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Helminth parasites of the endangered hooded grebe, *Podiceps gallardoi*, from Patagonia Argentina, with the description of two new digenean species

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Research Paper

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Abstract

In March 2011, a predator killed 33 hooded grebes, *Podiceps gallardoi* Rumboll (Podicipedidae), a critically endangered species, in a nesting colony at El Cervecero Lake, Santa Cruz Province, Argentina. The viscera of ten birds were examined for helminths. Two new species of Trematoda were recovered from the intestines. The plagiorchid *Plagiorchis patagonensis* n. sp. is mainly characterized by the larger size of the oral sucker relative to the ventral sucker, and by the distribution of the vitellarium in two lateral fields, confluent between the caecal bifurcation and the ventral sucker. The echinostomatid *Euparyphium tobianum* n. sp. is mainly characterized by possessing a head collar with 37–39 spines (4 angle spines on each ventral lappet, 4 lateral spines in a single row on each side, and 21–23 dorsal spines in a double row). An unidentified cestode, a tetramerid nematode and a notocotylid trematode were also recovered from the birds. This is the first record of helminths parasitizing the hooded grebe.

Introduction

Podiceps gallardoi Rumboll, 1974 (Podicipedidae), commonly known as the hooded grebe, is a waterbird with a restricted distribution in southern South America. This grebe spends the breeding season (October–April) on lakes of the high basaltic plateaus of western Santa Cruz and winters at a few estuaries on the Atlantic coast of this province (Roesler *et al.*, 2012a). Its presence has also been confirmed in southern Chile, including a small population resident in summer in the Torres del Paine National Park and Puerto Natales, and individuals reported occasionally on both sides of the Magellan Strait (Roesler, 2015). The hooded grebe is critically endangered (BirdLife International, 2017). Several threats have been proposed to explain the decline of hooded grebe populations, including depredation of eggs and chicks by the kelp gull, *Larus dominicanus* Lichtenstein, and the American mink, *Neovison vison* (Schreber), habitat modification by local climate changes and introduced fishes, mainly rainbow trout, *Oncorhynchus mykiss* (Walbaum) (Roesler *et al.*, 2012b, 2016). Until now, the helminth fauna of hooded grebes has been unknown.

The aim of this work was to determine the diversity of helminths in hooded grebes from natural environments.

Materials and methods

During a population census, Roesler *et al.* (2012b) found 33 dead hooded grebes in El Cervecero Lake, Buenos Aires plateau, Santa Cruz Province, Argentina. The grebes were killed by a single American mink, although only one was eaten by this predator (Roesler *et al.*, 2012a). Ten of these dead birds were recovered in good condition and dissected in the field by Roesler; their viscera were preserved in 10% formalin and transported to the laboratory for helminthological examination. Digenean specimens were removed, stored in 70% ethanol, stained with a 1:6 dilution in 96% ethanol of hydrochloric carmine, dehydrated and mounted between two microscope cover glasses in Canada balsam. The measurements below are given in micrometres (μm), as the range followed by mean in parentheses. Drawings were made with the aid of a drawing tube. The following abbreviations are used in the tables: ASl, angle spine length; ATl, anterior testis length; ATw, anterior testis width; Bl, body length; Bw, body width; Cl, collar length; CSl, cirrus sac length; CSw, cirrus sac width; Cw, collar width; DSl, dorsal spines length; El, egg length; Ew, egg width; Fo, forebody length; LSl, lateral spine length; Mel, metraterm length; Mew, metraterm width; Oe, oesophagus length; OSl, oral sucker length;

OSw, oral sucker width; Ovl, ovary length; Ovw ovary width; Phl, pharynx length; Phw, pharynx width; PTf, post-testicular field length; PTl, posterior testis length; PTw, posterior testis width; S, number of collar spines; VSl, ventral sucker length; VSw, ventral sucker width; Bl/El, body length/egg length; OS/Ph, oral sucker width/pharynx width; OS/VS, sucker width ratio; VS/OS, sucker width ratio. The following relative proportions were calculated after Kostadinova (2005): BW (%), maximum body width as a proportion of body length; FO (%), length of the forebody as a proportion of body length; U (%), distance between posterior margin of ventral sucker and anterior margin of ovary, as a proportion of body length (used as an approximation for the uterine field); T (%), length of the post-testicular field as a proportion of body length.

