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Iboyella, a new genus of epacteriscid copepod (Copepoda: Calanoida: Epacteriscidae) from Cuba

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Abstract

A new genus of Epacteriscidae is described from a single female of a new species, *Iboyella cubensis* gen. et sp. nov., collected in an anchialine cave on Cuba. This is the second genus in the family described from Cuba. The new genus belongs in the subfamily Epacteriscinae and is distinguished from related genera by a mosaic of setation characters relating both to the mouthparts and to swimming legs 1 to 5. The combination of the lack of an inner seta on the first exopodal segment of the female fifth leg with the retention of a single seta on the mandibular basis is shared only with *Gloinella*. The new genus has a much reduced rostrum compared with that of *Gloinella*, and there are differences in maxillulary and maxillipedal setation.

Key words: taxonomy, copepods, anchialine caves, new genus, Cuba

Introduction

The family Epacteriscidae was established by Fosshagen in 1973 to accommodate a new monotypic genus of calanoid, *Epacteriscus* Fosshagen, 1973, taken in bottom dredges and coral rubble washings in Florida and Colombia (Fosshagen 1973). The family remained monotypic until 1984 when a second genus, *Enantiosis*, was described by Barr, based on a single species taken from a cave on San Salvador Island in the Bahamas. Barr (1984) also reported that an undescribed *Epacteriscus* and four females of *Enantiosis* had been collected using emergence traps during a study of coral reef associated zooplankton at Quezon in the Philippines by Walter et al. (1982; see also Walter 1986). This material remains undescribed. A third genus, the extremely plesiomorphic *Erebonectes*, was established by Fosshagen & Iliffe (1985) for a new species found in a cave on Bermuda, and the same authors (Fosshagen & Iliffe 1994) described a second species of *Erebonectes* from material collected in a cave on the Caicos Islands. The latter species was considered to be the type of a fourth distinct genus, *Erebonectoides*, by Fosshagen et al. (2001) who described another eight new genera and 16 new species in the same paper. One further genus, *Bunderia*, described by Jaume & Humphreys in 2001 brings the total of named taxa in this family to 13 genera and 21 species.

A new genus is established here for a single female collected in a cave located on the southern coast of Cuba. This is the second epacteriscid reported from Cuba; *Gloinella yagerae* Fosshagen, Boxshall & Iliffe, 2001 is already known from a nearby anchialine cave, Cueva de los Carboneros close to Playa Girón (Fosshagen et al. 2001), and it raises to 16 the number of species belonging to this family known from Bermuda and the Caribbean region.

Materials and methods

The copepod studied was collected in El Brinco, an anchialine cave near the town of Playa Girón, Matanzas Province, Cuba. Material was collected by scuba-diving using a hand-held net.

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Drawings were prepared using a camera lucida on a Leitz Diaplan microscope equipped with differential interference contrast. Terminology used in descriptions follows Huys & Boxshall (1991).

Descriptions

Subclass Copepoda H. Milne Edwards, 1830
Order Calanoida G. O. Sars, 1903
Family Epacteriscidae Fosshagen, 1973
Subfamily Epacteriscinae Fosshagen, Boxshall & Iliffe, 2001

