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Snakes from the Pontal do Triângulo Mineiro Region, Cerrado Domain, Southeastern Brazil

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ABSTRACT:

Snakes play an important ecological role, interacting with other species and feeding on some that are considered pests and illness vectors. The present work aims to list the snake species present in the Municipality of Ituiutaba, southeastern Brazil. The data were obtained from preserved specimens deposited in zoological collections, visual surveys and occasional encounters. Fifty-seven individuals were analyzed, and we identified twenty-three species, distributed in five families. The number of species found is relatively high, considering the advanced degree of alterations in the natural environment, where only 15% remains intact. In our sample, we identified individuals of two viperid genera with medical and pharmacological importance. The present study contributes to the knowledge on snake assemblages in the Cerrado, and emphasizes the importance of inventories of the local fauna, mostly in environments with anthropic action, resulting in loss of habitats.

Keywords: *Species. Snakes. Ituiutaba.*

1 Introduction

Snakes are a highly diverse group, which are currently 392 known species in Brazil (COSTA and BÉRNILS, 2015). The Cerrado biome harbors a large number of these species (COSTA et al. 2007; MARQUES et al. 2015), even though herpetofauna is still poorly documented in several localities (COSTA et al. 2007). In five years the number of snake species rose from 107 in 2002 to 145 in 2007 (COLLI et al. 2002; COSTA et al. 2007), which reinforces the high diversity of snakes in this biome.

Agricultural expansion and intensification, together with cattle raising and urban development observed in the last decades in the Cerrado, the diversity of snakes may have been mainly affected by the loss and fragmentation of natural habitats (PONTES et al. 2009; WADE et al. 2003). This group has great ecological significance and the consequences of diversity loss can be severe, because as predators, they contribute to prey population control (ROCHA et al. 2008).

Some species in the Cerrado are considered as dangerous because of their highly toxic venom, which has medical and pharmacological importance, and the epidemiological distribution of accidents involving them is deeply linked with habitat modifications (WEN et al. 2002). Therefore, habitat loss may cause the snakes to invade anthropic environments, increasing the number of accidents (BASTOS et al. 2005) and frequently being killed by local residents.

The Cerrado biome is a recognized global biodiversity hotspot, with at least 87 priority areas for conservation (CAVALCANTI and JOLY, 2002). The Triângulo Mineiro region, in the west of the state of Minas Gerais, is especially under pressure due to the increase in cultivated areas, mainly for sugar cane, which is one of the major threats to biodiversity and can lead to population decline and local extinctions (GIARETTA et al. 2008; MICHELOTTO, 2008).

Species composition in a determined area is important as a framework for future research related to biodiversity and conservation (COLLI et al. 2002), thus, the aim of the present work was to inventory the snake species of the municipality of Ituiutaba, Minas Gerais. In addition, we compare the species list with a previous snake species list for the municipality of Uberlândia.

2 Materials And Methods

Study site

The municipality of Ituiutaba is located in the “Pontal do Triângulo Mineiro”, in the west of the State of Minas Gerais, (49° 27' 54" W; 18° 58' 08" S, figure 1), with a total area of about 2600 km². The local biome is characterized mainly by Cerrado phytophysionomies (IBGE, 2016). The climate is tropical with rainy summers and dry winters, where the average monthly temperature is about 18°C (TONIETTO, 2006), and an average annual rainfall of 1450 millimeters (QUEIROZ, 2012).



Figure 1 - Location of the Municipality of Ituiutaba (in yellow) in the state of Minas Gerais (in green), southeastern Brazil

Data collection

The work was carried out between May 2011 and June 2012 in non-standardized campaigns. Data collection was made through visual surveys for snakes in the field, on trails, access roads and forest patches near the university in Ituiutaba (Faculdade de Ciências Integradas do Pontal; FACIP - UFU), during diurnal and nocturnal periods. Possible shelters, such as fallen logs and burrows, were surveyed, as well as in vegetation up to five meters high (ZANELLA and CECHIN, 2006). Snakes found during the field activities of the FACIP students and teachers were identified and added to the list.

