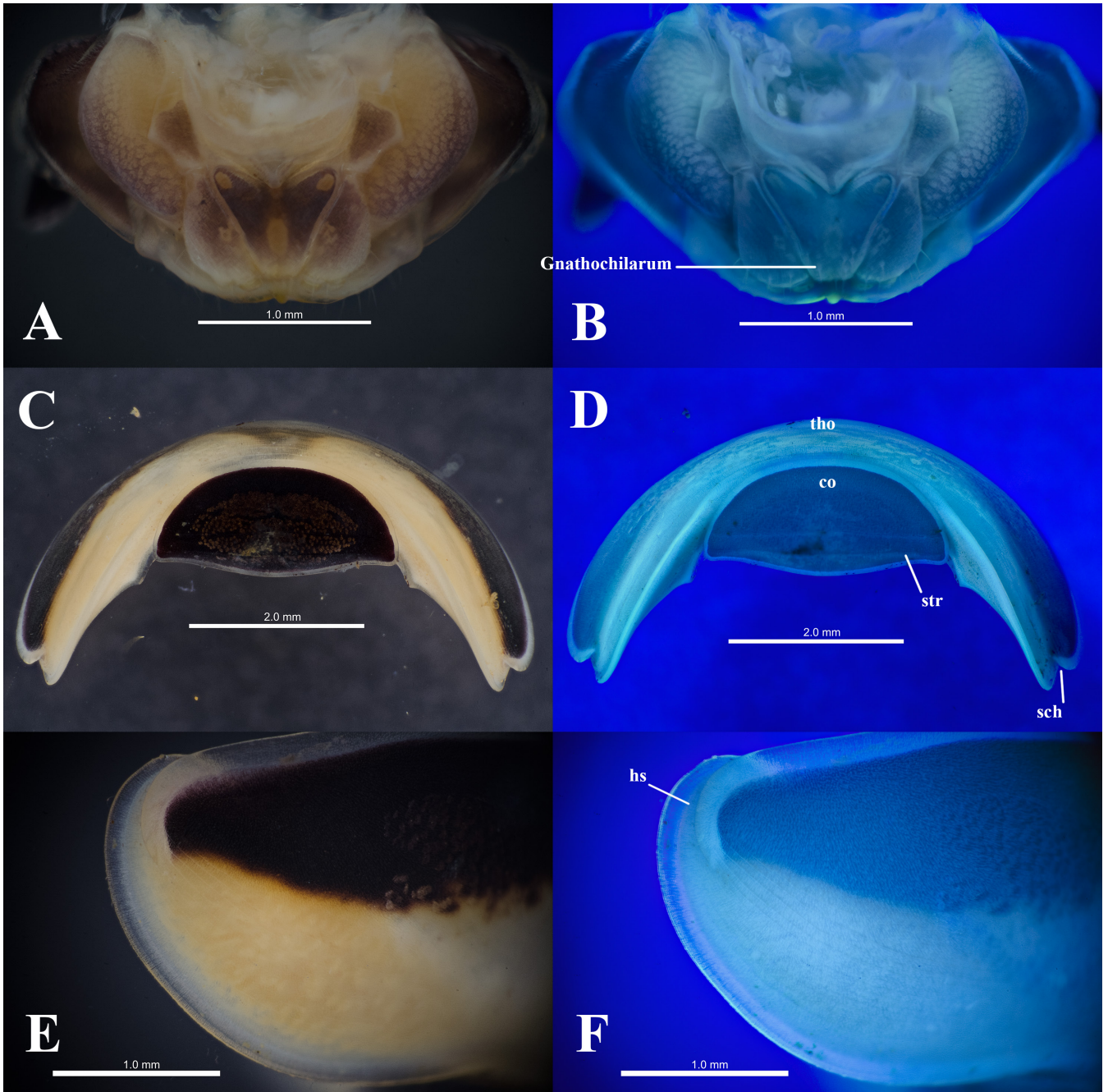


Fig. 28. *Hyleoglomeris lobus* new species, paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, gnathochilarum, ventral view, normal light; B, UV light; C, thoracic shield and collum, anterior view, normal light; D, UV light; E, lateral part of thoracic shield, normal light; F, UV light. Scale bar = 1 mm (A, B, E, F); 2 mm (C, D).



Fig. 29. *Hyleglomeris lobus* new species, holotype (FMNH INS 3716132) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, male first legs, normal light; B, UV light; C, paratype female first legs, normal light; D, UV light. Scale bar = 1 mm.

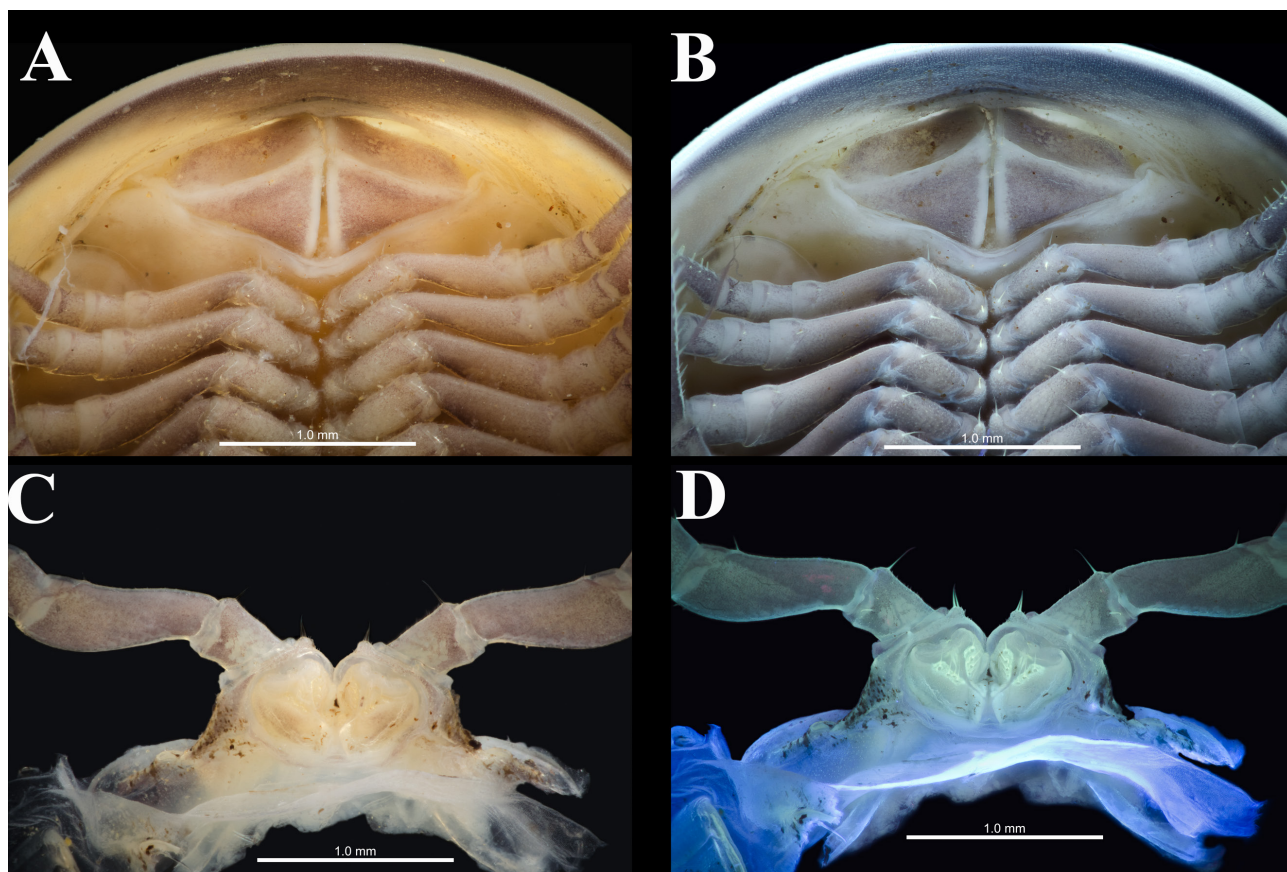


Fig. 30. *Hyleglomeris lobus* new species, female paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, anal part of body, ventral view, normal light; B, UV light; C, female second legs and vulva, posterior view, normal light; D, UV light. Scale bar = 1 mm.

