

## A new genus and species of deep-water marine cirolanid isopod (Crustacea: Isopoda: Cirolanidae) from the Philippines

Niel L. Bruce<sup>1</sup> & Michitaka Shimomura<sup>2</sup>

**Abstract.** *Sululana buta* new genus, new species is described from deep water in the Sulu Sea, Philippines. The new genus shows weak affinities to *Metacirolana* Kussakin, 1979, and no clear affinities to other cirolanid genera. The genus is defined by the unicuspid mandible incisor; maxilla with two simple lobes with endopod less than half size of exopod; all pereopods with haptorial pereopods (i.e., dactylus longer than propodus); pereopod dactylus lacking secondary unguis; pleopod 1 exopod opercular and indurate; and all endopods less than half size of exopods. *Sululana buta* new genus, new species is known only from the type locality in the Sulu Sea, at a depth of 1,016 m.

**Key words.** Crustacea, Isopoda, Cirolanidae, taxonomy, new genus, Philippines

### INTRODUCTION

The aquatic isopod fauna of The Philippines remains one of the most poorly known regional isopod faunas of the world. Indeed, the most recent comprehensive report on the isopod fauna of that region is that of Richardson (1910). In the years since then there are only a few publications specific to the region (Avdeev, 1973; Poore, 1984, 1991; Delaney, 1986; Markham, 1989; Williams & Bunkley-Williams, 1992; Bruce & Iliffe, 1993; Botosaneanu & Sket, 1999; An et al., 2012) with some further incidental records scattered in other publications (e.g., Boone, 1918; Bruce & Harrison-Nelson, 1988; Bruce & Bowman, 1989; Bruce, 1997; Lowry & Dempsey, 2006). Concomitantly, the number of cirolanids known from this region is equally small (Table 1).

The new genus described herein is of particular interest as it presents an unusual combination of characters that prevent placing it in any recognised group of cirolanid genera. The pleon shows a morphology that is seen in genera such as *Eurydice* Leach, 1815 and *Metacirolana* Kussakin, 1979 with pleonite five not being laterally overlapped by pleonite 4, but the clypeus lacks any form of blade, and the frontal lamina is uniquely broad posteriorly. The pleopods show an extreme reduction of the endopod, a character more usually associated with cave-dwelling cirolanids and probably

homoplasious. Operculate pleopod 1 occurs infrequently in the Cirolanidae, but the combination of an operculate pleopod 1 exopod together with all endopods reduced in size is unique. This unusual combination of characters necessitates the establishment of a new genus for the species.

### METHODS

Classification follows Brandt & Poore (2003), while terminology follows Keable (2006) and for pereopod orientation Bruce (2009). Pencil drawings were made using a Leica DM 2500 compound microscope with a *camera lucida*. Figures were inked manually, digitised, and assembled as plates using Adobe Photoshop CS6.

The species description was prepared in DELTA (Descriptive Language for Taxonomy, [see: Dallwitz, 1980; Dallwitz et al., 1997; Dallwitz et al., 2006; Coleman et al., 2010]) using a general Cirolanidae species character set. Some integer numeric character states in the description may include a zero (0) rather than the more usual ‘without’ or ‘none’; minor details qualifying a coded character state are given in parentheses. Diagnostic characters for the genus are in bold font.

The single specimen was collected during a deep-sea benthic survey of microarthropods in the Sulu Sea by the R.V. HAKUHO-MARU of the Ocean Research Institute, University of Tokyo in 2002 (the ship now belongs to Japan Agency for Marine-Earth Science and Technology), from station KH-02-4-08B. The gear used for the collection was an ORE beam trawl of 3 m span (mesh size approx. 5 mm). Sample was elutriated on board through a 0.5 mm mesh sieve. The specimen retained was fixed with 5% neutralised formalin solution diluted with seawater and preserved in 70% ethanol. Appendages of the specimen were dissected and observed using a compound and

<sup>1</sup>Biodiversity & Geosciences Program, Queensland Museum, PO Box: 3300, South Brisbane BC, Queensland 4101, Australia; Unit for Environmental Sciences and Management and Water Research Group (Ecology), North West University, Potchefstroom 2520, South Africa; Email: niel.bruce@qm.qld.gov.au (\*corresponding author)

<sup>2</sup>Seto Marine Biological Laboratory, Kyoto University, 459 Shirahama-cho, Nishimuro-gun, Wakayama 649-2211, Japan; Email: shimomura.michitaka.5w@kyoto-u.ac.jp

Table 1. Cirolanidae recorded from the Philippines.

Species	Comment	Reference
<i>Bathynomus affinis</i> Richardson, 1910	At 120 to 300 metres depth.	Lowry & Dempsey, 2006
<i>Bathynomus doederlini</i> Ortmann, 1894	At 100 to 680 metres depth.	Lowry & Dempsey, 2006
<i>Bathynomus kensleyi</i> Lowry & Dempsey, 2006	At 300 to 2,500 metres depth.	Lowry & Dempsey, 2006
<i>Bathynomus propinquus</i> Richardson, 1910	<i>Nomen dubium</i>	Lowry & Dempsey, 2006
<i>Cirolana conditoria</i> (Bruce & Iliffe, 1993)	Anchialine cave waters	Bruce & Iliffe, 1993
<i>Cirolana epimerias</i> Richardson, 1910	Shallow	Richardson, 1910
<i>Cirolana tuberculata</i> (Richardson, 1910)	Shallow	Delaney, 1986
<i>Eurydice orientalis</i> Hansen, 1890	Shallow, benthopelagic.	Nierstrasz, 1931; Bruce, 1986
<i>Excirrolana orientalis</i> (Dana, 1852)	Intertidal	Nierstrasz, 1931; Bruce, 1986
<i>Natanolana amplocula</i> Bruce, 1986	Shallow	Keable, 2006
<i>Natanolana curta</i> (Richardson, 1910)	Shallow	Keable, 2006
<i>Neocirolana excisa</i> (Richardson, 1910)	Shallow	Bruce, 1986
<i>Sululana buta</i> new genus, new species	At depth of 1,016 metres	Present work

stereomicroscope. Total length was measured from the tip of the head to the end of the pleotelson.

The type specimen is deposited in the Kitakyushu Museum of Natural History and Human History.

Abbreviations. KMNH: Kitakyushu Museum of Natural History and Human History; BL: body length; RS: robust seta/e; PMS: plumose marginal seta/e.

