



NOTA BREVE:

Anuran predators of scorpions: *Bufo marinus* (Linnaeus, 1759) (Anura: Bufonidae), first known natural enemy of *Tityus nematochirus* Mello-Leitão, 1940 (Scorpiones: Buthidae)

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Anuran predators of scorpions: *Bufo marinus* (Linnaeus, 1758) (Anura: Bufonidae), first known natural enemy of *Tityus nematochirus* Mello-Leitão, 1940 (Scorpiones: Buthidae)

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Abstract:

Even though there are several known frog and toad species which feed on scorpions, only three have been reported for the Neotropics. In the same way, only three scorpion species with anurans as natural enemies are known in this region. The extraction of the stomachal contents of five specimens of *Bufo marinus* allowed to find out that the scorpion *Tityus nematochirus* is included on this toad's diet at the City of Villavicencio (Colombia). In this way, a fourth anuran species feeding on scorpions and another scorpion predated by this amphibian group are presented for the Neotropical Region. Some considerations suggest that this toad may be feeding on other scorpion species which it is sympatric with in the studied zone.

Key words: Scorpiones, Buthidae, Anura, *Tityus*, *Bufo*, predation, natural enemies, Colombia, Villavicencio.

Anuros depredadores de escorpiones: *Bufo marinus* (Linnaeus, 1758) (Anura: Bufonidae), primer enemigo natural conocido de *Tityus nematochirus* Mello-Leitão, 1940 (Scorpiones: Buthidae).

Resumen:

A pesar de que se conocen varias especies de ranas y sapos que se alimentan de escorpiones, solo tres han sido registradas para el Neotrópico. De igual modo, tan solo se conocen en esta región tres especies de escorpiones con anuros como enemigos naturales. La extracción de los contenidos estomacales de cinco ejemplares de *Bufo marinus* permitió detectar que este sapo incluye en su dieta al escorpión *Tityus nematochirus* en la Ciudad de Villavicencio (Colombia). De este modo, se presentan una cuarta especie de anuro que se alimenta de escorpiones y otro escorpión depredado por este grupo de anfibios, en la Región Neotropical. Algunas consideraciones sugieren que este sapo puede estar alimentando de otras especies de escorpiones con las cuales se encuentra en simpatría en la zona estudiada.

Palabras clave: Scorpiones, Buthidae, Anura, *Tityus*, *Bufo*, depredación, enemigos naturales, Colombia, Villavicencio.

Introduction

Scorpions, as many arachnids, are in the middle of food chains where efforts for both obtaining preys and preventing to become such must be focused. Although some scorpion predators show diurnal activity periods and search for preys in their refuges, many others have nocturnal habits (i.e. some anuran species). Both vertebrate and invertebrate groups are known to be scorpion predators (Polis *et al.*, 1981; McCormick & Polis, 1990); among the first, anurans represent 6% of the species (McCormick & Polis, 1990).

In their contribution to the knowledge of scorpion predators, Polis *et al.* (1981) mentioned seven anuran species that had been reported in previous papers feeding on scorpions, that are five of the genus *Bufo* Laurenti, 1768 (Bufonidae), one of the genus *Pyxicephalus* Tschudi, 1838 (Ranidae) and one of the genus *Scaphiopus* Holbrook, 1836 (Scaphiopodidae). Of these, four reports are for the United States, two for South Africa and one for Singapore, and no previous report of anuran predation on scorpions was known for the Neotropics.

This was until the publication of Armas (1987), where he mentions the toad *Bufo (Peltaphryne) peltcephalus* Tschudi, 1838 predated on the scorpion *Rhopalurus junceus* (Herbst, 1800) (Buthidae) in Pinar del Río Province, West Cuba. Posteriorly, Lourenço & Cuellar (1995) found remains of adult females of *Tityus bastosi* Lourenço, 1984 (Buthidae) in four specimens of the frog *Leptodactylus pentadactylus* (Laurenti, 1768) (Leptodactylidae) collected in the region of San Pablo, Napo Province of Ecuador. A year later, Teruel (1996) reported the frog *Osteopilus septentrionalis* (Duméril & Bibron, 1841) (Hylidae) predated on the scorpion *Centruroides guanensis* Franganillo, 1930 (Buthidae) near the city of Las Tunas, East Cuba. All the anurans which are known from literature to predate on scorpions are compiled in Table I. This paper presents a new case of anuran predation on scorpions, the fourth of its nature known for the Neotropics and the first one for Colombia.

