

Diet and fecundity of the Glass-lizard, *Ophiodes striatus* (Sauria, Anguinae) from the Atlantic Forest in southeastern Brazil

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ABSTRACT: We analyzed the diet and fecundity of the Glass-lizard *Ophiodes striatus* occurring in coffee plantations next to a fragmented area of the Atlantic Forest in the hilly region of the state of Espírito Santo, southeastern Brazil. Ninety-six specimens were collected from December 1994 to April 1996. The snout-vent length (SVL) of preserved specimens varied from 59.0 to 235.0 mm and total mass varied between 1.2 and 52.7 grams. The slope of the length-mass relationship was not significantly different between males and females, but mean SVL and mean body mass differed, and females were larger and heavier than males. The main food types in the diet of *O. striatus* were Blattodea, Araneae, and Orthoptera. Prey length varied from 3.5 to 28.0 mm (mean = 18.1 mm). The mean number of prey items per stomach was 2.4 (range 1–7). Male/female sex ratio was 1:1.3. Twenty adult females (43.5%) were gravid, and the smallest had a SVL of 161.0 mm. Litter size varied from 3 to 11. There was a positive and significant relationship between clutch size and SVL as well as clutch size and total mass. Lecithotrophic viviparity defines the reproductive mode in *O. striatus*.

Key words: *Ophiodes striatus*, lecithotrophic viviparity, sex-ratio, coffee plantation.

RESUMO: **Dieta e fecundidade da cobra-de-vidro, *Ophiodes striatus* (Sauria, Anguinae) da Mata Atlântica do sudeste do Brasil.** Nós analisamos a dieta e a fecundidade da cobra-de-vidro, *Ophiodes striatus*, que ocorre em plantações de café próximas a fragmentos de Mata Atlântica na região serrana do estado do Espírito Santo, sudeste do Brasil. Noventa e seis exemplares foram coletados entre dezembro de 1994 e abril de 1996. O comprimento rostro-anal (CRA) de exemplares preservados variou de 59,0 a 235,0 mm, enquanto que a massa total variou entre 1,2 e 52,7 g. A relação do comprimento e massa corpórea não diferiu entre machos e

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fêmeas, mas as médias do CRA e da massa diferiram significativamente, sendo as fêmeas maiores e mais pesadas do que os machos. Os principais itens alimentares na dieta de *O. striatus* foram Blattodea, Araneae e Orthoptera. As presas variaram de 3,5 a 28,0 mm de comprimento (média = 18,1 mm). O número médio de presas por estômago foi de 2,4 (variando de 1 a 7). A razão sexual foi de 1:1,3 (machos:fêmeas). Vinte fêmeas adultas (43,5%) estavam grávidas e a menor tinha um CRA de 161,0 mm. O número de embriões variou de 3 a 11. Houve uma relação positiva e significativa entre a fecundidade e o CRA, assim como entre a fecundidade e a massa corporal dos lagartos. A viviparidade lecitotrófica define o modo reprodutivo de *O. striatus*.

Palavras-chave: viviparidade lecitotrófica, razão sexual, dieta, plantação de café.

Introduction

Lizards of tropical areas show a diversity of feeding habits, including carnivorous and herbivorous species, and also a variety of foraging strategies. The same is true for reproductive patterns, even among different populations of the same species (Rand, 1982; Vanzolini *et al.*, 1980; Vitt, 1983, 1993). The greatest diversity of reproductive patterns occurs in the seasonal tropics, which experience seasonal variation in rainfall (Clerke & Alford, 1993). Most lizards are oviparous, and the evolution of viviparity is usually associated with reproductive adaptations to high latitude or high altitude habitats where low environmental temperatures may constrain egg development (Blackburn, 1982). Considerable variation also exists in the degree of matrotrophy in viviparous reptiles (Blackburn *et al.*, 1984).

Seasonal reproductive activity may be common in tropical lizards, and it is often associated to the limitations of egg deposition sites for oviparous species, or associated to the decline of food availability for adults or juveniles (Colli *et al.*, 1997).

