Blood parasites of passerines in the Brazilian Pampas and their implications for a potential population supplementation program for the endangered Yellow Cardinal (*Gubernatrix cristata*)

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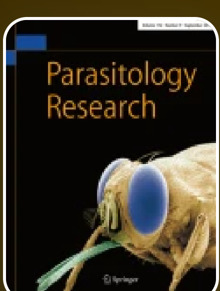

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Bianca Ressetti da Silva, Ralph Eric Thijl Vanstreels, Patricia P. Serafini, Carla Suertegaray Fontana, Thaiane Weinert da Silva, Eduardo Chiarani, Andréa M. Carvalho, Francisco C. Ferreira Junior, Érika Martins Braga & Rosangela Locatelli-Dittrich

Abstract

Espinilho savanna (“seasonal steppe savanna”) is a unique vegetation formation of the Pampas biome that is found near the tri-border of Brazil, Uruguay, and Argentina. The Yellow Cardinal (*Gubernatrix cristata*) is a flagship species of this ecosystem, but it is classified as “critically endangered” in Brazil due to habitat loss and poaching for the illegal trade. Population supplementation through the release of individuals that were captive-bred or apprehended by authorities from the illegal trade has been considered as a conservation strategy for this species; however, the risk of pathogen introduction is a critical concern. We used microscopy and molecular methods to investigate the occurrence of blood parasites in wild passerines (*n* = 64, including three Yellow Cardinals) at Espinilho State Park, Rio Grande do Sul, Brazil, and in captive Yellow Cardinals (*n* = 30) at three facilities in Brazil. Haemosporidian parasites were detected in the blood smears of 10.9% of the wild passerines, comprising the morphospecies *Haemoproteus erythrogravidus* in Rufous-collared Sparrow (*Zonotrichia capensis*), *H. quiscalus* in Grayish Baywing (*Agelaioides badius*), and *H. tyranni* in Great Kiskadee (*Pitangus sulphuratus*); these are the southernmost records for these morphospecies and their first record for the Pampas biome. No haemosporidian parasites were detected in the blood smears of the Yellow Cardinals, wild or captive. Microfilariae were detected in the blood smears of 14.1% of the wild passerines, including all wild Yellow Cardinals, and in 43.3% of captive Yellow Cardinals. *Trypanosoma* sp. was detected in the blood smear of one captive Yellow Cardinal. Nested PCR and gene sequencing of the *cyt-b* gene of *Haemoproteus/Plasmodium* was used to test a subset of wild passerines and captive Yellow Cardinals, allowing for the molecular barcoding of *H. quiscalus* lineage AGEBAD04 and *H. tyranni* lineage PITSUL01; additionally, DNA identical to that of lineage PITSUL01 was detected in the blood of one captive Yellow Cardinal. This study provides valuable data to support the conservation management of the Yellow Cardinal and other threatened passerines from the Pampas and highlights the need for further studies on the epidemiology and pathology of filarioid worms and trypanosomes in passerines from this biome.

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Data availability

Genetic sequences produced in this study were deposited at GenBank (accession codes ON703102–4) and MalAvi (lineages AGEBAD04 and PITSUL01).

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Author information

Authors and Affiliations

Programa de Pós-Graduação em Ciências Veterinárias, Setor de Ciências Agrárias, Universidade Federal do Paraná, Rua dos Funcionários 1540, Curitiba, PR, 80035-050, Brazil

Bianca Ressetti da Silva & Rosangela Locatelli-Dittrich

Instituto de Pesquisa e Reabilitação de Animais Marinhos, Rodovia BR 262 Km 0, Cariacica, ES, 29140-130, Brazil

Ralph Eric Thijl Vanstreels

Centro Nacional de Pesquisa e Conservação de Aves Silvestres, Instituto Chico Mendes de Conservação da Biodiversidade, Rodovia Jornalista Maurício Sirotski Sobrinho km 1, Florianópolis, SC, 88053-700, Brazil

Patricia P. Serafini

Laboratory of Biomarkers of Aquatic Contamination and Immunochemistry, Federal University of Santa Catarina, Servidão Caminho Do Porto S/N, Florianópolis, SC, 88034-257, Brazil

Patricia P. Serafini

Laboratório de Ornitologia, Museu de Ciências e Tecnologia, Programa de Pós-Graduação Em Ecologia E Evolução da Biodiversidade, Pontifícia Universidade Católica do Rio Grande do Sul, Avenida Ipiranga 6681, Porto Alegre, RS, 90619-900, Brazil

Carla Suertegaray Fontana, Thaiane Weinert da Silva & Eduardo Chiarani

Laboratório de Patologia Clínica Veterinária e Diagnóstico Molecular, Faculdade de Agronomia e Medicina

Veterinária, Universidade de Brasília, Brasília, DF, 70910-900, Brazil

Andréa M. Carvalho

Center for Conservation Genomics, Smithsonian Conservation Biology Institute, Washington, DC, USA

Center for Vector Biology, Rutgers University, New Brunswick, NJ, USA

Francisco C. Ferreira Junior

Departamento de Parasitologia, Universidade Federal de Minas Gerais, Avenida Presidente Antônio Carlos, 6627, Belo Horizonte, MG, 31270-901, Brazil

Érika Martins Braga

Contributions

BRS, PPS, CSF, TWS, EC, and RLD conceived the project. BRS, PPS, CSF, TWS, and EC conducted field expeditions and collected and processed data and biological samples. BRS, RETV, FCF, and EMB examined blood smears and morphologically identified the parasites. AMC, FCF, RETV, and EMB conducted molecular and phylogenetic analyses. BRS, RETV, and RLD wrote the first manuscript draft and prepared the tables and figures. All authors reviewed and edited the manuscript and approved its final version.

Corresponding author

Correspondence to Rosangela Locatelli-Dittrich.

Ethics declarations

Competing interests

The authors declare no competing interests.

Ethics approval

The study was approved by the Animal Use Ethics Committee of the Agricultural Sciences Campus of the Universidade Federal do Paraná (CEUA 038/2018) and was conducted under permits issued by the Brazilian Ministry of Environment (SISBIO 53935–6).

Consent to participate

Not applicable.

Consent for publication

Not applicable.

Conflict of interest

The authors declare no competing interests.

Additional information

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Supplementary Information

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