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Research Note

Helminths of *Liophis miliaris* (Squamata, Dipsadidae): a list of species and new records

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Summary

In order to have better knowledge of the parasites of the common water snake *Liophis miliaris* (Linnaeus, 1758), a checklist of its helminths was produced based on a review of the literature and new records of worms identified during the course of a parasitological survey combining data from stool analysis (n = 22) and necropsies (n = 8) of specimens of this snake from Muriaé, state of Minas Gerais, Brazil. Thirty-one helminth species (two acanthocephalans, one cestode, 11 nematodes and 17 trematodes) were so far reported in *L. miliaris* in the Neotropical region, already including the records in the present study of *Acanthorhabdias acanthorhabdias* Pereira, 1927, *Paracapillaria (Ophidiocapillaria) cesarpintoi* (Freitas & Lent, 1934) and *Strongyloides ophidiae* Pereira, 1929. Taxonomic comments on these nematode species are given, and areas of occurrence of *A. acanthorhabdias* and *P. cesarpintoi* are expanded in southeastern Brazil. In addition, factors related to parasite richness of *L. miliaris*, which is likely related to its aquatic habits, are discussed.
Keywords: *Liophis miliaris*; Neotropical snake; helminth fauna; parasite richness; checklist

Introduction

Despite the diversity of parasites observed in reptiles, studies on the helminth fauna of these vertebrates have been relatively scarce, especially in the Neotropic (Brooks & Hoberg, 2000; Dobson *et al*., 2008).

Among the snakes from this ecozone, the common water snake *Liophis miliaris* (Linnaeus, 1758) presents widespread geographical distribution in South America and is found from the north of the continent to northeastern Argentina and Uruguay. This species has morphological characteristics of a terrestrial snake, but is well adapted to aquatic environments and its diet consists mainly of amphibians and fish (Gans, 1964; Cunha & Nascimento, 1970; Amaral, 1978; Dixon, 1983; Vitt, 1983; Marques & Souza, 1992). Several previously conducted studies on the parasites of *L. miliaris*, of which some are not easily available, have demonstrated that this snake is the host for various helminths. However, these reports have been scattered in the literature and a checklist of helminths in *L. miliaris* that have been reported in South America is still necessary.

Thus, in view of the deficit in knowledge of the richness of parasitic fauna from snakes, and, particularly, the need to improve the understanding of helminths of *L. miliaris*, a parasitological survey combining data from stool analysis and necropsies of these reptile species was performed in the present study. New records of three species of nematodes from this snake and additional information concerning these parasite relationships are presented, as well as an updated list of helminths found in this dispsadid host, which reveals an unusual great diversity of species from *L. miliaris*. In parallel, prevalence data of these three species of nematodes and other helminths observed in stool samples of this snake are approached.

Material and Methods

Information relating to helminths found in *L. miliaris* came from a parasitological survey conducted on 22 specimens of this snake which had just been taken from their natural environment in the municipality of Muriaé (21° 08’ S - 42° 22’ W), state of Minas Gerais, Brazil between May 2002 and March 2003. The snakes remained housed in individual cages throughout the period when this study was conducted. Stool examinations were performed at all time points at which each snake evacuated over four weeks using the sedimentation method. Eight specimens with fecal analyses that were positive for helminths died during the period of captivity and were necropsied for parasite recovery.

The nematodes were firstly fixed in formalin at 70 °C, and then were counted, sexed (when necessary) and clarified in lactophenol. Morphological and morphometric analyses of the worms were performed under a light microscope, and measurements were made with the aid of a micrometer eyepiece. The nematodes were identified based on taxonomic keys (Yamaguti, 1961; Little, 1966a; Vicente *et al*., 1993; Moravec, 1982, 1986a, b; Anderson *et al*., 2009) and original descriptions of the worms (Freitas & Lent, 1934a, b; Pereira, 1927, 1929; Artigas *et al*., 1973; Fernandes & Souza, 1974). The specimens studied were deposited in the collection of Laboratório de Taxonomia e Biologia de Invertebrados, Department of Parasitology, Universidade Federal de Minas Gerais (DPIC).

The ecological terms used were as prescribed by Bush *et al*. (1997) and the abbreviations of Brazilian states used in the present study were as follows: Minas Gerais (MG), Paraná (PR), Rio de Janeiro (RJ) and São Paulo (SP).

