

УДК 595.61

## ONE NEW AND TWO LITTLE-KNOWN SPECIES OF THE MILLIPEDE FAMILY CRYPTODESMIDAE FROM INDOCHINA (DIPLOPODA, POLYDESMIDA)

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Received November 8, 2016

*Trichopeltis muratovi* sp. n. is described from forest litter in Laos. It differs from the seven known congeners primarily by certain gonopodal details. *Trichopeltis cavernicola* Golovatch 2016, the only presumed troglobiont among Asian Cryptodesmidae and occurring in a cave in central Laos, is recorded from another cave in the same region. *Circulocryptus faillei* Golovatch 2016, described from forest litter in a nature reserve in southern Vietnam, is recorded from additional three localities in both southern and central Vietnam. All three species are abundantly illustrated, and variation in both poorly-known ones is presented.

**Keywords:** millipede, Cryptodesmidae, *Circulocryptus*, *Trichopeltis*, new species, Laos, Vietnam

**DOI:** 10.7868/S0044513417070066

The (sub)tropical millipede family Cryptodesmidae currently comprises 38 genera and almost 130 species (Minelli, 2015; Golovatch, 2016). It occupies three major areas: Neotropical (Mexico to Argentina), Afrotropical (continental sub-Saharan Africa) and Asian + Australasian (Central Asia and the Himalayas to Japan and Papua New Guinea). In the last realm, Cryptodesmidae encompass only 12 genera (two dubious) and 35 species, just four genera and five species of which inhabit Indochina:

*Niponia nodulosa* Verhoeff 1931, widespread in southern Japan and Taiwan, recently recorded in northern Vietnam (Golovatch et al., 2011; Golovatch, 2016);

*Trichopeltis kometis* (Attems 1938) (= *T. deharvengi* Golovatch, Geoffroy, Mauriès et VandenSpiegel 2010), known from Vietnam, Laos and Cambodia and possibly endemic to the Indochina Peninsula (Golovatch, Akkari, 2016);

*T. cavernicola* Golovatch 2016, a presumed troglobiont described from a single Laotian cave (Golovatch, 2016);

*Ophrydesmus anichkini* Golovatch 2015, described from a tropical forest in southern Vietnam (Golovatch, 2015); and

*Circulocryptus faillei* Golovatch 2016, also from a forest in southern Vietnam (Golovatch, 2016).

The present paper describes a new epigeal cryptodesmid from Laos and provides new records of *C. faillei* and *T. cavernicola*, the former from three

Vietnamese localities and the latter from another Laotian cave.

The type series of *T. muratovi* sp. n. was collected by A. Abdou (Muséum national d'Histoire naturelle, Paris, France) and I. Muratov (Natal Museum, Pietermaritzburg, South Africa) during their collecting trip to Laos. The new samples of *T. cavernicola* were taken in a Laotian cave by P. Beron (Sofia, Bulgaria), those of *C. faillei* in forest litter in Vietnam by T.K. Sergeeva and I.I. Semenyuk (both from Moscow, Russia). Most of the material is deposited in the collection of the Zoological Museum of the Moscow State University, Moscow, Russia (ZMUM), except for one sample which is returned to the National Museum of Natural History, Sofia, Bulgaria (NMNHS), as indicated below.

### *Trichopeltis muratovi*

Golovatch et VandenSpiegel sp. n.  
(Figs 1, 2)

**Material.** Holotype ♂ (ZMUM p3511), Laos, Xieng Khoung Prov., ca 9 km NW of Vieng Thong, shale, clay, black soil, under rocks and logs, old secondary tropical forest, N 20°08.466', E 103°20.099', 870–910 m a.s.l., 12.VI.2006, leg. A. Abdou & I. Muratov. Paratype: 1 ♂ (ZMUM p3512), same data, together with holotype.

**Description.** Length of both holo- and paratype ca 15 mm, width of midbody pro- and metazonae



**Fig. 1.** *Trichopeltis muratovi* sp. n., paratype (1) and holotype (2–5): 1 – habitus, lateral view; 2, 3 – anterior part of body, dorsal and ventral views, respectively; 4 – midbody segments, dorsal view; 5 – posterior part of body, dorsal view. Pictures by K.V. Markarov, taken not to scale.

1.9 and 4.5 mm, respectively. General coloration in alcohol uniformly dark chocolate brown, only legs lighter, yellow- to grey-brown (Fig. 1, 1–5).

Body with 20 segments. In width, head  $\ll$  collum  $<$  segment 2  $<$  3  $<$  4 = 15; thereafter body tapering towards telson.

Head behind labrum densely and clearly microgranulate; epicranial suture superficial, more distinct in vertigial region. Antennae short, clearly clavate (Fig. 1, 3), C-shaped and placed mostly inside a

groove; in length, antennomere 1 = 7  $<$  3 = 4 = 5  $<$  2  $<$  6; antennomeres 5 and 6 each with a small, compact, apicodorsal group of minute bacilliform sensilla. Interantennal isthmus only slightly broader than diameter of antennal socket. Tegument dull to moderately shining, clearly microgranulate almost throughout, only prozonae leathery and finely shagreened. Dorsum rather strongly and regularly convex; paraterga mostly set at about upper 1/3 of body, very strongly developed, mostly a little less convex than mid-dorsal

