

**Three interesting new records of millipedes from southern Vietnam, with the description of a new species of the genus *Enghoffosoma* Golovatch, 1993 (Diplopoda: Polydesmida: Platyrrhacidae, Paradoxosomatidae)**

**Три интересные новые находки двупарноногих многоножек из Южного Вьетнама с описанием нового вида рода *Enghoffosoma* Golovatch, 1993 (Diplopoda: Polydesmida: Platyrrhacidae, Paradoxosomatidae)**

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KEY WORDS: taxonomy, iconography, distribution.

КЛЮЧЕВЫЕ СЛОВА: таксономия, иконография, распространение.

**ABSTRACT.** A collection of Diplopoda from a national park in the Gia Lai Province of southern Vietnam contains three noteworthy species of Polydesmida: *Platyrrhacus similis* Golovatch et Nguyen, 2007 (Platyrrhacidae), *Tylopus tuberculatus* Golovatch et Semenyuk, 2018, and *Enghoffosoma speculiforme* sp.n. (both Paradoxosomatidae). All three species are illustrated with colour pictures, *Platyrrhacus similis* is recorded from the Gia Lai Province for the first time, *Tylopus tuberculatus* is represented by strict typotypes, while *Enghoffosoma speculiforme* sp.n. is a sixth species of the genus to be reported from Vietnam, differing from all other 12 congeners primarily by the mirror-shaped postfemoral process of the gonopod.

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**РЕЗЮМЕ.** Коллекция Diplopoda из национального парка в провинции Зялай Южного Вьетнама содержит три примечательных вида Polydesmida: *Platyrrhacus similis* Golovatch et Nguyen, 2007 (Platyrrhacidae), *Tylopus tuberculatus* Golovatch et Semenyuk, 2018 и *Enghoffosoma speculiforme* sp.n. (оба Paradoxosomatidae). Все три вида снабжены цветными фотографиями, вид *Platyrrhacus similis* впервые отмечен в провинции Зялай, вид *Tylopus tuberculatus* представлен строгими топотипами, а *Enghoffosoma speculiforme* sp.n. — шестой вид этого рода, найденный во Вьетнаме, и он отличается от всех других 12 видов рода прежде всего похожим на зеркало постфеморальным отростком гонопода.

## Introduction

The millipede fauna of Vietnam with its 280 species [Nguyen *et al.*, 2025], however relatively well studied compared to the faunas of most other neighboring countries, e.g., Thailand with 263 species [Likhitrakarn *et al.*, 2023], Laos with 34 species [Likhitrakarn *et al.*, 2014a], Cambodia with 26 species [Likhitrakarn *et al.*, 2025] or Myanmar with 92 species [Likhitrakarn *et al.*, 2017], is far from fully assessed yet. Even the quite well prospected and long studied local diplopod faunas, or faunules, of some of Vietnam's protected areas, such as national parks or nature reserves, still yield novelties. Thus, a new millipede species has recently been described from the Bidoup – Nui Ba National Park, Lam Dong Province, one of the best explored faunules in Vietnam [Golovatch, 2024].

Similarly, a recent collection from the Kon Ka Kinh National Park, Gia Lai Province contains three noteworthy millipede records, one of which belongs to a new species. The present note is not only to provide their colourful iconographies, but it also is to describe the new species.

## Material and methods

All material reported below was taken in the Kon Ka Kinh National Park, Gia Lai Province, Vietnam, presently being deposited in the collections of either the Zoological Museum of the Moscow State University (ZMUM), Moscow, Russia or the Institute of Biology (previously known as Institute of Ecology and Biological Resources = IEBR), Vietnam Academy of Science and Technology, Hanoi, Vietnam.

Colour photographs of the ZMUM material were taken at the Paleontological Institute, Russian Academy of Sciences (PIN), Moscow, using a Flexacam C1 camera mounted on a Leica M165C stereo microscope with built-in LasX software. The colour images of the IEBR samples were taken at various focal

