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PARASITIC COPEPODS ON *Orthopristis ruber* AND
Haemulon steindachneri (OSTEICHTHYES: HAEMULIDAE)
FROM THE BRAZILIAN LITTORAL, WITH THE
DESCRIPTION OF A NEW SPECIES OF *Caligus*
(SIPHONOSTOMATOIDA: CALIGIDAE)

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(With 52 figures)

ABSTRACT

Information is given of five species of copepods parasitic on *Orthopristis ruber* and *Haemulon steindachneri* (Osteichthyes: Haemulidae) from the Sepetiba Bay, State of Rio de Janeiro (22°51'S, 43°56'W), Brazil. One of them, *Caligus sepetibensis* n.sp., can be differentiated from its congeners by having trisegmented fourth exopod, presence of an oval process on maxilliped, sternal furca with subquadrangular base and rami slightly divergent and spatulate, and genital complex suboval. *Lernanthropus rathbuni* Wilson, 1922 is redescribed. New geographical and host records for *Colobomatus belizensis* Cressey and Schotte, *Caligus haemulonis* Wilson, and *Clavellotis dilatata* (Krøyer) are included.

Key words: Copepoda, marine fishes, Haemulidae, *Colobomatus belizensis*, *Caligus sepetibensis* n.sp., *Caligus haemulonis*, *Lernanthropus rathbuni*, *Clavellotis dilatata*, Brazil.

RESUMO

**Copéodes Parasitos de *Orthopristis ruber* e *Haemulon steindachneri*
(Osteichthyes: Haemulidae) do Litoral do Brasil, com a Descrição
de uma Espécie Nova de *Caligus* (Siphonostomatoidea: Caligidae)**

Cinco espécies de copéodes parasitas de *Orthopristis ruber* e *Haemulon steindachneri* (Osteichthyes: Haemulidae) da Baía de Sepetiba, Estado do Rio de Janeiro (22°51'S, 43°56'W), são descritas e ilustradas. Uma delas, *Caligus sepetibensis* n.sp. é considerada espécie nova e pode ser diferenciada das outras espécies do gênero por uma combinação de caracteres que inclui o quarto exopodito tri-segmentado, a presença de um processo oval sobre o maxilípede, a furca esternal com base subquadrangular e ramos ligeiramente divergentes e espatulados e o complexo genital suboval. *Lernanthropus rathbuni* Wilson, 1922 é redes-

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crita. São incluídos novos registros geográficos e de hospedeiros para *Colobomatus belizensis* Cressey e Schotte, *Caligus haemulonis* Wilson e *Clavellotis dilatata* (Krøyer).

Palavras-chave: Copepoda, peixes marinhos, Haemulidae, *Colobomatus belizensis*, *Caligus sepetibensis* n.sp., *Caligus haemulonis*, *Lernanthropus rathbuni*, *Clavellotis dilatata*, Brasil.

INTRODUCTION

Studies on copepod parasites of marine fishes from Brazil are scarce considering the large number of marine fish species in the Brazilian coast. To date, 35 species of copepod parasites on teleost fishes are known, the majority of them were recorded infesting fishes of the families Belontiidae, Scombridae, and Mugilidae (Carvalho, 1951, 1956; Cressey and Collette, 1970; Cressey and Cressey, 1980; Cressey and Schotte, 1983; Alexander, 1983; Knoff and Boeger, 1994; Knoff *et al.*, 1994). Only two copepod species were recorded infesting fishes of the family Haemulidae from Brazil: *Colobomatus belizensis* Cressey and Schotte, 1983, and *Peniculus haemuloni* Alexander, 1983. In the present paper, five species of copepod parasites of the haemulid fishes *Orthopristis ruber* (Cuvier) and *Haemulon steindachneri* (Jordan and Gilbert) from the Sepetiba Bay, State of Rio de Janeiro, Brazil, are described and illustrated. A new species of *Caligus* is described and *Lernanthropus rathbuni* Wilson is re-described.

MATERIAL AND METHODS

One hundred and sixty-two specimens of *O. ruber* (Cuvier, 1829) and 80 specimens of *H. steindachneri* (Jordan and Gilbert, 1822) from the Sepetiba Bay (22°51'S, 43°56'W), State of Rio de Janeiro, Brazil, were collected and necropsied between April 1991 and April 1992. The copepods collected were fixed and preserved in ethanol 70°GL. For microscopy study, specimens were cleared in lactic acid and the appendages and whole specimens (Humason, 1979). Some specimens were stained with Gomori's trichrome for observation of segmentation and sutures. Illustrations were made with the aid of drawing tube using a Wild M-11 microscope. Measurements are indicated in micrometers (µm), unless otherwise stated, and range is followed by the mean within parentheses. Classification and nomenclature used for descriptions are as in Kabata (1979). Preva-

lence and mean intensity of infestation were used according to Margolis *et al.* (1982). Holotype, paratypes, and voucher specimens were deposited in the Coleção Carcinológica do Museu Nacional (MN), Quinta da Boa Vista, Rio de Janeiro, RJ, Brazil and Division of Crustacea, National Museum of Natural History, Smithsonian Institution (USNM), Washington, DC, USA.

DESCRIPTIONS

Colobomatus belizensis Cressey and Schotte, 1983 (Fig. 1)

Female (based on 25 specimens, 22 measured): Poecilostomatoida. Philichthyidae. Total length (Fig. 1) 7.20-9.15 mm (8.04 mm). Maximum width 1.23-1.55 mm (1.36 mm). Preoral cephalic process anterior to oral opening, acute in distal extremity, extending above buccal cone. Thoracic segments with four, long, slender processes with acute extremities. Anterior processes shorter than posterior ones. Left posterior process longer than others. Genital complex with small, lateral, incipient lobes. Eggs sacs as long as abdomen. Four abdominal segments weakly defined, third segment with two lateral processes with acute extremities. Caudal rami well developed, similar to abdominal processes. First antenna well reduced dorsoventrally, near to buccal cone insertion. Mandibule with small ventral processes. First and second maxilla bifid, distal segment of second maxilla with tooth-like processes. Maxilliped absent.

Male: Not collected.

Taxonomic summary

Host: *Haemulon steindachneri* (Jordan and Gilbert).

Site of infestation: Mandibular canals.

Locality: Sepetiba Bay, Rio de Janeiro, Brazil (22°51'S, 43°56'W).

Prevalence: 70.0%.

Mean intensity of infestation: 1.45.

PLATE I

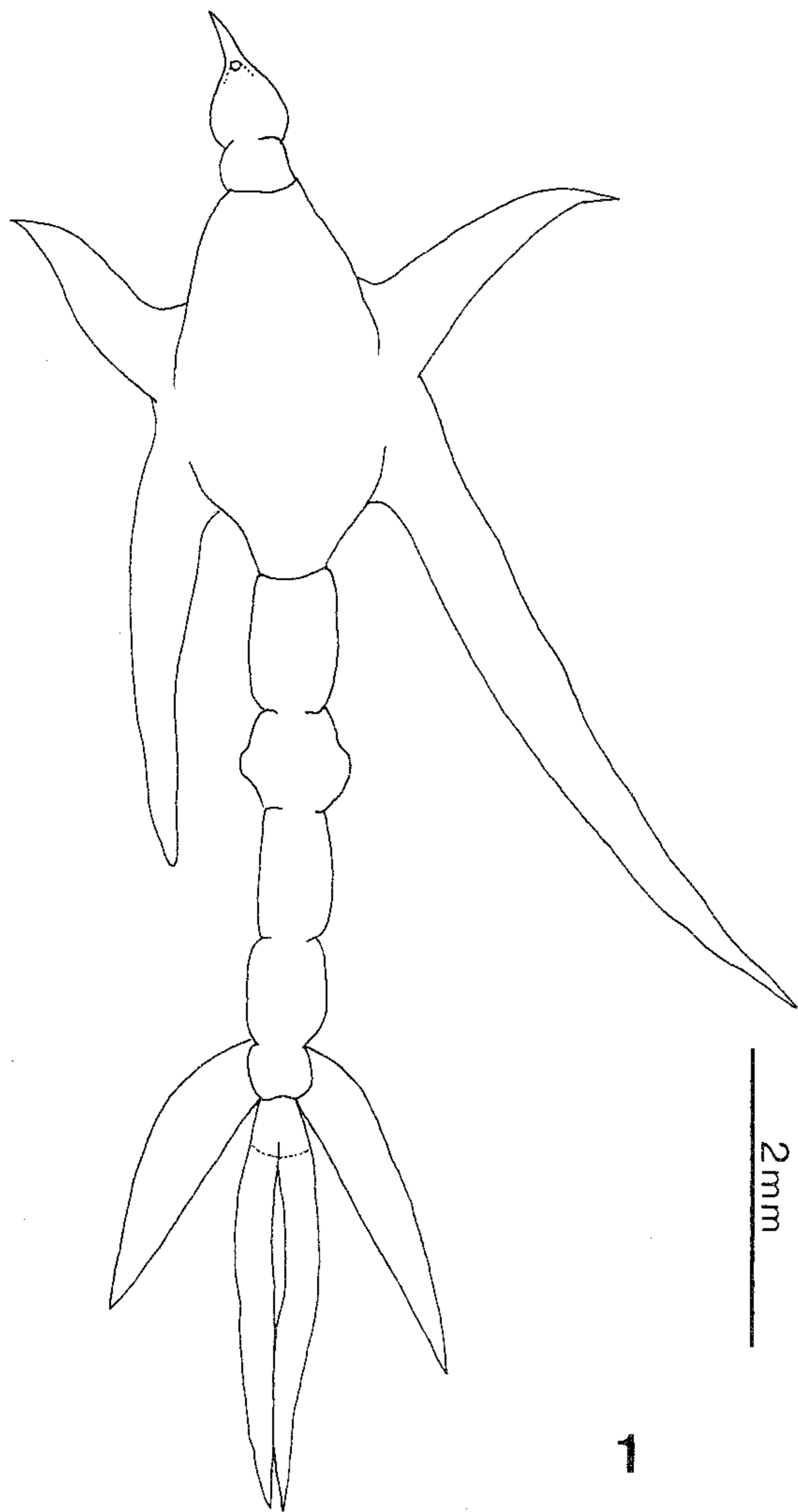


Fig. 1 — *Colobomatus belizensis* Cressey & Schotte, 1983. Female, ventral view.

