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Female reproduction in the lizard *Ameiva ameiva* (Squamata: Teiidae) in a Caatinga site of northeastern Brazil

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ABSTRACT

Ameiva ameiva is a lizard species widely distributed in Central and South America. In this study, we present data on clutch size and duration of reproductive cycle in a population of *A. ameiva* from a Caatinga site in northeastern Brazil, looking to answer the following questions: 1) What is the average clutch size in this population? 2) Is clutch size associated with body size of females? 3) Is reproduction continuous or seasonal? The fieldwork to collect the lizards consisted of monthly trips from October 2008 to September 2010. Additionally, from June 2009 to May 2010, we registered the abundance of hatchlings and adults in the population by counting active lizards in the field. We collected 15 adult females, ten of which were in reproductive condition. Average clutch size was 5.3 ± 0.7 (range: 2–8, *N* = 10), and was significantly associated with body size of females. Reproductive females were registered both in the rainy and dry seasons, suggesting a prolonged reproductive period throughout the year. However, the decline in adult abundance during the peak of dry season and the absence of hatchlings in the population during four consecutive months are indications that females did not reproduce continuously during 2009-2010.

Keywords: Clutch size; Life story; Reproductive cycle; Seasonality.

Reprodução das fêmeas do lagarto *Ameiva ameiva* (Squamata: Teiidae) em área de Caatinga do nordeste do Brasil

RESUMO

Ameiva ameiva é uma espécie de lagarto amplamente distribuída nas Américas Central e do Sul. Neste estudo, nós apresentamos dados sobre tamanho da ninhada e duração do ciclo reprodutivo numa população de *A. ameiva* de uma área de Caatinga do nordeste do Brasil, buscando responder as seguintes perguntas: 1) Qual é o tamanho médio da ninhada nesta população? 2) O tamanho da ninhada é associado com o tamanho corporal das fêmeas? 3) A reprodução é contínua ou sazonal? O trabalho de campo para coleta dos lagartos consistiu de excursões mensais de outubro de 2008 a setembro de 2010. Adicionalmente, de junho de 2009 a maio de 2010, nós registramos a abundância de recém-nascidos e de adultos na população através da contagem de lagartos ativos em campo. Nós coletamos 15 fêmeas adultas, dez das quais estavam em condição reprodutiva. O tamanho médio da ninhada foi 5,3 ± 0,7 (range: 2–8, *N* = 10), e foi significativamente associado com o tamanho corporal das fêmeas. Fêmeas reprodutivas foram registradas nas estações chuvosa e seca, sugerindo um período reprodutivo prolongado ao longo do ano. Entretanto, o declínio na abundância de adultos durante o pico da estação seca e a ausência de recém-nascidos na população durante quatro meses consecutivos são indicativos de que as fêmeas não se reproduziram continuamente durante 2009-2010.

Palavras-chave: Ciclo reprodutivo, História de vida, Sazonalidade, Tamanho da ninhada.

Introduction

Ameiva ameiva (Linnaeus, 1758) (Figure 1) is a mid-sized (snout-vent length up to 190 mm), active foraging lizard, widely distributed in Central and South America (PIANKA; VITT, 2003). Because of its broad geographical distribution, *A. ameiva* is ideal for interpopulacional studies on life story (COLLI, 1991). Data on reproduction exists for some *A. ameiva* populations from Amazonian rainforest (SIMMONS, 1975; VITT; COLLI, 1994), Amazonian savannas (MAGNUSSON, 1987; VITT; COLLI, 1994), Cerrado (COLLI, 1991), Caatinga (VITT, 1982) and restingas in Atlantic forest domain (ROCHA, 2008). Predictability in rainfall was proposed as the main factor dictating the length of reproductive cycle and clutch characteristics in this species (COLLI, 1991; VITT; COLLI, 1994). According to these authors, reproduction in *A. ameiva* is seasonal in environments that exhibit distinct and predictable seasonality (Cerrado and Amazonian savannas), and continuous in environments where rainfall is abundant all year (Amazonian rainforest) or seasonal but highly unpredictable (Caatinga).

