SPECIES RICHNESS OF REPTILES IN A CAATINGA AREA IN NORTHEASTERN BRAZIL

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ABSTRACT – We present the species richness of reptiles in a Caatinga area in the state of Piauí, northeastern Brazil. Sampling was carried out between August 2007 and June 2011 (five years) through active search. We recorded 28 species of reptiles, of which 26 belonged to Squamata (13 lizards, 12 snakes and one amphisbaenian), one Testudine and one Crocodilian. Most species (n = 21; 75%) had a general and wide geographic distribution, however, some species were typical of the Caatinga biome or had restricted distribution to northeastern Brazil (n = 7; 25%). Although in recent years several studies have been conducted in the state of Piauí, the Caatinga regions are still understudied, and greater attention and long-term studies should be carried out in this unknown biome that is exclusive to Brazil. This study is the first inventory of reptiles to an area of Caatinga sensu stricto for the state of Piauí.

KEY WORDS: Species richness; Geographical distribution; Squamata; Caatinga.

RIQUEZA DE ESPÉCIES DE RÉPTEIS EM UMA ÁREA DE CAATINGA NO NORDESTE DO BRASIL

RESUMO – Apresentamos a riqueza de espécies de répteis em uma área de Caatinga no estado do Piauí, nordeste do Brasil. As coletas foram realizadas no período de agosto de 2007 a junho de 2011 (cinco anos) por meio de busca ativa. Foram registradas 28 espécies de répteis, sendo 26 Squamata (13 lagartos, 12 serpentes e um anfisbenídeo), um Testudine e um Crocodiliano. A maioria das espécies (n = 21; 75%) é de ampla distribuição geográfica e generalista, contudo algumas espécies são típicas do bioma Caatinga ou apresentam distribuição restrita ao nordeste brasileiro (n = 7; 25%). Embora nos últimos anos, vários estudos tenham sido realizados no estado do Piauí, as regiões de Caatinga ainda são subestimadas necessitando de maior atenção e estudos de longo prazo devem ser realizados para este bioma exclusivamente brasileiro. Este é o primeiro inventário de répteis para uma área de Caatinga stricto sensu para o estado do Piauí.

PALAVRAS-CHAVE: Riqueza de espécies; Distribuição geográfica; Squamata; Caatinga.

RIQUEZA DE ESPECIES DE REPTEIS EN UNA ÁREA DE CAATINGA DEL NORDESTE DE BRASIL

RESUMEN – Presentamos la riqueza de especies de reptiles en una área Caatinga en el estado del Piauí, noreste de Brasil. Las muestras se obtuvieron de agosto 2007 a junio 2011 (cinco años) a través de la búsqueda activa. Se registraron 28 especies de reptiles, 26 Squamata (13 lagartos, 12 serpientes y anfisbenídeo), un testudine y un cocodrilo. La mayoría de las especies (n = 21; 75%) es amplia distribución geográfica y general, pero algunas especies son típicas del bioma Caatinga o presentan distribución restringida al nordeste de Brasil (n = 7, 25%). Aunque en los últimos años, varios estudios se han realizado en el estado de Piauí, las regiones de Caatinga estan siendo subestimadas en la necesidad de mayores estudios de atención y largo plazo deben ser realizados hasta la este bioma exclusivamente brasileño. Este es el primer inventario de los reptiles en una área de Caatinga sensu stricto en el estado del Piauí.

PALABRAS CLAVE: Riqueza de especies; Distribución geográfica; Squamata; Caatinga.

INTRODUCTION

Knowledge on taxonomy, species richness, and spatial distribution are basic requirements to studies on faunal diversity (Whittaker et al. 2005, Guedes et al. 2014). However, this information remains scarce and unknown for most taxonomic groups, resulting in patterns of distributions poorly understood and numerous knowledge gaps (Whittaker et al. 2005; Bini et al. 2006; Lomolino et al. 2010).

In Brazil there are 768 recognized species of reptiles, of which 264 are lizards, 71 are amphisbaenians, 388 are snakes, 39 are testudines and six crocodilians (Uetz 2014).

Pioneering works on reptiles in the Caatinga, early concluded that in this natural domain there were not significant variations or endemisms, and suggested that any records of other species would be extensions of the distribution of species that already occur naturally in other biomes (Vanzolini et al. 1980). These claims were refuted in later works that demonstrated high biological diversity, including many endemic species of herpetofauna (Rodrigues 1984, 2003, Manzani & Abe, 1990, Passos et al. 2011, Carvalho et al. 2013).

