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Journal of Natural History

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713192031>

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Online publication date: 25 November 2009

To cite this Article Gómez, S. and Gee, J. Michael(2009) 'On four new species of *Cletocamptus* Shmankevich, 1875 (Copepoda: Harpacticoida) from inland waters of Argentina', Journal of Natural History, 43: 45, 2853 – 2910

To link to this Article: DOI: 10.1080/00222930903374171

URL: <http://dx.doi.org/10.1080/00222930903374171>

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On four new species of *Cletocamptus* Shmankevich, 1875 (Copepoda: Harpacticoida) from inland waters of Argentina

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(Received 30 September 2008; final version received 29 September 2009)

Argentinean specimens of *Cletocamptus* of the collection of the Smithsonian Institution as well as recently collected material were analyzed and four new species are described. *Cletocamptus assimilis* sp. nov. and *C. tertius* sp. nov. seem to be related to *C. levis*. *Cletocamptus pilosus* sp. nov. seems to be related to *C. stimpsoni*. *Cletocamptus spinulosus* sp. nov. shares the armature formula of the mandibular palp, the armature formula of P1–P4 and the lower insertion level of the innermost seta of the male P5BENP with *C. levis*, *C. assimilis* sp. nov. and *C. tertius* sp. nov. *Cletocamptus spinulosus* sp. nov. shares the slender seta of the maxillulary arthrite with *C. pilosus* sp. nov. and *C. stimpsoni*, and is unique in the strong spinules along the posterior margin of the P2- to P4-bearing somites. Additional comments on some other species and an identification key to the species of *Cletocamptus* are presented.

Keywords: *Harpacticoida*; *Cletocamptus*; new species; Argentina

Introduction

At the time of Richard's (1897) original description of *Mesochra* (= *Cletocamptus*) *deitersi* (Richard, 1897) from somewhere in Naposta Grande River (Argentina), three other species, *C. retrogressus* Shmankevich, 1875, *C. albuquerqueensis* (Herrick, 1894) and *C. confuens* (Schmeil, 1894), easily separable from *C. deitersi*, had been described. Probably, at that time, the description of the caudal ramus and anal somite, female antennule, exopod of the antenna, maxilliped, female P2 and P5 and male P5 was enough to differentiate these four species. It is likely that it was this ease of separation that allowed Richard (1897) to present such a brief and incomplete description of *C. deitersi* (Gómez et al., 2004). However, since 1897, several populations of *Cletocamptus* have been found in North, Central, and South America (for a complete list of references see Gómez et al. [2004]). Rocha-Olivares et al. (2001) and Gómez et al. (2004) showed through molecular and morphological studies, that at least four populations of *C. deitersi* from USA and north-western Mexico were in fact four different species (*C. deborahdexterae* Gómez et al., 2004, *C. stimpsoni* Gómez et al., 2004, *C. sinaloensis* Gómez et al., 2004 and *C. fourchensis* Gómez et al., 2004) and Gómez et al. (2004), in an attempt to elucidate the identity of several species within the genus, considered some of them as *species inquirendae* and some records as doubtful and unverifiable, while some species previously considered as synonyms were considered as valid species. Since then, from voucher material

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housed in the Smithsonian Institution (US National Museum of Natural History) and from material recently collected by some colleagues and sent to the senior author for inspection, two species (*C. levis* Gómez, 2005 and *C. nudus* Gómez, 2005) and a new record of *C. sinaloensis* have been reported from Brazil. Also, *C. cecsurirensis* Gómez, Scheihing and Labarca, 2007 was described from Salar de Surire (Chilean high Andean Plateau). The present paper deals with the description of four new species of *Cletocamptus* that, following Richard's (1897) scheme and considering the high degree of polymorphism within and between populations, could well be identified with *C. deitersi*.

Material and methods

During the course of a long-term project about the revision of the genus *Cletocamptus* from the Americas, a number of specimens housed in the collection of the Smithsonian Institution were inspected. The vials containing the material were labelled as follows:

- *Cletocamptus deitersi* USNM 251696; Argentina, Formosa, Monte Lindo, 25 54 S, 058 W; Frutos, S.M. 19 Sep 1987; Reid, J.W. 27 Nov 1990; R 130, Acc. # 392619.
- *Cletocamptus deitersi* USNM 264522; Argentina, Province of Mendoza, Embalse Nihuil, on the Atuel River. Coll. S. Menu-Marque; Id. J. Reid; Delfino-Scheke, R. Jan 1986; Reid, J.W. Jul 1998.
- *Cletocamptus deitersi* USNM 264521; Argentina, Province of La Pampa, Santa Rosa, Laguna Don Tomás.

Additional material from a site near Puerto San Julian (49°12'493' S, 67°44'712'W) and from Puerto Madryn City lagoon (42°46'742'S, 65°01'904'W) was kindly collected and provided by Dr R.M. Warwick.

Observations and drawings at a magnification of 1000× were made from whole and dissected specimens mounted in lactophenol with a Leica compound microscope equipped with phase contrast and a drawing tube. The type material was deposited in the collection of the Smithsonian Institution. The material provided by Dr R.M. Warwick was deposited in the collection of the Instituto de Ciencias del Mar y Limnología, Mazatlán Marine Station. The terminology proposed by Huys and Boxshall (1991) for the general description was adopted. Abbreviations used in the text and tables are: P1–P6, first to sixth swimming legs; EXP, exopod; ENP, endopod; P1(P2–P4)EXP(ENP)1(2, 3) denotes the proximal (middle, distal) exopodal (endopodal) segment of P1, P2, P3 or P4; CV, fifth copepodite.

Taxonomic account

Family CANTHOCAMPTIDAE Sars, 1906 (*incertae sedis*) sensu Por, 1986

Genus *Cletocamptus* Shmankevich, 1875

Cletocamptus assimilis sp. nov.

(Figures 1–5)

Type material

One female holotype (USNM 251696) and nine female paratypes (USNM 1110177) preserved in alcohol, and six dissected female paratypes (USNM 1123780, USNM

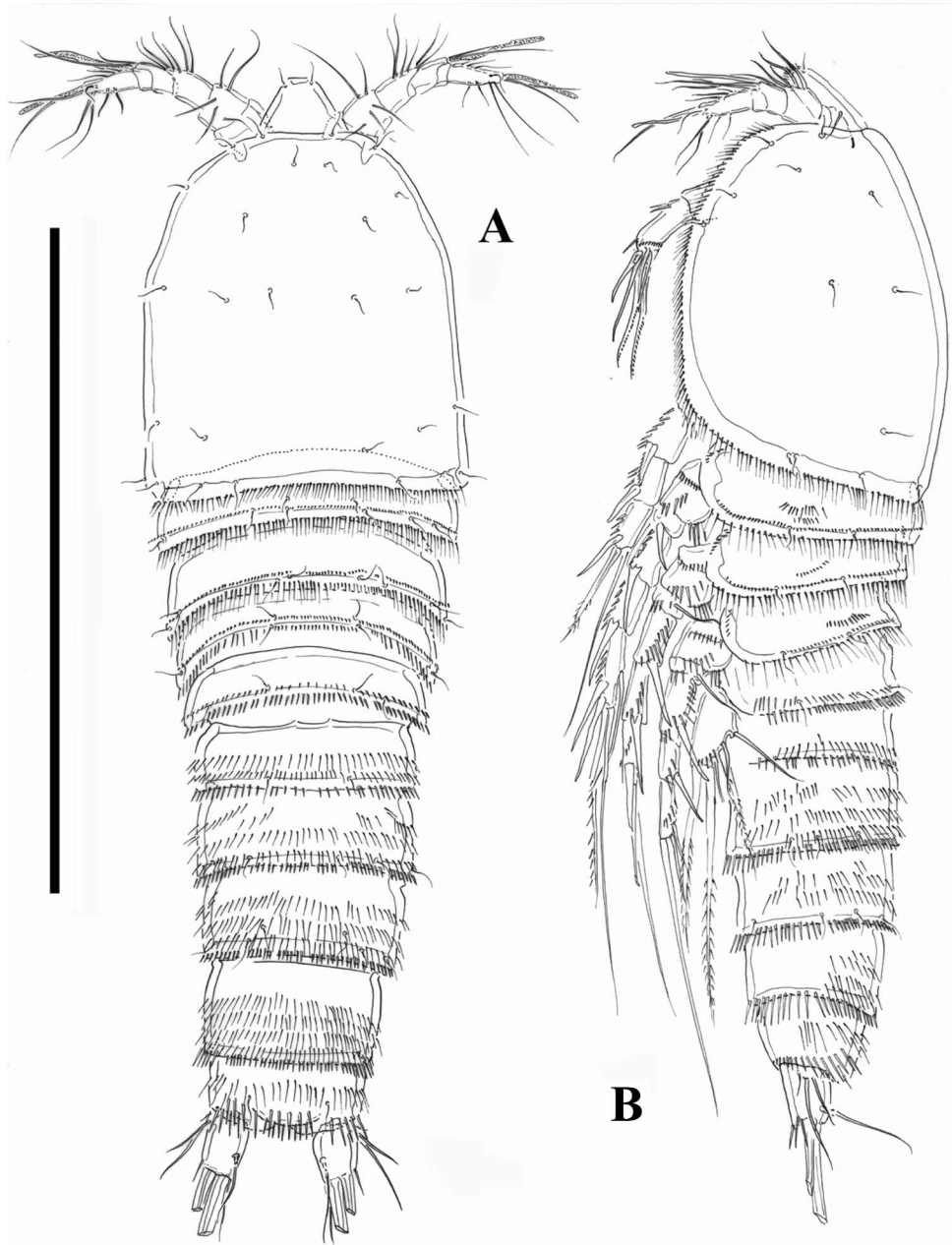


Figure 1. *Cletocamptus assimilis* sp. nov., female. (A) Habitus, dorsal; (B) habitus, lateral. Scale bar = 300 μ m.

1123781, USNM 1123782, USNM 1123783, USNM 1123784, USNM 1123785). The vial containing this material was labelled as follows: *Cletocamptus deitersi* USNM 251696; Argentina, Formosa, Monte Lindo, 25° 54' S, 058' W; Frutos, S.M. 19 Sep 1987; Reid, J.W. 27 Nov 1990; R 130, Acc. # 392619.

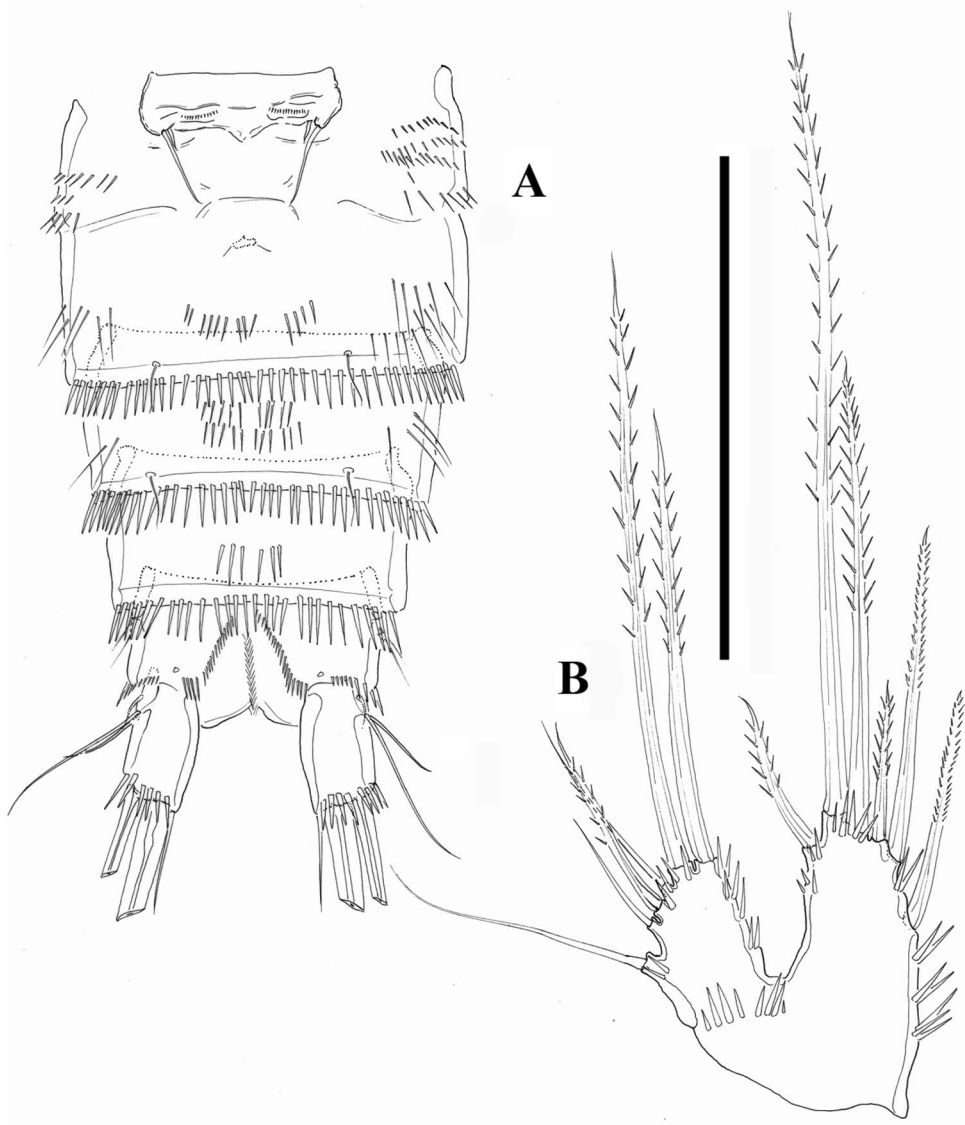


Figure 2. *Cletocamptus assimilis* sp. nov., female. (A) Urosome, ventral (P5-bearing somite omitted); (B) P5, anterior. Scale bars: (A) 140 μ m; (B) 100 μ m.

Type locality

Monte Lindo, Formosa, Argentina (25°54'S, 58°00'W).

Etymology

The specific name (*assimilis* = of great similarity) makes reference to the close resemblance of the species to *C. levis*.

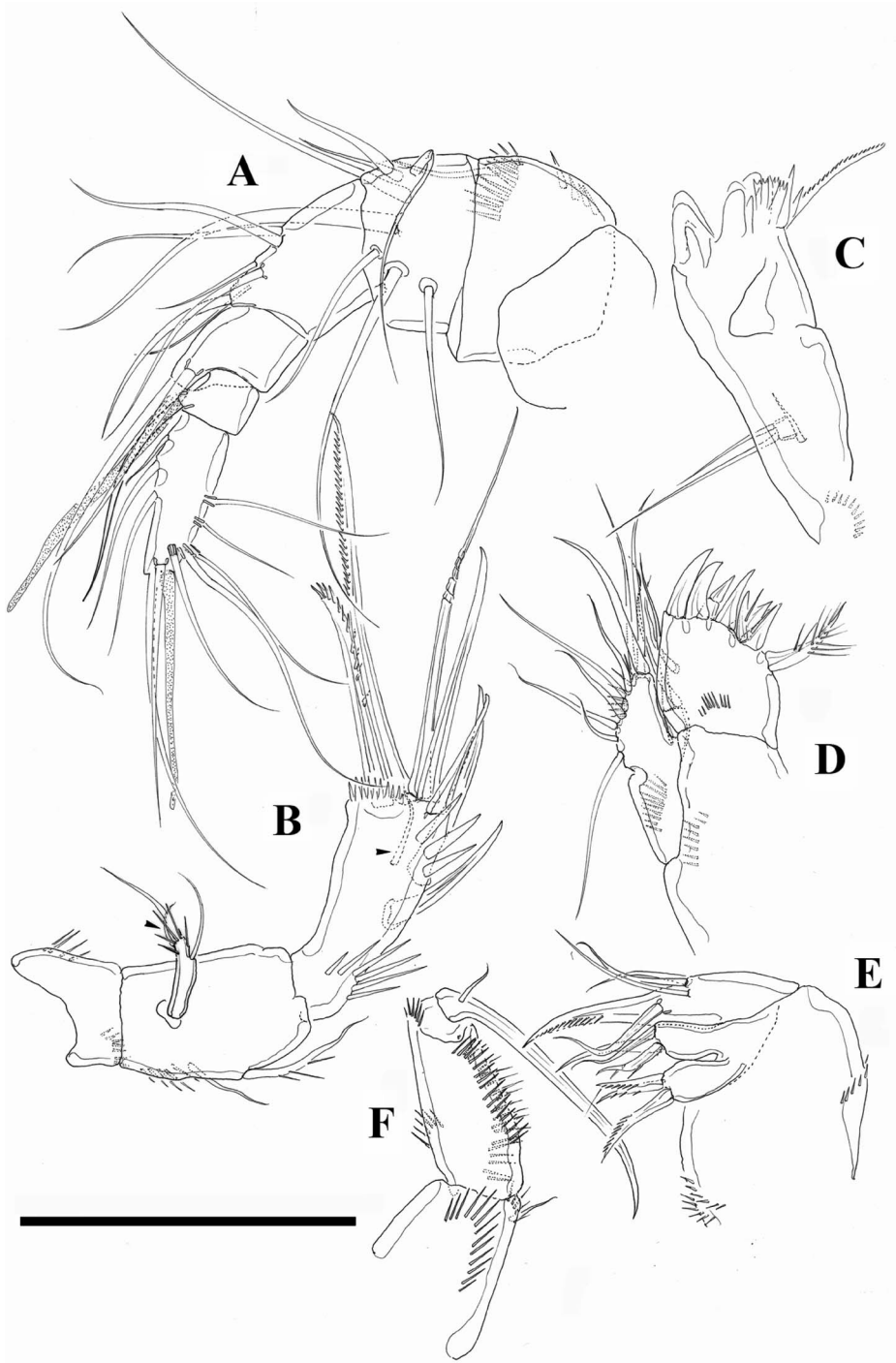


Figure 3. *Cletocampus assimilis* sp. nov., female. (A) Antennule; (B) antenna (reduced apical seta of the exopod and slender seta of the free endopodal segment indicated by arrows); (C) mandible; (D) maxillule; (E) maxilla; (F) maxilliped. Scale bars = 50 μ m.



Figure 4. *Cletocamptus assimilis* sp. nov., female. (A) P1, anterior; (B) P2, anterior. Scale bars = 100 μ m.

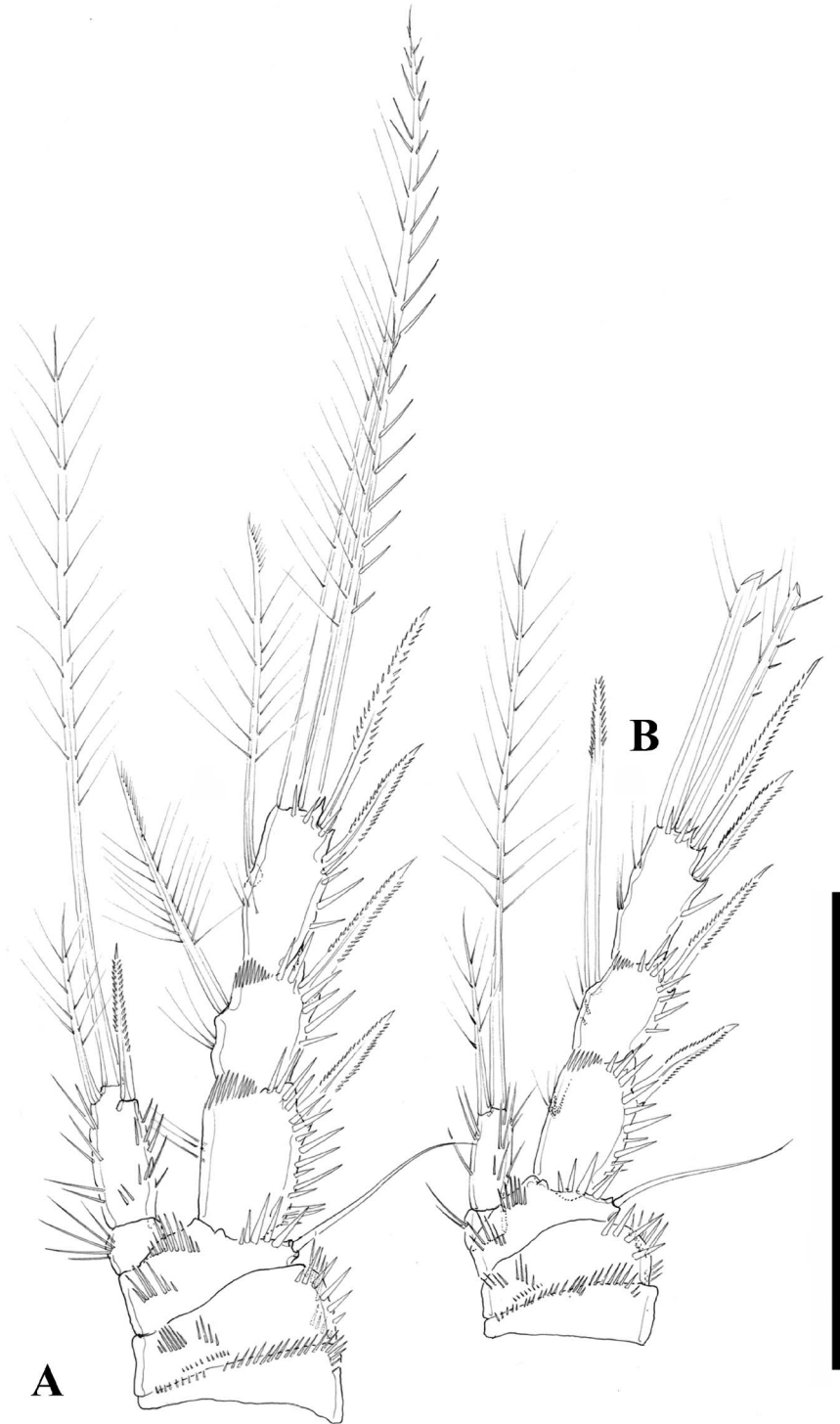


Figure 5. *Cletocamptus assimilis* sp. nov., female. (A) P3, anterior; (B) P4, anterior. Scale bars = 100 μ m.

Female

Habitus (Figure 1A–B). Tapering posteriorly; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 390 to 470 μm (mean, 409.5 μm ; $n = 10$; holotype, 460 μm). Rostrum defined at base, triangular, with pair of setules subapically and ornamented with small spinules distally on ventral surface. Cephalic shield with fine spinules along its posterior margin dorsally and laterally. Dorsal and lateral surface of free thoracic somites (P2- to P4-bearing somites) with few short transverse rows of minute spinules laterally, with longitudinal row of tiny spinules close to and with longer spinules along posterior margin. Dorsal and lateral surface of first urosomite (P5-bearing somite) seemingly smooth, with row of tiny spinules close to and with spinules (shorter and stronger than in preceding somites) along posterior margin. Genital double-somite with subcuticular rib dorsally and laterally indicating former division between second and third urosomites (Figure 1A, B), but completely fused ventrally (Figure 2A); dorsal and lateral surface of second and third urosomite (first and second genital somites) with transverse rows of spinules and with row of spinules along posterior margin (Figure 1A–B), and with ventral spinules as illustrated (Figure 2A). Fourth and fifth urosomites as in previous somite dorsally, with ventral spinular pattern as illustrated (Figure 2A). Dorsal surface of anal somite with transverse rows of spinules and with dorsolateral strong spinules close to joint with caudal rami; rounded anal operculum furnished with two rows of strong spinules. Caudal rami about 1.7 times as long as wide; dorsal and ventral surface smooth except for spinules close to posterior margin; with seven elements (Figures 1A–B and 2A).

