

## New distribution records for the Aesculapian snake *Zamenis longissimus* in Greek Thrace

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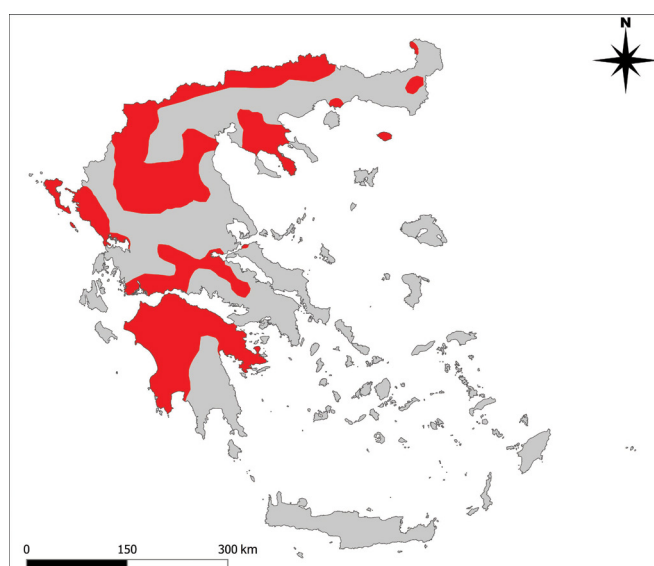
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The Aesculapian snake *Zamenis longissimus* (Laurenti, 1768) is widely distributed in Europe from north-eastern Spain through central and southern Europe to the Caspian Sea, northern Asia Minor and Caucasus region, with many isolated populations in Britain, Czech Republic, Germany, Poland, Ukraine, south-western Russia, and Elba Island (Italy), while its presence in Sardinia is disputed (Musilová et al., 2010; Di Nicola, 2020). In Greece, the species has been found in various parts of the mainland including the Peloponnese (Fig. 1), Samothraki island in the Aegean sea, and the islands of Corfu and Paxos in the Ionian Sea (Valakos et al., 2008; Stille & Stille, 2017; Pafilis & Maragou, 2020), while recently it was also confirmed in the north part of Euboea island (Strachinis, 2021). The species prefers woodland areas, especially deciduous forests, however it can be found in many habitat types, provided there is dense vegetation, shrubs, maquis, open forests, and thickets. It tends to frequent humid places, from sea level up to an altitude of 2,000 m (Valakos et al., 2008; Geniez, 2018).

The geographical region of Greek Thrace is located in the north-eastern part of Greece; bordering the Marmara Region (Turkey) to the east, and Eastern Macedonia (Greece) to the west, the Aegean sea to the south, and south-central Bulgaria to the north (Fig. 2). The region of Thrace consists of three prefectures (Xanthi, Rhodope and Evros), with a total area of 8,578 km<sup>2</sup> and is mainly characterised by lowland areas (46.2 %) followed by mountainous (28.5 %) and semi-mountainous (25.3 %) areas. Most of its land is covered by agro-pastoral (cultivations and pastures) activities (61 %), forests (32.3 %), and wetlands (2.6 %) (NSSG, 1995). There have been some herpetological surveys in Thrace, in which a total of 15 amphibian and 31 reptile species have been recorded (Valakos et al., 2008; Cattaneo & Cattaneo, 2014; Georgiev & Mollov, 2016; Cattaneo, 2017; Pafilis & Maragou, 2020; Christopoulos & Kotselis, 2021; Christopoulos, 2022). Most of these species occur in all three of the prefectures, while some are limited to one or two of them. The Aesculapian snake has been recorded in the Xanthi and Evros prefectures. According to the literature and our knowledge, in Xanthi the species is known from the Nestos River Delta, and in Evros it has been located in two areas: in the north-western part and in the wider area of the Dadia-Lefkimi-Soufli Forest

