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CONTRIBUTION ON THE DISTRIBUTION OF *ERYX JACULUS* LINNAEUS, 1758 (SQUAMATA: BOIDAE) IN CENTRAL GREECE, WITH NOTES ON THEIR HABITAT ATTRIBUTES

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Abstract

Due to its cryptic lifestyle, the *Eryx jaculus* is hard to detect, as a result of which is absence from many expected areas. In recent years in Greece, it has been found in several new locations, thus covering many of its distribution gaps. In this study we present for the first time the presence of the species in the prefectures of Phthiotis and Magnesia, with 12 and 1 records respectively. In addition, we considered important to give a description of the habitats in which the specimens were found, contributing to the knowledge of its habitat preference, due the species is not a fully studied in Greece.

Keywords: Magnesia, Phthiotis, Distribution, *Eryx jaculus*, First records, Habitat description

Introduction

The Erycinae (Bonaparte, 1831) is one of five subfamilies of Boidae family (Gray, 1825, Squamata) and includes three genera. One of them, the genus *Eryx* (Daudin, 1803) comprises 13 species of sand boas that occur in Europe, Africa, Asia, and Middle East (Pyron et al. 2014, Uetz et al. 2021). The javelin sand boa *Eryx jaculus* (Linnaeus, 1758) is distributed in N Africa, W Asia and SE Europe (Speybroeck et al. 2016, Geniez 2018, Uetz et al. 2021). In Greece, the species occurs throughout the mainland, the Peloponnese, on many Aegean Islands and Corfu Island on Ionian Sea (Fig. 1) (Chondropoulos 1989, Valakos et al. 2008, Pafilis & Maragou 2020, Christopoulos & Kotselis 2021).

Eryx jaculus lives in a variety of habitats including semi-desert coastal areas, dunes, rocky or sandy hills, shrublands such as Mediterranean maquis, light forests, phrygana, pastures, arable land, olive groves, and other type of dry habitats from sea level up to 1500 m altitude (Chondropoulos 1989, Valakos et al. 2008, Christopoulos et al. 2019). Difficult to observe, the species spends most of its life underground, except the breeding season and warmer periods when it moves to the surface of the ground, usually during dawn or dusk (Valakos et al. 2008, Speybroeck et al. 2016).

The reported herpetofauna of Phthiotis and Magnesia (except Sporades Archipelago) until today includes 41 and 30 terrestrial species respectively, while there are no *Eryx jaculus* mentions in either (Valakos et al. 2008, Sofianidou 2012, Pafilis & Maragou 2020, Christopoulos et al. 2021). Although Phthiotis and Magnesia are located in the middle of the mainland Greece (Fig. 2A), and adjacent with regions that hosting populations of *Eryx jaculus* (Fig. 1, 2B; Phocis; Aetoloacarnania; Larissa; Euboea), the species has never been recorded in these two prefectures (Böettger 1888, Chondropoulos 1989, Gasc et al. 1997, Valakos et al. 2008, Christopoulos et al. 2019, 2021). Here, we present the first records of *Eryx jaculus* from twelve locations on Phthiotis, and one on Magnesia (Fig. 2C).

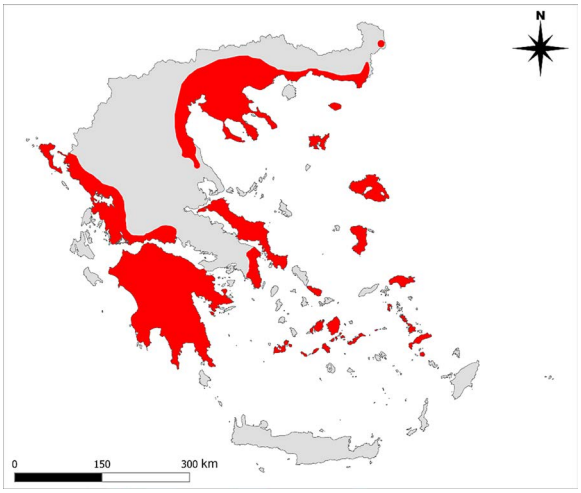

Fig 1. Map of Greece with the reported distribution of *Eryx jaculus* shown in red.

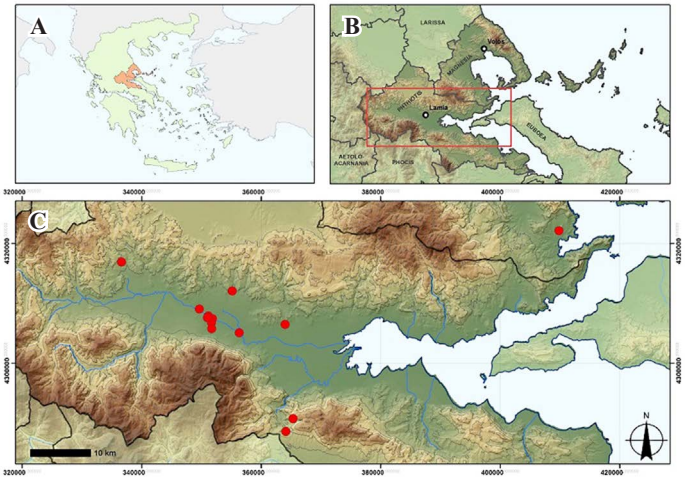

Fig 2. **A.** Location of the prefectures of Phthiotis and Magnesia in Greece (Sterea Hellas and Thessaly respectively) shown in orange. **B.** Prefectures of Phthiotis and Magnesia with their capitals and adjacent prefectures. **C.** Map with new *Eryx jaculus* records on central Greece. Red dots denote the localities where the specimens found in the two prefectures.

