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REVIEW ARTICLE /ARTÍCULO DE REVISIÓN

UPDATE OF CHECKLIST OF DIGENEAN PARASITES OF WILD BIRDS FROM ARGENTINA, WITH COMMENTS ABOUT THE EXTENT OF THEIR INVENTORY

ACTUALIZACIÓN DEL LISTADO DE DIGENEOS PARÁSITOS DE AVES SILVESTRES DE LA ARGENTINA, CON COMENTARIOS ACERCA DE SU INVENTARIO

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ABSTRACT

We present an update of the checklist of digenean parasites of birds from Argentina published by Lunaschi *et al*. (2007), including all additional records published since 2007 up to present and some records omitted in the preceding version. This new report includes information about 74 digenean taxa, distributed in 18 families and 45 genera, of which 68 species were reported parasitizing wild birds, 6 species were obtained experimentally, and 6 taxa identified at the generic level were recovered in wild birds and/or experimental host. Consequently, the actual number of digeneans recorded from Argentinean wild birds amounts 112 species in 65 genera of 20 families. The extension of this inventory was evaluated together with the number of host-parasite relations reported and the geographical distribution in the different ecoregions of the country. The species accumulation curve and the accumulation curve of host-parasite relations show that the inventory of digeneans of wild birds is far from being completed, even in the most studied areas. The taxonomic status of some species listed in Lunaschi *et al*. (2007), such as *Lyperosomum oswaldoi*, *Parastrigea brasiliana*, *Lyperorchis inexpectabilis* and *Stephanoprora podicipei*, was reconsidered according to new studies.

Keywords: Argentina - checklist - Digenea - inventory - parasites - wild birds.

RESUMEN

En este trabajo se presenta una actualización del listado de digeneos de aves de Argentina publicado por Lunaschi *et al*. (2007), incluyendo todos los registros adicionales publicados desde 2007 hasta la actualidad y algunos reportes omitidos en la versión precedente. Estos nuevos registros incluyen información de 74 taxa de digeneos distribuidos en 18 familias y 45 géneros, de los cuales 68 especies fueron reportadas parasitando aves silvestres, 6 especies fueron obtenidas experimentalmente y 6 taxa identificados a nivel genérico reportados en aves silvestres y/o hospedadores experimentales. Por consiguiente, el número actual de digeneos reportados en las aves silvestres de la Argentina alcanza 112 especies distribuidas en 65 géneros de 20 familias. La extensión de este inventario fue evaluada junto con el número de relaciones hospedador-parásito reportadas y la distribución geográfica en las distintas ecoregiones del país. Las curvas de acumulación de especies y de relaciones hospedador-parásito muestran que el inventario de digeneos de aves silvestres se encuentra lejos de ser completado, aún en las áreas más estudiadas. La posición taxonómica de algunas especies listadas en Lunaschi *et al*. (2007), tales como *Lyperosomum oswaldoi*, *Parastrigea brasiliana Lyperorchis inexpectabilis* y *Stephanoprora podicipei*, fue reconsiderada de acuerdo a nuevos estudios.

Palabras clave: Digenea – parásitos - aves silvestres – listado – inventario - Argentina.

INTRODUCTION

We present an update of Lunaschi *et al*. (2007), including all additional records published since 2007 up to present, some omitted reports in the preceding version, and the taxonomic relocation of some species listed in the former work, according to new investigations. Lunaschi *et al*. (2007) list information published between 1909 and 2006, consisting of 89 adult digenean species of birds from Argentina (81 species parasitizing natural host and 8 obtained experimentally) and 6 digeneans identified at generic level. In the last 8 years, the number of papers on digeneans from birds had a significant increase. In this update, we present information about 69 adult digenean species from birds (65 parasitizing wild birds and 4 obtained experimentally) and 7 digenea identified at generic level. The aim of this paper was to estimate the extent of inventory of digenean parasites of Argentinean wild birds, as well as the number of host-parasite relations using species accumulation curves, and to evaluate the distribution of these helminths in different regions of the country.

MATERIAL AND METHODS

This update was prepared on the basis of data published since 2007 to present from various regions of Argentina. The list of digenean taxa is presented in alphabetical order, within the different taxonomic hierarchy. Each record contains information about the species name, authorship and year, as well as the synonymous under which original records appeared, host(s), site of infection and localities (geographical coordinates when possible). Information on the life cycle of species listed herein or by Lunaschi *et al*. (2007) is also given. Detail concerning the material repository is listed, where this information was included in the original publication: collection acronym and code numbers. Reference to the literature is arranged chronologically. Species

referred to in theses, dissertations and scientific meetings were not considered. The taxonomic classification of digeneans is presented according to Gibson *et al.* (2002), Jones *et al.* (2005) and Bray *et al*. (2008). The nomenclature of birds follows Remsen *et al*. (2014). The map of ecoregions of Argentina is taken from Brown & Pacheco (2006).

Codes for the helminthological collections are as follow: collection at the Natural History Museum, London, UK (BMNH); Parasitological Collection of the Centro Nacional Patagónico, Puerto Madryn, Argentina (CNP-Par); Invertebrates collection of the Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina (MACN-Pa); Helmintological Collection of the Museo de La Plata (MLP-He), Buenos Aires Province, Argentina; Parasitological Collection of the Universidad Nacional del Comahue, Bariloche, Argentina (UNCo-Pa). Abbreviations for the life cycle are as follow: Hi_1: first intermediate host and Hi_2: second intermediate host. In order to evaluate the extent of the inventory, only taxa identified at specific level were counted.

RESULTS

A total of 74 reports of adult digeneans from birds are listed here. The new data consist mostly of species new to science, new host records, new geographical records and data on their life cycle. These reports include 68 species parasitizing wild birds, 6 species obtained experimentally, and 6 taxa identified at generic level recovered in wild birds and/or experimental host. These species are distributed in 18 families and 45 genera. There was an increase of 32 species in the last 8 years. A total of 29 bird species are listed as definitive hosts of digeneans, two species of birds and one of mammals as experimental hosts, and 27 hosts are listed as intermediate hosts (Table 1).

Superfamily Brachylaimoidea Joyeux & Foley, 1930

Family Brachylaimidae Joyeux & Foley, 1930
Genus *Brachylaima* Dujardin, 1843
Brachylaima yupanquii Freitas, Kohn & Ibáñez, 1967
Host: *Cariama cristata* (Linnaeus, 1766) (Cariamidae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'35"S; 59°06'67"W), Pirané, Formosa Province.
Material deposited: MLP-He 6444.
Reference: Lunaschi & Drago (2012).

Genus *Glaphyrostomum* Braun, 1901
Glaphyrostomum propinquum Braun, 1901
Host: *Guira guira* (Gmelin, 1788) (Cuculidae).
Site of infection: cloaca.
Locality: La Marcela farm (26°17'35”S; 59°06'67”W), Pirané, Formosa Province.
Material deposited: MLP-He 5575.
Reference: Lunaschi & Drago (2009a).

Family Leucochloridiidae Poche, 1907
Genus *Pojmanskia* Zamparo, Brooks & Causey, 2003
Pojmanskia riosae Zamparo, Brooks & Causey, 2003
Host: *Taraba major* (Vieillot, 1816) (Thamnophilidae).
Site of infection: cloaca.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6731.
Reference: Lunaschi *et al*. (2014).

Superfamily Clinostomoidea Lühe, 1901

Family Clinostomidae Lühe, 1901
Genus *Clinostomatopsis* Dollfus, 1932
Clinostomatopsis sorbens (Braun, 1899) Dollfus, 1932
Host: *Tigrisoma lineatum* (Boddaert, 1783) (Ardeidae).
Site of infection: esophagus.

Locality: Bellaco stream (26º14'S; 58º07'W), Pirané, Formosa Province.
Material deposited: MLP-He 5573.
Reference: Lunaschi & Drago (2009a).

Genus *Clinostomum* Leidy, 1856
Clinostomum marginatum (Rudolphi, 1819) Braun 1899
Host: *Tigrisoma lineatum* (Boddaert, 1783) (Ardeidae).
Site of infection: esophagus.
Locality: Bellaco stream (26º14'S; 58º07'W), Pirané, Formosa Province.
Material deposited: MLP-He 5574.
Reference: Lunaschi & Drago (2009a).

Superfamily Cyclocoeloidea Stossich, 1902

Family Cyclocoelidae Stossich, 1902
Genus *Spaniometra* Kossack, 1911
Spaniometra variolaris (Fuhrmann, 1904)
Host: Rostrhamus sociabilis (Vieillot, 1817) (Accipitridae).
Site of infection: air-sacs.
Locality: La Marcela farm (26°17'35"S; 59°06'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6718, MLP-He 6719.
Reference: Drago *et al*. (2014).

Family Eucotylidae Cohn, 1904
Genus *Tanaisia* Skrjabin, 1924
Tanaisia dubia Freitas, 1951
Hosts: *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae), *Pitangus sulphuratus* (Linnaeus, 1766) (Tyrannidae).
Site of infection: ureters.
Locality: La Marcela farm, (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6771, MLP-He 6672.
Reference: Lunaschi *et al*. (in press).

Superfamily Diplostomoidea Poirier, 1886

Family Diplostomidae Poirier, 1886
Genus *Austrodiplostomum* Szidat & Nani, 1951
Austrodiplostomum mordax Szidat & Nani, 1951
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: intestine.
Locality: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 6411.
Life cycle: Hi_2: metacercariae of *Austrodiplostomum* cf. *mordax*, in brain, optic nerve and spinal chord in *Odontesthes bonariensis* (Valenciennes, 1853), from Lacombe and Salada Grande lagoons, Buenos Aires Province.
References: Drago *et al.* (2011), Drago (2012).

