



Description of a new *Scottocheres* Giesbrecht, 1897 (Copepoda, Siphonostomatoida, Asterocheridae), including an emended diagnosis and key for the genus

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Abstract

The siphonostomatoid copepod genus *Scottocheres* was established by Giesbrecht in 1897 and now includes nine species. Consequently, these new species introduced new characteristics that must be considered to define the genus. This study provides an emended diagnosis of the genus, describes a new species, discusses the geographic distribution and hosts of the genus, and includes a key to the species. The new species was found associated with the sponge *Callyspongia* in Todos-os-Santos Bay and can be distinguished from its congeners by a set of characters that includes the presence of a unique seta on the inner margin of the second endopodal segment of legs 1 to 4 and only two spines on the outer margin of third endopodal element of leg 1.

Key words: associated copepod, biodiversity, Brazilian northeastern, sponges, taxonomy

Introduction

The genus *Scottocheres* was erected by Giesbrecht (1897) to accommodate the species *Acontiophorus elongatus* (Scott T and Scott A, 1894), previously assigned to *Acontiophorus*, Brady, 1880. However, the diagnosis for the new genus was only established by Giesbrecht (1899) two years later. After more than a century, a total of eight species have been described: *S. elongatus* (Scott T and Scott A, 1894), *S. longifurca* Giesbrecht, 1897, *S. stylifer* Giesbrecht, 1902, *S. gracilis* Hansen, 1923; *S. latus* Nicholls, 1944, *S. laubieri* Stock, 1967, *S. stocki* Malt, 1991, *S. youngi* Johnson, 2002 and *Scottocheres mipoensis* Kim, 2016. As a consequence of these new species, some of the defining characteristics have been slightly modified. Among others species, this occurred with *S. latus* and *S. stocki* regarding the number of segments of the antennule (Nicholls 1944, Malt 1991). Considering this situation, a revision of the diagnosis and an identification key to the genus are necessary.

Scottocheres is a cosmopolitan group recorded in the Mediterranean Sea, Pacific, Atlantic, and Antarctic Oceans. All identified hosts are sponges, except *S. gracilis*, *S. stylifer*, *S. latus*, and *S. longifurca*, which have non-informed hosts. There are, three species of *Scottocheres* registered along the Brazilian coast (Johnson & Neves 2012): *S. elongatus*, *S. laubieri*, and *S. youngi*. The latter is endemic, associated with the sponge *Monanchora* (Carter, 1883).

This work describes a new species of *Scottocheres* associated with the callyspongid sponge *Callyspongia* Duchassaing and Michelotti, 1864 and provides an emended diagnosis and a key to the genus.

Material and Methods

Sampling was conducted at Porto da Barra Beach, located in Todos-os-Santos Bay, Salvador city, in Bahia State, Brazil (13°00'10.6"S 38°32'00.9"W) on March 11th, 2016.

The samples were washed and filtered through a 100 µm mesh net; copepods were sorted in a petri dish filled with ethanol under a stereomicroscope.

A paratype was cleared in lactic acid, measured. Its body was drawn before being stained in Chlorazol Black E., dissected, and mounted permanently in CMC-9® (Masters Chemical Company, Inc.) mounting media. All drawings were made with a drawing tube fitted on an Olympus CH30 microscope. Roman numerals indicate the ancestral segments for the antennule formula, followed by the number of setae in Arabic numerals (Huys & Boxshall 1991). Roman numerals represent spines for the armature formula of legs 1-4, and Arabic numerals indicate setae. The abbreviations L1-L5 refer to legs 1-5. The studied specimens were deposited in the Museu de Historia Natural da Universidade Federal da Bahia.

