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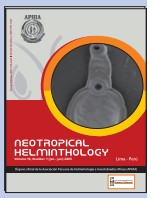

ORIGINAL ARTICLE / ARTÍCULO ORIGINAL

ENDOPARASITES OF LIZARDS IN CAATINGA HABITATS OF THE SEMIARID NORTHEAST OF BRAZIL

ENDOPARÁSITOS DE LAGARTOS EN HÁBITATS DE CAATINGA DE LA REGIÓN SEMIÁRIDA DEL NORESTE DE BRASIL

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ABSTRACT

This study characterizes the structure of endoparasite communities associated with lizards from six Caatinga vegetation areas, Brazil, and provides a detailed review of the occurrence and geographic distribution of the endoparasite species found. A total of 451 specimens from 16 lizard species from six sample locations within the Caatinga domain were examined. Endoparasites were surveyed in the digestive system, lungs, heart, liver, kidneys, and thoracic cavity. A total of 1648 was collected from 196 hosts, resulting in an overall prevalence of 43.46% and a mean infection intensity of 8.41 (Range: 1-80). The parasitic community was composed of Acanthocephala, Cestoda, Nematoda and Pentastomida. We identified 21 parasite species, of which *Parapharyngodon alvarengai* Freitas, 1957, *Physaloptera* sp. and *Physalopteroides venancioi* Lent, Freitas & Proença, 1946 were the most generalists in terms of host species infected, while *Centrorhynchus* sp., *Parapharyngodon largitor* Albo & Rodrigues, 1963, *Skrjabinellazia galiardi* Chabaud, 1973, *Spauligodon* sp. were the most specialized parasites found. This study brings 19 new host records along with their corresponding geographic areas. The

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data presented expands our understanding of endoparasites in the most human-populated semi-arid region in the world, advancing the knowledge of the distribution of parasitic species in the Caatinga and reducing the gaps in parasitological information related to lizards from the semi-arid region of Northeast Brazil.

Keywords: Acanthocephala – Cestoda – Nematoda – Parasites – Pentastomida – Sauria

RESUMEN

Este estudio caracteriza la estructura de las comunidades de endoparásitos asociadas a lagartos de seis áreas de vegetación de Caatinga, Brasil, y proporciona una revisión detallada de la ocurrencia y distribución geográfica de las especies de endoparásitos encontradas. Se examinaron 451 especímenes de 16 especies de lagartos de seis localidades de muestreo dentro del dominio de Caatinga. Se estudiaron los endoparásitos del aparato digestivo, los pulmones, el corazón, el hígado, los riñones y la cavidad torácica. Se recogió un total de 1648 en 196 hospedadores, lo que arrojó una prevalencia global del 43,46% y una intensidad media de la infección de 8,41 (amplitud: 1-80). La comunidad parasitaria estaba compuesta por Acanthocephala, Cestoda, Nematoda y Pentastomida. Se identificaron 21 especies de parásitos, siendo *Parapharyngodon alvarengai* Freitas, 1957, *Physaloptera* sp. y *Physalopteroides venancioi* Lent, Freitas & Proença, 1946 los más generalistas en cuanto a especies hospedadoras infectadas, mientras que *Centrorhynchus* sp., *Parapharyngodon largitor* Albo & Rodrigues, 1963, *Skrjabinellazia galiardi* Chabaud, 1973, *Spauligodon* sp. fueron los parásitos más especializados encontrados. Este estudio aporta 19 nuevos registros de hospedadores junto con sus correspondientes áreas geográficas. Los datos presentados amplían nuestra comprensión de los endoparásitos en la región semiárida más poblada por el hombre en el mundo, avanzando en el conocimiento de la distribución de las especies parásitas en la Caatinga y reduciendo las lagunas en la información parasitológica relacionada con los lagartos de la región semiárida del Nordeste de Brasil.

Palabras clave: Acanthocephala – Cestoda – Nematoda – Parásitos – Pentastomida – Sauria

INTRODUCTION

Parasites represent a significant portion of the biodiversity of the planet and represent the most common life strategy (Korallo *et al.*, 2007; Kuris *et al.*, 2008; Oliveira *et al.*, 2022). These organisms play an important role in understanding population dynamics, community structural shifts, and coevolution of their hosts (Ernst & Ernst, 1980; Buckingham & Ashby, 2022). They are key modulators of biodiversity across trophic levels and represent good models for studying host-parasite relationships (Barrett *et al.*, 2008; Robar *et al.*, 2010; Cardoso *et al.*, 2016).

Species inventories provide a baseline for determining which species and how many individuals inhabit a community, aiding in the understanding of species diversity and ecosystem functioning (Segalla *et al.*, 2021). Studies on the endoparasites of lizards have been well-documented in the Caatinga biome (e.g. Ávila *et al.*, 2012; Brito *et al.*, 2014; Lima *et al.*, 2017; Araujo-Filho *et al.*, 2020), revealing a rich and diverse parasitic fauna. The relationship between geographic areas and host distribution can influence the diversity parameters of parasites, highlighting the importance of spatial relationships in host-parasite interactions (Oliveira *et al.*, 2022, 2023).

Parasitic dynamics can be strongly influenced by changes in natural ecosystems, as well as by the phylogeny and life history of their hosts (Poulin, 2007; Brito *et al.*, 2014). Therefore, understanding the diversity and distribution of parasites is important for comprehending the role of host-parasite ecological relationships in ecosystem dynamics (Poulin & Krasnov, 2010; Campião *et al.*, 2015). In this context, this study aimed to characterize the structure of endoparasite communities associated with lizards from six Caatinga vegetation areas, Brazil and provide a detailed review of the occurrence and geographic distribution of the endoparasite species found.

MATERIAL AND METHODS

The Caatinga is the predominant vegetation of the Brazilian Northeast, characterized by a complex structure

of dry forests and shrublands (Silva *et al.*, 2017). This region has average temperatures ranging from 25 °C to 30 °C (Silva *et al.*, 2017), with annual rainfall concentrated over 3 to 4 months, varying from less than 400 mm to 1200 mm per year depending on local conditions, and characterized by unpredictable and high spatial-temporal irregularity (Andrade *et al.*, 2017).

In our study, we analyzed lizards deposited in the Coleção Herpetológica da Universidade Regional do Cariri, collected between 2014 and 2018, from six areas of Caatinga in the Brazilian Northeast (Figure 1): Bahia: Casa Nova (S 9º 24'W 41º 9'; 400 m altitude; 516 mm^3 annual precipitation), Contendas do Sincorá (S 13º 46', W 41º 2'; 356 m; 613 mm^3) and Palmas de Monte Alto (S 14º 17', W 41º 2'; 574 m; 792 mm^3); Ceará: Barro (S 7º 10' , W 38º 46'; 360m; 934mm^3); Paraíba: Cuité (S 6º 30', W 35º 57'; 470 m; 556 mm^3); and Pernambuco: Ouricuri (S 7º 52', W 40º 4'; 398m; 550mm^3).

