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ON THE BIOLOGY OF THE LITTLE KNOWN ANGUID LIZARD, *DIPLOGLOSSUS LESSONAE* IN NORTHEAST BRAZIL

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ABSTRACT

Field and museum data were accumulated pertinent to the morphology, ecology and reproduction of the little known anguid lizard *Diploglossus lessonae* of northeast Brazil. This species is terrestrial and semi-fossorial and feeds on invertebrates occurring under surface cover, including coleopteran pupae, harvesters (*Opiliones*), spiders and scorpions. Reproduction is seasonal and clutch size in this oviparous lizard varies from 1-7. Comparisons with other studied *Diploglossus* and sympatric lizards in four other families reveal that the reproductive strategy of *D. lessonae* is more similar to that of other species of *Diploglossus* than it is to sympatric lizards.

INTRODUCTION

Although first described in 1890 (Peracca, 1890), only a handful of specimens of the anguid lizard *Diploglossus lessonae* have been available for study until quite recently. Schmidt and Inger (1951) synonymized a later described species, *D. tenuifasciatus* with *D. lessonae*. Both Petzold (1971) and Myers (1973) have made additional comments on various *Diploglossus*. The most thorough study to date, focused on morphology (a biometrical analysis) and the ontogeny of color and pattern (Vanzolini, 1958). A brief ecological note is provided by Vanzolini (1972) based on observations made by Professor Cabral of the Institute of Anthropology, University of Rio Grande do Norte. More recently, Williams and Vanzolini (1980) mentioned a collection made at Arajara in northeastern Brazil. Finally, Vanzolini et al. (1980) summarize independent observations made by Dr. Vanzolini and I.

In this paper I present information on various aspects of the ecology, morphology, and natural history of *Diploglossus lessonae* based on my field observations and collections, and the excellent collection of these animals at the MZUSP. The distribution of *D. lessonae* includes caatinga, agreste, and Atlantic Forest habitats of northeast Brazil.

METHODS

Primary study area.

During 1977-1978, I spent 12 months in the immediate vicinity of Exu, Pernambuco, a caatinga habitat located near the Chapada do Araripe, a low

mountain range. Climatological and vegetational summaries of the area appear elsewhere (Ab'Saber, 1967; Eidt, 1968; Lima, 1960; Mares et al., 1981; Reis, 1976; Vanzolini, 1972, 1974, 1976). Climatological conditions during the study period (March 1977 - February 1978) have been summarized by Vitt and Goldberg (1983). Briefly, thermal conditions at the study site are seasonally equable, annual rainfall varies from less than 400 to slightly over 1000 mm, and there is a dry season (< 50 mm rain per month) extending from May until November. During 1977-1978, the dry season began in June and persisted until the end of November. During the year of this study, 725.3 mm rain was recorded at the Ouricuri weather station (50 km from the study site).

Pertinent to the ecology of *D. lessonae*, the thorn forest habitat near Exu is interrupted by granitic extrusions (lageiros). The rocky debris and the lageiros themselves provide ideal habitats for this reclusive lizard. Within the lageiros are many deep fissures which provide refuges for small vertebrates and deep fissures in the rocks hold water for extended periods due to a small proportional surface area exposed to evaporation.

Field and laboratory methods.

Lizards were collected alive by hand and usually placed on ice in the field. Upon return to the laboratory, lizards were killed by injecting the brain with nembutal. The following morphological measurements were taken for each lizard prior to fixation: snout-vent length (SVL), tail length and length of the regenerated portion of the tail (if any) to the nearest mm, body mass to 0.1 g with a Pesola scale, head width, head length, gape, body width, body height and hindleg length to the nearest 0.1 mm with dial calipers. Head length was the linear distance from the anterior end of the ear opening to the tip of the snout, and head width was the linear distance across the widest portion of the skull.

Following preservation and storage in 10% Formalin, lizards were necropsied and the following observations were recorded; for males, length, width (0.1 mm), and mass of testes (0.001 g); for females, number and size (length and width) of oviductal and/or follicular (vitellogenic) eggs. Stomachs were removed and their contents identified (see Vitt and Lacher, 1981, for methods of diet analysis).

Specimens in the MZUSP (primarily consisting of the excellent collection reported by Williams and Vanzolini [1980]) were measured and necropsied to increase the sample size for morphological comparisons between sexes and to enhance reproduction data. The MZUSP collection included specimens from the states Pernambuco, Ceará, Rio Grande do Norte, and Bahia.

