



## Article

### ***Apocuma* (Cumacea: Bodotriidae): two new species from the West-Atlantic and a significant extension of the known distribution of this genus in the Atlantic Ocean**

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#### **Abstract**

Two new species of the genus *Apocuma* are described and illustrated: *A. gerkenae* **n. sp.** and *Apocuma iorgui* **n. sp.** Both species were found off the coast of Brazil, but *A. gerkenae* was also recorded off the coasts of Georgia and Florida (both on the Atlantic Ocean and in the Gulf of Mexico). Additionally, specimens of *A. brasiliense* collected off the coast of Rio de Janeiro were examined. These three species differ mainly by (1) the presence / absence of a rudimentary exopod on the third pereopod of the female, (2) the sculpture of the carapace, and (3) the uropod setation. The distribution of this genus in the Atlantic Ocean is substantially extended based mainly on an unpublished database compiled by the late Norman S. Jones.

**Key words:** *Apocuma*, new species, taxonomy, distribution, Atlantic Ocean

#### **Introduction**

The genus *Apocuma* was erected by Jones (1973) to include a single species, *A. brasiliense*, collected off the coast of Recife, Brazil at 587–805 m. Since then, four other species have been added to this genus, viz., *A. australiense* (Hale, 1949), *A. mauritaniense* Ledoyer, 1997, *A. poorei* Petrescu, 2004 and *A. pacificum* Corbera, 2008. Furthermore, Jones (1990) reported *Apocuma* sp. n. DJ, an unidentified species from the Strait of Gibraltar that Ledoyer (1997) suggested could be conspecific with *A. mauritaniense*.

More recently, Heard *et al.* (2007) have reported a species from the waters of Florida that was provisionally designated as *Apocuma* sp. A. This species, which is now named *A. gerkenae* **n. sp.**, is herein fully described and reported from off the coasts of Florida and Georgia in the USA, and from off the coasts of Rio de Janeiro, São Paulo and Paraná in Brazil. Besides, *A. iorgui* **n. sp.** is described and illustrated based on specimens collected off the coast of Rio de Janeiro, and *A. brasiliense* is first recorded from this area as well.

The distribution of this genus in the Atlantic Ocean is substantially extended based on an unpublished database prepared by the late Norman S. Jones. In particular, *Apocuma brasiliense*, previously reported by Jones (1973) from Recife at 587–805 m, is also recorded in this database from Surinam at 523–2076 m and Argentina at 1676 m. Additionally, *Apocuma* sp. n. DJ originally recorded from Gibraltar at 1870–2035 m by Jones (1990) is also listed in this database from the British Isles and the Bay of Biscay at 1271–1993 m, and the Canary Islands at 1934 m. Finally, specimens from the Gulf of Mexico collected at a depth of 1032–1232 m, which were identified by Norman S. Jones as *Apocuma* sp. and are deposited in the USNM, are also reported herein.

## Material and methods

Habitus drawings were prepared using a camera lucida fitted to a Leica MZ8 dissecting microscope. Appendages were dissected, mounted in temporary slides using glycerine as mounting media, and drawn under a Carl Zeiss (Axioskop) compound microscope also equipped with a camera lucida.

The total length of the individuals was measured from the tip of the pseudorostrum (excluding siphons) to the end of the pleon (excluding uropods).

The angle at which the pseudorostrum projects up was estimated with the specimen in lateral view. One of the sides of this angle was the tangent to the upper surface of the pseudorostrum, while the other side was the projection of a straight line running from the posterior margin of the carapace to the ocular lobe (see Fig. 1A).

For maxillipeds and pereopods, the ratio “basis to remaining articles combined” is given. The term “remaining articles combined” refers to the length of the line (straight or curved) extending from the ischium to the dactylus, passing approximately across the middle of each article. For single article measurements, lengths were always taken along their longer sides.

Appendages are usually beset with marginal hyaline membranes on one or more of their articles. However, the recognition of these hyaline membranes depends on the dirtiness and state of preservation of the appendage, as well as the position of the appendage in the mounting media. Thus, some of these membranes could be overlooked.

Material for SEM was dehydrated through a graded ethanol series, critical point dried, mounted on aluminium stubs and sputter coated with palladium. Coated material was examined under a Philips XL30 TMP scanning electron microscope.

Setal terminology was adapted from that presented for decapods by Garm, 2004 (see also Alberico & Roccatagliata 2008).

Types and reference materials of the specimens herein studied are deposited in the following institutions: the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN), the Museu de Zoologia da Universidade de São Paulo (MZUSP), the Museu Nacional / Universidade Federal do Rio de Janeiro (UFRJ), and the National Museum of Natural History (USNM).

## Systematics

### Order Cumacea Kröyer, 1846

### Family Bodotriidae T. Scott, 1901

### Subfamily Bodotriinae T. Scott, 1901

### Genus *Apocuma* Jones, 1973

**Synonymy.** *Apocuma*. Jones, 1973: 297–298.

**Type species.** *Apocuma brasiliense* (by original designation).

**Diagnosis.** Pseudorostral lobes meeting for some distance at the front of carapace. Pereonite 1 visible in both sexes. Basis of third maxilliped not produced. Second pereopod with ischium. Female with well-developed exopods on pereopods 1 and 2, and usually with a rudimentary exopod on pereopod 3. Male with well-developed exopods on first four pereopods. Male with 5 pairs of pleopods. Endopod of the uropod with 1 article.

### *Apocuma gerkenae* n. sp.

(Figs. 1–5; 7A, B)

**Material examined.** **Sapelo Island Research Foundation.** Sta. 359, 30°48.05'N, 80°00.00'W, 461 ft [140.5 m], 09 Dec 1963, bucket dredge: 6 specimens (paratypes USNM 1182930). Sta. 362, 30°47.40'N, 80°00.45'W, 405 ft [123.4 m], 09 Dec 1963, bucket dredge: 10 specimens (USNM 1182931). **Harbor Branch Oceanographic Institution.**

“*Bodotria* X-1 and X-2, 0.5 mm”, 27°28.86’N, 79°56.40’W, 124 m, 27 May 1980, R. W. Virnstein coll.: 5 specimens (holotype USNM 1182932, paratypes USNM 1182933). **The Mississippi, Alabama, Florida (MAFLA) Outer Continental Shelf Baseline Environmental Study. Surveys 1975–1978.** Sta. MAFLA 2105, 26°24’59.5’’N, 83°49’57.6’’W, 90 m: 1 specimen (USNM 1182934). Sta. MAFLA 2426, 28°57’59.4’’N, 85°23’00.2’’W, 82 m: 1 specimen (USNM 1182935). Sta. MAFLA 2644, 29°36.2’N, 87°23.5’W, 75 m: 1 specimen (USNM 1182936). Sta. MAFLA 2958, 25°40’N, 83°50’W, 120 m: 2 specimens (USNM 1182937). **The Southwest Florida Shelf Ecosystems Study (SOFLA). Surveys 1980–1981.** SOFLA 5, 26°45.70’N, 84°00.13’W, 91 m: 4 specimens (USNM 1182938). SOFLA 12, 26°16.72’N, 83°47.67’W, 90 m: 1 specimen (USNM 1182939). SOFLA 24, 25°16.90’N, 83°43.18’W, 88 m: 1 specimen (USNM 1182940). SOFLA 34, 25°45.31’N, 83°57.63’W, 135 m: 3 specimens (USNM 1182941). **Instituto Oceanográfico da Universidade de São Paulo (IOUSP). R/V “Prof. W. Besnard”.** MBT 77, 23°39’S, 43°09’W, 128 m, 12 May 1970: 7 specimens (MACN-In. 38851). MBT 141, 23°25’S, 43°00’W, 113 m, 02 Sep 1970: 33 specimens (MZUSP 26084, MACN-In. 38852). MBT 142, 23°46’S, 43°00’W, 150 m, 02 Sep 1970: 36 specimens (MZUSP 26086, MACN-In. 38853). MBT 145, 23°25’S, 42°27’W, 130 m, 03 Sep 1970: 7 specimens (MACN-In. 38854). MBT 148, 23°19’S, 41°57’W, 136 m, 03 Sep 1970: 54 specimens (MZUSP 26085; MACN-In. 38855; SEM photos: MACN-In. 38855a, 38855b). MBT 152, 23°03’S, 41°10’W, 98 m, 04 Sep 1970: 47 specimens (MZUSP 26087, MACN-In. 38856). MBT 161, 21°42’S, 40°15’W, 56 m, 06 Sep 1970: 12 specimens (MACN-In. 38857). MBT 175, 25°58’S, 46°36’W, 140 m, 28 May 1971: 9 specimens (MACN-In. 38858). MBT 195, 24°03’05’’S, 44°59’00’’W, 73 m, 01 Jun 1971: 1 specimen (MACN-In. 38859).

