

Like pieces in a puzzle: first record of *Hierophis gemonensis* (Laurenti, 1768) (Reptilia Colubridae) on Skiathos island (Northern Sporades, Greece)

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ABSTRACT

The Balkan racer, *Hierophis gemonensis* (Laurenti, 1768) (Reptilia Colubridae) is a widespread colubrid snake in mainland Greece, with a rather irregular distribution across the Greek islands. Previous records from the Northern Sporades were limited to the islands of Tsougrias, Aspronisi, and Skopelos. In this note, we document the first recorded occurrence of *H. gemonensis* on Skiathos island and provide an updated assessment of its distribution within the Northern Sporades archipelago. We discuss the implications of this new record for understanding the species' biogeography in the region and the potential factors influencing its island distribution.

KEY WORDS

interspecific competition; *Hierophis gemonensis*; island biogeography; Northern Sporades.

Received 14.11.2024; accepted 06.12.2024; published online 30.12.2024

INTRODUCTION

The Aegean islands are renowned as a region of significant herpetological interest and have been the focus of numerous research papers throughout the last two centuries (Lymberakis et al., 2018). However, several gaps have yet to be filled in the distribution of certain species, highlighting the biogeographical complexity of the area. One such species is the Balkan racer, otherwise known as the Balkan whipsnake, *Hierophis gemonensis* (Laurenti, 1768), a medium-sized snake in the family Colubridae. It can reach a total length of 130 cm, with males being larger than females (Vanni et al., 2011). It is diurnal, fast-moving and euryphagous, known to feed on lizards, other snakes, mammals, small birds and arthropods (Stille & Stille, 2017). The species is endemic to the west Balkan region, ranging from the Southernmost tip of Slovenia along the Adriatic coast, down to the Southernmost point

of the Peloponnese peninsula and on Crete (Speybroeck et al., 2016). It is a rather widespread species in Greece, occurring throughout most of the country's prefectures in various habitats in inland, coastal, low and high elevation areas (Valakos et al., 2008). Although the species' easternmost range limit in mainland Greece remains poorly defined, it is seemingly absent east of the Axios (Vardar) river (Societas Hellenica Herpetologica, 2020), which may act as a biogeographical barrier. It has also been recorded from numerous Ionian and Aegean islands, such as Corfu, Kefalonia, Zakynthos, Paxos, Euboea, Aegina, Kythera and Crete, but is not found on any of the Cyclades and is not very widespread in the Northern Sporades (Chondropoulos, 1988). In the latter island group, it had previously only been recorded from two small, satellite islets of Skiathos; Aspronisi (or Aspro) and Tsougrias, as well as on the larger island of Skopelos (Foufopoulos et al., 2024).

MATERIAL AND METHODS

The Northern Sporades are a chain of islands located off the east coast of mainland Greece, belonging to the regional unit of Thessalia. Skiathos is the third largest island of the archipelago and the closest one to the mainland (Fig. 1). It is located 4.4 km east of the Pelion peninsula, from where maximum bathymetry only reaches approximately 45 m. It covers a land area of 49.8 km², has a maximum elevation of 433 m and is primarily covered by pine forests, olive groves and maquis. Skiathos is also rich in freshwater, with several streams and wetlands covering 1% of the island's total surface area (Catsadorakis & Paragamian, 2007). It also boasts the highest herpetofaunal diversity in the archipelago, holding a list of 15 recorded reptile and amphibian species (Cattaneo, 1997; Foufopoulos et al., 2024). Our visit to the island took place between 28th May and 2nd June 2024. We collected distributional records through visual encounter observations and by examining shed skins, the identification of which was made using Valakos et al. (2008) and Speybroeck et al. (2016).



Figure 1. A. Map of Skiathos, highlighting the islets of Tsougria and Aspronisi. Also shown is the finding locality (red dot) and map of the three major islands of the Sporades. Islands colored in orange are known to be inhabited by *H. gemonensis*.