RESULTS

Body size and morphology — The smallest male examined was 60 mm SVL and the largest male measured 162 mm SVL. The smallest female measured 61 mm and the largest measured 150 mm. Size distribution of males and females appears in Figure 1. The smallest sexually mature female (contained enlarged vitellogenic follicles) was 127 mm SVL. The smallest sexually mature male was 150 mm based on the presence of enlarged testes and convoluted epididymides. However, no smaller males were dissected and thus minimum size at sexual maturity may be much less. For all morphological comparisons of adult animals I use 127 mm as minimum size at maturity for both sexes. This value may also overestimate size at maturity because the female sample is small.

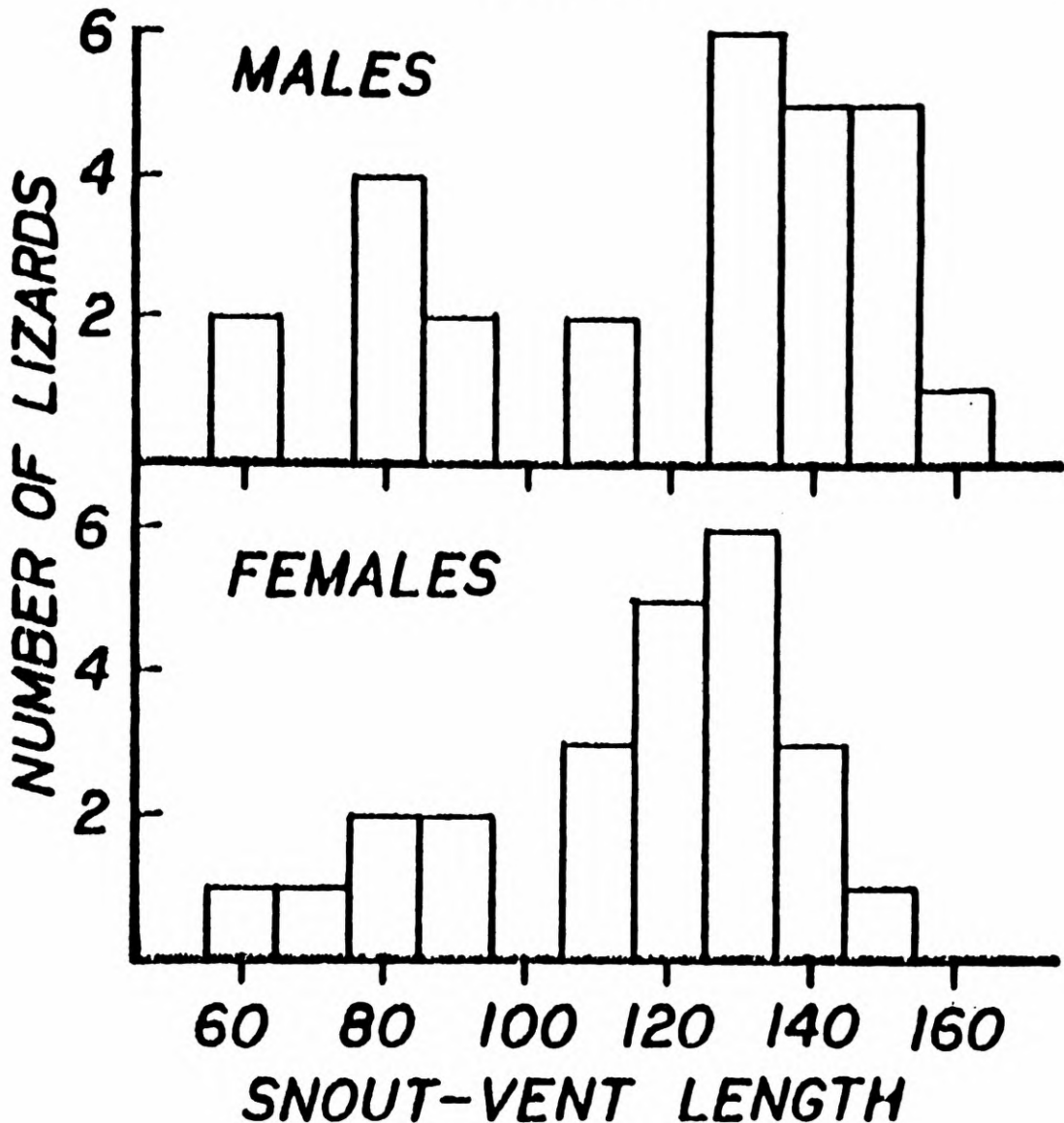


Fig. 1. Size-frequency distributions for male and female *Diploglossus lessonae*.