Furthermore, studies by different authors were consulted in order to establish higher taxonomic categories for Acanthocephala (Amin 1987), Cestoda (Khalil *et al*., 1994), Nematoda (Moravec, 1982; Vicente *et al*., 1993; Anderson *et al*., 2009) and Trematoda (Gibson *et al*., 2002; Jones *et al*., 2005; Bray *et al*., 2008) used in the updated list of helminths of *L. miliaris* produced in the present study.

Results and Discussion

A list of species based on new findings reported in this study and records obtained from scientific literature is presented in Table 1. *Liophis miliaris* presents a substantial parasite species richness: 31 in total so far, and the worm groups are as follows: two acanthocephalans (6.5 %), one cestode (3.2 %), 11 nematodes (35.5 %) and 17 trematodes (54.8 %). Most species of helminths (90.3 %) have been identified only from Brazilian specimens of *L. miliaris*, with reports of two species (6.5 %) in Argentina and one (3.2 %) in Uruguay.

Helminth eggs were commonly seen in the feces from most evaluated snakes in the parasitological survey. In fact, 72.7 % (16/22) of *L. miliaris* tested positive for at least one species, and 45.4 % (10/22) were coinfected with between two and five species of helminths. Aside from eggs of a cestode seen in 9.1 % (2/22) of stool samples, two different trematode eggs were found in feces from 18.2 % (4/22) and 13.6 % (3/22) of snakes and the respective morphologies of these egg morphotypes were similar (data not shown) to eggs seen in adult specimens of *Opisthogonimus fariai* Ruiz & Leão, 1943 and *Ophiodiplostomum spectabile* Dubois, 1936 which were previously diagnosed in *L. miliaris* from the same locality (Pinto *et al*., 2012). Nematode eggs (three morphotypes) were the most prevalent in this stool survey (see details below), and all infected snakes harbored at least one species of this parasite group. The species of nematodes identified in *L. miliaris* through fecal analysis and recovery of adult worms are given below:

Paracapillaria (Ophidiocapillaria) cesarpintoi (Freitas & Lent, 1934) (Enoplea, Capillariidae)

[Syn. *Capillaria cesarpintoi* Freitas & Lent, 1934;
Capillaria amarali Freitas & Lent, 1934;
Pseudocapillaria cesarpintoi (Freitas & Lent, 1934);
Pseudocapillaria amarali (Freitas & Lent, 1934)]

Host and locality: *L. miliaris*, Muriaé, MG (new locality).
Site of infection: Small intestine.
Prevalence of infection: 36.4 % (8/22) and 62.5 % (5/8) by stool analysis and necropsy, respectively.
Mean intensity of infection: 7.0 ± 4.5 (2 – 12), i.e. 4.0 ± 3.0 (1 – 7) females and 3.0 ± 1.5 (1 – 5) males.
Mean abundance of infection: 4.4 ± 4.9, i.e. 2.5 ± 3.1 females and 1.9 ± 2.0 males.
Type host and locality: *Liophis poecilogyrus* (Wied-Neuwied, 1825) (Dipsadidae), Rio de Janeiro, RJ (Freitas & Lent, 1934a).
Other reported host: *Ninia hudsoni* Parker, 1940 (Dipsadidae) (McAllister *et al*., 2010).
Other locality records: Rio de Janeiro, RJ (Freitas & Lent, 1935); Pastaza Province, Ecuador (McAllister *et al*., 2010).

Table 1. Checklist of helminths already recorded in *Liophis miliaris*. Helminth species marked with an asterisk were so far reported exclusively in this host

	Site of infection	Country	References
ACANTHOCEPHALA			
Oligacanthorhynchidae			
Oligacanthorhynchus spira (Diesing, 1861) - only cystacanths.	Peritoneum	Brazil	Travassos, 1917; Pizzato & Marques, 2006.
Echinorhynchidae			
Unidentified species, parasitic form not available.	Not available	Brazil	Noronha *et al*., 2009.
CESTODA			
Protocephalidae			
**Ophiotaenia arandasi* (Santos & Rolas, 1973)	Intestines	Brazil	Santos & Tayt-Son Rolas, 1973.
NEMATODA			
Ascarididae			
Ophidascaris trichuriformis Vaz, 1935	Stomach	Brazil	Vaz, 1935; Vicente *et al*., 1993.

