

## Balkan green lizard, *Lacerta trilineata* (Squamata: Lacertidae): a new member for the Serbian herpetofauna

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The Balkan green lizard (*Lacerta trilineata* Bedriaga, 1886) is the largest species within the genus *Lacerta*, reaching up to 16 cm snout-vent length (SVL) and 50 cm total length (Speybroeck et al., 2016). It is distributed from northern Croatia along the Adriatic coast (including many islands) to Albania, North Macedonia, Greece (including several of the larger Ionian and Aegean islands, Dodecanese and Crete), Bulgaria, south-eastern Romania, and western Anatolia (Speybroeck et al., 2016). Recently, *Lacerta trilineata* was revealed to be a species complex, and some subspecies being elevated to the species level (Kornilios et al., 2020). Although *L. trilineata sensu stricto* was recorded in the neighbouring regions of the surrounding countries, its presence has not been officially recorded in Serbia so far.

Up to this study, a total of 25 reptile species, eight of which are lacertid lizards, have been officially recorded in Serbia (Tomović et al., 2014; Urošević et al., 2015, 2020). Several Mediterranean species have been recorded in Serbia, especially in the southern and south-eastern parts of the country: *Podarcis erhardii*, *Testudo graeca*, *Platyceps najadum*, *Elaphe quatuorlineata* (Crnobrnja-Isailović and Aleksić, 1999;

Ristić et al., 2006; Ralev et al., 2013; Tomović et al., 2004, 2019). Due to climatic Mediterranean influences from North Macedonia, along the river valleys of Vardar and its tributaries (Radovanović, 1964; Tomović et al., 2004), that penetrate into southern Serbia, the region can possibly host additional Mediterranean species of reptiles, such as *L. trilineata* (Sterijovski et al., 2014; Tomović et al., 2014; Urošević et al., 2015). The southern and south-eastern parts of Serbia (valleys of the rivers Pčinja and Moravica) are regions with the highest national reptile diversity in Serbia (Tomović et al., 2015). The Valley of Pčinja River is a well-known corridor for Mediterranean species which spread from North Macedonia to the north (Radovanović, 1964). It is also an important herpetological area in Serbia and the Balkan Peninsula (Džukić, 1995; Tomović et al., 2014), with particular importance for marginal populations of Mediterranean reptile species. This study aimed to check the potential habitats for *L. trilineata* and detailed inspection of all captured individuals of green lizards.

During field research in spring and summer of 2021, within the national project for the establishment of a Natura2000 network in Serbia, we performed intensive faunistic studies in the south-eastern (Starac Mt., Kozjak Mt. and valley of Pčinja river) and southern (Rujan Mt., Karadag Mt. and valley of Moravica river) border areas of Serbia. Individuals of green lizards (*Lacerta* spp.) were captured and taxonomic characters were carefully checked using field guides (Arnold and Oviden, 2002; Speybroeck et al., 2016). Particularly, presence of brightly yellow coloured throat and sides of the head in adult animals, a large number of temporal scales, rostral scale touching the nostril and presence of a vertebral line in juveniles, were used as diagnostic characters. Due to the variation in morphology, we regarded only those animals with a combination of two or more characters as *L. trilineata* (Arnold and Oviden, 2002; Speybroeck et al., 2016). The lizards were caught by hand, and after checking their characters and taking photos they were released at the exact location of capture. For all

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**Table 1.** Precise information about field records of *Lacerta trilineata* in Republic of Serbia (v. – village).

