

## SHORT COMMUNICATION

# Body size, female reproduction and sexual dimorphism in the lizard *Ameiva ameiva* (Teiidae) in a restinga of southeastern Brazil

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**ABSTRACT.** In this study 57 specimens of the lizard *Ameiva ameiva* (Linnaeus, 1758) collected in the restinga at Barra de Maricá, in the state of Rio de Janeiro, southeastern Brazil, were analyzed to investigate size relations and reproduction (in females) and sexual dimorphism of this population. We answered the following questions: 1) what is the minimum reproductive body size in females? 2) what is the average clutch size and 3) how is clutch size related to body size? 4) Are body and head sizes sexually dimorphic? Mean clutch size was  $6.7 \pm 2.1$  eggs and was positively correlated with female body size. Sexual dimorphism favoring males was found: adult mean snout-vent length was great in males ( $124.2 \pm 17.8$  mm) than females ( $96.5 \pm 23.1$  mm SVL), and males were larger with respect to head width and length, and body mass. Thus, despite the marked seasonality at Barra de Maricá, *A. ameiva* has an extended reproductive period. Also, intrasexual selection may have acted on females to produce larger clutches, and on males, favoring larger males.

**KEY WORDS.** Body size-fecundity; clutch size; minimum size at maturity; reproduction.

**RESUMO.** Tamanho corpóreo, reprodução em fêmeas e dimorfismo sexual no lagarto *Ameiva ameiva* (Teiidae) em uma restinga do sudeste do Brasil. Neste estudo foram analisados 57 espécimes do lagarto teiideo *Ameiva ameiva* (Linnaeus, 1758) (22 fêmeas e 35 machos) coletados na restinga de Barra de Maricá, no estado do Rio de Janeiro, sudeste do Brasil, para investigar alguns aspectos reprodutivos das fêmeas e o dimorfismo sexual nessa população. O estudo visou responder às seguintes questões: 1) Qual o comprimento corpóreo mínimo das fêmeas na maturidade nesta população? 2) Qual o tamanho médio (número de ovos produzidos) da ninhada? 3) Há relação entre o tamanho corpóreo das fêmeas e o tamanho da ninhada (número de ovos)? 4) Há dimorfismo sexual no tamanho do corpo e da cabeça? O comprimento rostro-cloacal (CRC) médio dos machos adultos de *A. ameiva* ( $124,2 \pm 17,8$  mm) foi significativamente maior que o das fêmeas adultas ( $96,5 \pm 23,1$  mm de CRC). A massa corpórea dos machos ( $71,3 \pm 27,3$  g) foi significativamente superior àquela das fêmeas ( $26,7 \pm 20,9$  g). Analisamos a relação entre o tamanho corpóreo das fêmeas sobre o tamanho da ninhada produzida. O tamanho médio da ninhada das fêmeas de *A. ameiva* foi de  $6,7 \pm 2,1$  ovos, estando positiva e significativamente relacionado com o CRC da fêmea. Os dados sugerem que, a despeito da sazonalidade do ambiente na restinga Barra de Maricá, *A. ameiva* parece possuir uma atividade reprodutiva extensa e que a seleção intra-sexual parece ter atuado nas fêmeas para produzir maiores ninhadas e, nos machos, resultando em um maior tamanho do corpo e da cabeça, devido às vantagens associadas aos machos de maiores tamanhos terem acesso favorecido a fêmeas em encontros agonísticos entre machos.

**PALAVRAS-CHAVE.** Atividade reprodutiva; relação tamanho corpóreo e fecundidade, reprodução, tamanho mínimo na maturidade, tamanho da ninhada.

