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ECOSYSTEMS

Public parks in the city of Rio de Janeiro, southeast Brazil, and the risk of parasitosis transmission by freshwater gastropods

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Abstract: Urban parks are not only important for the wellbeing of the human population, but are also widely considered to be potentially important sites for the conservation of biodiversity. However, they may offer risk parasitic infections, such as schistosomiasis and fascioliasis, which are both transmitted by freshwater snails. The present study investigated the occurrence of freshwater gastropods in urban parks of the Brazilian city of Rio de Janeiro, and their possible infection by helminths of medical-veterinary importance. Gastropods were collected from six parks (2021 - 2022) and examined for the presence of larval helminths. In all, 12 gastropod species from different families were collected: Ampullariidae, Assimineidae, Burnupidae, Lymnaeidae, Physidae, Planorbidae, Succineidae, and Thiaridae. The parasitological examination revealed cercaria of three types in five snail species, with the *Pleurolophocerca cercariae* type in *Melanoides tuberculata* (the most abundant species), *Echinostoma cercariae* in *Physella acuta* and *Pomacea maculata*, and *Virgulate cercariae*, in *Pomacea* sp. and *Pomacea maculata*. None of the *Biomphalaria tenagophila* and *Pseudosuccinea columella* (the most frequent species) specimens were parasitized by *Schistosoma mansoni* or *Fasciola hepatica,* respectively. Even so, some parks may represent a considerable potential risk for transmission of both *Schistosoma mansoni* and *Fasciola hepatica*, given the presence of these gastropod vectors and the frequent contact of visitors with the waterbodies.

Key words: Biodiversity, freshwater snails, helminths, one health, parasitosis.

INTRODUCTION

Neotropical freshwater snails are still poorly studied in general, and there is a major knowledge gap for this group, with the exception of some families of medical-veterinary relevance, such as the Planorbidae and Lymnaeidae (Paraense 1975, Fernandez et al. 2020, Pointier & Vázquez 2020). Despite this, these snails are of considerable importance, not only in terms of their biodiversity, but also from a public health perspective, as the vectors of parasitic helminths. In particular, the planorbids *Biomphalaria glabrata* (Say, 1818), *Biomphalaria tenagophila* (d'Orbigny, 1835), and *Biomphalaria straminea* (Dunker, 1848) are intermediate hosts of the trematode *Schistosoma mansoni* Sambon, 1907, the etiological agent of Schistosomiasis mansoni (Paraense 1975, Fernandez et al. 2020). Other important parasitosis are human echinostomiasis and fasciolosis. Human echinostomiasis is a zoonosis transmitted by freshwater snails, such as *Pomacea maculata* Perry, 1810, and *Pomacea canaliculata* (Lamarck, 1822) (Saijuntha et al. 2011), and is caused by a number of different digenetic trematodes, mostly species of *Echinostoma cercariae* (Graczyk

& Fried 1998). Fasciolosis, in turn, is caused by the trematode *Fasciola hepatica* Linnaeus, 1758, whose intermediate hosts include the lymnaeids of the genera *Lymnaea*, *Pseudosuccinea*, and *Galba* (Thiengo & Fernandez 2013). This parasitosis is particularly relevant because, in addition to humans, it can also affect cattle, sheep, and goats, and has caused serious economic impacts on the production of livestock in Brazil and a number of other countries (Guimarães 2016). Some freshwater gastropods are agricultural pests, such as certain *Pomacea* species, which were introduced as a potential source of food in a number of Southeast Asian countries, but subsequently became pests, in particular in rice paddies, where they have caused serious economic damage (Hayes et al. 2008, Ohlweiler et al. 2013, Cowie et al. 2017).

With the growing urbanization of towns and cities, urban parks have increasingly become a refuge for residents in search of open spaces in which to relax or exercise (Dagnino et al. 2020). The reduction of stress is one of the principal human health benefits resulting from visits to urban parks (Soga et al. 2017). The inhabitants of large cities are typically exposed to high levels of stress, and green areas within the urban zone can have a positive impact on human health and wellbeing (Collet et al. 2008, Maller et al. 2009, Kardan et al. 2015).

