

NOTE

Procamallanus (Spirocamallanus) pintoi
(Kohn and Fernandes, 1988) (Nematoda:
Camallanidae) infecting species of
Callichthyidae from the Peruvian Amazon

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Abstract

In South America, *Procamallanus (Spirocamallanus) pintoi* (Kohn and Fernandes, 1988) has been identified parasitising species of *Corydoras* Lacépède, 1803 causing various damage and in some cases the death of fish. The present study reports the infection of this nematode in six species of Callichthyidae collected in the Peruvian Amazon.

Aquarium-reared ornamental fishes are frequently infected with introduced helminth parasites (in addition to others) that may be the cause of a high mortality of subsequently infected fishes. For example, camallanids (e.g., *Camallanus* spp. and *Procamallanus* spp.) have been reported as responsible of sanitary problems in different fish species (Moravec, 1998). In South America, 25 species of the genus *Procamallanus* Baylis, 1923 (*Spirocamallanus* Olsen, 1952) have been identified parasitising freshwater fishes. *Procamallanus (Spirocamallanus) pintoi* (Kohn and Fernandes, 1988) is a specific parasite of callichthyid armoured catfishes of the genus *Corydoras* Lacépède, 1803 (Moravec et al., 1999). This parasite was described from *Corydoras paleatus* (Jenyns, 1842) collected in the River Paraná, Brazil (Kohn and Fernandes,

1988). Moravec et al. (1999) found *P. (S.) pintoi* in specimens of *Corydoras reticulatus* Fraser-Brunner, 1938 exported from Peru to Germany, representing the only record of this parasite infecting a fish from Peru. In this study, we identified *P. (S.) pintoi* infecting six species of Callichthyidae from the Peruvian Amazon and we evaluated their parasitological indices.

The present study was conducted in the laboratory of Hydrobiology of the Universidad Nacional de la Amazonía Peruana located in Iquitos, Peru. Fish were collected by local fishermen of the Municipality of Belén in the city of Iquitos. Two-hundred callichthyids (20 individuals per species) were analysed: *Brochis multiradiatus* (Orcés V, 1960); *Corydoras arcuatus* Elwin, 1938; *Corydoras blochi* Nijssen, 1971; *Corydoras*

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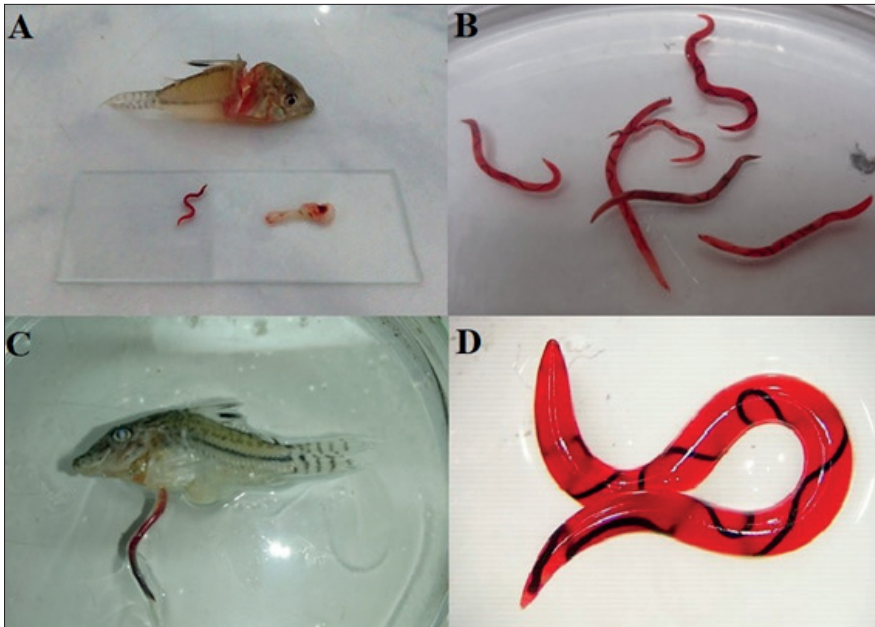


Figure 1. A. Specimen of *Procammallanus (Spirocamallanus) pintoii* (Kohn and Fernandes, 1988) collected from *Corydoras leopardus* Myers, 1933; B. Specimens of *P. (S.) pintoii* on a Petri dish; C. Specimen of *P. (S.) pintoii* infecting *Corydoras virginiae* Burgess, 1993; D. Female specimen of *P. (S.) pintoii* collected from species of *Callichthyidae*.

julii Steindachner, 1906; *Corydoras leopardus* Myers, 1933; *Corydoras punctatus* (Bloch, 1794); *Corydoras rabauti* La Monte, 1941; *C. reticulatus*; *Corydoras splendens* (Castelnau, 1855) and *Corydoras virginiae* Burgess, 1993.

