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Occurrence of gastrointestinal parasites in wild animals in State of Paraná, Brazil

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ABSTRACT

The objective of this study was to determine the prevalence and diversity of gastrointestinal parasites in fecal samples from wild birds and mammals from the State of Paraná. In total, 220 stool samples were sent to Parasitic Diseases Laboratory of the Federal University of Paraná during 13 months (Jan/2013-Jan/2014). A total of 52.7% (116/220) of the animals were positive for cysts, oocysts, eggs and/or trophozoites. In birds, the positivity rate was 37.9% (25/66) and mammals was 59.1% (91/154). Strongyloidea superfamily eggs were observed in 37.3% (82/220) of the samples, *Eimeria* spp. in 10% (22/220), and *Trichuris* spp. in 4.5% (10/220). The most frequent mammal species were llamas (*Lama glama*), and dromedaries (*Camelus bactrianus*) with infection rate of 70.1% (54/77) and 60.8% (14/23), respectively. In other hand, cockatiels (*Nymphicus hollandicus*) and ring necks (*Psittacula krameri*), were the most researched birds, with infection rate of 20% (40/50) and 100% (6/6), respectively. A high prevalence of gastrointestinal parasites was observed in most of wildlife animals. Further investigations should be conducted focusing on parasite control strategies and the conservation measurements for harmonizing the human-animal interaction on the long-term, reducing associated health risks.

Key words: cross-sectional study, environmental management, wild animals, zoonosis.

INTRODUCTION

The contact between wild animals and humans is increasing due to agricultural expansion, excessive deforestation, unplanned urbanization and the erroneously acquisition of these animals as "non-domestic pets" (Chomel et al. 2007). Even though, this proximity may impose environmental and health risk, because many species are host of exotic and zoonotic pathogens, the proximity can affect control strategies (Marietto-Gonçalves et al. 2009). Many of the major human infectious diseases, including some confined just in humans, occurred only after the agricultural expansion and the major contact with animals (Wolfe et al. 2007).

Wild animals, both in captivity or in the wild, are important in the epidemiology of many described diseases (Wobeser 2007). Several of these were newly discovered, and have been the focus of recent publications (Rhyan and Spraker 2010). Gastrointestinal parasites represent a major health problem and the symptoms resulting from these infections include: apathy, colic, diarrhea, malaise and weight loss. Studies are finding new

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informations about the ecology and biodiversity of endoparasites (Borg et al. 2014). However, due to the large number of animal species, there is still a lack of information about the various animals of the Brazilian and international fauna, and their parasitic population (Santos et al. 2008). Is a clear need for research with wildlife for discovery new pathogens, their life cycles and possibility of zoonotic transmission, only to find prevention and cure for such diseases (Jones et al. 2008).

Parasitological studies are fundamental to understand the life cycle of parasites and the potential transmissions to others animals and humans (Macpherson 2005). To assess and manage the effect of gastrointestinal parasites on any animal population dynamics, it is essential to evaluate their prevalence in wildlife populations (Bogale et al. 2014). Thus, the objective of this study was to determine the prevalence and the diversity of gastrointestinal parasites in fecal samples from wild birds and mammals in the State of Paraná, Brazil.

MATERIALS AND METHODS

This study was conducted in Paraná State, Brazil, between January 2013 and January 2014. Faecal birds samples (n = 66) were collected in these Paraná´s towns: Curitiba, Colombo, Cornélio Procópio, Faxinal do Sul, Laranjeiras do Sul, Londrina, Maringá, Pinhais, União da Vitória, Tijucas do Sul and Tunas do Paraná. Faecal mammals samples (n = 154) were collected in these Paraná´s towns: Bandeirantes, Curitiba, Colombo, Foz do Iguaçu, Guarapuava, Lapa, Pinhais and São José dos Pinhais.

The animals were from private owners, registered breeders, biological animal refuges or zoos located in the State of Paraná. The birds were isolated in cleaner cages and the samples were caught after defecation. To mammals, feces were collected directly from the rectum. In both cases, the samples were placed in plastic bags and stored in polystyrene foam containers with recyclable ice, maintaining temperature of about 4ºC within the container. The boxes were sent to Parasitic Diseases Laboratory of the Federal University of Paraná, UFPR, to be processed. All the samples were analyzed using three different methodologies, centrifuge-flotation, qualitative flotation and simple fecal sedimentation techniques using concentrated sucrose solution (d = 1,205 g/cm^3), as described method by Hoffmann (1987). Four slides of each sample were analyzed under an optical microscope at 10x with confirmation at 40x. The data were analyzed, to calculate the frequencies and prevalences, using the Epi-Info software, version 3.3.2 (CDC/WHO, Atlanta, USA, 2005).