Capillariidae			
Paracapillaria cesarpintoi (Freitas & Lent, 1934)	Small intestine	Brazil	Freitas & Lent, 1934; Vicente *et al*., 1993; present study.
Cosmocercidae			
**Aplectana travassosi* (Gomes & Mota, 1967)	Small intestine	Brazil	Gomes & Mota, 1967; Vicente *et al*., 1993.
Diaphanocephalidae			
Kalicephalus appendiculatus Molin, 1861	Intestines	Brazil	Schad, 1962; Vicente *et al*., 1993.
Kalicephalus costatus costatus (Rudolphi, 1819)	Intestines	Argentina	Ramallo, 2005.
Kalicephalus inermis inermis Molin, 1861	Intestines	Brazil	Schad, 1962; Vicente *et al*., 1993.
Physalopteridae			
Physaloptera liophis Vicente & Santos, 1974	Stomach	Brazil	Vicente & Santos, 1974; Vicente *et al*., 1993.
Rhabdiasidae			
Acanthorhabdias acanthorhabdias Pereira, 1927	Lungs	Brazil	Pereira, 1927; Artigas *et al*., 1973; Fernandes & Souza, 1974; Vicente *et al*., 1993; Siqueira *et al*., 2009; present study.
Rhabdias labiata Pereira, 1927	Lungs	Brazil	Pereira, 1927; Vicente *et al*., 1993.
Strongyloididae			
Strongyloides ophidiae Pereira, 1929	Small intestine	Brazil	Mati & Melo, 2014; present study.
TREMATODA			
Dicrocoeliidae			
Infidum similis Travassos, 1916	Gallbladder	Brazil	Travassos, 1944; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
Diplodiscidae			
Catadiscus dolichocotyle (Cohn, 1903)	Large intestine	Uruguay	Mañé-Garzón & Gortari, 1965, Fernandes & Kohn, 2014.
Catadiscus freitaslenti Ruiz, 1943	Large intestine	Brazil	Ruiz, 1943; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
Mesocoeliidae			
Mesocoelium monas (Rudolphi, 1819)	Small intestine	Brazil	Correa, 1980.
Opisthogonimidae			
**Liophistrema pulmonale* Artigas, Ruiz & Leão, 1942	Lungs	Brazil	Artigas *et al*., 1942; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
**Opisthogonimus fariai* Ruiz & Leão, 1943	Mouth and esophagus	Brazil	Leão & Ruiz, 1943; Pinto *et al*., 2012, Fernandes & Kohn, 2014.
Opisthogonimus fonsecai Ruiz & Leão, 1942	Mouth, esophagus and airways	Brazil	Correa, 1980, Fernandes & Kohn, 2014.
Opisthogonimus lecithonotus Lühe, 1900	Mouth, esophagus and airways	Brazil	Correa, 1980; Noronha *et al*., 2009.
Opisthogonimus megabothrium Pereira, 1928	Mouth and esophagus	Brazil	Pereira, 1928; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
Opisthogonimus serpentis Artigas, Ruiz & Leão 1943	Mouth and esophagus	Brazil	Artigas *et al*., 1943; Correa, 1980, Fernandes & Kohn, 2014.
Opisthogonimus sulina (Artigas, Ruiz & Leão, 1942)	Mouth and esophagus	Brazil	Correa, 1980.
Plagiorchiidae			
**Bieria artigasi* Leão, 1946	Lungs	Brazil	Leão, 1946; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
Travtrema stenocotyle (Cohn, 1902)	Small and large intestines	Brazil and Argentina	Freitas & Dobbin Jr, 1957; Lunaschi & Drago, 2007, Fernandes & Kohn, 2014.
Pleurogenidae			
**Aliptrema ribeiroi* Ruiz & Leão, 1955	Mouth and esophagus	Brazil	Ruiz & Leão, 1955; Travassos *et al*., 1969, Fernandes & Kohn, 2014.
Proterodiplostomidae			
**Ophiodiplostomum aristoterisi* (Ruiz & Rangel, 1954)	Small intestine	Brazil	Ruiz & Rangel, 1954; Travassos *et al*., 1969.
Ophiodiplostomum spectabile Dubois, 1936	Small intestine	Brazil	Ruiz & Rangel, 1954; Correa, 1980; Pinto *et al*, 2012, Fernandes & Kohn, 2014.
Reniferidae			
Renifer heterocoelium (Travassos, 1921)	Mouth and esophagus	Brazil	Correa, 1980, Fernandes & Kohn, 2014.

