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ORIGINAL ARTICLE

Two new asterocherid species (Siphonostomatoida: Asterocheridae) from Madeira and the Canary Islands (eastern Atlantic)

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Abstract

The siphonostomatoid family Asterocheridae Giesbrecht, 1899 uses a wide range of host phyla, mainly due to the host diversity of two genera – *Asterocheres* Boeck, 1859 and *Orecturus* Humes, 1992. In the present paper, two new asterocherid species from the eastern Atlantic are described and compared with their congeners. One of these species belongs to the genus *Asterocheres*, *A. madeirensis*, and was found associated with the sponge *Petrosia ficiformis* (Poiret, 1789) in Madeira Island. This sponge occurs both in the Mediterranean and on nearby Atlantic coasts, although currently there are no records of the presence of symbiotic asterocherids for its Mediterranean populations. The second new species, *Orecturus canariensis*, is the first record of the genus on the eastern Atlantic coasts and was found in association with the gorgonian *Villogorgia bebrycoides* (Koch, 1887) in the Canary Islands. The diagnosis of the genus *Orecturus* is slightly modified to include some features shown by this new species and some of its plesimorphic and derived characteristics compared with the remaining asterocherid genera. Although the gorgonian *Paramuricea grayi* (Johnson, 1861) occurs in the same ecological assemblages as the infested colonies of *V. bebrycoides*, no specimens of asterocherid copepods were found on *Paramuricea* colonies. Therefore, *O. canariensis* may be a monoxenous symbiont.

Key words: *Asterocheres, Asterocheridae, Canary Islands, Orecturus, Madeira*

Introduction

Siphonostomatoid copepods live in association with many marine invertebrates all around the world (Gotto 1979). The siphonostomatoidan family Asterocheridae Giesbrecht, 1899 uses a wide range of host phyla, including sponges, cnidarians, molluscs, bryozoans, polychaetes, echinoderms and ascidians (Ivanenko & Smurov 1997; Johnsson & Bustamante 1997). This is mainly due to the host diversity of two genera: *Asterocheres* Boeck, 1859 and *Orecturus* Humes, 1992 (Boxshall & Halsey 2004). The genus *Asterocheres* is also the most specious asterocherid genera, as it contains approximately 70 species, although only 16 of them have been reported for the eastern Atlantic. On the contrary, none of the 10 known *Orecturus* species has been reported in this area. In fact, the Asterocheridae fauna from the eastern Atlantic, and specifically that from Madeira and the Canary Islands, is poorly known. Thompson (1888) reported a list of 64 copepods species collected in Madeira and the Canary Islands during a cruise. However, out of this number, only two siphonostomatoid were found, the asterocherid *Acontiophorus scutatus* (Brady & Robertson 1875) and the artotrogid *Artotrogus normani* (Brady & Robertson 1875), both of them taken from Funchal Bay, Madeira. More than a century later, Johnsson (2001) described two copepods belonging to the family Artotrogidae – *Cryptopontius madeirensis* and *Dyspontius gerardius* – taken, respectively, from Reis Magos Beach and Porto Novo, Madeira.

In this paper, two new asterocherid species from Madeira and the Canary Islands, one belonging to *Asterocheres* and the other to the genus *Orecturus*, are described and compared with their respective congeners. The new species of *Asterocheres* was found associated with the sponge *Petrosia ficiformis* (Poiret, 1789) in Madeira and the new species of *Orecturus*

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was collected from the gorgonian *Villogorgia bebrycoides* (Koch, 1887) in the Canary Islands.

Material and methods

The colonies of *Villogorgia bebrycoides* were individually collected, each one being isolated in a plastic bag, by SCUBA diving at Guadamojete Point (Radazul, southeast coast of Tenerife, Canary Islands, Spain) (Figure 1) and immediately kept in cooled seawater (10°C) for several hours. Samples were then gently anaesthetized with MgCl. The sponge *Petrosia ficiformis* was individually collected by SCUBA diving at Porto da Cruz (Madeira Island, Portugal) (Figure 1) and immediately isolated in a plastic bag containing formalin 8–10% and seawater. In both cases, the symbiotic fauna were fixed with a 10% buffered formalin/seawater solution for 48 h and later sieved through a 100 μm net. The copepods were recovered from the sediment retained and preserved in 70% ethanol.

Selected specimens were stained with Chlorazol Black E, dissected in lactic acid, and examined as temporary mounts in lactophenol. All figures were drawn with the aid of a camera lucida on a Leica DMLB differential interference microscope. In order to detect minute details, a specimen of each species was dehydrated in a graded series of ethanol, critical-point dried, mounted on stubs, coated with gold palladium and observed and photographed using a Philips XL30 scanning electron microscope. All appendage segments and setation elements were named and numbered using the system established by Huys & Boxshall (1991).

Material examined in the present paper is deposited in the Museo Nacional de Ciencias Naturales in Madrid (MNCN) and in the collection of Biodiversidad y Ecología de Invertebrados Marinos research group of the University of Seville (BEIM).

Results

Order Siphonostomatida Thorell 1859
Family Asterocheridae Giesbrecht, 1899
Asterocheres Boeck, 1859
Asterocheres madeirensis, n. sp.
(Figures 2–6A–C)

Material examined

Holotype female (MNCN 20.04/7785), allotype male (MNCN 20.04/7786) and paratypes, two females and one male (MNCN 20.04/7787), associated with the sponge *Petrosia ficiformis* (Poiret, 1789) at Porto da Cruz, Madeira, Portugal, at about 3–5 m depth, September 1998. BEIM (COP–506) paratypes, eight females and five males, with the same sampling data as the holotype.

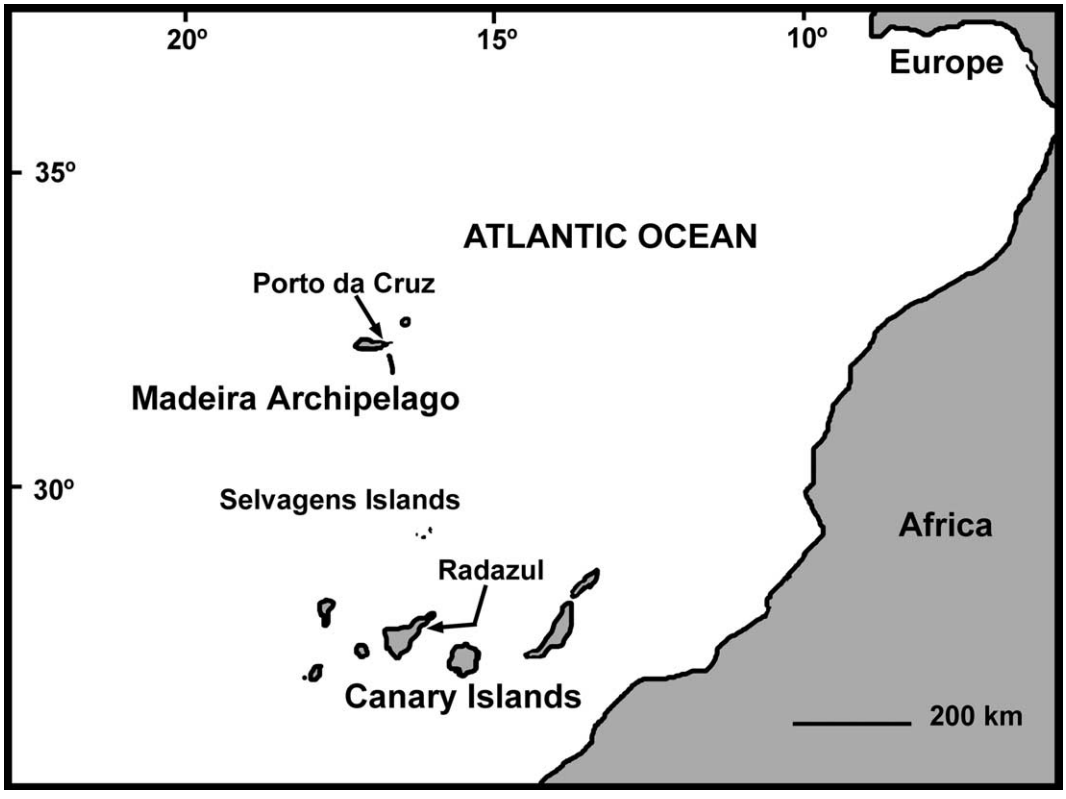

Figure 1. Situation of Madeira and the Canary Islands and the locations of sampling sites.

