

REPTILE SURVEY IN DINARA MOUNTAIN  
(CROATIA) REVEALED THE SOUTHERNMOST  
KNOWN POPULATION OF HORVATH'S ROCK LIZARD  
(*IBEROLACERTA HORVATHI*)

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Žagar, A., Carretero, M. A., Krofel, M., Lužnik, M., Podnar, M. & Tvrković, N.: Reptile survey in Dinara Mountain (Croatia) revealed the southernmost known population of Horvath's rock lizard (*Iberolacerta horvathi*). *Nat. Croat.*, Vol. 23, No. 1, 235–240, 2014, Zagreb.

The article presents results from a reptile survey conducted between 14 and 16 June 2013 in a montane and subalpine belt of the western part of Dinara Mountain in Croatia. The most interesting result is the southernmost finding of Horvath's Rock lizard (*Iberolacerta horvathi*). In the survey area we also recorded eight other reptile species: *Anguis fragilis*, *Lacerta agilis*, *L. viridis* sensu lato, *Podarcis muralis*, *P. melissellensis*, *Coronella austriaca*, *Zamenis longissimus*, and *Vipera ammodytes*.

**Keywords:** reptiles, Horvath's Rock lizard, *Iberolacerta horvathi*, Dinara Mt., Croatia

Žagar, A., Carretero, M. A., Krofel, M., Lužnik, M., Podnar, M. & Tvrković, N.: Otkriće najjužnije populacije velebitske gušterice (*Iberolacerta horvathi*) tijekom istraživanja gmazova planine Dinare (Hrvatska). *Nat. Croat.*, Vol. 23, No. 1, 235–240, 2014, Zagreb.

U radu su iznijeti rezultati istraživanja gmazova između 14. i 16. lipnja 2013. godine u gorskom i pretplaninskom pojasu zapadnog dijela planine Dinare u Hrvatskoj. Najznačajniji je dosad najjužniji nalaz velebitske gušterice (*Iberolacerta horvathi*). U istraženom području zabilježeno je i osam drugih vrsta gmazova: *Anguis fragilis*, *Lacerta agilis*, *L. viridis* sensu lato, *Podarcis muralis*, *P. melissellensis*, *Coronella austriaca*, *Zamenis longissimus* i *Vipera ammodytes*.

**Ključne riječi:** gmazovi, velebitska gušterica, *Iberolacerta horvathi*, Dinara, Hrvatska

## INTRODUCTION

The Balkan Peninsula is among the areas of Europe that have been insufficiently studied, despite the high species diversity reported here, including among reptiles (Džurkić & KALEZIĆ, 2004). Currently there is no published information on the reptile fauna

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of Dinara Mountain, except a short review about a herpetological survey included in the technical report of the PINMATRA project (ŠALAMON, 2006) and a report on findings of *Vipera ursinii* (JELIĆ, 2012). References relevant to our study site and species include the first general reptile checklists in Croatia (BRELIH & DŽUKIĆ, 1974), the species list of reptiles in Croatia (TVRTKOVIĆ, 2006), and the results from the reptile surveys conducted in nearby mountain areas of inland Croatia (MRŠIĆ, 1978; TVRTKOVIĆ, 1984; MRŠIĆ, 1987, TVRTKOVIĆ & KLETEČKI, 1993; SCHMIDTLER, 1999). None of them reveal the finding of Horvath's rock lizard on Dinara Mountain.

The distribution of Horvath's rock lizard (*Iberolacerta horvathi* Méhely, 1904) in its southern range was investigated by DE LUCA (1989), but the boundaries of the species distribution remain obscure. Current data show that the species is distributed from the pre-alpine and alpine part of north eastern Italy (BISCHOFF, 1984; LAPINI *et al.*, 2004; RASSATI, 2010), north western Slovenia (KROFEL *et al.*, 2009) and southern Austria (BISCHOFF, 1984; CABELA *et al.*, 2007) to the submontane, montane and subalpine part of the Dinaric Mountains of central and southern Slovenia (Notranjska, Kočevska) and northwestern Croatia (Mt Učka, Gorski kotar, Lika and Mt Velebit) (BISCHOFF, 1984; DE LUCA, 1989; KROFEL *et al.*, 2009). Dinara is a mountain range close to the currently known southernmost location of *I. horvathi* on Mt Poštak (DE LUCA, 1989) and represents a potential area for the presence of this lacertid species. DŽUKIĆ (1991) suggested Mt Dinara as a possible location for the westernmost record of another high-montane rock-dwelling lizard, the Mosor rock lizard (*Dinarolacerta mosorensis* Kolombatović, 1886).