The anguid lizard *Ophiodes striatus* (Spix, 1824), like other members of this genus, has a cylindrical and elongate body, no front limbs, and vestigial hind limbs (Cunha, 1961). This species is broadly distributed in Brazil, and also occurs in Argentina and Uruguay (Barbosa *et al.*, 1991; Peters & Donoso-Barros, 1970). However, it must be pointed out that *O. striatus*, as currently defined, apparently represents a species complex, and the taxonomy of its various populations is likely to change in the near future (M. Borges-Martins and M. Di Bernardo, unpubl. data). Species belonging

to the genus *Ophiodes* are viviparous and there is little information about their ecology. Superficially, these lizards are similar morphologically and ecologically to North American glass lizards (genus *Ophisaurus*), which are in a different subfamily (Anguinae) of anguid lizards. Because *Ophiodes* is a diploglossine, a typically Neotropical subfamily, these similarities likely reflect convergence on similar habits. In both genera *Ophiodes* and *Ophisaurus*, caudal replacements are very incomplete or at least extremely slow (Arnold, 1994).

The present study deals with some ecological characteristics of the Glass-lizard, *Ophiodes striatus*, occurring in fragments of the Atlantic Forest in the hilly region of the state of Espírito Santo, southeastern Brazil. As stated earlier, the name *O. striatus* currently represents a complex of species, and the name *O. fragilis* may be available to designate the population from Santa Teresa (M. Borges-Martins and M. Di Bernardo, unpubl. data). Nevertheless, we prefer to use the current taxonomy until a revision of this taxon is published. More specifically, the present study addresses the Glass-lizard's feeding habits, trophic ontogeny, and fecundity. The results are compared with *Ophisaurus* to evaluate the degree of convergence between the two genera.

Methods

This study was carried out at Alto Rio Saltinho (19°55'S 40°32'W, altitude ca. 700 m), in the municipality of Santa Teresa, state of Espírito Santo, southeastern Brazil. The region has a marked seasonality in climate, with a cool, dry winter (June to August) and a rainy summer (December to February). Fragments of Atlantic Forest occur on the hill top, surrounded by extensive coffee plantations on the slopes.

Individuals of *Ophiodes striatus* were collected monthly by hand by one of us (RLT) from December 1994 to April 1996, between 08:00 and 18:00 h. All animals collected were euthanized with ether and preserved in 10% formalin. After one week, they were washed and transferred to 70% alcohol. Preserved lizards had the snout-vent length (SVL) measured with calipers. They were weighed (0.01 g precision), and had their sex determined. Some small individuals were classified as juveniles, as their sex could not be determined with certainty. The number of eggs/embryos in the oviducts of mature females was recorded. Stomach contents were removed and identified. The frequency of occurrence (number of stomachs containing a given prey category), total number of items, and wet mass

(0.1 mg precision) for each prey type were recorded. Each intact prey had its length (in mm) measured with calipers. Voucher specimens of the Glass-lizard are housed in the zoological section of the Museu de Biologia Prof. Mello Leitão (MBML), Santa Teresa, Espírito Santo, Brazil.

Basic descriptive statistics provided include range, mean \pm one standard deviation, and sample size (n). Statistical comparison of sex ratio was made using the chi-square (X^2) test. Analysis of covariance (ANCOVA) was used to compare the slopes in the SVL/mass relationship between sexes. Mean SVL and mean body mass were compared between sexes using a one-way analysis of variance (ANOVA). Regression analysis was used to assess the relationship between number of eggs/embryos in the oviducts and snout-vent length and body mass of females. Cluster analysis was performed on SVL classes based on the wet mass of the main prey type in order to assess possible trophic ontogeny in the Glass-lizard. Data were \log_{10} transformed to normalize distributions. Mean prey length was compared among SVL classes using ANOVA. A Bartlett test was used *a priori* to test the homoscedasticity of variances and the Kolmogorov-Smirnov test was used to determine normality (Neter *et al.*, 1990). Because variances were heteroscedastic, data were \log_{10} transformed to meet ANOVA's assumptions. Tukey's "Honestly Significantly Difference" (HSD) test for unequal sample size was used *a posteriori* to detect where differences occurred.

