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***Spongiopsyllus redactus*, a new species of Entomolepididae (Copepoda, Siphonostomatoidea) associated with a scleractinian coral in Brazil**

ROBERTA CANÁRIO^{1,4}, ELIZABETH G. NEVES² & RODRIGO JOHNSON³

Universidade Federal da Bahia, Inst. Biologia, Dept. Zoologia, LABIMAR – Crustacea, Cnidaria & Fauna Associada, Av. Adhemar de Barros, s/n, Campus de Ondina, Bahia, BRAZIL - CEP: 40170-290. E-mails: ¹betaelfa@gmail.com, ²elizabeth.neves@gmail.com,

³r.johnsson@gmail.com

⁴Corresponding author

Abstract

The family Entomolepididae is represented in the South Atlantic Ocean solely by *Spongiopsyllus*, a monotypic genus found previously in association with sponges. A recent survey on the Boa Viagem Reefs, located off Salvador, Bahia State, on the northeastern region of Brazil, has revealed a new species of the genus, *Spongiopsyllus redactus* n. sp., found associated with the endemic scleractinian coral *Mussismilia hispida* (Verrill). The new species is distinguished from its congener, *S. adventicius* Johnson, 2000, by differences in the number of segments of the antennule, the ornamentation of the distal endopodal segment of the antenna, and the setation of the maxilliped and P1. An updated key to the species of Entomolepididae is also provided.

Key words: associated copepod, Scleractinia, *Mussismilia hispida*, symbiotic fauna

Introduction

The Entomolepididae Brady, 1899 is a small siphonostomatoid family of the Copepoda comprising 11 species classified in seven genera and reported from all major oceans of the world. Only the genera *Parmulodes* C. B. Wilson, 1944, *Parmulella* Stock, 1992, and *Spongiopsyllus* Johnson, 2000, all monotypic, have been recorded so far within the Atlantic Ocean (Wilson 1944; Stock 1992; Johnson 2000). Among these three genera, *Spongiopsyllus* is the only one recorded from the South Atlantic Ocean. Boxshall & Halsey (2004) stated that poriferans are the most common host group for the Entomolepididae. The present study describes a second species of *Spongiopsyllus* from Brazil and the first report of an entomolepidid associated with the scleractinian coral *Mussismilia hispida* (Verrill) (Cnidaria: Mussidae). An updated key to the species of Entomolepididae is also given.

Material and methods

A colony of *Mussismilia hispida* was hand-collected at a depth of 3 m at Boa Viagem Reefs, Salvador, Bahia (12°56'S, 38°30'W) (Fig. 1). The colony was placed in a plastic bag filled with seawater and then transported alive to the laboratory where it was fixed in 70% ethanol. The sample washing was filtered through a 100 µm plankton net, transferred to a petri dish filled with ethanol, and sorted for copepods under a dissecting microscope.