Specimens deposited: Voucher specimens: MN N°s 4427-4431 (seven females), USNM N° 274236 (four females).

Remarks

This species was described originally by Cressey and Schotte (1983) based on specimens collected in the mandibular canals of *Haemulon steindachneri* and *H. aureolineatum* Cuvier, from the Brazilian littoral. In the same paper, 10 other species of haemulid fishes are considered hosts of *C. belizensis* in the western Atlantic Ocean.

Cressey and Schotte (1983) observed inter-specific variations of the length of the thoracic processes of *C. belizensis*. The material studied in the present paper is characterized by the left inferior thoracic process being longer than the others, this characteristic is not observed in the variations illustrated by Cressey and Schotte (1983).

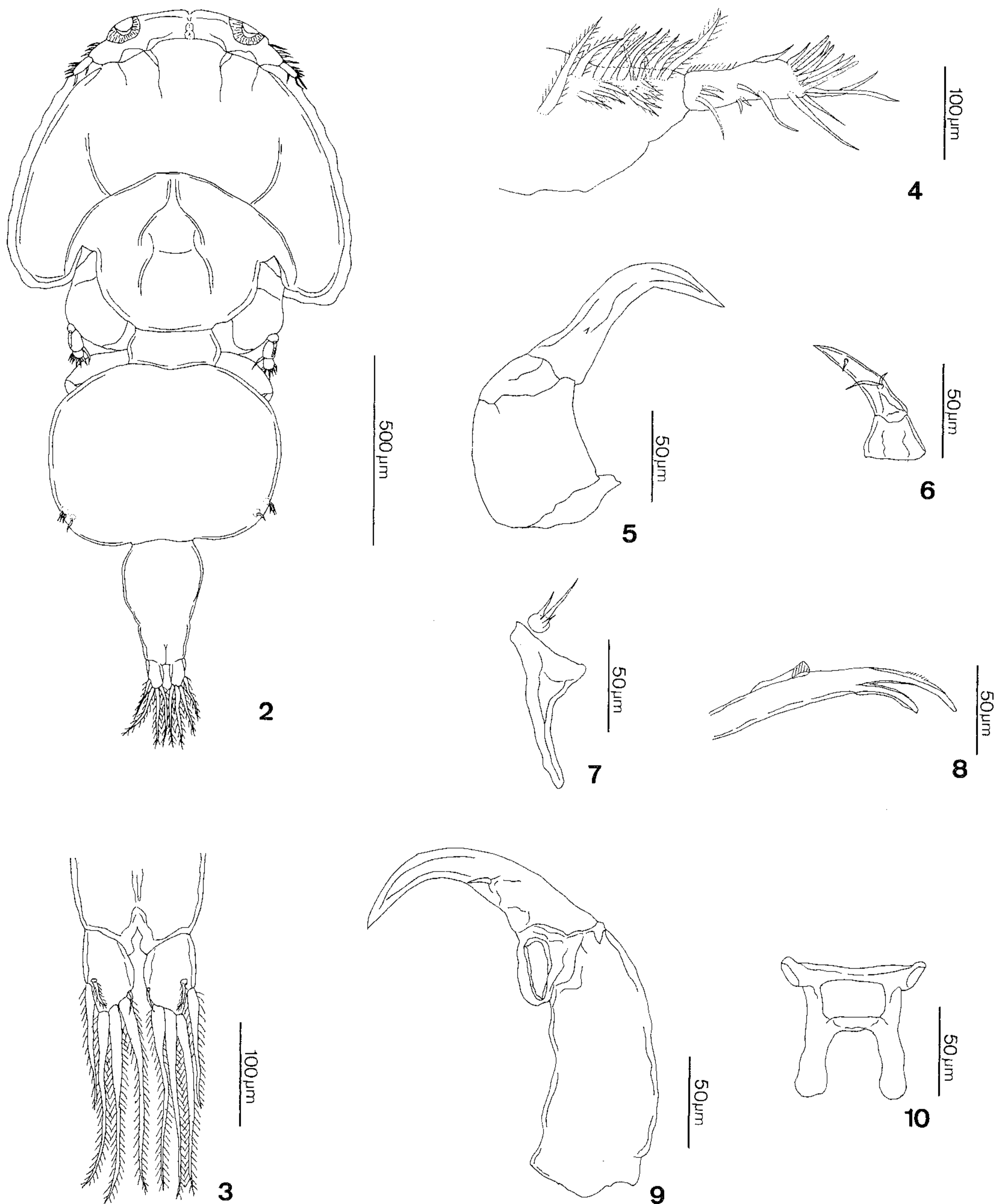
Colobomatus belizensis belongs to the group of species of the genus which presents lateral processes on the third abdominal segment. These species are *C. quadrifarius* Cressey and Schotte and *C. caribbi* Cressey and Schotte, also parasites of haemulid fishes from the western Pacific and Atlantic Oceans (Cressey and Schotte, 1983).

Caligus sepetibensis n.sp.

(Figs. 2-15)

Female (based on 15 specimens collected from *O. ruber*, and two collected from *H. steindachneri*; all measured): Siphonostomatoida. Caligidae. Total length (Fig. 2) (including caudal rami), 2.01-2.32 mm (2.16 mm). Maximum width 0.95-1.14 mm (1.04 mm). Cephalothorax total length 1.06-1.20 mm (1.12 mm). Genital complex suboval, 439-604 (503) long, 580-769 (629) wide. Egg sacs 823 long, 201 wide (in one specimen only). Abdomen unsegmented, 382-439 (400) long, 180-238 (192) wide. Caudal rami (Fig. 3) 80-95 (90) long, 51-58 (56) wide, with six pinnate setae, two of them very small, longest seta 240-255 (249) long. Frontal lunules 107-124 (110) in diameter, 263-285 (275) apart. First antenna bi-segmented (Fig. 4), basal segment with 16 pinnate setae and two naked setae, distal segment with 17 naked setae, two aesthetes. Second antenna (Fig. 5) with prominent claw bearing one spinule on lateral side, basal segment with conspicuous, subrectangular, process. Postantennal process (Fig. 6) is a developed claw, with three setae. First maxilla (Fig. 7) subtriangular with three setae of unequal size near base. Second maxilla (Fig. 8) typical of the genus, with membranous process on anterodistal margin of distal segment. Maxilliped robust (Fig. 9), corpus unarmed, with oval process on distal limit; curved claw, with diminute seta on suture. Sternal furca (Fig. 10) with subquadrangular base; rami slightly divergent, with length similar to base, rami extremities slightly spatulate. First leg (Fig. 11) with sympod subquadrangular with four naked setae, one on the inferior margin, one

PLATE II

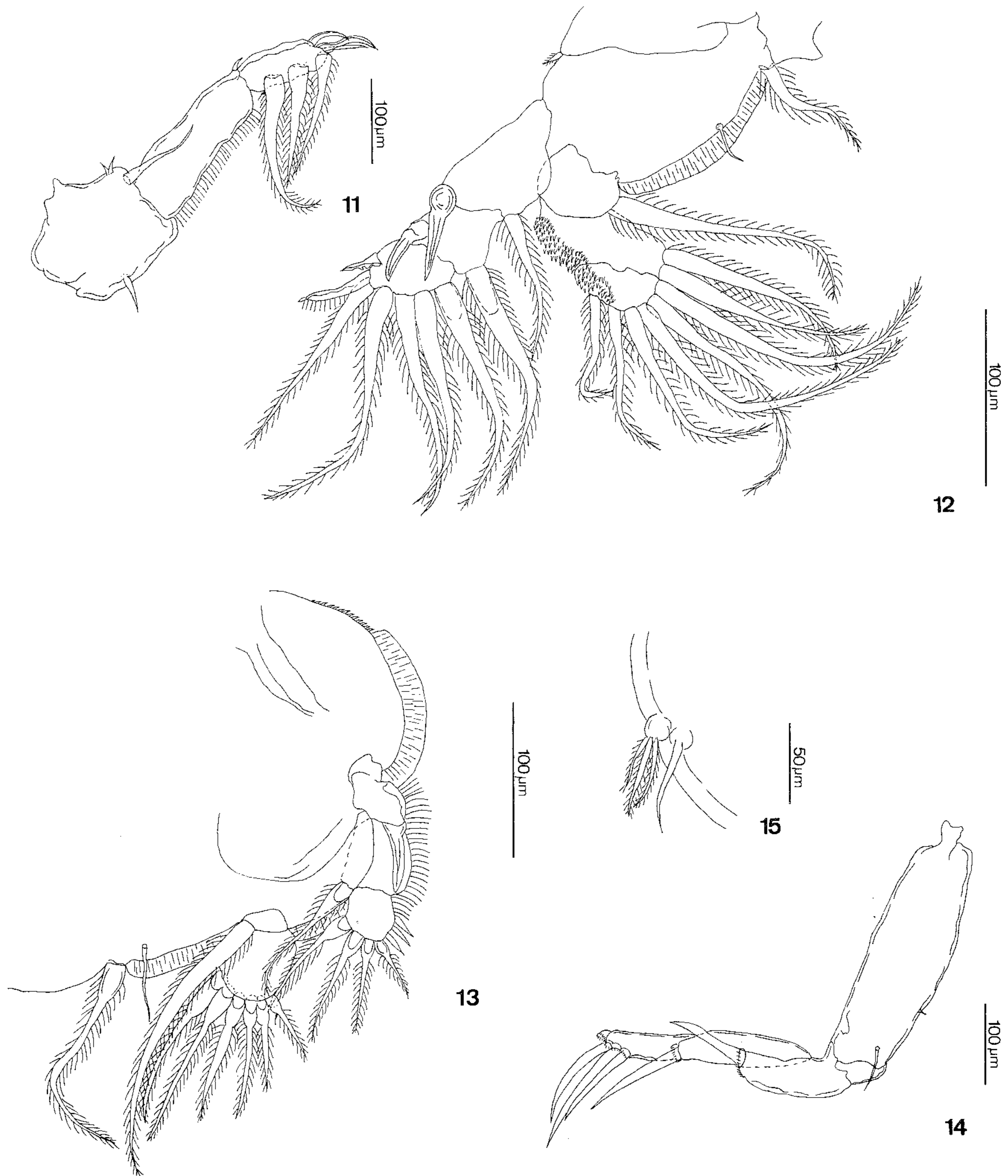


Figs. 2-10 — *Caligus sepetibensis* n.sp. Female. Fig. 2: dorsal view. Fig. 3: caudal rami. Fig. 4: first antenna. Fig. 5: second antenna. Fig. 6: post antennal process. Fig. 7: first maxilla. Fig. 8: second maxilla, detail of the distal segment. Fig. 9: maxilliped. Fig. 10: sternal furca.

