

First quantitative data on the ectoparasitic mites of *Sceloporus torquatus* (Squamata) from the Ecological Reserve of Pedregal de San Angel in Central Mexico

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Short note

ABSTRACT

Twenty four live lizards *Sceloporus torquatus* were collected in the rainy season in the Reserva Ecológica del Pedregal de San Ángel (REPSA) in Mexico City to establish their ectoparasite census. A total of 1251 mites belonging to four species in three families (*Ornithodoros talaje* in Argasidae, *Geckobiella pelaezi* and *Geckobiella texana* in Pterygosomatidae, and *Eutrombicula alfreddugesi* in Trombiculidae) were collected. This is the first record of *O. talaje* for this host species. We detected some differences in the infestation parameters of the four mite species. The prevalence of *G. pelaezi*, *G. texana*, and *E. alfreddugesi* was relatively high (>70%) and statistically different from that of *O. talaje* (<20%). Abundances of *G. pelaezi* and *E. alfreddugesi* were higher than in *O. talaje* and *G. texana*, and the latter species showed the lowest mean intensity. Further investigations are necessary to verify these differences and reveal their causes.

Keywords chiggers, reptiles, lizards, infection levels, *Ornithodoros talaje*

Introduction

The Reserva Ecológica del Pedregal de San Ángel (REPSA) is a natural area of 237.3 ha protected by the Universidad Nacional Autónoma de México (UNAM), located in their central campus at Mexico City; it has a vegetation of xerophytic scrub in low areas, as well as lake landscapes and wetlands located in a buffer zone known as the Cantera Oriente (Peralta-Higuera and Prado-Molina 2009). Its specific richness of amphibians and reptiles is high – about 30 species, including turtles, lizards and snakes. In the particular case of the lizards, six species of the genera *Barisia* and *Sceloporus* have been reported, the latter represented by *Sceloporus aeneus* Wiegmann, 1828, *Sceloporus anahuacus* Lara-Góngora, 1983, *Sceloporus grammicus* Wiegmann, 1828, *Sceloporus palaciosi* Lara-Góngora, 1983, and *Sceloporus torquatus* Wiegmann, 1828.

The spiny collared lizard (*S. torquatus*) is a species endemic to Mexico, distributed in the north and center of the country (Méndez de la Cruz *et al.* 2009). In the REPSA it is distributed from 2240 to 2580 m.a.s.l., being abundant in moderately disturbed areas and on the border of the Reserve (Méndez de la Cruz *et al.* 2009).

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Known mite fauna associated with this lizard species includes four species of Trombidiformes (Acariformes): three Pterygosomatidae, *Geckobiella texana* (Banks, 1904), *Geckobiella pelaezi* (Cunliffe, 1949), *Geckobiella trombidiformis* (Berlese, 1920) and one Trombiculidae, *Eutrombicula alfreddugesi* (Oudemans, 1910) (Paredes-León et al., 2008). Specifically in the REPSA, previous record for this lizard includes three mite species: *G. texana*, *G. pelaezi* and *E. alfreddugesi* (Paredes-León et al. 2008; Montiel-Parra et al. 2009). However, no study analyzing the population parameters of this acari-lizard association has been conducted. Objective of our work was to determine main parameters of mite infestation on *S. torquatus* in the REPSA during rainy season of 2016.

Materials and methods

The 24 *S. torquatus* analyzed were collected during May and October of 2016 (rainy season) in the botanical garden of the Instituto de Biología at UNAM, located in the buffer zone of REPSA (19.31826N, 99.19431W) (Peralta-Higuera and Prado-Molina, 2009). Lizards were collected using a slipknot tied to a fishing rod, under collection permit SGPA/DGVS/11338/15, issued to JJZV by the Secretaría de Medio Ambiente y Recursos Naturales, Mexico. They were released after their examination. Mites were removed directly from the body surface of the host using brushes and fine-tipped tweezers, and a census of mites on each host was made. In each collection date, we fixed and conserved all mites obtained from an individual host in a vial with 80% ethanol. Specimens were mounted in Hoyer's medium and identified under compound microscope (Leica ICC50HD), using specialized taxonomic keys (Kohls et al. 1965; Hoffmann 1990; Paredes-León et al. 2012). Reference material of each mite species was deposited in the Colección del Laboratorio de Acarología "Anita Hoffmann", Facultad de Ciencias, UNAM, Mexico City, with the catalog numbers LAFC-A 132-142.

