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A report on two alien invasive species of the genus *Sceliphron* Klug, 1801 (Hymenoptera Sphecidae) from Sicily, with a brief faunistic update on the native species

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ABSTRACT Two alien invasive species of the genus *Sceliphron* Klug, 1801 (Hymenoptera Sphecidae) were recently found in Sicily: *S. caementarium* (Drury, 1773) is recorded from Sicily (Messina province) for the first time; *S. curvatum* (F. Smith, 1870), previously recorded from Sicily only through generic data from literature and only one locality in a web forum of amateurs, is confirmed as definitely established in the Island. The Regional distribution of both alien species in Italy is revised based on data taken from literature and reliable reports from web forums. A brief faunistic account on the three native *Sceliphron* from Sicily is provided: *S. destillatorium* (Illiger, 1807) and *S. spirifex* (Linnaeus, 1758) are both new for the Aeolian Islands (respectively reported for Panarea and Vulcano).

KEY WORDS *Sceliphron caementarium*; first record; Sphecidae; Sicily; Italy; alien; invasive species.

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INTRODUCTION

In terms of alien species diversity within invertebrate orders, Hymenoptera ranks as third following Coleoptera and Hemiptera, with about 300 species, representing 30 families, introduced to Europe (Rasplus et al., 2010). Among the Mediterranean countries, Italy hosts the largest number of alien Hymenoptera, about half of the European species, 144 according to Rasplus et al. (2010). But the knowledge of alien hymenopteran species in insular contexts still remains under-explored. It is noteworthy to underline that for islands alien species could play a more relevant role rather than mailand areas, due to obvious geographic reasons and thus the peculiar ecological context, especially in smaller islands.

The genus *Sceliphron* Klug, 1801 (Hymenoptera Sphecidae) is a distinctive sphecid-wasp genus characterized by the predominantly black colour of the body with more or less extended yellow spots. The head has a flattened frons, antenna filiform, without placoids in the male, distance between antennal socket and fronto-clypeal suture at least 0.5 antennal socket diameter, mandible without teeth (with some exception in the female of a few species) and buccal parts short, with the third maxillary palpomere widened on its side; the legs have tarsal plantulae, without spines; the propodeum has the dorsal area sharply defined, with a longitudinal median furrow; the wings are hyaline, weakly yellowish, with both recurrent veins ending in the second submarginal cell; the metasoma has an elongate to very elongate tubular petiole (Bohart & Menke, 1976; Pagliano & Negrisolo, 2005).

The *Sceliphron* species build a mud multilocular pedotrofic nest attached to a wide range of substrates, mainly rock walls, in a more or less concealed position, and frequently many specimens

work closely each other to produce massive concentration of nests (Chatenoud et al., 2012). It is not unusual to find nests in strange substrates, e.g., a wide range of handworks (Gepp, 2003; pers. obs.). The pedotrophic cells are provided with a variable number of specimens of Aranaeae.

The genus has a worldwide distribution with 35 species (Pulawski, 2017), of which eight recorded for Europe and Mediterranean basin (Schmid-Egger, 2005) and five for Italy (Pagliano & Negrisolo, 2005), including both the three native and the two alien invasive species: *S. caementarium* (Drury, 1773) and *S. curvatum* (F. Smith, 1870). In Sicily three native species of the genus were recorded so far, although Strumia et al. (2012) indicated the presence of the alien *S. curvatum* since the year 2002 through a map, without indication of locality.

In the present note, we provide the first evidence of the presence in Sicily of the two alien invasive species of *Sceliphron* known for other parts of Italy.

