

# Species of *Strigea* (Digenea: Strigeidae), parasites of the savanna hawk *Buteogallus meridionalis* (Aves: Accipitridae) from Argentina, with the description of a new species

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**Abstract:** A new strigeid digenean, *Strigea meridionalis* sp. n., is described from the small intestine of the savanna hawk, *Buteogallus meridionalis* (Latham) (Aves: Accipitridae), from Formosa Province, Argentina. This species is characterised by the absence of a neck region in the hindbody, the presence of entire testes, a copulatory bursa with a membranous fold originated from the muscular ring (*Ringnapf*) and by the arrangement of vitelline follicles in the forebody. Other two strigeid species collected from the savanna hawk, *Strigea elliptica* (Brandes, 1888) and *Strigea microbursa* Pearson et Dubois, 1985, are described and illustrated. *Strigea microbursa* is reported for the first time from the Neotropical Region and *B. meridionalis* represents a new host record for *S. elliptica*. These findings allow us to increase the knowledge of these species, adding new metric and morphological data. A key to the species of the Neotropical *Strigea* Abildgaard, 1790 is presented including data on their geographical distribution.

**Key words:** Strigeidae, *Strigea meridionalis*, *Strigea elliptica*, *Strigea microbursa*, *Buteogallus meridionalis*, Accipitridae, Argentina

The savanna hawk, *Buteogallus meridionalis* (Latham) (Accipitridae), is a bird of prey found in the open savanna and swamp edges of the Neotropical Region, from Panama and Trinidad south to Bolivia, Uruguay and central Argentina (Thiollay 1994). The helminth fauna of the savanna hawk is poorly known and the only record of digeneans parasitizing this host species is that of *Stomylotrema vicarium* Braun, 1901 (Stomylotrematidae) from Argentina (Lunaschi and Drago 2009). During a helminthological study of birds from Formosa Province, Argentina, three digenean species were collected from the small intestine of the savanna hawk. Examination of this material revealed the presence of two known species of the genus *Strigea* Abildgaard, 1790 (Strigeidae). The remaining specimens represent a new species of this genus which is herein described.

## MATERIALS AND METHODS

Five specimens of *Buteogallus meridionalis* were collected between May 2005 and October 2007 from Bellaco wetland (26°17'35"S, 59°06'67"W) (Formosa Province, Argentina). The birds were dissected in the field, the viscera preserved in 10% formalin and transported to the laboratory for examination. The digeneans found were stored in 70% ethanol, stained with a 1:6 dilution in 96% ethanol of hydrochloric carmine, dehydrated and mounted in Canada balsam between cover glasses in order

to facilitate handling and observation. The drawings were made with the aid of a drawing tube. Measurements are given in micrometres ( $\mu\text{m}$ ) unless otherwise stated, as the range followed by the mean in parentheses. Type and voucher specimens of parasites and hosts were deposited in the Helminthological and Ornithological Collections of the Museo de La Plata (MLP), La Plata, Argentina, respectively.

## RESULTS

Strigeidae Railliet, 1919

Strigeinae Railliet, 1919

*Strigea meridionalis* sp. n.

Figs. 1, 2

**Description** (based on 10 specimens): Body slender, 1.256–2.265 mm (1.803 mm) in total length. Forebody cup-shaped, with large oblique opening, 464–832 (649) long by 222–445 (341) wide. Tegument smooth. Hindbody slender, cylindrical, without neck, 1.5–2.4 (1.9) times longer than forebody, 0.792–1.433 (1.154) mm long by 275–493 (372) wide. Oral sucker subterminal, poorly developed, projecting from opening, 60–88 (72) long by 62–97 (77) wide. Ventral sucker well developed, larger than oral sucker, 83–143 (112) long by 60–155 (99) wide. Distance between suckers 267–430 (365). Sucker-width ratio 1:1.3–1.9 (1.5). Holdfast organ lobes not projecting

