

**Trafficking in wild passerines, reintroduction and coccidial transmission: *Isoospora trincaferri* Berto, Balthazar, Flausino, Lopes, 2008 (Apicomplexa: Eimeriidae) from the buff-throated saltator *Saltator maximus* Müller (Passeriformes: Cardinalidae)**

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Submetido em 01.10.2013  
Aceito em 17.10.2013

**Abstract** Lopes BB, Balthazar LMC, Coelho CD, Berto BP, Neves DM, Lopes CWG. 2013. **Trafficking in wild passerines, reintroduction and coccidial transmission: *Isoospora trincaferri* Berto, Balthazar, Flausino, Lopes, 2008 (Apicomplexa: Eimeriidae) from the buff-throated saltator *Saltator maximus* Müller (Passeriformes: Cardinalidae).** [Tráfico de pássaros silvestres, reintrodução e transmissão de coccídios: *Isoospora trincaferri* Berto, Balthazar, Flausino, Lopes, 2008 (Apicomplexa: Eimeriidae) do temperavola *Saltator maximus* Müller (Passeriformes: Cardinalidae).] *Coccidia* 1, 6-9. Departamento de Biologia Animal, Instituto de Biologia, Universidade Federal Rural do Rio de Janeiro. BR-465 km 7, 23897-970 Seropédica, RJ, Brasil. E-mail: bertobp@ufrj.br

The current study reports buff-throated saltator *Saltator maximus* Müller parasitized by *Isoospora trincaferri* Berto, Balthazar, Flausino, Lopes, 2008. This coccidium was originally described parasitizing caged green-winged saltators *Saltator similis* D'Orbigny, Lafresnaye, possibly captured at some moment from the wild. Its oocysts are sub-spherical to ellipsoidal, 25.0 × 24.0 µm, with a smooth, bilayered wall. Micropyle and oocyst residuum are absent, but one or two polar granules are present. The sporocysts are ovoidal, 18.4 × 11.4 µm. The Stieda body is bubble-shaped and the substieda body is large and rounded. The sporocyst residuum is composed of scattered or clustered granules. The sporozoites are vermiform, with refractile bodies at both ends. This finding evidenced the role of the traffic of wild passerines (biopiracy) and reintroduction by centers screening of wild ani-

mals on the coccidial transmission, once that *I. trincaferri* oocysts were recovered from buff-throated saltators *S. maximus* kept under quarantine in preparation for reintroduction.

**Keywords** Morphology, sporulated oocysts, diagnostic, Coccidia, biopiracy, CETAS.

**Resumo** O presente estudo relata temperavolas *Saltator maximus* Müller parasitados por *Isoospora trincaferri* Berto, Balthazar,

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Flausino, Lopes, 2008. Este coccídio foi originalmente descrito parasitando trinca-ferros *Saltator similis* d'Orbigny, Lafresnaye engaiolados e possivelmente capturados em algum momento do ambiente silvestre. Seus oocistos são subesféricos a elipsóides,  $25,0 \times 24,0 \mu\text{m}$ , com parede de camada dupla e lisa. Micrópila e resíduo do oocisto estão ausentes, mas um ou dois grânulos polares estão presentes. Os esporocistos são ovóides,  $18,4 \times 11,4 \mu\text{m}$ . O corpo de Stieda é em forma de bolha e o corpo de substieda é grande e arredondado. O resíduo de esporocisto é composto de grânulos dispersos ou agrupados. Os esporozoítos são vermiformes, com corpos refractáveis em ambas as extremidades. Este relato evidencia o papel do tráfico de animais silvestres (biopirataria) e reintrodução pelos centros de triagem de animais silvestres na transmissão de coccídios, uma vez que oocistos de *I. trincaferri* foram recuperados de tempera-violas *S. maximus* mantidos sob quarentena, em preparação para a reintrodução.

**Palavras-chave** Morfologia, oocistos esporulados, diagnóstico, Coccidia, biopirataria, CETAS.

## Introduction

The buff-throated saltator *Saltator maximus* Müller is a New World passerine bird of the family Cardinalidae. It has a large geographic range in South and Central Americas. This species has always been of great interest to people due to its beauty and vocal repertoire and, for these reasons, has been illegally captured and traded in Brazil (Sick 1997, CBRO 2011, IUCN 2013).