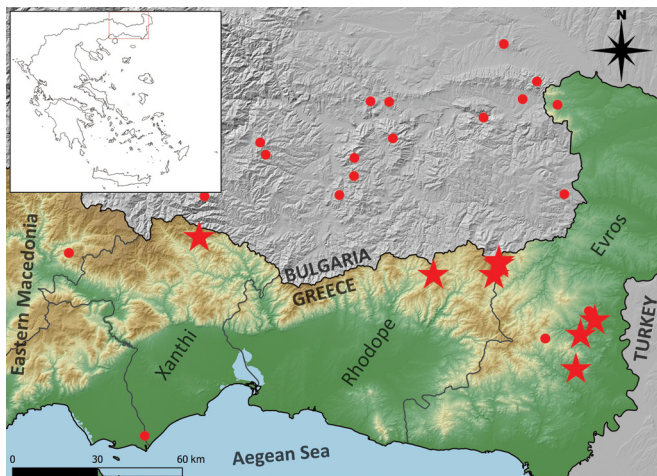


**Figure 1.** Map of Greece showing confirmed areas of distribution (in red) of the Aesculapian snake *Zamenis longissimus*

in the central part of the prefecture. Here, we report the Aesculapian snake for the first time from Rhodope prefecture in two locations, as we have also identified it in new locations of Xanthi and Evros prefectures.

In spring–summer 2021 and 2022, we undertook small-scale herpetological surveys in several areas of the three prefectures of Greek Thrace region. To locate the animals, we used line transects combined with searching for possible shelters and sunny spots that are frequently used by reptiles for basking. Furthermore, snakes were detected both on asphalt and on dirt roads when we were travelling by car. On roads, we recorded both alive and roadkill specimens. In all cases, we noted total length (TL) and snout-vent length (SVL), as well as the weather conditions, a brief habitat description, and geographical co-ordinates. Some specimens that were found dead on roads were collected and preserved in 96 % ethanol.

We found a total of eight specimens (Table 1) from widely ranging locations (Fig. 2), with the very first records for the Rhodope prefecture. Full details, including habitat descriptions and weather conditions, are given in Table 15



**Figure 2.** Location of Greek Thrace in Greece (inset) and map of the three prefectures of Greek Thrace and the areas it borders. The red stars show the localities where we found *Zamenis longissimus*, and the red dots show some other published records close by in Greece and Bulgaria. The records in Rhodope are the first for this prefecture.



**Figure 4.** Detail of the axanthic juvenile *Zamenis longissimus*, next to Hilia Plateau (#5, see Table 1)



**Figure 3.** Photographic documentation of the *Zamenis longissimus* individuals found in Greek Thrace (specimen numbers refer to Table 1) - **A.** Young road-killed specimen within the protected area of Lefkimmi forest (#1), **B.** Subadult road-killed snake between the villages of Organi and Smigada, dorsal and **C.** ventral view (#2), **D.** Juvenile individual, within the protected forest of Dadia (#3), **E.** Adult individual between the villages of Dadia and Giannouli (#4), **F.** Juvenile individual (axanthic) within the protected area of Mountainous Evros-Dereio Valley, next to Hilia Plateau (#5), and **G.** A road-killed juvenile snake in the same area (#6). **H.** Juvenile individual within the protected area of Filiouris River Valley, close to the village of Kechros (#7)

(see Supplementary Material). Photographs of seven of the eight specimens recorded are given in Figure 3.

Our observations include new records for the Aesculapian snake in the prefectures of Xanthi and Evros, while the species is reported for the first time from Rhodope prefecture. The presence of the species in our survey area was expected, as the area falls within the species' geographical range limits and its habitat type. To the best of our knowledge, there are a large number of published records in southern Bulgaria (Petrov, 2004; Petrov et al., 2006) and some from north-eastern Greece (Valakos et al., 2008; Pafilis & Maragou, 2020) (Fig. 2).