from opening. Proteolytic gland behind ventral sucker with two lobes, anterior follicular lobe 105–179 (135) long by 74–119 (92) wide, posterior compact lobe 48–76 (59) long by 48–102 (77) wide. Prepharynx not discernible; pharynx subequal to oral sucker, 50–83 (66) long by 58–83 (67) wide; oesophagus long, branched just anterior to ventral sucker; intestinal caeca long, narrow, reaching copulatory bursa. Ratio of pharynx length to oral sucker length 1:0.8–1.2 (1.0). Testes in tandem, large, rounded, entire or with irregular margins, situated in third quarter of hindbody; anterior testis 155–266 (197) long by 112–314 (225) wide; posterior testis 190–338 (234) long by 183–304 (240) wide. Seminal vesicle long, folded on itself, posterodorsal to posterior testis. Ovary ovoid, 86–133 (105) long by 93–214 (151) wide, at 238–473 (349) (24–37%) from intersegmental constriction. Laurer's canal short, opening dorsally between ovary and anterior testis. Mehlis' gland and vitelline reservoir in intertesticular region. Vitelline follicles similar in size in both body segments; in forebody, concentrated mainly in postacetabular region, extend into holdfast organ lobes and lateral body wall from second quarter of its length; in hindbody principally concentrated in preovarian region, extending ventrally to near posterior end. Uterus with large eggs, 83–98 (93) long by 52–67 (59) wide. Ratio of body length to egg length 1:13–26 (1:19). Copulatory bursa delimited by constriction, 121–155 (138) long by 179–324 (247) wide; genital atrium shallow; genital pore terminal. Muscular ring (*Ringnapf*) weakly developed, originating a conspicuous membranous fold. Genital cone well delimited from body parenchyma, slender when protruded, 190–321 (242) long by 67–107 (79) wide; ejaculatory duct and uterus join at base of genital cone forming hermaphroditic duct. Excretory vesicle not observed. Excretory pore ventro-subterminal at level of copulatory bursa.

Type host: *Buteogallus meridionalis* (Latham) (Falconiformes, Accipitridae).

Type locality: Bellaco wetland (26°17'35"S, 59°06'67"W), Pirané, Formosa Province, Argentina.

Date of collection: May 2005.

Site of infection: Small intestine.

Specimens deposited: Holotype MLP 5883; paratypes, 9 specimens, MLP 5884.

Prevalence: 1 of 5 (20%).

Intensity of infection: 21.

Etymology: The new species is named after the specific name of the host.

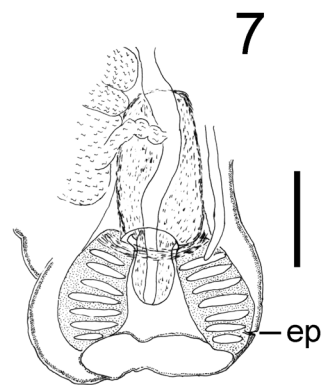
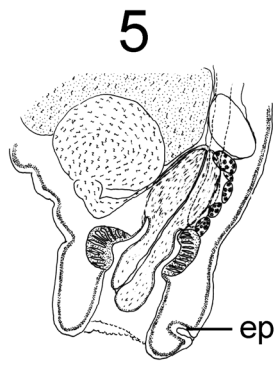
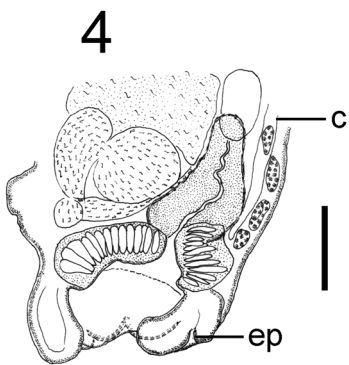
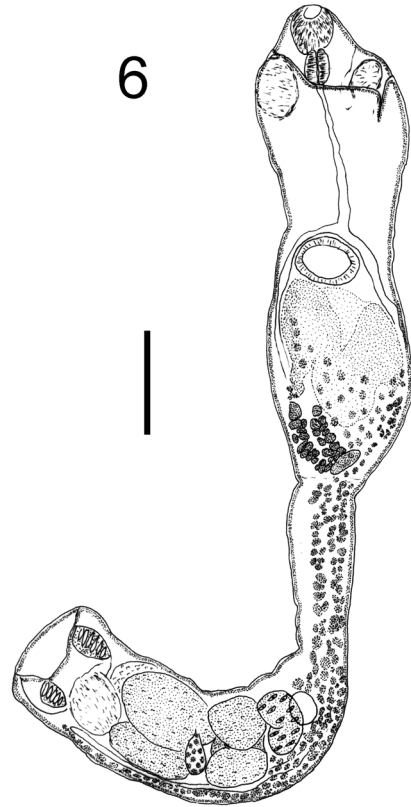
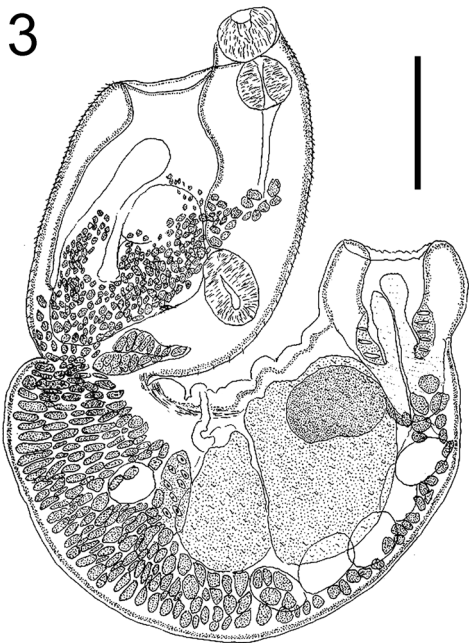
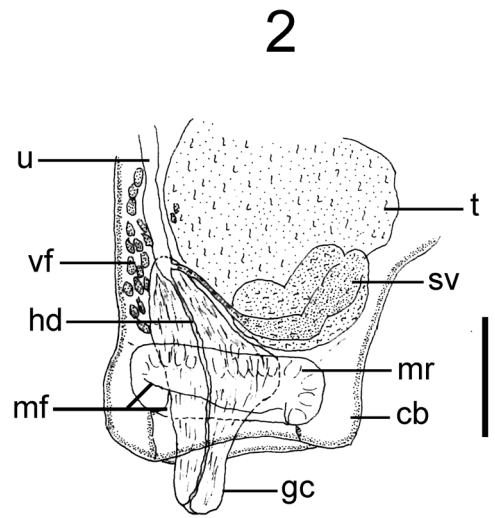
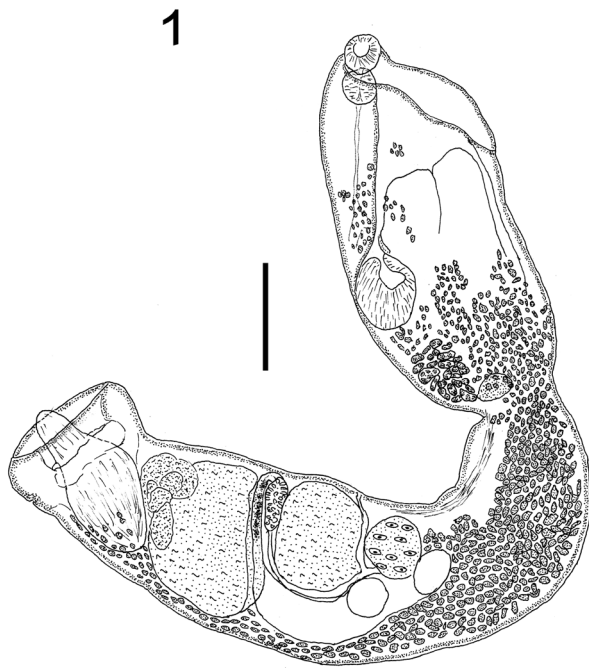
**Remarks.** The genus *Strigea* was established for *Festucaria strigis* Schrank, 1788 (type species), a parasite of strigiform and falconiform birds from Palaearctic Region (Dubois 1938, 1968). The main characteristics used to distinguish among its species are the shape of the forebody, hindbody and testes, the size of the copulatory bursa

