Journal of Animal & Plant Sciences, 32(6): 2022, Page: 1778-1783
ISSN (print): 1018-7081; ISSN (online): 2309-8694
https://doi.org/10.36899/JAPS.2022.6.0586

A NEW RECORD AND NEW SPECIES OF THE GENUS *ACUARIA* BREMSER, 1811 (ACUARIIDAE: NEMATODA) FROM SINDH / JUNGLE SAPRROW (PASSERIDAE: PASSERIFORMOES) IN LARKANA, SINDH, PAKISTAN.

I. Chandio*, A. M. Dharejo and M. M. Khan

Department of Zoology, University of Sindh, Jamshoro-76080, Pakistan.
*Corresponding author's email: irshadchandio14@gmail.com

ABSTRACT

The present study was conducted as part of a PhD project to introduce one of Sindh's bird species and helminthic parasites of *Passer pyrrhonotus* (Blyth, 1845) were examined from Larkana districts of Sindh Province, Pakistan. During present investigation for the helminthic parasites, total fourteen *Passer pyrrhonotus* (Sindh Jungle Sparrow) were examined from Larkana districts of Sindh Province, Pakistan. Out of fourteen birds, only one was found infected with five nematodes of genus Acuaria Bremser, 1811 (02♂, 03♀) belonging to Acuariidae: Nematoda, obtained from the intestine of *Passer pyrrhonotus*, were killed and processed in a 70% ethanol and glycerol solution for comprehensive study. The specimens were compared with the different species of genus Acuaria, reported from different birds around the world. The new species is named as *Acuaria pakistanensis* n.sp. The name of the new species relates to the name of the country from which it was obtained. However, this genus and host *Passer pyrrhonotus* (Sindh/ Jungle Sparrow) is reported first time from Pakistan.

Key words: *Acuaria pakistanensis* n.sp, *Passer pyrrhonotus* (Sindh/ Jungle Sparrow), Larkana, Sindh, Pakistan.

Published first online June 10, 2022 Published final November 20, 2022

INTRODUCTION

Passer pyrrhonotus Blyth (1845) is a resident sedentary sparrow, endemic to Indus flood plain and its major tributaries and it has distinction of being largely confined to the territory of Pakistan throughout its known range. Chandio *et al*., (2019). It is a non-commensal sparrow adapted essentially to tree groves alongside water, especially in riverine forests and regions subjected to seasonal inundation. They are arboreal, however, it will gather weed and grass seeds from ground. They were noted by T.R. Bell as being fond of seeds of Polygonum plebeja. Roberts (1992). Probably they are for the most part granivorous in diet aside from when sustaining youthful.

MATERIALS AND METHODS

Total fourteen alive *Passer pyrrhonotus* (Sindh/ Jungle Sparrow) were brought to RLP-DZUSJ- (Research Laboratory of Parasitology, Department of Zoology, University of Sindh, Jamshoro). For investigation of helminth parasites, after anaesthetizing hosts, internal organs were examined thoroughly. Out of fourteen birds, only one was found infected with five nematodes of genus Acuaria Bremser (1811) (02♂, 03♀) belonging to Acuariidae. Nematodes collected from intestine were dropped in 20% ethanol for cleaning purpose, then into test tube containing heated 70% ethanol, to avoid twisting and for instant death. For detailed study, nematodes were preserved in mixture of 70% ethanol and glycerol Sherwin and Schmidt (1988). For morphological study, temporary mounted slides were made and observed under light microscope. With the aid of the Lucida camera, diagrams were made and Nikon digital camera were used for the photography. The measurements were taken in millimeters (mm) and in micrometers (µm) for eggs.

RESULTS

Species: *Acuaria pakistanensis* n.sp.
Host: *Passer pyrrhonotus* (Blyth, 1945).
Site of infection: Intestine.
Locality: Larkana, Sindh, Pakistan.
No. of specimen recovered: Five (two ♂ and three♀).
Etymology: *Pakistanensis*, the name of the novel species, implies the country name in which it was collected.
Taxonomic status of species:
Family: Acuariidae (Seurat, 1913).
Genus: Acuaria (Bremser, 1811).
Species: *Acuaria pakistanensis* n.sp.