RESULTS AND DISCUSSION

From the 220 samples analyzed; 77 Llamas (*Lama glama*), 50 Cockatiels (*Nymphicus hollandicus*), 23 One-Humped Camel (*Camelus bactrianus*), 13 Capybaras (*Hydrochaeris hydrochoeris*), 10 Capuchin Monkeys (*Cebus apella*), 8 American Bisons (*Bison bison*), 7 Alpacas (*Vicugna pacos*), 6 Ring-necks (*Psittacula krameri*), 4 Spider Monkeys (*Ateles geoffroyi*), 3 Dromedarys (*Camelus dromedarius*), 3 Eared Owls (*Asia flammeus*), 3 Giraffes (*Giraffa camelopardalis*), 3 Gray-Cheeked Parakeets (*Brotogeris pyrrhoptera*), 2 True Parrots (*Amazona aestiva*), 1 Anteater (*Tamandua tetradactyla*), 1 Billed Toucans (*Ramphastos vitellinus*), 1 Ocelot (*Leopardus tigrinus*), 1 Pampa Fox (*Pseudalopex gymnocercus*), 1 Puma (*Puma concolor*), 1 Raccoon (*Procyon lotor*), and 1 Rufous-Bellied Thrushe (*Turdus rufiventris*); 52.7% (116/220) were positive for gastrointestinal parasites.

In a study carried with wild canids of Serra do Cipó National Park, Brazil, revealed the presence of endoparasites eggs in 94.73% (36/38) of samples (Santos et al. 2012). Fecal samples from wild

mammals and birds at rehabilitation centers in the States of Mato Grosso do Sul and São Paulo have shown that parasite eggs/oocysts were found in 71% (27/38) of the samples (Holsback et al. 2013). In Porto Alegre, State of Rio Grande do Sul, 38.9% (14/36) of the mammals, from private owners, were positive (Carneiro et al. 2011). Thus, as can be seen the parasite prevalence may present a wide range according to animal species, environmental conditions and health management applied in enclosures (Getachew et al. 2010).

Parasites were found in 67.3% (74/110) of the Camelidae family (Table I). In this work, 70.1% (54/77) of the examined llamas were positive for any parasites, one-humped camel 60.8% (14/23), alpacas 71.4% (5/7) and dromedaries 33.3% (1/3). These results are similar to several recent studies conducted in different regions of the world

TABLE I
Parasites diagnosed in mammals samples of Paraná State, Brazil, 2013.

Common name (Scientific name)	Parasite found	Number of samples	Absolute Percentage (%)
Capybaras (*Hydrochaeris hydrochoeris*)	*Fasciola hepatica*	4	30.76
	Fasciola hepatica + *Capillaria* spp.	2	15.38
	Negative	7	53.86
American bisons (*Bison bison*)	*Toxocara* spp.	5	66.67
	Negative	3	33.33
Giraffes (*Giraffa camelopardalis*)	Negative	3	100.00
Anteater (*Tamandua tetradactyla*)	Negative	2	100.00
Ocelot (*Leopardus tigrinus*)	Negative	1	100.00
Pampas fox (*Pseudalopex gymnocercus*)	Negative	1	100.00
Puma (*Puma concolor*)	Negative	1	100.00
Racoon (*Procyon lotor*)	Negative	1	100.00
Capuchin monkeys (*Cebus apella*)	*Enterobius* spp.	4	40.00
	Negative	6	60.00
Spider monkeys (*Ateles geoffroyi*)	*Enterobius* spp.	2	50.00
	Negative	2	50.00
Llamas (*Lama glama*)	Strongyloidea superfamily	45	58.44
	Strongyloidea superfamily + *Trichuris* spp.	6	7.79
	Strongyloidea superfamily + *Nematodirus* spp.	2	2.60
	Moniezia spp.	1	1.30
	Negative	23	29.87
One-humped camel (*Camelus bactrianus*)	Strongyloidea superfamily	14	60.87
	Negative	9	39.13
Alpacas (*Vicugna pacos*)	Strongyloidea superfamily + *Trichuris* spp.	3	42.86
	Trichuris spp.	1	14.29
	Strongyloidea superfamily + *Nematodirus* spp.	1	14.29
	Negative	2	28.57
Dromedarys (*Camelus dromedarius*)	Strongyloidea superfamily	1	33.33
	Negative	2	66.67