Remarks: Species of *Paracapillaria* Mendonça, 1963 can occur in fish, amphibians and reptiles, and in these last hosts, the parasites are found mainly in the tropical and subtropical regions. All species of *Paracapillaria* from snakes belong to the subgenus *Ophidiocapillaria* Moravec, 1986, which possesses a stichosome characterized by stichocytes with remarkably large nuclei and a nucleolus containing many distinct corpuscles. In Brazil, *P. (O.) cesarpintoi* and *P. (O.) murinae* are valid species already reported in snakes, since *Capillaria crotali* (Rudolphi, 1819) from *Crotalus durissus* Linnaeus, 1758 had been designated as *nomem nudum* (Travassos, 1915). Moreover, *Amphibiocapillaria freitasilenti* (Araújo & Gandhinagar, 1941) and *Pseudocapillaria (Ichthyocapillaria) maricaensis* Rodrigues, 1992 are also capillariid species found in Brazilian reptiles and described, respectively, from *Tropidurus torquatus* (Wied, 1820) and *Liolaemus lutzae* Mertens, 1938 (Moravec, 1986a; Rodrigues, 1992). Currently, *P. amarali* described based on specimens also obtained from *L. miliaris* is a junior synonymous of *P. cesarpintoi* (Moravec, 1986b). However, one of the characteristics used by Freitas and Lent (1934b) to consider these two species as distinct was the vulva with a notable anterior prominence, which was an easily viewable feature in our specimens. Therefore, additional studies are necessary, to better characterize this possible intraspecific variation. Moreover, there has not been any comparative and more detailed analysis of the stichosome and structures of the male caudal end (which have been used as taxonomic parameters for capillariid species), in relation to these nematodes obtained in Brazil from snakes. Nevertheless, this is a new record of *P. cesarpintoi* in this country since the pioneering studies of Freitas and Lent (1934a, b, 1935).

Acanthorhabdias acanthorhabdias Pereira, 1927
(Chromadorea, Rhabdiasidae)

Host and locality: *L. miliaris*, Muriaé, MG (new locality).
Site of infection: Lungs.
Prevalence of infection: 50.0 % (11/22) and 75 % (6/8) by stool analysis and necropsy, respectively.
Mean intensity of infection: 12.0 ± 11.8 (2 – 32).
Mean abundance of infection: 9.0 ± 11.5.
Type host and locality: *L. miliaris*, Irati, PR (Pereira, 1927).
Other reported host: *Bothrops alternatus* (Duméril, Bibron & Duméril, 1854) (Viperidae) (Siqueira *et al*., 2009).
Other locality records: Maricá, RJ (Fernandes & Souza, 1974); Guarulhos, SP; Pedro de Toledo, SP; Ponta Grossa, PR (Artigas *et al*., 1973); Três Corações, MG (Siqueira *et al*., 2009).
Remarks: *Acanthorhabdias* Pereira, 1927 is a monotypic genus established according to the anatomical feature of the anterior extremity of the parthenogenetic parasitic female that differs markedly from other rhabdiasids. In fact, as well as in the original description, the mouth of the specimens studied and identified as *A. acanthorhabdias* is bounded by a chitinous waist fitted with eight pyramidal spines possibly composed of chitin, although parasites presenting oral structures with ten spines have already been reported (Fernandes & Souza, 1974). There are two available studies concerning the redescription of the nematode (Artigas *et al*. 1973; Fernandes & Souza, 1974). In the first one, the authors also presented a description of the free-living and infective stages of *A. acanthorhabdias*.

Strongyloides ophidiae Pereira, 1929
(Chromadorea, Strongyloididae)

