

On reproductive biology of the High Atlas Mountain lizard *Lacerta andreanskyi* Werner, 1929

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In 1929 *Lacerta andreanskyi* was discovered and described by WERNER from the Djebel Toubkal of the High Atlas Mountains, Morocco. Since then all publications concerning this species refer to animals from the Toubkal region (WERNER 1929, 1931, 1935, SAINT GIRONS 1953, PASTEUR & BONS 1960, KLEMMER 1969, STEMMLER 1972, BUSACK 1987, JOGER & BISCHOFF 1989). Only KLEMMER (1969) mentions these lizards also from the volcano Siroua. Based on preserved specimens at the museums of Basel and Paris the distribution area will be enlarged immensely by two further places. Two unequivocal *L. andreanskyi* (NMB 13469 and MNHP 1939-156) were collected from Djebel Tarkedit (about 250 km east of Toubkal). Three further lizards (NMB 13468 and MNHP 1939-155) (ZFMK 49736, JOGER & BISCHOFF 1989) from Djebel Ayachi might be distinct from *L. andreanskyi* on subspecific or specific level.

The basis of this research is one pair of *L. andreanskyi* and their offspring. The parents were caught in the region of the Djebel Toubkal. *L. andreanskyi* was found at an altitude of 2300 m and higher, living solitary in spiny shrubs (*Alyssum spinosum*, *Bupleurum spinosum*, *Cytisus balansae*), which partially overgrow the rocks, thus forming a typical "hedgehog zone" (WERNER 1931, 1935, SAINT GIRONS 1953, STEMMLER 1972). *Podarcis hispanica vaucheri*, which is very abundant below 2200 m, is absent in this area. Two other species, *Quedenfeldtia trachyblepharus* and *Vipera monticola*, also endemic to the High Atlas Mountains, live sympatrically with *L. andreanskyi* (SAINT GIRONS 1953, KLEMMER 1969, STEMMLER 1972, BEERLI et al. 1986).

The majority of the publications concerning *L. andreanskyi* is restricted to descriptions of its morphology and its habitat. BUSACK (1987) is the first to mention biological data. This work presents results on the reproductive biology of this lizard species.

Results

In contrast to other lacertid lizards *L. andreanskyi* possesses a very slender body, which is especially elongate in the female sex. The tail, which is obviously used as fat depot, may reach nearly the same width as the body of a female. Furthermore, sex differences in femoral pores are more expressed than in other lacertid lizards. In females the pores are closed and often reduced in number (0/0-9/10). In males they form an uninterrupted row across both thighs (16/16-21/22).

In captivity, the lizards can easily be kept in pairs or in small groups of semi-adult animals. During the reproductive period females are very aggressive among each other. Copulation takes place by normal flank bite.

Under laboratory conditions the reproductive season begins in December or January and ends in April to June. Younger females produce 2 to 3 clutches, while older, fully grown females produce up to 6 clutches in one breeding season. The time between two clutches takes ca. 40 days or less, down to 20 days, when the temperatures at day and night becomes higher and more food is available.

Each clutch contains 1 or 2 eggs ($n=22$, $\bar{x}=1.6$). The smallest female measured 40 mm SVL when it deposited its first 1-egg clutch, and 45 mm when it deposited its first 2-egg clutch. The largest females, measuring now 48 mm SVL, have been producing 1 or 2 eggs per clutch. BUSACK (1987) also found females with 3 eggs. The largest females he caught had a SVL of 54 mm.

When oviposited the mean size of the eggs is 12.7 mm in length and 6.2 mm in width ($n=20$). During incubation the eggs remain elongate. The egg shell, which is thick and firm, keeps its shape even after the young lizards hatched. The average weight of freshly oviposited eggs is 284 mg ($n=20$). By rule single eggs ($\bar{x}=306$ mg, range 264-335 mg, $n=6$) are heavier than eggs from 2-egg clutches ($\bar{x}=282$ mg, range 220-340 mg, $n=14$).

The relationship between the weight of the clutch (C) and the weight of the female (F) right after egg deposition is used as measure of reproductive effort ($C \times 100 / F$). For 1-egg clutches it is 18.2-27.3%, $\bar{x}=21.5\%$ ($n=6$), and for 2-egg clutches 24.3-36.5%, $\bar{x}=31.5\%$ ($n=6$). For 3-egg clutches it should significantly increase over 40%. Thus the reproductive effort of *L. andreanskyi* equals that of other lacertid lizards (RYKENA, 1988).

The eggs were incubated at constant ($\pm 1^\circ\text{C}$) temperatures. At 30.5°C the incubation lasts 48-54 days, at 27.5°C it lasts 56-59 days, at 25°C 70-74 days, and at 21°C it lasts 146 days. Temperatures above 30°C do not accelerate the development, while 21°C seems to be the limit for successful hatching of the young.

