

***Dryadillo longiantenna* sp. nov., A NEW SPECIES OF CAVE-DWELLING
TERRESTRIAL ISOPODS (Oniscidea, Armadillidae) FROM A KARSTIC
ISLAND IN QUANG NINH PROVINCE, NORTH VIETNAM**

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ABSTRACT

Dryadillo longiantenna sp. nov. is described from subterranean habitats in North Vietnam. The species shows some troglomorphic traits, such as the reduction of pigment, reduction of eyes, and elongation of appendages. It can be distinguished from its congeners by the eyes formed by only 5 ommatidia, the very long fifth segment of peduncle and proximal segment of flagellum of antenna, large rounded ventral lobes on epimera of pereonite 2, uropod with narrow protopod and no sexual modifications of the male pereopod 7.

Keywords: *Dryadillo*, new species, troglobiont, Nha Tro cave, Vietnam.

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INTRODUCTION

The genus *Dryadillo* was established by Herold (1931) to accommodate nine species from Java, Bali, Flores and Lombok (Indonesia). However, Herold (1931) did not choose any type species for his *Dryadillo*, so this name was unavailable because it does not comply with Article 13.3 of the International Code of Zoological Nomenclature (ICZN). Taiti et al. (1992) revalidated the name *Dryadillo* by designating *Dryadillo baliensis* Herold, 1931 as the type species of the genus. The diagnostic characters of the genus are the following: (1) the cephalon with the frontal lamina not protruding above vertex; (2) the epimeron of pereonite 1 with lateral margin not thickened, posterolateral corner with a shallow schisma with inner lobe shorter than outer one; (3) the pereonite 2 with small semicircular ventral lobe; (4) telson with distal part narrower than basal; (5) uropodal protopod with dorsal medial tooth and short exopod (Taiti et al., 1992). According to the re-examination of syntypes of Herold's specimens, Kwon & Taiti (1993) distinguished the genus into two groups: the group of species with one nodulus lateralis per side on each pereonite more or less at the same distance from the lateral margin, and a second group with one nodulus lateralis per side on pereonites 1–6, with that on pereonite 4 far from the lateral margin, and two noduli per side on pereonite 7 (Kwon & Taiti, 1993; Taiti & Gruber, 2008).

The genus *Dryadillo* currently contains 17 species. The former group includes 10 species: *Dryadillo arcangelii* Herold, 1931, *Dryadillo montanus* Herold, 1931 and *Dryadillo schellenbergi* Herold, 1931 from Lombok, *Dryadillo chengziensis* Dai & Cai, 1998, *Dryadillo jinghongensis* Dai & Cai, 1998, *Dryadillo guizhouensis* Taiti & Gruber, 2008, and *Dryadillo parviocellatus* Taiti & Gruber, 2008 from China, *Dryadillo maculatus* (Arcangeli, 1927) from China and Vietnam, and *Dryadillo uenoi* Nunomura, 1995 from Vietnam. The latter group includes five species, *Dryadillo baliensis* Herold, 1931 from Bali, *Dryadillo hebereri* Herold, 1931 and *Dryadillo*

sexlineatus Herold, 1931 from Flores, *Dryadillo rectifrons* (Dollfus, 1898) and *Dryadillo kemaensis* Taiti, Ferrara & Kwon, 1992 from Sulawesi. For three species, *Dryadillo bedaliensis* Herold, 1931, *Dryadillo feuerborni* Herold, 1931 from Java, *Dryadillo magnificus* Herold, 1931 from Flores, no information is known on the number and position of noduli laterales (Taiti & Gruber, 2008).

In Vietnam, only a few publications exist about Vietnamese terrestrial isopods (Arcangeli, 1927, 1952; Taiti & Ferrara, 1988; Kwon et al., 1992; Ferrara et al., 1995) and most of the research on this group has been focused on the mountain forests. For the subterranean environment of Vietnam, including cave habitats, only one study by Nunomura (1995) is present, with descriptions of two terrestrial isopod species (*Dryadillo uenoi* and *Burmoniscus* sp.) from caves on limestone islands in Ha Long Bay.

In this paper, we describe a new species of *Dryadillo* from a karstic cave on Tra Ban Island, located in the Bai Tu Long Bay, Northeast Vietnam.

MATERIALS AND METHODS

Specimens were collected from small wood fragments on moist soil floor surface ca. 120 m into the dark zone area of Nha Tro cave (geographic coordinates of the cave entrance: 20°57'31.0"N, 107°29'12.1"E), which is located on Tra Ban Island in Bai Tu Long Bay, Quang Ninh Province, North Vietnam. This karst cave, located 17 m above sea level, has a large entrance and is about 350 m long, 10 m high and 15 m deep (Donatis et al., 2010; Tran & Chang, 2020). The cave is wet with some temporary small pools and clay deposits during the rainy season. The specimens were fixed in 75% ethanol. The appendages were dissected and mounted in glycerol. Specimens were observed and measured with a stereo microscope (Olympus SZX16) and a differential interference contrast microscope (Nikon Eclipse Ni-U).

