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A NEW SPECIES OF *HETEROSENTIS* VAN CLEAVE, 1931 (ACANTHOCEPHALA: ARHYTHMACANTHIDAE) PARASITIC IN *PSEUDOPERCIS NUMIDA* MIRANDA RIBEIRO, 1903 (PERCIFORMES: PINGUIPEDIDAE) FROM SOUTHEASTERN BRAZILIAN COASTAL ZONE

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ABSTRACT: *Heterosentis brasiliensis* n. sp. (Acanthocephala, Arhythmacanthidae), parasitic in namorado sandperch *Pseudopercis numida* Miranda-Ribeiro, 1903 (Perciformes, Pinguipedidae) from the littoral of Cabo Frio, State of Rio de Janeiro, Brazil, is described and illustrated herein. *Heterosentis brasiliensis* n. sp. differs from all congeneric species by having 10 longitudinal rows of hooks in the proboscis, 6 or 7 hooks in each row, 3 or 4 small basal hooks in each row, and spines in the anterior ventral surface of the body. The similar species, *Heterosentis heteracanthus* (Linstow, 1896) and *Heterosentis caballeroi* Gupta & Fatma, 1983, also have 10 longitudinal rows of hooks, but *H. heteracanthus* differs from the new species by possessing trunk spines in the ventral and dorsal body surface. *Heterosentis caballeroi* differs from *H. brasiliensis* by the presence of 1 apical and 1 subapical hook in each longitudinal row; the largest apical, subapical, and basal hooks; lemnisci that are smaller than the proboscis receptacles; and a pre-equatorial male reproductive system. This is the first record of a *Heterosentis* species in a pinguipedid fish and from Brazilian coastal zone.

Species of Arhythmacanthidae Yamaguti, 1935 (Acanthocephala, Paleacanthocephala) are parasites of fishes around the world (Pichelin and Cribb, 1999). The morphological characteristics of species of this family include the abrupt transition from larger apical and subapical hooks, with roots from small basal hooks, without roots on the proboscis, and with 6 cement glands (Pichelin and Cribb, 1999). This family is organized into 3 subfamilies: Neoacanthocephaloidinae Golvan, 1960, which has a long, cylindrical proboscis and a greater number of large apical hooks than small basal hooks; Paracanthocephaloidinae Golvan, 1969, in which the trunk spines are always absent; and Arhythmacanthinae Yamaguti, 1935, in which the proboscis is short, globular, or claviform, and it has either about the same number of large apical hooks as small basal hooks or fewer large hooks than small basal hooks (Amin, 1985, 1987; Pichelin and Cribb, 1999).

Heterosentis Van Cleave, 1931 (Arhythmacanthinae) includes 12 valid species (Pichelin and Cribb, 1999) and is distinguished from other genera by having a claviform proboscis and trunk spines, and by not having a large antero-dorsal body curvature. The differentiation of species wihin this genus is based on morphometric data of proboscis hooks, distribution, and morphometric data of body structures, proboscis armature, and distribution of trunk spines (Pichelin and Cribb, 1999). Species of *Heterosentis* are parasites of the intestine of freshwater and marine fishes from South America, Antarctic, Asia, and Oceania (Van Cleave, 1931; Yamaguti, 1935; Golvan, 1969; Nickol, 1972; Schmidt and Paperna, 1978; Gupta and Fatma, 1979, 1983; Zdzitowiecki, 1984).

To date, only 1 species of *Heterosentis*, *H. heteracanthus* (Linstow, 1896), has been reported from the South American and Antarctic coasts, where it parasitizes *Basilichthys microlepidotus* (Jenyns, 1841) (Atheriniformes, Atherinopsidae) (= *Atherinichthys microlepidotus*); *Notothenia neglecta* Nybelin, 1951 (Perciformes, Nototheniidae); *Notothenia rossi* Richardson, 1844; and *Gobionotothen gibberifrons* (Lönnberg, 1905) (Perciformes, Nototheniidae) (Van Cleave, 1931; Zdzitowiecki, 1984; Semenas and Trejo, 1997).