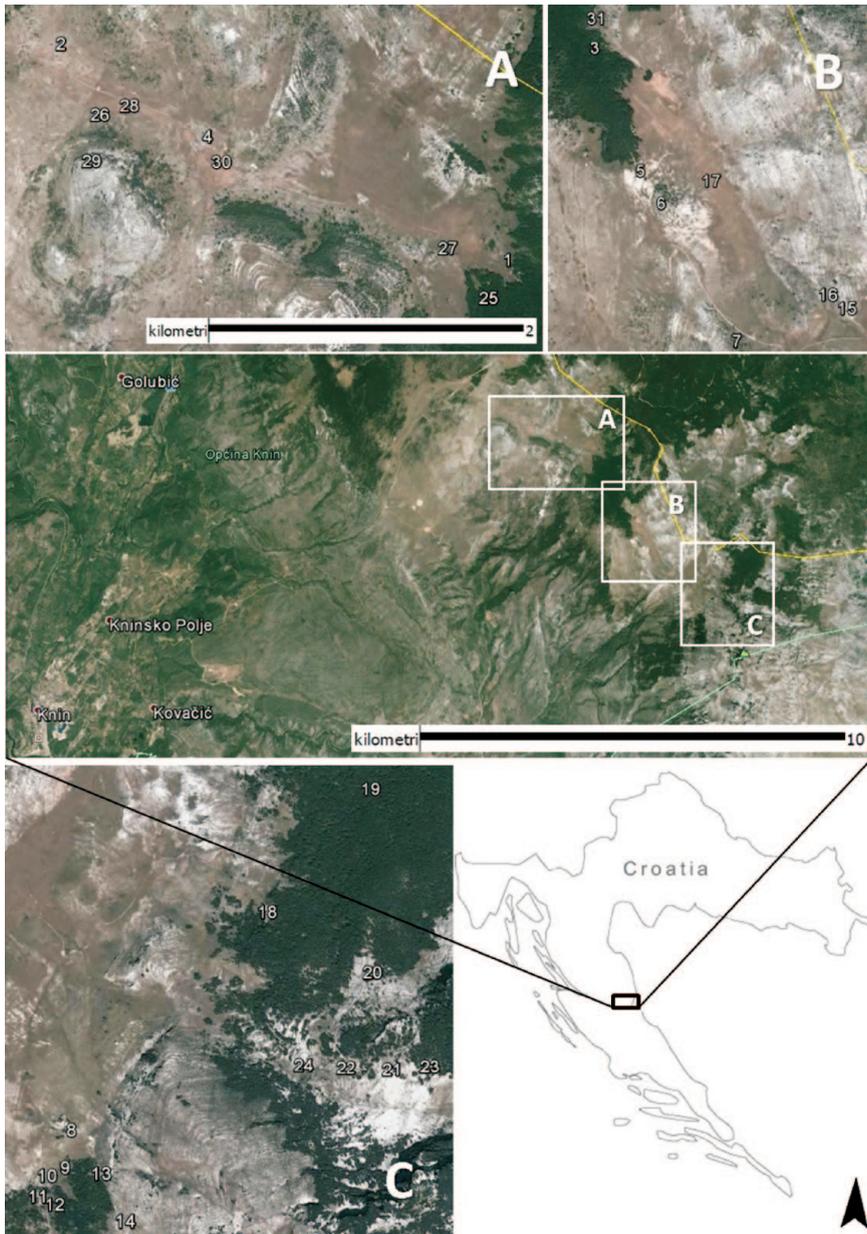
The Dinara Karst mountain chain extends over 100 km and it is situated in the central part of the Dinaric Mountains. It forms a long natural limestone wall between the Mediterranean and the Alpine bioregion. TVRTKOVIĆ *et al.* (2012) suggested it may be potentially rich in biodiversity, but the fauna of this mountain range is still far from being well-researched.