During our survey we made two unusual observations. Two juveniles (#3 & #7, Table 1) vibrated their tails when captured. Tail vibration was recently reported for the first time in an Aesculapian snake from Bulgaria (Dyugmedzhiev, 2020) and has also been observed in the Italian Aesculapian snake *Zamenis lineatus* Camerano, 1891 (Di Nicola et al., 2022). In addition, we observed (Hilia Plateau - 16 May 2022) a young axanthic individual (Fig. 3F & Fig. 4). The typical colouration of juvenile Aesculapian snakes is brown to dark brown on the head and back, with white or pale-yellow streaks and yellow labial plates and collar (Geniez, 2018). In axanthic juveniles, the yellow colouration is absent and replaced by light grey, while the brown colouration of head and back is replaced by dark brown or black, with numerous small light markings. Axanthic colouration in Aesculapian snakes has rarely been seen in Greece, but has been reported from other countries (Zadravec & Lauš, 2011; Cattaneo, 2015).

New knowledge concerning the distribution and ecology of forest reptile species, such as the Aesculapian snake, can contribute to more appropriate and targeted actions in managing and protecting a sensitive faunal group that live in an ecosystem that is increasingly exploited, leading to deforestation, fragmentation and degradation.

**Table 1.** Aesculapian snake individuals recorded in Greek Thrace, 2021 and 2022

#	Date & time	Dimensions	Life stage	Location	Notes
1	8 May 2021 09:56 h	TL: 536 mm SVL: 445 mm	Young, road-kill	41° 2'25" N, 26° 9'54" E, 228 m a.s.l. Protected area of Dadia-Soufli Forest, Evros. About 3 km north-west of the village of Lefkimmi	Fig. 3A, specimen deposited in the first author's collection
2	10 May 2021 14:20 h	TL: 673 mm SVL: 545 mm	Subadult, fresh road-kill	41° 15'55" N, 25° 42'47" E, 582 m a.s.l. Near north-western Filiouris River valley limit	Fig. 3B & C, specimen deposited in first author's collection. Appears to be first record of the species in the prefecture of Rhodope
3	13 May 2022 19:06 h	TL: 282 mm SVL: 233 mm	Juvenile, basking on road	41° 7'22" N, 26° 10'47" E, 184 m a.s.l. Protected area of Dadia-Soufli Forest - Evros Mountains, about 3.7 km west of the village of Dadia	Fig. 3D, released where captured. Presence of the species in the area already known
4	13 May 2022 dusk	TL: 974 mm SVL: 785 mm	Adult, crossing road	41° 9'26" N, 26° 13'29" E, 95 m a.s.l. Between the villages of Dadia and Giannouli, within the same protected area as record #3	Fig. 3E, released where captured. Presence of the species in the area already known
5	16 May 2022 15:10–17:00 h	TL: 317 mm SVL: 265 mm	Juvenile, on dirt road	41° 17'28" N, 25° 55'12" E, 803 m a.s.l. North-western part of the protected area of Mountainous Evros-Dereio Valley close to the Rhodope Prefecture's borders	Fig. 3F, species not reported previously from this area of Evros
6	Ditto #5	TL: 323 mm SVL: 267 mm	Juvenile, road- killed	41° 17'54" N, 25° 55'14" E, 800 m a.s.l. Ditto #5 but about 430 m further north	Fig. 3G, ditto #5
7	16 May 2022 18:50 h	TL: 342 mm SVL: 285 mm	Juvenile, basking on road	41° 15'54" N, 25° 54'17" E, 752 m a.s.l. North-eastern part of the protected area of Filiouris River Valley, at about 5.3 km north-east of the village of Kechros	Fig. 3H. Specimen released back into its habitat. Second record of the species in the prefecture of Rhodope
8	13 July 2022 17:45 h	TL: 481 mm SVL: 398 mm	Young, road- kill in poor condition	41° 21'18" N, 24° 58'14" E, 515 m a.s.l. Northern part of the prefecture of Xanthi, in the area of Thermes settlements	Presence of the species has not been reported previously reported from this area of Xanthi

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