**Diagnosis.** Carapace upper lateral carina runs sinuously from pseudorostral lobe, almost to upper posterior margin of carapace, with a downward branch at approximately 2/3-way along carapace. Third pereopod of female lacking exopod. Female uropod: endopod with 1 setulate seta at 2/3-way along inner margin and 2 cuspidate setae (1 subterminal, 1 distal); exopod with 1 terminal cuspidate seta only. Male uropod: endopod with 4 barely setulate setae on inner margin and 2 cuspidate setae (1 subterminal, 1 distal); exopod with 1 setulate seta on inner margin and 1 cuspidate seta distally.

**Description of the adult female** (based on the holotype USNM 1182932 and the dissected paratype USNM 1182930)

Total length 2.4 mm (holotype USNM 1182932).

Integument well calcified, opaque, brittle and granulate.

Carapace (Figs. 1B, C; 7A, B) approximately 0.4 total length. Width approximately 0.65 its length. With a faintly marked mid-dorsal carina, and two well-developed carinae on each side. Mid-dorsal carina double (made up of two contiguous branches, see Fig. 7B), running from ocular lobe almost to posterior margin of carapace. Upper lateral carina running sinuously from pseudorostral lobe almost to upper posterior margin of carapace, with a downward branch at approximately 2/3-way along carapace. Lower lateral carina almost straight, running from antero-lateral angle to posterior margin of carapace, where it is produced backwards to form a small subtriangular lobe. Upper lateral carina, its downward branch, and lower lateral carina outlining a moderately excavated area (sulcus). Dorsal outline convex, rising up into a low hump posteriorly. Pseudorostrum upturned at approximately 20°. Ocular lobe moderately large, tumid, broader than long, without lenses but with a clear area on each side. Antero-lateral sinus narrow and deeply excavated, antero-lateral angle rounded.

Pereonite 1 visible laterally. Last four pereonites with double mid-dorsal carinae, branches contiguous on pereonite 2 but gradually separating from each other on pereonites 3–5. Pereonites 2–5 with lateral shields.

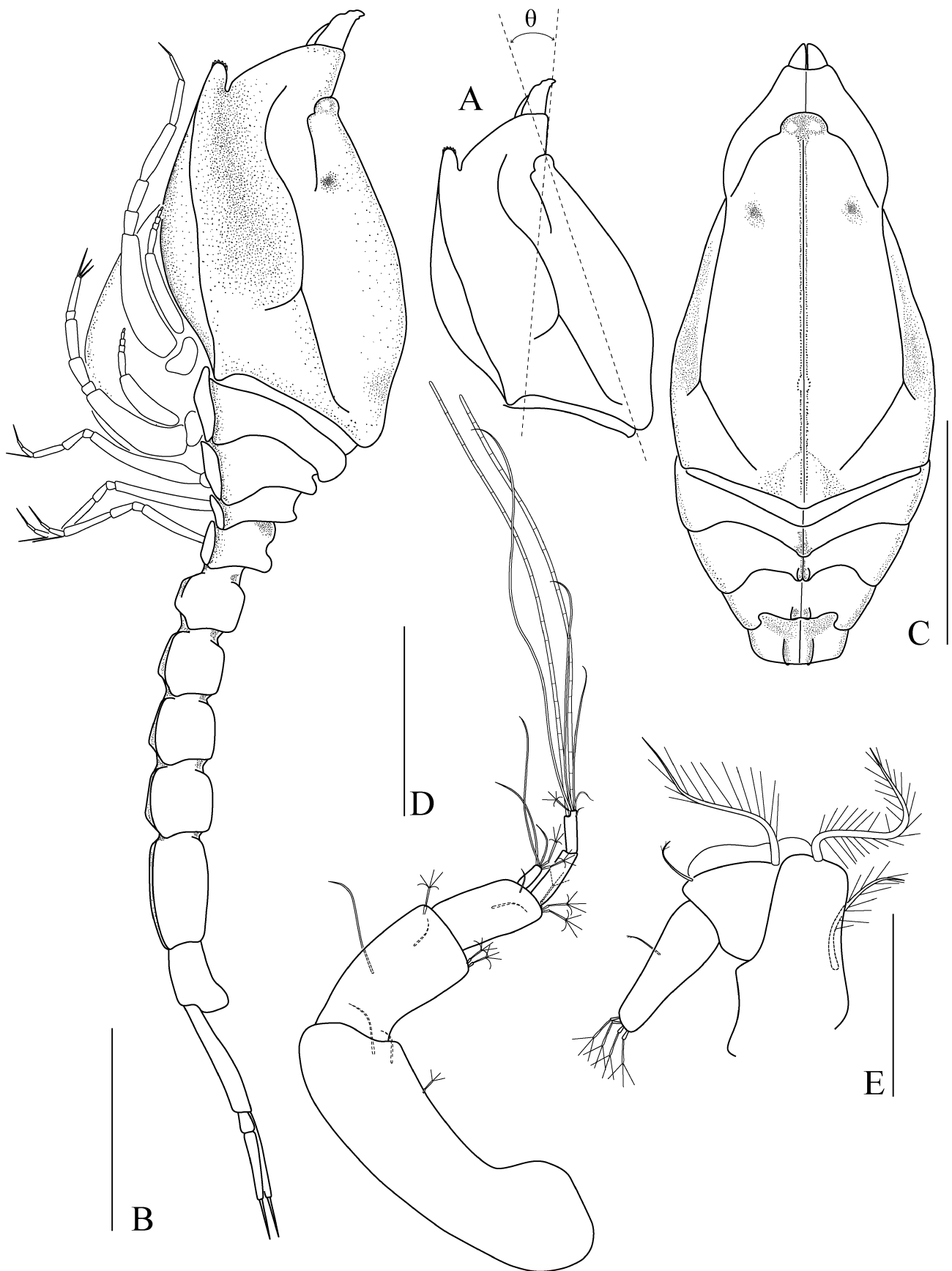
Pleon length approximately 0.8 of that of cephalopereon. Pleonites 1–4 with double mid-dorsal carinae (branches as apart as those of fifth pereonite on pleonites 1 and 2, branches sharp and contiguous on pleonites 3 and 4). Pleonite 5 with a single sharp mid-dorsal carina.

First antenna (Fig. 1D). Peduncle with basal article longer than remaining two articles combined; second article almost twice as long as third, with 1 simple seta medially. Main flagellum with 2 articles, most distal article with 2 aesthetascs and slender simple setae. Accessory flagellum approximately half as long as basal article of main flagellum, with broom setae and simple setae distally.

