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A new asterocherid genus (Copepoda: Siphonostomatoida) associated with *Callyspongia* Duchassaing & Michelotti and reassessment of six species of *Asterocheres* Boeck

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Abstract

The family Asterocheridae Giesbrecht has several genera associated with sponges including *Asterocheres* Boeck, 1859. The type genus is commonly found in sponges but it is also recorded in echinoderms, bryozoans, and corals. A revision of the diagnosis of *Asterocheres* conducted in 2010 was the beginning of a reorganization process, culminating in the present status of 63 valid species. This study describes a new species and genus of the Asterocheridae. *Neoasterocheres* **gen. nov.** shares many characteristics with *Asterocheres sensu stricto*, except for the antennule segmentation which shows ancestral segments IX–XII fused to segment XIII. The new species of *Neoasterocheres* **gen. nov.** was found in association with the sponge *Callyspongia* sp. sampled at the Yatch Club Bay, located in Todos-os-Santos Bay, Salvador city, Bahia State, Brazil. A revision of the *Asterocheres sensu stricto* indicates that *A. enewetakensis* Humes, 1997, *A. dysideae* Humes, 1996b, *A. humesi* Varela, 2012, *A. rotundus* Malt, 1991, *A. scutatus* Stock, 1966, and *A. serrulatus* (Humes, 1996a) share this fusion and therefore should be transferred to the new genus. A redescription of *Neoasterocheres serrulatus* n. comb. is also provided, based on the examination of type specimens.

Key words: associated copepod, Porifera, Siphonostomatoida, Asterocheridae

Introduction

The order Siphonostomatoida Thorell is composed almost entirely by symbiotic copepods associated with several other organisms (Boxshall & Halsey 2004; Johnsson & Neves 2012). Siphonostomatoid copepods can be classified according to the host type in two distinct groups: those found on vertebrates (mainly fishes) or on invertebrates (Ahyong *et al.* 2011). For some invertebrate hosts the most adequate term is "associate" due to absence of conclusive studies about the relationship between both groups. Actually, there are about 2459 described siphonostomatoid copepods belonging to 41 families, with approximately 40% of these species associated with invertebrates (Ahyong *et al.* 2011; Johnsson & Neves 2012). Members of the phylum Porifera are frequent hosts to copepods because they provide adequate microhabitats (Magnino *et al*. 1999; Mariani & Uriz 2001). The family Asterocheridae Giesbrecht, 1899 has several species associated with sponges mainly belonging to its type-genus *Asterocheres* Boeck, 1859. This genus is recognized by its possession of many plesiomorphic diagnostic characteristics, thus becoming a repository for many species. Kim (2010) redefined the diagnosis of the genus, focusing mainly on the leg setation and the antennule segmentation. He established and defined the genus characters which resulting in a restriction of the number of species. Subsequently, numerous taxonomic revisions and new descriptions of species of *Asterocheres* were published (Crescenti *et al.* 2010; Varela 2010, 2012; Conradi & Bandera 2011; Bandera & Conradi 2013; Kim & Min 2013; Bandera & Conradi 2014; Bahia *et al.* 2012). Consequently, the current number of valid species in *Asterocheres* is 63. The present study describes a new genus and transfers six species that were previously assigned to *Asterocheres*, to the new genus.

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Material and methods

Sampling was carried out at Yacht Club Bay (12º59'975''S, 38º31'851''W), located in Todos-os-Santos Bay, Salvador city, in Bahia State, Brazil, on November 25th, 2014 (Fig. 1). The sponge's colonies were collected and immediately placed in individual plastic bags. The samples were washed and filtered through a 100 µm plankton net, transferred to a petri dish filled with ethanol, and sorted for copepods under a dissecting microscope.

The paratype was cleared in lactic acid, measured, and the body was drawn before being stained in Chlorazol Black E. Then it was dissected and mounted permanently in CMC-9® (Masters Chemical Company, Inc.) mounting media. All drawings were made with the aid of a drawing tube fitted on an Olympus CH30 microscope. For the antennule formula Roman numerals indicate the ancestral segments followed by the number of setae in Arabic numerals. For the armature formula of legs 1−4, Roman numerals represent spines and Arabic numerals indicate setae (Huys & Boxshall 1991).

The specimen studied was deposited in the Museu de Zoologia da Universidade Federal da Bahia (UFBA).

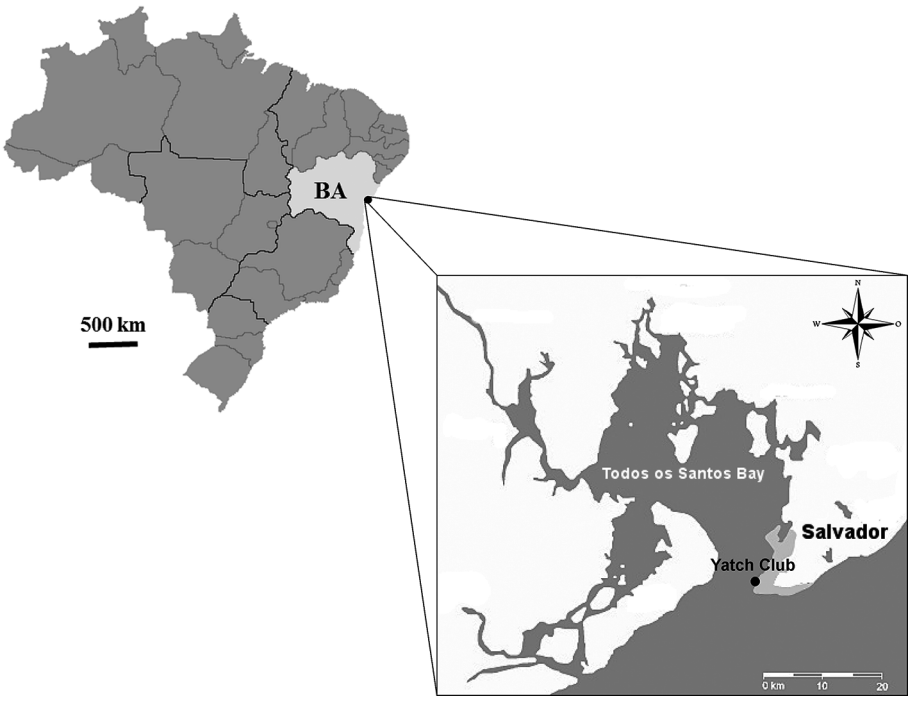

FIGURE 1. Location of the collection site at Yatch Club, Bahia (BA), Brazil (modified from Canário *et al.*, 2012).

