

**PROCAUDOTESTIS CORDIFORMIS SP. NOV. (DIGENEA: APOCREADIIDAE), PARASITE OF RHINELEPIS STRIGOSA (OSTEICHTHYES: LORICARIIDAE) FROM URUGUAY RIVER BASIN, URUGUAY**

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## ABSTRACT

*Procaudotestis cordiformis* sp. nov. (Digenea: Apocreadiidae) is described from specimens collected in the loricariid catfish *Rhinelepis strigosa* (Osteichthyes: Loricariidae) from Uruguay River basin, Uruguay. The new species is morphologically similar to the only species known of the genus, *Procaudotestis uruguayensis* Szidat, 1954. *P. cordiformis* is proposed for specimens with the following features: a heart-like body form, pharynx disproportionately larger, testes more anteriorly located, ovary and anterior testis with overlapping fields, vitellaria less extended in relation to body length and with fields not confluent posteriorly, and eggs wider than those described for *P. uruguayensis*. An amended diagnosis of the genus *Procaudotestis* is proposed.

**Key words:** *Procaudotestis cordiformis* sp. nov., Apocreadiidae, *Rhinelepis strigosa*, Uruguay river basin.

## RESUMEN

***Procaudotestis cordiformis* sp. nov. (Digenea: Apocreadiidae), parásito de *Rhinelepis strigosa* (Osteichthyes: Loricariidae) de la cuenca del río Uruguay, Uruguay.** *Procaudotestis cordiformis* sp. nov. (Digenea: Apocreadiidae) se describe a partir de especímenes recolectados en la "vieja de agua" *Rhinelepis strigosa* (Osteichthyes: Loricariidae) de la cuenca del río Uruguay, Uruguay. La nueva especie es morfológicamente similar a la única especie conocida para el género, *Procaudotestis uruguayensis* Szidat, 1954. Se propone *P. cordiformis* para especímenes con los siguientes rasgos: cuerpo con forma similar a la de un corazón, faringe desproporcionadamente más grande, testículos ubicados más anteriormente, ovario y testículo anterior con campos superpuestos, glándulas vitelógenas menos extendidas en relación a la longitud corporal y con campos no confluyendo posteriormente, y huevos más anchos que los descriptos para *P. uruguayensis*. Se propone una diagnosis modificada para el género *Procaudotestis*.

**Palabras clave:** *Procaudotestis cordiformis* sp. nov., Apocreadiidae, *Rhinelepis strigosa*, cuenca del río Uruguay.

## INTRODUCTION

The loricariid catfish *Rhinelepis strigosa* Valenciennes, 1840 (Loricariidae: Hypostominae) inhabits the basins of the Parana and Uruguay rivers in Argentina, Brazil, Paraguay and Uruguay (Ferraris, 2007). For the genus *Rhinelepis* Agassiz, 1829 only another species is considered valid, *Rhinelepis aspera* Spix & Agassiz, 1829 (Froese & Pauly, 2015). Parasitism by Protozoa, Monogenea and Nematoda has been published for *R. aspera* (Petter, 1994; Thatcher, 2006; Ribeiro *et al.*, 1989; Eiras *et al.*, 1990; Moravec *et al.*, 1992; Kohn *et al.*, 2000), and Monogenea and Nematoda for *R. strigosa* (Kohn *et al.*, 2011). So far there are no records of Digenea parasitizing either species. The genus *Procaudotestis* Szidat, 1954 (Apocreadiidae: Apocreadiinae) contains a single species, *P. uruguayensis* Szidat, 1954, a parasite of the stomach of *Loricaria vetula* from the Uruguay River, Province of Corrientes, Argentina (Szidat, 1954). Subsequently, that species was recorded parasitizing the intestine of *Loricaria* sp. from the Paraná River, Province of Itapúa, Paraguay (Bray *et al.*, 1996). Studying helminths recovered from the gut of *R. strigosa* from the Uruguayan coast of Uruguay River (Salto City), we found trematodes with a similar morphology to *P. uruguayensis*. However, a notorious difference was observed in the body shape: whereas in *P. uruguayensis* the body become tapered towards the posterior end, in *P. cordiformis* the body widens posteriorly with a deep concavity in the rear edge, giving them a heart-like appearance (Fig. 1). Further examination also showed quantitative differences in the dimensions and relative position of several structures. In this paper a new species is proposed within the genus *Procaudotestis*. We also suggest an amended diagnosis of the genus to include flukes with posterior end not tapering and other features present

in the new species, as testes more anteriorly located and ovary and anterior testis with overlapping fields. The new species parasitize a loriciid fish, but of a different species and genus (*Rhinelepis strigosa*) from that in which the type species of *Procaudotestis* has been recorded (*Loricaria* spp.).