longer on anterodistal margin, and two diminute setae near exopod base. Exopod bisegmented, basal segment with postero-laterally plumose and one spine on externo-distal angle; distal segment with three terminal setae, two bearing narrow strip

of transparent membrane on anterior margin, third seta naked and more slender than others; three lateral pinnate setae. Second leg (Fig. 12) with sympod bisegmented, rami trisegmented. Basipod with small pinnate seta on anterolateral margin,

PLATE III



Figs. 11-15 — *Caligus sepetibensis* n.sp. Female. Fig. 11: first leg. Fig. 12: second leg. Fig. 13: third leg. Fig. 14: fourth leg. Fig. 15: fifth leg.

near coxopod. Coxopod with pinnate seta long and small naked seta on ventral surface. Basal and medial segments of exopod with one spine and one long pinnate seta, distal segment with two spines bearing membranous semipinnate processes, and five long pinnate setae. Basal segment

of endopod armed with pinnate seta, medial and distal segments with two and six pinnate setae, respectively, covered by numerous spinules on extenrolateral margin. Third leg (Fig. 13) with sympod bearing one pinnate and one smaller naked seta. Exopod trisegmented, basal segment

with well sclerotized spine, medial segment with distal pinnate seta on inferior angule; distal segment with three spines on external posterior margin and four pinnate setae. Endopod bisegmented, basal segment with long, pinnate seta, distal segment with six apical pinnate setae. Fourth leg (Fig. 14) with sympod bearing diminute naked seta on inferior margin near limit with exopod, and spinule on medial inferior margin. Exopod trisegmented, basal and medial segment with one spine each, distal segment with three spines of unequal sizes, all spines with lamella on base. Fifth leg (Fig. 15) with two papillae on posterior margin of genital complex, anterior papilla with three pinnate setae, one of them longer than others; posterior papilla with longer, naked seta.

Male: Unknown.

Taxonomic summary

Type host: *Orthopristis ruber* (Cuvier).

Other host: *Haemulon steindachneri* (Jordan and Gilbert).

Site of infestation: Gills.

Type locality: Sepetiba Bay, Rio de Janeiro, Brazil (22°51'S, 43°56'W).

Prevalence: 8.02% on *O. ruber*, 2.50% on *H. steindachneri*.

Mean intensity of infestation: 1.07 on *O. ruber*, 1.00 on *H. steindachneri*.

Specimens deposited: Holotype (female): MN N° 4432. Paratypes: MN N°s 4433-4435 (three females), USNM N° 274240 (four females).

Etymology: The specific name *sepetibensis* refers to the type locality.

Remarks

Caligus is the largest genus of the Siphonostomatoida. Species of this genus have wide geographical distribution, infesting the body surface, oral cavity, and branchial chamber of fishes. Margolis *et al.* (1975) listed 317 species in their synopsis of the genus. Kabata (1979) stated that about 200 species of *Caligus* are known. Recent papers by Byrnes (1987), Jones (1988), Dojiri (1989), Cressey (1991), and Kabata (1992) are the main contributions to the knowledge of this genus in the recent years. For the Brazilian littoral, 11 *Caligus* species are known: *C. curtus* Müller, 1785; *C. gracilis* Dana, 1852; *C. productus* Dana, 1852; *C. coryphaenae* Streenstrup and Lütken, 1861; *C. chorinemi* Krøyer, 1863; *C. irritans* Heller, 1865;

C. tenax Heller, 1865; *C. trachynoti* Heller, 1865; *C. bonito* Wilson, 1905; *C. mutabilis* Wilson, 1905 and *C. oligoplitisi* Carvalho, 1956 (Margolis *et al.*, 1975; Cressey and Cressey, 1980).

Caligus sepetibensis n.sp. resembles species with trisegmented fourth exopod and geographical distribution restricted to the Atlantic Ocean: *C. isonyx* (Streenstrup and Lütken, 1861); *C. coryphaenae* Streenstrup and Lütken, 1861; *C. pelamydis* Krøyer, 1863; *C. chorinemi* Krøyer, 1863; *C. robustus* Bassett-Smith, 1898; *C. validus* Pearse, 1952; *C. oligoplitisi* Carvalho, 1956; *C. randalli* Lewis, 1964 and *C. kapuhili* Lewis, 1967 (Pearse, 1952; Carvalho, 1956; Yamaguti, 1963; Lewis, 1964, 1967; Cressey and Cressey, 1980; Cressey, 1991). The new species can be differentiated from *C. isonyx* by the shape of genital complex (subtriangular in *C. isonyx*, suboval in *C. sepetibensis* n.sp.), shape of sternal furca (trapezoidal base and longer than rami in *C. isonyx*, subquadrangular base and same length as rami in the new species), and spination of the second exopod (basal and medial segment with serrated spines at the outer distal corner in *C. isonyx*, not serrated in *C. sepetibensis* n.sp.). The characteristics which separate *C. sepetibensis* n.sp. from *C. coryphaenae* are segmentation of abdomen (unsegmented in the former, trisegmented in the latter), shape of sternal furca (with accessory sclerotized processes on each side in *C. coryphaenae*, without accessory sclerotized processes in the other), and the third leg armature (with prominent thumblike spine on exopod basal segment in *C. coryphaenae*, subconical and elongated in the new species). The new species can be separated from *C. pelamydis* by the shape of sternal furca (trapezoidal base and rami very spatulate in *C. pelamydis*, quadrangular base and rami slightly spatulate in *C. sepetibensis* n.sp.), and by the presence of naked spines on the fourth leg (pinnate in *C. pelamydis*).

Caligus sepetibensis n.sp. is easily differentiated from *C. chorinemi* by the characteristics of the first leg (endopod inconspicuous in the former, very prominent in the latter) by the shape of genital complex (longer than abdomen and caudal rami in *C. chorinemi*, subequal in *C. sepetibensis* n.sp.), size of the third endopod spine (reaching distal segment in *C. chorinemi*, not reaching the distal segment in the new species), and shape of

sternal furca (widely divergent rami in *C. chorinemi*, slightly divergent in the other). *Caligus sepetibensis* n.sp. can be separated from *C. validus* by the shape of sternal furca (rounded base and blunt divergent rami in *C. validus*, quadrangular base and slightly divergent rami in *C. sepetibensis* n.sp.), and armature of the first leg (with two setae on distal segment of exopod in *C. validus*, three setae in the other).

Caligus robustus and *C. oligoplitisi* are differentiated from the new species by the shape of genital complex (subtriangular in both species, suboval in *C. sepetibensis* n.sp.), the shape of external furca (suboval base and very spatulate rami in *C. robustus* and *C. oligoplitisi*, quadrangular base and slightly spatulate base in the new species), and claw of the second antenna (very recurved near tip in *C. robustus* and *C. oligoplitisi*, slightly curved in *C. sepetibensis* n.sp.). The new species can be easily differentiated from *C. randalli* and *C. kapuhili* by the shape of genital complex (longer than wide in *C. randalli*, subtriangular in *C. kapuhili*, and suboval in *C. sepetibensis* n.sp.), ratio between genital complex length and abdomen length (approximately 1:2 in *C. randalli* and *C. kapuhili*, 1:1.24 in the new species), and shape of sternal furca (rounded base in *C. randalli* and *C. kapuhili*, quadrangular base in *C. sepetibensis* n.sp.). Moreover, in *C. randalli*, the distal segment of the first antenna is notoriously longer than the basal segment whereas in the new species this character is absent. In *C. kapuhili* the endopod of the first leg is conspicuously rudimentary, whereas it is absent in the new species. Also, it is important to mention that the total body length of *C. sepetibensis* n.sp. is much smaller than those species which were compared in the present paper.

The available literature about *Caligus* shows that the maxilliped shape is not considered as a character of taxonomic importance (Kabata, 1979; Cressey, 1991). Moreover, many authors did not include illustrations of the maxilliped in their descriptions of *Caligus* species. However, in *C. sepetibensis* n.sp., the presence of an oval process on the distal limit of the maxilliped corpus is observed. This character was not observed anteriorly in this genus.

Caligus haemulonis Krøyer, 1863

(Figs. 16-32)

Female (based on 43 specimens collected on *O. ruber* and four collected on *H. steindachneri*, 40 measured): Siphonostomatoida. Caligidae. Total length (Fig. 16) (including caudal rami) 3.33-3.92 mm (3.61 mm). Maximum width 1.35-1.59 mm (1.43 mm). Cephalothorax total length 1.46-1.83 mm (1.70 mm). Genital complex 1.01-1.35 mm (1.09 mm) long, 622-1171 (845) wide. Egg sacs 1.43-2.28 mm (1.84 mm, n=35) long, 274-348 (296) wide. Abdomen unsegmented, 659-769 (715) long, 238-293 (264) wide. Caudal rami (Fig. 17) 91-110 (104) long, 73 wide, bearing three small pinnate and three long pinnate setae of subequal size, longest seta 256 long. Frontal lunules 272-311 (281) in diameter, 162-183 (170) apart. First antenna (Fig. 18) bisegmented, basal segment with 16 pinnate and two naked setae, distal segment with 11 naked setae and one aesthethe. Second antenna (Fig. 19) with curved claw bearing one lateral seta, basal process spatulate. Postantennal process (Fig. 20) prominent, curved, with subtriangular base and two pairs of setules. First maxilla (Fig. 21) subtriangular, superior angle elongate, with rounded extremity. Second maxilla (Fig. 22) bisegmented, with membranous lamella on distal segment. Maxilliped (Fig. 23) with corpus robust, unarmed, curved claw with two setae of unequal size on inferior margin. Sternal furca (Fig. 24) with conical base; convergent rami, with size approximately equal to base. First leg (Fig. 25) with sympod partially covered by spinules, bearing two pinnate setae. Exopod bisegmented, basal segment with diminute spine on superior margin, near limit with distal segment; distal segment with four sclerotized setae terminally, two shorter central setae bearing accessory processes. Endopod rudimentary, represented by small and irregular process. Second leg (Fig. 26) with sympod bisegmented and trisegmented rami. Basipod unarmed, coxopod bearing two slender naked setae on lateral margins. Basal and medial segments of exopod with sclerotized spine on external distal angle, and pinnate seta, spines with delicate external membrane; distal segment bearing three terminal spines (one small and naked, one with external membrane, and one semipinnate and with external membrane) and five pinnate setae. Basal segment of endopod with external mar-