Figure 1. (A) An adult male and (B) an adult female of *Ameiva ameiva* in the Seridó Ecological Station (ESEC Seridó), Rio Grande do Norte state, Brazil.

Herein, we present data on clutch size and duration of reproductive cycle in a population of *Ameiva ameiva* from a Caatinga site in Brazil, the Seridó Ecological Station (ESEC Seridó). Some life-story aspects of this *A. ameiva* population, such as sexual dimorphism, feeding ecology, thermal ecology and habitat use, are published elsewhere (SALES et al., 2011a; 2011b). In this study, we investigate female reproduction, looking to answer the following questions: 1) What is the average clutch size in this population? 2) Is clutch size associated with body size of females? 3) Is reproduction continuous or seasonal? We predicted that clutch size would be positively associated with female size, as in other

teiid species (e.g. VITT; COLLI, 1994; MESQUITA; COLLI, 2003; ZALDÍVAR-RAE et al., 2008), and that females would reproduce year-round as in another Caatinga site (VITT, 1982), thus corroborating the hypothesis of rainfall predictability (COLLI, 1991; VITT; COLLI, 1994).

Material and Methods

The ESEC Seridó (06°34'36.2"S, 37°15'20.7"W, datum: WGS84, altitude: 192 m) encompasses a Protected Area in the Caatinga with 1,166.38 hectares, located in the municipality of Serra Negra do Norte, Rio Grande do Norte state, northeastern Brazil. The Caatinga domain covers approximately 800,000 km^2 and experiences a semiarid climate, hot and dry, with unpredictability in timing and intensity of rainfall among years (AB'SABER, 1974; NIMER, 1982). The vegetation in ESEC Seridó is arboreal-bushy hyperxerophilous (VARELLA-FEIRE, 2002). The rainy season usually starts in January, and predominates between March and May; rainfall ranges between 500 and 800 mm/year (VARELLA-FEIRE, 2002).

The fieldwork consisted of monthly trips for three consecutive days, from October 2008 to September 2010. We collected lizards with 4.5 caliber air rifles (Urko®). In the lab, we autopsied them prior to fixation. In all captured adult females (snout-vent length > 100 mm, N = 15), we counted the number of follicles in each ovary, number of corpora lutea, and number of eggs in the oviducts. We documented size and color (white or yellow) of follicles, and considered yellow follicles with 3 mm or more in diameter as vitellogenic (VITT, 1982). We estimated clutch size as the number of vitellogenic follicles, eggs in the oviducts and corpora lutea (ROCHA, 1992). We considered the largest clutch size in females carrying vittellogenic follicles and eggs/corpora lutea simultaneously. The relationship between female body size (snout-vent length – SVL) and clutch size was calculated by a simple regression analysis (ZAR, 1999). From June 2009 to May 2010 (one-year period), we registered the abundance of hatchlings (SVL < 50 mm) and adults (SVL > 100 mm) in the population by counting active lizards in the field. All collected lizards were deposited in the Herpetological Collection of the Universidade Federal do Rio Grande do Norte (UFRN).

Results and Discussion

We collected a total of 15 adult females throughout the entire study, ten of which were in reproductive condition. Average clutch size was 5.3 ± 0.7 (range: 2–8, *N* = 10), and was significantly associated with body size of females (R^2 = 0.588, $F_{1,8}$ = 11.456, *P* = 0.009; Figure 2). Clutch size was similar to that found in another Caatinga site (5.7 ± 0.2 based on oviductal eggs and 5.6 ± 0.1 based on vitellogenic follicles, range 1–9; VITT, 1982), and slightly smaller than those found in the Cerrado of central Brazil (6.4 ± 0.2, range 3–11; COLLI, 1991) and in a restinga of southeastern Brazil (6.7 ± 2.1, range 6–10; ROCHA, 2008). Additionally, the clutch size of *A. ameiva* from ESEC Seridó was larger than that found in populations from the Amazon rainforest (e.g. Rio Xingu: 4.4 ± 0.4, Rondônia: 3.2 ± 0.1, Roraima: 3.9 ± 0.2; VITT; COLLI, 1994). These data suggest that lizards of this species from more xeric habitats tend to produce larger clutches, as pointed out by Rocha (2008). Female SVL explained approximately 60% of the variation in clutch size, a trend similar to that found for this species elsewhere (VITT; COLLI, 1994; ROCHA, 2008) and also in other teiids (e.g. VITT; CARVALHO, 1992; MESQUITA; COLLI, 2003; ZALDÍVAR-RAE et al., 2008).