## MATERIALS AND METHODS

Thirty-four specimens of *Rhinelepis strigosa* were collected with nets by artisanal fishermen between October-November 2011 and March 2013 from the Uruguay River at the port of Salto city (31°23'9"S, 57°58'33"W), Uruguay. In the *Laboratorio de Vectores y enfermedades transmitidas, Facultad de Veterinaria, CENUR Litoral Norte, Universidad de la República, Salto*, the digestive tract was separated and both stomach and intestine were examined for gastrointestinal helminths.

Parasites were removed, washed in tap water, fixed in 5% formalin and stored in 70% ethanol. For its measurement, trematodes were placed between slide and coverslip without pressure, in the same ethanol 70% used as a preservative. The number of specimen in which each of the structures could be measured is indicated in Results. Three specimens were stained with Mayer's hydrochloric carmine, dehydrated in a

graded ethanol series, cleared with Eugenol and mounted in Canada balsam. Drawing was made by freehand and measurements were performed using a Nikon Eclipse E200 optical microscope. All measurements are given in millimeters, with the mean followed by the range in parentheses. The prevalence and mean intensity of infection were calculated according to Bush *et al.* (1997).

## RESULTS AND DISCUSSION

Six out of thirty four *R. strigosa* examined contained digenetic trematodes ( $n = 9$ ) in the intestine, with a very distinctive heart-like body form, as the posterior region of the body is notoriously enlarged, ending in two posterolateral lobes (Fig. 1). According to Cribb, 2005, the lack of a cirrus-sac, two testes in the hindbody, naked seminal vesicle, prostatic cells forming a conspicuous mass, and presence of a hermaphroditic duct are features corresponding to the family Apocreadiidae Skrjabin, 1942. The oral sucker lacking sphincter and the genital pore anterior to ventral sucker are characteristic features of the subfamily Apocreadiinae Skrjabin, 1942 (Cribb, 2005). Affinities to the genus *Procaudotestis* Szidat, 1954: unspecialized suckers, ovary pretesticular, asymmetric testes in the hindbody, and vitelline follicles restricted to posterior half of hindbody (Cribb, 2005; Thatcher, 2006).

### *Procaudotestis* Szidat, 1954

#### *Procaudotestis cordiformis* sp. nov. (Fig. 1-3)

Description (based on holotype and six paratypes): Body almost triangular in fresh specimens, with two lobes in the posterior extremity giving it a heart-like appearance (Fig. 1, 2), 2.67 (1.70 – 3.42) long x 1.74 (0.95 – 2.40) wide ( $n=7$ ); width 65.5 (50.8 – 83.5) % of length ( $n=7$ ). Tegument unarmed. Oral sucker subterminal, 0.37 (0.21 – 0.53) x 0.32 (0.2 – 0.48) ( $n=7$ ). Ventral sucker rounded, 0.35 (0.22 – 0.49) x 0.32 (0.21 – 0.42) ( $n=7$ ). Sucker ratio 0.87 (0.71 – 0.96). Prepharynx short, 0.05 (0 – 0.13) ( $n=7$ ). Pharynx oval to almost quadrangular, 0.22 (0.12 – 0.32) x 0.21 (0.14 – 0.29) ( $n=7$ ). Pharynx/oral sucker ratio 1: 1.66 (1.55 – 1.75) ( $n=7$ ). Oesophagus 0.30 (0.23 – 0.38) long ( $n=5$ ). In fresh specimens, the intestinal bifurcation is at 28.8 (28.2 – 30.2) % of body length (such proportion may be modified in mounted specimens). Intestinal caeca slightly surpassing the testes level, to 0.63 (0.36 – 0.85) from posterior extremity (right caecum often shorter). Two testes, irregularly rounded, oblique, located at about the third quarter of the body, to 0.62 (0.41 – 0.84) from posterior end of body, measuring 0.18 (0.07 – 0.29) x 0.21 (0.10 – 0.32) ( $n=4$ ). Seminal vesicle rounded to oval, thin-walled, somewhat closer to ovary than to ventral sucker. Pars prostatica rectilinear, 0.13 wide, with a conspicuous field of gland-cells not reaching laterally the caeca and anteriorly surpassing the posterior margin of ventral sucker.