## TAXONOMY

### Order Isopoda Latreille, 1817

#### Suborder Cymothoida Wägele, 1989

#### Superfamily Cymothooidea Leach, 1814

#### Family Cirolanidae Dana, 1852

#### *Sululana*, new genus

**Type species.** *Sululana buta*, new species, by monotypy and original designation.

**Diagnosis (female).** Head anterior margin weakly concave with minute rostral point. Frontal lamina posteriorly wide (0.8 as wide clypeus), anteriorly narrowly rounded; clypeus ventrally flat, without acute process. Pleonites all free, all visible in dorsal view, pleonite 5 with free lateral margins; pleonite 5 slightly wider than pleotelson anterior margin. Mandible incisor without cusps. Maxilla reduced, composed of one simple lateral lobe, small mesial lobe. Maxilliped endite distally narrowed, without coupling hooks. Pereopods 1–7 ambulatory; propodus and dactylus haptorial, dactylus

elongate, longer than propodus; propodus without prominent RS opposing base of dactylus. Pereopods 1–3 with ischium and merus superior distal margins not produced, sparsely setose; pereopods 1–3 merus inferior margin without molariform RS; pereopods 5–7 basis without long PMS, ischium and merus distally without long setae; articles not flattened or otherwise expanded; propodus of pereopods 1–7 without RS opposing base of dactylus. Pleopod 1 exopod operculate, endopod reduced, less than 25% width and length of exopod. Uropodal peduncle with weak mesiodistal lobe; rami lammelar, exopod half as long as endopod, without marginal RS.

**Description.** Head approximately 71% as wide as pereonite 1. Body surfaces unornamented; pereonite 1 about 1.3 times as long as pereonite 2 in dorsal view. Pleon unornamented, about 10% BL, with 5 visible unfused segments, all with free lateral margins, all laterally acute. Pleotelson without longitudinal carinae, ridges or without tubercles; posterior margin without PMS and RS.

Antennula peduncle articles 1 and 2 not fused; peduncular articles 2 and 3 colinear with article 1; articles 1 and 2 combined lengths less than length of article 3; articles 2 and 3 collinear, flagellum 1.2× longer than peduncle; without callynophore. Antenna peduncle comprised of 5 articles, peduncular articles 1–3 shortest, articles 4 and 5 longest, 5 longer than 4; flagellum 0.6 as long as peduncle.

Frontal lamina short, posteriorly wide, ventrally flat, anterior produced to narrowly rounded point extending between antennal peduncle article 3, posteriorly abutting clypeus. Clypeus ventral surface not projecting relative to frontal lamina. Mandible incisors wide; spine row with 9 RS; mandible palp article 3 short, less than half as long as article 2. Maxillula mesial lobe with 3 weakly circumplumose RS

and 1 short simple RS. Maxilliped palp article 4 mesial margin weakly lobed; lateral margins of articles 2–5 with long setae; articles 3 and 4 distal margin width greater than proximal margin of article 4 and 5 respectively.

Pereopods 1–7, secondary unguis absent. Pereopod 7 basis not noticeably broader in distal half compared to proximal half; margins with few discontinuous setae; ischium and merus not flattened, distal margin weakly expanded, inferior margins with few setae.

Pleopod 1 endopod about 0.1 as wide and 0.3 as long as exopod, 2.4 times as long as wide. Pleopods 2–5 with 4 or 5 PMS present on all exopods, 2 PMS on all endopods; endopods all less than half size of exopod; endopod of pleopod 5 without proximomesial lobe. Uropod rami with simple margins.

**Male.** Only one female specimen (described herein) has been collected.

**Remarks.** The Cymothoidea includes two superfamilies, the Cirolanoidea Dana, 1852 and the Cymothooidae Leach, 1814 and contains families that range across a spectrum from free-living carnivorous scavengers and predators to fully obligate parasites (Brandt & Poore, 2003: table 3; Poore & Bruce, 2012; Smit et al., 2014). These families (the Anthuroidea Leach, 1814, Gnathiidae Leach, 1814, and crustacean parasitic families are not here considered) are characterised by the mandible having a blade-like mobile molar process (reduced in parasitic and micro-predators families such as the Aegidae White, 1850, Corallanidae Hansen, 1890, Cymothoidea Leach, 1818, and Tridentellidae Bruce, 1984), usually with five free pleonites (often reduced through differing fusions in cave dwelling cirolanids) and the biramous and lamellar (i.e., flat) uropods attached ventrally in an antero-lateral position and articulating laterally (see Brandt & Poore, 2003).

Cirolanids have long been characterised by and identified by the tridentate cultrate (cutting) mandibular incisor. The Cirolanidae in addition to the mentioned characters have a maxillula with the mesial lobe provided with three or four stout robust setae and the outer lobe with 11 to 13 serrated and simple large and curved robust setae. The present genus lacks an evident tridentate mandible incisor, but the mandible has the palp, molar and spine row that are all typical of the family. In addition, the mouthpart details clearly separate this genus from all other Cymothooidae by the broad mandibular incisor (narrow in all the other families). The Corallanidae, Tridentellidae, Aegidae, and Cymothoidea either have all pereopods prehensile (Cymothoidea), anterior pereopods prehensile (Aegidae), and the maxilliped with reduced articles and abrading spines (Aegidae, Cymothoidea). The Corallanidae, which are most similar to the Cirolanidae in general body morphology, have the maxillula and maxilla reduced to minute simple lobes, while the Tridentellidae have, among other characters, a maxilliped endite that is broad, flat and elongate.

*Sululana*, new genus has five unfused pleonites, each with free lateral margins, which places it in the group of genera that includes *Eurydice* Leach, 1815, *Exciorolana* Richardson, 1912, *Metacirolana* Kussakin, 1979 (see Bruce, 1986; Brusca et al., 1995), *Aphantolana* Moore & Brusca, 2003, and *Pontogelos* Stebbing, 1910 (see Bruce, 1995). These genera are further characterised by pleonite 5 not laterally overlapped or enclosed by pleonite 4 or pleonites 3 and 4, the clypeus with a varyingly developed ventrally or anteroventrally directed blade, and frontal lamina that is posteriorly narrow. These genera also show, where known, sexual dimorphism, with sexually mature males having longer antennula and antennal flagellum, larger eyes and a longer pleon than in the females. In all of these genera there are species both with and without eyes, and lack of eyes is not considered per se to be of generic merit. Typically, species in this group of genera have the appendix masculina attached in a basal or sub-basal position, and the pleopod rami are all approximately subequal in size.

