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FOOD HABITS OF THE LIZARD *Ameiva ameiva* (LINNAEUS, 1758) (SAURIA: TEIIDAE) IN A TROPOPHIC FOREST OF SUCRE STATE, VENEZUELA.

HÁBITOS ALIMENTARIOS DEL LAGARTO *Ameiva ameiva* (LINNAEUS, 1758) (SAURIA: TEIIDAE) EN UN BOSQUE TROPÓFILO DEL ESTADO SUCRE, VENEZUELA.

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ABSTRACT

Food habits among sexes of *Ameiva ameiva* were evaluated by the frequency of occurrence, trophic dominance, and diet similarity methods during periods of rain and drought in a tropophic forest in La Llanada Vieja, Sucre State, Venezuela. 431 prey items were identified in 20 stomachs analyzed. Diet for both periods showed a high frequency for Coleoptera, plant material, Isoptera, Nematoda, Araneae, and reptilian rests. Males and females showed differences in diet during the climatic periods analyzed. Females showed higher stomach volumes values than males. Results suggest the species is mainly insectivorous.

RESUMEN

Se evaluaron los hábitos alimentarios de *Ameiva ameiva*, mediante el método de frecuencia de aparición, dominancia trófica y similitud de la dieta entre sexos, abarcando los periodos de lluvia y sequía. La captura se realizó en un bosque tropófilo de los alrededores de la Llanada Vieja, estado Sucre, Venezuela. Se analizaron 20 estómagos, encontrándose un total de 431 presas. La dieta en los diferentes períodos mostró una alta frecuencia de Coleoptera, materia vegetal, Isoptera, Nematoda, Araneae y restos de lagartos. La alimentación de hembras y machos presentó diferencias entre los periodos climáticos y el mayor volumen estomacal se observó en hembras. Los resultados indican que la especie es principalmente insectívora.

Keywords: Lizard, *Ameiva ameiva*, diet, tropophic forest, Venezuela
Palabras clave: Lagarto, *Ameiva ameiva*, dieta, bosque tropófilo, Venezuela.

INTRODUCTION

An important element to understand the trophic level occupied by a species is the determination of their foods habits as these are useful for solving some practical problems in wildlife management. Studies on the feeding of wild animals focus on the type of food consumed and the results of such studies allow us to identify and compare the diets of species by sex, location, season, and availability of resources. (Ojasti, 2000; Zug *et al*. 2001). Therefore, diets are an important component of the natural history of species, providing information about their life history and behavioral patterns (Pollack *et al*. 2007).

Lizards of the genus *Ameiva* are well represented in Neotropical America (Figure 1). They are distributed from southern Mexico

through Central and South America comprising some 15 species, of which only two are present in Venezuela: *A. bifrontata* and *A. ameiva*.

Figure 1. *A. Ameiva* male.

The latter is distributed from Panama to tropical South America, Tobago and Margarita Island in Venezuela (Peters and Donoso-Barros, 1970, Ávila-Pires, 1995). The aim of this study is to evaluate the diet of the lizard *A. ameiva* in northwestern Sucre State, Venezuela.

MATERIALS AND METHODS

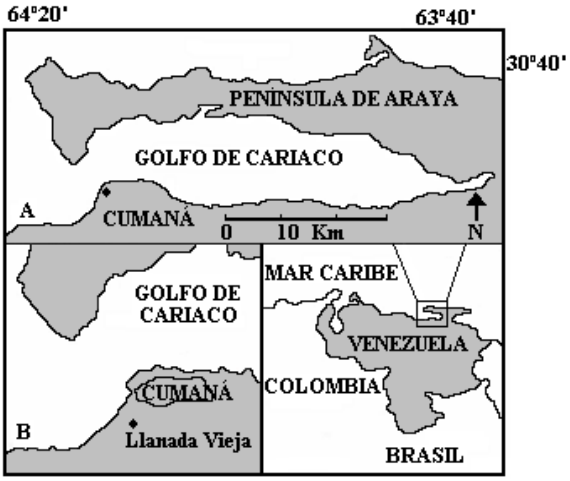

Figure 2. Sucre State, Venezuela (A). The Llanada Vieja (B).