and pharynx, the conformation of the genital cone as well as the distribution of the vitelline follicles in the forebody. With the present new species, the genus contains 37 species; 10 of them have been known from the Neotropical Region as parasites of strigiform, ciconiiform, falconiform, caprimulgiform, passeriform, gruiform, trogoniform and anseriform birds (Table 1).

Among these 10 Neotropical species of *Strigea*, the new species most closely resembles *Strigea caluri* Dubois, 1962 in having a membranous fold originated from a muscular ring (*Ringnapf*) in the copulatory bursa. However, *S. caluri* can be distinguished from the new species by the possession of a larger and plump body (forebody 0.880–1.100 × 0.850–1.130 mm; hindbody 1.250–1.800 × 0.850–1.240 mm), vitelline follicles extending from the anterior end of the forebody, a larger pharynx (160–180 × 130–150), testes which are strongly lobed (anterior testis 420–500 × 700–860; posterior testis 480–600 × 750–860) and a larger ovary (180–230 × 220–320) situated 14–17% of hindbody from the intersegmental constriction.

Three other Neotropical species, i.e., *Strigea caryophylla* (Diesing, 1850), *Strigea magniova* Dubois, 1988 and *Strigea arcuata* Dubois, 1988, can be differentiated from the new species by having the proximal and preovarian region of hindbody elongate and thinner than the gonadal region, occupying nearly 40–50% of this segment [this region was referred as the neck or *Halsteil* by Dubois (1968)]. In addition, *S. caryophylla* has a larger body size (up to 10 mm), and its genital cone is larger and ovoid; the eggs in *S. magniova* are larger than those of the new species (105–128 × 52–72) and the vitelline follicles in the forebody are dense and distributed from the anterior end; finally, *S. arcuata* differs from the Argentinean species by having a larger body size (3.7 mm), lobed testes and the genital cone included in a circular muscular formation.

