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A new and exceptional species of *Bradya* Boeck, 1873 (Copepoda: Harpacticoida: Ectinosomatidae) from the abyssal plain of the Angola Basin and the variability of deep-sea Harpacticoida*

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Abstract

Bradya kurtschminkei sp. nov. is described from deep-sea samples collected from the Angola Basin (Southeast Atlantic) during the DIVA 1 campaign in 2000, the Guinea and Cape Basins (Southeast Atlantic) during the DIVA 2 campaign in 2005, and the Porcupine Abyssal Plain (Northeast Atlantic) during the RRS ''Challenger'' cruise 111 in 1994. *B. kurtschminkei* sp. nov. is exceptional because of many characters, hitherto unknown from other *Bradya* species. *B. kurtschminkei* sp. nov. can be distinguished from its congeners by its unique habitus as the body is slightly flattened dorso-ventrally and the female cephalothorax is almost as long as the free pedigerous somites and the urosome together. The rostrum's length is a third of the cephalothorax length and it tapers to a point. The antennule is 5-segmented, the basis of maxillule is fused with exopod and endopod, and the endopod has only four setae. The endopod of maxilla has only one large claw, the exopod of the P5 is short, its distal end reaches to the distal end of the baseoendopod, and the outer seta of the baseoendopod has a double tip. The armature formula of P1–P4 is exceptional as there are in total seven setae less on the endopods than in all other species of *Bradya.* Like many other deep-sea Harpacticoida, *B. kurtschminkei* sp. nov. shows compared with shallow waters species a remarkable, as yet unknown morphological variability.

Key words: *Bradya*, species description, taxonomy, variability of deep-sea Harpacticoida

Introduction

Until now seven species of Harpacticoida have been described from DIVA 1 (Bröhldick 2005; George 2006a, 2006b; Seifried *et al*. 2007; Veit-Köhler 2005; Willen 2005). Among the harpacticoid species determined from multicorer samples taken in the deep sea of the Angola Basin during the DIVA 1 cruise, 97 species belong to Ectinosomatidae. These make up 15 % of the total number of species recorded. Six of these Ectinosomatidae belong to *Parabradya*- and 23 to *Bradya*. *Parabradya samsoni* Seifried, Plum & Schulz, 2007 was described from the DIVA 1 material. All other ectinosomatid species from DIVA 1 are new to science.

Lang (1944) subdivided the genus *Bradya* Boeck, 1873 into two subgenera, *Bradya* Boeck, 1873 and *Parabradya* Lang, 1944. Species of *Bradya* have been recorded from deep sea and the lower sublittoral of cold regions. Thompson (1889) reported *Bradya typica* Boeck, 1873 from a muddy shore at Penmon Point, Anglesey (Wales). However, this information has to be confirmed. Both subgenera were raised to genus rank by Seifried *et al*. (2007). To date, *Parabradya* includes five species and *Bradya* the type species *B. typica*, 10

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valid species described between 1912 and 1984 (*B. cladiofera* Lang, 1965; *B. congera* Sars, 1920; *B. furcata* Sars; 1920; *B. macrochaeta* Sars, 1920; *B. minutiseta* Soyer, 1973; *B. proxima* Scott, 1912; *B. pugiochaeta* Arlt, 1983; *B. scotti* Sars, 1920; *B. simulans* Sars, 1920; *B. theodori* Soyer, 1973), and 1 species incertae sedis (*Bradya limicola* Herrick, 1884).

In this paper, a new species of *Bradya* is described and the variability of deep-sea Harpacticoida is discussed.

Material and Methods

Benthic samples were taken with a Multicorer during the DIVA 1 campaign of the RV ‘‘Meteor’’ to the Angola Basin (Southeast Atlantic) from July 6 to August 2, 2000 (M48/1) and during the DIVA 2 campaign of the RV ‘‘Meteor’’ to the Guinea, Angola and the Cape Basin (Southeast Atlantic) in March 2005 (M63/2). Details on sampling strategy and sample treatment of the DIVA 1 cruise are described in Rose *et al.* (2005). Sample details: Station 37, Cape Basin, 28°06.7’S 07°20.8’E, 5032 m, 04.03.2005; Station 61, Guinea Basin, 00°00.0’S 02°25.0’W, 5062 m, 15.03.2005. Samples from Porcupine Abyssal Plain (Northeast Atlantic) were taken with a multicorer during the RRS ‘‘Challenger’’ cruise 111 in 1994. Sample details: 48°51,5’N 16°30,5’W, 4837 m, station 53201 # 7, 09.04.1994, depth in the sediment 0-1 cm.

The type material is kept in the collection of the Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt, Germany (SMF). 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). The following abbreviations are used in the text: RRS = Royal Research Ship; RV = Research Vessel; 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) and setal homologies and setae numbers follow Seifried (2003). The term groundpattern is used in the sense of “Grundmuster” sensu Ax (1984).

Results

Ectinosomatidae Sars, 1903

Bradya Boeck, 1873

***Bradya kurtschminkei* sp. nov.**

Type material: *Holotype* female: dissected and mounted on 22 slides, coll. no. SMF 32073/ 1-22, Atlantic Ocean, Angola Basin, 16°17.0’S 05°27.0’E, 5389 m, DIVA 1 station 346, 27.07.2000. *Allotype male*: dissected and mounted on 20 slides, coll. no. SMF 32074/ 1-20, Angola Basin, 16°16.9’S 05°27.0’E, 5389 m, DIVA 1 station 346, 27.07.2000. *Paratype 1*: dissected female, coll. no. SMF 32075/ 1-14, Angola Basin, 16°17.0’S 05°27.0’E, 5389 m, DIVA 1 station 346, 27.07.2000. *Paratype 2*: undissected male, coll. no. SMF 32076, Angola Basin, 16°17.0’S 05°27.0’E, 5389 m, DIVA 1 station 346, 27.07.2000. *Paratype 3*: undissected female coll. no. SMF 32077, Guinea Basin, 00°00.0’S 02°25.0’W, 5062 m, DIVA 2 station 61, 15.03.2005. *Paratype 4*: undissected male, coll. no. SMF 32078, Cape Basin, 28°06.7’S 07°20.8’E, 5032 m, DIVA 2 station 37, 04.03.2005.

Additional material: *Female 1*: Porcupine Abyssal Plain, 48°51,5’N 16°30,5’W, 4837 m, RRS ‘‘Challenger’’ cruise 111, station 53201 # 7, 09.04.1994. *One male* and *21 females* from DIVA 1 station 346.

Type locality: Atlantic Ocean, Angola Basin, station 346 of DIVA 1 expedition, 16°17.0’S 05°27.0’E, 5389 m; salinity 34.8 psu; temperature 2.48 °C near the sea bottom; silt and clay sediment.

Etymology: The specific name is given in grateful dedication to Prof. Dr. Horst Kurt Schminke, who promoted the biological systematics as founder president of the Gesellschaft für Biologische Systematik (GfBS), and helped to establish an international journal of biological systematics (Organisms Diversity & Evolution), who promoted the German Centre for Marine Biodiversity Research and who lead the zoology and marine biodiversity of the University of Oldenburg with enthusiasm. His passion for copepods was recognized with the presidency of the Wold Association of Copepodologists (WAC) and inspired many students to become copepodologists under his guidance.

Description of the female holotype. All drawings made of holotype except for the detail of maxillar endopod (Fig. 6B from paratype 1).

Body length (incl. rostrum and excl. caudal rami): 432 µm. Caudal rami: 19 µm. Maximum body width: 136 µm. Rostrum: 63 µm. Cephalothorax length (excl. rostrum): 174 µm.

Body (Figs 1A–B) slightly dorso-ventrally flattened, with a slight 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; free pedigerous somites and urosome together only 1.35 times longer than cephalothorax; 1 egg-sac. Cephalothorax longer than wide and wider than urosome. Cephalothorax and body somites with sensillae and pores (Figs 1A–B). Whole body except cephalic shield and genital field with varying rows of small setules (for details see Figs 10 C–D). Penultimate segment with a row of spinules ventrally (Fig. 9A), which begins ventrolateral (Fig. 1C). Hyaline frill of cephalothorax and last 2 abdominal somites plain. Hyaline frill of thoracic segments serrate, that of first 3 urosomites with small palisades (Fig. 10C). Penultimate segment with plain pseudoperculum, with minute setules terminally. Anal somite divided.

Rostrum (Figs 1A–B, 2B) reaching one third of cephalothorax length and nearly as long as broad; medially fused with cephalothorax and tapering to a point; no sensillae or pores.

Genital field (Fig. 9B) with 1 median copulatory pore and 2 integumental pores.

Caudal rami (Figs 1A–B, 9A, 12A–C) as long as wide with 7 setae; with rows of regular setules dorsally and laterally and ventrally completely covered with setules; posterior edge of rami terminating ventrally as acuminate lappet; setae IV and V unipinnate, all other setae bare.

Antennule (Fig. 2A) 5-segmented and short, reaching without setae at most one eighth of cephalothorax length; armature formula: 1, 11, 14+aes, 3, 7+aes; segments 2 and 3 making up more than half of the length; segments 1 and 4 broader than long; 33 setae unarmed and 3 plumose.

Antenna (Figs 3A–B): Basis with long spinules at lateral edge; enp-1 with 1 bipinnate seta near proximal margin; enp-2 with 3 strong lateral and 6 strong distal setae; enp-2 with 2 groups of long, thick spinules near proximal edge and near distal margin; exopod 3-segmented with 2, 1, 2 setae; exopod nearly as long as endopod, middle segment shortest; exp-3 with some spinules at distal edge.