PLATE IV

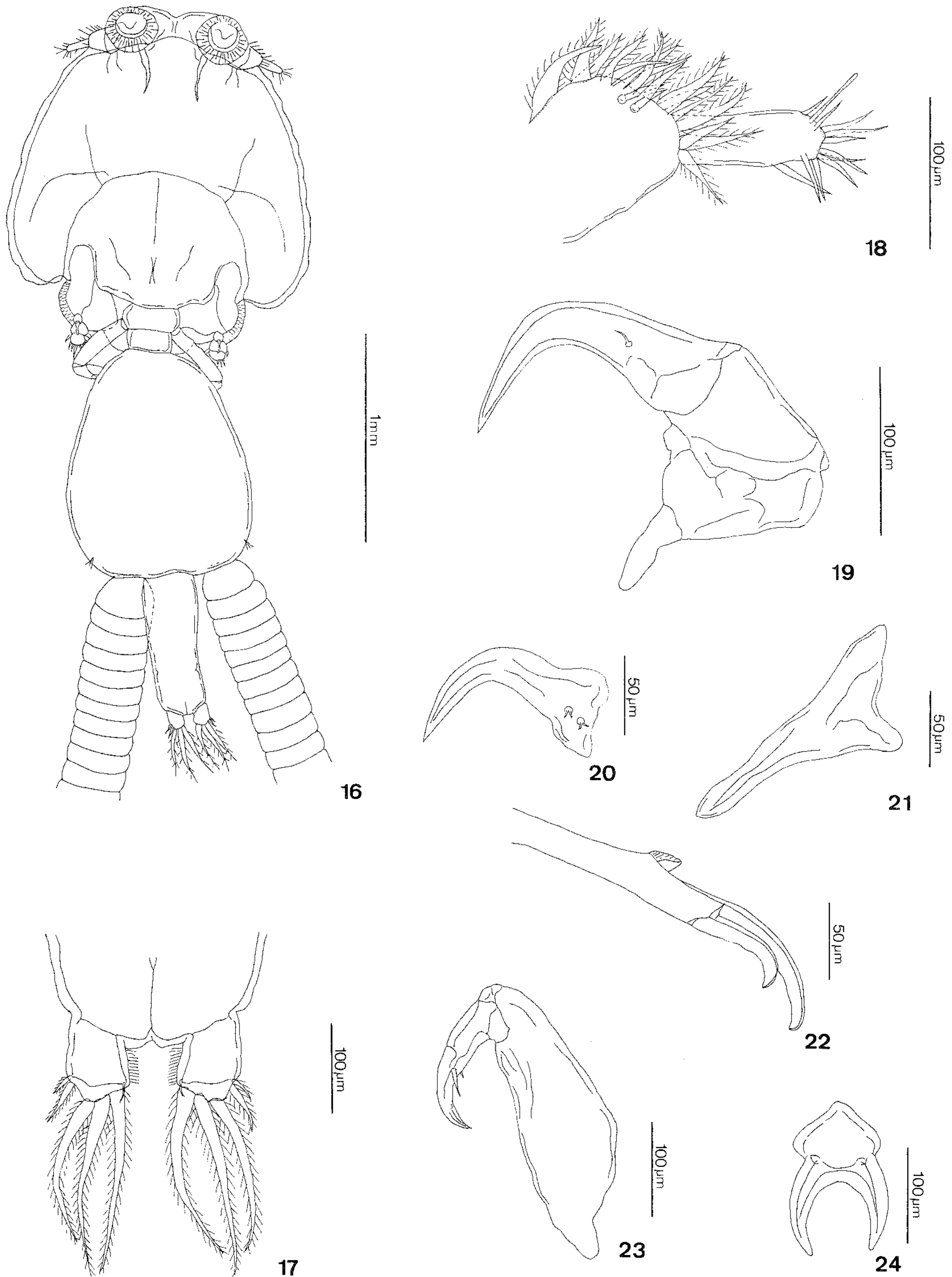
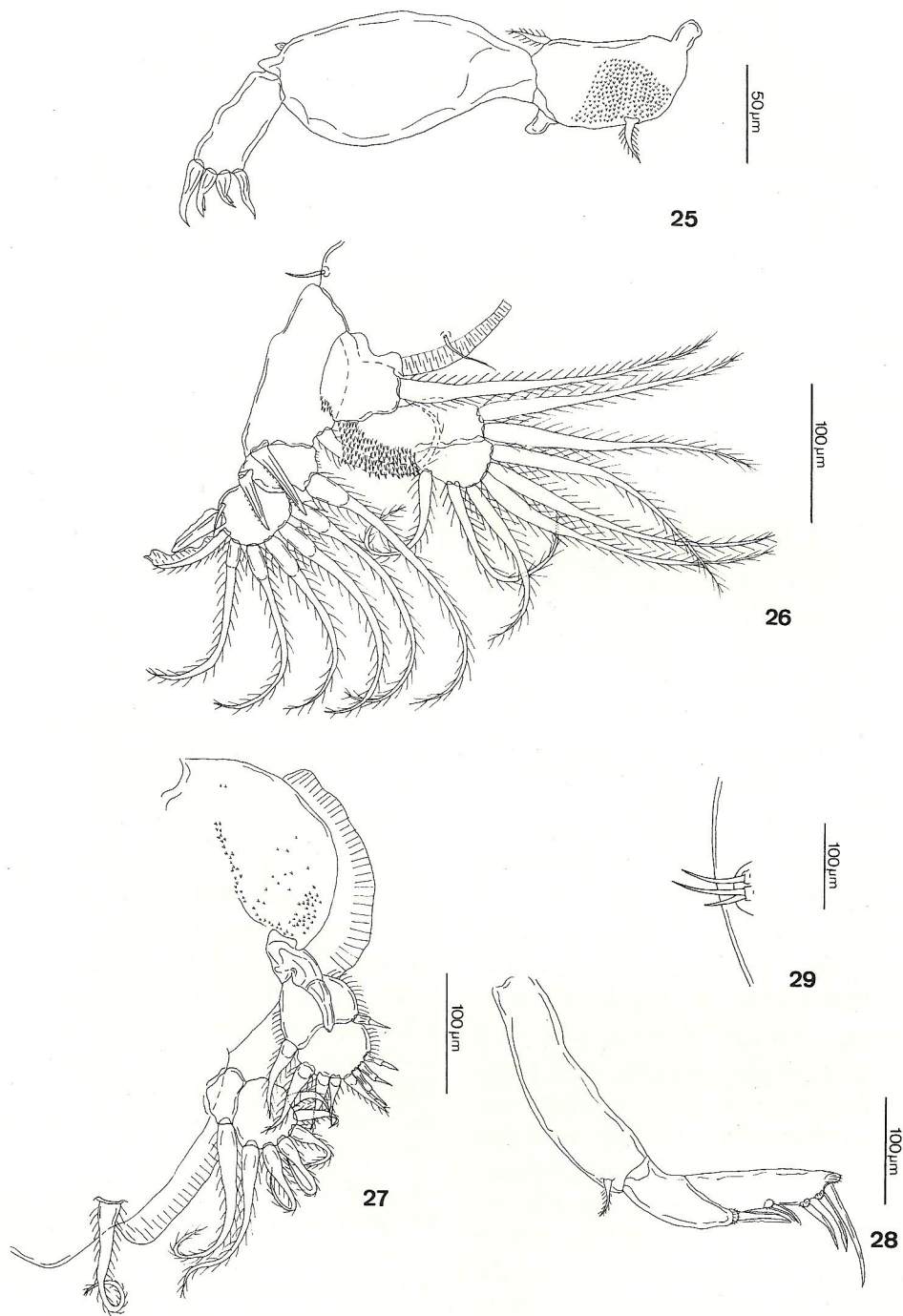


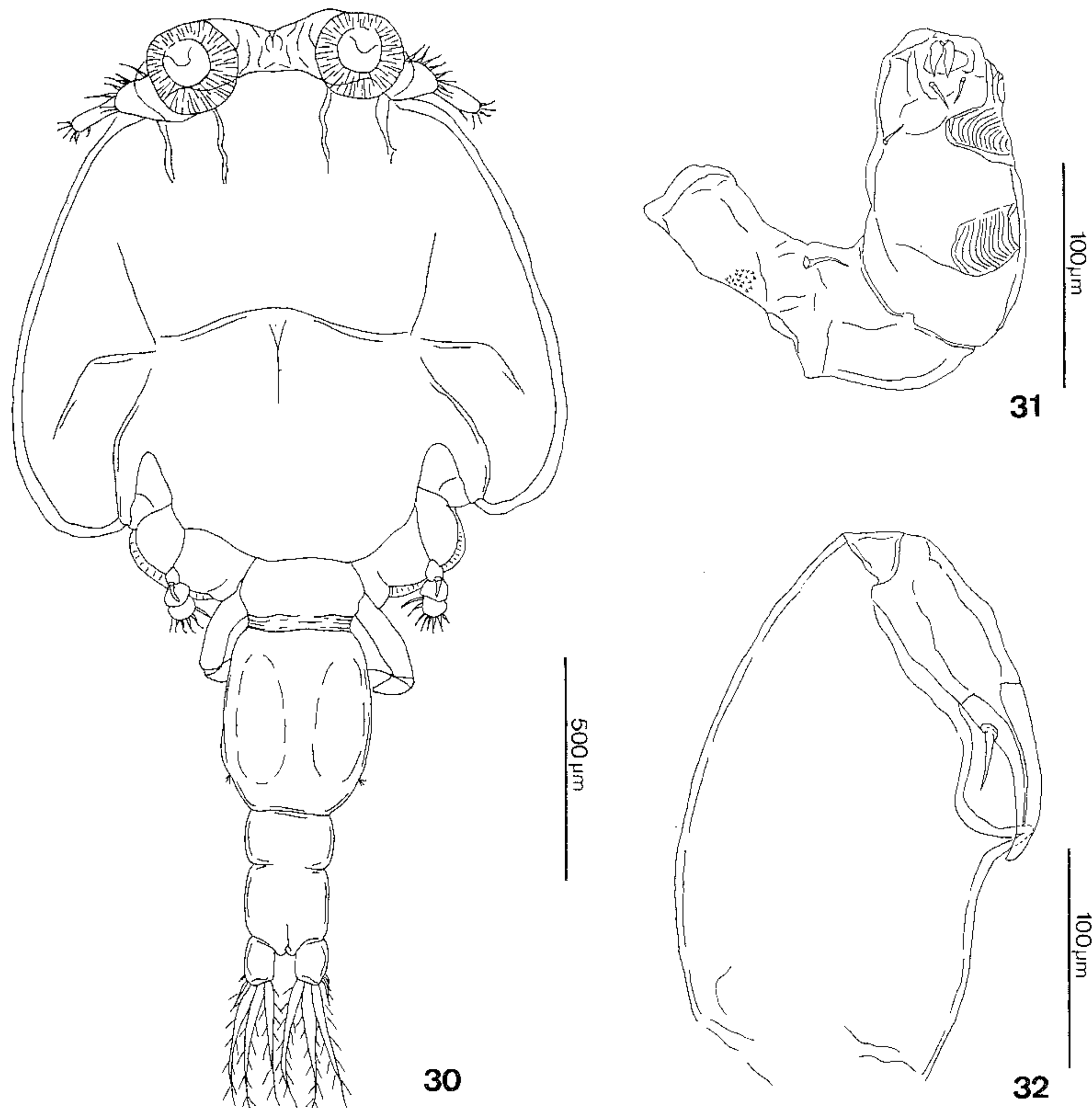
Fig. 16-24 — *Caligus haemulonis* Krøyer, 1863. Female. Fig. 16: dorsal view. Fig. 17: caudal rami. Fig. 18: first antenna. Fig. 19: second antenna. Fig. 20: post antennal process. Fig. 21: first maxilla. Fig. 22: second maxilla, detail of the distal segment. Fig. 23: maxilliped. Fig. 24: sternal furca.

