ARTÍCULO

Nematodes parasites of passeriform birds from Northeastern Argentina

Nematodes parásitos de aves Passeriformes del Noreste de la Argentina

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ABSTRACT: The aim of this paper was to increase the knowledge of the diversity of nematodes parasites of passeriform birds in Argentina. The helminthofauna of 34 specimens belonging to 26 species of passeriform birds from Northeastern Argentina was studied. Forty-seven percent of the birds were positive for nematodes. The richness of nematode taxa in the birds studied was low (1-2 species per host) and the infection intensity was moderate (1-15). Eight taxa, that were previously known, are briefly described, and 14 host-parasite associations are reported: *Acuaria cf. wangi* and *Acuaria* sp. (Acuariidae) parasitizing *Xiphocolaptes major* and *Tolmomyias sulphurescens*, respectively; the diplotriaenids *Diplotriaena americana* associated with *Cyanocorax chrysops* and *Diplotriaena bargusinica* parasitizing *Chrysomus ruficapillus* and *Agelasticus cyanopus*; *Aproctella cf. stoddardi* (Onchocercidae) associated with *Myiarchus tyrannulus*, *Pitangus sulphuratus*, *Ammodramus humeralis* and *Campylorhamphus trochilirostris*; *Skrjabinura* sp. (Seuratidae) parasitizing *Cyanocorax cyanomelas* and *C. chrysops*; *Microtetrameres minima* (Tetrameridae) associated with *Empidonomus aurantioatrocristatus* and *T. sulphurescens*; and capillariids parasitizing *Gnorimopsar chopi.* These findings allowed us to make the first records in Argentina of *D. americana*, *D. bargusinica*, *M. minima*, and of the genera *Acuaria* and *Aproctella*. Also, 10 new host-parasite associations are reported. The host-parasite relationships are discussed through the analysis of the birds diet, environmental disturbance and the life cycle of helminths.

Keywords: diversity, Nematoda, Passeriformes, Formosa Province

RESUMEN: El propósito de este trabajo fue incrementar el conocimiento de la diversidad de nematodes parásitos de aves Paseriformes de Argentina. Se estudió la fauna helmintológica de 34 ejemplares pertenecientes a 26 especies de Paseriformes procedentes del Noreste de Argentina. El 47 % de las aves estudiadas fue positivo para nematodes. La riqueza específica de los nematodes parásitos de los Paseriformes estudiados fue baja (1-2 especies por hospedador) y la intensidad de infección fue moderada (1-15). Ocho taxa, previamente conocidos, son brevemente descriptos y 14 asociaciones hospedador parásito son reportadas: *Acuaria cf. wangi* y *Acuaria* sp. (Acuariidae) parasitando a *Xiphocolaptes major* y *Tolmomyias sulphurescens*, respectivamente; los diplotraénidos *Diplotriaena americana* asociado con *Cyanocorax chrysops* y *Diplotriaena bargusinica* parasitando a *Chrysomus ruficapillus* y *Agelasticus cyanopus*; *Aproctella cf. stoddardi* (Onchocercidae) asociado con *Myiarchus tyrannulus*, *Pitangus sulphuratus*, *Ammodramus humeralis* y *Campylorhamphus trochilirostris*; *Skrjabinura* sp. (Seuratidae) parasitando a *Cyanocorax cyanomelas* y *C. chrysops*; *Microtetrameres minima* (Tetrameridae) asociado con *Empidonomus aurantioatrocristatus* y *T. sulphurescens*; y capiláridos parasitando a *Gnorimopsar chopi.* Estos hallazgos nos permiten realizar los primeros registros en Argentina de *D. americana*, *D. bargusinica*, *M. minima*, y de los géneros *Acuaria* y *Aproctella.* Además, 10 nuevas asociaciones hospedador-parásito son reportadas. Las relaciones hospedador-parásito son discutidas a través del análisis de la dieta de las aves, el disturbio ambiental y el ciclo de vida de los helmintos.

Palabras clave: diversidad, Nematoda, Passeriformes, provincia de Formosa

INTRODUCTION

Argentina harbours a high diversity of passeriform birds, with about 500 native species and five introduced species (Roesler and González Táboas, 2016); however, only 13 species within this group of birds have been reported as hosts of helminths. To date, 22 taxa of helminths were recovered in passeriforms: 11 of digeneans, nine of nematodes, one of acanthocephalans, and one of cestodes (Lunaschi *et al*., 2007; Drago and Lunaschi, 2015;

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Hernández-Orts *et al*., 2019; Drago *et al*., 2020, 2021). Among nematodes found parasitizing native passeriforms, six taxa were reported: *Aprocta colaptidis* Schuurmans Stekhoven, 1951 (Aproctidae) in *Furnarius rufus* (Gmelin) and *Zonotrichia capensis* (Müller) from Misiones Province; *Diplotriaena modesta* Schuurmans Stekhoven, 1951 (Diplotriaenidae) in *Asthenes modesta modesta* (Eyton) from Tucumán Province; *Diplotriaena muscisaxicola* Schuurmans Stekhoven, 1951 (Diplotriaenidae) and *Synhimantus* (*Dispharynx*) *brevicordon* Schuurmans Stekhoven, 1951 (Acuariidae) in *Muscisaxicola maculirostris maculirostris* d'Orbigny and Lafresnaye from Tucumán Province; *Hamatospiculum flagellispiculosum* Schuurmans Stekhoven, 1951 (Diplotriaenidae) in *Myiodynastes maculatus solitaries* (Vieillot) from Tucumán Province, and *Microtetrameres* sp. (Tetrameridae) in *Cyanocorax chrysops* (Vieillot) and *Coryphospingus cucullatus* (Müller) from La Plata Zoological Garden (Drago *et al*., 2020). Among introduced passeriforms, *Sturnus vulgaris* L. has been reported as host to four nematodes species in Buenos Aires Province: *Ornithocapillaria ovopunctata* (Linstow, 1873) (Capillariidae), *Pterothominx exilis* (Dujardin, 1845) (Capillariidae), *Synhimantus* (*Dispharynx*) *nasuta* Chabaud, 1975 (Acuariidae) and *Microtetrameres* sp. (Valente *et al*., 2014).