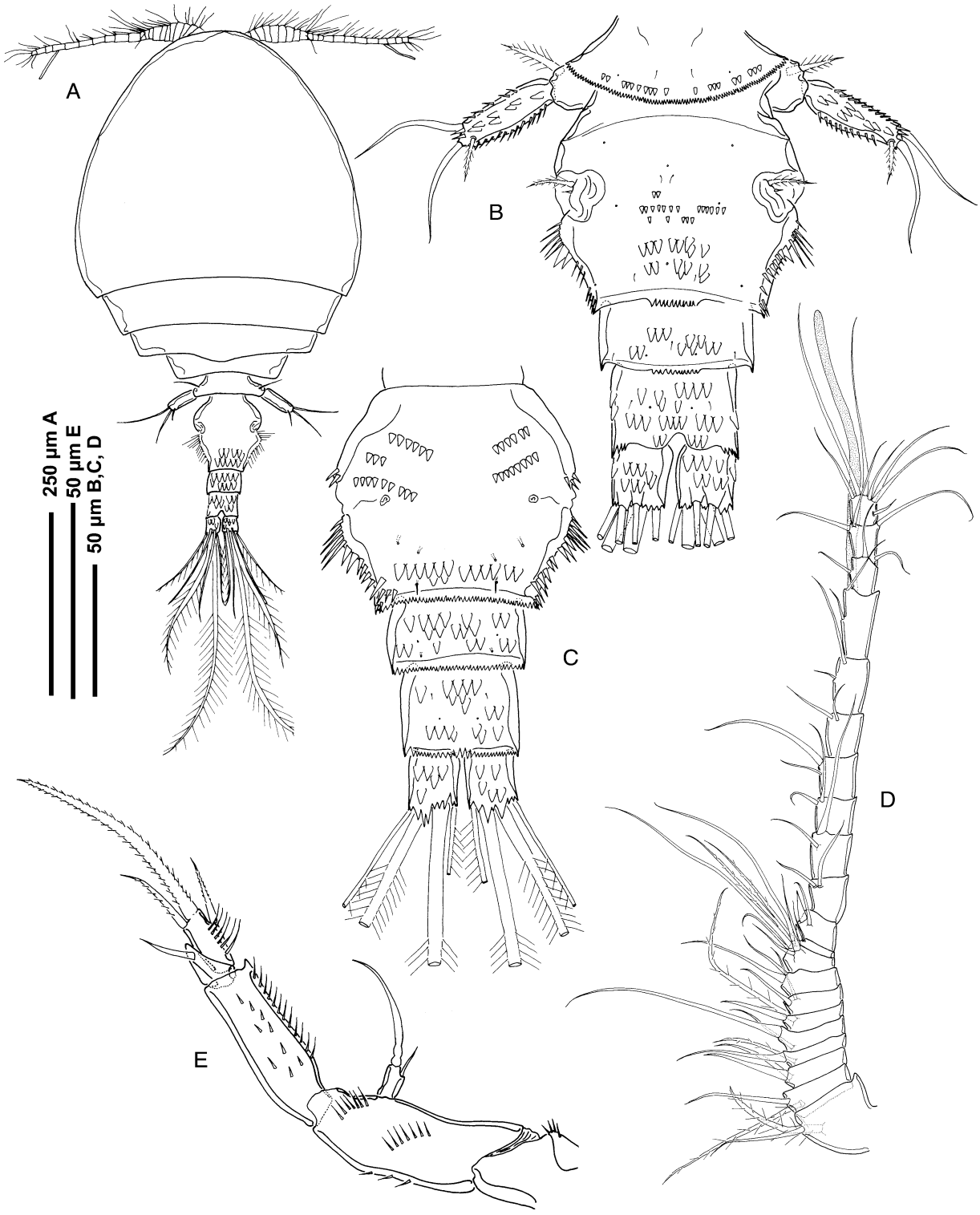

Figure 2. *Asterocheres madeirensis*, female. (A) Dorsal view. (B) Urosome, dorsal view. (C) Urosome, ventral view. (D) Antennule. (E) Antenna.

Description

Adult female. Body cyclopiform, slender with oval cephalothorax and cylindrical urosome (Figure 2A). Mean body length from rostral margin to posterior margin of caudal rami (without caudal setae) 560 µm (510–590 µm) and maximum width 330 µm (260–370 µm), based on three specimens. Ratio of length to width of prosome 1.2:1. Ratio of length of prosome to that of urosome 1.4:1. Prosome

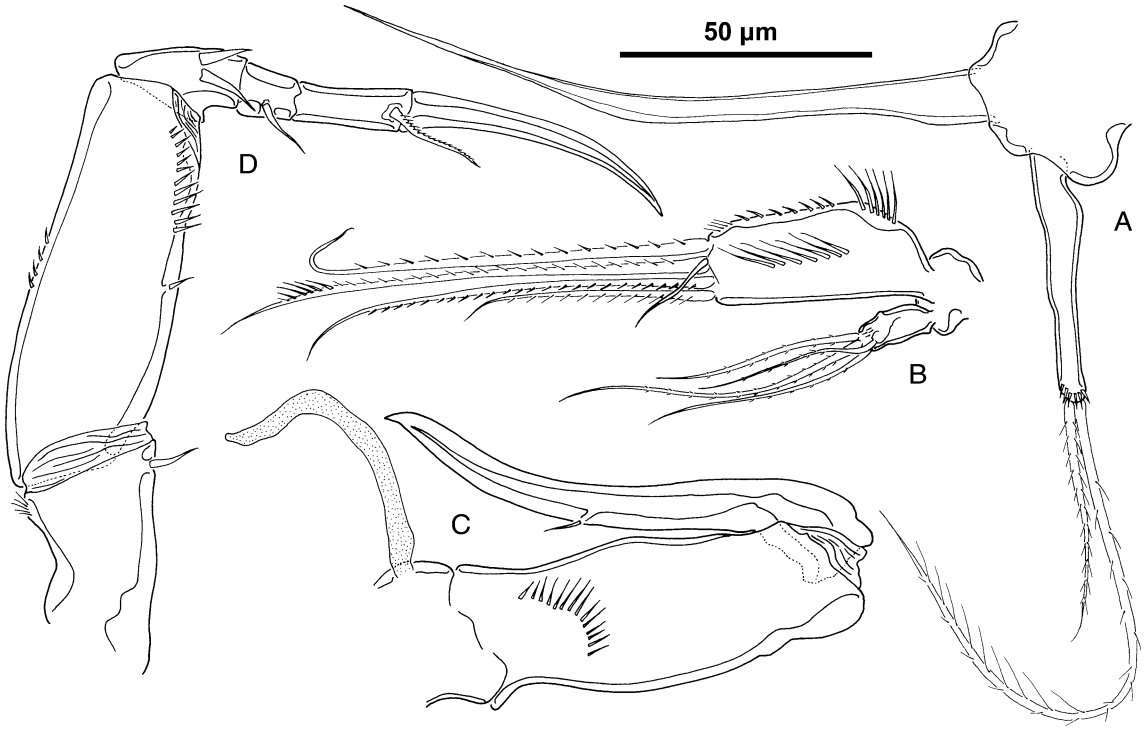

Figure 3. *Asterocheres madeirensis*, female. (A) Mandible. (B) Maxillule. (C) Maxilla. (D) Maxilliped.

comprising cephalothorax fully incorporating first pedigerous somite and three free pedigerous somites. Somite bearing leg 4 much smaller than preceding ones. Dorsal cephalothoracic shield and free pedigerous somites ornamented with integumental pores and sensilla. Urosome four-segmented comprising leg 5-bearing somite, genital double somite and two free abdominal somites. Somite bearing leg 5 (Figure 2B) wider than long, with some spinules on its dorsal surface and a narrow membrane along posterodorsal margin. Genital double somite approximately 1.15 times wider than long, bearing genital apertures, paired gonopores located laterally. Lateral margin of double somite ornamented with fringe of long spinules located about midway along double somite, posterior to gonopore level (Figure 2B, C). Each genital area armed with one plumose seta and one minute spinule. Genital double somite and following somites provided with large epicuticular scales arranged in overlapping pattern all around (Figure 6A). Posterior margin of urosomites ornamented with hyaline frills with serrated free margins. Integumental pores and sensilla present on urosomal somites (Figure 2C). Caudal rami about as long as wide, ornamented dorsally with epicuticular scales; armed with six setae, seta I absent and setae II and VII slightly offset on to dorsal surface.

Antennule 21-segmented (Figure 2D); segmental fusion pattern as follows: 1(I), 2(II), 3(III), 4(IV), 5(V), 6(VI), 7(VII), 8(VIII), 9(IX–XII), 10(XIII), 11(XIV), 12(XV), 13(XVI), 14(XVII), 15(XVIII), 16(XIX), 17(XX), 18(XXI), 19(XXII–XXIII), 20(XXIV–XXV), 21(XXVI–XXVIII). Segments 1–8 each with two setae; segment 9 with seven setae; segments 10–17 each with two setae; segment 18 with two setae plus an aesthetasc; segment 19 with two setae; segment 20 with four setae; segment 21 with seven setae. Segment 10(XIII) reduced, partly overlapped by distal expansion of compound segment 9(IX–XII).