Results

The helminthological analysis revealed the presence of five helminth taxa: one cestode, one nematode and three digeneans. The cestodes were found in the intestine with a prevalence of 100% and mean intensity of 86.4 (range: 4–246). The tetramerid nematode was found in the stomach with a prevalence of 10% and mean intensity of 1. The three digenean species comprised a notocotylid found in intestinal caeca, with a prevalence of 20% and mean intensity of 11 (10–12), and plagiorchid and echinostomatid species in the intestine. The latter two are new to science and are described below. Species determination of the cestode, tetramerid and notocotylid was not possible owing to the poor condition of specimens.

Plagiorchiidae: Plagiorchis patagonensis *n. sp.*

Description

Based on three mature specimens. Body small, elongate, 977–1514 (1204) long by 251–339 (305) wide (fig. 1). BW = 21–35% (26%). Tegument covered with numerous small spines. Oral sucker subterminal, large, more or less rounded, 193–203 × 179–213 (196 × 192). Ventral sucker round, significantly smaller than oral sucker, pre-equatorial, in second quarter of body, 95–116 × 95–121 (105 × 104). Oral sucker width:ventral sucker width ratio, 1: 1.76–1.93 (1:1.86). Forebody 386–469 (420) long, 31–42% (36%) of total body length. Prepharynx not observed. Pharynx well developed, round, 76–97 × 74–106 (85 × 86). Oral sucker width: pharynx width ratio 1:2–2.3 (2.2). Oesophagus very short, 24 long. Intestinal caeca long, extending to near the end of the body. Testes 2, post-ovarian, spherical to oval, entire, oblique; left testis anterior to right testis; anterior testis 131–145 × 82–119 (140 × 95), posterior testis 117–169 × 92–124 (151 × 107). Cirrus sac dorsal and posterodorsal to ventral sucker, very elongate and strongly muscular, its distal end usually curved around right margin of ventral sucker, and with proximal part always between ovary and ventral sucker, 286–302 × 55–90 (293 × 73); contains seminal vesicle divided into oval proximal part, 34–48 × 30–47 (41 × 38), and rounded distal part, 41 in diameter. Pars prostatica short; prostatic cells numerous, occupying entire cirrus sac. Cirrus long and unarmed. Genital pore median, just anterior to ventral sucker. Body length:cirrus sac length ratio 1:3.2–5.2 (1:4.1). Ovary oval or round, entire, 67–107 × 50–64 (83 × 57), near right side of proximal end of cirrus sac and just posterior to ventral sucker. Vitellarium well developed, consisting of two fields of small vitelline follicles on either side of body, extending from the caecal bifurcation to posterior extremity; vitelline fields confluent between caecal bifurcation and ventral sucker. Vitelline reservoir not seen. Mehlis' gland immediately posterior to ovary. Seminal receptacle and Laurer's canal present. Uterine loops intercaecal, with descending and ascending loops between testes and post-testicular region. Metraterm slightly shorter than cirrus sac. Eggs numerous, small, operculate, 29–38 × 17–26 (33 × 22). Excretory vesicle Y-shaped, with long stem and relatively short branches.

Taxonomic summary

Type host. *Podiceps gallardoi* Rumboll, 1974 (Podicipediformes, Podicipedidae) (hooded grebe).

Site of infection. Intestine.

Type locality. El Cervecero Lake, Buenos Aires plateau, Santa Cruz Province, Argentina (47°09′20″S, 71°16′32″W).

Date of collection. May 2011.

Type material. Holotype MLP–He 7392; paratypes MLP–He 7393 (two specimens).

Prevalence. 30%.

Mean intensity. 1.3 (range 1–2).

Etymology. The specific name refers to the geographical region where the parasite was collected.

