

**A DIAGNOSTIC TOOL TO IDENTIFY SPECIES OF THE GENUS  
*Isospora* SCHNEIDER, 1881 (APICOMPLEXA: EIMERIIDAE)  
BASED ON SPORULATED OOCYSTS FROM THAUPIDAE  
FAMILY (AVES: PASSERIFORMES): A DICHOTOMOUS KEY\***

**UMA FERRAMENTA DE DIAGNÓSTICO PARA IDENTIFICAR  
ESPÉCIES DE *Isospora* SCHNEIDER, 1881 (APICOMPLEXA:  
EIMERIIDAE) DA FAMÍLIA THAUPIDAE (AVES: PASSERIFORMES)  
COM BASE EM OOCISTOS ESPORULADOS:  
UMA CHAVE DICOTÔMICA**

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**ABSTRACT.** Berto B.P., Luz, H.B., Ferreira I., Flausino W. & Lopes C.W.G. A diagnostic tool to identify species of the genus *Isospora* Schneider, 1881 (Apicomplexa: Eimeriidae) based on sporulated oocysts from Thraupidae family (Aves: Passeriformes): a dichotomous key [Uma ferramenta de diagnóstico para identificar espécies de *Isospora* Schneider, 1881 (Apicomplexa: Eimeriidae) da família Thraupidae (Aves: Passeriformes): uma chave dicotômica]. *Revista Brasileira de Medicina Veterinária*, 32(3):182-186, 2010. Laboratório de Coccídios e Coccidioses, Departamento de Parasitologia Animal, Instituto de Veterinária, Universidade Federal Rural do Rio de Janeiro, BR 465 km 7, Seropédica, RJ 23890-000, Brasil. E-mail: bertobp@ufrj.br

The birds of the Thraupidae family, similar to other passerine birds can be infected by coccidia, and the genus *Isospora* can be considered the most relevant. *Isospora thraupis*, *I. andesensis*, *I. irisidornisi*, *I. tiesanguui*, *I. marambaiensis*, *I. sepetibensis*, *I. cadimi*, *I. navarroi*, *I. ramphoceli*, *I. sanhaci*, *I. sayacae* and *I. silvasouzai* were described from thraupids of South American and considering that these birds are sympatric hosts of other birds that inhabit South, North and Central Americas, it is concluded that these parasites should be widely dispersed in the America Continent. In this sense, this paper proposes to provide scientific background and a dichotomous key to assist in the identification of sporulated oocysts of the genus *Isospora* from passerine birds of the Thraupidae family.

**KEY WORDS.** Sporulated oocysts, dichotomous key, Passeriformes, South America.

**RESUMO.** As aves da família Thraupidae, de forma semelhante a outras aves da ordem Passeriformes, podem ser parasitadas por coccídios, sendo que o gênero

*Isospora* pode ser considerado o mais relevante. *Isospora thraupis*, *I. andesensis*, *I. irisidornisi*, *I. tiesanguui*, *I. marambaiensis*, *I. sepetibensis*, *I. cadimi*, *I. navarroi*,

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*I. ramphoceli*, *I. sanhaci*, *I. sayacae* e *I. silvasouzai* foram descritas de traupídeos sul-americanos e considerando que estas aves hospedeiras são simpátricas à outras aves que habitam às Américas do Sul, do Norte e Central, conclui-se que estes parasitos devem dispersar-se amplamente pelo Américas. Neste sentido, este trabalho propõe fornecer embasamento científico e uma chave dicotômica que auxilie na identificação dos oocistos esporulados de coccídios do gênero *Isoospora* parasitos de aves Passeriformes da família Thraupidae.

**PALAVRAS-CHAVE:** Oocistos, chave dicotômica, Passeriformes, América do Sul.

## INTRODUCTION

The Thraupidae family belongs to the order Passeriformes and definitely contributes to the high concept of beauty that has the Brazilian avifauna. Among the thraupids with intense and varied colorful, stand out the tanagers of the genus *Tangara* Brisson, 1760, the honeycreepers of the genus *Cyanerpes* Oberholser, 1899, the dacnis of the genus *Dacnis* Cuvier, 1816, the manakins of the genus *Chiroxiphia* Cabanis, 1847 and the Brazilian tanager *Ramphocelus bresilius dorsalis* Sclater, 1855 (Sick, 1997; CBRO, 2009; IUCN, 2009).

Similar to other passerine birds, the thraupids can be infected by coccidia, being that the genus *Isoospora* Schneider, 1881 can be considered the most relevant. The coccidiosis is diagnosed by observation of oocysts in feces, which are exogenous forms of these parasites (Soulsby, 1987; Lainson, 1994; Duszynski & Wilber, 1997; Templar et al., 2004; Metzelaars et al., 2005; Berto et al. 2008; 2009a; 2009b; 2010).

