Trabajo

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Feeding habits of the bromeligenous treefrog *Phyllodytes edelmoi* Peixoto, Caramaschi & Freire, 2003 (Anura: Hylidae) from the State of Alagoas, Northeastern Brazil

Katyuscia Araujo-Vieira[1], Ubiratan Gonçalves[2], Jhonatan Guedes dos Santos[3], Thame Gomes Ferreira[4], Gabriel O. Skuk[5]

[1] División Herpetología, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"-CONICET, Ángel Gallardo 470, C1405DJR, Buenos Aires, Argentina.

[2] Seção de Herpetologia, Museu de Historia Natural da Universidade Federal de Alagoas, Av. Amazonas, Prado (Praça da Faculdade), Maceió, Alagoas, Brazil.

[3] Laboratório de Conservação no Século XXI, Instituto de Ciências Biológicas e da Saúde, Campus A.C. Simões, Universidade Federal de Alagoas, Av. Lourival Melo Mota s/n, Tabuleiro dos Martins CEP 57072-900, Maceió, Alagoas, Brazil.

[4] Departamento de Ecologia e Biomonitoramento, Universidade Federal da Bahia, Rua Barão de Geremoabo, 147, Campus de Ondina, CEP 40170-290, Salvador, Bahia, Brazil.

[5] Deceased March 19, 2011.

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ABSTRACT
The hylid frog genus *Phyllodytes* comprised 12 species distributed in eastern Brazil and known to strictly inhabit inside bromeliads. In this study, we explore the feeding habits of *P. edelmoi* and test the prey selectivity of the species by comparing the prey items in the stomachs contents with the availability of preys in bromeliads. Our results show that *P. edelmoi* consumes high amounts of ants along the year, and therefore it could be considered an "ant specialist" species. This specialist feeding behaviour could be considered a synapomorphy of the genus *Phyllodytes*.

Key words: Atlantic Brazilian Forest; Heart-tongued frogs; Ant specialist; Ecology.

RESUMEN
Hábitos alimenticios de la rana bromélicola *Phyllodytes edelmoi* Peixoto, Caramaschi & Freire, 2003 (Anura: Hylidae) del Estado de Alagoas, Noreste de Brasil. El género de hílidos *Phyllodytes* está compuesto por 12 especies distribuidas en el este de Brasil y conocidas por habitar estrictamente bromeliáceas. En este estudio se exploran los hábitos alimenticios de *P. edelmoi* y se testea la selectividad de las presas por la especie comparando las presas encontradas en los estómagos con la disponibilidad de presas en las bromelias. Nuestros resultados muestran que *P. edelmoi* consume grandes cantidades de hormigas a lo largo del año, por lo que podría considerarse una especie "especializada en hormigas". Este comportamiento alimenticio especializado podría ser considerado una sinapomorfia para el género *Phyllodytes*.

Palabras clave: Bosque Atlántico brasileño; Ranas con lengua de corazón; Especialista en hormigas; Ecología.

Introduction

The hylid frog genus *Phyllodytes* Wagler, 1830 comprised 12 species distributed in eastern Brazil, from the north portion of the State of Rio de Janeiro to the State of Paraíba (Frost, 2017). These species are known to strictly inhabit inside bromeliads. The bromeliads are generally able to store water in a structure formed by their tightly-overlapping leaf bases. *Phyllodytes* uses the axils of these plants for refuge, foraging, and breeding (Bokermann, 1966; Peixoto *et al.*, 2003; Caramaschi *et al.*, 2004; Ferreira *et al.*, 2012; Motta-Tavares *et al.*, 2016). This dependence on bromeliads categorizes the species of *Phyllodytes* as bromeligenous (*sensu* Peixoto, 1995).

Phyllodytes edelmoi occurs in the Brazilian Atlantic Forest of Alagoas and Pernambuco states (Peixoto *et al.*, 2003; Moura, 2011) at altitudes

Author for correspondence: katy.vieira@gmail.com

ranging from sea level to 500 m a.s.l. (Gonçalves and Palmeira, 2016). It can be found in terrestrial, rupicolous, or more frequently epiphytic bromeliads located at the border of the forest remnants or in open areas in the Atlantic Forest (Peixoto *et al.*, 2003). The major threats to this species seems to be related to forest degradation and reduction in extent of remaining natural areas due to agricultural development, wood extraction, human settlement, and collection of bromeliads (Eliza and Peixoto, 2004).