For parasitological analyses, fish were euthanised by a quick immersion in a 75-mg clove oil-L⁻¹ solution (CONCEA, 2013). Posteriorly, the intestine was removed (Figure 1 A) and placed in a Petri dish with 0.7% saline solution for its observation under a stereoscope. All collected nematodes were placed in a Petri dish for counting (Figure 1 B, C, D) and preserved in plastic tubes containing 70% ethanol (Amato et al., 1991).

For the identification of the nematode species, the parasites were clarified in glycerin (Moravec et al., 1999). The identification of the parasite was based in the morphological characteristics described by Kohn and Fernandes (1988) and Moravec et al. (1999): Voucher specimens of helminths were deposited in the zoological collection of the Instituto Nacional de Pesquisas da Amazônia (INPA) (INPA 53, INPA 54, INPA 55, INPA 56, INPA 59, INPA 64, INPA 85.) The ecological terms used in this study followed Bush et al. (1997).

Procammallanus (Spirocamallanus) pintoii was identified parasitising the intestine of six fish species. The morphological characteristics observed for the species identification were: reddish coloration of the specimens when collected, female

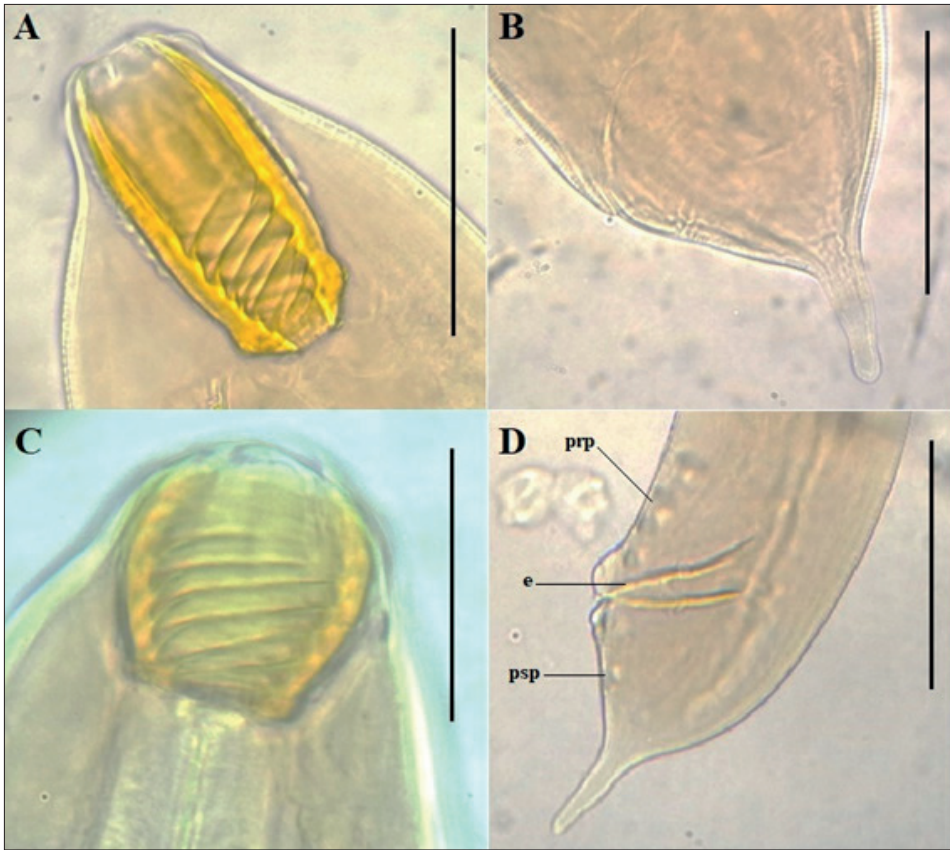


Figure 2. *Procammallanus (Spirocamallanus) pintoï* (Kohn and Fernandes, 1988) light micrographs. A. Buccal capsule of a female specimen ; B. Tail of female specimen; C. Buccal capsule of male specimen; D. Tail of male showing the spicules and caudal papillae, prp. preanal papillae, psp. postanal papillae, e. espicules. Bar scale: A, C = 50 μ m; B, D = 200 μ m.