The remaining species [*S. elliptica* (Brandes, 1888), *Strigea bulbosa* (Brandes, 1888), *Strigea nugax* Szidat, 1928, *Strigea vaginata* (Brandes, 1888), *Strigea falconis brasiliana* Szidat, 1929 and *Strigea sphaerocephala* (Westrumb, 1823)] are similar to *S. meridionalis* in the absence of a neck. However, *S. elliptica* differs from the new species in having a plump body, a smaller pharynx (60) and vitelline follicles occupying the entire forebody. *Strigea bulbosa* can be distinguished from the specimens found in *B. meridionalis* in having lobed testes and larger suckers and pharynx (oral sucker 90–150 in diameter, ventral sucker 135–250 in diameter, pharynx 100–150 × 65–150). *Strigea nugax* can be distinguished from the new species by having a larger dimensions of the body and some organs (body up to 6 mm in length, oral sucker 250, ventral sucker 300, pharynx, 150, copulatory bursa 800–1200). *Strigea vaginata* differs from *S. meridionalis* in its plump hindbody, larger copulatory bursa and an enormous genital cone (580–2000 × 300–900). *Strigea falconis brasiliana* can be separated from the new spe-



cies by the lobed testes and a strongly muscular and broad genital cone (129–310 wide). Finally, *S. sphaerocephala* can be differentiated from the new species by having a copulatory bursa not delimited from the body parenchyma and vitelline follicles extending from the anterior end.

Three other species of the genus, i.e., *Strigea flosculus* Nicoll, 1914, *Strigea baylisi* Dubois, 1937 and *Strigea nicolli* Dubois, 1937 from the Australian Region and *Strigea intermedia* Szidat, 1932 from the Ethiopian Region, have testes with entire margins similar to the new species; however, they differ in the body shape and the arrangement of vitelline follicles in the forebody.

***Strigea elliptica*** (Brandes, 1888) Szidat, 1928

Figs. 3–5

**Description** (based on 8 specimens): Body 1.137–2.101 mm (1.434) in total length. Forebody cup-shaped, with large opening, 384–613 (524) long by 353–473 (408) wide. Forebody in younger specimens armed with densely arranged tegumental spines that gradually diminish in size and number posteriorly, and smooth in older specimens. Hindbody plump, curved dorsally, without neck, 1.3–2.5 (1.8) times longer than forebody, 702–1488 (952) long by 324–522 (407) wide. Oral sucker subterminal, projecting from opening, 69–106 (86) long by 66–105 (89) wide. Ventral sucker located about 1/3 distance from anterior end, 102–130 (123) long by 76–115 (91) wide. Sucker-width ratio 1:0.8–1.3 (1.0). Holdfast organ lobes not projecting from opening; proteolytic gland at base of forebody, 55–95 (75) long by 121–166 (151) wide. Prepharynx present, 7–9 (8) long; pharynx large, 72–87 (79) long by 64–86 (77) wide; oesophagus long, branched just anterior to ventral sucker; intestinal caeca long, narrow, reaching copulatory bursa. Ratio of pharynx length to oral sucker length 1:0.8–1.1 (0.9). Testes in tandem, large, not lobed; anterior testis cuneiform, 119–168 (140) long by 190–275 (233) wide; posterior testis larger than anterior testis, 167–367 (250) long by 226–290 (267) wide. Seminal vesicle large, posterodorsal to posterior testis. Ovary oval, 60–97 (79) long by 116–213 (156) wide, at 142–314 (240) (20–32%) from intersegmental constriction. Laurer's canal short, opening dorsally between ovary and anterior testis. Mehlis' gland and vitelline reservoir in intertesticular region. Vitelline follicles of different size in both body regions; in forebody, small follicles extending into holdfast organ and lateral body wall from pharyngeal region or more posteriorly; in hindbody, large follicles mostly concentrated in preovarian region, extending

ventrally to copulatory bursa. Uterus ventral with large eggs, 81–101 (91) long by 48–60 (57) wide. Ratio of body length to egg length 1:13–20 (1:15). Copulatory bursa delimited by constriction in hindbody; genital atrium deep, 90–143 (117) in depth; pore terminal. Muscular ring (*Ringnapf*) well developed. Genital cone well delimited from body parenchyma, slender when protruded, 131–250 (179) long by 48–95 (63) wide; ejaculatory duct and uterus join at base of genital cone forming hermaphroditic duct. Ratio of genital cone width to egg width 1:0.9–1.3 (1:1.1). Excretory vesicle not observed. Excretory pore ventro-subterminal at level of copulatory bursa.