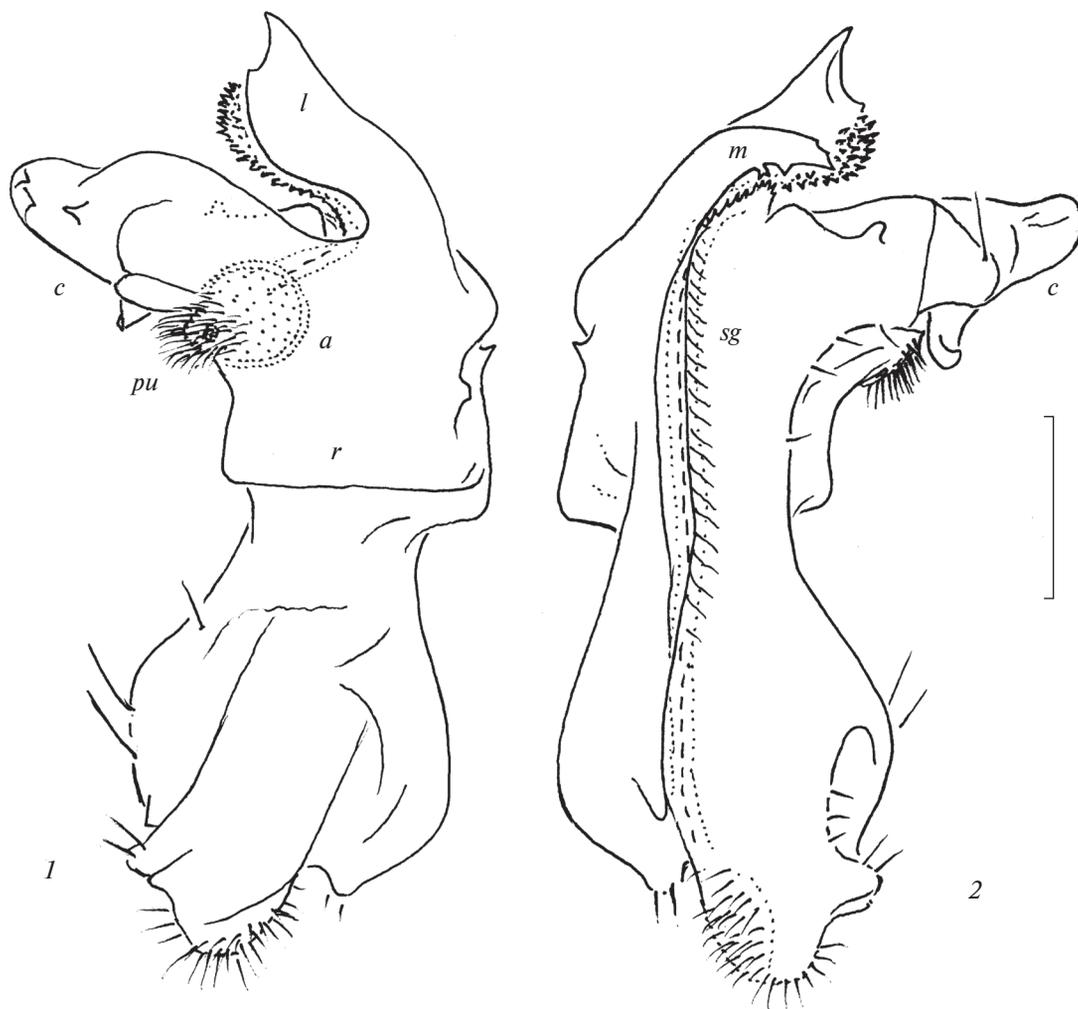


Fig. 2. *Trichopeltis muratovi* sp. n., holotype: left gonopod, lateral (1) and mesal (2) views, respectively. Designations explained in text. Scale bar (mm): 0.2 mm.

region, beginning with collum, tips usually slightly more strongly declined ventrad (Fig. 1, 1–5). Collum flabellate, completely covering the head from above, moderately strongly, but densely lobulated/crenulated along both antero- and caudolateral margins; fore margin slightly concave and less clearly crenulated centrally, caudal margin nearly smooth and regularly concave; paraterga almost pointed terminally; dorsal surface not only densely microgranulate, but also beset with small, irregular, roundish, abundant, setigerous knobs/tubercles (Fig. 1, 2–3).

Postcollum paraterga very broad, each clearly broader than prozona; lateral edge mostly subquadrate until about segment 12, thereafter anterolateral margin increasingly clearly rounded, caudal corner drawn increasingly behind rear tergal margin only in segments 16–19; paraterga 19 produced nearly as far behind as tip of epiproct. Fore margin/shoulder of paraterga straight, with neither radii nor crenulations, but an-

terolateral, lateral and, especially, caudal margins sufficiently distinctly lobulated, anterolateral and lateral edges with 3–10 lobulations, turning increasingly into laterals towards telson; caudal edge not radiate, but moderately lobulate, typically with 11–12 lobulations on each side before base (Fig. 1, 1–5). Mid-dorsal parts of metaterga, like collum, abundantly microgranulate and beset with irregularly scattered, small, rounded, setigerous tubercles/knobs, the latter arranged in 4–5 irregular transverse rows, only caudal row being more regular; 2–3 irregular rows of dorsal knobs growing increasingly obliterated when extended onto distal parts of paraterga. Tergal setae light, pointed, often abraded, but remaining ones well visible, 1/4–1/5 as long as metatergite. Neither an axial line nor pleurosternal carinae. Ozopores invisible, pore formula untraceable. Stricture dividing pro- and metazonae broad, shallow and microgranulate like adjacent metazonae, but more shining. Epiproct (Fig. 1,