In addition to promoting human health, urban parks may also have benefits for the health of animals and the environments, given that they provide open spaces for people and their pets to exercise and interact with nature, as well as contributing to the preservation of biodiversity and the reduction of pollution, of both the air and water (Kabashima et al. 2011, Su et al. 2022).

Tzoulas et al. (2007) and Kuo (2015) highlighted the importance of urban parks based on the *One Health* concept, in which human health is intimately linked to the health of the environment and its animals. Urban parks are thus a good example of integration of the care of this triad, from the perspective of the creation of a healthy and sustainable community.

Six public parks were the focus of the present study in the city of Rio de Janeiro, Brazil: Bosque da Barra Municipal Natural Park, and Prainha Municipal Natural Park (Parque Natural Municipal Bosque da Barra, Parque Natural Municipal da Prainha), Rio de Janeiro Botanical Garden (Jardim Botânico do Rio de Janeiro), Henrique Lage Park (Parque Henrique Lage), Quinta da Boa Vista and Recanto do Trovador Park (Parque Recanto do Trovador). These parks contribute to the formation of green space within the Rio de Janeiro metropolitan region (Lima et al. 2023).

Given that the vectors of both *S. mansoni* and *F. hepatica* are found in the municipality of Rio de Janeiro (Thiengo et al. 2001, Mazzoni et al. 2009, Oliveira et al. 2020, Ximenes et al. 2022), the mapping of the occurrence of these mollusks and the detection of potential infections by helminths of parasitological concern in areas visited by the human population, such as natural parks is an important public health initiative, which is also consistent with the *One Health* concept.

The present study reports on the findings of the freshwater gastropods survey of the six public parks, listed above, in the Brazilian city of Rio de Janeiro. These findings include a description of the helminths associated with these gastropods, which contributed not only to the further understanding of the biodiversity of the study areas, as well as the detection of areas prone to the epidemiological transmission of parasitosis.

MATERIALS AND METHODS

The gastropod specimens were collected in June, September, November, and December 2021 and in March 2022, according to the seasons of the year in Brazil, at two federal localities, the Rio de Janeiro Botanical Garden and Henrique Lage Park, two municipal Bosque da Barra and Prainha natural parks, the Recanto do Trovador Park, and Quinta da Boa Vista, all located in the city of Rio de Janeiro, in southeastern Brazil (Figure 1; Table I). Collections were carried out four times in each park, with the exception of Prainha Natural Park (three visits). The surveys were qualitative and were conducted invariably at the same points within each locality, by three collectors, during 10 minutes each one (Thiengo et al. 2012 adapted from Olivier & Schneiderman 1956). The parks were chosen because they have waterbodies and are easier to access. The survey points were georeferenced using a Garmin® Etrex 10 GPS, with the Lat-Long geodesic coordinates system, configured to the WGS84 geodesic reference.

For the parasitological examination, the specimens were exposed to the light of 60W incandescent lamps for 4 hours at a distance of 30 cm, and then analyzed under a Stereoscopic Microscope Tecnival with a magnification of 8x for the identification of the cercariae. Following this examination, the animals were kept in the dark until the following morning, when they were analyzed once again, to detect parasites that have nocturnal definitive hosts (Thiengo et al. 2012). The types of cercariae were identified based on the dichotomous key of Pinto & Melo (2013).

The ampullariid and tiarid specimens were fixed according to Fukuda et al. (2008). All other gastropods were first relaxed in sodium pentobarbital before being fixed using the

