



## The silent spreading of a giant mantis: a critical update on the distribution of *Sphodromantis viridis* (Forskål, 1775) in the Mediterranean islands (Mantodea: Mantidae)

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**Abstract.** The recent discovery of new specimens of *Sphodromantis viridis* (Forskål, 1775) in Sardinia, together with the increasing number of sightings reported in the literature for the Mediterranean islands, allow a first investigation of the spreading dynamics of this mantis outside of its continental habitat in a biogeographical perspective. An insect historically absent from the Mediterranean islands but often sinantropic and with spreading dynamics compatible with an anthropogenic dispersal is confirmed here as a new species for Italy.

**Riassunto.** La silenziosa diffusione di una mantide gigante: un aggiornamento critico sulla distribuzione di *Sphodromantis viridis* (Forskål, 1775) nelle isole del Mediterraneo (Mantodea: Mantidae). La recente scoperta di nuovi esemplari di *Sphodromantis viridis* (Forskål, 1775) in Sardegna, congiuntamente al sempre maggior numero di avvistamenti segnalati in letteratura per le isole mediterranee, consente una prima indagine sulle dinamiche di diffusione di questa mantide al di fuori del suo habitat continentale in una prospettiva biogeografica. Un insetto storicamente assente dalle isole mediterranee, ma spesso sinantropico e con dinamiche di diffusione compatibili con una dispersione antropogenica, viene qui confermato come una specie nuova per l'Italia.

**Key words.** Mantodea, distribution, taxonomy, biogeography, alien species, natural spread.

### Introduction

*Sphodromantis* Stål, 1871 is a xerothermophilous mantid genus (Mantodea: Mantidae), widely distributed in the African continent, and *Sphodromantis viridis* (Forskål, 1775) is the species with the northernmost distribution of the genus, reaching Southern Europe and the Mediterranean coast of the Middle East (LA GRECA, 1966). LA GRECA (1966) proposed a subdivision of the species into four subspecies belonging to different geographic areas of the Mediterranean and North Africa: *S. v. viridis* (Forskål, 1775) for the Egyptian area, where the typical specimens have been described by Forskål, *S. v. meridionalis* La Greca, 1950 in Ethiopia and Sudan, *S. v. barbara* La Greca, 1967 in Tunisia, Libya and the Algerian Sahara, *S. v. occidentalis* Werner, 1906 in the countries of the Atlantic coast of Africa from Morocco to Cameroon. *Sphodromantis viridis simplex* La Greca & Lombardo, 1987 is described in a second time by LA GRECA & LOMBARDO (1987), for Ethiopia and Somalia. LA GRECA (1966) did not examine any specimens from the Middle East and examined only few specimens from Spain, the only European country where this species was known at the time, and this lead him to speculate over a possible European subspecies, never described because of the lack of available material. ROY (2010) reviewed the positions of LA GRECA (1966) stating the impossibility to identify all the specimens of West Africa and Europe as a single homogeneous group, questioning the validity of *S. v. occidentalis* as subspecies. ROY (2010) rehabilitated the name “*vischeri*” for the subspecies from Spain using the historical specimen *Stagmatoptera vischeri* described by WERNER (1933), but left open the question on the West African populations.

The recent discovery of individuals of this species, historically absent from the insular areas of the Mediterranean and in particular the study of new specimens collected in Sardinia, the examination of their external morphology and the shape of the male genitalia, allow to give an overview on expansion dynamics of this species.

### Material and methods

In this work, we considered the scarce but detailed literature of this species, with particular attention to the records of the Mediterranean specimens. We examined, with a Leica Wild M3c stereomicroscope and a 2mpxl 50-200x digital microscope, the external shape and genitalia of: 1) an adult male captured in a mist-net in 2011 on the island of Spargi in Northern Sardinia (RUZZANTE & LEO, 2012); 2) an adult male found by the authors in 2016 in the Sardinian hinterland, attracted by the artificial lights of a parking lot in the countryside of Santa Giusta (Oristano). The morphology of these two specimens was then compared with the ones reported in the literature and with the specimens preserved in the private collections of the authors.

