

Redescription and first record of *Cymbasoma boxshalli* and *Monstrilla inserta* (Copepoda: Monstrilloida) from Curaçao, eastern Caribbean Sea

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Abstract: From a collection of epibenthic fauna in the reef area of Curaçao, eastern Caribbean Sea, three female monstrilloid copepods were recorded. One was identified as *Cymbasoma boxshalli*, a species which has been recorded previously only once, in the western Caribbean. Its original description lacks relevant details and it is redescribed here following new, upgraded standards. A comparison is made with the very closely related species *Cymbasoma rigidum* and *C. clapedii*. The other specimens were identified as *Monstrilla inserta*, a rare species which has not been adequately described. This species shows several distinctive characters, including the peculiar structures of the antennules and the fifth legs, and an anterior cephalic protuberance. The species is redescribed based on both the type specimens and the Caribbean material. Due to the lack of a designated holotype of the original syntypic series, a lectotype specimen and paralectotype specimens are designated. This species has been previously recorded only in the Indo-Malayan region and Japan. Its presence in the Caribbean seems to be related to post-Cretaceous dispersal trends connecting southeastern Asia and the Caribbean.

Résumé : *Redescription de Cymbasoma boxshalli et Monstrilla inserta (Copepoda: Monstrilloida) et première signalisation de ces espèces à Curaçao, Mer Caraïbe orientale*

A partir d'une récolte de faune épibenthique du récif de Curaçao, dans la mer Caraïbe orientale, trois exemplaires femelles de Copépodes Monstrilloïdes ont été trouvés. L'un d'eux a été identifié comme *Cymbasoma boxshalli*, une espèce qui n'avait été mentionnée qu'une seule fois dans les Caraïbes. Étant donné que certains détails importants manquaient à la description originale, l'espèce est redécrite ici, suivant de nouveaux critères améliorés. L'espèce est très proche de *Cymbasoma rigidum* et de *C. clapedii*, et une comparaison détaillée avec ces espèces est faite. Les autres exemplaires ont été identifiés comme appartenant à l'espèce *Monstrilla inserta*, une espèce rare qui n'a pas été décrite de façon adéquate. Cette espèce présente plusieurs caractères distinctifs, principalement la structure particulière des antennules et des cinquièmes pattes et la présence d'une protubérance antérieure céphalique. L'espèce est ici redécrite à partir des exemplaires types et du matériel des Caraïbes. En raison de l'absence d'un holotype désigné de la série originale syntypique, un exemplaire lectotype et plusieurs exemplaires paralectotypes sont désignés. L'espèce a été signalée jusqu'ici uniquement dans la région Indo-Malaise et au Japon. Sa présence dans les Caraïbes semble être liée à la dispersion post-Crétacée reliant l'Asie du Sud-Est aux Caraïbes.

Keywords: Reef zooplankton, tropical, copepod taxonomy, monstrilloids

Introduction

Monstrilloid copepods are, as larvae, parasites of polychaetes and molluscs. Adults are free-living, planktonic, non-feeding, and exclusively reproductive organisms (Isaac, 1975). Due to assorted taxonomic and nomenclatural problems, the entire order Monstrilloida is in urgent need of revision (Grygier, 1994a). Because several of the early species descriptions lack relevant details or information, several species have recently been redescribed or reclassified (Grygier, 1994b; Suárez-Morales & Riccardi, 1997). In this particular group, with a reduced set of potential taxonomic characters, detailed descriptions or redescriptions constitute the basis of any attempt at a satisfactory overall taxonomic revision.

Monstrilloids are frequently found in plankton collections, but their abundance is commonly very low when compared with that of other zooplanktonic crustaceans. However, due to the fact that planktonic adults must remain close to the bottom most of the time so as to stay close to potential hosts, under certain criteria they can be considered as part of the epibenthos.

During a series of surveys of mass spawnings of reef-building corals in a reef zone of Curaçao, an island in the southeastern Caribbean (Van Veghel, 1993), Dr. Manfred van Veghel collected a few specimens of monstrilloid copepods. They were mixed with specimens of benthic polychaetes sent originally to Dr. Sergio Salazar-Vallejo, who called my attention to the presence of these copepods. Dr. van Veghel kindly allowed me to analyse these specimens. The taxonomic analysis of this material yielded one species of *Cymbasoma* identified as *C. boxshalli* (Suárez-Morales, 1993) and a finding of the rare *Monstrilla inserta* A. Scott, 1909. These two species are redescribed herein according to upgraded standards for the description of monstrilloid copepods (Grygier & Ohtsuka, 1995).

Material and methods

Epibenthic samples were collected in Slangenbaai reef (see Van Veghel, 1993) a fringing reef area on the leeward coast of Curaçao (Bak, 1987), Netherlands Antilles. Several adult females of monstrilloid copepods were captured and transferred to 70% ethanol. Observations were made under a microscope and drawings were made with the aid of a camera lucida. The standard terminology for copepod morphology and monstrilloid antennular armature (Grygier & Ohtsuka, 1995) was followed. The type specimens are deposited in the Zooplankton Collection of El Colegio de la Frontera Sur (ECOSUR), in Chetumal, Quintana Roo, Mexico, in the National Museum of Natural History, Smithsonian Institution, Washington, D.C.

(USNM), and in the Zoölogisch Museum, Amsterdam (ZMA).

Results

Cymbasoma boxshalli (Suárez-Morales, 1993)

Thaumaleus boxshalli Suárez-Morales, 1993: 85-89, fig.1 (Figs 1-12)

Type material. Two adult females, Holotype (USNM 251838) and paratype (USNM 251839) from the type locality (the first specimen examined, an adult female from Slangenbaai reef Curaçao, Sept. 8, 1993 has been lost in mail).

Additional material. Two adult females from Bahía de la Ascensión, Quintana Roo, México, (ECO-CHZ00048) and an undissected adult female from Tulum, central coast of the Mexican Caribbean, Quintana Roo, Mexico, Oct. 13, 1992 (ECO-CHZ00515).

