



## On two South-West Atlantic *Diastylis* (Cumacea: Crustacea), *D. obliquisulcata* n. sp. and *D. geocostae*, with remarks on this speciose genus

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### Abstract

A new species, *Diastylis obliquisulcata* from eastern Patagonia, is fully described and illustrated based on specimens collected in shallow waters. *Diastylis obliquisulcata* shares with 14 other species of this genus an opercular maxilliped 3, a short telson and rudimentary exopods on pereopods 3 and 4 in the females. *Diastylis obliquisulcata* can be easily distinguished from all these species by the females having an oblique groove or *sulcus* on each side of the carapace. The taxonomic position of this group of species in the genus *Diastylis* is discussed. The adult male of *Diastylis geocostae* is described for the first time, the adult female briefly redescribed, and its distribution, up to now known from the type locality only (Cabo Frio, Rio de Janeiro State), is extended to off Rawson, Argentina. Within this species there are reported ontogenetic changes in the carapace ornamentation, in the chaetotaxy of the telson, and in the length ratio between the telson and the uropod peduncle.

**Key words:** taxonomy, Diastylidae, new species, ontogenetic changes

### Introduction

This is the fifth in a series of contributions on the South-West Atlantic cumaceans of the genus *Diastylis* published by both authors jointly and/or in collaboration with other colleagues (Moretti & Roccatagliata 2007; Alberico & Roccatagliata 2008, 2011; Cristales *et al.* 2010). Fourteen species belonging to this genus are known at present to occur in the southwestern Atlantic. Despite having now a more complete knowledge of this fauna, there is still a troublesome species and five incomplete descriptions: *D. manca* is known from a single manca specimen and its taxonomic status is uncertain, and for *D. fimbriata*, *D. araruamae*, *D. geocostae*, *D. racovitzai* and *D. brasilianus* only one sex has been described. Furthermore, drawings of the *habitus* for the latter two species are not available (see Sars 1873; Băcescu & Petrescu 1991; Petrescu & Băcescu 1991).

In the present contribution both sexes of *Diastylis obliquisulcata* n. sp. are fully described and illustrated based on specimens collected in shallow waters from Chubut and Santa Cruz Provinces, Argentina. In addition, the adult male of *D. geocostae* is herein described for the first time, the adult female briefly redescribed, and its range of distribution extended to off Rawson, Argentina. This species was described by Băcescu and Petrescu (1991) based on a few females collected south Cabo Frio, Rio de Janeiro State, Brazil, and no more records have been published since then.

### Material and methods

The samples examined in this study were collected from the Argentine-Uruguayan common fishing zone to Puerto Deseado, between 2 and 58 m depth.

Body lengths of the specimens were measured in lateral view from the tip of the pseudorostrum to the end of the telson (distal setae excluded). In the descriptions of the appendages, the length of single articles was always

taken along their longer sides. In the case that two or more articles are jointly measured, the length of these articles has been taken along their middle lines. The telsonic pre-anal and post-anal parts were measured with the specimen in ventral view: the former extends to the tip of the anal valves, the latter does not include the distal setae.

The illustrated specimens were stained with Chlorazole Black E. Habitus drawings were prepared using a Leica MZ8 stereomicroscope equipped with a *camera lucida*. After dissection, appendages were mounted in glycerin on temporary slides and drawn using a Carl Zeiss Axioskop compound microscope, also equipped with a *camera lucida*. Pencil drawings were captured in digital format and the line drawings were made using a Wacom digitizer board (see Coleman 2003). The specimens used to draw the *habitus* of the species were not dissected. Illustrations of the appendages of the new species herein described were based on two paratype females and two paratype males. When there was a slight discrepancy between the two dissected males (or females), the data of the second paratype was added to the text between parentheses.

For the setae terminology we follow Garm, 2004 (see also Alberico & Roccatagliata 2008, 2011). An additional type of seta is included: the bipectinate seta, which is a cuspidate seta with two rows of denticles along its shaft. This type of seta is found on the male uropods.

The specimens for SEM photographs were cleaned with 0.5% nonionic detergent Triton X100, ultrasound, dehydrated through a graded series of ethanol, critical-point dried, ion-sputtered, and examined under a Philips XL30 TMP microscope.

Type and reference specimens were deposited in the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” (MACN). All these specimens are preserved in 70% ethanol, except for those prepared for SEM examination, which are on aluminium stubs.

## Order Cumacea Kröyer, 1846

### Family Diastylidae Bate, 1856

#### Genus *Diastylis* Say, 1818

##### *Diastylis obliquisulcata* n. sp.

(Figures 1–8)

**Material examined.** —**Project ANPCyT 2004–2007, PICT 11180**, colls B. Doti, I. Chiesa, D. Roccatagliata. **Comodoro Rivadavia**, 05 Feb 2006. Sta. 3, 45°51.495'S, 67°27.917'W, 10 m: 2 ad. ♀♀, 10 subad. ♀♀, 6 subad. ♂♂, 56 juvs, 7 mancae (MACN-In. 39024). Sta. 4, 45°51.441'S, 67°27.816'W, 9 m: 4 ad. ♀♀, 29 subad. ♀♀, 5 ad. ♂♂, 29 subad. ♂♂, 214 juvs, 12 mancae (holotype MACN-In. 39025, paratypes MACN-In. 39026). Sta. 5, 45°51.629'S, 67°27.226'W, 13 m: 2 ad. ♀♀, 1 subad. ♂, 24 juvs. Sta. 6, 45°51.357'S, 67°27.134'W, 13.8 m: 2 subad. ♀♀, 1 subad. ♂, 15 juvs, 2 mancae. Sta. 7, 45°50.936'S, 67°27.029'W, 13.8 m: 1 subad. ♀. Sta. 8, 45°50.442'S, 67°27.655'W, 7.8 m: 1 ad. ♀, 1 juv., 1 manca. Sta. 9–10, 45°50.565'S, 67°27.610'W, 8.6 m: 1 ad. ♀, 6 subad. ♀♀, 7 subad. ♂♂, 96 juvs, 9 mancae. Sta. 11–12, 45°51.444'S, 67°27.769'W, 9 m: 3 ad. ♀♀, 32 subad. ♀♀, 6 ad. ♂♂, 23 subad. ♂♂, 380 juvs, 40 mancae (MACN-In. 39027). **Rada Tilly**, 09 Feb 2006. Sta. 4, 45°55.300'S, 67°31.687'W, 10 m: 26 subad. ♀♀, 2 ad. ♂♂, 3 subad. ♂♂, 124 juvs, 6 mancae. Sta. 14, 45°55.310'S, 67°31.883'W, 10–16 m: 1 subad. ♀. Sta. 15, 45°55.723'S, 67°31.924'W, 10–16 m: 2 ad. ♀♀, 1 subad. ♀, 2 ad. ♂♂, 1 subad. ♂, 3 juvs. Sta. 23, 45°55.389'S, 67°32.128'W, 10–16 m: 2 subad. ♀♀, 1 ad. ♂, 1 juv. Sta. 27, 45°55.316'S, 67°31.701'W, 10–16 m: 6 ad. ♀♀, 5 subad. ♀♀, 1 ad. ♂, 2 subad. ♂♂, 41 juvs, 27 mancae. Sta. 30, 45°55.298'S, 67°31.825'W, 10–16 m: 1 subad. ♀, 1 manca. **Puerto Deseado**, 07 Feb 2006. Sta. 3, 47°45.822'S, 65°50.326'W, 2–16 m: 1 ad. ♀. Sta. 13, 47°45.420'S, 65°52.595'W, 2–16 m: 1 ad. ♀, 1 subad. ♀, 6 juvs, 1 manca. Sta. 16, 47°45.673'S, 65°51.009'W, 2–16 m: 1 juv. Sta. 17, 47°45.654'S, 65°51.109'W, 2–16 m: 4 juvs. Sta. 18, 47°45.722'S, 65°50.944'W, 2–16 m: 1 juv., 1 manca. Sta. 28, 47°45.763'S, 65°55.728'W, 5 m: 2 mancae. **Puerto Deseado**, 23 Jan 2007. Sta. 17, 47°45.37'S, 65°50.75'W, 20 m: 1 subad. ♀. Sta. 20, 47°43.76'S, 65°50.26'W, 15 m: 2 subad. ♀♀, 3 juvs. —**Project PNUD ARG/02/018, 2005–2007**, coll. J.H. Vinuesa. **Comodoro Rivadavia**, Sta. 2, 45°50.85'S, 67°27.22'W, 5–7 m: 35 ad. ♀♀, 18 subad. ♀♀, 7 subad. ♂♂, 9 juvs, 1 manca. **Rada Tilly**, Sta. 1, 46°02.43'S, 67°35.54'W, 5–7 m: 2 ad. ♀♀, 1 subad. ♀, 1 subad. ♂, 1 juv.

**Diagnosis.** Female carapace rough with many minute conical protuberances, each side with two weak oblique

carinae (posterior one hardly visible) and a shallow groove or *sulcus* in between; male carapace with few conical protuberances, *sulcus* and posterior oblique carina absent, and anterior oblique carina less marked than in female. Female with rudimentary exopods on pereopods 3 and 4. Telson shorter than uropod peduncle, with 3–4 (female) or 4–5 (male) cuspidate setae on each side. Uropodal rami subequal, endopod of 3 articles.

**Description of the adult female** (based on the holotype MACN-In. 39025 and the paratypes MACN-In. 39026a and 39026b)

Total length (holotype): 5.5 mm.

Carapace (Figs. 1A, B; 2A–C) 1.4 times as long as wide. Surface rough, with minute conical protuberances (see detail in Fig. 2B). Each side with two parallel oblique carinae encircling a shallow depressed area or *sulcus*, the anterior carina runs from behind antero-lateral angle to almost dorsal surface, the posterior one much fainter and restricted to dorsal part of carapace. Each pseudorostral lobe with a barely traceable horizontal carina. Ocular lobe slightly wider than long, without lenses. Pseudorostrum approximately 3 times as long as ocular lobe. Inferior margin of carapace finely serrate. Antero-lateral angle rounded, antennal notch shallow.

Pereon (Figs. 1A, B; 2A, C) 0.8 as long as carapace.

Pleon (Fig. 1A) 0.9 as long as cephalopereon.

First antenna (Fig. 1C). Peduncle, first article 0.85 as long as second and third combined, inner distal corner with 1 setulate seta and 2 teeth, outer margin with 1 seta with tiny setulae; second article 0.8 as long as third, both articles with small simple setae and broom setae. Main flagellum of 5 articles, fourth and fifth articles with 1 aesthetasc each. Accessory flagellum reaching half-way along second article of main flagellum; of 3 articles, second one longest.

Second antenna (Fig. 1D). With 4 articles, distal one minute. First article with 2 setulate setae and 1 tiny finger-like seta (see detail), second and third articles with 1 setulate seta each, fourth article with 1 seta with tiny setulae. Third article, margin with a serration.

Right mandible (Fig. 3A). *Pars incisiva* with a rudimentary *lacinia mobilis* and 11 setae. Left mandible as right except for *lacinia mobilis* well developed.

First maxilla. As that of *Diastylis fabrizioi* (see Fig. 3B in Alberico & Roccatagliata 2008), i.e., outer endite with 14 cuspidate setae distally and 1 short setulate seta on outer margin; inner endite with 5 unequal setae distally.