Remarks

The genus *Plagiorchis* Lühe, 1899 (Plagiorchiidae), currently includes over 100 nominal species parasitic in amphibians, reptiles, birds and mammals worldwide. Seven species are known in the Neotropical region: *Plagiorchis freitasi* Vicente, 1978 and *Plagiorchis vicentei* Oliveira Rodrigues, 1994 in lizards from Brazil (Vicente, 1978; Oliveira Rodrigues, 1994); *Plagiorchis luehei* Travassos, 1927 in ophidians from Brazil and Argentina (Travassos, 1928; Lunaschi & Drago, 2010); *Plagiorchis parumbursatus* Freitas & Dobbin, 1961 in bats from Brazil (Freitas & Dobbin, 1961); *Plagiorchis didelphidis* (Parona, 1896) Stossich, 1904 in marsupials from Brazil, Peru and Paraguay (Travassos *et al.*, 1969; Masi Pallares & Benitez Usher, 1971; Tantalean *et al.*, 1992); *Plagiorchis rangeli* Artigas & Zerpa, 1961 in anurans from Brazil (Fernandes & Kohn, 2014) and *Plagiorchis* sp. in gulls from Peru (Jara *et al.*, 1987). All Neotropical species of *Plagiorchis* can be distinguished easily from the new species by the non-confluent distribution of vitelline glands in the forebody, unlike in *P. patagonensis* n. sp. In the Mexican Transition Zone (Morrone, 2005), where Neotropical and Nearctic biotas overlap, four species of *Plagiorchis* occur, each with a wide geographical distribution: *Plagiorchis muris* (Tanabe, 1922) (syn. *P.* (*Multiglandularis*) *muris*), parasitizing *Natalus stramineus mexicanus* Miller (as *N. mexicanus*) (Chiroptera) from Mexico (Caballero, 1943), also reported in mammals and birds naturally and/or experimental infections from Oriental and Nearctic regions (Dollfus, 1925; McMullen, 1937); *Plagiorchis noblei* Park, 1936 (syn. *P. gonzalchavezi* Zerecero, 1949) in *Tyrannus* sp. (Passeriformes) from Mexico (Zerecero, 1949), also reported in mammals and birds from the Nearctic region (Park, 1936; Blankespoor, 1974; MacKenzie & McKenzie, 1980); *Plagiorchis maculosus* (Rudolphi, 1802) in *Turdus migratorius* (Passeriformes) from Mexico (Pérez Ponce de León *et al.*, 2007), also reported in birds and mammals from Holarctic, Ethiopian, Oriental and Australian regions (Bock & Janssen, 1987); and *Plagiorchis*

