



## ***Boeckella antiqua* n. sp. (Copepoda, Calanoida, Centropagidae) from Patagonia**

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### **Abstract**

*Boeckella antiqua* n. sp. from samples collected in an ephemeral pond on the Patagonian plateau is described and illustrated. Diagnostic features of *B. antiqua* are almost exclusively related to the male fifth pair of legs, females being almost indistinguishable from those of the closely related *B. poppei*. The two-segmented, spine-bearing left endopod of the male fifth leg suggests that it may be the basal species in the genus.

**Abbreviations:** A1 – first antenna; A2 – second antenna; Mn – mandible; Mx1 – first maxilla; Mx2 – second maxilla; Mxp – maxilliped; P1–P5 – swimming legs 1–5; Pr – prosome; Cph – cephalosome; Th1–5 – thoracic segments 1–5; Ur – urosome; Ur1–Ur5 – urosome segments 1–5; CR – caudal rami; B1–B2 – basipods; Re – exopod; Re1–Re3 – exopod segments 1–3; Ri – endopod; Ri1–Ri3 – endopod segments 1–3

### **Introduction**

The genus *Boeckella* of South America has been recently reviewed by Bayly (1992). However, the knowledge on this genus is still incomplete and new species have been described (Menu-Marque & Zúñiga, 1994) or species identities clarified (Locascio de Mitrovich & Menu-Marque, 1997). While one of the authors was performing experiments with specimens of *Boeckella* presumed to be *B. poppei* (Mrázek), collected from a temporary pond in the Patagonian plateau, dissections were made to confirm their identity. Males' P5 appeared to be different in structure and armature, while females could not be distinguished from the former species. In this paper, we describe a new species of the genus *Boeckella* from a temporary pond of the Patagonian steppe.

### **Methods**

Specimens studied come from Laguna los Juncos, a small, temporary lake on the Patagonian steppe, close to Perito Moreno, province of Rio Negro, Argentina, at 41° 04' S, 71° 00' W. Samples were obtained by M. C. Diéguez and E. G. Balseiro making horizontal trawls with a 55 µm mesh plankton net.

Specimens were fixed in sugar-formalin, for dissections they were washed and preserved in 5% formalin. Some specimens were cleared with lactic acid and others stained with Chlorazol Black E. To observe, draw and measure whole specimens, thick, transitory slides were prepared in order to avoid distortion. Permanent slides of dissections deposited were made with polyvinyl-lactophenol. The present description is compared with the detailed redescription of *B. poppei* made by Paggi (1983), that of *B. gibbosa* (Brehm) by Locascio de Mitrovich & Menu-Marque (1997) and the original description of *B. diamantina* Menu-Marque & Zúñiga (1994).

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*Boeckella antiqua* n. sp**Material**

Type specimens are deposited at Museo Argentino de Ciencias Naturales (MACN) Bernardino Rivadavia, Buenos Aires, Colección División Invertebrados. Holotype, male MACN No 34098, Allotype, female MACN No 34099, Paratypes 5 males MACN No 34100, 5 females No 34101, all alcohol preserved. Dissected paratypes 1 male MACN No 34103 and 1 female MACN No 34102, one slide each.

**Description***Male (Figure 1a,b)*

Total length 1.89 mm ( $n=11$ ; max.=2.17 mm; min.=1.65 mm) excluding CR setae. A robust *Boeckella* whose Pr comprises 68% of total length, including Cph (32% T.L.) and next 5 segments clearly divided. Pr widest at Th2,  $1.94\times$  width. Short rounded prosomal wings surpassing the suture between Ur1 and Ur2, with tips bearing sensilla, other sensory pores are distributed as illustrated (Figure 1c). Ur (Figure 1d) with 5 segments and CR, their relative lengths are 18.5:13.5:13:14:21:20=100; CR subrectangular,  $1.6\times$  width, with hairy inner margins. Five unevenly plumose CR setae of which the central medial one is the longest,  $2.2\times$  CR length. The dorsal seta is naked and is bent almost halfway, the basal fifth is dark, followed by a hyaline midpiece bearing the whip shaped end.

Right A1 (Figure 1e) is 22-segmented, barely reaching the suture between the two last prosomal segments, even when fully extended. Each segment bears an aesthetasc save 4, 6, 8, 10, 17, 18, 20 and 21. Most segments bear 2 setae, except 2 which bears 3, 1 and 6 that carry only one, 20 showing 4 and 22 ending in a tuft of 5 setae. Segments 8, 10 and 11 bear a stout spine each while the one on 12 is smaller. Lamellae are present one each on segments 17 and 18 and two on 19.