Taxonomy

Order Siphonostomatoida Burmeister, 1835

Family Asterocheridae Giesbrecht, 1899

Neoasterocheres gen. nov.

Diagnosis. Asterocheridae. Body dorsoventrally flattened. Prosome ovoid or discoid, urosome cylindrical and 4-segmented in female. Antennule of female basically 19-segmented with large aesthetasc on 17th segment; ancestral segments IX–XIII fused; distal 3 segments frequently fused to become 1 or 2 segments. Antenna with 1-segmented exopod and 3-segmented endopod bearing distal claw. Oral cone short or elongated, siphon-like. Mandible consisting of stylet and 1- or 2-segmented palp bearing two distal setae. Maxillule bilobed. Maxilla 2-segmented; distal segment forming curved claw. Maxilliped with 6-segmented. Legs 1–4 with 3-segmented exopod and endopod. Free segment of leg 5 with 2 or 3 setae.

Remarks. Kim (2010) proposed a new definition for *Asterocheres*, with the main diagnostics characters

related to leg setation and number of antennule segments posteriorly to aesthetasc. Thus, the author restricted the number of valid species in *Asterocheres* and many species were considered as *species inquirendae*. Since then, new species of *Asterocheres* were described (Crescenti *et al.* 2010; Varela 2010, 2012; Kim & Min 2013) and redescriptions were published (Conradi & Bandera 2011; Bandera & Conradi 2013; Bandera & Conradi 2014). Although the new species being described shows the leg setation established by Kim for *Asterocheres*, the antennule segmentation highlights a relevant difference in the fusion pattern. *Neoasterocheres* **gen. nov.** can be distinguished from *Asterocheres* by having the fusion of antennule ancestral segments IX–XIII resulting in the aesthetasc located on the 17th segment, with 3 distal segments frequently fused to become 1 or 2. Kim (2010) stated that the female antennule is basically 21-segmented because depending on the existence of distal fusions the amount of segments can be reduced to 19, however these fusions occurs between the last 3 segments, which are posterior to ancestral segment XXI. When Kim (2010) established that the aesthetasc is located on segment 18 in *Asterocheres*, the author excluded the possibility of occurrence of other additional fusions previous to the 18th segment, and disregarded the existence of species presenting fusions of additional ancestral segments.

According to Huys & Boxshall (1991) on the ancestral pattern of a siphonostome antennule, segment XXI is characterized by the presence of an aesthetasc additional to the maximum armature of two setae found in an unfused segment. Therefore, the authors highlighted the presence of a group of setae on ancestral segment IX, thus indicating a fusion involving at least segments IX–XII. This is expressed in a maximum of 8 setae present on the segment and the existence of eight free single segments between this compound segment (IX–XII) and the one bearing the aesthetasc (XXI). The presence of less than eight free segments between these two landmarks indicates the occurrence of further fusions in the section. Besides that, a spine is commonly present on ancestral segment XIV, and may constitute another relevant landmark. In *Asterocheres* we found a segment between the compound segment (IX–XII) and the segment bearing a spine (XIV), thus indicating that ancestral XIII segment is free. In the new genus the segment with a spine (XIV) is close to the compound segment (IX–XII). The ancestral segment XIII is not free, it is fused with the previous segment (IX–XII). This pattern can be confirmed by the existence of only seven free segments between the original IX–XII and the XXI, and by the absence of any double segment between these two landmarks, which would be indicated by the presence of four setae and a segment with a length twice its regular size.

In addition, the new genus shows characters that differ from the remaining asterocherid genera. *Bythocheres* Humes, 1998, *Cheramomyzon* Humes, 1989, *Collocheres* Canu, 1893, *Collocherides* Stock, 1971, *Dermatomyzon* Claus, 1889, *Discopontius* Nicholls, 1944, *Gerulusosacculus* Ivanenko & Defaye, 2004, *Glyptocheres* Humes, 1987, *Ophiurocheres* Humes, 1998, *Meandromyzon* Stock, 1989, *Rhyncomyzon* Giesbrecht, 1895 and *Thermocheres* Kim, 2010 share an urosomite with 3 post-genital urosomites in the female (Claus 1889; Canu 1893; Giesbrecht 1895; Nicholls 1944; Stock 1971, 1989; Humes 1987, 1988, 1989, 1998; Ivanenko & Defaye 2004; Kim 2010) instead of two as observed in the new genus. The tergites of the third pedigerous somite are not expanded posteriorly over rest of prosome in *Neoasterocheres* **gen. nov.** as it is seen in *Phyllocheres* (Humes 1996b). Both *Discopontius* Nicholls, 1944 and *Meandromyzon coronatum* Stock, 1989 have 2 post-genital segments like *Neoasterocheres* n. gen., but *Discopontius* has a 2-segmented P4 endopod and *M. coronatum* has a 1-segmented mandibular palp, both characters diverging from those observed in *Neoasterocheres* n. sp. (Nicholls 1944, Stock 1989).