Austrodiplostomum ostrowskiae Dronen, 2009
Host: *Phalacrocorax brasilianus (Gmelin, 1789) (Phalacrocoracidae).*
Site of infection: large intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 6412.
Reference: Drago *et al.* (2011).

Genus *Dolichorchis* Dubois, 1961
Dolichorchis lacombeensis Lunaschi & Drago, 2006
Hosts: *Ardea cocoi* Linnaeus, 1766; *Ardea alba* Linnaeus, 1758 (Ardeidae).
Site of infection: intestine.
Locality: Lacombe lagoon (35° 49'S; 57° 49'W), Lezama, Buenos Aires.
Material deposited: MLP-He 5972; MLP-He 5973.
Reference: Drago & Lunaschi (2011a).

Genus *Hysteromorpha* Lutz, 1931
Hysteromorpha triloba (Rudolphi, 1819) Lutz, 1931
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: intestine.
Localities: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province; La Marcela farm (26°17'S; 59°06'W), Pirané and

Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: MLP-He 6414.
Reference: Drago *et al.* (2011).

Genus Neodiplostomum Railliet, 1919
Neodiplostomum travassosi Dubois, 1937
Host: *Buteogallus meridionalis* (Latham, 1790) (Accipitridae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'35"S; 59°06'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6714.
Reference: *Drago et al.* (2014).

Genus *Posthodiplostomum* Dubois, 1936
Posthodiplostomum macrocotyle Dubois, 1937
Host: *Busarellus nigricollis* (Latham, 1790) (Accipitridae).
Site of infection: small intestine
Locality: La Marcela farm (26°17'35"S; 59°06'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6716, MLP-He 6717.
Reference: Drago *et al*. (2014).

Posthodiplostomum nanum Dubois, 1937
Host: *Ardea alba Linnaeus,* 1758 (Ardeidae)
Site of infection: intestine.
Localities: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province and Clorinda (25°17'S, 57°43'W), Formosa Province.
Material deposited: MLP-He 5974, MLP-He 5975.
Host: *Tigrisoma lineatum* (Boddaert, 1783) (Ardeidae).
Site of infection: intestine.
Locality: Bellaco stream (26º14'S; 58º07'W), Formosa Province.
Material deposited: MLP-He 5977.
Reference: Drago & Lunaschi (2011a).

Posthodiplostomum sp.
Host: *Ardea cocoi* Linnaeus, 1766 (Ardeidae).
Site of infection: intestine.
Locality: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 6013.
Reference: Drago & Lunaschi (2011a).

Posthodiplostomum sp.
Natural definitive host: unknown.
Experimental hosts: *Gallus gallus* (Linnaeus, 1758) (*Phasianidae), Mus musculus* Linnaeus, 1758 (Muridae).
Life cycle: Hi_1: sporocysts and cercariae in *Anisancylus obliquus* (Broderip & Sowerby, 1832). Hi_2: metacercariae in *Galaxias maculatus* (Jenyns, 1842) from Patagua Lake, Neuquén Province.
Material deposited: experimental adults from chicks MACN-Pa 558/11-12, UNCo-Pa 239/1-6; from mice MACN-Pa 558/ 8-10, UNCo-Pa 240/1-13; metacercariae MACN-Pa 558/5-7, MACN-Pa 558/2-4, UNCo-Pa 241/1-12, UNCo-Pa 242/1-3; sporocyst MACN-Pa 558/1, UNCo-Pa 243/1-3.
Reference: Ritossa *et al*. (2013).

Genus *Sphincterodiplostomum* Dubois, 1936
Sphincterodiplostomum musculosum Dubois, 1936
Host: *Tigrisoma lineatum* (Boddaert, 1783) (Ardeidae).
Site of infection: intestine.
Locality: Bellaco stream (26º14'S; 58º07'W), Pirané, Formosa Province.
Material deposited: MLP-He 5970.
Reference: Drago & Lunaschi (2011a).

Genus *Tylodelphys* Diesing, 1850
Tylodelphys adulta Lunaschi & Drago 2004
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: small intestine.
Locality: Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: MLP-He 6413.
Reference: Drago *et al.* (2011).

Tylodelphys brevis Drago & Lunaschi, 2008
Host: *Mycteria americana* Linnaeus, 1758

(Ciconiidae).
Site of infection: Small intestine.
Locality: Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: Holotype, MLP-He 5741; paratypes MLP-He 5742.
Reference: Drago & Lunaschi (2008).
Host: *Busarellus nigricollis* (Latham, 1790) (Accipitridae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'35"S; 59°06'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6715.
Reference: Drago *et al*. (2014).

Tylodelphys elongata (Lutz, 1928) Dubois, 1937
Host: *Tigrisoma lineatum* (Boddaert, 1783) (Ardeidae).
Site of infection: intestine.
Locality: Bellaco stream (26º14'S; 58º07'W), Pirané, Formosa Province.
Material deposited: MLP-He 5971.
Reference: Drago & Lunaschi (2011a).

Family Strigeidae Railliet, 1919
Genus *Apharyngostrigea* Ciurea, 1927
Apharyngostrigea ardearum (Lutz, 1928) Dubois, 1968
[Syn. *Apharyngostrigea brasiliana* Szidat, 1929 of Labriola & Suriano (1998)]
Site of infection: intestine.
Host: *Ardea alba* Linnaeus, 1758 (Ardeidae).
Localities: Lacombe lagoon (35º49'S, 57º49'W), Lezama, Buenos Aires Province and Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: MLP-He 5965, MLP-He 5966.
Host: *Ardea cocoi* Linnaeus, 1766 (Ardeidae).
Locality: Lacombe lagoon (35º49'S, 57º49'W), Buenos Aires Province.
Material deposited: MLP-He 5967.
Hosts: *Ardea alba* Linnaeus, 1758, *Bubulcus ibis* (Linnaeus, 1758) (Ardeidae).
Locality: De Monte Lagoon, Buenos Aires Province.
Material deposited: MLP-He 5968, MLP-He 5969.
Comments: In Argentina, this species was cited by Labriola & Suriano (1998) as *Apharyngostrigea brasiliana* (Szidat, 1928) Szidat, 1929 parasitizing *A. alba* and *B. ibis* from De Monte lagoon. Later, was listed as *Parastrigea brasiliana* (Szidat, 1928) Dubois, 1964 in Lunaschi *et al*. (2007). Finally, these specimens were re-examined and transferred to *A. ardearum (*see Drago & Lunaschi, 2011a).
Reference: Drago & Lunaschi (2011a).

Genus *Australapatemon* Sudarikov, 1959
Australapatemon canadensis Dubois & Rausch, 1950
Host: *Cygnus melancoryphus* (Molina, 1782) (Anatidae).
Site of infection: small intestine.
Localities: Lacombe lagoon (35º51'42"S, 57º53'39"W), Lezama, Buenos Aires and Pellegrini Lake, Cinco Saltos (38º42'15"S, 67º59'47"W), Río Negro Province.
Material deposited: MLP-He 6065; MLP-He 616-617/C.
Reference: Drago & Lunaschi (2010).

Australapatemon magnacetabulum Dubois, 1988
Natural definitive host: unknown in Argentina.
Experimental definitive hosts: *Gallus gallus* (Linnaeus, 1758) (Phasianidae), *Anas platyrhynchos* Linnaeus, 1758.
Site of infection: anterior intestine.
Life cycle: Hi_1: sporocysts and cercaria in gonad and hepatopancreas of *Biomphalaria tenagophila* (d'Orbigny, 1835). Hi_2: metacercariae in parenchyma of *Helobdella adiastola* Ringuelet, 1972, *Helobdella triserialis* (Blanchard, 1849), *Haementeria eichhorniae* Ringuelet, 1978, *and Haementeria* sp. from Tres Palmeras, Valley of Lerma, Salta Province.
Material deposited: MACN-Pa 521/1-9 from *A. platyrhynchos*; MACN-Pa 521/10-19 from *G. g. domesticus*; MACN-Pa 521/20

sporocysts from *B. tenagophila*; MACN-Pa 521/21-24 sagittal sections of adults from *G. domesticus*; MACN-Pa 521/25 histological sections of leeches containing metacercariae.
Reference: Davies & Ostrowski de Núñez (2012).

Genus *Cardiocephaloides* Sudarikov, 1959
Cardiocephaloides physalis (Lutz, 1926)
Host: *Spheniscus magellanicus* (Foster, 1781) (Spheniscidae).
Site of infection: intestine.
Locality: coast of Península Valdés (42°04'-42°53'S; 63°38'-64°30'W), Chubut Province.
Material deposited: MLP-He 6085.
Reference: Díaz *et al.* (2010).

Genus *Strigea* Abildgaard, 1790
Strigea elliptica (Brandes, 1888) Szidat, 1928
Host: *Buteogallus meridionalis* (Latham, 1790) (Accipitridae).
Site of infection: small intestine.
Locality: Bellaco wetland (26°17′S, 59°06′W), Formosa Province.
Material deposited: MLP-He 5885.
Reference: Lunaschi & Drago (2009b).

Strigea falconis brasiliana Szidat, 1929
Hosts: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae), *Milvago chimachima* (Vieillot, 1816), *Caracara plancus* (Miller, 1777) (Falconidae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 6415, MLP-He 6712, MLP-He 6713
Reference: Drago *et al.* (2011, 2014).