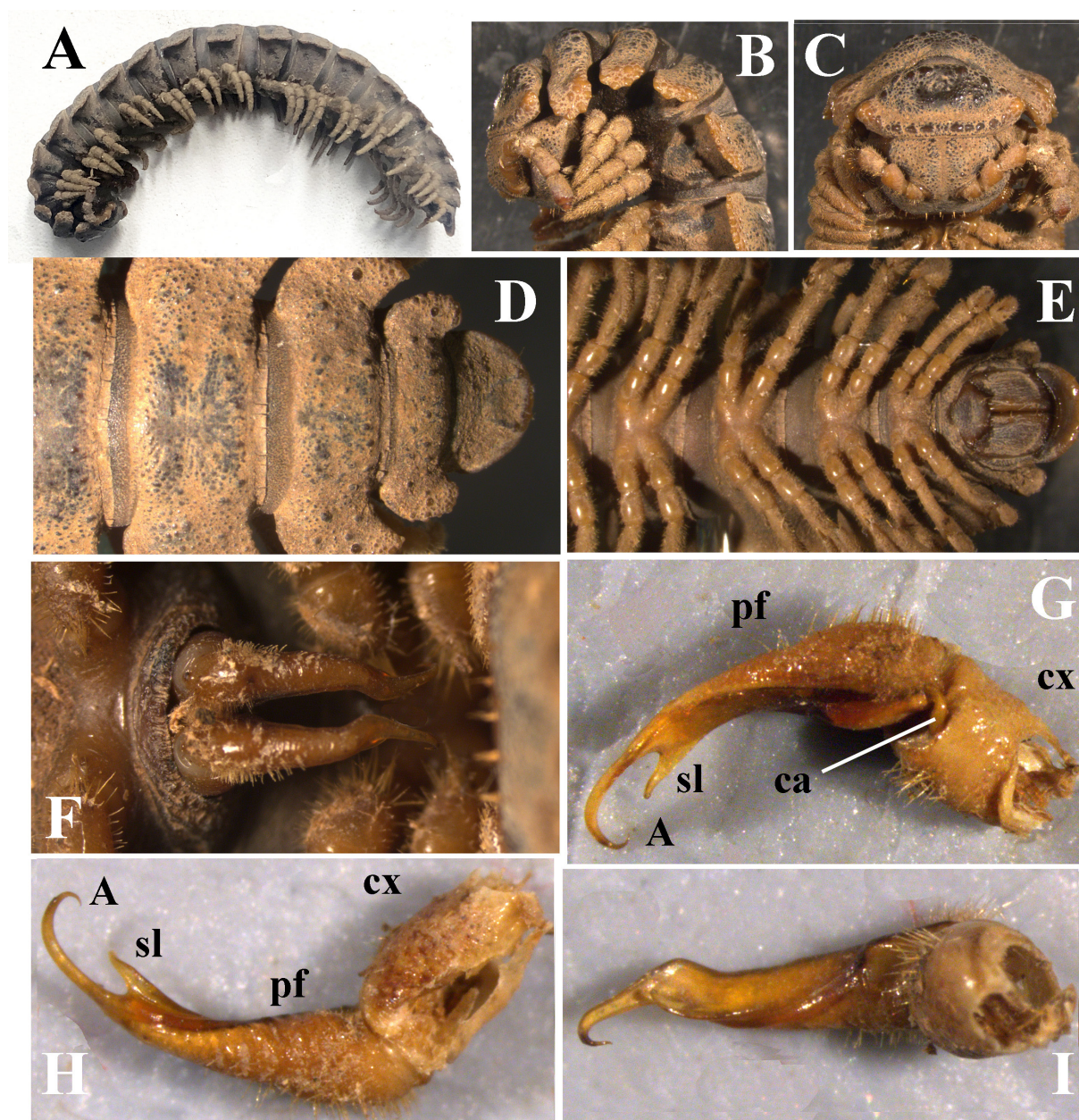


Fig. 1. *Platyrrhacus similis* Golovatch et Nguyen, 2007, ♂ from Kon Ka Kinh National Park. A — habitus, lateral view; B, C — anterior part of body, lateral and anteroventral views, respectively; D, E — posterior part of body, dorsal and ventral views, respectively; F — both gonopods *in situ*, ventral view; G–I — left gonopod, mesal, lateral and dorsal views, respectively. Abbreviations: A — acropodite; ca — cannula; cx — coxite; pf — prefemorite; sl — solenomere. Photographs by R.M. Rakitov, taken not to scale.

Рис. 1. *Platyrrhacus similis* Golovatch et Nguyen, 2007, ♂ из национального парка Кон Ка Kinh. А — общий вид, сбоку; В, С — передняя часть тела, соответственно сбоку и одновременно спереди и снизу; D, E — задняя часть тела, соответственно сверху и снизу; F — оба гонопода на месте, снизу; G–I — левый гонопод, соответственно изнутри, сбоку и сверху. Обозначения: А — акроподит; са — канюля; cx — коксит; pf — префеморит; sl — соленомер. Фотографии Р.М. Ракитова, сняты без масштаба.

planes using a Sony A6000 camera, coupled with a SMZ800N Nikon stereo microscope. UV images were taken using a Sony A6000 digital camera attached to the aforementioned SMZ800N Nikon stereo microscope under the UV flashlight Nichia Convoy. Images were stacked using Helicon Focus version 7.0 software and assembled in Adobe Photoshop CS6.

The terminology used to denote certain structures of the gonopods follows Likhitrakarn *et al.* [2014b], Golovatch & Semenyuk [2018a, b] and Nguyen & Golovatch [2016].

## Taxonomic part

### Family Platyrrhacidae

#### *Platyrrhacus similis* Golovatch et Nguyen, 2007

Fig. 1.

MATERIAL. 1 ♂ (ZMUM), Vietnam, Gia Lai Prov., ca 40 km ENE of Pleiku, 14°12'N, 108°19'E, Kon Ka Kinh National Park, 890–1500 m a.s.l., 21–30.V.2017, D. Fedorenko leg.