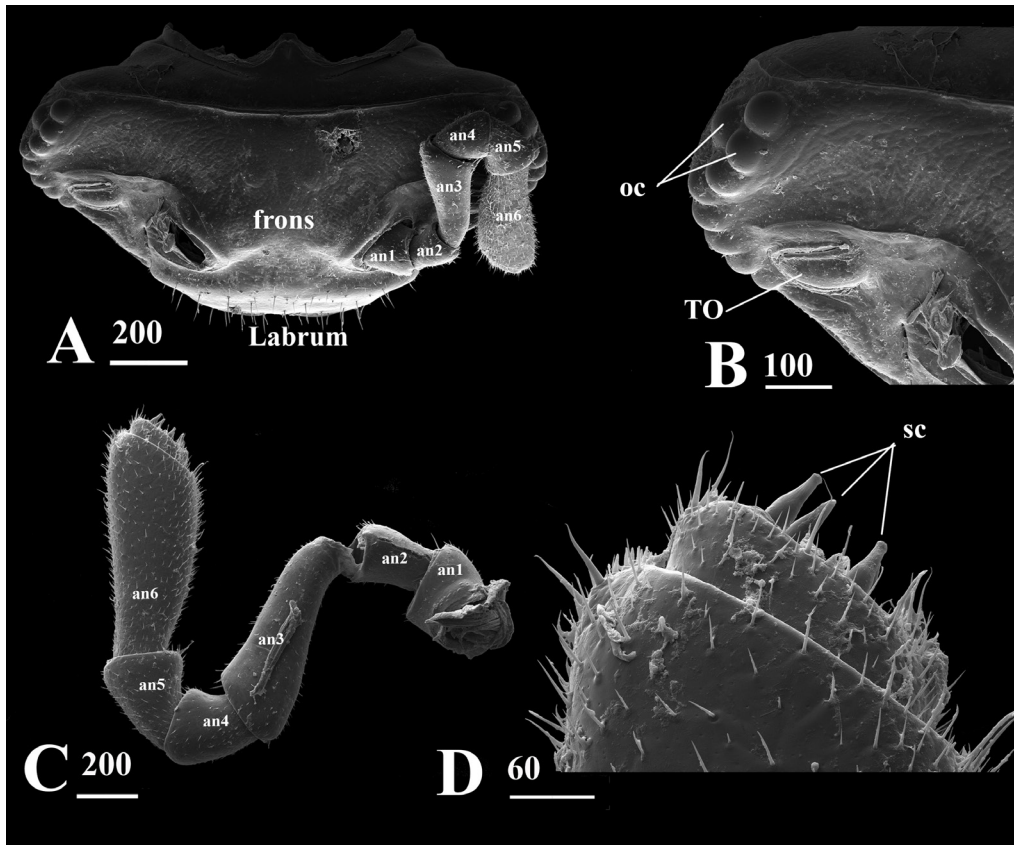


Fig. 31. *Hyleoglomeris lobus* new species, female paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, head, anterior view; B, lateral view; C, D, antenna and antennal tip. Scale bar in μm .

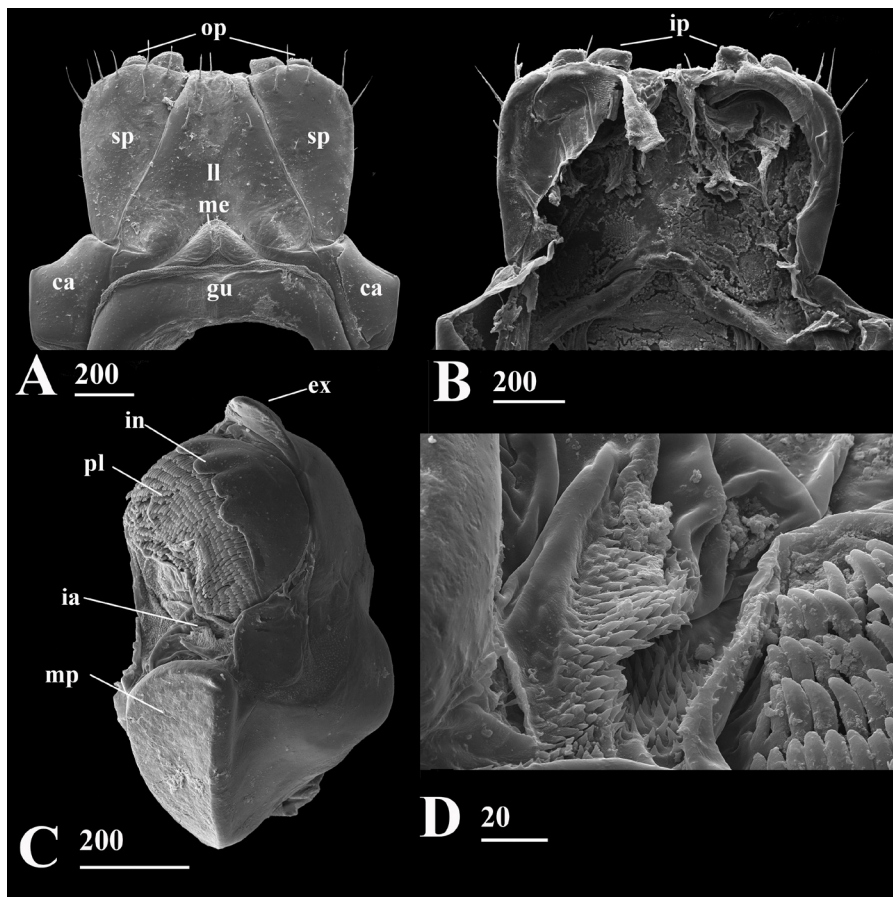


Fig. 32. *Hyleoglomeris lobus* new species, female paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, B, gnathochilarum, external and internal view; C, D, mandible. Scale bar in μm .

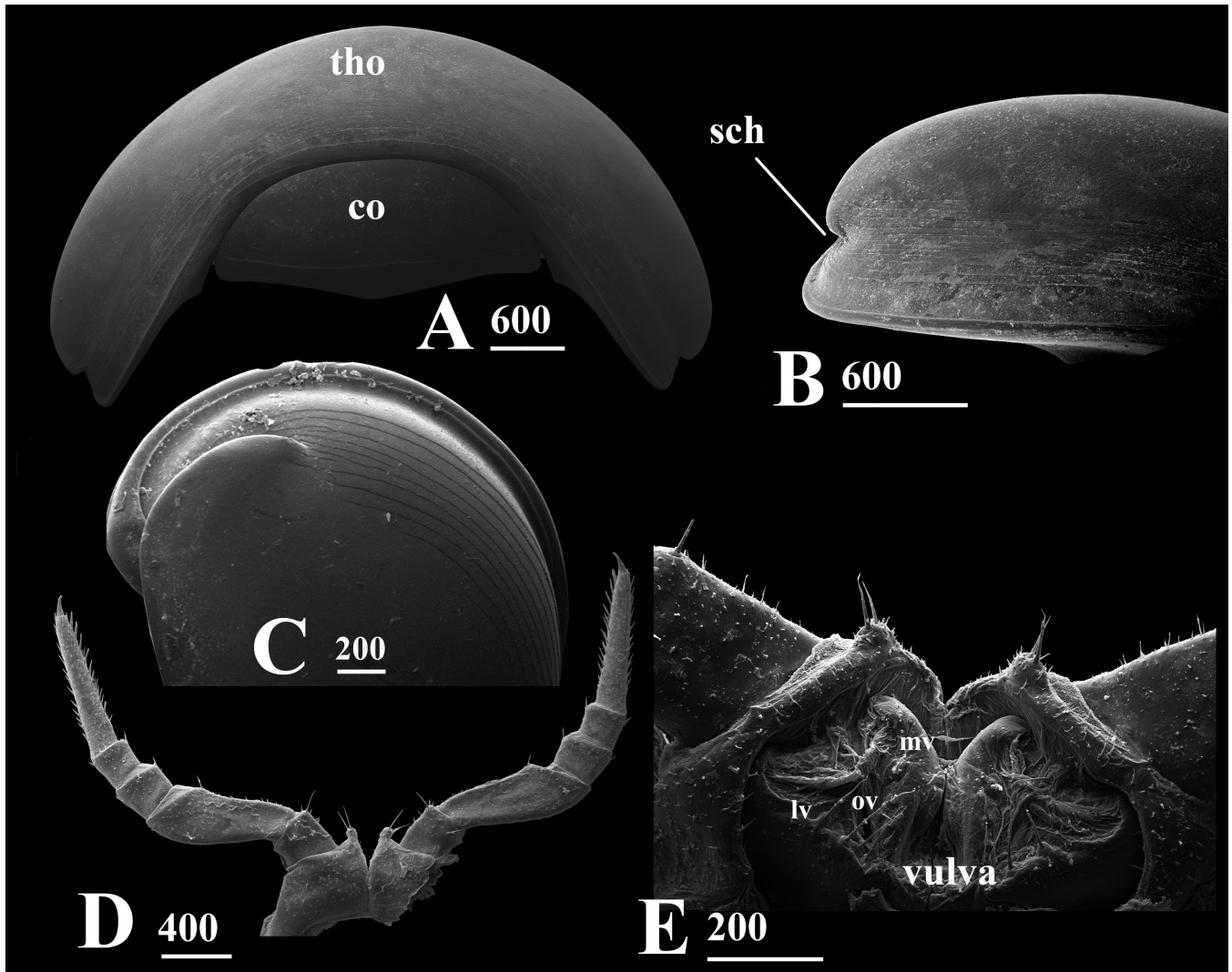


Fig. 33. *Hyleoglomeris lobus* new species, female paratype (FMNH INS 3716064) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, thoracic shield and collum, anterior view; B, lateral part of thoracic shield, anterior view; C, dorsal view; D, female first legs; E, female vulva, posterior view. Scale bar in μm .

(dfp) directed mesally, tip strongly recurved, bearing a large tubercle at 2/3 length (Figs. 34C–E, 35A–D). Tibia with a small, transverse, triangular process (tp) mesally (Fig. 35A, D). Tarsus curved, bearing two apical setae.