Pseudopercis numida Miranda-Ribeiro, 1903 (Perciformes, Pinguipedidae) (Namorado sandperch) is a demersal, nonmigratory fish found on rocky and sandy bottoms in coastal waters. This species is considered a euryphagous predator, feeding mainly on benthic fishes and crustaceans (Menezes and Figueiredo, 1985; Froese and Pauly, 2007). Its distribution includes southern Brazil, from Rio de Janeiro to the State of Santa Catarina (Menezes and Figueiredo, 1985), but recently it was also reported in Argentinean waters (Venerus et al., 2007).

During a parasitological survey of marine fishes off Rio de Janeiro, Brazil, specimens of an undescribed species of *Heterosentis* were recovered from the intestine of *P. numida*. In this paper, this new acanthocephalan is described.

MATERIALS AND METHODS

The acanthocephalans studied are part of the helminths collected from 62 specimens of *P. numida* off the coast of Cabo Frio, State of Rio de Janeiro, Brazil (22°52′43.26″S, 42°1′11.55″W), between October 2002 and June 2003. The hosts were identified according to Menezes and Figueiredo (1985). The fishes were kept frozen in plastic bags at −18 C until necropsy. The acanthocephalans were fixed in AFA and preserved in 70% ethanol. Parasites were stained in Mayer's carmalumen, cleared in creosote, and mounted in Canada balsam for examination as whole mounts. Parasites were examined with a Hund Wetzlar H-600 (Helmut Hund GmbH, Wetzlar, Germany) phase contrast microscope. Illustrations were made with the aid of a drawing tube. Measurements are given as ranges in micrometers (μm), with mean and standard deviation in parentheses. Identification and classification of the acanthocephalans to the generic level follow Amin (1985, 1987) and Pichelin and Cribb (1999). Type specimens are deposited in the Instituto Oswaldo Cruz Helminthological Collection (CHIOC), Rio de Janeiro, Brazil.

DESCRIPTION

Heterosentis brasiliensis n. sp.

(Figs. 1–4)

General: Sexual dimorphism not pronounced. Proboscis claviform, armed with 10 longitudinal rows: each consists of 1 medium apical hook

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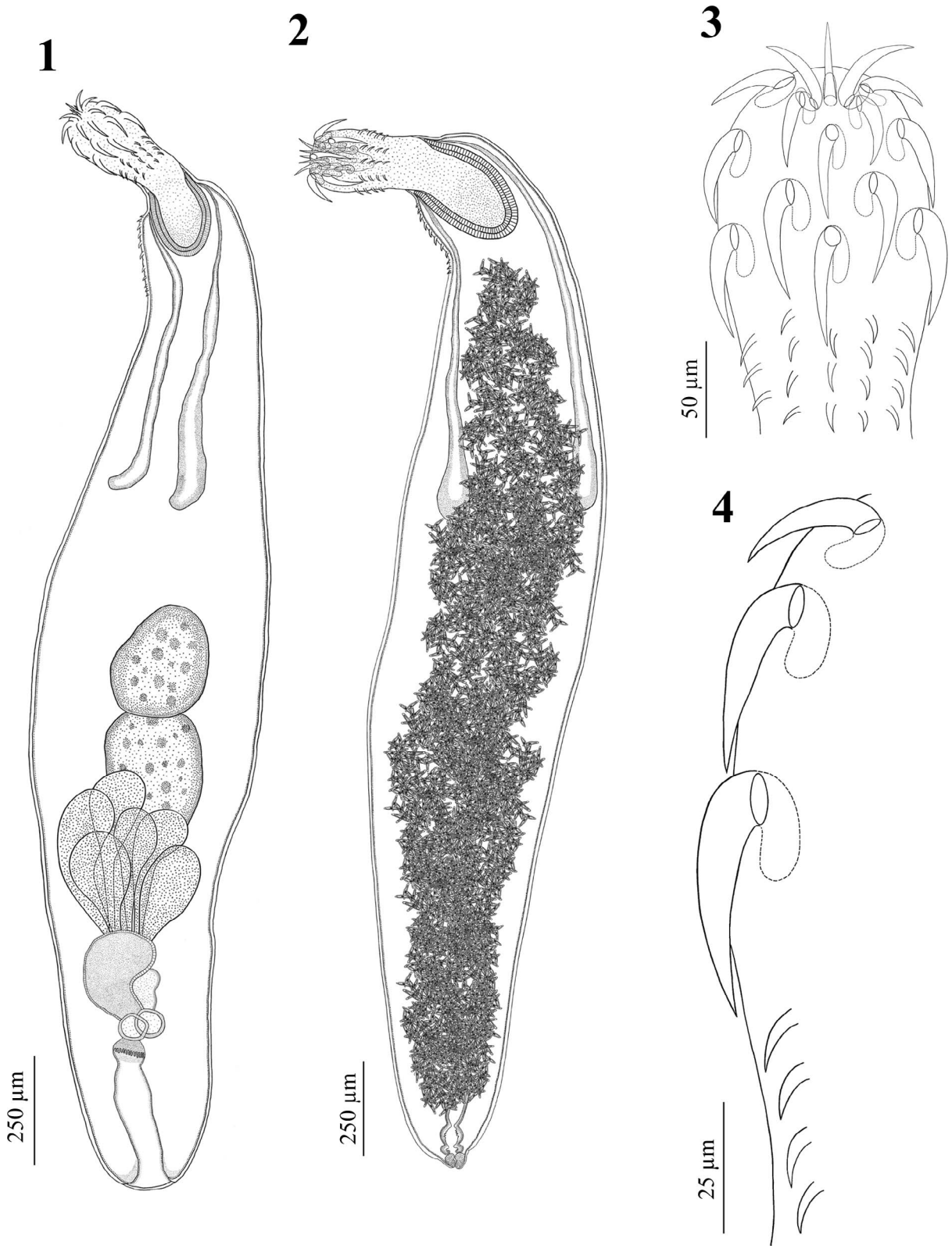

