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Rhabdochona mexicana sp. n. (Nematoda: Rhabdochonidae) from the intestine of characid fishes in Mexico

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Abstract. A new nematode, *Rhabdochona mexicana* sp. n., is described based on specimens recovered from the intestine of two species of fishes, *Astyanax mexicanus* (De Filippi) (type host) and *Astyanax fasciatus* (Cuvier) (Characidae: Characiformes) in central Mexico. This species is characterised by the following characters: 10 anteriorly directed teeth in the prostom, a larger (left) spicule which is slender in form with a small bifurcation at its distal tip covered by a cuticular membrane, a smaller (right) spicule without a barb at its distal tip, eggs bearing an irregular flock-like coating, and a conical tail without a cuticular spike (in both sexes).

In America, 19 *Rhabdochona* Railliet, 1916 species have so far been reported from the intestine of freshwater fishes (16 in North America, 1 in West Indies and 2 in South America). Three species and subspecies of *Rhabdochona* have so far been reported from fresh waters in Mexico: *Rhabdochona kidderi kidderi* Pearse, 1936 from *Rhamdia guatemalensis* (Günther), *Ogilbia pearsei* (Hubbs), and *Gambusia yucatana* Regan in cenotes (=sinkholes), cave waters and other water bodies in Yucatán; *R. kidderi texensis* Moravec et Huffman, 1988 from *Cichlasoma fenestratum* (Günther) and *C. urophthalmus* (Günther) from Yucatán and from Catemaco Lake, Veracruz; *R. lichtenfelsi* Sánchez-Alvarez, García-Prieto et Pérez-Ponce de León, 1998 from *Goodea atripinnis* Jordan, *Alloophorus robustus* (Bean) and *Neoophorus diazi* (Meek) in Pátzcuaro and Cuitzeo Lakes (Moravec 1998).

Recent investigations into helminth parasites of freshwater fishes, carried out by the research teams of the Institute of Biology, National Autonomous University of Mexico (UNAM) and the Centre for Biological Research, Autonomous University of Morelos State, in several river drainage systems in central Mexico, revealed the presence of a new species of *Rhabdochona*, which is described below.

MATERIALS AND METHODS

The nematodes studied were recovered from the intestine of *Astyanax mexicanus* (De Filippi) from four localities (Estorax, El Oasis, Fracción de Sánchez and El Rascón) in the Panuco River drainage system in central Mexico, collected from May to November 1996 and that of *Astyanax fasciatus* (Cuvier) from four localities (Cuyotepeji, Petlalcingo, San Agustín Atenango and Petatlán) in the Balsas River drainage system in central Mexico, collected from July to October 1998.

The nematodes were fixed in hot 4% formaldehyde and cleared with glycerine for examination. Drawings were made with the aid of an Aristoplan microscope drawing attachment. After examination, the specimens were stored in 70% ethanol. All measurements are given in millimetres unless otherwise stated. Type specimens have been deposited in the National Helminthological Collection of the Institute of Biology, National Autonomous University of Mexico (UNAM) in Mexico City and in the Helminthological Collection of the Institute of Parasitology, Academy of Sciences of the Czech Republic (ASCR), in České Budějovice.

RESULTS

Rhabdochona mexicana sp. n. Figs. 1, 2

Description: Medium sized nematodes with smooth cuticle. Oval mouth opening surrounded by four minute cephalic papillae and two lateral amphids. Prostom funnel-shaped, wide, with basal teeth, anterior margin of prostom armed internally with 10 teeth (exceptionally 11) (3 dorsal, 3 ventral and 2 lateral on each side) (Fig. 2A-C). Vestibule relatively long. Small deirids bifurcate (Fig. 2 D), situated short distance posterior to prostom. Tail of both sexes conical, with rounded end, without terminal spike (Fig. 2 E).

