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Calomera panormitana panormitana (Ragusa, 1906)

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Tiger beetles of Sicily (Coleoptera Cicindelidae)

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ABSTRACT Tiger beetles (Coleoptera Cicindelidae) are predators, both in the larval and adult state and each species tends to be specialized within a narrow habitat. For this reason, tiger beetles are excellent indicators of the quality of the biotopes in which they live and of the possible degradation of said biotopes due to anthropic actions. Currently, the populations of Cicindelidae are declining almost all over the world due to the destruction of the environments in which they live. In the Euro-Mediterranean area, including Italy, Cicindelidae mainly live in sandy environments like beaches, river mouths, the edges of lagoons and dune, and backdune ponds. Few species live on rocky coasts, in inland locations or in environments far from water such as paths and forest clearings. From what has been said, the coastal environments generally preferred by Cicindelidae are precisely those which in Italy, and also in Sicily, have undergone the greatest alteration and, often, destruction by man and his activities. In Sicily the Cicindelidae have always been studied since the first regional catalogs of the 19th century and other works were carried out in the following years, up to the present day. In the last decade, numerous reports have spread on the web, in numerous online chats, nature forums, etc. The aim of this work is to summarize and improve in a catalog what is known so far about the Sicilian Cicindelidae to highlight their peculiar systematic, ecological and geographical characteristics also in relation to the environment in which they live.

KEY WORDS Tiger beetles; Sicilian naturalists; biodiversity; taxonomy; culture; Italy.

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INTRODUCTION

Tiger beetles, with nearly 2900 species described worldwide, are arguably one of the most popular and well-studied insect families in the world (Pearson & Vogler, 2001; Wiesner, 2020). They are widespread on all continents - except the Antarctic continent, the northernmost regions of the world, Tasmania and some oceanic island groups such as Hawaii, the Canary Islands and the Maldives (Cassola, 1998). Due to their vital needs, Cicindelidae are more widespread and diversified in tropical countries. Their presence then progressively decrease at lower temperatures, and they are absent above 70° North latitude (Lindroth, 1992; Pearson & Cassola, 1992; Cassola & Pearson, 2000).

The Cicindelidae are predators, both in the larval and adult state and each species tends to be specialized within a narrow habitat. Larva and adult tiger beetles occupy very different ecological niches. Adult tiger beetles are active, diurnal, predatory invertebrates; the larvae are sedentary and construct burrows in the substrate at the site of oviposition. The Cicindelidae live in different habitats such as sandy beaches, river mouths, brackish ponds and humid areas, meadows, clearings and forest paths, from sea level to low and medium altitudes and rarely even at higher altitudes. Due to these characteristics, in particular the environmental needs of the larval stages (Pearson & Knisley, 1985; Knisley & Juliano, 1988), Cicindelidae are excellent indicators of the quality of the biotopes in which they live and of the possible degradation of said biotopes due to anthropic actions (Pearson, 1988; Cassola 1998).

Since always an object of study and research in Italy, Cicindelidae are cited in almost all the regional and national entomological catalogs of the country with 31 taxa reported (Casale, 2021) of which 14 are also present in Sicily.

The first information on the population of the Sicilian Cicindelidae can already be found in the first regional catalogs of the 19th century. To cite a few examples: Ghiliani (1842), Romano (1849), Reiche (1860), Rottenberg (1870), De Stefani-Perez & Riggio (1882), and Steck (1887).

Other ecological and faunal data on these beetles in Sicily can also be obtained from the first works dedicated to particular biotopes, such as Calcara (1842) for Termini Imerese, Pincitore Marott (1873) for Ficuzza and neighboring localities, Ragusa (1874) for the surroundings of Palermo, Ciofalo (1886) for the surroundings of Termini Imerese, Failla Tedaldi (1887) for the island of Lampedusa, Palumbo (1889–1896) for the surroundings of Selinunte. Enrico Ragusa, both with his "*Catalogo dei Coleotteri Siciliani*" (Catalog of Sicilian Coleoptera) (1883) and with numerous other articles, provided a fundamental contribution to the knowledge of the entire population of the Sicilian Cicindelidae. He provided new faunal and biological data, also addressing various taxonomic issues such as those linked to the description of *Calomera panormitana panormitana* (1906). Precisely on this species, Vitale (1913) provided his own contribution while other faunal data on the Sicilian Cicindelidae are summarized in his Catalog of Sicilian beetles (1912).

In 1900, various information on the Sicilian Cicindelidae can be found in Italian faunal works, such as Porta (1923, 1949) and Luigioni (1929), or specialist works such as Magistretti (1965, 1968), Cassola (1970, 1998, 2002) and Lisa (2002). Magistretti (1962, 1963, 1967, 1971) also carried out some works on the Sicilian Carabidae such as those collected on the Hyblaean Mountains, the Sicilian Apennines, and the Aegadian, Aeolian and Ustica Islands. Cassola (1983) instead published a fundamental monograph on the biology of the *C. panormitana panormitana*. Further contributions in the literature on this group in Sicily were made by Gridelli (1960), Aliquò et al. (1973) on the now destroyed coastal biotope of Buonfornello, Aliquò & Romano (1975), Aliquò (1981) on *Lophyra flexuosa*, Sturani (1981) on the biology of *Cephalota litorea goudotii* in Vendicari.

Other works are: on the Carabidae of the Trapani area by Aliquò & Castelli (1991), on the Cicindelidae of the Alliata collection of Palermo by Aliquò (1992) and by Arnone (1994) and of the Vitale collection of Messina by Facchini & Baviera (2004), on the Sicilian Coleoptera by Sparacio (1995), on the Carabidae of the Sicilian Channel by Vigna Taglianti (1995), on the beetles of the Etna region by Sapuppo (2002), on the coastal dune environments in Sicily by Lapiana & Sparacio (2008) and on the presence of *Cephalota circumdata imperialis* by Surdo (2016).

More recent works should also be noted, as they mainly concerned the study of the populations of *C. panormitana panormitana* (Romano & Sparacio, 2018; Sparacio & Surdo, 2021) or, more generally, the entomological population, including Cicindelidae, of the Aeolian Islands (Lo Cascio et al., 2022).

In the last decade, numerous reports have spread on the web, in numerous online chats, nature forums and other similar venues.

From what has been summarized so far, an overall catalog that highlights the particular and interesting systematic, ecological and biogeographical characteristics of the Sicilian

Cicindelidae is still missing. This is the main purpose of this work which we hope to have achieved.

MATERIAL AND METHODS

Study area and field research

Tiger beetles samplings were carried out in the whole Sicily during numerous years of studies, collections and observations, in many different localities, with particular effort in the best preserved habitats and on circumsicilian islands (Figs. 1–13).

The specimens were observed directly in their environments, photographed or collected with the aid of a entomological net. These data have been compared and combined with available literature records of regional presence, including the Maltese Islands, and with data obtained from public and private entomological collections. The material studied, unless otherwise indicated, is intended to be collected by the owner of the collection himself.

For each species, chorotype, geographical distribution, bibliography, new census finds, remarks on particular systematic, biological and faunal particularities and a map of the distribution in Sicily are provided.

This map is obtained from that of Sicily with the UTM grid divided into meshes of 100 km on each side (stronger section) further divided into smaller ones of 10 km on each side (thinner section). With this system, the coordinates of all the localities taken from the known bibliography (record = red dot) and the new ones (new record = green dot) were added. The localities cited in the bibliography and confirmed by our research are also reported (confirmed = yellow dot).

In the final map (Fig. 1), the links of the UTM system are not shown but the borders of the districts into which Sicily has been divided are represented (from Sabella, 1998, modified). These

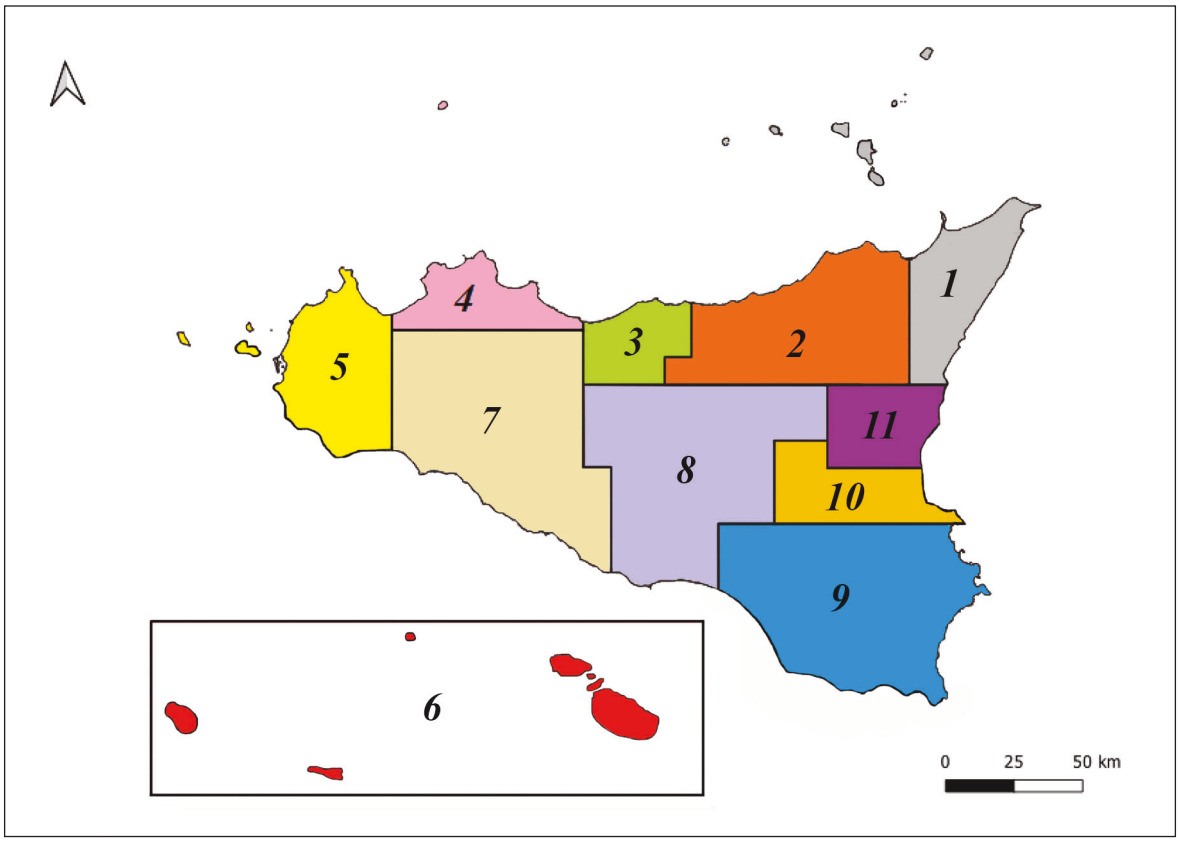

Figure 1. Map with the 11 districts into which Sicily has been divided.

11 districts into which Sicily has been divided are: Peloritani (including Aeolian Archipelago), Nebrodi, Madonie, Palermo (including Ustica Island), Trapanese (including Aegadian Archipelago), Canale di Sicilia (Pantelleria Island, Pelagian Islands and Maltese Archipelago), Sicani, Erei, Iblei, Piana di Catania, Etna.

Three final chapters are dedicated to the main faunal and biogeographical data, the ecology, the loss of biodiversity and conservation, and on the presence of the Sicilian Cicindelidae in the circum-Sicilian islands.

The systematic follows the contributions of Putchkov & Matalin (2003, 2017), Wiesner (2020), Casale et al. (2021) and other papers cited in the text (see also References). Often included in Carabidae, Cicindelidae are here considered as distinct family according to Duran & Gough (2010). The chorotypes follow the categories proposed by Vigna Taglianti et al. (1993, 1999), implemented by Parenzan (1994).

Photos by: Giovanni Altadonna (2, 3), Teodosio De Stefani Jr.(47, 48), Amedeo Falci (11, 12, 33, 36, 39), Calogero Muscarella (13, 31, 32, 35, 37, 38, 40, 41, 42, 43, 44), Elena Prazzi (51), Ignazio Sparacio (4, 5, 6, 7, 9, 10, 25, 30), Roberta Salmaso (20), Giovani Spinella (8), Salvatore Surdo (34 and Sicily maps).

Web-sourced data

Photographs of Cicindelidae taken in Sicily were obtained from various web sources. First, we used the web-application Morphic (Leighton et al., 2016), which allows users to specify search terms and retrieves photographs from the search engine Googleimages®. This web application (http://morphs.io), free and open source, is based on a perpetual hashing algorithm (Niu & Jiao, 2008) that enables to remove duplicate photographs and avoids geographical biases using Google's Hummingbird relevance algorithm (Lin & Yazdanifard, 2014). To further reduce the number of duplicates and to identify the original photographic source, we applied the Tineye reverse image search application (https://tineye.com). We then supplemented our morphic searches via manual searches from different naturalist and social media sites, Facebook (https://www.facebook. com/); and Twitter (https://twitter.com/) (see References). As for Facebook, the research was conducted within the following groups: Fauna Siciliana; AFNI Sezione Sicilia; Insetti e altri artropodi - un fantastico mondo da scoprire; Insetti e aracnidi italiani; Insetti e aracnidi; Identificazione ragni e insetti; Riconoscimento Insetti; Aracnidi e Insetti: Official Group; Centro di Educazione Ambientale ODV. These sites were not accessed via morphic tools, as they are not indexed by search engines (Leighton et al., 2016), but we decided to include them in our manual searches as they are very popular in the Sicilian entomological community.

ABBREVIATIONS AND ACRONYMS. Personal communication: pers. comm.; specimen/s: ex/x; photographed specimen: ex phot. Raniero Alliata collection, Museo Regionale di Storia Naturale e Mostra permanente del Carretto siciliano di Terrasini (Palermo) Italy (CRA-MRSNT); Vittorio Aliquò collection, Museum of Zoology "Pietro Doderlein" University of Palermo, Italy (CVA); Giovanni Altadonna collection, Messina, Italy (GAC); Teodosio De Stefani collection, Museo Regionale di Storia Naturale e Mostra permanente del Carretto siciliano di Terrasini (Palermo) Italy (DST-MRSNT); Luigi Failla Tedaldi collection, Museum of Zoology "Pietro Doderlein" University of Palermo, Italy (CFT); Amedeo Falci collection, Caltanissetta, Italy (CAF); Tommaso Lisa (Firenze, Italy); Pietro Lo Cascio collection, Lipari, Italy; Mario Mariani collection, Museo Regionale di Storia Naturale e Mostra permanente del Carretto siciliano di Terrasini (Palermo), Italy (CMM-MRSNT); Bruno Massa collection, Museum of Zoology "Pietro Doderlein" University of Palermo, Italy (CM); Museo civico di Storia Naturale di Genova "Giacomo Doria" (MSNG); A. Monastra collection, Museo civico di Storia Naturale di Genova "Giacomo Doria" (CAM-MSNG); Calogero Muscarella collection, Palermo, Italy (CM); Enrico Ragusa collection, Museo di Zoologia e Casa delle Farfalle dell'Università di Catania, Italy (ER-CMC); Marcello Romano collection, Capaci, Italy (CR); Ignazio Sparacio collection, Palermo, Italy (CS); Salvatore Surdo collection, Trapani, Italy (CSS); Vittorio Emanuele Orlando collection, Museo Regionale di Storia Naturale e Mostra permanente del Carretto siciliano di Terrasini (Palermo), Italy (VEO-MRSNT); Museo di Storia Naturale di Verona (MSNV).

Figure 2. Sicily, Peloritani Mountains (Messina): Curcuraci-Antennamare.

Figure 3. Sicily, Tusa (Messina): mouth of the Tusa stream.

Figure 4. Sicily, Madonie Mountains: Gibilmanna.

Figure 5. Sicily, Palermo surroundings: Piano dell'Occhio.

Figure 6. Sicily, Trapani: Macari and Mount Cofano.

Figure 7. Sicily, salt pans of Trapani

Figure 8. Sicily, Marsala, “Lo Stagnone”: Isola Lunga.

Figure 9. Agrigento, Menfi: mouth of the Carboj stream.

Figure 10. Sicily, Agrigento: Torre Salsa.

Figure 11. Sicily, Caltanissetta: southern Imera river at the confluence of the Vaccarizzo stream.

Figure 12. Sicily, Siracusa: Vendicari.

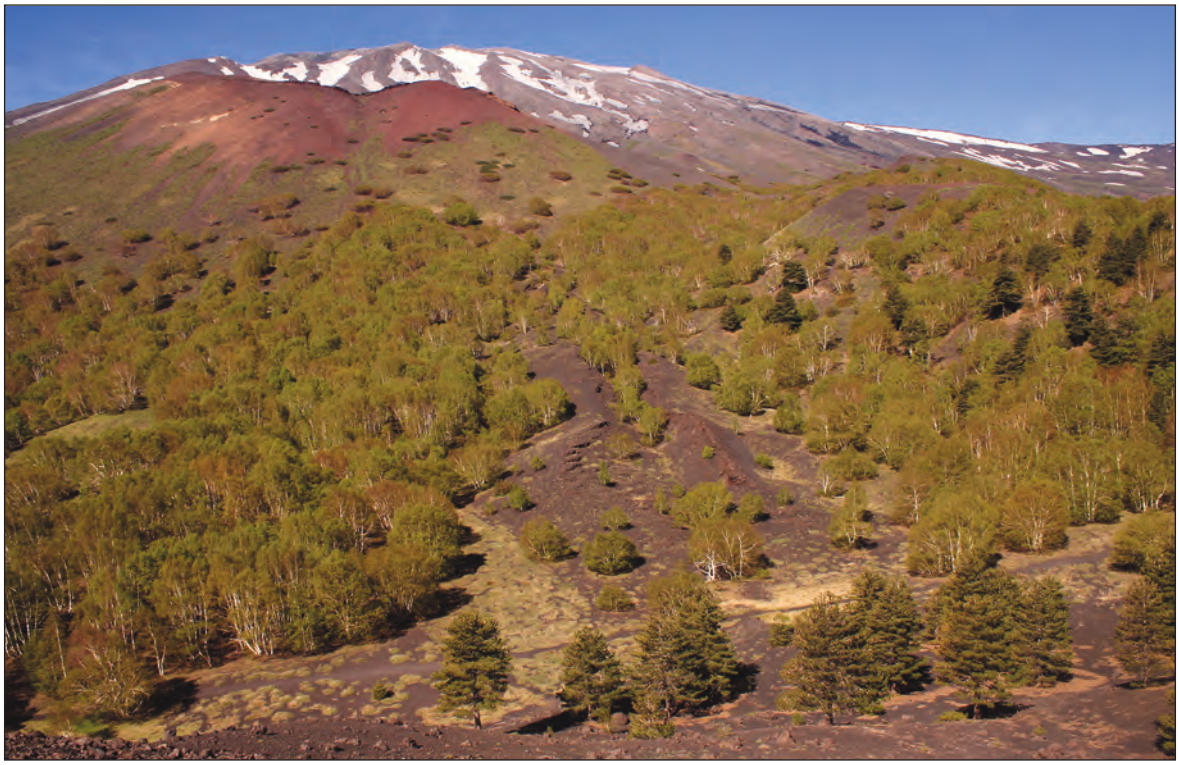

Figure 13. Sicily, Catania: Etna, Monti Sartorius

RESULTS

Systematics

Ordo C O L E O P T E R A
Subordo ADEPHAGA
Familia C I C IN D E L I D A E
Genus *Cassolaia* Wiesner, 1985

Cassolaia maura cupreothoracica Korell et Cassola, 1987

Chorotype and distribution. West-Mediterranean (WME).

Cassolaia maura maura (Linnaeus, 1758) is widespread in Algeria (locus typicus), Morocco, Spain, Portugal and, in Italy, it is recorded for Calabria (Casale et al., 2021). *Cassolaia maura cupreothoracica* lives in Tunisia and Sicily (Korell & Cassola, 1987; Putchkov & Matalin, 2003, 2017; Jaskula & Rewicz, 2015; Wiesner, 2020; Casale et al., 2021) (Figs. 14, 15, 31, 32).

