

# *Philometroides caudata* sp. n. (Nematoda: Philometridae) from *Rhamdia guatemalensis* (Pisces) in Yucatan, Mexico

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**Abstract.** A new nematode species, *Philometroides caudata* sp.n., is described from the swimbladder (under the serosa cover) of the freshwater pimelodid catfish, *Rhamdia guatemalensis*, from cenotes (= sinkholes) in Yucatan, southeastern Mexico. It differs from all hitherto known members of the genus, except *P. maplestoni* (Travassos, Artigas et Pereira, 1928), in having the functional anus, the conical tail with a terminal knob-like structure and the oesophagus without an anterior inflation in female, and in the structure of the caudal end in male. It can be distinguished from *P. maplestoni* (described only from females) by the extent of embossed cuticle, the size of body and the host type. *P. caudata*, representing a Neotropical element, is the first *Philometroides* species reported from freshwater fishes in Mexico.

During studies on the parasites of fishes in cenotes (= sinkholes) of the Yucatan Peninsula, southeastern Mexico, carried out in 1993 and 1994, a new nematode species referable to the philometrid genus *Philometroides* Yamaguti, 1935 was recovered from the swimbladder surface of the pimelodid catfish, *Rhamdia guatemalensis* (Günther), collected from two localities. The species is described below.

Cenotes or sinkholes are small surface, mostly freshwater bodies connected with subterranean streams, which are typical of the Peninsula of Yucatan; they represent unique ecosystems with characteristic biota.

## MATERIALS AND METHODS

The nematodes were recovered from the swimbladder surface of fish where they were located under the serosa cover; males and small females were collected from scrapings of the swimbladder. After washing in physiological saline, the specimens were fixed in hot mixture of 40 % formaldehyde and physiological saline (1 : 9). Later they were stored in vials with 4 % formaldehyde and cleared with glycerine for examination. *En face* views were prepared according to Anderson's (1958) method. Drawings were made with the aid of either a Zeiss or an Olympus microscope drawing attachment. After examination some specimens were mounted in glycerine-gelatin preparations, others have been stored in vials with 70 % ethanol. All measurements are given in millimetres.

