ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/236995225

Asterocherids (Copepoda: Siphonostomatoida) from Picinguaba, São Paulo, State, Brazil

Article · January 2001

CITATIONS
12

READS
91

3 authors:

R. Johnsson
Universidade Federal da Bahia
95 PUBLICATIONS **700** CITATIONS
SEE PROFILE

Carlos Rocha
University of São Paulo
136 PUBLICATIONS **1,596** CITATIONS
SEE PROFILE

Elizabeth Gerardo Neves
Universidade Federal da Bahia
64 PUBLICATIONS **683** CITATIONS
SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Comunidade planctônica do Norte Fluminense View project

REPRESENTAÇÕES COLONIAIS E PÓS-COLONIAIS: VIESES TEÓRICOS E CRÍTICOS DA PRÁTICA SOCIAL, POLÍTICA, IMAGÉTICA, LITERÁRIA E CULTURAL NA CONTEMPORANEIDADE View project

All content following this page was uploaded by R. Johnsson on 22 May 2014.

The user has requested enhancement of the downloaded file.

Asterocherids (Copepoda: Siphonostomatoida) from Picinguaba, São Paulo State, Brazil.

Johnsson, R; Rocha, C. E. F. and Neves, E. G.
Departamento de Zoologia, IB, Universidade de São Paulo, Rua do Matão, Travessa 14, nº 321 - 05508-900 São Paulo, SP
e-mail: johnsson@ib.usp.br

Abstract

The siphonostomatoids associated with invertebrates from Picinguaba (São Paulo State) are studied for the first time. Three new species belonging to the genus *Asterocheres* are described. Two of them were associated with sponges and can be differentiated based on the length of the siphon, the maxillule, the exopod of the antenna, the length of the caudal rami and the ornamentation of legs 1 to 4. The third species described was found associated with echinoideans and ascidians and its main characteristics refer to the length of the siphon, the mandibular palp, the armature of the maxillule and the free segment of leg 5. Two sibling species of the genus *Scottocheres*, *S. elongatus* (T. and A. Scott) and *S. laubieri* Stock have been recorded for the first time from the South Atlantic and are redescribed in order to provide more complete information on these species.

Key Words: Copepoda; Siphonostomatoida; Asterocheridae; Invertebrates; Brazil

Introduction

The siphonostomatoid fauna that lives associated with invertebrates remains partially known along the Brazilian coast. Despite the previous studies on the siphonostomatoid fauna conducted by the first author in different areas, mainly along the northeast coast (Johnsson, 1997; 1998a; b; c; 1999, 2000), the variety of possible hosts and the length of the coast line contribute to this situation. Knowledge of the siphonostomatoids from the southeast region remains restricted to a few studies along the Rio de Janeiro coast (Alvarez, 1988; Johnsson and Bustamante, 1997; Johnsson, 1998a).

The present study was carried out in Picinguaba (São Paulo State) mainly with sponges, and describes three new species of the genus *Asterocheres*. Two sibling species of *Scottocheres* are also redescribed. Stock (1967) described *S. laubieri*, separating it from *S. elongatus* (T. and A. Scott, 1894), because both of them were found at the same locality in the Mediterranean Sea. Stock (*op. cit*) pointed out that they have very similar morphology but occur in different hosts which have different habitats. *Scottocheres elongatus* lives in sponges from soft substrates, while the sponges in which *S. laubieri* occurs come from hard substrates. The species found in Picinguaba were sorted from a sample of different sponges, thus the actual host is impossible to determine. As the siphonostomatoid fauna is not commonly worldwide distributed, the occurance of these two species might reflect the introduction of alien species within the Brazilian waters as has already happened with coral species in the south of Rio de Janeiro State, near this locality (Neves, pers. comm.)

Material and Methods

The copepods were recovered by washing the living invertebrates in 5% ethyl alcohol and sea water. The wash water was strained through a fine net and the copepods picked up from the residuum. All measurements were made from specimens cleared in lactic acid, dissected and mounted in permanent slides. The body lengths do not include the setae on the caudal rami. In the spine and setal formulas of legs 1 to 4 the Roman numerals indicate spines and the Arabic numerals represent setae. All figures have been drawn with the aid of a camera lucida. The abbreviations P1 to P5 refer to legs 1 to 5.

The specimens studied here are deposited in the Museu Nacional/Universidade Federal do Rio de Janeiro (MNRJ).

Order Siphonostomatoida Thorell, 1859
Family Asterocheridae Giesbrecht, 1899

1. *Asterocheres neptunei* Johnsson sp. nov. (figs. 1 - 3)

Material examined - Holotype: female MNRJ 12831; allotype: male MNRJ 12832. Paratypes: 63 females MNRJ 12833 and 11 males MNRJ 12834. Associated with sponges from Picinguaba, São Paulo State, Brazil; 26/Dec./1996, coll. R. Johnsson and P. S. Young.

Description - Female: Body length (excluding caudal setae) 676 μm, greatest body width 410 μm; thus body 1.65 times longer than wide. Body shape cyclopiform (fig. 1a), with prosome slightly enlarged, dorso-ventrally flattened and urosome cyclindrical. Length 676 μm (584 - 723 μm) (excluding caudal setae) and greatest width 410 μm (376 - 445 μm) based on 64 specimens.

Cephalosome and pedigerous somite 2 with epimera slightly pointed. Pedigerous somites 3 and 4 narrower than preceding somite, with rounded epimera and partially covered by preceding somite. Somite of leg 5 partially covered by fourth somite. Ratio of length to width of prosome 1.2:1, ratio of length of prosome to urosome 2.1:1.

Urosome (fig. 1b) five-segmented. Genital double-somite 89 x 96 μm, ratio of length to width 0.9:1, rounded anterolaterally. Two postgenital somites both wider than long (32 x 54 μm, 36 x 50 μm), ratio of length to width 0.6:1 and 0.7:1 respectively, both with posterior corners pointed and lateral margins covered with setules. Caudal rami elongated, 27 x 23 μm, 1.2:1 times longer than wide, armed with 6 setae. Seta I absent. Length of setae II-VII, 89, 79, 270, 314, 91, and 111 μm, respectively. All setae plumose.

Antennule slender (fig. 1c), 338 μm long (not including setae), and 20-segmented. Lengths of segments measured along their posterior margins: 47 μm (16 μm along anterior margin), 14, 9, 8, 7, 8, 7, 10, 12, 9, 15, 18, 19, 19, 20, 22, 25, 30, 14, and 25 μm respectively. Segmental homologies and setation as follows. Romans numerals indicate the original segments followed by the number of setae in Arabic numerals, according to Huys and Boxshall (1991): I-2; II-1; III-1; IV-1; V-2; VI-1; VII-2; VIII-2; IX-XII-7; XIII-1; XIV-1; XV-2; XVI-1; XVII-1; XVIII-1; XIX-1; XX-1; XXI-1+ae; XXII-XXIII-2; XXIV-XXVIII-7. Aesthetasc on segment XXI 78 μm long.

Antenna (fig. 1d) 238 μm long (including claw) with basis 70 μm long. Exopod 1-segmented, 10 μm long, armed with 3 setae. Endopod 3-segmented; first segment 55 μm long, unarmed; second segment 14 μm long, with apical seta; third segment 21 μm long, with seta close to terminal claw 78 μm long. Oral cone (fig. 1a) 214 μm, reaching insertion of leg 1. Mandible (fig. 1e) comprised of stylet 191 μm long, and slender 2-segmented palp, 25 and 14 μm long, with 2 apical setae.

Maxillule (fig. 1f) bilobed; inner lobe 64 μm, more than twice as long as outer lobe, with 27 μm long; both lobes armed apically with 4 setae. Maxilla (fig. 1g) with syncoxa 85 μm long and almost straight claw, 140 μm long, with short subapical seta. Maxilliped (fig. 1h) 5-segmented, 293 μm long, comprising syncoxa 39 μm long, with small seta on inner margin; basis, 92 μm long, with apical seta. Endopod 3-segmented, segments measuring 16, 15, and 38 μm long respectively. Second segment with apical seta. Third endopodal segment bearing apical seta close to claw-like element 93 μm long, distally curved.

Swimming legs 1-4 (P1-P4; figs. 2a - 2d) biramous, all with 3-segmented rami.

	coxa	basis	exopod	endopod
P1	0-1	1-1	I-1; I-1; III-4	0-1; 0-2; 1-2-3
P2	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-2-3
P3	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-1+I-3
P4	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-1+I-2

Fifth leg with free segment (fig. 3a), inner and outer margins covered with setules. Somite 5 (fig. 1b) bearing seta near insertion of free segment.

Description - Male: Body similar to female, but smaller (fig. 3b). Length (excluding caudal setae) 532 μm long, greatest body width 292 μm, 1.8 times longer than wide. Cephalosome and pedigerous somite 2 with epimera slightly pointed. Pedigerous somite 3 with epimera slightly rounded and entirely covering pedigerous somite 4 and partially covering pedigerous somite 5. Ratio of length to width of prosome 1.3:1. Ratio of lengths of prosome to urosome 2.1:1.

Urosome (fig. 3c) 5-segmented. Genital somite 105 x 107 μm, rounded antero-laterally. Three abdominal somites, all wider than long, 20 x 52, 16 x 50, 27 x 48 μm, ratio of length to width 0.4, 0.3, and 0.7:1, respectively. Caudal rami 20 x 21 μm, wider than long, armed with 6 setae.

Antennule (fig. 3d) 270 μm long (not including setae), 17-segmented. Lengths of segments measured along their posterior margins 40 μm (24 μm along anterior margin), 11, 7, 7, 5, 6, 8, 7, 15, 3, 9, 23, 20, 15, 36, 27, and 31 μm, respectively. Segmental homologies and setation as follows: I-1; II-1; III-1; IV-2; V-1; VI-2; VII-1; VIII-1; IX-XII-7; XIII-1; XIV-1; XV-1; XVI-1; XVII-1; XVIII-XIX-2; XX-XXI-2+ae; XXII-XXVIII-6. All setae smooth. Aesthetasc on segment XXI 69 μm long.

All other appendages as in the female.

Etymology - The specific name "*neptunei*" refers to Neptune, the Roman sea god.

Remarks - *Asterocheres neptunei* sp. nov. has a 214 μm long siphon, reaching insertion of leg 1 and the free segment of leg 5 with 2 setae. In the genus *Asterocheres* the following species have these two characteristics: *A. latus* (Brady, 1872); *A. boecki* (Brady, 1880); *A. intermedius* (Hansen, 1923) and *A. paraboecki* Johnsson, 1998.

Asterocheres neptunei sp. nov. has 4 setae on each lobe of the maxillule as in *A. latus* and *A. paraboecki* (Gotto, 1993 and Johnsson, 1998a, respectively); while *A. boecki* and *A. intermedius* have 4 and 3 setae on the inner and outer lobes respectively (Hansen, 1923 and Sars, 1915, respectively).

Asterocheres neptunei sp. nov. has the antennal exopod armed with 3 setae. in *A. paraboecki* and *A. boecki* (Johnsson, 1998a and Sars, 1915) the exopod has 2 setae. In *A. latus* and *A. intermedius* this feature has not been described. *Asterocheres neptunei* sp. nov. also differs from *A. latus* in the ratio of length to width of the caudal rami, in the new species it is 1.2:1 and in *A. latus* it is twice longer than wide.

2. *Asterocheres picinguabensis* Johnsson sp. nov. (figs. 4 - 6)

Material examined - Holotype: female MNRJ 12807; paratypes: 8 females MNRJ 12829. Associated with sponges from Picinguaba, São Paulo State, Brazil; 26/Dec./1996, coll. R. Johnsson and P. S. Young.

Description - Female: Body length (excluding caudal setae) 768 μm, greatest body width 453 μm; thus body 1.69 times longer than wide. Body shape cyclopiform (fig. 4a), cephalosome and pedigerous somite 2 with slightly pointed epimera. Pedigerous somite 3 partially covering pedigerous somite 4. Ratio of length to width of prosome 1.2:1. Ratio of length of prosome to urosome 2.5:1.

Urosome (fig. 4b) 4-segmented. Genital double-somite 96 x 116 μm, ratio of length to width 0.8:1, with posterior margin serrulated. Two abdominal somites (36 x 73 μm, 45 x 68 μm), ratio of length to width 0.5, 0.7:1, respectively. Caudal rami 30 x 28 μm, ratio of length to width 1.1:1, armed with 6 setae. Seta I absent. Lengths of setae II-VII, 73, 159, 264, 348, 145, and 50 μm, respectively. All setae plumose.

