Strongylurus amazonicus n. sp. (Nematoda: Heterakidae): A parasite of Tropidurus oreadicus from the Brazilian Amazon

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ABSTRACT

Tropidurus oreadicus Rodrigues 1987 is a recently described species, thus there are no reports of helminthes parasites for this species. In this study, a morphological characterisation was performed of a nematode species parasite of the large intestine of T. oreadicus captured in an urban area. This urban area is similar to the estuarine dale from Guamá river and the “igarapé” of Belém, Pará State, Brazil. Morphological analysis suggested that the parasite is a new species of nematode, based mainly on the number and distribution pattern of the caudal papillae in males, which is unique for this species. In the present work, we describe for the first time the structure, number, and disposition of the cervical papillae. The morphological data were supported by scanning electron microscopy, which served as an important tool for distinguishing these nematodes from other species of the genus.

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1. Introduction

Tropidurus oreadicus (Squamata: Tropiduridae) Rodrigues, 1987 is an endemic species from Brazil that is frequently observed in open vegetation areas; it is common in the central Brazilian “Cerrado” areas and is also found in open enclaves in the Amazonian forest, south of the Amazon River (Colli et al., 1992; Faria and Araujo, 2004; Frost et al., 2001).

Despite the extensive literature on the helminthes of lizards in Brazil, including studies of hosts of the genus Tropidurus, only 13 species of nematodes have been described for these hosts, and there are no data on helminthes parasites of T. oreadicus (Ávila and Silva, 2010; Vicente et al., 1993).

A total of 31 species are recognised within the genus Strongylurus Müller, 1894 that parasitise the intestines of amphibian and reptiles: 29 species from reptiles and 2 from amphibians. In the Neotropical region, 4 species have been described: S. acaudata Caballero, 1941; S. oscari Travassos, 1923; S. panamaensis Bursey et al., 2003, and S. similis Caballero, 1934 (Bursey et al., 2003).

S. oscari is the only species that has been described in Brazil. The present work describes a new species of Strongylurus from the intestinal tract of T. oreadicus from Belém, Pará State, Brazil.

2. Materials and methods

A total of 26 hosts were caught in an urban area of Federal University of Pará, Campus Belém, situated on the eastern margin of the Guamá River (48°32’W to 48°29’W, 1°15’S to 1°29’S) between January 2007 and March 2008. The lizards were transported alive to the laboratory. The animals were anaesthetised with sodium thiopental, weighed, and euthanised by exsanguination [Comitê de Ética em Pesquisa Animal da Universidade Federal do Pará (CEPAE-UFPA) license BIO 010-10]. Worms were then collected. Subsequently, the nematodes in the large intestine were rinsed with phosphate-buffered saline

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3. Results

3.1. Strongylurus amazonicus n. sp. (Figs. 1–5)

General description from light microscopy and SEM: Heterakidae Railliet and Henry, 1912; Spinicaudinae Travassos, 1920. The anterior end is similar in both sexes. Three triangular lips (1 dorsal and 2 ventro-lateral); each lip has 1 tooth. Each of the lateral lips has amphid and 1 cephalic papilla, whereas the dorsal lip features 2 papillae. The limitations of the lips present a characteristic groove. Twenty pairs of caudal pedunculated papillae, distributed in 4 rows of 5 papillae (2 latero-dorsal and 2 latero-ventral), with a prominent button central structure located in a circular depression. Cuticular transversal ridges along the body. Oesophagus with a triangular lumen, divided into the pharynx, corpus, and valved bulb. Excretory pore located on the anterior third of the body, anterior to the oesophagus bulb and presenting a longitudinal elliptical aperture. Intestine rectilinear with anterior dilatation.

3.1.1. Males (1 holotype and 9 paratypes)

Total length $8.05 \pm 0.36$ (7.52–8.41) and width $0.42 \pm 0.04$ (0.35–0.48) at bulb level. Oesophagus total length $1.50 \pm 0.40$ (1.44–1.56) $\times$ $0.08 \pm 0.01$ (0.06–0.07). Pharynx $0.22 \pm 0.01$ (0.2–0.23) and corpus $1.24 \pm 0.04$ (1.16–1.27). Bulb $0.26 \pm 0.20$ (0.22–0.28) with a maximum width of $0.25 \pm 0.20$ (0.2–0.26). Nerve ring $0.43 \pm 0.03$ (0.37–0.47) and excretory pore $1.04 \pm 0.07$ (0.9–1.12) from the anterior end. Posterior end with a truncated copulatory bursa, with a pre-cloacal chitinous sucker.
at 0.21 ± 0.020 (0.18–0.26) from the tail tip and 95.9 μm ± 10 (80–100) diameter. One pair of sub-equal spicules: left 0.71 ± 0.04 (0.62–0.77) and right 0.75 ± 0.04 (0.69–0.81). Caudal pedunculated papillae with the following pattern: 3 pre-cloacal pairs (1 anterior pair and 2 pairs adjacent to the sucker) and an unpaired micro-papilla located medially along the inferior border of the sucker; 3 ad-cloacal pairs (1 ventral pair, 1 ventro-lateral pair, and 1 lateral pair); 3 post-cloacal pairs (two median pairs and 1 lateral pair) and a phasmid pair located lateral to the caudal appendix. Conical and short caudal appendix ventrally curved and needle shaped.