Description: Cylindrical, elongated and fragile are the nematodes (Fig.1A, 2A). Anterior extremity without any thickening or covering of the cuticles, but straight cordons (Fig.2A) directed in the posterior direction. Behind the nerve ring, cervical papillae; mouth with two straight lateral lips; Buccal cavity with thick walls and striated transversely (Fig.2A). The cylindrical

esophagus, which consists of two parts (Muscular and Glandular).

Figure 1: *Acuaria pakistanensis* n. sp.
A. Male Anterior region.

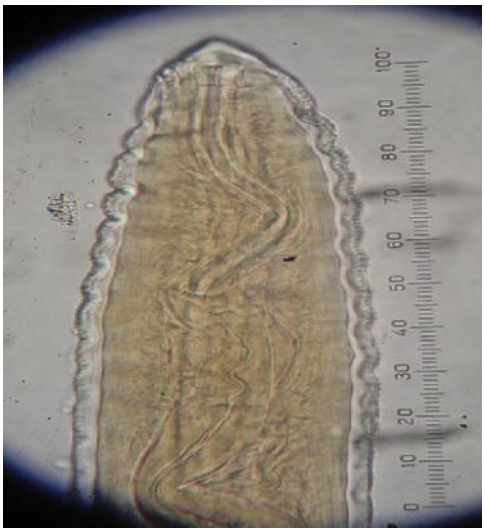

Figure 2: *Acuaria pakistanensis* n. sp.
A. Female Anterior region

Male: The body of the male worm is transparent, cylindrically long, and very thin (Fig.1A, 5A). The maximum body length is 6.9-7.5 mm and the width is 0.147-0.20 mm. buccal capsule (Fig.5C) length: 0.142-0.173 mm. 0.19-0.20 mm long cephalic cordons. The esophagus (Fig.5B) is divided into two regions; 0.394-0.581 mm of muscular region and 0.934-1.638 mm of glandular region. 0.121-0.137 mm nerve ring from the anterior side. 0.022-0.027mm excretory pore. There are four pre-anal pairs and six pairs of post-anal caudal papillae (Fig.6D). Spicules are divergent and unequal. The left spicule is (Fig. 6B) 0.195-0.2 mm and 0.125-0.137 mm is right spicule in length (Fig. 6C). Transparent cone tail (Fig.4A, 6A).

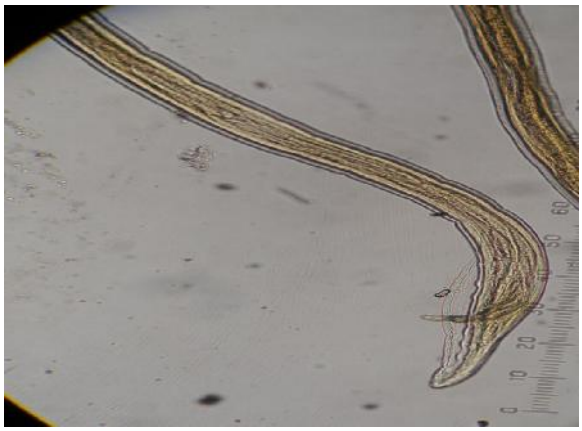

Figure 4: *Acuaria pakistanensis* n. sp.
A. Male Posterior region

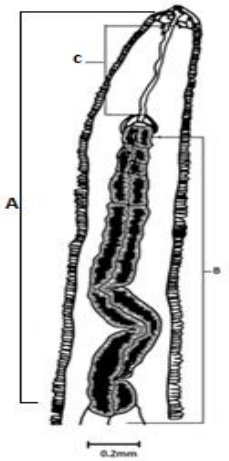

Figure 5: *Acuaria pakistanensis* n. sp.
A. Male Anterior region. B. Esophagus. C. Buccal cavity.