*Ameiva ameiva* (Linnaeus, 1758) in Teiidae, is one of the most widespread lizard species in South America, usually in open habitats (VANZOLINI 1986, VITT & COLLI 1994). The species is fairly well studied, with most reports on diet (MAGNUSSON *et al.* 1985, VITT 1991, VITT & COLLI 1994, VITT & CARVALHO 1995, ROCHA 2000, VITT *et al.* 2000, ZALUAR & ROCHA 2000, SILVA *et al.*

2003), thermal ecology (MAGNUSSON 1987, VITT & COLLI 1994, CRUZ-NETO & GORDO 1996, VITT *et al.* 2000, ZALUAR & ROCHA 2000) and fewer on reproduction (SIMMONS 1975, VITT 1982, MAGNUSSON 1987, COLLI 1991, VITT & COLLI 1994). The few studies of reproduction in Brazil were from the caatinga, cerrado, and Amazonian forests and savannas (VITT 1982, MAGNUSSON 1987, COLLI

1991, VITT & COLLI 1994). *A. ameiva* is also common in restinga, comprising a relatively large area of the coastal Atlantic Forest (ARAÚJO 1992, ROCHA 2000), but is relatively unstudied there. In a study of diet in Gururi in the state of Espírito Santo, brief mention of clutch size is included (SILVA *et al.* 2003).

*Ameiva ameiva* is one of eight lizard species found at the restinga of Barra de Maricá, in the state of Rio de Janeiro (ARAÚJO 1984). Here, as part of a larger project of sand dune reptiles of the Department of Ecology of the Universidade do Estado do Rio de Janeiro over a five-year period (1988-1992), we collected and analysed samples of *A. ameiva* to answer the following questions: 1) what is the minimum reproductive body size in females? 2) what is the average clutch size and 3) how is clutch size related to body size? 4) Are body and head sizes sexually dimorphic?

The restinga of Barra de Maricá (22°57'S, 42°50'W), in the municipality of Maricá, is approximately 38 km east of the city Rio de Janeiro, in southeastern Brazil. Restinga is the coastal sand plains with herbaceous and shrubby vegetation along the Atlantic coast of Brazil (SUGUIO & TESSLER 1984). The climate of this restinga is markedly seasonal with a warm, wet summer and a cooler, dry winter (NIMER 1972, FRANCO *et al.* 1984). Mean annual temperature varies between 22-24°C and annual rainfall varies from 350-1350 mm (NIMER 1972). The dry season is May-September and the wet is October-April (FRANCO *et al.* 1984, ROCHA 1992). Here, the restinga comprises five major habitat types: beach, primary and secondary dunes, dune slack, and swamp (SILVA & SOMMER 1984). Lizards used here came from the primary sand dunes which also have clusters of shrubs scattered throughout.

Female reproduction (clutch size with respect to body size) and sexual dimorphism (three morphological measurements) were examined in 57 adults (22 females, 35 males) collected September 1988 – March 1992. Snout-vent length (SVL), head width and length was measured with a caliper (to the nearest 0.1 mm). Weight was measured with an electronic scale (to the nearest 0.1 g). Females were dissected to count the number of follicles in each ovary, the size and color (white or yellow) of the largest follicle (yellow follicles were considered as vitellogenic), number and size of corpora lutea, number of eggs in the oviduct, and weight of abdominal fat bodies. Clutch size was estimated as the number of vitellogenic follicles, eggs in the oviduct and corpora lutea (ROCHA 1992). The relationship between female SVL and clutch size was calculated by a simple regression analysis (ZAR 1999). The occurrence of multiple clutches per season was estimated by the simultaneous occurrence of vitellogenic ovarian follicles and eggs in the oviduct or corpora lutea. The months in which gravid females were found were examined to determine reproductive seasonality. Sexual dimorphism in body length (SVL) was tested using Student's *t*-test and in the shape (head width and head length) was tested by ANCOVA, using SVL as covariate.