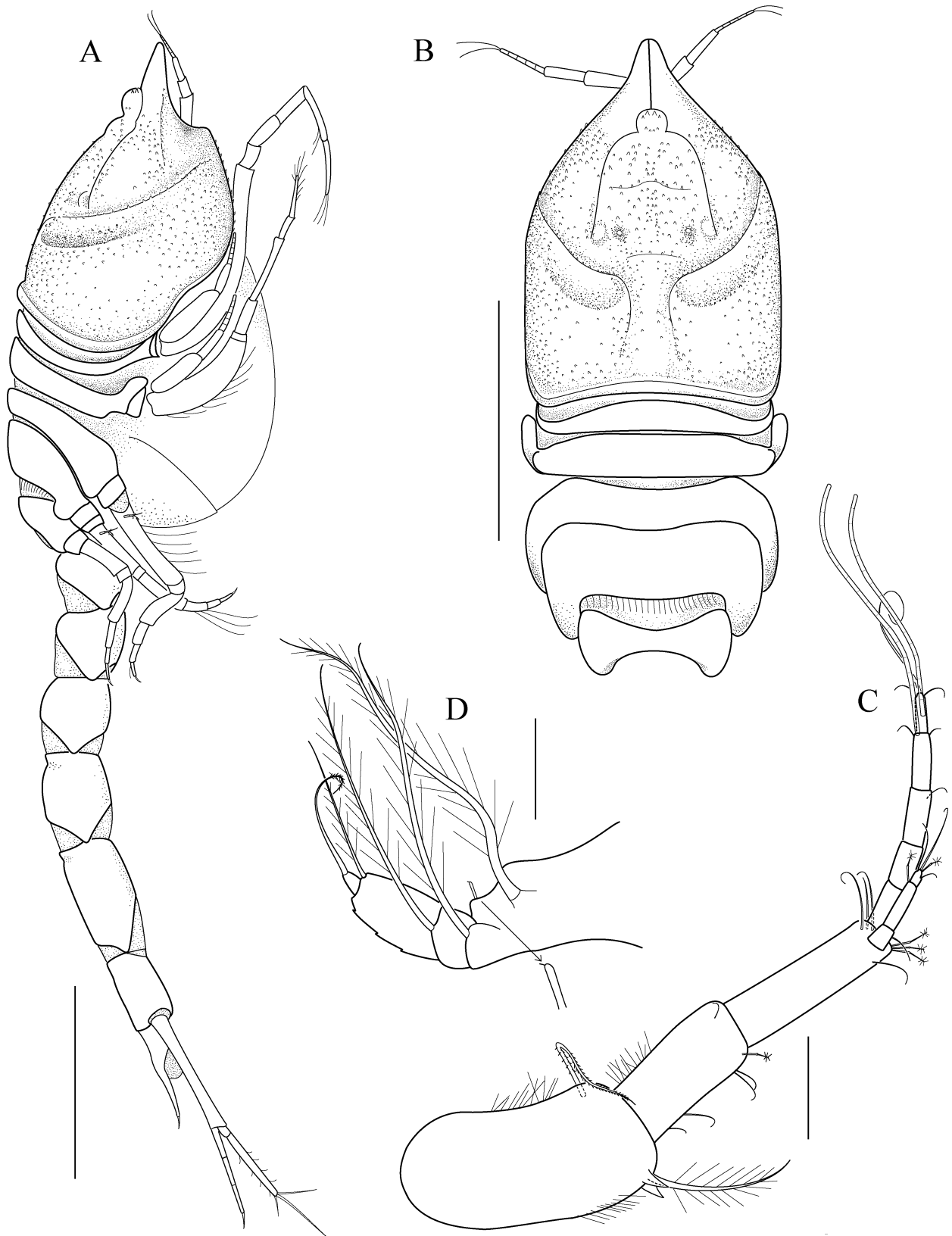
Second maxilla. As that of *Diastylis fabrizioi* (see Fig. 3C in Alberico & Roccatagliata 2008), i.e., outer endite with 3 serrulate and 3 serrate setae; inner endite with 1 serrulate and 3 serrate setae.

First maxilliped (Fig. 3B). Basis with 5–6 setuloserrate setae on inner margin. Carpus, inner margin with a row of 9 setuloserrate setae; ventral surface with many thin setae with rounded tip (not drawn); outer distal corner with 1 large setulate seta. Propodus with 2 serrulate setae on outer distal corner, many thin setae with rounded tip (not drawn) on inner margin and on ventral surface and 3 large setulate setae distally. Dactylus with 2 serrulate and 2 simple setae.

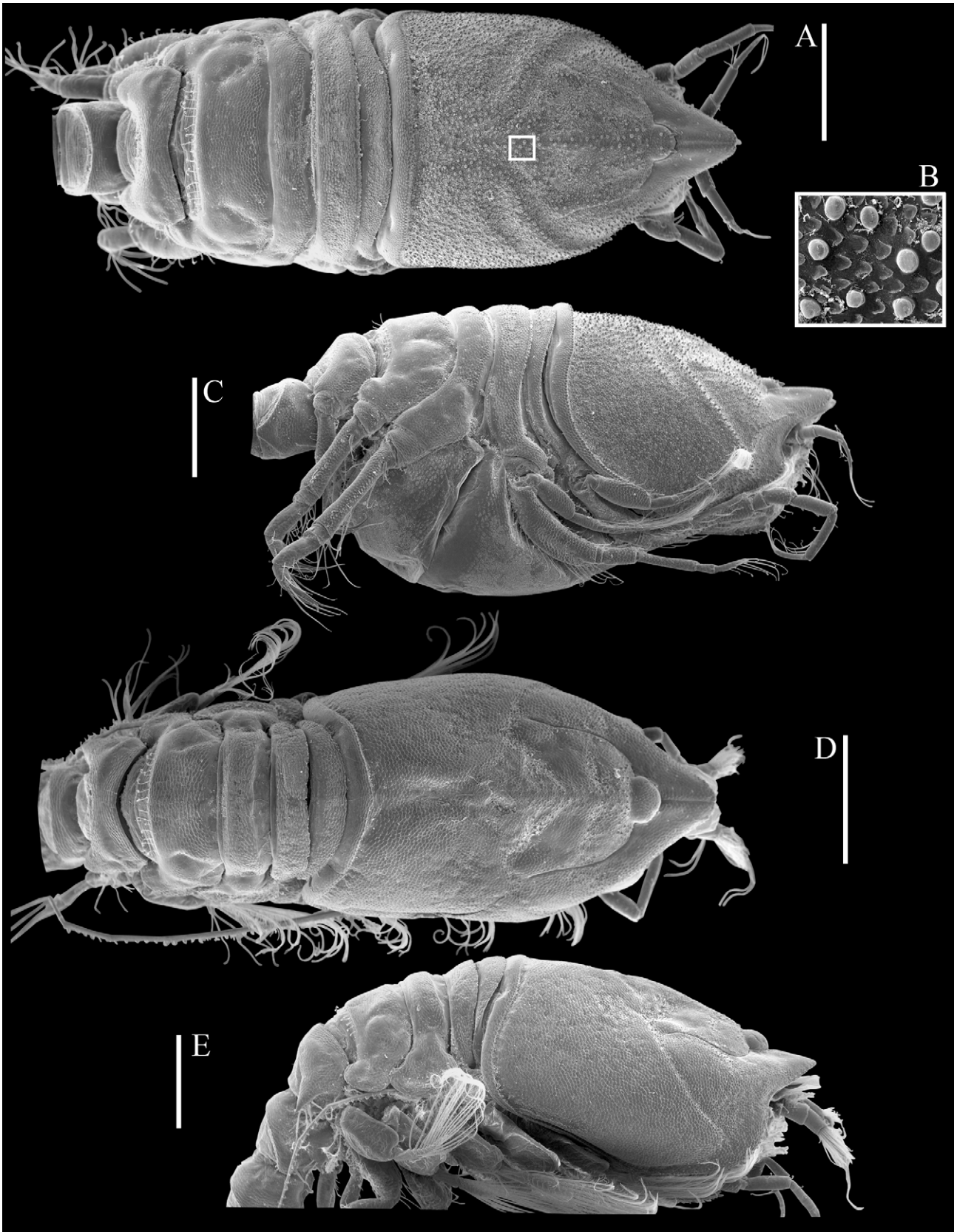
Second maxilliped (Fig. 3C). Basis 0.8 as long as remaining articles combined, with 4 setulate setae distally. Merus with 1 setulate seta on outer distal corner, and 1 short and 1 long setulate setae on ventral surface. Carpus 0.9 as long as propodus and dactylus combined, outer margin with 2 unequal setulate setae, inner margin with 10 setulate setae. Propodus, outer margin with 1 large setulate seta at 1/3-way along article and 1 setulate seta on distal corner, inner margin with many barely setulate setae (not drawn), 4 of them also serrulate distally. Dactylus with 2 serrulate and several simple setae.

Third maxilliped (Fig. 4A). Basis approximately twice as long as remaining articles combined, inner margin serrate and with setulate setae; outer distal corner not extending beyond ischium-merus articulation, with 6 long and 1 short (not drawn) setulate setae. Ischium to carpus with teeth on inner margin. Ischium with 1 setulate seta on inner margin. Merus 0.4 as long as carpus, with 1 large setulate seta on outer margin and 3 setulate setae on or near inner margin. Carpus 0.8 as long as propodus, with 2 setulate setae on outer distal corner and 4 setulate setae on or near inner margin. Propodus with 7 barely setulate setae on inner margin and 1 setulate seta on outer distal corner. Dactylus 0.6 as long as propodus, with simple and serrulate setae. Exopod flagellum of 6 articles.

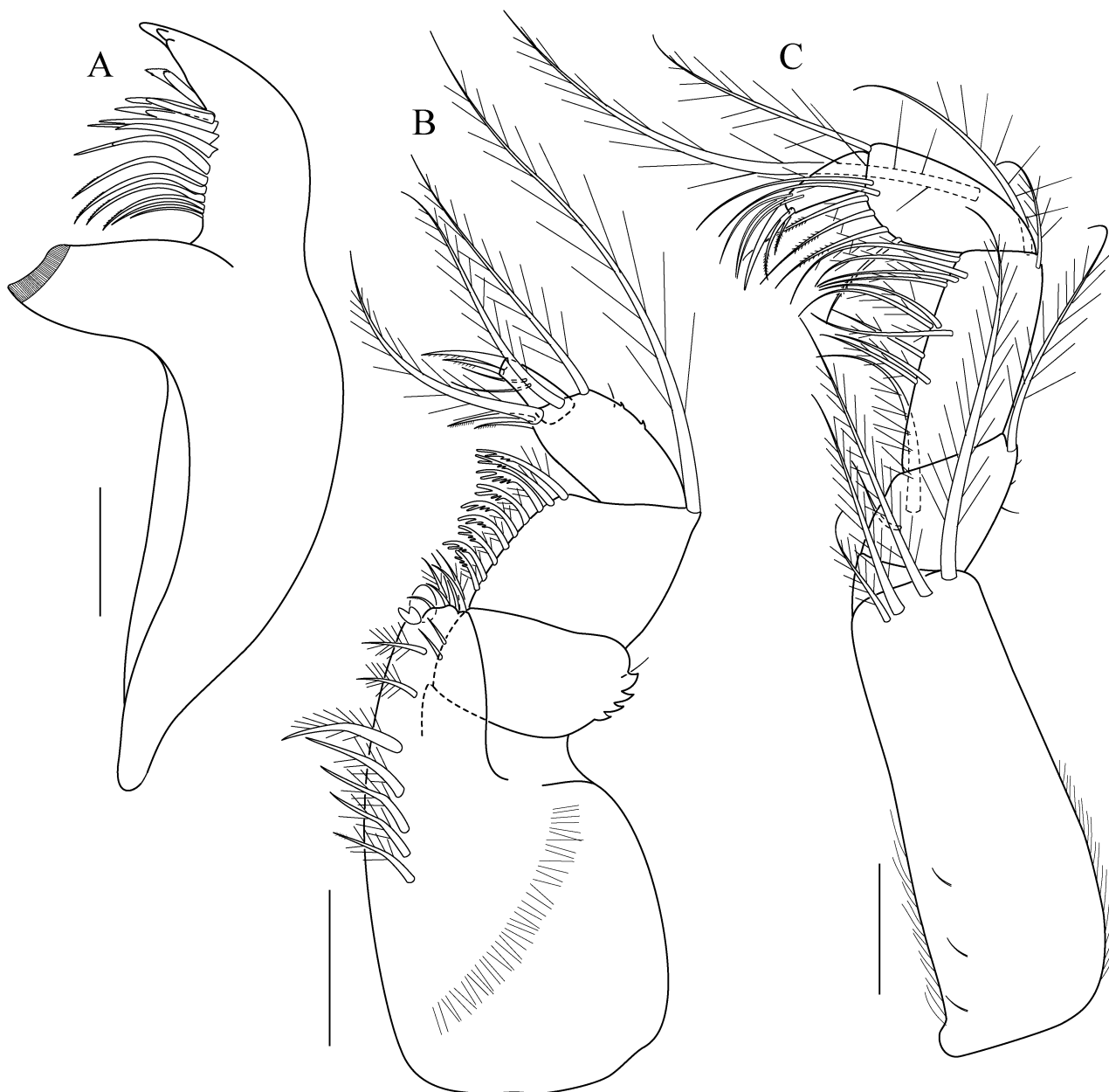
First pereopod (Fig. 4B). Basis approximately as long as remaining articles combined, with setulate setae on both margins and distally, and with teeth on inner margin. Ischium and merus combined approximately as long as carpus. Merus to propodus with simple setae only. Merus and carpus combined 1.3 times as long as propodus. Dactylus 0.8 as long as propodus, with simple and finely serrulate setae. Exopod flagellum of 7 articles.