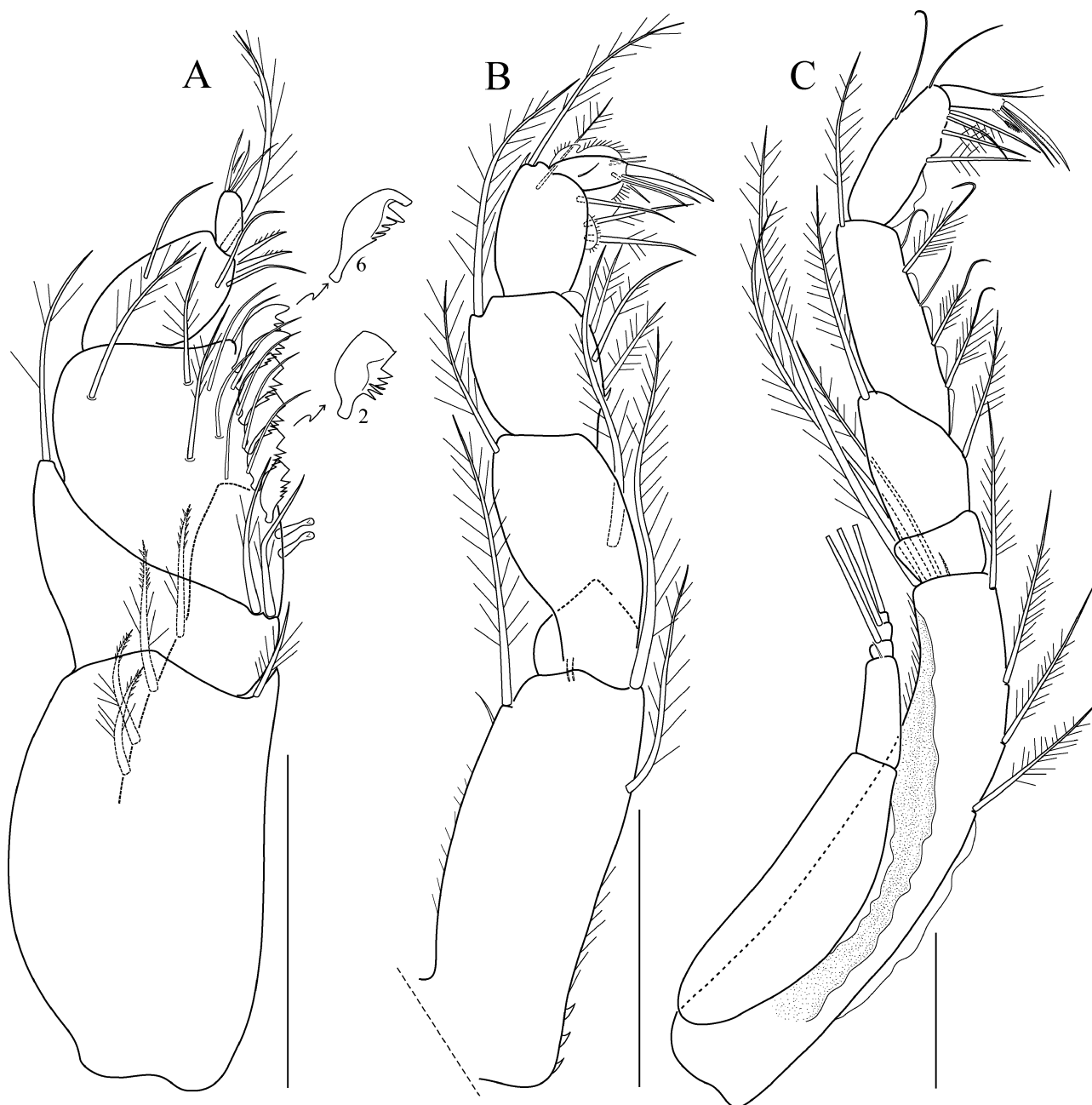
Second antenna (Fig. 1E) with 3 articles, having thick setulate setae and hyaline scales; third article narrow and cylindrical with 4 broom setae distally.

Mouthparts, general aspect as shown in Corbera (2008).

Right mandible with 11 setae (left mandible with 10 setae and a *lacinia mobilis*) between pars incisiva and molar process.



**FIGURE 1.** *Apocuma gerkenae* n. sp. Adult female. A, schema showing how the pseudorostrum angle was measured. B, C, holotype USNM 1182932: B, habitus in lateral view; C, cephalopereon in dorsal view. D, E, dissected paratype USNM 1182930: D, first antenna; E, second antenna. Scale bars: 0.5 mm (B, C), 0.1 mm (D, E).



**FIGURE 2.** *Apocuma gerkenae* n. sp. Adult female, dissected paratype USNM 1182930: A, first maxilliped and detail of second and sixth flattened setae; B, second maxilliped; C, third maxilliped. Scale bars: 0.1 mm (A–C).

First maxilla. Outer endite with approximately 13 cuspidate setae distally, inner endite with 4 unequal setae distally. Palp with 2 unequal long setae.

Second maxilla. Outer endite with 1 simple, 2 serrulate and 4 serrate setae distally; inner endite with 1 simple and 6 serrate setae distally.

First maxilliped (Fig. 2A). Basis with a row of 4 setuloserrate setae, endite reaching half-way along carpus. Carpus with 6 flattened setae on inner margin, proximal ones truncate, distal ones having rounded tips (see details).

Second maxilliped (Fig. 2B). Basis length approximately 0.8 of that of remaining articles combined, with 3 setulate setae on or near distal end. Merus second longest article, with 2 setulate setae. Carpus and propodus with 4 and 5 setulate setae, respectively. Propodus and dactylus with hyaline scales fringed with tiny setulae. Unguis longer than dactylus.

Third maxilliped (Fig. 2C). Several articles with delicate hyaline scales. Basis approximately as long as remaining articles combined, with 4 setulate setae on inner margin and 3 on outer distal corner. Merus with 1 setulate seta on inner margin and 1 setulate seta on outer distal corner. Carpus slightly longer than ischium and

merus combined, with 3 setulate setae (setulae on proximal half of shaft only) and 2 simple setae on inner margin, 1 setulate seta on outer distal corner. Propodus length approximately 0.70 of that of carpus, inner margin with 4 barely setulate setae, outer margin with 2 slender simple setae (at 2/3-way along article and distally). Dactylus length approximately 0.4 of that of propodus, unguis longer than article. Exopod flagellum with 4 articles.

First pereopod (Fig. 3A). Several articles with delicate hyaline scales. Basis length approximately 2/3 that of remaining articles combined, with 2 setulate setae on inner margin (1 half-way along article, 1 distal) and 2 setulate setae near distal outer corner. Carpus next longest article, approximately twice as long as merus. Propodus length approximately 0.6 of that of carpus. Dactylus with a comb of setules on outer margin; unguis, distal half faintly serrulate dorsally. Exopod flagellum with 5 articles.

Second pereopod (Fig. 3B). Several articles with delicate hyaline scales. Basis slightly shorter than remaining articles combined. Basis, ischium and merus with 1 setulate seta on distal inner corner. Carpus second longest article, slightly longer than ischium and merus combined, with 1 serrulate seta on distal inner corner. Propodus length approximately 0.42 of that of dactylus. Dactylus length approximately equal to ischium and merus combined, with 3 unequal cuspidate setae, middle seta as long as propodus and dactylus combined. Exopod flagellum with 5 articles.

Third pereopod (Fig. 3C). Basis length approximately 1.2 times that of remaining articles combined, with delicate hyaline scales marginally and 1 setulate seta distally. Carpus second longest article, approximately as long as propodus and dactylus combined. Propodus with 1 stiff simple seta distally, reaching half-way along unguis. Unguis longer than dactylus and not distinctly demarcated from it. Without exopod.

Fourth pereopod similar to third, except for: basis approximately as long as remaining articles combined, distal seta simple (not setulate). Carpus length approximately 1.1 times that of propodus and dactylus combined.

Fifth pereopod (Fig. 3D) similar to third, except for: basis length approximately 0.6 of that of remaining articles combined, distal seta simple (not setulate). Carpus length approximately 1.2 times that of propodus and dactylus combined.

Uropod (Fig. 3E). Peduncle length approximately 1.7 times that of sixth pleonite, proximal half of inner margin serrate. Rami subequal in length, approximately half as long as peduncle. Exopod distal article, inner margin serrate and distal end with 1 long cuspidate seta (approximately half as long as ramus). Endopod with 1 article, inner margin serrate, with 1 setulate seta on distal 1/3 of article, 1 subterminal cuspidate seta and 1 long cuspidate seta (similar to that of exopod) distally.

**Description of the adult male** (based on the paratype USNM 1182941 and the dissected paratype USNM 1182933)

Total length 3.2 mm (paratype USNM 1182941).

Habitus as in female except for: carapace (Figs. 4A, B) approximately 1/3 of total length, width approximately 0.55 its length, dorsal outline less convex than in female. Double mid-dorsal carina distinct on anterior half of carapace only. Ocular lobe larger. Antero-lateral sinus widely open and shallow. Pereon: double mid-dorsal carinae of pereonites 2–5 less prominent, lateral shields absent. Pleon: more robust, approximately as long as cephalopereon; double mid-dorsal carinae absent on first four pleonites and poorly developed on fifth.

First antenna (Fig. 4C). Peduncle, basal article longer than remaining two articles combined; second article approximately 1.5 times as long as third, with 1 simple seta medially and 2 simple setae laterally. Main flagellum with 4 articles, basal article with 3 aesthetascs, most distal article with 2 aesthetascs and slender simple setae. Accessory flagellum approximately half as long as basal article of main flagellum, with a group of simple setae in midregion of article, and broom setae and simple setae distally.