Strigea inflecta Lunaschi & Drago, 2012
Host: *Cariama cristata* (Linnaeus, 1766) (Cariamidae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'35"S; 59°06'67"W), Pirané, Formosa Province.
Material deposited: Holotype MLP-He 6445; paratypes MLP-He 6446.
Reference: Lunaschi & Drago (2012).

Strigea meridionalis Lunaschi & Drago, 2009
Host: *Buteogallus meridionalis (Latham,* 1790) (Accipitridae).
Site of infection: small intestine.
Locality: Bellaco wetland (26°17′S, 59°06′W), Formosa Province.
Material deposited: Holotype MLP-He 5883; paratypes MLP-He 5884.
Reference: Lunaschi & Drago (2009b).

Strigea microbursa Pearson & Dubois, 1985
Host: *Buteogallus meridionalis* (Latham, 1790) (Accipitridae).
Site of infection: small intestine.
Locality: Bellaco wetland (26°17′S, 59°06′W), Formosa Province.
Material deposited: MLP-He 5886.
Reference: Lunaschi & Drago (2009b).

Strigea vaginata (Brandes, 1888) Szidat, 1928
Host: *Coragyps atratus* (Bechstein, 1793) (Cathartidae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 5964.
Reference: Drago & Lunaschi (2011a).

Strigea orbiculata Lunaschi & Drago, 2013
Host: *Taraba major* (Vieillot, 1816) (Thamnophilidae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: Holotype MLP-He 6672; paratypes MLP-He 6673.
Reference: Lunaschi & Drago (2013).

Strigea proteolytica Drago, Lunaschi & Draghi, 2014
Host: *Buteogallus urubitinga* (Gmelin, 1788) (Accipitridae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'35”S; 59°06'38”W), Pirané, Formosa Province.

Material deposited: Holotype MLP-He 6709; paratypes MLP-He 6710, voucher specimens: MLP-He 6711.
Reference: Drago *et al*. (2014).

Genus *Parastrigea* Szidat, 1928
Comments: The citations of *P. brasiliana* reported by Boero *et al.* (1972a) and Labriola & Suriano (1998) listed in Lunaschi *et al*. (2007) were regarded erroneous (see Drago & Lunaschi 2011a).

Parastrigea macrobursa Drago & Lunaschi 2011
Host: Buteogallus urubitinga (Gmelin, 1788*) (Accipitridae).*
Site of infection: small intestine.
Locality: La Marcela farm (26°17''S; 59°06''W), Pirané, Formosa.
Material deposited: Holotype MLP-He 6272; paratypes MLP-He 6273, MLP-He 6274; voucher specimens: MLP-He 6275 (in cross-sections), MLP-He 6276.
Reference: Drago & Lunaschi (2011b).

Superfamily Echinostomatoidea Looss, 1899

Family Echinostomatidae Looss, 1899
Genus Drepanocephalus Dietz, 1909
Drepanocephalus spathans Dietz, 1909
Host: *Phalacrocorax brasilianus (Gmelin, 1789) (Phalacrocoracidae).*
Site of infection: intestine.
*L*ocalities: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province; La Marcela farm (26°17'S; 59°06'W), Pirané and Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: MLP-He 6422, MLP-He 6423.
Reference: Drago et al. (2011).

Genus *Edietziana* Özdikmen, 2013
Edietziana serrata (Diesing, 1850) Özdikmen, 2013
Host: *Aramus guarauna* (Linnaeus, 1766) (Aramidae).
Site of infection: small intestine.
Locality: La Marcela farm (26°17'35”S; 59°08'38”W), Pirané, Formosa Province.
Material deposited: MLP-He 6604.
Reference: Lunaschi *et al.* (2015).

Genus *Echinostoma* Rudolphi, 1809
Echinostoma revolutum “group”
Host: *Sturnus vulgaris* Linnaeus, 1758 (Sturnidae).
Site of infection: intestine.
Locality: Bernal (34°41''44''S; 58°16'0''W), Buenos Aires Province.
Material deposited: MLP-He 6732.
Reference: Valente *et al.* (2014).

Genus *Himasthla* Dietz, 1909
Himasthla escamosa Díaz & Cremonte, 2004
Host: *Larus atlanticus* Olrog, 1958 (Laridae).
Site of infection: intestine.
Locality: Bahía Blanca estuary (38°48'S; 62°15'W), Buenos Aires Province.
Material deposited: MLP-He 5735 (indicated as 5800-5804).
Reference: La Sala et al. (2009).
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: intestine.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf, and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 5233, MLP-He 5234, CNP-Par. 6.
Reference: Díaz *et al*. (2011).

Genus *Lyperorchis* Travassos, 1921
Lyperorchis lyperorchis Travassos, 1921
(Syn. *Lyperorchis inexpectabilis* Digiani, 1997)
Host: *Aramus guarauna* (Linnaeus, 1766) (Aramidae).
Site of infection: cloaca.
Localities: Punta Blanca (34°56'S; 57°41'W), Magdalena, Buenos Aires Province; La Marcela farm (26°17'35”S; 59°08'38”W), Pirané, Formosa Province.

Material deposited: MLP-He 3323/2; MLP-He 6603.
Reference: Lunaschi *et al.* (2015).
Comments: *Lyperorchis inexpectabilis* Digiani, 1997 was listed in Lunaschi *et al*. (2007) parasitizing *A. guarauna* from Buenos Aires Province. Later, this species was synonymized with *Lyperorchis lyperorchis* by *Lunaschi et al. (2015).*

Genus *Nephrostomum Dietz, 1909*
Nephrostomum limai Travassos, 1922
Host: *Syrigma sibilatrix* (Temminck, 1824) (Ardeidae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6787.
Reference: Lunaschi *et al.* (2015).

Genus *Paryphostomum* Dietz, 1909
Paryphostomum segregatum Dietz, 1909
Host: *Coragyps atratus* (Bechstein, 1793) *(Cathartidae)*.
Site of infection: intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 6010.
Reference: Drago & Lunaschi (2011a).
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: intestine.
Localities: Clorinda (25°17'S; 57°43'W), Formosa Province and Lacombe lagoon (35º49'S, 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 6419, MLP-He 6420.
Reference: Drago *et al.* (2011).

Paryphostomum parvicephalum (Rietschel & Werding, 1978) Kostadinova, Vaucher & Gibson, 2002
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 6421.
Reference: Drago *et al.* (2011).

Genus *Petasiger* Dietz, 1909
Petasiger argentinensis Lunaschi & Drago 2010
Hosts: *Podiceps major* (Boddaert, 1783); *Rollandia rolland* (Quoy & Gaimard, 1824) (Podicipedidae).
Site of infection: small intestine.
Locality: Lacombe lagoon (35°49´S; 57°49´W), Lezama, Buenos Aires.
Material deposited: Holotype MLP-He 6061; paratypes MLP-He 6062; voucher specimens MLP-He 6063; MLP-He 6064.
Reference: Lunaschi & Drago (2010).

Petasiger sp.
Host: *Ardea cocoi* Linnaeus, 1766 (Ardeidae).
Site of infection: intestine.
Lacombe lagoon (35º49'S, 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 6012.
Reference: Drago & Lunaschi (2011a).

Petasiger sp.
Host: *Coragyps atratus* (Bechstein, 1793) (Cathartidae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'S; 59°06'W), Pirané, Formosa Province.
Material deposited: MLP-He 6011.
Reference: Drago & Lunaschi (2011a).

Genus *Stephanoprora* Odhner, 1902
Stephanoprora aylacostoma Ostrowski de Núñez & Quintana, 2008
Natural definitive host: unknown.
Experimental definitive host: *Gallus gallus* (Linnaeus, 1758) (Phasianidae).
Site of infection: posterior intestine.
Life cycle: Hi_1: sporocysts, rediae and cercariae in gills of *Aylacostoma chloroticum* Hylton Scott, 1954 (natural host). Hi_2: metacercariae encysted on gill filaments and gill chamber of *Moenkhausia dichroura* (Kner,

1858), *Astyanax erythropterus* (Holmberg, 1891) and *Hyphesobrycon serpae* (Durbin in Eigenmann 1908) (natural hosts), and *Cnesterodon decemmaculatus* (Jenyns, 1842) and *Poecilia reticulata* Peters, 1859 (experimental hosts).
Locality: Paraná River in Heller Peninsula (27°20'S; 55°55'W), Misiones Province.
Material deposited: MACN-Pa 441/1-6.
Reference: Ostrowski de Núñez & Quintana (2008).

Stephanoprora podicipei Etchegoin & Martorelli, 1997
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: intestine.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf, and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 6307; CNP-Par 9.
Reference: Díaz *et al*. (2011).
Comments: *Stephanoprora podicipei* was listed as synonymous of *Stephanoprora uruguayense* Holcman-Spector & Olagüe, 1989 in Lunaschi *et al*. (2007). Díaz *et al*. (2011) regarded to *S. podicipei* as a valid species, through a personal communication of Dr. Ostrowski de Núñez.

