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A new species of *Parabradya* Lang, 1944 (Copepoda: Harpacticoida: Ectinosomatidae) from the abyssal plain of the Angola Basin*

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*Results of the DIVA-1 expedition of RV "Meteor" (Cruise M48/1)

Abstract

Parabradya samsoni **sp. nov.** is described from deep-sea samples collected from the Angola Basin during the DIVA-1 campaign in July 2000. *Parabradya samsoni* can be distinguished from its congeners by: its bigger size, the ornamentation of the body, the cuticula (except for that of the cephalic shield and the genital field) is covered with spinules, the multipinnate setae of A1, A2, mouthparts, P1–P5 and caudal rami, and the position of the innermost seta of P5, which is not directly situated at the inner distal corner, but displaced towards the outer edge. Full generic rank is assigned to both *Bradya* Boeck, 1873 and *Parabradya* Lang, 1944. With *P. samsoni* **sp. nov.** *Parabradya* includes five species.

Key words: *Parabradya*, species description, taxonomy, deep sea, scanning electron microscopy.

Introduction

A group of 28 German and Spanish scientists participated in the DIVA-1 (Latitudinal Gradients of Deep-Sea BioDIVersity in the Atlantic Ocean) expedition to the Angola Basin in July and August 2000 on board the German research vessel ''Meteor''. Samples were taken with an array of different gears in six areas along a 700-mile-long transect crossing the southern part of the Angola Basin on either side of the Benguela Front. As one of the pioneering projects of the international 10-year project CeDAMar (Census of the Diversity of Abyssal Marine Life), DIVA expeditions are designed to greatly enhance our knowledge of the fauna inhabiting sediments in Atlantic deep-sea basins from pole to pole. In the meiofauna samples, harpacticoids were the second most abundant metazoans after nematodes. The differences in alpha diversity of Harpacticoida of selected cores from repeatedly sampled multicorer stations are presented in Rose *et al.* (2005). More than 600 species have been determined from multicorer samples and more than 99% of them are new to science. Until now five species of Harpacticoida have been described from this cruise (Bröhldick 2005; George 2006a; George 2006b; Veit-Köhler 2005; Willen 2005).

In most marine habitats, the diversity and abundance of Ectinosomatidae Sars, 1903 is high. Ectinosomatidae, for example, dominate the harpacticoid fauna in an intertidal sandflat area in the inner Jade Bay (German Bight, North Sea) making up 63.1% of the adult individuals (Rose and Seifried, 2006). In the Angola Basin, 97 species of Ectinosomatidae have been identified from multicorer samples: six *Parabradya*- and 23 *Bradya*-species, all undescribed. Species of *Bradya* Boeck, 1873 and *Parabradya* Lang, 1944 have been recorded from deep sea and the lower sublittoral of cold regions. Thompson (1889) reported *Bradya typica*

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Boeck, 1873 from a muddy shore at Penmon Point, Anglesey (Wales). However, this information has to be confirmed. Lang (1944) subdivided the genus *Bradya* into two subgenera, *Bradya* and *Parabradya*, on the basis of differences in P5 segmentation, the exopod being either fused to the baseoendopod in *Parabradya* or distinct in *Bradya*.

In this paper, we present the description of a new species of *Parabradya* and review the taxonomic rank of the subgenus *Parabradya*.

Material and methods

Samples were taken with an epibenthic sledge (EBS) and a multicorer (MUC) during the DIVA-1 campaign of the RV ‘‘Meteor’’ M48/1 to the Angola Basin (Southeast Atlantic) from July 6 to August 2, 2000. For station data of MUC samples and haul lengths of the EBS samples see Table 1. The EBS possessed an epinet and a supranet of 500 μm mesh, both equipped with a cod end of 300 μm (Brenke 2005; modified after Brandt and Barthel 1995). On deck, EBS-samples were sieved (300 μm mesh) gently with precooled seawater and then immediately transferred into 80% ethanol. Specimens were partly sorted on board or later in the laboratory at Bochum University by N. Brenke. Later, all Harpacticoida were transferred to glycerine. Sampling of the meiofauna on board was carried out with the MUC by Dr Elke Willen (University of Oldenburg, AG Zoosystematics and Morphology) and Dr Kai Horst George (DZMB, Deutsches Zentrum für Marine Biodiversitätsforschung, Wilhelmshaven). Details on sampling strategy and sample treatment are described by Rose *et al.* (2005).

TABLE 1. MUC- and EBS-stations of the DIVA-1 expedition with RV “Meteor” in the Angola Basin.

a)

MUC station	Date	Position	Depth (m)
346	27.07.2000	16°17.0`S 5°27.0`E	5389

b)

EBS stations	Date	Position start	Depth (m)	Position end	Depth (m)	Trawled distance (m)
318	09.07.2000	22°20.0`S 3°18.3`E	5125	22°20.2`S 3°18.4`E	5144	3146.9
340	22.07.2000	18°18.3`S 4°41.3`E	5395	18°19.4`S 4°41.9`E	5395	3984.6
344	25.07.2000	17°06.2`S 4°41.7`E	5415	17°07.5`S 4°42.3`E	5415	5372.9
348	28.07.2000	16°18.1`S 5°27.2`E	5390	16°19.3`S 5°27.2`E	5387	4261.5

The holotype and paratypes are deposited in the Copepod Collection of the AG Zoosystematik und Morphologie, University of Oldenburg, Germany (see below).

Drawings were made with the aid of a drawing tube on a Leica differential interference contrast microscope (DMLB with UCA condensor, IC prism and doubler x 1.5 and x 2).

The following abbreviations are used in the text: MUC = multicorer; EBS = epibenthic sledge; P1–P6 = first to sixth thoracopod; enp = endopod; exp = exopod; enp-1 (2, 3) = proximal (middle, distal) segment of endopod; exp-1 (2, 3) = proximal (middle, distal) segment of exopod; aes = aesthetasc.

The terminology is adopted from Seifried (2003). For setal homology and setae numbers Seifried (2003) is followed here. The terms autapomorphy and synapomorphy are used as defined by Ax (1984, 1987). The term groundpattern is used in the sense of “Grundmuster” and represents the hypothetical morphology of the members of the last common population of the species group in question (Wägele 2000).

Results

Ectinosomatidae Sars, 1903

Parabradya Lang, 1944 grad. nov.

Diagnosis (autapomorphies in italics): **Body length** of female ≥ *1200 μm*. Exopod of **antenna** as long as endopod and *as strong as enp-2*. One lateral seta of endopod of **mandible** *situated near the basis*. Segments of **P1–P4** exopod *broad*. Exopod of **P5** *fused* with baseoendopod *to form one plate*.

Groundpattern of *Parabradya*: **Female**. **Body length** ≥ 1200 μm. **Nauplius eye** absent. **Rostrum** incompletely fused at base with cephalothorax. **Prosome** consisting of cephalothorax and 3 free pedigerous somites; first pedigerous somite completely fused to dorsal cephalic shield. **Urosome** 5-segmented, comprising somite bearing P5, genital double-somite, and 3 free abdominal somites; 1 egg-sac, 1 copulatory pore. **Anal somite** divided longitudinally; anus covered by pseudoperculum. **Caudal rami** with 7 setae. **Antennule** 7-segmented; armature formula: 1, 10, 10+aes, 1, 3, 4, 7+aes. **Antenna** composed of coxa, basis, 2-segmented endopod and 3-segmented exopod; basis without seta; enp-1 with 1 seta displaced to the proximal part of the endopod; enp-2 with 3 subterminal and 7 distal setae; subterminal setation of enp-2 composed of 3 spine-like setae, one very long; exopod as long as endopod and as strong as enp-2 with 2, 1, 2 setae, middle segment shortest. **Labrum** not prominent. **Paragnaths** fused. **Mandible** with coxa bearing well-developed gnathobase; cutting edge with 1 seta at proximal and 1 seta at distal corner and distinct teeth; palp comprising basis, endopod and exopod; basis wider than high with 4 setae; endopod 1-segmented with 3 setae laterally, one situated near the basis, and 7 apical setae; exopod 1-segmented with 4 lateral and 2 distal setae. **Maxillule** with praecoxa, coxa, basis, exopod, and endopod; praecoxal arthrite: anterior surface in outer half with 2 neighbouring setae, apically with 3 spines and 3 setae; formula of armature: 2, III, 1, 2, 0; coxa with short coxal endite with 2 setae, epipodite without setae; basis with 3 + 4 setae; endopod 1-segmented with 6 setae; exopod 1-segmented with 2 setae. **Maxilla** 5-segmented consisting of syncoxa, allobasis, and 3-segmented endopod; syncoxa with (2 + 2), 2, 3 setae, the 2 proximal endites fused; allobasis very large with reduced endite; accessory armature of allobasis consisting of a spine (I) and 6 setae; claw (I) reduced to spine; endopod 3-segmented with armature formula: I + 1, I + 1, 4; proximal and middle segment with large spine anteriorly (V + VII). **Maxilliped** 3-segmented, comprising syncoxa, basis and 1-segmented endopod; syncoxa with 2 coxal setae at inner and outer distal corner (10 + 11); basis very large, without setae; endopod 1-segmented with 1 lateral seta and 3 distal ones. **P1–P4** biramous with 3-segmented rami; praecoxa present; leg pairs joined by intercoxal sclerite; armature formula:

	coxa	basis	exopod	endopod
P1	0-0	1-I	I-0; I-1; III-I+1-1	0-1; 0-1; I-II-I+1
P2	0-0	1-0	I-1; I-1; III-II-2	0-1; 0-1; I-II-I+1
P3	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-II-I+2
P4	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-II-I+1

P5 baseoendopod and exopod fused to form 1 plate, left and right P5 separated; baseoendopod with 1 outer basal seta, endopodal lobe with 2 setae (4 + 5); exopodal lobe with 3 marginal setae and 1 surface seta (9–12). **P6** with 1 seta.

