

Raphidascaris (Sprentascaris) lanfrediae sp. nov. (Nematoda: Anisakidae) from the fish *Satanoperca jurupari* (Osteichthyes: Cichlidae)

Marly de Fátima Carvalho de Melo^{1,2}, Jeannie Nascimento dos Santos¹, Elane Guerreiro Giese^{1,3},
Everton Gustavo Nunes dos Santos⁴, Cláudia Portes Santos^{4/+}

¹Laboratório de Biologia Celular e Helmintologia Profa. Dra. Reinalda Marisa Lanfredi, Instituto de Ciências Biológicas

²Laboratório de Parasitologia, Faculdade de Farmácia, Instituto de Ciências da Saúde, Universidade Federal do Pará, Belém, PA, Brasil

³Laboratório de Pesquisa Dr. Carlos Azevedo, Instituto de Saúde e Produção Animal, Universidade Federal Rural da Amazônia, Belém, PA, Brasil

⁴Laboratório de Avaliação e Promoção da Saúde Ambiental, Instituto Oswaldo Cruz-Fiocruz, Av. Brasil 4365, 21040-360 Rio de Janeiro, Brasil

Raphidascaris (Sprentascaris) lanfrediae sp. nov. is described from the intestine of the freshwater fish *Satanoperca jurupari* (Heckel) (Cichlidae) from the Guamá River, state of Pará, Brazil. The prevalence in fish ($n = 59$) was 27% with intensity of one-124 (mean 16) nematodes per fish. The new species is characterized mainly by the markedly larger size of ventricular appendix in relation to the oesophagus, presence of short male caudal alae, 14-16 subventral pairs of preanal papillae and six pairs of postanal papillae.

Key words: *Raphidascaris (Sprentascaris) lanfrediae* sp. nov. - Nematoda - Anisakidae - *Satanoperca jurupari* - Brazil

The Cichlidae is a fish family well represented in freshwater bodies of South America; within this group, the cichlid *Satanoperca jurupari* (Heckel, 1840) (= *Geophagus jurupari* Heckel, 1840), commonly named demon heartthumper, is a typical representative of the estuary of the Amazon River (Matos et al. 2002). The distribution of *S. jurupari* includes the Amazon River basin: Bolivia, Brazil, Colombia, Ecuador, French Guyana and Peru (Reis et al. 2003). During a survey of this fish species from the Guamá River, close to the Amazon River Delta, state of Pará (PA), Brazil, specimens of *Raphidascaris (Sprentascaris)* Petter and Cassone, 1984 were encountered. These proved to represent a new species which is described herein.

MATERIALS AND METHODS

The fish were collected from March 2009-October 2010 in the Guamá River (01°27'21"S 48°30'14"W). A total of 59 specimens (total body length 9-24 cm, 50-180 g) were examined. The fish were examined using a dissecting microscope. The recovered nematodes were placed in Petri dishes filled with physiological saline and then fixed in hot alcohol, formaldehyde and acetic acid solution (AFA). For light microscopy, specimens were cleared in glycerine and, after examination, stored in 70% ethanol. Drawings were made with the aid of an Olympus CX31 microscope drawing tube. For scanning electron microscopy, nematodes were post-fixed in 1% osmium tetroxide in phosphate buffer, dehydrated through a graded acetone series, critical-point dried and sputter-coated with gold. They were examined using a JEOL JSM-6390LV

scanning electron microscope at an accelerating voltage of 15 kV. All measurements are in micrometres unless otherwise stated, with means in parentheses.

Anisakidae Railliet and Henry, 1912
Raphidascaris Railliet and Henry, 1915

Raphidascaris (Sprentascaris) lanfrediae sp. nov.
(Figs 1, 2)

Diagnosis - Small-sized nematodes with smooth cuticle. Cervical cuticular alae present. Body whitish. Lips well developed; interlabia absent. Pulp of all lips with anterior round processes. Pulp of dorsal lip bearing two double papillae; ventrolateral lips with one double papilla, one single papilla and one amphid. Lateral membranous margins forming two finger-shaped protrusions at each side of lips, coating labiae internally. Mouth aperture triangular. Small cuticular elevation at base of lips present. Oesophagus expanded at its posterior half. Ventriculus shorter than broad; ventral ventricular appendix longer than broad. Excretory pore situated short distance posterior to level of nerve ring. Tail of both sexes conical.