**Host:** *Buteogallus meridionalis* (Latham) (Falconiformes, Accipitridae).

**Locality:** Bellaco wetland (26°17'35"S, 59°06'67"W), Pirané, Formosa Province, Argentina.

**Date of collection:** May 2005.

**Site of infection:** Small intestine.

**Specimens deposited:** 11 specimens, MLP 5885.

**Prevalence:** 1 of 5 (20%).

**Intensity of infection:** 17.

**Remarks.** The material studied in this work can be separated in two groups. Members of the first group have a spinous forebody and vitelline follicles extending from the immediately pre-equatorial region (Fig. 3); members of the second group have a smooth forebody and vitelline follicles extending from the pharyngeal region. In our opinion, the presence or absence of spines could be related to variations in the developmental stage of the parasite. A similar variation in the tegumental spination was also observed in specimens of *S. falconis brasiliiana* found parasitizing the roadside hawk, *Buteo magnirostris* (Gmelin), from the Neotropical Region (Lunaschi and Drago 2006).

However, based on the close metric and morphological similarities observed between our material and the previous descriptions of *S. elliptica* (Szidat 1928, 1929, Dubois 1968), we have assigned the specimens collected from *B. meridionalis* to this species. Life-history and/or molecular studies should be conducted on the parasites to confirm the significance of the differences in tegumental armature.

The presence of *S. elliptica* in *B. meridionalis* represents a new host record and the first report of this parasite in Argentinean birds. This finding allowed us to increase the knowledge of this species, adding new metric and morphological data.

**Figs. 1–7.** Strigeids from *Buteogallus meridionalis* from Argentina. **Fig. 1.** *Strigea meridionalis* sp. n., entire worm. **Fig. 2.** *S. meridionalis*, enlarged view of terminal genitalia. **Fig. 3.** *Strigea elliptica* (Brandes, 1888), entire worm. **Figs. 4, 5.** *S. elliptica*, enlarged view of terminal genitalia. **Fig. 6.** *Strigea microbursa* Pearson et Dubois, 1985, entire worm. **Fig. 7.** *S. microbursa*, enlarged view of terminal genitalia. **Abbreviations:** c – caecum; cb – copulatory bursa; ep – excretory pore; gc – genital cone; hd – hermaphroditic duct; mf – membranous fold; mr – muscular ring; sv – seminal vesicle; t – posterior testis; u – uterus; vf – vitelline follicles. Scale bars: Figs. 1, 3, 6 = 200 µm; Figs. 2, 4, 5 = 100 µm; Fig. 7 = 50 µm.

**Table 1.** Records of *Strigea* Abildgaard, 1790 species in the Neotropical Region.

Species	Host	Locality	Reference
<i>Strigea arcuata</i> Dubois, 1988	<i>Accipiter erythronemius</i> (Kaup) <i>Parabuteo unicinctus</i> (Temminck)	Paraguay	Dubois 1988
<i>Strigea bulbosa</i> (Brandes, 1888)	<i>Ajaja ajaja</i> (L.) <i>Elanoides forficatus</i> (L.) <i>Nyctibius grandis</i> (Gmelin) <i>Theristicus caudatus</i> (Boddaert)	Brazil	Dubois 1968, Travassos et al. 1969
<i>Strigea caluri</i> Dubois, 1962	<i>Pharomachrus mocinno</i> De la Llave	Central America	Dubois 1968
<i>Strigea caryophylla</i> (Diesing, 1850)	<i>Accipiter bicolor pileatus</i> (Temminck)	Brazil	Dubois 1968
<i>Strigea elliptica</i> (Brandes, 1888)	<i>Bubo magellanicus</i> (Gmelin) <i>Bubo virginianus nacurutu</i> (Vieillot) <i>Buteogallus meridionalis</i> (Latham)	Brazil Brazil Argentina	Travassos et al. 1969 Dubois 1968 present study
<i>Strigea falconis brasiliiana</i> Szidat, 1929	<i>Buteo albicaudatus</i> Vieillot <i>Buteo jamaicensis umbrinus</i> Bangs <i>Buteo magnirostris</i> (Gmelin) <i>Buteo platypterus cubanensis</i> Burns <i>Caracara plancus</i> (Miller) <i>Coragyps atratus</i> (Bechstein) <i>Gallinula chloropus galeata</i> (Lichtenstein) <i>Herpetotheres cachinnans</i> (L.) <i>Spizaetus ornatus</i> (Daudin)	Brazil Cuba Brazil Cuba Brazil Brazil Venezuela Brazil	Travassos et al. 1969 Pérez Viguera 1944, 1955, Dubois 1968 Travassos et al. 1969 Lunaschi and Drago 2006 Dubois and Macko 1972 Dubois 1968 Dubois 1970 Lamothe-Argumedo and Jaimes Cruz 1982 Travassos et al. 1969
<i>Strigea magniova</i> Dubois, 1988	<i>Buteo magnirostris</i> (Gmelin)	Paraguay Argentina	Dubois 1988 Lunaschi and Drago 2006
<i>Strigea meridionalis</i> sp. n.	<i>Buteogallus meridionalis</i> (Latham)	Argentina	present study
<i>Strigea microbursa</i> Pearson et Dubois, 1985	<i>Buteogallus meridionalis</i> (Latham)	Argentina	present study
<i>Strigea nugax</i> Szidat, 1928	<i>Mycteria americana</i> L.	Brazil	Travassos et al. 1969
<i>Strigea sphaerocephala</i> Westrumb, 1823	<i>Amazonetta brasiliensis</i> (Gmelin) <i>Psarocolius decumanus</i> (Pallas) <i>Pyroderus scutatus</i> Shaw <i>Theristicus caudatus</i> (Boddaert)	Brazil Brazil Brazil Colombia	Travassos et al. 1969 Dubois 1968, Travassos et al. 1969 Dubois 1968, Travassos et al. 1969 Dubois 1981
<i>Strigea vaginata</i> (Brandes, 1888)	<i>Amazonetta brasiliensis</i> (Gmelin) <i>Caracara plancus</i> (Miller) <i>Cariama cristata</i> (L.) <i>Cathartes aura aura</i> (L.) <i>Cathartes burrovianus urubitinga</i> Pelzeln <i>Cercibis oxycerca</i> (Spix) <i>Coragyps atratus</i> (Bechstein) <i>Theristicus caudatus</i> (Boddaert) <i>Sarcoramphus papa</i> (L.) <i>Spizaetus ornatus</i> (Daudin)	Venezuela Colombia Brazil Cuba Brazil Colombia Brazil Venezuela Colombia Brazil Brazil	Dubois 1970 Dubois 1978 Travassos et al. 1969 Dubois and Macko 1972 Travassos et al. 1969 Dubois 1981 Travassos et al. 1969 Caballero y C. and Díaz-Ungria 1958, Dubois 1970 Dubois 1981 Travassos et al. 1969 Travassos et al. 1969