Chelacheres has a claw-like element distally on the antennary endopod (Stock & Humes 1995), which is absent in the new genus. *Neoasterocheres* **gen. nov.** differs from *Cephalocheres* Kim, 2010, *Humesimyzon* Kim, 2010 and *Mimacheres* Leigh-Sharpe, 1934 once it does not show reduction or absence of the antennary exopod to a single seta (Leigh-Sharpe 1934; Kim 2010) or the 2-segmented condition as described in *Humescheres* Kim, 2005 (Kim 2005). The mandibular palp is 1-segmented or absent in *Asteropontella* Stock, 1989, *Asteropontius* Thompson & Scott, 1903, *Asteropontopsis* Stock, 1987, *Gascardama* Kim, 2010, *Hetairosyna* Humes, 1991, *Hetairosynopsis* Humes, 1996 and *Stenomyzon* Kim, 2010 (Thompson & Scott 1903; Stock 1987, 1989; Humes 1991, 1996a; Kim 2010) and 2-segmented with 1 seta in *Parasterocheres* Humes, 1996 (Humes 1996b) while a 2-segmented palp with 2 distal setae is found in *Neoasterocheres* **gen. nov.** *Hetairosynella* Kim, 2010 possesses five setae on the inner maxillulary lobe (Kim 2010) instead of four as in *Neoasterocheres* n. gen. *Stockmyzon* Bandera & Huys, 2008 shows a five-segmented maxilliped (Bandera & Huys 2008) differencing from *Neoasterocheres* **gen. nov.** The new genus can also be distinguished by its possession of a biramous P4 with 3-segmented exopod and endopod. This condition diverges from *Cletopontius* Thompson & Scott, 1903, *Cyclocheres* Kim, 2010,

Cystomyzon Stock, 1981, *Discopontius* Nicholls, 1944, *Kolocheres* Johnsson, 1999, *Obesiella* Ridewood, 1903, *Oedomyzon* Stock, 1981, *Peltomyzon* Stock, 1975, *Siphonopontius* Malt, 1991 and *Tuphacheres* Stock, 1965 (Ridewood 1903; Thompson & Scott 1903; Nicholls 1944; Stock 1965, 1975a, 1981; Malt 1991; Johnsson 1999a; Kim 2010). In addition, *Neoasterocheres* **gen. nov.** has two inner setae on the second endopodal segments of all legs, thus diverging from *Cecidomyzon* Stock, 1981, *Gomumucheres* Humes, 1996, *Hermacheres* Stock, 1987, *Indomyzon* Ummerkutty, 1966, *Inermocheres* Boxshall, 1990, *Onychocheres* Stock & Gooding, 1986, *Psilomyzon* Stock, 1965, *Scottocheres* Giesbrecht, 1897, *Sinopontius* Giesbrecht, 1897 and *Tychomyzon* Humes, 1991, all with the second endopodal segments of at least one leg armed with one inner seta (Giesbrecht 1897; Ummerkutty 1966; Stock & Gooding 1986; Boxshall 1990; Humes 1991, 1996b; Stock, 1965, 1975a, 1981, 1987). *Neoasterocheres* **gen. nov.** differs from *Acontiophorus* Brady, 1880, *Asterocheroides* Malt, 1991, *Asteropontoides* Stock, 1975, *Hammatimyzon* Stock, 1981, *Mesocheres* Norman & Scott, 1905, *Orecturus* Humes, 1992, *Paracontiophorus* Eiselt, 1961 and *Parasteropontius* Johnsson, 1999 by carrying five elements on the third endopodal segment of leg 4 (Brady 1880; Norman & Scott 1905; Eiselt 1961; Stock 1975b, 1981; Malt 1991; Humes 1992; Johnsson 1999b). *Laperocheres* Ivanenko, 1999 lacks an inner seta on the first exopodal segment of legs 1–4 (Ivanenko 1999) while these setae are present in *Neoasterocheres* **gen. nov.** *Neoasterocheres* **gen. nov.** can be distinguished from *Monocheres* Stock, 1966 by the presence of a free one-segment of leg 5 (Stock 1966a) and additionally differs from *Doropontius* Thompson & Scott, 1903 which possess a two-segmented leg 5 (Thompson & Scott 1903).

Further, some of the species treated as valid *Asterocheres* by Kim (2010) share the antennulary fusion pattern herein defined as belonging to *Neoasterocheres* **gen. nov.** So, we propose that six species, i.e., *A. enewetakensis* Humes, 1997, *A. dysideae* Humes, 1996, *A. rotundus* Malt, 1991, *A. scutatus* Stock, 1966 and *A. serrulatus* (Humes, 1996) are transferred to the new genus. *Asterocheres humesi* Varela, 2012 was described posteriorly to Kim´s work and also have this fusion pattern in the antennule (Varela 2012) and should be in *Neoasterocheres* **gen. nov.**

Etymology. The name '*Neoasterocheres*' is a combination of 'neo' (from the Greek adjective meaning 'new') and *Asterocheres*, referring to the similarities between the new genus and its congener.

Type species by original designation: *Neoasterocheres breviseta* sp. nov.

Other species:
N. enewetakensis (Humes 1997) comb. nov.
N. dysideae (Humes 1996) comb. nov.
N. humesi (Varela 2012) comb. nov.
N. rotundus (Malt 1991) comb. nov.
N. scutatus (Stock 1966) comb. nov.
N. serrulatus (Humes 1996) comb. nov.

***Neoasterocheres breviseta* sp. nov.**
(Figs. 2–3)

Material examined. Holotype female (UFBA 3178) and paratype female (UFBA 3179), Yacht Club Bay (12°59'975''S, 38°31'851''W), located in Todos-os-Santos Bay, Salvador city, in Bahia State, Brazil, on November 25th, 2014. All specimens were found associated with *Callyspongia* sp.