Significant sexual differences existed in the relationships of head width, head length, and head height to SVL (Table 1). Mean values for morphological characteristics of adult (≥ 127 mm SVL) *D. lessonae* appear in Table 2. The point at which heads of males became significantly larger than those of females at the same SVL, was about 101 mm SVL. This is exemplified for one head characteristic, head width, in Figure 2. Note that this value (101 mm) is considerably less than the estimate of size at maturity based on reproductive condition (127 mm). Thus it is clear that actual sexual dimorphism occurs, but at this point the underlying causal mechanism cannot be identified.

Reproduction. — Only nine of the adult females examined contained vitellogenic follicles or oviductal eggs. Clutch size varied from 1 to 7 (Fig. 3) and the relationship of clutch size to SVL was not significant ($R^2 = 0.11$, slope of regression not significantly different from zero; $t = 0.95$, $df = 9$), although there was a tendency for larger females to produce more eggs.

TABLE 1

Results of analysis of covariance comparing head and body characteristics between sexes of *Diploglossus lessonae*. Snout-vent length (SVL) is the covariate.

Variable	Equal slopes		Equal intercepts	
	F	P	F	P
Head width	18.3 _{1,47}	<0.0001	7.1 _{1,45}	0.0104
Head length	13.7 _{1,46}	0.0006	4.7 _{1,44}	0.0367
Head height	9.2 _{1,46}	0.0041	3.8 _{1,44}	0.0571

TABLE 2

Mean values for morphological characteristics of adult ≥ 127 mm SVL) *Diploglossus lessonae*

Characteristic	males	males
	$\bar{x} \pm SE$ (n)	$\bar{x} \pm SE$ (n)
Snout-vent length	144.3 \pm 2.26 (17)	138.5 \pm 2.02 (11)
Body mass	52.7 \pm 2.04 (6)	54.3 (2)
Head width	17.7 \pm 0.28 (17)	15.6 \pm 0.33 (9)
Head length	23.8 \pm 0.31 (17)	20.3 \pm 0.57 (10)
Head height	12.4 \pm 0.21 (16)	10.7 \pm 0.27 (9)

The breeding season appears to be cyclical, with females laying eggs during at least July. Because, during August, a female was collected which contained near ovulatory sized follicles, the egg laying season may extend over a couple of months. Juvenile sized (≈ 60 mm) individuals were collected during January. Because I do not have data on incubation times or exact size at hatching, the exact time of hatching cannot be determined, but it certainly falls somewhere during mid-dry season (September-October). Females containing slightly enlarged vitellogenic follicles were observed during March. During this same period, males had enlarged testes and convoluted epididymides. Presumably mating takes place sometime during this period.

On several occasions, both during the mating season and following the presumed egg laying season, male-female pairs of *D. lessonae* were observed. This suggests the possibility of social system involving monogamy. Further observations are necessary to substantiate this.