References. Catania, Siracusa (Ghiliani, 1842 sub *Cicindela Sicula* Kunz.); Sicily (Romano, 1849); Sicily (Reiche, 1860); Castelbuono (Ragusa, 1871); Oreto river (Ragusa, 1874 sub *Cicindela Sicula* Redt. - *maura*); Santa Ninfa, Termini Imerese, Ficuzza, Palermo (De Stefani-Perez & Riggio, 1882 sub *maura* and var. *sicula* Redt.); Sicily (Ragusa, 1883 sub *maura* and var. *sicula* Redt.: "*è comune credo in tutta l'isola* [I think it's common throughout the island]; surroundings of Termini Imerese (Ciofalo, 1886 sub *Cicindela Maura* and *maura* v. *sicula*); Sicily (Steck, 1887); Sicily (Kraatz, 1890); Trapani (Palumbo, 1892); Sicily (Fleutiaux, 1892 sub *Cicindela maura* v. *sicula* Redt.); "*Sicilia tota*" (Vitale, 1912); Sicily (Luigioni, 1929); Capo S. Marco (Sciacca), Capo Feto (Mazara del Vallo); Messina, Catania, Delia (Canicattì), Biviere di Gela, Sciacca (Magistretti, 1967); Peloritani: Messina (Magistretti, 1963); Messina, Delia (Canicattì) (Magistretti, 1965); Catania, Biviere lake (Gela), Sciacca, Capo S. Marco (Sciacca), Capo Feto (Mazara del Vallo) (Magistretti, 1968); Balestrate (Mignani, 1970); Buonfornello near Termini Imerese, Messina, Catania, Biviere di Gela, Capo S. Marzo, Capo Feto, Delia, Camporeale, Castelbuono, Pollina, Vicari (Aliquò et al., 1973); Palermo: mouth of the Oreto river, Altavilla Milicia (Aliquò, 1992); Torto river, Oreto river, Altavilla Milicia (Arnone, 1994); Agrigento (Lanza, 1994); Sicily (Sparacio, 1995); mouth of the Simeto river (Lisa, 2002); Rometta, San Michele (Facchini & Baviera, 2004); salt pans of Trapani (Romano, 2008); mouth of the Belice river (Brancato, 2011); Fulgatore (Ferrante, 2012); Trapani: Marausa (Barraco, 2015); Giallonardo (Castiglia, 2018); Geloi wetland (Zafarana, 2018); San Biagio Platani (De Simone G., 2022).

Materials. M a d o n i e. Madon[ie], E. Ragusa, 1 ex (ER-ER-CMC); Castelbuono, 14.VI.1970 (CAV).

P a l e r m i t a n o. [Fiume] Oreto, 6, E. Ragusa, 1 ex (ER-CMC); Balestrate, 2.6, E. Ragusa (ER-CMC); Palermo, 1 ex 17.7.913 (ER-CMC); Balestrate, 1.VI.1970 (CAV); mouth of the Torto river, 6.VI.1971 (CAV); Balestrate, mouth of the Calatubo river, 9.VI.1974, 2.VI.2001 (CR).

T r a p a n e s e. [Trapani] Xitta stream, 13 exx 19.VII.1944 (DST- MRSNT); Birgi, 30.VI.1974 (CR); mouth of the Birgi river, 4 exx 9.VI.1994, 37°54'59.1"N 12°28'11.4"E (CS); Paceco, 37°57'45.9"N 12°36'31.7"E, ex phot. 4.VI.2018;

Figure 14. *Cassolaia maura cupreothoracica*, Oreto river (Palermo), 1938, Alliata entomological collection (from Lo Valvo, 2022).

Trapani: Diga Rubino, 37°54'06.4"N 12°43'27.0"E, 1 ex 8.VII.2019 (CSS).

Sicani. Ficuzza, 6, E. Ragusa, 1 ex (ER-CMC); Sciacca, 6, E. Ragusa, 1 ex (ER-CMC); Palma di Montechiaro: Punta Bianca, 21.V.1978, legit B. Massa (CS); Torre Salsa, 15.VI.1995, legit B. Massa (CAV); Agrigento, 11.VI.1974 (CR); Torre Salsa, 4.V.2013 (CR); Siculiana: Torre Salsa, Pantano, 37°21'37"N 13°20'41"E, 25.V.2012, 2 exx 4.V.2013, 3 exx 11.V.2016, 19.VII.2017, 4 exx 8.VI.2021 (CM); Siculiana: Torre Salsa, 37°21'42.7"N 13°20'37.8"E, 9 exx 4.V.2013 (CS); Palma di Montechiaro, 37°11'19.3"N 13°44'43.4"E, 1 ex phot. 23.V.2020 (I. Gurreri, pers. comm.); Siculiana: RN Torre Salsa, 4 exx 23.VII.2015, 1 ex 10.VI.2017, 3 exx 29.VII.2021 (CAF).

Erei. [Caltanissetta] Capodarso, 2 exx 16.VI.1950 (MM- MRSNT); Caltanissetta, 4 exx VI.1950 (MM- MRSNT); Gela, 11.VI.1996, legit B. Massa (CAV); Santa Caterina Villaermosa: Ponte 5 Archi, 37°36'10.0"N 14°07'57.3"E, 1 ex 13.VI.2009 (CS); Marina di Butera: Manfria, 37° 6'15"N 14° 6'38"E, 1 ex 18.VII.2021 (CM); Ravanusa, 37°14'12.4"N 13°59'10.1"E, 1 ex phot. 26.VI.2022 (S. Russotto, pers. comm.); Caltanissetta: Salito river, Trabona, 2 exx 21.VII.2018, 3 exx 6.VI.2020, 2 exx 20.VII.2021 (CAF); Mussomeli: Salito river, Cozzo Reina, 2 exx 22.VII.2010, 3 exx 21.VIII.2013, 2 exx 8.VII.2015 (CAF); Mussomeli: Salito river, Pizzo della Candela, 4 exx 22.VII.2010, 2 exx 22.VII.2010 (CAF); Mussomeli: Platani river, Case Rainieri, 1 ex 22.VII.2010, 2 exx 10.VII.2012, 2 exx 21.VIII.2013, 3 exx 8.VII.2015 (CAF); Mussomeli: Salito river, Monte Raffe, 6 exx 22.VII.2010, 3 exx 10.VII.2012, 1 ex 21.VIII.2013 (CAF); Caltanissetta: RN Lago Sfondato, Vallone Formicai, 2 exx 1.VII.2001, 2 exx 10.VII.2012, 3 exx 12.VII.2014, 1 ex 2.VII.2017 (CAF); Campofranco: RN Monte Conca, Gallodoro river, 5 exx 4.VII.2002, 11 exx 5.VI.2003 (CAF); Aragona: RN Macalube Aragona, 3 exx 21.VI.2007, 2 exx 10.VIII.2010, 2 exx 07.VI.2011 (CAF); Enna: RN Lago Pergusa, 2 exx 23.VII.1996, 5 exx 1.VIII.2001, 1 ex 5.VII.2003 (CAF); Caltanissetta: southern Imera river, Lannari, 3 exx 21.VII.2008, 2 exx 20.VI.2012, 5 exx 20.VIII.2019, 7 exx 21.VII.2022, 4 exx 27.VIII.2023 (CAF); Pietraperzia: southern Imera river, Cozzo Bersaglio 1 ex 21.VII.2008, 9 exx 20.VIII.2019, 5 exx. 21.VII.2022, 3 exx. 21.VI.2023, 2 exx 28.VIII.2023 (CAF); Sommatino: southern Imera river, Ponte Trabia-Tallarita, 1 ex. 19.VI.2014, 6 exx 21.VII.2018, 2 exx 19.VI.2022, 3 exx 21.VI.2023, 4 exx 28.VIII.2023 (CAF); Butera: southern Imera river, La Muculufa, 2 exx 18.VII.2011, 3 exx 20.VIII.2022 (CAF); Villarosa: Diga Villarosa, 6 exx 4.VII.1998, 2 exx 23.VII.2008, 5 exx 21.VII.2018 (CAF); Macalube of Aragona, 9.VIII.2007, legit B. Massa (CR).

Iblei. mouth of the Eloro river, 13 and 23.VI.1974 (CR); Mazzarino (CL): Diga Disueri, 1 ex 23.VI.2006, 5 exx 14.VII.2017, 5 exx 23.VII.2017, 7 exx 23.VIII.2023 (CAF); Mazzarino: Mount Gibliscemi, 1 ex 5.VI.2020 (CS).

Piana di Catania. Catania, 19.VI.1974 (CR); Dittaino river: Stazione Libertinia, 14.VI.1974 (CR); mouth of the Simeto river, 7.VI.1981, 11.VI.1982, 26.VI.1984, 5.VI.1999 (CR); mouth of the Simeto river, 37°23'57.5"N 15°05'14.0"E, 3 exx 26.VI.1984 (CS).

BIOLOGY. Species with wide ecological value, present at the mouths of rivers, along the coasts but also on the edges of lakes and inland waterways, both on sandy, clayey and salty soils.

REMARKS. It is relatively widespread throughout the Sicilian territory but with isolated populations. It prefers the edges of watercourses in inland locations. Palumbo (1892) describes his observations on this species in the Sicilian territory, stating that "*si vede spesso sulle sponde argillose dei fiumi, in terreni acquitrinosi e anche sui sassi che s'innalzano sul livello dell'acqua nel bel mezzo dei torrenti, dei fiumi e dei pantani* [it is often seen on the clayey banks of rivers, in marshy terrain and also on stones that rise above the water level in the middle of streams, rivers and of the marshes]".

Genus *Cephalota* Dokhtourov, 1883
Subgenus *Taenidia* Rivalier, 1950

Cephalota (Taenidia) circumdata imperialis (Klug, 1834)

CHOROTYPE AND DISTRIBUTION. Mediterranean (MED).

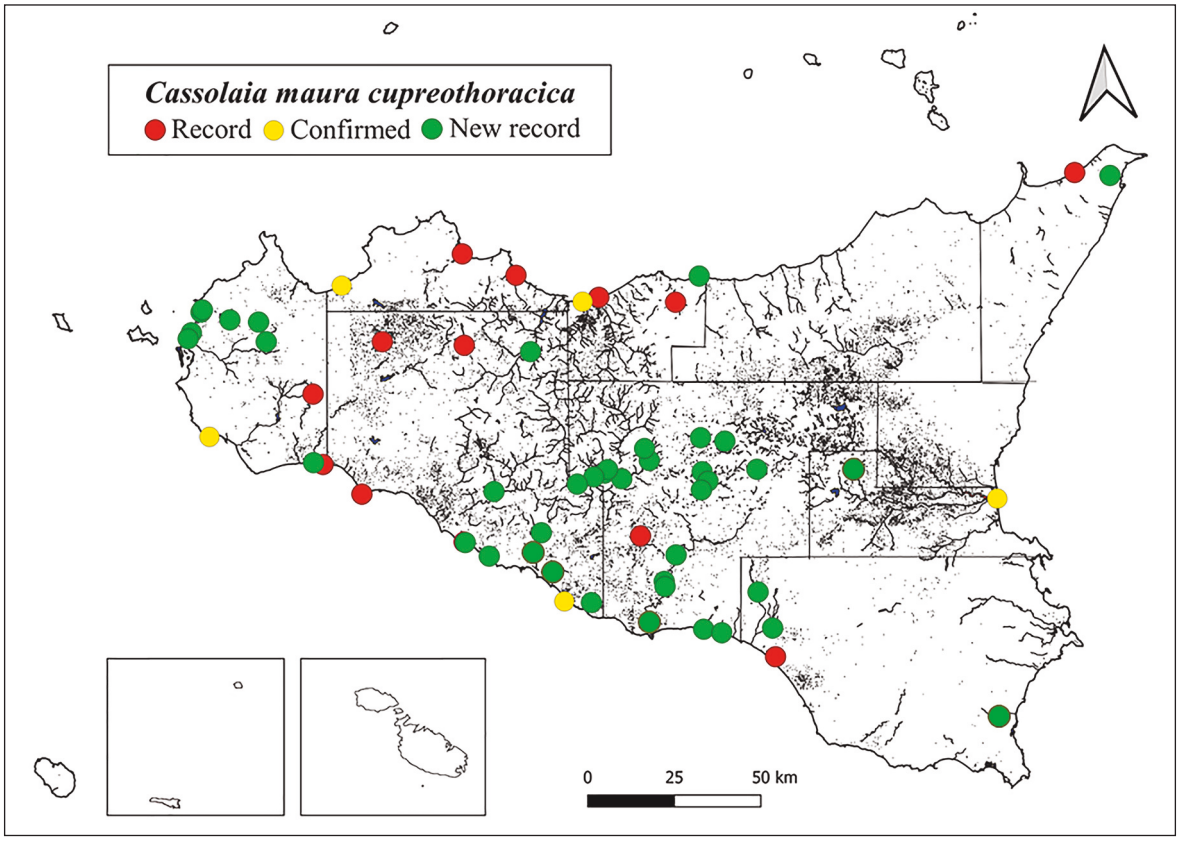

Figure 15. Distribution in Sicily of *Cassolaia maura cupreothoracica.*

Cephalota (Taenidia) circumdata s.l. is widespread throughout the Mediterranean basin, from Spain to Asia Minor with four subspecies (Putchkov & Matalin, 2003, 2017; Wiesner, 2020): *C.* (*T.*) *circumdata circumdata* (Dejean, 1821) is widespread in the eastern Mediterranean and recorded in Italy for Basilicata, Puglia and Calabria (Cassola et al., 2021), *C.* (*T.*) *circumdata leonschaeferi* (Cassola, 1970) is present with some coastal populations in southern France and Tuscany, *C.* (*T.*) *circumdata imperialis* lives in the western Mediterranean, Sardinia and Sicily (Cassola, 1970a, b, 1972a, b) and *circumdata hattusae* Franzen, 1996 in Turkey.

References. Trapani (Ragusa, 1883: "*io la posseggo in un solo esemplare catturato dal Capitano de Marchi presso Trapani e donatomi dall'amico Professore Augusto Palumbo* [I have only one specimen captured by Captain de Marchi near Trapani and given to me by my friend Professor Augusto Palumbo]"; Trapani (Vitale, 1912); Trapani (Luigioni, 1929); salt pans of Trapani, Isola Lunga of the Stagnone of Marsala (Aliquò & Castelli, 1991); surroundings of Trapani (Sparacio, 1995); Augusta, Messina, Selinunte, Trapani (Facchini & Baviera, 2004); Isola Lunga of the Stagnone of Marsala (Lisa, 2002; Surdo, 2016; Sparacio & Surdo, 2021) (Figs. 16, 33).

Materials. T r a p a n e s e. Trapani prior to 1900, E. Ragusa, 1 ex (ER-CMC); 1 ex (ER-CMC); Trapani prior to 1900, 1 ex (CFT); Isola Lunga, 11.VI.1978, legit B. Massa (CR); Isola Lunga of the Stagnone of Marsala, 1 ex 15.V.2017, 1 ex 31.V.2019, 1 ex 10.VI.2019 (CSS); Isola Lunga of the Stagnone of Marsala, 3 exx 14.VI.2003 (CS).

Biology. It lives on salty lands, such as lagoons and salt pans. Active in the warmer months and with high temperatures, it feeds mainly on Arthropods (Insects) which are preyed on with various techniques studied above all in the populations of *C. circumdata leonschaeferi* of the Orbetello Lagoon (Favilli & Eusebi, 1990; Lovari et al., 1992).

REMARKS. The report of this species for the salt pans of Trapani carried out by Aliquò & Castelli (1991) on the discovery of an elytra, after the examination of this elytra preserved in D. Castelli collection is attributable to *C. litorea goudotii*.

Facchini & Vitale (2004) report that: "*Gli esemplari conservati nella collezione Vitale risultano particolarmente importanti in quanto* circumdata imperialis *è estremamente rara in Sicilia* [The specimens preserved in the Vitale collection are particularly important as *circumdata imperialis* is extremely rare in Sicily]".

Cephalota (Taenidia) litorea goudotii (Dejean et Boisduval, 1829)

CHOROTYPE AND DISTRIBUTION. Mediterranean (MED).

Cephalota litorea litorea Forskal, 1775 occupies the eastern part of the Mediterranean Sea (Cyprus, Syria, Egypt, Tripolitania and the African coasts of the Red Sea), while the ssp. *goudotii* occupies the western part of this basin (southern Spain, Morocco, Tunisia, Algeria, Sardinia and Sicily) (Puchkov & Matalin, 2003; 2017; Wiesner, 2020; Casale et al., 2021). The subspecies *litorea alboreducta* (W. Horn, 1934) is found in Somalia, Djibouti, Yemen, Saudi Arabia, Oman (Cassola & Rihane, 1996) (Figs. 17, 18, 34).

REFERENCES. Siracusa (Ghiliani, 1842); Sicily (Romano, 1849); Trapani (De Stefani-Perez & Riggio, 1882); surroundings of Termini Imerese (Ciofalo, 1886 sub *Cicindela littorea*); salt pans of Trapani, Trapani (Ragusa, 1883; Vitale, 1912; Magistretti, 1967; Aliquò & Castelli, 1991); Trapani (Palumbo, 1892 sub *Cicindela littorea*); Trapani (Luigioni, 1929 sub *Cicindela litorea*); Vendicari (Sturani, 1981); Sicily (Sparacio, 1995); Island of Capo Passero (Angelini, 1999); salt pans of Trapanese (Lisa, 2002); Selinunte, Trapani (Facchini & Vitale, 2004); Marsala, Isola Lunga, (Surdo, 2016).

MATERIALS. Trapanese. Trapani, E. Ragusa, 1 ex (ER-CMC); salt pans of Trapani, 10.IX.1973, legit M. Romano (CAV); salt pans of Trapani,

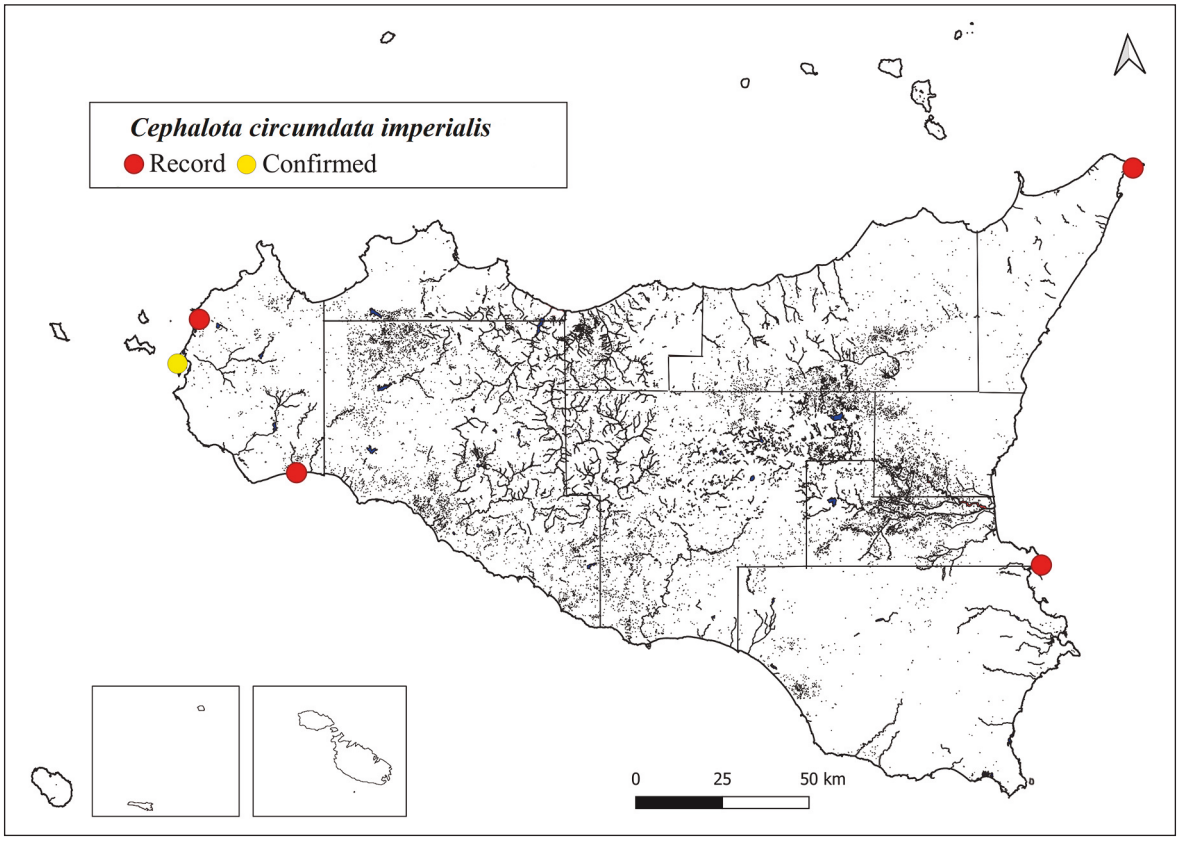

Figure 16. Distribution in Sicily of *Cephalota (Taenidia) circumdata imperialis.*

10.IX.1973, 11.VIII.2006 (CR); mouth of the Birgi river, 11.VIII.2006 (CR); salt pans of Trapani, 37°58'29.7"N 12°29'49.1"E, 5 exx 29.VII.1994, 6 exx 11.VIII.1994 (CS); salt pans of Trapani, 37°58'53"N 12°29'40"E, 26.VIII.2012 (CM); salt pans of Trapani, 37°59'14.4"N 12°30'42.6"E, ex phot. 12.IX.2018, 2.IX.2019 (CSS); idem, exx phot. 1.X.2023, D. D'Amico and L. Barraco; Marsala, Saline: Punta San Teodoro, 37°54'28.77"N 12°27'33.28"E, 2 exx VIII.2022, leg. M. Amorelli (CM); Marsala, Isola Lunga, exx phot. 24.VIII.2023 (CSS).

Sicani. Licata, 9.906, F. Re, 1 ex (ER-CMC).

