



***Didymocystis lamotheargumedi* n. sp. (Digenea:Didymozoidae) a parasite of three species of scombrid fishes**

***Didymocystis lamotheargumedi* n. sp. (Digenea:Didymozoidae) parásito de tres especies de peces escómbridos**

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Abstract. *Didymocystis lamotheargumedi* n. sp. is described from the operculum and palate of *Thunnus atlanticus* (Lesson, 1831), palate of *Thunnus albacares* (Bonnaterre, 1788), and the operculum of *Katsuwonus pelamis* (Linnaeus, 1758) caught on the coast of Rio de Janeiro, Brazil. The new species is most similar to *D. alalongae* (Yamaguti, 1938), *D. exiguus* (Yamaguti, 1970), and *D. oesophagicola* (Yamaguti, 1970), based on the vitelline and ovarian branches lacking ramifications. It variously differs from these 3 species in the number of ovarian and vitelline branches, the length of the vitelline branches, egg size, body size and site within the host. Immature forms associated with adults are also described.

Key words: Digenea, Didymozoidae, *Thunnus atlanticus*, *Thunnus albacares*, *Katsuwonus pelamis*.

Resumen. *Didymocystis lamotheargumedi* n. sp. se describe como parásito del opérculo y del paladar de *Thunnus atlanticus* (Lesson, 1831), del paladar de *Thunnus albacares* (Bonnaterre, 1788) y del opérculo de *Katsuwonus pelamis* (Linnaeus, 1758) capturados en la costa de Rio de Janeiro, Brasil. La especie nueva es semejante a *D. alalongae* (Yamaguti, 1938), *D. exiguus* (Yamaguti, 1970) y *D. oesophagicola* (Yamaguti, 1970), por la ausencia de ramificaciones en las vitelógenas y en los ovarios. Estas 3 especies difieren en el número de ramificaciones de las vitelógenas y ovarios, en la longitud de ramificaciones de las vitelógenas, tamaño del cuerpo y sitio dentro del hospedador. Se describen también las formas inmaduras asociadas con sus respectivas formas adultas.

Palabras clave: Digenea, Didymozoidae, *Thunnus atlanticus*, *Thunnus albacares*, *Katsuwonus pelamis*.

Introduction

During a survey of the helminth parasites of scombrid fishes from the Rio de Janeiro coast, a new species of *Didymocystis* Ariola, 1902, was found parasitizing 3 different species of tunas.

Pozdnyakov (1990) published a revision of *Didymocystis* and proposed a new genus *Didymosulcus* to include all the species with a median groove on the hindbody and considered the genera *Coeliodidymocystis*, *Didymocystoides* and *Univitellodidymocystis*, erected by Yamaguti (1970), as synonyms of *Didymocystis*. In 1996, the same author published a large revision of the suborder Didymozoata, in which he proposed new combinations to some *Didymocystis* species. Murugesu and Madhavi (1995) did not accept the presence of the median groove as

a valid generic character and considered *Didymosulcus* to be a synonym of *Didymocystis*.

Recently, the authors obtained the papers of Pozdnyakov (1990, 1996), kindly provided by the author, which were not available to Kohn et al. (2001), Justo and Kohn (2005) and to Kohn et al. (2007) when they reported *Didymosulcus wedli* (Ariola, 1902) and *Didymosulcus orbitalis* (Yamaguti, 1970) from Brazil as *Didymocystis*. After reviewing this material we agree with Pozdnyakov's classification of Didymozoidae and consider *Didymocystis* and *Didymosulcus* to be valid genera.

Materials and methods

Forty-five *T. atlanticus* (45-82 cm total body length; 1.3-6.0 kg), 38 *T. albacares* (38-80 cm total body length; 0.55-7.8 kg) and 42 *K. pelamis* (30-81 cm total body length; 1.0-

9.4 kg) were obtained from fishermen and transported to the laboratory for parasitological examination. Cysts were carefully removed from the palate and operculum and dissected. The parasites were fixed in AFA (alcohol, formalin, acetic acid) under slight coverslip pressure or without pressure, stained with Langeron alcoholic-acid carmine, dehydrated in an alcohol series, cleared in beachwood creosote and mounted in Canada balsam as permanent slides. Measurements are in micrometers. The range is followed by the mean in parentheses and the number of specimens measured, where applicable. Light micrographs were taken with a digital camera connected to a Nikon Eclipse E 800 microscope and confocal scanning light micrographs with a ZEISS microscope LSM 510.