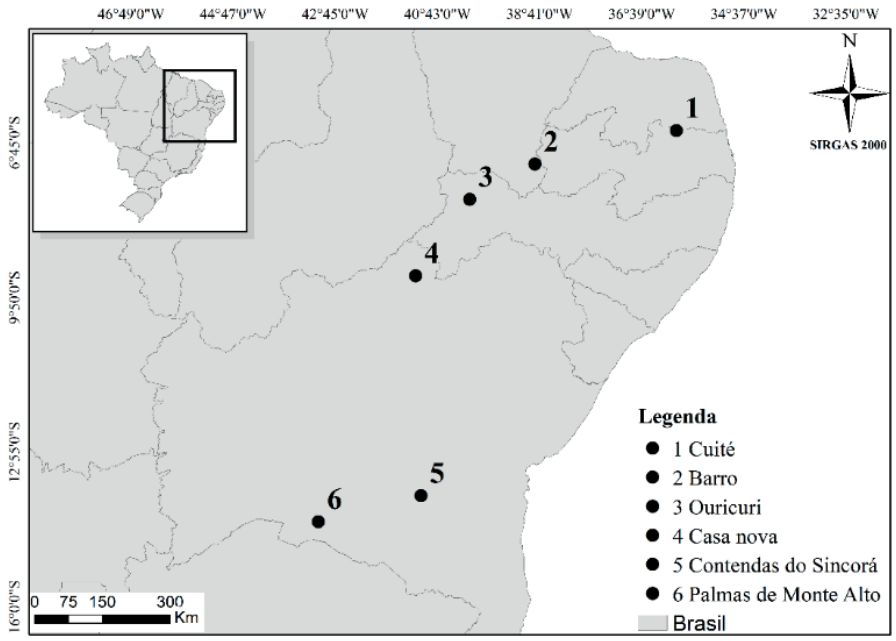

Figure 1. Sampling localities of lizards in the semi-arid Caatinga, northeastern Brazil.

We necropsied lizards under a stereoscopic microscope and examined them for the presence of macro endoparasites infecting the digestive system, lungs, heart, liver, kidneys and thoracic cavity. Endoparasites found were counted, identified, and preserved in 70% ethyl alcohol.

For species identification, we prepared the endoparasites following specialized methodologies for each taxonomic group (Yamaguti, 1971; Schmidt, 1986; Vicente *et al.*, 1993; Amato *et al.*, 1991; Andrade, 2000). The specimens were identified under a DMLB light microscope with interference phase contrast. Once identified, all endoparasite specimens were deposited in the Coleção Parasitológica of the Universidade Federal do Cariri (Voucher: CHERP - P - 90 to CHERP - P - 165). We calculated the overall prevalence, mean intensity of infection, and mean parasite abundance following Bush *et al.* (1997).

Ethic aspects: This study was conducted using lizard specimens previously deposited in the Herpetological Collection of the Universidade Regional do Cariri, Crato, Ceará, Brazil.

RESULTS

We examined 451 lizard specimens from 16 species, of which 196 were infected with at least one parasite. This resulted in an overall prevalence of 43.46% and a mean infection intensity of 8.41 (Range: 1-80) per infected host (Table 1).

The parasitic community was composed of Acanthocephala, Cestoda, Nematoda and Pentastomida. We identified 21 parasite species, with the highest prevalence observed in the nematodes *Pharyngodon cesarpintoi* Pereira, 1975 and *Physaloptera* sp., both with overall prevalence of 8.20% (37 hosts infected out of 451 lizards infected). Among these, *P. cesarpintoi* showed the greatest abundance of individuals collected (n = 551). In

Table 1. Community of parasites infecting lizards in caatinga areas in semi-arid Brazil. Infection Site = I.S.; N = Number of Parasites; NH = Number of Hosts; P% = Prevalence; MII = Mean intensity of infection ± Range; AB ± EP = Abundance ± Standard Error; Thoracic Cavity (TC); Lung (Lu); Small Intestine (SI); Large Intestine (LI); Stomach (S); (*) New host record; BA = Bahia state; CE = Ceará state; PB = Paraíba state; PE; Pernambuco state.

Host (n-examined)	IS	Parasite	N	NH	P%	MII (Range)	AB ± EP	State
Acratosaura mentalis (03)	TC	*Oswaldofilaria* sp.*	5	2	66.67	2.5 (1 - 4)	1.67	PB
	S	*Parapharyngodon alvarengai*	6	2	66.67	3 (2 - 4)	2	PB
	S	*Spauligodon* sp.	3	1	33.33	3	1	PB
Ameiva ameiva (30)	TC	Cistacanth	4	2	6.67	2 (1 - 3)	0.13 ± 0.06	CE
	SI	*Oochoristica* sp.	59	4	13.33	14.75 (1 - 28)	1.97 ± 0.63	CE
	LI	*Parapharyngodon* sp.	16	3	10	5.33 (5 - 6)	0.53 ± 0.18	CE
	LI	*Parapharyngodon alvarengai*	5	1	3.33	5	0.17	CE
	LI	*Parapharyngodon sceleratus*	3	1	3.33	3	0.1	CE
	LI	*Pharyngodon cesarpintoi*	24	1	3.33	24	0.8	CE
	LI	*Pharyngodon travassosi*	31	2	6.67	15.5 (3 - 28)	1.03	CE; PE
	S	*Physaloptera lutzi*	23	1	3.33	23	0.77	CE; PE
	S	*Physaloptera retusa*	5	2	6.67	2.5 (2 - 3)	0.17	CE
	S; TC	*Physaloptera* sp.	40	11	36.67	3.64 (1 - 13)	1.33 ± 0.33	CE
Ameivula nigrigula (03)	S	*Physaloptera* sp.*	3	2	66.67	1.5 (1 - 2)	1	BA
	Lu	*Raillietiella* sp.*	1	1	33.33	1	0.33	BA
Ameivula pyrrhogularis (125)	SI	*Oochoristica* sp.	3	1	0.8	3	0.02	PE
	LI	*Pharyngodon cesarpintoi*	509	32	25.6	15.9 (1 - 50)	4.07 ± 0.58	PE
	LI	*Pharyngodon travassosi*	123	6	4.8	20.5 (1 -80)	0.98 ± 0.17	PE
	S	*Physaloptera lutzi*	7	3	2.4	2.33 (1 - 4)	0.06 ± 0.1	PE
	S	*Physaloptera retusa*	3	2	1.6	1.5 (1 - 2)	0.024	PE
	S	*Physalopteroides venancioi*	20	3	2.4	6.67 (1 - 17)	0.16 ± 0.03	PE
	S	*Physaloptera* sp.	2	1	0.8	2	0.02	BA
	SI	*Spauligodon oxkutzcabiensis*	10	2	1.6	5 (2 - 8)	0.08	PE
Brasiliscincus heathi (11)	SI	*Oochoristica* sp.	1	1	9.09	1	0.09	PB
	TC	*Oswaldofilaria* sp.*	4	2	18.18	2 (1 - 3)	0.36	PB
	LI	*Parapharyngodon alvarengai*	8	4	36.36	2 (1 - 3)	0.73 ± 0.28	PE
	LI	*Parapharyngodon* sp.	2	1	9.09	2	0.18	PB
	S	*Physalopteroides venancioi*	2	1	9.09	2	0.18	PE