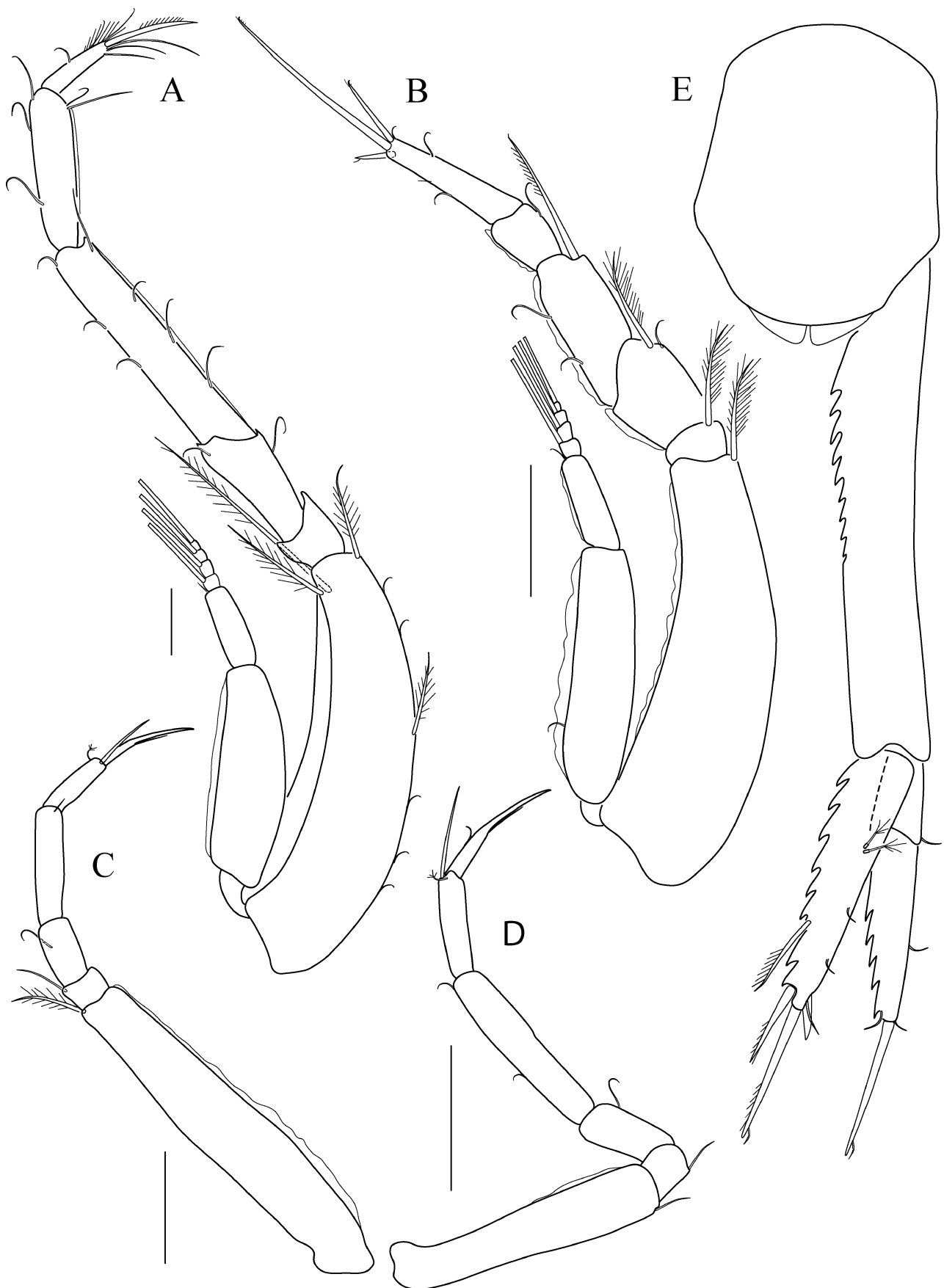
Second antenna reaching end of pleon.

Mouthparts and first and second maxillipeds as in female.

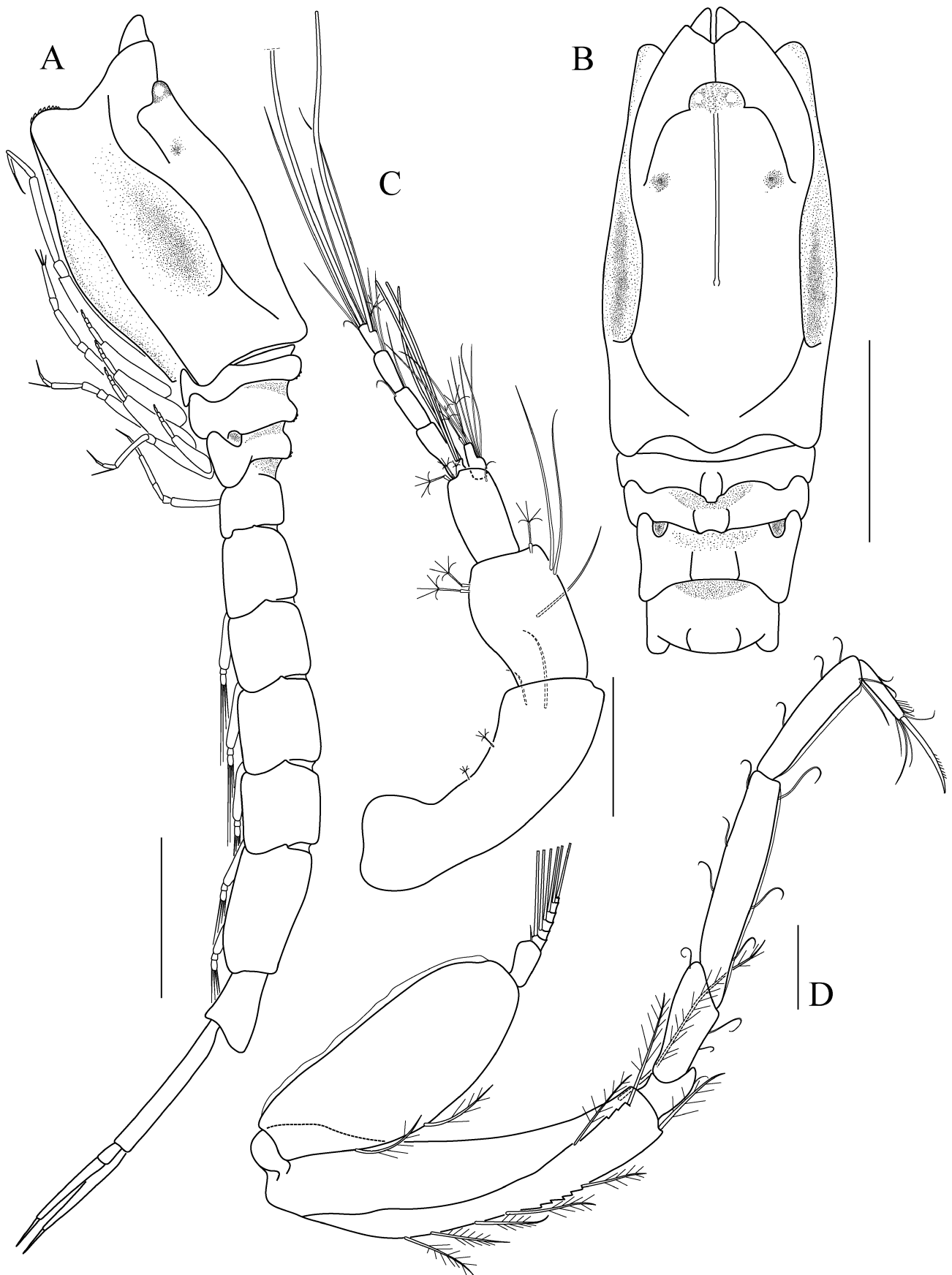
Third maxilliped as in female, except for: basis slightly longer than remaining articles combined, with 5 setulate setae on inner margin. Exopod: basis larger, flagellum with 6 articles.

First pereopod (Fig. 4D) as in female, except for: basis length approximately 0.7 of that of remaining articles combined, with 6 setulate setae on inner margin, 1 setulate seta on ventral surface at 4/5-way along article, and 2 setulate setae near outer distal corner. Exopod: basis larger, flagellum with 7 articles.