Results

Order Siphonostomatoida Burmeister, 1835

Family Asterocheridae Giesbrecht, 1899

Genus *Scottocheres* Giesbrecht, 1897

Scottocheres Giesbrecht, 1987

Emended diagnosis: Body elongated, cylindrical, thoracic somites without lateral projections. Rostrum absent. Female and male urosome with 3 to 4 and 4 to 5 somites, respectively. Female antennule 17 to 19-segmented, with one segment after the aesthetasc, or 2, as in *S. latus*. Male antennule 16-segmented with 12 supplementary aesthetascs. Antenna with exopod 1-segmented and endopod 3-segmented. Siphon forming long and thin tube. Mandibular palp absent. Maxillule with 3 setae on each lobe. Outer lobe smaller than inner one. Third exopodal segment of legs 1 to 4 with 4 plumose setae on each. Third endopodal segment of legs 1 to 4 with 6, 6, 5-6 and 4 setae, respectively. Leg 5 with basoendopod, with inner seta representing the endopod and flattened exopod, 1-segmented and armed with 3 setae. Egg sacs paired, ventral, ellipsoidal, with 3 to 5 eggs each.

Remarks: When defining the diagnosis for *Scottocheres*, Giesbrecht (1899) described a female antennule as having 17 or 18 segments. However, Nicholls (1944) and Malt (1991) described species with 19-segmented antennules, *S. latus*, and *S. stocki*, respectively. To accommodate these *Scottocheres* species, it was necessary to revise the diagnosis to include 19-segmented antennules as well.

Scottocheres spinoparva sp. nov.

(Figs. 1–2)

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Material examined. Holotype female (UFBA 3266) and three paratypes (UFBA 3267, UFBA 3268, UFBA 3269), collected from Porto da Barra Beach, Salvador, Brazil (13°0'135"S, 38°32'189"W) on March 11th, 2016. All specimens were found associated with *Callyspongia*.

Description of female—Mean body length (excluding caudal setae) 593 µm and mean body width 173 µm. Body (Fig. 1A) cycloform with prosome slightly fusiform; urosome cylindrical. Cephalothorax with rounded epimera. Pedigerous somite with rounded epimera. Prosome length: width ratio= 1.9:1. Prosome: urosome ratio of length 1.2:1.

Urosome (Fig. 1B) four-segmented. Genital double-somite elongate, 110 × 83 µm, length: width ratio 1.3:1.

First postgenital somite as long as wide ($50 \times 50 \mu\text{m}$), length: width ratio 1:1; Second postgenital somite longer than wide ($42 \times 31 \mu\text{m}$), length: width ratio 1.4:1. Caudal rami elongated, $55 \times 16 \mu\text{m}$ armed with six setae. Egg sac not observed.