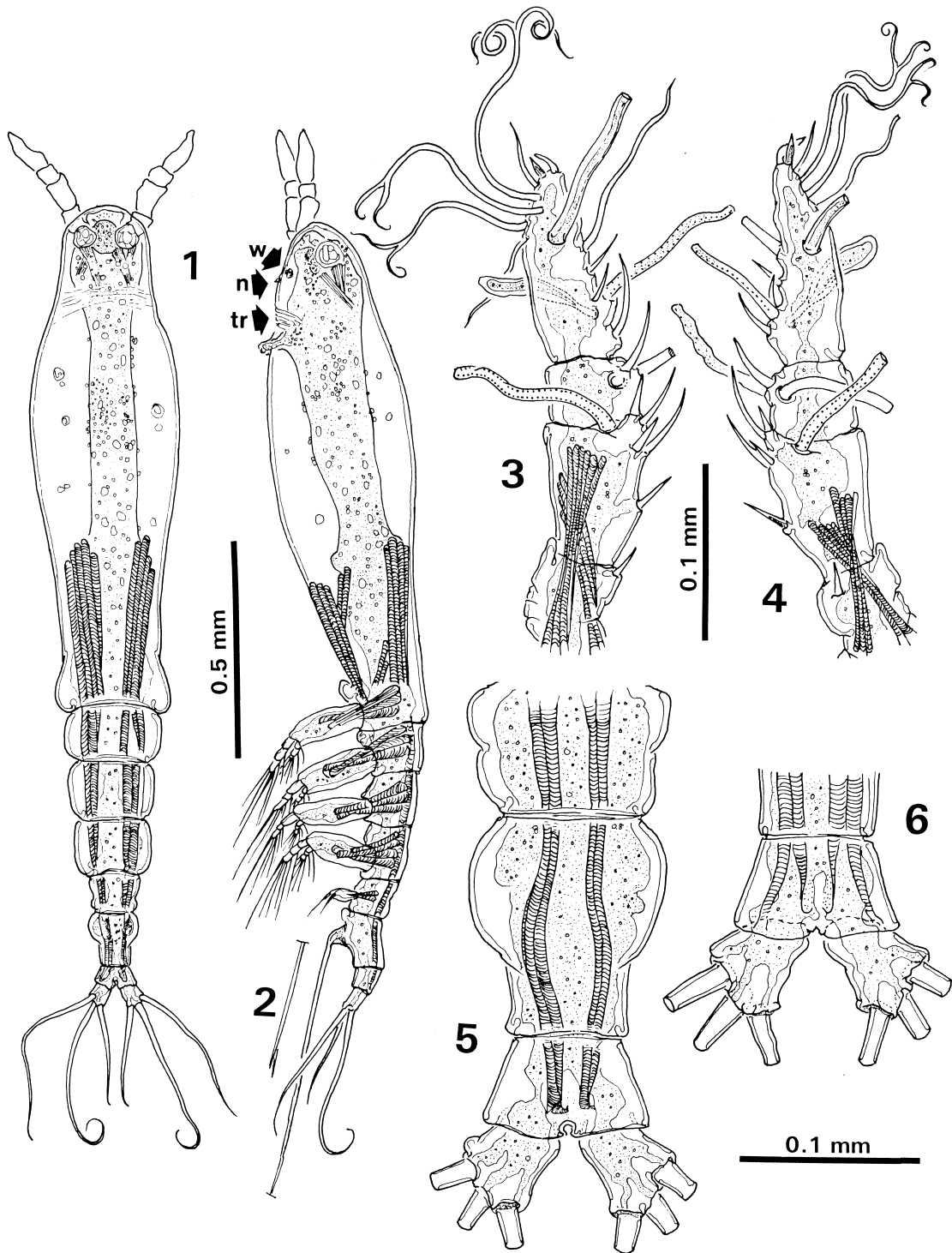
Type locality. Bahía de la Ascensión, Quintana Roo, Mexico.

New locality. Slangenbaai reef, a fringing reef on the leeward coast of Curaçao (Bak, 1997), Netherlands Antilles (12°11'N; 69°00'W), from water column, 12 m depth.

Description

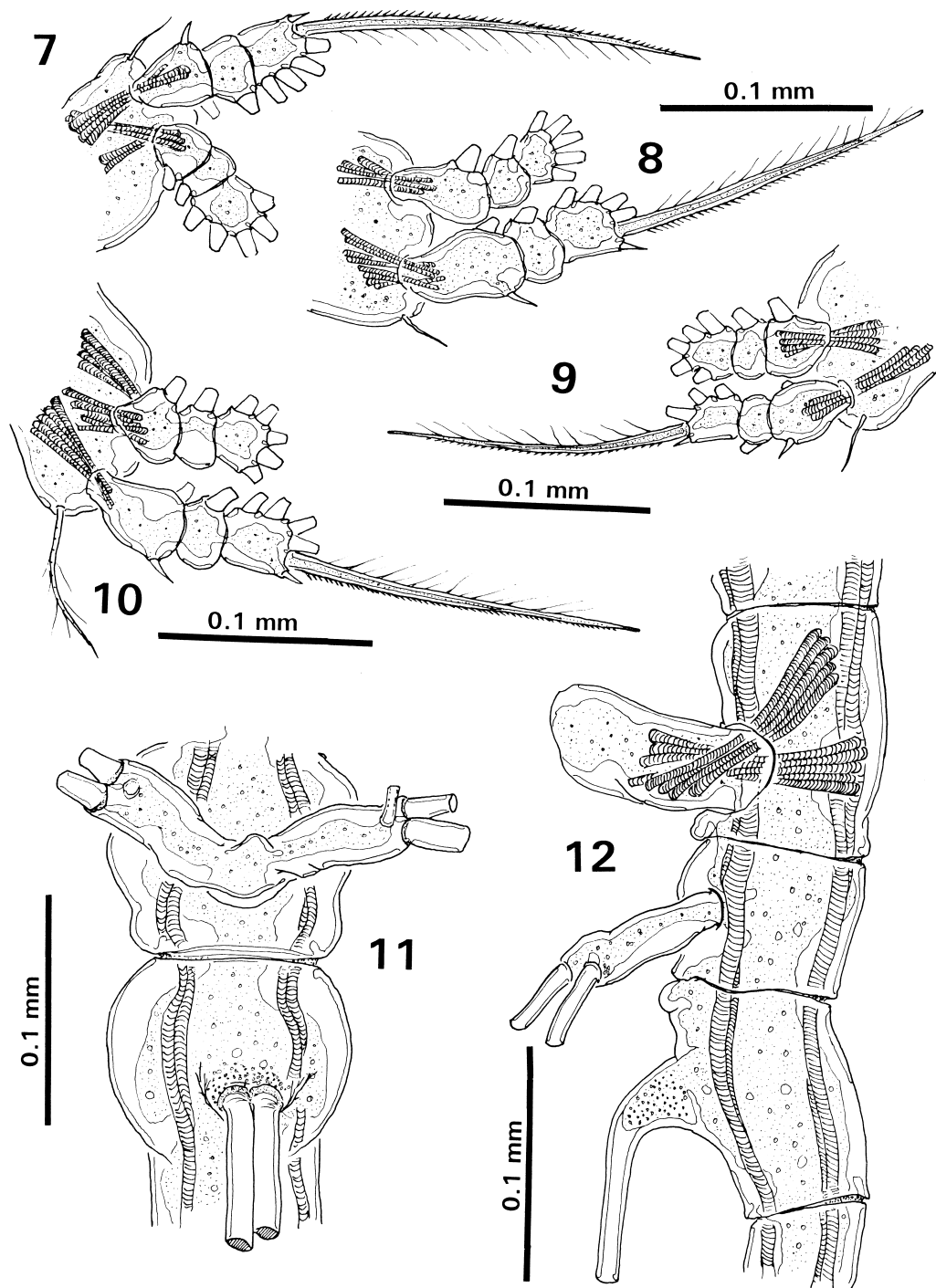
Female. Mean body length 1.8 mm, measured from anteriormost part of head to posterior margin of anal somite. Cephalothorax (incorporating first pedigerous somite) accounting for 60-63.6% of total body length. Ventral margin of anterior portion of cephalothorax straight in lateral view. Oral papilla moderately protuberant, lying midventrally 0.19-0.23 of way back along cephalothorax. Anterior end of cephalothorax slightly protuberant (Fig. 2), slender, with cuticular ornamentation represented by a pair of cuticular whorls (w), a pair of nipple-like processes (n), and transverse pattern of faint ridges (tr) between oral papilla and antennule bases (arrowed in Fig. 2). Naupliar eye present, with medium development, ocelli with rounded shape, slightly (Curaçao specimen) to strongly (Mexican Caribbean specimen) pigmented, separated from each other by less than one ocellum diameter. Cuticular ornamentation over dorsal anterior 1/5 of cephalothorax, with faint pattern of transverse striations behind eye region (Fig. 1).