Antennule slender (fig. 4c), 363 μm long (not including setae), 19-segmented. Lengths of segments measured along their posterior margins: 53 μm (33 μm along anterior margin), 14, 13, 12, 10, 10, 11, 14, 18, 9, 21, 19, 16, 21, 19, 23, 16, 29, and 25 μm, respectively. Segmental homologies and setation as follows: I-1; II-2; III-2; IV-2; V-1; VI-1; VII-1; VIII-1; IX-XII-7; XIII-1; XIV-1; XV-1; XVI-1; XVII-1; XVIII-1; XIX-1; XX-1; XXI-1+ae; XXII-XXVIII-7. Aesthetasc on segment XXI 75 μm long.

Antenna (fig. 4d) 267 μm long (including claw), with basis 84 μm long. Exopod 1-segmented, with 2 apical setae. Endopod 3-segmented; first segment 62 μm long, unarmed; second segment 14 μm long, with seta. Third endopodal segment 16 μm long, armed with 2 setae, terminal claw 91 μm long, slightly curved distally.

Oral siphon (fig. 4a) 318 μm long, reaching between insertions of P2 and P3. Mandible (fig. 4e) comprised of stylet 259 μm long, and mandibular palp 2-segmented, 35 and 17 μm long; with 2 apical setae.

Maxillule (fig. 4f) bilobed. Inner and outer lobes 81 and 32 μm long respectively, both armed with 3 setae. Maxilla (fig. 4g) with syncoxa 117 μm long and claw 173 μm long, curved distally.

Maxilliped (fig. 5a), 5-segmented, comprising syncoxa 54 μm long, armed with small seta on inner margin, basis 99 μm long. Endopod 3-segmented, segments measuring 21, 17, and 43 μm long, respectively. Second endopodal segment with small seta; third segment with seta close to claw-like element 104 μm long, curved distally.

Swimming legs 1-4 (figs. 5b-c – 6a-b) biramous, all with 3-segmented rami.

	coxa	basis	exopod	endopod
P1	0-1	1-1	I-1; I-1; III-4	0-1; 0-2; 1-2-3
P2	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-2-3
P3	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-2-3
P4	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-1+I-2

Fifth leg (fig. 6c) with free segment 51 x 20 μm armed with 2 setae; both lateral margins covered with setules. Somite 5 bearing short naked seta near insertion of free segment, lateral margins serrulated.

Male: unknown.

Etymology - The specific name refers to the type locality of the specimen.

Remarks - Four species of *Asterocheres* have the siphon reaching beyond the insertion of the P2: *A. proboscideus* Stock, 1966; *A. siphonatus* Giesbrecht, 1899; *A. stimulans* Giesbrecht, 1899 and *A. stocki* Nair and Pillai, 1984. However their siphon present different lengths; in *A. proboscideus* it reaches the caudal rami (Stock, 1966); in *A. siphonatus* and *A. stocki* the siphon reaches between the insertion of P4 and the genital double-somite (Gotto, 1993 and Nair and Pillai, 1984 respectively).

Asterocheres stimulans has the siphon reaching between the insertion of P3 and P4, being the species with the most similar siphon to *A. picinguabensis* sp. nov. There are other differences between the new species and *A. stimulans*. In the latter the maxillule has 4 setae on each lobe; the third endopodal segment of P1 to P4 have a prominent tooth distally; the second endopodal segment of P1 and P2 show 2 enlarged distal teeth. In *A. picinguabensis* sp. nov. the maxillule has 3 setae on each lobe, the third endopodal segment of P1 to P4 do not show the proeminent tooth distally, and the teeth on the second endopodal segment of P1 and P2 are small.

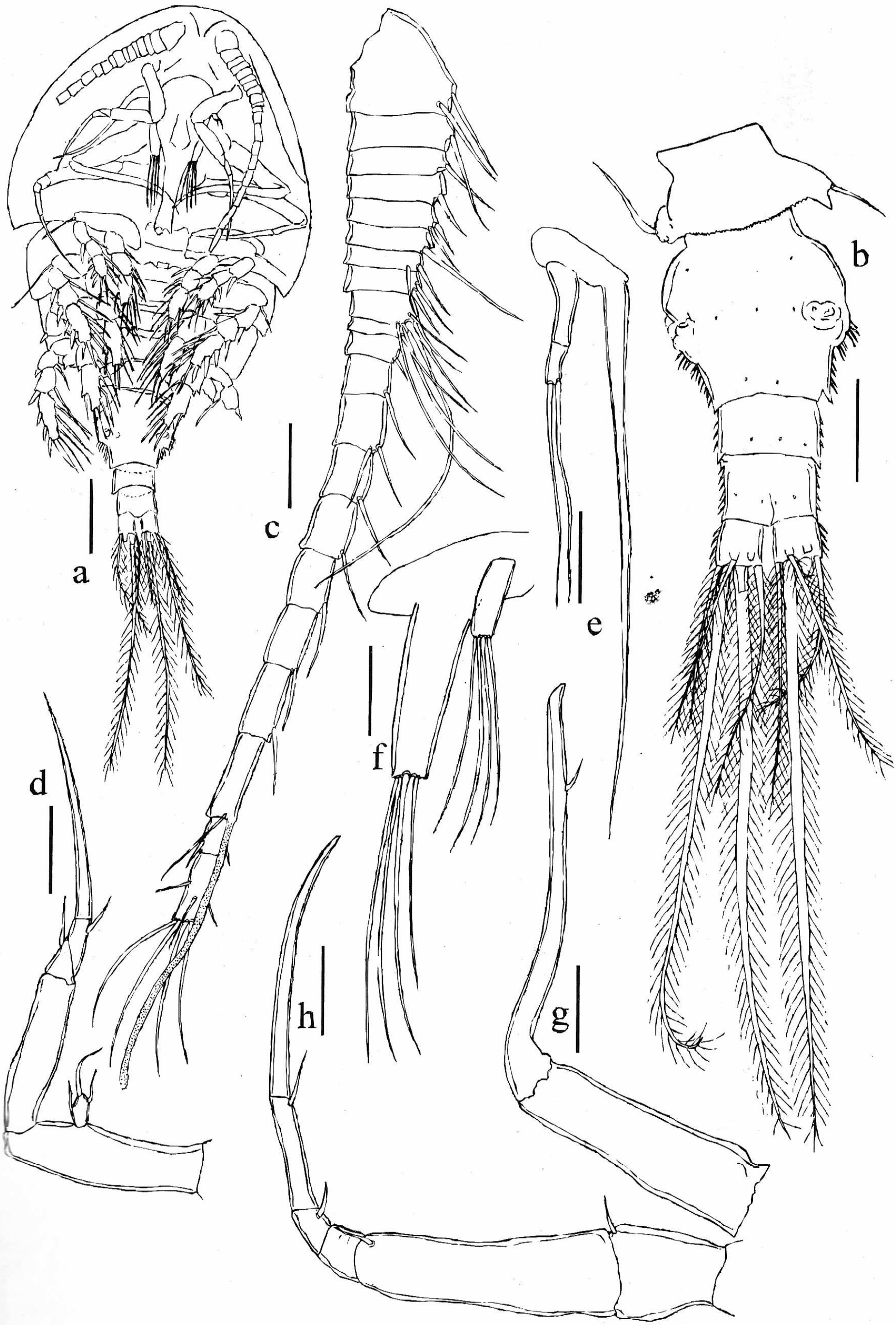
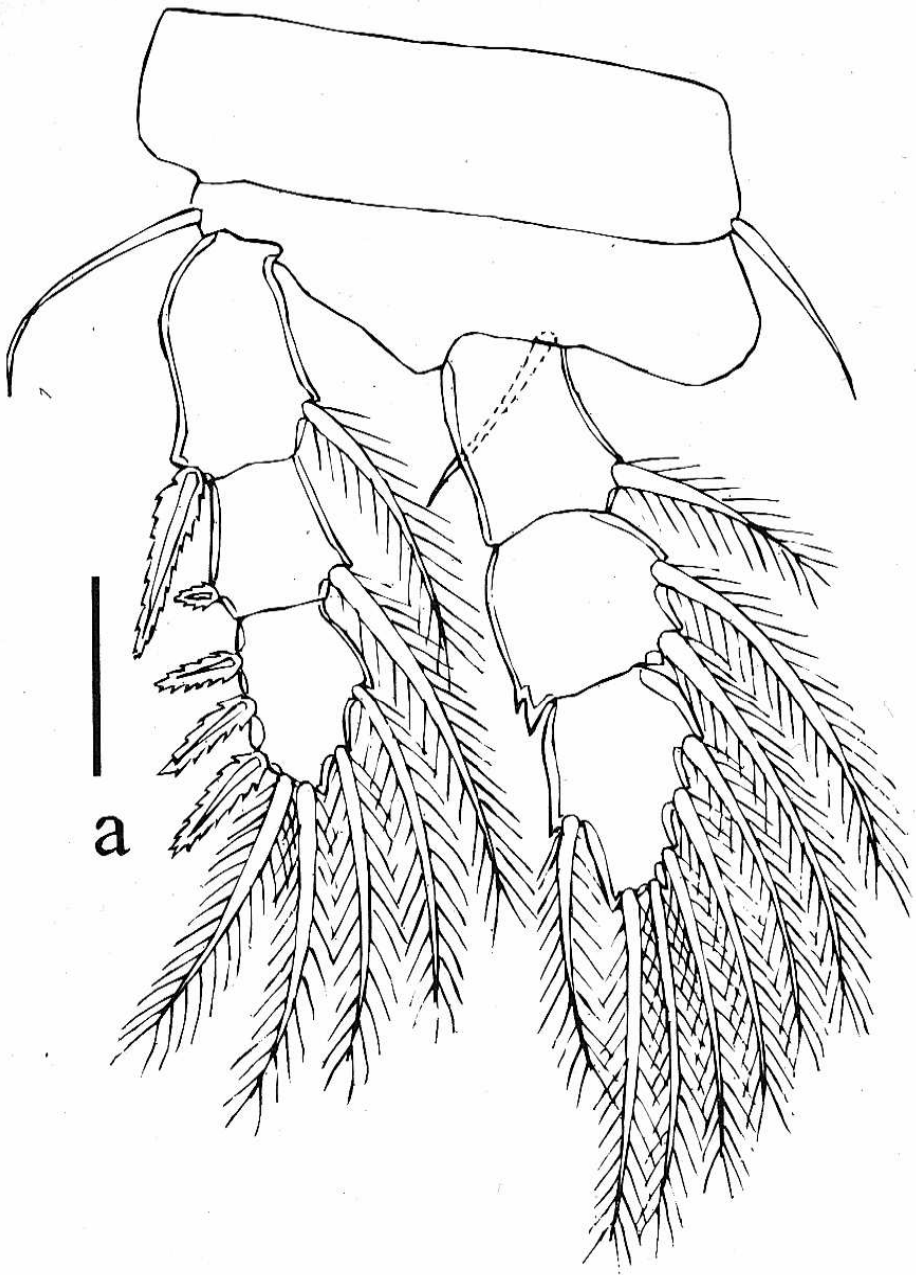
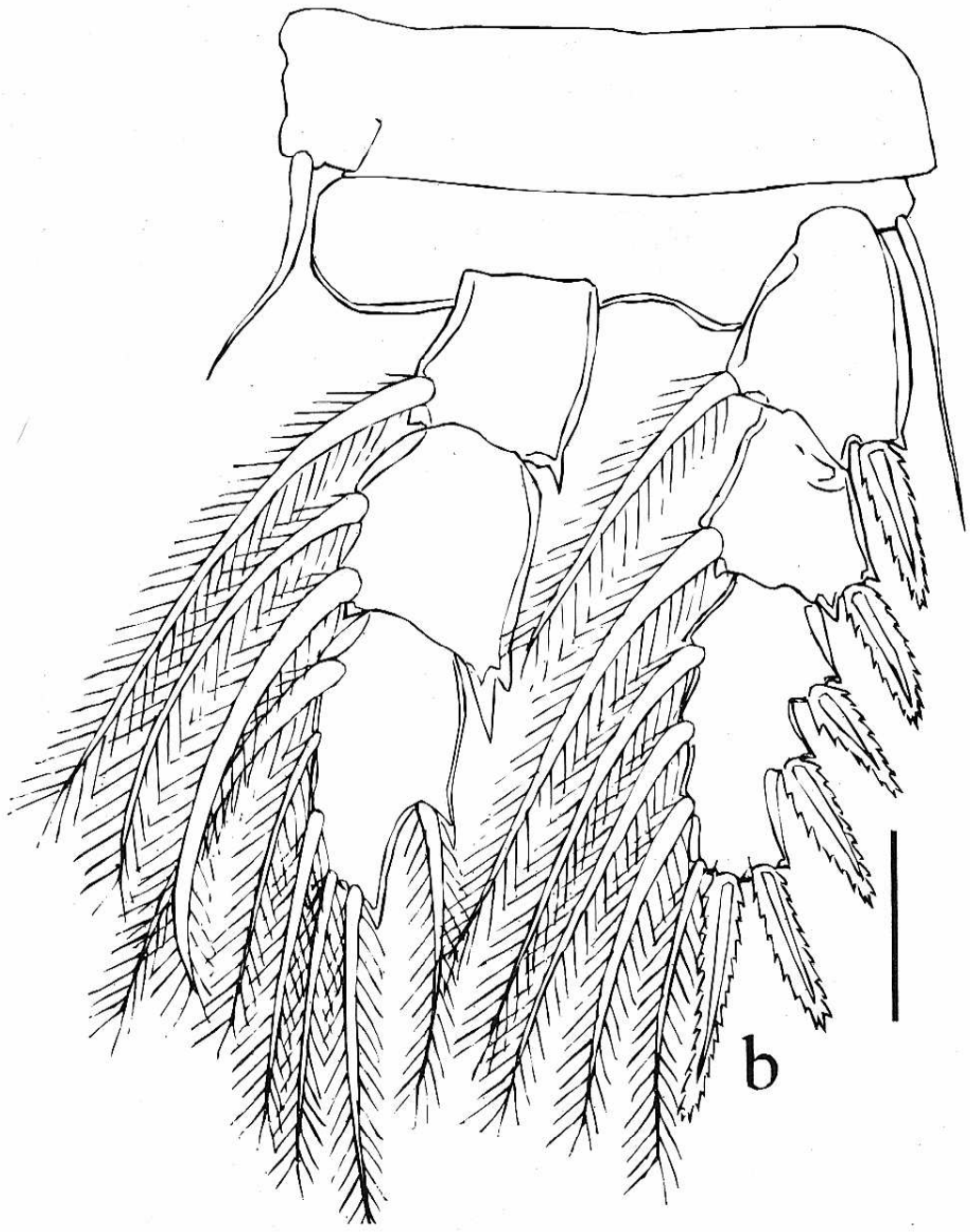
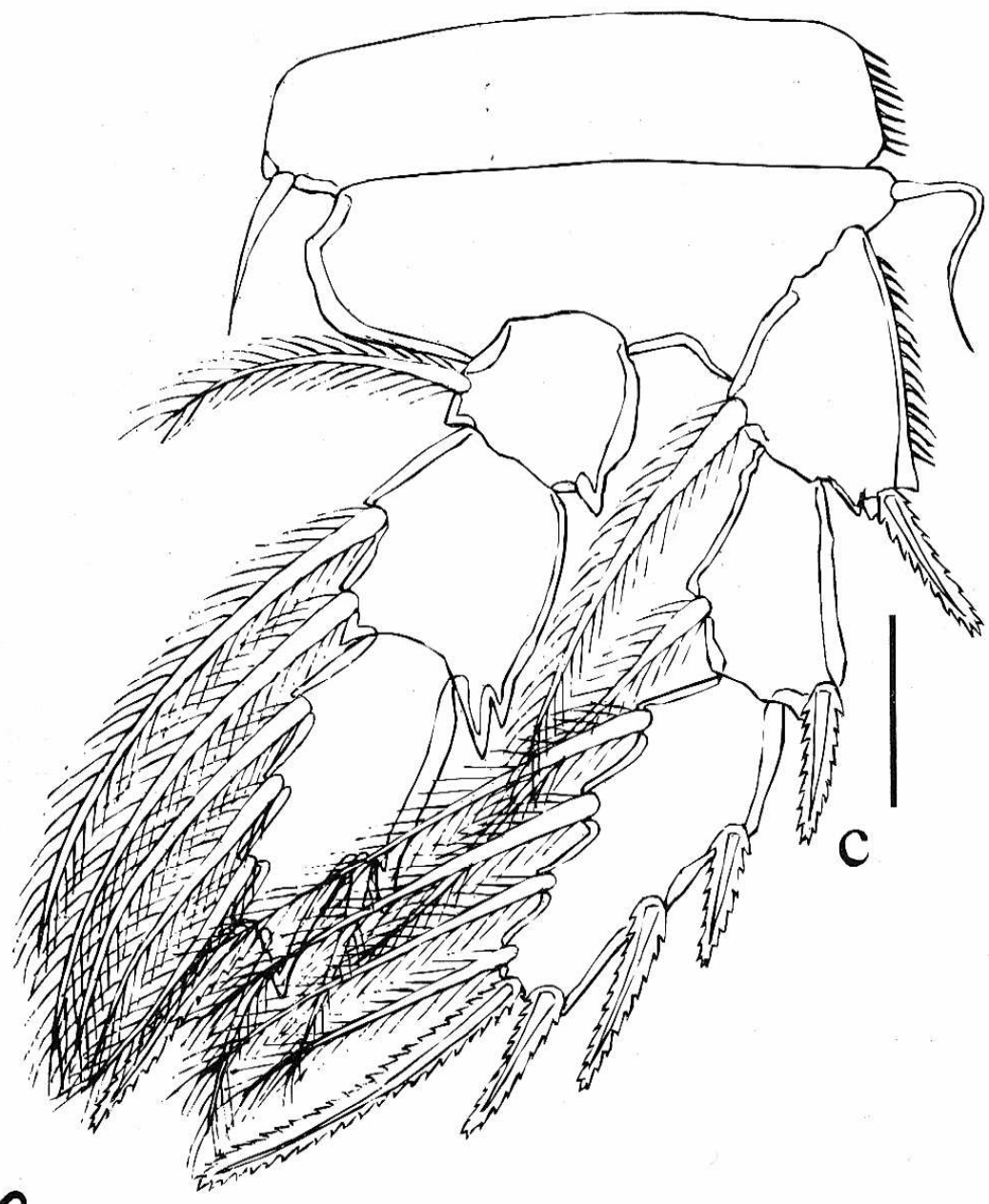


