



Reserch note

First record of the genus *Rhabdias* (Nematoda: Rhabdiasidae), endoparasite from *Scinax staufferi* (Anura: Hylidae) in Mexico

Primer registro del género *Rhabdias* (Nematoda: Rhabdiasidae), endoparásito de *Scinax staufferi* (Anura: Hylidae) en México

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Abstract. A lungworm of the genus *Rhabdias* (Nematoda: Rhabdiasidae) was recovered from *Scinax staufferi* (Anura: Hylidae) collected in Guadalupe Victoria Mapastepec, Chiapas, Mexico (15°28'28"N, 92°53'26"W, 102 m). Morphology of the nematode is briefly described and compared with other species of the genus, and mainly with parasites of hylids in the Neotropical Realm. This study represents the first record of a species of *Rhabdias* species parasitizing *S. staufferi*, and also constitutes the first record of a nematode parasite of hylid frogs in Chiapas State, Mexico.

Key words: *Rhabdias*, Rhabdiasidae, Nematoda, parasite, lungworm, *Scinax staufferi*, Hylidae, Chiapas, Mexico.

Resumen. Un gusano pulmonar del género *Rhabdias* (Nematoda: Rhabdiasidae) fue recuperado de *Scinax staufferi* (Anura: Hylidae) recolectado en Guadalupe Victoria Mapastepec, Chiapas, México (15°28'28"N, 92°53'26"O, 102 m). La morfología del rhabdiásido se describe brevemente y se compara con otras especies del género y principalmente con aquellas parásitas de hílidos distribuidos en la región Neotropical. El presente estudio representa el primer registro de una especie de *Rhabdias* como parásito de *S. staufferi*, y también constituye el primer registro de un nematodo parásito en hílidos para el estado de Chipas, México.

Palabras clave: *Rhabdias*, Rhabdiasidae, Nematoda, parásito, gusano pulmonar, *Scinax staufferi*, Hylidae, Chiapas, México.

Scinax staufferi Cope 1865 (Anura: Hylidae) is distributed in lowlands along the Gulf of Mexico and Caribbean of Mexico and Central America, from central Tamaulipas south through the Yucatan Peninsula and into Belize, Guatemala, Honduras and Nicaragua. On the Pacific slope, it is distributed from Guerrero, through the Isthmus of Tehuantepec south to northwestern Costa Rica (Lee, 1996; Cedeño-Vázquez et al., 2006; Amphibia Web, www.amphibiaweb.org, Sept, 2008). To the best of our knowledge, with the exception of the papers by Goldberg and Bursey (2008) and Brooks et al. (2006) on the helminth parasites of selected frogs from Costa Rica, no other report exists on the endoparasites of *Scinax*

spp. Likewise, no reports on rhabdiasid nematodes have been published in species of this genus. In one study, *S. elaeochrous* Cope, 1875 was found to be parasitized by 3 nematodes, *Cosmocerca podicipinus* Baker and Vaucher, 1984, *Oswaldocruzia costaricensis* Bursey and Goldberg, 2005, both of which were found in the intestine, while a larva of Acuariidae gen. sp. was found encysted in the stomach wall (Goldberg and Bursey, 2008). *Scinax boulengeri* Cope, 1887 was found to be infected in the urinary bladder with a monogenean, *Polystoma naevius* Caballero and Cerecero, 1941 (Brooks et al., 2006). The aim of the present work is to report for the first time the presence of a helminth parasite of *S. staufferi*.

On August 17th 2007, 2 specimens of *S. staufferi* were collected in Guadalupe Victoria, Mapastepec,

Chiapas, Mexico (15°28'28"N; 92°53'26"W; 102 m) (Figs. 1 and 2). Frogs were dissected after an overdose of sodium pentobarbital. All internal organs were examined for helminths using a stereoscope. A single nematode was collected and placed in saline solution (0.65%), and fixed by immersion in hot (steaming) 70% ethanol, and finally stored in 70% ethanol. The worm was cleared with a mixture of ethanol-glycerin (7:3) and the taxonomic determination was conducted by comparing morphological traits with descriptions from the literature and with reference to material deposited in the United States National Parasite Collection, Beltsville, Maryland (USNPC) and the Colección Nacional de Helminthos (CNHE), Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City. For comparison, the following specimens were studied: *Rhabdias alabialis* Kuzmin, Tkach and Brooks, 2007 (USPNC 098144.00), *R. americanus* Baker, 1987 (USPNC 081011.00, 089802.00), *R. bakeri* Tkach, Kuzmin and Pullis, 2006 (USPNC 096379.00, 096381.00), *R. elegans* Gutierrez, 1945 (USPNC 084920.00, 087516.00), *R. füelleborni* Travassos, 1926 (USPNC 032536.00, 083796.00; CNHE 001975, 3771, 3776), *R. hermaphrodita* Kloss, 1971 (USPNC 08525.00), *R. hylae* Johnston and Simpson, 1942 (USPNC 091190.00), *R. joaquinensis* Ingles, 1935