Antennules 4-segmented, armed with 0,I; 1,V; 2,I; 8,V setae and spines, plus large ventral aesthetasc on terminal segment (Figs 3,4). Two of these spines terminal, forming pincer-like structure. In comparison to basic setal pattern proposed by Grygier and Ohtsuka (1995), seta IVd missing on last segment of right and left antennules; setae b1-3 bifurcated from distal third of their length; spines 4d₁ and 4d₂ and one of setae b4 or b5 missing in both antennules; both aesthetascs 4aes and 6aes present. Ratio of lengths of



Figures 1-6. *Cymbasoma boxshalli* (Suárez-Morales, 1993). Adult female from Curaçao. **1.** habitus, dorsal. **2.** habitus, lateral. **3.** left antennule, dorsal. **4.** right antennule, dorsal. **5.** urosome, dorsal. **6.** last urosomite and caudal rami, ventral. Cuticular ornamentation: (*w*) cuticular whorls, (*n*) nipple-like processes, (*tr*) transverse ridges.

Figures 1-6. *Cymbasoma boxshalli* (Suárez-Morales, 1993). Fémelle adulte de Curaçao. **1.** Habitus, vue dorsale. **2.** Habitus, vue latérale. **3.** Antennule gauche, vue dorsale. **4.** Antennule droite, vue dorsale. **5.** Urosome, vue dorsale. **6.** Dernier urosomite et rames caudales, vue ventrale. Ornementation cuticulaire : (*w*) volute, (*n*) processus en forme de mamelon, (*tr*) stries transversales.



Figures 7-12. *Cymbasoma boxshalli*. Adult female from Curaçao. 7. leg 1, posterior. 8. leg 2, anterior. 9. leg 3, posterior. 10. leg 4, anterior. 11. fifth pedigerous somite and genital double somite, ventral. 12. fourth and fifth pedigerous somites and genital double somite, lateral. Most natatory setae cut short in all figures; ovigerous spines cut short in Figs. 11 and 12; coxae omitted in Figs. 7-10.

Figures 7-12. *Cymbasoma boxshalli*. Femelle adulte de Curaçao. 7. Patte 1, vue postérieure. 8. Patte 2, vue antérieure. 9. Patte 3, vue postérieure. 10. Patte 4, vue antérieure. 11. Cinquième somite portant des pattes et double somite génital, vue ventrale. 12. Quatrième et cinquième somites portant des pattes et double somite génital, vue latérale. La plupart des soies natatoires ont été coupées dans toutes les figures; les épines ovigères sont coupées dans les figures 11 et 12; coxae omises dans les figures 7-10.

antennule segments: 40: 13.3: 29.1: 17.5 (=100). Antennules relatively short (length: 0.28 mm), 14-17.7% of total body length or about 23% of cephalothorax length.

Incorporated first pedigerous somite and three free succeeding pedigerous somites each bearing pair of biramous swimming legs (Figs 7-10). Pedigerous somites 2-4 accounting for 22.3% of total length in dorsal view. Legs 1-4 decreasing in size posteriorly, endopodites and exopodites triarticulated. Armature of swimming legs:

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

Basis with lateral hair-like seta; this seta on leg 3 sparsely and biserially setulated, at least 2.5 times longer and noticeably thicker than the others. Exopodal outer apical seta with outer row of short spinules, inner margin sparsely setulated; this seta increasing in size from leg 1 through 4, relatively longer in leg 4 (2.3 times exopodal length), shorter in leg 2 (1.5 times).

Fifth legs fused medially at base, with low, medial, subtriangular protuberance between them (Fig. 11); uniramous, endopod absent; exopodal lobe elongate, 2.5-2.6 times longer than wide. Exopodal lobe armed with two biserially plumose setae, subequal in length and breadth, plus a small, inner seta, broken at base (Figs 11, 12).

Urosome consisting of fifth pedigerous somite, genital double-somite, and one free (anal) somite. Urosome, including caudal rami, accounting for 17.4% of total body length. Genital double-somite comprising almost half of length of urosome (Fig. 5), with laterally visible protuberance on proximal part of ventral margin (Fig. 12) and proximal 2/3 of somite clearly globular in dorsal and ventral views (Figs 5, 11). Ratio of lengths of fifth pedigerous somite, genital double-somite, and free abdominal somite: 29.0: 47.8: 23.2 (= 100). Genital double-somite bearing relatively short ovigerous spines, latter about 43.4-52.7% of total body length (relatively longer in Curaçao specimen), extending only slightly beyond setae of caudal rami. Ovigerous spines separate to base, arising from apex of conical, non-swollen elevation of ventral surface. This elevation anteriorly projected. Caudal rami almost as long as wide, moderately divergent, bearing three terminal setae, as usual in the genus. Innermost seta shortest, middle one longest (Fig. 6).

Male, unknown.

