

About the presence of *Crocidura suaveolens* group (Soricomorpha, Soricidae) on Astipalaia Island (Dodecanese, Greece)

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Abstract - The presence of *Crocidura* sp. on Astipalaia Island was shown, for the first time, in the nineties of the twentieth century. After the re-examination of the already available specimens and the analysis of the more recent material, it emerged that this insular shrew population refers to *Crocidura suaveolens* group. The presence of this *taxon* is also reported for the neighboring island of Amorgos. The presence of *Crocidura suaveolens* group in the Mediterranean islands is a result of Pleistocene survivors as well as human introductions, a both morphometric and genetics investigation on these specimens is deserving of further insights.

Key words: *Crocidura suaveolens*, Astipalaia, Eastern Mediterranean, biogeography.

Riassunto - Sulla presenza del gruppo *Crocidura suaveolens* (Soricomorpha, Soricidae) sull'isola di Stampalia (Dodecaneso, Grecia).

La presenza del genere *Crocidura* era già nota sull'isola di Stampalia dal 1992, anche se dai resti dei crani e delle mandibole ritrovati in borre di barbagianni e civetta non era stato possibile identificare la specie. In questo lavoro è stato riesaminato tutto il materiale, aggiungendone anche altro raccolto più recentemente e ne è stata accertata l'appartenenza al gruppo *Crocidura suaveolens*. La presenza di *C. suaveolens* nelle isole del Mediterraneo può essere interpretata come una sopravvivenza di fauna Pleistocenica e/o come risultato di introduzioni umane passive. Sarebbero auspicabili indagini biomolecolari e morfometrico-comparative.

Parole chiave: *Crocidura suaveolens*, Stampalia, Mar Egeo, biogeografia.

INTRODUCTION

The presence and the taxonomic status of genus *Crocidura* from Eastern Mediterranean, was longer controversial.

Catzefflis *et al.* (1985) and Vogel *et al.* (1986), after chromosomal, biochemical and morphological analyses, show that *C. russula monacha* Thomas, 1906, from Turkey, Syria, Lebanon and Israel belongs to *C. suaveolens*.

C. r. gueldenstaedti Pallas, 1811, from Turkey, proposed as *incertae sedis* by Catzefflis *et al.* (1985), was more recently placed to *C. suaveolens* group, as a separate species (Zaitsev, 1991; Bannikova *et al.*, 2006; Vogel *et al.*, 2003) or a subspecies of *C. suaveolens* (Hofmann, 1996; Dubey *et al.*, 2006; 2007). On the basis of the genetics data, this *taxon* can be considered as occurring in Turkey, Crete, Georgia (Dubey *et al.*, 2006), Israel, western Syria, and western Iran (Dubey *et al.*, 2007).

In fact, a study carried out upon samples from different localities, shows that populations of *C. russula* previously reported in Turkey, were belong to *C. suaveolens* (Kefelioğlu & Tez, 1999).

With regard to Crete Island, *C. canae* Miller, 1909, was later referred to *C. russula canae* (Ellermann & Morrison-Scott, 1951; Wettstein, 1953; Corbet, 1978), *C. gueldenstaedtii canae* (Richter, 1966; 1970) and *C. suaveolens* (Hutterer, 1981; Vogel *et al.*, 1986). *C. ariadne* Pieper, 1979, also described from Crete, according to Hutterer (1981) is perhaps a juvenile of *C. suaveolens*. *C. russula zimmermanni* Wettstein, 1953 was considered a distinct species by Vermanis & Kahmann (1978), as confirmed by Vogel (1986) and Vogel *et al.* (1986) from genetics data. This last one is an endemic and endangered species by Crete.

On the basis of the recent knowledge's, the *Crocidura* populations present in the Ionian, and Aegean Islands are attributable to *C. suaveolens* group, *C. leucodon* and *C. zimmermanni* (Masseti, 2012).

Remnants of skulls and jaws of *Crocidura* sp. were found both in barn owl (*Tyto alba*) pellets (Angelici & Riga, 1994) that in little owl (*Athene noctua*) pellets (Angelici *et al.*, 1997). Still it was not possible to capture a specimen alive or dead, despite the specific trapping campaigns (Angelici *et al.*, 1992). Later, in 2015, M. Grano and C. Cattaneo have collected more barn owl pellets and remains.

The aim of this paper is to investigate the taxonomic status of this insular population.

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Study area

Astipalaia (36°33'29"N; 26°21'06"E) is a small Greek island belonging to the Dodecanese Archipelago, in the South Aegean Administrative region, Kalymnos Regional unit.

This island has an unusual butterfly shape and covers an area of 97 km². Because of its shape, Astipalaia can be divided into two parts: a western half (Exo Nisi) and an eastern one (Mesa Nisi), joined by a narrow isthmus (Steno), 105 m wide (Fig. 1).

