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Nematodes in *Sceloporus variabilis* (Squamata: Phrynosomatidae) in localities in the Altas Montañas region of Veracruz, Mexico

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ABSTRACT

Objective: Identify nematodes of the digestive tract of the lizard *Sceloporus variabilis*.

Methodology: In different localities in the Altas Montañas region, 11 individuals of *S. variabilis* were collected and a range of morphological characteristics measured. Their intestines were dissected to identify the nematodes present.

Results: Were identified 17 nematodes belonging to the Oxyuridae family, present in the lizard *S. variabilis*. Not found differences in the frequency of nematodes between sexes and localities.

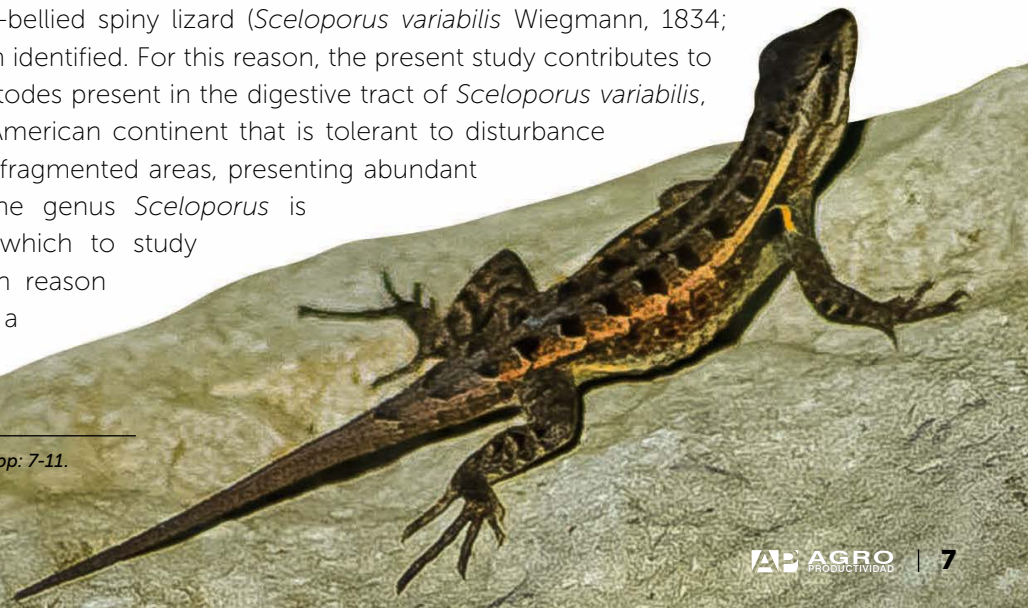
Implications: Identification of nematodes in *S. variabilis* is basic information for the knowledge of the parasite-host relationship.

Conclusions: The nematodes of the Oxyuridae family may cause mechanical symptoms in *S. variabilis*.

Key words: Reptilia, Squamata, Sauria, Phrynosomatidae, parasitism, host, Oxyuridae.

Diseases and their agents have been little studied in reptiles but some groups, such as the lacertilia, act as reservoirs, mainly of protozoa (Mata, 2018). Studying the influence of parasitic helminths on the life cycle and ecological processes of their hosts, is important in the context of describing parasite-host relationships (Aho, 1990). In addition, identifying endoparasites in reptiles is important to relating aspects of the biology of the species to their environment (Wilson and Carpenter, 1996).

In particular, the helminths in the pink-bellied spiny lizard (*Sceloporus variabilis* Wiegmann, 1834; Sauria: Phrynosomatidae) have not been identified. For this reason, the present study contributes to the knowledge of the diversity of nematodes present in the digestive tract of *Sceloporus variabilis*, a species of wide distribution on the American continent that is tolerant to disturbance of the ecosystems and has adapted to fragmented areas, presenting abundant populations (Chaves *et al.*, 2013). The genus *Sceloporus* is considered a biological model with which to study the parasite-host interaction, for which reason it is important to evaluate its role as a transmitter of nematodes towards



other groups of reptiles (Garduño-Montes de Oca *et al.*, 2017).