Labrum (Fig. 6C) very large but not prominent; with field of short and long spinules ventrally and with spinules at posterior edge.

Mandible (Figs 4A–B): Cutting edge with 1 large and 4 multicuspid smaller teeth not fused to cutting edge, 1 bipinnate seta at proximal and 1 bare seta at distal corner; basis with 2 rows of setules and 4 unarmed setae; endopod 1-segmented with 3 setae laterally, 1 seta displaced towards the proximal part of the endopod and 7 distal setae fused with endopod; exopod 1-segmented, shorter than endopod, with 4 lateral and 2 distal setae, 2 being bipinnate, 3 unipinnate and 1 plumose; exopod with setules at outer lateral margin and 1 transverse row of setules.

Maxillule (Figs 5A–B): Arthrite of praecoxa with 2 setae on anterior surface and apically with 4 spines and 1 seta, coxa with 2 apical setae on a short endite; basis with 2+2 setae on the endites; endopod and exopod fused with basis; endopod with 4 setae; exopod with 2 setae; praecoxa, coxa, and basis with rows of long setules.

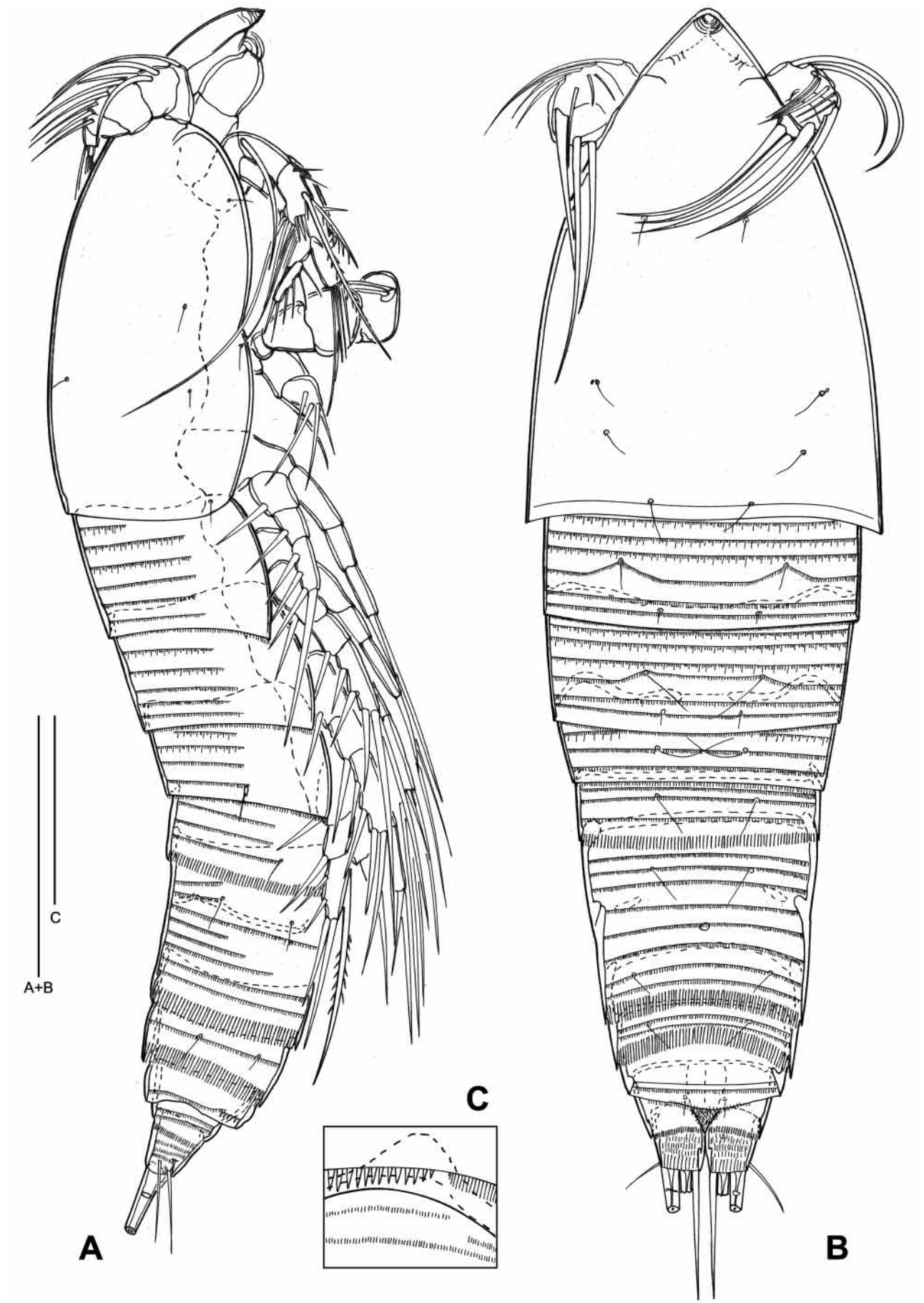

FIGURE 1. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) habitus lateral; (B) habitus dorsal, (C) detail of ornamentation of penultimate segment, lateral. Scale bars A–B = 100 µm, C = 20 µm.

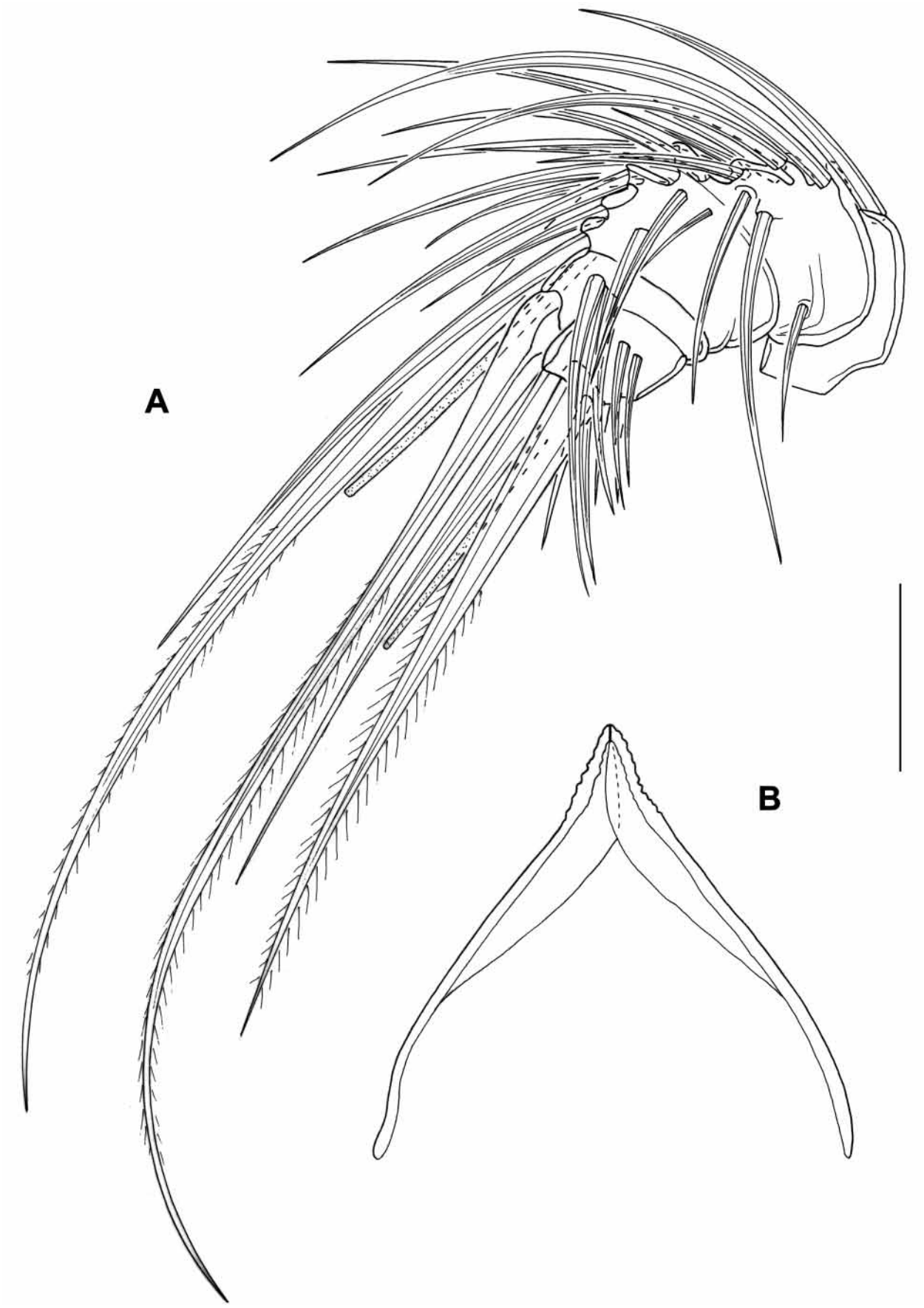

FIGURE 2. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) antennule (B) rostrum, ventral. Scale bar = 20 µm.