The purported apomorphies that define *Sululana*, new genus are: the unicuspid mandible incisor; maxilla with two simple lobes with endopod less than half size of exopod; all pereopods haptorial (i.e., dactylus longer than propodus); pereopod dactylus lacking secondary unguis; pleopod 1 exopod opercular and indurate; and all endopods less than half the size of the exopod.

**Relationships.** *Sululana*, new genus has an operculate and indurate (thickened) pleopod 1, a character that occurs rarely in the Cirolanidae. Operculate pleopod 1 occurs in *Conilera* Leach, 1818, *Conilorpheus* Stebbing, 1905, *Oncilorpheus* Paul & Menzies, 1971, and the unrelated genus *Calyptolana* Bruce, 1985 (see Bruce, 1985, fig. 1). In all these genera except *Calyptolana* pleopod 1 is also thickened. In *Oncilorpheus* the exopod forms the operculum while in the other genera both the endopod and exopod are together operculate; in *Sululana* it is the operculate exopod along with the greatly reduced endopod on all pleopods that is unique within the Cirolanidae. The morphology of the pleon and all appendages of *Sululana* in comparison with these genera are so different that no phylogenetic relationship can be seen.

The pereopods of *Sululana* can be considered as both ambulatory and haptorial, pereopods 5–7 with slender articles that lack abundant setae and are not flattened (as in so-called natatory pereopods of genera such as *Natatolana* Bruce, 1981 and *Eurydice* Leach, 1815), and dactyli that are longer than the respective propodus. Such pereopods are seen in genera related to *Cirolana* Leach, 1818 as well as *Metacirolana* and *Aphantolana*. There are few characters shared with *Cirolana*, though the articles of the antennal peduncle have similar proportions of articles 1–3 short, 4 and 5 long, a character also shared with *Metacirolana*. The antennula differs from *Cirolana* and related genera in having all three peduncular articles about equal in length, with article 3 shorter than article 2, a character shared with *Metacirolana* and *Aphantolana*. The maxilliped is also more similar in form to that of *Metacirolana* rather than *Cirolana*

or *Natatolana* Bruce, 1981 and their related genera. Both *Sululana* and *Metacirolana* have maxilliped palp articles 3 and 4 with weak mesial lobes (vs well-developed in most other genera) and a short quadrate article 5 (vs. distally rounded, *c.* 3× as long as wide). However, the clypeus and frontal lamina are not of the form shown either by *Metacirolana* nor by *Eurydice*.

We conclude that *Sululana* shows some affinities to *Metacirolana* and related genera in the pleon, antennula, mouthpart and general pereopod morphology, with no evident potentially derived shared characters with any other group of genera.

**Etymology.** Named after the Sulu Sea in the Philippines. Gender is feminine.

*Sululana buta*, new species

**Material examined.** Holotype ♀ (non-ovig. 2.9 mm; dissected), Sulu Sea, Philippines, 118° 34.770E–08°08.511'N, 118°34.452E, 23 November 2002, 1,012–1,016 m, 3 m ORE beam trawl, coll. R.V. HAKUHO-MARU (KMNH IvR 500923).

**Description.** Body 3.0 times as long as greatest width, dorsal surfaces smooth, widest at pereonite 5, lateral margins weakly sub-parallel. Head lateral margin with lateral flange. Eyes absent. Pereonite 1 with posteroventral angle rounded, lateral margin forming a flange; coxae 2–7 without carina; posterior margins narrowly rounded; posterior of pereonites 1–7 smooth. Pleonites each with acute posterolateral margins; posterior margin all smooth. Pleotelson 1.1 times as long as anterior width, dorsal surface without longitudinal carina; lateral margins weakly convex, margins smooth, posterior margin sub-truncate, without median point, weakly serrate, without RS.

Antennula peduncle article 2 1.9 times as long as article 1, articles 3 and 4 0.7 times as long as combined lengths of articles 1 and 2, article 3 2.1 times as long as wide; flagellum with 7 articles, extending to anterior of pereonite 1. Antenna peduncle article 4 1.8 times as long as wide, 1.5 times as long as article 3, inferior margin with distal plumose setae, anterior margin with 3 short simple setae; article 5 1.4 times as long as article 4, 3.2 times as long as wide, inferodistal margin with 3 pappose setae, anterior margin with 4 short simple setae; flagellum with 7 articles, extending to posterior of pereonite 1.

Frontal lamina posteriorly 0.9 times as wide labrum.

Mandible molar process; right mandible spine row composed of 9 spines; mandible palp article 2 3.5 times as long as wide, with 4 distal setae; mandible palp article 3 0.3 as long as article 2, with 3 pectinate setae. Maxillula mesial lobe with 3 large and weakly circumplumose RS; lateral lobe with 10 RS. Maxilla lateral lobe with 2 simple setae; mesial lobe 0.5 as long as lateral lobe, without setae. Maxilliped palp article 2 mesial margin with 3 slender setae, lateral margin distally

with 1 plumose slender setae; article 3 mesial margin with 3 slender setae, lateral margin with 3 plumose setae; article 4 mesial margin with 5 slender setae, lateral margin with 2 slender setae; article 5 distal margin 6 setae; endite with 1 long CPS and two short simple setae.

Pereopod 1 basis 2.7 times as long as greatest width, superior posterior margin with 1 palmate seta, inferior margin with 2 short simple setae; ischium 0.6 length of basis, inferior margin with 2 short simple setae, superior margin with 1 RS; merus 0.5 length of ischium, inferior margin with 5 acute RS, superior distal angle with 2 setae; carpus inferior margin with 2 RS; propodus 1.8 times as long as wide, superior margin convex, inferior margin with 3 stout RS; dactylus weakly curved, 1.07 as long as propodus, 6.4 as long as proximal width. Pereopod 2 basis 4.5 times as long as greatest width, superior posterior margin with 1 palmate seta, inferior margin with 3 short simple setae; ischium 0.4 times as long as basis, inferior margin with 2 short simple setae, superior margin with 1 RS mid-length; merus equal in length to ischium, inferior margin with 2 acute RS, superior distal angle with 2 setae; carpus inferior margin with 4 RS; propodus 2.3 times as long as wide, superior margin convex, inferior margin with 1 RS; dactylus weakly curved, 1.2 as long as propodus, 7.7 as long as proximal width. Pereopod 3 ischium inferior margin with 2 short simple setae, superior margin with 1 RS (large); merus inferior margin with 1 stout acute RS, superior distal margin with 2 acute RS; carpus inferior margin with 3 RS and 1 simple seta; propodus 3.3 as long as wide, with 1 RS; dactylus 1.3 as long as propodus. Pereopod 6 similar to pereopod 7. Pereopod 7 basis 6.0 times as long as greatest width, margins subparallel, superior margin with 3 palmate setae, inferior margin with 3 short simple setae; ischium 0.5 as long as basis, inferior margin with 1 short simple seta, superior distal angle with 1 RS and 1 simple seta; merus 1.0 as long as ischium, 2.1 times as long as wide, inferior margin with 1 RS, superior distal angle with 2 RS, inferior distal angle with 2 RS; carpus 0.8 as long as ischium, 3.0 times as long as wide, inferior margin with 0 RS, superior distal angle with 0 RS, inferior distal angle with 3; propodus 1.3 as long as ischium, 4.7 times as long as wide, inferior margin with 1 RS, superior distal angle with 3 and 1 palmate slender setae, inferior distal angle with 3 RS; dactylus weakly curved, as long as propodus.