Antennule (Figure 3A). Six-segmented, surface of segments smooth except for two spinular rows on first segment. Armature formula, 1-(1), 2-(8), 3-(6), 4-(1 + [1+ae]), 5-(1), 6-(9 + [1+ae]).

Antenna (Figure 3B). With small coxa. Allobasis armed with two abexopodal setae. Free endopodal segment with inner spinules proximally and subdistally, with two lateral inner spines and a slender seta (the latter indicated by arrows in Figure 3B), and five distal elements. Exopod one-segmented; about five times as long as wide, with few spinules, and with one lateral and two apical setae (one of them reduced – indicated by arrows in Figure 3B).

Mandible (Figure 3C). Robust; chewing edge with bi- and multicuspidate teeth, one pyriform element and one lateral seta. Palp one-segmented, with two setae; with one small seta arising nearby.

Maxillule (Figure 3D). Robust; arthrite of praecoxa with few spinules, with one surface seta, seven distal spines and one spinulose and strong lateral seta. Coxa with some spinules and with two slender setae. Basis with some median spinules. Homology of the setae of basis, exopod and endopod difficult to determine. Basis seemingly with three apical and two lateral setae, endopod and exopod seemingly represented by three and one seta, respectively.

Maxilla (Figure 3E). Syncoxa with spinules along inner margin; with two endites bearing three setae each. Allobasis drawn into strong claw with one accompanying strong seta. Endopod represented by three elements.

Maxilliped (Figure 3F). Subchelate. Syncoxa with spinular rows as illustrated and with small seta on inner distal corner. Basis unarmed; with anterior and posterior longitudinal row of spinules along inner margin; with small spinules medially and subapically. Endopod drawn into long and slender claw with one accompanying small seta.

P1 (Figure 4A). Praecoxa with spinules close to joint with coxa. The latter with spinular rows as illustrated. Basis with inner and outer spine; with median spinular row, and with stronger spinules at base of inner and outer spine and between rami. Exopod three-segmented. Endopod two-segmented, reaching the middle of EXP3.

P2 (Figure 4B). Praecoxa and coxa as in P1. Basis as in P1 except for lack of inner spine; outer element spine-like. Exopod three-segmented and ornamented as illustrated; EXP2 and EXP3 with inner seta. Endopod two-segmented, reaching tip of EXP1; first segment small, about as wide as long and ornamented as illustrated; second segment long, about four times as long as wide, ornamented as depicted and armed with one outer spine, one apical long seta and one inner short element.

P3 (Figure 5A). Praecoxa and coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod and endopod as in P2.

P4 (Figure 5B). Praecoxa, coxa and basis as in P3. Exopod as in P3 except for lack of inner seta in P4EXP3. Endopod two-segmented, reaching middle of EXP1; first segment very small; second segment about three times as long as wide, armed with one inner and one apical seta.

P5 (Figure 2B). Both legs distinct. Exopod and baseoendopod fused. Baseoendopodal lobe slightly longer than exopodal lobe, and ornamented with spinules as shown; with one outer, one apical and four inner setae; relative length of setae as shown. Exopodal lobe ornamented with spinules as illustrated, with five setae plus outer seta of basis. The armature formula of female P1–P5 is presented in Table 1.

P6 (Figure 2A). Represented by median plate in anterior half of second urosomite (first genital somite); each vestigial leg represented by one outer long seta and one inner small element. Copulatory pore in the middle of genital double-somite.

Table 1. Armature formula of *Cletocamptus assimilis* sp. nov. female P1–P5

	P1	P2	P3	P4	P5
Exopod	I-0;I-1;I,II,1	I-0;I-1;II,2,1	I-0;I-1;II,2,1	I-0;I-1;II,2,0	5
Endopod	0-1;0,II,1	0-0;I,1,1	0-0;I,1,1	0-0;0,2,0	6

Male

Unknown.

Variability

One female was observed to possess a very small outer spine on P4EXP3.

***Cletocamptus pilosus* sp. nov.**
(Figures 6–14)

Type material

One dissected female holotype (USNM 264522), 1 dissected male allotype (USNM 1010097), 11 female, 38 male and 2 female CV paratypes preserved in alcohol (USNM 1010098), and 7 dissected female (USNM 1123789, USNM 1123790, USNM 1123791, USNM 1123792, USNM 1123793, USNM 1123794, USNM 1123795) and male paratypes (USNM 1123796, USNM 1123797, USNM 1123798, USNM 1123799, USNM 1123800, USNM 1123801, USNM 1123802). The vial containing this material was labelled as follows: *Cletocamptus deitersi* USNM 264522; Argentina, Province of Mendoza, Embalse Nihuil, on the Atuel River. Coll. S. Menú-Marque; Id. J. Ried; Delfino-Scheke, R. Jan 1986; Reid, J.W. Jul 1998.

Type locality

Embalse Nihuil, Province of Mendoza, Argentina.

Additional material

One dissected female (EMUCOP-200306-01), and three females and one male CV preserved in alcohol (EMUCOP-200306-02). Collected in year 2005, from a site near Puerto San Julian, Province of Santa Cruz (49°12'493'S, 67°44'712'W), 26 m above sea level, salinity 11.8‰. Coll R.M. Warwick

Etymology

The specific name (*pilosus* = hairy) refers to the hairy appearance of the body dorsally and laterally.

Female

Habitus (Figure 6A–B). Tapering posteriorly; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 515 to 685 µm (mean, 610 µm; $n = 16$; holotype, 585 µm). Rostrum (Figure 8H) defined at base, triangular, with pair of setules subapically and ornamented with small spinules distally on ventral surface. Cephalic shield (Figure 6A–B) with small spinules along its posterior margin. Dorsal and lateral surface of free thoracic somites (P2- to P4-bearing somites) with transverse rows of spinules, and with longer spinules along posterior margin. Dorsal and lateral surface of first urosomite (P5-bearing somite) with long spinules, and with spinules (shorter and stronger than

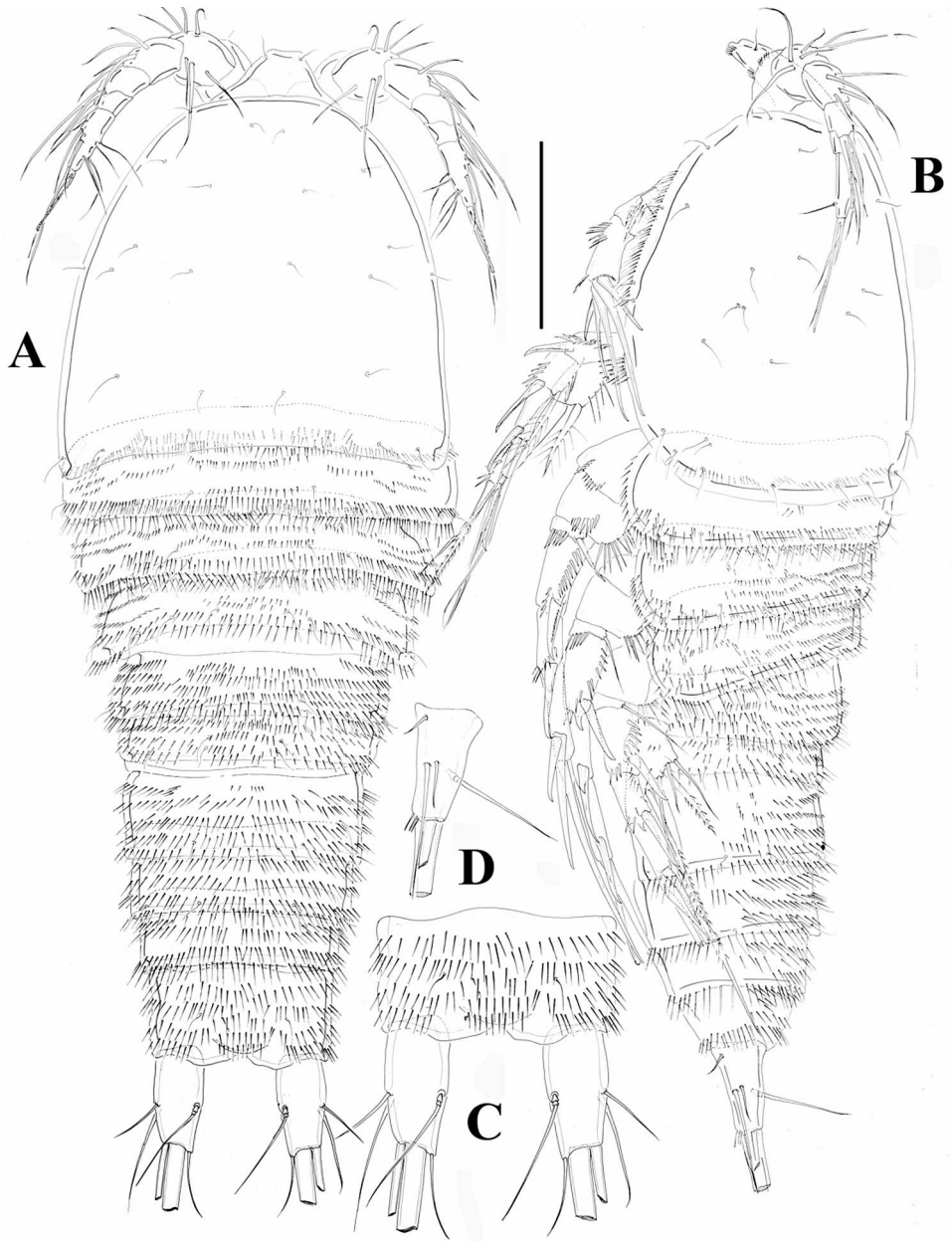


Figure 6. *Cletocamptus pilosus* sp.nov., female. (A) Habitus, dorsal; (B) habitus, lateral; (C) anal somite and caudal rami, dorsal; (D) left caudal ramus, lateral. Scale bars: (A–B) 100 μ m, (C–D) 80 μ m.

in preceding somites) along posterior margin. Genital double-somite with subcuticular rib dorsally and laterally indicating former division between second and third urosomites (Figure 6A–B), but completely fused ventrally (Figure 7A); dorsal and lateral surface of second and third urosomites (first and second genital

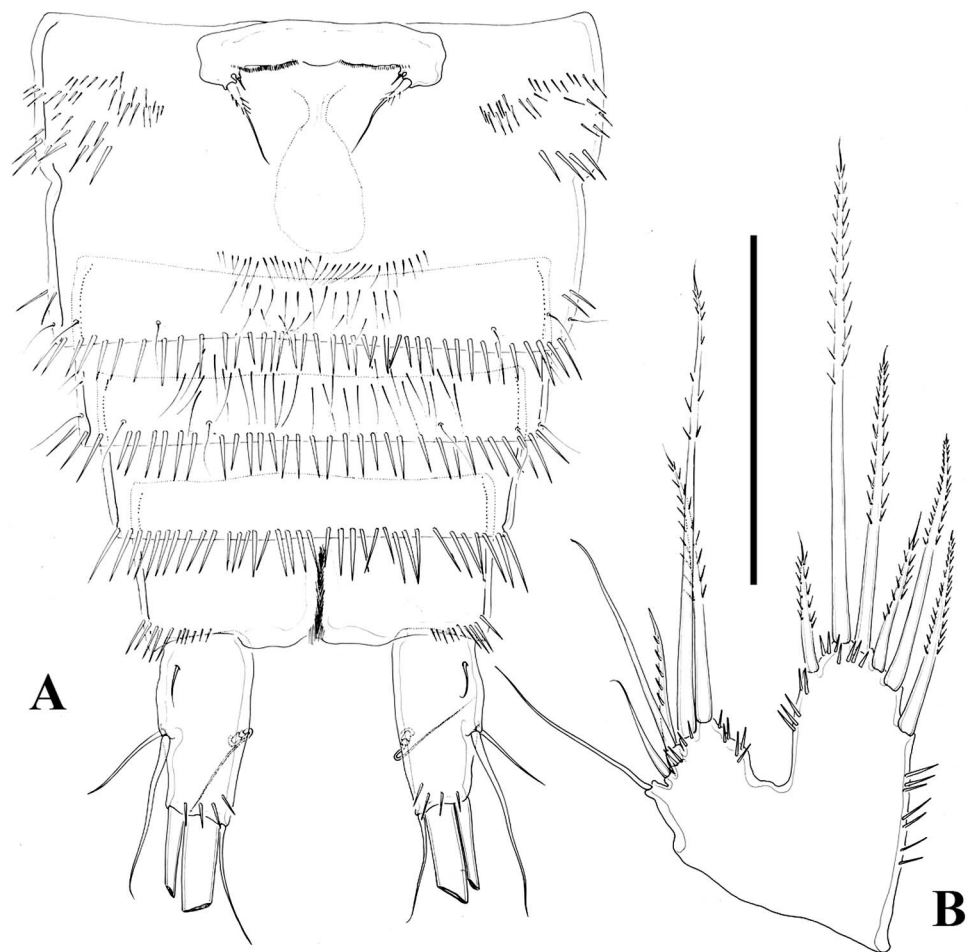


Figure 7. *Cletocamptus pilosus* sp. nov., female. (A) Urosome, ventral (P5-bearing somite omitted); (B) P5, anterior. Scale bar = 100 μ m.

somites) with transverse rows of long spinules and with row of spinules along posterior margin, ventrally with spinules as illustrated (Figure 7A). Fourth and fifth urosomites as in previous somite dorsally, with ventral spinular pattern as illustrated (Figure 7A). Dorsal surface of anal somite with transverse rows of long spinules, and with dorsolateral spinules close to joint with caudal rami; rounded anal operculum furnished with two rows of long and slender spinules (Figure 6C). Caudal rami about twice as long as wide and slightly tapering posteriorly; dorsal and ventral surface smooth, with few spinules close to base of seta V ventrally; with seven elements (Figures 6A–D, 7A).

Antennule (Figure 8A). Six-segmented; surface of segments smooth except for two spinular rows on first segment. Armature formula, 1-(1), 2-(9), 3-(4), 4-(1+[1+ae]), 5-(1), 6-(9+[1+ae]).

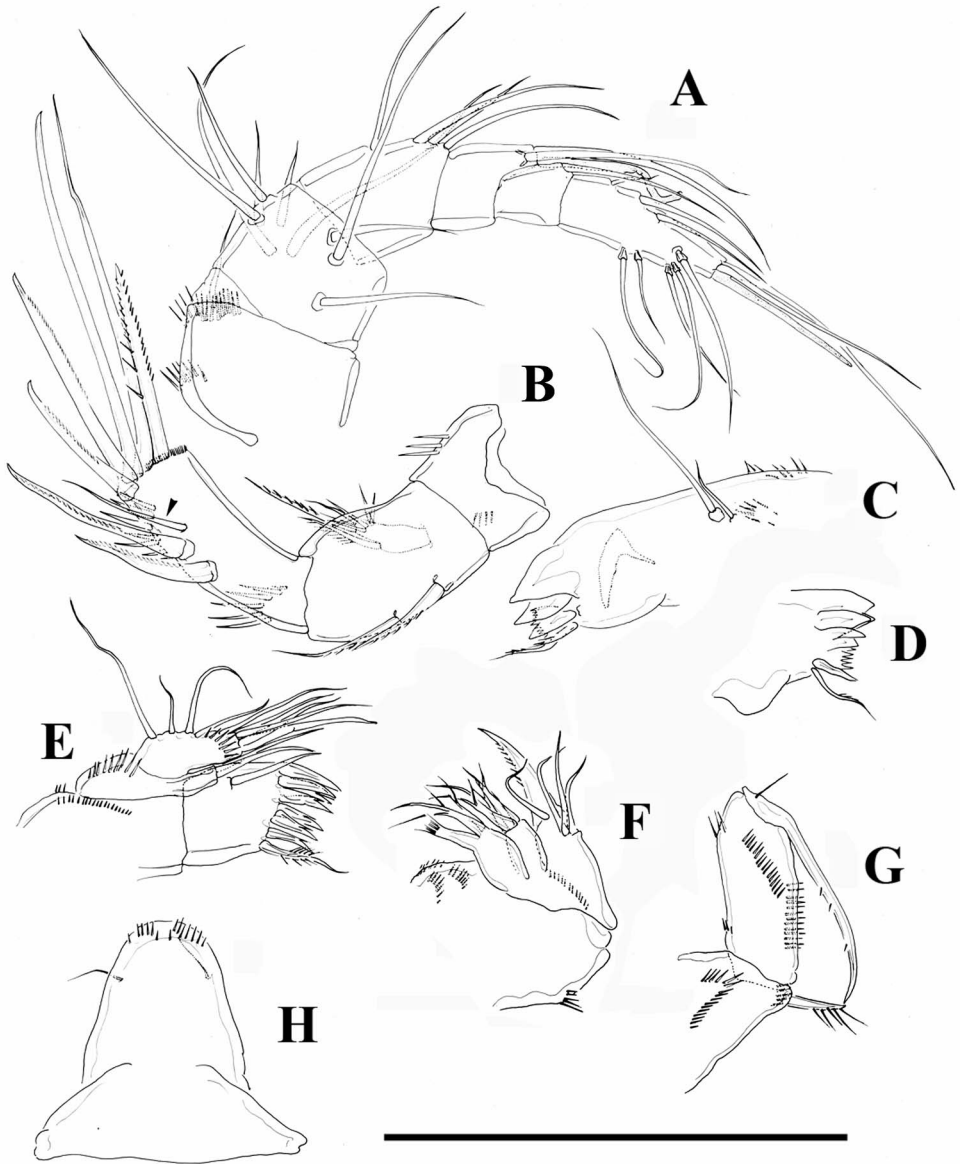


Figure 8. *Cletocamptus pilosus* sp. nov., female. (A) Antennule; (B) antenna (slender seta of the free endopodal segment indicated by arrow); (C) mandible; (D) gnathobase of mandible; (E) maxillule; (F) maxilla; (G) maxilliped; (H) rostrum, ventral. Scale bar = 100 μ m.

Antenna (Figure 8B). With small coxa. Allobasis armed with two abexopodal setae. Free endopodal segment with inner spinules proximally and subdistally; with a slender seta (indicated by arrow in Figure 8B) and two lateral inner spines, and five distal elements. Exopod one-segmented; about five times as long as wide; with few spinules and armed with one lateral and two apical setae (one of them reduced – indicated by arrow in Figure 8B).

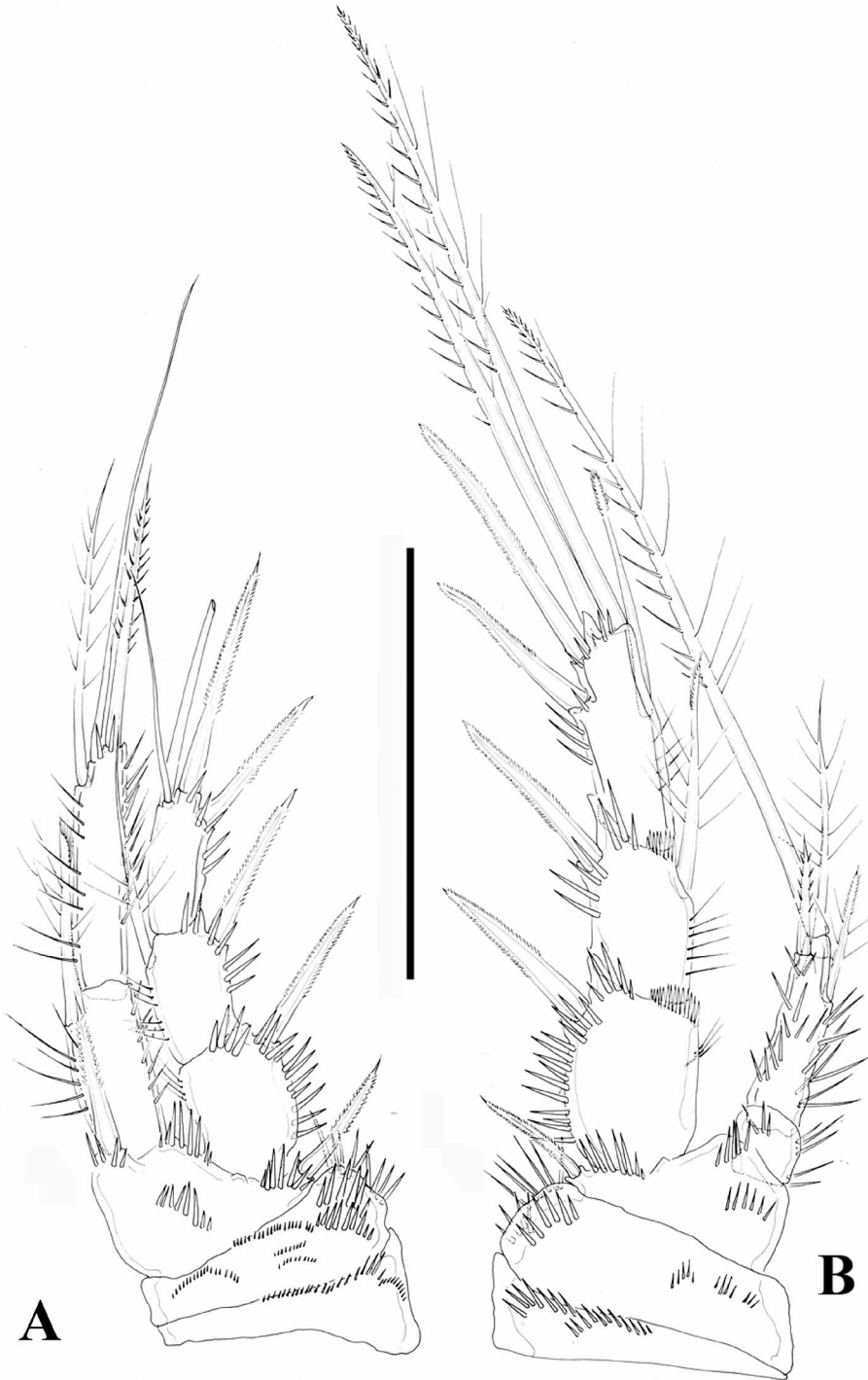


Figure 9. *Cletocamptus pilosus* sp. nov., female. (A) P1, anterior; (B) P2, anterior. Scale bars = 100 μ m.