(Chhabra and Gupta 2006, Mohammed et al. 2007, Kamani et al. 2008, Rabana et al. 2011, Bamaiyi and Kalu 2011, Correa et al. 2012, Ukashatu et al. 2012, Anvari-Tafti et al. 2013). The Strongyloidae superfamily eggs were found in 65.5% (72/110), *Trichuris* sp. in 9.1% (10/110), *Nematodirus* sp. in 2.7% (3/110), and *Moniezia* sp. in 0.9% (1/110). Duguma et al. (2014) observed higher prevalence of nematodes, the Strongyloidae eggs were primarily found, followed by *Monezia* sp. and *Trichuris* sp. Despite we reported the presence of many parasite species, the most common also were nematodes. Anvari-Tafti et al. (2013) obtained similar results, with 81.3% of infection rate in studied camels, and the Strongyloidea superfamily endoparasites were the most prevalent.

Although Camelids are known to be infected with various helminths (Mohammed et al. 2007) parasite infections cause few health problems, and quite often very parasitized animals are asymptomatic (Borji et al. 2010). This feature is probably due to the harsh conditions of the regions where the animals come from with unstable nutritional conditions (Bamaiyi and Kalu 2011) imposing a strong selection pressure for the co-evolution. Some camelids parasites are zoonotic, creating a health-risk condition to people who work with these animals (Rabana et al. 2011).

Wild birds showed positive diagnosis of parasitic infections in 37.9% (25/66) (Table II). In cockatiels, 20% (10/50) were positive, ring neck 100% (6/6), eared owls 100% (3/3), gray-cheeked parakeet 100% (3/3), 100% true parrot (2/2), billed

TABLE II
Parasites diagnosed in birds samples of Paraná State, Brazil, 2013.

Common name (Scientific name)	Parasite found	Number of samples	Absolute Percentage (%)
Cockatiels (*Nymphicus hollandicus*)	*Eimeria* spp.	4	8.00
	Eimeria spp. + Strongyloidea superfamily	3	6.00
	Strongyloidea superfamily	1	2.00
	Capillaria spp.	1	2.00
	Strongyloidea superfamily + *Capillaria* spp.	1	2.00
	Negative	40	80.00
Ring necks (*Psittacula krameri*)	*Eimeria* spp.	5	83.33
	Eimeria spp. + Cestoda class	1	16.67
	Negative	0	0.00
Eared owls (*Asia flammeus*)	*Eimeria* spp. + Strongyloidea superfamily + *Giardia* spp.	2	66.67
	Eimeria spp. + Strongyloidea superfamily	1	33.33
	Negative	0	0.00
Gray-cheeked parakeet	*Eimeria* spp. + Strongyloidea superfamily	2	66.67
	Eimeria spp.	1	33.33
	Negative	0	0.00
True parrots (*Amazona aestiva*)	*Eimeria* spp.	2	100.00
	Negative	0	0.00
Billed toucans (*Ramphastos vitellinus*)	*Eimeria* spp.	1	100.00
	Negative	0	0.00
Rufous-bellied thrushe (*Turdus rufiventris*)	Negative	1	100.00

toucans 100% (1/1) and rufous-bellied thrushe 0% (0/1). Carneiro et al. 2011 analyzed 36 samples of wild birds from private breeders and 38.89% of these (14/36) were positive. Freitas et al. 2002, in a survey conducted in Recife, Pernambuco, examined 685 samples, from two national parks, and in 46.7% (320/685) were detected the presence of endoparasite eggs. Marietto-Gonçalves et al. 2009, investigated the presence of gastrointestinal helminths in 207 captive birds attended at the Ornithopathology and Parasitic Diseases of Veterinary Hospital, São Paulo State University, campus Botucatu, 19.6% (41/207) were diagnosed as positive. To piciformes, psittaciformes and strigiformes, gastrointestinal intestinal parasites are a major cause of mortality (Valadão et al. 2006, Wobeser 2007). Anorexia, listlessness, mainly light-green diarrhea and ruffled feathers are the most common signs (Yoshino et al. 2009). Despite the many clinical cases, little has been documented about the epidemiology and the prevalence of endoparasites in caged and wild birds (González-Acuña et al. 2007).