Male (based on 20 specimens from *A. mexicanus* and 3 specimens from *A. fasciatus*; measurements of holotype in parentheses): Length of body 4.55-9.23 (8.71), maximum width 0.079-0.188 (0.151). Prostom

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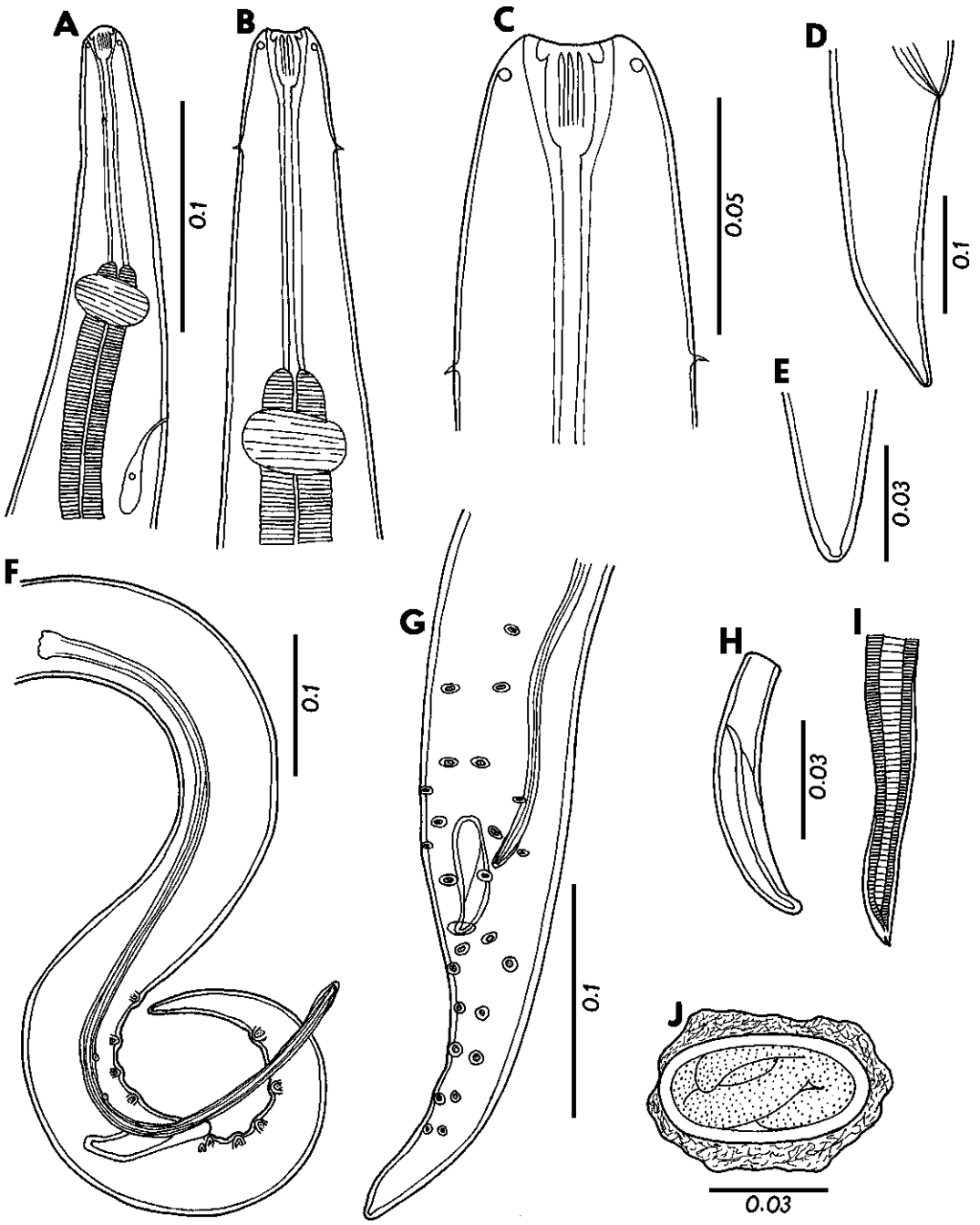

Fig. 1. *Rhabdochona mexicana* sp. n. **A** – anterior end of male, lateral view; **B** – anterior end of female, ventral view; **C** – cephalic end of female, ventral view; **D** – female tail; **E** – tail tip of male; **F, G** – posterior end of male, lateral and ventral views; **H** – right spicule; **I** – distal end of left spicule; **J** – egg. Scale bars in mm.