Antenna biramous (Figure 2E), 180 µm long, with small unarmed coxa ornamented with tuft of spinules and large unarmed basis with fine spinule rows. Exopod small, one-segmented, bearing one subapical and one apical seta. Endopod three-segmented; first segment elongated, unarmed but ornamented with spinules and lateral row of fine spinules; second segment produced distally on medial side but articulating with third segment proximally on lateral side and armed with one smooth seta; third segment armed with two short pinnate setae and large distal claw also ornamented with lateral rows of fine spinules.

Mandible with one-segmented palp and stylet-like gnathobase (Figure 3A). Stylet located in oral cone. Palp slender, ornamented with crown of fine spinules apically and armed with two terminal plumose setae. Oral cone long and slender, 126 µm long, reaching the insertion of maxillipeds.

Maxillule bilobed (Figure 3B); praecoxal endite (inner lobe) nearly three times longer than palp

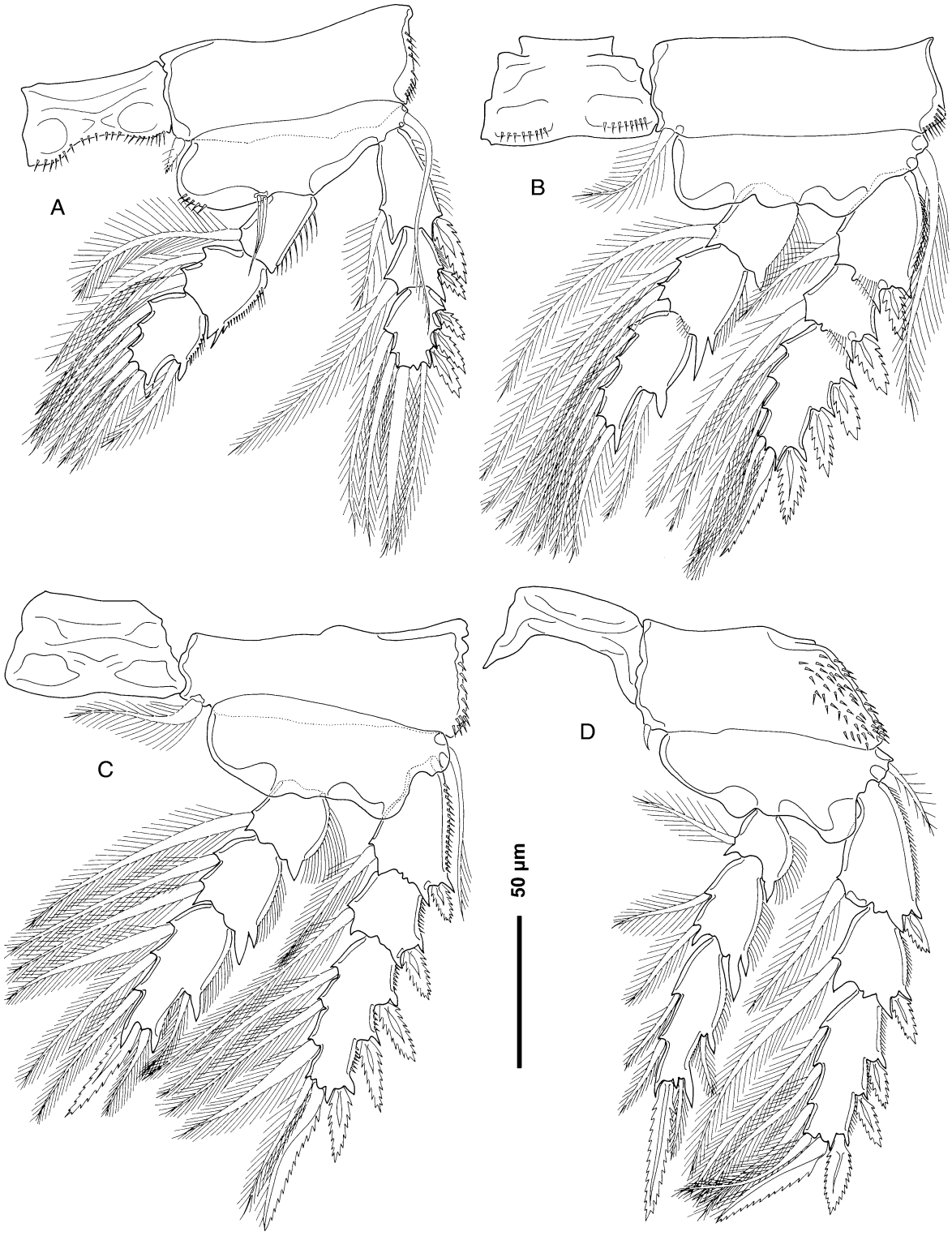

Figure 4. *Asterocheres madeirensis*, female. (A) Leg 1. (B) Leg 2. (C) Leg 3. (D) Leg 4.

(outer lobe). Endite ornamented with long setules proximally and spinules distally on the lateral margin and row of long setules medially; armed with five distal setae, four of them ornamented with spinules and one short and smooth. Palp armed with four barbed terminal setae.

Maxilla two-segmented (Figure 3C) but with partial transverse suture on syncoxa (proximal segment) possibly marking plane of praecoxa–coxa fusion; praecoxal part bearing long flaccid element medially (Figure 6C), representing tubular extension over the opening of the maxillary gland; coxal part

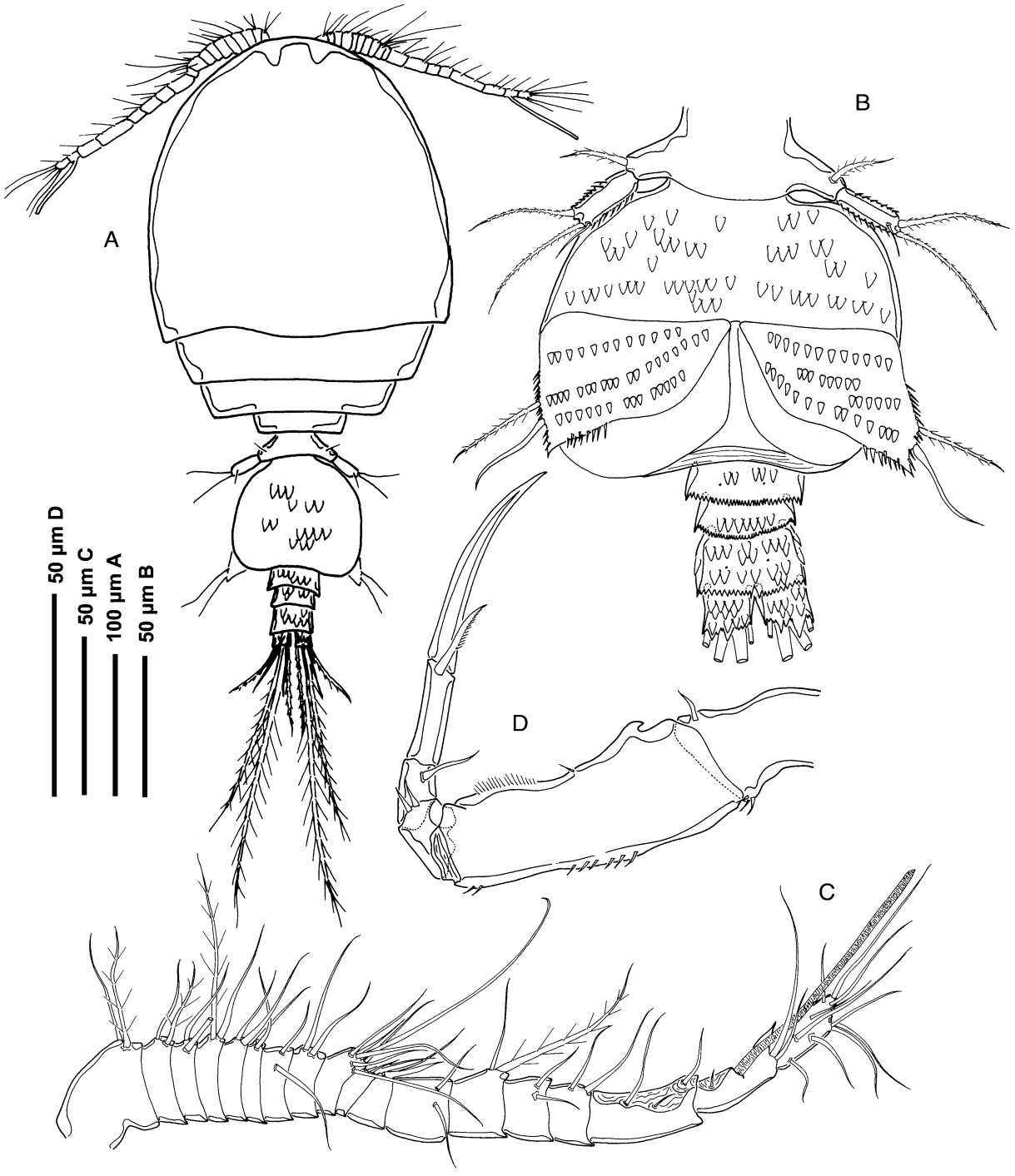

Figure 5. *Asterocheres madeirensis*, male. (A) Dorsal view. (B) Urosome, dorsal view. (C) Antennule. (D) Maxilliped.

unarmed but ornamented with a row of spinules proximally. Claw-like basis more or less straight; armed with one very small lateral seta at approximately half its length.