**FIGURE 1.** *Diastylis obliquisulcata* n. sp., adult female. A, habitus in lateral view; B, cephalopereon in dorsal view (A, B, holotype MACN-In. 39025). C, first antenna; D, second antenna (C, D, paratype MACN-In. 39026a). Scale bars: 1 mm (A, B), 0.1 mm (C, D).



**FIGURE 2.** *Diastylis obliquisulcata* n. sp., SEM photos. Adult female. A, cephalopereon and first pleonite in dorsal view; B, a detail of the carapace surface (frame of Fig. 2A enlarged); C, cephalopereon and first pleonite in lateral view (A–C, MACN-In. 39024a). Adult male. D, cephalopereon and first pleonite in dorsal view; E, cephalopereon and first pleonite in lateral view (D, E, MACN-In. 39027a). Scale bars: 0.5 mm (A, C–E).



**FIGURE 3.** *Diastylis obliquisulcata* n. sp., adult female. A, right mandible (paratype MACN-In. 39026b). B, first maxilliped; C, second maxilliped (B, C, paratype MACN-In. 39026a). Scale bars: 0.1 mm (B, C).

Second pereopod (Fig. 4C). Basis 0.75 as long as remaining articles combined, with setulate setae on both margins and distally and with a few teeth on outer margin (more conspicuous in paratype MACN-In. 39026b). Ischium and merus combined 0.6 as long as carpus. Merus with 3 setulate setae. Carpus 1.3 times as long as propodus and dactylus combined, with 2–3 cuspidate setae distally. Propodus and dactylus with simple setae only. Exopod flagellum of 7 articles.

Third pereopod (Fig. 5A). Basis as long as remaining articles combined, with setulate and small simple setae. Ischium with 3 simple setae. Merus slightly longer than carpus and propodus combined, with simple setae. Carpus with a row of 6 simple setae on one side and 2 simple setae on opposite side (not drawn). Propodus with 1 simple seta distally. Dactylus with claw and 1 simple seta. Exopod of 2 articles, distal article with 4 simple setae.

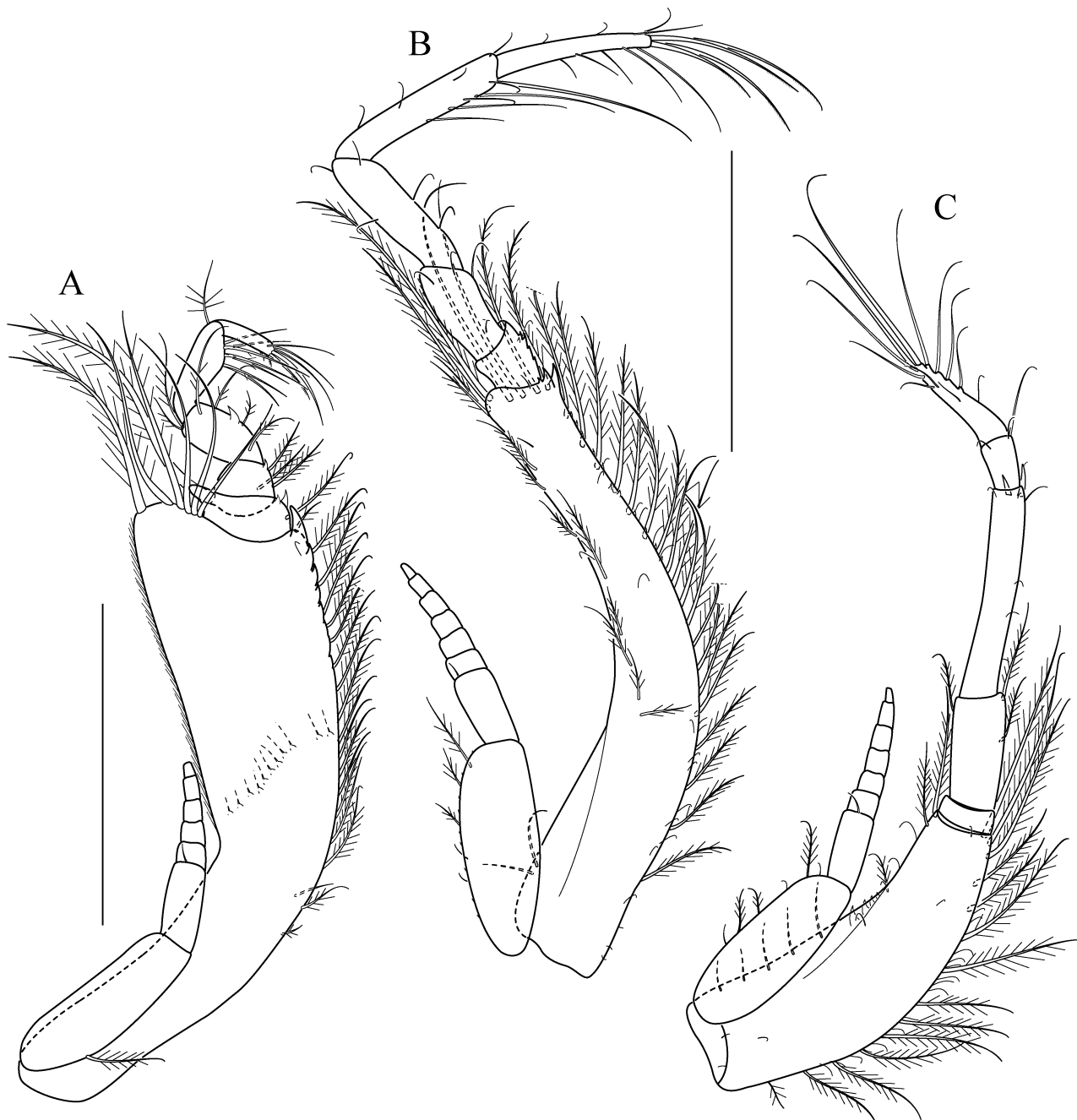
Fourth pereopod as third except for: basis 0.7 as long as remaining articles combined, with fewer setulate setae. Merus 0.9 as long as carpus and propodus combined.

Fifth pereopod (Fig. 5B). Basis approximately half as long as remaining articles combined, with setulate and

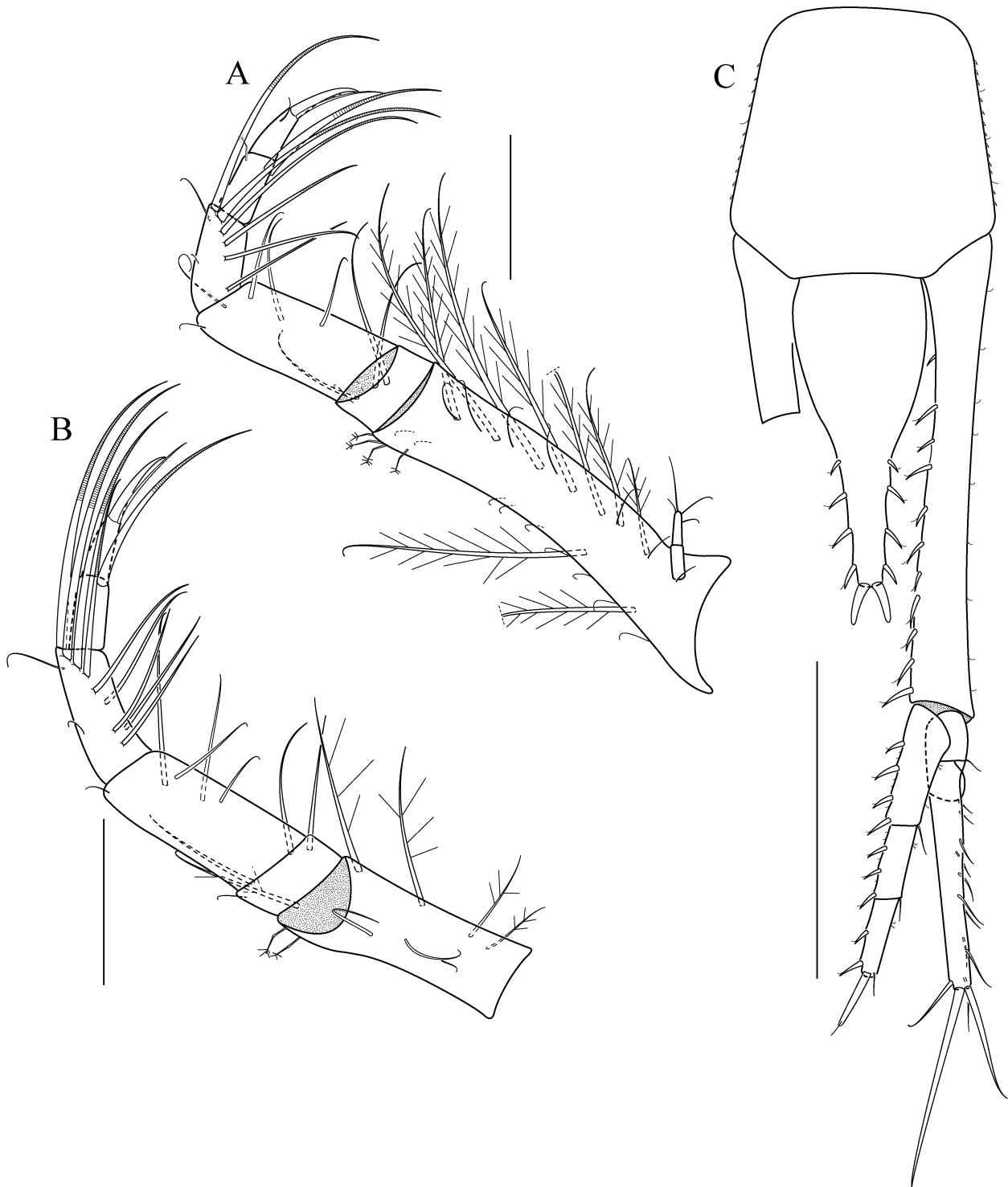
small simple setae. Ischium with 3 simple setae. Merus 0.85 as long as carpus and propodus combined, with simple setae. Carpus with a row of 7 simple setae on one side and 2 simple setae on opposite side. Propodus with 1 simple seta distally. Dactylus with claw and 1 simple seta. Without exopod.

Telson (Fig. 5C) 1.2 times as long as last pleonite, pre-anal part 1.4 times as long as post-anal part, each side with 4 (3–4) cuspidate setae with sensory tip, distal end with 2 divergent cuspidate setae.