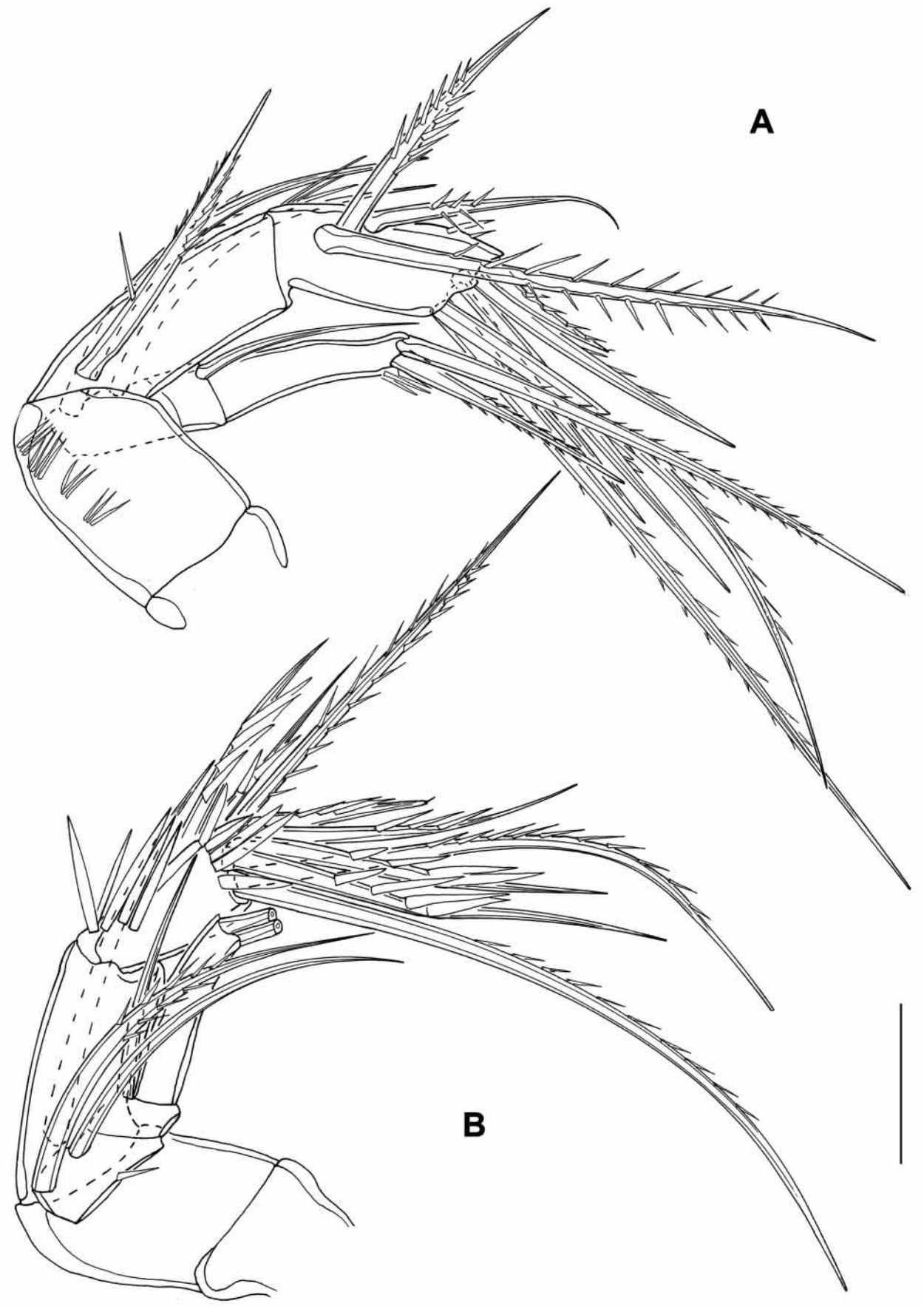

FIGURE 3. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) left antenna; (B) right antenna. Scale bar = 20.

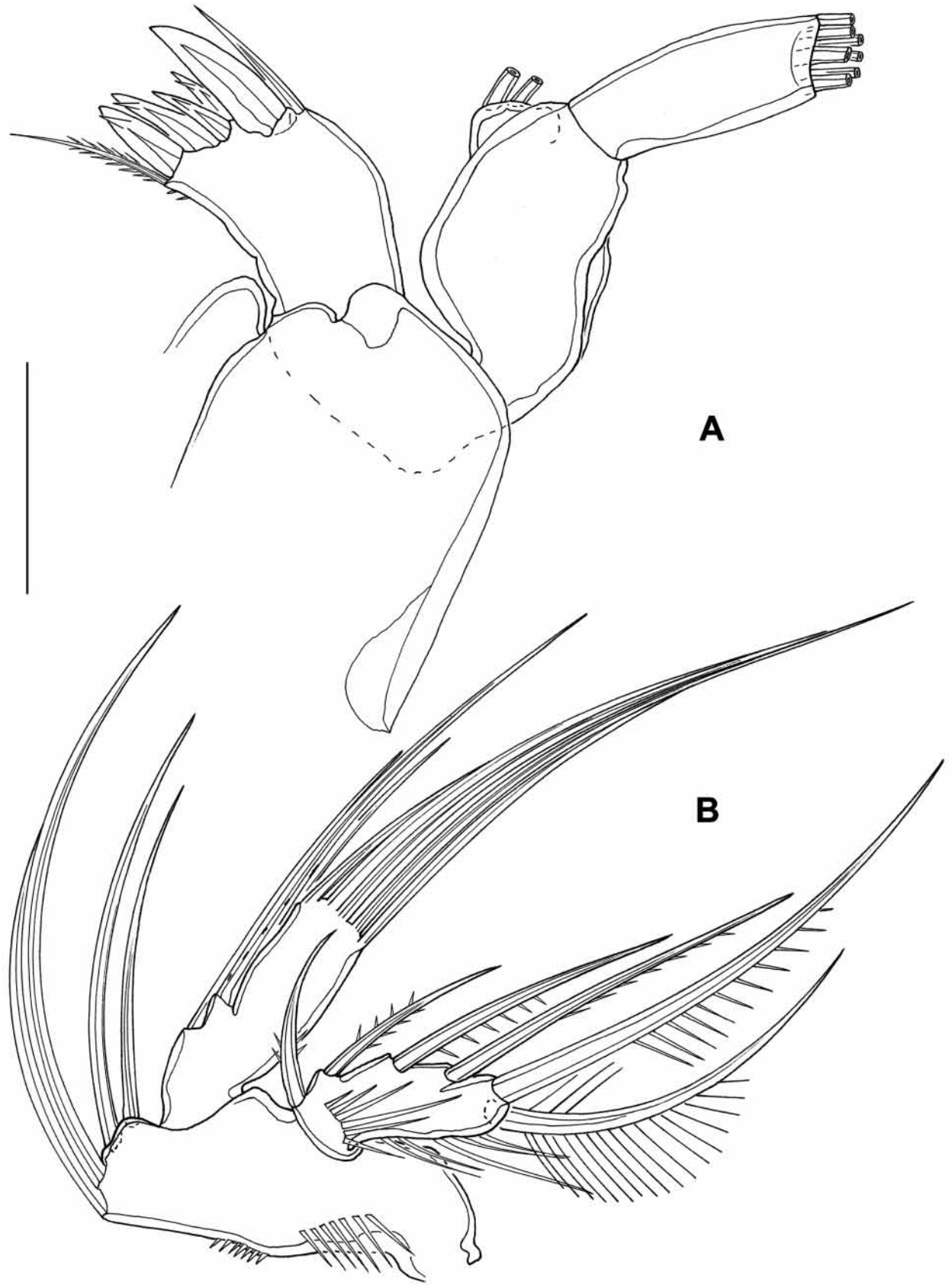

FIGURE 4. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) mandible, exopod and most setae of basis and endopod omitted; (B) palp of mandible. Scale bar = 20 µm.