Variation. Width of second tergum 4.8–5.3 mm (males), 4.8–7.0 mm (females), body length 6.5–8.5 mm (males), 11.5–13.0 mm (females).

Remarks. Of eight species recorded from Vietnam, the new species differs from troglomorphic species in darker body

pigmentation. The species is also similar to its topotypical congener, *H. fedorenkoi* from Xuan Son National Park, but differs in the shape of the syncoxial lobe and horns, and the structure of femoral process. *Hyleoglomeris fedorenkoi* has a high, sub-quadrate, syncoxial lobe; syncoxial horns directed mesoventrad, lower than syncoxial lobe, without an apical spine. In contrast, *H. lobus*, new species, has a strongly bilobed syncoxial lobe; syncoxial horns highly elevated, directed ventrad, tip broadly truncated, with an apical spine.

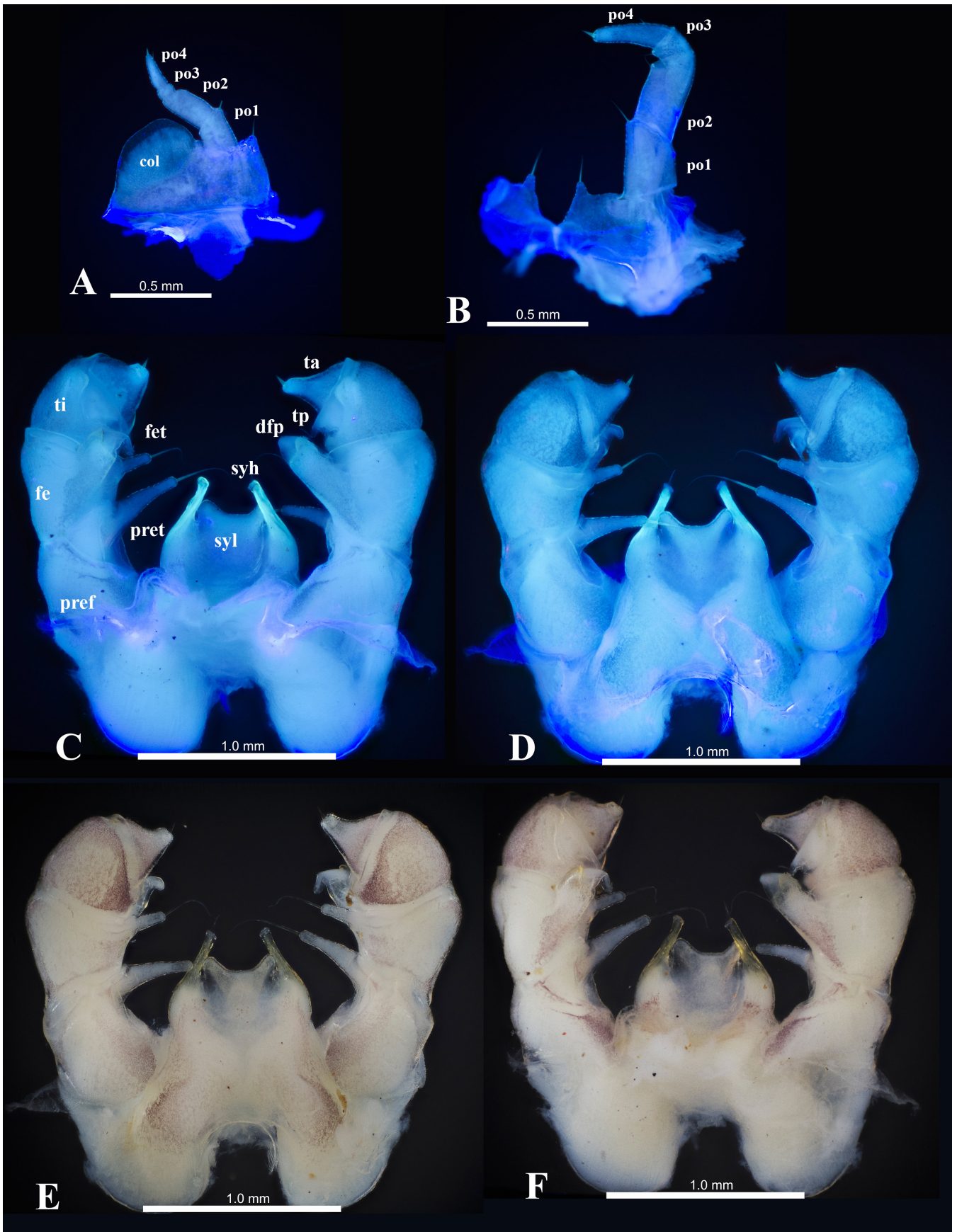


Fig. 34. *Hyleoglomeris lobus* new species, holotype (FMNH INS 3716132) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, leg 17, under UV light; B, leg 18, under UV light; C, telopods, under UV light, posterior view; D, anterior view; E, telopods, normal light, posterior view; F, anterior view. Scale bar = 0.5 mm (A–B); 1 mm (C–F).

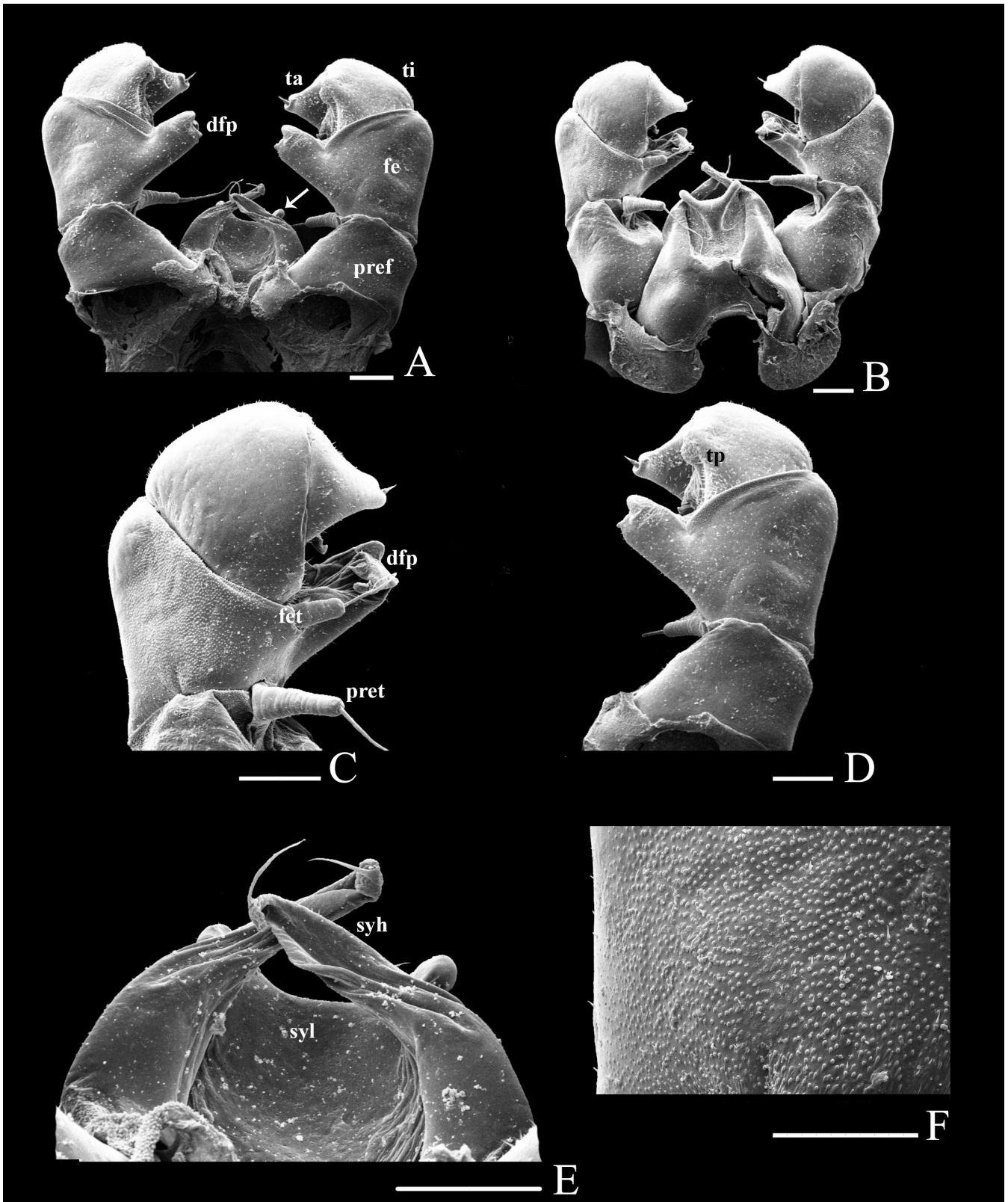


Fig. 35. *Hyleoglomeris lobus* new species, holotype (FMNH INS 3716132) from Cuc Phuong National Park, Ninh Binh Prov, northern Vietnam. A, telopods, anterior view; B, posterior view; C, right telopod, posterior view; D, anterior view; E, syncoxial lobe and horns, anterior view; F, micropapillae pattern. Scale bar = 200 μ m (A–E); 100 μ m (F).

