

DIET OF THE LIZARD *Mabuya agilis* (SAURIA; SCINCIDAE) IN AN INSULAR HABITAT (ILHA GRANDE, RJ, BRAZIL)

ROCHA, C. F. D.,¹ VRCIBRADIC, D.^{1,2} and VAN SLUYS, M.¹

¹Setor de Ecologia, DBAV, I. Biologia, Universidade do Estado do Rio de Janeiro,
R. São Francisco Xavier, 524, CEP 20550-013, Rio de Janeiro, RJ, Brazil

²Pós-Graduação em Ecologia, Departamento de Zoologia, IB, Universidade Estadual de Campinas,
C.P. 6109, CEP 13081-970, Campinas, SP, Brazil

Correspondence to: Carlos Frederico D. Rocha, Setor de Ecologia, DBAV, I. Biologia, Universidade do Estado do
Rio de Janeiro, R. São Francisco Xavier, 524, CEP 20550-013, Rio de Janeiro, RJ, Brazil, e-mail: cfdrocha@uerj.br

Received September 27, 2002 – Accepted February 7, 2003 – Distributed February 29, 2004

ABSTRACT

We examined the stomach contents of 21 specimens of *Mabuya agilis* (Sauria; Scincidae) collected during February 2001 at the restinga habitat of Praia do Sul, in Ilha Grande, RJ, Brazil. Diet was composed of various types of small arthropods, with no plant material being eaten. Spiders were the most important items in the diet, followed by orthopterans. Apart from the absence of isopterans, the diet of *Mabuya agilis* from this insular area was similar to those of other conspecific mainland populations. This suggests that factors such as insularity and the absence of other small sympatric lizards may not have a significant effect on the feeding habits of the Praia do Sul population.

Key words: *Mabuya agilis*, diet, restinga, insular habitat.

RESUMO

Dieta do lagarto *Mabuya agilis* (Sauria; Scincidae) em um habitat insular (Ilha Grande, RJ, Brasil)

Examinamos os conteúdos dos estômagos de 21 espécimes de *Mabuya agilis* (Sauria; Scincidae) coletados em fevereiro de 2001 no habitat de restinga de Praia do Sul, na Ilha Grande, RJ, Brasil. A dieta estava composta de vários tipos de artrópodes pequenos, sem consumo de material vegetal. Aranhas foram os itens mais importantes na dieta, seguidos por ortópteros. Exceto pela ausência de isópteros, a dieta de *Mabuya agilis* dessa área insular foi semelhante à de outras populações continentais coespecíficas. Isto sugere que fatores como a insularidade e a ausência de outros pequenos lagartos simpátricos podem não ter efeito significativo nos hábitos alimentares da população de Praia do Sul.

Palavras-chave: *Mabuya agilis*, dieta, restinga, habitat insular.

INTRODUCTION

The ecology of lizard species in the Atlantic Rainforest biome in eastern Brazil is still little studied, although the amount of information on the subject has increased considerably within the last ten years (Sazima & Haddad, 1992; Rocha, 1994, 2000, and included references). Most information has come from studies carried out in mainland coastal habitats of Rio de Janeiro, Espírito Santo, and São Paulo States

in southeastern Brazil (Vanzolini & Rebouças-Spieker, 1976; Rocha, 1994, 2000), but the ecology of lizard populations living in insular habitats is mostly unknown, but for a few studies (e.g., Vanzolini & Rebouças-Spieker, 1976; Rocha *et al.*, 2002). This lack of knowledge impedes understanding of how ecological differences may arise as a result of the insular environment. The community equilibria of islands are relatively fragile and their conservation depends on considerable knowledge, not only on

species composition, but especially on the range of the many ecological aspects under which they operate (Rocha *et al.*, 2002).

The lizard *Mabuya agilis* (Scincidae) is widespread along the coastal plains of southeastern, and part of northeastern Brazil (Rocha, 2000; Rocha *et al.*, 2002). Information regarding its ecology, including diet, has recently been published for mainland populations inhabiting restinga habitats (Rocha & Vrcibradic, 1996, 1999; Vrcibradic & Rocha, 1995a, 1996, 2002). The only available data on ecological aspects of an insular population of *M. agilis* come from the recent study of Rocha *et al.* (2002) in the Abrolhos Archipelago, about 70 km off the coast of southern Bahia State, northeastern Brazil. At the restinga habitat of Praia do Sul in the island of Ilha Grande, Rio de Janeiro State, *M. agilis* is apparently the only small diurnal lizard species present, whereas in all other areas where the ecology of that species has been studied it shares its habitat with other similar-sized diurnal lizards, which may be potential competitors.