Uropod (Fig. 5C). Peduncle 1.5 times as long as telson (excluding distal cuspidate setae), with 11–12 cuspidate setae with sensory tip on inner margin. Endopod of 3 articles: first article 1.6 times as long as second, with 4 cuspidate setae with sensory tip on inner margin; second article with 3 cuspidate setae with sensory tip on inner margin; third article as long as second, with 2–3 cuspidate setae with sensory tip on inner margin and 1 cuspidate seta with sensory tip distally. Exopod approximately as long as endopod, with 2 rows of simple setae on outer margin, 1 subterminal simple seta on inner margin and 2 long simple setae distally.



**FIGURE 4.** *Diastylis obliquisulcata* n. sp., adult female. A, third maxilliped (basis, setulae of the three inner distal setae omitted); B, first pereopod; C, second pereopod (A–C, paratype MACN-In. 39026a). Scale bars: 0.5 mm (A–C).



**FIGURE 5.** *Diastylis obliquisulcata* n. sp., adult female. A, third pereopod; B, fifth pereopod; C, last pleonite, telson and uropod (A–C, paratype MACN-In. 39026a). Scale bars: 0.2 mm (A, B), 0.5 mm (C).

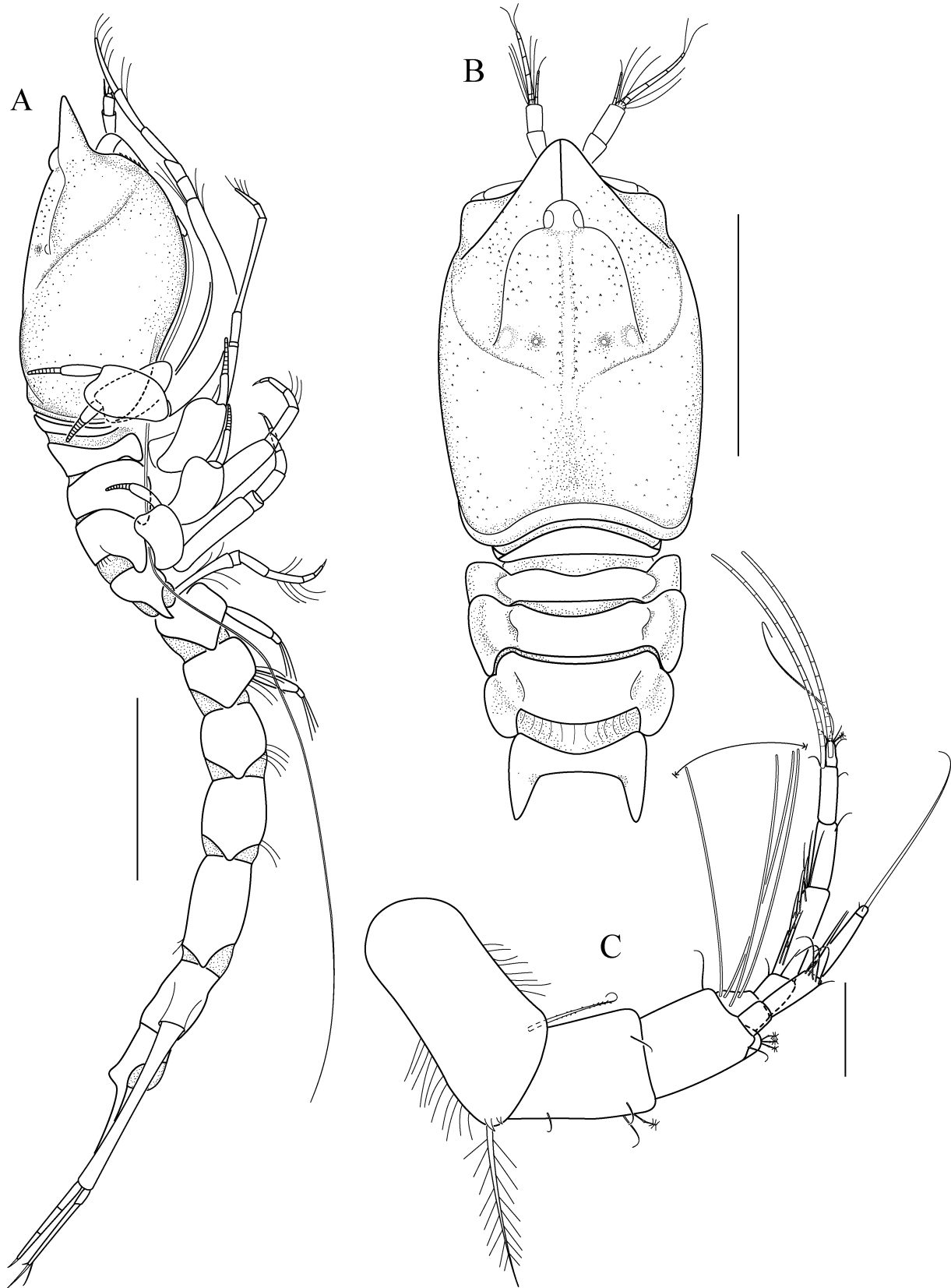
**Description of the adult male** (based on the paratypes MACN-In. 39026c, 39026d and 39026e)

Total length (paratype 39026c): 5.9 mm.

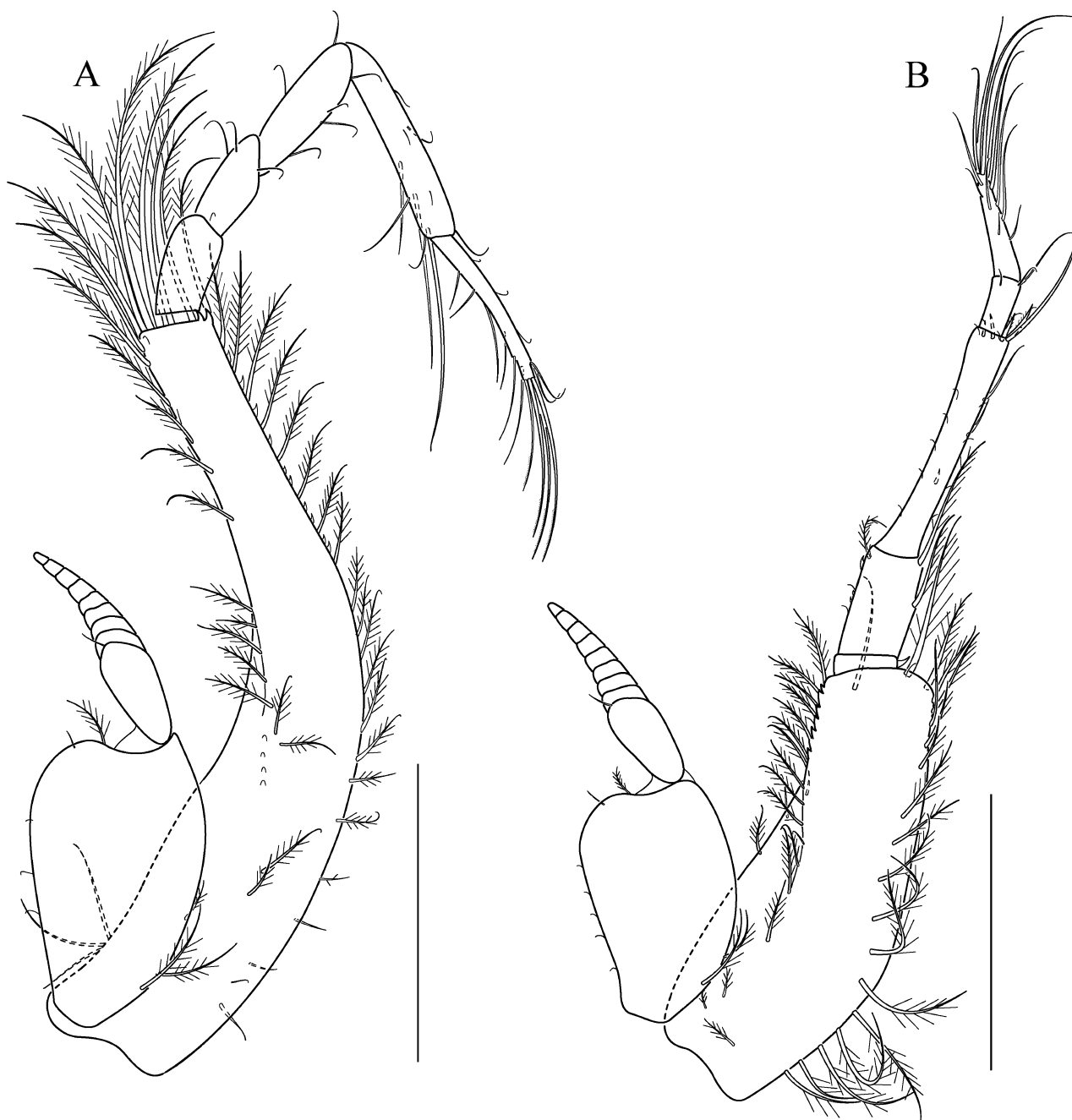
Carapace (Figs. 2D, E; 6A, B) as in female except for: ocular lobe larger, with lenses. Posterior oblique carina and *sulcus* absent, anterior oblique carina less visible than in female. Pseudorostral horizontal carina absent. Pseudorostrum approximately twice as long as ocular lobe. Antero-lateral angle absent.

Pereon (Figs. 2D, E; 6A, B) 0.8 as long as carapace, last pereonite produced posteriorly.





**FIGURE 6.** *Diastylis obliquisulcata* n. sp., adult male. A, habitus in lateral view; B, cephalopereon in dorsal view (A, B, paratype MACN-In. 39026c). C, first antenna (paratype MACN-In. 39026d). Scale bars: 1 mm (A, B), 0.1 mm (C).



**FIGURE 7.** *Diastylis obliquisulcata* n. sp., adult male. A, first pereopod (split at the basis-ischium joint); B, second pereopod (A, B, paratype MACN-In. 39026d). Scale bars: 0.5 mm (A, B).

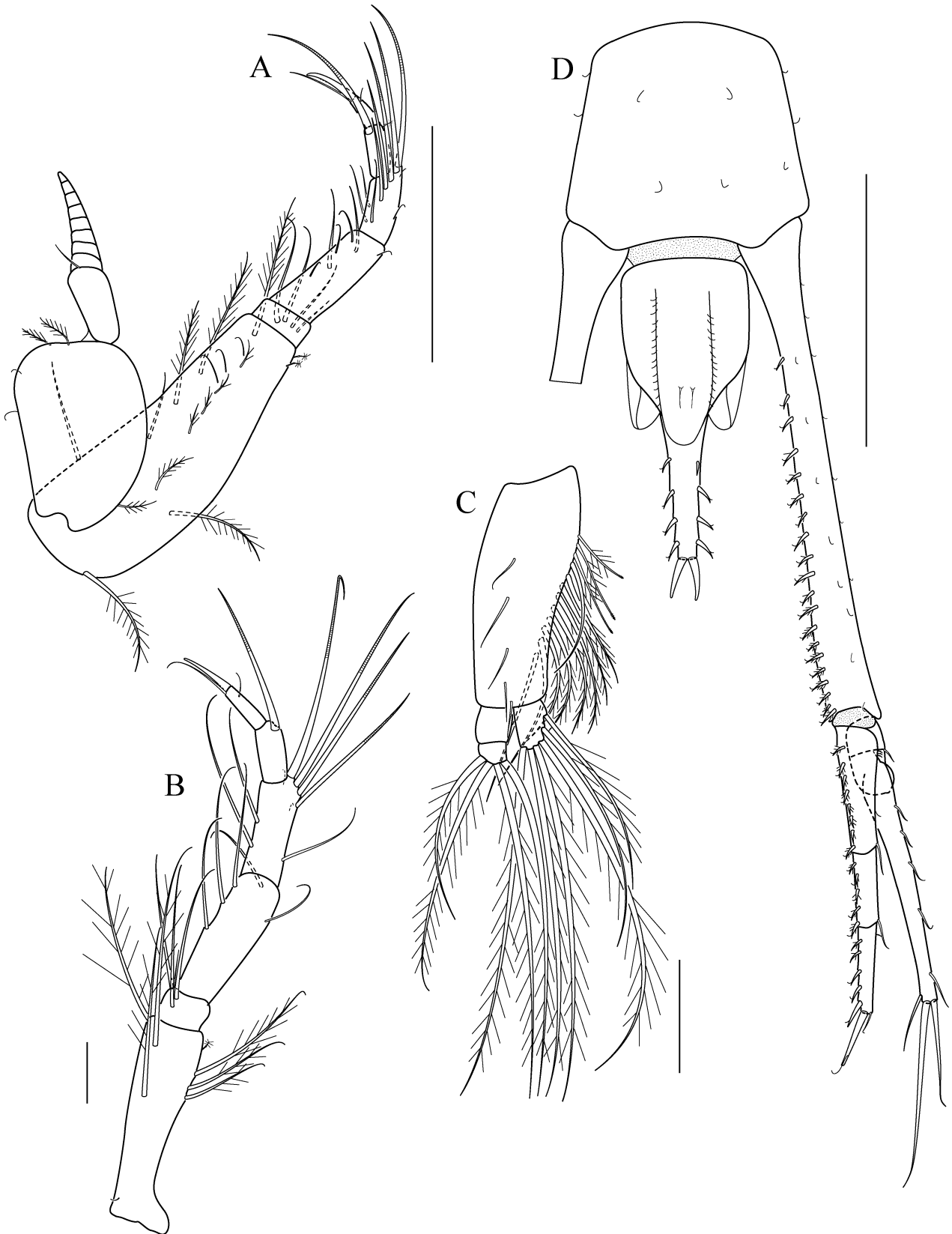
Pleon (Fig. 6A) 0.8 as long as cephalopereon.