(USPNC 088047.02), *R. kuzmini* Martínez-Salazar and León-Règagnon, 2007 (CNHE 05807, 5808, 5809, 5810, 5811; USPNC 99550.00), *R. manantlanensis* Martínez-Salazar, 2008 (CNHE 5804, 5805, 5806), *R. ranae* Walton, 1930 (USPNC 0885986.00), *R. savagei* Bursey and Goldberg, 2005 (USPNC 094848.00; CNHE 5034), *R. pseudosphaerocephala* Kuzmin, Tkach and Brooks, 2007 (USPNC 098146.00). In addition, material originally assigned to *R. cf. sphaerocephala* Goodey, 1924 (CNHE 001986, 002057, 002227, 002284) was also analyzed.

Measurements of the specimen are given in micrometers (μm) unless otherwise stated. Voucher specimens of host and parasite were deposited in the Colección Nacional de Herpetología, Instituto de Biología, UNAM (IBH22163-IBH22164), and in the CNHE (6768), respectively.

Only 1 nematode was found in the left lung (prevalence and intensity of infection: 1 of 2 host infected (50%), 1 specimen) (Fig. 3). This nematode was identified as an undetermined species of the genus *Rhabdias* Stiles and Hassall (Rhabdiasidae). This hermaphrodite nematode possesses a cylindrical body and is relatively small (5.483 mm body length x 286 width). The specimen is characterized by having a truncated anterior end, tapered posterior end, body cuticle slightly swollen in the anterior end, comparatively thin in mid-body and terminal end; capsule cup-like in lateral view (7 depth x 19 width), with 6 indistinct lips observed in lateral and dorsal view. The esophagus is almost cylindrical (esophagus length 352, 6.43% of body length), 33 width at anterior region of the body, 34 at muscular region, 54 at the glandular region, with indistinct posterior bulb, 62 wide. An inconspicuous cuticular nerve ring, 186 from the anterior region of the body (3.39% of body length) is present. Intestine wide

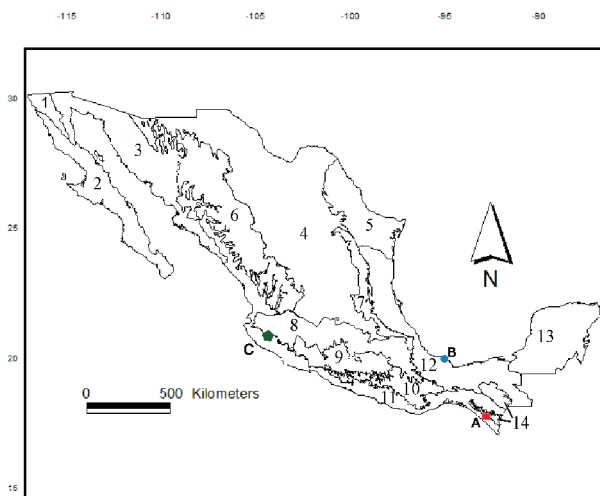


Figure 1. Geographical distribution of *Rhabdias* sp. parasite of hylids from Mexico: A. *Rhabdias* sp. parasite of *Scinax staufferi* (present work). B. *Rhabdias* sp. parasite of *Dendropsophus microcephalus* [= *R. tobagoensis* of Goldberg et al. (2002)]. C. *R. manantlanensis* parasite of *Craugastor occidentalis* (Martínez-Salazar, 2008). Mexican provinces based on Morrone (2006): 1, California; 2, Baja California; 3, Continental Nearctic Sonora; 4, Mexican Plateau; 5, Tamaulipas; 6, Mexican transition zone Sierra Madre Occidental; 7, Sierra Madre Oriental; 8, Transmexican Volcanic Belt; 9, Balsas Basin; 10, Sierra Madre del Sur; 11, Neotropical region Caribbean Mesoamerican Mexican Pacific Coast; 12, Mexican Gulf; 13, Yucatán Peninsula; 14, Chiapas.



Figure 2. *Scinax staufferi* from Guadalupe Victoria Mapastepec, Chiapas, Mexico (Photography: Guillermo Velo).