3.1.2. Females (1 allotype and 9 paratypes)

Total length 8.53 ± 0.33 (8.04–9.31) and width at bulb level 0.5 ± 0.03 (0.43–0.54). Oesophagus total length 1.49 ± 0.05 (1.53–1.68) × 80 μm ± 10 (70–90). Pharynx 0.22 ± 0.01 (0.21–0.24/0.2). Corpus 1.30 ± 0.05 (1.21–1.36). Bulb 0.28 ± 0.02 (0.26–0.32) × 0.28 ± 0.01 (0.26–0.3). Nerve ring 0.48 ± 0.06 (0.43–0.6) and excretory pore 1.11 ± 0.07 (1.0–1.12) from the anterior end. Vulva 5.5 ± 0.27 (5.24–6.19) from the anterior end. Tail 0.24 ± 0.03 (0.21–0.27). Elliptical eggs with thick shell 60 μm ± 1 (61–68) × 40 μm ± 1.5 (40–42).

3.2. Taxonomic summary

Type host: T. oreadicus (Squamata: Tropiduridae) Rodrigues, 1987
Site of infection: Large intestine
Type locality: Belém, Pará, Brazil (48°27′W to 41°82′W, 1°27′S to 18°04′S)
Data type and depository: The holotype (No. MPEG 0017), allotype (No. MPEG 0018) and paratypes (No. MPEG 0019 to MPEG 0022) were deposited at the Coleção Helmintológica do Museu Paraense Emílio Goeldi (MPEG).

Comparative material examined: Strongylurus pana- mensis HWML No. 16970 and Strongylurus similis HWML No. 67113 and 67114 at the Harold W. Manter Laboratory of Parasitology, University of Nebraska, Lincoln, NE, USA.

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**Fig. 3.** Scanning electron microscopy analysis of the cephalic region of Strongylus amazonicus n. sp. (a) Anterior extremity view showing the distribution of the 5 pairs of cephalic papillae: (aa) anterior pair, (mp) medial pair, and (pp) posterior pair; bar: 20 μm. (b) Mouth details, with cephalic structures, 3 lips with the cephalic papillae (cp) and the amphids (am) in the ventro-lateral lips; bar 10 μm. (c) Detail of the lips (l), in which it is possible to observe 1 tooth at each lip; bar: 5 μm. (d) Superior view of the mouth showing the teeth (t) in 2 ventro-lateral lips and the dorsal lip (dl); bar: 6 μm. (e) Detail of the cephalic papillae; bar: 4 μm.

**Etymology:** The species has been named after the biome in which it was found.

**Host-parasite data:** Prevalence, 42.3%; range of intensity 1–7.

### 4. Discussion

This new species, *S. amazonicus* n. sp., has the general characteristics of the genus (*Anderson et al., 2009*). A total of 31 species of *Strongylus* have been described as intestinal parasites of reptiles and, occasionally, amphibians (*Baker, 1984; Bursey et al., 2003*).

There have been few reports of species of *Strongylus* that exhibit papillae in the cervical region. Among the species described, only *Caballero (1938)* and *Caballero (1968)* reported sessile papillae in the cervical region of *S. similis Caballero, 1938* and *S. skarjibini Caballero, 1968*, respectively. In a review of the family Heterakidae, *Inglis (1957)* highlighted the presence of sessile papillae as a common characteristic of this genus. However, there have been no reports of the number, distribution, and characteristics of these papillae, and analysis of the specimens *Strongylus panamensis HWML n° 16970* and *Strongylus similis HWML n° 67113* and 67114 deposited in the Harold W. Manter Laboratory of Parasitology revealed cervical papillae in *S. similis*; however, it was not possible to identify the number and distribution pattern.

For *S. amazonicus* n. sp., we used light microscopy to observe the papillae with an intracuticular peduncle and scanning electron microscopy analysis to confirm the number and disposition of these papillae (20 papillae distributed in 4 rows of 5 papillae each: 2 latero-ventral and 2 latero-dorsal rows). This is the first report of this characteristic pattern and number of cervical papillae, which is unique among the species of the genus.