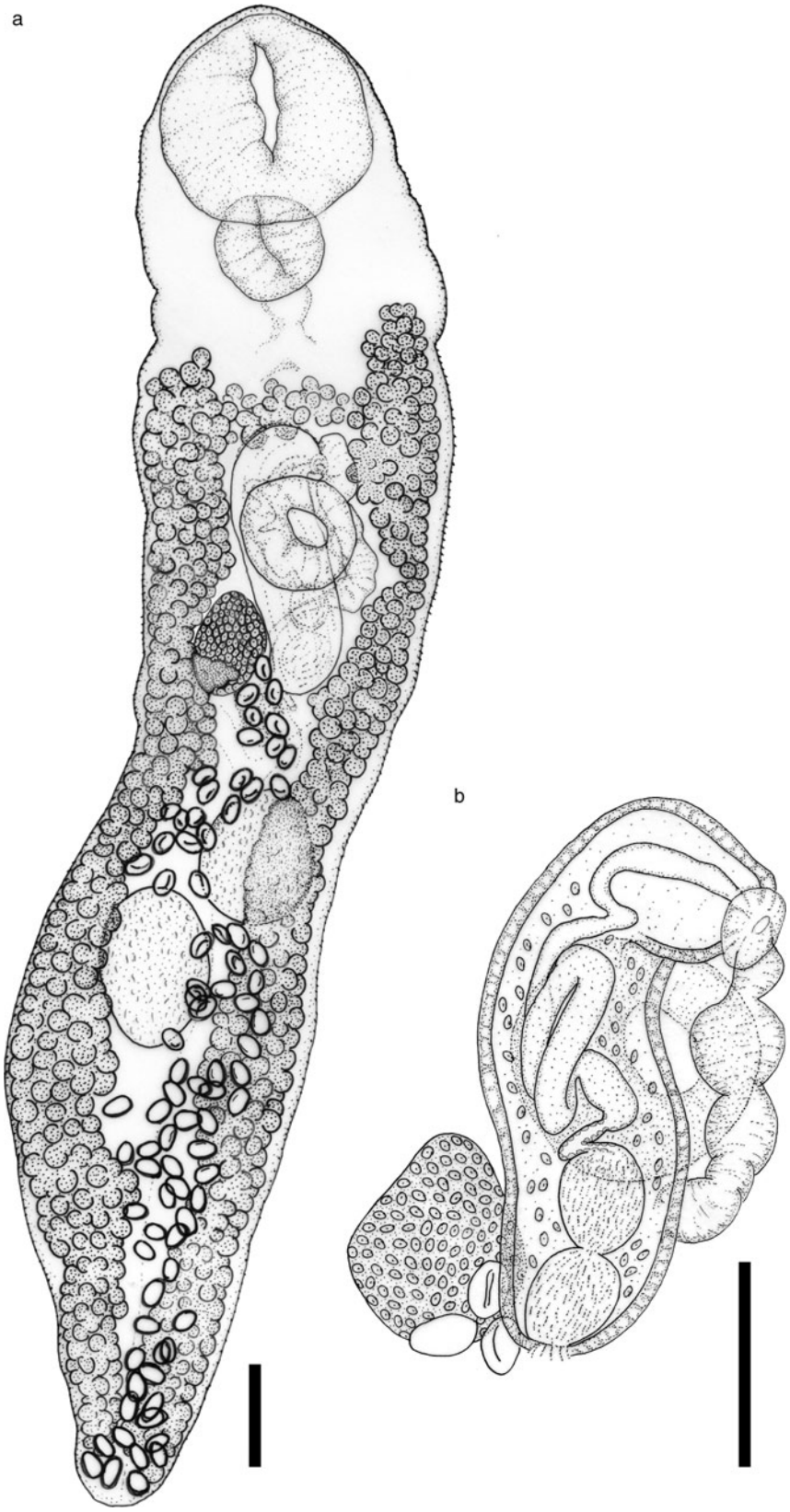

Fig. 1. *Plagiorchis patagonensis* n. sp.: (a) entire worm, ventral view (holotype); (b) enlarged view of terminal genitalia, ventral view (holotype). Scale bars: 100 μm.

vespertilionis (Mueller, 1784) Braun, 1900, recorded in bats from Mexico (Caballero, 1940), also reported in bats from Holarctic, Ethiopian and Oriental regions, although Tkach *et al.* (2000) considered only European forms to be true representatives of *P. vespertilionis*. *Plagiorchis maculosus* and *P. vespertilionis* can be differentiated easily from *P. patagonensis* n. sp. by having vitelline glands not confluent in the forebody, and the oral sucker smaller than or sub-equal to the ventral sucker. *Plagiorchis noblei*, *P.*

muris and the new species have a similar distribution of vitelline glands in the forebody. *Plagiorchis noblei* is known from a wide spectrum of phylogenetically unrelated hosts (mammals and birds), and has enormous morphological and morphometric variations. Such plasticity may be explained, in part, by the lack of host specificity (Blankespoor, 1974; MacKenzie & McKenzie, 1980). Blankespoor (1974) examined numerous adult specimens of *P. noblei* obtained experimentally in 51 vertebrate species exposed to metacercariae, and found wide plasticity in most characters (i.e. extent of vitellaria, position of suckers, size of gonads, size and position of cirrus sac, among others); the only stable characters were the size-ratio of suckers and egg size. According to descriptions given by Park (1936), Zerecero (1949), Blankespoor (1974) and MacKenzie & McKenzie (1980), *P. noblei* differs from the new species mainly by the size-ratio of suckers (1:1–1.4 vs. 1:1.7–1.9) (table 1). *Plagiorchis muris* differs from *P. patagonensis* n. sp. mainly by having a larger body size (up to 2670 vs. up to 1514) and smaller oral:ventral sucker ratio (1:1.1–1.7 vs. 1.7–1.9) (table 2).

In *Podiceps* spp., only two species of *Plagiorchis* have been reported: *Plagiorchis laricola* Skrjabin, 1924 in *Podiceps grisegena* (Boddaert) and *Podiceps nigricollis* Brehm from the Palaearctic region, and *P. maculosus* parasitizing *Po. grisegena* from the Holarctic region (Storer, 2000), which was discussed above. According to Rees (1952), *P. laricola* is characterized by having a larger ovary than ventral sucker, vitelline glands confluent in the forebody and the cirrus sac not extending beyond the posterior margin of the ovary. Therefore, *P. laricola* can be differentiated from the new species found in *Po. gallardoi* by the large size of its ovary relative to the ventral sucker.

This is the first species of *Plagiorchis* to be described from Neotropical birds.

Echinostomatidae: Euparyphium tobianum *n. sp.*

Description

Based on five mature specimens. Small worms of elongate body (BW = 14–20%), 1600–2800 × 324–411 (2300 × 383), with maximum width at level of ventral sucker (fig. 2). Forebody ventrally concave, with tegument densely spiny, short to long 401–532 (468) in length (FO = 16–26%).

Head collar reniform, well developed, with ventral ridge, 152–304 × 193–343 (218 × 273). Collar spines 37–39; 4 angle spines on each ventral lappet (2 dorsal and 2 ventral) longer than marginal spines, 4 lateral spines in a single row on each side; 21–23 dorsal spines in double row, aboral spines slightly longer than oral. Angle spines 48–81 × 12–17 (64 × 14); lateral spines smaller than the angle spines, 50–71 × 10–12 (60 × 12); dorsal spines in aboral row, 43–64 × 10–14 (57 × 11), dorsal spines in oral row, 31–60 × 10–12 (45 × 11).

