

Nematodes associated with *Iguana iguana* (Linnaeus, 1758) (Squamata, Iguanidae) in Semi-arid areas of Northeastern Brazil

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Abstract

Nematodes were analyzed in *Iguana iguana*, a large lizard Iguanidae that is widely distributed throughout the Americas. The aims of the study were investigate the helminths associated with the lizard, *I. iguana* in semi-arid areas of northeastern Brazil and analyze the parasitological indices (prevalence, and mean intensity of infection). A total of 18 specimens of *I. iguana* were examined (8 males and 10 females). The overall prevalence of infection was 66.6% (12/18), while in males, it was 75% (6/8) and in females, 60% (6/10). *Iguana iguana* was identified as a new host for *Physaloptera* sp., *Atractis* sp., *Piratuba* sp. and *Subulura* sp. This registered contributes to the knowledge of helminth diversity associated with this host.

Keywords: helminths, Green Iguana, parasitism, Caatinga domain.

Nematoda associados a *Iguana iguana* (Linnaeus, 1758) (Squamata: Iguanidae) em áreas do semi-árido do nordeste do Brasil

Resumo

Foram analisados os nematóides em *Iguana iguana*, um grande lagarto Iguanidae que possui ampla distribuição pelas Américas. Os objetivos do estudo foram investigar os helmintos associados ao lagarto *I. iguana* e seus índices parasitológicos (prevalência e intensidade média de infecção). Foram examinados 18 espécimes (oito machos e 10 fêmeas). A prevalência total foi de 66,6% (12/18), nos machos foi de 75% (6/8) e nas fêmeas 60% (6/10). *Iguana iguana* foi identificado como um novo hospedeiro para *Physaloptera* sp., *Atractis* sp., *Piratuba* sp., e *Subulura* sp. Este registro contribui para o conhecimento da diversidade de helmintos associados a este hospedeiro.

Palavras-chave: helmintos, Iguana Verde, parasitismo, domínio de Caatinga.

1. Introduction

Iguana iguana (Linnaeus, 1758) occurs in regions of North America (Mexico), Central America (Panama, Nicaragua, Guatemala and Costa Rica), South America (Brazil, Peru, Venezuela) (Lara-López and González-Romero, 2002; Arrojo, 2002), and some Caribbean islands, such as Cozumel, Utila and Roatan (Arce-Nazario and Carlo, 2012). There are introduced populations in the United States, in Florida and Hawaii (Connant and Collins, 1998; Smith et al., 2007), Puerto Rico (López-Torrez et al., 2012),

Dominican Republic (Pasachnik et al., 2012), and Antilles (Powell et al., 2011).

Iguana iguana includes heliothermal arboreal lizards of diurnal activity that grow to a large size in adulthood, up to about 1.80 m total length. The females of this species nest close to rivers, streams, and other bodies of water, where the nest generally contains 14 eggs (Campos, 2004). They often use vegetation microhabitats close to bodies of water. Their diet essentially consists of plant material,

mainly leaves, thus they are considered a polyspecific herbivore (Lara-López and González-Romero, 2002).

Parasitological investigations into these iguanids have shown that they host a diverse group of parasites, including nematodes (Breves et al., 2011; Lopes et al., 2006; Sarmiento et al., 1999; Freitas and Lent, 1937; Dyer et al., 1999), trematodes (Ávila and Silva, 2011; Freitas and Lent, 1937), cestodes (Ávila and Silva, 2010), and mites and ticks (Dantas-Torres et al., 2008).

The aims of the study were to investigate the helminths associated with *I. iguana* in semi-arid areas of the Brazil and the parasitological indices (prevalence and mean intensity) of the infections.

