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# A new species of *Spauligodon* (Nematoda: Pharyngodonidae) in *Sceloporus* (Squamata: Phrynosomatidae) from the Reserve of the Biosphere Barranca de Metztitlán, Hidalgo, Mexico

## Una especie nueva de *Spauligodon* (Nematoda: Pharyngodonidae) en *Sceloporus* (Squamata: Phrynosomatidae) de la Reserva de la Biosfera Barranca de Metztitlán, Hidalgo, México

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**Abstract.** A new species of *Spauligodon* collected from the digestive tract of *Sceloporus minor* and *Sceloporus grammicus* is described. The species is assigned to *Spauligodon* because the caudal alae start at the level of the precloacal papillae and embed the adcloacal papillae. The species described herein is most similar to *S. garciaprietoi, S. goldbergi,* and *S. mearnsi* because all of them present spicules; diagnostic traits include having male worms with 1-5 spines in the tail, tripartite lateral alae with 5 ridges, females with spines in the tail and eggs that are fusiform. *Spauligodon lamothei* n. sp. was found in 4 of 9 individuals of *S. minor* and 1 of 5 individuals of *S. grammicus*. This species is the tenth recorded in the neotropics and the third from Mexico.

Key words: *Spauligodon lamothei* n. sp., *Sceloporus grammicus*, *Sceloporus minor*, description, Hidalgo, Mexico.

**Resumen.** Se describe una especie nueva de *Spauligodon* colectada del tubo digestivo de *Sceloporus minor* y *Sceloporus grammicus.* La especie fue asignada a *Spauligodon* porque el ala caudal inicia al nivel de la papila precloacal y la papilla adcloacal está embebida en la misma. La especie que se describe es similar a *S. garciaprietoi, S. goldbergi,* y *S. mearnsi* porque todas presentan espículas, los machos presentan de 1-5 espinas en la cola, ala lateral tripartita con 5 crestas, las hembras presentan espinas en la cola, y huevos fusiformes. *Spauligodon lamothei* n. sp. se encontró en 4 de 9 ejemplares de *S. minor* y en 1 de 5 individuos de *S. grammicus*. Esta especie representa el décimo registro en el neotrópico y el tercero de México.

Palabras clave: *Spauligodon lamothei* n. sp., *Sceloporus grammicus*, *Sceloporus minor*, descripción, Hidalgo, México.

## Introduction

During an ongoing study of the biodiversity of the Reserve of the Biosphere Barranca de Metztitlán, Hidalgo, Mexico, individuals of *Sceloporus grammicus* Wiegmann, 1828 and *Sceloporus minor* Cope, 1885 were found to be infected with nematodes of an undescribed species of *Spauligodon* Skrjabin, Schikhobalova and Lagodovskaja, 1960. Currently, 43 species have been assigned to this cosmopolitan genus of pharyngodonid nematodes (Bursey et al., 2005); 4 of them occur in the Nearctic region and 8 in the Neotropical region, 2 of which have been described from Mexican hosts. The purpose of this work is to describe a third species from Mexican lizards.

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## Materials and methods

Specimens of *Sceloporus minor* (9 individuals) and *S. grammicus* (5) were collected by hand in the Reserve of the Biosphere Barranca de Metztitlán, Hidalgo, Mexico, between September 2004 and June 2005. Lizards were killed by an overdose of ethyl ether within 12 hr after capture. Carcasses were processed for preservation and deposition in museums by conventional techniques for reptiles; symbiotype and type specimens are deposited in the Colección de Helmintos (CHE), Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo, and Colección Nacional de Helmintos (CNHE), Instituto de Biología, Universidad Nacional Autónoma de México, México D.F., Mexico. Viscera and body cavity of each lizard were examined for parasites and nematodes were killed in glacial acetic acid and

stored in 70% ethanol. Subsequently, nematodes were cleared in glycerol and identified following Ramallo et al. (2002) and Jiménez-Ruiz et al. (2003). Drawings were made with the aid of a drawing tube. Measurements are given in micrometers (µm), unless otherwise noted, in the form range (average±standard deviation; n = number of measurements taken). Because the study location is part of a fragile national reserve, and thus at risk of destruction by unauthorized collectors, exact coordinates of the locality are only available to scientists holding valid collecting permits through direct contact with the administrators of the reserve.

