Diet of *Ameerega braccata* (Steindachner, 1864) (Anura: Dendrobatidae) from Chapada dos Guimarães and Cuiabá, Mato Grosso State, Brazil

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(With 3 figures)

Abstract

The understanding of feeding habits is important for anurans in general, both from an ecological and a phylogenetic perspective. For diurnal poison frogs belonging to the Dendrobatidae family, diet aspects play a crucial role in their defense and survival. Herein, we investigated feeding habits, foraging behaviour, and overall effects of habitat, sex, and body size on the diet of individuals of *Ameerega braccata*, a poorly known dendrobatid species. Specimens were observed and collected in the type-locality, Chapada dos Guimarães, and in the neighbouring municipality of Cuiabá, both in the State of Mato Grosso, Midwestern Brazil. The most important prey categories for *A. braccata* were Formicidae, Isoptera, and Acari, whose representatives were caught during active foraging. Individuals from Chapada dos Guimarães population consumed more Acari but fewer Isoptera than individuals from Cuiabá. Despite this, niche breadth values were narrow and similar for the two populations. Individuals from two distinct habitats (campo sujo and cerrado stricto sensu) showed differences in their diet, probably as an effect of differential prey availability. Females consumed more Isoptera than males. The number of prey categories used as food was not influenced by the variation of body size of the target species. However, the abundance and the volume of consumed Acari were statistically correlated with body size. The main results suggest that *Ameerega braccata* has a narrow niche breadth, as well as a specialised diet in ants, termites, and mites, which reinforces the hypotheses of close association between Acari consumption and the presence of skin toxic alkaloids, already found in other species of Dendrobatidae. Although differences in prey consumption between sexes are uncommon among poisonous frogs, differences in the diet composition between age classes, which probably reduce intraspecific competition, are frequently reported.

Keywords: Ameerega braccata, niche breadth, Anura, Dendrobatidae, diet.

Dieta de *Ameerega braccata* (Steindachner, 1864) (Anura: Dendrobatidae) de Chapada dos Guimarães e Cuiabá, Estado do Mato Grosso, Brasil

Resumo

A compreensão de hábitos alimentares é de relevância ecológica e filogenética para espécies de anuros em geral. Para sapos diurnos da família Dendrobatidae, aspectos da dieta exercem papel crucial na defesa e, consequentemente, na sobrevivência. No presente trabalho, investigamos a composição alimentar, comportamento de obtenção de presas, o efeito do tipo de habitat, sexo e tamanho do corpo sobre a dieta de indivíduos de *Ameerega braccata*, uma espécie da família Dendrobatidae ainda pouco conhecida. Os espécimes foram observados e coletados na localidade tipo, Chapada dos Guimarães e em Cuiabá, Mato Grosso, centro-oeste do Brasil. As categorias de presas mais importantes nos estômagos de *A. braccata* foram Formicidae, Isoptera e Acari, cujos representantes foram capturados por forrageamento ativo. Os indivíduos da população de Chapada dos Guimarães consumiram mais Acari e menos Isoptera do que os indivíduos da população de Cuiabá, mas os valores de amplitude de nicho foram estreitos e similares entre as duas

populações. Indivíduos de diferentes tipos de habitat (campo sujo e cerrado stricto sensu) apresentaram diferenças na dieta, como um provável efeito da distinta disponibilidade de presas em cada um dos habitat. Fêmeas consomem mais Isoptera do que os machos. A variação no tamanho do corpo não exerce efeito sobre o número de categorias de presas consumidas. Abundância e volume de ácaros consumidos são significativamente relacionados com o tamanho do corpo dos indivíduos. Os principais resultados sugerem que *Ameerega braccata* tem estreita amplitude de nicho e dieta especializada em formigas, cupins e ácaros, corroborando a ideia de associação entre este último item e a presença de alcaloides na pele de espécies da família Dendrobatidae. Poucos autores encontraram diferenças entre sexos no consumo de presas por anuros. Diferenças na composição da dieta entre jovens e adultos, entretanto, são frequentes e podem ser consideradas uma característica conservativa, que impede a competição intraespecífica entre classes etárias.