Iboyella, new genus

Diagnosis. Body with first pedigerous somite completely separate from cephalosome. Urosome 4-segmented in female; genital double-somite slightly produced ventrally. Caudal rami symmetrical, caudal setae asymmetrical with inner setular tuft on seta VI on left side only; seta I lacking. Rostrum weakly developed, a broad plate bearing pair of short, thick subapical filaments; rostral windows absent. Female antennule 23-segmented, with failure to express articulations between ancestral segments II–IV, X–XI (partially expressed), and XXVI–XXVIII; segments II, VIII, XIX, XX, XXII to XXV all lacking aesthetascs; most setae on segments I to V modified, flattened proximally and with filament-like distal portion. Antenna with endopod markedly shorter than exopod; proximal endopodal segment shorter than distal. Labrum broad, globular, with sclerotized dentate distal margin. Mandible directed ventrally, with coxal gnathobase cutting edge bearing large, bifid, ventralmost tooth; palp biramous with basis carrying single seta; endopod with incorporated proximal segment and free distal segment; exopod 5-segmented. Maxillule lacking outer basal seta, with unsegmented endopod clearly separated from basis. Maxilla with syncoxa; basis about twice as long as wide; endopod with 11 setae, 4 carried on prominent proximal endite; 4 of the distal endopodal setae stout, with spinous margin. Maxilliped well developed, slender, with endopodal segment I partly incorporated into basis; segment VI minute, offset from segment V. Leg 1 with distal spine on outer margin of third exopodal segment flagellate. Legs 3 and 4 with 3 outer spines on third exopodal segment. Female fifth legs unmodified, with 3-segmented rami, lacking inner seta on first exopodal segment and with 3 outer spines on third exopodal segment. Legs 1 to 4 lacking outer basal seta.

Type species. *Iboyella cubensis* gen. et sp. nov., by original designation and monotypy.

Etymology. The generic name refers to the acronym IBOY, for the International Biodiversity Observation Year, an initiative of DIVERSITAS, which has done so much to help promote the work on anchialine habitats carried out by its component project "Exploration and Conservation of Anchialine Faunas".

Iboyella cubensis, new species (Figs. 1–4)

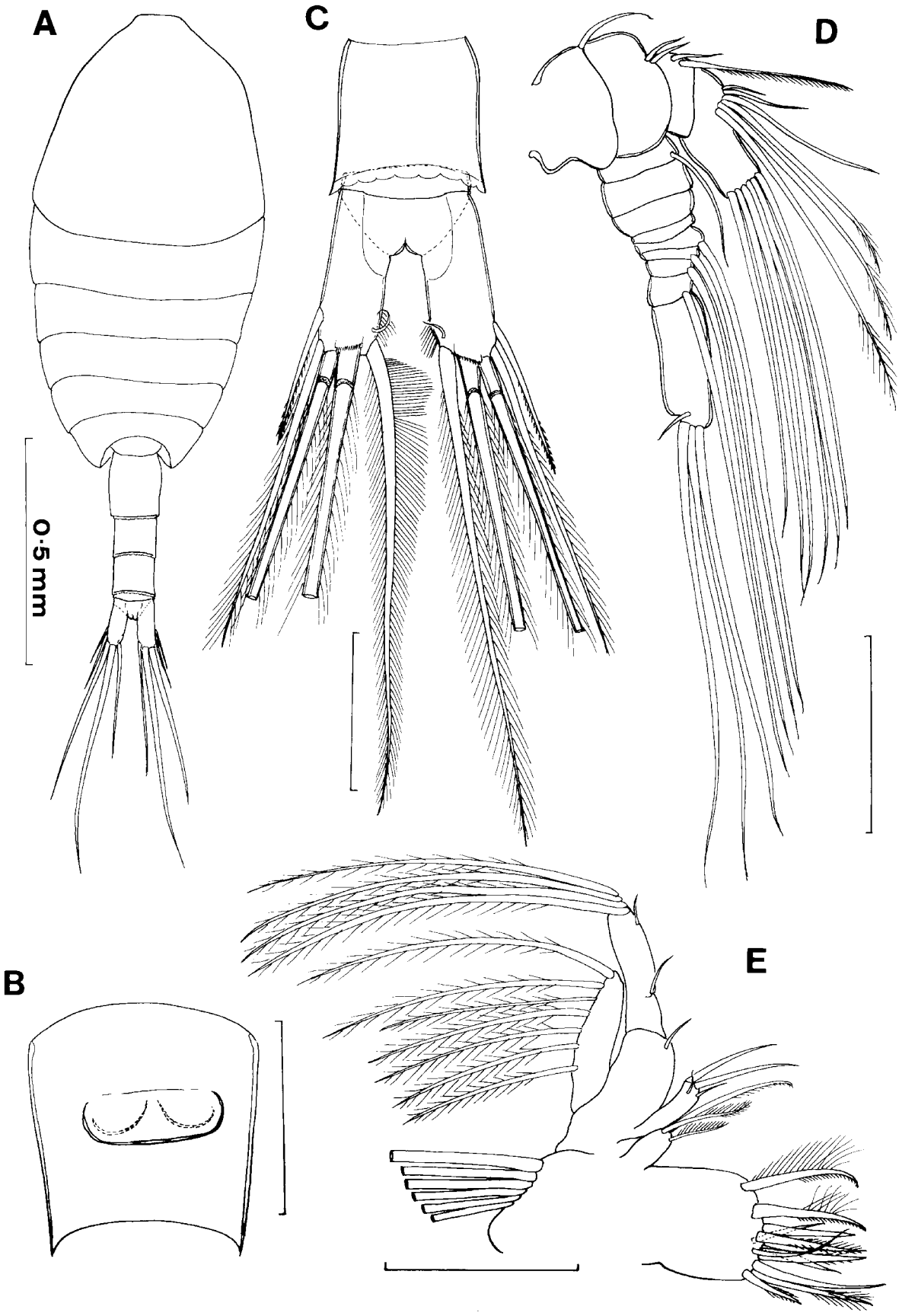
Type material. Holotype female prosome preserved in alcohol, remaining body parts dissected on 5 glass slides, permanently mounted in lactophenol, sealed with nail varnish. All holotype parts deposited in The Natural History Museum, London, Registration Number BMNH 2002.995. Type locality: El Brinco, Playa Girón, Matanzas Province, Cuba; collected by J. Ormeroid on 28 June 1994.

