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INTERFACES CIENTÍFICAS

OCCURRENCE OF NEMATODES IN TERRESTRIAL GASTROPODS FROM FUNDÃO ISLAND, RIO DE JANEIRO, BRAZIL

OCORRÊNCIA DE NEMATÓDEOS EM GASTRÓPODES TERRESTRES DA ILHA DO FUNDÃO, RIO DE JANEIRO, BRASIL

OCURRENCIA DE NEMATODOS EN GASTERÓPODOS TERRESTRES EN LA ILHA DO FUNDÃO, RIO DE JANEIRO, BRASIL

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ABSTRACT

Terrestrial gastropods are important intermediate hosts of nematodes of veterinary and medical relevance, particularly in urban environments where human-animal interactions are frequent. This study reports nematode infections in terrestrial gastropods collected at selected sites on the Ilha do Fundão campus of the Federal University of Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil. Gastropods were collected at nine predefined sites and examined through taxonomic identification and parasitological analysis using artificial tissue digestion. Larvae morphologically compatible with Metastrongyloidea were isolated and molecularly identified by sequencing a fragment of the mitochondrial cytochrome c oxidase subunit I (COI) gene. Three gastropod species were analyzed: *Achatina fulica* (Bowdich, 1822), *Bradybaena similaris* (Férussac, 1821), and *Sarasinula linguaeformis* (Semper, 1885). *A. fulica* was the most abundant species and had the highest infection rate. Three nematode groups were identified-Metastrongylidae, Rhabditidae, and Kathlaniidae-and coinfections were detected, including *Angiostrongylus cantonensis* and *Cruzia tentaculata*. Infection patterns varied spatially and seasonally, with higher prevalence in fall and summer. These findings document infected gastropods in areas of intense human circulation at UFRJ.

KEYWORDS

Achatina fulica; *Angiostrongylus cantonensis*; nematode transmission; terrestrial gastropods; public health.

RESUMO

Gastrópodes terrestres desempenham um papel importante como hospedeiros intermediários de nematoides de relevância veterinária e médica, particularmente em ambientes urbanos onde as interações entre humanos e animais são frequentes. Este estudo relata a ocorrência de infecções por nematoides em gastrópodes terrestres coletados em locais selecionados no campus da Universidade Federal do Rio de Janeiro (UFRJ), Ilha do Fundão, Rio de Janeiro, Brazil. Os gastrópodes foram coletados em nove locais predefinidos e examinados por meio de identificação taxonômica e análise parasitológica utilizando digestão artificial de tecidos. Larvas morfologicamente compatíveis com Metastrongyloidea foram isoladas e identificadas molecularmente por sequenciamento de um fragmento do gene mitocondrial da subunidade I do citocromo C oxidase (COI). Três espécies de gastrópodes foram selecionadas: *Achatina fulica* (Bowdich, 1822), *Bradybaena similaris* (Férussac, 1821) e *Sarasinula linguaeformis* (Semper, 1885). A. fulica foi a espécie mais abundante e apresentou a maior taxa de infecção. Foram identificados três grupos de nematóides, Metastrongylidae, Rhabditidae e Kathlaniidae, com coinfecções detectadas, incluindo *Angiostrongylus cantonensis* e *Cruzia tentaculata*. Os padrões de infecção variaram espacial e sazonalmente, com maior prevalência durante o outono e o verão. Esses achados documentam a ocorrência de gastrópodes infectados em áreas com intensa circulação humana na UFRJ.

PALAVRAS-CHAVE

Achatina fulica; *Angiostrongylus cantonensis*; Transmissão de nematoides; Gastrópodes terrestres; Saúde pública.

RESUMEN

Los gasterópodos terrestres desempeñan un papel importante como hospedadores intermediarios de nematodos de relevancia veterinaria y médica, particularmente en entornos urbanos donde las interacciones entre humanos y animales son frecuentes. Este estudio informa sobre la presencia de infecciones por nematodos en gasterópodos terrestres recolectados en sitios seleccionados del campus de la Universidad Federal de Río de Janeiro (UFRJ), en Ilha do Fundão, Río de Janeiro, Brasil. Los gasterópodos se recolectaron en nueve sitios predefinidos y se examinaron mediante identificación taxonómica y análisis parasitológico utilizando digestión tisular artificial. Se aislaron larvas morfológicamente compatibles con Metastrongyloidea y se identificaron molecularmente mediante la secuenciación de un fragmento del gen mitocondrial de la subunidad I de la citocromo c oxidasa (COI). Se seleccionaron tres especies de gasterópodos: *Achatina fulica* (Bowdich, 1822), *Bradyba-*

ena similaris (Férussac, 1821) y *Sarasinula linguaeformis* (Semper, 1885). *A. fulica* fue la especie más abundante y presentó la tasa de infección más alta. Se identificaron tres grupos de nematodos, Metastrongylidae, Rhabditidae y Kathlaniidae, y se detectaron coinfecciones, incluyendo *Angiostrongylus cantonensis* y *Cruzia tentaculata*. Los patrones de infección variaron espacial y estacionalmente, observándose una mayor prevalencia durante el otoño y el verano. Estos hallazgos documentan la presencia de gasterópodos infectados en áreas de intensa circulación humana en la UFRJ.