The hylids are often recognized as generalist feeders (Ferreira *et al.*, 2012), with strategies of opportunistic foraging. However, prey characteristics such as size, movement, palatability, abundance, and nutritional value can influence on predation, as well as the abundance and availability of prey in the habitat (Ferreira *et al.*, 2012; Pertel *et al.*, 2010). Toft (1980; 1981) distinguished two patterns in the diet of tropical frogs: "ant specialists", those eat more chitinous preys such as termites and ants; and "non-ant specialists", those that ingest a varied spectrum of less chitinized arthropods such as spiders and grasshoppers.

Ants and termites are the dominant food items in the stomach contents of *Phyllodytes luteolus* (Ferreira *et al.*, 2012; Motta-Tavares *et al.*, 2016). This specialization on colonial arthopods could be an advantage for this frog (Ferreira and Teixeira, 2009), since ants are abundant inside bromeliads in the Brazilian Atlantic Forest (Mestre *et al.*, 2001; Juncá and Borges, 2002) and unpalatable to many predators because of formic acid (Zug and Zug, 1979). However, in the absence of studies on prey availability in the bromeliads, they could not confirm to what extent *P. luteolus* specializes in these colonial insects (Ferreira *et al.*, 2012; Motta-Tavares *et al.*, 2016).

The present study aimed to explore the feeding habits of *Phylodytes edelmoi* and test the prey selectivity of the species by comparing the prey items into the stomachs with the availability of preys inside bromeliads. We also comment the occurrence of seasonal (rainy *vs.* dry seasons) differences in diet composition of this frog.

Materials and methods

Study area. The fieldwork was carried out from August 2004 to April 2005 at the locality of Serra da Saudinha (09°22'S, 35°45'W, about 1,210 ha), a remnant of Atlantic Forest, located at the Municipality of Maceió, State of Alagoas, northeastern Brazil (Fig. 1). It is an area of crystalline rocks located in the extreme north-northwest of Maceió, surrounded by Tabuleiros Costeiros and formed by a granitic steep slope, deeply wrought in slopes between 160 and 300 m a.s.l (Assis, 2000; Gonçalves *et al.*, 2012). This locality belongs to a sugar cane ethanol factory Usina Cachoeira and it is surrounded by sugar cane crops (Fig. 2B).

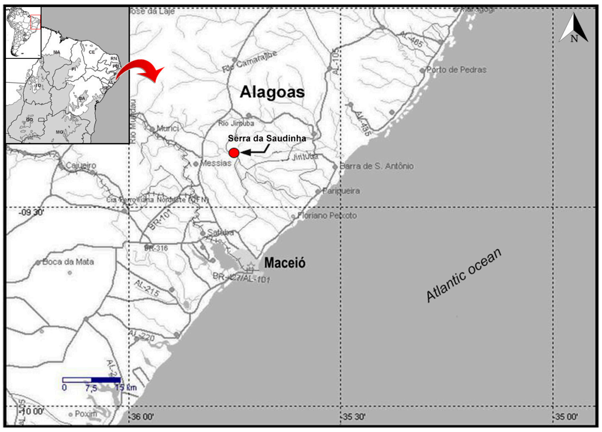

Figure 1. Location map of the study area. The red circle indicates the locality of Serra da Saudinha (09°22'S, 35°45'W, about 1,210 ha), Maceió, Alagoas, northeastern Brazil.

The weather is hot and rainy, with a dry season between October and April, and a rainy season between March and September. Mean annual temperature ranges from 10 to 30°C and mean annual precipitation varies between 0 and 349 mm.

Data collection. A total of 33 individuals of *Phyllodytes edelmoi* (Fig. 2A) were captured by hand during day and night, from 0800 to 2300 h; then were euthanized with 2% lidocaine hydrochloride, immediately fixed in 10% formalin (to stop the digestion processes and preserve the stomach content), and stored in 70% ethanol. They are deposited in the Herpetological Collection of the Museu de História Natural da Universidade Federal de Alagoas (MUFAL 8475–8477, 8479, 8481–8484, 8487–8511).