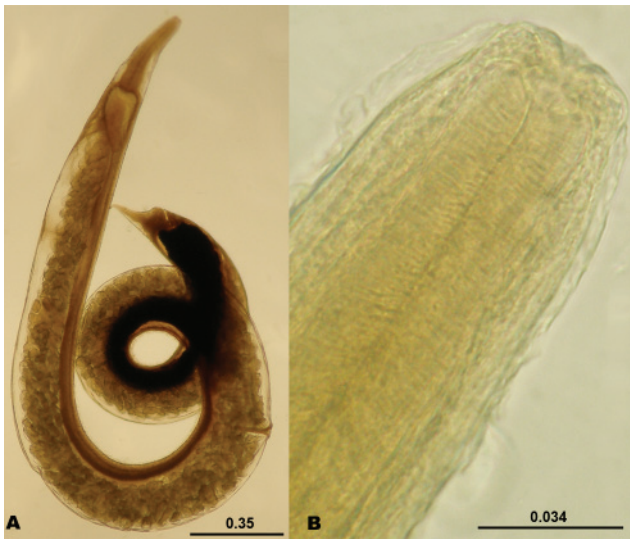


Figure 3. *Rhabdias* sp. parasite of *Scinax staufferi* from Chiapas State. A. Body total, lateral view. B. Cephalic end, lateral view. Scale bar values are given in mm.

and filled with brown and black contents, distinguished easily from the internal structures. Vulva near middle body, located 2.821 mm (51.45% of body length) from anterior end. Tail comparatively short, conical, 251 long (4.59% of body length), with sharp terminal point. Genital system amphidelphic, with limbs approximately equal in length. Ovaries straight, extending along intestine. Uteri filled with numerous, oval, thin-walled eggs (100 x 58) in different stages of development, some containing larvae.

Rhabdiasids are typical lung parasites of amphibians and reptiles; species of *Rhabdias* are host-specific and rarely are parasites of more than 1 host group (see Kuzmin et al., 2003, Martínez-Salazar, 2006, 2008; Tkach et al., 2006). There are 17 species described from the Neotropical Realm: *R. alabialis*, *R. androgyna* Kloss, 1974, *R. anolis* Bursey, Goldberg and Telford, 2003, *R. elegans*, *R. füelleborni*, *R. hermafrodita*, *R. kuzmini*, *R. lamothei* Martínez-Salazar and León-Règagnon, 2006, *R. leonae* Martínez-Salazar, 2006, *R. manantlanensis*, *R. mucronata* Schuurmans-Stekhoven, 1952 (species inquirenda, adults unknown), *R. nicaraguensis* Bursey, Goldberg and Vitt, 2007, *R. pseudosphaerocephala*, *R. savagei*, *R. tobagoensis* Moravec and Kaiser, 1995, *R. truncata* Schuurmans-Stekhoven, 1952 (species inquirenda, adults unknown), and *R. vellardi* Pereira, 1928. Nine species of this group of nematodes have been recorded in Mexico: *R. füelleborni*, *R. kuzmini*, *R. lamothei*, *R. leonae*, *R. manantlanensis*, *R. savagei*, *Rhabdias* sp. [= *R. tobagoensis* of Goldberg et al. (2002)], *Rhabdias* sp. [= *R. cf. elegans* of Goldberg et al. (2002)], and *R. pseudosphaerocephala*

[=*R. sphaerocephala* of Bravo Hollis and Caballero (1940)] (see Martínez-Salazar and León-Règagnon, 2007 and Martínez-Salazar, 2008).

The material examined in the present study differs from *R. savagei* and *R. leonae* in that those species present a postequatorial vulva instead of equatorial as in our specimen; it can also be distinguished because the former species parasitize exclusively Ranidae (frogs) and Polychrotidae (lizards), respectively (Bursey et al., 2003; Martínez-Salazar, 2006). With respect to *R. lamothei*, it differs mainly in body shape (coiled in *R. lamothei* instead of cylindrical as in the specimen herein reported) and body size, smaller in *R. lamothei*. In addition, *R. lamothei* infects snakes and not anurans (Martínez-Salazar and León-Règagnon, 2006).

From *R. elegans*, *R. füelleborni*, *R. kuzmini*, and *R. pseudosphaerocephala*, the material collected from *S. staufferi* can be differentiated by body dimensions (larger in all those species) (see Martínez-Salazar and León-Règagnon, 2007), and by host preference (all the 4 species are typical parasites of Bufonidae while the specimen examined here is a parasite of Hylidae).

