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Down in the funnel: re-confirming the presence of *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) in Sicily, with a lizard interaction and ecological notes

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Abstract: The spider *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) belongs to a genus remarkable for its social habits. Its known distribution ranges from the Iberian Peninsula and North Africa to the Middle East, including southern Italy (Campania, Sicily), from where, however, recent records are completely lacking. Here we re-confirm the presence of the species in the Sicily region, adding some ecological information and also a predator-prey interaction with the wall lizard *Podarcis siculus* Rafinesque, 1810 (Reptilia: Lacertidae).
Key words: Araneae, Eresidae, *Stegodyphus*, *Podarcis*, distribution, ecology, Sicily, Italy.

Bajo el embudo: reconfirmación de la presencia de *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) en Sicilia, incluyendo una interacción con una lagartija y notas ecológicas
Resumen: La araña *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) pertenece a un género destacado por sus comportamientos sociales. Su distribución conocida comprende desde la Península Ibérica y el norte de África al Oriente Medio, incluyendo la zona sur de Italia (Campania, Sicilia), de donde no hay, sin embargo, registros recientes. Aquí confirmamos la presencia de la especie en la región de Sicilia, añadiendo datos ecológicos y también sobre la posible relación depredador-presa que se manifesta con la lagartija *Podarcis siculus* Rafinesque, 1810 (Reptilia: Lacertidae).
Palabras clave: Araneae, Eresidae, *Stegodyphus*, *Podarcis*, distribución, ecología, Sicilia, Italia

Giù per l'imbuto: riconferma della presenza di *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) in Sicilia, incluse una interazione con lucertola e note ecologiche
Sommario: Il ragno *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) appartiene ad un genere ben noto per i comportamenti sociali. Distribuito in Nord Africa, Penisola Iberica e ad est fino al Medio Oriente, è segnalato anche per l'Italia meridionale (Campania, Sicilia) dove però mancano del tutto segnalazioni recenti. Qui viene riconfermata la presenza della specie per la regione Sicilia, e vengono fornite alcune informazioni di carattere ecologico, nonché un tentativo di predazione da parte della lucertola campestre *Podarcis siculus* Rafinesque, 1810 (Reptilia: Lacertidae).
Parole chiave: Araneae, Eresidae, *Stegodyphus*, *Podarcis*, distribuzione, ecologia, Sicilia, Italia.

Introduction

The spider *Stegodyphus lineatus* (Latreille, 1817) (Araneae: Eresidae) (Fig.1) belongs to a widely-known genus including some social species (Le Peru, 2011; Miller *et al*., 2012).

Its distribution goes from Portugal (Bacelar, 1929) and Spain (Franganillo, 1925, 1926; Latreille, 1817; Melic, 1995) to Greece and Turkey (Kraus & Kraus, 1989), North Africa (El-Ennawy, 2009, Simon, 1908), Middle-East (El-Ennawy, 2009) and Central Asia (El-Ennawy, 2009; Ergashev, 1990; Nenilin & Pestova, 1986; Simon, 1911).

Italian records are scarce and old (Canestrini & Pavesi, 1870; Kraus & Kraus, 1989; Pavesi 1876, 1878; Simon, 1873), and even recent quotes seem to refer to them (Pantini & Isaia, 2015; Pesarini, 2003; Van Helsdingen, 2015). Its ecology is well-known elsewhere (e.g. Bacelar, 1929; Ergashev, 1990; Franganillo, 1926; Kraus & Kraus, 1989; Melic, 1995; Miller *et a*l., 2012), but virtually no data exist for Italy.

Material and methods

During this study spider webs were searched by inspecting bushes, trees and trunks.

Photos were taken in the field with Nikon D700 and D750 digital cameras provided with 90 mm and 105 mm macro lenses and two flashes for macrophotography; blank map has been created on the specific website http://www.stepmap.com/ and modified with Microsoft Publisher.

