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Review article

Checklist of nematode parasites of reptiles from Argentina

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ABSTRACT. A summary of the parasitic nematodes of reptiles from Argentina is presented. It is a compilation of 29 parasitological papers published between 1992 and May 2020. This review includes information about 40 species of reptiles (4 snakes, 3 turtles, 1 anfisbaenian and 32 lizards). Twenty-six nematodes species have been reported from reptiles. The present review provides data on hosts, geographical distribution and site of infection. A host/parasite list is also provided.

Keywords: anfisbaenians, endoparasites, lizards, herpetofauna, snakes, turtles

Introduction

Studies about parasite nematodes of the Argentine herpetofauna are scarce and incomplete. The first studies on parasitic nematodes of reptiles in the country are those of [1] and [2]. Subsequently, publications by [3–6], were an important contribution to the knowledge of parasitic nematodes of lizards, *Liolaemus* and *Phymaturus*; as well as the descriptions of new species and keys for the identification of the genera *Spauligodon* spp. and *Parapharyngodon* spp. Likewise, [7] made a list of parasitic nematodes of reptiles from Argentina. Ávila and Silva [8] carried out a review on reptile helminths in South America (Reptilia, Squamata). After that review, more parasitic nematodes were recorded in reptile taxa from Argentina. We carried out an update on the parasitic nematodes of reptiles in Argentina.

In order to obtain the information on parasitic nematodes, identification and/or determination of nematode taxa of own material were carried out and, on the other hand, consulting [9].

Bibliographic search covered publications until May 2020 in different search engines: SciELO (Scientific Electronic Library Online), Dialnet, Google Scholar and WorldWideScience.org. In addition, the journals that were not shown in the academic search were reviewed, such as the Argentine Journal of Parasitology and Latin American Parasitology. Abstracts presented at congresses or doctoral and undergraduate theses were not included. Trophic ecology and dietary studies were also considered as they could provide information on parasitic nematodes.

For the geographical record, we used the following abbreviations for Argentinean provinces: Buenos Aires (BA), Catamarca (CA), Corrientes (C), Chaco (CH), Entre Ríos (ER), La Rioja (LR), Mendoza (MZ), Misiones (M), Neuquén (NQ), Río Negro (RN), San Juan (SJ), Salta (SA), Tucumán (T) and (?) Province from Argentina not mentioned by the autor.

The material deposited is indicated (the

Table 1. Distribution of nematodes in reptiles by province from Argentina. Abbreviations for provinces: Buenos Aires **(BA)**, Catamarca **(CA)**, Chaco **(CH)**, Corrientes **(C)**, Entre Rios **(ER)**, La Rioja **(LR)**, Mendoza **(MZ)**, Misiones **(M)**, Neuquén **(NQ)**, Rio Negro **(RN)**, Salta **(SA)**, San Juan **(SJ)**, Tucumán **(T)**, **(?)** Province from Argentina not mentioned by the autor.

Parasites/Provinces	BA	CA	CH	C	ER	LR	MZ	M	NQ	RN	SA	SJ	T	?
Kathlaniidae														
Falcaustra sp.												X		
Atractidae														
Labiduris sp.												X		
Hedruridae														
H. dratini	X													
H. orestiae	X													
Pharyngodonidae														
Pharyngodon sp.												X		
Parapharyngodon sp.				X							X	X		
S. maytacapaci		X							X					
S. loboi		X											X	
P. riojensis						X	X		X			X		
P. sanjuanensis												X		
Thelandros sp.											X			
Physalopteridae														
T. eleodori												X		
Physaloptera sp.						X					X	X		
P. retusa						X			X	X		X		
P. lutzi											X		X	
P. liophis			X											
Gnathostomatidae														
S. contortus	X													
Cosmocercidae														
A. tucumanensis													X	
A. travassosi			X											
Diaphanocephalidae														
D. galeatus														X
Kalicephalus sp.			X											
K. subulatus				X										
K. costatus					X									
Strongylidae														
S. oscari											X			
Camallanidae														
Camallanus sp.			X											
H. boddaertii								X						

collection acronym and the code numbers); (UNSJPar) parasitological collection of the Department of Biology, National University of San Juan. (CH-N-FML) Helminthological Collection, Fundación Miguel Lillo, San Miguel de Tucumán, Tucumán, Argentina. (CECOAL) Helminthological Collection of Centro de Ecologia Aplicada del Litoral. (MLP-He) Colección Helmintológica del Museo La Plata. (INMeT_Es) Helminthological Collection of the National Institute of Tropical Medicine, Puerto Iguazú, Argentina. United States National Parasite Collection. (UNNEC) Herpetological collection of Universidad Nacional del Nordeste.