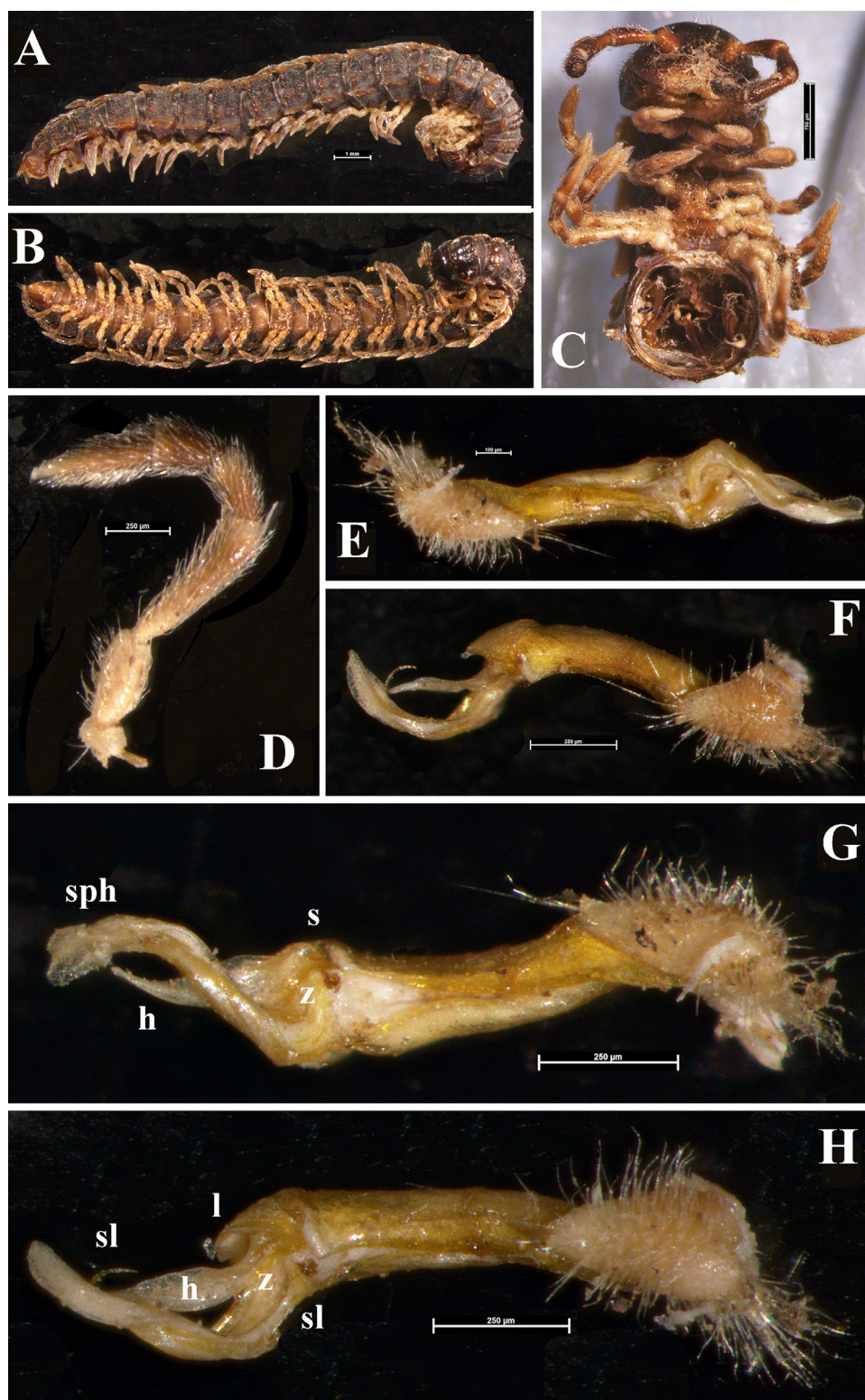


Fig. 2. *Tylopus tuberculatus* Golovatch et Semenyuk, 2018, ♂ from Kon Ka Kinh National Park. A, B — habitus, dorsolateral and ventral views, respectively; C — anterior part of body, ventral view; D — leg 7, lateral view, E–H — left gonopod, dorsal, subventral, mesal and ventral views, respectively. Abbreviations: h, z — postfemoral processes; l — postfemoral lobe; s — distofemoral sulcus; sl — solenomere; sph — solenophore. Photographs by R.M. Rakitov, taken not to scale.

Рис. 2. *Tylopus tuberculatus* Golovatch et Semenyuk, 2018, ♂ из национального парка Кон Ка Kinh. А, В — общий вид, соответственно одновременно сверху и сбоку, а также снизу; С — передняя часть тела, снизу; D — нога 7, сбоку, E–H — левый гонопод, соответственно сверху, почти снизу, изнутри и снизу. Обозначения: h, z — постфеморальные отростки; l — постфеморальная пластинка; s — дистофеморальная бороздка; sl — соленомер; sph — соленофор. Фотографии Р.М. Ракитова.