Description of female. Body (Fig. 1A), with broad prosome and slender urosome; body length of holotype female 1.41 mm; length ratio of prosome to urosome 2.3:1. Prosome oval in dorsal aspect, comprising cephalosome plus 5 free pedigerous somites; prosomal somites with evenly rounded posterolateral margins. Rostrum (Fig. 4A) weakly developed, forming broad shallow plate with large rostral filaments located subdistally at each outer corner; rostral windows lacking. Nauplius eye absent.

Urosome 4-segmented. Genital double-somite slightly produced ventrally, hyaline frill along posterodorsal margin only; genital operculum located medially about middistance along ventral surface of double-somite (Fig. 1B); paired, crescent-shaped gonoporal slits visible internally. Free abdominal somites with hyaline frill on posterior margins. Anal somite extremely short and almost completely concealed by telescoping within preceding somite; anal operculum lacking. Caudal rami (Fig. 1C) symmetrical, about 2.8 times longer than wide, with patch of setules distally on inner margin; caudal seta VI asymmetrical, with setular tuft present proximally on inner margin of seta on left ramus; seta I absent; seta II almost as long as ramus. Relative lengths of setae as in Fig. 1A.

Antennules (Fig. 2A–B) 23-segmented, extending beyond posterior margin of cephalosome; articulations between ancestral segments II to IV, and XXVII–XXVIII, not expressed; those between segments X–XI and segments XXVI and XXVII–XXVIII partially expressed. Segmentation pattern and armature as follows: segment 1 (corresponding to ancestral segment I): 1 seta + aes-

