

**RESEARCH NOTE/NOTA CIENTÍFICA*****CUCULLANUS (CUCULLANUS) PINNAI PINNAI* PARASITE OF *RHAMDIOGLANIS FRENATUS* (SILURIFORMES, HEPTAPTERIDAE) IN A COASTAL STREAM OF ATLANTIC FOREST, BRAZIL*****CUCULLANUS (CUCULLANUS) PINNAI PINNAI* PARÁSITO DE *RHAMDIOGLANIS FRENATUS* (SILURIFORMES, HEPTAPTERIDAE) EN UN ARROYO COSTERO DE LA MATA ATLÁNTICA, BRASIL**

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**ABSTRACT**

During surveys on helminth parasites of freshwater fishes from the Cubatão River, a new occurrence of *Cucullanus (Cucullanus) pinnai pinnai* parasitizing *Rhamdioglanis frenatus* (Siluriformes, Heptapteridae) was recorded. This nematode has been reported infecting several host species from different localities, mainly Siluriformes and some Characiformes. The present study is the first parasitological survey from *R. frenatus* and expands the range of fishes parasitized with *C. (C.) p. pinnai* in the Neotropical region.

**Keywords:** Atlantic Forest - Cucullanidae - Freshwater Fish - Nematoda.

**RESUMEN**

Durante los estudios de helmintos parásitos de peces de agua dulce del arroyo Cubatão, se registró una nueva ocurrencia de *Cucullanus (Cucullanus) pinnai pinnai* parasitando *Rhamdioglanis frenatus* (Siluriformes, Heptapteridae). Este nematodo se ha registrado en varios especies huéspedes de diferentes localidades, siendo la mayoría Siluriformes y algunos Characiformes. El presente estudio es el primer estudio parasitológico de *R. frenatus* y amplía la lista de peces parasitados por *C. (Cucullanus) pinnai pinnai* en la región Neotropical.

**Keywords:** Cucullanidae - Mata Atlántica Nematoda - pez dulceacuicola.

## INTRODUCTION

The Atlantic Forest is one of the main biodiversity hotspots for conservation priorities and highly threatened of the planet (Myers *et al.*, 2000). According to Colombo & Joly (2010), this complex biome contains higher biodiversity than most of the Amazon forests. Therefore, there is only 7.6%, of the original Atlantic Forest left, and less than 50% of the remnants are protected in Conservation Units (Colombo & Joly, 2010). “Serra do Mar” is a mountain ridge covered by the Atlantic Forest with many streams and high fish species diversity estimated at 269 species belonging to 89 genera and 21 families (Abilhoa *et al.*, 2011).

Siluriformes Cuvier, 1817 comprises the most morphologically diverse and geographically widespread order of Ostariophysi with approximately 36 families, 477 genera, and 3088 valid species (Ferraris, 2007). The catfish family Heptapteridae Gil, 1861 is one of the most diverse from Central and South America (Rosas-Valdez & Pérez-Ponce de León, 2008). *Rhamdioglanis frenatus* Ihering, 1907 lives in streams with pools and riffles, bed sediments of sand, gravel or rock on the bottom, and clear water. This fish species is distributed from the North of Santa Catarina State to South of Rio de Janeiro State, Brazil (Menezes *et al.*, 2007).

The Neotropical fauna of nematode parasites from freshwater fish features more than 137 species and subspecies belonging to 52 genera in 10 superfamilies. Cucullanidae Cobbold, 1864 is a large family of parasitic nematodes, members of which have been described from almost every part of the world (Ndew *et al.*, 2014). The cucullanids are peculiar intestinal parasites of fishes and rarely turtles. Parasites of this family are characterized by a highly developed buccal cavity formed from the oesophagus (i.e. oesophastome) (Berland, 1970). The genus *Cucullanus* Müller, 1777

includes approximately 100 species (Timi & Lanfranchi, 2006). According to Giese *et al.* (2010), there are 26 known Neotropical species of *Cucullanus* reported in South American, in which 16 species have been described in Brazil. Originally, *Cucullanus (Cucullanus) pinnai pinnai* Travassos, Artigas & Pereira, 1928 was described from intestine of *Pimelodus clarias* Linnaeus, 1758 and *Pseudoplatystoma sp.* from the Paraná River, São Paulo State, Brazil (Moravec *et al.*, 1993). The aim of this study was to report the new occurrence of *C. (C.) pinnai pinnai* parasitizing *R. frenatus* from Cubatão River, São Paulo State, Brazil.