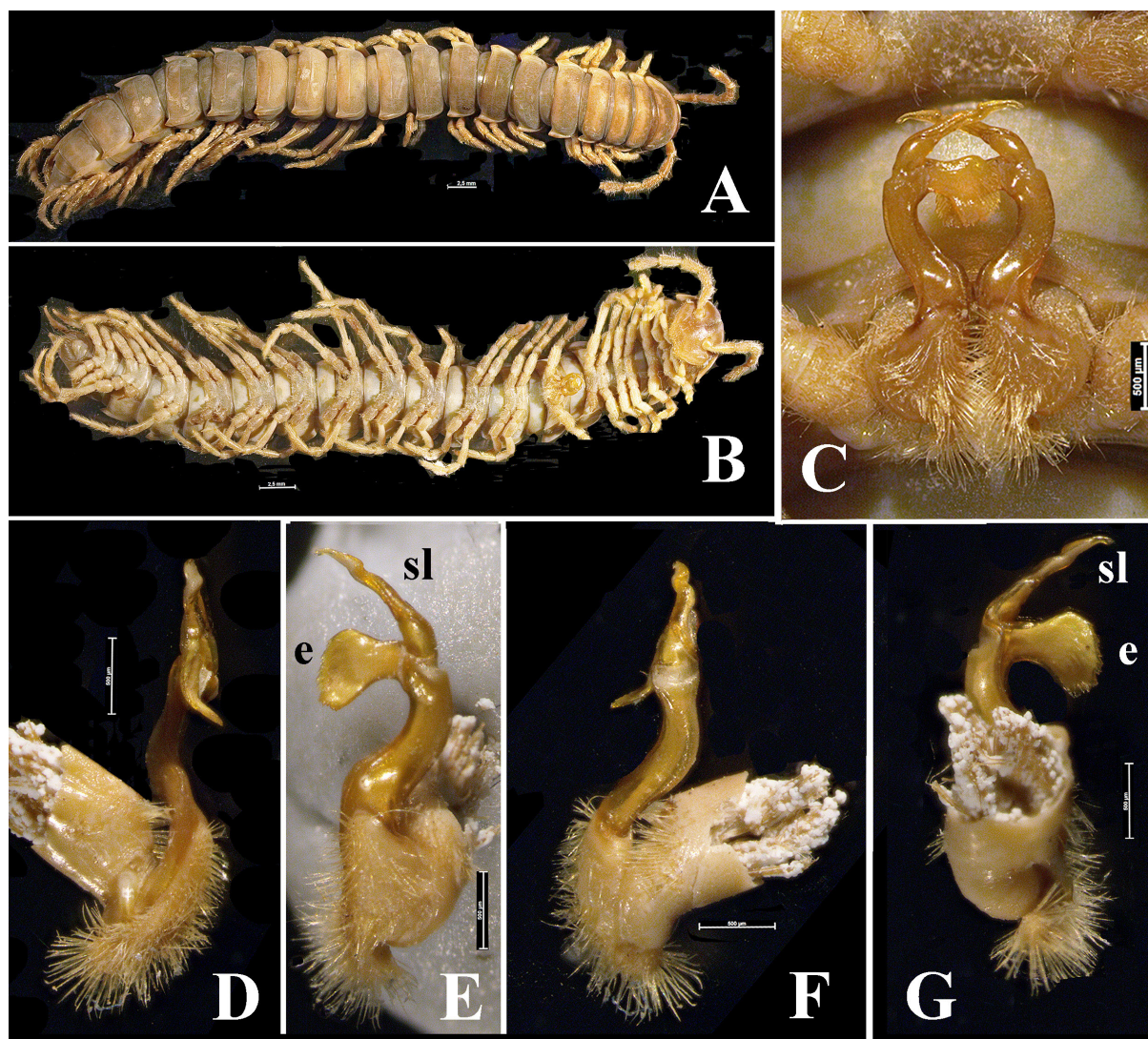


Fig. 3. *Enghoffosoma speculiforme* sp.n., ♂ holotype. A, B — habitus, dorsal and ventral views, respectively; C — both gonopods in situ, ventral view; D–G — left gonopod, mesal, ventral, lateral and dorsal views, respectively. Abbreviations: e — postfemoral process; sl — solenomere. Photographs by R.M. Rakitov.

Рис. 3. *Enghoffosoma speculiforme* sp.n., голотип ♂. А, В — общий вид, соответственно сверху и снизу; С — оба гонопода на месте, снизу; D–G — левый гонопод, соответственно изнутри, снизу, сбоку и сверху. Обозначения: е — постфеморальный отросток; сл — соленомер. Фотографии Р.М. Ракитова.

**BRIEF DESCRIPTIVE NOTES.** The single ♂ seems to be the largest specimen of this species to be recorded yet. It measures ca 68 mm in length, and 6.0 and 13 mm in width on midbody pro- and metazona, respectively, vs length 50–65 mm (♂, ♀), width on midbody pro- and metazona 45–52 and 8.0–11.5 mm (♂) or 6.5–7.5 and 10.0–12.5 mm (♀), respectively, in the original description [Golovatch, Nguyen, 2007]. Coloration uniformly dark grey-brown, but in places considerably lighter red- to yellow-brown due to an earth crust covering much of the body. All important somatic characters as in Fig. 1A–E. Gonopods (Fig. 1F–I) in situ held parallel to each other, directed cephalad, each composed of a short cylindrical coxite (cx) bearing a usual, curved and distomesal cannula (ca), and a much longer telopodite, this latter's 2/3 taken up by a prefemurite (pf), as usual densely setose and clearly demarcated by an oblique sulcus, and a bifurcated, gradually attenuating, apically broadly and very clearly curved, and acuminate acropodite (A). Seminal groove fully curved, its basal part borne on a distinct

and rounded rib framing a fossa and its apical portion borne on a shorter, simple, only slightly curved and similarly acuminate solenomere (sl), with its onset a little distomesal to pf apex.

**REMARKS.** Vietnam is known to host only two species of Platyrhacidae, both in *Platyrhacus* C.L. Koch, 1847. The one confined to northern Vietnam is *P. borealis* Golovatch et Nguyen, 2007, whereas *P. similis* is especially widespread, occurring in the central and southern parts of the country [Golovatch, Nguyen, 2007].

#### Family Paradoxosomatidae

#### *Tylopus tuberculatus* Golovatch et Semenyuk, 2018 Fig. 2.

**MATERIAL.** 2 ♂♂ (ZMUM), Vietnam, Gia Lai Prov., ca 40 km ENE of Pleiku, 14°12'N, 108°19'E, Kon Ka Kinh National Park, 890–1500 m a.s.l., 21–30.V.2017, D. Fedorenko leg.