Left A1 (Figure 1f) is 25-segmented, not much longer than the right one. Aesthetascs are present on segments 1, 2, 3, 5, 7, 9, 11, 12, 14, 16, 19 and 25. Segments have two setae each except 1, 6 and 13 bearing only one, 17 carrying 3 and 25 with 5. A short spine is present on 8 and 12.

A2 (Figure 1g) with globose B1 and B2 distinctly segmented, bearing 1 and 2 setae respectively on the inner distal corner. Ri 3-segmented, following the typical 2, 9, 7 setae distribution pattern. The single row of spines on the distal half of Ri1 is straight; a patch of spinules is present on the inner distal corner of Ri3. Re is made up of 9 segments of which 2 and 3 are incompletely separated on the external rim; the setae on the inner margin of Re increase in length distally and are inserted one on each of the first 8 segments, the ninth bearing a short seta midway on the inner margin and 3 very long ones at the tip. Mn (Figure 2a) with structure and setation as in *B. poppei* and *B. gibbosa* but with fewer spines, a sparse patch on B2 between both branches and a few small ones on the distal half of the external border of Ri2, although some specimens show two curved rows of spines as in *B. gibbosa*.

Mx1 (Figure 2b) shows in some specimens a remarkable degree of segmentation, preserving the divisions at the base of Ri and among its 3 segments, the two basal ones being fused in most specimens. Gnato-base bearing 9 strong spinulated spines and 5 naked setae, external lobe with usual 9 plumose setae, with a basal comb of teeth located on the praecoxa; coxa with naked external seta, coxal endites with 4 setae each, basis with 5; 3 segments can be distinguished in Ri, bearing 2, 2 and 5 setae; Re carrying 8 setae.

Mx2 (Figure 2c) with the first four endites bearing long spinulated marginal setae and shorter submarginal ones: 3+3, 2+1, 2+1, 2+1. Corresponding to the allobasis, the fifth endite bears 2 long spinulated setae and a shorter curved one, not claw-like or particularly stronger than the rest, followed by a rounded lobe which carries an excentric long setae. Ri imperfectly segmented, 4 segments bearing a long setae each, the 2 last accompanied by a shorter submarginal seta.

Mxp (Figure 2d) structure and setation is similar to that of *B. diamantina*. B2 shows a conspicuous submarginal row of teeth close to the inner margin which bears long hairs on its proximal half. It differs from Paggi's (1983) description and illustration of Antarctic specimens of *B. poppei*, but material assigned to this species from Laguna Súnica in Patagonia ( $43^{\circ} 03' S$ ,  $71^{\circ} 04' W$ ) showed only subtle differences with *B. antiqua* such as the length of the longest of the 2 setae of Ri1 which is slightly shorter in the latter.

P1-P4 (Figure 2e-h) as in other species of the genus. Seta ornamentation as in *B. poppei* and *B. diamantina*. The inner margin of Re segments is hairy in all legs while the outer margin of Ri segments is naked in P1 and hairy in the rest. Distinctive features

