



## The first blind *Paranthura* species (Crustacea, Isopoda, Paranthuridae) from the 'El Cachucho' Marine Protected Area (Le Danois Bank, southern Bay of Biscay)

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### Abstract

A new paranthurid isopod, *Paranthura santiparraei* sp. nov. is described from specimens collected in the 'El Cachucho' Marine Protected Area, southern Bay of Biscay. The new species can be distinguished from all the known species of the genus *Paranthura* by the absence of eyes, from the native NE Atlantic species *Paranthura nigropunctata* and *Paranthura costana* by the lack of body pigmentation, antenna 1 and pereopod morphology and from the non-indigenous species *Paranthura japonica* (recently discovered in the Arcachon Bay) by the pleonites not fused mediodorsally. The genus *Paranthura* is rediagnosed to accommodate the new taxon and an identification key is provided for European species. Ecological data on the new species are presented.

**Key words:** Isopoda, Paranthuridae, *Paranthura*, new species, 'El Cachucho' MPA, Le Danois Bank, Bay of Biscay

### Introduction

In their world list of anthuroid isopods, Negoescu and Wägele (1984) cited 57 genera, among which the genus *Paranthura* was the most speciose, with 41 valid species. Later on, many new *Paranthura* species from various geographical areas were added to this first list (see Appeltans *et al.* 2010, Schotte *et al.* 2011), showing a high diversity of the genus in the Indian and Pacific oceans. Poore (2001) rediagnosed the Paranthuridae mainly based on the absence of statocyst on telson and only included 6 genera in this family: *Califanthura*, *Colanthura*, *Cruranthura*, *Cruregens*, *Paranthura* and *Pseudanthura*. Taking into account the most recent studies, the genus *Paranthura* comprises 64 valid species, 3 of them recorded in European waters: the native species *P. nigropunctata* (Lucas, 1849) and *P. costana* Bate & Westwood, 1868 and the non-indigenous one *P. japonica* Richardson, 1909, recently discovered in the Arcachon Bay, SW France (unpublished record).

This paper deals with the description of the first blind species in the genus *Paranthura*, a bathyal species collected at the Le Danois Bank (S Bay of Biscay), nowadays classified as the first offshore Spanish Marine Protected Area ('El Cachucho' MPA; see Heredia *et al.* 2008). This new *Paranthura* is compared with the previously known species from European waters and an identification key is provided for these species. Furthermore, some ecological data on the new species are also given.

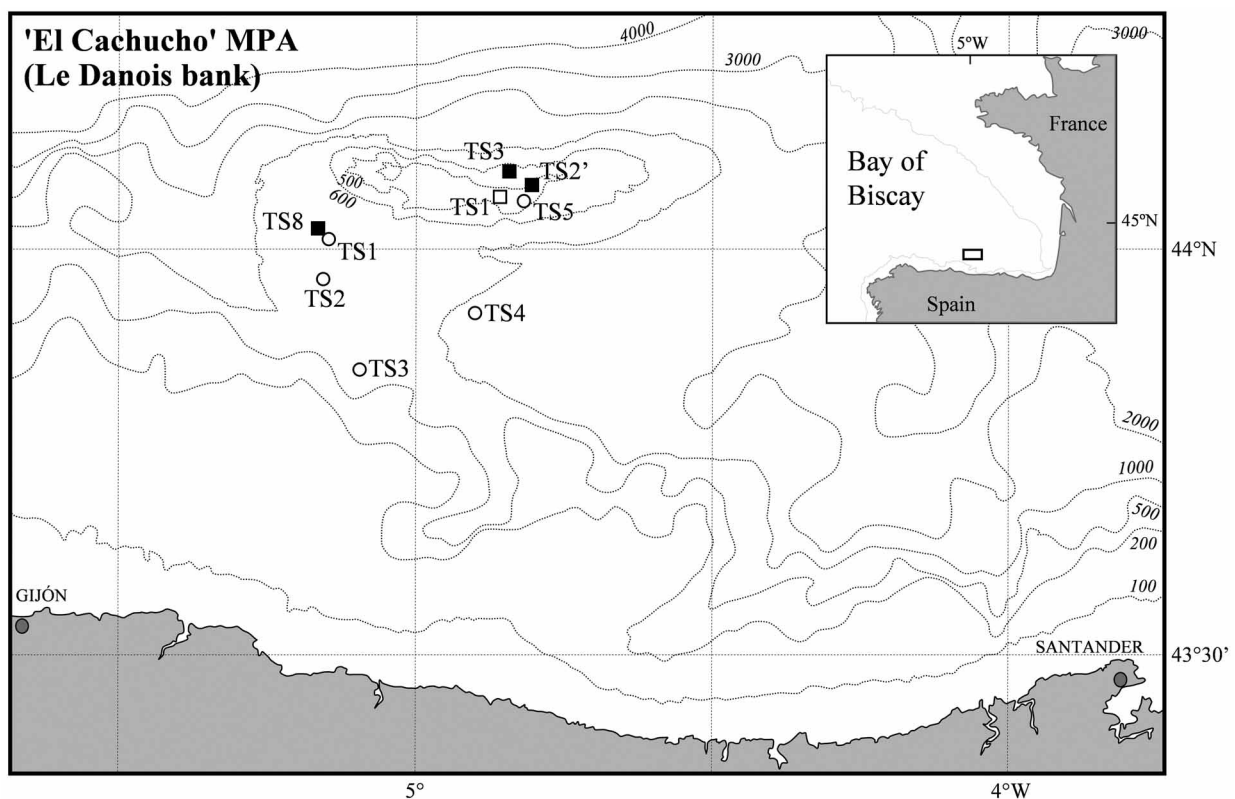
### Material and methods

Within the ECOMARG project framework (see www.ecomarg.net), two multidisciplinary surveys ECOMARG 03 (October 2003) and ECOMARG 04 (April 2004) were carried out in the 'El Cachucho' MPA (Fig. 1). During these surveys, the suprabenthic fauna was quantitatively sampled with a suprabenthic sled equipped with opening-clos-

ing superimposed nets (0.5 mm mesh size) and a TSK flowmeter for haul length estimations (see Sorbe 1983). Abundance data are expressed as ind./100 m<sup>3</sup> for the 0–50 and 50–100 cm water layers, and as ind./100 m<sup>2</sup> according to the area swept by the sled during each haul (0–100 cm water layer). On board, samples were fixed with a solution of 4% formalin in sea water. At the laboratory, the *Paranthura* specimens were sorted and conserved separately in 70% ethanol for later examination.

The *Paranthura* specimens examined in the present study were only recorded during ECOMARG 03 cruise at 3 stations located between 498 and 817 m depth (Table 1, Fig. 1). Males, females and manca specimens (post-mar-supial development stages without pereopod 7 and sex undifferentiated) were examined. The total body length (BL) of individuals was measured from the anterior margin of cephalon to the telson apex. Specimens were examined under a Nikon SMZ 1500 stereomicroscope and figured with a camera lucida. Dissected appendages were mounted in dimethyl hydantoin formaldehyde and illustrated using an optical microscope, ZEISS 474620-9900, equipped with a camera lucida. Selected specimens were prepared for more detailed examinations with a ZEISS DSM 950 scanning electron microscope (SEM), after drying at critical point with liquid carbon dioxide and cover by palladium-gold. The morphological nomenclature herein used follows Poore, 2001.

The type specimens are deposited in the Museo Nacional de Ciencias Naturales (MNCN), Madrid.



**FIGURE 1.** Location of stations sampled with a suprabenthic sled within the 'El Cachucho' MPA (Le Danois Bank) during ECOMARG 03 (squares) and ECOMARG 04 cruises (circles). Solid symbols: samples including *Paranthura santiparrai* **sp. nov.** Isobaths in metres.

**TABLE 1.** Haul characteristics and abundance of the isopod *Paranthura santiparrai* **sp. nov.** in the 0–50 cm, 50–100 cm (ind./100 m<sup>3</sup>) and 0–100 cm (ind./100 m<sup>2</sup>) near-bottom water layers at three stations of the 'El Cachucho' MPA (Le Danois Bank) sampled with a suprabenthic sled during ECOMARG 03 cruise.

Haul code	Date d/m/y	Time <sup>a</sup> h:m	Position <sup>a</sup>		Depth <sup>b</sup> (m)	Abundance		
			N	W		0–50	50–100	0–100
E03-TS2'	16/10/03	11:51	44°04.77'	4°48.49'	499–498	0.3	0.0	0.2
E03-TS3	17/10/03	10:28	44°05.85'	4°51.08'	574–574	45.1	-	22.8
E03-TS8	20/10/03	14:56	44°01.59'	5°09.93'	817–816	0.5	0.5	0.6

<sup>a</sup>At beginning of haul; <sup>b</sup>At beginning/end of haul; -: not sampled.

