

RESEARCH NOTE

Coccidia in passerines from the Nevado de Toluca National Park, Mexico

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Abstract

In this study, we found unsporulated coccidia oocysts in passerines from the Nevado de Toluca National Park, Mexico. We captured birds and took samples of their droppings during three field visits. We examined a total of 72 fecal samples and found unsporulated coccidia oocysts in 10 samples from five passerine species: *Atlapetes pileatus* (3), *Cardelina ruber* (1), *Mniotilta varia* (1), *Oreothlypis celata* (2) and *Regulus calendula* (3). This appears to be the first recorded study of unsporulated coccidia oocysts in passerine species from Mexico.

Keywords

Coccidia, passerine, birds, Mexico

Coccidia are common in a number of passerine avian species of the Americas. As other vertebrates, passerine birds can be infected by coccidia, mainly by *Isospora* Schneider, 1881 and, to a lesser extent, by *Eimeria* Schneider, 1875 (Berto *et al.* 2011).

The order Passeriformes includes over 5,000 species worldwide and accounts for more than 60% of all avian species (Sibley and Monroe 1990). Currently, 1,123 to 1,150 avian species are known in Mexico, 194 to 212 of which are endemic (Navarro-Sigüenza *et al.* 2014).

The State of Mexico is located in Central Mexico. Until now, 475 avian species have been registered there (Aguilar-Miguel 2007). The Nevado de Toluca National Park is one of the most important protected natural areas in that Mexican State. Approximately 60 avian species have been identified in the Park (Gómez de Silva and Medellín 2001; Sánchez-Jasso *et al.* 2013).

Virtually nothing is known about the presence of coccidian parasites in Mexican birds (Berto and Lopes 2013). Hence,

the aim of the present study was the identification of a possible presence of coccidia oocysts in birds of the Nevado de Toluca National Park.

We carried out the study at the Parque Ecológico Ejidal de Cacalomacán located within the Nevado de Toluca National Park (19°12'37"N, 99°44'42"O; 19°12'31"N, 99°43'51"O; 19°11'31"N; 99°44'22"O, 19°11'47"N; 99°45'09"O), on an altitudinal gradient ranging from 2,800 to 3,247 meters above sea level (Sánchez-Jasso *et al.* 2013). We captured birds in 7 mist nets and took samples of their droppings in September, November, and December 2013. We placed the nets at the relevant points of bird activity as previously recorded (Sánchez-Jasso *et al.* 2013). Birds were caught from 6:00 a.m. to 03:00 p.m. After capture and prior to their release, we recorded the following traits: weight, tarsus and wing lengths, body condition, and presence of brood patch. These data will be used in further studies. We banded individuals of the migratory species on the tarsus, so as to allow us to compare health status upon their recapture. We obtained the samples of

droppings from the holding bags where birds were stored before manipulation, and put them in 1.5 ml micro-centrifuge tubes. We examined native preparations by light microscopy at 10× – 40× within 24 h after sampling, otherwise keeping them refrigerated until examination. Unsporulated coccidia oocysts were identified on the basis of typical morphologies (Dorresteijn 2009). Samples were examined in two laboratories: CIESA (Mexico) and Laboratório de Coccidios e Coccidioses, Universidade Federal Rural do Rio de Janeiro (Brazil).

We obtained and examined 72 fecal samples from passerines and found unsporulated coccidia oocysts in 10 samples (14% of all samples) from the following passerine species: *Atlapetes pileatus* (3), *Cardelina ruber* (1), *Mniotilta varia* (1), *Oreothlypis celata* (2) and *Regulus calendula* (3).

Afterwards, we performed an extensive search of the following keywords (in Spanish, English, and Latin): coccidia, coccidiosis, oocyst, oocysts, oocisto, oocistos, *Eimeria*, *Isospora*, ave, aves, pájaro, pájaros, bird, birds, passerine, Passeriformes, Mexico, in the most popular databases (e.g., Web of Knowledge, PubMed, Searchable Ornithological Research Archive, Scopus, SciELO, Redalyc). We found no study concerning the presence of coccidia in Mexican passerine species. A comprehensive review of the distribution and dispersion of coccidia in wild passerines of the Americas have been recently published and showed no records for Mexico (Berto and Lopes 2013). Thus, our study seems to provide the first evidence of the presence of coccidia in passerine birds from Mexico. Furthermore, we provide evidence of the presence of these unicellular parasites in two endemic avian species: *A. pileatus* and *C. ruber*.

Both the condition and health of the individuals captured seemed not to be affected by the presence of coccidia. It is concordant with the results of Lopes *et al.* (2013) in Brazil. The fact that the presence of coccidia does not affect significantly both the health and the condition of the birds, increases the possibility of infection in both reproductive and wintering distribution zones: the migration distance and goal of healthy birds with presence of coccidia will be the same as the healthy and non-infected individuals, and thus, these unicellular parasites are expected to infect birds along migration routes. If this is true, it is not clear why the presence of coccidia has not been reported previously in Mexican birds. Also, it is unknown if the two endemic *A. pileatus* and *C. ruber* species were infected by either endemic or non-endemic parasites. As *A. pileatus* and *C. ruber* are endemic, it is reasonable to assume that their parasites are endemic, although other susceptible passerine hosts with wide geographical ranges can disperse these coccidia (Berto *et al.*, 2014a). It is needed to determine the quantitative effect of the coccidia load on the Mexican passerine populations, the health of the individuals, and the effect of this load on fitness-related traits.

Currently, neither the accurate Mexican fecal coccidia species diversity is known, nor are their pathogenic capabilities estimated. Morphologic and genetic studies on coccidian oocysts of Mexican passerine birds are needed (Berto *et al.* 2014b).

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