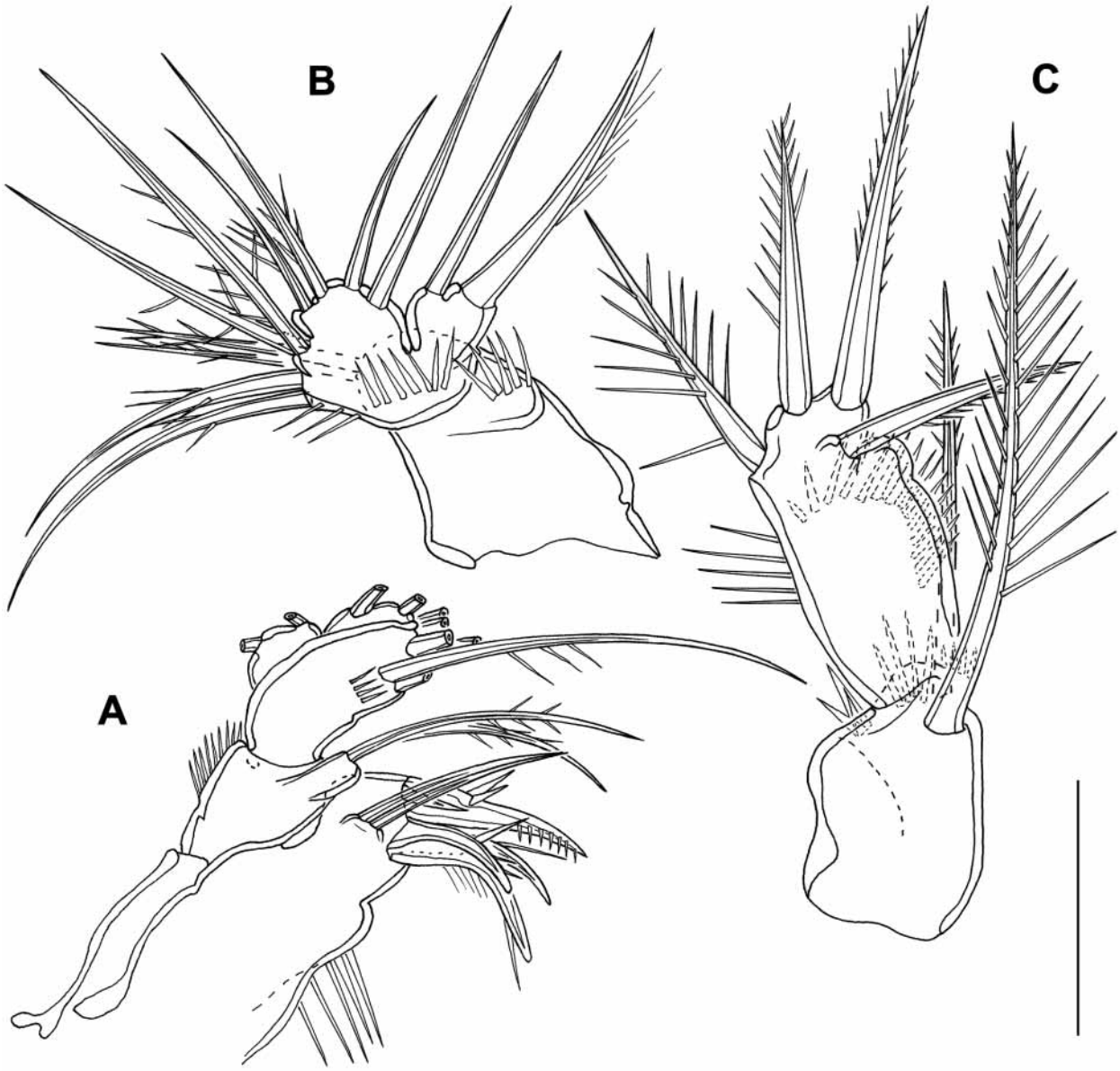

FIGURE 5. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) maxillule; (B) maxillule, setae of arthrite of praecoxa omitted; (C) maxilliped. Scale bar = 20 µm.

Maxilla (Figs 1A, 6A–B) robust and prominent (Fig. 1A); syncoxa with 2 endites, the coxal with 2 setae, the other representing the fused 2 praecoxal endites with (2+2) setae; rows of setules on anterior surface of syncoxa and endites; allobasis with 1 spine and 5 setae at distal edge; remaining endopod indistinctly 3-segmented, the two proximal segments fused anteriorly, middle segment with one large claw, claw of proximal segment developed as a seta; armature formula: 1, I+1, 4.

Maxilliped (Fig. 5C): Syncoxa with 2 bipinnate coxal setae at inner and outer distal corner (setae 10+11) and 1 row of setules along outer margin; the outer seta (10) longer than syncoxa, basis and endopod together; endopod fused to basis at an angle; basis narrow, 1.6 times longer than wide, without setae but with 1 semicircular row of spinules and long setules along outer edge; endopod with 2 lateral and 2 distal setae.

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-I-1
P2	0-0	1-0	I-1; I-1; III-II-2	0-1; 0-1; I-I-1
P3	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-I-I+1
P4	0-0	1-0	I-1; I-1; III-II-3	0-1; 0-1; I-I-I+1

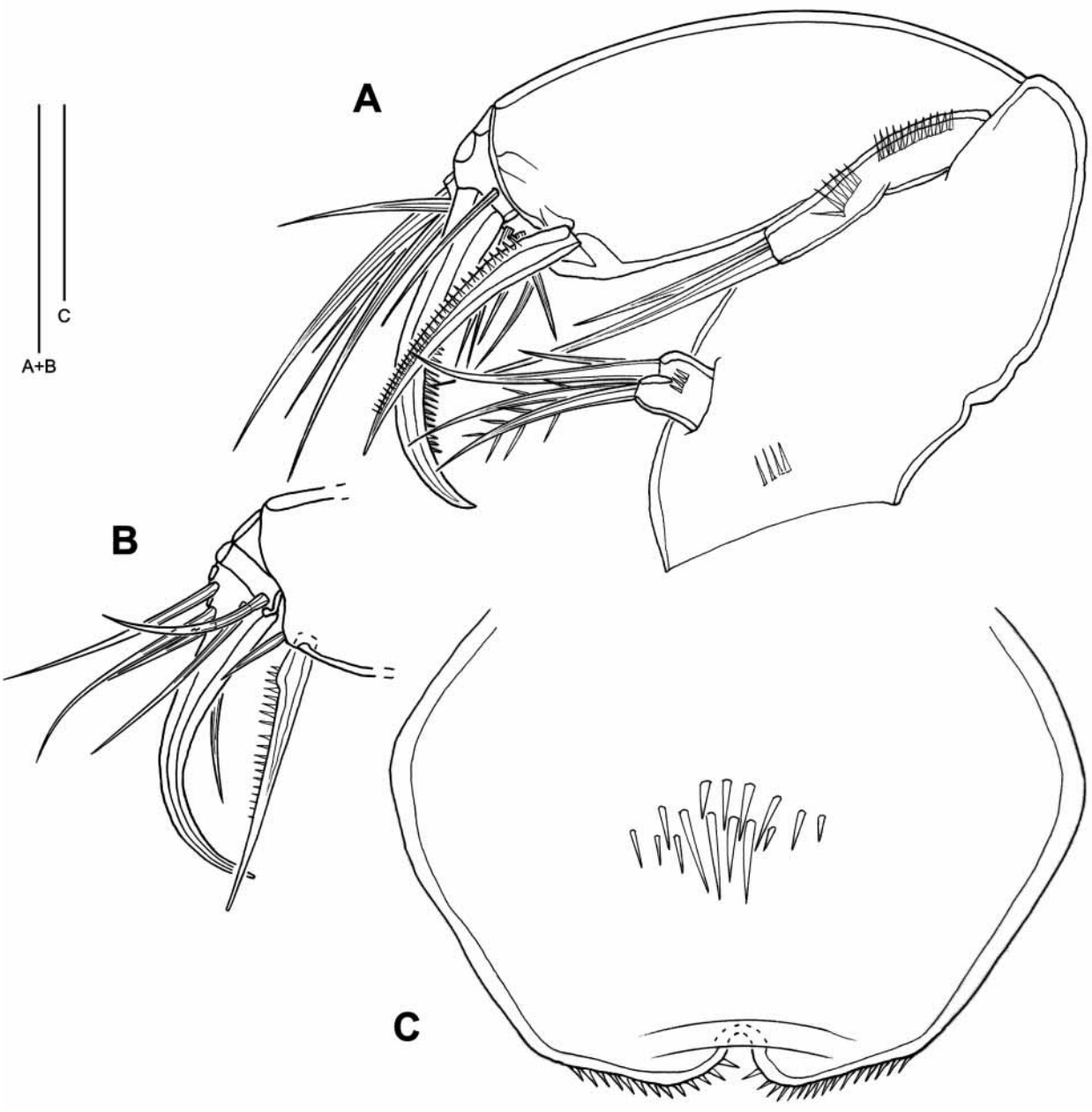

FIGURE 6. *Bradya kurtschminkei* **sp. nov.**, (A) holotype female: maxilla anterior; (B) paratype 1: maxilla endopod posterior (C) holotype female: labrum. Scale bars = 20 µm.