Results

Parasitic reptile nematodes were recorded in 14 provinces from Argentina (Table 1). Table 2 shows the summary list of host/parasite observed in Argentina.

Family Kathlaniidae

Falcaustra

Falcaustra sp. [10]

Host and record: *Chelonoidis chilensis* (SJ)

Site of infection: small intestine

Material deposited: UNSJPar 255

Family Atractidae

Labiduris

Labiduris sp. [10]

Host and record: *Chelonoidis chilensis* (SJ)

Site of infection: small intestine

Material deposited: UNSJPar 256

Family Hedruridae

Hedruris

Hedruris dratini [11]

Host and record: *Hydromedusa tectifera* (BA), *Phrynops hilarii* (BA)

Site of infection: stomach

Material deposited: MLP He

Hedruris orestiae [12]

Host and record: *Hydromedusa tectifera* (BA)

Site of infection: stomach

Material deposited: MLP He 7143

Family Pharyngodonidae

Pharyngodon

Pharyngodon sp. [13]

Host and record: *Teius teyou* (SJ)

Site of infection: stomach

Material deposited: UNSJPar 259

Spauligodon

Spauligodon maytacapaci [7]

Host and record: *Liolaemus chiliensis* (NQ), *Liolaemus elongatus* (NQ), *Liolaemus pictus* (NQ), *Liolaemus tenuis* (NQ), *Liolaemus andinus* (CA)

Site of infection: large intestine

Material deposited: United States National Parasite Collection 92473, 92479, 92480

Spauligodon loboi [5]

Host and record: *Liolaemus capillitas* (CA), *Liolaemus ornatus* (CA), *Liolaemus quilmes* (T), *Liolaemus ramirezae* (T), *Liolaemus huacahuasicus* (T)

Site of infection: large intestine

Material deposited: CH-N-FML

Parapharyngodon

Parapharyngodon sp. [14–17]

Host and record: *Liolaemus ruibali* (SJ), *Liolaemus parvus* (SJ), *Liolaemus fitzgeraldi* (SJ), *Tropidurus torquatus* (C), *Tropidurus etheridgei* (SA)

Site of infection: intestine, stomach

Material deposited: UNSJPar 253, 260, 261; UNNEC 8082-8084; 8086-8088

Parapharyngodon riojensis [6,7,18–21]

Host and record: *Phymaturus punae* (LR), *Phymaturus extrilidus* (SJ), *Phymaturus palluma* (NQ) (MZ), *Liolaemus ruibali* (SJ), *Liolaemus parvus* (SJ), *Liolaemus buergeri* (MZ)

Site of infection: large intestine

Material deposited: CH-N-FML 7733, 7734; 7746, 7666, 7667, UNSJPar 250, 251, United States National Parasite Collection 92474, 92475, 92476, 92482

Parapharyngodon sanjuanensis 016 [22]

Host and record: *Phymaturus punae* (SJ), *Phymaturus williamsi* (SJ)

Site of infection: large intestine

Material deposited: CH-N-FML

Thelandros

Thelandros sp. [17]

Host and record: *Tropidurus etheridgei* (SA)

Site of infection: intestine

Family Physalopteridae

Thubunaea

Thubunaea eleodori [23]

Host and record: *Liolaemus eleodori* (SJ)

Site of infection: stomach

Material deposited: CH-N-FML

Physaloptera

Physaloptera sp. [13,17,24–26]

Host and record: *Liolaemus olongasta* (SJ), *Homonota underwoodi* (SJ), *Pristidactylus*

scapulatus (SJ), *Aurivela tergolaevigata* (LR), *Tropidurus etheridgei* (SA)
Site of infection: stomach, intestine
Material deposited: UNSJPar 254, 258; CH-N-FML 7754
Physaloptera retusa [7,13]
Host and record: *Liolaemus neuquensis* (NQ), *Leiosaurus belli* (RN), *Leiosaurus catamarcensis* (LR), *Salvator rufescens* (SJ)
Site of infection: stomach
Material deposited: UNSJPar 257; United States National Parasite Collection 92471, 92472, 92478
Physaloptera lutzi [4]
Host and record: *Liolaemus quilmes* (SA); (T), *Liolaemus ornatus* (SA), *Liolaemus puna* (*L. alticolor*) (SA)
Site of infection: stomach, foregut and cloaca
Material deposited: CH-N-FML
Physaloptera liophis [27]
Host and record: *Xenodon merremi* (CH)
Site of infection: intestine
Material deposited: MLP-He 7251

