

Prevalence and intensity of infection by *Raillietiella gigliolii* Hett, 1924 (Pentastomida) in *Amphisbaena alba* Linnaeus, 1758 and *A. vermicularis* Wagler, 1824 (Amphisbaenidae) from Northeastern Brazil

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Received August 26, 2008 – Accepted October 20, 2008 – Distributed November 30, 2009

Abstract

Raillietiella gigliolii is a Neotropical pentastomid parasite found in *Amphisbaena alba*. Collections were made in northeastern Brazil in a remnant area of Atlantic Forest (07° 10' S and 35° 05' W) in the municipality of Cruz do Espírito Santo, Paraíba State, and in a Humid Forest area (07° 16' S and 39° 26' W) on the slopes of the Chapada do Araripe Mountains, municipality of Crato, Ceará state, Brazil. Nine specimens of *A. alba* and 12 of *A. vermicularis* were collected to gather basic ecological data (prevalence and mean intensity of infection) concerning these parasites. *Raillietiella gigliolii* was found infecting the lungs of both species. The prevalence for *A. alba* was 55.5% (5/9), with a mean intensity of infection of 5.0 ± 2.53 and amplitudes of 1-13. *A. vermicularis* demonstrated prevalence of 50%, with a mean intensity of infection of 5.3 ± 2.1 and amplitudes of 1-14. This represents the first record of *R. gigliolii* as a parasite of *A. vermicularis*. Our results suggest that *R. gigliolii* is a generalist parasite species and that an overlapping diet is the determinant factor in the sharing of its final hosts.

Keywords: endoparasites, *Amphisbaena*, *Raillietiella*, Neotropical region.

Prevalência e intensidade de infecção por *Raillietiella gigliolii* Hett, 1924 (Pentastomida) em *Amphisbaena alba* Linnaeus, 1758 e *A. vermicularis* Wagler, 1824 (Amphisbaenidae) da região Nordeste do Brasil

Resumo

Raillietiella gigliolii constitui uma espécie de pentastomídeo neotropical parasita registrada em *Amphisbaena alba*. No intuito de suplementar dados ecológicos básicos (prevalência e intensidade média de infecção) foram coletados na região nordeste do Brasil nove espécimes de *A. alba* em um remanescente de Mata Atlântica (07° 10' S e 35° 05' O) no município de Cruz do Espírito Santo, Estado da Paraíba, e 12 *A. vermicularis* em ambiente de Mata Úmida (07° 16' S e 39° 26' O) na encosta da Chapada do Araripe, município de Crato, Estado do Ceará. Em ambas as espécies foi encontrada *R. gigliolii* infectando os pulmões analisados. A prevalência encontrada para *A. alba* foi de 55,5% (5/9) com intensidade média de infecção de $5,0 \pm 2,53$, amplitude 1-13. Em *A. vermicularis*, encontramos uma prevalência de 50% e intensidade média de infecção de $5,3 \pm 2,1$, amplitude 1-14. Este representa o primeiro registro de *R. gigliolii* como parasita de *A. vermicularis*. Os resultados sugerem que *R. gigliolii* constitui uma espécie generalista e a superposição da dieta parece ser o fator determinante para o compartilhamento de hospedeiros definitivos.

Palavras-chave: endoparasitas, *Amphisbaena*, *Raillietiella*, região Neotropical.

1. Introduction

Brazil has approximately 52 species of amphisbaenas, of which 18 occur in the northeastern region of the country. Due to the fossorial habits of the amphisbaenas, little is known about the biology of these animals or about their rates of infection by parasites. Of all of the species that occur in northeastern Brazil, only *Amphisbaena alba* has been examined for macroparasites: nematodes (*Aplectana pusilla* Miranda, 1924 and *A. unguiculate* [Rud., 1819]) and pentastomids (*Raillietiella gigliolii*) (Vicente et al., 1993; Almeida et al., 2006). There is only data available concerning microparasites from Valverde et al. (2005), who reported coccidian cysts in *A. alba* and *A. vermicularis*.

