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Short Communication

Notes on egg and hatchling size in *Podarcis siculus* (Squamata: Lacertidae) from central Italy

Marta Biaggini and Claudia Corti
Museo di Storia Naturale dell'Università degli Studi di Firenze, Sede "La Specola". Via Romana 17, 50125 Florence, Italy.

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The Italian Wall Lizard, *Podarcis siculus* (Rafinesque-Schmaltz, 1810), is mainly distributed in Italy and surrounding islands, and along the eastern coast of the Adriatic Sea; it is oviparous with a seasonal reproductive cycle (Corti *et al.* 2010 and references therein). Females become fertile after reaching a snout–vent length of 50 mm (Henle 1988) and as many as three egg depositions may occur in the same reproductive season (Angelini *et al.* 1982, Henle 1988, Capula *et al.* 1993). Despite the many aspects of reproduction in *P. siculus* that have been studied (Corti *et al.* 2010 and references therein), there are few data on eggs and hatchlings. In particular, data on newborns often are based on occasional observations of a few individuals (e.g., Gubanyi 2003).

We provide data on egg and hatchling sizes, and explore the relationship between the sizes of the eggs, hatchlings, and females in *Podarcis siculus.* In June 2008, we collected 13 gravid females by noosing, in central Italy (43°56' N, 10°59' E, ca. 100 m a.s.l.).We housed females in individual terraria exposed to natural conditions (light, ventilation, and temperatures) and provided mealworm (*Tenebrio molitor* Linnaeus, 1758) larvae and water ad libitum. Eggs were laid at most 1 wk after the lizards were captured; thus, even though egg deposition occurred in terraria, egg development was affected by the conditions experienced by females in their natural environment. We checked terraria for eggs twice a day. Upon egg deposition, each female was measured (snout–vent length, SVL) and released at the site of capture. For each clutch, we recorded the number of eggs, egg weight to the nearest 0.001 g using a digital balance, egg length and width to the nearest 0.1 mm using calipers. Eggs were incubated at 27°C and checked several times a day. Soon after hatching, we recorded the weight and following measurements of the newborn: SVL; tail length; pileus length (from the tip of the snout to the head posterior scale); head width; and front and rear stylopodium (on the right side). We released newborns in the site of capture of the corresponding adult female within a day from hatching. To analyze the relationships among the sizes of

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the eggs, hatchlings, and females, we performed a Spearman correlation among egg weight, length and width, hatchling body and tail length, hatchling head measures and female body length. We log-transformed data to reduce variability. We used PAST 2.17b (Hammer *et al.* 2001) for the analysis.

Clutch size was 3.38 ± 1.04, fitting the range 3.1–4.7 indicated in previous studies (Henle 1988, Monti *et al.* 2013, Biaggini and Corti 2017), while Capula *et al.* (1993) recorded quite larger clutches, made up of 6.00 ± 1.52 eggs. Eggs (*N* = 44) weighed 0.369 ± 0.072 g and were 12.29 ± 1.12 × 7.28 ± 0.40 mm; In den Bosch and Bout (1998), measuring 18 eggs, recorded a mean weight of 0.4 ± 0.05 g and mean lengths of 11.3 ± 0.7 × 7.8 ± 0.3 mm at oviposition. Hatching success was about 84% (*N* = 36) and the incubation period was 32.53 ± 1.02 days, similar to that reported by Gubanyi (2003) at a comparable temperature (31 days at 26.7°C). The mean weight of hatchlings was 0.410 ± 0.060 g, comparable to the value reported by In den Bosch and Bout (1998) (*N* = 14, 0.5 ± 0.06 g); SVL and tail length were 26.13 ± 1.56 mm and 42.85 ± 3.43 mm, respectively. Henle (1988) recorded a total length of 66.3 mm in the Balkan region, whereas Gubanyi (2003) reported 65 mm for nine newborns from an introduced population in the state of Kansas in the U.S. Front and rear stylopodium lengths were 2.85 ± 0.16 and 3.66 ± 0.45 mm, respectively, in our sample; hatchling head was 0.44 ± 0.03 mm wide and pileus was 0.75 ± 0.06 mm long. We did not find reference data for head and stylopodium measurements. Maternal size (*N* = 13, SVL = 58.93 ± 2.73 mm) was negatively correlated with egg size and with egg and hatchling weight (Table 1). Indeed, in *Podarcis siculus,* bigger females usually lay more eggs, and eggs from larger clutches tend to be smaller than eggs from smaller clutches (Biaggini and Corti 2017). The trade-off between egg number and size is a quite a common trait in lizards (e.g., Amat 2008, Warne and Charnov 2008). Hatchling size (SVL), as well as tail length and head width, positively correlated with egg weight (and size); the length of the front stylopodium increased slightly in heavier hatchlings, whereas the length of pileus and rear stylopodia had almost no correlations with other measurements (Table 1).

Table 1. Correlations among egg weight (E-We), length (E-L1) and width (E-L2), hatchling weight (H-We), body length (H-SVL), pileus length (H-Pl), head width (H-HWi), tail (H-tail), front and rear stylopodium (H-fSt, H-rSt) and female body size (F-SVL) in *Podarcis siculus:* Pearson coefficients and significance: ns = not significant; * = $p < 0.05$; ** = $p \leq 0.01$; *** = $p \leq 0.001$.

	E-L1	E-L2	H-We	H-SVL	H-Pl	H-HWi	H-tail	H-fSt	H-rSt	F-SVL
E-We	0.871***	0.570***	0.917***	0.510**	0.188ns	0.342*	0.620***	0.217ns	-0.025ns	-0.496**
E-L1		0.327ns	0.793***	0.438**	0.309ns	0.308ns	0.499**	0.234ns	0.009ns	-0.536***
E-L2			0.618***	0.471**	-0.093ns	0.123ns	0.410*	0.179ns	-0.018ns	-0.270ns
H-We				0.694***	0.299ns	0.420**	0.740***	0.341*	0.159ns	-0.392*
H-SVL					0.338ns	0.281ns	0.567***	0.319ns	0.277ns	-0.318ns
H-Pl						0.168ns	0.118ns	0.200ns	0.167ns	-0.317ns
H-HWi							0.225ns	0.068ns	0.199ns	0.012ns
H-tail								0.531**	0.279ns	-0.083ns
H-fSt									0.396*	0.045ns
H-rSt										0.086ns

Additional data from across the range of *Podarcis siculus* are needed to verify the reliability of our observed relationships among sizes of eggs, hatchlings, and females and to explore whether hatchlings have a similar degree of morphological variation as the adults do.

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