Material used for scanning electron microscopy (SEM) was fixed in 2.5% glutaraldehyde in 0.1 M phosphate buffer (pH

7.2–7.4) for 2 hours, followed by fixation in 1% cold osmium tetroxide (at about 5 °C) in the same buffer for 12 hours. After dehydration through a graded series of ethanol (70, 80, 90, 95 and 100%) for 30 minutes each, the material was critical point dried, coated with gold/palladium, and then examined with a scanning electron microscope (Thermo Scientific Prisma E) operated at 10 KV.

Type specimens are deposited in the Institute of Biology (IB), Ha Noi, Vietnam.

RESULTS AND DISCUSSION

Systematic account

Family Armadillidae Brandt, 1831

Genus *Dryadillo* Taiti, Ferrara & Kwon, 1992

Dryadillo longiantenna sp. nov.

Material examined

Holotype: ♂ (IB-ISOP2018-068), 10.2 mm long, 6.0 mm wide, dissected, Quang Ninh province, Tra Ban Island, Nha Tro Cave; 9 May 2018; leg. D.L. Tran.

Allotype: ♀ (IB-ISOP2018-069), 12.8 mm long, 6.9 mm wide, dissected, data as for holotype.

Paratypes: 1 ♂ (IB-ISOP2018-070), 10.0 mm long, 5.8 mm wide, dissected, data as for holotype; 1 ♀ (IB-ISOP2018-071), 13.0 mm long, 6.9 mm wide, dissected, data as for holotype; 1 ♂ (IB-ISOP2023-072), 9.8 mm long, 5.2 mm wide, dissected, same locality as for holotype; 20 March 2023; leg. T.C. Nguyen; 1 ♀ (IB-ISOP2023-073), 12.2 mm long, 6.8 mm wide, dissected, same locality as for holotype; 20 March 2023; leg. T.C. Nguyen; 7 ♂♂ and 12 ♀♀ (IB-ISOP2018.05.09), preserved intact, data as for holotype; 4 ♂♂ and 8 ♀♀ (IB-ISOP2023.03.20), preserved intact, same locality as for holotype; 20 March 2023; leg. T.C. Nguyen; 2 ♂♂ and 2 ♀♀, data as for holotype, prepared for SEM examination, retained in the collection of the corresponding author (DLT).

Description

Maximum dimensions: ♂, 10.2 × 6 mm; ♀, 13 × 6.9 mm. Body colourless, dorsum smooth and very convex, animals able to roll up into a ball. Dorsal cuticle covered with small triangular scale-setae; pereonites 1–7 bearing one nodulus lateralis per side inserted more or less on same line, far from lateral margins of segments (Fig. 1).

Cephalon (Figs. 2A–C) with frontal shield with triangular depression and turned back on vertex in middle part, upper margin protruding above vertex at sides and slightly concave upper margin; in frontal view, lateral sides of shield rounded.

Eye reduced, visible only as five tiny dots of pigment (Figs. 2A–B).

Pereonite 1 (Figs. 2B, 3A) with lateral part flat and slightly curved outwards; deep schisma on posterolateral corner with rounded inner and outer lobes, outer lobe protruding posteriorly compared to inner one. Pereonite 2 (Fig. 3B) with triangular epimera, bent caudally with a rounded ventral lobe. Pereonites 3–4 (Figs. 3C–D) with triangular epimera with rounded apices. Pereonite 5 (Fig. 3E) with quadrangular epimera, distal margin curved. Pereonites 6–7 (Figs. 3F–G) with quadrangular epimera, distal margin almost straight.

Telson (Fig. 2E) hourglass-shaped, slightly longer than wide, basal part wider, distal part with distal margin at obtuse angle. Antennula (Fig. 2D) of three articles, second article much shorter than first and third, a series of superimposed short aesthetascs on distal half of third article. Antenna (Figs. 4A–B) long and slender, reaching rear margin of pereonite 4; flagellum shorter than fifth segment of peduncle, distal article of flagellum about 1.5 times as long as proximal one with row of 8 aesthetascs in middle part. Mandibles (Figs. 4C–D) with molar penicil semidichotomized, consisting of numerous plumose setae arising from common stem; right mandible with 2 and left one with 3 penicils between molar penicil and lacinia mobilis. Maxillula (Fig. 4E) with outer branch

bearing 4 + 6 simple teeth; inner branch with rounded distal margin bearing two thickset penicils. Maxilla (Fig. 4F) distally bilobate, with inner lobe distinctly narrower than outer lobe, covered with numerous short setae at apex. Maxilliped (Fig. 4G) with endite rectangular, bearing three stout setae on distal

margin and conical process at inner angle; palp reduced, two segmented, proximal segment rectangular with two setae, distal segment with slender distal part divided from proximal one by indistinct suture and bearing two long, stout setae on inner margin of proximal part.