The aim of this study was to increase the knowledge of the diversity of nematodes parasites of native passeriform birds from Northeastern Argentina.

MATERIALS AND METHODS

Between 2009 and 2013, 34 specimens belonging to 26 species of passeriform birds were collected with a shotgun at La Marcela farm, Pirané, Formosa Province, Argentina (26°17'35"S; 59°06'38"W), and examined for helminths. The bird species analysed were: two Unicolored blackbird, *Agelasticus cyanopus* (Vieillot), one Golden-winged cacique, *Cacicus chrysopterus* (Vigors), one Chestnut-capped blackbird, *Chrysomus ruficapillus* (Vieillot), and one Chopi blackbird, *Gnorimopsar chopi* (Vieillot) (Icteridae); one Grassland sparrow, *Ammodramus humeralis* (Bosc) (Passerellidae); one Red-billed scythebill, *Campylorhamphus trochilirostris* (Lichtenstein), one Planalto woodcreeper, *Dendrocolaptes platyrostris* Spix, and one Great rufous woodcreeper, *Xiphocolaptes major* (Vieillot) (Dendrocolaptidae); one Southern beardless-tyrannulet, *Camptostoma obsoletum* Temminck, one Crowned slaty flycatcher, *Empidonomus aurantioatrocristatus* (d'Orbigny), one Brown-crested flycatcher, *Myiarchus tyrannulus* (Müller), one Great kiskadee, *Pitangus sulphuratus* (L.), one Vermilion flycatcher, *Pyrocephalus rubinus* (Boddaert), one Straneck's tyrannulet, *Serpophaga griseicapilla* Straneck, two Southern scrub-flycatcher, *Sublegatus modestus* (Wied-Neuwied), one Suiriri flycatcher, *Suiriri suiriri* (Vieillot), and one White Monjita, *Xolmis irupero* (Vieillot) (Tyrannidae); one Chestnut-vented conebill, *Conirostrum speciosum* (Temminck), four Bluish-grey saltator, *Saltator coerulescens* Vieillot, and one Green-winged saltator, *Saltator similis* d'Orbigny (Thraupidae); one Lark-like brushrunner, *Coryphistera alaudina* Burmeister, and one Greater thornbird, *Phacellodomus ruber* (Vieillot) (Furnariidae); three Plush-crested jay, *Cyanocorax chrysops* (Vieillot), and two Purplish jay, *Cyanocorax cyanomelas* (Vieillot) (Corvidae); one Variable antshrike, *Thamnophilus caerulescens* Vieillot (Thamnophilidae); and one Yellow-olive flycatcher, *Tolmomyias sulphurescens* (Spix) (Pipromorphidae).

The birds were captured with authorization of Ministerio de la Producción y Ambiente of Formosa Province (N°003516). Specimens were dissected in the field, nematodes found in air sacs and body cavity were preserved in 4% hot saline formalin (Salgado Maldonado, 2023). The remaining viscera were preserved in 10% formalin, transported to the laboratory, and examined under stereoscopic microscopy (Zeiss Stemi 2000C) for helminths. Nematodes found in viscera were stored in 4% formalin. Subsequently, the specimens were cleared in Amman's lactophenol or in a glycerin-alcohol solution and studied under a light microscope (Zeiss Standard 25). Measurements are given in micrometres (µm) unless otherwise is stated, with the range followed by the mean in parentheses. Voucher specimens were deposited in the Helminthological Collection of the Museo de La Plata (MLP-He).

RESULTS

Of the total hosts studied, 16 birds (47%) belonging to 12 species were positive for nematodes. Eight helminth taxa were recovered: *Acuaria cf. wangi* Zhang, Brooks and Causey, 2003, *Acuaria* sp. (Acuariidae), *Aproctella cf. stoddardi* (Onchocercidae), Capillariidae gen. et sp. indet., *Diplotriaena bargusinica* Skrjabin, 1917 and *Diplotriaena americana* Walton, 1927 (Diplotriaenidae), *Microtetrameres minima* (Travassos, 1914) (Tetrameridae) and *Skrjabinura* sp. (Seuratidae) (Table 1).

Family Acuariidae

***Acuaria cf. wangi* Zhang, Brooks and Causey, 2003** (Fig. 1 a-b).

Description

Female (based on one specimen): small acuariid with tapered ends. Length 8.171 mm. Maximum width 215. Four long cordons not recurrent and not anastomosing arise dorsally and ventrally between two triangular pseudolabia, extending laterally in longitudinal direction beyond the middle of the

Table 1. Nematodes from passeriform birds from Northeastern Argentina, including the number of examined host (EH), helminth taxa, number of infected host (IH), number of parasites (NP), sex of adult nematodes (Sex) and immature stages (IS).

