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A New Species of *Ichthyouris* Inglis, 1968 (Nematoda: Pharyngodonidae) Parasitizing Two Characiform Fishes from Tocantins River, Maranhão State, Brazil

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ABSTRACT: A new oxyuroid nematode, *Ichthyouris nunani* n. sp., is described from the intestine of the freshwater benthopelagic characiform fishes *Laemolyta taeniata* and *Curimata acutirostris*, both of which were caught in the Tocantins River, State of Maranhão, Brazil. The new species is easily distinguished from all other species of the genus mainly because of the distribution of the male caudal papillae, the morphology of the spicule, and the fact that the eggs have an operculum and many long, thread-like filaments at each pole. This is the first helminth species described in both hosts, and this report contributes to the knowledge of the helminthological fauna of fish in the Neotropical region.

KEY WORDS: *Ichthyouris nunani* n. sp., Nematoda, Brazil, Tocantins River, Characiformes, *Laemolyta taeniata*, *Curimata acutirostris*, fish, Pharyngodonidae.

The Tocantins River arises in the state of Goiás, in central Brazil, and runs northwards through different sedimentary basins for 2,500 km through the states of Tocantins, Maranhão, and Pará. It is formed by the confluence of 2 main tributaries: the Paraná and Maranhão Rivers (Provet, 2013).

Laemolyta taeniata (Kner, 1858) (Anostomidae, Characiformes) is a freshwater benthopelagic fish distributed in the Amazon and Orinoco basins (Froese and Pauly, 2018). It is an omnivorous grazer that browses solid surfaces for algae, insect larvae, and other small items in its natural habitats (Reis et al., 2003; Maurari and Menezes, 2006). *Curimata acutirostris* Vari & Reis, 1995 (Curimatidae, Characiformes) is an endemic fish from the Araguaia-Tocantins basin (Ribeiro et al., 1995; Bartolette et al., 2017). To date, in Brazil, no species of helminths have been collected from *C. acutirostris* and *L. taeniata*, although a single species of copepod has been described from *L. taeniata* (Malta, 1996).

The family Pharyngodonidae Travassos, 1919 includes 9 genera of parasitic nematodes of fish in the Neotropical region, among which, 7 have been reported in Brazil. In the present paper, a new species of *Ichthyouris* is described from *C. acutirostris* and *L. taeniata*, contributing to our knowledge of the helminthological fauna of fish in the Neotropical region.

MATERIALS AND METHODS

During August 2010, 3 specimens of *L. taeniata* (total length 173–243 cm; total weight 50.3–153.4 g) and 3 specimens of *C. acutirostris* (total length 143–155 cm; total weight 42–48.6 g) obtained from the Tocantins River, Maranhão State, Brazil, were examined for helminths. Fishes were acquired with the aid of local fisherman and were examined for parasites immediately upon capture. Internal organs were separated in Petri dishes containing 0.9% NaCl, and examined with the aid of a stereoscopic microscope. Nematodes found were washed in 0.9% NaCl, fixed in AFA (2% glacial acetic acid, 3% formaldehyde, and 95% ethanol 70° GL), and cleared with phenol or glycerin for light microscopical examination. The nematodes were observed with the use of a Zeiss Axioscope 2 microscope equipped with a camera lucida and a Sony MPEG Movie EX DSC-S75 digital camera. All measurements are given in millimeters, unless otherwise stated. Specimens studied were deposited in the “Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC)” in Brazil.

