Revista Mexicana de Biodiversidad

Revista Mexicana de Biodiversidad 91 (2020): e913109

Ecology

# Helminth fauna of *Passer domesticus* (Passeriformes: Passeridae) in the southern extreme of Brazil

## *Helmintofauna de* Passer domesticus *(Passeriformes: Passeridae) en el extremo sur de Brasil*

Luciana Siqueira-Silveira dos Santos [a, *], Carolina Silveira-Mascarenhas [b], Paulo Roberto Silveira-dos Santos [c], Nara Amélia da Rosa-Farias [d]

[a] *Laboratório de Parasitologia, Departamento de Microbiologia e Parasitologia, Instituto de Biologia, Universidade Federal de Pelotas, Campus Universitário, s/n - CEP 96160-000, Capão do Leão, Rio Grande do Sul, Brasil*

[b] *Laboratório de Parasitologia de Animais Silvestres, Departamento de Microbiologia e Parasitologia, Instituto de Biologia, Universidade Federal de Pelotas, Campus Universitário, s/n - CEP 96160-000, Capão do Leão, Rio Grande do Sul, Brasil*

[c] *Centro Nacional de Pesquisa para a Conservação das Aves Silvestres – CEMAVE, Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio, Rua Uruguai, 1251, apto. 301, Centro, CEP 96010-630, Pelotas, Rio Grande do Sul, Brasil*

[d] *Laboratório de Parasitologia, Departamento de Microbiologia e Parasitologia, Instituto de Biologia, Universidade Federal de Pelotas, Campus Universitário, s/n - CEP 96160-000, Capão do Leão, Rio Grande do Sul, Brasil*

*Corresponding author: sssluciana@yahoo.com.br (L. Siqueira-Silveira dos Santos)

Received: 17 June 2019; accepted: 24 December 2019

**Abstract**

The objective of this study was to report helminth parasite species of *Passer domesticus* (Linnaeus, 1758) (sparrow) and to analyze infection rates in relation to total length, body mass and sexual gender of hosts. Each of the 100 sparrows caught in the urban area of Pelotas, Rio Grande do Sul, Brazil, was weighed, measured, submitted to euthanasia and necropsied for collection of helminths. The helminths and their respective prevalence were: *Synhimantus (Dispharynx) nasuta* (2%), *Aproctella* sp. (1%) (Nematoda), *Prosthogonimus ovatus* (8%), *Eumegacetes* sp. (2%), *Tanaisia zarudnyi* (4%) (Digenea), *Choanotaenia passerina* (26%) (Cestoda), and *Mediorhynchus* sp. (2%) (Acanthocephala). The prevalence and mean intensity of infection of the *C. passerina* between male and female hosts did not present significant differences, and there was no correlation between the abundance of parasite species, body mass and total length of the sparrows. The helminth fauna of *P. domesticus* has remained the same throughout the propagation of this bird for new geographical areas and ecosystems, with the exception of the nematode *Aproctella* sp., found for the first time parasitizing this host.

*Keywords:* Sparrows; Nematoda; Digenea; Cestoda; Acanthocephala; Parasitological indices

ISSN versión electrónica: 2007-8706; Universidad Nacional Autónoma de México, Instituto de Biología. Open Access bajo la licencia CC BY-NC-ND (4.0) https://doi.org/10.22201/ib.20078706e.2020.91.3109

**Resumen**

El objetivo de este estudio fue registrar a las especies de helmintos parásitos de *Passer domesticus* (Linnaeus, 1758) (gorrión) y analizar los índices de infección en relación al género sexual, peso y tamaño de los hospedadores. Para ello, cada uno de los 100 gorriones capturados en el área urbana de Pelotas, Rio Grande do Sul, Brasil, fue pesado, medido, sometido a eutanasia y a uma necropsia para la recolección de helmintos. Los helmintos y sus respectivas prevalencias fueron: *Synhimantus (Dispharynx) nasuta* (2%), *Aproctella* sp. (1%) (Nematoda), *Prosthogonimus ovatus* (8%), *Eumegacetes* sp. (2%), *Tanaisia zarudnyi* (4%) (Digenea), *Choanotaenia passerina* (26%) (Cestoda), y *Mediorhynchus* sp. (2%) (Acanthocephala). La prevalencia e intensidad media de la infección por *C. passerina* entre hospedadores machos y hembras no presentó diferencia significativa, así como no hubo correlación entre la abundancia de esta especie, su masa corporal y la longitud total de los gorriones. La helmintofauna de *P. domesticus* se ha mantenido a lo largo de la propagación del ave a nuevas áreas geográficas y ecosistemas, con excepción del nemátodo *Aproctella* sp., encontrado por primera vez parasitando a dicho hospedero.

*Palabras clave*: Gorriones; Nematoda; Digenea; Cestoda; Acanthocephala; Índices parasitológicos

## Introduction

Parasitism is the most successful interspecific relationship in nature, measured by the frequency with which it evolved and by the parasite diversity currently recognized (Poulin & Morand, 2000). Parasites are among the most common organisms and represent various members of all the biological communities (Hoberg & Kutz, 2013), being extremely important in ecological and evolutionary processes (Gómez & Nichols, 2013). Birds are hosts of a variety of parasites, among which helminths are found with complex biological cycles, and most of the time birds act as definitive hosts (Crompton, 1997).

*Passer domesticus* (Linnaeus, 1758) (Passeriformes: Passeridae) is a bird from Eurasia and North Africa, which was intentionally introduced to the Americas (Global Invasive Species Database, 2018). In Brazil, it was introduced in 1906, for biological control of insects (Sick, 1997). Currently, it is found dispersed throughout Brazil. It is a non-migratory, terricolous bird that adapts easily to the agricultural environment, urban and suburban, taking advantage of anthropogenic action, occupying built-up areas that serve for shelter and nesting (Major et al., 2004).