Data from both collection dates was pooled. For each mite species found in *S. torquatus*, the following ecological parameters were calculated: prevalence, mean abundance, and mean intensity (according to Bush et al. 1997). We conducted statistical comparisons of these three ecological parameters among mite species by building and comparing confidence intervals through a bootstrap resampling procedure (1000 replicates) (Manly 2007). These intervals had a confidence level of 84%, which, according to MacGregor-Fors and Payton (2013), is equivalent to an analysis of variance with a significance level of 0.05.

Results and discussion

A total of 1251 mites belonging to three families and four species (Argasidae: *Ornithodoros talaje* (Guérin-Méneville, 1849); Pterygosomatidae: *G. pelaezi* and *G. texana*; Trombiculidae: *E. alfreddugesi*) were collected on the 24 studied lizards (Table 1; Figure 1).

We detected significant differences among mite species in their prevalence, mean abundance, and mean intensity (Figure 2A, B and C). The prevalence of *G. pelaezi*, *G. texana*, and *E. alfreddugesi* was relatively high (>70% for these three mites) and statistically different from the prevalence of *O. talaje* (<20%, Figure 2A). We found the latter mite species on only 12.5% of the lizards. The highest abundances corresponded to *G. pelaezi* and *E. alfreddugesi* while the abundances of *G. texana* and *O. talaje* were significantly lower (Figure 2B). Finally, the lowest mean intensity corresponded to *G. texana*, and was significantly lower than the mean intensity of *G. pelaezi* and *E. alfreddugesi* (Figure 2C).

With the exception of *O. talaje*, species that constitute the acarofauna associated with *S. torquatus* had been previously registered in the same host and locality (Paredes-León et al. 2008; Montiel-Parra et al. 2009). The species of the family Pterygosomatidae that we collected are permanent parasites and specialists of lizards of the family Phrynosomatidae (Paredes-León et al. 2012). In contrast, the species of Trombiculidae is a protelean generalist mite that has

Month	Host number	<i>G. pelaezi</i>	<i>G. texana</i>	<i>O. talaje</i>	<i>E. alfreduggesi</i>	TOTALS
May	1	250	25	-	-	275
	2	-	7	-	-	7
	3	139	2	-	-	141
	4	36	4	3	-	43
	5	21	3	-	-	24
	6	7	16	-	16	39
	7	2	-	-	16	18
	8	12	6	-	8	26
	9	7	7	-	-	14
	10	3	1	-	10	14
	11	-	-	-	41	41
	12	2	14	-	8	27
October	13	6	1	-	8	16
	14	-	9	-	-	12
	15	14	9	-	14	38
	16	5	4	-	72	81
	17	3	2	-	89	95
	18	5	-	-	51	56
	19	15	1	-	53	69
	20	7	6	-	11	24
	21	17	13	-	3	33
	22	1	4	29	14	48
	23	-	2	26	40	68
	24	-	4	-	24	28
TOTALS		552	140	58	478	1237
%		79.2	87.5	12.5	70.8	
MA		23	5.8	2.4	20	
MI		29.1	6.7	19.3	28.1	
±SD		55.9	6.1	7.8	24.8	

Table 1 Number of mites collected by individual hosts (*Sceloporus torquatus*) and their infestation parameters in the Reserva Ecológica del Pedregal de San Ángel, Mexico City.

been recorded parasitizing reptiles, birds and mammals (Hoffmann and López-Campos 2000; Rocha *et al.* 2008).