This diversity was expected because the Caatinga occurs in most part of northeast of Brazil and north of state of Minas Gerais, in an area of 735,000 km2, with high environmental heterogeneity (Prado, 2003, Leal et al. 2005). The Caatinga has received little conservation efforts, and its biodiversity remains underestimated, with little information, mostly from the scarce inventories, when compared to those available to other biomes (Lewinsohn & Prado 2002, Silva et al. 2004).

Knowledge about reptiles in the state of Piauí is limited to occasional work focusing zoogeography (Vanzolini 1976), taxonomic (Manzani & Abe, 1990, Rodrigues et al. 2001, Bour & Zaher 2005, Arias et al. 2011), geographic distribution records (Loebmann et al. 2006; Freitas & Veríssimo 2012; Freitas et al. 2012; Delfim et al. 2011; Benício et al. 2013) and ecology (Roberto et al. 2012).

To date, reptile inventories in Piauí mainly occurred along the coast (Loebmann & Valdujo 2010), in the Serra da Capivara and Sete Cidades National Parks (Araújo et al. 1998; Rocha & Prudente 2010; Cavalcanti et al. 2014), in the Estação Ecológica de Uruçuí-Una (Dal Vechio et al. 2013), municipality of José de Freitas (Rocha & Santos 2004), and in an ecotone zone between the Caatinga and

Cerrado biomes (Rodrigues & Prudente 2011). This paper provides a list of reptiles of the municipality of Picos, state of Piauí, contributing to the knowledge about species composition of a poorly known area, with typical Caatinga physiognomy.

MATERIAL AND METHODS

This study was conducted in the municipality of Picos, state of Piauí, with typical vegetation of Caatinga (Figure 1). The climate in this area is semi-arid, with average annual rainfall less than 900 mm, irregularly distributed into two to three months, and average annual temperature 27.3° C (Lima et al. 2000). We conducted eight semi-annual expeditions between August 2007 and June 2011. The method used was the Active Visual Search (see Crump and Scott, 1994), that consisted of going on foot, slow, pre-existing trails in visual search with bounded tracks where was conducted the inspection of burrows, termite mounds, scrub vegetation, grasses, etc. This procedure was performed for 70 days between the 8:00h – 10:00h and 18:00h – 24:00h in different caatinga physiognomies.

We sampled three sites: 1) an area of shrubby caatinga (7°5'1.29"S, 41°24'6.45"W), 2) an area of arboreal caatinga (7°5'6.28"S, 41°24'13.55"W), and 3) an area of gallery forest with a permanent lake (7°5'15.86"S, 41°24'3.08"W) (Figure 2). The three areas sampled were far at least 200 m apart. Sampled reptiles specimens were classified into the following microhabitats: ground, tree, fossorial, litter, and water. Some animals were collected and placed in plastic bags and, euthanized with ketamine (100-150 mg / kg), fixed in 10% formalin, and preserved in 70% ethanol (Franco et al. 2002). Voucher specimens (Appendix 1) were deposited in the Coleção Herpetológica Jorge Jim, Universidade Federal do Piauí (UFPI), Campus de Picos. Permit for collecting zoological (SISBIO: 22508 – 1).

To analyze the species richness curve was constructed species accumulation versus time (in years), with the aid of the program EstimateS version 7.5 (Colwell, 2005), based on records for active visual search (Figure 2).

