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Remarks on the deep-sea genus *Chalarostylis* (Cumacea: Lampropidae)

NATALIA A. ALBERICO¹, DANIEL ROCCATAGLIATA¹ & UTE MÜHLENHARDT-SIEGEL²

¹ Instituto de Biodiversidad y Biología Experimental y Aplicada (IBBEA, CONICET), Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Ciudad Universitaria, C1428EGA, Buenos Aires, Argentina.

² Universität Hamburg, Biozentrum Grindel und Zoologisches Museum, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany

Corresponding author. E-mail: nalberico@bg.fcen.uba.ar

Abstract

Chalarostylis is a deep-sea genus close to *Hemilamprops* but easily distinguished from the latter mainly by its robust first pereopod. However, this appendage is frequently broken off at the anterior margin of the basis, making the identification of the species of the genus difficult. Regarding *Hemilamprops brenkei*, both the adult male holotype and the additional specimens herein reported from the Weddell Sea and the Guinea, Argentine and Brazilian Basins exhibit a huge first pereopod. Thus, this species is transferred to *Chalarostylis* and its description completed. Two other species until now in *Hemilamprops*, *H. canadensis* and *H. longisetae* are also transferred to *Chalarostylis*. In addition, an unknown species of *Chalarostylis* from the Bay of Biscay for which no name is given is briefly described. The diagnosis of this genus is emended.

Key words: *Chalarostylis*, *Hemilamprops*, taxonomy, deep-sea Atlantic

Introduction

Norman (1879) erected the genus *Chalarostylis* to accommodate *C. elegans*, a new species he described based on a single adult male collected off Rockall, North East Atlantic (199 m). This old description consists of a short text, with no accompanying figures. In addition, this specimen has its first pereopod broken off at the basis-ischium articulation. Gerken & McCarthy (2007) redescribed and illustrated *C. elegans* based on the re-examination of the male holotype and a female collected off the Porcupine Bank (1564 m). This female has a robust first pereopod bearing a brush of setae on its dactylus. Based on this information, Gerken & McCarthy (2007) emended the diagnosis of the genus and transferred *Dasygampros guanchi* Reyss, 1978 from the Canary Islands to *Chalarostylis*, making *C. guanchi* the second species of the genus.

In the present contribution *Hemilamprops brenkei* Mühlenhardt-Siegel, 2005 is partially redescribed, and since this species also has a strong first pereopod, it is transferred to the genus *Chalarostylis* as well. Two other species until now in *Hemilamprops*, i.e., *H. canadensis* Vassilenko, 1988 and *H. longisetae* Corbera, 2006 are also transferred to *Chalarostylis*. In addition, an unknown species of *Chalarostylis* from the Bay of Biscay (2138 – 2246 m), provisionally identified as *Chalarostylis* sp. A, is briefly described. Finally, the diagnosis of the genus is emended.

Material and methods

The material examined was collected by (1) the RV “Polarstern” during the Antarctic deep-sea expeditions ANDEEP II (ANT-XIX/4) and ANDEEP III (ANT-XXII/3) carried out in 2002 and 2005, respectively; (2) the RV “Meteor” deep-sea expeditions to the Angola and Guinea Basins (DIVA II, 2005), and to the Argentine and Brazilian Basins (DIVA III, 2009); and (3) the RV “Jean Charcot” POLYGAS survey to the Bay of Biscay done in 1972.

The ANDEEP and DIVA samples were collected using an epibenthic sledge (see Brenke 2005). Most of the

specimens were fixed in cooled 96% ethanol, which was changed after half an hour to render possible subsequent molecular genetic analyses, whereas the specimens from Sta. 533-E and 534-S were fixed in 4% formalin-sea water solution and stored in 70% ethanol after 24 hours. The specimens of the expedition POLYGAS were collected using a Sanders epibenthic dredge, and these specimens are preserved in 70% ethanol.

Specimens were stained with Chlorazole Black E®, and the appendages dissected and temporarily mounted in glycerin. Habiti were drawn using a Leica MZ12 dissecting microscope, and appendages using a Leica DM2500 compound microscope, both equipped with a camera lucida.

Line drawings were captured in digital format and inked with a Wacom tablet after Coleman (2003).

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. To calculate the angle of the merus / carpus articulation of the first maxilliped, the tangent to the inner margin of the carpus and the tangent to the merus / carpus articulation were considered (see Fig. 1A).

The following types of setae have been mentioned in the description: (1) simple setae lack outgrowths on their shafts; (2) setulate setae bear long setules scattered along the shaft; (3) serrulate setae have one or two rows of short and extremely thin setules in the distal half; (4) setulo-serrulate setae bear long setules proximally but they have one or two rows of short and thin setules distally; (5) cuspidate setae, spine-like and with a subterminal pore; may or may not have denticles along their shafts (6) broom setae are tiny, with a supracuticular articulation (pedestal) and extremely thin setules distally; (7) plumose setae, similar to the broom setae, but much larger and with sparse setules emerging on the opposite sides of the shaft (these setae, unlike typical plumose setae, do not have a feather-like appearance). See Garm (2004) and Garm & Watling (2013) for more detailed descriptions.

The ANDEEP and DIVA specimens were deposited in the Zoological Museum Hamburg (ZMH), whereas the POLYGAS specimens were stored in the Muséum national d'Histoire naturelle, Paris (MNHN).

Taxonomy

Family Lampropidae Sars, 1878

Genus *Chalarostylis* Norman, 1879

Diagnosis (emended). First antenna, accessory flagellum shorter than main flagellum. Male second antenna not extending beyond second abdominal segment. First maxilliped, basis short, merus outer distal angle projected forwards providing an oblique edge of articulation with carpus greater than 45°. First pereopod with long and stout merus, and dactylus with a brush of strong simple setae (in some species the propodus also carried a strong simple seta distally). Telson distinctly shorter than uropod peduncles.