specimens presenting 9 – 10 inner spiral thickenings occupying about two posterior thirds of the buccal capsule, vulva postequatorial (Figure 2 A, B); male specimens presenting 6 – 10 inner spiral thickenings occupying about two posterior thirds of buccal capsule, caudal papillae: 4 pairs of preanal and 2 pairs of postanal papillae, spicules short, similar, subequal, with arrow-like tips (Figure 2 C, D); Parasitological indices are presented in Table 1.

Procammallanus (Spirocamallanus) pintoï is a specific parasite of callichthyid armoured catfishes of the genus *Corydoras* (Moravec et al., 1999). This parasite was described from *C. paleatus* collected in the River Paraná, Brazil (Kohn and Fernandes, 1988), posteriorly it was reported in *C. aeneus* (Gill, 1858) from Venezuela (Moravec et al., 1997), in *C. reticulatus* from Peru (Moravec et al., 1999), in *C. paleatus* from reservoirs of the State of Paraná, Brazil (Ito et al., 2005), in *Corydoras metae* (Eignmann, 1914) from Colombia (Piñeiros et al., 2017) and in *Corydoras micracan-*

Table 1. Parasitological indices of the studied fish species. N=sample size, PF = parasitised fish, P% = prevalence, I = intensity of infection, mI = mean intensity, mA = mean abundance.

Species	N	PF	P%	I	mI	mA
<i>Brochis multiradiatus</i>	20	9	45	19 (1-3)	2.11 ± 1.96	0.95 ± 0.08
<i>Corydoras arcuatus</i>	20	0	0	0	0	0
<i>Corydoras blochi</i>	20	18	90	24 (1-2)	1.33 ± 0.48	1.2 ± 0.61
<i>Corydoras julii</i>	20	0	0	0	0	0
<i>Corydoras leopardus</i>	20	19	95	29 (1-2)	1.52 ± 0.51	1.45 ± 0.60
<i>Corydoras punctatus</i>	20	0	0	0	0	0
<i>Corydoras rabauti</i>	20	0	0	0	0	0
<i>Corydoras reticulatus</i>	20	18	90	32 (1-3)	1.77 ± 0.54	1.6 ± 0.75
<i>Corydoras splendens</i>	20	12	60	23 (1-5)	1.91 ± 1.24	1.15 ± 0.06
<i>Corydoras virginiae</i>	20	17	85	28 (1-2)	1.64 ± 0.49	1.4 ± 0.75

thus Regan, 1912 and *C. paleatus* from Argentina (Ailán-Choke et al., 2018). In this study, five new hosts are recorded for this parasite. Moreover, this nematode is recorded for the first time in the genus *Brochis* (Orcés V, 1960), showing specificity for species of Callichthyidae.

The life cycle of *P. (S.) pintoii* is not known; but in other congeneric species, copepods act as intermediate hosts (Moravec, 1998). Since species of *Corydoras* feed on crustaceans, worms, insects and vegetables (Burgess, 1989), they may be acquiring the infection by feeding on copepods with infective stages of the parasite. From the total of examined fish species, six were parasitised, the remaining ones were not infected. This finding reflects that not all callichthyids are susceptible to infection of *P. (S.) pintoii*. This may be due to inherent characteristics from one species to another, influencing in the resistance against this parasite or due to the consumption of different food items. In this way, the non-infected fish species reported may not be consuming the intermediate host.

According to Bauer et al. (1977), the pathogenic activity of parasites necessarily affects host condition in a negative way. Camallanids are blood-feeders and may cause severe damage to infected fish (Moravec et al., 2006). The parasitic infection disturbs the physiological as well as metabolic activities of the host (Madhavi, 2003). Considering the parasitism of *P. (S.) pintoii*, the size of the fish, and the size of the parasites that occupy almost the entire intestine, probable damage that affects the health status of fish may be expected, which could affect the quality of fish for exportation and also cause economic losses.

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