The diversity of helminths associated with *P. domesticus* was studied in the USA (Cooper & Crites, 1974; Hamer & Muzzall, 2013; Hopkins & Wheaton, 1935; Kintner, 1938; Koch & Huizinga, 1971), in Brazil (Brasil & Amato, 1992; Calegaro-Marques & Amato, 2010a) and in Europe (Illescas-Gomez & Lopez-Roman, 1980; Joszt, 1962; Ozmen et al., 2013; Sciumilo, 1963). However, in spite of being a synanthropic bird with wide geographic distribution and found in several environments, there are few helminthological studies in different habitats, where the birds were introduced.

Parasitological studies of introduced host species are important, because these generally have their parasitic fauna reduced, and may contain only half of the richness found in native species, although they may acquire new parasites. This reduction may favor the population growth of invasive species and give them a competitive advantage over endemic species (Calegaro-Marques & Amato, 2010a). However, the sparrow has the potential to transport invasive species (vector), including important pathogens and parasites that impact biodiversity, economy and public health, causing damage to the native fauna throughout its geographic distribution (Conabio, 2017).

In this context, the study aimed to identify the species of helminth parasites of *P. domesticus* and to analyze the infection rates in relation to sex, body mass and total length of hosts, coming from an urban área of Rio Grande do Sul state, extreme southern of Brazil.

## Material and methods

One hundred specimens [90 adults (52 males: 38 females), 9 juveniles (7 males: 2 females) and 1 indeterminate juvenile] of *P. domesticus* were captured with the use of mist nets (30 mm mesh), in 13 locations (squares, gardens of private properties and wasteland), in an urban area of Pelotas city, Rio Grande do Sul, Brazil, between March 2016 and February 2018. The capture, transportation and euthanasia of birds was licensed by Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio nº 51118-3) and approved by the Comissão de Ética em Experimentação Animal at Universidade Federal de Pelotas (CEEA/UFPel nº 4915).

After being transported in an appropriate cage to UFPel's Parasitology Laboratory, each specimen was weighed and measured, and the information recorded was: body mass and total body length, sex and age (adult and/or young). Thereafter, the hosts were euthanized separately by administration of a overdose of inhalational anesthetic

Isoflurane as recommended by the Resolution nº 1000 of May 2012 of Conselho Federal de Medicina Veterinária (CFMV, 2012). Subsequently, the birds were individually packed in properly identified plastic bags and refrigerated at approximately 7 ºC until necropsy, that occurred within 2 days after capture.

During the necropsy, eyeball, oral cavity, nasal cavity, esophagus, proventriculus, gizzard, cecum, intestine, trachea, lungs, liver, gall bladder, kidneys, gonads and cloaca were examined. They were individualized in Petri plates containing physiological solution, opened and inspected separately under the stereomicroscope, along with the contents and mucous. The helminths were fixed in AFA (70% alcohol, 37% formalin and glacial acetic acid) and preserved in 70% alcohol, according to techniques recommended by Amato and Amato (2010).

For identification, helminths from Nematoda were clarified in Amann's lactophenol, studied in temporary preparations and identified according to Pereira and Vaz (1933), Anderson and Bain (2009), and Bartmann and Amato (2009). The parasites belonging to Trematoda and Cestoda and to Acanthocephala were dyed with Langeron Carmine or Delafiled Hematoxylin and individually set on permanent blades with Canada balsam (Amato & Amato, 2010). Identifications were made according to Freitas (1951), Kanev et al. (2002), Monteiro et al. (2007), Lotz and Font (2008), and Jones (2008) for Trematoda; Kintner (1938) for Cestoda; and Van Cleave (1916) for Acanthocephala.

The parasitological parameters of prevalence (P%), mean abundance (MA) and mean intensity of infection (MII) were calculated according to Bush et al. (1997). Helminth infections among male and female hosts, independent of sexual maturity stage, were compared through prevalence by Chi-square test ($\chi^2$) and the mean intensity of infection by t-test via "bootstrap" ($BC_a$ $p < 0.05$) in Quantitative Parasitology 3.0 program (Rózsa et al., 2000). In order to verify the existence of a correlation between helminth abundance and body mass, such as the total length of the hosts, a regression analysis was performed (RA) according to the model y = a+bx, as well as determination coefficient ($r^2$), whose limit is ≥ 0 or ≤ 1, and Pearson's correlation coefficient (*r*), whose limit is ≥ -1 or ≤ 1 (Mukaka, 2012). A nestling host was disregarded for this analysis. Regression analysis and Chi-square test, as well as the t-test were performed for helminths that presented a prevalence greater than or equal to 10% (Bush et al., 1990).

Vouchers were deposited in Coleção Helmintológica do Instituto Oswaldo Cruz - CHIOC (numbers 40074a-f; 40075 - 40080a-b - 40086) from Rio de Janeiro, and Coleção de Helmintos do Laboratório de Parasitologia de Animais Silvestres - CHLAPASIL (numbers 759 - 778) at Departamento de Microbiologia e Parasitologia, Instituto de Biologia, Universidade Federal de Pelotas, Brazil.

## Results

Among the 100 specimens of *P. domesticus* examined, 40 were parasitized by at least 1 helminth taxon. Among the parasitized birds, 67.5% (n = 27) were male (4 juveniles) and 32.5% (n = 13) were females (1 juvenile).