## RESULTS

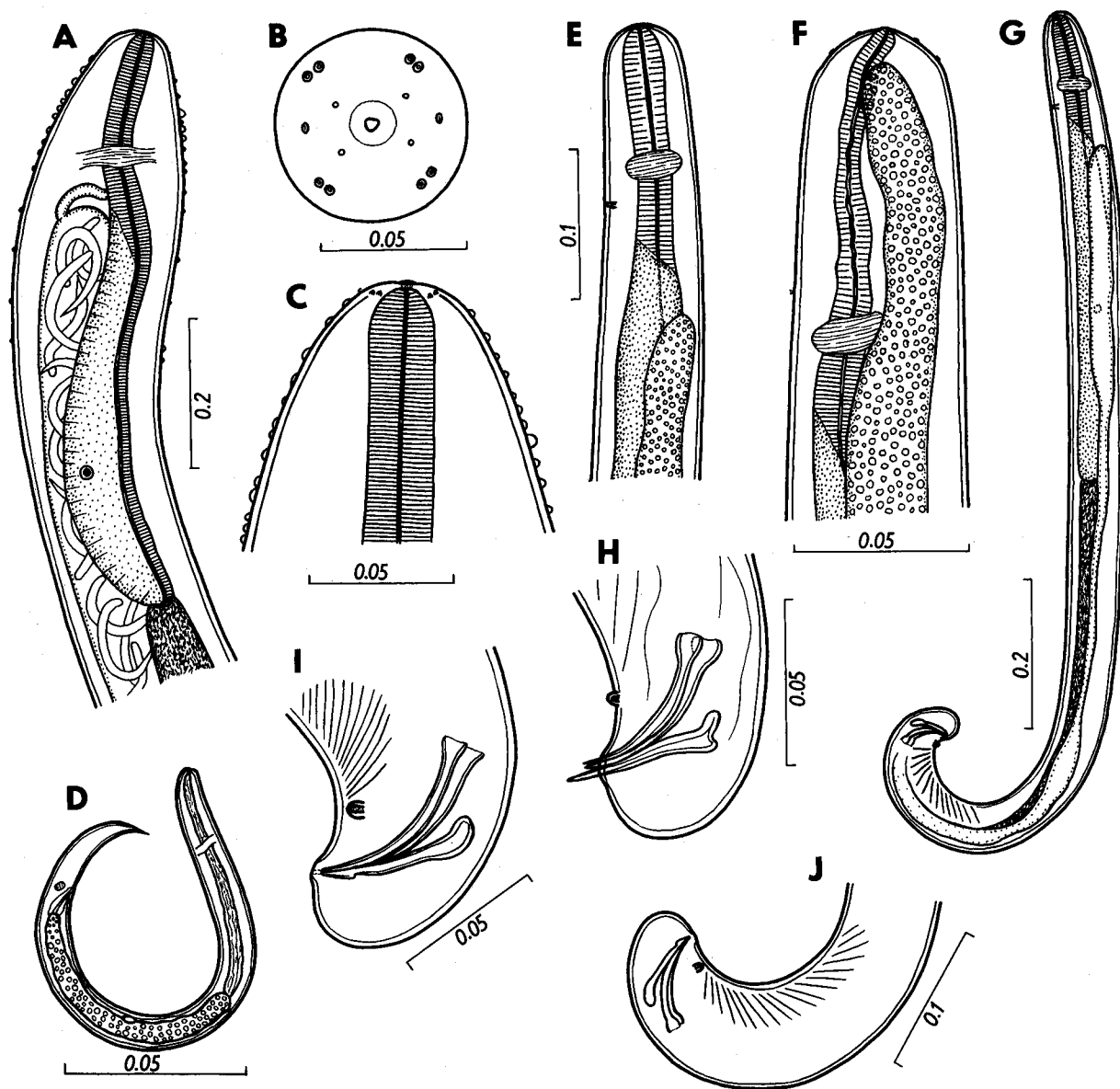
*Philometroides caudata* sp. n.

Figs. 1–2

**Description:** Body elongate, yellowish. Cephalic end rounded, provided with small papillae arranged in two circlets; outer circlet consisting of eight papillae (forming four pairs), inner circlet formed by four single papillae. Oesophagus without anterior inflation. Oesophageal gland well developed, with distinct cell nucleus. Oesophagus opening into intestine through valve.

**Male** (4 specimens; measurements of holotype in parentheses): Body filiform, 1.28–1.44 (1.38) long and 0.048–0.072 (0.070) wide. Cuticle smooth. Anterior end rounded, with minute cephalic papillae. Entire oesophagus 0.555–0.748 (0.610) long; its anterior part narrow, muscular, without inflation at its anterior end; width of this part of oesophagus 0.012–0.024 (0.023). Approximately two posterior thirds of oesophagus covered by large oesophageal gland provided with distinct cell nucleus; width of oesophagus at oesophageal gland portion 0.036–0.040 (0.040). Nerve ring and cell nucleus of oesophageal gland 0.090–0.120 (0.090) and 0.385–0.528 (0.385), respectively, from anterior extremity. Excretory pore 0.148–0.225 (0.148) from anterior end of body. Testis reaching anteriorly somewhat below nerve ring level, in one paratype nearly up to anterior end of body (Fig. 1F). Spicules well sclerotized, equal,

