Nematode parasites of fishes of the Paraná River, Brazil. Part 1. Trichuroidea, Oxyuroidea and Cosmocercoidea

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Abstract. The present paper comprises a systematic survey of nematodes of the superfamilies Trichuroidea, Oxyuroidea and Cosmocercoidea collected from fishes of the Paraná River, southern Brazil, in 1985 and 1991. The following species were recorded: Paracapillaria piscicola, Capillariidae gen. sp. 1, Capillariidae gen. sp. 2, Travemena travnema, T. araujoii, Cosmoxynema vianai, Cosmoxynemoides aguirrei, Ichthyurus laterifilamenta sp. n., I. brasilienis, Brasilinema pimelodellae, Parasyndontisia petterae and Rondonia rondoni, I. lateristriga sp. n. from Trachydras paraguayensis is characterized mainly by the presence of lateral egg filaments and by the structure of mouth elements and the male caudal end. Most nematode species are briefly redescribed and illustrated and some problems concerning their taxonomy, hosts and geographical distribution are discussed.

The Paraná River is the second largest stream of South America, measuring some 4,700 km. Flowing from southern Brazil, it forms partly the eastern and south-eastern border between Brazil and Paraguay and Paraguay and Argentina and, after flowing through the territory of north-eastern Argentina, it enters the Atlantic Ocean near Buenos Aires.

Although most records of fish helminths in Brazil originate from the Paraná River drainage system, there is only a few data concerning these parasites from the river itself. The present knowledge of the nematode fauna of fishes of this river is very poor, being based on occasional findings from Brazil and Argentina (e.g. Travassos 1945, Pinto et al. 1974, Hamann 1982a, b, 1984, 1985). But in general, the nematode fauna of South-American freshwater fishes is little known so far.

During two expeditions of Brazilian co-authors (A. Kohn and B. M. M. Fernandes) to the Paraná River in 1985 and 1991, a considerable material of fish nematodes was collected, providing new information on their taxonomy, zoogeography and host-parasite relationships. The nematodes recovered allowed the establishment of several new taxa and the recognition of many, mostly inadequately described nematode species. Some data based on these materials have already been published in the papers by Moravec et al. (1990, 1992). The results of the systematic evaluation of nematodes of the superfamilies Trichuroidea, Oxyuroidea and Cosmocercoidea are presented in this paper.
MATERIALS AND METHODS

The nematode specimens originated from fishes from the Paraná River in Guaira (collected from 30th September–11th October 1985) and Foz do Iguaçu (23rd April–3rd May 1991) and from the reservoir of the hydroelectric power station of Itaipu – Foz do Iguaçu (23rd April–3rd May 1991). The nematodes were fixed and preserved in 70% ethanol and cleared with glycerine for optical microscopy examination. Drawings were made with the aid of a Zeiss microscope drawing attachment. For examination in SEM, the nematodes were postfixed in 1% OsO₄, dehydrated through an ethanol series and aceton and then subjected to critical point drying. The specimens were coated with gold and examined with the Tesla BS-300 scanning electron microscope at an accelerating voltage of 15 kV. All measurements are given in millimetres; width refers to maximum width. Scientific names of host fishes are after Godoy (1986).

REVIEW OF SPECIES

TRICHUROIDEA

Fam. Capillariidae Neveu-Lemaire, 1936

1. Paracapillaria piscicola (Travassos, Artigas et Pereira, 1928)  Fig. 1

Description: Comparatively small nematodes with smooth cuticle. Anterior end of body narrow, rounded, with indistinct mouth papillae. Two fairly wide lateral bacillary bands present, extending along almost whole length of body. Muscular oesophagus relatively short. Stichosome consisting of single row of stichocytes each subdivided into numerous transverse annuli and provided with conspicuously large cell nuclei; all stichocytes uniform in colour. Nerve ring encircling muscular oesophagus approximately at border of its first and second thirds. Two distinct wing-like cells present at junction of oesophagus and intestine.

Male (1 specimen): Body 4.37 long and 0.048 wide. Lateral bacillary bands 0.012 wide. Entire oesophagus 2.57 long (59% of body length). Muscular oesophagus 0.294 long, distance of nerve ring from anterior extremity 0.072. Stichosome 2.28 long, stichocytes 47 in number. Spicule smooth, slender, well sclerotized, 0.345 long; its proximal end somewhat expanded, distal end rounded. Spicule 0.015 wide at anterior end, 0.006 at middle portion, 0.003 at posterior end. Spicular sheath nonspiny; evaginated sheath 0.240 long, with broad distal end; 0.021 wide in middle, 0.036 at its distal end. Seminal vesicle and vas deferens 0.165 and 0.156 long and 0.009 and 0.027 wide, respectively. Posterior end of body rounded, provided with well developed membranous bursa supported by two wide lateral projections with triangular ends oriented posteriorly and reaching almost to posterior margin of bursa. One pair of large round postanal papillae present at base of caudal projections. Tail 0.006 long.