Pleopod 1 exopod 2.2 times as long as wide, mesial margin straight, lateral margin strongly convex, curving smoothly to distomesial point (i.e. no clearly defined distal margin), distal two-thirds with 8 PMS; endopod 0.3 as long and 0.11 as wide as exopod, 6.1 times as long as wide, margins straight, sub-parallel, distally narrowly rounded, with 1 PMS on distal margin only; peduncle 1.3 times as wide as long; mesial margin with 3 coupling setae. Pleopod 2 exopod 1.9 as long as wide, with 4 PMS, endopod 0.7 as long as endopod, 3.4 as long as wide, with 2 PMS; endopod. Pleopod 3 exopod 1.9 as long as wide, with 4 PMS, endopod 0.7 as long as endopod, 3.4 as long as wide, with 2 PMS; endopod. Pleopod 3 exopod with 4 PMS, endopod with 2 PMS. Pleopod 4 exopod with 4 PMS, endopod with 2 PMS. Pleopod 5 exopod with 4 PMS, endopod with 2 PMS. Pleopod 1 peduncle with 3 coupling

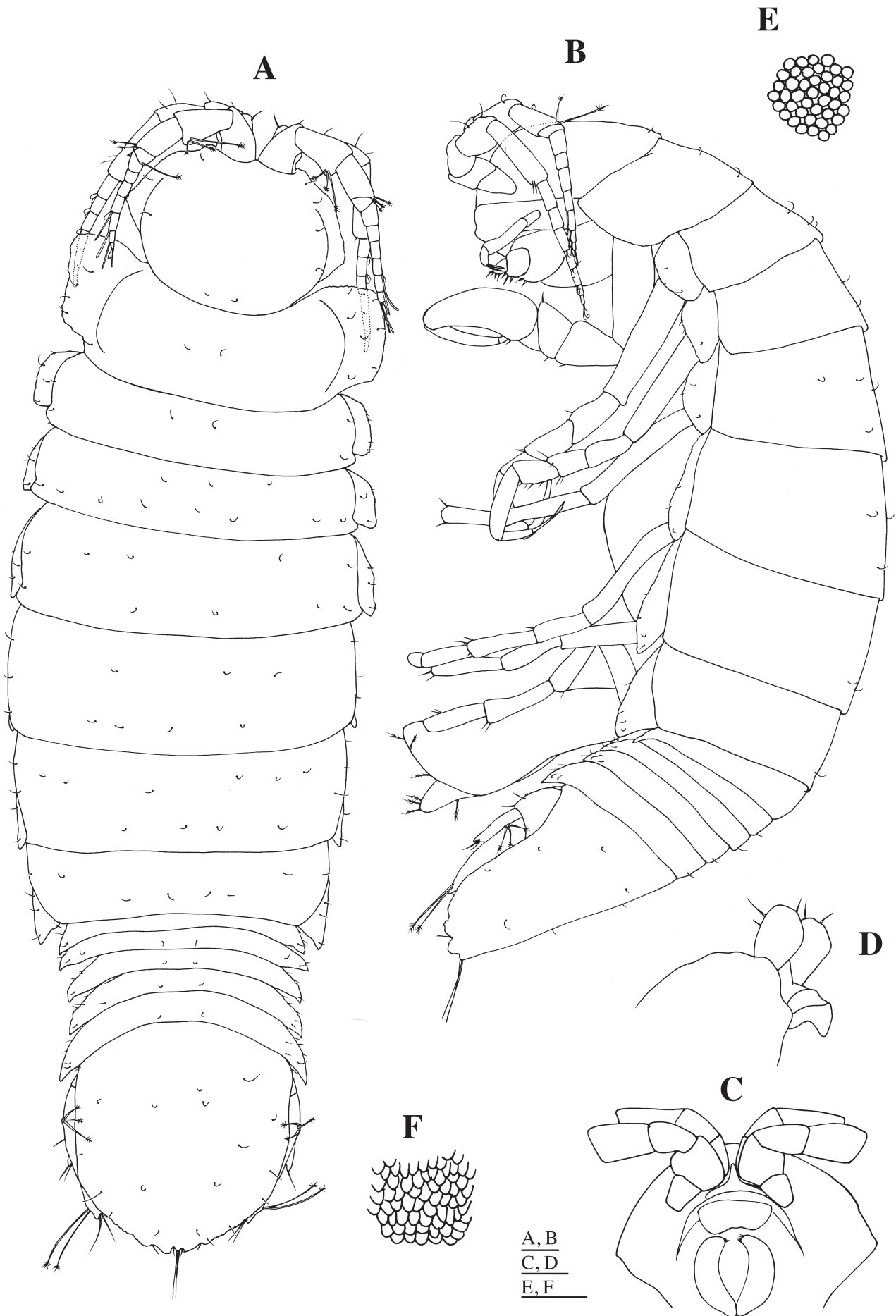


Fig. 1. *Sululana buta*, new species. A, habitus, dorsal; B, habitus, lateral; C, cephalon, ventral view; D, head in lateral view, showing frontal lamina, clypeus, and labrum; E, scales on cephalon, dorsal; F, scales on pleotelson, dorsal. Scales = 100  $\mu$ m.

