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A new cucullanid species (Nematoda) from the freshwater fish *Thorichthys helleri* (Cichlidae) in Mexico

J. M. CASPETA-MANDUJANO¹, G. SALGADO-MALDONADO², E. MARTÍNEZ-RAMÍREZ³

¹Laboratorio de Parasitología de Animales Silvestres, Facultad de Ciencias Biológicas y Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Morelos, Av. Universidad No. 1001, Col. Chamilpa, C.P. 62209, Cuernavaca, Morelos, México, E-mail: caspeta@uaem.mx; ²Laboratorio de Helmintología, Instituto de Biología, Universidad Nacional Autónoma de México, A.P. 70-153, 04510, México, D.F., México; ³Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional Unidad Oaxaca, Instituto Politécnico Nacional. Hornos No. 1003, Col. Noche Buena, Santa Cruz Xoxocotlán, Oaxaca, México.

Summary

A new nematode species, *Cucullanus oaxaquensis* n. sp., is described from specimens recovered from the intestine of *Thorichthys helleri* Steindachner, 1864 from the Río Modelo, Los Chimalapas, state of Oaxaca, Mexico. It is characterized largely by possessing unusual features among *Cucullanus* spp., i.e., net-like sculpture on the surface of eggs, a pair of small papillae near tail tip of females and a small terminal sclerotized structure at tail tip of both males and females. This finding represents the fourth species reported from freshwater fishes in Mexico and the second for cichlid fishes.

Keywords: Nematoda; *Cucullanus*; Cichlidae; *Thorichthys helleri*; Oaxaca; Mexico

Introduction

The yellow cichlid *Thorichthys helleri* (Steindachner, 1864) (Cichlidae) ranges from Guatemala to Mexico, inhabiting rivers (Miller, 2005). Available data about its parasites in Mexico suggest a high richness, which included 30 species of Trematoda, three of Monogenea, one of Cestoda, two of Acanthocephala and seven of Nematoda (Salgado-Maldonado, 2006). Examination of this host species captured from the Río Modelo in the state of Oaxaca, Mexico, revealed the presence of a new species of nematode belonging to the genus *Cucullanus* Müller, 1777 which is described herein.

Material and methods

Fishes were collected by using an electro-fishing machine from the Río Modelo, Los Chimalapas (17°08'5.2" N, 94°44'42" W), state of Oaxaca, Mexico. The nematodes recovered from the intestine were fixed in hot 4 % formaldehyde and cleared with glycerine for examination. Drawings were made with the aid of a Nikon microscope

drawing attachment. After examination, the specimens were stored in vials with 70 % ethanol. Three specimens were dried by critical point method for study with a scanning electron microscope (SEM). All measurements are given in µm unless otherwise stated. Type specimens have been deposited in the National Helminthological collection of the Institute of Biology, National Autonomous University of Mexico (UNAM), Mexico City, and in the Parasitological Collection of the Autonomous University of Morelos State, Mexico.