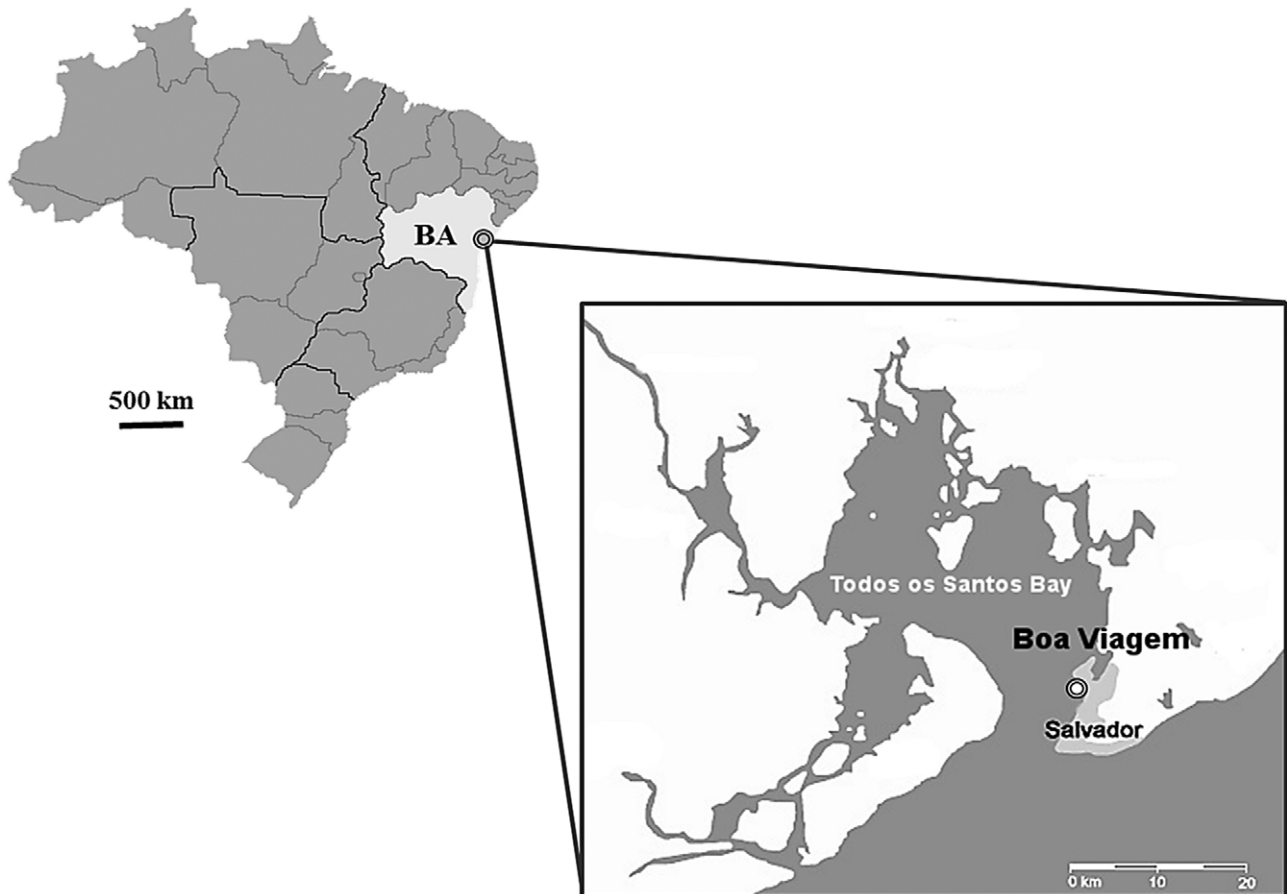


FIGURE 1. Location of the collection site at Boa Viagem Beach, Bahia (BA), Brazil.

The holotype was cleared in lactic acid, measured, and its body 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 the aid of a drawing tube fitted on an Olympus CH30 microscope. The length of the antennule segments were measured along the posterior, non-setiferous margin. For the antennule formula Roman numerals indicate the ancestral segments followed by the number of setae in Arabic numerals (Huys & Boxshall 1991). For the armature formula of legs 1–4, Roman numerals represent spines and Arabic numerals indicate setae. The abbreviations P1–P5 refer to legs 1–5, and MNRJ refers to Museu Nacional of the Universidade Federal do Rio de Janeiro.

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

Results

Spongiopsyllus redactus n. sp. (Figs 2–4)

Material examined. Holotype ♀ (UFBA 400 CRU), associated with *Mussismilia hispida* at 3 m depth in Boa Viagem Reefs, Salvador, Bahia, Brazil, collected by Roberta Canário, Rodrigo Johnsson, Elizabeth G. Neves, Marcos M. Nogueira, Cristiano Bahia and Iara Magalhães, 2 March 2010.