PLATE V



Figs. 25-29 — *Caligus haemulonis* Krøyer, 1863. Female. Fig. 25: first leg. Fig. 26: second leg. Fig. 27: third leg. Fig. 28: fourth leg. Fig. 29: fifth leg.

PLATE VI



Figs. 30-32 — *Caligus haemulonis* Krøyer, 1863. Male. Fig. 30: dorsal view. Fig. 31: second antenna. Fig. 32: maxilliped.

gin partially covered by numerous spinules and with long pinnate seta; medial segment with developed spine and two setae, external side totally covered by spinules; distal segment with six pinnate setae. Third leg (Fig. 27) with sympod bearing numerous spinules. Exopod with well developed spine on basal segment; medial segment with plumose lateral margins, pinnate seta and spine; distal segment with three spines and four short pinnate setae. Endopod with armature characteristic of the genus. Fourth leg (Fig. 28) with sympod bearing small pinnate seta. Exopod bisegmented, basal segment with spine bearing external membrane, distal segment with medial seta with external membrane and three terminal spines; all spines with pectinated lamellae at base. Fifth leg (Fig. 29) with minute papilla near to posterior margin of genital complex, bearing three naked setae, one smaller than others.

Male (based on 36 specimens collected on *O. ruber* and four collected on *H. steindachneri*; 35 measured): Total length (Fig. 30) (including caudal rami), 2.03-2.12 mm (2.09 mm). Maximum width 1.15-1.19 mm (1.17 mm). Cephalothorax total length 1.06-1.32 mm (1.25 mm). Genital complex oval, 403-421 (411) long, 311-329 (320) wide. Abdomen bisegmented; first segment 128 long, 183 wide; second segment 183 long, 183 wide. Caudal rami 110 long, 55 wide, longest seta 311 long. Appendages similar to those of females, except the second antenna and maxilliped. Frontal lunules 183-201 (193) in diameter, 91-110 (106) apart. Second antenna (Fig. 31) with modified bifid short claw, two small setae near base; basal segment with seta, small zone covered by spinules, and two adhesive zones. Maxilliped (Fig. 32), with acute process on myxal area in opposition to claw; claw with seta on inferior margin.

Taxonomic summary

Hosts: *Orthopristis ruber* (Cuvier), *Haemulon steindachneri* (Jordan and Gilbert).

Site of infestation: Gills.

Locality: Sepetiba Bay, Rio de Janeiro, Brazil (22°51'S, 43°56'W).

Prevalence: 25.31% on *O. ruber*, 11.25% on *H. steindachneri*.

Mean intensity of infestation: 1.97 on *O. ruber*, 1.66 on *H. steindachneri*.

Specimens deposited: Voucher specimens, collected from *O. ruber*. MN N°s 4436, 4437, 4440, 4441, 4443, 4444 (five females, eight males), USNM N° 274238 (18 females, 15 males). Collected from *H. steindachneri*: MN N°s 4438, 4439, 4442 (two females, one male), USNM N° 274239 (two females, three males).

Remarks

Since the original description, *Caligus haemulonis* has been reported for marine fishes from the western Atlantic Ocean, mainly species of Haemulidae (Margolis *et al.*, 1975; Cressey and Nutter, 1987). Recently, Cressey (1991) described *C. haemulonis* based on specimens collected from haemulid fishes from the Gulf of Mexico and the Caribbean Sea. According to Cressey (1991), other five species of *Caligus* are parasites of haemulid fishes in the western Atlantic Ocean, *C. longipedis* Basset-Smith, 1898, *C. rufimaculatus* Wilson, 1905, *C. atromaculatus* Wilson, 1913, *C. biaculeatus* Brian, 1914, and *C. xysercus* Cressey, 1991. This is the first record for *C. haemulonis* from the Brazilian coast. *Orthopristis ruber* and *H. steindachneri* are new host records for this species.

The specimens studied in the present paper have some minor differences in relation to the specimens described by Cressey (1991). In the specimens collected in Rio de Janeiro, the first leg does not present setules on the inferior margin of the exopod basal segment and the second antenna of the male presents two adhesive zones on the basal segment. The configuration of the first leg armature – *i.e.* the lack of three lateral setae on the last exopod segment – is considered a diagnostic character for this species. This configuration is only present in *C. productus* Dana, 1852, a parasite with high specificity for fishes of Scombridae (Cressey and Cressey, 1980), which can be easily

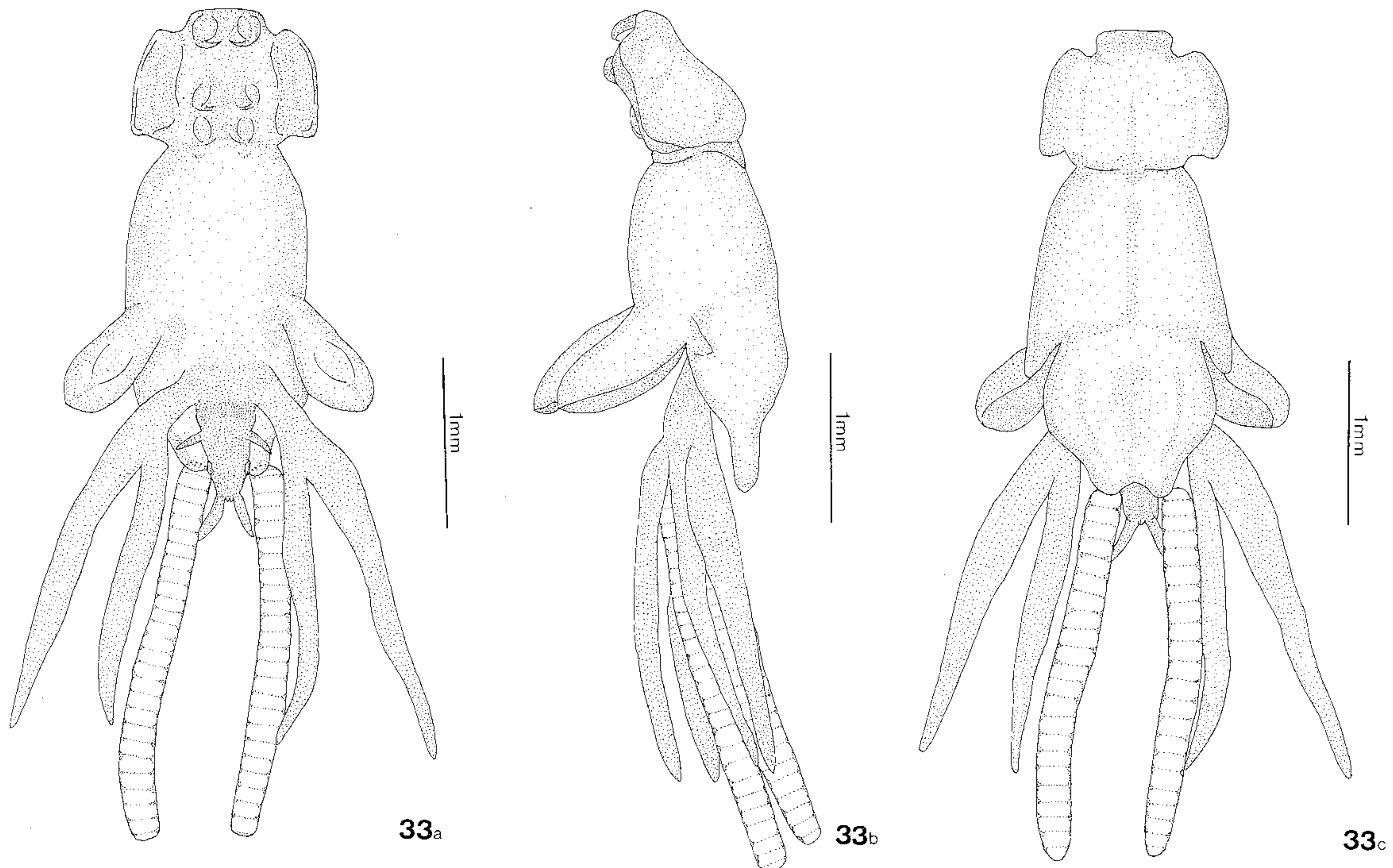
differentiated from *C. haemulonis* by a combination of characters that include the postantennal process, the second antenna, and the sternal furca.

