



## Helminthic Parasites of Chickens (*Gallus Domesticus*) in Different Regions of São Paulo State, Brazil

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### ■ Keywords

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### ABSTRACT

The Brazilian poultry industry is an outstanding national and international agribusiness sector. Among the Brazilian states, São Paulo is the largest producer of commercial eggs and the fourth largest producer and exporter of chicken meat. Alternatively, semi-intensive and/or organic poultry production have also obtained a significant share of the domestic market as a result of consumer demand. Helminths affect the performance of the birds, causing significant direct or indirect losses. The objective of the present study was to identify the main helminth species present in chickens reared in 17 municipalities of the state of São Paulo. In total, 359 adult birds were investigated. The birds were reared in different housing systems and were obtained from 69 farms in the selected regions. The birds were submitted to procedures for the detection and identification of helminth parasites, following international standards. The evaluation of the small intestine employed the Mello-Campos method (Mello & Campos, 1974), which allows better recovery of cestode scolices attached to the intestinal mucosa. Stereomicroscopy was used to evaluate the collected materials, and light microscopy was used to identify the species based on their morphological characteristics. The following helminth species were diagnosed in chickens reared in 17 municipalities of the state of São Paulo: nematodes (*Ascaridia galli*, *Capillaria* sp., *Cheilospirura hamulosa*, *Heterakis gallinarum*, *Oxyspirura mansoni*, and *Strongyloides* sp.), cestodes (*Amoebotaenia cuneata*, *Choanotaenia infundibulum*, *Hymenolepis* sp., *Railletina cesticillus*, *Railletina echinobothrida*, and *Railletina tetragona*), and trematodes (*Zygocotyle lunata* and *Postharmostomum commutatum*).

### INTRODUCTION

The Brazilian poultry industry is an important national and international agribusiness sector. Among Brazilian states, São Paulo is the largest producer of commercial eggs and the fourth largest producer and exporter of chicken meat (UBA, 2014). According to the Brazilian Institute of Geography and Statistics (IBGE in Portuguese; Brasil, 2011), the Bastos and Amparo municipalities are the largest producers of commercial eggs and broilers, respectively.

However, alternative, semi-intensive and/or organic poultry production has conquered a significant share of the domestic market (Madeira *et al.*, 2010) as a result of consumers' demand. These production systems are regulated in Brazil by the Ministry of Agriculture and Food Supply (Brasil, 1999).

Helminths, when present, affect poultry performance, causing significant direct or indirect losses (Reid & McDougald, 1997; Silva, 2009). São Paulo chicken farmers that use semi-intensive systems



report that helminth control is one of the key obstacles to successful production.

Nematodes are an important group of bird parasites both in terms of the number of species and the damage caused (Ruff & Norton, 1997). Out of the 25 families of nematodes, 13 infect birds: Strongyloididae, Trichuridae, Syngamidae, Trichostrongylidae, Subuluridae, Heterakidae, Ascarididae, Spiruridae, Thelaziidae, Gnathostomatidae, Physaloptera, Acuariidae, and Dipetalonematidae.

Approximately 1400 species of cestodes that parasitize domestic and wild birds have been described. Three families (Davainidae, Dilepididae, and Hymenolepidae) and ten genera (*Amoebotaenia*, *Choanotaenia*, *Davainea*, *Diorchis*, *Drepanidotaenia*, *Imparmargo*, *Metroliasthes*, *Raillietina*, *Hymenolepis*, and *Fimbriaria*) were identified in a survey performed in the United States (Reid & McDougald, 1997).

The class Trematoda includes 27 families, 125 genera, and approximately 500 species that are found in birds. Flukes are less host-specific than tapeworms, so wild birds often introduce infection in areas where domestic poultry is reared (Reid & McDougald, 1997).