Description

Didymocystis lamotheargumedoi n. sp.

Description based on specimens from *T. atlanticus* (type host), *T. albacares* and *K. pelamis*. Cysts rounded (Fig.1A), with hard sclerotized walls of host origin, containing 2 hermaphroditic worms almost of the same size and shape. Forebody slender, attached to near anterior end of hindbody on its ventral side, 800-1 350 (1 110) long by 200-350 (250) wide (n=19); hindbody ventrally concave, 1 270-2 750 (1 860) long by 720-2 250 (1 210) (n=19) largest width. Oral sucker terminal, pyriform, 30-50 (44) long by 25-35 (32) (n=18) wide, directly followed by globular pharynx, 25-37 (31) in diameter (n=18) wide. Ventral sucker absent. Oesophagus 320-640 (450) (n=10) long. Caeca narrow in forebody, inflated and twisted in hindbody, containing dark ingesta, ending near posterior extremity. Testes tubular extending along anterior margins of hindbody, 400-950 (530) long by 100-150 (120) (n=10) wide; vas deferens narrow, not forming distinct seminal vesicle. Ovary divided into 5-6 tubular branches lacking ramifications; branches extend through lateral fields of hindbody, ending at different levels, 30-57 (44) (n=16) wide. Juel's organ oval, 112-125 (120) long by 107-150 (125) (n=3) wide. Mehlis's gland present. Vitelline gland consists of 7-8 tubules, without ramifications, extending along convex side to posterior extremity of hindbody. Initial portion of uterus containing immature eggs; uterine coils winding throughout all available space of hindbody. Genital pore ventrolateral to oral sucker; metraterm muscular, sinuous in forebody, the epithelium of which appears to be ciliated (Fig.1F). Eggs bean-shaped 14-17 (15) long by 9-10 (10) (n=38) wide.

Immature forms were found freely associated with more advanced stages in the same location among the adults in

the 3 host species (Figs. 1 C, 2 C-D). Descriptions and all measurements of immature forms based on 10 specimens from *T. atlanticus* (type host). *First immature stage* (Fig. 2C): body lanceolate, 2 200-4 400 (3 220) long by 210-380 (290) wide; oral sucker 38-62 (46) long by 30-37 (32) wide, directly followed by pharynx 23-37 (27) long by 23-36 (31) wide; caeca twisted, inflated and constricted at many places, containing dark ingesta. *Second immature stage* (Fig. 2D). Body distinctly divided into subcylindrical forebody 650-1 250 (1 000) long by 180-290 (220) wide and oval hindbody 1 000-1 670 (1 370) long by 470-790 (620) wide. Oral sucker 38-50 (42) long by 25-38 (32) wide; pharynx 20-35 (27) by 25-33 (30) wide; caeca inflated and contracted at places, ending at different levels; genital pore lateral to oral sucker. *Third immature stage*. Forebody 560-1 000 (830) long by 160-210 (180) wide; hindbody globular to oval, 1 000-1 500 (1 190) long by 500-960 (660) wide; oral sucker 37-50 (44) long by 26-35 (31) wide and directly followed by pharynx 25-32 (28) in diameter. Caeca twisted, inflated and constricted at many places, containing dark ingesta; testes filiform, paired. Filiform female reproductive organs (except the uterus) show their definitive pattern of arrangement. Genital pore lateral to oral sucker.

Taxonomic summary

Host and sites: operculum and palate of *Thunnus atlanticus* (Lesson, 1831) (type host), local name "albacorinha", palate of *Thunnus albacares* (Bonnaterre, 1788), local name "albacora-de-laje" and operculum of *Katsuwonus pelamis* (Linnaeus, 1758) local name "bonito-de-barrigalistrada".

Type locality: Rio de Janeiro coast (22°52'46" S, 42°01'07" W), Rio de Janeiro State, Brazil, Atlantic Ocean.

Deposition of types: Helminthological Collection of the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (holotype 36927 A and paratypes 36927 B - P ; 36929 A - B; 36931; 36932 A - D and 36930 from *T. atlanticus* (type host); paratypes 36933 from *T. albacares* and paratypes 36928 A-B from *K. pelamis*).

