THREE SPECIES OF MONSTRILLOIDS (COPEPODA: MONSTRILLOIDA) FROM BANCO CHINCHORRO, MEXICAN CARIBBEAN SEA

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ABSTRACT

Plankton samples were collected at the oceanic atoll Banco Chinchorro, located in the westernmost part of the Caribbean Sea. Several specimens of monstrilloids were present in the samples. Based only on male specimens, two new species of *Monstrilla* are described according to the upgraded standards for the description of monstrilloids. A new, illustrated record and a complementary description is given for the male of *Cymbasoma quintanarooense* Suárez-Morales, not previously recorded in Banco Chinchorro. The first new species, *Monstrilla marioi* n.sp. is easily distinguishable for having a pair of coarsely rugose genital lappets with a terminal seta at the tip of each lappet. The other species of *Monstrilla* (*Monstrilla globosa* n.sp.) can be separated by the unique structure of its genital apparatus, ending in a pair of spherical structures not described before; it also has a peculiar pair of reduced fifth leg lobes not previously reported. These are the first records of Monstrilloida in Banco Chinchorro.

Monstrilloid copepods are protelean parasites of marine benthic polychetes and molluscs. They are caught in zooplankton nets mainly as adults, which are the most conspicuous in the free-living stage (Isaac, 1975a; Davis, 1984). They are commonly found in coastal and neritic waters, but are rare in oceanic samples. Reef areas tend to have a diverse copepod fauna (Villiers and Bodiou, 1996; Suárez-Morales and Gasca, 2000), and this is true for monstrilloid copepods as well (Suárez-Morales, 1994; Suárez-Morales and Gasca, 1998).

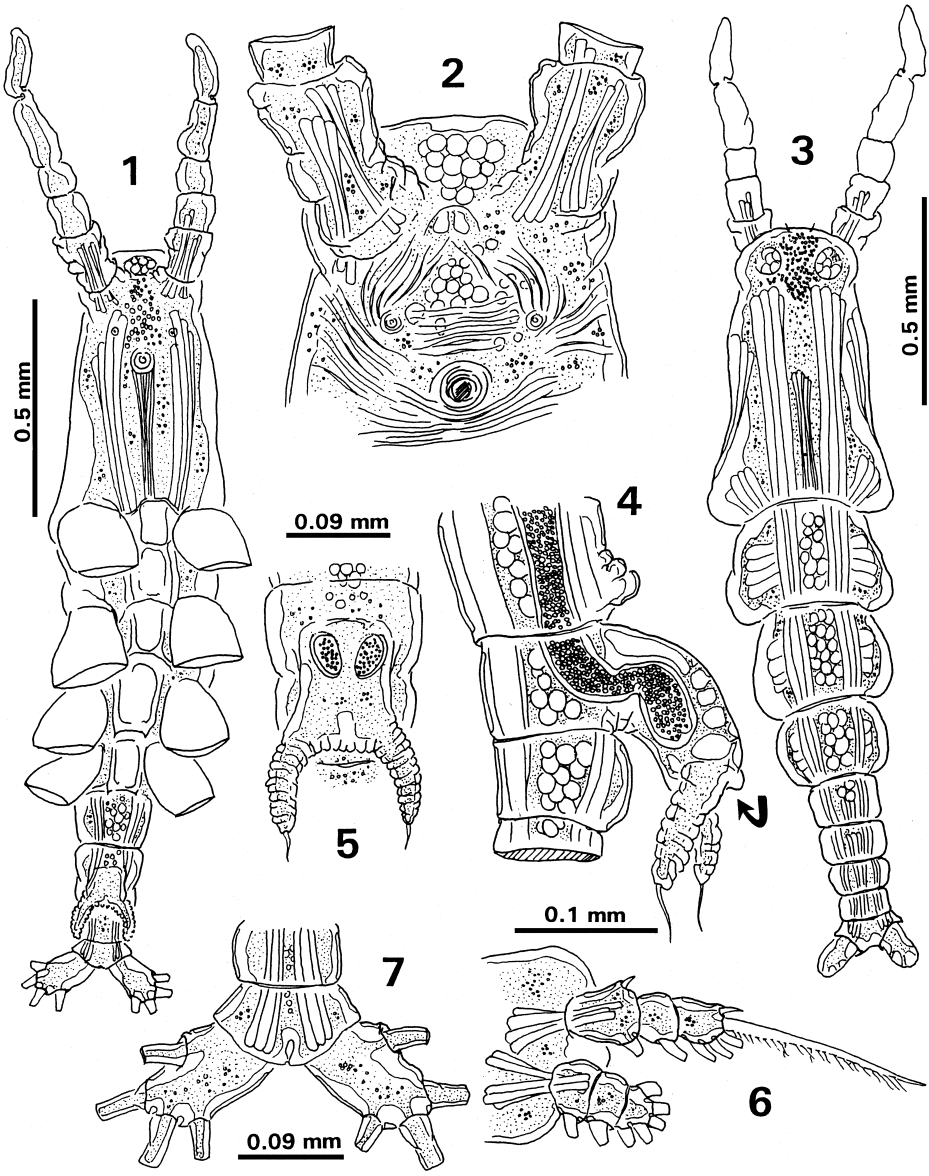
Zooplankton samples were collected during 1996 and 2000 at the oceanic atoll Banco Chinchorro, located in the westernmost portion of the Caribbean Sea. During these sampling efforts, several specimens of monstrilloid copepods were collected and separated for identification. Only the males of three different species are included in this report; females were treated separately in a previous report (Suárez-Morales, 2001). The two new species of *Monstrilla* are described in full following the upgraded taxonomic standards set by Grygier and Ohtsuka (1995) for the description of monstrilloid copepods. All the specimens found are deposited in the zooplankton collection of El Colegio de la Frontera Sur (ECO-CH-Z), Chetumal, Mexico.

