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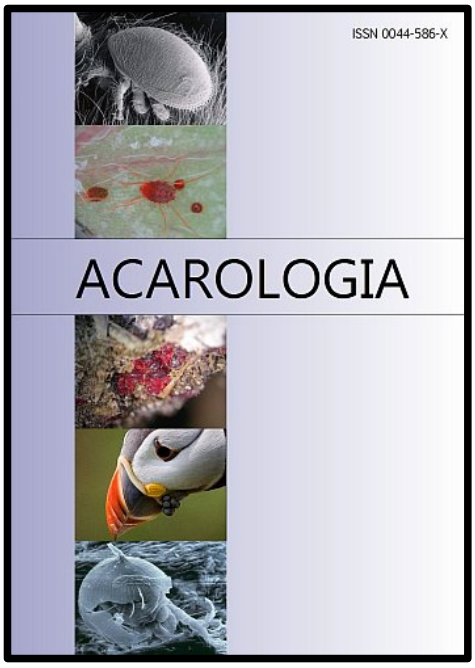

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Occurrence of the mite *Ophionyssus natricis* (Acari: Macronyssidae) on captive snakes from Panama

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ABSTRACT — We report for the first time the presence of the snake mite, *Ophionyssus natricis* (Gervais) (Mesostigmata: Macronyssidae) on captive snakes kept in Panama City, Panama. This occurrence adds a new record to the geographical distribution of *O. natricis* as well as confirming its high prevalence on captive reptiles. Several Boidae species, *Boa constrictor*, *Epicrates maurus*, *Corallus ruschenbergerii*, *Corallus caninus* and a Pythonidae, *Python regius* were found infested with intensities varying from 10 to 2200 mites each. These findings represent the second record of *O. natricis* for Central America.

KEYWORDS — parasitic mites; reptile pets; Boidae; Pythonidae; Panama

The exotic pet trade has reached worldwide proportions and involves a variety of wild animals from invertebrates to vertebrates. The movement of these exotic pets incorporates the translocation of many zoonotic diseases and vectors, most of which are still poorly studied and understood. Invertebrates, either pets or vectors are perhaps the most understudied. Chelicerates are a good example, with a huge body of literature lecturing on ticks (Ixodida) but very little on small parasitic mites of exotic pets (Masan *et al.*, 2012). *Ophionyssus natricis* (Gervais, 1844) is the most widespread mite-pest of captive reptiles, particularly snakes (Squamata). This preference for reptiles seems to be characteristic of the genus *Ophionyssus*. Of the 16 species of this genus, 15 have been reported as parasites of reptiles, with only one species described from a mammal (Moraza *et al.*, 2009).

Bites of *O. natricis* cause damages on the skin of captive reptiles, and if the level of infestation is high enough or out of control, it will consequently lead to irritation, anemia and even death (Beck and Pantchev, 2006, Hoppman and Wilson, 2007, Rataj *et al.*, 2011). In addition, this mite is able to transmit pathogens as hemogregarines, *Aeromonas* spp., being the mechanical vector of hemorrhagic septicemia, caused by the motile anaerobic bacillus *Aeromonas hydrophila*, and responsible of or associated with the still under investigation "Inclusion Body Disease" (Camin, 1948; Yunker, 1956; Chang and Jacobson, 2010; Mariana *et al.*, 2011). *O. natricis* is of great concern to zoos, pet shops and private

TABLE 1: Instars of *Ophionyssus natricis* observed in subsamples collected from *Boa constrictor* and its terrarium. [MM: males; FF: females; ẋ: average; σ: standard deviation].

Subsamples	Adults		Sex ratio	Immature instars	Total
	# females	# males	(MM/FF+MM)		
1	9	7	0,44	367	383
2	7	6	0,46	398	411
3	37	11	0,23	437	485
Total	53	24	0,31	1202	1279
ẋ	18	8	0,31	401	426
σ	17	3		35	53
%	4,2	1,9		93,9	100

collections of reptiles, especially due to its ability to spread fast from a single parasitized animal to others in the same enclosure or nearby (Rodríguez and Lazcano, 1992). Despite being pests of specific reptile hosts, *O. natricis* can opportunistically move to other hosts, like other blood sucking mites do, particularly in the domestic environment, e.g. like those in the families Macronyssidae, Dermanyssidae and Laelapidae (O'Donel Alexander, 1984), and whenever there is a shortage of food or the infestation is too severe, implying high competition for resources, the mites are able to affect humans, such as pet owners, keepers and handlers of infested snakes (Hoppman and Wilson, 2007; Rataj *et al.*, 2011; Amanatfard *et al.*, 2014).