(Table 1 Continued)

(Table 1 Continued)

Host (n-examined)	IS	Parasite	N	NH	P%	MII (Range)	AB ± EP	State
Eurolophosaurus divaricatus (08)	LI	*Pharyngodon* sp.*	5	1	12.5	5	0.63	BA
	S	*Physaloptera* sp.*	4	4	50	1	0.5	BA
Gymnodactylus geckoides (44)	TC	*Oswaldofilaria* sp.*	1	1	2.27	1	0.02	PE
	LI	*Parapharyngodon alvarengai*	6	4	9.09	1.5 (1 - 3)	0.14 ± 0.04	PE
	LI	*Pharyngodon travassosi*	1	1	2.27	1	0.02	PE
	S	*Physaloptera* sp.	2	2	4.54	1	0.05	CE; PE
	S	*Physalopteroides venancioi**	1	1	2.27	1	0.02	PE
	Lu	*Raillietiella mottae*	1	1	2.27	1	0.02	PE
Hemidactylus brasilianus (31)	LI	*Parapharyngodon largitor**	2	2	6.46	1	0.06	PE
	LI	*Parapharyngodon sceleratus*	1	1	3.22	1	0.03	PE
	S	*Physaloptera lutzi*	31	5	16.13	6.2 (1 - 11)	1 ± 0.3	PE
	S	*Physaloptera* sp.	1	1	3.22	1	0.03	BA; PE
	S	*Physalopteroides venancioi*	8	2	6.46	4 (1 - 7)	0.25 ± 0.09	PE
Lygodactylus klugei (28)	TC	*Centrorhynchus* sp.*	56	1	3.57	56	2	PE
	SI	*Oochoristica* sp.*	1	1	3.57	1	0.04	PE
	S	*Physaloptera retusa**	1	1	3.57	1	0.04	PE
	S	*Physaloptera* sp.	22	4	14.29	5.5 (1 - 11)	0.79 ± 0.25	PE
	S	*Physalopteroides venancioi**	1	1	3.57	1	0.04	PE
	SI	*Skrjabinellazia galiardi**	6	4	14.28	1.5 (1 - 2)	0.21 ± 0.07	PE
	SI	*Skrjabinellazia* sp.*	1	1	3.57	1	0.04	CE
	LI	*Spauligodon oxkutzcabiensis*	3	1	3.57	3	0.11	PE
Nothobachia ablephara (04)	LI	*Pharyngodon cesarpintoi**	4	2	50	2 (1 - 3)	1	BA
Polychrus acutirostris (04)	LI	*Pharyngodon* sp.	1	1	25	1	0.25	CE
	S	*Physaloptera* sp.	1	1	25	1	0.25	CE
Phyllopezus periosus (07)	S; TC	*Physaloptera* sp.	13	2	28.57	6.5 (3 - 10)	1.86	PB; PE
	SI	*Skrjabinellazia* sp.	1	1	25	1	0.25	CE
	Lu	*Raillietiella mottae*	1	1	14.28	1	0.14	PB
Phyllopezus pollicaris (71)	LI	*Parapharyngodon alvarengai*	22	6	8.45	3.67 (1 - 13)	0.31 ± 0.07	PE

(Table 1 Continued)

(Table 1 Continued)

Host (n-examined)	IS	Parasite	N	NH	P%	MII (Range)	AB ± EP	State
	S	*Physaloptera* sp.	1	1	1.41	1	0.01	PE
	S	*Physalopteroides venancioi*	1	1	1.41	1	0.01	PE
	LI	*Spauligodon oxkutzcabiensis*	303	28	39.44	10.82 (1 - 39)	4.27 ± 0.7	PE
	Lu	*Raillietiella mottae*	4	3	4.22	1.33 (1 - 2)	0.05 ± 0.01	PE
Tropidurus cocorobensis (07)	TC	Cistacanth*	3	1	14.29	3	0.43	BA
	S	*Physaloptera lutzi*	1	1	14.29	1	0.14	BA
	S	*Physaloptera retusa**	4	1	14.29	4	0.57	BA
	S; TC	*Physaloptera* sp.*	20	5	71.43	4 (1 - 7)	2.86 ± 0.82	BA
Tropidurus hispidus (58)	TC	*Oswaldofilaria* sp.	21	3	5.17	7 (1 - 12)	0.36 ± 0.09	PB
	LI	*Parapharyngodon alvarengai*	6	2	3.44	3 (1 - 5)	0.1	CE; BA
	LI	*Parapharyngodon sceleratus*	41	8	13.79	5.13 (2 - 8)	0.71 ± 0.16	PE
	LI	*Parapharyngodon* sp.	4	2	3.44	2 (1 - 3)	0.07	CE
	LI	*Pharyngodon cesarpintoi*	14	2	3.44	7 (1 - 13)	0.24	PE
	SI	*Pharyngodon* sp.	2	1	1.72	2	0.03	PE
	S	*Physaloptera lutzi*	80	16	27.59	5 (1 - 19)	1.38 ± 0.27	BA; CE; PE
	S; TC	*Physaloptera* sp.	4	3	5.17	1.33 (1 - 2)	0.07 ± 0.02	BA; CE; PE
	LI	*Spauligodon oxkutzcabiensis*	2	1	1.72	2	0.03	PE
	Lu	*Raillietiella mottae*	14	9	15.51	1.56 (1 - 3)	0.24 ± 0.05	BA; PE
	Lu	*Raillietiella* sp.	2	1	1.72	2	0.03	BA
Tropidurus semitaeniatus (06)	Lu	*Raillietiella* sp.	1	1	16.67	1	0.17	PB

contrast, *Parapharyngodon largitor* Albo & Rodrigues, 1963 had the lowest parasitic abundance recorded, with only two individuals observed (Table 2).

DISCUSSION

With an average of five parasite species per host, our findings reveal that parasite diversity in reptiles is relatively low compared to other taxa, corroborating Aho (1990). This diversity can be influenced by several factors, including life history (Araujo-Filho *et al.*, 2017; 2020), host morphology (Poulin, 2001), sex (Galdino *et al.*, 2014), phylogeny (Brito *et al.*, 2014), host life history traits (Sousa *et al.*, 2014; Alcantara *et al.*, 2019), and environmental factors (Poulin, 2003; Brito *et al.*, 2014). However, teiids like *Ameiva ameiva* (Linnaeus, 1758) (n = 10) and tropidurids such as *Tropidurus hispidus* (Spix, 1825) (n = 11) exhibited a high parasite diversity among the lizards examined. Endoparasite aggregation may change throughout environmental seasons, changes in host microhabitat use and exploitation, and colonization by larger individuals (MacArthur & Wilson, 1967; Aho, 1990; Araujo-Filho *et al.*, 2020). For lizards in our study, these findings suggest that host natural history seems to be a key determinant of the final parasite diversity among species, similar to what was observed in amphibians from highland enclaves in the Brazilian northeast (Oliveira *et al.*, 2023).