Palavras-chave: Ameerega braccata, largura de nicho, Anura, Dendrobatidae, dieta.

1. Introduction

Aspects of feeding habits of amphibians have been intensively studied (e.g., Strüssmann et al., 1984; Lima and Magnusson, 1998; Lima, 1998; Van Sluys and Rocha, 1998; Van Sluys et al., 2001; Lima et al., 2002; Vaz-Silva et al., 2005; Jordão-Nogueira et al., 2006; Siqueira et al., 2006; Almeida-Gomes et al., 2007a,b), which is certainly related to the outstanding trophic role played by these organisms in many ecological systems. The majority of amphibian species is considered generalist regarding diet, and opportunistic regarding prey selection (Duellman and Trueb, 1994; Teixeira and Coutinho, 2002; Santos et al., 2004). Therefore, for the majority of species, the spectrum of dietary items is wide, and reflects the availability of prey items in the environment (Giaretta et al., 1998; Santos et al., 2004). However, many other features may influence prey consumption, such as foraging strategies (wide foraging versus ambush predation), spatial and temporal variations, sex, ontogeny, and body size (Strüssmann et al., 1984; Biavati et al., 2004).

The Dendrobatidae family includes 169 recognised species of mainly diurnal anurans distributed on the Amazonian rain forest (Frost, 2009). These frogs are poisonous, have specialised diets, mainly composed of ants, termites, and mites (Toft, 1980; Caldwell, 1996; Lima et al., 2002; Santos et al., 2003; Biavati et al., 2004), and are species are characterised by their bright colouration and potent skin toxins (Lötters et al., 2000). In many species of dendrobatids, a close association has been found between selected prey items and such skin toxic substances, suggesting that they are sequestered from diet (e.g., Dumbacher et al., 2004; Mortari et al., 2004; Takada et al., 2005. See also Darst et al., 2005).

Ameerega braccata (Steindachner, 1864) is a colorful dendrobatid distributed in the savannah-like Cerrado ecosystem from Central and Midwestern Brazil, where it is known from localities in the States of Mato Grosso, Mato Grosso do Sul, and Goiás (Frost, 2009). A few aspects of the natural history of this species have already been addressed (Haddad and Martins, 1994; Forti et al., 2010).

The present study aims to investigate some aspects of the diet of *A. braccata* in its natural environment, specifically: 1)- What are the most important dietary items for *Ameerega braccata* from Chapada dos Guimarães (type-locality) and Cuiabá, Midwestern Brazil? 2) Is this a specialised or a generalised species regarding prey selection? 3) What feeding strategies are employed in prey capture? 4) Are there any effects of habitat type, sex, and body size on the diet of *A. braccata*?

2. Material and Methods

2.1. Study area

The field work was conducted in two localities, only 9 km away from one another, but situated in two distinct municipalities from the State of Mato Grosso, Midwestern Brazil: Chapada dos Guimarães (approximately 15° 24' S and 55° 50' W; 650 m a.s.l.) - the type-locality of the species, and Cuiabá (approximately 15° 20' S and 55° 53' W; 250 m a.s.l.). Data collection occurred in the wet season, from October 2007 to March 2008. Forty-four individuals were found in two open physiognomies of the Cerrado ecosystem (Figure 1): campo sujo, mainly composed of grasses and sparse tall shrubs, and cerrado stricto sensu, where small trees are sparsely present in the landscape. For a more detailed description of the sampled physiognomies see Conceição (2000).

The annual mean precipitation in Chapada dos Guimarães ranges from 1,800 to 2,000 mm, and the mean temperature, from 22.8 °C in July, to 27.2 °C, in October (Pinto and Hay, 2005). In Cuiabá, the climate is nearly the same as in Chapada, semi-humid (Aw in Köppen's classification, see Nimer, 1979), with two well defined seasons: a cold and dry season (from April to September), and a warm and wet season, from October to March each year (Diniz et al., 2008), with a mean temperature of 25 °C (Schreiner et al., 2009).