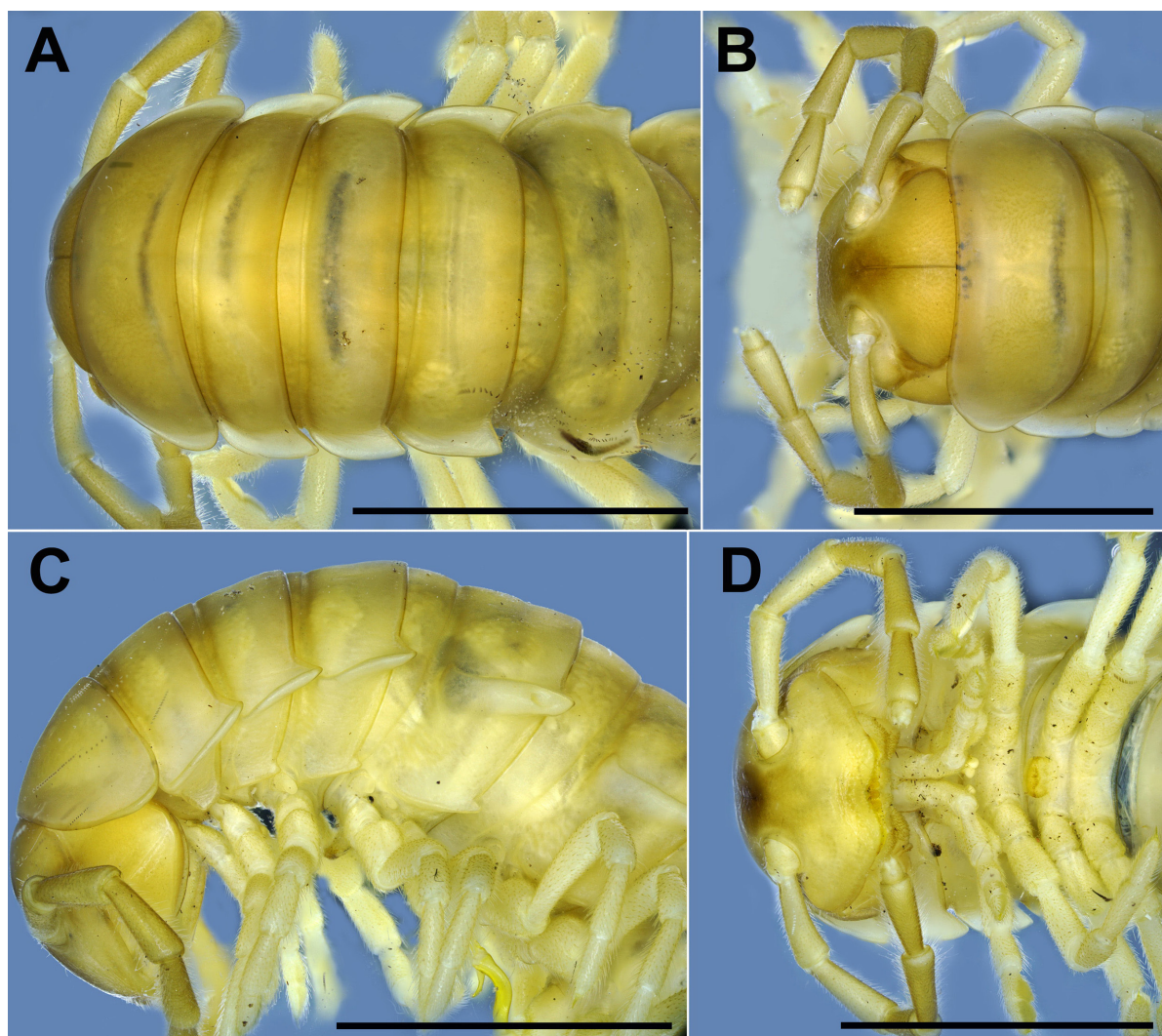


Fig. 4. *Enghoffosoma speculiforme* sp.n., ♂ paratype (IEBR-Myr 629). A–D — anterior part of body, dorsal, anterodorsal, lateral and ventral views, respectively. Scale bars 5 mm. Photographs by Anh D. Nguyen.

Рис. 4. *Enghoffosoma speculiforme* sp.n., паратип ♂ (IEBR-Myr 629). A–D — передняя часть тела, соответственно сверху, одновременно спереди и сверху, сбоку и снизу. Масштаб 5 мм. Фотографии Ань Д. Нгуена.

**BRIEF DESCRIPTIVE NOTES.** The new samples fully agree with the original description [Golovatch, Semenyuk, 2018], again being illustrated in Fig. 2. The somatic characters are as in Fig. 2A–C, a leg is in Fig. 2D, while the left gonopod is as in Fig. 2E–H.

Both ♂♂ ca 24 mm long, width of midbody pro- and metazona 1.2 and 2.0 mm, respectively. Coloration dark brown to dark red-brown, venter and legs mostly lighter brown. Metaterga with conspicuous, characteristic, oblong, setigerous tubercles in two transverse rows, 2+2 and 2(3)+2(3) per ring (Fig. 2A, B). A high, bipartite, densely setose lobe between coxae 4 (Fig. 2C). Prefemora not bulged laterad (Fig. 2D). Gonopod telopodite with a distinct sulcus (s) demarcating a postfemoral region, the latter with a rudimentary mesal outgrowth z at its base, a distinct lateral lobe l, a prominent, long, simple, lanceolate and slightly coiled process h, and an even longer, likewise coiled solenophore (sph) showing an exposed tip of a long and flagelliform solenomere (sl).

**REMARK.** These ♂♂ represent strict topotypes [Golovatch, Semenyuk, 2018], the species likely being endemic to the Kon Ka Kinh National Park.

#### *Enghoffosoma speculiforme* sp.n. Figs 3–7.

**HOLOTYPE** ♂ (ZMUM), Vietnam, Gia Lai Prov., ca 40 km ENE of Pleiku, 14°12'N, 108°19'E, Kon Ka Kinh National Park, 890–1500 m a.s.l., 21–30.V.2017, D. Fedorenko leg.

**PARATYPES:** 1 ♂ (IEBR-Myr 629) and 1 ♂ (IEBR-Myr 630), same locality, but 660–890 m a.s.l., forest, 17–24.IV.2017, Anh D. Nguyen leg.

**DIAGNOSIS.** Differs from congeners, including the apparently most similar *E. digitatum* Nguyen et Golovatch, 2016, *E. fedorenkoi* (Golovatch, 2016) and *E. triangulare* Nguyen et Golovatch, 2016, all three also from southern Vietnam [Nguyen, Golovatch, 2016], primarily by the large size (body width up to 6.0 mm), coupled with the speculiform, mirror-shaped, rounded postfemoral process (e) of the gonopod.