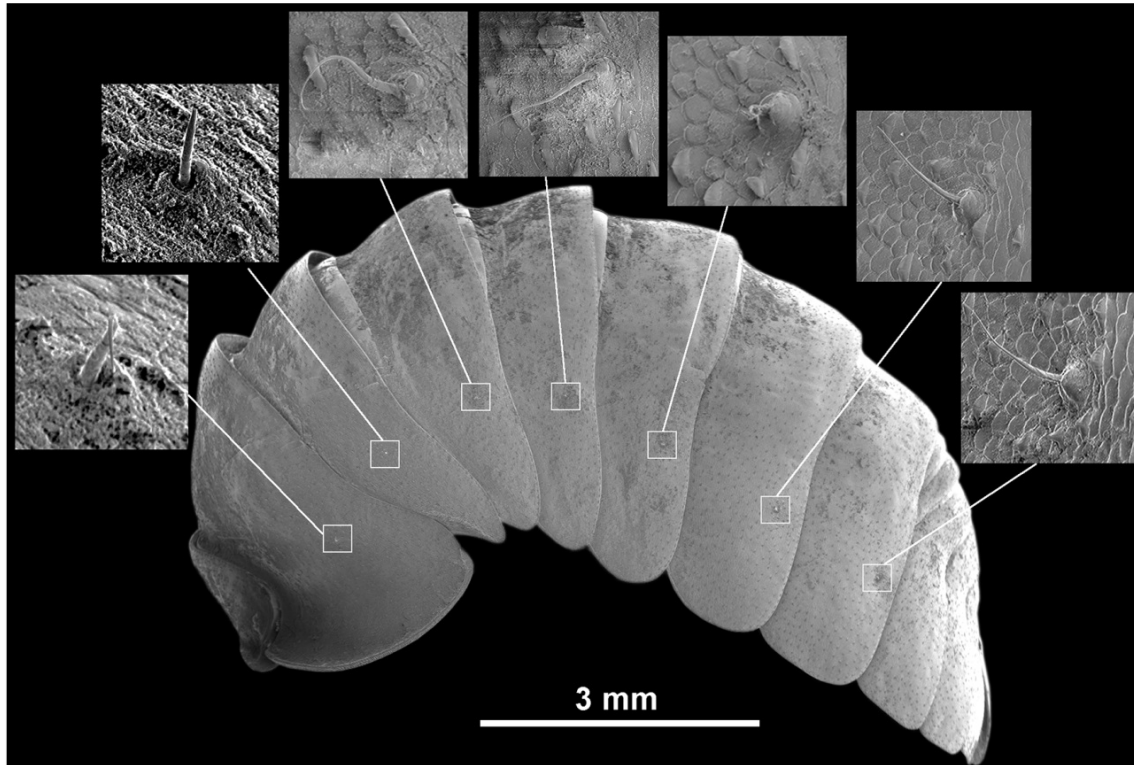


Figure 1. *Dryadillo longiantenna* sp. nov. SEM micrograph, male. Body (lateral view) with position of noduli laterales (in quadrangular frames). Antennae and all pereopods removed

All pereopods long and slender. Pereopod 1 (Fig. 5A) with basis oblong, about 4.9 times as long as wide, bearing numerous short setae on sternal and tergal margins; ischium about 0.6 times as long as basis; merus 0.7 times as long as ischium, with 10–12 setae on sternal margin and 3 setae on tergal distal corner; carpus 1.15 times as long as merus, with setose groove on rostral surface; propodus elongated, 1.3 times as long as carpus, with 5 shorter setae on basal half and 5 longer setae on distal half of sternal margin.

Pereopods 2–6 (Figs. 5B–F) all similar in shape and equal in size, with basis elongated,

about 5.2 times as long as wide, bearing numerous short setae on sternal and tergal margins; ischium about 0.6 times as long as basis; merus 0.6 times as long as ischium, with 6–8 setae on sternal margin and 1–2 setae on tergal distal corner; carpus elongated, 1.5 times as long as merus, sternal margin with 8–10 long setae, tergal margin, rostral and caudal surfaces with many short setae; propodus as long as carpus, sternal margin with 5–8 long setae, tergal margin, rostral and caudal surfaces with many short setae.

Pereopod 7 (Figs. 5G–H) with basis about 4.5 times as long as wide, with two setae on

sternal distal corner and bearing numerous short setae on sternal and tergal margins; ischium about 0.8 times as long as basis; merus 0.6 times as long as ischium, with 3 setae on tergal distal corner; carpus elongated,

1.6 times as long as merus, with 10–12 long setae on sternal margin; propodus 1.1 times as long as carpus, sternal margin with 9–10 long setae, tergal margin, rostral and caudal surfaces with many short setae.