First antenna (Fig. 6C). Peduncle as in female except for: first article 1.2 times as long as second and third combined, second article 1.25 times as long as third. Main flagellum of 6 articles, first article the widest and with many thin aesthetascs (only some of them drawn), third article the longest with many simple setae, fifth and sixth articles with 1 aesthetasc each. Accessory flagellum slightly extending beyond third article of main flagellum; of 4 articles, third article the longest, fourth article minute.

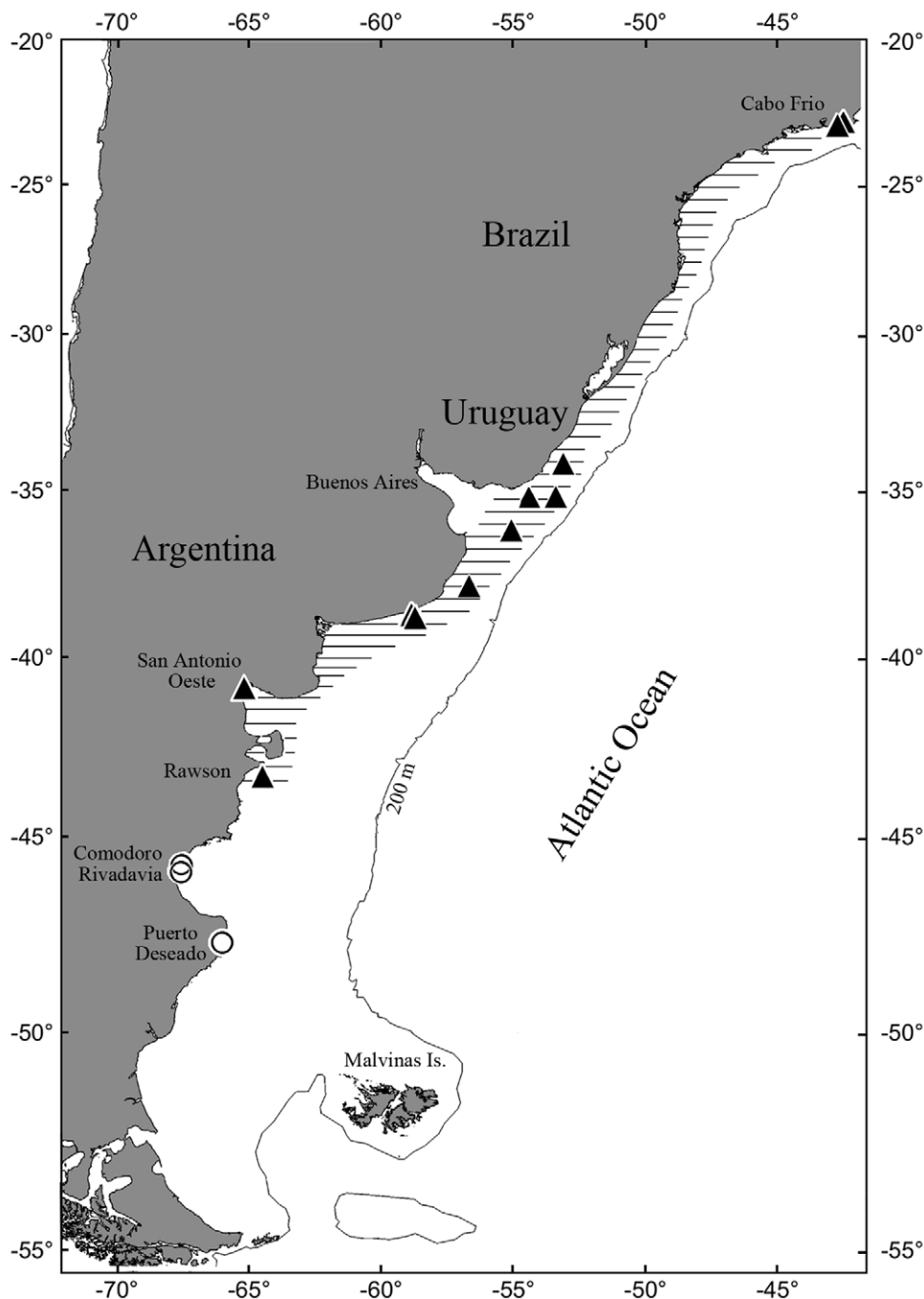
Mouthparts and first maxilliped as in female.

Second maxilliped. As in female except for: basis approximately as long as remaining articles combined. Carpus slightly longer than propodus and dactylus combined, inner margin with 10–11 setulate setae.

Third maxilliped. As in female except for: merus 0.6 as long as carpus. Propodus with 8 barely setulate setae on inner margin. Exopod larger, flagellum of 8 articles.



**FIGURE 8.** *Diastylis obliquisulcata* n. sp., adult male. A, third pereopod; B, fifth pereopod; C, first pleopod; D, last pleonite, telson and uropod (A–D, paratype MACN-In. 39026d). Scale bars: 0.5 mm (A, D), 0.1 mm (B, C).



**FIGURE 9.** Distribution of *Diastylis obliquisulcata* n. sp. (○) and *D. geocostae* Băcescu & Petrescu 1991 (▲). The striped area shows the expected distribution of the latter species.

First pereopod (Fig. 7A). As in female except for: basis slightly longer than remaining articles combined. Ischium and merus combined 1.3 times as long as carpus. Merus and carpus combined approximately as long as propodus. Exopod larger, flagellum of 9 articles.

Second pereopod (Fig. 7B). As in female except for: basis 0.9 as long as remaining articles combined. Ischium and merus combined approximately half as long as carpus. Carpus 1.5 times as long as propodus and dactylus combined, with 2–3 simple setae on inner margin, 1 simple seta on inner distal corner and 4 cuspidate setae distally. Exopod larger, flagellum of 9 articles.

Third pereopod (Fig. 8A). Basis slightly longer than remaining articles combined, with setulate and small simple setae. Ischium with 4 simple setae. Merus approximately as long as carpus and propodus combined, with simple setae. Carpus with a row of 6 simple setae on one side and 2 simple setae on opposite side. Propodus with 1 simple seta distally. Dactylus with claw and 1 simple seta. Exopod flagellum of 9 articles.

Fourth pereopod. As third except for: basis 0.8 as long as remaining articles combined. Merus 0.85 as long as carpus and propodus combined.

Fifth pereopod (Fig. 8B). Basis 0.55 as long as remaining articles combined, with setulate setae. Ischium with 1 short and 3 long simple setae. Merus 0.9 as long as carpus and propodus combined, with simple setae on both margins and distally. Carpus with a row of 5 simple setae on one side and 2 simple setae on opposite side. Propodus with 1 simple seta distally. Dactylus with claw and 1 simple seta. Without exopod.

First pleopod (Fig. 8C). Basis with 3–4 coupling setae and 7–9 (6–7) setulate setae on inner margin, and short simple setae on anterior surface. Exopod of 2 articles, second article with 4 setulate setae. Endopod of 1 article, with 6 setulate setae.

Second pleopod. As first except for: basis, inner margin with only 4 coupling setae, anterior surface with fewer simple setae.

Telson (Fig. 8D) 1.4 times as long as last pleonite, pre-anal part 1.4 times as long as post-anal part, each side with 4 (5) cuspidate setae with sensory tip, distal end with 2 divergent cuspidate setae.

Uropod (Fig. 8D). Peduncle 1.7 times as long as telson (excluding distal cuspidate setae), with 19–20 (21) cuspidate setae with sensory tip on inner margin (most proximal setae simple, remaining ones bipectinate). Endopod of three articles: first article 1.7 times as long as second, with 8 bipectinate setae on inner margin; second article with 5 bipectinate setae on inner margin; third article slightly longer than second, with 4–5 cuspidate setae with sensory tip on inner margin (most proximal setae bipectinate, remaining ones simple), and 1 cuspidate seta with sensory tip distally. Exopod approximately as long as endopod, with two rows of simple setae (only dorsal ones drawn) on outer margin, 1 subterminal simple seta on inner margin and 2 long simple setae distally.

**Etymology.** The specific name, derived from the Latin, refers to the slant *sulcus* on each side of female carapace.

**Distribution.** From Comodoro Rivadavia to Puerto Deseado between 2 and 20 m depth (Fig. 9).

**Remarks.** *Diastylis obliquisulcata* can be easily distinguished from the remaining species of the genus by the following combination of characters: (1) female carapace rough with minute conical protuberances, and presenting on each side two weak oblique carinae delimiting a shallow groove or *sulcus*, (2) third maxilliped expanded distally, (3) third and fourth pereopods with rudimentary exopods in the female, (4) telson shorter than uropod peduncles, (5) uropod rami subequal in length, and (6) endopod of three articles.