### Results

Examined specimens. **Sardinia:** Zinnigas, Santa Giusta (Oristano), 39°51'45.9" N 8°36'27.0" E (WGS84), 2 m a.s.l., 5.VIII.2016, S. Andria leg., 1 adult male, coll. Battiston; La Maddalena (Olbia-Tempio), Isola Spargi, Cala Corsara, 41°13'47" N 9°20'49" E (WGS84), 4 m a.s.l., 19.X.2011, G. Ruzzante leg., 1 adult male, coll. Ruzzante.

The examination of the genitalia of these two males showed a perfect compatibility with the variability reported by LA GRECA (1966) for the Spanish specimens, in particular with those from Cordoba and especially for the shape of the pronotum and of the pseudophallus (Fig. 1), the latter with almost straight and sub-parallel margins, distinct from the curved ones from Africa. These two characters, referred as diagnostic in the taxonomy of LA GRECA (1966), highly variable within the *occidentalis* group show a remarkable homogeneity among the Sardinian specimens (Fig. 2) and between the Sardinian and Iberian specimens. This similarity and the marked differences from all the other known subspecies lead to assume the existence of a Sardinian population probably related to the Iberian subspecies. It must be noted that only a deep molecular analysis on a greater number of specimens will be able to absolutely confirm it but, since the shape of male genitalia proved to be a good taxonomical character to separate geographical populations, these specimens can be therefore identified as *Sphodromantis viridis vischeri* (Werner, 1933).

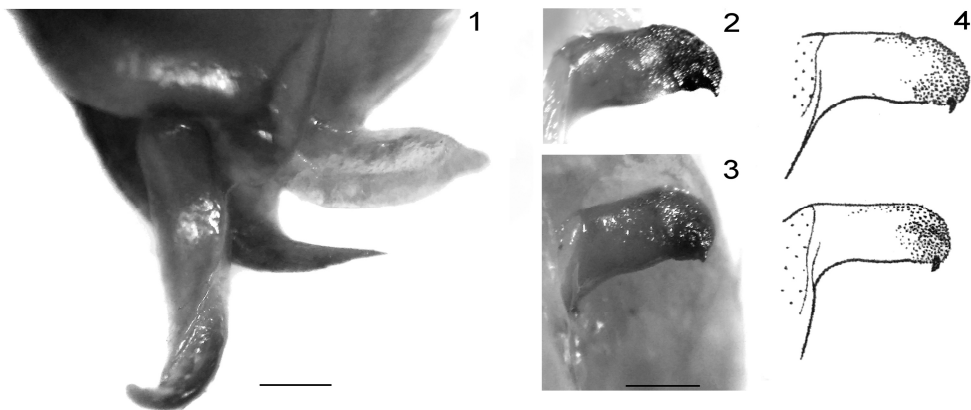


Fig. 1. Male genitalia of *S. viridis vischeri* (Werner, 1933). 1) left epiphallus and hypophallus of the specimen from Santa Giusta in dorsal view; 2) pseudophallus of the specimen from Spargi; 3) pseudophallus of the specimen from Santa Giusta; 4) pseudophalli of the specimens from Cordoba – Spain (from LA GRECA, 1966). Scale bar: 1 mm.



Fig. 2. Males habitus of *S. viridis vischeri* (Werner, 1933): specimen from Spargi on the left and specimen from Santa Giusta on the right. Scale bar: 10 mm.

### Discussion

The two Sardinian specimens, despite their numerical scarcity that excludes any statistical consideration, contextualized with the previous data collected in the Mediterranean, allow a first critical analysis of the process of spreading of this species in the Mediterranean islands. According to La Greca's biogeographical analysis of the morphology of the subspecies he described, this species began its spreading north of the Sahara probably in the Pleistocene, during the warming of the Mediterranean climate, colonizing new territories thanks to the new conditions favourable for its biology (LA GRECA, 1966). The isolation of the northern populations has presumably occurred during the post-glacial period and considering the Iberian climatological history (MARTINEZ-CORTIZAS *et al.*, 1999) we can hypothesise that the arrival of this mantis has been relatively recent in Europe, perhaps during the Medieval age characterized by a significant rise of the temperatures, and definitely before the XX century. BOLIVAR (1898) indeed mentions this species as well spread in the Spanish territories of Andalucia: Malaga, Seville and Cadiz. Its presence in Portugal is reported only later in 2008 and in the southern areas near the Spanish border (MARABUTO *et al.*, 2014). The same authors however make evident a historic lack of mantidological records for that country that may have kept the presence of this species hidden in previous years. From Southern Spain this species seems to have reached only very recently the insular Spain: it is absent in the detailed investigation of GANGWERE & LLORENTE (1992) on the orthopteroids of the Balearic, and the first record for this islands is dated 2004 on the island of Mallorca (CANYELLES & ALOMAR, 2006).