Methods

During a field practice at El Carmen, Villavicencio (Department of Meta, Colombia) on April 2005, five

specimens of *Bufo marinus* (Linnaeus, 1758) were collected and the arthropods contained in their stomachal contents were removed and determined at the Entomology Laboratory of the Pontificia Universidad Javeriana (PUJ, Bogotá), where they are deposited.

The studied area is located in the Tropical belt of the Eastern slope of the Cordillera Oriental, between 4° 8' N and 73° 40' W (900-1000 m above sea level). It is found in the transitional zone between the Cordillera and the Orinocence grasslands, in the portion of what has been considered by various authors as a Centre of Endemism (Rodríguez *et al.*, 2004).

Results and discussion

Metasomal and pedipalpal remains mainly of the scorpion *Tityus nematochirus* Mello-Leitão, 1940 (Fig. 1a) were obtained from two adult toads, apparently corresponding to a single adult scorpion in one specimen, and two adult individuals and one juvenile in the other. This is the first report of a natural enemy of *T. nematochirus* and the first one of *B. marinus* predated on scorpions.

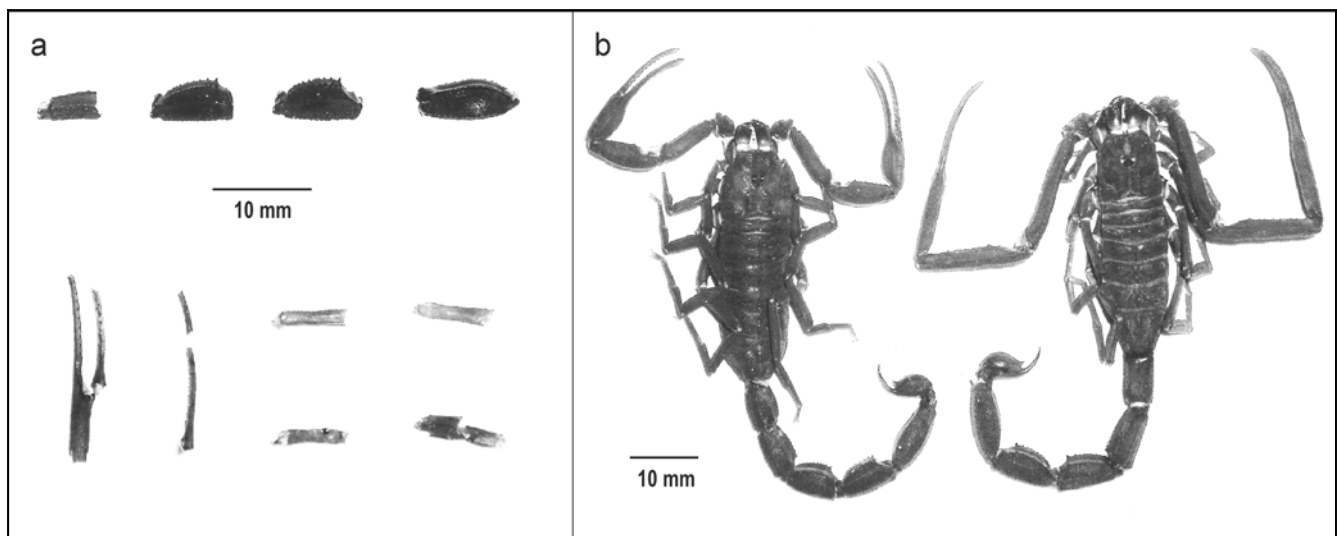


Figure 1: *Tityus nematochirus*. (a). metasomal (above) and male pedipalpal (below) segments obtained from the stomachal contents of *Bufo marinus*. (b). male (right) and female (left) from Villavicencio showing sexual dimorphism.

Taxonomic identity of the juvenile scorpion should be confirmed because its remains are notably degraded due to the stomachal digestion and poor degree of sclerotization. This is of great importance because in three previous scorpion samplings carried out in the same region, it was possible to identify, additional to *T. nematochirus*, the species *T. bastosi* (the same species Lourenço & Cuellar [1995] reported as being predated) and *Ananteris* sp. (Buthidae), which could also be actually predated by *B. marinus*.