Male (7 specimens) - Length of body 3.92-6.45 (5.43) mm, maximum width 150-250 (217). Lips 25-30 (27) (Figs 1B, C, 2A-D). Oesophagus 395-685 (565) long, 65-100 (88) wide. Nerve ring 225-300 (264) and excretory pore 212-325 (281), respectively, from anterior extremity. Ventriculus 30-50 (40) long, 80-100 (91) wide; length of ventricular appendix 160-212 (186), its width 25-55 (44) (Fig. 1A, B). Ventricular appendix/oesophageal length ratio 1: 0.27-0.40 (1: 0.34). Spicules equal, simple, well sclerotized, 125-155 (133) long. Caudal alae poorly developed, short, 106-240 long, extending from mid-length of spicules to level of last pair of papillae (Fig. 1D). Preanal papillae 14-16 subventral pairs; first four of them (counting from cloacal opening) small, difficult to observe. Postanal papillae six pairs, first three pairs close to each other, two pairs in middle of tail and last, small pair just anterior to phasmids. Tail conical, 90-120 (106) long (Figs 1D, E, 2G-H).

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+ Corresponding author: cpsantos@ioc.fiocruz.br

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Female (10 specimens) - Length of body 2.11-6.52 (3.88) mm, maximum width 100-290 (164) (Fig. 1A). Cervical cuticular alae well visible (Fig. 2E, insert). Lips 20-37 (25) long. Oesophagus 290-710 (459) long, 45-135 (79) wide. Ventriculus 18-40 (27) long, 50-80 (64) wide; length of ventricular appendix 122-315 (157), its width 25-45 (35). Ventricular appendix/oesophageal length ratio 1: 0.27-0.42 (1:0.36). Nerve ring 140-290 (198) and excretory pore 163-440 (273), respectively, from anterior extremity. Vulva at short distance below oesophagus, 0.40-1.06 (0.69) mm from anterior extremity; vulval lips simple (Fig. 2F). Vagina muscular, 130-310 (197) long, directed posteriorly from vulva. Eggs 12-17 × 10-12 (14 × 11). Tail conical, 120-340 (208) long (Fig. 2E).

Type host - *S. jurupari* (Perciformes: Cichlidae).

Site of infection - Intestine.

Type-locality - Guamá River, PA, Brazil.

Type data and depository - Holotype collected 24 March 2009. Type-specimens deposited at the Helminthological Collection of the Oswaldo Cruz Institute, Rio de Janeiro (holotype male 35714a, paratypes 35716b-c).

Host-parasite data - Prevalence (n = 59) 27%; intensity of one-124 (mean 16) nematodes per fish.

Etymology - The specific name is given in honour of the late Dr Reinalda Marisa Lanfredi, for encouraging students and professionals to develop helminthological studies.