Biology. Halobiont species, with a habitat restricted to the salty soils of the open edges of ponds and lagoons or near salt pans. Sturani (1981) expands the knowledge of this tiger beetle by describing the larvae found in Torre Vendicari. He also identifies their main source of nourishment, at least in this biotope, in the Isopods of the genus *Ligia*,

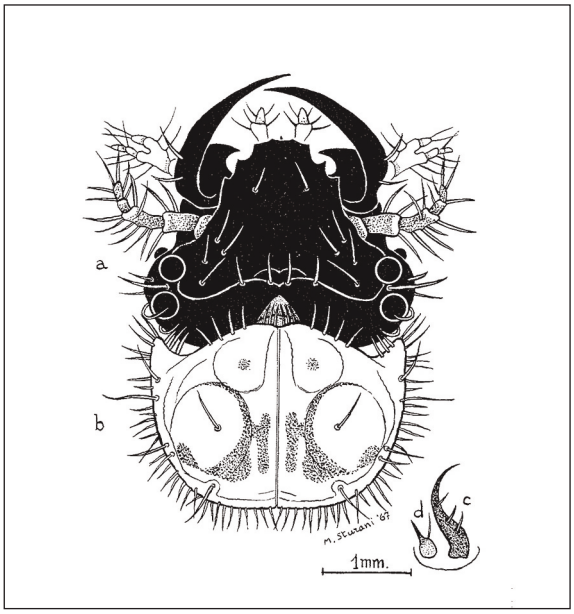

Figure 17. Larval morphology of *Cephalota (Taenidia) litorea goudotii* from Vendicari (Italy, Sicily) (from Sturani, 1981).

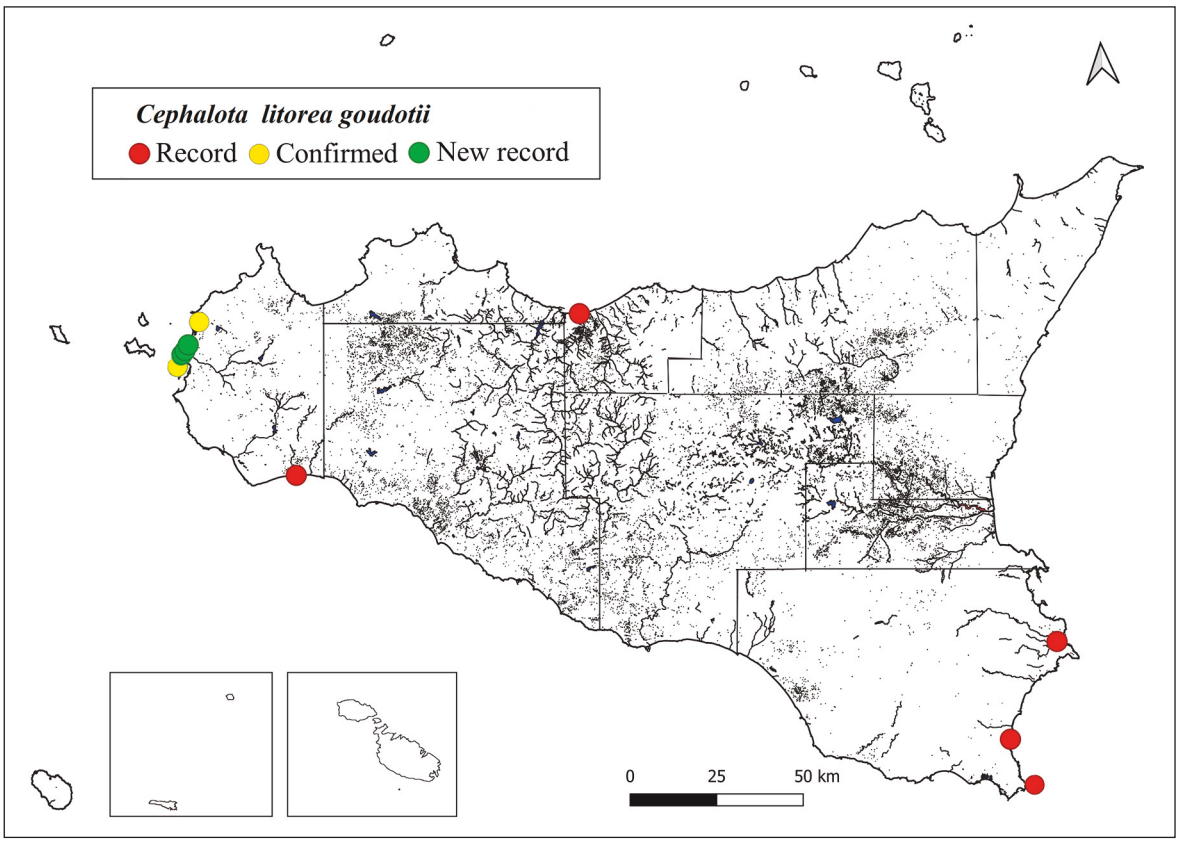

Figure 18. Distribution in Sicily of *Cephalota (Taenidia) litorea goudotii.*

whose remains he found abundant around the mouths of the larval galleries.

This subspecies adapts to a different ecological niche in the localities where it is sympatric with *C. circumdata imperialis*. *Cephalota circumdata imperialis* occupies the strip of territory in direct contact with the water, while *C. litorea goudotii* is found in the innermost part.

REMARKS. Particularly vulnerable species (like many other tiger beetles) to modifications of their habitat (Cassola, 1998, 2002).

Genus *Cicindela* Linnaeus, 1758
Subgenus *Cicindela* Linnaeus, 1758

Cicindela (Cicindela) campestris siculorum Schilder, 1953

CHOROTYPE AND DISTRIBUTION. West Paleartic (WPA).

Species with wide distribution in the western Paleartic with about 40 taxa including 13 species (Gebert et al., 2020). In Italy it is present with the following subspecies: *C. campestris campestris* Linnaeus, 1758 throughout the peninsula up to Basilicata, the ssp. *calabrica* Mandl, 1944 in Calabria, the ssp. *nigrita* Dejean, 1825 in Corsica and Sardinia, the ssp. *saphyrina* Gené, 1836 only on the island of Santo Pietro in Sardinia, the ssp. *siculorum* in Sicily (Figs. 19, 35) and the ssp. *didyme* Sparacio, Lo Cascio, Muscarella, Surdo, Falci et Allegrino, 2023 only on the islands of Salina and Lipari (Aeolian Archipelago). (Sparacio et al., 2023). In Sicily, the ssp. *suffriani* Loew, 1843, which has an eastern Mediterranean distribution, is also cited, sometimes with doubt. *Cicindela campestris atlantis* Mandl, 1944 is widespread in North Africa.

REFERENCES. Surroundings of Termini Imerese (Calcara, 1842); Sicily (Ghiliani, 1842); Sicily (Romano, 1849); Sicily (Reiche, 1860); Palermo (Rottenberg, 1870); Ficuzza: Catagnano (Pincitore Marott, 1873); Monte Pellegrino slopes (Ragusa, 1873); Termini Imerese, Palermo, Castelbuono (De Stefani-Perez & Riggio, 1882); Sicily (Ragusa, 1883: "*La più comune Cicindela*…[the most common tiger beetle species]"; 1921); surroundings of Termini Imerese (Ciofalo, 1886); Castelvetrano, Selinunte (Palumbo, 1890); Trapanese (Palumbo, 1892); Malta (Cameron & Gatto, 1907); "*Sicilia tota*", Balestrate, [Palermo] Favorita (Vitale, 1912); Palermo: Passo di Rigano (Luigioni & Tirelli, 1912); Sicily (Porta, 1923; 1949); Colle Castellaccio, Rometta-Marea, hills of Messina (Vitale, 1927 sub *C. campestris* and *C. campestris suffriani*); Sicily (Luigioni, 1929); Messina and surroundings (Mandl, 1944); "*dintorni di Messina*" (Porta, 1959); Pachino (Magistretti, 1962 sub *C. campestris suffriani* Loew.); Peloritani: S. Martino (Spadafora), Messina and surroundings; Nebrodi: Floresta, Madonie: Castelbuono, Palermo, Ficuzza, Pachino (Magistretti, 1963 sub *C. campestris suffriani* Loew.); Palermo, Ficuzza, Castelbuono, Floresta, S. Martino (Spadafora), Pachino, Agrigento, Montallegro (Magistretti, 1965); Palermo, Ficuzza, Castelbuono, Floresta (Nebrodi), Cesarò, S. Martino (Spadafora), Pachino, Gela, Agrigento, Montallegro, Malta (Magistretti, 1967); Cesarò, Gela (Magistretti, 1968 sub *C. campestris siciliana* Luig.); Malta: Mistra (Cilia, 1989 sub *C. campestris siciliana* Luig.); Salemi (Aliquò & Castelli, 1991); Palermo Boccadifalco, Palermo Addaura, Palermo Malaspina, Oreto river banks, Ficarazzi river, Casteldaccia, S. Martino delle Scale, Mount Cuccio, Montaspro (Madonie), Castellana Sicula, Caronia (Aliquò, 1992); Palermo: San Martino delle Scale, Caronia, Oreto river, Palermo: Boccadifalco, Balestrate, Monte Cuccio, Palermo: Malaspina, Palermo: Malaspina stream, Palermo: Valle Corta, Ficarazzi (Fiume), Gucia, Palermo: Addaura, Castellana Sicula, Madonie: Montaspro, Madonie (Arnone, 1994); Sicily (Sparacio, 1995); Malta (Magrini & Schembri, 1997 sub *C. campestris*); Mucciaccio (?), S. Stefano, Rometta, Messina, Briga (Facchini & Baviera, 2004); San Vito Lo Capo: Castelluzzo (Romano, 2010); Messina: Forte Petrazza (Altadonna, 2010); Sughereta of Niscemi (Lunetta, 2012); Buseto Palizzolo: Mount Scorace (Barraco, 2013); Grammichele (Patti, 2015); Ficuzza: Gorghi del Drago (Schifani, 2016); Butera (Mulè, 2016); Barcellona Pozzo di Gotto (Scibilia, 2017); Piazza Armerina (Giudice, 2017); Piazza Armerina (Sciagura, 2018); Grisì (Gurreri, 2018); San Giuseppe Jato (Gurreri, 2019); Trapani: Mendola (Barraco, 2019); Mazara del Vallo: Roccolino Soprano (Ditta, 2022); Resuttano: San Nicola (Leone, 2023); Licata (Russotto, 2022); Trapani: Borgo Fazio (Pecoraro, 2023).

MATERIALS. P e l o r i t a n i. Messina, E. Ragusa, 1 ex (ER-CMC); Messina, 1903, F. Vitale, 5 exx (ER-CMC); [Messina:] Badiazza, 16.11.903, Vitale (ER-CMC); [Messina: Piano] Ravelli, 23.2.04, Vitale (ER-CMC); Messina: Forte Petrazza (240 m), 38°10'53.8"N 15°31'41.3"E, 1 ex 24.X.2010 (GAC).

N e b r o d i. Troina, 2 exx 2.IV.1943 (DST-MRSNT); Biviere di Cesarò, 15.V.1969 (CAV); Mistretta, 1100 m, 17.V.1970 (CR); Mount Soro, 1800 m, 1.X.1972, 21.V.1978, 7.VI.1981 (CR); Bosco Medda, 25.IV.1974 (CR); Mount Soro: Portella Femmina Morta, 1300 m, 20.V.1978 (CR); Bosco di Mangaliviti (Nebrodi), 13.VII.1993 (CR); Mount Soro: Portella Femmina Morta, 37°55'05.9"N 14°39'15.8"E, 12.IX.1988 (CS); Raccuja: Mount Giannì (1300 m), 37°59'53.2"N 14°55'07.8"E, 1 ex 25.IV.2015 (GAC); Tortorici: Pisciotto lake (1240 m), 37°58'44.1"N 14°50'49.5"E, 1 ex 25.IV.2015 (GAC).

M a d o n i e. [Madonie] Pizzo Antenna, 14-16.VII.1951, 1 ex (DST-MRSNT); Piano Battaglia, 3.VII.1970 (CAV); Madonie, Mandarini, 16.VI.1976 (CR); Piano Battaglietta, 1600 m, 17.V.1978, 26.V.1984, 19.V.1985, 29.V.1994 (CR); Caltavuturo, 8.VI.1974 (CR); Piano Battaglia, 37°52'29.7"N 14°01'11.6"E, 18.VI.1980, 2 exx (CS). Gibilmanna, 37°59'22"N 14° 1'33"E, 4.X.2019 (CM); Castellana Sicula: Tufo Gipsi, 6 exx 21.IX.2016, 6 exx 25.IX.2018, 5 exx. 23.IX.2019, 7 exx 17.IX.2023 (CAF); Polizzi Generosa: Calanchi Xireni, 12 exx 23.IX.2019, 5 exx 17.IX.2023 (CAF); S. Mauro Castelverde: Cerritello (900 m), 37°56'10.6"N 14°14'18.2"E, 1 ex 17.XII.2022 (GAC).

P a l e r m i t a n o. Oreto [river], 4, E. Ragusa, 7 exx (ER-CMC); Mondello, 4, E. Ragusa, 1 ex (ER-CMC); F. Pellegrino, E. Ragusa, IV, 6 exx (ER-CMC); Favorita, 11, E. Ragusa (ER-CMC); Balestrate, 5, E. Ragusa (ER-CMC); [Palermo:] Passo di Rigano, 3.911, Sic. G. Marino (ER-CMC); Palermo, 5.4.912, 1 ex (ER-CMC); Giacalone, 28.IV.1938 – 17.IV.1938, 2 xx (DST-MRSNT);

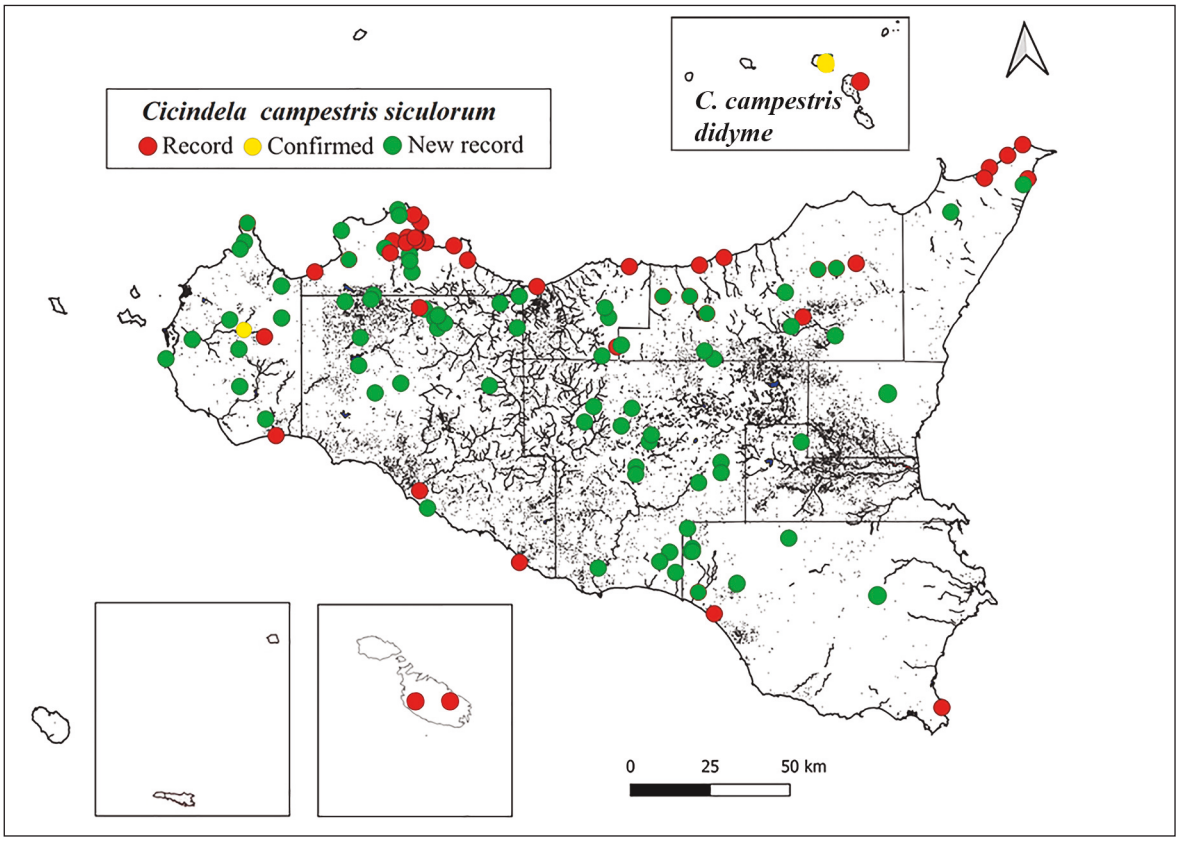

Figure 19. Distribution in Sicily of *Cicindela (Cicindela) campestris siculorum* and *C.* (*C.*) *campestris didyme.*

Sferracavallo, 22.III.1941, 8.III.1941, 4.V.1941, 40 exx (DST-MRSNT); [Palermo] Tommaso Natale, 2 exx 4.V.1941, 1 ex March 1960 (DST-MRSNT); "Fiume Oreto a Villa Ciambra", 4 exx 17.X.1943 (DST-MRSNT); "Fiume Oreto a Santo Spirito", 6 exx 10.IV.1944 (DST-MRSNT); Altavilla Milicia, 2 exx 6.X.1946 (DST-MRSNT); Mezzojuso, 1 ex 25.IX.1951 (DST-MRSNT); Altavilla Milicia, 30.III.1961 (CAV); Palermo: Sferracavallo, 1.V.1964 (CAV); Palermo: San Martino delle Scale, 28.III.1967 (CAV); Trappeto, 1.V.1970 (CAV); Terrasini, Cala Rossa, 2 exx 1.V.1964 (VEO-MRSNT); Ficuzza, 6.IV.1968, 19.IV.1970, 5.IV.1981 (CR); Ficuzza: Bosco del Cappelliere, 27.IV.1983 (CR); Torretta: Piano dell'Occhio, 38°05'57.6"N 13°14'00.4"E, 1 ex 9.IV.2011 (CS); Altofonte, Rebuttone, 38°1'43.33"N 13°19'35.00"E, 22.III.2012 (CM); Caccamo, lake surroundings, 37°55'45"N 13°38'7.87"E, 2.V.2020 (CM); Caccamo, Mount San Calogero, 37°56'49"N 13°42'19"E, 2.V.2020 (CM); Mount Cuccio: Piano dell'Occhio, 20.III.2005 (CR);

T r a p a n e s e. Calatafimi, 2.X.1977, 1 ex (DST-MRSNT); Castellammare, Mount Inici, 39°0'17.31"N 12°51'31.53"E, 29.X.2010 (CM); Castelvetrano, Birribaida, 7.IV.2013 (CM); San Vito Lo Capo: Macari, 38°07'31.5"N 12°43'48.9"E, 7 exx 13.IV.2002 (CS); San Vito Lo Capo, 22.IV.2007 (CR); Marsala: Dara, 37°51'47.2"N 12°32'03.1", 2 exx IV.2023, M. Amorelli (pers. comm.); Marsala, Parco Salinella, 37°48'37.0"N 12°26'18.6"E", 1 ex IV.2023, M. Amorelli (pers. comm.); Trapani: Diga Rubino, 37°53'04.3"N 12°43'10.1"E", 1 ex I.2023, under a stone, M. Amorelli (pers. comm.); Gallitello: Pantani di Anguillara, 37°51'27"N 12°55'19"E, 9 exx (CM).

S i c a n i. Ficuzza, 11.IV.1967, 1.V.1970 (CAV); Godrano, 37°54'16.9"N 13°24'47.9"E, 2 exx 23.III.1979, 4 exx 21.III.1992, 1 ex 17.IV.2002, 2 exx 1.X.2006 (CS); Gorghi del Drago (Ficuzza), 37°53'46.0"N 13°24'05.3"E, 5 exx 21.III.1992 (CS); Diga Scanzano, 3 exx 1.X.1995, 37°54'33.7"N 13°22'24.6"E (CS); Lercara Friddi: S. Caterina A.D., 1 ex 24.X.2004, 37°41'53.9"N 13°35'05.6"E (CS); Caccamo, near Stazione Montemaggiore Belsito, 37°51'27.93"N 13°41'34.25"E, 24.IV.2012 (CM); Contessa Entellina: Rocca di Entella, 37°46'17.46"N 13° 7'22.24"E, 20.IV.2012 (CM); Bisacquino: Mount Triona, 37°42'58.65"N 13°16'11.19"E, 6.XI.2013 (CM); Roccamena: Rocca di Maramfusa, 37°51'0.54"N 13° 7'57.72"E, 26.X.2013 (CM); Mezzojuso, 37°52'50.96"N 13°26'7.80"E, 19.IX.2012 (CM); Mount Genuardo, Sambuca di Sicilia, 24.III.2017, 37°41'31.55"N 13°10'38.53"E (CM); Ficuzza: Alpe Cucco, 37°52' 3"N 13°24'34"E, 12.IV.2018 (CM); Siculiana: Torre Salsa, Pantano, 37°21'34"N 13°22'1"E, 1 ex 5.III.2022 (CM).