***Strigea microbursa* Pearson et Dubois, 1985**

Figs. 6, 7

**Description** (based on 6 specimens): Body slender, 1.266–3.021 mm (1.853 mm) in total length. Forebody bell-shaped, with equatorial constriction and large opening, 0.832–1.083 (0.952) mm long by 328–551 (429) wide. Tegument smooth. Hindbody slender, cylindrical, 1.2–2.3 (1.5) times longer than forebody, 1.083–2.102 (1.402) mm long by 232–435 (302) wide, with neck region 112–169 (137) in width, 36–42% (39%) of posterior segment length. Oral sucker subterminal, projecting from opening, 69–107 (83) long by 74–117 (96) wide. Ventral sucker equatorial, 1.0–1.8 (1.4) times longer than oral sucker, 107–143 (117) long by 116–143 (129) wide.

Pseudosuckers well developed. Holdfast organ lobes not reaching anterior margin of forebody. Proteolytic gland at base of forebody, 143–193 (178) long by 126–152 (141) wide, with three lobes: two anterior follicular lobes, one posterior compact lobe. Pharynx subequal to oral sucker, 62–83 (72) long by 52–64 (60) wide; oesophagus long, branched just anterior to ventral sucker; intestinal caeca long, narrow, reaching copulatory bursa. Ratio of pharynx length to oral sucker length 1:0.7–1.0 (0.8). Testes in tandem, bilobed, large; anterior testis 143–280 (209) long by 131–343 (210) wide; posterior testis 179–241 (209) long by 157–314 (221) wide. Seminal vesicle long, folded on itself, posterodorsal to posterior testis. Ovary bilobed, 105–138 (112) long by 88–217 (137) wide, at 432–760

(573) from intersegmental constriction. Laurer's canal short, opening dorsally between ovary and anterior testis. Mehlis' gland and vitelline reservoir in intertesticular region. Vitelline follicles of similar size in both regions of body; in forebody extending from level of ventral sucker or more posteriorly; in hindbody arranged in two ventral rows in preovarian region, extending ventrally to near posterior end. Uterus without eggs or with 1–3 large eggs, 83–129 (108) long by 52–98 (70) wide. Ratio of body length to egg length 1:14–25 (1:20). Copulatory bursa 104–420 (262) long by 102–381 (242) wide; genital atrium shallow, genital pore terminal. Muscular ring (*Ringnapf*) well developed. Genital cone delimited from body parenchyma, slender when protruded; ejaculatory duct and uterus join in anterior third of genital cone. Excretory vesicle not observed. Excretory pore ventro-subterminal at level of copulatory bursa.

Host: *Buteogallus meridionalis* (Latham) (Falconiformes, Accipitridae).

Locality: Bellaco wetland (26°17'35"S, 59°06'67"W), Pirané, Formosa Province, Argentina.

Date of collection: October 2007.

Site of infection: Small intestine.

Specimens deposited: 4 specimens, MLP 5886.

Prevalence: 1 of 5 (20%).