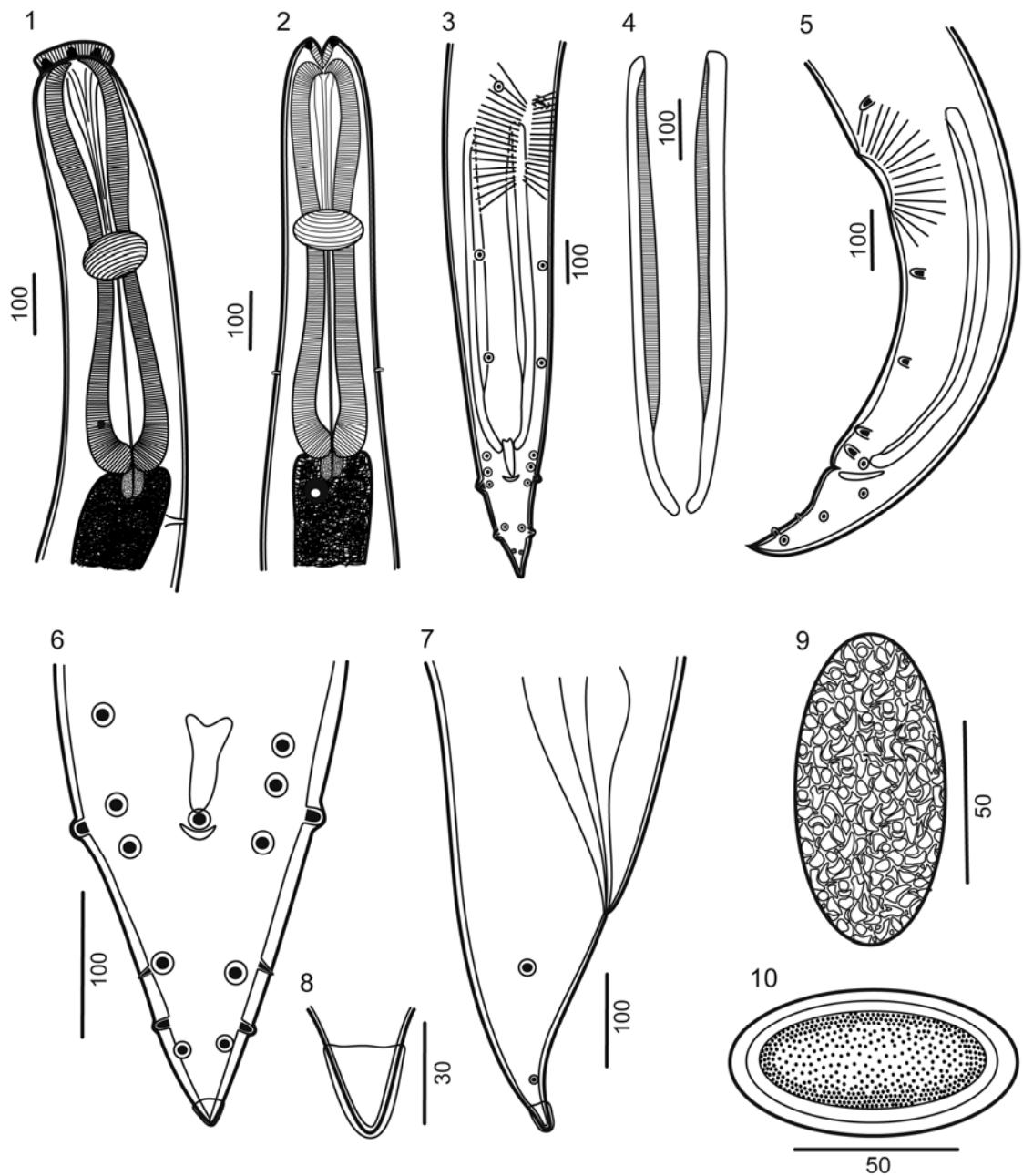
Results

Cucullanus oaxaquensis n. sp.

(Figs. 1 – 17)

General: Medium sized nematodes. Head end rounded. Oral opening dorsoventrally elongate, surrounded by a collarite armed with numerous minute denticles on each side. Four submedian cephalic papillae and pair of lateral amphids present (Fig. 11) Pseudobuccal cavity well developed (oesophastome) as wide as posterior part of oesophagus. Oesophagus long and narrow, expanded at both extremities, it opens into intestine through a valve. Nerve ring encircling oesophagus at its middle length (Figs. 1, 2). Deirids simple, slightly asymmetrical, just anterior to oesophago-intestinal junction (Figs. 1, 2, 15). Excretory pore situated short distance below end of oesophagus (Figs. 1, 2). Tail of both sexes conical, ending in small terminal sclerotized structure at tip, being more conspicuous in females (Figs. 6, 7, 8, 12, 14, 17).

Male (5 specimens, holotype in parentheses): Length 5.25 – 6.80 (6.70) mm width 275 – 337 (337). Entire oesophagus 681 – 750 (750) (11 – 13 % of body length), its minimum width 73 – 98 (98), maximum width in anterior region 142 – 150 (150). Nerve ring, excretory pore and deirids 293 – 362 (362), 662 – 862 (862) and 337 – 718 (718), respectively, from anterior extremity. Length of

