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RESEARCH NOTE / NOTA CIENTÍFICA

STRONGYLOIDES CRUZI (RHABDITIDA: STRONGYLOIDIDAE) IN *OPHIODES STRIATUS* (SQUAMATA: ANGUIDAE) FROM BRAZIL: NEW HOST AND LOCALITY RECORDS WITH TAXONOMIC COMMENTS ON *STRONGYLOIDES* OF LIZARDS

STRONGYLOIDES CRUZI (RHABDITIDA: STRONGYLOIDIDAE) EN *OPHIODES STRIATUS* (SQUAMATA: ANGUIDAE) EN EL BRASIL: NUEVOS REGISTROS DE HUÉSPED Y LOCALIDAD CON COMENTARIOS TAXONÓMICOS SOBRE *STRONGYLOIDES* DE LOS LAGARTOS

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Abstract

Strongyloides cruzi Rodrigues, 1968 was found in *Ophiodes striatus* (Spix, 1825) from Itabirito, state of Minas Gerais, Brazil. The morphology of the nematodes obtained was briefly described and compared with previous reports of *Strongyloides* spp. from lizards. Taxonomic comments about these parasites are presented and a species of *Strongyloides*, a genus whose members have rarely been reported in lizards, is for the first time observed in an anguid reptile.

Keywords: *Ophiodes striatus* – reptile - *Strongyloides cruzi* - strongyloidiasis

Resumen

Strongyloides cruzi Rodrigues, 1968 fue encontrado en *Ophiodes striatus* (Spix, 1825) en Itabirito, estado de Minas Gerais, Brasil. La morfología de los nematodos obtenidos es descrita brevemente y comparada con reportes previos de *Strongyloides* spp. en lagartos. Comentarios taxonómicos sobre estos parásitos son presentados y una especie de *Strongyloides*, un género cuyos integrantes rara veces se han observado en lagartos, es reportado por primera vez en un reptil ánguido.

Palabras clave: Estrongiloidosis, *Ophiodes striatus*, reptil, *Strongyloides cruzi*.

INTRODUCTION

There is still a substantial deficit in knowledge of helminths from Neotropical reptiles, and considering existing information about parasites from lizards, the number of species known to parasitize these animals is proportionally lesser than that of other reptiles (Ávila & Silva, 2010), perhaps due to shortage of surveys of their helminth fauna.

Among the South American species of lizards, the Striped Worm Lizard *Ophiodes striatus* (Spix, 1825) occurs in northern Argentina, Paraguay, Uruguay and Brazil (Peters & Donoso-Barros, 1970; Bérnils & Costa, 2012; Cacciali & Scott, 2012). *Ophiodes* spp. present a cylindrical and elongate body with hind limbs only that are reduced and flap-like (Peters & Donoso-Barros, 1970). The taxonomy of these lizards is complicated and *O. striatus* may be a species complex. Some authors based on unpublished information have considered *O. fragilis* (Raddi, 1820), for example, as other valid species from Brazil (Gutsche *et al.*, 2007; Cacciali & Scott, 2012), and the color of *Ophiodes* might be useful in the specific identification (Lema, 2002).

Without doubt helminths from these lizards need to be further studied, since only two species of nematodes have been reported in anguid host in the continent: *Cyrtosomum* sp. and *Physaloptera retusa* Rudolphi, 1819 in *O. striatus* from Brazil (Baker, 1987, Ávila & Silva, 2010; Ávila *et al.*, 2010).

Strongyloides spp. have been recorded in different reptile hosts worldwide, including the species *S. cruzi* Rodrigues, 1968, *S. ophiusensis* Roca & Hornero, 1992 and *S. darevskyi* Sharpilo, 1976 described from lizards (Rodrigues, 1968, 1970; Sharpilo, 1973, 1976; Roca & Hornero, 1992; Khanum *et al.*, 2002; Murvanidze *et al.*, 2008). Moreover, unidentified *Strongyloides* have also been reported in these reptiles (Perera *et al.*, 2013).