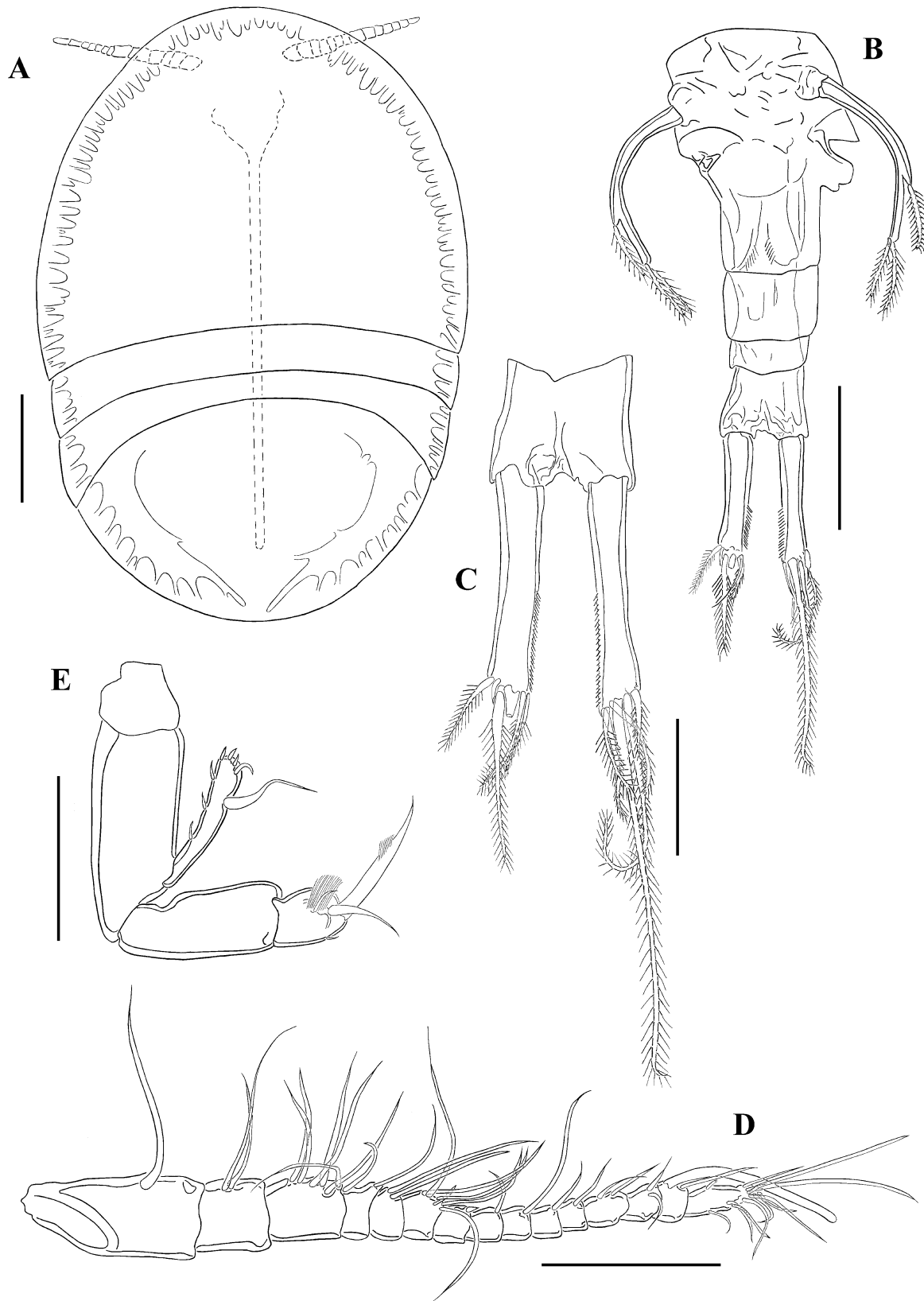


FIGURE 2. *Spongiopsyllus redactus* n. sp., female holotype (UFBA 400 CRU). A, habitus, dorsal view; B, urosome; C, anal somite and caudal rami; D, antennule; E, antenna; Scale bars: A = 200 μm ; B = 100 μm ; C–E = 50 μm .

Description of female. Mean body length (excluding caudal setae) 1089 μm and mean body width 718 μm . Prosomal shield flattened (Fig. 2A), with radiating bands along outer margin. Pedigerous somites 2–4 free. Urosome (Fig. 2B) 4-segmented. Genital double-somite fused with fifth pedigerous somite, 170 μm long, and with length:width ratio 1.4:1. Three postgenital somites present, all wider than long (45×64 , 23×52 , 41×50 μm , respectively). Prosome:urosome length ratio 1.5:1. Caudal rami (Fig. 2C) elongate, 86 μm long, with setules along inner distal margin, and armed with 6 plumose setae distally. Seta I absent; setae II–VII 36, 30, 93, 147, 42 and 34 μm , respectively.

Antennule (Fig. 2D) slender, 204 μm long (not including setae), and 15-segmented. Length of segments: 49, 20, 21, 7, 9, 9, 10, 9, 7, 7, 7, 17, 9, 7 and 17 μm , respectively. Segmental homologies and setation as follows: I-1; II–III-2; IV–VI-6; VII-2; VIII-2; IX–XIII-6; XIV-1; XV-1; XVI-1; XVII-1; XVIII-1; XIX-2; XX-2; XXI-1 +ae; XXII–XXVIII-11. All setae naked. Aesthetasc 53 μm long. Antenna (Fig. 2E) 186 μm long (including distal claw); basis 68 μm long. Exopod 1-segmented, 45 μm long, and with 2 unequal, sub-distal setae and 6 small spinules along lateral and distal margins. Endopod 2-segmented; first segment 47 μm long, unarmed; second segment 23 μm long, ornamented with row of setules along outer margin, and armed with 3 naked setae and 1 straight, short (41 μm) terminal claw bearing setules on outer distal margin.

