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VERSITA

A new species of *Colobomatus* (Copepoda, Phylichthyidae) parasitic on *Mullus argentinae* (Perciformes, Mullidae) from South American Atlantic coast

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Abstract

A new species of *Colobomatus* Hesse, 1873 is described from pores of the cephalic sensory system and nostrils of Argentine goatfish, *Mullus argentinae* Hubbs et Marini, 1933 (Perciformes: Mullidae), living along the southwestern Atlantic coast. The fish were collected at different latitudes, stretching from the State of Rio de Janeiro in the north, through Santa Catarina, Rio Grande do Sul (Brazil) to of Mar del Plata (Argentina) in the south. The prevalence of the infection ranged from 42% through 84%. The new species look alike to two other species, parasites of mullids (*C. steenstrupi* and *C. mulli*) particularly in the body shape and the number, shape, and ornamentation of cephalic, thoracic, and genital processes. The new species, however, can be readily distinguished by having the central cephalic process shorter than lateral ones, the later being bilobed at tip forked, and a relatively larger abdomen. Furthermore, *C. steenstrupi* possesses relatively wider trunk processes with rounded tips, a short abdominal dorsal process, and attains a larger size (up to 3.6 mm). *C. mulli* also differs by having all body processes with forked tips, and relatively shorter sixth thoracic somite and abdominal segments 1–3. This is the third record of a species of *Colobomatus* in South American Atlantic waters.

Keywords

New species, *Colobomatus*, *Mullus argentinae*, Copepoda

Introduction

The genus *Colobomatus* Hesse, 1873 (Phylichthyidae) comprises at present 63 valid species that live in the mucous canals of the mandibular and preopercular areas or in the cephalic canal system of fishes (Romero and Muñoz 2011). Only two species of *Colobomatus* have been recorded in the southwestern Atlantic, *C. belizensis* Cressey et Schotte, 1983 parasitizing *Haemulon steindachneri* and *Orthopristis ruber*, and an unidentified species in the gills of *Micropogonias furnieri* (see Luque and Tavares 2007).

During parasitological examinations of specimens of Argentine goatfish, *Mullus argentinae* Hubbs et Marini, 1933, caught in Brazilian and Argentine waters, parasitic copepods referable to the genus *Colobomatus* were found in pores of the cephalic sensory system and nostrils of the host fish. These parasites, previously undetected as components the parasite fauna of *M. argentinae* (see Luque *et al*. 2002, Lanfranchi *et al*. 2009) due to their cryptic habitat, represented a new species which is herein described.

Materials and methods

Three hundred and thirty specimens of *M. argentinae*, caught by commercial trawlers from coastal zones along the Atlantic coasts of Brazil and Argentina, were examined for parasites. The following samples were collected: (1) 200 goatfish captured off the State of Rio de Janeiro, Brazil (22°55′S, 43°12′W) within January 2010 – April 2011; (2) 50 specimens collected off the State of Santa Catarina, Brazil (27°10′S, 48°35′W) within August 2010; (3) 50 fish captured off the State of Rio Grande do Sul, Brazil (32°04′S, 52°09′W) during July 2010; (4) 30 specimens from Mar del Plata, Argentina (38°08′S, 57°32′W), caught during August 2011.