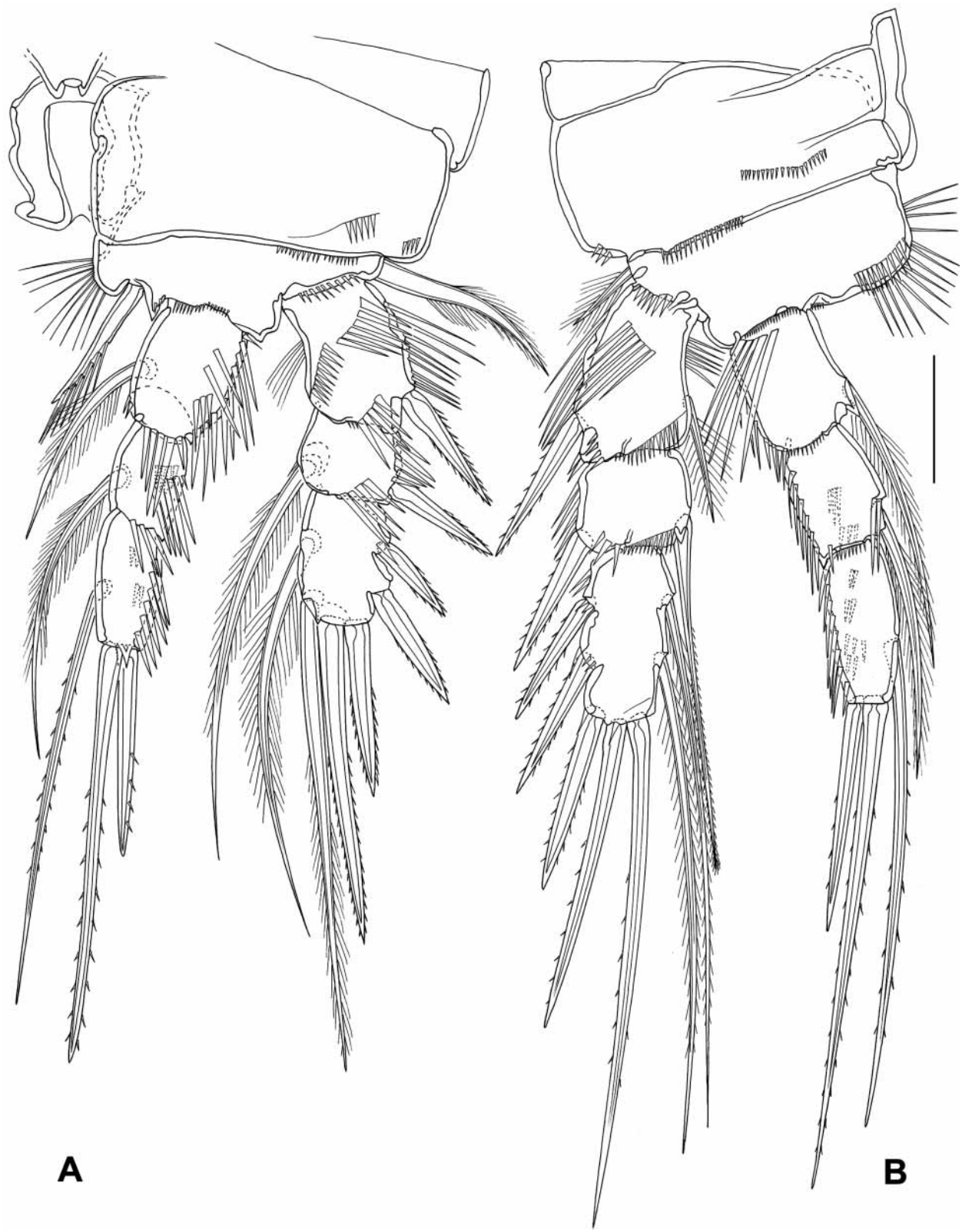

FIGURE 7. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) P1. (B) P2. Scale bar = 20 µm.

P1 (Fig. 7A): Coxa with 2 rows of setules and 1 row of spinules; basis with 1 row of spinules at base of exopod and a row of long setules at inner distal corner; endopod as long as exopod; enp-1 and enp-3 equal in length and longer than enp-2; outer edge of each segment strongly spinulose; anterior surface of enp1 and enp-2 and posterior surface of enp-2 and enp-3 with rows of spinules; exp-1 and exp-3 equal in length and

longer than exp-2; outer edge of exp-1 and exp-2 spinulose; anterior surface of exp-1 and exp-2 with rows of spinules; inner edge of exp-1 with a row of setules.

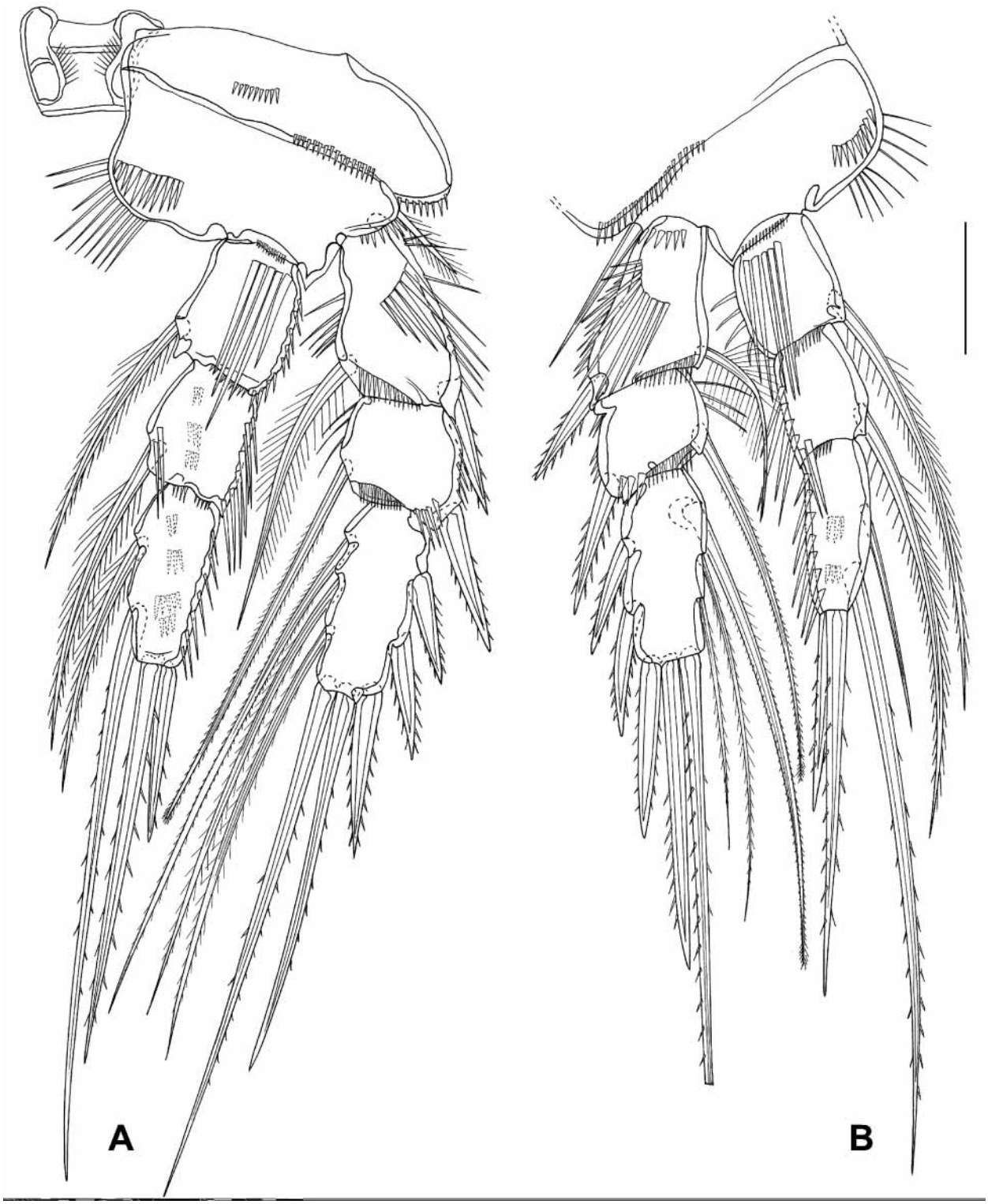

FIGURE 8. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) P3. (B) P4. Scale bar = 20 µm.

P2–P4 (Figs 7B, 8A–B): Coxa and basis with rows of spinules on anterior surface; endopod as long as exopod; enp-1 and enp-3 equal in length and longer than enp-2; enp-3 especially of P4 tapering towards the top; anterior surface of enp-1 with 1 row of strong setules; outer edge of each segment with strong spinules; posterior surface of most segments with rows of spinules; exp-1 and exp-3 equal in length and longer than

exp-2; anterior surface of exp-1 with 1 row of strong setules; outer edge of exp-1 and exp-2 spinulose; inner edge of exp-1 of P2 and P3 with a row of setules.

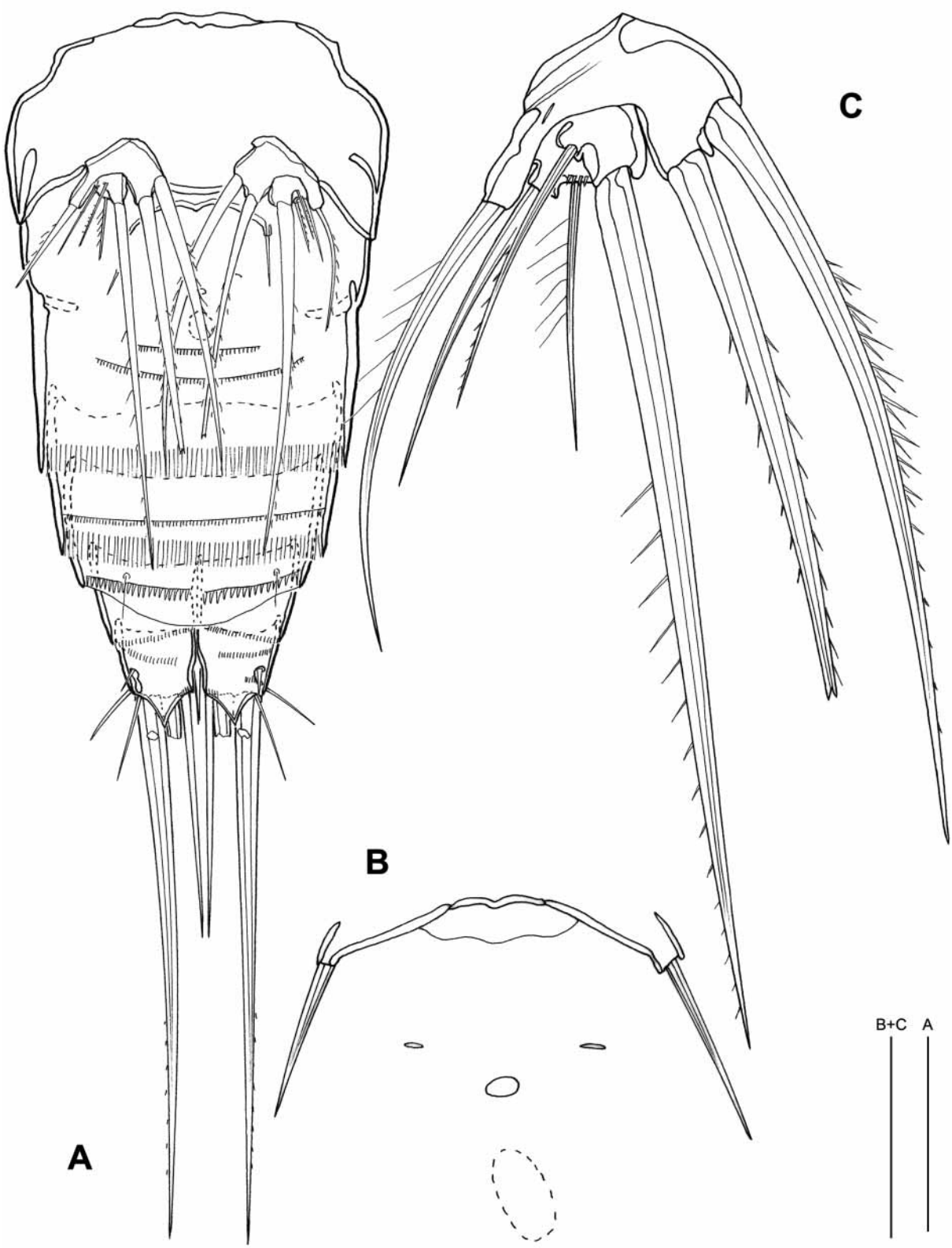

FIGURE 9. *Bradya kurtschminkei* **sp. nov.**, holotype female: (A) abdomen, ventral; (B) genital field; (C) P5. Scale bars A = 50 µm, B–C = 20 µm.