Oral cone 816 μm long, reaching anal somite (Fig. 2A). Mandible (Fig. 3A) comprising stylet and slender 2-segmented palp measuring 37 and 45 μm long, respectively. Stylet slender, with subapical denticulated margin. Palp with second segment armed with 2 apical, unequal plumose setae and ornamented with setules along outer margin.

Maxillule (Fig. 3B) bilobed; inner lobe 40 μm long, armed with 3 short apical setae and ornamented with setules along inner margin. Outer lobe 35 μm long, armed with 3 long setae. All setae naked. Maxilla (Fig. 3C) with syncoxa and curved claw measuring 164 and 145 μm long, respectively. Maxilliped (Fig. 3D) 5-segmented, 214 μm long (excluding claw); syncoxa 54 μm long, with inner seta; basis 103 μm long, unarmed. Endopod 3-segmented, 19, 24 and 28 μm long, respectively, and bearing 2, 1, 1 setae plus curved claw; latter measuring 48 μm long. All setae naked.

P1–P3 (Figs. 3E–F, 4A) biramous, with 3-segmented rami. P4 (Fig. 4B) with 3-segmented exopod and endopod absent. Armature formula of P1–P4 as follows:

	Coxa	Basis	Exopod	Endopod
P1	0-1	1-1	I-1; I-1; III,2,2	0-1; 0-2; 1,2,3
P2	0-1	1-0	I-1; I-1; III,I,4	0-1; 0-2; 1,2,2
P3	0-0	0-0	I-1; I-1; II,I,4	0-0; 0-1; 0,1,1
P4	0-0	0-0	I-1; I-1; II,I,3	Absent

Third endopodal segment of P1 (Fig. 3E) prolonged distally into sharpened process, therefore distal setae located sub-distally on inner margin. Free exopodal segment of P5 (Fig. 2B) elongate, curved, 134 μm long, reaching distal margin of genital double-somite, and armed with 2 distal and one outer plumose setae.

Male. Unknown.

Etymology. The specific name '*redactus*' means reduction in Latin, referring to the curtailment of some appendages as compared to *S. adventicius* Johnsson, 2000, the other known species of the genus.

