Ecologia

DIET OF Hemidactylus mabouia (SAURIA, GEKKONIDAE) IN URBAN AREA OF SOUTHERN BRAZIL

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ABSTRACT

In this study we analyzed the stomach content of 55 specimens of *Hemidactylus mabouia* (28 juveniles, 14 adult females and 13 adult males) captured in urban areas of Porto Alegre City, RS, Brazil, aiming to evaluate diet and sexual and ontogenetic variation on prey consumption. The diet comprised 17 prey groups, mainly arthropods. Cannibalism was observed in this population. Diptera was the most frequent (30.91%) and numerically most important (39.27%) order of prey. There was no significant difference in diet between males and females. Adult lizards fed on significantly larger prey in comparison to juveniles (U = 176.00; p < 0.001). Diet similarity was higher between males and females ($O_{jk} = 0.94$) and prey diversity was higher for adult females (H' = 2.83). The most important item in the diet of *H. mabouia* (Importance Value Index) was Diptera (IVI = 0.83). The data indicate that the population of *Hemidactylus mabouia* studied at the urban area of Porto Alegre shows a generalistic and opportunistic feeding pattern, feeding mainly on arthropods.

Key words: diet, Hemidactylus mabouia, southern Brazil.

RESUMO

Dieta de Hemidactylus mabouia (Sauria, Gekkonidae) em área urbana no sul do Brasil

Foram analisados os conteúdos estomacais de 55 espécimes de *Hemidactylus mabouia*, (28 jovens, 14 fêmeas adultas e 13 machos adultos), coletados em áreas urbanas do município de Porto Alegre, RS, Brasil, para avaliar a variação sexual e ontogenética no consumo de presas. A dieta foi composta por 17 grupos de presas, na maioria artrópodes. Nesta população houve casos de canibalismo. Díptera foi a ordem mais freqüente (30,91%) e numericamente mais representativa (39,27%). Não houve diferença significativa entre a dieta de machos e fêmeas. Lagartos adultos alimentaram-se de presas significantemente maiores, em relação aos jovens (U = 176,00; p < 0,001). A similaridade na dieta foi maior entre machos e fêmeas ($O_{jk} = 0,94$) e a diversidade de presas foi maior nas fêmeas adultas (H' = 2,83). De acordo com o índice de valor de importância o item mais importante na dieta de *H. mabouia* foi Diptera (VI = 0,83). Os dados indicam que a população de *Hemidactylus mabouia* estudada em área urbana de Porto Alegre, apresenta um padrão alimentar generalista e oportunista, alimentando-se principalmente de artrópodes.

Palavras-chave: dieta, Hemidactylus mabouia, sul do Brasil

INTRODUCTION

The study of the diet composition of a given species generates information about the prey types and also about the relative importance of each prey for the lizard, as well as the strategies it uses to detect prey (BELVER and ÁVILA, 2001). The success on using several habitats involves, as a major factor; the exploitation of supposedly abundant items in the environment, which is more important for exotic species which plasticity of feeding habits, associated to ecological and biological conditions, create

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possibilities of establishment and colonization of such species in new environments (ZAMPROGNO and TEIXEIRA, 1998).

Hemidactylus mabouia (Moreau de Jonnès, 1818) belongs to family Gekkonidae, from Africa, possibly brought to Brazil in slave ships (VANZOLINI, 1968, 1978). It is an effective colonizer, widely distributed and frequently associated to urban areas (HOWARD et al., 2001). It is currently well distributed all over the country, generally in urban areas, but also found in natural environments of several biomes of Brazil (VANZOLINI, 1968, 1978; VITT, 1986; ZAMPROGNO and TEIXEIRA, 1998). Few studies evaluated natural history of this species in Brazil, and most information is about feeding habits (VITT, 1986; VITT, 1995; ZAMPROGNO and TEIXEIRA, 1998; VANZOLINI et al., 1980; RAMIRES and FRAGUAS, 2004).

This study analyzes the diet of *Hemidactylus mabouia* in urban areas of Porto Alegre, Rio Grande do Sul State, evaluating sexual and ontogenetic variation in diet.