FIGURES 1–4. *Heterosentis brasiliensis* n. sp. (**1**) Holotype, male whole mount, lateral view; (**2**) allotype, female whole mount, lateral view; (**3**) male proboscis armature—holotype, lateral view; (**4**) male proboscis row of hooks—paratype, lateral view.

with root; 2 larger subapical hooks with root; and 3–4 smaller, basal, curved hooks without root (Fig. 4), with a total of 6–7 hooks in each longitudinal row (Fig. 3). Neck unarmed. Trunk fusiform, armed with a few small spines on ventral surface, pointing posteriorly, from anterior end of trunk to posterior margin of proboscis receptacle (Figs. 1, 2). Proboscis receptacle double-walled. Lemnisci elongated, roughly equal in length (Figs. 1, 2), extend beyond posterior margin of proboscis receptacle. Genital spines absent.

Male (based on 3 mature adults): Trunk 2,213–2,400 (2,329 ± 100.7; n = 3) long, 347.3–551.7 (474.00 ± 110.7; n = 3) wide. Proboscis 292.6–381.0 (338.2 ± 44.3; n = 3) long, 82.6–131.0 (111.8 ± 25.7; n = 3) wide. Apical hooks 36.0–38.9 (37 ± 1.3; n = 4) long, subapical hooks 35.0–63.6 (51.1 ± 8.7; n = 35) long, basal hooks I 16.8–24.4 (20.7 ± 3.2; n = 6) long, basal hooks II 14.4–19.4 (17.4 ± 1.9; n = 6) long, basal hooks III 11.35–18.0 (15.4 ± 2.6; n = 7) long, basal hooks IV 11.2–17.3 (14.4 ± 2.2; n = 5) long. Proboscis length:trunk length ratio 1:6.9. Proboscis receptacle 220.0–451.5 (300.2 ± 131; n = 3) long, 97.1–141.0 (118.9 ± 21.9; n = 3) wide. Ventral anterior trunk spines 10.7–13.4 (12.1 ± 1.1; n = 7) long. Lemnisci 651.2–754.7 (709.3 ± 34.6; n = 6) long, 46.4–89.5 (69.9 ± 18.7; n = 6) wide. Whole reproductive system post-equatorial. Testes equal, ovoid, contiguous. Anterior testis 247.4–267.0 (258.7 ± 10.1; n = 3) long, 195.0–214.9 (205.6 ± 10.0; n = 3) wide. Posterior testis 205.9–285.2 (238.5 ± 41.4; n = 3) long, 198.2–235.0 (212.1 ± 20.0; n = 3) wide. Six cement glands, pyriform; some glands contiguous with margin of posterior testis, 63.1–117.0 (87.7 ± 15.5; n = 17) long. Säfftigen's pouch pyriform, 176.0–176.6 (176.3 ± 0.5; n = 2) long, 85.6–96.5 (91.1 ± 7.7; n = 2) wide. Gonopore terminal.