Stephanoprora uruguayense Holcman-Spector & Olagüe, 1989
Natural definitive hosts: see Lunaschi *et al.* (2007).
Experimental definitive hosts: *Gallus gallus* (Linnaeus, 1758) (Phasianidae), *Mus musculus* Linnaeus, 1758 (Muridae).
Site of infection: posterior intestine.
Material deposited: MACN-Pa 440/1-4 from *G. g. domesticus*, 440/5 from *M. musculus*.
Life cycle: Hi_1: sporocysts in gills, rediae and cercariae in hepatopancreas and gonads of *Heleobia parchappei* (d'Orbigny, 1835) from Buenos Aires City, rediae and cercaria in digestive gland and gonad of *Heleobia australis* (d'Orbigny, 1835) from Buenos Aires Province. Hi_2: metacercariae in gills of *Cnesterodon decemmaculatus* (Jenyns, 1842) from Buenos Aires City, *Galaxias maculatus* (Jenyns, 1842) and *Aplochiton zebra* Jenyns, 1842 from Patagonia.
References: Ostrowski de Núñez (2007), Viozzi *et al.* (2009), Fernández *et al.* (2010, 2012), Alda & Martorelli (2014).

Family Philophthalmidae Travassos, 1918
Genus *Parorchis* Nicoll, 1907
Parorchis sp.
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: cloaca, rectum, bursa Fabricii.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf and Puerto Madryn Beach (42°47'S; 65°02' S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 6308, CNP-Par 15.
Reference: Díaz *et al*. (2011).

Family Psilostomidae Looss, 1900
Genus *Psilochasmus* Lühe, 1909
Psilochasmus oxyurus (Creplin, 1825) Lühe, 1909
Host: *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae).
Site of infection: intestine.
Locality: Bahía Blanca estuary (38º49'S; 62º06'W), Buenos Aires Province.
Material deposited: MLP-He 5984.
Life cycle: Hi_1 and Hi_2: rediae and metacercariae in *Heleobia australis* (d'Orbigny, 1835) from Bahía Blanca estuary.
References: Alda *et al.* (2011a), Alda & Martorelli (2014).

Genus *Ribeiroia* Travassos, 1939
Ribeiroia ondatrae (Price, 1932) Price, 1942
Host: Phalacrocorax brasilianus (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: stomach.
Localities: Lacombe lagoon (35º49'S;

57º49'W), Lezama, Buenos Aires Province; La Marcela farm (26°17'S; 59°06'W), Pirané and Clorinda (25°17'S; 57°43'W), Formosa Province.
Material deposited: MLP-He 6416, MLP-He 6417.
Reference: Drago *et al.* (2011).

Superfamily Gorgoderoidea Looss, 1899
Family Dicrocoeliidae Looss, 1899
Genus *Athesmia* Looss, 1899
Athesmia heterolecithodes (Braun, 1899) Looss, 1899
Host: *Nothura maculosa* (Temminck, 1815) (Tinamidae)
Site of infection: not reported
Locality: San Jaime de la Frontera (Juan B. Arruabarrena), Entre Rios Province.
Material deposited: not reported.
Reference: Byrd *et al.* (1967), Bump & Bump (1969).
Host: *Nothura darwinii* Gray, 1867 (Tinamidae).
Site of infection: not reported.
Locality: Uriburu, La Pampa Province.
Material deposited: not reported
Reference: Byrd *et al.* (1967).
Hosts: *Cariama cristata* (Linnaeus, 1766) (Cariamidae); *Guira guira* (Gmelin, 1788) (Cuculidae); *Milvago chimachima* (Vieillot, *1816*) (Falconidae); *Rostrhamus sociabilis* (Vieillot, *1817*) (Accipitridae); *Theristicus caudatus* (Boddaert, 1783) (Threskiornithidae).
Site of infection: liver bile ducts.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 5576, MLP-He 6788; MLP-He 6789.
References: Lunaschi & Drago (2009a), Lunaschi *et al*. (2015).

Genus *Lubens* Travassos, 1919
Lubens lubens (Braun, 1901) Strom, 1940
Host: *Taraba major* (Vieillot, 1816) (Thamnophilidae).
Site of infection: intestine.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6730.
Reference: Lunaschi *et al*. (2014).

Genus *Lyperosomum* Looss, 1919
Lyperosomum oswaldoi (Travassos, 1919) Travassos, 1944
Host: *Taraba major* (Vieillot, 1816) (Thamnophilidae).
Site of infection: bile ducts.
Locality: La Marcela farm (26°17'35"S; 59°08'38"W), Pirané, Formosa Province.
Material deposited: MLP-He 6674.
Comments: This species was reported by Boero *et al*. (1972b) parasitizing *Molothrus bonariensis* (Gmelin, 1789) (Passeriformes, Icteridae) (Lunaschi *et al*. 2007). Later, this report was considered erroneous by Lunaschi & Drago (2013).
Reference: Lunaschi & Drago (2013).

Lyperosomum sp.
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: pancreas.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 6306, CNP-Par 16.
Reference: Díaz *et al*. (2011).

Genus *Zonorchis* Travassos, 1944
Zonorchis sp.
Host: *Nothura maculosa* (Temminck, 1815) (Tinamidae)
Site of infection: liver.
Locality: not reported.
Material deposited: not reported.
Reference: Bump & Bump (1969).

Superfamily Gymnophalloidea Odhner, 1905
Family Gymnophallidae Odhner, 1905
Genus *Bartolius* Cremonte, 2001
Bartolius pierrei Cremonte, 2001

Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: intestine.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf; Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 6310; CNP-Par 12.
Reference: Díaz *et al*. (2011).

Genus *Gymnophallus Odhner, 1900*
Gymnophallus australis Szidat, 1962
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: intestine.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf, and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Life cycle: Hi_2: metacercariae in central extrapallial space, between the valve and mantle of *Perumytilus purpuratus* (Lamarck, 1819), *Mytilus edulis* (Linnaeus, 1758) and *Aulacomya atra* (Molina, 1782) from Comodoro Rivadavia, Chubut Province.
Material deposited: adults from natural host MLP-He 6311 and CNP-Par 14. Experimental adults: MACN-Pa 437/1-4 and BMNH 2007.2.21.17. Metacercariae: MACN-Pa 438/1-4 and BMNH 2007.2.21.18.
References: Cremonte *et al*. (2008), Díaz *et al*. (2011).

Superfamily Microphalloidea Ward, 1901

Family Microphallidae Ward, 1901
Genus *Levinseniella* Stiles & Hassall, 1901, in Ward (1901)
Levinseniella cruzi Travassos, 1920
Hosts: *Larus atlanticus* Olrog, 1958 (Laridae); *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae).
Site of infection: intestine.
Locality: Bahía Blanca estuary, (38°48'S; 62°15'W; 38º49'S; 62º06'W) Buenos Aires Province.
Life cycle: Hi1, sporocysts in digestive gland and gonad of *Heleobia australis* (d'Orbigny, 1835) from Bahía Blanca estuary; Hi_2: metacercariae in gonads of *Cyrtograpsus angulatus* Dana, 1851 and *Neohelice granulata* (Dana, 1851) from Bahía Blanca estuary.
Material deposited: MLP-He 5734 (indicated as 5800-5804); MLP-He 5986.
Reference: La Sala *et al.* (2009), Alda et al. (2011a-b), Alda & Martorelli (2014).

Genus *Maritrema* Nicoll, 1907
Maritrema bonaerense Etchegoin & Martorelli, 1997
Host: *Larus atlanticus* Olrog, 1958 (Laridae).
Experimental host: *Gallus gallus* (Linnaeus, 1758) (Phasianidae).
Site of infection: intestine.
Locality: Bahía Blanca estuary (38°48'S; 62°15'W), Buenos Aires Province.
Life cycle: Hi_1: sporocysts and cercariae in *Heleobia australis* (d'Orbigny, 1835) from Bahía Blanca estuary; Hi_2: metacercariae in gills, haemocoel, muscle and ovary of *Cyrtograpsus angulatus* Dana, 1851 and *Neohelice granulata* (Dana, 1851) from Bahía Blanca estuary.
Material deposited: Adult from natural host MLP-He 5731 (indicated as 5800-5804); sporocysts and cercariae MLP-He 6525; metacercariae MLP-He 6526; experimental adult MLP-He 6527.
References: La Sala *et al.* (2009), Alda *et al.* (2011b, 2013), Alda & Martorelli (2014).

Maritrema formicae Díaz, Gilardoni & Cremonte, 2012
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: small intestine.
Locality: Fracasso Beach (42°25'S; 64°07'W), Peninsula Valdes, Chubut Province.
Material deposited: Holotype MLP-He 6501, paratypes MLP-He 6502, voucher specimens MLP-He 6503; CNP-Par 13.
Comments: These specimens were reported as Maritrema sp. by Díaz *et al.* (2011).

Reference: Díaz *et al*. (2011, 2012).

Maritrema madrynense Díaz & Cremonte, 2010

Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).

Site of infection: small intestine.

Locality: Puerto Madryn coast (42°46'S, 65°02'W), Fracasso Beach (42°25'S; 64°07'W), San José Gulf, and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.

Material deposited: Holotype MLP-He 6087, paratypes MLP-He 6088, voucher: specimens MLP-He 6089, 6090 (metacercariae and experimentally obtained adults).

Life cycle: Hi_2: metacercariae in body cavity of *Cyrtograpsus altimanus* Rathbun, 1914 from Puerto Madryn coast.

References: Díaz & Cremonte (2010), Díaz *et al*. (2011).

Maritrema orensense Cremonte & Martorelli, 1998

Host: *Larus atlanticus* Olrog, 1958 (Laridae).

Experimental definitive host: *Gallus gallus* (Linnaeus, 1758) (Phasianidae).

Site of infection: intestine.