## Abbreviations

The following abbreviations are used in the text and Table 2: A1, antenna 1; A2, antenna 2; C, cephalothorax; Md, mandible; Mxp, maxilliped; P, pereopod; Pl, pleopod; Pln, pleonite; Plt, pleotelson; Prn, pereonite.

## Taxonomy

### Order ISOPODA Latreille, 1817

### Suborder CYMOTHOIDA Wägele, 1989

### Family Paranthuridae Menzies & Glynn, 1968

### *Paranthura* Bate & Westwood, 1866

**Emended diagnosis.** Body pigmented or not. Prn7 half as long as Prn6. Pln 1–5 free and articulating, or 1–5 fused (or sutures immoveably indicated), or 1 free, 2–5 not indicated by folds dorsally. Plt with posterior margin of Pln6 indicated dorsally, delineated from telson. Pln and Plt articulating. Eyes well developed (grouped or scattered ommatidia) or absent. A1 flagellum of 3–10 articles. A2 flagellum less than 5 articles. Md molar absent; incisor acute, palp of three articles, palp article 3 with longitudinal row of 7 or more setae on apex or with fewer than 4 terminal setae. Mxp endite small or obsolete; palp free from basis and almost as long as basis, with articles 1–4 fused and 5 minute if visible. P1 subchelate; propodus inflated, with setae on mesial face evenly spaced along palm; palm without marginal short complex robust setae. P2–3 propodus much less inflated. P4–7 carpus roughly rectangular. P7 present on adults. P1 endopods with several margin setae. P11 exopod operculiform. Uropodal exopod narrowly leaf-shaped, or broad and more or less notched. Telson lacking statocyst.

### *Paranthura santiparrai* sp. nov.

(Figs 2–10)

**Material examined. Holotype:** 1 brooding female, 6.6 mm total body length, MNCN 20.04/8224, NE Atlantic Ocean, 'El Cachucho' MPA, RV *Vizconde de Eza*, ECOMARG 03 cruise, 17 October 2003, Arcachon suprabenthic sled, station E03-TS3b, 44°05.85'N, 4°51.08'W, 574 m depth, 0–50 cm near-bottom water layer; dissected, three slides and one vial.

**Allotype:** 1 male, MNCN 20.04/8225, data as for holotype; dissected, two slides and one vial.

**Paratypes:** 1 female, MNCN 20.04/8368, data as for holotype, prepared for SEM. 1 female, MNCN 20.04/8369, data as for holotype, prepared for SEM. 3 males and 3 females, MNCN 20.04/8370, data as for holotype, one vial. 1 immature male, MNCN 20.04/8438, data as for holotype, one slide and one vial. 1 manca stage, MNCN 20.04/8459, data as for holotype, one vial.

**Etymology.** The species is named after Dr Santiago Parra, benthologist at the Instituto Español de Oceanografía, La Coruña, Spain.

**Description. Holotype, adult female with oostegites** (Figs 2–5).

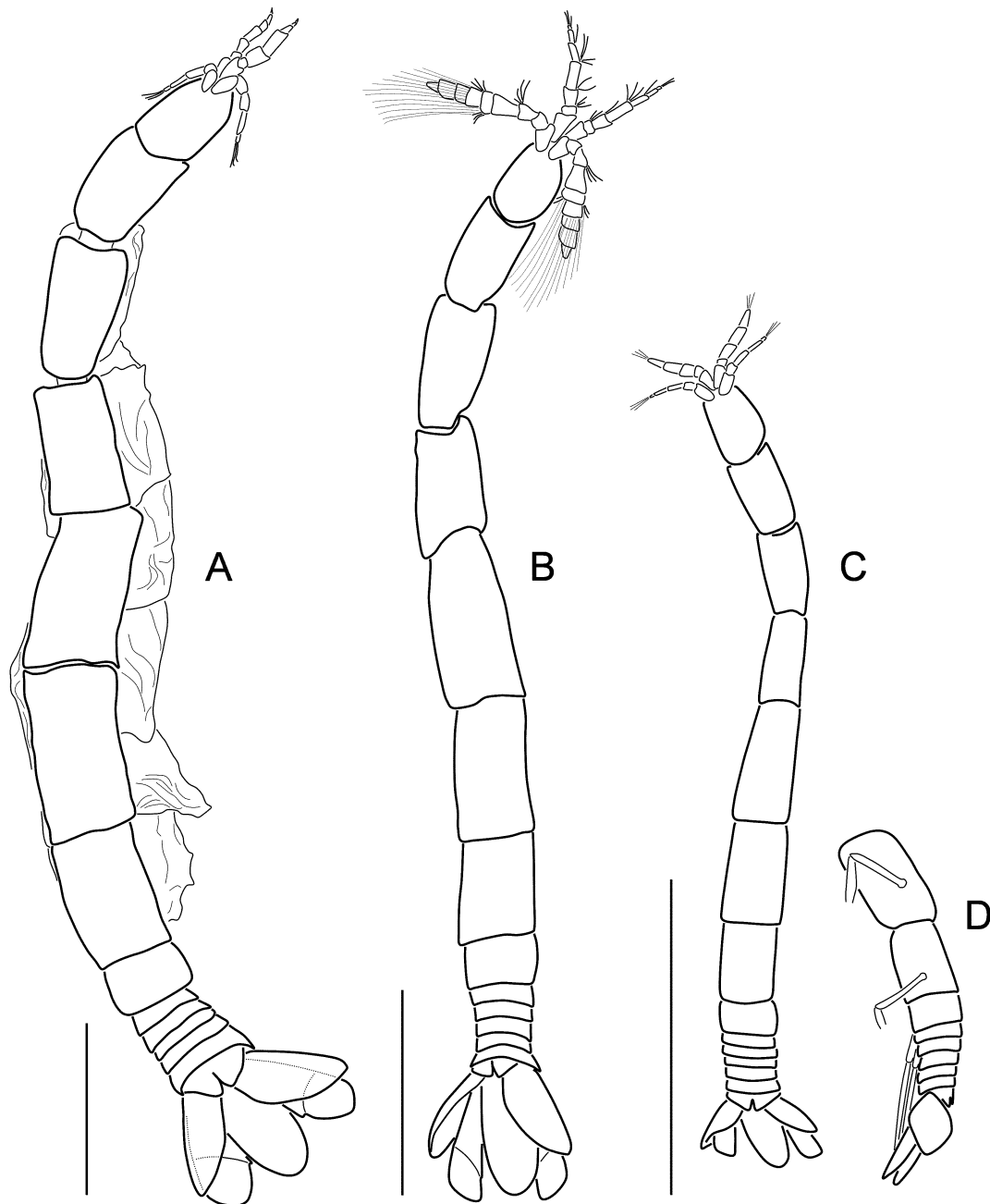
Total body length 6.6 mm, about 13.3 times longer than greatest width; colour pale yellow in alcohol, pigmentless. Body proportions: C<1<2>3<4~5>6>7<Pln<Plt. Cephalothorax 1.5 times longer than wide, without eyes. Pleon shorter than pleotelson, anterior part narrower than pereonite 7 width; pleonites 1–5 free, equal in length; pleonite 6 dorsally with medial incision on distal margin (Fig. 2A).

*Antenna 1* (Fig. 3A) peduncle 2 times longer than flagellum; article 1 almost as long as articles 2 and 3 together, article 2 shortest. Flagellum of 4 articles, shorter than two last articles of peduncle; article 1 short, article 2 longest, articles 3 and 4 minute.

*Antenna 2* (Fig. 3B) peduncle having article 2 most robust, article 5 slightly shorter than articles 3 and 4 together; flagellum of 4 articles, last three minute, distal one hidden by long apical setae emerging from third one.

*Mandible* (Fig. 3C) incisor acute, longer than palp. Palp of 3 articles: article 1 shorter than article 3; article 2

with a sub-distal seta; article 3 distally with a comb-like longitudinal row of 10 thick setae increasing in length towards the apex.