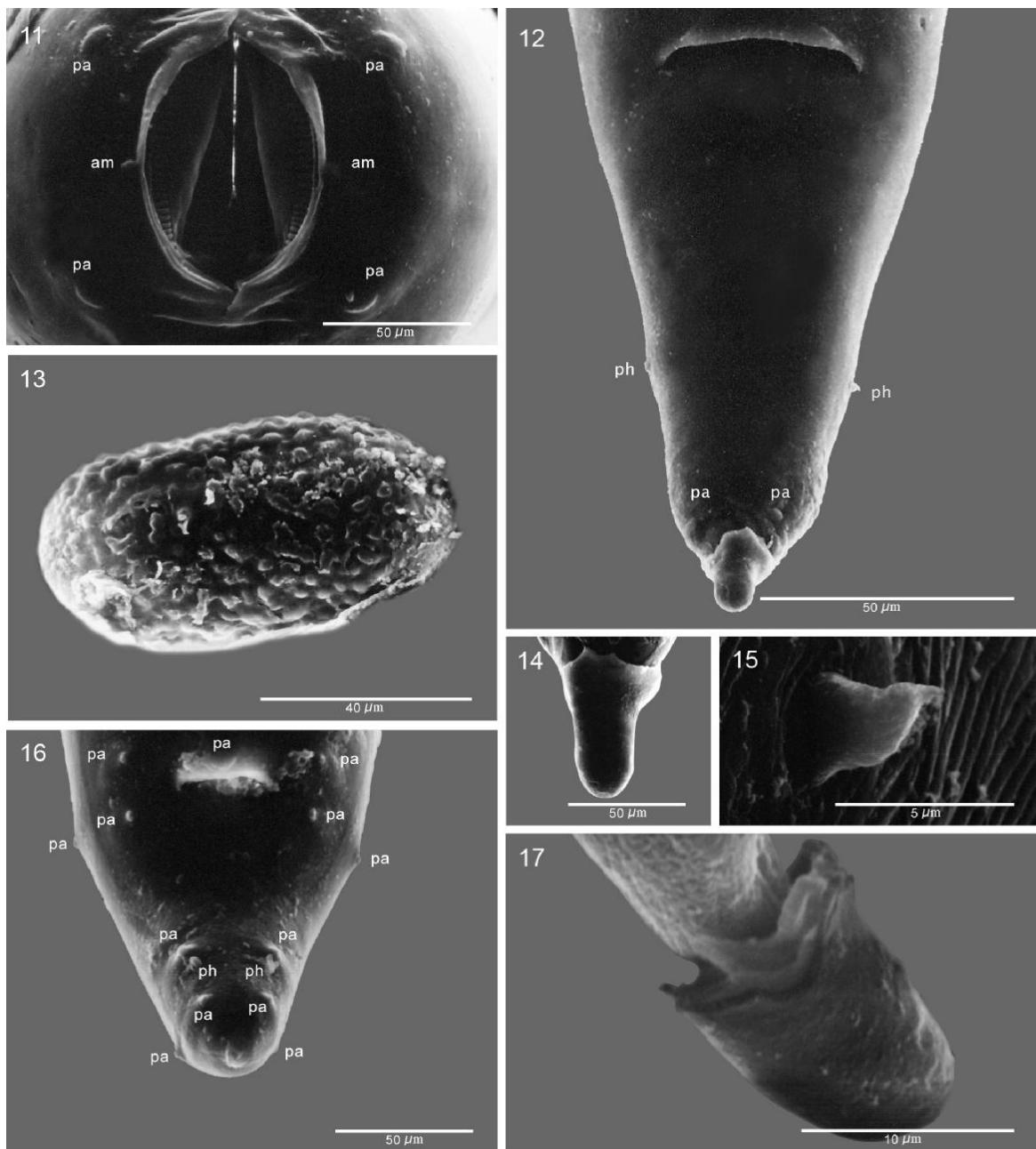


Figures 1-10. *Cucullanus oaxaquensis* n. sp. (1) Anterior end of male, lateral view. (2) Anterior end of female, ventral view. (3, 5) Posterior end of male, ventral and lateral views. (4) Spicules. (6) Posterior end of male, ventral view. (7) Posterior end of female, lateral view. (8) Detail of tail tip. (9, 10) Eggs.