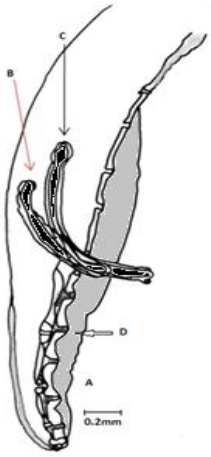

Figure 6: *Acuaria pakistanensis* n. sp.
A. Male Posterior region**.** B. Left spicules. C. Right spicule. D. Caudal papillae.

Female: The female worm body (Fig.2A, 7A) is translucent, long, very delicate, 8.47-14.1 mm long, and 0.25-0.35 mm wide in size. Cordons (Fig.7D) total in length is 0.17-0.218 mm. Buccal capsule is quite thick and maximum 0.142 in length and minimum 0.2 mm is width. The esophagus (Fig. 7B) is divided into 0.28-0.342 mm anterior muscular portions and 0.55-0.934 mm long glandular portions. The ring of the nerve is located approximately 0.137-0.157 mm from the anterior end. There is a cone-shaped tail indeed. Eggs are smooth (Fig. 3A, 8A), shelled round, oval and thick (Fig.8A) (37-40 x 20-25) µm and the vulva is located 0.094-0.15 mm in the posterior fourth of the body.

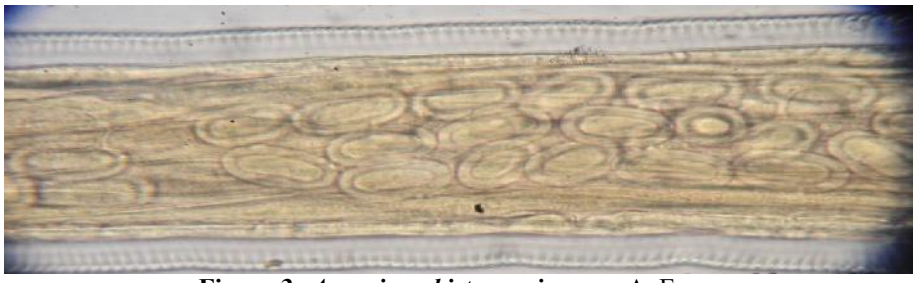

Figure 3: ***Acuaria pakistanensis*** **n. sp.** A. Eggs.

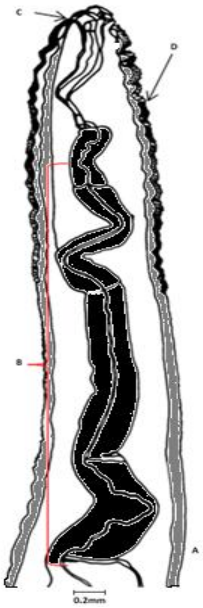

Figure 7: ***Acuaria pakistanensis*** **n. sp.**
A. Female Anterior region. B. Esophagus. C. Excretory pore. D. Cordons.

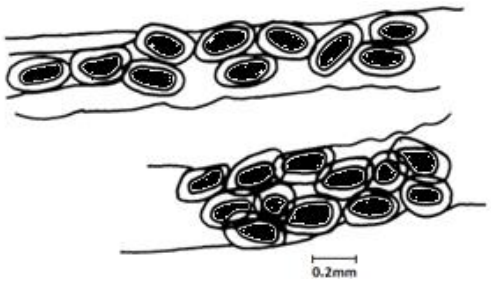

Figure 8: ***Acuaria pakistanensis*** **n. sp.** A. Eggs (in uterus)**.**

Table 01: Morphological and Meristic features for males of Acuaria (Skrjabini Ozerskaya 1926), in the present study and other studies.

