








First record of *Procyrnea* sp. (Nematoda: Habronematidae) in *Buteogallus schistaceus* (Sundevall) (Accipitriformes: Accipitridae) in Brazilian Amazon

Primeiro registro de *Procyrnea* sp. (Nematoda: Habronematidae) em *Buteogallus schistaceus* (Sundevall) (Accipitriformes: Accipitridae) na Amazônia Brasileira

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How to cite: Mangas TP, Cruz KPP, Ribeiro ASS, Pinheiro RHS, Benigno RNM, Giese EG, et al. First record of *Procyrnea* sp. (Nematoda: Habronematidae) in *Buteogallus schistaceus* (Sundevall) (Accipitriformes: Accipitridae) in Brazilian Amazon. *Braz J Vet Parasitol* 2020; 29(2): e001420. <https://doi.org/10.1590/S1984-29612020032>

Abstract

Buteogallus schistaceus (Sundevall) is an endemic bird of prey from the Amazon region, with a declining population according to international conservation agencies. The objective of this study was to report the occurrence of a parasitic nematodes in an individual treated at the Ambulatório de Animais Silvestres of Universidade Federal Rural da Amazônia, Belém campus. The animal was captured on campus and showed no resistance to capture. Fluid therapy and deworming were made, later the bird regurgitated ten nematodes identified as belonging to the genus *Procyrnea* Chabaud (1958). Reviewing the scientific literature, it was found that so far there are no records on the helminth fauna of this bird species, which is therefore the first report of a nematode in *B. schistaceus*.

Keywords: Nematode, Slate-colored Hawk, Pará.

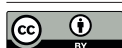
Resumo

Buteogallus schistaceus (Sundevall) é uma ave de rapina endêmica da região amazônica, com população em diminuição, segundo órgãos de conservação internacional. Logo, o objetivo deste trabalho foi relatar a ocorrência de nematódeos parasitos em um indivíduo atendido no Ambulatório de Animais Silvestres, da Universidade Federal Rural da Amazônia, campus Belém. O animal foi capturado nas dependências do campus e não apresentou resistência à captura. Foram então instituídos fluidoterapia e vermifugação, após os quais o animal regurgitou dez nematódeos identificados como pertencentes ao gênero *Procyrnea* Chabaud (1958). Ao revisar a literatura científica, verificou-se que, até o momento, não existem quaisquer registros sobre a helmintofauna dessa espécie de ave, sendo, portanto, o primeiro relato de um nematódeo em *B. schistaceus*.

Palavras-chave: Nematódeos, gavião-azul, Pará.

Received January 22, 2020. Accepted April 17, 2020.

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Introduction

The Brazilian avifauna comprises over 1900 species among which 91 are birds of prey (Piacentini et al., 2015). This group is essential for population regulation because they are the end of the food chain (Andery et al., 2013). The Slate-colored Hawk *Buteogallus schistaceus* (Sundevall) is a non-migrant, diurnal neotropical bird of prey endemic to the Amazon rainforest, which occurs from southern Bolivia, through Peru, Ecuador, Colombia, Venezuela, French Guiana and Brazil; in the latter mainly in the states of Amazonas, Pará and Amapá. It is currently declining in its population, despite being classified in conservation status as “least concern” according to BirdLife International (2016). It has a varied diet that includes lizards, snakes and some insects (e.g., orthopteran and moths) (Robinson, 1994).

Procyrnea Chabaud, 1958 contains 60 species described around the world. Of these, 15 have been reported in the Neotropical Region, ten in Brazil (Table 1). They are parasites of the upper digestive system of birds, especially of the ventricle and proventriculus (Arrona-Rivera et al., 2016). They can cause severe inflammation of the parasitized organ mucosa and consequent organic weakness followed by death (Niemuth et al., 2013).

Table 1. Records to the species of the Neotropical *Procyrnea* Chabaud, 1958 from birds, indicating their hosts and geographical distributions.