Description of the female. Mean body length (excluding caudal setae) 393 µm and mean body width 202 µm. Body (Fig. 2A) cyclopiform with prosome slightly enlarged and dorso-ventrally flattened; urosome cylindrical. Pedigerous somite 1 completely fused to cephalosome to form cephalothorax with pointed epimera. Pedigerous somite 2 with slightly pointed epimera. Pedigerous somites 3 and 4 with rounded epimera.

Prosome 253 µm long and 200 µm width. Length: width ratio = 1.2:1. Prosome: urosome ratio of length 1.4:1. Urosome (Fig. 2B) 4-segmented. Genital double-somite 72 µm long, maximum width 50 µm, length: width ratio = 1.5:1, rounded anterolaterally, with posterior epimera pointed. Two postgenital somites, both wider than long (25 × 31 µm, 18 × 31 µm, respectively), length: width ratio 0.8:1 and 0.6:1 respectively, lateral margins naked, with pointed epimera. Caudal rami slightly longer than wide, 17 × 12 µm armed with six setae (seta I absent); setae II, VI and VII naked and setae III, IV and V plumose.

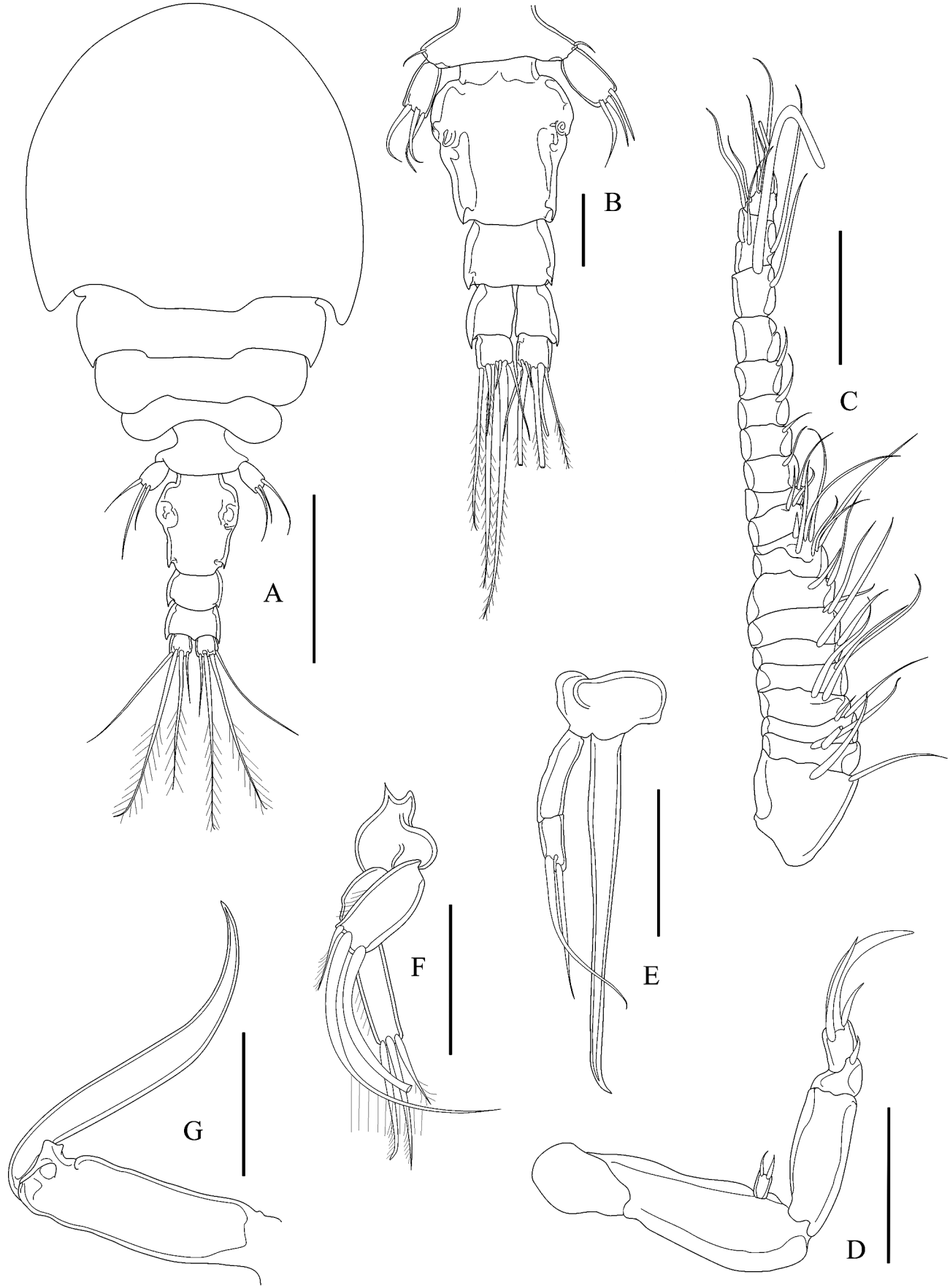

FIGURE 2. *Neoasterocheres breviseta* n. sp., female (paratype: UFBA 3179). A, habitus, dorsal view; B, urosome; C, antennule; D, antenna; E, mandible; F, maxillule; G, maxilla. Scale bars: A = 100 µm; B–G = 25 µm.