Male. Sexual dimorphism in body size, genital segmentation, antennule, P5 and P6. **Urosome** consisting of somite bearing P5 and 4 abdominal somites; 1 spermatophore. **Antennule** subchirocer with 7 segments. **P5** baseoendopod and exopod fused to form 1 plate, left and right P5 separated; baseoendopod with 1 outer basal seta, endopodal lobe with 2 setae (4 + 5); exopodal lobe with 3 marginal setae and 1 surface seta (setae 9–12).

P6 symmetrical, with 2 setae.

Type species: *Bradya* (*Parabradya*) *confluens* Lang, 1936 = *Parabradya confluens* (Lang, 1936) comb. nov.

Other species: *Parabradya atlantica* (Bodin, 1968), *Parabradya bodini* (Božić, 1980), *Parabradya dilatata* (Sars, 1904), *Parabradya samsoni* **sp. nov.**

***Parabradya samsoni* sp. nov.**

Diagnosis (autapomorphies in italics):

Female. Whole **body** except cephalic shield and genital field *covered with spinules*. Many setae of **A1, A2, mouthparts, P1–P5** and **caudal rami** *multipinnate*. Innermost seta of **P5** not directly situated at inner distal, but *displaced towards outer edge*.

Type material: *Holotype* female, dissected and mounted on 22 slides, deposited in the Copepod Collection of the AG Zoosystematics and Morphology, University of Oldenburg, Germany (UNIOL Coll. No. 2006.006/1-22), Atlantic Ocean, Angola Basin, 18°18.3'S 4°41.3'E, 5395 m. *Paratype 1*: dissected female (UNIOL Coll. No. 2006.007/1-12), 16°18.1'S 5°27.2'E, 5390 m. *Paratype 2*: dissected female (UNIOL Coll. No. 2006.008/1-6), 16°17.0'S 5°27.0'E, 5389 m. *Paratype 3*: undissected female (UNIOL Coll. No. 2006.009/1), 16°18.1'S 5°27.2'E, 5390 m. *Paratype 4*: female prepared for SEM (2005, sample 8; UNIOL Coll. No. 2006.0017/1), 17°06.2'S 4°41.7'E, 5415 m. *Paratype 5*: female prepared for SEM (2005, sample 7; UNIOL Coll. No. 2006.0016/1), 16°18.1'S 5°27.2'E, 5390 m.

Additional material: 11 females from stations 318, 340, 344, and 348 (Tab. 1).

Type locality: Atlantic Ocean, Angola Basin, station 340 of DIVA-1 expedition, 18°18.3'S 4°41.3'E, 5395 m; salinity 34.8 psu; temperature 2.48 °C near the sea bottom; silt and clay sediment.

Description of the female holotype

All drawings made of holotype except paragnaths (Fig. 4D from paratype 1), one detail of mandible (Fig. 5B from paratype 2) and one detail of maxilla (Fig. 7B from paratype 2). SEM pictures are from paratypes 4 and 5.

Body length (incl. rostrum and without caudal rami): 1725 µm. Caudal rami: 110 µm. Maximum body width: 565 µm. Rostrum: 77 µm. Cephalothorax length (incl. rostrum): 690 µm.

Body (Figs 1A–C, 12–13) with distinction between prosome and urosome; prosome consisting of cephalothorax and 3 free pedigerous somites; first pedigerous somite completely fused to dorsal cephalic shield; urosome 5-segmented, comprising somite bearing P5, genital double-somite, and 3 free abdominal somites; 1 egg-sac, 1 copulatory pore. Cephalothorax longer than wide and wider than urosome. Cephalothorax and body somites with sensillae and pores (Figs 1A–C). Whole body except for cephalic shield and genital field covered with small spinules (Figs 12–13). Hyaline frill of cephalothorax and last 2 abdominal somites plain (Figs 13 B,D), that of cephalothorax with reticulated subcuticular strengthening. All other hyaline frills serrate (Fig. 13), that of P4 laterally with reticulated subcuticular strengthening. Lateral edges of pleurotergites of somites bearing P2–P4 with spinules (Fig. 13G). Anterior third of P2 to P5 somites with 2 rows of spinules longer than other spinules of the body (Fig 13C), covered laterally by hyaline frill of the preceding segment. Penultimate segment with plain pseudoperculum. Anal somite divided.

Rostrum (Figs 1A–C) fused medially with cephalothorax and nearly 1.5 times longer than broad; 2 sensillae and 2 pores on dorsal surface and 2 bulbous sensillae at distal edge, each with a knob at the tip (Fig. 12B).

Genital field (Fig. 2B) with 1 median copulatory pore and 2 integumental pores; without spinules.

Caudal rami (Figs 2D–F, 12D–F) 1.5 times longer than wide with 7 setae; rami completely covered with

spinules and outer distal edge dorsolaterally with long setules; posterior edge of rami terminating ventrally as acuminate lappet covered with spinules; all setae except naked dorsal seta VII multipinnate; seta V with stripes at base.

Antennule (Figs 3A–B, 12A) short and thick, 7-segmented; armature formula: 1, 10, 10+aes, 1, 3, 4, 7+aes; first segment with a row of long spinules; segments 2 and 3 making up more than half of the length; segments 1 and 4–7 broader than long; 28 of the 36 setae multipinnate, 5 bipinnate, 1 plumose, 1 naked and 1 with a row of small regular palisades.

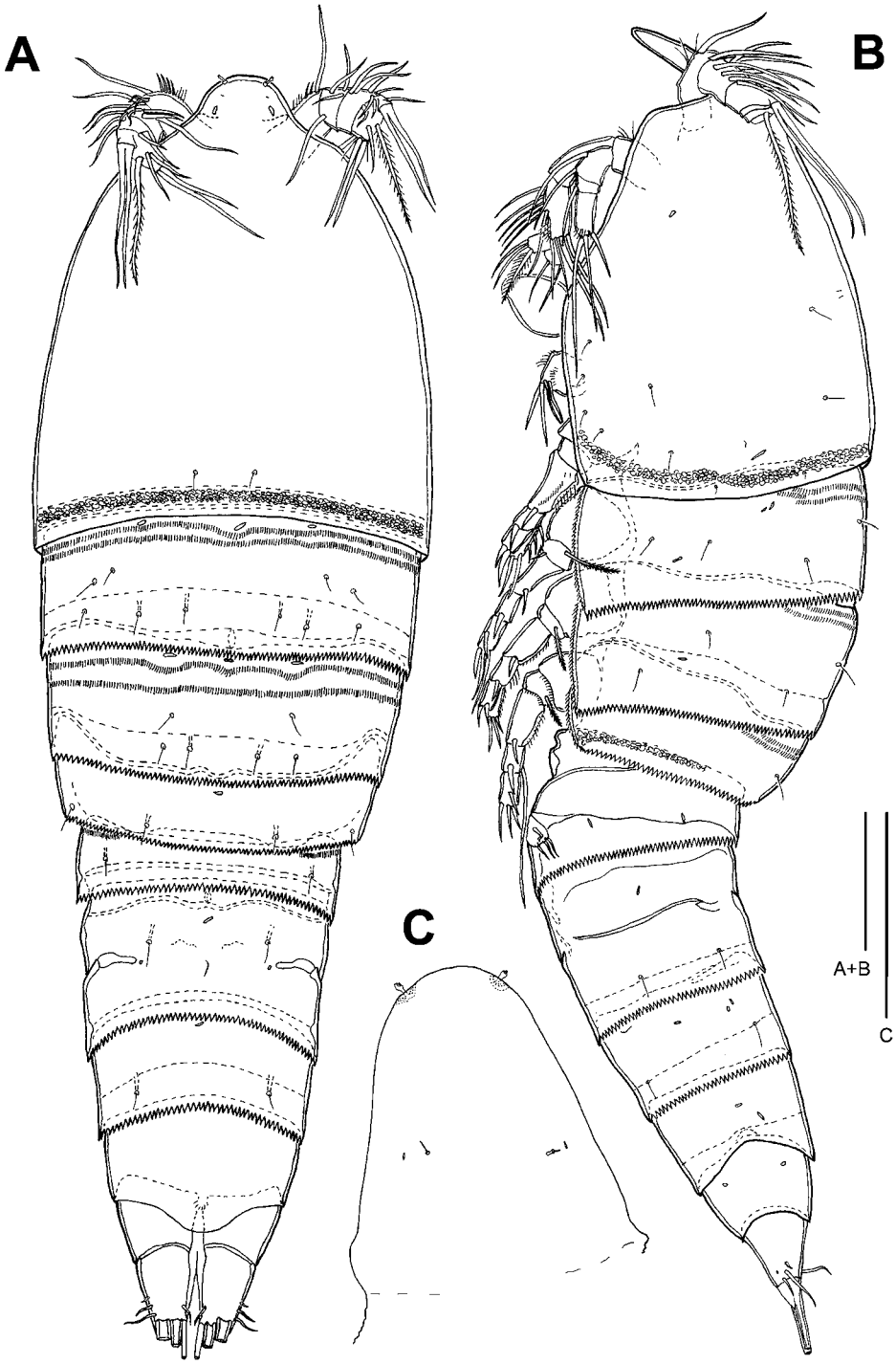

FIGURE 1. *Parabradya samsoni* **sp. nov.**, holotype female: (A) habitus dorsal; (B) habitus lateral; (C) rostrum. Scale bars A–B = 200 µm, C = 100 µm.