In this study we analyze the feeding ecology of an insular population of *Mabuya agilis* from Ilha Grande, Angra dos Reis municipality, Rio de Janeiro State, and compare with other populations of this species for which data on diet are available.

MATERIAL AND METHODS

The study was carried out during February 2001 at the restinga habitat of Praia do Sul (23°10'S, 44°18'W), on Ilha Grande, an island located in the south of Rio de Janeiro State, southeastern Brazil. Restinga habitats occur along most of the southern portion of the island (Araújo & Oliveira, 1988). Praia do Sul is currently a biological reserve. Annual rainfall in the area is about 2,300 mm and mean annual temperature is about 23°C (Pereira & Araújo, 2000). The study area is located at sea level.

Lizards were collected using rubber bands and Victor® mouse glue-traps. After collection, we recorded each lizard's body mass (to the nearest 0.1 g) using a Pesola® spring balance, and fixed the animals with 10% formalin solution and later storing them in 70% alcohol. In the laboratory, the snout-vent length (SVL) of each individual was measured

with a digital caliper (to the nearest 0.1 mm) and all lizards were dissected for stomach content analysis. After excision, lizard stomachs were opened and their contents were spread on a Petri dish and examined under a stereomicroscope. Arthropod prey were identified to the taxonomic level of Order. For each food item found we measured its length and width with a digital caliper (to the nearest 0.1 mm) and estimated its volume using the formula for a prolate spheroid: $V = 4/3\pi(\text{length}/2)(\text{width}/2)^2$ (Vitt, 1991). Mean prey size was calculated as the average length of the five largest identifiable prey items (or of all prey items, for individuals containing less than five items in the stomach). For each prey category, we also calculated an index of importance (I_k) (Powell *et al.*, 1990) which represents the sum of the proportions of the number, volume, and frequency of occurrence of each prey in the diet divided by three. We also recorded the proportion of individuals of *M. agilis* with empty stomachs. We tested for size (SVL) differences between male and female *M. agilis* using one-way analysis of variance (ANOVA) (Zar, 1999). Sexual differences in head length (taken as the distance from the snout to the posterior border of the ear opening) was tested using analysis of covariance (ANCOVA), with lizard SVL as the covariate (Zar, 1999). Differences in mean prey length between males and females were tested by one-way ANOVA. The relationship between mean prey length and lizard SVL was analyzed using simple regression analysis. Descriptive statistics are presented throughout the text as arithmetic mean \pm one standard deviation.

RESULTS

Females averaged 61.6 ± 12.9 mm in SVL (range 51.4 – 77.6 mm; N = 5) and males averaged 64.0 ± 9.1 mm in SVL (range 42.1 – 72.7 mm; N = 16). The two groups did not differ significantly in SVL (ANOVA; $F_{1,19} = 0.21$; $p = 0.65$), but males had proportionally larger heads (ANCOVA; $F_{1,19} = 38.68$; $p < 0.001$). Of the 21 lizards examined for diet analyses, three (14.3%) had empty stomachs. The proportion of animals with empty stomachs did not differ significantly between males (2/16; 12.5%) and females (1/5; 20%) (Z-test, $Z = 0.418$; $p = 0.34$).

Mabuya agilis at Praia do Sul consumed basically arthropods, with no ingestion of plant material (Table 1). In terms of proportional volume, the most important items in the diet of *M. agilis* at Praia do Sul were spiders, orthopterans, and blattarians (Table 1). Spiders were also the most numerous and the most frequent prey item (Table 1). Spiders and orthopterans were overall the most important prey items consumed ($I_x = 0.416$ and 0.220 , respectively; Table 1). The number of identifiable food items per stomach averaged 3.9 ± 1.9 (range 1-7; $N = 15$). Mean prey length averaged 6.7 ± 2.5 mm (range 2.4 – 12.2 mm; $N = 14$) and did not differ significantly between sexes (t-test; $t = 0.16$; $p = 0.87$; $DF = 12$). The relationship between mean prey length and lizard head size ($r = 0.52$; $F = 4.35$; $p = 0.059$; $N = 14$) and lizard SVL ($r = 0.47$; $F = 3.39$; $p = 0.09$; $N = 14$) were near significance.

