



## BIOLOGICAL SCIENCES

# ***Lecithochirium monticellii* digenetic trematode parasites of *Trichiurus lepturus* (Actinopterygii) from the state of Rio de Janeiro, Brazil, with notes on its taxonomy**

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**Abstract:** *Trichiurus lepturus* (Actinopterygii, Perciformes) is a commercially and economically important fish. A total of 60 specimens of this cutlassfish were collected of the coast the municipalities of Niterói and Cabo Frio, state of Rio de Janeiro, Brazil. The fish were measured, necropsied, filleted and had their organs investigated for digenetic trematodes. Taxonomic identification was based on morphological and morphometric characters. The specimens of *T. lepturus* were parasitized with adult specimens of *Lecithochirium monticellii*. Parasite indices of prevalence, intensity, mean intensity, abundance, mean abundance, range of infection, and site of infection of parasitic species were evaluated. Notes on the taxonomy of the parasite were also included. This is the first report of *L. monticellii* parasitizing *T. lepturus* in Brazil.

**Key words:** Cutlassfish, Hemiuridae, Lecithochiriinae, *Lecithochirium monticellii*, Trematoda, *Trichiurus lepturus*.

## INTRODUCTION

The cutlassfish *Trichiurus lepturus*, L. 1758 (Actinopterygii, Perciformes), is considered a benthopelagic species and is found on continental shelves and underwater slopes from the surface to 2000 m deep in tropical and temperate waters that are not of low salinity (Nakamura & Parin 1993, Martins & Haimovici 1997). Considered one of the six species with the highest volume of fish landings in the world (Martins & Haimovici 2000, FAO 2005, Martins et al. 2005, Chiou et al. 2006, Bittar et al. 2008), *T. lepturus* has great commercial importance in the state of Rio de Janeiro (Meyer & Smale 1991, Martins & Haimovici 1997, Figueiredo & Menezes 2000).

Helminth parasites (Platyhelminthes, including digenetic trematodes, monogenoids, and trypanorhynch and “tetrphyllid” cestodes; anisakid and raphidascaridid nematodes; and acanthocephalans) of *T. lepturus* have been reported in specimens off the coast of the state of Rio de Janeiro (Barros & Amato 1993, São Clemente et al. 1995, Silva et al. 2000a, b, Carvalho & Luque 2009, 2011, Mattos et al. 2013, Borges et al. 2015).

Parasites of the genus *Lecithochirium* Lühe 1901 (Hemiuroidea, Hemiuridae, Lecithochiriinae) are commonly observed in the stomach and intestine of marine teleost fish throughout the world (Yamaguti 1971, Bray 1991, Gibson et al. 2002, Shih et al. 2004, Kohn

et al. 2007, Al-Zubaidy 2010, Feki et al. 2016, Claxton et al. 2017). Species of this genus have been described as having complex morphology, with variation in, and different combinations of, internal and external structures that provide specific taxonomic characteristics. As a result, a large number of species have been described for the genus. However, some reviews have considered such differences to be intraspecific variation and thus proposed synonymizing several of the names (Manter 1934, 1954, Linton 1940, Skrjabin & Guschanskaja 1955, Nasir & Diaz 1971, Yamaguti 1971, Bray 1991).

Six species of *Lecithochirium* were recorded parasitizing marine teleost fish of the Brazilian coast: *L. imovacus* (Looss 1907) Skrjabin & Guschanskaja 1955, *L. manteri* Freitas & Gomes 1971, *L. microstomum* Chandler 1935, *L. monticellii* (Linton 1898) Skrjabin & Guschanskaja 1955, *L. perfidum* Gomes, Fábio & Rolas, 1972, *L. texanum* (Chandler, 1941) Manter, 1947 and *L. zeloticus* (Travassos, Freitas & Bührnheim 1966) Nasir & Diaz 1971 (Kohn et al. 2007).

The present study aimed to taxonomically identify specimens of digenetic trematodes in *T. lepturus* commercialized along the coast of the state of Rio de Janeiro, Brazil, and to present their parasite indices of prevalence, mean intensity, mean abundance, range of infection and infection sites.