Host species/Family	EH	Helminth taxa	IH	NP	Sex/IS
Ammodramus humeralis (Passerellidae)	1	*Aproctella cf. stoddardi**	1	2	2 ♀♀
Campylorhamphus trochilirostris (Dendrocolaptidae)	1	*Aproctella cf. stoddardi**	1	1	1 ♂
Agelasticus cyanopus (Icteridae)	2	*Diplotriaena bargusinica**	1	3	1 ♂, 2 ♀♀
Chrysomus ruficapillus (Icteridae)	1	*Diplotriaena bargusinica*	1	15	9 ♂♂, 6 ♀♀
Cyanocorax chrysops (Corvidae)	3	*Diplotriaena americana* *Skrjabinura* sp.	3 1	12 1	5 ♂♂, 7 ♀♀ 1 ♀
Cyanocorax cyanomelas (Corvidae)	2	*Skrjabinura* sp.*	1	2	2 ♀♀
Empidonomus aurantioatrocristatus (Tyrannidae)	1	*Microtetrameres minima**	1	4	4 ♂♂
Gnorimopsar chopi (Thraupidae)	1	Capillariidae gen. *et* sp. indet.	1	1	1 ♀
Myiarchus tyrannulus (Tyrannidae)	1	*Aproctella cf. stoddardi**	1	8	4 ♂♂, 4 ♀♀
Pitangus sulphuratus (Tyrannidae)	1	*Aproctella cf. stoddardi**	1	1	1 ♀
Tolmomyias sulphurescens (Pipromorphidae)	1	*Microtetrameres minima** *Acuaria* sp.*	1 1	2 4 #	2 ♂♂ ♂♂, ♀♀
Xiphocolaptes major (Dendrocolaptidae)	1	*Acuaria cf. wangi**	1	2	1 ♀, 1 juvenile

*New host record, # 1 whole male and parts of specimens of both sexes.

glandular esophagus, 1.644 mm long. Nerve ring and excretory pore at 276 and 372 from anterior end, respectively. Deirids situated anterior to nerve ring, at 235 from anterior end. Buccal cavity 217. Muscular esophagus 561 long, glandular esophagus 1.470 mm long.

Taxonomic summary

Host: *Xiphocolaptes major* (Dendrocolaptidae).

Site of infection: gizzard.

Deposited material: MLP-He 8291.

Distribution and hosts: in the Neotropical Region, five *Acuaria* spp. are known: *A. cordonspinosa* Baruš and Garrido, 1968 parasitizing *Vireo griseus noveboracensis* (Gmelin) (Vireonidae) from Cuba; *A. paraguayensis* Mutafchiev, Boyko and Georgiev, 2012 parasitizing *Sirystes sibilator* (Vieillot) (Tyrannidae) from Paraguay; *A. wangi* parasitizing *Hylophylax naevioides* (Lafresnaye) (Thamnophilidae) and *Gymnopithys leucaspis* (Sclater) (Formicariidae) from Costa Rica; *A. mamillaris* (Molin, 1860) Railliet, Henry and Sisoff, 1912 parasitizing *Cyanocorax cayanus* (L.) (Corvidae) from Brazil; and *A. mayori* Lent, Freitas and Proença, 1945, described parasitizing Corvidae from Paraguay and cited in Thraupidae and Tyrannidae from Brazil and Costa Rica (Mutafchiev *et al*., 2012).

Remarks: three of the five Neotropical species of *Acuaria* have relatively long cordons comparable to those of the specimens studied here: *A. cordonspinosa*, *A. paraguayensis* and *A. wangi*.

The female specimen found in *X. major* closely resembles females of *A. wangi* in almost all measures, with a slightly higher ratio between cordon and total length (0.2 vs. 0.155-0.198). In the other two species this ratio is even lower, 0.147-0.186 (*A. cordonspinosa*) and 0.087-0.130 (*A. paraguayensis*) (Mutafchiev *et al*., 2012).

The finding of *A. cf. wangi* parasitizing *X. major* represents a new host-parasite association.

***Acuaria* sp.** (Fig. 1 c-d).

Description

Male (based on one specimen): total length 3.083 mm. Maximum width 200. Anterior end with

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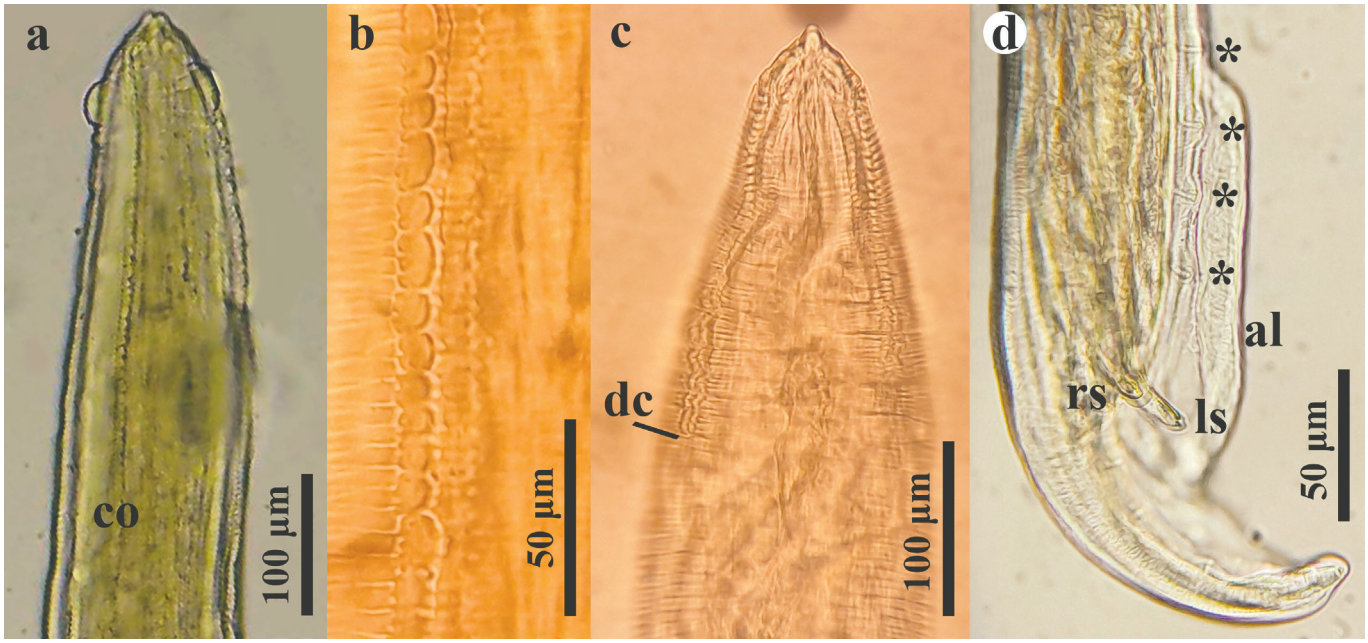