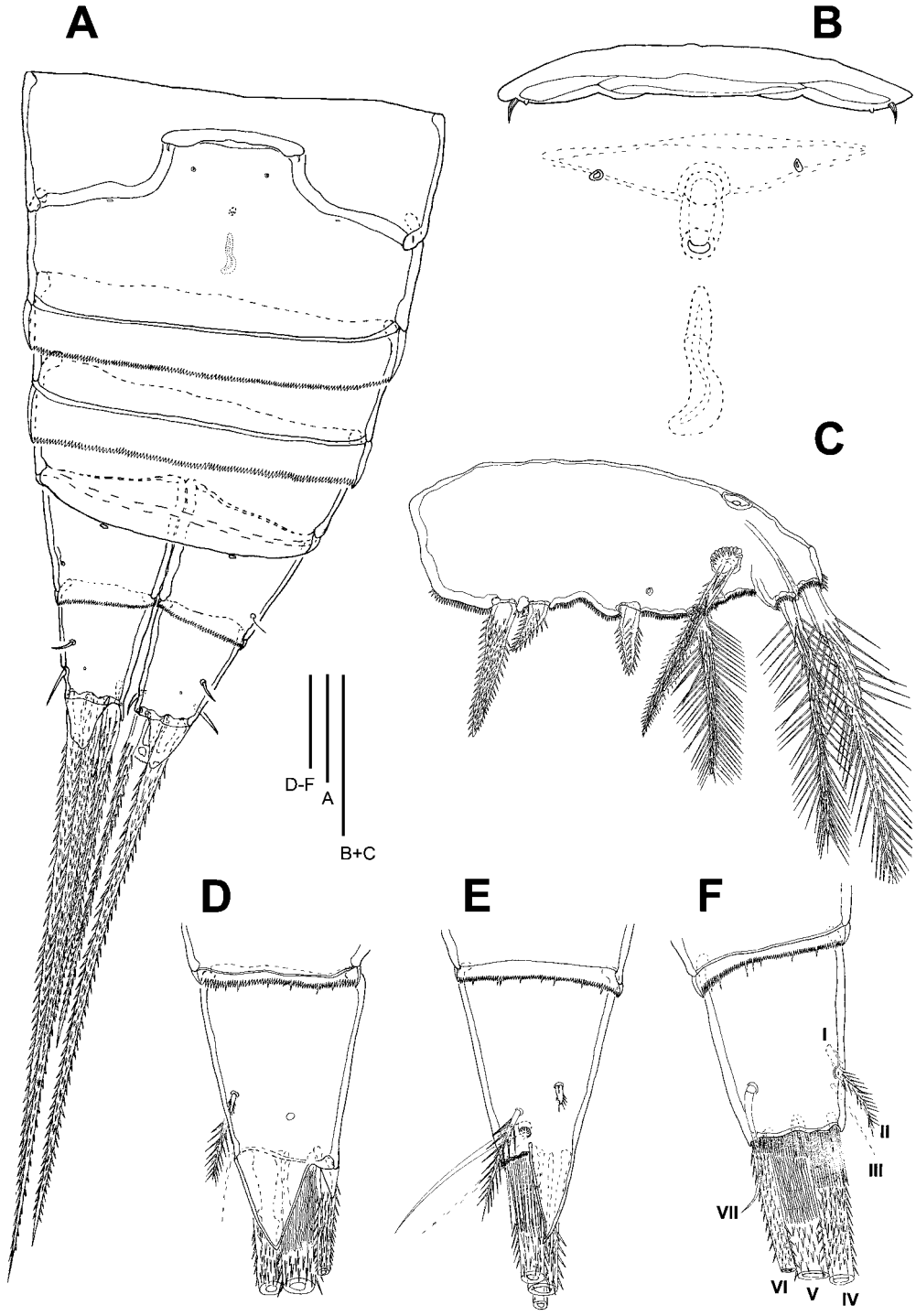

FIGURE 2. *Parabradya samsoni* **sp. nov.**, holotype female: (A) abdomen, ventral; (B) genital field; (C) P5; (D) caudal ramus, ventral; (E) caudal ramus, lateral; (F) caudal ramus, dorsal. Scale bars A = 100 µm, B–F = 50 µm.

Antenna (Figs 4A–B): Basis with many long spinules at lateral edge; enp-1 with 1 seta near proximal margin; enp-2 with 3 strong lateral and 6 strong distal setae, 1 lateral and 1 distal seta multipinnate; enp-2 with 3 groups of long spinules near proximal edge, at lateral side and near distal margin; exopod 3-segmented with 2, 1, 2 setae, 2 setae multipinnate and 4 bipinnate; exopod as long as endopod and as strong as enp-2, middle segment shortest; exp-1 with 2 rows of setules; exp-3 with 1 transverse row of strong spinules at distal edge and 1 field of small setules at outer side.

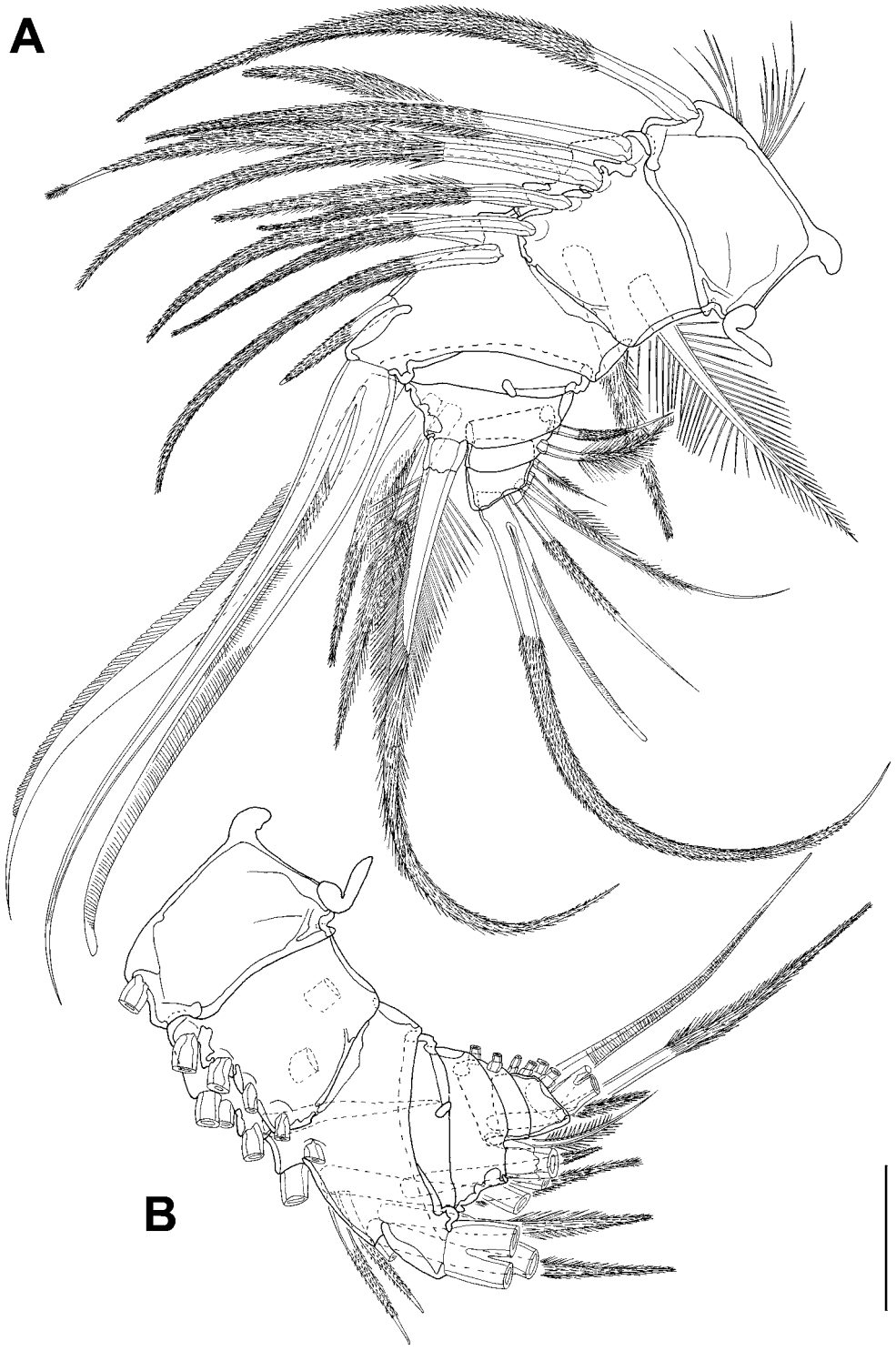

FIGURE 3. *Parabradya samsoni* **sp. nov.**, holotype female: (A) antennule ventral, setae drawn in Fig. 3B omitted; (B) antennule ventral, setae drawn in Fig. 3A omitted. Scale bar = 50 µm

Labrum (Fig. 4C) not prominent; dorso-lateral with 1 field and 1 row of small spinules at left and right corner; ventrally equipped with 1 pore, 1 circle of long setules, and 1 field of small spinules.

Paragnaths (Paratype 1: Fig. 4D) fused; both sides with many long and thin setules and 3 strong spinules.

Mandible (Fig. 5A, paratype 2: Fig. 5B): Cutting edge with 1 large and 7 smaller fused teeth, 1 bipinnate seta at proximal and 1 naked seta at distal corner; the 6 proximal of the smaller teeth multicusped; gnathobase

with 1 field, 1 large row and 4 small rows of spinules; basis with 2 rows of long setules and 4 setae (2 multipinnate and 2 bipinnate); endopod 1-segmented with 3 multipinnate setae laterally, 1 seta displaced to the proximal part of the endopod and 7 distal setae; exopod 1-segmented, shorter than endopod with 4 lateral and 2 distal setae, 3 multipinnate and 3 bipinnate; exopod with 4 transverse rows of spinules.

Maxillule (Figs 6 A–D): Arthrite of praecoxa with 2 setae on anterior surface and apically with 2 spines and 4 setae (Figs 6 A,D), coxa with 2 apical setae on a short endite; basis with 3+4 setae on the endites; endopod with 6 setae; exopod with 2 setae, smaller than endopod; praecoxa, coxa, basis, and exopod with rows of long setules, coxa and basis also with rows of short setules.