## MATERIALS AND METHODS

Between June 2017 and February 2018 a total of 60 specimens of *Trichiurus lepturus*, (74 – 142 cm total length, 0.400 – 3.0 kg weight) were obtained in small markets selling fish caught from offshore of the municipalities of Niterói (22°53'00" S, 43°06'13" W) and Cabo Frio (22°52'46" S, 42°01'07" W), in the state of Rio de Janeiro, Brazil. The specimens were transported in isothermal boxes with ice to Laboratório de

Parasitologia, Instituto Biomédico, Universidade Federal Fluminense, in the municipality of Niterói, state of Rio de Janeiro. The specimens were identified to species according to Figueiredo & Menezes (2000), and then necropsied for analysis of stomach contents and the intestines, which revealed the presence of a species of digenetic trematode. The helminths were fixed with AFA, stained with Semichon carmine or Delafield hematoxylin and whole mounted in Canada balsam (Knoff & Gomes 2012), and then analyzed using a Zeiss Axiophot bright-field microscope. Measurements (in mm) were made with the aid of an Olympus BX-41 bright-field microscope with an ocular micrometer. Measurements are provided as ranges followed by means in parentheses. Taxonomic classification of the parasites followed Gibson et al. (2002). Voucher specimens were deposited in the Helminthological Collection of the Oswaldo Cruz Institute (CHIOC), FIOCRUZ, Rio de Janeiro, RJ, Brazil. Parasitological terminology followed Bush et al. (1997).

## RESULTS

Forty-three of the 60 specimens of *T. lepturus* analyzed were parasitized with a total of 929 adult specimens of a species of digenetic trematode. The majority of specimens were found alive and exhibiting high motility. The parasites included some immatures and exhibited pronounced variability in size, indicating continuous recruitment. The parasites were identified as follows:

- Hemiuridae Looss, 1899
- Lecithochiriinae Lühe 1901
- *Lecithochirium* Lühe 1901
- *Lecithochirium monticellii* (Linton 1898) Skrjabin & Guschanskaja 1955 (Figures 1a-b, 2a, b)

### General description

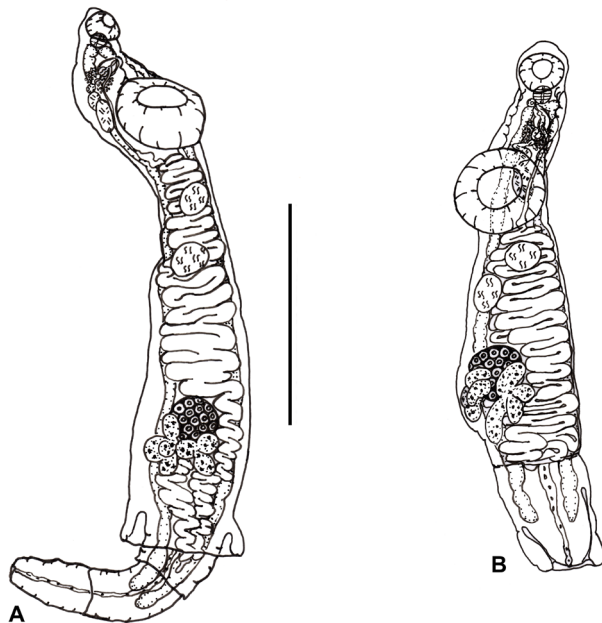
Morphological features were observed on 40 whole mounts specimens. Body elongate, subcylindrical with smooth tegument. Preoral lobe present. Ecsoma well developed, retracted in some specimens. Oral sucker subglobular, subterminal. Ventrocervical groove present with thickened walls. Pharynx subglobular, smaller than oral sucker, partly overlying oral sucker. Ventral sucker subglobular, developed, larger than oral sucker, pre-equatorial. Ceca lined with thick epithelium, entering ecsoma. Testes two, rounded, smooth, slightly diagonal, posterior and close to ventral sucker, pre-ovarian, intercecal, in largely coincident fields, in distant zones in larger specimens, in smaller specimens the posterior portion of the anterior testicle coincides with the anterior portion of the posterior testicle, margins often obscured by uterine loops. Vas efferens uniting to vas deferens close to medium margin of ventral sucker. Vas deferens, small, uniting to seminal vesicle. Seminal vesicle tripartite, partially overlapping anterior margin of ventral sucker, with thick wall, posterior portion largest, anterior portion smallest, uniting to ejaculatory duct. Ejaculatory duct small, slightly sinuous, sometimes swollen in its proximal, median and even distal portion, appearing as an external ejaculatory vesicle, surrounded by numerous prostatic cells, forming a well-developed pars prostatica. Ejaculatory duct uniting to sinus sac meeting ejaculatory vesicle. Sinus sac 'separogermiductus-type', oval, well developed, thick walled, containing well-developed ejaculatory vesicle (sometimes described as a prostatic vesicle), and a long muscular, protrusible, hermaphroditic duct that opens in the genital pore. Genital pore median, at or slightly posterior to pharyngeal level. Ovary rounded, smooth, post-testicular, intercecal, at mid-hindbody or more posteriorly, at some distance from posterior testis, in the same field