2.2. Data collection

Feeding strategies, location, and the period of feeding of individuals of *Ameerega braccata* were observed during 100 hours by using focal animal method (Altmann, 1974). Dietary items from the stomachs of 44 individuals (28 from Cuiabá collected in cerrado stricto sensu and 16 from Chapada dos Guimarães, of with 14 collected in cerrado campo sujo and other two, in cerrado stricto sensu) were removed and analysed in the Herpetological Laboratory at Universidade Federal do Mato Grosso, Cuiabá, Brazil.

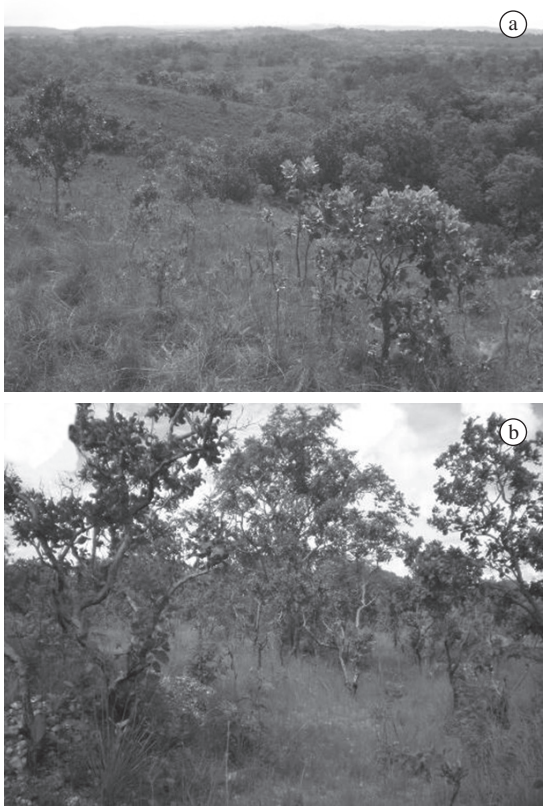

Figure 1. General aspect of two distinct habitats in which individuals of the anuran *Ameerega braccata* were studied in Midwestern Brazil: a) campo sujo; and b) cerrado stricto sensu.

All individuals were euthanised immediately after being captured, by using standard protocols (Calleffo, 2002). Dietary items were identified until order and family level, whenever possible. Snout-vent length (SVL) of all anurans was measured to the nearest 0.01 mm by using a digital caliper (BTS®). The sex of individual frogs was obtained either in the field (only for calling males) or in the laboratory (by gonad inspection after dissection). Animals were collected under IBAMA permit number 2075225, and are presently housed in the *Coleção Zoológica da Universidade Federal de Mato Grosso* (UFMT), Cuiabá, Brazil, under the accession numbers UFMT 7695, 7696, 7698-7713, 7729-7735, 7749, 7751-7757, 7775-7785.

2.3. Data analyses

To describe the representativeness of the main prey items consumed by individuals of *A. braccata* from the two populations examined, each prey category was analysed regarding its total frequency (F), relative frequency (F%), total abundance (N), relative abundance (N%), total volume (V), relative volume (V%), and importance index (I). We also calculated the numeric mean (NM) and volumetric mean (VM) of each prey category in each individual stomach examined.

The volume (in mm^3) of each single prey item was estimated by using the ellipsoid formula ($V= 4/3 \times \varpi \times W^2/4 \times L/2$, where L = prey width, and C = prey length, both measurements in mm, by using a digital caliper). A fragmented prey was counted only when a corresponding head was found. Width and length of fragmented prey were estimated based on intact specimens of the same kind of prey.

The importance index of each prey category was calculated by means of the formula: I = (F%+N%+V%)/3.

To correct for sample size the number of prey categories consumed by the two populations for sample size, a rarefaction curve with 1000 aleatorizations was constructed to each locality. The species richness of preys was computed using the software EcoSim 7.0 (Gotelli and Entsminger, 2009).

