

Diet of *Leptodactylus bufonius*
BOULENGER, 1894,
in the Brazilian Chaco

The Chaco is the southernmost ecoregion of the diagonal zone of seasonally-dry open areas in South America, which includes the Caatinga in northeastern and the Cerrado in central Brazil (PENNINGTON et al. 2000; SOUZA et al. 2010). The climate is “Aw” type (tropical wet and dry or savanna climate; with the driest month having precipitation less than 60 mm and less than 4 % of the total annual precipitation), according to KÖPPEN’s (1884) climate classification (ALVARES et al. 2013), with a hot rainy season from October to April and a dry season from May to September.

Vizcachera’s White-lipped Frog, *Leptodactylus bufonius* BOULENGER, 1894, occurs in the Chaco from southern Bolivia to northern Argentina, Paraguay and central Brazil, where it is found in the state of Mato Grosso do Sul (SOUZA et al. 2010; FROST 2016). The species belongs to the *Leptodactylus fuscus* (SCHNEIDER, 1799) group (HEYER 1969), a monophyletic clade, and is closely related to *Leptodactylus troglodytes* LUTZ, 1926 (PONSSA 2008; DE SÁ et al. 2014), a species endemic to the semi-arid Caatinga in northeastern Brazil (ARZABE & ALMEIDA 1997). In a single study conducted in a population from Argentina, *L. bufonius* was considered a generalist forager, employing an intermediate foraging strategy between sit-and-wait and active search (DURÉ & KEHR 2004). However, *L. bufonius* showed a narrower trophic niche than the sympatric species *Leptodactylus latinasus* JIMÉNEZ DE LA ESPADA, 1875, with both species showing a high overlap in diet but low overlap in microhabitat preferences (DURÉ & KEHR 2004).

Most information on the Chaco herpetofauna is limited to Paraguay and Argentina (e.g., LEYNAUD & BUCHER 1999; BRUSQUETTI & LAVILLA 2006). Although the first list of amphibians and reptiles from the Brazilian Chaco was published six years ago (SOUZA et al. 2010), studies on the feeding ecology of anurans from this area are still missing.

Thus, in the present study the authors describe (1) the diet of *L. bufonius* in the

Table 1: Prey items found in the stomachs of 27 individuals of *Leptodactylus bufonius* BOULENGER, 1894, sampled at Porto Murtinho in the State of Mato Grosso do Sul, central Brazil. *N* – number of prey items; % *N* – proportion of all prey items; Vol – volume of prey items (mm³); % Vol – volume of prey items relative to the volume of all prey items; Freq – frequency of occurrence (number of *L. bufonius* containing prey of this category).

Prey taxonomic category		<i>N</i>	% <i>N</i>	Vol (mm ³)	% Vol	Freq
Insecta	Isoptera	234	81.82	1,300	15.47	6
	Hemiptera	1	0.35	< 1	-	1
	Orthoptera	11	3.85	2,223	26.45	9
	Hymenoptera (ants)	12	4.20	238	2.83	8
	Hymenoptera (non ants)	3	1.05	60	0.71	3
	Coleoptera	7	2.45	466	5.54	6
	Insect larvae	5	1.75	1,239	14.74	5
	Arachnida	Araneae	2	0.70	633	7.53
	Acari	1	0.35	< 1	-	1
	Scorpiones	4	1.40	1,351	16.07	3
	Pseudoscorpiones	1	0.35	13	0.15	1
	Uropygi	1	0.35	2	0.02	1
Chilopoda	Scolopendromorpha	2	0.70	240	2.86	1
Anura	<i>Leptodactylus</i> sp.	1	0.35	420	5.00	1
	<i>Elachistocleis</i> sp.	1	0.35	220	2.62	1
Total		286	100	8,405	100	-

Brazilian Chaco where *L. latinasus* does not occur and (2) ontogenetic changes in prey consumption by *L. bufonius*.