Figure 1. a-b) Female of *Acuaria cf. wangi*. a) Anterior end. b) Detail of cordon. c-d) Males of *Acuaria* sp. c) Anterior end. d) Posterior end. Abbreviations: al- caudal alae, co- cordon, dc- distal end of cordons, ls- left spicule, rs- right spicule, * precloacal papillae.

two triangular pseudolabia. Four short cordons not recurrent and not anastomosing arise dorsally and ventrally between pseudolabia, extending laterally in longitudinal direction to anterior portion of muscular esophagus, 232 long. Nerve ring and excretory pore at 126 and 166 from anterior end, respectively. Buccal cavity 157. Muscular esophagus 380, glandular esophagus 752 long. Posterior end spirally rolled with caudal alae. Spicules stout, left 152 long, right 117 long. Caudal papillae arranged as four pairs precloacal, one pair adcloacal and six pairs postcloacal.

Taxonomic summary

Host: *Tolmomyias sulphurescens* (Pipromorphidae).

Site of infection: gizzard.

Deposited material: MLP-He 8292.

Remarks: two of the five Neotropical species of *Acuaria* possess relatively short cordons comparable to those of the specimens studied here: *A. mayori* and *A. mamillari.* The males of *A. mamillari* are unknown; therefore, it is not possible to make any comparison. According to Mutafchiev *et al*. (2012), measurements, hosts and geographical distribution of *A. mayori* should be restricted to those included in the original description. Male specimens of subsequent records are longer and have smaller spicules; therefore, their identification as *A. mayori* is uncertain and requires further studies. The male specimen studied here is similar to the specimens in the original description of *A. mayori*, but is smaller (3.083 vs 4.2-4.9), has smaller spicules (left 152 vs. 190-230, right 117 vs. 130-160) and greater ratio between cordon and length (0.075 vs. 0.047-0.053) (Mutafchiev *et al.*, 2012).

The finding of *Acuaria* sp. in *T. sulphurescens* constitutes a new host-parasite association.

Family Capillariidae

Female with a long and thin body, posterior part of the body longer than the anterior part, and slightly thicker than the esophageal region.

Taxonomic summary

Host: *Gnorimopsar chopi* (Icteridae).

Site of infection: intestine.

Remarks: considering that only part of a female specimen was recovered, the morphology of the body and eggs allows us to identify it as a member of the family Capillariidae. In Argentina, four genera within this family have been recorded parasitizing birds (*Capillaria* Zeder, 1800, *Eucoleus* Dujardin, 1845, *Ornithocapillaria* Baruš and Sergeeva, 1990 and *Pterothominx* Freitas, 1959). To date, none of these have been found in the Northern part of Argentina (Drago *et al*., 2020). Of these capillariids, *O. ovopunctata* and *P. exilis* were found parasitizing introduced passeriforms (*S. vulgaris*) in Buenos Aires Province (Valente *et al*., 2014).

Family Diplotriaenidae

***Diplotriaena americana* Walton, 1927** (Fig. 2 a-b)

Description

Cuticle with fine transverse striations. Anterior extremity with two chitinous structures in trident shape. Trident smooth, manubrium truncated and well separated branches. Esophagus divided into an anterior, shorter, narrower muscular part and a posterior glandular part.

Males (based on one entire specimen and three damaged specimens): length 36 mm, maximum width 696-716 (706). Nerve ring at 145 from anterior end. Excretory pore not observed. Muscular esophagus 251 long. Glandular esophagus 3.54 mm. Trident 93-121

(107). Spicules dissimilar and unequal, left spicule 960 long, right spicule 650 long, with three twists. Spicular ratio 1.36. Tail 68-145 (106) long.

Females (based on one complete specimen and five damaged specimens): length 90-93 (92) mm, maximum width 857-947 (902). Nerve ring at 155-242 (198) from anterior end. Excretory pore not observed. Muscular esophagus 271-333 (302) long. Vulva pre-equatorial at 658-774 (716) from anterior end. Tail 532 long. Eggs 48-60 (55) long by 31-45 (36).

Taxonomic summary

Host: *Cyanocorax chrysops.*

Site of infection: air sacs.

Deposited material: MLP-He 8293.

Distribution and hosts: *Diplotriaena americana* was found parasitizing *Colaptes auratus* (L.) (Picidae) from USA (Walton, 1927; Anderson, 1959), *Melanerpes superciliaris* (Temminck) (as *Centurus* s. s.) from Cuba (Sonin and Baruš, 1968; Baruš, 1971); *C. cyanomelas* and *C. chrysops* from Brazil (Pinto *et al*., 1997), *Melanerpes carolinus* (L.) (Picidae) from USA (Foster *et al*., 2002), and *Pheucticus chrysogaster* (Lesson) (Cardinalidae) from Peru (Hon *et al*., 2013).

Remarks: *Diplotriaena americana* was originally described by Walton (1927) parasitizing *C. auratus* from the USA, and re-described by Anderson (1959) based on new material found in the same host. The morphological and morphometric characters of the specimen here studied are consistent with those previously described for *D. americana*, with the exception of some measurements provided by Walton (1927); however, Anderson (1959) suggested that this author may have made some errors when measuring structures, such as the right spicule.

This is the first report of *D. americana* in Argentina.