E r e i. Nicosia, 1 ex 18.III.1942 (DST-MRSNT); Gela, 13.IV.1977 (CAV); Biviere di Gela, 13.IV.1975, 29.III.1980, 24.IV.1983, 15.X.1986 (CR); Piazza Armerina, 17.IV.1977 (CR); Butera: Comunelli river, 22.IV.2007 (CR); Sperlinga, 37°45'58.3"N 14°21'19.6"E, 6 exx 1.XI.2004 (CS); Piazza Armerina: Mount Rossomanno, 37°26'58.4"N 14°23'30.8"E, 2 exx 15.IV.2008 (CS); Castel di Judica (CT), 37°29'37.98"N 14°40'47.54"E, 17.IV.2017 (CM); Aidone: Bosco (600 m), 37°27'16.9"N 14°24'53.7"E, 1 ex 28.II.2017 (GAC); Caltanissetta: Calanchi Milicia, 5 exx 21.X.2008, 8 exx 24.X.2008, 7 exx 29.IX.2014, 3 exx 25.IX.2017, 3 exx 1.IV.2019, 11 exx 28.IX.2022, 6 exx 13.IX.2023 (CAF); Caltanissetta: Bosco Scorsone, 2 exx 21.IV.1999, 3 exx 19.IV.2013, 1 ex 16.IV.2021 (CAF); Petralia Sottana: Calanchi Chibbò, 4 exx 30.IX.2021, 2 exx 21.IV.2022 (CAF); Caltanissetta: Mount Gibil Gabib, 4 exx 13.IV.2012, 2 exx 18.IV.2017, 5 exx 28.IV.2020 (CAF); Enna: Mount Capodarso, western side, 2 exx 21.IV.2017, 1 ex 16.IV.2018, 2 exx 23.IX.2022, 3 exx 17.IX.2012, 2 exx 23.IV.2022; Mazzarino: Mount Formaggio, 2 exx 14.III.2009, 2 exx 21.IX.2017 (CAF); Butera: Poggio La Spia, 1 ex 21.IX.2018, 1 ex 18.IX.2022 (CAF); Pietraperzia: Calanchi Caprara, 1 ex 31.VIII.2019, 1 ex 21.III.2020 (CAF).

I b l e i. Canicattini Bagni dintorni, 1 ex 12.6.2002 (CS); Mazzarino: Mount Gibliscemi, 1 ex 23.III.2013, 3 exx 21.IV.2020, 2 exx 21.III.2023 (CAF); RN Sughereta Niscemi, 1 ex 5.IV.2011, 1 ex 6.IV.2019, 3 exx 21.IX.2019, 1 ex. 7.IV.2021, 1 ex 21.III.2023 (CAF).

E t n a. Bronte, 3 exx 7.IV.1943 (DST-MRSNT); Zafferana Etna, 15.VII.1999, 1 ex (CS).

BIOLOGY. *Cicindela* (*C.*) *campestris siculorum* lives in sandy and clayey soils, in open and sunny

environments, in pastures, along country paths or in clearings, river banks and on the edges of cultivated land, from sea level up to the high mountains. In Sicily it is active early in the spring months and then in autumn.

Remarks. The Sicilian population were named by Porta (1923) with the name "*siciliana*" following indication *in litteris* by Luigioni. Schilder (1923) correctly indicates the current replacement name of "*siculorum*".

Cicindela (*C.*) *campestris siculorum* is still relatively widespread in Sicily but disappeared from many places where it lived. Currently it is almost always present with small populations.

Cicindela (Cicindela) campestris didyme Sparacio, Lo Cascio, Muscarella, Surdo, Falci et Allegrino, 2023

Chorotype and distribution. This subspecies is endemic to the Aeolian Archipelago (Lipari and Salina islands) (Figs. 19, 36).

References. Salina (Magistretti, 1971 sub *C. campestris suffriani* Loew.); Salina Island (Dent, 2017); Salina (sub *C. campestris siculorum*: Lo Cascio & Magrini, 1998; Lo Cascio & Navarra, 2003; Lo Cascio & Pasta, 2004; Lo Cascio, 2017; Lo Cascio et al., 2022). Lipari: Poggio dei Funghi, Mount Chirica (Lo Cascio et al., 2022 sub *C. campestris siculorum*); Salina (Monte delle Felci) and Lipari (Mount Chirica) (Sparacio et al., 2023)

Materials. P e l o r i t a n i. Salina Island: Monte Fossa delle Felci, XI.2017, legit P. Lo Cascio (MSNG); idem, 4 females, III.1999 (PLC); 2 females, III.1999, legit P. Lo Cascio and F. Tassi (PLC); idem, 1 female, XI.2019 (PLC); idem, 1 female, 22.V.2009, legit P. Lo Cascio and F. Grita (PLC); idem, 2 females, 29.IX.2009 (PLC); idem, 2 males and 4 females, 14.IV.2015 (CM); idem, 5 males and 5 females, III.2023, legit P. Lo Cascio (CS); idem, 6 males and 3 females, XI.2023 (PLC); Lipari Island: Poggio dei Funghi, 1 male, XI.2008, (PLC); idem, 1 male 21.II.2021, legit P. Lo Cascio and L. La Fauci (PLC).

Biology. It lives in open and sunny areas with barren ground or scarce vegetation, at the edge of forest and pre-forest formations on Monte Fossa delle Felci at Salina and on Poggio dei Funghi and Monte Chirica at Lipari. The phenology of the species has two peaks in February-April and August-October.

Remarks. *Cicindela* (*C.*) *campestris didyme* is morphologically different from both the nearby Sicilian populations and those of Calabria. The main differences are found in its dimensions, the elytral granulation, the shape of the aedeagus, in the characteristic dorsal coloration more or less extensively green-brown elytra or entirely red-brown.

Genus *Cy1indera* Westwood, 1831
Subgenus *Cy1indera* Westwood, 1831

Cylindera (Cylindera) germanica muelleri (Magistretti, 1966)

Chorotype and distribution. Central-Asiatic-European chorotype (CAE).

Cylindera germanica (Linnaeus, 1758) s.l. is widespread with several subspecies throughout Eu-

Figure 20. *Cylindera (Cylindera) germanica muelleri* labeled "Sicilia coll. Padewieth" from Magistretti entomological collection (MSNV).

rope (except Scandinavia and the southern Iberian Peninsula), Central Asia up to Mongolia, China, Turkestan, Iran and Afghanistan (Puchkov & Matalin, 2003). Four subspecies of this tiger beetle are recognized in Europe: *C. germanica germanica* in Central Europe, Russia, central-northern Italy and the Balkan Peninsula up to Turkey, *C. germanica michaelensis* Vidal et Lopez, 1916 in France, *C. germanica sobrina* Gory, 1833 in France and northern Spain, *C. germanica muelleri* in the Balkan Peninsula, Greece and Turkey while for Italy it is reported by Casale et al. (2021) only for Puglia, Basilicata, Calabria and with doubt for Sicily. Recently (Boetzl & Franzen, 2020), two other new subspecies have been described: *C. germanica erzincana* Boetzl et Franzen, 2020 from eastern Anatolia and *C. germanica persiana* Boetzl et Franzen, 2020 from southern Iran.

REFERENCES. Sicily (Ragusa, 1883 sub *Cicindela germanica* var. *sobrina* Gory); Sicily (Magistretti, 1966; Lisa, 2002).

MATERIALS. "Sicilia coll. Padewieth", 1 ex Magistretti collection (MSNV) (Fig. 20).

BIOLOGY. This species lives at low and medium altitudes, on uncovered, sandy, clayey and muddy soils, often with low vegetation but also in the bends of watercourses, forest clearings and uncultivated fields. It runs quickly on the ground, rarely flies, and also hunts among vegetation. She is attracted to artificial lights.

REMARKS. The record of *C. germanica muelleri* in Sicily made by Ragusa (1883) refers to a communication received from Fairmaire. Magistretti (1966) reports it on an example from his collection labeled generically for Sicily. The presence of this species in Sicily is to be confirmed (Lisa, 2002).

In the Magistretti collection (MSNV) there is a specimen from Sicily (reported in Materials, see also Fig. 20). According to what was reported by R. Poggi (*in litteris*), the brothers Eugen and Franjo Dobiasch (or Dobiaš), living in Gospić (Croatia) had a company in Senj that traded in insects (such as Deyrolle, Reitter, Winkler, etc.), but the collections were almost always indicated with the name of Franjo's wife, M. Padewieth, hence: coll. Padewieth. And always as "M. Padewieth" new articles have been published and new species described.

Subgenus *Eugrapha* Rivalier, 1950

Cylindera (Eugrapha) arenaria arenaria Füessly, 1775

CHOROTYPE AND DISTRIBUTION. Sibero-European chorotype (SIE).

In Italy, *Cylindera (Eugrapha) arenaria arenaria* is recorded in almost all continental and peninsular regions and in Sicily (Casale et al., 2021).

REFERENCES. Catania, Menfi (Ragusa, 1883 sub *Cicindela arenaria* Fuessl. 1776); Italy (Porta, 1923); Sicily (Luigioni, 1929); Sicily (Porta, 1949); Sicily (Magistretti, 1967).

BIOLOGY. It lives on the sandy banks of rivers and streams, in open and sunny environments, at low and medium altitudes, and is found above all in the small unstable sandy banks of streams and rivers.

REMARKS. Recorded for Sicily by Ragusa (1883), it was included by Magistretti (1967) in his catalog on the Carabidae of Sicily without any other indication. Lisa (2002) reports it for all of Italy except Sardinia. Also recorded generically for Italy by Puchkov & Matalin (2003, 2017).

Cylindera (Eugrapha) trisignata siciliensis (W. Horn, 1891)

CHOROTYPE AND DISTRIBUTION. Mediterranean (MED) extended to the Black Sea and the Atlantic area.

Cylindera trisignata (Dejean in Latreille et Dejean, 1822), with various subspecific populations, is distributed throughout the Mediterranean basin with an area extending eastwards to the northern coasts of the Black Sea and westwards up to the Atlantic coasts of Europe (north up to Holland) and Morocco. In Italy, *C. trisignata* is recorded along the beaches of almost all continental, peninsular regions and Sardinia (Magistretti, 1965; Cassola, 1972; Casale & Vigna Taglianti, 1996; Casale et al., 2021); ssp. *corsica* Rivalier, 1962 is recorded in

Corsica and the ssp. *siciliensis* is widespread in Sicily, Malta, North Africa and the Balearic Islands (Korell & Cassola, 1987; Puchkov & Matalin, 2003, 2017; Jaskula & Rewicz, 2015; Wiesner, 2020; Casale et al., 2021) (Figs. 21, 30, 37).

REFERENCES. Catania (Ghiliani, 1842 sub *sinuata* Fabr. and *trisignata* Illig.); Catania, Menfi (Agrigento) (Ragusa, 1883 sub *literata* v. *sinuata* Fabr. and *trisignata* Dej.); Sicily (Steck, 1887); Sicily, Malta (Fleutiaux, 1892 sub *trisignata* v. *siciliensis* W. Horn); Lampedusa (Ragusa, 1892: "*piuttosto abbondante* [quite abundant]"); Balestrate, Catania, Porto Empedocle, Menfi, Licata (Vitale, 1912); Balestrate, Licata, (Luigioni, 1929 sub *trisignata* v. *siciliensis* W. Horn); Linosa, Balestrate, Malta (Gridelli, 1944; 1960; Magistretti, 1965); Sicily, Malta, Linosa (Porta, 1949); Peloritani: F. Termini [Terme Vigliatore] (Magistretti, 1963); F. Termini, Porto Empedocle, Menfi, Licata, Trapani (Magistretti, 1965); Catania, Balestrate, Porto Empedocle, Menfi, Ispica, Licata, Trapani, Malta island, Linosa island (Magistretti, 1967); Ispica (Magistretti, 1968); Porto Empedocle (Arnone, 1994); Sicily (Sparacio, 1995: "*frequente nella Sicilia sud-orientale* [it is frequent in south-eastern Sicily"); Malta (Magrini & Schembri, 1997); Pozzallo (Whalther F., 2001); Linosa, Marina di Modica (Lisa, 2002); P[orto] Empedocle (Facchini & Vitale, 2004); Ispica (Galasso, 2022).

MATERIALS. T r a p a n e s e. Capo Granitola: Kartibubbo, 37°33'54.3"N 12°40'07.5"E, 6 exx 20.VI.1996, legit D. Castelli (CS); Menfi, Porto Palo, 1 ex 4.IX.2014, legit T. La Mantia (CS); Menfi, Porto Palo: mouth of the Carboj river, 37°33'43.2"N 12°57'51.3"E, 1 ex 15.VIII.2019 (CS).

S i c a n i. Porto Emped[ocle], 6, E. Ragusa (ERCMC); Foci F. Platani, 37°23'46.7"N 13°16'15.3"E, 1 ex 31.VII.1993 (CS); Cattolica Eraclea: Foce F. Platani, 37°23'48"N 13°16'14"E, 18.VII.2012 (CM); Siculiana: Torre Salsa, Pantano, 37°21'36"N 13°20'52"E, 21.VI.2011, 3 exx 8.VII.2011 (CM);

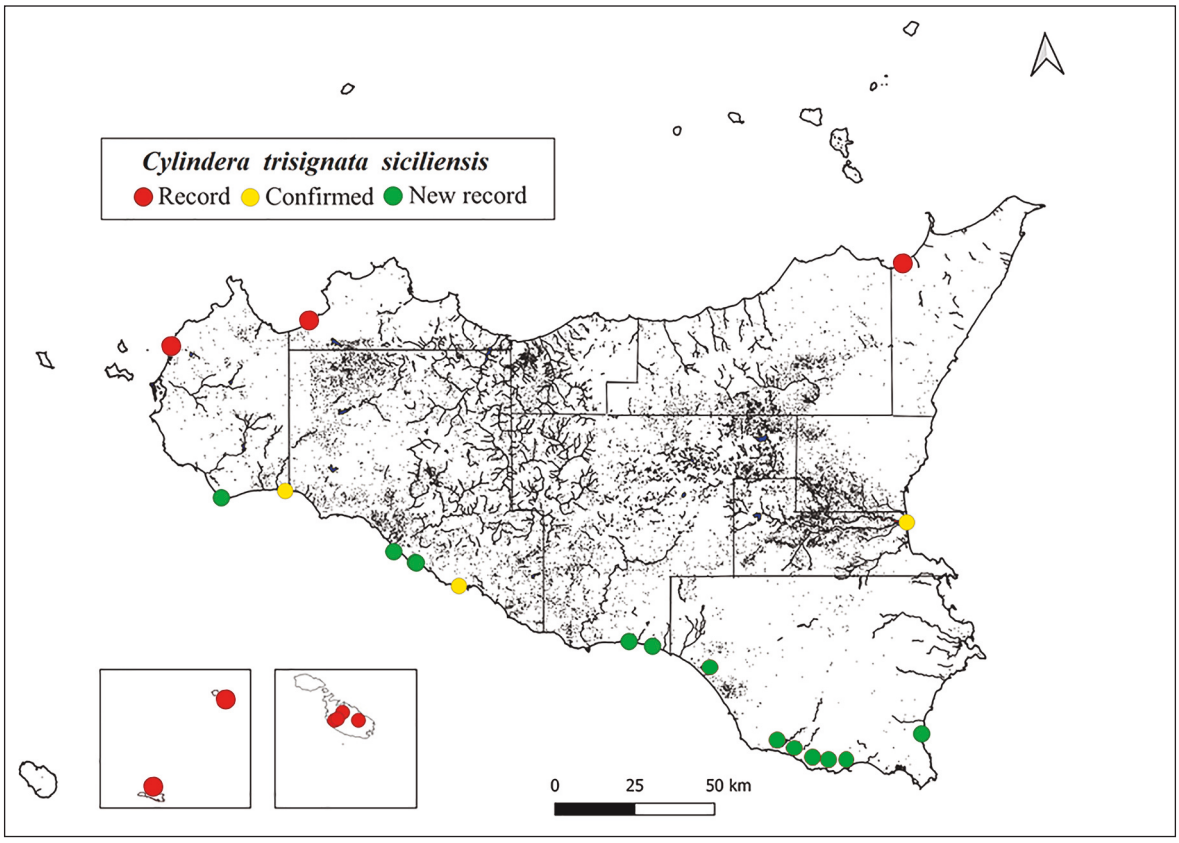

Figure 21. Distribution in Sicily of *Cylindera* (*Eugrapha*) *trisignata siciliensis*.

Siculiana: RN Torre Salsa, 5 exx 23.VII.2015, 3 exx 10.VI.2017, 6 exx 29.VII.2021 (CAF).

E r e i. Macconi di Gela, 25.VII.1973 (CR); Gela: Roccazzelle, 6 exx 23.VI.2012, 6 exx 27.VII.2018, 2 exx 21.VII.2021 (CAF); Butera, Desusino, 23.VI.2012, 2 exx (CAF).

I b l e i. Pozzallo, 19.VI.1966 (CAV); Sampieri (RG) VIII.1981 (CAV); Modica beach, 30.VI.1989 (CAV); Pozzallo, 25.V.1969, legit V. Aliquò (CR); mouth of the Irminio river, 31.V.1979, 5.VI.1979, 25.VI.1979 (CR); Scicli: lido Arizza, 10.VII.1979 (CR); Vendicari, 5 exx 31.VII.2012, 9 exx 27.VII.2015, 8 exx 22.VII.2020, 4 exx 22.VII.2023 (CAF).

P i a n a d i C a t a n i a. Catania, 6, E. Ragusa, 1 ex (ER-CMC); mouth of the Simeto river, 3.VI.1982 (CAV); Foci F. Simeto, 11.VI.1982 (CR); mouth of the Simeto river, 2 exx 11.VI.1982, leg. M. Arnone (CAM-MSNG); mouth of the Simeto river, 37°23'56.5"N 15°05'21.5"E, 2 exx 26.VI.1984 (CS).

BIOLOGY. This species lives on sandy coasts, in brackish environments, near the mouths of watercourses, and in lagoons behind the dunes. Strongly declining throughout Italy, including Sicily. Vigna Taglianti, 1995: "*come tutti gli elementi psammo-alobi, legati alle coste sabbiose, le sue popolazioni vengono facilmente frammentate e distrutte da un impatto antropico eccessivo, quale l'uso consumistico delle spiagge*" [like all psammo-alobia species, living in sandy coasts, its populations are easily fragmented and destroyed by excessive anthropic impact, such as the consumerist use of beaches]".

REMARKS. The original record of Gridelli (1944) for Linosa island, reported by Porta (1949) and Magistretti (1965), was not subsequently reconfirmed by Gridelli himself (1960). Species considered extinct on this island according to Vigna Taglianti (1995).

Genus *Lophyra* Motschoulsky, 1859
Subgenus *Lophyra* Motschoulsky, 1859

Lophyra (Lophyra) flexuosa sardea (Dejean, 1831)

CHOROTYPE AND DISTRIBUTION. *Lophyra flexuosa* (Fabricius, 1787) s.l. has a predominantly western and southern Mediterranean (MED) chorotype, extending to the Atlantic coasts of Europe (recorded north as far as the Loire) and Morocco.

Lophyra flexuosa sardea is widespread in Sardinia, Sicily and Tunisia (Figs. 22, 38, 39).

REFERENCES. Sicily (Ghiliani, 1842 sub *flexuosa* Fabr.); Sicily (Reiche, 1860 sub *C. flexuosa*); "*Fiumare von Ficarazzi*", Catania (Rottenberg, 1870 sub *C. flexuosa*); Mondello (Ragusa, 1874 sub *C. flexuosa*); Trapani, Menfi (De Stefani-Perez & Riggio, 1882 sub *C. flexuosa* Fabr. var. *Sardea*); Castelvetrano, Trapani (Ragusa, 1883 sub *C. flexuosa* var. *Sardea* Dej.); near Termini Imerese (Ciofalo, 1886 sub *C. flexuosa*); Sicily (Steck, 1887 sub *flexuosa* Klug); Selinunte, Gurgu Cuttuni [small coastal lake near Castelvetrano does not exist anymore: Aliquò & Castelli, 1991] (Palumbo, 1890 sub *C. flexuosa* and *C. flexuosa* var. *sardea*); Lampedusa (Ragusa, 1892: "*trovai un esemplare della* Cicindela *var.* sardea *Dej., ma morto* [I found a specimen of *Cicindela* var. *sardea* Dej., but dead]"; Trapani (Palumbo, 1892 sub *C. flexuosa*); Sicily, Balestrate (Vitale, 1912 sub *C. flexuosa*); Castelvetrano: Marinella (Vitale, 1927 sub *C. flexuosa* a. *smaragdina* Benth.); Sicily (Luigioni, 1929 sub *C. flexuosa*); Pachino, Donnalucata (Magistretti, 1962 sub. *flexuosa*); Linosa (Luigioni, 1929 sub *Cicindela flexuosa*; Porta, 1949, Magistretti, 1965; Barajon, 1966; Aliquò, 1981); Madonie: Imera river, "*tutte le spiagge della Sicilia* [all the beaches in Sicily] (Magistretti, 1963 sub. *flexuosa*); mouth of the Modione river, mouth of the Belice river, Golfo di Bonagia, salt pans of Trapani, mouth of the Birgi river, Capo Feto, Licata, Torre di Gaffe, Manfria near Gela, Marina di Macari, Cala Mosca near Noto, Pantano Longarini, Capo Passero, mouth of the Ippari river (Scoglitti), Eloro, Pozzallo, Portopalo di Capo Passero, Donnalucata, Pantano Morghella (Siracusa), Vendicari (Aliquò, 1981 sub *flexuosa sardea*); mouth of the Birgi river, Marausa (Aliquò & Castelli, 1991: "*Molto comune in quasi tutti i mesi, di solito nella* morpha sardea *Dej., raramente in quella* circumflexa *Dej*…[Very common in almost all months, usually in the *morpha sardea* Dej., rarely in the *circumflexa* Dej…]"; Isola delle Femmine (Aliquò, 1992); Isola delle Femmine, Milicia stream, Torto

river, Scoglitti (Arnone, 1994 sub *Lophyra flexuosa sardea*); Sicily (Sparacio, 1995); Isola di Capo Passero (Angelini, 1999 sub *L. flexuosa flexuosa*); Biviere di Gela, Lampedusa, Linosa (Lisa, 2002 sub *flexuosa*); Trapani, mouth of the Belice river (Lisa, 2002 sub *flexuosa sardea*); Mazara del Vallo: Capo Feto (Romano, 2006); Trapani: Marausa, (Barraco, 2010).

