

Parasitic nematodes in two species of lizards of the family Leiosauridae in Argentina

Out of the approximately 408 reptile species in Argentina (Abdala et al. 2012), only 40 species have been studied (Castillo et al. 2020) for the presence of parasitic nematodes. The main studies on reptile parasitism were conducted in the Liolaemidae family on the genera *Liolaemus* Wiegmann, 1834 and *Phymaturus* Gravenhorst, 1838 in central and northeast Argentina (Ramallo & Díaz 1998, Ramallo et al. 2002a,b, Goldberg et al. 2004, Castillo et al. 2020). So far, the species of the family Leiosauridae are the least studied at a parasitic level in Argentina (Castillo et al. 2020). The family Leiosauridae comprises the subfamilies Enyaliinae and Leiosaurinae (Frost et al. 2001). Subfamily Enyaliinae is composed of the genera *Anisolepis*, *Enyalius*, and *Urostrophus*, while the subfamily Leiosaurinae is composed of the genera *Diplolaemus*, *Leiosaurus*, and *Pristidactylus* (Pyron et al. 2013).

Nematode records from different species in the family Leiosauridae has indicated scarce endoparasite faunas dominated by generalist nematodes (Vrcibradic et al. 2008, Dorigo et al. 2014). The main studies were conducted on *Enyalius bilineatus*, *E. brasiliensis*, *E. catenatus*, *E. iheringii*, and *E. perditus*, recording nematodes of the genera *Oswaldocruzia*, *Rhabdias*, *Physaloptera*, *Strongyluris*, *Aplectana* and *Cosmocerca* (Sousa et al. 2007, Vrcibradic et al. 2008, Ávila & Silva 2010, Barreto-Lima et al. 2012, Dorigo et al. 2014). In Argentina, data on the endoparasite faunas associated with lizards of the family Leiosauridae were limited to a report of *Physaloptera* Hall & Wigdor, 1918 from *Leiosaurus belli* and *Pristidactylus scapulatus* (Goldberg et al. 2004, Castillo et al. 2019). Therefore, it is unknown whether other parasites may be found in these hosts and whether this parasite (*Physaloptera*) host interaction also occurs in different

localities of Argentina.

Particularly, *Leiosaurus belli* Duméril & Bibron, 1837 is an oviparous lizard occurring in the Monte desert of Argentina, whose distribution extends from the center of Mendoza province to the south of Chubut province (Scrocchi et al. 2010). *Pristidactylus scapulatus* Burmeister, 1861 is an oviparous lizard associated with an insectivorous and carnivorous diet (Acosta et al. 2017). It is distributed along the Pre-Andes and Andes mountains in Mendoza and San Juan, Argentina, in environments exposed to anthropic activities of great impact (Acosta et al. 2017, Gómez Alés et al. 2021).

To contribute to endoparasitic knowledge in the search for new host-parasite associations in reptiles from Argentina, we analyzed specimens of lizards of the family Leiosauridae from new localities.

Two species of lizards, *L. belli* (Fig. 1) and *P. scapulatus* (Fig. 2), belonging to the family Leiosauridae, were collected between February 2020 and December 2021 from different localities in Argentina. Using hand-held noose traps, two adult male *L. belli* (SVL 70 mm) were collected from Rincón de los Sauces locality (37°23'25"S, 68°55'31"W; WGS84), Neuquén province, and one adult male *P. scapulatus* (SVL 85 mm) was collected from Portezuelo locality (31°22'S, 69°30'O), Calingasta district, San Juan province, Argentina. They were sacrificed with an intraperitoneal injection of Euthanyle® (sodium pentobarbital), fixed in Bouin solution for 24 hours, labeled, and preserved in 70% ethanol.

Subsequently, they were dissected to remove endoparasites through a ventral longitudinal snout-vent incision. All organs were removed and examined for the presence of nematodes using a stereoscopic binocular microscope (Arcano Xsz 100). The nematodes found in the stomach were preserved in 70% ethanol. Semi-permanent preparations using lactophenol solution were made for observation and identification/determination of the

nematodes (following Anderson et al. 1974). The nematodes are housed in the Parasitology Collection of the Biology department of the School of Exact, Physical and Natural Sciences, National University of San Juan: *Pristidactylus scapulatus* (*Physaloptera retusa*, adult, UNSJPar 271, *Skrjabinodon* sp., female, UNSJPar 272) and *Leiosaurus belli* (*Physaloptera* sp., larva, UNSJPar 261). We estimated the indicators of parasitic infection proposed by Bush et al. (1997).



Figure 1. Specimen of *Leiosaurus belli*



Figure 2. Specimen of *Pristidactylus scapulatus*

Three taxa of parasitic nematodes were identified: *Physaloptera* sp. (larva), *Physaloptera retusa* Rudolphi, 1819 (adults) (Physalopteridae), and *Skrjabinodon* sp. Inglis, 1968 (adult females) (Pharyngodonidae) (Figs. 3, 4).