Maxilliped five-segmented (Figure 3D) comprising short syncoxa, long basis and distal subchela consisting of three free endopodal segments armed with distal claw-like element. Syncoxa with short seta distally; basis elongated and slender with minute hyaline seta approximately half its length on inner edge and row of spinules on lateral distal margin. First endopodal segment bearing two short setae and second with smooth short seta. Third endopodal segment with terminal claw, 57 µm long with no ornamentation, and additional apical plumose seta.

Swimming legs 1–4 biramous (Figure 4A–D), with three-segmented protopods and three-segmented rami. Intercoxal sclerite present in legs 1–4,

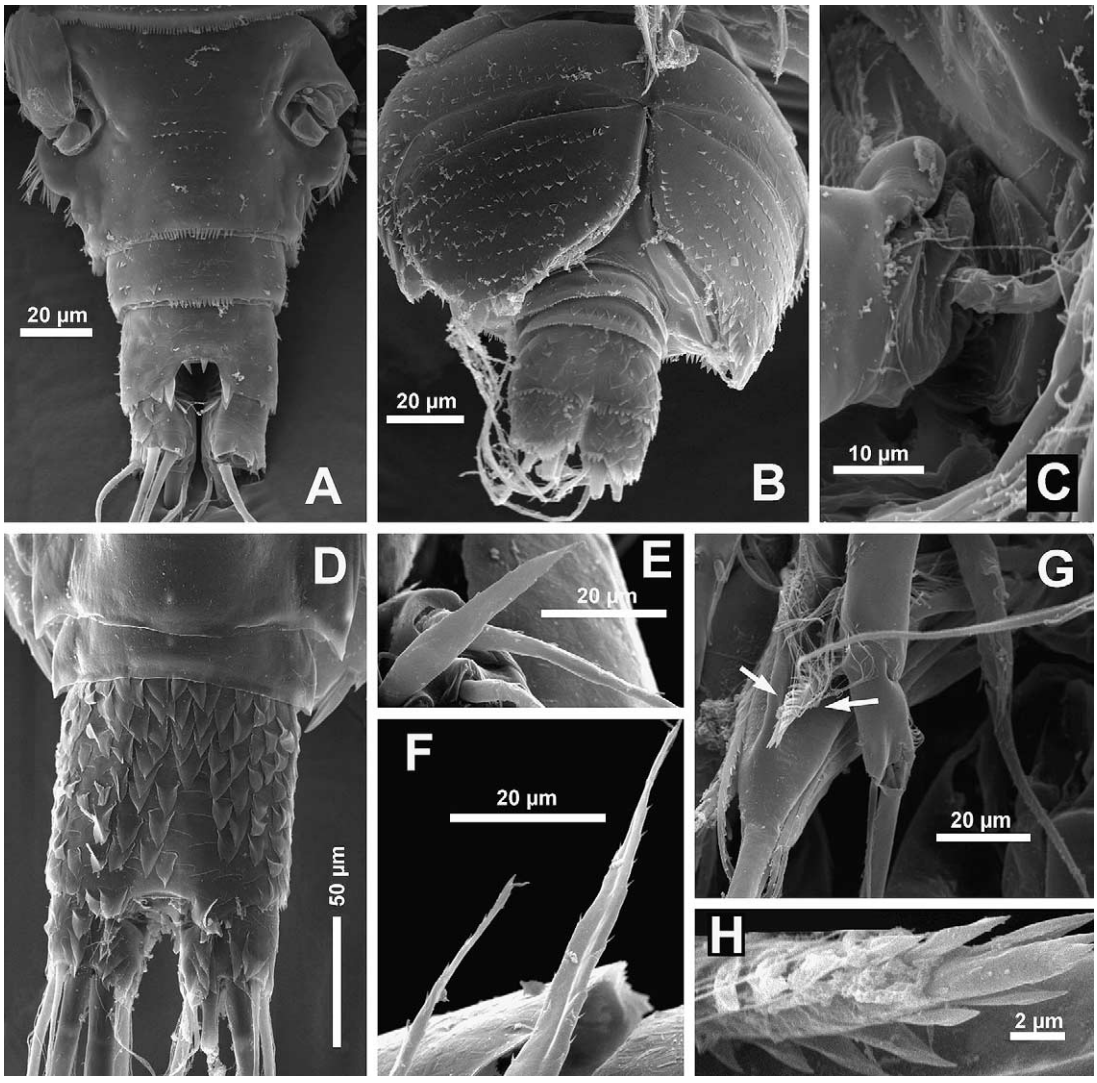

Figure 6. *Asterocheres madeirensis*: detail of the epicuticular scales in the urosome, dorsal view in (A) female and (B) male. (C) Maxilla, detail showing the flaccid element of the praecoxa. *Orecturus canariensis*, female: (D) detail of the epicuticular scales in the urosome, dorsal view; (E–F) antennule, detail of the spinous seta (E), and the seta with an apical setule that has an apical hollow (F) from the first to third segments; (G–H) maxillule, detail of the armature of one seta of the endite.

ornamented with rows of spinules in legs 1 and 2. Table I shows the formula for armature.

Coxae of all legs ornamented with spinule rows laterally, as figured. Inner coxal seta plumose in legs 1–3 and reduced and naked in leg 4. Outer spines of exopodal segments in legs 1–4 bilaterally serrated. Lateral margins of exopodal segments in legs 2–4 with minute serrations; lateral margins of endopodal segments in legs 1–4 with rows of setules. Second and third endopodal segments in legs 2–4 with beak-like spiniform process distally. Leg 5 with protopodal segment incorporated into somite (Figure 2B). Elongated free segment armed with two smooth terminal setae and subterminal plumose seta; ornamented with large epicuticular scales and fine spinules laterally. Leg 6 represented by seta on genital area (Figure 2B).

Table I. *Asterocheres madeirensis*, female, formula for armature of legs 1–4.

	Coxa	Basis	Exopodal segments	Endopodal segments
Leg 1	0–1	1–I	I–1;I–1;III,2,2	0–1;0–2;1,2,3
Leg 2	0–1	1–0	I–1;I–1;III,I,4	0–1;0–2;1,2,3
Leg 3	0–1	1–0	I–1;I–1;III,I,4	0–1;0–2;1,1+I,3
Leg 4	0–1	1–0	I–1;I–1;III,I,4	0–1;0–2;1,1+I,2

Adult male. Body cyclopiform, slightly more slender than female, with cephalothorax oval and cylindrical urosome (Figure 5A). Mean body length 450 µm (410–490 µm) and greatest width 240 µm (220–260 µm), based on three specimens. Ratio of length to width of prosome 1.2:1. Ratio of length of prosome to that of urosome 1.4:1. Prosome comprising cephalothorax fully incorporating first

pedigerous somite and three free pedigerous somites. Somite bearing leg 4 much smaller than preceding ones. Dorsal cephalothoracic shield and free pedigerous somites ornamented with integumental pores and sensilla. Urosome five-segmented, comprising fifth pedigerous somite, genital somite and three free abdominal somites. Dorsal and ventral surfaces of genital and free abdominal somites ornamented with large epicuticular scales arranged in overlapping pattern (Figure 6B). Posterior margin of urosomites ornamented with hyaline frills with more or less serrated free margins. Genital somite slightly wider than long, bearing genital apertures posterolaterally on ventral surface (Figure 5B). Caudal rami approximately as long as wide; armed with six setae as in female. Appendages as in female except for antennules, maxillipeds, and fifth and sixth legs.