PALABRAS CLAVE

Achatina fulica; *Angiostrongylus cantonensis*; transmisión de nematodos; gasterópodos terrestres; salud pública.

1 INTRODUCTION

Terrestrial gastropods constitute one of the most diverse groups within Mollusca, occupying a wide range of habitats and playing essential ecological roles in natural ecosystems (STRONG *et al*., 2008). In addition to their environmental relevance, several species hold sanitary importance as intermediate hosts of helminths of medical and veterinary concern.

Among the nematodes associated with terrestrial gastropods, the superfamily Metastrongyloidea stands out for including species of significant zoonotic impact. *Angiostrongylus cantonensis* (Chen, 1935) is the etiological agent of eosinophilic meningoencephalitis, an emerging disease in several countries, including Brazil (THIENGO *et al*., 2013; MORASSUTTI *et al*., 2014). Clinical cases described by Tsai *et al*. (2001) illustrate the severe potential of this infection in humans. Another relevant species, *Angiostrongylus costaricensis* Morera & Céspedes, 1971, responsible for abdominal angiostrongyliasis, has a wide range of intermediate hosts across Latin America, including species documented in Brazil (TEIXEIRA *et al*., 1993; VALENTE *et al*., 2020).

Other groups of nematodes may also use gastropods as intermediate or paratenic hosts. Among these, *Cruzia tentaculata* (Rudolphi, 1819) Travassos, 1917 stands out, an oxyurid traditionally associated with amphibians, but recently reported to use mollusks as natural intermediate hosts (RAMOS-DE-SOUZA *et al*., 2021). This finding expands the understanding of the species' ecological plasticity and reinforces the potential of gastropods as vectors for a broader diversity of helminths than previously recognized. Additionally, opportunistic nematodes such as those of the genus *Rhabditis* Dujardin, 1845 have been observed in isolated human clinical cases, reflecting the complexity of parasite interactions in anthropized environments (STACHURSKA-HAGEN *et al*., 2016; YANG *et al*., 2018).

In the Brazilian context, the invasive gastropod *Achatina fulica* (Bowdich, 1822) stands out due to its wide distribution, high population density, and confirmed role as an intermediate host of nematodes of medical and veterinary relevance, including *A. cantonensis* and *Aelurostrongylus abstrusus*

Railliet 1898 (THIENGO *et al*., 2008; RAMOS-DE-SOUZA *et al*., 2018; BARBOSA *et al*., 2020; RODRIGUES *et al*., 2022; SILVA *et al*., 2020; THIENGO *et al*., 2022). The rapid spread of this species throughout the country, detailed by Thiengo *et al*. (2007), highlights its epidemiological potential and its role as a major vector of zoonotic pathogens. The diversity of intermediate hosts of metastrongyloids in Brazil, particularly *A. costaricensis*, was documented by Teixeira *et al*. (1993), reinforcing the need for continued investigations into parasite cycles involving terrestrial mollusks.

Despite increasing attention to synanthropic malacofauna, several highly frequented urban areas remain poorly characterized regarding the occurrence of infected gastropods (MOREIRA *et al*., 2024). Fundão Island, in Rio de Janeiro, is a densely populated setting that includes a large university campus, essential services, and an intense daily flow of people, conditions that may favor interactions among humans, green areas, and synanthropic fauna, thereby facilitating parasite transmission. The present study aimed to document the occurrence and distribution of nematode infections in selected terrestrial gastropod species collected from areas of the Fundão Island.

2 MATERIALS AND METHODS

2.1 STUDY AREA AND SAMPLING

Specimens were manually collected at nine strategic sites on Fundão Island, Rio de Janeiro, Brazil (Figure 1), over a 15-month period between August 2023 and November 2024. At each site, at least one day of inspection per season was conducted in August (winter) and October (spring) of 2023, and in February (spring), June (summer), and November (fall) of 2024, consisting of a 30-minute active search performed by two people. Sites were chosen based on high human circulation and the presence of environmental stressors, such as rodents, improper waste disposal, and water accumulation, which increase the risk of infection by nematodes of public health concern (Figure 2).

Collections were performed at night, preferably on rainy days or shortly after precipitation, to increase the likelihood of locating active gastropods. Specimens were placed in labeled plastic containers indicating the sampling site and transported to the laboratory for subsequent analysis.