Remarks

The specimen from Curaçao is assigned to the genus *Cymbasoma* by virtue of the presence of only one free somite between the genital double-somite and the caudal rami (Isaac, 1975). Another generic feature is the presence of only three furcal setae per ramus, a character exclusive of *Cymbasoma*. The genus name is used herein following

Grygier's (1994a) demonstration that the type species of *Thaumaleus* is a species of *Monstrilla*. *Cymbasoma boxshalli* was described by Suárez-Morales (1993) from material collected in the western Caribbean Sea, and two of the additional specimens reported herein were taken near the type locality. As mentioned by Suárez-Morales (1993) and Isaac (1975), this species is identifiable as *Cymbasoma claparedii* (Giesbrecht, 1892a). *C. claparedii* was originally described from female specimens collected at Naples, in the Mediterranean (Giesbrecht, 1892a,b). The male is not known. This species was considered by Giesbrecht (1892a) to be a possible synonym of *C. rigidum* Thompson, 1888, in the same paper. Scott (1904) and Sars (1921) among others accepted this, but Isaac (1975) separated them on the basis of 1) the presence of a suture on the anal somite in *C. rigidum*, which is absent in *C. claparedii*, and 2) the absence of an inner lobe of the fifth leg in *C. claparedii*. It is not clearly established yet whether these two nominal species are distinct. The anal suture is absent in all specimens of *C. boxshalli* which differs from both *C. claparedii* and *C. rigidum* in having uniramous fifth legs armed with two large and one small setae; in fact, this combination of features is not present in any other species of *Cymbasoma*, but *C. boxshalli*. Females of all the other known species of the genus have three subequal setae on the outer lobe of the fifth leg, and most have an inner lobe, the relative size of which differs among species. The small, hyaline, slightly setulate inner seta of the fifth leg is difficult to see. It is broken on both rami in the Curaçao specimen of *C. boxshalli* and only at higher magnification could their bases be observed (Fig. 11). This small inner seta is clearly present in the Mexican material; it is less than 40% as long as the other two setae (see Suárez-Morales, 1993).

Another character used by Isaac (1975) to separate species of *Cymbasoma* is a swollen female genital double-somite. This somite is clearly swollen in *C. boxshalli* (Fig. 5), a feature shared with *C. thompsoni* Giesbrecht, 1892a and *C. rigidum* (see Sars, 1921). In *C. thompsoni*, the swelling is nearly globular, whereas in *C. rigidum* it is less pronounced than in *C. boxshalli*, which represents an intermediate stage between these two forms.

Cymbasoma rigidum and *C. boxshalli* have similar body proportions, with relatively short antennules and an anteriorly swollen cephalothorax in lateral view; the proportional lengths of the antennular segments are also quite similar (see Sars, 1921). However, in addition to differences in the fifth leg and anal somite (with or without a suture), *C. rigidum* has ovigerous spines that are relatively longer than in *C. boxshalli*, and its rostral area is flat, contrasting with the softly curved, protuberant forehead of *C. boxshalli*.

The range of lengths of the western Caribbean specimens is 2.1-2.3 mm, slightly longer than the Curaçao specimen

(1.8 mm). The body shape and proportions are very similar in the western and eastern Caribbean specimens. However, in the original description of this species, Suárez-Morales (1993) described a very strong pigmentation of the ocelli, a character not present in the Curaçao specimens. A ventral protuberance on the anterior part of the genital double-somite is present in specimens from the eastern and western Caribbean, but it is slightly less pronounced in the Curaçao specimen. The description of the antennular armature and the cuticular ornamentation, being incompletely described by Suárez-Morales (1993), is supplemented in the present redescription. Legs 1-4 are also fully described and depicted.

Females of up to six species of *Cymbasoma* are known to occur in tropical waters of the Northwestern Atlantic Ocean (see Grygier, 1995; Razouls, 1996; Suárez-Morales & Gasca, 1998): *C. quadridens* (Davis, 1947) from Florida, *C. boxshalli*, from the eastern and western Caribbean, *C. quintanarooense* (Suárez-Morales, 1994a), and *C. bowmani* Suárez-Morales & Gasca, 1998 from the eastern coast of the Yucatan Peninsula, and *C. chelemense* Suárez-Morales & Escamilla, 1997 from the northern coast of the Yucatan Peninsula. The present record of *C. boxshalli* represents a significant eastward range extension for the species; hence, it is likely to be found in all the Caribbean coastal and reef areas.

Monstrilla inserta A. Scott, 1909
(Figs 13-40)

Type material is deposited in the Zoölogisch Museum Amsterdam (ZMA 201480) (see "remarks"). The designated female lectotype from the Siboga Expedition was collected in the Indo-Malayan Archipelago (see "remarks"). Paralectotypes: four adult females from the same area as lectotype.

Locality of type material undetermined, from Siboga Expedition: either 1. – Station 40, anchorage point off Pulau Kawassang, Paternoster Islands, no coordinates; Suárez-Morales (2000) suggests that these islands are probably part of the southern Moluccas archipelago, or 2. – Station 66, bank between islands of Bahuluwang and Tambolungan, south of Salayer, no coordinates, or 3. – Station 282, anchorage point between Nusa Besi and the N.E. point of Timor (8° 25' 12" S, 127° 18' 24" E).

New locality: Slangenbaai reef zone, Curaçao, Netherlands Antilles, Caribbean Sea (19°47.10' N; 87°33.15' W), from water column 1.5 m depth.

Material examined. Two adult females, collected at Slangenbaai reef, Curaçao, Netherlands Antilles, September 8, 1993; undissected specimens deposited in Zooplankton Collection at ECOSUR-Chetumal, Mexico under catalogue number ECO-CH-Z00514. Specimens ethanol-preserved. Five adult females (= type material).