Study area. The sample site is located nearby the Llanada Vieja (10 ° 23 '97"N, 64 ° 10' 30"W) (Figure 2). The area is characterized by irregular rainfall (less than 444.29 mm), and an annual temperature that varies between 23º and 29ºC. The dry season extends from December to June and the rainy season from July to October (Prieto *et al.* 2001; Foghin-Pillin, 2002). Its vegetation is characterized as a macrotermic tropophyllous forest, with a characteristic deciduous vegetation formed by three strata: 1) Arboreous, dominated by *Bourreria cumanensis*, *Capparis pacchaca*, *C. linearis*, *Mimosa arenosa*, *Cereus griseus*, *Subpilocereus repandus*, *Pilosocereus moritzianus*, *Plumeria alba*, and *Bursera simaruba*; 2) Shrub, dominated by *Opuntia lilae*, *O. elatior*, and *Calliandra* sp., and 3) Herbaceous plants consisting of various trees and shrubs such as *Melocactus curvispinus*, *Evolvulus sp*., *Convolvulus sp*., and *Bromelia humilis*. The soil is stony with a layer of slightly decomposed litter (Cumana, 2005, Velásquez *et al*. 2007).

Field methods. Samples were taken between August 2007 and August 2008, covering periods of rain and drought. The lizards were collected with an air rifle and each was assigned an identification tag containing a collection number, specimen sex, and date of capture.

Laboratory methods. Lizards were weighed on a digital balance of 1.000 g and 0.1 g accuracy. Snout-vent length was measured with a digital vernier of 150 mm and 0.1 mm accuracy. A tape measure was used for larger specimens. Individuals were fixed in 10% formalin and preserved in 70% ethanol. The stomach contents were obtained through an incision in the ventral region. Volume ingested was calculated by the displacement of a known initial volume in a 40 ml graduated cylinder. The stomach contents were placed in a sieve, washed with tap water and poured into a Petri dish previously filled with 70% ethanol. Observations were made with a stereoscopic microscope (Korschgen, 1980). Each item found was identified to Order with the help of specialized literature (Borror and Delong 1966, Borror and White 1970, Richards and Davies 1984, Ruppert and Barnes 1996, and Castner 2006).

Data analysis. Stomach content volumes during periods of drought and rain are represented by histograms generated with Excel 2007. The diet of *A. Ameiva* was analyzed by calculating: 1. Frequency of occurrence FA = NE / NT, where NE is the number of stomachs with certain items and NT is the total number of

stomachs studied. 2. Trophic dominance D = NI / NT, where NI is the total number of individuals of a particular item and NT is the total number of individuals of all items found (González *et al*., 2007) and 3. Diet similarity between sexes and climate period, determined by the Jaccard similarity index (Moreno, 2001). The computer program Cluster Analysis version 4.0 was used (Coyula, 1990).

RESULTS

Size, weight and volume of stomach contents. The highest length and weight measured for a male was 165 mm and 127.70 g, respectively. The largest female measured 156 mm and weighed 100.40 g. (Table 1).

During the rainy period the largest stomach content volume (5 ml) corresponded to the female with the highest length and weight. In the dry season females showed a stomach content maximum volume of 1.5 ml. The female of maximum length measured 107.2 mm and weighted 24.80 g (Figure 3A and 3B).

Diet Composition. In 20 stomachs (11 females and 9 males) examined a total of 431 prey items, mostly small arthropods, were found. During the dry season adult Coleoptera (1) and Isoptera (0.900) were the most frequent food items. Isoptera (0.756) was the dominant item. During the rainy season the most frequent items were adult Coleoptera (1), Nematoda (0.636), plant material (0.636), Araneae (0.545), Coleoptera larvae (0.364), and Blattaria (0.364). Isoptera (0.348) and Nematoda (0238) were the dominant items. For both seasons Coleoptera (0.952), plant material (0.571), and Isoptera (0.524) showed frequencies, while Isoptera (0.600) was the dominating item (Table 2).

Table 1. *A. ameiva*. lenght and weigth. N= simple size; P= mean; V= Variance.

Variables	**N**	**Interval**	**P**	**V**
Females				
Lenght (mm)	11	47.88 - 156	114.36	33.92
Weight (g)	11	2,8 - 100,4	72.37	31.91
Males				
Lenght (mm)	9	52.67 -165.	115.23	50.44
Weight (g)	9	3,7 - 127.7	58.31	63.48

Table 2. *A. ameiva* diet composition.
N= number of items; FA= frecuency of occurrence; D = Dominancy.

Ítems	Rain	Drought	Both periods						
	N	D	FA	N	D	FA	N	D	FA
Isoptera	57	0.348	0.273	204	0.756	0.9	261	0.601	0,524
Coleoptera adults	20	0.122	1	10	0.037	1	30	0.069	0.952
Coleoptera larvae	4	0.024	0.364	1	0.004	0.100	5	0.012	0.143
Hymenoptera	6	0.037	0.091	38	0.141	0.200	44	0.101	0.143
Diptera	2	0.012	0.182	2	0.007	0.200	4	0.009	0.095
Diptera pupae	2	0.012	0.182	-	-	-	2	0.005	0.095
Blattaria	12	0.073	0.364	-	-	-	12	0.028	0.190
Orthoptera	4	0.024	0.182	-	-	-	4	0.009	0.095
Nematoda	39	0.238	0.636	-	-	-	39	0.090	0.381
Araneae	8	0.049	0.545	-	-	-	8	0.019	0.381
Gasteropoda	2	0.012	0.182	2	0.007	0.200	4	0.009	0.190
Acarina	-	-	-	2	0.007	0.200	2	0.005	0.095
Reptile rests	3	0.018	0.182	2	0.007	0.200	5	0.012	0.238
Plant rests	5	0.030	0.636	9	0.033	0,200	14	0.032	0.571
TOTALS	164			270			434		

