Parasitological survey on birds at some selected Brazilian zoos

Levantamento parasitológico em aves de alguns zoológicos brasileiros

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Abstract

A parasitological survey was conducted at some zoos in the states of São Paulo and Paraná, Brazil, from 2009 to 2011. Several groups of birds were surveyed for fecal samples, but the most important was Psittacidae. Among the parasites, *Eimeria* (coccidian) and *Capillaria, Ascaridia* and *Heterakis* (nematodes) were observed in almost one third of the samples. Presence of a rich parasite fauna associated with captive birds seems to be an effect of captivity, since data on free-ranging birds indicate few or virtually no parasites at all. The discovery of new coccidian species during this survey reveals the need of more research on the subject as even well-known bird species have unknown parasites, but caution must be exercised in order to avoid descriptions of pseudoparasites.

Keywords: Ascaridia, Capillaria, Cracidae, Eimeria, Psittacidae.

Introduction

Most of the birds kept at zoos in Brazil belong to native species. Among these, psittacine species are the most common and diverse, but Cracidae, Ramphastidae, Passeriformes and ratites are also present. Little is known about their parasites and deaths are fairly common in captivity, some probably due to high parasite loads. For instance, the infection with *Sarcocystis falcatula* may lead psittacids to acute fatal disease (CLUBB & FRENKEL, 1992). The most common gut parasites of birds are nematodes (mainly ascarids and capillariids) and protozoa (usually coccidians). In a survey conducted by Cordón et al. (2009) on birds (mostly psittacids) at the Almuñécar ornithological garden in Spain, roughly half of the samples were positive for some type of parasite. *Capillaria* sp. was the most prevalent nematode, but *Ascaridia* sp. and *Heterakis* sp. were found as well. Among protozoa, the most prevalent were *Blastocystis* sp. and coccidians (mostly *Eimeria* sp. and unidentified oocysts). Hemoparasites were also found, namely *Plasmodium* and *Haemoproteus*. Patel et al. (2000) also found parasite prevalence of 50% among birds at the Gujarat zoo, India, and the most common parasitic genera were *Capillaria, Ascaridia* and *Eimeria*.

In Brazil, Freitas et al. (2002) found overall prevalence of 46.7% among Psittacidae, Cracidae, Phasianidae, Columbidae and other avian groups in captivity. The most common parasitic genera were again *Capillaria* and *Ascaridia*, along with *Strongyloides*, *coccidians* and others.

The aim of this study was to obtain data on prevalence and diversity of intestinal parasites from fecal samples of captive birds, mostly psittacids, kept in some selected Brazilian zoos.

Materials and Methods

Fecal samples (n = 170) from individuals or pairs of the same species were collected by fresh deposit on cage floor or dry paper, when possible, from 2009 to 2010 from several species of birds kept at some Brazilian zoos. These species were mostly Psittacidae.
(85.3% of the samples) along with Cracidae (4.1%), Cacatuidae (1.8%) and others (8.8%): Cathartidae, Ramphastidae, Psophidae, Struthioniformes, Icteridae and Musophagidae. The samples were stored in 2.5% potassium dichromate solution (K₂Cr₂O₇). These samples were obtained from zoos in Americana, Bosque dos Jequitibás (Campinas), Itatiba and Guarulhos, which are all in the state of São Paulo; and from the Bird Park of Foz do Iguacu, Paraná.

In the laboratory, the fecal material was filtered through a 154 μm sieve using clean water and was concentrated by means of centrifugation at 1,200 g for 5 min. Nematode eggs and coccidian oocysts were obtained by flotation in sucrose solution (d = 1.2 g/mL) using the Sheather method (SHEATHER, 1923). Unsporulated oocysts obtained in this way were allowed to sporulate on a dish containing 2.5% potassium dichromate solution at room temperature for a few days.

The oocysts and nematode eggs were photographed under a Zeiss® light photomicroscope and then measured using the Image Manager IM50© software (Leica IM50 4.0 Imagic Bildverarbeitung AG; Leica Microsystems Imaging Solutions Ltd., Cambridge, U.K.).

**Ethics**

Although not involving animal experimentation, all procedures performed through this project were subject to and approved by our Institution’s Ethics Committee for Animal Use (CEUA, UNICAMP) under number 1923-1.

**Results**

Despite low prevalence of coccidians (3.5%), nematodes were present in every zoo surveyed, with prevalence of 26.5%. The overall prevalence of samples testing positive for nematode eggs or coccidian oocysts was 29.4% (50 out of 170).

**Coccidia**

Coccidians, mostly *Eimeria*, were infrequently observed (6 out of 170 samples), although present in samples from Psittacidae, Cracidae and Ramphastidae. Some new eimerian species were described as part of this project: *E. abmitu* (Figure 1), host: *Mitu tuberosum* (HOFSTATTER & GUARALDO, 2011a) and

**Figures 1-4.** 1. *Eimeria abmitu* from *Mitu tuberosum*; 2. *Eimeria aestivae* from *Amazona aestiva*; 3. *Eimeria forresteri* from *Ramphastos toco*; 4. Unidentified polysporocystic oocyst from *Cacatua alba*, probably an adeleid pseudoparasite from insects.
E. amazonae (Figure 2), host: Amazona aestiva (HOFSTATTER & GUARALDO, 2011b).