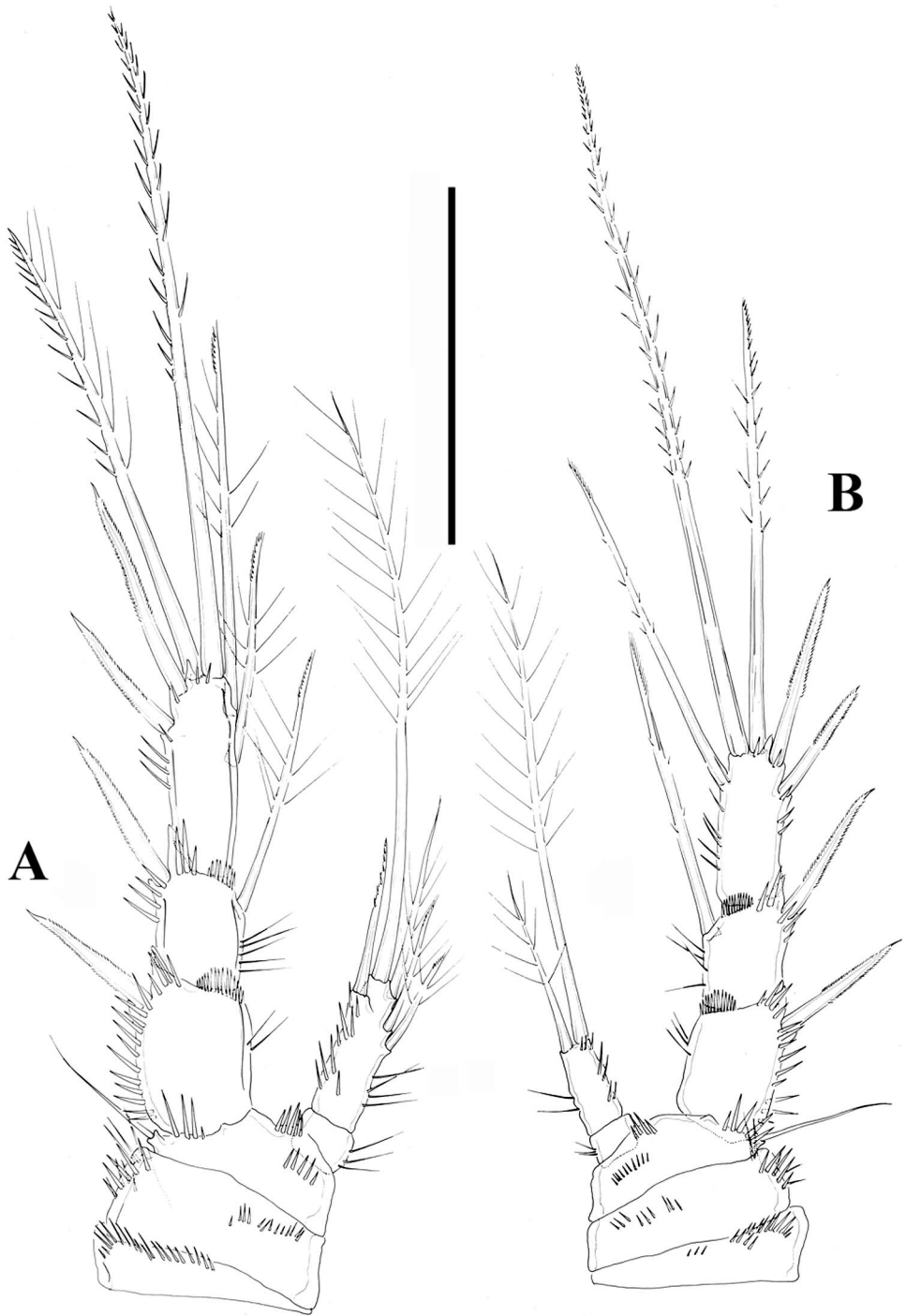


Figure 10. *Cletocamptus pilosus* sp. nov., female. (A) P3, anterior; (B) P4, anterior. Scale bars = 100 μ m.

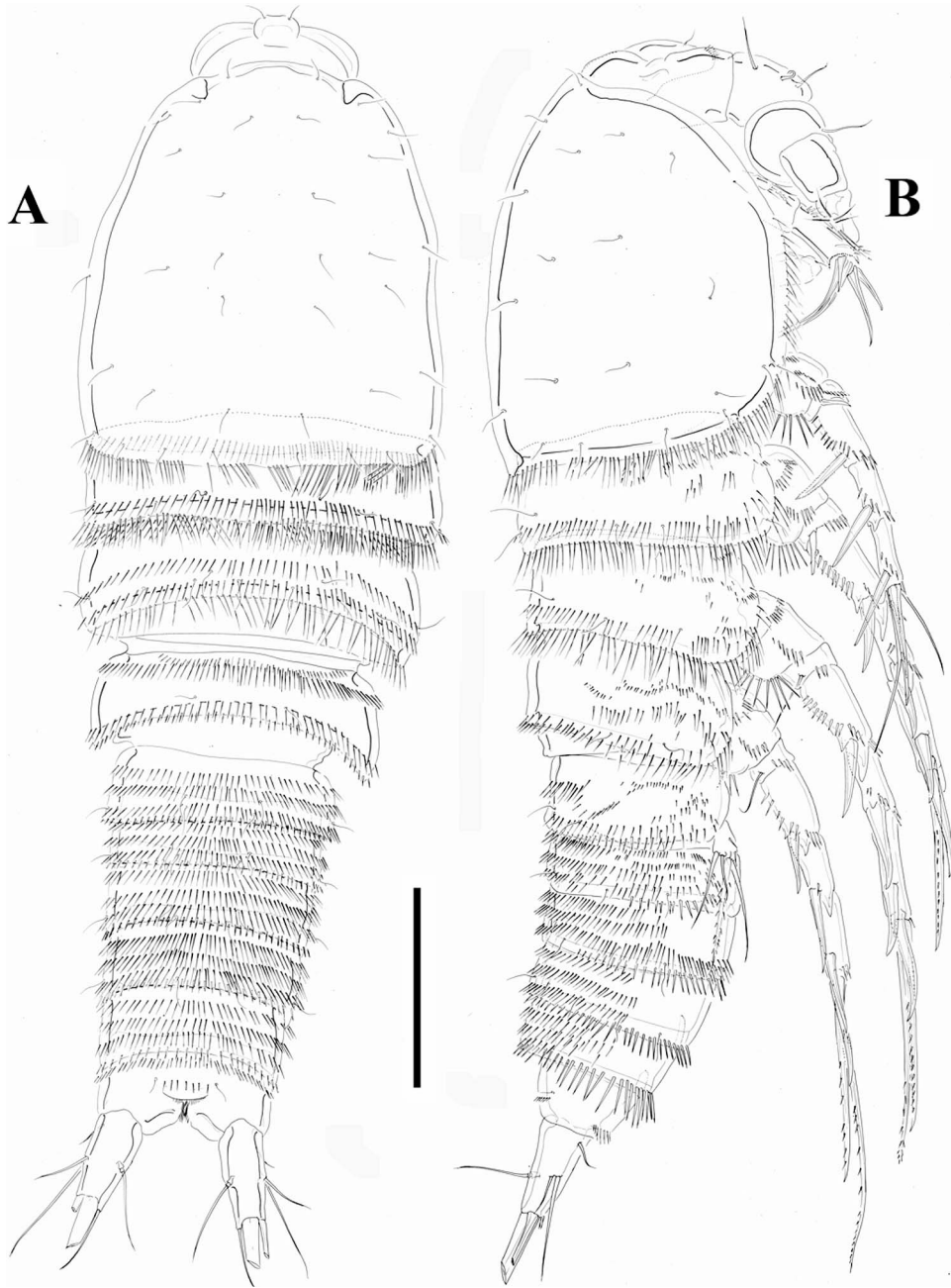


Figure 11. *Cletocamptus pilosus* sp. nov., male. (A) Habitus, dorsal; slightly compressed during the mounting process; (B) habitus, lateral. Scale bar = 100 μ m.

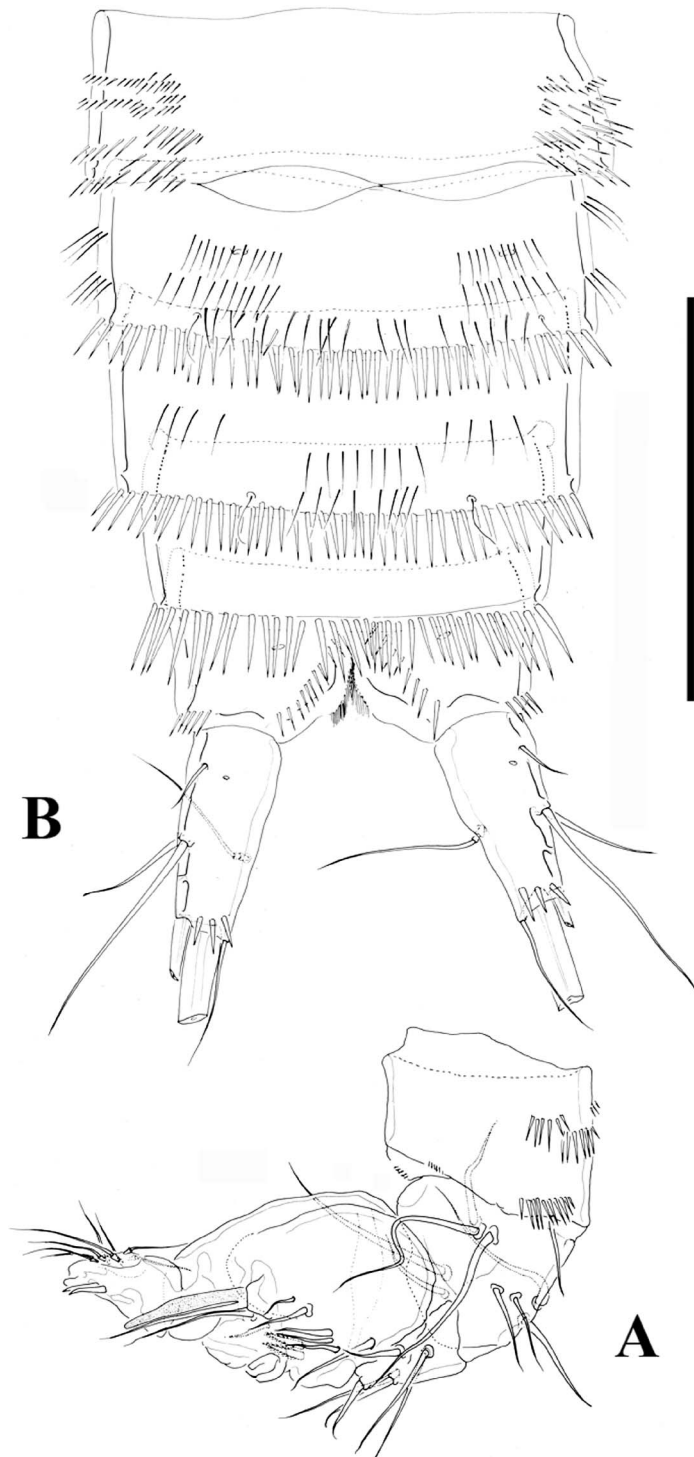


Figure 12. *Cletocamptus pilosus* sp. nov., male. (A) Antennule; (B) urosome, ventral (P5-bearing somite omitted). Scale bar = 100 μ m.

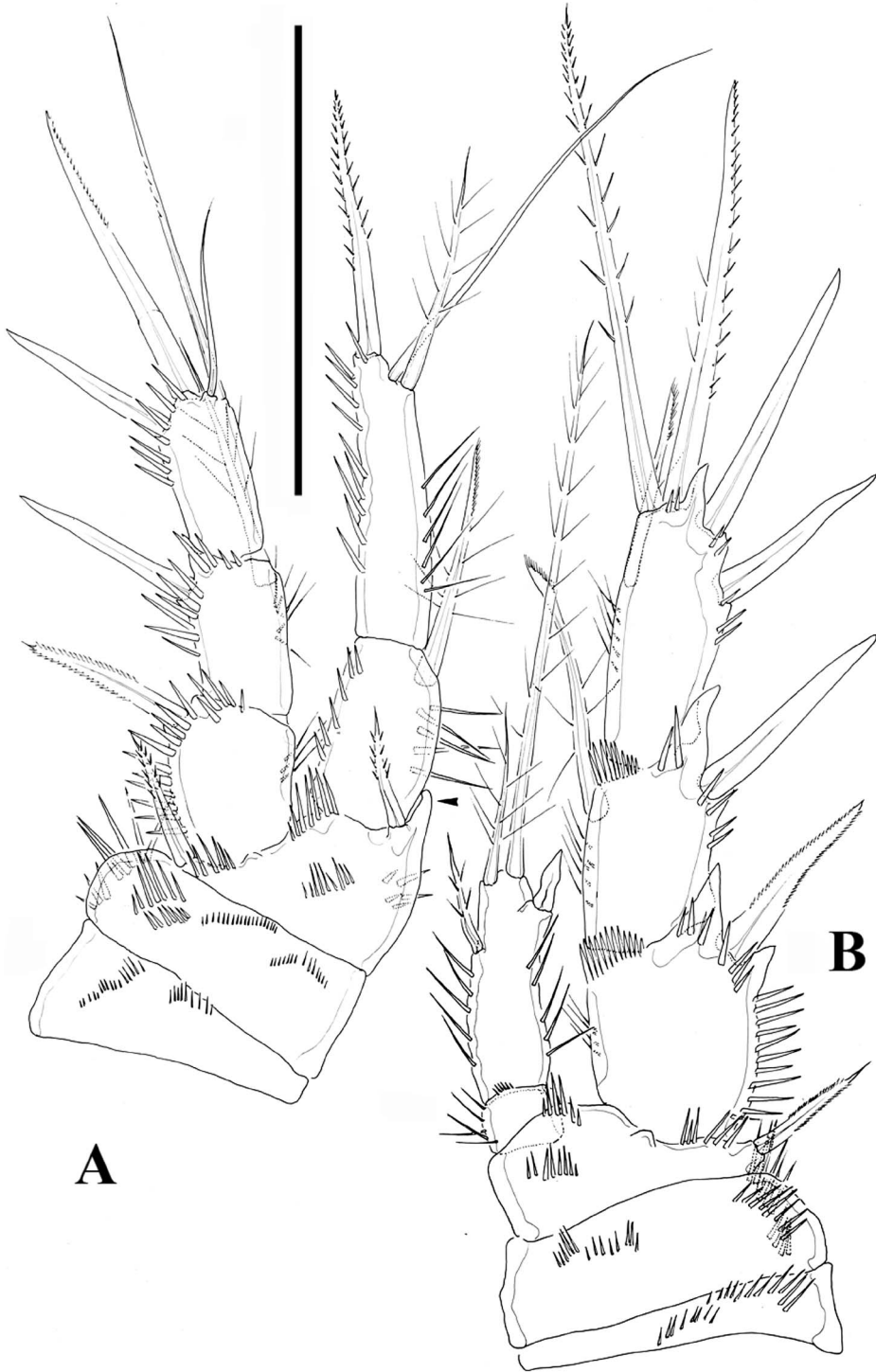


Figure 13. *Cletocamptus pilosus* sp. nov., male. (A) P1, anterior (inner dimorphic projection of basis indicated by arrow); (B) P2, anterior. Scale bar = 100 μ m.

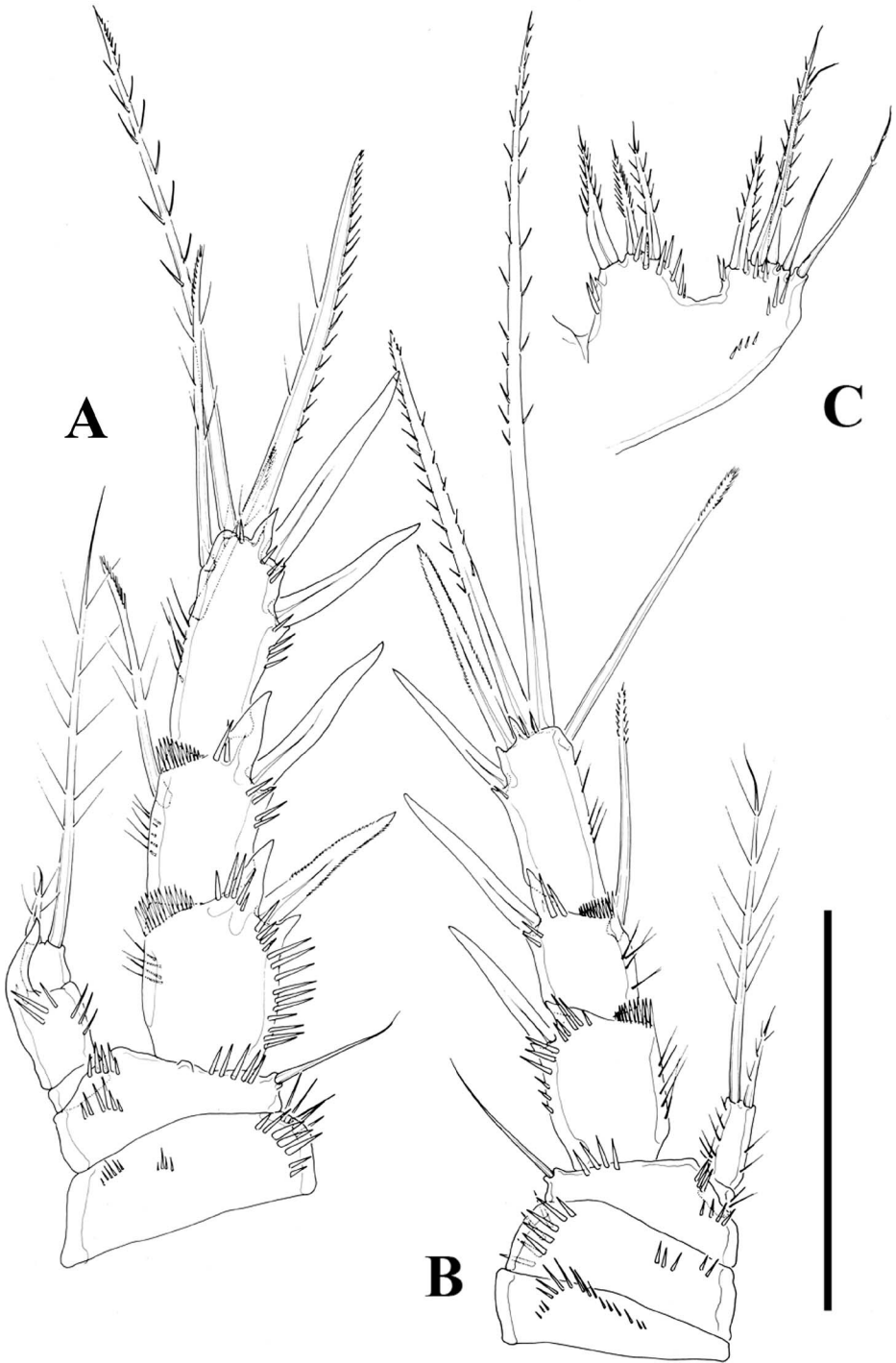


Figure 14. *Cletocamptus pilosus* sp. nov., male. (A) P3, anterior; (B) P4, anterior; (C) P5, anterior. Scale bar = 100 μ m.

Mandible (Figure 8C–D). Robust; chewing edge with bi- and multicuspidate teeth, one pyriform element and one lateral seta. Palp one-segmented, with one slender seta; with a small seta arising nearby.

Maxillule (Figure 8E). Robust; arthrite of praecoxa with one surface seta, seven distal spines and one spinulose and slender lateral seta. Coxa with some spinules and with two slender setae. Basis with some median spinules. Homology of the setae of basis, exopod and endopod difficult to define. Basis seemingly with three apical and two lateral setae, endopod and exopod seemingly represented by three and one setae, respectively.

Maxilla (Figure 8F). Syncoxa with spinules along inner margin; with two endites with three setae each as illustrated. Allobasis drawn into strong claw bearing one accompanying seta. Endopod represented by three setae.

Maxilliped (Figure 8G). Subchelate. Syncoxa with spinular rows as illustrated and with inner seta on distal corner. Basis unarmed; with one anterior and one posterior longitudinal row of spinules along inner margin; with small spinules medially and subapically. Endopod drawn into long and slender claw with one accompanying small seta.

P1 (Figure 9A). Praecoxa with spinules close to joint with coxa. The latter with spinular rows as illustrated. Basis with inner and outer spine; with median spinular row, and with stronger spinules at base of inner and outer spines and between rami. Exopod three-segmented. Endopod two-segmented, longer than exopod.

P2 (Figure 9B). Praecoxa and coxa as in P1. Basis as in P1 except for lack of inner spine in P2; with outer spine-like element. Exopod three-segmented and ornamented as illustrated; EXP2 and EXP3 with inner seta. Endopod two-segmented, reaching middle of EXP2; first segment small, nearly as wide as long and ornamented as illustrated; second segment long, about four times as long as wide, ornamented as depicted and armed with one outer spine, one apical setae and two inner elements.

P3 (Figure 10A). Praecoxa and coxa as in P2. Basis as in P2 except for outer seta-like element. Exopod three-segmented; EXP2 with one, EXP3 with two inner setae. Endopod two-segmented, slightly beyond EXP1; ENP1 small, nearly as long as wide; ENP2 about four times as long as wide, with one outer spine, one apical and three inner setae.

P4 (Figure 10B). Praecoxa, coxa and basis as in P3. Exopod as in P2, except for insertion site of inner seta of EXP3. Endopod two-segmented, reaching above middle of EXP1; first segment very small; second segment about three times as long as wide and armed with two setae.

P5 (Figure 7B). Exopod and baseoendopod fused. Baseoendopodal lobe about two times longer than exopodal lobe; with one outer, one apical and four inner setae; relative length of setae as shown. Exopodal lobe with five setae plus outer seta of basis. The armature formula of female P1–P5 is presented in Table 2.

Table 2. Armature formula of *Cletocamptus pilosus* sp. nov. female P1–P5

	P1	P2	P3	P4	P5
Exopod	I-0;I-1;I,II,1	I-0;I-1;II,2,1	I-0;I-1;II,2,2	I-0;I-1;II,2,1	5
Endopod	0-1;0,II,1	0-0;I,1,2	0-0;I,1,3	0-0;0,2,0	6

P6 (Figure 7A). Represented by median plate in anterior half of second urosomite (first genital somite); each vestigial leg represented by one outer long seta and one inner tiny element. Copulatory pore in the middle of genital-double somite.

Male

Habitus (Figure 11A–B). More slender than in female, with second and third urosomites distinct; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 420 to 615 μm (mean, 544 μm ; $n = 14$; holotype, 590 μm). Rostrum as in female. Cephalic shield (Figure 11A–B) as in female except for longer spinules along margin dorsally and laterally. Ornamentation of pro- and urosomites as in female except for less dense spinular ornamentation on male first urosomite and anal somite (compare Figures 6A and 11A, and 7A and 12B). Caudal rami (Figures 11A–B and 12B) as in female.

Antennule (Figure 12A). Subchirocer, six-segmented; surface of segments smooth except for more spinular rows on first segment. Armature formula difficult to define but probably as follows: 1-(1), 2-(9), 3-(6), 4-(10+[1+ae]), 5-(0), 6-(8). Last segment with three teeth.

Antenna, mandible, maxillule, maxilla and maxilliped (not shown). As in female.

P1 (Figure 13A). As in female except for inner projection of basis (indicated by arrow in Figure 13A).

P2 (Figure 13B). Praecoxa, coxa and basis as in female. Exopod as in female except for stronger outer spines and comparatively shorter elements on EXP3 in male. Endopod as in female, except for dimorphic outer spine.