Stomachs were removed through an abdominal incision and preserved in 70% ethanol; their contents were analyzed quantitatively and qualitatively. The snout-vent length (SVL) of frogs was measured with a digital caliper under a stereomicroscope and rounded to the nearest 0.1 mm. Sex was determined by examination of secondary sexual characters (nuptial pads, vocal slits, and expansion of the vocal sac).

Bromeliads were cut off at their root base and transported to the laboratory in plastic bags. They were analyzed only when frogs were found inside

Figure 2. (**A**) Adult of *Phyllodytes edelmoi* in life (unvouchered specimen). Photo: Gabriel O. Skuk. (**B**) A remnant of the Atlantic Forest of Serra da Saudinha, surrounded by sugar cane crops. (**C**) and (**D**) Habitat of *P. edelmoi*.

the plants. Three genera of bromeliad plants were identified in the area studied: *Aechmea*, *Canistrum* (*C. alagoanum* and *C. aurantiacum*), and *Hohenbergia* (Fig. 2C, D). For each bromeliad, we calculated the volume (in cubic meters) using the formula: V = π radius^2 height/3, where radius was the distance between the central axis and the longest leaf, and height was the distance from the root base to the tip of the longest leaf. Ten aglomerates of bromeliads (41 bromeliad plants) were examined totalizing a volume of 33.95 m^3 in the rainy season (August and September, 2004 and April, 2005) and eight aglomerates (19 bromeliads plants) with a volume of 30.18 m^3 in the dry season (October and November, 2004 and January, 2005). Although the number of bromeliad was different among seasons, the total volume of bromeliads analyzed was similar standardizing the sampling effort.

At laboratory, invertebrates inside bromeliads were extracted using a Berlese funnel (modified from Maranhão, 1976), which works by creating a temperature gradient over the sample such that invertebrates will move away from the higher temperatures and fall into a collecting recipient with 70% ethanol, where they are stored for examination.

Sampled specimens were identified under a stereomicroscope (Nikon, SMZ-800) to the taxonomic level of order (or family, in the case of Formicidae) following Borror and DeLong (1988) and Ruppert *et al.* (2004).

We measured preys volume (in cubic millimeters) in the stomachs and invertebrates inside bromeliads with the following procedure: each individual was photographed using a digital camera attached to a steromicroscope (Nikon SMZ-800) with a scale in millimeters. The photos were organized in different plates for each specimen of *Phyllodytes edelmoi* and for the bromeliads; then we used these photos to measure the width and length of each prey specimen employing the software ImageTool v3.0 (Wilcox *et al.*, 2002). These measurements were used to calculate the volume, which was estimated using the formula for an ovoid spheroid: V = 4/3π (length/2) (width/2)^2 following Dunham (1983).

Statistical analysis. The homogeneity analysis of variances of frog SVL was performed using Levene F test (Levene, 1960). The Student's t test was used to compare the SVL mean values between sexes. Frequency of occurrence for each prey type was calculated dividing the total number of stomachs containing an item prey by the total number of no empties stomachs. The diversity of prey consumed by each specimen and the diversity of invertebrates found in the bromeliads were estimated by the Shannon Diversity Index $H' = -\Sigma pi \ln pi$, where *pi* was the relative abundance of the prey taxon *i* in the stomachs or bromeliads (Magurran, 1988). Seasonal differences between diversity values were tested by t test for diversity. The equitability was calculated using the Shannon's formula $E = H'/\ln S$, where S was the number of different taxa in the stomachs or bromeliads (Magurran, 1988). A Spearman's correlation test was performed to compare the diversity of prey consumed and that of invertebrates inside bromeliads (Vrcibradic and Rocha, 1995; Kolodiuk *et al.*, 2010). The electivity was estimated by the Ivlev Index (Krebs, 1989) that ranges from -1 (total avoidance) to 1 (total preference).

A Spearman's correlation test was performed to determine if there was correlation between frogs SVL and prey of maximum volume, the prey of minimum volume, and the mean volume of preys into the stomachs. To compare the volume of preys with the volume of invertebrates in the bromeliads, we considered as potential preys only invertebrates with the maximum volume equal or less than the maximum volume of the prey found into the frog stomachs, which was a Coleoptera of 24.7 mm^3. The means volume of preys into the stomachs and invertebrates inside bromeliads were compared using a Student's t test.