Presumably from here, in even more recent times, the specimens (or their ancestors) found in Spargi in 2011 (RUZZANTE & LEO, 2012) and in the Sardinian hinterland in 2016 may have arrived. The orthopteroid fauna of Spargi is quite well known after the entomological surveys of BACCETTI (1996), where the species is not reported and it seems unlikely that, by its size and appearance, this species was not collected. On the contrary, its arrival time in the Sardinian hinterland of Santa Giusta, less known in its entomologic fauna, appears less evident.

In the meanwhile *S. viridis* also colonized some islands in the eastern part of its habitat: a specimen was collected in Cyprus in 1977 (EHRMANN, 2011) and its presence in this island has been confirmed later with a reproductive couple observed by the authors in 2011 (Battiston, unpublished data). Known for the Tunisian hinterland, this species was found in the island of Djerba in 2005 (BATTISTON *et al.*, 2010) with another reproductive couple of individuals and some oothecae (Fig. 3). If the arrival

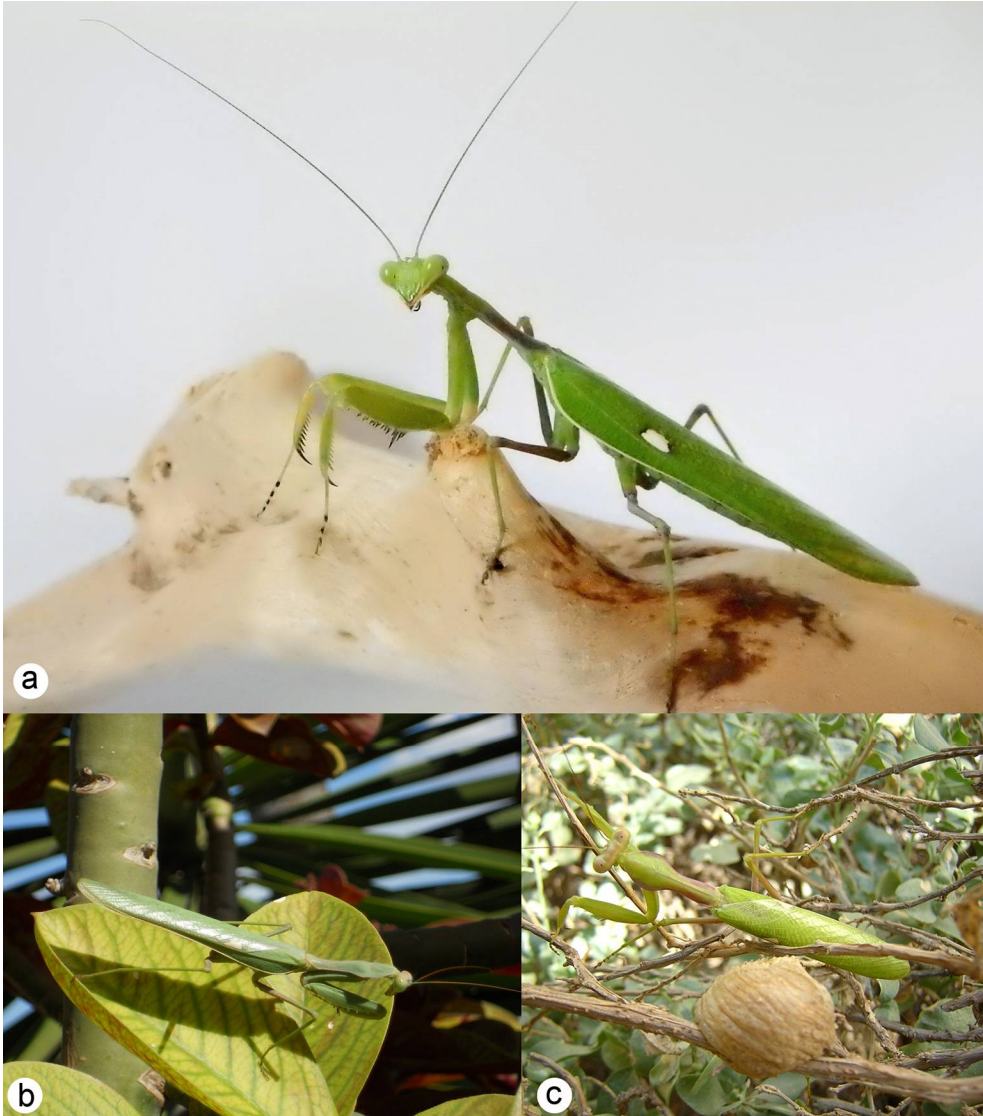


Fig. 3. Male individuals of *S. viridis* (Forskål, 1775): a) specimen from Santa Giusta, ph. R. Perra; b) specimen from Cyprus ph. P. Zanolin; c) specimen from Djerba with an ootheca, ph. R. Battiston.

of this presence in Tunisian island just a few kilometres far from the inland, was easily conceivable, less clear is the situation in Cyprus since its presence in neighbouring Turkey remained uncertain until 1996 (EHRMANN, 2011). Its presence on the Greek islands is at the moment uncertain, mostly because of the recent spreading in that area of *Hierodula transcaucasica* Brunner von Wattenwyl, 1878 (Battiston, unpublished data), a closely related mantis from the same Tribe but with an Asian distribution, with whom can easily be confused. While it is clear that the insular distribution of this species is generally very recent, the question of the naturalness of this trend remains open. The size and wing length of this mantid (BATTISTON *et al.*, 2010) makes it unsuitable for long-range flights. The passive transport of the ootheca, in this species with a particularly thick protective cover (Fig. 3c), seems the most likely hypothesis, but the naturalness of this process, in relation to this extraordinarily recent expansion, seems not plausible. The life cycle of this insects is annual and the permanence of the larvae in the ootheca can be measured, depending on the latitude, from a few weeks to a few months. The timing of a passive drift of marine larva from the Spanish coast to the Balearic platform has been measured in about one month (OLIVER, 1991) and the shortest distance from Mallorca to Sardinia is greater by about two times but the surface circulation of course follows much longer routes (ROBINSON *et al.