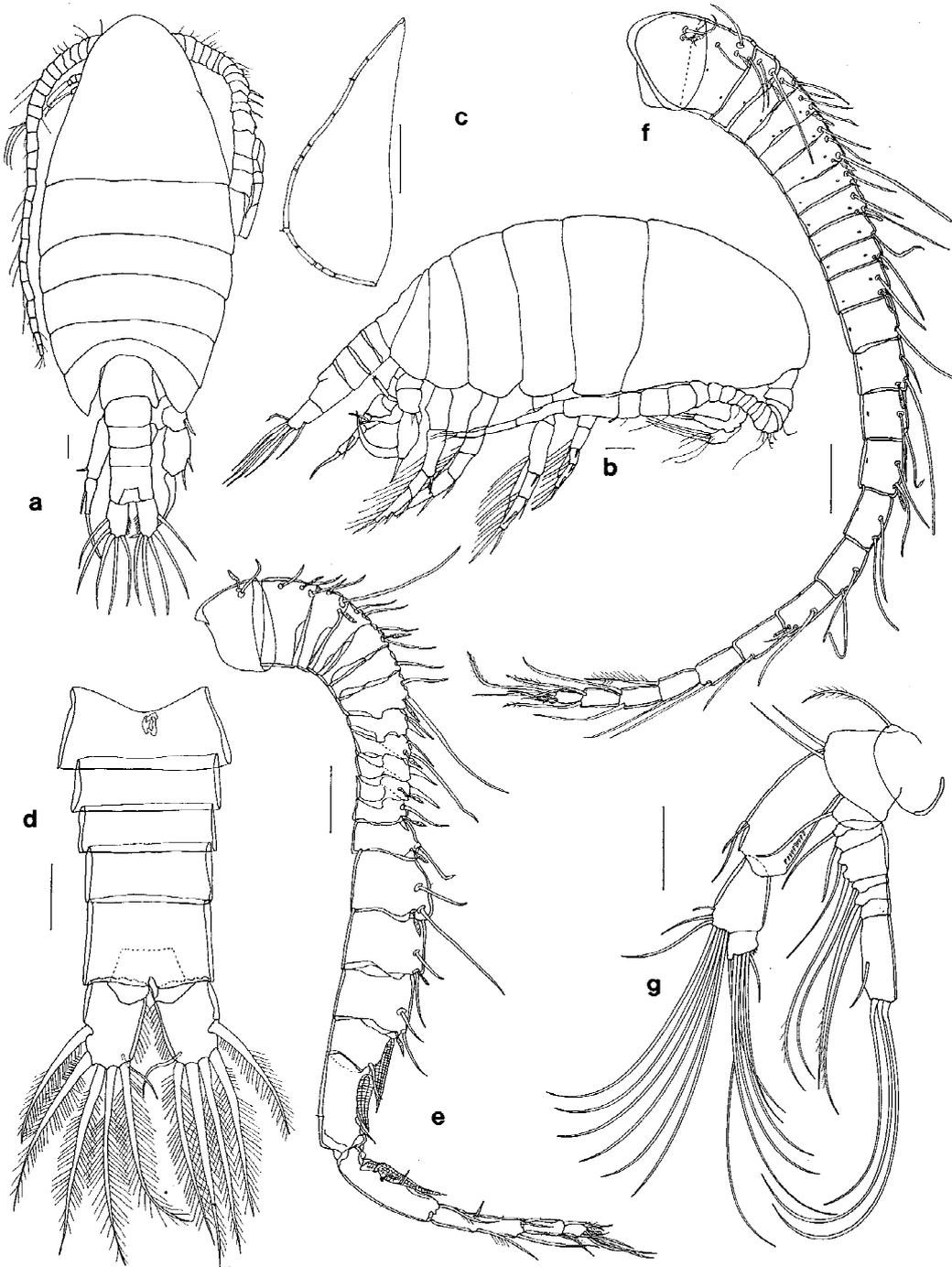


Figure 1. Male. (a) habitus, dorsal; (b) habitus, lateral; (c) detail of left prosomal wing; (d) Ur, ventral; (e) right A1; (f) left A1; (g) A2.