Oral sucker subterminal, 79–112 × 89–129 (97 × 103). Ventral sucker large, deep, in the first quarter of body, 290–406 × 222–275 (354 × 253). Ventral sucker width:oral sucker width ratio 1:2–2.7 (1:2.5). Prepharynx short. Pharynx, elongate, shorter than oral sucker, 64–95 × 33–43 (79 × 39). Oral sucker width:pharynx width ratio 1:2.4–3.2 (1:2.7). Oesophagus 203–309 (272) long. Intestinal bifurcation anterior and close to ventral sucker; intestinal caeca end blindly, close to posterior extremity.

Testes tandem, contiguous, oval, elongate, of similar size, and situated in the third quarter of the body. Anterior testis, 179–314 × 106–193 (239 × 144). Posterior testis, 202–386 × 111–193 (288 × 137). Post testicular field long, 396–803 (574) (T = 21–29%).

Cirrus sac dorsal to ventral sucker, 119–238 × 67–76 (171 × 71), containing an undivided and oval internal seminal vesicle, an elongate and convoluted pars prostatica, and tubular unspined cirrus. Genital pore median, just posterior to intestinal bifurcation.

Ovary entire, spherical, 71–130 × 63–116 (102 × 82). Laurer's canal present. Mehlis' gland well developed, median, situated between ovary and anterior testis. Uterine seminal receptacle conspicuous. Vitellarium follicular, follicles large, distributed in two lateral fields from midway between ventral sucker and ovary to almost the posterior extremity of the body. Uterine field short, with intercaecal loops (U = 5–12%). Metraterm muscular, similar in size to cirrus sac, 250–314 × 39–44 (277 × 41). Eggs not numerous, up to 5, 90–119 × 55–61 (102 × 57). Body length:egg length ratio 1:20–29.

Taxonomic summary

Type host. *Podiceps gallardoi* Rumboll, 1974 (Podicipediformes, Podicipedidae) (hooded grebe).

Type locality. El Cervecero Lake, Buenos Aires plateau, Santa Cruz Province, Argentina (47°09′20″S, 71°16′32″W).

Date of collection. May 2011.

Site of infection. Intestine.

Type material. Holotype MLP–He 7394; paratypes MLP–He 7395 (four specimens).

Prevalence. 90%.

Table 1. Comparative measurements of main morphological characters of *P. patagonensis* n. sp. and *P. noblei*.

	P. patagonensis n. sp. Present study	*P. noblei*			
		Park (1936)	Zerecero (1949)	Blankespoor (1974)	MacKenzie & McKenzie (1980)
OS	193–203 × 179–213	144–280 × 136–252	213 × 204	167–260 × 172–249	116–261 × 116–255
VS	95–116 × 95–121	116–232 × 108–228	160 × 155	143–237 × 155–213	81–244 × 81–267
E	29–38 × 17–26	33 × 20	40 × 23	35–40 × 19–21	29–41 × 17–23
OS/VS	1:1.76–1.93	1:1.1–1.26*	1:1.32*	1:1.11–1.17*	1:0.95–1.43*
Country	Argentina	USA	Mexico	USA	Canada
Hosts	*Podiceps gallardoi*	*Agelaius phoeniceus californicus*	*Tyrannus* sp.	*Passer domesticus*§	*Tyrannus tyrannus, Tyrannus verticalis*

*Calculated from original descriptions.
§Experimental.

Table 2. Comparative measurements of *P. patagonensis* n. sp. and *P. muris*.

	P. patagonensis n. sp. Present study	*P. muris* (Tanabe, 1922)		
		Dollfus (1925)	McMullen (1937)	Caballero (1943)
Bl	977–1514	800–2200	2670	2410**
Bw	251–339	240–800	520	680**
OS	193–203 × 179–213	167–220 in diameter	213 in diameter	233–266 × 233–250
VS	95–116 × 95–121	150–200 in diameter	144 in diameter	144–168 × 140–156
Ph	76–97 × 74–106	70–83 in diameter	– × 107	104–108 × 100
CS	286–302 × 55–90	330–433 × 60–83	–	508–592 × 56–80
AT	131–145 × 82–119	140–300 × 140–280	231 in diameter	120–188 × 128–180
PT	117–169 × 92–124		252 in diameter	152–232 × 140–168
Ov	67–107 × 50–64	116–280 × 83–200	196 in diameter	112–180 × 124–148
E	29–38 × 17–26	30–37 × 20–23	38 × 19	32–40 × 16–22
T (%)	19–33	10	21**	26**
OS/VS	1.76–1.93	1.1*	1.48*	1.60–1.66*
Country	Argentina	Japan	USA	Mexico
Hosts	Hooded grebe	Rodents§	Pigeons, rodents§	Bats

*Calculated from original descriptions.
**Calculated from original drawings.
§Experimental hosts.