Type species. *Chalarostylis elegans* by monotypy.

Species. *C. elegans* Norman, 1879; *C. guanchi* (Reyss, 1978b); *C. canadensis* (Vassilenko, 1988) n. comb.; *C. brenkei* (Mühlenhardt-Siegel, 2005) n. comb.; *C. longisetae* (Corbera, 2006) n. comb.

Remarks. *Chalarostylis* is a deep-sea genus close to *Hemilamprops*, but easily distinguished from the latter by its stout first pereopod. However, this appendage is usually broken off at the level of the basis-ischium joint in the specimens examined. If the distal part of the first pereopod is lacking, the member of *Chalarostylis* can be distinguished from those of *Hemilamprops* by the following combination of characters: the accessory flagellum of the first antenna shorter than the main flagellum, the telson distinctly shorter than the uropod peduncles, and the male antenna not reaching beyond the second abdominal segment. In addition, the first maxilliped with its short basis and a merus / carpus articulation greater than 45° is proposed in this study as an additional diagnostic character to recognize the members of *Chalarostylis*. It is worth noticing that *C. elegans* (the type species of the genus), *C. canadensis* n. comb. and *C. brenkei* n. comb. show the first maxilliped characteristic of the genus (see Gerken & McCarthy 2009; Vassilenko 1988, and Fig. 1D herein). In addition, we have corroborated that the POLYGAS specimens herein designated as *Chalarostylis* sp. A also have this particular first maxilliped, i.e., with a short basis and a merus / carpus articulation greater than 45°.

Chalarostylis brenkei (Mühlenhardt-Siegel, 2005)

Syn.: *Hemilamprops brenkei* Mühlenhardt-Siegel, 2005.

Material examined. Type material. ANGOLA BASIN: DIVA I. Sta. 350, 16°14.3'S, 05°26.8'E, 5389 m, 29 Jul 2000, 1 A ♂ (Holotype, ZMH K-40418). Sta. 318, 22°20.0'S, 03°18.3'E, 5125 m, 07 Jul 2000, 1 A ♀ (Paratype, ZMH K-40419).

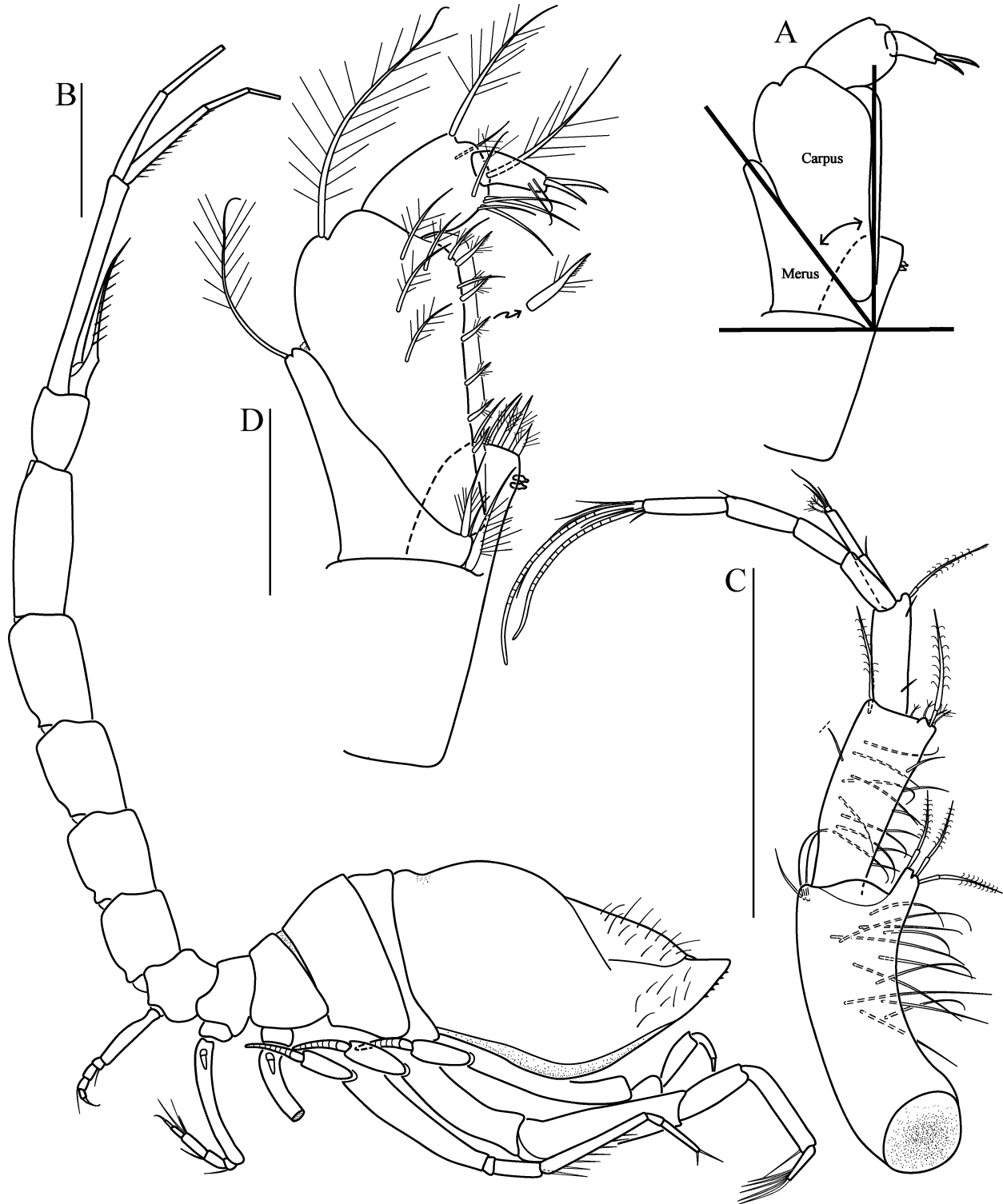


FIGURE 1. *Chalarostylis brenkei* (Mühlenhardt-Siegel, 2005). A, first maxilliped, sketch showing measurement of merus / carpus angle. Adult female (ZMH K-43179): B, habitus. C, first antenna. D, first maxilliped and detail of a carpal setulo-serrulate seta. Scales: B, C, 1 mm. D, 0.5 mm.