Family Gnathostomatidae

Spiroxys
Spiroxys contortus [12]
Host and record: *Phrynops hilarii* (BA), *Hydromedusa tectifera* (BA)
Site of infection: stomach
Material deposited: MLP He 7141

Family Cosmocercidae

Aplectana
Aplectana tucumanensis [35]
Host and record: *Amphisbaena bolivica* (T)
Site of infection: intestine
Material deposited: CH-N-FML 07452, 07453, 07454
Aplectana travassosi [27]
Host and record: *Xenodon merremi* (CH)
Site of infection: intestine
Material deposited: MLP-He 7250
Order Strongylida

Family Diaphanocephalidae

Diaphanocephalus
Diaphanocephalus galeatus [1]
Host and record: *Salvator rufescens* (?)
Site of infection: intestine
Kalicephalus
Kalicephalus sp. [27]
Host and record: *Xenodon merremi* (CH)
Site of infection: intestine
Material deposited: MLP-He 7252

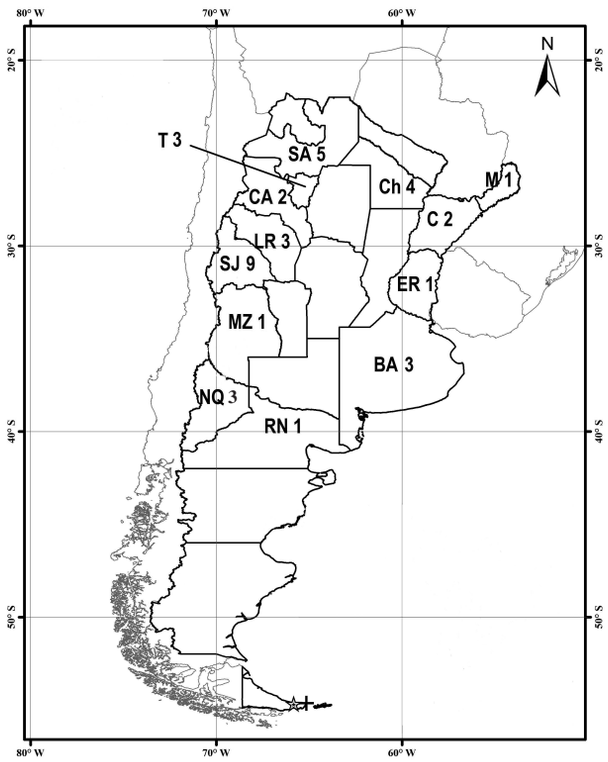

Figure 1. Nematode richness by province and number of registered taxa

Kalicephalus subulatus [28]
Host and record: *Xenodon merremi* (C)
Site of infection: intestine
Material deposited: CECOAL 16061001
Kalicephalus costatus [29]
Host and record: *Erythrolamprus miliaris* (= *Liophis miliaris*) (ER)
Site of infection: intestine

Family Strongylidae

Strongylus
Strongyluris oscari [2]
Host and record: *Tropidurus spinulosus* (SA)
Site of infection: intestine
Material deposited: MLP- He 4010/2, 4013/3
Order Spirurida

Family Camallanidae

Camallanus
Camallanus sp. [3]
Host and record: *Hydrodynastes gigas* (CH)
Site of infection: stomach
Material deposited: CH-FML 1609
Hexametra
Hexametra boddaertii [30]
Host and record: *Oxyrhopus guibei* (M)
Site of infection: intestine
Material deposited: INMeT_Es_001:15)

