

# Occurrence of gastrointestinal and renal helminths in *Zenaida auriculata* (Des Murs, 1847) trap-captured from Brazil

Ocorrência de helmintos gastrintestinais e renais em *Zenaida auriculata* (Des Murs, 1847) capturados no Brasil

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## Abstract

This study aimed to determine the prevalence of gastrointestinal and renal helminths from naturally infected *Zenaida auriculata* captured in Londrina, Paraná State. Two hundred and one Eared doves were trapped and the gastrointestinal and renal helminths were collected and identified according to morphological structures. One hundred and sixteen (57.71%) doves were parasitized by helminths with specific prevalences for *Ornithostrongylus quadriradiatus* in 50 doves (24.88%), *Ascaridia columbae* in 47 (23.38%), *Paratanaisia bragai* and *P. confusa* in 34 (16.92%), *Tetrameres fisispina* in 17 (8.46%), *Synhimantus nasuta* in 14 (6.47%), *Brachylaima mazzantii* in 4 (1.99%) and *Raillietina allomyodes* in 2 doves (1.00%). Seventy four/201 (37.00%) birds were infected with only one species, and 96/201 (48.00%) pigeons were infected with nematodes. The association between different classes of helminths occurred in 40/201 (20.00%) animals. The results showed statistically differences between the presence of nematode ( $p = 0.00001$ ) and trematode species ( $p \leq 0.05$ ) in the doves, and there was an association between the local of capture and the presence of trematodes and *A. columbae* ( $p \leq 0.05$ ). This study is the first to report the infection of *Z. auriculata* from Brazil with *O. quadriradiatus*, *A. columbae*, *T. fisispina*, *S. nasuta*, *R. allomyodes*, *P. bragai* and *P. confusa*.

**Keywords:** Pigeon, eared dove, occurrence, worms, systematics.

## Resumo

O objetivo deste estudo foi determinar a prevalência de helmintos gastrintestinais e renais de *Zenaida auriculata* naturalmente infectados capturados em Londrina, Paraná. Duzentos e um pombos-de-bando foram capturados e os helmintos gastrintestinais e renais foram coletados e identificados de acordo com as estruturas morfológicas. Cento e dezesseis (57,71%) pombos estavam parasitados por helmintos com as seguintes prevalências: *Ornithostrongylus quadriradiatus* em 50 pombos (24,88%), seguido por *Ascaridia columbae* em 47 (23,38%), *Paratanaisia bragai* e *P. confusa* em 34 (16,92%), *Tetrameres fisispina* em 17 (8,46%), *Synhimantus nasuta* em 14 (6,47%), *Brachylaima mazzantii* em 4 (1,99%) e *Raillietina allomyodes* em 2 pombos (1,00%). Setenta e quatro/201 (37,00%) aves apresentaram-se infectadas por apenas uma espécie, e 96/201 (48,00%) pombos com nematodas. A associação entre diferentes classes de helmintos ocorreu em 40/201 (20,00%) animais. Os resultados mostraram diferenças estatísticas entre a presença de nematodas ( $p = 0,00001$ ) e trematodas ( $p \leq 0,05$ ) em pombos, e houve associação entre o local de captura e a presença de trematodas e *A. columbae* ( $p \leq 0,05$ ). Este trabalho é o primeiro a relatar a infecção de *Z. auriculata* no Brasil com *O. quadriradiatus*, *A. columbae*, *T. fisispina*, *S. nasuta*, *R. allomyodes*, *P. bragai* e *P. confusa*.

**Palavras-chave:** Pombo, pombo-de-bando, ocorrência, vermes, sistemática.

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## Introduction

*Zenaida auriculata* (Des Murs, 1847) (Aves: Columbiforme) is endemic to an area ranging from Antilles to Tierra del Fuego, passing through Brazil. This dove is popularly known as the eared dove (CÂNDIDO et al., 2008; SHIBATTA et al., 2009) and is found in fields, farms and urban areas (CÂNDIDO et al., 2008), where it can cause damage and potentially transmit pathogens (SHIBATTA et al., 2009).