In addition to the present record, 2 other species of *Rhabdias* have been recorded in hylid frogs in Mexico: *Rhabdias* sp. (= *R. tobagoensis*) from *Dendropsophus microcephalus* Cope, 1886 (= *Hyla microcephala*) (Anura: Hylidae) in Veracruz State (Goldberg et al., 2002), and *R. manantlanensis* from *Craugastor occidentalis* Taylor, 1921 (= *Eleutherodactylus occidentalis*) (Anura: Craugastoridae) in Jalisco State (Martínez-Salazar, 2008) (Fig. 2). The original record of *R. tobagoensis* was made as a parasite of *Pristimantis charlottevillensis* Kaiser, Dwyer, Feichtinger, and Schmidt, 1995 (= *Eleutherodactylus charlottevillensis*) (Anura: Strabomantidae) from Tobago Island, in the West Indies (Moravec and Kaiser, 1995). The Mexican record of *R. tobagoensis* is controversial; Martínez-Salazar (2008) suggested that this material could pertain to other species based on host preference. Unfortunately, these specimens are not available for re-examination (Goldberg et al., 2002).

Our material differs from the other 2 aforementioned *Rhabdias* species infecting hylid frogs from the Neotropical Realm by body and buccal capsule size, esophagus length (Table 1), as well as the shape of body cuticle (in *R. tobagoensis* the outer layers of body are inflated along the body; in *R. manantlanensis* cuticle is slightly swollen, thin and smooth, and the specimen described here has body cuticle slightly swollen, being more evident in anterior and uniform at middle body and terminal ends).

Finally, these 3 species parasitize hosts of different families: *R. manantlanensis* and *R. tobagoensis* are typical parasites of Craugastoridae and Strabomantidae

Table 1. Morphometric comparison of *Rhabdias* spp., parasites of hylid frogs from the Neotropical Realm

| Host family/ Parasite species | Buccal capsule* (μm) | Body length x width (mm x μm) | Vulva position | Esophagus (μm) | Egg size** (μm) | Reference |
|----------------------------------|--------------------------------------|--|---|--------------------------------|---------------------------------|------------------------------|
| Hylidae | | | | | | |
| <i>Rhabdias</i> sp. | 7 x 19 | 5.483 x 286 | Equatorial | 352 | 100 x 58 | Present work |
| Craugastoridae | | | | | | |
| <i>R. manantlanensis</i> | 13 x 21 | 6.48 – 9.64 (7.85) x 175 -239 (203) | Equatorial (slightly pre-equatorial) | 397-515 (451) | 94 x 50 | Martínez-Salazar (2008) |
| Strabomantidae | | | | | | |
| <i>R. tobagoensis</i> | 6 x 18 | 7.34-7.56 (7.34) x 408 -476 (476) | Equatorial (pre- or post-equatorial) | 476-530 (530) | 108 x 54 | Moravec and Kaiser (1995) |

*depth x width

**length x width

respectively, whereas our specimen was found in Hylidae.

The conservative morphology of *Rhabdias* has resulted in the incorrect identification of some species; re-examination of these species with new taxonomical tools, e.g., molecular markers, scanning electron microscopy, etc., as well as considering host specificity and geographic distribution, has allowed to redefine the specific composition of the genus (see re-determinations in Kuzmin et al., 2003, Tkach et al., 2006; Kuzmin et al., 2007, Martínez-Salazar, 2008). Species richness of rhabdiasid nematodes had been under-estimated in Mexico; helminthological surveys on several species of the Mexican herpetofauna that have not been studied previously, revealed the existence of 4 new species and 2 more which description is currently in process.

Since only 1 specimen of nematode was collected from *S. staufferi*, it was not possible to establish the proper identification at species level, even though a comparison with species of *Rhabdias* parasitic in hylids and a comparison with congeners found as parasites of several species of amphibians in the Neotropical Realm were conducted. The morphology and host preference of the species of *Rhabdias* reported here suggest that it may represent an undescribed species. However the low prevalence and abundance values preclude a proper description, and more specimens will be required for both a morphological and a molecular study.

This note represents the first record of a nematode as a parasite of hylid frogs from Chiapas State in Mexico, and provides the first record of a member of the genus *Rhabdias* as parasite of *Scinax staufferi* from anywhere along its distribution. More studies on the parasite fauna of hylids and other host families of frogs are needed to obtain more information about the geographical distribution and host

specificity of members of the genus *Rhabdias* in Mexico.

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