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Author(s): P. G. Hofstatter and A. M. A. Guaraldo

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A NEW EIMERIAN SPECIES (APICOMPLEXA: EIMERIIDAE) FROM THE BLUE-FRONTED AMAZON PARROT *AMAZONA AESTIVA* L. (AVES: PSITTACIDAE) IN BRAZIL

P. G. Hofstatter and A. M. A. Guaraldo*

Departamento de Biologia Animal, Instituto de Biologia, Universidade Estadual de Campinas (UNICAMP), CP 6109, R. Monteiro Lobato 255, CEP 13083-862 Campinas, São Paulo, Brazil. e-mail: guaraldo@unicamp.br

ABSTRACT: The Neotropical psittacine species *Amazona aestiva*, commonly known as the blue-fronted Amazon, is one of the most common and best-known psittacine birds kept as a pet worldwide. However, very little is known about the diseases or parasites of these birds. In this study, we describe a new species, *Eimeria aestivae*, associated with these parrots. The new species is characterized by: ovoid smooth oocysts ($n = 60$), $36.8 (33.2\text{--}41.5) \times 23.7 (21.7\text{--}25.7) \mu\text{m}$, length/width ratio = 1.55; polar granule present; ellipsoidal sporocysts ($n = 25$), $19.8 (17.5\text{--}21.6) \times 9.3 (8.3\text{--}9.9) \mu\text{m}$; Stieda, sub-Stieda body, and sporocyst residuum present. Sporozoites ($n = 20$), 2 per sporocyst, elongate and curved, $17.6 (15.8\text{--}19.2) \times 3.8 (3.2\text{--}4.8) \mu\text{m}$; each with 2 refractile bodies. The oocysts of the other 2 eimerian species described for *Amazona* are larger than those of the presented species, but they all seem to be closely related because of some similarities among them.

The Neotropical psittacine species *Amazona aestiva* L., the blue-fronted Amazon parrot, occurs in Brazil, Bolivia, Paraguay, and Argentina, with 2 subspecies currently recognized, *Amazona aestiva aestiva* and *Amazona aestiva xanthopteryx*. These birds have always attracted much attention because of their beauty and ability to imitate human speech and sounds from domestic animals. These characteristics have resulted in their over-exploitation in nature and extensive trade worldwide. From 1980 to 1992, approximately 406,000 birds were “legally” exported from Argentina to Europe and the United States (Juniper and Parr, 1998). The intense exploitation of these birds by legal and illegal dealers is increased by the difficulty in breeding this species in captivity (Beissinger and Snyder, 1992).

In this report, we describe a new species of *Eimeria* from blue-fronted Amazon parrots. This parasite was discovered during a parasitological survey of fecal material from several parrot species maintained in zoos in the State of São Paulo, southeastern Brazil.

MATERIAL AND METHODS

Fecal samples were collected in August 2009 from several specimens of *A. a. aestiva* kept in the municipal zoo at Americana and were stored in 2.5% potassium dichromate solution ($\text{K}_2\text{Cr}_2\text{O}_7$). In the laboratory, the fecal material was filtered through a 154- μm sieve with distilled water and concentrated by centrifugation at 1,200 g for 5 min. Parasite oocysts were obtained by flotation in sucrose solution ($d = 1.2 \text{ g/ml}$) using the Sheather (1923) method. 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, sporocysts, and sporozoites were photographed with a Zeiss light photomicroscope and then measured with Image Manager IM50[®] software (Leica IM50 4.0 Imagic Bildverarbeitung AG, Leica Microsystems Imaging Solutions Ltd., Cambridge, U.K.). Measurements were taken from 60 oocysts; sizes are expressed in μm .

Williams et al. (2010) demonstrated that a 2.5% (w/v) aqueous solution of potassium dichromate at 4 C can preserve the morphology and DNA of eimerian oocysts from chickens for at least 25 yr, so we also chose to retain the oocysts of the present material in potassium dichromate rather than employing alcohol or formalin as a preservative.

DESCRIPTION

Eimeria aestivae sp. n.
(Figs. 1, 2)

Diagnosis: Oocysts ($n = 60$) ovoid, bilayered, $36.8 (33.2\text{--}41.5) \times 23.7 (21.7\text{--}25.7)$, length/width ratio = 1.55; outer layer: smooth and colorless.