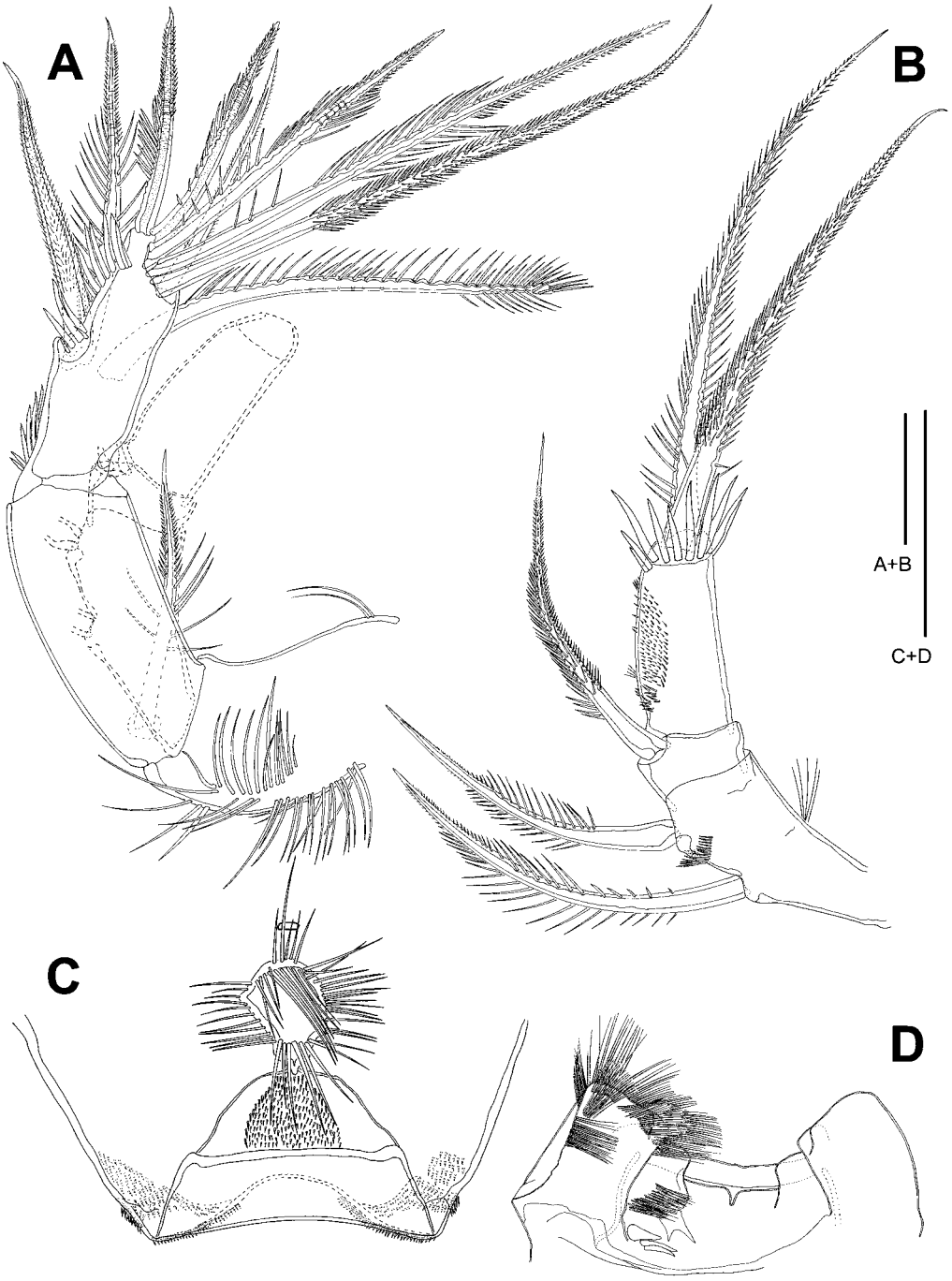

FIGURE 4. *Parabradya samsoni* **sp. nov.**: (A) holotype female, antenna; (B) holotype female, exopod of antenna; (C) holotype female, labrum; (D) paratype 1 female, paragnaths. Scale bars = 100 µm.

FIGURE 5. *Parabradya samsoni* **sp. nov.**: (A) holotype female, mandible; (B) paratype 2 female, cutting edge of mandible; (C) holotype female, maxilliped. Scale bars = 50 μm.

Maxilla (Figs 7A–C) robust, without setae and spines twice as long as maxilliped; syncoxa with 3 endites with (2+2), 2, 3 setae, the 2 praecoxal endites fused and rows of setules and spinules on anterior surface; allobasis with 1 spine and 6 setae at distal edge (basis setae I-4, endopodal setae 9–11) and 1 field of strong setules on anterior surface; endopod indistinctly 3-segmented, segments fused anteriorly, armature formula: I+0, I+1, 3.

Maxilliped (Fig. 5C): Syncoxa with 2 multipinnate coxal setae at inner and outer distal corner (10+11) and 1 row of setules at outer edge; seta 10 as long as syncoxa, basis and endopod together; basis without setae but with 1 row of spinules and 1 pore on anterior surface and long setules along outer edge; endopod 1-segmented with 1 lateral and 3 distal setae.

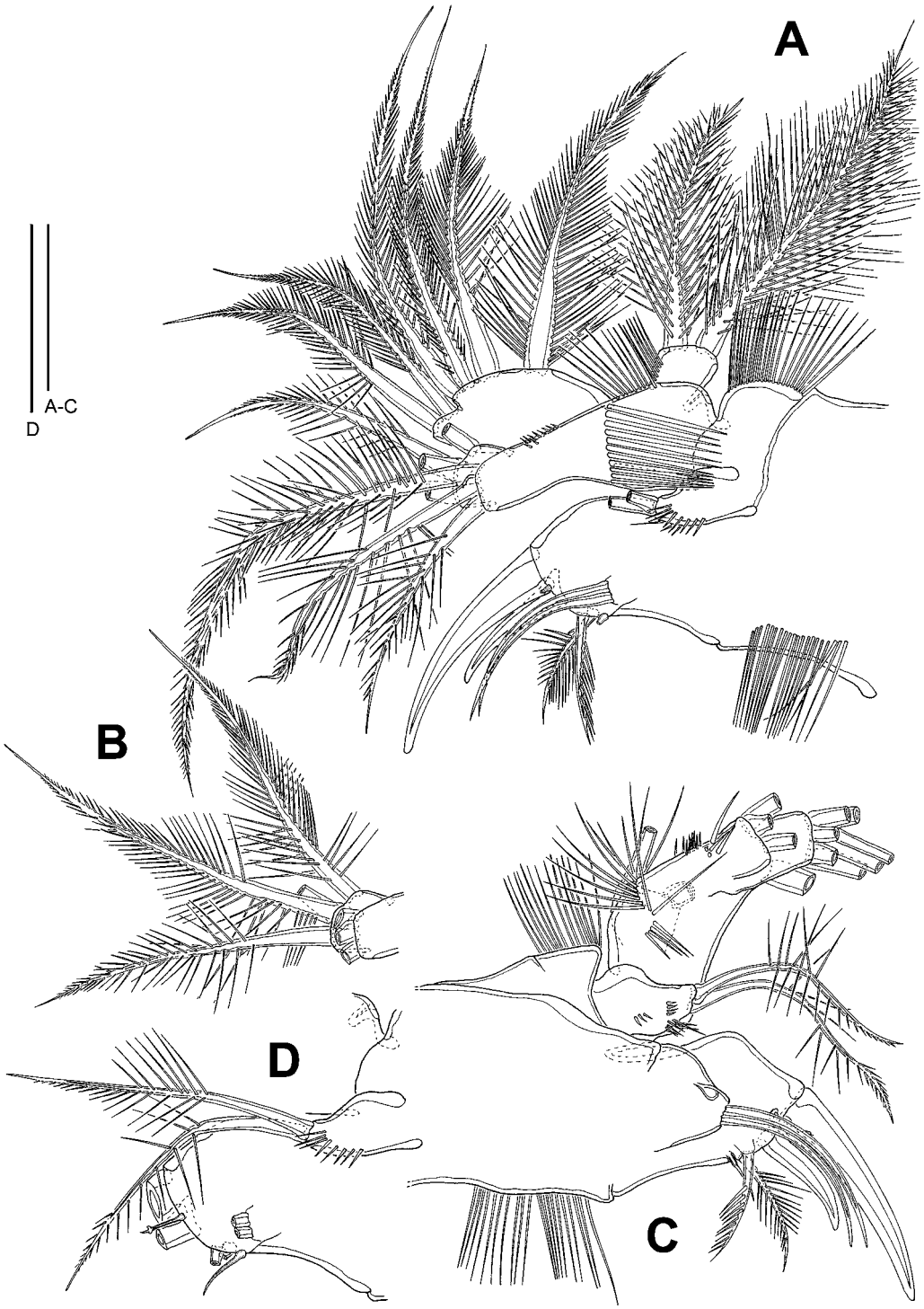

FIGURE 6. *Parabradya samsoni* **sp. nov.**, holotype female: (A) maxillule; (B) maxillule, endites of basis; (C) maxillule; (D) maxillule, two small setae of arthrite of praecoxa and basis setae. Scale bars = 50 µm.

