

On the maximum size of the European Green Lizard *Lacerta viridis* (Squamata: Lacertidae) from Bulgaria

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The European Green Lizard *Lacerta viridis* (Laurenti, 1768) is a medium-sized lacertid species, widespread in southeast Europe and North Turkey (Nettmann and Rykena, 1984; Ananjeva et al., 2004; Sillero et al., 2014), with isolated populations in northeast Germany (Böhme et al., 2007b). The species is part of a complex with its sister taxon *L. bilineata* Daudin, 1802, and was confirmed as a distinct species based first on the results of hybridisation experiments (Rykena, 1991, 2001) and allozyme studies (Amann et al., 1997; Joger et al., 2001), and later by molecular studies based on mtDNA sequences (Brückner et al., 2001; Godinho et al., 2005; Böhme et al., 2007a; Marzahn et al., 2016; Jauss et al., 2021). Although within the species *L. viridis* sensu stricto its taxonomy is still unclear (see Jauss et al., 2021 about the Adriatic clade for instance). Nevertheless, at least three valid subspecies were recognised: *L. viridis guentherpetersi* Rykena et al., 2001, *L. v. meridionalis* Cyrén, 1933 and *L. v. viridis* (Laurenti, 1768).

In Bulgaria, *Lacerta viridis* is one of the most widespread and common lizard species (Beshkov and Nanev, 2002; Stojanov et al., 2011), which inhabits various habitats (Vacheva et al., 2020) up to 1200 m elevation, and rarely up to 1800 m at the southern parts of the country (Petrov, 2007). *L. viridis* is present in Bulgaria with two subspecies: *L. v. viridis* in North-

Western Bulgaria, and *L. v. meridionalis* in the South-Eastern parts of the country; the two taxa have a wide contact zone, where individuals with mixed features were detected. It can reach up to 135 mm snout-vent length (SVL), with a total length of up to 400 mm (Stojanov et al., 2011). In *L. viridis* typically males are the larger sex and display well pronounced sexual size dimorphism – males have larger total length, larger head size and longer limbs (Grozdanov and Tzankov, 2004).

Typically, the maximal given body size is around 130 mm SVL (i.e., Arnold and Ovenden, 2002 or Speybroeck et al., 2016). Lehrs (1910) gives a maximal SVL = 136 mm for a female from Basel, Switzerland and SVL = 134 mm for a female from Bolzano, Italy. Nevertheless, according to the later taxonomic changes, both individuals may refer to *L. bilineata*. For another female from Villach, Austria, which probably may be attributed to *L. viridis*, the author gives SVL = 134 mm. Similar sizes were given in Nettmann and Rykena (1984) but is not clear to which species they can be assigned. Rykena et al. (2002) give maximal SVL at 138 mm and tail length at 269 mm (total length = 407 mm) for male, and SVL 134 mm and tail length 212 mm for female *L. v. guentherpetersi* from Euboea, Greece. In this study, we report a new maximum body size record for *Lacerta viridis*.

On 14 July 2021, during a field trip in Stara Planina Mts. at Vrachanski Balkan Nature park, above “Borov kamak” waterfall (43.1451° N, 23.5023 ° E, 1092 m elevation), an adult male *Lacerta viridis viridis* was observed and captured (Fig. 1) with SVL of 150 mm and total length 420 mm. The individual inhabited an open upland meadow near a dirt road, and the area is surrounded by beech forest. The area is close to an abandoned copper quarry. The specimen was captured, measured and photographed, then released at the exact site. Measurements were taken with a transparent ruler (to the nearest 0.5 mm) and digital calliper (to the nearest 0.01 mm); weight was measured with a digital scale with 0.1 g precision. All of the measurements are given in Table 1. To our knowledge, this is the longest

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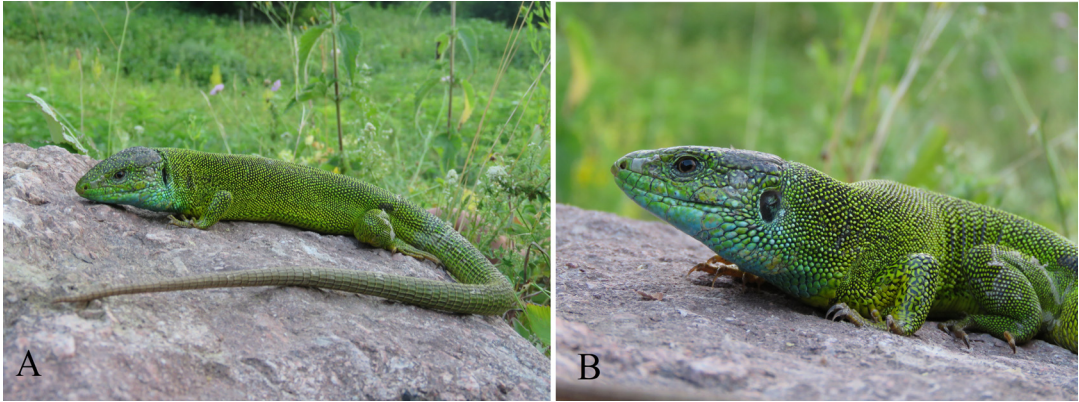


Figure 1. Photographs of male *Lacerta viridis* in situ from „Vrachanski Balkan“ Nature park, NW Bulgaria (A). Closer view of the same individual *Lacerta viridis* (B). Photos by Emiliya Vacheva.

L. viridis, as well as the heaviest specimen documented not only for Bulgaria but from the whole of its range.

A possible explanation for the larger size of the captured specimen may be referred to the higher altitude at which it was found (around 1100 m elevation), since some lizards follow Bergmann's rule, according to which they achieve larger body size at higher latitudes (Zamora-Camacho et al., 2014). Differences in mean body size between populations at altitudinal gradient were documented for some agamids (Ergül et al., 2014), geckos (Altunışık et al., 2022), as well as in some lacertids (Iraeta et al., 2006; Roitberg and Smirina, 2006b). Lizards body size and growth rate depends on several environmental factors like temperature (Díaz, 1996; Angilletta, 2009), microhabitat (Capula et al., 2009), altitude (Iraeta et al., 2006), as well as prey availability (Dunham, 1978; Olsson and Shine,

2002), presence/absence of predators (Ballinger, 1979; Roitberg and Smirina, 2006a) or inter- and intraspecific competition (Sagonas et al., 2017). At higher altitudes the activity period is shorter, due to unfavourable thermal conditions, and in many cases the food availability is scarce (Amat et al., 2008). Despite the decrease in temperature with increasing altitude and scanty food sources, fewer predators are observed at higher altitudes which also may benefit larger size and longevity in lizards (Domínguez-Godoya et al., 2020). In addition, to reduce the climatic restriction some species display faster growth rates in cooler/higher areas (Caley and Schwarzkopf, 2004; Iraeta et al., 2006), and bigger size gives the advantage to the thermoregulation (Stevenson, 1985; Díaz, 1996). We recommend further research on mountain populations of the species to support these assumptions.

Table 1. Some morphometric measurements from the adult male *Lacerta viridis*. Legend: SVL – snout-vent length, TL – tail length, Tot.L – total length, PL – pileus length, HL – head length, HW – head width, and W – weight.

Measurements	<i>L. viridis</i>
SVL	150 mm
TL	270 mm
Tot.L	420 mm
PL	34.02 mm
HL	32.28 mm
HW	23.49 mm
W	89.32 g

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