RESULTS

On 28th May, at approximately 19:50h, we uncovered an individual of the species under a large rock near Megalos Aselinos beach (39.1645, 23.4216; elevation 14 m) (Figs. 2, 3). The habitat was a roadside meadow with loose, sandy soil, reed beds, tall annual herbs and occasional shrubs. It bordered a west-facing hillside covered by maquis and pine forest to the right and an intermittent stream with a riparian forest remnant and olive groves to the left. The snake was measured, photographed and released at the initial finding spot. It had a total length of 370 mm and a snout-to-vent length of 280 mm, corresponding to a juvenile individual (Lisičar et al., 2015; Stille & Stille, 2016). The coloration and pattern were typical for the species (Speybroeck et al., 2016) (Fig. 2).

On 30th May, we found a second, larger juvenile of the species under a slab of concrete in the same meadow. It was not captured, but our brief look of the snake allowed us to identify it as a distinct individual. Furthermore, we found a partial shed snake skin under a stack of roofing tiles approximately 600 m from the two juvenile individuals. The 19 rows of smooth dorsal scales at mid-body along with the lack of visible pattern led us to believe that it belonged to *H. gemonensis*, though other species, such as *Dolichophis caspius* (Gmelin, 1789), cannot be ruled out (Speybroeck et al., 2016). An additional partial shed skin, likely attributable to the same species, was found on 29th May near Mitikas peak (39.1938, 23.4686; elevation 387 m). Other reptile species found at the same localities were *Malpolon insignitus* (Geoffroy St. Hilaire, 1809), *Platyceps najadum* (Eichwald, 1831), *Lacerta trilineata* Bedriaga, 1886, *Ablepharus kitaibelii* (Bibron et Bory de St. Vincent, 1833) and *Testudo hermanni* Gmelin, 1789.

DISCUSSION AND CONCLUSIONS

The island of Skiathos has been visited by several herpetologists since the early 20th century (e.g. Werner, 1938; Bucholz & Schultze-Westrum, 1964; Bergman, 1995; Cattaneo, 1997), none of whom reported *H. gemonensis*. Grano et al.



Figure 2. Juvenile specimen of *Hierophis gemonensis* (Laurenti, 1768) from Skiathos.



Figure 3. Roadside habitat where two juvenile individuals were discovered.

(2013) speculated that competition from *Malpolon insignitus* likely plays an important role in the distribution of *H. gemonensis* in the Sporades. The species had previously been recorded from the small offshore islet of Aspronisi (Bucholz & Schultze-Westrum, 1964), located approximately 385 m from the westernmost point of Skiathos, as well as from Tsougrias islet (Grano et al., 2013), located 2.5 km southeast of Skiathos. More recently, the finding of a voucher specimen from Skopelos, deposited in the Alexander Koenig Natural History Museum of Bonn, was published in an updated checklist of the Northern Sporades herpetofauna (Foufopoulos et al., 2024).

Considering the above, as well as the occurrence of *H. gemonensis* in the adjacent Pelion peninsula (pers. obsv.), its discovery on Skiathos was expected (Bucholz & Schultze-Westrum, 1964, Grano et al., 2013, Foufopoulos et al., 2024). Therefore, our record fills a major distributional gap in the known range of the species across the Sporades, following a west to east direction. The discovery of *H. gemonensis* on Skiathos raises the number of known ophidian taxa on the island to six, a remarkable number considering the small surface area (49.8 km²). This makes Skiathos the only island in Greece with a total surface area of less than 50 km² to host more than five snake species. This is likely possible due to the island's recent connectivity (an estimated 8.5 kya) to the mainland, as a shorter time of insular isolation seems to correlate with higher herpetofaunal diversity (Foufopoulos et al., 2024). It is worth noting that *H. gemonensis* is known from several small (often less than 1 km²), rocky islets throughout Greece, e.g. in the Argo-Saronic gulf and on several islets north of Crete (Clark, 1989; Chondropoulos, 1989). It is therefore plausible that the species is present on more islets of similar size in the Sporades, such as Arkos (south of Skiathos) and Dasia (south of Skopelos), where no snakes have been recorded yet. On Aspronisi and Skopelos, no more than one individual of the species has been recorded from each of the two islands, unlike on Tsougrias, where multiple individuals have been found. It is consequently critical to confirm their presence there, since both discoveries originate from the 1950s, with no subsequent records made since.