Material and Methods

Most of the records are opportunistic observations and traffic victims that took place in the period 2007-2020 in central Greece. Only two specimens were found during herpetological surveys by AC with the method of line transect. In most cases the snakes were photographed, while some in good condition roadkill specimens were collected, placed in ethanol 97% and deposited in the collection of AC.

Eryx jaculus, as all Boidae species, is listed in the Appendix II of CITES catalogues. Here included species which become endangered or extinct because of international trade. For the species' protection of illegal collection, we intentionally did not include the exact coordinates of the records.

Study Area

The Prefecture of Phthiotis is located at eastern part of central Greece, belongs to the Region of Sterea Hellas and the capital is the town of Lamia (Fig. 2A-B). Phthiotis is the fourth-largest prefecture of Greece (4,441 km^2) and is characterized as a mountainous and semi-mountainous regional unit with the mountains occupy 79% in contrast to lowland areas comprise 21%. The main land cover of the prefecture is occupied by forests (48,3%) and cultivations (42,7%), followed by the pastures (6,5%). The Prefecture of Magnesia is bordered with northeastern part of Phthiotis, belongs to the Region of Thessaly and the capital is the town of Volos (Fig. 2A-B). Magnesia covers an area of 2,636 km^2 and is characterized as a mountainous and semi-mountainous regional unit with the mountains occupy 70% in contrast to lowland areas comprise 30%. Climate of both prefectures in mountainous parts is cold, while on lowland and coastal areas is mild in winter and warm or cool in summer (Stamatelatos & Vamva 1996a, 1996b, IMSI 1999-2000).

Results

On 16 September 2007, an adult *Eryx jaculus* was found dead on a road by AC at Spercheios River Valley between Lianokladi and Hypati area (altitude 46 m). The surrounding habitat includes a riverbed, riparian tree clumps, arable land and alluvium soils. The specimen was collected and deposited in the collection of the first author (total length [TL]: 375 mm; snout vent length [SVL]: 332 mm; Fig. 3A-B).

On 4 May 2009, an adult snake was observed to moving in Spercheios River riverbed between Lianokladi and Rodonia area by AC a few hundred meters further west than the previous record (altitude 53 m). The main habitat comprised a dry cobbled riverbed with sandy/clay soil and sparse shrubs with dominant species the *Spartium junceum* and *Nerium oleander*.

On 12 and 13 January 2010, eight *Eryx jaculus* individuals (two adults, six juveniles) were found by archaeologist LS during an archaeological excavation in ancient chamber tombs at Spercheios River Valley (altitude 37 m), approximately 6 km east from the first record was made in 2007. The boas were hibernating inside the tombs with other squamata species (*Pseudopus apodus*; *Xerotyphlops vermicularis*; *Dolichophis caspius*). Some specimens were photographed before they were released back on ground (Fig. 3C). The excavation took place on a small and low hill next to the river, with its terrain consists of soft tufa, and the surrounding habitat includes olive groves and small *Quercus coccifera* clusters.

On 6 June 2011, an adult snake was observed standing still next to a building wall at the southern part of Lamia City by AC close to Lamia Railway Station (altitude 67 m). The habitat type was an urban and anthropogenic environment.

On 14 August 2011, one subadult *Eryx jaculus* was found to basking on a dirt road at Spercheios River Valley by AC, at approximately 800 meters east from the first record was made in 2007 (altitude 39 m). The habitat consists of a cobbled riverbed, shrubs and riparian tree clumps, arable land and tree crops.

On 10 May 2013, an adult *Eryx jaculus* was observed by AC while crossing a dirt road, at approximately 700 meters south than the previous record (altitude 40 m). The main habitat includes arable land, tree crops and a small stream with *Tamarix* sp. and *Phragmites australis*.

On 17 August 2014, an adult individual specimen was found dead on a road in bad condition by AC between Hypati's thermal springs and Mexiates Village (altitude 47 m), almost 1 km south of the location where the previous record was made in 2013. The surrounding habitat comprised arable land, olive groves, sparse trees and pastures.