Birds may be parasitized by a wide variety of endoparasites (Fedynich 2009) and in our study *Eimeria* sp. was found in 33.3% (22/66), Strongyloidea eggs in 15.2% (10/66), *Capillaria* sp. in 3% (2/66), *Giardia* sp. in 3% (2/66) and the Cestoda class egg in 15% (1/66). Endoarasites usually cause little distress to healthy individuals in the wild, but are among the most important sanitary problems in captive avians (Yoshino et al. 2009). The prevalence of parasite may also vary according to geographical area, habitat conditions and the avian species. These infections may be aggravated in situations such as high population density, stress and adaptation to new environment or prolonged periods in a confined space (Papini et al. 2012). In addition to the species found in this experiment, Costa et al. (2010) also listed *Balantidium coli* and *Cryptococcus neoformans* having a great importance in Brazil. It is emphasized that bird breeders, veterinarians and people who have contact with wild birds must take precautions when handling these animals, always wearing personal protection equipment (PPE) to avoid infection and possible zoonotic agents (Boseret et al. 2013).

The contamination rate in capuchin monkey was of 40% (4/10) and Spider monkeys of 50% (2/4) (Table I). *Enterobius* sp. were found in 42.6% (6/14) of the samples. In a study conducted in Ski Lanka, 52% (65/125) of the monkeys analyzed were contaminated by this endoparasite (Ekanayake et al. 2006). *Enterobius* sp. is the most important parasitic disease in non-human primates, because of its zoonotic transmission potential (Mbaya and Udendeye 2011). The infection has been described by Monteiro et al. (2003) and Holsback et al. (2013). Owing to 98% of genetic similarity between nonhuman primates and humans, there are more than 150 zoonosis diseases among species, many of them from parasite origin (Souza Júnior 2007). Thus, there is great significance in epidemiological studies to determine the parasite population of those animals, in order to prevent the spread of potentially harmful pathogens.

Parasites were found in 36.7% (11/30) of the other animals (Table I). In capybaras, positivity was observed in 46.2% (6/13) samples. All positive animals where infected with *Fasciola hepatica*. *Capillaria* sp. was found in 15.4% (2/13) of the samples. *F. hepatica* is endemic in the South of Brazil and may cause an important liver infection in humans. Capybaras and others wild mammals infected may act as reservoirs of this trematode (Timm 2010). El-Kouba et al. (2008) analyzed faeces from 33 capybaras from three public parks in the State of Paraná, Brazil, found a positivity index of 57.6% (19/33) and *Capillaria* sp. in 15% (5/33). Bellato et al. (2009), analysed the prevalence of *F. hepatica* in cattle and capybaras raised together, also in the South of Brazil. The results demonstrated *F. hepatica* prevalence of 18.12% and 8.96% to to cattle and capybaras, respectively. This emphasize

the importance of these animals as definitive hosts in the biological cycle of *F. hepatica.*

In american bison, 62.5% (5/8) of the samples were positive, but only had *Toxocara* sp. eggs. This large roundworm is commonly found in the small intestines of cattle living in tropical and subtropical regions (Woodbury et al. 2012). This parasite also has been described in Belgium (Goossens et al. 2007) and The Netherland (Swierstra et al. 1959). In stool samples of giraffes no contamination was observed 0% (0/3). In anteater feces 0% (0/2), ocelot 0% (0/1), pampas fox 0% (0/1), puma 0% (0/1) and raccoon 0% (0/1), also do not endoparasites eggs were found. However, it is known that these animals are susceptible to infection by important protozoan, e.g., *Cryptosporidium* spp. and *Giardia* spp. (Farret et al. 2008, Silva et al. 2008, Kodadkova et al. 2010, Fanfa et al. 2011, Forsyth et al. 2012).

The close relationship with domestic or wild animals may bring many benefits from physical to psychological to humans. However, to maintain harmonious coexistence, many precautions to animal and human health should be taken. Epidemiological studies are important to know the common diseases of various kinds or to discover new diseases (Bartosik and Górski 2010). Only examining the health of the animals, one can conduct effective measures aiming to prevent and control zoonoses (Wobeser 2007).

Based on parasitological profile we found a high prevalence of gastrointestinal endoparasites in birds and wild mammals in the State of Paraná. Epidemiological studies of parasite species occurring in wild hosts are important for planning control programs and preventing contamination to others animals, humans and the environment. Therefore, further researches are necessary to determine the rate of parasitic diseases and propose conservation measures for harmonizing the human-animal interaction.

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