P3 (Figure 14A). Coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod as in female except for dimorphic and stronger outer spines; EXP2 with one, EXP3 with two inner setae. Endopod dimorphic, three-segmented; first segment very small, about two times as wide as long; second segment with inner apophysis hardly reaching beyond third segment, the latter small and armed with two setae.

P4 (Figure 14B). Coxa and basis as in P3. Exopod as in P2, except for insertion site of inner seta of EXP3. Endopod as in female, except for being comparatively smaller and with comparatively shorter setae than in female.

P5 (Figure 14C). Both legs fused medially. Exopod and baseoendopod fused. Baseoendopodal lobe slightly beyond exopodal lobe; with three apical setae. Exopodal lobe with four setae plus outer seta of basis.

P6 (Figure 12B). Represented by median plate. Without armature.

Variability

The female holotype was observed to possess two inner setae in P2EXP3. The male allotype was observed to possess three setae in P2ENP2 (without inner seta). Six female paratypes were dissected and the following was observed. One female possess three elements (one of them aberrant) in left P1EXP3 and one inner seta in right P4ENP2. Another female showed an aberrant inner seta in right P1ENP2. One female showed an aberrant right P2EXP3. One female lacked the inner seta in left P3EXP3 and another female showed the right P3ENP2 with one inner seta. One female showed one inner seta in left P4ENP2. One male was observed to possess two inner setae in right P4ENP2.

Cletocamptus tertius sp. nov. (Figures 15–24)

Type material

One female holotype (USNM 264521) preserved in alcohol, 1 male allotype (USNM 1010095) preserved in alcohol, 10 dissected female (USNM 1123805, USNM 1123806, USNM 1123807, USNM 1123808, USNM 1123809, USNM 1123810, USNM 1123811, USNM 1123812, USNM 1123813, USNM 1123814) and 7 dissected male paratypes (USNM 1123815, USNM 1123816, USNM 1123817, USNM 1123818, USNM 1123819, USNM 1123820, USNM 1123821), 58 female and 8 male paratypes preserved in alcohol (USNM 1010096). The vial containing this material was labelled as follows: *Cletocamptus deitersi* USNM 264521; Argentina, Province of La Pampa, Santa Rosa, Laguna Don Tomás.

Type locality

Laguna Don Tomás, Santa Rosa, Province of La Pampa, Argentina.

Etymology

The specific epithet (*tertius* = third) makes reference to the fact that this is the third species closely related to *C. levis* and *C. assimilis* sp. nov., with which it shares most character states.

Female

Habitus (Figure 15A–B). Tapering posteriorly; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 555 to 725 μm (mean, 615 μm ; $n = 11$; holotype, 625 μm). Rostrum (Figure 17G) defined at base, triangular, with pair of setules subapically and ornamented with small spinules distally on ventral surface. Cephalic shield (Figure 15A–B) with long spinules along the posterior

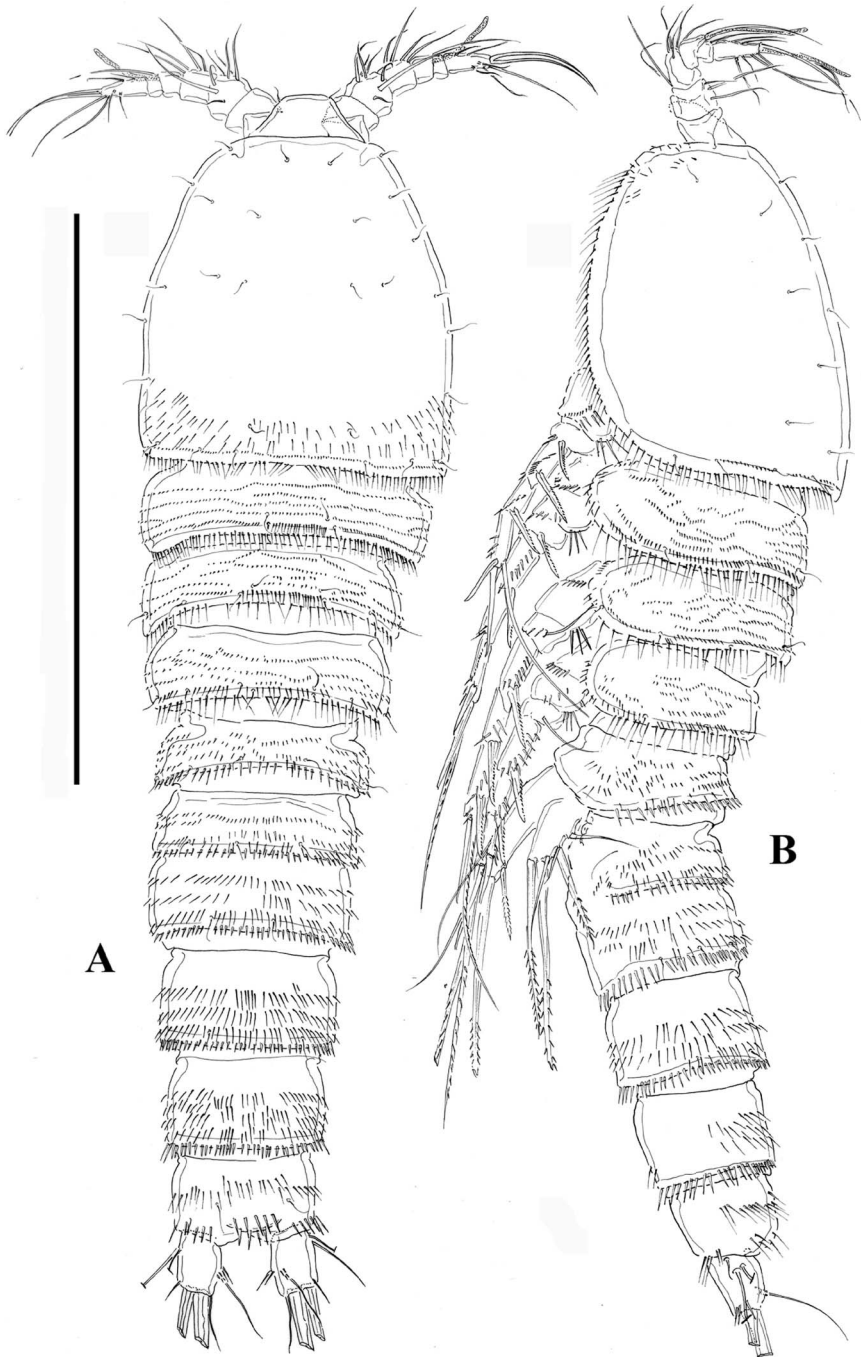


Figure 15. *Cletocamptus tertius* sp. nov., female. (A) Habitus, dorsal; slightly compressed during the mounting process; (B) habitus, lateral. Scale bars = 300 μ m.

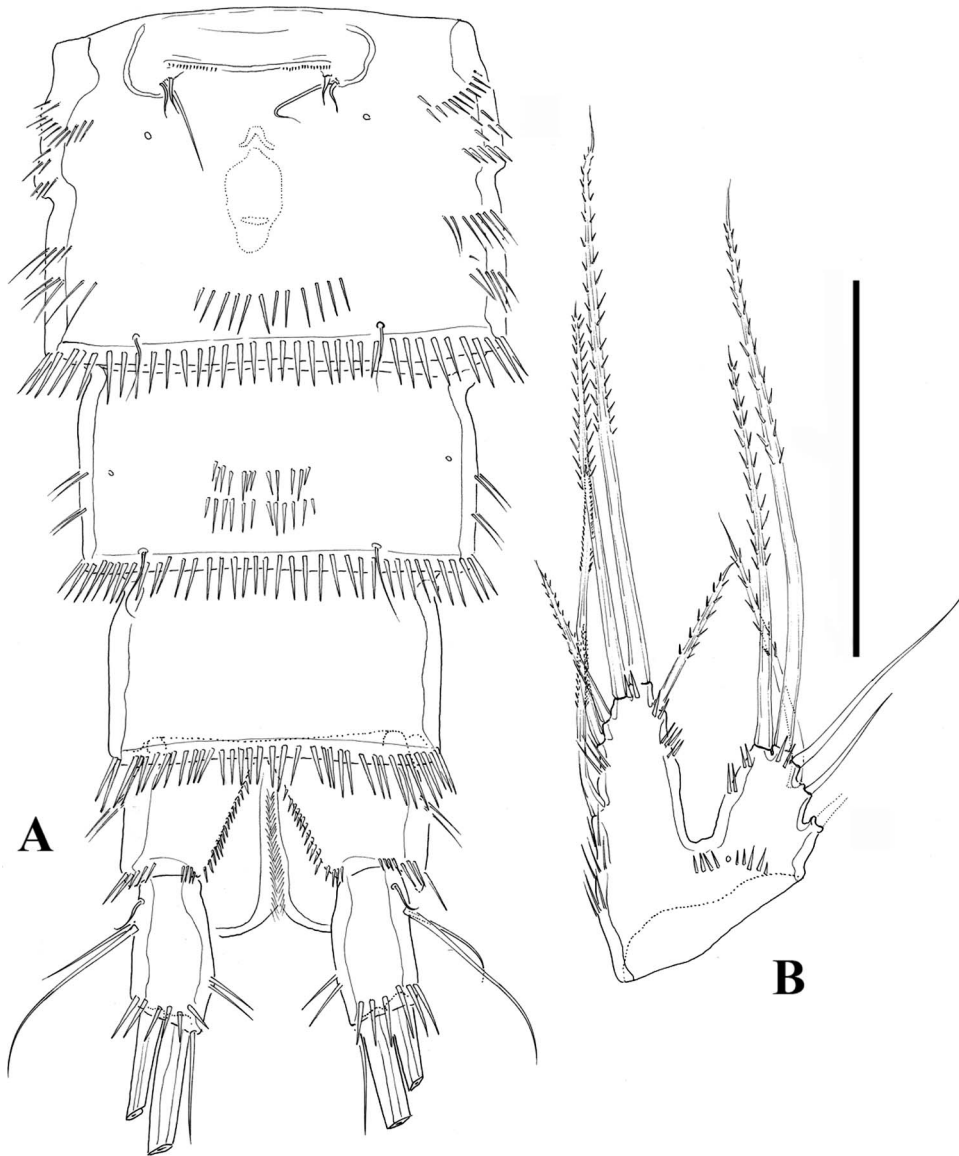


Figure 16. *Cletocamptus tertius* sp. nov., female. (A) Urosome, ventral (P5-bearing somite omitted); (B) P5, anterior. Scale bars = 100 μ m.

margin dorsally and laterally. Dorsal and lateral surface of free thoracic somites (P2- to P4-bearing somites) with transverse rows of minute spinules, with row of tiny spinules close to and with longer spinules along posterior margin. Dorsal and lateral surface of first urosomite (P5-bearing somite) as in preceding somites, with stronger spinules along posterior margin. Genital double-somite with subcuticular rib dorsally and laterally indicating former division between second and third urosomites (Figure 15A–B), but completely fused ventrally (Figure 16A). Dorsal and lateral surface of second urosomite (first genital somite) with transverse rows of small spinules and

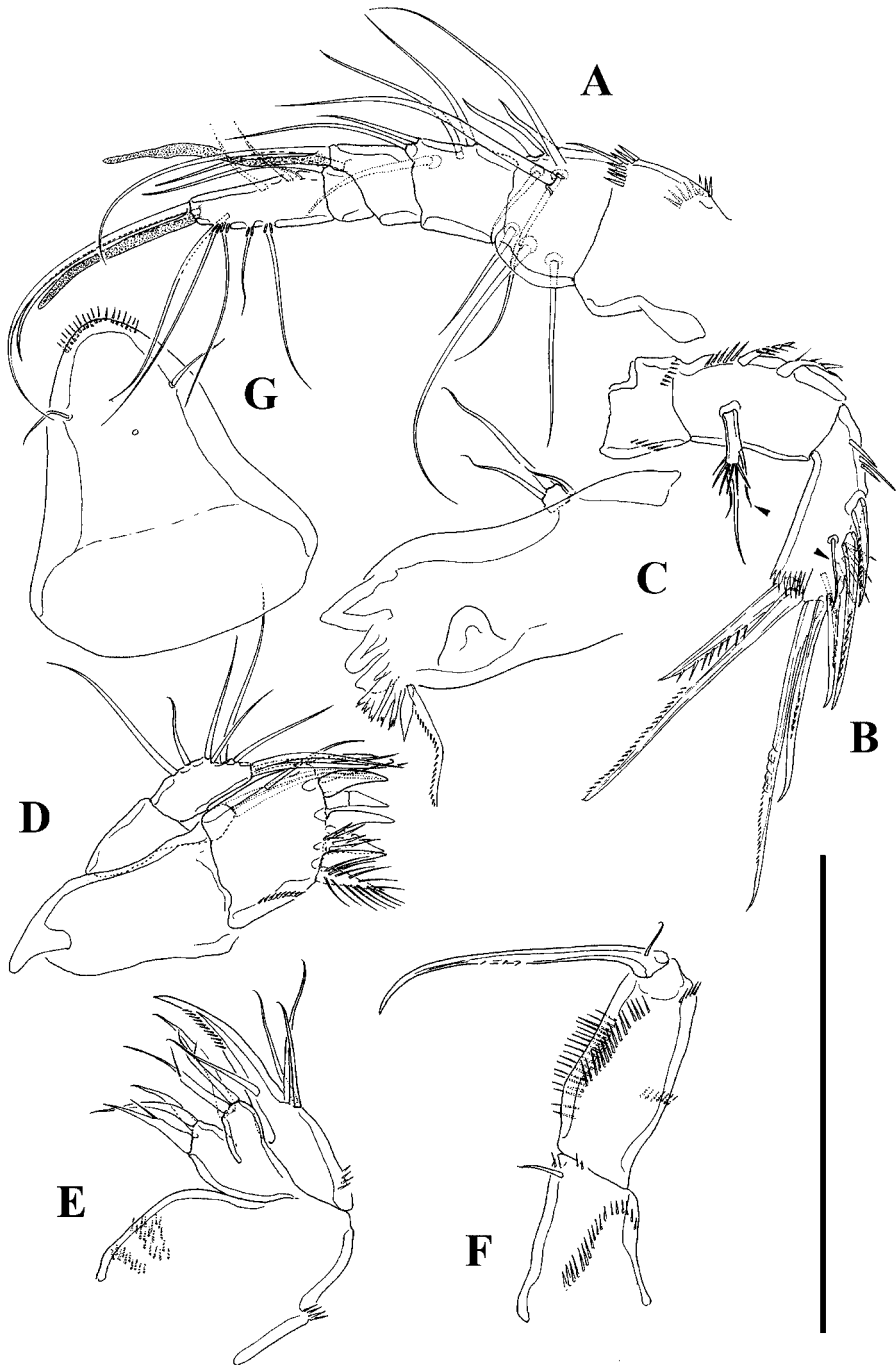


Figure 17. *Cletocamptus tertius* sp. nov., female. (A) Antennule; (B) antenna (reduced apical seta of the exopod, and slender seta of the free endopodal segment indicated by arrows); (C) mandible; (D) maxillule; (E) maxilla; (F) maxilliped; (G) rostrum, dorsal. Scale bars: (A–B) 235 μ m, (C–G) 71 μ m.



Figure 18. *Cletocamptus tertius* sp. nov., female. (A) P1, anterior; (B) P2, anterior. Scale bar = 100 μ m.



Figure 19. *Cletocamptus tertius* sp. nov., female. (A) P3, anterior; (B) P4, anterior. Scale bar = 100 μ m.

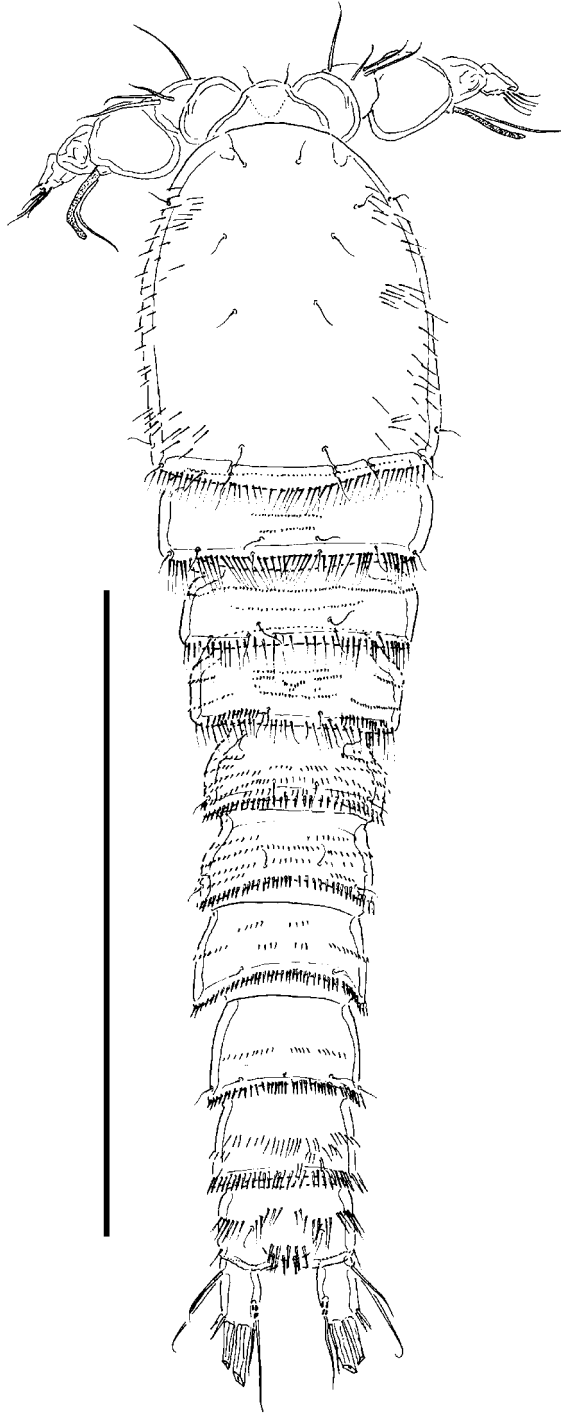


Figure 20. *Cletocamptus tertius* sp. nov., male. Habitus, dorsal; slightly compressed during the mounting process. Scale bar = 300 μ m.

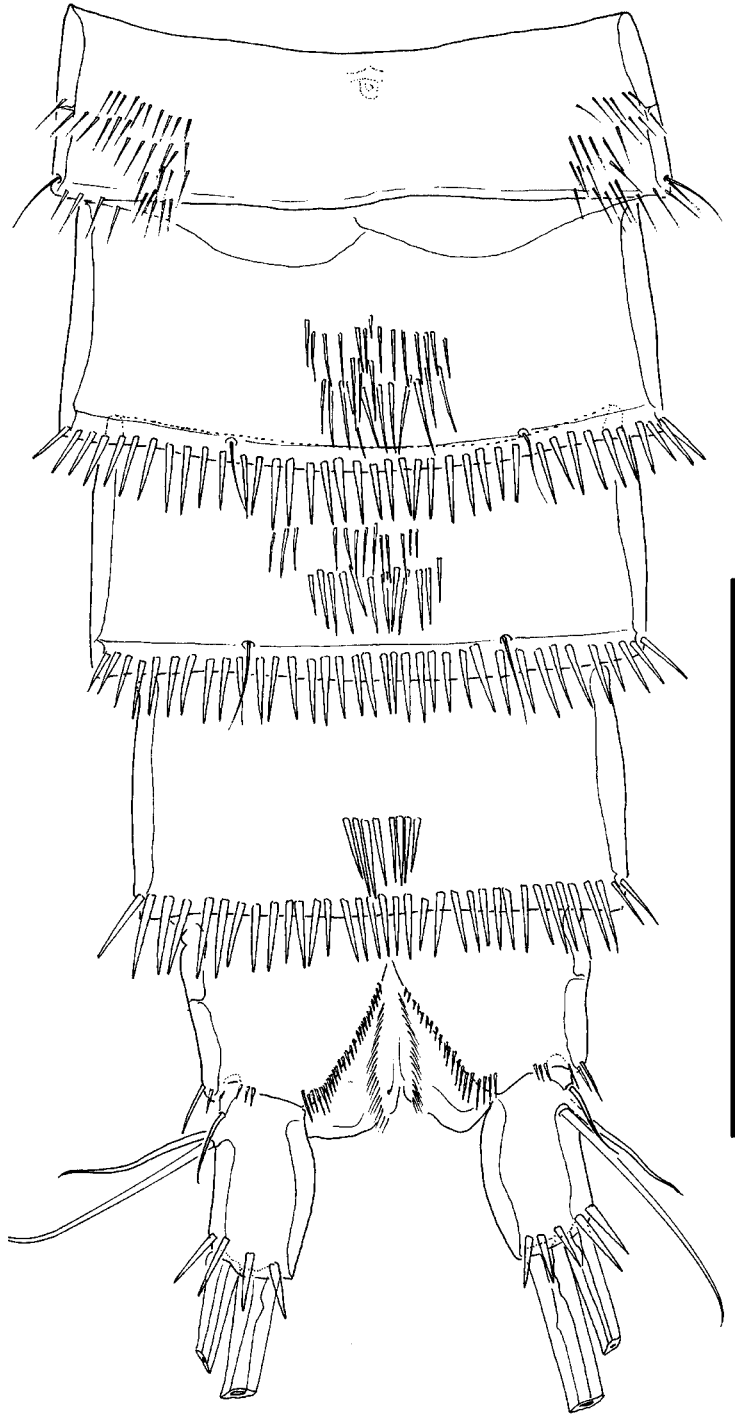


Figure 21. *Cletocamptus tertius* sp. nov., male. Urosome, ventral (P5-bearing somite omitted). Scale bar = 100 μ m.