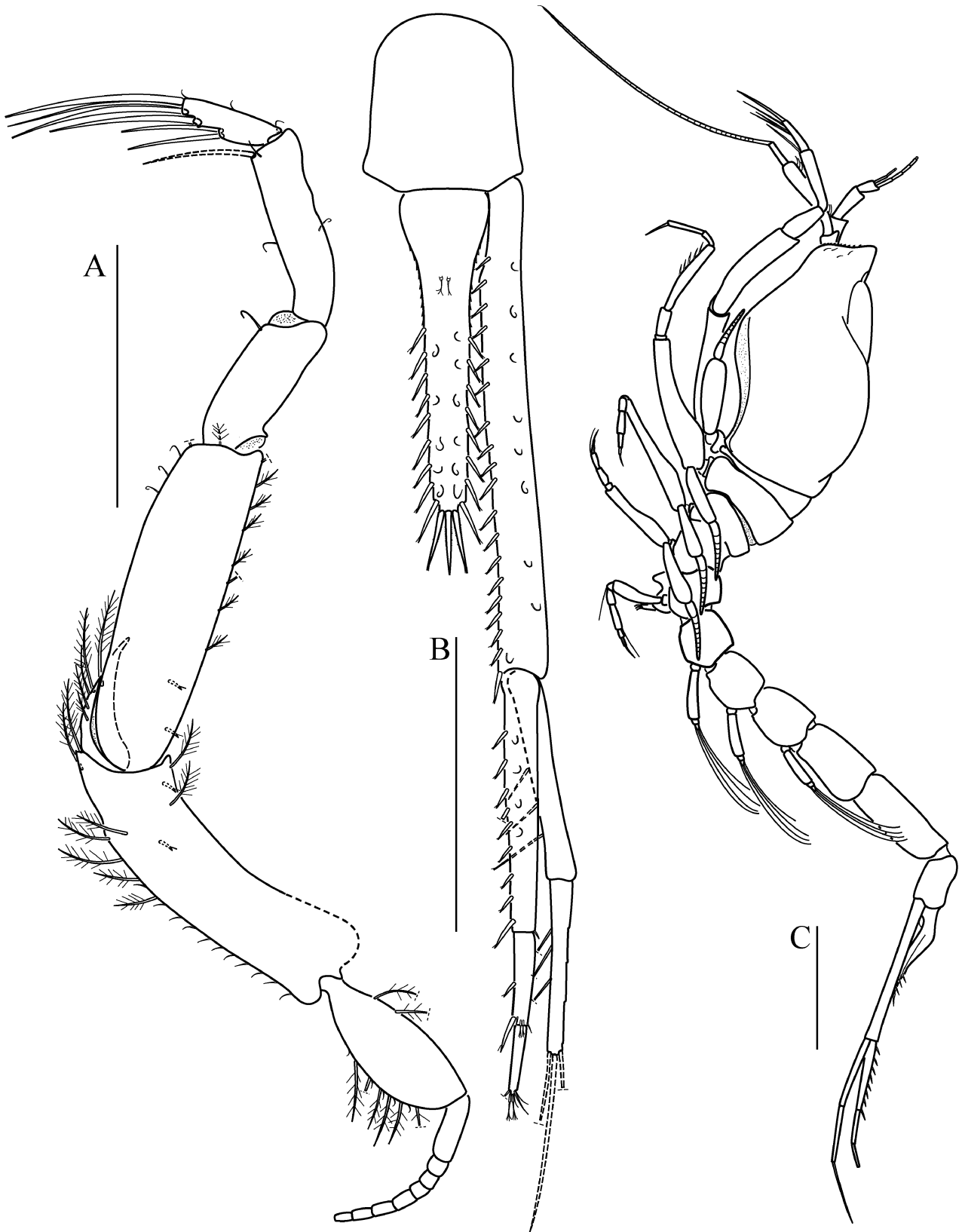


FIGURE 2. *Chalarostylis brenkei* (Mühlenhardt-Siegel, 2005). A, B, Adult female (ZMH K-43179): A, first pereopod (propodus strong seta represented in dash-line). B, last abdominal segment, telson and uropod. C, Adult male (ZMH K-43180), habitus. Scales: A – C, 1 mm.