Antennule 18-segmented (Figure 5C), geniculate; segmental fusion pattern as follows: 1(I), 2(II), 3(III), 4(IV), 5(V), 6(VI), 7(VII), 8(VIII), 9(IX–XII), 10(XIII), 11(XIV), 12(XV), 13(XVI), 14 (XVII), 15(XVIII), 16(XIX–XX), 17(XXI–XXIII), 18(XXIV–XXVIII). Geniculation located between segments 16(XIX–XX) and 17(XXI–XXIII). Segments 1–8 each with two setae; segment 9 with seven setae; segments 10–15 each with two setae; segment 16 with three setae; segment 17 with two setae plus an aesthetasc; segment 18 with nine setae. Segment 10 (XIII) reduced, partly overlapped by distal expansion of compound segment 9(IX–XII). Maxilliped five-segmented (Figure 5D), similar to that of female but second segment with medial proximally directed thorn-like process. Leg 5 with protopodal segment incorporated into somite (Figure 5B), armed with smooth seta. Free segment bearing two barbed terminal setae and smooth subterminal seta; ornamented with rows of fine spinules.

Leg 6 forming large opercular plates closing off genital apertures (Figure 5B), armed with two setae, one plumose and one smooth, and ornamented with rows of fine spinules.

Etymology

The specific name *madeirensis* refers to Madeira Island where the species was collected.

Discussion

Although the precise antennule segmentation of some *Asterocheres* species is unknown due to its original description being either incomplete or based only on the male with the female unknown, *Asterocheres* is characterized as a genus with females possessing 18- to 21-segmented antennules. Boxshall & Huys (1994) considered seven *Asterocheres* species with 21-segmented antennules, including their new species *A. reginae* Boxshall & Huys, 1994. These species were: *A. suberitis* Giesbrecht, 1899, *A. violaceus* (Claus, 1889), *A. minutus* (Claus, 1889), *A. bulbosus* Malt, 1991, *A. jeanyeatmanae* Yeatman, 1970 and *A. tenuicornis* Brady, 1910 (according to Eiselt 1965). However, these authors overlooked *A. simulans* (T. Scott, 1898), which also has a 21-segmented antenule according to both Scott's (1898) illustrations and the redescription of this species made by Ivanenko (1997).

Since 1994, a further five species have been described with this antennule segmentation: *A. flustrae* Ivanenko & Smurov, 1997, the only *Asterocheres* found associated with a bryozoan (Ivanenko & Smurov 1997), *A. lunatus* Johnsson, 1998, associated with Brazilian sponges (Johnsson 1998a), *A. urabensis* Kim, 2004 hosted by a coral from the Pacific coast of Panama (Kim 2004), *A. hirsutus* Bandera et al., 2005, which lives in association with an Antarctic hexactinellid sponge (Bandera et al. 2005) and *A. astroidicola* Conradi et al., 2006 associated with a Mediterranean coral (Conradi et al. 2006). Two more species, *A. echinicola* (Norman, 1868) and *A. lilljeborgi* Boeck, 1859, are also included in the 21-segmented antennule group, as further studies of these species (see Boxshall & Huys 1998; Ivanenko & Ferrari 2003) found that they have one segment more than appeared in their original descriptions. Therefore, there are 15 *Asterocheres* species having a 21-segmented antennule in the female.

Asterocheres madeirensis differs from 12 of these 15 species (*A. astroidicola, A. echinicola, A. flustrae, A. hirsutus, A. jeanyeatmanae, A. lilljeborgi, A. lunatus, A. reginae, A. simulans, A. suberitis, A. tenuicornis, A. urabensis*) in the possession of a two-segmented mandibular palp, in contrast to the one-segmented mandibular palp present in the new species.

The setation formula of the maxillule separates *A. madeirensis* from *A. bulbosus*, as the new species possesses five setae in the endite and four setae in the palp, but *A. bulbosus* presents four setae in the endite and three setae in the palp.

Among the species with a 21-segmented antennule in the female group, *A. violaceus* and *A. minutus*, two sibling species, are the closest to the new species. However, a detailed comparison among these three species reveals a number of significant differences. Thus, compared with these two species, *A. madeirensis* has an additional seta in the third segment of the antennary endopod and one seta less in the exopod. The inner lobe of the maxillule is almost three times longer than the outer lobe in *A. madeirensis*, whereas it is about as long as the outer

lobe in both *A. violaceus* and *A. minutus*. Furthermore, the longest seta of the outer lobe is three times longer than the others in *A. violaceus* and *A. minutus*, but is as long as the remaining setae in the new species.

Host

Although the genus *Asterocheres* has been found associated with many marine invertebrate phyla, nearly 56% of the known species have been found associated with sponges (Bandera et al. 2005). This is also the host phylum of the new species, as *A. madeirensis* was found in *Petrosia ficiformis*, a sponge with an Atlantic–Mediterranean distribution. Although there are no records of the presence of symbiotic *A. madeirensis* for the Mediterranean populations of *P. ficiformis*, the presence of symbionts is also possible. One of the sponges collected was the host of two males of *Acontiophorus* sp. as well as the new *Asterocheres* species described above.

Genus *Orecturus* Humes, 1992
Orecturus canariensis n. sp.
(Figure 6D–H, 7–10)

Material examined

Holotype female (MNCN 20.04/7788), allotype male (MNCN 20.04/7789), and paratypes, two females, (MNCN 20.04/7790) associated with the gorgonian *Villogorgia bebrycoides* (Koch, 1887), at Guadamojete Point, Tenerife, Canary Islands, 85 m depth, January 1997. BEIM (COP–508) paratypes, seven females and two males, with the same sampling data as the holotype.

Emended diagnosis of the genus

Asterocheridae. Prosome dorsoventrally flattened, expanded laterally. Anal somite elongated, longer than preceding somite. Antennule 16- to 20-segmented in female, 12- to 17-segmented in male. Antennary exopod one-segmented, bearing one very long seta, one short setule apically, and one lateral seta. Oral cone long, reaching from level of third pair of legs to genital somite. Mandible with slender needle-shaped masticatory blade and one-segmented palp bearing terminal setulose seta. Maxillule with one stout and setulose seta on inner lobe. Maxilla two-segmented; claw armed with one seta. Maxilliped sexually dimorphic. Formula of third endopodal segment of legs 1–4 as (1,2,3); (1,1+I,3); (1,I,3) and (1,I,2). Leg 5 placed ventrally, free segment bearing five elements.

Description

Adult female. Body cyclopiform, slender with oval cephalothorax and cylindrical urosome (Figure 7A, B). Mean body length 1043 μm (900–1114 μm) and greatest width 526 μm (450–600 μm), based on six specimens. Ratio of length to width of prosome 1.21:1. Ratio of length of prosome to that of urosome 2.4:1. Prosome comprising cephalothorax fully incorporating first pedigerous somite and three free pedigerous somites. Epimeral areas of somites bearing legs 1–3 pointed (Figure 7A). Somite bearing leg 4 rounded laterally and much smaller than preceding somite. Dorsal cephalothoracic shield and tergites of free pedigerous somites ornamented with few integumental pores and sensilla. Urosome four-segmented comprising leg fifth pedigerous somite, genital double somite and two free abdominal somites. Somite bearing leg 5 (Figure 7C) wider than long, with some spinules on its lateral surface. Posterior margins of anal somite and caudal rami ornamented with hyaline frills with more or less serrated margins. Genital double somite approximately 1.8 times wider than long (width measured at small anterior rounded expansions), bearing genital apertures, paired gonopores located laterally (Figure 7C). Each genital area armed with one smooth seta. First postgenital somite wider than long, with no ornamentation. Elongated anal somite, more than four times as long as preceding somite, ornamented all round with large, flattened epicuticular scales, arranged in irregular, overlapping rows. Integumental pores and sensilla present on urosomal somites (Figure 6D, 7C).

Caudal rami slightly wider than long, ornamented with epicuticular scales, arranged in irregular overlapping rows. Armed with six setae; seta I absent, setae II and VII offset on to dorsal surface, placed near lateral margins of rami.

Antennule 20-segmented (Figure 7E, F); segmental fusion pattern as follows: 1(I), 2(II), 3(III–IV) 4(V), 5(VI), 6(VII), 7(VIII), 8(IX–XII), 9(XIII), 10(XIV), 11(XV), 12(XVI), 13(XVII), 14(XVIII), 15(XIX), 16(XX), 17(XXI), 18(XXII), 19(XXIII–XXIV), 20 (XXV–XXVIII). Segments 1 and 2 each with two setae; segment 3 with three setae; segments 4–7 each with two setae; segment 8 with eight setae; segments 9–16 each with two setae; segment 17 with two setae plus an aesthetasc; segment 18 with two setae; segment 19 with four setae and segment 20 with eight setae. Certain setae on segments 1 and 3 spinous, and some other setae with lateral setules that have an apical hollow (Figure 6E–F). Segment 9 (XIII) reduced, partly overlapped by distal expansion of compound segment 8 (IX–XII).