Armature formula P1–P4:

	coxa	basis	exopod	endopod
P1	0-0	1-I	I-0; I-1; III-I+1-1	0-1; 0-1; I-II-I+1
P2	0-0	1-0	I-1; I-1; III-II-2	0-1; 0-1; I-II-I+1
P3	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-II-I+2
P4	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-II-I+1

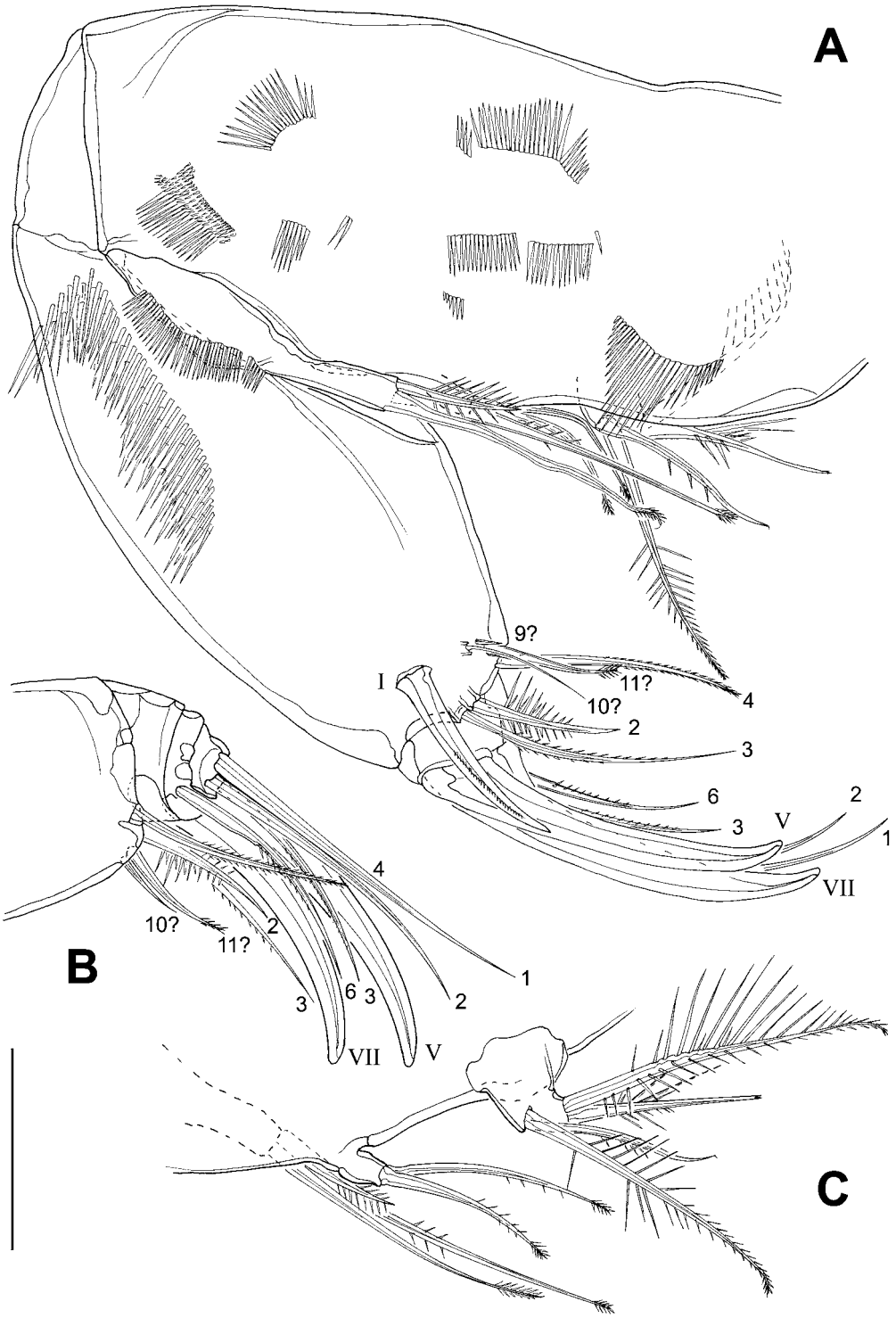

FIGURE 7. *Parabradya samsoni* **sp. nov.**: (A) holotype female, maxilla anterior; (B) paratype 2 female, endopod and setae of basis of maxilla, posterior; (C) holotype female, maxilla, endites of syncoxa posterior. Scale bar = 50 µm.

P1 (Fig. 8): Coxa with a row of strong setules, a field of small spinules, and 2 rows of spinules at outer distal corner; basis with 1 row of spinules at base of outer seta, a row of long setules on anterior surface, and a row of long setules at inner distal edge; enp-1 and enp-3 equal in length and longer than enp-2; outer edge of each segment strongly spinulose; anterior and posterior surface of each segment with rows of spinules; outer, enp-2 with a pore; 2 distal, and outer seta of enp-3 multipinnate; distal inner seta also developed as spine, seta multipinnate in the middle and bipinnate at the tip and the proximal part; exp-1 longer than exp-2 and exp-3;

outer edge of each segment spinulose; anterior and posterior surface of each segment with rows of spinules and setules; inner edge of exp-1 with a row of setules; exp-2 with a pore.

P2–P4 (Figs 9–11): Coxa and basis with rows of spinules and setules on anterior surface; enp-1 and enp-3 equal in length and longer than enp-2; anterior surface of enp-1 with 2 rows of strong setules; anterior and posterior surface of each segment with rows of spinules and outer edge with strong spinules; outer, 2 distal, and 1 inner seta of enp-3 multipinnate; distal inner seta also developed as spine, seta multipinnate in the middle and bipinnate at the tip; exp-1 longer than exp-2 and exp-3; anterior surface of exp-1 with 1 row of setules; anterior and posterior surface of each segment with rows of spinules; outer edge of each segment strongly spinulose; inner edge of exp-1 with a row of setules; inner distal seta of exp-3 of P4 extremely small.

FIGURE 8. *Parabradya samsoni* **sp. nov.**, holotype female, P1. Scale bar = 100 µm.

FIGURE 9. *Parabradya samsoni* **sp. nov.**, holotype female, P2. Scale bar = 100 µm.

P5 (Figs 2C, 12C) small, left and right P5 separated; baseoendopod and exopod fused to form 1 plate; P5 with 6 marginal (3 endopodal and 3 exopodal) and 1 exopodal surface seta (surface seta and 3 innermost setae multipinnate; 3 outermost setae plumose); outer basal seta longest; innermost seta of baseoendopod about 2.5 times as long as the other seta of baseoendopod; innermost seta not directly situated at the inner distal corner, but displaced towards the outer edge; entire ventral surface of P5 covered with spinules; 1 pore on anterior surface and 1 on outer part of the proximal edge.

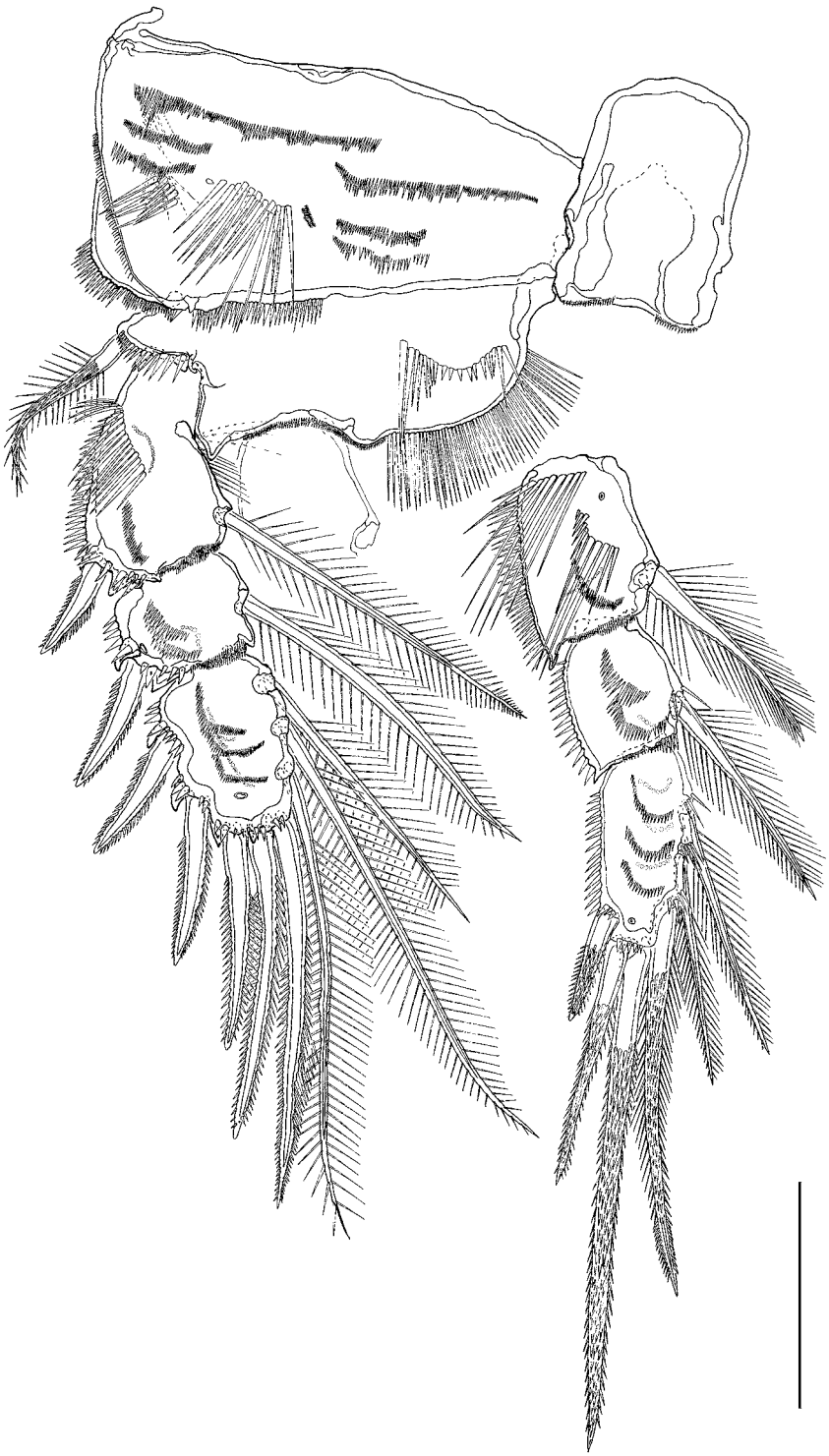

FIGURE 10. *Parabradya samsoni* **sp. nov.**, holotype female, P3. Scale bar = 100 μm.

P6 (Fig. 2B) with 1 seta and a small knob.

Male unknown.

Variability: Body length of females varies between 1,460 and 2,135 μm (mean = 1,675 μm; n = 15).