Fig. 1. *Iboyella cubensis* gen. et sp. nov., holotype female. **A**. Body, dorsal aspect. **B**. Genital double-somite, ventral. **C**. Detail of third and fourth (= anal) abdominal somites and caudal rami, dorsal. **D**. Antenna. **E**. Maxillule. Scale bars 100 µm, unless otherwise stated.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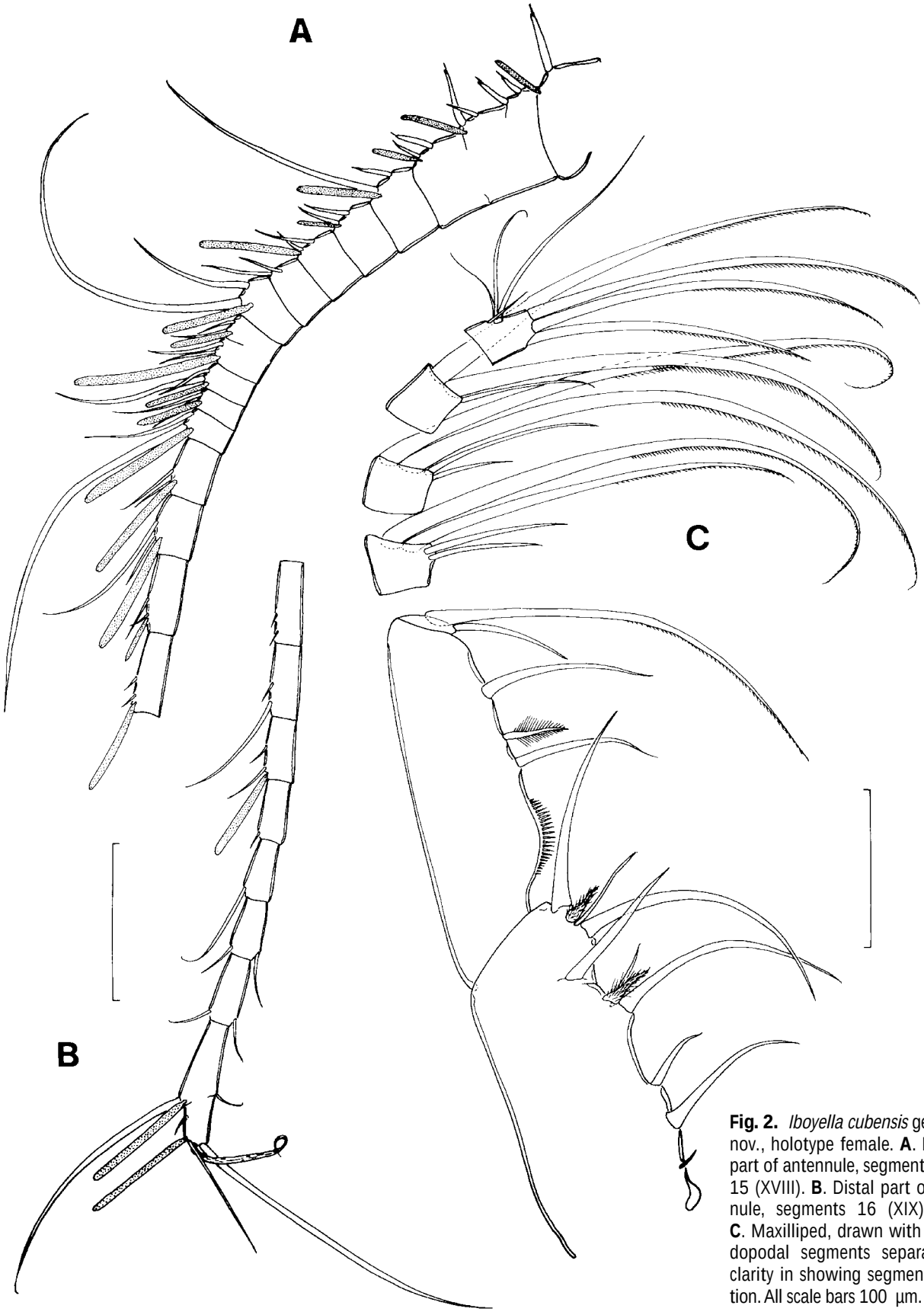

Fig. 2. *Iboyella cubensis* gen. et sp. nov., holotype female. **A**. Proximal part of antennule, segments 1 (I) to 15 (XVIII). **B**. Distal part of antennule, segments 16 (XIX) to tip. **C**. Maxilliped, drawn with free endopodal segments separated for clarity in showing segmental setation. All scale bars 100 μm.