Extensive studies on helminth parasites of poultry have been conducted, and new species have been described (Kolluri *et al.*, 1985; Permin *et al.*, 1999; Malhotra & Capoor, 1984; Dixit & Capoor, 1990). International studies examining poultry under different management conditions (Maqbool *et al.* (1998) in Pakistan; Permin *et al.* (1999) in Denmark; Hernández *et al.* (2002) in Cuba; Komba (2013) in Tanzania; Adang *et al.* (2014) in Nigeria; Alam *et al.* (2014) in Bangladesh and Butt *et al.* (2014) in Pakistan) have diagnosed an increasing prevalence of helminths, including *Acuaria hamulosa*, *Amoebotaenia cuneata*, *Ascaridia galli*, *Capillaria sp.*, *Choanotaenia infundibulum*, *Cotugnia digonopora*, *Dispharinx spiralis*, *Heterakis spp.*, *Heterakis gallinarum*, *Heterakis isolonche*, *Hymenolepis cantaniana*, *Hymenolepis carioca*, *Raillietina spp.*, *Raillietina cesticillus*, *Raillietina echinobothrida*, *Raillietina magninumida*, *Raillietina tetragona*, and *Subulura suctoria*.

In Brazil, Costa *et al.* (1986) conducted a literature review and described 50 species of helminthic parasites of chickens based on their occurrences in Brazilian states and territories. The literature review mentions 29 parasites belonging to the class Nematoda, 12 belonging to the class Cestoda, eight belonging to the class Trematoda, and one belonging to the class Acanthocephala, with 19 nematode species, 10

cestode species, and two flukes present in poultry in São Paulo State.

An increasing occurrence of *Ascaridia sp.*, *Capillaria sp.*, *Heterakis sp.*, and *Raillietina sp.* was determined in poultry in Rio de Janeiro State, Brazil, (D'Avila *et al.*, 2004 and Gomes *et al.*, 2009). In Northern Paraná State, Brazil, Vieira (2010) described the occurrence of *Ascaridia galli*, *Capillaria spp.*, *Capillaria annatis*, *Capillaria annulata*, *Capillaria collaris*, *Capillaria contorta*, *Capillaria obsignata*, *Choanotaenia infundibulum*, *Dispharinx spiralis*, *Heterakis gallinarum*, *Hymenolepis carioca*, *Oxyspirura mansoni*, *Physaloptera truncata*, *Postharmostomum commutatum*, *Raillietina spp.*, *Raillietina cesticillus*, *Raillietina echinobothrida*, *Raillietina tetragona*, *Strongyloides oswaldoi*, *Subulura brumpti*, *Syngamus trachea*, *Tropisurus americanus* and *Tropisurus fissispinus* in birds. The helminths *Ascaridia galli*, *Heterakis gallinarum*, and *Raillietina cesticillus* showed a greater intensity of infection.

In a study evaluating antihelminthic drugs for poultry in Northwestern and Northeastern São Paulo State, Brazil, Silva *et al.* (1999) recorded the occurrence of the following species: *Amoebotaenia cuneata*, *Davainea proglottina*, *Choanotaenia infundibulum*, *Hymenolepis cantaniana*, *Raillietina echinobothrida*, *R. cesticillus*, and *R. tetragona*.

Literature describing helminthological surveys with domestic chickens (*Gallus domesticus*) in São Paulo State is scarce; the most important study, published in 1986 by Costa *et al.*, compiled the distribution of helminthic parasites of domestic animals in Brazil.

The objective of the present study was to determine the occurrence of the main helminth species present in domestic chickens (*Gallus domesticus*) reared in different municipalities of São Paulo State.

## MATERIAL AND METHODS

The surveyed region included 17 municipalities (Amparo, Araçatuba, Bastos, Cedral, Fernandópolis, Guararapes, Guataparã, João Ramalho, Monte Alegre do Sul, Nhandeara, Panorama, Pereira Barreto, Presidente Prudente, Rancheira, Regente Feijó, Valentim Gentil and Votuporanga), according to divisions determined by the IBGE (Brazil, 2011). The municipalities included in the research represent 10 microregions (Andradina, Araçatuba, Amparo, Tupã, Presidente Prudente, Ribeirão Preto, São José do Rio Preto, Fernandópolis, Nhandeara, and



Votuporanga) and, consequently, six mesoregions of São Paulo State.