Recently, some coccidian parasites were reported from green-winged saltators *Saltator similis* D'Orbigny, Lafresnaye: (1) *Isospora vanriperorum* Levine, 1982; (2) *Isospora saltatori* Berto, Balthazar, Flausino, Lopes, 2008; (3) *Isospora trincaferri* Berto, Balthazar, Flausino, Lopes, 2008; and (4) *Isospora similisi* Coelho, Berto, Neves, Oliveira, Flausino, Lopes, 2013 (Lopes et al. 2007, Berto et al. 2008, Coelho et al. 2013).

The current study reports buff-throated saltator *S. maximus* parasitized by *I. trincaferri*. These saltators were held in CETAS (Centro de Triagem de Animais Silvestres – Center

for Triage of Wild Animals), IBAMA (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis – Brazilian Institute of Environment and Natural Resources), MMA (Ministério do Meio Ambiente – Ministry of Environment) for rehabilitation and reintroduction into the wild.

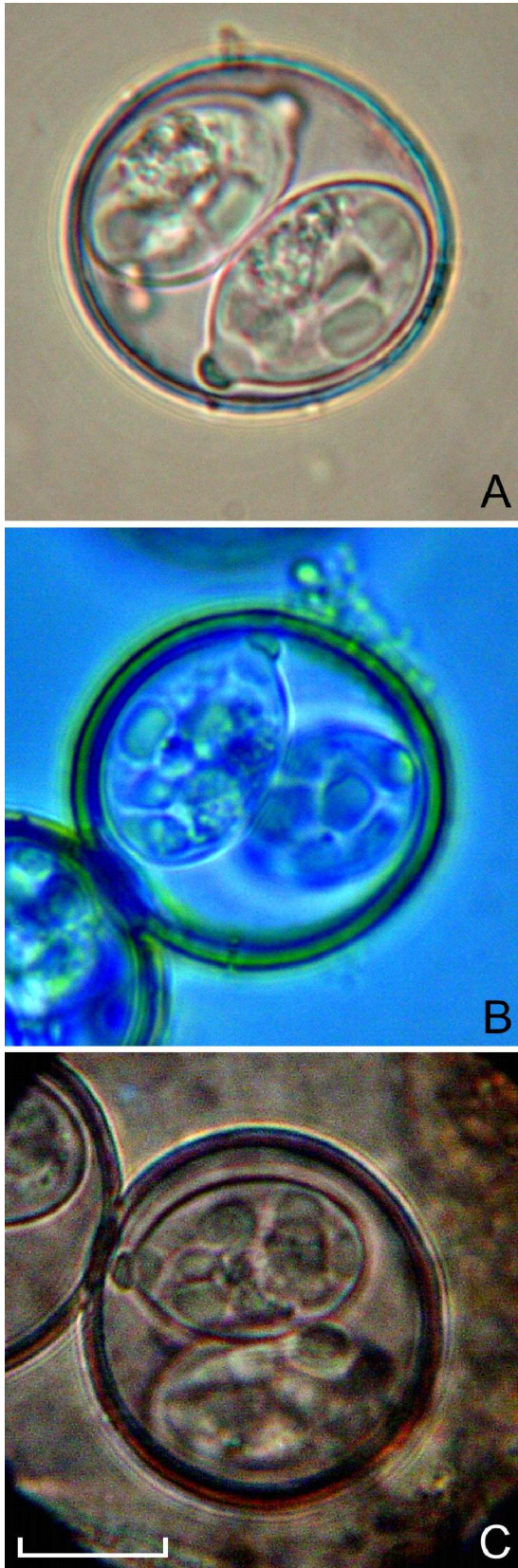
## Materials and methods

Fecal samples were collected from three buff-throated saltators held in individual cages at the CETAS, IBAMA, MMA facility, located at the Municipality of Seropédica in the State of Rio de Janeiro, Brazil. The risk of contamination from the previous birds was minimum because the samples were collected from newly arrived birds in CETAS. Feces were collected immediately after defecation and placed in plastic vials containing 2.5% potassium dichromate solution ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) 1:6 (v/v). Samples were transported to the Laboratório de Coccídios e Coccidioses located at the Universidade Federal Rural do Rio de Janeiro (UFRRJ). Samples were placed in a thin layer (~5 mm) of  $\text{K}_2\text{Cr}_2\text{O}_7$  2.5% solution in Petri dishes, and incubated at 23–28°C for 10 days or until 70% of oocysts were sporulated. Oocysts were recovered by flotation in Sheather's sugar solution (S.G. 1.20) and microscopically examined using the technique described by Duszynski & Wilber (1997). Morphological observations, photomicrographs and measurements, given in micrometers, were made using a Olympus BX binocular microscope coupled to a digital camera Eurocam 5.0. Size ranges are in parentheses following the means.