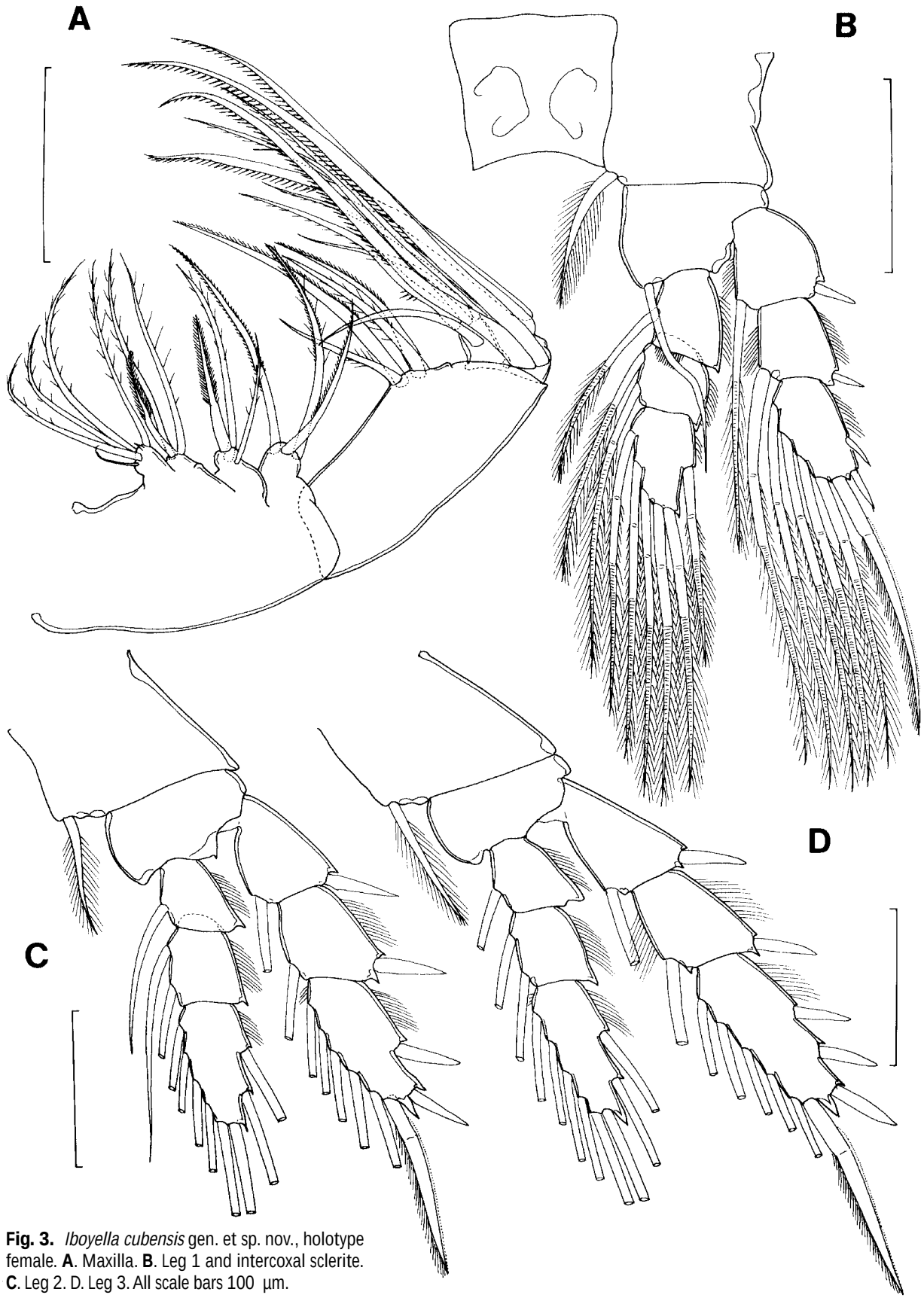

Fig. 3. *Iboyella cubensis* gen. et sp. nov., holotype female. **A**. Maxilla. **B**. Leg 1 and intercoxal sclerite. **C**. Leg 2. D. Leg 3. All scale bars 100 μm.