Female (1 gravid specimen): Body 5.51 long and 0.068 wide. Lateral bacillary bands 0.015 wide. Entire oesophagus 2.76 long (50% of body length). Muscular oesophagus 0.195 long, stichosome 2.57 long; number of stichocytes 42. Distance of 328
Fig. 1. Paracapillaria piscicola (Travassos, Artigas et Pereira, 1928). A – anterior end of male; B – stichosome region; C – oesophageal region of body with marked lateral bacillary band; D – vulva region; E – posterior end of female; F – egg; G, H – proximal end, middle part and distal end of spicule; J, K – posterior end of male; L, M – caudal end of male, ventral and lateral views.
nerve ring from anterior extremity 0.054. Vulva 0.036 behind level of oesophagus end, vulvar lips not elevated. Vagina 0.210 long. Eggs unembryonated, oval, polar plugs not protruding. Egg wall two-layered; inner layer hyaline, outer layer very thin, with distinct superficial sculpture. Size of eggs 0.048–0.051 × 0.024–0.027, wall 0.002 thick. Polar plugs 0.006–0.007 wide, 0.003–0.005 high. Eggs arranged in one file in uterus. Ovary reaching posteriorly to mid-length of rectum; length of rectum 0.114. Posterior end of body rounded, anus distinctly subterminal; tail 0.009 long.

Host: *Salminus maxillosus* Valenciennes, local name “dourado” (Characidae).

Site of infection: stomach.

Locality: Paraná River – Foz do Iguaçu.

Comments: – This species was originally described by Travassos et al. (1928) from the stomach of the Brazilian freshwater fish designated as *Acestrorhamphus* sp. and later redescribed by Freitas and Lent (1935) and Mendonça (1963) from the same host species from the type locality (R. Mogi Guassu, Pirassununga, State São Paulo). Since type specimens were not available, Moravec (1987) in his monograph dealing with fish capillariids presented a description of *P. piscicola* compounded from those given by the above mentioned authors; he also remarked that a more detailed redesignation was desirable, especially considering the fact that *P. piscicola* is a type species of the genus.

Specimens of the present material correspond, more or less, to the existing descriptions of *P. piscicola*, they originate from a fish belonging to the same family as its type host from the same river drainage system and, therefore, are considered to be conspecific with *P. piscicola*. Contrary to the original description, the measurements of spicule and eggs of our specimens are slightly greater and the male caudal lateral projections appear to be distinctly shorter than those illustrated in the papers by Freitas and Lent (1935) and Mendonça (1963). However, these differences are minor and may be ascribed to intraspecific variability. The number of stichocytes has been established in this species for the first time.

In 1987, Moravec et al. described a new capillariid, *Capillostrongyloides anci stri*, from the intestine of the aquarium of the aquarium-reared armoured catfishes, *Ancistrus dolichopterus* and *Ancistrus* sp., from Czechoslovakia; apparently, the parasite was brought to Europe by importation of ornamental fishes from South America. The morphology of this species is rather similar to that of *Paracapillaria piscicola* and both these species might be confused, especially when the taxonomic position of the closely related genera *Capillostrongyloides* Freitas et Lent, 1935 and *Paracapillaria* Mendonça, 1963 has not yet been satisfactorily solved due to an inadequate description of the type species (*C. zederi* Freitas et Lent, 1935 = *C. sentinosa* (Travassos, 1927)) of the first genus (see Moravec 1987). The present study of *P. piscicola* specimens shows that both these species differ not only in the shape of male lateral caudal projections, but also the number of stichocytes is distinctly higher (42–47) compared to 23–30 in *C. anci stri* and the evaginated spicular sheath is considerably shorter and of a different shape in *P. piscicola*.

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Travassos et al. (1928), Freitas and Lent (1935), and Mendonça (1963) designated *Acestrorhamphus* sp. to be the type host of *P. piscicola*. According to Kohn and Fernandes (1987), this fish host species was in fact *Acestrorhynchus falcatus* (fam. Characidae) to which also the fish designated by Travassos and Kohn (1965) as *Cynopotamus humeralis* belonged. Other reported fish host species of *P. piscicola* are *Galeocharax knerii*, *Cynopotamus humeralis*, *Salminus hilarii*, *S. maxillosus*, *Oligossarcus* sp. (all Characidae), *Leporellus vittatus*, *Leporinus copelandii* (both Anostomidae), and *Hoplias malabaricus* (Erythrinidae) (Travassos and Kohn 1965, Vicente et al. 1985, Kohn and Fernandes 1987). The present finding of *P. piscicola* in *Salminus maxillosus* confirms that the digestive tract of this fish species is parasitized by two species of capillariids, *P. piscicola* and *Freitascapillaria maxillosa* (Vaz et Pereira, 1934), which differ considerably from each other in their morphology; the latter is known only from *S. maxillosus*.

All previous authors reported *P. piscicola* from the River Mogi Guassu near Cachoeira de Emas, Pirassununga, State São Paulo; this is the first record of *P. piscicola* outside this locality and the first one from the Paraná River.

2. **Capillariidae** gen. sp. 1

**Description of female** (2 gravid specimens): Medium-sized nematodes with smooth cuticle. Body 17.84–21.24 long and 0.068–0.082 wide. Lateral bacillary bands 0.030–0.033. Entire oesophagus 6.53–6.81 long (30–37% of body length). Muscular oesophagus 0.381–0.396 long, distance of nerve ring from anterior extremity 0.066–0.087. Stichosome 6.13–6.43 long, stichocytes 40 in number; stichocytes uniform in colour, relatively long, each strongly subdivided into 8–11 annuli; nuclei of stichocytes markedly elongated. Vulva 0.054–0.084 behind level of oesophagus end, vulvar lips not elevated. Eggs unembryonated, oval, polar plugs not protruding. Egg wall two-layered, inner layer hyaline, outer layer very thin with distinct superficial sculpture. Size of eggs 0.048–0.054 × 0.021–0.024, wall 0.002 thick. Polar plugs 0.006 wide, 0.003 high. Eggs numerous, arranged mostly in two files in uterus, only 1–3 eggs closest to vulva in one file. Ovary reaching posteriorly to approximately mid-length of 0.090–0.096 long rectum. Posterior end of body rounded, anus distinctly subterminal; tail 0.012–0.015 long.