Etymology: This species is named after the German character "Samson" of the TV show "Sesame Street" because of its big size and the unique ornamentation of body and setae.

Food: The dissected paratype 1 has remains of leg-segments and setae of a copepod in its gut. This leads to the conclusion that this species feeds on copepods at least as a part of its diet.

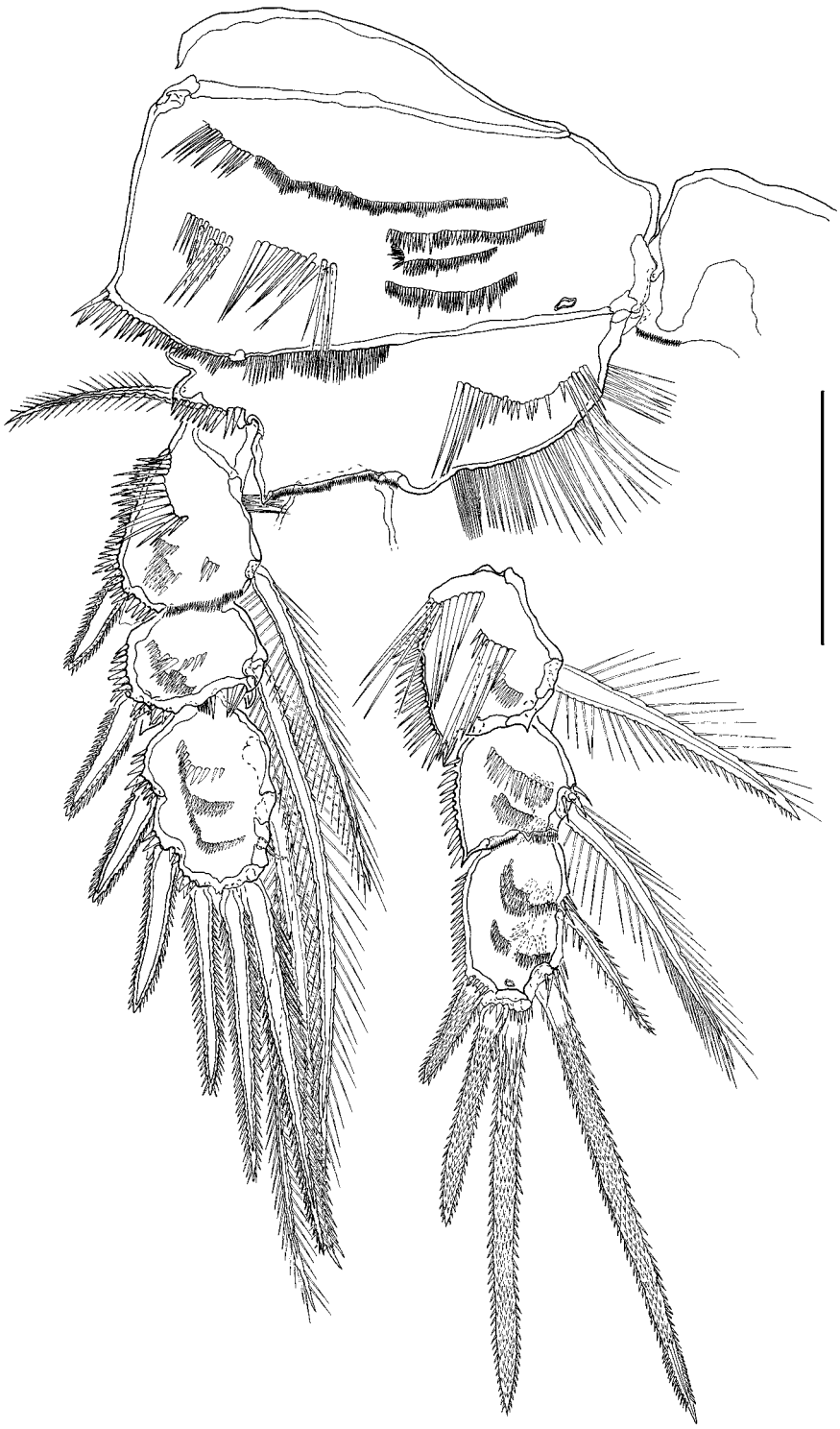

FIGURE 11. *Parabradya samsoni* **sp. nov.**, holotype female, P4. Scale bar = 100 µm.

Bradya Boeck, 1873

Diagnosis (autapomorphies in italics): Endopod of **maxilliped** *fused to basis at an angle.*

Type species: *Bradya typica* Boeck, 1873.

Other species: *Bradya cladiofera* Lang, 1965; *Bradya congera* Sars, 1920; *Bradya furcata* Sars; 1920;

Bradya macrochaeta Sars, 1920; *Bradya minutiseta* Soyer, 1973; *Bradya proxima* Scott, 1912; *Bradya pugiochaeta* Arlt, 1983; *Bradya scotti* Sars, 1920; *Bradya simulans* Sars, 1920; *Bradya theodori* Soyer, 1973.

Species incertae sedis: *Bradya limicola* Herrick, 1884.

Discussion

Taxonomic rank of *Parabradya* and *Bradya*

Lang (1944) subdivided the genus *Bradya* into two subgenera, *Bradya* and *Parabradya*, based on the differences in P5 segmentation, the exopod being fused to the baseoendopod in *Parabradya* but being distinct in *Bradya*. On the basis of the morphological differences and autapomorphies described above both subgenera are here upgraded to generic rank. The genus *Parabradya* is characterized by the following autapomorphies (italics): body length of female $\geq$ *1200 µm*; exopod of antenna as long as endopod and *as strong as enp-2*; one lateral seta of the endopod of mandible *situated near the basis*; segments of P1–P4 exopod *broad*; exopod of P5 *fused* with baseoendopod *to form one plate*. The autapomorphy characterising the genus *Bradya* is the maxillipedal endopod being *fused to the basis at an angle*. However, as the fusion is not complete in some as yet undescribed *Bradya*-species, the morphology of *Bradya* has to be looked at more closely particularly by studying the new and as yet undescribed species. Although fusion of the maxillipedal basis and endopod has been reported for species of *Parabradya* (see for example Boxshall and Halsey, 2004; Huys et al. 1996), this is erroneous as the endopod is distinct in all described *Parabradya* species (Fig. 5C). The distinct exopod of P5 is not an autapomorphy of *Bradya*, as it is a plesiomorphic character within Ectinosomatidae. *Bradya pugiochaeta* was listed in Bodin (1997) as *Parabradya*, but it probably belongs to *Bradya* because the exopod of P5 is distinct. The maxilliped of *B. pugiochaeta* is not described.

Bradya and *Parabradya* share the following synapomorphies: antennule *very short* compared with the cephalothorax; distal segment of antenna endopod with 1 or 2 lateral setae *developed as very long spines*; exopod of A2 *as long as* endopod; maxilliped *highly characteristic* (Fig. 5C), maxillipedal endopod distinct in *Parabradya* but fused in *Bradya*; mandible tooth *separated*; P2–P4 distal inner seta of distal endopod segment *developed as spine*.

Groundpattern of Ectinosomatidae

The groundpattern (for explanation see “Material and Methods”) of Ectinosomatidae was reconstructed by Seifried (2003). As *Parabradya samsoni* exhibits a very plesiomorphic morphology within Ectinosomatidae, reconstruction of the groundpattern has to be completed. The praecoxal arthrite of the maxillule has two neighbouring setae on the surface and six elements apically (armature formula: 2, III, 1, 2, 0). It thus has six elements less than reconstructed for the groundpattern of Oligoarthra Lang, 1944 (Seifried 2003). This formula of armature was already considered to be an alternative hypothesis for the praecoxal arthrite of maxillule of Ectinosomatidae in Seifried (2003, p. 82). The number and form of the elements of the arthrite of maxillule is one of the autapomorphies of Ectinosomatidae (Seifried 2003).

The allobasis of the maxilla of *P. samsoni* has one spine and six setae and therefore the same number of elements as reconstructed for the groundpattern of Syngnatharthra Seifried & Schminke, 2003 (basis setae I–4, endopodal setae 9–11; Seifried 2003; Seifried and Schminke 2003). Consequently, there are two more setae in the groundpattern of Ectinosomatidae as hypothesized in Seifried (2003). The typical form of the allobasis and the size-reduction and displacement of the setae are autapomorphies of Ectinosomatidae (Seifried 2003).

Species morphology and discrimination

All five *Parabradya* species have the same setal formula of swimming legs. The best characters to distinguish the known *Parabradya* species are those of the P5, as every species has a unique one (Figs 14A–E).

Parabradya samsoni can also be distinguished from its congeners by its bigger size, the ornamentation of the body, the cuticula (except for that of the cephalic shield and the genital field) being covered with spinules, the multipinnate setae of A1, A2, mouthparts, P1–P5 and caudal rami, and by the position of the innermost seta of P5 which is not directly situated at the inner distal corner, but displaced towards the outer edge. *Parabradya samsoni* shares with *P. dilatata* the spine-like occurrence of the lateral setae of the mandible endopod.