P5 (Figs 9A, C): left and right P5 separate; exp short, as long as baseoendopod; exp with 3 terminal setae and 1 surface seta, inner terminal seta longest; small spinules at base of proximal middle seta; baseoendopod

with 2 setae on inner part, inner seta longer, outer with a double tip; 1 seta and 1 pore on outer part of the baseoendopod.

P6 (Fig. 9B) with 1 seta.

Description of the male allotype. All drawings made of allotype. Antenna, mouthparts, P1–P4, labrum, and caudal rami as in female.

Body length (incl. rostrum and excl. caudal rami): 442 µm. Caudal rami: 24 µm. Maximum body width: 135 µm. Rostrum: 35 µm. Cephalothorax length (excl. rostrum): 152 µm. Spermatophore: 66 µm.

Body (Figs 10A–D, 12D) as in female, but slightly more slender, free pedigerous somites and urosome together only 1.8 times longer than cephalothorax; urosome 6-segmented, consisting of somite bearing P5 and 5 abdominal somites; fourth and fifth urosomites with a ventral row of long irregular spinules; 1 spermatophore.

Antennule (Figs 11A–E) 7-segmented and short, with geniculation between segments 5 and 6; armature formula: 1, 1, 11, 7, 12+aes / 4, 11+aes; 39 of the 47 setae unarmed, 2 unipinnate, 3 bifid and 3 developed as short spines. The characteristically formed cuticular cone of Ectinosomatidae on the 5th segment is used together with the pointed inner edge of the 5th segment as hinge for the 6th and 7th segment (Fig. 11E).

P5 (Figs 12D–E): left and right P5 fused; exopod with 3 terminal setae and 1 surface seta, inner seta longest, 2 innermost setae with a double tip; baseoendopod with 2 setae on inner part, both setae with same length, inner seta with a double tip.

P6 (Fig. 12D) asymmetrical, left P6 bigger than right one; each side with 3 setae and a row of tiny setules.

Note: The ornamentation of body, mouthparts, legs and all setae and spines is very difficult to see. A minimum magnification of 1250 times is necessary, to see traces of the setules and spinules. In no case are the rows of the setules and spinules clearly visible. Often the object of study has to be observed from different angles to discern the complete ornamentation. The lateral ornamentation of the thoracic somites could only be seen when the cuticle was removed from the body and flattened on a separate slide.

Irregularities: The endopod of the maxilliped on the other side of the body of the holotype has two lateral and three distal setae.

Variability: Body length (incl. rostrum and excl. caudal rami) of females varies between 280 and 432 µm (mean = 350 µm; n = 21). The males are 310, 315, 418, and 442 µm long (mean = 371 µm; n = 4).

The individuals of this species always have the same numbers of setae on mouthparts and legs, but the ornamentation of many setae is very variable. Compared with the holotype, the proximal seta of mandible basis (Paratype 1), the outer distal seta of maxillipedal endopod (Allotype, Paratype 1, Paratype 3), the distal spine of enp-3 of P1 (Paratype 2), and the inner seta of baseoendopod P5 of male (Paratype 2) are longer. The spinules of the enp-2 and the exp-1 seta of antenna (Paratype 1 and 3), the enp-1 seta of antenna (Female 1), the two distal setae of maxilliped (Paratype 1 and 3), and of all spines of the exopod and endopod of P1–P4 (Paratype 1, 3, 4; female 1) are longer. The setules of the setae of P2–P4 (Paratype 2) and the two setae of baseoendopod as well as the two inner setae of exopod of male P5 (Paratype 2) are longer. The spinules of the long basis seta and the outer endopodal seta of maxilliped are shorter (Female 1). The distance between spinules and setules of the spines and setae of P1–P4 is variable. The innermost seta of exp P5 of female has two rows of spinules on the outer side and the outer seta of baseoendopod has no double tip (Paratype 3). The proximal and distal setae of mandible basis are bipinnate (Paratype 1). Sometimes some additional rows of spinules are present on the first segment of antennule (Paratype 1), the exp-3 of antenna (Paratype 4), and the syncoxa of maxilliped (Paratype 1).

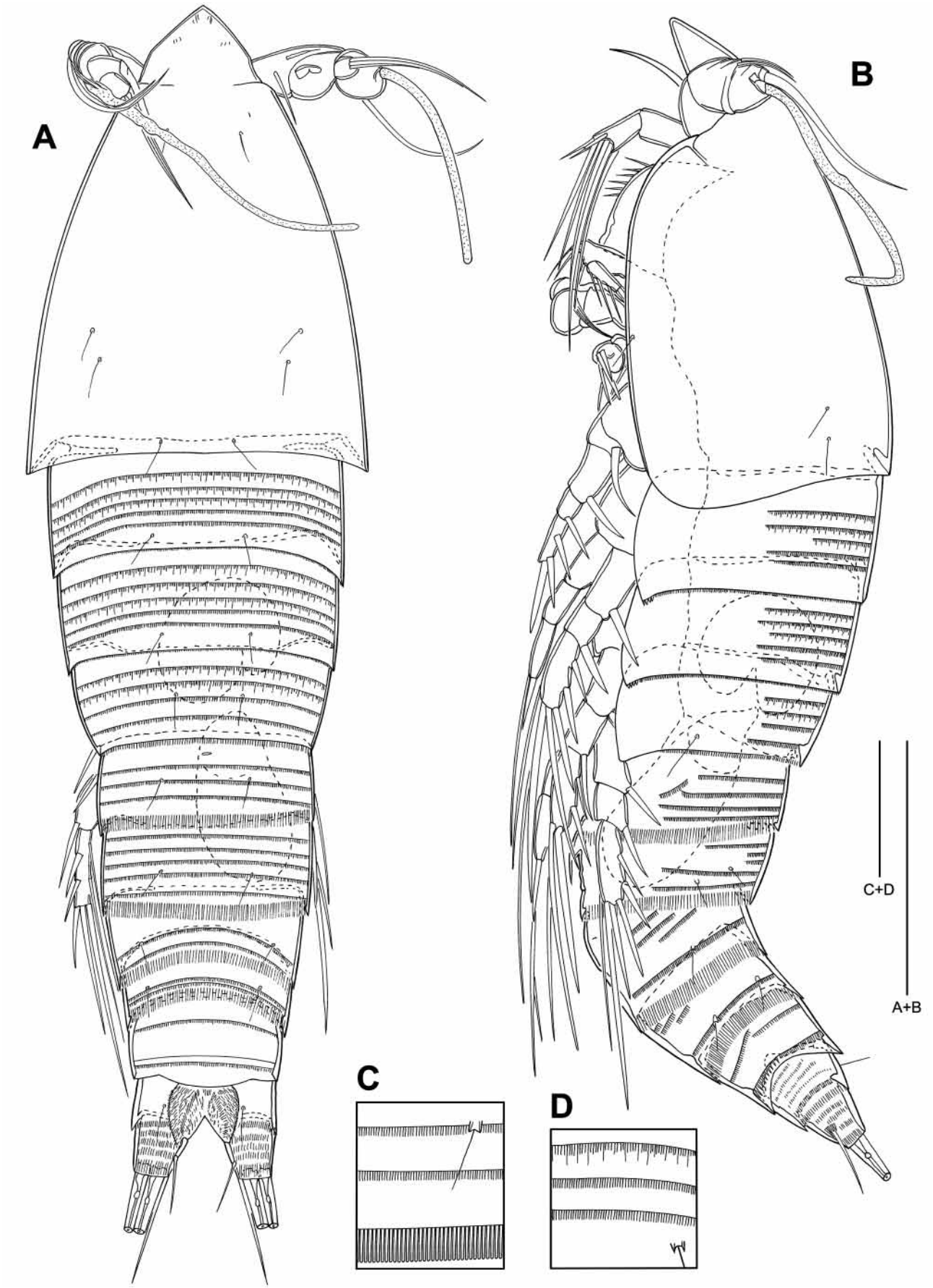

FIGURE 10. *Bradya kurtschminkei* **sp. nov.**, allotype male: (A) habitus dorsal; (B) habitus lateral, (C) detail of third free abdominal somite, dorsal; (D) detail of first free abdominal somite, dorsal. Scale bars A–B = 100 µm, C–D = 20 µm.