Lernanthropus rathbuni Wilson, 1922

(Figs. 33-46)

Redescription-Female (based on 12 specimens collected on *O. ruber* and one collected on *H. steindachneri*; all measured): Siphonostomatoidea. Lernanthropidae (Figs. 33 a,b,c). Total length 4.57-4.66 mm (4.75 mm). Maximum width 1.08-1.13 mm (1.10 mm). Cephalothorax 823-860 (838) long, 1006 wide, trapezoid, delimited from trunk by a constriction. Trunk with rounded lateral margins and conspicuous constriction near to base of third leg. Dorsal plate subcircular, distal extremity with conspicuous notch; not covering genito-abdomen. Genito-abdomen (Fig. 34) conical, with short caudal rami, 183-222 (211) long, with two setules near base. Egg sacs 2.10-2.93 mm (2.52 mm, n=3) long 219.6 wide. First antenna (Fig. 35) six-segmented, one setule near to basal segment, segment armature (setules not considered): 3, 4, 4, 3, 2 + 1 aesthete, 6. Parabasal flagellum with dilated base and plumose margin. Second antenna (Fig. 36), corpus subcylindrical with base slightly flattened, subchela with claw well curved. Mandible (Fig. 37) siphonostome, with seven minute teeth. First maxilla (Fig. 38) biramous. Exopod subcircular, smaller than endopod, with apical spine. Endopod conical with apical spine and two minor subapical spines. Second maxilla (Fig. 39) brachiform, lacertus robust, with two spiniform processes near limit with brachium. Brachium slender, slightly curved distally with two subapical processes, proximal short and irregular, distal long and slender; apex with two rows of minute teeth, 20 in number. Maxilliped (Fig. 40) with subcylindrical corpus, bearing spine on myxal area; claw slender, with seta. First leg (Fig. 41) with rami unsegmented, sympod short, robust, with seta on lateral side of exopod and other near base of endopod. Exopod subrectangular with five distal, subequal, teeth-like spines and numerous spinules on lateral margin. Endopod subconical, similar size to exopod, with apical seta slightly shorter than ramous, numerous spinules on lateral margin. Second leg (Fig. 42) biramous, sympod with pinnate seta near base of endopod and flagelliform near base of exopod.

PLATE VII



Figs. 33a-c — *Lernanthropus rathbuni* Wilson, 1922. Female. Fig. 33a: ventral view. Fig. 33b: lateral view. Fig. 33c: dorsal view.

Exopod bearing two apical teeth-like spines and two shorter, subapical, teeth-like spines; lateral margin with numerous spinules. Endopod with small apical seta, numerous spinules covering lateral and apical regions. Third leg (Figs. 33 a,b,c) foliolate, oblique to ventral surface of trunk. Fourth leg 2.04-2.15 mm (2.10 mm) long, biramous, armed with numerous spinules arranged in two longitudinal rows, exopod slightly longer than endopod, approximately $\frac{3}{4}$ of body length. Fifth leg (Fig. 34) 146.4 long, inserted at base of genito-abdomen, $\frac{1}{3}$ of total length of genito-abdomen.

Male (based on 20 specimens collected on *O. ruber* and five collected on *H. steindachneri*; all measured): (Figs. 43 a,b). Total length 2.41-2.86 mm (2.81 mm). Cephalothorax 659-732 (713) long, 805-878 (825) wide. Trunk short and cylindrical. Genito-abdomen small. Dorsal plate subtriangular, anterior region wider than posterior, lateral margins folded ventrally. Appendages with characteristics of females, with exception of the following: first antenna (Fig. 44) seven-seg-

mented, segment armature (setules not considered): 3, 2, 4, 2, 1, 2 + 1 aesthete, 4. First leg (Fig. 45) with exopod suboval, with five apical teeth-like processes, subdistal, smaller, five spines, numerous spinules on lateral margin, small seta near base. Endopod similar to that of female. Second leg (Fig. 46) with exopod longer than endopod, with four subtriangular apical spines and numerous spinules, two setae, and two setules near base. Endopod subconical, with apical, long, seta, partially covered by spinules. Third leg (Figs. 43 a,b) biramous, unsegmented, oblique posteroventrally. Fourth leg 1.40-1.59 mm (1.53 mm) long. Caudal rami 144-183 (177) long.

Taxonomic summary

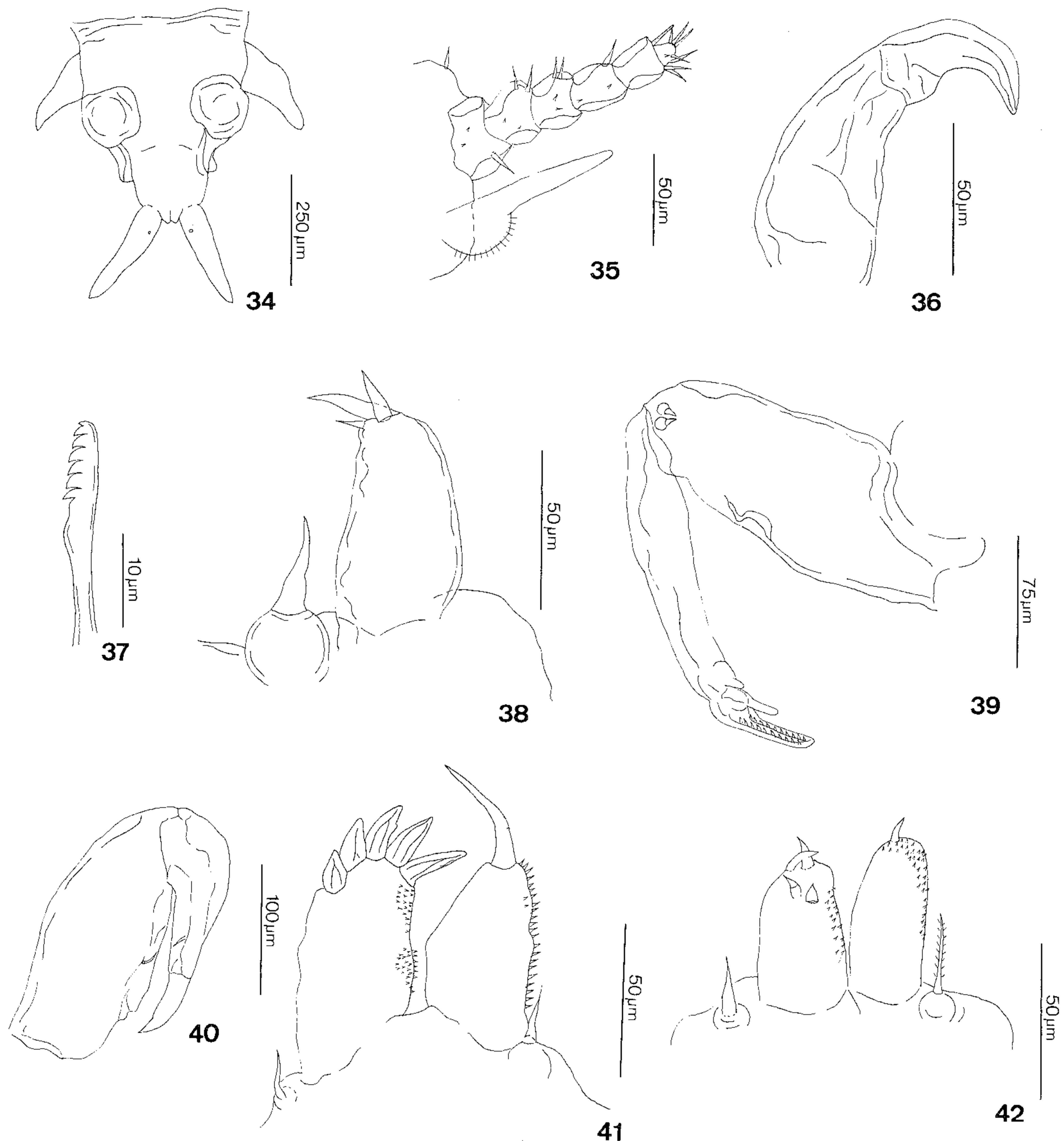
Hosts: *Orthopristis ruber* (Cuvier), *Haemulon steindachneri* (Jordan and Gilbert).

Site of infestation: Gill filaments.

Locality: Sepetiba Bay, Rio de Janeiro, Brazil (22°51'S, 43°56'W).

Prevalence: 15.43% on *O. ruber*, 7.50% on *H. steindachneri*.

PLATE VIII



Figs. 34-42 — *Lernanthropus rathbuni* Wilson, 1922. Female. Fig. 34: genito-abdomen, fifth leg and caudal rami. Fig. 35: first antenna. Fig. 36: second antenna. Fig. 37: Mandible. Fig. 38: first maxilla. Fig. 39: second maxilla. Fig. 40: maxilliped. Fig. 41: first leg. Fig. 42: second leg.

Mean intensity of infestation: 1.32 on *O. ruber*, 1.00 on *H. steindachneri*.

Specimens examined: Four females collected by R. Bere from an unidentified "sea catfish" from Florida, USA, USNM N° 155196.