Species	Present species	*Acuaria* (Skrjabini Ozerskaya, 1926) Mohammad K.M *et al.*,2012	*A.paraguayensis* Mutafchiev, Y *et al* ., 2012	*A.irhami* Dewi, K., & Zhang, L. 2010	*A.wangi* Zang *et al.*,2003	*A.coloradensis* Sharwin & Schmidt 1988	*A.condonspinosa* Barus & Garrido 1968	*A.cyanocitta* Boyd 1956	*A.minor* Williams, 1929	*A.anthuris* (A. nebraskensis) Williams 1929
Male	N=2	N=2	N=7	N=2	N=4	N=1	N=2	---	N=1	---
Body length	6.9-7.5	4.23-8.96	6.0-6.7	7.16-8.10	4.2-4.9	7.2	3.9	7.5-10.0	4.7	6.7-10.4
Body width	0.147-0.20	0.003-0.130	0.148-0.173	0.1-0.11	0.133-0.185	0.164	0.2	0.16-0.18	0.156	0.256-0.312
Buccal capsule	0.142-0.173	0.135-0.172	0.138-0.185	0.09-0.1	0.137-0.156	0.145	0.14-0.15	0.185-0.205	0.132	0.173-0.206
Esophagus	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
Muscular	0.394-0.581	0.350-0.412	0.391-0.452	0.3-0.34	0.486-0.524	0.395	0.4-0.43	0.513-0.595	0.312	0.594-0.837
Glandular	0.934-1.638	0.802-1.020	0.888-1.23	0.96-1.08	1.159-1.425	1.58	1.24-1.32	1.52-1.725	0.812	1.64-2.34
Cordon length	0.19-0.20	0.190-0.230	0.678-0.868	0.235-0.25	0.786-0.951	1.39	0.78-0.85	0.652-0.725	1.44-1.74	2.5-3.670
Nerve ring	0.121-0.137	0.120-0.196	Not given	0.135-0.15	0.182-205	Not given	Not Given	Not Given	Not given	Not given
Excretory pore	0.022-0.027	Not given	0.143-0.203	0.22-0.242	0.263-0.285	Not given	Not given	Not given	Not given	Not given
Spicules	Unequal and dis-similar	Unequal	Unequal	Equal and Similar	Sub-equal but dis-similar	Unequal	Unequal	Unequal	Unequal	Unequal
Left spicule	0.195-0.2	0.173-0.200	0.223-0.242	0.18-0.21	0.19-0.209	0.14	0.206-0.237	0.315-0.73	0.152	0.271-0.325
Right spicule	0.125-0.137	0.093-.110	0.192-0.205	0.18-0.21	0.103-0.129	0.125	0.136-0.152	0.22-0.23	0.156	0.231-0.282
Caudal papillae Post anal pairs	6	---	6	6	6	7	6	6	6	8
Host	*Passer pyrrhonotus*	*Passer domesticus biblicus*	*Siryster sibilator*	*Dicrurus hottentottus jentincki*	*Hylophylax naevioides*	*Tachycineta thalassina*	*Vireo griseus noveboracensis*	*Cyanocitta cristata*	*Sturnella neglecta*	*Corvus brachyrhynchos*
Locality	Larkana Pakistan	Baghdad, Iraq	Paraguay	Kangean Island, Indonesia	Costa Rica	USA	Cuba	USA	USA	USA

Table 02: Morphological and Meristic features for females of Acuaria (Skrjabini Ozerskaya1926).