The remains of the adult scorpions were compared

with the specimens collected in the region, and the trichobothrial pattern characteristic of family Buthidae together with 17 oblique rows of granules in the movable finger of pedipalp chela, unique of *Tityus* C. L. Koch, 1836, were still visible. Also, the pedipalpal fragments showed the marked sexual dimorphism of *T. nematochirus* (Figs. 1a, b). Even though there are other Colombian buthid species which exhibit similar sexual dimorphisms, they do not occur in the studied region (Flórez, 2001) which is the original locality of *T. nematochirus* holotype (Mello-Leitão, 1940).

T. nematochirus belongs to the *Tityus asthenes* species complex. It reaches huge size (almost 10 cm length) and its colour varies from dark brown to black. Able to occupy different habitats it may be found in the 100-1000 m range, and presents populations in the Orinocence and Amazonian geographic regions of Colombia (Flórez, 2001), in Peru and Venezuela (Fet & Lowe, 2000). On the other hand, *B. marinus* is a species

of nocturnal habits which is distributed from Southern Texas through Central and South America reaching Brazil. This toad is native to Colombia (Global Amphibian Assessment, unpublished data) where it presents a wide geographical distribution with abundant populations, mainly in lowlands (A. R. Acosta, pers. comm.).

Anuran predator	Scorpion prey	Locality	Authority
<i>Bufo cognatus</i> Say, 1823		Oklahoma (USA)	Smith & Bragg, 1949 *
<i>Bufo compactilis</i> Wiegmann, 1833		Oklahoma (USA)	Smith & Bragg, 1949 *
<i>Bufo terrestris</i> (Bonnaterre, 1789)		Oklahoma (USA)	Smith & Bragg, 1949 *
<i>Bufo melanostictus</i> Schneider, 1799		Singapore	Berry & Bullock, 1962 *
<i>Bufo regularis</i> Reuss, 1833		South Africa	Wager, 1965 *
<i>Pyxicephalus adspersus</i> Tschudi, 1838		South Africa	Wager, 1965 *; Grobler, 1972 *
<i>Scaphiopus couchii</i> Baird, 1854		South-western USA	Whitaker <i>et al.</i> 1977 *
<i>Bufo (Peltaphryne) pelticephalus</i> Tschudi, 1838	<i>Rhopalurus junceus</i> (Herbst, 1800)	Pinar del Río Province (Cuba)	Armas, 1987
<i>Leptodactylus pentadactylus</i> (Laurenti, 1768)	<i>Tityus bastosi</i> Lourenço, 1984	San Pablo (Napo Province, Ecuador)	Lourenço & Cuellar, 1995
<i>Osteopilus septentrionalis</i> (Duméril & Bribon, 1841)	<i>Centruroides guanensis</i> Franganillo, 1930	Las Tunas (Cuba)	Teruel, 1996
<i>Bufo marinus</i> (Linnaeus, 1758)	<i>Tityus nematochirus</i> Mello-Leitão, 1940	El Carmen (Villavicencio, Colombia)	**

Table I: Anuran predators of scorpions that are known from literature. * References cited by Polis *et al.* (1981), included in the “Cited References” section. ** Predation case presented in this paper.

This case of predation results interesting considering that although *T. nematochirus* is not known to have any medical importance, its huge size and aggressivity would be expected to be a successful mechanism against its predation by *B. marinus*. Nevertheless, according to Polis *et al.* (1981) and McCormick & Polis (1990) many scorpion predators are immune to their venoms and even able to break their metasoma, thus decreasing the likelihood of being stung and subsequently envenomated. Apparently, these aspects have not been studied on this toad species, and due to the circumstances at which this study was developed and the condition of the scorpion remains, they could not be determined. Further research should be done to establish whether *B. marinus* is immune to the venom of this scorpion, or if its faculty of feeding on it responds to behavioural or internal morphological adaptations.