Niche breadth (B) for each population was calculated by using Levin's measure (Krebs, 1998), expressed as follows: $B = 1/\sum pi^{2,}$ where *i* is the resource category, and *p* is the proportion of the resource category *i*. For the standardisation of the obtained values between zero and one, we employed the formula: $B_A = B - 1/ n - 1$, where B_A is the standardised niche breadth and *n* is the total number of prey categories found in the stomachs (Krebs, 1998).

The abundance and volume of prey were log-transformed and graphs were generated to evaluate if there were differences in the diet composition between sexes in *A. braccata* (valid just for Cuiabá population) and between individuals occupying distinct habitats (campo sujo and cerrado stricto sensu). To evaluate if body size affects the variety of consumed prey, a linear regression was run, using SVL as the explanatory variable and the number of prey categories (taxa) as the response/dependent variable. Regression analyses were also performed to evaluate potential changes in the consumption of selected prey types by frogs of distinct body sizes. This was done by plotting SVL as the explanatory variable, and the abundance and volume of the prey categories with higher importance indexes as dependent variables.

3. Results

Males of *Ameerega braccata* foraged mainly after the end of their calling session, both in the morning (approximately between 7:30 AM and 9:00 AM) and in the afternoon (approximately between 6:30 PM and 7:30 PM). Males were first sighted when still vocalizing, perched in vegetation as described in Forti et al. (2010). Just after having stopped to call, they jump to the ground and begin to feed on the leaf litter. Seven females observed while feeding also foraged on the leaf litter.

A total of 1,746 prey items, in 13 categories (12 orders and one family), were found in the stomachs of *Ameerega braccata.* We found a mean of 39.7 ± 40.6 items in each stomach. Mean volume of prey by stomach was 105.52 ± 166.00 mm^3. Most frequent prey items were Formicidae, Acari (most of them belonging to the family Oribatidae), Coleoptera, Isoptera, and Hymenoptera. When

considering all stomachs together, Formicidae was the most abundant prey, followed by Isoptera and Acari. Regarding the volume of the prey, Formicidae also surpassed other prey types, being followed by Isoptera and Coleoptera.

The rarefaction estimative indicated that individuals from Cuiabá consumed 12 types of prey categories and those from Chapada dos Guimarães consumed 9 (Figure 2). Nevertheless, Formicidae was the most consumed prey category in the two populations. Individuals from Cuiabá consumed more Isoptera than individuals from Chapada dos Guimarães, which in turn consumed higher numbers of Acari (Table 1 and 2).

Based in prey abundance in the stomachs of *A. braccata*, niche breadth for the species was 1.729 (or 0.091, in a standardised scale from zero to one) in Chapada dos Guimarães, and 1.954 (or 0.080, in a standardised scale from zero to one) in Cuiabá. When volumetric data of prey were considered, niche breadth was 1.136 (or 0.017, in a standardised scale from zero to one) in Chapada dos Guimarães, and 1.946 (or 0.079, in a standardised scale from zero to one), in Cuiabá.

Similarly to the comparison between populations, both species composition and prey abundance slightly differed in stomachs of individuals of *A. braccata* occupying distinct habitats (Figure 3a, b). Formicidae was the main prey category for individuals in both kinds of habitats. However, individuals from cerrado stricto sensu consumed more Isoptera than individuals from phytophysiognomies of campo sujo, which in turn consumed more Acari. Volumetrically, individuals living in cerrado stricto sensu consumed higher volume of Isoptera, while individuals