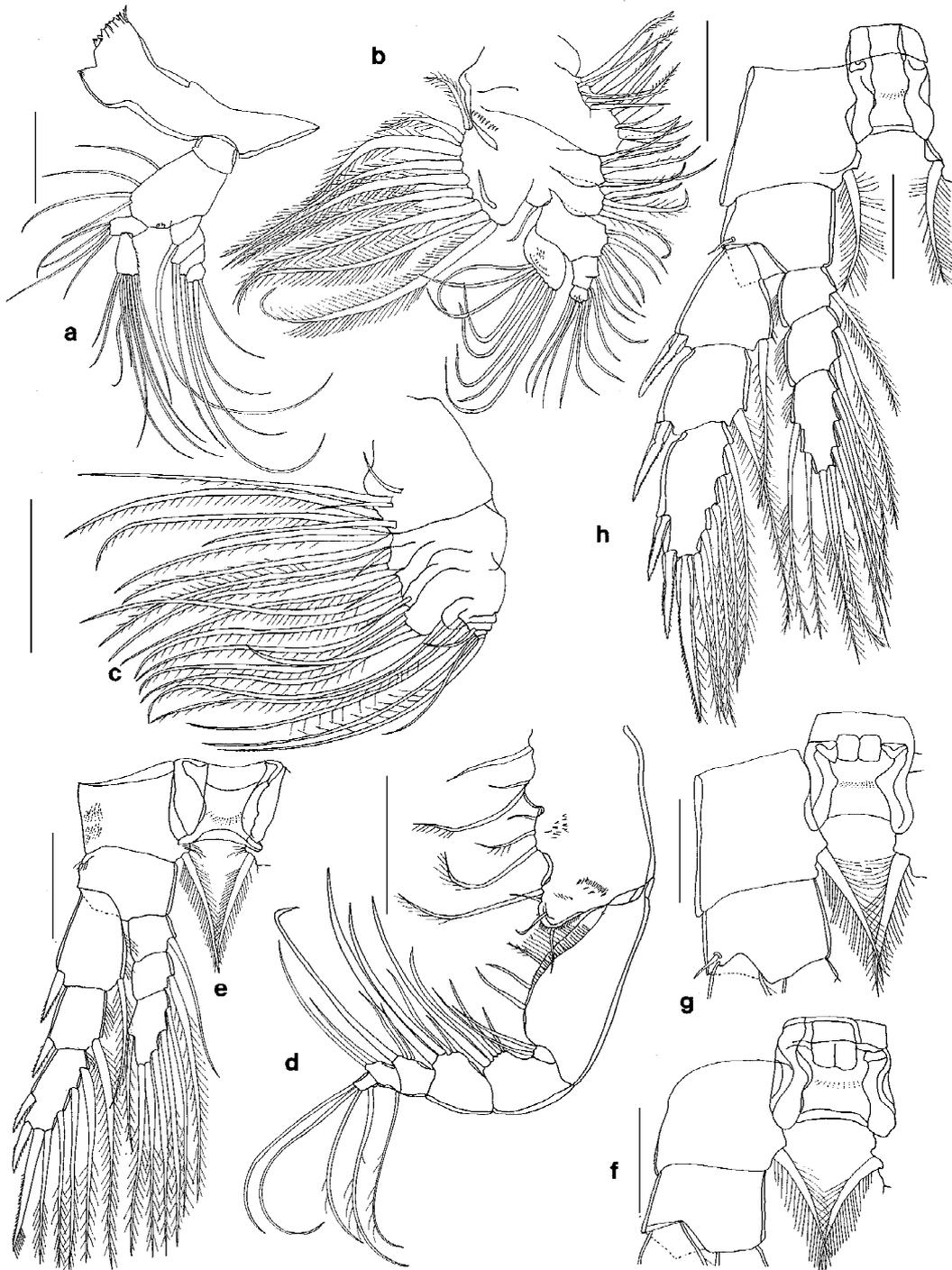


Figure 2. Male. (a) Mn; (b) Mx1; (c) Mx2; (d) Mxp; (e) P1 and basal plate, caudal side; (f) basal segments and basal plate of P2, caudal side; (g) basal segments and basal plate of P3, caudal side; (h) P4 and basal plate, caudal side.

can be detected on P1: a tuft of long hairs on the caudal face of the B1 disto-medial corner while on the frontal side a patch of hairs is visible on the basal half close to the external margin; B2 presents a latero-frontal curved ridge on the basal portion carrying a fan of setae. As in *B. gibbosa*, the short smooth submarginal seta on the caudal side of B2 is present both on P3 and P4. The basal plates show a faint curved line of hairs on the frontal side, only visible in cleared material.

P5 (Figure 3a) both B1 without setae and connected by a slightly asymmetrical basal plate. Right leg: B2 bearing a submarginal seta; Re1 with straight serrate spine on distolateral corner as long as the segment's external margin; Re2 almost oval, with straight serrate spine on the distal fourth of the external margin; Re3 projected into a strong inwardly curved claw with row of spinules extending over more than half the distal inner margin. Ri almost straight or slightly curved outwards, 3-segmented, in some cases two last segments fused, first two segments naked, distal one bearing 4 spines of variable length, the subterminal external one being always the longest. Left leg with B2 bearing a submarginal seta close to the external margin and produced on the frontal side into a triangular projection at the distal inner corner. Re (Figure 3b) 3-segmented. Re1 subrectangular with a hairy pit (Figure 3c) at the basal inner region and a straight serrate spine almost at the distal end of the external margin. Re2 forming the basal portion of the left claw, with a marked indenture almost midway of the external margin where a spine that does not reach the end of the segment is inserted. Re3 completes the slightly curved left claw which shows a short row of teeth at the tip. The most striking feature is the well developed 2-segmented Ri (Figure 3d) which normally is projected backwards at a right angle with the rest of the leg (Figure 3e). Ri1 is cylindrical and bears a hairy patch (Figure 3f) on the basal portion facing the pit on Re1. Ri2 is longer and bears from 2 to 4 spines (Figures 3d to 3f), the sub-terminal one, which is the longest, being always present.