Parabradya dilatata can be distinguished from its congeners by the endopod of maxilla having only one big claw. The other species have two big claws like most Ectinosomatidae. It can also be distinguished by the length of the two distal setae of the antenna exopod, of which one is only half the length of the other. In the other species the distal setae are the same length or one seta is only slightly shorter than the other. Erroneously, the basis of the antenna of *P. dilatata* shows a seta, but this seta belongs to the proximal segment of the endopod which inserts at the proximal part as in other species (Fig. 4A; Seifried 2003). For *P. atlantica*, only the male is described so it is not possible to compare the P5 directly as it is sexually dimorphic in Ectinosomatidae and no male is known for the other species. However, the P5 of *P. atlantica* male resembles that of the female of *P. bodini* (Figs 14A-B): Among other characters the two endopodal elements and the inner element of the exopod are developed as spines. In these two species the distal segments of the P1–P4 endopods are also thicker than those of the exopods. *Parabradya bodini* differs from the other species by the proximal inner element of the distal endopod segment of P1 and P2 being developed as a long spine and not as a plumose seta. Additionally, the proximal inner element of the distal endopod segment of P4 is as long as the other elements and not shortened as in the other species. The description of the maxilliped of *P. bodini* appears to be wrong, as all four distal setae always lie on the endopodal part in Ectinosomatidae. The segmental border between basis and endopod as drawn by Božić (1980) is unlikely. Božić (1980) also mentions, that the inner seta of the proximal exopodal segment of P4 was lost in the described female. The description of *P. confluens* is inadequate, being confined to the female P5. The seta formula of the distal exopod segment of P2 (III-I+1-3) is probably wrong, as no Harpacticoida has 3 inner setae, but only a maximum of 2 (III-I+1-2). Unfortunately, the type material is lost. The single female Lang (1936) used for his description is not in his collection in the Swedish Museum of Natural History in Stockholm (Seifried 2003, p. 242). However, on the basis of Lang's description *P. confluens* can be identified because the left and right sides of the P5 fused to form one plate (Fig. 14E). In the other species, the left and right sides are distinct. Additionally, the exopod of P5 of *P. confluens* shows 5 setae. This is very unusual within Ectinosomatidae. The body form of *P. confluens* resembles that of *P. dilatata*, the prosome being very robust and oval and the urosome clearly thinner. As opposed to this, the prosome of *P. samsoni* is not oval and the urosome only slightly narrower than the prosome. In *P. bodini* and *P. atlantica* there is no distinction between prosome and urosome as in most Ectinosomatidae.

The differences between the species in some of the characters, for example the setation of the endopod of the mandible, the allobasis of maxilla or the arthrite and basis of maxillule may be explained by deficient drawings and incorrect setae numbers. The same may be true for the segmentation of the antennule. The endopod of maxilla of *P. samsoni* is indistinctly 3-segmented, as the segments are fused anteriorly. In posterior view, the endopod is clearly 3-segmented. The maxillar endopods of *P. bodini* and *P. atlantica* are described as being 3-segmented. However, it is not clear, if an anterior fusion has been overlooked.

In the Angola Basin *P. samsoni* lives on silt and clay sediment at a depth of around 5,300 m. During DIVA-1 expedition a salinity of 34.8 psu and a temperature of 2.48°C were measured near the sea bottom (Kröncke and Türkay 2003). *Parabradya atlantica* was found at a depth of 900 m (Golf de Gascogne), *P. bodini* at 4,652 m (Golf de Gascogne) and *P. confluens* on Biloculina clay at a depth of 2,700 m (near Spitzbergen). Sars (1904) described one *P. dilatata*-female from 50 m (Oslo-Fjord). Species of *Parabradya* have been found in the deep sea and on the continental shelf of cold regions, but not in intertidal zones.

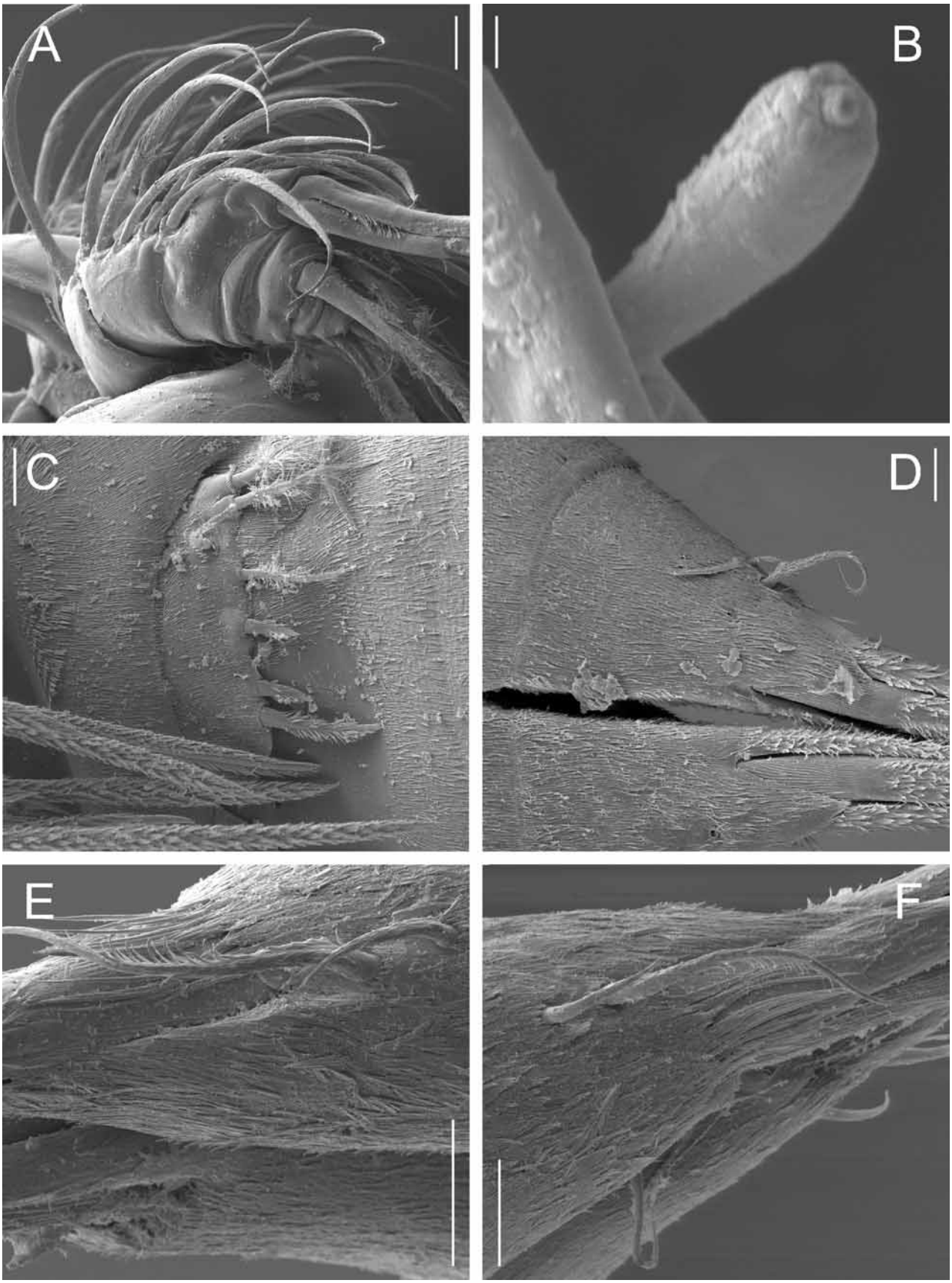

FIGURE 12. *Parabradya samsoni* **sp. nov.**, paratype 4 A–E, paratype 5 F: (A) antennule; (B) bulbous sensilla of rostrum with knob; (C) P5; (D) caudal rami ventral; (E) caudal rami ventrolateral; (F) caudal rami dorsolateral. Scale bars A, C–F = 20 µm, B = 1 µm.

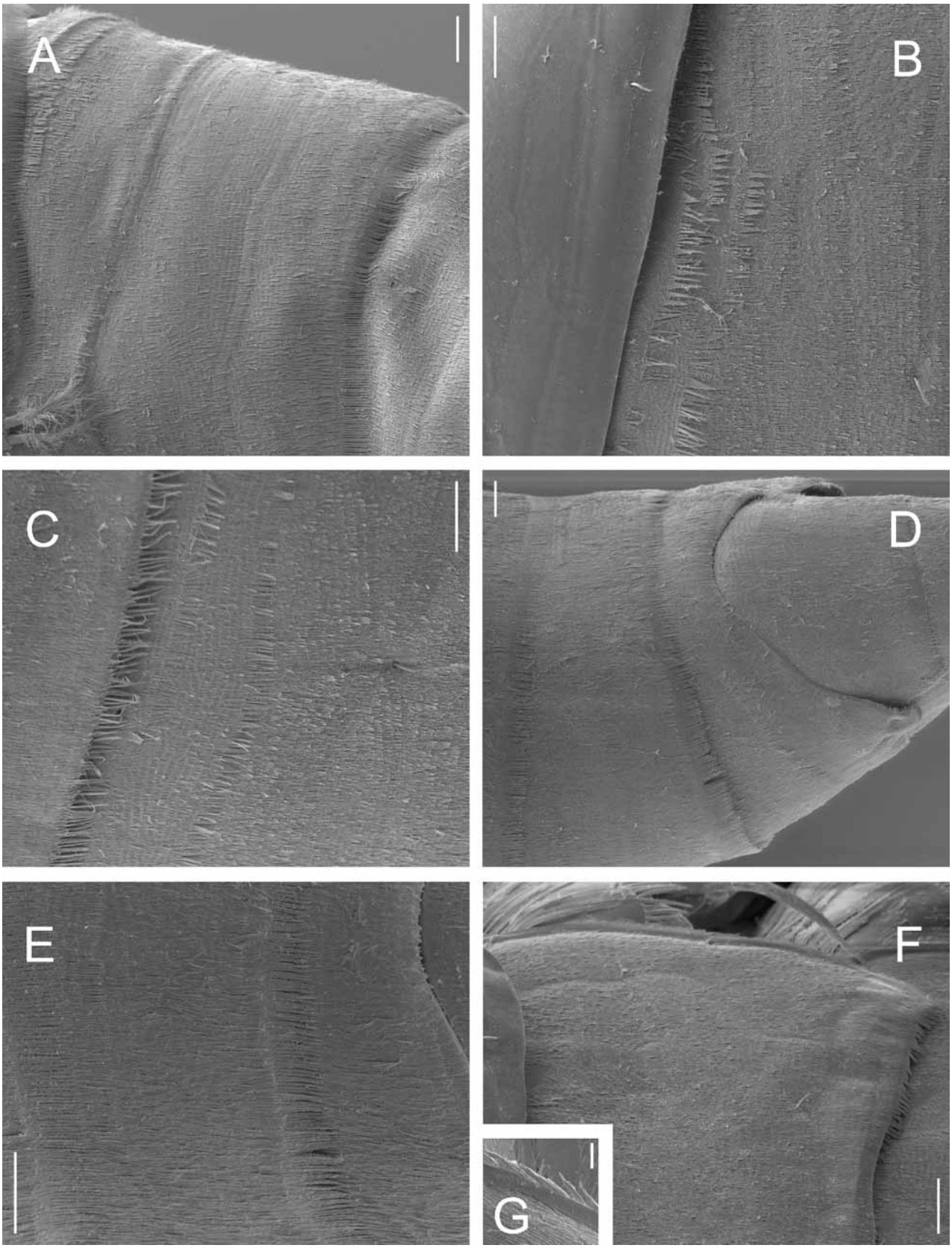

FIGURE 13. *Parabradya samsoni* **sp. nov.**, paratype 4 A, F, G, paratype 5 B–E: (A) genital double somite ventrolateral; (B) hyaline frill of cephalothorax and ornamentation of P2-somite, dorsolateral; (C) hyaline frill of P2-somite and ornamentation of P3-somite, dorsolateral; (D) last three abdominal somites ventrolateral; (E) hyaline frill of the genital double somite and ornamentation of following somites, ventrolateral; (F) P2-somite lateral; (G) lateral edge of pleurotergite of P2-somite. Scale bars A–F = 20 µm, G = 5 µm.