2. Materials and Methods

Eighteen specimens of *I. iguana* were analyzed (eight males and 10 females). The hosts were obtained from the Herpetological Collection of the Regional University of

Cariri (URCA-H) under the following numbers: 5535-5537, 6736-6737, and 9474-9486. Specimens of *I. iguana* came from seven different municipalities of northeast Brazil: Exu (N=7) (07° 30' S, 39° 43' W) and Moreilândia (N=1) (07° 38' S, 39° 33' W) in the state of Pernambuco and Aiuaba (N=3) (06° 34' S 40° 07' W), Barro (N=1) (07° 10' S, 38° 46' W), Crato (N=1) (07° 14' 02" S 39° 24' 32" O), Juazeiro do Norte (N=1) (07°12' S, 39°18' W) and Santana do Cariri (N=4) (07° 11' S, 39° 44' W) in the state of Ceara. All of these municipalities are part of the Caatinga domain (Figure 1).

Each specimen was dissected by a longitudinal incision, and the respiratory, digestive and urinary tracts were removed and analyzed separately with the use of a stereomicroscope. The helminths were quantified, fixed in AFA, mounted on temporary slides in Hoyer medium (Everhart, 1957), and identified under a light microscope. Specimens of the parasites were deposited in the Parasitological Collection

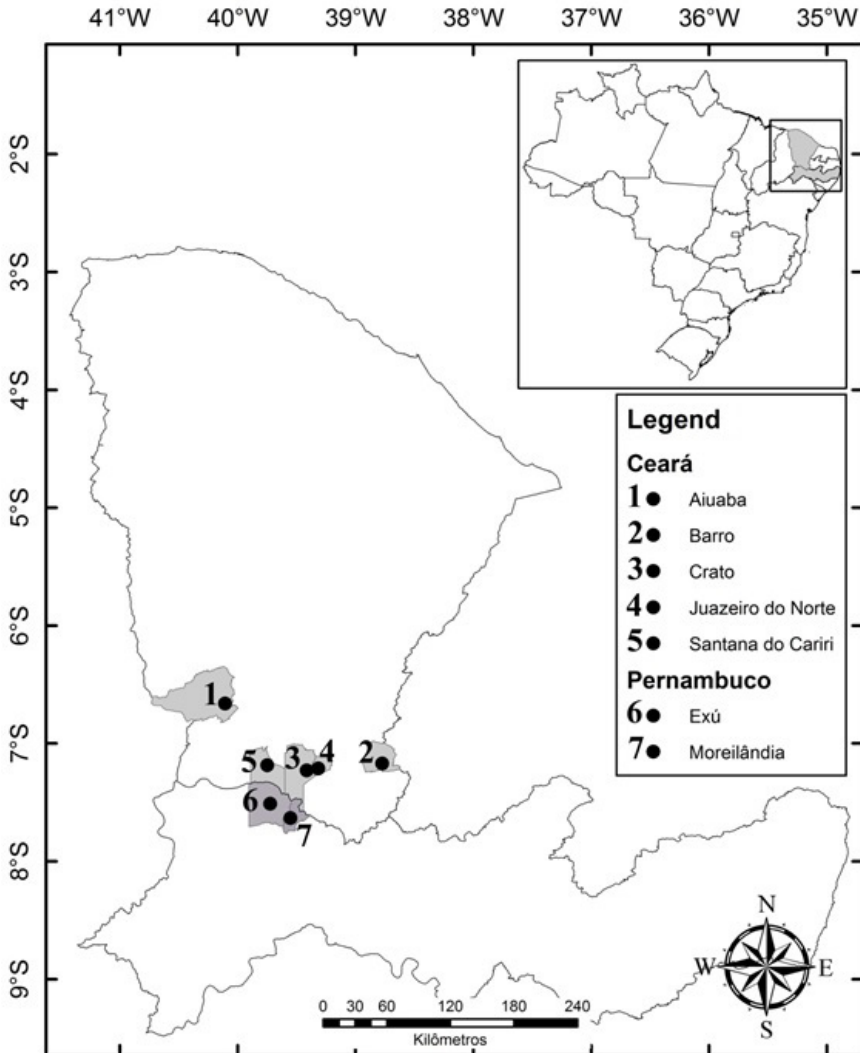


Figure 1. Site of collection of the *Iguana iguana* in semi-arid areas of northeastern from Brazil.

of the Universidade Regional do Cariri – URCA-P (Numbers 423-443 URCA-P).