Individuals were collected in natural temporary ponds (reference point: 21°42' 3"S, 57°43'1"W), located in the municipality of Porto Murtinho, State of Mato Grosso do Sul, Brazil, between August 2008 and March 2010, euthanized with 10 % Lidocaine, fixed in 10 % formalin, preserved in 70 % ethanol (MCDIARMID 1994) and deposited at the ZUFMS (Coleção Zoológica de Referência da Universidade Federal de Mato Grosso do Sul) collection, Campo Grande, Mato Grosso do Sul state, Brazil. Snout-vent length (SVL) and head width (HW) were measured using digital calipers (accuracy 0.01 mm). The stomachs were removed through an incision in the abdominal region, preserved in alcohol 70 % and their animal contents identified to the lowest possible taxonomic level. The number of prey items per stomach, the volume of each of prey item, as well as their presence or absence in the stomachs (frequency of occurrence) were recorded. The volume of each prey item was measured by compressing it on millimetric grid plates between coverslips of known height (HELLAWELL & ABEL 1971).

The authors separated male from female frogs according to gonadal and ex-

ternal characters and considered individuals to be juveniles when testes or ovaries were at an immature developmental stage. However, all specimens entered the regression analyses to investigate ontogenetic changes in diet. The ratio between total volume and total number of prey items per stomach (ratio volume/number; RVN) was calculated, and linear regressions were analyzed between SVL and HW, and SVL and RVN, respectively. The relationships between these variables were supposed to indicate changes in the size of the consumed items relative to the frogs' increase in size, since prey size increases during ontogenesis (LIMA & MOREIRA 1993). Four individuals were excluded from regression analyses because of negligible prey item volumes (< 1 mm³).

From a total of 121 collected individuals of *L. bufonius*, 27 (22 %) had stomach contents: 10 males (SVL: $\bar{x} \pm SD = 44.42 \pm 4.98$ mm; range = 39.25 – 54.74 mm), 10 females (SVL: $\bar{x} \pm SD = 48.10 \pm 4.09$ mm; range = 40.58 – 55.99 mm), and seven juveniles (SVL: $\bar{x} \pm SD = 35.92 \pm 2.38$ mm; range = 33.51 – 38.62 mm). The diet was composed of prey assigned to 15 categories (Table 1, Fig. 1), dominated in number by Isoptera (82 %) and in volume by Orthoptera (26 %). Orthoptera were also the most numerous items (Table 1). For males, Isoptera were the dominant prey in number (87

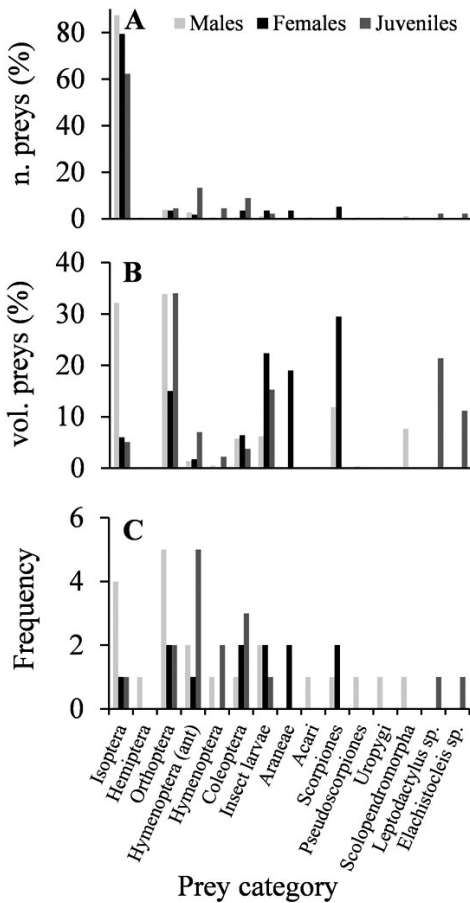


Fig. 1: A – Number, B – volume, and C – frequency of prey taxonomic categories found in the stomachs of males, females and juveniles of *Leptodactylus bufonius* BOULENGER, 1894, sampled in the municipality of Porto Murinho, Mato Grosso do Sul state, central Brazil.