## Description

*Spauligodon lamothei* n. sp. (Figs. 1-2)

Description based on 83 adult specimens (74 females and 9 males). Small nematodes, both ends tapering gradually (Figs. 1A, 1F). Cuticle with fine transverse striations (Figs. 2B-2D). Males with lateral alae, absent in females. Stoma with 3 lips, each lip with 2 papillae (Fig. 2A), esophagus divided into corpus and esophageal bulb (Figs. 1A, 1F, 2C). Excretory pore with lightly cuticularized walls, posterior to esophageal bulb in males and at level of bulb in females (Figs. 1A, 1F, 2C-D).

*Male:* Based on 9 specimens. Nematodes, white color *in vivo*, 1750-2200 (1999±172, n = 9) long and 125±20 (84±150, n = 9) wide at level of esophageal bulb. Cuticle with striations at intervals of 5-8 (7±1, *n* = 9). Lateral alae tripartite, 1170-1575 (1366±147, *n* = 9) long by 42-94 (67±18, *n* = 9) at widest part, starting slightly anterior to nerve ring and extending to cloacal level (Figs. 1A, 2B); alae ornamented with 5 ridges (Fig. 1C). Esophagus, including bulb, 225-352 (291±44, *n* = 9) long and 22-29 (26±2, *n* = 9) wide at mid-esophagus; bulb 65-78 (71±5, *n* = 9) long and 56-84 (73±9, *n* = 9) wide. Nerve ring and excretory pore at 85-110 (96±9, *n* = 8) and 370-530 (467±48, *n* = 8) from anterior end, respectively. Caudal alae 60-70 (64±4, *n* = 8) long and 72-95 (83±7, *n* = 8) wide. Three pairs of mamiliform genital papillae present (Figs. 1B, 2E-F); first pair anterior to prominent genital cone. Anterior 2 pairs of papillae embedded in the caudal alae and posteriormost pair situated at base of tail; adcloacal pair of papillae bifurcate (= "forked" *sensu* Edgerly, 1952). Pseudosucker with rows of lateral spines located anterior to genital cone. Single spicule 55-96 (79±15, *n* = 8) long (Fig. 1E). Anal opening immediately anterior to base of genital cone. Tail filiform, 380-565 (480±61, *n* = 8) long (Figs. 1A-B), with 1-5 (2±1, *n* = 9) cuticular spines.

Female: Based on 74 gravid specimens. Length larger than males, pale yellow color *in vivo*, 3515-7600 (5756±1091, *n* = 72) long by 225-420 (292±42, *n* = 72) wide at maximum width (level of esophageal bulb). Cuticle with striations at intervals of 6-18 (12±3, *n* = 71). Esophagus, including bulb, 475-700 (632±46, *n* = 71) long and 29-42 (36±2, *n* = 74) wide at mid-esophagus; bulb 114-142 (128±6, *n* = 73) long and 125-150 (138±6, *n* = 74) wide. Nerve ring, excretory pore, and vulva at 90-204 (135±31, *n* = 48), 490-800 (614±72, *n* = 71), and 475-950 (702±87, *n* = 67) from anterior end, respectively (Fig. 9). Ovijector thin-walled; 2 uteri present. Tail filiform, 700-1020 (855±70, *n* = 72) long with 8-16 (13±2, *n* = 72) cuticular spines (Fig. 1F). Eggs fusiform, slightly flattened at one pole, 38-108 (60±19, *n* = 59) long by 12-42 (20±8, *n* = 59) wide (Fig. 1D).

## Taxonomic summary

*Type-host: Sceloporus minor* Cope, 1885.

*Type locality:* Reserve of the Biosphere Barranca de Metztitlán, Zona núcleo 1, between the parallels 98º 23' 00" and 98º 57' 08" W and 20º 14' 15" and 20º 45' 26" N, with elevations between 1 000 and 2 000 m.

