Research Note

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Multiparasitism in a wild cat (*Leopardus colocolo*) (Carnivora: Felidae) in southern Brazil

Multiparasitismo em um felino silvestre (*Leopardus colocolo*) (Carnivora: Felidae) no Sul do Brasil

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Abstract

Parasitic diseases reflect the health and balance of ecosystems, affecting not only individuals but also entire populations or communities. The aim of this study was to report on the diversity of parasitic helminths detected in the feces of a wild feline in southern Brazil. Parasites were obtained from fecal samples, and four techniques were used for parasitological examination: direct examination, centrifugal flotation with zinc sulfate (Faust technique), simple sedimentation (Hoffman technique) and Baermann-Moraes. The parasites were identified through micrometry and morphology, as follows: *Ancylostoma* sp., *Toxocara* sp., Trichuridae, *Aelurostrongylus abstrusus*, *Alaria* sp., and *Spirometra* sp. We recorded the genus *Ancylostoma* parasitizing *L. colocolo* for the first time.

Keywords: Helminth, *Ancylostoma* sp., felines, pampas cat.

Resumo

Doenças parasitárias refletem a saúde e o equilíbrio dos ecossistemas, influenciando não só um indivíduo e sim uma população ou comunidade. Este trabalho teve por objetivo relatar a diversidade de helmintos encontradas nas fezes de um felino silvestre na região Sul do Brasil. Os parasitos foram obtidos a partir de amostras fecais, sendo utilizadas quatro técnicas para os exames parasitológicos: exame direto, centrífugo-flutuação com sulfato de zinco (Técnica de Faust), sedimentação simples (Técnica de Hoffman) e Baermann-Moraes. Os parasitos foram identificados através de micrometria e morfologia, sendo esses: *Ancylostoma* sp., *Toxocara* sp., Trichuridae, *Aelurostrongylus abstrusus*, *Alaria* sp. e *Spirometra* sp. Estudos da fauna parasitária de animais silvestres são relevantes, tanto para o equilíbrio e saúde desses animais, como para o controle e prevenção de doenças transmitidas ao homem. *Ancylostoma* spp. foi identificado pela primeira vez em *L. colocolo*.

Palavras-chave: Helminto, *Ancylostoma* sp., felinos, gato-dos-pampas.

Leopardus colocolo (Molina, 1782), popularly known in Brazil as "gato-palheiro" or "gato-dos-pampas", is a rare species of South American feline that is found in a great diversity of habitats. This species is widely distributed in South America and has been described in countries like Brazil, Peru, Bolivia, Chile, Argentina and Paraguay. It can be found in cerrado regions pantanal and pampas of Brazil (ESPINOSA et al., 2016).

Currently, the scarcity of records prevents satisfactory assessment of the current population status of *L. colocolo*. However, Queirolo et al. (2013) suggest that this would be a rarer species than other cats in the state of Rio Grande do Sul, Brazil. This species has been categorized as vulnerable (VU) on the national list of threatened and endangered (EN) fauna in the state of Rio Grande do Sul (QUEIROLO et al., 2013). Here, we present a report on multiparasitism in a wild feline in southern Brazil.

A male "gato-palheiro" (*L. colocolo*) was run over on a highway in the central region of Rio Grande do Sul, Brazil. The animal appeared to be approximately 2 years old and weighed 5.2 kg. At the radiological examination, a right scapular fracture was found, and the animal was sent for osteosynthesis surgery. Four days after surgery, its feces were collected and sent for parasitological analysis.

The samples were processed through four techniques: fresh examination, centrifugal flotation with zinc sulfate (Faust technique), Baermann-Moraes and simple sedimentation (Hoffman technique) (MONTEIRO, 2011). The eggs and larvae were identified through micrometry and morphology, under an Olympus stereoscopic microscope (CX40 series), using the Motic Images Plus 2.0 software. The identification was based on literature records (BOWMAN et al., 2002; BELDOMENICO et al., 2005; BELTRÁN-SAAVEDRA et al., 2009). To obtain the amplitude, mean and standard deviation of eggs and larvae, the SigmaPlot

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11.0 statistical software was used. The standard deviation was obtained by measuring five eggs and larvae.