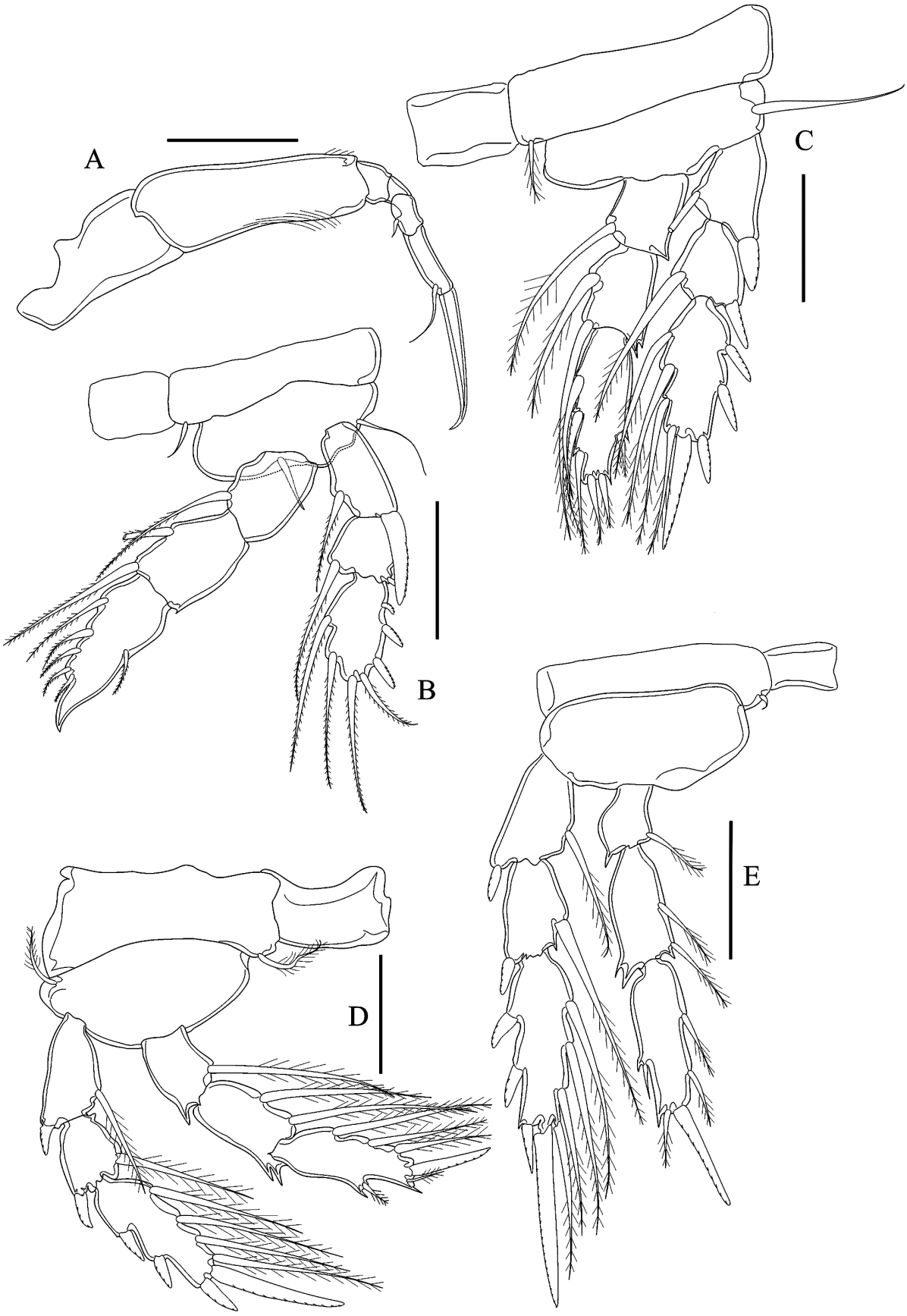

FIGURE 3. *Neoasterocheres breviseta* **n. sp.**, female (paratype: UFBA 3179). A, maxilliped; B, leg 1; C, leg 2; D, leg 3; E, leg 4. Scale bars: A–E = 25 µm.

Antennule (Fig. 2C) 125 µm long (not including apical setae), 19-segmented. Length of segments: 19, 8, 3, 6, 4, 4, 5, 6, 6, 5, 3, 7, 6, 5, 6, 8, 9, 10 and 4 µm, respectively. Segmental homologies and armature as follows: 1(I)-2; 2(II)-2; 3(III)-2; 4(IV)-2; 5(V)-1; 6(VI)-2; 7(VII)-2; 8(VIII)-2; 9(IX–XIII)-7; 10(XIV)-2; 11(XV)-2; 12(XVI)-1; 13(XVII)-1; 14(XVIII)-1; 15(XIX)-1; 16(XX)-0; 17(XXI)-1+ae; 18(XXII–XXV)-3; 19(XXVI–XXVIII)-5; all setae smooth. Aesthetasc 45 µm long. Segments 9 and 18 with marks indicating fusions of ancestral segments IX–XII and XIII and XXII–XXIII and XXIV–XXV.

Antenna (Fig. 2D) 97 µm long (including distal claw), with basis 16 µm long and totally naked. Exopod 1-segmented, 4 µm long with two short apical setae. Endopod 3-segmented, first segment 21 µm long, unarmed; second segment 6 µm long, armed with small distal naked seta; third segment 7 µm long with two setae, one distal and other subdistal near curved claw (25 µm long).

Oral cone 88 µm long, reaching to maxillipedal basis. Mandible (Fig. 2E) with slender 2-segmented palp; measuring 16 and 10 µm long, respectively; second segment with two distal smooth setae. Mandibular stylet 66 µm long, proximally stout, tapering distally into a narrow sharpened ending.

Maxillule (Fig. 2F) bilobed; both lobes armed with three setae and with row of setules on inner margins. Inner lobe, 23 µm long armed with short, distally plumose setae. Outer lobe 15 µm long with two long setae and a shorter one. Maxilla (Fig. 2G) 180 µm long, consisting of syncoxa and long curved claw, with 42 and 138 µm long, respectively.

Maxilliped (Fig. 3A) 6-segmented, 107 µm long; syncoxa 30 µm long, unarmed; basis 45 µm long with long setules on inner margin and few setules on distal outer margin. Endopod 4-segmented, segments measuring 7; 4; 8 and 13 µm, respectively; first and second segment unarmed; third segment with small seta medially; fourth segment with distal seta near straight claw-like element distally curved, 26 µm long.