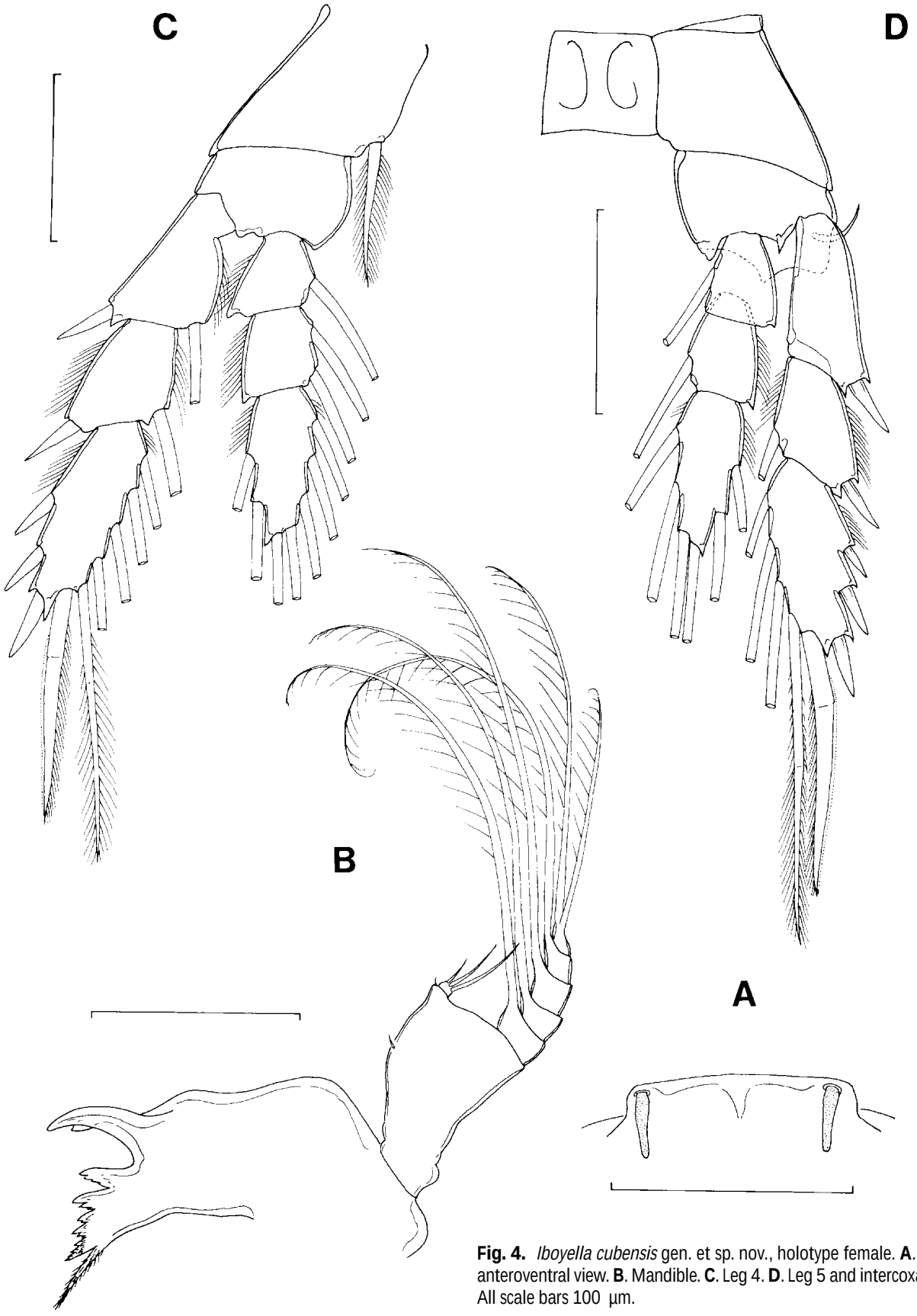

Fig. 4. *Iboyella cubensis* gen. et sp. nov., holotype female. **A**. Rostrum, anteroventral view. **B**. Mandible. **C**. Leg 4. **D**. Leg 5 and intercoxal sclerite. All scale bars 100 µm.