Female (based on 2 gravid specimens): Trunk 2,163 (n = 1) long, 433.8 (n = 1) wide. Proboscis 280.2 (n = 1) long, 129.9 (n = 1) wide. Apical hooks 45.8–46.3 (46.1 ± 0.4; n = 2) long, subapical hooks 41.0–89.7 (69.2 ± 14.3; n = 21) long, basal hooks I 21.1–36.6 (27.5 ± 7.3; n = 4) long, basal hooks II 16.1–27.2 (23.5 ± 5.1; n = 4) long, basal hooks III 14.2–25.9 (21.1 ± 5.0; n = 4) long, basal hooks IV 18.0–22.4 (19.9 ± 1.9; n = 4) long. Proboscis length: trunk:length ratio 1:7.7. Proboscis receptacle 259.7 (n = 1) long, 143.9 (n = 1) wide. Lemnisci 1,081–1,140 (1,111 ± 41.8; n = 2) long, 97.0–100.0 (98.4 ± 2.1; n = 2) wide. Ventral anterior trunk spines 13.8–17.8 (16.1 ± 2.0; n = 3) long. Mature eggs fusiform, elongate, 54.0–61.0 (58.2 ± 2.7; n = 9) long, 18.6–22.1 (20.2 ± 1.1; n = 9) wide. Gonopore subterminal.

Taxonomic summary

Type host: Pseudopercis numida Miranda-Ribeiro, 1903 (Perciformes, Pinguipedidae) (Namorado sandperch).

Site of infection: Intestine.

Type locality: Coast of Cabo Frio, State of Rio de Janeiro, Brazil (22°52′43.26″S, 42°1′11.55″W).

Prevalence: 22.6% (14 of 62 fishes necropsied).

Mean intensity of infection: 4.1 ± 4.2.

Type specimens: Holotype male CHIOC no. 37103 (whole mount); allotype female CHIOC no. 37104 (whole mount); 2 paratypes CHIOC no. 36672 (male) and 37105 (female) (whole mounts).

Etymology: The specific name refers to the type locality of the species.

Remarks

Heterosentis brasiliensis n. sp. is included in this genus by having a claviform proboscis, trunk with spines, and no trunk antero-dorsal curvature. This species differs from some other species of the genus by possessing 10 longitudinal rows of hooks in the proboscis, while *H. zdzitowieckii* (Kumar, 1992); *H. hirsutus* Pichelin & Cribb, 1999; *H. parasiluri* Yin & Wu, 1984; *H. fusiformis* Yamaguti, 1935; *H. plotosi* Yamaguti, 1935; *H. paraplagusiarum* (Nickol, 1972); and *H. septacanthus* (Sita in Golvan, 1969) have 13 or more longitudinal rows of hooks in the proboscis (Pichelin and Cribb, 1999).

Among the species that have fewer than 13 longitudinal rows of hooks, *H. brasiliensis* differs from *H. thapari* (Gupta & Fatma, 1979) by having apical hooks longer than 30 μm, while *H. thapari* presents apical hooks 15–16 μm long and 10–12 longitudinal rows of hooks in the proboscis (Gupta and Fatma, 1979; Pichelin and Cribb, 1999). *Heterosentis brasiliensis* differs from *H. overstreeti* Schmidt & Paperna, 1978 by possessing trunk spines restricted to the ventral body surface, while *H. overstreeti* has trunk spines covering the entire trunk (Schmidt and Paperna, 1978; Pichelin and Cribb, 1999). The new species differs from *H. pseudobagri* (Wang & Zhang, 1987) by having 3 or more basal hooks, while *H. pseudobagri* has fewer than 3 basal hooks in the proboscis and 12 longitudinal rows of hooks in the proboscis (Pichelin and Cribb, 1999).