## MATERIAL AND METHODS

The Cubatão River has approximately 35 km long and is located in the “Baixada Santista” watershed. It occupies an area of 175.55 km<sup>2</sup> (Abreu-Santos *et al.*, 2014) and is inserted in the Conservation Unit of the “Parque Estadual da Serra do Mar” (PESM), Itutinga Pilões. The headwaters of the Cubatão River are located in the city of São Bernardo do Campo, and that finish discharging at Cubatão municipality, São Paulo State, Brazil (Luiz-Silva *et al.*, 2002) (23°56'03.3" to 23°55'50.2"S and 46°31'31.1" to 46°31'10.8"W) (Figure 1). This work was approved by the Brazilian Institute of Environment (IBAMA) SISBIO N. 25826-2.

A total of 32 specimens of *R. frenatus* were sampled in July 2013 and February 2014 from Cubatão River using electrofishing. Fish were fixed in 4% formalin and after, they were necropsied and the organs were surveyed for endoparasites. Nematodes found were stored in 70% ethanol and diaphanized with lactic acid or lactophenol. Identification of the *C. (Cucullanus) pinnai pinnai* followed Moravec (1998). All measurements are in micrometers with the mean followed by the range and the

number of specimens measured between parentheses. The images were made using a differential interference contrast microscope (Leica DM 5000B).

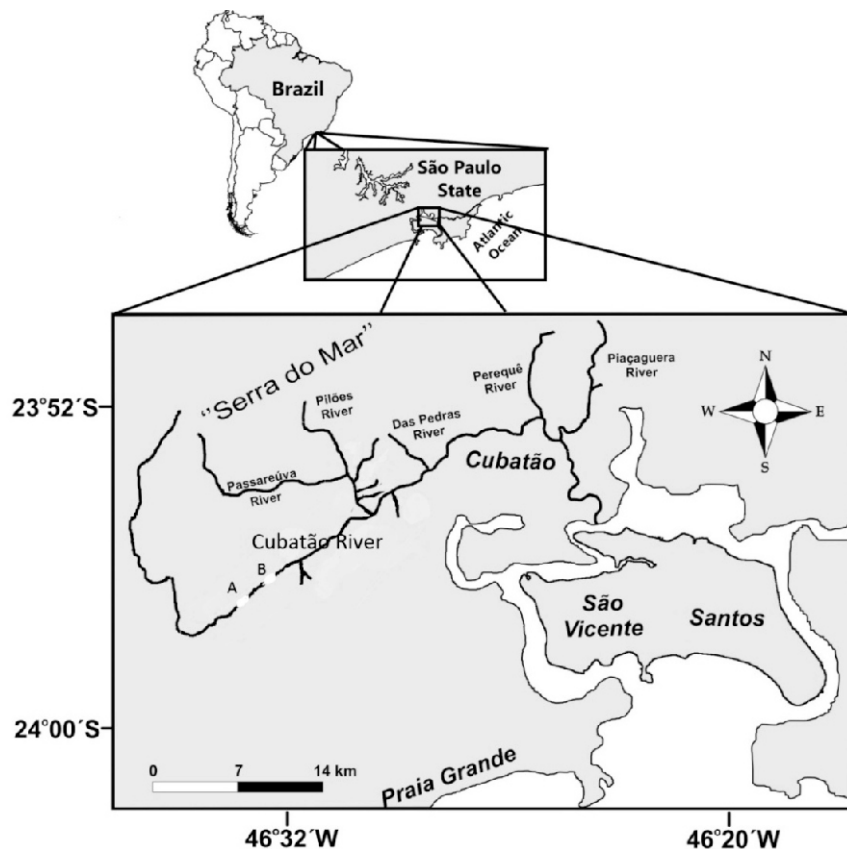
## RESULTS

Phylum Nematoda Rudolphi, 1808  
 Class Secernentea Von Linstow, 1905  
 Order Ascaridida Skrjabin and Schulz, 1940  
 Family Cucullanidae Cobbold, 1864  
 Genus *Cucullanus* Müller, 1777  
*Cucullanus (Cucullanus) pinnai pinnai*  
 Travassos, Artigas & Pereira, 1928  
 (Figure 2)

ventral oral aperture surrounded by a cuticular ring with an internal row of denticles, and two pairs of submedial cephalic papillae. Muscular esophagus expands until the anterior end to form a pseudo oral capsule (esophastome). Nerve ring surrounding esophagus near its narrowest region. Excretory pore near but not beyond posterior end of esophagus. Tails pointed.

Female (based on 7 specimens): Body 4.16 (2.31 – 4.97, n=7) long; 0.27 (0.14 – 0.36, n=7) wide. Esophagus 0.53 (0.44 – 0.59, n=7) long; width 0.12 (0.10 – 0.14, n=7) in the anterior portion and 0.11 (0.07 – 0.13, n=7) in posterior portion. Cauda 0.17 (0.14 – 0.21, n=7) long. Vulva with slightly projected lips 1.34 (0.96 – 2.30, n=5), and muscular vagina. Anus 0.02

Diagnosis: Nematode medium size. Dorso-



**Figure 1.** Map of Cubatão River, municipality of Cubatão, São Paulo State, Brazil, showing the areas (A and B) of collection of the *Rhamdioglanis frenatus* specimens included in this study.