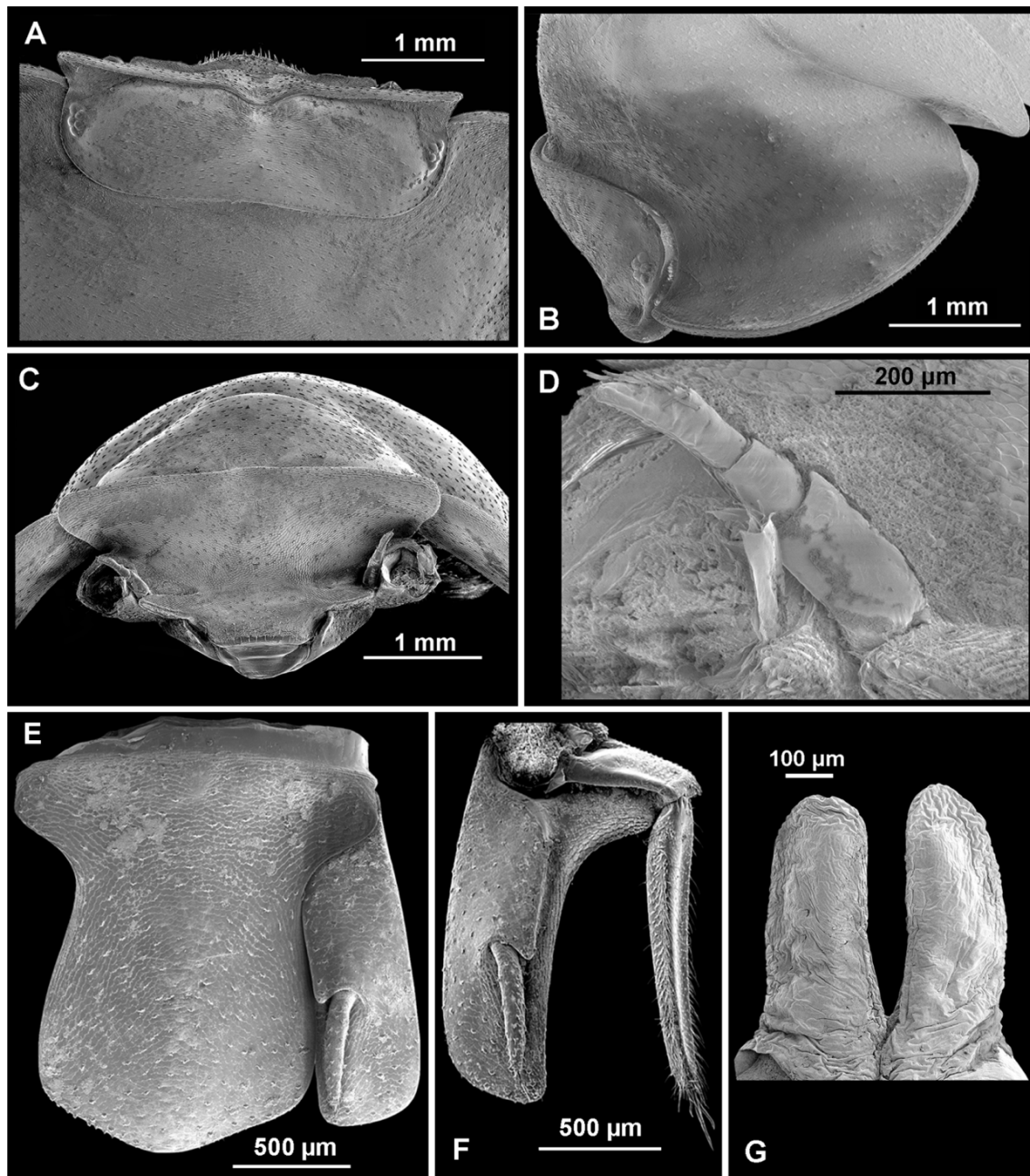


Figure 2. *Dryadillo longiantenna* sp. nov. SEM micrographs, male. A, cephalon, dorsal view; B, cephalon, pereonites 1 and 2, lateral view; C, cephalon, frontal view; D, antennula; E, telson and right uropod, dorsal view; F, left uropod, dorsal view; G, ventral lobes of pereonite 7



Figure 3. *Dryadillo longiantenna* sp. nov. SEM micrographs, male. A–G, epimera of pereonites 1–7, ventral view; H, epimera of pleonites 3–5, ventral view