One case of anuran predation mentioned above (see Lourenço & Cuellar [1995]) involves *L. pentadactylus*, a frog species similar in size to *B. marinus*, feeding on *T. bastosi*. The adults of this scorpion do not exceed 4 cm length and their strategy to avoid potential predators is to simulate being dead (Lourenço & Cuellar, 1995). This behaviour is referred to as tanatosis and is absent in *T. nematochirus* (pers. obs.). Regarding this point, it must be considered that frogs and toads typically feed on moving preys (Lourenço & Cuellar, 1995), and as tanatosis is absent in this scorpion it may be easily predated, in spite of its cryptic colouration with soil

substrate where usually *B. marinus* awaits its preys. In this way, such crypsis could be an effective mechanism to reduce the risk of being detected by potential predators (as stated by McCormick & Polis [1990]) different than frogs and toads.

Even though numerous species appear to be scorpion-specialized predators, there are many others for which scorpions are not a common item in the diet (Polis *et al.*, 1981). Concerning this matter, it should be noted that within the overall stomachal content removed from the examined toads in this study, 13 arthropod Orders additional to Scorpiones were identified, included in the Classes Insecta, Diplopoda, Arachnida, Chilopoda and Malacostraca in decreasing order of abundance of specimens extracted. Although these results are not of the main purpose of the present study, they point out that in the studied region *B. marinus* is a generalist, opportunistic predator. Is for this reason that I suggest that in that zone this toad is also predated on *Ananteris* sp. and *T. bastosi*, moreover taking into account their small size (less than 4 cm length) and the high population density of the last species in the area (pers. obs.).

On the other hand, the fact that in the studied region this toad feeds on *T. nematochirus* (in part) corresponds well with the characteristics that according to Polis *et al.* (1981) make scorpions a good prey item. These are i) their high population densities in some areas and ii) their larger body size if compared with the majority of invertebrates in many communities.

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Cited references

- ARMAS, L. F. DE. 1987. Depredación de arácnidos por dos vertebrados cubanos. *Miscelánea Zoológica, Instituto de Zoología, Academia de Ciencias de Cuba*, **34**: 1-2.
- BERRY, P. Y. & J. A. BULLOCK. 1962. The food of the common Malayan toad, *Bufo melanostictus* Schneider. *Copeia*, **1962**: 736-741.
- FET, V. & G. LOWE. 2000. Family Buthidae. Pp. 54-286. In: *Catalog of the Scorpions of the World (1758-1998)*. V. Fet, W. D. Sissom, G. Lowe & M. E. Braunwalder (eds.). The New York Entomological Society. New York. 690 pp.
- FLÓREZ, D. E. 2001. Escorpiones de la familia Buthidae (Chelicerata: Scorpiones) de Colombia. *Biota Colombiana*, **2**(1): 25-30.
- GROBLER, J. H. 1972. Observations on the amphibian *Pyxicephalus adspersus* Tschudi in Rhodesia. *Arnoldia (Rhodesia)*, **6**(3): 1-4.
- LOURENÇO, W. R. & O. CUELLAR. 1995. Neotropical frog *Leptodactylus pentadactylus* eats scorpions. *Alytes*, **12**(4): 191-192.
- MCCORMICK, S. J. & G. A. POLIS. 1990. Prey, predators and parasites. Pp. 294-320. In: *The Biology of Scorpions*. G. A. Polis (ed.). Stanford University Press. Stanford. 587 pp.
- MELLO-LEITÃO, C. DE. 1940. Um pedipalpo e dois escorpiones da Colombia. *Papéis Avulsos*, **1**: 51-56.
- POLIS, G. A., W. D. SISSOM & S. J. MCCORMICK. 1981. Predators of scorpions: field data and a review. *Journal of Arid Environments*, **4**: 309-326.
- RODRÍGUEZ, N., D. ARMENTERAS, M. MORALES & M. ROMERO. 2004. *Ecosistemas de los Andes Colombianos*. Instituto de Investigación de Recursos Biológicos Alexander von Humboldt. Bogotá.
- SMITH, C. C. & A. N. BRAGG. 1949. Observations on the ecology and natural history of Anura, VII. Food and feeding habits of the common species of toads in Oklahoma. *Ecology*, **30**: 333-349.
- TERUEL, R. 1996. Enemigos naturales de los escorpiones cubanos. *Garciana*, **24-25**: 13-14.
- WAGER, V. A. 1965. *The Frogs of South Africa*. Purnell. Cape Town.
- WHITAKER, J. O., D. RUBIN & J. R. MUNSEE. 1977. Observations on food habits of four species of spadefoot toads, genus *Scaphiopus*. *Herpetologica*, **33**: 468-475.