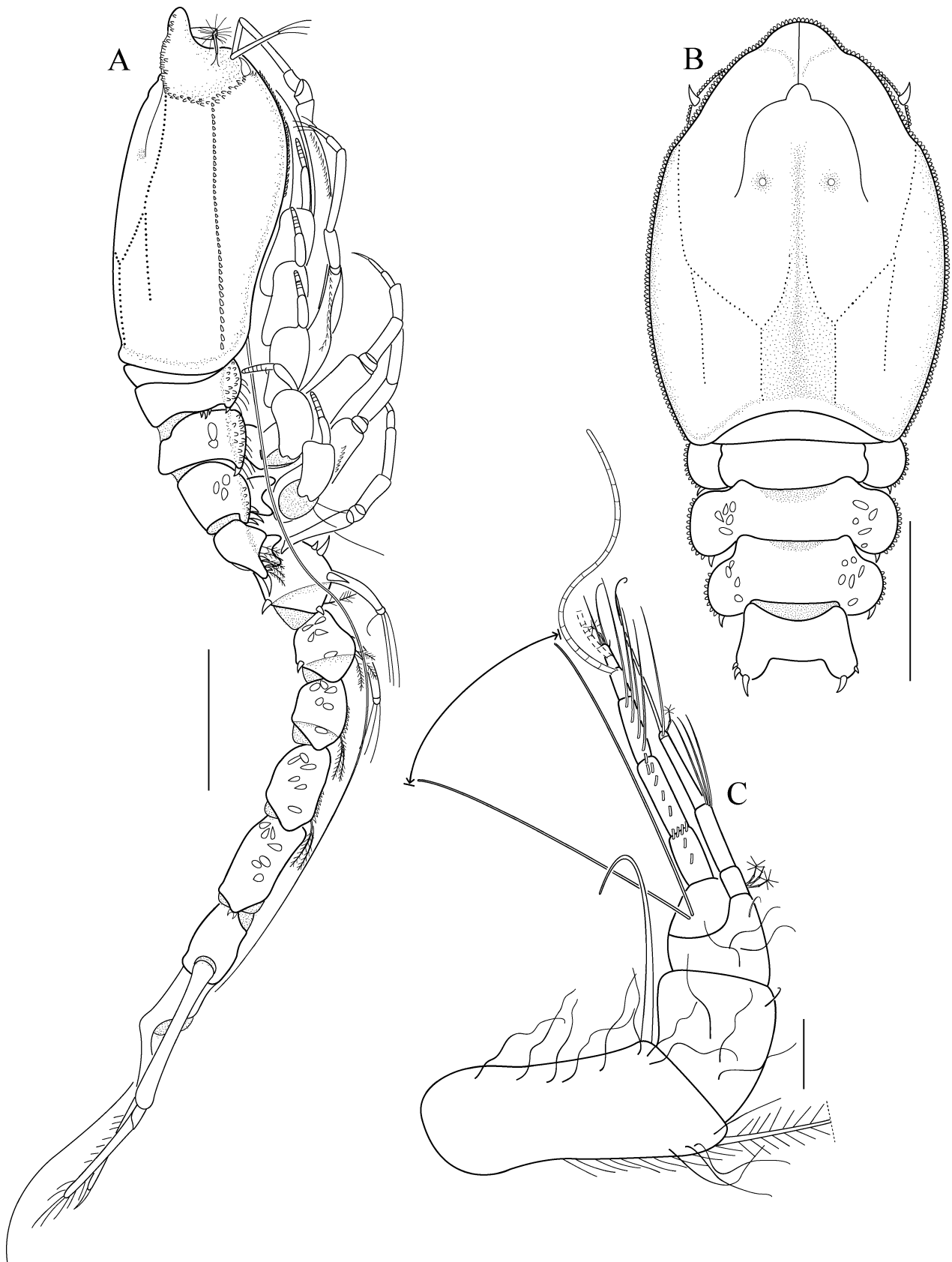
Among its congeners from the SW Atlantic, *D. obliquisulcata* resembles *D. sympterygiae* Băcescu & Queiroz 1985. However, in the latter species the carapace is smooth, the female lacks oblique carinae and *sulcus*, and the basis of the third maxilliped is exceptionally expanded (see Cristales *et al.* 2010).

### *Diastylis geocostae* Băcescu & Petrescu 1991

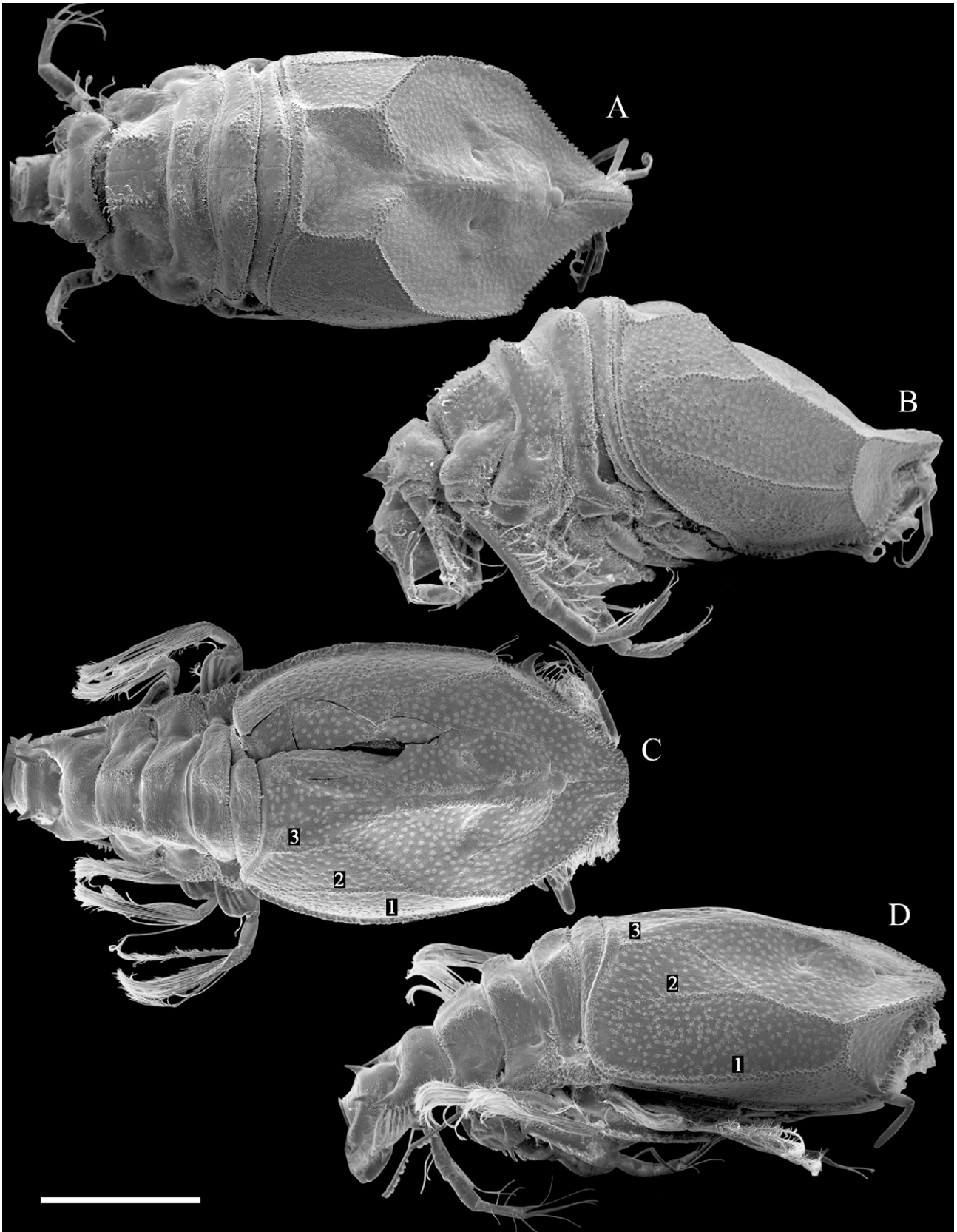
(Figures 10–15)

*Diastylis geocostae* Băcescu & Petrescu, 1991, pp. 334–337, fig. 3 [description of adult ♀, type locality: south of Cabo Frio, Brazil]. —Petrescu, 1992, p. 270 [list]. —Roccatagliata, 1998, p. 536 [catalogue]. —Moretti & Roccatagliata, 2007, p. 2638 [comparison with other members of the genus]. —Alberico & Roccatagliata, 2008, p. 1060 [comparison with other members of the genus]. —Alberico & Mühlenthal-Siegel, 2010, p. 40 [comparison with other members of the genus]. —Cristales *et al.*, 2010, p. 34, Table 1.

**Material examined.** —R/V “Prof. W. Besnard”, DEPROAS project. Sta. 7076, 22°58.43'S, 42°30.34'W, 37 m, 24 Jul 2001: 1 ad. ♀ (MZUSP 16732). —R/V “Aldebarán”. Sta. 2002-05 R2, 34°10'S, 53°00'W, 33 m, ? Dec 2002: 1 ad. ♀, 2 subad. ♀♀, 6 ad. ♂♂, 5 juvs, 5 mancae (MACN-In. 39028). Sta. 2002-05 R1, 35°11'S, 54°16'W, 30 m, 13 Dec 2002: 1 ad. ♂, 1 juv. —R/V “Cruz del Sur”. Sta. 8801/21, 35°10'S, 53°13'W, 48 m, 18 Jan 1988: 1 ad. ♀, 1 juv., 4 mancae. —R/V “Meteor” 11/3. Sta. 1193, B-I-4-3, 36°13'S, 54°56'W, 46 m, 16 Dec 1989: 1 ad. ♀, 4 subad. ♀♀, 3 ad. ♂♂, 1 subad. ♂, 7 juvs, 2 mancae (MACN-In. 39029). —R/V “Capitán Cánepa”, Sta. 35/00, 37°47.85'S, 56°35.05'W, 50 m, 21 Nov 2000: 1 ad. ♀, 2 subad. ♀♀, 9 juvs, 6 mancae. —Puerto Quequén, 15 Dec 2005. Sta. 9, 38°47.216'S, 58°41.604'W, 51.7 m: 1 manca. Sta. 12, 38°50.557'S, 58°41.079'W, 57.7 m: 2 juvs. —San Antonio Oeste, Sta. 5, 40°53.863'S, 65°04.533'W, 18 m, 03 Jan 2005: 1 juv. —R/V “Meteor” 11/3, Sta. 1149, A-III-1-1, 43°20.1'S, 64°22.7'W, 47.5 m, 10 Dec 1989: 1 ad. ♀ (MACN-In. 39030).



**FIGURE 10.** *Diastylis geocostae* Băcescu & Petrescu 1991, adult male. A, habitus in lateral view; B, cephalopereon in dorsal view (A, B, MACN-In. 39028a). C, first antenna (MACN-In. 39028b). Scale bars: 1 mm (A, B), 0.1 mm (C).



**FIGURE 11.** *Diastylis geocostae* Băcescu & Petrescu 1991, SEM photos. Adult female. A, cephalopereon and first pleonite in dorsal view; B, cephalopereon and first pleonite in lateral view (A, B, MACN-In. 39030). Adult male. C, cephalopereon and first pleonite in dorsal view; D, cephalopereon and first pleonite in dorso-lateral view (C, D, MACN-In. 39028c). Scale bar: 1 mm. A–D share the same scale bar. 1–3 stand for inferior, middle and upper carinae, respectively.



**FIGURE 12.** *Diastylis geocostae* Băcescu & Petrescu 1991, adult male. A, third maxilliped; B, first pereopod; C, second pereopod (A–C, MACN-In. 39028b). Scale bars: 0.5 mm (A–C).

**Diagnosis.** Carapace with strong denticulate carinae, two oblique ones enclose an antero-dorsal depressed area or plateau (carinae less marked in the male). Pereopods 3 and 4 of the female without exopods. Telson slightly shorter than uropod peduncle, each side with 5 cuspidate setae in the female and 6 in the male. Endopod shorter than exopod, of two articles.

**Description of the adult male** (based on the specimens MACN-In. 39028a and 39028b)

Total length (specimen MACN-In. 39028a): 7.7 mm.

Carapace (Figs. 10A, B; 11C, D). Surface whitish, with small pits all over, 1.3 times as long as wide. With two oblique carinae enclosing a large antero-dorsal area (plateau). At about 1/3 of its length from the front, each



oblique carina joins another carina that runs down vertically to turn forward abruptly at 45 degrees. This angulated carina borders an anterior trapezoidal area on each side of carapace and bears a strong horn before ending on inferior margin of carapace. Posterior part of carapace with three horizontal (inferior, middle and upper) carinae. The inferior carina, the strongest, starts on the apex of the angulated carina and ends at hinter margin of carapace; the middle and upper carinae run backwards from oblique carina, the middle one disappears a short distance before reaching hinter margin of carapace, the upper one extends to hinter margin. Ocular lobe wider than long, without lenses. Pseudorostrum approximately 4 times as long as ocular lobe. Inferior margin of carapace finely serrate. Antero-lateral angle absent, antennal notch shallow.

Pereon (Figs. 10A, B; 11C, D) 0.7 as long as carapace. Pereonites 2–5, lateral margins with teeth, most posterior tooth the largest.