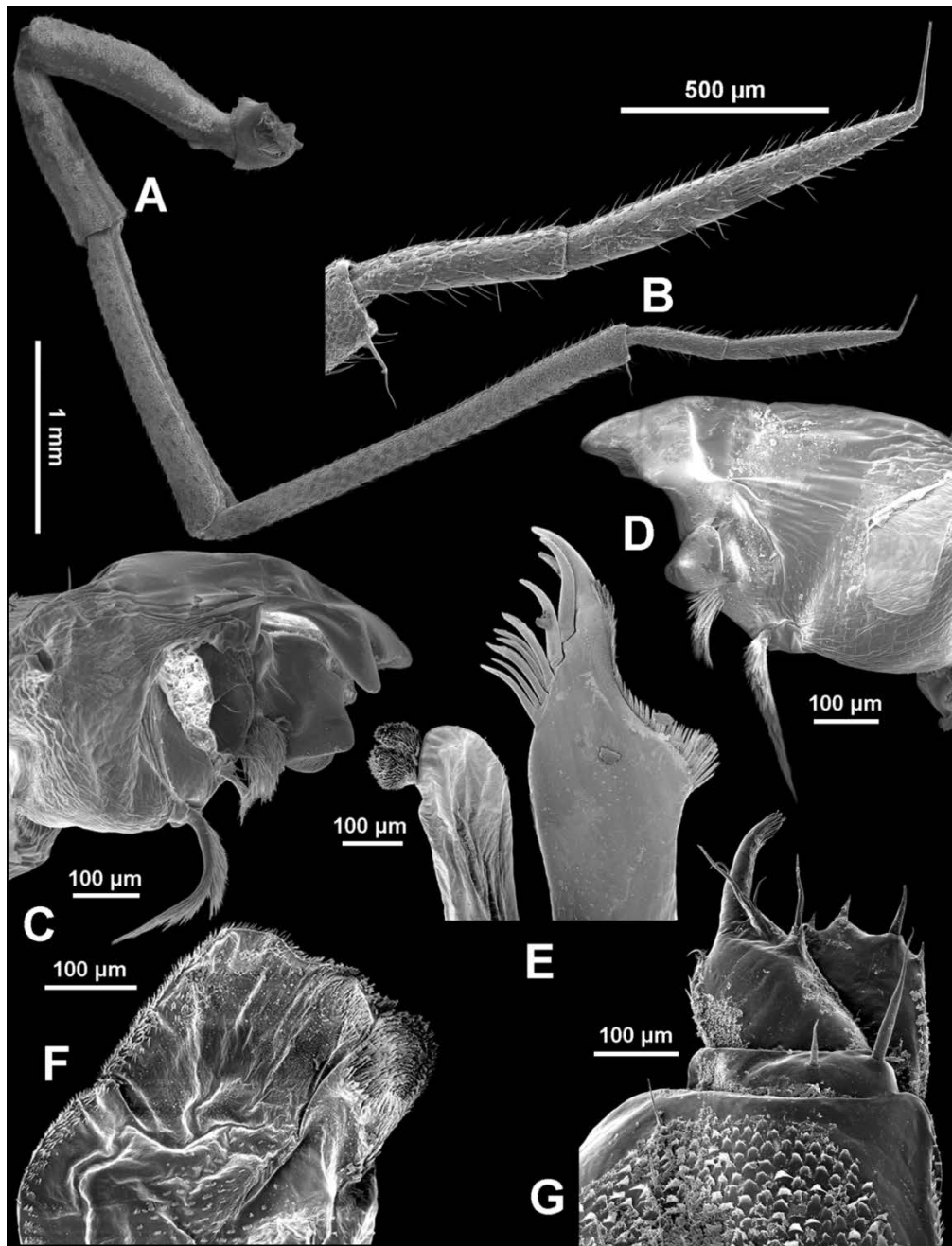


Figure 4. *Dryadillo longiantenna* sp. nov. SEM micrographs, male. A, antenna; B, flagellum of antenna; C, left mandible; D, right mandible; E, maxillula; F, maxilla; G, maxilliped

All pleopodal exopods with monospiracular lungs.

Uropod (Fig. 2F) protopod elongated, with quadrangular distal part reaching tip of telson; exopod thin, inserted dorsally beneath

large tooth in middle of protopod; endopod long, almost reaching rear margin of protopod.

Male. Ventral lobe of pereonite 7 (Fig. 2G) with deeply bilobed median part.