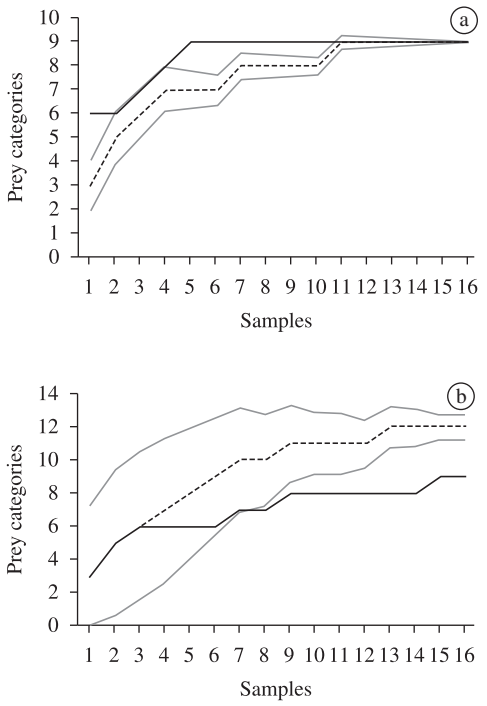

Figure 2. Rarefaction curves of prey categories consumed by individuals of *Ameerega bracatta* from two localities: a) Chapada dos Guimarães; and b) Cuiabá. The black solid line is the accumulation curve; broken line represents the average, calculated after 1000 aleatorizations, while grey lines represent deviation from average.

Table 1. Diet composition of *Ameerega braccata* from Cuiabá, Mato Grosso state, Midwestern Brazil. (n) number of analysed specimens; (F) total frequency; (%F) relative frequency; (N) total abundance; (%N) relative abundance; (NM) numeric mean; (V) total volume; (%V) relative volume; (VM) volumetric mean; (I) importance index.

Prey groups	Frequency (n = 28)		Abundance (n = 28)			Volume (n = 27)			Importance
	F	% F	N	% N	NM	V (mm^3)	% V	VM	I
Acari	11	39.29	39	4.69	1.39 ± 2.51	7.57	0.28	0.27 ± 0.80	14.75
Araneae	5	17.86	8	0.96	0.28 ± 0.81	11.19	0.41	0.40 ± 1.16	6.41
Chilopoda	2	7.14	2	0.24	0.07 ± 0.26	4.13	0.15	0.15 ± 0.47	2.51
Coleoptera (both larvae and adults)	11	39.29	16	1.93	0.57 ± 0.88	58.86	2.14	2.10 ± 4.76	14.45
Collembola	3	10.71	10	1.20	0.35 ± 1.52	0.35	0.01	0.01 ± 0.06	3.98
Diplopoda	1	3.57	2	0.24	0.07 ± 0.37	x	x	x	x
Diptera (both larvae and adults)	4	14.29	4	0.48	0.14 ± 0.35	3.29	0.12	0.11 ± 0.37	4.96
Formicidae (both larvae and adults)	26	92.86	571	68.71	20.40 ± 35.13	799.17	29.08	28.54 ± 48.74	63.55
Hemiptera	3	10.71	6	0.72	0.21 ± 0.78	2.77	0.10	0.10 ± 0.52	3.85
Hymenoptera*	6	21.43	8	0.96	0.28 ± 0.60	4.24	0.15	0.15 ± 0.55	7.52
Homoptera	3	10.71	4	0.48	0.14 ± 0.45	57.13	2.08	2.04 ± 6.41	4.42
Isoptera	16	57.14	159	19.13	5.67 ± 11.38	1799.06	65.46	64.25 ± 159.58	47.25
Thysanoptera	2	7.14	2	0.24	0.07 ± 0.26	0.59	0.02	0.02 ± 0.11	2.47

*Excepting Formicidae

Table 2. Diet composition of *Ameerega braccata* from Chapada dos Guimarães, Mato Grosso State, Midwestern Brazil. (n) number of analysed specimens; (F) total frequency; (%F) relative frequency; (N) total abundance; (%N) relative abundance; (NM) numeric mean; (V) total volume; (%V) relative volume; (VM) volumetric mean; (I) importance index.

Prey groups	Frequency (n = 16)		Abundance (n = 16)			Volume (n = 15)			Importance
	F	% F	N	% N	NM	V (mm^3)	% V	VM	I
Acari	14	87.5	140	15.30	8.75 ± 12.31	7.79	0.463	0.55 ± 0.70	34.42
Araneae	5	31.25	5	0.55	0.31 ± 0.47	6.44	0.383	0.46 ± 1.21	10.73
Coleoptera (both larvae and adults)	8	50	20	2.19	1.25 ± 1.52	60.99	3.623	4.35 ± 6.90	18.60
Collembola	3	18.75	4	0.44	0.25 ± 0.57	0.91	0.054	0.06 ± 0.20	6.41
Diptera (both larvae and adults)	2	12.5	2	0.22	0.12 ± 0.34	7	0.416	0.5 ± 1.87	4.38
Formicidae (both larvae and adults)	16	100	679	74.21	42.43 ± 38.52	1577.96	93.735	112.71 ± 117.43	89.31
Hymenoptera*	5	31.25	10	1.09	0.62 ± 1.08	9.63	0.572	0.68 ± 1.75	10.97
Homoptera	1	6.25	1	0.11	0.06 ± 0.25	0.1	0.006	0.01 ± 0.02	2.12
Isoptera	3	18.75	54	5.90	3.37 ± 12.45	12.6	0.748	0.90 ± 2.52	8.47