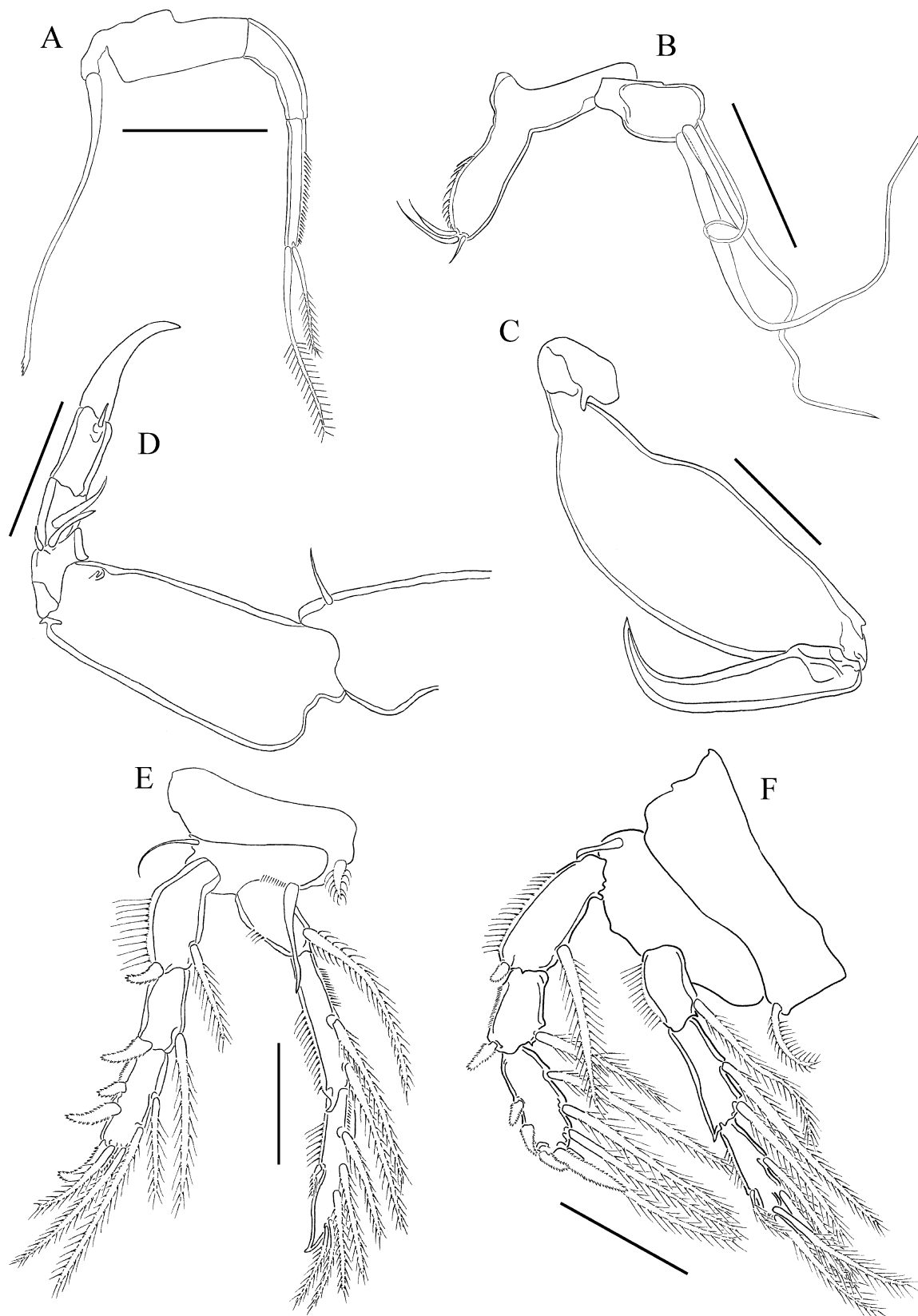


FIGURE 3. *Spongiopsyllus redactus* n. sp., female holotype (UFBA 400 CRU). A, mandible; B, maxillule; C, maxilla; D, maxilliped; E, P1; F, P2. Scale bars: A–F = 50 μ m.

Remarks. *Spongiopsyllus redactus* n. sp. has all the characters of the genus *Spongiopsyllus* such as a body shield covering the urosome, except for the tip of the caudal rami, three postgenital somites, and the reduction in leg setation in the female. In the original description of *Spongiopsyllus adventicius*, Johnsson (2000) described the second segment of the mandibular palp as having 3 setae, a very uncommon condition, and the antennal endopod as being 3-segmented, with the formula 0, 1, 2+claw, yet the illustration of this appendage shows the formula 0, 0, 3+claw. Our re-examination of one paratype female (MNRJ 11416) of *S. adventicius* revealed that this species has a 2-segmented mandibular palp armed with 2 distal setae and the antennal endopod is 2-segmented, with the first segment unarmed and the second segment bearing 3 setae and 1 terminal claw, as observed in *S. redactus* n. sp.

However, the new species can be distinguished from its congener by having a 15-segmented (vs. 17-segmented) antennule, a row of setules (vs. naked) along the outer margin of the second endopodal segment of the antenna, a 3-segmented endopod on the maxilliped with formula 2,1,1+claw (vs. 0,2,1+claw), and the third endopodal segment of P1 with setation 1,2,3 (vs. 1,2,2) in the female. This combination of unique characters supports our decision to establish a new species, and therefore expands the number of species of Entomolepididae to 12.

Of the known cnidarian hosts of the Entomolepididae, *Entomopsyllus stocki* Kim, 2004 was described in association with the octocoral *Tubipora musica* (Linnaeus) (Cnidaria: Tubiporidae) from the coast of Madagascar (Kim 2004). Thus, this is the first record of Entomolepididae associated with scleractinian corals, the first register of a coral of the family Mussidae as host, and the first entomolepidid-cnidarian association reported from the Atlantic Ocean.