Fig. 1: *Asteropheres neptunei* new species, holotype female (MNRJ 12831): a) habitus, ventral, b) urosome, c) antennule, d) antenna, e) mandible, f) maxillule, g) maxilla, h) maxilliped. Scale: 100 μm (a), 50 μm (b), 30 μm (d-h).







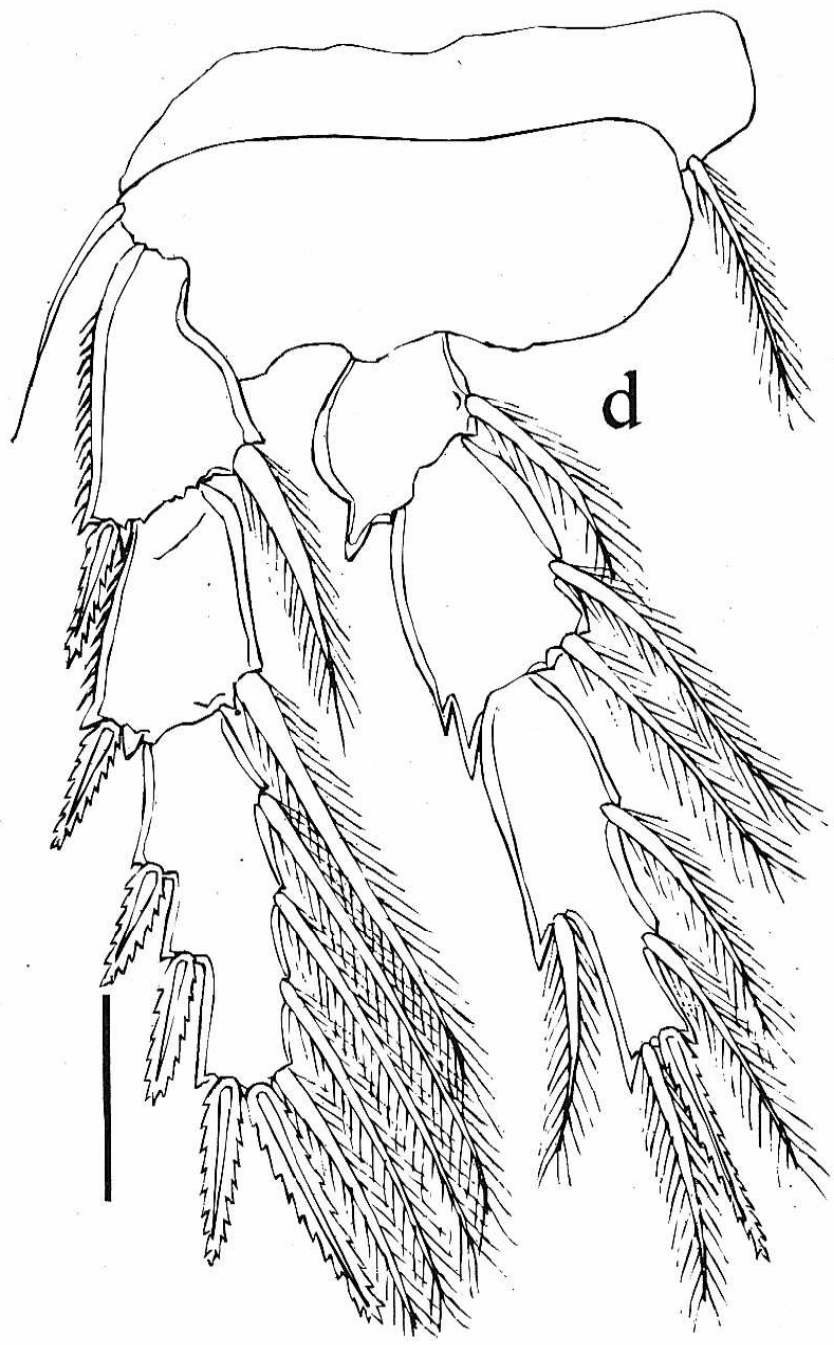


Fig. 2: *Asterocheres neptunei* new species, holotype female (MNRJ 12831): a) P1, b) P2, c) P3, d) P4. Scale: 30 μm (a-d).

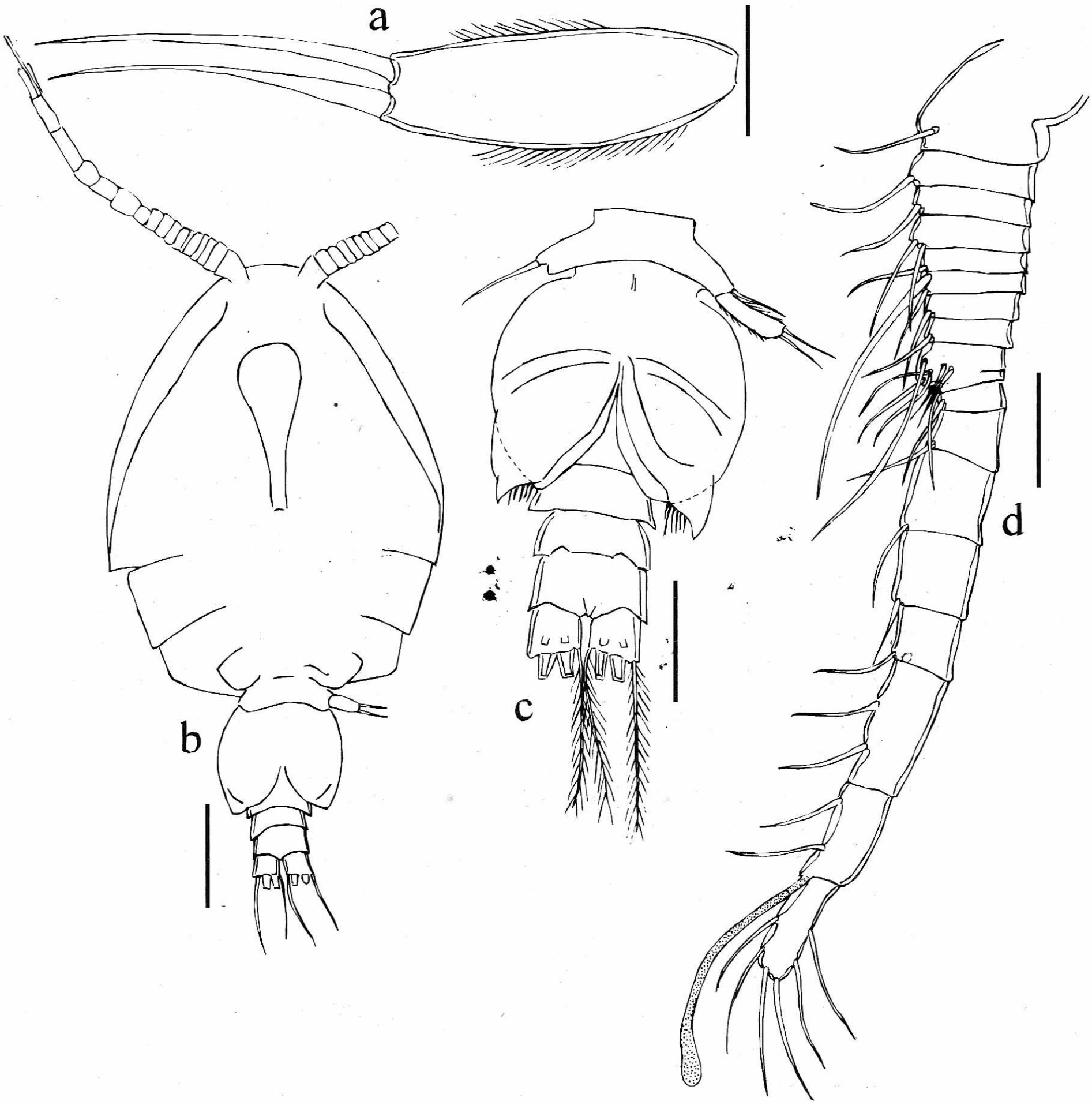


Fig. 3: *Asterocheres neptunei* new species, holotype female (a) (MNRJ 12831), allotype male (b-d) (MNRJ 12832): a) free segment of P5, b) habitus, ventral, c) urosome, d) antennule. Scale: 100 μm (b), 50 μm (c), 30 μm (a, d).