(0.02 – 0.04, n=7) from posterior end extremity. Excretory pore 0.14 (0.26 – 0.39, n=3) from anterior extremity. Conical tail.

Male (based on 9 specimens): Body 3.07 (2.47 – 3.57, n=9) long; 0.20 (0.17 – 0.22, n=9) wide. Esophagus 0.47 (0.36 – 0.52, n=9) long; width 0.11 (0.083 – 0.14, n=9) in the anterior portion and 0.09 (0.08 – 0.11, n=9) in posterior portion. Caudal 0.16 (0.13 – 0.18, n=9) long. Tail tip 0.03 (0.03 – 0.05, n=9) long. Excretory pore 0.09 (0.23 – 0.29, n=3). Spicules equal and

sclerotized 0.45 (0.32 – 0.51, n=8) long.

#### Taxonomic summary

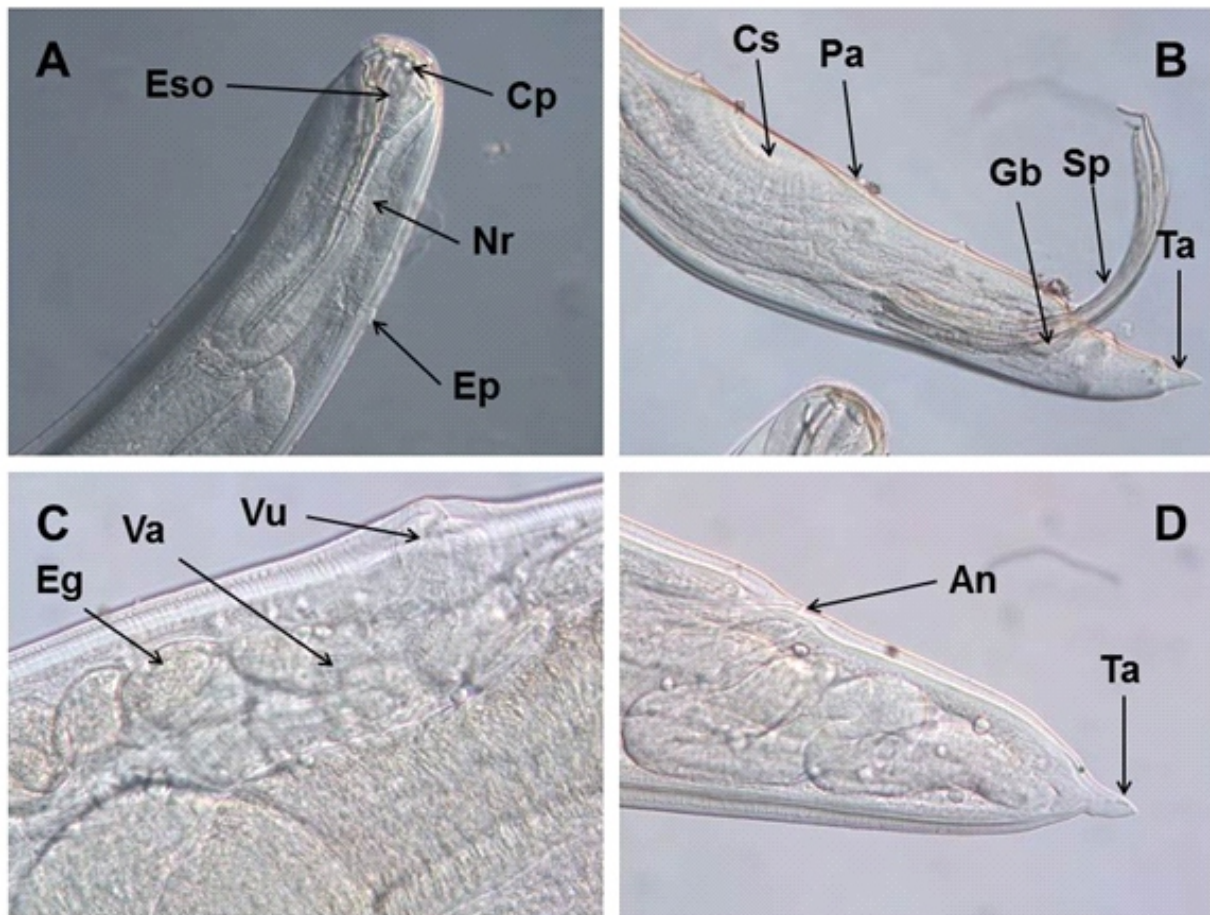
Type-host: *Rhamdioglanis frenatus* Ihering, 1907

Locality: Cubatão River, São Paulo State, Brazil.