Table 2. Parasitic helminths recorded in Caatinga areas in the Brazilian semi-arid region. NH = number of hosts infected; P% = Prevalence; MII = Mean intensity of infection.

Parasite	NH	P%	MII (Range)
Acanthocephala			
Centrorhynchus sp.	1	0.22	56
Cistacanth	3	0.67	2.33 (1 - 3)
Cestoda			
Oochoristica sp.	7	1.55	9.14 (1 - 28)
Nematoda			
Oswaldofilaria sp.	8	1.78	3.88 (1 - 12)
Parapharyngodon alvarengai	19	4.21	2.79 (1 - 13)
Parapharyngodon largitor	2	0.44	1
Parapharyngodon sceleratus	10	2.21	4.5 (1 - 8)
Parapharyngodon sp.	6	1.33	3.66 (1 - 6)
Pharyngodon cesarpintoi	37	8.2	14.90 (1 - 50)
Pharyngodon travassosi	8	1.77	19.25 (1 - 80)
Pharyngodon sp. (larvae)	15	3.26	3.26 (1 - 13)
Physaloptera lutzi	26	5.77	5.47 (1 - 23)
Physaloptera retusa	6	1.33	2.17 (1 - 4)
Physaloptera sp. (larvae)	37	8.2	3.05 (1 - 13)
Physalopteroides venancioi	9	2	3.66 (1 - 17)
Skrjabinellazia galiardi	4	0.89	1.5 (1 - 2)
Skrjabinellazia sp.	2	0.44	1
Spauligodon oxkutzcabiensis	32	7.1	9.93 (1 - 39)
Spauligodon sp.	3	0.22	3
Pentastomida			
Raillietiella mottae	14	3.1	1.42 (1 - 3)
Raillietiella sp.	3	0.67	1.33 (1 - 2)
TOTAL	196	43.46	8.41 (1 - 80)

Species of *Parapharyngodon* are well-documented as parasites of several vertebrate groups, including reptiles (Ramallo *et al.*, 2002; Ávila *et al.*, 2012). In lizards, infection of *Parapharyngodon sceleratus* (Travassos, 1923) has been reported infecting *A. ameiva, Anolis brasiliensis* Vanzolini & Williams, 1970, *Brasiliscincus agilis* (Raddi, 1823), *Hemidactylus mabouia* (Moreau de Jonnès, 1818), *Phyllopezus pollicaris* (Spix, 1825), *Psychosaura macrorhyncha* (Hoge, 1946), *Tropidurus hispidus*, *Tropidurus semitaeniatus* (Spix, 1825) and *Tropidurus torquatus* (Wied-Neuwied, 1820) (Ávila & Silva, 2010; Anjos *et al.*, 2013; Lacerda *et al.*, 2023). The congener *P. largitor* has been documented infecting *A. ameiva, A. parecis* (Colli, Costa, Garda, Kopp, Mesquita, Péres, Valdujo, Vieira & Wiederhecker, 2003), *Aspronema dorsivittatum* (Cope, 1862), *Brasiliscincus agilis, Colobosauroides cearensis* Cunha, Lima-Verde & Lima, 1991, *Copeoglossum nigropunctatum* (Spix, 1825), *H. mabouia, Micrablepharus maximiliani* (Reinhardt & Lütken, 1862), *Notomabuya frenata* (Cope, 1863), *Polychrus acutirostris* (Spix, 1825), *Tropidurus guarani* Alvarez, Cei & Scolaro, 1994, *Tropidurus oreadicus* (Rodriguez, 1987), *Tupinambis teguixin* (Linnaeus, 1758) and *Vanzosaura rubricauda* (Boulenger, 1902)

(Vrcibradic *et al*., 2002; Anjos *et al*., 2005; Ávila & Silva, 2010; 2011; Lacerda *et al*., 2023). In the semi-arid region of northeast Brazil, *P. sceleratus* has been reported in the states of Ceará, Bahia, Paraíba, Pernambuco, Piauí and Rio Grande do Norte, while *P. largitor* has a single record in Ceará (Lacerda *et al*., 2023). In this study, we provide the first record of infection of *P. largitor* in the lizard *Hemidactylus brasilianus* Amaral, 1935 and extended the distribution of this parasite to the state of Pernambuco.

For the genus *Pharyngodon*, *P. cesarpintoi* has been reported infecting *A. ameiva*, *Ameivula nigrigula* (Arias, De Carvalho, Rodrigues & Zaher, 2011), *A. ocellifera* (Spix, 1825), *A. pyrrhogularis* (Basto Da Silva & Ávila-Pires, 2013), *Liolaemus lutzae* Mertens, 1938, *Lygodactylus klugei* (Smith, Martin & Swain, 1977), *Manciola guaporicola* (Dunn, 1935), *P. pollicaris, Salvator merianae* (Duméril & Bibron, 1839), *Tropidurus hispidus, T. semitaeniatus, T. itambere* Rodrigues, 1987 and *Vanzosaura multiscutata* (Amaral, 1933), with records from Ceará, Ceará, Bahia, Paraíba e Sergipe (Ávila & Silva, 2010; Araujo-Filho *et al*., 2020; Lacerda *et al*., 2023). Additionally, *P. travassosi* has been observed infecting *Ameiva* sp. and *Anolis fuscoauratus* D'orbigny, 1837, documented in the states of Paraíba and Ceará (Ávila *et al*., 2012; Mesquita *et al*., 2020; Lacerda *et al*., 2023). With our findings, we expand the geographic distribution of *P. cesarpintoi* and *P. travassosi* to Pernambuco. We also present the first record of *P. cesarpintoi* infecting *Nothobachia ablephara* Rodrigues 1984, and *Pharyngodon* sp. infecting *Eurolophosaurus divaricatus* (Rodrigues, 1986).