***Diplotriaena bargusinica* Skrjabin, 1917** (Fig. 2 c-g)

Description

Cuticle with fine transverse striations. Anterior extremity with two chitinous structures in trident shape. Trident smooth, apex tapered, dome shaped, branches irregular, swollen at end. Esophagus divided into an anterior, shorter, narrower muscular part and a posterior glandular part.

Males (based on five specimens): length 18.1-32 (27.1) mm, maximum width 800-900 (836). Nerve ring at 183-208 (200) from anterior end. Excretory pore not observed. Muscular esophagus 212.5-280 (257.5) long. Glandular esophagus 3.2-3.5 (3.3) mm. Trident 105-124 (115). Spicules dissimilar and unequal, left spicule 647-716 (675) long, right spicule 440-515 (481) long, with three twists. Spicular ratio 1.33-1.54 (1.45). Tail 71-174 (106) long.

Females (based on one complete specimen and three damaged specimens): length 38-50 (42.6) mm. Maximum width 957-1029 (984). Nerve ring at 135 from anterior end. Excretory pore not observed. Muscular esophagus 290 long. Glandular esophagus 1.3 mm. Trident 105-109 (108). Vulva pre-equatorial at 661 from anterior end. Tail 275-348 (312) long. Eggs 45-50 (48) long by 31-33 (32).

Taxonomic summary

Hosts: *Chrysomus ruficapillus*, *Agelasticus cyanopus* (Icteridae).

Site of infection: air sacs.

Deposited material: MLP-He 8294 and 8295.

Distribution and hosts: members of *Diplotriaena* Railliet and Henry, 1909 (Nematoda: Diplotriaenidae) infect the air sacs of a great variety of birds, including Anseriformes, Apodiformes, Galliformes, Charadriiformes, Columbiformes, Piciformes and Passeriformes. In the Neotropical region, *D. bargusinica* has been recorded parasitizing Passeriformes (Icteridae, Dendrocolaptidae, Corvidae, Emberizidae) from Brazil (Vieira *et al*., 2017). Among Icteridae, these nematodes were reported parasitizing *C. ruficapillus*, *Cacicus cela* (L.), *Cacicus haemorrhous* (L.) *Gnorimopsar chopi*, *Icterus croconotus* (Wagler), *Molothrus bonariensis* (Gmelin), *Psarocolius decumanus maculosus* (Chapman) (as *Ostinops d. m.*) and *Psarocolius yuracares* (d'Orbigny) (as *Gymnostinops yuracares*) from Brazil (Vicente *et al*., 1983; Gonçalves *et al*., 2002, Vieira *et al*., 2017, Bernardon *et al*., 2018).

Remarks: the general morphology, the shape of the trident and the metric characters of the specimens here studied are consistent with those described by Vieira *et al*. (2017) parasitizing *C. ruficapillus*, and with those described by Vicente *et al*. (1983) parasitizing other icterids.

This is the first report of *D. bargusinica* in Argentina, and *Agelasticus cyanopus* represents a new host record.

Family Onchocercidae

Aproctella cf. stoddardi (Fig. 3).

Description

Small nematodes with slightly tapering ends. Cuticle smooth. Mouth rounded, with a weakly cuticularized ring. Buccal capsule small, with small cuticularized processes on the lateral walls which project outwards through the mouth as small, round, liplike structures. With four pairs of small, submedian, cephalic papillae in two circles. Esophagus not divided. Males with short spicules, nearly equal in length but distinct in form. Viviparous females with vulva situated behind esophagus.

Males (based on five specimens): length 6.3-9.9 (8.6) mm, maximum width 220-250 (230). Nerve ring at 148-159 (154.7) from anterior end. Excretory pore not observed. Esophagus 314-338 (327.2) long. Left spicule 85.7-104.5 (92.9) long, right spicule 77-83.3 (79.8) long. Caudal papillae absent. Tail of 66.6-83 (75.9) long.

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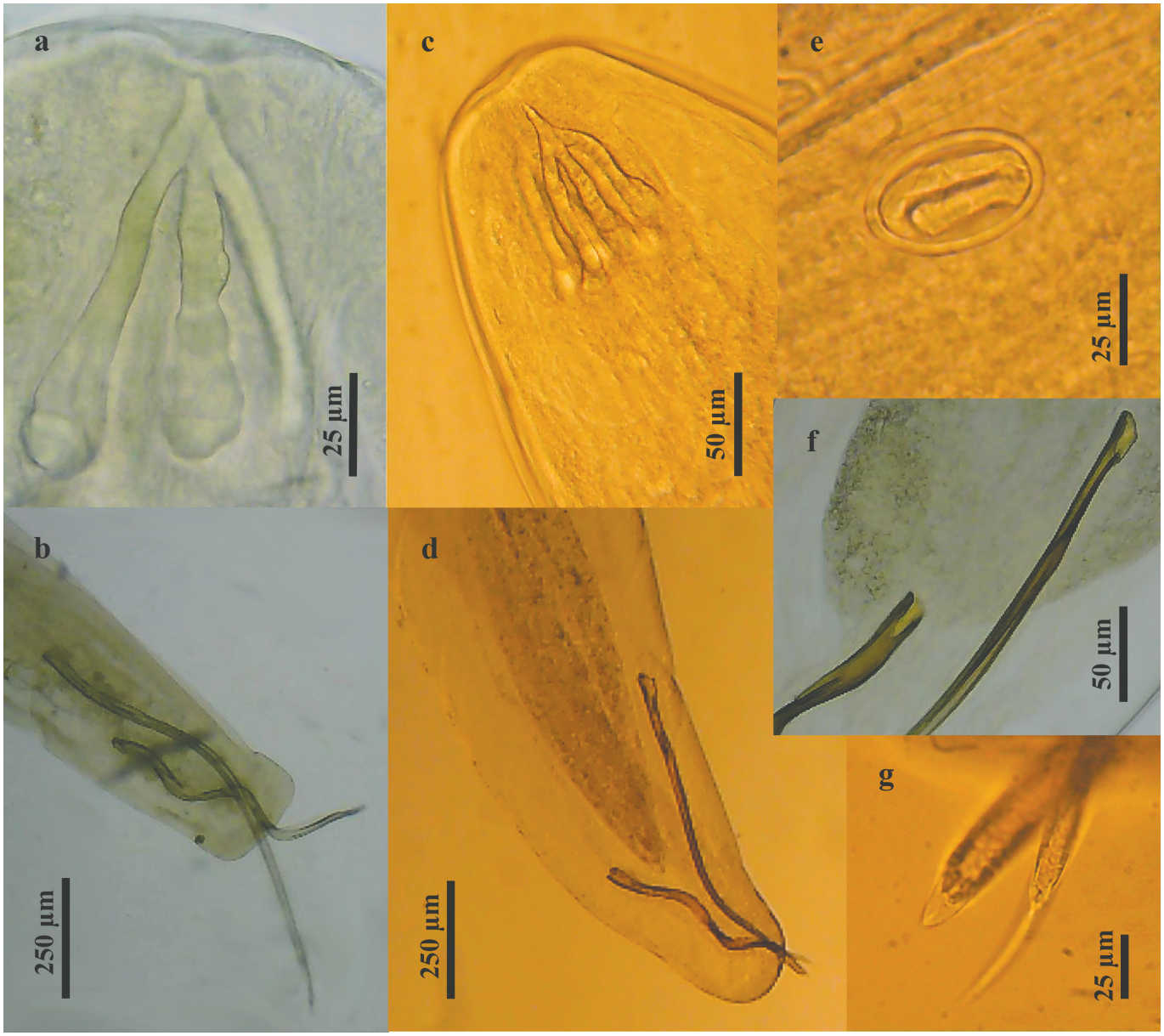