The parasites that were identified through fecal examinations are shown in Table 1. In our study, operculated eggs compatible with cestodes of the genus *Spirometra* (Faust, 1929) were identified (Figure 1a). Parasites like *Spirometra* sp. have an indirect cycle in which immature stages (coracidia) are ingested by copepods (primary hosts), where procercoid forms develop. When a secondary host (vertebrates other than fish) ingests infected copepods, the procercoids develop into plerocercoids. These settle in the muscles and connective tissues, thus developing the disease known as animal or human sparganosis. When a definitive host (cat, wild feline, canine or human) ingests a secondary host containing plerocercoid forms, these develop into the adult stage of the worm, thereby producing inflammation in the tissues (BOWMAN et al., 2002).

Alaria sp. (Greville, 1830) is a trematode, and like *Spirometra* sp., presents a cycle with three hosts. Adults parasitize the gut of carnivores and the immature stages of miracidia and cercariae have snails and amphibians, respectively, as intermediate hosts. Paratenic hosts such as reptiles, birds and rodents (SOULSBY, 1987) can act in the cycle of this parasite by ingesting secondary intermediate hosts. Humans can also be paratenic hosts through ingesting contaminated frogs with metacercariae (MURPHY et al., 2012). These trematode eggs was identified through their size, shape, presence of opercula (black arrow) (Figure 1b) and a pattern of circles and tangles that can be seen within the egg of *Alaria* specie (red arrow) (Figure 1b) (SLOSS et al., 1999).

Lung parasites are recurrent in felines, especially *Aelurostrongylus abstrusus* (Railliet, 1898) (NORONHA et al., 2002; VIEIRA et al., 2008). This parasite has an indirect cycle, in which the definitive host becomes infected through eating slugs and snails or even paratenic hosts (birds, frogs, rodents and lizards) that are infected with third-stage larvae (TRAVERSA et al., 2008). The diagnosis is made by viewing the first stage larvae (L1) of *A. abstrusus* in feces or through tracheal lavage examination. The larvae of *A. abstrusus* were identified by the characteristic notched, shaped kinked tail and your laength (Figure 1c) (TRAVERSA et al., 2008; ELLIS et al., 2010). However, it needs to be noted that these larvae can easily be misidentified as *Angiostrongylus* sp. (Kamensky, 1905) larvae, which is reported commonly in wild canids and has also recently been reported for the first time in a wild feline (*Puma* (*Herpailurus*) *yagouaroundi*) (Geoffroy, 1803) (VIEIRA et al., 2013).

Presence of nematodes of the family Trichuridae have been reported in wild felines such as *Leopardus tigrinus* (Schreber, 1775) (BELDOMENICO et al., 2005), *Lycalopex gymnocercus* (Fischer, 1814) (NORONHA et al., 2002) and *Puma concolor* (Linnaeus, 1771) (VIEIRA et al., 2008). Among the species commonly described, *Trichuris campanula* (Von Linstow, 1879) and *T. serrata* (Von Linstow, 1879) (which are both intestinal parasites) and *Eucoleus aerophilus* (Creplin, 1839) (syn. *Capillaria aerophila*, a parasite of the respiratory tract), are noteworthy. Eggs of specimens of Trichuridae are generally characterized by being barrel-shaped with a protruding operculum at each pole (Figure 1d). This similarity can make it difficult to distinguish between different species, or even between genera, especially because of the similarity between the shapes of the eggs. Variation in the dimensions of *Trichuris trichiura* (Linnaeus, 1758) eggs was observed in one study, such that there were smaller eggs of approximately 57 x 26 µm and larger eggs reaching 78 x 30 µm (YOSHIKAWA et al., 1989). Such variations can make it difficult to correctly identify and parasitologically diagnose the parasites.