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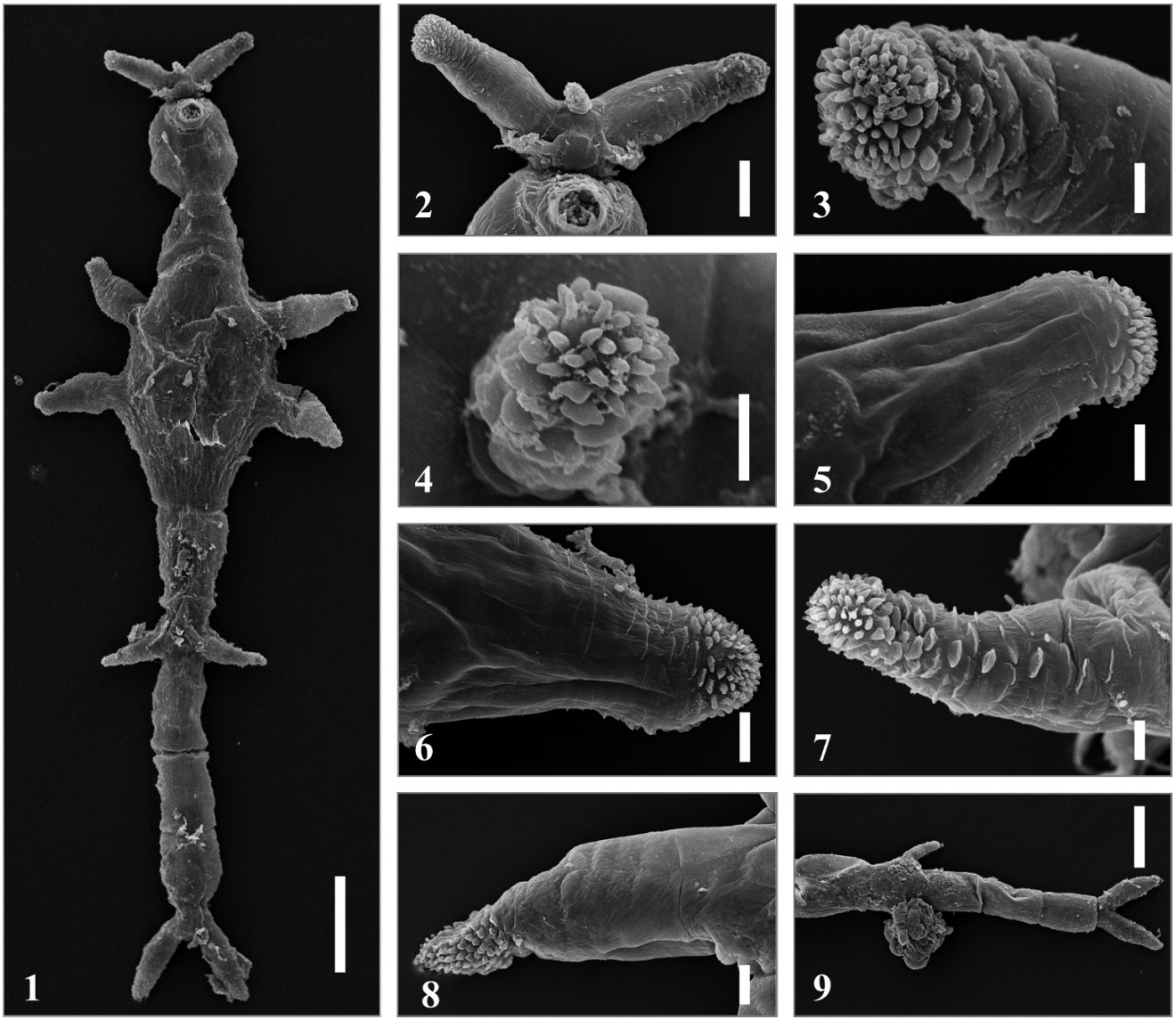
The fish were examined under a dissecting microscope. Parasites were gently removed from the sensory canals of the fish skin with the aid of dissecting needles, fixed in 4% formaldehyde solution, and then transferred to 70% ethanol for storage. Whole specimens were cleared in lactic acid, and examined under a light microscope. Illustrations were drawn with the aid of a drawing tube. Some specimens intended for scanning electron microscopy (SEM) were dehydrated, using a series of ethanol washes, dried by evaporation with hexamethyldisilazane, coated with gold palladium, and examined using a JEOL JSM 6460-LV SEM (JEOL, Tokyo, Japan). Measurements are given in millimetres, with the mean followed by a range in parentheses. The terms prevalence and mean intensity of infection were used according to Bush *et al*. (1997). The type material was deposited in the Crustacea Collection of the Museu Nacional do Rio de Janeiro (MNRJ), Brazil, and Carcinological Collection of the Museo de La Plata (MLP), La Plata, Argentina.