MATERIALS. T r a p a n e s e. Trapani prior to 1900, A. Palumbo, 1 ex prior to 1900; mouth of the Belice river, 28.X.1969 (CAV); Selinunte, 12.VI.1978 (CAV); Mazara and surroundings, 4.X.1981 (CAV); Marausa, 8.III.1982 (CAV); Capo Feto, 8.IV.1982 (CAV); Stagnone: Isola Lunga 29.V.1992, legit M. Arnone (CAV); mouth of the Belice river, 1 ex 14.III.1975, 7 exx 9.V.1979, 1 ex 31.III.1982, 6 exx 13.IV.1984, 1 ex 31.V.1984, 1 ex 23.IX.1985, 5 exx 7.V.1986 (CAM-MSNG); Campobello di Mazara, 11 exx 20.V.1981, Mazara del Vallo: Capo Feto, 1 ex 1.VI.1982 (CAM-MSNG); Capo Feto, 25.IV.1973, 13.IV.1980 (CR); mouth of the Belice river, 28.IV.1973, 28.X.1973, 27.II.1974, 17.XI.1974 (CR); salt pans of Trapani, 10.IX.1973 (CR); mouth of the Birgi river, 30.IV.1978, 29.VI.1980 (CR); mouth of the Modione river, 13.IV.1980 (CR); Marsala: mouth of the Birgi river, 37°55'00.4"N 12°28'07.0"E, 18.IV.1988 (CS); Marsala: mouth of the Birgi river, 37°55'2.78"N 12°28'11.30"E, 2 exx X.2022 (CM); Mazara del Vallo: Capo Feto, 37°39'35.2"N 12°32'18.5"E, 1 ex 24.IV.1993 (CS); Capo Feto, 14 exx 9.VI.1978 (DST-MRSNT); Mazara del Vallo: Capo Feto, 37°39'33"N 12°31'59"E, 1 ex 29.IV.2011, 2 exx 11-12.V.2013 (CM); San Vito lo Capo, 38°10'34.3"N 12°44'44.8"E, 3 exx 13.IV-2002 (CS); mouth of the Belice river, 37°34'57.00"N 12°51'53"E, 28.V.2010, 8.X.2010, 31.V.2011, 1.VI.2012, 22-24.V.2020 (CM); mouth of the Belice river, 37°34'58.4"N 12°51'53.5"E, 7 exx 12.IV.1979 (CS); mouth of the Modione river, 37°34'57.8"N 12°49'12.4"E, 3 exx 12.IV.1979 (CS); Mazara del Vallo: Capo Feto, 1 ex V.2023 (Amorelli, pers. comm.).

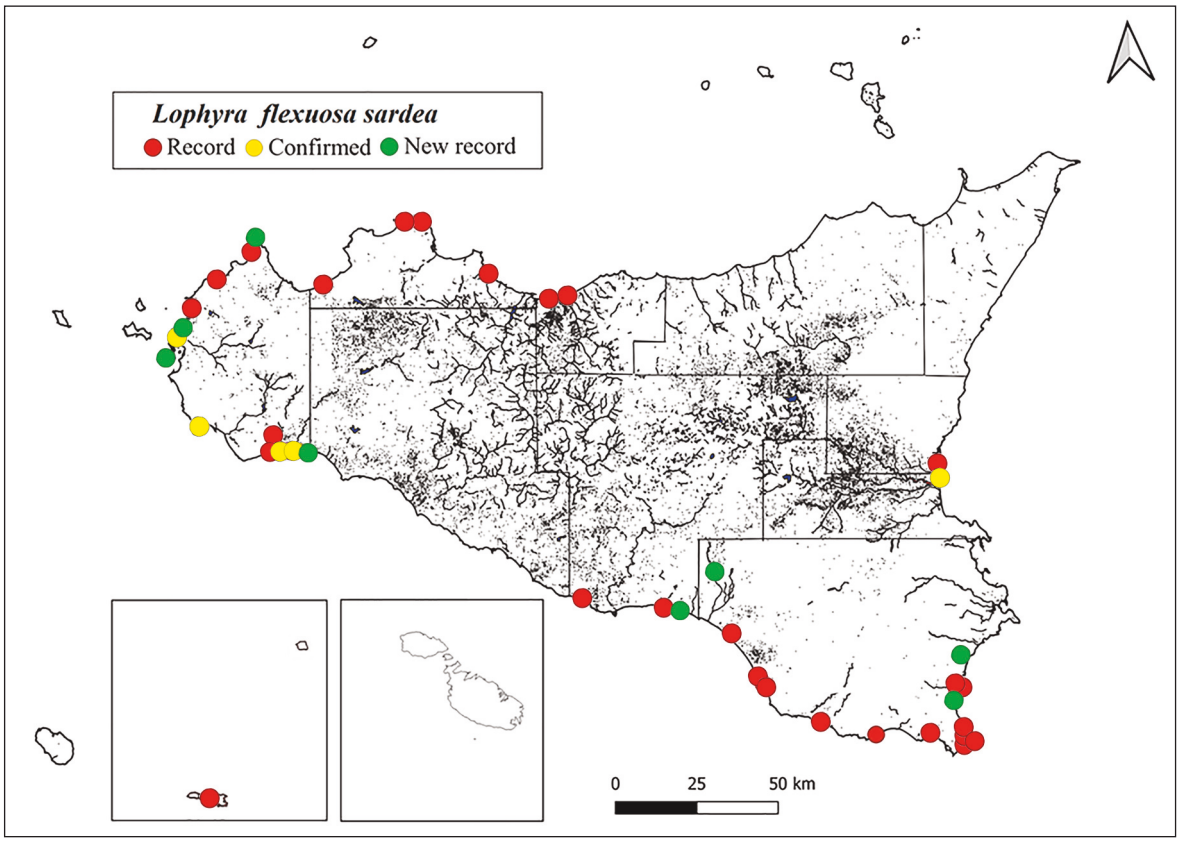

Figure 22. Distribution in Sicily of *Lophyra* (*Lophyra*) *flexuosa sardea*.

S i c a n i. Menfi: spiaggia delle Solette, 37°34'39"N 12°53'46"E, 4.VI.2011 (CM);

E r e i. Gela: Rozzazzelle, 4 exx 21.IV.2016, 2 exx 20.V.2017 (CAF).

I b l e i. Porto Palo (Siracusa), 3.V.1969 (CAV); Eloro, 18.V.1969–4.V.1969 (CAV); Siracusa: former salt pans of Pantano Marghello, 15.V.1973, legit B. Massa (CR); Vendicari, 18.V.1979 (CR); Vendicari, 36°47'44.7"N 15°05'42.6"E, 3 exx 18.VIII.1993, 6 exx 5.IX.2015 (CS); Vendicari, >20 exx 18.IV.2001, 8 exx 31.III.2012, 6 exx 27.IV.2015, 11 exx 21.III.2020 (CAF); Mazzarino (Caltanissetta): Diga Disueri, 9 exx 23.VII.2022, 5 exx 23.VIII.2023 (CAF).

BIOLOGY. Psammo-alobia species, lives along sandy beaches, at river mouths, in sandy paths and along the edges of dune and behind-dune lakes.

REMARKS. The presence of *L. sardea* for Linosa reported by Luigioni (1929, sub *Cicindela flexuosa*), taken up by subsequent authors (Porta, 1949, Magistretti, 1965; Barajon, 1966; Aliquò, 1981) is not confirmed by Gridelli (1960). In the absence of recent data, Vigna Taglianti (1995) considers this population extinct. The systematics of the taxa "*sardea*" and "*circumflexa*" still remain unclear. In the past the two taxa have often been confused with each other and some of the citations for Sicily of "*circumflexa*" could refer to "*flexuosa*" and vice versa. Aliquò (1981) and Cassola (2011) have highlighted the presence in Sicily of both the *sardea* and *circumflexa* "forms". Cassola (2011), in particular, observing how this situation could also occur in Tunisia, hypothesizes that it could be two different species. More recently, Puchkov & Matalin (2003; 2017) consider only one taxon: *L. flexuosa flexuosa* (= *circumflexa*) with *L. flexuosa sardea* endemic to Sardinia. Casale et al. (2021) consider for Italy only *L. flexuosa flexuosa* (= circumflexa Dejean, 1831) in Liguria and Sicily and *L. flexuosa sardea* in Sardinia and Sicily. At the moment, in the absence of further studies, we prefer to follow the indications of Cassola (2011) and consider the two forms as distinct taxa.

Lophyra (Lophyra) circumflexa (Dejean, 1831)

CHOROTYPE AND DISTRIBUTION. Sicily. Tunisia (?).

REFERENCES. Fiume Giaretta (Ghiliani, 1842 sub *circumflexa* Dahl.); Trapani, Menfi (De Stefani-Perez & Riggio, 1882 sub *flexuosa* Fabr. var. *circumflexa*); Sicily (Ragusa, 1883 sub *flexuosa* Fabr. var. *circumflexa* Dej.); surroundings of Termini Imerese (Ciofalo, 1886 sub *flexuosa* v. *circumflexa*); Gurgu Cuttuni [small coastal lake near Castelvetrano that does not exist anymore, cf. Aliquò & Castelli, 1991] (Palumbo, 1890 sub *C. flexuosa* var. *circumflexa*); Sicily (Fleutiaux, 1892 *flexuosa* v. *circumflexa* Dej.); Licata (Vitale, 1912 sub *C. circumflexa*); Isola di Linosa (Luigioni, 1929); Mondello, Fiume Imera, mouth of the Simeto river, Pachino, Donnalucata, mouth of the Belice river, Selinunte (Magistretti, 1965); Mondello, Imera river, mouth of the Simeto river, Pachino, Donnalucata, Pozzallo, Ispica, mouth of the Platani river (Agrigento), mouth of the Belice river, Selinunte (Magistretti, 1967 sub *flexuosa circumflexa*); Pozzallo (Magistretti, 1968 sub *flexuosa circumflexa*); Buonfornello near Termini Imerese (Aliquò et al., 1973 sub *flexuosa circumflexa* Dej.); Balestrate, mouth of the Pollina river, mouth of the Imera river, Altavilla, Porto Empedocle, Biviere di Gela, mouth of the Platani river, Torto river, Montemaggiore Belsito, Troina (Aliquò, 1981 sub *circumflexa*); Altavilla, Porto Empedocle, Selinunte (Facchini & Baviera, 2004 sub *Lophyra flexuosa circumflexa*) (Fig. 23).

MATERIALS. N e b r o d i. Troina, 1 ex VI.1930, leg. E. Di Napoli (DST- MRSNT).

M a d o n i e. Mouth of the Pollina river (Palermo), 24.VI.1973 (CR); mouth of the Pollina river, 38°01'06.5"N 14°10'43.5"E, 1 ex 20.V.1981 (CS).

T r a p a n e s e. Mouth of the Modione river, 23.IV.1979 (CAV).

S i c a n i. Licata, Torre di Gaffe, 23.IV.1978 (CR); Sciara: Torto river, 37°54'09.3"N 13°46'18.2"E, 1 ex 30.VI.1985 (CS).

E r e i. Gela, 22.IV.1969 (CAV); Biviere di Gela, 24.IV.1978, 29.III.1980, 25.IV.1983 (CR).

BIOLOGY. It is relatively widespread throughout the Sicilian territory but with small isolated populations in coastal areas or along the edges of waterways in inland locations.

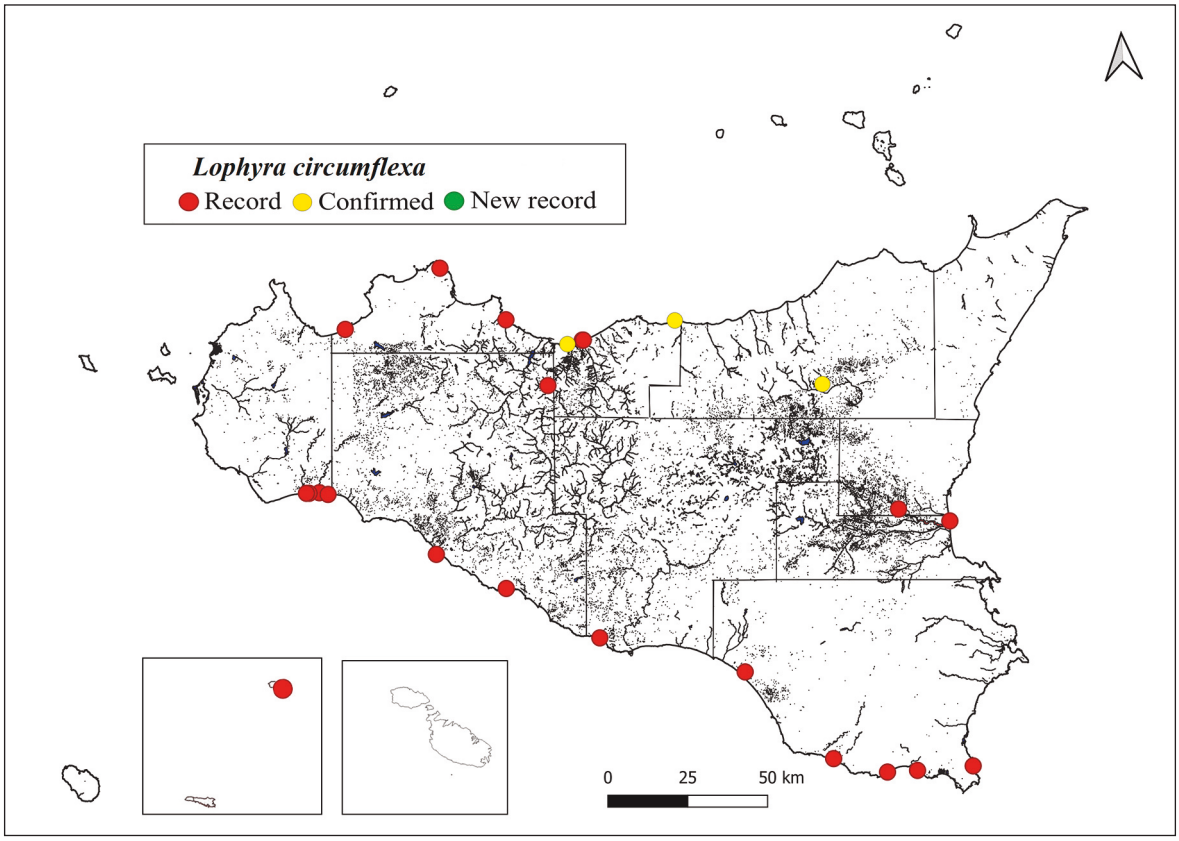

Figure 23. Distribution in Sicily of *Lophyra (Lophyra) circumflexa.*

Remarks. Some of the citations for Sicily of "*circumflexa*" could refer to "*flexuosa*" and vice versa.

Genus *Calomera* Motschulsky, 1862

Calomera lunulata (Fabricis, 1781)

Chorotype and distribution. North African species with Lampedusa island as the only Italian and European locality where the species was reported (Korell & Cassola, 1987; Vigna Taglianti, 1995). Recently, there have been new findings for southern Spain (López Pérez & García Casas, 2007; https://www.inaturalist.org/observations/53271278) .

References. Lampedusa (Failla-Tedaldi, 1887: sub *Cicindela littoralis* v. *Ragusae*, "*trovata al Porto e precisamente sotto le mure del castello* [found at the Port and precisely under the castle walls]"; Lampedusa (Ragusa, 1892: *alla Wilgia era comunissima* [it was very common in Wilgia]; Lampedusa (Vitale, 1912, Luigioni, 1929; Schatzmayr, 1936; Porta, 1949); Lampedusa: Faro (Gridelli, 1960: "*maggio 1956, 1 esemplare* [May 1956, 1 specimen]"); Lampedusa (Magistretti, 1962, 1965, 1967; Barajon, 1966; Korell & Cassola, 1987; Vigna Taglianti, 1993; Sparacio, 1995; Lisa, 2002); Lampedusa, Lampedusa Porto Vecchio (Vigna Taglianti, 1995).

Materials. C a n a l e d i S i c i l i a. [Lampedusa], 3 exx labelled "*littoralis* var. *Ragusae* Failla" (CFT) (Fig. 24); Lampedusa, 5, E. Ragusa, 7 exx (ER-CMC).

Biology. *Calomera lunulata* lives in the humid environments of the "chotts" (Cassola, 1973), but also in the coasts, near the mouths of rivers and in brackish environments, in the wetter soils and at low altitudes (Korell & Cassola, 1987; Jaskuła & Płóciennik, 2020).

Figure 24. *Calomera lunulata* from Lampedusa (entomological collection Failla-Tedaldi - CFT) labeled "*littoralis* var. *Ragusae* Failla".

REMARKS. Failla Tedaldi (1887) was the first to discover this species in Lampedusa which he describes as "*Cicindela littoralis* v. *Ragusae*" immediately identifying these populations as different from all other Sicilian cicindeles: "*Si distingue soprattutto per il fondo affatto nero del dorso, per avere la macchia mediana trasversa, quasi rettangolare, appena marcata da una lieve strozzatura nel mezzo, ... Il di sotto è di un bleu nerastro*...[It stands out above all for the completely black back, for having the transverse median spot, almost rectangular, just marked by a slight narrowing in the middle, ... The underneath it is a blackish blue...]"). Ragusa, who also went to Lampedusa (1892), correctly classified this population as Vitale (1912) later described in detail. Vigna Taglianti (1995), in reporting some new locations of this species on Lampedusa, highlights how there is no more data on this species on the island after 1975 and considers it most likely extinct.

Calomera littoralis nemoralis (Olivier, 1790)

CHOROTYPE AND DISTRIBUTION. Central-European-Mediterranean (CEM) (Figs. 25, 26, 40).

Calomera littoralis littoralis (Fabricius, 1787) is recorded in Libya, Tunisia, Algeria, Morocco, the Iberian Peninsula, the French Atlantic coast up to Normandy and the Balearic Islands and in Italy in almost all continental and peninsular regions (Casale et al., 2021). The subspecies *nemoralis* is widespread in Sicily and other northern and eastern coastal regions of the Mediterranean Sea; the subspecies *fiorii* (Grandi, 1906) lives only in Sardinia.