Based on the number of papillae in the male caudal region, *S. amazonicus* n. sp. belongs to the group of species with unpaired papillae close to the caudal sucker; this group includes...
S. oscari Travassos, 1923; S. elegans Railliet and Henry, 1914; S. media Harwood, 1935; S. riojai Caballero, 1968; S. similis Caballero, 1938; S. skrjabini Caballero, 1968; S. winteri Caballero, 1968; and S. panamaensis Bursey et al., 2003. However, among the species listed above, only 4 species of Strongylurus have been described from the Neotropical region: S. oscari Travassos, 1923; S. similis Caballero, 1938; S. acuadata Caballero, 1941; and S. panamaensis Bursey et al., 2003 (Bursey et al., 2003).

Among the Neotropical species, S. oscari has the greatest total length (11.3–14.8 in males and 12.5–17.4 mm in females), and the smaller species are S. panamaensis (4.9–6.5 in males and 5.8–7.7 in females) and S. acuadata (5.3–5.9 in males and unknown in females). These values are different from those observed for S. amazonicus n. sp., but they indicate that the new taxon is more similar to S. similis (8.9–9.4 in males and 9.8–10.4 in females).

Based on the number and distribution of the caudal papillae, S. amazonicus n. sp. is easily distinguishable from Neotropical species because it possesses the unique characteristics of 19 caudal papillae distributed in 3 pre-cloacal pairs, an unpaired papilla situated centrally in the inferior border of the caudal sucker, 3 ad-cloacal pairs and 3 post-cloacal pairs (7:6:6), as well as a pair of phasmids lateral to the caudal end (Table 1).

S. amazonicus n. sp. is the second species described from lizards of the genus Tropidurus in Brazil; the other species is S. oscari, which was described for T. torquatus (Weid, 1820) by Travassos (1923). S. media has 21 papillae, but it was described from Chamaeleon multitudinatus (a different host) in an Ethiopian region and has a different pattern of papillae (7:4:10).

Table 1

<table>
<thead>
<tr>
<th>Species</th>
<th>Male length (mm)</th>
<th>Spicule length</th>
<th>Papillae pattern*</th>
<th>Female length (mm)</th>
<th>Vulva length from anterior end (mm)</th>
<th>Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongylurus amazonicus n. sp.</td>
<td>7.52–8.41</td>
<td>0.71/0.75</td>
<td>21 (7:6:8)</td>
<td>7.52–8.41</td>
<td>5.5</td>
<td>Tropidurus oredicus</td>
</tr>
<tr>
<td>S. oscari Travassos, 1923</td>
<td>8.2–8.8</td>
<td>0.8/0.9</td>
<td>21 (11:4:6)</td>
<td>8.3–9.0</td>
<td>5.5–5.8</td>
<td>Tropidurus torquatus</td>
</tr>
<tr>
<td>S. acuadata Caballero, 1941</td>
<td>5.3–5.9</td>
<td>0.75/0.8</td>
<td>20 (12:0:8)</td>
<td>Female unknown</td>
<td>3.0–4.7</td>
<td>Sceloporus ferrariipecteri</td>
</tr>
<tr>
<td>S. panamaensis Bursey et al., 2003</td>
<td>4.9–6.5</td>
<td>0.5/0.7</td>
<td>21 (9:2:10)</td>
<td>5.8–7.7</td>
<td>6.35</td>
<td>Anolis biporcutus</td>
</tr>
<tr>
<td>S. similis Caballero, 1938</td>
<td>8.9–9.4</td>
<td>0.72/0.8</td>
<td>21 (9:2:10)</td>
<td>9.8–10.4</td>
<td></td>
<td>Sceloporus torquatus</td>
</tr>
</tbody>
</table>

* Total (precloacal:adcloacal:postcloacal).

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5. Conclusions

The morphological analysis revealed similarities between the new taxon and *S. similis* with respect to the number of caudal papillae and the presence of cervical papillae. However, the two are easily distinguishable by the number and distribution of the papillae.

SEM analysis revealed morphological details of the features and added new data to the morphology of the genus. The number, disposition, and characteristics of the cephalic papillae, in addition to those of the caudal papillae and pre-cloacal sucker, were clearly observed by SEM and were corroborated by light microscopy analysis.

SEM is an important tool because it permits the observation of surface details that occasionally cannot be adequately visualised by light microscopy analysis. This technique adds new details to the morphology of helminthes parasites, which enriches taxonomic keys and facilitates the description of new species by alpha taxonomy.

The present paper proposes the 32nd species in the genus *Strongyluris*, the fifth for the Neotropical region, the second species of the genus of parasites of lizards of the genus *Tropidurus* and from Brazil, and the first for the host *T. oreadicus* and the Amazon region.

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