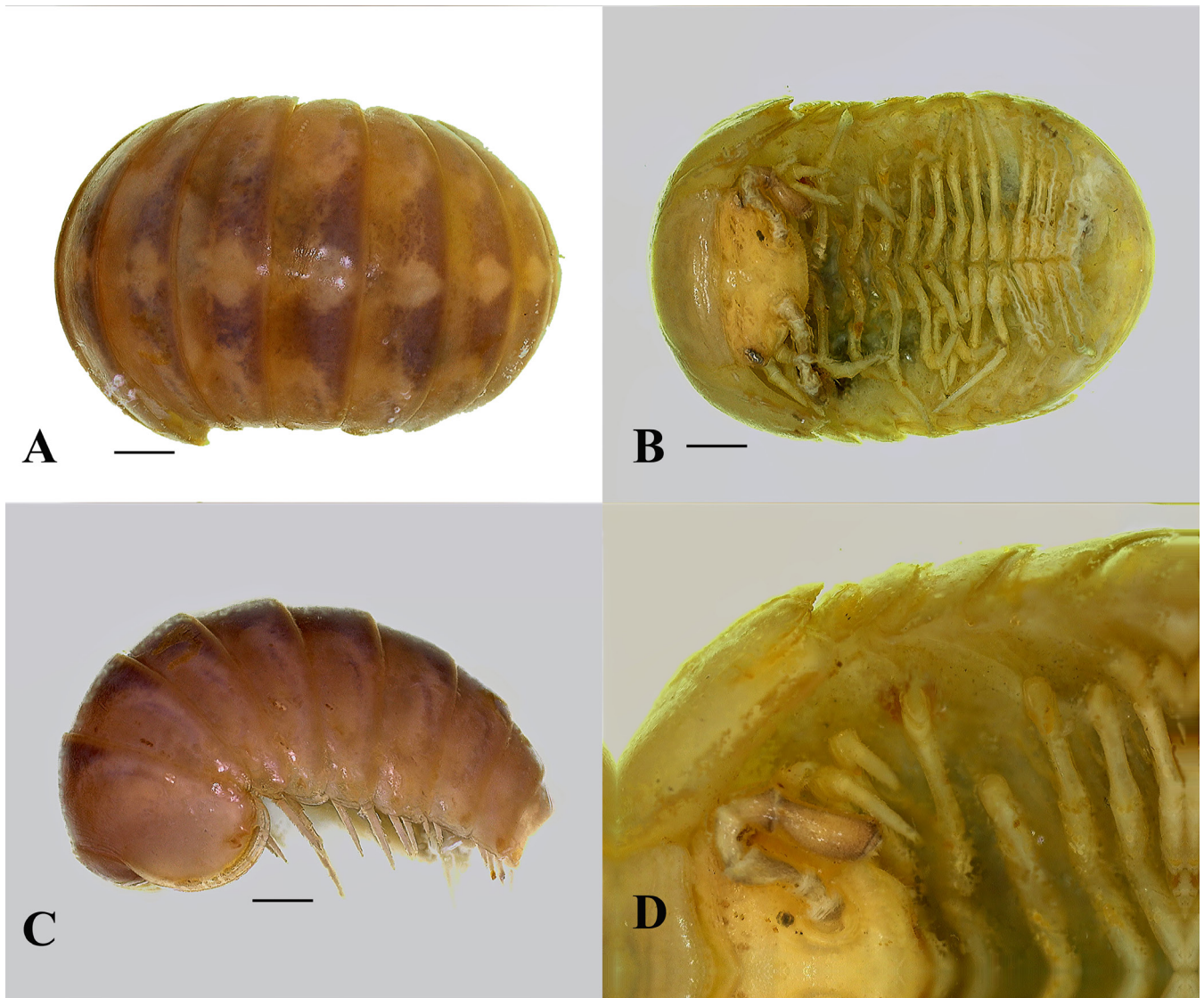


Fig. 36. *Hyleoglomeris coloratoides* new species, holotype (IEBR-Myr 658H) from Huong Son District, Ha Tinh Prov. A, whole body, dorsal view; B, ventral view; C, lateral view; D, antenna, ventral view. Scale bar = 1 mm.

***Hyleoglomeris coloratoides*, new species**
(Figs. 36–39)

Material examined. Holotype: male (IEBR-Myr 658H) Vietnam, Ha Tinh Province, Huong Son District, Cau Treo, secondary forests, elevation of 800 m, 30 May 2004, coll. Nguyen A.D.

Paratypes: 4 females (IEBR-Myr 658P) same data as for holotype.

Etymology. Named after the similarity to its congener, *Hyleoglomeris colorata* Golovatch et al., 2013 from the neighbouring province, Quang Binh.

Diagnosis. The species is differentiated by the following character combination: Thoracic shield with 10 superficial transverse striae. Telopods with a bilobed chevron-shaped syncoxial lobe. The new species is similar to its congeners, *H. colorata*, from Quang Binh Province in telopod shape, but differs in syncoxial lobe medially concave (vs roundly

sub-trapeziform) and legs of leg-pair 17 with 4 podomeres (vs. 3 podomeres in *H. colorata*).

Description. Holotype male (IEBR-Myr 658H). Width of 2nd tergum 5.3 mm, body length 6.5 mm.

Exoskeleton: Ethanol-preserved specimens light yellow, terga with traces of two paramedian transverse oval spots, and a medioposterior light yellow triangular spot (Fig. 36A–D).

Head: Ocelli 6+1, lenses convex, black contrasting against yellow background of head. Tömösváry organs transverse oval, 2.0× wider than long. Antenna clavate. Antennomere 6 large, about 2.5× longer than wide. Antennal tip with four large, apical sensory cones. **Tergites:** Collum semicircular, with faint middle transverse oval spot, with two transverse striae. Second tergum with a narrow hyposchism, not reaching caudal margin, with 10 superficial transverse striae. Anal shield rounded, not concave medially. **Legs:** Leg-pair 17 strongly reduced, 4-segmented, coxa with a regular outer lobe. Leg-pair 17 (Figs. 37A, 38A) in males with a setiferous

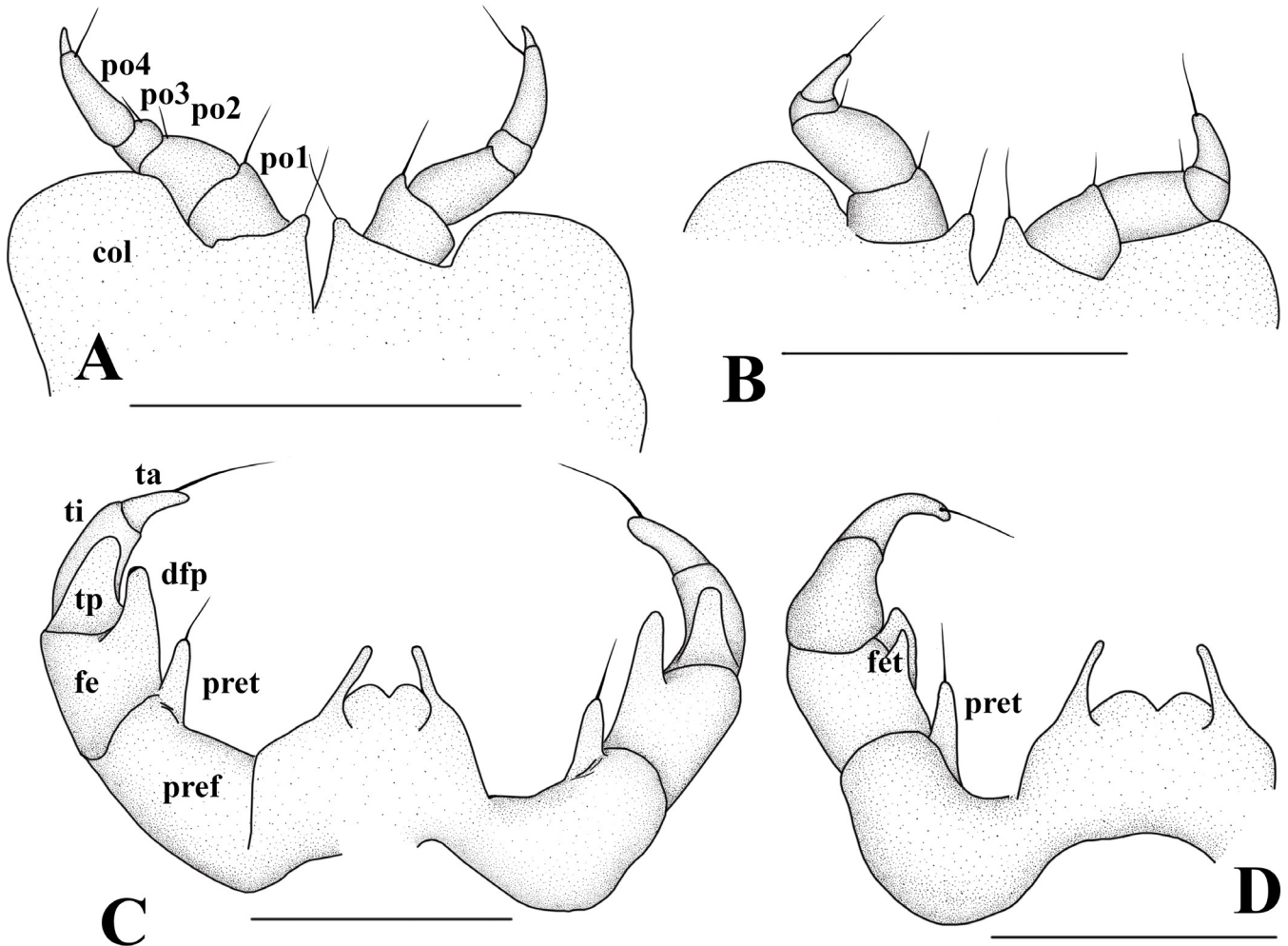


Fig. 37. *Hyleoglomeris coloratoides* new species, holotype (IEBR-Myr 658H). A, legs 17, anterior view; B, legs 18, anterior view; C, telopods, anterior view; D, posterior view. Scale bar = 1mm.