REFERENCES. Sicily (Ghiliani, 1842 sub *nemoralis* Oliv. and *littoralis* Fabr.); Sicily (Reiche, 1860 sub *littoralis* Fab.); Castelbuono (Rottenberg, 1870 sub *littoralis* Fabr. e var. *barbara*); Ficuzza: Catagnano (Pincitore Marott, 1873 sub *littoralis* Fabr. "*torrente…sull'umida sabbia…*"); Mondello (Ragusa, 1874 sub *littoralis*); Sicily (De Stefani-Perez & Riggio, 1882, "*comune da per tutto* [common everywhere]", sub *littoralis* e var. *barbara*); Sicily, Castelbuono, Mondello (Ragusa, 1883 sub *littoralis*, *littoralis* var. *nemoralis* Oliv., var. *barbara* Cast., var. *lugens* Dahl.; 1921); ner Termini Imerese (Ciofalo, 1886 sub *littoralis*); Sicily (Steck, 1887 sub *littoralis*); Selinunte, Gurgu Cuttuni [small coastal lake near Castelvetrano does not exist anymore, cf. Aliquò & Castelli, 1991] (Palumbo, 1890 sub *C. littoralis* and *C. littoralis* var. *nemoralis*); Trapani (Palumbo, 1892 sub *C. littoralis*); Sicily (Fleutiaux, 1892 sub *lunulata* v. *lugens* Dej.); Malta: Marsa, Mistra, Birzebuggia, Marsa Scala, Marsa Scirocco, Melleha, Ramla and Gozo island (Cameron & Caruana, 1907 sub *C. littoralis*); Palermo, Messina (Vitale, 1912); Sicily (Luigioni, 1929); Malta (Mandl, 1934); Sicily, Malta (Porta, 1949 sub *lunulata nemoralis*); Pachino, Lentini (Magistretti, 1962); Peloritani: Milazzo, Messina; Nebrodi: F. Mazzarà, Tindari; Madonie: Castelbuono (Magistretti, 1963); Balestrate, Altavilla Milicia, Tindari, F. Mazzara, Milazzo, Lentini, mouth of the Simeto river, Pachino, Gela, mouth of the Belice river, Selinunte, Buseto Palizzolo, Porto Palo (Sciacca), Montallegro, Alcamo Marina (Magistretti, 1965); Castelbuono, Palermo, Messina, Altavilla Milicia (Palermo), Tindari, F. Mazzarà, Catania, mouth of the Simeto river, Pachino, Gela, Porto Palo (Sciacca); Montallegro, mouth of the Belice river, Selinunte, Buseto Palizzolo, Alcamo Marina, Balestrate, Malta (Magistretti, 1967); Catania (Magistretti, 1968); Buonfornello near Termini Imerese (Aliquò et al., 1973 sub *flexuosa circum-*

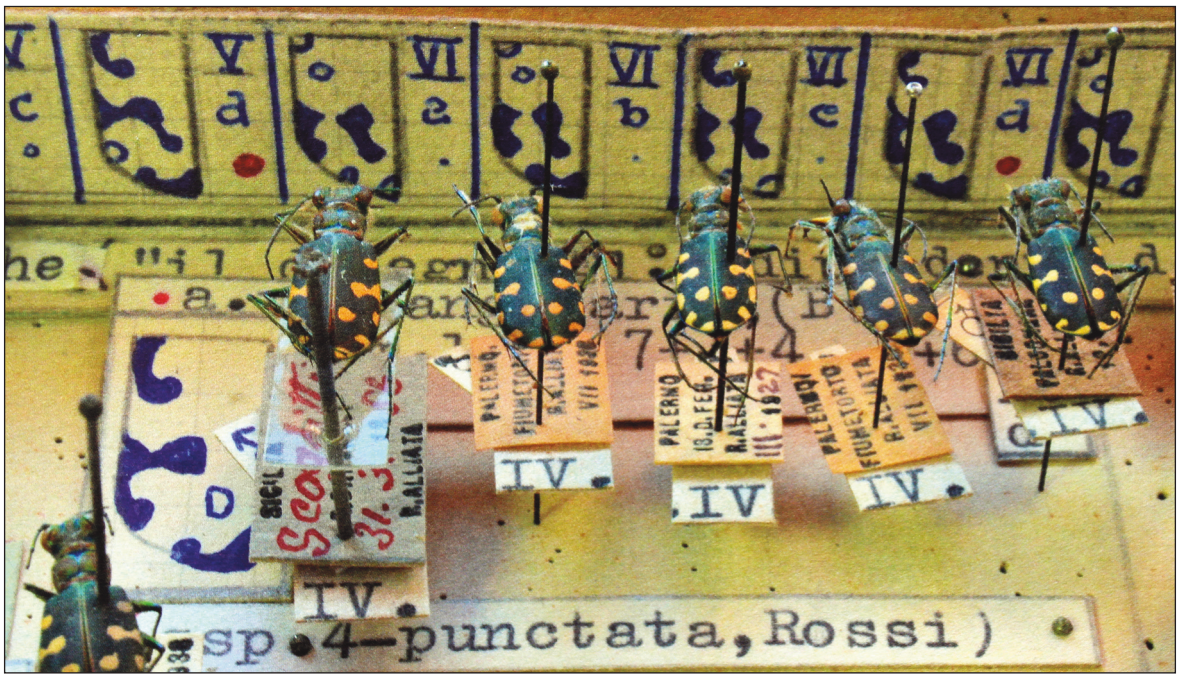

Figure 25. *Calomera littoralis nemoralis*, Alliata entomological collection (from Lo Valvo, 2022).

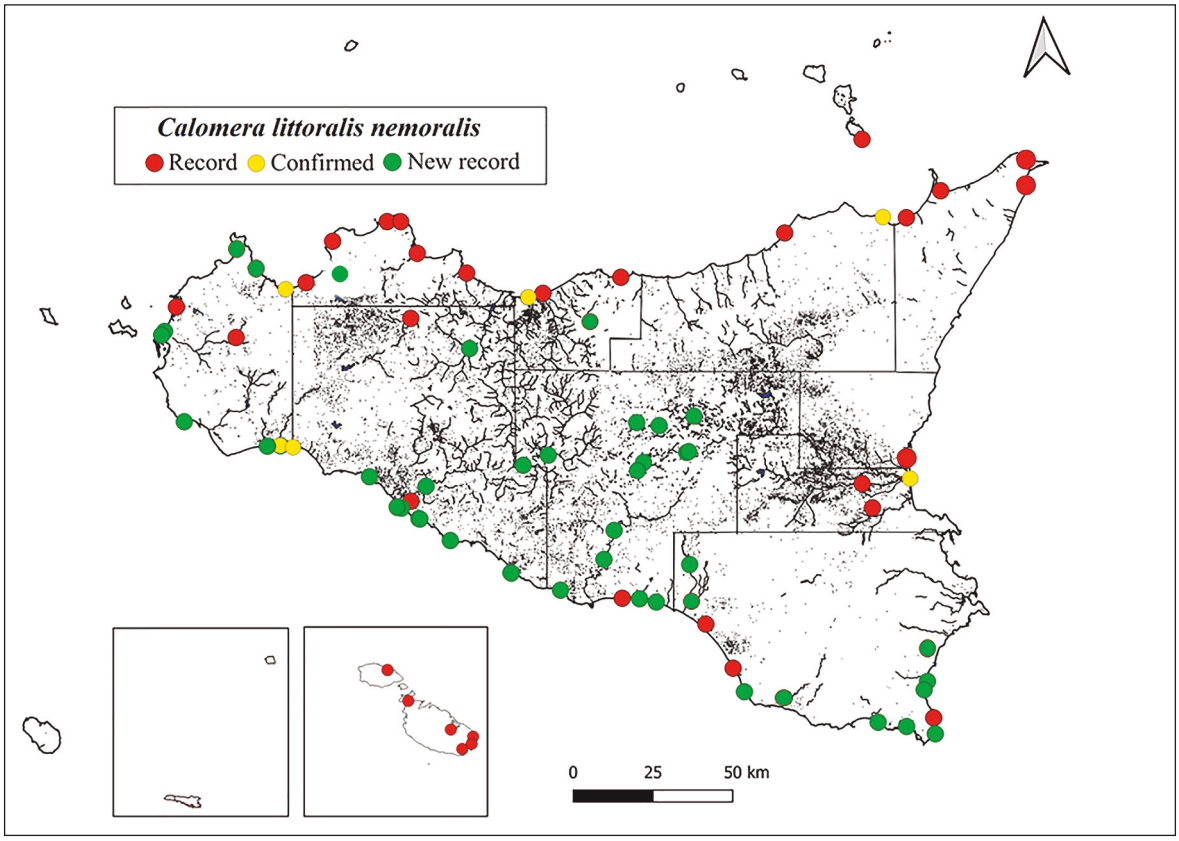

Figure 26. Distribution in Sicily of *Calomera littoralis nemoralis.*

flexa Dej.); Malta (Cilia, 1989 sub *C. littoralis* and *C. littoralis nemoralis*); Rubino lake, salt pans of Trapani (Aliquò & Castelli, 1991); Palermo: mouth of the Oreto river, Isola delle Femmine, Terrasini; Zappulla (ME), Scoglitti (RG), Falconara (CL) (Aliquò, 1992); Torto river, Milicia stream, Oreto river, Zappulla, Balestrate, Falconara, Terrasini, Isola delle Femmine, Scoglitti (Arnone, 1994); Agrigento (Lanza, 1994); (Sparacio, 1995: "*comune* [common]"); Malta (Magrini & Schembri, 1997); Catania: Plaja, Boschetto, Primosole on the banks of the Simeto river, Piana di Catania near Gornalunga stream (Sapuppo, 2002 sub *lunulata nemoralis*); Colla, Bausò (Facchini & Baviera, 2004); Torre Salsa (Galliani, 2011); mouth of the Simeto river (Galliani, 2011; Minati, 2019; Forzese, 2022; Maiorana, 2022); Vulcano island (Brancato, 2016); Termini Imerese, (Schifani, 2016); Vendicari (Godeau, 2017); mouth of the Belice river (Campo, 2018); Platani river (Bartolucci, 2019; Infanti, 2021); Ispica, Santa Maria del Focallo beach (Liberati, 2022); Vulcano: Gelso beach (Lo Cascio, 2017; Lo Cascio et al., 2022).

MATERIALS. Peloritani. Barcellona Pozzo di Gotto: mouth of the Patri stream, 1 ex 19.X.2023 (CS); Terme Vigliatore: Foce Torrente Mazzarra, 1 ex 19.X.2023 (CS).

Nebrodi. Laghetti di Tindari, 38°08'34.1"N 15°02'57.4"E, 14.VIII.1992 (CS);

Madonie. Buonfornello, 1 ex 23.VII.1972 (CAM-MSNG); mouth of the Pollina river, 10.VI.1973 (CR);

Palermitano. Ficarazzi, 4, E. Ragusa, 1 ex (ER-CMC); Mondello, 8, E. Ragusa, 1 ex (ER-CMC); Oreto [river], 8, E. Ragusa, 1 ex (ER-CMC); Balest[rate], 7, E. Ragusa, 1 ex (ER-CMC); Balestrate, 2.6, E. Ragusa, 1 ex (ER-CMC); Balestrate, 1916, Fug. (ER-CMC); Trappeto 1.V.1970 (CAV); Balestrate 1.V.1970 (CAV); Balestrate, 1 ex 25.VII.1971 (CAM-MSNG); Trappeto, 1 ex 13.VIII.1972 (CAM-MSNG); Terrasini: mouth of the Nocella stream, 9.IV.1972 (CR); Balestrate: mouth of the Calatubo river, 4.VII.1972, 12.VI.1973 (CR); mouth of the Calatubo river, 38°02'27.1"N 12°58'47.4"E, 6 exx 13.V.1979 (CS); Termini Imerese: mouth of the Torto river, 37°58'19"N 13°46'12"E, 16.IV.2017 (CM).

Trapanese. Trapani, 1 ex, A. Palumbo (ER-CMC); Foci F. Modione, 23.IV.1973 (CR); salt pans of Trapani, 10.IX.1973 (CR); Birgi, 30.VI.1974 (CR); San Vito Lo Capo, 25.VII.1982 (CR); mouth of the Belice river, 8 exx 9.V.1979, 2 exx 14.IX.1983, 5 exx 13.IV.1984, 1 ex 31.V.1984, 3 exx 17.VII.1985 (CAM-MSNG); Campobello di Mazara, 2 exx 20.V.1981 (CAM-MSNG); Mazara del Vallo: Capo Feto 8.IV.1982 (CAV); mouth of the Belice river, 37°34'56.9"N 12°51'51.9"E, 2 exx 12.IV.1979, 1 ex 5.VIII.1993 (CS); Castellammare del Golfo, 38°01'28.3"N 12°54'16.7"E, 6 exx 10.IV.1985 (CS); mouth of the Modione river, 37°34'57.9"N 12°49'13.1"E, 2 exx 28.VII.1986 (CS); Castellammare del Golfo: mouth of the San Bartolomeo river, 38° 1'28"N 12°54'24"E, 1.VII.2014 (CM); mouth of the Belice river, 37°34'57.00"N 12°52'0"E, 28.V.2010, 4 exx 22-24.V.2020 (CM); Marsala Saline: Punta San Teodoro, 37°54'28.77"N 12°27'33.28"E, 1 ex VIII.2022, leg. M. Amorelli (CM); Mazara del Vallo: Capo Feto, 2 exx 25.VII.1978, 4 exx 1.VI.1979 (DST-MRSNT); Isola delle Femmine, 1 ex 1.VI.1945 (DST-MRSNT).

Sicani. Ficuzza, Geo C. Kr., 1 ex (ER-CMC); Sciacca, 6, E. Ragusa, 1 ex (ER-CMC); Sicilien, Ficuzza, Geo C. Kr., v. *nemoralis* Oliv., 1 ex (ER-CMC); Eraclea Minoa, 1 ex 16.IV.1984 (CAM-MSNG); Menfi: Porto Palo, 37°34'33.5"N 12°55'27.3"E, 12.VII.1984 (CS); Eraclea Minoa, 37°23'31.9"N 13°17'09.6"E, 2 exx 12.IX.1985 (CS); Licata: Torre di Gaffe, 37°08'23.0"N 13°50'01.1"E, 24.IV.1986 (CS); Vicari, 37°50'05.8"N 13°33'07.8"E, 2 exx 6.VIII.1986 (CS); mouth of the Platani river, 37°23'46.1"N 13°16'14.2"E, 4 exx 1.V.1992, 2 exx 31.VII.1993 (CS); Sciacca: Torre Makauda, 37°29'05.4"N 13°10'38.8"E, 6 exx 3.VIII.1997 (CS); Realmonte, 37°17'40.3"N 13°27'11.9"E, 2 exx 30.VII.2006 (CS); Licata: Poliscia Mollarella, 37°06'18.8"N 13°52'31.8"E, 3 exx 31.VII.2006 (CS); Agrigento: Punta Bianca, 37°11'43.94"N 12°27'33.28"E, 8.VII.2011 (CM); Siculiana: Torre Salsa, Pantano, 37°21'38"N 13°20'45"E, 28.VI.2009, 8.VII.2011, 25.V.2012, 28.VI.2012, 4.V.2013 (CM); Foce F. Platani, 37°23'40"N 13°16'18"E, 28.VI.2009, 1 ex 10.V.2011, 18.VIII.2012, 4 exx 5.VII.2020, 1 ex 5.III.2022 (CM); Torre Salsa, 37°21'37.1"N 13°20'39.8"E, 6 exx 4.V.2013 (CS); Licata: Due Rocche, 37° 6'24"N 14° 2'11"E, 4 exx 4.VI.2020 (CM); Marina di Butera: Manfria, 37° 6'15"N 14°

6’38”E, 3 exx 18.VII.2021 (CM); Siculiana: RN Torre Salsa, 6 exx 23.VII.2015 (CAF); idem, 3 exx 10.VI.2017 (CAF); 5 exx 29.VII.2021 (CAF).

E r e i. Biviere di Gela, 5.VIII.1984 (CR); Santa Caterina Villaermosa: Ponte 5 Archi, southern Imera river, 37°36’08.2”N 14°07’57.1”E, 1 ex 30.IX.1986 (CS); Biviere di Gela, 37°00’57.2”N 14°21’07.2”E, 4 exx 8.IV.1989 (CS); southern Imera river, 37°40’57.6”N 14°03’24.8”E, 1 ex 19.V.1994 (CS); Pergusa lake, 37°30’55.6”N 14°18’43.2”E, 1 ex 10.VI.1991 (CS); Caltanissetta: southern Imera river, Lannari, 2 exx 21.VII.2008, 3 exx 20.VI.2012, 2 exx 21.VII.2022, (CAF); Butera: southern Imera river, La Muculufa, 4 exx 8.VII.2011, 1 ex 20.VIII.2021 (CAF); Mussomeli: Salito river, Cozzo Reina, 5 exx 22.VII.2010, 2 exx 21.VIII.2013, 3 exx 8.VII.2015 (CAF); Campofranco: Gallodoro river, 2 exx 4.VII.2002, 1 ex 5.VI.2003 (CAF); Enna: Diga Nicoletti, 4 exx 7.VI.2012, 2 exx 5.IX.2016, 4 exx 28.VIII.2022 (CAF); Villarosa: Diga Villarosa, 2 exx 4.VII.1998, 1 ex 23.VII.2008, 3 exx 21.VII.2018 (CAF); Gela: Roccazzelle, 1 ex 23.VI.2012, 2 exx 21.VII.2015, 3 exx 8.VII.2015 (CAF); Enna: Pergusa lake, 6 exx 5.VII.2003, 2 exx 2.IX.2023 (CAF).

I b l e i. Eloro 18.V.1969 (CAV); mouth of the Dirillo river, 25.III.1974 (CR); mouth of the Irminio river, 12.VI.1974, 25.VI.1979 (CR); Scoglitti: mouth of the Ippari river, 36°52’35.9”N 14°26’22.5”E, 2 exx 17.VIII.1994 (CS); Vendicari: Calamosche, 36°49’27.79”N 15° 6’17.78”E, 20.VII.2014 (CM); Portopalo di Capo Passero, 36°40’29.80”N 15°7’15.68”E, 20.VII.2014 (CM); Ragusa, Cava Randello, 36°49’31.66”N 14°27’40.31”E, 12.VII.2015 (CM); Ispica: Santa Maria del Focallo beach, 36°43’3”N 14°55’24”E, 26.VI.2022 (CM); Mazzarino: Diga Disueri, 3 exx 23.VI.2006, 3 exx 14.VII.2017, 9 exx 23.VII.2022, 12 exx 23.VIII.2023 (CAF).

P i a n a d i C a t a n i a. Catania, ott. 1911, 1 ex (ER-CMC); Dittaino river: Stazione Libertinia, 14.VI.1974 (CR); mouth of the Simeto river, 13.VI.1974, 29.IV.1976 (CR); mouth of the Simeto river, 37°24’07.1”N 15°05’22.6”E, 1 ex 19.VIII.1993, 2 exx 21.V.1986, 4 exx 20.X.2012 (CS).

Biology. Species with broad ecological value (Contarini, 1992; Audisio, 2002; Jaskuła, 2013; Mazzei et al., 2014), common in Sicily especially along sandy coasts, on the banks of coastal lagoons and river mouths. It is also found in inland locations on the banks of lakes, rivers and streams. In some biotopes it is present with large populations.

Remarks. *Lophyridia littoralis nemoralis*, although in regression like all the other Sicilian Cicindelidae and having disappeared from some now destroyed locations, still retains numerous presences along the Sicilian coasts with often abundant populations. It resists human presence and is observed in the summer months along the shoreline of southern beaches frequented by tourists and swimmers. Molecular genetic studies to reveal the presence of cryptic species and provide further phylogeographic data have been conducted on *C. littoralis* populations from the eastern Mediterranean and Pontica region (Jaskula et al., 2016).

Calomera panormitana panormitana (Ragusa, 1906)

Chorotype and distribution. East-Mediterranean chorotype (EME).

Calomera panormitana (Ragusa, 1906) is a species with eastern Mediterranean range present

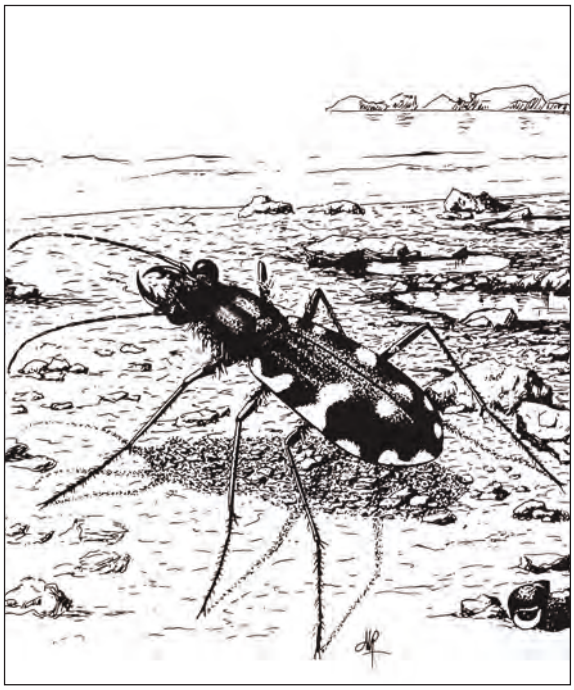

Figure 27. *Calomera panormitana panormitana*, drawing by Michele Reina (from Sparacio, 1995).

with the nominal subspecies in Sicily (Figs. 27, 28, 41), with the subspecies *cypricola* (Mandl, 1981) in Cyprus and Rhodes and with the subspecies *cretensis* Romano et Sparacio, 2018 in Crete (Romano & Sparacio, 2018). *Calomera aphrodisia* (Baudi di Selve, 1864), a related species, is present in the coasts of Turkey, Syria and Lebanon.

REFERENCES. Mondello near Palermo (Ragusa, 1874 sub *C. littoralis* var., 1882, 1883, 1884, 1887, 1904); Sicily (Fleutiaux, 1892 *aulica* v. *aphrodisia* Baudi); Mondello (Vitale, 1912); Mondello, Balestrate, Bauso (Vitale, 1912, 1913); Balestrate (Ragusa, 1921); Mondello, Balestrate, Bauso (Vitale, 1927 sub *aphrodisia*: "[Bauso:] *presso uno stagno in contrada Vina* [near a pond in the Vina district]"); Mondello, Balestrate (Luigioni, 1929); Mondello, Isola delle Femmine, Sferracavallo, Balestrate, mouth of the Simeto river (Aliquò & Romano, 1975); Vendicari, San Vito Lo Capo, Macari, Birgi (Torre San Teodoro), Penisola della Maddalena, Faro Castelluccio near Siracusa (Cassola, 1982, 1983); Porticello (Aliquò, 1992); Mondello, Porticello, Isola delle Femmine (Arnone, 1994); Sicily (Sparacio, 1995); Siracusa: Fontane Bianche, mouth of the Simeto river, Fontane Bianche near Siracusa (Lisa, 2002); Mondello (Facchini & Baviera, 2004); San Vito Lo Capo, Cinisi, Carini: Torre Pozzillo, Sferracavallo: Punta Matese and Barcarello, Isola delle Femmine: Punta della Catena, Castelluzzo: Golfo di Cofano (Romano & Sparacio, 2018); Palermo: Addaura and Capo Gallo, coastline from Barcarello-Sferracavallo-Isola delle Femmine, Isola delle Femmine, Villagrazia di Carini (Torre Pozzillo, Torre della Tonnara dell'Ursa), Cinisi (Magaggiari-Torre Mulinazzo), Tonnara di San Cusumano (Erice), Pizzolungo, Monte Cofano (Custonaci), Lido Valderice-Monte Cofano, San Vito Lo Capo-Gulf of Cofano, Isola Lunga of the Stagnone di Marsala, Torre San Teodoro, Levanzo island (Sparacio & Surdo, 2021) (Figs. 27, 28, 30, 41).