Of the numerous health problems that can affect pigeons, parasite infections may be the most important (MARQUES et al., 2007). Little is known of the species of gastrointestinal parasites that infect these birds (MARQUES et al., 2007).

There are very few studies on the presence of gastrointestinal helminths in *Z. auriculata*; Travassos and Freitas (1942) documented gastrointestinal helminths of doves in Brazil's Northeast Railroad; Adriano et al. (2001) reported the presence of the trematode *Brachylaima mazzantii* in the small intestine of this dove at Junqueirópolis-SP. Additionally, Durette-Desset et al. (2000) described the presence of a new species of helminth, *Ornithostrongylus volcani* n. sp., in doves in Venezuela. The only study on the prevalence of helminths in *Z. auriculata* was conducted in Chile by González et al. (2004); these authors encountered *Killigrewia delafondi* (9.4%), *Raillietina* sp. (1.7%), *Heterakis gallinarum* (0.4%) and *Echinostomum* sp. (0.9%).

The aim of the present study was to determine the prevalence of gastrointestinal and renal helminths in naturally infected *Z. auriculata* captured in the city of Londrina, Paraná State.

## Materials and Methods

### Study area and host data collection

Londrina is located in the north of Paraná state, southern Brazil (23°08'47" and 23°55'46" S, 50°52'23" and 51°19'11" W) (IBGE, 2010). Two hundred and one doves (*Z. auriculata*) were captured using gauze-traps from January 2010 to June 2011. These animals were collected from three different areas: 140 birds from a soybean seed industry, 45 from the campus of State University of Londrina, and 16 from a dairy cattle farm. This work was approved by the Brazilian Institute of Environment (IBAMA) SISBIO N. 16428-1 and by the Ethics Committee of Animal Experiments of the State University of Londrina no. 70/2008.

### Helminth data collection

The animals were euthanized in a CO<sub>2</sub> chamber, and their gastrointestinal tracts were removed and opened from the esophagus to the cloaca. The esophagi, crops, proventriculi, gizzards, small intestines and large intestines were individualized and placed in Petri dishes with 0.9% saline solution. Each organ was cut lengthwise and scanned for helminths. The helminths were removed from the crop and proventriculus after a detailed examination. The gastrointestinal content was taken from the mucosa, washed and

passed through sieves with apertures of 600 µm, 425 µm and 150 µm (PAVANELLI; FERNANDES, 1982) for the separation of the helminths. The kidneys were removed from the abdominal cavity and cut lengthwise, and the renal tubules were slightly compressed to obtain the helminths.

### Permanent slides preparation and identification

To prepare permanent slides of the parasites, the helminths were refrigerated for 24 hours (PAVANELLI; FERNANDES, 1982). The nematodes were placed in 37 °C Railliet-Henry solution for fixation, while the cestodes and trematodes were pressed between glass slides and dipped in Railliet-Henry solution (TRAVASSOS, 1950). Subsequently, the nematodes were cleared in Hoyer solution and a slide and coverslip were prepared according to the method described by Sloss et al. (1999). The thin nematodes were stained with lactophenol cotton blue (TRAVASSOS, 1950) before the slide preparation. The cestodes and trematodes were washed for five hours in distilled water, stained with Carmine Mayer, then allowed with acid alcohol and dehydrated in alcoholic series. After the dehydration, the cestodes and trematodes were cleared in Hoyer solution and placed between the slide and coverslip for observation by optic microscopy (PESSOA, 1967). Helminth specimens were identified following taxonomic keys of Travassos (1913, 1914, 1919, 1921), Yamaguti (1958, 1959, 1961), Travassos and Kohn (1966), Travassos et al. (1969), Vicente et al. (1995) and Saif et al. (2008).