Intensity of infection: 15.

**Remarks.** The presence of a neck in the specimens described above is a trait shared with six species of the genus *Strigea*: *S. caryophylla*, *S. magniova* and *S. arcuata* from the Neotropical Region, *S. vandenbroekae* Dubois, 1966 and *S. gracilicollis* Dubois et Fain, 1956 from the Holarctic Region and *S. microbursa* from the Oriental Region (Dubois 1968, 1988, Pearson and Dubois 1985). Nevertheless, by having a larger body size, testes different in shape and a distinct arrangement of vitelline fields, *S. caryophylla*, *S. vandenbroekae*, *S. gracilicollis* and *S. arcuata* can be distinguished from the specimens described here. *Strigea magniova* differs from the specimens studied here by having a smaller forebody (320–340 vs. 0.832–1.083 mm in our material), a higher ratio of hindbody length to forebody length (2.8–3.8 vs. 1.2–2.3) and because the vitelline follicles in the forebody are densely distributed from the anterior end, while in the Argentinean specimens the vitelline follicles are scarce.

The morphological and metric traits of our specimens are in full agreement with those of *S. microbursa* described by Pearson and Dubois (1985) parasitizing the crested serpent-eagle, *Spilornis cheela* (Latham) (Accipitridae) from Indonesia. Therefore, the specimens found parasitizing *B. meridionalis* should be assigned to *S. microbursa*.

*Strigea microbursa* parasitizing *B. meridionalis* represents a new host record and the first report of this parasite species in Neotropical birds. This finding allows us to increase the knowledge of this species, adding new metric and morphological data.

### Key to the Neotropical species of *Strigea*

- 1 Hindbody slender, neck region present or absent .. 2
  - Hindbody plump, curved dorsally ..... 10
- 2 Neck region present in hindbody ..... 3
  - Neck region absent in hindbody ..... 6
- 3 Holdfast organ lobes projecting from opening of forebody ..... 4
  - Holdfast organ lobes not projecting from opening of forebody ..... 5
- 4 Vitelline glands in forebody distributed dorsally from posterior edge of ventral sucker. Oral sucker smaller than pharynx. In Accipitridae from Brazil ..
  - ..... *S. caryophylla*
  - Vitelline glands densely distributed in forebody from anterior end. Oral sucker larger than pharynx. In Accipitridae from Paraguay and Argentina .....
    - ..... *S. magniova*
- 5 Forebody without equatorial constriction. Genital cone included in circular muscular formation. In Accipitridae from Paraguay ..... *S. arcuata*
  - Forebody with equatorial constriction. Genital cone not included in circular muscular formation. In Accipitridae from Indonesia and Argentina.....
    - ..... *S. microbursa*
- 6 Testes entire ..... 7
  - Testes lobed ..... 9
- 7 Copulatory bursa with membranous fold originated from muscular ring (*Ringnapf*). In Accipitridae from Argentina ..... *S. meridionalis*
  - Copulatory bursa without membranous fold ..... 8
- 8 Copulatory bursa similar in size to forebody and delimited by constriction in hindbody. In Ciconiidae from Brazil ..... *S. nugax*
  - Copulatory bursa smaller than forebody and not delimited by constriction in hindbody. In Icteridae, Cotingidae and Anatidae from Brazil and Venezuela .....
    - ..... *S. sphaerocephala*
- 9 Body not distinctly bipartite; hindbody similar in length to forebody. Genital cone smaller than ovary. In Accipitridae, Nyctibiidae and Threskiornithidae from Brazil ..... *S. bulbosa*
  - Body distinctly bipartite; hindbody 2–4 times longer than forebody. Genital cone larger than ovary. In Accipitridae, Falconidae and Cathartidae from Cuba, Brazil, Venezuela and Argentina .....
    - ..... *S. falconis brasiliiana*
- 10 Testes entire. In Strigidae and Accipitridae from Brazil and Argentina ..... *S. elliptica*
  - Testes multilobed ..... 11

- 11 Testes deeply lobed. Copulatory bursa with membranous fold originated from muscular ring (*Ringnapf*). Genital cone medium-sized. In Trogonidae from Central America ..... *S. caluri*<sup>1</sup>
- Testes with shallow lobes. Copulatory bursa without membranous fold. Genital cone enormous. In Cathartidae, Falconidae, Accipitridae, Cariamidae, Threskiornithidae and Anatidae from Colombia, Venezuela, Brazil and Cuba ..... *S. vaginata*

<sup>1</sup>*S. caluri* was described (Dubois 1962) parasitizing the quetzal, *Pharomachrus mocinno* De la Llave (Trogonidae), from Artis

Zoological Garden of Amsterdam (in nature this bird occurs exclusively in Central America).