Snakes from the Zoonosis Control Center (CCZ) collection were identified and added to the list as well. Additional records were obtained by consulting the herpetological collections of the João Moojen Zoological Museum (MZUFV) at the Federal University of Viçosa, and the Ezequiel Dias Foundation (FUNED).

The encounters with snakes were photographically documented, however, they were not captured. Dead animals we encountered were deposited in the FACIP teaching collection. All snakes were identified to the lowest taxonomic level based on identification keys according to Peters and Orejas-Miranda (1970) and Campbell and Lamar (2004), comparing the specimens with photographic guides: Marques et al. (2004) and Marques et al. (2015). The resulting list was then compared to a previously published snake species list from the Municipality of Uberlândia, located about 130 kilometers from Ituiutaba (BRITES and BAUAB, 1988). The species names presented here follow those of Costa and Bérnils (2015).

3 Results

During the study, 57 specimens were examined. We recorded for the “Pontal do Triângulo Mineiro” region 23 snake species, distributed in 16 genera and five families (Table 1, Figure 2). In field surveys, (FS) we registered 17 species, including all species of the Boidae family with occurrence in the region. In the Zoonosis Control Center (CCZ) collection, 13 species were identified (six species were only sampled at CCZ), two species were recorded at Ezequiel Dias Foundation (FUNED), all previously recognized in our sample (visual surveys and occasional encounters), and one new record at João Moojen Zoological Museum (MZUFV): *Xenodon merremii*. The snakes were classified in four categories based on the state in which they were found: Preserved (n=33), Alive (n=9), Road-killed (n=13) or Killed by humans (n=2), (Figure 3).

Table 1: List of snake species recorded in the municipality of Ituiutaba, with the number of individuals (N), and origin: Field Survey (FS), Zoonosis Control Center (CCZ), Ezequiel Dias Foundation (FUNED), and João Moojen Zoological Museum of the Federal University of Viçosa (MZUFV). The (*) represents the species recorded in the municipality of Uberlândia.

Family/Species	FS	CCZ	FUNED	MZUFV
Boidae				
<i>Boa constrictor</i> Linnaeus, 1758*	1			
<i>Epicrates cenchria</i> (Cope, 1862)	1			
<i>Eunectes murinus</i> (Linnaeus, 1758)	2			
Colubridae				
<i>Chironius flavolineatus</i> (Boettger, 1885)*		2		
<i>Mastigodryas bifossatus</i> (Raddi, 1820)*		2		
<i>Simophis rhinostoma</i> (Schlegel, 1837)*	1			
Dipsadidae				
<i>Apostolepis assimilis</i> (Reinhardt, 1861)*		3	1	
<i>Erythrolamprus almadensis</i> (Wagler in Spix, 1824)*	1			
<i>Erythrolamprus poecilogyrus</i> (Wied, 1825)*	1			
<i>Erythrolamprus reginae</i> (Linnaeus, 1758)*	1			
<i>Oxyrhopus guibei</i> Hoge & Romano, 1978*	2	2	2	
<i>Oxyrhopus trigeminus</i> Duméril, Bibron & Duméril, 1854*		1		
<i>Philodryas agassizii</i> (Jan, 1863)*	1			
<i>Philodryas nattereri</i> Steindachner, 1870		1		
<i>Philodryas olfersii</i> (Lichtenstein, 1823)*	1	1		

to be continued...

Table 1: continuation...

Family/Species	FS	CCZ	FUNED	MZUFV
<i>Philodryas patagoniensis</i> (Girard, 1858)*		1		
<i>Phimophis guerini</i> (Duméril, Bibron & Duméril, 1854)*	1	1		
<i>Sibynomorphus mikanii</i> (Schlegel, 1837)*	3	5		
<i>Xenodon merremii</i> (Wagler in Spix, 1824)*				1
Elapidae				
<i>Micrurus frontalis</i> (Duméril, Bibron & Duméril, 1854)*	1			
Leptotyphlopidae				
<i>Trilepida koppesi</i> (Amaral, 1955)	2			
Viperidae				
<i>Bothrops moojeni</i> Hoge, 1966*	3	3	4	
<i>Bothrops neuwiedi</i> (Wagler, 1824)*	1	1		
<i>Crotalus durissus</i> (Linnaeus, 1758)*	1	1	1	
Total number of individuals	24	24	8	1
Total number of species	17	13	4	1



Figure 2: Representatives of snake species found during the field study: A) *Epicrates cenchria*; B) *Erythrolamprus poecilogirus*; C) *Erythrolamprus reginae*; D) *Phimophis guerini*; to be continued....