Mean intensity. 150 (range 3–307).

Etymology. The new species is named after the common name of the host, macá tobiano.

Remarks

The morphological characters and most body proportions of the specimens described here are similar to those reported by Kostadinova (2005) for the genus *Euparyphium* Dietz, 1909, except for the number of collar spines. The new species described here has 37–39 collar spines, whereas 27, 45 or 55 spines are known in *Euparyphium* (according to Kostadinova, 2005). Nevertheless, the latter genus diagnosis likely reflects the small number of species currently included in *Euparyphium*. In light of other morphological and morphometric similarities between our specimens and species of *Euparyphium*, we consider that the number of collar spines in the generic diagnosis must be amended.

Kostadinova & Gibson (2002) considered the genus *Euparyphium* to be constituted by four species. The type species, *Euparyphium capitaneum* Dietz, 1909 (syn. *Euparyphium anhingae* Premvati, 1968) described from birds from Neotropical and Nearctic regions, and *Euparyphium guerreroi* Tubangui, 1931, *Euparyphium murinum* Tubangui, 1931 and *Euparyphium albuferensis* Esteban, Toledo, Sánchez & Muñoz-Antolí, 1997, from mammalian hosts from Palaearctic and Oriental regions.

Euparyphium capitaneum, a parasite of *Anhinga anhinga* (L.) (Suliformes, Anhingidae), was described briefly by Dietz (1910) in Brazil. It was described later in Cuba by Pérez Vigueras (1944) and the USA by Premvati (1968) (as *E. anhingae*), and redescribed by Kudlai *et al.* (2015). This species mainly differs from *E. tobianum* n. sp. by having fewer spines in the cephalic collar (27 vs. 37–39), very elongated and wavy testes, larger body size, smaller eggs, greater body length:egg length ratio, shorter metraterm and larger angle spines (table 3).

The three remaining species of *Euparyphium*, described from rodents, mainly differ from the new species in the number collar spines, i.e. 55 in *E. guerreroi*, 45 in *E. murinum* and *E. albuferensis* vs. 37–39 in *E. tobianum* n. sp. The species from mammalian hosts also differ in most metrical characters and relative proportions (table 3) (Tubangui, 1931a, b; Esteban *et al.*, 1997).

Discussion

The present report of cestodes, tetramerids, notocotylids, *P. patagonensis* n. sp. and *E. tobianum* n. sp. constitutes the first record of helminths in wild populations of *Po. gallardoi*. Four other species of Podicipedidae inhabit Patagonia, Argentina: *Podiceps major* (Boddaert), *Podiceps occipitalis* Garnot, *Rollandia rolland* (Quoy & Gaimard) and *Podilymbus podiceps* (Linnaeus). The digenean fauna of grebes from Patagonia is poorly known. There are only the reports of *Stephanoprora argentinensis* Sutton, Lunaschi & Topa, 1982 parasitizing *Po. major* and *R. rolland* from Pellegrini Lake, Río Negro Province. A few other records of helminths from grebes exist in central Argentina: *Petasiger argentinensis* Lunaschi & Drago 2010 (Echinostomatidae) in *Po. major* and *R. rolland*; *Tylodelphys adulta* Lunaschi & Drago, 2004 (Diplostomidae) and *Stephanoprora uruguayense* Holcman-Spector & Olague, 1989 (Echinostomatidae) in *Po. major*; and *Levinseniella cruzi* Travassos, 1920 in *R. rolland* (Microphallidae) from Buenos Aires Province (Lunaschi *et al.*, 2007; Drago & Lunaschi, 2015).