Systematics

Monstrilla marioi new species

(Figs. 1–13)

Material.—Three adult males, ethanol-preserved, undissected. Collected in Banco Chinchorro, Quintana Roo, Mexico. Plankton sample. Holotype male collected at station 14 (18°42.901′N, 87°22.115′W), March 28, 2000. Paratypes collected at station 15 (18°38.000′N, 87°18.092′W), March 28, 2000. Vials deposited in the zooplankton collec-



Figures 1–6. *Monstrilla marioi* nov. spec. Adult male holotype. 1. Habitus, ventral view; 2. head, ventral view; 3. habitus, dorsal view; 4. genital apparatus and lappets, lateral view; 5. same, ventral view; 6. first swimming leg; 7. caudal rami, dorsal view.

tion of ECOSUR under numbers ECO-CHZ-01123 (holotype) and ECO-CHZ-01125 (paratype).

Type Locality.—Banco Chinchorro, Quintana Roo, Mexico.

Etymology.—The species is named after the son of the author, Mario.

Description.—Male. Total body length of three individuals ranged from 1.55–1.72 mm, average: 1.61 mm. Total length measured from anterior end of cephalothorax to posterior margin of anal somite. Cephalothorax (incorporating first pedigerous somite) accounting

for 37.8% of total body length and measuring 1.2–1.3 mm in the three specimens (Figs. 1,3). Anteriormost part of cephalothorax flat, with two short, slender sensillae. Ventral surface of cephalic part with vertical striations leading to a ventral protuberance visible in lateral view. Two nipple-like cuticular processes between oral papilla and ventral protuberance. Additional set of transverse striations present between nipples and another just below oral papilla (see Fig. 2).

Oral papilla lying midventrally 0.37 of way back along cephalothorax, not protuberant (Fig. 8). Nauplius eye present, weakly developed, ocelli large, with rounded shape. Ocelli separated by distance equalling one eye diameter (Fig. 3).

Antennule measuring between 0.52–0.63 mm, relatively long, slender, slightly longer than 87% of cephalothorax length, and about 33.5% of total body length (see figs. 1,3). Antennule 5-segmented (Figs. 9,10). In terms of pattern described by grygier and ohtsuka (1995) for monstrilloid antennular armature, setae and spines present on purported first segment is element 1, on second segment: $2d_{2-3}$, $2v_1$, $2v_2$, and iid; element $2d_1$ absent. On third segment elements 3, IIId and IIv are present. Segment four bearing elements $4d_{1,2}$, $4v_{1-3}$, IVd, and IVv; aesthetasc 4aes is absent. Fifth segment with Vv, b_{1-5}, 6aes, 61, 62.

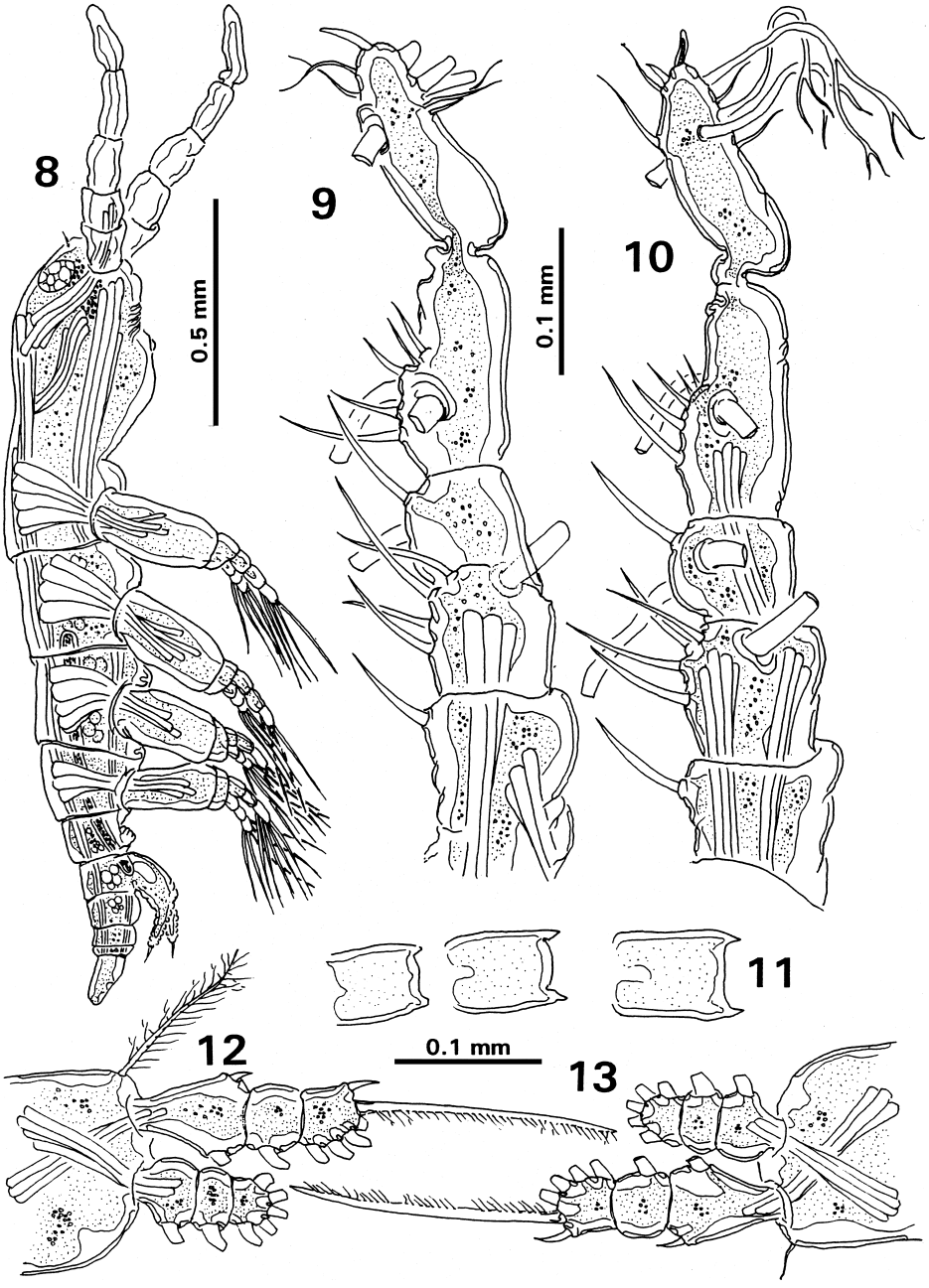
Incorporated first pedigerous somite and three free succeeding pedigerous somites each bearing a pair of biramous swimming legs. Pedigerous somites 2–4 free, together accounting for 38.3% of total length in dorsal view. Swimming legs 1–4 slightly decreasing in size posteriorly. Posterior margin of intercoxal sclerite of legs 1–3 with process on each side forming a spinelike end (Fig. 11), but missing in leg 4. Basis of legs with diagonal division articulating with large, rectangular coxa along diagonal line. Basis with lateral hair-like seta on legs 1–4; on leg 3, this seta about 4.5 times longer, lightly pinnated and thicker than those on the other legs (see Fig. 12). Endopodites and exopodites of swimming legs 1–4, triarticulated. Ramus setae all biserially plumose except spiniform outer seta on exopod 1 and 3 of each leg. Outermost exopodal setae with outer margin naked, inner margin lightly setulated to tip of setae (Figs. 6,12,13). Armature formula of swimming legs:

	basis	endopodite	exopodite
leg 1	1–I	0–1; 0-1; 1, 2, 2	I–0; 0–1; I, 1, 3
legs 2–4	1–I	0–1; 0-1; 1, 2, 2	I–1; 0–1; I, 1, 2, 2

Fifth legs reduced, represented by a bud-like protuberance visible in lateral view (Fig. 4). Protuberance formed by three lobes of different sizes. Genital complex formed by short, wide-based shaft with two terminal lappets. Lappets coarsely corrugated along and around surface. Both lappets end in a short, single seta. Corrugation is present also on the margin connecting both lappets (see Figs. 4,5). A rounded process visible in lateral view (arrowed in Fig. 4).

Urosome consisting of five somites: fifth pedigerous somite, genital double somite, and three free abdominal somites. Urosome, excluding caudal rami, accounting for 19% of total body length. Ratio of length of fifth pedigerous somite, genital somite and free abdominal somite being: 36.6:25.7:22.8:14.8 (= 100). Caudal rami subrectangular, about 1.3 times as long as wide, widely divergent. Caudal rami bearing four setae, two terminal, one outer lateral seta and one inner seta (Fig. 7).

Remarks.—This species is included in the genus *Monstrilla* by having two somites between the genital and the anal somites (Isaac, 1975a). The most striking characteristic



Figures 8–13. *Monstrilla marioi* nov. spec. Adult male holotype. 8. Habitus, lateral view; 9. right antennule, ventral view; 10. same, dorsal view; 11. intercoxal sclerite of swimming legs 1–3 (I–III in figure); 12. third swimming leg; 13. fourth swimming leg.

to distinguish this species from all its congeners is the structure of the genital complex. The lappets are clearly corrugated and have a terminal seta at the tip. The structure of the fifth legs is one of the most important taxonomic characteristic used to identify species in the males of Monstrilloida (McAlice, 1985; Suárez-Morales, 2000). The general type of genital complex in the genus is formed by a pair of genital lappets with a wide variety of shapes and lengths. These structures might show a protuberance between the bases as in *M. anglica* Lubbock, 1897 (Isaac, 1975a). Most of these apparati have no terminal appendages or structures such as setae or spines. The genital apparatus of *M. longicornis* Thompson, 1890 and of *M. longiremis* Giesbrecht, 1891 have a short, strong terminal spine on each lappet (see Sars, 1921). It differs from the apparatus of the new species in having a much shorter set of lappets which have a smooth surface, and in having a more spiniform terminal seta. In the new species the lappets are represented by longer arms with a corrugated surface and with a short, weak terminal seta on each arm. In *M. leucopis* Sars, 1921 and *M. papilliremis* Isaac, 1975b there is also a set of terminal spine-like structures at the tip of the genital apparatus. However, in the new species the apparatus is not bifurcated as it is in the other two species (see Sars, 1921; Isaac, 1975b).

The spine-like processes on the intercoxal sclerite have not been described previously in the group. The shape and structure of this sclerite can have different forms and ornamentation, such as the patches of spinules present in an undescribed species (pers. obs.), but its taxonomical value has not been explored.