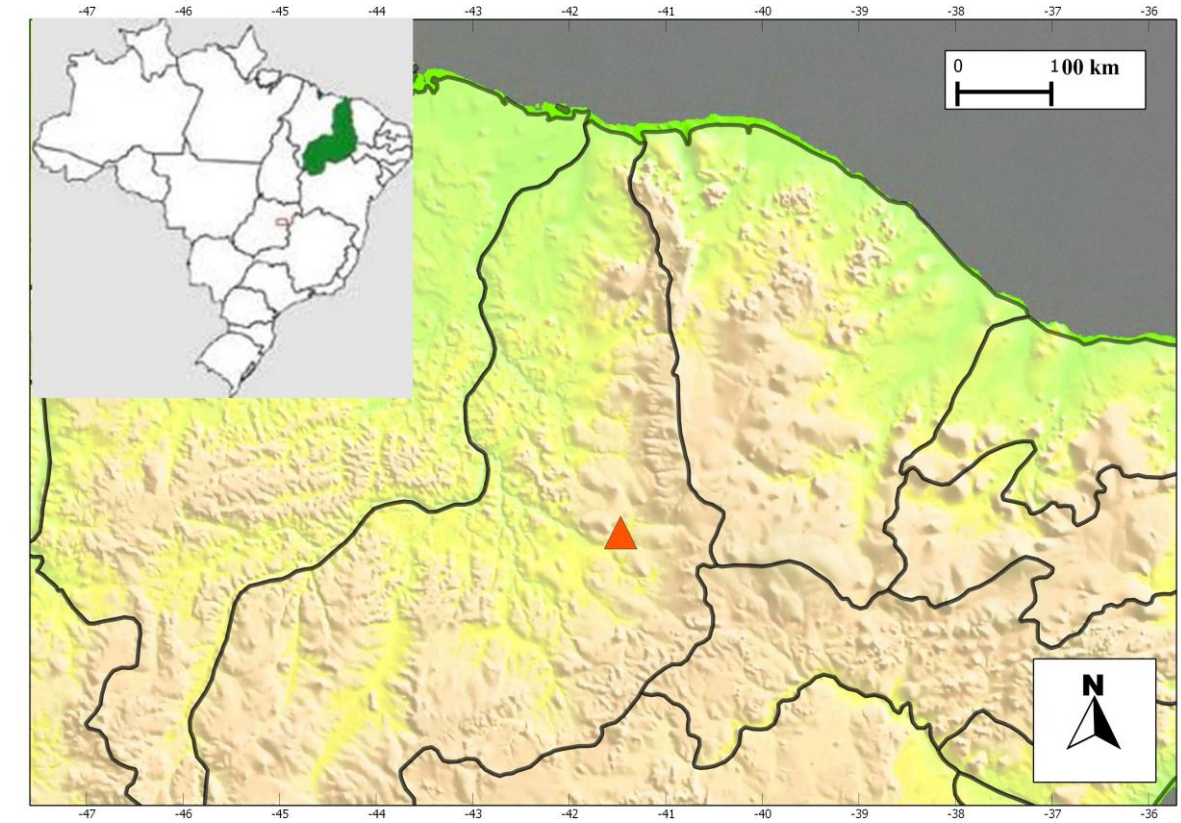

Figure 1. Geographical location of the study area, municipality of Picos, state of Piauí.

Figure 2. Sampled environments: a – shrub caatinga, b – arboreal caatinga, c – gallery forest.

RESULTS AND DISCUSSION

We recorded 28 reptiles species, of which 26 were Squamata, one Testudine and one Crocodilian (Table 1). Lizards were the more representative Squamata, with 13 species (eight families). We also obtained 12 snakes species from five families, and only one amphisbaenian. About the distribution patterns in the environment, the reptiles fauna from Picos is composed mainly of generalist, species with wide geographic distribution (n = 21; 75%). However, few species (n = 7; 25%) are endemic or only associated with the Caatinga.

Table 1. Reptiles species and their distribution in the municipality of Picos, state of Piauí. Sampled environments: Sc – shrubby caatinga; Ac – arboreal caatinga; Gf – gallery forest. Microhabitats: G – ground; T – tree; F – fossorial; L – leaf litter; W – water. * Endemic of the Caatinga.