The genus *Physaloptera* infects several groups of terrestrial vertebrates, and is widely distributed across the Caatinga (Sousa *et al*., 2014; Lacerda *et al*., 2023; Gonçalves-Sousa *et al*., 2024). In South America, *Physaloptera lutzi* Guimaraes, Cristófaro & Rodrigues, 1976 has been recorded infecting *A. ameiva, A. ocellifera, Coleodactylus meridionalis* (Boulenger, 1888), *Dactyloa punctata* (Daudin, 1802), *Dryadosaura nordestina* Rodrigues, Xavier Freire, Machado-Pellegrino & Sites, 2005, *Enyalius bilineatus* (Duméril & Bibron, 1837), *Eurolophosaurus amathites* (Rodrigues, 1984), *E. divaricatus, E. nanuzae* (Rodrigues, 1981), *Hemidactylus agrius* Vanzolini, 1978, *H. brasilianus* Amaral, 1935, *Glaucomastix abaetensis* (Dias, Rocha & Vrcibradic, 2002), *G. littoralis* (Rocha, Bamberg Araújo, Vrcibradic & Mamede Da Costa, 2000), *Gymnodactylus geckoides* Spix, 1825, *Kentropyx calcarata* Spix, 1825, *Liolaemus alticolor* Barbour, 1909, *L. ornatos* Koslowsky, 1898, *L. quilmes* Etheridge, 1993, *L. klugei, M. maximiliani, Anolis ortonii* Cope, 1868, *P. pollicaris, S. merianae, Strobilurus torquatus* Wiegmann, 1834, *Tropidurus guarani, T. hispidus, T. hygomi* Reinhardt & Lütken, 1862, *T. itambere, T. jaguaribanus* Passos, Lima & Borges-Nojosa, 2011, *T.* psammonastes Rodrigues, Kasahara, Yonenaga-Yassuda, 1988, *T. semitaeniatus, T. torquatus,* and *V. multiscutata* (Ávila & Silva, 2010; Anjos *et al*., 2013; Teixeira *et al*., 2018; Alcantara *et al*., 2018; 2019; Lacerda *et al*., 2023). In Brazil, *P. retusa* has been found parasitizing *A. ameiva*, *Ameivula nativo* (Rocha, Bergallo & Peccinini-Seale, 1997), *A. ocellifera, C. nigropunctatum, E. bibronii, G. abaetensis, H. mabouia, K. calcarata, A. brasiliensis, P. pollicaris, P. acutirostris, S. merianae, T. hispidus, T. semitaeniatus, T. torquatus,* and *S. torquatus* (Ribas *et al*., 1998; Anjos *et al*., 2013; Araujo-Filho *et al*., 2014; Sousa *et al*., 2014; Lacerda *et al*., 2023). Consistent with other studies, *Physaloptera* species were the most widely distributed among the sampled sites, infecting most examined host species. This finding highlights the phenotypic plasticity and the generalist host selection of this parasite group. Despite the numerous records of *Physaloptera* species parasitizing lizards in Caatinga areas, we report the first record of the genus *Physaloptera* infecting *A. nigrigula* and *E. divaricatus,* as well as *P. retusa* infecting *L. klugei* and *Tropidurus cocorobensis* Rodrigues, 1987, and *P. lutzi* infecting *T. cocorobensis.* These results underscore the importance of ongoing studies, even in well-known species and regions.

Physalopteroides venancioi is known to parasite amphibians (Campião *et al*., 2009), snakes (Araujo *et al*., 2020), and lizards, such as *A. nativo, A. pyrrhogularis, Copeoglossum arajara* (Reboucas-Spieker, 1981), *H. mabouia, P. macrorhyncha* and *T. hispidus* (Ávila & Silva, 2010; Lacerda *et al*., 2023). This parasite has been found in Caatinga areas of Bahia, Ceará, and Piauí (Lacerda *et al*., 2023). Here, we present the first record of *P. venancioi* infecting *L. klugei* and *G. geckoides*, as well as the first record of the species in lizards from the state of Pernambuco.

Skrjabinellazia are heteroxenous parasites commonly found infecting geckonids (Anjos *et al*., 2011; Lima *et al*., 2017). In Brazil, *Skrjabinellazia* spp. have been found parasitizing lizards of the genus *Anolis, Ameivula, Gonatodes, Hemidactylus, Phyllopezus, Stenocercus, Tropidurus* and *Urostrophus* (Ávila & Silva, 2010; Lacerda *et al*., 2023). *Skrjabinellazia intermedia* Freitas, 1940 is the only species known to occur in the Brazilian Northeast, where it has been reported infecting *Anolis fuscoauratus, Hemidactylus agrius, H. brasilianus,* and *P. pollicaris* (Lacerda *et al*., 2023). Here, we present the first record of *S. galiardi* infecting *L. klugei*, marking the first report of this species in this semi-arid region.

In South America, *Spauligodon oxkutzcabiensis* Chitwood, 1938 has been found infecting *Acratosaura mentalis*

(Amaral, 1933), *A. ocellifera, G. geckoides, H. agrius, H. brasilianus, H. mabouia, L. klugei, Microlophus occipitalis* (Peters, 1871), *Phyllodactylus inaequalis* Cope, 1875, *P. johnwrighti* Dixon & Huey, 1970, *P. microphyllus* Cope, 1875, *P. reissi* Peters, 1862, *Phyllopezus lutzae* (Loveridge, 1941), *P. periosus* Rodrigues, 1986*, P. pollicaris, T. hispidus, T. semitaeniatus,* and *V. multiscutata* (Ávila & Silva, 2010; Lacerda *et al*., 2023). Recorded in Alagoas, Ceará, Piauí, Rio Grande do Norte, and Sergipe (Lacerda *et al*., 2023), we extend the known geographical range of *Spauligodon* sp. infecting *A. mentalis* and *S. oxkutzcabiensis* infecting *A. pyrrhogularis* in the Caatinga, with new records from Paraíba and Pernambuco.

Pentastomids are parasites known to inhabit the respiratory tract in vertebrates, commonly found in the lungs of lizards (Almeida *et al*., 2008). *Raillietiella mottae* Almeida, Freire & Lopes, 2008 has been found infecting *A. ameiva, C. arajara, G. geckoides, H. agrius, H. brasilianus, H. mabouia, M. maximiliani, P. pollicaris, P. periosus, T. hispidus* and *T. semitaeniatus* in Caatinga areas (Brito *et al*., 2014; Sousa *et al*., 2014; Lima *et al*., 2017; Silva *et al*., 2018; Gonçalves-Sousa *et al*., 2024). Our finding of *Raillietiella* sp. in *A. nigrigula* is the first record of this genus infecting this lizard and extends the known geographical range of *Raillietiella* to the southern Bahia region.

In Brazil, species of *Oochoristica* have been found in several lizard species, including *Oochoristica travassosi* Rego & Ibanez, 1965 infecting *Ameivula pyrrhogularis*, *Trachylepis atlântica* (Schmidt, 1945) and *Tropidurus jaguaribanus* (Lacerda *et al*., 2023); *Oochoristica bresslaui* Fuhrmann, 1927 in *Tropidurus hispidus*, *T. semitaeniatus* and *T. torquatus* (Anjos *et al*., 2013; Maia-Carneiro *et al*., 2018); *Oochoristica vanzolini* Rêgo & Oliveira-Rodrigues, 1965 in *Tropidurus semitaeniatus* (Bezerra *et al*., 2016); *Oochoristica ameivae* (Beddard, 1914) in *A. ameiva*, *A. nativo*, *B. agilis* and *P. macrorhyncha* (Vrcibradic *et al*., 2002; Menezes *et al*., 2004; Ávila & Silva, 2010), *Oochoristica bresslaui* Fuhrmann, 1927 in *T. guarani*, *T. hispidus* and *T. torquatus* (Galdino *et al*., 2014; Maia-Carneiro *et al*., 2018); *O. vanzolinii* in *H. mabouia* and *E. nanuzae* (Ávila & Silva, 2010); *O. noronhae* in *T. atlântica* (Bursey *et al*., 2010) and *Oochoristica* sp. in *A. mentalis, A. ameiva, A. nigrigula, A. ocellifera, Apoglossus* sp., *Brasiliscincus heathi* (Schmidt & Inger, 1951), *C. cearensis, G. geckoides, H. agrius, H. brasilianus, H. mabouia, M. maximiliani, N. ablephara, N. frenata, P.pollicaris, P. periosus, Procellosaurinus erythrocercus* Rodrigues, 1991*, S. merianae, T. hispidus, T. merianae, T. oreadicus* and *T. semitaeniatus* (Ramalho *et al*., 2009; Ávila & Silva, 2010; Anjos *et al*., 2013; Sousa *et al*., 2014; Lima *et al.,* 2017; Araujo-Filho *et al*., 2020; Gonçalves-Sousa *et al*., 2024). This study brings the first record of *Oochoristica* sp. in *L. klugei*.