Results

A total of 33 individuals of *Phyllodytes edelmoi* were collected inside bromeliads (17 females and 16 males). Males of *P. edelmoi* vocalize between 1900 and 0200 h on the bromeliad leaves, but in general during the day inhabit the axils and the central tube of these plants near or semi-submerged in the water. *Phyllodytes edelmoi* was found mainly in bromeliads of the genus *Aechmea*, and less frequently in smaller bromeliads of the genus *Canistrum* (*C. aurantiacum* and *C. alagoanum*). We did not find *P. edelmoi* in larger bromeliads of the genus *Hohenbergia*.

Morphology. The homogeneity of variances of males ($n = 16$) and females ($n = 17$) tested by Levene F test showed no significant differences ($F_{Levene} = 3.004$, g.l. = 1, $p = 0.097$). The Student's t test indicated that there was no significant differences ($t = -0.079$, g.l. = 22, $p = 0.937$) between the size of males (24.3 ± 1.6, 21.7–26.1 mm, $n = 16$) and females (24.3 ± 2.5, 20.1–28.3 mm, $n = 16$), after excluding an immature female, with a small SVL (MUFAL 8501, SVL 12.4 mm).

Spearman's test showed significant and positive correlations between the SVL of *Phyllodytes edemoi* and the mean volume of preys consumed (Rho = 0.375, p= 0.032, $n = 33$) and the prey of maximum volume (Rho = 0.364, p= 0.038, $n = 33$), but there was no correlation between the SVL and the prey of minimum volume (Rho = -0.090, p= 0.620, $n = 33$).

Diet. We found no empty stomachs in sampled specimens; therefore, stomach contents of the 33 individuals of *Phyllodytes edelmoi* were analyzed, from which 14 were collected in the rainy season and 19 in the dry season. Stomach and bromeliads contents were classified into 28 prey items comprising eight invertebrate item groups (see Table 1).

A total of seven prey items were identified into the stomachs of *Phyllodytes edelmoi*, with Formicidae (ants) being the most abundant prey item (Table 1). Ants were present in the stomachs of all individuals analyzed. There was no significant difference in the diversity of preys items in stomachs of *P. edelmoi* between the rainy ($H'_{rainy} = 0.188$) and dry ($H'_{dry} = 0.167$) seasons ($t = 4.04$; $p > 0.05$). The equitability of preys consumed was similar in both seasons ($E_{rainy} = 0.105$ and $E_{dry} = 0.104$). *Phyllodytes edelmoi* eats predominantly ants along the seasons, with coleopterans and ostracods rarely present in the diet.

A total of 4,079 specimens of invertebrates were found inside bromeliads, from which 1,267 were collected during the rainy season and 2,812 during the dry season, being Formicidae (ants) the most abundant taxon in both seasons (Table 1). The higher number of specimens in the dry season was mainly due to the high number of ants (81.86%; 2,302 individuals).

The diversity of invertebrates was higher in the rainy season ($H'_{rainy} = 1.533$) than dry season ($H'_{dry} = 0.887$; $t = 12.44$; $p > 0.01$), and the equitability of invertebrates showed higher values in the rainy season [$E_{rainy} = 0.496$] than dry season [$E_{dry} = 0.279$)].

Table 1. Diet composition of *Phyllodytes edelmoi* and invertebrates collected inside bromeliads in the rainy (14 individuals) and dry (19 individuals) seasons, locality of Serra da Saudinha, Maceió, Alagoas, northeastern Brazil.