MATERIAL AND METHODS

The study was carried out in urban areas of Porto Alegre City (30°04' S, 51°11' W), Rio Grande do Sul, from January to December 2003. Specimens were captured between 19:00 and 23:00 h. Specimens captured (n = 80) were sacrificed, fixed in 10%formalin and preserved in 70% alcohol. The lizards weight was measured with Pesola® Spring Scales (precision 0.25 g) and their snout-vent length (SVL) was measured with Mitutoyo® caliper (accuracy 0,01 mm). The lizards were dissected in laboratory and their stomach contents were analyzed under stereomicroscope. Prey items were identified and classified to the taxonomic level of Order. The food remains we could not identify were grouped as "nonidentified arthropods" (NIA). The food items of each specimen were counted and measured (larger length and width) with digital caliper. The volume of each item (mm³) was estimated by the spheroid volume formula:

$$V = \frac{4}{3}\pi \left(\frac{length}{2}\right) \left(\frac{width}{2}\right)^2$$

The similarity degree between the diets of females and males and juveniles (SVL < 72.00 mm) and adults was determined using the O_{jk} similarity index (PIANKA, 1973):

$$O_{jk} = \frac{\sum P_{ij}P_{ik}}{\sqrt{\sum P_{ij}^2 \sum P_{ik}^2}}$$

where P_{ij} and P_{ik} are the proportion of food items of category i in the groups j and k. Values vary from 0 (no similarity) to 1 (complete similarity).

Trophic diversity concerning number of prey found in the stomachs of males, females and juveniles was calculated using Shannon-Wiener index (KREBS, 2001): H' = $-\Sigma p_i \log_2 (p_i)$, being p_i the relative abundance of prey i taxon in the diet of the lizards.

The relative importance of each item was described calculating the Importance Value of prey (GADSDEN and PALACIOS-ORONA, 1997):

$$IV = V'_{ii} + N'_{ii} + F'_{ii}$$

where: V'_{ij} = V_{ij} / SV_{ij}; N'_{ij} = N_{ij} / SN_{ij}; F'_{ij} = F_{ij} / SN_j; IV = Importance Value; V_{ij} = Volume of food item i in predator j; SV_{ij} = Total Volume of stomach content; N_{ij} = Number of elements of food item i in predator j; SN_{ij} = Total number of prey in the sample; F_{ij} = Number of stomachs of predator j in which food item i was found; N_j = Total number of stomachs of predator j.

Differences in number and mean volume of prey consumed by adults and juveniles were tested using Mann-Whitney test.

The specimens analyzed were deposited in the Herpetological Collection of Museu de Ciências e Tecnologia of Pontifícia Universidade Católica do Rio Grande do Sul (MCP): 15459, 15460, 15462, 15463, 15464, 15465, 15468, 15469, 15470, 15,471, 15472, 15474, 15475, 15476, 15480, 15481, 15482, 15483, 15484, 15485, 15487, 15488, 15490, 15491, 15492, 15493, 15494, 15495, 17896, 17897, 17898, 17899, 17900, 17901, 17903, 17904, 17905, 17906, 17907, 17908, 17910, 17911, 17912, 17913, 17915, 17916, 17917, 17918, 17919, 17922, 17923, 17924, 17927, 17928, 17930.

RESULTS

Among the captured lizards (n = 80), 55 specimens (28 juveniles, 14 females and 13 males) had stomach content.

The diet of *Hemidactylus mabouia* was basically composed of arthropods, including 12 orders of

insects, two orders of crustaceans and two orders of arachnids. Two male specimens had one juvenile of *H. mabouia* each in the stomach.

Diptera was the most frequent order, being present in 30.9% of stomachs, and the numerically most important taxon, corresponding to 39.27% of the total ingested prey (n = 275) and to 10.55% of the total volume of prey. Araneae was the second most frequent item in the diet of *H. mabouia*, being present in 27.2% of the total sample, corresponding to 5.82% of the total number of prey and to 13.12% of the total volume. Numerically, the most important item after Diptera (39.27%) was Hemiptera, which corresponded to 26.5% of the total ingested, to 7.41% of the total volume of prey and was present in 21.82% of the stomachs (Tab. 1).

Regarding volume of prey, the most important item was Orthoptera (20.4%), corresponding to 5.45% and 1.09% of frequency and number of prey, respectively. The second most important item concerning volume was Araneae (Tab. 1).

The mean diversity of prey in each stomach was 1.98 (SD = 1.03) and 5 taxa was the maximum richness found in a stomach. The highest number of prey items found in one specimen was 51, and the general mean was 5.49 (DP = 9.38) items.

The mean number of prey consumed by adult males was 5.69 ± 11.35 , and by adult females 4.69 ± 6.35 ; the difference between males and females was not significant (U = 75.0; p = 0.62). The mean volume of prey consumed by adult males was 239.58 ± 262.03 mm³, and by females 146.28 ± 223.10 mm³; the difference was not significant either (ANOVA F = 1.02; p = 0.32, n = 27).