It is well-documented that species which inhabit matching ecological niches can exhibit 'checkerboard distributions' on small islands, where competitive interspecific relationships, combined with a small land area, do not allow competing species to occur in sympatry (Foufopoulos et al., 2024). However, the co-occurrence of *Hierophis gemonensis*, *Malpolon insignitus*, and *Platyceps najadum* – three species exhibiting strikingly similar life histories (Valakos et al., 2008) – within the same microhabitat on Skiathos is noteworthy. This assemblage may suggest that niche partitioning is employed to mitigate interspecific competition, as has been observed in other island ecosystems characterized by limited resource availability (Luiselli, 2006). Additionally, Cattaneo (1997) also proposed that niche partitioning likely occurs on this island, specifically noting that *Malpolon insignitus* and *Elaphe quatuorlineata* (Lacépède, 1789) exhibit complementary patterns of activity and dietary preferences. On the other hand, it is important to note that on 'younger', more productive islands, interspecific competition between competing species can be reduced by the abundance of resources, allowing them to coexist in overlapping niches without significant partitioning (Chesson, 2000). Young islands often experience high primary productivity and resource availability, as they are characterized by relatively early stages of ecological development and may have lower levels of resource limitation compared to older, more ecologically stabilized islands (Foufopoulos et al., 2024). This can explain the evident absence of *H. gemonensis* from Alonissos and its satellite islets, which belong to an 'older' part of the Northern Sporades island chain (i.e. approximately 15 kya of isolation for Alonissos and >200 kya for Skantzoura; Kalb, 2021). In that part of the archipelago, strong selective pressure would be exerted by *Dolichophis caspius* (Gmelin, 1789), a closely related colubrid (Nagy et al., 2004), the diet and life history of which seems to have significant overlap with that of *H. gemonensis* (Valakos et al., 2008; Stille & Stille, 2016). Extensive ecological studies should be conducted in order to better understand the niche selection and interspecific interactions between insular snake communities, especially on smaller islands. Finally, it is apparent that despite the vast literature on the herpetofauna of the Greek islands, new records are

still being made on a regular basis (e.g. Christopoulos et al., 2019; Sindaco & Rossi, 2020; Strachinis, 2022; Kalogiannis & Stefanopoulos, 2023; Grano et al., 2024), further indicating that additional scrupulous surveys, even in previously studied areas, are imperative.