Three gastropod species, *Achatina fulica*, *Bradybaena similaris* (Férussac, 1821), and *Sarasinula linguaeformis* (Semper, 1885), were selected for detailed parasitological examination (Figure 3). These species were chosen based on their body size, availability of healthy specimens suitable for parasitological inspection, and findings from previous studies (THIENGO *et al*., 2022), which identified them as exhibiting high infection rates among terrestrial gastropods in Brazil.

Figure 1 - Map of Fundão Island (Rio de Janeiro, Brazil) showing the georeferenced locations of the nine gastropod sampling sites surveyed in the study. Sampling points are indicated as P1 to P9, corresponding respectively to: P1 – Health Sciences Center; P2 – University Administration Building; P3 – Technology Center; P4 – Student Housing Complex; P5 – University Village; P6 – Bike Path; P7 – Center for Mathematical and Natural Sciences; P8 – School of Letters; and P9 – Technology Park.

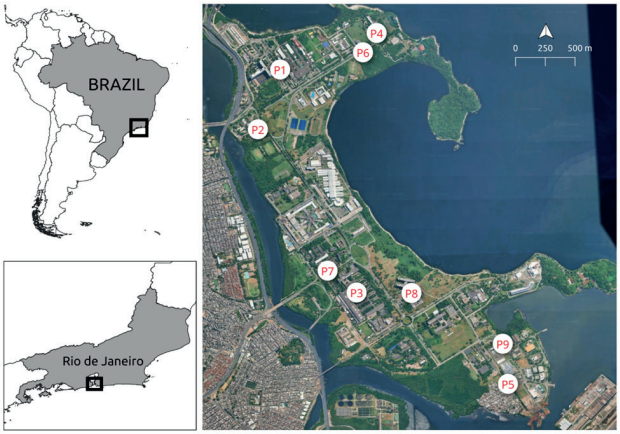


Figure 2 - Gastropod sampling sites distributed across Fundão Island, Rio de Janeiro, Brazil. Sampled locations include: (A) P1; (B) P2; (C) P3; (D) P4; (E) P5; (F) P6; (G) P7; (H) P8; and (I) P9.

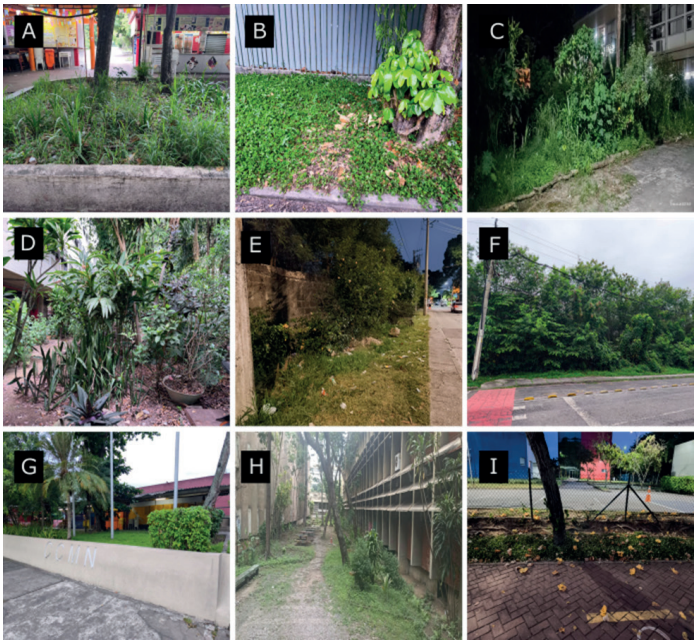


Figure 3 - Gastropod species found infected by nematodes during the study. (A) *Achatina fulica*; (B) *Bradybaena similaris*; and (C) *Sarasinula linguaeformis*.



2.2 MORPHOLOGICAL IDENTIFICATION AND MEASUREMENT OF GASTROPODS

In the laboratory, shells and external morphology of gastropods were examined, taking into account shell-related features such as shape, texture, color patterns, and size. Shell width for each individual was measured using a caliper to a precision of 0.05 mm, and all species were recorded for subsequent analyses. In the case of slugs, one specimen of each species was also dissected for anatomical examination, with particular attention to the reproductive system for species-level identification. Voucher specimens of each identified species were deposited in the Malacological Collection of the Biological Institute of the Federal University of Rio de Janeiro (IBUFRJ), Brazil.

2.3 PARASITOLOGICAL ANALYSIS AND IDENTIFICATION OF NEMATODES

Collected specimens were processed using a digestion-based protocol for the isolation of nematodes (CANALI *et al.*, 1998). The soft tissues of the mollusks were digested in a pepsin–hydrochloric acid solution at 37°C, and the resulting sediment was examined under a bright-field microscope for larval detection. Recovered larvae were heat-inactivated and fixed in AFA solution (2% glacial acetic acid, 3% formaldehyde, 95% ethanol) for morphological assessment.