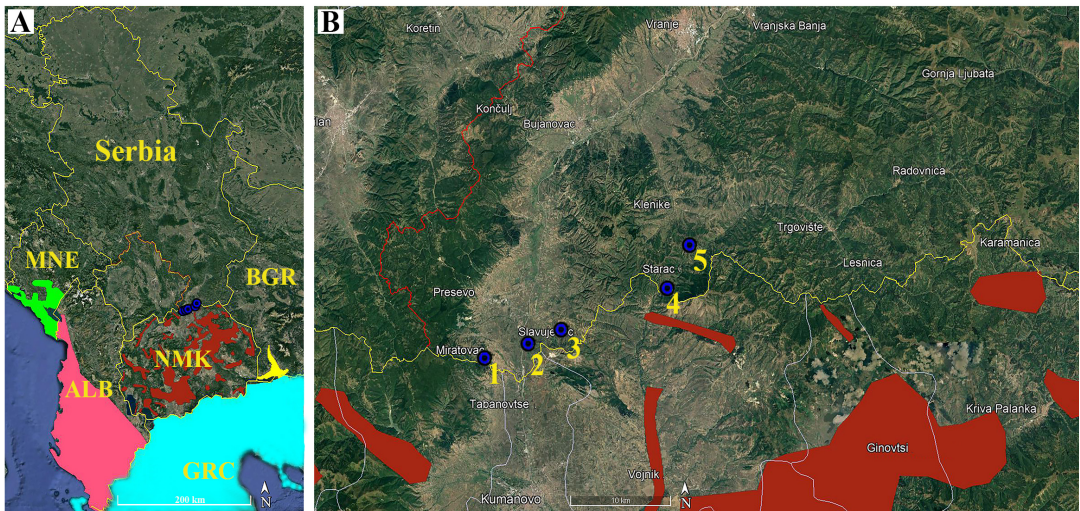
ID	Broad locality	Precise locality	N	E	Elev.	Sex	Date	Type	Legator
1	Karadag Mt.	v. Miratovac	42.2531	21.6569	619	female	15 June 2021.	specimen	V. Bjelica
2	Rujan Mt.	v. Mamince	42.2651	21.7098	454	female	13 June 2021.	roadkill	G. Danon
3	Rujan Mt.	v. Slavujevac - v. Strezovac	42.2769	21.7499	546	female	13 June 2021.	photo	M. Anđelković
4	Starac Mt.	v. Starac	42.3127	21.8798	411	female	30 July 2010.	photo	A. Urošević
5	Starac Mt.	v. Vogance	42.3507	21.9078	728	juvenile	18 April 2021.	photo	V. Lakušić

individuals, we recorded geographical coordinates, habitat types, age, and sex; we collected tips of the tails for future genetic research. Additionally, we double-checked all individuals of green lizards from southern and south-eastern Serbia deposited in the Herpetological Collection of the Institute for Biological Research “Siniša Stanković” (Džukić et al., 2017) (Table 1), as well as photographs taken during previous faunistic studies at the abovementioned geographic regions. We did not find *L. trilineata* in the Herpetological Collection, however, among the photographs taken during previous faunistic studies we found one individual of *L. trilineata* (Table 2, ID 4).

During field research, individuals of *L. viridis* were found in all localities, while individuals of *L. trilineata*

were found in only five localities (Fig. 1; Table 1). In each explored locality, we found only one or few individuals of *L. trilineata*; all specimens (except one) were adult females (Fig. 2). The individuals were found in open or degraded habitats near a large shrub or a tree, while one individual was killed on the road. Based on field impressions, we noticed that individuals of *L. viridis* were far more abundant than individuals of *L. trilineata* and that they occurred in more densely vegetated microhabitats, with less open areas and more shrub and degraded oak cover.

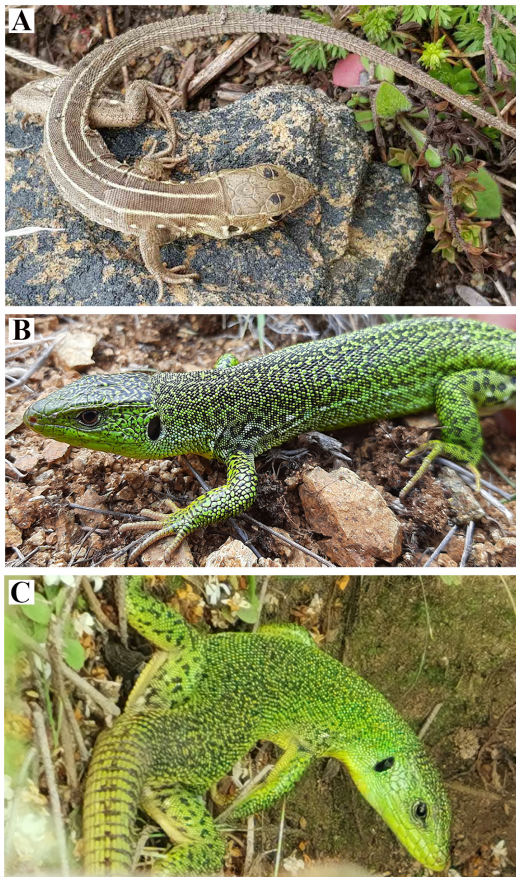
Despite recent faunistic research in southern and south-eastern parts of Serbia (Tomović et al., 2015, 2019; Urošević et al., 2015) as well as in North Macedonia next to the Serbian border (the closest findings in



**Figure 1.** Records of *Lacerta trilineata* (Bedriaga, 1886) in Serbia and neighbouring countries. Our records positioned on a map of Serbia (blue circles) and distribution in North Macedonia (Sterijovski and Arsovski, 2020 - red polygons), Montenegro (Ljubisavljević et al., 2018 - green polygons), Albania (Haxhiu, 1998 - pink polygons), Greece (Speybroeck et al., 2016 - light blue polygons), Bulgaria (Biserkov et al., 2007 - yellow polygons) (A); and Detailed map of the analysed area (B): Karadag Mt, v. Miratovac (1), Rujan Mt., v. Mamince (2), Rujan Mt., v. Slavujevac - v. Strezovac (3), Starac Mt., v. Starac (4), Starac Mt., v. Vogance (5).