Locality: Bahía Blanca estuary (38°48'S; 62°15'W), Buenos Aires Province.

Life cycle: Hi_1: sporocysts and cercariae in *Heleobia australis* (d'Orbigny, 1835) from Bahía Blanca estuary. Hi_2: metacercariae in gills of *Cyrtograpsus angulatus Dana, 1851* and *Neohelice granulata* (Dana, 1851) from Bahía Blanca estuary.

Material deposited: Adult from natural host: 5732 (*indicated* as 5800-5804); experimental adult MLP-He 6524; cercariae MLP-He 6522; metacercariae MLP-He 6198, MLP-He 6523.

References: La Sala et al. (2009), Alda et al. (2011b, 2013), Alda & Martorelli (2014).

Maritrema patagonica Rauque, Flores & Brugni, 2013

Natural definitive host: unknown.

Experimental definitive host: *Gallus gallus* (Linnaeus, 1758) *(Phasianidae).*

Site of infection: intestine.

Life cycle: Hi_2: metacercariae encysted in gill axis of *Aegla neuquensis* Schmitt, 1942 and *Aegla riolimayana* Schmitt, 1942.

Locality: Aluminé River, 38°55'S; 71°10'W (Type locality), Limay River, Rucachoroi Lake, Caleufu River, Nahuel Huapi Lake, Comallo River, Ñireco River (Patagonia).

Material deposited: MACN-Pa 557/1, Holotype from experimental infection in *Gallus gallus*; MACN-Pa 557/2, Paratype from *G. g. domesticus*; MLP-He 6657, Paratypes from *G. g. domesticus*; UNCo-Pa 48/1-2; Paratypes from *G. g. domesticus*; MACN-Pa 557/3a, 557/3b, 557/4, 557/5, Voucher specimens; MLP-He 6658 - 6660 Voucher specimens; UNCo-Pa 217/1, . 218/1-4, 220/1, voucher specimens.

Reference: Rauque *et al*. (2013).

Genus *Megalophallus* Cable, Connor & Balling 1960

Megalophallus deblocki Kostadinova, Vaucher & Gibson, 2006

Hosts: *Rostrhamus sociabilis* (Vieillot, 1817); *Buteogallus meridionalis* (Latham, 1790) (Accipitridae).

Site of infection: intestine.

Locality: La Marcela farm (26°17'35"S; 59°06'38"W), Pirané, Formosa Province.

Material deposited: MLP-He 6720, MLP-He 6721.

Reference: Drago *et al.* (2014).

Microphallus Ward, 1901

Microphallus simillimus (Travassos, 1920) Martorelli, 1991

Natural definitive hosts: see Lunaschi *et al.* (2007).

Life cycle: *Hi_1 and Hi_2:* sporocysts and metacercariae in gonad and digestive gland of *Heleobia australis* (d'Orbigny, 1835) from Bahía Blanca estuary, Buenos Aires Province.

Reference: Alda *et al.* (2010), Alda *et al.* (2011c), Alda & Martorelli (2014).

Genus *Odhneria* Travassos, 1921

Odhneria odhneri Travassos, 1921
Host: *Larus atlanticus* Olrog, 1958 (Laridae).
Site of infection: intestine.
Locality: Bahía Blanca estuary (38°48'S; 62°15'W), Buenos Aires Province.
Material deposited: MLP-He 5733 (indicated as 5800-5804).
Reference: La Sala *et al.* (2009).
Host: *Larus dominicanus* Lichtenstein, 1823 (Laridae).
Site of infection: intestine.
Localities: Fracasso Beach (42°25'S; 64°07'W), San José Gulf and Puerto Madryn Beach (42°47'S; 65°02'S), Nuevo Gulf, Chubut Province.
Material deposited: MLP-He 6309, CNP-Par 10.
Reference: Díaz *et al*. (2011).

Family Prosthogonimidae Lühe, 1909
Genus *Prosthogonimus* Lühe, 1899
Prosthogonimus ovatus (Rudolphi, 1803) Lühe, 1899
Host: *Phalacrocorax brasilianus* (Gmelin, 1789) (Phalacrocoracidae).
Site of infection: bursa Fabricii.
Locality: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 6418.
Reference: Drago *et al.* (2011).

Family Stomylotrematidae Poche, 1926
Genus *Stomylotrema* Looss, 1900
Stomylotrema vicarium Braun, 1901
Hosts: *Busarellus nigricollis* (Latham, *1790*); *Buteogallus meridionalis* (Latham, 1790) (Accipitridae); *Theristicus caudatus* (Boddaert, 1783) (Threskiornithidae).
Site of infection: cloaca.
Locality: La Marcela farm (26°17'35"S; 59°06'-*59°08'W*).
Material deposited: MLP-He 5743, MLP-He 5577, MLP-He 6790.
References: Lunaschi & Drago (2009a), Lunaschi *et al* (2015).

Superfamily Ophistorchioidea Looss, 1899

Family Heterophyidae Leiper, 1909
Genus *Ascocotyle* Looss, 1899
Ascocotyle diminuta Stunkard & Haviland, 1924
Host: *Ardea alba* Linnaeus, 1758 (Ardeidae).
Site of infection: intestine.
Locality: Lacombe lagoon (35º49'S; 57º49'W), Lezama, Buenos Aires Province.
Material deposited: MLP-He 5976.
Reference: Drago & Lunaschi (2011a).

Ascocotyle (*Ascocotyle*) *felippei* Travassos, 1928
Host: *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae).
Site of infection: caeca.
Locality: Bahía Blanca estuary, (38º49'S; 62º06'W) Buenos Aires Province.
Material deposited: MLP-He 5985.
Reference: Alda *et al.* (2011a).

Genus *Pygidiopsis* Looss, 1907
Pygidiopsis crassus Ostrowski de Núñez, 1995
Host: *Himantopus melanurus* Vieillot, 1817 (Recurvirostridae).
Site of infection: small intestine.
Locality: Bahía Blanca estuary, Buenos Aires Province.
Material deposited: MPL He 5983.
Reference: Alda *et al.* (2011a).

Superfamily Paramphistomoidea Fischoeder, 1901

Family Zygocotylidae Ward, 1917
Genus *Zygocotyle* Stunkard, 1917
Zygocotyle lunata (Diesing, 1836) Stunkard, 1917
Natural hosts: see Lunaschi *et al.* (2007).
Experimental hosts: *Gallus gallus* (Linnaeus, 1758) (*Phasianidae)*, *Mus musculus* Linnaeus, 1758 (Muridae).
Life cycle: Hi_1: sporocysts, rediae and cercariae in *Biomphalaria peregrina* (d'Orbigny, 1835) from Buenos Aires City and *Biomphalaria tenagophila* (d'Orbigny, 1835)

from Lerma Valley, Salta Province (natural hosts), and *Biomphalaria straminea* (Dunker, 1848) (experimental host). Metacercariae encyst on the substrate.
References: Ostrowski de Núñez *et al*. (2011).

Superfamily Pronocephaloidea Looss, 1899

Family *Notocotylidae* Lühe, 1909
Genus *Catatropis* Odhner, 1905
Catatropis chilinae Flores & Brugni, 2003
Natural host: unknown.
Experimental hosts: see Lunaschi *et al.* (2007).
Life history: Hi_1: rediae in *Chilina dombeiana* (Bruiguiere, 1789) from Mascardi Lake, Río Negro Province.
Reference: Flores & Semenas (2008).

Genus *Notocotylus* Diesing, 1839
Notocotylus biomphalariae Flores & Brugni, 2005
Natural host: unknown.
Experimental hosts: see Lunaschi *et al.* (2007).
Life history: *Hi_1:* rediae in *Biomphalaria peregrina* (d'Orbigny, 1835) *from Fantasma pond, Patagonia.*
Reference: Flores *et al.* (2010).

Inventory of digenean parasites of wild birds from Argentina
The inventory work of digeneans from birds in Argentina began in 1909 with few and isolated reports on their taxonomy. It was not until 4 decades later that the formal survey work started with Lothar Szidat. In the 1970s, Argentinean parasitologists described a considerable number of digenean species parasitizing birds, in separate and isolated reports, mostly new species from particular host species collected in specific localities. In the following two decades the number of records decreases, however since 1996 to present it had a significant increase, reaching 112 species including studies related to taxonomic and ecological aspects. However, the species accumulation curve shows that the asymptote has not been reached yet (Fig. 1). The most represented families are Echinostomatidae, Strigeidae and Diplostomidae, with 26, 18 and 15 species, respectively (Fig. 2).
Host-parasite relations

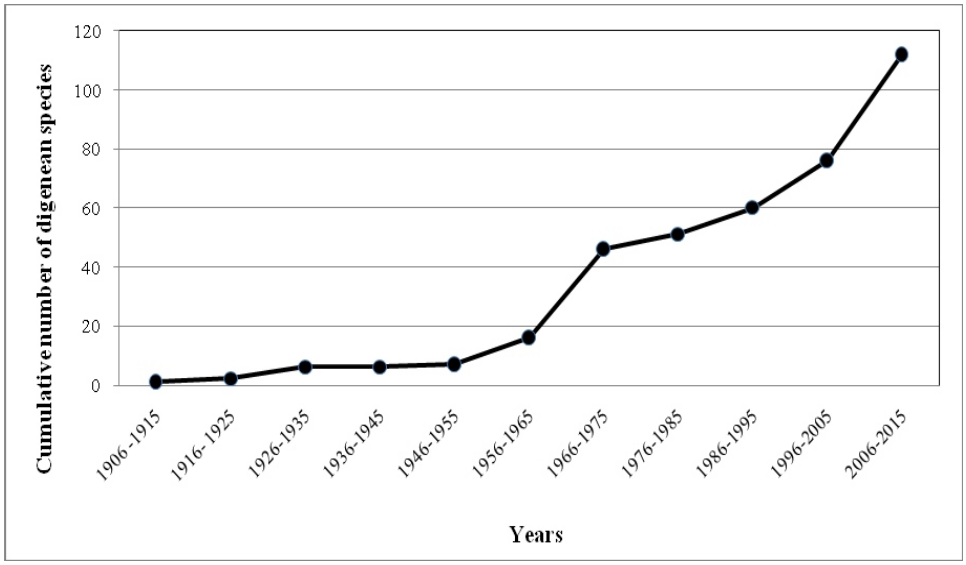

Figure 1. Species accumulation curve of digenean species from wild birds in Argentina from the decade of the 1900s to the present.