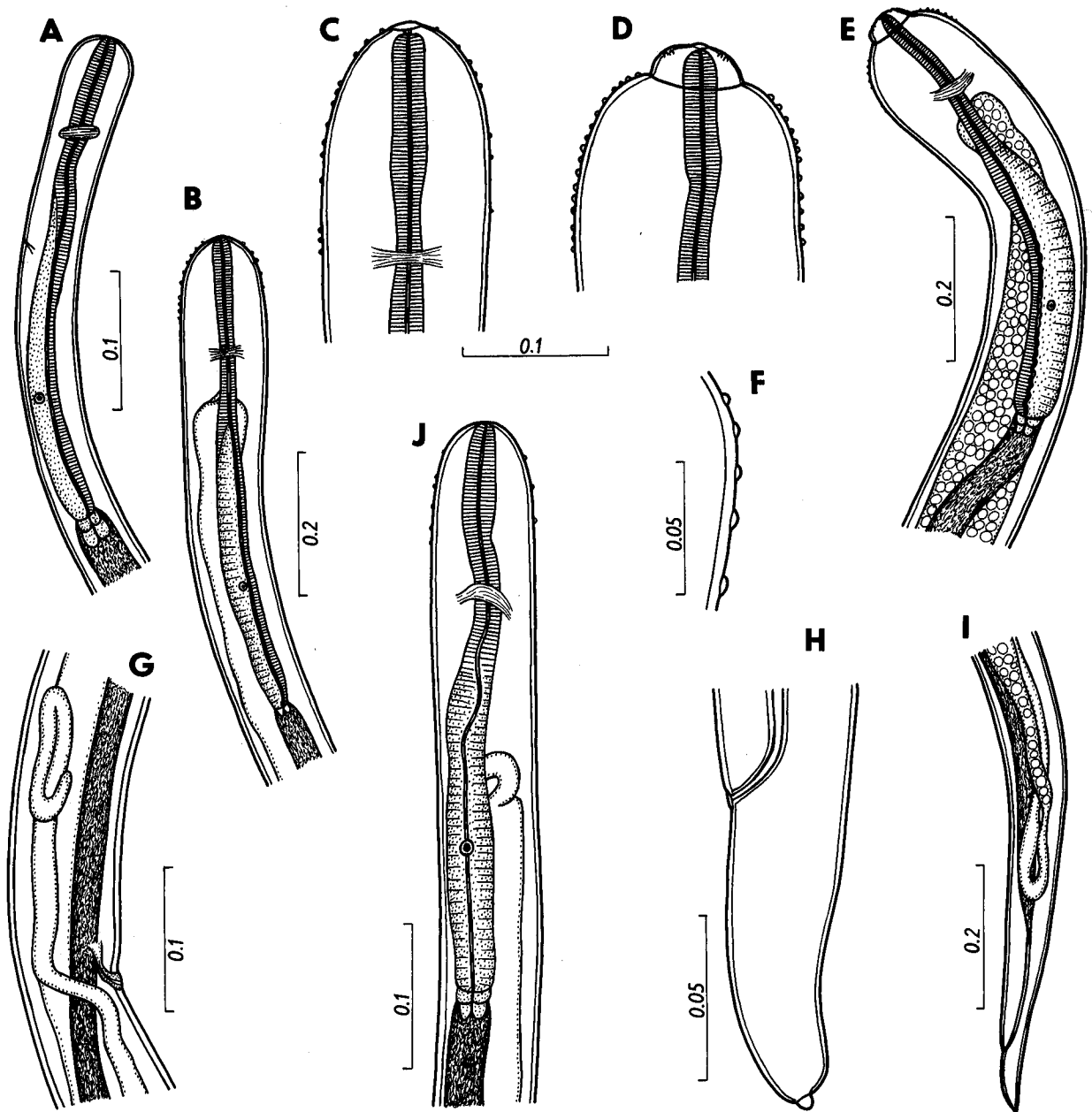
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**Fig. 1.** *Philometroides caudata* sp. n. A-C – gravid female (A – anterior end of body, lateral view; B, C – cephalic end, apical and lateral views); D – first-stage larva from uterus; E-J – male (E – anterior end of body; F – same of another specimen with testis reaching almost to anterior extremity; G – general view; H, I – tail; J – posterior part of body).