It is mainly mountainous (highest elevation 506 m a.s.l.) with calcareous soils on the eastern and exterior western sides, arenaceous and schistous soils in the remaining parts. The vegetation is poor and characterized by phrygana with spiny shrubs, olive-groves, orchards, vineyards and cereal growings.

From a climatic point of view, Astipalaia has a typical Mediterranean climate, with mild and rainy winters and dry summers. The available data from the National Meteorological Service (EMY) (<http://www.hnms.gr/>), reported between 1977 and 2013 an average annual temperature of 19.27°C. The average minimum temperature was recorded in February with values of 7.73°C and the average maximum in July, until 32.09°C. The annual average relative humidity values are around 70.13% and the average annual rainfall recorded from 1985 to 2012 is around 400 mm.

The smallest distance from the continent reaches 80 km with the Datça district of Muğla province, Turkey; the nearest isles are: Amorgos (40 km), Anáfi (43 km), Stefania (31 km) and Kos (42 km). On the basis of these data, Astipalaia is one of the more "isolated" islands in the Eastern Mediterranean (Cattaneo & Grano, 2016).

The specimens analyzed in this work were found in abandoned buildings and in three caves located in Ftera, Dhrakospilia, and in a site close Zafeiri Bay.

Ftera (427 m a.s.l.) is one of the highest peaks, located on the orographic axis along the western part of Astipalaia. It consists mostly of Eocene limestones and the cave is karstic, with stalactites and stalagmites formations. It is here evident an exploitation by sheeps and goats. The Dhrakospilia cave (40 m a.s.l.) is located in NW extremity of the eastern half of the island, at the base of the Aghios Thomas Mount. It consists of Cretaceous limestones, as the NE side of the island (Leontaris, 1974). The cave close Zafeiri (100 m a.s.l.) is placed on the CE edge. It is constituted of clay and shows several niches often used as perches by raptors. This sites are characterized essentially by a phryganic vegetation whose most representative species are *Sarcopoterium spinosum*, *Thymra capitata*, *Salvia fruticosa*, *Genista acanthoclada* and *Calicotome villosa*. Only in the close proximity of the cave of the Zafeiri bay is present a monospecific maquis based on *Juniperus phoenicea* with the occasional presence of *Pistacia lentiscus* (Cattaneo & Grano, 2016).