MATERIAL AND METHODS

The examined material includes two specimens recently collected through hand-net by the authors in Messina province. The material has been identified by the first author based on the keys and diagnoses provided by Bitsch et al. (1997), Pagliano & Negrisolo (2005) and Schmid-Egger (2005). To reconstruct the distribution of the treated species in Italy it has been taken into account data from specialist literature as well as reliable records (e.g., only those containing photos, thus allowing a safe identification, as well as precise collecting data) published in social forums, namely: "Forum Entomologi Italiani", referred as F.E.I. in the text, available at https: www.entomologiitaliani.net/forum (accessed June 11, 2017); "Natura Mediterraneo", section Hymenoptera, referred as Na.Me. in the text, available at https://www.naturamediterraneo.com (accessed June 11, 2017); "Aracnofilia, Associazione Italiana di Aracnologia", referred in the text as A.I.A., available at http://forum.aracnofilia.org (accessed June 11, 2017); "Forum Acta Plantarum", referred in the text as Ac.Pl., available at http://www.floraitaliae.actaplantarum.org/index.php (accessed June 16, 2017). Moreover, the status of the treated alien species has been detected in the website DAISIE (Delivering Alien Invasive Species Inventories for Europe), being the major public source for information on biological invasions, available at http://www.europe-aliens.org/default. do (accessed June 17, 2017). Photographs were produced with a Canon Power Shot SX130 IS digital camera with a 12.1 mega pixels' resolution into a light chamber with the aid of 11W fluorescent light-source.

RESULTS AND DISCUSSION

The present addition allows to raise the number of the known *Sceliphron* species of Sicily from three to five, which represent all the species currently known to Italy (Pagliano & Negrisolo, 2005).

Sceliphron caementarium (Drury, 1773) (Fig. 1)

EXAMINED MATERIAL. 1 female, Sicily, Messina province, Messina, Tremestieri, 35 m a.s.l. (38°08'36.9"N/15°31'21.7"E), 23.VIII.2013, G. Altadonna leg. (G.F. Turrisi collection, Pedara, Italy).

DESCRIPTION. Main colour black, including trochanters and femurs of hind legs and petiole, except: antennal scapes, tegulae, pronotum, scutellum of mesonotum, upper part of mesopleurae, metanotum, distal part of propodeum, most of fore and mid legs (except coxae, basal half of femurs and tarsomeres 2–5), basal half of hind tibiae and hind tarsomeres 1–3, most of metasomal tergite 1 (except base), yellow; wings hyaline, sharply yellowish with distal half slightly infuscate. Petiole straight, slightly shorter than rest of metasoma (ratio: about 0.9); last sternite without carina.

REMARKS. In origin, it was a Nearctic species (Pulawski, 2017), which is become very widespread in the World, being accidentally introduced into Europe, Asia, Australasia (including Fiji, Micronesia, Cook Islands), South America, Hawaiian Islands, Antille, Martinique, Marquesas Islands (Pagliano et al., 2000a, 2000b; Pagliano & Negrisolo, 2005; Schmid-Egger, 2005; Pulawski, 2017). In Europe, it has been introduced several times during 19th and 20th centuries (Rasplus, 2010); it is believed that the introducing way was mainly by ship cargos (Berland, 1946; Bogusch & Macek, 2005). It was first reported in 1945 from Versailles (but was never subsequently reported there) and in 1949 from southern France (Berland, 1946; Rasplus, 2010). Bogusch & Macek (2005) documented the possible first finding of the species in Europe, through a spe-

cimen collected in 1942. Anyway, only since the 1970s this species becomes well established in many countries of Europe and Asia: Belgium, Luxembourg, France (including Corsica), Germany, Austria, Switzerland, Czech Republic, Slovakia, Croatia, Italy, Spain (including Canary Islands), Portugal, Ukraine, Iran, India (Leclercq, 1974, 1975; Haeseler, 1976; Erlandsson, 1978; Leclercq & Claparede, 1978; Schneider & Pelles, 1988; Hamon et al., 1989; Pauly, 1999; Pagliano, 1992, 1995; Pagliano et al., 2000a, b; Gusenleitner, 2002; Vernier, 2003; Hellrigl, 2004; Bogusch & Macek, 2005; Pagliano & Negrisolo, 2005; Schmid-Egger, 2005; Bitsch & Barbier, 2006; Veprek & Straka, 2007; Fallahzadeh et al., 2009; Pagliano, 2009; Bitsch, 2010, 2014; Rasplus, 2010; Callot & Brua, 2013; Kannagi et al., 2013; Zettel et al., 2014; Dollfuss, 2016; DAISIE, 2017). However, the distribution at country level still remains under-explored and in need of further investigation above all to establish whether its presence also includes natural habitats and which types. In Italy, *S. caementarium* was found for the first time in 1990 in Tuscany, near Pisa (Strumia, 1996). Field observations evidence an apparent slow rate of spread, about 30 km in eight years (Pagliano et al., 2000a, 2000b). Based on literature, the presence of the species in Italy covers the following Regions: Liguria, Piedmont, Veneto, Valle d'Aosta, Lombardy, Trentino-Alto Adige, Friuli-Venezia Giulia, Emilia-Romagna, Tuscany (including Elba and Montecristo), Marche, Latium, Umbria, Abruzzo, Molise, Campania, Apulia, Basilicata, Sardinia (Pagliano, 1992, 1995; Strumia, 1996; Campadelli et al., 1999; Hellrigl, 2004; Pagliano & Negrisolo, 2005; Pavesi, 2008; Pagliano, 2009; Ceccolini & Paggetti, 2011, 2012a, 2012b; Strumia et al., 2012; Cillo & Bazzato, 2013; Dollfuss, 2016; F.E.I., 2017; Na.Me., 2017; A.I.A., 2017; Ac.Pl., 2017). The species is newly recorded from Sicily, becoming the southernmost Italian area with its presence.