Pleon (Fig. 10A) 0.8 as long as cephalopereon. Pleonite 1 with 2 sharp teeth on mid-ventral surface.

First antenna (Fig. 10C). Peduncle with thin sinuate setae, first article 1.6 times as long as second and third combined, inner distal corner with 1 setulate seta, outer margin with 1 simple seta; second article 1.5 times as long as third. Main flagellum of 6 articles, first article the thickest and with many thin aesthetascs (only two drawn), second-fourth articles with simple setae, fifth and sixth articles with 1 aesthetasc each (aesthetasc of sixth article broken). Accessory flagellum reaching 1/3 of fourth article of main flagellum; of 4 articles, third article the longest.

Third maxilliped (Fig. 12A). Basis-carpus with thin sinuate setae. Basis approximately twice as long as remaining articles combined, inner margin with setulate setae and several small teeth; outer distal corner not produced, with 4 long and 1 short setulate setae, distal margin with strong teeth. Ischium with 3 setulate setae. Merus 0.55 as long as carpus, outer margin with 1 large setulate seta and 1 tooth, inner margin with 2 setulate setae. Carpus approximately as long as propodus, with 7 setulate setae. Propodus with 9 barely setulate setae on inner margin and 1 simple seta on distal margin. Dactylus 0.6 as long as propodus, with several simple setae. Exopod flagellum of 7 articles.

First pereopod (Fig. 12B). Basis-propodus with thin sinuate setae. Basis slightly longer than remaining articles combined, with setulate setae on both margins and distally, and with teeth on outer margin. Ischium and merus combined 0.6 as long as carpus. Merus with 2 setulate setae. Carpus-dactylus with simple setae only. Carpus 0.9 as long as propodus. Dactylus 0.7 as long as propodus. Exopod flagellum of 8 articles.

Second pereopod (Fig. 12C). Basis-dactylus with thin sinuate setae. Basis slightly longer than remaining articles combined, with setulate setae and teeth on both margins. Ischium with 1 tooth on inner distal corner. Ischium and merus combined 0.6 as long as carpus. Merus with setulate setae on inner margin and distally and with teeth on both margins. Carpus 1.6 times as long as propodus and dactylus combined, with 7 serrulate setae on inner margin. Propodus and dactylus with simple setae only. Exopod flagellum of 8 articles.

First pleopod (Fig. 13A). Basis with 4–5 coupling setae, 6–7 setulate setae on inner margin, short simple setae and thin sinuate setae on anterior surface. Exopod of 2 articles, distal article with 4 setulate setae. Endopod of 1 article, with 6 setulate setae.

Second pleopod. As first except for: basis inner margin with only 2–3 coupling setae, endopod with 5 setulate setae.

Telson (Fig. 13B). Approximately twice as long as last pleonite, with thin sinuate setae, pre-anal part 1.4 times as long as post-anal part, each side with 6 long cuspidate setae with sensory tip, distal end with 2 divergent cuspidate setae.

Uropod (Fig. 13B). With thin sinuate setae. Peduncle slightly longer than telson (excluding distal cuspidate setae), with 19–21 cuspidate setae (most proximal setae simple, remaining ones larger and bipectinate) on inner margin. Endopod of two articles: first article approximately as long as second, with 9 bipectinate setae on inner margin and several broom setae on outer margin; second article with 11 bipectinate setae on inner margin, and 1 cuspidate seta with sensory tip distally. Exopod slightly longer than endopod, with two rows of simple setae (only dorsal ones drawn) on outer margin, 1 subterminal simple seta on inner margin and 2 long simple setae distally.

**Brief redescription of the adult female** (based on the specimens MACN-In. 39028d and 39029a)

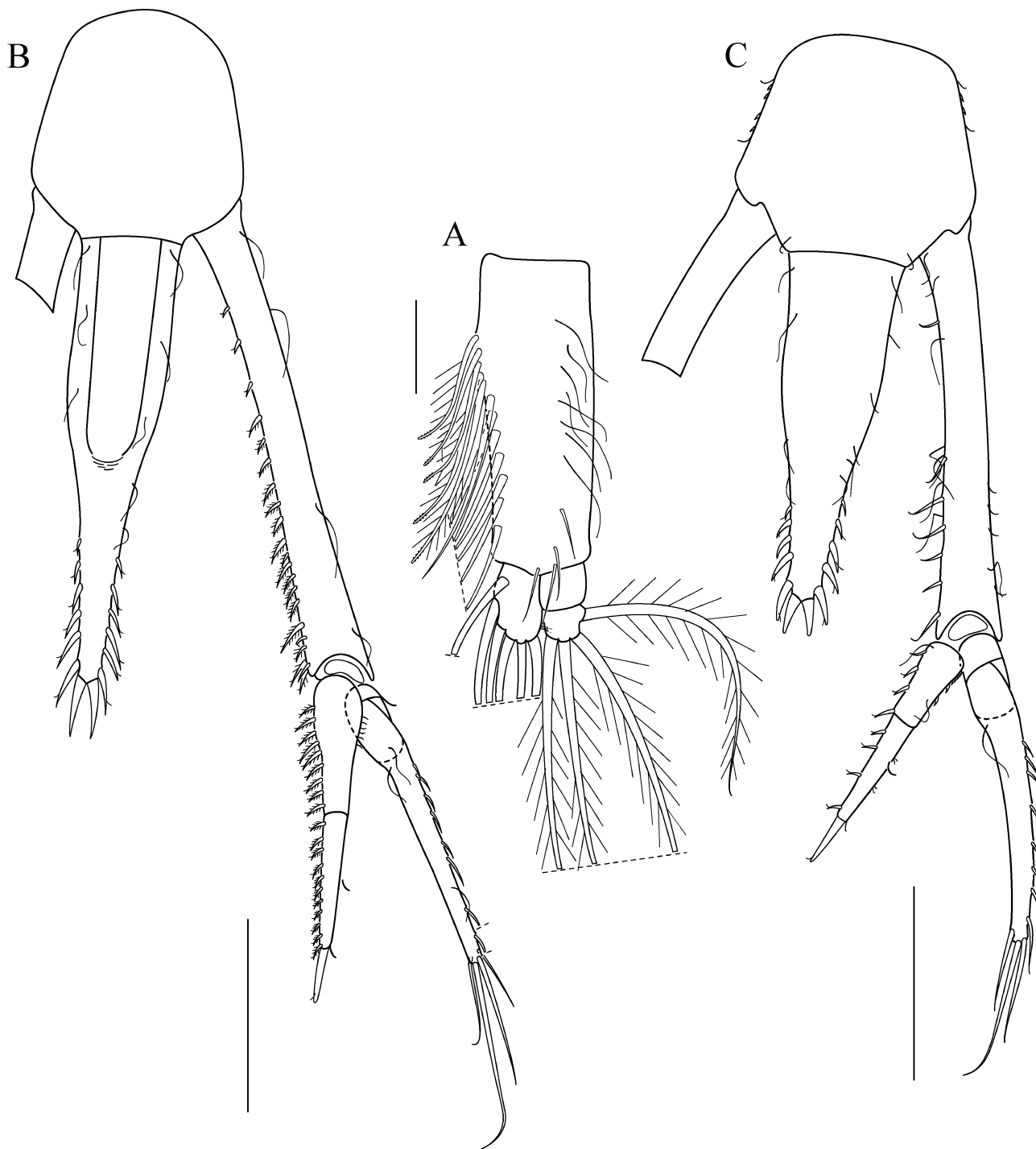
Total length (specimen MACN-In. 39029a): 6.9 mm (this measure is rather unsatisfactory because the pleon is arched).

Habitus (specimen MACN-In. 39029a) as shown by Băcescu and Petrescu (1991) in their fig. 3A, B (see also SEM images herein presented in Fig. 11A, B).

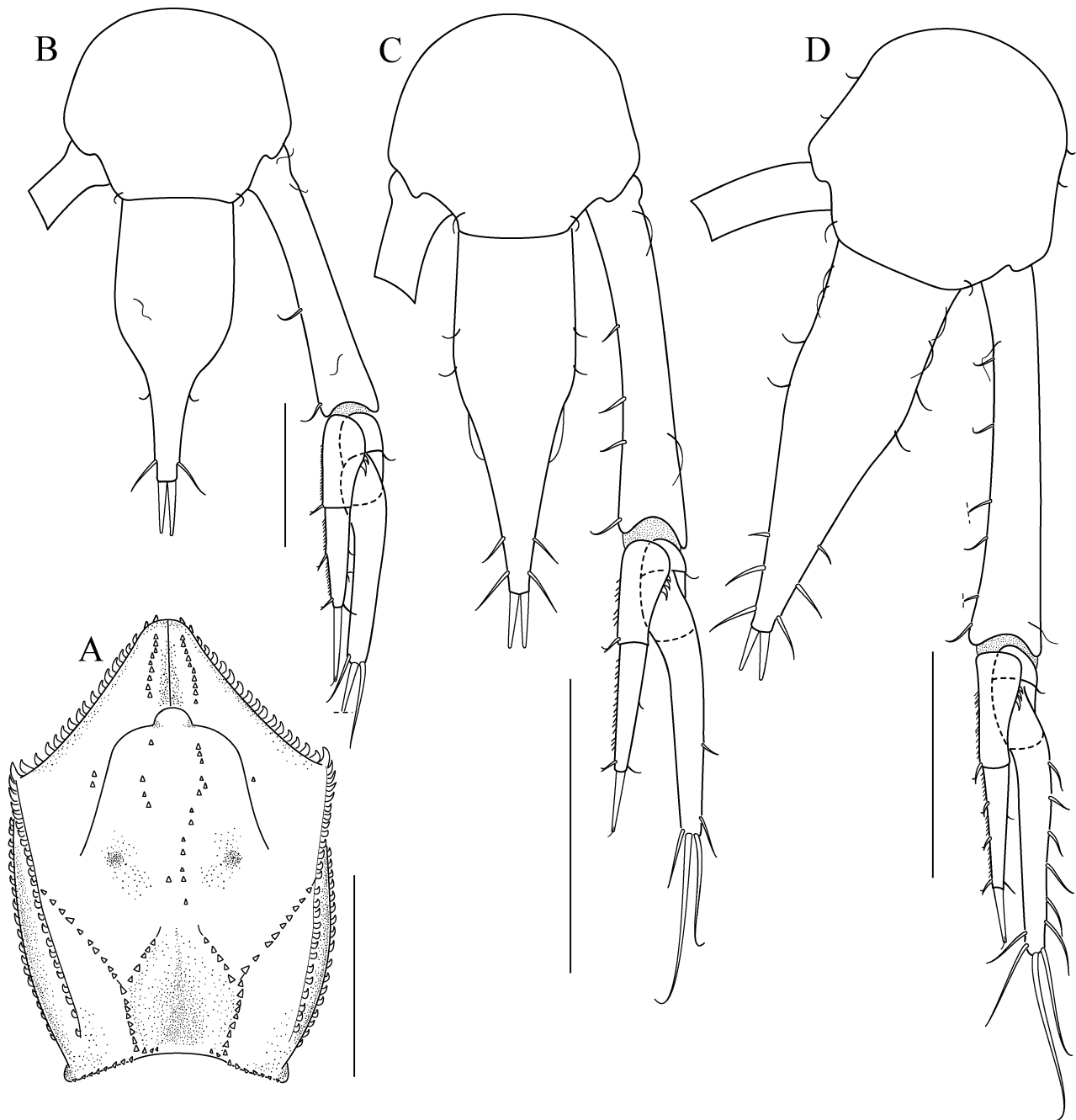
Third maxilliped. Basis-carpus with thin sinuate setae. Basis 1.8 times as long as remaining articles combined, inner margin with setulate setae and several teeth; outer distal corner not produced, with 4 long and 1 short setulate

setae, distal margin with strong teeth. Ischium with 3 setulate setae on inner margin. Merus 0.8 as long as carpus, outer margin with 1 large setulate seta and 1 tooth, inner margin with 2 setulate setae. Carpus approximately as long as propodus, with 6 setulate setae. Propodus with 8 barely setulate setae on inner margin and 1 simple seta on distal margin. Dactylus 0.8 as long as propodus, with several simple setae. Exopod flagellum of 6 articles.