3. *Asterocheres unicus* Johnsson sp. nov. (figs. 7 - 9)

Material examined - Holotype: female MNRJ 12823; allotype: male MNRJ 12824. Paratypes: 3 females MNRJ 12825 and 1 male MNRJ 12826 associated with ascidians; 4 females MNRJ 12827 and 6 males MNRJ 12828, associated with echinoideans. All from Picinguaba, São Paulo State, Brazil, 26/Dec./1996, coll. R. Johnsson and P. S. Young.

Description - Female: Body length (excluding caudal setae) 723 μm, greatest body width 376 μm; thus body 1.92 times longer than wide. Body shape cyclopiform (fig. 7a), prosome enlarged, almost rounded posteriorly in ventral view, urosome cylindrical. Cephalosome and pedigerous somites 2 and 3 imbricated, showing rounded epimera. Pedigerous somite 3 covering pedigerous somites 4 and 5. Ratio of length to width of prosome 1.1:1. Ratio of length of prosome to urosome 2.2:1.

Urosome (fig. 7b) 4-segmented. Genital double-somite 96 x 109 μm, ratio of length to width 0.9:1, with setules on lateral margins. Two abdominal somites, both wider than long (36 x 71 μm, 42 x 62 μm), ratio of length to width 0.5 and 0.7:1, respectively. Caudal rami, 33 x 25 μm, 1.3 times longer than wide, armed with 6 setae. Seta I absent. Lengths of setae II-VII, 81, 113, 224, 211, 143 and 129 μm, respectively. All setae plumose.

Antennule (fig. 7c) 339 μm long (not including setae), and 18-segmented. Lengths of segments measured along their posterior margins: 51 μm (24 μm along anterior margin), 11, 9, 7, 7, 7, 8, 9, 11, 9, 17, 21, 25, 21, 24, 29, 34, and 39 μm, respectively. Segmental homologies and setation as follows: I-1; II-2; III-1; IV-2; V-1; VI-2; VII-1; VIII-2; IX-XIII-7; XIV-1; XV-2; XVI-2; XVII-1; XVIII-1; XIX-1; XX-1; XXI- 1+ae; XXII-XXVIII-10. Aesthetasc on segment XXI 95 μm long.

Antenna (fig. 7d) 266 μm long (including distal claw) with basis 90 μm long. Exopod 1-segmented, 9 μm, with long apical seta. Endopod 3-segmented. First segment 57 μm long, unarmed; second segment 13 μm long, with 1 seta. Third endopodal segment 23 μm long, with 2 setae and terminal claw 83 μm long, curved distally. Oral siphon (fig. 7a) 168 μm, reaching between insertion of maxilliped and P1. Mandible (fig. 7e) comprised of stylet 174 μm long, and 1-segmented mandibular palp, 45 μm long, armed with 2 apical setae.

Maxillule (fig. 7f) bilobed, inner lobe 61 μm long and armed with 4 apical setae. Outer lobe, 18 μm long, with 3 setae. Maxilla (fig. 7g) with syncoxa 93 μm long and claw 117 μm long, slightly curved distally.

Maxilliped (fig. 8a) 5-segmented, comprising syncoxa 42 μm, armed with 1 short inner seta; basis 107 μm long and unarmed. Endopod 3-segmented, segments measuring 23, 10, and 29 μm long, respectively. First endopodal segment unarmed; second segment with 1 short inner seta; and third segment bearing apical seta and claw-like element 77 μm long, curved distally.

Swimming legs 1-4 (figs. 8b - d; 9a) biramous; with 3-segmented rami.

	coxa	basis	exopod	endopod
P1	0-1	1-I	I-1; I-1; III-4	0-1; 0-2; 1-2-2
P2	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-2-3
P3	0-1	1-0	I-1; I-1; II-I-5	0-1; 0-2; 1-2-3
P4	0-1	1-0	I-1; I-1; III-1-4	0-1; 0-2; 1-I+1-2

Fifth leg (fig. 7b) with free segment armed with 2 naked setae; both lateral margins covered with setules. Pedigerous somite 5 bearing naked seta near insertion of free segment.

Description - Male: Body length (excluding caudal setae) 574 μm, greatest body width 283 μm; thus body 2.02 times longer than wide. Body shape cyclopiform (fig. 9b), prosome slightly enlarged, urosome cylindrical. Cephalosome and pedigerous somites 2 and 3 with slightly pointed epimera. Pedigerous somite 4 narrower than preceding somite and totally covered by preceding somite. Ratio of length to width of prosome 1.4:1, ratio of length of prosome to urosome 2.1:1.

Urosome (fig. 9c) 5-segmented. Genital somite 89 x 100 μm, ratio of length to width 0.9:1, rounded anteriorly and pointed posteriorly, bearing 1 seta on each posterior corner. Three abdominal somites, all wider than long (14 x 51 μm, 19 x 46 μm, 30 x 47 μm), ratio of length to width 0.3, 0.4, and 0.6:1, respectively. Caudal rami 21 x 21 μm, armed with 6 setae.

Antennule (fig. 9d) 264 μm long (not including setae), and 17-segmented. Lengths of segments measured along their posterior margins 41, (15 μm along anterior margin), 8, 9, 6, 7, 6, 7, 8, 13, 7, 11, 23, 19, 14, 36, 28, and 21 μm, respectively. Segmental homologies and setation as follows: I-1; II-2; III-1; IV-1; V-1; VI-2; VII-1; VIII-2; IX-XIII-6; XIV-1; XV-1; XVI-1; XVII-1; XVIII-1; XIX-XX-2; XXI-2+ae; XXII-XXVIII-7. Aesthetasc on segment XXI 91 μm long.

All other appendages as in the female.

Etymology - The specific name refers to the existence of a single seta on the antennal exopod.

Remarks - *Asterocheres unicus* sp. nov. has a short siphon, 168 μm long, reaching between the insertion of the maxilliped and P1, and the free segment of P5 armed with 2 setae. The following species share these characteristics: *Asterocheres abyssi* (Hansen, 1923) (Hansen, 1923); *A. canui* Giesbrecht, 1899; *A. indicus* Sewell, 1949 (Sewell, 1949); *A. jeanyeatmanae* Yeatman, 1970 (Yeatman, 1970); *A. longisetosus* Nair and Pillai, 1984 (Nair and Pillai, 1984); *A. ovalis* Sewell, 1949 (Sewell, 1949); *A. renaudi* Canu, 1892 (Canu, 1892); *A. simplex* Schirl, 1973 (Schirl, 1973); *A. spinopaulus* Johnsson, 1998 (Johnsson, 1998a); *A. tenerus* (Hansen, 1923) (Hansen, 1923); *A. uncinatus* (Kritchagin, 1873) (Marcus and Por, 1960) and *A. ventricosus* (Brian, 1928) (Brian, 1928).

Asterocheres unicus sp. nov. has the mandibular palp 1-segmented. In *A. canui*; *A. jeanyeatmanae*; *A. simplex*; *A. spinopaulus*; *A. renaudi* and *A. uncinatus* it is 2-segmented (Canu, 1892; Johnsson, 1998a; Marcus and Por, 1960; Schirl, 1973 and Yeatman, 1970). In *A. longisetosus* and *A. ovalis* it is also 1-segmented (Nair and Pillai, 1984 and Sewell, 1949) while this structure is not described in *A. abyssi*; *A. indicus*; *A. tenerus* and *A. ventricosus* nothing is mentioned about it.

The armature of the maxillule of *A. unicus* sp. nov. is armed with 4 and 3 setae on the inner and outer lobes respectively. This only occurs in *A. renaudi*, *A. tenerus* and *A. uncinatus* (Canu, 1892; Hansen, 1923 and Marcus and Por, 1960). *A. canui* and *A. longisetosus* have 3 setae on each lobe (Canu, 1892 and Nair and Pillai, 1984) and *A. jeanyeatmanae*, *A. ovalis*, *A. simplex* and *A. spinopaulus* have 4 setae on each lobe (Johnsson, 1998a; Schirl, 1973; Sewell, 1949 and Yeatman, 1970).

4. *Scottocheres elongatus* (T. and A. Scott, 1894) (figs. 10 - 11)
Acontiophorus elongatus. - T. and A. Scott, 1894: 137-149, pl. 9
Scottocheres elongatus. - Giesbrecht: 1899: 17, 104: pl. 4, figs. 1-28; Stock: 1967: 206

Material examined - 3 females MNRJ 12803, associated with sponges from Picinguaba, São Paulo State, Brazil; 26/Dec./1996, coll. R. Johnsson and P. S. Young.

Description - Female: Body length (excluding caudal setae) 921 μm, greatest body width 406 μm; thus body 2.26 times longer than wide. Body shape elongated (fig. 10a). Cephalosome and pedigerous somites 2 to 4 with rounded epimera. Ratio of length to width of prosome 1.4:1. Ratio of lengths of prosome to urosome 1.8:1.

Genital double-somite (fig. 10 b) 164 x 129 μm, ratio of length to width 1.3:1, with indentation on lateral margin, close to genital openings. Postgenital somite 93 x 73 μm, ratio of length to width 1.3:1. Anal somite, 46 x 64 μm, ratio of length to width 0.7:1. Caudal rami 20 x 23 μm, ratio of length to width 0.9:1, armed with 6 setae. Seta I absent. Setae II-VII, 35, 50, 175, 211, 73, and 28 μm, respectively. All setae plumose.

Antennule (fig. 10 c) 355 μm long (not including setae), and 17-segmented. Length of segments measured along posterior margins: 54 μm (20 μm along anterior margin), 21, 27, 9, 13, 6, 19, 12, 13, 23, 19, 20, 20, 21, 23, 22, and 33 μm, respectively. Segmental homologies and setation as follows: I-1; II-1; III-IV-2; V-1; VI-1; VII-1; VIII-1; IX-XIII-6; XIV-1; XV-1; XVI-1; XVII-1; XVIII-2; XIX-2; XX-1; XXI-1+ae; XXII-XXVIII-8. Aesthetasc on segment XXI 61 μm long.

Antenna (fig. 10 d) 219 μm long (including claw), with basis 75 μm long. Exopod 1-segmented, 9 μm long, with 2 apical setae. Endopod 2-segmented; first segment 57 μm long, unarmed. Second segment 21 μm long, with 2 small setae. Terminal claw 71 μm long, curved apically.

Oral cone (fig. 10 a) 571 μm, reaching genital double-somite. Mandible (fig. 10 e) comprising sharp stylet 185 μm long. Mandibular palp absent. Maxillule (fig. 10 f) bilobed, inner lobe and outer lobe 41 and 23 μm long, respectively. Both lobes armed with 3 apical setae.