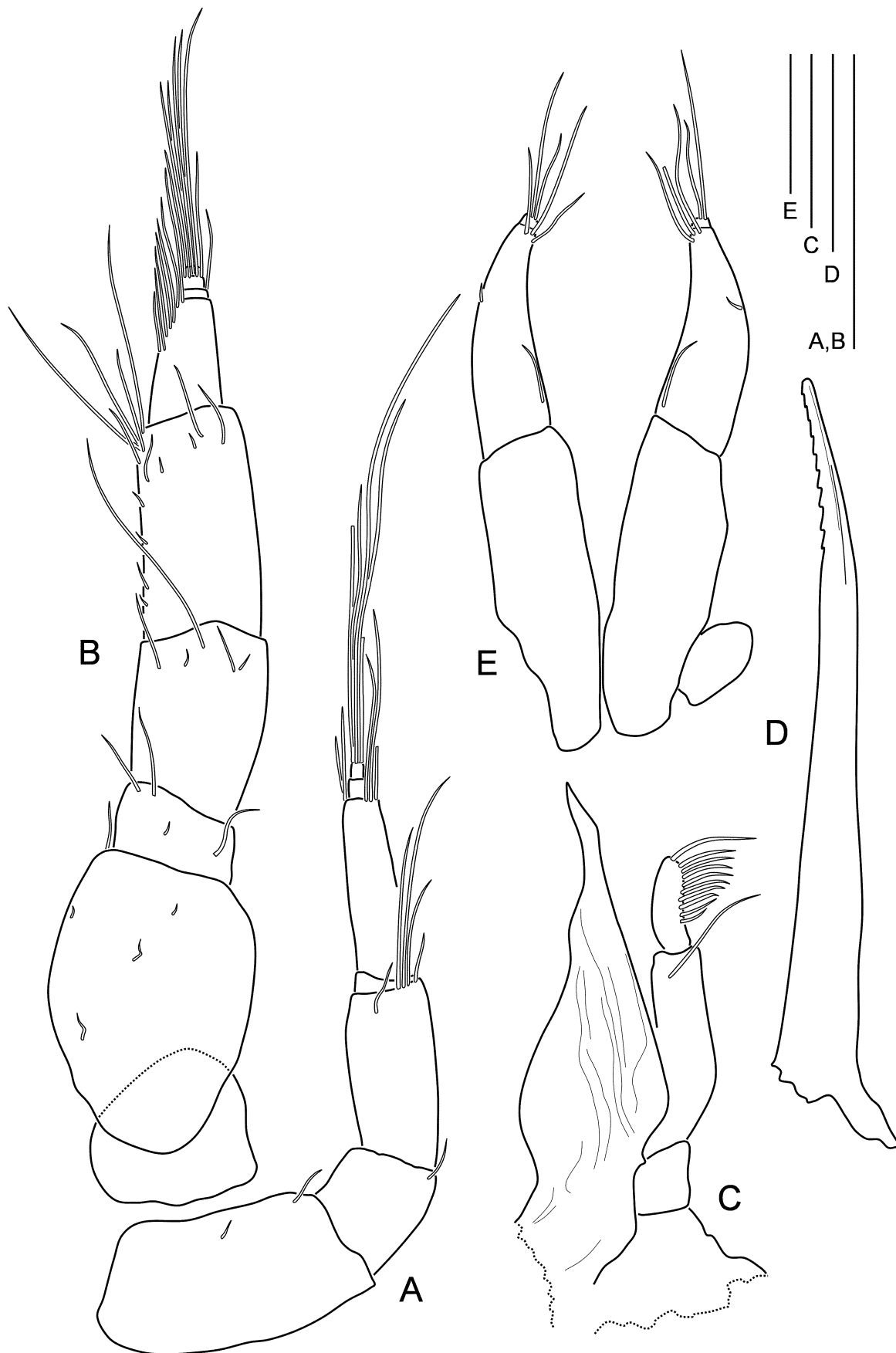


**FIGURE 2.** *Paranthura santiparrai* sp. nov., dorsal views of holotype female (MNCN 20.04/8224) (A), allotype male (MNCN 20.04/8225) (B) and paratype manca (MNCN 20.04/8459) (C). Lateral view of paratype manca (posterior part) showing the absence of pereopod 7 (D). Scale bars = 1 mm.

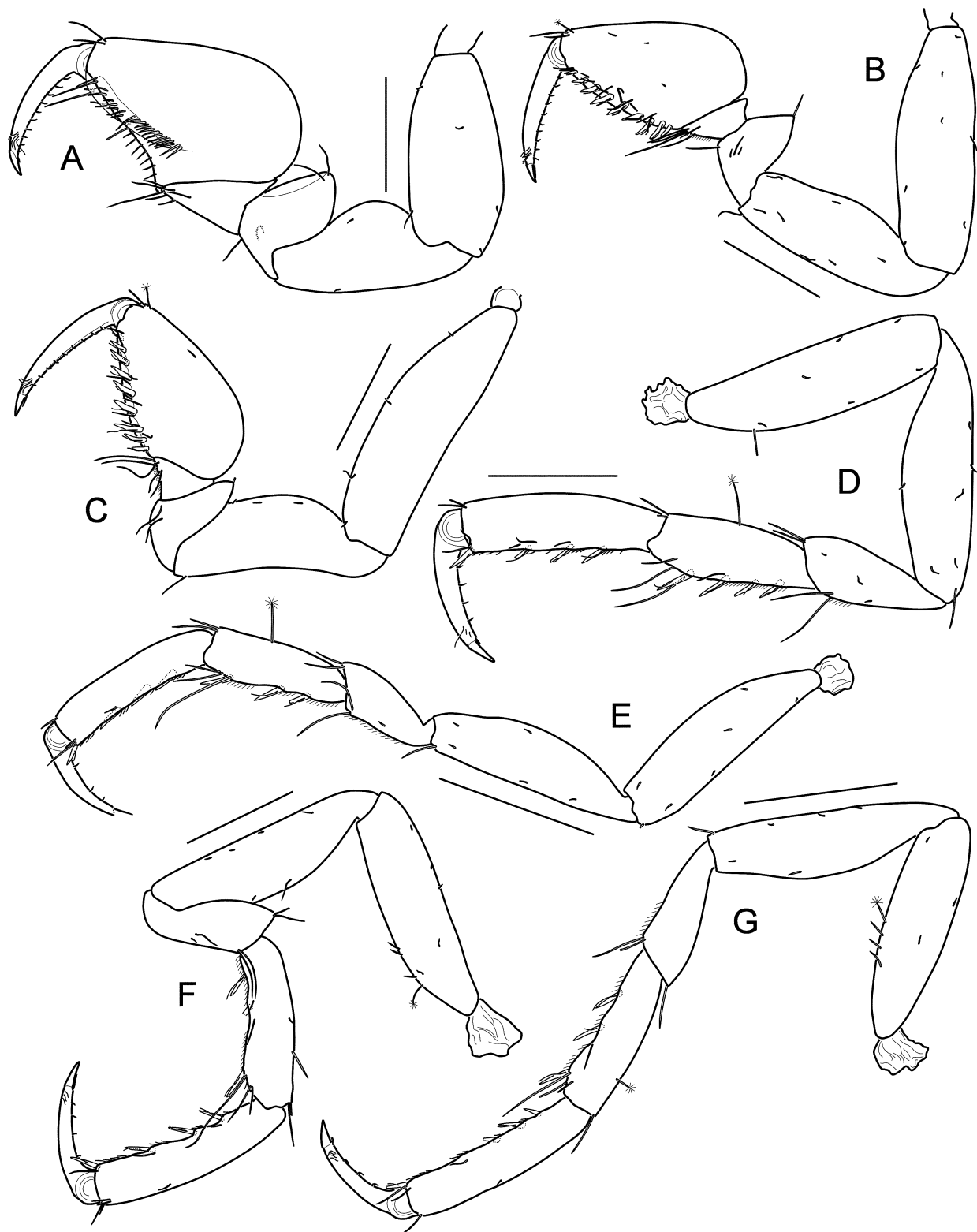
*Maxilla* (Fig. 3D) in form of a finely toothed stylet, with 10 teeth.

*Maxilliped* (Fig. 3E) palp of 2 articles, apical one minute; article 1 medially with one proximal seta and 3 distal ones, and laterally with 1 seta; article 2 with 2 apical setae.

*Pereopods* (Fig. 4). P1 most robust, subchelate, basis 2.0 longer than wide, carpus triangular with a distal group of simple setae; propodus enlarged, 1.3 times longer than wide, posterior margin bordered by simple setae, proximally ended by a small lobe, dactylus closing across mesial propodus face, palm convex with a continuous row of 14 setae, dactylar unguis reaching propodal lobe (Fig. 4A). P2 and P3 similar; P2 basis 3.0 times longer than wide, carpus triangular, propodus oval, 1.6 times longer than wide, with setae and 9 stout sensory setae on slightly convex palm (Fig. 4B); P3 basis 3.6 times longer than wide, carpus triangular, propodus oval, 1.7 times longer than



**FIGURE 3.** *Paranthura santiparrai* sp. nov., holotype female (MNCN 20.04/8224). (A) right antenna 1, (B) right antenna 2, (C) right mandible, (D) right maxilla, (E) maxillipeds. Scale bars: A, B = 0.3 mm; C, D, E = 0.1 mm.

