Camallanus emydidius n. sp. (Nematoda: Camallanidae) in Trachemys
dorbigni (Duméril & Bibron, 1835) (Testudines: Emydidae) from
Southern Brazil

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ABSTRACT

This paper describes a new species of Camallanus found in the freshwater turtle Trachemys
dorbigni. Sixty hosts collected in Southern Brazil were examined. All hosts (100%) were parasitized by a new
species of Camallanus, which was described as Camallanus emydidius n. sp. The new species differs from other
Camallanus species of freshwater turtles mainly because of the morphology of the right spicule, the
number of male precloacal and postcloacal papillae, and the presence of “mucrons” in the female
posterior extremity.

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1. Introduction

Camallanidae Railliet & Henry, 1915 enjoys an extensive
distribution and is composed of three subfamilies:
Camallaninae Railliet & Henry, 1915, Procamallaninae Yeh, 1960
and Paracamallaninae Stromberg & Crites, 1974, which are represented
by species that occur mainly in fish, some amphibians and in reptiles
(Stromberg and Crites, 1974a; Gibbons, 2010).

About the Camallanidae that parasite freshwater turtles from
South America, were reported species of Serpinema Yeh, 1960,
Camallanus Railliet & Henry, 1915 and Spirocamallanus Olsen, 1952
in Venezuela, Bolivia and Brazil (Table 1). Species of Camallanus are
characterized by having a buccal capsule composed of two lateral
valves supported by longitudinal ridges, without separation be-
tween the dorsal and ventral ridges (Chabaud, 2009). Serpinema
was described by Yeh (1960) based on the presence of the gap
between the dorsal and ventral groups of ridges of buccal valves,
and transferred the species of Camallanus described in turtles, up
till then, to Serpinema. Species of Spirocamallanus are characterized
by having ridges in spiral (Chabaud, 2009).

In Trachemys dorbigni (Duméril & Bibron, 1835), Brazilian slider
turtle, there is only the report of Camallanus sp. in this host species
from Rio Grande do Sul, Brazil (Bernardon et al., 2014) (Table 1). In
this context, this study describes a new species of Camallanus,
parasitizing T. dorbigni, one of the more abundant freshwater tur-
tles species found in Southern Brazil (Bujes and Verrastro, 2008).

2. Material and methods

From July 2010 to December 2012, 60 turtles were collected in
the municipalities of Capão do Leão (31°48’01.1”S - 52°30’48.6”W)
and Pelotas (31°46’16.9”S - 52°18’45.9”W), Rio Grande do Sul State,
Brazil. Turtles were manually collected with nets and transported
in plastic containers (56 L) to the Laboratório de Parasitologia de
Animais Silvestres (LAPASIL/UFPel), where they were weighed
and measured. The research was carried out under the license of
the Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio/
n°23196), and approved by Comissão de Ética e Experimentação
Animal da Universidade Federal de Pelotas (CEEA/n° 3026).
Euthanasia was performed as recommended in Resolution Nº
1000/ 2012 of the Conselho Federal de Medicina Veterinária (CFV, 2012).
Fifty-six turtles were necropsied after being frozen, the others
were examined shortly after death. During necropsy all organs
were individualized and examined. Nematodes were fixed in AFA,
preserved in glycerine alcohol (5% glycerine in 70% ethanol).
Nematodes were cleared and mounted in Amann’s lactophenol
(phenol, lactic acid, glycerin and water) (Amato and Amato, 2010)

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and identified generically according to Yeh (1960) and Chabaud (2009). Measures are expressed in micrometers (μm), unless otherwise indicated. The measures and standard deviation are shown in parentheses. Parasitological indexes were calculated according to Bush et al. (1997). Photomicrographs were prepared in the microscope Olympus® BX 41 with camera system and the plates of micrographical photos and drawings were made in the Adobe Photoshop® CS5. Specimens were deposited in the "Coleção Helminológica do Museu Carlos Ritter" (CHMR - UFPel), Rio Grande do Sul, Brazil and “Coleção de Helmintos do Laboratório de Parasitologia de Animais Silvestres da Universidade Federal de Pelotas” (CHLAPASIL-UFPel), Rio Grande do Sul, Brazil. Vouchers of the turtles were deposited in the “Coleção Herpetológica do Instituto Oswaldo Cruz” (CHIOC), Rio de Janeiro, Brazil (Numbers 78–79).