Host: *Schizodon fasciatus* Agassiz, local name “piau” (Anostomidae).
Site of infection: intestine.

**Comments:** – Since only females were obtained, their generic and specific identification is impossible. Comparing them with other capillariid species parasitizing South-American freshwater fishes, these nematodes resemble by their body length only *Freitascapillaria maxillosa* (Vaz et Pereira, 1934), a specific parasite of *Salminus maxillosus*; the female body of other species is much shorter, not exceeding some 8 mm. However, *F. maxillosa* differs from them in having larger eggs.
(0.063–0.066 × 0.027–0.030) and its oesophagus in female is markedly longer in relation to the whole body length (43–57 %) among other differences. Consequently, it may well be a new species, but we refrain from establishing it until males are also available. No capillariids have so far been recorded from *Schizodon fasciatus*.

3. **Capillariidae** gen. sp. 2

**Description of female** (1 gravid specimen and a body fragment of another): Medium-sized nematodes with smooth cuticle. Body 15.99 long and 0.068 wide. Lateral bacillary bands 0.024 wide. Entire oesophagus 5.51 long (34 % of body
length). Muscular oesophagus 0.282 long, distance of nerve ring from anterior extremity 0.114. Stichosome 5.23 long, stichocytes 38 in number, long, subdivided into many transverse annuli, their nuclei elongated. Vulva 0.060 behind level of oesophagus end; vulvar lips not elevated. Eggs unembryonated, oval, polar plugs not protruding. Egg wall two-layered, inner layer hyaline, outer layer very thin, with distinct superficial structure. Size of eggs 0.051–0.054 × 0.021–0.024, wall 0.0015 thick. Polar plugs 0.006 wide, 0.003 high. Eggs arranged mostly in one row. Ovary not reaching posteriorly to 0.114–0.162 long rectum. Posterior end of body rounded, anus distinctly subterminal. Tail 0.006–0.007 long.

Host: *Pseudoplattystoma coruscans* (Agassiz), local name “pintado” (Pimelodidae).
Site of infection: intestine.

**Comments:** – Only female nematodes were available and, therefore, it was not possible to determine their genus and species. Their general morphology is similar to that of the foregoing species and both forms resemble each other also in body measurements. Although slight morphological differences were observed, e.g. in the structure of bacillary bands and the size of eggs, they may well be conspecific. However, considering their host types (Cypriniformes vs. Siluriformes), we are treating them separately.

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**Fig. 3.** Capillariidae gen. sp. 2 from *Pseudoplattystoma coruscans*; female. A – anterior end of body; B – stichocyte; C – vulva region; D – oesophageal region of body with marked lateral bacillary band; E – posterior end of female; F – egg.
There are only two records of capillariids from South-American freshwater catfishes. Moravec et al. (1987) described Capillostrongyloides ancistri, undoubtedly a parasite of South-American origin, from the intestine of aquarium-reared Ancistrus dolichopterus and Ancistrus sp. from Europe and Kohn et al. (1988) reported Capillaria sp. from the stomach of Plecostomus derbyi in Brazil; both these records involve armoured catfishes of the family Loricariidae. The present finding represents the first record of capillariids in catfishes of the Pimelodidae.

OXYUROIDEA

Fam. Pharyngodonidae Travassos, 1919

4. Travnema travnema Pereira, 1938

Description of female (2 gravid specimens): Small, whitish nematodes. Body 2.86–3.05 long and 0.340 wide. Cuticle transversely striated, striation more distinct on anterior end of body where rings are 0.006–0.009 long. Head end rounded, with four small cephalic papillae. Thin-walled buccal capsule without teeth posteriorly present, 0.009 long \( \times 0.027–0.030 \) wide. Oesophagus short, consisting of strongly developed anterior pharyngeal part and short posterior part provided with well developed bulb opening into intestine through large valve; both parts approximately equal in length. Entire oesophagus 0.246–0.249 long; pharyngeal part 0.120–0.123 long, 0.066–0.069 wide; narrow part (isthmus) 0.036–0.045 long, 0.033–0.036 wide; bulb 0.081–0.090 long, 0.087–0.093 wide; sclerotized apparatus in bulb absent. Nerve ring encircling isthmus anterior to bulb, 0.138–0.144 from anterior extremity; distance of excretory pore from anterior extremity 0.816–0.830. Two thin parallel ovaries extending along almost whole body length originate at level of oesophageal bulb and end at level of rectum. Uterus filled with many eggs; fully mature eggs containing larvae present only in region near posterior end of body. Vulva postequatorial, 1.59 from anterior end of body; vulvar lips not elevated. Vagina short, directed posteriad. Mature eggs oval, thin-walled, smooth, operculated at one pole; operculum small, its diameter 0.030–0.039; diameter of operculum less than half of maximum width of egg. Size of eggs 0.180–0.216 \( \times 0.084–0.102 \). Mature egg containing fully formed larva. Tail conical, sharply pointed, 0.147–0.156 long; tail tip separated from rest of tail by cuticular constriction.

Host: Pseudocurimata elegans elegans (Steindachner), local name “sairû” (Curimatidae).
Site of infection: intestine.

Comments: – The morphology and measurements of two available female specimens correspond, more or less, to the original description of this species given by Pereira (1938). However, in the original description, cephalic papillae were not
noted and eggs were smaller (0.164–0.169 × 0.074–0.082 mm); only more advanced eggs were measured in our study. Egg filaments were not observed by us, but since only stained nematode specimens mounted in Canada balsam were studied, their presence cannot be excluded; it was also the reason why lateral cuticular alae were not observed, although these were described by Pereira (1938). The observed cuticular constriction at the tail tip, observed in both specimens of the present material, was not mentioned in the original description.