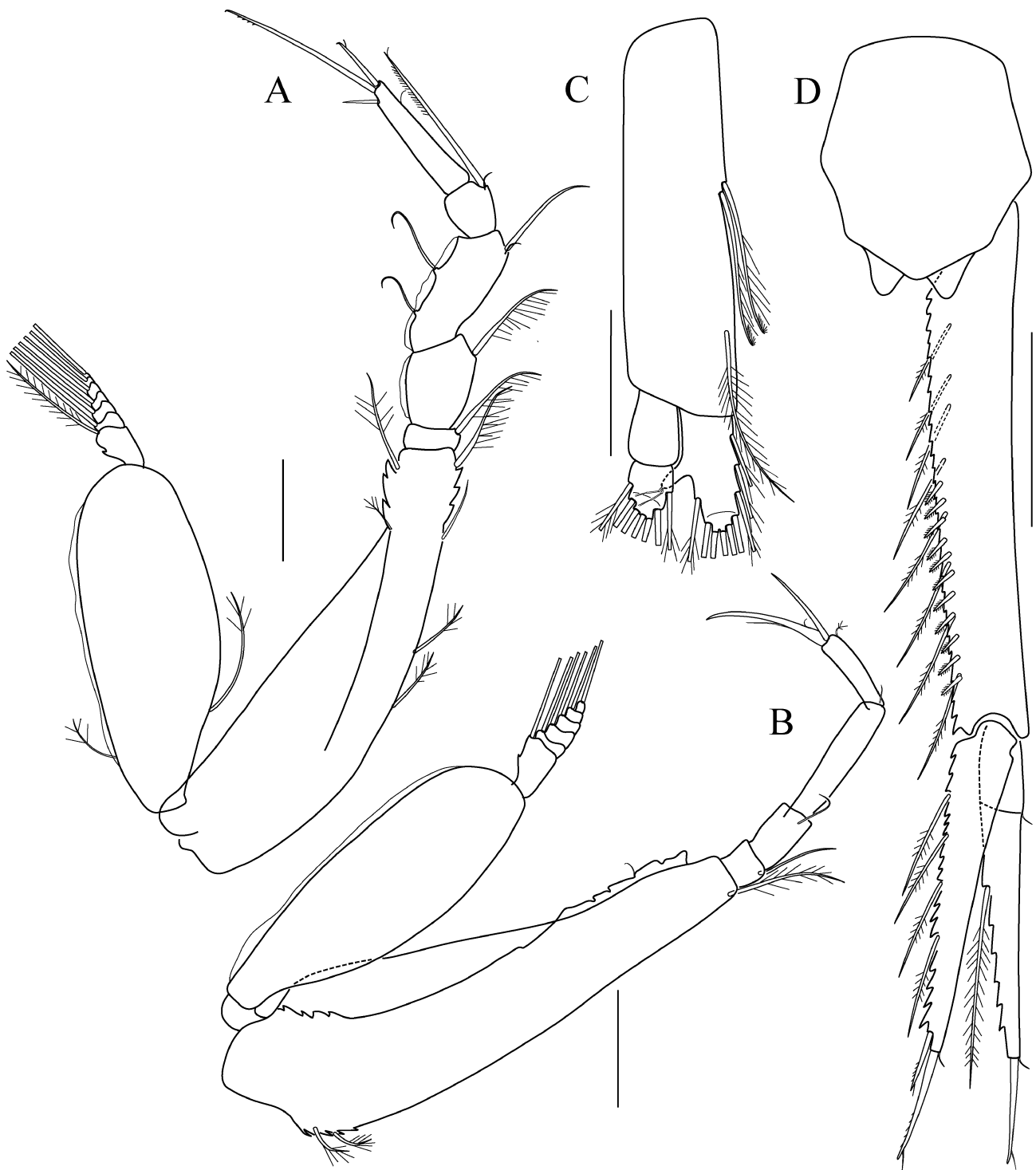
Second pereopod (Fig. 5A) as in female, except for: basis length approximately 1.2 times that of remaining articles combined. Carpus, distal inner corner with a simple seta (serrulate in its counterpart). Propodus with 1 long serrulate seta extending beyond distal end of dactylus. Exopod: basis larger, flagellum with 7 articles.



**FIGURE 3.** *Apocuma gerkenae* n. sp. Adult female, dissected paratype USNM 1182930: A, first pereopod; B, second pereopod; C, third pereopod; D, fifth pereopod; E, sixth pleonite and right uropod. Scale bars: 0.1 mm (A, B, C, D), 0.2 mm (E).



**FIGURE 4.** *Apocuma gerkenae* n. sp. Adult male, A, B, paratype USNM 1182941: A, habitus in lateral view; B, cephalopereon in dorsal view. C, D, dissected paratype USNM 1182933: C, first antenna; D, first pereopod. Scale bars: 0.5 mm (A, B), 0.1 mm (C, D).



**FIGURE 5.** *Apocuma gerkenae* n. sp. Adult male, dissected paratype USNM 1182933: A, second pereopod; B, third pereopod; C, second pleopod (rami setae cut off); D, sixth pleonite and right uropod. Scale bars: 0.1 mm (A–C), 0.2 mm (D).

Third pereopod (Fig. 5B) as in female, except for: basis length approximately 1.6 times that of remaining articles combined, inner margin with 1 setulate seta distally and 2 setulate setae proximally. Carpus length approximately 1.3 times that of propodus and dactylus combined. Exopod: basis large, flagellum with 6 articles.

Fourth pereopod as third, except for: basis approximately 0.90 as long as remaining articles combined, proximal setulate setae absent. Exopod: flagellum with 5 articles.

Fifth pereopod as in female, except for: carpus approximately 1.5 times as long as propodus and dactylus combined.

Pleopods (Fig. 5C) with a finger-shaped process on outer edge of inner ramus.

Uropod (Fig. 5D). Peduncle approximately 2.3 times as long as sixth pleonite, inner margin serrate, with 8 long serrulate setae and 11 short serrulate setae. Rami subequal and approximately 0.6 as long as peduncle. Exopod distal article, inner margin serrate and with 1 long setulate seta, distal end with 1 long cuspidate seta (approximately 1/3 as long as article). Endopod of 1 article, inner margin serrate, with 4 long serrulate setae (similar to those of peduncle), 1 cuspidate seta subterminally, and 1 long cuspidate seta (similar to that of exopod) distally.

**Distribution.** This species was found off the coasts of Georgia, Florida (both on the Atlantic Ocean and the Gulf of Mexico), Rio de Janeiro, São Paulo and Paraná States, between 56 and 150 m.

**Etymology.** This species is dedicated to Sarah Gerken, in recognition of her valuable contributions to the taxonomy of cumaceans.

### *Apocuma iorgui* n. sp.

(Figs. 6; 7C, D)

**Material examined.** Instituto Oceanográfico da Universidade de São Paulo (IOUSP). R/V “Prof. W. Besnard”. MBT 141, 23°25’S, 43°00’W, 113 m, 02 Sep 1970: 1 specimen (MACN-In. 38860). MBT 142, 23°46’S, 43°00’W, 150 m, 02 Sep 1970: 3 specimens (MACN-In. 38861). MBT 145, 23°25’S, 42°27’W, 130 m, 03 Sep 1970: 7 specimens (MACN-In. 38862). MBT 148, 23°19’S, 41°57’W, 136 m, 03 Sep 1970: 236 specimens (holotype MZUSP 26081; paratypes: MZUSP 26082, MACN-In. 38863; SEM photos: paratypes MACN-In. 38863a, 38863b). MBT 149, 23°41’S, 41°55’W, 250 m, 04 Sep 1970: 207 specimens (MZUSP 26083, MACN-In. 38864).

**Diagnosis.** Carapace upper lateral carina arched and limited to midregion (neither extending on pseudorostral lobe nor in the distal end of carapace). Many specimens with a short arched furrow, slanting 45°, starting at approximately 1/3-way along lower lateral carina. Female with a rudimentary exopod on third pereopod. Female uropod endopod with 1 short serrulate seta at 2/3-way along its inner margin, and 1 minute subterminal seta and 1 cuspidate seta distally, exopod with 1 terminal cuspidate seta only. Male unknown.

**Description of the adult female** (based on the holotype MZUSP 26081 and the dissected paratype MZUSP 26082)

Total length 3.8 mm (holotype MZUSP 26081).

Carapace (Figs. 6A, B; 7C, D) approximately 0.36 total length. Width approximately 0.71 its length. Dorsal outline hardly convex, raised into a moderate hump posteriorly. With a faintly marked double mid-dorsal carina (the two branches set close together) and two pairs of lateral carinae. Double mid-dorsal carina distinct on anterior half of carapace and just before the posterior hump. Upper lateral carina convex ending at 4/5-way along carapace. Lower lateral carina straight, sharper than the upper one, extending from antero-lateral angle to posterior margin of carapace, where it produces backwards to form a small subtriangular lobe. Sides excavated (sulcus) below the upper carina. Many specimens with short arched furrow, 45° slanted, starting at approximately 1/3-way along lower lateral carina (an arrow points to this furrow in Fig. 7C). Pseudorostrum upturned at approximately 30°. Ocular lobe moderately large, broader than long, without lenses but with clear area on each side (see Figs. 7C, D). Antero-lateral sinus narrow and deeply excavated, antero-lateral angle rounded and dentate.

Pereonite 1 visible laterally. Pereonites 3–5 with low dorso-lateral carinae, gradually becoming more prominent backwards. Pereonites 2–5 with lateral shields.