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*To whom correspondence should be addressed.

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Micropyle and oocyst residuum absent; polar granule present (1—rounded). Sporocysts ($n = 25$) ellipsoid, $19.8 (17.5\text{--}21.6) \times 9.3 (8.3\text{--}9.9)$, Stieda body and sub-Stieda body present; sporocyst residuum present (globular, granular). Sporozoites ($n = 20$), 2 per sporocyst, elongate and curved, $17.6 (15.8\text{--}19.2) \times 3.8 (3.2\text{--}4.8)$; each with 2 refractile bodies.

Taxonomic summary

Type host: *Amazona aestiva aestiva* Linnaeus, 1758.

Type locality: Americana, São Paulo, Brazil ($22^\circ 45' 11''\text{S}$, $47^\circ 21' 10''\text{W}$).

Type material: Photosyntypes (see Duszynski, 1999) and type material kept in 2.5% (w/v) aqueous solution of potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) with oocysts were deposited in the Museu de Zoologia, Universidade Estadual de Campinas (ZUEC), São Paulo, Brazil, under the number: ZUEC05.

Remarks

Infected birds showed no apparent symptoms of disease, such as diarrhea, prostration, or lack of activity. To date, only 2 species of *Eimeria* have been described from Amazon parrots, *Eimeria amazonae* Hofstatter and Kawazoe, 2011 and *Eimeria ochrocephalae* Hofstatter and Kawazoe, 2011. The differences between the new species and the other 2 are shown in Table 1.

DISCUSSION

Another eimerian species, described from *Aratinga canicularis*, *Eimeria aratinga* (Upton and Wright, 1994), seems very similar to the new species, but it is known that avian coccidia are strictly host-specific (Vetterling, 1976). Moreover, *A. canicularis* and *A. aestiva* have distinct distribution areas, with the first occurring along the Pacific coast of Central America and the former occurring through central Brazil, south of the Amazon forest (del

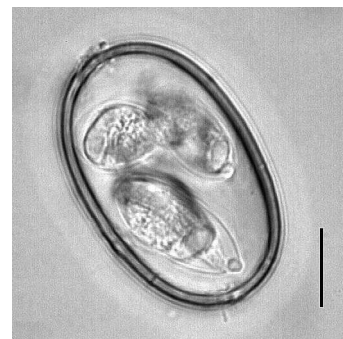


FIGURE 1. Photomicrograph of *Eimeria aestivae* n. sp., sporulated oocyst. Scale bar = 10 μm .

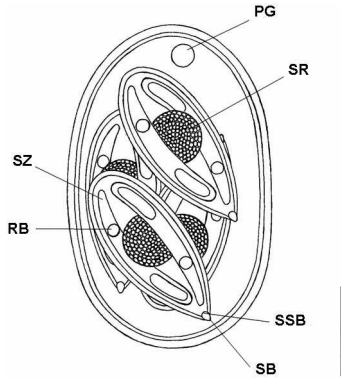


FIGURE 2. Line drawing of a sporulated oocyst of *Eimeria aestivae* n. sp. Abbreviations: PG—polar granule; SB—Stieda body; SSB—sub-Stieda body; SR—sporocyst residuum; SZ—sporozoite; RB—refractile body. Scale bar = 10 μ m.

Hoyo et al., 1997; Juniper and Parr, 1998). Any resemblances between the 2 species may be due to the close evolutionary relationship between the hosts, both of which belong to the new world psittacine tribe Arini (Wright et al., 2008). Rooney et al. (2001) observed the presence of coccidia in feces of *Amazona autumnalis*, although they did not present any descriptions of the parasite.

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TABLE I. *Eimeria* species formally described from *Amazona*.

Species	Type hosts	Oocyst		Author
		Length (μ m)	Width (μ m)	
<i>Eimeria amazonae</i>	<i>Amazona ochrocephala</i>	48.9	36.2	Hofstatter and Kawazoe (2011)
<i>Eimeria ochrocephalae</i>	<i>Amazona ochrocephala</i>	43.8	27.7	Hofstatter and Kawazoe (2011)
<i>Eimeria aestivae</i> n. sp.	<i>Amazona aestiva</i>	36.8	23.7	This study