Legs 1–4 (Figs. 3B–E) biramous, with 3-segmented rami. Armature formula as follows:

	coxa	basis	exopod	endopod
Leg 1	0-1	1-1	I-1; I-1; III,2,2	0-1; 0-2; 1-5
Leg 2	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,2,3
Leg 3	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,1+I,3
Leg 4	0-1	0-0	I-1; I-1; III,I,4	0-1; 0-2;1,1+I,2

Spine of first exopodal segment of leg 1 longer than others, reaching beyond insertion of first spine of third exopodal segment. Distal inner margin of third endopodal segment with long tooth, setation 1–5 (Fig. 3B). Second endopodal segments of legs 2–4 with lateral margin bifurcate. Coxa of leg 4 with very small naked seta, basis of leg 4 unarmed. Outer setae and distal setae of third endopodal segments of all swimming legs reduced in size.

Fifth leg (Fig. 2B) with free segment armed with three smooth setae. Fifth pedigerous somite with small seta near insertion of free segment.

Male. unknown.

Type locality. Yacht Club Bay (12º59'975''S, 38º31'851''W), located in Todos-os-Santos Bay, Salvador city, in Bahia State, Brazil.

Etymology. The specific name '*breviseta'* is a combination of Latin words 'brevis' (= short) and 'seta' (= bristle), referring to the small size of the endopodal setae of the third endopodal segments of legs 1–4.

Discussion. *Neoasterocheres breviseta* **sp. nov.** has 19-segmented antennule as its congeners but can be distinguished from *N. dysidea*, *N. eniwetakensis*, *N. humesi, N. rotundus* and *N. serrulatus* by having of a 6-segmented maxilliped, thus diverging from the 5-segmented condition found in these other species (Malt 1991; Humes 1996a, 1996b, 1997; Varela 2012). In addition, *N. breviseta* sp. nov. differs from *N. scutatus* by having 3 setae on both maxillary lobes instead 4 as observed in both maxillary lobes of *N. scutatus* (Stock 1966b). The reduced size of the setae of the third endopodal segment of legs 1–4 and the reduction of the body length are also other unique features of the new species. *Neoasterocheres breviseta* sp. nov. has body length of less than 400 µm, clearly the smallest species of the genus; the body size of its congeners is over 720 µm (as in *N. humesi*).

***Neoasterocheres serrulatus* (Humes, 1996) n. comb.**
(Figs. 4–5)

Madacheres serrulatus Humes, 1996
Asterocheres serrulatus (Humes, 1996)

Material examined. Female holotype (USNM 268463), in 2m, associated with *Galaxea fascicularis* (L.), west of Pte. Mahatsinjo, Nosy Bé, northwestern Madagascar, January 31th 1964.

Description of the female. Body length (excluding caudal setae) 1147 µm, width 853 µm. Body cyclopiform (Fig. 4A), prosome slightly wider than long with sensiles on dorsal surface, urosome cylindrical. First pedigerous somite completely fused to cephalosome to form cephalothorax and showing epimera projected. Pedigerous somite 2 to 4 with rounded epimera and gradually reducing on width. Pedigerous somite 4 partially overlapped by third somite, almost entirely covering fifth pedigerous somite. Prosome length: width ratio = 0.9:1. Prosome: urosome ratio of length = 1.8:1.

Urosome (Fig. 4B) 4-segmented. Genital double-somite as long as wide, with widest portion located medially on region of genital pores. Genital apertures ventral, with two short setae, lateral margins with row of setules close to genital pores. First post-genital somite as long as wide. Anal somite 1.5 times wider than long. Both post-genital somites showing posterior margin serrated and lateral margins covered with setules. Caudal rami slightly longer than wide with posterior margin serrated and bearing tooth-like projection (Fig. 4C), armed with six setae, seta I absent, setae II to VII present. All setae plumose.

Antennule (Fig. 4D) 519 µm long (not including setae), 19-segmented. Length of segments: 50, 13, 17, 17, 10, 13, 10, 13, 13, 20, 23, 27, 47, 57, 47, 37, 67, 33 and 47 µm respectively. Segmental homologies and armature as follows: 1(I)-2; 2(II)-2; 3(III)-2; 4(IV)-2; 5(V)-2; 6(VI)-2; 7(VII)-2; 8(VIII)-2; 9(IX-XIII)-6; 10(XIV)-1+spine; 11(XV)-2; 12(XVI)-1; 13(XVII)-2; 14(XVIII)-2; 15(XIX)-1; 16(XX)-1; 17(XXI)-1+ae; 18(XXII–XXIII)-2; 19(XXVI–XXVIII)-6; all setae smooth. Aesthetasc 167 µm long.

Antenna (Fig. 4E) 290 µm long (including distal claw). Coxa and basis unarmed. Basis 84 µm long. Exopod one-segmented, 14 µm long, with two short apical and one lateral setae. Endopod 3-segmented, first segment 79 µm long, unarmed, with row of setules on outer margin; second segment 14 µm long, with medial naked seta; third segment 9 µm long, with two distal setae near thin claw distally curved (73 µm long).

Oral cone (Fig. 4A) 247 µm long, siphon-like, reaching to maxillipedal basis. Mandible (Fig. 4F) with slender 2-segmented palp; measuring 98 and 34 µm long, respectively, both with setules covering outer margins; second segment with two distal smooth setae. Mandibular stylet 229 µm long, proximally stout, tapering distally into a narrow sharpened ending.

Maxillule (Fig. 4G) bilobed; outer lobe, 40 µm long, armed with three smooth setae; inner lobe 107 µm long, armed with four distal smooth setae. Maxilla (Fig. 5A) 340 40 µm long, consisting of long and narrow syncoxa and long narrow curved claw, with 156 and 190 µm long, respectively.