**Acknowledgements.** We gratefully thank Dr. L. García Prieto (Instituto de Biología, UNAM, México) for his critical review and valuable suggestions on an earlier version of the manuscript, and Cecilia Moreno for the English review. The authors, Lía Lunaschi and Fabiana Drago, are members of the Comisión de Investigaciones Científicas de la provincia de Buenos Aires (CIC) and Universidad Nacional de La Plata (UNLP), respectively. The present study was supported by a grant from the Comisión de Investigaciones Científicas de la provincia de Buenos Aires (File 2157-3090/07, Res. 730).

## REFERENCES

- CABALLERO Y CABALLERO E., DÍAZ-UNGRÍA C. 1958: Intento de un Catálogo de los Tremátodos Digéneos registrados en territorio Venezolano. Mem. Soc. Cienc. Nat. La Salle 18: 19–36.
- DUBOIS G. 1938: Monographie des Strigeida (Trematoda). Mém. Soc. Neuchâtel. Sci. Nat. 6: 1–535.
- DUBOIS G. 1962: Les Strigeida (Trematoda) de la collection E. van den Broek. Bull. Soc. Neuchâtel. Sci. Nat. 85: 109–120.
- DUBOIS G. 1968: Synopsis des Strigeidae et des Diplostomatidae (Trematoda). Mém. Soc. Neuchâtel. Sci. Nat. 10: 1–258.
- DUBOIS G. 1970: Les Strigeata (Trematoda) de la collection A. Lutz. Mem. Inst. Oswaldo Cruz 68: 169–196.
- DUBOIS G. 1978: Notes Helminthologiques IV: Strigeidae Railliet, Diplostomidae Poirier, Proterodiplostomidae Dubois et Cyathocotylidae Poche (Trematoda). Rev. Suisse Zool. 85: 607–615.
- DUBOIS G. 1981: Notes Helminthologiques V: Strigeidae Railliet, Diplostomidae Poirier et Proterodiplostomidae Dubois. Rev. Suisse Zool. 88: 227–232.
- DUBOIS G. 1988: Quelques Strigeoidea (Trematoda) récoltés au Paraguay par les expéditions du Muséum d'Histoire naturelle de Genève, au cours des années 1979, 1982 et 1985. Rev. Suisse Zool. 95: 521–532.
- DUBOIS G., MACKO J. 1972: Contribution a l'étude de Strigeata La Rue, 1926 (Trematoda: Strigeida) de Cuba. Ann. Parasitol. Hum. Comp. 47: 51–75.
- LAMOTHE-ARGUMEDO R., JAIMES CRUZ B. 1982: Trematoda. In: S.H. Hurlbert and A. Villalobos Figueroa (Eds.), Aquatic Biota of Mexico, Central America and the West Indies. San Diego State University, California, pp. 73–84.
- LUNASCHI L.I., DRAGO F.B. 2006: Strigeid parasites of *Buteo magnirostris* (Aves: Falconiformes) from Argentina. Zootaxa 1106: 25–33.
- LUNASCHI L.I., DRAGO F.B. 2009: Digenean parasites of six species of birds from Formosa Province, Argentina. Rev. Mex. Biodivers. 80: 39–46.
- PEARSON J.C., DUBOIS G. 1985: Strigeida d'Indonésie et de Malaisie, et quelques-uns d'Australie et de Tasmanie. I. Strigeoidea. Bull. Soc. Neuchâtel. Sci. Nat. 108: 5–21.
- PÉREZ VIGUERAS I. 1944: Tremátodos de la superfamilia Strigeoidea. Descripción de un género y siete especies nuevas. Rev. Univ. La Habana 52–54: 293–314.
- PÉREZ VIGUERAS I. 1955: Contribución al conocimiento de la fauna helmintológica cubana. Mem. Soc. Cubana Hist. Nat. 22: 195–233.
- SZIDAT L. 1928: Zur Revision der Trematodengattung *Strigea* Abildgaard. Zentralbl. Bakteriol. 1. Abt., Orig. 105: 204–215.
- SZIDAT L. 1929: Beiträge zur Kenntnis der Gattung *Strigea* (Abildg.). II. Spezieller Teil: Revision der Gattung *Strigea* nebst Beschreibung einer Anzahl neuer Gattungen und Arten. Z. Parasitenkd. 1: 688–764.
- THIOLLAY J.M. 1994: Family Accipitridae. In: J. del Hoyo, A. Elliott and J. Sargatal (Eds.), Handbook of the Birds of the World. Vol. 2. Lynx Edicions, Barcelona, Spain, pp. 52–205.
- TRAVASSOS L., TEIXEIRA DE FREITAS J.F., KOHN A. 1969: Trematódeos do Brasil. Mem. Inst. Oswaldo Cruz 67: 1–886.

Received 6 April 2009

Accepted 29 May 2009