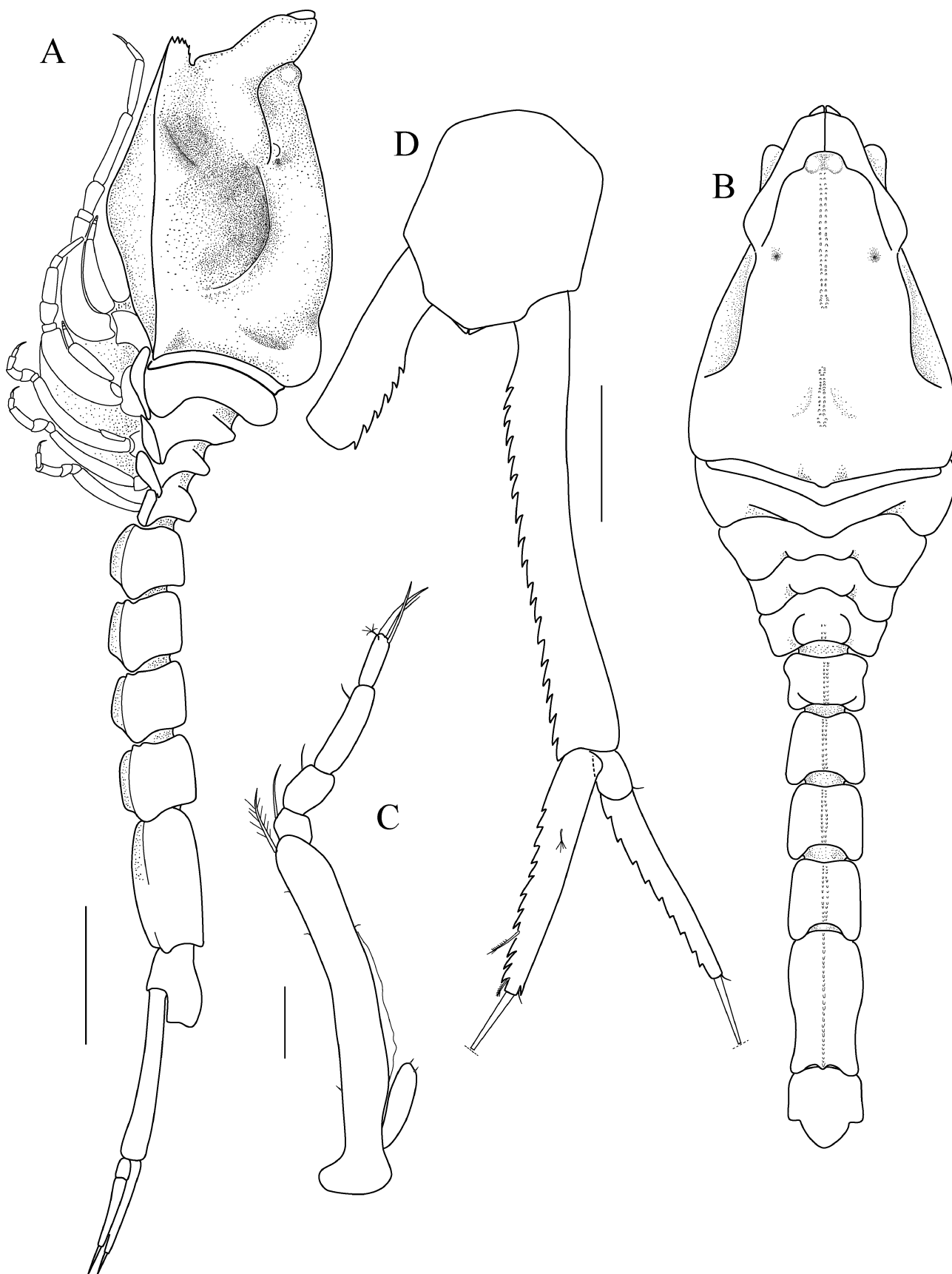
Pleon approximately as long as cephalopereon. First four pleonites with double mid-dorsal carinae, branches sharp and contiguous. Pleonite 5 with a single sharp mid-dorsal carina.

Mouthparts and maxillipeds as in *A. gerkenae*.

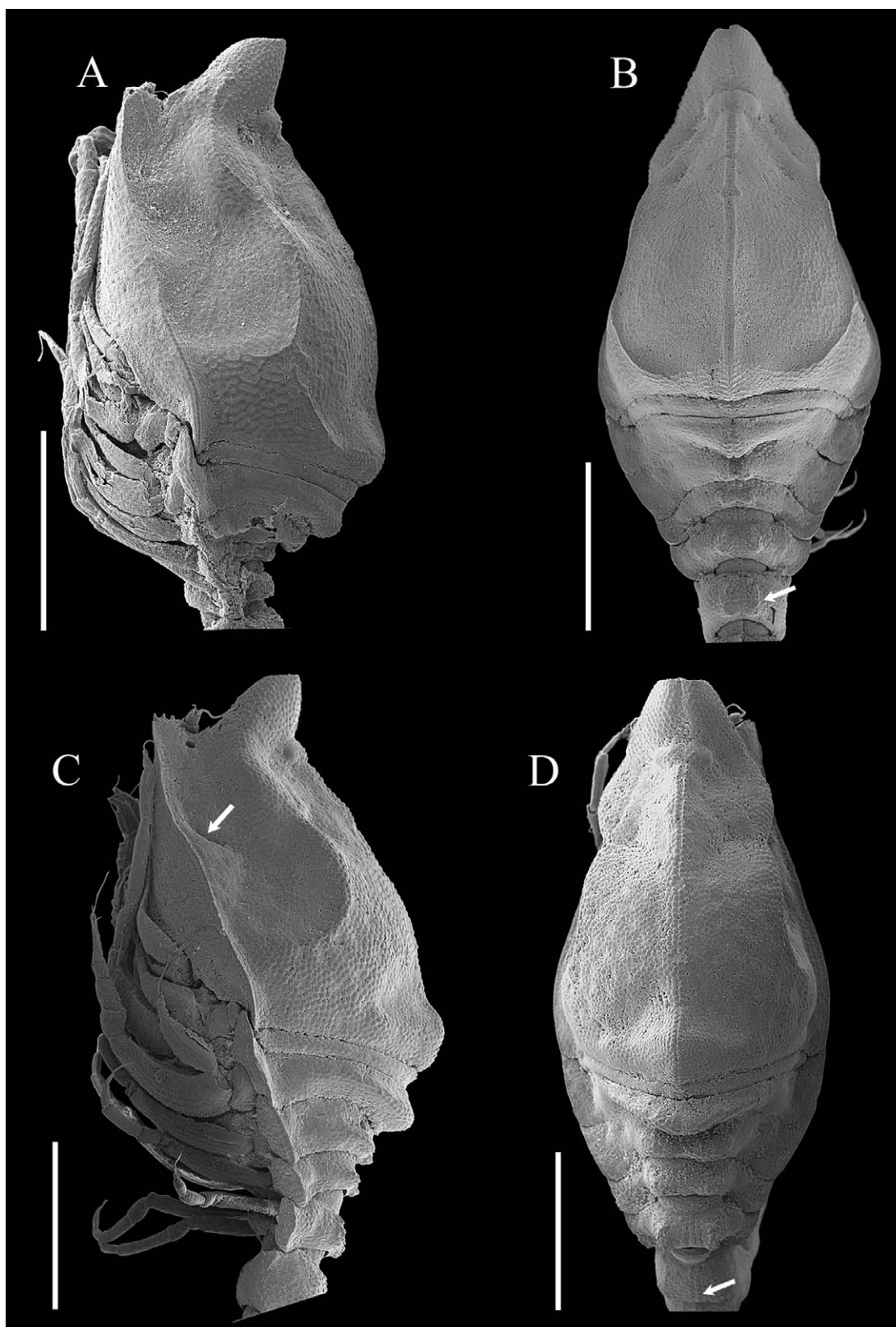
First pereopod as in *A. gerkenae*, except for: basis with 3 setulate setae (2 along article, 1 distal) on inner margin.

Second pereopod as in *A. gerkenae*.

Third pereopod (Fig. 6C). Basis approximately 1.4 times as long as remaining articles combined, with delicate hyaline scales marginally and 1 setulate seta distally. Carpus second longest article, approximately 1.2 times as long as propodus and dactylus combined. Propodus with 1 stiff simple seta distally, almost reaching end of unguis. Unguis longer than dactylus, not distinctly marked off from it. With unsegmented rudimentary exopod.