For females we found a total of 45 prey items in the rainy season and 165 during the dry season. The most frequent items during the rainy season were Coleoptera (1) and Isoptera (1) with Nematoda (0.378) showing the highest dominance value. During the dry season Coleoptera (1) and Nematoda (0.500) had the highest frequency values, while Isoptera (0.642) and Hymenoptera (0.230) were the dominant items. For males we found a total of 105 prey items in the rainy season and 119 during the dry season. The most frequent items during the rainy season were Coleoptera (1) and Isoptera (1) with Isoptera (0.479) showing the highest dominance value. During the dry season Coleoptera (1) and Isoptera (0.600) had the highest frequency values, while Isoptera (0.933) was the dominant item (Table 3). These results show that insects were the dominant item during both climatic periods.

Table 3. *A. ameiva* diet composition by sex.
N= number of items; FA=frecuency of occurrence; D = Dominancy.

	Rainy season							Dry season						
	Females				males			Females				Males		
Items	N	D	FA		N	D	FA	N	D	FA		N	D	FA
Isoptera	-	-	-		57	0.479	0.600	106	0.642	1		98	0.933	1
Coleoptera adults	10	0.222	1		10	0.084	1	6	0.036	1		4	0.038	1
Coleoptera larvae	2	0.044	0.333		2	0.017	0.400	1	0.006	0.200		-	-	-
Hymenoptera	6	0.133	0.167		-	-	-	38	0.230	0.400		-	-	-
Diptera	-	-	-		2	0.017	0.400	2	0.012			-	-	-
Diptera larvae	-	-	-		2	0.017	0.400	-	-	-		-	-	-
Blattaria	2	0.044	0.333		10	0.084	0.400	-	-	-		-	-	-
Orthoptera	-	-	-		4	0.034	0.400	-	-	-		-	-	-
Nematoda	17	0.378	0.500		22	0.185	1	-	-	-		-	-	-
Araneae	3	0.067	0.500		5	0.042	1	-	-	-		-	-	-
Gasteropoda	-	-	-		2	0.017	0.400	2	0.012	0.400		-	-	-
Acarina	-	-	-		-	-	-	2	0.012	0.400		-	-	-
Rests of reptiles	2	0.044	0.333		1	0.008	0.200	1	0.006	0.333		1	0.010	0.500
Rests of plants	3	0.067	0.500		2	0.017	0.400	7	0.042	1		2	0.019	0.500
TOTALS	45				119			165				105		

Diet similarity. The analysis for males and females during the dry and rainy seasons using the Jaccard distance resulted in three separate groups. The first one comprises the association of males and females in the rainy season with a maximum similarity value of 53.85%. This group was in turn associated with females captured during the dry season with a value of 45.83%. These two groups are related to the males of the dry season with a value of 38.89% (Figure 4).

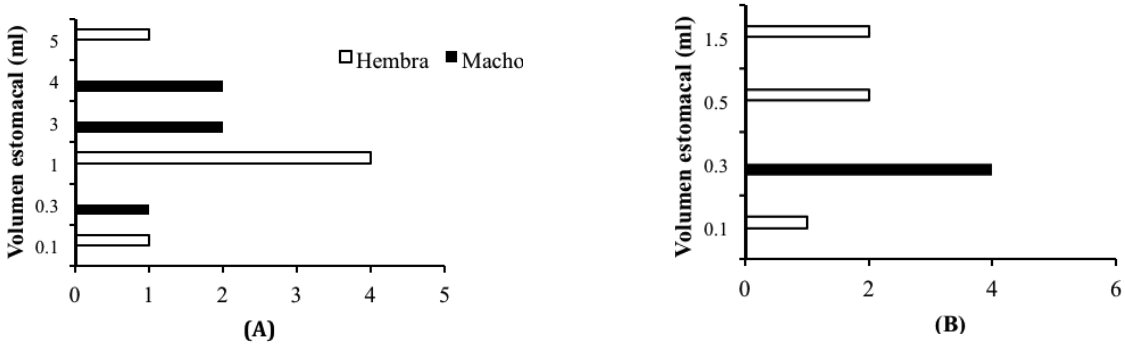

Figure 3. Stomach contents volumes for male and female *A. ameiva*. Rain (A), drought (B).