*Site of infection*: stomach, small intestine, and large intestine.

*Prevalence and intensity:* 4 of 9 individuals of *S. minor* and 1 of 5 individuals of *S. grammicus*; 1-29 (19.5) and 5 (5), respectively.

*Additional hosts: S. grammicus* Wiegmann, 1828.

*Type specimens:* holotype male, CNHE-5992; allotype CNHE-5993; paratypes CNHE-5994, 5995; CHE F-0013.

*Symbiotype: Sceloporus minor*, collected 22 September 2001, CHE H-0063, *S. grammicu*s, CHE H-0064; voucher specimens CHE H-0065.

*Etymology:* the specific epithet honors Dr. Rafael Lamothe-Argumedo, Instituto de Biología, Universidad Nacional Autónoma de México, for his lifelong work as a teacher and leader of parasitologists in Mexico, of whom GP-F and SM are proud to be counted.

## Remarks

Three genera of pharyngodonid nematodes are commonly found in reptiles and exhibit a vulvar opening in the anterior part of the body, just posterior to the postbulbar excretory pore: *Pharyngodon* Diesing, 1861, *Skrjabinodon* Inglis, 1968, and *Spauligodon*. These genera can be separated by the relationship of the caudal alae to the genital papillae (Bursey and Goldberg, 1995). Males of *Skrjabinodon* do not have caudal alae. Males of both *Pharyngodon* and *Spauligodon* have caudal alae: in the former all genital papillae are embedded in the caudal alae and in the latter only the 2 anteriormost pairs of papillae are embedded in the alae. The described specimens are