Female (Figures 3g, h). Total length 2.24 mm ( $n=10$ ; max.=2.45 mm; min.=2.05 mm), excluding CR setae. Pr about 72% of total length, including Cph (32% T.L.) and 5 well defined segments. Pr widest at Th2, stouter than in male,  $1.87\times$  width. Moderately large triangular prosomal wings not surpassing Ur1. Tip with a hair sensilla, 5 other sensory pores on the ventral margin and 6 on the dorsal one (Figure 3j). Ur with 3 segments, the relative lengths of these and the CR are: 40, 17, 24, 19; CR slightly more globose

than in the male,  $1.3\times$  width, with hairy inner margin; plumose CR setae proportionally shorter than in the male; central medial longest, barely twice CR length. Ur1 (Figure 3k) almost as wide as long, slightly asymmetrical, bulging more on the left side. Sensory pores are unevenly distributed, 3 on the right side and 4 on the left, the 2 proximal ones very close to each other and located at the tip of the protuberance. Genital field with a semicircular proximal margin and subtriangular distal rim. Genital operculum with distal plate  $1.5\times$  proximal plate.

Egg sac containing from 17 to 30 eggs, spherical or slightly oval, most  $0.16 \times 0.18$  mm in diameter.

A1 exactly like male left A1, fully extended not reaching the end of Th5. A2, mouthparts and swimming legs with the same structure as in the male.

P5 (Figure 3l) Pentagonal B1 adjoined to a scarcely sculptured basal plate. B2 with a large frontal notch where Re is inserted, pentagonal on caudal view where a submarginal short seta is inserted near the external margin and an asymmetrical triangular process juts at the base of Ri. Both branches are three-segmented. Re1 bears a serrated spine slightly shorter than the width of the segment, inserted in the distal external corner, Re2 almost as long as broad with an external distal spine and produced into a stout biserrated disto-medial claw scarcely reaching the end of Re3. Re3 length  $1.94\times$  width, bearing a serrated spine at the last third of the external margin, two terminal serrated spines, the internal is the longest,  $1.66\times$  the external one and a short spine on the distomedial corner similar to the one inserted on the distal half of the medial margin; there is sometimes a second notch on the internal margin but a second spine has not been observed. This trait is enormously variable in the Antarctic populations of *B. poppei*. (Paggi, 1983) but not so in the studied population of *B. antiqua*. Ri1 and Ri2 bear a sparsely plumose seta each at the last fourth of the medial margin; Ri3 is the longest segment  $2.24\times$  width, bearing 2 spines on the external margin, 2 setae on the medial margin and 2 apical setae, although an abnormal specimen with only one inner seta appeared. The inner proximal seta seems to be always closer to the base of the segment than the outer proximal spine, while they are usually at the same distance in *B. poppei*.