The taxonomic determination of our material as *O. talaje* is based on the re-description of larvae reared from adults collected in Guatemala by Kohls *et al.* (1965); however, Venzal *et al.* (2008) pointed out that larvae collected by them near the type locality (Salamá, Baja Verapaz, Guatemala) differ morphologically from the ones collected in Mexico and southeastern United States. For this reason, in this study we keep the original name of the species until we have strong morphological and/or molecular evidence that suggests its inclusion into another.

The addition of *O. talaje* in the acarological record of *S. torquatus* increases to five the number of species associated with this host, four of them being collected in the very locality of our study (i.e., Pedregal de San Ángel). With this, the spiny collared lizard is the species of the genus *Sceloporus* with the highest richness of associated mites in Mexico, because in the 24 remaining species of the genus that have been studied from this perspective in the country, the richness value goes from one to four species, but collected in different localities (Paredes-León

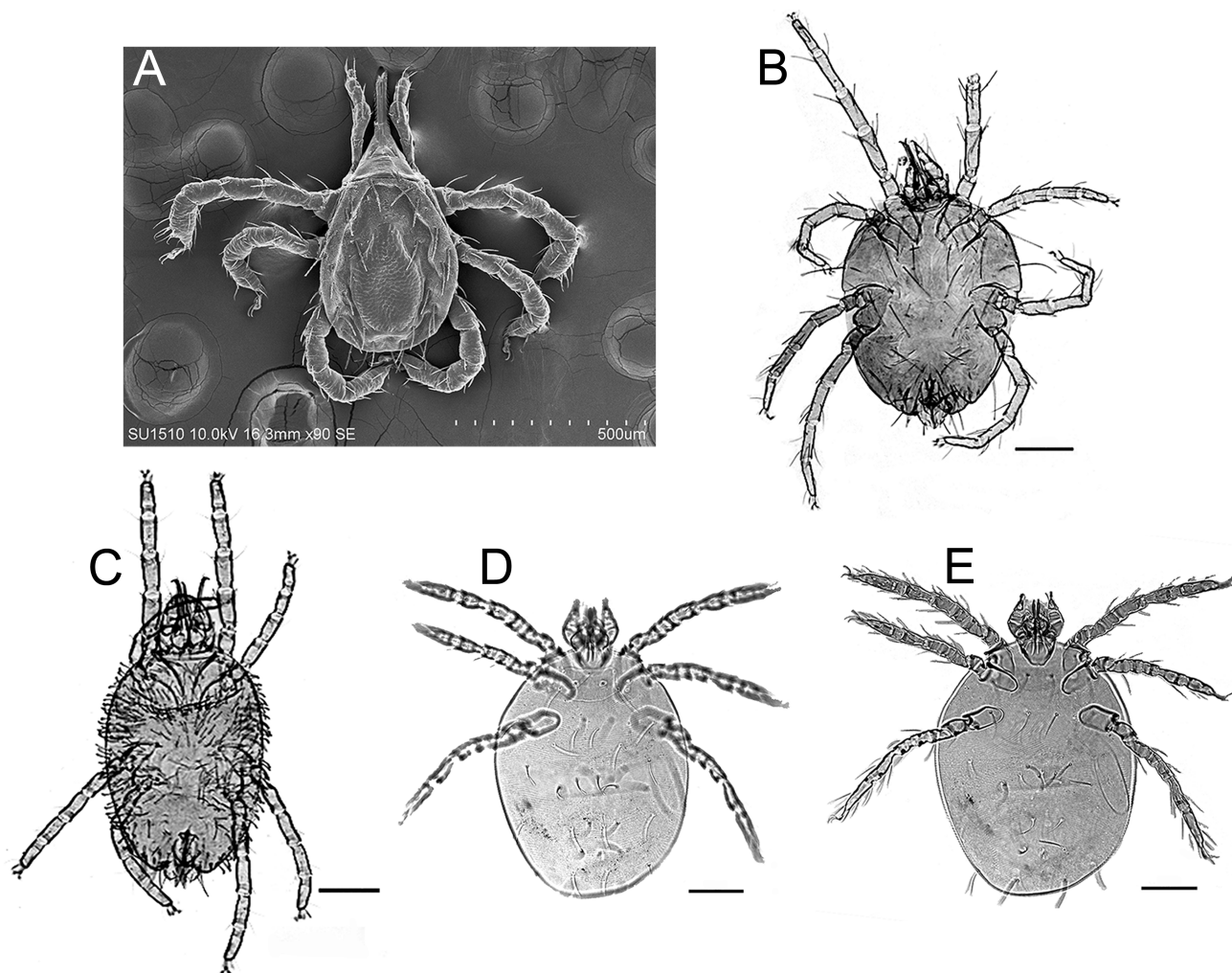


Figure 1 Parasitic mites associated with *Sceloporus torquatus* in the REPSA, Mexico City. A – Argasidae, *Ornithodoros talaje*. B-C, Pterygosomatidae, scale bars 200 µm: B – *Geckobiella pelaezi*; C – *Geckobiella texana*. D, Trombiculidae, *Eutrombicula alfreddugesi*, scale bars 80 µm: D – Ventral view, E – Dorsal view.