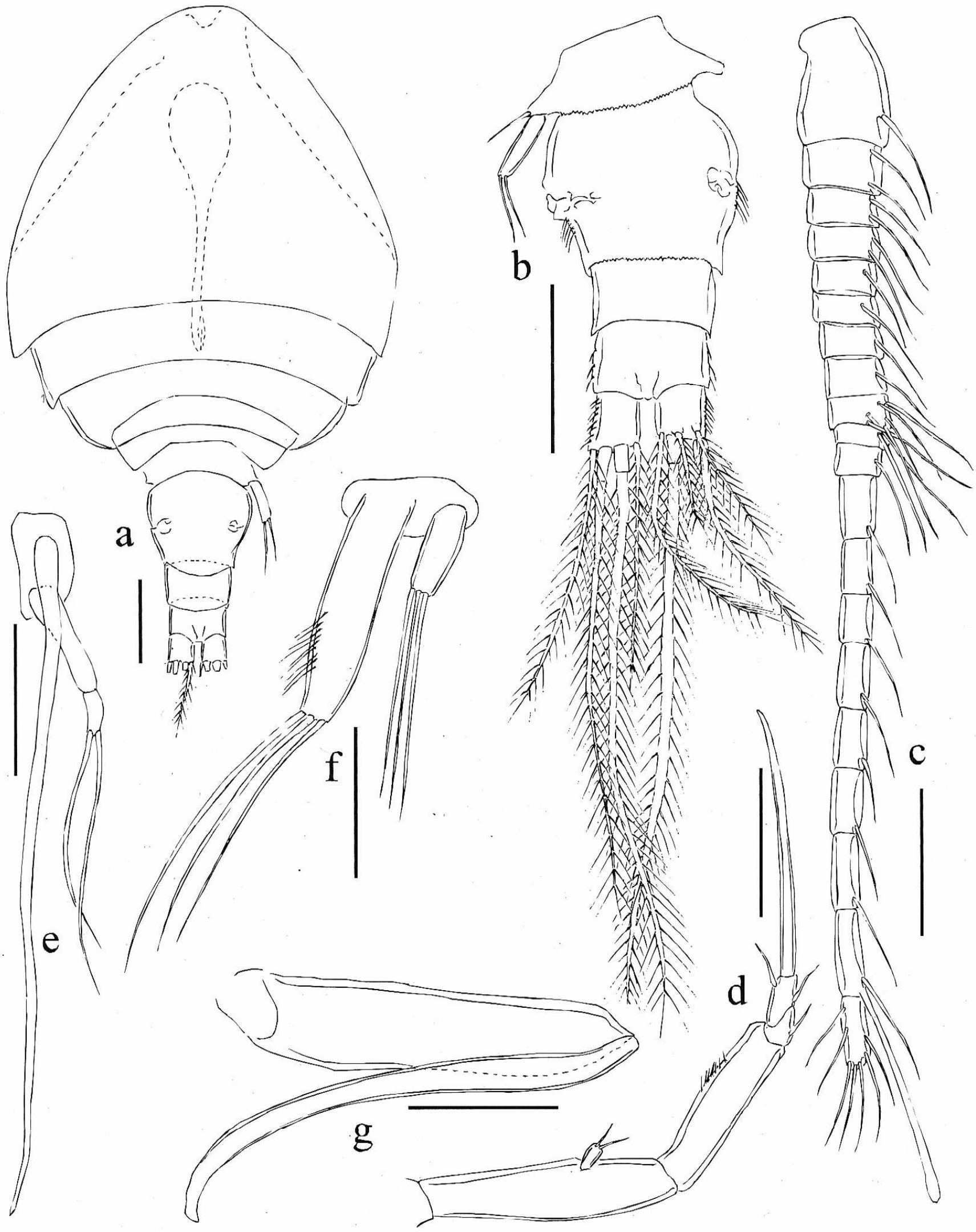


Fig. 4: *Asterocheres picinguabensis* new species, holotype female (MNRJ 12807): a) habitus, dorsal, b) urosome, c) antennule, d) antenna, e) mandible, f) maxillule, g) maxilla. Scale: 100 μm (a-b), 50 μm (c-g).

Maxilla (fig. 10 g) with syncoxa 103 μm long and claw 163 μm long, strongly curved distally. Maxilliped (fig. 11 a) 5-segmented, comprising syncoxa and basis 37 and 107 μm long, respectively. Endopod 3-segmented, segments measuring 20, 35, and 37 μm long, respectively. Second and third segments armed with apical seta; claw-like element 68 μm long and curved distally.

Swimming legs 1-4 (figs. 11 b - e) biramous, with 3-segmented rami throughout.

	coxa	basis	exopod	endopod
P1	0-1	1-I	I-1; I-1; III-4	0-1; 0-1; 1-2-3
P2	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-1; 1-2-3
P3	0-1	1-0	I-1; I-1; III-I-4	0-1; 0-2; 1-1+I-3
P4	0-1	1-0	I-1; I-1; III-I-3	0-1; 0-2; 1-I-2

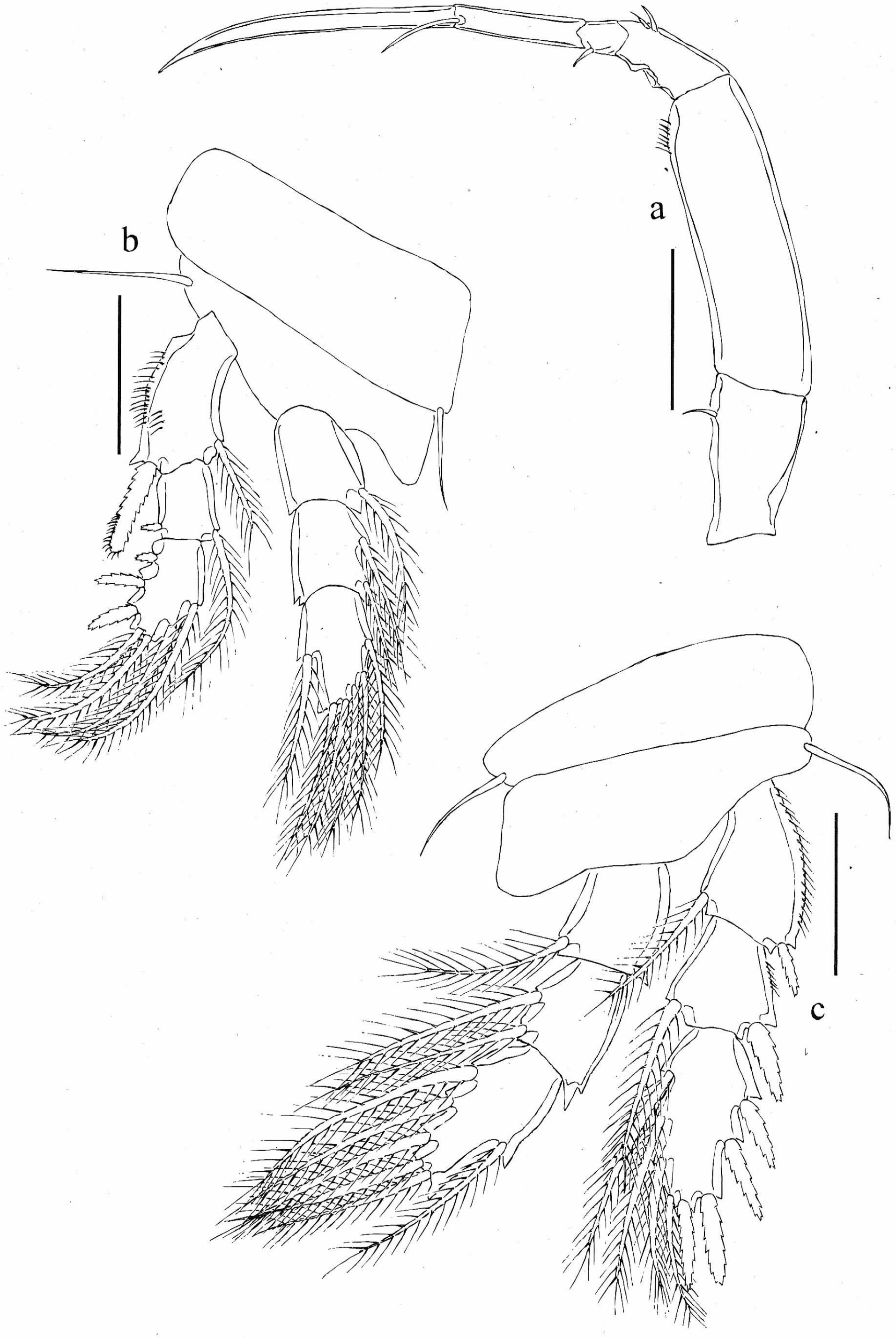


Fig. 5: *Asterocheres picinguabensis* new species, holotype female (MNRJ 12807): a) maxilliped, b) P1, c) P2. Scale: 50 μm.

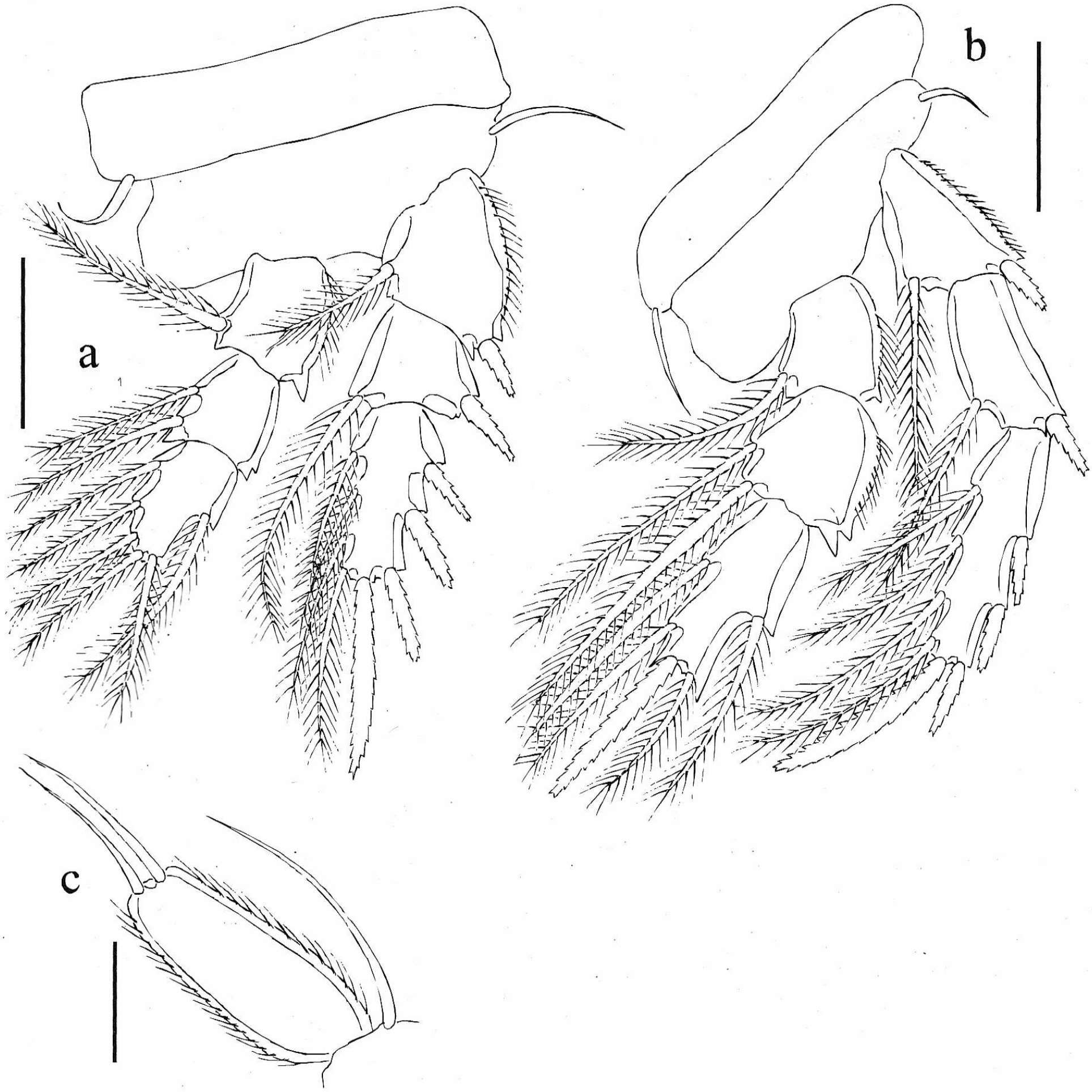


Fig. 6: *Asterocheres picinguabensis* new species, holotype female (MNRJ 12807): a) P3, b) P4, c) free segment of P5. Scale: 50 μm.

Fifth leg (fig. 11 f) with basal triangular segment armed with seta on inner margin. Distal segment of P5 62 x 34 μm, with 3 apical setae.

Remarks - Among the 7 species of the genus *Scottocheres, S. longifurca* Giesbrecht, 1899 (Stock, 1967); *S. gracilis* Hansen, 1923 (Hansen, 1923) and *S. stylifer* Giesbrecht, 1899 (Giesbrecht, 1899) have the caudal rami longer than wide. In *S. elongatus* the caudal rami is wider than long, as in *S. latus* Sewell, 1949 (Sewell, 1949); *S. laubieri* Stock, 1967 (Stock, 1967) and *S. stocki* Malt, 1991 (Malt, 1991).

Scottocheres latus has the free segment of P5 armed with 1 seta and the second endopodal segment of P1 with 2 setae. *Scottocheres elongatus* and the remaining species of the genus have 3 setae on the free segment and 1 seta on the second endopodal segment of P5.

Scottocheres laubieri has the third endopodal segment of P2 and P3 with 7 elements, these being 3 spines and 4 setae (Stock, 1967) and in *S. elongatus* there are 8 elements, 4 spines and 4 setae. The third exopodal segment of P4 of *S. laubieri* has 3 spines and 3 setae, and in *S. elongatus* there are 4 spines and 3 setae.