The helminths were identified according to Inglis et al. (1960), Vicente (1966) and Vicente et al. (1993).

The prevalence and mean intensity of infection was calculated according to Bush et al. (1997).

3. Results

The hosts were infected by Nematoda with prevalence was 66.6% (12/18), while in males, it was 75% (6/8) and in females, 60% (6/10). The intensity of infection overall was (15.02), while in males (6.6) and in females (8.4). Among nematodes found infecting *I. iguana* Pharingodonidae species were the most prevalent and with high mean intensity and Cosmocercidae larvae occurs with low prevalence (5%) and high mean intensity (1.600). The others helminths occurs with prevalence among five and 11% and mean intensity ranging from 40 and 60 helminths/host. The Table 1 shows the nematodes and their respective parasitological indices and sites of infection.

Larvae of Pharyngodonidae and unidentified species of *Alaeuris* and *Ozolaimus* were found infecting the stomach and intestines of *I. iguana*. In this case, these nematodes were found in the larval and juvenile stages difficulting the identification at the species level.

4. Discussion

The species of *Atractis* Dujardin, has been reported infecting Testudinae (Salizar and Sanchez, 2007) and carnivorous lizards (Goldberg and Bursey, 2000; Ávila and

Silva, 2010) in South America. *Atractis cruciata* Linstow, 1902 has been registered infecting *Tupinambis teguixin* Linnaeus, 1758 and *Stenocercus roseiventris* Duméril & Bibron, 1837 in Ecuador (Ávila and Silva, 2010).

Onchocercidae consist a nematode family composed for *Macdonaldius* Khana, 1933, *Oswaldofilaria* Travassos, 1933, *Piratuba* Lent and Freitas, 1921 and *Piratuboides* Bain and Sulahian, 1974 which infecting essentials carnivorous reptiles (Ávila and Silva, 2010).

Piratuba Lent and Freitas, 1921 is a group of seven species found in neotropical regions. Four species have been recorded in Brazil infecting lizards: *Piratuba digiticauda* Lent & Freitas, 1941 infecting *Plica umbra* Linnaeus, 1758, *Tropidurus torquatus* Wied, 1820 and *T. spinulosus* (*T. guarani*) Alvarez, Cei and Scolaro, 1991; *Piratuba laisoni* Bain, 1974 infecting *Polychrus marmoratus* Linnaeus, 1758 and *Anolis punctatus*; *Piratuba scaffi* Bain, 1974 infecting *Ameiva ameiva* Linnaeus, 1758; *Piratuba shawi* Bain, 1974 infecting *Kentropix calcarata* Spix, 1825 (Vicente, 1981; Vicente et al, 1993; Ávila and Silva, 2010).

Physaloptera spp. infects various groups of vertebrates (Anderson, 2000), principally amphibians and reptiles throughout the Americas (Espinoza-Jiménez et al., 2007; Silva et al., 2008). In Brazil, unidentified species of *Physaloptera* have been recorded in the following species of lizards: Gekkonidae, Gymnophthalmidae, Hoplocercidae, Mabuyidae, Polychrotidae, Teiidae and Tropiduridae (Ávila and Silva, 2010). The specimens of *Physaloptera* we found were not identified to the species level due to the sample examined consisting only of individuals in the juvenile stages.

Table 1. Prevalence (%), mean intensity and site of infection of gastrointestinal nematodes associated with *Iguana iguana* in semi-arid areas of northeastern from Brazil.