In total, 359 adult chickens were investigated. The chickens were reared under different housing systems (extensive, intensive, and semi-intensive) and were obtained from 69 farms. The birds were submitted procedures for the detection and identification of helminthic parasites, following international criteria (Vich Topic GL21, 2001; Yazwinski *et al.*, 2003).

During necropsy, the gastrointestinal organs of each chicken were separated, and their contents were collected to form a pool (five birds per farm) of each organ and was subsequently fixed in 70% ethanol. The remaining systems and organs were also assessed individually with respect to the helminthological study.

The evaluation of the small intestine employed the Mello-Campos method (Mello & Campos, 1974),

which allows better recovery of cestode scolices attached to the intestinal mucosa. Stereomicroscopy was used to evaluate the collected materials, and light microscopy was used to identify the species according to their morphological characteristics (Yamaguchi, 1959; Schmidt, 1970; Reid & McDougald, 1987 and Ruff & Norton, 1987).

## RESULTS AND DISCUSSION

The results showed the presence of parasitic nematodes, cestodes, and trematodes in domestic chickens in the investigated regions of São Paulo (Tables 1 and 2).

Nematodes were found in the small intestine (*Ascaridia galli*, *Capillaria* spp., and *Strongyloides* sp.), cecum (*Heterakis gallinarum* (Figure 1) and *Capillaria* sp.), gizzard (*Cheylospirura hamulosa*) (Figure 1), crop

**Table 1** – Helminths diagnosed in the regions of São Paulo State addressed in this study (17 municipalities/10 microregions/6 mesoregions).

REGIONS			HELMINTHS														
Mesoregions	Microregions	Municipalities	N. BIRDS	Nematodes						Cestodes						Trematodes	
				<i>Oxspirura mansoni</i>	<i>Acuaria hamulosa</i>	<i>Ascaridia galli</i>	<i>Capillaria</i> sp.	<i>Heterakis gallinarum</i>	<i>Strongyloides</i> sp.	Raillietina						<i>Postharmostomum commutatum</i>	<i>Zygocotyle lunata</i>
Araçatuba	Andradina	Pereira Barreto	20	-	-	-	-	-	-	-	+	-	+	-	-	-	-
	Araçatuba	Araçatuba	5	+	-	+	+	+	-	+	+	+	+	+	+	-	-
		Guararapes	5	-	-	-	-	+	-	+	+	+	+	-	-	-	-
Campinas	Amparo	Amparo	20	+	-	+	+	+	+	+	+	+	+	+	+	-	-
		Monte Alegre do Sul	10	+	-	+	-	+	-	+	-	-	+	-	-	-	-
Marília	Tupã	Bastos	135	-	-	+	-	+	-	-	+	-	+	-	-	-	-
Presidente Prudente	Presidente Prudente	Rancharia	10	-	-	-	-	-	-	-	+	-	-	-	-	-	-
		João Ramalho	10	-	-	-	-	-	-	-	-	+	-	+	-	-	-
		Regente Feijó	10	-	-	-	-	-	-	-	-	+	-	-	-	-	-
		Presidente Prudente	10	+	-	+	-	+	-	-	+	+	-	+	+	-	-
		Panorama	5	-	-	+	+	+	-	+	+	+	+	+	+	+	-
Ribeirão Preto	Ribeirão Preto	Guataparã	50	-	-	+	+	+	-	+	+	+	+	+	-	+	
São José do Rio Preto	S. J. Rio Preto	Cedral	10	+	-	+	+	+	-	+	+	+	+	+	+	-	-
	Fernandópolis	Fernandópolis	10	-	-	+	+	+	-	+	+	+	-	+	+	-	-
	Nhandeara	Nhandeara	10	-	-	+	+	+	-	-	-	-	-	-	+	-	
	Votuporanga	Votuporanga	34	+	+	+	+	+	-	+	+	+	+	+	-	-	-
		Valentim Gentil	5	+	-	+	-	+	-	+	+	+	-	+	+	4	+



**Table 2** – Occurrence (%) of helminth species diagnosed in the regions of São Paulo State addressed in this study  
(17 municipalities/10 microrregions/6 mesoregions).