Prevalence and intensity: 10 of 45 (22.2%) specimens of *T. atlanticus* were parasitised by 36 to about 1 000 parasites encysted in pairs; 11 of 38 (28.9%) specimens of *T. albacares* were parasitised with 8 to about 1 000 encysted parasites, and 1 of 42 (2.3%) specimens of *K. pelamis* with 28 parasites in cysts. Free immature forms were found associated with the encysted adult worms from the 3 species of fish that were examined.

Etymology: the new species is dedicated to Prof. Rafael Lamothe-Argumedo for his remarkable contribution to the field of helminthology.

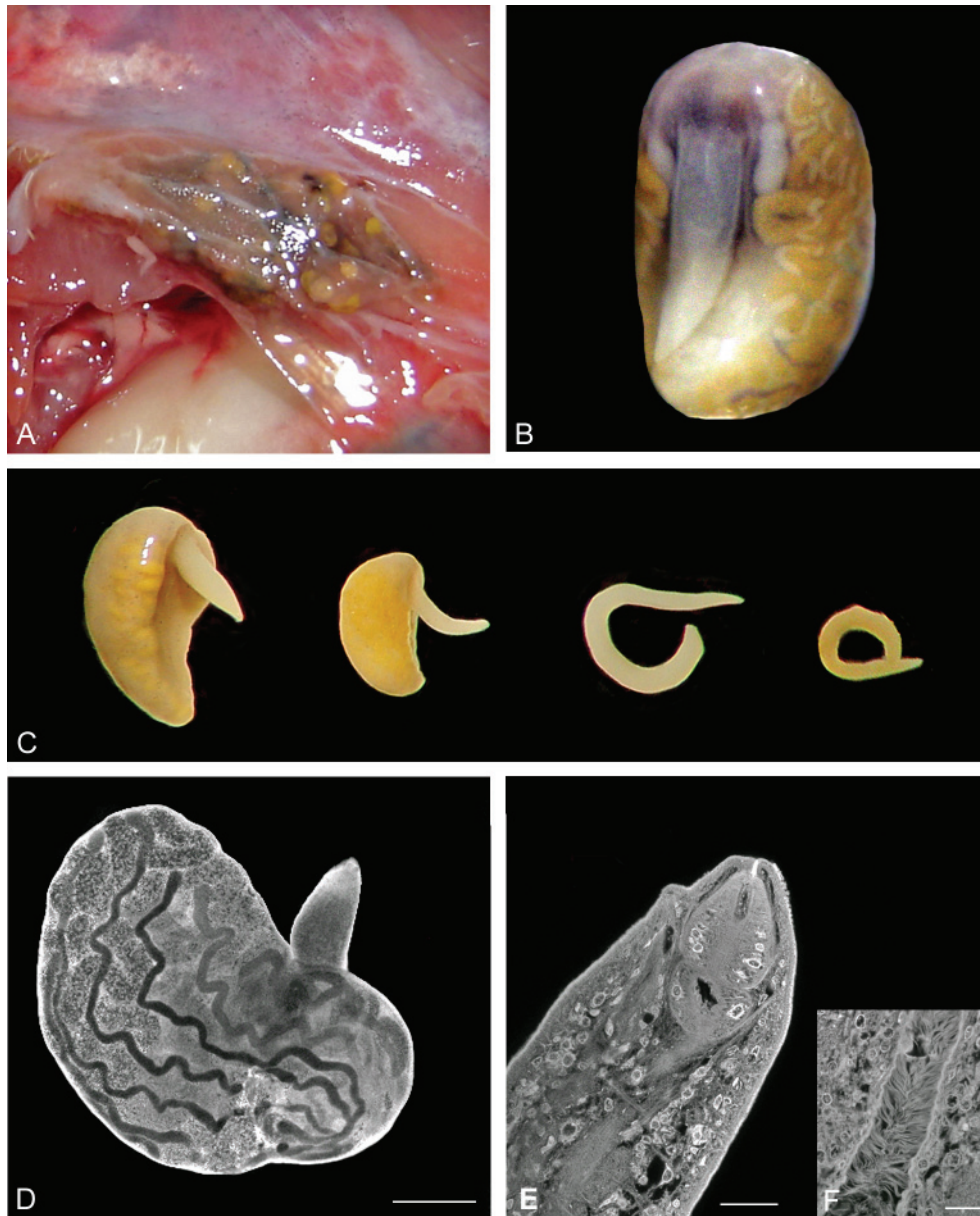


Figure 1. A, Cysts of *Didymocystis lamotheargumedei* n. sp. in operculum of *T. atlanticus*. B-F, *Didymocystis lamotheargumedei* n. sp. from *T. atlanticus*. B, light micrograph of adult specimen, X 30. C, light micrograph of immature and adult specimens, X 20. D, confocal scanning light micrograph of adult specimen, scale-bar: 500µm. E, confocal scanning light micrograph of anterior extremity of forebody, scale-bar: 20µm. F, higher magnification of fig. E showing epithelium of metraterm wich appears to be ciliated, scale-bar:10µm.

Remarks

At this time, *Didymocystis* contains 29 valid species and 3 *inquirenda*. *Didymocystis lamotheargumedei* n. sp. is more closely related to *Didymocystis alalongae* (Yamaguti, 1938), *Didymocystis exiguus* (Yamaguti,

1970) and *Didymocystis oesophagicola* (Yamaguti, 1970) by presenting the vitelline and ovarian branches lacking ramifications.

Yamaguti (1938) described *D. alalongae* from specimens from the gill arches of *Thunnus alalunga* (= *Thynnus alalunga*) that had a forebody that was 6 500