**DESCRIPTION.** Body length of holotype ca 45 mm, width of midbody pro- and metazona 4.0 mm and 6.0 mm, respectively. Paratypes ca 43.9 or 52.2 mm long, 4.7 or 5.3 mm and 3.8 or 4.2 mm wide on midbody pro- and metazona, respectively. Tegument generally dull, prozona shagreened, metaterga mi-



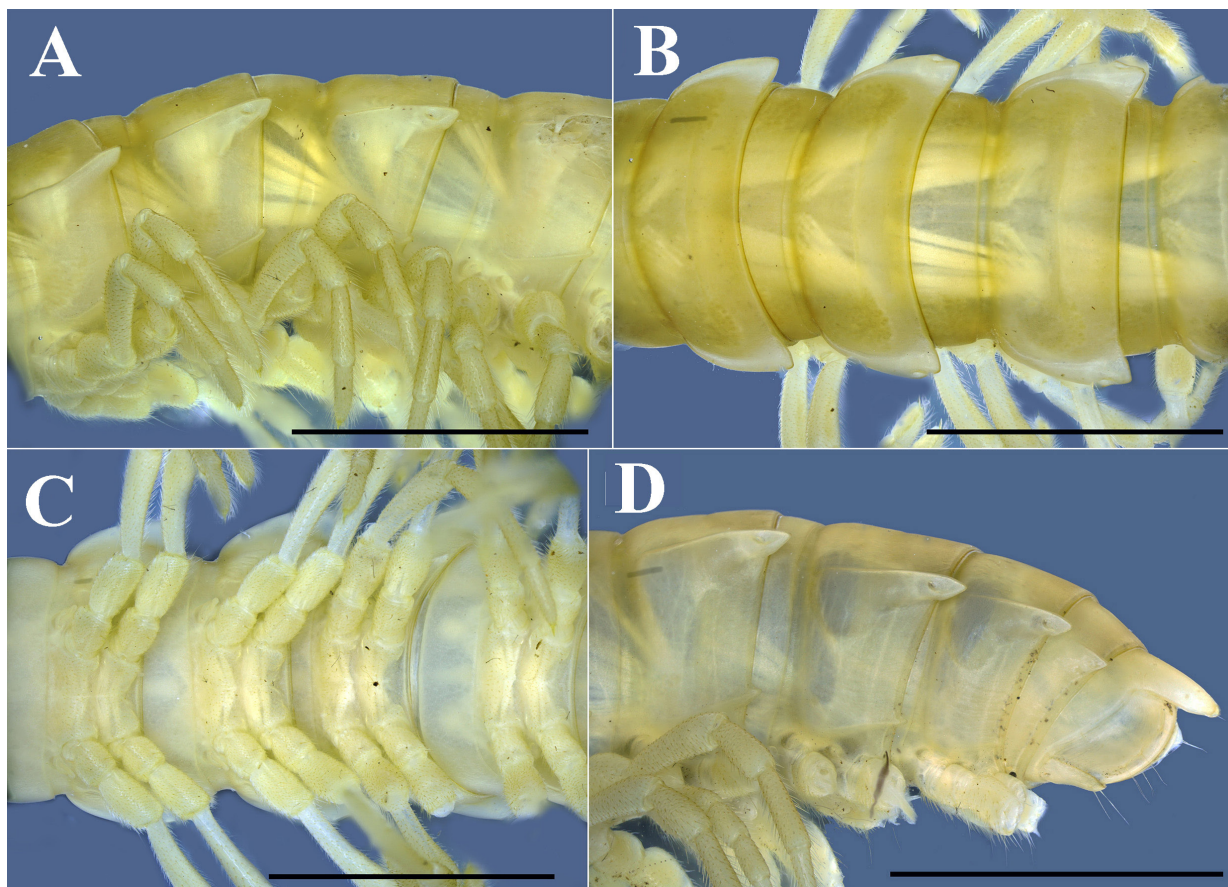


Fig. 5. *Enghoffosoma speculiforme* sp.n., ♂ paratype (IEBR-Myr 629). A–C — middle part of body, lateral, dorsal and ventral views, respectively; D — caudal part of body lateral view. Scale bars 5 mm. Photographs by Anh D. Nguyen.

Рис. 5. *Enghoffosoma speculiforme* sp.n., паратип ♂ (IEBR-Myr 629). А–С — средняя часть тела, соответственно сбоку, сверху и снизу; D — задняя часть тела, сбоку. Масштаб 5 мм. Фотографии Ань Д. Нгуена.

cropunctate. Coloration mostly light grey-brown (holotype) to very light olive brown, almost pallid (paratypes), anterior 1/3 body more vividly coloured (Fig. 4); posterior 1/4 of most metaterga between paraterga in holotype a little lighter; often crossing the dorsum; calluses/peritremata on metaterga entirely or, more usually, only caudally lighter, yellowish; tip of epiproct, venter and legs lighter grey-brown; antennae mostly brown, but antennomere 7 lighter and tip nearly pallid (Figs 3A, B, 4–6).

Head with squarish genae, clypeolabral region densely setose, vertex less densely so; epicranial suture evident (Figs 3B, 4). Antennae rather long and slender, only slightly clavate, drawn past ring 3 when stretched dorsally; interantennal isthmus ca 1.5 times as broad as antennal socket. In length, antennomere  $3 > 5 > 7 > 1$  (Figs 3B, 4).

In width, head < collum < ring  $3 = 4 < 2 = 5 - 16$ , thereafter body gradually tapering towards telson (Fig. 4A). Collum with broadly rounded paraterga (Fig. 4C). Metaterga with a row of  $3 + 3$  setae in front of transverse sulcus, setation pattern traceable due to insertion points alone; a caudal row of setae untraceable. Transverse metatergal sulci very thin, poorly traceable on rings 5–18, not reaching the bases of paraterga (Figs 3A, 4A, 6A). Postcollum paraterga (Fig. 3A, B, 4–6) rather small, anterolateral corners always broadly rounded, anteriorly devoid of shoulders; all caudal corners acute to spiniform, drawn behind posterior margin and pointed or nearly so, increasingly prominent towards telson. Lateral margins smooth; calluses/peritremata evident, smaller on poreless paraterga, but larger

on pore-bearing ones, completely delimited by distinct sulci dorsally, but only to about posterior half ventrally (Figs 3A, B, 4–6). Ozopores dorsolateral, visible from above, located inside ovoid grooves a little in front of caudal corners of paraterga (Fig. 5). Pleurosternal carinae strongly developed, ridge-shaped (Fig. 4C, D), present on rings 2–18, absent from 19th. Stricture between pro- and metazona narrow, rather shallow and smooth. An axial line absent. Epiproct (Figs 3A, B, 5D, 6A–C) rather long and conical, subtruncate at tip, subterminal papillae very small. Hypoproct roundly subtriangular,  $1 + 1$  setae near caudal margin borne of small knobs (Figs 3B, 6B, C).