DISCUSSION

The components of the diet of *A. ameiva* found in this study are different from those reported by Gonzalez & Prieto (1997) for *A. a. melanocephala* = *A. ameiva* in a rain forest in the Cordillera de la Costa in Venezuela; these authors found a higher frequency of occurrence of Lepidoptera larvae and adult Coleoptera. In this study Lepidoptera were absent while Coleoptera were found at a higher frequency. Although Coleoptera larvae, Diptera larvae, and Orthoptera were abundant in the diet of that subspecies, they did not show high level of frequency or dominance. The different type of forest habitat used by each species probably caused this discrepancy. Vitt & Colli (1994) working with *A. ameiva* in Brazil obtained partially similar results as the ones in this paper. They reported high numbers for prey items such as eggs, larvae, and pupae of insects, grasshoppers, crickets, beetles, scorpions, cicada, and vertebrate material. Mesquita *et al*. (2006) studying the ecology of *A. ameiva* in Jalapão Brazil indicated a high importance value for Isoptera. Similar results were reported by Silva *et al*. (2003) who found that populations of *A. ameiva* in southeastern Brazil consumed Blattoptera and Isoptera more frequently. In contrast to species showing passive foraging behaviors several authors claim that *A. ameiva* is an active open habitat forager who tends to consume congregated or generally sedentary prey (González and Prieto, 1997, Silva *et al*., 2003, González *et al*., 2003).

Gonzalez *et al*. (2003) analyzed the diet of *Ameiva bifrontata* in the vicinity of the Tacal river in Sucre state, Venezuela and identified a total of 15 prey types, indicating that Diptera larvae were more frequent during the rainy season while Isoptera were more frequent during the dry period. Diet studies in members of the Teiidae family have described the importance of Isoptera in their diets (Mesquita and Colli, 2003; Menezes *et al*., 2006; Teixeira-Filho *et al.*, 2003). Figueras (2008) reported differences in diet from rainforest and xerophytic habitats for *Cnemidophorus lemniscatus* in Sucre state Venezuela, indicating that *A. ameiva* consumes more Isoptera in xerophytic habitats.

Large stomach content volumes found in females during the period of drought may be related to preparation for the breeding season, which largely coincides whit the rainy period (González and Prieto, 1999), although Vitt (1982) suggests a continuous reproduction throughout the year in *A. ameiva*. Pianka (1970) argues that the reproductive potential in lizards varies with rainfall, and these in turn, affect the availability of food. Males and females of *A. ameiva* consumed large numbers of insects during the period studied. This behavior is also exhibited by *A. bifrontata*, *Tropidurus hispidus* and *C. lemniscatus* in nearby areas.

Eating vegetables and lizards remains is also common in these lizards, either accidentally or as part of their diet. Lizard remains have been reported for a male *A. bifrontata*; male *Tropidurus hispidus* consume juvenile *A. bifrontata*, as well as *Cactus caesius* and *Melocactus curvispinus* fruits, a behavior for which this species has been considered as a seed disperser. Similar behavior has also been observed in *C. lemniscatus* (González *et al*., 2003; Velásquez *et al*., 2007; Figueras, 2008). As a result of these studies it has been suggested that *A. ameiva* is mainly insectivorous, consuming plant materials occasionally.

The result of the analysis of similarity of diets between sexes and climate periods by the Jaccard distance is similar to those by González *et al.* (2003) in *A. bifrontata* in the vicinity of Cumana, Sucre, Venezuela.

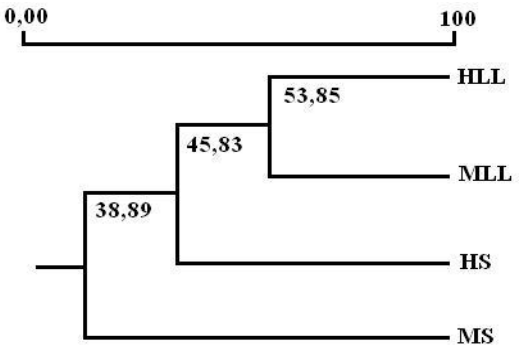

Figure 4. Jaccard similarity percentage between diets by sex both periods. FR: Female rain, MR: Male rain, FD: Female dry y MD: Male dry.

During the dry period when the availability of prey is scarce males depend more on Isoptera and adult Coleoptera as prey items. In addition to these two items, females consume at least six other items during this period. During the rainy season the similarity between males and females is greater due to the abundance of plants, leaves and flowers, which in turns causes increases in insect and arthropod prey items. *Ameiva* additionally consumes plant material, such a leaves and flowers. It is necessary to further investigate *A. ameiva* activity patterns to obtain information about its natural history and its relation to their their eating habits.

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