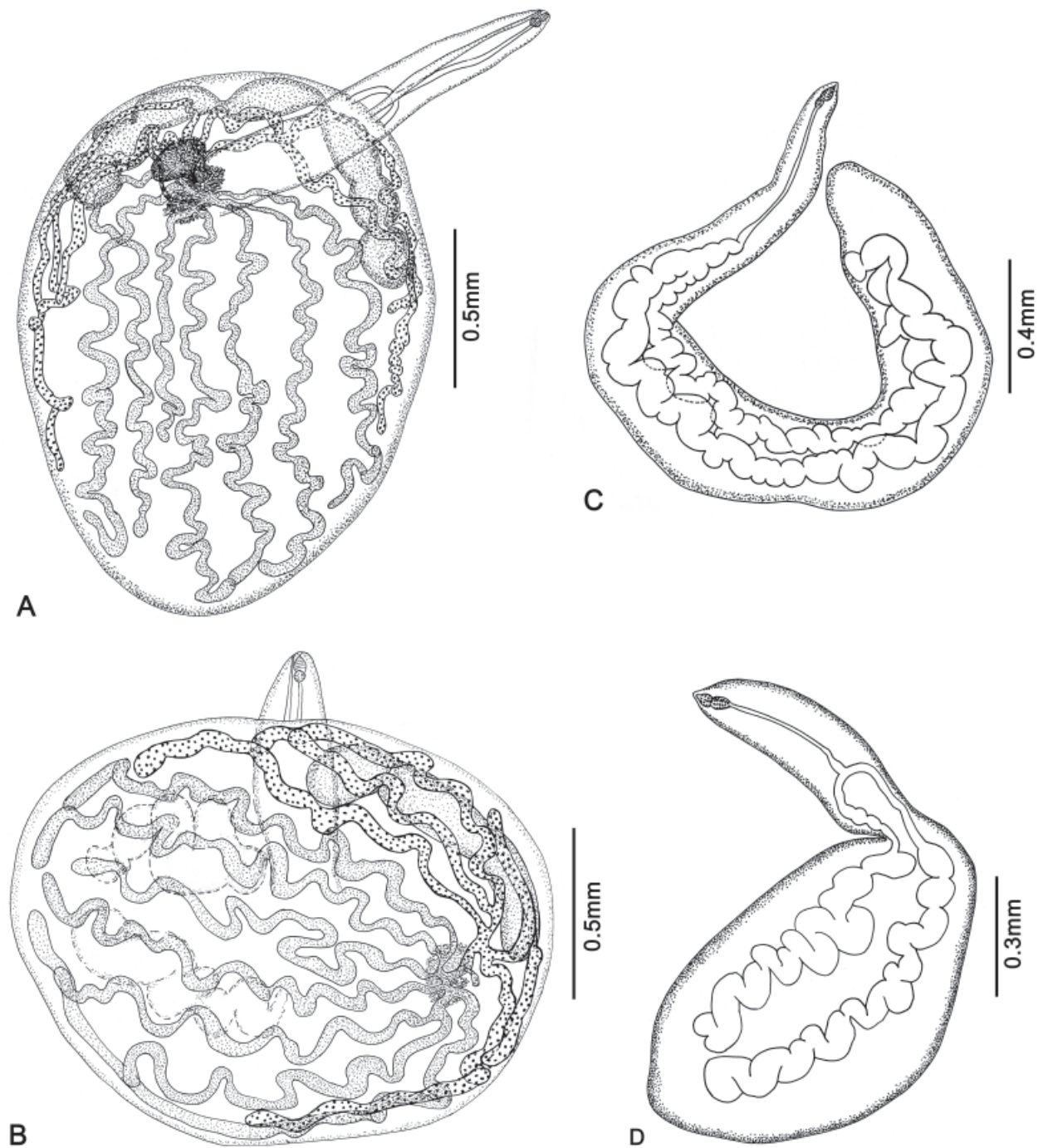


Figure 2. A-D, *Didymocystis lamotheargumedi* n. sp. A, entire from *K. pelamis*, ventral view. B, entire (holotype) from *T. atlanticus*, dorsal view. C, first larval stage from *T. atlanticus*. D, second larval stage from *T. atlanticus*.

x 630, hindbody 10 000 x 6 000, ovary divided into 2 main branches, each of which has 2 short side branches, 1 ending single and the other in 2 longer branches and with 4 long, slender and sinuous vitelline branches, and eggs that measured 18-20 x 9-10. In 1995, Muruges and Madhavi redescribed *D. alalongae* using smaller specimens from the operculum of *Thunnus tonggol* that had a forebody measuring 1 200-2 400 x 176-320 and hindbody with 3 250-4 280 x 2 420-2 800; ovary with common stem and 2 winding branches and vitellarium with 5-7 terminal branches, and eggs that measured 18-20 x 10-12.

Didymocystis lamotheargumedei n. sp. differs from both descriptions mainly in having a smaller body size (forebody 800-1 350 x 200-350 and hindbody 1 270-2 750 by 720-2 250), in the number of ovarian branches (5-6) lacking ramifications; in the extension and number of vitelline branches (7-8) and in egg length (14-17).

The new species differs from *D. exiguus*, described from outer wall of the oesophagus of *Neothunnus macropterus* and from the intestine of *Euthynnus yaito* by Yamaguti (1970), in having a larger body (forebody 800-1 350 long instead of 160-400 and hindbody 1 270-2 750 by 720-2 250 instead of 500-1 000 by 400-800); in the number of ovarian branches (5-6 rather than 2) and in the number of vitelline branches (7-8 instead of 3-4); and differs also in the habitat (operculum and palate instead of intestine).

