

PROGENETIC METACERCARIAE OF PARAHEMIURUS MERUS (PLATYHELMINTHES, DIGENEA, HEMIURIDAE) INFECTING PARASAGITTA FRIDERICI (CHAETOGNATHA) FROM SOUTHERN COAST BRAZIL

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RESUMO

Metacercárias progenéticas de *Parahemiurus merus* (Platyhelminthes, Digenea, Hemiuridae) parasitando *Parasagitta friderici* (Chaetognatha) da costa sul do Brasil

Parahemiurus merus é um hemiurideo amplamente distribuído e que normalmente infecta peixes pelágicos de regiões temperadas. Há alguns registros deste parasito em chaetognatos. Seu ciclo de vida não é conhecido. Neste estudo metacercárias progenéticas de *P. merus* encontradas parasitando *Parasagitta friderici* da baía de Paranaguá (Brasil) são descritas. A prevalência desta parasitose foi de 86.8%, intensidade de infecção variando de 1 a 11, média de 2,26 e abundância média de 1,96 (n=190). Medidas e descrição de alguns espécimes de *P. merus* parasitas de *P. friderici* são apresentadas. Ovos livres, alguns eclodindo e liberando miracidio foram encontrados na cavidade do corpo dos hospedeiros. Os índices parasitológicos são os mais elevados já reportados na relação entre Hemiuridae e Chaetognata. Este é o primeiro registro de metacercárias progenéticas em *P. merus* infectando chaetognatas no Brasil.

PALAVRAS CHAVE: Chaetognatha; Digenea; Hemiuridae; *Parahemiurus merus*; Parasito; Plâncton.

ABSTRACT

Parahemiurus merus is a hemiurid widely dispersed and its life cycle is unknown. However, this species usually infects temperate pelagic fishes and chaetognaths. In this study, description and measurements of *P. merus* progenetic metacercariae found parasitizing *Parasagitta friderici* from Paranaguá Bay (Brazil) are presented. The prevalence was 86.8%, intensity of infection varied from 1 to 11, mean 2.26 and, mean abundance was 1.96 (n=190). In addition, some hosts were highly infected and the parasites released eggs inside its body cavity. These eggs were able to hatch inside the chaetognath. This is the first record of *P. merus* progenetic metacercariae infecting chaetognaths in Brazil.

KEY WORDS: Chaetognatha; Digenea; Parasite; Hemiuridae; *Parahemiurus merus*; Plankton.

INTRODUCTION

Parahemiurus (Vaz and Pereira, 1930) species (Digenea, Hemiuridae) are found over a wide area, mainly in subtropical and temperate waters (Bray 1990), extending from Gulf of Mexico towards South American Atlantic Ocean, also in American Pacific Ocean and, probably, in Japanese waters (Manter 1940). *Parahemiurus* spp., especially *P. merus* (Linton, 1910), have been frequently recorded infecting temperate pelagic fishes (e.g. clupeids, carangids, salmonids and engraulids) from most oceans (Bray 1990). Few species of Hemiuridae have its life cycle described (Køie 1979, 1990, 1991, 1992, 1995) and no species of *Parahemiurus* has its life cycle completely described (Bray 1990).

The digeneans that use three hosts are a good example of a complex life cycle (Marcogliese 1995). Species like *Hemiurus communis* Odhners, 1905 which uses molluscs, copepods and fishes as host (Køie 1995) shows the usual Digenea life cycle. Each transmission between the hosts is a challenge and the risk of a failed event may be reduced with strategies such as the ability of some species to perform a

truncated life cycle (Poulin 2001, Poulin & Cribb, 2002). The development of progenetic metacercariae in the second intermediate host is one way to abbreviation of the life cycle (Poulin & Cribb 2002). In the present study, were identified progenetic metacercariae of *P. merus* found in *Parasagitta friderici* (Ritter-Zahony, 1911) (= *Parasagitta fredrici*?).