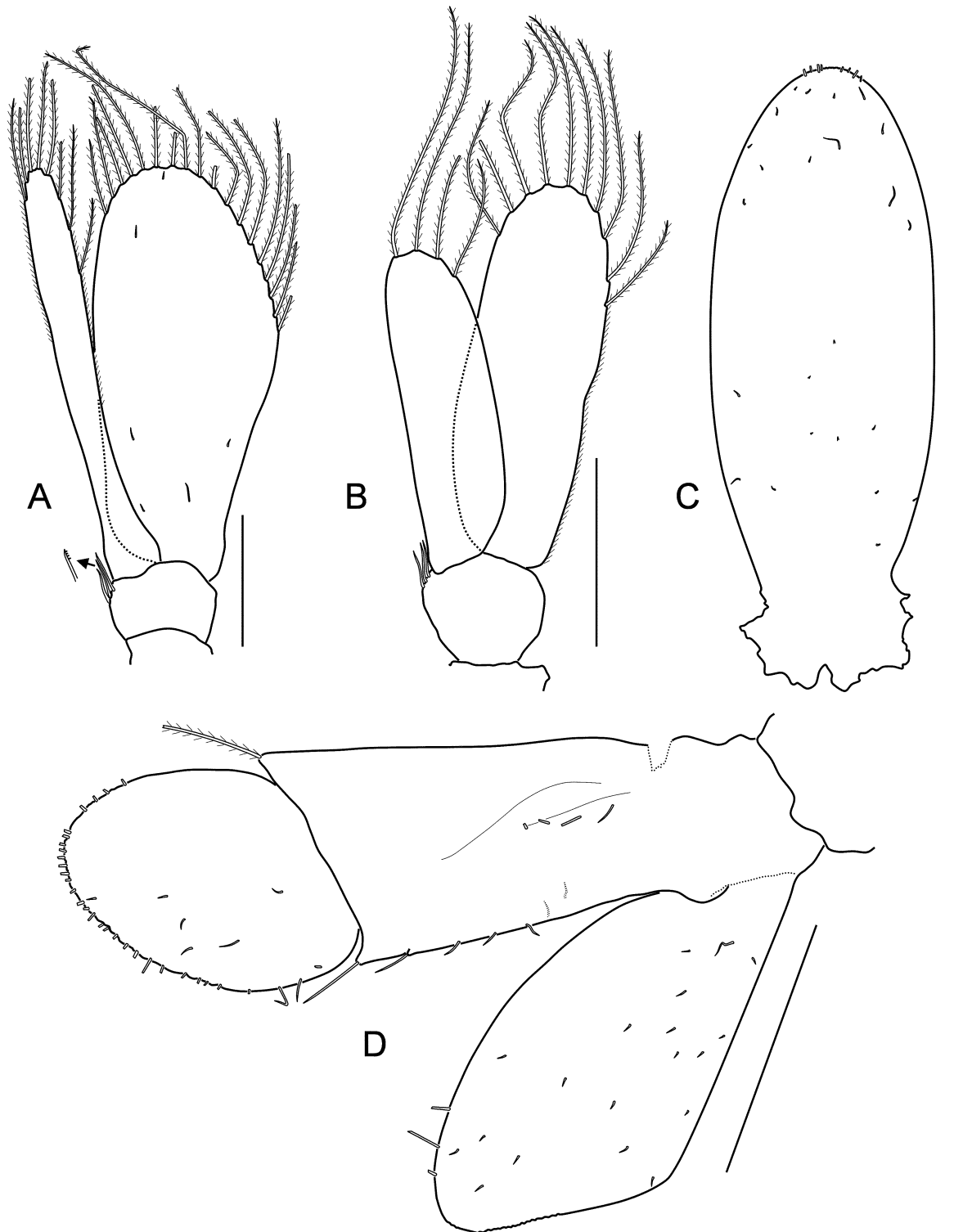


**FIGURE 4.** *Paranthura santiparrai* sp. nov., holotype female (MNCN 20.04/8224). (A) right pereopod 1, (B) right pereopod 2, (C) right pereopod 3, (D) left pereopod 4, (E) left pereopod 5, (F) left pereopod 6, (G) right pereopod 7. Scale bars = 0.3 mm.

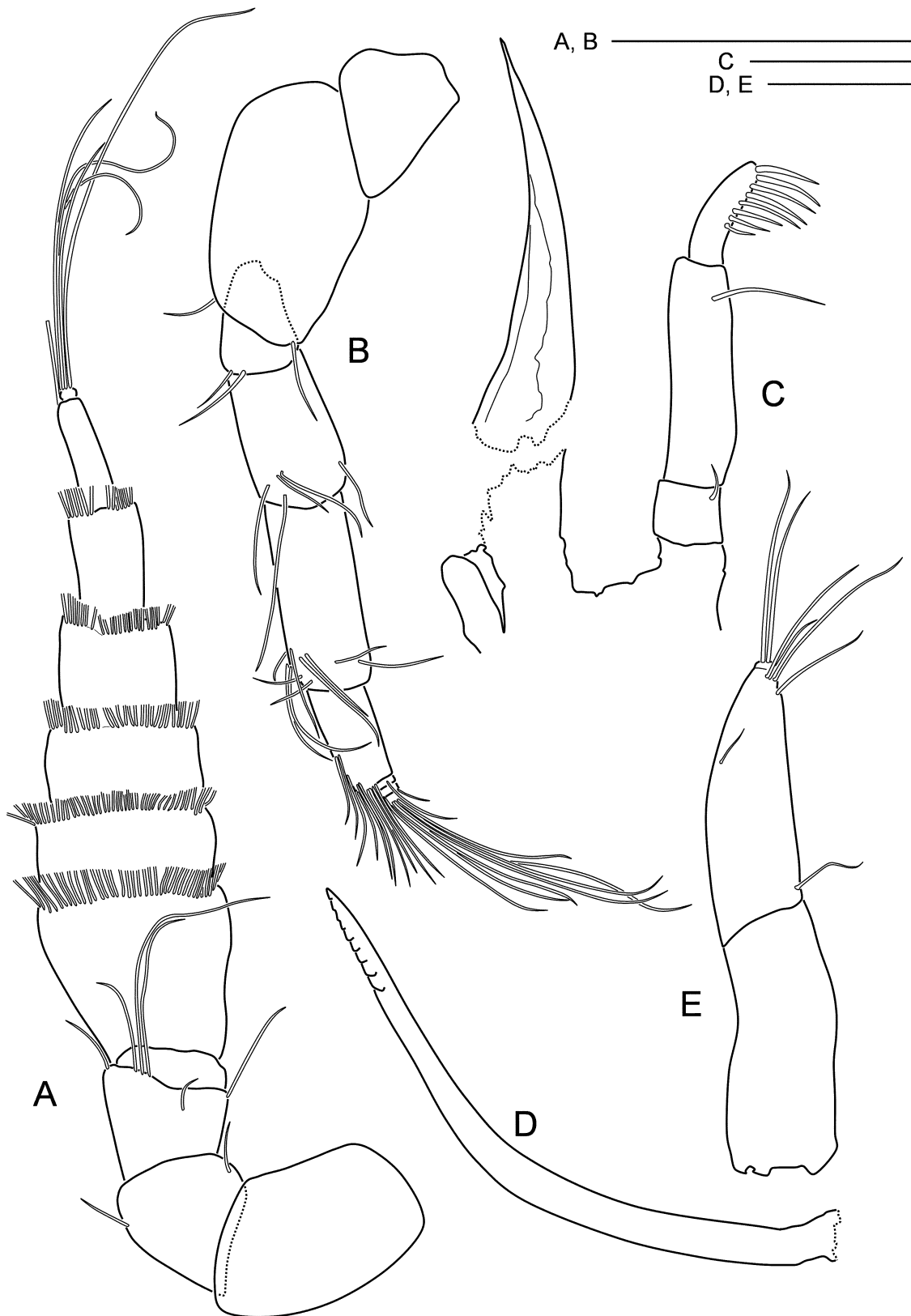
wide, palm slightly convex with submarginal row of setae and 9 stout sensory setae (Fig. 4C). P4 and P5 similar: basis 3.3 and 3.9 times longer than wide (respectively), ischium as wide as basis, merus with 2 anterodistal and 2 posterodistal simple setae, carpus rectangular 2.6 and 2.9 times longer than wide (respectively), with long setae as well as 4 and 3 stout sensory setae on posterior margin (respectively); propodus rectangular 3.7 and 4.5 longer than



wide (respectively), with scales and 4 stout sensory setae on posterior margin (Fig. 4D, E). P6 and P7 similar; P6 basis 3.6 times longer than wide, ischium as wide as basis, merus with 2 anterodistal and 2 posterodistal simple setae; carpus rectangular 3.4 times longer than wide, with long setae and 3 stout sensory setae on posterior margin; propodus rectangular 4.7 times longer than wide, with 4 stout sensory setae on posterior margin (Fig. 4F); P7 the longest, basis 3.5 times longer than wide, ischium as wide as basis, merus with 1 anterodistal and 2 posterodistal simple setae; carpus rectangular 3.7 times longer than wide, with scales and 3 stout sensory setae on posterior margin; propodus rectangular 4.5 longer than wide, with scales and 4 stout sensory setae on posterior margin (Fig. 4G).