Description

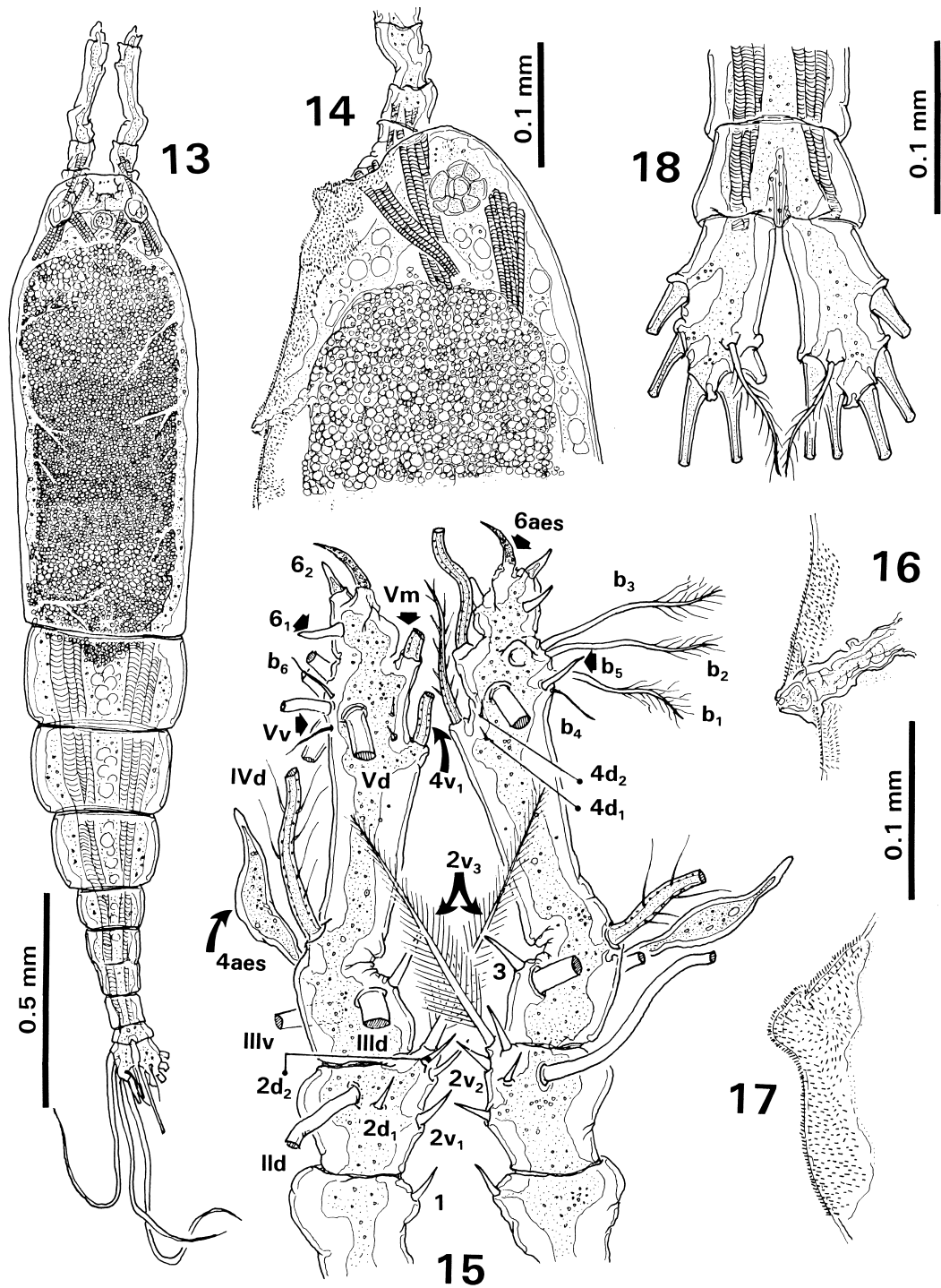
Female. Mean total body length of two individuals (Curaçao): 2.1 mm (1.97, 2.04 mm); of three type individuals (Indo-Malayan): 2.66 mm (2.4-2.9 mm). Cephalothorax (incorporating first pedigerous somite) robust, about 2.5 times longer than wide, accounting for almost 53% of total body length. Antero-ventral portion of cephalothorax, near antennule insertion, slightly curved in lateral view, with anteriorly directed, subtriangular, keel-like process of variable form (Figs 14, 17, 27, 28). Ventral margin between this process and oral papilla nearly straight, ornamentation variable, Curaçao specimen with pilose surface extending from below oral papilla to front end (Figs 14, 16), pattern in type lot varying from faint pilose patch to complex arrangement of protuberances (see Figs 27-29). Two wide-based, sensilla-like structures present midventrally between antennular bases (Figs 30, 31). Oral papilla lying midventrally 0.26 of way back along cephalothorax. Nauplius eye present, weakly developed, ocelli slightly pigmented with rounded shape, widely separated from each other by more than twice diameter of one ocellus (Fig. 13). No cuticular ornamentation observed on dorsal cephalothorax surface.

Antennule relatively short, 31.2% as long as cephalothorax, representing 16% (Curaçao) and 17-21% (type lot) of total body length; 3-segmented, distal segments appearing fused to form long shaft (Fig. 32). Ratio of lengths of antennule segments: 13.8: 16.6: 69.6 (=100). Antennule armed with 0,I; 1,V; 12,V setae and spines, plus one large and one small aesthetasc, the former on proximal third, the latter on distal third of third segment. In terms of the basic setal pattern described by Grygier & Ohtsuka (1995), most elements complete (see Fig. 15), but elements IVv and 4v_{2,3} missing. Setae b1-3 simple, unbranched, with terminal 1/3 lightly setulated. Aesthetascs 4aes and 6aes present, the latter slightly longer in the type lot than in Curaçao specimens (Fig. 32). Element 2v₃ unusually long, reaching 55% (Curaçao) and up to 57% (type specimens) of length of succeeding segment; this seta biserially setulated in the Curaçao specimens, naked in the type lot (Figs 15, 32).

Incorporated first pedigerous somite and three free succeeding pedigerous somites each bearing pair of biramous swimming legs (Figs 23-25). Pedigerous somites 2-4 accounting for 27.7% of total length in dorsal view. Endopodites and exopodites of legs 1-4 triarticulated, these legs increasing in size posteriorly. Armature of swimming legs as:

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

Basipodites 1 and 2 separated from respective coxopodites by diagonal intersegmental divisions in all swimming legs; basipodites with lateral hair-like seta on