Figure 2: continuation...E) *Sibynomorphus mikanii*; F) *Bothrops moojeni*; G) *Bothrops neuwiedi*; H) *Crotalus durissus*. Photography authors: Siqueira, L. H. C. (B, C and E) and Facure, K. G. (A, D, F, G and H).

The Dipsadidae was the most diverse family, corresponding to 56.5% of the total richness and 55% of the total abundance. Considering all individuals analyzed, the most common species was *Bothrops moojeni* (n=10, 18.5%), followed by *Sibynomorphus mikanii* (n=8, 14.8%), and *Oxyrhopus guibei* (n=6, 11%). Four analyzed individuals could not be identified, three because of the poor state of conservation and roadkill in one case.

Twenty-eight species were recorded in the municipality of Uberlândia, being that nineteen species of that list were found in this study (Table 1). Nine species (*Liotyphlops ternetzii*, *Clelia clelia*, *Erythrolamprus aesculapi*, *Oxyrhopus rhombifer*, *Pseudoboa nigra*, *Sibynomorphus turgidus*, *Thamnodynastes strigilis*, *Micrurus lemniscatus*, and *Bothrops alternatus*) were not registered in our study. On the other hand, four species were recorded only in the municipality of Ituiutaba (*Epicrates cenchria*, *Eunectes murinus*, *Philodryas nattereri*, and *Trilepida koppesi*).

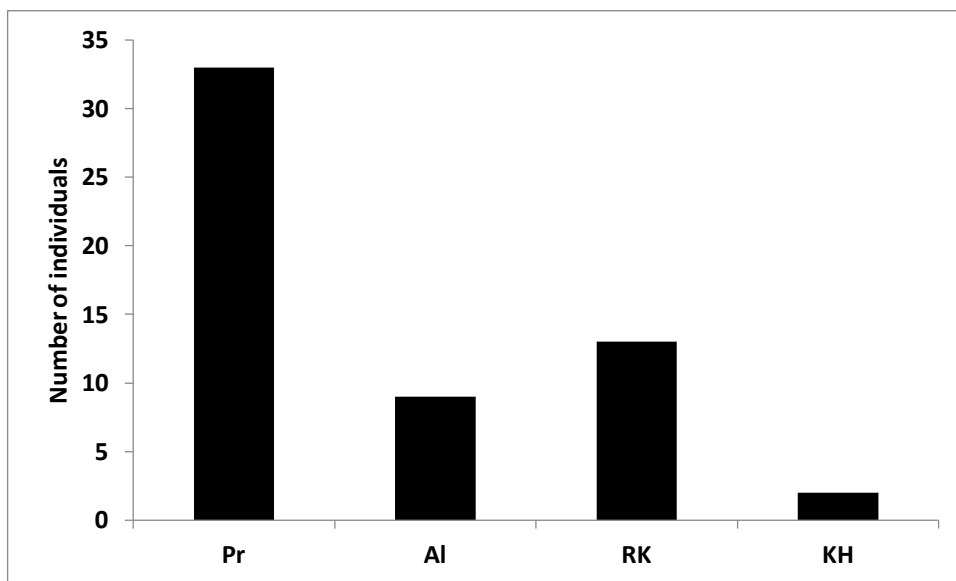


Figure 3 - Number of snakes found in each category: Preserved (Pr), Alive (Al), Road-killed (RK), and Killed by Humans (KH)