MATERIALS. Palermitano. Enrico Ragusa collection (ER-CMC): "*Cicind. aulica* a. *panormitana* Rag.": 1 ex labelled "*Sicilia, Mondello, E. Ragusa, 8*" - red label: *Calomera panormitana* Ragusa, 1906 - Lectotypus, M. Romano & I. Sparacio des. 2018; 3 exx labelled "*Sicilia, Balestr*.[ate], *E. Ragusa, 6*". 8 exx without labels; "*Cicind. aulica* a. *lugens* Rag.": 1 ex labeled "*Sicilia, Mondello, 21.7.07*"; 1 ex labelled "*Sicilia, Mondello, E. Ragusa, 8*"; 7 exx without labels; "*Cicind. aulica* a. *luctuosa* Rag."; 1 ex labelled "*Sicilia, 2.8.921, Isola scogliera, A. Modica*"; 6 exx without labels. All these specimens, except the lectotype, have a red label: *Calomera panormitana* Ragusa, 1906 - Paralectotypus - M. Romano & I. Sparacio des. 2018.

Palermo: Mondello, 1 ex 14.VIII.1912, legit E. Prestigiacomo (MM-MRSNT); Isola delle Femmine, 1 ex IX.1932, legit E. Di Napoli (DST-MRSNT); Cinisi, 2 exx 6.VIII.1983, 5 exx 18.VIII.1983, 4 exx 7.VII.1986, 2 exx 19.VIII.1989, 2 exx 2.VIII.1993 (CS); Carini: Torre Pozzillo, 2 exx 6.VII.1985 (CS); Palermo: Sferracavallo, Punta Matese, 4 exx 2.VIII.1986, 1 ex 6.VIII.1986, 3 exx 25.VIII.1988, 1 ex 8.VIII.1997, 1 ex 10.VII.2000, 2 exx 13.VIII.2001 (CS); Isola delle Femmine: Punta della Catena, 2 exx 2.VIII.1993, 3 exx 14.VIII.1993 (CS); Palermo: Sferracavallo, Barcarello, 2 exx 13.VIII.2011 (CS); Isola delle Femmine, 38°12'14"N 13°16'43"E, 4 exx 16 and 20.VIII.2013 (CM).

Trapanese. San Vito Lo Capo, 14.VI.1981 (CAV); San Vito lo Capo, 11.VI.1983, 6 exx - 30.VI.1987, 4 exx (CAM-MSNG); San Vito Lo Capo, 10 exx 22.VII.1982, 1 ex 23.VIII.1994, 1 ex 23.VII.1995, 4 exx 2.VIII.1996, 18 exx 20.VI.1997 (CMR); San Vito Lo Capo, 3 exx 13.VI.1982, 4 exx 28.VI.1997 (CS); Castelluzzo: Golfo di Cofano, 8 exx 5/8.VIII.2008 (CS); Cornino, 9.VII.2023 (SS); Favignana island, 10 exx 10.VII.2023 (SS); Lido Valderice, 18.VII.2023 (SS).

Iblei. Vendicari, 36°48'13"N 15° 5'52"E, 26.VII.2014 (CM); Siracusa: Plemmirio, 37° 1'25.20"N 15°19'8.61"E, 29.VI.2017 (CM).

BIOLOGY. Cassola (1983), by studying Sicilian populations, provides important information on the habits of this species that lives in the particular environment of rocky coasts. Here, it feeds on small invertebrates such as crustaceans of the genus *Ligia* Fabricius, 1798 and gastropod molluscs of the genera *Littorina* Férussac, 1822 and *Gibbula* Risso, 1826 that it seeks in the summer months.

This type of rocky coast is almost always characterized, along the tidal line, by the presence of a vermetid "trottoir". The vermetid trottoir (or rim, sidewalk) is a coastal carbonate platform, posi-

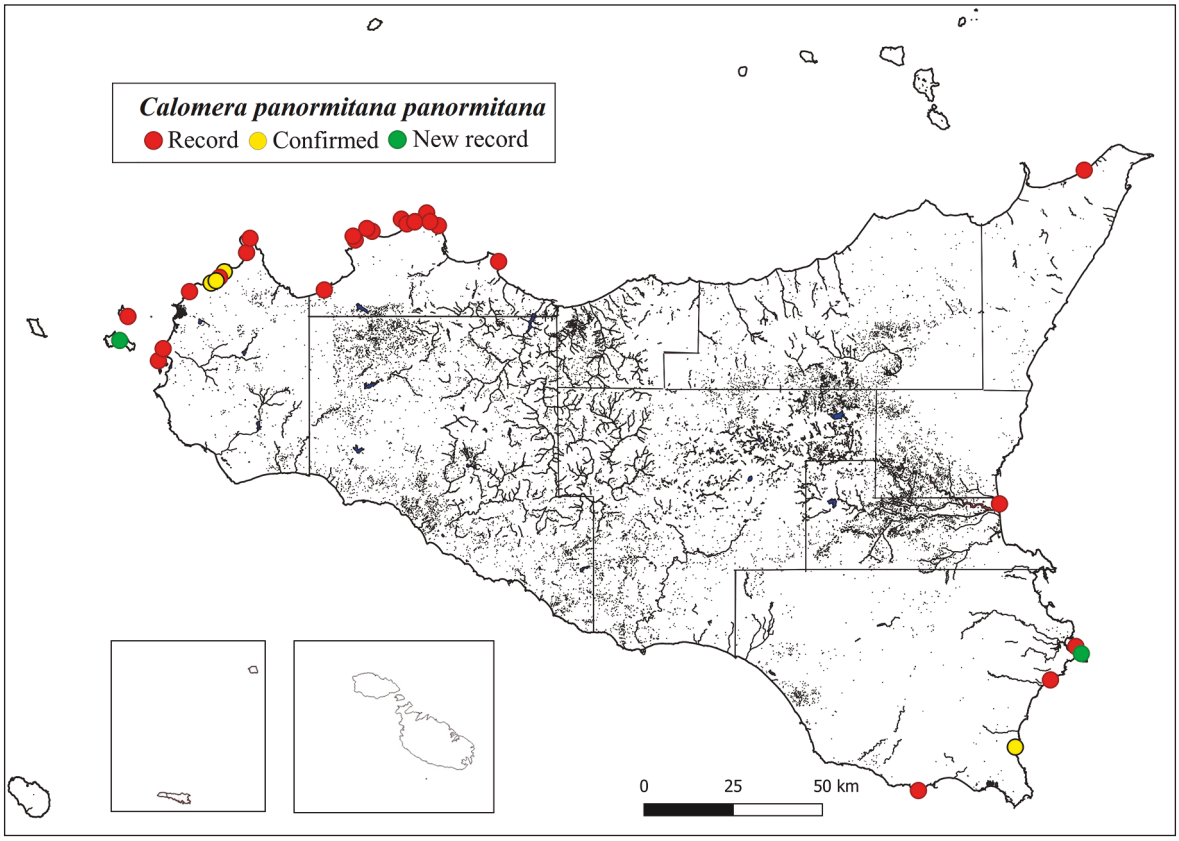

Figure 28. Distribution in Sicily of *Calomera panormitana panormitana.*

tioned between the sea and the rocky coast, formed as a result of a process of cementation of shells of some species of molluscs of the family of Vermetidae, in particular *Dendropoma cristatum* (Biondi, 1857) and *Vermetus triquetrus* Bivona-Bernardi, 1832. This biostructure, characteristic of the Mediterranean Sea and similar to coral reefs, plays an ecological role of great importance by promoting the settlement and development of numerous animal and plant species (Pandolfo et al., 1992; Chemello et al., 2000; Chemello, 2009; Gordó-Vilaseca et al., 2021). Sparacio & Surdo (2021) have shown that vermetid trottoirs offer this tiger beetle a more favorable environment for its life because it is less subject to the force of the waves and more sheltered from the sea (Sparacio & Surdo, 2021).

Remarks. Ragusa (1882) discovered in Sicily, in the same day and in the same locality, "*Cicindela littoralis* var. *lugens* Dahl." and "*Cicindela littoralis* var. *aphrodisia* Truqui". Subsequently, Ragusa (1884, 1904) better distinguished the two mentioned taxa by describing the Sicilian populations of *C. aphrodisia* as a distinct variety that he named "*panormitana*" (Ragusa, 1906).

In recent years, there have been differing interpretations both on the taxonomic role of these populations, especially in relation to their original ranges, and on the correct attribution of the name "*panormitana*" for the Sicilian populations as summarized by Romano & Sparacio (2018). The latter designate the lectotype of *Calomera panormitana panormitana* and the neotype of C. *littoralis nemoralis* var. *lugens* Dejean, 1831 (preserved in ER-CMC).

Calomera panormitana panormitana was considered for many years, especially in the first decades of 1900, to have disappeared from the Sicilian territory or at least to be in strong regression (Vitale, 1913). Cassola (1983), while confirming the presence of this species in several stations already known and reporting many new ones, underlined the ecological peculiarities of *C. panormitana panormitana*. It lives in small environments of rocky coast

near the sea, restricted and isolated from each other, often due to the presence of anthropic alterations of the coast (Surdo & Sparacio, 2021).

Genus *Myriochile* Motschoulsky, 1862
Subgenus *Myriochile* Motschoulsky, 1862

Myriochile (Myriochile) melancholica (Fabricius, 1798)

CHOROTYPE AND DISTRIBUTION. Chorotype: Afro-tropical-Indo-Mediterranean (AIM).

Species with wide Afro-Indian-Mediterranean distribution, present in central-southern Italy, Sicily, and Sardinia (Figs. 29, 42).

REFERENCES. Catania, Paternò (Ghiliani, 1842 sub *aegyptiaca* Klug.); Catania (De Stefani-Perez & Riggio, 1882 sub *Aegyptiaca* Klug.); Palermo: Boccadifalco, Finale near Castelbuono, Catania (Ragusa, 1883 sub *Aegyptiaca* Klug.); near Termini Imerese (Ciofalo, 1886 sub *aegyptiaca*); Sicily (Steck, 1887 sub *aegyptiaca* Klug); Malta: Marsa (Cameron & Caruana Gatto, 1907; Luigioni, 1929); Palermo, Catania, Castelbuono (Vitale, 1912); Sicily (Luigioni, 1929); Sicily, Malta (Porta, 1949); Madonie: Castelbuono (Magistretti, 1963); Palermo, Catania, Castelbuono, Malta (Magistretti, 1967); salt pans of Trapani (Aliquò & Castelli, 1991); Palermo villa Alliata; Isola delle Femmine; mouth of the Torto river; Zappulla (ME) (Aliquò, 1992); Isola delle Femmine, Torto river, Palermo: Villa Alliata, Zappulla (Arnone, 1994); Messina (Lanza, 1994); Lampedusa island: Spiaggia dei Conigli (Vigna Taglianti, 1995); Malta: Ghajn Rihana, Fiddien, Wied il-Hemsija (Magrini & Schembri, 1997); Pelagian islands, Ragusa: mouth of the Acate river (Lisa, 2002); Monreale, Sicily, Messina (Facchini & Baviera, 2004); Lipari island (Lo Cascio et al., 2006; 2022); Petrosino, Isola Lunga of the Stagnone of Marsala (Sparacio & Surdo, 2021).

MATERIALS. Peloritani. Messina surroundings, 1 ex 6.VI.1990 (CS); Milazzo, 1 ex 19.X.2023 (CS); Sant'Agata di Militello, 1 ex 19.X.2023 (CS).

Madonie. Foci F. Pollina, 24.V.1973, 10.VI.1973 (CR); Finale di Pollina, 24.VI.1973 (CR).

Palermitano. Balestrate: moth of Calatubo river, 4.VII.1972 (CR); Piana degli Albanesi lake, 37°58'47.3"N 13°18'41.0"E, 5 exx 5.VIII.1993 (CS); Ustica island: Gorgo Salato, 38°43'7.63"N 13°10'34.35"E, 16.VII.2017 (CM).

Trapanese. Saline di Trapani, 10.IX.1973 (CR); Birgi, 30.VI.1974 (CR); Pantano Leone, 19.VIII.1986 (CR); Foci F. Belice, 27.VII.1988, 12.VI.1991 (CR); San Vito Lo Capo, 20.VI.1997; Foci F. Modione, 9.VII.2009 (CR); San Vito Lo Capo: Macari, 2.VII.1991 (CAV); mouth of the Belice river, 37°34'56.8"N 12°51'57.2"E, 8 exx 5.VIII.1993 (CS); Cave di Cusa: Pantano Leone, 37°36'51.6"N 12°43'14.9"E, 8 exx 13.VIII.2005 (CS); idem, exx phot. 14.X.2019 (SS); Favignana island: Tonnara Florio, 1 ex 8.VIII.2010 (CS); Marettimo island, 30.V.2010; (CS); mouth of the Belice river, 37°34'57.00"N 12°51'53"E, 10.VII.2010, 2 exx 22-24.V.2020 (CM); Castelvetrano: Triscina, mouth of the Modione river, 37°34'57.00"N 12°52'0"E, 17.VII.2010 (CM); Mazara del Vallo: Capo Feto, 37°39'40"N 12°31'13"E, 4 exx 11.V.2013 (CM); Favignana island: surroundings of Punta Faraglione, 37°56'58.31"N 12°18'6.04"E, 20.VII.2017 (CM); Castelvetrano: Lago Trinità, 37°43'22.77"N 12°45'37.81"E, 18.VII.2018 (CM); idem, exx phot. 26.VIII.2019 and 30.VIII.2021 (SS); Campobello di Mazara: Pozzitello, ex phot. 13.VII.2019 (A. Ditta, pers. comm.); Paceco: Diga Paceco, exx phot. 3 and 17.IX.2018 (SS); mouth of the Belice river, ex phot. 26.VIII.2019 (SS).

Canale di Sicilia. Lampedusa island: Isola dei Conigli, 12.IX.1984 (CR); Lampedusa island: Capo Ponente, 10.VI.1998 (CR); Lampedusa island: Cala Croce, 10.VI.1998 (CR); Pantelleria island: Lago di Venere, 36°48'41"N 11°58'35"E, 4 exx 20.VI.2021 (CM); Lampedusa island: Spiaggia dei Conigli, 28.VI.2003 (CM); idem, 20.X.2023, E. Prazzi pers. comm.; Lampedusa island: La Tabaccara, 2008, E. Prazzi pers. comm.

Sicani. Ficuzza, 8, E. Ragusa, 1 ex (ER-CMC); mouth of the Platani river, 37°23'48"N 13°16'14"E, 18.VIII.2012, 1 ex 5.VII.2020, 18.VIII.2012 (CM); Sambuca di Sicilia: Diga Arancio, 37°38'22.2"N 13°03'32.8"E, exx phot. 25.VIII.2018 (SS); Siculiana: RN Torre Salsa, 10 exx 23.VII.2015 (CAF); idem, 10 exx 10.VI.2017 (CAF); idem, 4 exx 29.VII.2021 (CAF).

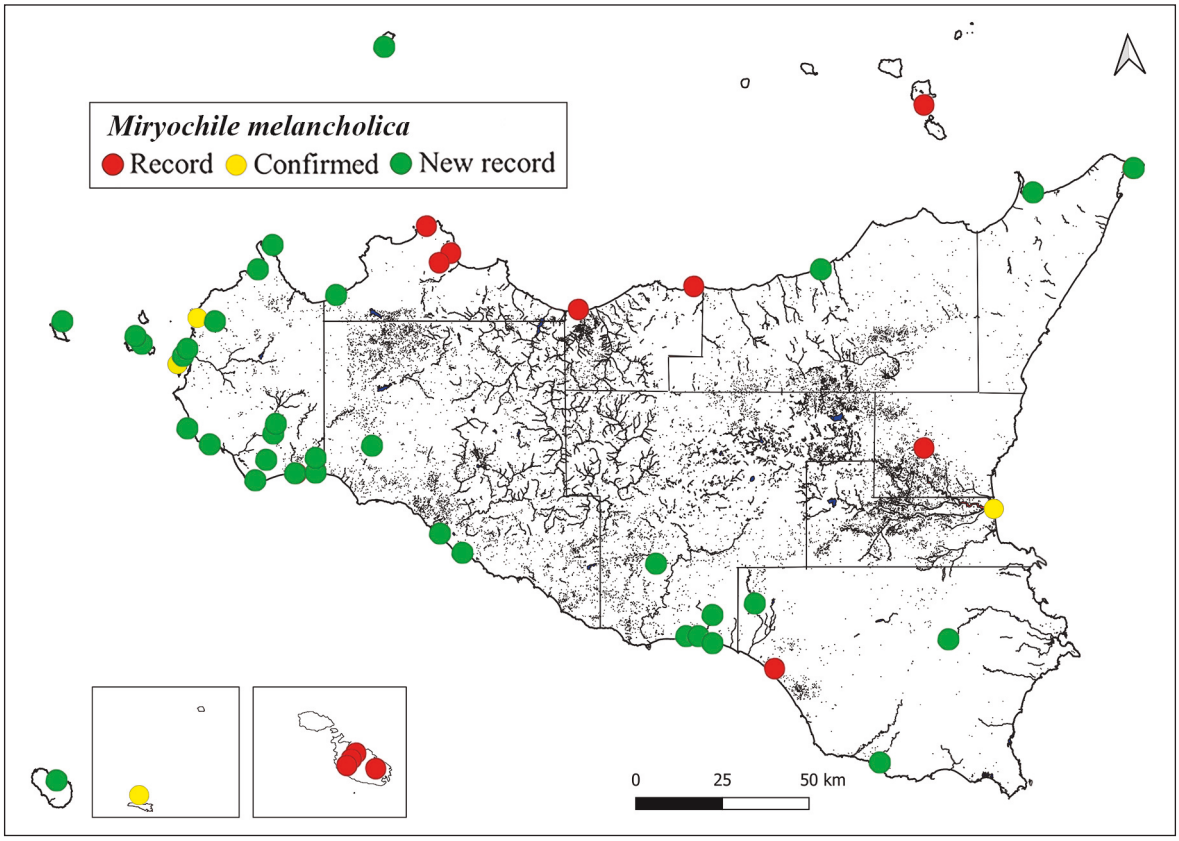

Figure 29. Distribution in Sicily of *Myriochile* (*Myriochile*) *melancholica.*

E r e i. Biviere di Gela, 17.VI.1974, 5/9.VIII.1984 (CR); Marina di Butera: torre di Manfria, 37° 6'15"N 14° 6'38"E, 1 exx 18.VII.2020 (CM); Gela: Roccazzelle, 23.VI.2012, 3 exx (CAF); idem, 5 exx 21.VII.2015 (CAF); idem, 23.VII.2018, 2 exx (CAF); Butera: Desusino, 1 ex 23.VI.2012 (CAF); idem, 2 exx 21.VII.2015 (CAF); Sommatino: Diga Gibbesi, 5 exx 22.VIII.2021 (CAF); Butera: Diga Comunelli, 10 exx 23.VI.2012 (CAF); idem, 11 exx 27.VII.2018 (CAF).

I b l e i. Mouth of the Irminio river, 25.VI.1979 (CR); ; Palazzolo Acreide, 1 ex 6.VII.2022 (CS).

P i a n a d i C a t a n i a. Catania, 7, E. Ragusa (ER-CMC); mouth of the Simeto river, 18.X.1990, 2 exx 19.VIII.1993 (CS).

Biology. *Myriochile melancholica* lives mainly in the muddy edges of lakes, rivers and coastal marsh environments. In Malta, Magrini & Schembri (1997) report it "*on the muddy edges of large freshwaters pools*".

Remarks. This tiger beetle has extensive colonization capabilities (Ponel et al., 2018) and is present throughout Sicily at low and medium altitudes but fragmented into, only rarely, numerous populations. It is the most widespread tiger beetle in the circum-Sicilian islands.

Figure 30. *Cylindera (Eugrapha) trisignata siciliensis,* mouth of the Carboj stream (Agrigento).

Figure 31. *Cassolaia maura cupreothoracica*, Torre Salsa (Agrigento).

Figure 32. *Cassolaia maura cupreothoracica*, Macalube of Aragona (Agrigento).

Figure 33. *Cephalota* (*Taenidia*) *circumdata imperialis*, Isola Lunga (Stagnone of Marsala, Trapani).

Figure 34. *Cephalota (Taenidia) litorea goudotii*, salt pans of Trapani.

Figure 35. *Cicindela* (*Cicindela*) *campestris siculorum*, Monte Mimiani: Bosco Scorsone (Caltanissetta).

Figure 36. *Cicindela* (*Cicindela*) *campestris didyme*, Monte Fossa delle Felci (Salina island).

Figure 37. *Cylindera* (*Eugrapha*) *trisignata siciliensis*, mouth of the Platani river (Agrigento).

Figure 38. *Lophyra* (*Lophyra*) *flexuosa sardea*, Vendicari (Siracusa).