spicules 575 – 825 (725), provided with membranous alae, which does not run a long of whole lenght (Fig. 4). Gubernaculum well sclerotized, 76 – 87 (76) long (Figs. 3, 5, 6). Ventral preanal sucker present, surrounded by first and second pair of precloacal papillae (Figs. 3, 5). Caudal papillae consisting of an unpaired median papilla present on anterior cloacal lip and 11 pairs of papillae, including phasmids: 3 pairs preanal (pair 1 anterior and pair 2 posterior to ventral sucker, respectively; pair 3 between sucker and cloaca but closer to latter), 4 pairs adcloacal (3 subventral [4 – 6], 1 lateral [7] situated at level of, or more frequently, slightly posterior to pair 6) and 4 pairs of postcloacal (pairs 8 and 10 subventral; pair 8 subdorsal, follow papillae numbering proposed by Petter (1974),

small phasmids situated slightly anterior to or at level of pair 8. Tail conical 175 – 275 (212) long, ending in small terminal sclerotized structure at tip 12 – 35 (35) long (Figs. 3, 5, 6, 16).

Female (5 specimens, allotype in parentheses): Length 9.88-12.15 (11.83) mm, width 497 – 537 (512). Entire oesophagus 850 – 987 (987) (8 – 10 % of body length), its minimum width 125 – 137 (137), maximum width in posterior region 212 – 230 (212). Nerve ring, excretory pore and deirids 312 – 412 (312), 0.987 – 1.12 (0.987) mm and 762 – 900 (762), respectively, from anterior extremity. Vulva postequatorial, 6.00 – 7.16 (6.93) mm from cephalic end. Vulvar lips elevated. Uteri opposed, containing immature and mature eggs, 92 – 95 x 50 – 52, surface



Figures 11-17. *Cucullanus oaxaquensis* n. sp., scanning electron micrographs. (11) Cephalic end of female, apical view. (12) Tail of female, ventral view. (13) Egg. (14) Tail tip of female. (15) Deirid. (16) Tail of male, ventral view. (17) Tail tip of female, lateral view.

Abbreviations: am – amphid, pa – papilla, ph – phasmid.

scutellate (Figs. 9, 10, 13). Tail conical, 206-262 (233) long, ending in small terminal sclerotized structure at tip, 17 – 28 (28) long (Figs. 7, 8, 12, 14). A pair of small lateral papillae (phasmids) present near mid-length of tail and a pair of small subventral papillae present near tip (Figs. 7, 12).

Taxonomic summary

Type host: *Thorichthys helleri* Steindachner, 1864 (Cichlidae).

Site of infection: Intestine.

Type locality: Río Modelo, Ciudad Cuautemoc, Los

Chimalapas, State of Oaxaca, Mexico.

Prevalence and range of intensity: 40 % (10 fishes examined/4 fishes infected) 2-4 nematodes.

Date of collection: March 2009.

Etymology: The specific epithet relates to the Mexican State of Oaxaca, where this species was found.

Deposition of types: Holotype, allotype and paratypes in the Institute of Biology, UNAM, in Mexico, City (CNHE-6940, 6941, 6942) and Faculty of Biology, Parasitological Collection of the Universidad Autónoma del Estado de Morelos, Mexico (COPAUAE N-374).

Discussion

Genus *Cucullanus* contains a large number of species parasitizing various freshwater, brackish-water and marine fishes around the world, more rarely they are found in aquatic turtles (Petter, 1974). Their morphology is rather uniform, therefore, some authors prefer to deal with these parasites according to their zoogeographical regions (e.g., Petter, 1995; Caspeta-Mandujano *et al.*, 2000; Moravec *et al.*, 2005; Cabañas-Carranza & Caspeta-Mandujano, 2007). At present, 19 species and subspecies of *Cucullanus* have been reported from freshwater fishes in the Americas, 6 from North America (*C. truttae* Fabricius, 1794; *C. sphaerocephalus* Rudolphi, 1809); *C. clitellarius* Ward et Magath, 1917; *C. caballeroi* Petter, 1977; *C. mexicanus* Caspeta-Mandujano, Moravec et Aguilar-Aguilar 2000; *C. angeli* Cabañas-Carranza et Caspeta-Mandujano, 2007) and 13 from South America (*C. pinnai* Travassos, Artigas et Pereira, 1928; *C. zungaro* Vaz et Pereira, 1934; *C. pauliceae* Vaz et Pereira, 1934; *C. mogi* Travassos, 1948; *C. colossum* Díaz-Ungría, 1968; *C. oswaldoocruzi* Santos, Vicente et Jardim, 1979; *C. grandistomis* (Ferraz et Thatcher, 1988); *C. brevispiculus* Moravec, Khon et Fernandes, 1993; *C. pimelodellae* Moravec, Khon et Fernandes, 1993; *C. pseudoplatystomae* Moravec, Khon et Fernandes, 1993; *C. rhamphichthydis* Moravec, Khon et Fernandes, 1997; *C. pinnai pterodorasi* Moravec, Khon et Fernandes, 1997; *C. heliomartinsi* Moreira, Rocha et Costa 2000 (Caspeta-Mandujano *et al.*, 1999, 2000; Moravec, 1998; Moreira *et al.*, 2000; Cabañas-Carranza & Caspeta-Mandujano, 2007). Of them, only three species have been recorded in Mexican freshwater fishes, *C. angeli*, *C. caballeroi* and *C. mexicanus* (Caspeta-Mandujano, 2005).