Host and locality: *L. miliaris* (n = 3), Muriaé, MG.
Site of infection: Small intestine.
Prevalence of infection: 27.3 % (6/22) and 37.5 % (3/8) by stool analysis and necropsy, respectively.
Mean intensity of infection: 3.7 ± 0.6 (3 – 4).
Mean abundance of infection: 1.4 ± 1.9.
Type host and locality: *Mastigodryas bifossatus* (Raddi, 1820) (Colubridae), São Paulo, SP (Pereira, 1929).
Other reported host: *Oxyrhopus guibei* Hoge & Romano, 1978 (Dipsadidae) (Santos *et al*., 2010).
Other locality record: Lençois Paulista, SP (Santos *et al*., 2010).
Remarks*:* *Strongyloides* Grassi, 1979 has already been observed not only in reptiles, but also in amphibians, birds and mammals. Parthenogenetic parasitic females of *S. ophidiae* live in host small intestines, while the biology of the free-living forms is complex and presents many unknowns, especially in relation to the free-living males. In addition to the original description of the nematode that presents certain shortcomings, Santos *et al.* (2010) studied morphological and molecular aspects of *S. ophidiae*, and the life history and additional taxonomic data of this species were recently described in *L. miliaris* naturally and experimentally infected (Mati & Melo, 2014). In North America, *S. serpentis* Little, 1966, another parasite of snakes, is morphologically closed to *S. ophidiae* that may be differenced from *S. serpentis* in terms of the shape of the ovaries, the number of eggs in the uteri, the mean ratio of the length of esophagus to the total length and the length of the tail (Litlle, 1966b; Mati & Melo, 2014). *Strongyloides ophidiae* is so far the only species of the genus described from snakes in Brazil, although another species from reptiles is known in the country: *S. cruzi* Rodrigues, 1968, a parasite of *Hemidactylus* spp. and *Ophiodes striatus* (Spix, 1825) (Rodrigues, 1968; Mati *et al*., 2013).

It is noteworthy that these three records were based on studies on a total of 118 specimens of helminths. Monoparasitism was observed in 37.5 % (3/8) of the snakes that died (one infected with *P. cesarpintoi* and two with *A. acanthorhabdias*), while 50 % (4/8) were parasitized with two species of worms (two infected with *P. cesarpintoi* and *A. acanthorhabdias*, one with *P. cesarpintoi* and *S. ophidiae* and another one with *A. acanthorhabdias* and *S. ophidiae*) and 12.5 % (1/8) with the three species of nematodes. These findings confirm data from stool survey, indicating that infections with more than one species of helminth may be common in *L. miliaris*, even under natural conditions.
Since there is a deficit in knowledge about the prevalence of parasites from snakes in nature, the observation of high percentages of occurrence of helminths in *L. miliaris* becomes more relevant, especially given the fact that most of the parasitological surveys in reptiles refer to captive animals, for which prevalence rates in stool samples may vary greatly due to the conditions of confinement

and/or periodic deworming (Rataj *et al.*, 2011; Okulewicz *et al.*, 2014; Wolf *et al.*, 2014).

Table 1 shows that a large number of species of helminths have *L. miliaris* as their host. In fact, the 31 species of helminths reported in this snake constitute an unusual large number that substantially exceeds the overall projections for the average number of helminth species for each species of reptile (4.02 species, i.e. 0.42, 0.39, 2.15 and 1.06 for acanthocephalans, cestodes, nematodes and trematodes, respectively) (Poulin & Morand, 2004; Dobson *et al*., 2008). This observation reiterates the necessity to expand the knowledge on parasitic species richness (Gregory *et al*., 1996; Brooks & Hoberg, 2000; Hugot *et al*., 2001; Dobson *et al*., 2008), particularly in the tropics.

The parasite richness in *L. miliaris* and particularly the numerical predominance of species of trematodes observed in this snake may be partially explained by its feeding and aquatic habits, as already suggested to other host species belonging to different vertebrate groups, including herptiles (Bush *et al*., 1990; Poulin & Morand, 2004). In fact, many trematodes species meet the requirements for maintaining their life cycles in aquatic environment as snail first intermediate hosts and tadpoles and fish that are the second intermediate hosts for several of these Neotropical trematodes, which not infrequently have low specificity for the vertebrate host (Ruiz & Leão, 1943; Hamann & González, 2009; Pinto *et al*., 2012). Interestingly, in a survey on parasites of reptiles in the Republic of Belarus, the highest number of parasite species among the hosts evaluated (26 species of helminths) was observed for *Natrix natrix* (Linnaeus, 1758), another snake with aquatic habits that also presented a large number of trematode species (Shimalov, 2010), as seen in *L. miliaris* for the first time in the in the Neotropical zone. Indeed, it was also found that host phylogeny, environment and diet seemed to have important roles in structuring the helminth community of aquatic snakes from two habitats in Louisiana, United States of America (Fontenot & Font, 1996). Furthermore, Jiménez-Ruiz *et al*. (2002) evaluated the helminth fauna of *Thamnophis eques* (Reuss, 1834) and *T. melanogaster* (Wiegmann, 1830) in the Mesa Central of Mexico and observed that in the localities where these snakes occurred in sympatry, the helminth communities were more diverse and species-rich in *T. melanogaster*. These snakes primarily feed on their prey in the water and show better adaptation to aquatic environments than shown by *T. eques*. However, in these two species of *Thamnophis*, unlike what was observed in *N. natrix* and *L. miliaris*, nematode species were recovered in higher numbers than were trematodes. Furthermore, the number of nematode species, which is at least five times higher than observed for trematodes in lizards and amphisbaenians in South America (Ávila & Silva, 2010), poses questions that might be related to less closeness of contact of many of these reptiles with water bodies over their evolutionary process, although further studies would be needed.