DISCUSSION

The diet of *Mabuya agilis* at Praia do Sul was characterized by the consumption of a relatively wide

spectrum of food item categories (11 prey types) which characterizes the diet of an opportunistic predator. Also, the diet of the insular population did not contain plant material, an item not common and of low importance in the lizards of the genus *Mabuya* (Vrcibradic, 2001). Lizards of the genus *Mabuya* are, in general, non-specialized predators of arthropods (e.g., Huey & Pianka, 1977; Vitt & Blackburn, 1991; Castanzo & Bauer, 1993, 1998; Vitt, 1995; Vrcibradic & Rocha, 1995a, b, 1996, 1998; Vitt *et al.*, 1997). The consumption of a wide array of prey types, including both relatively sedentary (e.g., larvae) and highly mobile preys (e.g., spiders, orthopterans), has also been found for some mainland populations of *M. agilis* in restingas of Rio de Janeiro and Espírito Santo States (Vrcibradic & Rocha, 1995a, 1996) and also for the insular population of Abrolhos Archipelago (Rocha *et al.*, 2002). This relatively wide consumption of prey types has been argued to reflect the mixed (active-ambush) foraging strategy of this species (Vrcibradic & Rocha, 1995a, 1996; Rocha *et al.*, 2002).

TABLE 1

Volume (in mm³), number, frequency of occurrence and Index of Importance (I_x) for each prey category for *Mabuya agilis* ($N = 21$) in Praia do Sul, Ilha Grande, RJ. Volumetric values given to the right of the transverse bar represent the values recalculated after excluding the “miscellany” category; those values were the ones used to calculate I_x .

Items	Volume (%)	Number (%)	Frequency (%)	I_x
Insecta				
Dictyoptera	251.9 (14.9/17.2)	7 (12.3)	6 (28.6)	0.194
Coleoptera	3.9 (0.2/0.3)	2 (3.5)	2 (9.5)	0.044
Homoptera	21.1 (1.2/1.4)	3 (5.3)	3 (14.3)	0.070
Hymenoptera				
Formicidae	63.0 (3.7/4.3)	7 (12.3)	5 (23.8)	0.135
Others	1.0 (0.1/0.1)	2 (3.5)	2 (10.5)	0.047
Orthoptera	467.1 (27.6/31.8)	6 (10.5)	5 (23.8)	0.220
Lepidopteran larvae	12.7 (0.8/0.9)	2 (3.5)	2 (9.5)	0.073
Arachnida				
Araneae	595.4 (35.2/40.5)	21 (36.8)	10 (47.6)	0.416
Pseudoscorpionida	1.9 (0.1/0.1)	1 (1.8)	1 (4.8)	0.022
Crustacea				
Isopoda	30.7 (1.8/2.1)	5 (8.8)	3 (14.3)	0.084
Gastropoda	20.5 (1.2/1.4)	1 (1.8)	1 (4.8)	0.027
Miscellaneous	223.3 (13.2)	–	–	–
Total	1,692.6/1,469.3	57		

The consumption of spiders by *M. agilis* at Praia do Sul was remarkable (it was the most important prey category by number, volume, and frequency). But because we have no data on relative prey availability in the area, we do not know to what extent this high consumption of spiders reflects selectivity of this prey type in the insular habitat of Ilha Grande. Orthopterans and cockroaches were also important prey consumed by *M. agilis* at Ilha Grande (high I_x values).

Those three prey types are usually among the most important items in the diets of *M. agilis* in other areas (Vrcibradic & Rocha, 1995a, 1996; Vrcibradic, 2001; Rocha *et al.*, 2002) and in the diets of other Brazilian *Mabuya* species (Vitt & Blackburn, 1991; Vitt, 1995; Vrcibradic & Rocha, 1995b, 1996; Vitt *et al.*, 1997; Pinto, 1999). Thus, it seems that the insular habitat and the absence of potential competitors (i.e., other similar-sized diurnal lizards) do not have a strong influence on the general food habits of *M. agilis* at Praia do Sul.