REFERENCES

- Bergman J., 1995. Neues zur Herpetofauna der Insel Skiathos, Nördliche Sporaden, Griechenland. *Herpetofauna*, 17: 26–28.
- Buchholz K.F. & Schultze-Westrum T., 1964. Zur Kenntnis der Schlangenfauna der Nördlichen Sporaden. *Zoologischer Anzeiger*, 173: 127–136.
- Cattaneo A., 1997. L'erpetofauna dell'isola greca di Skiathos (Sporadi settentrionali). *Atti della Società Italiana di Scienze Naturali e del Museo Civico di Storia Naturale di Milano*, 136: 145–156.
- Catsadorakis G. & Paragamian K., 2007. Inventory of the wetlands of the Aegean Islands: Identity, ecological status and threats. *World Wildlife Fund for Nature – WWF Greece, Athens*, 392 pp.
- Chesson P., 2000. Mechanisms of maintenance of species diversity. *Annual Review of Ecology, Evolution, and Systematics*, 31: 343–366.
<https://doi.org/10.1146/annurev.ecolsys.31.1.343>
- Clark R., 1989. A checklist of the herpetofauna of the Argo-Saronic Gulf district, Greece. *British Herpetological Society Bulletin*, 28: 8–24.
- Christopoulos A., Verikokakis A.G., Detsis V., Nikolaides I., Tsiokos L., Pafilis P. & Kapsalas G., 2019. First records of *Eryx jaculus* (Linnaeus, 1758) from Euboea Island, Greece (Squamata: Boidae). *Herpetology Notes*, 12: 663–666.
- Chondropoulos B.P., 1989. A checklist of Greek reptiles, II. The Snakes. *Herpetozoa*, 2: 3–36.
- Foufopoulos J., Roussos S., Kalogiannis S., Kalb S., Strachinis I. & Brock K.M., 2024. The herpetofauna of the Sporades islands (Aegean Sea, Greece): New discoveries and a review of a century of research. *Herpetozoa*, 37: 231–256.
- Grano M., Cattaneo C. & Cattaneo A., 2013. First record of *Hierophis gemonensis* (Laurenti, 1867) (Reptilia Serpentes Colubridae) in the Aegean island of Tsougria, Northern Sporades, Greece. *Biodiversity Journal*, 4: 553–556.
- Grano M., Cattaneo C. & Cattaneo A., 2024. New herpetological reports for the Aegean islands of Kitriani, Telendos and Pserimos (Greece). *Ecologia Balkanica* 16: 134–139.
- Kalb S., 2021. Climatic and environmental drivers of extinction in Mediterranean island reptiles since the height of the last Ice Age. MS Thesis, University of Michigan, Ann Arbor, Michigan, United States.
- Kalogiannis S. & Stefanopoulos P., 2023. First report on the herpetofauna of Palaio Trikeri island (Pagasetic gulf, Greece). *Ecologia Balkanica*, 15: 107–111.
- Lisičar P., Lauš B., Vilaj I. & Jelić D., 2015. Distribution and Morphology of the Balkan Whip Snake, *Hierophis gemonensis* (1768, Laurenti). 12th Croatian Biological Congress, September 2015, Sveti Martin na Muri, Croatia.
- Luiselli L., 2006. Resource Partitioning and Interspecific Competition in Snakes: The Search for General Geographical and Guild Patterns. *Oikos*, 114: 193–211.
- Lymberakis P., Pafilis P., Poulakakis N., Sotiropoulos K., & Valakos E.D., 2018. The Amphibians and Reptiles of the Aegean sea. In: *Biogeography and Biodiversity of the Aegean*, Nicosia, Cyprus: Broken Hill Publishers, pp. 169–189.
- Nagy Z.T., Lawson R., Joger U. & Wink M., 2004. Molecular systematics of racers, whipsnakes and relatives (Reptilia: Colubridae) using mitochondrial and nuclear markers. *Journal of Zoological Systematics and Evolutionary Research*, 42: 223–233.
- SHH [Societas Hellenica Herpetologica], 2020. *Ατλαντας των Ερπετών και Αμφιβίων της Ελλάδας* [Atlas of Reptiles and Amphibians of Greece]. Available at: <http://herpatlas.gr>. Accessed on 9 November 2024.
- Sindaco R. & Rossi R., 2020. First report on the herpetofauna of Meganissi Island (Lefkada, Ionian Islands, Greece). *Herpetology Notes* 13: 81–84.
- Speybroeck J., Beukema W., Bok B., Van der Voort J. & Velikov I., 2016. *Field Guide to the Amphibians and Reptiles of Britain and Europe*. Bloomsbury Publishing, London, 432 pp.
- Stille B. & Stille M., 2017. *The Herpetofauna of Corfu and Adjacent Islands*. Frankfurt am Main, Germany, Edition Chimaira.
- Strachinis I., 2022. First Insights on the Herpetofauna of Ammouliani Island, Chalkidiki, Greece. *Ecologia Balkanica*, 14: 199–203.
- Vanni S., Nistri A., Lanza B. & Bressi N., 2011. *Hierophis gemonensis* (Laurenti, 1768). In: Corti C., Capula M., Luiselli L., Razzetti E., Sindaco R. (Eds), *Fauna d'Italia: Reptilia*, Vol. XLV. Edizioni Calderini de Il Sole 24 ORE, Editoria Specializzata S.r.l., Bologna, 505–509.
- Valakos E.D., Pafilis P., Sotiropoulos K., Lymberakis P., Maragou P. & Foufopoulos J., 2008. *The Amphibians and Reptiles of Greece*. Frankfurt am Main, Germany, Chimaira, 563 pp.
- Werner F., 1938. *Ergebnisse der achten zoologischen Forschungsreise nach Griechenland (Euböa, Tinos,*

Skiathos, Thasos usw.). Sitzungsberichte der Österreichischen Akademie der Wissenschaften,

Mathematisch - Naturwissenschaftliche Klasse, Wien, 147: 151–163.