Species	Present species	*Acuaria* (Skrjabini Ozerskaya, (1926) Mohammad K.M *et al.*,2012	*A.paraguayensis* Mutafchiev, Y *et al* ., 2012	*A.wangi* Zhang *et al.*, 2003	*A.condonspinosa* Barus & Garrido 1968	*A.cyanocitta* Boyd 1956	*A.minor* Williams 1929	*A.anthuris (A. nebraskensis)* Williams 1929
Female	N=3	N=2	N=2	N=9	N=2	Not mentioned	N=2	Not mentioned
Body length	8.47-14.1	26.532-32.707	12.4-12.9	6.80-10.04	5.87-7.29	12.8-18.4	11.8-13.0	17.6-20.3
Body width	0.25-0.35	0.192-0.345	0.253-0.277	0.205-0.311	0.3	0.23-0.297	0.287-0.312	0.412-0.556
Buccal capsule	0.142-0.2	0.176-0.321	0.19-0.205	0.144-0.19	0.14-0.15	0.215-0.25	0.173-0.194	0.2-0.219
Esophagus	Divided	Divided	Divided	Divided	Divided	Divided	Divided	Divided
Muscular	0.28-0.342	0.580-1.020	0.63-0.626	0.623-0.844	0.46-0.57	0.17-0.92	0.625	0.84-1.01
Glandular	0.55-0.934	1.420-2.241	1.503-1.758	1.48-1.88	1.17-132	1.75-2.25	1.141-1.87	2.34-2.75
Cordon length	0.17-0.218	0.362-0.550	1.113-1.615	1.26-1.85	1.07-1.09	1.095-1.39	4.4-4.58	4.5-7.48
Nerve ring	0.137-0.157	0.189-0.279	0.217-0.237	0.197-0.266	Not given	Not given	Not given	Not given
Vulva	0.094-0.15	13.660	6.5-6.6	3.56-5.64	0.63	0.50	0.46-0.56	0.39- 0.49
Eggs	Round and oval		Oval	Ellipsoid	Not given	Not given	Not given	Not given
Eggs Length (µm)	37-40	301- 450	34-36	31-37	36-39	42	36-40	41-45
Eggs width (µm)	20- 25	205- 302	23-24	18-22	27-29	24	23-25	24-29
Host	*Passer pyrrhonotus*	*Passer domesticus biblicus*	*Siryster sibilator*	*Hylophylax naevioides*	*Vireo griseus Novebora-censis*	*Cyanocitta Cristata*	*Sturnella neglecta*	*Corvus brachyrhynchos*
Locality	Larkana, Pakistan	Baghdad, Irqa	Paraguay	Costa Rica	Cuba	USA	USA	USA

DISCUSSION

Description of present nematodes is based on two male and three female species. According to literature, to contain parasites from bird nematodes, the *Acuaria* genus Bremser (1811) was established. *Acuaria anthuris* Rudolphi (1819), syn.., is the type species. *A. Nebrashensis* Williams (1929) in Oriolus galbula ,Coracias garrula; Europe. Also from Canada, Europe, U.S.A. India, Japan Rudolphi (1819), Williams (1929) in Corvus, Urocissa, Pyrrhocorax, Dendrocitta, Pica.

Other genus, species include *Acuaria anththuris (A. nebraskensis)* in American crow (C. barachyrhynchos), *Acuaria minor* Williams (1929) in Sturnella neglecta,; *Acuaria cyanocitta* Boyd (1956) ; *A. condonspinosa* in Vireo griseus Novebora-censis, Barus and Garrido (1968) ; *A. coloradensis* in Tachycineta thalassina Sherwin and Schmidt (1988) ; *A. wangi* in Hylophylax naevioides Zhang *et al*., (2003) ; *A. irhami,* in Dicrurus hottentottus jentincki, Dewi and Zhang (2010) ; *A. paraguaynesis* in Siryster sibilator Mutafchiev *et al*., (2012) and *Acuaria Skrjabini* Ozerskaya (1926) in *Passer domesticus biblicus,* Mohammad *et al*., (2012) .

The nematode *A. skrjabini* Ozerskaya (1926) was formerly described from various type of birds of Aidemosyne modesta, Poephila acuticauda and Erythrura psittacea Mc Orist *et al*., (1982) ; saturatus, Sturnus cineraceus Sato *et al*., (2005) from Japanese in *Passer montanus* Sato *et al*., (2005); and Mohammad *et al*., (2012) from *Passer domesticus biblicus*

Mohammad K.M, *et al*., (2012) distinguishes *Acuaria Skrjabini* Ozerkaya (1926) in body length and width, esophagus and cordon length and 7 post anal caudal papillae pairs from present male specimen.