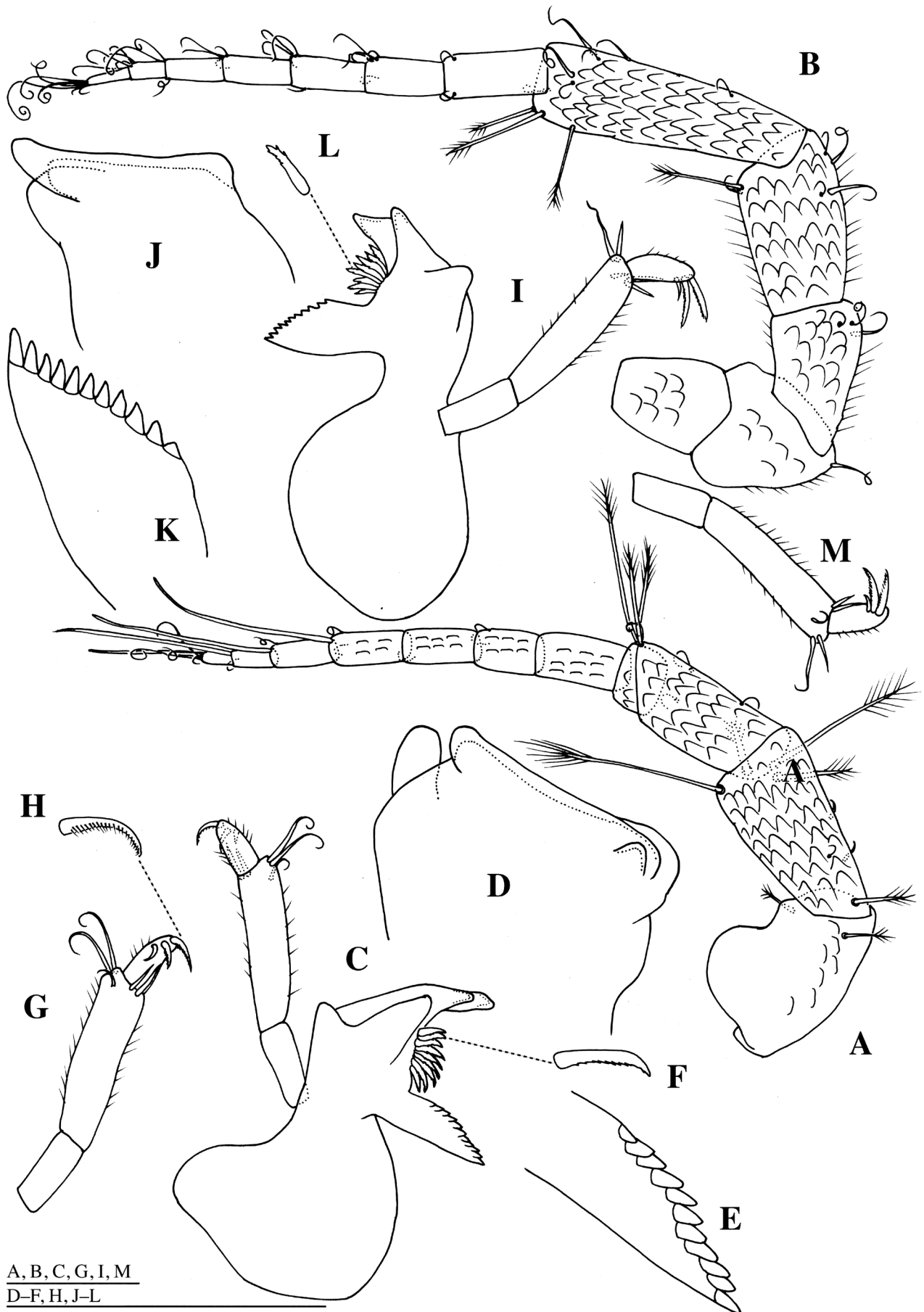


Fig. 2. *Sululana buta*, new species. A, right antennula, ventral; B, right antenna, ventral; C, left mandible, dorsal; D, incisor of left mandible, dorsal; E, molar process of left mandible, dorsal; F, seta of setal row, dorsal; G, palp of left mandible, ventral; H, seta on third article of mandibular palp, ventral; I, right mandible, dorsal; J, incisor of right mandible, dorsal; K, molar process of right mandible, ventral. Scales = 100  $\mu$ m.