First pereopod. Basis-propodus with thin sinuate setae. Basis approximately as long as remaining articles combined, with setulate setae on both margins and distally, and with teeth on outer margin. Ischium and merus combined slightly longer than carpus. Merus with 1 setulate seta. Carpus-dactylus with simple setae only. Carpus approximately as long as propodus. Dactylus 0.7 as long as propodus. Exopod flagellum of 7 articles.



**FIGURE 13.** *Diastylis geocostae* Băcescu & Petrescu 1991. Adult male. A, first pleopod; B, last pleonite, telson and uropod (A, B, MACN-In. 39028b). C, last pleonite, telson and uropod of adult female (MACN-In. 39028d). Scale bars: 0.1 mm (A), 0.5 mm (B, C).



**FIGURE 14.** *Diastylis geocostae* Băcescu & Petrescu 1991. Manca. A, carapace in dorsal view; B, last pleonite, telson and uropod (A, B, MACN-In. 39028e). C, last pleonite, telson and uropod of a juvenile female (MACN-In. 39028f). D, last pleonite, telson and uropod of a subadult female (MACN-In. 39028g). Scale bars: 0.2 mm (B), 0.5 mm (A, C, D).

Second pereopod. Basis-dactylus with thin sinuate setae. Basis slightly shorter than remaining articles combined, with setulate setae and teeth. Ischium with a large tooth on inner distal corner. Ischium and merus combined 0.75 as long as carpus. Merus with setulate setae distally and teeth on both margins. Carpus 1.1 times as long as propodus and dactylus combined. Carpus-dactylus with simple setae only. Exopod flagellum of 7 articles.

Telson (Fig. 13C) 1.6 times as long as last pleonite, with thin sinuate setae, pre-anal part 1.8 times as long as post-anal part, each side with 5 cuspidate setae with sensory tip, distal end with 2 divergent cuspidate setae.

Uropod (Fig. 13C). With thin sinuate setae. Peduncle slightly longer than telson (excluding distal cuspidate setae), with 7–11 cuspidate setae with sensory tip on inner margin. Endopod of two articles: first article 0.75 as long as second, with 3–4 cuspidate setae with sensory tip on inner margin and several teeth on outer margin; second article with 4–5 cuspidate setae with sensory tip on inner margin, and 1 cuspidate seta with sensory tip distally.

Exopod 1.5 times as long as endopod, with two rows of simple setae (only dorsal ones drawn) on outer margin, 1 subterminal simple seta on inner margin and 2 long simple setae distally.

**Ontogenetic changes.** The carapace ornamentation varies with age in *D. geocostae*. In addition to the oblique, the angulated and the 3 horizontal carinae, the manca shows two mid-dorsal carinae running from pseudorostrum to finally merge posteriorly with the right and left oblique carina respectively. They are well developed in all their extension or faintly visible beyond pseudorostrum (see Fig. 14A). These mid-dorsal carinae are still evident in some juveniles but absent in subadult and adult specimens.

The chaetotaxy of the telson also changes with age. The manca has 0-1 simple seta on each side of the telson (Fig. 14B). The number of simple setae increases from juveniles (1-3 pairs) to subadult females (3-5 pairs) or subadult males (3-4 pairs) (Figs. 14C, D). In contrast, the adults have cuspidate setae, 3-5 pairs in females, 5-10 pairs in males (Figs. 13B, C).

Finally, the ratio of the telson length to that of the uropod peduncle is also ontogenetically dependent in *D. geocostae* (Pearson's correlation,  $p < 0.001$ ). In the mancae the telson is about as long as or longer than the uropod peduncle, in adults the telson is shorter than the peduncle, whereas the juveniles and subadults show intermediate values (Figs. 13B, C; 14B-D and 15).

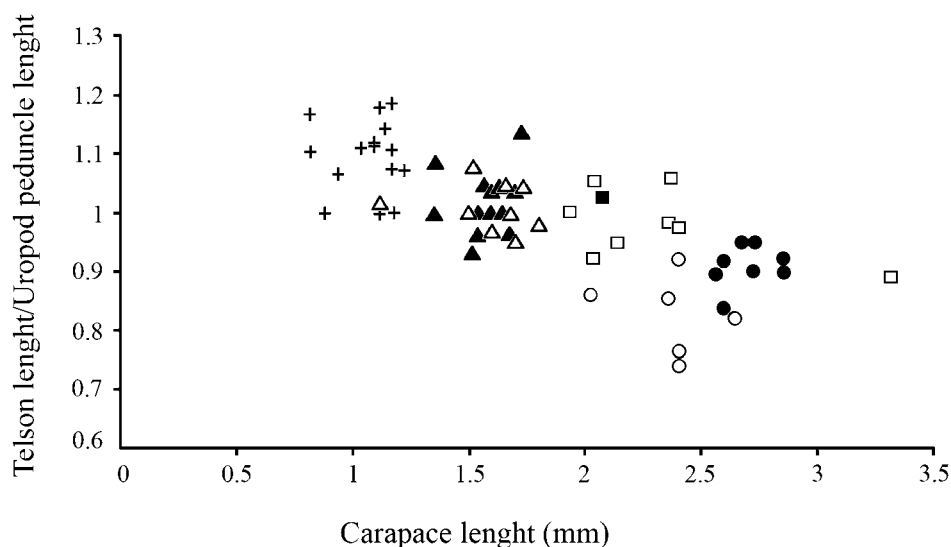
Changes in the telson/uropods ratio and in the chaetotaxy of the telson were also reported to *Diastylis hammoniae* (see Alberico & Roccatagliata 2011). This variability must be kept in mind when diastylids from different instars are compared.

**Distribution.** Originally found south Cabo Frio, Brazil between 31 and 66 (71?) m depth, it is again recorded from the type locality at 37 m, and also from many localities off the coast of Uruguay and Argentina between 18 and 58 m depth. Rawson (43°20'S) being now the southernmost record of this species (Fig. 9).

**Remarks.** *Diastylis geocostae* can be easily distinguished from all the other species of the genus by having an antero-dorsal flat area (plateau) on the carapace and a 2-segmented uropodal endopod. At least four additional species, i.e., *Diastylis californica* Zimmer (California), *D. araruamae* Petrescu & Băcescu (Brazil), *D. fabrizioi* Alberico & Roccatagliata (Brazil, Uruguay and Argentina) and *D. planifrons* Calman (Argentina and Chile), show a flat area or plateau on the carapace as well. However, in these four species the uropod endopod has three articles. Băcescu and Petrescu (1991) mentioned that the carapace of *D. racovitzai* is "crossed by strong carinae which frontally delimit a plane surface" and that *D. brasiliensis* has a plateau. Nevertheless, the *habitus* or general views of the carapaces of these two species have not been drawn by these authors. *Diastylis racovitzai* can be quickly separated from *D. geocostae* by its uropod endopod of three articles. In addition, *D. racovitzai* and the four above mentioned species differs from *D. geocostae* by having minute exopods on the third and fourth pereopods of the female, and the basis of the third maxilliped expanded.

On the other hand, *D. brasiliensis* is a problematic species. Băcescu and Petrescu (1991) based their description on a female with developing oostegites (Iorgu Petrescu, pers. comm.). These authors stated that the holotype has reduced exopods on third and fourth pereopods, four pairs of "fine lateral spines" on the telson, and the endopod of uropods with three articles (the distal one minute). This uropod endopod with a minute distal article is unique for the genus. There may exist the possibility that in the endopod drawn by Băcescu and Petrescu (1991) the second article is cracked distally (or the distal spine broken basally) and thus, the endopod has actually two articles. Unfortunately, the uropod depicted by Băcescu and Petrescu (1991) in their fig. 4E was lost after dissection, and the endopod still present on the holotype is broken distally (only the first article and part of the second remain, Iorgu Petrescu, pers. comm.). Therefore, further specimens from the type locality are necessary to investigate this issue.

An adult female (MZUSP 16732) collected in the type locality area (Cabo Frio, Brazil) was also examined. The *habitus*, uropods and telson of this specimen completely fit those of the adult female herein described. However, the specimen from Brazil is smaller (2.05 mm CL) than those from Argentina and Uruguay (2.36-2.64 mm CL). This difference in size could be related to the temperature gradient along the latitudinal distribution of this species. A similar correlation has been reported for *Diastylis sexpectinata* (see Alberico & Roccatagliata 2011).



**FIGURE 15.** Ratio of the length of the telson to that of the uropod peduncle plotted against the carapace length in mancae (+), juveniles ( $\Delta$ ,  $\blacktriangle$ ), subadults ( $\square$ ,  $\blacksquare$ ), and adults ( $\circ$ ,  $\bullet$ ) of *Diastylis geocostae*. The full triangles, squares and circles stand for the male instars and the empty symbols to the female instars. n = 61.

### Comments on the genus *Diastylis*

The genus *Diastylis*, the oldest of all cumacean genera, was established by the North American zoologist Th. Say in 1818. This is the type genus of the family, and comprises at present a large number of species (ca. 110). In addition, *Diastylis* doesn't appear to be a natural group but rather a polyphyletic assemblage of species. A significant portion of the problem was that the type specimen of the genus (*Diastylis arenarius* Say) is lost and its description, although detailed at the time, is inadequate at present. In order to rectify this situation Gerken (1999) petitioned the International Commission on Zoological Nomenclature (ICZN) to designate *Cuma rathkii* as the type species of the genus *Diastylis*, which was subsequently approved (see BZN 61(1): 68–69, Opinion 2020).

*Diastylis rathkei* is probably the best known species of all cumaceans. It has no rudimentary exopods on the third and fourth pereopods in the female, the maxilliped 3 is not markedly expanded distally, the uropod endopod bears three articles and is shorter than the exopod, and it possesses a large telson (extending as far as the end of the uropod peduncles). It should be noted that many species at present included in this speciose genus do not fit one or more of the features listed above.

The genus *Diastylis* includes species with two or three articles on the endopod of the uropods. Stebbing (1912) was aware of this variability and erected the monotypic family Ekdiastylidae to accommodate those diastylids with uropodal endopods of two articles. However, neither this family nor its genus have been widely accepted by later researchers. To date, the genus *Diastylis* includes 16 species with uropodal endopods of two articles, viz., *D. abbreviata* Sars, *D. sculpta* Sars, *D. fimbriata* Sars, *D. polita* Smith, *D. horrida* Sars, *D. argentata* Calman, *D. granulata* Zimmer, *D. paraspinulosa* Zimmer, *D. cornuifera* Blake, *D. ornata* Lomakina, *D. loricata* Lomakina, *D. zimmeri* Ledoyer, *D. geocostae* Băcescu & Petrescu, *D. sentosa* Watling & McCann, *D. andeepae* Alberico & Mühlenhardt-Siegel, and *D. sexpectinata* Alberico & Roccatagliata. Since this group of species cannot be distinguished from *D. rathkei* except by the reduced segmentation of the endopod, their removal from the genus *Diastylis* is not justified. It is worth mentioning that *Makrokyllindrus*, a deep sea genus closely related to *Diastylis*, also encompasses species with uropod endopods of 2 and 3 articles.

On the other hand, Gerken and Watling (1998) pointed out that in this genus there is a group of 10 species that differ from *D. rathkei* by having an opercular third maxilliped, a short telson and rudimentary exopods on the third and fourth pereopods in the females. More recently, Cristales *et al.* (2010) included another 4 species, to which should be added *D. obliquisulcata*. Even though these 15 species are probably not conspecific with *D. rathkei*, we have decided not to remove them from the genus *Diastylis* until a major investigation on this genus is carried out.

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