Species	Hosts	Locality	Reference
<i>Procyrnea anterovulvata</i> Pinto, Vicente & Noronha, 1996	<i>Chelidoptera tenebrosa brasiliensis</i> Sclater	Brazil	Pinto et al. (1996)
<i>Procyrnea brevicaudata</i> Zhang, Brooks & Causey, 2004	<i>Crypturellus cinnamomeus</i> (Lesson)	Costa Rica	Zhang et al. (2004)
<i>Procyrnea choique</i> Bagnato, Frixione, Digiani & Cremonte, 2018	<i>Rhea pennata</i> (d'Orbigny)	Argentina	Bagnato et al. (2018)
<i>Procyrnea colaptes</i> (Walton, 1927)	<i>Celeus lugubris lugubris</i> (Malherbe) ^a <i>Celeus elegans jumanus</i> (Spix) ^b	Brazil Brazil	Pinto et al. (1996) Pinto et al. (1996)
<i>Procyrnea leptoptera</i> (Rudolphi, 1819)	<i>Caracara plancus</i> (Miller) ^c <i>Falco sparverius cearae</i> (Cory) <i>Geranospiza caerulescens caerulescens</i> (Vieillot) <i>Harpagus diodon</i> (Temminck) <i>Heterospizias meridionalis</i> (Latham) <i>Milvago chimachima chimachima</i> (Vieillot) <i>Rupornis magnirostris magnirostris</i> (Gmelin) ^d <i>Rupornis magnirostris nattereri</i> (Sclater & Salvin) ^e	Brazil Brazil Brazil Brazil Brazil Brazil Brazil Brazil	Pinto et al. (1994) Pinto et al. (1994) Pinto et al. (1994) Vicente et al. (1995) Pinto et al. (1994) Pinto et al. (1994) Pinto et al. (1994) Pinto et al. (1994)
<i>Procyrnea longistriata</i> (Molin, 1859)	<i>Colaptes campestris</i> (Vieillot) ^f	Brazil	Cram (1927)
<i>Procyrnea mclennanae</i> Zhang, Brooks & Causey, 2004	<i>Helioaster constantii</i> (De Lattre)	Costa Rica	Zhang et al. (2004)
<i>Procyrnea mansioni</i> (Seurat, 1914)	<i>Celeus grammicus</i> (Natterer & Malherbe) ^g <i>Rupornis magnirostris</i> (Gmelin) ^h	Brazil Brazil	Pinto et al. (1994) Pinto et al. (1994)
<i>Procyrnea mawsonae</i> Zhang, Brooks & Causey, 2004	<i>Rupornis magnirostris</i> (Gmelin) ^h	Costa Rica	Zhang et al. (2004)
<i>Procyrnea pileata</i> (Walton, 1927)	<i>Celeus flavescens flavescens</i> (Gmelin) <i>Celeus lugubris lugubris</i> (Malherbe) ^a <i>Celeus elegans jumanus</i> (Spix) ^b <i>Campephilus melanoleucos melanoleucos</i> (Gmelin) <i>Campephilus robustus</i> (Lichtenstein) ⁱ <i>Campephilus rubricollis trachelopyrus</i> (Malherbe) ^k <i>Picumnus cirratus macconnelli</i> Sharpe <i>Ramphastos tucanus</i> Linnaeus	Brazil Brazil Brazil Brazil Brazil Brazil Brazil Brazil	Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996) Pinto et al. (1996)
<i>Procyrnea ruschii</i> (Freitas, 1967)	<i>Colibri serrirostris</i> (Vieillot) <i>Chlorostilbon lucidus pucherani</i> (Bourcier & Mulsant) ^j	Brazil Brazil	Vicente et al. (1995) Vicente et al. (1995)
<i>Procyrnea spinosa</i> (Gendre, 1923)	<i>Milvago chimango chimango</i> (Vieillot) <i>Milvago chimango temucoensis</i> Sclater	Chile Chile	San Martín et al. (2006) Oyarzún-Ruiz et al. (2016)
<i>Procyrnea uncinipenis</i> (Molin, 1860)	<i>Rhea americana</i> (Linnaeus)	Brazil	Cram (1927) Ederli & Oliveira (2019)
<i>Procyrnea unilateralis</i> (Molin, 1860)	<i>Ramphastos tucanus</i> Linnaeus ^m <i>Ramphastos vitellinus</i> Lichtenstein	Brazil Brazil	Cram (1927) Cram (1927)
<i>Procyrnea waltoni</i> (Freitas & Lent, 1947)	<i>Rhea americana</i> (Linnaeus)	Brazil	Freitas & Lent (1947)