Results

Ninety-six specimens of *O. striatus* were collected during fieldwork, most of them from November to January. No specimen of *O. striatus* was found during the coolest months (June to August). Most specimens were collected on leaf litter on the ground, mainly within the coffee plantation, but a few were collected in places without vegetation. Snout-vent length varied from 119.0 to 206.0 mm (160.0 ± 18.7 , $n = 36$) in males, and from 111.0 to 235.0 mm (170.7 ± 25.5 , $n = 41$) in females (Figure 1). Females were significantly longer than males (ANOVA: $F_{1,93} = 98.2$, $p < 0.01$). Body mass varied from 6.9 to 35.3 g (19.9 ± 1.9 , $n = 36$) in males, and from 6.0 to 53.7 (23.7 ± 9.6 , $n = 46$) in females. Females were also significantly heavier than males (ANOVA: $F_{1,93} = 91.3$, $p < 0.01$). The smallest individuals collected had a SVL of 59.0 mm (1.2 g). The slope of the exponential length-mass relationship of preserved specimens was not significantly different between sexes (ANCOVA: $F_{1,79} = 1.35$, $p = 0.24$). Fourteen

individuals were juveniles and their sex could not be determined with precision, therefore they were not included in the analyses described above.

Only ten (10.4%) of the specimens collected had empty stomachs. Seventeen different food types belonging to six major groups were eaten (Table 1). Insects were by far the most common food items, followed by arachnids. Plant remains were probably ingested incidentally. The only remains of vertebrates in the diet were scales from shed skins of other reptile species (Colubridae and other similar to scales of *Mabuya agilis*). In terms of occurrence, number, and wet mass of prey, the main food items in the diet of *O. striatus* were: Blattodea, Araneae, and Orthoptera (Table 1).

The main prey types did not change much as a function of SVL classes. Nevertheless, cluster analysis identified two groups, indicating trophic ontogeny in *O. striatus* (Figure 2). One group contained specimens from SVL < 100 mm to 100–119 mm that had ingested mainly Blattodea, and the other group contained the larger specimens. Predation on Arachnida and Orthoptera increased in larger animals. Size of prey varied from 3.5 to 28.0 mm in length (Figure 3), and tended to increase with snout-vent length. Prey size differed significantly among SVL classes (ANOVA: $F_{6,69} = 14.51$, $p < 0.0001$), but only the smallest individuals (SVL < 100 mm) differed from the others (Table 2). Number of prey per stomach varied between 1 and 7 (mean = 2.4).

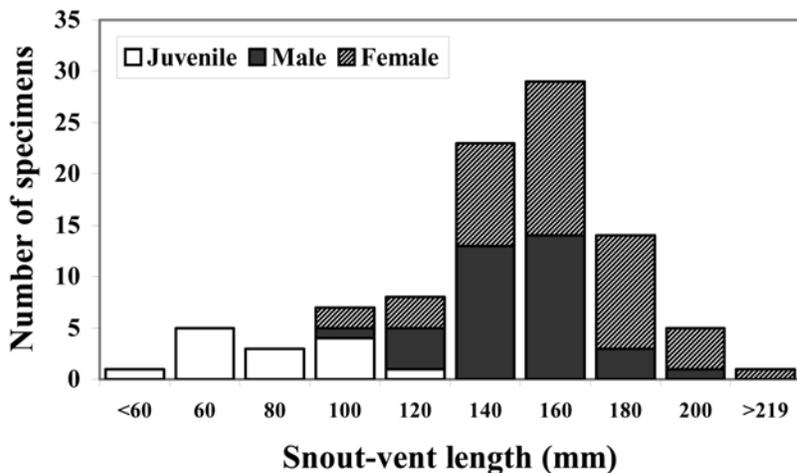


Figure 1. Snout-vent length distribution in specimens of the glass-lizard *Ophiodes striatus* from southeastern Brazil.

Table 1. Types of prey found in the stomach of *O. striatus* ($n=86$) in southeastern Brazil. F = frequency of occurrence; N = number of prey items; M = wet mass of prey items.