Eleven of 22 females were reproductive and the minimum SVL at maturity for females was 89.3mm. Mean clutch size was  $6.7 \pm 2.1$  eggs (range 6-10) and increased with body

size ( $F = 5.768$ ;  $r^2 = 0.391$ ;  $N = 11$ ;  $p < 0.001$ ). Female SVL explained approximately 40% of the variation in clutch size, a trend similar to that found elsewhere (*e.g.* VITT & COLLI 1994). Clutch size of *A. ameiva* at Barra de Maricá was similar to that found in the caatinga of northeastern Brazil ( $5.5 \pm 0.2$ ) and in cerrado in central Brazil ( $6.3 \pm 0.2$ , VITT & COLLI 1994), but greater than that found in the Amazon (*e.g.* Rio Xingu =  $4.4 \pm 0.4$ , Rondônia =  $3.2 \pm 0.1$ , Roraima =  $3.9 \pm 0.2$ , VITT & COLLI 1994). This suggests that lizards of this species from more xeric habitats tend to produce larger clutches.

Reproductive females were found in both the wet (October, September, December, and January) and dry seasons (June, July, and September). Although Barra de Maricá has a marked seasonality in rainfall (NIMER 1972, ROCHA 1992) these data suggest that reproduction may not be seasonal (a trait common to most tropical lizard species living in seasonal environments), but rather reproduce year round. Year round reproduction has been found for different populations of *A. ameiva* and for other *Ameiva* sp. in different environments in South America (VITT 1982, VITT & COLLI 1994). Reproductive activity should be extended for all populations of *A. ameiva* in Brazil, but the duration of the reproductive period remains unknown for most populations (VITT & COLLI 1994). Further study should examine how food abundance interacts with reproduction for this species.

Mean SVL of adult males ( $124.2 \pm 17.8$  mm; range 93.2-147.4 mm) was larger than that of adult females ( $96.5 \pm 23.1$  mm SVL; range 53.4-131.7 mm) ( $t = 4.829$ ,  $p < 0.001$ ,  $N = 51$ ). Males were also larger than females in head width and length (ANCOVA,  $F_{\text{width}} = 14.87$ ,  $p < 0.001$ ;  $F_{\text{length}} = 12.38$ ,  $p < 0.001$ ), and weight (males  $-71.3 \pm 27.3$  g, females  $26.7 \pm 20.9$  g;  $t = 6.014$ ,  $p < 0.001$ ). Body weight is correlated with SVL ( $F = 170.32$ ,  $r^2 = 0.802$ ,  $p < 0.001$ ). Differences in size and shape between sexes may result from different evolutionary forces on each sex. In the case of *A. ameiva*, as in other teiids, the evolution of larger body and head size in males may result from the competitive advantage that larger males gain as access to more females, thereby increasing reproductive success (ANDERSON & VITT 1990). Sexual dimorphism is found in other populations of *A. ameiva* (ANDERSON & VITT 1990, COLLI 1991, VITT & COLLI 1994), which suggests that this characteristic is conservative along the continuum of habitats of the species range, and is probably an ancestral trait of the Teiidae (ANDERSON & VITT 1990).

We conclude that *A. ameiva* has an extended reproductive period despite the marked seasonality in the restinga habitat at Barra de Maricá. Also, that intrasexual selection may have acted 1) in females, with larger females producing larger clutches, 2) in males in which larger size provides greater fitness.

## ACKNOWLEDGEMENTS

This study was carried out within the Programa de Ecologia, Conservação e Manejo de Ecossistemas do Sudeste Brasileiro of the Departamento de Ecologia, Instituto de Biologia, Universidade do Estado do Rio de Janeiro. We are grateful to

A.M. Marques for help in the laboratory and to D. Vrcibradic for kindly his revision with helpful comments of this manuscript. C.F.D. Rocha (Processes 307653/03-0 and 477715/06-0) received research grants from the CNPq and from FAPERJ (Process E-26/100.471/2007, Programa Cientistas do Nosso Estado).

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Submitted: 17.XI.2007; Accepted: 27.V.2008.

Editorial responsibility: Lena Geise