### Statistical analysis

The terms prevalence (P), abundance (A) and mean intensity of parasitism (MI) follow the definitions of Bush et al. (1997), and these parameters were evaluated in Microsoft Excel 2007 (Microsoft Corporation, Redmond, Washington, USA). Chi square ( $\chi^2$ ) test corrected by Yates was used to compare the variables (Epi Info Program, version 6.04). A P-value of  $\leq 0.05$  was considered significant.

## Results

In the proventriculi, were found *Synhimantus nasuta* and *Tetrameres fissispina*; in the renal tubules, it was encountered *Paratanaisia bragai* and *P. confusa*. No worms were found in the esophagi, crops, gizzards or large intestines. Eighty six (42.79%) small intestines, 34 (16.92%) renal tubules and 23 (11.44%) proventriculi were parasitized. *P. bragai* and *P. confusa* were present together in all 23 renal tubules.

*Ornithostrongylus quadriradiatus* was the most prevalent species and occurred in 24.88% of the eared doves; *A. columbae* was the second most prevalent species and was encountered in 23.38% of the doves. However, *P. bragai* + *P. confusa* had the highest mean intensity of parasitism (220.62). Table 1 presents the number of parasitized animals, the prevalence, the abundance, the mean intensity of parasitism and the range of parasitism of the species. There were significant differences when nematodes *O. quadriradiatus*,

*A. columbae*, *S. nasuta* and *T. fisispina* were compared. Additionally, when the presence of trematodes was studied (Table 1), the doves had 10.03 times-higher *P. bragai* + *P. confusa* than *B. mazzantii* (OR = 10.03, 3.46<OR<39.51, p<0.05).

Of the 201 captured doves, 97/201 (48.26%) were male and 104/201 (51.74%) were female. A total of 49/97 (50.52%) of the males and 67/104 (64.42%) of the females had parasites. Both male and female doves presented each class of helminth in the gastrointestinal tract and renal tubules. However, 25 females had trematodes and only 13 males presented this class (Table 2). There were no differences between male and female doves considering the infection from Class Nematoda (p>0.10) and Class Trematoda (p>0.08).

Association between the parasites and the locality of trap capture is shown in Table 3. The parasites from Class Nematoda

were taking all together and compared with place of trap capture, and no differences were observed (p>0.06), however, *A. columbae* was more frequent in dairy farms (p = 0.005). In Trematoda class the soybean industry had a higher prevalence than University (OR = 0.21, 0.04<OR<0.74, p = 0.01). This occur by the fact that *P. bragai* + *P. confusa* were found just in the industry (p = 0.00025), additionally, no trematodes were observed in dairy farms.

It was observed that among the positive birds, they had one to four different species of helminths in the gastrointestinal tract and renal tubules. The majority of infected *Z. auriculata* 74/201 (37.00%) were parasitized with one species of parasite. The Nematoda class was the most frequently encountered class of parasite, found in 96/201 (48.00%) doves, followed by the Trematoda class in 38/201 (19.00%) doves and the Cestoda class in 2/201 (1.00%) doves.

**Table 1.** Prevalence, abundance, mean intensity of parasitism, the range of parasitism, the total of helminths collected, Odds ratio and p-value in *Zenaida auriculata* in Londrina, 2013.

Helminths	N	Mh	P (%)	A	MI	Range	Total	OR (CI = 95%)	p
<b>Nematoda</b>									
<i>Ornithostrongylus quadriradiatus</i> <sup>a</sup>	50	SI	24.88	1.14	4.58	1-67	229	NC	0.00001
<i>Ascaridia columbae</i> <sup>a</sup>	47	SI	23.38	1.40	5.98	1-60	281		
<i>Tetrameres fisispina</i> <sup>b</sup>	17	Pr	8.46	0.47	5.53	1-34	94		
<i>Synhimantus nasuta</i> <sup>b</sup>	14	Pr	6.47	0.55	7.93	1-21	111		
<b>Cestoda</b>									
<i>Raillietina allomyodes</i>	2	SI	1.00	0.01	1.00	1	2		NC
<b>Trematoda</b>									
<i>Paratanaisia bragai</i> + <i>P. confusa</i> <sup>a</sup>	34	RT	16.92	37.32	220.62	14-1101	7501	10.03 (3.46<OR<39.51)	0.0000002
<i>Brachylaima mazzantii</i> <sup>b</sup>	4	SI	1.99	0.26	13.25	4-21	53		