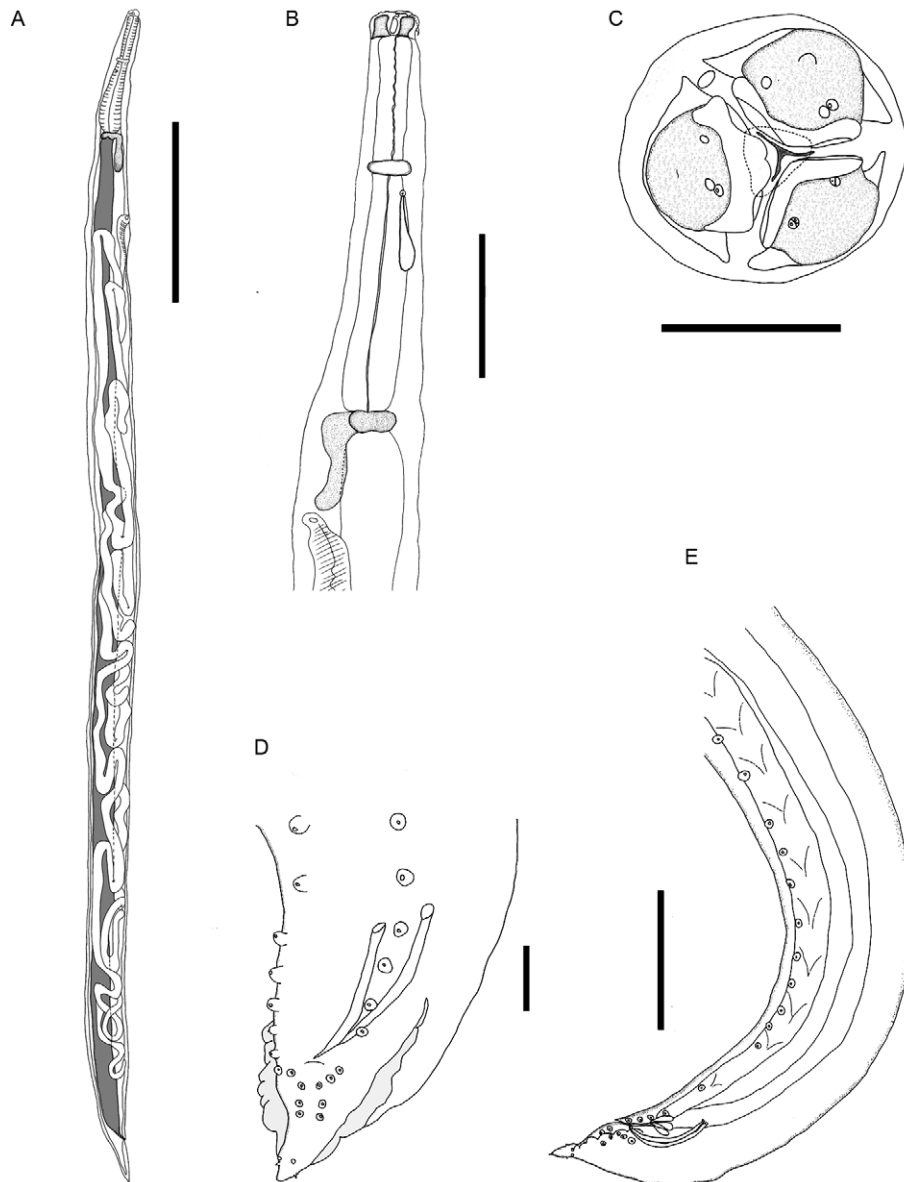


Fig. 1: *Raphidascaris (Sprentascaris) lanfrediae* sp. nov. A: general view of female; B: anterior end of body; C: apical view of lips; D: mail tail, ventro-lateral view; E: posterior end of male. Bars: A: 1 mm; B: 200 µm; C, D: 50 µm; E: 500 µm.

DISCUSSION

Petter and Cassone (1984) proposed the genus *Sprentascaris* to accommodate the three ascaridoid species newly described from catfishes of the families Loricariidae and Pimelodidae from Paraguay. The genus was later reduced to a subgenus *Raphidascaris* (*Sprentascaris*) by Moravec et al. (1990). At present, the genus includes four South American species: *Raphidascaris* (*Sprentascaris*) *hypostomi* (Petter & Cassone 1984), *Raphidascaris* (*Sprentascaris*) *mahnerti* (Petter & Cassone 1984), *Raphidascaris* (*Sprentascaris*) *pimelodi* (Petter & Cassone 1984) and *Raphidascaris* (*Sprentascaris*) *marano* Ramallo 2009; *Raphidascaris* (*Sprentascaris*) sp. was also reported from the cichlid *Geophagus brasiliensis*

from the Paraná River, Brazil without specific identification (Moravec et al. 1993, Moravec 1998, Vicente & Pinto 1999, Ramallo 2009, Eiras et al. 2010).

Previous records of *R. (S.) hypostomi* in Brazil were reported from *Ancistrus cirrhosus*, *Hypostomus albopunctatus*, *Hypostomus cochliodon*, *Hypostomus commersoni*, *Hypostomus derbyi*, *Hypostomus* sp. and *Metynnis lippincottianus* from the states of Paraná and Rio Grande do Sul, Brazil (Moravec et al. 1990, Moravec 1998, Vicente & Pinto 1999, Thatcher 2006, Takemoto et al. 2009, Eiras et al. 2010). In Paraguay, it is reported from *A. cirrhosus* and *Cochliodon cochliodon* (Petter & Cassone 1984, Petter 1995). This species is more robust and differs from *R. (S.) lanfrediae* sp. nov. in the shape of the lips with a some-