*Excepting Formicidae

in campo sujo consumed a higher volume of Formicidae (Figure 3c, d).

Males and females differed regarding the abundance of consumed prey (Figure 3e, f). Volumetrically, however, stomachs of male frogs contained a higher volume of Formicidae, thus differing from the females who consumed a higher volume of Isoptera (Figure 3g, h).

The regression analysis between the number of prey categories and body size of the frogs (SVL) was not statistically significant ($r^2 = 0.08$, $p > 0.05$, $F = 3.86$, $N = 42$).

Regression analysis between abundance of each prey category and SVL (Table 3), and between the volume of each prey category and SVL (Table 4) were only significant for Acari.

4. Discussion

Considering the relative high frequency, high abundance, and high volume of Formicidae among prey categories consumed by *A. braccata*, this frog species can be regarded as an ant specialist. Toft (1980) proposed some generalizations on the feeding habits of amphibians and characterised two guilds: 1) the ant specialists, which tend to be active foragers, poisonous, and prey on many small items in a feeding session, and 2) the non ant specialists, ambushing and cryptic predators, which consume a few big prey each day. The first guild typically includes many species of the family Dendrobatidae (Taigen and Pough, 1983; Caldwell, 1996; Lima, 1998). Active foraging behavior leads to a longer exposition time outside shelter and to an increased risk of predation. This may explain why species employing this feeding strategy are usually more toxic, more colorful, or even more cryptic than ambushing species (Toft, 1980).

Toxic substances present in living organisms have two possible origins: 1) they are synthesised by the organism itself (endogenous route), or 2) they are aquired from items in the diet (exogenous route) (Darst et al., 2005). Results from experiments in which dendrobatids were maintained in enclosures (genera *Ameerega, Dendrobates, Oophaga* and others) suggest and corroborate the idea that toxic alkaloids are sequestered from some specific prey (Daly et al., 1994). Although there is no biosynthetic evidence in support to this hypothesis (Takada et al., 2005), the specialised diet in ants recorded for many dendrobatids has been considered associated both with the presence of skin alkaloids and with aposematic coloration, as defensive strategies (Caldwell, 1996; Darst et al., 2005).

Acari (mainly of the family Oribatidae, which according Takada et al., 2005, may also contain alkaloids that can be sequestered by predators) were also frequently found in the stomachs of individuals of *A. braccata*. Volumetricaly, however, Isoptera was the most relevant prey category. Biavati et al. (2004) argumented that termites (Isoptera) are energetically worthwhile, as they contain fewer amounts of sclerotised material and higher levels of carbohidrates than ants. This may explain why females of *A. braccata* consumed a higher volume of Isoptera than males, due to the higher energetic demands during reproduction. Nevertheless, Biavati et al. (2004) did not find any difference in the composition of the diet of males and females of *A. flavopicta*.