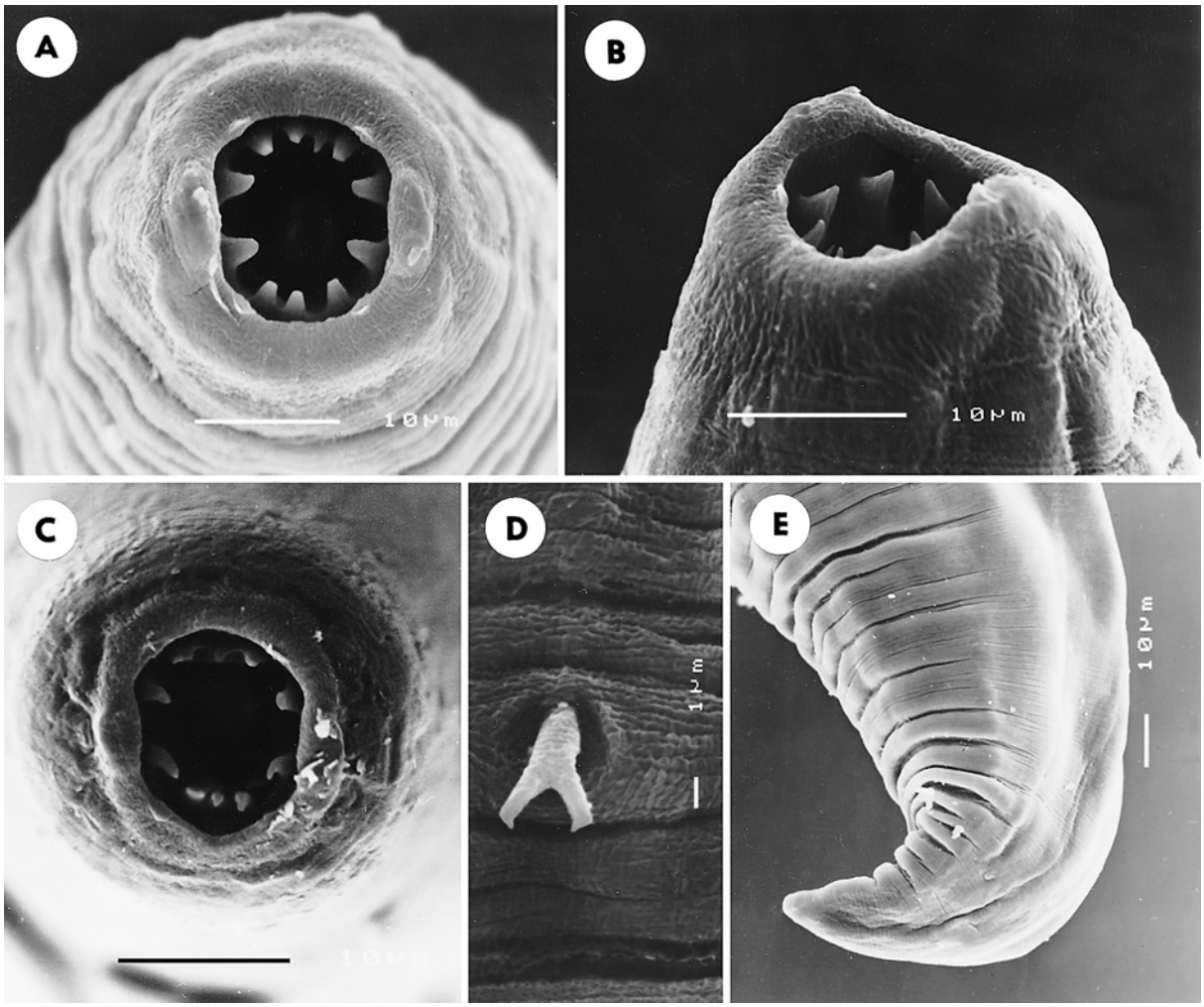

Fig. 2. *Rhabdochona mexicana* sp. n., SEM micrographs. **A** – cephalic end, apical view (specimen from *Astyanax fasciatus* with atypical number of teeth); **B** – anterior end, ventrolateral view; **C** – cephalic end, apical view (specimen from *Astyanax mexicanus*); **D** – deirid; **E** – female tail. Scale bar: C = 10 µm.