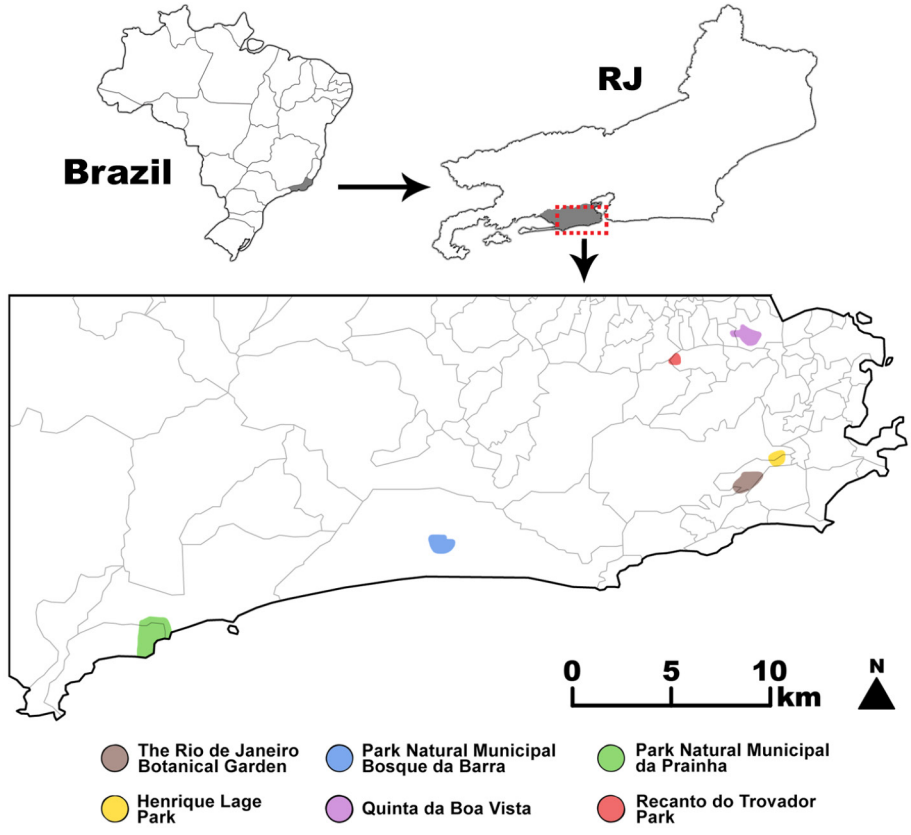

Figure 1. Natural parks surveyed in the city of Rio de Janeiro, Brazil (gray area in Rio de Janeiro state) between June 2021 and March 2022 (adapted from Lima et al. 2023).

protocol of Thiengo et al. (2012) for morphological study.

The mollusks were identified based on the detailed examination of their shells and the dissection of the specimens for the observation of diagnostic features, as well as comparison with the literature (Paraense 1975, Simone 2006, Fernandez et al. 2008, 2020, Thiengo et al. 2017, 2020, Berning 2020, Collado 2020, Cuezzo 2020, Gregoric 2020, Pointier & Vázquez 2020, Santos et al. 2020). The shells of the snails of the Burnupidae and Ancylinae were mounted on stubs, metalized with gold and viewed with a Jeol-JSM-6390-LV scanning electron microscope at the Fiocruz Electronic Microscopy Platform (Silveira 2007).

Table I. Survey points sampled in the natural parks in the city of Rio de Janeiro, southeastern Brazil.

Park	Latitude	Longitude	Description of the survey point	Biotope
Jardim Botânico (Botanical Garden)	22°58'11.5"S	43°13'30.3"W	1 - Sensorial garden	Small fountain
	22°58'11.2" S	43°13'30.6" W	2 - Cactus garden pond	Permanent pond
	22°58'06.0" S	43°13'16.7" W	3 – Palm avenue	Lotic stream
	22°38'06.7" S	43°13'18.8" W	4 – Japonese pond	Permanent pond
	22°58'02.4" S	43°13'44.0" W	5 – Bromeliad garden pond	Permanent pond
Henrique Lage	22°57'38.5" S	43°12'38.5" W	6 – Children's pond	Permanent pond
	22°57'35.8" S	43°12'36.9" W	7 – Aquarium pond	Permanent pond
	22°57'32.0" S	43°12'43.1" W	8 – Duck pond	Permanent pond
	22°57'25.9"S	43°12'39.0"W	9 - Waterfall	Waterfall
Recanto do Trovador	22°54'58.4"S	43°15'37.6"W	10 – Bridge Lake	Permanent pond
	22°54'58.6"S	43°15'39.4"W	11 – Small Lake	Permanent pond
Quinta da Boa Vista	22°54'30.8"S	43°13'26.6"W	12 – Botanical Garden Ditch	Drainage ditch
	22°54'30.8"S	43°13'26.6"W	13 – Botanical Garden Lake	Permanent pond
	22°54'28.2"S	43°13'22.6"W	14 – Main Entrance Lake	Permanent pond
Bosque da Barra	22°59'45.5" S	43°22'08.9" W	15 – Lake margin	Permanent pond
	22°59'37.8"S	43°22'14.0"W	16 - Swampy	Temporary pond
	22°59'37.5" S	43°22'33.3" W	17 – Sewer Manifold	Permanent pond
Prainha	23°02'23.2"S	43°30'24,5"W	18 - Reservoir	Permanent reservoir
	23°02'27.2"S	43°30'21.7"W	19 - Stream at the park entrance	Lotic stream