of testes but in separated zones, margins often obscured by uterine loops. Uterus descending into postvitelline space, reaching ecsoma and filling most of the hindbody, metraterm entering sinus sac ventrally, joining male duct slightly anterior to ejaculatory vesicle. Vitellaria paired, contiguous, overlapping posterior portion of ovary, one tri- and one quadri-lobed with lobes somewhat longer than wide. Eggs small and operculate, numerous. Excretory pore terminal, excretory duct bifurcating posterior to ventral sucker, arms unite dorsally to oral sucker.

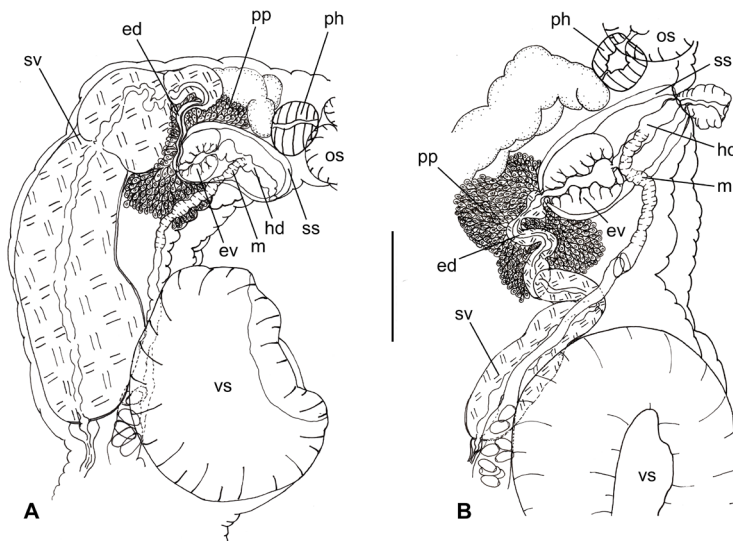
### Measurements

Measurements for 10 of the larger specimens: body 2.02-4.02 (2.84) long by 0.27-0.52 (0.40) wide at level of ventral sucker. Ecsoma 0.15-1.52 (0.58) long by 0.22-0.42 (0.28) wide. Oral sucker 0.06-0.14 (0.10) in diameter. Ventral sucker 0.21-0.41 (0.23) in diameter. Sucker ratio 1:1.95-2.41. Anterior testis 0.05-0.20 (0.12) long by 0.05-0.19 (0.09) wide. Posterior testis 0.06-0.21 (0.14) long by 0.06-0.17 (0.11) wide. Sinus sac, 0.05-0.10 (0.07) long. Seminal vesicle, 0.11-0.34 (0.22) long. Ovary, 0.05-0.22 (0.11) long by 0.06-0.20 (0.13) wide. Distance from posterior testis to ovary 1/5-1/6 of body length. Eggs 22.5-27.5 (24.2)  $\mu\text{m}$  long by 10-12.5 (10.6)  $\mu\text{m}$  wide.

Measurements for 10 of the smaller specimens: body, 1.02-1.90 (1.40) long by 0.22-0.50 (0.35) wide at level of ventral sucker. Ecsoma retracted 0.17-0.50 (0.25) long by 0.12-0.22 (0.17) wide. Oral sucker 0.07-0.13 (0.10) in diameter. Ventral sucker 0.15-0.31 (0.26) in diameter. Sucker ratio 1:1.73-2.10. Anterior testis 0.05-0.13 (0.08) long by 0.05-0.11 (0.09) wide. Posterior testis 0.06-0.15 (0.08) long by 0.06-0.13 (0.08) wide. Sinus sac, 0.02-0.10 (0.06) long. Seminal vesicle 0.05-0.17 (0.10) long. Ovary, 0.05-0.13 (0.07) long by 0.06-0.15 (0.10) wide. Distance from posterior testis to ovary 1/15 of body length. Eggs 15-27.5 (18.2)  $\mu\text{m}$  long by 10-12.5 (10.2)  $\mu\text{m}$  wide.



**Figure 1.** *Lecithochirium monticellii* from *Trichiurus lepturus*: a, Entire worm of one of the larger specimens, ventro-lateral view. b, Entire worm of one of the smaller specimens, ventro-lateral view. Scale bars: a = 1 mm and b = 0.5 mm.