An interesting result was the absence of isopterans in the diet of *M. agilis* at Praia do Sul, although they are a frequent prey of *M. agilis* in some mainland restinga areas (Vrcibradic & Rocha, 1995a, 1996; Vrcibradic, 2001). However, the *M. agilis* population from Abrolhos Archipelago does not seem to consume isopterans either (Rocha *et al.*, 2002). Because *Mabuya* spp. usually have a varied diet (e.g., Castanzo & Bauer, 1998; Vrcibradic, 2001), the absence of isopterans in the diets of some populations may simply reflect low availability of such insects in those areas. Alternatively, since the lizard sample was collected over a relatively short period of time (January to February) and isopterans can be a seasonally available prey in some areas, any interpretation must be done with caution, especially because the evaluation of the availability of isopterans to other lizard species is limited by the absence of local sympatric lizards.

Our data suggest that prey size is affected by lizard body and head size at Praia do Sul. In both cases the relationships were near significance, suggesting a biological trend. Because sample size was relatively small, simply considering that lizard size does not affect prey size would imply a significant risk of incurring in a type II error.

We conclude that *M. agilis* from Praia do Sul has a varied diet characterized by a relatively wide variety of arthropods and by a lack of plant material and isopterans, the latter being a usual component

of the diet in other *M. agilis* populations. Apart from this fact, the diet did not differ significantly from those of other conspecific populations, suggesting that the effects of insularity and of the absence of other small sympatric lizards may have a negligible effect on the feeding habits of the Praia do Sul population.

Acknowledgments — This study was made as part of the Biota/Fapesp Project Instituto Virtual da Biodiversidade (www.biotas.org.br) (process n. 99/08291-5) and is a portion of the results of the “Programa de Ecologia, Conservação e Manejo de Ecossistemas do Sudeste Brasileiro” and of the Southeastern Brazilian Vertebrate Ecology Project (Vertebrate Ecology Laboratory), both of the Setor de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro. We thank the coordination of the CEADS/SR-2/UERJ for institutional support and for many facilities throughout the study. We are also grateful to H. G. Bergallo and D. M. Peccinini-Seale for kindly revising the manuscript and offering helpful suggestions. During the development of this study C. F. D. Rocha (Process n. 300819/94-3 and 477981/2003-8), D. Vrcibradic (n. 143607/98-7), and M. Van Sluys (n. 301 117/95-0) received grants from the Conselho Nacional do Desenvolvimento Científico e Tecnológico (CNPq).

REFERENCES

- ARAÚJO, D. S. D. & OLIVEIRA, R. R., 1988, Reserva Biológica da Praia do Sul (Ilha Grande, Estado do Rio de Janeiro): lista preliminar da Flora. *Acta Bot. Bras.*, 1(supl.): 83-94.
- CASTANZO, R. A. & BAUER, A. M., 1993, Diet and activity of *Mabuya acutilabris* (Reptilia: Scincidae) in Namibia. *Herpetol. J.*, 3: 130-135.
- CASTANZO, R. A. & BAUER, A. M., 1998, Comparative aspects of the ecology of *Mabuya acutilabris* (Squamata: Scincidae), a lacertid-like skink from arid south-western Africa. *J. Afr. Zool.*, 112: 109-122.
- HUEY, R. B. & PIANKA, E. R., 1977, Patterns of niche overlap among broadly sympatric versus narrowly sympatric Kalahari lizards (Scincidae: Mabuya). *Ecology*, 58: 119-128.
- PEREIRA, O. J. & ARAÚJO, D. S. D., 2000, Análise florística das restingas dos estados do Espírito Santo e Rio de Janeiro. In: F. A. Esteves & L. D. Lacerda (eds.), *Ecologia de restingas e lagoas costeiras*. Macaé, NUPEM/UF RJ, pp. 25-63.
- PINTO, M. G. M., 1999, *Ecologia das espécies de lagarto simpátricas Mabuya nigropunctata e Mabuya frenata (Scincidae) no cerrado de Brasília e Serra da Mesa (GO)*. Dissertação de Mestrado, Universidade de Brasília, Brasília, DF, 104p.
- POWELL, R., PARMERLEE, J. S., RICE, M. A. & SMITH, D. D., 1990, Ecological observations on *Hemidactylus brooki haitianus* Meerwarth (Sauria: Gekkonidae) from Hispaniola. *Carib. J. Sci.*, 26: 67-70.
- ROCHA, C. F. D., 1994, Introdução à ecologia de lagartos brasileiros. In: A. T. Bernardes, L. B. Nascimento & G. A. Cotta (eds.), *Herpetologia do Brasil – I*. Belo Horizonte, PUC-MG, pp. 39-57.