RESULTS

A total of 2203 gastropod specimens were collected and deposited at the Mollusk Collection of the Oswaldo Cruz Institute (CMIOC 14593 – CMIOC 14715), which represented the families Thiaridae (831 specimens / 37.72% of the specimens), Ampullariidae (470 / 21.33%), Planorbidae (419 / 19.02%), Physidae (336 / 15.25%), Lymnaeidae (134 / 6.08%), Burnupidae (8 / 0.36%), Succineidae (3 / 0.14%) and Assimineidae (2 / 0.09%), The most common the most abundant species was *Melanoides tuberculata* (Müller, 1774), with 831 specimens collected, followed by *P. maculata* (n = 420), *B. tenagophila* (n = 368), *Physella acuta* (Draparnaud, 1805) (n =237), *Pseudosuccinea columella* (Say, 1817) that was the most frequent species (n = 134), *Stenophysa marmorata* (Guilding, 1828) (n = 99), *Pomacea* sp. (n = 50), *Drepanotrema anatinum* (d'Orbigny, 1835) (n = 40), *Omalonyx matheroni* (Pointiez & Michaud, 1835) (n = 3) and *Assiminea* sp., represented by only two specimens (Figure 2). Two other species were also collected, *Gundlachia ticaga* (Marcus & Marcus, 1962) (n = 11) and *Burnupia ingae* Lanzer, 1991 (n = 8) (Table II; Figure 3).

The parasitological examination of the specimens revealed the presence of cercariae of the *Pleurolophocerca cercariae*, *Virgulate cercariae*, and *Echinostoma cercariae* types (see Figure 4) in *M. tuberculata*, *P. maculata*, *Pomacea* sp., and *P. acuta* specimens respectively collected from three parks – Recanto do Trovador, Quinta da Boa Vista, and the Rio de Janeiro Botanical Garden (Table III).