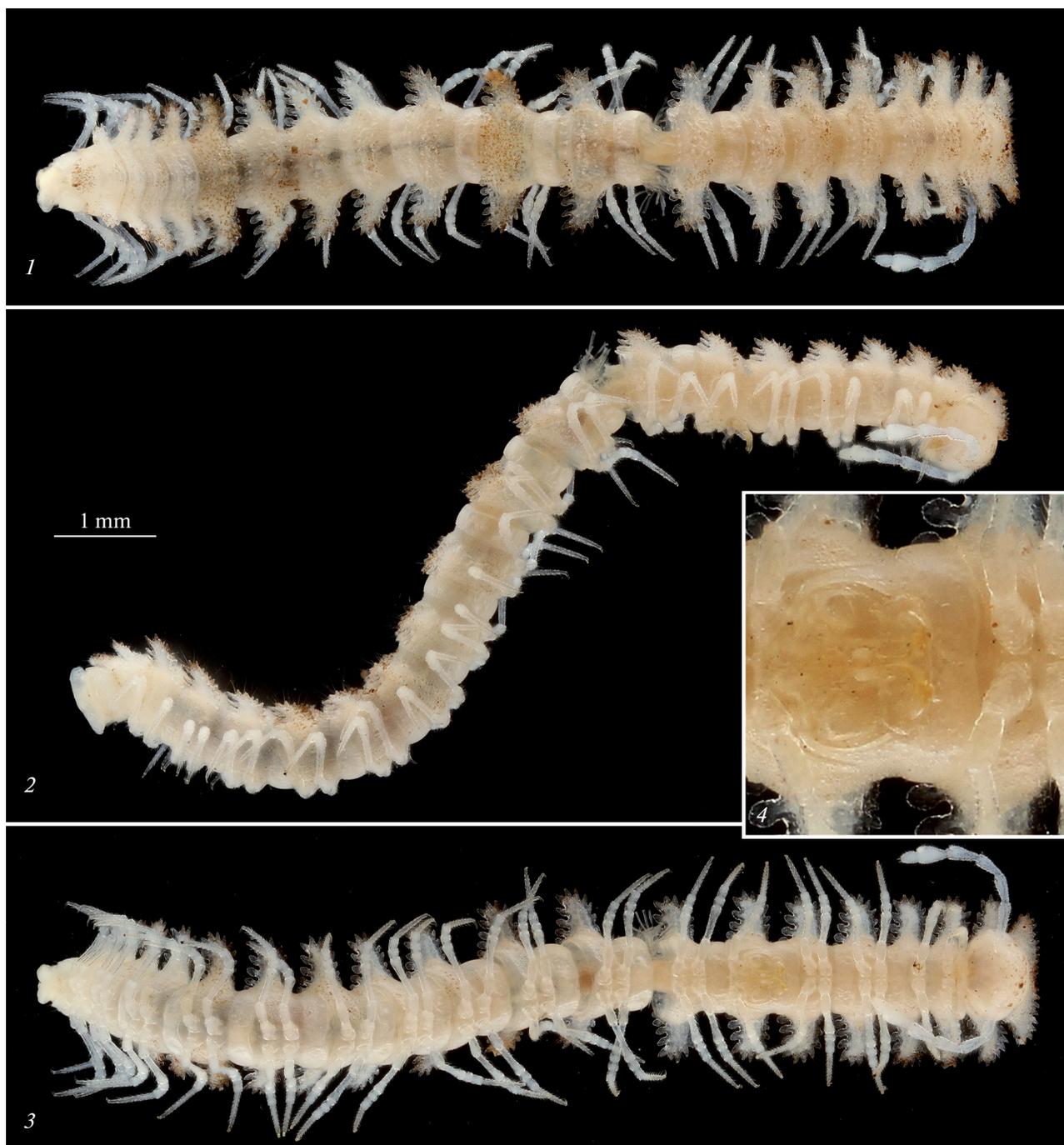


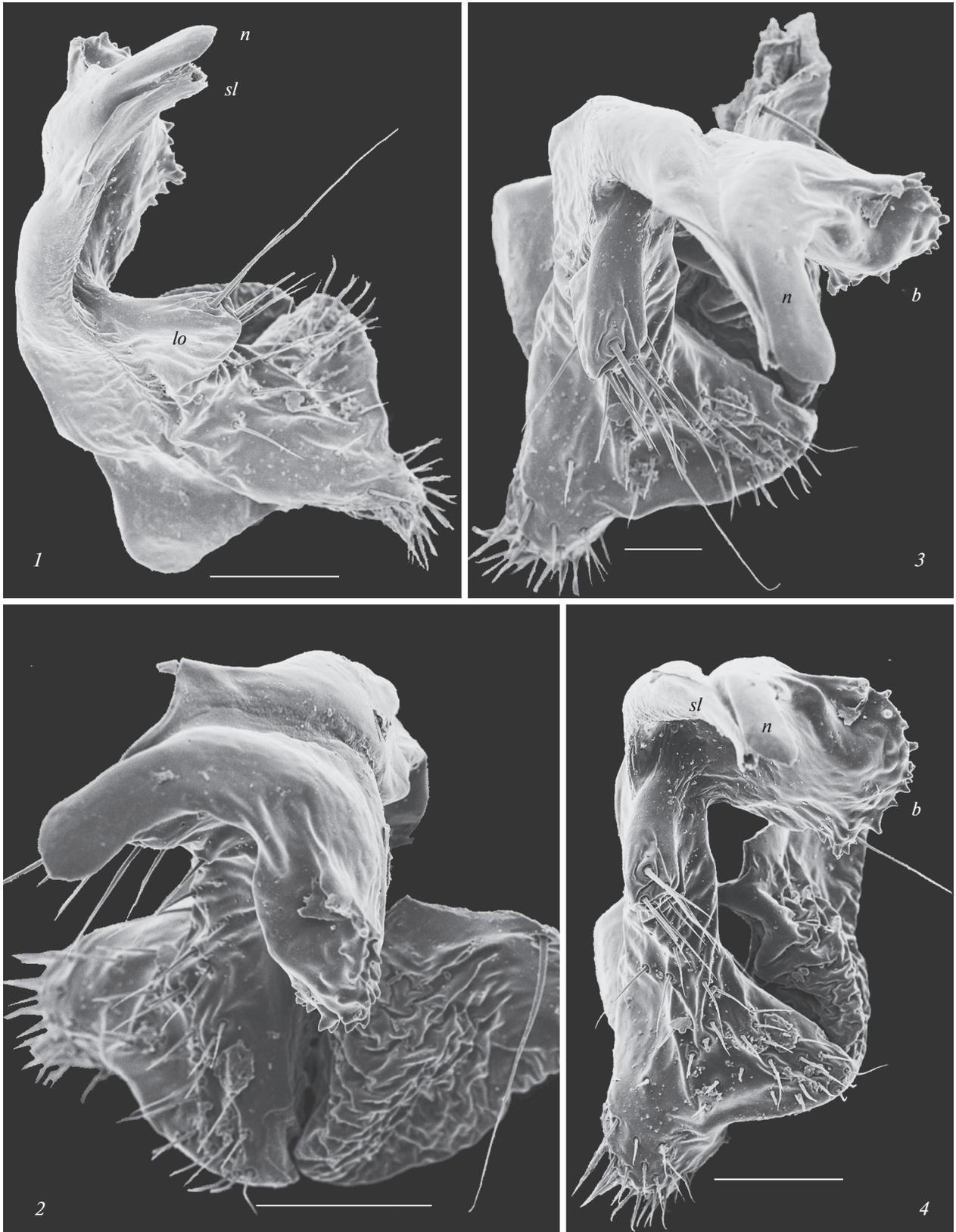
Fig. 3. *Trichopeltis cavernicola* Golovatch 2016, male from Cave Tham Nam Lod: habitus (1–3) and body segments 6 and 7 (4), dorsal, lateral, ventral and ventral views, respectively. Scale bar (mm): 1.0 (1–3) or taken not to scale (4, courtesy J. Brecko).

1, 5) rather long, clearly flattened dorsoventrally, conical, rounded at apex. Hypoproct subtrapeziform, 1 + 1 caudal setae clearly separated, borne on small knobs.

Sternites narrow (Fig. 1, 3), sparsely setose, moderately impressed along main axis, clearly broadened only between coxae 7 and 9, respectively. Legs long and slender, without modifications, about as long as paratergal width (male); in length, femora = tarsi  $\gg$

$\gg$  prefemora > coxae > postfemora and tibiae; gonapophyses on coxae 2 small cones; neither adenostyles nor tarsal brushes. Claws simple, slightly curved ventrad. Gonopod aperture transversely ovoid, caudal and lateral margins thin, slightly elevated.

Gonopods (Fig. 2, 1–2) complex, in situ both held parallel to each other. Telopodite stout, slightly curved caudodistally, somewhat constricted at about mid-



**Fig. 4.** *Trichopeltis cavernicola* Golovatch 2016, male from Cave Tham Nam Lod: SEM micrographs of left gonopod, mesal, sub-lateral, ventromesal and ventral views, respectively. Designations explained in text. Scale bars (mm): 0.1 (1, 2, 4) and 0.05 (3).