%) and the second most dominant in volume (32 %), followed by Orthoptera (34 %), which were dominant in number (Fig. 1). Also for females, Isoptera were dominant in number (79 %) whereas Scorpiones dominated in volume (29 %). Insect larvae accounted for 22 % of the prey volume, followed by Orthoptera (15 %) (Fig. 1). No food category was dominant in frequency of occurrence (Fig. 1). Similarly, for juveniles Isoptera dominated in number (62 %) and

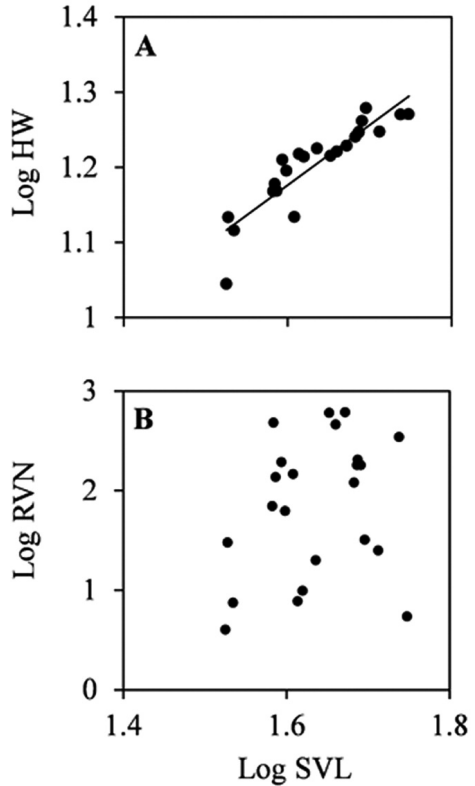


Fig. 2: A – Linear regression between snout-vent length (SVL) and head width (HW) ($r^2 = 0.81$; $P < 0.001$), and B – between SVL and the ratio volume/number (RVN) ($P = 0.23$) in 23 individuals of *Leptodactylus bufonius* BOULENGER, 1894, collected in the Brazilian Chaco at Porto Murinho, Mato Grosso do Sul state, central Brazil. Increasing values of RVN are indicative of reduction in number and increment in volume of prey items.

Orthoptera in volume (34 %), however, Hymenoptera (ants) were the most frequent items. Only juveniles had vertebrates (Anura) in their stomachs: one specimen of *Leptodactylus* sp. and one of *Elachistocleis* sp. were found in two out of seven juvenile stomachs analyzed, representing 21 % and 11 % of the prey volume, respectively (Fig. 1). Range values of SVL and HW were 33.51 – 55.99 mm and 11.08 – 19.00 mm, respectively. There was a significant positive relationship between SVL and HW ($HW = 0.795 SVL - 0.094$, Fig. 2A), but not so between SVL and RVN (Fig. 2B).

In general, active foragers consume large quantities of small stationary prey and forage over large areas whereas, species that exhibit a sit-and-wait strategy feed on larger active prey and present a more sedentary foraging behavior (TOFT 1981; PERRY & PIANKA 1997). Based on the types and proportions of prey, *L. bufonius* exhibits an intermediate strategy between these two extremes (DURÉ & KEHR 2004). At the study area, Orthoptera were dominant in volume, and Isoptera (termites) in number in the stomachs of males, females and juveniles. Isoptera were also the most numerous prey item in a *L. bufonius* sample from Argentina, where Orthoptera were not part of its diet, despite being consumed by the sympatric congener *L. latinasus* JIMÉNEZ DE LA ESPADA, 1875 (DURÉ & KEHR 2004). Since *L. bufonius* was found to prey on Orthoptera and Araneae (this study), in Argentina the diet overlap between *L. bufonius* and *L. latinasus* may be wider than detected.

Size-dependent changes in diet were reported for several Neotropical frog species in previous studies (e.g., LIMA & MOREIRA 1993; BLACKBURN & MOREAU 2006). With *L. bufonius* growing in size the authors expected replacement of small by larger prey animals, which exhibit smaller surface-to-volume ratios and thus contain comparatively less chitin (LIMA & MOREIRA 1993). That some prey taxonomic categories (especially Orthoptera and Araneae) were consumed by *L. bufonius* in the present study, but not in Argentina, could be indicative of size-dependent prey composition in individuals from the Brazilian Chaco (where *L. latinasus* does not occur). The absence of a significant relationship between HW and RVN indicates that larger individuals of *L. bufonius* did not change the proportion of small and large prey in their diet. Although *L. bufonius* did not reveal any changes in the preference for one or another prey type during growth, it is clear that larger individuals did not exclude small prey from their diet. This pattern becomes even more evident by the larger average number of prey items found in the Brazilian compared to the Argentinian specimens (15 versus seven, respectively; DURÉ & KEHR 2004). The result may be explained by the abundant availability of small prey, such as termites,

and by the opportunistic foraging behavior of *L. bufonius* at the study site.

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