By the presence of a ventral sucker and gubernaculum, *C. oaxaquensis* n. sp. is easily distinguished from *C. grandistomis*, *C. pimelodellae* and *C. mogi*, the ventral sucker is lacking in the first two species and the gubernaculum in the later. In addition, *C. mogi* has narrow caudal alae, which has not been reported in any other freshwater species of *Cucullanus*. Even though males of *C. rhamphichthydis* are unknown, a comparison of the females was sufficient to distinguish it from the new species. In *C. rhamphichthydis* the deirids and the excretory pore are located far from the posterior end of oesophagus. All the remaining species have a ventral sucker which is shortly oval, surrounded by the first two pairs of precloacal papillae, except in *C. mexicanus*, in which the ventral sucker is conspicuously elongated and only the first pair of preanal papillae is situated near the posterior end of the precloacal sucker.

By the position of deirids, excretory pore, presence of unpaired papilla in the anterior cloacal lip and the location of phasmids (slightly up or at level of last 8 pair of postcloacal papillae), the new species differs from all congeners, except with *Cucullanus angeli*. However they can be easily distinguished by the length of spicules and gubernaculum (175 – 475 vs. 575 – 825 and 76 – 87 vs. 107 – 175, respectively), absence of membranous alae in

spicules, which is present in the new species, ornamentation on surface' eggs, which is absent in *C. angeli* and presence of small terminal sclerotized structure at tail tip in both sexes. The presence of an unpaired papilla located in the anterior cloacal lip, seems to be unique among all species of *Cucullanus* reported from freshwater fishes; because these features have been only reported from one freshwater species of *Cucullanus*, *C. angeli* (Cabañas-Carranza & Caspeta-Mandujano, 2007), it seems to be more common in *Cucullanus* spp. from marine waters (i.e. *Cucullanus pedroi*, *C. bonaerensis*) (Lanfranchi *et al.*, 2004; Timi & Lanfranchi, 2006). The location of phasmids in freshwater *Cucullanus* spp. has been reported slightly anterior or at level of last two pairs of postcloacal papillae (i.e. *C. pseudoplatystomae*, *C. sphaerocephalus*) or posterior or at level of last pair of papillae (i.e. *C. caballeroi*, *C. mexicanus*, *C. pauliceae* (Moravec, 1998; Caspeta-Mandujano, 2005).

Moravec *et al.* (2005) reported a new species of *Cucullanus*, *C. oceaniensis* from the intestine of *Anguilla* spp. from Polynesia and Melanesia, which is rather similar to *C. oaxaquensis* n. sp. However, *C. oaxaquensis* differs from *C. oceaniensis* by the length of spicules and gubernaculum (575 – 825 and 76 – 87 vs. 668 – 1,022 and 111 – 135), size of eggs (92 – 95 long and 50 – 52 wide vs. 75 – 84 long and 42 – 45 wide), surface of eggs, which is smooth in *C. oceaniensis*, and presence of small terminal sclerotized structure at tail tip in both sexes, which is absent in *C. oceaniensis*.

The new species can be differentiated from all congeners so far reported all over the world by possessing three unusual features: 1) a net-like sculpture on the surface of eggs, 2) a pair of small papillae near the females tail tip, and 3) a small terminal sclerotized structure at tail tip. The findings of the new species in *T. helleri* represents the second species reported from Cichlidae.

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