The biology of the species has been largely studied in both native (e.g. Eberhard, 1970; Powell & Taylor, 2017) and non-native areas (e.g. Chatterjee, 2015). In Europe, some biological aspects have been studied in some detail by Campadelli et al. (1999), with data on nest, preys, phenology, parasitoids and inquilines. The collecting site is comprised in the wide urban context of Messina.

Sceliphron curvatum (F. Smith, 1870) (Fig. 2)

Examined material. 1 female, Sicily, Messina province, Caronia, Torre del Lauro, 5 m a.s.l. (38°02'39.75"N/14°31'57.44"E), 30.VI.2014, G.F. Turrisi leg. (G.F. Turrisi collection, Pedara, Italy).

Description. Main colour black, including trochanters and femurs of hind legs and petiole, except: clypeus, ventral part of antennal scapes, apex of antennomeres 3-4, tegulae, pronotum, middle part of mesoscutellum, upper part of mesopleurae, two spots on base and distal part of propodeum, ventral surface of distal half of fore and mid legs, distal half of metasomal tergite 1, yellow; tibiae, basal half of hind femurs and tarsi yellowish orange; metasomal tergites other than 2, with a discontinuous pale yellowish band; wings hyaline, only slightly yellowish along a narrow line of costal to marginal cell. The yellow colour could vary from yellow to yellowish-brown and reddish orange (e.g., see photos at F.E.I., Na.Me., and Ac.Pl.). Petiole sharply arcuate upwards, quite shorter than rest of metasoma (ratio: about 0.5); last sternite with a weak but distinct carina carinate.

Remarks. According to Hensen (1987), originally the species seemed to be confined to mountainous regions South and West of the Himalayas, in Tajikistan, Pakistan, India and Nepal. Currently, its distribution covers a wider area including Iraq, Iran, Turkmenistan, Uzbekistan, Kyrgyzstan, Afghanistan, with extension to Central and South Europe and recently recorded also from South America: Argentina and Chile (Hensen, 1987; Schmid-Egger, 2005; Compagnucci & Roig Alsina, 2008; Barrera-Medina & Garcete-Barrett, 2008; Ćetković et al., 2011; Kannagi et al., 2013; Gulmez & Can, 2015; Dollfuss, 2016; Yildirim et al., 2016; Pulawski, 2017). In Europe, it was first recorded in southeastern Austria apparently being probably accidentally introduced in the 1970s, with a specimen collected in 1979 (van der Vecht, 1984). Later, Gepp (1995) added new records from Austria with a detailed reconstruction of the possible "first road" of the species in Europe, through a north-eastern direction from the first documented recorded locality: Steiermark, 40 km south-western of Graz, to Wien during the years 1979–1992. The distribution of the species in Europe, recently revised by Ćetković et al., 2011 (with many additional updates, see below), appears to be wide, with a remarkable expansion of the range in all directions. It is believed that the species in Europe has spread on its own through the main river valleys, as suggested by Schmid-Egger (2005) and