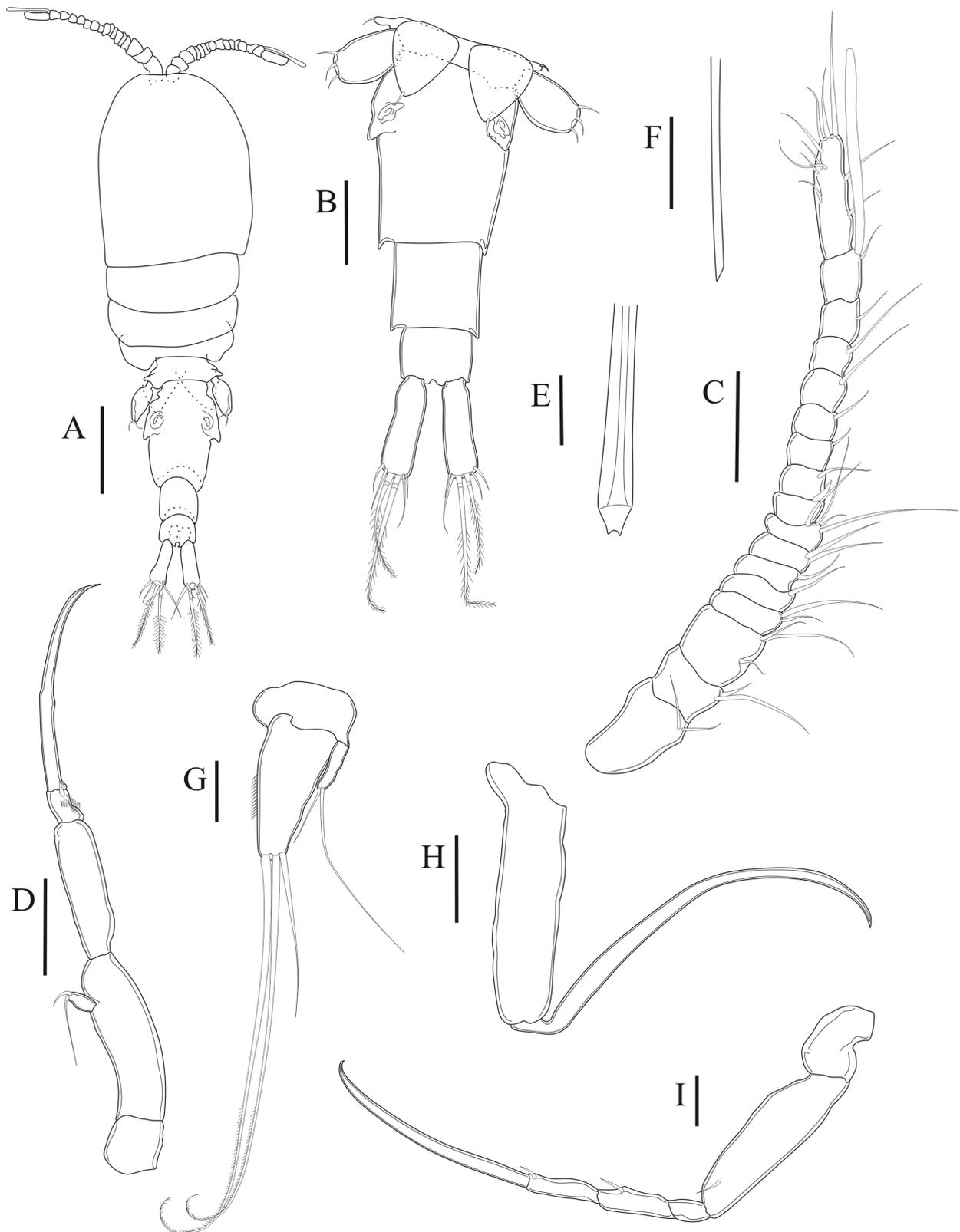


FIGURE 1. *Scottocheres spinoparva* n. sp., female (paratype: UFBA 3267). A, habitus, dorsal view; B, urosome; C, antennule; D, antenna; E, siphon; F, mandible stylet; G, maxillulle; H, maxilla; I, maxilliped. Scale bars: (A) $100 \mu\text{m}$; (B) $50 \mu\text{m}$; (C, D, H, I) $25 \mu\text{m}$; (E, F) $5 \mu\text{m}$; (G) $10 \mu\text{m}$.