Taxon	Environments			Microhabitats				
Family/Species	Sc	Ac	Gf	G	T	F	L	W
Gekkonidae								
Hemidactylus mabouia (Moreau de Jonnes, 1818)		X			X			
Lygodactylus klugei (Smith, Martin & Swain, 1977)		X			X			
Gymnophthalmidae								
Vanzosaura rubricauda (Boulenger, 1902)		X					X	
Iguanidae								
Iguana iguana (Linnaeus, 1758)			X		X			
Phyllodactylidae								
Gymnodactylus geckoides Spix, 1825		X		X			X	
Phyllopezus pollicaris (Spix, 1825)	X			X				
Polychrotidae								
Polychrus acutirostris Spix, 1825			X		X			
Mabuyidae								
Brasiliscincus heathi (Schmidt & Inger, 1951)	X			X				
Teiidae								
Ameiva ameiva Linnaeus, 1758	X	X		X				
Ameivula ocellifera (Spix, 1825)	X	X		X				
Salvator merianae (Duméril & Bibron, 1839)	X	X		X				
Tropiduridae								
Tropidurus hispidus (Spix, 1825)	X	X		X	X			
Tropidurus semitaeniatus (Spix, 1825)	X			X				
Boidae								
Boa constrictor Linnaeus, 1758	X	X		X	X			
Colubridae								
Leptodeira annulata (Linnaeus, 1758)	X				X			
Leptophis ahaetulla (Linnaeus, 1758)		X			X			
Oxybelis aeneus (Wagler, 1824)		X			X			
Dipsadidae								
Erythrolamprus poecilogyrus (Wied, 1825)	X			X				
Erythrolamprus viridis (Günther, 1862)			X	X				
Oxyrhopus trigeminus Duméril, Bibron-Duméril, 1854	X			X				
Philodryas olfersii (Lichtenstein, 1823)		X			X			
Philodryas nattereri Steindachner, 1870	X			X				
Pseudoboa nigra (Duméril, Bibron-Duméril, 1854)	X			X				
Elapidae								
**Micrurus* sp.		X					X	
Viperidae								
**Bothrops erythromelas* Amaral, 1923	X			X				
Amphisbaenidae								
Amphisbaena vermicularis Wagler, 1824	X	X				X		
Chelidae								
Phrynops geoffroanus (Schweigger, 1812)			X					X
Alligatoridae								
Paleosuchus palpebrosus (Cuvier, 1807)			X					X

Four lizards are generalists and have widespread occurrence in the Caatinga (*Iguana iguana*, *Ameiva ameiva*, *Tropidurus hispidus* and *Salvator merianae*) (Vanzolini et al. 1980, Rodrigues 2003), six species (*Ameivula ocellifera*, *Brasiliscincus heathi*, *Gymnodactylus geckoides*, *Phyllopezus pollicaris*, *Vanzosaura rubricauda* and *Polychrus acutirostris*) occur largely in the Caatinga and Cerrado (Colli 2005, Werneck &

Colli 2006), and two species (*Lygodactylus klugei* and *Tropidurus semitaeniatus*) are restrict to the Caatinga (Borges-Nojosa & Santos 2005; Werneck & Colli 2006). These, *Lygodactylus klugei* and *Gymnodactylus geckoides* not yet formally registered in Piauí.

Lygodactylus klugei and *Gymnodactylus geckoides* were found only in arboreal Caatinga, contrasting with other information according to which these species are referred to as elements exclusively from dry and open environments (Borges-Nojosa & Caramaschi 2003).

Tropidurus hispidus, *Gymnodactylus geckoides* and *Hemidactylus mabouia* were the most frequent species, and *Vanzosaura rubricauda* were registered only in the rainy period and in humid leaf litter in areas with arboreal caatinga.

All snakes collected are generalists, with wide geographic distribution (Rodrigues 2003). *Boa constrictor*, *Leptodeira annulata*, *Leptophis ahaetulla, Erythrolamprus poecilogyrus*, *Erythrolamprus viridis*, *Oxybelis aeneus*, *Oxyrhopus trigeminus*, *Philodryas olfersii* and *Philodryas nattereri* occur in forests or open areas in the Caatinga (Vanzolini et al. 1980; Strüssmann & Sazima 1993; Marques et al. 2001; Argôlo 2004; Hartmann & Marques 2005; Pontes & Rocha 2008).

The most common species were *Erythrolamprus viridis* (n = 16) and *Philodryas nattereri* (n = 12). *Bothrops erythromelas* is endemic to the Caatinga (Borges-Nojosa & Cascon 2005) and was the only viperid collected in municipality of Picos. *Micrurus* sp. is also endemic to the Caatinga, being the most abundant and widespread coral snake in this region (Guedes et al. 2014) and was called *Micrurus ibiboboca* by Vanzolini et al. (1980).

Phrynops geoffroanus was the only Testudines found. This species has wide geographic distribution (Iverson 1992), occurs with great frequency in water bodies in the study area and was reported only for the coast of Piauí (Loebmann & Valdujo 2010). The crocodilian *Paleosuchus palpebrosus* is also a species widely distributed (Recoder et al. 2011) and was previously registered to a location near the state of Ceará (Lima et al. 2011). It is formally recorded for the first time Piauí here. Three nests of *P. palpebrosus* were found between December and February on the banks of a permanent lake in the area of gallery forest. Nests were about 50 meters from the shore and were about 40 cm tall.