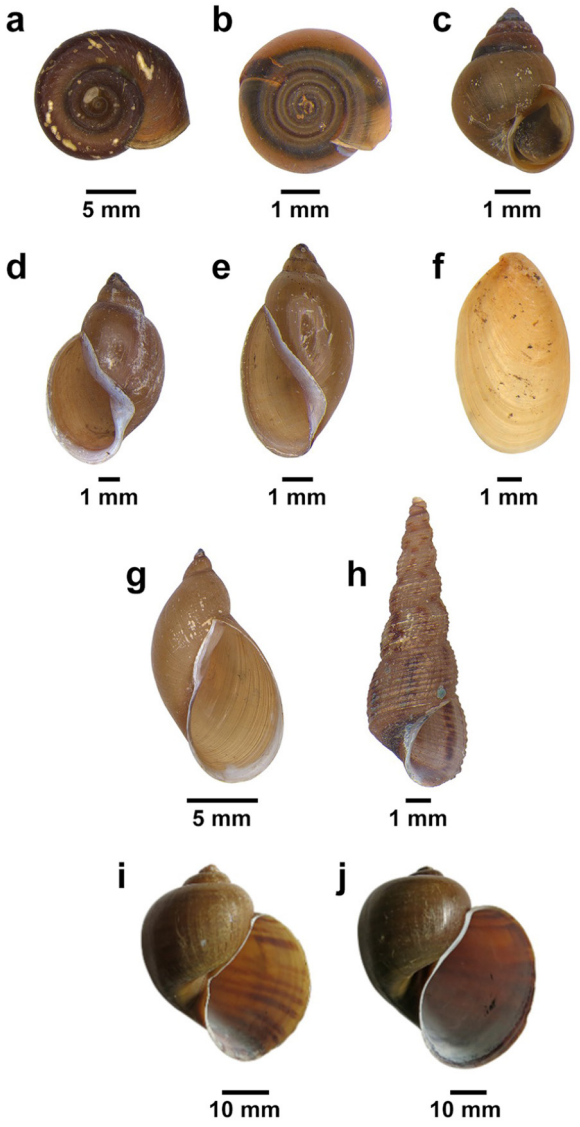

Figure 2. Shells of gastropod specimens collected during the present study: a: *Biomphalaria tenagophila*, b: *Drepanotrema anatinum*, c: *Assiminea* sp. d: *Physella acuta*, e: *Stenophysa marmorata*, f: *Omalonyx matheroni*, g: *Pseudosuccinea columella*, h: *Melanoides tuberculata*, i: *Pomacea maculata*, j: *Pomacea* sp.

DISCUSSION

In an inventory of the gastropod fauna of the Metropolitan mesoregion of the Brazilian state of Rio de Janeiro, Thiengo et al. (2001) recorded for the city of Rio de Janeiro 15 species: *P. canaliculata*, *Pomacea lineata* (Spix in Wagner, 1827), *Pomacea sordida* (Swainson, 1823), *Heleobia davisi* Silva & Thomé, 1985, *M. tuberculata*, *Antillorbis nordestensis* (Lucena, 1954), *B. glabrata*, *B. straminea*, *B. tenagophila*, *D. anatinum*, *Drepanotrema cimex* (Moricand, 1838), *Drepanotrema lucidum* (Pfeiffer, 1839), *P. acuta*,

Table II. Gastropod species recorded during the present study and the number of specimens collected from each of the six parks studied in the city of Rio de Janeiro, Brazil. The origin of species (native or non-native) is also provided.

Locality	Families	Species	Number of specimens collected	Category
Jardim Botânico (Botanical Garden)	Ampullariidae	*Pomacea maculata*	220	Native
	Assimineidae	*Assiminea* sp.	2	Non-native
	Lymnaeidae	*Pseudosuccinea columella*	104	Native
	Physidae	*Physella acuta*	195	Non-native
	Planorbidae	*Biomphalaria tenagophila*	208	Native
Henrique Lage	Ampullariidae	*Pomacea maculata*	32	Native
	Burnupidae	*Burnupia ingae*	8	Native
	Lymnaeidae	*Pseudosuccinea columella*	9	Native
	Physidae	*Stenophysa marmorata*	3	Native
	Planorbidae	*Gundlachia ticaga*	5	Native
Recanto do Trovador	Ampullariidae	*Pomacea maculata*	136	Native
	Lymnaeidae	*Pseudosuccinea columella*	10	Native
	Physidae	*Physella acuta*	4	Non-native
	Planorbidae	*Gundlachia ticaga*	4	Native
	Thiaridae	*Melanoides tuberculata*	531	Non-native
Quinta da Boa Vista	Ampullariidae	*Pomacea* sp.	50	Native
	Ampullariidae	*Pomacea maculata*	32	Native
	Lymnaeidae	*Pseudosuccinea columella*	9	Native
	Physidae	*Stenophysa marmorata*	67	Native
	Physidae	*Physella acuta*	38	Non-native
	Planorbidae	*Biomphalaria tenagophila*	147	Native
	Planorbidae	*Gundlachia ticaga*	2	Native
	Succineidae	*Omalonyx matheroni*	2	Native
	Thiaridae	*Melanoides tuberculata*	8	Non-native
Bosque da Barra	Lymnaeidae	*Pseudosuccinea columella*	2	Native
	Physidae	*Stenophysa marmorata*	9	Native
	Planorbidae	*Drepanotrema anatinum*	40	Native
	Planorbidae	*Biomphalaria tenagophila*	13	Native
	Succineidae	*Omalonyx matheroni*	1	Native
Prainha Park	Thiaridae	*Melanoides tuberculata*	292	Non-native