Travnema travnema was originally described by Pereira (1938) from Pseudocurimata elegans from north-eastern Brazil (Lakes Porangaba, Soure and Tauape, Fortaleza, CE) and later it was recorded from Pseudocurimata elegans, P. gilberti and P. plumbea from the River Mogi Guassu, Pirassununga, State São Paulo, by Kohn et al. (1985) and Kohn and Fernandes (1987). The present record is the first in the Paraná River.

**Description:** Medium sized, whitish nematodes. Cuticle tranversely striated, striae on anterior end of body distinctly shorter than those in middle part. Head end rounded, with four small cephalic papillae. Buccal capsule large, well sclerotized. Oesophagus short, consisting of strongly developed, very short pharyngeal part and longer posterior part bulbously inflated at its posterior half; oesophagus opening into intestine through large valve. Nerve ring encircling posterior part of oesophagus at its anterior end. Excretory pore situated far behind posterior end of oesophagus. Tail conical, sharply pointed.

**Male** (1 specimen): Body 2.35 long and 0.204 wide. Cuticular rings on anterior and middle parts of body 0.006 and 0.009 long, respectively. Buccal capsule well developed, 0.015 long, 0.027 wide; teethless at bottom. Entire oesophagus 0.249 long; pharyngeal part 0.093 long, 0.060 wide; narrow part of oesophagus (isthmus) 0.081 long, 0.048 wide; bulb without sclerotized apparatus, 0.075 long, 0.075 wide. Nerve ring encircling isthmus, 0.147 from anterior extremity; distance of excretory pore 0.66 from anterior extremity. Spicule one, well sclerotized, 0.063 long. Gubernaculum absent. Only one pair of subventral postanal papillae observed, at mid-length of tail, 0.084 posterior to cloacal opening. Small genital cone, 0.015 high. Tail conical, pointed, 0.219 long.

**Female** (5 specimens; measurements of one non-gravid specimen in parentheses): Body 4.62–5.78 (2.94) long and 0.367–0.490 (0.258) wide. Buccal capsule large, 0.015–0.018 (0.015) long × 0.042–0.048 (0.051) wide; one large, dorsal conical tooth, 0.006–0.009 (0.006) long at bottom of capsule. Entire oesophagus 0.345–0.396 (0.375) long; pharyngeal part 0.126–0.141 (0.138) long, 0.096–0.102 (0.093) wide; isthmus 0.081–0.108 (0.123) long, 0.063–0.066 (0.060) wide; bulb 0.129–0.159 (0.114) long, 0.111–0.135 (0.105) wide; without sclerotized apparatus. Nerve ring and excretory pore 0.183–0.204 (0.189) and 1.06–1.40 (0.90), respectively, from anterior extremity. Two thin parallel ovaries extending along almost whole body length, initiate somewhat posterior to level of oesophagus end and end at level of rectum. Uterus gravid with many eggs; fully mature eggs containing larvae present only in postvulvar region. Vulva somewhat preequatorial, 2.05–2.76 (1.48) from anterior end of body; vulvar lips not elevated. Vagina short. Mature egg thin-walled, elongate, distinctly broader on operculated pole; operculum conspicuously large, with diameter 0.060–0.072, almost as wide as egg. Size of eggs 0.225–0.255 × 0.069–0.090. Mature egg containing fully formed larva. Tail conical, sharply pointed, 0.201–0.270 (0.240) long.

**Host:** *Pseudocurimata gilberti* (Quoy et Gaimard), local name “sairú” (Curimatidae).

**Site of infection:** intestine.

**Locality:** Paraná River – Guaira.

**Comments:** – Fernandes et al. (1983) described *Travnema araujoi* from the intestine of *Pseudocurimata gilberti* from the reservoir of Ilha Solteira, São Paulo, Brazil. The authors distinguished it from the type species, *T. travnema*, by the
generally greater measurements of the body, various organs and eggs and by the presence of two pairs (one preanal and one postanal) of caudal papillae in the male. The species has not been recorded since.

Fig. 5. Travnema araujoi Fernandes, Campos et Artigas, 1983. A – lateral view of female; B – buccal capsule of female; C – buccal capsule of male; D – anterior end of female; E – anterior end of male; F – egg; G – female tail; H – posterior end of male.
The present material of *T. araujoi* included only permanent preparations in Canada balsam and, therefore, it was not possible to study certain features. Nevertheless, some important morphological characters, not mentioned in the original description, were revealed. A more detailed comparison of *T. araujoi* and *T. travnema* is now possible. In addition to biometrical differences, a large tooth in the buccal capsule of *T. araujoi* females is present (absent in *T. travnema*) and a much shorter anterior pharyngeal portion of the oesophagus in relation to its posterior part appears characteristic of *T. araujoi* (both portions are almost equal in *T. travnema*). In addition to the pair of postanal papillae of *T. araujoi* males, Fernandes et al. (1983) also reported a pair of preanal papillae that were not observed in our material. The longer eggs of *T. araujoi* are distinctly broader at the opercular end and the operculum is conspicuously larger (Fig. 5 F) compared to the ovoid eggs of *T. travnema* (Fig. 4 E). Egg filaments were not observed in *T. araujoi* that were, however, inspected only within the cleared nematode body; their existence cannot be dismissed. The vulva is relatively preequatorial in *T. araujoi* and postequatorial in *T. travnema*.