| Prey type | F | %F | N | %N | M | %M |
|--|----|------|-----|-------|---------|-------|
| Insecta | | | | | | |
| Blattodea | 53 | 61.6 | 105 | 50.0 | 21.9668 | 55.2 |
| Orthoptera | 18 | 20.9 | 18 | 8.6 | 3.5815 | 9.0 |
| Thysanoptera | 7 | 8.1 | 7 | 3.3 | 1.1278 | 2.8 |
| Lepidoptera (larvae) | 5 | 5.8 | 6 | 2.8 | 0.3419 | 0.8 |
| Coleoptera (larvae) | 2 | 2.3 | 2 | 0.9 | 0.2184 | 0.5 |
| Isoptera | 1 | 1.2 | 1 | 0.5 | 0.0009 | <0.1 |
| Diptera | 1 | 1.2 | 1 | 0.5 | 0.0003 | <0.1 |
| Hymenoptera (ants) | 1 | 1.2 | 1 | 0.5 | 0.0026 | <0.1 |
| Hymenoptera (bees) | 1 | 1.2 | 1 | 0.5 | 0.0130 | <0.1 |
| Insect eggs | 2 | 2.3 | 3 | 1.4 | 0.4505 | 1.1 |
| unidentified insect remains | 7 | 8.1 | 7 | 3.3 | 0.9028 | 2.3 |
| Arachnida | | | | | | |
| Araneae | 32 | 37.2 | 2 | 24.8 | 10.5473 | 26.5 |
| Myriapoda | | | | | | |
| Chilopoda | 1 | 1.2 | 1 | 0.5 | 0.0855 | 0.2 |
| Crustacea | | | | | | |
| Isopoda | 2 | 2.3 | 5 | 2.4 | 0.1138 | 0.3 |
| Reptilia | | | | | | |
| Snake (Colubridae scales) | 1 | 1.2 | – | – | 0.0228 | <0.1 |
| Lizard scales (<i>Mabuya agilis</i>) | 3 | 3.5 | – | – | 0.3967 | 1.0 |
| Macrophytes | | | | | | |
| Unidentified plant | 2 | 2.3 | – | – | 0.0599 | 0.1 |
| Total | 86 | – | 210 | 100.0 | 39.8217 | 100.0 |

Table 2. Probabilities of the *a posteriori* Tukey HSD for unequal sample size test of mean prey size and the snout-vent length (SVL) classes in mm.

| SVL | <100 | 100–119 | 120–139 | 140–159 | 160–179 | 180–199 |
|---------|--------|---------|---------|---------|---------|---------|
| 100–119 | 0.0012 | | | | | |
| 120–139 | 0.0034 | 0.9887 | | | | |
| 140–159 | 0.0001 | 0.9488 | 0.4398 | | | |
| 160–179 | 0.0001 | 0.9998 | 0.8754 | 0.7629 | | |
| 180–199 | 0.0001 | 0.9531 | 0.4531 | 1 | 0.9795 | |
| >200 | 0.0001 | 0.894 | 0.3226 | 1 | 0.8403 | 1 |

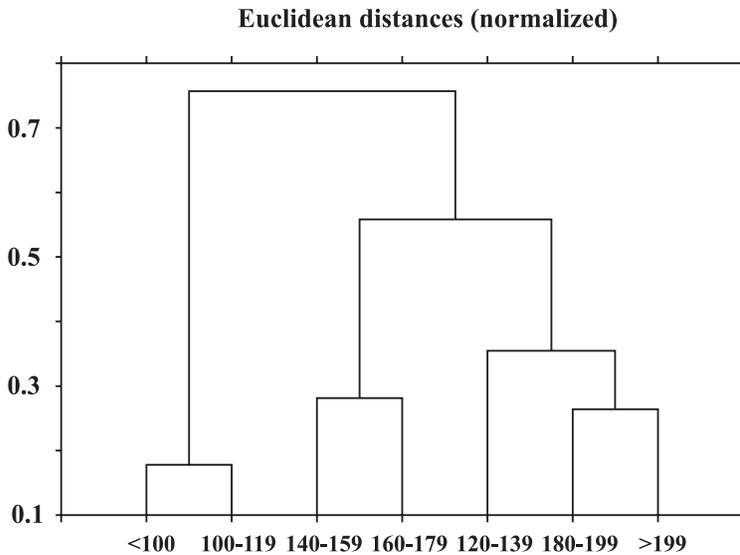


Figure 2. Cluster analysis based on the main food types according to snout-vent length of *Ophiodes striatus* from Santa Teresa, Espírito Santo, southeastern Brazil.