Formicidae has been the main prey of *Ameerega bracatta* at both study sites (Chapada dos Guimarães and Cuiabá), however, there was a relevant difference in composition of prey between these two populations. In the present study, diet comparisons between populations can be considered quite equivalent to comparisons between habitats, due to the prevalence of cerrado stricto sensu in Cuiabá, while

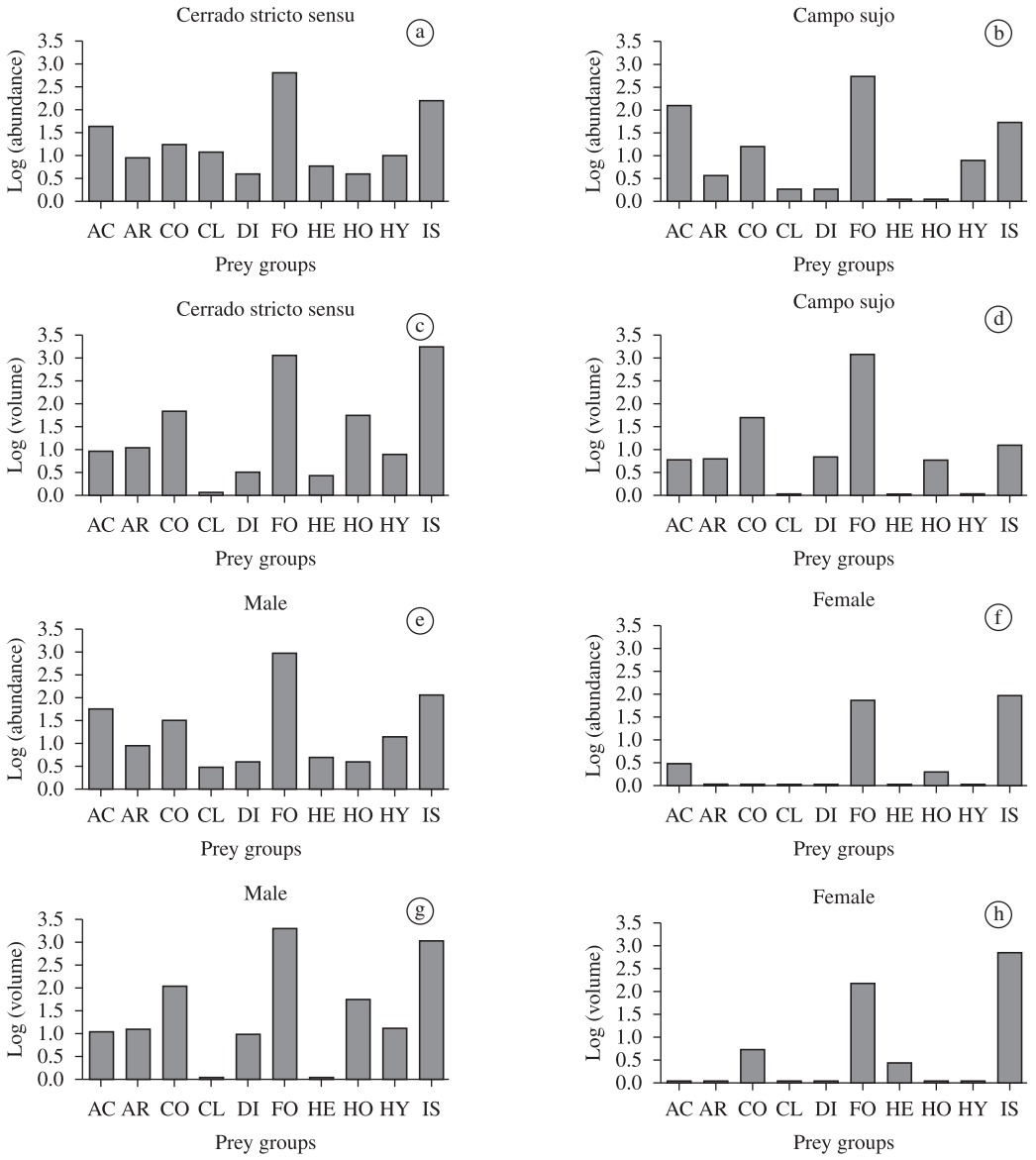

Figure 3. Log-transformed prey abundance in the stomachs of 44 individuals of *Ameerega braccata* captured in a) cerrado stricto sensu (N = 30) and b) campo sujo (N = 14); Log-transformed prey volume in 42 individuals of *A. braccata* from c) cerrado stricto sensu (N = 30) and d) campo sujo (N = 12); Log-transformed prey abundance from e) males (N = 29) and f) females (N = 8) of *A. braccata*; Log-transformed prey volume from g) males (N = 27) and (H) females (N = 8) of *A. braccata*. Abbreviations for prey categories: Acari (AC), Araneae (AR), Coleoptera (CO), Collembola (CL), Diptera (DI), Formicidae (FO), Hemiptera (HE), Homoptera (HO), Hymenoptera (HY), Isoptera (IS).

individuals from Chapada dos Guimarães were collected mainly in cerrado campo sujo.