**Table 2.** Double-checked individuals of green lizards from southern (S) and south-eastern (SE) Serbia deposited in the Herpetological Collection of the Institute for Biological Research “Siniša Stanković” (Džukić et al., 2017).

Collection number	Species	Country	Region	Locality 1	Locality 2	Date	Legator	No. of specimens
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	21 August 1994	G. Džukić, M. Kalezić	7
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	20 June 1996	G. Džukić, M. Kalezić, J. Crnobrnja Isailović	4
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	11 April 2004	Lj. Tomović, R. Ajtić	2
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	27 April 2000	Lj. Tomović, R. Ajtić	1
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	17 June 2009	M. Kalezić	1
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	Monastery Prohor Pčinjski	28 April 2000	Lj. Tomović, R. Ajtić	3
7	<i>L. viridis</i>	Serbia	SE	Starac Mt.	v. Starac	06 May 2002	Lj. Tomović, R. Ajtić	1
25	<i>L. viridis</i>	Serbia	S	Preševo	Orahovica hill	13 May 1977	G. Džukić	1
25	<i>L. viridis</i>	Serbia	S	Vranje		07 August 1958	D. Nedeljković	2
25	<i>L. viridis</i>	Serbia	S	Bujanovac	v. Biljača	17 July 1978	G. Džukić	1
102	<i>L. viridis</i>	Serbia	SE	Besna Kobila Mt.	v. Musulj	25 September 2005	G. Džukić, M. Kalezić, M. Marković	1
102	<i>L. viridis</i>	Serbia	SE	Surdulica	v. Klisura	19 May 1978	G. Džukić	1
102	<i>L. viridis</i>	Serbia	SE	Trgovište	r. Crnovska Reka	29 April 2000	Lj. Tomović, R. Ajtić	1
102	<i>L. viridis</i>	Serbia	SE	Trgovište	r. Crnovska Reka	03 May 2002	Lj. Tomović, R. Ajtić	5
102	<i>L. viridis</i>	Serbia	SE	Trgovište	v. Šaince	18 June 2009	G. Džukić	1
102	<i>L. viridis</i>	Serbia	SE	Trgovište	Vražji Kamen	04 June 1998	J. Crnobrnja Isailović, I. Aleksić	1

**Figure 2.** Photographs of juvenile individual (A) and adult females (B and C) of *Lacerta trilineata*. Photos by V. Lakušić (A), V. Bjelica (B) and M. Anđelković (C) at localities: v. Vogance, v. Miratovac v. and Slavujevac - v. Strezovac, respectively.

Serbia are 2.6 km far from the closest polygon in North Macedonia) (Sterijovski et al., 2014; Sterijovski and Arsovski, 2020), the registration of *L. trilineata* in our country was late. Likely this is given misidentifications as there is character overlap with *L. viridis*: such as body colour, number of rows of ventral scales, absence of vertebral lines in juvenile *L. trilineata*. Populations of *L. trilineata* in Serbia occur within the marginal zone of its distribution range. Apart from the geographically closest populations in North Macedonia, populations of *L. trilineata* in neighbouring Albania, Bulgaria and Montenegro are situated much further south from the Serbia borders; in the Kresna gorge in Bulgaria and along the Adriatic coast in Albania and Montenegro (Haxhiu, 1998; Biserkov et al., 2007; Ljubisavljević et al., 2018). In the places where these two species overlap, *L. trilineata* almost always replaces *L. viridis* in warmer and drier conditions, with clumps of dense vegetation more separated by open ground (Arnold, 1987). Therefore, more detailed field research is needed to assess the population and conservation status of this species, as was done for other reptile species in Serbia (Tomović et al., 2015).

The conservation status of *L. trilineata* according to the EU Habitats directive (Appendix IV), Bern convention (Appendix II) and IUCN criteria (Least

Concern) indicates that there are no major conservation threats for this species. However, some populations may be affected by habitat loss due to agricultural intensification and forest fires, as well as other pressures (Böhme et al., 2009). In Serbia, there are numerous potential anthropogenic and natural pressures for this species, such as habitat degradation, traffic or fires.

More detailed research on *L. trilineata* is needed to obtain precise distribution information, the state of populations and habitats. This work will also contribute to improving the knowledge on the distribution of other common and widespread species such as *L. viridis*, currently represented with scattered data in Serbia (Urošević et al., 2015). Data about the distribution of species are fundamental for further studies of species ecology, evolutionary biology, biogeography and especially conservation biology (Tomović et al., 2014).

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