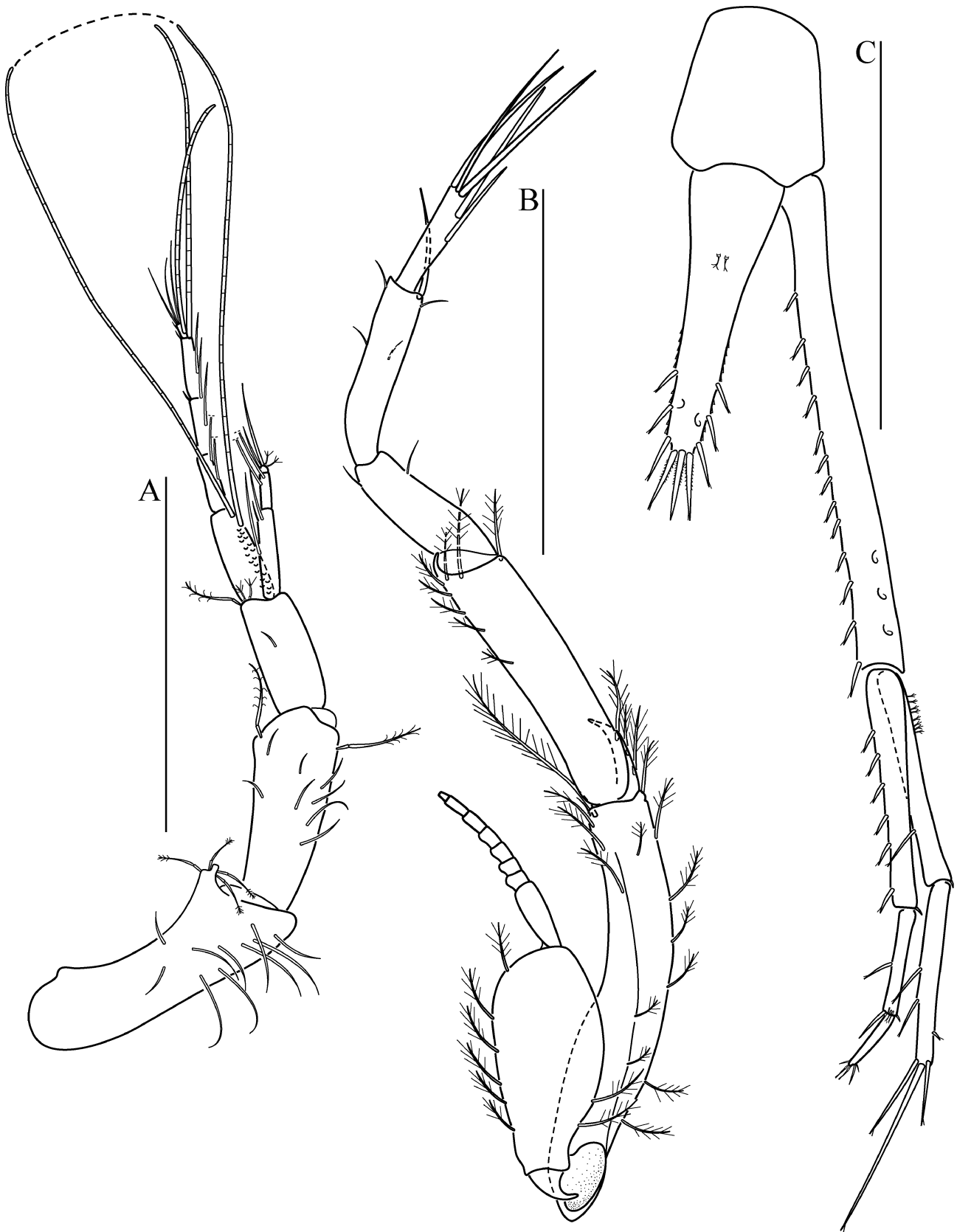


FIGURE 3. *Chalarostylis brenkei* (Mühlenhardt-Siegel, 2005). Adult male (ZMH K-43180): A, first antenna. B, first pereopod. C, last abdominal segment, telson and uropod. Scales: A – C, 1 mm.

Additional material examined. ANTARCTICA: ANDEEP II (ANT-XIX/4). Sta. 132-E, 65°18.25'S, 53°22.79'W, 2082 m, 06 Mar 2002, 1 A ♂ (ZMH K-43180). ANDEEP III (ANT-XXII/3). Sta. 59-E, 67°30.75'S,

00°00.23'W, 4651 m, 14 Feb 2005, 1 SA ♂ (ZMH K-43186). Sta. 88-E, 68°03.84'S, 20°31.39'W, 4928 m, 27 Feb 2005, 2 SA ♂♂, 1 Juv., 1 Manca (ZMH K-43182). Sta. 88-S (same data that Sta. 88-E), 2 SA ♂♂ (ZMH K-43183). Sta. 94-E, 66°39.08'S, 27°09.26'W, 4889, 02 Mar 2005, 1 SA ♂, 1 Juv. (ZMH K-43184). Sta. 94-S (same data that Sta. 94-E), 1A ♂ (ZMH K-43185). Sta. 102-E, 65°18.25'S, 53°22.79'W, 2082 m, 06 Mar 2005, 1 A ♂ (ZMH K-43292). Sta. 110-S, 64°59.20'S, 43°02.05'W, 4698 m, 10 Mar 2005, 1 SA ♂ (ZMH K-43181). **GUINEA BASIN:** DIVA II. Sta. 89-6-S, 00°42.95'N, 05°31.29'W, 5142 m, 20 Mar 2005, 1 A ♂ (ZMH K-43961). **ARGENTINE BASIN:** DIVA III. Sta. 533-E, 36°00.20'S, 49°01.96'W, 4602 m, 15 Jul 2009, 1 A ♀, 1 SA ♀ (ZMH K-43179). Sta. 534-S, 36°00.61'S, 49°01.54'W, 4608 m, 16 Jul 2009, 1 SA ♂ (ZMH K-43189). **BRAZILIAN BASIN:** DIVA III. Sta. 561-S, 26°34.78'S, 35°13.90'W, 4484 m, 23 Jul 2009, 2 SA ♂♂, 1 Juv. (ZMH K-43187). Sta. 580-S, 14°58.91'S, 29°56.49'W, 5131 m, 30 Jul 2009, 2 SA ♀♀, 2 SA ♂♂ (ZMH K-43188).

Redescription adult female (ZMH K-43179)

Total length: 9.4 mm (specimen drawn).

Carapace (Fig. 1B) rather thin and transparent, with setae on frontal and pseudorostral lobes. Width approximately 0.74 its length. Anterior half with sharp middorsal carina, which has no teeth and in lateral view is slightly convex. Branchial chamber inflated leaving a narrow middorsal depression in between. Pseudorostrum almost 3 times length of ocular lobe, with a few teeth anteriorly. Ocular lobe slender, without lenses. Antero-lateral notch absent, antero-lateral angle rounded.