Of the almost 1000 bird species known in Argentina, only 70 (7%) has been reported as definitive natural hosts of digenean. The families of birds more studied are Laridae, Ardeidae and Accipitridae, with 32, 29 and 17 digenean species reported.

The accumulation curve of host-paraste relations (digenean species and wild bird species) is similar to the accumulation species curve up to year 2000, because in most of the papers the authors describe each species parasitizing a particular host species collected in specific localities. The increase of papers on ecology and biogeography of digeneans over the last two decades cause a rise in reports on host-parasite relations, reaching 190 reports. However, the host-parasite relations accumulation curve shows that the asymptote has not been reached yet (Fig. 3).

Ecoregions richness

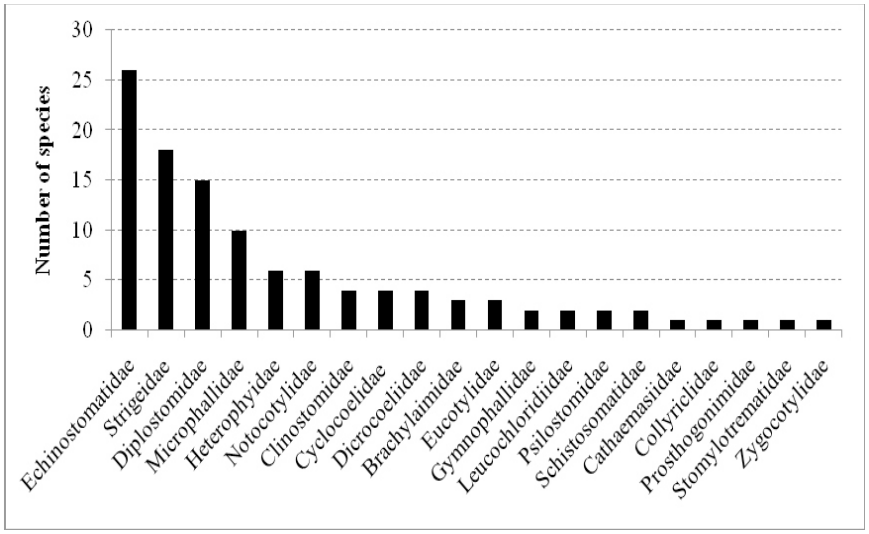

Figure 2. Number of species per family reported in Argentina.

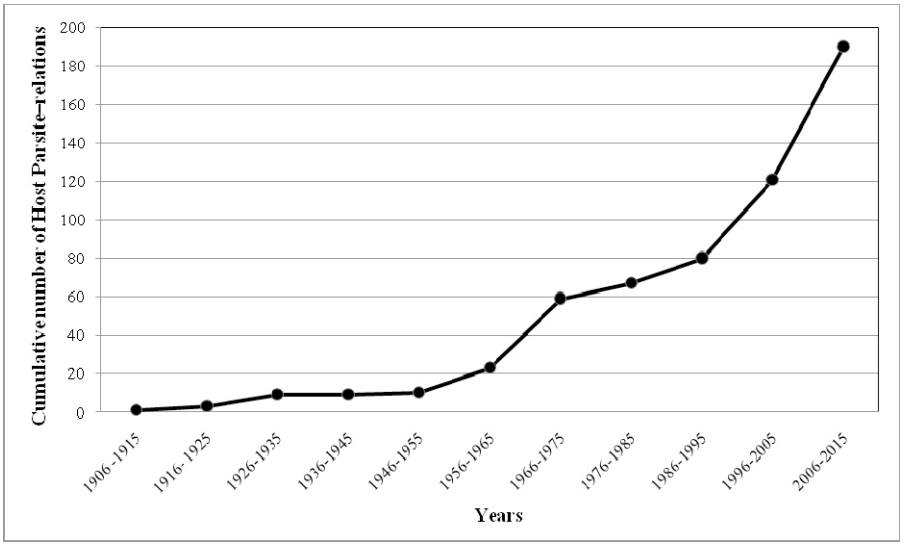

Figure 3. Accumulation curve of digenean species and wild birds relations in Argentina from the decade of the 1900s to the present.

Among the 15 continental ecoregions recognized in Argentina, there are reports of digeneans from birds in 7 of them, and a single report in the South Atlantic Islands ecoregion (Fig. 4). The highest richness of species and host-parasite relations were reported in the northeastern and the central part of the country, mainly in the Humid Chaco, Pampa and Paraná Flooded Savanna ecoregions. The Espinal, Patagonian Steppe and Monte of Plains and Plateaus ecoregions have low species richness (Fig. 5).

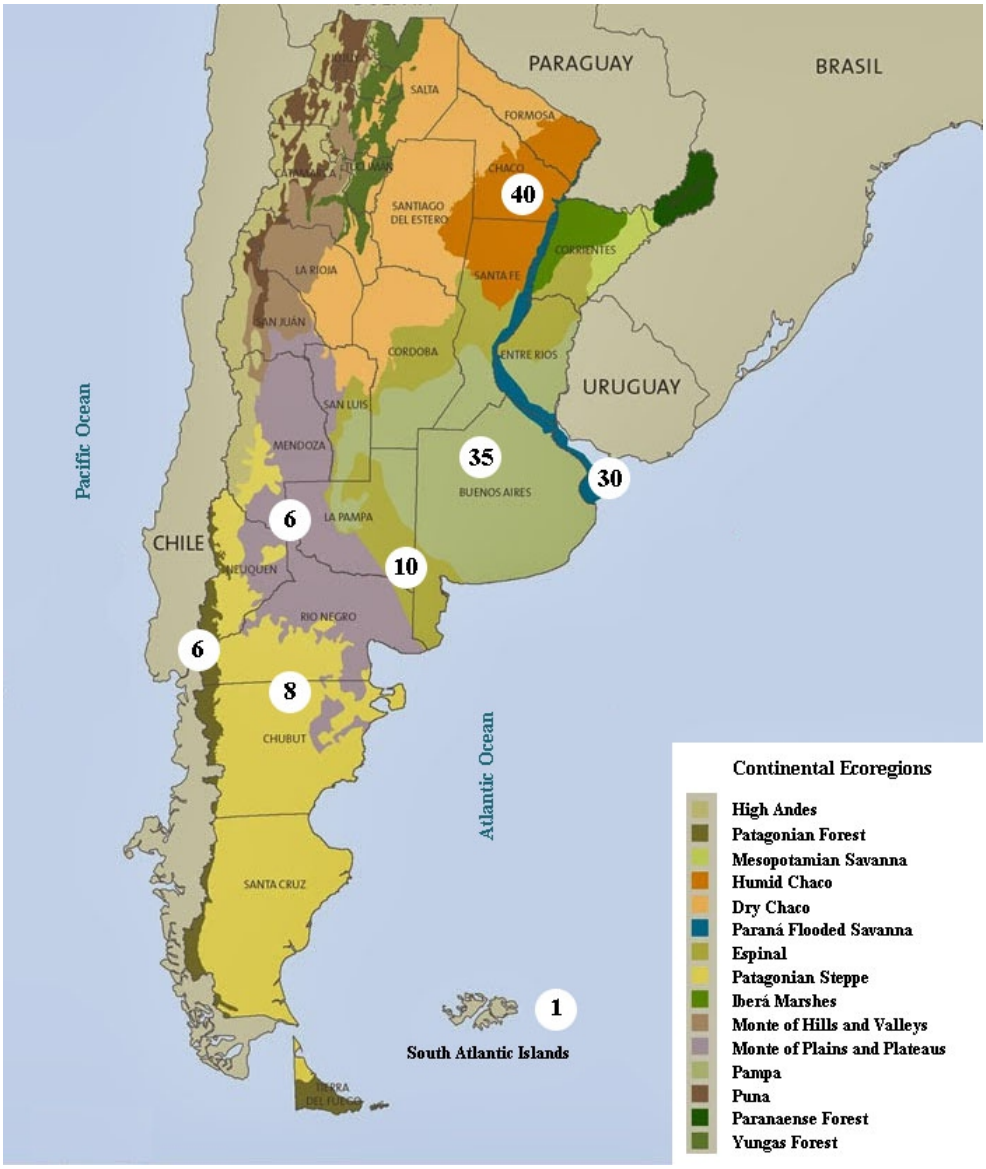

Figure 4. Map of the ecoregions of Argentina indicating the number of digenean species recorded in wild birds.