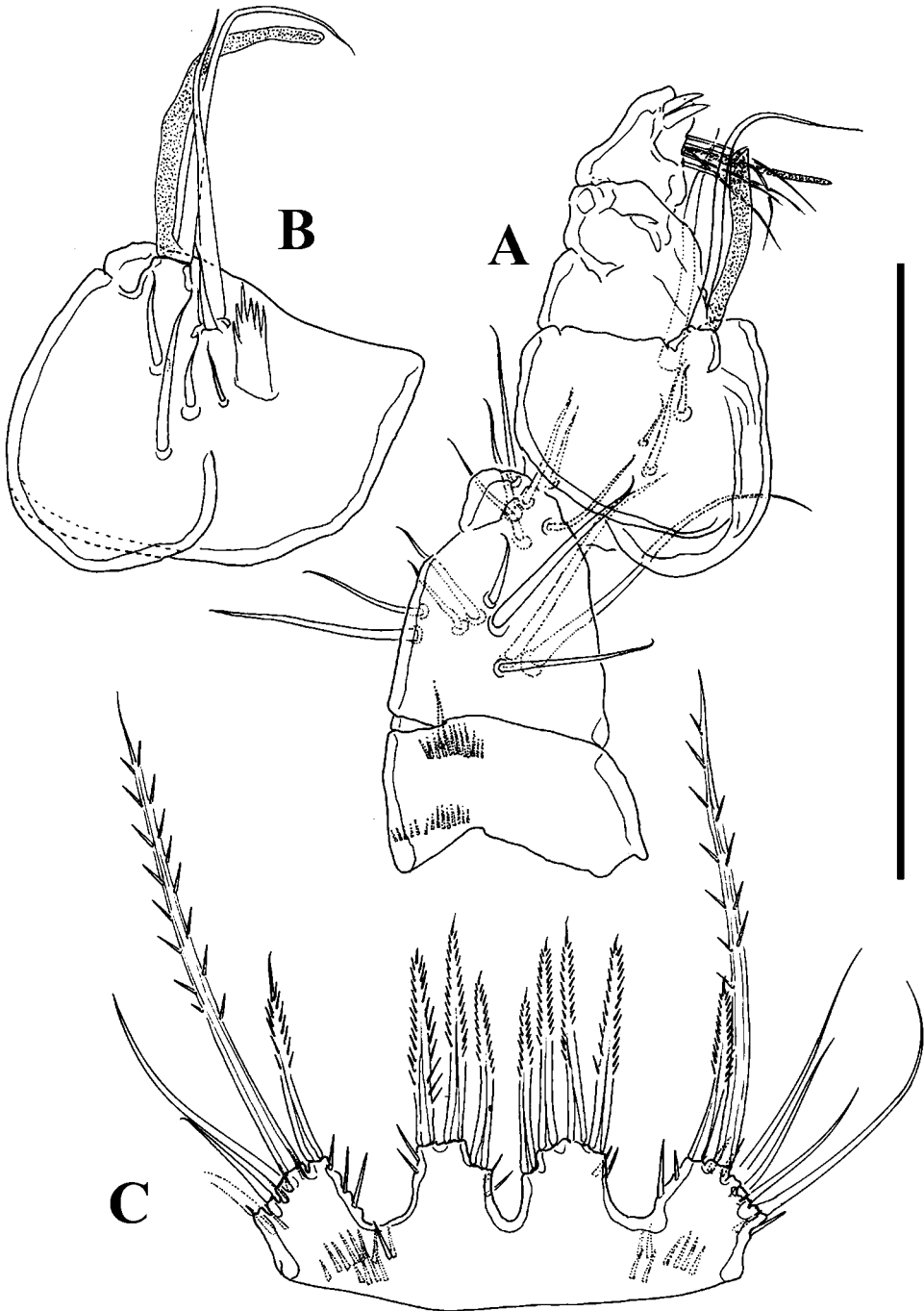


Figure 22. *Cletocamptus tertius* sp. nov., male. (A) Antennule; (B) fourth segment of antennule; (C) P5, anterior. Scale bars: (A, C) 100 μ m, (B) 70 μ m.

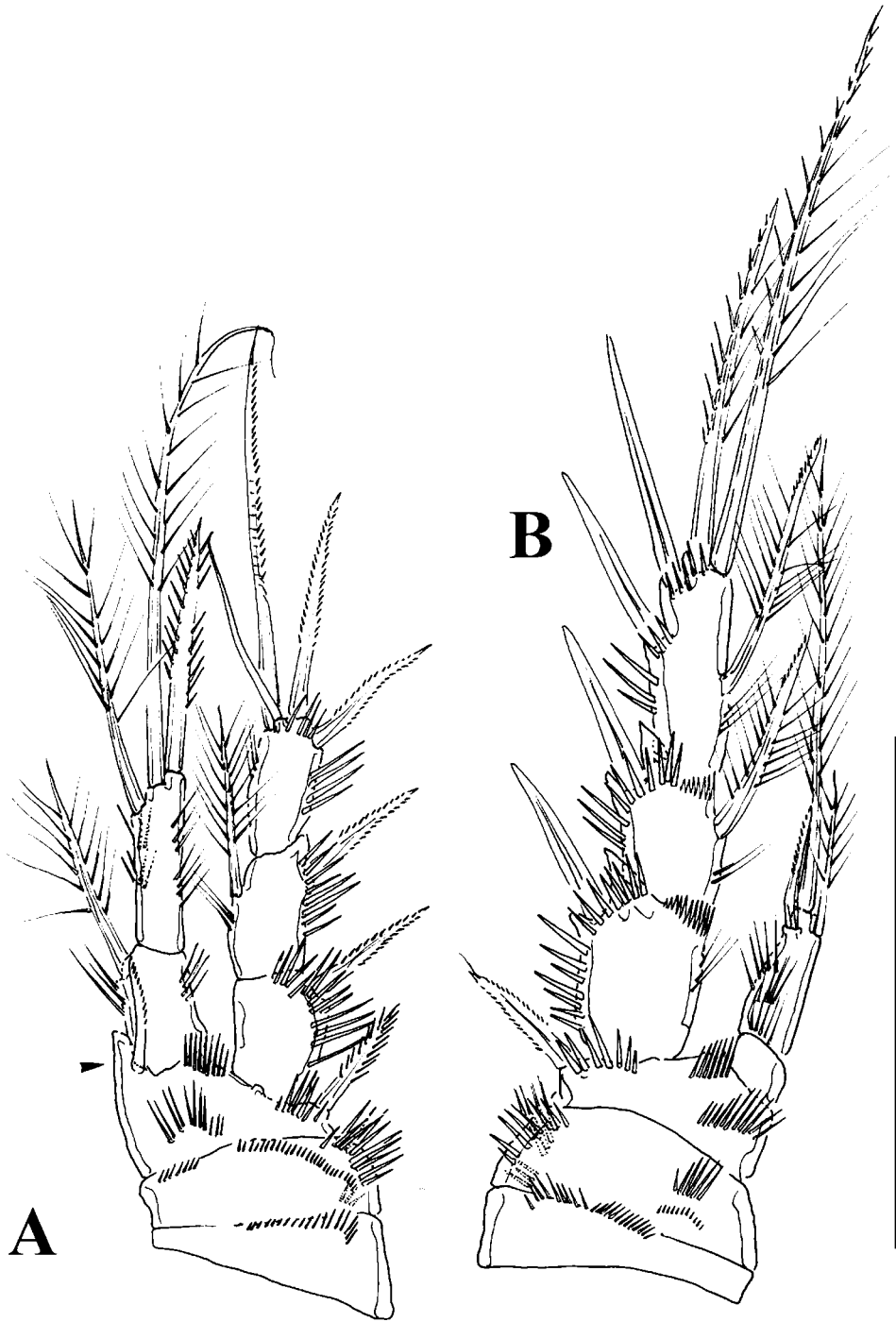


Figure 23. *Cletocamptus tertius* sp. nov., male. (A) P1, anterior (inner dimorphic projection of basis indicated by arrow); (B) P2, anterior. Scale bar = 100 μ m.

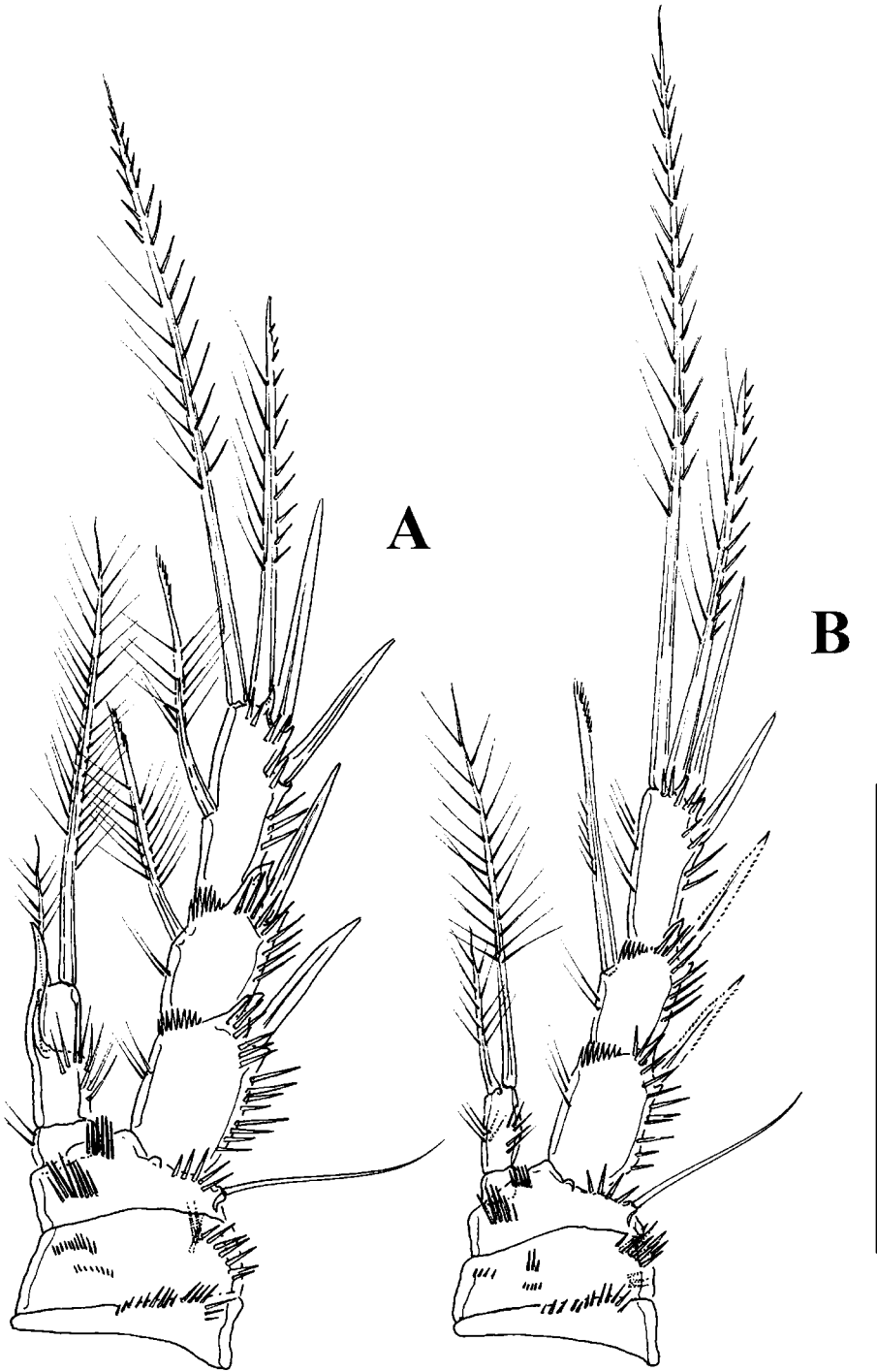


Figure 24. *Cletocamptus tertius* sp. nov., male. (A) P3, anterior; (B) P4, anterior. Scale bar = 100 μ m.

with row of stronger spinules along posterior margin, ventrally with spinules as illustrated (Figure 16A). Third urosomite (second genital somite) as in previous somite except for longer spinules dorsally and laterally, ventrally with spinules as illustrated (Figure 16A). Fourth and fifth urosomites as in previous somite dorsally, with ventral spinular pattern as illustrated (Figure 16A). Dorsal surface of anal somite with transverse rows of long spinules, and with dorsolateral spinules close to joint with caudal rami; rounded anal operculum furnished with two rows of strong spinules (Figure 15A–B). Caudal rami about three times as long as wide, not tapering posteriorly; dorsal and ventral surface smooth except for inner strong spinules and for some strong spinules close to seta IV and V ventrally (Figure 16A); with seven elements.

Antennule (Figure 17A). Six-segmented; surface of segments smooth except for two spinular rows on first segment. Armature formula, 1-(1), 2-(9), 3-(5), 4-(1+[1+ae]), 5-(1), 6-(9+[1+ae]).

Antenna (Figure 17B). With small coxa. Allobasis armed with two small abexopodal setae. Free endopodal segment with inner spinules proximally and subdistally; with two lateral inner spines and a slender seta (indicated by arrows in Figure 17B) and five distal elements. Exopod one-segmented; about five times as long as wide; with few spinules and with one lateral and two apical setae (one of them reduced – indicated by arrows in Figure 17B).

Mandible (Figure 17C). Robust; chewing edge with bi- and multicuspidate teeth, one pyriform element and one lateral seta. Palp one-segmented, with two slender setae; with a small seta arising nearby.

Maxillule (Figure 17D). Robust; arthrite of praecoxa with one surface seta, seven distal spines and one spinulose and strong lateral seta. Coxa with two slender setae. Homology of the setae of basis, exopod and endopod difficult to define. Basis seemingly with three apical and two lateral setae, endopod and exopod seemingly represented by three and one seta, respectively.

Maxilla (Figure 17E). Syncoxa with spinules along inner margin; with two endites, each bearing three setae as illustrated. Allobasis drawn into strong claw bearing one accompanying seta. Endopod represented by three setae.

Maxilliped (Figure 17F). Subchelate. Syncoxa with spinular rows as illustrated and with inner small seta on distal corner. Basis unarmed; with one anterior and one posterior longitudinal row of spinules along inner margin; with outer small spinules medially and subapically. Endopod drawn into long and slender claw with one accompanying small seta.

P1 (Figure 18A). Praecoxa with spinules close to joint with coxa. The latter with spinular rows as illustrated. Basis with inner and outer spines; with median spinular row, and with stronger spinules at base of spines and between rami. Exopod three-segmented. Endopod two-segmented, reaching middle of EXP3.

P2 (Figure 18B). Praecoxa and coxa as in P1. Basis as in P1 except for lack of inner spine in P2; outer element spine-like. Exopod three-segmented and ornamented as

illustrated; EXP2 and EXP3 with inner seta. Endopod two-segmented, reaching proximal third of EXP2; first segment small, nearly as wide as long and ornamented as illustrated; second segment long, about four times as long as wide, ornamented as depicted and armed with one outer spine, one apical and one inner seta.

P3 (Figure 19A). Praecoxa and coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod three-segmented; EXP2 and EXP3 with one inner seta. Endopod two-segmented, slightly beyond EXP1; ENP1 small, nearly as long as wide; ENP2 about four times as long as wide, with one outer spine, one apical and one inner seta.

P4 (Figure 19B). Praecoxa, coxa and basis as in P3. Exopod as in P2 and P3 except for lack of inner seta in P4EXP3. Endopod two-segmented, reaching distal third of EXP1; first segment very small; second segment about three times as long as wide, armed with two setae.

P5 (Figure 16B). Exopod and baseopod fused. Baseopodal lobe about two times longer than exopodal lobe; with one outer, one apical and four inner setae; relative length of setae as shown. Exopod with five setae plus outer seta of basis. The armature formula of female P1–P5 is presented in Table 3.

P6 (Figure 16A). Represented by median plate in anterior half of second urosomite (first genital somite); each vestigial leg represented by one outer small seta, one median long element and one small inner element. Copulatory pore in the middle of genital-double somite.

Male

Habitus (Figure 20). More slender than in female, with second and third urosomites distinct; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 495 to 580 μm (mean, 534 μm ; $n = 9$; allotype, 580 μm). Rostrum as in female. Cephalic shield (Figure 20) as in female. Ornamentation of pro- and urosomites as in female except for less dense spinular ornamentation on male pro- and urosomites (compare Figures 15A and 20). Caudal rami (Figures 20–21) as in female.

Antennule (Figure 22A–B). Subchirocer, six-segmented; surface of segments smooth except for two spinular rows on first segment. Armature formula difficult to define but probably as follows: 1-(1), 2-(9), 3-(6), 4-(7+[1+ae]), 5-(0), 6-(8+ae). Last segment with three teeth.

Antenna, mandible, maxillule, maxilla and maxilliped (not shown). As in female.

Table 3. Armature formula of *Cletocamptus tertius* sp. nov. female P1–P5

	P1	P2	P3	P4	P5
Exopod	I-0;I-1;I,II,1	I-0;I-1;II,2,1	I-0;I-1;II,2,1	I-0;I-1;II,2,0	5
Endopod	0-1;0,II,1	0-0;I,1,1	0-0;I,1,1	0-0;0,2,0	6

P1 (Figure 23A). As in female except for inner projection of basis (the latter indicated by arrow in Figure 23A).

P2 (Figure 23B). Praecoxa, coxa and basis as in female. Exopod as in female except for stronger outer spines and comparatively shorter elements in the male EXP3. Endopod as in female.

P3 (Figure 24A). Coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod as in female except for dimorphic and stronger outer spines. Endopod dimorphic, three-segmented; first segment very small, about two times as wide as long; second segment with inner apophysis reaching far beyond third segment, the latter armed with two setae.

P4 (Figure 24B). Coxa and basis as in P3. Exopod as in female except for stronger outer spines. Endopod as in female, except for being comparatively smaller and with comparatively shorter setae than in female.

P5 (Figure 22C). Both legs fused medially. Exopod and baseoendopod fused. Baseoendopodal lobe as long as exopodal lobe; with three apical setae. Exopod with four setae plus outer seta of basis.

P6 (Figure 21). Represented by median plate. Without armature.

Variability

One female was observed to possess three rows of inner spinules on right P4EXP3. Another female possesses a dwarfed outer spine on right P1ENP2, lacks inner seta on left P1EXP2, exhibits two inner rows of spinules on left P4ENP2 (one row in right P4ENP2), presents four elements plus outer seta of basis on right P5EXP and four spines on right P5BENP. Another female possesses two elements on right P1ENP2 (innermost aberrant) and three rows of inner spinules on right P4EXP3 (two rows on left P4EXP3), and lacks inner seta on left P2EXP3. Another female lacks inner seta on left P2ENP2, possesses an aberrant first endopodal segment (very small) and an aberrant innermost seta on second segment of right P4ENP, and an aberrant second endopodal segment on left P4. Another female possesses three inner rows of spinules on right P4EXP3 (only two rows on left P4EXP3). One male was observed to possess three inner rows of spinules on left P4EXP3 (only two rows on right P4EXP3).

Cletocamptus spinulosus sp. nov.

(Figures 25–37)

Type material

One female holotype (EMUCOP-200306-03) and 1 male allotype (EMUCOP-200306-04) preserved in alcohol, 8 male (EMUCOP-200306-05, EMUCOP-200306-06, EMUCOP-200306-07, EMUCOP-200306-08, EMUCOP-200306-09, EMUCOP-200306-10, EMUCOP-200306-11, EMUCOP-200306-12) and 8 female (EMUCOP-200306-13, EMUCOP-200306-14, EMUCOP-200306-15, EMUCOP-200306-16,

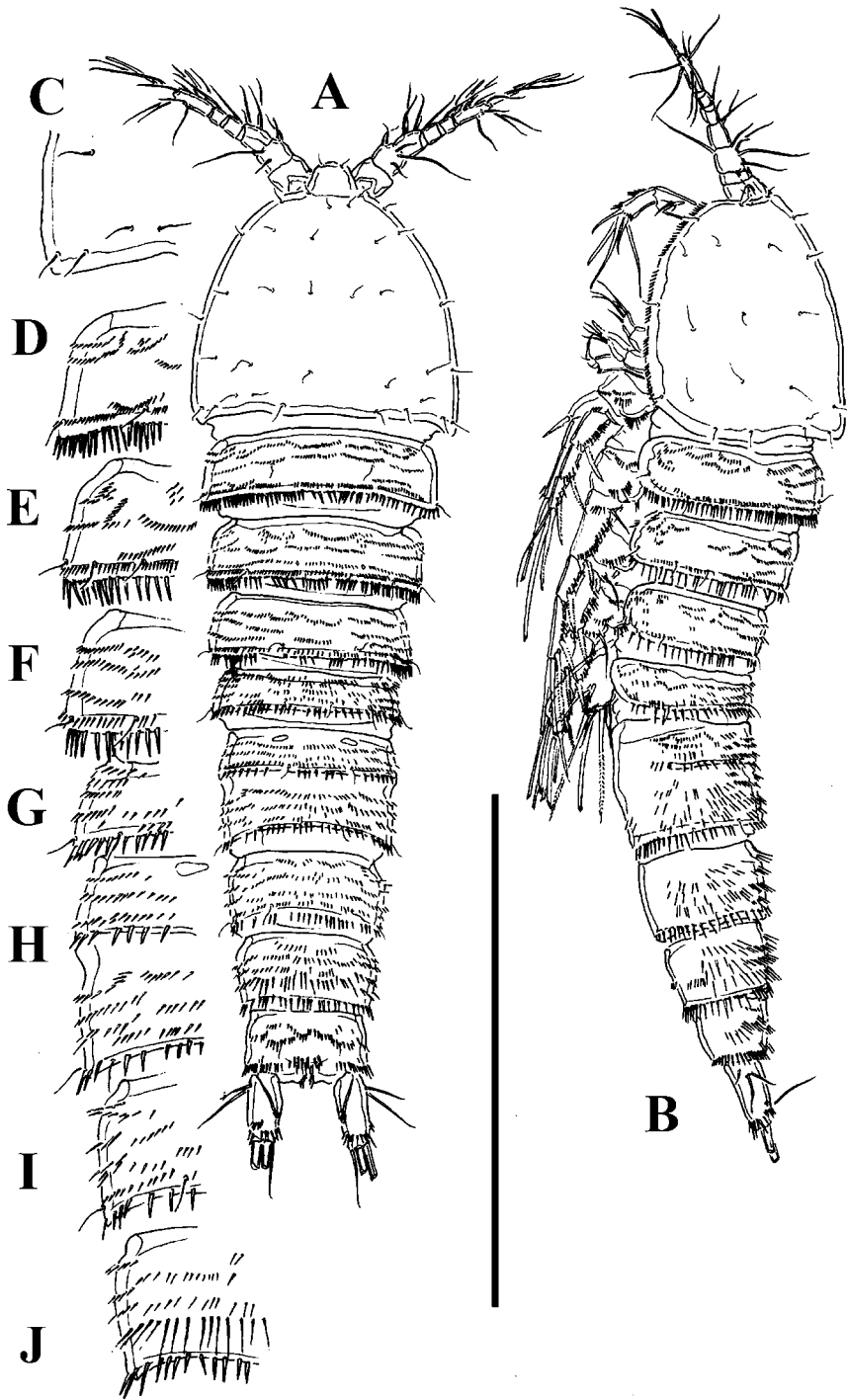


Figure 25. *Cletocamptus spinulosus* sp. nov., female. (A) Habitus, dorsal; slightly compressed during the mounting process; (B) habitus, lateral; (C–J) posterior distal corner of cephalothorax: (C) P2- to P5-bearing somites; (D–G) genital double-somite; (H) fifth and sixth urogenital somites; (I–J). Scale bars: (A–B) 500 μ m, (C–J) 256 μ m.