Nematodes	Prevalence	Mean intensity	Site of infection
Atractidae			
<i>Atractis</i> sp.	5	60	large and small intestines
Cosmocercidae			
Cosmocercidae larvae	5	1,600	Stomach
Onchocercidae			
<i>Piratuba</i> sp.	5	60	large and small intestines
Pharingodonidae			
<i>Alaeuris vogelsangi</i> Lent & Freitas, 1948	77	2,343.07 ± 1,047	large and small intestines
<i>Alaeuris caudatus</i> Lent & Freitas, 1948	77	1,937.14 ± 949.49	large and small intestines
<i>Alaeuris</i> spp.	72	607.14 ± 521.04	large and small intestines
<i>Ozolaimus megatyphlon</i> Rudolphi, 1819	77	1,078.57 ± 366.22	large and small intestines
<i>Ozolaimus cirratus</i> Linstow, 1906	77	764.28 ± 233.22	large and small intestines
<i>Ozolaimus</i> spp.	66	691.66 ± 162.13	large and small intestines
Physalopteridae			
<i>Physaloptera</i> sp.	5	40	Stomach
Subuluridae			
<i>Subulura</i> sp.	11	55	large and small intestines

Subulura Molin, 1860 commonly infects various species of birds and mammals (primates, rodents and marsupials) (Anderson, 2000). In Brazil, the first report of in reptiles was *Subulura lacertilia* Vicente, Van-Sluis, Fontes & Kiefer, 2000 infecting *Eurolophosaurus nanuzae* Rodrigues, 1981 from Serra do Cipó, Minas Gerais and *Cnemidophorus nativo* Rocha, Bergallo & Peccinini-Seale, 1997 from Guaratiba, resting areas, Bahia State (Ávila and Silva, 2010).

Alaeuris caudatus and *Alaeuris vogelsangi* are common parasites of *I. iguana* (Vicente et al., 1993). *Alaeuris caudatus* has been recorded infecting this lizard in Brazil, Peru, Venezuela and Puerto Rico (Vicente et al., 1993; Dyer et al., 1999; Ávila and Silva, 2010), but there has been no report of the parasitological indices for abundance these species. There have been reports of *A. vogelsangi* infecting iguanas in the following countries: Brazil (Petter, 1970; Ávila and Silva, 2013), Puerto Rico (Dyer et al., 1999) and Venezuela (Lent and Freitas, 1948). In the Caatinga areas from Ceará, Brazil, Lopes et al. (2007) noted prevalence 100% (3/3) and mean intensity of infection $4,866.6 \pm 318.1$, and Ávila and Silva (2011) registered prevalence 40% (2/5) and mean intensity of infection $9,604.5 \pm 5,424.2$ in Mato Grosso, Brazil. In Puerto Rico, Dyer et al. (1999) report prevalence 100% (1/1) and intensity of infection 27.

Ozolaimus cirratus and *Ozolaimus megatyphlon* infecting *I. iguana* from: Peru (Arrojo, 2002), Panama (Burseley et al., 2007), Colombia, Suriname and Brazil (Ávila and Silva, 2010). In Panama, Bursey et al. (2007) reported prevalence was 50% (1/2) and mean intensity of infection 792 ± 880 to *O. cirratus*. In, *O. megatyphlon*, the prevalence noted by Ávila and Silva (2011) in Mato Grosso, Brazil was 40% (2/5) and mean intensity $9,604.5 \pm 5,424.2$.

Parasitological indices found in the present study and in previous studies suggest that *Alaeuris* spp. and *Ozolaimus* spp. are common species of *Iguana iguana*.

According to Roca et al. (2005), one of the characteristics of helminth component community for herbivorous reptiles is that they are not infected with helminths heteroxenous life cycles. However, recent studies have contradicted this assumption, as shown by the review study by Ávila and Silva (2010) who recorded the presence of Cestoda and Trematoda infecting *I. iguana* (Ávila and Silva, 2011, 2010). As the findings of our study that found the presence of heteroxenous nematodes *Physaloptera* spp. and *Subulura* spp. infecting *I. iguana*. Therefore, we believe that new studies can clarify the community component of herbivorous lizards in the Neotropical region.

Moreover, we report here the first records of *Atractis* sp., *Piratuba* sp., *Physaloptera* sp. and *Subulura* sp. in the lizard, *I. iguana*.

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