Monstrilla globosa new species

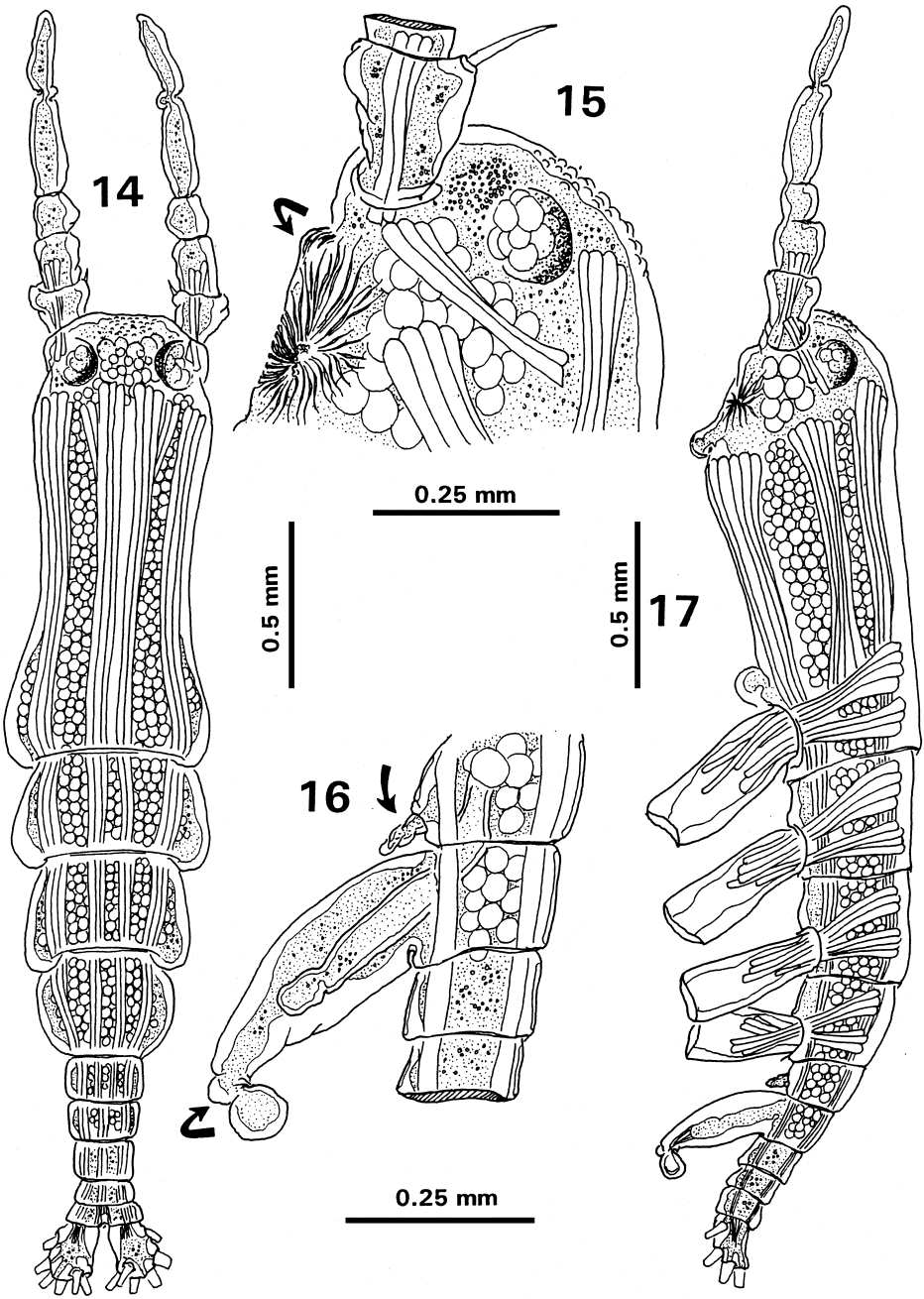
(Figs. 14–22)

Material.—One holotype adult male, ethanol-preserved, undissected. Banco Chinchorro, plankton sample. Collected at station 5 (18°34.070′N, 87°22.470′W), March 29, 2000. Catalogue number: ECO-CHZ01124.

Type Locality.—Banco Chinchorro, Quintana Roo, Mexico.

Etymology.—The specific epithet for this species refers to the globose shape of the distal part of its genital apparatus.

Description.—Male. Body length of analyzed specimen 2.8 mm. Cephalothorax 2.25 mm long, representing about 47% of body length considered to posterior margin of anal somite (Figs. 14,17). Oral papilla relatively well developed, protuberant, represented by cylindrical structure located 0.14 of way back along ventral surface of cephalothorax (Fig. 17). Cephalothorax broad, nearly cylindrical; cephalic region broadest on anterior third, thoracic part gradually broadening to the same width. Ocelli present, well developed, lightly pigmented, rounded in dorsal view. Pigment cups separated by a distance equal to 1.5 times the eye diameter. Cephalic region flat in dorsal view. Cephalic sensillae not seen. Forehead with patch of blister-like processes on dorsal surface (Fig. 15). Two pairs of chitinized, nipple-like cuticular processes located ventrally between oral papilla and antennular bases (Fig. 20). First pair of nipple-like processes larger than second, formed by a whorl of long ridges reaching ventral protuberance. Whorl on left side with additional process similar to main one, but reduced. Second pair represented by whorl-like processes on each side of oral papilla. Relatively large protuberance covered with longitudinal ridges lying above these nipple-like processes (arrowed in Figs. 15,20).



Figures 14–17. *Monstrilla globosa* nov. spec. Adult male holotype. 14. Habitus, dorsal view; 15. head, lateral view (ventral protuberance arrowed); 16. genital complex, lateral (bud of fifth leg arrowed); 17. habitus, lateral.