Table 2. Parasite/host list for reptiles from Argentina

Family	Host species	Parasitic species
Testudinidae	*Chelonoidis chilensis*	*Falcaustra* sp.
		Labiduris sp
Chelidae	*Hydromedusa tectifera*	*Hedruris dratini*
		Hedruris orestiae
		Spiroxys contortus
	Phrynops hilarii	*Hedruris dratini*
		Spiroxys contortus
Colubridae	*Hydrodynastes gigas*	*Camallanus* sp.
	Xenodon merremi	*Physaloptera liophis*
		Aplectana travassosi
		Kalicephalus sp.
		Kalicephalus subulatus
	Oxyrhopus guibei	*Hexametra boddaertii*
Dipsadidae	*Erythrolamprus miliaris* (= *Liophis miliaris*)	*Kalicephalus costatus*
Teiidae	*Teius teyou*	*Pharyngodon* sp.
	Salvator rufescens	*Physaloptera retusa*
		Diaphanocephalus galeatus
	Aurivela tergolaevigata	*Physaloptera* sp.
Phyllodactylidae	*Homonota underwoodi*	*Physaloptera* sp.
Amphisbaenidae	*Amphisbaena bolivica*	*Aplectana tucumanensis*
Tropiduridae	*Tropidurus torquatus*	*Parapharyngodon* sp.
	Tropidurus etheridgei	*Parapharyngodon* sp.
		Thelandros sp.
		Physaloptera sp.
	Tropidurus spinulosus	*Strongyluris oscari*
Leiosauridae	*Pristidactylus scapulatus*	*Physaloptera* sp.
	Leiosaurus belli	*Physaloptera retusa*
	Leiosaurus catamarcensis	*Physaloptera retusa*
Liolaemidae	*Liolaemus ruibali*	*Parapharyngodon* sp.
		Parapharyngodon riojensis
	Liolaemus parvus	*Parapharyngodon* sp.
		Parapharyngodon riojensis
	Liolaemus olongasta	*Physaloptera* sp.
	Liolaemus fitzgeraldi	*Parapharyngodon* sp
	Liolaemus eleodori	*Thubunaea eleodori*
	Liolaemus andinus	*Spauligodon maytacapaci*
	Liolaemus buergeri	*Parapharyngodon riojensis*
	Liolaemus chiliensis	*Spauligodon maytacapaci*
	Liolaemus elongatus	*Spauligodon maytacapaci*
	Liolaemus pictus	*Spauligodon maytacapaci*
	Liolaemus neuquensis	*Physaloptera retusa*
	Liolaemus tenuis	*Spauligodon maytacapaci*
	Liolaemus capillitas	*Spauligodon loboi*
	Liolaemus ornatus	*Spauligodon loboi*
		Physaloptera lutzi
	Liolaemus quilmes	*Spauligodon loboi*
		Physaloptera lutzi
	Liolaemus ramirezae	*Spauligodon loboi*
	Liolaemus puna (*L. alticolor*)	*Physaloptera lutzi*
	Liolaemus huacahuasicus	*Spauligodon loboi*
	Phymaturus punae	*Parapharyngodon riojensis*
		Parapharyngodon sanjuanensis
	Phymaturus williamsi	*Parapharyngodon sanjuanensis*
	Phymaturus extrilidus	*Parapharyngodon riojensis*
	Phymaturus palluma	*Parapharyngodon riojensis*

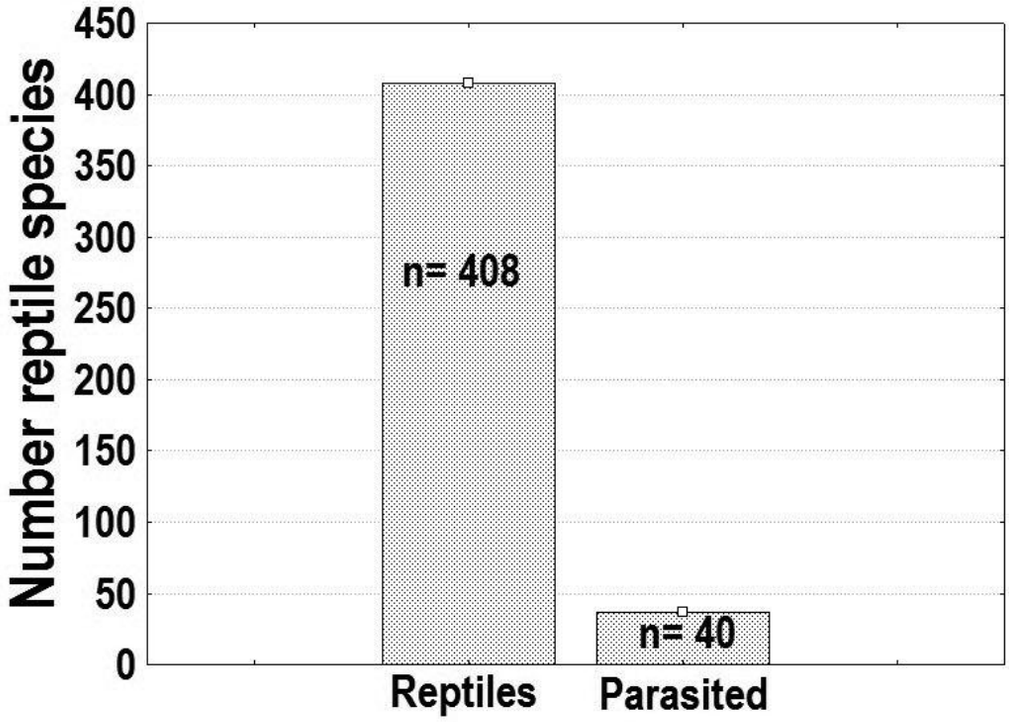

Figure 2. Number of reptile species in Argentina and species parasitized by nematodes