Adult lizards (males and females) consumed mean number of 5.19 ± 9.03 prey, whereas juveniles consumed mean number of 5.83 ± 10.12 prey; the difference was not significant (U = 274.0; p = 0.46). The mean volume of prey consumed by adults (191.20 ± 239.51 mm³) was significantly larger than the mean volume of prey consumed by juveniles (65.03 ± 134.85 mm³) (U = 176.00; p < 0.001).

The correlation between number of prey in each stomach and the body size of the lizard was not significant (ANOVA, F = 0.47; p = 0.83). The correlation between the mean volume of prey in each stomach and the SVL of the lizards was positive and significant (ANOVA, $R^2 = 0.15$; F = 9.76, p < 0.01).

The feeding similarity (concerning number of prey groups) was higher between males and females ($O_{ik} = 0.94$) than between females and juveniles

 $(O_{jk} = 0.57)$ or males and juveniles $(O_{jk} = 0.55)$. Concerning volume of prey, the feeding similarity was higher between juveniles and adult males $(O_{jk} = 0.32)$ than between adult males and females $(O_{jk} = 0.09)$ or juveniles and adult females $(O_{ik} = 0.10)$.

Trophic diversity was higher in the diet of adult females (H' = 2.83) than in the diet of juveniles (H' = 2.32) and males (H' = 2.09).

The Importance Value Index of feeding items revealed Hemiptera as the most important item in the diet of juveniles (IVI = 1.02), whereas Diptera is the most important item in the diet of adult males and females (IVI = 0.93 and IVI = 0.90, respectively). In general, the most important item was Diptera (IVI = 0.83), followed by Araneae (IVI = 0.49) and Hemiptera (IVI = 0.46).

DISCUSSION

The data indicates that the population of Hemidactylus mabouia studied in the urban area of Porto Alegre is generalistic and opportunistic, feeding mainly on arthropods, corroborating other studies on the species in natural areas. However, differences in the proportion of certain prey categories are observed. VITT (1995) mentions that insect larvae are important in the diet of *H. mabouia* in the Caatinga region of Brazil. In Porto Alegre, however, this category is represented by a single specimen in only one lizard. ZAMPROGNO and TEIXEIRA (1998) found Aranae, Homoptera, and Isopoda in a population of this species in the Sandy Costal Plain of Espírito Santo. In our data, Diptera was the most important item of *H. mabouia*, most likely because of the higher availability of this prey category in urban areas. According to ZAMPROGNO and TEIXEIRA (1998), diet variation in *H. mabouia* may be a consequence of its opportunistic behavior allied to differential prey availability in different areas studied.

Among the total of specimens captured (n = 80), 25 lizards did not present stomach content. According to Huey et al., 2001, nocturnal species of lizards tend to present higher proportion of individuals with empty stomachs when compared to diurnal species. This high number of empty stomachs may be due to the fact that most captures happened in early hours of night, when the lizards were emerging and had no long enough foraging time to catch prey.

According to Cooper (1994), family Gekkonidae presents "sit-and-wait" foraging mode, which is in accordance to the diet found for this population of *Hemidactylus mabouia*; most specimens fed on fast-moving prey such as dipterans and spiders and few slow-moving prey (termites, collembolans and larvae).

Some studies revealed that morphological differences between sexes might result in differences on diet composition (FITCH, 1978; SCHOENER et al., 1982). However, for adult males and females of *H. mabouia* significant differences of diet were not found regarding the parameters analyzed (number of prey and volume), which might be, at least partially, explained by the absence of sexual dimorphism on snout-vent length, tail length, head length and head width (BONFIGLIO et al., 2005).

The data indicate that there is no tendency to increase on number of prey consumed along with the increase on lizard SVL. Prey categories with higher Importance Value Indexes in the diet of the species (Diptera, Hemiptera and Araneae) are represented by small prey in relation to the SVL of juveniles and adults.

The feeding niche overlap was numerically larger between adult males and females and volumetrically larger between juveniles and adult males. This larger volumetric similarity between juveniles and adult males was probably result of the consumption of a blattodean by a female, which represented 41% of the total volume of prey consumed by females.

