Habitat use by a tree frog species of *Scinax* (Amphibia, Hylidae) at an urban forest fragment from south-eastern Brazil

Conrado A. B. Galdino[1], Ronald R. Carvalho Jr.[2], Mauren A. V. Noronha e Menezes[3] & Luciana B. Nascimento[4]

1. Departamento de Biologia, Universidade Federal do Ceará, Campus do Pici, Bloco 906, 60455-760, Fortaleza, CE, Brazil. (galdinoc@gmail.com)
2. Programa de Pós-graduação em Zoologia de Vertebrados, Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Avenida Dom José Gaspar, 290, Bairro Coração Eucarístico, 30535-901 Belo Horizonte, MG, Brazil.
3. Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, Cx. Postal 1686, 30536-610 Belo Horizonte, MG, Brazil.
4. Departamento de Ciências Biológicas, Pontifícia Universidade Católica de Minas Gerais Rua do Rosário, 1.081 Bairro Angola, 32630-000 Betim, MG, Brazil.

ABSTRACT. We studied the pattern of habitat use by the tree frog *Scinax* **aff.** *perereca*. Fieldworks were performed from August 1996 to August 1997 at Parque das Mangabeiras, Belo Horizonte, State of Minas Gerais, southeastern Brazil. Calling males were observed in September, October and December 1996, February to April and June 1997. Females were found only in October 1996. Specimens were found perched on vegetation, on the ground or on stones near waterfall. At Parque das Mangabeiras, *S.* **aff.** *perereca* occupied nine types of substrata. The most frequently used substrata were shrubs, stones at the stream edges, and fallen trunks. The pattern of spatial occupation varied among months. Males were found calling in aggregations on the vegetation and spatial niche breadth was related to species abundance.

KEYWORDS. Hylidae, *Scinax*, habitat use, Atlantic forest, environment.

RESUMO. Uso do hábitat por uma espécie de *Scinax* (Amphibia, Hylidae) em um fragmento florestal urbano no sudeste do Brasil. No presente estudo é tratado o uso do hábitat por *Scinax* **aff.** *perereca*, durante o período de agosto de 1996 a agosto de 1997 em uma área de mata urbana em Belo Horizonte, Minas Gerais, sudeste do Brasil. Machos em atividade de vocalização foram encontrados em setembro, outubro e dezembro de 1996 e de fevereiro a abril e junho de 1997. As fêmeas foram capturadas apenas em outubro de 1996. Os indivíduos foram encontrados em galhos da vegetação no solo ou em pedras próximas a quedas de água. Na área estudada, *S.* **aff.** *perereca* usa nove tipos de substratos, sendo os mais freqüentes a vegetação herbácea, pedras na margem do riacho e troncos caídos. O padrão de ocupação espacial variou ao longo dos meses. Os machos foram encontrados vocalizando em agregados e a largura de nicho espacial foi diretamente relacionada a abundância da espécie.

PALAVRAS-CHAVE. Hylidae, *Scinax*, uso do habitat, Mata Atlântica.

Habitat is one of the three main categories of resource dimension of animals (Pianka, 1973) and can be divided in two subcategories: macro and microhabitat. Generally, it is the first resource dimension partitioned among amphibians (Toft, 1985). For example, Crump (1974) assumed that spatial partitioning enabled the coexistence of 74 anuran species at Santa Cecilia, Ecuador. Krzysik (1977) and Krzysik & Miller (1979) showed that substratum particle size is an important microhabitat parameter to determine the coexistence patterns within desmognathine salamanders. Hence, information about habitat use of a given species could be helpful in understanding other aspects of its biology, as well as the structure of the community it belongs to.

Knowledge of habitat use by tropical anuran species is restricted to descriptive information in studies of communities (e.g. Cardoso *et al.,* 1989; Heyer *et al.,* 1990; Haddad & Sazima, 1992; Nascimento *et al.*, 1994; Pombal, 1997). Studies on spatial organization of anuran populations are nearly unknown for Brazilian species. Nonetheless, Eterovick (1999) performed a quantitative analysis on the use of bromeliads as call and retreat sites of *Phyllodytes luteolus* (Wied, 1824) (Hylidae) and Van Sluys & Rocha (1998) proposed that spatial segregation between *Pseudopaludicola* sp. (Leptodactylidae) and *Dendropsophus minutus* (Peters, 1872) (Hylidae) reflect taxonomic differences.

The tree frog genus *Scinax* is the largest within the Hylinae and occurs from eastern and southern Mexico to east central Argentina, Uruguay, and also Trinidad and Tobago (Frost, 2005). Despite its wide distribution, studies concerning the ecology of *Scinax* species are scarce (but see Barroeta, 2004).