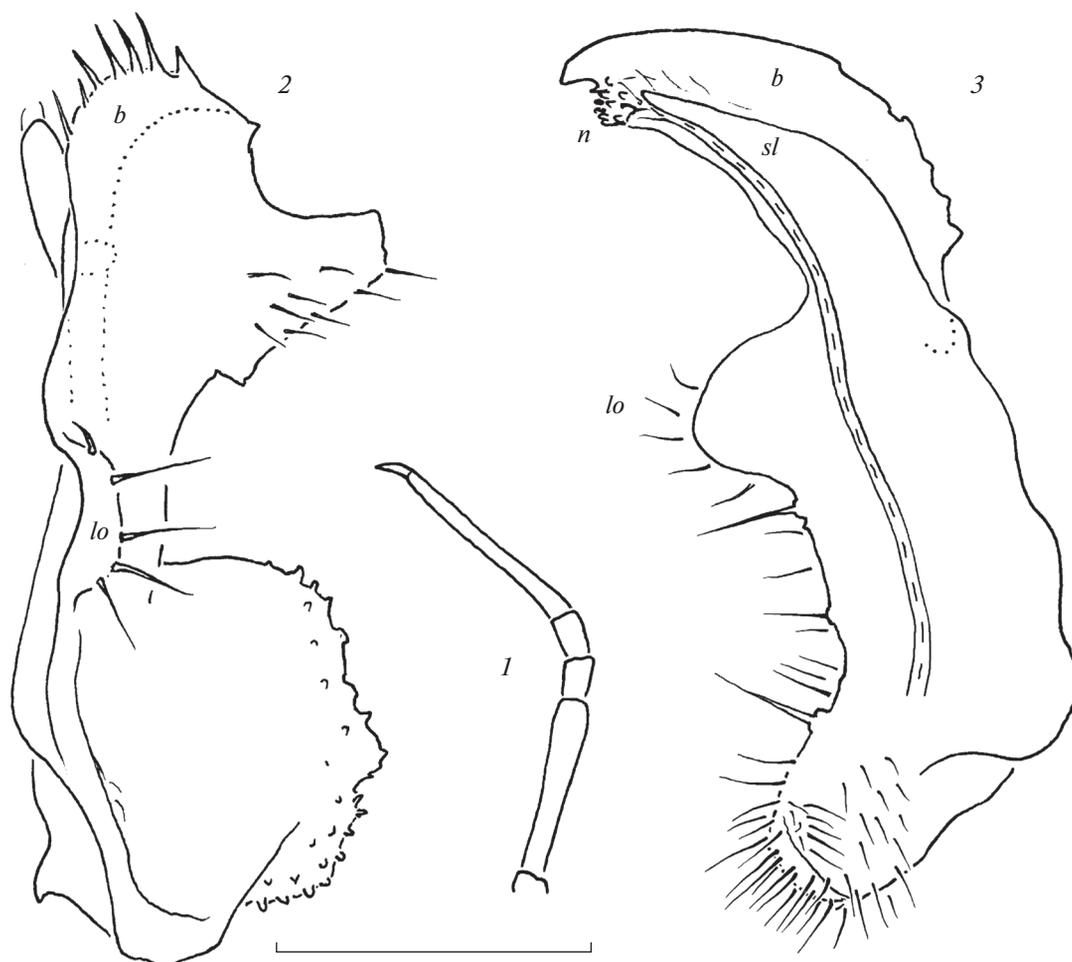


Fig. 5. *Trichopeltis cavernicola* Golovatch 2016, male from Cave Tham Nam Lod: leg 7 (1) and right gonopod (2, 3), lateral, sub-lateral and mesal views, respectively. Scale bar (mm): 0.2 (2, 3) and depicted not to scale (1). Designations explained in text.

length. Distal half delimited by an evident, transverse, laterobasal ridge (*r*); acropodite tripartite, divided into a prominent distocaudal, somewhat folded, complex, finger-shaped protuberance (*c*) and two apical processes, i.e. a curved, irregular, acuminate, mesal blade (*m*) and a higher, larger, basally abundantly microdentate, also acuminate, lateral tooth (*l*). Seminal groove (*sg*) largely mesal, delimited by a finely striolate fold until a short apical loop at the very joint base of both *l* and *m* to move laterad and quickly debauch into a well-developed accessory seminal chamber (*a*), the latter with an evident hairy pulvillus (*pu*) at a orifice.

**Diagnosis and remarks.** The genus *Trichopeltis* Pocock 1894 (= *Otodesmus* Cook 1896, = *Pseudoniponiella* Verhoeff 1942) has recently been reviewed and rediagnosed; it presently comprises the following seven species, nearly all keyed (Golovatch et al., 2010; Golovatch, 2016; Golovatch, Akkari, 2016):

*T. bicolor* (Pocock 1894), the type-species, Sumatra, Indonesia;

*T. cavernicola* Golovatch 2016, a cave in Laos;

*T. doriae* (Pocock 1895), Myanmar;

*T. feae* (Pocock 1895), Myanmar;

