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ESCAPE BEHAVIOR OF THE LIZARD *PHYLLOPEZUS POLLICARIS POLLICARIS* (SPIX, 1825) IN REMNANTS OF THE CAATINGA BIOME

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ABSTRACT

We analyzed the escape behavior of the lizard *Phyllopezus pollicaris pollicaris* (Spix, 1825), by using field observations. This species has nocturnal habits and is generally found on rocky outcrops. We aimed to evaluate the escape behavior of the lizard *P. pollicaris* under a possible threat of predation, and check if it varies according to: (I) the kind of shelter, (II) the size of individuals (III) and the distance from the individual to the shelter. Regardless the size of the individual, the decision of when to flee was performed in the same way by the lizards, stating that the pattern is the same between juveniles and adults. Analyses showed that as closer to the shelter less is the distance between the observer and the lizard, and there is probably no preference between adults or juveniles regarding the shelter when they are escaping from predators.

Key words: Phyllodactylidae, avoidance, shelter, predator, prey.

RESUMO

Analisamos o comportamento de fuga do lagarto *Phyllopezus pollicaris pollicaris* (Spix, 1825), por meio de observações de campo. Esta espécie tem hábitos noturnos e é geralmente encontrada em afloramentos rochosos. Nosso objetivo foi avaliar o comportamento de fuga do lagarto *P. pollicaris* sob uma possível ameaça de predação, e verificar se ele varia de acordo com: (I) o tipo de abrigo, (II) o tamanho dos indivíduos (III) e a distância do indivíduo para o abrigo. Independentemente do tamanho do indivíduo, a decisão de quando fugir foi realizada da mesma maneira pelos lagartos, indicando que o padrão é o mesmo entre juvenis e adultos. As análises mostraram que quanto mais perto do abrigo menor é a distância entre o observador e o lagarto, e que provavelmente não há preferência entre adultos ou juvenis sobre o abrigo quando eles estão escapando dos predadores.

Palavras-chave: Phyllodactylidae, fuga, abrigo, predador, presa,.

INTRODUCTION

The genus *Phyllopezus* Peters, 1877 occurs in open areas throughout South America and is a taxon consisting of animals with large body size, arboreal, or that live in rocky outcrops, composed of three species (Gamble et al., 2012).

Within the family Phyllodactylidae, *Phyllopezus pollicaris* (Spix, 1825) is one of the largest Brazilian species of the family, occurring associated with clefts of large granitic extrusions. It is subdivided into two subspecies, *Phyllopezus pollicaris pollicaris* (Spix, 1825) and *Phyllopezus pollicaris przewalskii* Koslowsky, 1895. The first is found in semi-arid regions of South America, such as the caatinga biome, occupying a large area of northern Minas Gerais (Gonzalez, 2009; Lima et al., 2011).

P. pollicaris is a forager-type sit-and-wait, with cryptic aspect, which relies on visual stimuli to detect potential prey and has a diet composed mainly of ants, termites and beetles (Vitt and Carvalho, 1995; Gamble et al., 2012). Studies by Vitt (1986) in the northeastern Caatinga point *P. pollicaris* like a lizard with continuous reproduction throughout the year, being conservative on the number of eggs per clutch (two eggs). According to the studies of Recorder *et al.* (2012) most of the observations on this species were conducted at night.

The Escape Theory was developed to explain how close prey allows the predator to approach before starting the process of escaping, called initial distance of flight. Considering the evaluation of risks, a prey that detects a predator at a distance does not flee immediately, but monitors the approach until some criterion of escape is established Cooper e Frederick (2010). Studies on avoidance behavior can be performed with individuals of that species in the Caatinga biome due to the abundance of individuals in the study site.

Unfavorable conditions in the refugees (eg oxygen levels and temperature) may trigger some physiological costs for the animal, such as hypothermia, hyperthermia and hipoaxia. Lizards should minimize the time spent inside the refuge, especially when conditions

are unfavorable thermal refuge in relation to the external environment (Lopez, 1999).

The model pointed by Ydenberg and Dill (1986) describes the trade-off between risk and cost of escape to the refuge of prey, such as the distance that the animal begins to run (distance approach) would be the point where the cost of staying (predation risk) exceeds the cost of escaping (especially the loss of opportunity). Risks and costs must be clearly balanced to determine the output of the refuge (Lopez, 1999).