Scottocheres stocki has a setation of the legs different from the other species of the genus. The first and second endopodal segments of P4 are unarmed and the third segment has 0-5 instead of the 1-I-2 or 1-1+I-2 commonly observed.

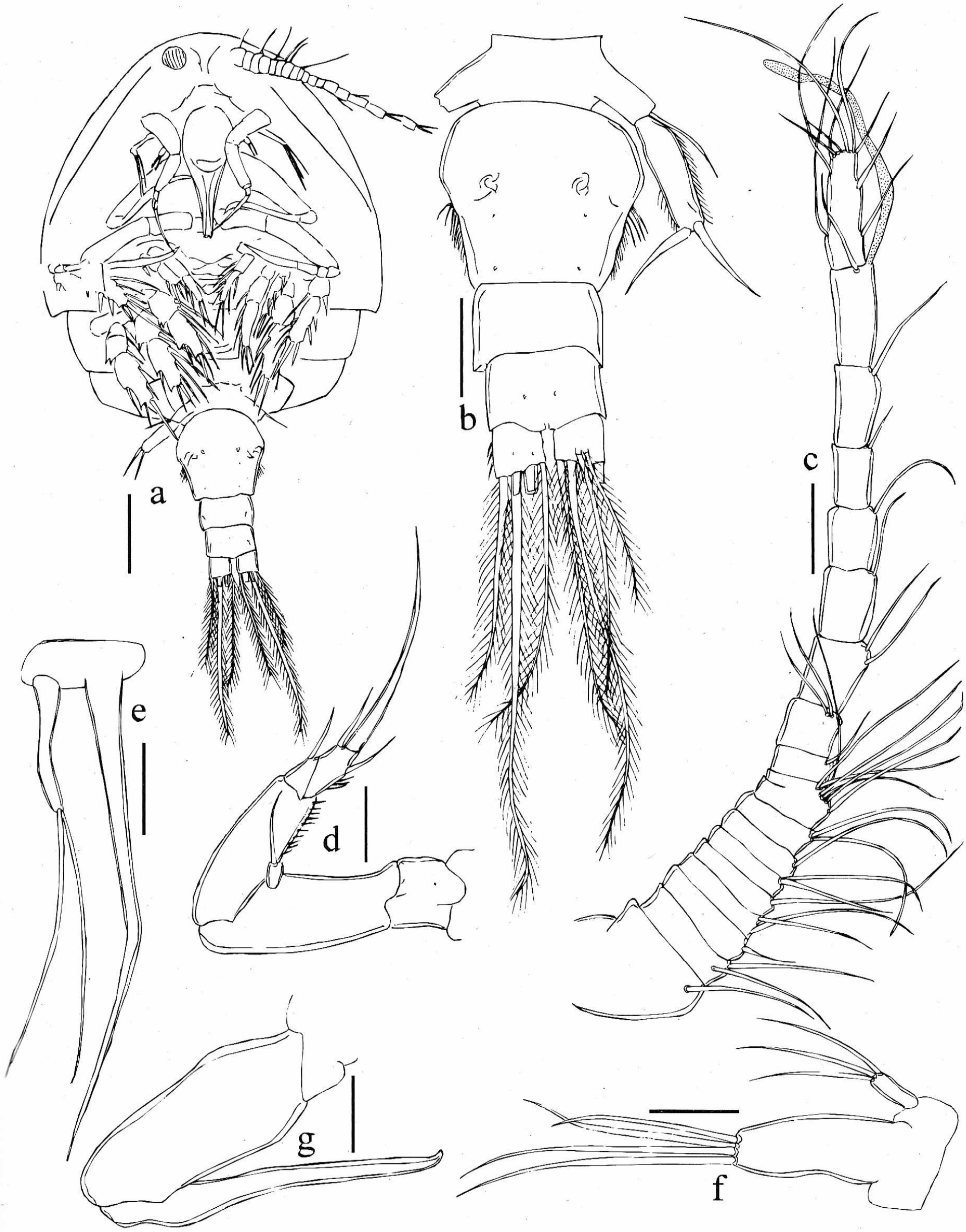


Fig. 7: *Asterocheres unicus* new species, holotype female (MNRJ 12823): a) habitus, ventral, b) urosome, c) antennule, d) antenna, e) mandible, f) maxillule, g) maxilla. Scale: 100 μm (a), 50 μm (b), 30 μm (c-g).

5. *Scottocheres laubieri* Stock, 1967 (figs. 12 - 13)

Scottocheres laubieri Stock, 1967: 206-211, figs. 1-19

Material examined - 12 females MNRJ 12802, associated with sponges from Picinguaba, São Paulo State, Brazil; 26/Dec/1996, coll. R. Johnsson and P. S. Young.

Description - Female: Body length (excluding caudal setae) 769 μm, greatest body width 338 μm,

thus body 2.27 times longer than wide. Body shape elongated and cyclopiform (fig. 12 a). Cephalosome and pedigerous somites 2 to 4 with rounded epimera. Ratio of length to width of prosome 1.5:1. Ratio of length of prosome to that of urosome 1.8:1.

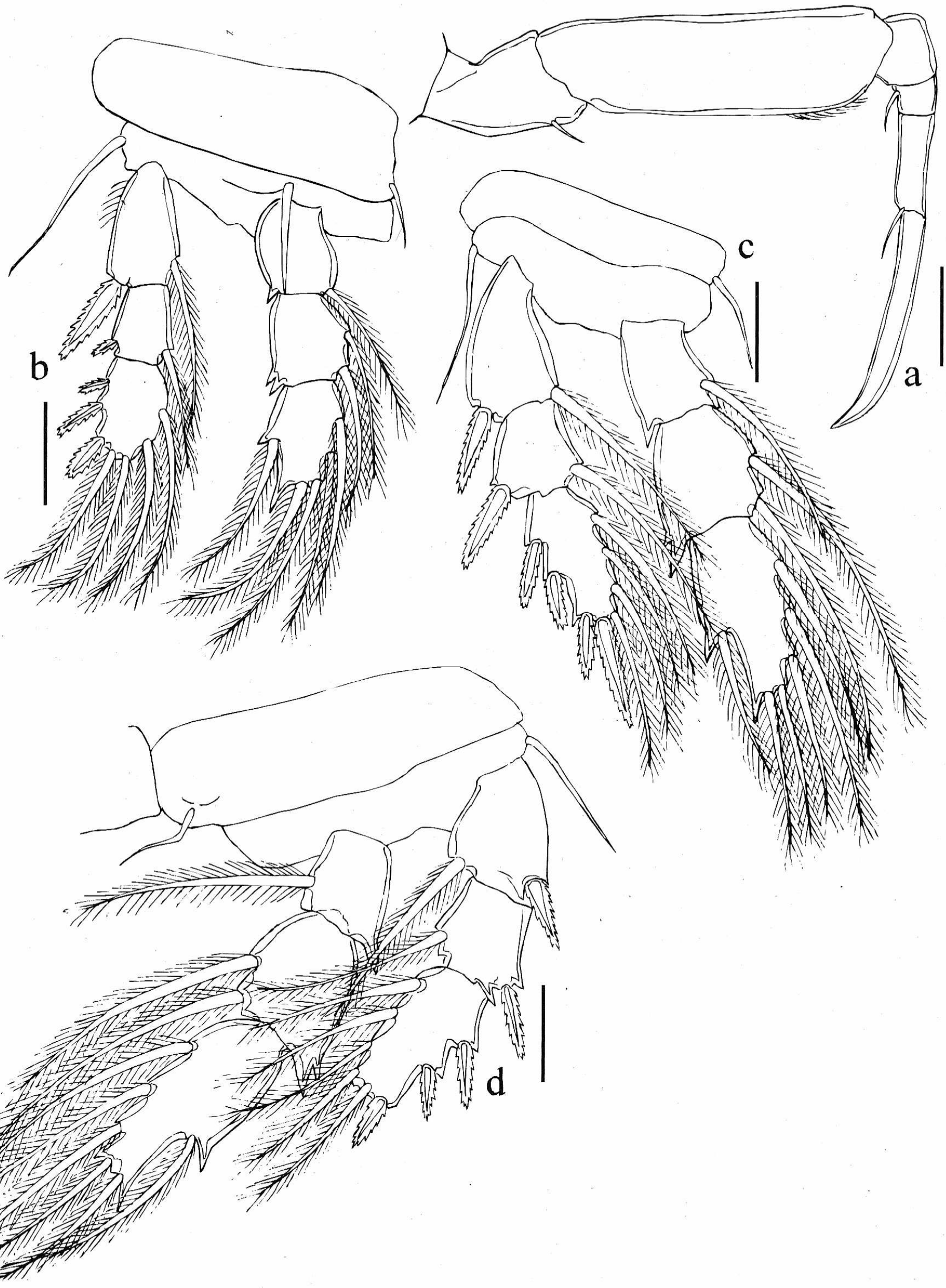


Fig. 8: *Asterocheres unicus* new species, holotype female (MNRJ 12823): a) maxilliped, b) P1, c) P2, d) P3. Scale: 30 μm (a-d).

Genital double-somite (fig. 12 b) 146 x 116 μm, ratio of length to width 1.3:1, with indentation on each lateral margin, close to genital openings. Postgenital somite 68 x 66 μm. Anal somite 39 x 61 μm, ratio of length to width 0.6:1. Caudal rami 14 x 20 μm, ratio of length to width 0.7:1, armed with 6 setae. Seta I absent. Lengths of setae II to VII, 95; 61; 245; 198; 66 and 61 μm, respectively. All setae plumose.

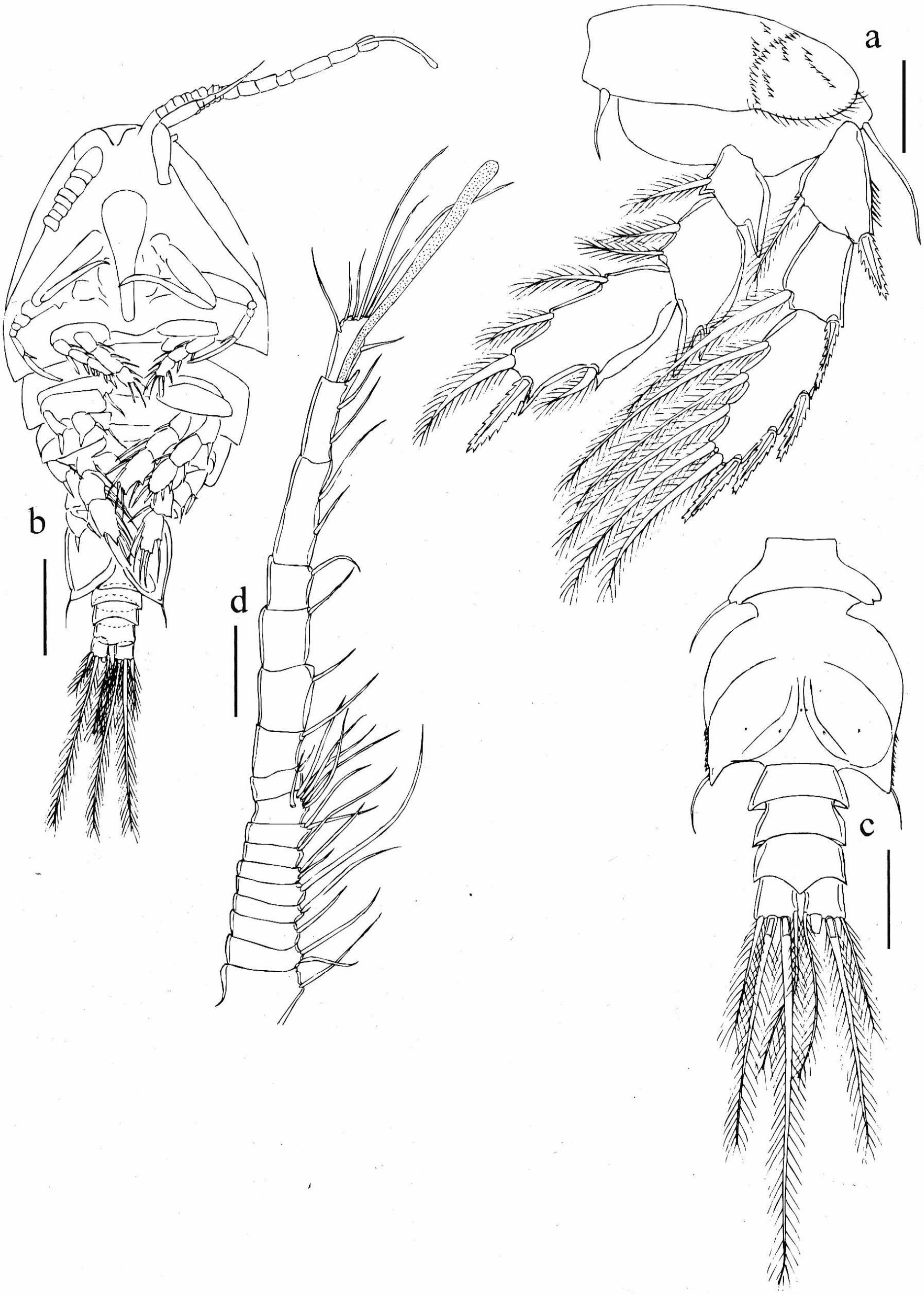


Fig. 9: *Asterocheres unicus* new species, holotype female (a) (MNRJ 12823), allotype male (b-d) (MNRJ 12824): a) P4, b) habitus, ventral, c) urosome, d) antennule. Scale: 100 μm (b), 50 μm (c), 30 μm (a,d).