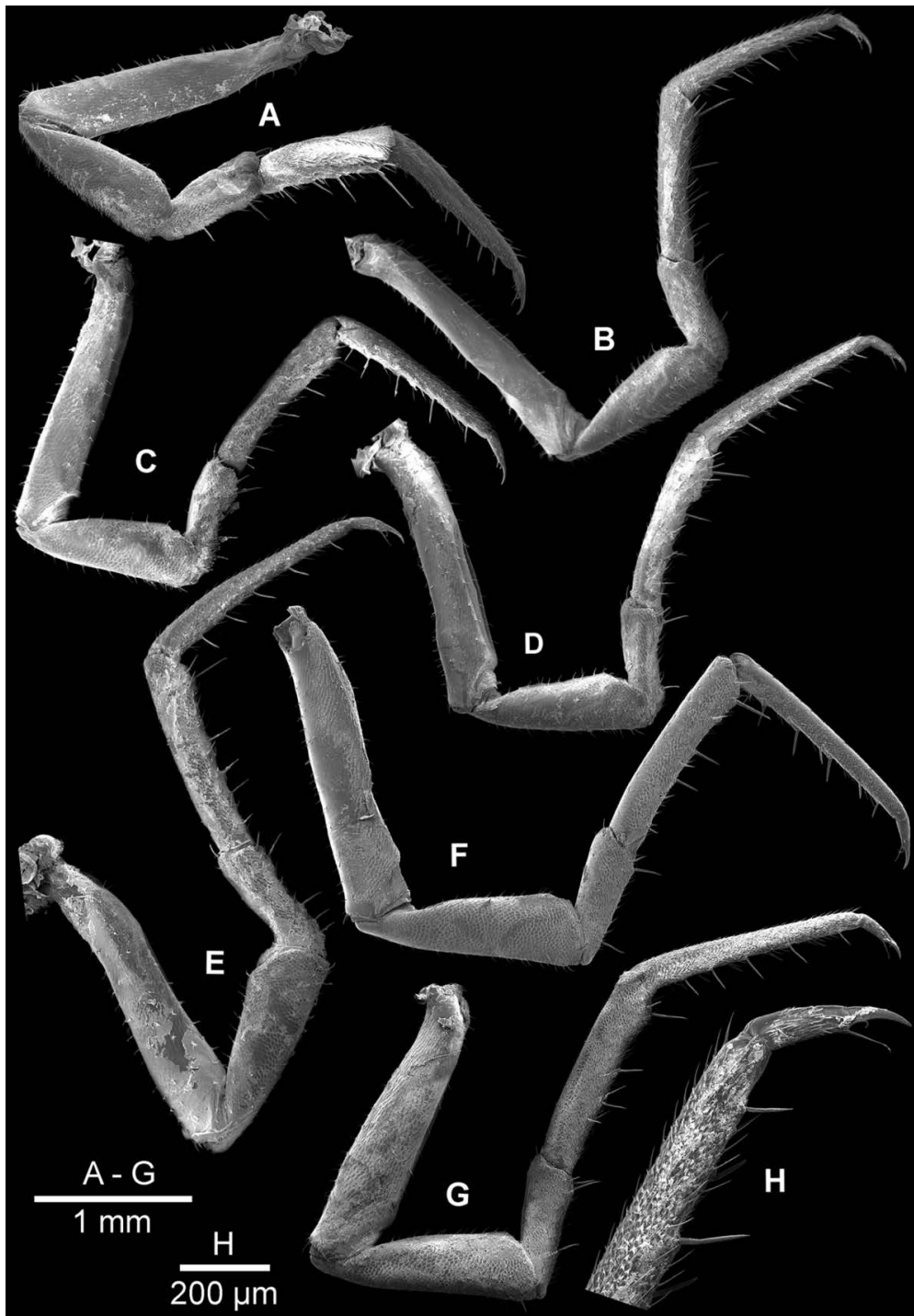


Figure 5. *Dryadillo longiantenna* sp. nov. SEM micrographs, male. A–G, pereopod 1–7; H, distal part of propodus and dactylus of pereopod 7

Genital papilla (Fig. 6A) fusiform, with rounded distal margin bearing many tiny setae.

Pleopod 1 (Figs. 6A–D) exopod about 2.4 times wider than long, with rounded inner lobe,

with monospiracular lung; endopod with distal third slightly bent outwards, triangular apex, bearing longitudinal row of small setae on caudal surface near medial margin. Pleopod 2 (Figs. 6E–F) exopod elongated, triangular with distal part slightly bent outwards, outer margin distinctly concave with few short setae, with monospiracular lung; endopod slightly longer

than exopod, with styliform distal part. Pleopod 3 exopod (Figs. 7A–B) with trapezoidal basal part and long triangular point on medial part, with 6–8 setae on outer margin, with large monospiracular lung. Pleopod 4–5 exopods (Figs. 7C–F) subrectangular on the basal part and triangular on the medial part, with monospiracular lungs.