- ROCHA, C. F. D., 2000, Biogeografia de Répteis de Restingas: distribuição, ocorrência e endemismos. In: F. A. Esteves & L. D. Lacerda (eds.), *Ecologia de restingas e lagoas costeiras*. Macaé, NUPEM/UFRJ, pp. 99-116.
- ROCHA, C. F. D. & VRCIBRADIC, D., 1996, Thermal ecology of two sympatric skinks (*Mabuya agilis* and *Mabuya macrorhyncha*) in Brazilian restinga habitat. *Austr. J. Ecol.*, 21: 110-113.
- ROCHA, C. F. D. & VRCIBRADIC, D., 1999, Reproductive traits of two sympatric viviparous skinks (*Mabuya macrorhyncha* and *Mabuya agilis*) in a Brazilian restinga habitat. *Herpetol. J.*, 9: 43-53.
- ROCHA, C. F. D., DUTRA, G. F., VRCIBRADIC, D. & MENEZES, V. A., 2002, The terrestrial reptile fauna of the Abrolhos Archipelago: species list and ecological aspects. *Braz. J. Biol.*, 62: 285-291.
- SAZIMA, I. & HADDAD, C. F. B., 1992, Répteis da Serra do Japi: notas sobre história natural. In: L. P. Morelato (ed.), *História Natural da Serra do Japi: ecologia e preservação de uma área florestal do Sudeste do Brasil*. Campinas, Editora da UNICAMP/FAPESP, pp. 212-236.
- VANZOLINI, P. E. & REBOUÇAS-SPIEKER, R., 1976, Distribution and differentiation of animals along the coast and in continental islands of the State of São Paulo, Brazil. 3. Reproductive differences between *Mabuya caissara* and *Mabuya macrorhyncha* (Sauria, Scincidae). *Pap. Avul. Zool. (São Paulo)*, 29: 95-109.
- VITT, L. J., 1991, An introduction of ecology of Cerrado Lizards. *J. Herpetol.*, 25: 79-90.
- VITT, L. J., 1995, The ecology of tropical lizards in the Caatinga of northeastern Brazil. *Occ. Pap. Okla. Mus. Nat. Hist.*, 1: 1-29.
- VITT, L. J. & BLACKBURN, D. G., 1991, Ecology and Life History of the viviparous lizard *Mabuya bistrriata* (Scincidae) in the Brazilian Amazon. *Copeia*, 1991: 918-927.
- VITT, L. J., ZANI, P. A. & MARINHO-FILHO, A. C., 1997, Heliotherms in tropical rain forest: the ecology of *Kentropix calcarata* (Teiidae) and *Mabuya nigropunctata* (Scincidae) in the Curuá-Una of Brazil. *J. Trop. Ecol.*, 13: 199-220.
- VRCIBRADIC, D., 2001, *Ecologia de cinco espécies de Mabuya (Lacertilia: Scincidae) no Sudeste do Brasil: padrões reprodutivos, térmicos, tróficos e comunidades de nematódeos parasitas associados*. Tese de Doutorado, Universidade Estadual de Campinas, Campinas, SP, 197p.
- VRCIBRADIC, D. & ROCHA, C. F. D., 1995a, Ecological observations of the scincid lizard *Mabuya agilis* in a Brazilian Restinga Habitat. *Herpetol. Rev.*, 26: 129-131.
- VRCIBRADIC, D. & ROCHA, C. F. D., 1995b, Variação sazonal na dieta de *Mabuya macrorhyncha* (Sauria: Scincidae) na Restinga da Barra de Maricá, RJ. *Oecol. Bras.*, 1: 143-153.
- VRCIBRADIC, D. & ROCHA, C. F. D., 1996, Ecological differences tropical sympatric skinks (*Mabuya agilis* and *Mabuya macrorhyncha*) in Southeastern Brazil. *J. Herpetol.*, 30: 60-67.
- VRCIBRADIC, D. & ROCHA, C. F. D., 1998, Ecology of the skink *Mabuya frenata* in an area of rock outcrops in southeastern Brazil. *J. Herpetol.*, 32: 229-237.
- VRCIBRADIC, D. & ROCHA, C. F. D., 2002, Use of cacti as heat sources by thermoregulating *Mabuya agilis* (Raddi) and *Mabuya macrorhyncha* Hoge (Lacertilia, Scincidae) in southeastern Brazil. *Revta. Bras. Zool.*, 19: 77-83.
- ZAR, J. H., 1999, *Biostatistical analysis*. 4. ed. Upper Saddle River, Prentice-Hall, 663p.