Results

***Colobomatus sudatlanticus* sp. nov.** (Figs 1–23)

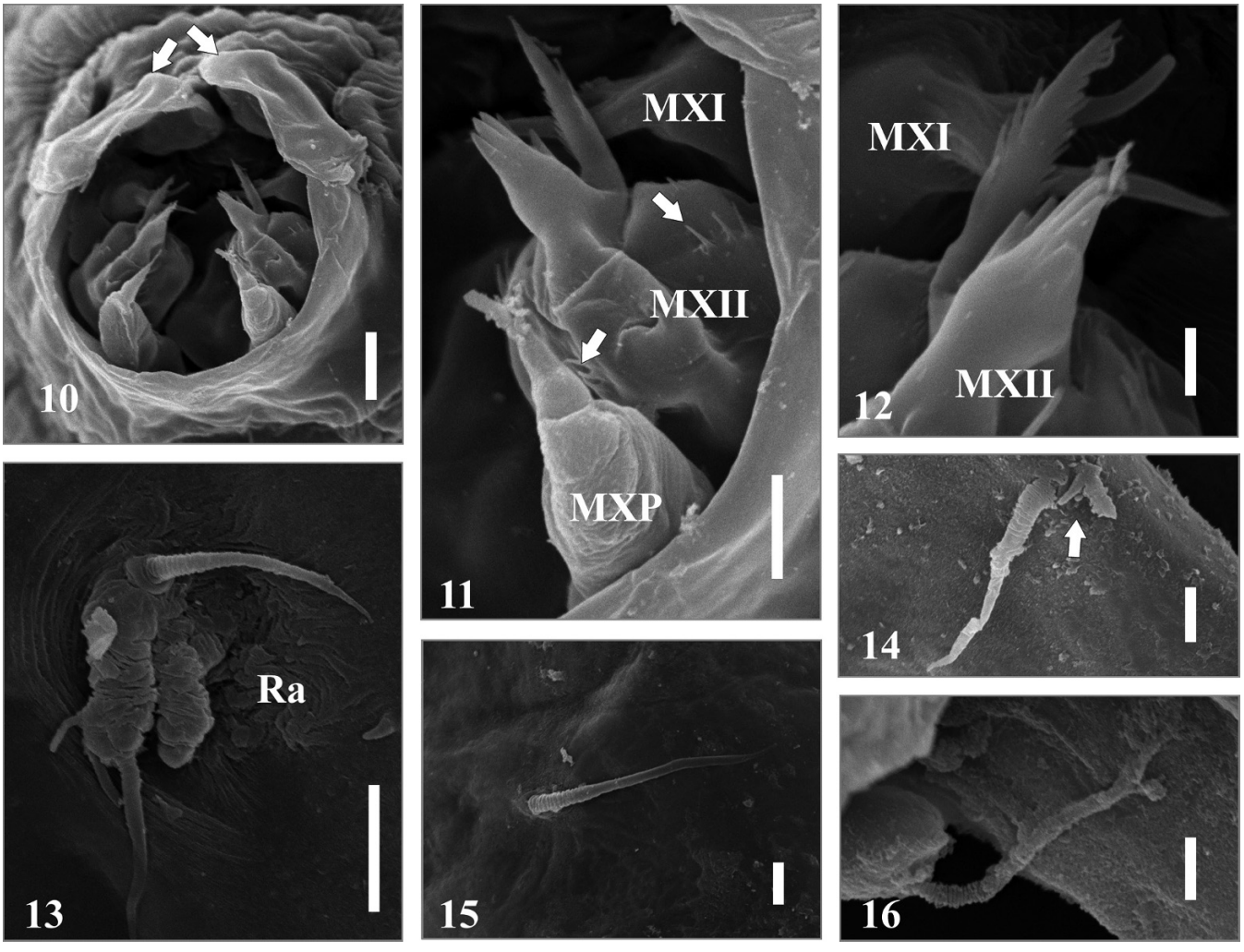
Description (all dimensions in mm)

Female (based on 10 specimens): Body elongate 2.60 (2.40–2.84) long (Figs 1, 17). Head with 3 anterior cephalic proces-