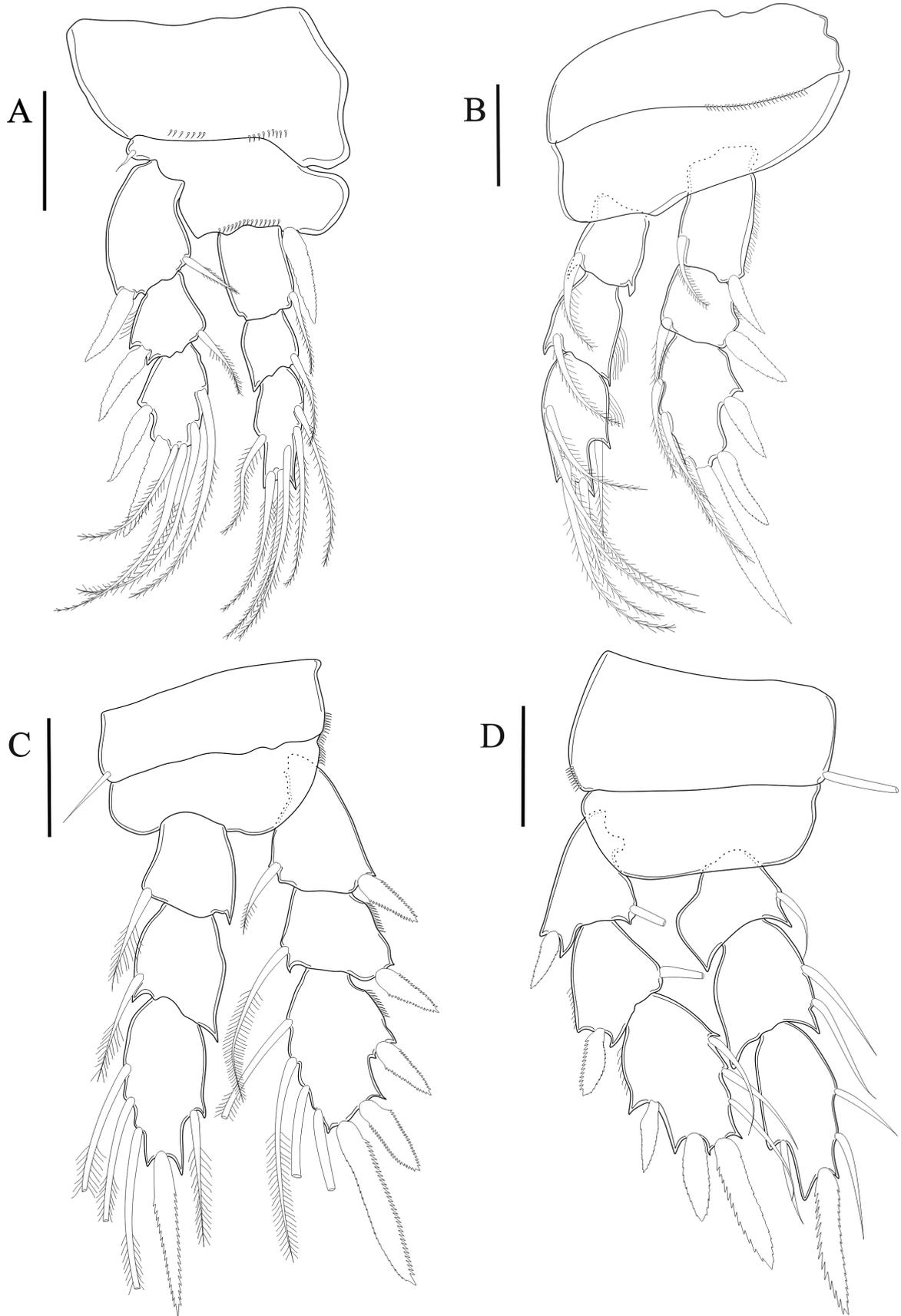


FIGURE 2. *Scottocheres spinoparva* n. sp., female (paratype: UFBA 3267). A, leg 1; B, leg 2; C, leg 3; D, leg 4. Scale bars: (A–D) 25 μ m.

Antennule (Fig. 1C) slender 163 μm long (not including setae), 17-segmented. Length of segments measured along posterior to anterior margin: 22, 8, 13, 6, 4, 4, 5, 8, 7, 7, 6, 8, 9, 8, 9, 11 and 28 μm , respectively. Segmental homologies and setation as follows: 1(I)-2; 2(II)-2; 3(III-IV)-3; 4(V)-2; 5(VI)-1; 6(VII)-1; 7(VIII)-2; 8(IX-XIII)-4; 9(XIV)-1; 10(XV)-1; 11(XVI)-1; 12(XVII)-1; 13(XVIII)-1; 14(XIX)-1; 15(XX)-1; 16(XXI)-1+ae; 17(XXII-XXVIII)-11; all setae smooth. Aesthetasc on segment XXI 49 μm long.