Fig 3. Some of the *Eryx jaculus* individuals that have been detected in central Greece within the last years. **A**. Dorsal view of dead adult individual close to Hypati's thermal springs. **B.** ventral view of the same specimen (photograph by AC). **C**. Two juveniles out of a total of eight individuals which found during archaeological excavation in an ancient tomb next to Spercheios River (photograph by LS). **D**. Adult individual at southwestern foothills of Othrys Mountain (Photograph by SK). **E**. Road killed subadult specimen at Kallidromo Mountain (Photograph by AC). **F**. Juvenile traffic victim at Spercheios River valley (Photograph by AC). **G**. Adult individual at western Othrys Mountain (photograph by GD). **H**. Adult individual close to Oiti Mountain (photograph by TT). **I**. Adult individual at Pteleos area on Magnesia Prefecture (photograph by AC).

On 7 June 2018, a big adult *Eryx jaculus* was observed at the southern foothills of Othrys Mountain range, close to Stirfaka Village (altitude 144 m) by beekeeper SK while the snake was moving among the grasses and the beehive boxes at dusk. The area's terrain is dominated by ophiolite rock complex and the low hilly habitat consists of phrygana (mainly *Thymus* sp.; *Cistus* sp.), scattered shrubs (*Quercus coccifera*; *Paliurus spina-christi*; *Vitex agnus-castus*), olive groves and pastures. The specimen was estimated at approximately 700 mm in total length and photographed *in situ* (Fig. 3D).

On 7 July 2018, a subadult *Eryx jaculus* was found dead on a road by AC and TT at Kallidromo Mountain (altitude 635 m), close to Skamnos Village. The habitat includes the western limestone slopes of Kallidromo Mountain which are covered by Mediterranean maquis shrublands. The specimen was collected and deposited in the collection of the first author (TL: 270 mm; SVL: 235 mm; Fig. 3E).

On 8 September 2018, a juvenile specimen was found freshly-dead on a road by AC at Spercheios River Valley, close to Hypati's thermal springs (altitude 52 m), some meters south of the location where the first observation was made in 2007. The surrounding habitat consists of arable land and olive groves. The specimen was collected and deposited in the collection of the first author (TL: 205 mm; SVL: 180 mm; weight: 7,1 g; Fig. 3F).

On 16 May 2020, an adult *Eryx jaculus* was observed by GD while crossing a road at western part of Othrys Mountain, close to Nea Giannitsou Village (altitude 328 m). The specimen was photographed

and then was moved next to the road (Fig. 3G). The habitat comprised fields with scattered shrubs (dominated by *Paliurus spina-christi*; *Pyrus amygdaliformis*; *Quercus coccifera*), vineyards and olive groves.

On 14 June 2020, one adult snake was observed to basking on a road by TT at the mountain pass from Kallidromo Mt. to Oiti Mt. (altitude 575 m), at approximately 2,5 km SW from the location where the July 2018 record was made. The specimen was captured, photographed and then transported and released to a meadow near the site where it was found, to avoid potential road killing (Fig. 3H). The habitat consists of grass fields, cereal crops, scattered shrubs and trees (mainly *Platanus orientalis*; *Quercus* spp.) while the terrain of the area comes from alluvial sediments.

Finally, the record of the Prefecture of Magnesia (Thessaly, Greece), located close to the eastern border of Phthiotis, was made on 11 May 2007. An adult individual was found by AC while basking on a dirt road at Pteleos Village area (altitude 65 m). The habitat characterized by extended olive groves and patches of maquis vegetation. The specimen was photographed before it was moved at the edge of the road (Fig. 3I).

Discussion

Concisely, all records were made May to September (excluding one hibernation case) with more than half being recorded at May and June. The altitude ranges between 37 and 635 m, with an average of 164 m. Tree crops (olive groves mainly), arable land, grass fields, pastures, scattered or in clump shrubs and trees, shrublands, phrygana and dry sandy or cobbled riverbed, are the main habitats where the specimens detected. The terrain in these lowland or hilly areas is dominated mainly by deposits of alluvium sediments and some by ophiolite or limestone. The most common behavior that was observed was moving. The 13 records are shown on a map in Figure 2C.

These records as a puzzle pieces fill in the range gaps of *Eryx jaculus* in Greece. There are not known records of the species from these central Greece's areas previously.

The cryptic lifestyle of the species in combination with few mainland surveys justifies its sparse records in Greece and other countries of its range. In recent years, with the increase of professional and amateur herpetologists, naturalists and wildlife photographers there has been an increase in *Eryx jaculus* records both in new and old locations (Covaciu-Marcov et al. 2012, Gholamifard et al. 2012, Afsar et al. 2013, Pulev et al. 2014, Aloufi & Amr 2015, Insacco et al. 2015, Sahlean et al. 2015, Roussos 2016, Uhrin et al. 2016, Mizsei et al. 2017, Rosso et al. 2018, Christopoulos et al. 2019, Christopoulos & Kotselis 2021).

The distribution of herpetofauna in mainland Greece remains lacking, as in many areas has never been diligent surveyed, and records of their presence in such areas are opportunistic (Pafilis & Maragou 2013). As the result of this neglect, the large gaps of absence of some common and widespread species, are evident (Valakos et al. 2008, Legakis & Maragou 2009, Pafilis & Maragou 2020).

Future surveys will give us new data about possible distribution areas of *Eryx jaculus*, and will shed light on its secret life aspects.

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