thetasc; segment 2 (ancestral II–IV): 6 + 2 ae; segments 3 to 5 (ancestral V to VII): 2 + ae each; segment 6 (ancestral VIII): 2 setae; segment 7 (ancestral IX): 2 + ae; segment 8 (X–XI): 4 + 2 ae; segments 9 to 15 (XII to XVIII): 2 + ae each; segments 16 and 17 (XIX and XX): 2 setae each; segment 18 (XXI): 2 + ae; segments 19 and 20 (XXII and XXIII): 1 seta each; segments 21 and 22 (XXIV and XXV): 1 + 1 setae each; segment 23 (XXVI–XXVIII): 6 + 2 ae. Setae on segments 1 to 3 (I to V) modified, flattened proximally and with thinner, filament-like distal portion; degree of modification of setae decreasing progressively from segment 1 to 3. Distal setae on segments 3 (V), 7 (IX) and 11 (XIV) very long.

Antenna (Fig. 1D) biramous, with exopod markedly longer than endopod; coxa and basis separate, coxa with 1 seta, basis with 2 setae. Exopod distinctly 9-segmented but proximal segments not completely defined on all surfaces, implanted on pedestal; setal formula: 1,0,0,0,1,1,1,1,(1 + 3). Endopod 2-segmented, proximal segment markedly shorter than compound distal segment; setal formula 2, (6 + 6).

Labrum broad, rounded, with surface ornamentation of spinules and setules; free distal margin dentate. Paragnaths not observed.

Mandible strongly developed, with coxal gnathobase cutting edge (Fig. 4B) bearing large, sharp, bicuspidate ventralmost tooth, row of 5 multicuspidate subsimilar teeth, plus pinnate dorsalmost seta; row of short spinules located subdistally, close to tooth row. Mandibular palp biramous, with large basis bearing single minute seta about midway along medial margin; endopod with proximal segment incorporated into basis, bearing single tiny seta; distal segment with 3 unequal setae. Exopod 5-segmented, setal formula 1,1,1,1,2.

Maxillule (Fig. 1E) with well-developed praecoxal arthrite bearing 11 marginal spines distally, ornamented as figured. Coxal epipodite with row of 6 long setae; coxal endite with 3 unequal setae. Outer basal seta lacking; proximal basal endite well developed, elongate, with 2 long and 2 short setae; distal basal endite represented by single seta. Exopod unsegmented, long and slender, armed with 7 sparsely plumose setae. Endopod elongate, unsegmented, setal formula 1 + 1 + 4.

Maxilla (Fig. 3A) 4-segmented, robust, raptorial. Praecoxa and coxa completely incorporated, forming syncoxa; proximal 2 endites derived from praecoxa partly fused, enditic armature formula 5 + short spine, 3, 3, 3; ornamentation of enditic setae as figured. Basis elongate, about as long as syncoxa, rectangular (about twice as long as wide), with 4 unequal setae ornamented as figured, positioned distally on inner margin. Endopod highly condensed, proximal well defined endite derived from ancestral segment I, armed with 4 setae, distal part of endopod armed with 7 setae, 4 of these strongly developed with spinulate inner margins.

Maxilliped (Fig. 2C) 7-segmented, powerfully developed, raptorial. Syncoxal endites hardly developed, setal formula 1,2,4,4; shortest seta on 2 distal endites short and hirsute; other setae ornamented as figured. Basis about as long as syncoxa, with 3 unequal setae, 1 brush-like, plus marginal row of spinules proximally on inner margin; first endopodal segment partially incorporated into basis, bearing 2 unequal setae. Free endopod 5-segmented; setal formula 4, 4, 3, 3 + 1, 3; apical segment minute, offset on distal margin of subapical segment; setal ornamentation as figured.