^aCited as *Celeus flavescens lugubris*; ^bCited as *Celeus jumana jumana*; ^cCited as *Polyborus plancus*; ^dCited as *Buteo magnirostris magnirostris*; ^eCited as *Buteo magnirostris nattereri*; ^fCited as *Picus campestris*; ^gCited as *Picus grammicus*; ^hCited as *Buteo magnirostris*; ⁱCited as *Phloeocastus melanoleucos melanoleucos*; ^jCited as *Phloeocastus robustus*; ^kCited as *Phloeocastus rubricollis trachelopyrus*; ^lCited as *Chlorostilbon aureoventris pucherani*; ^mCited as *Ramphastos erythrorhynchus*.

One hundred and seventy years after its original description, there are still no references to the helminth fauna of *B. schistaceus* in the specialized literature. This fact is of great importance when considering that parasitic action, along with anthropic action, may interfere with its *ex situ* conservation (Santos et al., 2015). Therefore, the objective of this study was to report the occurrence of *Procyrnea* sp. in *B. schistaceus* in the state of Pará, Brazil.

Case report

A young specimen of *Buteogallus schistaceus* was received for care at the Ambulatório de Animais Silvestres of Universidade Federal Rural da Amazônia, Belém campus. All applicable institutional, national and international guidelines for the care and use of animals were followed. Scientific Collecting Permits were provided by Comitê de Ética no Uso de Animais (CEUA/ UFRA) (Permit Number 23084.022512/2014-18). The animal was observed by a university official on campus grounds (1°27'12.3"S, 48°26'36.5"W), who informed the clinic that the bird appeared to be ill. During capture the animal showed no resistance. At clinical examination, the animal was lethargic, with no escape reflex, with moderate dehydration, weighing 453 g. Direct parasitological examination of the feces did not reveal helminth eggs. The therapeutic protocol consisted of subcutaneous fluid therapy (0.9% saline solution in a total application of 26 mL for three days, combined with a single dose of Vitamin A 20,000 IU) and oral deworming (Praziquantel, Pirantel Pamoate and Oxantel Pamoate in combination) in two applications in a 15-day interval. After the first deworming the animal regurgitated ten nematodes that were collected, fixed in AFA (alcohol-formaldehyde) solution and sent to the Animal Helminthology Laboratory for taxonomic identification. Nematode specimens were clarified with 50% Aman lactophenol and temporarily mounted between slide and coverslip for observation and measurement of morphological characters under light microscope LEICA DM2500 with an imaging capture system. For the taxonomic classification of nematodes, the works of Vicente et al. (1995) and Bagnato et al. (2018) were consulted. Thirty days after admission the animal was returned to the wild.

The nematodes (one male, eight female and one broken specimen) had a thin body, with attenuated extremities and transversely striated cuticle. Mouth with two lips, one ventral and one dorsal, and two lateral pseudolabia with teeth at their anterior border. Esophagus divided into short anterior muscle part and long posterior glandular part. Deirids anterior to the nerve ring. Excretory pore posterior to the nerve ring. Body with two asymmetrical lateral alae. Male with unequal and dissimilar spicules. Gubernaculum present. Caudal alae present with longitudinal cuticular thickening. Females with median vulva, of lateral-ventral opening, and pointed tip. These characteristics are compatible with those described for the genus *Procyrnea* Chabaud, 1958 (Figure 1 and Table 2). Diagnosis at the specific level was not possible due to the collection of a single male with an extremely curled tail, making it impossible to observe the quantity and disposition of the caudal papillae.

Table 2. Morphometric data of *Procyrnea* sp. (Nematoda: Habronematidae) regurgitated by *Buteogallus schistaceus* (Sundevall), Belém, Pará State, Brazil. Measurements are given in micrometers unless otherwise stated, with the range followed, in parenthesis, by the mean and standard deviation.