From the stomach of *P. scapulatus* (no parasites were recorded in the rest of the organs), we isolated six nematodes corresponding to two taxa: *Physaloptera retusa* (adult, 1 male, and 3 females) characterized by females with vulva in the first third of the body, 20–26% of total body length, and males with 21 caudal papillae (Fig. 3A). Furthermore, we identified two adult female specimens of *Skrjabinodon* sp., characterized by triangular mouth opening surrounded by three bilobate lips; lateral wings absent; with excretory pore and vulva posterior to the esophageal bulb; the tail is long and presents seven thorns in total (Fig. 3B). The species could not be determined because the diagnostic features are found in the male. In *L. belli*, we determined a *Physaloptera* nematode in the larval stage, characterized by a

cephalic neck and a mouth with large triangular lips, each with teeth (Figs. 3C, D). The data on prevalence and intensity are shown in Table 1.

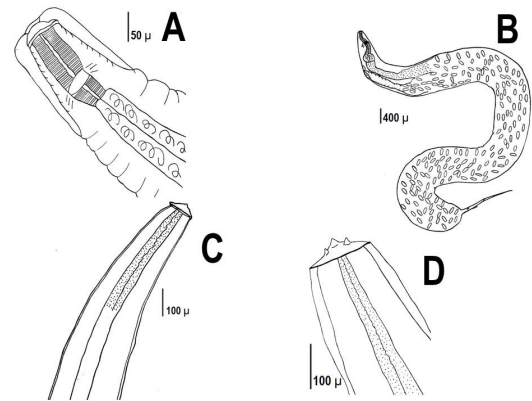


Figure 3. Nematodes recorded in lizards of the family Leiosauridae; (A) *P. retusa* (adult male) anterior lateral view (host *P. scapulatus*). (B) *Skrjabinodon* sp. (adult female) lateral view (host *P. scapulatus*). (C, D) *Physaloptera* sp. (larva) anterior lateral view (host *L. belli*).

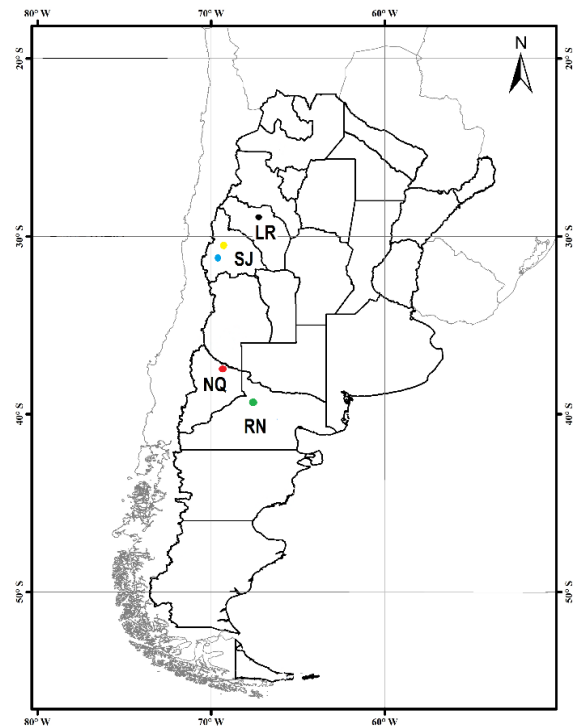


Figure 4. Nematode records for lizards of the family Leiosauridae, up to the present day, are indicated by province in Argentina. Provinces: La Rioja (LR), San Juan (SJ), Neuquén (NQ), Río Negro (RN). Current records in this note are indicated, determining new records and distribution expansion: Red Point, Rincón de los Sauces, Neuquén Province: *Leiosaurus belli* (*Physaloptera* sp. larvae). Blue Point, Calingasta Department, San Juan Province: *Pristidactylus scapulatus* (*Physaloptera retusa*, *Skrjabinodon* sp. adult female). Previous records: Yellow point, Iglesia Department, San Juan Province: *Pristidactylus scapulatus* (*Physaloptera* sp. larvae). Black point, Anillaco District, La Rioja Province: *Leiosaurus catamarcensis* (*Physaloptera retusa*). Green point, General Roca Department, Río Negro Province: *Leiosaurus belli* (*Physaloptera retusa*).