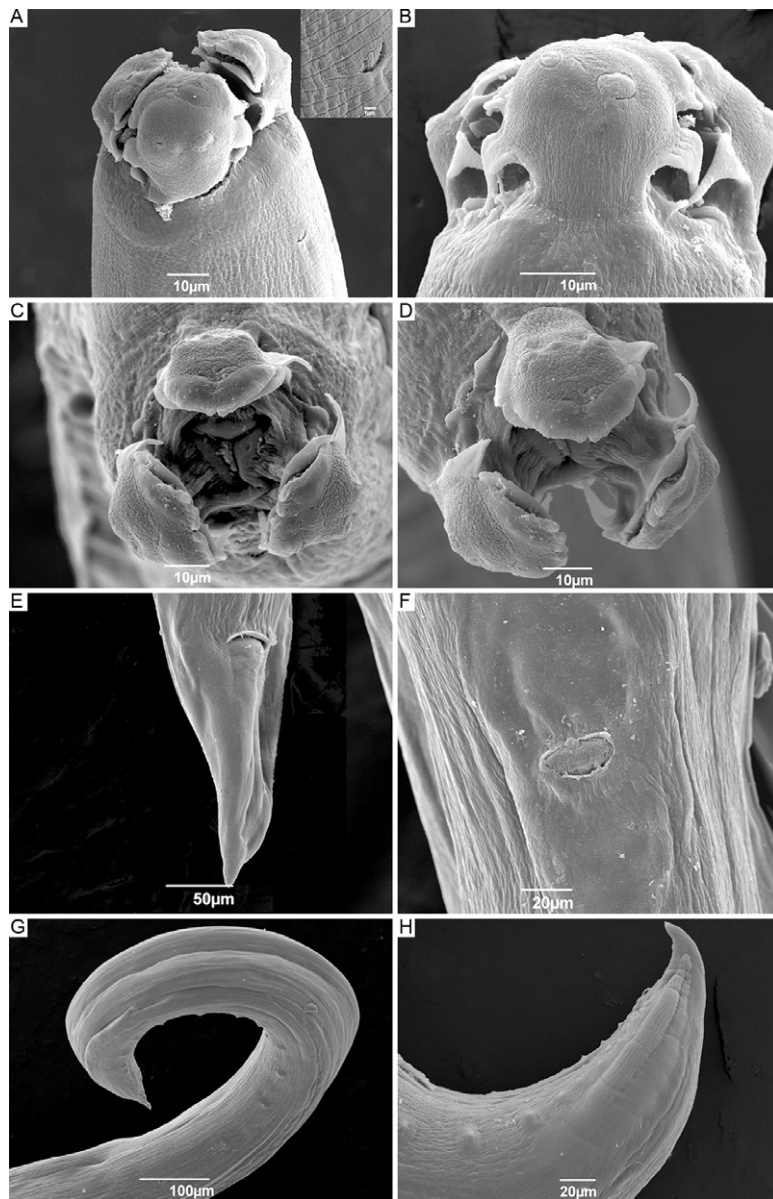


Fig. 2: *Raphidascaris* (*Sprentascaris*) *lanfrediae* sp. nov., scanning electron microscopy micrographs. A: anterior end of body (insert: possible bed of deirids); B: lateral lip with projections and papillae; C, D: apical view of lips with projections; E: female tail, ventro-lateral view; F: vulva of female; G, H: posterior end of male.

what triangular peduncle, by the broad shape and small size of oesophagus, absence of male caudal alae and number and disposition of caudal papillae.

R. (S.) mahnerti was reported from *Pseudohemiodon laticeps*, *Loricariichthys brunneus*, *Loricariichthys labialis*, *Loricariichthys platymetopon*, *Loricariichthys* sp. and *M. lippincottianus* from Paraná and Uruguay Rivers, Brazil (Moravec et al. 1990, 1993, Fortes et al. 1999, Vicente & Pinto 1999, Thatcher 2006, Takemoto et al. 2009, Eiras et al. 2010, Moreira et al. 2010). It also parasitizes *L. platymetopon* and *L. labialis* in Paraguay (Petter & Cassone, 1984) and *L. brunneus* in Venezuela (Moravec et al. 1997). It is closely related to *R. (S.) lanfrediae* sp. nov., but can readily be differentiated by the ventricular appendix/oesophageal length ratio 1: 0.11-0.21 (0.16) vs. 1: 0.27-0.40 (0.34) in males and 1: 0.12-0.20 (0.16) vs. 1: 0.27-0.42 (0.36) in females, the former being calculated based on measurements of Peter and Cassone (1984). The male caudal alae are also different, being longer in *R. (S.) mahnerti* (400 µm or longer) (Peter & Cassone 1984, Moravec et al. 1990). The geographical distribution of both species and their fish hosts are also well distinguished.

R. (S.) pimelodi was reported from *Pimelodus maculatus* from the Paraguay River, Paraguay and *R. (S.) marano*, from the loricariid catfish *Hypostomus cordovae* from the Marapa River, Argentina. *R. (S.) pimelodi* is well distinguished from *R. (S.) lanfrediae* sp. nov. by their overall large dimensions with a long oesophagus and ventriculus and the ventricular appendix/oesophageal length ratio of 1: 0.072-0.111 [based on measurements of Moravec (1998)] in contrast to the new species ratio, which is 1: 0.27-0.42.