tubercle distomesally on each side of the syncoxite, with large syncoxial lobe, podomere 1 with small distomesal setiferous knob. Leg-pair 18 less reduced (Figs. 37B, 38B), legs similar to leg pair 17, but podomere 3 strongly reduced, very short, and syncoxial lobe small.

Telopods (Figs. 37C, D, 38C, D, 39) with a bilobed chevron-shaped syncoxial lobe, sparsely setose, two horns paramedially (Fig. 39D), each directed ventrad, longer than syncoxial lobe. Prefemur and femur with trichosteles. Femur with a straight, large, triangular, distal process. Tibia with stout, broadened process (tp) near base (Figs. 37C, 38D). Tarsus S-shaped, acuminate apically (Fig. 39A).

Variation. Width of tergum 2 ca. 5.5–6.3 mm (female); length ca. 8.5–11.3 mm (female). Holotype ca. 6.5 mm long, width ca. 5.3 mm at tergum 2.

A key to *Hyleoglomeris* species from Vietnam

- 1. Body largely or entirely unpigmented. Trogllobites.....2
- Body pigmented. Non-trogllobites.....4
- 2. Body length ca. 6.0 mm, width of 2nd tergum ca. 3.0 mm. Thoracic shield with 6 transverse striae. Telopod with subquadrate syncoxial lobe..... *H. spelaea*

- Body length ca. 8.5–10.0 mm, width of 2nd tergum ca. 4.0–4.1 mm. Thoracic shield with more than 6 transverse striae. Telopodite with subtrapeziform syncoxial lobe.....3
- 3. Syncoxial lobe broadly subtrapeziform, slightly concave. Syncoxial horns without an apical seta.....*H. cavernicola*
- Syncoxial lobe not broadly subtrapeziform, not concave. Syncoxial horns with an apical seta.....*H. speophila*
- 4. Colouration pattern peculiar, striped, annulated. Legs 17 3-segmented. Central Vietnam.....*H. colorata*
- Colouration pattern different. Legs 17 4-segmented. Southern and Northern Vietnam5
- 5. Syncoxial lobe of telopods subtrapeziform, slightly concave6
- Syncoxial lobe of telopods other form.....8
- 6. Thoracic and anal shield, each with dark spots. Terga 3–11, each with 3 rows of large yellow spots*H. triangulifera*
- Thoracic shield and terga 3–11, each with two large spots strongly contrasting with background7
- 7. Tergal spots blackish strongly contrasting with yellow–brown background. Thoracic shield with 6–7 transverse striae, of which 3–4 cross dorsum*H. cattienensis*
- Tergal spots yellow or gray–yellow strongly contrasting dark or blackish background Thoracic shield with 9–10 transverse striae, of which 7–8 cross dorsum..... *H. robusta*
- 8. Syncoxial lobe of telopods high, sub-quadrate; syncoxial horns directed mesoventrad, shorter than syncoxial lobe
..... *H. fedorenkoi*
- Syncoxial lobe of telopods not quadrate; syncoxial horns longer than lobe9

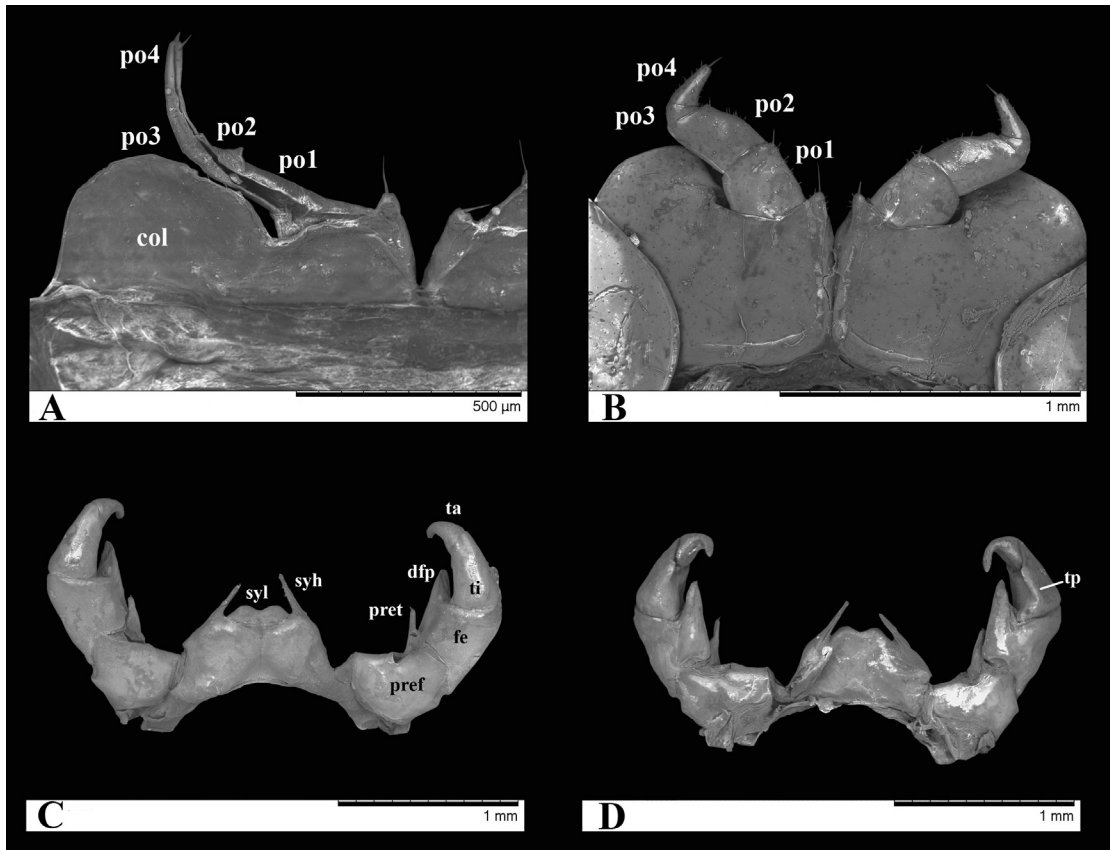


Fig. 38. *Hyleoglomeris coloratoides* new species, holotype (IEBR-Myr 658H). A, legs 17, anterior view; B, legs 18, anterior view; C, telopods, posterior view; D, anterior view. Scale bar = 0.5 mm (A); 0.1 mm (B–D).