Larvae recovered via artificial digestion were examined under light microscopy, focusing on body morphology, cephalic structures, cuticular ornamentation, sensory papilla arrangement, and the morphology of the esophagus and tail. Taxonomic identification was based on established diagnostic criteria (THIENGO *et al.*, 2008; RAMOS-DE-SOUZA *et al.*, 2021).

Molecular identification of nematodes belonging to the superfamily Metastrongyloidea was performed using genomic DNA extracted from pools of ten larvae morphologically compatible with the group. DNA extraction followed the heat-shock method, consisting of immersing microtubes containing larvae in ice for 1 minute, followed by heating at 95°C for 20 minutes. This procedure was repeated three times to ensure disruption of nematode tissue and DNA release, and samples were stored at –20°C until analysis. A partial fragment of the mitochondrial cytochrome c oxidase subunit I gene (MT-CO1) was amplified by polymerase chain reaction (PCR) using forward and reverse primers (Nem_F3 and Nem_R3, 0.2 µM each), as described by Prosser *et al.* (2013) and following the internal protocol of the National Reference Laboratory for Animal Helminthiases (LRNEM). PCR reactions were performed in a final volume of 25 µL containing 12.5 µL GoTaq G2 Hot Start Master Mix (Promega, USA), 4.5 µL ultrapure water, 1.5 µL of each primer, and 5.0 µL of extracted DNA. Thermocycling

conditions included an initial denaturation at 95°C for 5 min, followed by 35 cycles of 95°C for 40 s, 51°C for 40 s, and 72°C for 1 min, with a final extension step at 72°C for 1 min. Amplification products were visualized on a 1.5% agarose gel, purified using the Illustra GFX PCR DNA and Gel Band Purification Kit (GE Healthcare, Chicago, USA), and sequenced bidirectionally using the BigDye Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems, California, USA). Sequencing was performed at the DNA Sequencing Platform of the Oswaldo Cruz Foundation (PDTIS/FIOCRUZ), using the ABI 3730 system (Applied Biosystems), subunit RPT01A. The *A. cantonensis* sequence obtained in the present study was deposited in GenBank (PX596396).

2.4 DATA ANALYSIS

The dataset comprising seasons, georeferenced sampling sites, collection dates, gastropod species, specimen condition (empty shells or fresh specimens), counts of collected specimens, examined specimens, infected specimens, and corresponding parasite species, was organized into electronic spreadsheets. All statistical analyses were performed using R software version 4.5.2 (R CORE TEAM, 2025). The datasets analyzed during the current study are available from the corresponding author upon request.

2.5 STUDY LIMITATIONS

Based on targeted, convenience sampling of specific gastropod species at selected sites, this study does not represent a probabilistic survey, nor does it intend to reflect the full diversity of terrestrial gastropods on Fundão Island. Site selection and sampling under conditions favorable to gastropod activity may have increased detection probability but also introduced selection and detection biases. Accordingly, the findings should be interpreted as descriptive observations of parasite occurrence rather than as population-level estimates of prevalence. In addition, environmental variables, host density, and definitive hosts were not assessed. Therefore, the study does not allow inference regarding ecological or epidemiological drivers of infection.

3 RESULTS

A total of 89 terrestrial gastropods were analyzed, belonging to three species: *Achatina fulica* (n = 61; 68.5%), *Bradybaena similaris* (n = 17; 19.1%), and *Sarasinula linguaeformis* (n = 11; 12.4%) (Figure 3). *A. fulica* exhibited the widest distribution and highest numerical representation across sampling sites, whereas *B. similaris* and *S. linguaeformis* occurred more locally and in lower abundance.

Parasitological examination revealed three groups of nematodes infecting the collected gastropods (Figure 4): Metastrongylidae (*Angiostrongylus cantonensis*), Rhabditidae, and Kathlaniidae (*Cruzia tentaculata*). Among parasitized specimens, *Angiostrongylus cantonensis* were the most frequent, accounting for 56.7% of cases, followed by Rhabditidae (13.3%) and *Cruzia tentaculata* (6.7%). Coinfections were observed in 23.4% of parasitized specimens, involving combinations of *Angiostrongylus cantonensis* and Rhabditidae (16.7%) or *Angiostrongylus cantonensis* and *Cruzia tentaculata* (6.7%).

Considering only parasitized specimens (Figure 5A), *Achatina fulica* accounted for 86.7% of infection cases, whereas *Bradybaena similaris* and *Sarasinula linguaeformis* represented 10% and 3.3%, respectively. When evaluating all collected specimens, 43% of *A. fulica* specimens were infected (Figure 5B). Infection rates in *B. similaris* and *S. linguaeformis* were 18% (Figure 5C) and 9% (Figure 5D), respectively.

Parasites were detected in different seasons throughout the sampling period (Figure 6). *Angiostrongylus cantonensis* and Rhabditidae exhibited detection peaks during fall and summer, showing similar amplitudes of fluctuation. *Cruzia tentaculata* occurred less frequently overall, displaying a modest peak during winter.