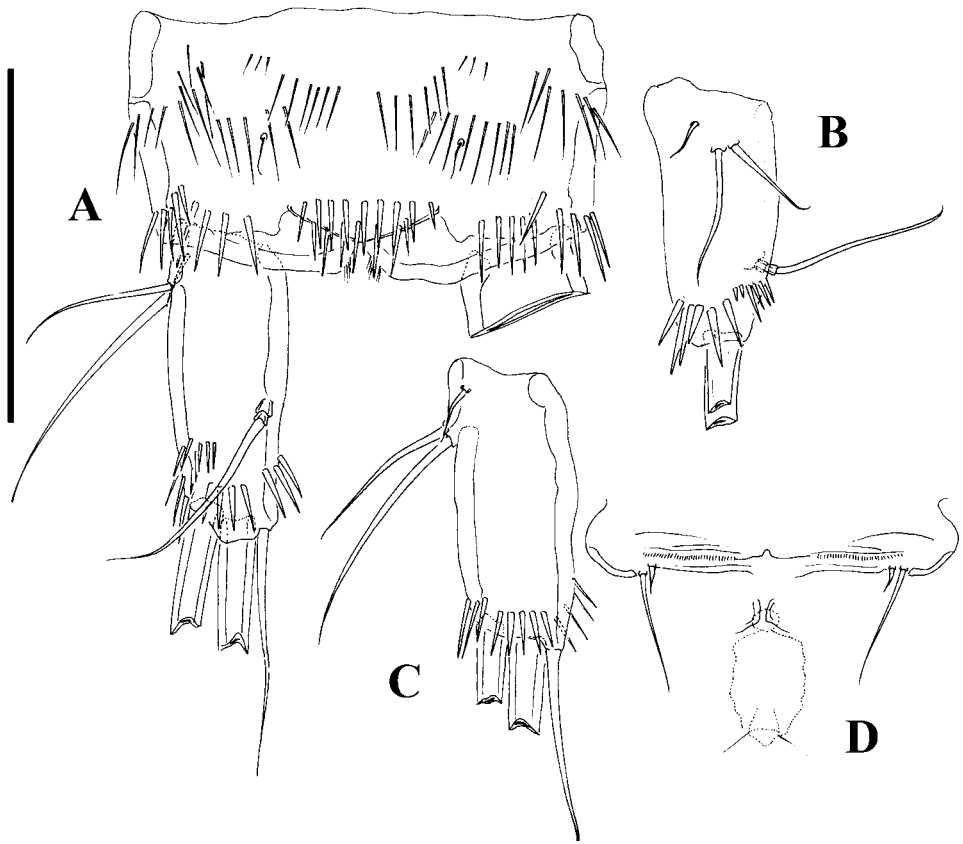


Figure 26. *Cletocamptus spinulosus* sp. nov., female. (A) Anal somite and left caudal ramus, dorsal; (B) left caudal ramus, lateral; (C) right caudal ramus, ventral; (D) P6 and genital field. Scale bar = 100 μ m.

EMUCOP-200306-17, EMUCOP-200306-18, EMUCOP-200306-19, EMUCOP-200306-20) dissected paratypes, and 20 female, 66 male and 43 copepodite paratypes preserved in alcohol ((EMUCOP-200306-21). Collected in year 2005, near Caleta Olivia (46°28'912'S, 67°31'069'W); 11 m above sea level; salinity, 50‰ Coll. R.M. Warwick.

Type locality

46°28'912'S, 67°31'069'W (near Caleta Olivia), Province of Santa Cruz, Argentina.

Additional material

Forty-two females, 41 males and 18 copepodites preserved in alcohol (EMUCOP-200306-22). Collected in year 2005, in Puerto Madryn City lagoon, Province of Chubut (42°46'742'S, 65°01'904'W); 20 m above sea level; salinity, 11.7‰ Coll. R.M. Warwick.

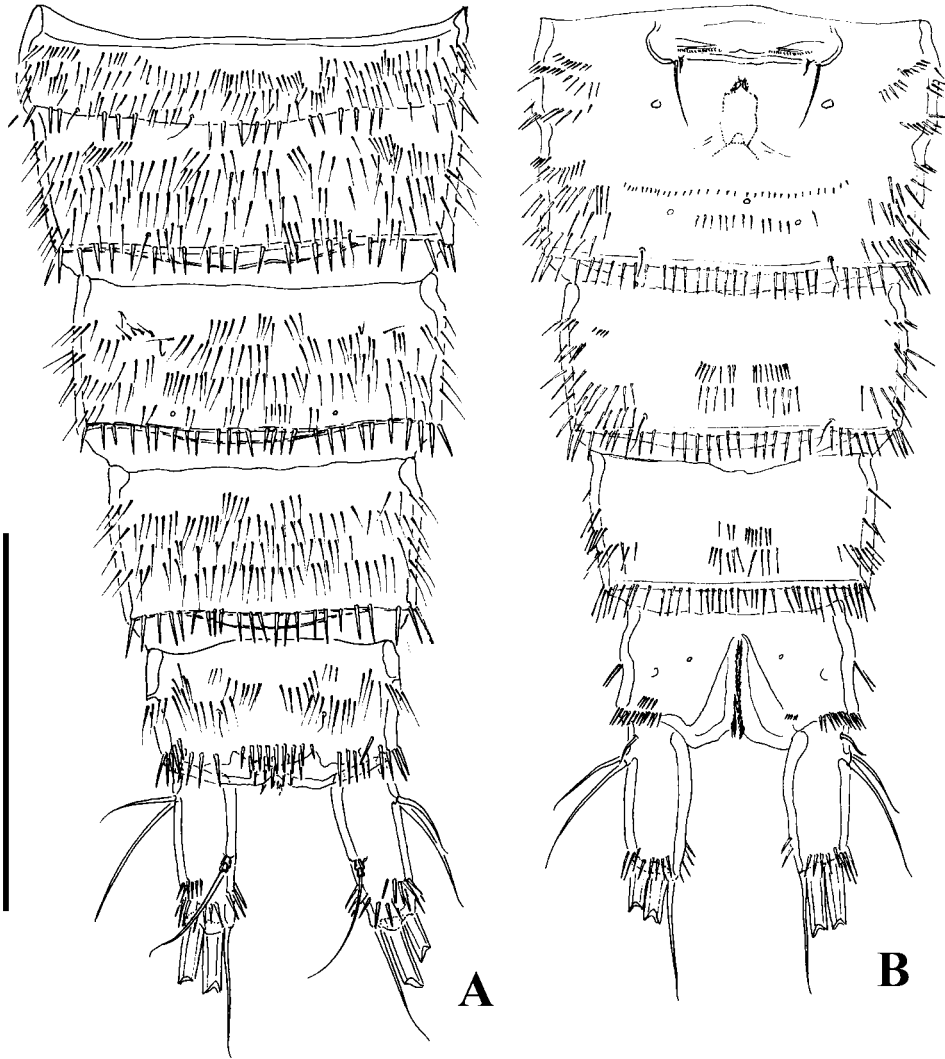


Figure 27. *Cletocamptus spinulosus* sp. nov., female. (A) Urosome, dorsal (P5-bearing somite omitted); (B) urosome, ventral (P5-bearing somite omitted). Scale bar = 200 μ m.

Etymology

The specific name makes reference to the presence of strong instead of slender and long spinules along posterior margin of P2- to P4-bearing somites.

Female

Habitus (Figure 25A–B). Tapering posteriorly; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 800 to 1050 μ m (mean, 911 μ m; n= 16; holotype, 910 μ m). Rostrum (Figure 28A) defined at base, triangular,

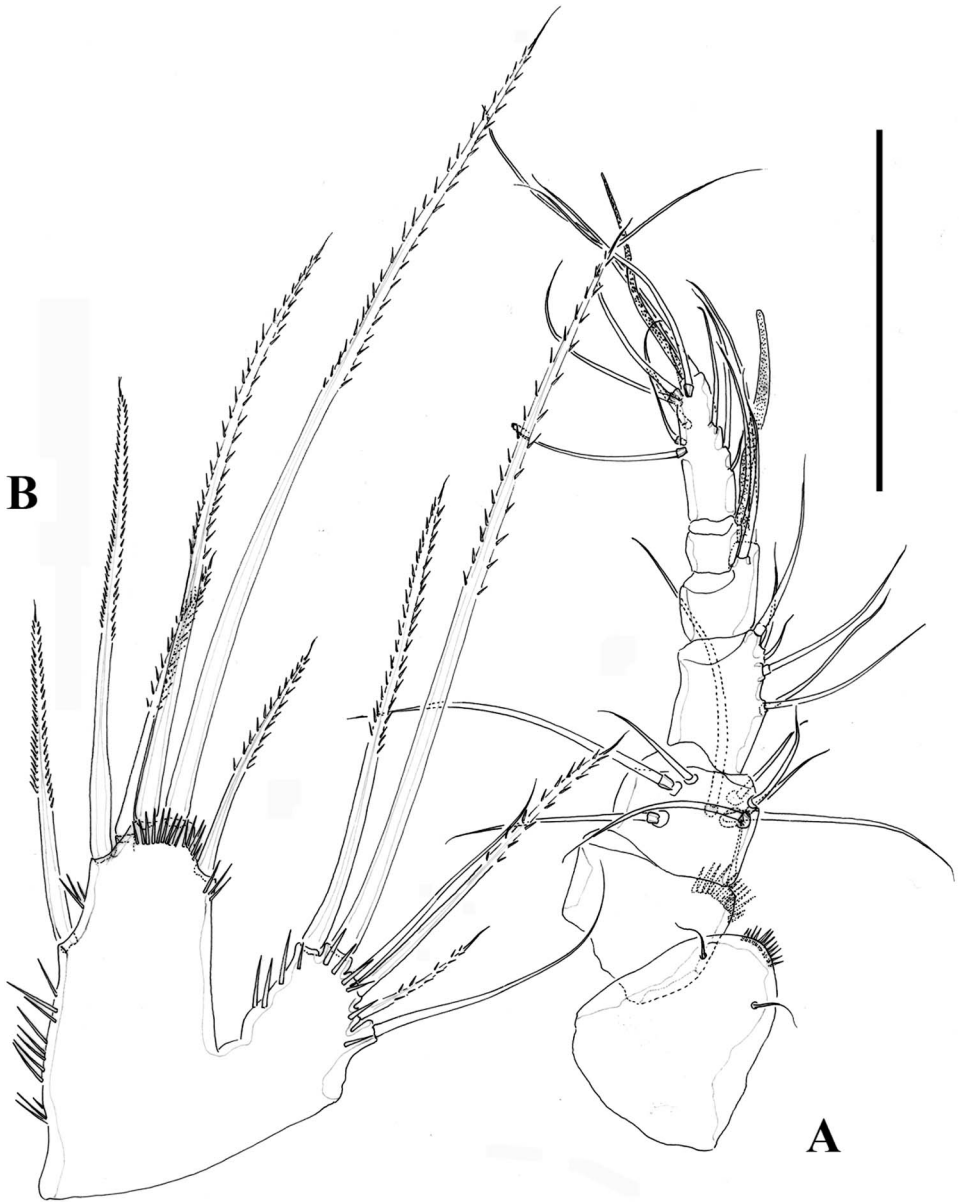


Figure 28. *Cletocamptus spinulosus* sp. nov., female. (A) Rostrum and antennule; (B) P5, anterior. Scale bar = 100 μ m.

with pair of setules subapically and ornamented with small spinules distally on ventral surface. Posterior margin of cephalic shield with small spinules laterally, bare or with few spinules dorsally (Figure 25A–C). Dorsal and lateral surface of free thoracic somites (P2- to P4-bearing somites) with transverse rows of minute spinules, with row of tiny spinules close to posterior margin and with strong and short spinules along

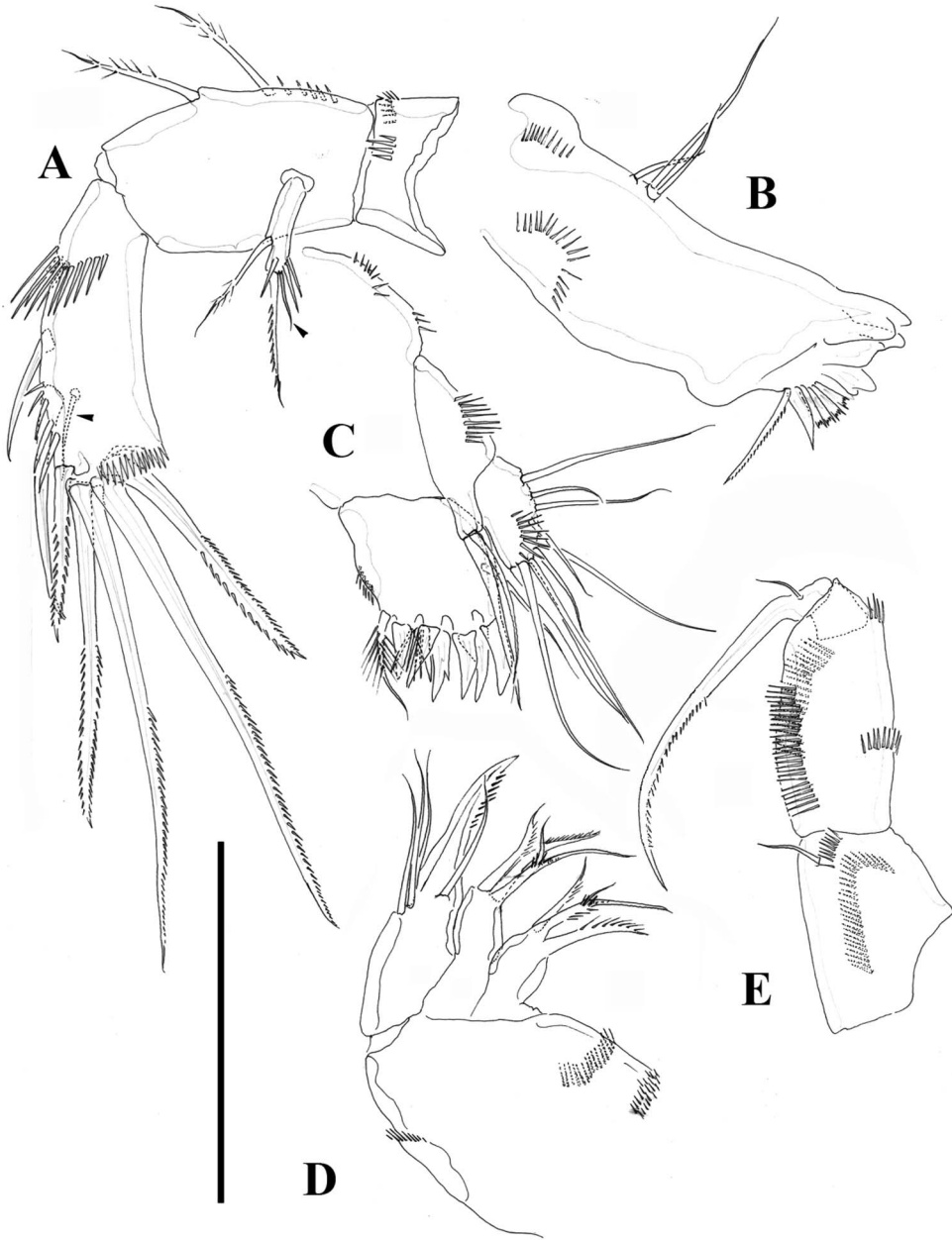


Figure 29. *Clotocamptus spinulosus* sp. nov., female. (A) Antenna (reduced apical seta of the exopod, and slender seta of the free endopodal segment indicated by arrows); (B) mandible; (C) maxillule; (D) maxilla; (E) maxilliped. Scale bar = 100 μ m.

posterior margin (Figure 25A–B, D–F). Dorsal and lateral surface of first urosomite (P5-bearing somite) as in preceding somites (Figure 25A–B, G). Genital double-somite with subcuticular rib dorsally and laterally indicating former division between second and third urosomites (Figures 25A–B and 27A), but completely fused

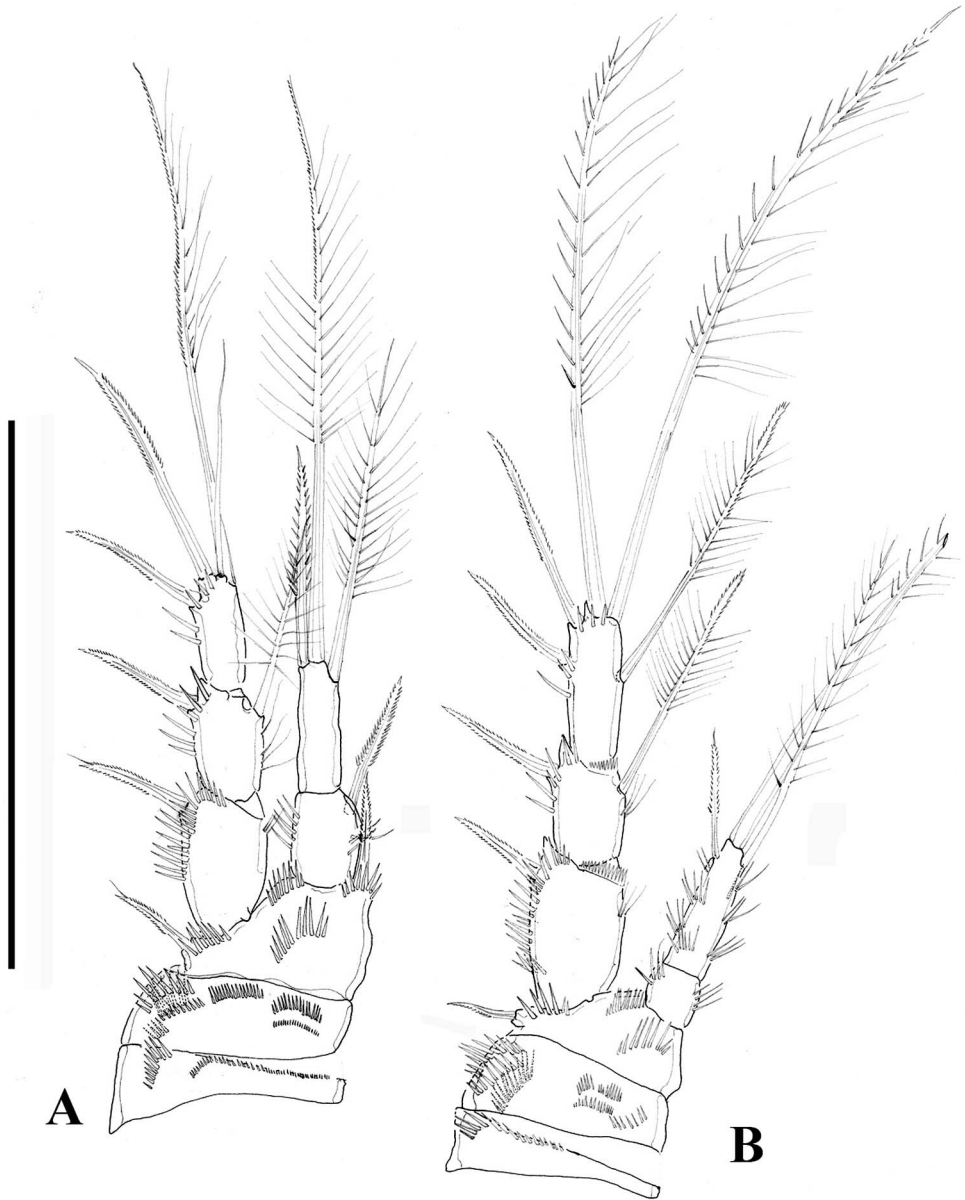


Figure 30. *Cletocamptus spinulosus* sp. nov., female. (A) P1, anterior; (B) P2, anterior. Scale bars: (A) 200 μm , (B) 231 μm .

ventrally (Figure 27B). Dorsal and lateral surface of second urosomite (first genital somite) with transverse rows of small spinules and with row of stronger spinules along posterior margin (Figure 25A–B, H), ventrally with spinules as in Figure 27B. Third urosomite (second genital somite) as in previous somite. Fourth and fifth

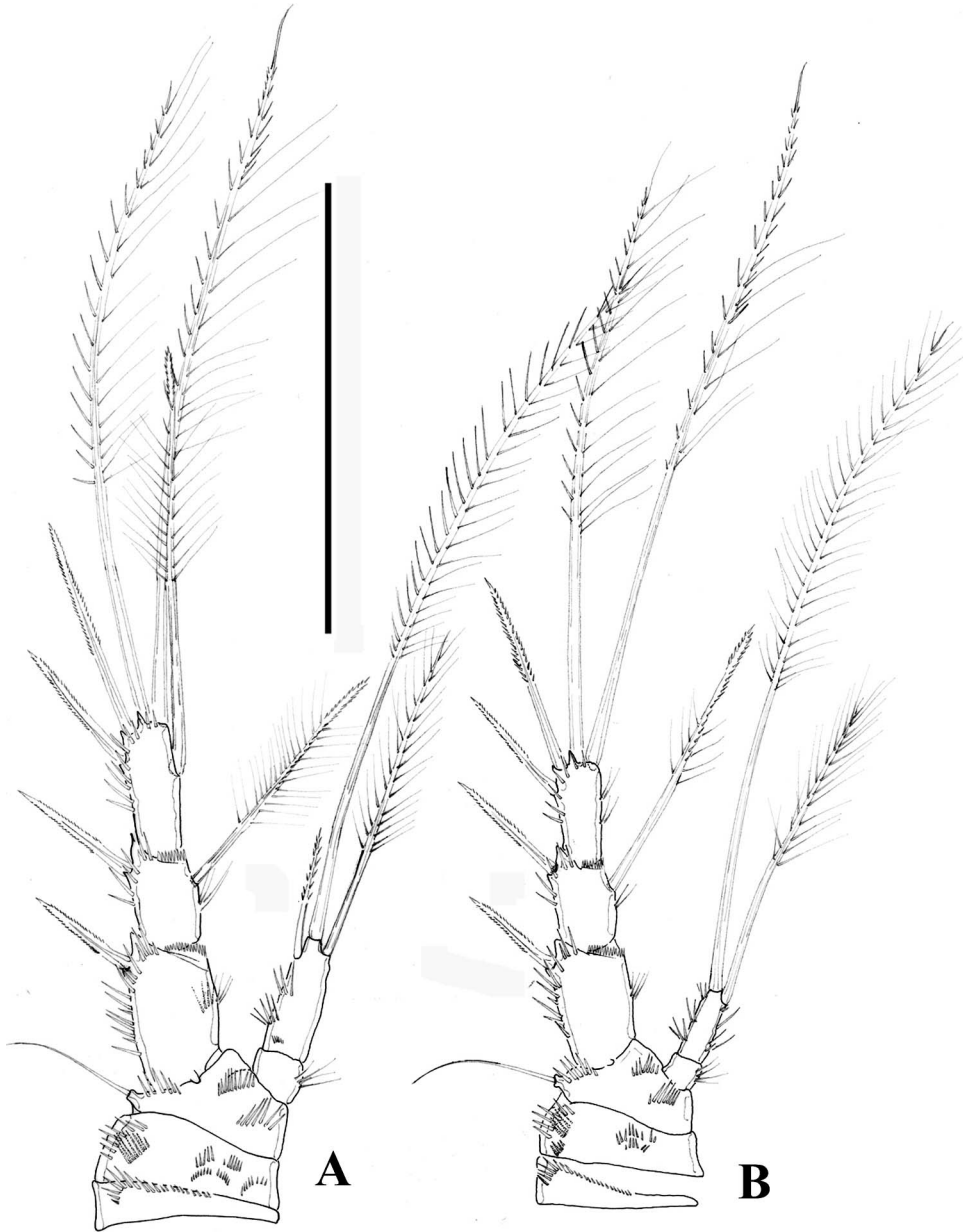


Figure 31. *Cletocamptus spinulosus* sp. nov., female. (A) P3, anterior; (B) P4, anterior. Scale bar = 200 μ m.

urosomites as in previous somite dorsally, ventrally with spinular pattern as illustrated (Figure 27B). Dorsal surface of anal somite with transverse rows of long spinules, and with dorsolateral spinules close to joint with caudal rami; rounded anal operculum furnished with two rows of strong spinules (Figure 26A). Caudal rami about three times as long as wide, slightly tapering posteriorly; dorsal, lateral and ventral surfaces with spinules as illustrated (Figure 26A–C); with seven elements.