All species recorded in this study have already been recorded for the Caatinga (Rodrigues 2003). The average species richness found in our study is similar to other studies conducted to Caatinga areas in the states of Ceará, Paraíba and Pernambuco (Arzabe et al. 2005; Borges-Nojosa & Cascon 2005; Borges-Nojosa & Santos 2005). However, the species accumulation curve a function of time (in years), obtained from the incidence of species for samples quantifiable methodologies (active visual search), not reached the asymptote at the end of the sampling effort (Figure 3), indicating that areas have yet unpublished species that can be added.

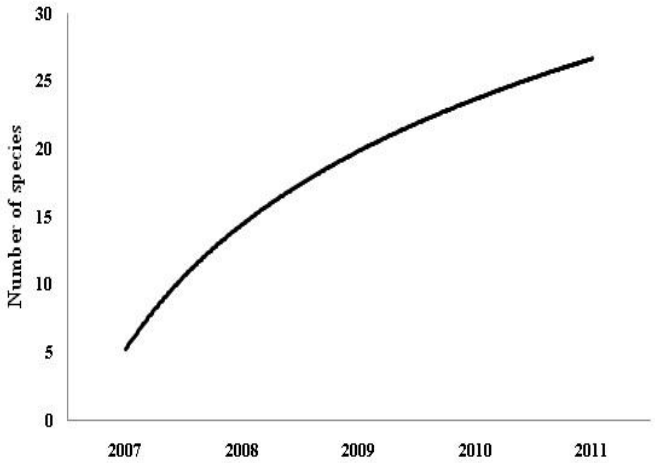

Figure 3. The species accumulation curve a function of time (in years).

Although in recent years several studies have been conducted in the state of Piauí, Caatinga regions are still underestimated and greater attention and long-term studies should be carried out to this unknown exclusively Brazilian biome. Therefore, we present the first inventory of reptiles to an area of Caatinga stricto sensu for the state of Piauí.

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APPENDIX 1.

Voucher specimens. Brazil, Piauí, Picos, Universidade Federal do Piauí, Laboratório de Ecologia, Coleção Herpetológica Jorge Jim: *Hemidactylus mabouia*: CHJJ 0052, CHJJ 0219, CHJJ 0239, CHJJ 0328-0332, CHJJ 0483-0484, CHJJ 0485, CHJJ 0486-0488. *Lygodactylus klugei*: CHJJ 0342-0343, CHJJ 0481. *Vanzosaura rubricauda*: CHJJ 0236, CHJJ 0482. *Iguana iguana*: CHJJ 0223, CHJJ 0233, CHJJ 0285, CHJJ 0285. *Gymnodactylus geckoides*: CHJJ 0226, CHJJ 0237, CHJJ 0283, CHJJ 0314-0317, CHJJ 0489-0500. *Phyllopezus pollicaris*: CHJJ 0409, CHJJ 0473-0477. *Polychrus acutirostris*: CHJJ 0218, CHJJ 0286. *Brasiliscincus heathi*: CHJJ 0053, CHJJ 0471, CHJJ 0478. *Ameiva ameiva*: CHJJ 0232. *Ameivula ocellifera*: CHJJ 0058, CHJJ 0227, CHJJ 0466, CHJJ 0472, CHJJ 0479. *Salvator merianae*: CHJJ 0057, CHJJ 0288-0289. *Tropidurus hispidus*: CHJJ 0054-0055, CHJJ 0158, CHJJ 0229, CHJJ 0327, CHJJ 0468-0470. *Tropidurus semitaeniatus*: CHJJ 0651. *Boa constrictor*: CHJJ 0045. *Leptodeira annulata* CHJJ 0650. *Leptophis ahaetulla*: CHJJ 0040, CHJJ 0406. *Oxybelis aeneus*: CHJJ 0051. *Erythrolamprus poecilogyrus*: CHJJ 0043. *Erythrolamprus viridis*: CHJJ 0030-0031, CHJJ 0034-0039, CHJJ 0044, CHJJ 0408. *Oxyrhopus trigeminus*: CHJJ 0033, CHJJ 0042, CHJJ 0049. *Philodryas olfersii*: CHJJ 0524. *Philodryas nattereri*: CHJJ 0032, CHJJ 0048. *Pseudoboa nigra*: CHJJ 0041. *Micrurus* sp.: CHJJ 0046, CHJJ 0405. *Bothrops erythromelas*: CHJJ 0047. *Amphisbaena vermicularis*: CHJJ 0050, CHJJ 0480. *Phrynops geoffroanus*: CHJJ 0108, CHJJ 0338. *Paleosuchus palpebrosus*: CHJJ 0279-0281.