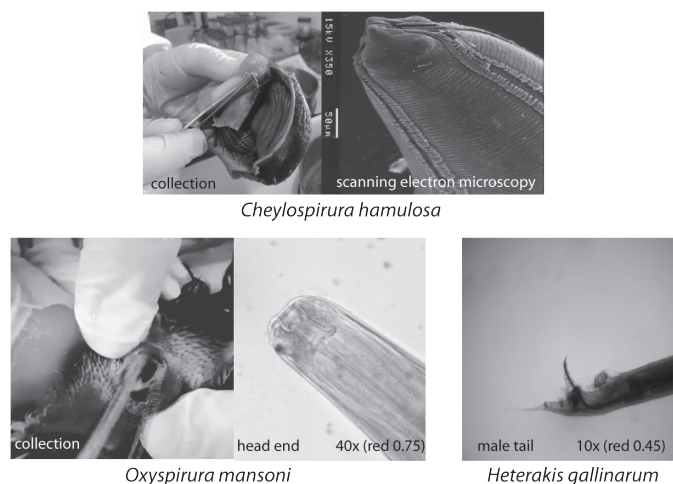
CLASS	HELMINTHS		OCCURRENCE (%)		
	SPECIES	MUNICIPALITIES (17*)	MICRORREGIONS (10**)	MESOREGIONS(6***)	
NEMATODES	<i>Oxyspirura mansoni</i>	41	50	67	
	<i>Acuaria hamulosa</i>	6	10	17	
	<i>Ascaridia galli</i>	71	90	100	
	<i>Capillaria sp.</i>	59	80	83	
	<i>Heterakis gallinarum</i>	76	90	100	
	<i>Strongyloides sp.</i>	6	10	17	
CESTODES	<i>Amoebotaenia cuneata</i>	59	70	83	
	<i>Choanotaenia infundibulum</i>	88	90	100	
	<i>Hymenolepis sp.</i>	59	70	83	
	<i>Raillietina echinobothrida</i>	53	70	83	
	<i>Raillietina cesticillus</i>	65	80	100	
	<i>Raillietina tetragona</i>	47	70	67	
TREMATODES	<i>Zygoctyle lunata</i>	6	10	17	
	<i>Postharmostomum commutatum</i>	6	10	17	

\*Municipalities: Amparo, Araçatuba, Bastos, Cedral, Fernandópolis, Guararapes, Guataparã, João Ramalho, Monte Alegre do Sul, Nhandeara, Panorama, Pereira Barreto, Presidente Prudente, Rancheira, Regente Feijó, Valentim Gentil, Votuporanga

\*\*Microregions: Andradina, Araçatuba, Amparo, Tupã, Presidente Prudente, Ribeirão Preto, São José do Rio Preto, Fernandópolis, Nhandeara, Votuporanga

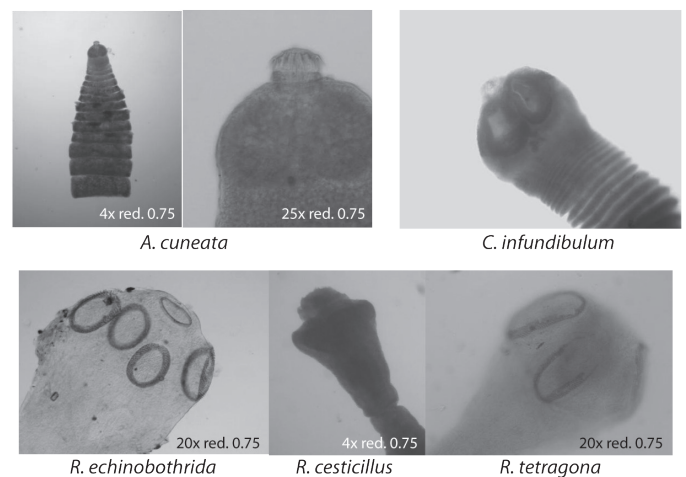
\*\*\*Mesoregions: Araçatuba, Campinas, Marília, Presidente Prudente, Ribeirão Preto e São José do Rio Preto

(*Capillaria sp.*) and eye (*Oxyspirura mansoni* (Figure 1), which supports the results of Costa *et al.* (1986). *Ascaridia galli* and *Heterakis gallinarum* were the most frequently observed nematodes. Similar results were observed in São Paulo (Costa *et al.*, 1986) and in a study performed in Rio de Janeiro (Gomes *et al.*, 2009), where *Ascaridia*, *Capillaria* and *Heterakis* were the most commonly diagnosed nematodes in domestic chickens.