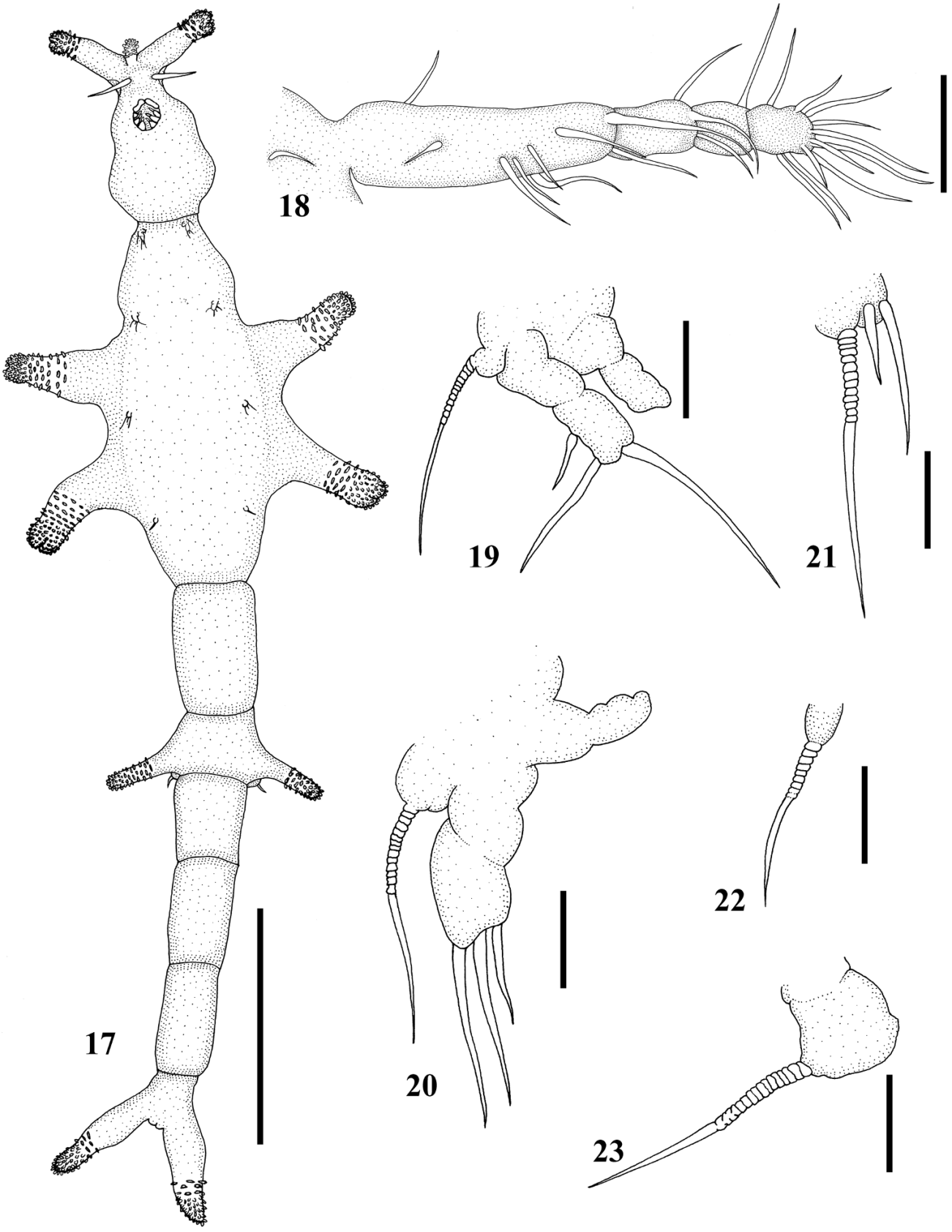


Figs 1–9. *Colobomatus sudatlanticus* sp. nov., female. **1.** Habitus, ventral view. **2.** Cephalic processes, ventral view. **3.** Distal end of lateral cephalic process, ventral view. **4.** Medial cephalic process, apical view. **5.** First lateral thoracic process, ventral view. **6.** Second lateral thoracic process, ventral view. **7.** Genital process, ventral view. **8.** Caudal ramus, ventral view. **9.** Genito-abdomen with one egg clutch attached, ventral view. Scale bars = 1, 9: 200 μm, 2: 50 μm, 3–4, 7: 10 μm, 5–6, 8: 20 μm