Most life cycles of *Plagiorchis* spp. involve lymnaeid snails, such as *Lymnaea* spp., *Radix* spp. and *Stagnicola* spp., as first intermediate host. The metacercariae can develop inside the sporocyst without emerging from the snail; in other snail species;

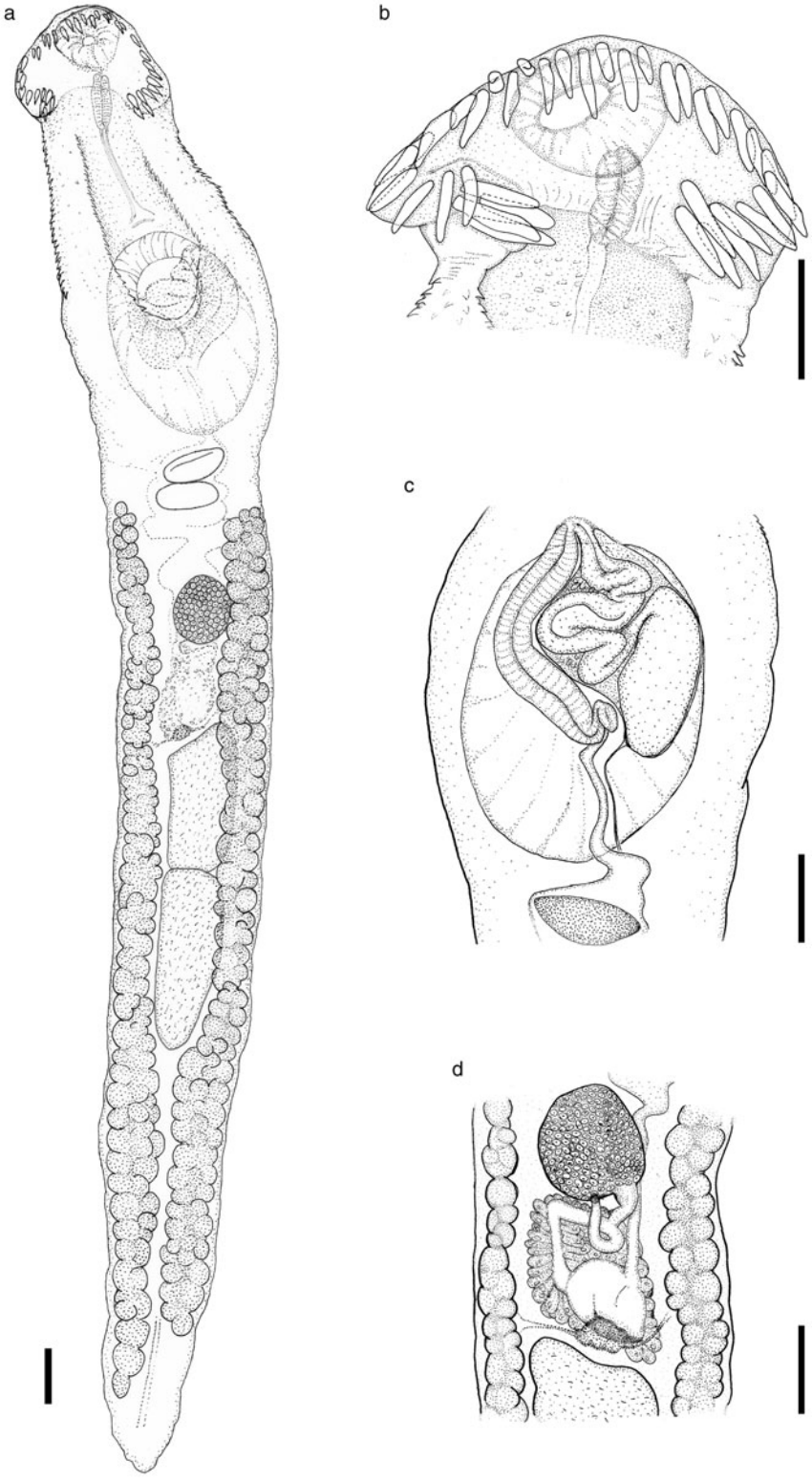

Fig. 2. *Euparyphium tobianum* n. sp.: (a) entire worm, ventral view (holotype); (b) head collar with 37 collar spines (paratype); (c) enlarged view of terminal genitalia, dorsal view (holotype); (d) enlarged view of ovarian complex, dorsal view (holotype). Scale bars: 100 µm.

in larval aquatic insects, mainly chironomids, ceratopogonids and culicids; or in crustaceans (Rees, 1952; Yamaguti, 1975; Blankespoor, 1977; Bock & Janssen, 1987; Zikmundová *et al.* 2014). In the life cycles of *Euparyphium* spp., the cercariae develop in pulmonate gastropods (Planorbidae) and the metacercariae develop in the same planorbid, or in lymnaeid or physid species (Esteban *et al.*, 1997; Kostadinova, 2005).

The diet of the hooded grebe is scarcely known. During the breeding season on lakes of western Santa Cruz, these grebes feed mainly on snails (*Lymnaea diaphana* King) and other aquatic invertebrates, such as amphipods, copepods, cladocerans, larvae of chironomids and water beetles, and leeches (Fjeldså, 1986). In wintering grounds on the estuaries of the Atlantic coast of the province, they consume fish, crustaceans, hydrozoans,

Table 3. Comparative measurements of *Euparyphium tobianum* n. sp. and *Euparyphium* spp.