## STUDY AREA AND METHODS

Between 14<sup>th</sup> and 16<sup>th</sup> June 2013 the authors conducted a reptile survey in parts of Dinara Mountain on the Croatian side of the border at altitudes between 830 and 1530 m a.s.l. (Fig. 1). Visual search for all reptile species was conducted during the day, from approximately 10 a.m. until 6 p.m., when environmental temperatures were suitable for reptile activity. For each reptile sighting the geographical coordinates and provisional altitude were recorded using a handheld GPS. More precise altitude data was obtained from digital cartography. Reptiles that were caught during our survey were photographed and released on site. For two species, Horvath's rock lizard and the common wall lizard (*Podarcis muralis*), caught at locality 8, we also measured snout-vent length (SVL to the nearest 0.1 mm) using callipers. For all other individuals, only species and locality were recorded.

## RESULTS

In total, we recorded 56 individuals of nine reptile species at 31 localities (Tab. 1, Fig. 1). The most common species were the common wall lizard (25 individuals) and the Sand lizard (*Lacerta agilis*) (12 ind.). The first was found on rocks and walls and the second was most common on the ground, either in grass or shrubs. From each of four other lizard species we found five or less individuals. Three snake species were found; one individual per locality.



**Fig. 1.** Map of the area surveyed for reptiles between June 14 and 16, 2013 on Dinara Mountain (Croatia). Numbers correspond to localities in Tab. 1.

The most interesting were the findings of Horvath's rock lizard (Fig. 2) - previously not known to be present in the region. Here we report the southernmost locality for this species known so far (Loc. 8 on Fig. 1.C.), which was a rocky outcrop at the elevation of 1527 m a.s.l. We found one juvenile (SVL = 26.6 mm), one female (SVL = 61.6 mm) and

**Tab. 1.** Overview of species, with numbers of adults, subadults, juveniles, and localities, recorded during reptile survey on Dinara Mountain (Croatia) between June 14–16, 2013.

Common name Latin name	Adults (N)	Sub-adults (N)	Juveniles (N)	TOTAL IND.	Localities (correspond to numbers on Fig. 1)
Slow worm <i>Anguis fragilis</i>	1	1		2	4, 19
Horvath's rock lizard <i>Iberolacerta horvathi</i>	3		1	4	8
Sand lizard <i>Lacerta agilis</i>	14	1		15	7, 9, 10, 11, 13, 14, 17, 19, 23, 24, 27, 31
Green lizard <i>Lacerta viridis sensu lato</i>	2			2	28, 30
Dalmatian wall lizard <i>Podarcis melisellensis</i>	3			3	1, 5, 6
Common wall lizard <i>Podarcis muralis</i>	20	4	2	26	2, 3, 8, 9, 12, 15, 18, 20, 21, 22, 23, 25, 26, 29, 31
Smooth snake <i>Coronella austriaca</i>	1			1	1
Nose-horned viper <i>Vipera ammodytes</i>	2			2	8, 13
Aesculapian snake <i>Zamenis longissimus</i>		1		1	16
<b>TOTAL</b>	<b>46</b>	<b>7</b>	<b>3</b>	<b>56</b>	



**Fig. 2.** Photographs of right and dorsal sides of a female (above) and male (below) Horvath's rock lizard (*Iberolacerta horvathi*) found on Dinara Mountain (Croatia).

two males (SVL = 51.9/55.3 mm). In the same spot (in syntopy) we also found five individuals of common wall lizard, from which we caught one female (SVL = 54.5 mm) and one male (SVL = 55.0 mm).