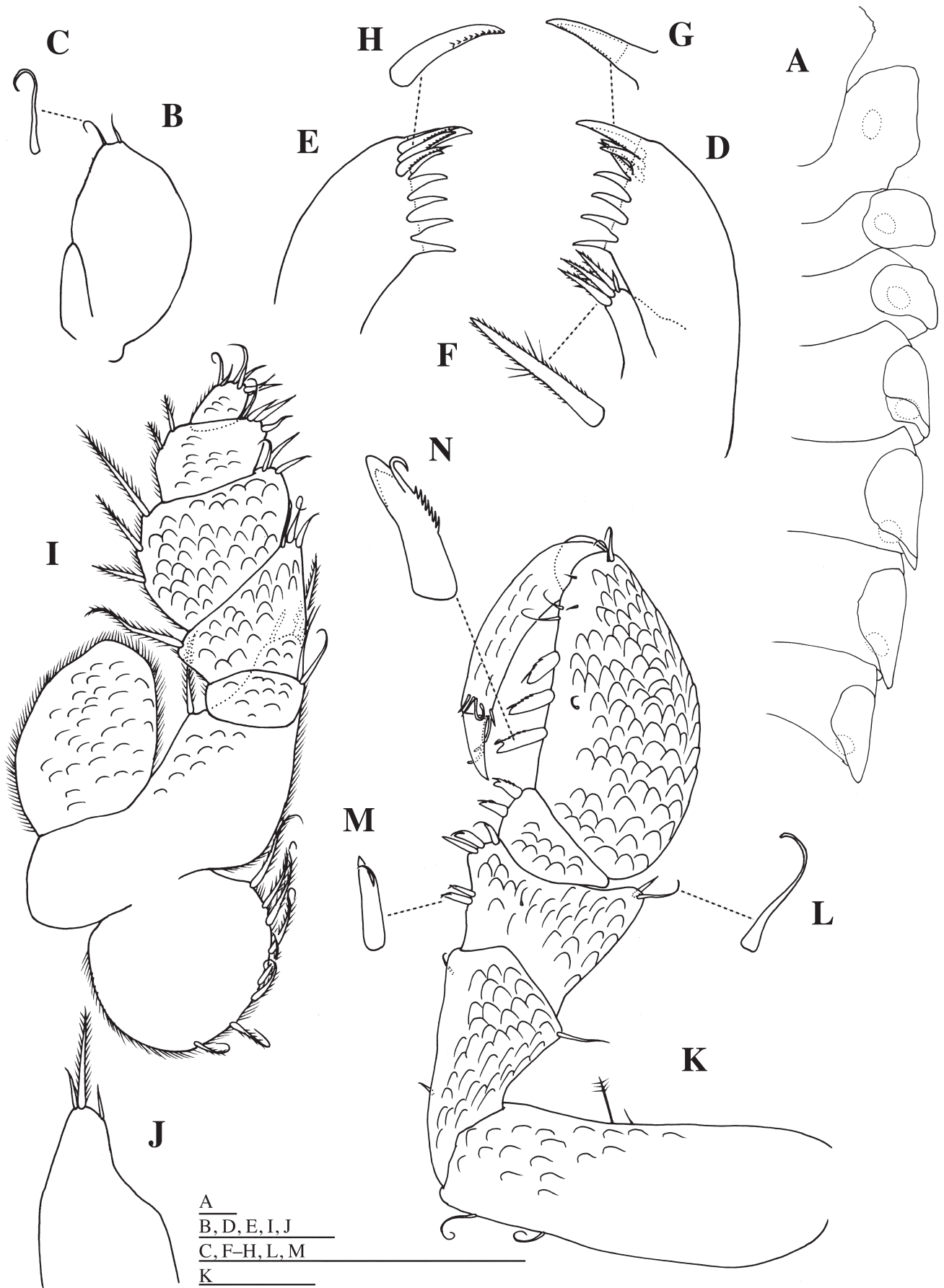


Fig. 3. *Sululana buta*, new species. A, coxal plates on left side of pereon, ventral; B, left maxilla, ventral; C, seta on outer ramus of left maxilla; D, left maxillula, ventral; E, left maxillula, dorsal; F, seta on inner ramus of left maxillula, ventral; G, seta on outer ramus of left maxillula, ventral; H, seta on outer ramus of left maxillula, dorsal; I, right maxilliped, ventral; J, endite of right maxilliped, dorsal; K, right pereopod I, medial; L, dorsal seta on merus, medial; M, ventral seta on merus, medial; N, ventral seta on propodus, medial. Scales = 100  $\mu$ m.

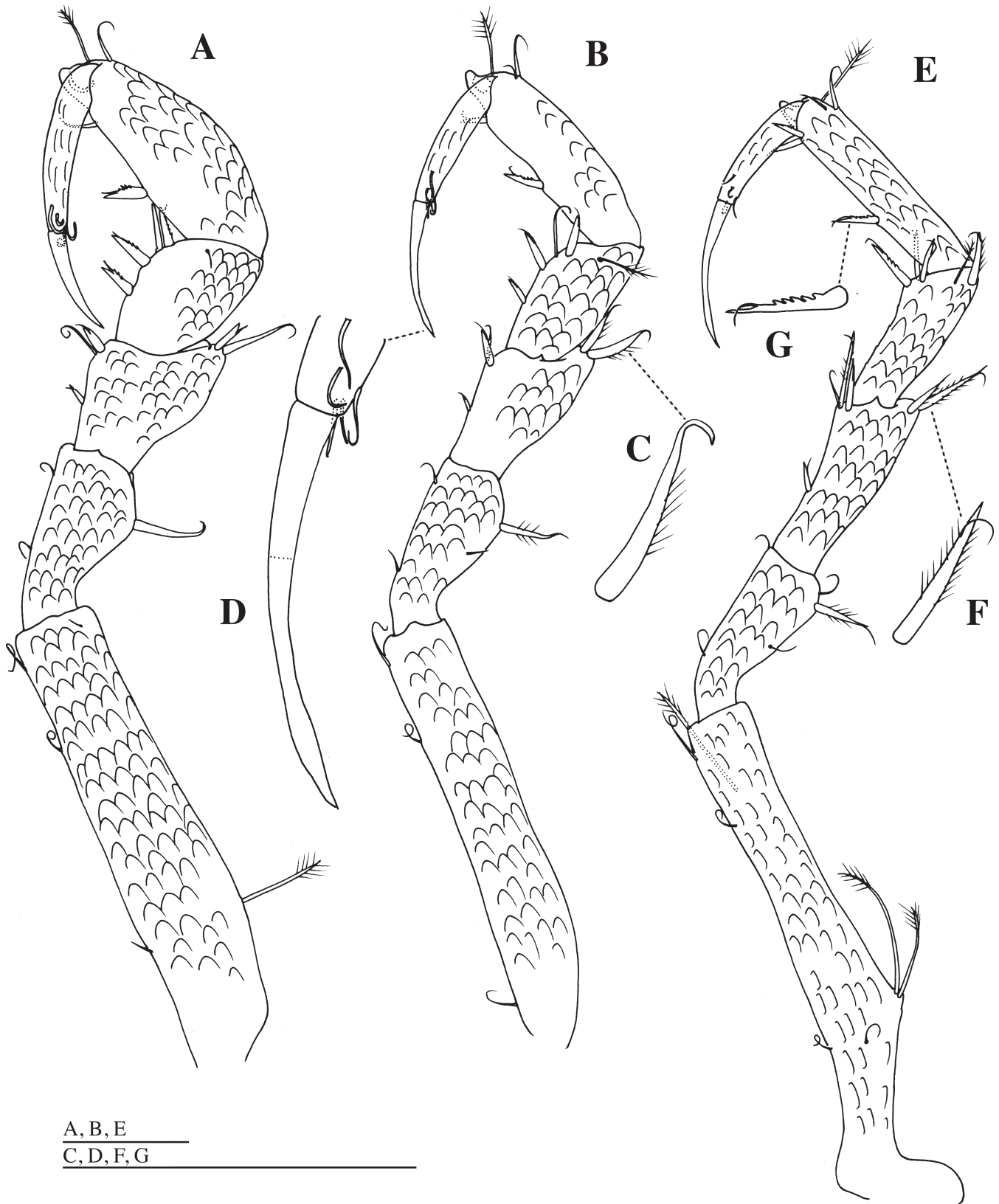


Fig. 4. *Sululana buta*, new species. A, right pereopod 2, medial; B, right pereopod 3, medial; C, dorsal seta on merus of right pereopod 3, medial; D, distal part of dactylus of right pereopod 3, medial; E, right pereopod 4, medial; F, dorsal seta on merus of right pereopod 4, medial; G, ventral seta on propodus of right pereopod 4, medial. Scales = 100  $\mu$ m.