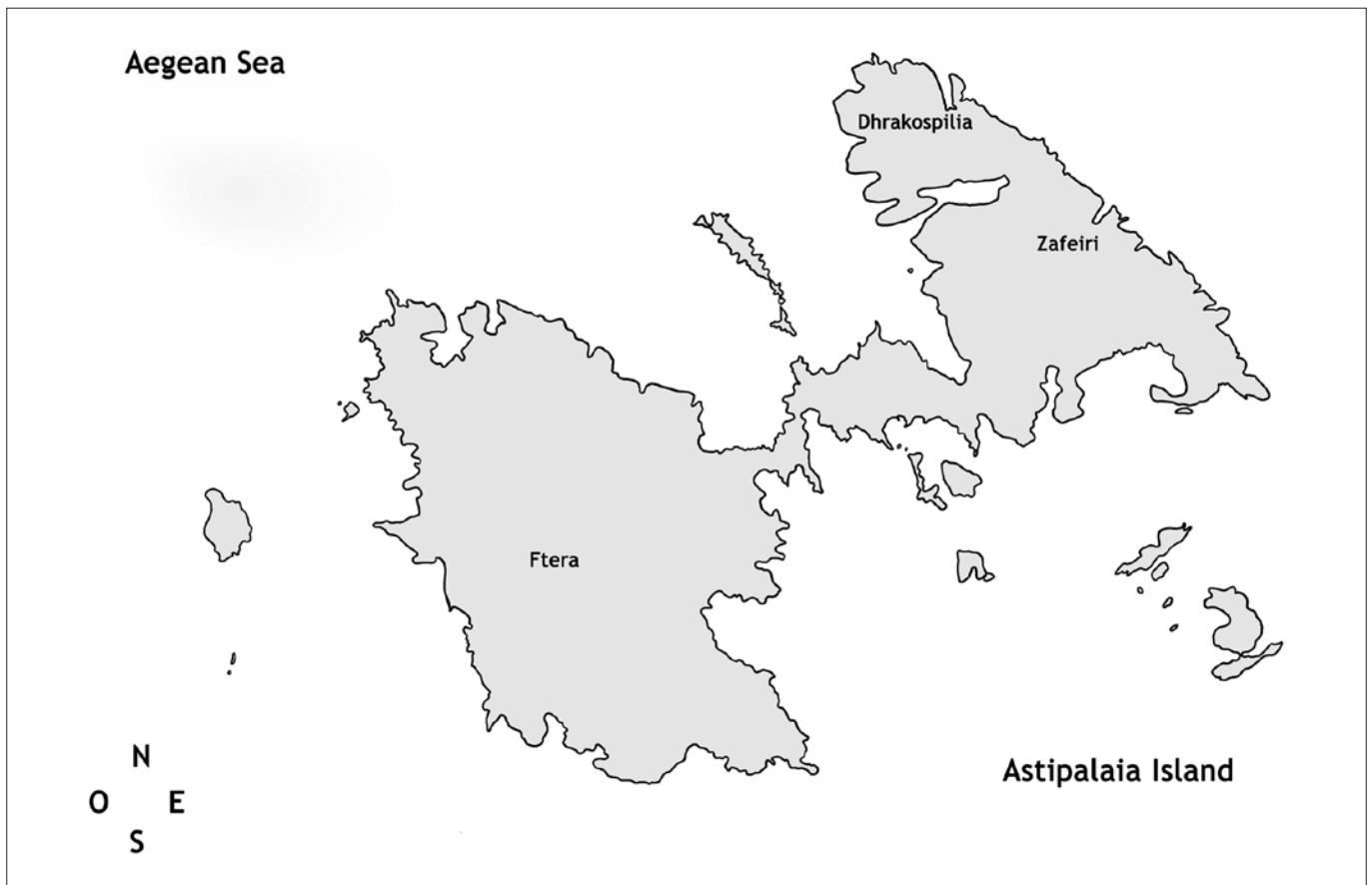


Fig. 1 - Astipalaia Island.

MATERIALS AND METHODS

The analyzed material consists of skulls and jaws from barn owl (*Tyto alba*) and little owl (*Athene noctua*) pellets. Zygomatic breadth and mandibular height was measured by a caliper of 1/100 m precision, the values was later approximated at 1/10 mm.

Little owl pellets were collected (June 1990) in abandoned buildings and in a few rocky site (Angelici *et al.*, 1997). First collection of barn owl pellets were found (Angelici *et al.*, 1992; Angelici & Riga, 1994) on a calcareous wall near an empty creek and in a ruin located inside an olive tree plantation. All first barn owl pellet collections were found in September 1988, and in June, and August 1990. The following, more recent collection dates, are: 03-August-2015 (Ftera), 13-August-2015 (Dhrakospilia and Zefeiri bay).

The identification was carried out according to Nithammer & Krapp (1990) and Kryštufek & Vohralík (2001).

RESULTS AND DISCUSSION

The pellets analysis provided us 60 skulls, 104 right and 87 left hemi-mandibles. 7 skulls, 7 right hemi-mandibles and 5 left hemi-mandibles were not measurable; 1 right hemi-mandibles were not determinable.

The values of the zygomatic width and of the hemi-mandibles height are summarized in Tab. 1.

Tab. 1 - The considered measurements of the *Crocidura* samples from Astipalaia. ZW: zygomatic width; HH: hemimandible height.

	ZW	HH right	HH left
N.	55	99	82
Min	5.1	3.8	3.9
Max	5.9	4.6	4.5
Average	5.5	4.2	4.2

On the basis of the considered measurements as well as of some morphological characters such as the shape of the zygomatic bones, of the upper premolar, of the articular and angular processes of the jaw, together with measurements carried out, we can say that the skulls and the jaws belong to *C. suaveolens* group. Further investigation will be needed to determine the exact taxonomic status of this population.

The finding of a good number of specimens, in fresh and intact pellets collected from 1988 to 2015 in more sites, allows to state that on the Astipalaia Island there is a stable shrew population. In fact, these cannot be considered as some predations on other islands or on the mainland, by erratic raptors, as sometimes it can happen (Nappi, 2011), with a subsequent emission of the pellets at Astipalaia. For instance, the study carried out by Angelici & Riga (1994) from barn owl pellets, shows that *Crocidura* is representing the 22.0% of the captured preys (n=141).

C. suaveolens (Pallas, 1811) is a shrew showing a wide distribution across the Palaearctic, from the Atlantic coast of Iberian Peninsula extending eastwards through Europe and Asia to Siberia (Hutterer *et al.*, 2008). At present, among the Ionian, and Aegean Islands, *C. suaveolens* is reported from Corfu, Zakynthos, Kythera, Euboea, Crete, Theodorou, Rhodes, Amorgos, Kos, Samos, Psara, Chios, Lesbos, Samothrace and Thasos (Masseti, 2012; Cheke, *pers. comm.*).

On the basis of a recent research, carried out by analyzing mitochondrial cytochrome b gene, around the Mediterranean basin, the insular presence of *Crocidura suaveolens* group is a result of Pleistocene survivors as well as human introductions (Dubey *et al.*, 2007), an investigation on Astipalaia specimens will be interesting.

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