Thus, the objective of this study was to evaluate the escape behavior of the lizard *P. pollicaris* under a possible threat of predation, and check if it varies according to: (I) the kind of shelter, (II) the size of individuals (III) and the distance from the individual to the shelter.

MATERIAL AND METHODS

The study was conducted in November 2012 in the Unidade de Conservação Estadual Monumento Natural Grota do Angico (9 º 41'S and 38 ° 31'W), which is situated between the towns of Poço Redondo and Canindé do São Francisco. This conservation area is bordered by the Rio São Francisco, and has an area of 2183 hectares and an annual average rainfall of 500 mm.

Our observations were performed in two temporary streams situated on rocky outcrops. The streams are located along valleys perpendicular to the San Francisco River. The vegetation on the banks of the creek is sparse and consists mainly of cacti, and shrubs.

Individuals were sampled by active search, which is the method of systematic survey in the environments frequented by the animals. The active search was limited by time and consisted of three observations, during the night, from 18:00 to 24:00 over the course of the streams, For each individual observed were recorded, with a digital caliper, the following biometric information: snout-vent length (SVL) and tail length. After measurements the individuals were released in the collecting field. The abiotic variables recorded were: microhabitat use, distance from the shelter, shelter type and distance from the observer. The minimum distance of flight and distance to the

shelter (total displacement) were recorded using a digital laser tape.

To verify if the life stage of individuals influences the minimum distance of flight and if the distance to the shelter influences the approach distance of the observer was performed an ANOVA in the program R version 2.13.0. To evaluate whether the type of shelter used on the trail varies with the stage of life was made a chi-square test in the program PAST version 2.17b.

RESULTS AND DISCUSSION

We analyzed 56 specimens of *P. pollicaris* during the three days of sampling. Statistical analyzes performed with the data collected allowed us to infer that the minimum approach distance of the observer does not differ with the life stage of this lizards ($p = 0.75$). This means that regardless the size of the individual, the decision of when to flee was performed in the same way by the lizards, stating that the pattern is the same between juveniles and adults (Figure 1).

The important variable in the decision of when to flee was the distance to the shelter ($p < 0.001$). Analyses showed that as closer to the shelter less is the distance between the observer and the lizard. Perhaps the animal feels more secure because of the proximity of the shelter, allowing a potential predator to get closer. In contrast, the lizard flees sooner if it is distant to the shelter (Figure 2).

Our analyzes corroborate with Bulova (1994) when she evaluated the Antipredator behavior in four Populations of zebra-tailed lizards (Callisaurus draconoides) and two Populations of greater earless lizards (Cophosaurus texanus). In her study the lizards were approached in the field, and five of wariness Measures were recorded. She found that in these lizards populations distance to nearest cover when first sighted had significant direct effects on flight behavior.