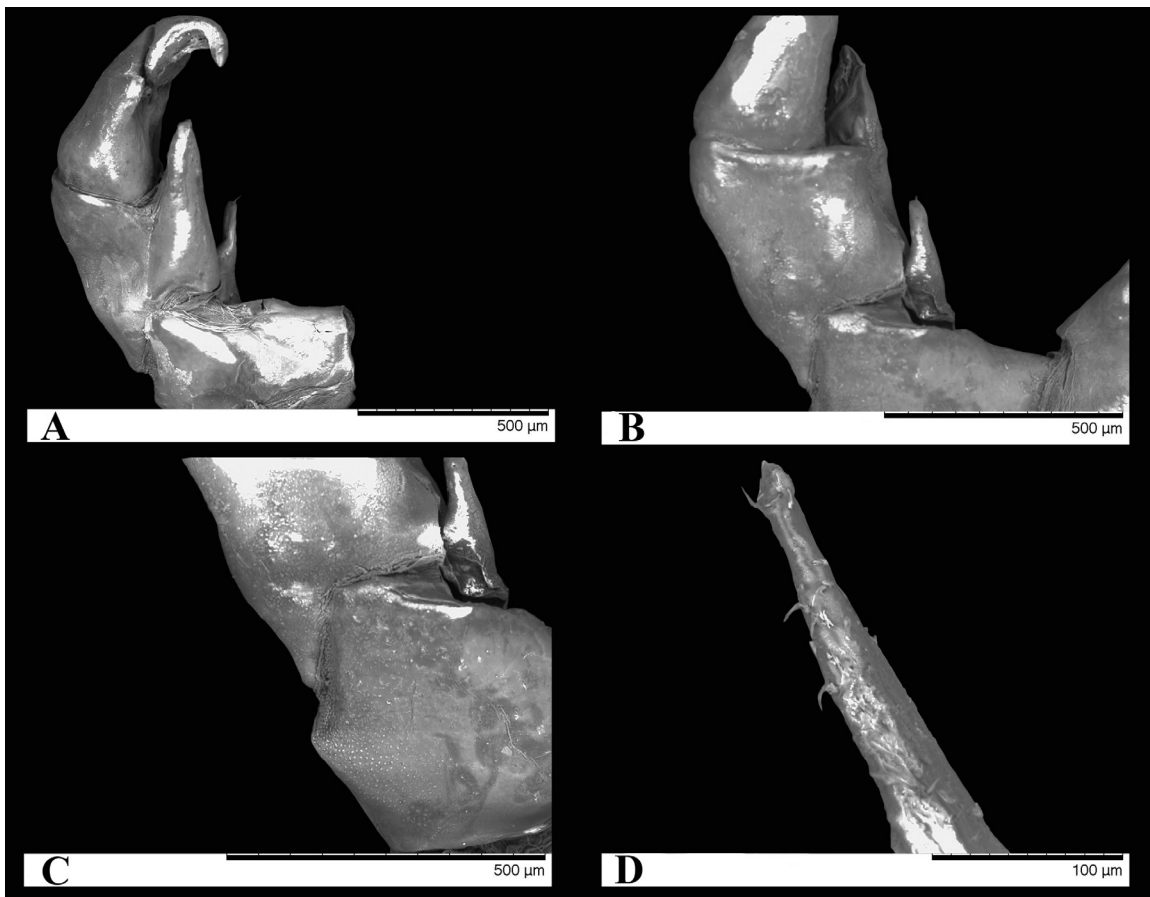


Fig. 39. *Hyleoglomeris coloratoides* new species, holotype (IEBR-Myr 658H). A, left telopod, anterior view; B, prefemorite and femorite, anterior view; C, surface of prefemorite and femorite; D, syncoxial horn. Scale bar = 0.5 mm (A–C); 0.1 mm (D).

9. Syncoxial lobe of telopods strongly concave medially, forming two distolateral tubercles. Syncoxial horns highly elevated, directed ventrad, tip broadly truncated, with an apical spine..
.....*lobus* new species
- Syncoxial lobe of telopods medially concave to form two rounded lobes. Syncoxial horns very long, directed mesoventrad, tip without an apical spine.....*H. coloratoides* new species

Genus *Rhopalomeris* Verhoeff, 1906

Type species. *Rhopalomeris carnifex* (Pocock, 1889) by subsequent designation.

Remarks. The genus *Rhopalomeris* is strictly known from the mainland of southeast Asia (Vietnam, Thailand, Malaysia) with four described species (Golovatch & Semenyuk, 2016). Two have been recorded from Vietnam: *R. tonkinensis* Silvestri, 1917 from Lang Son Province, northern Vietnam and *R. variegata* Golovatch & Semenyuk, 2016 from Gia Lai Province in the Highlands of Vietnam. The other two species are known from Thailand, Malaysia (*R. monacha* Silvestri, 1917) and Myanmar (*R. carnifex* Pocock, 1889). The genus is characterised by antenna having numerous apical sensory cones, antennomere 6 unusually large, trichosteles present in both the prefemur and femur of telopods. An identification key to *Rhopalomeris* species was recently provided by Golovatch & Semenyuk (2016).

***Rhopalomeris sauda*, new species**

(Figs. 40–43)

Material examined. Holotype: male (IEBR–Myr 533H) Vietnam, Bac Kan Province, Ba Be National Park, forest on limestone, elevations of 400–500m, 10–11 July 2013, coll. Anh D. Nguyen.

Paratypes: 2 males, 3 females (IEBR–Myr 533P) same data as for holotype; 4 males, 3 females (IEBR–Myr 654) Vietnam, Vinh Phuc Province, Phuc Yen Town, Ngoc Thanh Commune, MeLinh Station for Biodiversity, 21.3850°N, 105.7119°E, 5 August 2017, coll. Anh D. Nguyen.

Other materials: 1 male, 2 females (FMNHINS 3716094), 3 males, 2 females (FMNH INS 3716073) 2 males, 2 females (FMNH INS 3716075) Vietnam, Vinh Phuc Province, Phuc Yen town, Ngoc Thanh commune, MeLinh Station for Biodiversity, 21.3850°N, 105.7119°E, regenerated forests, 10–16 September 2016, coll. P. Sierwald et al.; 1 female (FMNH INS 3716130) Vietnam, Vinh Phuc Province, Tam Dao district, Tam Dao NP, TV tower trail, natural forests, N21.460945°, E105.647021°, 17 September 2016, coll. P. Sierwald et al.

Etymology. The Vietnamese name “Sâu đá”, refers to pill millipedes (noun in apposition).

Diagnosis. The species is easily recognised by terga being mostly yellowish, with two close paramedian marbled blackish, large spots, and two distolateral small black spots; syncoxial lobe of telopod slightly concave medially or round;



Fig. 40. *Rhopalomeris sauda* new species from Vinh Phuc Prov., habitus. Photo by: Anh D. Nguyen, image not to scale.

syncoxial horns directed ventrad, higher than lobe; telopods with a large, tuberculiform, femoral process; tibia with a long, sigmoid mesad, acute process, and seta in middle. The new species differs from *R. variegata* Golovatch & Semenyuk, 2016 from the Highlands of Vietnam in colouration (yellow colour plus several black spots vs variegated colour). Another species, *R. tonkinensis* Silvestri, 1917, was described from female specimens, the male remains unknown. However, the new species is clearly distinguishable from *R. tonkinensis* in colour pattern (mostly yellow plus several black spots vs. mostly black in *R. tonkinensis*). The number of ocelli differs between the species (7+1 in *R. sauda* vs 8+1 in *R. tonkinensis*).

Description. Holotype male (IEBR–Myr 533H). Width of 2nd tergum 6.0 mm, body length 11.0 mm.

Exoskeleton (Figs. 40, 41): Terga black, with four lateral light-brown reniform spots, and a medioposterior, light-yellow triangular spot. Anal shield black, with a thin, medial yellow line; caudal and lateral margins yellow. Thoracic shield with similar colour pattern to other terga.

Head: Ocelli 7+1, lenses convex, black contrasting against light-brown background of head. Tömösváry organ transverse strongly horseshoe-shaped. Antenna clavate (Fig. 41F). Antennomere 6 largest and longest, 2.5–3.0× long as wide. Antennal tip with numerous apical sensory cones. **Tergites:** Collum semicircular, light yellow, with a marbled yellow–brown, transverse oval spot in the middle, with two transverse striae (Fig. 41C). Second tergum with a narrow hyposchism, not reaching caudal margin, and with 2–3 striae; other terga with 2–3 striae distolaterally. Anal shield rounded, not concave medio-caudally (Fig. 41C). **Legs:** Leg-pair 17 (Figs. 42A, 43A) strongly reduced, with 4 podomeres, with a high, regularly rounded outer coxal lobe; coxa with an apical setiferous spine; podomere 4 with two apical setae. Leg-pair 18 (Figs. 42B, 43B) strongly reduced as legs of leg-pair 17, with 4 podomeres, with a simple syncoxial notch (see arrow).