		E. capitaneum					
	E. tobianum n. sp Present study	Dietz (1910)	Pérez Vigueras (1944)	Kudlai *et al.* (2015)	*E. guerreroi* Tubangui (1931a)	*E. murinum* Tubangui (1931b)	*E. albuferensis* Esteban *et al.* (1997)
Bl	1600–2800	4500	4000	2600–5800	2920–4030	2650–4500	2980–6070
Bw	324–411	380–410	560	315–563	370–500	450–650	515–1031
Cl	152–304	–	–	95–185	220–260 in diameter	–	–
Cw	193–343	210–206	–	170–301		230–270	241–317
S	37–39	27	26	27	55	45–46	45
ASl	48–81 × 12–17	86–108 × 19–22	90–100	90–114 × 13–17	25–32 × 9–11	38–44 × 8–9	46–63 × 21–29
LSl	50–71 × 10–12	64–84 × 12–14		52–105 × 8–19	27–29 × 9		31–57 × 17–23
DSl	31–64 × 10–14			72–94 × 8–14	11–14 × 7–9		
OSl	79–112	60–100 in diameter	90 in diameter	53–97	–	–	110–179
OSw	89–129			62–112	100–120	100	111–162
VSl	290–406	300–330 in diameter	420	313–462	260–360	320–420	402–614
VSw	222–275		330	233–370	310–340	230–320	344–517
Fo	401–532	1000**	–	620–1456	539**	420**	540–919
Phl	64–95	129–143	140	99–176	100–110	100–130	125–185
Phw	33–43	96–116	90	62–119	70–80	70–90	108–162
Oe	203–309	385–616	560	321–964	80–150	70–120	149–218
CSl	119–238	385–400	–	175–453	170–270	250–360	321–569
CSw	67–76	123–138	–	98–194	100–130	100–130	115–258
ATl	179–314	700–1050 × 154–261	335	339–761	190–360	320–480	437–931
ATw	106–193		290	119–231	150–220	160–250	235–444
PTl	202–386		530	449–991	270–390	330–530	460–943
PTw	111–193		330	114–218	120–200	150–260	230–569
PTf	396–803	1411**	–	832–1938	1000**	710**	950**
Ovl	71–130	60–95	220	101–301	100–150	–	161–304
Ovw	63–116	43–68	110	62–154	70–130	100–150	172–256
Mel	250–314	–	–	92–212	–	–	–
Mew	39–44	–	–	75–145	–	–	–
El	90–119	67	68	63–81	79–86	88–95	74–97
Ew	55–61	49	38	33–52	54–61	58–61	43–61
VS/OS	1:2–2.7	1:3–5*	1:3.7*	1:3.3–3.8*	1:2.8–3.1*	1:2.3–3.2*	1:2.9–3.5
OS/Ph	1:2.4–3.2	0.6–0.9*	1:1*	1:0.94–1*	1:1.4–1.5*	1:1.1–1.4*	1:1*
Bl/El	1:20–29	1:67*	1: 59*	1:32–92*	1:34–51*	1:28–51*	1:31–82*
BW%	14–20	11*	14*	7–14	12*	14–17*	17*
FO%	16–26	22**	23**	20–32	15**	15**	15–18*
T%	21–29	31**	37**	27–50	28**	14**	19**
U%	5–12	4**	0**	0–7	23**	24**	19**
Country	Argentina	Brazil	Cuba	USA	Philippines		Spain
Hosts	*Podiceps gallardoi*	*Anhinga anhinga*			*Rattus norvegicus*		*R. norvegicus*, *Rattus rattus*

*Calculated from original descriptions.
**Calculated from original drawings.

algae and chitons (Torres & Vargas, 2005). In light of what is known of the life cycles of members of *Plagiorchis* and *Euparyphium*, with snails as the main route of infection, hooded grebes probably acquire both digenean species during the breeding season on lakes of western Santa Cruz.

The pathogenicity of *Plagiorchis* spp. and *Euparyphium* spp. seems to be low, except in cases of massive infections. *Plagiorchis laricola* can cause necrotic enteritis, affecting the whole of the small intestine and duodenum, which may cause the death of the birds in cases of high infections (Foggie, 1937). The low intensity of infection of *P. patagonensis* n. sp. found in this study does not indicate that these parasites pose a threat to hooded grebe populations.

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