Maxilliped (Fig. 5B) 5-segmented, 440 µm long; syncoxa 110 µm long, armed with inner smooth seta; basis 150 µm long, unarmed. Endopod three-segmented, segments measuring 8, 14 and 58 µm, respectively; each segment armed with one seta distally. Third segment with distal seta located close to straight claw-like element, 100 µm long.

Legs 1–4 (Fig. 5C–F) biramous, with 3-segmented rami. Armature formula as follows:

	Coxa	Basis	Exopod	Endopod
Leg 1	0-1	1-1	I-1; I-1; III,I+1,2	0-1; 0-2; 1,2,3
Leg 2	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,1+I,3
Leg 3	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,1+I,3
Leg 4	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,1+I,2

Spine of first exopodal segment of leg 1 reaching distal margin of second exopodal segment. Third exopodal segment of leg 1 armed distally with spine and seta. Third endopodal segment of legs 2 to 4 with seta and spine distally. Distal spine of third exopodal segment of leg 4 with setules on inner margin. Fifth leg (Fig. 5G) with free segment armed with two setae and rows of setules on lateral margins. Fifth pedigerous somite with single seta near insertion of free segment.

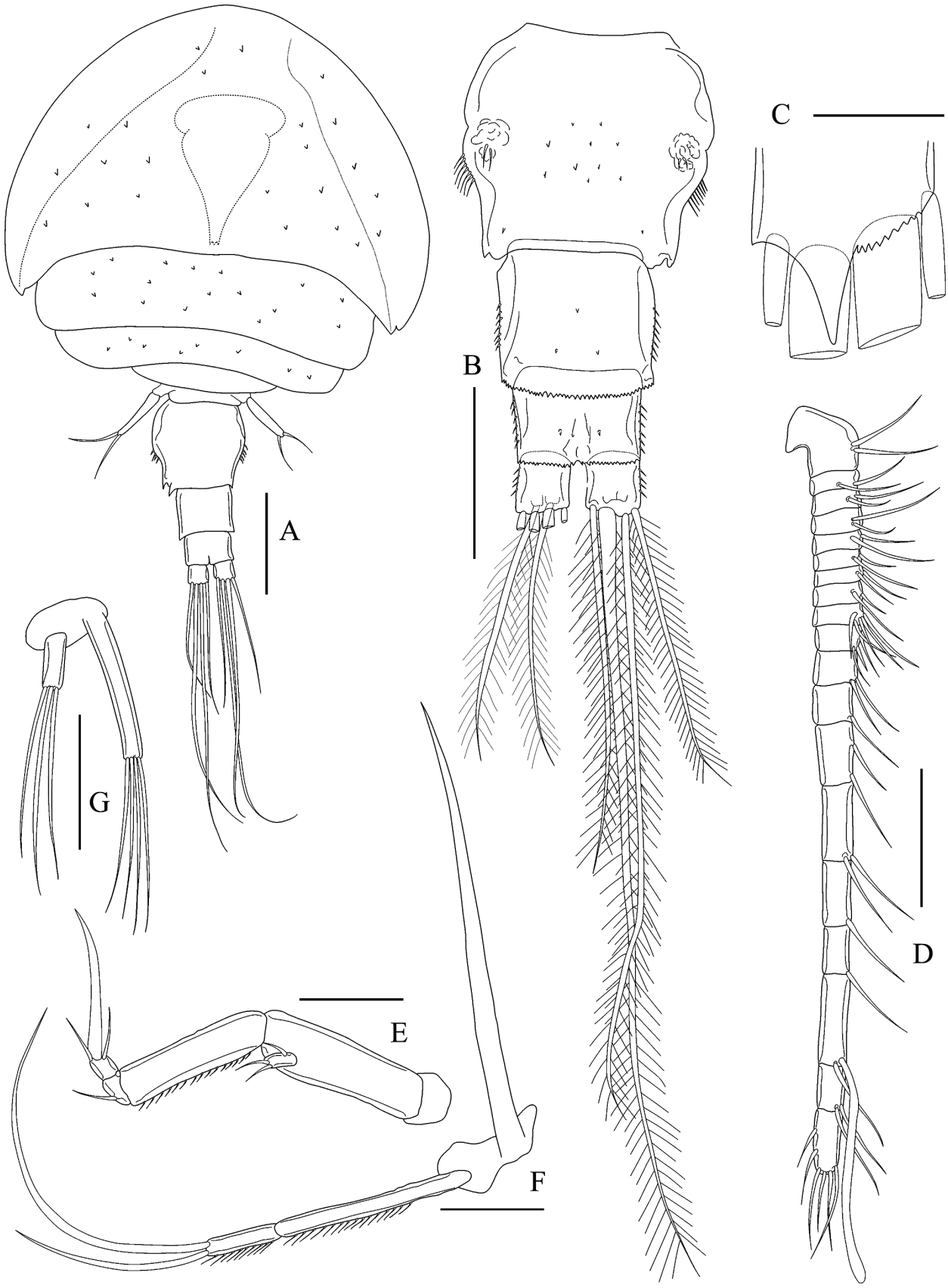

FIGURE 4. *Neoasterocheres serrulatus* (Humes, 1996) n. com., female (holotype: USNM 268463). A, habitus, dorsal view; B, urosome; C, left caudal rami, dorsal view; D, antennule; E, antenna; F, mandible; G, maxillule. Scale bars: A = 200 µm; B, D, G = 100 µm; C = 25 µm; E–F = 50 µm.