Antennules relatively long, measuring 1.1 mm, representing close to 78% of the cephalothorax length. As usual in monstrilloid males, antennules with five clearly separated segments. Length ratio of antennular segments starting from proximalmost being: 13.7:18.8:12.7:30.9:23.9 (= 100) (Figs. 18,19). In terms of basic setal nomenclature of Grygier and Ohtsuka (1995) for monstrilloid copepod antennules, elements on first (1), second ($2d_{1,2}$, $2v_{1-3}$,IId), and third (IIId, IIIv, 3), complete. Fourth segment bearing all elements ($4v_{1-3}$, $4d_{1,2}$, IVd), except missing IVv and 4aes. Distal (fifth) segment with elements Vv, 5, 6aes, 6_2, b_{1-5} only. A bifid element occupied places for 6_1 and 6_2 (arrowed in Figs. 18,19), probably representing a fusion of these two elements.

First pediger incorporated into cephalothorax. This and succeeding three pedigers each bearing well developed swimming legs, all with trisegmented rami and with same armament pattern, except for leg 1 exopod which has one seta less on the terminal segment of the exopod. Exopods longer than endopods in all cases. Coxae of each pair unarmed, joined by subrectangular intercoxal sclerite. Basis separated from coxa posteriorly by diagonal articulation. Outer margin of basis of swimming legs 1, 2 and 4 with small, thin seta; seta on leg 3 about 2.5 times larger than in the other legs, naked. Outer distal corner of first and third exopodal segments of legs 1–4 each with relatively long spine. Spine on third exopodal segment of swimming legs about one quarter as long as segment proper. All natatory setae lightly and biserially plumose except for spiniform seta on outer distal corner of third exopodal segments of swimming legs 1–4, with finely denticulated outer margin and naked inner margin (Fig. 22).

Armament formula of swimming legs:

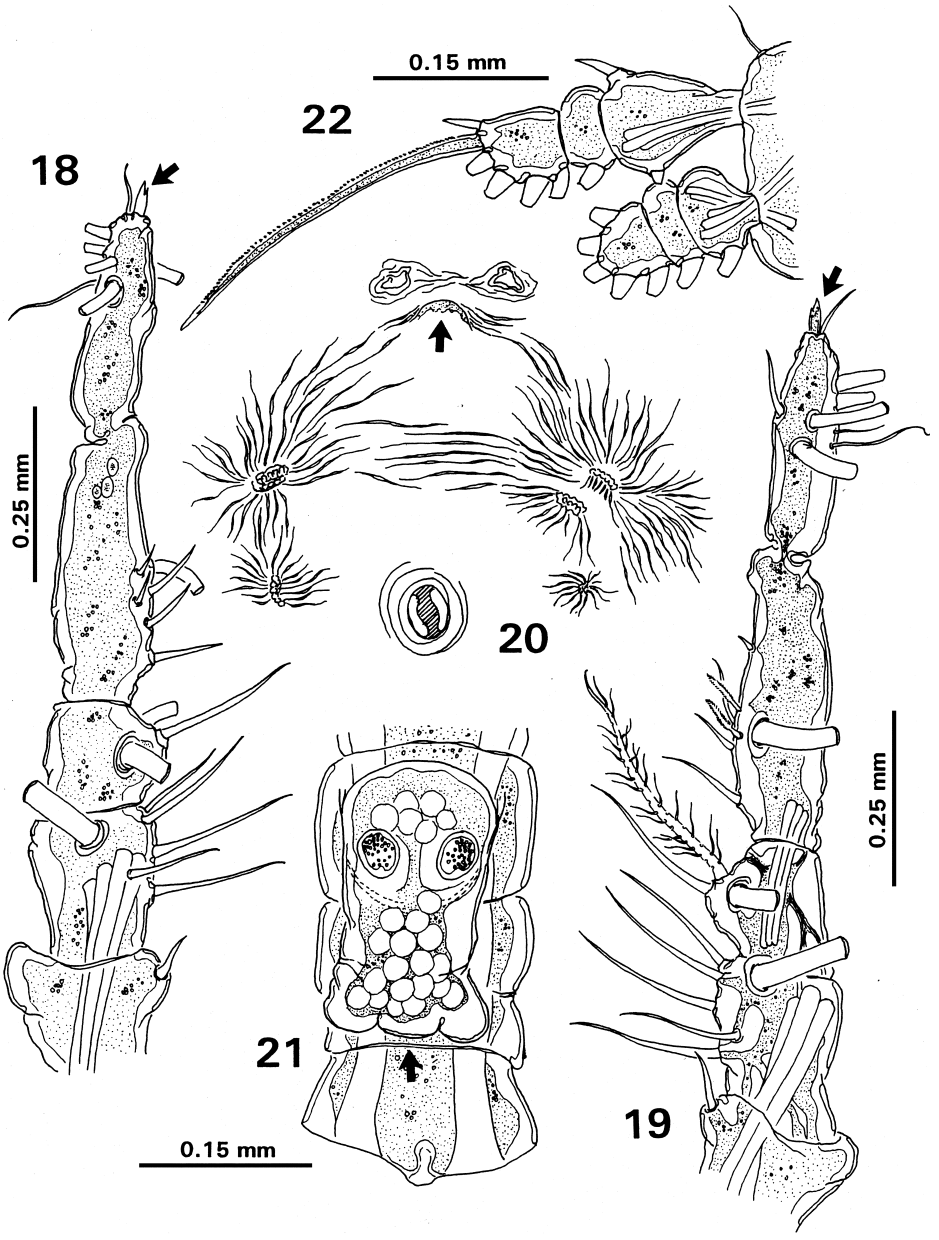
	basis	exopod	endopod
leg 1	0–1	I–1; 0–1; I, 2, 2	0–1; 0–1; 1, 2, 2
legs 2–4	0–1	I–1; 0–1; I, 2, 3	0–1; 0–1; 1, 2, 2