R. (S.) marano resembles *R. (S.) mahnerti* in the triangular shape of lips, a feature which well distinguishes them from *R. (S.) lanfrediae* sp. nov. In addition, *R. (S.) marano* has indistinct lateral projections of lips and a different number of caudal papillae (3 + 22), and it also differs in the absence of caudal alae and dimensions of body, oesophagus and ventriculus.

A remarkable feature by which *R. (S.) lanfrediae* sp. nov. seems to differ from all congeners is the larger size of ventricular appendix in relation to the oesophagus and, altogether with the presence of short male caudal alae and the number of papillae, we propose the erection of a new species, which represents the first nominal species of *Raphidascaris (Sprentascaris)* parasitizing a cichlid fish in South America.

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REFERENCES

- Eiras JC, Takemoto RM, Pavanelli GC 2010. *Diversidade dos parasitas de peixes de água doce do Brasil*, ClicheTec Editora, Maringá, 333 pp.
- Fortes E, Hoffmann RP, Querol MVM 1999. Presença de *Raphidascaris (Sprentascaris) mahnerti* (Petter et Cassone, 1984) Nematoda, Anisakidae em *Loricariichthys platymetopon* (Casudo viola) da Bacia do Rio Uruguai Médio, Uruguaiana, Rio Grande do Sul, Brasil. *Rev Bras Med Vet* 21: 13-14.
- Matos E, Santos MNS, Azevedo C 2002. Biflagellate spermatozoon structure of the hermaphrodite fish *Satanoperca jurupari* (Heckel, 1840) (Teleostei, Cichlidae) from the Amazon River. *Braz J Biol* 62: 847-852.
- Moravec F 1998. *Nematodes of freshwater fishes of the Neotropical Region*, Academy of Sciences of the Czech Republic, Praha, 464 pp.
- Moravec F, Kohn A, Fernandes BMM 1990. First record of *Raphidascaris (Sprentascaris) hypostomi* (Petter et Cassone, 1984) comb. n. and *R. (S.) mahnerti* (Petter et Cassone, 1984) comb. n. (Nematoda: Anisakidae) from Brazil with remarks on the taxonomic status of the genus *Sprentascaris* Petter and Cassone, 1984. *Folia Parasitol* 37: 131-140.
- Moravec F, Kohn A, Fernandes BMM 1993. Nematode parasites of fishes of the Paraná River, Brazil. Part. 2. Seuratoidea, Ascaridoidea, Habronematoidea and Acuarioidea. *Folia Parasitol* 40: 115-134.
- Moravec F, Prouza A, Royero R 1997. Some nematodes from freshwater fishes in Venezuela. *Folia Parasitol* 44: 33-47.
- Moreira LHA, Yamada FH, Ceschini TL, Takemoto RM, Pavanelli GC 2010. The influence of parasitism on the relative condition factor (Kn) of *Metynnis lippincottianus* (Characidae) from two aquatic environments: the upper Paraná River floodplain and Corvo and Guairacá Rivers, Brazil. *Acta Sci Biol Sci* 32: 83-86.
- Petter AJ 1995. Nématodes de Poissons du Paraguay. VIII. Habronematoidea, Dracunculoidea et Ascaridoidea. *Rev Suisse Zool* 102: 89-102.
- Petter AJ, Cassone J 1984. Nématodes de Poissons du Paraguay. I. Ascaridoidea: *Sprentascaris* n. gen. *Rev Suisse Zool* 91: 617-634.
- Ramallo G 2009. A new species of *Raphidascaris (Sprentascaris)* (Nematoda: Anisakidae) in *Hypostomus cordovae* (Pisces: Loricariidae) from Argentina. *Zootaxa* 2045: 60-64.
- Reis RE, Kullander SO, Ferraris JR CJ 2003. *Check list of the freshwater fishes of South and Central America*, Edipucrs, Porto Alegre, 729 pp.
- Takemoto RM, Pavanelli GC, Lizama MAP, Lacerda ACF, Yamada FH, Moreira LHA, Ceschini TL, Bellay S 2009. Diversity of parasites of fish from the Upper Paraná River floodplain, Brazil. *Braz J Biol* 69 (Suppl.): 691-705.
- Thatcher V 2006. *Amazon fish parasites*, 2nd ed., Pensoft Publishers, Moscow, 507 pp.
- Vicente JJ, Pinto RM 1999. Nematóides do Brasil. Nematóides de peixes. Atualização: 1985-1998. *Rev Bras Zool* 16: 561-610.