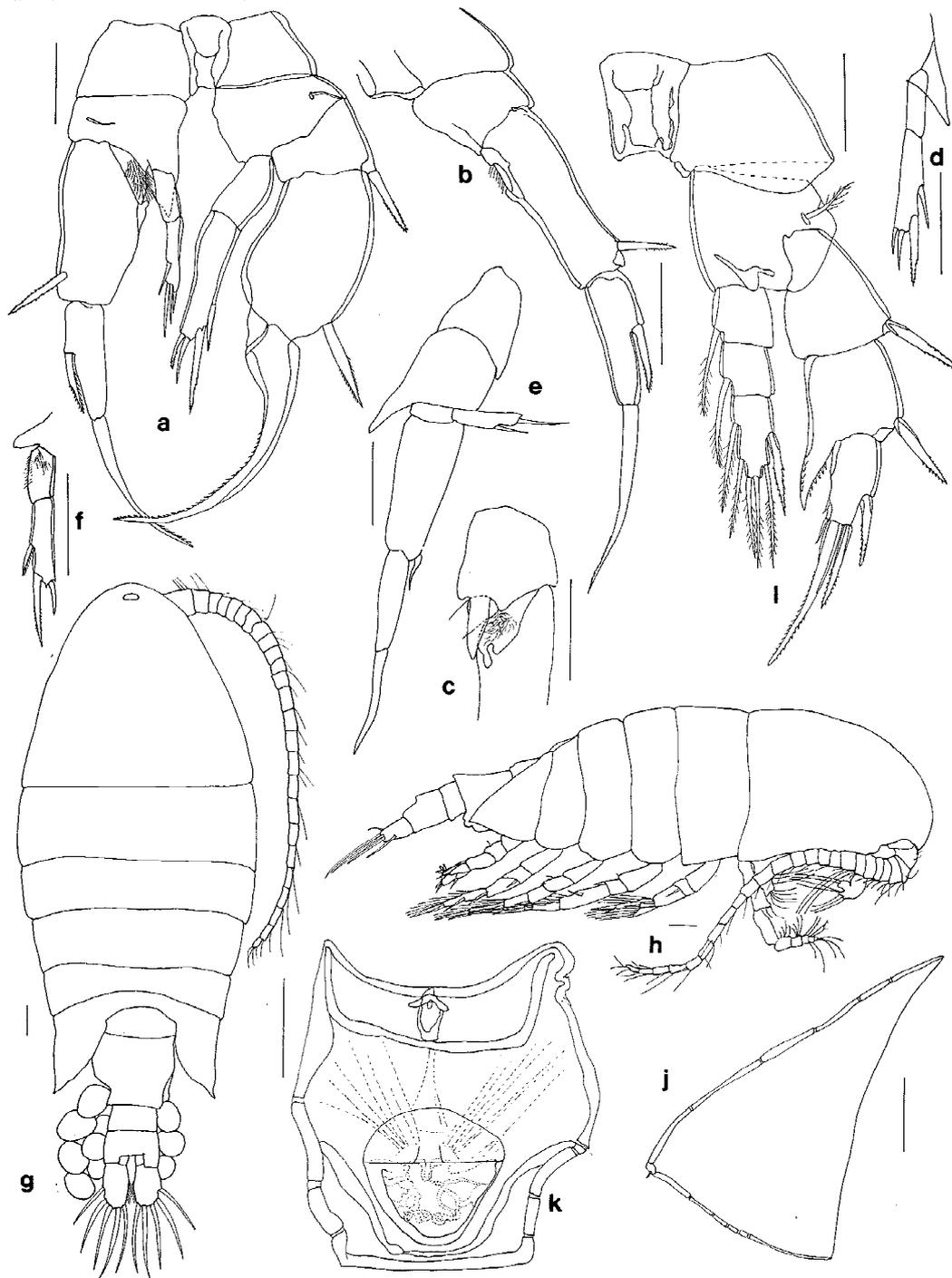


Figure 3. a–f. Male. (a) P5, caudal side; (b) P5, left Re, latero-frontal view; (c) P5, detail of hairy pit at the base of left Re1; (d) left Ri, frontal view; (e) lateral view of left P5; (f) left Ri, latero-caudal view; (g–l) Female. (g) habitus, dorsal; (h) habitus, lateral; (j) detail of left prosomal wing; (k) genital segment, ventral; (l) P5, caudal side.

### Etymology

The specific epithet means ancient, referring to the probable basal position of this species in the *Boeckella* clade.

### Discussion

*Boeckella antiqua* is very closely related to *B. poppei*, both species belonging to the group formerly pertaining to the genus *Pseudoboeckella*. In fact, the females of both species are totally alike, only subtle differences such as the relative positions of the basal spine and seta of the P5 Ri3 and probably the length of the setae of the first segment of the Mxp Ri might be of some use to distinguish them, but these traits may turn up to be also variable when more populations of *B. antiqua* appear. A detailed comparative study of the genital field of both species will be performed in the hope of finding firmer diagnostic features.

Meanwhile, the identity of *B. antiqua* can undoubtedly be diagnosed by the peculiar structure of the male P5, being so far the only species of the genus with a well developed two-segmented left Ri, carrying moreover spines on its distal end. The number of these ranges from 2 to 4, this last condition being the most frequent in the studied population. This plesiomorphic feature, together with the high number of Re segments (9) in A2 and the segmented condition of the Ri of the

Mx1 of certain specimens, lead us to speculate that this is the most basal species of the South American *Boeckella*. A complete study of the phylogeny of the whole genus is needed.

The new species was found at Laguna Los Juncos, a small (20 000 m<sup>2</sup>), shallow (1 m of maximum depth), ephemeral water body. The pH is 7.8, conductivity ( $K_{20}$ ) 500  $\mu$ S/cm, elevated turbidity and a lot of organic matter related to the large concentrations of waterfowl. It usually dries during the summer from December to March, and freezes during winter (July). Adults are present during spring. This species coexists with *Daphnia pulex* and the predaceous calanoid *Parabroteas sarsi*. However, *B. antiqua* is the most abundant crustacean of the lake.

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