## DISCUSSION

The results of our survey represent the first published detailed documentation of the reptiles in this area. The shortness of the survey period and time of survey (June) restricted the inventory to nine species of reptiles. Others (*Algyroides nigropunctatus*, *Dalmatolacerta oxycephala*, *Lacerta trilineata*, *Pseudopus apodus*, *Elaphe quatuorlineata*, *Malpolon insignitus*, *Natrix natrix*, *Zamenis situla*, *Vipera ursinii* and *Vipera berus*) are likely to occur but were not found. As we expected, the small lacertids were the most common (the highest number of localities and individuals found) and snakes were found only occasionally. Our survey suggests that the most common lizards are the common wall lizard and the Sand lizard that were both found (sympatrically) across the surveyed area. Dalmatian wall lizards (*Podarcis melisellensis*) and green lizards (*Lacerta viridis* sensu lato) were found only at localities below 1250 m a.s.l. No exact species determination of the green lizards found was possible because we did not have the possibility to perform genetic analysis and adults cannot be distinguished merely on the basis of morphology (BÖHME *et al.*, 2006). The most unexpected and interesting result was the new finding of the southernmost known population of Horvath's Rock lizard.

Horvath's rock lizards were found only at one locality despite intensive search in the vicinity, to the west and north of the site's rocky outcrop and about half a kilometre east. We assume that additional areas at higher elevation could be occupied by this species, especially south-east of the peak Dinara, since the mountain range continues in this direction. Additional detailed field surveys should be conducted in this area, as well as on the Bosnian side of the border to further resolve the southern distribution range of this species. The species occurs in this locality in syntopy with the common wall lizard, which has been reported to be frequent through most of the range of Horvath's rock lizards (e.g. TIEDEMANN, 1997; ŽAGAR *et al.*, 2013). Certainly, previous records of *Dalmatolacerta oxycephala* (ŠALAMON, 2006) on the same mountain and the promising results of this small survey emphasize the importance of the Dinara region in terms of (reptile) biodiversity and suggest the need for new, more intensive searches to be carried out.

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## REFERENCES

- BISCHOFF, W., 1984. *Lacerta horvathi* Méhely 1904 - Kroatische Gebirgseidechse: pp. 265-289. In: BÖHME, W. (ed.). Handbuch der Reptilien und Amphibien Europas, Bd 2/I, Echsen (Sauria) II, Lacertide II (Lacerta). Wiesbaden (Aula).