Features	<i>Procyrnea</i> sp.*	
	Male (n=1)	Female (n=8)
Body length, mm	9.34	9.42-19.40 (13.76 ± 3.39)
Body width	120	128.00-290.00 (239.88 ± 53.61)
Left lateral ala length	1.65	2.08-5.45 (4.33 ± 1.15)
Right lateral ala length, mm	3.97	1.88-3.05 (2.50 ± 0.39)
Bucal capsule length	20	20.00-25.00 (21.14 ± 2.04)
Bucal capsule width	13	13.00-20.00 (14.57 ± 2.82)
Muscular esophagus length	371	233.00-528.00 (404.50 ± 87.13)
Muscular esophagus width	36	33.00-71.00 (42.25 ± 12.96)
Glandular esophagus length, mm	2.00	1.67-2.78 (2.16 ± 0.36)
Glandular esophagus width	96	43.00-129.00 (76.29 ± 27.18)
Deirid†	130	50.00-165.00(132.63 ± 22.74)
Nerve ring†	213	180.00-250.00 (222.38 ± 36.99)
Excretory pore†	310	242.00-333.00 (301.00± 34.53)

*one broken specimen not included on measurements; †from anterior end.

Table 2. Continued...

Features	<i>Procyrnea</i> sp.*	
	Male (n=1)	Female (n=8)
Tail	217	153.30-243.00 (188.54 ± 30.73)
Right spicule	316	-
Left spicule	880	-
Gubernaculum	37	-
Vulva, mm [†]	-	3.97-6.71 (5.67 ± 0.96)
Egg length	-	28.00-34.00 (30.94 ± 2.48)
Egg width	-	14.33-17.00 (15.72 ± 1.12)

*one broken specimen not included on measurements; †from anterior end.