The helminth fauna of *P. domesticus* was composed of *Synhimantus (Dispharynx) nasuta* (Rudolphi, 1819) (Nematoda: Acuariidae) and *Aproctella* sp. (Nematoda: Onchocercidae); *Prosthogonimus ovatus* (Rudolphi, 1803) (Digenea: Prosthogonimidae), *Eumegacetes* sp. (Digenea: Eumegacetidae) and *Tanaisia zarudnyi* (Skrjabin, 1924) (Digenea: Eucotylidae); *Choanotaenia passerina* (Fuhrmann, 1907) (Cestoda: Dilepididae), and *Mediorhynchus* sp. (Acanthocephala: Gigantorhynchidae).

Cestoda was the most prevalent group, occurring in 26% of the hosts, followed by Trematoda with 13%. Nematoda and Acanthocephala occurred in only 2% of the birds. Most helminths were found in the gastrointestinal system, however, 1 species was found parasitizing the kidneys of the hosts. Found helminths and their respective infection sites and parasitological parameters are presented in tables 1 and 2.

*Choanotaenia passerina* presented a higher prevalence (26%), where as *T. zarudnyi* occurred with higher mean intensity of infection (96 helminths/host). Two species, *P. ovatus* and *Eumegacetes* sp., were found parasitizing the cloaca of *P. domesticus*, both with low infection rates (Table 1). Co-infection by these 2 digenetics occurred in a single host, which presented 1 helminth of each species. The remaining helminths found showed low infection rates (Table 1).

Males were parasitized by 6 taxa, while females were parasitized by 4 taxa. *Prosthogonimus ovatus*, *T. zarudnyi* and *C. passerina* occurred in both genders (Table 2). The prevalence (P%) and mean intensity of infection (MII) by *C. passerina* in male hosts (P% = 27.1%, MII = 4.25 helminths/host) and females (P% = 25%, MII = 2.9 helminths/host), independent of the maturity stage, did not present a significant difference ($p > 0.05$).

The correlations among the abundance of *C. passerina*, body mass (grams) and total length (millimeters) of the hosts showed low magnitude. It was not possible to identify functional relationship among variables, because Pearson's correlation coefficient (*r*) presented positive values close to zero (Fig. 1).

https://doi.org/10.22201/ib.20078706e.2020.91.3109

Table 1

Helminths found in *Passer domesticus* (Linnaeus, 1758) (Passeriformes: Passeridae) (n = 100) captured in urban area of Pelotas, Rio Grande do Sul, Brazil, and their respective sites of infection (SI), prevalence (P%), mean intensity of infection (MII ± SD), mean abundance (MA ± SD) and infection intensity range (R).

| Helminths | SI | P (%) | MII ± SD | MA ± SD | R |
|---|---|---|---|---|---|
| Nematoda | | | | | |
| *Synhimantus (Dispharynx) nasuta* ♂♂ | Esophagus | 2 | 2 | 0.02 ± 0.2 | 1 |
| *Aproctella* sp. ♀ | Gizzard | 1 | 1 | 0.01 ± 0.1 | 1 |
| Trematoda | | | | | |
| *Prosthogonimus ovatus* | Cloaca | 8 | 2.75 ± 2.18 | 0.22 ± 0.94 | 1 - 7 |
| *Eumegacetes* sp. | Cloaca | 2 | 1 | 0.02 ± 0.14 | 1 |
| *Tanaisia zarudnyi* | Kidney | 4 | 96 ± 145.11 | 3.84 ± 31.55 | 1 - 311 |
| Cestoda | | | | | |
| *Choanotaenia passerina* | Intestine | 26 | 3.73 ± 5.04 | 0.97 ± 3.01 | 1 – 21 |
| Acanthocephala | | | | | |
| *Mediorhynchus* sp. ♀♀ | Intestine | 2 | 1 | 0.02 ± 0.14 | 1 |

SD: Standard deviation

Table 2

Helminths found in males and females, independent of the maturity stage, of *Passer domesticus* (Linnaeus, 1758) (Passeriformes: Passeridae), captured in the urban area of Pelotas, Rio Grande do Sul, Brazil, and their respective infection rates, prevalence (P%), mean intensity of infection (MII) and mean abundance (MA).

| Helminths | Hosts | | | | | |
|---|---|---|---|---|---|---|
| | Males (n = 59) | | | Females (n = 40) | | |
| | P (%) | MII | MA | P (%) | MII | MA |
| Nematoda | | | | | | |
| *Synhimantus (Dispharynx) nasuta* ♂♂ | – | – | – | 2.5 | 2 | 0.05 |
| *Aproctella* sp. ♀ | 1.6 | 1 | 0.03 | – | – | – |
| Trematoda | | | | | | |
| *Prosthogonimus ovatus* | 6.7 | 2.5 | 0.1 | 10 | 3 | 0.3 |
| *Eumegacetes* sp. | 3.3 | 1 | 0.03 | – | – | – |
| *Tanaisia zarudnyi* | 5 | 24.3 | 1.2 | 2.5 | 311 | 7.7 |
| Cestoda | | | | | | |
| *Choanotaenia passerina* | 27.1 | 4.25 | 1.15 | 25 | 2.9 | 0.72 |
| Acanthocephala | | | | | | |
| *Mediorhynchus* sp. ♀♀ | 3.3 | 1 | 0.03 | – | – | – |

https://doi.org/10.22201/ib.20078706e.2020.91.3109

## Discussion

The fauna of helminths found in *P. domesticus* in this study is similar to records made in other regions of Brazil (Brasil & Amato, 1992; Calegaro-Marques & Amato, 2010a; Freitas, 1951), as well as in the USA (Cooper & Crites, 1974; Hopkins & Wheaton, 1935; Kintner, 1938) and in Europe (Joszt, 1962).