Antennule (fig. 12 c) 299 μm long (not including setae), 17-segmented. Lengths of segments measured along their posterior margins: 35 μm (18 μm along anterior margin), 17, 24, 9, 11, 7, 11, 17, 6, 20, 16, 18, 15, 19, 20, 23, and 30 μm, respectively. Segmental homologies and setation as follows: I-1; II-2; III-IV-3; V-2; VI-2; VII-1; VIII-2; IX-XIII-6; XIV-2; XV-1; XVI-1; XVII-2; XVIII-1; XIX-1; XX-1; XXI-1+ae; XXII-XXVIII-10. Aesthetasc on segment XXI 67 μm long.

Nauplius

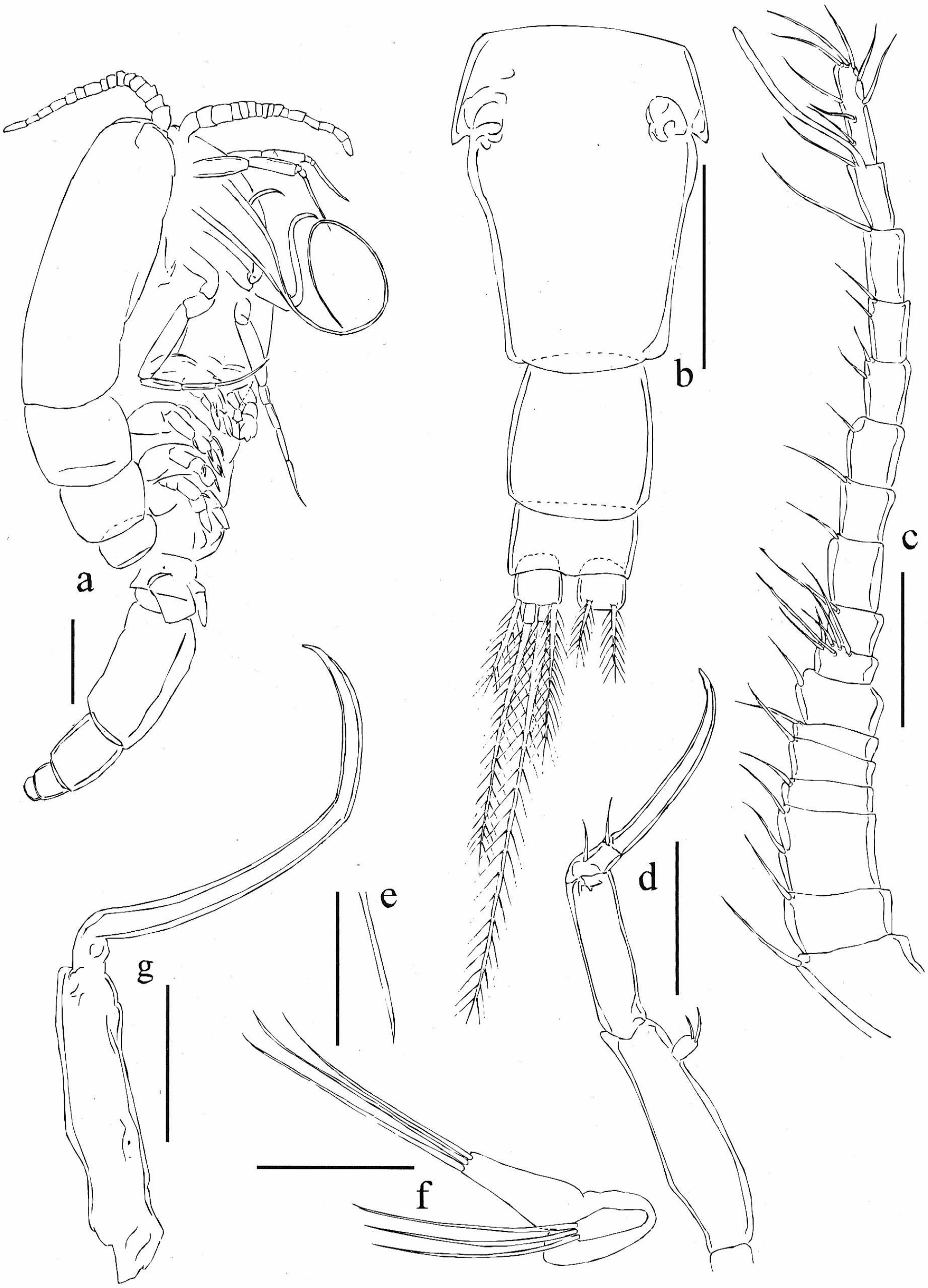


Fig. 10: *Scottocheres elongatus* (T. and A. Scott, 1894) (MNRJ 12803): a) habitus, lateral, b) urosome, c) antennule, d) antenna, e) distal part of mandible, f) maxillule, g) maxilla. Scale: 100 μm (a-b), 50 μm (c-g).

Antenna (Fig. 12 d) 195 μm (including claw), with basis 71 μm long. Exopod 1-segmented, 7 μm long, with 2 apical setae. Endopod 2-segmented, first segment unarmed, 54 μm long. Second segment 13 μm long, armed with 3 setae; terminal claw 57 μm long, distally curved. Oral cone (fig. 12a) 518 μm long, reaching genital somite. Mandible (fig. 12 e) comprising sharp stylet 241 μm long. Mandibular palp absent.

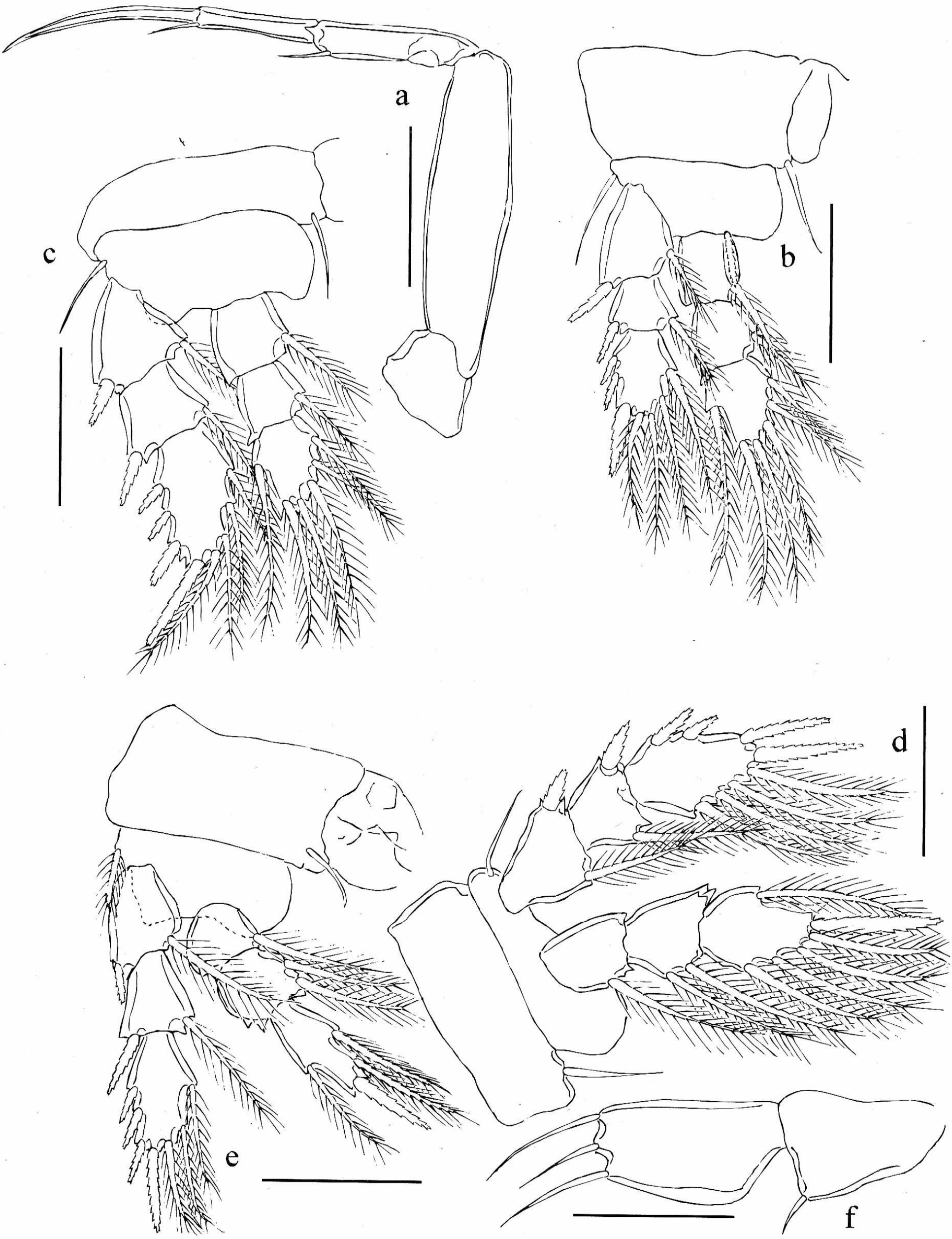


Fig. 11: *Scottocheres elongatus* (T. and A. Scott, 1894) (MNRJ 12803): a) maxilliped, b) P1, c) P2, d) P3, e) P4, f) P5. Scale: 50 μm.

Maxillule (fig. 12 f) bilobed, inner and outer lobes 89 and 39 μm long, respectively, both lobes armed with 3 setae. Maxilla (fig. 12 g) with syncoxa 92 μm long and claw 171 μm long. Maxilliped 5-segmented. Syncoxa armed with small seta. Basis unarmed. Endopod 3-segmented. First segment 17 μm long and with 2 setae, second and third endopodal segments 36 and 31 μm long respectively, both armed with a single seta; claw-like element 71 μm, almost straight, distally stout and blunt.