**Figure 2.** *Lecithochirium monticellii* from *Trichiurus lepturus*. Detail of terminal genitalia showing seminal vesicle (sv), ejaculatory duct (ed), pars prostatica (pp), ejaculatory vesicle (ev), sinus sac (ss), hermaphroditic duct (hd), metraterm (m), pharynx (ph), oral sucker (os) and ventral sucker (vs). a, Seminal vesicle completely filled with semen. b, Seminal vesicle not completely filled with semen and ejaculatory duct swollen in its median and distal portion. Scale bar = 0.4 mm.

### Taxonomic summary

- **Host:** *Trichiurus lepturus*.
- **Localities:** municipalities of Niterói and Cabo Frio, RJ, Brazil.
- **Number of collected specimens:** 929.
- **Prevalence:** 71.6%.
- **Mean intensity:** 21.26.
- **Mean abundance:** 15.48.
- **Range of infection:** 1 to 125 specimens by host.
- **Infection sites:** stomach and intestine.
- **Material deposited:** CHIOC n. 40008a- c, 40009a- d, 40010a, b, 40011, 40012, 40013a, b, 40014a- f, 40015.
- **Material examined:** *L. manteri* in *T. lepturus* (CHIOC 30557, 33452); *L. microstomum* (in *T. lepturus* CHIOC 32245, *Oligoplites palometa* CHIOC 33616, *Caranx latus* CHIOC 34316, *Micropogonias furnieri* CHIOC 34014, *Paralanchurus brasiliensis*

CHIOC 36208, *Cynocion guatucupa* CHIOC 36355); *L. monticelli* (in *Trachurus lathami* CHIOC 32121, 32122), *L. perfidum* (in *Scomber colias* CHIOC 30745); *L. texanum* (in *Selene vomer* CHIOC 31070).

## DISCUSSION

The morphology and morphometry of the specimens of *L. monticelli* of the present study are in accordance with the specimens described by Linton (1940), Skrzjabin & Guchankaja (1955), Nasir & Diaz (1971) and Fernandes et al. (1985)

*Lecithochirium monticellii* was described by Linton (1898) as *Distomum monticellii* from *Remora remora* at Woods Hole, Massachusetts, USA. Later, Lühe (1901) created the genus *Lecithochirium*. Skrzjabin & Guchankaja (1955) reviewed the existing species of *Lecithochirium* and listed *D. monticellii*, *Hemiurus monticellii* (Linton 1898) Looss 1899 and *Sterrhurus monticellii* (Linton 1898) Linton 1910, as synonyms, as previously suggested by Crowcroft (1946).

The species has been reported from some species of fish from off the coast of South America, including *Echeneis naucrates* Linnaeus 1758 for Argentina, *T. lepturus* for Venezuela and *Trachurus lathami* Nichols 1920 for Brazil. This is the first report of *L. monticellii* in *T. lepturus* for Brazil.

According to Nasir & Diaz (1971) and Bray (1991) the genus *Lecithochirium* contains about 100 nominal species, including morphologically and morphometrically closely related species, some of which have been synonymized. It should be noted that when describing *L. microstomum* from *T. lepturus* from Galveston Bay, Texas, USA, Chandler (1935) pointed out that the species *Distomum monticellii* could be a species of *Lecithochirium*, and that it could even be the

same that he had described: "...although some of the forms referred by Linton (1898, 1901, 1905) to *Distomum monticelli* may be species of *Lecithochirium* and may even be identical with the form here described. ...". In addition, all six species of *Lecithochirium* recorded parasitizing marine teleostean fish in Brazil have morphological structures within the same size range, and *L. manteri* and *L. microstomum* have been recorded parasitizing *T. lepturus* (Kohn et al. 2007). Therefore, we suggest future studies aim to verify the validity of these species.

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All authors presented relevant contribution in the manuscript. Luma França was responsible for data sampling, analysis, literature review and manuscript writing; Dr Michelle CG Fonseca, Dr Delir C Gomes, Dr Nilza N Felizardo and Dr Sérgio São Clemente contributed to the analysis and interpretation of data for identification and taxonomy. Dr Marcelo Knoff contributed for identification, taxonomy, and prepared the figures. Dr Micheli S. Ferreira was academic co-advisor and contributed with critical revision of the manuscript. Dr Danuza PBG Mattos was academic advisor and project supervisor, responsible for study conception, design and revision of the manuscript.