**FIGURE 6.** *Apocuma iorgui* n. sp. Adult female. A, B, holotype MZUSP 26081: A, habitus in lateral view; B, habitus in dorsal view (appendages omitted). C, D, dissected paratype MZUSP 26082: C, third pereopod; D, sixth pleonite and right uropod. Scales bars: 0.5 mm (A, B; these figures share the same scale bar), 0.1 mm (C), 0.2 mm (D).



**FIGURE 7.** SEM photographs. *Apocuma gerkenae* n. sp. Adult female. A, cephalopereon in lateral view (MACN-In. 38855a); B, cephalopereon plus first pleonite in dorsal view, the arrow points to the double mid-dorsal carina of first pleonite (MACN-In. 38855b). *Apocuma iorgui* n. sp. Adult female. C, cephalopereon plus first pleonite in lateral view, arrow points to the short arched furrow (paratype MACN-In. 38863a); D, cephalopereon plus first pleonite in dorsal view, the arrow points to the double mid-dorsal carina of first pleonite (paratype MACN-In. 38863b). Scale bars: 0.5 mm (A–D).

Fourth pereopod as third, except for: basis approximately 1.1 times as long as remaining articles combined, distal seta simple (not setulate). Carpus approximately 1.4 times as long as propodus and dactylus combined. Without exopod.

Fifth pereopod as third, except for: basis approximately 0.6 as long as remaining articles combined, distal seta simple (not setulate). Carpus approximately 1.7 times as long as propodus and dactylus combined. Without exopod.

Uropod (Fig. 6D). Peduncle approximately twice as long as sixth pleonite, serrate along inner margin. Rami subequal in length, approximately half as long as peduncle. Exopod distal article, inner margin serrate and distal end with 1 cuspidate seta (tip broken). Endopod of 1 article, inner margin serrate, with 1 small serrulate seta (setulae detected at high magnification only) at 2/3-way along article, distal end with 1 minute subterminal seta and 1 cuspidate seta (tip broken).

**Distribution.** Found at five stations off Rio de Janeiro State (Brazil), between 113 and 250 m.

**Etymology.** The species is named in honour of Iorgu Petrescu, a renowned expert in Cumacean taxonomy.

### *Apocuma brasiliense* Jones, 1973

**Material examined.** Museu Nacional / Universidade Federal do Rio de Janeiro (UFRJ). Oceanprof I # 44: 22°11.443'S, 39°54.767'W, 754 m, 10 Dec 2002: 1 specimen (UFRJ 21271). Oceanprof II # 44: 22°11.443'S, 39°54.767'W, 749 m, 01 Jul 2003: 1 specimen (UFRJ 21275).

Originally described from off the coast of Recife, at 587–805 m, it is now recorded from a station off the coast of Rio de Janeiro, within this depth range. Further records of this species are from off the coasts of Surinam (523–2076 m) and Argentina (1679 m) (see below).

### Remarks

*Apocuma gerkenae*, *A. iorgui* and *A. brasiliense* are closely related species. Main morphological differences among the females of these three species are listed in Table 1.

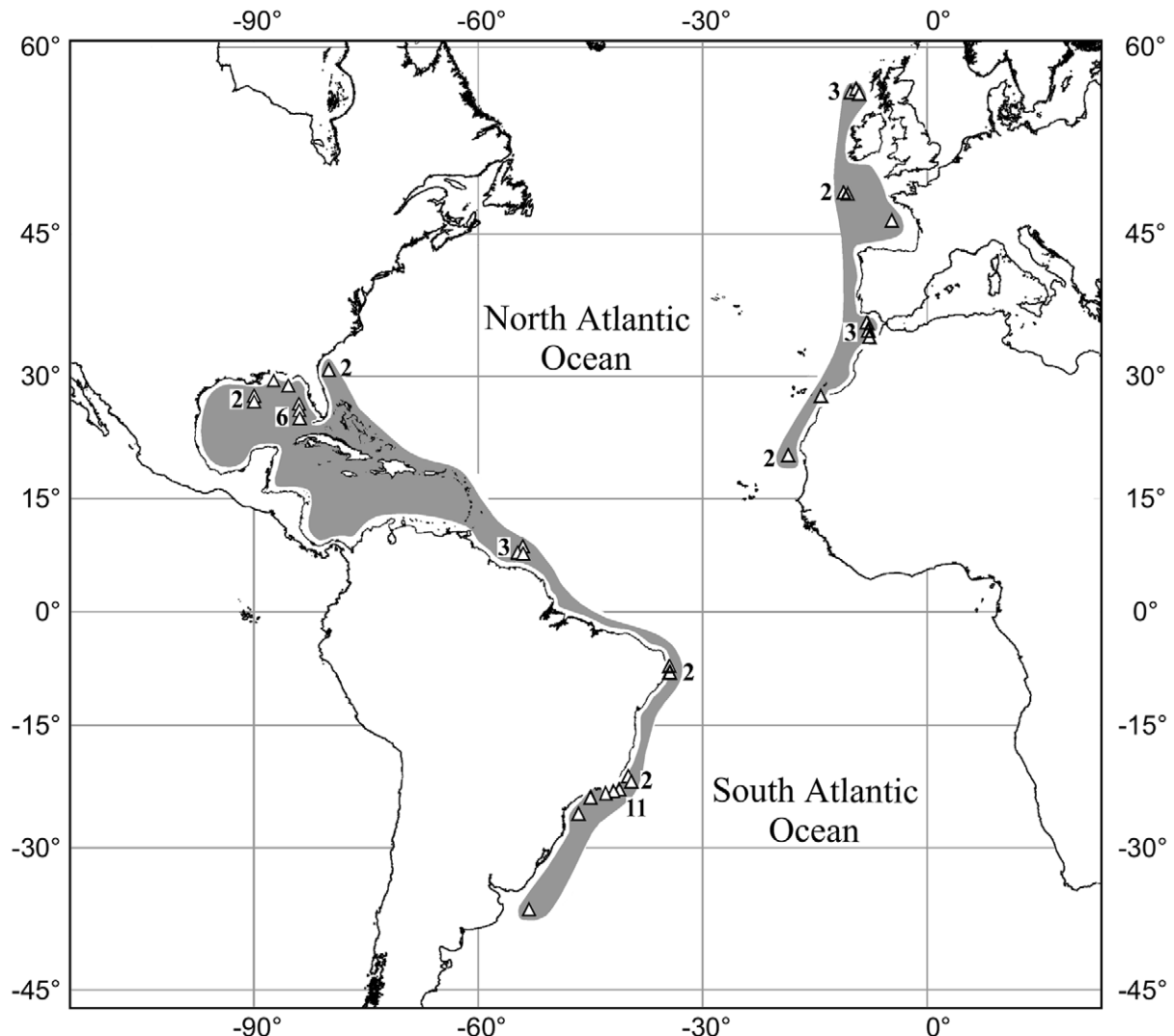
One of the most important characters distinguishing the species of this genus is the sculpture of the carapace. However, the carapace sculpture is less developed in adult males than in females and immature instars, making the adult male identification difficult. Moreover, the male of *A. brasiliense* is briefly described and no males have been reported for *A. iorgui*. A possible assumption is that the males of *A. gerkenae* and *A. iorgui* are morphologically almost identical, and thus we were not able to distinguish them from each other. Until this problem is solved, females or immature specimens are needed to identify these species with certainty.

**TABLE 1.** Comparison of selected characters of the females of *Apocuma gerkenae* n. sp., *A. iorgui* n. sp. and *A. brasiliense* Jones, 1973.

		<i>A. gerkenae</i> n. sp.	<i>A. iorgui</i> n. sp.	<i>A. brasiliense</i>
Size		2.4 mm	3.8 mm	4.7 mm
Carapace	Upper lateral carina	sinuous, running from pseudostrostrum to almost posterior margin of carapace	arched, limited to middle area of carapace	sinuous, running from frontal lobe to posterior margin of carapace
	Furrow near to lower carina	absent	present or absent	absent
	Dorsal posterior hump	low	moderate	well developed
Third pereopod		with rudimentary exopod	lacking exopod	lacking exopod
Uropod	Endopod inner margin	with a well-developed setulate seta 2/3-way along article	with a small serrulate seta at 2/3-way along article	without seta?

## Distribution of the Atlantic species of the genus *Apocuma*

In order to present the most accurate picture of the distribution of this genus in the Atlantic Ocean, all the stations from where specimens of *Apocuma* were reported are plotted in Fig. 8. The data from all these stations, except those already listed in the “Material examined” sections, are provided in Table 2.



**FIGURE 8.** Hypothetical distribution of the genus *Apocuma* in the Atlantic Ocean. The East-Atlantic group includes the following: *A. mauritaniense* and *Apocuma* sp. n. DJ, and the West-Atlantic group: *A. brasiliense*, *A. gerkenae* n. sp., *A. iorgui* n. sp. and *Apocuma* sp. In the cases where the symbols for the stations (triangles) fall one upon another, the total number of overlapped triangles is indicated next to the group.