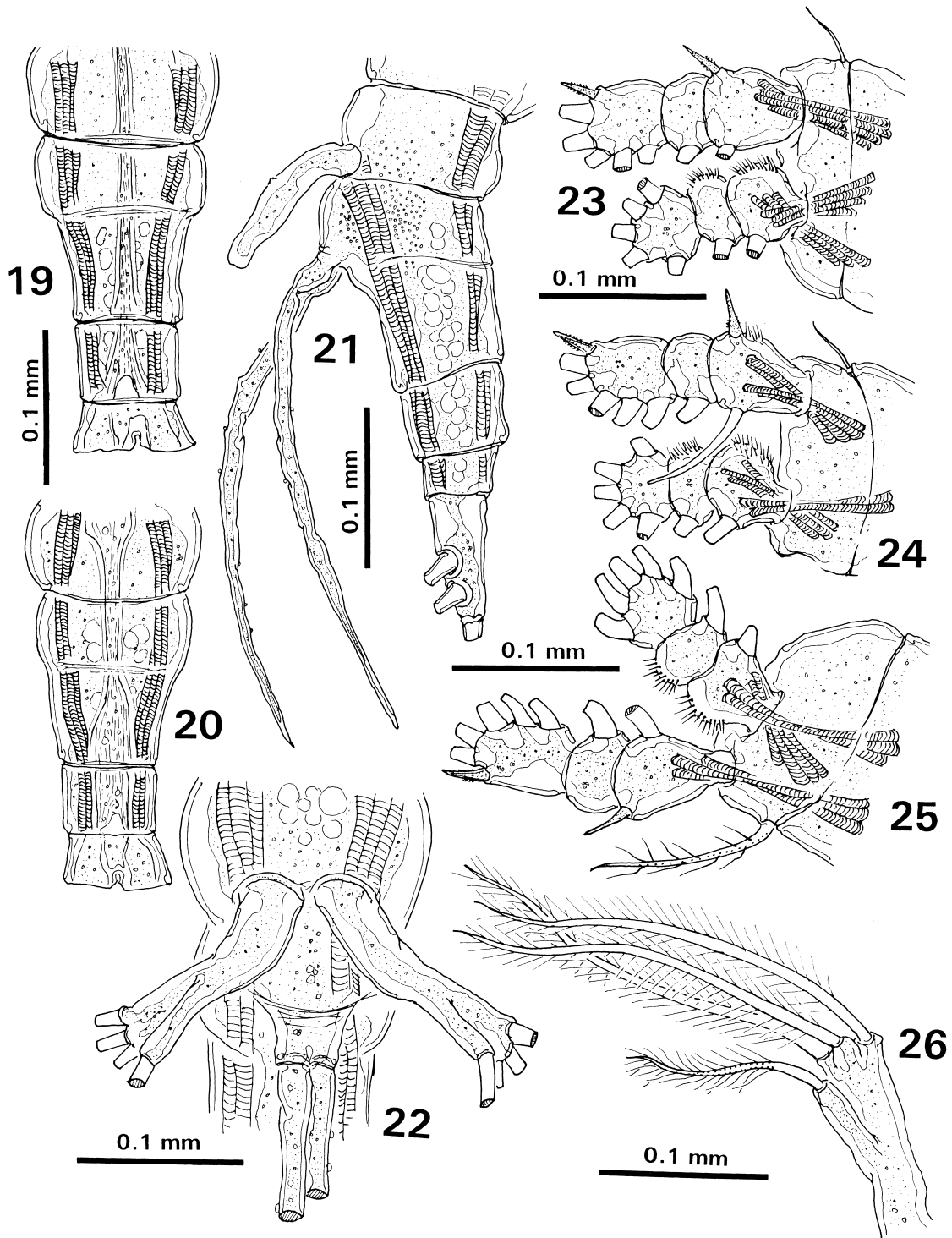


Figures 13-18. *Monstrilla inserta* A. Scott, 1909. Adult female from Curaçao. **13.** habitus, dorsal. **14.** head, lateral. **15.** right and left antennules, dorsal. **16.** oral papilla, detail. **17.** frontal keel-like process, detail. **18.** last urosomite and caudal rami, dorsal.

Figures 13-18. *Monstrilla inserta* A. Scott, 1909. Femelle adulte de Curaçao. **13.** Habitus, vue dorsale. **14.** Tête, vue latérale. **15.** Antennules droite et gauche, vue dorsale. **16.** Papille orale, détail. **17.** Processus frontal, détail. **18.** Dernier urosomite et rames caudales, vue dorsale.

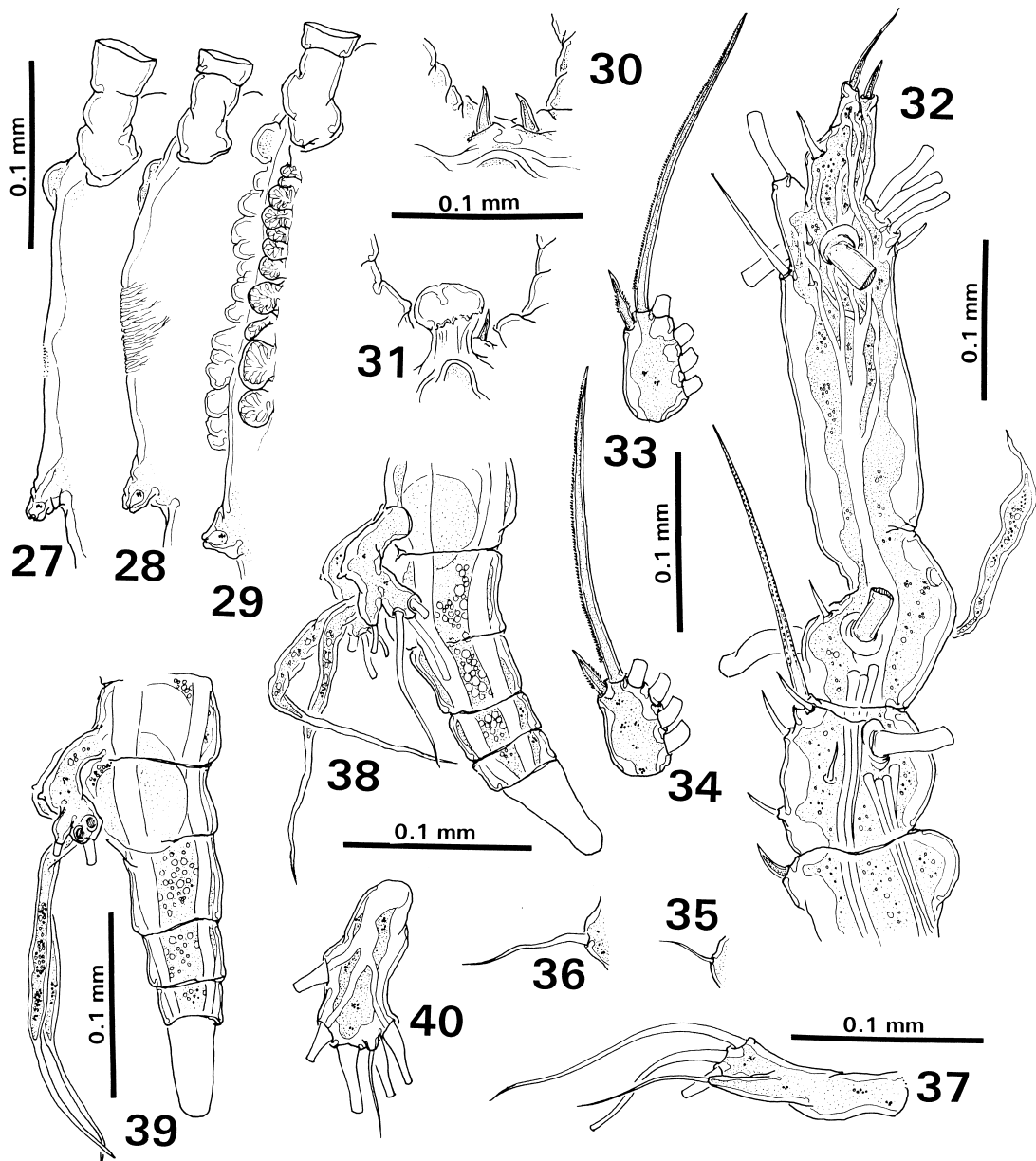
legs 1, 2, and 4, that on leg 3 setulate and at least 3 times

35, 36). First two endopodal segments of legs 1-4 with short, stiff, hair-like setules along inner margin, present on



Figures 19-26. *Monstrilla inserta*. Adult female from Curaçao. 19. urosome, dorsal. 20. urosome, ventral. 21. urosome, lateral (setae omitted from leg 5). 22. fifth leg and bases of ovigerous spines, ventral. 23. leg 4, dorsal. 24. leg 2, dorsal. 25. leg 3, anterior. 26. fifth leg showing complete setae. Most setae cut short in Figs 22-25.