Legs 1 to 5 (Figs 3B–D; 4C, D) symmetrical, unmodified, biramous, both rami 3-segmented. Spine and seta formulae as follows:

	Coxa	Basis	Exopodal segment			Endopodal segment		
Leg 1	0–1	0–1	I–1;	I–1;	II,1,4	0–1;	0–2;	1,2,3
Leg 2	0–1	0–0	I–1;	I–1;	II,I,5	0–1;	0–2;	2,2,4
Leg 3	0–1	0–0	I–1;	I–1;	III,I,5	0–1;	0–2;	2,2,4
Leg 4	0–1	0–0	I–1;	I–1;	III,I,5	0–1;	0–2;	2,2,3
Leg 5	0–0	1–0	I–0;	I–1;	III,I,4	0–1;	0–1;	2,2,2

Leg 1 (Fig. 3B) with small exopodal spines, distalmost bearing subterminal flagelliform process; distal seta on exopod with outer margin fringed with hyaline frill, inner margin plumose. Inner basal seta located anteriorly, with posterior surface brush-like. Legs 2 to 4 (Figs 3C, D; 4C) each with distal exopodal spine with outer margin fringed with hyaline frill, inner margin plumose; rest of exopodal spines with hyaline frill along both margins. Margins of ramal segments ornamented with setule rows as figured.

Leg 5 (Fig. 4D), distal spine on exopod of leg 5 roughly S-shaped, with tip bent towards outer side; outer margin of spine pinnate, inner margin plumose; remaining exopodal spines apparently lacking hyaline frill. First exopodal segment of leg 5 lacking inner seta.

Etymology. The specific name refers to the island of Cuba where the new species was found.

Discussion

The new genus, known from the female only, presents an interesting mosaic of apomorphic character states shared with other epacteriscid genera. For example, the loss of the inner seta from the first exopodal segment of the female fifth leg is shared only with *Epacteriscus* and *Gloinella*, the extreme reduction in the length of the antennary endopod relative to the exopod with *Oinella* Fosshagen, Boxshall & Iliffe, 2001, *Bofuriella* Fosshagen, Boxshall & Iliffe, 2001, *Bomburiella* Fosshagen, Boxshall & Iliffe, 2001, and *Edaxiella* Fosshagen, Boxshall & Iliffe, 2001, and the presence of just a single seta on the basis of the mandibular palp with *Gloinella*.

Interpreting the phylogenetic relationships of the new genus will require a full parsimony-based analysis, but this would be premature without knowledge of the male character states since the many important differential characters at generic level are based on the morphology of the male fifth legs (Jaume & Humphreys 2001).

Using the key to genera of Fosshagen et al. (2001), the new genus keys out at the couplet differentiating *Enantronia* Fosshagen, Boxshall & Iliffe, 2001 from *Enantiosis*. It has several synapomorphies with these two genera, including the presence of modified setae on the proximal segments of the female antennule, the setation of the maxillulary rami, the presence of 3 setae on a single free endopodal segment on the mandibular palp, and the setal tuft on seta VI on the left caudal ramus only. The new genus can be distinguished from *Enantronia* by differences in the anal somite, which is extremely reduced and concealed in the new genus but well developed in *Enantronia*, and in the reduction of the antennary endopod, which is well developed in *Enantronia*. Other differences between *Enantronia* and the new genus include the setation of the antennary endopod and the number of setae on the proximal praecoxal endite of the maxilla.

The new genus resembles *Enantiosis* in sharing the apomorphic extreme reduction of the anal somite and in the antennary endopod being markedly shorter than the exopod. It can be distinguished by the retention of the following relative plesiomorphies: 3 and 4 setae, respectively, on the coxal and proximal basal endites of the maxillule (2 + 1 in *Enantiosis*), 6 + 6 setae on the compound distal segment of the antennary endopod (3 + 6 in *Enantiosis*), 1 seta on the mandibular basis (0 in *Enantiosis*), and 5 setae plus a spinule on the proximal maxillary endite (4 setae in *Enantiosis*), in combination with the apomorphic loss of the inner seta on the first exopodal segment of the female fifth leg (present in *Enantiosis*) and the loss of the outer basal seta on both legs 3 and 4 (present in *Enantiosis*).

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