It is likely that the findings regarding the parasitic fauna of *L. miliaris* present peculiarities and are not satisfactorily explained in isolation. This species has been studied in parasitological terms over the past century, perhaps because it is aglyphous and presents a wide distribution (Gans, 1964; Cunha & Nascimento, 1970; Amaral, 1978; Dixon, 1983), thus making it easier to obtain specimens of this snake. Although a great diversity of parasites has been previously documented, a general survey on helminths from *L. miliaris* was nonexistent. Thus, it can still be identified as a new host for other species.

The fact that specimens of *L. miliaris* that have been evaluated over the years were wild is also a factor that may have favored the observation of higher parasite species richness. This is unlike many recent studies in Brazil which were conducted using snakes kept in captivity (Araújo *et al*., 1999; Silva *et al*., 2001; Dias *et al*., 2004; Barbosa *et al*., 2006; Siqueira *et al*., 2009), thereby implicating selection bias that favored identification of certain parasites, such as those with faster and direct life cycles.

In fact, helminths found in these surveys do not have usually high specificity for their reptilian hosts. However, seven species (one cestode, one nematode and five trematodes) were so far reported exclusively in *L. miliaris* (indicated by asterisks in Table 1). The factors related to the low index of host specificity exhibited by these species and its ecological implications need to be clarified.

On the other hand, coinfections occurred in *L. miliaris*, thus indicating that the presence of one parasite does not seem to preclude establishment of another infection. This snake not only is susceptible to simultaneous infections, but also is involved in a wide and diverse range of parasitic relationships. Indeed, *L. miliaris* is the definitive host for species of Cestoda, Nematoda and Trematoda and, apart from the parasites of the respiratory tract and lungs, all other adult helminths recovered live in the digestive system (mouth, esophagus, intestines and gallbladder). Moreover, these snakes also play a role as a paratenic host in the life cycle of acanthocephalans. It is known that hatching of the cystacanth occurs after ingestion of the egg by an arthropod, but this process may also occur in an inappropriate host, and the larvae then migrate into the body cavity (Petrochenko, 1956, Schmidt, 1985; Goldberg & Bursey, 2004). Thus, cystacanths of *Oligacanthorhynchus spira* (Diesing, 1861), for which cathartid birds are the definitive host, have been found in the peritoneum of *L. miliaris* (Travassos, 1917; Pizzato & Marques, 2006).

Through the present study, the areas of occurrence of *P. cesarpintoi* and *A. acanthorhabdias* were expanded, since both species were recorded in a new locality from southeastern Brazil. Among the three nematode species studied, the lowest prevalence and mean intensity of infection were in relation to *S. ophidiae*, while the highest were in relation to *A. acanthorhabdias*, thus confirming that this rhabdiasid seems to be a very common species from *L. miliaris*. Furthermore, *P. cesarpintoi* is the one of the three species that remains as exclusive parasite of the family Dipsadidae, but the scarcity of reports on these nematodes makes any attempt of analysis on the specificity unwise. Nevertheless, aspects of the biology of these nematode species are still poorly known, as well as the possible pathological processes induced by them, except to a few data related to *A. acanthorhabdias* (Siqueira *et al.*, 2009) and *S. ophidiae* (Mati & Melo, 2014).

Since the knowledge available on the biodiversity and distribution of helminths from Neotropical reptiles is at an early stage, and considering that for *L. miliaris* more than 30 species of parasitic worms have been recorded, further studies aiming to expand the information on parasites in other reptilian hosts are desirable. If similar patterns, with a large number of parasite species per host species, are common among other reptiles from tropical regions, especially among those with aquatic habitats, our unfamiliarity with the parasite richness of these vertebrates may be even greater than has been supposed.

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