Parasitized gastropods were recorded at six of the nine sampling sites (Figure 7). At four locations (P2, P3, P4, and P6), only a single parasite group was detected: *Cruzia tentaculata* at P2, *Angiostrongylus cantonensis* at P3 and P4, and Rhabditidae at P6. Sites P1 and P5 exhibited greater parasite diversity, including multiple combinations of infections (Figure 8). At site P1, *Angiostrongylus cantonensis* showed an infection rate of 43.8%, while Rhabditidae were detected in 18.8% of specimens. Two categories of coinfection were observed: *Angiostrongylus cantonensis* + Rhabditidae (25%) and *Angiostrongylus cantonensis* + *Cruzia tentaculata* (12.5%). At site P5, 50% of cases were attributed to *Cruzia tentaculata* and 50% to coinfections involving *Angiostrongylus cantonensis* and Rhabditidae.

Figure 4 - Overall parasite species diversity recorded in all infected gastropod specimens of *Achatina fulica*, *Bradybaena similaris*, and *Sarasinula linguaeformis* from Fundão Island, Rio de Janeiro, Brazil.

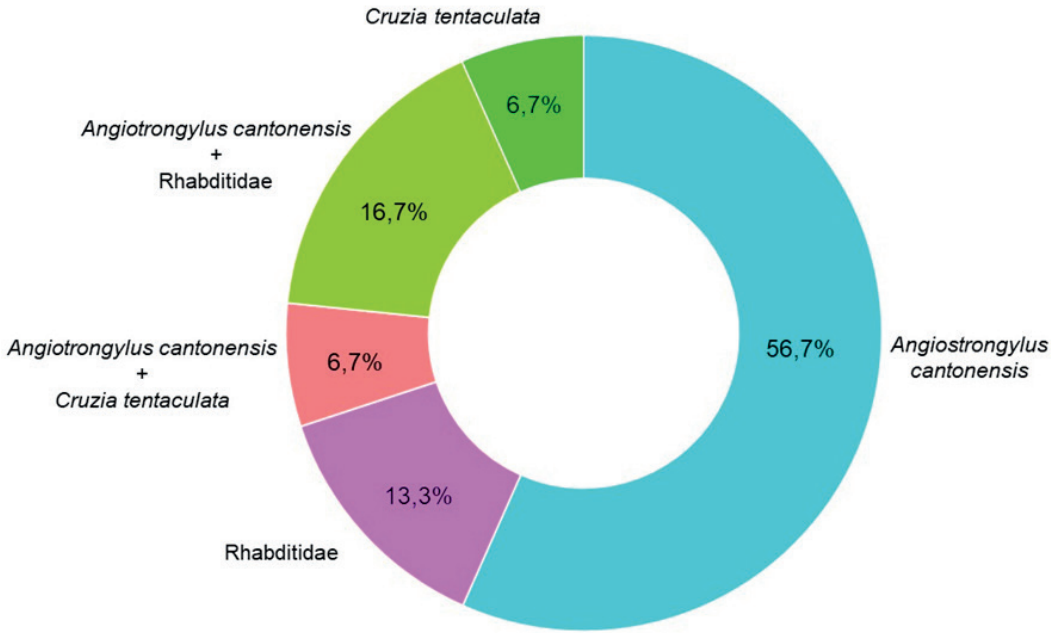
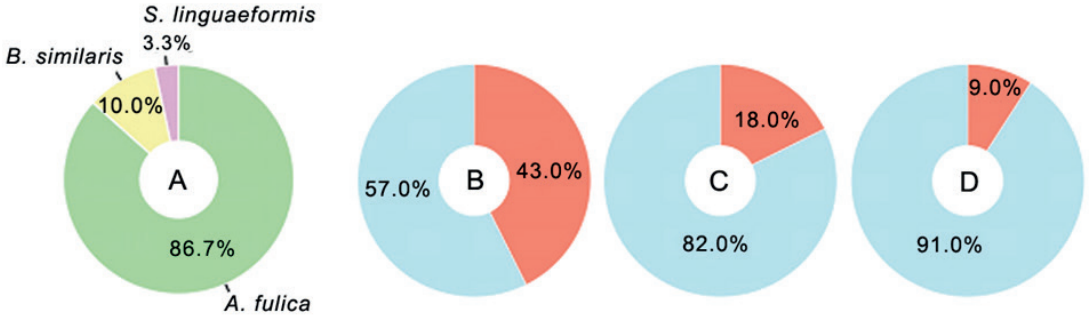


Figure 5 - Prevalence of infection among the three gastropod species examined in Fundão Island, Rio de Janeiro, Brazil. (A) Relative contribution of each species to the total number of infected specimens recorded in the study. (B–D) Percentage distribution of infected (red) and non-infected (blue) specimens by species, corresponding to (B) *Achatina fulica*, (C) *Bradybaena similaris*, and (D) *Sarasinula linguaeformis*, respectively.