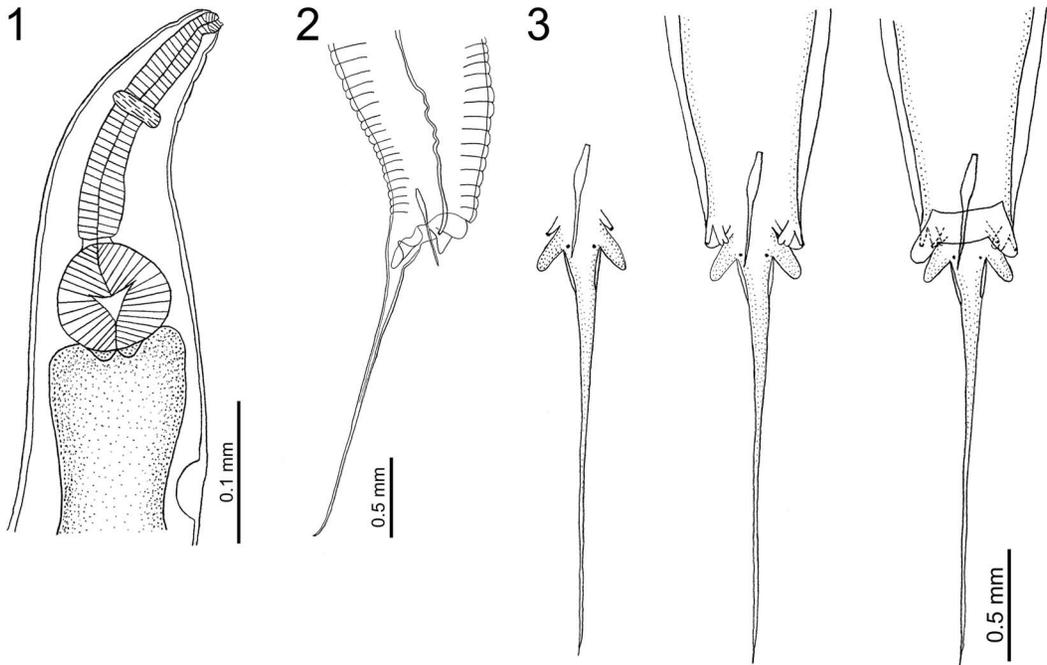
RESULTS

Nematoda Rudolphi, 1808
Secernentea Linstow, 1905
Oxyurida Chabaud, 1974
Oxyuroidea Cobbold, 1864
Pharyngodonidae Travassos, 1919
***Ichthyouris* Inglis, 1962**
***Ichthyouris nunani* n. sp.**
(Figs. 1–9)

Description

General diagnosis: Small nematodes, males smaller than females. Cuticle transversely striated, more

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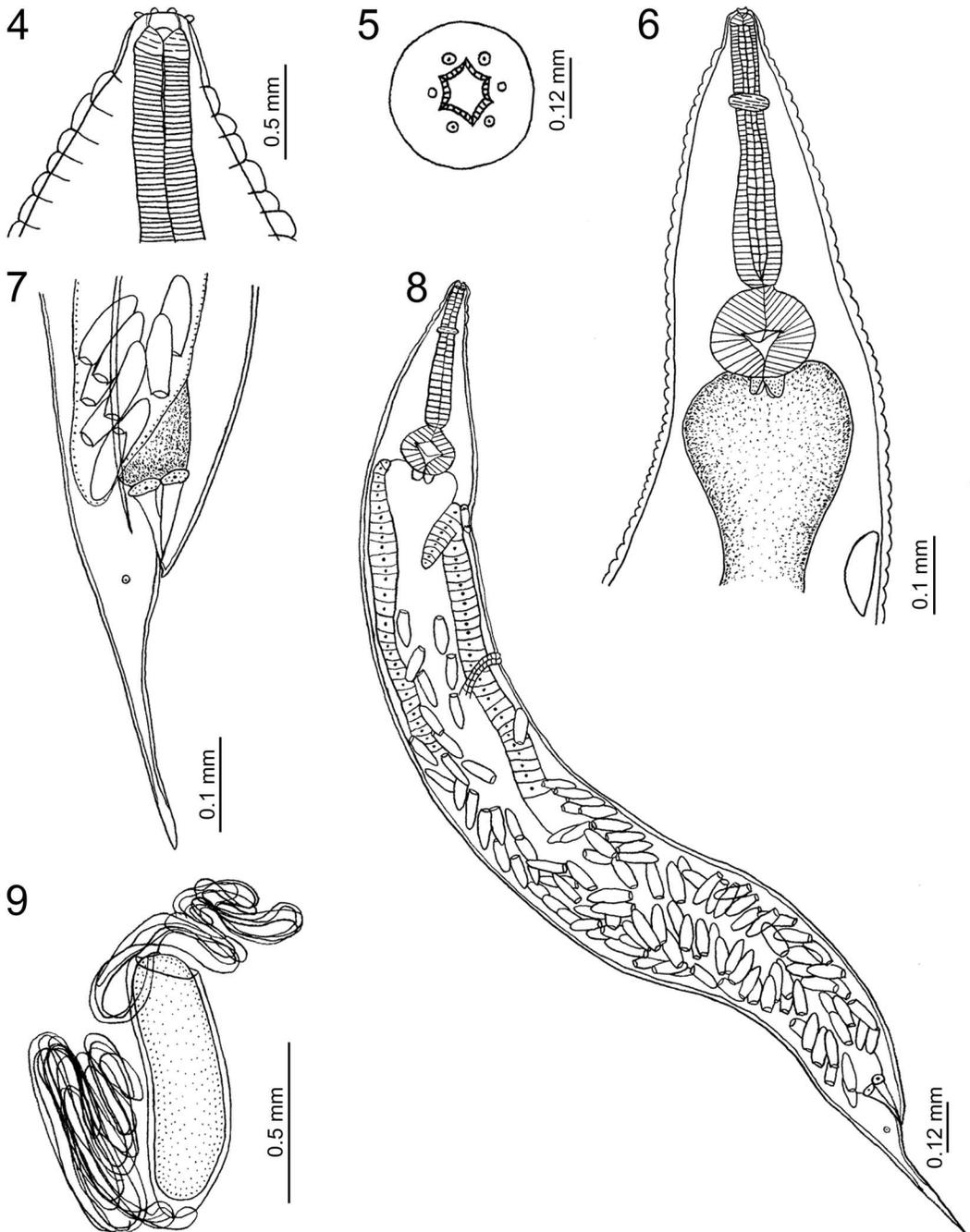
Figures 1–3. Line drawings of *Ichthyouris nunani* sp. n.; male. **1.** Anterior region of male, lateral view. **2.** Posterior region of male, lateral view. **3.** Posterior region of male, ventral view, showing the distribution of papillae.