This study was conducted in three localities in the year 2019 (Figure 1): 1) Peñuela (18° 46' and 18° 58' N; 96° 49' and 96° 58' W); 2) Huiloapan de Cuauhtémoc (18° 48' and 18° 50' N; 97° 06' and 97° 10' W); and Palma Sola (18° 45' N and 96° 47' W). Eleven specimens of *S. variabilis* were collected and transported to the Laboratorio de Microscopía Óptica of the Facultad de Ciencias Biológicas y Agropecuarias, Orizaba-Córdoba region, of the Universidad Veracruzana and sacrificed through hypothermia induced by freezing (García, 2013). The sex of the lizards was determined by sexual dimorphism and the age category estimated from the measurement snout-vent length (SVL) < 42.4 mm for juvenile and > 42.4 mm for adults. A range of morphological characteristics was also recorded in the lizards (Table 1; Serna-Lagunes, 2005). The contents of the digestive tracts of the lizards were prepared in an aqueous solution in Petri dishes and observed under a microscope in order to quantify the frequency of nematodes per age category and sex of the lizard. An ocular micrometer was used to obtain the anatomical characteristics of the nematodes and these

were compared to examples in the scientific literature, books, laboratory manuals and specialized keys for the taxonomic identification of the nematodes (Anderson *et al.*, 1989).

The *S. variabilis* lizards evaluated in this study included three females (27% of the total) and eight males (73%). Regarding age category, 10 were adults (90% of the total) and one was juvenile (10%). The lizards presented a higher quantity of nematodes in Palma Sola (n=10) and Peñuela (n=7). In this sense, 17 morphotypes of nematodes were identified as belonging to the family Oxyuridae (Figure 2); four specimens [three males (75% of the total) and a female (25%)] of *S. variabilis* presented the highest prevalence of helminths (Table 1), while 36% of the lizards presented no nematodes, for which reason it is considered that *S. variabilis* does not act as a reservoir of nematodes. No association was presented between the nematodes and the sex, age category and localities of the lizards (X^2 ; $P > 0.05$).

On comparison of the results with those of Breves *et al.* (2011), studying Iguana iguana in Brazil, three males and three females presented more than 100 endoparasites

belonging to the family Oxyuridae. This family coincides with that reported in this study for *S. variabilis*. Salizar (2008) studied parasitic helminths of the Peru desert tegu (*Dicrodon guttulatum* Dumeril and Bibron, 1893) in Peru and, of 38 hosts sampled, 34 (89.47%) were parasitized with 7929 (99.85%) nematodes, with the males presenting greater parasitism (75.76%) than the females (15%). Comparing this with the case of *S. variabilis*, there was no significant frequency between sexes, which could be due to the difference in the number of hosts collected in each study.

On the other hand, Stephen *et al.* (2003) found 404 endoparasites (seven nematodes) in seven lizard species of the genus *Sceloporus* (including *S. variabilis*) of Mexico, a frequency

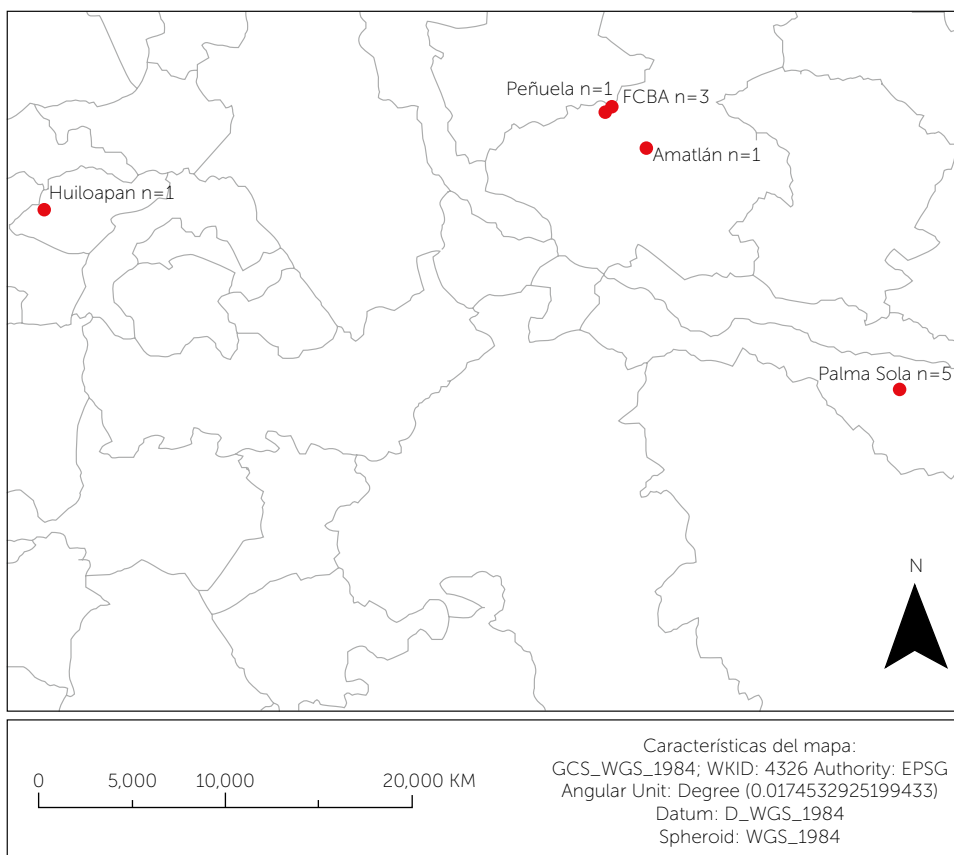


Figure 1. Sites at which the prevalence of nematodes was determined in *S. variabilis*. The map shows the sample size (n) at each sampling location.