The analysis of the Importance Value of each feeding item indicated that Diptera was the most important category in the diet of *H. mabouia.* Order Hemiptera had the second higher Importance Value Index for the species and the higher value for juveniles. Both groups belong to winged forms that were probably attracted by the artificial lights of the urban environment. Another important taxon was Order Araneae, also strongly related to human residences. Ramires and Fraguas (2004), studying *H. mabouia* in laboratory, demonstrated that the species could be used as a biological controller of *Loxosceles intermedia* (Mello-Leitão, 1934), a spider of medical importance due to the high number of accidents it causes (e.g. RIBEIRO et al., 1993).

We concluded that the diet of *Hemidactylus mabouia* in urban area in Porto Alegre City is composed of arthropods, mainly dipterans, hemipterans and spiders, with no difference in diet of adult males and females. The prey size tends to increase along with the lizard size, and the volume of prey consumed by adult lizards was significantly larger than that consumed by juveniles.

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TABLE 1. Number (N), volume (in mm³) (V), frequency (F) and importance value (IV) of prey in the diet of juveniles, adult males and adult females of *Hemidactylus mabouia* in urban area of Porto Alegre, Rio Grande do Sul. NIA = Non-identified Arthropods.

	Juveniles (n = 28)				Adult Males (n = 13)				Adult Females (n = 14)			
Item	N (%)	V (%)	F (%)	IV	N (%)	V (%)	F (%)	IV	N (%)	V (%)	F (%)	IV
Reptilia												
H. mabouia					2 (2,70)	567,64 (17,71)	2 (15,38)	0,37				
Crustacea												
Amphipoda	3 (2,14)	22,14 (1,20)	1 (7,69)	0,07	3 (4,05)	16,35 (0,51)	1 (7,69)	0,12				
Isopoda	3 (2,14)	28,98 (1,57)	2 (7,14)	0,11	3 (4,05)	236,21 (7,37)	3 (23,08)	0,35	3 (4,92)	24,66 (1,20)	2 (14,29)	0,21
Insecta												
Blattodea									1 (1,64)	848,36 (41,43)	1 (7,14)	0,53
Coleoptera									2 (3,28)	312,33 (15,25)	2 (14,29)	0,34
Collembola	8 (5,71)	3,43 (0,19)	5 (17,86)	0,24					5 (8,20)	3,84 (0,19)	1 (7,14)	0,16
Dermaptera	3 (2,14)	5,07 (0,28)	2 (7,14)	0,10	3 (4,05)	98,25 (3,06)	1 (7,69)	0,15	1 (1,64)	33,72 (1,65)	1 (7,14)	0,11
Diptera	35 (25,00)	84,67 (4,59)	10 (35,71)	0,65	47 (63,51)	440,26 (13,73)	2 (15,38)	0,93	26 (42,62)	223,87 (10,93)	5 (35,71)	0,90
Hemiptera	66 (47,14)	422,53 (22,92)	9 (32,14)	1,02	4 (5,41)	11,24 (0,35)	1 (7,69)	0,13	3 (4,92)	92,00 (4,49)	2 (14,29)	0,24
Hymenoptera	8 (5,71)	14,04 (0,76)	3 (10,71)	0,17	4 (5,41)	28,93 (0,90)	3 (23,08)	0,29	7 (11,48)	17,72 (0,87)	3 (21,43)	0,34
Isoptera	1 (0,71)	28,34 (1,54)	1 (3,57)	0,06	3 (4,05)	116,13 (3,62)	1 (7,69)	0,16	4 (6,56)	23,72 (1,16)	2 (14,29)	0,22
Lepidoptera									4 (6,56)	107,07 (5,23)	3 (21,43	0,34
Lepidoptera	1 (0 71)	1 07 (0 11)	1 (2 57)	0.04								
Larvae	1 (0,71)	1,97 (0,11)	1 (3,57)	0,04								
Neuroptera	1 (0,71)	1,25 (0,07)	1 (3,57)	0,04								
Orthoptera	1 (0,71)	310,0 (16,82)	1 (3,57)	0,21	2 (2,70)	1139,40 (35,54)	2 (15,38)	0,55				
Psocoptera	1 (0,71)	0,08 (<0,01)	1 (3,57)	0,04								
Arachnida												
Acari									1 (1,64)	7,55 (0,37)	1 (7,14)	0,09
Araneae	9 (6,43)	768.49 (41.69)	8 (28,57)	0,77	3 (4,05)	110,48 (3,45)	3 (23,08)	0,31	4 (6,56)	52,32 (2,55)	4 (28,57)	0,38
NIA		152,14 (8,25)				440,85 (13,75)				300,75 (14.68)		
Total	140	1843,16			74	3205,74			61	2047,91		