Pereon shorter than carapace, five segments visible.

Abdomen approximately as long as cephalothorax.

Telson (Figs. 1B, 2B). Almost twice as long as last abdominal segment, 0.64 as long as uropod peduncle and approximately 1.22 times the length of first article of uropod endopod. With 8–9 cuspidate setae on each side and 3 cuspidate setae distally.

First antenna (Fig. 1C). Peduncle, first article approximately as long as second and third together, with many simple setae, inner distal corner produced as a lobe with 3 (4?) plumose setae. Second article with many simple setae and 2 plumose setae distally. Third article approximately 0.6 as long as second, with 1 plumose seta on inner distal corner. Main flagellum of 5 articles, last two articles with 1 aesthetasc each. Accessory flagellum of 3 articles (distal one minute), almost reaching distal end of second article of main flagellum.

First maxilliped (Fig. 1D). Basis short, slightly longer than carpus (including the endite), with a stout setulate seta on inner margin. Merus / carpus articulation at an angle greater than 45°. Merus slightly longer than basis (excluding the endite), with a stout setulate seta on inner distal corner and 1 large setulate seta on outer distal corner. Carpus with a row of 6 setulo-serrulate setae on inner margin (see detail), several setulate setae on ventral surface and 1 large setulate seta on outer distal corner. Propodus approximately 0.43 as long as carpus, with 4 simple setae on inner distal corner, 2 subterminal setulate setae (on ventral and dorsal surface, respectively), and 2 large setulate setae distally. Dactylus 0.60 as long as propodus, with 2 unequal serrulate setae distally.

First pereopod (Fig. 2A). Basis 0.44 as long as remaining articles together, with setulate setae on both margins and distally. Ischium spoon shaped, providing a concave surface of articulation on which the proximal inner surface of merus fits, ischium / merus articulation distinctly on ventral surface but hardly visible on dorsal surface; with 5 setulate setae. Merus huge, about as long as basis, with setulate setae on outer margin and distally. Carpus approximately 0.8 as long as propodus. Propodus with a strong simple seta on inner distal corner (this seta is missing in appendage drawn; it is represented in dash lines in Fig. 2A). Dactylus slightly more than ½ as long as propodus, with 8 strong simple setae, 5 on inner margin (only 3 drawn) and 3 distally. Exopod, flagellum of 8 articles.

Uropod (Fig. 2B). Peduncle with 19–20 cuspidate setae on inner margin. Endopod approximately 0.80 as long as peduncle, consisting of 3 articles. First article approximately 1.5 times as long as the other two together, with 9–11 cuspidate setae on inner margin; second article with 2 cuspidate setae on inner margin; third article the smallest, with 2 broom setae and a few tiny setae distally. Exopod slightly shorter than endopod (it reaches approximately half length of third endopod article), of 2 articles; first article slightly longer than second, with 3 elongate cuspidate setae on inner margin; second article with 3 elongate cuspidate setae on inner margin, 4 sockets (setae missing) on outer margin (2 small cuspidate setae and 2 sockets lacking setae on the counterpart), distal end with 3 sockets (setae missing). Counterpart second article with 3 unequal elongate (cuspidate?) setae distally, the longest seta as long as article. These missing setae are represented in dash-line in Fig. 2B.

Redescription adult male (ZMH K-43180)

Total length: 7.1 mm (specimen drawn).

Habitus (Fig. 2C) as in female except for: Carapace, width 0.70 its length, with a few setae on pseudorostral lobes only. Pseudorostrum approximately twice ocular lobe length. Third, fourth and fifth pereonites with a conical projection ventrally. Abdomen robust and with 3 pairs of well developed pleopods.

Genital papillae. Each papilla exhibits a bundle of thread-like spermatophores, showing a braid arrangement.

Telson (Figs. 2C, 3C). Almost twice as long as last abdominal segment and approximately 0.6 as long as uropod peduncle, with 3 cuspidate setae on each side and 3 cuspidate setae distally. Note: 5–7 cuspidate setae on each side were recorded in the other adult males examined.

First antenna (Fig. 3A) as in female except for: Peduncle, first article approximately 0.90 as long as second and third articles together, inner lobe with 4 plumose setae. First and second articles, simple setae less abundant. Main flagellum, first article inflated and with many aesthetascs, fourth and fifth articles each with 1 aesthetasc (thicker and shorter than those of first article). Accessory flagellum reaching approximately half way along second article of main flagellum.

Second antenna reaching approximately end of pereon.

First pereopod (Fig. 3B) as in female except for: Basis 0.60 as long as remaining articles together. Ischium with 3 setulate setae on inner margin. Merus approximately 0.7 as long as basis. Exopod stronger than in female. Note: only 5 of the 8 strong simple setae of dactylus were drawn.

Uropod (Fig. 3C) as in female except for: Peduncle with 12–13 cuspidate setae on inner margin. Endopod first article with 6–7 cuspidate setae on inner margin. Exopod approximately as long as endopod, first article with 1 elongate cuspidate seta on inner margin; second article with 2 elongate cuspidate setae on inner margin and 1 small cuspidate seta on outer margin. Note: the holotype (ZMH K-40418) also has 1 small cuspidate seta on the outer margin of the exopod second article (not shown in the Figure 3 presented by Mühlenhardt-Siegel 2005).

Distribution. Previously recorded from the Angola Basin at 5125 – 5389 m, this species is now recorded also from the Guinea Basin (5142 m), the Weddell Sea (2082 – 4928 m), the Argentine Basin (4602 – 4608 m) and the Brazilian Basin (4484 – 5131 m) (Fig. 6).