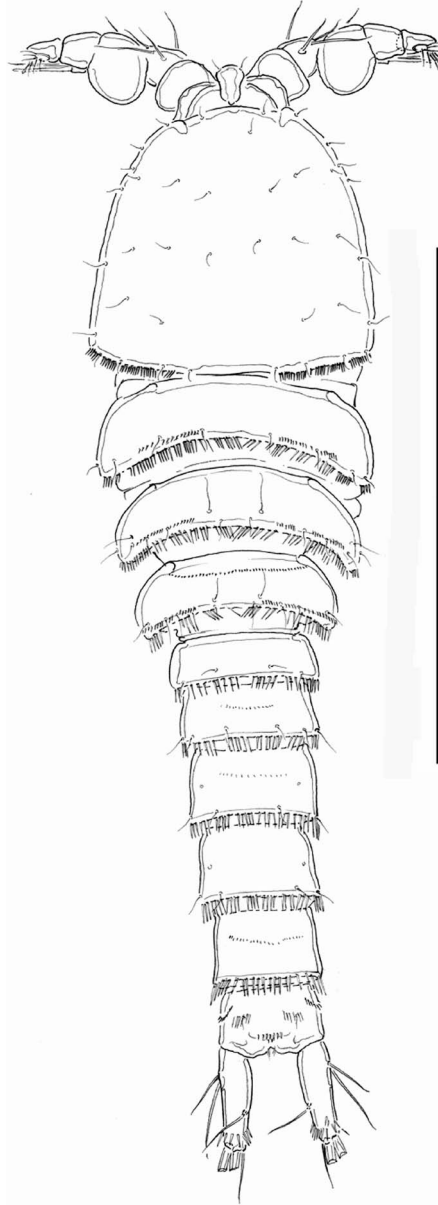


Figure 32. *Cletocamptus spinulosus* sp. nov., male. Habitus, dorsal; slightly compressed during the mounting process. Scale bar = 500 μ m.

Antennule (Figure 28A). Six-segmented; surface of segments smooth except for spinular row on first segment. Armature formula, 1-(1), 2-(9), 3-(6), 4-(1+[1+ae]), 5-(1), 6-(10+[1+ae]).

Antenna (Figure 29A). Small coxa furnished with spinules as shown. Allobasis armed with two well-developed abexopodal setae. Free endopodal segment with inner

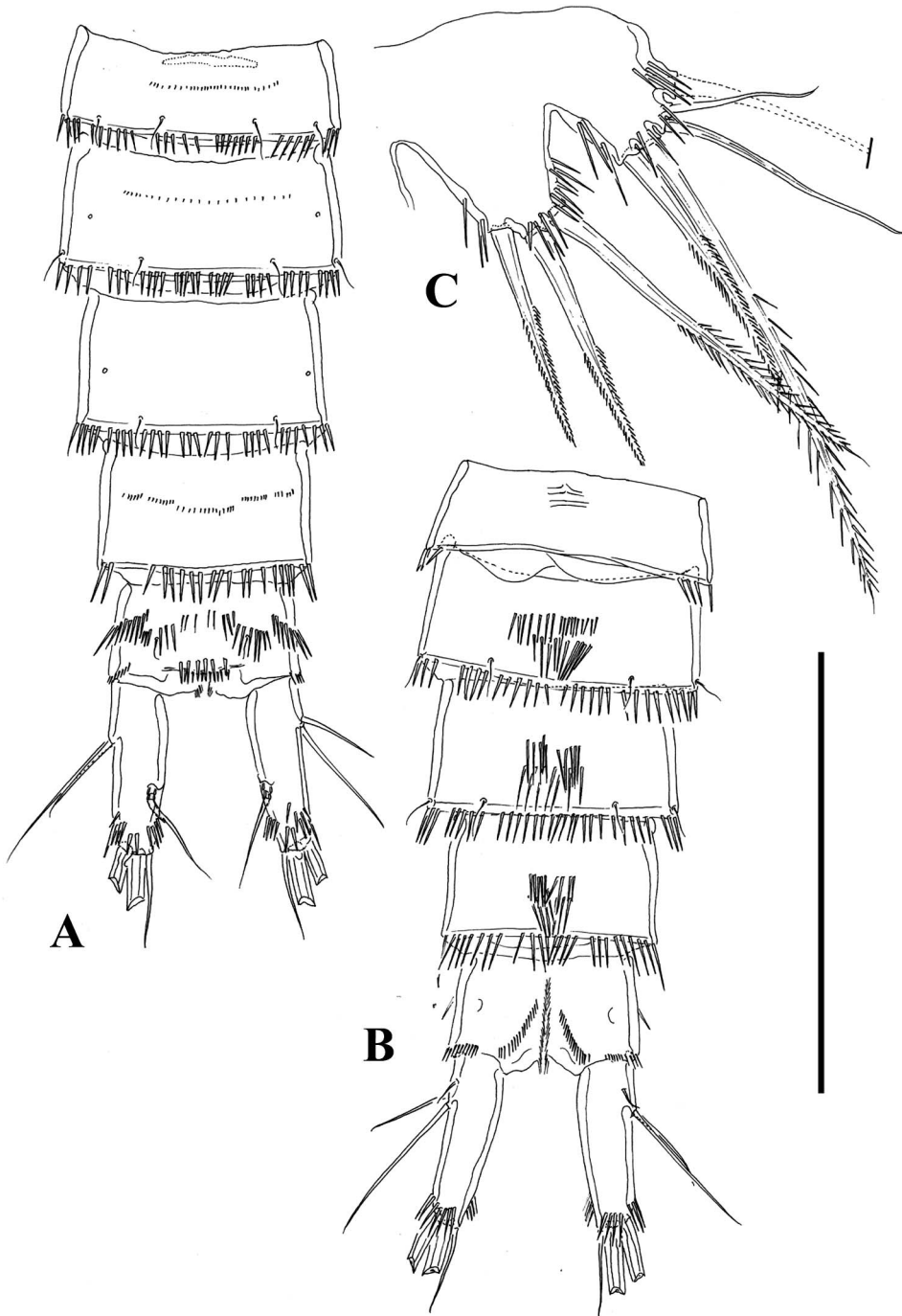


Figure 33. *Cletocamptus spinulosus* sp. nov., male. (A) Urosome, dorsal (P5-bearing somite omitted); (B) urosome, ventral (P5-bearing somite omitted); (C) P5, anterior. Scale bars: (A, B) 241 μ m, (C) 100 μ m.

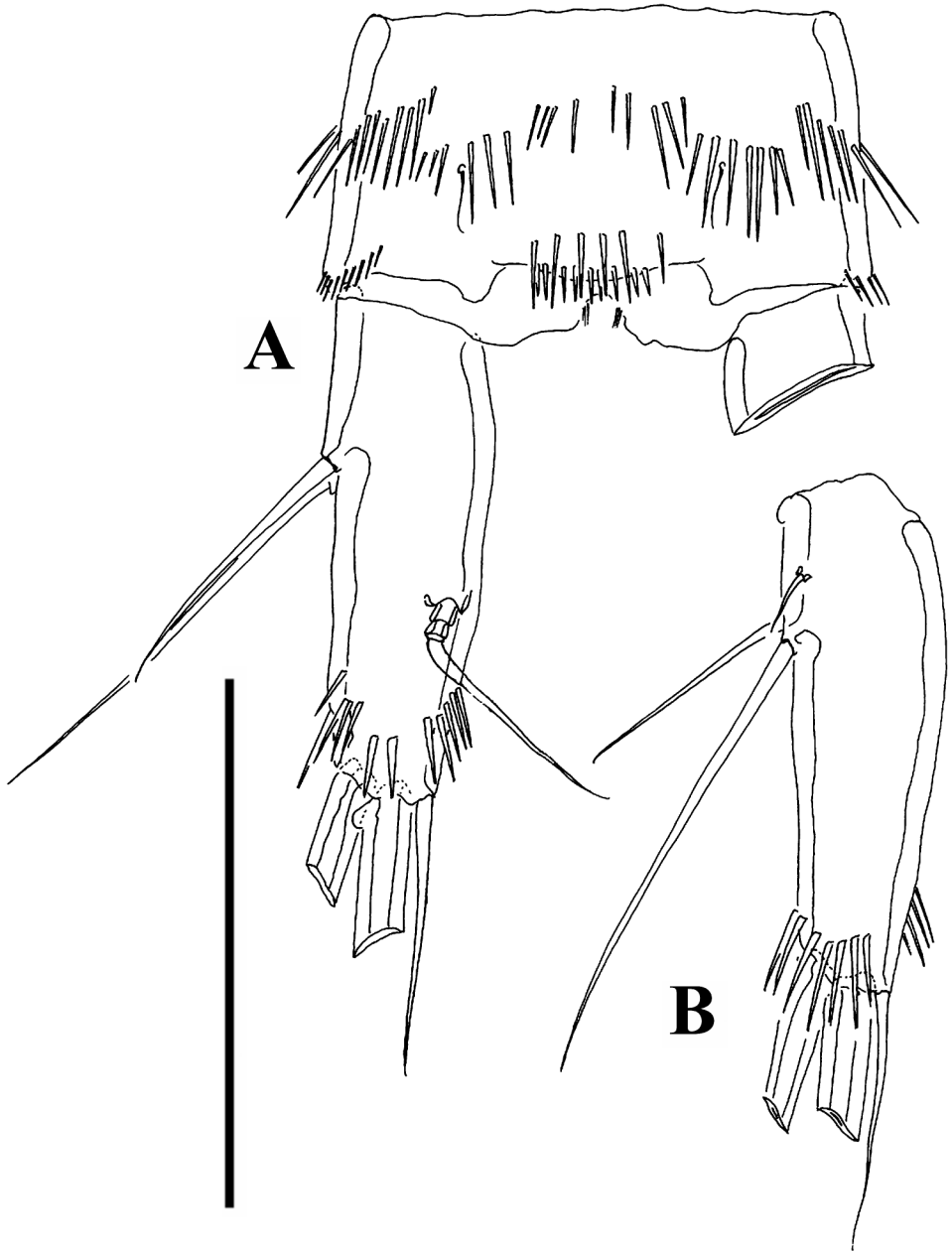


Figure 34. *Cletocamptus spinulosus* sp. nov., male. (A) Anal somite and left caudal ramus, dorsal; (B) right caudal ramus, ventral. Scale bar = 100 μ m.

spinules proximally and subdistally; with two lateral inner spines and a slender seta (the latter indicated by arrow in Figure 29A) and five distal elements. Exopod one-segmented; about five times as long as wide; with few spinules and with one lateral and two apical setae (one of them reduced – indicated by arrow in Figure 29A).

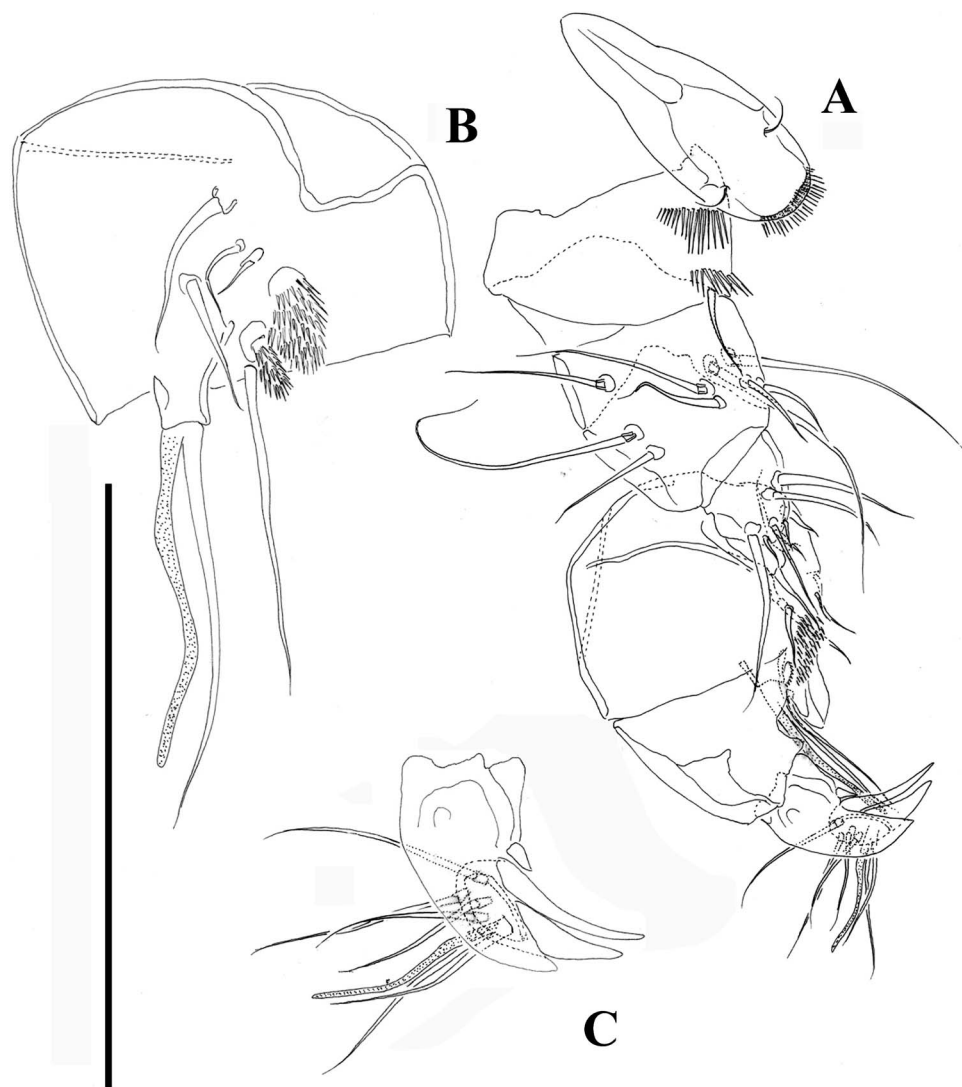


Figure 35. *Cletocamptus spinulosus* sp. nov., male. (A) Rostrum and antennule; (B) fourth antennular segment; (C) sixth antennular segment. Scale bars: (A) 160 μm , (B–C) 100 μm .

Mandible (Figure 29B). Robust; chewing edge with bi- and multicuspidate teeth, one pyriform element and one lateral seta. Palp one-segmented, with two slender setae; with a small seta arising nearby.

Maxillule (Figure 29C). Robust; arthrite of praecoxa with one surface seta, seven distal spines and one spinulose lateral seta (the latter more slender than in other species in which this seta is very strong). Coxa with two slender setae. Homology of the setae of basis, exopod and endopod difficult to define. Basis seemingly with three apical

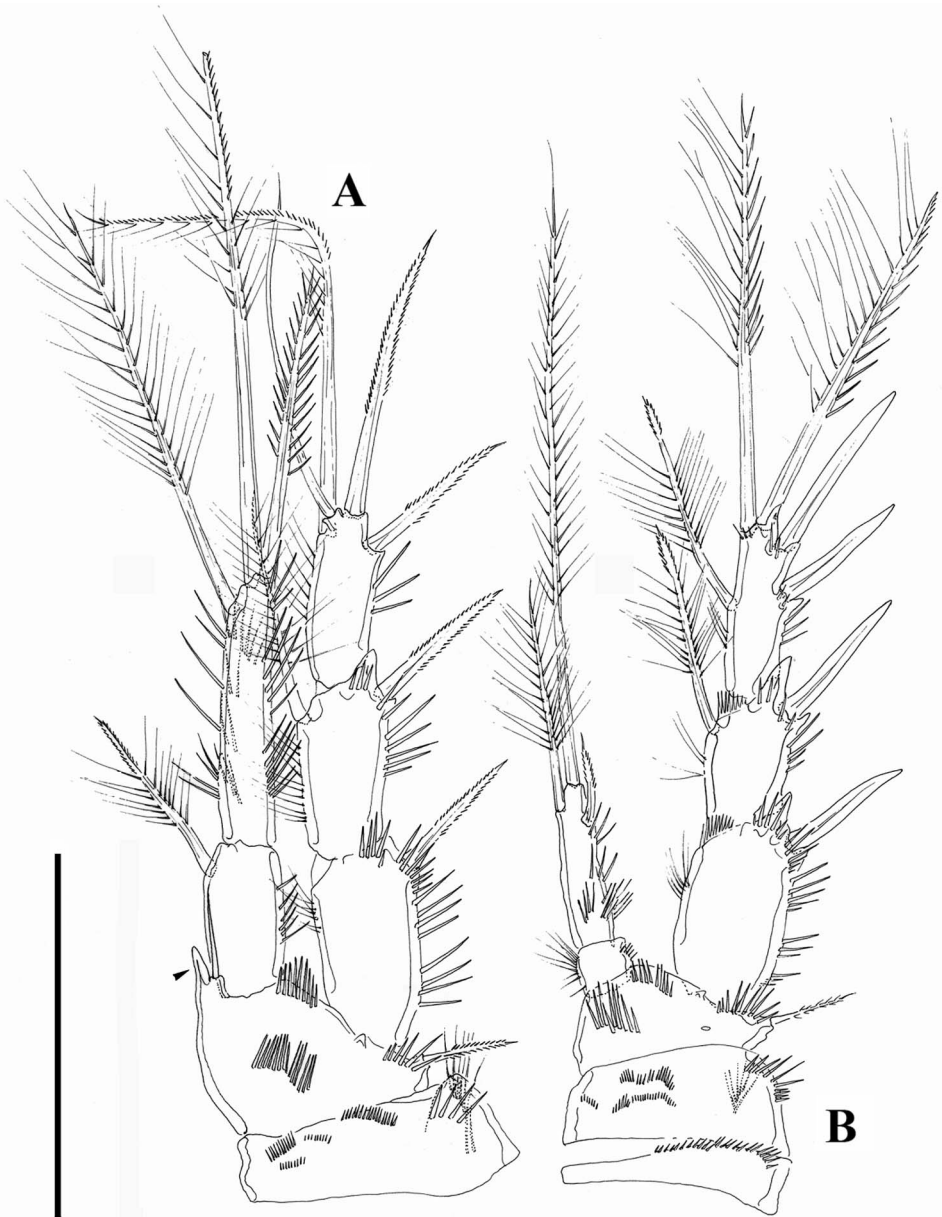


Figure 36. *Cletocamptus spinulosus* sp. nov., male. (A) P1, anterior (inner dimorphic projection of basis indicated by arrows); (B) P2, anterior. Scale bars: (A) 100 μm , (B) 143 μm .

and two lateral setae, endopod and exopod seemingly represented by three and one seta, respectively.

Maxilla (Figure 29D). Syncoxa with spinules along inner margin; with two endites, each bearing three setae as illustrated. Allobasis drawn into strong claw bearing one accompanying seta. Endopod represented by three setae.



Figure 37. *Cletocamptus spinulosus* sp. nov., male. (A) P3, anterior; (B) P3ENP, anterior; (C) P4, anterior. Scale bars: (A, C) 143 μm , (B) 100 μm .

Maxilliped (Figure 29E). Subchelate. Syncoxa with spinular rows as illustrated and with inner small seta on distal corner. Basis unarmed; with one anterior and one posterior longitudinal row of spinules along inner margin; with outer small spinules medially and subapically. Endopod drawn into long and slender claw with one accompanying small seta.

P1 (Figure 30A). Praecoxa with spinules close to joint with coxa. The latter with spinular rows as illustrated. Basis with inner and outer spine; with median spinular row, and with stronger spinules at base of spines and between rami. Exopod three-segmented. Endopod two-segmented, slightly beyond EXP2.

P2 (Figure 30B). Praecoxa and coxa as in P1. Basis as in P1 except for lack of inner spine in P2; with outer spine-like element. Exopod three-segmented and ornamented as illustrated; EXP2 and EXP3 with inner seta. Endopod two-segmented, reaching proximal third of EXP2; first segment small, nearly as wide as long and ornamented as illustrated; second segment long, about four times as long as wide, ornamented as depicted and armed with one outer spine, one apical and one inner seta.

P3 (Figure 31A). Praecoxa and coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod three-segmented; EXP2 and EXP3 with one inner seta. Endopod two-segmented, slightly beyond EXP1; ENP1 small, nearly as long as wide; ENP2 about four times as long as wide, with one outer spine, one apical and one inner seta.

P4 (Figure 31B). Praecoxa, coxa and basis as in P3. Exopod as in P2 and P3 except for lack of inner seta in P4EXP3. Endopod two-segmented, reaching middle of EXP1; first segment very small; second segment about three times as long as wide, armed with two setae.

P5 (Figure 28B). Exopod and baseopod fused. Baseopodal lobe about two times longer than exopodal lobe; with one outer, one apical and four inner setae; relative length of setae as shown. Exopod with five setae plus outer seta of basis. The armature formula of female P1–P5 is presented in Table 4.

P6 (Figures 26D and 27B). Represented by median plate in anterior half of second urosomite (first genital somite); each vestigial leg represented by one outer long seta and one inner tiny element. Copulatory pore in the middle of genital-double somite.

Male

Habitus (Figure 32). More slender than in female, with second and third urosomites distinct; total body length measured from tip of rostrum to posterior margin of caudal rami ranging from 760 to 970 μm (mean, 854 μm ; $n = 13$; allotype, 970 μm). Rostrum (Figure 35A) dimorphic, more slender than in female. Cephalic shield (Figure 32) with more dense spinular rows along posterior margin than in female, interrupted medially. Pro- and urosomites with much less dense spinular ornamentation than in

Table 4. Armature formula of *Cletocampus spinulosus* sp. nov. female P1–P5

	P1	P2	P3	P4	P5
Exopod	I-0;I-1;I,II,1	I-0;I-1;II,2,1	I-0;I-1;II,2,1	I-0;I-1;II,2,0	5
Endopod	0-1;0,II,1	0-0;I,1,1	0-0;I,1,1	0-0;0,2,0	6

female; shape of spinules along posterior margins as in female. Caudal rami (Figures 33A–B and 34A–B) more slender than in female.

Antennule (Figure 35A–C). Subchirocer, six-segmented; surface of segments smooth except for two spinular rows on first segment. Armature formula difficult to define but probably as follows: 1-(1), 2-(9), 3-(8), 4-(7+[1+ae]), 5-(0), 6-(6+ae). Last segment with three teeth.

Antenna, mandible, maxillule, maxilla and maxilliped (not shown). As in female.

P1 (Figure 36A). As in female except for inner projection of basis (the latter indicated by arrow in Figure 36A).

P2 (Figure 36B). Praecoxa, coxa and basis as in female. Exopod as in female except for stronger outer spines and comparatively shorter elements in the male EXP3. Endopod as in female, except for comparatively shorter elements of ENP2 (outer spine dimorphic).

P3 (Figure 37A–B). Coxa as in P2. Basis as in P2 except for outer seta-like element in P3. Exopod as in female except for dimorphic and stronger outer spines. Endopod dimorphic, three-segmented; first segment small, nearly as wide as long; second segment with inner apophysis reaching slightly beyond third segment, the latter armed with two setae.

P4 (Figure 37C). Praecoxa, coxa and basis as in P3. Exopod as in female except for stronger outer spines. Endopod as in female, but with comparatively shorter setae than in female.