Differences in the abundance and volume of prey consumed by individuals of *A. braccata* living in distinct habitats may be associated with the structural peculiarities of each surveyed site, such as soil type, microclimate, vegetation structure, which possibly influence the local distribution and availability of prey. In Cerrado environments of Central Brazil, Biavati et al. (2004) recorded Isoptera as the main food for *A. flavopicta*, and also as the most abundant prey items available in those habitats where the frogs were obtained.

Niche breadth values found for *Ameerega braccata* populations were relatively low and similar to values reported for other dendrobatid species, such as *A. bilinguis, A. flavopicta*, *A. hahneli, A. parvula, A. petersi, A. picta, A. trivittata, Dendrobates auratus, Oophaga pumilio* and *Ranitomeya ventrimaculata* (Biavati et al., 2004; Darst et al., 2005; Toft, 1980). All these species consume a small variety of prey, being usually specialised in consuming a

Table 3. Results of linear regression analysis between abundances of the seven prey categories with higher importance indexes in the diet of *Ameerega braccata* from Chapada dos Guimarães and Cuiabá (Mato Grosso, Brazil), and the snout-vent length of 42 individuals.

Prey	Intercept	F	r^2	p
Acari	23.87	47.74	53.3	<0.01**
Araneae	0.47	0.04	0.11	>0.05
Coleoptera	1.14	0.08	0.21	>0.05
Collembola	2.38	2.46	5.8	>0.05
Formicidae	29.9	0.0008	0	>0.05
Hymenoptera	0.67	0.11	0.28	>0.05
Isoptera	–8.98	1.25	3.05	>0.05

Table 4. Results of linear regression analysis between volume of the seven prey categories with higher importance indexes in the diet of *Ameerega braccata* from Chapada dos Guimarães and Cuiabá (Mato Grosso, Brazil), and the snout-vent length of 33 individuals.

Prey	Intercept	F	r^2	p
Acari	2.77	5.21	13.66	<0.05*
Araneae	0.63	0.006	0.02	>0.05
Coleoptera	–1.22	0.33	1.01	>0.05
Collembola	0.14	0.34	1.04	>0.05
Formicidae	42.63	0.04	0.13	>0.05
Hymenoptera	0.27	0.004	0.01	>0.05
Isoptera	–15.07	0.12	0.37	>0.05

single group of arthropodes, such as Formicidae or Isoptera (Biavati et al., 2004; Darst et al., 2005; Toft, 1980).

Although body size did not affect the number of prey categories consumed by individuals of *A. braccata*, smaller individuals of this frog tend to consume more representatives of Acari than larger individuals. As Acari may be the main cumulative source of toxic sequesterable alkaloids, it should be worthwhile to the froglets to consume higher proportions of this prey item, as early as possible. However, a gradual decrease in the number and volume of Acari ingested by individuals of *Ameerega braccata*, as they increase in size, may be merely a reflex of the growing capacity of the frogs to ingest bigger prey. Acari are very small items, and consequently they are suitable for the young metamorphs, which consume them in higher proportions.

Changes in the kind and size of prey in relation to body size were already reported for six anuran species occuring in the leaflitter of an Amazonian tropical rainforest (Lima, 1998). Another alternative hypothesis to explain ontogenetic changes in the diet of anurans involves changes in the spectrum of prey sizes available to predators of distinct body sizes (Giaretta et al*.,* 1998). Nevertheless, dietary ontogenetic changes might prevent intraspecific competition for feeding resources between froglets and adult individuals (Lima, 1998). However, additional studies must be conducted to assess whether ontogenetic changes in the diet are usual for anurans.

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