	Rainy season			Dry season		
	Diet		Bromeliads	Diet		Bromeliads
Food items	***n* (%)**	**F (%)**	***n* (%)**	***n* (%)**	**F (%)**	***n* (%)**
Insecta						
Hymenoptera (Formicidae)	464 (96.5)	100	811 (64)	451 (97.0)	100	2302 (81.9)
Coleoptera	1 (0.2)	7.1	65 (5.1)	8 (1.7)	21	168 (6.0)
Neuroptera	-	-	-	1 (0.2)	5.3	-
Diptera (larvae)	2 (0.4)	7.1	72 (5.7)	-	-	68 (2.4)
Diptera (adults)	-	-	1 (0.1)	-	-	3 (0.1)
Blattodea	-	-	56 (4.4)	-	-	59 (2.1)
Isoptera	-	-	92 (7.3)	-	-	23 (0.9)
Odonata (larvae)	-	-	7 (0.5)	-	-	12 (0.4)
Orthoptera	-	-	3 (0.2)	-	-	9 (0.3)
Hemiptera	-	-	-	-	-	5 (0.2)
Homoptera	-	-	-	-	-	3 (0.1)
Dermaptera	-	-	-	-	-	2 (0.1)
Thysanura	-	-	1 (0.1)	-	-	-
Embioptera	-	-	1 (0.1)	-	-	-
Unidentified eggs	-	-	3 (0.2)	-	-	3 (0.1)
Crustacea						
Ostracoda	12 (2.5)	14.3	19 (1.5)	4 (0.9)	10.5	3 (0.1)
Nematoda	1 (0.2)	7.1	-	1 (0.2)	5.3	-
Arachnida						
Acarina	1 (0.2)	7.1	30 (2.4)	-	-	58 (2.1)
Pseudoscorpiones	-	-	24 (1.9)	-	-	5 (0.2)
Aranae	-	-	12 (0.9)	-	-	31 (1.1)
Opiliones	-	-	5 (0.4)	-	-	3 (0.1)
Scorpiones	-	-	4 (0.3)	-	-	3 (0.1)
Platyhelminthes	-	-	-	-	-	22 (0.8)
Myriapoda						
Isopoda	-	-	16 (1.3)	-	-	10 (0.3)
Chilopoda	-	-	10 (0.8)	-	-	10 (0.3)
Diplopoda	-	-	4 (0.3)	-	-	5 (0.2)
Entognatha						
Collembola	-	-	11(0.9)	-	-	1
Mollusca						
Gastropoda	-	-	20 (1.6)	-	-	4 (0.1)
Total	481 (100)		1267 (100)	465 (100)		2812 (100)

Furthermore, despite the values to near zero, the Ivlev index of electivity showed positive values for ants in the rainy (Iv_{rainy} = 0.086) and dry seasons (Iv_{dry} = 0.023). The Ivlev index was negative for Coleoptera in both seasons (Iv_{rainy} = -0.938; Iv_{dry} = -0.594), the second most abundant food item in bromeliads during dry season, and the fourth in rainy season. Isoptera (termites), the second most abundant food item in bromeliads during rainy season and the sixth in dry season, were absent in the diet of *Phyllodytes edelmoi*. Also, there was significant difference between the diversity of prey consumed and invertebrates in bromeliads ($rs = 0.2831$; $p = 0.1442$; $n = 28$); this could indicate a specialist diet of *P. edelmoi*, with a greater preference for ants.

In the analysis of volume, we examined 1,756 specimens of invertebrates found inside bromeliads with volume ≤ 24.7 mm³ (Table 2), and ants (n = 1,208) were still the most abundant item food in bromeliads in both rainy and dry seasons, followed

Table 2. Volume (in mm³) of preys found in the stomachs of *Phyllodytes edelmoi* (33 individuals) and the invertebrates collected inside bromeliads in both rainy and dry seasons, locality of Serra da Saudinha, Maceió, Alagoas, northeastern Brazil. Mean ± standard error, range into parenthesis.