This study aims to evaluate the pattern of habitat use by *Scinax* **aff.** *perereca*, 1995 in an urban forest fragment in southeastern Brazil. The studied species belongs to the *Scinax ruber* clade (see Faivovich *et al*., 2005) and it is still undescribed (L. Nascimento, unpubl. data), and is found in open areas associated with streams in the state of Minas Gerais, Brazil. Inasmuch as there is a marked seasonality in rainfall and this species has a constant occurrence at the studied area (L. Nascimento, unpubl. data), we hypothesize that the pattern of habitat use would vary seasonally. Specifically, we addressed the following questions: i) What are the preferential microhabitats used by *Scinax* **aff.** *perereca*? ii) Is there any seasonal variation in the pattern of microhabitat use? iii) Are the patterns of species abundance of this species related to climatic

variables? iv) Is there any relationship between species abundance and the pattern of microhabitat usage?

MATERIAL AND METHODS

The present study was conducted at the Parque das Mangabeiras, a secondary forest fragment located at the transition between semi-decidous forest (Atlantic Forest *sensu lato*) and Cerrado domains (Nascimento *et al*., 2001), Belo Horizonte municipality, state of Minas Gerais, southeastern Brazil (19º55'57''S and 43º56'32''W, 800 to 1,000 m altitude). The principal stream of Parque das Mangabeiras is the Córrego da Serra and at two points, this stream flows into artificial lakes. The vegetation on the stream bank and around the lakes consists of trees, shrubs, herbaceous plants, and some exotic species such as bamboo. Rainfall data were obtained from the Instituto Nacional de Meteorologia (5º Distrito, Belo Horizonte, Minas Gerais). The climate is markedly seasonal with two distinct seasons: cold and dry, from April to September, and warm and rainy from October to March. Annual rainfall averages 1,515 mm ranging from 21.7 to 510.5 mm per month. Mean monthly temperatures vary from 14.6 to 20.2 ºC.

Field observations were performed monthly from August 1996 to August 1997, during four nights each month. At the beginning of each sample, air and water temperatures were taken with an alcohol thermometer (to the nearest 0.05ºC). We systematically searched for individuals and tadpoles through 200 m transects along two different sections of Córrego da Serra. All traced animals were hand-captured and the snout-vent length (SVL) was taken with a calliper (to nearest 0.1 mm). The following data were recorded for each captured individual: substratum at first sight, horizontal distance from water (DFW), height above water (HAW), height above ground (HAG), and sex. In the case of males we also record if each individual was calling. Specimen were marked by toe clipping (Martof, 1953) and released at the same site at which they were first sighted.

We used Shannon's index of diversity (Pielou, 1975) to calculate spatial niche breadth (H'):

$$H' = - \sum p_i \log_n p_i$$

where p_i represents the proportion of individuals associated with the *i*th class of substratum. This index was standardized dividing H' by H' max (maximum value of H');

$$H'\ max = \log_n n$$

where n was the total number of substratum categories (Pianka, 1986). Thus, H' ranged from 0 (no substrate category used) to 1 (all substrates categories used). The Shapiro-Wilk test was performed to check for data normality, when this was not achieved we performed the appropriate non-parametric test. The effects of seasonality upon H' and mean distance of nearest neighbour were evaluated by Mann-Whitney U test. The relationship between mean monthly temperature and rainfall and species abundance were tested by Spearman rank correlation. Linear simple regression analyses was used to test the relationship between species abundance and spatial niche breadth. Sexual differences in body size (SVL) were tested with the Student t-test.

RESULTS

Calling males of *Scinax* **aff.** *perereca* were observed in September, October and December 1996, February to April and June 1997. Females was observed only in October (n=1), December (n=3), February (n=1) and April (n=2). All of them had oocytes in abdomen cavity, visualized through skin transparency. We marked 44 individuals, 37 males and seven females. Mean male SVL was 36.08 ± 1.8 mm (range 33 to 41 mm). Females were significantly larger (mean SVL= 39.57 ± 2.4 mm; range 36 to 44 mm) than males in our sample ($t=4.504$, $DF=42$, $p < 0.001$).

Specimens were found perched on vegetation (58.5%), on the ground (35.4%), or on stones near water falls (6.2%). The following data were obtained: mean DFW was 6.34 ± 1.5 m (range 4.63 to 9.03 m; n=16); mean HAW, 0.9 ± 0.83 m (range 0.00 to 3.0 m; n=17); mean distance of nearest neighbour 1.54 ± 1.30 m (range 0.12 to 4.43 m; n=18), and mean HAG 1.31 ± 0.71 m (range from 0.15 to 2.56 m; n=30).

We recognized nine types of microhabitat used by *S.* **aff.** *perereca*. The most frequently used substrata were shrubs (39.4%; n=66), stones on lake banks (24.2%), and fallen trunks (13.6%) (Tab. I). The pattern of spatial occupation of *S.* **aff.** *perereca* varied among months and the number of individuals found on substrata close to the stream was higher in June 1997 (Fig. 1).

The distance of nearest neighbor of rainy season was 2.46 ± 2.27 (range 0.2 to 8.4) and that of dry season correspond to 0.58 ± 0.4 (range 0.12 to 1.2) differing between seasons ($U=12$, $p=0.043$). Spatial niche breadth (H') did not vary between seasons ($U=13.50$, $P=0.779$), but showed a direct relationship with species abundance ($r^2=0.85$; $F_{1,5}=27.84$ $p=0.003$ $n=7$). Spatial niche breadth and species abundance varied through the study period; December and April were the months with the highest values (Fig. 2). Species abundance was not associated to temperature or rainfall ($r_s=0.10$ and $r_s=-0.04$, respectively $P > 0.05$).