Figures 19-26. *Monstrilla inserta*. Femelle adulte de Curaçao. 19. Urosome, vue dorsale. 20. Urosome, vue ventrale. 21. Urosome, vue latérale (soies de la patte 5 omises). 22. Pattes 5 et bases des épines ovigères, vue ventrale. 23. Patte 4, vue dorsale. 24. Patte 2, vue dorsale. 25. Patte 3, vue antérieure. 26. Patte 5 montrant les soies entières. La plupart des soies sont coupées dans les figures 22-25.



Figures 27-40. *Monstrilla inserta*. Lectotypic adult female specimens from the Siboga Expedition. **27.** anterior ventral ornamentation of paralectotype. **28.** same of lectotype. **29.** same of peculiar paralectotype. **30.** interantennular processes of lectotype, ventral view. **31.** same of peculiar paralectotype. **32.** right antennule of lectotype, dorsal view. **33.** distal segment of exopod of leg 3, lectotype specimen. **34.** same of leg 4. **35.** outer basipodal seta of leg 1. **36.** same of leg 3. **37.** fifth leg of lectotype. **38.** urosome of lectotype, lateral view. **39.** same of peculiar paralectotype. **40.** right caudal ramus of lectotype, dorsal view.

Figures 27-40. *Monstrilla inserta*. Spécimen de la série type, femelle adulte de l'expédition Siboga. **27.** Vues antérieure et ventrale de l'ornementation du paralectotype. **28.** Idem pour le lectotype. **29.** Idem pour le paralectotype particulier. **30.** Processus inter-antennulaire du lectotype, vue ventrale. **31.** Idem pour le paralectotype particulier. **32.** Antennule droite du lectotype, vue dorsale. **33.** Segment de l'exopodite de la patte 3 du lectotype. **34.** Idem pour la patte 4. **35.** Soie basipodale extérieure de la patte 1. **36.** Idem pour la patte 3. **37.** Cinquième patte du lectotype. **38.** Urosome du lectotype, vue latérale. **39.** Idem pour le paralectotype particulier. **40.** Rame caudale droite du lectotype, vue dorsale.

Curaçao specimens only. Terminal spiniform seta on exopods of legs 1-4 slightly curved, inner margin naked, outer margin with row of denticles (Figs 33, 34). First

exopodal segment of leg 2 with tuft of hairs near base of outer spine, present on Curaçao specimens only. Fifth legs biramous, noticeably elongated, separated at base (Fig. 22).

Exopodal lobe 4.8 times longer than wide, lobe armed with three long setae, these slightly plumose (Curaçao) or naked (type specimens), subequal in length and breadth, 1.3-2.1 times longer than bearing lobe (Figs 26, 37). Endopodal lobe slender, partially fused with exopodal lobe, shorter than it, with only one terminal, relatively short seta, almost of same length as exopodal lobe.

Urosome consisting of fifth pedigerous somite, genital double-somite, and two free abdominal somites. Urosome, including furcal rami, accounting for 21.4% of total body length. Ratio of lengths of fifth pedigerous somite, genital double somite, and free abdominal somites: 23: 49.5: 17.2: 9.5 (= 100). Genital double-somite comprising almost half of length of urosome (47.6%) (Figs 21, 38, 39), with dorsal suture at about midlength. Anterior ventral portion of genital double-somite moderately swollen, bearing basally separate ovigerous spines, latter slightly swollen along shaft, but slender distally, equal to 22% of total body length and extending slightly beyond caudal rami, those of Curaçao specimens being slightly longer (Figs 21, 38, 39). Caudal rami about 2.3 times longer than wide, not divergent, bearing six setae: two apical, one subapical median, one subapical lateral, one midlength lateral, and one dorsal, all slightly setulate (Figs 13, 18, 40). Dorsal seta shorter than caudal ramus; remaining setae wide-based, long; seta on distal outer margin slightly thicker than others. *Male*, unknown.

Remarks

These specimens from Curaçao are assigned to the genus *Monstrilla* owing to the presence of two free somites between the genital double somite and the caudal rami (Isaac, 1975). *Monstrilla inserta* was originally described from seven female specimens collected during the Siboga Expedition, in the Indo-Malayan Archipelago (Scott, 1909). The male is not known.

The original description is quite brief (Scott, 1909), and the type material had to be examined in order to determine the real status of the Curaçao material. The Curaçao specimens could be identified as *Monstrilla inserta* by the general proportions of the body, the relative length, general structure and armature of the peculiar antennule, and the close resemblance of the fifth legs with those of the type specimens, among other characters. At least three of the five specimens of *M. inserta* collected during the Siboga Expedition more than 95 years ago are in a good condition and allowed examination of the main taxonomic features for comparison. The other two specimens are damaged, with the urosome absent. The number of specimens found in the ZMA vial does not agree either with A. Scott (1909) (seven specimens) or with Grygier's (1995) summary of Scott's work (eight specimens). Apparently, there are two missing specimens of *M. inserta*, both would also belong to the

syntypic series and, except for the lectotype, all the seven original specimens mentioned by Scott (1909) must be considered also as paralectotypes according to art. 74 of the Code of Zoological Nomenclature. Due to the fact that the specimens of *M. inserta*, collected from three different Siboga Expedition stations including the one designated as the lectotype herein, were put together in the same vial, it is not possible to determine which station is the type locality. Before the lectotype was designated, all the three Siboga Expedition stations constituted the type locality (CZN, art. 73.2.3, 76.1). Selection of a lectotype fixes the type locality, but due to the mixing of specimens, the type locality will remain vague. Grygier (1995) erroneously noted Siboga station 182 as a locality for *M. inserta* and provided the geographic coordinates for this locality; the correct station number is 282, with different geographic data, as set out here in Locality of type material section.

Unfortunately, A. Scott did not designate a holotype from this original group of syntypic specimens. Hence, one of the specimens corresponding best to A. Scott's (1909) illustrations and description and preserved in a good condition, was selected to become the lectotype. The other four extant and the two lost individuals from the same original syntype series are here designated as paralectotypes. Having the type specimens and additional new material available, and considering the urgent need of upgraded redescrptions within the group (Suárez-Morales & Riccardi, 1997), this species has been fully redescrbed here.

There is an unconfirmed record of this species in the central Pacific area, supposedly collected during the last cruise of the "Carnegie" (Wilson, 1942). Wilson reported seven females of *Monstrilla inserta*, but he did not illustrate these copepods and the material is unavailable. Some illustrations of specimens identified as *M. inserta* were provided by Tanaka (1965) and Yamaji (1966) from material collected in Japan (Grygier, 1995).