0.060–0.063 (0.063) long; their proximal ends funnel-shaped, distal ends sharply pointed. Gubernaculum sclerotized, 0.042–0.054 (0.053) long, with proximal end somewhat expanded and provided with large ventral lobe-like process, and distal end sharply pointed; dorsal barb slightly outlined on distal end of gubernaculum or absent. Only one pair of large preanal papillae present, postanal papillae not observed. Precloacal region of body with distinct ventral oblique muscle bands. Caudal end of body rounded, length of tail 0.013–0.024 (0.013). Cuticle around cloacal opening somewhat elevated.

**Gravid female** (1 incomplete specimen): Body fragment (anterior part of body) 6.08 long, maximum width 0.258; body yellowish, almost cylindrical, somewhat expanded below level of nerve ring. Cuticle almost smooth, only at region of anterior half of oesophagus covered by numerous small cuticular bosses; individual minute bosses sparsely scattered also on more posterior part of body. Cephalic end rounded. Oral aperture small, almost circular, surrounded by ring of slightly elevated cuticle. Cephalic papillae small, arranged in two circlets; papillae of outer circle forming two dorsolateral and two ventrolateral pairs; inner circle



**Fig. 2.** *Philometroides caudata* sp. n., mature nongravid and subgravid females. A – anterior end of nongravid female 3 mm long; B, C – nongravid female 16 mm long (B – anterior part of body; C – cephalic end); D–F and H–I – subgravid female 37 mm long (D – cephalic end; E – anterior part of body; F – cuticular bosses; H – tail; I – posterior part of body); G, J – nongravid female 9 mm long (G – region of vulva; J – anterior end of body).

consisting of four simple, minute papillae located dorso-laterally and ventrolaterally. Small lateral amphids present. Oesophagus muscular, without usual bulbous inflation at anterior end. Anterior part of oesophagus narrow (width 0.041); posterior part of oesophagus (length 0.585) expanded (width 0.109) by well-developed dorsal oesophageal gland covering partly muscular oesophagus and provided with large cell nucleus. Nerve ring 0.200 from anterior extremity. Intestine

light-coloured, narrow, straight. Anterior ovary at region posterior to nerve ring. Uterus reaching anteriorly to anterior end of oesophageal gland, containing numerous first-stage larvae. Larval body 0.408–0.414 long and 0.021 wide, its cephalic end rounded, caudal end conical, sharply pointed; oesophageal region 0.120 to 0.135 long, length of tail 0.075–0.093.

**Subgravid female** (1 specimen, allotype): Body elongate, yellowish, posterior part of body more slender

than anterior one; length of body 37.42, maximum width near anterior end 0.200. Cuticle smooth, only at region of anterior body extension densely covered by numerous small cuticular bosses. Cephalic end rounded, with distinct transverse cuticular constriction separating anterior part of body (0.030 long and 0.080 wide) with smooth cuticle from following, somewhat expanded part of body with embossed cuticle. Oral opening surrounded by small cephalic papillae. Oesophagus without bulbous inflation at anterior end. Anterior part of oesophagus (0.310 long) narrow (width 0.035); posterior part of oesophagus (length 0.505) expanded (width 0.075) by well-developed dorsal oesophageal gland covering partly muscular oesophagus and provided with large cell nucleus; length of entire oesophagus 0.815. Small ventriculus present, opening into intestine through valve. Nerve ring 0.190 from anterior extremity. Light-coloured intestine narrow, straight. Rectum a thin, fine hyaline tube 0.255 long. Functional anus present. Tail conical, 0.100 long, with distinct terminal knob 0.005 long. Vulva and vagina atrophied. Uterus opposed, occupying most space of body, extending anteriorly nearly to nerve ring level and posteriorly near to level of end of intestine; numerous eggs and embryos at morula stage present in uterus. Ovaries very long, forming reflecting coils.