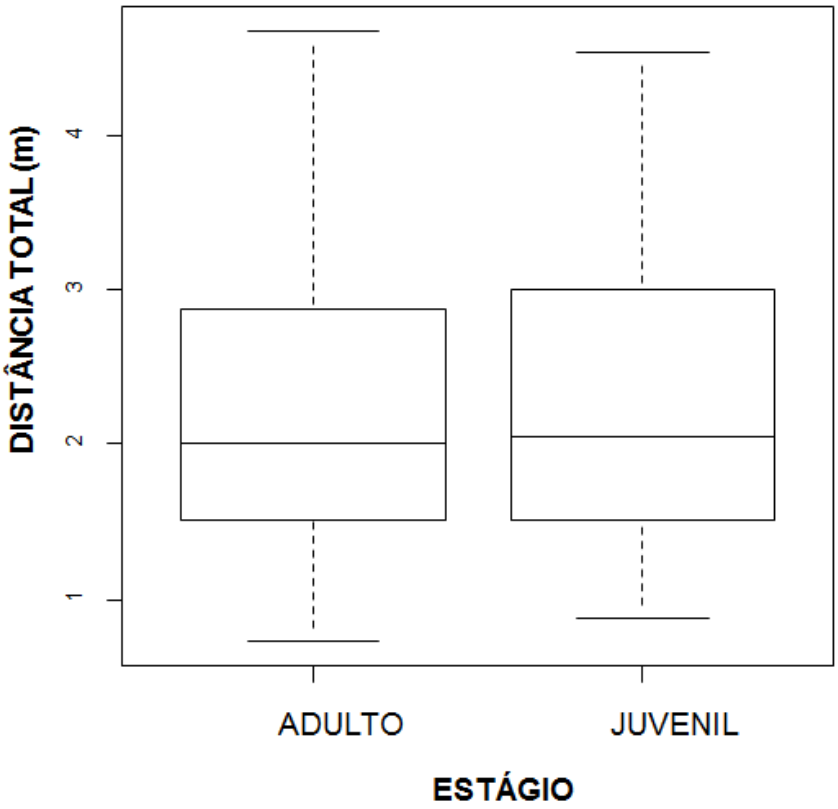

Figure 1 Relationship between the life stage and escape distance.

The chi-square test used to check wether the type of shelter used on the trail varies with the stage of life showed no significant difference ($p = 0.057$). Note that trunks were also recorded as being a kind of shelter, but because of the low incidence (one for each life stage) it was not used in the statistical test. This demonstrates that there is probably no preference between adults or juveniles regarding the shelter when they are escaping from predators.

Table 1 Percentage of juveniles and adult with the types of shelters used on trails.

Type of shelter	Adult	juvenile
Cracks	78%	43%
Shrubs	7%	43%
Rocks	15%	14%

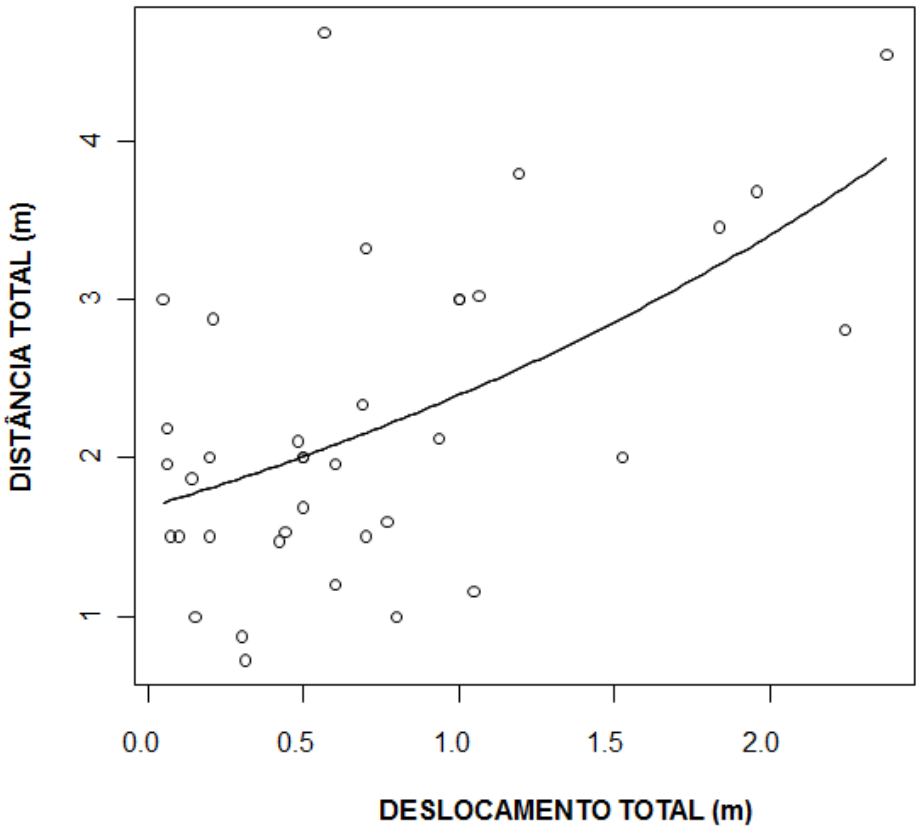

Figure 2 Relationship between distance to the shelter (Total displacement) and distance to escape (total distance).

Martin and Lopez (1995) compared the escape behaviour of juvenile and adult *Psammodromus algirus* lizards. They found the approach distance of juveniles was not affected by habitat, but initial and total flight distances were shorter in covered microhabitats. There was no significant effect of environmental temperature on approach and initial flight distances of juveniles. However, the total flight distances were significantly correlated with air temperatures

From the data collected for this study it was suggest that the distance of flight of the lizard *Phyllopezus pollicaris pollicaris* is influenced only by the distance from the shelter, regardless of the substrate or the life stage of the animal.

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