Considering the recent reports on new species of *Isoospora* parasitizing thraupids in Brazil should be concluded that these parasites are dispersed widely by South, North and Central America, once that the South American birds, which were described coccidia, are sympatric with other birds inhabiting the American continent.

Thus, this paper aims to provide scientific background and a dichotomous key to assist in the identification of oocysts of *Isoospora* parasites of passerine birds of the Thraupidae family.

### *Isoospora* from Thraupidae family

To date, 12 species of coccidia have been described parasitizing birds of the Thraupidae family.

The first report are made for Boughton et al. (1938) when coccidia was recovered of four Andean tanagers, the southern palm tanager, *Thraupis palmarum* Wied, 1823, the magpie tanager, *Cissopis leverianus* Gmelin, 1788, the southern silver-beaked tanager, *R. carbo*

Pallas, 1764, and the Brazilian tanager, *R. b. dorsalis*. However, all were reported from captured birds in zoos and none of the coccidia were described or named.

*Isoospora thraupis* Lainson, 1994 is considered the first species described in the Thraupidae family. The oocysts that provided this description were recovered from feces of palm tanagers, *T. palmarum*, from Amazon (Lainson, 1994).

Templar et al. (2004) described *I. andesensis* Templar, McQuiston & Capparella, 2004 from the common bush tanager *Chlorospingus ophthalmicus* Du Bus de Gisignies, 1847 and Metzelaars et al. (2005) described *I. irisidornisi* Metzelaars, Spaargaren, McQuiston & Capparella, 2005 from the yellow-throated tanager, *Iridosornis analis* Tschudi, 1844. Both studies were conducted on birds of Peru.

Recently, Berto et al. (2008; 2009a; 2009b; 2010) described nine *Isoospora* species from Brazilian thraupids: (1) *Isoospora tiesangui* Berto, Flausino, Luz, Ferreira & Lopes, 2008; (2) *Isoospora marambaiensis* Berto, Flausino, Luz, Ferreira & Lopes, 2008; (3) *Isoospora sepetibensis* Berto, Flausino, Luz, Ferreira & Lopes, 2008; (4) *Isoospora cadimi* Berto, Flausino, Luz, Ferreira & Lopes, 2009; (5) *Isoospora navarroii* Berto, Flausino, Luz, Ferreira & Lopes, 2009; and (6) *Isoospora ramphoceli* Berto, Flausino, Luz, Ferreira & Lopes, 2010 from *R. b. dorsalis* of Marambaia Island, Rio de Janeiro, Brazil, and (7) *Isoospora sanhaci* Berto, Balthazar, Flausino & Lopes, 2009; (8) *Isoospora sayacae* Berto, Balthazar, Flausino & Lopes, 2009; and (9) *Isoospora silvasouzai* Berto, Balthazar, Flausino & Lopes, 2009 from sayaca tanagers *T. sayaca* of Teresópolis, Rio de Janeiro, Brazil.

The comparative morphology and morphometry of the oocysts of these *Isoospora* species parasites of the Thraupidae family can be observed in Figure 1 and Table 1.

### Dichotomous key for identification of *Isoospora* from Thraupidae family

After observing the morphological and morphometric features of oocysts of *Isoospora* from Thraupidae family was able to accomplish a dichotomous key. These should be useful in the differentiation and identification of species, however, must observe all the structures in detail, including those not cited in the dichotomous key, and compare them with the drawings and micrographs of the species description, as other characteristics may arise due to evolutionary adaptation or new species can be observed.