3. Results

3.1. Description

3.1.1. Morphology

Camallanus emydidius n. sp. (Figs. 1–4).
Reddish Nematodes with transversely striated cuticle. Four cephalic papillae were observed. Amphids was not observed. Buccal capsule typical of the genus with basal ring and two valves. Buccal ring slightly wider than the proximal portion of the muscular esophagus (Fig. 1 e 2). Each valve of buccal capsule with 12–17 longitudinal ridges, divided into three groups: dorsal (4–6 ridges), median (4–6 ridges) and ventral (4–6 ridges), median ridges have variable size (Fig. 2). Two tridents, one dorsal and the other ventral, situated outside buccal capsule. Esophagus divided into muscular portion, expanded posteriorly (claviform), and other portion...
arrows show the 2 pairs of ventral papillae near of cloaca, and the postcloacal papillae (Bar (1 adult and 1 larva), liver (6 adults).

3.1.2. Taxonomic summary

3.1.1.1. Male (n = 13). Measurements are shown in Table 2. Tail curved, caudal alae developed. Thirteen pairs of pedunculated caudal papillae: 7 precloacal; 2 pairs adanal; 4 pairs poscloacal (first three pairs grouped and separated from the fourth pair). A little pair of phasmids papilla-like situated near caudal extremity. Spicules unequal in size, both of which have simple distal extremity. Gubernaculum absent (Figs. 1C–D and 3).

3.1.1.2. Female (n = 15). Measurements are shown in Table 2. Vulva equatorial, sometimes pos-equatorial, well-developed vulvar lip. Vagina posteriorly directed and amphidelphic uterus with presence of larvae (viviparous). Conical tail with spinelike projections (mucrons), and a pair of the phasmids (Fig. 4).

3.1.2. Type host: Trachemys dorbigni (Duméril & Bibron, 1835), Brazilian slider turtle.

3.2. Remarks

According to Yeh (1960) and Chabaud (2009) Camallanus have buccal valves with three groups of ridges (dorsal, median and ventral), different from species of Serpinema, which present a gap between groups of the ventral and dorsal ridges. Yeh (1960) described Serpinema and transferred all the known species of Camallanus described in turtles to Serpinema. After this taxonomic arrangement, six new species of Camallanus in freshwater turtles were described. In Pelusios sinuatus (Pelomedesidae) from South Africa, was described Camallanus chelonius Baker, 1983 (Baker, 1983). In Australia, in Chelidae turtles, were reported Camallanus nithoggi Rigby et Sharma, 2008 in Myuchelys latisternum; Camallanus waellhreow Rigby et Sharma, 2008 in Emydura krefftii, Emydura macquarii and Emydura dharra; Camallanus tuckeri Kuzmin et Maier, 2009 in Emydura australis and Chelodina burrengandji; Camallanus beveridgei Kuzmin et Bell, 2011 in Elseya dentate and Camallanus sprenti Kuzmin et Bell, 2011 in M. latisternum and E. krefftii (Rigby et al., 2008; Kuzmin et al., 2009, 2011).

Camallanus emydidius n. sp. has the characteristics of the genus presented by Yeh (1960) and Chabaud (2009), that is, buccal capsule with a group of ridges between the dorsal and ventral group. The geographical distribution and the morphological characteristics of the C. emydidius n. sp., such as vulvar lip and tail of female, morphology of the right spicule and numbers of caudal papillae of male, were determinants to describe C. emydidius n. sp. as a new species, the first species described in T. dorbigni.

Camallanus emydidius n. sp. differs from C. chelonius by right spicule morphology, which has a hook-like projection in the distal portion in C. chelonius (Baker, 1983), unlike of the C. emydidius n. sp., in which the distal portion of the spicule is simple, and slender.

Etymology: The specific name of this nematode relates to the family of host, because this is the first species of Camallanidae described in freshwater turtle Emydidae from South America.
without any projection or process. Furthermore, *C. chelonius* male presents 6 precloacal papillae and “mucrons” in the tail extremity (Baker, 1983), whereas *C. emydidius n.* sp. has 7 precloacal papillae and absence of “mucrons”.