Table 1. Morphometric variables of the pink-bellied spiny lizard *S. variabilis* and prevalence of nematodes (counts of nematodes present per individual).

No. Ind.	Male of <i>S. variabilis</i>	Total length (TL) cm	Snout-vent length (SVL) cm	Head width (HW) cm	Head length (HL) cm	Left leg length (LL)	Prevalence /absence of nematodes
1	Adult	13.5	6	1	2.1	1.7	0
4	Adult	9	4.5	1.5	2	0.5	5
5	Adult	13.2	5	1.2	2	2.7	0
6	Adult	13	4.5	1.5	3	2	0
7	Adult	9	4.5	0.5	1.5	3	3
8	Adult	15.5	7	1.7	1.5	3.5	0
9	Juvenile	4.5	2.5	0.5	0.8	1	0
10	Adult	12.5	5	1	1.5	1.5	0
	Mean	11.28	4.88	1.11	1.80	1.99	
	Standard deviation	3.30	1.22	0.42	0.60	0.96	
No. Ind.	Female of <i>S. variabilis</i>	Total length (TL) in cm	Snout-vent length (SVL) cm	Head width (HW) cm	Head length (HL) cm	Left leg length (LL)	
2	Adult	10	7	1.5	2	1.5	0
3	Adult	11	5.5	1	1.5	2	5
11	Adult	12	5.5	1	1.5	3	0
	Mean	11	6	1.16	1.66	2.16	
	Standard deviation	0.81	0.7	0.23	0.23	0.62	

of nematodes that was similar to that reported in this study. For this reason, the analysis of *S. variabilis* conducted in this study confirms the presence of nematodes of the family Oxysuridae, but this presence is not associated with the sex of the lizards.

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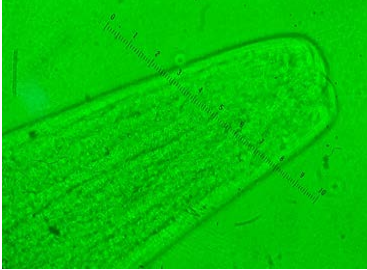
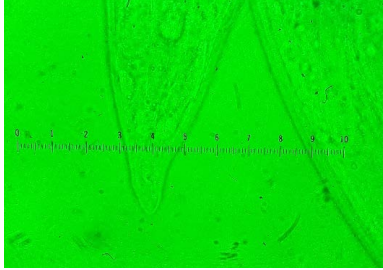








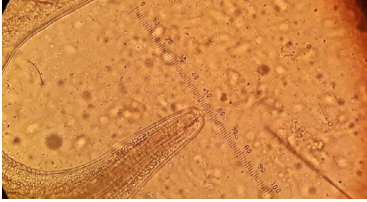
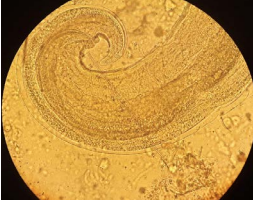
No.	Nematodes observed under a phase contrast microscope at magnification 400 X	
1	 <p data-bbox="552 442 738 472">Head of nematode</p>	 <p data-bbox="998 442 1169 472">Tail of nematode</p>
Nematodes observed under a compound microscope		
2	 <p data-bbox="519 798 771 825">Head of nematode (100X)</p>	 <p data-bbox="909 798 1258 825">Complete body of nematode (100X)</p>
3	 <p data-bbox="527 1117 763 1144">View of the head (100X)</p>	 <p data-bbox="982 1117 1193 1144">View of the tail (100X)</p>
4	 <p data-bbox="495 1415 795 1442">Observation of the head (400X)</p>	 <p data-bbox="941 1415 1226 1442">Observation of the tail (400X)</p>
5	 <p data-bbox="495 1681 795 1708">Observation of the head (400X)</p>	 <p data-bbox="941 1681 1226 1708">Observation of the tail (400X)</p>
6	 <p data-bbox="495 1932 795 1959">Observation of the head (100X)</p>	 <p data-bbox="941 1932 1226 1959">Observation of the tail (100X)</p>

Figure 2. Specimens of nematodes of the family Oxyuridae in the intestine of *S. variabilis*. A): Head. B): Tail. Observation under a microscope at 100X and 400X.

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