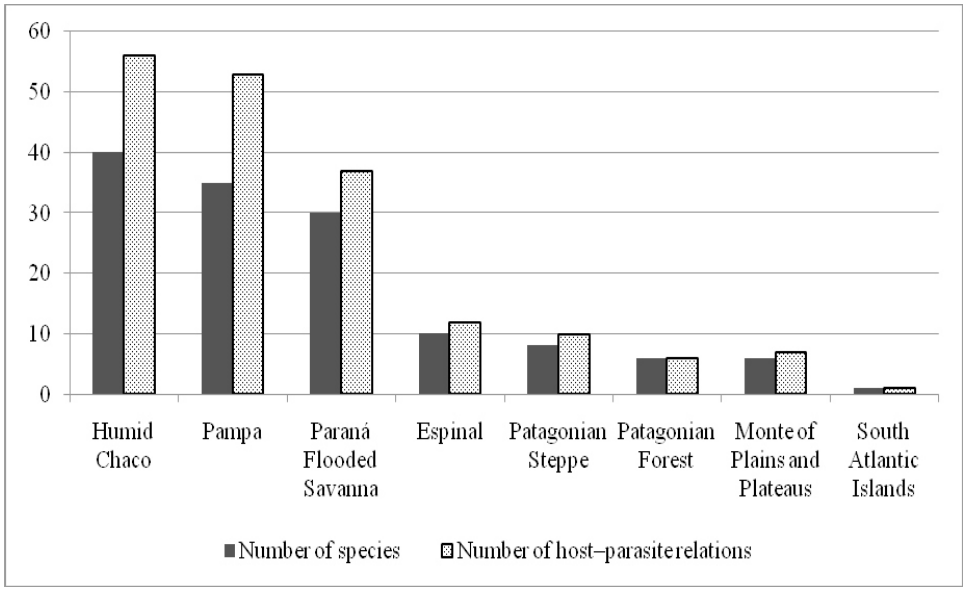

Figure 5. Number of species and host-parasite relations in each ecoregion of Argentina.

Table 1. Host-parasite list since Lunaschi *et al*. (2007) up to present from Argentina.

		Wild Bird Hosts	
Order/Family	**Species**	**Digenean species**	**References**
Accipitriformes			
Accipitridae	*Busarellus nigricollis*	*Posthodiplostomum macrocotyle*	Drago *et al*. (2014)
		Stomylotrema vicarium	Lunaschi & Drago (2009a)
		Tylodelphys brevis	Drago *et al.* (2014)
	Buteogallus meridionalis	*Megalophallus deblocki*	Drago *et al.* (2014)
		Neodiplostomum travassosi	Drago *et al*. (2014)
		Stomylotrema vicarium	Lunaschi & Drago (2009a)
		Strigea elliptica	Lunaschi & Drago (2009b)
		Strigea meridionalis	Lunaschi & Drago (2009b)
		Strigea microbursa	Lunaschi & Drago (2009b)
	Buteogallus urubitinga	*Parastrigea macrobursa*	Drago & Lunaschi (2011b)
		Strigea proteolytica	Drago *et al.* (2014)
	Rostrhamus sociabilis	*Athesmia heterolecithodes*	Lunaschi & Drago (2009a)
		Megalophallus deblocki	Drago *et al.* (2014)
		Spaniometra variolaris	Drago *et al*. (2014)
Anseriformes			
Anatidae	*Cygnus melancoryphus*	*Australapatemon canadensis*	Drago & Lunaschi (2010)
Cariamiformes			
Cariamidae	*Cariama cristata*	*Athesmia heterolecithodes*	Lunaschi *et al*. (2015)
		Brachylaima yupanquii	Lunaschi & Drago (2012)
		Strigea inflecta	Lunaschi & Drago (2012)
Cathartiformes			
Cathartidae	*Coragyps atratus*	*Paryphostomum segregatum*	Drago & Lunaschi (2011a)
		Petasiger sp.	Drago & Lunaschi (2011a)
		Strigea vaginata	Drago & Lunaschi (2011a)

Cont. Table 1

Ciconiiformes			
Ciconiidae	*Mycteria americana*	*Tylodelphys brevis*	Drago & Lunaschi (2008)
Charadriiformes			
Laridae	*Larus atlanticus*	*Himasthla escamosa*	La Sala *et al*. (2009)
		Levinseniella cruzi	La Sala *et al*. (2009)
		Maritrema bonaerense	La Sala *et al*. (2009)
		Maritrema orensensis	La Sala *et al*. (2009)
		Odhneria odhneri	La Sala *et al*. (2009)
	Larus dominicanus	*Bartolius pierrei*	Díaz *et al*. (2011)
		Gymnophallus australis	Díaz *et al*. (2011)
		Himasthla escamosa	Díaz *et al*. (2011)
		Lyperosomum sp.	Díaz *et al*. (2011)
		Maritrema formicae	Díaz *et al*. (2011, 2012).
		Maritrema madrynense	Díaz & Cremonte (2010), Díaz *et al*. (2011)
		Odhneria odhneri	Díaz *et al*. (2011)
		Parorchis sp.	Díaz *et al*. (2011)
		Stephanoprora podicipei	Díaz *et al*. (2011)
Recurvirostridae	*Himantopus melanurus*	*Ascocotyle* (*A*.) *felippei*	Alda *et al*. (2011a)
		Levinseniella cruzi	Alda *et al*. (2011a)
		Psilochasmus oxyurus	Alda *et al*. (2011a)
		Pygidiopsis crassus	Alda *et al*. (2011a)
		Tanaisia dubia	Lunaschi *et al*. (in press).
Cuculiformes			
Cuculidae	*Guira guira*	*Athesmia heterolecithodes*	Lunaschi & Drago (2009a)
		Glaphyrostomum propinquum	Lunaschi & Drago (2009a)
Falconiformes			
Falconidae	*Caracara plancus*	*Strigea falconis brasiliana*	Drago *et al*. (2014)
	Milvago chimachima	*Athesmia heterolecithodes*	Lunaschi & Drago (2009a)
		Strigea falconis brasiliana	Drago *et al*. (2014)
Gruiformes			
Aramidae	*Aramus guarauna*	*Edietziana serrata*	Lunaschi *et al*. (2015)
		Lyperorchis lyperorchis	Lunaschi *et al*. (2015)
Passeriformes			
Sturnidae	*Sturnus vulgaris*	*Echinostoma revolutum* "group"	Valente et al. (2014)
Thamnophilidae	*Taraba major*	*Lubens lubens*	Lunaschi *et al*. (2014)
		Lyperosomum oswaldoi	Lunaschi & Drago (2013)
		Pojmanskia riosae	Lunaschi *et al*. (2014)
		Strigea orbiculata	Lunaschi & Drago (2013).
Tyrannidae	*Pitangus sulphuratus*	*Tanaisia dubia*	Lunaschi *et al*. (in press)
Pelecaniformes			
Ardeidae	*Ardea alba*	*Apharyngostrigea ardearum*	Drago & Lunaschi (2011a)
		Ascocotyle diminuta	Drago & Lunaschi (2011a)
		Dolichorchis lacombeensis	Drago & Lunaschi (2011a)
		Posthodiplostomum nanum	Drago & Lunaschi (2011a).
	Ardea cocoi	*Apharyngostrigea ardearum*	Drago & Lunaschi (2011a)
		Dolichorchis lacombeensis	Drago & Lunaschi (2011a)
		Petasiger sp	Drago & Lunaschi (2011a)
		Posthodiplostomum sp..	Drago & Lunaschi (2011a)
	Bubulcus ibis	*Apharyngostrigea ardearum*	Drago & Lunaschi (2011a)
	Syrigma sibilatrix	*Nephrostomum limai*	Lunaschi *et al*. (2015)
	Tigrisoma lineatum	*Clinostomatopsis sorbens*	Lunaschi & Drago (2009a)
		Clinostomum marginatum	Lunaschi & Drago (2009a)
		Posthodiplostomum nanum	Drago & Lunaschi (2011a)
		Sphincterodiplostomum musculosum	Drago & Lunaschi (2011a)
		Tylodelphys elongata	Drago & Lunaschi (2011a)