evident in the anterior region (Fig. 4). Lateral alae extending along entire body. Tail narrowing posteriorly in a long terminal spike (Figs. 3, 7). Oral aperture hexagonal, surrounded by three two-lobed lip-like ventral structures, each lobe provided with well-developed, oral lamella (Fig. 5). Four rather large median cephalic papillae and 1 pair of lateral amphids present (Fig. 5). Esophagus forming a long corpus with slightly outlined “pharynx” at anterior end, very short isthmus and well-developed bulb with sclerotized apparatus and small valve. Excretory pore with a large aperture, posterior to posterior end of esophagus (Figs. 1, 6).

Male (based on 2 specimens from *L. taeniata*; measurements of holotype in parentheses): Total body including tail spike 1.06 (1.58) long, maximum width 0.14 (0.13) (Fig. 3). Buccal cavity not observed. Esophagus including bulb 0.25 (0.29) long; corpus including “pharynx” 0.18 (0.20) long; “pharynx” 7 μ m (10 μ m) long; isthmus 2 (7) μ m long and 20 wide; bulb 0.07 (0.08) long and 0.06 (0.08) wide (Fig. 1). Nerve ring encircles esophagus close to midlength of corpus. Excretory pore 0.37 (0.27) from anterior end of body

(Fig. 1). Single, slightly sclerotized spicule present, larger in the anterior portion and tapered in the posterior portion, 0.06 (0.06) long (Figs. 2, 3). Tail bears lateral caudal alae, with 5 pairs of pedunculated papillae. One pair of large elongated subventral preanal papillae, overlapping the 3 pairs of papillae situated at level of cloaca, ventral, the median one bifurcated. One pair of large postanal papillae, subventral. A pair of minute phasmids situated at the level of postanal papillae (Fig. 3). Length of tail including caudal spike 0.26 (0.35); caudal spike 0.25 (0.25) long (Figs. 2, 3).

Female (based on 10 specimens from *C. acutirostris* and *L. taeniata*; measurements of allotype in parentheses) (Figs. 4–9): Body including tail spike 1.85–4.25 (2.45) long, maximum width 0.30–0.42 (0.32) (Figs. 7, 8). Lateral alae very narrow. Small buccal cavity, 5–12 (7) μ m long (Fig. 4). Esophagus including bulb 0.42–0.51 (0.46); corpus including “pharynx” 0.34–0.41 (0.35) long and 0.03–0.05 (0.04) wide; “pharynx” 0.01–0.02 (0.02) long; isthmus 5 (5) μ m long and 27–30 (30) wide; bulb 0.10–0.12 (0.11) long and 0.12–0.16 (0.14) wide (Fig. 6). Nerve ring encircling esophagus 0.11–0.14 (0.13) from anterior



Figures 4–9. *Ichthyouris nunani* sp. n.; female. **4.** Cephalic end, lateral view. **5.** Apical end, apical view. **6.** Anterior region, lateral view. **7.** Tail, lateral view. **8.** General view. **9.** Egg.

extremity (Fig. 6). Excretory pore wide, situated at level of bulb, in the anterior region of intestine, 0.32–0.85 (0.44) from anterior end of body (Fig. 6). Vulva pre-equatorial, 0.89 (0.92) from anterior end, at 36% (33%) of body length (Fig. 8). Both ovaries parallel. Uterus prodelphic, posterior to vulva, containing numerous eggs, occupying most space of body (Fig. 8). Eggs oval, 0.08–0.10 (0.09–0.10) in length and 0.03–0.04 (0.03) in width, operculated, nonlarvated, containing many long, thread-like filaments at each pole (Fig. 9). Tail including slender caudal spike, 0.40–0.60 (0.50) long, bearing a pair of minute lateral phasmids; tail spike, 0.25–0.35 (0.30) long (Figs. 7, 8).