The genus *Oswaldofilaria* is a well-known parasite of reptiles, with a widespread geographical distribution (Travassos, 1933). In South America, *O. azevedoi* has been reported infecting *Anolis transversalis* Duméril, 1851, *Stenocercus roseiventris* D'orbigny in Duméril & Bibron, 1837 and *Polychrus marmoratus* (Linnaeus, 1758) (Bursey *et al*., 2005); *O. brevicaudata* (Rhodain & Vuylsteke, 1937) in *Iguana iguana* (Linnaeus, 1758)*, Anolis punctatus* (Daudin, 1802) and *Cercosaura schreibersii* Wiegmann, 1834 (Vicente & Jardim, 1980; Goldberg *et al*., 2006; Ávila & Silva, 2010); *O. chabaudi* Pereira, Lima & Bain, 2010 in *Tropidurus torquatus* (Pereira *et al*., 2012); *O. petersi* Bain & Sulahian 1974 in *S. merianae, T. hispidus* and *T. teguixin* (Vicente *et al*., 1993; Silva & Kohlsdorf, 2003; Teixeira *et al*., 2016); *O. spinose* Bain & Sulahian, 1974 in *Varzea bistriata* (Spix, 1825) (Vicente *et al*., 1993; Silva & Kohlsdorf, 2003; Teixeira *et al*., 2016); *Oswaldofilaria* sp. in *A. ocellifera, Anolis phyllorhinus* Myers & Carvalho, 1945, *Notomabuya frenata, Ophiodes striatus* (Spix, 1824), *Plica umbra* (Linnaeus, 1758) and *T. teguixin* (Ávila & Silva, 2010; Brito *et al*., 2014; Lacerda *et al*., 2023). Our finding of *Oswaldofilaria* sp. infecting *A. mentalis, B. heathi* and *G. geckoides* expands its known geographic range into the states of Paraíba and Pernambuco, marking the first record of this parasite infecting these lizards.

In summary, our study presents 19 new host records along with their corresponding geographic areas, expanding our understanding of endoparasites in the most human-populated semi-arid region in the world. The data collected in this study bring relevant insights into parasitism in Caatinga lizards, advancing our knowledge of the distribution of parasitic species and helping to fill gaps in parasitological information related to lizards from the semi-arid region of Northeast Brazil. However, further research in other sites from this region is still needed to deepen our knowledge of the diversity of macro endoparasites associated with lizards.

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BIBLIOGRAPHIC REFERENCES

Aho, J.M. (1990). Helminth communities of amphibians and reptiles: comparative approaches to understanding patterns and processes. pp. 157-195 In Esch, G.W., Bush, A.O., & Aho. J.M. (Eds) *Parasite Communities: Patterns and processes*. Chapman & Hall.

Alcantara, E.P., Ferreira-Silva, C., Goncalves-Sousa, J.G., Morais, D.H., & Avila, R.W. (2019). Feeding ecology, reproductive biology, and parasitism of *Gymnodactylus geckoides* Spix, 1825 from a Caatinga area in northeastern Brazil. *Herpetological Conservation and Biology, 14*, 641-647.

Alcantara, E.P., Ferreira-Silva, C., Sousa, J.G.G., Ávila, R.W., & Morais, D.H. (2018). Ecology and parasitism of the lizard *Tropidurus jaguaribanus* (Squamata: Tropiduridae) from northeastern Brazil. *Phyllomedusa: Journal of Herpetology*, *17*, 195-210.

Almeida, W.O., Santana, G.G., Vieria, W.L.S., Wanderley, I.C., Freire, E.M.X., & Vasconcellos, A. (2008). Pentastomid, *Raillietiella mottae* Almeida, Freire and Lopes, 2008, infecting lizards in an area of caatinga, northeast, Brazil. *Brazilian Journal of Biology*, *68*, 203-207.

Amato, J., Boeger, W., & Amato. S. (1991). *Protocolos para Laboratório–Coleta e Processamento de Parasitos de Pescado.* Seropédica, Imprensa Universitária, Universidade Federal do Rio de Janeiro.

Andrade, C. (2000). *Meios e soluções comumente empregados em laboratórios*. Rio de Janeiro, Brazil: Editora Universidade Rural, UFRRJ.

Andrade, E.M., Aquino, D.D.N., Chaves, L.C.G., & Lopes, F.B. (2017). Water as capital and its uses in the Caatinga. pp 281-302, In: J.M.C. Silva *et al. Caatinga: the largest tropical dry forest region in South America*, Springer, Cham.

Anjos, L.A., Ávila, R.W., Ribeiro, S.C., Almeida, W.O., & da Silva, R.J. (2013). Gastrointestinal nematodes of the lizard *Tropidurus hispidus* (Squamata: Tropiduridae) from a semi-arid region of north-eastern Brazil. *Journal of Helminthology, 87*, 443-449.

Anjos, L.A., Bezerra, C.H., Passos, D.C., Zanchi, D., & Galdino, C.A.B. (2011). Helminth fauna of two gecko lizards, *Hemidactylus agrius* and *Lygodactylus klugei* (Gekkonidade), from Caating biome, Northeastern Brazil. *Neotropical Helminthology, 5,* 285-290.

Anjos, L.A., Rocha, C.F.D., Vrcibradic, D., & Vicente, J.J. (2005). Helminths of the exotic lizard *Hemidactylus mabouia* from a rock outcrop area in southeastern Brazil. *Journal of Helminthology, 79,* 307-313.

Araújo, K.D.C., Silva, C.D.S., Machado, H.T.D.S., Oliveira, C.R., & Ávila, R.W. (2020). Endoparasites of *Philodryas olfersii* (Lichtenstein, 1823) in Restinga environments of the Parnaíba River Delta, Northeastern Brazil. *Neotropical Helminthology*, *14*, 129-141.

Araujo-Filho, J.A., Brito, S.V., Lima, V.F., Pereira, A.M.A., Mesquita, D.O., Albuquerque, R.L., & Almeida, W.O. (2017). Influence of temporal variation and host condition on helminth abundance in the lizard *Tropidurus hispidus* from north-eastern Brazil. *Journal of Helminthology, 91*, 312-319.