**Mature nongravid female** (10 specimens; measurements of 1 incomplete, more advanced specimen in parentheses): Body yellowish (partly reddish in largest specimen), 3.02–9.48 (16.40) long and 0.041–0.090 (0.140) wide. Anterior end rounded, without transverse constriction of cuticle; cuticle at this region provided with numerous minute bosses in specimens 8.86 long and longer, but smooth in smaller specimens (3.02–4.35 long); otherwise cuticle smooth. Length of entire oesophagus 0.390–0.519 (0.811), of its more slender anterior part 0.120–0.200 (0.305), of posterior part 0.300–0.320 (0.505); width of anterior and posterior parts 0.021–0.025 (0.030) and 0.027–0.045 (0.050), respectively. Distance of oesophageal gland nucleus from anterior extremity 0.306–0.380 (0.600), that of nerve ring 0.087–0.138 (0.190). Vulva postequareatorial, situated 2.03–6.27 (–) from anterior end of body, i.e. at 66–69 (–) % of body length; short vagina directed anteriorly. Uterus empty, extending from oesophagus level to about end of intestine in more advanced specimens. Ovaries very long, forming reflecting coils; anterior ovary extending posteriorly to short distance anterior to vulva, posterior ovary extending anteriorly anterior to vulva (Fig. 2G). Tail conical, 0.055–0.093 (–) long; length of its terminal knob 0.003–0.006 (–). Length of rectum 0.093–0.165 (–).

**Type host:** *Rhamdia guatemalensis* (Günther), local name "juil de cenote" or "bagre" (fam. Pimelodidae, Siluriformes).

**Site of infection:** under serosa cover of swimbladder.

**Type locality:** Ixin-há Cenote (20°37'14" N, 89°06'40" W) (Zona Sotuta), Yucatan, Mexico (holotype collected on 20 September 1994, other specimens on 26 October 1993, and 13 June, 11 July, 22 August and 17 October 1994).

**Another locality:** Xmucuy Cenote (20°33'63" N, 88°59'50" W) (Zona Sotuta), Yucatan, Mexico (25 July 1994).

**Prevalence and intensity:** Ixin-há – 8 fishes infected/90 fishes examined, intensity 1–2 nematodes; Xmucuy – 3/14, 1–2.

**Deposition of specimens:** holotype, allotype and most paratypes in the Institute of Parasitology, Academy of Sciences of the Czech Republic, in České Budějovice (Helm. Coll. No. N-658); two paratypes (♂ + ♀) in Universidad Nacional Autónoma de México, Mexico City.

**Etymology:** The specific name "*caudata*" (= tailed) relates to the characteristic shape and structure of the female caudal end of this species.

## DISCUSSION

Nematodes of the family Philometridae represent taxonomically one of the most difficult groups of parasitic nematodes of vertebrates. This is mainly due to the fact that while gravid females of these mostly histozoic nematodes are conspicuous, large-sized, the males are of microscopic size and their localization in the host body is usually different from that of gravid females. Moreover, adults of most species occur only within a certain period of the year. This results in the fact that usually only females are found, whereas males remain unknown. Of many presently known genera and species of philometrids, males have not yet been described in most of them (Moravec 1986).

Considering this fact, Rasheed (1963) created a system of nematodes of this family based principally on features found in gravid females. Although her classification seems to be somewhat artificial, it is practical of use and it has been accepted, sometimes with small modifications, by subsequent authors (e.g., Ivashkin et al. 1971, Chabaud 1975, Moravec 1994).

Nematodes of the present material represent an interesting species which, on the basis of its morphological features (e.g., the structure of oesophagus and male copulating apparatus, atrophied vulva, conspicuous sexual dimorphism), belongs to the family Philometridae, representing undoubtedly a new species.

A characteristic feature of this species is the presence of cuticular bosses on the cephalic region of gravid, subgravid and larger mature nongravid females. According to the present system of philometrids (e.g.,

Chabaud 1975, Moravec and Shaharom-Harrison 1989), the presence or absence of cuticular bosses in females is considered a generic feature. Now there exist only two genera, *Philometroides* Yamaguti, 1935 and *Paraphilometroides* Moravec et Shaharom-Harrison, 1989, the females of which have the embossed cuticle. In contrast to the new species, the monotypic genus *Paraphilometroides* has a more complicated structure of the cephalic end (see Moravec and Shaharom-Harrison 1989); the only species of this genus, *P. nemipteri* Moravec et Shaharom-Harrison, 1989, is parasitic in the opercle of the marine fish *Nemipterus peronii* in Malaysia.