Infection rates also varied across sites throughout the seasons (Figure 9). All specimens examined at site P4 during fall were parasitized. In summer, P1 and P4 presented infection rates of 85.7% and 80%, respectively. During winter, all gastropods examined at site P1 were infected.

Figure 6 - Percentage of all infected specimens of *Achatina fulica*, *Bradybaena similaris*, and *Sarasinula linguaeformis* recorded throughout the year in Fundão Island, Rio de Janeiro, Brazil. The bars represent the total number of infected specimens in each season across all three gastropod species analyzed. The lines depict the total number of infected specimens in each season categorized by parasite species.

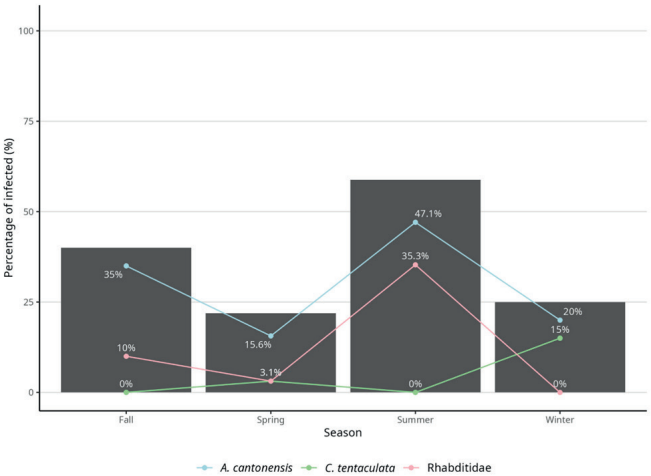


Figure 7 - Annual percentage of infected specimens of *Achatina fulica, Bradybaena similaris*, and *Sarasinula linguaeformis*, categorized by sampling site on Fundão Island, Rio de Janeiro, Brazil.

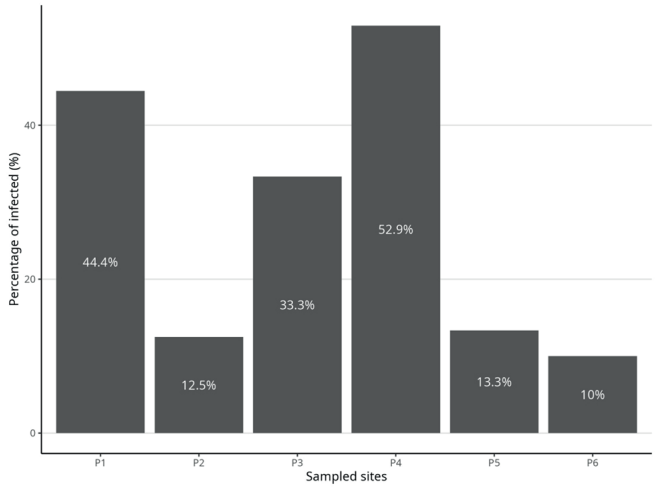


Figure 8 - Comparison of parasite-specific infection rates across sampling sites, based on all infected gastropod specimens of *Achatina fulica*, *Bradybaena similaris*, and *Sarasinula linguaeformis* examined in Fundão Island, Rio de Janeiro, Brazil.