*Choanotaenia passerina* is part of the original distribution of the helminth assembly of *P. domesticus*, as there are records of their occurrence in sparrows from various locations in Europe (Illescas-Gomez & Lopez-Roman, 1980; Joszt, 1962; Sciumilo, 1963) and North America (Hopkins & Wheaton, 1935; Kintner, 1938; Stunkard & Milford, 1937). Ever since, *C. passerina* was the only species found in all regions where helminth fauna of sparrows was studied (Calegaro-Marques & Amato, 2010a). In studies conducted in Brazil, *C. passerina* was the most prevalente species in Rio de Janeiro (21.1% of 142 sparrows) (Brasil & Amato, 1992) and in Porto Alegre (10% of 160 birds) (Calegaro-Marques & Amato, 2010a), with mean infection intensity of 2.96 and 4.69, respectively. These results corroborate the parasitism of this cestode observed in *P. domesticus* in the region of the present study. This fact can be explained by the high association of *P. domesticus* and house flies (*Musca domestica* Linnaeus, 1758) (intermediate hosts) with humans, since the use of human food residues by sparrows may be related to their infection by this cestoid, once they are constantly preying on domestic flies, which feed on decaying organic matter present in the waste (Yamaguti, 1959).

*Tanaisia zarudnyi* was described in *Passer monatanus* (Linnaeus, 1758) in Turkestan, Central Asia (Byrd & Denton, 1950; Freitas, 1951). The species was cited in Brazil in 1935, parasitizing *P. domesticus*, however the location of registration was not specified (Freitas, 1951). In American continet, *T. zarudnyi* was also recorded in several Passeriformes in Texas (USA) (Byrd & Denton, 1950). The records of *T. zarudnyi* are related to taxonomic studies, with no data on parasitological indices. Another species from the same group, *Tanaisia inopina* (= *Tamerlania inopina*) (Freitas, 1951) was reported in *P. domesticus* in Rio de Janeiro and Rio Grande do Sul, with prevalences similar to the one found in the present study, for *T. zarudnyi*. However, the mean infection intensity was lower, ranging from 12.47 helminths/host (Brasil & Amato, 1992) and 7 helminths/host (Calegaro-Marques & Amato, 2010a). The species of *Tanaisia* Skrjabin, 1924, may use as intermediate hosts, terrestrial gastropods molluscs, which must be ingested by birds for infection with the metacercariae (Ahmad & Gabrion, 1975). The low prevalence of *T. inopina* and *T. zarudnyi* in *P. domesticus* suggest a low infection by metacercariae, indicating that possibly gastropod moluscs are not a preferred item in the diet of this granivorous passeriform. This hypothesis corroborates the information about the diet of the species, which feeds mainly on seeds in the winter and insects in the spring (Sánchez-Aguado, 1986).

According to Monteiro et al. (2007), *P. ovatus* has records parasitizing a wide variety of hosts around the world (poultry and wild birds). In Rio Grande do Sul, the species was reported in aquatic birds with the respective values of prevalence and mean intensity of infection in *Dendrocygna bicolor* (Vieillot, 1816) (n = 33), P = 3% and MII = 1 helminth/host; *Netta peposaca* (Vieillot, 1816) (n = 20), P = 15% and MII = 4.3 helminths/host (Anseriformes: Anatidae) and *Phalacrocorax brasilianus* (Gmelin, 1789) (Suliformes: Phalacrocoracidae) (n = 47), P = 2.1% and MII = 1 helminth/host (Monteiro et al., 2007). *Prosthogonimus ovatus* was recorded in the southern region of the state, parasitizing Passeriformes: *Paroaria coronata* (Miller, 1776) (Thraupidae) (n = 40) with P = 7.5% and MII = 3 helminths/host (Mascarenhas et al., 2009); *Molothrus bonariensis* (Gmelin, 1789) (Icteridae) (n = 5) with P = 20% and MII = 5 helminths/host (Bernardon et al., 2016); and *Chrysomus ruficapillus* (Vieillot, 1819) (Icteridae) (n = 122) with P = 14.75% and MII = 1.38 helminths/host (Bernardon et al., 2018). The infection of the birds occurs by the ingestion of young or adult dragonflies (second intermediate hosts) containing the encrusted metacercariae; the first intermediate host is a mollusk (Boddeke, 1960).

The life cycle of helminths belonging to *Eumegacetes* Looss, 1900, involves Odonata larvae (dragonflies) (Pinto & Melo, 2013). They are parasites of the intestinal tract, including rectum, cloaca and renal system of the birds (Lotz & Font, 2008). In Rio Grande do Sul, *Eumegacetes* sp. was mentioned in *P. domesticus* (Calegaro-Marques & Amato, 2010a) and in *C. ruficapillus* (Bernardon et al., 2018). The low infection rates in these Passeriformes corroborate those found in the present study.

*Synhimantus (Dispharynx) nasuta* was described by Rudolphi (1819) in the proventriculus of *P. domesticus* in Austria (Europe), and it is a parasite commonly found in the proventriculus and gizzard of several species of birds (aquatic and terrestrial) in different continents (Goble & Kutz, 1945). Only in Rio Grande do Sul, this nematode was mentioned parasitizing species of Passeriformes, Cuculiformes, Columbiformes and Charadriiformes. The infection rates of *S. (D.) nasuta* in Passeriformes from the same geographic region resemble those recorded in the present study, the nematode was found in *P. coronata* (n = 40) with P = 5% and MII = 5 helminths/host (Mascarenhas et al., 2009); *Pitangus sulphuratus* (Linnaeus, 1766)