Taxonomic summary

Type host: *Laemolyta taeniata* (Kner, 1858) (Characiformes: Anostomidae).

Other host: *Curimata acutirostris* Vari & Reis, 1995 (Characiformes: Curimatidae).

Site of infection: Intestine.

Type locality: Tocantins River (06°33'38"S, 47°27'04"W), Estreito municipality, State of Maranhão, Brazil.

Prevalence and intensity: 42 specimens (2 males and 40 females) in 1 of 3 (33.3%) *L. taeniata* examined, and 17 specimens (all females) in 1 of 3 *C. acutirostris* (33.3%).

Etymology: The species name is after Dr. Gustavo Wilson Nunan *in memoriam*, of the Department of Vertebrates, National Museum, Federal University of Rio de Janeiro (UFRJ), RJ, Brazil, for his great contribution to the knowledge of Brazilian fish.

Deposition of types: Holotype male CHIOC 38.581a, allotype female CHIOC 38.581b, 1 paratype (male CHIOC 38.581c); 5 paratypes (females) CHIOC 38.581d–g; 38.582

DISCUSSION

The new species is allocated to the genus *Ichthyouris* based on its general morphology, mainly by the caudal end of the male. The genus was erected by Inglis (1962) to accommodate specimens of *Ichthyouris ro* Inglis, 1962 collected from the intestine of *Mesonauta festivus* (= *Cichlasoma festivum*) (Heckel) from Guyana (formerly British Guiana). To date, *Ichthyouris* refers only to parasitic nematodes of freshwater fishes and is represented by 6 species.

Four species have been described from Brazil: *Ichthyouris brasiliensis* Moravec, Kohn, and Fernandes, 1992 from *Megalancistrus aculeatus* (Perugia) (Loricariidae); *Ichthyouris laterifilamenta* Moravec, Kohn, and Fernandes, 1992 from *Trachydoras paraguayensis* (Eigenmann & Ward) (Doradidae); *Ichthyouris ovifilamentosa* Moravec and Thatcher, 2001 from *Cichlasoma* sp. (Cichlidae); and *Ichthyouris voltagrandensis* Martins, Yoshitoshi and Umekita, 2001 from *Myleus tiete* Eigenmann & Norris (Characidae) (Moravec et al. 1992a, b; Martins et al., 2001; Moravec and Thatcher, 2001). Recently, Cárdenas et al. (2018) reported *I. ro* and *Ichthyouris bursata* Moravec and Prouza, 1995 collected from *Mesonauta festivus* (Heckel, 1840) in the central Brazilian Amazon region, representing the first report of these species in Brazil.

Although *I. bursata* was described in Europe from the aquarium-reared discus (*Symphysodon discus* Heckel, 1840) the authors mentioned that the type host was apparently originally introduced together with fish from South America (Moravec and Prouza, 1995). Subsequently, *I. bursata* was redescribed by Moravec and Laoprasert (2008) from *Symphysodon* spp. and hybrids from Thailand. In the same paper, these authors mentioned records of *I. bursata* parasitizing *S. aequifasciatus* from an unknown locality in Brazil.

Ichthyouris nunani n. sp. can easily be distinguished from its congeners mainly by the distribution of the male caudal papillae, the morphology of the spicule, and by features of the eggs, the latter including characteristic numbers and positions of egg filaments, amongst other features. *Ichthyouris nunani* n. sp. differs from *I. voltagrandensis*, *I. ovifilamentosa*, and *I. ro* also by the absence of cuticularized plate-like structures on the male caudal end and from *I. brasiliensis* by the absence of conspicuous sclerotized lateral spines at the level of the anal opening in the female.

The new species is closely related to *I. laterifilamenta* but differs from the latter especially in the size and position of the filaments on the eggs (smaller and lateral filaments on the eggs of *I. laterifilamenta* versus larger and polar filaments in the new species), in having smaller eggs (0.077–0.102 length × 0.030–0.037 width vs. 0.117–0.138 length × 0.051–0.069 width in *I. laterifilamenta*), and in possessing a different number and distribution of caudal papillae on the males (4 pairs in *I. laterifilamenta* vs. 5 pairs in the new species).

Despite the richness of fish species in the Neotropical region, relatively little is known about their

helminth parasites. In Brazil, only the copepod *Ergasilus triangularis* Malta, 1996 has been described parasitizing *L. taeniata* from the Jamari River in the state of Rondônia (Malta, 1996). Thus, the present article contributes towards increasing our knowledge of the nematode parasites of fish and towards expanding the geographical distribution of these worms.

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