4 Discussion

The snakes we found have already been reported in the Cerrado and correspond to about 15.6% of the richness of this biome and none endemic species were recorded (COLLI et al. 2002; COSTA, 2007). The number of species found was smaller than those found in well-preserved and protected natural areas in this biome (richness ranged from 29 to 47; ARAUJO et al. 2010; FREITAS et al. 2016; RODRIGUES et al. 2015; SAWAYA et al. 2008; VALDUJO et al. 2009; VAZ-SILVA et al. 2007). However, considering the highly disturbed areas in the region of Ituiutaba, the snake assemblage presented here is relatively diverse. Besides, the visual surveys were conducted during the dry season (April, May and June), whereas snakes tend to have their activity peak during the wet/rainy season (BROWN et al. 2002; BROWN and SHYNE, 2002; MARQUES et al. 2000).

Five species (27.7%) from our sample are considered potentially dangerous (*Philodryas olfersii*, *Micrurus frontalis*, *Bothrops moojeni*, *Bothrops neuwiedi* and *Crotalus durissus*), including the most abundant species, *Bothrops moojeni*. This number represents almost one third of the species sampled in this region, which draws attention to the need of studies of these species mostly for the medical area (BERNARDE, 2011). Still, considering the proximity to the urban environment, several snakes can feed on animals that possibly are illness vectors, such as rodents, bats and snails (ZANOTTI-MAGALHÃES et al. 1991).

Several taxonomic groups have their historical classification marked by confusion, and the *Bothrops* complex is a very good example of it. During the data collection of the present study, the genus *Bothrops* was divided into “*Rhinocerophis*, *Bothrops* and *Bothropoides* (*Bothrops pauloensis* was included in this list)” (FENWICK et al. 2009). Carrasco et al. (2012) proposed the synonymization of the three genera under *Bothrops* a few years later. This instability in nomenclature is a complicating factor to taxonomy and future surveys and can be especially dangerous for medical and pharmacological issues (CARRASCO et al. 2016).

There were a huge number of snakes found dead either roadkill or killed by humans (Figure 3). This number must be due to the length of the snakes and their slow speed when crossing roads, besides they have the habit of using these sites, which provides considerable heat for thermoregulation (KUNZ and GHIZONI Jr., 2009).

Comparing our results with those shown by Brites and Bauab (1988) for the municipality of Uberlândia, it is possible to observe that the number of sampled species is approximately the same. This fact can be explained by the proximity of the study sites, despite the divergence in time expended in data collection (13 months in this work and 39 months in BRITES and BAUAB, 1988) and methodology (field surveys and material examined in collections in this work, while snakes were brought to the university by citizens in BRITES and BAUAB, 1988). Combining both lists, the total number of snake species known to the Triângulo Mineiro region is thirty-two. In both studies, *S. mikanii* was one of the most abundant, indicating that this species is very common in that region.

The species richness in the municipality of Ituiutaba is probably higher, and this subsample might be associated partly with the fossorial or cryptic habits of some snakes, such as *Apostolepis assimilis* (LEMA, 2001), which makes it difficult to find those species. Such habits can explain the absence of snakes of the Anomalepididae family, recorded previously in Uberlândia (BRITES and BAUAB, 1988).

5 Conclusions

The snake assemblage of the municipality of Ituiutaba has a large diversity of habitat use, and many are widely distributed, including other biomes, e.g. the Atlantic Forest (MARQUES et al. 2004). Hence, it is necessary to consider that due to strong anthropic pressure, since there are different ways the species may be impacted, mainly by population decline and community homogenization (MCKINNEY, 2006). It is important to stress that the majority of snakes recorded were identified from preserved animals in collections; such fact is an evidence of the great importance of zoological collections for biodiversity studies.

For the species discussed here, many have ecological and medical importance (ROCHA et al. 2008), which evidences the necessity to know the local fauna. The present study contributes to the knowledge about the snake assemblage in the west of Minas Gerais (Ituiutaba region), and sheds light on the need of future studies on diversity and distribution of this vertebrate group in the Cerrado under an unfavorable scenario with respect to conservation of natural areas.

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