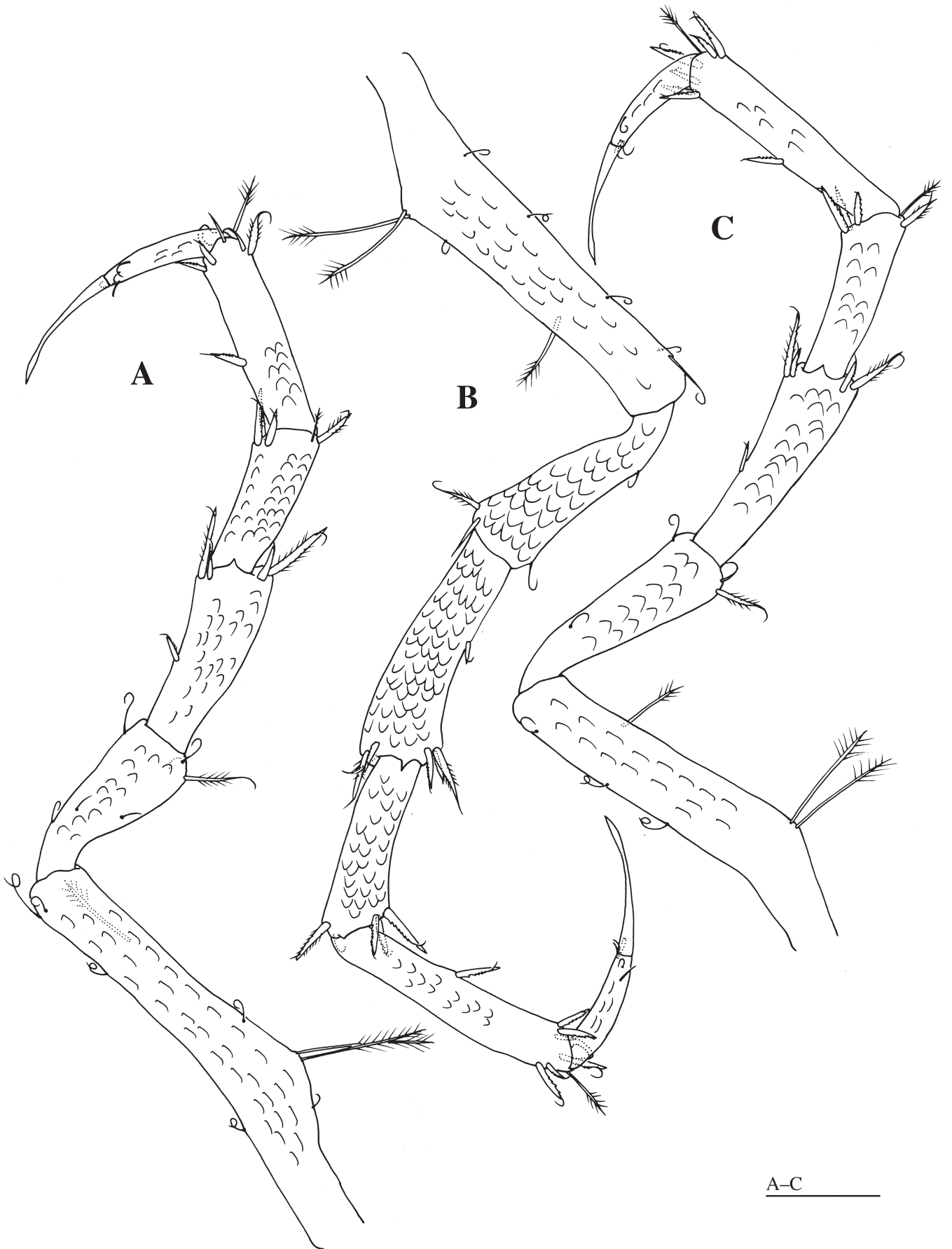


Fig. 5. *Sululana buta*, new species. A, right pereopod 5, medial; B, right pereopod 6, medial; C, right pereopod 7, medial. Scale = 100  $\mu$ m.