Males were observed calling in aggregations in patches of habitat composed by shrubs, bamboos, or some trees on nights of high individual abundance (Fig. 1).

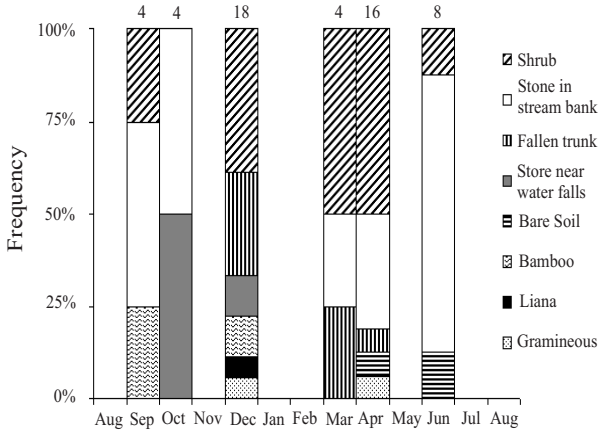

Fig. 1. Preferential substrata used by males *Scinax* **aff.** *perereca* at Parque das Mangabeiras, southeastern, Brazil, from August 1996 to August 1997. Numbers above bars represent sample sizes.

Table I. Overall substrate occupancy by males *Scinax* **aff.** *perereca* (n=66) at Parque das Mangabeiras, southeastern Brazil, from August 1996 to August 1997.

Substrate	Overall substrate occupancy (%)
Shrub	39.4
Stone in stream bank	24.2
Fallen trunk	13.6
Stone near water fall	6.1
Bare Soil	4.5
Bamboo	4.5
Gramineous	3.0
Cliff	3.0
Liana	1.5

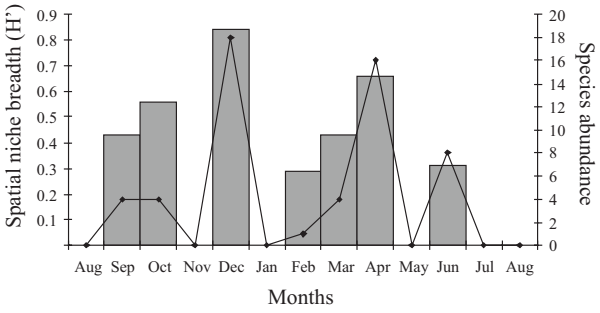

Fig. 2. Variation in spatial niche breadth (H') (bars) and in species abundance (continuous line) of *Scinax* **aff.** *perereca* at Parque das Mangabeiras, southeastern Brazil, from August 1996 to August 1997.

DISCUSSION

In the present study males of the species studied were not found during all months, and only few females and tadpoles were observed. Parque das Mangabeiras is an urban reserve and during the period of the study the preferred substrata of *Scinax* **aff.** *perereca* were frequently occupied as human recreational areas. Other environmental changes noted during this study were the great amount of detritus drained to the streams and the manual or mechanical removal of this material. Moisture is the major factor affecting the ecological distribution of amphibians (DUELLMAN & TRUEB, 1986). Nonetheless, rainfall and temperature did not affect the occurrence of *S*. **aff.** *perereca*; a similar observation was made with the syntopic congeneric species *S. longilineus*, but the latter showed an inverse relationship between species abundance and rain (R. Carvalho, unpubl. data). Temperature shows little variation during the year at the study site and may have a secondary importance affecting the occurrence of *S*. **aff.** *perereca*.

R. Carvalho (unpubl. data) demonstrated that, during cold nights, individuals of *Scinax longilineus* occupy substrata closer to the stream, reducing their vertical distance above water. Although our data were insufficient to confirm this trend, it seems that a similar pattern occurred with *Scinax* **aff.** *perereca*. On cold nights, individuals tended to stay close to the water, decreasing the horizontal and vertical distances to the stream.

Individuals of *Scinax* **aff.** *perereca* preferentially occupied central portions of shrubs around lake banks at Parque das Mangabeiras. Central branches, covered by vegetation, may provide a shelter for calling males and avoidance of acoustically orientated predators (TUTTLE *et al*., 1981).

A cluster of calling males is an important factor promoting mate encounter for reproduction (WELLS, 1977; CARDOSO, 1982). Thus, the aggregative behaviour of males *Scinax* **aff.** *perereca* may be a consequence of the preferential microhabitat use by individuals for reproduction at nights of high species abundance. However studies addressing to the function of males aggregations in *S.* **aff.** *perereca* are needed.

Territoriality is a frequent phenomenon in anurans (e.g. BASTOS & HADDAD, 1996). We found an increase of the spatial niche breadth when abundance was higher. Thus, the high abundance could have lead to the increase of microhabitat categories used and, consequently, an increase in spatial niche breadth. In frog aggregations, the behaviour of a given calling male depends on the activity of his neighbour (GIVEN, 1993), and may contribute in organizing the spatial distribution of individuals.

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