Antenna (Fig. 1D) 195 μm long (including distal claw), with a basis of 51 μm long. Exopod 1-segmented, 8 μm long with two, one short and other long, distal setae. Endopod 2-segmented, the first segment 50 μm long, unarmed; second segment 15 μm long, with one strong seta on claw basis and a row of setules on inner margin, 62 μm long. Oral cone (Fig. 1E) 328 μm long, reaching somite of the fifth leg. Mandible comprised of sharp stylet (Fig. 1F), 283 μm long. Mandibular palp absent.

Maxillule (Fig. 1G) bilobed; inner lobe 22 μm long, armed with three setae and row of setules on inner margins. Outer lobe 8 μm long, armed with two setae. Maxilla (Fig. 2A) with syncoxa 69 μm long and long, curved claw 116 μm long. Maxilliped (Fig. 2B) 5-segmented, comprising syncoxa 27 μm long, unarmed; basis 63 μm long with one seta. Endopod 3-segmented, segments measuring 12, 25, and 24 μm , respectively; first segment unarmed; second segment with one seta; third segment bearing one seta near straight claw-like element, 95 μm long. Swimming legs 1-4 (Fig. 2C-D; 3A-B) biramous, with 3-segmented rami. The armature formula is as follows:

	Coxa	Basis	Exopod	Endopod
L1	0-0	I-0	I-1; I-1; II,2,2	0-1; 0-1; 1,2,3
L2	0-0	0-0	I-1; I-1; II,1,3	0-1; 0-1; 1,2,3
L3	0-1	0-0	I-1; I-1; II,1,4	0-1; 0-1; 1,1,3
L4	0-1	0-0	I-1; I-1; II,1,3	0-1; 0-2; 1,1,2

Third exopodal segment of legs 1-4 lacking one spine on outer margin. Second endopodal element of legs 1-3 with single inner seta. Coxa of legs 1-2 and basis of leg 1 with a row of setules on distal margin. Outer margins of coxa and basis of leg 3 and outer margin of coxa of leg 4 with setules. Distal angles of first and second endopodal segments of leg 2 with prominent teeth. Setae of leg 4 short and smooth.