**Figure 1** – Nematodes (*Cheylospirura hamulosa*, *Heterakis gallinarum* and *Oxyspirura mansoni*) present in chickens originating from state of São Paulo.

*Oxyspirura mansoni* was found only in municipalities that belonged to the mesoregions of São José do Rio Preto and Presidente Prudente. Parasitism by *Cheylospirura hamulosa* was observed in only one chicken from the mesoregion of São José do Rio Preto, and *Strongyloides sp.* was observed in the municipality of Amparo. According to Costa *et al.* (1986), these species occur in São Paulo State and have been reported in the northern region of the state.

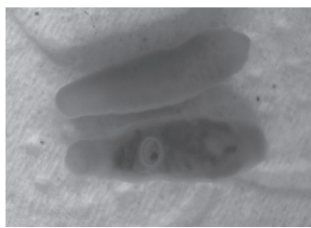


**Figure 2** – Cestodes (*Amoebotaenia cuneata*, *Choanotaenia infundibulum*, *Raillietina echinobothrida*, *Raillietina cesticillus* and *Raillietina tetragona*) present in chickens originating from state of São Paulo.

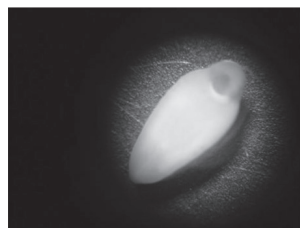


Six cestode species were diagnosed (*Amoebotaenia cuneata*, *Choanotaenia infundibulum*, *Hymenolepis* sp., *Raillietina cesticillus*, *Raillietina echinobothrida*, and *Raillietina tetragona* - Figure 2). Out of these species, the occurrence of *Hymenolepis* sp. in São Paulo state had not been reported by Costa *et al.* (1986). The results showed the absence of parasitism by *Davainea proglottina*, one of the species considered most pathogenic for young chickens (Reid & McDougald, 1997); its occurrence was previously reported in São Paulo state (Costa *et al.*, 1986). *Choanotaenia infundibulum* and *Raillietina cesticillus* were the most common cestodes.

Two species of trematodes were recovered from the cecum, *Postharmostomum commutatum* and *Zygocotyle lunata* (Figure 3), of chickens reared in the municipalities of Guatapar and Valentim Gentil, respectively. *Postharmostomum commutatum* was previously reported in Northern So Paulo State by Costa *et al.* (1986).



*Postharmostomum commutatum*



*Zygocotyle lunata*

**Figure 3** – Trematodes (*Postharmostomum commutatum* and *Zygocotyle lunata* - stereomicroscopy) present in chickens originating from state of So Paulo.

Parasitological surveys at different locations and times are important for the epidemiological tracking of parasites because changes in animal husbandry due to advances in facilities, management, and preventive measures can lead to changes in the parasitic fauna of a particular location/region over time. Although most of the species diagnosed in the present study are consistent with those reported by Costa *et al.* (1996) with regard to their occurrence in So Paulo State, the number of species recovered was smaller than that compiled by those authors. However, this study detected the presence of *Hymenolepis* sp. and *Zygocotyle lunata*, which were not mentioned in the cited review.

Thus, further studies including additional municipalities and time periods are recommended for the constant tracking of the distribution of helminthic parasites in domestic poultry in So Paulo State and Brazil.

## CONCLUSIONS

The following helminth species were diagnosed in chickens reared in the regions sampled in the present study:

- nematodes: *A. galli*, *Capillaria* sp., *C. hamulosa*, *H. gallinarum*, *O. mansoni*, and *Strongyloides* sp.;
- cestodes: *C. infundibulum*, *R. cesticillus*, *A. cuneata*, *Hymenolepis* sp., *R. echinobothrida*, and *R. tetragona*;
- trematodes: *P. commutatum* and *Z. lunata*.

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