Ophionyssus natricis was first described from native European snakes and later became associated with captive reptiles of different biogeographical regions (Fain, 1962; Domrow, 1985; Fain and Bannert, 2000; Paredes-León *et al.*, 2008), with just a handful of papers mentioning infestation of wild snakes (Yunker, 1956, Simonov and Zinchenko, 2010). To date, *O. natricis* have been reported in Africa (Yunker, 1956), Europe (Beck and Pantchev, 2006; Simonov and Zinchenko, 2010), Oceania (Domrow, 1985), Asia (Mariana *et al.*, 2011), and America (Schroeder, 1934; Camin, 1948). Specifically for the Neotropical region, *O. natricis* has been only reported from Mexico (Rodríguez and Lazcano, 1992; Paredes-León *et al.*, 2008) and Nicaragua (Rimbaud *et al.*, 2006).

This is the first report documenting *O. natricis* on captive snakes from the City of Panama, Panama. Occurrence of mites was recorded between May and June 2015, from homes that kept reptiles as pets, captive in small micro-cosmos. The findings included five species of snake-hosts: *Boa constrictor* Linnaeus, 1758, *Epicrates maurus* Gray 1849, *Corallus ruschenbergerii* (Cope, 1876), *Corallus caninus* (Linnaeus, 1758) and *Python regius* (Shaw, 1802). The snakes had been living in captivity in their respective homes for several months (9-48 months). In all cases they were maintained in individual terrariums constructed with wooden frames, glass walls, and with wood paper as substrate. The owners indicated that the snakes were more aggressive than usual, and any severe skin damage was observed and recorded. After collection of mites from the snakes, all snakes and terrariums were treated with Fipronex® and the success of the control became evident days later.

The ectoparasites were removed manually by one of the authors (JEC), and preserved by placing them in vials with 70% ethanol. Once in the laboratory, a sample of 30 mites (randomly taken from the 5 snakes) was treated with 10% NaOH and mounted using Hoyer's medium. Species identification followed the key of Moraza *et al.* (2009). The slides were deposited into the "Dr. Eustorgio Mendez" Zoological Collection of the Gorgas Memorial Institute.

The number of mites collected on *E. maurus*, *C. ruschenbergerii*, *C. caninus* and *P. regius* was between 10-50 specimens. Remarkable was the infestation

over *Boa constrictor* and its terrarium, estimating that there were approximately 4000 individuals, estimation based on three subsamples of 2 ml each (Table 1). Most specimens were immature stages and adults (females) (Figure 1). Empty puparia of Phoridae flies and some individuals of *Glycycometus malaysiensis* (Fain and Nadchatram, 1980) (Aeroglyphidae) were also present in this sample.

FIGURE 1: Habitus of *Ophionyssus natricis* female, collected from *Boa constrictor* terrarium. Scale bar = 0.35 mm.

Previous reports of mites parasitizing pet-reptiles in Panama include a tick species close to *Amblyomma flavomaculatum* on *Varanus exanthematicus* (Bosc, 1792) (Bermúdez and Miranda, 2011), the pterygosomatid mite *Geckobiella stamii* Hirst, 1917 on *Iguana iguana* (L. 1758) (Murgas *et al.*, 2013) and the argasid tick *Ornithodoros puertoricensis* Fox 1947 on Varanidae and Pythonidae (Bermúdez *et al.*, 2015).

The predominance of females (Table 1, sex ratio) and immature stages was noted earlier by Domrow (1985) and Mariana *et al.* (2011), and these two works emphasised that a single female could generate a large offspring. In fact, a female bias is the canon for haplodiploid species and *O. natricis* is one of them, this is also a common feature of many Macronyssidae. They reproduce by arrhenotokous parthenogenesis, where females are diploid and males are the result of unfertilized eggs (Oliver, 1966). Its nidicolous behavior corresponds well with acarine haplodiploid clades having adaptations to live in patchy or ephemeral environments (Perotti and Braig, 2009).

This mite species must be considered a risk to humans, pet owners or keepers, in addition to reptiles, due to the stress caused by the implicit bites and further infection (Schultz, 1975, Rataj *et al.*, 2011, Amanatfard *et al.*, 2014). There is also an extra risk for humans handling animals, especially if the snakes are not normally aggressive, because this behavior increases with high infestations of *O. natricis* (Amanatfard *et al.*, 2014).

Finally, the infestations of captive animals by *O. natricis* should be considered as a serious risk in the trade business and maintenance procedures of exotic reptiles, and efforts should focus on keeping captive animals under periodic health checks and under treatment. The application of biological control methods including the use of predatory mites such as Laelapidae and/or *Cheyletus* (Schillinger *et al.*, 2013) or the applications of low toxicity acaricide compounds (Rodríguez and Lazcano, 1992) have proven to be successful and affordable to keep captive pets in good health.

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