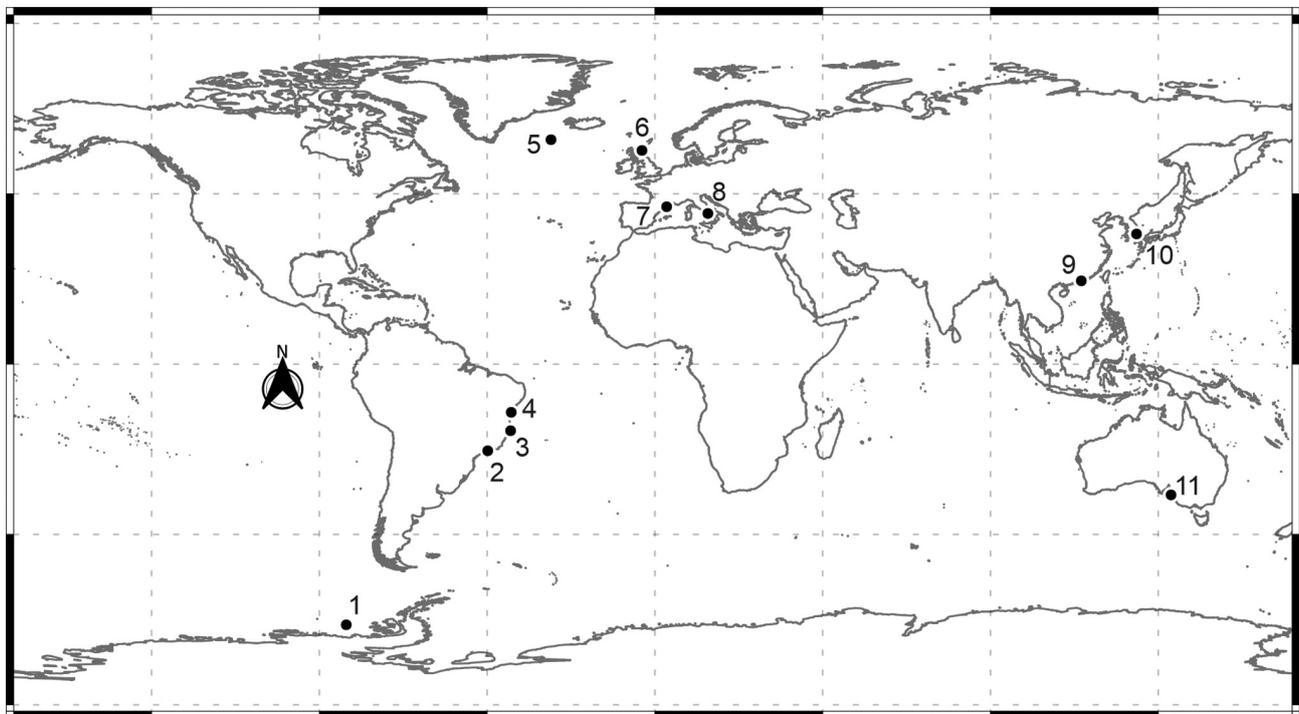


FIGURE 3. *Scottocheres* species cosmopolitan distribution. 1, Antarctic Ocean; 2, Pinguaba—Brazil; 3, California Reef, Abrolhos—Brazil; 4, Todos-os-Santos Bay—Brazil; 5, South West of Iceland; 6, Moray Firth—Scotland; 7, Banyuls—France; 8, Gulf of Naples—Italy; 9, Chik Chau—Hong Kong; 10, Japan Sea—South Korea; 11, Sellick Reef—Australia.

Fifth leg (Fig. 1B) with free segment armed with three smooth setae. Somite five fused to genital double somite, bearing small seta near the insertion of P5 free segment.

Male. Unknown.

Etymology. The specific name ‘*spinoparva*’ is a combination of ‘spine’ and the Latin term ‘parva’ (= few), referring to the absence of one spine on the lateral outer margin of the third element of legs exopods. The gender is feminine.

Remarks. The species of *Scottocheres* form three groups according to antennule segmentation. The first one includes *Scottocheres longifurca*, *S. stylifer*, *S. mipoensis*, and *S. youngi* with an 18-segmented antennule; the second includes *S. latus* and *S. stocki* with a 19-segmented antennule (Giesbrecht, 1897, 1902; Johnsson, 2002; Kim, 2016; Malt, 1991; Nicholls, 1944). The new species plus *S. elongatus*, *S. gracilis*, and *S. laubieri* form the third group with a 17-segmented antennule. (Hansen, 1923; Johnsson *et al.*, 2001).

Scottocheres spinoparva n. sp. has only two spines on the outer margin of the third endopodal element of leg 1, differing from *S. elongatus* and *S. laubieri* (Johnsson *et al.*, 2001). Furthermore, the new species can also be distinguished from *S. laubieri* by the absence of setae on the first endopodal segment of the maxilliped (Johnsson *et al.*, 2001). Additionally, *S. spinoparva* n. sp. is unique in the genus by showing only one seta on the inner margin of the second endopodal segment of legs 1 to 4.

Distribution. *Scottocheres* is a cosmopolitan genus with records on the Antarctic, Tropical Atlantic, North Atlantic and Pacific Oceans. These species were also recorded on the Mediterranean, North and Japan Seas (Figure 3). Johnsson (2001) recorded *S. elongatus* and *S. laubieri* in Pinguicula, littoral of São Paulo state. Later, he recorded *S. laubieri* in California Reef on the archipelago of Abrolhos, where he also found the first Brazilian species, *S. youngi*, associated with the sponge *Monanchora* sp. Carter, 1883 (Johnsson, 2002). *Scottocheres spinoparva* n. sp. represents the second Brazilian species and was found in association with a sponge of genus *Callyspongia* collected on Todos-os-Santos Bay (Table 1).