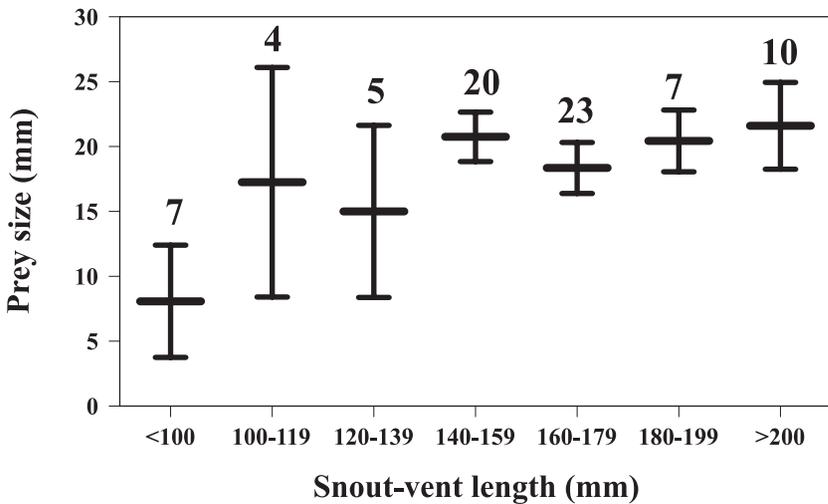


Figure 3. Prey size according to snout-vent length classes in *Ophiodes striatus* from Santa Teresa, Espírito Santo, southeastern Brazil. Horizontal bars = mean prey size; vertical bars = confidence intervals for 95.0%.

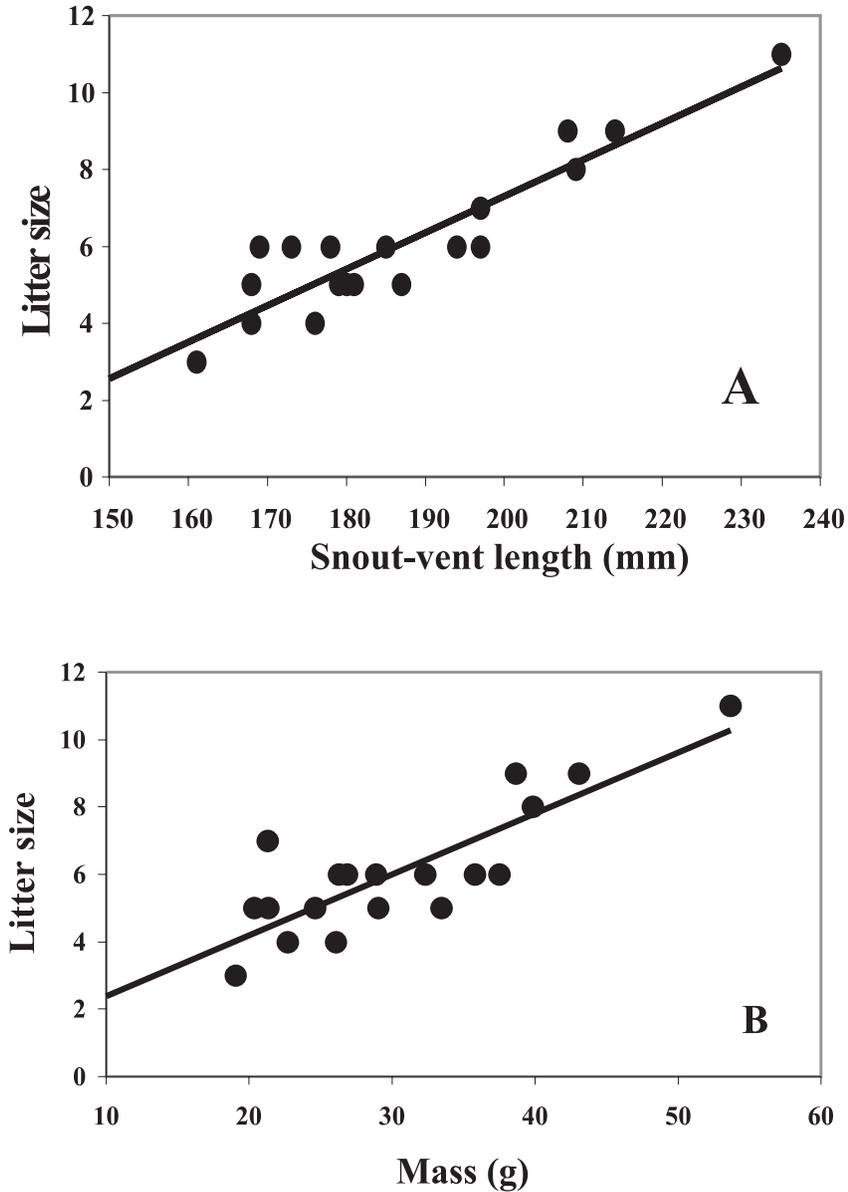


Figure 4. Relationship between litter size and snout-vent length (A) and mass (B) of preserved specimens of *Ophiodes striatus* from Santa Teresa, Espírito Santo, southeastern Brazil.