Mohammad K.M, *et al*., (2012) distinguishes *Acuaria Skrjabini* Ozerkaya (1926) in larger body length, larger esophagus, vulva, cordon length and eggs size (301-450 x 205-302 vs 37-40 x 20-25) from present female specimen.

Mutafehiev Y *et al*., (2012) distinguishes *A. paraguayensis* in body size, small esophagus region, and longer cordon, shape of spicules and length of left and right from present male specimen. However, post anal pairs of caudal papillae is the same in number.

A. paraguayensis Mutafehiev Y *et al*., (2012) distinguishes in body length, cordon length, muscular and glandular regions, vulva and eggs size (34-36 x 23-24 vs 37-40 x 20-25) from present female specimen.

Dewi & Zang, (2010) distinguishes *A. irhami* in body size, cordon length longer, smaller esophagus, the right spicule is smaller, but has a slight variation in length of left spicule (0.18-0.21 vs 0.195-0.2) from the current male specimen but identical in having six post-anal pairs of caudal papillae.

Dewi & Zang (2010) only identified male specimen because a female was not found.

Zang *et al*., (2003) distinguishes *A. wandgi* in smaller body size, cordon length larger, small esophagus, spicules are sub-equal, and left spicule length, right spicule is smaller in size, but identical in having the same number of caudal papillae pairs from current male specimen.

Zang *et al*., (2003) distinguishes *A. wandgi* in body length is smaller, length of muscular and glandular esophagus, vulva length and ellipsoid shape of eggs and in size (31-37x 18-22 vs. 37-40 x 20-25) from current female specimen.

Sharwin and Schmidt (1988) distinguishes *A.coloradensis* in smaller size of body, length of cordon, esophagus is smaller in length, and left and right spicules are shorter in length and seven pairs of post-anal caudal papillae from current male specimens. In 1988, only male specimen was identified by Sharwin and Schmidt.

Barus and Garrido (1968) distinguishes *A. condonspinosa* in body length is smaller, both region of esophagus are smaller in length, left and right spicules in length from current male specimen but resembles in post-anal caudal papillae pairs.

Barus and Garrido (1968) distinguishes *A. condonspinosa* in size of body is small, small esophagus regions are small in length, length of cordon and vulva and size of eggs (36-39 x 27-29 vs. 37-40 x 20-25) from the present female specimen.

Boyd (1956) distinguishes *A. cyanocitta* in size of body, esophagus, cordon length, longer left and right spicules from current male specimen, but is close to having the same pairs of caudal papillae.

Boyd (1956) distinguishes *A. cyanocitta* in body is larger, muscular region of esophagus is smaller but glandular region of esophagus is longer, length of cordon and vulva and size of eggs (42 x 24 vs. 37-40 x 20- 25) from current female specimen.

Williams (1929) distinguishes *A. minor* in body size is smaller, cordon length, region of esophagus are smaller, left spicule is shorter and right spicule is longer from present male specimen but resembles the same caudal papillae post anal pairs.

Williams (1929) distinguishes *A. minor* in body size is smaller, length of cordon and esophagus, vulva from present female specimen but resembles almost the same (36-40 x 23-25 vs. 37- 40 x 20-25) egg size.

Williams (1929) distinguishes *A. anthuris (A. nebraskensis)* in greater body size, cordon length, length of esophagus, spicules length of left and right spicules and eight pairs of post-anal caudal papillae from present male specimen.

Williams (1929) *A. anthuris (A. nebraskensis)* distinguishes in size of body is larger, longer cordon, esophagus in length and eggs size are larger (41-45 x 24-29 vs. 37-40 x 20-25) from current female specimens.

Tables - 01 and 02 include the comparative morphometric characteristics of the current specimen and its comparative specimen.

Conclusion: A nova *Acuaria pakistanensis* species is postulated based on the diagnostic differences discussed above. However, the genus and host *Passer pyrrhonotus* have been reported from Pakistan for the first time.