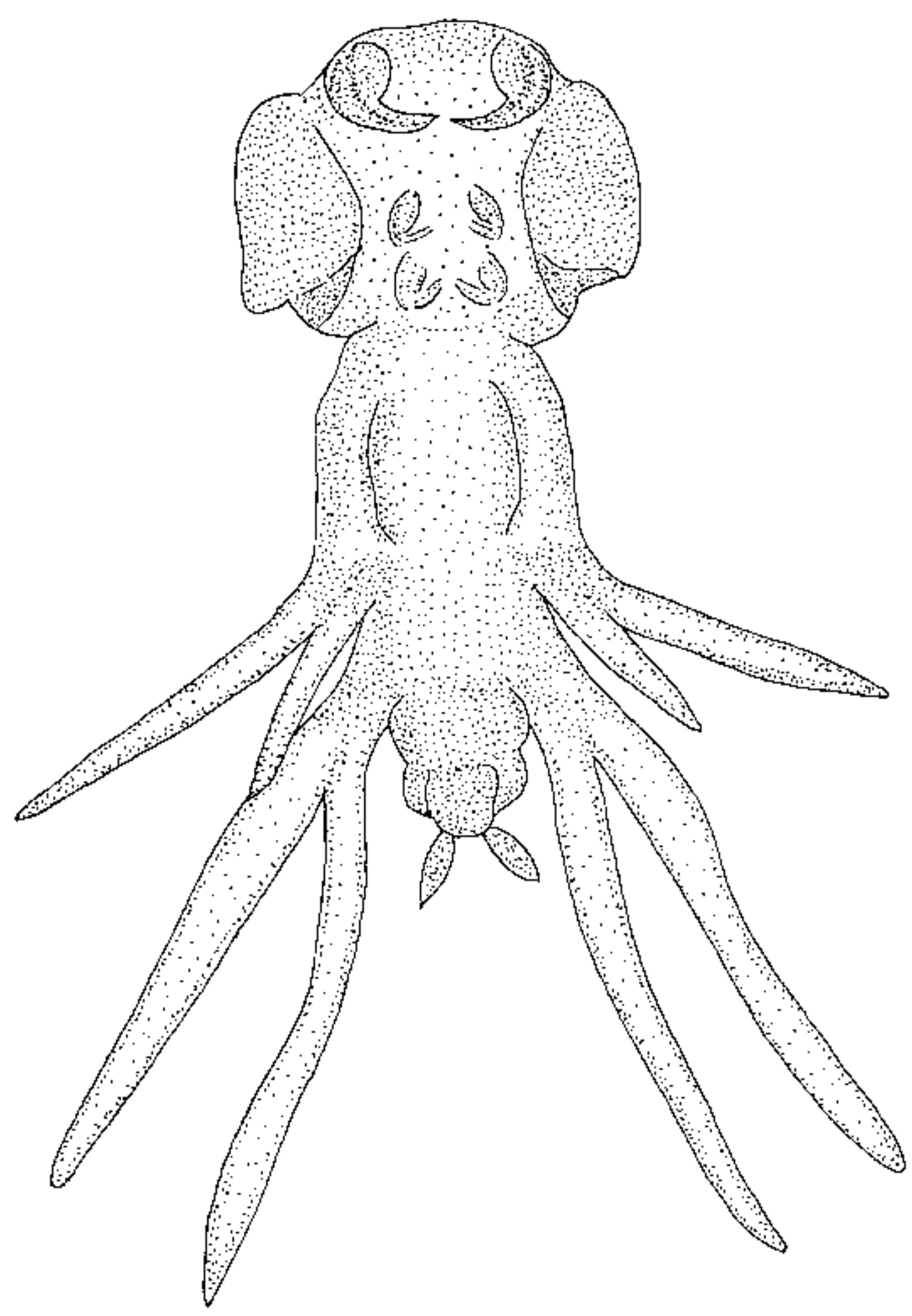
Specimens deposited: Voucher specimens, collected from *O. ruber*: MN N°s 4445-4448, 4450 (five females, four males), USNM N° 274241 (eight females, five males). Collected from *H. ste-*

indachneri: MN N° 4449 (one female, one male), USNM N° 274242 (three males).

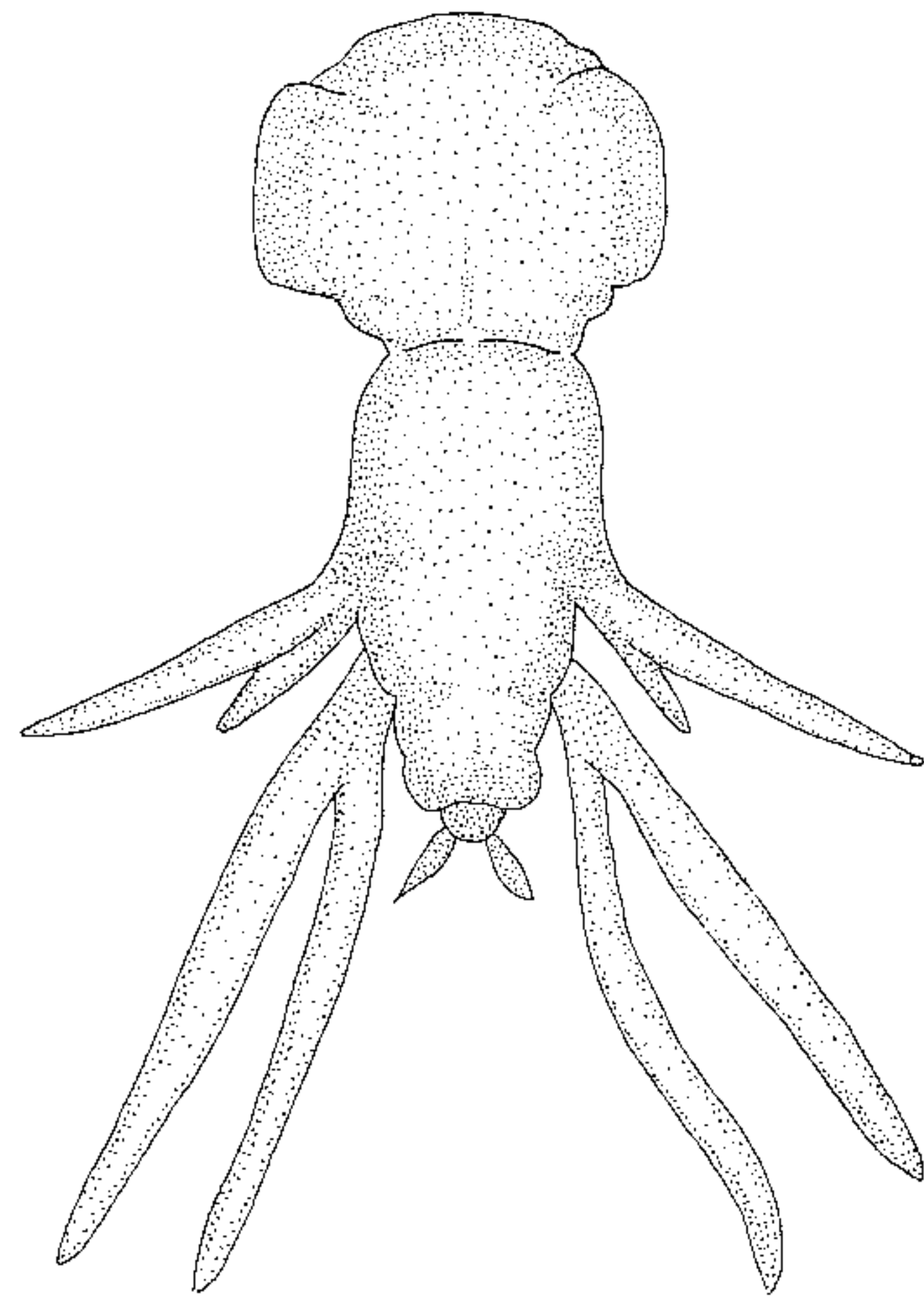
Remarks

This species was described originally by Wilson (1922), based on two females collected on gills of *Orthopristis chrysopterus* (Linnaeus) from Beaufort, North Carolina, USA. The original description does not give detailed illustrations of the

PLATE IX

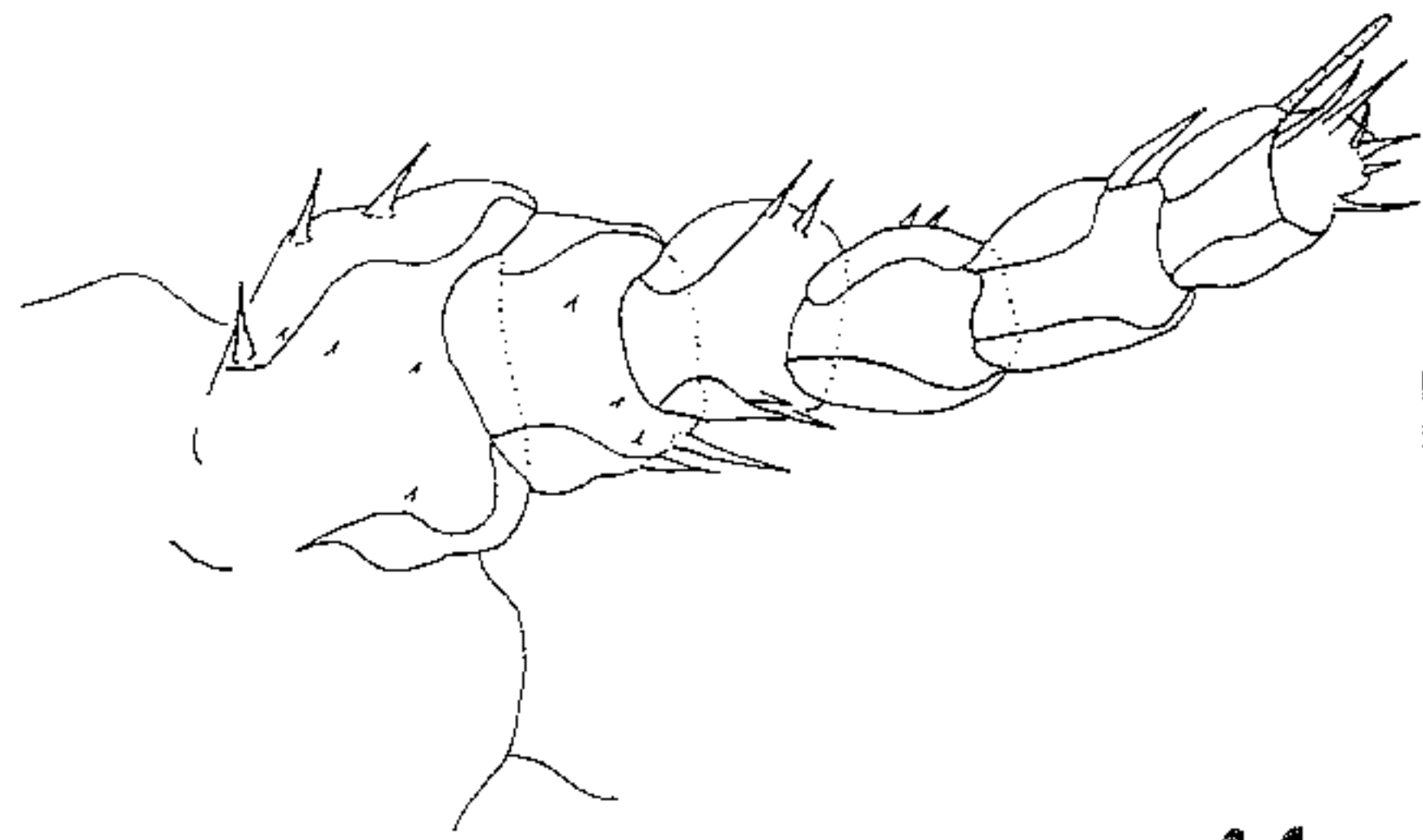


43a



43b

1mm



44

50µm



45

50µm



46

50µm

Figs. 43-46 — *Lernanthropus rathbuni* Wilson, 1922. Male. Fig. 43a: ventral view. Fig. 43b: dorsal view. Fig. 44: first antenna. Fig. 45: first leg. Fig. 46: second leg.

appendages. Bere (1936) recorded females of *L. rathbuni* on the same host from Lemon Bay, Florida, USA, but did not indicate the number of specimens collected and did not present the respective illustrations. However, four females deposited by Bere in the United States National Museum were examined by the authors. These specimens presented the characteristics of *L. rathbuni*, but were collected from an unidentified host catalogued as "sea catfish", possibly, a fish of the family Ariidae. Pearse (1952) recorded one female specimen of *L. rathbuni* from 19 specimens of *Elops saurus* Linnaeus from the Texas littoral. This paper also did not present illustrations and did not indicate the deposition number of the parasites. In the description of Wilson (1922) the characteristic constriction of the trunk of *L. rathbuni* females at the third leg base was not included, a character which can be important for the differentiation of this species from its congeners. This constriction was also observed in the Bere's specimens deposited in the United States National Museum. Moreover, the specimens studied in the present paper, showed larger measurements than those studied by Wilson (1922) and than those collected from the "sea catfish".