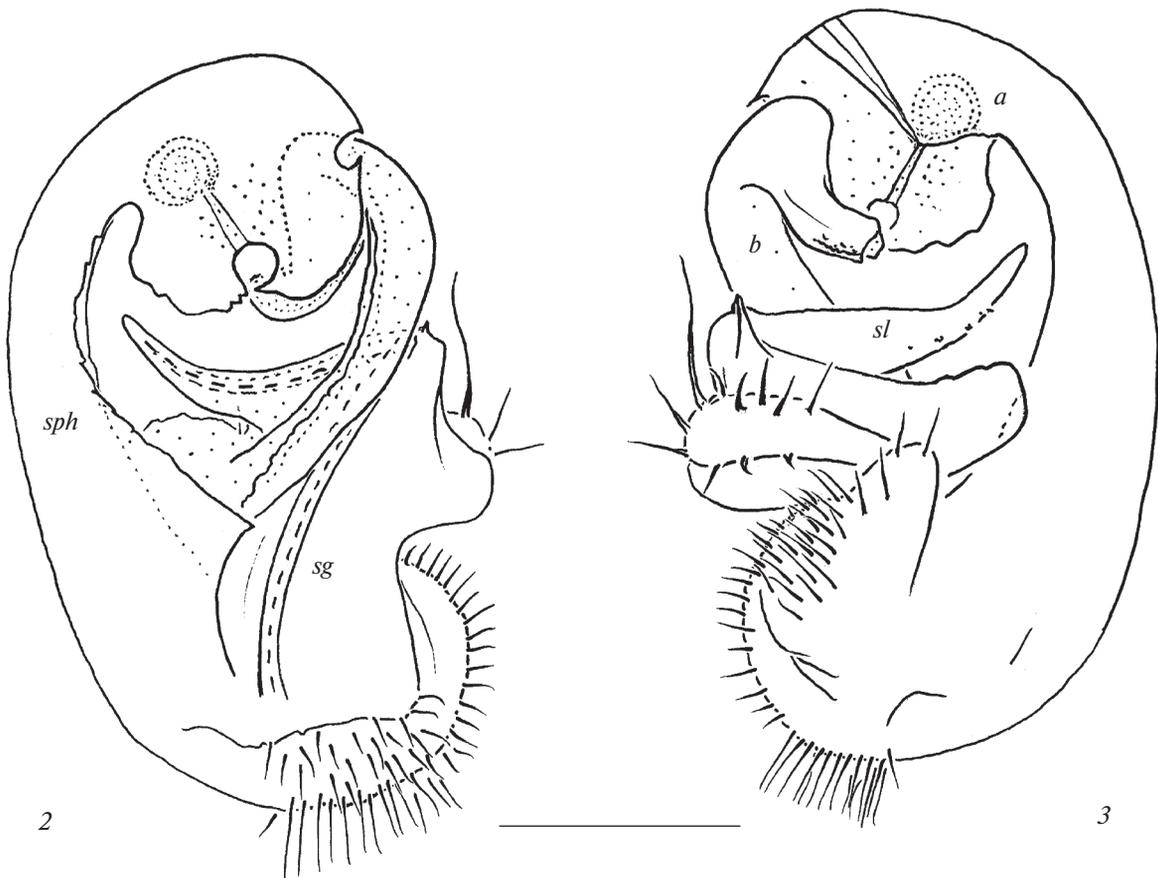
*T. kometis* (Attems 1938), Vietnam, Laos and Cambodia;

*T. latellai* Golovatch, Geoffroy, Mauriès et VandenSpiegel 2010, two caves in Guizhou Province, southern China; and

*T. watsoni* (Pocock 1895), Myanmar and Darjeeling District, India.

Using the available key (Golovatch et al., 2010), *T. muratovi* sp. n. keys out to couplet 2, but differs from all congeners by a relatively shallow notch between the apical branches of the gonopod, the absence of visible ozopores and a solenomere, and the presence of a midlength gonopodal constriction, a considerable accessory seminal chamber and an evident hairy pulvillus (Fig. 2, 1–2).

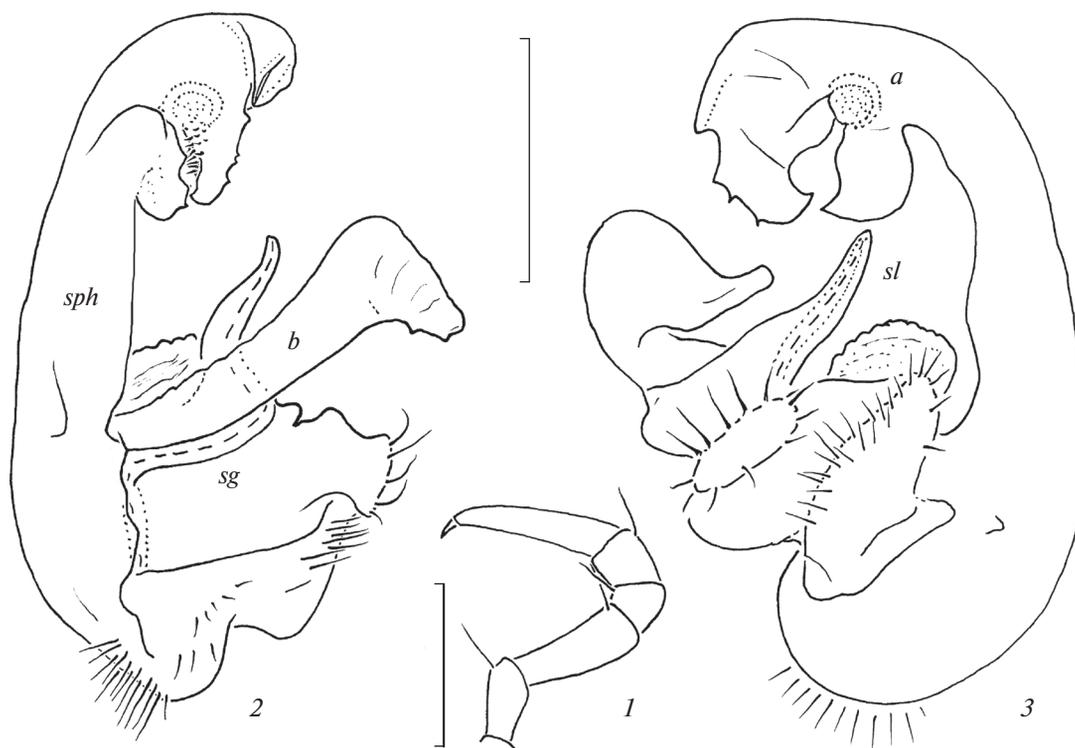
**N a m e.** Honours Igor Muratov, one of the collectors.



**Fig. 6.** *Circulocryptus faillei* Golovatch 2016, males from Kon Tum Province: 1 – live animal, dorsal view; 2, 3 – left gonopod, mesal and lateral views, respectively. Designations explained in text. Scale bar (mm): 0.2 (2, 3) or taken not to scale (1, courtesy I.I. Semenyuk).