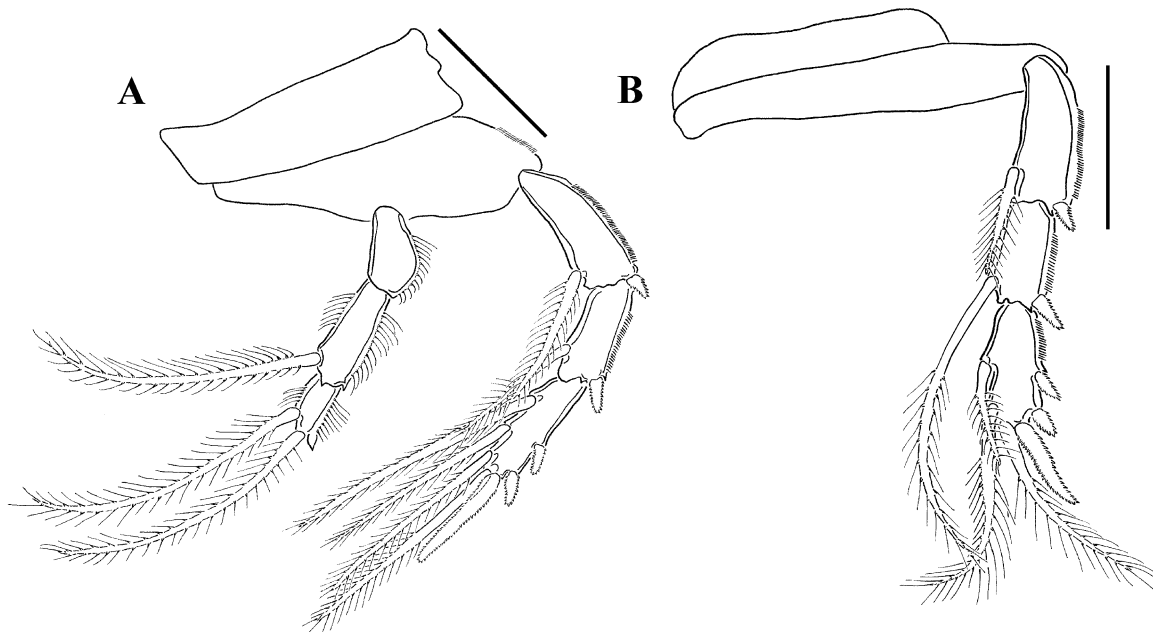


FIGURE 4. *Spongiopsyllus redactus* n. sp., female holotype (UFBA 400 CRU). A, P3; B, P4. Scale bars: A–B = 50 μ m.

Key to the species of the Entomolepididae (adapted from Johnsson (2000))

- | | | |
|---|--|--|
| 1 | Pedigerous somite 2 free in dorsal view (Parmulodinae Eiselt, 1959)..... | 2 |
| - | Pedigerous somites 2 and 3 free in dorsal view (Entomolepidinae Eiselt, 1959)..... | 4 |
| 2 | Most of urosome hidden under body shield..... | 3 |
| - | Most of urosome exposed..... | <i>Parmulella emarginata</i> Stock, 1992 |

3	P3 biramous	<i>Parmulodes verrucosus</i> C. B. Wilson, 1944	
-	P3 uniramous	<i>Paralepeopsyllus mannarensis</i> Ummerkutty, 1960	
4	P4 absent (<i>Entomolepis</i> Brady, 1899).....		5
-	P4 present		6
5	Caudal ramus 5–6 times longer than wide.....	<i>E. ovalis</i> Brady, 1899	
-	Caudal ramus at least 10 times longer than wide.....	<i>E. hamondi</i> McKinnon, 1988	
6	P4 endopod absent		7
-	P4 endopod reduced to a single small segment (<i>Lepeopsyllus</i> Thompson & Scott, 1903)		8
7	Three postgenital somites in female and four in male (<i>Spongiopsyllus</i> Johnsson, 2000)		9
-	Two postgenital somites in female and three in male (<i>Entomopsyllus</i> McKinnon, 1988)		10
8	Female antennule 15-segmented	<i>L. typicus</i> Thompson & Scott, 1903	
-	Female antennule 13-segmented	<i>L. ovalis</i> Thompson & Scott, 1903	
9	Female antennule 17-segmented	<i>Spongiopsyllus adventicius</i> Johnsson, 2000	
-	Female antennule 15-segmented	<i>Spongiopsyllus redactus</i> n. sp.	
10	Endopod of P1 shorter than exopod	<i>E. nicholli</i> McKinnon, 1988	
-	Endopod of P1 longer than exopod		11
11	Female antennule 16-segmented, exopod of P4 with armature II,I,3	<i>E. adriae</i> (Eiselt, 1959)	
-	Female antennule 15-segmented, exopod of P4 with armature II,I,2	<i>E. stocki</i> Kim, 2004	

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