0.019-0.026 (0.023) long and 0.013-0.023 (0.019) wide. Length of vestibule including prostom 0.115-0.161 (0.151), of muscular oesophagus 0.184-0.280 (0.277), of glandular oesophagus 1.50-4.55 (2.93). Nerve ring, excretory pore and deirids 0.135-0.188 (0.171), 0.204-0.306 (0.264) and 0.039-0.059 (0.046), respectively, from anterior extremity. Subventral preanal papillae: 3 or 4 papillae on one side and 5 papillae on the other side. Additional two pairs of lateral preanal papillae present between first, second and third subventral preanal pairs (counting from cloacal opening). Postanal papillae: six pairs; second pair lateral, remaining pairs subventral. Area rugosa absent. Larger (left) spicule 0.468-0.587 (0.534) long, length of its shaft 0.138-0.178 (0.158) (representing 26-37% (32%) of whole spicule length); distal tip reduced, ending in a small bifurcation covered by narrow membrane. Smaller (right) spicule 0.082-0.108 (0.102) long, without dorsal barb. Length ratio of spicules 1 : 5.2-6.9 (5.2). Tail conical, 0.165-0.217 (0.217) long.

Female (based on 20 specimens from *A. mexicanus* and 5 specimens from *A. fasciatus*; measurements of allotype in parentheses): Length of body of gravid specimens 8.90-18.18 (17.17), maximum width 0.155-0.300 (0.290). Prostom 0.023-0.033 (0.033) long and 0.019-0.026 (0.019) wide. Length of vestibule including prostom 0.102-0.234 (0.184), of muscular oesophagus 0.214-0.425 (0.356), of glandular oesophagus 2.40-5.41 (4.38). Nerve ring, excretory pore and deirids 0.165-0.250 (0.204), 0.250-0.359 (0.300), and 0.052-0.075 (0.075), respectively, from anterior extremity. Tail conical, 0.101-0.224 long. Vulva postequatorial, 4.96-10.89 (9.99) from anterior end of body. Muscular vagina directed posteriorly. Uterus not reaching level of posterior end of oesophagus anteriorly. Size of mature (larvated) eggs 0.036-0.039 × 0.019 mm; surface of eggs with fine, irregular flock-like coating.

T y p e h o s t : *Astyanax mexicanus* (De Filippi) (Characidae: Characiformes).

O t h e r h o s t : *Astyanax fasciatus* (Cuvier).

S i t e o f i n f e c t i o n : Intestine.

T y p e l o c a l i t y : River near the village of Estorax (21°02'28"N, 99°46'57"W), Mexico.

O t h e r l o c a l i t i e s : El Oasis Brook (21°00'02"N, 99°42'43"W), brook near the village of Fracción Sánchez (21°40'05"N, 100°41'11"W) and El Rascón River (22°00'04"N, 99°15'01"W) in the Panuco drainage system; brook near the village of Cuyotepeji (17°57'35"N, 97°41'06"W), brook near the village of Petlalcingo (18°04'35"N, 97°55'29"W), brook near the village of San Agustín Atenango (17°39'03"N, 98°06'49"W) and brook near the village of Petatlán (17°35'31"N, 99°00'27"W) in the Balsas drainage system; Mexico.

P r e v a l e n c e a n d i n t e n s i t y : *A. mexicanus*: River near the village of Estorax: 59% (32 fishes infected / 54 fishes examined), 1-6 (mean 2) nematodes per infected fish in May; El Oasis Brook: 58% (7 / 12), 1-7 (mean 3) in May and 67% (25 / 37), 1-12 (mean 2) in November; brook near the village of Fracción de Sánchez: 22% (11 / 49), 1-8 (mean 3) in October; El Rascón River: 5% (1 / 21), 1 in November. *A. fasciatus*: brook near the village of Cuyotepeji: 18% (2 / 11), 1-2 (mean 1.5); brook near the village of Petlalcingo: (1 / 9), 1; brook near the village of San Agustín Atenango: 53% (8 / 15), 1-2 (mean 1.5); brook near the village of Petatlán: 50% (1 / 2), 1.