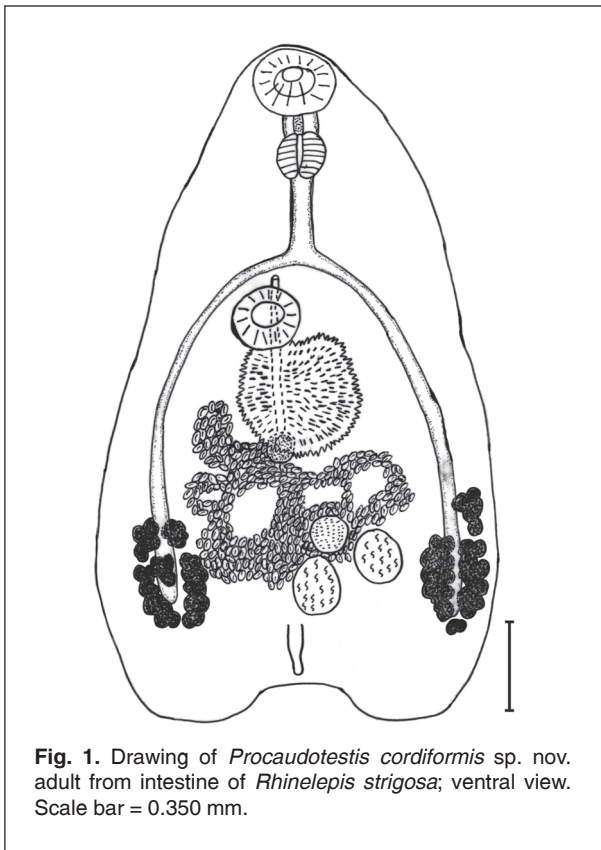


Fig. 1. Drawing of *Procaudotestis cordiformis* sp. nov. adult from intestine of *Rhinelepis strigosa*; ventral view. Scale bar = 0.350 mm.

Genital pore median, immediately anterior to ventral sucker. Ovary oval, pre-testicular, submedian, 0.12 x 0.11, in a field overlapping with the anterior testis, separated from ventral sucker by 0.72 (0.54 – 0.84). Seminal receptacle, Laurer's canal, and Mehlis' gland not seen. Uterous well developed, overlapping testes and looping at the level of ventral sucker, not overlapping caeca (except in one specimen at its most posterior part). Eggs large, operculate, 0.099 (0.085 – 0.110) x 0.057 (0.055 – 0.060) (n=7). Vitellarium follicular, extra and intra-caecal, in two lateral fields surpassing the ovary ahead and reaching a level slightly posterior to caeca; fields not confluent posteriorly. Excretory pore subterminal, in the center of body's posterior notch, excretory vesicle I-shaped.

### Taxonomic summary

Type host: *Rhinelepis strigosa* Valenciennes, 1840 (Osteichthyes: Loricariidae).

Type locality: Port of Salto city, Uruguay river basin (31°23'9"S, 57°58'33"W), Salto department, Uruguay.

Site of infection: Intestine.

Prevalence: 17.6%.

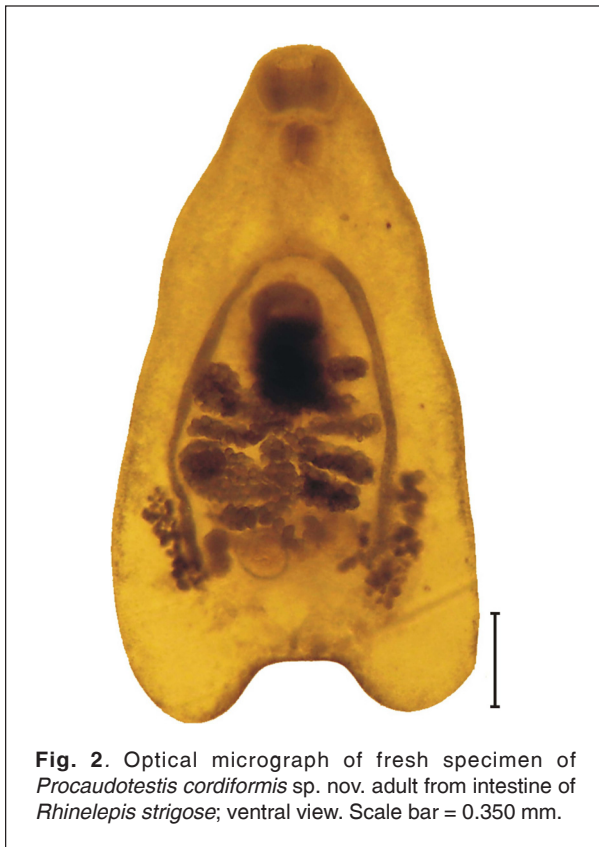
Mean intensity: 1.5 (range: 1 – 2).