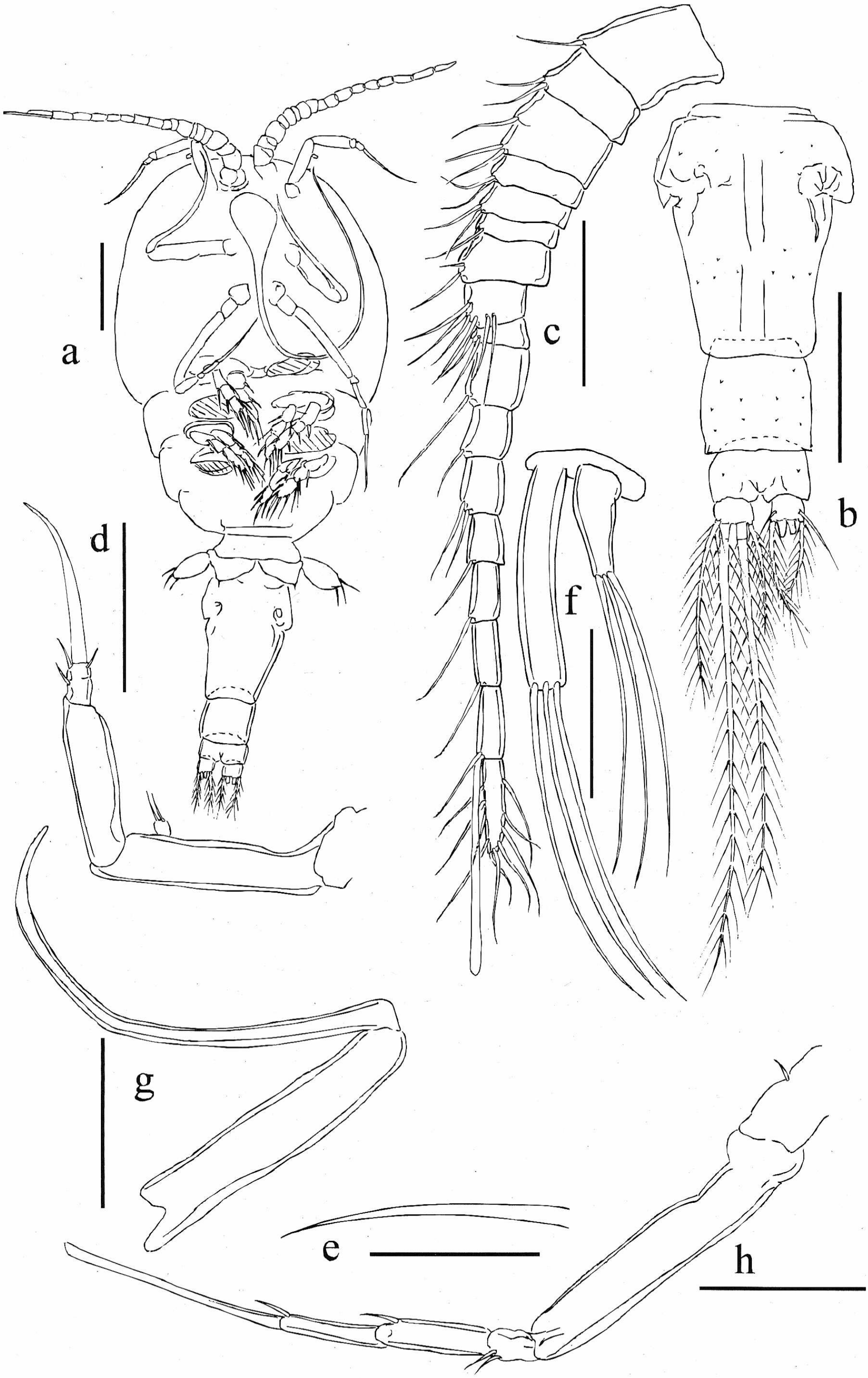


Fig. 12: *Scottocheres laubieri* Stock, 1967 (MNRJ 12802): a) habitus, ventral, b) urosome, c) antennule, d) antenna, e) distal part of mandible, f) maxillule, g) maxilla, h) maxilliped. Scale: 100 μm (a-b), 50 μm (c-h).

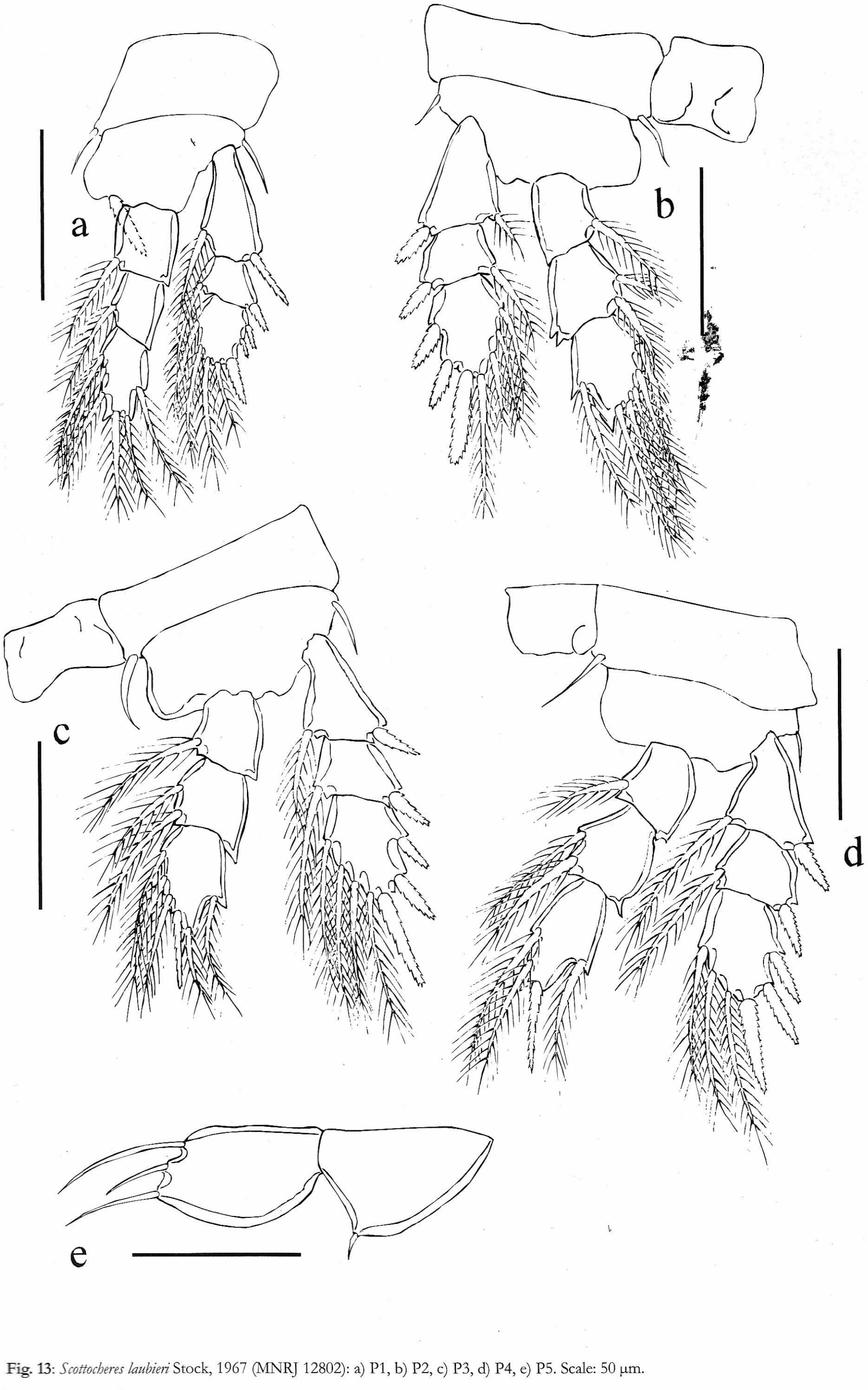


Fig. 13: *Scottocheres laubieri* Stock, 1967 (MNRJ 12802): a) P1, b) P2, c) P3, d) P4, e) P5. Scale: 50 μm.

Swimming legs (figs. 13 a – 13 d) biramous, with 3-segmented rami throughout.

	coxa	basis	exopod	endopod
P1	0-1	1-I	I-1; I-1; III-4	0-1; 0-1; 1-2-3
P2	0-1	1-0	I-1; I-1; II-I-4	0-1; 0-2; 1-2-3
P3	0-1	1-0	I-1; I-1; II-I-4	0-1; 0-2; 1-1+I-3
P4	0-1	1-0	I-1; I-1; II-I-3	0-1; 0-2; 1-I-2

Fifth leg (fig. 13e) with basal triangular segment 53 x 33 μm armed with 1 seta on inner margin. Segment of P5 47 x 32 μm with 3 apical setae.

Remarks: *Scottocheres laubieri* differs from *S. longifurca*, *S. stylifer* and *S. gracilis* because in these species the caudal ramus is longer than wide instead of wider than long (Giesbrecht, 1899; Hansen, 1923 and Stock, 1967).

Scottocheres latus has the antennule 19-segmented and 2 segments posteriorly to the segment armed with the aesthetasc while *S. laubieri* has a 17-segmented antennule. *Scottocheres stocki* Malt, 1991 has the antennule 16-segmented and the endopod of P4 is 0-0; 0-0; 0-5 (Malt, 1991), *S. laubieri* has the endopod of P4 with 0-1; 0-2; 1-I-2.

Scottocheres elongatus is the closest species to *S. laubieri*, as previously stated by Stock (1967). However they differ in the setation of the third exopodal segment of P2 to P4. In *S. elongatus* the outer margin has 3 setae and in *S. laubieri* there are only 2 setae.

Acknowledgements

RJ is thankful to P. S. Young (Museu Nacional / UFRJ, Rio de Janeiro) for the opportunity to study the material. This study was partially developed at the Museu Nacional in 1998, with financial support from the Fundação de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) and the Fundação Universitária José Bonifácio (FUJB), and it was completed at the Universidade de São Paulo (USP), supported by a grant from the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP-98/15333-3) to the first author.

References

Alvarez, M. P. J., 1988. A new siphonostomatoid copepod, *Rhynchomyzon compactum* n. sp., from the Brazilian continental shelf. Crustaceana 55(1): 88-92.

Brian, A., 1928. I Copepodi bentonici marini. Archivio Zoologico Italiano 12: 293-343.

Canu, E., 1892. Les Copepodes du Boulonnais. Morphologie, embryologie, taxonomie. Travaux de la Station de Zoologie Maritime de Wimereux 6:1-292.

Giesbrecht, W., 1899. Die Asterocheriden des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Fauna und Flora des Golfes von Neapel und der Angrenzenden Meeres-Abschnitte, Herausgegeben von der Zoologischen Station zu Neapel 25: 1-217.

Gotto, V., 1993. Commensal and parasitic copepods associated with marine invertebrates (and whales). Linnean Society of London, London: 264 pp.

Hansen, H. J., 1923. Crustacea Copepoda. II. Copepoda Parasita and Hemiparasita. Danish Ingolf-Expedition 3(7):1-92.

Huys, R. and Boxshall, G. A. 1991. Copepod Evolution. Ray Society, London, 159: 468 pp.

Johnsson, R., 1997. *Asterocheroides elephantinus* n. sp., a new siphonostomatoid (Crustacea - Copepoda) associated with a sponge from the Brazilian coast. Nauplius 5 (2): 1-8.

Johnsson, R., 1998a. Six new species of the genus *Asterocheres* (Copepoda; Siphonostomatoida) associated with sponges in Brazil. Nauplius 6: 61-99.

View publication stats

Johnsson, R., 1998b. *Kolocheres angustus* a new species and genus of Asterocheridae (Copepoda: Siphonostomatoida) associated with sponges in Brazil. Nauplius 6: 1-7.

Johnsson, R., 1998c. A new species of *Orecturus* Humes, 1992, Siphonostomatoida (Crustacea, Copepoda) associated with *Echinaster* sp. and sponges in Bahia (Brazil). Boletim do Museu Nacional 395: 1-7.

Johnsson, R., 1999. *Cletopontius titanus* new species, a new siphonostomatoid (Crustacea: Copepoda) associated with sponges from Brazil. Bulletin of Marine Science 64(2): 195-200.

Johnsson, R., 2000. *Spongiopsyllus adventicius* new species and genus of Entomolepididae (Copepoda: Siphonostomatoida) associated with sponges in Brazil. Hydrobiologia 417: 115-119.

Johnsson, R. and Bustamante, A. O 1997. *Monocheres cagarrensis* sp. nov. (Copepoda: Siphonostomatoida) from Brazil. Crustaceana 70(8): 894-900.

Malt, S. J., 1991. The copepod inhabitants of sponges and algae from Hong Kong. Bulletin of the British Museum (Natural History), Zoology 57(2): 167-183.

Marcus, A. and Por, F. D. 1960. Die Copepoden einer Probe aus dem Felsbiotop von Jalta (Krimhalbinsel). Travaux du Museum d'Histoire Naturelle 'Grigore Antipa' 2: 145-163.

Nair, B. U. and Pillai, N. K. 1984. On three new species of asterocherid copepods, with a redescription of *Indomyzon quasimi* Ummerkutty. Records of the Zoological Survey of India 81(3/4): 357-372.

Sars, G. O., 1915. An account of the Crustacea of Norway, 6. Copepoda Cyclopoida - parts IX - X. Bergen Museum, Bergen: pp. 105-140, pls 65-80.

Schirl, K., 1973. Cyclopoida Siphonostoma (Crustacea) von Banyuls (Frankreich, Pyrenees-Orientales) mit besonderer Berucksichtigung des Gast-Wirtverhaltnisses. Bijdragen tot de Dierkunde 43(1): 64-92.

Scott, T. and Scott, A. 1894. On some new and rare Crustacea from Scotland. Annals and Magazine of Natural History. 13(6):137-149.

Sewell, R. B. S., 1949. The littoral and semi-parasitic Cyclopoida, the Monstrilloida and Notodelphyoida. Scientific Reports of the John Murray Expedition. Publication of the British Museum (Natural History) 9(2): 17-199.

Stock, J. H., 1966. Cyclopoida Siphonostoma from Mauritius (Crustacea, Copepoda). Beaufortia 159(13): 145-194.

Stock, J. H., 1967. Copépodes associés aux invertébrés des côtes du Roussillon. VII. Sur deux espèces-jumelles de cyclopoïdes siphonostomes: *Scottocheres elongatus* (T. and A. Scott) et *S. laubieri* spec. nov. Vie et Milieu XVIII (1A): 203-214.

Yeatman, H. C., 1970. Copepods from Chesapeake Bay sponges including *Asterocheres jeanyeatmanae* sp. nov. Transactions of the American Microscopical Society 89(1): 27-38.

Received: 15th Nov 2001
Accepted: 20th May 2002