Most spines and setae of the peculiar antennules of *M. inserta* can be identified easily in terms of Grygier and Ohtsuka's (1995) pattern. However, the distribution of armature in these antennules shows differences from the normal pattern due to the unusual elongation of the fused segments 3-4. This elongation seems to have resulted in the separation of setal group IV, which is adjacent to aesthetasc 4aes, from setal group V. In both cases setae are normally at the same level, inserted dorsally and ventrally respectively, opposite one another (Grygier & Ohtsuka, 1995). In *M. inserta*, the former setal group (with element IVv absent) plus aesthetasc 4aes remain at its "original" place, and the latter setal group is displaced to the distal portion of the segment, joining the b₁₋₃ setal group, which is always on the terminal part of the antennule. The peculiar elongation of this segment results in a polarized concentration of elements on both its distal and proximal thirds. However, this pattern

seems to be not exclusive of this species but present in at least another species (Suárez-Morales, pers. obs.). Therefore, the unusual structure and the setation pattern of this species seem to be distinctive characters useful for separating two species from all other species of *Monstrilla*. Despite this, the antennular structure was only briefly mentioned by A. Scott (1909) and by other authors. The unusual development of seta $2v_3$ is shared with only one other species of *Monstrilla* (Suárez-Morales, unpublished.).

Monstrilla inserta has other important distinctive characters. The presence of a ventral keel on the rostral area with ornamentations on the anterior portion of the cephalothorax was not mentioned in the original description (A. Scott, 1909), nor in later works (Tanaka, 1965; Yamaji, 1973). The same kind of cuticular structure is present in a few other monstrillids of the same genus, viz *M. barbata* Suárez-Morales & Gasca-Serrano, 1992 and *M. brevicornis* Isaac, 1974. However, the cephalic keel is distinctly built in these other two species, as a large naked process with irregular edges (Suárez-Morales & Gasca-Serrano, 1992; Isaac, 1974), whereas it is a simple, subtriangular to rounded, pilose or naked process in *M. inserta*. This is the only resemblance of *M. inserta* with *M. barbata* and *M. brevicornis*, which otherwise differ strongly in the structure and armature of the antennules and of the fifth legs. A distinctive keel is another strong character for identifying this species. There is a wide range of variation in the ornamentation pattern in the region between the cephalic keel and the oral papilla (see Figs 14, 27-29) in *M. inserta*.

The structure of the fifth legs of *M. inserta*, with two slender lobes, and with three setae on the exopodal lobe and one on the endopodal lobe is shared with some other species of *Monstrilla*: *M. longicornis* Thompson, 1890; *M. longiremis* Giesbrecht, 1892a; *M. clavata* Sars, 1921. However, the structure of the fifth legs in these species is quite different, the endopodal lobe being little more than a proximal protuberance of the outer lobe (Sars, 1921; Isaac, 1975). In these three species, one of the setae of the outer lobe is noticeably smaller than the other two, whereas the three are subequal in *M. inserta*. A. Scott (1909) accorded great importance to the morphology of the fifth leg and used it to separate *M. inserta* from *M. grandis* Giesbrecht, 1891, with two setae on the inner lobe.

The relatively deep and extended dorsal suture on the genital double-somite of *M. inserta* was also noticed by A. Scott (1909). It shares this feature with several other species of the genus, such as *M. longicornis*, *M. gracilicauda* Giesbrecht, 1892a, and *M. longiremis* (see Sars, 1921; Isaac, 1975).

A comparison of the length of the Curaçao specimens of *M. inserta* with A. Scott's (1909) data shows some differences. The total length of *M. inserta* female reported by Scott is 3.4 mm, including the antennules; excluding

them, the lectotype and the two best-preserved paralectotypes measured 2.7, 2.6, and 2.9 mm, respectively. They are thus slightly larger than the Curaçao specimens. Length variations of about the same extent have been reported in several species of *Monstrilla* (Isaac, 1975).

Slight differences were found between the two Curaçao specimens in size and morphology of the genital double-somite. In one specimen, the width of this somite is reduced abruptly to one-third length (Fig. 19), whereas the somite tapers more or less gradually in the other (Fig. 20). Some morphological variation may be expected when surveying specimens from different localities, and even from the same locality (Suárez-Morales & Gasca, 1998). These variations do not necessarily imply distinct taxa. In the case of *M. inserta*, intraspecific variation is slight in the taxonomically relevant features, but strong in other structures such as the cuticular ornamentation, the taxonomic value of which has not been fully evaluated.

Until now, ten species of *Monstrilla* are known to occur in the Tropical Northwestern Atlantic (Suárez-Morales & Gasca, 1998; Grygier, 1995): *M. floridana* Davis, 1949, *M. reticulata* Davis, 1949, *M. grandis* Giesbrecht, 1891, *M. rugosa* Davis, 1947, *M. rebis* Suárez-Morales, 1993, *M. mariaeugeniae* Suárez-Morales & Islas-Landeros, 1993, *M. reidae* Suárez-Morales, 1993, *M. barbata* Suárez-Morales & Gasca, 1992, and *M. elongata* Suárez-Morales, 1994b, and now *M. inserta*. After the records of *M. grandis* from Puerto Rico and Barbados and of *Monstrilla* sp. from Venezuela (Fish, 1962; Nutt & Yeaman, 1975), *M. inserta* represents the fourth record of the genus in the Eastern Caribbean Sea.

The Indo-Malayan area is one of the most diverse zones for Monstrilloidea (see Suárez-Morales, 2000), as it is also for other zooplanktonic groups. About 80% of the recent distributional patterns of meroplanktonic taxa indicate an Indo-Malayan origin (Van der Spoel, 1996). At least two Asian species of *Monstrilla*, one from the Philippines, *M. elongata* Suárez-Morales, 1994 (Suárez-Morales, 2000), and the other, *M. inserta* from the Indo-Malayan area, have been recently found in the Caribbean. This fact seems to be related to old dispersion events originating in southeastern Asia, the area thought to be the main tropical biodiversity centre for zooplankton (Van der Spoel, 1996). These events seem to be relatively recent, taking place after the great extinction of planktonic species at the border between the Cenozoic and the Mesozoic (65 m.y.). In the Late Eocene (35 m.y.), the India-Indo-Malayan area had favourable conditions for development of diverse planktonic faunas, and due to these conditions, most holoplanktic taxa survived the extinction. During the Paleocene and Eocene (30 m.y.), this stock dispersed by several routes and preserved a meroplanktic life cycle, strongly linked with neritic areas (Van der Spoel, 1983). Van der Spoel (1996) stated that

medusae with a sessile stage could have their dispersion limited by deep oceans, and he described the main dispersal trends connecting Asia and the Caribbean through Pacific (Panama) passages. Having an equivalent meroplanktonic life cycle, with a dependence upon benthic stages (their hosts), and with short-term dispersal capabilities, some Asian monstrilloid copepods could have colonized the Caribbean via similar routes. Another comparable theory is that of Kubota (1987) suggesting a direct Tethyan influence on the distribution of some Asian medusae associated with bivalves and distributed in the Caribbean area.

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