P5 (Figure 33C). Both legs fused medially. Exopod and baseoendopod fused. Baseoendopodal lobe only slightly longer than exopodal lobe; with three apical setae. Exopod with four setae plus outer seta of basis.

P6 (Figure 33B). Represented by median plate. Without armature.

Variability

One female was observed to possess an aberrant right P1EXP3 with three elements only (without outer spine). One male possessed an aberrant (dwarfed) inner seta on P4ENP2. Another male lacked an inner seta on left P2EXP2. One male possessed an aberrant apical spine in right P3EXP3 and another male possessed a dwarfed right P4EXP3 with two outer spines only.

Discussion

In addition to the four species described previously, the following are the other valid species within *Cletocamptus*: *C. retrogressus*, *C. confluens*, *C. trichotus* Kiefer, 1929, *C. feei* (Shen, 1956), *C. affinis* Kiefer, 1957, *C. gravihatus* (Shen and Sung, 1963), *C. mongolicus* Sterba, 1968, *C. helobius* Fleeger, 1980, *C. merbokensis* Gee, 1999, *C. axi*

Mielke, 2000, *C. schmidti* Mielke, 2000, *C. deborahdexterae*, *C. stimpsoni*, *C. sinaloensis*, *C. fourchensis*, *C. levis*, *C. nudus* and *C. ceccurirensis* (for some comments on the status of *C. albuquerqueensis* see later). Of a total of 23 species, 14 have been described from the Americas. *Cletocamptus helobius* was described from sediment samples taken from Bayou Fourchon (Lafourche Parish, Louisiana, USA) and has been found also in North Inlet Estuary (Georgetown County, South Carolina) (Fleeger 1980). *Cletocamptus sinaloensis* was originally described from Sinaloa, north-western Mexico (Gómez et al. 2004) but was found also in samples from São Luís Island, Maranhão, Brazil (Gómez 2005). *Cletocamptus fourchensis* was described from Port Fourchon and Cocodrie (Louisiana, USA) (Gómez et al. 2004), and has been reported also from the Florida Keys (Reid and Hribar 2006; Hribar and Reid 2008). *Cletocamptus deborahdexterae* was found in samples taken from Salton Sea (California, USA) (Gómez et al. 2004). *Cletocamptus stimpsoni* was found in samples from Fred Stimpson Wildlife Refuge in Jackson (Alabama, USA) (Gómez et al. 2004). *Cletocamptus axi* was originally described from Lagoon of Puerto Nuñez (Santa Cruz, Galapagos) and was also found in Floreana (Galapagos) (Mielke 2000). *Cletocamptus schmidti* was described also from Santa Cruz (Galapagos), but was found also in most of the islands of the Galapagos Archipelago (Mielke 2000). *Cletocamptus albuquerqueensis* was originally described by Herrick (1894) from Rio Grande (New Mexico), but has been reported from a variety of localities in USA, Mexico, Bonaire (Netherlands Antilles) and Argentina (see Pallares, 1962 for a complete list of references) (also see later). *Cletocamptus levis* was described from Cananéia (São Paulo, Brazil) (Gómez 2005), and *C. nudus* from São Luís Island (Maranhão, Brazil) (Gómez 2005). *Cletocamptus ceccurirensis* was recently described from Salar de Surire (Chile) (Gómez et al. 2007).

Within the species described so far from the Americas, *C. assimilis* sp. nov. and *C. tertius* sp. nov. are similar to *C. sinaloensis*, *C. fourchensis*, *C. deborahdexterae*, *C. axi* and *C. levis* in the armature formula of the mandibular palp, shape of the lateral spinulose element of the maxillary arthrite and armature formula of P1–P4. However, they seem to be most closely related to *C. levis* with which they share most character states, including P1EXP and ENP length ratio, the elongate female P5EXP, and the lower insertion level of the inner most seta of the male P5BENP. Gómez (2005) presented a wide spectrum of intraspecific variability of the surface ornamentation of body somites and some variation in the relative length of the setae of the female P5 baseoendopod of *C. levis*. The surface ornamentation of body somites and relative length of the setae of the female P5 baseoendopod of *C. assimilis* sp. nov. and *C. tertius* sp. nov. fall within the range of variability of *C. levis*. However, no intraspecific variability of these two characters was observed for *C. assimilis* sp. nov. and *C. tertius* sp. nov. Gómez et al. (2004) observed that intraspecific variation occurs in specific appendages (and other characters) in different species, that the range of variation between species seldom overlaps, thus being rather species-specific and constant within a given species, and that such intraspecific variation is possibly under genetic control. The fact that no variability in surface body ornamentation and relative length of the female P5 baseoendopod was observed for *C. assimilis* sp. nov. and *C. tertius* sp. nov., even if these fall within the range of variability observed for *C. levis*, supports the hypothesis that *C. assimilis* sp. nov. and *C. tertius* are different from but closely related to *C. levis*. *Cletocamptus tertius* sp. nov. can be separated from *C. levis* by the male dimorphic rostrum in the latter, and by the relative length of the setae of

the male P5EXP. Unfortunately, the male of *C. assimilis* sp. nov. remains unknown and nothing can be said in this regard. The females of *C. levis*, *C. assimilis* sp. nov. and *C. tertius* sp. nov. can be separated by the female P6 (with two elements in *C. levis* and *C. assimilis* sp. nov., but with three elements in *C. tertius* sp. nov.), the ventral spinular ornamentation of urosomites (with small spinules in *C. levis*, but with strong and larger spinules in *C. assimilis* sp. nov. and *C. tertius* sp. nov.).

Prior to this study, three species, *C. stimpsoni*, *C. schmidti* and *C. nudus*, had been described with a II.II.2 and II.II.1 armature formula of P3EXP3 and P4EXP3, respectively. *Cletocamptus pilosus* sp. nov. is the fourth species reported with the same armature formula and seems to be more closely related to *C. stimpsoni* with which it shares also the rather slender lateral seta of the maxillary arthrite, the I13 and I12 armature formula of female P3ENP2 and male P2ENP2, respectively, and the general shape of the dimorphic male P3ENP2 (apophysis barely reaching beyond P2ENP3). These two species can be separated by the spinular surface ornamentation of body somites (coarser in *C. stimpsoni*, hairy in *C. pilosus* sp. nov.), insertion site of setae II and III of the caudal rami (more proximal in *C. stimpsoni*), armature formula of the mandibular palp (minute segment with two well-developed setae and without the typical seta that arises nearby in *C. stimpsoni*, but minute segment with one well-developed seta only and with small seta arising nearby in *C. pilosus* sp. nov.), in the relative length of the P1EXP and ENP (endopod clearly shorter than exopod in *C. stimpsoni*, but slightly longer in *C. pilosus* sp. nov.), and shape of outer seta of basis of female and male P2 (seta as in *C. stimpsoni*, spine like in *C. pilosus* sp. nov.).

Cletocamptus spinulosus sp. nov. shares most character states with *C. levis*, *C. assimilis* sp. nov. and *C. tertius*. It has to be noted that these species share the combination of the armature formula of the mandibular palp, the armature formula of P1–P4 and the lower insertion level of the inner most seta of the male P5BENP. However, *C. spinulosus* sp. nov. also shares the uncommon slender seta of the maxillary arthrite with *C. pilosus* sp. nov. and *C. stimpsoni*. *Cletocamptus spinulosus* sp. nov. is unique in that this species presents strong spinules along the posterior margin of the P2-, P3- and P4-bearing somites, instead of the slender and long spinules observed for all the other species.

The genus *Cletocamptus* is well known for its high polymorphism within and between populations and/or species. This polymorphism has been documented in previous works (Fleeger 1980 and references cited therein; Mielke 2000; Gómez et al. 2004; Gómez et al. 2007; Gómez 2005). Such intraspecific variability prompted Fleeger (1980) to suggest it would be difficult to write an identification key for the species within the genus. Similarly, the high polymorphism within *Cletocamptus* prompted several authors to suggest that the species within the genus might consist of a number of morphologically indistinguishable sibling species (Dexter 1995; Suárez-Morales et al. 1996; Mielke 2000, 2001) or that the entire genus might be an amalgam of a number of genera (Gee 1999).

Based on the high intraspecific variability and widespread occurrence of *C. confluens*, Mielke (2000) recognized that this species could “in reality represent an assemblage of barely discernible species”. *Cletocamptus confluens* was added to the key below based on Mielke’s (2000) complete and detailed description. Nevertheless, it is highly advisable to take into account the range of morphological variation when trying to identify an organism which is under suspicion of belonging or being related to any of the species within *Cletocamptus*. This can be of some help during the identification

process, since, as suggested by Gómez et al. (2004), the intraspecific variation within the genus is possibly under genetic control, being the range or morphological variation different (they seldom overlap) for each species.

Gómez (2005) suggested that *C. albuquerquensis* might be a complex of related species. This species has been found to be widely distributed (Lang 1948, and references cited therein; Pallares 1962). Recently, Dr Ray Gerber (Saint Joseph's College, USA) and Dr Lianna Jarecki (H. Lavity Stoutt Community College, USA) found specimens belonging or closely related to *C. albuquerquensis* in samples taken from Saint John (US Virgin Islands) and Tortola Island (British Virgin Islands). The material was sent to the senior author for preliminary inspection. The following are some comments on the species.

Herrick (1894) coined the genus *Marshia* Herrick, 1894 for a new harpacticoid species (*Marshia albuquerquensis* Herrick, 1894) from the Rio Grande Valley. Herrick (1894) found males and females, but unfortunately he only described with some detail the female and gave only some lines on the male antennule, P5 and caudal rami (nothing is said about the sexual dimorphism in the male P3 and rostrum). Chappuis (1933) found two male specimens, and despite the fact that *Marshia albuquerquensis* was originally described as having a one-segmented endopod of P4 (Herrick [1894] did not give the description of the male P4, thus assuming that both male and female P4 are identical), Chappuis (1933) identified his specimens (even when he illustrated the male P4 endopod as two-segmented) with *M. albuquerquensis* and suggested there was no need to re-diagnose the genus. Chappuis (1933) synonymized *Marshia* with *Cletocamptus*, thus reallocating *Marshia albuquerquensis* within *Cletocamptus*. Some years later, Lang (1948) presented a brief diagnosis for the species and gave some other synonyms (see Lang [1948: 1277], Pallares [1962] and Chappuis [1933] for a more complete list of synonyms). Lang (1948) also showed the different illustrations for the species known at that time. In those illustrations, the male P4 endopod is consistently presented as a two-segmented ramus, and in his Table XXIII (Lang 1948: 1249) of the armature formula of swimming legs of *C. albuquerquensis*, the (female?) P4 endopod is shown to be one-segmented. Pallares (1962) noted that in her specimens from Luro lagoon (La Pampa, Argentina) there is a very weak division between the first and second endopodal segments. One of us (SG) had the opportunity to dissect and analyze male specimens from St. John Island kindly sent by Dr Ray Gerber, and it is not clear whether the male P4 endopod is one-segmented or if the first endopodal segment is very small. In some cases the male P4 endopod clearly seems to be one-segmented, but in other cases there seems to be a tiny first endopodal segment. The genus is well known for its high intraspecific variability and either the one- or the two-segmented condition of the male P4 could well be intraspecific variability. Herrick (1894) did not give the description of the exopod of the antenna and it was omitted also in his drawing, and Chappuis (1933) described the antennary exopod as represented by a single seta. The same condition was observed in the material from the US Virgin Islands. On the contrary, Pallares (1962) described her material of *C. albuquerquensis* from Argentina with a small antennary exopod armed with three slender setae. Herrick (1894) and Chappuis (1933) omitted the detailed description of the mandible, maxillule, maxilla and maxilliped, and Pallares (1962) described the mandibular palp with two setae. In the material from US Virgin Islands there are three setae as normally found in other species of *Cletocamptus*. The maxillule of the US Virgin Islands specimens, however, is different to most species within the genus, being the

lateral spine rather weak and less spinulose. Based on the foregoing, it is suggested to relegate *C. albuquerqueensis* to *species inquirenda* until detailed revision of the species.

The elaboration of a identification key to the species of *Cletocamptus* is not an easy task due, on one hand to the poor and incomplete descriptions of some species and, on the other hand, to the high polymorphism within the different species of the genus. However, in the following section we present an identification key that might prove useful, at least, for preliminary identification of the valid *Cletocamptus* species world-wide.

It is worth mentioning that the identification of specimens attributed to *Cletocamptus* might prove difficult. It is suggested that special attention be paid to the range of morphological variability and sexual dimorphism of the population under study, and that the material under inspection be carefully compared with the available descriptions.

Key to the species of *Cletocamptus*

- 1a. P4ENP represented by one very small segment bearing one very reduced inner seta and one well-developed outer element; posterior margin of cephalothorax, free thoracic somites, and/or fourth, and fifth urosomites, anal somite and anal operculum crenulate, without spinules; male P5 completely fused to somite; lateral seta of maxillary arthrite rather strong with many short spinules or slender with few long spinules 2
- 1b. P4ENP two-segmented, distal segment with two well-developed setae; mandibular palp one- or two-segmented; lateral seta of maxillary arthrite very strong with many long spinules or slender with many short spinules; male P5 articulating with somite 3
- 2a. Caudal rami two times as long as wide, without seta I; A2EXP one-segmented, elongate, armed with one lateral and two apical setae; mandibular palp one-segmented, well developed, with five elements, without accessory seta; lateral seta of maxillary arthrite slender with few long spinules; P2 and P3ENP2 with two elements; P5EXP and BENP fused but separated by deep groove; male P3ENP three-segmented, second segment with apophysis about 2.5 times as long as supporting segment, distal segment armed with one small and one long plumose seta; male P5EXP with four setae. *C. merbokensis* Gee, 1999
- 2b. Caudal rami 1.2 times as long as wide, with seta I; A2EXP represented by one seta; mandibular palp one-segmented, well developed, with three elements, without accessory seta; lateral seta of maxillary arthrite rather strong with many short spinules; P2 and P3ENP2 with three elements; P5EXP and BENP almost fused completely and separated by shallow groove; male P3ENP two-segmented, second segment with apophysis and armed with one long plumose seta and one spine; male P5EXP with four setae *C. helobius* Fleegeer, 1980
- 3a. Female P3ENP2 with three setae; caudal rami about 1–1.7 times as long as wide 4
- 3b. Female P3ENP2 with three setae; caudal rami about two or three times as long as wide 10

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- 3c. Female P3ENP2 with four setae; caudal rami about three times as long as wide; P4EXP3 with one inner seta; female P5BENP with seven setae *C. feei* (Shen, 1956)
- 3d. Female P3ENP2 with five setae; caudal rami about 1.5 times as long as wide; posterior margin of cephalothorax and free thoracic somites with very small spinules; exopod of antenna one-segmented, elongate, with three setae; mandibular palp one-segmented, very small, with two setae, without accessory seta; lateral seta of the arthrite of the maxillule slender; P1EXP longer than ENP (EXP/ENP length ratio, about 1.2); P3EXP3 with two inner setae; P4EXP3 with one inner seta *C. stimpsoni* Gómez et al., 2004
- 3e. Female P3ENP2 with five setae; caudal rami from 2 to 2.5 times as long as wide. 13
- 3f. Female P3ENP2 with five setae; caudal rami about three times as long as wide; posterior margin of cephalothorax and free thoracic somites with fine, long spinules; exopod of antenna one-segmented, very small, with one seta; mandibular palp one segmented, elongate, with one lateral and two apical setae; lateral seta of maxillary arthrite very strong and ornamented with long spinules; P3EXP3 with one inner seta; P4EXP3 without inner seta; female P5EXP with four setae, BENP with six setae, EXP and BENP almost fused completely and separated by shallow groove; male P3ENP two-segmented (basal segment broadened, distal segment produced into two dentiform projections framing a short naked seta and a long plumose element); male P2–P4EXP strongly dimorphic; male P5 completely fused to somite; male P5EXP and BENP with three setae each; male caudal rami longer than in female *C. confluens* (Schmeil, 1894)
- 4a. Caudal rami up to 1.5 times as long as wide; female anal operculum with or without spinules 5
- 4b. Caudal rami more than 1.5 times as long as wide; anal operculum with two rows of strong spinules. *C. assimilis* sp. nov.
- 5a. P3EXP3 with two inner setae; P4EXP3 with one inner seta. *C. nudus* Gómez, 2005
- 5b. P3EXP3 with one inner setae; P4EXP3 without inner seta 6
- 6a. Male rostrum dimorphic; female caudal rami about 1.5 times as long as wide; female P6 represented by one seta 7
- 6b. Male rostrum as in female; female caudal rami about as long as wide or about 1.5 times as long as wide; female P6 represented by long outer seta and small inner element. 9
- 7a. Ratio of length of apophysis of male P3ENP2/length of ENP3 of about 1.3; female anal operculum without spinules; length ratio of the setae of the female P5EXP and BENP* (from inner to outer seta) 1.4/1.0/2.7/3.3/6.6 and 4.5/4.0/3.3/2.0/1.0/4.0 respectively; of male* (from inner to outer seta) 2.3/1.0/2.3/7.0 and 1.8/1.5/1.0 respectively. *C. fourchensis* Gómez et al., 2004
- 7b. Ratio of length of apophysis of male P3ENP2/length of ENP3 of about 1.7; female anal operculum with spinules; length ratio of the setae of the female and male P5EXP and BENP* (from inner to outer seta) different. 8

- 8a. Female anal operculum with one row of small spinules; length ratio of the setae of the female P5EXP and BENP* (from inner to outer seta) 1.9/1.0/2.9/3.0/7.4 and 3.5/3.2/3.8/1.9/1.0/4.4 respectively, of male* (from inner to outer seta) 1.9/1.0/1.3/2.9 and 1.2/1.1/1.0 respectively
 *C. deborahdexterae* Gómez et al., 2004
- 8b. Female anal operculum with two rows of strong spinules; length ratio of the setae of the female P5EXP and BENP* (from inner to outer seta) 2.1/1.0/3.2/3.5/8.9 and 3.6/3.0/4.4/1.9/1.0/4.2 respectively, of male* (from inner to outer seta) 2.2/1.0/1.9/3.7 and 1.4/1.3/1.0 respectively
 *C. sinaloensis* Gómez et al., 2004
- 9a. Spinular ornamentation of female anal operculum highly variable; female caudal rami about 1.5 times as long as wide; outer spine of male P2ENP2 strongly dimorphic (very strong and curved spine)
 *C. levis* Gómez, 2005
- 9b. Female anal operculum with two rows of strong spinules; female caudal rami about 1.1 times as long as wide; outer spine of male P2ENP2 slightly modified
 *C. cecsurirensis* Gómez et al., 2007
- 10a. Female caudal rami two times as long as wide; female anal operculum with one or two rows of spinules, if two rows, then spinules strong; lateral seta of the arthrite of the maxillule strong, with long spinules; male rostrum as in female11
- 10b. Female caudal rami three times as long as wide; female anal operculum with two rows of strong spinules; lateral seta of the arthrite of the maxillule strong or slender, with long spinules; male rostrum dimorphic or as in female12
- 11a. Female anal operculum with one row of spinules; P3EXP3 with one inner seta; P4EXP3 without inner seta *C. axi* Mielke, 2000
- 11b. Female anal operculum with two rows of strong spinules; P3EXP3 with two inner seta; P4EXP3 with one inner seta *C. schmidtii* Mielke, 2000
- 12a. Lateral seta of the arthrite of the maxillule strong, with long spinules; female P6 represented by three seta; male rostrum as in female *C. tertius* sp. nov.
- 12b. Lateral seta of the arthrite of the maxillule slender, with long spinules; female P6 represented by two setae; male rostrum dimorphic *C. spinulosus* sp. nov.
- 13a. P3EXP3 with one inner seta; P4EXP3 without inner seta; P1EXP/ENP length ratio more than 1.0 (ENP shorter than EXP)14
- 13b. P3EXP3 with two inner setae; P4EXP3 with one inner seta; P1EXP/ENP length ratio less than 1.0 (ENP longer than EXP)17
- 14a. P1ENP1 without inner seta *C. mongolicus* Sterba, 1968
- 14b. P1ENP1 with inner seta15
- 15a. P2ENP2 with four setae; female caudal rami two times as long as wide; female antennule six-segmented; P1EXP and ENP of about the same length (P1EXP/ENP length ratio, 1.1); length ratio of apophysis of male P3ENP2/P3ENP3 of 2.8 *C. trichotus* Kiefer, 1929
- 15b. P2ENP2 with three setae; female caudal rami about 2.5 times as long as wide; female antennule six- or seven-segmented; P1EXP clearly longer than

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- ENP (P1EXP/ENP length ratio about 1.3 or 1.7); length ratio of apophysis of male P3ENP2/P3ENP3 of 2.3 or 2.0 16
- 16a. Female antennule six-segmented; P1EXP/ENP length ratio about 1.3; length ratio of apophysis of male P3ENP2/P3ENP3 of 2.3; length ratio of the setae of the female P5EXP and BENP* (from inner to outer seta) 1.4/1.0/2.1/1.8/4.2 and 1.7/1.7/2.7/1.5/1.0/2.7 respectively; of male* (from inner to outer seta) 1.2/1.0/1.4/1.4 and 1.1/1.0/1.0 respectively *C. affinis* Kiefer, 1957
- 16b. Female antennule seven-segmented; P1EXP/ENP length ratio about 1.7; length ratio of apophysis of male P3ENP2/P3ENP3 of 2.0; length ratio of the setae of the female P5EXP and BENP* (from inner to outer seta) 1.5/1.0/3.9/3.0/9.0 and 3.0/2.5/3.4/1.9/1.0/3.1 respectively, of male* (from inner to outer seta) 1.8/1.0/1.4/4.7 and 1.1/1.0/1.3 respectively *C. gravihatus* Shen and Sung, 1963
- 17a. Female caudal rami 2.5 times as long as wide; caudal setae IV and V fused; male P2ENP2 with three elements; length ratio of apophysis of male P3ENP2/P3ENP3 of 2.1 *C. retrogressus* Shmankevich, 1875
- 17b. Female caudal rami at most two times as long as wide; caudal seta IV and V not fused; male P2ENP2 with four elements; length ratio of apophysis of male P3ENP2/P3ENP3 of 1.4 *C. pilosus* sp. nov.

*Calculated by dividing the length of the longest seta by the length of each of the other elements (inner to outer seta). These ratios give information about the position of the longest seta (length ratio = 1.0) as well as the relative length of all the seta in relation to the longest element.

Acknowledgements

The first author is indebted to Mr T. Chad Walter and Dr Frank Ferrari (National Museum of Natural History [Smithsonian Institution]) for the loan and permission to dissect part of the material deposited in the collection of the Smithsonian Institution, and to William Keel for the catalogue numbers for the material deposited in the collection of the National Museum of Natural History (Smithsonian Institution). The material provided by Dr Richard M. Warwick, of the Plymouth Marine Laboratory, was collected while on a Royal Society travel grant to study the meiofauna of Argentinian inland saline lakes in collaboration with Dr Catalina T. Pastor de Ward of the Centro Nacional Patagónico (CONICET), Puerto Madryn, Chubut, Argentina. We are grateful to Dr Ray Gerber (Saint Joseph's College, USA) for providing us with material from the US Virgin Islands.

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