**FIGURE 5.** *Paranthura santiparrai* sp. nov., holotype female (MNCN 20.04/8224). (A) right pleopod 1, (B) right pleopod 2, (C) telson dorsal view, (D) left uropod ventral view. Scale bars: A, B = 0.2 mm; C, D = 0.3 mm.



**FIGURE 6.** *Paranthura santiparrai* sp. nov., allotype male (MNCN 20.04/8225). (A) right antenna 1, (B) right antenna 2, (C) right mandible, (D) right maxilla, (E) right maxilliped. Scale bars: A, B = 0.3 mm; C, D, E = 0.1 mm.

*Pleopods* (Fig. 5A, B). P11 sympod with 3 distal serrulate setae on mesial margin; exopod operculiform, 2.0 times longer than wide, distally surrounded by 18 plumose setae, with some short simple setae on dorsal surface;



endopod narrow, 7.7 times longer than wide, slightly reaching beyond apex of exopod, distally with 8 plumose setae. P12 sympod with 3 distal serrulate setae on mesial margin; exopod 3.0 times longer than wide, distally surrounded by 10 plumose setae; endopod 3.5 times longer than wide, not reaching apex of exopod, with 4 distal plumose setae.

*Telson* (Fig. 5C) without statocyst, posterior margin evenly rounded, 2.3 times longer than greatest width.

*Uropod* (Fig. 5D) sympod elongate, rectangular, 2.1 times longer than wide, as long as exopod, with 1 plumose seta at mesiodistal angle and 1 simple seta at outer distal angle. Endopod ovate, 1.5 times longer than wide, reaching apex of telson, surrounded laterally and distally by 27 long simple setae and a few smaller ones. Exopod oval-shaped with rounded tip, 2.1 times longer than wide; left and right exopods folded over pleotelson, proximally not meeting each other in dorsal view.

**Allotype, adult male** (Figs 2, 6–9).

Total body length 5.4 mm, about 13.9 times longer than greatest width; without eyes; colour pale yellow in alcohol, pigmentless. Body proportions C<1<2>3<4>5>6>7<Pln<Plt, Prn 4 longest (Fig. 2B).

*Antenna 1* (Fig. 6A) peduncle of 3 articles, first one longest. Flagellum of 8 articles; article 1 short, about one quarter of article 2 length; article 2 longest; articles 3, 4 and 5 equal in length, about half of article 2 length; articles 6 and 7 equal in length, about 0.8 of article 2 length, article 8 smallest; articles 2–8, each with long setae and long aesthetascs disposed in transverse circles along distal margin.

*Antenna 2* (Fig. 6B) like in female.

*Mandible* (Fig. 6C) like in female. Palp: article 1 with a distal seta; article 3 distally with a comb-like longitudinal row of 8 thick setae, proximal one shortest.

*Maxilla* (Fig. 6D) like in female, but with only 9 teeth.

*Maxilliped* (Fig. 6E) like in female. Palp: article 1 mesially with one proximal seta and 4 distal ones, and laterally with 1 seta.

*Pereopods* (Fig. 7). P1 most robust, subchelate, propodus enlarged, 1.6 times longer than wide, with a continuous row of 19 setae on mesial face, dactylus unguis reaching proximal propodal lobe (Fig. 7A). P2 and P3 similar; P2 propodus oval, 2.0 times longer than wide, with setae and 9 stout sensory setae on convex palm (Fig. 7B); P3 propodus oval, 2.1 times longer than wide, with setae and 7 stout sensory setae on convex palm (Fig. 7C). P4 and P5 similar: carpus 2.8 and 3.2 times longer than wide (respectively), with long setae and 3 stout sensory setae on posterior margin; propodus rectangular 3.5 and 5.0 longer than wide (respectively), with scales and 3 stout sensory setae on posterior margin of P4, and 4 ones on P5 (Fig. 7D, E). P6 and P7 similar; P6 carpus rectangular, 3.7 times longer than wide, with long setae and 3 stout sensory setae on posterior margin; propodus rectangular, 4.5 longer than wide, with 4 stout sensory setae on posterior margin (Fig. 7F). P7 longest: basis 3.9 times longer than wide, ischium as wide as basis, merus with 1 anterodistal and 2 posterodistal simple setae; carpus 4.1 times longer than wide, with scales and 3 stout sensory setae on posterior margin; propodus rectangular, 4.6 longer than wide, with scales and 3 stout sensory setae on posterior margin (Fig. 7G).

*Pleopods* (Fig. 8A, B). P11 sympod with 3 distal serrulate setae on mesial margin; exopod operculiform, distally surrounded by 13 plumose setae, with some short simple setae on dorsal surface; endopod narrow, reaching apex of exopod, distally with 10 plumose setae. P12 sympod with 2 distal serrulate setae on mesial margin; exopod with 8 distal plumose setae; endopod reaching apex of exopod, with 4 distal plumose setae; appendix masculina stylet-like, articulating in proximal fourth part of endopod mesial margin, 1.1 times longer than endopod, reaching well beyond endopod, apically hooked.

*Uropod* (Fig. 9A) sympod elongate, rectangular; endopod ovate, surrounded laterally and distally by about 22 simple long setae, slightly reaching beyond apex of telson; exopod oval-shaped with rounded tip, slightly shorter than sympod, with about 20 plumose and simple setae on mesial margin; left and right exopods folded over pleotelson, proximally not meeting each other in dorsal view.

*Telson* (Fig. 9B) without statocyst, 2.0 times longer than greatest width, oval, tapering in rounded apex with 8 apical setae, dorsally with 9 pairs of fine setae.

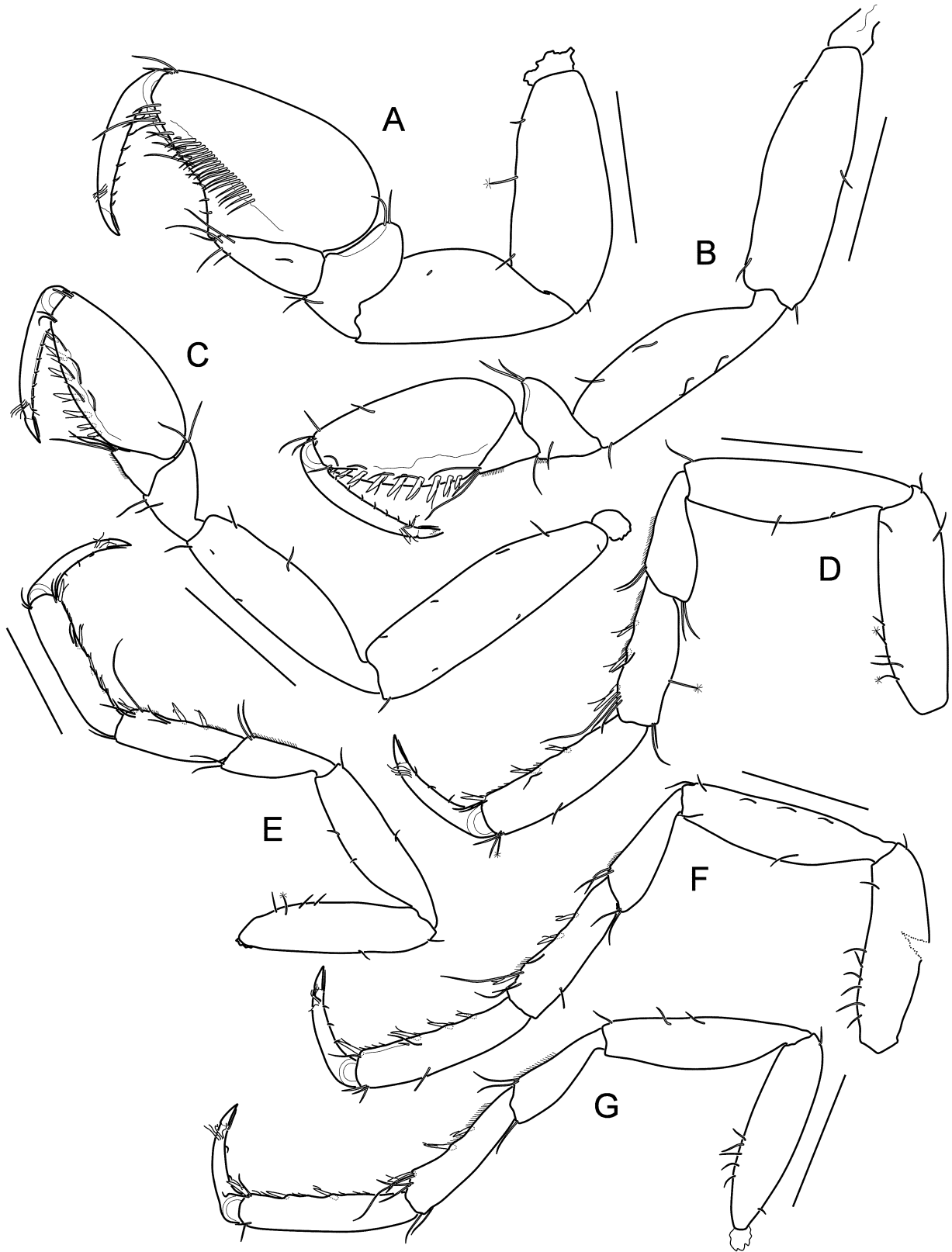
**Paratype, manca** (Fig. 2C, D)