Fifth leg nearly cylindrical appendage protruding from near posterior margin of fifth pediger (arrowed in Fig. 16). Succeeding somite with ventral protuberance, which is the base of a long genital apparatus, nearly cylindrical but having two divergent terminal lobes. Lobes globose on lateral view (Fig. 16). A low, rounded process is present between bases of lobes (arrowed in Fig. 16). Inner and outer margins of apparatus smooth, naked (Figs. 16,21).

Urosome consisting of five somites: fifth pediger, genital somite (with genital complex) and three free—postgenital, preanal, and anal—somites. Urosome representing about 19% of total body length. Caudal rami subrectangular, bearing six setae, one outer lateral, three terminal, one dorsal, and one inner lateral.

Remarks.— This species was included in the genus *Monstrilla* by having three somites between the genital somite and the caudal rami. Another character used to assign this species to the genus *Monstrilla* is the presence of fifth legs (although reduced in this species) and of six caudal setae. These two characters are exclusive of *Monstrilla*.

The presence of a reduced fifth leg in the males is a characteristic useful to separate this species from its congeners with fifth legs, such as *M. wandeli* Stephensen, 1913, *M. longicornis* Thompson, 1890, *M. longiremis* Giesbrecht, 1892, and *M. leucopis* G.O. Sars, 1921 (see Sars, 1921). All these species have a relatively well-developed fifth leg, with a short lobe bearing one or two setae. This pattern differs from the reduced, naked bud-like lobe shown by the new species. It differs also from the rounded protuberance shown by



Figures 18–22. *Monstrilla globosa* nov. spec. Adult male holotype. 18. left antennule, dorsal; 19. right antennule, dorsal; 20. cephalic area, ventral, showing cuticular ornamentation; 21. genital complex, ventral view; 22. second swimming leg.

M. marioi (see Fig. 4). There is no other known monstrilloid with such a reduced fifth pedigerous appendage.

The genital apparatus of the new species, with this peculiar, cylindrical process tapering into a rounded distal knob has been recorded mainly in species of *Monstrilla* (i.e. *M. reidae* Suárez-Morales, 1993, and in a Brazilian species of *Monstrilla* (pers. obs.). How-

ever, this is not exclusive of the genus since it is also present in species of *Monstrillopsis* as well (see Huys and Boxshall, 1991; figs. 2.5.8c,d).

The new species differs from *M. reidae* by having a pair of terminal clearly globose structures at the distal end of the apparatus (see Suárez-Morales, 1993). It is differently built in *M. reidae* (see Suárez-Morales, 1993) and in the Brazilian species (pers. obs.); in both species the apparatus is clearly straight, not curved in lateral view as in *M. globosa*.

Cymbasoma quintanarooense (Suárez-Morales, 1994)
(Figs. 23–36)

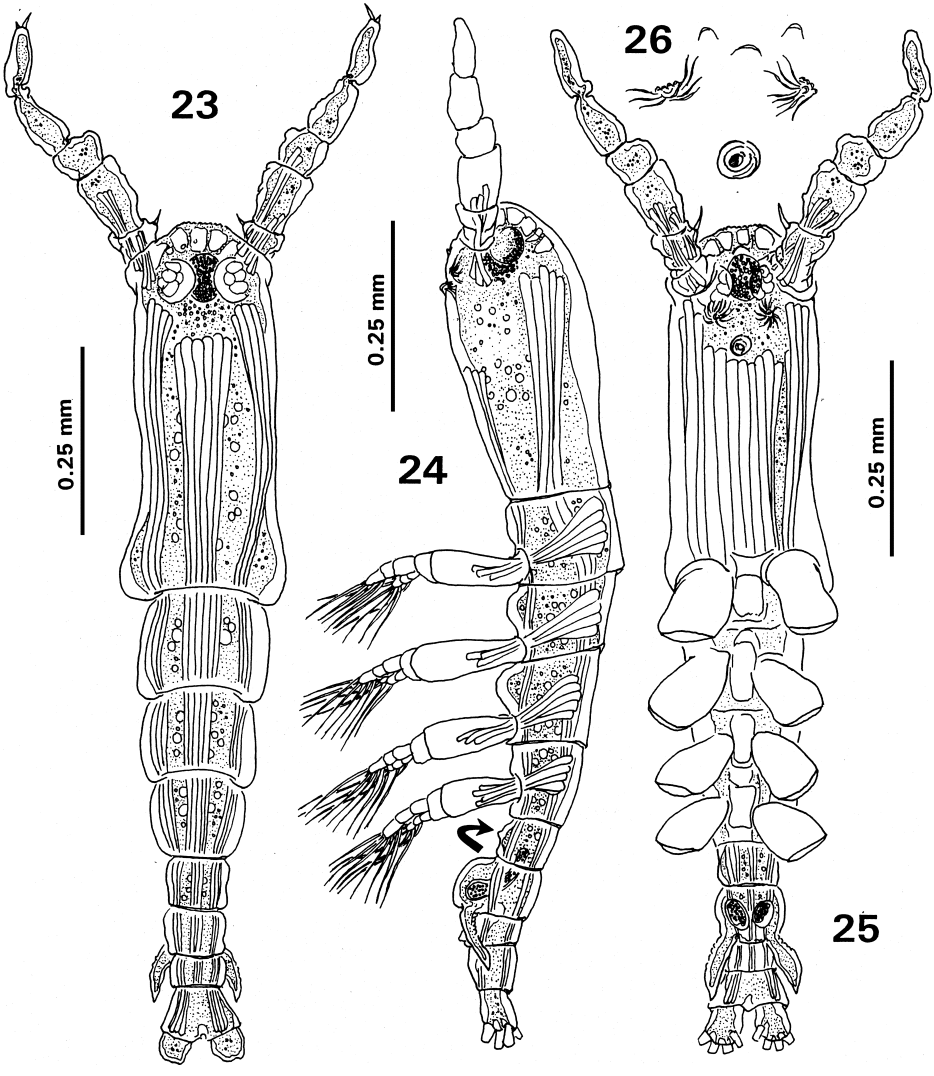
Material.—Three adult males, ethanol-preserved, undissected. Banco Chinchorro, plankton sample. One specimen collected March 28, 2000, from station 14 (18°42.901'N, 87°22.115'W). Two specimens collected March 29, 2000 from Banco Chinchorro station 5 (18°34.070'N, 87°21.901'W). Catalogue numbers: ECO-CHZ-01121, ECO-CHZ-01122, respectively.