## Results and discussion

Three buff-throated saltators were examined; being that one was positive for coccidia. Initially, the oocysts were nonsporulated, while 70% sporulated by day five.

The identified oocysts (Fig. 1a-b) were sub-spherical to ellipsoidal,  $25.0 (24-27) \times 24.0 (23-26) \mu\text{m}$ , with shape-index of 1.04 (1.0-1.1). Oocyst wall bi-layered and smooth,  $1.2 \mu\text{m}$ . Micropyle and oocyst residuum are absent, but one or two polar granules are present. Sporocysts ovoidal,  $18.4 (17-20) \times 11.4 (10-12) \mu\text{m}$ , with shape-index of with



**Fig. 1.** Sporulated oocysts of *Isospora trincasferri* recovered from buff-throated saltators *Saltator maximus* (a, b) and green-winged saltators *Saltator similis* (c) (Berto et al. 2008). Scale-bar: 10  $\mu$ m.

1.62 (1.6-1.7). Stieda body bubble-shaped, 1.5 high  $\times$  2.5 wide. Substieda body large and rounded, 2.5 high  $\times$  3.5 wide. Parastieda body absent. Sporocyst residuum composed of scattered or clustered granules. Sporozoites vermiform, with refractile bodies at both ends. These oocysts had the same characteristic features of the oocysts of *I. trincasferri* described from *S. similis* (Table 1, Fig. 1)

The oocysts of *I. trincasferri* from the original description were recovered from green-winged saltators *S. similis* possibly captured at some moment from the wild. These saltators were caged in a breeding in the mountainous region of Rio de Janeiro. In this sense, this finding evidenced the role of the traffic of wild passerines (biopiracy) and reintroduction by centers screening of wild animals on the coccidial transmission. Berto & Lopes (2013) claim that the trade of birds should enhance the transmission of its coccidia among species of the same family. Besides, the centers screening of wild animals become more important since the failure to identify a parasite of a bird seized, followed by their release in the wild, different from its original, would provide the introduction of a new parasite to susceptible hosts.

Finally, in the current study, a new host for *I. trincasferri* is recorded, once that feature-similar oocysts were recovered from buff-throated saltators *S. maximus* kept under quarantine in preparation for reintroduction.

#### Acknowledgements

This study was supported by grants from the Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ) to B. P. Berto (E-26/110.987/2013). We are thankful to CETAS/IBAMA (Centro de Triagem de Animais Silvestres - Center for Triage of Wild Animals)/Ministério do Meio Ambiente at the municipality of Seropédica, who enabled our collect samples from birds held to rehabilitation and reintroduction into the wild.

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**Table 1.** Comparative morphology of *Isospora trincaferri* recovered from *Saltator similis* and *Saltator maximus*.

| Coccidia                    | Hosts                   | References          | Oocysts                      |                             |                |                  | Sporocysts    |         |                             |                           | Residuum                        |                |
|-----------------------------|-------------------------|---------------------|------------------------------|-----------------------------|----------------|------------------|---------------|---------|-----------------------------|---------------------------|---------------------------------|----------------|
|                             |                         |                     | Shape                        | Measurements (µm)           | Shape index    | Wall             | Polar granule | Shape   | Measurements (µm)           | Stieda body               |                                 | Substieda body |
| <i>Isospora trincaferri</i> | <i>Saltator similis</i> | Berto et al. (2008) | sub-spherical to ellipsoidal | 26.2 × 23.6 (24-29 × 22-25) | 1.1 (1.0-1.2)  | bi-layered, ~1.2 | present       | ovoidal | 17.5 × 11.5 (17-18 × 10-13) | bubble-shaped, ~1.7 x 2.7 | large and prominent, ~2.8 x 4.2 | diffuse        |
|                             | <i>Saltator maximus</i> | current work        | sub-spherical to ellipsoidal | 25.0 × 24.0 (24-27 × 23-26) | 1.04 (1.0-1.1) | bi-layered, ~1.2 | present       | ovoidal | 18.4 × 11.4 (17-20 × 10-12) | bubble-shaped, ~1.5 x 2.5 | large and rounded, ~2.5 x 3.5   | diffuse        |

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