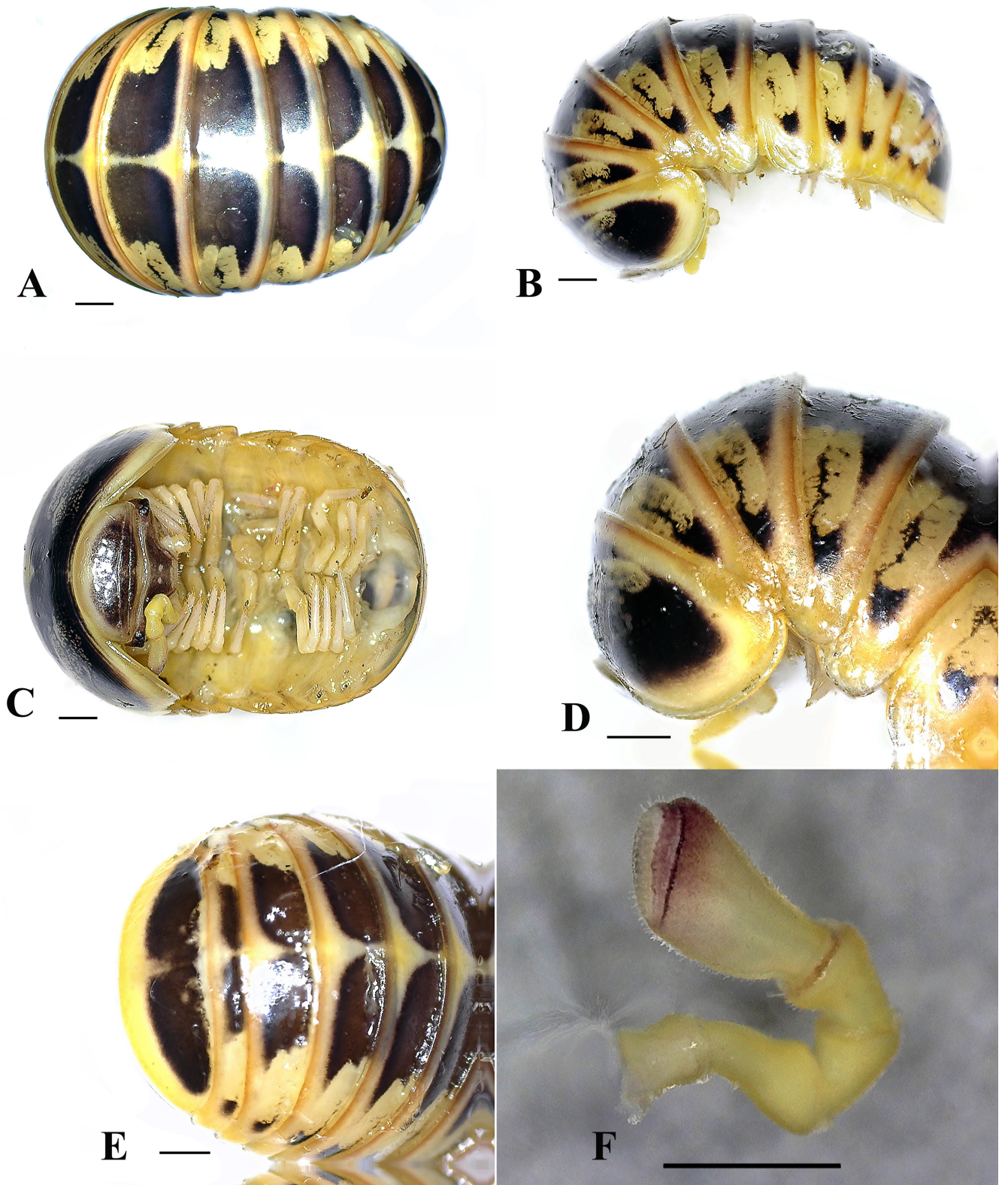


Fig. 41. *Rhopalomeris sauda* new species from Ba Be National Park (IEBR-Myr 564). A, whole body, dorsal view; B, lateral view; C, ventral view; D, thoracic shield, lateral view; E, anal shield, subposterior view; F, antenna, lateral view. Scale bar = 1 mm.

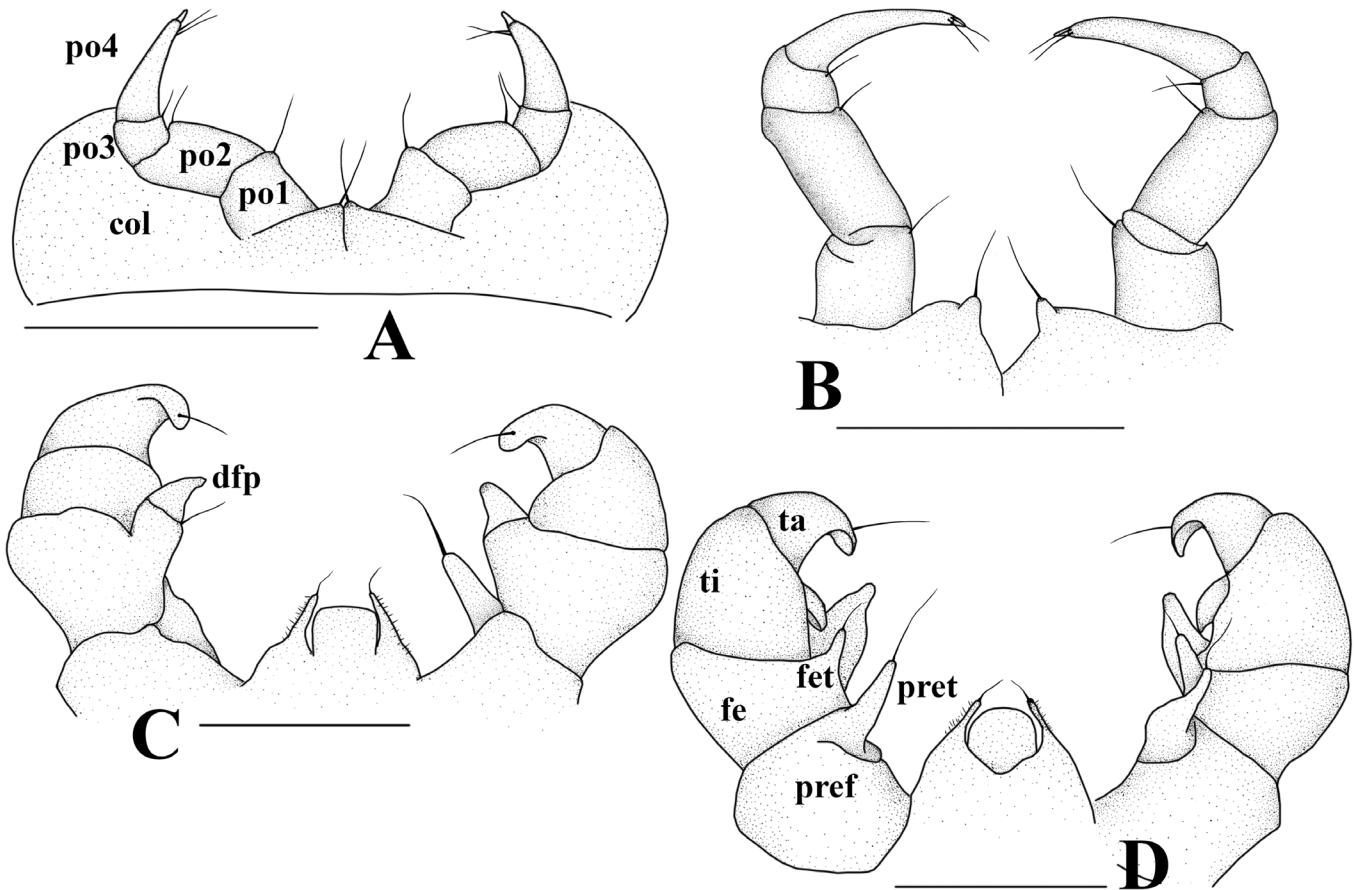


Fig. 42. *Rhopalomeris sauda* new species from Vinh Phuc Prov. A, legs 17; B, leg 18; C, telopods, anterior view; D, posterior view. Scale bar = 1 mm.

Telopods (Figs. 42C, D, 43D, 44) with a trapeziform, slightly convex medially or round, sparsely setose, central syncoxial lobe with two setiferous horns, each directed ventrad, longer than syncoxial lobe (Figs. 42C, D, 44D). Prefemur and femur with long trichosteles (Fig. 44C). Prefemur without additional processes. Femur with large, tuberculiform process present, distal part bowed and acuminate apically. Tibia with a long, sigmoid mesad, acute tuberculiform process, and seta in medially. Tarsus slightly sigmoid anteriomesad, subacuminate apically (Figs. 42C, D, 44A–C).

A key to genera of the family Glomeridae from Vietnam

- 1. Antenna with numerous apical sensory cones2
- Antenna with only four large apical sensory cones.....3
- 2. Telopods with both prefemoral and femoral trichosteles
Rhopalomeris
- Telopods with only a prefemoral trichosteles.....*Peplomeris*
- 3. Leg-pair 18 very well developed, robust; podomere 3 with distal knobs
Tonkinomeris
- Leg-pair 18 reduced, small; podomere 3 without distal knobs4
- 4. Schisma of thoracic shield unusually deep. Thoracic shield with more than 14 striae. Trichosteles on telopods absent.....
Annameris
- Schisma of thoracic shield not unusually deep. Thoracic shield with less than 14 striae. Trichosteles on telopods present on either prefemora or both prefemora and femora.....5
- 5. Telopods with both prefemoral and femoral trichosteles well developed, finger-shaped.....
Hyleoglomeris

- Telopods only with a prefemoral trichosteles well developed, finger-shaped. Femoral trichosteles strongly reduced, even totally missing.....*Hyperglomeris*

DISCUSSION

With approximately 300 species in nearly 34 genera (Wesener, 2015; Sierwald, 2018), members of the order Glomerida are widely distributed in the northern hemisphere, and occur in North and Central America, Europe east to Iran and in Southeast Asia reaching as far south as Sulawesi (Indonesia). The classification of the order is not fully clarified. The current classification, as listed in Wesener (2010: 29) and employed in Wesener (in Minelli, 2015: 378), was mainly established by Mauriès, 2006, with slight alteration by Golovatch et al. (2010). Most higher taxa are not substantiated by clearly defined apomorphies, e.g., Haploglomerinae (in the Glomeridae) is likely ‘an artificial grouping’ (Wesener in Minelli, 2015: 381). The family Protoglomeridae appears to be non-monophyletic (Oeyen & Wesener, 2015: 62), and spans the Glomeridelloidea and Glomeroidea (categorised as superfamilies by Golovatch et al., 2010: 2, and as suborders by Oeyen & Wesener, 2015: 62). Among the somatic characters documented here, the mandibles show remarkable uniformity, also when compared to those documented in other families, e.g. in *Eupeyerimhoffia* (Protoglomeridae). The setiferous tubercle on the mesal distal edge of the leg coxae occurs in many members of the