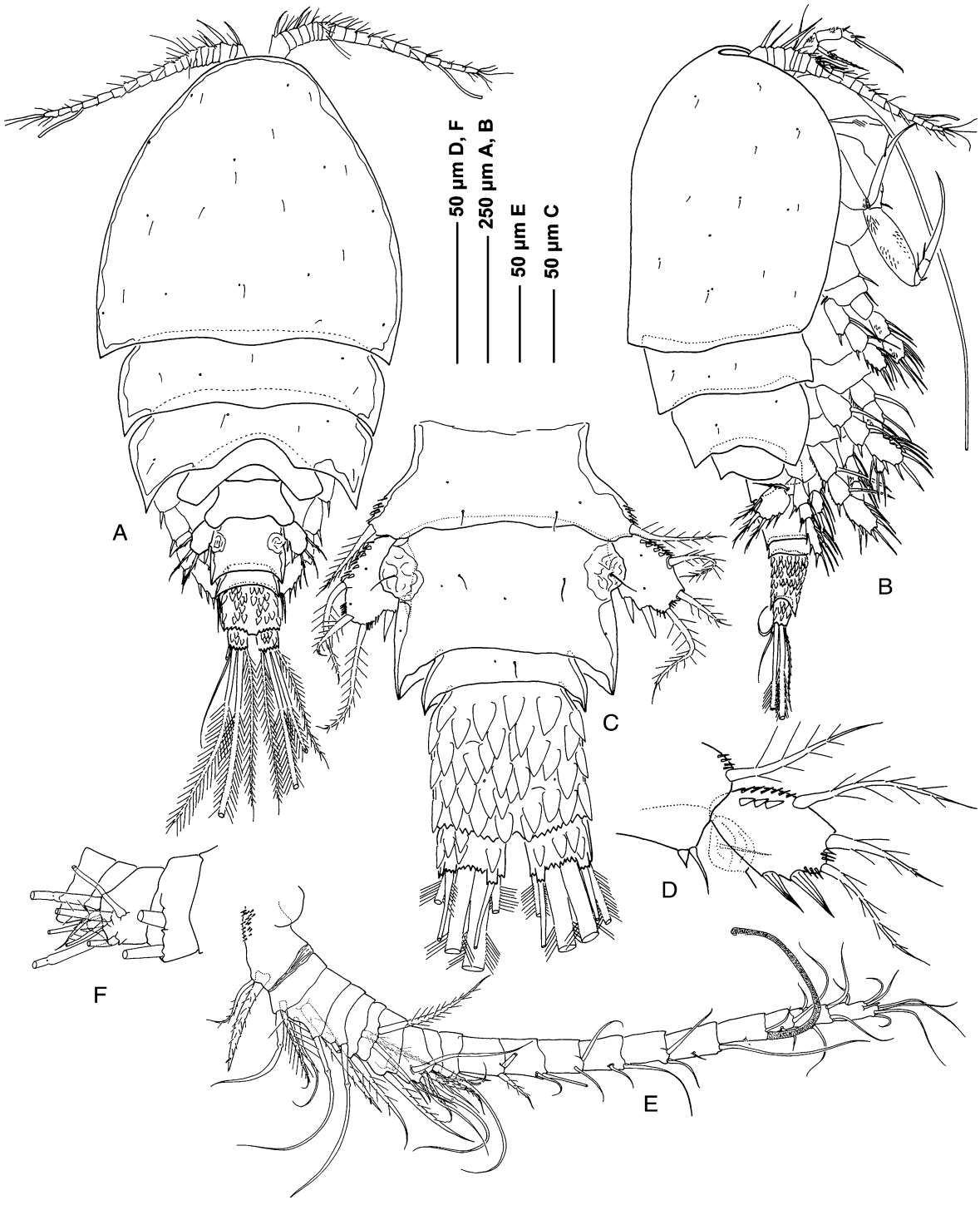

Figure 7. *Orecturus canariensis*, female. (A) Dorsal view. (B) Lateral view. (C) Urosome, dorsal view. (D) Leg 5. (E) Antennule. (F) Same, detail of compound segment IX–XII.

Antenna biramous (Figure 8A); 300 µm long, protopodal part comprising short unarmed coxa and elongated basis with patch of fine spinules on outer margin. Exopod one-segmented, slender, bearing small inner smooth seta and long terminal barbed seta, and having spinules along outer side and tuft of fine setules apically. Endopod two-segmented; first segment elongated, unarmed but ornamented with lateral and terminal rows of fine spinules; second segment ornamented with row of fine setules laterally and a row of fine spinules on terminal part, and bearing one smooth seta proximally, one plumose seta near midregion and one smooth seta distally. Large terminal claw.

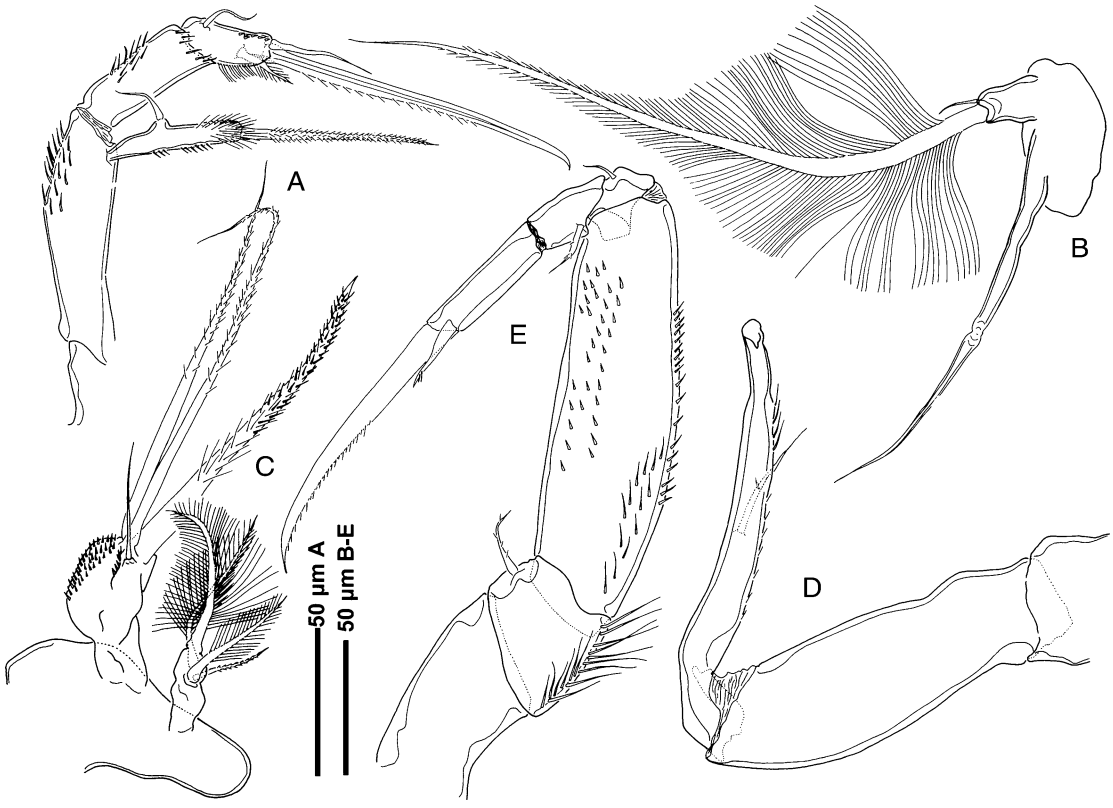

Figure 8. *Orecturus canariensis*, female. (A) Antenna. (B) Mandible. (C) Maxillule. (D) Maxilla. (E) Maxilliped.

Mandible comprising stylet-like gnathobase and short one-segmented palp (Figure 8B). Stylet slightly compressed approximately half its length. Palp bearing small smooth terminal seta and very long feathered apical seta. Oral cone long and slender, 750 µm long, reaching nearly anterior edge of genital segment (Figure 7B).

Maxillule bilobed (Figure 8C); praecoxal endite larger than palp. Endite ornamented with patch of spinules laterally and row of spinules medially and armed with four distal setae: three very long – two barbed (Figure 6G–H) and one with spinules terminally and setules proximally – and one smooth and short. Palp armed with four setae on distal part, three long and plumose, one of them densely plumose, and one shorter and barbed.

Maxilla two-segmented (Figure 8D); with unarmed praecoxa and coxa. Claw-like basis with recurved tip and armed with smooth seta at half its length; distal margin of claw provided with row of minute spinules and few setules distally.

Maxilliped five-segmented with unarmed pedestal arising from the ventral body wall (Figure 8E). First segment, short with minute plumose inner seta and rows of long setules on outer margin. Second segment elongated and unarmed but ornamented with rows of minute setules on outer margin and rows of small spinules on surface close to the inner margin. Segments 3, 4 and 5 forming part of distal subchela. Third segment armed with small smooth outer seta; fourth segment with slightly plumose inner seta, and fifth segment with apical seta with two minute spinules distally. Long terminal claw with minute setules on inner margin.