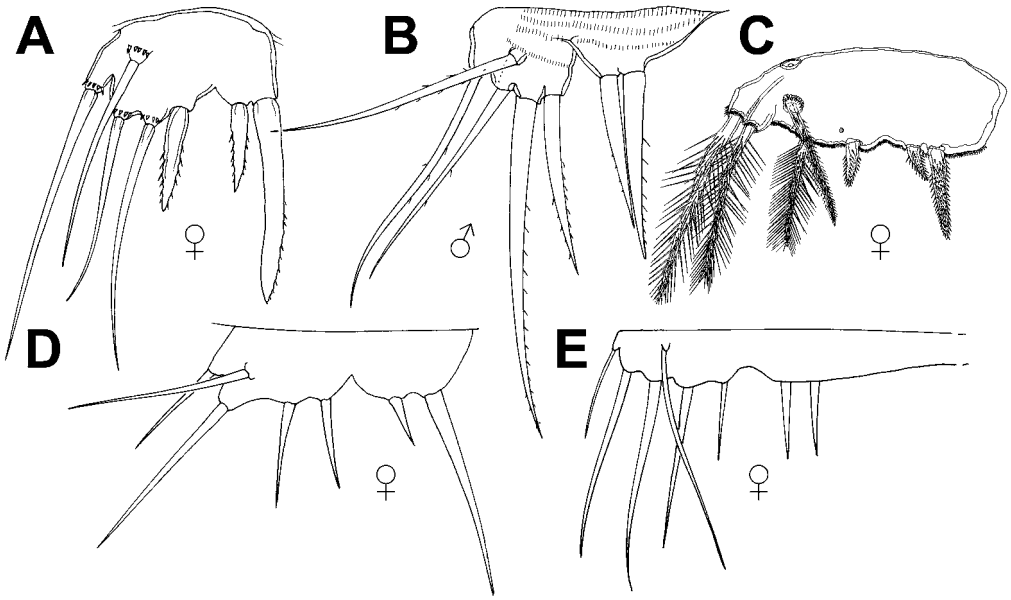

FIGURE 14. P5: (A) *P. bodini* female (after Božić 1980); (B) *P. atlantica* male (after Bodin 1968); (C) *P. samsoni* female; (D) *P. dilatata* female (after Sars 1904); (E) *P. confluens* female (after Lang 1936).

Variability

The body length of *P. samsoni* is remarkably variable for a species of Harpacticoida, as the smallest female in the samples (1,460 μm) is 30% smaller than the biggest one (2,135 μm). However, this seems to be a deep-sea phenomenon, as other as yet undescribed harpacticoid species from the Angola Basin show the same variability. With an average body length of 1,675 μm, *P. samsoni* is one of the largest harpacticoids in the basin. In addition, there are single species of Aegisthidae Giesbrecht, 1892, Argestidae Por, 1986, Ameiridae Monard, 1927, Canthocamptidae Sars, 1906, and Pseudotachidiidae Lang, 1936 which reach body lengths of more than 1,500 μm.

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References

Ax, P. (1984) *Das Phylogenetische System. Systematisierung der lebenden Natur aufgrund ihrer Phylogenese*. Gustav Fischer Verlag, Stuttgart, 349 pp.

Ax, P. (1987) *The phylogenetic system. The systematization of organisms on the basis of their phylogenesis*. John Wiley & Sons, Chichester, 340 pp.

Bodin, P. (1968) Copépodes Harpacticoïdes des étages bathyal et abyssal du Golfe de Gascogne. *Mémoires du Muséum National d'Histoire Naturelle*, 55(1), 1–107.

Bodin, P. (1997) Catalogue of the new marine Harpacticoid Copepods. *Studiedocumenten van het Koninklijk Belgisch Instituut voor Natuurwetenschappen*, 89, 1–304.

Boxshall, G.A. & Halsey, S.H. (2004) *An introduction to copepod diversity.* Ray Society, London, 166, 966 pp.
Božić, B. (1980) *Bradya* (*Parabradya*) *bodini* n. sp. du Golfe de Gascogne (Crustacea, Copepoda, Harpacticoidea). *Bulletin du Muséum nationale d'Histoire naturelle*, 1A(4), 1109–1113.
Brandt, A. & Barthel, D. (1995) An improved supra- and epibenthic sledge for catching Peracarida (Crustacea, Malacostraca). *Ophelia*, 43(1), 15–23.
Brenke, N. (2005) An epibenthic sledge for operations on marine soft bottom and bedrock. *Marine Technology Society Journal*, 39(2), 10–21.
Bröhldick, K. (2005) A new taxon of Idyanthidae (Copepoda, Harpacticoida) from the deep sea of the Angola Basin. *Organisms Diversity and Evolution*, 5, Suppl. 1, 43–57.
George, K.H. (2006a) New Ancorabolinae Sars, 1909 (Copepoda: Harpacticoida: Ancorabolidae) of the Atlantic and the Pacific Ocean. The taxa *Ceratonotus* Sars, and *Dendropsyllus* Conroy-Dalton. *Meiofauna Marina*, 15, 87–122.
George, K.H. (2006b) Ancorabolinae Sars (Copepoda: Harpacticoida: Ancorabolidae) of the deep Atlantic Ocean. *Ancorabolina chimaera* gen. et sp. nov. including remarks to ancorabolid phylogeny and to the evolution of the first natatorial leg in comparison with Laophontoidea T. Scott. *Meiofauna Marina*, 15, 157–176.
Huys, R., Gee, J.M., Moore, C.G. & Hamond, R. (1996) *Marine and brackish water harpacticoid copepods. Part 1*. In: D.M. Kermack, R.S.K. Barnes & Crothers J.H. (eds). Synopses of the British Fauna (New series), London, 352 pp.
Kröncke, I. & Türkay, M. (2003) Structural and functional aspects of the benthic communities in the deep Angola Basin. *Marine Ecology Progress Series*, 260, 43–53.
Lang, K. (1936) Die während der schwedischen Expedition nach Spitzbergen 1898 und nach Grönland 1899 eingesammelten Harpacticiden. *Kungliga Svenska Vetenskaps-Akademiens Handlingar*, (3)15(4), 1–55.
Lang, K. (1944) *Monographie der Harpacticiden (Vorläufige Mitteilung)*. Almquist & Wiksells Boktryckeri Ab, Uppsala, 39 pp.
Rose, A. & Seifried, S. (2006) Small-scale diversity of Harpacticoida (Crustacea, Copepoda) from an intertidal sandflat in the Jade Bay (German Bight, North Sea). *Senckenbergiana maritima*, 36(2), 109–122.
Rose, A., Seifried, S., Willen, E., George, K.H., Veit-Köhler, G., Bröhldick, K., Drewes, J., Moura, G., Martínez Arbizu, P. & Schminke, H.K. (2005) A method for comparing within-core alpha diversity values from repeated multicorer samplings, shown for abyssal Harpacticoida (Crustacea: Copepoda) from the Angola Basin. *Organisms Diversity and Evolution*, 5, Suppl. 1, 3–17.
Sars, G.O. (1904) *An account of the Crustacea of Norway, 5. Copepoda Harpacticoida*. Parts III&VI: 29–56, pls. 17–48.
Seifried, S. (2003) *Phylogeny of Harpacticoida (Copepoda): Revision of "Maxillipedasphalea" and Exanechentera*. Cuvillier Verlag, Göttingen, 259 pp.
Seifried, S. & Schminke, H.K. (2003) Phylogenetic relationships at the base of Oligoarthra (Copepoda, Harpacticoida) with a new species as the cornerstone. *Organisms Diversity and Evolution*, 3, 13–37.
Thompson, I.C. (1889) Third report on the Copepoda of Liverpool Bay (the L.M.B.C. District). *Proceedings of the Liverpool Biological Society*, 3, 181–191.
Veit-Köhler, G. (2005) First deep-sea record of the genus *Kliopsyllus* Kunz, 1962 (Copepoda: Harpacticoida) with the description of *Kliopsyllus diva* sp. n.—the most abundant member of Paramesochridae at two different sites of the Angola Basin. *Organisms Diversity and Evolution*, 5, Suppl. 1, 29–41.
Wägele, J. W. (2000) *Grundlagen der Phylogenetischen Systematik.* Verlag Dr. F. Pfeil, München, 315 pp.
Willen, E. (2005) A new species of *Paranannopus* Lang, 1936 (Copepoda, Harpacticoida, Pseudotachidiidae) with atrophic mouthparts from the abyssal of the Angola Basin. *Organisms Diversity and Evolution*, 5, Suppl. 1, 3–17.