The genus *Philometroides* comprises many species parasitic both in freshwater and marine fishes, but none of them possesses a knob-like structure on the tail; moreover, except for *P. maplestoni* (Travassos, Artigas et Pereira, 1928), their oesophagus is bulbously inflated at its anterior end and the whole female body is usually covered by cuticular bosses. All these morphological features as well as the host type, the site of infection and the area of distribution clearly distinguish the present nematodes from other *Philometroides* species.

In addition to the above mentioned differences, some morphological features of *P. caudata* sp. n. seem to be almost unique within the family Philometridae, indicating that this species may well represent a new genus. The most important character is the presence of the functional anus (the anus is atrophied in almost all philometrids) and also the number and arrangement of male caudal papillae is unlike that in other philometrids where males are known, except for *Philometra paraguayensis* Petter, 1995.

In having the functional anus, the conical tail and the oesophagus without an anterior inflation in female, the new species resembles only *Philometroides maplestoni*, a parasite of the characid *Salminus hilarii* in Brazil (Travassos et al. 1928); in all other *Philometroides* species the anus is absent. In contrast to *P. caudata*, the female body of *P. maplestoni* is covered by cuticular bosses throughout and there is no terminal knob on the tail; the male of *P. maplestoni* is unknown. The functional anus in female was described by Travassos (1960) also for *Nilonema senticosa* (Baylis, 1927), a parasite of *Arapaima gigas* in Brazil, although it was reported to be absent in the original description of this species (Baylis 1927).

Of many *Philometroides* species, males have been described only for *P. sanguinea* (Rudolphi, 1819), *P. cyprini* (Ishii, 1931), *P. huronensis* Uhazy, 1976 and *P. belousae* Vidal-Martínez, Aguirre-Macedo et Moravec, 1995 (see Wierzbicki 1960, Moravec 1971, Vasilkov in Ivashkin et al. 1971, Uhazy 1976, Ermolenko 1984,

Vidal-Martínez et al. 1995); their morphology is similar to that in most species of *Philometra* Costa, 1845 and unlike that in *Philometroides caudata*. The only species the males of which possess a pair of conspicuous preanal papillae similar to that in *P. caudata* is *Philometra paraguayensis* Petter, 1995, a parasite recently described from a single male found in the characid *Salminus maxillosus* in Paraguay (Petter 1995); since no females were available, the male was only tentatively assigned to *Philometra*. In our opinion, subsequent studies may show *P. paraguayensis* to be conspecific with *Philometroides maplestoni*. Males of *Philometroides caudata* differ from *Philometra paraguayensis* mainly in the shape and size of oesophagus and oesophageal gland, and in much smaller body measurements (body length 1.28–1.44 mm vs. 2.76 mm).

In spite of some important morphological differences between *Philometroides caudata* and the majority of congeneric species, we refrain from establishing a new genus to accommodate it; for the time being, we place this species provisionally in the genus *Philometroides*. The main reason is that the type species of *Philometroides*, *P. seriolae* (Ishii, 1931), is inadequately described (males are unknown), which makes it impossible to delimit this genus more precisely. Moreover, Moravec and Nagasawa (1989) drew attention to the fact that there existed considerable differences in the structure of oesophagus among *Philometroides* species, indicating a necessity to make a taxonomical revision of this genus in the future, when more data are available.

*Philometroides caudata* is the first species of this genus reported from freshwater fishes in Mexico and Central America. Its morphological resemblance to some philometrids parasitic in freshwater fishes in South America (*Philometroides maplestoni*, *Philometra paraguayensis*, *Nilonema senticosa*) as well as the host type (a pimelodid catfish) indicate that *P. caudata* is a Neotropical element in the nematode fauna of fishes in Yucatan.

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