Figure 2. a-b) *Diplotriaena americana*. a) Trident. b) Posterior end of male. c-g) *Diplotriaena bargusinica.* c) Anterior end of male showing tridents. d) Posterior end of male. e) Egg. f) Detail of the base of the spicules. g) Detail of the tip of the spicules.

Females (based on three complete specimens and 1 damaged specimen): length 13.3-15.3 (14.3) mm, maximum width 250-360 (303). Nerve ring at 145-170 (154.7) from anterior end. Excretory pore not observed. Esophagus 314-459 (375.3) long. Vulva pre-equatorial at 1100-1571 (1381) from anterior end. Microfilariae 120-170 long.

Taxonomic summary

Hosts: *Myiarchus tyrannulus* (Tyrannidae), *Pitangus sulphuratus* (Tyrannidae), *Ammodramus humeralis* (Passerellidae), *Campylorhamphus trochilirostris* (Dendrocolaptidae).

Site of infection: body cavity.

Deposited material: MLP-He 8296, 8297, 8298 and 8299.

Distribution and hosts: four species of *Aproctella* have been cited in the Neotropical Region (Rabelo *et al*., 2022): *A. alessandroi* Bain, Petit, Kozek, and Chabaud, 1981 parasitizing *Thraupis episcopus* (L.) and *Sicalis flaveola* (L.) (Thraupidae) from Colombia and Brazil respectively (Bain *et al*., 1981; Alves, 2024), *A. cariinii* (Pereira and Vaz, 1933), reported in Passeriformes and Pelecaniformes from Brazil (Mascarenhas *et al*., 2009), *A. golvani* Bain, Petit, Kozek, and Chabaud, 1981 parasitizing *Loxigilla noctis* (L.) (Thraupidae) from Guadeloupe (Bain *et al*., 1981), and *A. stoddardi*, a generalist species reported in North America (USA, Canada and Mexico), Russia, Cuba and Brazil parasitizing several bird hosts (Coraciiformes, Charadriiformes, Galliformes, Passeriformes) (Rabelo *et al*., 2022).

Remarks: the males here studied resemble those of *A. stoddardi*, mainly in the absence of caudal papillae. Contrary, *A. alessandroi*, *A. cariinii* and *A. golvani* have pericloacal and/or postcloacal papillae.

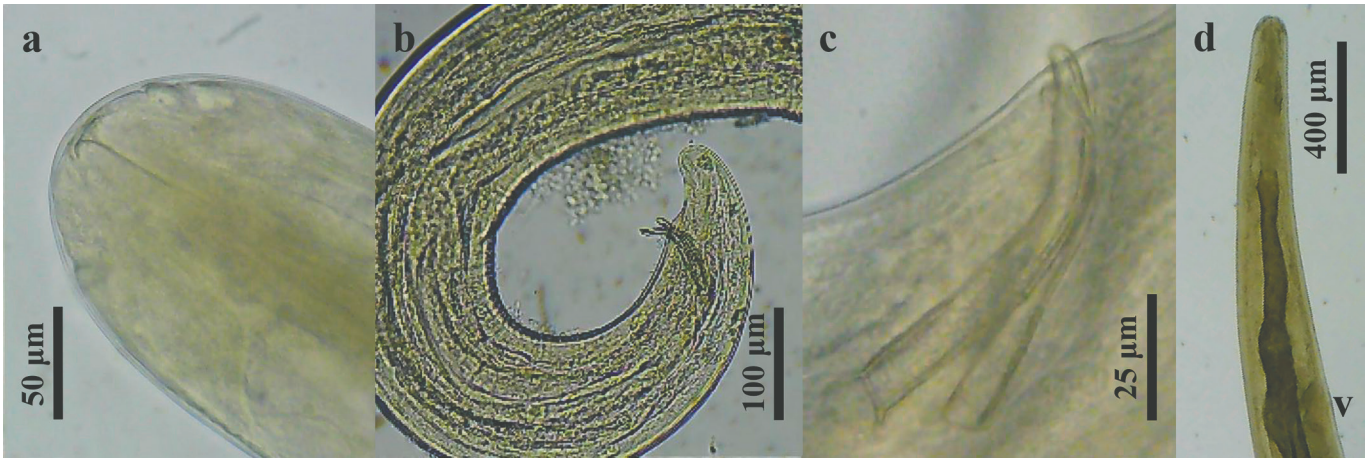

Figure 3. *Aproctella cf. stoddardi*. a) Anterior end of male. b) Posterior end of male. c) Spicules. d) Anterior end of female. Abbreviation: v- vulva.