Among the main species of *Toxocara* sp. (Figure 1e) that are parasites of felines, *Toxocara cati* (or *T. mystax*) (Schrank, 1788) in *Leopardus colocolo*, *Leopardus geoffroyi* (D'orbigny & Gervais, 1844), *Leopardus tigrinus*, *Puma* (*H.*) *yagouaroundi* (GALLAS & SILVEIRA, 2011), *Panthera onca* (Linnaeus, 1758), *Puma concolor* (NORONHA et al., 2002) and *Leopardus pardalis* (Linnaeus, 1758) (VIEIRA et al., 2008) can be highlighted. The species *Toxocara canis* (Werner, 1782) has lower prevalence in felines, and canids are its main hosts. However, it has been reported parasitizing species like *Leopardus pardalis* and *Puma concolor* (NORONHA et al., 2002).

In Brazil, have been reported *Ancylostoma bidens* (Molin, 1861) in *Puma* (*H.*) *yagouaroundi* (NORONHA et al., 2002; VIEIRA et al., 2008); *Ancylostoma braziliense* (Gomes de Faria, 1910) in *Leopardus pardalis* (NORONHA et al., 2002; VIEIRA et al., 2008), *Puma* (*H.*) *yagouaroundi* (NORONHA et al., 2002) and *Puma concolor* (NORONHA et al., 2002; VIEIRA et al., 2008); *Ancylostoma caninum* (Ercolani, 1859) in *Lycalopex gymnocercus*, *Panthera onca* and *Puma* (*H.*) *yagouaroundi* (VIEIRA et al., 2008); and *Ancylostoma pluridentatum* (Alessandrini, 1905) in *Leopardus wiedii* (Schinz, 1821) (NORONHA et al., 2002; VIEIRA et al., 2008), *Panthera onca* (VIEIRA et al., 2008) and *Puma concolor* (NORONHA et al., 2002; VIEIRA et al., 2008). In addition, *Ancylostoma tubaeforme* (Zeder, 1800) in *Oncifelis geoffroyi* (*Leopardus*

Table 1. Measurements (in microns) on eggs and larvae of endoparasites in *Leopardus colocolo*.

Endoparasites	Range of measurements on dimensions (µm)		Average ± SD (µm)	
	Length	Width	Length	Width
Nematodes				
Aelurostrongylus abstrusus	246-317	11-17	291 ± 28	13 ± 2
Ancylostoma sp.	54-61	31-38	57 ± 2	34 ± 2
Toxocara sp.	49-70	45-56	61 ± 7	52 ± 4
Trichuridae	51-56	24-29	54 ± 1	27 ± 1
Trematodes				
Alaria sp.	110-122	54-58	116 ± 4	56 ± 1
Cestodes				
Spirometra sp.	51-58	31-36	55 ± 2	32 ± 2