**Fig. 7.** Habituses of *Circulocryptus faillei* Golovatch 2016, males from Kon Chu Rang (1–3) and Buon Luoi (4, 5), alcohol material, dorsal, lateral, ventral, dorsal and ventral views, respectively. Pictures by K.V. Makarov, taken not to scale.



**Fig. 8.** *Circulocryptus faillei* Golovatch 2016, male from Kon Chu Rang: 1 – leg 8, lateral view; 2, 3 – left gonopod, mesal and lateral views, respectively. Designations explained in text. Scale bars (mm): 0.5 (1) and 0.2 (2, 3).

*Trichopeltis cavernicola* Golovatch 2016  
(Figs 3–5)

*Trichopeltis cavernicola* Golovatch 2016: 34, original description.

**Material.** 2 ♂♂, 1 ♀ (NMNHS), 1 ♂ (ZMUM p3490), Laos, Khammouane Prov., ca 65 km N of Thakaek, Cave Tham Nam Lod, 21.I.2016, leg. P. Beron.

**Descriptive notes.** The new material constitutes near-topotypes that allow us to refine the original description (Golovatch, 2016). New illustrations of this troglomorphic species (Figs 3–5) show a pallid, nearly transparent body which is 10–11 mm long, 0.9 and 1.6–1.7 mm wide on midbody pro- and metazonae, respectively (vs 0.8 and 1.7 mm in the holotype). The paraterga are mostly upturned, while the legs and antennae, unusually long and slender, only reinforce the troglomorphic appearance of this first presumed troglobiont Asian cryptodesmid.

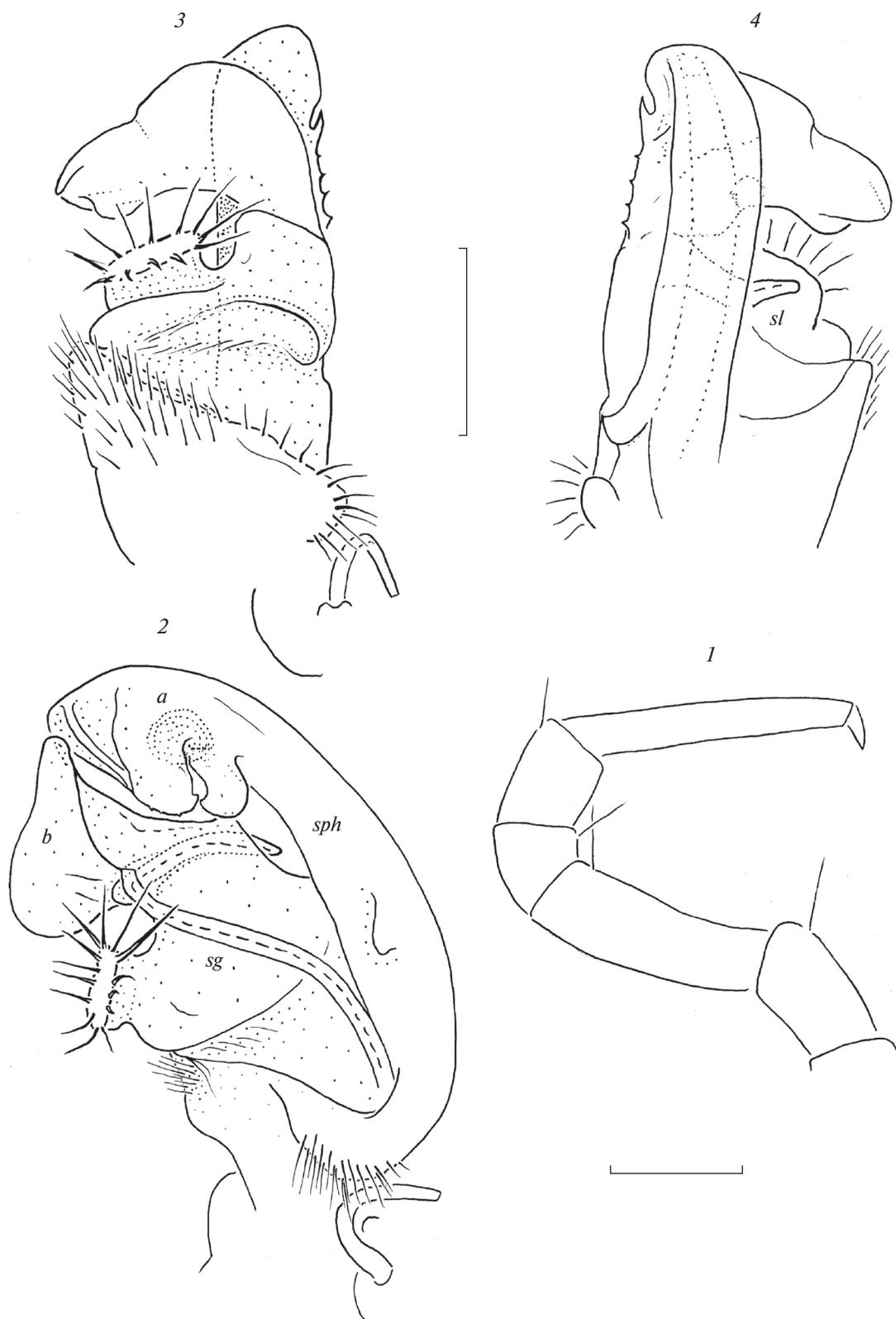
The gonopodal telopodite (Figs 4; 5, 2–3) has a small, rounded, setose, caudal lobe (*lo*) near midlength, while the complex acropodite curves distocaudad. In addition, there is a notch between the mesal branch (*n*) accompanying a rudimentary rod-shaped solenomere (*sl*) and a large, lateral, densely microdentate, setose, irregularly shaped projection (*b*).