Table 2 includes many records taken from the database compiled by the late Norman S. Jones that have not been published before. Based on these unpublished records, the distribution of *Apocuma brasiliense* and *Apocuma* sp. n. DJ is considerably extended. *Apocuma brasiliense*, described by Jones (1973) from off the coast of Recife, is also recorded off the coasts of Surinam and Argentina in this database. *Apocuma* sp. n. DJ was first recorded by Jones (1990) from the Strait of Gibraltar, and in this database it is also listed from off the coasts of the British Isles, Bay of Biscay and Canary Islands. The specimens dealing with these unpublished records are all deposited in the Natural History Museum, London (NHM).

In Watling’s 2009 comprehensive biogeographic analysis of the Atlantic cumaceans there is listed an *Apocuma* sp. among the dominant species of his “Cluster group H”. This cluster group includes stations from the Northeast Atlantic Basin. It is worth noting that all these stations come from the database compiled by N.S. Jones and

consequently, *Apocuma* sp. and *Apocuma* sp. n. DJ refer to the same species (Les Watling, pers. comm.). In fact, three of the stations included in “Cluster group H” (ES04, ES20, and Z447) are listed herein in Table 2.

Finally, a few specimens collected in deep waters from the Gulf of Mexico that were identified by Norman S. Jones as *Apocuma* sp. are also listed in Table 2. This material is deposited in the United States National Museum (USNM).

**TABLE 2.** Records of *Apocuma brasiliense*, *Apocuma mauritaniense*, *Apocuma* sp. n. DJ and *Apocuma* sp. from the Atlantic Ocean. Abbreviations: COB = Centre Océanologique de Bretagne, Brest (now Institut Français pour l’Exploitation de la Mer, IFREMER); IOS = Institute of Oceanographical Sciences, Wormley (now Southampton Oceanography Centre); JGOFS = Joint Global Ocean Flux Study, International programme; LGL = Lgl Ecological Research Associates, Inc.; MBA = Marine Biological Association of the United Kingdom, Plymouth; NGOMCS = Northern Gulf of Mexico Continental Slope Study; NHM = Natural History Museum, London; NSJ = unpublished spreadsheets assembled by Norman S. Jones; SMBA = Scottish Marine Biological Association, Dunstaffnage (now Scottish Association for Marine Science, SAMS); USNM = United States National Museum; WHOI = Woods Hole Oceanographic Institution.

Species	Institution	Cruise	Station	Latitude Longitude	Depth (m)	Date	Source / Deposited in
<i>Apocuma brasiliense</i>	WHOI	Knorr 25	293	08° 58.1’N 54° 04.3’W	1518	27.02.72	NSJ; NHM
<i>Apocuma brasiliense</i>	WHOI	Knorr 25	299	07° 55.1’N 55° 42’W	2076	29.02.72	NSJ; NHM
<i>Apocuma brasiliense</i>	WHOI	Knorr 25	297	07° 45.3’N 54° 24’W	523	28.02.72	NSJ; NHM
<i>Apocuma brasiliense</i>	WHOI	Chain 35	12	07° 09’S 34° 25.5’W	770	06.04.63	Jones, 1973; NHM
<i>Apocuma brasiliense</i>	WHOI	Atlantic II 31	169	08° 03’S 34° 23’W	587	21.02.67	Jones, 1973; NHM
<i>Apocuma brasiliense</i>	WHOI	Atlantic II 60	239	36° 49’S 53° 15.4’W	1679	11.03.71	NSJ; NHM
<i>Apocuma mauritaniense</i>	JGOFS	Eumeli	CPH 4	20° 33.4’N 18° 35.3’W	2003	06.02.91	Ledoyer, 1997
<i>Apocuma mauritaniense</i>	JGOFS	Eumeli	CPH 5	20° 30.5’N 18° 33.7’W	1855	06.02.91	Ledoyer, 1997
<i>Apocuma</i> sp. n. DJ	SMBA	Challenger	ES04	56° 52’N 10° 01’W	1993	05.06.73	NSJ; NHM
<i>Apocuma</i> sp. n. DJ	SMBA	Challenger	ES14	56° 45’N 09° 46’W	1770	22.09.73	NSJ; NHM
<i>Apocuma</i> sp. n. DJ	SMBA	Challenger	ES20	56° 46’N 09° 17’W	1271	23.09.73	NSJ; NHM
<i>Apocuma</i> sp. n. DJ	MBA	Sarsia	66	46° 16.3’N 04° 44’W	1427	25.07.67	NSJ; NHM
<i>Apocuma</i> sp. n. DJ	COB	Balgim 84	DW107	36° 05’N 08° 05.6’W	1917	10.06.84	Jones, 1990
<i>Apocuma</i> sp. n. DJ	COB	Balgim 84	CP68	35° 11.9’N 07° 52.6’W	2035	05.06.84	Jones, 1990
<i>Apocuma</i> sp. n. DJ	COB	Balgim 84	CP99	34° 28.2’N 07° 43.3’W	1870	09.06.84	Jones, 1990; NSJ
<i>Apocuma</i> sp. n. DJ	IOS	Discovery	6701	27° 45.2’N 14° 13’W	1934	16.03.68	NSJ; NHM
<i>Apocuma</i> sp.	LGL	NGOMCS 3	C08-4	27.50861°N 89.82278°W	1232	14.11.84	USNM
<i>Apocuma</i> sp.	LGL	NGOMCS 3	C07-4	27.7411°N 89.9844°W	1032	14.11.84	USNM

## Discussion

The genus *Apocuma* currently contains seven species. Four of them are reported from the Atlantic Ocean, viz., *A. brasiliense*; *A. mauritaniense* Ledoyer, 1977; *A. gerkenae* and *A. iorgui*. The remaining three species were found in the Australasian Region, viz., *A. australiense* (Hale, 1949); *A. poorei* Petrescu, 2004 and *A. pacificum* Corbera, 2008.

Most females of the genus *Apocuma* have a rudimentary exopod on the third pereopod. In contrast, this rudimentary exopod is missing in the female of *A. gerkenae*, and probably in *A. australiense* as well. Hale (1949) described *Cumellopsis australiensis* based on a female with developing marsupium. More recently, Petrescu (2004) transferred this species to the genus *Apocuma* and described some additional specimens. However, in the fig. 2d presented by Petrescu (2004) the third pereopod of the female has a rudimentary exopod, but in the fig. 11 presented by Hale (1949) the third pereopod lacks exopod. Thus, the re-examination of the type material of *Cumellopsis australiensis* is required to confirm if this tiny exopod was overlooked by Hale (1949) or if it is actually absent.

In a phylogenetic study on the family Bodotriidae presented by Haye (2007), she showed that the number of pereopods with exopods decreases from ancestral to more derived forms. If this trend is also valid for the members of the genus *Apocuma*, *A. gerkenae* should be considered one of the most derived species of the genus. Furthermore, since *A. gerkenae* and *A. iorgui* are closely related and sympatric species, it seems likely that the latter is the ancestral species from which *A. gerkenae* has evolved.

Except for *Apocuma brasiliense*, adult males have not been reported previously for this genus. Moreover, the description of *A. brasiliense* is based mainly on the adult female; only the general appearance and the uropods were described for the male (see Jones 1973).

Our samples include some adult males of *A. gerkenae*. This allowed us to report two features: (1) the propodus of the second pereopod bears an unusual long serrulate seta, which is absent in the female of *A. gerkenae*, and (2) the inner ramus of the pleopods has a finger-shaped process on the outer edge. This process is present not only in the adult males but also in the immature ones.

Petrescu (2004) illustrated the pleopods of the immature males of *A. australiense* and *A. poorei*, but he did not depict such finger-like process in his figs. 3a and 5a. Furthermore, based on Petrescu's figures, Haye (2007) assumed that this pleopod process is absent in the members of the genus. However, the finding of such finger-like process in *A. gerkenae* suggests that the pleopods of *A. brasiliense* could have such process as well. In this regard, the re-examination of the type material of *A. brasiliense* is required.

The genus *Apocuma* occurs from the British Isles to Mauritania on the E. Atlantic, and from Georgia (USA) to Argentina in the W. Atlantic. The bathymetrical distribution of the Atlantic species ranges from 56 to 2076 m and the lower depths correspond to the two new species described in this paper. The lack of records of *Apocuma* species from the African shallow waters seems to be an artefact of undersampling rather than a real absence.

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