Other species of *Lernanthropus* parasitic on haemulid fishes in America are *Lernanthropus amplitergum* Pearse, 1951 and *L. antofagastensis* Castro and Baeza, 1985. *Lernanthropus amplitergum* was recorded from *Anisotremus virginicus* (Linnaeus), *Haemulon album* (Cuvier and Valenciennes), *Haemulon sciurus* (Shaw), and *Conodon nobilis* (Linnaeus) from Bimini, Bahamas Islands (Pearse, 1951). This species presents a notch on the posterior extremity of the dorsal plate and can be differentiated from *L. rathbuni* by the shape of the body, and also, by the genito-abdomen which is totally covered by the dorsal plate. *Lernanthropus antofagastensis* is a parasite of *Anisotremus scapularis* (Tschudi) from the Peruvian and Chilean littoral (Castro and Baeza, 1985; Luque *et al.*, 1989). This copepod species presents some appendages similar to those of *L. rathbuni*, but it does not present the characteristic notch on posterior extremity of dorsal plate and lateral constriction of the trunk on base of the third leg.

Orthopristis ruber and *H. steindachneri* are new host records for *L. rathbuni*, a copepod recorded for the first time from the Southwestern

Atlantic Ocean. In the present paper, male specimens of *L. rathbuni* were described for the first time.

Clavellotis dilatata (Krøyer, 1863)

(Figs. 47-52)

Female (based on 11 specimens, all measured): Siphonostomatoida. Lernaeopodidae. Cephalothorax subcylindrical (Fig. 47), 1.62-1.68 mm (1.66 mm) long, 311-329 (326) wide, twice longer than trunk, dorsal plate conspicuous, with prominent aliform lateral processes at base. Trunk subcircular and slightly longer than wide, 0.95-1.06 mm (1.02 mm) long, 0.91-1.10 mm (1.03 mm) wide, without processes in posterior extremity. Genital process conspicuous, 238 long, 165 wide. Egg sacs 0.64-1.79 mm (1.32 mm, n=8) long, 329-366 (340) wide. First antenna (Figs. 48 a,b) four-segmented, apical armature with two tubercles (1,3), digitiform seta (4), bifid seta (5), and slender, long seta (6). Second antenna (Fig. 49) sympod sclerotized. Exopod longer than endopod, dorsal surface covered by small conical processes. Endopod bulbous, apparently bisegmented, apical armature with three spines, ventral surface of distal segment with some spinules. Mandible (Fig. 50) with dental formula P1S1, P1S1, P1S1, B4. First maxilla (Fig. 51) with exopod bearing two papillae with one seta each one, setule near base. Endopod with two papillae with terminal seta in each one. Second maxilla 549-640 (608) long, approximately 1/3 of cephalothorax length; bulla typical of the family. Maxilliped (Fig. 52) with robust corpus bearing spine on myxal area; subchela with long shaft, short claw, barb and spinules on distal portion of internal margin of shaft.

Male: Not collected.

Taxonomic summary

Host: *Haemulon steindachneri* (Jordan and Gilbert).

Site of infestation: Gill rakers.

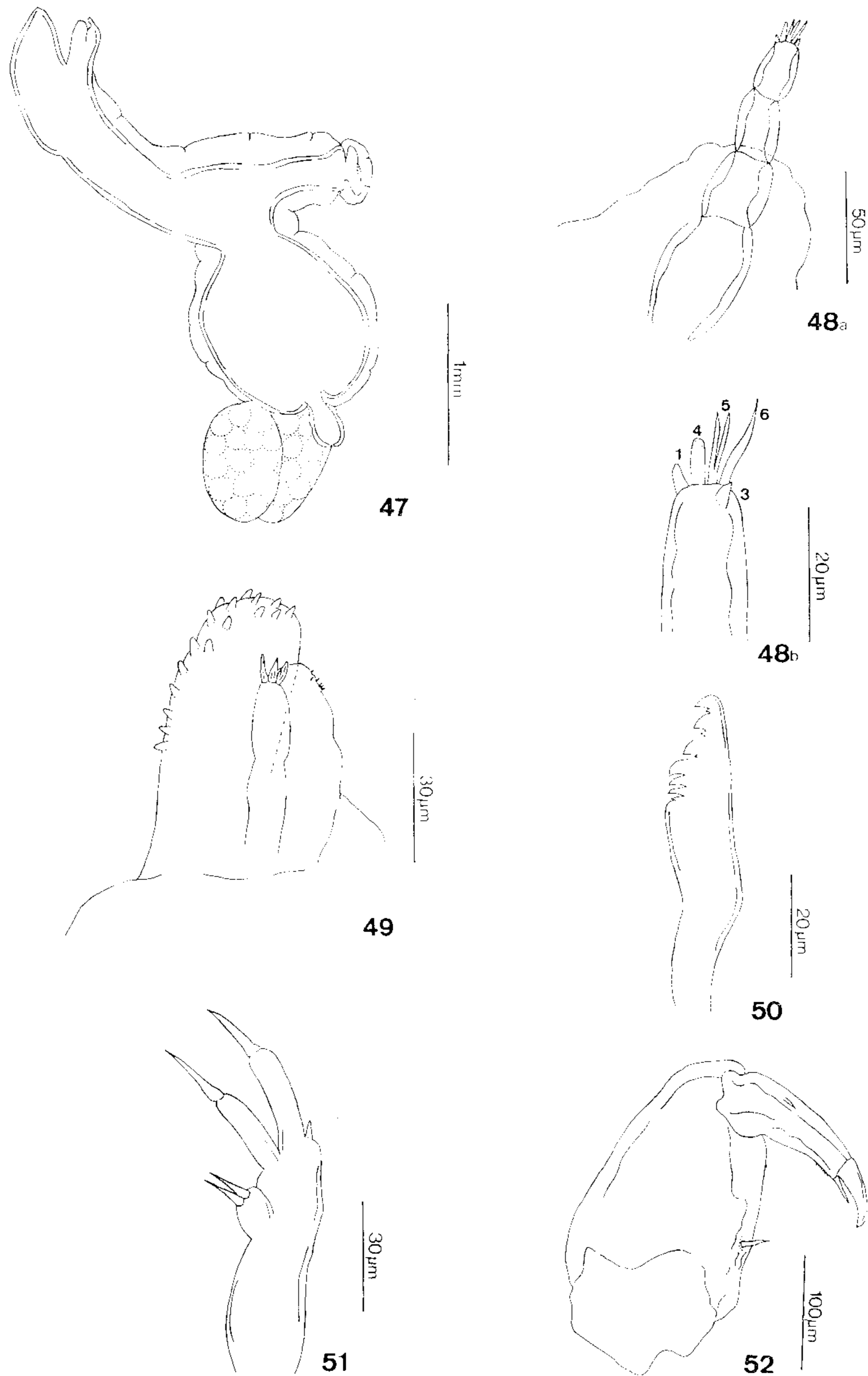
Locality: Sepetiba Bay, Rio de Janeiro, Brazil (22°51'S, 43°56'W).

Prevalence: 8.75%.

Mean intensity of infestation: 1.57.

Specimens deposited: Voucher specimens, MN N° 4451-4453 (six females), USNM N° 274237 (two females).

PLATE X



Figs. 47-52 — *Clavellotis dilatata* (Krøyer, 1863). Female. Fig. 47: lateral view. Fig. 48a: first antenna. Fig. 48b: first antenna, detail of the apical armature. Fig. 49: second antenna. Fig. 50: mandible. Fig. 51: first maxilla. Fig. 52: maxilliped.

Remarks

The genus *Clavellotis* was proposed by Castro and Baeza (1984) from the redescription of *Anchorella dilatata* Krøyer, 1863, using as generic characters the presence of aliform processes at base of cephalothorax, conspicuous genital proc-

ess, and second antenna with reduced endopod. Kabata (1990), considering the variation in other lernaeopodids of some generic characters proposed by Castro and Baeza (1984), emended the diagnosis of the genus *Clavellotis*, and incorporated to the genus seven additional species, anteri-

only included in other lernaeopodid genera, mainly *Clavellopsis* Wilson, 1915. The characteristic of the specimens studied are in agreement with Castro and Baeza (1984). However, some minor differences were found in the dentition of the mandible, maxilliped, and second antenna endopod, but these do not justify the proposition of a new taxon.

Skinner (1978) recorded *Clavellopsis strumosa* Brian, 1906, a species transferred to *Clavellotis* by Kabata (1990), and parasite of the haemulid fish *Anisotremus virginicus* Linnaeus, from Florida, USA. However, this species presents significant differences with *Clavellotis dilatata*, mainly in the trunk shape and in the second antenna armature.

Clavellotis dilatata presents low specificity and has been previously found fishes of Sparidae and Sciaenidae from Japan and Peru, respectively (Do and Ho, 1983; Luque and Farfán, 1990). *Haemulon steindachneri* is a new host record for *C. dilatata*, species which is recorded for the first time in the Southwestern Atlantic Ocean.

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