S. marmorata, and *P. columella*. The collections carried out by these authors took place in the Barra da Tijuca neighborhood, where the Bosque da Barra Municipal Natural Park is located (the study area of the present work) and in 2 adjacent neighborhoods (Jacarepaguá and Recreio dos Bandeirantes). In this previous study, specimens of *B. tenagophila* from the city of Rio de Janeiro were found to be infected with trematodes: Xiphidiocercariae and *Echinostoma cercariae*. The present study confirmed the occurrence of *M. tuberculata*, *B. tenagophila*, *D. anatinum*, *S. marmorata*, and *P. columella*, as well as infections by Xiphidiocercariae and *Echinostoma cercariae*. However, the *Virgulate cercariae*, a type that belongs to the Xiphidiocercaria group, was found in *P. maculata* and *Pomacea* sp., whereas *Echinostoma cercariae* was observed in *Physella acuta* and *P. maculata*. Thiengo et al. (2001) reported the occurrence of 359 cases of schistosomiasis in the city of Rio de Janeiro over a period of five years (1996–2000), although they did not record any *Biomphalaria* specimens infected with *S. mansoni*, which is consistent with the findings of the present study.

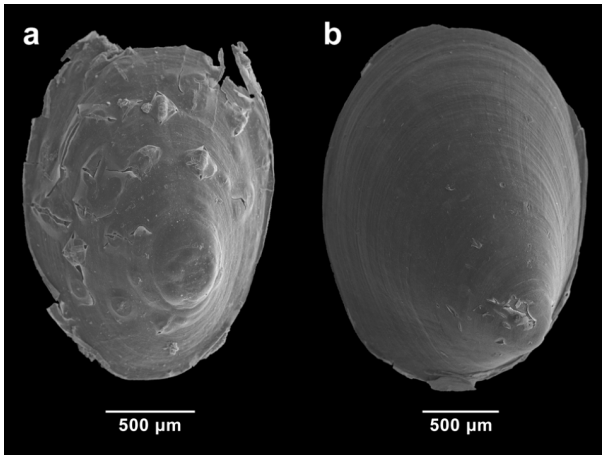

Figure 3. Outer surface of the shells of Burnupidae and Ancylinae in Scanning Electron Microscopy. a: *Burnupia ingae* Lanzer, 1991 (CMIOC 14670), b: *Gundlachia ticaga* (Marcus & Marcus, 1962) (CMIOC 14638). Scale bar: 500 µm.

Gonçalves et al. (2021) recorded six gastropod species in the Mario Xavier National Forest in the municipality of Seropédica, Rio de Janeiro state – *S. marmorata*, *G. ticaga*, *Drepanotrema lucidum*, *B. straminea*, *Pomacea* sp., and *O. matheroni*. The mollusk collection of the Oswaldo Cruz Institute in Rio de Janeiro holds specimens of *B. straminea* from Quinta da Boa Vista (CMIOC 14716), although this species was not recorded in this park in the present study. Similarly, Oliveira et al. (2020) found *B. glabrata* and *Physa acuta* (synonym of *Physella acuta*) in this park's principal pond, although in the present study specimens of *P. acuta* were collected from the areas surveyed but *B. glabrata* was not found. The previous study also recorded rediae and cercariae similar to those of *Typhlocoelum cucumerinum* (Rudolphi, 1809) (Typhlocoelidae, Digenea), which parasitizes the waterfowl of the order Anseriformes, and reinforced the importance of monitoring the waterbodies located within public parks to better evaluate the risk of transmission of helminths by mollusk vectors.

In a survey of the freshwater gastropods of five municipal parks in the western extreme of the municipality of Rio de Janeiro Chico Mendes Municipal Natural Park, Marapendi Municipal Natural Park, Prainha Municipal Natural Park, Grumari Municipal Natural Park and Bosque da Barra Municipal Natural Park, Paes & Fernandez (2006) recorded 10 different species, including *B. tenagophila*, which was found in all the parks, except Prainha, where only *M. tuberculata* was recorded, as in the present study.