Chalarostylis sp. A

Material examined: POLYGAS. Sta. DS15, 47°35.2'N, 08°40.1'W, 2246 m, 21 Oct 1972: 10 specimens (MNHN-IU-2013-11345). Sta. DS18, 47°32.2'N, 08°44.9'W, 2138 m, 22 Oct 1972: 9 specimens (MNHN-IU-2013-11346).

All these specimens are so badly damaged that an adequate description is not allowed. Despite that, this material alerts us about the presence of another species of *Chalarostylis* in the North-East Atlantic. A few remarks on this undescribed species are presented below.

Only a subadult female from the POLYGAS Sta. DS15 has an entire first pereopod. Like in *H. canadensis*, the carpus and propodus of the first pereopod are armed with teeth (Fig. 4B). However, this POLYGAS specimen differs from *H. canadensis* by having a larger merus (about as long as basis), and a shorter dactylus (about 1/3 as long as propodus) with 6 instead of 7 strong simple setae. The telson from all the POLYGAS specimens examined are armed with a medial distal seta distinctly stronger than the lateral ones (see Figs. 4C, 5A, 5C), a setal arrangement that resembles that of *Hemilamprops longisetae* from New Caledonia. In addition, both in the subadult females and the adult males the uropod peduncle is about three times the length of the telson. Unfortunately, the first pereopod of *H. longisetae* is unknown and the uropods are damaged with only the proximal part of the peduncles remaining. Despite that, the POLYGAS specimens herein reported are easily separated from the latter species by its accessory flagellum of the first antenna, which is longer and composed of 3 articles (see Figs. 4A and 5B). The flagellum of *H. longisetae* is very short and has only 2 articles.

Distribution. Recorded so far at two close stations in the Bay of Biscay, between 2138 and 2246 m (Fig. 6).

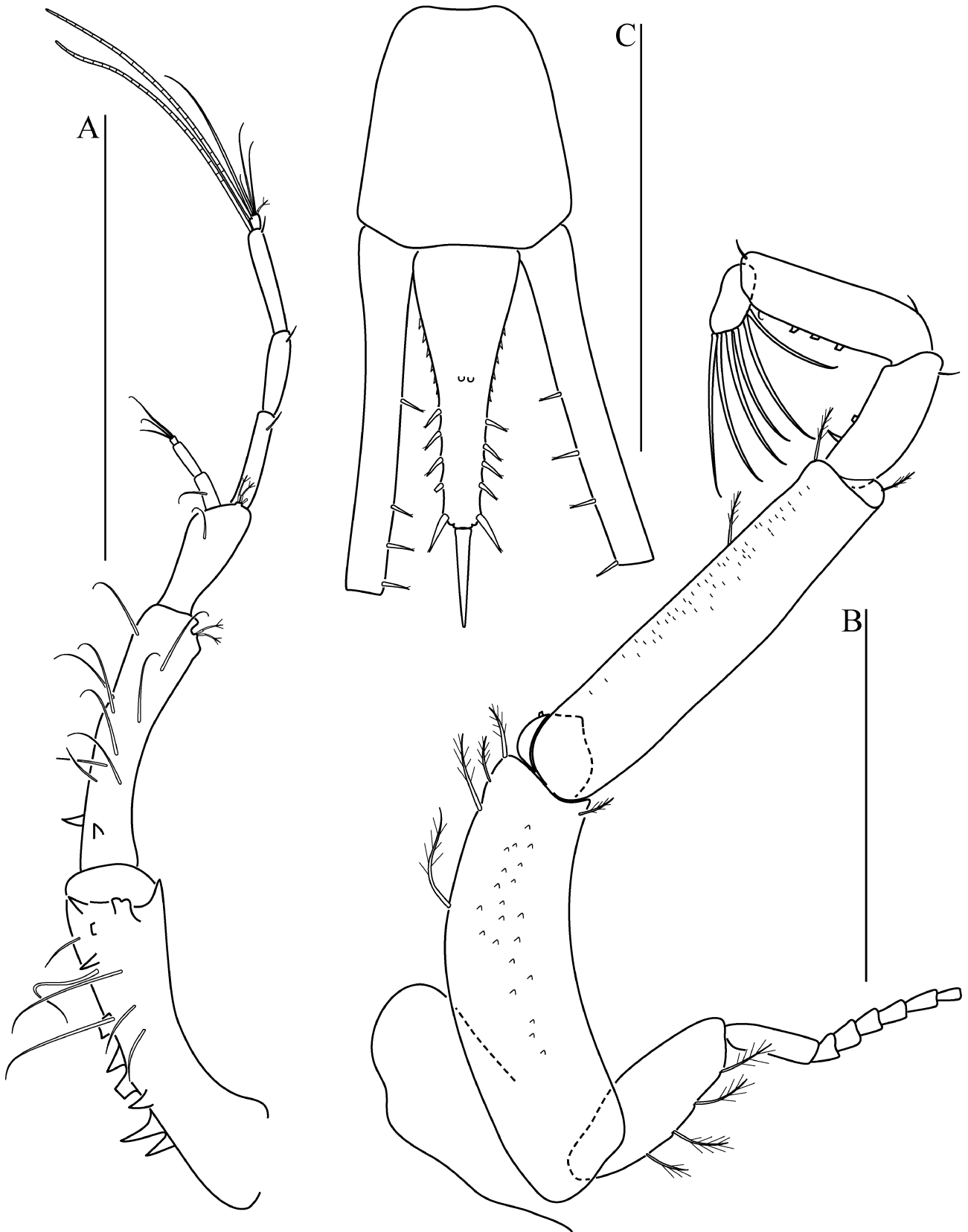


FIGURE 4. *Chalarostylis* sp. A. Subadult female (MNHN-IU-2013-11346): A, first antenna. B, C, Subadult female (MNHN-IU-2013-11345): B, first pereopod. C, last abdominal segment, telson and uropod peduncles (broken). Scales: A, 0.5 mm. B, C, 1 mm.