Table 1. Current records for nematodes in the family Leiosauridae in Argentina. Site of infection: stomach. (N= number of captured lizards; n= number of parasitized lizards)

| Host | N | n | Nematodes | Prevalence | Intensity | Locality | References |
|----------------------------------|---|---|--|------------|-----------|---|-----------------------------|
| <i>Leiosaurus belli</i> | 1 | 1 | <i>Physaloptera retusa</i> | 100% | 211 | Río Negro Province, General Roca Department | Goldberg <i>et al.</i> 2004 |
| | 2 | 1 | <i>Physaloptera</i> sp. (larvae) | 50% | 1 | Neuquén Province, Rincón de los Sauces Locality | Current study |
| <i>Leiosaurus catamarcensis</i> | 2 | 2 | <i>Physaloptera retusa</i> | 100% | 2.5 | La Rioja Province, Anillaco Department | Goldberg <i>et al.</i> 2004 |
| | 2 | 1 | <i>Physaloptera</i> sp. (larvae) | 50% | 17 | San Juan Province, Iglesias Department, Tocota Locality | Castillo <i>et al.</i> 2019 |
| <i>Pristidactylus scapulatus</i> | 1 | 1 | <i>Physaloptera retusa</i> | 100% | 4 | San Juan Province, Calingasta Department, Portezuelo Locality | Current study |
| | 1 | 1 | <i>Skrjabinodon</i> sp. (adult female) | 100% | 2 | San Juan Province, Calingasta Department, Portezuelo Locality | Current study |

Globally, the genus *Physaloptera* includes 105 species that are parasites of reptiles, amphibians, birds, and mammals (Pereira *et al.* 2012, 2014). Of these, only eight species are known to parasitize reptiles' stomachs in the Neotropics (Castillo *et al.* 2020). In Argentina, only three species *Physaloptera* have been recorded: *P. retusa*, *P. lutzi* Cristofaro, Guimarães & Rodrigues, 1976 and *P. liophis* Vicente & Santos, 1974, which parasitize lizards (Ramallo & Díaz 1998, Goldberg *et al.* 2004, Castillo *et al.* 2020). It is impossible to say whether the parasite indices recorded are low or high in these hosts due to the low number of specimens analyzed. In addition, a comparison would be unwarranted because few species in the family Leiosauridae have been studied.

Thus far, in Argentina, there are only three mentions of nematodes for lizards of the family Leiosauridae; Goldberg *et al.* (2004) reported *P. retusa* as a parasite of *Leiosaurus catamarcensis* Koslowsky 1898 in the La Rioja province and *L. belli* in Río Negro province. Castillo *et al.* (2019) recorded for the first time larval stages of *Physaloptera* sp. in *P. scapulatus* in the Iglesia district, Tocota locality, San Juan province (Fig. 2); until now, these were the only records for Leiosauridae.

Concerning the genus *Skrjabinodon*, eight species are currently known to parasitize Neotropical lizard, occurring in Cuba, Brazil, Mexico, Costa Rica, and Ecuador (Caballero 1938, Barus & Coy-Otero 1974, Vicente *et al.* 2000, 2002, Bursey & Goldberg 2006, 2007, 2011, de Sousa *et al.* 2022). So far, the genus *Skrjabinodon* has not been reported in Argentina (Castillo *et al.* 2020); thus, we report its presence for the first time in *P. scapulatus*. Of the eight species of *Skrjabinodon* females, one has a smooth tail without thorns (*S. aspercaudus* Bursey & Goldberg, 2011), and the others have thorny tails (*S. dixoni* Bursey & Goldberg, 2007, *S. spinosulus* Vicente, Vrcibradic, Rocha & Pinto, 2002, *S. heliocostai* Vicente, Vrcibradic, Muniz-Preira & Pinto, 2000, *S. scelopori* Caballero, 1938, *S. cricosaurae* Barus & Coy-Otero, 1974 and *S. campiaoae* De Sousa, Silva De Oliveira, Morais, Da Silva Pinheiro & Ávila, 2022). Among these, *S. cricosaurae* presents three to seven thorns in the caudal filament in females, which is consistent with our record of *Skrjabinodon* in *P. scapulatus*. However, due to the small sample and the lack of male nematodes, we cannot confidently assign our species to *S. cricosaurae*.

In the present note, we report, as novel information, the first record for Argentina of the genus *Skrjabinodon* (females) in *P. scapulatus* and the first record of *P. retusa* in this host species. We extended the distribution of *P. retusa* to

Calingasta district, Portezuelo locality, 210 km away from the first record in Tocota, Iglesia district (Castillo *et al.* 2019). Regarding *L. belli*, we report the first record of the *Physaloptera* nematode for this host species in Neuquén province. The nematode taxa recorded in these hosts are generalist parasites and are likely to be widely found within the reptile fauna of Argentina. However, we do not rule out the possibility of finding new species or other genera of nematodes different from those found in this study. In our current study, the lack of male nematodes and adult stages made it difficult to determine the species; however, they likely correspond to new species. Because of this, we suggest intensifying the sampling studies.

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