Raillietiella gigliolii is a species of pentastomid parasite of amphisbaenas that has been described as being specific to *A. alba* (Rego, 1983; Ali et al., 1984). Hett (1924) described the species based only on male specimens. A description of the females was only later made by Ali et al. (1984) using material from Trinidad (in the Caribbean). A taxonomic review was undertaken by Ali et al. (1985), and in this work (as in all of the earlier publications), *R. gigliolii* was described as a specific parasite of *A. alba*.

Rego (1983) reported the occurrence of three male specimens of *R. gigliolii* in a specimen of *A. alba* from an undisclosed locality in Brazil. Another occurrence was reported by Almeida et al. (2006) with an analysis of three male specimens collected from the lungs of a specimen of *A. alba* collected in the municipality of Crato, Ceará State, northeastern Brazil. Almeida et al. (2006) published the first data available concerning parasite infection rates (prevalence and infection intensity) even though only three specimens of *A. alba* were available.

The present study was undertaken to investigate infection rates (prevalence and mean infection intensity) for pentastomids in two sympatric and syntopic *Amphisbaena* species.

2. Materials and Methods

The present study with *A. alba* was undertaken from November to December 2007 in an area of remnant Atlantic Forest belonging to the Companhia Usina São João farm, located in the municipality of Cruz do Espírito Santo, Zona da Mata, Paraíba state, Brazil. The forest fragment chosen for the study (07° 10' S and 35° 05' W) is situated within a sugar cane plantation matrix along its northern border, while it is defined along its southern border by the BR 101 Federal Highway. The forest fragment has an area of 731.5 ha and can be characterised as regenerating secondary forest, with woody species (trees and shrubs) representing many different plant families. Some of the forest areas have an understory layer with herbaceous plants and even grasses (as a result of anthropogenic interference). Epiphytes and vines are present in the area, indicating the recuperation of the forest. The

study site is cut (east to west) by the Massangana River, which was dammed to form the Cafundó Reservoir.

Field work to capture *Amphisbaena vermicularis* was carried out from January to May 2008 on the lower slopes of the Chapada do Araripe Mountains (07° 16' S and 39° 26' W) within the limits of the Chapada do Araripe Environmental Protection Area in the municipality of Crato, Ceará State, Brazil. The vegetation of the region is composed of secondary forests. The area has been subjected to anthropogenic alterations as a result of occupation for agricultural purposes, harvesting natural resources, and land sub-divisions. The regional climate is warm, semi-arid tropical, with mean annual temperatures between 24 and 26 °C. The rainy season extends from January to May, and the average annual rainfall is 1,100 mm (IPECE, 2008).

The amphisbaenids were captured by using the classical herpetological techniques of active patterned collecting (Auricchio and Salomão, 2002). After collection, the animals were euthanised with ether, fixed, and then preserved in 70% ethanol. The amphisbaenids were subsequently identified according to Barros-Filho and Valverde (1996) and Vanzolini (2002). Snout-vent length (SVL) was measured using calipers (in centimetres).

The respiratory tracts of the amphisbaenids were removed and the presence of pentastomids determined by examination under a stereomicroscope. All pentastomids found were cleared in Hoyer's medium and subsequently mounted on slides. Identifications were based on the dimensions of the hooks and copulatory spicules of the males that were measured using a microscope fitted with a micrometric ocular (Ali et al., 1984, 1985). Drawings were made using a drawing tube connected to a bright-field microscope. The eco-parasitological terminology used followed Bush et al. (1997).

3. Results

A total of 21 amphisbaenids were captured. The nine specimens of *A. alba* ranged in SVL from 42.0 to 63.0 cm (mean = 51.1 ± 2.5 cm), while the 12 specimens of *A. vermicularis* ranged from 20.0 to 50.5 cm (mean = 40.0 ± 3.0 cm).

Analyses of the specimens of *A. alba* revealed that five individuals were infected by *Raillietiella gigliolii* (prevalence of 55.5%, mean infection intensity 5.0 ± 2.53 with amplitudes of 1-13) (Table 1).

The analyses of *A. vermicularis* indicated that six individuals were infected by *R. gigliolii* (prevalence of 50%, mean infection intensity 5.3 ± 2.1 with amplitudes of 1-14) (Table 1). This represents the first record of *R. gigliolii* as a parasite of *A. vermicularis*.

The mean of SVL between infected and non-infected individuals and between males and females did not differ significantly.