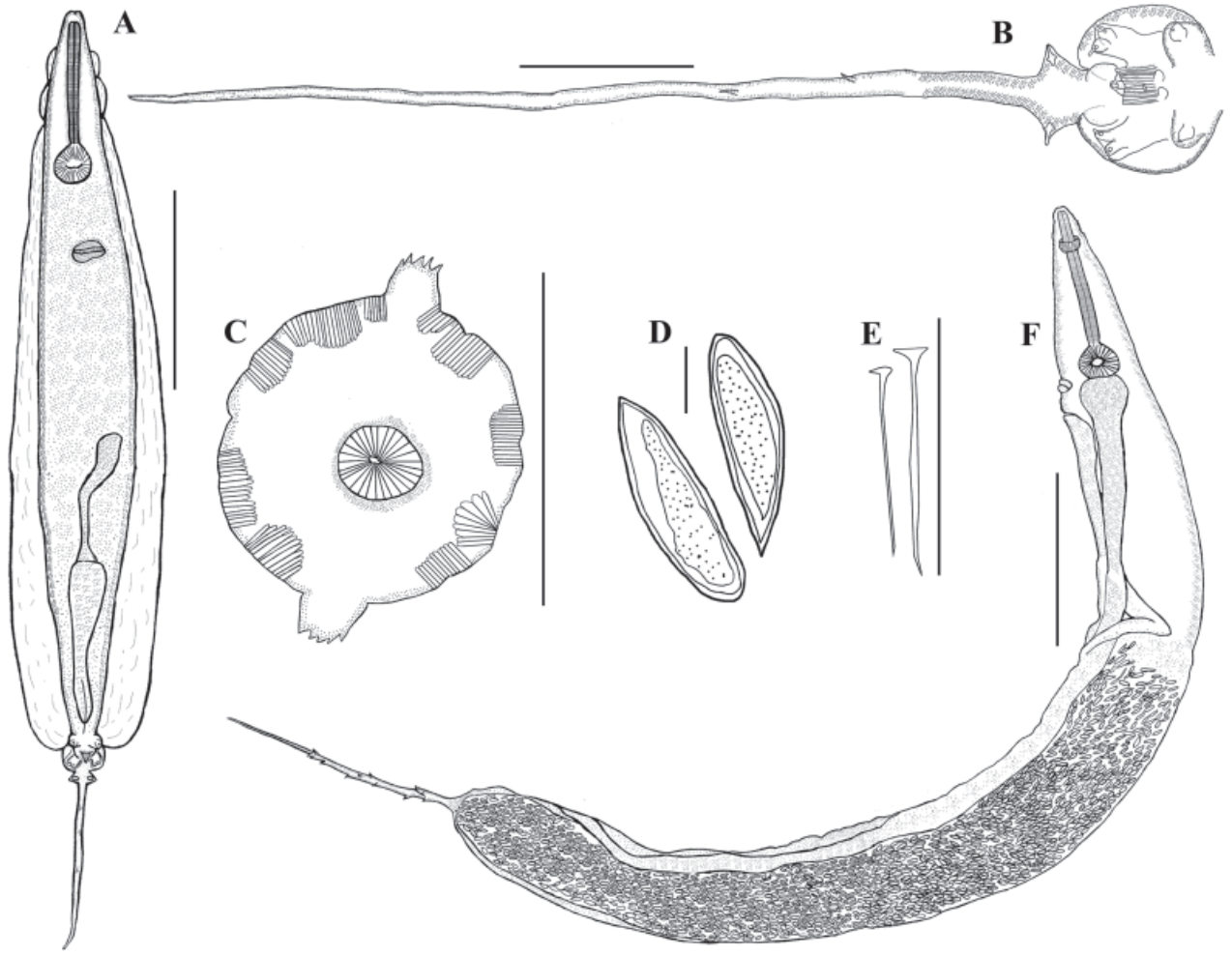


**Figure 1.** *Spauligodon lamothei* n. sp. A, holotype, male, ventral view. B, tail of holotype. C, cross-section of male, at level of esophagus, depicting ridges of lateral alae. D, eggs. E, spicules from 2 males. F, allotype, female, lateral view. Scale bars: A = 15 μm; B = 25 μm; C = 25 μm; D = 20 μm; E = 25 μm; F = 15 μm.

assigned to *Spauligodon* based on males of the species having the 2 anteriormost pair of papillae embedded in the alae.

Species of *Spauligodon* are distinguished on the basis of the presence or absence of a spicule, the presence or absence of spines on the tail filament of adults, the shape of the egg, and the geographical distribution (Bursey et al., 2005; Chabaud and Brygoo, 1962). Of the 43 known species, 12 species occur in the Nearctic and Neotropical realms (Table I., Bursey et al., 2005). The species described herein and these 12 species can be divided arbitrarily into 2 groups based on the presence or absence of a spicule in the male. Only *S. lamothei* n. sp., *S. garciaprietoi, S. goldbergi,* and *S. mearnsi* have males that possess spicules; however, the ranges in length overlap and thus are not diagnostic (55-96, 53-82, 80-90, and 75-80, respectively). Both *S. lamothei* n. sp. and *S. goldbergi* have males that possess tails with spines (1-5 and 3-7, respectively) and those of *S. garciaprietoi,* and *S. mearnsi* are aspinose. The range in number of spines on the tail of males of *S. lamothei* n. sp. and *S. goldbergi* overlaps (1-5 and 3-7, respectively), but the former has 5 ridges on the lateral alae and the adcloacal papillae are bifurcate while the latter has only 1 ridge on the lateral alae and the adcloacal papillae are not bifurcate. Males of *S. mearnsi* also have adcloacal papillae that are bifurcate but the males of that species have aspinose tails. The species described herein has males with tripartite lateral alae with 5 ridges and males of *S. garciaprietoi* have alae that are unipartite with 2 ridges; of the 4 species mentioned herein, only males of *S. lamothei* n. sp. have