- BÖHME, M. U., FRITZ, U., KOTENKO, T., DŽUKIĆ, G., LJUBISAVLJEVIĆ, K., TZANKOV, N. & BERENDONK, T. U., 2006: Phylogeography and cryptic variation within the *Lacerta viridis* complex (Lacertidae, Reptilia). Zool. Scr. 1-13.
- BRELIH, S. & DŽUKIĆ, G., 1974: Catalogus Faunae Jugoslaviae. Academia Scientiarum et Artium Slovenica, Ljubljana.
- CABELA, A., GRILLITSCH, H. & TIEDEMANN, F., 2007: Habitat preferences of co-occurring *Podarcis muralis* (Lacertidae, Reptilia) and *Iberolacerta horvathi* (Lacertidae, Reptilia) (Squamata: Sauria: Lacertidae). Herpetozoa, 19 (3/4), 149-160.
- DE LUCA, N., 1989: Taxonomic and biogeographic characteristics of Horvath's rock lizard (*Lacerta horvathi* Méhely, 1904 Lacertidae, Reptilia) in Yugoslavia. Scopolia, 18, 1-48.
- DŽUKIĆ, G., 1991: Amphibians and Reptiles, Materials to the fauna of Durmitor Mountain's amphibians and reptiles (Amphibia – Reptilia), 9-76. In: NOVEILLER, G. et al. (eds.), The Fauna of Durmitor, 3. Crnogorska akademija nauka i umjetnosti, posebna izdanja, knj. 24, Odeljenje prirodnih nauka, knj. 15, Titograd.
- DŽUKIĆ, G. & KALEZIĆ, M. L., 2004: The biodiversity of amphibians and reptiles in the Balkan peninsula. pp. 167-192. In: GRIFFITHS, H. I., KRVIŠTUFEK, B. & REED, J.M. (eds.). Balkan biodiversity: pattern and process in the European hotspot. Kluwer Academic Publishers, Netherlands.
- JELIĆ, D., 2012: Distribution and conservation of *Vipera ursinii macrops* (Méhely, 1911) in Croatia. Hyla, 2012, 44-45.
- KROFEL, M., CAFUTA, V., PLANINC, G., SOPOTNIK, M., ŠALAMUN, A., TOME, S., VAMBERGER, M. & ŽAGAR, A., 2009: Distribution of reptiles in Slovenia: a review of data collected until 2009. Natura Sloveniae, 11/2, 61-99.
- LAPINI, L., DAL'ASTA, A., LUISELLI, L. & NARDI, P., 2004: *Lacerta horvathi* in Italy: a review with new data on distribution, spatial strategy and territoriality (Reptilia, Lacertidae). Italian Journal of Zoology, 71 (1), 145-151.
- MRŠIĆ, N., 1978: A contribution to the knowledge of the taxonomy, zoogeography and ecology of the reptiles of the Velebit Mountain-chain. Dissertationes, 21/1, Academia Scientiarum et Artium Slovenica, Ljubljana, 43 pp.
- MRŠIĆ, N., 1987: Contribution to the knowledge on reptiles (Reptilia) of Biokovo. Acta Biokovica, 4, 277-306.
- RASSATI, G., 2010: A contribution to the knowledge of the distribution of Horvath's rock lizard *Iberolacerta horvathi* and Common wall lizard *Podarcis muralis* in the Friuli Venezia Giulia and in the Veneto regions (North-eastern Italy). Atti Mus. Civ. Stor. nat. Trieste, 54, 133-146.
- SCHMIDTLER, J. F., 1999: Notes on the altitudinal distribution of lizards and some other reptiles on mount Biokovo (Croatia) and its immediate surroundings. Natura Croatica, 8, 223-237.
- ŠALAMON, D., 2006: Reptiles, 53-54, In: TVRTKOVIĆ, N. & VEEN, P. (eds.). The Dinaric Alps Rare Habitats and Species, A Nature Conservation Project in Croatia, CHNM et KNNV, Zagreb.
- TIEDEMANN, F., 1997: *Lacerta horvathi* Méhely, 1904: pp. 244-245. In: GASC, J.P., CABELA, A., CRNOBRNJA-ISAILOVIĆ, J., DOLMEN, D., GROSSENBACHER, K., HAFFNER, P., LESCURE, J., MARTENS, H., MARTINEZ RICA, J.P., MAURIN, H., OLIVEIRA, M.E., SOFIANIDOU, T.S., VEITH, M. & ZUIDERWIJK, A. (eds.), Atlas of Amphibians and Reptiles in Europe (IEGB/SPN). SEH & Muséum National d'Histoire Naturelle, Paris.
- TVRTKOVIĆ, N., 1984: Altitudinal distribution of amphibians, reptiles and mammals (Amphibia, Reptilia, Mammalia) in the Northern Velebit Mt. (Hrvatska, Jugoslavija), pp. 403-407. In: DRZDAREVIĆ, M. (ed.): III kongres ekologija Jugoslavije, Sarajevo, 24-30, Knjiga I (short communications and abstracts), Sarajevo.
- TVRTKOVIĆ, N. (ed.), 2006: Red book of amphibians and reptiles of Croatia. State Institute for Nature Protection, Ministry of Culture, Republic of Croatia, Zagreb, pp. 94.
- TVRTKOVIĆ, N. & KLETEČKI, E., 1993: Preliminary investigations on terrestrial vertebrates of Biokovo Mt. Acta Biokovica, 6, 11-18.
- TVRTKOVIĆ, N., ŠAŠIĆ, M., MIHOCI, I., VUKOVIĆ, M. & BJELIĆ, M., 2012: Review of the butterfly fauna (Hesperioidea & Papilionoidea) of the Dinara mountain range. Natura Croatica, 21 (2), 471-481.
- ŽAGAR, A., KOS, I. & VREZEC, A., 2013: Habitat segregation patterns of reptiles in Northern Dinaric Mountains (Slovenia). Amphibia-Reptilia, 34, 263-268.