The ratio of males to females was 1:1.3, and it was not significantly different from the expected 1:1 ratio ($X^2 = 1.22$, $p = 0.27$). Twenty females (43.5%) were gravid. Of these, 4 were collected in March, 3 in April, 2 in September, 8 in October, and 3 in November. The smallest gravid female had a SVL of 161.0 mm.

The number of oviductal ova/embryos varied between 3 and 11 (6.0 ± 2.0). There was a significant and positive relationship between fecundity (Fec) and female SVL (Fec = $0.095 \text{ SVL} - 11.688$, $n = 20$, $R^2 = 0.84$, $p < 0.001$) and between fecundity and body mass (Fec = $0.181 \text{ mass} + 0.573$, $n = 20$, $R^2 = 0.70$, $p < 0.001$) (Figure 4).

There is no egg shell in *O. striatus*, and the embryos are surrounded by a thick layer of tissue (sac-like), without a connection to the female's body. There is no obvious evidence of a maternal-offspring placental connection, with embryos nutrition being apparently provided by yolk in the ova.

Discussion

The Glass-lizard *O. striatus* has successfully colonized areas now almost totally covered by coffee plantations in southeastern Brazil. We do not know whether presence of the lizards in coffee plantations depends on the occurrence of neighboring natural habitat (such as the Atlantic Forest remnants at Alto Rio Saltinho). Some populations of forest-restricted lizard species may be pre-adapted to life in open formations, constituting a full ecological vicariant (Vanzolini & Williams, 1981).

The three main prey types in the diet of *O. striatus* (Blattodea, Araneae, and Orthoptera) were also the main items in the diet of the sympatric skink *Mabuya agilis*, and the diets of the two species were very similar overall (Teixeira *et al.*, 2003). This may reflect the similarities in some ecological aspects between these two species, which are both diurnal, terrestrial elongated lizards, which forage actively among the grass and herbaceous vegetation. The fact that we found colubrid and lizard scales in the stomach of *O. striatus* suggests that these lizards may sometimes feed on dead organic material such as shed skins or prey on other squamates. This further suggests that chemical cues play an important role in prey identification as in other anguid lizards. The diet of *O. striatus* differed greatly from that of the fossorial anguid lizard *Diploglossus lessonae* of the Brazilian semi-arid Caatinga, which fed on arthropods (mainly opiliones and Scarabeidae pupae) generally found underneath rocks (Vitt, 1985).

Trophic ontogeny was observed in *O. striatus* in this study. As there is no evidence of spatial partitioning between juvenile and adults, both may be dividing the available food resource. Only for the smallest juveniles was the size of prey ingested significantly different from the other size classes, revealing that larger *O. striatus* do not select the largest prey. Specialization on large prey is uncommon in most lizards (Gasnier *et al.*, 1994), but occurs in some iguanians, and in most varanoids (Andrews, 1979).

Ophiodes striatus is sexually dimorphic: mean SVL of females was significantly greater than males, as well as mean body mass. A similar result was obtained by Pizzatto (2005) for *O. fragilis*. A larger body allows a better reproductive success in lizards (Vitt, 1983). Fecundity of *O. striatus* from Santa Teresa was similar to that of other populations or species of *Ophiodes*. Greer (1967) found from 9 to 15 oviductal eggs in the neotropical congener *O. vertebralis*. However, the clutch size recorded by Leitão (1973) for *O. striatus* ranged from 5 to 24 eggs, and was thus much greater than these recorded here. Pizzatto (2005) found the clutch size ranging from 5 to 13 for *O. fragilis*. Fecundity may vary with different food availability, egg size, and extreme environmental conditions in this widespread species of lizard. However, as already pointed out, more than one species are currently being treated under the name of *O. striatus*, and thus the differences among different populations may perhaps imply different evolutionary trajectories.