Total body length 2.52 mm, without eyes, P7 absent, sex undifferentiated.

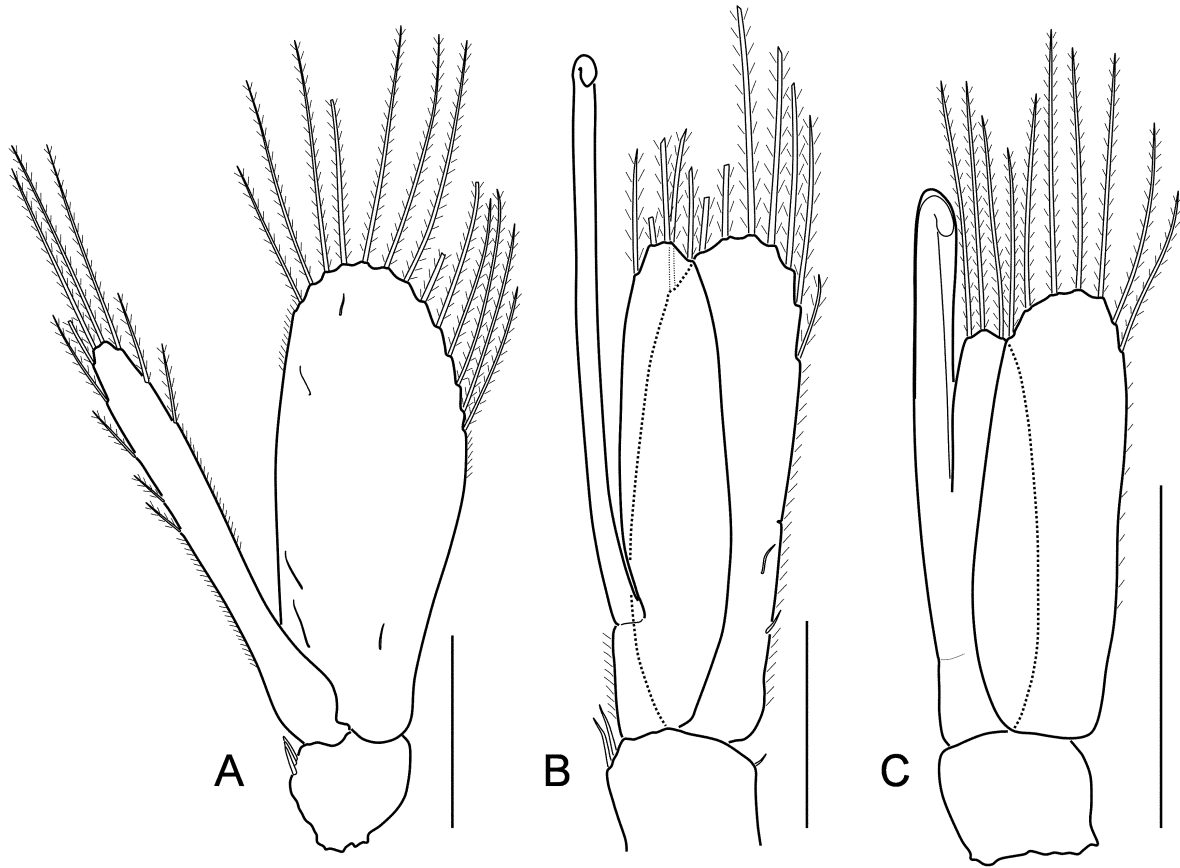
**Paratype, immature male** (Fig. 8C)

Total body length 4.23 mm, without eyes. A1 without aesthetascs. P12 exopod with 7 distal plumose setae; endopod not reaching apex of exopod, with 3 distal plumose setae; appendix masculina reaching well beyond endo-

pod and not yet fully separated from it, enclosed in a cuticular bag giving a wider appearance than in adult male, apically hooked.



**FIGURE 7.** *Paranthura santiparra* sp. nov., allotype male (MNCN 20.04/8225). (A) right pereopod 1, (B) right pereopod 2, (C) right pereopod 3, (D) right pereopod 4, (E) right pereopod 5, (F) right pereopod 6, (G) right pereopod 7. Scale bars = 0.3 mm.



**FIGURE 8.** *Paranthura santiparrai* sp. nov., allotype male (MNCN 20.04/8225). (A) right pleopod 1, (B) right pleopod 2. Paratype male (MNCN 20.04/8438) (C) left pleopod 2 of immature male. Scale bars: A = 0.3 mm; B, C = 0.2 mm.

#### Paratype, females

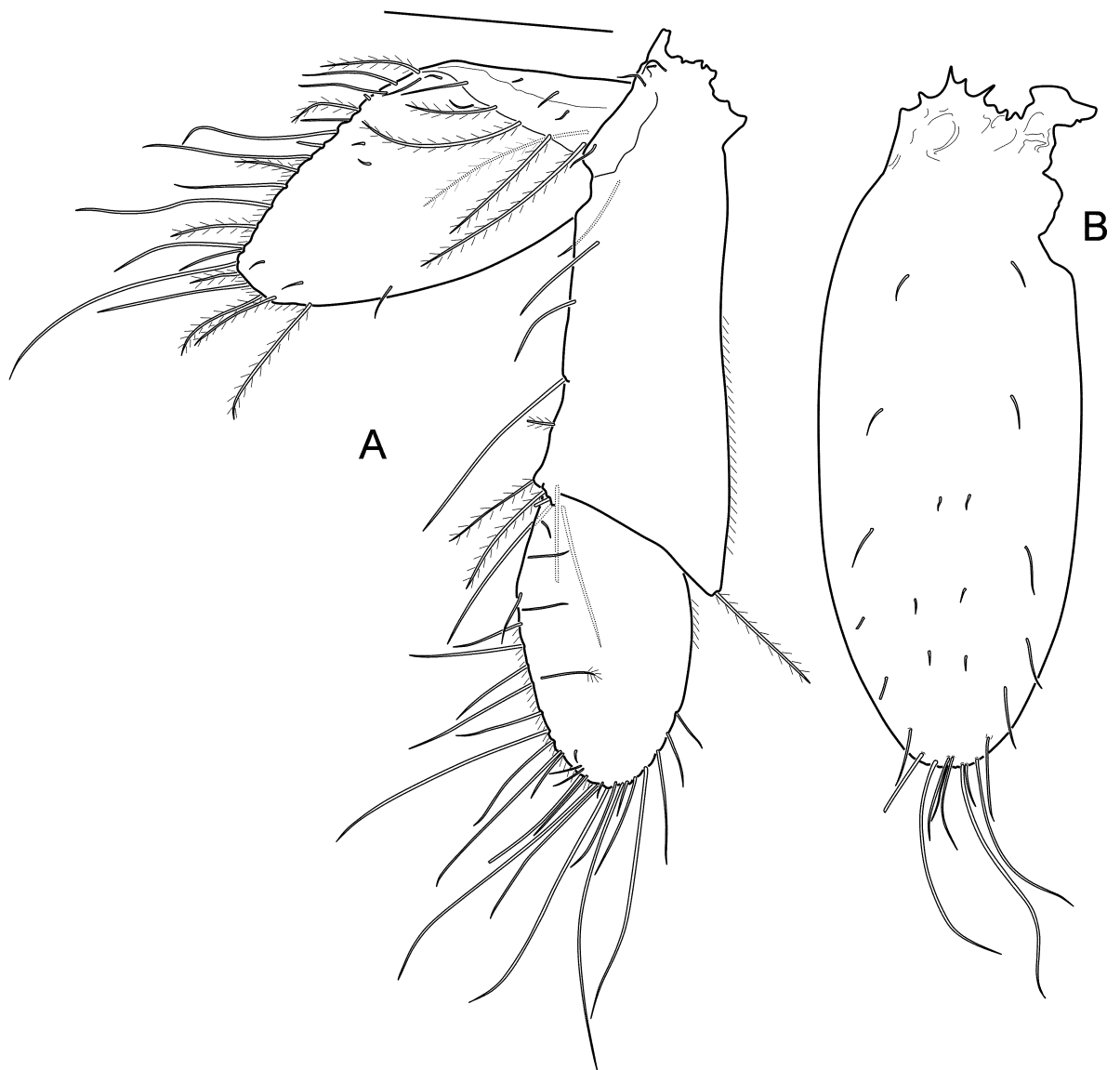
SEM observations carried out on two paratype females (MNCN 20.04/8368 and MNCN 20.04/8369) confirm the absence of ocular structure on the cuticular surface of the head (pictures not shown).