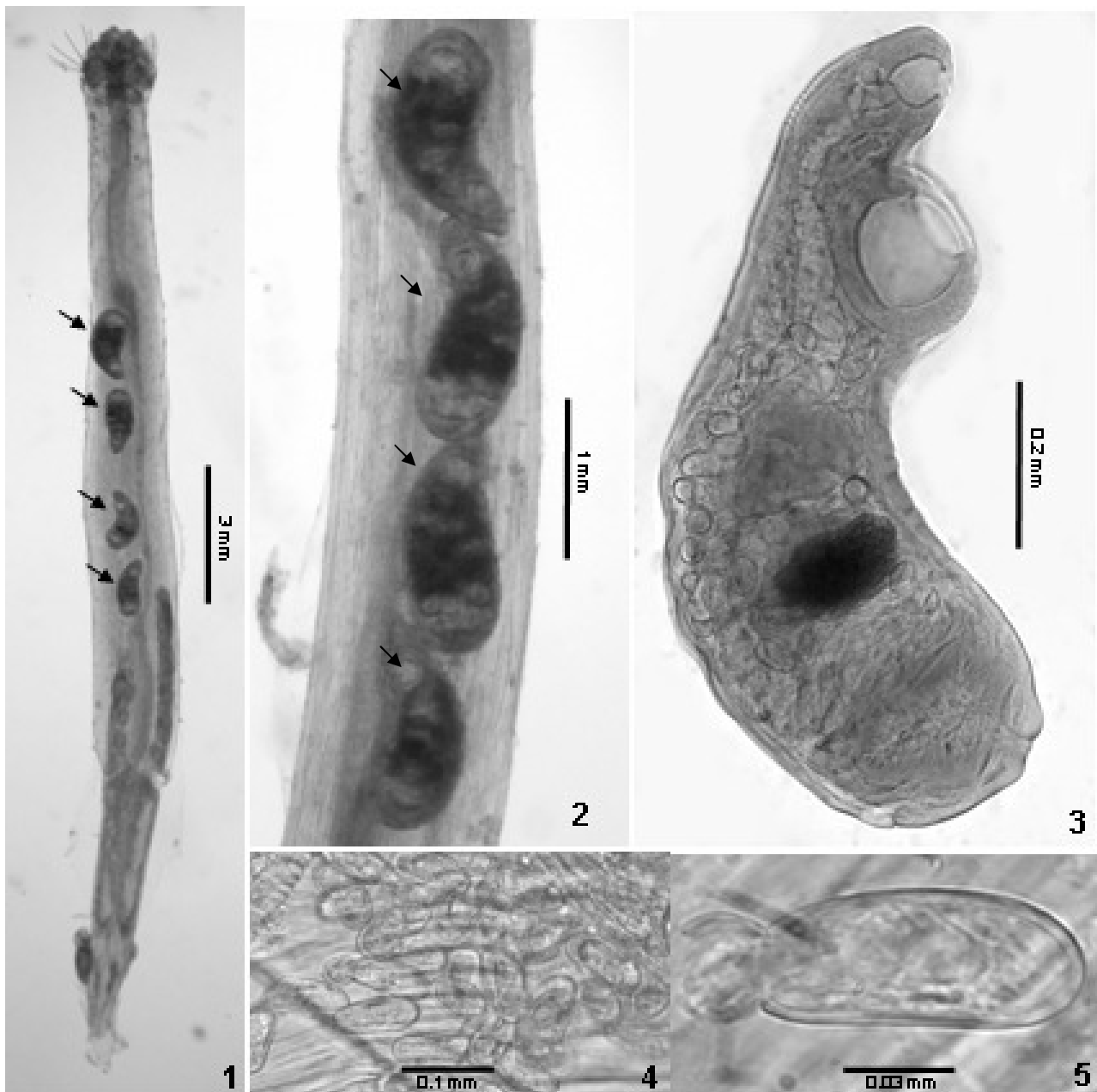
MATERIAL AND METHODS

The hosts were collected in the Baía de Paranaguá (25°30'S, 48°31'W), Paraná, southern of Brazil, during September and October 1996. A sub-sample (n=190) of chaetognaths was examined and the parasitological index of prevalence, mean intensity and mean abundance of infection (all *sensu* Bush *et al.* 1997) of *P. merus* were established. Some parasite specimens were stained with Semichon's carmine, cleared with beechwood creosote, and mounted in Canada balsam. Others were examined with Aman's lactofenol with a drop of picric acid solution. Measurements of ten parasites specimens were taken using light microscope and the mean value is presented in mm followed by the standard deviation (\pm SD).