6. *Cosmoxynema vianai* Travassos, 1949

**Description of female** (3 gravid specimens): Small nematodes with distinct transverse striation of cuticle. Body 3.92–4.76 long and 0.299–0.394 wide. Cuticular rings at middle part of body 0.012–0.018 long. Anterior end of body rounded, oral opening simple, surrounded by four small cephalic papillae. Large, thick-walled, well sclerotized buccal capsule 0.018–0.024 long × 0.033–0.039 wide; bottom of capsule armed with three conical teeth 0.004–0.006 high. Oesophagus divided into long anterior portion with posterior half conspicuously expanded and posterior bulboid portion, with sclerotized apparatus, that opens into intestine through small valve. Entire oesophagus 0.498–0.564 long; anterior portion 0.378–0.429 long × 0.048–0.051 wide at anterior half, 0.108–0.120 at posterior half; bulb 0.120–0.135 long and 0.135–0.147 wide. Nerve ring encircling oesophagus 0.219–0.233 from anterior extremity. Excretory pore somewhat posterior to posterior end of oesophagus and slightly anterior to vulva, 0.680–0.952 from anterior end of body. Vulva in anterior part of body, 0.816–1.156 from anterior extremity; vulvar lips not elevated. Vagina directed posteriorly. Position of ovaries and uterus not certain. Uterus contains many eggs in posterior half of body. Eggs elongate, thin-walled, with one end somewhat broader than opposite one; broader end with oblique operculum (diameter 0.024–0.030), narrower end with one or more polar filaments; length of filaments not established. Size of eggs 0.165–0.174 × 0.033–0.042. Tail conical, sharply pointed, 0.165–0.462 long.

**Male:** unknown.

Host: *Pseudocurimata giberti giberti* (Quoy et Gaimard), local name “sairú” (Curimatidae).

Site of infection: intestine.

Comments: This species was described by Travassos (1949) from the intestine of *Pseudocurimata gilberti* from Brazil (R. Barra Seca and L. Juparanã, State Espirito Santo) who had established a new genus *Cosmoxyynema* to accommodate it. Later Vicente et al. (1985) also listed *Curimata (= Pseudocurimata)* sp. as its host and gave another locality, the R. Moggi Guassu, State São Paulo.

Fig. 6. *Cosmoxyynema vianai* Travassos, 1949, female. A – lateral view; B – anterior end of body; C – head end; D – tail; E – egg.
The original description of *Cosmoxychema vianai* was based solely on female specimens and some morphological features (presence of cephalic papillae, position of excretory pore) were not reported or were inadequately described (eggs). Since the males of *C. vianai* were not known and female morphology was incomplete, the status of *Cosmoxychema* was considered uncertain by various authors. Travassos (1949) and Skryabin et al. (1961) listed it in the family Cosmocercidae; Yamaguti (1961) placed it in Oxyuridae, subfamily Cosmocercinae; Vincente et al. (1985) listed it in Oxyuridae. Petter and Quentin (1976) discussed *Cosmoxychema* Travassos, 1949 and *Cosmoxychemoides* Travassos, 1949 with the family Pharyngodonidae but considered them of doubtful status and excluded them from the key to genera of this family.

The present material consisted of only three females. Since all these specimens were stained and mounted in Canada balsam, lateral cuticular alae were not observed (described in the original description); but, some previously undescribed characters (cephalic papillae, excretory pore) were, however, found. Eggs were studied only within the cleared nematode body; it was possible to observe a well-developed operculum on one egg pole and filaments on the opposite pole; the filaments are probably thread-like, long, but only their basal parts were visible (see Fig. 6 E).

The observed general morphology of females and especially the structure of eggs show close affinities of *C. vianai* to members of Pharyngodonidae and, therefore, we are listing it within this family. Characteristic features of *Cosmoxychema* distinguishing it from other species of Pharyngodonidae include the presence of a large, well sclerotized buccal capsule and the structure of eggs.

7. *Cosmoxychemoides aguirrei* Travassos, 1949  

**Description of female** (5 gravid specimens): Small nematodes with distinct transverse striation of cuticle. Body 2.99–3.36 long and 0.258–0.326 wide; cuticular rings at middle part of body 0.009 long. Anterior end of body obtuse, oral opening simple, surrounded by four cephalic papillae. Buccal capsule absent; mouth depressed, forming spacious buccal cavity 0.006 long × 0.009–0.012 wide. Oesophagus divided into longer anterior portion with inflated posterior half and posterior bulboid portion with sclerotized apparatus and opening into intestine through small valve. Entire oesophagus 0.396–0.484 long; anterior portion 0.279–0.321 long × 0.036 wide at anterior half, 0.087–0.108 at posterior half; bulb 0.105–0.114 long × 0.108–0.135 wide. Nerve ring encircling oesophagus 0.162–0.174 from anterior extremity. Excretory pore somewhat posterior to posterior end of oesophagus and somewhat anterior to vulva, 0.653–0.680 from anterior end of body. Vulva in anterior half of body, 0.830–0.884 from anterior extremity; vulvar lips not elevated. Vagina directed posteriorly. Ovaries coiled near vulva; their thin, long distal parts extend in posterior half of body. Uterus of uncertain shape, contains many eggs in posterior half of body occasionally extend-
ing into tail. Eggs elongate, thin-waled, with relatively broader end having oblique operculum (diameter 0.024–0.030); narrower end with one 0.300 long, wide filament of fibrous structure. Size of eggs 0.183–0.198 × 0.033–0.045. Tail conical, 0.360–0.394 long, tapering posteriorly to sharp spike.

**Male**: unknown.

**Host**: *Pseudocurimata giberti* giberti (Quoy et Gaimard), local name “sairú”, and *P. elegans elegans* (Steindachner), “sairú” (Curimatidae).