**Distribution.** The known distributional area of the new *Paranthura* species is at the moment limited to the 'El Cachucho' MPA (S Bay of Biscay).

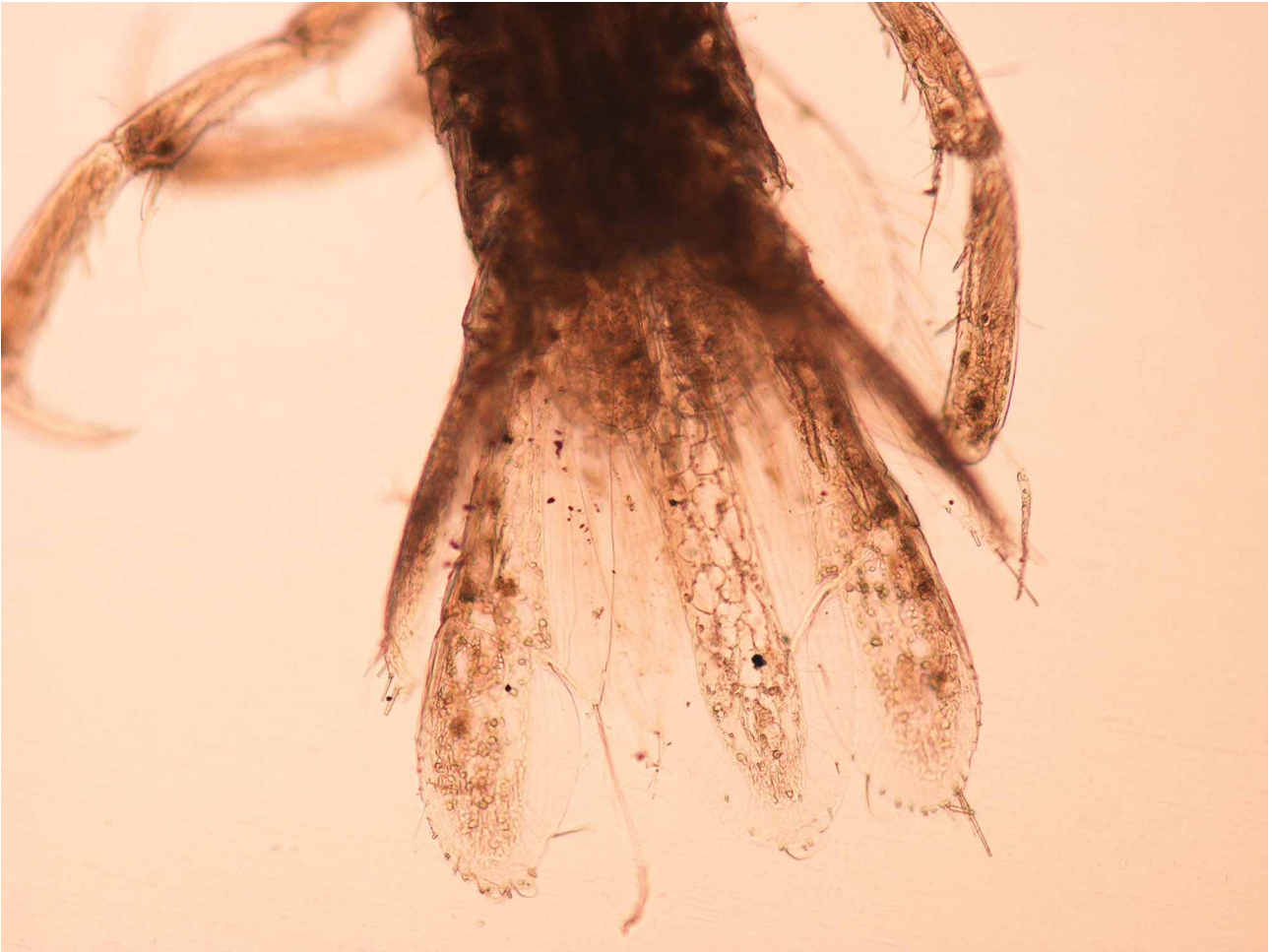
**Remarks.** The family Paranthuridae (*sensu* Poore 2001) comprises six genera that share two synapomorphies: lack of statocyst and maxillipedal palp with fused articles, except sometimes for minute distal one. The specimens from the 'El Cachucho' MPA show these two characters (Fig. 10) and belong to the family Paranthuridae. They are blind and pigmentless, as also mentioned for the two paranthurid genera *Pseudanthura* and *Cruregens*. However, they can be attributed to none of these two genera. In the first one, all pleonites and pleotelson are fused in a single posterior unit (pleonites 1–5 free in the 'El Cachucho' specimens). In the second one (a monotypic genus represented by a hypogean freshwater species from New Zealand), P7 are absent in adults (present in adults of the 'El Cachucho' specimens). Furthermore, in both genera, the posterior margin of Pln 6 is not visible dorsally (dorsally well delineated from telson in the 'El Cachucho' specimens). The four remaining paranthurid genera generally show a pigmented body and more or less developed eyes (scattered ommatidia in some species). According to Poore (2001), the genus *Paranthura* can be distinguished from the three other ones (*Califanthura*, *Colanthura* and *Cruranthura*) by the following characters: mandibular incisor acute (*vs.* blunt), mandibular molar absent (*vs.* curved flange-like molar), mandibular palp present (*vs.* absent), maxillipedal palp almost as long as basis (*vs.* half as long as basis), row of setae evenly spaced along palm on mesial face of P1 propodus (*vs.* row of closely-set setae confined proximally), P7 present in adults (*vs.* absent). All these 6 discriminating characters are actually observed in the 'El Cachucho' specimens and they are therefore assigned to genus *Paranthura*. However, such an assignment is not full accordance with the successive diagnoses given for this genus (Barnard 1925; Miller & Menzies 1952; Poore 1980, 1984, 2001; Kensley & Schotte 1989, 2000), all of them mentioning the presence of developed eyes.

Consequently, we propose an emendation of the most recent diagnoses of genus *Paranthura* given by Kensley and Schotte 2000 and Poore 2001.

Whereas some deep-sea anthuroids are blind (see Kensley 1982), all the known *Paranthura* species living at more than 200 m depth have well developed eyes (*P. antarctica* Kussakin, 1967, 3–334 m; *P. argentinae* Kussakin, 1967, 399–508 m; *P. ciliata* Whitelegge, 1901, 98–329 m; *P. costana* Bate & Westwood, 1868, 0–355 m; *P. longa* Wägele, 1985, 514 m; *P. neglecta* Beddard, 1886, 131–283 m; *P. possessia* Kensley, 1980, 508–2707 m; data from Poore 2001). The bathyal *P. santiparrae* **sp. nov.** can be easily distinguished from the other European *Paranthura* (the natives *P. costana* and *P. nigropunctata* as well as the non-indigenous *P. japonica*) by the lack of eyes and body pigmentation. Some other discriminating morphological features can also be used (see key and Table 2). On the basis of these data (known depth range of species, structure of appendix masculina apex), the new species is closer to *P. costana* than to *P. nigropunctata* (both species are mentioned from northern Spain, see Junoy & Castelló 2003), suggesting that it could have evolved from this shallower eyed species in relation with the seamount-like feature of the Le Danois Bank, a deep plateau more or less isolated from the adjacent Cantabrian shelf (isolation mechanism of speciation).