TABLE 1. Distribution and sponge hosts of *Scottocheres* species (data collected from the following references: Scott T and Scott A, 1894; Giesbrecht, 1897, 1902; Hansen, 1923; Nicholls, 1944; Stock, 1967; Malt, 1991; Johnsson *et al.*, 2001; Johnsson, 2002).

Species	Location	Hosts
	Moray Firth, Scotland	<i>Unknown host</i>
	Gulf of Naples, Italy (Giesbrecht, 1897)	<i>Unknown host</i>
<i>Scottocheres elongatus</i> (T. & A. Scott, 1894)	Banyuls, France (Stock, 1967)	<i>Ulosa digitata</i> (Schmidt, 1866), <i>Dysidea tupa</i> (Pallas, 1766) and <i>Desmacella annexa</i> Schmidt, 1870 (Stock, 1967)
	Pinguicula, Brazil (Johnsson, 2001)	<i>Unknown host</i>
<i>Scottocheres gracilis</i> Hansen, 1923	South West of Iceland	<i>Unknown host</i>
<i>Scottocheres latus</i> Nicholls, 1944	Sellick Reef, Australia	<i>Unknown host</i>
	Banyuls, France	<i>Agelas oroides</i> (Schmidt, 1864) and <i>Hymeniacidon</i> Bowerbank, 1858
<i>Scottocheres laubieri</i> Stock, 1967	Pinguicula, Brazil (Johnsson, 2001)	Unknown sponge
	California Reef, Abrolhos, Brazil (Johnsson, 2002)	<i>Aplysina lacunosa</i> , (Lamarck, 1814)
<i>Scottocheres longifurca</i> Giesbrecht, 1897	Gulf of Naples, Italy	Unknown host
<i>Scottocheres stocki</i> Malt, 1991	Chik Chau, Hong Kong	<i>Ircinia</i> Nardo, 1833
<i>Scottocheres stylifer</i> Giesbrecht, 1902	Antarctic Ocean	Unknown host
<i>Scottocheres youngi</i> Johnsson, 2002	California Reef, Abrolhos, Brazil	<i>Monanchora</i> Carter, 1883
<i>Scottocheres mipoensis</i> Kim, 2016	Japan Sea, South Korea	Unknown sponge
<i>Scottocheres spinoparva</i> n. sp.	Todos-os-Santos Bay, Brazil	<i>Callyspongia</i> Duchassaing & Michelotti, 1864

Key to the species of *Scottocheres*:

1. Antennule 17-segmented 2
Antennule 18-segmented 5
Antennule 19-segmented 8
2. Third exopodal segment of leg 1 with three spines on outer margin 3
Third exopodal segment of leg 1 with two spines on outer margin *S. spinoparva* n. sp.
3. Maxillipedal endopod with formula 0,1,1+claw 4
Maxillipedal endopod with formula 2,1,1+claw *S. laubieri* Stock, 1967
4. Caudal rami longer than wide *S. gracilis* Hansen, 1923
Caudal rami wider than long *S. elongatus* (Scott T. & Scott A., 1894)
5. 2-segmented antennal endopod 6
3-segmented antennal endopod *S. youngi* Johnsson, 2002
6. Exopod of the antenna with one setae *S. stylifer* Giesbrecht, 1902
Exopod of the antenna with more than one setae 7
7. Exopod of the antenna with two setae *S. longifurca* Giesbrecht, 1897
Exopod of the antenna with three setae *S. mipoensis* Kim I.H., 2016
8. Second endopodal segment of leg 1 with one inner seta *S. stocki* Malt, 1991
Second endopodal segment of leg 1 with two inner setae *S. latus* Nicholls, 1944

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