thus, the accidental dispersal by human activities was of less importance. Based on the extensive available literature, the present European and Middle Asian distribution of the species covers the following Countries: The Netherlands, Germany, Poland, Austria, Czech Republic, Hungary, Bulgaria, Slovenia, Croatia, Serbia, Montenegro, Spain (including Balearic Islands), Portugal, France (including Corsica), Italy (including Sardinia and Sicily), Caucasus, Ukraine, Georgia, Turkey, Kyrgyzstan, Tajikistan, Uzbekistan (Van der Vecht, 1984; Scaramozzino, 1995, 1996; Gogala, 1995; Gusenleitner, 1996; Pagliano et al., 2000a, 2000b; Gonseth et al., 2001; Osten, 2003; Shorenko, 2003; Ćetković et al., 2004, 2011; Bogusch et al., 2005; Jacobi, 2005; Schmid-Egger, 2005; Bitsch & Barbier, 2006; Gayubo & Izquierdo, 2006; Vepřek & Straka, 2007; Castro, 2007; 2010; Bury et al., 2009; Guéorgiev & Ljubomirov, 2009; Lopez-Villalta, 2009; Bitsch, 2010, 2014; Dobosz, 2010; Prokofiev & Skomorokhov, 2010; Imre, 2012; Schardt et al., 2012; Callot & Brua, 2013; Olszewski et al., 2013; Rey-Muniz, 2013; Wiśniowski et al., 2013; Bilanski et al., 2014; Khvir, 2014; Schneider et al., 2014; Gulmez & Can, 2015; Dollfuss, 2016; Yildirim et al., 2016; DAISIE, 2017). However, the distribution at country level still remains under-explored and in need of further investigation to establish whether its presence also includes natural habitats and which types.

In Italy, it is documented as established since the year 1995 in Piedmont (Torino), Friuli-Venezia Giulia (Lignano Sabbiadoro, Udine province) and Emilia-Romagna (Bologna) (Scaramozzino, 1995, 1996; Pagliano et al., 2000a, 2000b; Pagliano & Negrisolo, 2005; Pagliano, 2009). Further subsequent observations clearly indicate that this species is become widely present in the whole Italy including Islands: Liguria, Piedmont, Lombardy, Veneto, Friuli-Venezia Giulia, Trentino Alto-Adige, Emilia-Romagna, Tuscany, Latium, Marche, Molise, Abruzzo, Campania, Basilicata, Calabria, Sardinia and Sicily (Scaramozzino, 1995, 1996; Grillenzoni & Pesarini, 1998; Pagliano et al., 2000a, b; Hellrigl, 2001, 2002, 2004, 2005; Jacobi, 2005; Cillo et al., 2009; Pagliano, 2009; Olivieri, 2010; Adamo, 2011; Ceccolini & Paggetti, 2011, 2012c; Chatenoud et al., 2012; Strumia et al., 2012; F.E.I., 2017; Na.Me., 2017; Ac.Pl., 2017). The available data seem to indicate that the spread of *S. curvatum* in Italy started in the mid 1990s in the Northern and quickly expanded its range in the Mid and Southern areas to reach Calabria and Sicily presumably in the year 2002 as indicated by Strumia et al. (2012). The species, in the literature, has only been roughly indicated as present in Sicily through a map (Rasplus, 2010; website DAISIE, 2017, see Material and Methods). Strumia et al. (2012) indicated an unknown locality of Messina province through in a map. The unique precise record for Sicily is that of Cammarata (Agrigento province) by Piazza S., with a photographic report showing nest and adult observed on April 07, 2013 (Na.Me., available at https://www.naturamediterraneo.com/forum/topic.asp?TOPIC_ID=201489). The new record confirms the presence of the species in the north-eastern Sicily. The several records allow to indicate this alien species as definitely established in Sicily, where it is apparently widespread.

The biology of the species in Europe has been studied in some detail by Gepp (1995) with data on nest, preys, phenology, morphology of larva, pupa and images; further interesting data on host range were added by Carrière (2005), Dorow & Jäger (2005), Rahola (2005) and more recently by Ćetković et al. (2011), Csaba & Imre (2015), Gulmez & Can (2015), Madl &Vidlar (2005), and Schedl (2016).

The studied specimen has been collected in a semi-natural area close to the coast, outside the small village Torre del Lauro, in Caronia municipality, the nearest urban center being Acquedolci, about 5 km eastwards. It was not possible to locate the nesting site of the species; the specimen was observed to collect mud in a small creek.