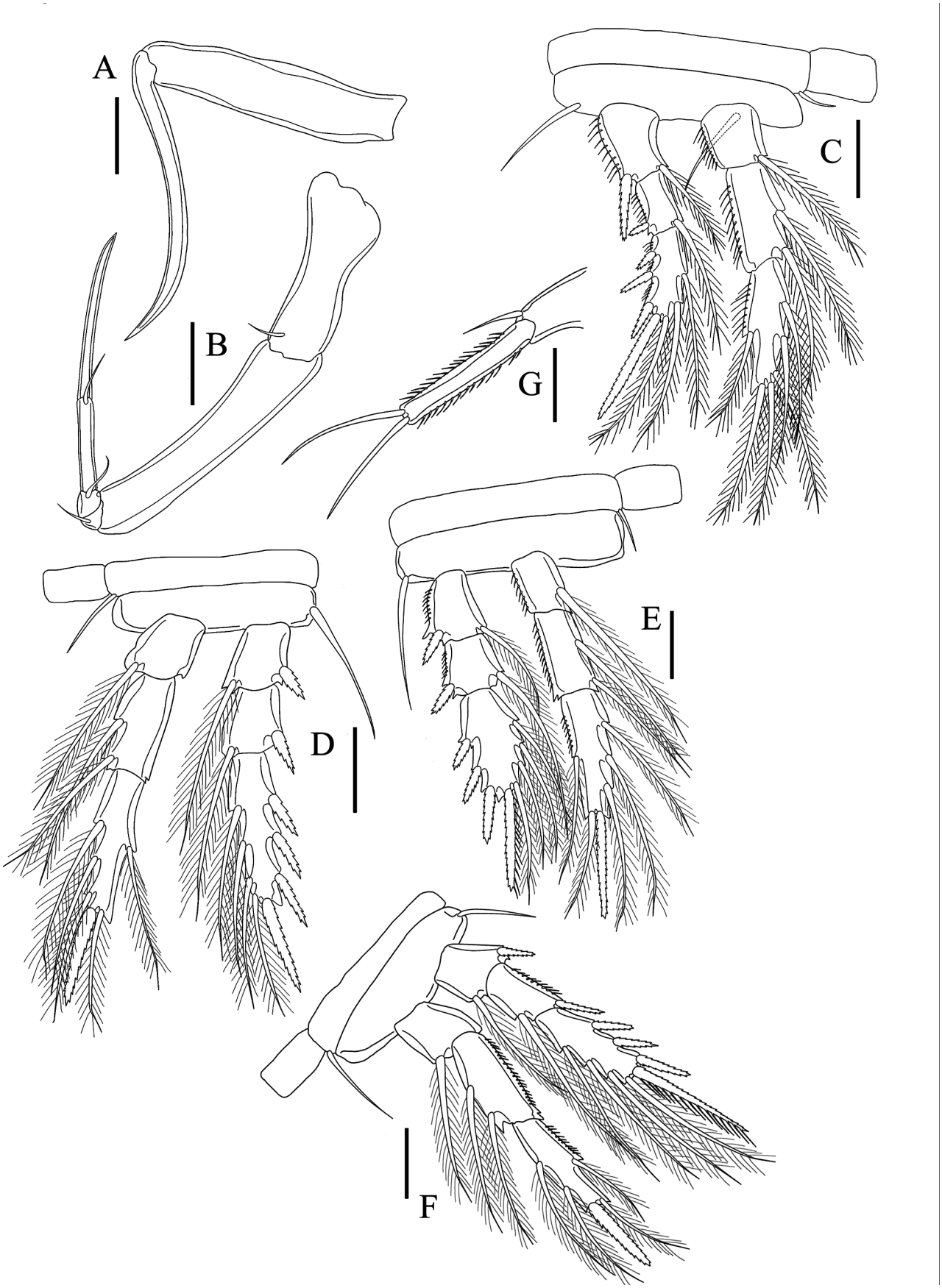

FIGURE 5. *Neoasterocheres serrulatus* (Humes, 1996) n. com., female (holotype: USNM 268463). A, maxilla; B, maxilliped; C, leg 1; D, leg 2; E, leg 3; F, leg 4; G, leg 5. Scale bars: A–G = 50 µm.

Male. Unknown.

Discussion. The redescription show some inconsistences between the characteristics observed here and the original description of *Neoasterocheres serrulatus* made by Humes (1996a). The first concerning the second endopodal segment of the antenna that has only a seta instead three cited by Humes (1996a). In the original description, Humes (1996a) mentioned the siphon reaching near insertion of leg 1, however the siphon is little short, reaching the maxilliped. The maxilliped possesses a seta on the coxa, not observed by Humes (1996a). Humes (1996a) also misinterpreted the maxilla when quoted a suture on the median portion of claw, which was not observed. Humes (1996a) described the third exopodal segment of leg 1 as having two distal setae instead a seta and a spine observed here. According Humes (1996a) the third segment of leg 2 has two setae on distal portion but this segment show a seta and a spine distally. Humes (1996a) depicted this species as possessing two terminal spines on third endopodal segments of legs 3 and 4. However, the reported armature setation for the swimming legs, these segments appeared as having a seta and a spine distally, a condition observed in this revision. Another difference observed regards the number of setae on leg 5, which has two setae instead three as described by Humes (1996a).

Among the major problems related previously with the original description of the genus by Humes (1996a) is the fact that the characters used to justify the status of *Madacheres* as a genus does not support it, because it is not possible to effectively differentiate *Madacheres* from *Neoasterocheres.* This situation has been observed by Ivanenko (1999) and confirmed by Kim (2010).

Distribution. *Neoasterocheres* **gen. nov.** is cosmopolitan, although restricted to the tropical region. Its members are known to occur in the Indian, Indo-Pacific and Atlantic Oceans. *Neoasterocheres enewetakensis*, *N. dysidea* and *N. rotundus* are recorded from the Marshall Island, Mollucas and Indonesia, respectively. *Neoasterocheres serrulatus* occurs in Madagascar and *N. scutatus* occurs in the Gulf of Aqaba, both in the Indian Ocean. Both *Neoasterocheres humesi* and *N. breviseta* n. sp. occur in the Western Atlantic Ocean, the first in the North Atlantic and the latter in the South Atlantic. It is not evident the existence of a biogeographic distributional pattern of the *Neoasterocheres* n. gen.

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