Type specimens: Holotype: one adult mounted in a slide, obtained from the type host and locality mentioned

above, coll. J.M. Venzal and M.L. Félix, March 3, 2013, deposited in the Helminthological Collection of Museo Nacional de Historia Natural, Montevideo (MNHNM), Uruguay (MNHNM 4202). Allotype adult mounted in separated slide, same data of holotype (MNHNM 4203). Paratypes: one adult mounted in a slide, same data of holotype, October 29, 2012 (MNHNM 4204); one adult in ethanol, same data of holotype, October 17, 2011 (MNHNM 4205); one adult in ethanol, same data of holotype, October 29, 2012 (MNHNM 4206); two adults in ethanol, same of holotype, November 13, 2011 (MNHNM 4207); two adults in ethanol, same of holotype, November 13, 2011 (MNHNM 4208).

**Etymology:** The name of the new species, derived from the Latin «*cordiformis*», refers to the heart-shaped body.

**Remarks:** *Procaudotestis cordiformis* sp. nov. is clearly congeneric with *P. uruguayensis*, but shows some morphological differences that justify the erection of a new species. Aside the neatly distinct body form, the new species is some longer and notably wider [(width x 100 / long = 65.5 %, range 50.8 – 83.5 %, than *P. uruguayensis* (22 to 29.5 % as calculated from descriptions of Szidat, 1954 and Bray *et al.*, 1996)]. Suckers (oral slightly larger than ventral) are somewhat



larger in the new species, pharynx disproportionately larger in the present specimens (the pharynx' longitudinal axis is, on average, 8.4 % of body length in our specimens; this proportion is 5 % and 3.9 % according to the description of Szidat, 1954 and Bray *et al.*, 1996, respectively). The intestinal bifurcation is more posteriorly located in relation to body length (28.8 %, range 28.2 – 30.2 %) in the new species than in *P. uruguayensis* as figured by Szidat (19.3 %) and Bray *et al.* (21.1 %). In our proposed species the testes are located at about the third quarter of the body, whereas in *P. uruguayensis* near to the posterior end (particularly in the specimens described by Bray *et al.*, 1996). In *P. cordiformis* the ovary and anterior testis have overlapping fields, while in *P. uruguayensis* the ovary is separated from testes. Vitellaria are less extended in relation to body length (21.1 – 24.3 %) than in *P. uruguayensis* (37.2 % and 36.8 % as estimated from figures of Szidat, 1954 and Bray *et al.*, 1996, respectively), and do not converge posteriorly. Additionally, eggs are wider than those described for *P. uruguayensis* for Szidat (1954) and Bray *et al.* (1996).

These morphological differences seem sufficient to justify the erection of a new species, which, like the only other species recognized from the genus, also parasitizes a loricariid fish from the Paraná-Uruguay rivers basin.

In his diagnosis of genus *Procaudotestis*, Szidat (1954) includes the characteristic "lanceolate body", and Thatcher (2006) states "body tapering posteriorly". In turn, Cribb (2005), although without specifying the body form, points out "testes and ovary closer to posterior end of body than ventral sucker" and ovary "anterior to and well separated from testes". These conditions must be modified to accommodate the new species proposed. Therefore, we suggest the following amended diagnosis of the genus *Procaudotestis* Szidat, 1954: Body form lanceolate or almost triangular ("heart-like"). Tegument unarmed. Oral sucker unspecialized. Ventral sucker unspecialized. Prepharynx short. Oesophagus short. Intestinal bifurcation in forebody. Caeca blind. Testes oblique, in the hindbody. Genital pore median, immediately anterior to ventral sucker. Ovary entire, anterior and well separated from testes or with field overlapping anterior testis. Vitelline follicles restricted to posterior half of hindbody. Uterus extensive, occupies bulk of hindbody. Excretory vesicle I-shaped, extends to posterior testis; pore terminal or subterminal. In stomach or intestine of freshwater loricariid fishes from South America. Type-species *P. uruguayensis* Szidat, 1954.

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