OBSERVATIONS ON INVASIVENESS OF THE ALIEN *SCELIPHRON*

Sphecid wasps of the genus *Sceliphron* are good and active colonizers, they are generalist spider predators, they have good features to live and nest in human settlements and have a good kind of dispersion. As far as it is known, among the two-alien species, *S. caementarium* seems to be more invasive than *S. curvatum*, since the latter shows a narrower habitat preferences rather than the other three native species. The possible ecological impact of the allochthon *S. curvatum* over the native *Sceliphron* species has been discussed by Gepp (2003), especially referring to the native *S. destillatorium*, due to the apparent decreasing frequency of observations of the native species. Anyway, the invas-

iveness and thus the impact of *S. curvatum* on native *Sceliphron* species is still poorly understood and mostly anecdotic as underlined by Lukas et al. (2006), and needs further study in a wider geographic and ecological scale. Based on available data, this alien species seems to be more synanthropic than the other native species, e.g., *S. destillatorium*, showing preference for urban areas and nesting at human buildings and dry and hot places (Schedl, 2016). This narrower ecological niche in Europe should predict that the possible competition for preys and nesting areas observed by Gepp (2003) should only regard populations occurring in small villages and suburbs of larger towns and cities, without impact at a larger scale (see also Lukas et al., 2006). The possible ecological impact of the allochthon *S. caementarium* over the native *Sceliphron* species has been first discussed by Piek (1986), outlining that this alien species could replace the native species, namely referring to *S. spirifex*. Campadelli et al. (1999) provided evidence on a case of apparent replacing of the native species *S. destillatorium* in Emilia-Romagna, estimating this over a period of only ten years. Probably, it is not possible to predict the replacement of native species in the case of coexistence with alien ones, due to local ecological features, e.g., availability of nesting places and prey abundance. For instance, *S. curvatum* in Sicily has been observed in semi-natural habitat, differently than observed in other European countries. Thus, whether the presence of alien *Sceliphron* in Sicily represents a true threat for the native species still remains under great uncertainty although this matter deserves further monitoring acts over a significant period to collect significant data on the distribution and the basic ecological traits.

Figures 1, 2. Alien *Sceliphron* recorded from Sicily. Fig. 1: *S. caementarium*; Fig. 2: *S. curvatum*. Photos by Turrisi G.F.

FAUNISTIC SUMMARY ON THE NATIVE *SCELIPHRON* FROM SICILY

Although species of the genus *Sceliphron* in Italy are not of great faunistic interest, due to its prone to colonize a wide range of habitat, including those urban, in the following we provide a faunistic appendix with data on native *Sceliphron* from Sicily recorded in literature (including social forum of amateurs) along with material preserved in our collections. This is mainly to provide a basic framework to monitor their distribution and to relate it, in the near future, with those of alien species. Despite these species seems to be widespread and common in Sicily, the results clearly show that there are only few records and that the Regional distribution still remains poorly known.

Sceliphron destillatorium (Illiger, 1807)

Data from literature. Sichel, 1860 (Sicilia); De Stefani Perez, 1881 (Sciacca: torrente Caraballace); De Stefani Perez, 1883, 1889, 1895 (Sicilia); Giordani Soika, 1944 (Messina; Falcone; Fiumetorto; Agrigento); Pagliano, 1985 (Scicli); Pagliano, 1990 (Pizzenti); Gayubo et al., 1991 (Levanzo; Maraone); Negrisolo, 1995 (Sicilia); Schmid-Egger, 2003 (Castellammare; Ragusa); Pagliano & Negrisolo, 2005 (Sicilia).

Data from web sources. Trapani province: Fulgatore, 15.VI.2012, M. Ferrante (F.E.I.). Ragusa province: Modica, VII.2009, V. Risoldi (F.E.I.).

Examined material. Messina province: 1 female, Aeolian Islands, Panarea, 18.VI.1967, Sulfaro leg.; 1 male, Montalbano Elicona, Monte Polverello, 1257 m a.s.l., 37°58’48.’’N/ 14°57’35.’’E,

11.VII.2015, on *Thapsia* sp., G. Altadonna leg. Catania province: 1 female, Piana di Catania, Contrada Primosole, 11.VI.1996, on flowers of *Cachrys sicula* L., G.F. Turrisi leg.; 1 male, 1 female, Iblei, Vizzini, Fiume Vizzini, Contrada Rubalà, 320 m a.s.l., 29.V.1999, G.F. Turrisi leg. Syracuse province: 1 female, Iblei, Noto, Testa dell'Acqua, 1.VII.1993, G.F. Turrisi leg.