The development of viviparity in squamates evolved from a gradual transition between egg-laying ancestor by varying degrees of eggshell thinning and egg retention (Guillette, 1993), associated with cold climatic conditions at high latitudes or high altitudes (Blackburn, 1982; Heulin *et al.*, 1997). Steps that lead to vivipary in reptiles include eggshell reduction, increased periods of egg retention, and the development of some kind of primitive placenta, simply for gas and water exchange (Guillette, 1987, 1993). Shouten (1929) defined *O. intermedius* as a viviparous species, as well as Cunha (1961) referring to *O. striatus*. Gallardo (1966) pointed out that *O. vertebralis* and *O. intermedius* were oviviparous. Fitch (1970) suggested that among the anguids, the genus *Ophiodes* includes only viviparous species. Later, Leitão (1973) cited that *O. striatus* was oviviparous. Lecithotrophic viviparity defines the reproductive mode in this lizard because there is no apparent placental connection between mother and embryo, as in the genus *Mabuya* (Vitt & Blackburn, 1991).

Finally, overall morphological and ecological similarities between *Ophiodes* (Diploglossinae) and *Ophisaurus* (Anguinae) suggest convergence most likely based on use of microhabitats in which limb loss,

elongation of the body and tail, and serpentine locomotion provided a selective advantage. Species in both genera are limbless, snake-like, and feed largely on arthropods (Noble & Mason, 1933; Hamilton & Pollack, 1961; Vinegar, 1968; Fitch, 1984). Both appear to be seasonal in reproduction (Trauth, 1984), which is typical of temperate zone anguid lizards (Fitch, 1970).

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References

- ANDREWS, R. M. 1979. The lizard *Corytophanes cristatus*: an extreme “sit-and-wait” predator. *Biotropica*, 11: 136–139.
- ARNOLD, E. N. 1994. Caudal autotomy as a defense. In C. Gans (ed.), *Biology of the Reptilia*. Branta Books, Ann Arbor, p. 235–274.
- BARBOSA, O. R., MACHADO, C. & FERNANDES, L. 1991. Notas sobre a parturição da “cobra-de-vidro”, *Ophiodes striatus* (Spix, 1825) (Sauria, Anguidae). *Revista Brasileira de Biologia*, 51(1): 285–287.
- BLACKBURN, D. 1982. Evolutionary origins of viviparity in the Reptilia. I. Sauria. *Amphibia-Reptilia*, 3: 185–205.
- BLACKBURN, D., VITT, J. L. & BEUCHAT, C. A. 1984. Eutherian-like reproductive especializations in a viviparous reptile. *Proceedings of the National Academy of Sciences*, 81: 4860–4863.
- CLERKE, R. B. & ALFORD, R. A. 1993. Reproductive biology of four species of tropical Australian lizards and comments on the factors regulating lizard reproductive cycles. *Journal of Herpetology*, 27: 400–406.
- COLLI, G. R., PÉRES, JR., A. K. & ZATZ, M. 1997. Foraging mode and reproductive seasonality in tropical lizards. *Journal of Herpetology*, 31: 490–499.
- CUNHA, O. R. 1961. II. Lacertílios da Amazônia. *Boletim do Museu Paraense Emílio Goeldi*, 39: 1–189.
- FITCH, H. S. 1970. Reproductive cycles of lizards and snakes.