**Site of infection**: intestine.

**Locality**: Paraná River – Guaira.

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**Fig. 7.** *Cosmoxynemoides aguirrei* Travassos, 1949, female. A – lateral view; B – anterior end of body; C – head end; D – tail; E – egg.
Comments: – Travassos (1949) described only *Cosmobynemoides aguirrei* females from *Pseudocurimata gilberti* and *Geophagus brasiliensis* from Brazil (R. Barra Seca and L. Juparanã, State Espírito Santo). Later it was also reported from *Curimata* (= *Pseudocurimata*) sp. in the R. Moggi Guassu, State São Paulo by Vicente et al. (1985) and from *P. gilberti* in the same locality by Kohn and Fernandes (1987).

The present material consisted of five females mounted in Canada balsam; four from *Pseudocurimata gilberti* and one from *P. elegans*. It was not possible to observe lateral cuticular alae mentioned in the original description. We, however, found, for the first time, the presence of cephalic papillae, excretory pore, and an operculum and a filament on the egg. The genera *Cosmobynemoides* and *Cosmobynema* are apparently closely related, differing by the absence or presence of a sclerotized buccal capsule. Differences between *C. aguirrei* and *C. vianai* females are found also in the shape of the anterior portion of the oesophagus, shape of the tail and in egg sizes. It is apparent from this study that *Cosmobynemoides* should also be listed in the family Pharyngodonidae.

*Pseudocurimata elegans* represents a new host record.

8. *Ichthyouris laterifilamenta* sp. n. Figs. 8–11


Male (10 specimens; measurements of holotype in parentheses): Body including tail spike 1.16–1.44 (1.39) long and 0.082–0.109 (0.109) wide. Lateral alae narrow, 0.006 (0.006) wide, extending from level of mid-length of oesophageal corpus to level anterior to cloacal opening. Oesophagus including bulb 0.231–0.264 (0.237) long; corpus 0.165–0.186 (0.168) long × 0.018–0.024 (0.021) wide; isthmus 0.012–0.015 (0.012) long × 0.015 (0.015) wide; bulb 0.054–0.063 long × 0.048–0.057 (0.057 × 0.048) wide. Nerve ring encircling oesophagus approximately at mid-length of corpus, 0.111–0.135 (0.135) from anterior extremity. Excretory pore well posterior to end of oesophagus, 0.375–0.456 (0.414) from anterior end of body. Tail with relatively short, wide membranous lateral caudal alae not supported by caudal papillae, extending from level of preanal papillae to level of large postanal papillae; alae 0.012–0.015 (0.015) long. Single, slightly sclerotized spicule 0.036–0.045 (0.036) long. Distinct small genital cone present. Genital papillae represented by one pair of large, elongate subventral preanal
papillae and two pairs of papillae situated approximately at level of cloacal opening; latter papillae consist of one pair of large, very long (length 0.021) subventral papillae with somewhat narrowed ends and one pair of small ventral

Fig. 8. *Ichthyouris laterifilamenta* sp. n., female. A, B – anterior end of gravid female, lateral and dorsal views; C, D – head end, lateral and apical views; E – lateral view; F – vulva region; G – region of anus, ventral view; H, I – tail of female, lateral and ventral views.
papillae at each side of cloacal opening. Pair of minute phasmids somewhat posterior to posteriormost pair of long papillae. Tail gradually narrowing posteriorly behind posteriormost pair of long papillae to form slender caudal spike; tail including caudal spike 0.063–0.087 (0.087) long.

**Female** (10 gravid specimens; measurement of allotype in parentheses): Body including tail spike 2.56–3.33 (0.218) long and 0.190–0.299 (0.218) wide. Lateral alae 0.012 (0.012) wide, extend approximately from level of mid-distance between nerve ring and anterior end of oesophagus to short distance anterior to anal

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**Fig. 9. Ichthyouris laterifilamenta** sp. n. A – posterior end of male, ventral view; B, C – posterior end of male, lateral and ventral views; D – cloaca region of male, ventral view: E – immature egg; F, G – fully mature egg.

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opening; posterior ends of alae gradually narrowing. Oesophagus including bulb 0.441–0.501 (0.477) long; corpus 0.345–0.387 (0.372) long × 0.039–0.048 (0.045) wide; isthmus 0.009–0.012 (0.012) long × 0.027–0.033 (0.030) wide; bulb 0.087–0.105 × 0.090–0.114 (0.093 × 0.099). Nerve ring encircles oesophagus anterior to middle of corpus, 0.159–0.168 (0.159) from anterior extremity. Excretory pore well posterior to posterior end of oesophagus, 0.625–0.707 (0.707) from anterior end of body. Vulva preequatorial, 0.857–0.938 (0.911) from anterior end. Vagina pointing first anteriorly and then posteriorly. Uterus prodelpic, posterior to vulva; both ovaries at level of vulva. Uterus containing numerous oval, thin-walled eggs, 0.117–0.138 × 0.051–0.069 (0.123–0.138 × 0.060–0.069) in size; each

Fig. 10. *Ichthyouris laterifilamenta* sp. n. – head end of female, dorsal view (× 340); B, C – mature egg (× 470).
egg bears many long (about 0.140), thread-like filaments on lateral side closer to operculum. Fully developed eggs (containing larvae) with distinct subapical operculum at one pole. Tail including slender caudal spike 0.480–0.600 (0.510) long; minute lateral phasmids situated at end of broader anterior part of tail; tail spike 0.414–0.495 (0.447) long.