REFERENCES

Barus, V. and Garrido, O.H. (1968). Nematodes parasitic in birds of the order Passeriformes in Cuba. Folia Parasitologica, (2), pp.147-160. https://www.cabdirect.org/cabdirect/abstract/19700802837.

Boyd, E.M. (1956). Two new species of stomach worms (Nematoda: Spiruroidea) from the blue jay, Cyanocitta cristata L. Proceedings of the Helminthological Society of Washington, 23(1), pp.70-74. http://science.peru.edu/COPA/html/1956_23_1_.html.

Chandio, I., Dharejo, A. M., Khan, M. M., & Naz, S. (2019). New host record for the Diplotriaena monticolae (Filariidae: Nematoda) from the thoracic cavity of Passer pyrrhonotus, Blyth 1845,(Passeridae: Passeriformes) in Larkana, Sindh, Pakistan. Pure and Applied Biology (PAB), 8(1), 580-584. http://dx.doi.org/10.19045/bspab.2018.700219.

Dewi, K. and Zhang, L. (2010). Two new species of spiruroid nematodes in birds from Kangean Island, Indonesia. J. helminthology, 84(3), p.245. doi: 10.1017/S0022149X09990599.

McOrist, S. and Browning, J.W. (1982). Carriage of Campylobacter jejuni in healthy and diarrhoeic dogs and cats. Australian Veterinary J., 58(1), pp.33-34.doi: 10.1111/j.1751-0813.1982.tb00587.x.

Mohammad, M.K. and Al-Moussawi, A.A. (2012). Gizzard nematodes of the House Sparrow Passer domesticus biblicus Hartert collected in Baghdad city, Central Iraq. Bulletin of the Iraq Natural History Museum (P-ISSN: 1017-8678, E-ISSN: 2311-9799), 12(2), pp.25-37. https://www.iasj.net/iasj/article/70417.

Mutafchiev, Y., Mariaux, J. and Georgiev, B.B. (2012). Acuaria paraguayensis n. sp. from Sirystes sibilator (Aves: Tyrannidae) in Paraguay and a redescription of A. mamillaris (Molin, 1860) from Cyanocorax cayanus (Corvidae) in Brazil, with a key to the species of Acuaria Bremser, 1811 (Nematoda: Acuariidae) in the New World. Systematic parasitology, 81(1), pp.51-64.doi:10.1007/s11230-011-9322-y.PMID: 22139009.

Ozerskaja, V.N. (1926) [Zur Fauna der parasitischen Wurmer de Haussperlinge des Dongebietes.] Trudy Gasudarstv. Inst. Eksper. Vet.2 (2), 102-108.

Roberts, T.J. (1992). The Birds of Pakistan. 2 Passeriformes. ISBN 978-0-19-577405-4.

Rudolph, KA, and since 1819. Entozoorum synopsis: to which are added, and the indices of the mantissa of the two kinds selected from the wealthiest. https://www.biodiversitylibrary.org/item/37488.

Sato, H.; Osanai, A.; Kamiya, H. and Une, Y. 2005. Gizzard spirurid nematode Acuaria skrjabini in Japanese tree sparrows and a gray starling from Tokyo. J. Vet. Med. Sci., 67: 607-609.

Sherwin, F.J. and Schmidt, G.D. (1988). Helminths of swallows of the mountains of Colorado, including Acuaria coloradensis n. sp. (Nematoda: Spirurata). The J. parasitology, pp.336-338. PMID: 3357125.

Williams, O.L. (1929). A Critical Analysis of the Specific Characters of the Genus" Acuaria" Nematodes of Birds, with Descriptions of New American Species, by Owen L. Williams. University of California Press. (Google Scholar)

Zhang, L., Brooks, D.R. and Causey, D. (2003). Two species of Acuaria Bremser, 1811 (Nematoda: Acuarioidea: Acuariidae) in passerine birds from the Area de Conservación Guanacaste, Costa Rica. J. Parasitology, 89 (5), pp.1039-1043. doi: 10.1645/GE-3144 PMID: 14627153.