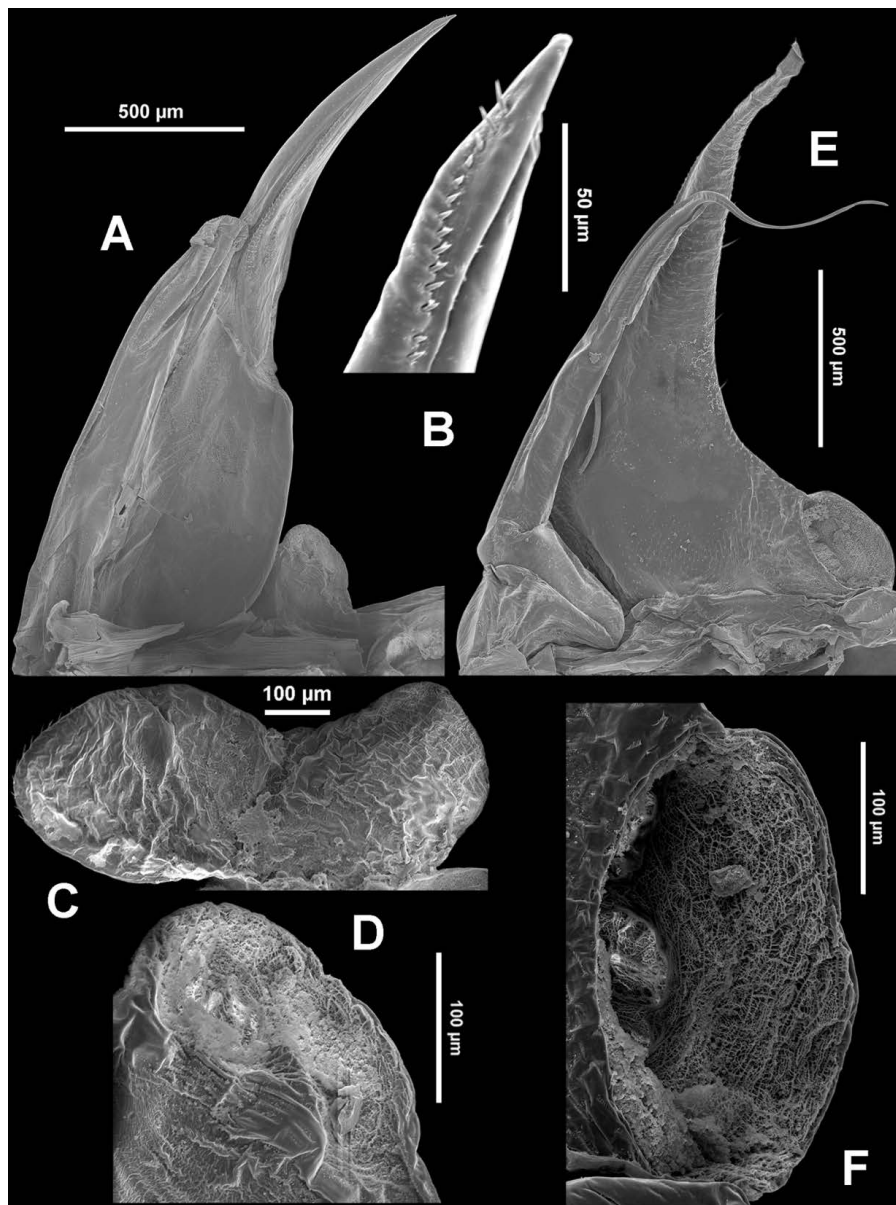


Figure 6. Dryadillo longiantenna sp. nov. SEM micrographs, male. A, genital papilla and pleopod 1; B, distal part of pleopod 1 endopod; C, pleopod 1 exopod, ventral view; D, outer part of pleopod 1 exopod, dorsal view; E, pleopod 2; F, outer part of pleopod 2 exopod, dorsal view

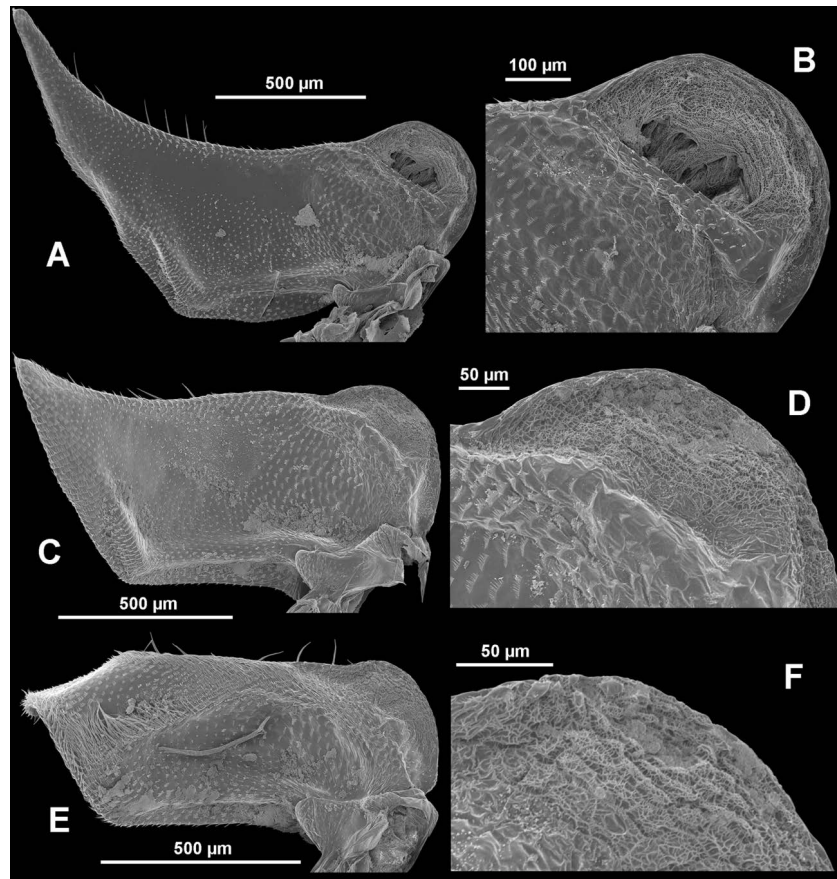


Figure 7. *Dryadillo longiantenna* sp. nov. SEM micrographs, male. A, pleopod 3 exopod; B, outer part of pleopod 3 exopod; C, pleopod 4 exopod; D, outer part of pleopod 4 exopod; E, pleopod 5 exopod; F, outer part of pleopod 5 exopod

Etymology

The specific epithet refers to the very long antenna, especially the proximal segment of flagellum in relation to the length of the distal segment.