Sterna densely setose and mostly flat, cross-impressions indistinct, without evident modifications except for a densely setose bulge with a thin and subtrapeziform lamina between coxae 4 (Figs 3B, 6D). Legs long and slender, very densely setose, about 1.5–1.6 times as long as midbody height (♂) (Fig. 3B); prefemora slightly, but clearly bulged laterad; femora without modifications; distotibial and tarsal brushes present and gradually thinning out towards leg-pair 12 (♂). Gonapophyses on coxae 2 small rounded knobs (Fig. 4D).

Gonopods (Figs 3C–G, 7) relatively simple. Coxite large, stout; distoventral part densely setose. Telopodites regularly curved mesad, crossing each other distally. Prefemorite densely setose as usual, separated laterally from femorite by a transverse sulcus. Femorite slender, cylindrical, but somewhat curved ventrad, slightly enlarged distally, with neither processes nor other modifications. Postfemoral region consisting only of a



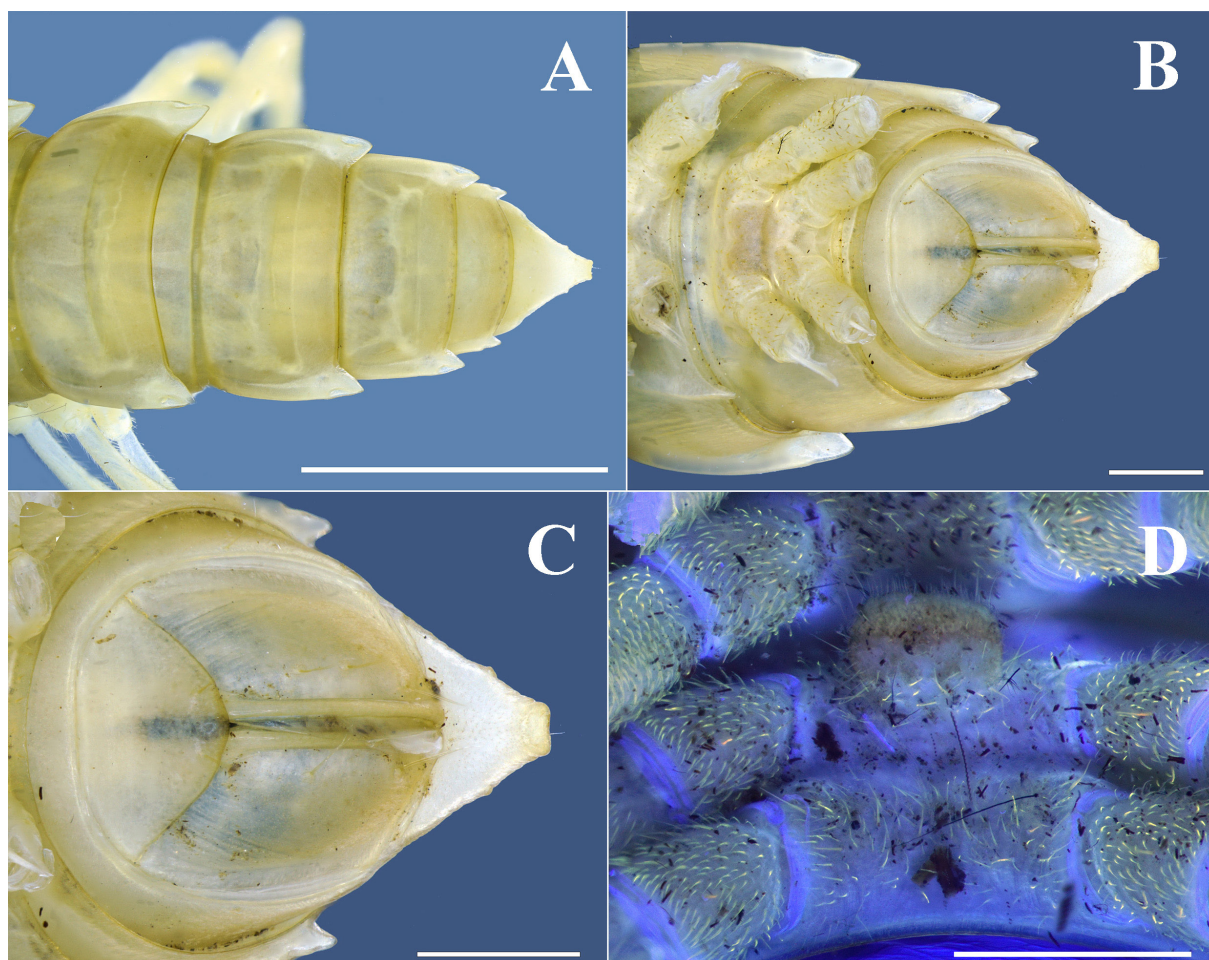


Fig. 6. *Enghoffosoma speculiforme* sp.n., ♂ paratype (IEBR-Myr 629). A, B — posterior part of body, dorsal and ventral views, respectively; C — telson, ventral view; D — sterna between coxae 3–5, ventral view. Scale bars 5 mm (A), 1 mm (B–D). Photographs by Anh D. Nguyen.