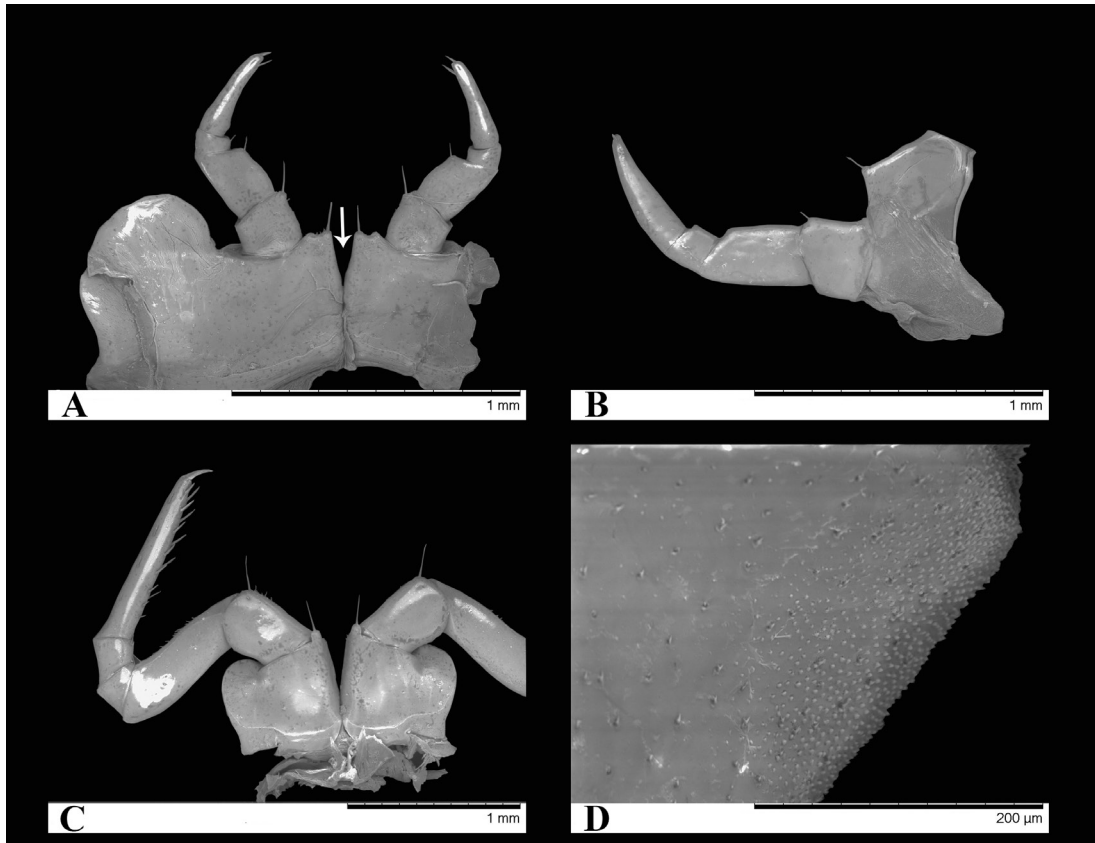


Fig. 43. *Rhopalomeris sauda* new species (IEBR-Myr 533) from Ba Be National Park. A, legs 17; B, leg 18; C, leg 16; D, surface of telopod prefemorite. Scale bar = 1 mm (A–C); 0.2 mm (D).

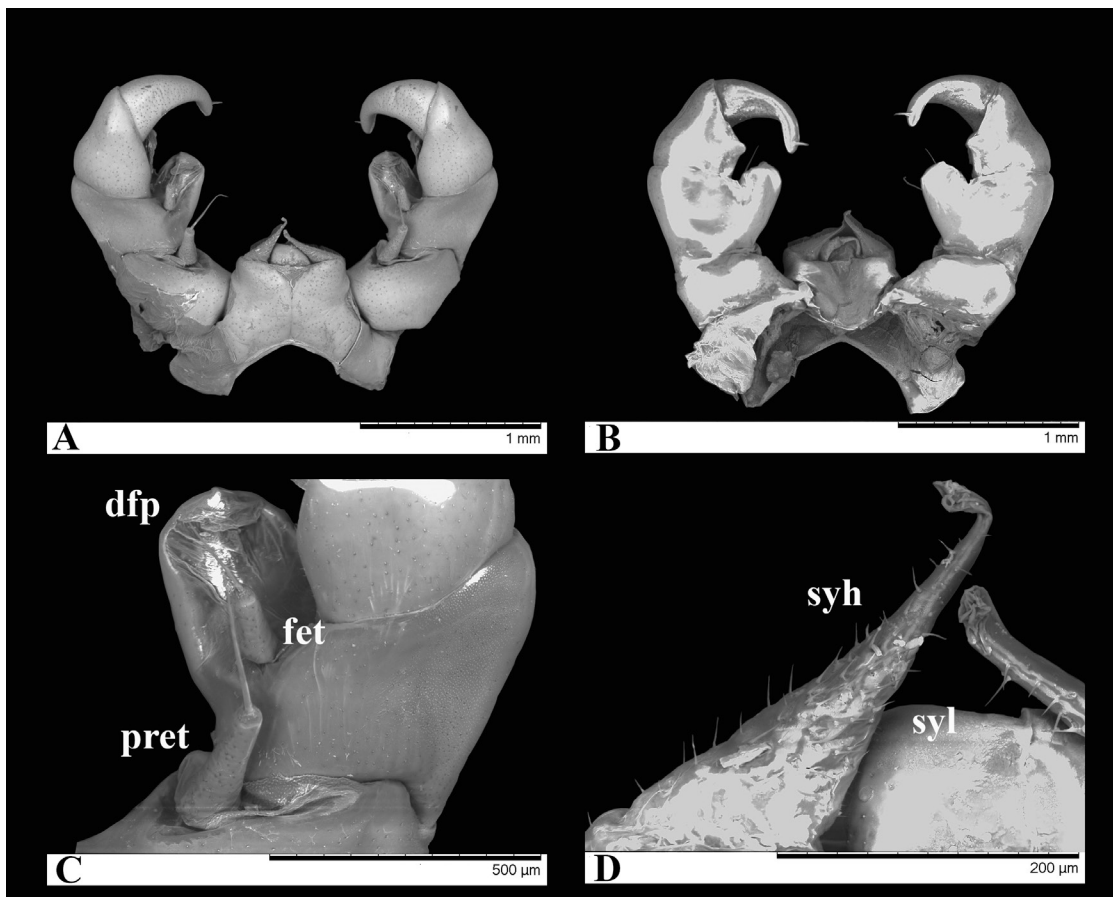


Fig. 44. *Rhopalomeris sauda* new species (IEBR-Myr 533) from Ba Be National Park. A, telopods, posterior view; B, anterior view; C, telopod femorite, posterior view; D, syncoxial horns. Scale bar = 1 mm (A–D); 0.4 mm (C); 0.2 mm (D).

Glomeridae. The vulval characters illustrated here only show features seen in the vulvae of other glomerids so far. The relatively large, knob-shaped mentum in the gnathochilarium of *Peplomeris magna* appears to be unusual for the order.

Six glomerid genera have been recorded from Vietnam: *Annameris* Verhoeff, 1915; *Rhopalomeris* Verhoeff, 1906; *Peplomeris* Silvestri, 1917; *Hyleoglomeris* Verhoeff, 1910; *Hyperglomeris* Silvestri, 1917, and *Tonkinomeris*, new genus. Every described species is known only from its type locality, except *Rhopalomeris variegata* Golovatch & Semenyuk, 2016 that has been found in two nearby places in the Highlands of Vietnam (Golovatch & Semenyuk, 2016; Golovatch, 2017) and *Rhopalomeris sauda*, with new species from Bac Kan and Vinh Phuc Provinces. At the generic level, except the widespread genus *Hyleoglomeris*, four genera, including *Annameris*, *Peplomeris*, *Hyperglomeris*, and *Tonkinomeris*, are known only from northern Vietnam. These genera are considered to be endemic to Vietnam.

Of the six genera, *Annameris* is the most poorly known genus, currently consisting of two species: *A. curvimana* Verhoeff, 1915 and *A. robusta* Verhoeff, 1921. Both of their type localities are highly uncertain, because Verhoeff (1915, 1921) only recorded “Tonkin” (=northern Vietnam) and “Annam” (=central Vietnam). The genus can be recognised by a very thick hyposchism, schisma very deep or strongly concave, telopods without trichosteles, femur apically forming a spine-like process, and a tibia with a membranous lobe. Unfortunately, no other records have been reported since the descriptions of its species. More intensive surveys in the country may uncover additional species and help to clarify its generic distribution.

CONCLUSION

To date, a total of 25 glomerid species have been recorded from Vietnam. The current number of species is far from thoroughly encompassing the rich fauna of glomerid millipedes in the country. While many more unknown species are awaiting discovery, additional intensive surveys are needed to better understand millipede biodiversity of the region.

ACKNOWLEDGEMENTS

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