Araujo-Filho, J.A., Ribeiro, S.C., Brito, S.V., Teles, D.A., Sousa, J.G.G., Ávila, R.W., & Almeida, W.O. (2014). Parasitic nematodes of *Polychrus acutirostris* (Polychrotidae) in the Caatinga biome, Northeastern Brazil. *Brazilian Journal of Biology, 74*, 939-942.

Araujo-Filho, J.A., Teixeira, A.A.M., Teles, D.A., Rocha, S.M., Almeida, W.O., Mesquita, D.O., & Lacerda, A.C.F. (2020). Using lizards to evaluate the influence of average abundance on the variance of endoparasites in semiarid areas: dispersion and assemblage structure. *Journal of Helminthology, 94*, e121.

Ávila, R.W., & Silva, R.J. (2010). Checklist of helminths from lizards and amphisbaenians (Reptilia, Squamata) of South America. *Journal of Venomous Animals and Toxins including Tropical Diseases, 16,* 543-572.

Ávila, R.W., & Silva, R.J. (2011). Helminths of lizards (reptilia: squamata) from Mato Grosso state, Brazil. *Comparative Parasitology, 78,* 129-139.

Ávila, R.W., Anjos, L.A., Ribeiro, S.C., Morais, D.H., Silva, R.J., & Almeida, W.O. (2012). Nematodes of lizards (Reptilia: Squamata) from Caatinga biome, northeastern Brazil. *Comparative Parasitology, 79,* 56-63.

Barrett, L.G., Thrall, P.H., Burdon, J.J., & Linde, C.C. (2008). Life history determines genetic structure and evolutionary potential of host–parasite interactions. *Trends in ecology & evolution, 23,* 678-685.

Bezerra, C.H., Ávila, R.W., Passos, D.C., Zanchi-Silva, D., & Galdino, C.A.B. (2016). Levels of helminth infection in the flat lizard *Tropidurus semitaeniatus* from north-eastern Brazil. *Journal of Helminthology, 90,* 779-783.

Brito, S.V., Corso, G., Almeida, A.M., Ferreira, F.S., Almeida, W.O., Anjos, L.A., & Vasconcellos, A. (2014). Phylogeny and micro-habitats utilized by lizards determine the composition of their endoparasites in the semiarid Caatinga of Northeast Brazil. *Parasitology Research, 113*, 3963-3972.

Buckingham, L.J., & Ashby, B. (2022). Coevolutionary theory of hosts and parasites. *Journal of Evolutionary Biology, 35*, 205-224.

Bursey, C.R., Goldberg, S.R., & Parmelee, J.R. (2005). Gastrointestinal helminths from 13 species of lizards from Reserva Cuzco Amazónico, Peru. *Comparative Parasitology, 72*, 50-68.

Bursey, C.R., Rocha, C.F.D., Menezes, V.A., Ariani, C.V., & Vrcibradic, D. (2010). New species of *Oochoristica* (Cestoda; Linstowiidae) and other endoparasites of *Trachylepis atlantica* (Sauria: Scincidae) from Fernando de Noronha Island, Brazil. *Zootaxa, 2715*, 45-54.

Bush, A.O., Lafferty, K.D., Lotz, J.M., & Shostaki, E.A.W. (1997). Parasitology meets ecology on its own terms: Margolis et al. revisited. *The Journal of parasitology*, *83*, 575-583.

Campião, K.M., Ribas, A., & Tavares, L.E.R. (2015). Diversity and patterns of interaction of an anuran–parasite network in a neotropical wetland. *Parasitology, 142,* 1751-1757.

Campião, K.M., Silva, R.J., & Ferreira, V.L. (2009). Helminth parasites of *Leptodactylus podicipinus* (Anura: Leptodactylidae) from south-eastern Pantanal, state of Mato Grosso do Sul, Brazil. *Journal of Helminthology, 83*, 345-349.

Cardoso, T.D.S., Simões, R.O., Luque, J.L.F., Maldonado, J.A., & Gentile, R. (2016). The influence of habitat fragmentation on helminth communities in rodent populations from a Brazilian Mountain Atlantic Forest. *Journal of Helminthology, 90,* 460-468.

Ernst, C., & Ernst, E. (1980). Relationships between North American turtles of the *Chrysemys* complex as indicated by their endoparasitic helminths. *Proceedings of the Biological Society of Washington, 93,* 339-345.

Galdino, C.A., Ávila, R.W., Bezerra, C.H., Passos, D.C., Melo, G.C., & Zanchi-Silva, D. (2014). Helminths infection patterns in a lizard (*Tropidurus hispidus*) population from a semiarid Neotropical area: associations between female reproductive allocation and parasite loads. *The Journal of Parasitology, 100,* 864-867.

Goldberg, S.R., Bursey, C.R., & Vitt, L.J. (2006). Parasites of two lizard species, *Anolis punctatus* and *Anolis transversalis* (Squamata: Polychrotidae) from Brazil and Ecuador. *Amphibia Reptilia, 27*, 575.

Gonçalves-Sousa, J.G., Silva, C.S., Ribeiro, S.C., Oliveira, H.F., & Ávila, R.W. (2024). Metazoan Endoparasites of the Gecko *Phyllopezus periosus* (Squamata: Phyllodactylidae) Inhabiting the Rock Cliffs of a Waterfall Canyon in the Semi-Arid Region from Northeastern Brazil. *Acta Parasitologica, 69,* 1587-1591.

Korallo, N.P., Vinarski, M.V., Krasnov, B.R., Shenbrot, G.I., Mouillot, D., & Poulin, R. (2007). Are there general rules governing parasite diversity? Small mammalian hosts and gamasid mite assemblages. *Diversity and Distributions, 13*, 353-360.

Kuris, A.M., Hechinger, R.F., Shaw, J.C., Whitney, K.L., Aguirre-Macedo, L., Boch, C.A., & Lafferty, K.D. (2008). Ecosystem energetic implications of parasite and free-living biomass in three estuaries. *Nature, 454*, 515-518..

Lacerda, G.M.C., Santana, J.D.A., Araujo-Filho, J.A., & Ribeiro, S.C. (2023). Checklist of parasites associated with 'reptiles' in Northeast Brazil. *Journal of Helminthology, 97*, e3.

Lima, V.F., Brito, S.V., Araujo-Filho, J.A., Teles, D.A., Ribeiro, S.C., Teixeira, A.A.M., Pereira, A.M.A., & Almeida, W.O. (2017). Helminth parasites of Phyllodactylidae and Gekkonidae lizards in a Caatinga ecological station, northeastern Brazil. *Biota Neotropica, 17*, e20160263.

MacArthur, R.H., & Wilson, E.O. (1967). *The theory of island biogeography*. Princeton University Press.

Maia-Carneiro, T., Motta-Tavares, T., Ávila, R.W., & Rocha, C.F. (2018). Helminth infections in a pair of sympatric congeneric lizard species. *Parasitology Research, 117,* 89-96.