Remarks

In the group of species of *Dryadillo* with only one line of noduli laterales per side on the pereonites, *D. longiantenna* sp. nov. shares the large rounded ventral lobe on the pereonite 2 with *D. jinghongensis*, *D. chengziensis* and *D. guizhouensis*, and shares the body depigmentation and eye reduction with *D. uenoi*. The new species shows closest affinities with *D. uenoi* and *D. jinghongensis* in lacking sexual modifications on the male pereopod 7.

However, *D. longiantenna* sp. nov. is distinguished from congeneric species by the unique characteristics as the eye with only 5 ommatidia, long fifth segment of the peduncle and proximal segment of the flagellum of the antenna, the narrow, quadrangular distal part of the uropodal protopod (Table 1). Moreover, the new species differs from *D. uenoi*, *D. montanus* and *D. schellenbergi* in the larger body size; from *D. maculatus*, *D. schellenbergi*, *D. uenoi*, *D. chengziensis*, *D. jinghongensis* and *D. parviocellatus* in having the frontal shield with a triangular depression in the middle; from *D. maculatus* in lacking the denticles on the apical part of the male pleopod 1 endopod; from *D. uenoi* in having no ventral lobe on pereonite 3.

Table 1. Comparison of *Dryadillo* species belonging to the group with one line of noduli laterales per side on the pereonites

	<i>Dryadillo maculatus</i>	<i>Dryadillo arcangelii</i>	<i>Dryadillo montanus</i>	<i>Dryadillo schellenbergi</i>	<i>Dryadillo uenoi</i>	<i>Dryadillo chengziensis</i>	<i>Dryadillo jinghongensis</i>	<i>Dryadillo guizhouensis</i>	<i>Dryadillo parviocellatus</i>	<i>Dryadillo longiantenna</i> sp. nov.
Size (mm) (♂/♀)	10.0 (♀)	8.0 (♀)	6.0 (♂)	6.5/6.5	4.7–6.6/4.1–7.1	9.0/9.0–9.5	9.0–9.5/9.0–9.5	8.0/9.5	8.0/9.5	9.8–10.2/12.2–13.0
Colour	-	yellow-brown	yellowish	dark brown	colourless	violet-brown	yellow-brown	dark brown	pale brown	colourless
No. of ommatidia of eye	21	18	18	20	absent	20	16	17-19	9-11	5
Frontal shield of cephalon	flat	flat	flat	flat	flat	flat	flat	triangular depression	flat	triangular depression
The medial area of cephalon frontal line	slightly turned back	-	-	-	without any concavity	turned back	turned back	turned back	slightly turned back	turned back
The epimera of pereonite 1	slightly turned up	-	-	-	-	-	-	turned up	slightly turned up	turned up
Ventral lobe on pereonite 3	absent	absent	absent	absent	present	absent	absent	absent	absent	absent
Width/length ratio of telson	1.5	~1.0	1.3	1.5	-	-	-	1.2	~1.0	~1.0

	<i>Dryadillo maculatus</i>	<i>Dryadillo arcangelii</i>	<i>Dryadillo montanus</i>	<i>Dryadillo schellenbergi</i>	<i>Dryadillo uenoi</i>	<i>Dryadillo chengziensis</i>	<i>Dryadillo jinghongensis</i>	<i>Dryadillo guizhouensis</i>	<i>Dryadillo parviocellatus</i>	<i>Dryadillo longiantenna</i> sp. nov.
Length/width ratio of fifth segment of peduncle of antenna	6.3	4.0	4.0	~4.0	4.2	4.5	4.7	5.7	8.4	12.5
Length ratio between fifth segment of peduncle and flagellum of antenna	1.4	-	1.3	-	1.5	1.5	1.7	1.4	1.5	1.5
Length ratio between distal segment of flagellum and proximal one	2.5	-	-	-	3.0	4.0	2.5	4.2	3.8	1.5
Distal part of male basis pereopod 7 sternal margin	covered by small setae	-	-	-	without dense covering of setae or scales	covered by small setae	without dense covering of setae or scales	covered by small setae	covered by short scales	without dense covering of setae or scales
Apical part of the male pleopod 1 endopod	straight with denticules	-	-	-	straight with no denticules	straight with no denticules	bent outward with no denticules	slightly bent outward with no denticules	slightly bent outward with no denticules	slightly bent outward with no denticules

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