In the present note, the first record of *Strongyloides* in an anguid lizard, *O. striatus* from Brazil, and a new location of occurrence of the parasite are presented. Additionally, taxonomic aspects correlated to *Strongyloides* spp. of lizards, whose reports were scattered in the literature, are discussed.

MATERIAL AND METHODS

One golden specimen of anguid lizard from Itabirito (20°15'10''S, 43°48'03''W), metropolitan region of Belo Horizonte, state of Minas Gerais, southeastern Brazil, was already dead when it was sent to the laboratory, identified as *O. striatus* (Peters & Donoso-Barros, 1970; Hoogmoed & Gruber, 1983), necropsied and after deposited in the collection of the Department of Parasitology, UFMG (DPIC 2414). Viscera were separated in Petri dishes containing saline (0.85% NaCl) and examined with aid of a stereomicroscope to recover parasites which were fixed in 10% formalin and then analyzed with aid of a light microscope. Images were obtained using a Leica ICC50 HD digital camera attached to the microscope, and measurements were obtained by analyzing the captured images using the Leica Application Suite (LAZ EZ) software, version 2.0. Taxonomic identification of the parasites was based on morphological criteria according different authors (Little, 1966a, b; Rodrigues, 1968, 1970; Sharpilo, 1973; Roca & Hornero, 1992; Vicente *et al.*, 1993). Nematode specimens were deposited in the same collection (DPIC 6274).

RESULTS

Specimens of minuscule nematodes were collected from the large intestine of the *O. striatus* necropsied. Measurements and the main taxonomic traits of the parasites recovered in the present study and data of *Strongyloides* from lizards reported by other authors are presented in Table 1. After morphological analysis the parasite was identified as *Strongyloides cruzi* Rodrigues, 1968 (Figs. 1-3, Table 1).

Taxonomic summary

Host: *Ophiodes striatus* (new host).

Locality: Itabirito, Metropolitan region of Belo Horizonte, State of Minas Gerais, Brazil (new locality).

Site of infection: Large intestine.

Intensity of infection: 3 specimens.

Other hosts and localities reported: *Hemidactylus mabouia* (Moreau de Jonnès, 1818) (host type), Rio de Janeiro, Brazil (Rodrigues, 1968, 1970); *H. flaviviridis* Rüppell, 1835, Dhaka, Bangladesh (Khanum *et al.*, 2002).