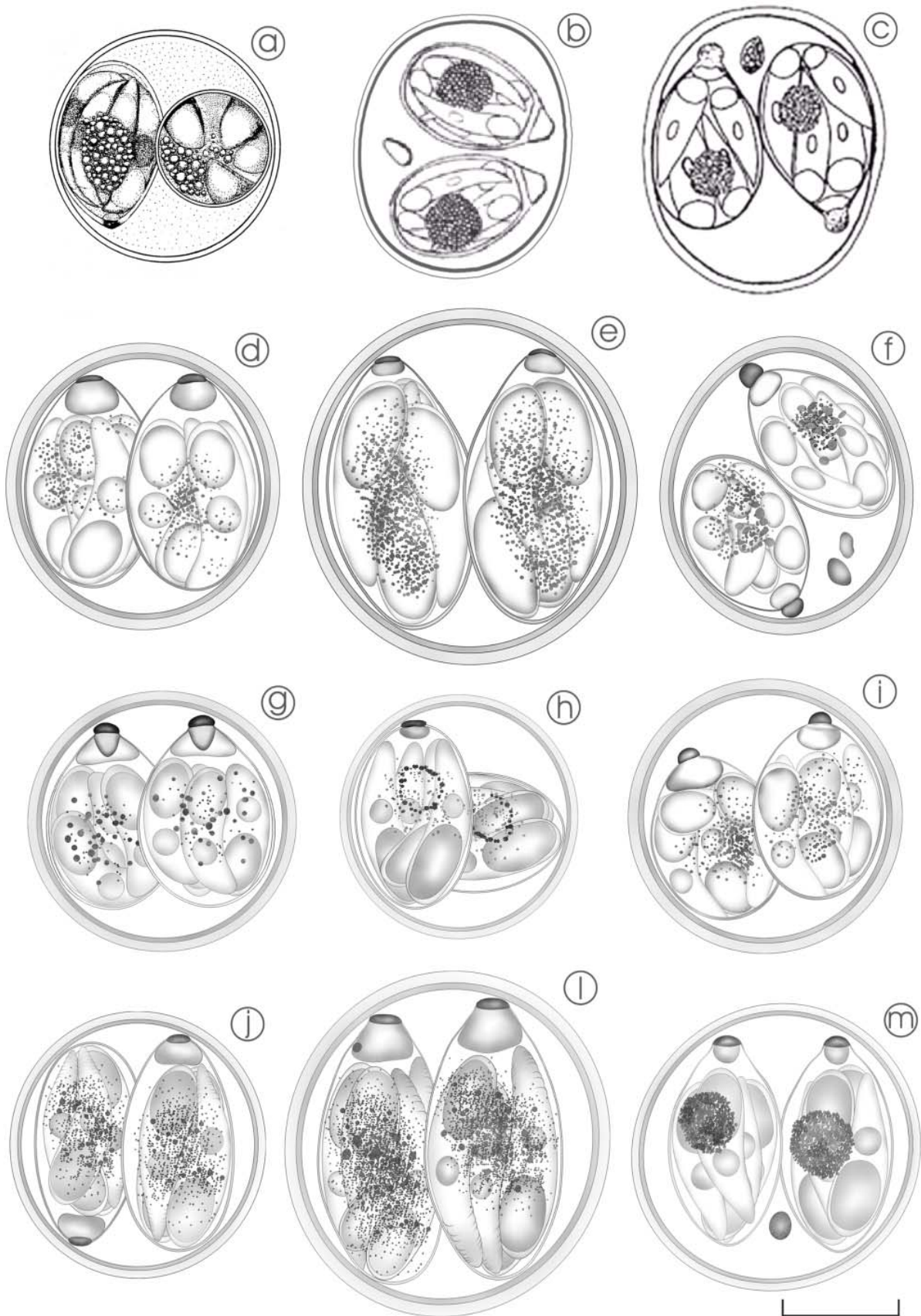


Figure 1. Comparative morphology and morphometry of *Isospora* spp. recorded from Thaupidae family: *Isospora thraupis* (Lainson, 1994) (a), *I. andesensis* Templar et al. (2004) (b), *I. irisidornisi* Metzelaars et al. (2005) (c), *I. tiesangui* (d), *I. marambaiensis* (e), *I. sepetibensis* (f), *I. cadimi* (g), *I. navarroi* (h), *I. ramphoceli* (i), *I. sanhaci* (j), *I. sayacae* (l), e *I. silvasouzai* (m).

Table 1. Comparative morphology and morphometry based on sporulated oocysts of the genus *Isoospora* recorded from Thraupidae family.