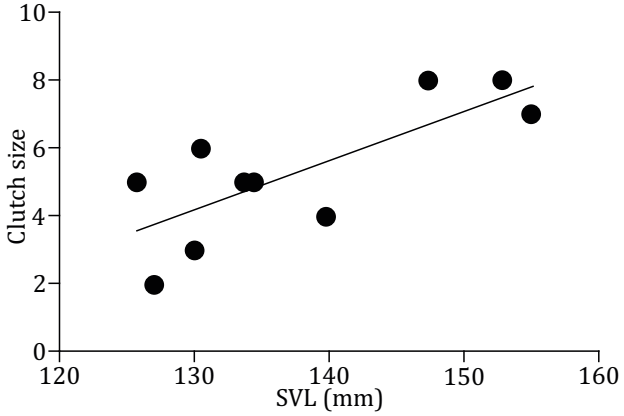

Figure 2. Relationship between clutch size and snout-vent length (SVL) in *Ameiva ameiva* from ESEC Seridó, Rio Grande do Norte state, Brazil.

We collected reproductive females in both rainy (two in March 2009, one in June 2009, two in February 2010, one in March 2010, and one in May 2010) and dry seasons (one in July 2009 and two in September 2009). Eight females carried vitellogenic follicles, one carried corporea lutea, and one carried vitellogenic follicles and corporea lutea simultaneously.

We registered presence of active adults during almost the entire year, but during the driest months (October-December 2009), almost no adult was observed active in the field (Figure 3). The observed decrease in adult abundance may be related to aestivation and/or increased mortality rate (SALES et al., 2011b). Hatchlings were observed in the population from June to December 2009, but were not registered during four consecutive months (January-April 2010); only in May 2010 we registered again hatchlings in the population (Figure 3).

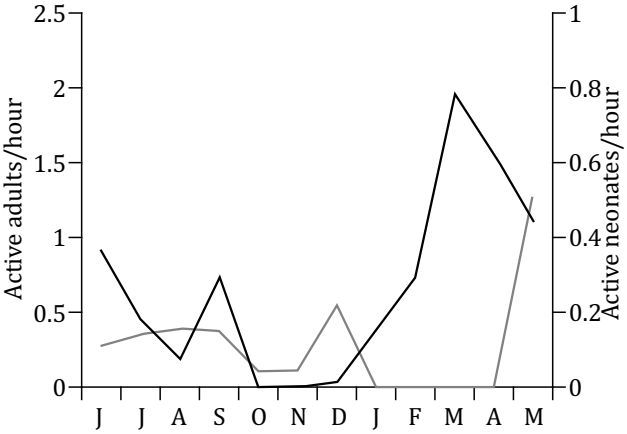

Figure 3. Number of active adult (black line) and hatchlings (gray line) of *Ameiva ameiva* observed per sampling hour between June 2009 and May 2010, at ESEC Seridó, Rio Grande do Norte state, Brazil.

Our results suggest that *A. ameiva* has a prolonged reproductive period in the Caatinga of ESEC Seridó, since we registered reproductive females both in the rainy and dry seasons. However, the decline in adult abundance during the peak of dry season and the absence of hatchlings in the population during four consecutive months are indications that females did not reproduce continuously during 2009-2010. Reproduction in *A. ameiva* was continuous, but with annual variations in intensity in a Caatinga site in

Pernambuco state (VITT, 1982), located about 330 km from ESEC Seridó. Similarly, the whiptail lizard *Ameivula ocellifera* (Spix, 1825), another teiid species investigated in the same study site during the same years, presented a prolonged reproductive period, apparently continuous, but with a strong decrease in reproductive activity in the peak of dry season (SALES; FREIRE, 2016). We conclude that female reproduction in *A. ameiva* from ESEC Seridó was prolonged throughout the years of 2009-2010, but ceased or markedly reduced during the peak of dry season.

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