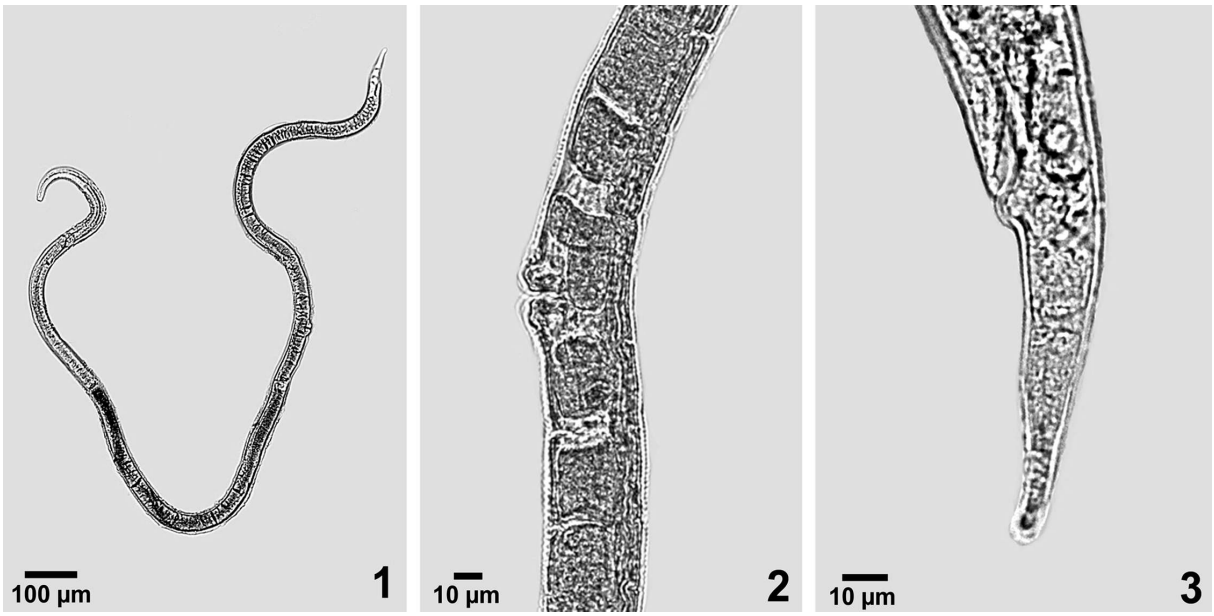
Remarks: *Strongyloides cruzi* was described from one single specimen of *H. mabouia* from Brazil and differs from the species *S. ophiusensis* and *S. darevskyi* reported in lizards from Balearic Islands (Spain) and Transcaucasia (Azerbaijan and Georgia), respectively, by its longer and wider body, higher number of intrauterine eggs (slightly shorter in size), longer tail and distinct shapes of ovaries. In the specimens of *S. cruzi* analysed, the anterior ovary was spiraled twice around intestine and posterior ovary presented one or one and half spiral, and this shape of ovaries is in accordance with the figure of the parasite provided by Rodrigues (1970). The anterior ovary of *S. ophiusensis* forms one spiral around the intestine and the posterior ovary lies parallel to the organ (Roca & Hornero, 1992). Ovaries of *S. darevskyi* are oftentimes also spiraled, but details on their shapes were not related in the description. However, a posterior ovary with partial spiral is noticeable based on the drawing of the parasite (Sharpilo, 1973, 1976). *Strongyloides ophiusensis* and *S. darevskyi* are more closely related to each other than with *S. cruzi* and additional morphological studies on these two species are still desirable. However, the body of *S. ophiusensis* is shorter and thinner than *S. darevskyi*. Eggs of the former species are narrower and can achieve greater length, the nerve ring is to a shorter distance from the mouth and the vulva is about three-fourth of the body length from the anterior end (Sharpilo, 1973, 1976; Roca & Hornero, 1992). On the other hand, the vulva of *S. cruzi* is located in the two-third from the anterior end, similar to that was described for *S. darevskyi*, however, in previous reports (Rodrigues, 1968, 1970), and also in the present study, the nerve ring of *S. cruzi* was not observed.

As other species of *Strongyloides* of lizards, *S. cruzi* differs from *Strongyloides* of snakes mainly by smaller size of body and esophagus, shorter distance between the mouth and vulva, and, except in relation to *S. natricis*, Navarro & Lluch, 1993, shape of ovaries (Pereira, 1929; Singh, 1954; Little, 1966b; Navarro & Lluch, 1993; Santos *et al.*, 2010). Furthermore, *Strongyloides* spp. from snakes usually have the tails more sharply pointed and a greater number of eggs in uteri than the species from lizards. In fact, tails of *Strongyloides* from these reptiles are in general short and narrow posteriorly to the anus terminating in a blunt moderately tip (Fig. 3).

DISCUSSION

Reports of *Strongyloides* spp. from lizards are scarce and the present study, despite sampling limitations, contribute to knowledge about these nematodes from Neotropical reptiles, especially when considering also the taxonomic comments that were presented.

Until now, *S. cruzi* is the only representative of the genus *Strongyloides* already recorded in New World lizards, although this species has been reported in Asian *H. flaviviridis* by Khanum *et al.* (2002) that suggested a wide distribution of the parasite. However, the specificity of *Strongyloides* spp. to the host is usually not limited to generic level of the host, since a same species of *Strongyloides* has been reported in different families of hosts (Little, 1966a, b). In the present study, the find of *S. cruzi* in a new host species of the family Anguidae for which hitherto there was no record of parasitism by *Strongyloides* may also suggest the existence of certain unspecificity of this parasite to its lizard hosts.



Figures 1-3. Parasitic female of *Strongyloides cruzi*: (1) total view; (2) detail of vulva and intrauterine eggs, lateral view; (3) tail, lateral view.