Concerning Australian species, *C. emydidius n.* sp. differs by the presence of “mucrons” in the posterior extremity of the female. In *C. nithoggi*, *C. waelhrew*, *C. tuckeri*, *C. beveridgei* and *C. sprenti* the females have conic tail without “mucrons” (Rigby et al., 2008; Kuzmin et al., 2009, 2011). Furthermore, the females of *C. nithoggi* and *C. waelhrew* do not have well-developed vulvar lip (Rigby et al., 2008) as occurs in the female of *C. emydidius n.* sp. Concerning the morphology of male specimens, there is a difference in the number of postcloacal papillae, *C. emydidius n.* sp. has four pairs of postcloacal pedunculated papillae, whereas *C. nithoggi*, *C. waelhrew* and *C. tuckeri* have five pairs of postcloacal pedunculated papillae, whereas *C. beveridgei* and *C. sprenti* have five pairs of postcloacal papillae, four of which are pedunculated and one pair is sessile (Rigby et al., 2008; Kuzmin et al., 2009, 2011).

Specimens of *Camallanus* sp. reported in *T. dorbigni* (Bernardon et al., 2014) and *P. hilarii* (Bernardon et al., 2013) were examined, however, the conservation of specimens make it difficult to the specific identification, as reported by the authors, to register the nematode. Concerning *Camallanus* sp. reported in *H. tectifera* and *A. spixii* (Mascarenhas et al., 2013), we believe that they may belong to *C. emydidius n.* sp., however, examining these specimens we concluded that there is the need to collect more nematodes in these hosts to make a proper identification.

4. Discussion

Stromberg and Crites (1974b) suggested that *Serpinema* might be synonymous with *Camallanus* and Baker (1983) commented the possibility of *Serpinema* being a subgenus of *Camallanus*, due to the similarity in buccal valves morphology, the spicules morphology, and the distribution of male caudal papillae.

It is possible that *S. amazonicus*, *S. monospiculatus*, *S. magathi*
and Serpinema trispinosus (Leidy, 1852) belong to Camallanus due to the morphology of the buccal capsule as shown by Ribeiro (1940), Freitas et al. (1971), Baker (1979) and Moravec and Vargas-Vázquez (1998). In the description made by these authors, it was observed that there is no complete separation between the dorsal and ventral groups of longitudinal ridges in the buccal valves, there being a median group with variation in size (length) of the ridges (Ribeiro, 1940; Freitas et al., 1971; Baker, 1979; Moravec and Vargas-Vázquez, 1998), as observed in specimens of C. emydidius n. sp. On the other hand, we observe in the description of Serpinema microcephalus (Dujardin, 1845) by Baker (1979) a clear separation between the dorsal and ventral group of ridges according to the characterization of Serpinema proposed by Yeh (1960). Therefore, there is a need for a review of the group to clarify the validity of Serpinema.

Rigby et al. (2008) used scanning electron microscopy (SEM) for describe C. nithoggi and C. waehlrow, they observed differences in morphology of buccal capsule, which are difficult to observe in light microscopy, and therefore ignored in the description C. emydidius n. sp. Kuzmin et al. (2009), used SEM to describe C. tuckeri, and commented about presence of eight cephalic papillae distributed in two circles with four papillae each, being that four are large and easily observed in light microscopy and the others are very small and therefore better observed using SEM. inc. C. emydidius n. sp. were observed (in light microscopy) four cephalic papillae, however, we do not rule out the presence of other papillae, as it is characteristic of Camallanidae (Ivashkin et al., 1971 cited by Kuzmin et al., 2009). Kuzmin et al. (2011), employed molecular characterization of C. nithoggi, C. waehlrow, C. tuckeri, C. beveridgei and C. sprinti, contributing to the understanding of the group that parasite freshwater turtles in Australia.

In this context, we reinforced the need for future research that include SEM analysis and molecular biology for study of Camallanidae that occurring in freshwater turtles in the world, and to clarify the systematic/taxonomic position of Serpinema and Camallanus species; identifying possible synonyms and contributing to the understanding of the group’s evolution.

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