In relation to the size of the adults, the hatchlings are extremely large. The 15 hatchlings measure 21-26.5 mm SVL, $\bar{x}=23.3$ mm; the tail is 27.5-36.0 mm long, $\bar{x}=32.0$ mm; their weight ranges from 220-350 mg, $\bar{x}=285$ mg. The weight of the hatchlings takes only 94.9% in mean of the weight of the egg at oviposition (range 84.8-106.8%, $n=14$). This is due to the relatively thick egg shell, which allows only a limited water uptake. Other lacertid lizards produce eggs with thinner egg shells, which take up larger quantities of water, so that the hatchlings may be as heavy or even heavier than the egg when oviposited (e.g. *Lacerta agilis* $\bar{x}=108.9\%$, range 96-134%, $n=118$, RYKENA 1988).

Until reaching sexual maturity the youngs grow relatively fast and continuously. Young lizards reached maturity in December or January, regardless whether they hatched in the beginning of March or the end of July. Subsequently, females reaching maturity early and thus being smaller will produce only 1-egg clutches during their first breeding season, while females which are older and therefore larger when they reach maturity are able to produce 2-egg clutches.

Discussion

Considering the presented incubation times and the finding of hatchlings in the wild in the beginning of June (ZFMK 49806, BUSACK 1987) it can be concluded that the first egg deposition must take place as early as March. Thus, the natural breeding season begins only little later than under laboratory conditions. Catching gravid females in June (ZFMK 44116 and 49805, BUSACK 1987) indicates that usually several clutches are produced. In June BUSACK (1987) found only one specimen with a vitellogenic follicle among 17 gravid females. Thus the ending of the breeding season can be postulated for June/July.

Reproductive effort is comparable to other lacertids, but *L. andreanskyi* is investing in low numbers of large eggs. This causes low numbers of progeny per year and requires long adult lifetimes. Such K-strategy may be understood as adaptation to low food resources and difficult egg incubation conditions in a high alpine environment.

References

- BEERLI, P., BILLING, H. & SCHÄTTI, B. (1986): Taxonomischer Status von *Vipera latasti monticola* Saint Girons, 1953 (Serpentes: Viperidae). – *Salamandra* **22**: 101-104.
- BUSACK, S. (1987): Notes on the biology of *Lacerta andreanskyi* (Reptilia: Lacertidae). – *Amphibia-Reptilia* **8**: 231-236.
- JOGER, U. & BISCHOFF, W. (1989): Erste Ergebnisse einer herpetologischen Forschungsreise nach Nordwest-Afrika. – *Tier und Museum* **1**(4): 99-106.
- KLEMMER, K. (1969): Beobachtungen an den Hochgebirgsreptilien *Quedenfeldtia trachyblepharus* (Gekkonidae) und *Lacerta andreanskyi* (Lacertidae) des Hohen Atlas, Marokko. – *Zool. Anz. Suppl.* **32** (= *Verh. dt. zool. Ges.*): 325-327.
- PASTEUR, G. & BONS, J. (1960): Catalogue des reptiles actuels du Maroc. – *Trav. Inst. Sci. Chérif., sér. zool.* **21**: 1-132.
- RYKENA, S. (1988): Ei- und Gelegemaße bei *Lacerta agilis*: ein Beispiel für innerartliche Variabilität von Fortpflanzungsparametern. – In: GLANDT, D. & BISCHOFF, W. (eds): *Biologie und Schutz der Zauneidechse (Lacerta agilis L.)*. – *Mertensiella* **1**: 75-83.
- SAINT GIRONS, H. (1972): Notes d'écologie sur les reptiles du Haut Atlas. – *Bull. Soc. zool. France* **78**: 13-24.
- STEMMLER, O. (1972): Herpetologische Beobachtungen in Marokko XII. Im Hochtal des Oued Rihraia. – *Aquaterra* **9**(1): 8-12.
- WERNER, F. (1929): Wissenschaftliche Ergebnisse einer zoologischen Forschungsreise nach Westalgerien und Marokko. – *Sb. Akad. Wiss. Wien, math.-naturw. Kl. Abt. I.* **138**: 1-34.
- WERNER, F. (1931): Ergebnisse einer zoologischen Forschungsreise nach Marokko. – *Sb. Akad. Wiss. Wien, math.-naturw. Kl. Abt. I.* **140**: 271-318.

WERNER, F. (1935): Auf Fang seltener Lacerten in drei Erdteilen. – *Bl. Aquar. Terrar.-kunde* 46: 33-37.

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