Santos et al. (2003) conducted the first survey of the freshwater mollusks of Pedra Branca State Park (Parque Estadual da Pedra Branca), in western Rio de Janeiro. The authors recorded eight gastropods in the *Engenho Novo*, *Rio Grande*, and *Rio Pequeno* streams – *Heleobia* sp. (Hydrobiidae), *M. tuberculata*

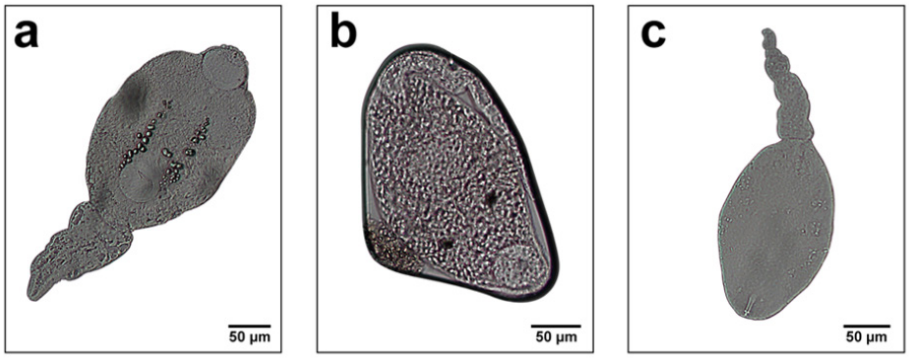

Figure 4. Cercariae found in the snail specimens collected from the parks in the city of Rio de Janeiro, showing a: *Echinostoma cercariae*, b: *Pleurolophocerca cercariae*, and c: *Virgulate cercariae* types. Scale bar: 50 µm.

(Thiaridae); *P. sordida* (Ampullariidae), *Physa cubensis* (synonym of *Physa acuta*) (Physidae); *A. nordestensis* (Planorbidae), *B. tenagophila* (Planorbidae), *G. ticaga* (Ancylinae), *Ferrissia* sp. (Ancylinae), and *Pisidium* sp. (Sphaeriidae).

More recently, Rangel et al. (2021) surveyed the freshwater gastropods from Fiocruz Atlantic Forest Biological Station, which is part of the PEPB, where they reported the occurrence of *B. tenagophila*, *M. tuberculata*, *P. acuta*, *S. marmorata*, and *P. sordida*. This latter species is known to occur in the western extreme of Rio de Janeiro (Lopes 1955, Thiengo 1989, Simone 2006, Barbosa et al. 2022), and it has not been found in either the Prainha or the Bosque da Barra Municipal Natural parks, in western Rio de Janeiro, nor in the other localities investigated in the present study. This supports the threatened status of *P. sordida*, which is listed in the Brazilian Red List of Endangered Fauna (ICMBio 2018).

In the specific case of the ampulariids, Simone (2006) referred to the occurrence of *P. canaliculata* in the state of Rio de Janeiro, while Mesquita et al. (1990a, b, c) published data on the micro-anatomy of the male and female reproductive systems of specimens obtained from the Botanical Garden of Rio de Janeiro. The diagnostic characteristics of the male reproductive system of the *P. maculata* specimens collected in the present study are similar to those of the specimens analyzed by these authors. In a detailed study of the taxonomy of the *canaliculata* group, Hayes et al. (2012) concluded that *P. canaliculata* occurs only in southern most Brazil, and in neighboring countries such as Argentina and Uruguay. The sum of this evidence indicates that the specimens described by Mesquita et al. (1990a, b,c) were, in fact, *P. maculata*.

In a recent survey performed at the Botanical Garden of Rio de Janeiro, Ximenes et al. (2022) found six native gastropod species – *G. ticaga*, *P. columella*, *B. tenagophila*, *S. marmorata*, *Pisidum punctiferum* (Guppy, 1867), and *Pomacea insularum* (synonym of *P. maculata*) – as well as four non-native species – *Assiminea* sp., *M. tuberculata*, *P. acuta*, and *Ferrisia californica* (Rowell, 1863). The authors also highlighted the diversity of species found at this site and reinforced the importance of research on the diversity of mollusks and the value of public parks and other green urban areas for future research on both the conservation of native species, and the control of exotic ones. In particular, they cited the example of *S. marmorata*, which had recently been included in the Brazilian Red List (ICMBio 2018), due to population decline, which is likely the result of competition from invasive species, such as *P. acuta*. Cuezzo (2020) reported that the ecological characteristics of this species, such as its high reproductive rates, passive dispersal

Table III. Localities at which cercariae were detected in the gastropod specimens collected from the parks of the city of Rio de Janeiro, Brazil.