The three collected specimens from representative localities, preserved in 75% ethylic alcohol, are actually deposited in A. Decae collection.

MATERIAL EXAMINED: 29.VI.2016, 1 adult ♀, Punta Karuscia, Pantelleria island, Sicily, Italy; 19.IV.2017, 1 juv., Mursia, Pantelleria Island, Sicily, Italy; 21.IV.2017, 1 juv., Ghirlanda, Pantelleria Island, Sicily, Italy. For all specimens M. Colombo and M.Di Nicola leg., M.Colombo & A.Decae det.

STUDY AREA. Pantelleria Island is located in Sicily channel, about 70 km far from Tunisia and 120 km from Sicily, to which it politically belongs (Fig.2).

This volcanic island originated from a submerged rift more than 300.000 years ago and it's now about 80 km^2 wide, with a maximum altitude of about 800 m a.s.l. (Mahood & Hildreth, 1986).

The climate belongs to the harshest thermotype, inframediterranean on the coasts (Cardona Pons, 2013) and thermomediterranean on the mountain (Regione Siciliana *et a*l., 2009); average annual temperature is 18-19°C on the coasts and 16-18°C towards the top, while precipitations show great differences with <400 mm/year on the coast versus 600-800 mm/year on the mountains according to Gianguzzi *et al*. (2015). Vegetation is characterized by pine trees and oaks on the reliefs and steppe /Mediterranean maquis towards the coast (Gianguzzi *et al*., 2015; M.Colombo & M.Di Nicola, pers.obs.).

Results and discussion

Stegodyphus lineatus (Latreille, 1817) is a very poorly known species in Italy, with few available data. In the past, it has been recorded in Campania ("Napolitano": Canestrini & Pavesi, 1870) and Sicily (Canestrini & Pavesi, 1870; Kraus & Kraus, 1989; Simon, 1908; Simon, 1911), in particular Catania (Pavesi, 1878; Simon, 1873d) and Messina (Simon, 1873).

As far as Pantelleria Island is concerned, a specific record is reported by Pavesi (1876).

The species is quoted in more recent publications (Pantini & Isaia, 2015; Pesarini, 2003; Van Helsdingen, 2015) but only apparently on the basis of the previous ones.

With this work, we reconfirm the current presence of *S.lineatus* on Pantelleria island. The abundance of specimens in this geographic area, widespread and almost ubiquitous, probably reflects the lack of specific studies in recent times, and not an effective rareness.

According to bibliography, this species is associated to hot and dry habitats with bushes (Le Peru, 2011; Miller *et al.*, 2012), and this is confirmed for Italy by our data.

S.lineatus seems to be widespread on volcanic terracings on the coast, with steppic vegetation (Fig.3), but was also found in partially wooded areas with Mediterranean maquis.

In particular, most of observations were taken between 10 and 316 m a.s.l., but investigation of altitudinal distribution on the island is certainly incomplete: in fact, it is possible the species reaches major heights, compatibly with the climate (becoming more rainy on the top; Gianguzzi *et al*., 2015). Unfortunately, it has not been possible to visit the mountainous areas due to a huge fire occurring in the days of research, devastating more than 600 hectares of territory (Virtuani, 2016).

Spider webs were seen on herbaceous vegetation and bushes, from 20 to 150 cm above the ground; main plant species colonized by spiders were mastic (*Pistacia lentiscus* L., 1753), caper (*Capparis spinosa* L., 1753), Mediterranean smilax (*Smilax aspera* L., 1753) and olive trees (*Olea europea* L., 1753). Webs were detected in high densities depending on the site, with a maximum registered on a 5.5 m wide mastic bush hosting 53 inhabited shelters and some abandoned others.