Complementary Description.— Male. Body length ranged from 1.05–1.2 mm, average: 1.1 mm. Cephalothorax ranged between 0.85–0.93 mm, representing about 44% of body length (Figs. 23–25). Oral papilla poorly developed, slightly protuberant, represented by subtriangular structure located 0.15 of way back along ventral surface of cephalothorax (Fig. 24). Eyes separated by a distance equal to less than one-half eye diameter. Cephalic region slightly protuberant in dorsal view, not bifid. Cephalic sensillae not seen. Forehead rugose (Fig. 23). One pair of chitinized, whorl-like cuticular processes located ventrally between oral papilla and antennular bases (Fig. 26). A small protuberance above these nipple-like processes (Fig. 29). Cuticular ventral processes formed by a whorl of long ridges almost reaching ventral protuberance (Fig. 26).

Antennular length of studied specimens ranged between 0.38–0.4 mm, representing about 73% of the cephalothorax length. Length ratio of antennular segments starting from the proximalmost being: 18.7:25.1:13.1:21.8:21.3 (= 100) (Figs. 27,28). In terms of basic setal nomenclature of Grygier and Ohtsuka (1995), elements on first (1), second ($2d_{1,2}$, $2v_{1-3}$,IId), and third (IIId, IIIv, 3), complete. Fourth segment bearing all elements ($4v_{1-3}$, $4d_{1,2}$, IVv), except missing IVd and 4aes. Distal (fifth) segment with elements Vm, 5, 6aes, 6_1, 6_2, b_{1-3} only.

Swimming legs 1–4 with trisegmented rami and same armament pattern, except for leg 1 exopod which has one seta less on terminal segment of exopod (see Fig. 30). Outer margin of basis of swimming legs 1, 2 and 4 with small, thin seta (Figs. 30,31); seta on leg 3 about 3.5 times larger than those on other legs, lightly plumose (Fig. 36). Outer distal corner of first and third exopodal segments of legs 1–4 each with spinelike seta. Spine on third exopodal segment of swimming legs about half the length of segment proper. All natatory setae lightly and biserially plumose except for spiniform seta on outer distal corner of third exopodal segments with finely denticulated outer margin, inner margin with sparsely distributed setules (Figs. 30,31).

Fifth leg absent, but fifth pedigerous somite with reduced bud-like protuberance (arrowed in Figs. 24,33). Genital complex represented by pair of genital lappets nearly cylindrical, moderately divergent, tapering at distal end, directed backwards. Both lappets protruding from genital somite, separated at base and almost reaching posterior end of anal somite (Figs. 32–34).