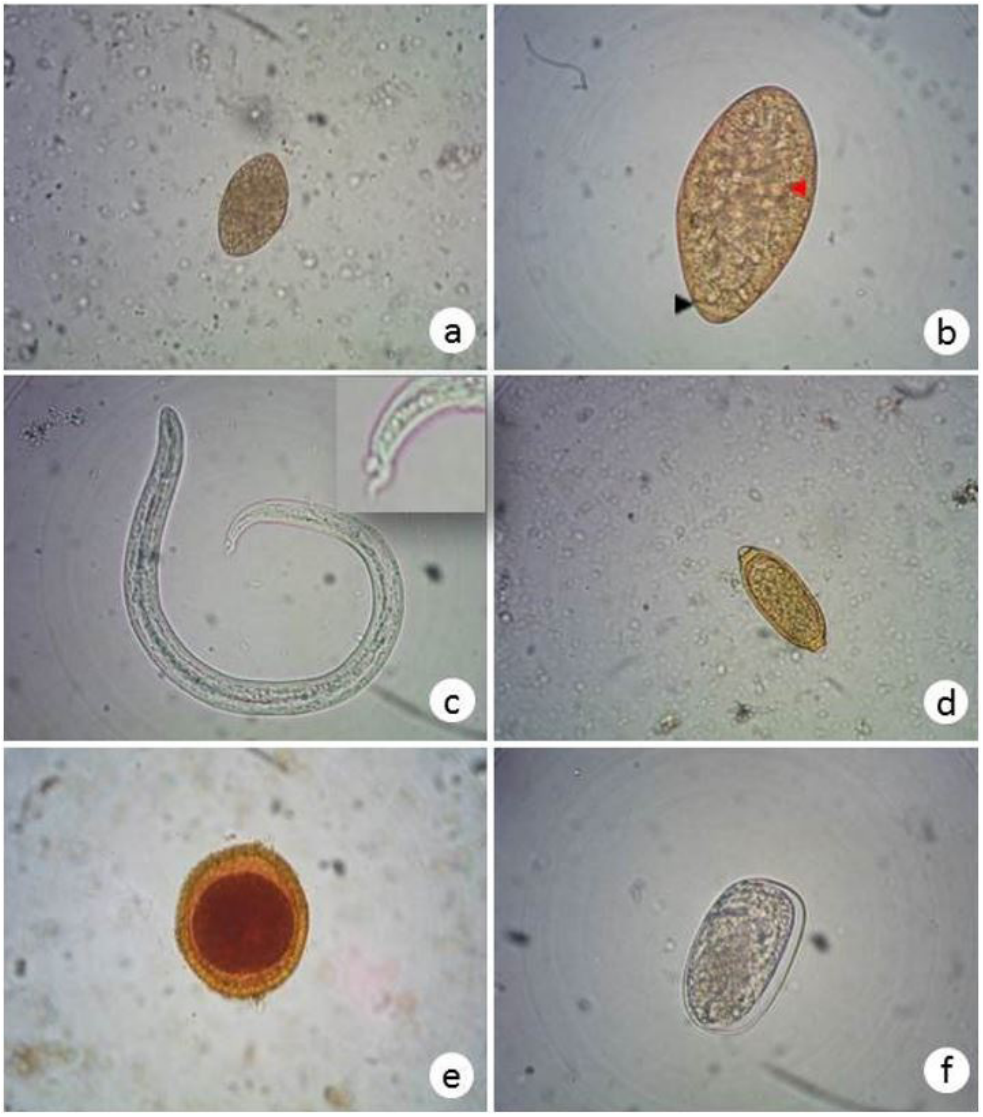

Figure 1. Parasites identified in fecal examinations on *Leopardus colocolo* (Rio Grande do Sul, BR). Magnification of 400X. (a) *Spirometra* sp.; (b) *Alaria* sp.; (c) *Aelurostrongylus abstrusus*; (d) Trichuridae; (e) *Toxocara* sp.; (f) *Ancylostoma* sp..

geoffroyi) has been reported in Argentina (BELDOMENICO et al., 2005). In the present study, *Ancylostoma* sp. (Figure 1f) in a *L. colocolo* is reported for the first time.

The diet of *L. colocolo* includes small mammals (particularly rodents of the genus *Ctenomys*), birds, reptiles (lizards and snakes) and insects (QUEIROLO et al., 2013). Thus, the low selectivity of the diet may contribute towards infection by multiple species of parasites, and this needs to be better studied. *L. colocolo* is not a direct subject of research in Brazil, but whenever possible, it is analyzed as part of the carnivorous mammal community. Thus, there is poor data on this species in Brazil and it has been better studied particularly in Argentina (QUEIROLO et al., 2013).

Furthermore, the consequences of parasitism can become significant, through detrimentally affecting the physiology, morphology and reproduction of animals. This influences not only single individuals, but also the regulation of populations or even the structure of ecological communities (MARCOGLIESE, 2005). In the case of vulnerable or endangered species, these factors can be considered to worsen the future of many species.

More than 45% of zoonotic pathogens have a carnivorous host in their life cycle (MURPHY et al., 2012). Thus, wild felines play a major role in maintaining and transmitting pathogens to other wild animals, domestic animals and even humans. Hence, studies on parasite fauna in wild animals are important for controlling and preventing parasitic diseases. We recorded the genus *Ancylostoma* parasitizing *L. colocolo* for the first time, reporting data and images in order to assist new comparative studies.

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