Many plants hosting spider webs were thorny, and this agrees with the previous synonym *Eresus acanthophilus* (=thorn-lover; Dufour, 1820); even according to Simon (1892) and Kraus & Kraus (1989) they live on thorny bushes. In Portugal, it is reported to thrive on *Opuntia* Mill., 1768 (Bacelar, 1929); in Spain, in dry environments on bushes of gorse and rosemary at about 50 cm above ground (Melic, 1995) or Umbelliferae at 20-100 cm above the ground (Kraus & Kraus, 1989). A single case of female in a heap of stones is reported from Tunisia (Kraus & Kraus, 1989).

The high densities observed on some bushes in Pantelleria can be linked to the low-dispersal behaviour of *S.lineatus* with colonial life-style in earlier stages of development (Le Peru, 2011).

Most females had a flattened and lenticular, white cocoon in their funnels at the moment of observation (end of April and end of May; Fig.4): this is compatible with data from other areas, reporting young specimens from at least June and September, as adult females die soon after eggs hatching (Bacelar, 1929; Kraus & Kraus, 1989; Simon, 1892).

The species is known to use chitinous remains of invertebrates to cover the silk on the outer side of the shelters (Miller *et al*., 2012). During this work, we observed prey items belonging to Coleoptera, Hymenoptera, Hemiptera, Diptera and Orthoptera (in order of abundance; Fig.5), as already recorded for example in Uzbekistan (Ergashev, 1990), confirming that this is a generalist species.

Spiders belonging to the genus *Stegodyphus* are preyed upon by birds, ants and araneophagous spiders, and solitary species as *S.lineatus* are more affected than social ones (Henschel, 1998).

On May 31st, 2016 during an excursion looking for spiders, a sub-adult female Italian wall lizard (*Podarcis siculus* Rafinesque, 1810) was observed on the top of a mastic bush, 1.5 m above the ground, inspecting a *S.lineatus* web (Fig.6a); then, it reached the entrance of the funnel and it went inside (Fig.6b).

As the orientation of the funnel was vertical, with aperture on top, the lizard found itself upside down, crawling inside towards the bottom, only the tip of the tail could be visible from outside.

Probably disturbed by the presence of observers, the lizard then came out in reverse way and escaped jumping on the ground. After few minutes, the same specimen was seen returning towards the spider web, but stopping at the sight of observers, so it was not possible to witness the complete action.

According to various studies, spiders are part of Italian wall lizard *P.siculus* diet (Capula & Aloise, 2011; Rugiero, 1994; Zuffi & Giannelli, 2013), but *S.lineatus* in particular has not been reported yet.

The observed behaviour of a female lizard entering in the funnel of a spider web can be associated to a predatory event (at least on eggs) with few doubts, even though in that specific case the specimen didn't succeed due to human presence.

At the moment it is not possible to assess whether this is a learned or innate behaviour, nor if *S.lineatus* is included among usual or occasional preys; further studies, maybe using faecal pellets techniques (Pérez-Mellado *et al*., 2011), are desiderable. Other research in historical areas of presence are also requested, in order to (re)confirm this species, whose distribution is certainly underestimated, in different Italian regions.

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Fig.1. *Stegodyphus lineatus*, adult female from Pantelleria (Sicily), dorsal view (photo by Marco Colombo). **Fig.2.** Geographical map of Italy indicating Pantelleria island, between Sicily and Tunisia. **Fig.3.** Typical habitat of *Stegodyphus lineatus* in Pantelleria: terrancing on volcanic stones with Mediterranean scrubland and stone walls (photo by Marco Colombo). **Fig.4.** Female *Stegodyphus lineatus* with cocoon (photo by Matteo Di Nicola). **Fig.5.** Prey items found in a typical *Stegodyphus lineatus* web in Pantelleria (photo by Matteo Di Nicola). **Fig.6.** Italian wall lizard *Podarcis siculus* **a**) hanging on *Stegodyphus lineatus* web and **b**) introducing itself down in the funnel in order to prey upon the spider (photo by Marco Colombo & Matteo Di Nicola).

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