Swimming legs 1–4 biramous (Figure 9A–D), with three-segmented rami. Intercoxal sclerite present in legs 1–4, ornamented with pair of processes only in leg 1. Table II shows the spine and seta formulae of all legs.

Coxae ornamented with spinule rows laterally in legs 1 and 2. Outer spines of exopodal segments bilaterally serrated in leg 1 and smooth in legs 2–4, except for those of first segment in legs 2 and 3. Fringed spines on first exopodal segment of legs 1 and 2, on exopodal segments of leg 3 and on terminal segments of endopod and exopod of leg 4. Apical elements of legs 3 and 4 rounded at their base. Endopodal segments of legs 1 and 2 with minute spinules. Lateral margins of exopodal segments with minute serrations; lateral margins of endopodal segments, except for leg 4 which is serrated, with row of setules.

Leg 5 with protopodal segment incorporated into somite (Figure 7D), ornamented with rows of fine

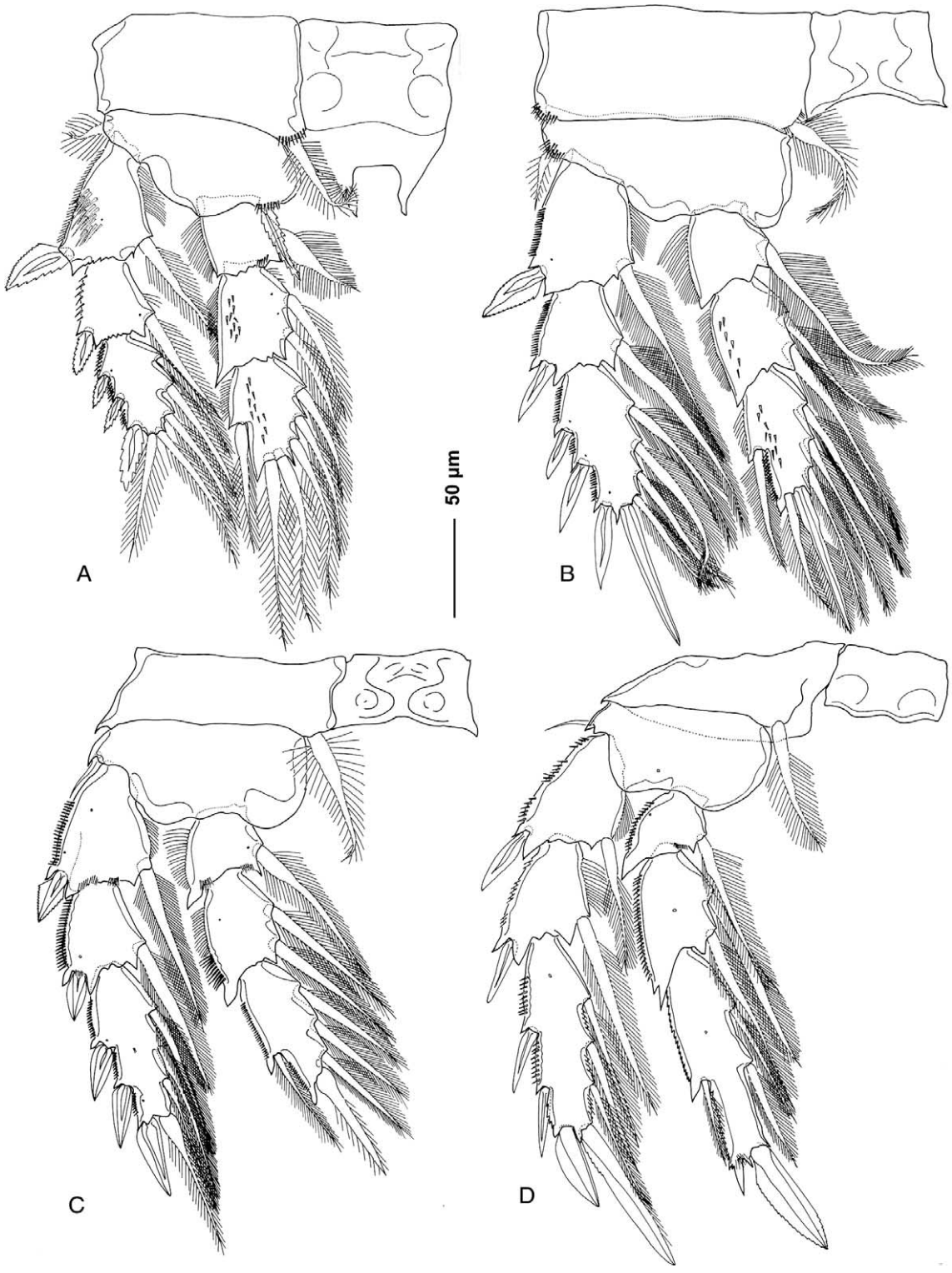

Figure 9. *Orecturus canariensis*, female. (A) Leg 1. (B) Leg 2. (C) Leg 3. (D) Leg 4.

setules laterally and armed with plumose seta located dorsally and two triangular inner lobes each armed with smooth seta and spine. Exopod oval, placed ventrally, ornamented with spinules and fine setules dorsally and armed with three outer plumose setae and two inner spines.

Leg 6 represented by paired opercular plates closing off gonopores on genital double somite; armed with smooth seta (Figure 7A, C).

Adult male. Body cyclopiform, slender with cephalothorax oval and cylindrical urosome (Figure 10A).

Table II. *Orecturus canariensis*, female, formula for armature of legs 1–4.

	Coxa	Basis	Exopodal segments	Endopodal segments
Leg 1	0–1	1–I	I–1; I–1; III,2,3	0–1; 0–2; 1,2,3
Leg 2	0–1	1–0	I–1; I–1; III,I,4	0–1; 0,2; 1,1+I,3
Leg 3	0–1	1–0	I–1; I–1; II,I,4	0–1; 0–2; 1,1,3
Leg 4	0–1	1–0	I–1; I–1; II,II,3	0–1; 0–2; 1,I,2

Mean body length 695 μm (690–700 μm) and greatest width 350 μm (345–355 μm), based on two specimens. Ratio of length to width of prosome 1.44:1. Ratio of length of prosome to that of urosome 2.78:1. Prosome comprising cephalothorax fully incorporating first pedigerous somite and three free pedigerous somites. Epimeral areas of somites bearing legs 1–4 pointed. Somite bearing leg 4 much smaller than preceding somite. Dorsal surface without visible sensilla.

Urosome five-segmented comprising leg fifth pedigerous somite, genital somite and three free abdominal somites. Somite bearing leg 5 wider than long, with some spinules on its lateral surface (Figure 10B). Posterior margins of anal somite and caudal rami ornamented with hyaline frills with more or less serrated margins. First and second postgenital somites wider than long, with no ornamentation. Elongated anal somite, ornamented with large, flattened epicuticular scales, arranged in irregular, overlapping rows.

Caudal rami slightly wider than long, ornamented dorsally with epicuticular scales, arranged in irregular, overlapping rows. Armed with six setae; seta I absent, setae II and VII offset on to dorsal surface, placed near lateral margins of rami. Appendages as for female except antennules, maxillipeds and fourth, fifth and sixth legs.

Antennule 17-segmented (Figure 10C), geniculate; segmental fusion pattern as follows: 1(I), 2(II), 3(III–IV), 4(V), 5(VI), 6(VII), 7(VIII), 8(IX–XII), 9(XIII), 10(XIV), 11(XV), 12(XVI–XVII), 13(XVIII–XIX),