Table 1. Morphological data of *Strongyloides cruzi* found in *Ophiodes striatus* from Brazil and other *Strongyloides* spp. of lizards reported by different authors. Abbreviations: NA: not available; L: length; W: width; A: anterior; P: posterior.

		Present study	*Strongyloides cruzi* Rodrigues (1968)	Rodrigues (1970)	*S. ophiusensis* Roca & Hornero (1992)	*S. darevskyi* Sharpilo (1976)
		(n = 3)	(n = 3)	(n = NA)	(n = 26)	(n = 10)
Body	L	2,307 ± 162 (2,123-2,430)	1,630-2,910	1,630-3,220	1,140 ± 127 (880-1,456)	1,400-1,600
	W	47 ± 4 (43-50)	40-90	40-90	28 ± 3 (23-34)	33-36
Esophagus	L	637 ± 42 (589-667)	525-632	525-728	479 ± 50 (372-592)	460-600
Mouth to vulva	L	1,496 ± 387 (1,403-1,575)	1,295-1,790	1,295-2,050	806 ± 76 (652-956)	920-1,050
Tail	L	73 ± 3 (70-77)	74-81	72-81	51 ± 4 (42-58)	49-60
Shape of ovaries	A	Two spirals	NA	Spiraled (two spirals*)	One spiral	Spiraled
	P	One or one and half spiral	NA	Spiraled (one and half spiral*)	Parallel to the intestine	(One half spiral*)
Intrauterine eggs	N	5 ± 2 (2-7)	Few eggs	Few eggs	2	1-3
Eggs	L	45 ± 4 (40-50)	49-55	39-55	55 ± 5 (48-68)	50-60
	W	30 ± 3 (26-33)	33-35	25-35	28 ± 2 (18-26)	27-30
Locality		Brazil (Minas Gerais)	Brazil (Rio de Janeiro)	Brazil (Rio de Janeiro)	Spain (Balearic Islands)	Azerbaijan and Georgia
Host		*Ophiodes striatus*	*Hemidactylus mabouia*	*Hemidactylus mabouia*	*Podarcis pityusensis*	*Darevskia saxicola*

* Information about shape of ovaries based on figures presented by authors, since detailed descriptions have not been provided in the text of the respective studies.

In helminthological surveys performed in lizards, many of them with a substantial number of animals sampled, species of *Strongyloides* have not been found (Lewin, 1990, 1992a, b; Fontes *et al.*, 2003; Goldberg *et al*., 2006, 2007; Adeoye & Ogunbanwo, 2007; Ávila *et al.*, 2010, 2011; Ávila & Silva, 2011; Albuquerque *et al.*, 2012) indicating that the parasite may be rare in this host group. In fact, the prevalence of infection of *Podarcis pityusensis* (Boscá, 1883) with *S. ophiusensis* was 1.2% and the mean intensity was 9.7 (Roca & Hornero, 1992). In relation to *S. cruzi* from *H. flaviviridis* the mean prevalence and intensity were 5.8 and 4.6 ± 2.5, respectively (Khanum *et al.*, 2002). Due to this low intensity of infection and the consequent difficulty in diagnosis of the infection, a molecular screening of *Strongyloides* in lacertid lizards has recently been proposed (Perera *et al*., 2013). However, higher prevalences of *S. darevskyi* (up to 75%) with variable intensity of infection (1-55) were found in some populations of *Darevskia* spp. from Transcaucasia (Sharpilo, 1973, 1976). In addition to the type host *D. saxicola* (Eversmann, 1884), this author reported *S. darevskyi* in *D. armeniaca* (Méhely, 1909), *D. rostombekovi* (Darevsky, 1957) and *D. rudis* (Bedriaga, 1886).

In the present study new locality and host for *S. cruzi* are reported. No record of parasitism by any species of Rhabditida, not only of *Strongyloides*, had so far been carried out for *O. striatus*. The diversity of potential hosts and distribution of *S. cruzi* are likely underestimated and studies aiming to elucidated new interaction between Neotropical lizards and their parasites are still necessary.

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