*, 2001). This means several months or years of travel, which is not compatible with the biology of this insect. On the contrary, in almost all locations where this species has been observed in nature by the authors in recent years (Morocco, Tunisia, Sardinia, Cyprus), it has always shown not to dislike well anthropized habitats, and was often found in city parks or gardens, car parking lots and roadsides verges. Significantly different however is the case of Spargi, a small island, uninhabited and with occasional, well-regulated tourist accesses. Even the arrival of this species on the port area of Calvià, in the island of Mallorca from the near Spanish coast was considered as a probable artificial introduction (CANYELLES & ALOMAR, 2006). The introduction of alien species of mantids in Europe has already been reported for Portugal (MARABUTO, 2014), even if related to Afrotropical and Middle East species as *Miomantis caffra* Saussure, 1871 and *M. paykullii* Stål, 1871, completely foreign to Western Europe. In this case the arrival of *S. viridis* in the Mediterranean islands by natural oothecae transportation can not be excluded (and the specimen of Spargi may actually fall into this dynamic), although generally this situation is unlikely to appear. More likely is the artificial transportation of oothecae laid on manufactured goods, timber or other material transported quickly on the well frequented shipping routes of the Mediterranean. Even if the morphological homogeneity of the two individuals collected supports the hypothesis of a wide spread Sardinian population, we cannot exclude that they may have been also introduced directly and in separate occasions, i. e. attracted by artificial lights on ferries or boats, as already hypothesized for *Lethocerus patruelis* (Stål, 1855) (CIANFERONI & NARDI, 2013). At present, the presence of this mantid in Italy is still a questionable case. However the collected evidences: the spread of this species in the Mediterranean islands occurred in recent times, together with the increasing of marine vessel traffic, and the well documented attraction of mantids for artificial light and surfaces, to lay the oothecae (LOPEZ, 1998), tend to consider this a potential alien species for many Mediterranean countries. Local and specific studies are however encouraged to check the individual cases and the impact that this new guest can have on already delicate balance of the Mediterranean insular environments.

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