- Miscellaneous Publicatios of the University of Kansas Museum of Natural History*, 52: 1–247.
- FITCH, H. S. 1984. A field study of the slender glass lizard, *Ophisaurus attenuatus*. in northeastern Kansas. *Occasional Papers of the Museum of Natural History*, 125: 1–50.
- GALLARDO, J. M. 1966. Las especies argentinas del genero “*Ophiodes*” Wagler. *Revista del Museo Argentino de Ciencias Naturales Bernardino Rivadavia*, 9: 94–99.
- GASNIER, T. R., MAGNUSSON, W. E. & LIMA, A. P. 1994. Foraging activity and diet of four sympatric lizard species in a tropical rainforest. *Journal of Herpetology*, 28(2): 187–192.
- GREER, A. E. 1967. Notes on the mode of reproduction in anguid lizards. *Herpetologica*, 23: 94–99.
- GUILLETTE, JR., L. J. 1987. The evolution of viviparity in fishes. amphibians. and reptiles: An endocrine perspectives. In D. O. Norris and R. E. Jones (eds). *Hormones and Reproduction in Fishes, Amphibians, and Reptiles*. Plenum Press, New York, p. 523–562.
- GUILLETTE, JR., L. J., 1993. The development and evolution of viviparity in lizards. *BioScience*, 43: 742–751.
- HAMILTON, JR., W. J. & POLLACK, J. A. 1961. The food of some lizards from Fort Benning, Georgia. *Herpetologica*, 17: 99–106.
- HEULIN, B., OSENEGG-LECONTE, K. & MICHEL, D. 1997. Demography of a bimodal reproductive species of lizard (*Lacerta vivipara*): survival and density characteristics of oviparous populations. *Herpetologica*, 53(4): 432–444.
- LEITÃO, M. D. 1973. Ovoviviparidade em *Ophiodes striatus* (Spix, 1824), Sauria, Anguidae. *Iheringia*, 42: 34–39.
- NETER, J., WASSERMAN, W. & KUTNER, M. H. 1990. *Applied linear statistical models, regression, analysis of variance, and experimental designs*. 3rd ed. Richard D. Irwin, Inc., Homewood, 1181 p.
- NOBLE, G. K. & MASON, E. R. 1933. Experiments on the brooding habits of the lizards *Eumeces* and *Ophisaurus*. *American Museum Novitates*, 1933: 1–29.
- PETERS, J. A. & DONOSO-BARROS, R. 1970. Catalogue of the neotropical Squamata. Part II. Lizards and amphisbaenians. *United States National Museum Bulletin*, 297: 1–293.
- PIZZATTO, L. 2005. Reproductive biology of the “Glass Snake” *Ophiodes fragilis* (Squamata: Anguidae) in south-east Brazil. *Herpetological Journal*, 15: 9–13.

- RAND, A. S. 1982. Clutch and egg size in Brazilian lizards. *Herpetologica*, 38:171–178.
- SHOUTEN, G. B. 1929. Notas sobre la oologia de alguns saurios del Paraguay y los paises limitrofes. *Revista Chilena de Historia Natural*, 33: 518–521.
- TEIXEIRA, R. L., ROCHA, C. F. D., VRCIBRADIC, D. & CUZZUOL, M. G. T. 2003. Ecology of *Mabuya agilis* (Squamata. Scincidae) from a montane Atlantic rainforest area in southeastern Brazil. *Cuadernos de Herpetología*, 17:101–109.
- TRAUTH, S. E. 1984. Seasonal incidence and reproduction in the western slender glass lizard, *Ophisaurus attenuatus attenuatus* (Reptilia. Anguidae) in Arkansas. *The Southwestern Naturalist*, 29: 271–275.
- VANZOLINI, P. E. & WILLIAMS, E. E. 1981. The vanishing refuge: a mechanism for ecogeographic speciation. *Papéis Avulsos de Zoologia*, 34: 251–255.
- VANZOLINI, P. E., RAMOS-COSTA, A. M. M. & VITT, L. J. 1980. *Répteis das Caatingas*. Academia Brasileira de Ciências, Rio de Janeiro.
- VINEGAR, A. 1968. Brooding of the eastern glass lizard, *Ophisaurus ventralis*. *Bulletin of the Southern California Academy of Sciences*, 67: 65–68.
- VITT, L. J. 1983. Reproduction and sexual dimorphism in the tropical teiid lizard *Cnemidophorus ocellifer*. *Copeia*, 1983: 359–366.
- VITT, L. J. 1985. On the biology of the little known anguid lizard, *Diploglossus lessonae* in northeast Brazil. *Papéis Avulsos de Zoologia*, 36: 69–76.
- VITT, L. J. 1993. Ecology of isolated open-formation *Tropidurus* (Reptilia: Tropiduridae) in Amazonian lowland rain forest. *Canadian Journal of Zoology*, 71: 2370–2390.
- VITT, L. J. & BLACKBURN, D. G. 1991. The ecology and life history of the viviparous lizard *Mabuya bistrriata* (Scincidae) in the Brazilian Amazon. *Copeia*, 1991: 917–927.