	Diet		Bromeliads		Bromeliads Invertebrates with volume ≤ 24.7 mm³	
Food items	***n***	**volume**	***n***	**volume**	***n***	**volume**
Insecta						
Hymenoptera (Formicidae)	915	1.8±1.7 (0.1–17.0)	3113	2.7±7.15 (0.05–41.6)	1208	2.7±7.15 (0.05–24.7)
Coleoptera	9	10.9±8.7 (1.1–24.7)	233	42.1±38.8 (1.5–170.3)	42	15.2±5.8 (1.5–23.6)
Neuroptera	1	5.6	-	-	-	-
Diptera (larvae)	2	3.3	140	5.3±17.3 (0.02–140.5)	128	2.0±2.5 (0.02–22.4)
Diptera (adults)	-	-	4	0.79	4	0.79
Blattodea	-	-	115	217.9±407.9 (0.6–1713.1)	18	7.3±11.9 (0.6–22.9)
Isoptera	-	-	115	2.7±7.15 (0.1–53.9)	113	1.8±2.5 (0.1–18.4)
Odonata (larvae)	-	-	19	68.9±57.8 (27.1–195.3)	-	-
Orthoptera	-	-	12	13.6±11.2 (1.6–28.7)	8	9.8±8.9 (1.6–23.4)
Hemiptera	-	-	5	-	-	-
Homoptera	-	-	3	-	-	-
Dermaptera	-	-	2	-	-	-
Thysanura	-	-	1	-	-	
Embioptera	-	-	1	2.3	1	2.3
Unidentified eggs	-	-	6	-	-	-
Crustacea						
Ostracoda	16	0.9±0.3 (0.4–1.5)	22	0.5±0.2 (0.2–0.9)	22	0.5±0.2 (0.2–0.9)
Nematoda	2	2.0±1.0 (1.3–2.7)	-	-	-	-
Arachnida						
Acarina	1	0.7	88	-	-	-
Pseudoscorpiones	-	-	29	-	-	-
Aranae	-	-	43	5201.1±10101.6 (6.16–31653.3)	6	6.8±0.8 (6.16–7.9)
Opiliones	-	-	8	78.1±48.0 (0.4–107.8)	2	0.4
Scorpiones	-	-	7			
Platyhelminthes	-	-	22	-	-	-
Myriapoda						
Isopoda	-	-	26	94.4±80.3 (10.4–270.8)	6	17.5±5.8 (10.4–22.8)
Chilopoda	-	-	20	113.2±104.3 (1.1–259.5)	4	2.3±1.3 (1.1–3.5)
Diplopoda	-	-	9	119.5±85.4 (39.8–249.7)	-	-
Entognatha						
Collembola	-	-	12	1.4±2.0 (0.1–5.1)	12	1.4±2.0 (0.1–5.1)
Mollusca						
Gastropoda	-	-	24	804.9±1074.9 (33.8–2960.5)	-	-

by larvae (Diptera; $n = 128$), termites ($n = 113$), and coleopterans ($n = 42$). There was a significant difference between the mean of volume of ants consumed (1.8 mm^3) and that inside bromeliads (2.7 mm^3) ($t = -8.610$; $p < 0.001$). It can indicate a preference for smaller ants, although *Phyllodytes edelmoi* could eat ants with a higher mean volume (mean volume of ants = 1.8 mm^3, larger ant consumed = 17.0 mm^3, larger ant into bromeliads = 24.7 mm^3).

Discussion

We found *Phyllodytes edelmoi* mainly in bromeliads of the genus *Aechmea* and less frequently in the smaller bromeliads *Canistrum alagoanum* and *C. aurantiacum*. Another species of the genus from the Brazilian State of Espiríto Santo, *Phyllodytes luteolus*, inhabits mainly the bromeliads *Aechmea nudicaulis* and *A. blanchetiana*, and rarely the species *Vriesea neoglutinosa* (Schineider and Teixeira, 2001; Mageski *et al.*, 2016). Mageski *et al.* (2016) also observed that *P. luteolus* selects these plants based on specific architectural characteristics (e.g., number of leaves) and physicochemical characteristics of the water (e.g., conductivity). Similarly, Eterovick (1999) showed that *P. luteolus* selects deeper bromeliads with lower pH. Cunha and Napoli (2016) also mentioned that *P. melanomystax* prefers bromeliads without or with a small amount of debris. Although our observations were preliminary and we could not corroborate that *P. edelmoi* selected a particular species of bromeliad, the fact of the frogs were not find in all taxa examined (e.g., *Hohenbergia*) could suggest some form of selection of these frogs for certain breeding sites.