D e p o s i t i o n o f s p e c i m e n s : Holotype, allotype and paratypes in the Institute of Biology, UNAM, in Mexico City (Cat. Nos. 3886, 3887, 3888) and paratypes in the Institute of Parasitology, ASCR, in České Budějovice (Cat. No. N-758).

E t y m o l o g y : The specific name is derived from the name of the country of origin.

DISCUSSION

Nematodes of the genus *Rhabdochona* are widely distributed intestinal parasites of freshwater fishes (Moravec and Coy Otero 1987, Moravec 1994). According to Sánchez-Alvarez et al. (1998), 97 nominal species have so far been described. Twenty one species and subspecies have been reported from America: *Rhabdochona acuminata* (Molin, 1860), *R. californiensis* Maggenti, Abdel-Rahman et Del Prado, 1992, *R. canadensis canadensis* Moravec et Arai, 1971, *R. canadensis bifilamentosa* Moravec et Huffman, 1988, *R. cascadilla* Wigdor, 1918, *R. catostomi* Kayton, Kritsky et Tobias, 1979, *R. cotti* Gustafson, 1949, *R. cubensis* Moravec et Coy Otero, 1987, *R. decaturensis* Gustafson, 1949, *R. kidderi kidderi* Pearse, 1936, *R. kidderi texensis* Moravec et Huffman, 1988, *R. kisutchi* Margolis, Moravec et McDonald, 1975, *R. lichtenfelsi* Sánchez-Alvarez, García-Prieto et Pérez-Ponce de León, 1998, *R. longleyi* Moravec et Huffman, 1988, *R. milleri* Choquette, 1951, *R. ovifilamenta* Weller, 1938, *R. paxmani* Maggenti, Abdel-Rahman et Del Prado, 1992, *R. rotundicaudatum* Byrne, 1992, *R. salmonis* Maggenti, Abdel-Rahman et Del Prado, 1992, *R. uruyeni* Díaz-Ungría, 1968, and *R. zacconis* Yamaguti, 1936. Most of them were reported from North America. *Rhabdochona zacconis* was only listed by Arai and Mudry (1983) and there is no description of this species from North America.

Rhabdochona mexicana belongs to a group of species possessing 10 anterior teeth in the prostom. In America this group includes: *R. kisutchi* described from Pacific salmon, *Oncorhynchus kisutch* (Walbaum), from British Columbia, Canada; *R. catostomi* from suckers, *Catostomus catostomus* (Foster) and *C. ardens* Jordan et Gilbert, from Alberta, Canada; *R. paxmani* and *R. salmonis* from rainbow trout, *Oncorhynchus mykiss* (Walbaum), from California, USA; *R. lichtenfelsi* from goodeids, *Alloophorus robustus*, *Goodea atripinnis* and *Neoophorus diazi* from Michoacán, Mexico. The rest of the species possess 6, 14 or 16 teeth in the prostom. *Rhabdochona mexicana* differs from the other species possessing 10 teeth in having no dorsal or ventral barb on the spicules. This is except for *R. lichtenfelsi*, which can easily be distinguished by its filamented mature eggs; moreover, both species distinctly differ in the shape of the distal end of the left spicule, in addition to some other features.

Moreover, *Rhabdochona mexicana* markedly differs from *R. kisutchi* in the character of eggs (eggs with irregular flock-like coating vs. eggs with polar caps), but also in the number of preanal papillae (4-6 vs. 7-10 on each side, respectively), and in the form of the distal tip of the larger (left) spicule (bifurcate, with narrow cuticular membrane vs. lanceolate, with wide cuticular membrane). From *R. catostomi*, *R. paxmani* and *R. salmonis* it differs in the character of eggs (irregular flock-like coating vs. one filament on each egg pole in *R. catostomi* and polar caps in *R. paxmani* and *R. salmonis*) and in a shorter right spicule (0.082-0.102 vs. 0.151-0.154, 0.115-0.135 and 0.117-0.140 mm long, respectively).

Only two species of *Rhabdochona* have been reported from characid fishes: *R. acuminata* and *R. uruyeni* (both from South America) (Moravec 1998); however, the new species differs from them substantially in having fewer prostomal teeth (10 vs. 14).

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