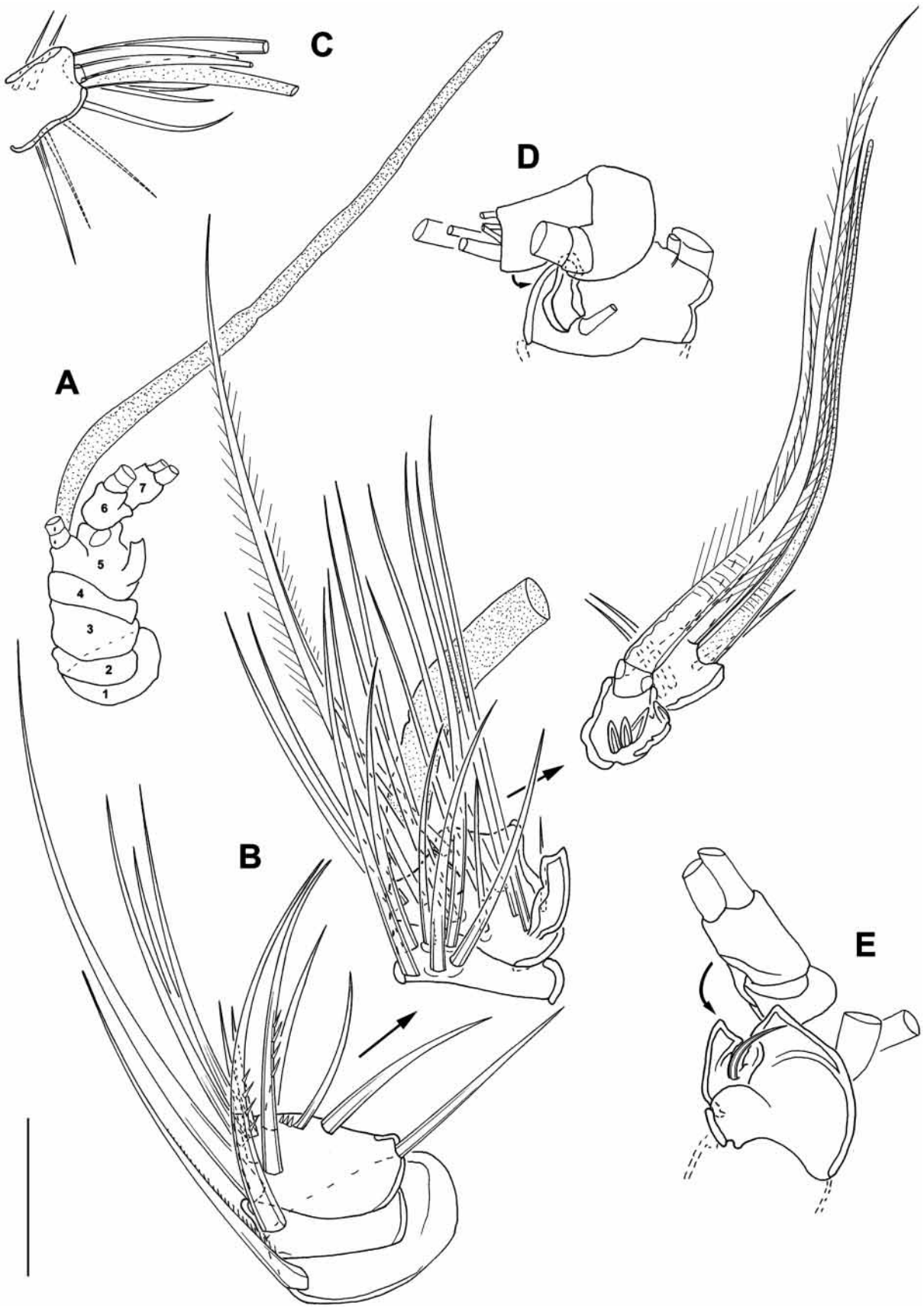

FIGURE 11. *Bradya kurtschminkei* **sp. nov.**, allotype male: (A) right antennule without setae; (B) right antennule; (C) distal segment of left antennule; (D) segments 5-7 of left antennule; (E) segments 5-7 of right antennule . Scale bar = 20 µm.

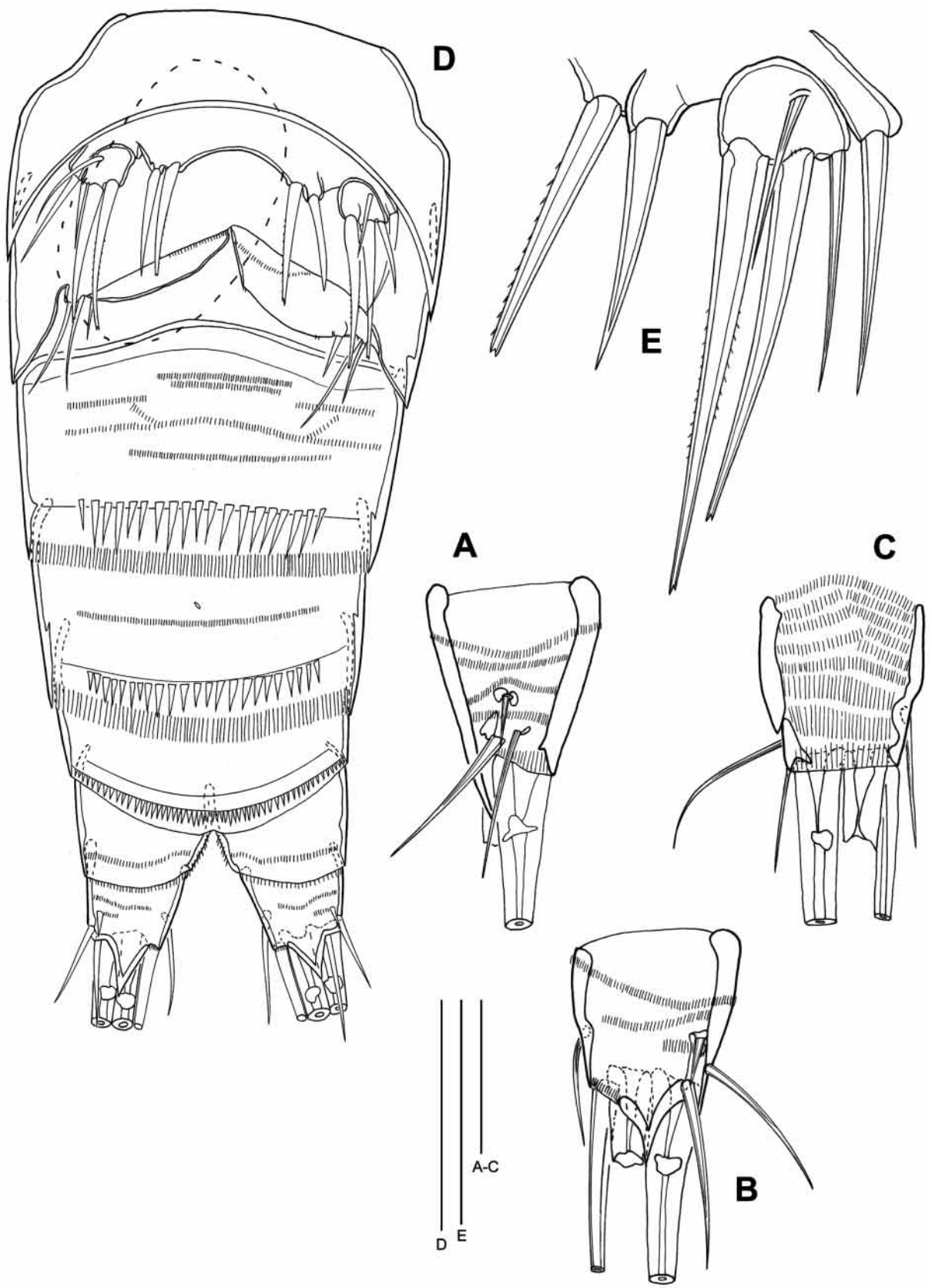

FIGURE 12. *Bradya kurtschminkei* **sp. nov.**, allotype male: (A) caudal ramus lateral; (B) caudal ramus ventral; (C) caudal ramus dorsal; (D) abdomen ventral; (E) P5. Scale bars D = 50 µm, A–C, E = 20 µm.

Discussion

Species morphology and discrimination

Bradya kurtschminkei sp. nov. is exceptional, because of many characters unknown in other *Bradya* species. *B. kurtschminkei* sp. nov. can be distinguished from its congeners by its unique habitus, as the body is slightly flattened dorso-ventrally, the female cephalothorax is almost as long as the free pedigerous somites and the urosome together. The rostrum is large, as it is a third the length of the cephalothorax and it tapers to a point. The antennule is only 5-segmented, the basis of maxillule is fused with exopod and endopod, the endopod has only four setae, the endopod of maxilla has only one large claw on the middle segment, as the claw of the proximal segment is developed as a seta, the exopod of P5 is short as it reaches only the length of the baseoendopod, and the outer seta of the baseoendopod has a double tip. Also, the armature formula of P1–P4 is exceptional; in total there are seven setae fewer on the endopods than in all other species of *Bradya*. All other *Bradya* species, for which the respective characters have been described, show the typical *Bradya* habitus: The length of the cephalothorax is no more than a third of the total body length, the body is not flattened dorso-ventrally, and the rostrum is not acute and protruding, but small and rounded at the tip. The antennule is 6- or 7-segmented (not 5-segmented), exopod and endopod of maxillule are free (not fused), the endopod of maxillule has always six setae (not four), there are at least seven setae more on the endopods of P1–P4, the exopod of P5 reaches beyond the baseoendopod, and the outer seta of the baseoendopod P5 has no double tip.