N = number of doves, Mh = microhabitats, P = prevalence, A = abundance, MI = mean intensity of parasitism, SI – small intestine, Pr = proventriculus, RT = renal tubules, OR = Odds Ratio, CI = Confidence Interval, NC = not calculated, p-values, <sup>a, b</sup> = same letter are not significantly, however, different ones are.

**Table 2.** Prevalence, abundance, mean intensity of parasitism, the range of parasitism, the total of helminthes collected, Odds ratio and p-value in male and female *Zenaida auriculata* in Londrina, 2013.

Helminths	Gender	N	P(%)	A	MI	Range	Total	OR (CI = 95%)	p
<b>Nematoda</b>									
	Male	40	41.24					NC	0.10
	Female	56	53.85						
<i>Ornithostrongylus quadriradiatus</i>	Male	20	21.28	1.50	7.05	1-67	214	NC	0.24
	Female	30	29.70	0.87	2.93	1-24	88		
<i>Ascaridia columbae</i>	Male	19	20.21	2.28	11.26	1-60	141	NC	0.29
	Female	28	27.72	0.66	2.39	1-18	67		
<i>Tetrameres fisispina</i>	Male	8	8.51	0.70	8.25	1-34	66	NC	0.89
	Female	9	8.91	0.28	3.11	1-11	28		
<i>Synhimantus nasuta</i>	Male	7	7.45	0.67	9.00	1-21	63	NC	0.89
	Female	7	6.93	0.48	9.86	1-20	48		
<b>Cestoda</b>									
<i>Raillietina allomyodes</i>	Male	1	0.50	0.005	1.00	1	1		NC
	Female	1	0.50	0.005	1.00	1	1		
<b>Trematoda</b>									
	Male	13	13.40					NC	0.08
	Female	25	31.65						
<i>Paratanaisia bragai</i> + <i>P. confusa</i>	Male	12	12.77	29.79	233.33	70-712	2800	NC	0.14
	Female	22	21.78	46.54	213.68	14-1101	4701		
<i>Brachylaima mazzantii</i>	Male	1	1.06	0.22	21.00	21	21	NC	0.66
	Female	3	2.97	0.32	10.67	4-14	32		

N = number of doves, Mh = microhabitats, P = prevalence, A = abundance, MI = mean intensity of parasitism, SI – small intestine, Pr = proventriculus, RT = renal tubules, OR = Odds Ratio, CI = Confidence Interval, NC = not calculated, p-values.

**Table 3.** Outcome of association between the local of capture and helminths found in *Zenaida auriculata*, Londrina, 2013.