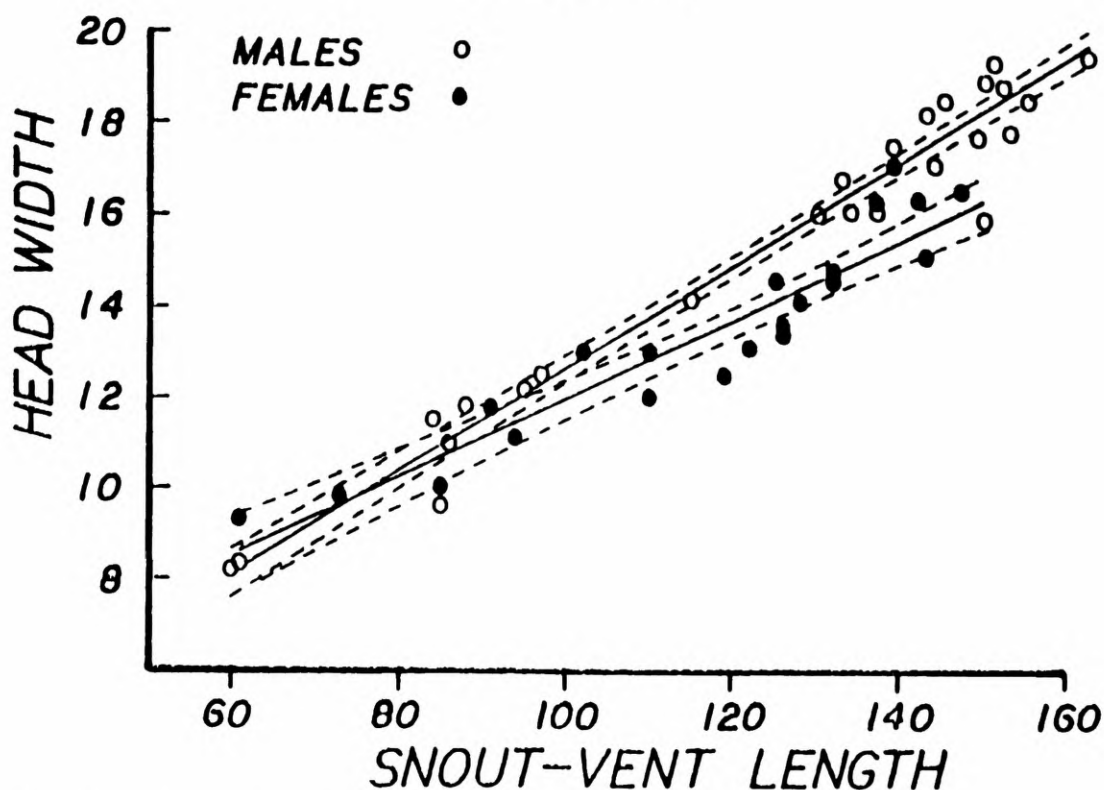


Fig. 2. Relationship of head width to snout-vent length (in mm) for male and female *Diploglossus lessonae*. The regression line is solid, with the 95% confidence limits of the regressions for each sex indicated by a dashed line.

Diet. — The diet of *D. lessonae* consists of terrestrial arthropods which are usually found underneath rocks or other surface items (Table 3). These

TABLE 3

Composition of the diet of six *Diploglossus lessonae* from northeastern Brazil

Prey Category	Number of prey	% total Number of prey	Prey Vol.	% total prey vol.	Frequency
Insects					
Coleoptera					
Scarabeidae pupae	1	10.0	2.98	37.6	1
Tenebrionidae larva	1	10.0	.20	2.5	1
Carabidae	1	10.0	.26	3.3	1
Dermaptera					
unid. parts	—	—	.46	5.8	1
Spiders					
Theraphosidae	2	20.0	2.05	25.9	2
unid. parts	—	—	.02	0.3	1
Harvesters (Opiliones)	3	30.0	.87	11.0	2
Scorpions					
Buthidae	1	10.0	1.04	13.1	1
Totals	10	100.0	7.93	100.0	

results are consistent with my observations on the foraging behavior and microhabitats where these lizards were most frequently observed. *Diploglossus lessonae* generally forage at rock-ground interfaces, entering crevices between rocks and open spaces under rocks.

The jaws of *D. lessonae* are quite powerful and facilitate the crushing and eating of very large prey. One individual, for example, contained a large (2.0 cm body length) buthid scorpion (*Rhopalurus laticauda*) and a medium sized tarantula (family Theraphosidae). Because both of these large invertebrates are capable of inflicting considerable damage to a would-be predator, strong jaws of *Diploglossus* would be important for immobilizing such potentially dangerous prey.