et al. 2008).

According to Cooley and Kohls (1944), rodents of the genera *Dipodomys*, *Neotoma*, and *Rattus* are frequent hosts of *O. talaje*; however this species has been recorded in a wide variety of hosts such as birds, serpents, domestic mammals, and even humans (Cooley and Kohls 1944). The first record of *O. talaje* parasitizing a reptile was made by Dunn (1933), who reported this mite on a rainbow boa *Epicrates cenchria* in a suburb of Panama City. In Mexican reptiles, this species has been previously recorded in three lizard species of the genus *Phyllodactylus* from Oaxaca (Paredes-León *et al.* 2008). The presence of this tick species in only three hosts in the REPSA could be explained by the occasional contact of the lizards with the nests of their primary host, i.e., rodents (Hoffmann and López-Campos 2000).

The acarofauna of *S. torquatus* is composed by two groups of species: permanent parasites (*G. texana* and *G. pelaezi*) and temporal parasites (*E. alfreddugesi* and *O. talaje*). The permanent infestation of pterygosomatid mites on the lizards is probably the main factor that determines the significant differences found in the prevalence levels of our sample between the pterygosomatid mites and *O. talaje*. On the contrary, the high observed prevalence of *E. alfreddugesi*, which is a temporal parasite of these lizards, may be explained by the fact that we conducted our sampling during the rainy season. In temperate zones, temperature seems to act