Variables	Local of capture	Positives (%)	Negatives (%)	Total	OR (CI = 95%)	p
<b>Nematoda</b>	Londrina State University	22 (48.89)	23 (51.11)	45	NC	0.06
	Soybean Industry	62 (44.29)	78 (55.71)	140		
	Dairy farm	12 (75.00)	4 (25.00)	16		
<i>Ornithostrongylus quadriradiatus</i>	Londrina State University	14 (31.11)	31 (68.89)	45	NC	0.57 <sup>1</sup>
	Soybean Industry	33 (23.57)	71 (76.43)	140		
	Dairy Farm	3 (18.75)	13 (81.25)	16		
<i>Ascaridia columbae</i>	Londrina State University <sup>a</sup>	9 (20.00)	36 (80.00)	45	NC	0.005
	Soybean Industry <sup>a</sup>	28 (20.00)	76 (80.00)	140		
	Dairy Farm <sup>b</sup>	10 (62.50)	6 (37.50)	16		
<i>Synhimantus nasuta</i>	Londrina State University	2 (4.44)	43 (95.56)	45	NC	0.73 <sup>1</sup>
	Soybean Industry	11 (7.86)	129 (92.14)	140		
	Dairy Farm	1 (6.25)	15 (93.75)	16		
<i>Tetrameres fissispina</i>	Londrina State University	2 (4.44)	43 (95.56)	45	NC	0,17 <sup>1</sup>
	Soybean Industry	15 (10.71)	125 (89.29)	140		
<b>Trematoda</b>	Londrina State University <sup>a</sup>	3 (6.67)	42 (93.33)	45	0.21 (0.04<OR<0.74)	0.01 <sup>1</sup>
	Soybean Industry <sup>b</sup>	35 (25.00)	105 (75.00)	140		
<i>Brachylaima mazzantii</i>	Londrina State University	3 (6,67)	42 (93.33)	45	NC	0.15 <sup>1</sup>
	Soybean Industry	1 (0.71)	139 (99.29)	140		
<i>Paratanaisia bragai</i> + <i>P. confusa</i>	Londrina State University	0 (0.0)	45 (100.0)	45	NC	0.000025 <sup>1</sup>
	Soybean Industry	34 (24.28)	106 (75.72)	140		

OR = Odds Ratio, CI = Confidence Interval, NC = not calculated, p-values, <sup>1</sup> Fisher's exact test, <sup>a, b</sup> = same letter are not significantly, however, different ones are.

## Discussion

A few studies on *Z. auriculata* helminths have been conducted worldwide. To the authors' knowledge, however, the data on prevalence, abundance, and mean intensity of parasitism of helminths in *Z. auriculata* have not previously been collected.

Lee et al. (2004) worked with *Z. macroura* in the USA and they did not observe differences between local of capture, and sex of those birds compared with the presence of helminths. In a different study, with another species of bird, *Z. asiatica*, Glass et al. (2002) showed that helminths may be found equally in both sex. Those results are similar to what we observed in the present study.

The presence of *A. columbae* in doves from dairy farm was higher than other localities in our study, and this was observed previously (GLASS et al., 2002). In fact, the environment is more complex in farms and the presence of others intermediate hosts, which are important for such parasites, could explain this. However, we need further evaluation.

Helminth prevalences described in *Zenaida* doves ranged from 2.75% to 93.34% in *Z. macroura* doves (BARROWS; HAYES, 1977; CONTI; FORRESTER, 1981; LEE et al., 2004), and from 50.29% to 95.6% in *Z. asiatica* doves (CONTI; FORRESTER, 1981; GLASS et al., 2002). González et al. (2004) studied *Z. auriculata* in Chile but reported the prevalence of each species of helminths rather than the prevalence of infected doves.

We observed a higher number of parasites of the Trematoda class in doves captured at the soybean industry; this finding could be related to a higher occurrence of intermediate hosts at this site, but other studies must be conducted to confirm this hypothesis. According to Freitas (1979), gastropod mollusks are intermediate hosts in the life cycles of cestodes and trematodes. Sick (1997)

affirmed that *Z. auriculata* feeds on mollusks and diplopods during the reproduction season, suggesting that these birds require the ingestion of animal protein and calcium during this period.

The majority of the animals infected with helminths in this study had single infections (37.00%); only 21% of the birds had multiple infections. The most found mixed infection was between *A. columbae* and *O. quadriradiatus*. Lee et al. (2004) also reported this helminth association in *Z. macroura*.

## Conclusions

This study is the first to describe the occurrence of *A. columbae*, *T. fissispina*, *S. nasuta*, *R. allomyodes*, *P. bragai* and *P. confusa* in *Z. auriculata* from Brazil. More studies should be conducted to determine whether these doves represent sources of infection for other birds because none of the parasites observed in this study were species specific.

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