Cont. Table 1

Threskiornithidae	*Theristicus caudatus*	*Athesmia heterolecithodes*	Lunaschi *et al*. (2015)
		Stomylotrema vicarium	Lunaschi *et al*. (2015)
Podicipediformes			
Podicipedidae	*Podiceps major*	*Petasiger argentinensis*	Lunaschi & Drago (2010).
	Rollandia rolland	*Petasiger argentinensis*	Lunaschi & Drago (2010)
Sphenisciformes			
Spheniscidae	*Spheniscus magellanicus*	*Cardiocephaloides physalis*	Díaz *et al*. (2010).
Suliformes			
Phalacrocoracidae	*Phalacrocorax brasilianus*	*Austrodiplostomum mordax*	Drago *et al*. (2011)
		Austrodiplostomum ostrowskiae	Drago *et al*. (2011)
		Drepanocephalus spathans	Drago *et al*. (2011)
		Hysteromorpha triloba	Drago *et al*. (2011)
		Paryphostomum parvicephalum	Drago *et al*. (2011)
		Paryphostomum segregatum	Drago *et al*. (2011)
		Prosthogonimus ovatus	Drago *et al*. (2011)
		Ribeiroia ondatrae	Drago *et al*. (2011)
		Strigea falconis brasiliana	Drago *et al*. (2011)
		Tylodelphys adulta	Drago *et al*. (2011)
Tinamiformes			
Tinamidae	*Nothura darwinii*	*Athesmia heterolecithodes*	Byrd *et al*. (1967)
	Nothura maculosa	*Athesmia heterolecithodes*	Byrd *et al*. (1967)
		Zonorchis sp.	Bump & Bump (1969)
		Experimental Bird Hosts	
Galliformes			
Phasianidae	*Gallus gallus*	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
		Maritrema bonaerense	Alda *et al*. (2013)
		Maritrema orensensis	Alda *et al*. (2013)
		Maritrema patagonica	Rauque *et al*. (2013)
		Posthodiplostomum sp.	Ritossa *et al*. (2013)
		Stephanoprora aylacostoma	Ostrowski de Núñez & Quintana (2008)
		Stephanoprora uruguayense	Ostrowski de Núñez (2007)
		Zygocotyle lunata	Ostrowski de Núñez *et al*. (2011)
Anseriformes			
Anatidae	*Anas platyrhynchos*	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
		Experimental Mammal Hosts	
Rodentia			
Muridae	*Mus musculus*	*Posthodiplostomum* sp.	Ritossa *et al*. (2013)
		Stephanoprora uruguayense	Ostrowski de Núñez (2007)
		Zygocotyle lunata	Ostrowski de Núñez *et al.* (2011)
		Intermediate Hosts	
Class/Family	**Species**	**Digenean species**	**References**
Gastropoda			
Chilinidae	*Chilina dombeiana*	*Catatropis chilinae*	Flores & Semenas (2008).
Cochliopidae	*Heleobia australis*	*Levinseniella cruzi*	Alda & Martorelli (2014)
		Maritrema bonaerense	Alda *et al.* (2013), Alda & Martorelli (2014)
		Maritrema orensensis	Alda *et al.* (2013), Alda & Martorelli (2014)
		Microphallus simillimus	Alda & Martorelli (2014)
		Psilochasmus oxyurus	Alda & Martorelli (2014)
		Stephanoprora uruguayense	Alda & Martorelli (2014)
	Heleobia parchappei	*Stephanoprora uruguayense*	Ostrowski de Núñez (2007)
Planorbidae	*Anisancylus obliquus*	*Posthodiplostomum* sp.	Ritossa *et al*. (2013)
	Biomphalaria peregrina	*Notocotylus biomphalariae*	Flores *et al*. (2010).
		Zygocotyle lunata	Ostrowski de Núñez *et al*. (2011)
	Biomphalaria straminea	*Zygocotyle lunata*	Ostrowski de Núñez *et al*. (2011).
	Biomphalaria tenagophila	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
		Zygocotyle lunata	Ostrowski de Núñez *et al*. (2011)
Thiaridae	*Aylacostoma chloroticum*	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)

Cont. Table 1

Bivalvia			
Mytilidae	*Aulacomya atra*	*Gymnophallus australis*	Cremonte *et al*. (2008)
	Mytilus edulis	*Gymnophallus australis*	Cremonte *et al*. (2008)
	Perumytilus purpuratus	*Gymnophallus australis*	Cremonte *et al*. (2008)
Hirudinea			
Glossiphoniidae	*Haementeria eichhorniae*	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
	Helobdella adiastola	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
	Helobdella. triserialis	*Australapatemon magnacetabulum*	Davies & Ostrowski de Núñez (2012)
Malacostraca			
Aeglidae	*Aegla neuquensis*	*Maritrema patagonica*	Rauque *et al*. (2013)
	Aegla riolimayana	*Maritrema patagonica*	Rauque *et al*. (2013).
Varunidae	*Cyrtograpsus altimanus*	*Maritrema madrynense*	Díaz & Cremonte (2010)
	Cyrtograpsus angulatus	*Levinseniella cruzi*	Alda *et al*. (2011b)
		Maritrema bonaerense	Alda *et al*. (2011b), Alda *et al*. (2013)
		Maritrema orensensis	Alda *et al*. (2011b), Alda *et al*. (2013)
	Neohelice granulata	*Levinseniella cruzi*	Alda *et al*. (2011b)
		Maritrema bonaerense	Alda *et al*. (2011b), Alda *et al*. (2013)
		Maritrema orensensis	Alda *et al*. (2011b), Alda *et al*. (2013)
Actinopterygii			
Atherinopsidae	*Odontesthes bonariensis*	*Austrodiplostomum* cf. *mordax*	Drago (2012)
Characidae	*Astyanax erythropterus*	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)
	Hyphesobrycon serpae	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)
	Moenckhausia dichroura	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)
Galaxiidae	*Aplochiton zebra*	*Stephanoprora uruguayense*	Fernández *et al*. (2012)
	Galaxias maculatus	*Posthodiplostomum* sp.	Ritossa *et al*. (2013)
		Stephanoprora uruguayense	Viozzi *et al*. (2009), Fernández *et al*. (2010)
Poeciliidae	*Cnesterodon decemmaculatus*	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)
		Stephanoprora uruguayense	Ostrowski de Núñez (2007)
	Poecilia reticulata	*Stephanoprora aylacostoma*	Ostrowski de Núñez & Quintana (2008)

DISCUSSION

The actual number of digenean species recorded from Argentinean wild birds amounts 112 species, distributed in 65 genera of 20 families. Reports from the last 8 years account for 28% of all reported species. Also, the reports of the host-parasite relations experienced similar increase during tha last years (32%), reaching a total of 190 reports vs 130 in 2007. The full life cycle was elucidated for 25 species of digeneans and some aspects about their life history have been studied in 14 species. In addition to the records mentioned above, there are many records of metacercariae from fishes and amphibians without correspondence with their definitive hosts, even in the most studied families. Among the diplostomids, six species of the genus *Tylodelphys* were described based on metacercariae found parasitizing the brain, the pericardial cavity or the visceral cavity of freshwater fishes: *Tylodelphys destructor* Szidat & Nani, 1951, *Tylodelphys jenynsiae* Szidat, 1969 and *Tylodelphys cardiophilus* Szidat, 1969, *Tylodelphys barilochensis* Quaggiotto & Valverde, 1992, *Tylodelphys crubensis* Quaggiotto & Valverde, 1992, *Tylodelphys argentinus* Quaggiotto & Valverde, 1992 (Szidat & Nani, 1951; Szidat, 1969; Quaggiotto & Valverde, 1992). Nevertheless, only three species of adult are known, *T. adulta*, *T. brevis* and *T. elongata* (Lunaschi & Drago, 2004; Drago & Lunaschi, 2008, 2011a). Other diplostomids, such as *Lophosicyadiplostomum nephrocystis* (Lutz, 1928) reported in anurans (Hamann &

González, 2009, Hamann *et al*., 2010) and *Diplostomum gymnoti* Szidat, 1969 recovered from fishes (Szidat, 1969), were never found parasitizing birds. Among the strigeids, metacercariae of *Cotylurus*, described as *Tetracotyle loricariae* Szidat, 1969 were reported parasitizing fishes (Szidat, 1969), however the adult forms were never found in birds. Moreover, numerous adult digeneans were obtained experimentally, but their natural hosts are unknow, such as *Echinoparyphium megacirrus* Semenas, Brugni & Ostrowski de Núñez, 1999, *Stephanoprora aylacostoma* (Echinostomatidae), *Pygidiopsis crassus* Ostrowski de Núñez, 1995, *Pygidiopsis australis* Ostrowski de Núñez, 1996, *Ascocotyle* (*Ascocotyle*) *secunda* Ostrowski de Núñez, 2001, *Ascocotyle* (*Ascocotyle*) *tertia* Ostrowski de Núñez, 2001 (Heterophyidae), *Catatropis chilinae*, *Notocotylus biomphalariae* (Notocotylidae), *Maritrema patagonica* (Microphallidae); or has never been found in Argentinean birds, such as *Australapatemon magnacetabulum* (Strigeidae), *Ascocotyle* (*Phagicola*) *angeloi* Travassos, 1928 and *Ascocotyle* (*Phagicola*) *longa* Ransom, 1920 (Heterophyidae).

The distribution pattern of digeneans from birds in the different ecoregions does not reflect the real diversity of this group of helminth in Argentina, since large areas remain unexplored. Also, the bird species examined in each ecoregion is different. For example, in the Humid Chaco, the ecoregion with the highest species richness, the hosts more studied are the accipitrids, being the strigeids the digeneans more frequent (12 species). In the Pampa ecoregion, the larids and ardeids are the best inquired, and the echinostomatid the group most recognized (10 species). In the Paraná Flooded Savanna ecoregion, the ardeids and rallids are the best studied, being the echinostomatids the group most representative (13 species). In the Espinal ecoregion, the larids are the most studied, and the microphallids (4 species) the most frequent group. In the remaining ecoregions is not possible to recognize the representive groups because of the scarce number of reports. The frecuency of particular families of digeneans in each region appear to be related to the focus of the investigations, mostly in connection to the habits and feeding preferences of birds, rather than to the geographical distribution. Thus, echinostomatids and microphallids are frecuently recorded in those areas where studies were focused on aquatic birds, while strigeids are dominant in areas where most of the studies were conducted on birds with terrestrial habits.

The limitations to complete the inventory of wild birds in Argentina are related with the scarce number of bird species studied (only 7 % of Argentinean birds were reported as host of digeneans), and the existence of large areas few explored or unexplored.

Considering the above mentioned observations, and that the curves of species accumulation and host-parasite relations indicate that the asymptote has not been reached, we conclude that the inventory of digeneans of wild birds in Argentina is far from being completed, even in the most studied areas.

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