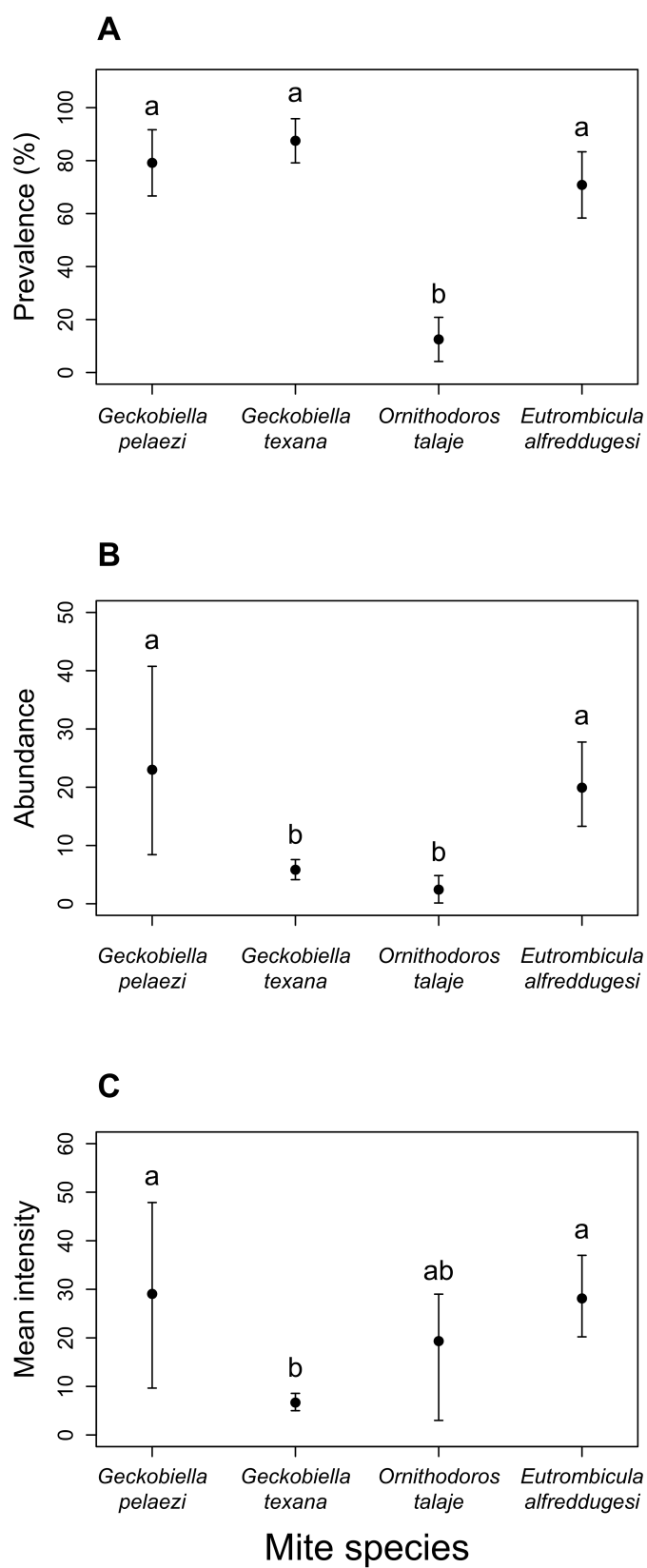


Figure 2 Prevalence, abundance, and mean intensity of four species of mites that infest the lizard *Sceloporus torquatus* in the Reserva Ecológica del Pedregal de San Ángel, Mexico City. Error bars denote confidence intervals (84%). Different letters indicate statistically significant differences.

as the main determining factor whereas the amount of precipitation is a more important cause in tropical regions (Sasa 1961). Thus, environmental humidity seems to favor the abundance of *E. alfreddugesi*, which is consistent with the general pattern observed in Trombiculidae. In this family, population numbers increase toward the higher levels of environmental humidity (Michener 1946). Particularly for *E. alfreddugesi*, Clopton and Gold (1993) demonstrated that larval population densities are greatest in areas of high relative humidity, moderate temperature, and low incident sunlight.

In addition, during the rainy season, females of *S. torquatus* undergo vitellogenesis, allocating energy and fat reserves to the production of oocytes (Feria-Ortiz *et al.* 2001). On the other hand, males of this species also carry out reproductive activities during rains, such as the establishment and defense of territories (Feria-Ortiz *et al.* 2001). These activities are costly and can negatively affect certain components of the lizards' immune system (Belliure *et al.* 2004), which apparently makes them particularly susceptible to the infestation by *E. alfreddugesi* during the wet season.

Interestingly, even though *G. texana* was found in almost 90% of the lizards that we examined, its abundance and mean intensity were significantly lower compared to those of *G. pelaezi*. These differences are difficult to explain based on the punctual sample that we made. However, we can hypothesize that factors such as host immune response, seasonal variations in the population levels of both mite species, host preference and even interspecific competition could be elements determining such differences.

The poor knowledge of mites associated with reptiles of Mexico (51 species associated with 92 reptile species according to Paredes-León *et al.* 2008) highlights the importance of continuing the inventory of this taxonomic group, considering the richness and endemism of reptiles in this country (864 species, see Flores-Villela and García-Vázquez (2014)). In parallel with the above, the knowledge of biological and ecological aspects of these arthropods must be increased, in order to achieve an integral understanding of this parasite-host relationship.

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