Discussion

We present an update of records of parasitic nematodes of reptiles in Argentina. This update shows that the available information is scarce and fragmented (see Figures 1, 2 and 3). According to the bibliographic review from 1992 to date, 29 articles have been published on the subject. Based on these articles, four snake species, three turtle species, one amphisbaena species and 32 lizard

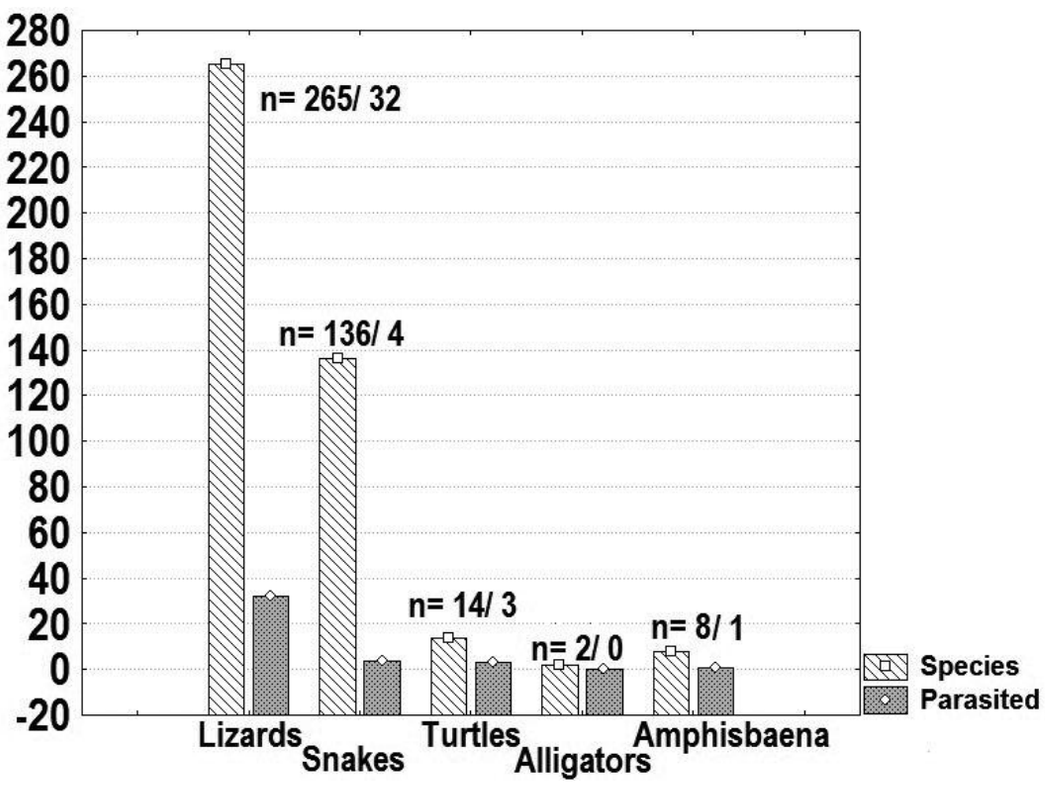

Figure 3. Proportion of snakes, lizards, turtles and alligators parasitized by nematodes in Argentina

species have been reported as parasitized. That number is relatively low (40 taxa analized) considering the abundance of reptile species in Argentina (408 taxa of reptiles). According to recent classifications, there are approximately 408 species of reptiles in Argentina. Of these, 136 species correspond to snakes, 265 to lizards, eight to amphisbaena, 14 to turtles and two to alligators [31–34]. The provinces with the highest number of registered nematode taxa are: San Juan (8) and Salta (5), followed by Chaco (4), Buenos Aires (4) and La Rioja (3). Most of the studies to locate parasitic helminths were carried out on *Phymaturus* spp. and *Liolaemus* spp.

Finally, there are no studies in Argentina on life cycles of parasitic nematodes of reptiles. In addition, 53% of the Argentine territory, there are no records of parasitic nematodes of reptiles. This lack of information is probably related to the few research groups on the subject. Our results highlight the need for more research regarding the parasite/host relationship.

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