Differences between the species in some other characters such as the setation of the endopod of the mandible, the allobasis of the maxilla or the arthrite and basis of the maxillule may be explained by deficient drawings and incorrect setal numbers. The endopod of the maxilla of *B. kurtschminkei* sp. nov. is indistinctly 3-segmented, as two segments are fused anteriorly. In posterior view, the endopod is clearly 3-segmented. All described maxillar endopods of the other *Bradya* species are described as being 3-segmented. However, it is not clear, whether an anterior fusion has been overlooked.

The descriptions of all *Bradya* species are incomplete, especially the ornamentation of the body is not mentioned, restricting systematic comparisons. *B. kurtschminkei* sp. nov. shares with *B. pugiochaeta* only two endites on the syncoxa of the maxilla, all other described species of *Bradya* have three. The fused basis of the maxilliped of *B. furcata*, *B. kurtschminkei* sp. nov., *B. macrochaeta*, and *B. scotti* is narrow, 1.5 times longer than wide. In all other species the fused basis is as long as wide or only slightly longer. In *B. congera*, *B. kurtschminkei* sp. nov., *B. minutiseta*, and *B. typica*, the terminal inner seta of the exopod of female P5 is the longest. In all other species either the middle seta is the longest or the two innermost setae have the same length. The inner seta of the baseoendopod of female P5 is nearly as long as the outer one in *B. furcata*, *B. kurtschminkei* sp. nov., and *B. proxima*, whereas the inner seta of all other species is (much) longer than the outer one. *B. congera*, *B. kurtschminkei* sp. nov., *B. minutiseta*, *B. proxima*, and *B. theodori* have caudal rami as long as wide, they are longer than wide in other species.

B. kurtschminkei sp. nov. belongs to *Bradya*, because the endopod of the maxilliped is fused to the basis at an angle (Seifried *et al*. 2007). Although fusion of maxillipedal basis and endopod has been reported for species of *Parabradya*, these observations are in error; the endopod is distinct in all *Parabradya* species (Seifried *et al*. 2007). The distinct exopod of P5 used by Lang (1944) to characterize *Bradya* is not an autapomorphy of *Bradya*, it is a plesiomorphic character within Ectinosomatidae. *B. kurtschminkei* sp. nov. is a species within *Bradya* with many derived character states. However, to erect a new genus it would mean to leave a paraphyletic *Bradya* behind.

Groundpattern of Ectinosomatidae

The groundpattern of Ectinosomatidae was reconstructed by Seifried (2003). Additional characters were added by Seifried *et al.* (2007), some more can be derived from the morphology of *B. kurtschminkei* sp. nov.. The female antennule has an armature formula of 1, 11, 14+aes, 3, 7+aes; this means one seta more on the sec-

ond segment and three setae more on the third than reconstructed in Seifried (2003) for the groundpattern of Ectinosomatidae. Thus, the armature formula of the 7-segmented female antennule in the groundpattern of Ectinosomatidae is 1, 11, 14+aes, 3, 3, 4, 7+aes. The male antennule of *B. kurtschminkei* sp. nov. has an armature formula of 1, 1, 11, 7, 12+aes / 4, 11+aes. Therefore the groundpattern of the 7-segmented male antennule of Ectinosomatidae is 1, 1, 11, 9, 12+aes / 4, 11+aes, as there are two setae more on the fifth, three on the sixth and five on the seventh segment.

Variability of deep-sea Harpacticoida

The body length of *B. kurtschminkei* sp. nov. is variable compared to species of Harpacticoida, as the smallest female in the samples (280 µm) is 35% smaller than the largest (432 µm). *Parabradya samsoni* and other as yet undescribed harpacticoid species from the Angola Basin show similar variability in body length (Seifried *et al*. 2007), which let us assume that this could be a common phenomenon in the deep sea.

B. kurtschminkei sp. nov. shows a remarkable morphological variability as compared with species known from shallow waters. The setae can differ in length between individuals and they are sometimes with and sometimes without ornamentation. The spinules of the setae and the body ornamentation can be more or less developed, the setules of the setae and the body ornamentation can vary in length, and the distance between spinules and setules of spines and setae can vary. Sometimes, there are some additional rows of spinules or setules on the mouthparts, legs or the body. The individuals of the species show the whole spectrum of character combinations. For example, the holotype of *B. kurtschminkei* sp. nov. from the Angola Basin has the greatest number of unarmed setae, the smallest number of rows of spinules or setules, and the thinnest spinules and shortest spinules and setules. Paratype 1 from the Angola Basin in almost every detail has the longest and the greatest number of ornamentations on the setae of mouthparts, legs and body. All other 28 males and females from the different deep-sea basins show an intermediate condition between the holotype and paratype 1. The variability of individuals from the Angola-Basin display more variability than these from the other sampling locations together (Guinea Basins, Cape Basins, Porcupine Abyssal Plain). The variability is gradual, all combinations of morphology exist and there appears to be a continuous grade between the holotype and the paratype 1.

Individuals of *B. kurtschminkei* sp. nov. always have the same number of setae on mouthparts and legs; however, these numbers are variable in some undescribed species of *Bradya*. Even the segment number can vary, especially that of the endopods of the legs of some species. Similar variability has hitherto not been recorded for deep-sea copepod species, probably because most descriptions have been made on the basis of one or two individuals only. Deep-sea collections with several individuals per species are rare because of the high abyssal alpha-diversity and the high costs originated by replicative sampling designs. However, not all deep-sea species of Harpacticoida show such an unusual variability. Many species are morphologically constant, as for example *Parabradya samsoni* (Seifried *et al.* 2007).

Another phenomenon that seems to be more common the deep sea than than in shallow waters is the occurrence of contralateral variability (asymmetrical development) on single specimens. The holotype of *B. kurtschminkei* sp. nov., for example has two distal setae on one side of the maxillipedal endopod and three on the other. In some other specimens observed by us setal numbers and even segment numbers may differ between right and left side of one leg-pair, and sometimes this is also the case on the mouthparts.

Distribution

B. kurtschminkei sp. nov. occurs in the Guinea Basin (DIVA 2), the Angola Basin (DIVA 1), the Cape Basin (DIVA 2), and the Porcupine Abyssal Plain (RRS ‘‘Challenger’’ cruise 111; Fig. 13), but is absent from any of the numerous samples we have from the Antarctic deep sea (ANDEEP).

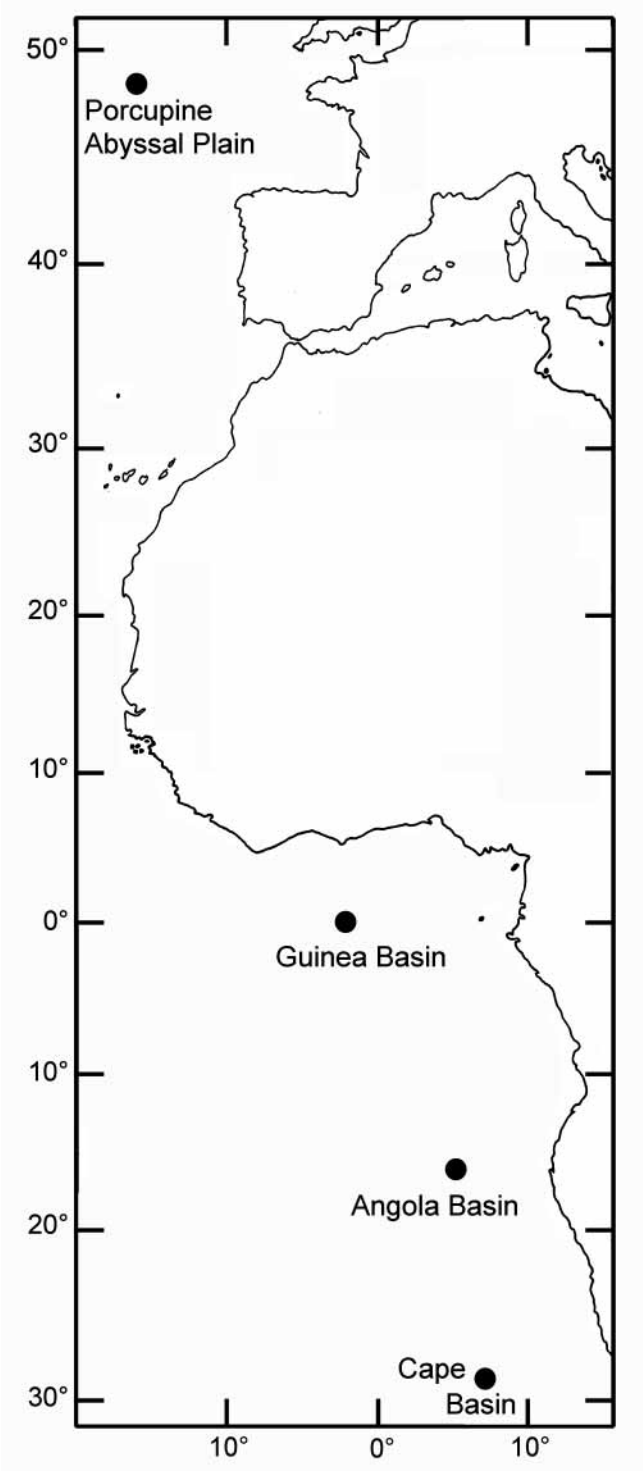

FIGURE 13. Distribution of *Bradya kurtschminkei* **sp. nov.**

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