https://doi.org/10.22201/ib.20078706e.2020.91.3109

(Tyramidae) (n = 78) with P = 3.85% and MII = 2.66 helminths/host (Mendes, 2011); and *M. bonariensis* (Gmelin, 1789) (Icteridae) (n = 5) with P = 20% and MII = 2 helminths/host (Bernardon et al., 2016). In *P. domesticus* (n = 160), from the metropolitan area of Porto Alegre, a mean infection intensity of 18 helminths/host was observed (Calegaro-Marques & Amato, 2010a), higher than that registered in this host in the southern region of the state. Similarly, Coimbra et al. (2009) observed higher mean infection intensity in *Columbina picui* (Temminck, 1813) (Columbidae) (n = 34), in with MII was 19.5 helminths/host. In Cuculiformes, *Guira guira* (Gmelin, 1788) (n = 120) and *Crotophaga ani* Linnaeus, 1758 (Cuculidae) (n = 120), as well as in the Charadriiforme *Vanellus chilensis* (Molina, 1782) (Charadriidae) (n = 28), the prevalence of *S. (D.) nasuta* was higher than that registered in *P. domesticus*, ranging from 26.6% to 28.6% and the MII from 5.1 to 14.38 helminths/host (Avancini, 2009; Bartmann & Amato, 2009). The divergent parameters among the different families of birds may be related to the food habits of each species, since this nematode utilizes terrestrial crustaceans as intermediate hosts (Permin & Hansen, 1998), which are not a preferred item in the diet of *P. domesticus*.

According to Pereira and Vaz (1933), there are 2 species of *Aproctella* (Cram, 1931) in Passeriformes in Brazil, *A. carinii* (Pereira & Vaz, 1933) and *A. stoddardi* (Cram, 1931). In Rio Grande do Sul, *A. carinii* was reported in *P. coronata* (Mascarenhas et al., 2009); *A. stoddardi* was found in *Turdus rufiventris* (Vieillot, 1818) (Passeriformes: Turdidae) (Calegaro-Marques & Amato, 2010b), and *Aproctella* sp. in *P. sulphuratus* (Mendes, 2011). In these passerines the infection rates were higher than those found in *P. domesticus*. This filarid has as host Culicidae mosquitoes, the microfilariae develop in the thoracic muscles and hemocele of the insect (Bain et al., 1981).

The species of *Mediorhynchus* Van Cleave, 1916, are common in terrestrial birds (Smales, 2002). Acanthocephala have complex biological cycles, where the infection of the definitive hosts (vertebrate) occurs through the ingestion of arthropods (invertebrate intermediate hosts) containing infective larvae (cystacants) (Moore, 1962). In Brazil, *M. papillosus* Van Cleave, 1916 was registered for the first time in 1.4% of 142 sparrows (Brasil & Amato, 1992). In other Passeriformes from the same region of study, the low prevalence of *Mediorhynchus* species resemble those found in *P. domesticus*: Mascarenhas et al. (2009) obtained a prevalence of 5% of *Mediorhynchus* sp. in *P. coronata* (n = 40); and Bernardon et al. (2018), P = 2.46% of *M. micracanthus* (Rudolphi, 1819) in *C. ruficapillus* (n = 122).

In the present study, there was no significant difference in the prevalence and intensity of infection by *C. passerina* in relation to the sexual gender of the hosts. Similar results were found by Brasil and Amato (1992) and Calegaro-Marques and Amato (2010a, b), indicating that male and female sparrows enjoy the same ecological niche, with no preference for types of food. These results contrast the hypothesis that some authors defend, which suggests that the rates of helminth infection in different taxons (fish, birds and mammals) are generally higher in male hosts compared to females due to immunological, genetic and behavioral differences (Klein, 2004; Poulin, 1996; Reimchen & Nosil, 2001; Zuk & McKean, 1996; Zuk & Stoehr, 2010).

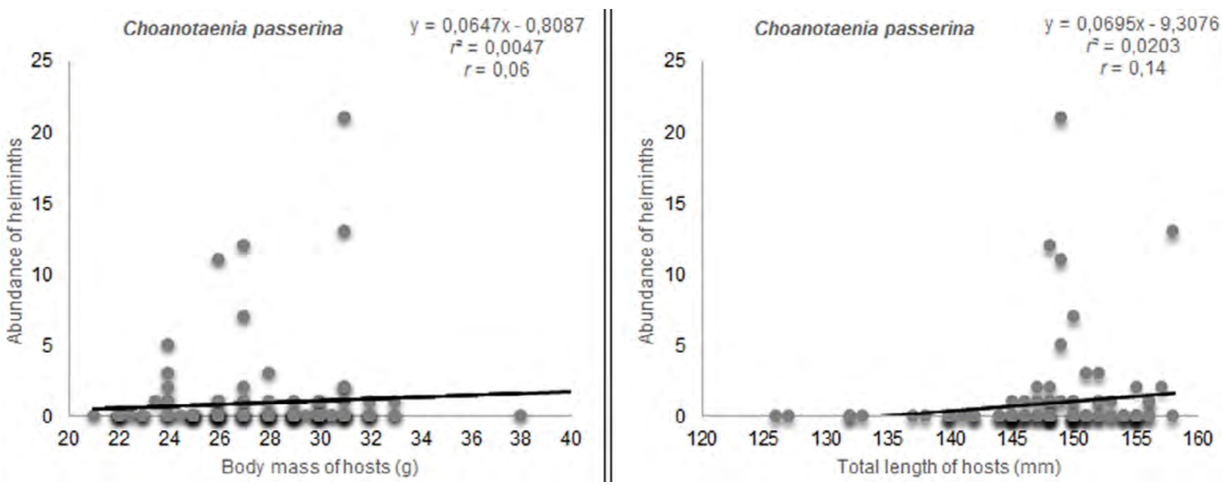


Figure 1. Dispersal abundance pattern of *Choanotaenia passerina* (Fuhrmann, 1907) (Cestoda: Dilepididae) in relation to the body mass (g) and to the total length of hosts (mm) belonging to the *Passer domesticus* (Linnaeus, 1758) (Passeriformes: Passeridae) from urban area of Pelotas, Rio Grande do Sul, Brazil.