In anurans, there is usually a correlation between their body sizes and volume of preys consumed; this correlation could indicate the type of prey captured by the frogs (Toft, 1980). Positive correlations between body size and both mean prey volume and prey of maximum volume consumed; as well as the negative correlation between body size and the prey of minimum volume, could indicate that there is a slightly tendency for larger individuals of *Phyllodytes edelmoi* to eat larger preys. Despite the fact that *P. edelmoi* is able to eat large preys (e.g., Isoptera and Coleoptera with volumes ≤ 24.7 mm^3), our results showed that it ate predominantly ants along the sampled seasons (volume range of 0.1–17.0 mm^3). Ferreira *et al.* (2012) reported that the mean prey size was positively correlated with the body size in individuals of *P. luteolus* from the State of Espírito Santo. They found that smaller specimens (SVL < 18.0 mm) fed mainly on ants, whereas larger specimens (SVL > 18.0 mm) fed mainly on termites. Another measurement, the jaw width, is also usually correlated with prey size (Parmelee, 1999; Lima *et al.*, 2000). Although we did not test the influence of this measurement in the prey selection of *P. edelmoi*, Mota-Tavares *et al.* (2016) observed that the volume of prey consumed was influenced by the jaw width in at least two populations of *P. luteolus* from the Brazilian States of Bahia and Espírito Santo.

The composition of the diet of *Phyllodytes edelmoi* did not differ in both seasons, despite the higher values of diversity and equitability of invertebrates inside bromeliads for the rainy season. Ants were the predominant prey item, with coleopterans and ostracods rarely present in the diet. Therefore, the diet of *P. edelmoi* is relatively homogeneous along the seasons. However, the low values of diversity and equitability of invertebrates into bromeliads could be a consequence of the higher number of ants, which represent more than 60% of the available invertebrates in these plants.

Ants were the most abundant invertebrate collected inside bromeliads and, as mentioned above, the main prey item found in the stomachs of *Phyllodytes edelmoi*. Termites were the second item in abundance in bromeliads along the rainy season and the sixth in the dry season, but they were absent in the stomachs of *P. edelmoi*. On the other hand, *P. luteolus* eats ants and termites in similar proportions (Ferreira *et al.*, 2012; Motta-Tavares *et al.*, 2016). The preference of *P. edelmoi* for ants rather than termites could be a consequence of the higher numbers of ants in the bromeliads which can facilitate their capture and consumption by frogs.

Phyllodytes edelmoi can be classified as an “ant specialist” (*sensu* Toft, 1980; 1981). Evidences of this specialized diet are the presence of ants as main prey item for males and females and the frequency and high number of ants in the stomachs throughout the rainy and dry seasons. These results agree with Ferreira *et al.* (2012) and Motta-Tavares *et al.* (2016), who analyzed stomachs contents from males, females, and juveniles of *P. luteolus* from four localities of the Brazilian Restinga in Bahia and Espírito Santo states. They found that *P. luteolus* eats preferentially ants and termites in all localities, having apparently a conservative diet, independently of the local peculiarities and differences among sites. Ferreira and Teixeira (2009) suggested that ant specialists have certain advantage by reducing food competition with other insectivores, since ants are unpalatable to many predators because of formic acid (Zug and Zug, 1979). Furthermore, similar to *Phyllodytes luteolus*, *P. edelmoi* can be classified into the Toft's (1980; 1981) characterization as an active predator, those that eat preferentially small preys and have a high number of ants in their stomachs. The invertebrates hidden inside axils of the bromeliads also may encourage the active foraging habits of these frogs (Ferreira *et al*., 2012).

Ants and termites are usually present in the diet of hylid frogs (e.g., Labanick, 1976; Maneyro and Da Rosa, 2004; Vaz-Silva *et al*., 2005; Solé and Pelz, 2007; López *et al*., 2009; Moreno-Barbosa and Hoyos-Hoyos, 2014; Castro *et al*., 2016). However, these food items were not present in high numbers in their stomachs suggesting that they are no "ant specialists" (Toft 1980; 1981). Moreover, to better evaluate if these frogs have a diet specialized in ants and termites, it would be necessary to analyze the prey availability in their habitats (Díaz-Páez and Ortiz, 2003).

Conclusions

Our results showed that *Phyllodytes edelmoi* is an ant-specialist and use an active foraging strategy to capture ants, the most abundant food item inside bromeliads, and rarely eats other invertebrates. This specialist feeding behaviour commonly named as mymercophagy could be considered a synapomorphy of the genus *Phyllodytes*, although this proposition requires additional trophic ecology studies. Furthermore, this study demonstrated that data on food resource availability are essential for the analysis of feeding ecology of frogs because they provide essential information for a useful categorization as generalist or specialist predators.

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