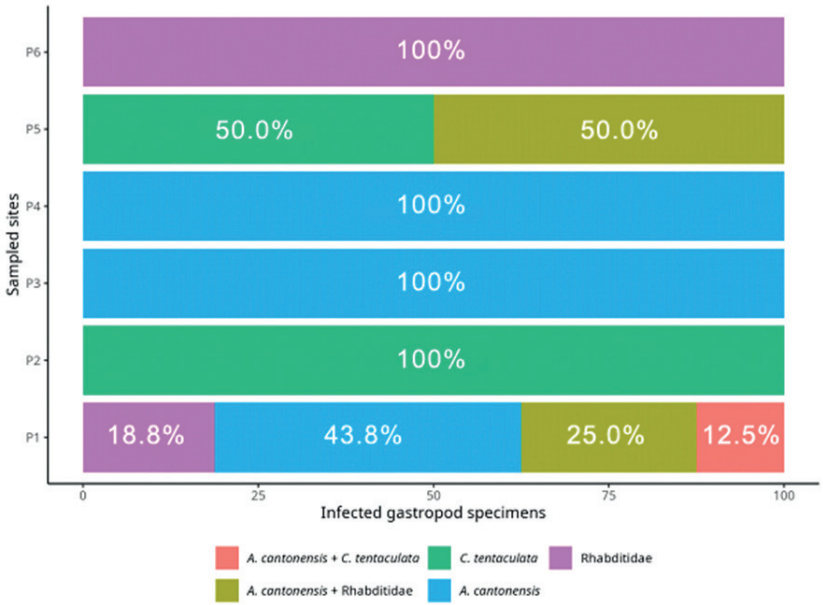
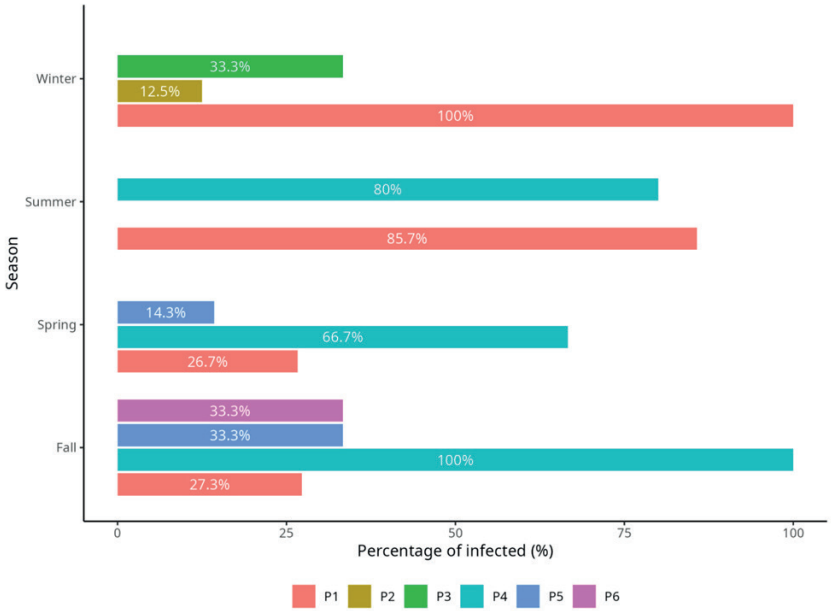


Figure 9 - Seasonal and spatial variation across sampling sites in the percentage of infected gastropods of *Achatina fulica*, *Bradybaena similaris*, and *Sarasinula linguaeformis* examined on Fundão Island, Rio de Janeiro, Brazil.



4 DISCUSSION

The predominance of *Achatina fulica* among the species collected and infected in this studyis consistent with previous studies conducted in Brazil, which recognizes this species as one of the main intermediate hosts of medically important metastrongylid nematodes, including *Angiostrongylus cantonensis* and *Aelurostrongylus abstrusus* (THIENGO *et al.*, 2008; MORASSUTTI *et al.*, 2014; BARBOSA *et al.*, 2020; RODRIGUES *et al.*, 2022). The high infection rate observed in *A. fulica*, reflected both in the number of parasitized specimens and in the diversity of nematodes detected, is consistent with its reported role as an important intermediate host in urban environments. This species exhibits high ecological plasticity, elevated reproductive capacity, and generalist feeding habits (THIENGO *et al.*, 2007), traits that facilitate its widespread dispersal and frequent contact with environments where infective larval stages may be present, as described in previous studies (THIENGO *et al.*, 2013).

Although less numerous in the samples, *Bradybaena similaris* and *Sarasinula linguaeformis* were also found to be infected by nematodes. Similar findings have been reported in previous studies documenting multiple gastropod species serving as intermediate hosts of metastrongylids and other helminths (RAMOS-DE-SOUZA *et al.*, 2018; SILVA *et al.*, 2020). The differences observed among the

three species may be associated with ecological differences reported in the literature, including microhabitat preference, feeding behavior, and movement patterns, which modulate exposure to infective larval stages in the environment (VALENTE *et al*., 2020; THIENGO *et al*., 2022).

Three nematode families were identified: Metastrongylidae, Rhabditidae, and Kathlaniidae. The high prevalence of *Angiostrongylus cantonensis* aligns with studies documenting their broad distribution and frequent detection in synanthropic mollusks, particularly *A. fulica* (THIENGO *et al*., 2008; RAMOS-DE-SOUZA *et al*., 2018; BARBOSA *et al*., 2020). The morphology of the recovered larvae, along with the epidemiological context of the study area, is consistent with descriptions of metastrongylid larvae reported in similar urban settings, including *A. cantonensis*, although species-level confirmation was not established (VALENTE *et al*., 2020). The occurrence of coinfections in 23.4% of infected gastropods further is consistent with previous reports describing coinfections in terrestrial gastropods, commonly associated with anthropized environments characterized by dense populations of both definitive and intermediate hosts (RAMOS-DE-SOUZA *et al*., 2018; BARBOSA *et al*., 2020).