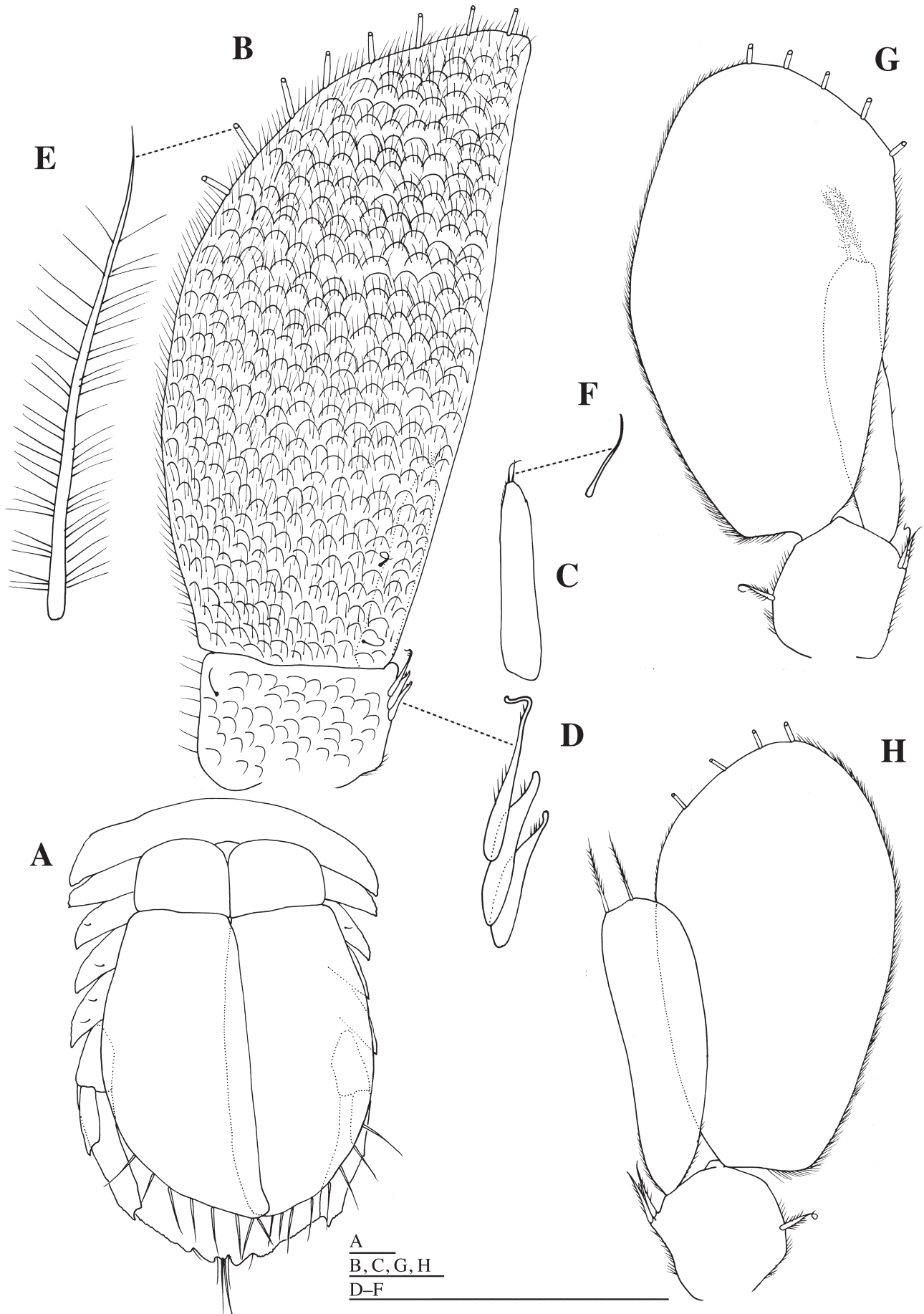


Fig. 6. *Sululana buta*, new species. A, pleon and first pleopods, ventral; B, left pleopod 1, ventral; C, endopod of left pleopod 1, dorsal; D, coupling hooks of left pleopod 1, ventral; E, seta on outer ramus of left pleopod 1, ventral; F, seta on endite of left pleopod 1, dorsal; G, left pleopod 2, ventral; H, left pleopod 3, dorsal. Scales = 100  $\mu$ m.

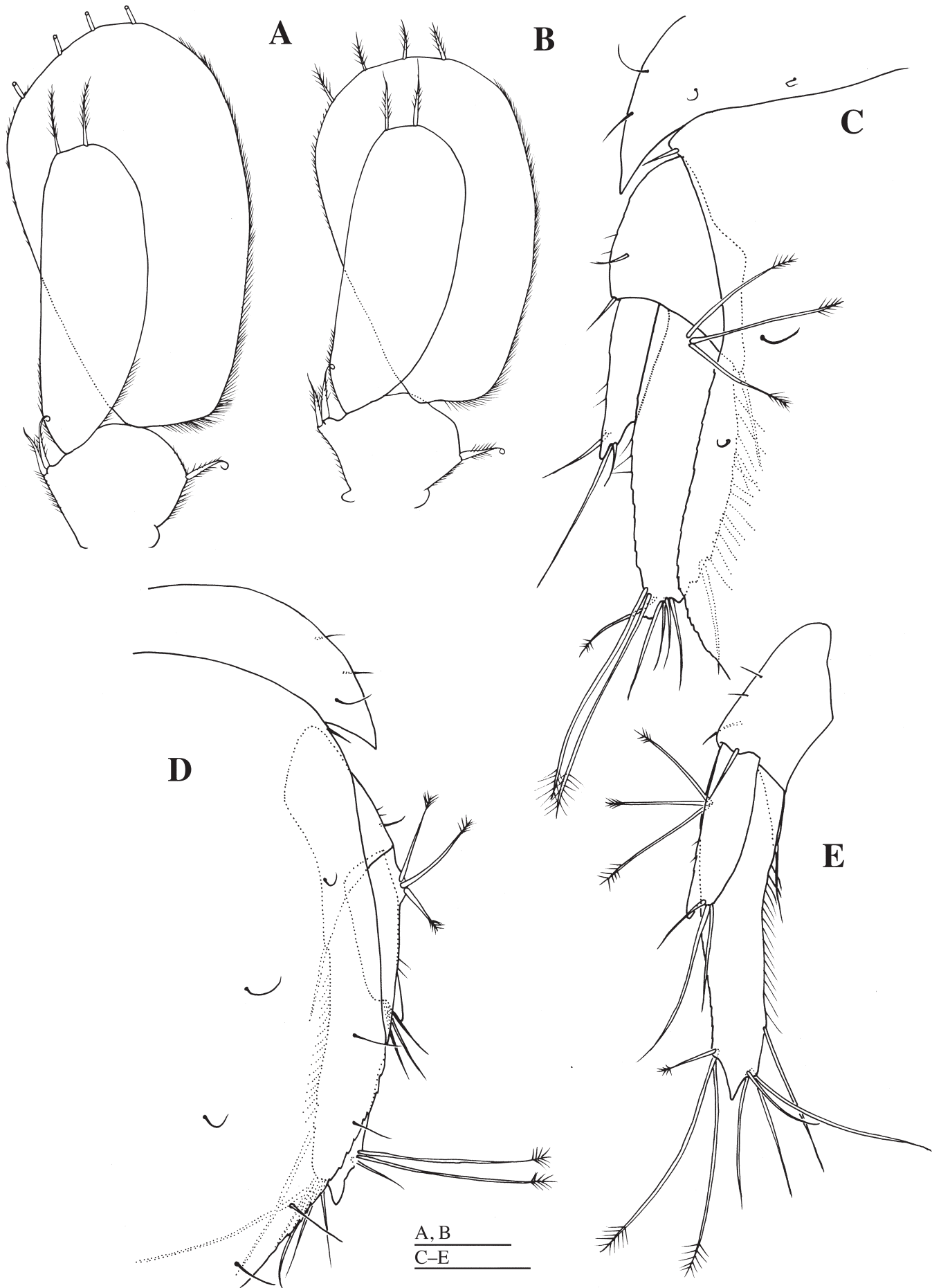


Fig. 7. *Sululana buta*, new species. A, left pleopod 4, dorsal; B, left pleopod 5, dorsal; C, left uropod, lateral; D, right uropod, dorsal; E, right uropod, ventral. Scales = 100  $\mu$ m.

hooks, pleopods 2–5 peduncle each with 2 weak coupling hooks RS, later margin with single acute RS.

Uropod peduncle ventrolateral margin with 1 seta, lateral margin with medial simple seta; rami not extending beyond pleotelson, without RS, apices with acute lateral process, not bifid. Endopod 2.9 as long as greatest width, lateral margin weakly convex, mesial margin convex; distal lateral margin with 1 long seta RS, mesial margin with 2 long sub-apical setae. Exopod 3.2 times as long as greatest width, 0.6 as long as endopod; lateral margin straight, with 1 long sub-apical seta, mesial margin straight, with 2 long sub-apical seta.

**Male.** Not known.

**Remarks.** The species can be identified by the generic characters, notably the operculate pleopod 1 exopod, broadly rounded pleotelson, slender legs with notably long dactylus, small body size and lack of pigmented eyes.

**Etymology.** The epithet is the Tagalog word meaning blind (noun in apposition).

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