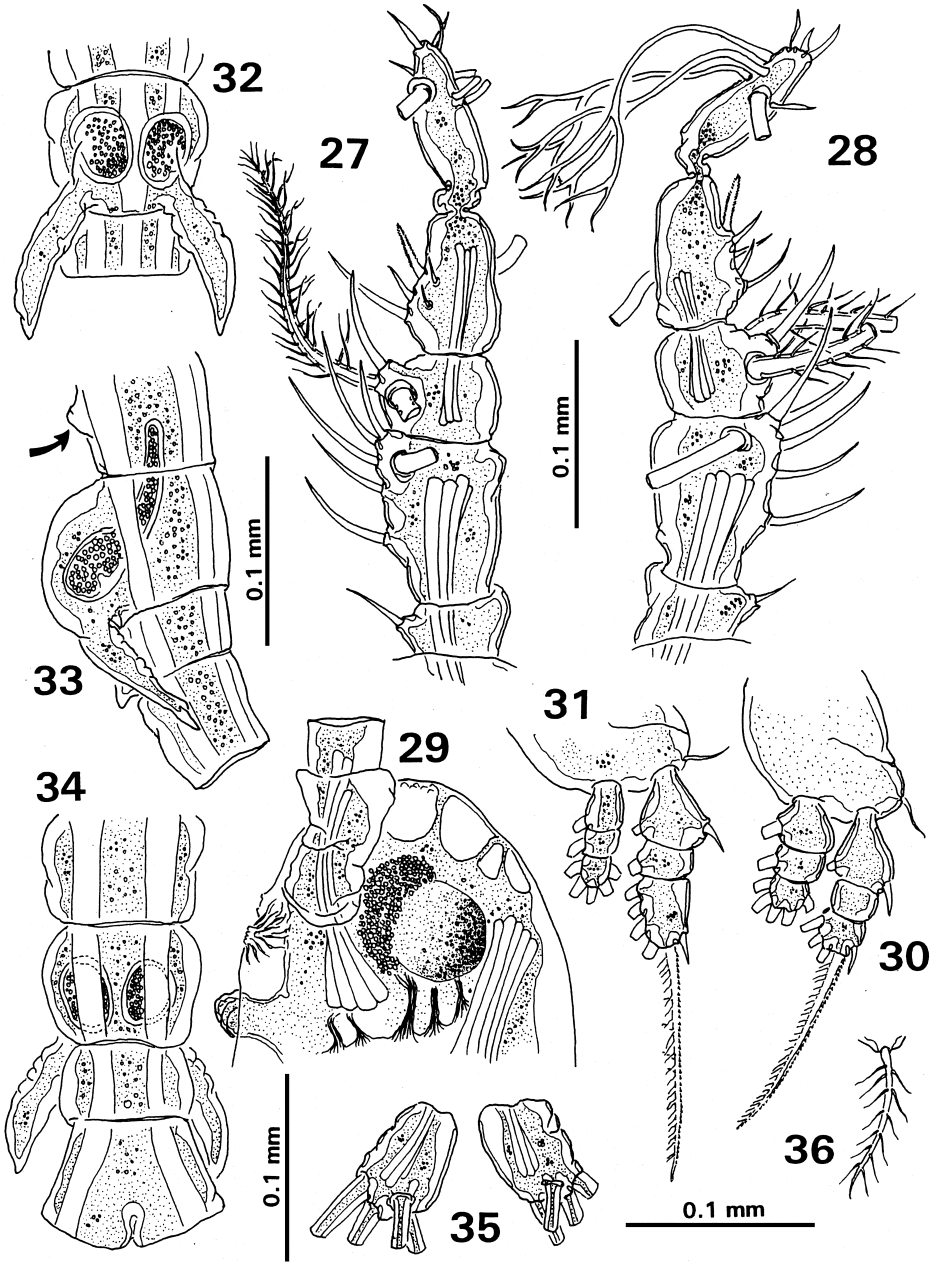


Figures 23–26. *Cymbasoma quintanarooense* (Suárez-Morales, 1994) Adult male from Banco Chinchorro. 23. Habitus, dorsal view; 24. same, lateral view; 25. same, ventral view, arrow shows subtriangular ventral process on fifth pediger; 26. cephalic area, ventral, showing cuticular ornamentation.

Urosome consisting of four somites: fifth pediger, genital somite (with genital complex) and two free—preanal and anal—somites. Fifth pedigerous somite with subtriangular ventral process on anterior surface (arrowed in Figs. 24,33). Postgenital somite with ventral subtriangular process on posterior margin. Urosome about 19% of total body length. Caudal rami with four setae, one outer lateral, two terminal, one dorsal, and one on inner margin (Fig. 35). All other characters as described by Suárez-Morales (2000).

Remarks.—The males of *Cymbasoma* have only one segment between the genital and the anal somites. This is why the present specimens were included in this genus.

Following the recently published key for the known males of *Cymbasoma* (Suárez-Morales, 2000), the specimens from Banco Chinchorro do not correspond to *C.*



Figures 27–36. *Cymbasoma quintanarooense* (Suárez-Morales, 1994). Adult male from Banco Chinchorro. 27. Right antennule, dorsal view; 28. left antennule, dorsal view; 29. head, lateral view; 30. first swimming leg; 31. fourth swimming leg; 32. genital complex, ventral view; 33. same, lateral view, fifth pediger ventral process arrowed; 34. same, dorsal view; 35. caudal rami, dorsal; 36. lateral basipodal seta of third swimming leg.

quintanarooense. This is because of the non-bifid condition of the forehead shown by the Chinchorro specimens. However, the species is identified as *C. quintanarooense* by all the other characteristics exhibited by this species, including mainly the backwardly directed genital lappets, the protuberance of the base of the lappets, and the ventral process on the postgenital somite (see Suárez-Morales, 2000).

There are some other differences between the Mahahual (Suárez-Morales, 2000) and the Chinchorro specimens: the relative lengths of the antennules (0.85 % vs 76% of the cephalothorax, respectively) and of the antennule segments. The armature of the antennules is presented here according to the nomenclature proposed by Grygier and Ohtsuka (1995), which was not followed in the original description of the male published by Suárez-Morales (2000). Most elements have the same structure and arrangement as shown in the original figures, but element $2d_2$, not found in the Mahahual specimens, is clearly present in the Chinchorro group. The anal somite of the Mahahual specimens show a serrated posterior margin, whereas it is nearly smooth in the Chinchorro material. The genital lappets are serrated along both sides in the Mahahual material but only on the outer margin in the Chinchorro specimens. Therefore, except for a few species (*C. similirostrate* Isaac, 1974, *C. thompsonii* Giesbrecht, 1892, *C. tumorifrons* Isaac, 1975), the appearance of the forehead seems to be a non-reliable character to separate species of *Cymbasoma*. Nevertheless, the structure of the genital complex still includes the most relevant characteristics for identification of the members of this genus. The most distinctive characters for the present species, besides the lappets, are: the protuberance on the base of the genital lappets and the ventral process on the postgenital somite (see Figs. 33,24 and Suárez-Morales, 2000, fig. 6).

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