The number of longitudinal rows (10) of hooks in the proboscis and the distribution of spines only in the anterior region of the trunk in *H. brasiliensis* are similar to *H. heteracanthus* (Linstow, 1896) and *H. caballeroi* Gupta & Fatma, 1985. The type species of this genus, *H. heteracanthus*, possesses trunk spines that extend well past the proboscis receptacle (Pichelin and Cribb, 1999), but *H. brasiliensis* has trunk spines restricted to the ventral body surface, while *H. heteracanthus* possesses trunk spines in the ventral and dorsal body surfaces (Van Cleave, 1931; Zdzitowiecki, 1984). Another difference between these 2 species is the number of hooks in each longitudinal row in the proboscis, i.e., *H. brasiliensis* has 1 apical hook, 2 subapical hooks, and 3 or 4 small basal hooks, totaling 6 or 7 hooks in each longitudinal row, while *H. heteracanthus* has 1 or 2 subapical hooks, and 3 small basal hooks, totaling 4 or 5 hooks in each row (Van Cleave, 1931; Zdzitowiecki, 1984).

Heterosentis caballeroi also has 10 longitudinal rows of hooks and 4 small basal hooks in each longitudinal row in the proboscis (Gupta and Fatma, 1983; Pichelin and Cribb, 1999). Nevertheless, *H. brasiliensis* differs from this species by the presence of 1 apical and 2 subapical hooks in each longitudinal row. In the original description of *H. caballeroi*, there was no information provided for female specimens (Gupta and Fatma, 1983), which does not allow for comparison with females of the new species. Another difference between these 2 species is the mean size of the proboscis hooks. In males of *H. brasiliensis*, the mean size of the apical, subapical, and basal hooks is smaller than that of males of *H. caballeroi*, where the apical and subapical hooks measure 58 μm long, and small basal hooks measure 24 μm long (Gupta and Fatma, 1983). Another character observed in the proboscis armature of *H. brasiliensis* is the unequal size of basal hooks in each longitudinal row (Figs. 3, 4). In the new species, in both sexes, the distal basal hooks are larger than the proximal basal hooks (Fig. 4). In *H. caballeroi*, this difference was not observed (Gupta and Fatma, 1983). In *H. caballeroi*, the lemnisci are smaller than the proboscis receptacle and the male reproductive system is pre-equatorial (Gupta and Fatma, 1983), while in *H. brasiliensis*, the elongated lemnisci extend beyond the posterior margin of the proboscis receptacle (Figs. 1, 2), and the male reproductive system is post-equatorial (Fig. 1).

DISCUSSION

Arhythmacanthinae includes species of *Hypoechinorhynchus* Yamaguti, 1939, *Spiracanthus* Muñoz & George-Nascimento, 2002, and *Heterosentis* (Pichelin and Cribb, 1999; Muñoz and George-Nascimento, 2002). *Hypoechinorhynchus* spp. are distinguished by the presence of antero-dorsal body curvature (Pichelin and Cribb, 1999), and *Spiracanthus* spp. possess basal hooks that are distributed in diagonal rows (Muñoz and George-Nascimento, 2002). *Heterosentis* spp. have a claviform or globular proboscis, a trunk with spines, and no antero-dorsal curvature of the trunk (Pichelin and Cribb, 1999).

Before the present study was conducted, *Heterosentis* included 12 valid species (Pichelin and Cribb, 1999). The differentiation of species of *Heterosentis* is based on morphometric data on proboscis hooks, body structures, proboscis armature, and distribution of trunk spines (Pichelin and Cribb, 1999). *Heterosentis brasiliensis* is distinguished from the other species of the genus by having a combination of the following characters: proboscis armature with 10 longitudinal rows of hooks, with 1 apical, 2 subapical, and 3 or 4 small basal hooks, totaling 6 or 7 hooks in each row; a trunk armed with few small spines on the anterior ventral surface of the body; lemnisci extended be-

yond the posterior margin of the proboscis receptacle; and a male post-equatorial reproductive system.

Among the species of *Heterosentis*, only 1, *H. heteracanthus*, was recorded in fishes from the coastal zone of South America and the Antarctic. *Heterosentis heteracanthus* was originally described as an intestinal parasite in *B. microlepidotus* from Chile (Van Cleave, 1931; Semenas and Trejo, 1997), and has also been reported in *N. neglecta*, *N. rossi*, *and G. gibberifrons* in the Antarctic Ocean near the coastal zones of Argentina and Chile (Zdzitowiecki, 1984).

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