The findings of *Aproctella cf. stoddardi* parasitizing *M. tyrannulus*, *P. sulphuratus*, *A. humeralis* and *C. trochilirostris* constitute the first records of the genus in Argentina and new host records.

Family Seuratidae

***Skrjabinura* sp.** (Fig. 4 a).

Description

Female (based on three damaged specimens): body spirally twisted two times, 55 mm long. Cephalic vesicle 629 long. Eggs embryonated, 150-155-x 130-135.

Taxonomic summary

Hosts: *Cyanocorax cyanomelas*, *Cyanocorax chrysops*.

Site of infection: intestine.

Deposited material: MLP-He 8300 and 8301.

Distribution and hosts: in the Neotropical Region species of *Skrjabinura* were reported parasitizing caprimulgiforms, cuculiforms, piciforms, falconiforms, passeriforms, strigiforms and trogoniforms: *Skrjabinura vali* (Guerrero, 1971) in Venezuela and Costa Rica, *Skrjabinura mesoamericana* Zhang and Brooks, 2005 in Costa Rica; *Skrjabinura spiralis* Gnedina, 1933 in Brazil, *Skrjabinura* sp. in Paraguay and Argentina (Masi Pallarés and Benítez Usher, 1971; Vicente *et al*., 1995, 1996; Pinto *et al*., 1996; Zhang and Brooks, 2005, Drago *et al.*, 2015). Among the analysed bird species in the present study, *C. chrysops* was previously reported as host of *S. spiralis* by Pinto *et al*. (1997).

Remarks: although no males were found, the body spirally twisted of females and the presence of a distinctive cephalic vesicle, allow us to identify this specimen as a member of the genus *Skrjabinura*. The presence of numerous fertilized eggs in the uterus indicates that *C. cyanomelas* and *C. chrysops* are suitable hosts.

The finding of *Skrjabinura* sp. in *C. cyanomelas* represents a new host record, and the second record of the genus in Argentina.

Family Tetrameridae

***Microtetrameres minima* (Travassos, 1914)** (Fig. 4 b-c).

Description

Male (based on three specimens): minute worms with elongated body, tapering towards both ends. Total length 1300-1480. Maximum width 65-71. Cuticle with fine transverse striations. Buccal capsule cylindrical, moderately sclerotized, 16-17 in depth and 5-8 of inner diameter. Esophagus (measured in one specimen) 286.5 long, muscular portion 46.5. Nerve ring at 101 from the anterior end. Spicules very unequal, right spicule (observed in one specimen) 86 long, with a simple tip. Left spicule (broken in two specimens) 1270, 32-50% of body length. Ratio left spicule/right spicule 1:14.8 (calculated from spicules of different individuals). Two pairs of precloacal papillae and two pairs of postcloacal papillae. Tail 89-107 long.

Taxonomic summary

Hosts: *Empidonomus aurantioatrocristatus* (Tyrannidae) and *Tolmomyias sulphurescens* (Pipromorphidae).

Site of infection: proventriculus.

Deposited material: MLP-He 8302 and 8303.

Distribution and hosts: *Microtetrameres minima* was described by Travassos (1914) parasitizing *Loriotus cristatus* (L.) (as *Tachyphonus cristatus bruneus* Spix) (Thraupidae) from Brazil, and has not been reported again since its original description.

Remarks: only two members of the genus *Microtetrameres* are known in Argentina, *Microtetrameres urubitinga* Dueñas Díaz, Drago and Núñez, 2018 parasitizing *Buteogallus urubitinga* (Gmelin) (Accipitridae) from Formosa province, and *Microtetrameres canadensis argentinensis* Labriola and Suriano, 1996 parasitizing *Ardea ibis ibis* (L.)

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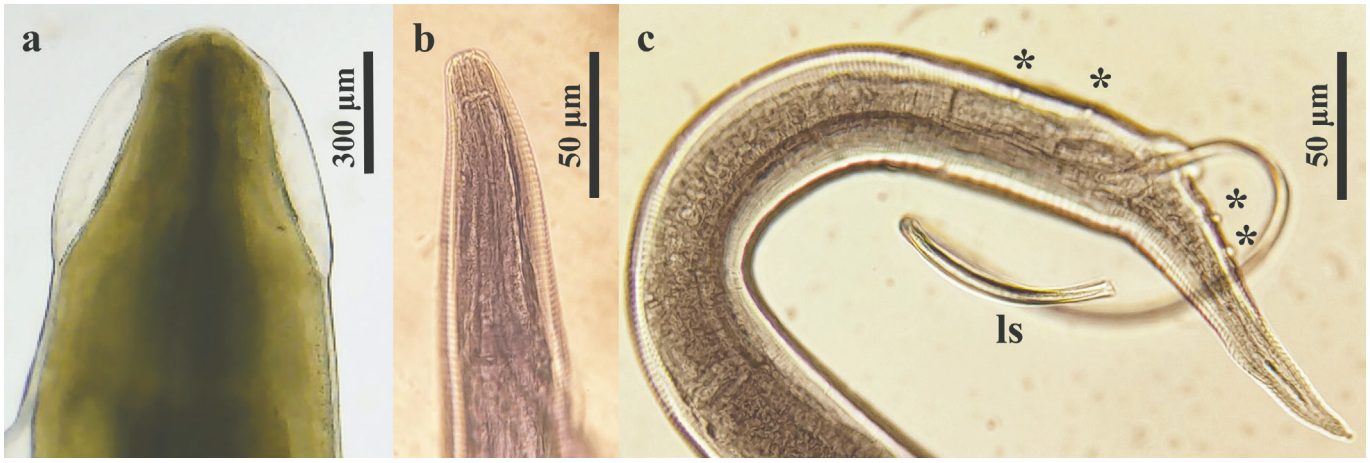