REMARKS. Newly recorded for Aeolian Islands (Panarea), already known for other circumsicilian islands (Levanzo, Maraone). Interesting biological information on this species in Italy have been provided by Campadelli & Pagliano (1987).

Sceliphron madraspatanum tubifex (Latreille, 1809)

DATA FROM LITERATURE. Sichel, 1860 (Sicilia); De Stefani Perez, 1881 (Sciacca: torrente Caraballace); De Stefani Perez, 1886 (Palermo: Monti di Renda); De Stefani Perez, 1889, 1895 (Sicilia); De Stefani Perez, 1894 (Trapani: Santa Ninfa); Giordani Soika, 1944 (Falcone); Pagliano, 1985 (Cefalù); Negrisolo, 1995 (Sicilia); Schmid-Egger, 2003 (Castellammare); Pagliano & Negrisolo, 2005 (Sicilia); Pagliano, 2008 (Sicilia).

DATA FROM WEB SOURCES. Trapani province: Marausa, 27.VII.2013, L. Barraco (F.E.I.).

EXAMINED MATERIAL. Catania province: 1 male, Fiume Alcantara, Calatabiano, 13.VIII.1991, G.F. Turrisi leg. Caltanissetta province: 1 male, Gela, Biviere di Gela, 16-17.VII.2005, G.F. Turrisi leg.; 1 male, same locality, 27.V.2006, G.F. Turrisi leg.

Sceliphron spirifex (Linnaeus, 1758)

DATA FROM LITERATURE. Riggio & De Stefani Perez, 1888 (Ustica); De Stefani Perez, 1881 (Sciacca: torrente Caraballace); De Stefani Perez, 1883, 1889, 1895 (Sicilia); De Stefani Perez, 1886 (Palermo: Monti di Renda); De Stefani Perez, 1894 (Trapani: Santa Ninfa); Giordani Soika, 1944 (Messina; Falcone; Agrigento); Pagliano, 1985 (Scicli; Cefalù; Marsala; Palermo); Pagliano, 1990 (isola di Lampedusa); Negrisolo, 1995 (Sicilia); Pagliano & Scaramozzino, 1995 (Lampedusa); Schmid-Egger, 2003 (Avola); Pagliano & Negrisolo, 2005 (Sicilia).

DATA FROM WEB SOURCES. Trapani province: Marausa, 15.VIII.2009, L. Barraco (F.E.I.).

EXAMINED MATERIAL. Messina province: 1 female, Aeolian Islands, Vulcano Island, Piano, 330 m a.s.l., 6.VII.2012, G. Altadonna leg.; 1 female, Messina, Tremestieri, 30 m a.s.l., 38°08'33.0"N 15°31'20.6"E, 3.III.2015, dead specimen, G. Altadonna leg.. Catania province: 1 male, Fiume Alcantara, Calatabiano, 13.VIII.1991, G.F. Turrisi leg.; 1 male, same locality, 4.VI.1999, G.F. Turrisi leg.; 1 male, Etna, Pedara, 700 m a.s.l., VII.2006, A. Vaccaro leg.; 1 female, Etna, Gravina di Catania, 350 m a.s.l., 4.XI.1991, C. Arena leg.; 1 male, Etna, Tremestieri Etneo, 350 m. a.s.l., 20.X.1991, G.F. Turrisi leg.; 1 female, same locality, 12.IX.1995, E. Turrisi leg.); 1 female, San Gregorio di Catania, 200 m a.s.l., 28.IX.1990, S. Bella leg.; 1 female, Piana di Catania, Contrada Primosole, 16.VII.2002, A. Messina leg.; 1 male, same locality, 19.VIII.2009, on leaves of *Punica granatum* L., G.F. Turrisi leg.. Syracuse province: 1 male, Iblei, Pachino, VII.1994, C. Bella leg. Caltanissetta province: 4 males, Gela, Biviere di Gela, 16-17.VII.2005, G.F. Turrisi leg.; 1 male, same locality, 27.V.2006, G.F. Turrisi leg.

REMARKS. Newly recorded for Aeolian Islands (Vulcano), already known for other circumsicilian islands (Ustica and Lampedusa).

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