Site of infection: Intestine.

Prevalence: 31.25% (10 of 32 fishes examined).

Mean Intensity of infection:  $1.6 \pm 4.24$ .



**Figure 2.** *Cucullanus (Cucullanus) pinnai pinnai* parasite of *Rhamdioglanis frenatus* in a coastal stream of Atlantic Forest, Brazil. **A)** Anterior end, showing cephalic papillae (Cp), esophastome (Eso), nervous ring (Nr), and excretory pore (Ep). **B)** Lateral view of the male posterior region, showing cloacal sucker (Cs), caudal papillae (Pa) gubernaculum (Gb), spicules (Sp), and caudal tail (Ta). **C)** Detail of the vulvar region, showing vulva (Vu), muscular vagina (Va), and eggs (Eg). **D)** Lateral view of the female posterior region, showing anus (An), and caudal tail (Ta).

**Table 1.** Checklist of host species parasitized with *Cucullanus (Cucullanus) pinnai pinnai* and geographical distribution from Neotropical region.

Host species	Locality	References
<i>Ageneiosus valenciennesi</i> Bleeker, 1864	Parana River - Brazil	Moravec <i>et al.</i> (1993)
<i>Galeocharax knerii</i> Steindachner, 1879	Parana River - Brazil	Moravec <i>et al.</i> (1993)
<i>Leporinus copelandii</i> Steindachner, 1875	Mogi Guaçu River – Brazil	Kohn & Fernandes (1987)
<i>Loricaria</i> sp.	Mogi Guaçu River – Brazil	Moravec <i>et al.</i> (1997)
<i>Luciopimelodus pati</i> Valenciennes, 1835	Parana River – Argentina	Moravec <i>et al.</i> (1993)
<i>Megalonema platinum</i> Günther, 1880	Parana River – Uruguay	Petter (1995)
<i>Paulicea luetkeni</i> Steindachner, 1876	Parana River - Foz do Iguaçu	Moravec <i>et al.</i> (1997)
<i>Pimelodella gracilis</i> Valenciennes, 1835	Parana River Brazil	Moravec <i>et al.</i> (1997)
<i>Pimelodus albicans</i> Valenciennes, 1840	Parana River – Argentina	Chemes & Takemoto (2011)
<i>P. clarias</i> Linnaeus, 1758	Parana River - Brazil	Kohn & Fernandes (1987)
<i>P. maculatus</i> Lacepède, 1803	Itaipu Reservoir - Brazil	Moravec <i>et al.</i> (1997)
<i>P. ornatus</i> Kner, 1858	Paraná River - Brazil	Moravec <i>et al.</i> (1993)
<i>Pimelodus</i> sp.	Paraná River - Brazil	Moravec <i>et al.</i> (1993)
<i>Pseudopimelodus roosevelti</i> Borodin, 1927	Mogi Guaçu River - Brazil	Kohn & Fernandes (1987)
<i>Pseudoplatystoma</i> sp.	Parana River - Brazil	Moravec <i>et al.</i> (1993)
<i>P. coruscans</i> Spix & Agassiz, 1829	Parana River - Uruguay	Petter (1995)
<i>Rhamdioglanis frenatus</i> , Ihering, 1907	Cubatão River - Brazil	Present study
<i>Schizodon borellii</i> Boulenger, 1900	Parana River - Brazil	Machado <i>et al.</i> (1994)
<i>Steindachneridion parahybae</i> Steindachner, 1877	Mogi Guaçu River - Brazil	Kohn & Fernandes (1987)

## DISCUSSION

*Cucullanus (Cucullanus) pinnai pinnai* have been reported for several host species of different localities (Eiras *et al.*, 2010; Kohn *et al.*, 2011)(Table 1).

This finding represents the first record for *Cucullanus (Cucullanus) pinnai pinnai* parasiting *R. frenatus* from Cubatão River, São Paulo State, Brazil and expands the biogeography and occurrence of this nematode species, corroborating Moreira *et al.* (2014), that suggesting low specificity of this nematode that has been reported parasitizing several host species from Neotropical region.

According to Eiras *et al.* (2011), in the past two decades the studies of parasite of freshwater fishes has been focused mainly on fishes with valuable resource. There is a lack of studies on

the parasite fauna of fishes from streams of “Serra do Mar”. Furthermore, this paper provides information of fish parasite from stream of Atlantic forest one of the most threatened Brazilian biome and that requires conservation and sustainable policies.

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