Figure 4. a) Anterior end of *Skrjabinura* sp. b-c) Male of *Microtetrameres minima*. b) Anterior end. c) Posterior end. Abbreviations: ls- left spicule, * caudal papillae.

from Buenos Aires Province (Labriola and Suriano, 1996; Dueñas Díaz *et al*., 2018). Also, there are three reports of females of *Microtetrameres* sp. parasitizing passeriform birds from Argentina (*C. chrysops*, *C. cucullatus* and *S. vulgaris* (Boero and Led, 1968; Valente *et al*., 2014) and one in accipitrids from La Marcela Farm, Formosa Province (Dueñas Díaz *et al*., 2024).

The nematodes here studied differ from those of *M. urubitinga* in that the males are shorter (1300-1480 vs. 2020-2540), have a higher spicule length ratio (14.8 vs. 3.8-5.9) and a lower ratio body/left spicule length (1.2 vs. 2-3.2). Also differ from *M. canadensis argentinensis* in having shorter males (1300-1480 vs. 4760), lower spicule length ratio (14.8 vs. 24), and different distribution of caudal papillae (two pairs precloacal and two pairs postcloacal vs. three pairs precloacal and four pairs postcloacal). In contrast, the anatomical characters of the nematodes here studied are entirely similar to those described by Travassos (1914) as *M. minima.*

This is the first report of the species since its original description, adding two new hosts.

DISCUSSION

Nematodes of Argentine passeriform birds have received little attention; to date, only two studies on native passeriforms have been published. The first one, published in 1951, described five species of nematodes collected from birds in Northern Argentina (Tucumán and Misiones Provinces) (Schuurmans Stekhoven, 1951). The second, published in 1968, was based on material collected from a bird in a Zoological Garden (Boero and Led, 1968).

Considering these previous studies, passeriforms do not appear to host a large number of nematode species (six helminth taxa and six bird species reported as hosts). However, the results of the present study, carried out in a single locality, reveal the presence of eight taxa of nematodes parasitizing 12 species of passeriforms. The scarcity of reports of nematodes in this group of birds could be related to the inherent difficulties in studying these helminths. Many species are fragile and easily damaged, especially when recovered from viscera fixed in formalin. In addition, because they are dioecious organisms, it is necessary to find individuals of both sexes to make a reliable identification.

The examination of 34 birds from La Marcela Farm allowed us to make the first records of the genera *Acuaria* and *Aproctella*, and of three species (*D. americana*, *D. bargusinica* and *M. minima*) in Argentina. Also, 10 new host-parasite associations are reported.

Most helminth taxa found parasitizing the studied birds have heteroxenous life cycles and the birds are infected by trophic transmission or through insect bites, except the members of Capillariidae that may have direct or indirect cycles, these latter involving earthworms (Anderson, 2000). The known life cycles of *Diplotriaena* spp. involve grasshoppers as experimental intermediate hosts and birds as definitive hosts (Anderson, 2000). *Diplotriaena americana* was found parasitizing *C. chrysops*, a generalist bird that feeds on plants, vertebrates and invertebrates, including orthopterans (De la Peña, 2019a). Therefore, grasshoppers probably act as natural hosts for these nematodes. *Diplotriaena bargusinica* was found in *A. cyanopus* and *C. ruficapillus*, which feed mainly on vegetables and insects (De la Peña, 2019b). However, grasshopper consumption has only been reported in *A. cyanopus*, while for *C. ruficapillus*, where the highest intensity of infection was found (15), there are no records of orthopterans in their diet. Considering that these birds consume a wide variety of insects (Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera, Odonata), some of them may probably act as natural hosts of *D. bargusinica.* The known life cycles of *Acuaria* spp. involve various insect species (particularly Orthoptera and Coleoptera) and diplopods as experimental intermediate hosts (Anderson, 2000).

Acuaria sp. was found in *T. sulphurescens*, a bird whose diet is poorly known, with records only of coleopterans (De la Peña, 2019c), and *A. cf. wangi* in *X. major*, a bird with a broad diet that includes plants, vertebrates and invertebrates, including orthopterans and coleopterans (De la Peña, 2019d). Therefore, coleopterans probably act as natural hosts for these acuariids. The known life cycles of *Microtetrameres* spp. involve grasshoppers and cockroaches as experimental intermediate hosts. *Microtetrameres minima* was found in the tyranids *E. aurantioatrocristatus* and *T. sulphurescens*. The former bird species has a broad diet that includes plants and insects, including orthopterans, whereas the latter has a poorly known diet, with some reports of coleopterans (De la Peña, 2019c). The life cycle of *Skrjabinura* species is unknown, but among the few seuratids for which life cycles are known, insects act as intermediate hosts (Anderson, 2000). *Aproctella* spp. use hemophagous insects as intermediate hosts (Anderson, 2000). Further studies on potential natural intermediate hosts of these groups of nematodes and on the detailed diets of the birds are necessary to make inferences about their possible life cycles in natural environments.

The helminth richness of the passeriforms studied was low (1-2 species per host) and the infection intensity was moderate, 1-15 (2.5). This could be related to the environment where the birds were collected—a farm with extensive agricultural activity, where pesticide use is common—and the life cycles of most of the nematodes studied, which involve insects as intermediate hosts. Pesticide application can affect the development of insect populations and therefore interfere with the dynamics of nematode life cycles.

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