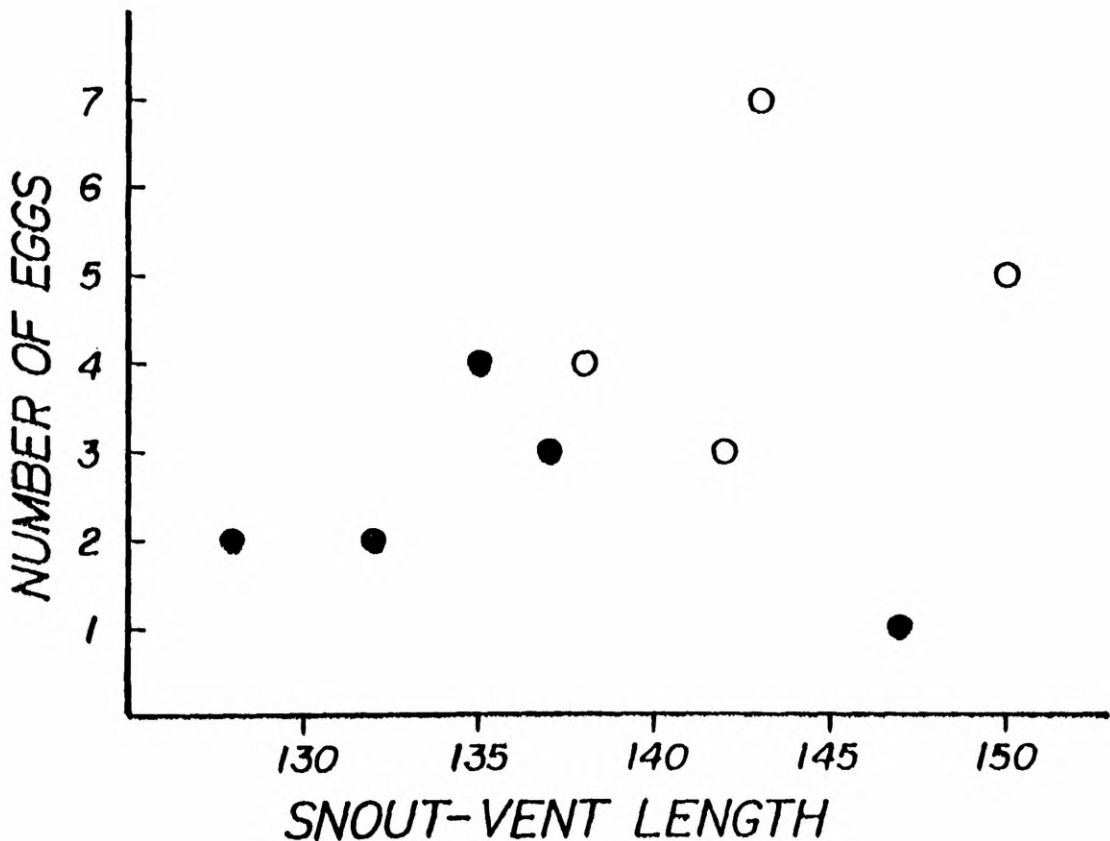


Fig. 3. Relationship of clutch size to female size (SVL in mm) in *Diploglossus lessonae*. Solid circles represent counts of oviductal eggs and open circles represent counts of vitellogenic follicles.

DISCUSSION

I will attempt to compare aspects of the biology of *D. lessonae* first with other species of *Diploglossus* and second, with sympatric lizards in other taxa, but studied during the same time period at the same locality.

For the most part, there is little information available on the biology of any species of *Diploglossus*, with the exception of basic reproductive data.

Some species are oviparous whereas others are viviparous (Fitch, 1970). None of the species produce large broods or clutches. Greer (1967) reported 3-9 offspring in *D. costatus*, 2-5 in *D. cruscus*, 2-4 in *D. curtissi*, and 2-4 in *D. pleii*. *Diploglossus stenurus* produces litters of at least 5-7 young (Ober, 1968). Among the oviparous species, *D. delasagra* produces clutches of at least 2-5 eggs (Greer, 1967). *D. bilobatus* produces clutches of at least six eggs (Fitch, 1970; Taylor, 1956). Brooding of eggs has been reported in at least two of the oviparous species, *D. delasagra* and *D. bilobatus* (Fitch, 1970). If any generality emerges, it is simply that among *Diploglossus* species, parity mode (viviparity vs oviparity) may vary, at least some oviparous forms guard eggs, and clutch or brood size ranges from 1-7 both within (*D. lessonae*) and among species.

At least 17 lizard species representing 4 families (Gekkonidae, Iguanidae, Scincidae, and Teiidae) occur sympatrically with *D. lessonae* in caatinga of northeastern Brazil (Vanzolini et al., 1980). None of these species occurs in the same microhabitat associated with *Diploglossus* and most likely, only *Cnemidophorus ocellifer* and *Ameiva ameiva* would be potential competitors for food. These two species frequently dig for prey and thus might acquire some of the prey species used by *Diploglossus*.

In terms of reproductive strategy, *D. lessonae* appears to fall within the late maturing, single clutch, long-lived category recognized by Tinkle et al. (1970). It undoubtedly produces only one clutch per year, and that clutch is produced during the dry season. Among the caatinga lizards, only the iguanid *Polychrus acutirostris* (Vitt and Lacher, 1981), and the scincid *Mabuya heathi* (Vitt and Blackburn, 1983) are highly seasonal in reproduction. *Polychrus* produces clutches in the early wet season (December-February) and *Mabuya* produces broods during the mid- to late-dry season (September-November). Two other iguanids, *Platynotus semitaeniatus* and *Tropidurus torquatus* have reproductive seasons that are extended, covering most of the dry season and the early wet season (Vitt and Goldberg, 1983). The sympatric teiids reproduce throughout the year (Vitt, 1982a,b, 1983) as do the gekkonids (Vanzolini et al., 1980; Vitt, unpublished data). Thus a diversity of reproductive strategies exists among sympatric caatinga lizards, a pattern noted elsewhere in tropical lizard communities (Dixon and Soini, 1975; Duellman, 1978; Fitch, 1973a,b; Schwaner, 1980).

There remains much to be learned about the biology of lizards in the genus *Diploglossus*. The secretive habits of these lizards render them difficult to study in the field and thus any quantitative observations on the biology of these little known lizards would be welcomed.

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