Рис. 6. *Enghoffosoma speculiforme* sp.n., паратип ♂ (IEBR-Myr 629). А, В — задняя часть тела, соответственно сверху и снизу; С — тельсон, снизу; D — стерниты между тазиками 3–5, снизу. Масштаб 5 мм (А), 1 мм (В–D). Фотографии Ань Д. Нгуена.

solenomere (sl), clearly separated from femorite by a cingulum. Solenomere erect, helicoid, at base nearly as large and about as long as femorite, gradually tapering towards an acuminate tip; postfemoral process (e) characteristically large, rounded, flattened dorsoventrally and mirror-shaped. Seminal groove running distodorsad entirely mesally along femorite before entering onto a thick solenomere.

REMARKS. The genus *Enghoffosoma* Golovatch, 1993 is presently known to comprise 12 species, all in Southeast Asia and their distributions mapped: Myanmar, southern China, Laos, Cambodia, Thailand and, especially, Vietnam [Nguyen, Golovatch 2016]. All five species of *Enghoffosoma* occurring in Vietnam have been keyed [Nguyen, Golovatch 2016], recorded from the Cat Tien National Park, Dong Nai Province (4 sympatric species) and both the Chu Yan Sin National Park, Dak Lak Province and the Bi Doup-Nui Ba National Park, Lam Dong Province (1 species, *E. fedorenko*). No *Enghoffosoma* species have so far been recorded from either the Kon Ka Kinh National Park or generally the Gia Lai Province.

#### Compliance with ethical standards

CONFLICT OF INTEREST: The authors declare that they have no conflict of interest.

**Ethical approval:** No ethical issues were raised during our research.

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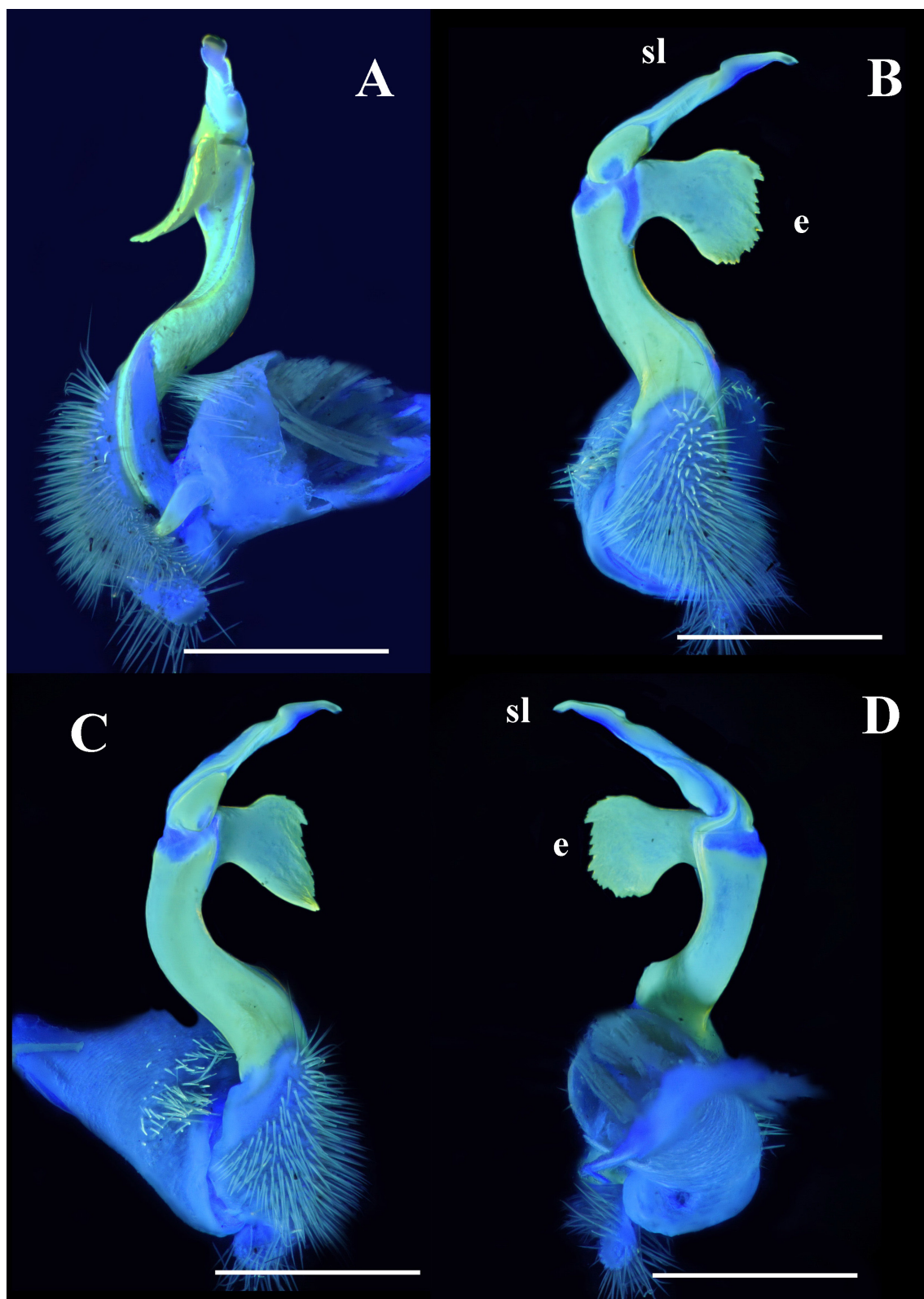


Fig. 7. *Enghoffosoma speculiforme* sp.n., ♂ paratype (IEBR-Myr 629). A–D — right gonopod, mesal, ventral, lateral and dorsal views, respectively. Scale bars 1 mm. Abbreviations: e — postfemoral process; sl — solenomere. Photographs by Anh D. Nguyen.

Рис. 7. *Enghoffosoma speculiforme* sp.n., паратип ♂ (IEBR-Муг 629). А–Д — правый гонопод, соответственно изнутри, снизу, сбоку и сверху. Масштаб 1 мм. Обозначения: е — постферомальный отросток; sl — соленомер. Фотографии Ань Д. Нгуена.



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