ses (Figs 2, 3, 4) pair of lateral processes 191 (150–220) long, dorsal to central one 95 (80–100) long, latter directed ventrally and representing 25.4% (15.0%–33.3%) of length of lateral ones. Lateral processes (Figs 5, 6) apically bilobate, central process with blunt end, all apically covered by field of densely arranged blunt spines, that gradually became more sparse and transforming into tubercles and then into scale-like structures towards base; same armature present in trunk and genital processes, as well as in caudal rami. Antennules (Fig. 18) located at base of these processes. Antennules apparently 4-segmented, basal segment with 2 basal-, 5 medial-, and 2 distal setae, second segment armed with three distal setae; third segment bearing one distal setae and apical segment armed with 3 subapical- and 10 apical setae; additional seta present on head near base of antennule. Antennae covering anterior region of siphon-like buccal area. Cephalosome ovoid 273 (240–310) long, 224 (150–270) wide (maximum width); with convex sides, or slightly swollen in latero-posterior borders. Second through fifth thoracic somites fused, having octagonal to ovoid shape, 771 (650–840) long, representing about 30% of total length; 487 (400–600) wide (maximum width) excluding lateral processes, bearing two pairs of dorso-lateral conical processes located at angles of square central region; both pairs of processes similar each other in size and shape with dorso-ventrally bilobed tips, first pair 188 (130–250) long, second pair 197 (140–240) long. Sixth thoracic somite cylindrical, longer than wide, 290 (220–390) long, 235 (200–300) wide (maximum width). Seventh thoracic somite (genital), subquadrangular, shorter than wide and shorter than previous somite, 159 (100–210) long, 237 (190–300) wide (excluding lateral processes), bearing single pair of lateral processes (Fig. 7) arising from its posterior margin ventral to genital orifices; processes similar in shape than anterior ones, but smaller 149 (120–170) long. Abdomen 4-segmented, segments 1–3 cylindrical, 232 (190–290) long, 211 (170–260)



Figs 10–16. *Colobomatus sudatlanticus* sp. nov., female. **10.** Buccal cone, ventral view, arrows showing antennae. **11.** Oral appendages, ventral view; arrows showing rows of spines on basal segment of maxilla. **12.** Detail of maxillule and distal processes of maxilla. **13.** Leg 2, ventral view. **14.** Leg 3, ventral view, arrow showing base of broken setae. **15.** Leg 4, ventral view. **16.** Leg 6, ventral view. MXI: maxilla; MXII: maxillule; MXP: maxilliped; Ra: rugose area. Scale bars = 10, 13: 10 μm; 11, 14–16: 5 μm



Figs 17–23. *Colobomatus sudatlanticus* sp. nov., female. **17.** Habitus, ventral view. **18.** Antennule, ventral view. **19.** Leg 1, ventral view. **20.** Leg 2, ventral view. **21.** Leg 3, ventral view. **22.** Leg 4, ventral view. **23.** Leg 6, ventral view. Scale bars = 17: 500 μm; 18: 50 μm; 19–23: 20 μm