In addition, the abundance of *C. passerina* in relation to the body mass and the total length of the studied hosts, showed that there was no functional correlation, that is, the amount of this cestoid does not vary as the weight and the size of the birds increase. Divergent results were found by Monteiro et al. (2011), in which 5 of the 20 species of helminths found in *P. brasilianus* had their infection rates influenced by the variables weight, gender and sexual maturity status of hosts. According to Poulin (1996), such variation may be related to territorialism and to social interaction of birds.

Generally, we could observe that the helminth fauna and their respective rates of infection in *P. domesticus* in the present study corroborates other studies around the world and may be related to the feeding and synanthropic habits of the host species. Because it is a wild bird with a wide world distribution, it is necessary to study the parasitic fauna of this passeriform, since its dispersion favors a greater exposure to new parasites, as well as a dissemination of new parasites in new geographical areas, affecting native fauna; even though the parasite richness of introduced host species may be reduced and the period since its introduction also influences the composition of parasite communities (Calegaro-Marques & Amato, 2010a).

The fauna of helminths and their infection rates in *Passer domesticus* in the southern region of Rio Grande do Sul is similar to that registered in this host in other regions. However, a filarid belonging to *Aproctella* is recorded for the first time parasitizing this host and the occurrence of *Prosthogonimus ovatus* for the first time in *P. domesticus* in Brazil. Also recorded are the infection rates of *Tanaisia zarudnyi* in *P. domesticus*, since the only report of the digenetic in this host species in Brazil did not address aspects related to parasitological parameters. The sexual gender of the hosts, as well as the body mass and total length of the birds did not influence the infections by the cestoid *Choanotaenia passerina*.

## Acknowledgments

Many thanks to Cristina Helena Carneiro and Ana Silva Ramos of the Laboratório de Tradução, Versão e Revisão em Inglês, from the Instituto Federal do Espírito Santo, Campus Guarapari, Brazil, for providing this extension service.

## References

Ahmad, A. S., & Gabrion, C. (1975). Observation chez deux Hélicelles des formes larvaires de *Tanaisia (Tamerlania) zarudnyi* (Skrjabin, 1924) Denton et Byrd, 1950. *Annales de Parasitologie*, *50*, 17–24. https://doi.org/10.1051/parasite/1975501017

Amato, J. F. R., & Amato, S. B. (2010). Técnicas gerais para coleta e preparação de helmintos endoparasitos de aves. In S. Von Matter, F. C. Straube, V. Q. Piacentini, I. A. Accordi, & J. F. Jr. Cândido (Eds.), *Ornitologia e conservação: ciência aplicada, técnicas de pesquisa e levantamento* (pp. 1–25). Rio de Janeiro: Technical Books Editora.

Anderson, R. C., & Bain, O. (2009). Spirurida. In R. C. Anderson, A. G. Chabaud, & S. Willmott (Eds.), *Keys to the Nematode parasites of vertebrates*. Archival Volume. London: CABI.

Avancini, L. F. (2009). *Helmintos e artrópodes de* Vanellus chilensis *(Molina, 1782), quero-quero, da região sul do Rio Grande do Sul (M. Sc. Thesis)*. Instituto de Biologia, Universidade Federal de Pelotas. Pelotas.

Bain, O., Petit, G., Kozek, W. J., & Chabaud, A. G. (1981). Sur les Filaires Splendidofilariinae du genre *Aproctella*. *Annales de Parasitologie*, *56*, 95–105. https://doi.org/10.1051/parasite/1981561095

Bartmann, A., & Amato, S. B. (2009). *Dispharynx nasuta* (Nematoda: Acuariidae) in *Guira guira* and *Crotophaga ani* (Cuculiformes: Cuculidae) on Rio Grande do Sul state, Brazil. *Ciência Rural*, *39*, 1152–1158. https://doi.org/10.1590/S0103-84782009005000059

Bernardon, F. F., Soares, T. A. L., Vieira, T. D., & Müller, G. (2016). Helminths of *Molothrus bonariensis* (Gmelin, 1789) (Passeriformes: Icteridae) from southernmost Brazil. *Revista Brasileira de Parasitologia Veterinária*, *25*, 279–285. https://doi.org/10.1590/S1984-29612016042

Bernardon, F. F., Pesenti, T. C., Silva, R. Z., Pereira, J., & Müller, G. (2018). Helminths assemblage of *Chrysomus ruficapillus* (Vieillot, 1819) (Passeriformes: Icteridae) in southern Brazil. *Neotropical Helminthology*, *12*, 161–178.

Boddeke, R. (1960). The life history of *Prosthogonimus ovatus* Rudolphi II. The intermediate hosts. *Tropical and Geographical Medicine*, *12*, 363–377.

Brasil, M. C., & Amato, S. B. (1992). Faunistic analysis of the helmints of sparrows (*Passer domesticus* L., 1758) captured in Campo Grande, Rio de Janeiro, RJ. *Memórias do Instituto Oswaldo Cruz*, *87*, 43–48. https://doi.org/10.1590/S0074-02761992000500009

Bush, A. O., Aho, J. M., & Kennedy, C. R. (1990). Ecological versus phylogenetic determinants of helminth parasite community richness. *Evolutionary Ecology*, *4*, 1–20. https://doi.org/10.1007/bf02270711

Bush, A. O., Lafferty, K. D., Lotz, J. M., & Shostak, A. W. (1997). Parasitology meets ecology on its own terms: Margolis et al. revisited. *The Journal of Parasitology*, *83*, 575–583. https://doi.org/10.2307/3284227

Byrd, E. E., & Denton, J. F. (1950). The helminth parasites of birds. I. A review of the trematode genus *Tanaisia* Skrjabin, 1924. *American Midland Naturalist*, *43*, 32–57. https://doi.org/10.2307/2421875