The molecular confirmation of *Angiostrongylus cantonensis* via COI gene sequencing carries considerable epidemiological weight, given that Fundão Island represents a densely occupied urban environment with continuous human circulation. *A. cantonensis* is the etiological agent of eosinophilic meningoencephalitis, a potentially severe neurological disease whose clinical manifestations range from self-limiting headache and paresthesia to life-threatening encephalitis, particularly in immunocompromised individuals (GRAEFF-TEIXEIRA *et al*., 2009; TSAI *et al*., 2001). In Brazil, the rapid and ongoing spread of *A. fulica*, the primary intermediate host identified in this study, has been directly associated with the geographic expansion of *A. cantonensis* transmission foci, including in urban centers of Rio de Janeiro state (THIENGO *et al*., 2007; THIENGO *et al*., 2010; RANGEL *et al*., 2023). The detection of this parasite on a university campus with high daily foot traffic, green areas accessible to the public, and documented rodent activity underscores the public health relevance of the present findings and reinforces the need for active surveillance, environmental management, and risk communication targeting both the academic community and surrounding neighborhoods.

The detection of nematodes from the family Kathlaniidae, represented by *Cruzia tentaculata*, is particularly noteworthy and warrants careful taxonomic contextualization. Although the genus *Cruzia* more broadly encompasses parasites of amphibians, reptiles, and mammals, *C. tentaculata* specifically is classically described as a parasite of the cecum of Neotropical Didelphid marsupials (ADNET *et al*., 2009; RAMOS-DE-SOUZA *et al*. 2021).

The study by Ramos-de-Souza *et al*. (2021) provided morphological and molecular evidence of a previously unrecognized heteroxenous life cycle, in which terrestrial gastropods act as natural intermediate hosts. The present study reinforces and geographically extends this finding, constituting one of the first records of *C. tentaculata* larvae in gastropods on Fundão Island and further consolidating the role of synanthropic mollusks in this unexpected transmission route. The seasonal detection of *C. tentaculata* with a modest peak during winter, contrasting with the warm-season peaks of *A. cantonensis* and Rhabditidae, may reflect the activity patterns of marsupial definitive hosts such as *Didelphis aurita* (Wied-Neuwied, 1826), a common synanthropic species in Rio de Janeiro.

Differences in the number of infected specimens were observed across sampling periods, with higher frequencies of *Angiostrongylus cantonensis* and Rhabditidae infections during summer and fall, may reflect patterns previously associated with climatic factors influencing gastropod activity and larval survival, particularly humidity and temperature, affect gastropod activity and larval survival in the environment (THIENGO *et al.*, 2013; VALENTE *et al.*, 2020). The winter peak in *Cruzia tentaculata* reinforces the ecological plasticity of *C. tentaculata* and its ability to persist under contrasting climatic conditions, although environmental variables were not directly measured in this study.

Of the nine sites sampled, six yielded infected gastropods, with notable emphasis on sites P1 and P4. The parasite diversity found at these locations is consistent with environmental conditions previously associated with parasite occurrence in urban areas, features also documented in other studies conducted in urban environments (THIENGO *et al.*, 2013; SILVA *et al.*, 2020). The consistent detection of metastrongylid larvae at these sites aligns with previous studies reporting associations between environmental conditions and parasite occurrence, the presence of definitive hosts, and the proliferation of *A. fulica*.

The finding that site P4 showed marked fluctuations in parasite prevalence, coinciding with periods of greater student activity and increased production of organic waste, highlights the role of anthropogenic factors in shaping the dynamics of parasitic cycles. Although causal relationships cannot be firmly established without further studies, these patterns align with observations from other Brazilian urban areas (THIENGO *et al.*, 2013) and reinforce the importance of integrating social, environmental, and behavioral variables into surveillance strategies, although these variables were not directly assessed in the present study.

Overall, our results support the relevance of considering gastropods in integrated surveillance approaches targeting both mollusks and rodents in urban areas, with emphasis on environments characterized by high human circulation. The presence of multiple nematode families, including species of medical, veterinary, and ecological relevance, indicates that continued monitoring may be useful. Future studies may focus on expanded molecular characterization of detected larvae, assessment of infective potential of recovered stages, and investigation of the potential relevance of these findings for animal and human health, thereby advancing the understanding of helminth eco-epidemiology in urbanized Brazilian environments.

5 CONCLUSION

This study documents the occurrence of nematode infections in terrestrial gastropods collected from selected sites on Fundão Island, Rio de Janeiro. Infected specimens were detected across different host species, locations, and sampling periods, indicating that synanthropic gastropods may act as reservoirs of larval nematodes in urban environments.

Given the targeted sampling strategy, limited sample size, and uneven distribution of specimens across species and seasons, the results should be interpreted as descriptive evidence of parasite occurrence rather

than as a quantitative assessment of infection risk or transmission dynamics. The study design does not allow robust comparisons among sites or seasons, nor inference about environmental drivers of infection.

Despite these limitations, the findings provide baseline information on gastropod–nematode associations in a highly urbanized setting and reinforce the relevance of terrestrial mollusks in the ecology of zoonotic parasites. Future studies employing standardized and probabilistic sampling designs, coupled with environmental and host-related variables, will be essential to better understand the epidemiological significance of these interactions.

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