4. Discussion

As precision in measuring infection rates is intimately related to sample size, significant efforts should be

Table 1. Pulmonary infection by *Raillietiella gigliolii* in *Amphisbaena* species (with their respective host habitat type), and values of prevalence (in %), intensity of infection, the corresponding range of the intensity of infection, and data source.

Host	Biome	N	SVL (cm)	Prevalence	Infection intensity	Source
<i>A. alba</i> ♀	Atlantic Forest	8	52.24 ± 2.49	50% (4/8)	6.0 ± 3.0 (1-13)	Present study
<i>A. alba</i> ♂	Atlantic Forest	1	42.0	100% (1/1)	1.0 ± 0.0	Present study
<i>A. alba</i> ♀	Caatinga	3	48.66 ± 16.75	33.3% (1/3)	3.0 ± 0.0	Almeida et al. (2006)
<i>A. vermicularis</i> ♀	Caatinga	10	48.80 ± 2.93	40% (4/10)	3.5 ± 1.83 (1-9)	Present study
<i>A. vermicularis</i> ♂	Caatinga	2	42.0 ± 2.0	100% (2/2)	2.0 ± 1.0 (1-3)	Present study

taken to adequately census study populations - although this is not easily done with fossorial animals that are difficult to collect. Almeida et al. (2006) were able to collect only three specimens of *A. alba* and reported an infection rate of 33.3% (1/3) and an infection intensity of 3.0 ± 0.0 . The results of the present study are quite different, demonstrating significantly higher prevalence and intensity of infection values (Table 1).

Pentastomid host specificity was defended by Self and Kuntz (1967) who pointed out their long evolutionary association; while Riley (1986) estimated that approximately 50% of the Pentastomid species were specific for their hosts. Our results demonstrate that *R. gigliolii* is not specific to *A. alba*. Similar results were presented in the study of Almeida et al. (2007, 2008a, 2008b) for various species of snakes and lizards parasitised by *Cephalobaena tetrapoda* and *Raillietiella mottae* respectively. The snakes and lizards studied by these authors demonstrated overlapping diets, similar to that seen for *A. alba* and *A. vermicularis* in the present work. Almeida et al. (2006) hypothesised that termites and ants must be the intermediate hosts of *R. gigliolii*, and we encountered these arthropods in the stomachs of both amphisbaenids species studied here.

According to Aho (1990), prevalence values above 50% indicate that the parasite species in question may be the "core" species of the host's helminth community. Only *A. alba* demonstrated a prevalence level of 55.5% in the present study, but data obtained by Almeida et al. (2006, 2007, 2008a, 2008b) indicated that pentastomids are not "core" species in lizards and snakes.

Tissue lesions caused by pentastomids are most common in the larva and nymphal stages (due to their migratory process when organs can be perforated) and during encysting (which can cause marked granulomatous inflammations (Ambrose and Riley, 1988; Boyce and Kazacos, 1991). Final hosts, however, do not normally present visible symptoms (pentastomids are rarely coughed up or regurgitated) or tissue damage (such as discoid scars covering the reticular or membranous regions of the lung) (Riley, 1981; Almeida et al., 2008a). Riley (1986: 98), in fact, observed that there is little evidence that pentastomids are responsible for significant pathologies in naturally infected definitive hosts. In the

present study, the lung tissue was observed to be intact and without lesions, scars, or traces of hemorrhaging.

As such, additional studies with larger samples will be necessary to elucidate additional details of parasitism in amphisbaenas.

Acknowledgements — We are grateful to the Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico – FUNCAP, for our research grant (BPI-0112-2.05/08), the scholarship awarded to S.C. Ribeiro and the productivity fellowship for W.O. Almeida (02/2008-BPI); to the Brazilian National Research Council – CNPq, for its support through a PIBIC scholarship to DL. Sales; the Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES for the scholarship awarded to G.G. Santana; the Brazilian Institute for the Environment and Natural Resources – IBAMA for the collecting permit (process number 14100-1 and 007/ 2007 – CGFAP/ IBAMA 02007.001009/2004); and Roy Funch (UEFS) for reviewing the manuscript. The experiments described here comply with current Brazilian regulations.

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