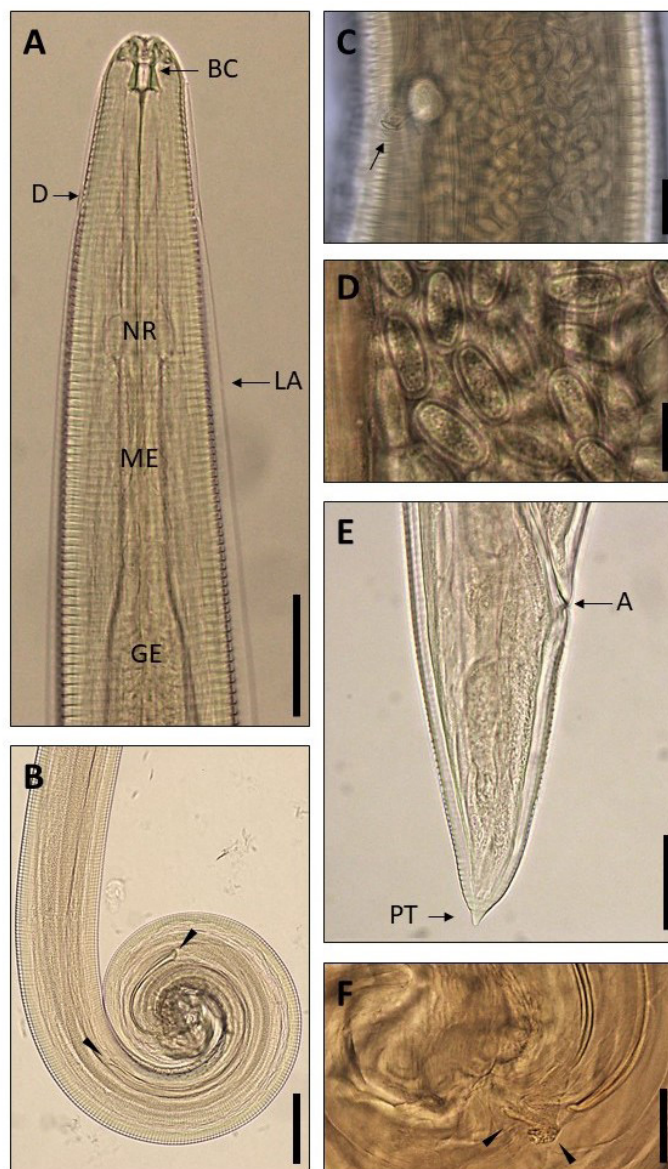


Figure 1. Photomicrographs of *Procyrnea* sp. (Nematoda: Habronematidae) regurgitated by *Buteogallus schistaceus* (Sundevall), Belém, Pará State, Brazil. (A) Male anterior end, ventral view. Note the lateral ala on each side of the body. Bar: 100 µm; (B) Male tail, lateral view. Arrowheads indicate the beginning of spicules. Bar: 200 µm; (C) Vulva (arrow), lateral view. Bar: 50 µm; (D) View of the eggs. Bar: 25 µm; (E) Female tail with, lateral view. Bar: 50 µm; (F) Detail of the posterior end of the spicules and gubernaculum (arrowheads). Bar: 50 µm. Abbreviations: A = anus; BC = buccal capsule; D = deirid; GE = glandular esophagus; LA = lateral alae; ME = muscular esophagus; NR = nerve ring; PT = pointed tip.

Discussion

Chabaud analyzing the cephalic structures of habronematid nematodes, relocated some species described as *Habronema* Diesing, 1861, creating the *Procyrnea* subgenus within the genus *Cyrnea* Deshayes, 1858. Finally, Chabaud's work establishes the *Procyrnea* as genus (Zhang et al., 2004). *Procyrnea* nematodes are bird parasites, mainly in birds of prey of the Falconiformes and Strigiformes orders around the world (Eduardo & Villa, 2011; Bagnato et al., 2018). They use as an intermediate host an orthopteran insect in whose hemocele they develop from larvae to infective stage L3, remaining encapsulated or free inside (Anderson, 2000). Of ten species reported in Brazil, only two were observed in accipitrids: *P. mansioni* (Seurat, 1914) in *Rupornis magnirostris* (Gmelin); and *P. leptoptera* (Rudolphi, 1819) in *R. magnirostris*, *Geranospiza caerulescens caerulescens* (Vieillot), *Harpagus diodon* (Temminck), *Heterospizias meridionalis meridionalis* (Latham), *R. magnirostris magnirostris* (Gmelin) and *R. magnirostris nattereri* (Sclater & Salvin) (Pinto et al., 1994; Vicente et al., 1995). In a recent publication, *Procyrnea* sp. has been reported in *Geranoaetus polyosoma* (Quoy & Gaimard) (Aves: Accipitridae) in Chile (Grandón-Ojeda et al., 2019).

Species of the genus parasitize the upper digestive system of birds, especially the ventricle and proventriculus (Arrona-Rivera et al., 2016). Clinical examination of the bird showed dehydration and low weight, which may be related to *Procyrnea* parasitism, considering its physiological recovery after the establishment of the fluid therapy and deworming protocol. Failure to observe eggs in the parasitological examination of feces does not rule out this possibility since false negatives may occur in non-specific tests, such as this one.

Based on research in the specialized scientific literature, this is the first report of the occurrence of *Procyrnea* sp. in *B. schistaceus*. No other reports of helminth parasitism were found in this bird of prey species, making this the first report of endoparasite in this bird.

Acknowledgements

The authors are grateful to the following: the Laboratório de Histologia e Embriologia Animal, Instituto da Saúde e Produção Animal, Universidade Federal Rural da Amazônia – UFRA, campus Belém, state of Pará, Brazil for the use laboratorial equipments. This study is part of the Ph.D. thesis of Tiago Paixão Mangas, developed for the Programa em Saúde e Produção Animal da Amazônia, Universidade Federal Rural da Amazônia.

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES – Ministério da Educação do Brasil – Finance Code 001) and Raul Henrique da Silva Pinheiro was supported by a research fellowship from the “Universidade Federal do Oeste do Pará – CAPES – Ministério da Educação do Brasil – Finance Code 001”

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