Fig. 11. Ichthyouris laterofilamenta sp. n., SEM micrographs. A – head end of female (× 520); B – head end, apical view (× 1,360); C – egg with lateral filaments (× 740); D – excretory pore (× 4,260); E – egg operculum (× 2,200).
Type host: *Trachydoros paraguayensis* (Eigenmann et Ward), local name “armadinho” (Doradiidae).

Site of infection: intestine.

Type locality: Reservoir of the hydroelectric power station of Itaipu – Foz do Iguaçu (24°20’ S, 52°38’ W), State Paraná, Brazil (23 April–3 May 1991).

Deposition of types: Institute of Parasitology, CAS, České Budějovice (holotype, allotype, para-types: N – 581); Instituto Oswaldo Cruz, Rio de Janeiro (paratypes 32.925).

Etymology: The specific name “laterifilamenta” describes a characteristic feature of this species, i.e. the presence of lateral filaments on eggs.

Comments: – At present the genus *Ichthyouris* Inglis, 1962 comprises two species, both described from South-American freshwater fishes: *I. ro* Inglis, 1962 from *Cichlasoma festivum* from British Guiana and *I. brasiliensis* Moravec, Kohn et Fernandes, 1962 from *Pterygoplichthys aculeatus* from Brazil (Inglis 1962, Moravec et al. 1992). Nematodes of the present material differ considerably from both of these two species. *I. laterifilamenta* sp. n. differs from *I. ro* mainly in the shape of the oral opening (triangular vs. hexagonal) and cephalic papillae (elongate vs. spherical), presence of egg filaments, and in the structure of the male tail (absence of a pair of massive, strongly cuticularized plate-like structures near the cloacal opening, caudal alae not exceeding posteriorly large postanal papillae). It is easily distinguished from *I. brasiliensis* by the markedly elongate cephalic papillae (vs. almost spherical), absence of lateral caudal spines in females, presence of lateral egg filaments, and by the fact that the two last pairs of male genital papillae are located at level of the cloacal opening (vs. markedly postanal).


Host: *Pterygoplichthys aculeatus* (Perugia), local name “cascudo-abacaxi” (Loricariidae).

Site of infection: intestine.


Comments: – This species has already been discussed by Moravec et al. (1992).


Host: *Pimelodella lateristriga* (Müller et Troeschel), local name “mandi-chorão” (Pimelodidae).

Site of infection: intestine.


Comments: – This species has already been discussed by Moravec et al. (1992).


Host: *Rhinelepis aspera* Spix, local name “cascudo-preto” (Loricariidae).

Site of infection: intestine.


Comments: – This species has already been discussed by Moravec et al. (1992).

**COSMOCERCOIDEA**

Fam. Atractidae Travassos, 1919

**Description:** Medium-sized nematodes, cuticle smooth. Very narrow lateral alae present at cervical region. Deirids small, slightly anterior to level of oesophageal bulb. Head end rounded, oral opening roughly triangular or hexagonal (depending on contraction), surrounded by six ridges radiating from mouth margin. Mouth surrounded by three bilobed lips; mouth papillae small, arranged in two circlets, each circlet consisting of four papillae; two small, elongate lateral amphids present. Oesophagus consists of dilated oesophageal corpus, isthmus and valved bulb; anterior end of oesophagus triradiate, forming short “pharynx”. Nerve ring slightly posterior to posterior end of oesophageal corpus, excretory pore posterior to oesophagus.

**Male** (7 specimens): Body 3.88–8.05 long and, 0.109–0.326 wide. Lips 0.006–0.015 long. Anterior part of oesophagus (corpus) 0.192–0.476 long × 0.030–0.095 wide; “pharynx” 0.006–0.021 long. Posterior part of oesophagus including bulb 0.326–0.396 long, bulb 0.063–0.122 long; 0.033–0.068 wide at anterior narrow part, 0.060–0.109 at bulb. Nerve ring and excretory pore 0.270–0.558 and 0.43–1.16, respectively, from anterior extremity. Tail conical, slender, 0.558–0.857 long, sharply pointed. Caudal papillae: 3 pairs of preanal and 4 pairs of postanal subventral papillae present; additional 3 pairs of lateral papillae present, one of them being analanal and two postanal. Small median, unpaired protuberance on anterior cloacal lip. Spicules unequal and dissimilar, large spicule 0.192–0.240 long, small spicule 0.096–0.126 long. Gubernaculum simple, 0.060–0.069 long.

**Female** (5 gravid specimens): Body of gravid 6.79–9.91 long and 0.326–0.530 wide. Lips 0.015 long. Anterior part of oesophagus (corpus) 0.462–0.517 long × 0.095–0.109 wide; “pharynx” 0.015 long. Posterior part of oesophagus including bulb 0.326–0.503 long, bulb 0.109–0.150; width of anterior narrow part 0.054–0.068, of bulb 0.060–0.109. Nerve ring and excretory pore 0.530–0.585 and 1.12–1.22, respectively, from anterior extremity. Tail conical, slender, 1.16–1.32 long, sharply pointed. Vulva opening into rectum; vagina short; uterus contains gradually developing eggs and free larvae 0.054–0.075 wide; ovary one, in middle third of body.

**Hosts:** *Pterodoras granulosus* (Valenciennes), local name “armado”, and *Trachyodoras paraguayensis* (Eigenmann et Ward), local name “armadinho” (both Doradidae); only 2 juvenile female nematodes found in the latter.

**Site of infection:** intestine.

**Localities:** Paraná River – Foz do Iguacú and the reservoir of the hydroelectric power station of Itaipu – Foz do Iguacu.