Representative vouchers were deposited at Helminthological Collection of Instituto Oswaldo Cruz in Rio de Janeiro (Brazil) CHIOC. Slides with progenetic metacercariae inside of host: CHIOC 36596a – d; Slides with progenetic metacercariae only: CHIOC 36967 a–d.

RESULTS AND DISCUSSION

In the examined sub-sample (n=190), most of chaetognaths were parasitized (n=165) by *P. merus* (Fig. 1, 2, 3), corresponding a prevalence of 86.8%. Sometimes, high intensity of infection (1 to 11) was observed and the mean intensity of infection was 2.26. The mean abundance was 1.96.



Figures 1 – 5. *Parahemiurus merus* in *Parasagitta friderici* (Chaetognatha). **1.** *P. friderici* infected by *P. merus* (arrows). **2.** Detail of the hemiurids (arrows) in the host body cavity. **3.** Removed *P. merus* from host body cavity. **4.** Eggs released by parasites in the host body cavity. **5.** Miracidium escaping through operculum of egg within host body cavity.

The parasitism of Chaetognata by trematodes was already reported throughout the world. Some cases include Biscayne Bay (Overstreet 1969), Indian Ocean (Øresland & Bray 2005), and Argentine coast (Cavalieri 1963, Pearre 1976). In this study is reported high intensity of infection. In contrast, Prado - Rosas *et al.*, (2005) examined many specimens (n= 22.508) of six chaetognath species from Mexican Caribbean Sea, and found only 19 hemiurids, with an intensity of infection of 1 for all parasitized host.

Measurements of the morphometric characters of *P. merus* are: 0.44 (± 0.05) total length, 0.16 (± 0.02) width; oral sucker 0.04 (± 0.01) diameter; pharynx 0.03 length, 0.02 width; acetabulum 0.08 (± 0.01) diameter; seminal vesicle 0.02 diameter; anterior testes 0.06 (± 0.01) length, 0.04 (± 0.02) width; posterior testes 0.06 (± 0.01) length, 0.04 (± 0.01) width; ovary 0.07 (± 0.01) length, 0.03 (± 0.01) width; eggs 0.02 length, 0.01 width; two vitelline masses, 0.07 (± 0.01) length, 0.05 (± 0.03) width and 0.06 (± 0.01) length, 0.07 (± 0.07) width.

All measurements in this study are smaller than those reported for *P. merus* parasitizing fishes (Bray 1990), except the oral sucker and eggs length. These measurements must be analyzed with prudence, owing the different techniques used to prepare the parasites, which can alter the original size of the organism. In addition, Bray (1990) do not specify which techniques were used to prepare de measured parasites. On the other hand, changes in size can be expected, since the parasites may show distinct responses according to different environments, as an adaptation to improve the success in their lifecycles (Poulin 2005). According to this, the reduced space available in the chaetognaths body cavity may limit parasite growth but do not hinder

their sexual maturation.

The observed parasites had the uterus filled with eggs (Fig. 3). In most part of the cases, some parasites eggs had been released in the host body cavity (Fig. 4). Some of them were hatched, showing a miracidium escaping through the egg operculum (Fig. 5). Daponte *et al.* 2008, had also reported eggs production by *P. merus* parasitizing *P. friderici* in Argentina. However, these parasites represented a small part of the sample, and their eggs appeared in small number. This is the first record of *P. friderici* infected by *P. merus* progenetic metacercariae in Brazilian waters.

The infection of chaetognaths may occur through predation on infected copepods or cladocerans, since it preys on zooplankton (Dollfus 1960, Pearre 1976). Conversely, all metacercariae were found in the chaetognaths' body cavity. It suggests that the infection does not occur through feeding or that metacercariae ingested are able of migrate from the digestive tract lumen towards the body cavity. According to Prado-Rosas *et al.* (2005) the body cavity infection is resultant of direct penetration.

Adults of *P. merus* are usually found in fishes. The role of chaetognaths in *P. merus* life cycle is uncertain. The infection may be accidental, with the chaetognath representing a dead-end host. On the other hand, it is possible to admit that chaetognaths really participate as an additional intermediary host in the *P. merus* life cycle. In this case, metacercariae may have become progenetic in chaetognaths that have escaped from the predation by the parasite's definitive host, such as a fish. This study supports this idea, since embrionated eggs and miracidia were found inside the most part of chaetognaths examined.