Park	Type of cercaria	Snail species	Collection period
Jardim Botânico (Botanical Garden)	*Echinostoma cercariae*	*Pomacea maculata*	03/07/2022
Recanto do Trovador	*Pleurolophocerca cercariae*	*Melanoides tuberculata*	09/08/2021
			11/30/2022
			03/07/2022
	Virgulate cercariae	*Pomacea maculata*	09/08/2021
			11/30/2022
			03/07/2022
Quinta da Boa Vista	*Pleurolophocerca cercariae*	*Melanoides tuberculata*	03/07/2022
	Echinostoma cercariae	*Physella acuta*	09/08/2021
			11/30/2022
	Virgulate cercariae	*Pomacea* sp.	09/08/2021
			03/07/2022

capacity, and tolerance of polluted water, all favor the capacity of *P. acuta* to invade new environments.

Simberloff et al. (2013) and Dalapicolla et al. (2021) emphasize the importance of parks and conservation units for the preservation of biodiversity, as well as the need to catalog the species that occur in these areas, not only to better understand their local ecological standing, but too understand how exotic species may be impacting the native taxa.

Regarding the trematodes, Pinto et al. (2015) reported Xiphidiocercariae in specimens of *P. maculata* from the lowlands of the Brazilian state of Maranhão, and the first record of *Stomylotrema gratiosus* Travassos, 1922, an intestinal parasite of birds, in this snail species. Boaventura et al. (2007) also reported the occurrence of Xiphidiocercariae in ampulariids and planorbids, as well as *Echinostoma cercariae* in ampulariids, hidrobiids, planorbids, and physids, and *Pleurolophocerca cercariae* in tiariids and hydrobiids.

Echinostoma cercariae, *Pleurolophocerca cercariae*, and *Virgulate cercariae* types are related to different types of parasitosis. *Pleurolophocerca cercariae*, for example, are associated with *Clonorchis sinensis* (Looss, 1907), *Opisthorchis* spp., and *Centrocestus formosanus* (Nishigori, 1924). These cercariae parasitize freshwater gastropods and their metacercariae are formed in fish. They are parasites of the biliary system of humans in Asia, with cases imported into Brazil. *Echinostoma cercariae* are related to Echinostomiasis. They are small cercariae with a ventral sucker and collar spines surrounding an oral sucker found in freshwater mollusks, fish or amphibians and can infect humans, mainly in Southeast Asia. Xiphidiocercariae evolve into metacercariae, which typically form in the larvae of aquatic insect or amphibians. *Virgulate cercariae* are known to occur in a number of different species of bat, although infections in humans have not yet been reported (Scholz & Salgado-Maldonado 2000, Pinto & Melo 2013).

The risk of transmission of water-borne parasites in these public spaces must be considered, therefore, it is important that the parks studied here signal their visitors to avoid contact with the water collections present in the parks. While none of the snail specimens examined in the present study were parasitized by either *S. mansoni* or *F. hepatica* cercariae, four snails (*Pomacea* sp., *P. maculata*, *P. acuta* and *M. tuberculata*) were infected by trematodes that affect the health of humans and animals (cercariae of the *Virgulate cercariae*, *Echinostoma cercariae*, and *Pleurolophocerca cercariae* types) in three parks that are frequented by large numbers of visitors – Quinta da Boa Vista, Recanto do Trovador, and the Botanical Garden of Rio de Janeiro.

CONCLUSIONS

A diverse freshwater gastropod fauna, with a total of 12 species, was observed in the parks surveyed in the present study, including nine native species and three non-native ones. We highlight that populations of *B. tenagophila* and *P. columella* were recorded in the Rio de Janeiro Botanical Garden, Recanto do Trovador, Quinta da Boa Vista, Henrique Lage, and Bosque da Barra. These parks are visited by large numbers of people and animals, which facilitates their contact with the infected gastropods of the local waterbodies, greatly increasing the overall risk of human and animal infection.

Overall, the study reinforces the importance of public parks and green urban spaces for the maintenance of populations of freshwater mollusks. The presence of non-native species is also important, given that they may compete with the native species and represent a potential threat in parks adjacent to conservation units, which play an important role in the preservation of the local biodiversity.

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