Eimeria forresteri (UPTON et al., 1984) (Figure 3) was identified in samples from Ramphastos toco. An unidentified poly-sporocystic coccidian was observed in Cacatua alba (Figure 4), probably a pseudoparasite from insects.

**Nematodes**

Nematodes were much more frequent than protozoa (45 out of 170 samples). Among these, *Capillaria* sp. (or *Ornithocapillaria* sp.) was the most abundant in psittacid samples. Its presence was confirmed in every zoo. *Capillaria plagiatica* (FREITAS et al., 1959) was obtained from the gut of a dead Hyacinth Macaw individual. Furthermore, *Ascaridia* sp., *Heterakis* sp. and an unidentified nematode were also present in samples from psittacids. Unidentified nematode eggs were also observed in samples from ostriches (*Struthio camelus*) (Table 1).

**Discussion**

In our study, almost one-third of the samples were positive for at least one parasite. This result was similar to the findings from other surveys in zoos, and this prevalence was higher than among free-ranging birds. The results of Freitas et al. (2002) regarding captive psittacids in northeastern Brazil were very similar to ours, thus indicating that the same parasitic agents are associated with Brazilian psittacids all over the country and elsewhere too, since data from studies in other countries also bear similarities to ours (CORDÓN et al., 2009; PATEL et al., 2000). Thus, the most important parasites of parrots in captivity are nematodes of the genera *Capillaria* and *Ascaridia*.

Authors working with free-ranging birds have failed to detect any intestinal parasites associated with psittacine birds (GILARDI et al., 1995; STONE et al., 2005; MASELLO et al., 2006; ALLGAYER et al., 2009). In contrast, the data obtained from birds in zoos show high prevalence of parasites (PATEL et al., 2000; CORDÓN et al., 2009), thus indicating that captivity may facilitate transmission between individuals and also raise the parasitic load in the hosts. There seems to be a trend for captive birds to have bigger loads of associated parasitic fauna than those of free-ranging birds.

It seems that high prevalence and heavy parasitic load are not natural among those birds, which may threaten the health of birds held in captivity and even cause deaths, either due to the parasites themselves or due to secondary infections derived from their presence. Several suspicious deaths of individuals occurred in these zoos before and during this study, which may be attributed to complications caused by heavy parasite loads. Reasonable knowledge of the associated parasite fauna would enable more efficient disease control, in order to prevent the loss of specimens through easily avoidable causes. Clubb & Frenkel (1992) have controlled outbreaks of fatal *Sarcocystis* infection in psittacine birds by cockroach control in and around the facility where the birds were held.

The description of new coccidian species during this survey reveals the need of more research on the subject as even well-known bird species have unknown parasites. Most surveys are superficial in identification of parasites and it seems to be the case, several new species are frequently overlooked as in Freitas et al. (2002), Patel et al. (2000) and Cordón et al. (2009). But we need to exercise caution in order to avoid erroneous descriptions.

**Table 1.** Nematodes, their hosts and zoos surveyed from 2009 to 2010 in the State São Paulo and Paraná, Brazil.

| Nematodes                        | Hosts                                      | Zoos                  |
|----------------------------------|--------------------------------------------|-----------------------|
| Capillaria sp. (Figure 5)        | Ana ararauna, A. macao                     | Bosque dos Jequitibás |
|                                  | Amazona aestiva, A. amazonica              | Zoológico de Americana|
|                                  | Amazona aestiva                            |                       |
|                                  | Anodorhynchus hyacinthinus                 |                       |
|                                  | Ana ararauna, A. rubrogenis, A. macao       |                       |
| Capillaria sp. (Figure 5)        | Ana chloropterus, Ana macao, Ana ararauna    | Zooparque de Itatiba  |
|                                  | Amazona aestiva, A. brasiiliensis, A. farinosa, A. ochrocephala |                       |
|                                  | Pionus menstruus                            |                       |
|                                  | Amazona vinacea                             |                       |
|                                  | Pionus maximiliani                          |                       |
| Ascaridia sp. (Figure 6)         | Ana macao                                   | Parque das Aves (Bird Park) Foz do Iguaçu |
|                                  | Amazona amazonica                           |                       |
|                                  | Amazona aestiva, A. ochrocephala            |                       |
| Heterakis sp. (Figure 7)         | Amazona aestiva, A. ochrocephala            |                       |
| Unidentified psittacid nematode  | Amazona aestiva                            |                       |
| Unidentified ostrich nematode    | Struthio camelus                            |                       |
of new species, as pseudoparasites may be present in the samples (BERTO et al., 2010). The polysporocystic oocysts found in our analysis probably represents an adeleid pseudoparasite from insects.

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