Calegaro-Marques, C., & Amato, S. B. (2010a). Helminths of introduced house sparrows (*Passer domesticus*) in Brazil: does population age affect parasite richness? *Iheringia*

*Série Zoologia*, *100*, 73–78. https://doi.org/10.1590/S0073-47212010000100010

Calegaro-Marques, C., & Amato, S. B. (2010b). Parasites as secret files of the trophic interactions of hosts: the case of the rufous-bellied thrush. *Revista Mexicana de Biodiversidad*, *81*, 801–811. http://dx.doi.org/10.22201/ib.20078706e.2010.003.650

Coimbra, M. A. A., Mascarenhas, C. S., Krüger, C., & Müller, G. (2009). Helminths parasitizing *Columbina picui* (Columbiformes: Columbidae) in Brazil. *Journal of Parasitology*, *95*, 1011–1012. https://doi.org/10.1645/GE-1948.1

Comisión Nacional para el Conocimiento y Uso de la Biodiversidad (CONABIO). (2017). Método de Evaluación Rápida de Invasividad (MERI) para especies exóticas en México. *Passer domesticus* Linnaeus, 1758. Vertebrados. Recuperado el 01 febrero, 2018 de: https://www.gob.mx/cms/uploads/attachment/file/222386/Passer_domesticus.pdf

Conselho Federal de Medicina Veterinária (CFMV). (2012). Resolução nº 1.000: Dispõe sobre procedimentos e métodos de eutanásia em animais e dá outras providências. Recuperado el 08 julio, 2015 de: http://portal.cfmv.gov.br/lei/index/id/326

Cooper, C. L., & Crites, J. L. (1974). Helminth parasitism in juvenile house sparrows, *Passer domesticus* (L.), from South Bass Island, Ohio, including a list of helminths reported from this host in North America. *Ohio Journal of Science*, *74*, 388–389.

Crompton, D. W. T. (1997). Birds as habitat for parasites. In D. H. Clayton, & J. Moore (Eds.), *Host-parasite evolution: general principles and avian models* (pp. 253–270). New York: Oxford University Press.

Freitas, J. F. T. (1951). Revisão da família Eucotylidae Skrjabin, 1924 (Trematoda). *Memórias do Instituto Oswaldo Cruz, 49,* 3–123. https://doi.org/10.1590/S0074-02761951000100003

Global Invasive Species Database (GISD). (2018). Species profile: *Passer domesticus*. Invasive Species Specialist Group. Recuperado el 01 febrero, 2018 de: http://www.iucngisd.org/gisd/species.php?sc=420

Goble, F. C., & Kutz, H. L. (1945). The genus *Dispharynx* (Nematoda: Acuariidae) in Galliform and Passeriform birds. *The Journal of Parasitology*, *31*, 323–331. https://doi.org/10.2307/3273088

Gómez, A., & Nichols, E. (2013). Neglected wild life: Parasitic biodiversity as a conservation target. *International Journal for Parasitology*, *2*, 222–227. https://doi.org/10.1016/j.ijppaw.2013.07.002

Hamer, G. L., & Muzzall, P. M. (2013). Helminths of american robins, *Turdus migratorius*, and house sparrows, *Passer domesticus* (Order: Passeriformes), from suburban Chicago, Illinois, U.S.A. *Comparative Parasitology*, *80*, 287–291. https://doi.org/10.1654/4611.1

Hoberg, E. P., & Kutz, S. J. (2013). *Parasites in Arctic Biodiversity: Status and trends in Arctic biodiversity*. Conservation of Arctic Flora and Fauna (CAFF). Retrieved on January 16, 2019 from: http:// www.arcticbiodiversity.is/the-report/chapters/parasites

Hopkins, S. H., & Wheaton, E. (1935). Intestinal parasites of english sparrows in Illinois. *The Journal of Parasitology*, *21*, 316–317. https://doi.org/10.2307/3271371

Illescas-Gomez, P., & Lopez-Roman, R. (1980). *Choanotaenia passerina* (Fuhrmann, 1907) Fuhrmann, 1932; primera cita en España, parasito del *Passer domesticus* L. *Revista Ibérica de Parasitología*, *40*, 399–405.

Jones, A. (2008). Family Prosthogonimidae Lühe, 1909. In D. I. Gibson, A. Jones, & R. A. Bray (Eds.), *Keys to the Trematoda. Volume 3* (pp. 577–590). London: CABI.

Joszt, L. (1962). Helminth parasites of sparrow *Passer domesticus* (L.) in the environment of Warszawa. *Acta Parasitologica Polonica*, *10*, 113–116.

Kanev, I., Radev, V., & Fried, B. (2002). Family Eucotylidae Cohn, 1904. In D. I. Gibson, A. Jones, & R. A. Bray (Eds.), *Keys to the Trematoda. Volume 1* (pp. 147–152). London: CABI.

Kintner, K. E. (1938). Notes on the cestode parasites of english sparrows in Indiana. *Parasitology*, *30*, 347–357. https://doi.org/10.1017/S0031182000025920

Klein, S. L. (2004). Hormonal and immunological mechanisms mediating sex differences in parasite infection. *Parasite Immunology*, *26*, 247–264. https://doi.org/10.1111/j.0141-9838.2004.00710.x

Koch, C. F., & Huizinga, H. W. (1971). *Splendidofilaria passerine* sp. n. (Nematoda: Filarioidea) from the english sparrow in Illinois. *The Journal of Parasitology*, *57*, 473–475. https://doi.org/10.2307/3277895

Lotz, J. M., & Font, W. F. (2008). Family Eumegacetidae Travassos, 1922. In D. I. Gibson, A. Jones, & R. A. Bray (Eds.), *Keys to the Trematoda. Volume 3* (pp. 501–504). London: CABI.