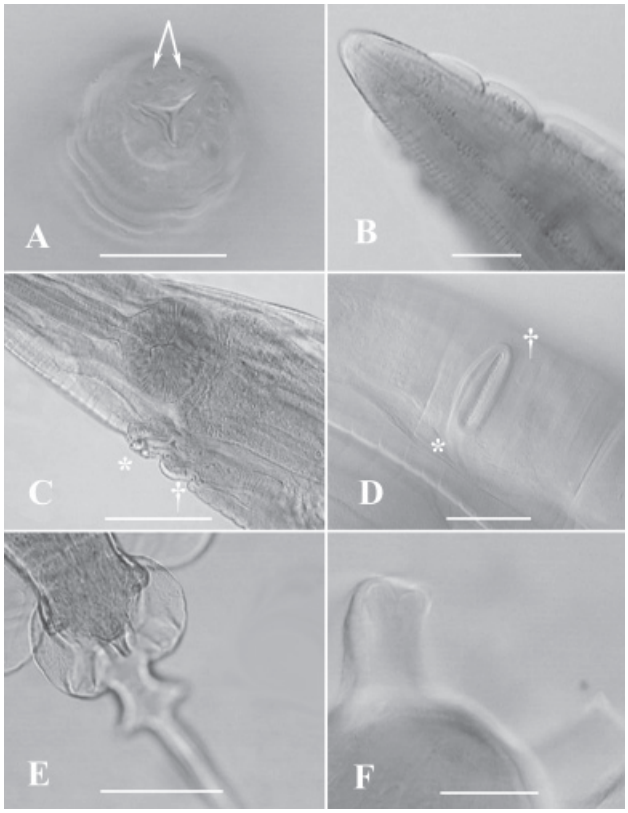


**Figure 2.** *Spauligodon lamothei* n. sp. A, stoma, *en face* (arrows indicating papillae). B, anterior end, male, ventral view. C, vulvar region of female, lateral view (* = excretory pore, † = vulva). D, vulvar region of female, ventral view (* = excretory pore, † = vulva). E, detail of the caudal region of male, ventral view, showing caudal alae, papillae and pseudosuckers. F, ventral view of adcloacal papillae, showing bifurcation at distal ends. Scale bars: A = 1 µm; B = 5 µm; C = 120 µm; D = 2 µm; E = 25 µm; F = 20 µm.

tripartite lateral alae. The tail of females of *S. lamothei* n. sp. and *S. mearnsi* are spinose and those of the other 2 species are aspinose. *Spauligodon lamothei* n. sp. and *S. mearnsi* can be distinguished on the basis of egg shape (fusiform and barrel-shaped, respectively).

## Discussion

A search of the literature revealed only 3 known species with adcloacal papillae that are not unipartite: *S. lamothei* n. sp., *S. mearnsi*, and *S. dimorpha* (Chabaud and Brygoo, 1962). Hosts of the first are individuals of *Sceloporus* sp., the second, *Petrosaurus mearnsi* (Stejneger, 1894) (as *Streptosaurus mearnsi*) from California (Edgerly, 1952), and the third, *Chamaeleo pardalis* Cuvier, 1829 from Madagascar (Chabaud and Brygoo, 1962). Males of both *S. lamothei* n. sp. and *S. mearnsi* exhibit bifurcate adcloacal papillae while males of *S. dimorpha* are described as having trifurcate adcloacal papillae. However, Fig. 11 of (pg. 587; Chabaud and Brygoo, 1962) shows a male with bifurcate adcloacal papillae and their Fig. 12 (pg. 588) depicts a male with what could be interpreted have having trifurcate papillae; the authors describe the papillae as having "…très gros pédoncules…" (p. 588).

*Spauligodon lamothei* n. sp. is the ninth species recorded in the neotropics, and it may be added to the list provided by Bursey et al. (2005) according to the features mentioned above. It is only the third species described from Mexico, an extremely complex biogeographic zone (Jiménez-Ruiz et al., 2002; Jiménez-Ruiz et al., 2003). *Spauligodon oxkutzcabiensis* and *S. garciaprietoi* previously were described from Mexican hosts and *S. giganticus* also has been reported previously (Goldberg et al., 1996; Goldberg et al., 2003). However, despite a long tradition of parasitological studies, as indicated by the great number of species known from Mexican hosts (Lamothe-Argumedo et al., 1997, and more recent works), it is expected that a large part of the helminth diversity of Mexico is still unknown to science (Pérez-Ponce de León et al., 2002). *Spauligodon lamothei* n. sp. is the first member of that genus described from Hidalgo, Mexico, and it and its hosts, *Sceloporus minor* and *Sceloporus grammicus*, are reported for the first time from the Reserve of the Biosphere Barranca de Metztitlán.

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