*Circulocryptus faillei* Golovatch 2016  
(Figs 6–9)

*Circulocryptus faillei* Golovatch 2016: 39, original description.

**Material.** 7 ♂♂, 1 ♀ (ZMUM p3513, ZMUM p3514), Vietnam, Kon Tum Prov., N 14°43.455', E 108°18.882', 1000–1260 m a.s.l., tropical forest, rotting wood, suspended soil, on logs and in leaf litter, IV.2015, leg. I.I. Semenyuk; 1 ♂ (ZMUM p3515), Vietnam, Gia Lai Prov., Kon Chu Rang Nature Reserve, N 14°30'54", E 108°32'47", 1000 m a.s.l., mixed tropical forest, on log, V.2016, leg. I.I. Semenyuk; 1 ♂ (ZMUM p3516), Vietnam, Gia Lai Prov., Tay Nguyen Plateau, ca 65 km N of Ankhe, Buon Luoi Research Station, primary tropical forest, litter, 9.I.1981, leg. T.K. Sergeeva.

**Descriptive notes.** Compared to the holotype which comes from Khanh Hoa Province, southern Vietnam (Golovatch, 2016), the new samples show the following variations. Body length 14–15 (male) or 16 mm (female), width of midbody prozonae 0.9–1.1 (male) or 1.5 mm (female), width of midbody paraterga 2.9–3.1 (male) or 3.7 mm (female) (vs 11, 1.2 and 2.9 mm, respectively). Coloration dull reddish brown, dark brown or brown, only venter, legs and partly head with antennae considerably lighter, yellowish to light brown (Figs 6, 1; 7) (vs mostly red to



**Fig. 9.** *Circulocryptus faillei* Golovatch 2016, male from Buon Luoi: 1 – leg 8, lateral view; 2–4 – right gonopod, mesal, aboral and oral views, respectively. Designations explained in text. Scale bars (mm): 1.0 (1) and 0.2 (2–4).

light reddish). All other somatic characters and leg structure as in holotype (Figs 6, 1; 7; 8, 1; 9, 1).

Gonopods (Figs 6, 2–3; 8, 2–3; 9, 2–4) show minor variations in the shape and armament of certain outgrowths of the telopodite. Thus, the distal part of the parbasal process *b* subtending a curved solenomere (*sl*) can be more or less complex, subunciform, *sl* quite long, directed laterad, more or less clearly barbed, terminating a mostly mesal seminal groove (*sg*); the distal third of the solenophore branch (*sph*) bilobate and fringed/microspiculate. In contrast to the holotype, however, the new samples show a distinct accessory seminal chamber (*a*) with faint rudiments of a pulvillus (visible as an indistinct field of minute spikes near *a* orifice), but no traces of a small mesal trichostele at the very base of the telopodite.

**Remarks.** Taking into account the rather vast distribution of *C. faillei*, at least in southern and central Vietnam, all the minor morphological variations seem to be individual or populational at most, with only a single species being actually involved.

#### ACKNOWLEDGEMENTS

We are most grateful to all collectors who rendered us their material for study. The sole picture of a live animal (Fig. 6, 1) belongs to Irina I. Semenyuk (Institute for Problems of Ecology and Evolution, Russian Academy of Sciences, Moscow, Russia), published here through her kind permission. Focus stacking pictures were skillfully taken by J. Brecko (Royal Museum for Central Africa, Tervuren, Belgium) or K.V. Makarov (Moscow Teachers' Training University, Moscow,

Russia). Both Kirill G. Mikhailov and Elena Kudryavtseva kindly helped us incorporate certain material into the ZMUM collection. Rowland Shelley (Department of Entomology and Plant Pathology, University of Tennessee, Knoxville, U.S.A.) very generously revised the English of an advanced draft.

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## ОДИН НОВЫЙ И ДВА МАЛОИЗВЕСТНЫХ ВИДА ДИПЛОПОД СЕМЕЙСТВА CRYPTODESMIDAE ИЗ ИНДОКИТАЯ (DIPLOPODA, POLYDESMIDA)

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Описан новый вид, *Trichopeltis muratovi* sp. n., собранный в лесной постилке в Лаосе. Он отличается от всех семи других видов этого рода, прежде всего, некоторыми деталями строения гонопода. *Trichopeltis cavernicola* Golovatch 2016, единственный предположительно троплобионт среди азиатских Cryptodesmidae, описанный из пещеры в Центральном Лаосе, обнаружен еще в одной пещере в том же районе. Вид *Circulocryptus faillei* Golovatch 2016, описанный из лесной подстилки в заповеднике в Южном Вьетнаме, отмечен в трех других местах в Южном и Центральном Вьетнаме. Описание всех видов подробно иллюстрированы, приведены данные по изменчивости двух малоизвестных форм.

**Ключевые слова:** диплопода, Cryptodesmidae, *Circulocryptus*, *Trichopeltis*, новый вид, Лаос, Вьетнам