Isoospora species	Host species	Oocysts			Sporocysts			Substieda body	Residium		
		Shape	Measurements (µm)	Shape index	Wall	Polar	Shape (µm)			Measurements body	Sieda granule
<i>I. thraupis</i> Lainson, 1994	<i>Thraupis palmarum</i> Wied, 1821	sub-spherical	19.9x19.0 (19.21x19.20)	1.0 (1.0-1.1)	one-layered	absent	pear-shaped	14.2x9.2 (14-16x9-10)	delicate	small	compact
<i>I. andesensis</i> Tempilar, McQuiston, Capparella, 2004	<i>Chlorospingus ophthalmicus</i> Du Bus de Gisignies, 1847	sub-spherical	22.6x18.7 (20-24x17-20)	1.2 (1.1-1.3)	bi-layered	present	ovoidal	14.1x8.5 (13-15x8-9)	triangular	absent	diffuse
<i>I. iridosornisi</i> Meizelaars, Spaargaren, McQuiston, Capparella, 2005	<i>Iridosornis analis</i> Tschudi, 1844	ovoidal	22.1x18.9 (20-25x16-23)	1.2 (1.1-1.3)	bi-layered	present	ovoidal	13.6x9.0 (9-17x8-11)	bubble-shaped	collar-shaped	diffuse
<i>I. itesangui</i> Berto, Flausino, Luz, Ferreira, Lopes, 2008	<i>Ramphocelus bresilius dorsalis</i> Sclater, 1855	sub-spherical	24.2 x 23.4 (22-26 x 21-26)	1.0 (1.0-1.1)	bi-layered	absent	ovoidal	17.7x11.5 (17-19x11-13)	flattened	prominent	diffuse
<i>I. marambaensis</i> Berto, Flausino, Luz, Ferreira, Lopes, 2008	<i>R. b. dorsalis</i>	sub-spherical	29.4x27.9 (27-31x26-29)	1.0 (1.0-1.1)	bi-layered	absent	ellipsoidal	22.6x13.0 (21-24x12-14)	flattened	small	diffuse
<i>I. sepeibensis</i> Berto, Flausino, Luz, Ferreira, Lopes, 2008	<i>R. b. dorsalis</i>	sub-spherical	25.5 x 23.8 (24-29 x 22-26)	1.1 (1.0-1.2)	bi-layered	present, 1 or 2	ellipsoidal	16.9x11.0 (16-18x10-12)	knob-like	prominent	diffuse or compact
<i>I. cadimi</i> Berto, Flausino, Luz, Ferreira, Lopes, 2009	<i>R. b. dorsalis</i>	sub-spherical	24.2x22.9 (22-26x21-24)	1.1 (1.0-1.1)	bi-layered	absent	ovoidal	16.9x11.6 (15-18x10-13)	nipplelike	with compartment	diffuse
<i>I. navarroi</i> Berto, Flausino, Luz, Ferreira, Lopes, 2009	<i>R. b. dorsalis</i>	sub-spherical	21.4 x 20.6 (19-24x18-23)	1.1 (1.0-1.1)	bi-layered	absent	ellipsoidal	16.1x10.2 (14-19x9-12)	flattened	small	diffuse
<i>I. ramphoceli</i> Berto, Luz, Flausino, Ferreira, Lopes, 2010	<i>R. b. dorsalis</i>	spherical to sub-spherical	23.7x22.8 (22-26x21-24)	1.0 (1.0-1.1)	bi-layered	absent	ellipsoidal or slightly ovoidal	16.0 x 11.4 (14-18x10-13)	knob-like	large, rounded	diffuse
<i>I. sanhaci</i> Berto, Balthazar, Flausino, Lopes, 2009	<i>Thraupis sayaca</i> Linnaeus, 1766	sub-spherical	22.1x21.0 (19-24x17-23)	1.1 (1.0-1.1)	bi-layered	absent	ovoidal	17.0x9.9 (15-19x9-11)	nipplelike	prominent	diffuse
<i>I. sayacae</i> Berto, Balthazar, Flausino, Lopes, 2009	<i>T. sayaca</i>	sub-spherical	28.9x27.4 (28-30x24-29)	1.1 (1.0-1.1)	bi-layered	absent	bottle-shaped	23.4x11.8 (23-25x11-12)	prominent	large	diffuse
<i>I. silvasouzaei</i> Berto, Balthazar, Flausino, Lopes, 2009	<i>T. sayaca</i>	sub-spherical	25.5x22.6 (22-28x19-25)	1.1 (1.0-1.2)	bi-layered	present	pear-shaped	17.6x10.5 (17-18x10-11)	delicate	small	compact

A dichotomous key is proposed as follows:

- 1a.** Polar granule present ..... 2  
**1b.** Polar granule absent ..... 3  
**2a.** Sporocyst ellipsoidal or pear-shaped ..... 4  
**2b.** Sporocyst ovoid ..... 5  
**3a.** Sporocyst height of less than 20 µm ..... 6  
**3b.** Sporocyst height of greater than 20 µm ..... 7  
**4a.** Stieda body knob-like and substieda body prominent ..... *I. sepeibensis*  
**4b.** Stieda body delicate and small substieda body ..... *I. silvasouzaei*  
**5a.** Stieda body triangular and substieda body absent ..... *I. andesensis*  
**5b.** Stieda body bubble-shaped and substieda body collar-shaped ..... *I. irisidornisi*  
**6a.** Stieda and substieda bodies delicate and barely discernible ..... 8  
**6b.** Stieda and substieda bodies discernible ..... 9  
**7a.** Stieda body flattened and small substieda body ..... *I. marambaensis*  
**7b.** Stieda body prominent and large substieda body ..... *I. sayacae*  
**8a.** Sporocyst ellipsoidal and sporozoites with a robust refractile body ..... *I. navarroi*  
**8a.** Sporocyst pear-shaped and sporozoites with two refractile bodies ..... *I. thraupis*  
**9a.** Stieda body flattened and substieda body rounded ..... *I. tiesangui*  
**9b.** Stieda body nipplelike and substieda body prominent ..... *I. sanhaci*  
**9c.** Stieda body prominent and knob-like and large substieda body ..... *I. ramphoceli*  
**9d.** Substieda body compartmentalized ..... *I. cadimi*

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