Major, I., Sales, Jr, L. G., & Castro, R. (2004). *Aves da Caatinga*. Fortaleza: Edições Demócrito Rocha.

Mascarenhas, C. S., Krüger, C., & Müller, G. (2009). The helminth fauna of the red-crested cardinal (*Paroaria coronata*) Passeriformes: Emberizidae in Brazil. *Parasitology Research*, *105*, 1359–1363. https://doi.org/10.1007/S00436-009-1569-8

Mendes, M. M. (2011). *Helmintos e ácaros nasais parasitos de* Pitangus sulphuratus *(Passeriformes: Tyrannidae), bem-te-vi, no Rio Grande do Sul, Brasil (M. Sc. Thesis).* Instituto de Biologia, Universidade Federal de Pelotas. Pelotas.

Monteiro, C. M., Amato, J. F. R., & Amato, S. B. (2007). *Prosthogonimus ovatus* (Rudolphi) (Digenea: Prosthogonimidae) em três espécies de aves aquáticas da região sul do Brasil. *Revista Brasileira de Zoologia*, *24*, 253–257. https://doi.org/10.1590/S0101-81752007000100035

Monteiro, C. M., Amato, J. F. R., & Amato, S. B. (2011). Helminth parasitism in the neotropical cormorant, *Phalacrocorax brasilianus*, in Southern Brazil: effect of host size, weight, sex, and maturity state. *Parasitology Research*, *109*, 849–855. https://doi.org/10.1007/s00436-011-2311-x

Moore, D. V. (1962). Morphology, life history, and development of the acanthocephalan *Mediorhynchus grandis* Van Cleave,

1916. *The Journal of Parasitology*, *48*, 76–86. https://doi.org/10.2307/3275416

Mukaka, M. M. (2012). Statistics corner: A guide to appropriate use of correlation coefficient in medical research. *Malawi Medical Journal*, *24*, 69–71.

Ozmen, O., Adanir, R., Haligur, M., Albayrak, T., Kose, O., & Ipek, V. (2013). Parasitologic and pathologic observations of the house sparrow (*Passer domesticus*). *Journal of Zoo and Wildlife Medicine*, *44*, 564–569. https://doi.org/10.1638/2012-0013R2.1

Pereira, C., & Vaz, Z. (1933). *Carinema carinii*, n. gen. e n. sp. de filarideo parasito do corrupião (*Xanthornus* sp.) passaro Fringilliformes. *Instituto Biológico de São Paulo*, *4*, 56–58.

Permin, A., & Hansen, J. W. (1998). *Epidemiology, diagnosis and control of poultry parasites*. Roma: Food and Agriculture Organization of the United Nations (FAO).

Pinto, H. A., & Melo, A. L. (2013). Metacercariae of *Eumegacetes medioximus* (Digenea: Eumegacetidae) in larvae of Odonata from Brazil. *Biota Neotropica*, *13*, 351–354. https://doi.org/10.1590/S1676-06032013000200039

Poulin, R. (1996). Helminth growth in vertebrate hosts: Does host sex matter? *International Journal for Parasitology*, *26*, 1311–1315. https://doi.org/10.1016/S0020-7519(96)00108-7

Poulin, R., & Morand, S. (2000). The diversity of parasites. *The Quarterly Review of Biology*, *75*, 277–293.

Reimchen, T. E., & Nosil, P. (2001). Ecological causes of sex-biased parasitism in threespine stickleback. *Biological Journal of the Linnean Society*, *73*, 51–63. https://doi.org/10.1006/bijl.2001.0523

Rózsa, L., Reiczigel, J., & Majoros, G. (2000). Quantifying parasites in samples of hosts. *The Journal of Parasitology*, *86*, 228–232. https://doi.org/10.1645/0022-3395(2000)086[0228:QPISOH]2.0.CO;2

Sánchez-Aguado, F. J. (1986). Sobre la alimentacion de los gorriones molinero y comum (*Passer montanus* L. y *P. domesticus* L.), en invierno y primavera. *Ardeola*, *33*, 17–33.

Sciumilo, R. P. (1963). La fauna parassitaria del passeri delle zone centrali della Moldavia e sua importanza pratica. *Parassitologia*, *5*, 225–240.

Sick, H. (1997). *Ornitologia Brasileira*. *2nd ed.* Rio de Janeiro: Nova Fronteira.

Smales, L. R. (2002). Species of *Mediorhynchus* (Acanthocephala: Gigantorhynchidae) in Australian birds with the description of *Mediorhynchus colluricinclae* n. sp. *The Journal of Parasitology*, *88*, 375–381. https://doi.org/10.2307/3285592

Stunkard, H. W., & Milford, J. J. (1937). Notes on the Cestodes of North American sparrows. *Zoologica*, *22*, 177–183.

Van Cleave, H. J. (1916). Acanthocephala of the genera *Centrorhynchus* and *Mediorhynchus* (new genus) from North American birds. *Transactions of the American Microscopical Society*, *35*, 221–232. https://doi.org/10.2307/3221908

Yamaguti, S. (1959). *Systema Helminthum*. *Volume II.* The Cestodes of Vertebrates. New York: Interscience Publishers.

Zuk, M., & McKean, K. A. (1996). Sex differences in parasite infections: Patterns and processes. *International Journal for Parasitology*, *26*, 1009–1024. https://doi.org/10.1016/S0020-7519(96)00086-0

Zuk, M., & Stoehr, A. M. (2010). Sex differences in susceptibility to infection: an evolutionary perspective. In S. Klein, & C. Roberts (Eds.), *Sex hormones and immunity to infection* (pp. 1–17). Berlin: Springer. https://doi.org/10.1007/978-3-642-02155-8_1