The new species differs from *D. oesophagicola*, described from outer wall of the oesophagus of *Thunnus albacares* (= *Neothunnus macropterus*) by Yamaguti (1970), mainly in the number of ovarian branches (5-6 instead of 3) and in the different habitat (operculum and palate instead of oesophagus).

Muruges and Madhavi (1995) redescribed specimens of *D. oesophagicola* from *Thunnus tonggol* and *D. exiguus* from *Auxis thazard* and *Euthynnus affinis*, confirming the differences from *D. lamotheargumedei* n. sp.

The new species can be distinguished from all other species of the genus, including those from same hosts and similar habitat, mainly by the ovarian and vitelline branches lacking ramifications.

Yamaguti (1970) characterized and named the different larval and immature stages of didymozoids and described and figured several juvenile forms associated with adults. The first immature form found freely associated with juvenile and adult forms of *D. lamotheargumedei* n. sp. is similar to that of *Postmonilicaecum*, described by Yamaguti (1970), and the second immature stage represents an intermediate stage between *Postmonilicaecum* and juvenile forms (third immature stage).

Attempts have been made to classify larval didymozoids (Nikolaeva, 1965; Yamaguti, 1970, 1975; Kurochkin and

Nikolaeva, 1978), however the proposed schemes were not successful because they were based on variable criteria that change with age.

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