long, and 191 (150–240) long and 151 (130–180) wide, 144 (120–179) wide, and 141 (110–170) wide, respectively. Terminal segment small, 105 (90–150) long, laterally carrying lanceolate caudal rami (Fig. 8) 217 (190–250) long. Buccal area (Figs 10, 11) forming tube-like structure covered anteriorly by second antennae and formed posteriorly for simple labium. Maxillules (Fig. 12) 1-segmented, bearing two apical spines. Maxillae with massive basal segment bearing short rows of spines, mostly 3, apically bearing strong spine denticulate in both margins and auxiliary hand-like spinose process. Maxillipeds with basal segment and one distal spine. Legs 1–4 small, located in ventro-lateral position. Legs 1 and 2 inserted in rugose area. Leg 1 (Fig. 19) biramous, located immediately posterior to junction of cephalosome and second thoracic somite, comprising basipod carrying long lateral seta irregularly annulated at base, apparently unsegmented unarmed endopod and indistinctly 2-segmented exopod, armed distally with 3 setae. Leg 2 (Figs 13, 20) biramous, located immediately anterior to level of first pair of thoracic processes, comprising basipod carrying lateral seta annulated at base, 2-segmented unarmed endopod and 2-segmented endopod, distal segment carrying lateral spine and 2 distal seta. Leg 3 (Figs 14, 21) minute, located at mid-length between both pairs of thoracic processes and reduced to 3 setae of different size, largest irregularly located at base. Leg 4 (Figs 15, 22) reduced to single seta, located immediately posterior to second pair of thoracic processes. Leg 5 absent; Leg 6 (Figs 16, 23) near genital apertures, represented by lobe armed with distal seta. Setae of legs 4 and 6 irregularly annulated at base, representing probably basipodal setae. Some females were observed with egg mass attached to genital orifice (Fig. 9).

Male: unknown.

Type host: *Mullus argentinae* Hubbs et Marini, 1933 (Perciformes: Mullidae), Argentine goatfish.

Type locality: Florianópolis, State of Santa Catarina, Brazil (27°10′S, 48°35′W), date of collection: August 2010.

Other localities: Coastal waters off Rio de Janeiro (22°55′S, 43°12′W), Brazil, date of collection January 2010 – April 2011. Coastal off Rio Grande, State of Rio Grande do Sul, Brazil (32°04′S, 52°09'W), date of collection: July 2010. Coastal waters off Mar del Plata, Argentina (38°08′S, 57°32′W), date of collection: August 2011.

Site of infection: pores of the cephalic sensory system and nostrils of hosts.

Prevalence: Rio de Janeiro: 42%; Santa Catarina: 84%; Rio Grande do Sul: 50%; Mar del Plata: 76.7%.

Mean intensity and range: Rio de Janeiro: 3.13 (1–11); Santa Catarina: 5.51 (1–15); Rio Grande do Sul: 3.24 (1–12); Mar del Plata: 3.57 (1–10).

Type material: Holotype (female) MNRJ No. 23317. Paratypes (10 females) MNRJ No. 23318-23320, (five females) MLP No. 26759.

Etymology: The specific name refers to known geographic distribution of the fish host.

Discussion

Species of *Colobomatus* are highly modified copepods; with metamorphosed females displaying a series of processes – in the cephalic region, as well as in the trunk, genital area, abdomen, and caudal rami – used as holdfasts to survive in their particular microhabitats. The number, position, and shape of such processes are important taxonomic characteristics facilitating identification of species within this genus.

The presence of one medio-ventral simple cephalic process and two latero-dorsal cephalic processes is shared by a reduced number of species in the genus (Essafi *et al*. 1983, Castro-Romero and Muñoz 2011), among these congeners, the new species closely resembles *C. steenstrupi* (Richiardi, 1876) and *C. mulli* Essafi, Raibaut et Boudaoud-Krissat, 1983 in the body shape and the number shape and ornamentation of cephalic, thoracic and genital processes (Essafi *et al*. 1983). Both species are parasites of the mullids *Mullus barbatus* Linnaeus and *M. surmuletus* Linnaeus from the Mediterranean (Essafi *et al*. 1983). Species of *Colobomatus* have narrow host specificity (Grabda and Linkowski 1978) or are specific to host families or genera (Hayward 1996), and the three species from mullids are undoubtedly closely related. However both species are readily distinguished from the new species by having a central cephalic process larger than (in *C. mulli*) or similar in length to (in *C. steenstrupi*) lateral cephalic processes, lateral cephalic processes forked at tip against bilobed in the new species, and a relatively shorter abdomen. Furthermore, *C. steenstrupi* possesses relatively wider trunk processes with rounded tips, a short abdominal dorsal process, and attains a larger size (up to 3.6 mm). *Colobomatus mulli* also differs from the new species by having all body processes with forked tips, and relatively shorter sixth thoracic somite and abdominal segments 1–3. On the base of these differences, a new species, *Colobomatus sudatlanticus* sp. nov. is proposed.

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