**Comments:** Although this species has been described by several authors (Travassos 1920, Travassos et al. 1928, Baylis 1936, Costa 1963, Santos et al. 1979, Hamann 1982a), the present study shows that some important morphological features were inadequately described or overlooked. These include the structure of oral features, presence of deirids and cervical cuticular alae and the
Fig. 13. *Rondonia rondoni* Travassos, 1920. A – anterior end of female (× 100); B – head end (× 390); C – anus and vulva region of female (× 375); D, E – head end, apical view (D – with triangular mouth opening, E – with mouth opening appearing as hexagonal) (× 770); F – mouth opening (× 2,080); a – amphid, ip – inner papilla, op – outer papilla; G – male caudal papilla of first lateral pair (× 6,250); H – excretory pore (× 1,980); I – male caudal papilla of last lateral pair (× 6,250).
number and arrangement of caudal papillae in the male. In spite of these differences, we consider the nematodes of the present material to belong to this species. This is supported by the fact that *Pterodoras granulosus*, in which all adult specimens were found, is one of the most frequent hosts of *R. rondoni* in the same river basin (see e.g. Travassos et al. 1928, Hamann 1982b). We recorded it from all 7 *P. granulosus* specimens examined, with the intensity of infection 1–1000 (average 177) nematodes per fish. Hamann (1982b) reported *R. rondoni* from 96% of *P. granulosus* examined from the middle reaches of the Paraná River in Argentina where the intensity was up to 120,000 nematodes per fish. High intensities of *R. rondoni* infection were also reported from other fish species, e.g., Kohn et al. (1985) recovered thousands of this nematode from the intestine of two of four *Colossoma mitrei* examined from ponds in Pirassununga, Brazil.

*Rondonia rondoni* was reported from different river systems from Brazil (Travassos 1920, 1945, Travassos et al. 1928, 1939, Costa 1962, 1963, Travassos and Kohn 1965, Santos et al. 1979, Kohn et al. 1985, Kohn and Fernandes 1987), Paraguay (Masi Pallares et al. 1973) and Argentina (Hamann 1982a, b); in the Paraná River it was recorded by Travassos (1945) and Hamann (1982a, b). It was found to parasitize fishes of the families Characidae (*Colossoma bidens*, *C. brachypomum*, *C. mitrei*, *Myletes torquatus*, *Myletes* sp., *Myloplus asterias*, *Salminus* sp.), Doradidae (*Doras brunescens*, *Pterodoras granulosus*) and Pimelodidae (*Pimelodus clarias*, *Luciopimelodus pati*, *Zungaro zungaro*). *Trachydroras paraguayensis* represents a new host record.

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TRAVASSOS L., FREITAS J. F. T., LENT H. 1939: Relatório da excursão científica do Instituto Oswaldo Cruz realizada na zona da Estrada de Ferro Nordeste do Brasil, em outu-
A NOTE ON COMPATIBILITY OF CZECHOSLOVAK POPULATIONS OF CULEX PIPIENS S. L.

All the members of the Culex pipiens complex are theoretically compatible (i.e., crossing of all members can give a fertile progeny). However, some populations show either a partial or a total incompatibility (Laven H. 1967 in Wright and Paal (Eds.), Genetics of insect vectors of disease, Elsevier, Amsterdam, pp. 251–275.) The incompatible or semicompatible populations may often be of a near geographical origin (Magnin et al. 1987: Genetica 74: 125–130). Incompatibility is caused by various strains of the intracellular symbiont Wolbachia pipiensis (Yen J. H. and Barr R. A. 1984 in PalR. and Whitten M. S. (Eds.), The use of genetics in insects control, Elsevier, North Holland, pp. 97–118, Rousset F. and Raymond M. 1991: TREE, 6: 54–57 and many others). The epidemiological importance of this phenomenon becomes clear when the vectorial capacity of particular members of the complex is compared. C. quinquefasciatus belongs to epidemiologically the most dangerous species, while the epidemiological importance of C. pipiens s. str., and especially, C. molestus, is negligible, especially in temperate zones. The study of the compatibility of various populations can be interesting for two reasons:

1. The possibility of suppressing target species populations by introduction of specimens, the hybrids of which are not viable.
2. Danger of extension of epidemiologically important populations outside of their original region (e.g. by plains) and infiltration of genes responsible for vector ability to indigenous populations.

Four laboratory and one wild strain of C. pipiens complex were crossed with each other in the laboratories of the Institute of Parasitology, Czechoslovak Academy of Sciences. For rearing and experiments, plexiglass boxes 25 × 40 × 40 cm were used (Oljejníček, in press). Each crossing was initiated with 20 virgin specimen of each sex (= 20 pairs of parental generation). A laboratory mouse was offered to mosquito females as the source of blood. The following strains were used for experiments:

1. C. molestus, laboratory strain, parental generation originated from České Budějovice, Bohemia, Czechoslovakia (CmB)
2. C. molestus, laboratory strain, parental generation originated from Mosul, Iraq, (CmM)
3. C. quinquefasciatus, laboratory strain, parental generation from Pondicherry, India (CqI)
4. C. quinquefasciatus, laboratory strain, parental generation from Cuba (CqC)
5. C. pipiens s. str., wild population, adults used in experiment were reared from larvae captured in the field in České Budějovice (CpB).

The adults in all the boxes were observed for copulation. In all the experimental groups, copulation was observed in more than one pair during the first day. No differences were observed in precopulatory behavior between those kept in different experimental conditions. The attempts of rearing Culex pipiens s. str. in our laboratory have so far failed. The main reason was that females refused to suck blood in the laboratory not only on mice but also on pigeons and chickens. It is interesting that when the females of