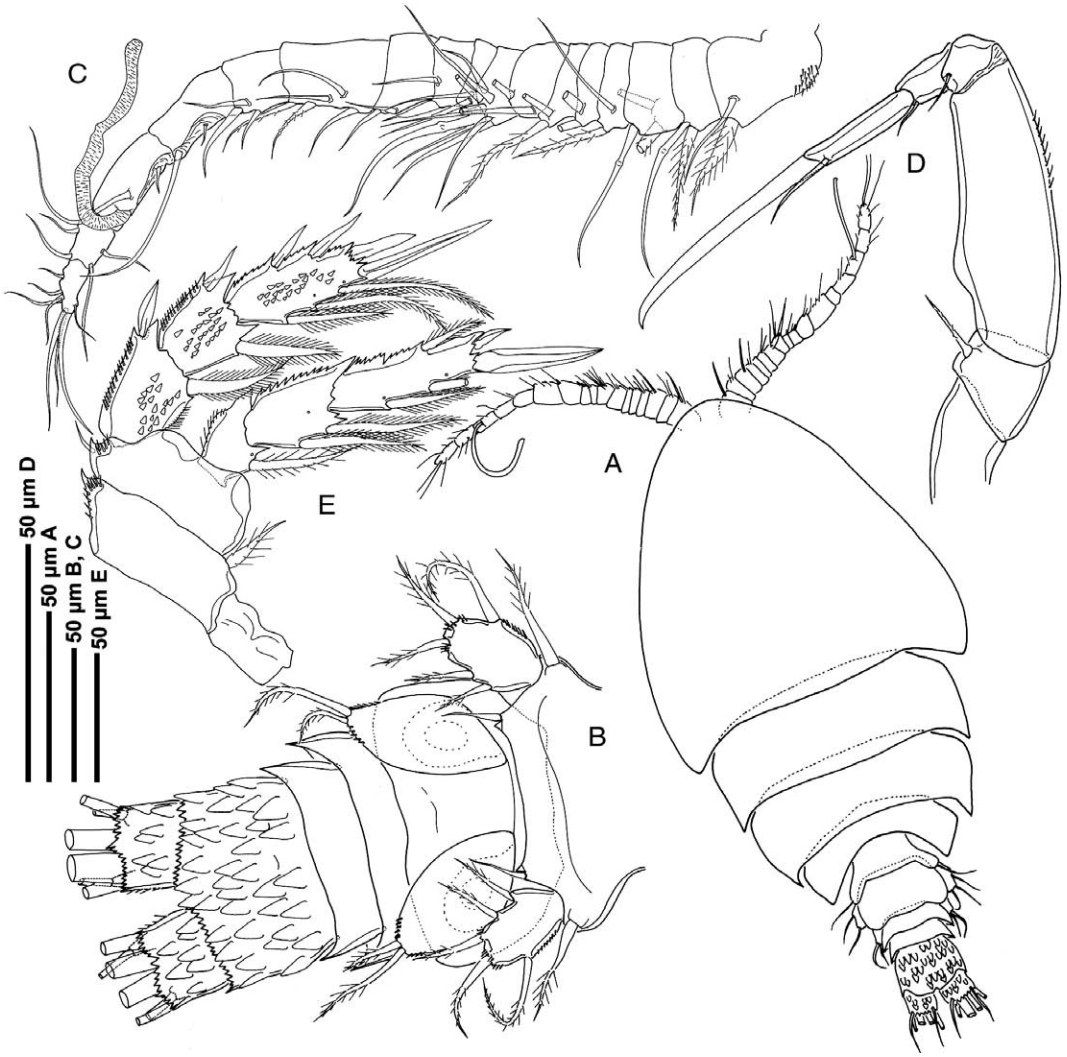

Figure 10. *Orecturus canariensis*, male. (A) Dorsal view. (B) Urosome, dorsal view. (C) Antennule. (D) Maxilliped. (E) Leg 1.

14(XX), 15(XXI–XXIII), 16(XXIV–XXV), 17 (XXVI–XXVIII). Geniculation located between segments 14(XX) and 15(XXI–XXIII). Segments 1 and 2 each with two setae; segment 3 with three setae; segments 4–7 each with two setae; segment 8 with eight setae; segments 9–11 each with two setae; segment 12 with five setae; segment 13 with three setae; segment 14 with two setae; segment 15 with two setae plus one aesthetasc; segment 16 with four setae; segment 17 with eight setae. Segment 9(XIII) reduced, partly overlapped by distal expansion of compound segment 8(IX–XII).

Maxilliped five-segmented with unarmed pedestal arising from the ventral body wall (Figure 10D). First segment, short with plumose inner seta. Second segment showing sexual dimorphism in having pronounced lobe on inner side; elongated and unarmed but ornamented with row of minute setules on outer margin. Segments 3, 4 and 5 forming part of distal subchela. Third segment armed with small smooth inner seta; fourth segment with smooth inner seta, and fifth segment with one apical smooth seta. Long terminal claw.

Leg 4 biramous (Figure 10E), with three-segmented rami. Intercoxal sclerite present. Coxa armed with plumose inner seta and ornamented with setule rows laterally. Basis unarmed but ornamented with few setules. Exopodal segments ornamented with minute flattened, epicuticular scales, arranged in irregular rows. Lateral margins of endopodal and exopodal segments with minute serrations. Spine and seta formula as follows: exopodal segments with I–1;I–1;II,II,3 and endopodal segments with 0–1;0–2;1,II,2.

Leg 5 with protopodal segment incorporated into somite (Figure 10B), with outer plumose seta located ventrally and two triangular inner lobes each armed with smooth seta and spine; exopod oval, placed ventrally, ornamented with fine setules and armed with five plumose setae.

Leg 6 forming large opercular plates closing off genital apertures (Figure 10B), armed with two plumose unequal setae and ornamented with fine setules.

Etymology

The specific name *canariensis* refers to the Canary Islands where the species was collected.

Discussion

Since Humes erected the genus *Orecturus* in 1992, 10 new species have been described. In order to accommodate some of these new species, the original diagnosis of the genus has been slightly modified. Thus, the segmentation of the antennule in the *Orecturus* females was enlarged to 16 or 17 segments to include *O. bahiensis* Johnsson, 1998 (Johnsson 1998b). The variability of this appendage has to be enlarged again to include the new species here described, *O. canariensis*, which has a 20-segmented antennule. The length of the oral cone within the genus is also variable. Although most species have a siphon that extends up to the intercoxal plate of leg 3, there are some exceptions, such as *O. forticulus* Humes, 1993, which possesses the shortest siphon of the genus (it only reaches to leg 1), and *O. finitimus* Humes, 1993, which has a much longer siphon, reaching to leg 5 (Humes 1993). However, *O. canariensis* becomes the *Orecturus* species with the longest siphon, as it extends beyond leg 5, reaching to the genital segment.

Most species of the genus *Orecturus*, like many asterocherid genera, have the protopod of leg 5 fully incorporated into the somite and represented by a single outer seta (Huys & Boxshall 1991; Boxshall & Halsey 2004). However, the new species together with three previously described species: *O. bahiensis*, *O. grandisetiger* Humes, 1992, and *O. sakalavicus* Humes, 1994 present an expansion, commonly triangular, in the protopod as a reminiscence of the fusion between the protopod and the somite. Among these four species, *O. bahiensis* and *O. canariensis* have a small inner seta on the protopod as a vestigial endopod. This endopod is not represented, as in the majority of siphonostomatoids, in other *Orecturus* species. This plesiomorphic characteristic, although unusual in *Orecturus* species, is not unique among the asterocherid genera, as some of them, such as *Acontiophorus* Brady, 1880, *Dermatomyzon* Claus, 1889, *Paracontiophorus* Eiselt, 1961 and *Scottocheres* Giesbrecht, 1897, have a small inner seta on the protopod representing the endopod (Huys & Boxshall 1991). The genus *Laperocheres* Ivanenko, 1998 has the protopod partially fused with the somite (Ivanenko 1998) and some asterocherid genera, such as *Collocheres* Canu, 1893, *Collocherides* Stock, 1971, *Cheramomyzon* Humes, 1989, *Dermatomyzon* and *Glyptocheres* Humes, 1987 have a clearly differentiated protopod (Claus 1889; Canu 1893; Stock 1971; Humes 1987, 1989). Therefore, there is a tendency towards fusion of the protopod of leg 5 and the somite bearing this in different asterocherid genera, which may imply convergent evolution.

The distinctive features of the new species, *O. canariensis*, are: 20-segmented antennule; oral cone reaching nearly the anterior edge of the genital segment; basis of legs 2–4 unarmed; protopodal segment of leg 5 with one inner seta and spine.

Host

The gorgonian *Villogorgia bebrycoides* is known to occur in both the Mediterranean and the eastern Atlantic coasts, between 63 and 700 m (Grasshoff 1977). In the Canary Islands, *V. bebrycoides* colonizes hard bottoms with corals, the axes of other gorgonians, rocks, shell masses and, less frequently, unstable detritic bottoms. It is particularly common in the orange coral, *Dendrophyllia ramea* (Linné, 1758) assemblage (Arístegui et al. 1987). The gorgonian *Paramuricea grayi* (Johnson, 1861) also occurs in the same assemblages as the infested colonies of *V. bebrycoides* (Martin et al. 2002). However, no specimens of asterocherid copepods were found on these colonies. Thus, *O. canariensis* may be a monoxenous symbiont. The colonies of *V. bebrycoides* harboured an abundant associated epifauna, including both mobile and sedentary species. Among them are the bivalve *Pteria hirundo* (Linné, 1758), the syllids *Grubeosyllis limbata* (Claparède, 1868), *Eusyllis lamelligera* Marion & Bobretzki, 1875, *Haplosyllis villogorgicola* Martin, Nuñez, Riera & Gil, 2002, the amphipod *Caprella aequilibra* Say, 1818 and several harpacticoid copepods (Martin et al. 2002). There are no records of the presence of *Orecturus* for the Mediterranean populations of *V. bebrycoides*, although the presence of this symbiont is also possible.

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