ACKNOWLEDGMENTS

We are grateful to J. G. F. Bersano (Oceanography Department, Zooplankton Laboratory of Universidade Federal do Rio Grande – FURG) for identification of chaetognath; to H. L. Spach (Centro de Estudos do Mar, Universidade Federal do Paraná - UFPr) for samples collect, and to Ieda Quadro (Morphobiological Department, FURG) for help in the laboratory techniques.

REFERENCES

- BRAY, RA. 1990. A review of the genus *Parahemiurus* Vaz & Pereira, 1930 (Digenea: Hemiuridae). *Syst. Parasitol.* 15: 1-21.
- BUSH, AO, KD LAFFERTY, JM LOTZ & AW SHOSTAK. 1997. Parasitology meets ecology on its own terms: Margolis et al. revisited. *J. Parasitol.* 83 (4): 575-583.
- CAVALIERI, F. 1963. Nota preliminar sobre *Sagitta* (Chaetognatha) del litoral Atlántico Argentino. *Physis* 24(67): 223-236.
- DAPONTE, MC, AA GIL DE PERTIERRA, MA PALMIERI & M OSTROWSKY DE NUÑES. 2008. Monthly occurrence of parasites of the chaetognath *Sagitta friderici* off Mar Del Plata, Argentina. *J. Plank. Res.*, 30 (5): 567-576.
- DOLLFUS, RPH. 1960. Distomes des chaetognates. *Bull. Inst. Pech. Maroc*, 4:19-45.
- KØIE, M. 1979. On the morphology and life cycle-history of

- Derogenes varicus* (Müller, 1784) Loss, 1901 (Trematoda, Hemiuridae). *Parasitol. Res.*, 59:67-78.
- KØIE, M. 1990. On the morphology and life cycle-history of *Hemiurus luehei* Odner, 1905 (Digenea: Hemiuridae). *J. Helminthol.*, 64:193-202.
- KØIE, M. 1991. Aspects of the morphology and life cycle of *Lecithocladium excisum* (Digenea, Hemiuridae), a parasite of *Scomber* spp. *Int. J. Parasitol.*, 21(5):597 – 602.
- KØIE, M. 1992. The life-cycle and structure of the fish digenean *Brachyphallus crenatus* (Hemiuridae). *J. Parasitol.*, 78:338-343.
- KØIE, M. 1995. The life-cycle and biology of *Hemiurus communis* Odner, 1905 (Digenea, Hemiuridae). *Parasite*, 2: 195-202.
- MANTER, HW. 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighboring Pacific. In: Allan Hancock Pacific Expedition. The University of Southern California Press, Los Angeles, California, 496 p.
- MARCOGLIESE, DJ. 1995. The role of zooplankton in the transmission of helminth parasite to fish. *Rev. Fish Biol. Fish.*, 5: 336-371.
- ØRESLAND, V & RA BRAY. 2005. Parasites and headless chaetognaths in the Indian Ocean. *Mar. Biol.*, 147: 725-734.
- OVERSTREET, RM. 1969. Digenetic trematodes of marine teleost fishes from Biscayne Bay, Florida. *Tulane Stud. Zool. and Bot.*, 15(4): 119-176.
- PEARRE, S. 1976. Gigantism and partial parasitic castration of Chaetognatha infected with larval trematodes. *J. Mar. Biol. Ass. U. K.*, 56: 503-513.
- POULIN, R. 2001. Progenesis and reduced virulence as an alternative transmission strategy in a parasitic trematode. *Parasitology*, 123: 623-630.
- POULIN, R. 2005. Evolutionary Ecology of Parasites. London, Chapman & Hall. 212p.
- POULIN, R & TH CRIBB. 2002. Trematode life cycles: short is sweet? *Trends Parasitol.*, 18 (4): 176-183.
- PRADO – ROSAS, MCG, JN ALVAREZ – CADENA, L SEGURA-PUERTAS & R LAMOTHE-ARGUMEDO. 2005. Hemiurid Matecercariae (Trematoda) in Chaetognaths from the Mexican Caribbean Sea. *Comp. Parasitol.*, 72:230 – 233.

Recebido: 26/06/2008
Aceito:30/10/2008