Menezes, V.A., Vrcibradic, D., Vicente, J.J., Dutra, G.F., & Rocha, C.F. (2004). Helminths infecting the parthenogenetic whiptail lizard *Cnemidophorus nativo* in a restinga habitat of Bahia State, Brazil. *Journal of Helminthology*, *78,* 323-328.

Mesquita, J.M.S., Oliveira, S.S., Perez, R. & Ávila, R.W. (2020). Helminths associated with *Norops fuscoauratus* (Squamata, Dactyloidae) in highland marshes of the Brazilian semi-arid. *Journal of Helminthology, 94,* e153.

Oliveira, C.R., Gonçalves-Sousa, J.G., de Carvalho, E.F.F., Ávila, R.W., & Borges-Nojosa, D.M. (2023). Effect of altitude and spatial heterogeneity on the host-parasite relationship in anurans from a remnant humid forest in the Brazilian semiarid. *Parasitology Research, 122,* 2651-2666.

Oliveira, C.R., Mascarenhas, W., Batista-Oliveira, D., de Castro Araújo, K., Ávila, R.W., & Borges-Nojosa, D.M. (2022). Endoparasite community of anurans from an altitudinal rainforest enclave in a Brazilian semiarid area. *Journal of Helminthology, 96*, e62.

Pereira, F.B., Sousa, B.M., & Souza-Lima, S. (2012). Helminth community structure of *Tropidurus torquatus* (Squamata: Tropiduridae) in a rocky outcrop area of Minas Gerais state, southeastern Brazil. *Journal of Parasitology, 98*, 6-10.

Poulin, R., & Krasnov, B.R. (2010). Similarity and variability of parasite assemblages across geographic space. In: Morand S., & Krasnov B.R. (eds) *The biogeography of host-parasite interactions*. Oxford University, pp. 115–128.

Poulin, R. (2001). Interactions between species and the structure of helminth communities. *Parasitology, 122*, S3-S11.

Poulin, R. (2003). The decay of similarity with geographical distance in parasite communities of vertebrate hosts. *Journal of biogeography, 30*, 1609-1615.

Poulin, R. (2007). Are there general laws in parasite ecology? *Parasitology, 134*, 763-776.

Ramalho, A.C.O., Da Silva, R.J., Schwartz, H.O., & Péres Jr, A.K. (2009). Helminths from an introduced species (*Tupinambis merianae*), and two endemic species (*Trachylepis atlantica* and *Amphisbaena ridleyi*) from Fernando de Noronha Archipelago, Brazil. *Journal of Parasitology, 95*, 1026-1028.

Ramallo, G., Bursey, C.R., & Goldberg, S.R. (2002). *Parapharyngodon riojensis* n. sp.(Nematoda: Pharyngodonidae) from the lizard *Phymaturus punae* (Squamata: Iguania: Liolaemidae) from northwestern Argentina. *Journal of Parasitology, 88,* 979-982.

Ribas, S.C., Rocha, C.F.D., Teixeira-Filho, P.F., & Vicente, J.J. (1998). Nematode infection in two sympatric lizards (*Tropidurus torquatus* and *Ameiva ameiva*) with different foraging tactics. *Amphibia-Reptilia, 19*, 323-330.

Robar, N., Burness, G., & Murray, D.L. (2010). Tropics, trophics and taxonomy: the determinants of parasite-associated host mortality. *Oikos, 119,* 1273-1280.

Schmidt, G.D. (1986). *CRC handbook of tapeworm identification*. Boca Raton, CRC Press.

Segalla, M.V., Berneck, B., Canedo, C., Caramaschi, U., Cruz, C.A.G., Garcia, P.C.A., Grant, T., Haddad, C.F.B., Lourenço, A.C.C., Mângia, S., Mott, T., Nascimento, L.B., Toledo, L.F., Werneck, F.P. & Langone, J.A. (2021). List of Brazilian Amphibians. *Herpetologia Brasileira, 10,* 121-216.

Silva, E.G., Santos, M.E.P., Brito, S.V., Almeida, W.O., & Ribeiro, S.C. (2018). *Raillietiella mottae* (Pentastomida: Raillietiellidae) infecting *Ameiva ameiva* (Squamata: Teiidae) in Araripe Plateau, Northeast Brazil. *Brazilian Journal of Biology, 79*, 100-103.

Silva, J.M.C., Barbosa, L.C.F., Leal, I.R., & Tabarelli, M. (2017). The Caatinga: understanding the challenges. pp. 3-19. In: J.M.C.D. Silva *et al*. (Eds.). *Caatinga: the largest tropical dry forest region in South America*. Springer.

Silva, R.J., & Kohlsdorf, T. (2003). *Tropidurus hispidus* Spix 1825 (Sauria, Tropiduridae): a new host for *Oswaldofilaria petersi* Bain & Sulahian 1974 (Nematoda, Onchocercidae). *Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 55,* 377-379.

Sousa, J.G.G., Brito, S.V., Ávila, R.W., Teles, A., Araujo-Filho, J.A., Teixeira, A.A.M., Anjos, LA., & Almeida, W.O. (2014). Helminths and Pentastomida of two synanthropic gecko lizards, *Hemidactylus mabouia* and *Phyllopezus pollicaris*, in an urban area in Northeastern Brazil. *Brazilian Journal of Biology, 74*, 943-948.

Teixeira, A.A.M., Brito, S.V., Teles, D.A., Ribeiro, S.C., Araujo-Filho, J.A., Lima, V.F., & Almeida, W.O. (2016). Helminths of the lizard *Salvator merianae* (Squamata, Teiidae) in the caatinga, northeastern Brazil. *Brazilian Journal of Biology, 77*, 312-317.

Teixeira, A.A.M., Franzini, L.D., Brito, S.V., Almeida, W.O., & Mesquita, D.O. (2018). Very low prevalence of infection by *Physaloptera lutzi* (Nematoda: Physalopteridae) parasitizing *Kentropyx calcarata* (Squamata: Teiidae), from fragments of Atlantic Forest in Northeast Brazil with a summary of nematodes infecting congeneric species. *Herpetology Notes, 11,* 799-804.

Travassos, L. (1933). Sobre os filarideos dos crocodillos sul-americanos. *Memórias do Instituto Oswaldo Cruz, 27,* 159-164.

Vicente, J., & Jardim, C. (1980). *Filariids in the helminthological collection of the Instituto Oswaldo Cruz. I. Fish, amphibians and reptiles*.

Vicente, J.J., Rodrigues, O., Gomes, D.C., & Pinto, R.M. (1993). Nematóides do Brasil. Nematóides de Répteis. Parte III. *Revista Brasileira de Zoologia, 10*, 21-33.

Vrcibradic, D., Rocha, C.F.D., Bursey, C.R., & Vicente, J.J. (2002). Helminth communities of two sympatric skinks (*Mabuya agilis* and *Mabuya macrorhyncha*) from two 'restinga'habitats in southeastern Brazil. *Journal of Helminthology, 76,* 355-361.

Yamaguti, S. (1971). *Synopsis of digenetic trematodes of vertebrates*. Vols I and II. Keigaku Publishing Co. 1074p.

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