**FIGURE 9.** *Paranthura santiparrae* **sp. nov.**, allotype male (MNCN 20.04/8225). (A) right uropod ventral view, (B) telson dorsal view. Scale bars = 0.3 mm.



**FIGURE 10.** *Paranthura santiparrai* **sp. nov.**, Optical microscope picture of paratype male (MNCN 20.04/8370). Dorsal view of pleotelson temporally mounted, to show the absence of statocyst.

**TABLE 2.** Morphological comparisons between known European *Paranthura* isopods (adult specimens). *P. nigropunctata* and *P. costana* data according to Wägele (1982).

	<i>P. nigropunctata</i>		<i>P. costana</i>		<i>P. santiparrai</i> <b>sp. nov.</b>	
	male	female	male	female	male	female
Body length (mm)	9.5	8.1	4	9	5.4	6.6
Body pigmentation	present	present	present	present	absent	absent
Eyes	present	present	present	present	absent	absent
A1 flagellum, no of articles	7	7	7	7	8	4
Md palp distal article, no of setae	11	15	4	7	8	10
Mxp palp, no of distal setae	10	13	9	10	6	5
P2 propodus, no of stout sensory setae	8	9	4	7	9	9
P3 propodus, no of stout sensory setae	8	8	4	6	7	9
P4 propodus, no of stout sensory setae	4	4	2	4	3	4
P7 propodus, no of stout sensory setae	3	4	2	3	3	4
Appendix masculina, apex	straight		hooked		hooked	

As frequently mentioned for many other anthuroid taxa (e.g. Kensley 1978, Negoescu 1999), the pleopodal symphonds of the new *Paranthura* species bear a few distal setae on their mesial margins. Careful observations of right and left paired pleopods reveal that these setae are actually in close contact in the sagittal plane but not mor-



phologically structured to cling to each other (see Figs 5A, B; 8A, B). Therefore, they cannot be designated as retinacles according to the definition given by Negoescu (1994; retinacula: coupling hook on pleopod sympod, simple or with outgrowths). According to the setal classification system proposed by Garm (2004; pers. comm.), these distal setae show small setules only located on the distal part of their shaft and therefore belong to the serrulate setal type.

As yet pointed out by Negoescu (2000), many descriptions of new anthuroid species are incomplete and frequently based on adult specimens exclusively. Fortunately, in the case of genus *Paranthura*, three species were described in a highly detailed manner, including all successive developmental stages encountered in their respective populations: *P. nigropunctata* and *P. costana* by Wägele (1982; European species) and *P. brucei* by Negoescu (1999; from Fiji islands). In both *P. costana* and *P. brucei*, the figured appendix masculina of young males was apparently not enclosed in a cuticular bag, a peculiar morphological feature well observed in the case of immature *P. santiparrae* **sp. nov.** Apparently never mentioned in anthuroid literature, such an original feature of immature males probably represents a premolt condition before maturity stage characterized by a free functional appendix masculina.

### Key to species of *Paranthura* Bate & Westwood, 1866 recorded in European waters

1. Pleonites fused in the middle of their dorsal region, but distinct at their sides ..... *Paranthura japonica* Richardson, 1909;  
Coastal, Arcachon Bay (non-indigenous species\*)
- Pleonites free ..... 2
2. Without eyes. Body without pigmentation ..... *Paranthura santiparrae* **sp. nov.**;  
Bathyal, 'El Cachucho' MPA (Le Danois Bank)
- Eyes well developed and pigmented. Body pigmented. .... 3
3. Uropodal exopod narrow and pointed. In males, appendix masculina straight ..... *Paranthura nigropunctata* (Lucas, 1849);  
Coastal, Atlantic Ocean (from British Isles to Cape Verde Islands) and Mediterranean Sea
- Uropodal exopod broad and oval. In males, appendix masculina hooked ..... *Paranthura costana* Bate & Westwood, 1868;  
Coastal, Atlantic Ocean (from British Isles to Cape Verde Islands) and Mediterranean Sea

\* this species was recently sampled on intertidal oyster/mussel beds and in some channels of the Arcachon Bay, SW France. It was probably non-intentionally introduced in the bay with oyster spat transfers from eastern Japan during the seventies.

**Ecological notes.** As previously pointed out by Barnard (1925), little is known about the ecology and biology of subtidal anthuroids (including the most speciose *Paranthura* genus), probably because they never constitute abundant populations in marine benthic ecosystems. During the ECOMARG survey, only 85 specimens of *Paranthura santiparrae* **sp. nov.** were sampled in three different demersal/epibenthic habitats of the Le Danois Bank (as defined by Sánchez *et al.* 2008): the *Gryphus vitreus-Galeus melastomus* community from the top of the bank (station TS2'), the *Phormosoma placenta-Trachyrincus scabrus* community from the north-eastern bank break (station TS3) and the *Pheronema carpenteri-Deania calcea* community from the inner basin (station TS8). According to available sedimentological data (Parra, pers. comm.), *P. santiparrae* **sp. nov.** lives on fine sands from the top of the bank (median grain size: 166.1 µm; particles <62 µm: 29.33%; particles 62–500 µm: 65.57%; particles >500 µm: 5.09%; organic content: 3.41%) as well as on mud from the inner basin between the bank and the adjacent Cantabrian shelf (median grain size: 28.2 µm; particles <62 µm: 64.93%; particles 62–500 µm: 34.42%; particles >500 µm: 0.65%; organic content: 6.26%). Within its known distributional area, this species is a strict benthic inhabitant of upper bathyal bottoms, between 498 and 817 m depth, where near-bottom temperatures and salinities range between 10.3–10.9°C and 35.6–35.8, respectively (Sánchez, pers. comm.). Most specimens (98.8%) were collected in the 0–50 cm near-bottom water layer, indicative of their poor swimming abilities and epibenthic behaviour. In the study area, a maximum abundance of 22.8 ind./100 m<sup>2</sup> was observed at station TS3 (see Table 1), a value significantly lower than the maximum values mentioned by Arrontes and Anadón (1990) for *P. nigropunctata* (150.6 ind./m<sup>2</sup> in August; rocky intertidal, Cantabrian coast) and by Choy *et al.* (2009) for an undetermined *Paranthura* species (135 ind./m<sup>2</sup> in February; bare intertidal flat, Korean coast).



**Biology.** Protogynic hermaphroditism has been first described in the Anthuridae species *Cyathura carinata* (Kröyer, 1847), *C. polita* (Stimpson, 1855) and *Ptilanthura tenuis* Harger, 1878 (see references in Negoescu 1999). Negoescu (1999) also mentions such a biological peculiarity for the paranthurid *Paranthura brucei* (Fiji Islands). In this species, she distinguishes primary males (development through successive manca, postmanca and juvenile stages) from secondary males (development from reproductive females after breeding), the later showing higher body length than the former. In the case of *P. santiparrae* **sp. nov.** from the Le Danois Bank, all mature males of our collection (A2 and P12 fully developed; BL range: 4.28–5.24 mm; BL mean  $\pm$  s:  $4.74 \pm 0.30$  mm) were significantly smaller ( $P < 0.001$ ) than mature females (marsupium with embryos or empty; BL range: 5.40–6.71 mm; BL mean  $\pm$  s:  $5.87 \pm 0.38$  mm), suggesting that protogynic hermaphroditism is not a generalized biological process in *Paranthura* species.

To our knowledge, fecundity data are apparently inexistent for *Paranthura* species, probably related to frequent partial loss of marsupial content in anthuroid brooding females during collection and sorting processes. However, Kensley (1982) mentions a maximum fecundity of 14 ind./marsupium for the bathyal Anthuridae *Cyathura profunda* Kensley, 1982 (mean: 7.3 ind./marsupium;  $n = 15$ ). In our collection, on a total of 15 mature females, only 5 specimens carried offspring in their marsupium and a maximum fecundity of 8 embryos was registered in one of them (marsupium apparently intact). Intramarsupial development seems to be synchronic for all individuals of the same brood. Young embryos are oblong-shaped, with a maximum diameter of 0.38 mm (brooding female BL: 5.65 mm;  $n = 4$ ). One of these brooding females (BL: 5.48 mm) carried a single elongated individual in a late developmental stage (manca), characterized by a total body length of 0.95 mm, a maximum width of 0.28 mm and showing developing non-setigerous appendages.

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