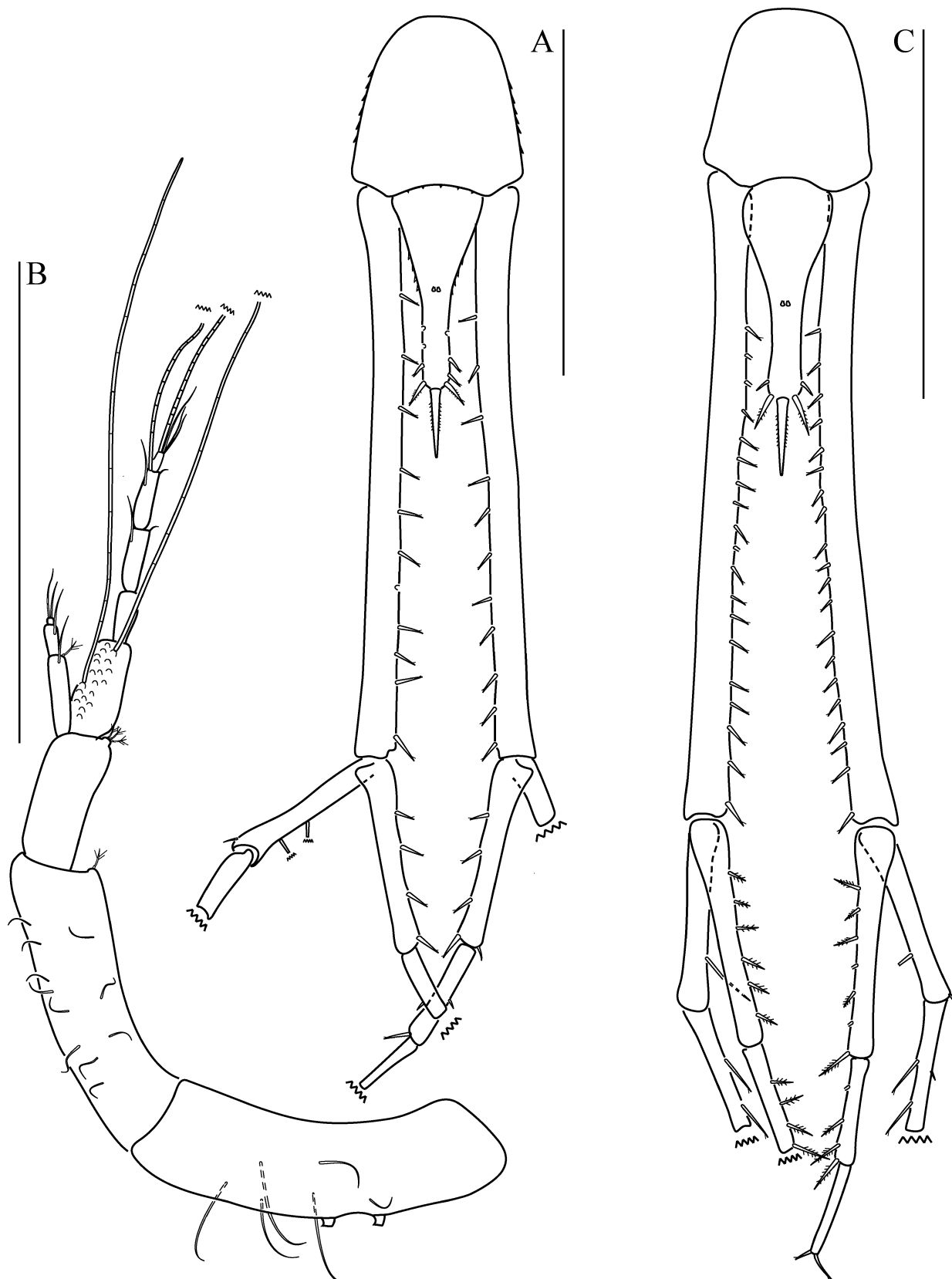


FIGURE 5. *Chalarostylis* sp. A. Subadult female (MNHN-IU-2013-11346): A, last abdominal segment, telson and uropods (rami broken). B, C, Adult male (MNHN-IU-2013-11346): B, first antenna. C, last abdominal segment, telson and uropods (right endopod complete, remaining rami broken). Scales: A, C, 1 mm. B, 0.5 mm.

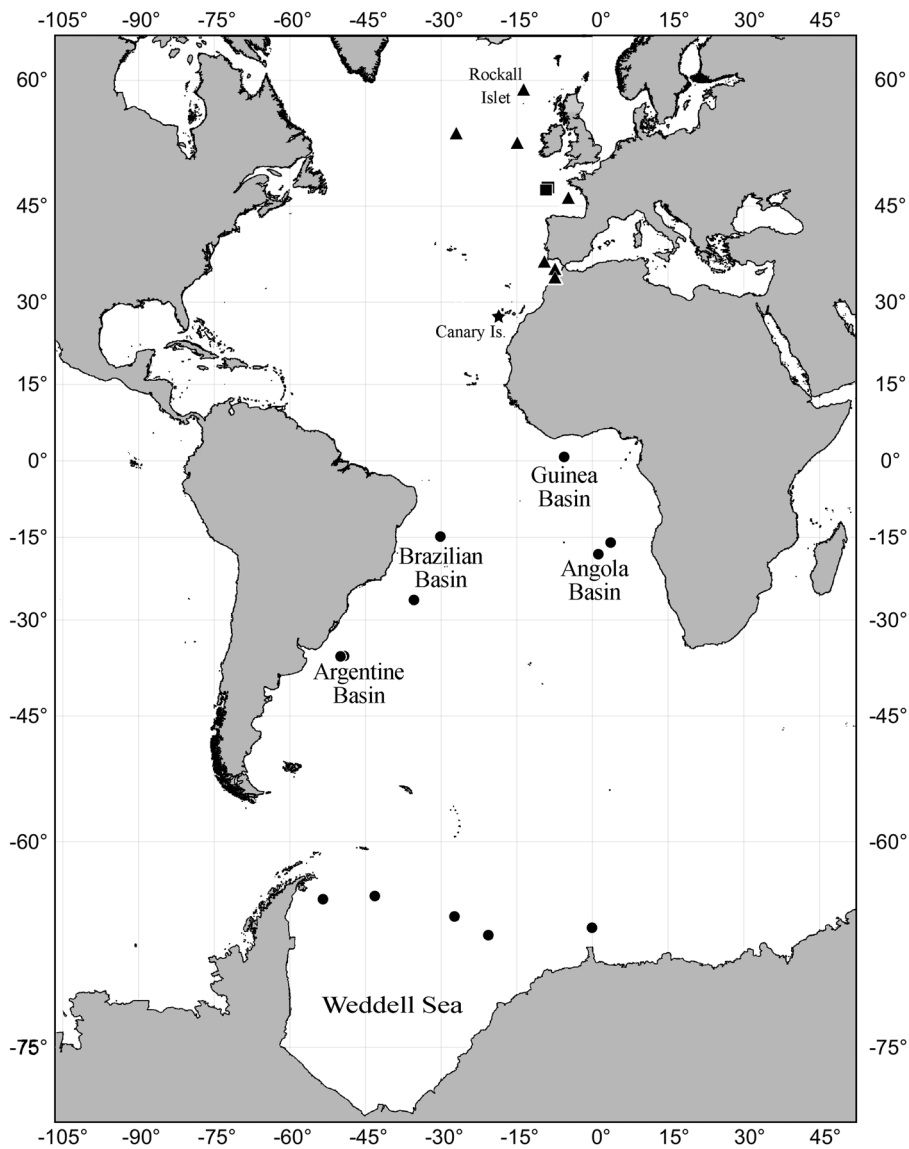


FIGURE 6. Records of the genus *Chalarostylis* from the Atlantic. *C. elegans* Norman (1879) (triangles); *C. guanchi* (Reyss, 1978) (stars); *C. brenkei* (Mühlenhardt-Siegel, 2005) (circles); *Chalarostylis* sp. A (squares). References: Norman (1879); Reyss (1978a, b); Jones (1990); Gerken & McCarthy (2007).

Discussion

Norman (1879) erected the genus *Chalarostylis* and described *C. elegans* based on a single adult specimen collected off Rockall (British Isles). More recently, Reyss (1978a), Jones (1990) and Gerken & McCarthy (2007) reported additional specimens also from the eastern North Atlantic. Moreover, Reyss (1978b) described *Chalarostylis guanchi* from a single station off the Canary Islands.

In the present contribution *Hemilamprops brenkei* from Angola Basin is transferred to the genus *Chalarostylis* as well as *Hemilamprops canadensis* from the Arctic Sea, which also shares the diagnostic characters of the genus *Chalarostylis*. Regarding *Hemilamprops longisetae* from New Caledonia, the first pereopod is broken off at the anterior margin of the basis, and the first maxilliped was not described. However, this species is strikingly similar to the material herein described from the POLYGAS survey, and with no doubt it also belongs to this genus.

In total the genus *Chalarostylis* contains now six species: *C. elegans*, *C. guanchi*, *C. brenkei*, *C. canadensis*, *C. longisetae* and a species in open nomenclature, *Chalarostylis* sp. A.

Chalarostylis brenkei (Mühlenhardt-Siegel, 2005) n. comb. is the only species of this genus recorded up to

now from the South Atlantic. This species, formerly reported by Mühlenhardt-Siegel (2005) from the Angola Basin, is now recorded also from the Guinea Basin (less than one degree north of the Equator), the Weddell Sea, the Argentine and the Brazilian Basins. All these records are mapped in Fig. 6.

Chalarostylis is a deep-sea genus close to *Hemilamprops* but easily distinguished from the latter mainly by its robust first pereopod. In addition, this appendage shows useful diagnostic characters to separate the species of the genus, viz.,

(1) the ischium is rectangular, i.e., with inner and outer margin equal in length (*C. guanchi*), or wedge-shaped, i.e., with inner margin tapering and obliquely articulated with the merus (*C. elegans*, *C. brenkei*, *C. canadensis*, and the POLYGAS material herein studied);

(2) the carpus and propodus are armed with serrations (*C. elegans*) or strong teeth (*C. canadensis* and the POLYGAS specimens herein studied), or are unarmed (*C. brenkei* and *C. guanchi*) and

(3) the number of strong simple setae on dactylus vary from 6 to 9, and the propodus may have a strong simple seta too.

The strong setae of dactylus are simple, and thus are not expected to act as a filter. In addition, the first pereopod is not sexually dimorphic, therefore this appendage doesn't seem to be involved with courtship behaviour.

Unfortunately, the first pereopod is usually broken off at the basis-ischium joint. In the absence of this appendage, the species of *Chalarostylis* can be separated from those of *Hemilamprops* by having the accessory flagellum of the first antenna shorter than the main flagellum, the telson distinctly shorter than the uropod peduncle, and the male second antenna not extending beyond the second abdominal segment. Besides, the first maxilliped is herein proposed as a diagnostic appendage by having a short basis and a merus / carpus joint at an angle greater than 45 degrees (see Fig. 1D).

Norman (1879) stated that the first antenna of *C. elegans* has "the basal joint covered with numerous spines [teeth], especially on the underside". However, in the redescription presented by Gerken & McCarthy (2007) the margins of the first antenna of the holotype are described as smooth. Most probably, these authors have overlooked these teeth since this old preserved specimen is, as noted by them, in a poor shape and soft.

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