Figure 39. *Lophyra* (*Lophyra*) *flexuosa sardea*, Capo Feto (Mazara del Vallo, Trapani).

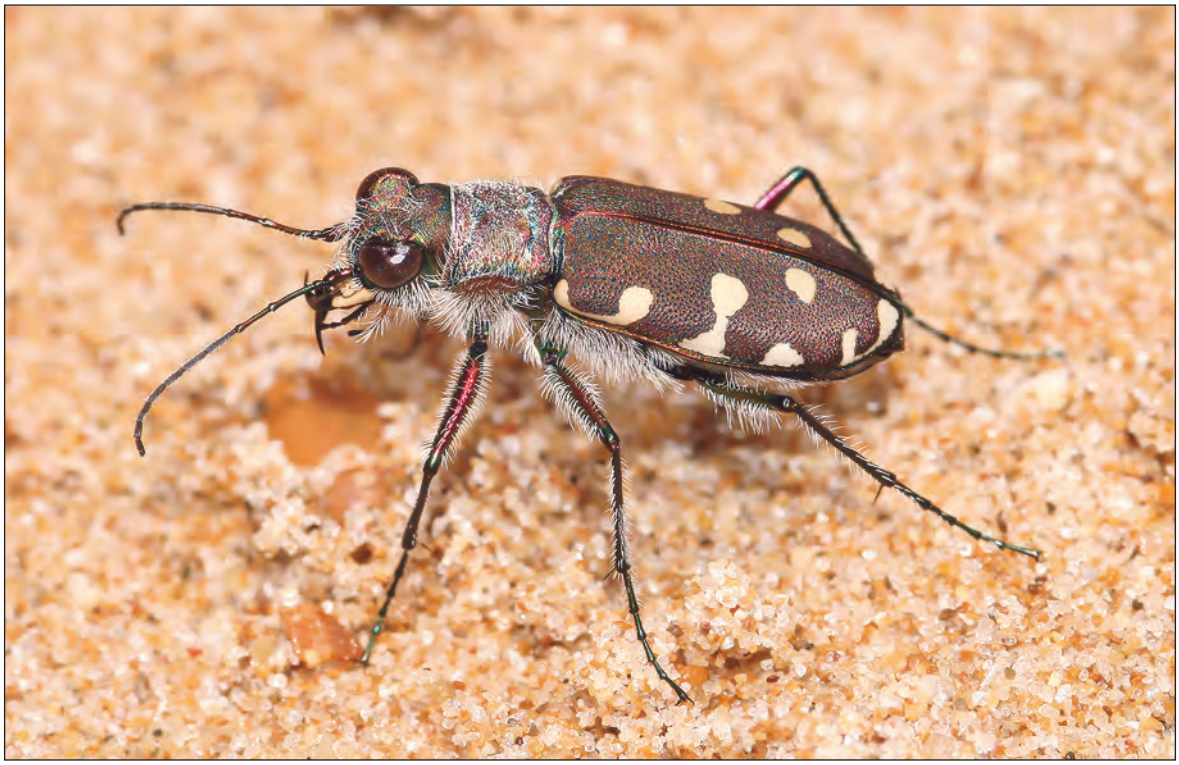

Figure 40. *Calomera littoralis nemoralis*, Punta Bianca (Agrigento).

Figure 41. *Calomera panormitana panormitana*, Isola delle Femmine (Palermo).

Figure 42. *Myriochile* (*M.*) *melancholica*, mouth of the Belice river (Trapani).

SICILIAN TIGER BEETLES: FAUNISTIC AND BIOGEOGRAPHICAL DATA

Faunistic data

By summarizing the ecological and faunal data exposed in the first part of the catalog and on the basis of their current presence on the island, we can divide the Cicindelidae currently reported for the Sicilian territory as follows:

Relatively widespread species with reduction of the original range:
Cassolaia maura cupreothoracica
Cicindela (Cicindela) campestris siculorum
Lophyra (Lophyra) flexuosa sardea
Lophyra (Lophyra) circumflexa
Calomera littoralis nemoralis
Calomera panormitana panormitana
Myriochile (Myriochile) melancholica

Species at risk of extinction with strong reduction of its original range:
Cephalota (Taenidia) circumdata imperialis
Cephalota (Taenidia) litorea goudotii
Cylindera (Eugrapha) trisignata siciliensis

Species of uncertain presence or probably extinct:
Cylindera (Cylindera) germanica muelleri
Cylindera (Eugrapha) arenaria arenaria
Calomera lunulata

Species with strictly limited geographical area:
Cicindela (Cicindela) campestris didyme

Biogeographical data

The geographic ranges of these Cicindelidae are summarized below. The chorotype they belong to, or that of the species as a whole - when it does not coincide with the chorotype of the Sicilian population - is reported in brackets.

Sibero-European (SIE):
Cylindera (Eugrapha) arenaria arenaria

Afrotropical-Indo-Mediterranean (AIM):
Myriochile (Myriochile) melancholica

West-Mediterranean (WME):
Cephalota (Taenidia) circumdata imperialis (Mediterranean)
Cephalota (Taenidia) litorea goudotii (Mediterranean)

SE-European:
Cylindera (Cylindera) germanica muelleri (Central-Asiatic-European)
Calomera littoralis nemoralis (Central-European-Mediterranean)

N-African:
Calomera lunulata

Sub-Endemic:
Cassolaia maura cupreothoracica: Tunisia, Sicily, Calabria (West-Mediterranean)
Cylindera (Eugrapha) trisignata siciliensis: Tunisia, Sicily, Malta (Mediterranean)
Lophyra (Lophyra) flexuosa sardea: Tunisia, Sardinia, Sicily (Mediterranean)

Endemic:
Cicindela (Cicindela) campestris siculorum (West Paleartic)
Cicindela (Cicindela) campestris didyme (West Paleartic)
Lophyra (Lophyra) circumflexa: Sicily, Tunisia?
Calomera panormitana panormitana (East-Mediterranean)

The analysis of the geographical distributions of Sicilian cicindelids allows us to expand our knowledge on the biogeographical aspect of this population.

Two species have a wide distribution: *Cylindera* (*Eugrapha*) *arenaria arenaria* (Siberian-European) and *Myriochile* (*Myriochile*) *melancholica* (Afro-Tropical).

Two other taxa are widespread in south-eastern Europe representing wider ranges such as *Cylindera* (*Cylindera*) *germanica muelleri* and *Calomera littoralis nemoralis* (CEM) while *Calomera lunulata* is of North-African origin.

The most widespread chorotype is the Mediterranean chorotype – six taxa of which 1 is eastern Mediterranean, 1 western Mediterranean while the other 4 are Mediterranean. By examining in particular the subspecific populations, two taxa are widespread in the western Mediterranean:

Cephalota (*Taenidia*) *circumdata imperialis* and *Cephalota* (*Taenidia*) *litorea goudotii*.

Three others, instead, are subendemic, located in Sicily and strictly neighboring regions: *Cassolaia maura cupreothoracica*, *Cylindera* (*Eugrapha*) *trisignata siciliensis* and *Lophyra* (*Lophyra*) *flexuosa sardea*.

Lastly, one taxon of eastern Mediterranean origin is endemic to Sicily: *Calomera panormitana panormitana*.

The other three endemic species are *Cicindela* (*Cicindela*) *campestris siculorum*, an exclusively Sicilian population of a widely distributed western Paleartic species, *Cicindela (Cicindela) campestris didyme* (Aeolian Archipelago: Lipari e Salina), and *Lophyra* (*Lophyra*) *circumflexa*, perhaps also present in Tunisia.

Overall, endemic and sub-endemic taxa are 7 out of 14 taxa in total (50%) while only endemic taxa are 4 (28%). However, except *Myriochile* (*Myriochile*) *melancholica* - a widespread species - the remaining 6 non-endemic taxa also present peculiar ecological, biogeographical and faunal characteristics which characterize the Sicilian population of these tiger beetles as very interesting and worthy of protection.

ECOLOGY, BIODIVERSITY LOSS AND CONSERVATION OF SICILIAN TIGER BEETLES

Insects are widespread in almost all terrestrial ecosystems and many species or groups are used as biological indicators. Among these latter, the family Cicindelidae has been largely considered a key-group for biodiversity assessment and and evaluation of environmental quality, due to their biological and ecological characteristics (see for instance Rodriguez et al., 1998; Cassola, 1998; Pearson & Cassola, 1992, 2005; Cassola & Pearson, 2000; Cassola , 2002; Aydın et al., 1998).

Members of this family are predators able to fly (Fig. 43) with strong relationships to the level of conservation of their habitats. Moreover, field monitoring of tiger beetles is relatively easy, and often simply based on their occurrence or absence on selected sites (Schultz, 1988; Hudgins et al.,

Figure 43. *Calomera littoralis nemoralis* while preying a small crustacean (mouth of the Platani river, Agrigento).

2011). Tiger beetles are also used in the evaluation of conservation levels at global, regional and local scales (Pearson & Wiesner, 2023).

Cicindelidae include stenoecious species, generally with scarce tolerance to environmental disturbance, especially during the larval stages when they result particularly exposed to changes of the substrate structure and composition, as well as to other constraints.

The larvae usually live in open areas characterized by high density of potential preys, and belong to the morpho-ecological types of "*burrow trappers*" (Sharova, 1960; 1981; Thiele, 1977; Zetto Brandmayr et al., 1998; Luff, 2005). Larvae occupy vertical tunnels in the ground where they are able to intercept the preys, while also allowing them to close the opening of the galleries if they are threatened. They can also leave these gallery to forage within short distances from their refuges.

According to Sturani (1881), at Torre Vendicari (Sicily) the larvae of *Cephalota litorea goudotii* live in tunnels built exclusively in the thin (3–4 cm) layer of soil (stromatolitic deposits) within the rock pools near the sea shores (Fig. 44). It may expose the insects to strong environmental changes as the water evaporates or submerges the tunnels.

In both cases, the larvae block the opening of the tunnel, waiting for the return of suitable conditions. Tunnels may also be developed horizontally. In this biotope, the main nourishment of the larvae of *C. litorea goudotii* are crustacean isopods belonging to the genus *Ligia*.

This example can explain how the larval development of Cicindelidae can be extremely vulnerable, and as any minimum variation could lead to the local extinction from such peculiar biotope.

In Italy as well as in the Euro-Mediterranean area, Cicindelidae are mainly living in sandy environments like beaches, river mouths, shores of lagoons and dunal or backdunal ponds. Only few species are found on rocky shores, while others inhabit inner places such banks of rivers and lakes or dry environments as paths or forest clearings.

Unfortunately, most part of the coastal environments preferred by tiger beetles are the same that in Italy, as well as in Sicily, have undergone to the most important alterations, often related to the anthropic activity and disturbance.

Cassola (2002) used the loss of biodiversity of this group for outlining the history of the anthropization of the Italian coast during the last two centuries. Until the first half of 19th century, coastal environments - often marshy and unhealthy

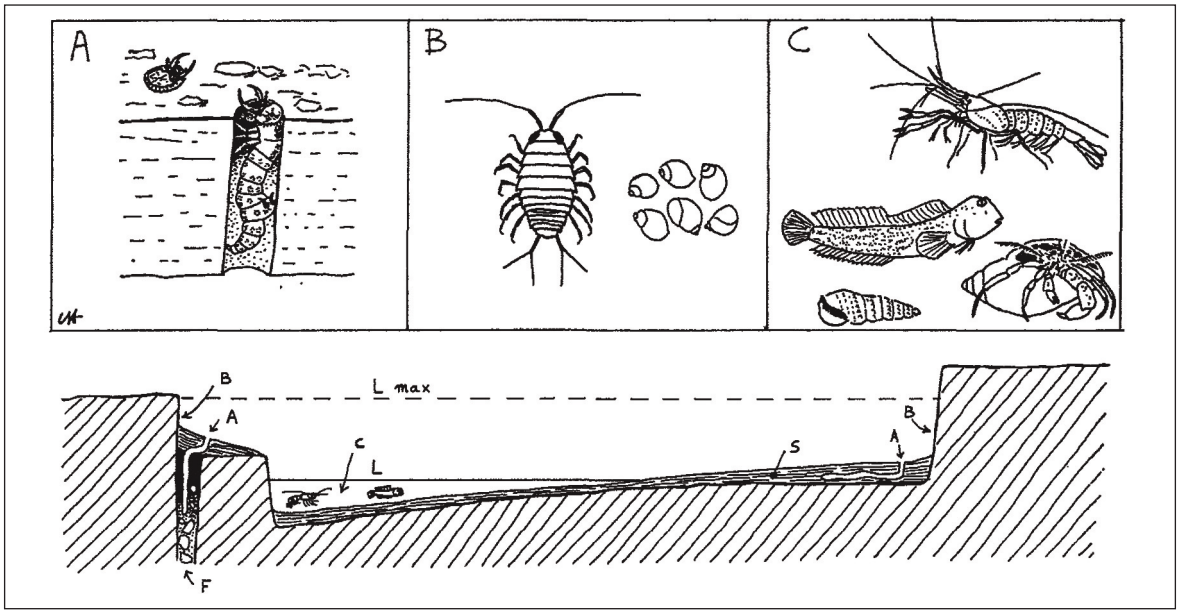

Figure 44. Drawing from Sturani (1981). Larval ecology of *Cephalota* (*Taenidia*) *litorea goudotii* in Vendicari. A: larval tunnel. B: Isopods (*Ligia*) and *Littorina* shells. C: associated fauna (Gasteropods, Blennids, Crustaceans). Bottom: position of the tunnels near the edges of the periodically submerged basins.

- have been scarcely disturbed, due to their low suitability for agriculture or other activities. In fact, human settlements and fishing activity were usually placed in rocky shores, also for defensive reasons, and the sandy coasts of peninsular Italy, Sicily and Sardinia were generally uninhabited, retaining a good level of conservation.

According to Cassola (2002), the first changes match with the the Unification of Italy, when a phase of expansion was linked to the building of railroads: "*il treno diventa infatti il veicolo attraverso il quale il paesaggio italiano viene offerto, per la prima volta, agli occhi del viaggiatore. Con un singolare ribaltamento psicologico di prospettiva, è il tracciato che deve divenire, appunto, "panoramico", nel senso che deve rendere visibile e godibile, per il viaggiatore comodamente seduto nella carrozza, il paesaggio della costa e del mare: non importa se poi la presenza della ferrovia medesima, costruita spesso a ridosso o in prossimità della costa, altera e distrugge per sempre, in sostanza, quel paesaggio medesimo* [The train in fact becomes the vehicle through which, for the first time, the eyes of the traveller can gaze upon the Italian landscape. With a singular psychological reversal of perspective, the route must become, precisely, "scenic", in the sense that [the route] must make the landscape of the coast and the sea visible and enjoyable for the traveler comfortably seated in its carriage: it does not matter if the presence of the railway itself, often built close to or near the coast, essentially alters and destroys that same landscape forever]" (Cassola, 2002).

These strong transformations continued in the following years also with the building of the road network. Easily accessible, the beaches have been hence widely used for industrial, residential and tourist-recreational purposes, and destroyed after the sprawl of seaside resorts and hotels. This process has also included the private appropriation of large traits of coast - previously considered of public property - and its results are visible "*ormai [nel]la quasi totalità delle nostre coste, irrispettosa di ambiente e paesaggio, con tutto il suo carico di rifiuti e inquinamenti, di sporcizia e degrado* [now almost on most part of our coasts, disrespectful of the environment and landscape, with all its load of waste and pollution, dirt and degradation]" (Cassola, 2002). These general considerations are sadly valid even for the Sicilian coasts.

In Sicily, it was mainly due to the extensive reclamation works carried out on wet coastal lands as measures against the malaria, that caused drastic changes in the original dune and backdune landscape. These actions were done also during the 1700s, but their maximum impact has been recorded during the 19th century and has culminate in the first decades next century, after specific laws on integral reclamation. The first coastal biotopes near the villages or towns that disappeared were the marshes and dunes of Mondello (near Palermo), Gorgo Cottone (near Selinunte: Fig. 45), and the wet coastal systems of the Catania Plain. Successively, other strong transformations involved Lake Lentini, the Scicli marshes, the Lisimelie marshes near Syracuse, the Xitta and Birgi marshes and Salina Grande near Trapani.

As summarized by Lapiana & Sparacio (2010), "*in questo periodo furono realizzati massicci prosciugamenti e imponenti opere idrauliche, con la costruzione di canali, argini, colmate, deviazioni di interi corsi d'acqua, che hanno segnato la scomparsa di numerosi biotopi naturali e l'alterazione profonda di estesi tratti del territorio siciliano e di quello costiero in particolare* [in this period, massive drainages and impressive hydraulic works were carried out, with the construction of canals, embankments, fill-ins, and diversions of

Figure 45. The ancient coastal of Selinunte between the Modione River and the now disappeared Gorgo Cottone (from Hulot & Fougères, 1910). This biotope was always mentioned by Palumbo (1889-1896) in his entomological excursions.

entire watercourses, which marked the disappearance of numerous natural biotopes and the profound alteration of extensive stretches of the Sicilian territory and the coastal landscape in particular]".

Between 1950s and 1970s, the Sicilian coasts were devastated by the new industrial agglomerations, while especially since 1970s an impressive and often illegal private allotment of wide coastal areas has spread.

"*Piuttosto che recuperare e valorizzare gli ambienti naturali, una colata di cemento sotto forma di industrie, strade, abusivismo edilizio e urbanizzazioni incontrollate si è abbattuta sul sistema costiero siciliano con inaudita violenza cementificando decine di chilometri di coste, in particolare quelle sabbiose, provocando un grave dissesto idro-geologico e paesaggistic*o [rather than recovering and valuing the natural environments, a pour of concrete in the form of industries, roads, illegal building construction and uncontrolled urbanization has hit the Sicilian coastal system with unprecedented violence, covering with concrete tens of kilometers of coasts, in particular the sandy beaches, causing serious hydro-geological and landscape disruption]" (Lapiana & Sparacio, 2010).

To understand better the scale of this process, it is useful to recall once again the dejected words written by Teodosio De Stefani Jr. in his notes (Bellavista et al., 1989). De Stefani, who was out of Sicily from 1962 to 1976, visited with his children the places where he had lived and carried out research before his departure. His words dramatically summarize what happened along the Sicilian coasts just in few years (Figs. 46, 47).

"*Selinunte agosto 1976. Sulla spiaggia residuano ancora diversi esemplari della flora alofila in distruzione. Capaci, 27.8.1977: ...la spiaggia è adesso completamente alterata e sono scomparse tutte le piante e gli insetti che vent'anni or sono si trovavano là in abbondanza. Adesso tutto è pieno di cabine per bagni e bagnanti. Sferracavallo, 4.9.1977:...è tutto lottizzato, fauna e flora spontanea distrutta, tutto mura e cancelli. Anche la magnifica spiaggia fossilifera del Tirreniano è scomparsa* [Selinunte, August 1976. On the beach there are still several specimens of the

Figure 46. The beach of Capaci-Isola delle Femmine (Palermo) reviewed by Teodosio De Stefani-Perez Jr. after about 15 years of absence (see text).

Figure 47. Another photo of the beach of Capaci-Isola delle Femmine (Palermo) reviewed by Teodosio De Stefani-Perez Jr. after about 15 years of absence (see text).

destroyed halophilic flora. Capaci, 27.8.1977...the beach is now completely changed and all the plants and insects that were found there in abundance twenty years ago are now gone. Now everywhere is full of cabins for sunbathers. Sferracavallo, 4.9.1977: …it's all parceled out, spontaneous fauna and flora destroyed, only walls and gates. Even the magnificent fossiliferous beach of the Tyrrhenian Sea is lost]".

De Stefani also took photographs of the coast of Isola delle Femmine-Capaci on 27.8.1977, writing on their back: "*Spiaggia sabbiosa di Capaci, un tempo ricchissima di piante alofile e di Insetti particolari. Come invece è ridotta oggi. Da SW (sin.) a NE (destra) fino ad Isola delle Femmine* [Sandy beach of Capaci, once very rich in halophilic plants and particular insects. The state it is in today. From SW (left) to NE (right) up to Isola delle Femmine]". In another photo from 1978, he only noted "*Spiaggia odierna di Capaci. Flora alofila tutta distrutta* [The current beach of Capaci. Halophilic flora completely destroyed]".

As a direct consequence of this degradation, a remarkable destruction of almost all animal and plant species typical of these environments has occurred, leading to decreases of the original ranges and the number of populations for many species, if not even their extiction. That has involved even the Cicindelidae, previously abundant on these environments.

As previously reported, almost all the Sicilian species of Cicindelidae have already been reported in several faunal inventories since the first decades of the 19th century, such those given by Enrico Ragusa where there are detailed information on the distribution and consistency of these populations. Ragusa (1874) has wrote a monthly catalogue of his entomological findings in the surroundings of Palermo; many species of Cicindelidae were present in places now highly degraded (such as *Cassolaia maura cupreothoracica* at the mouth of the Oreto River) or totally destroyed (such as Mondello). According to his "*Catalogo ragionato dei Coleotteri Siciliani*" (Ragusa, 1883–1897), Cicindelidae were widespread throughout the island.

Augusto Palumbo collected several species of this family in the surroundings of Castelvetrano (Palumbo, 1889–1896) and especially near the Gorgo Cottone in Selinunte (Fig. 45), a coastal biotope which has now disappeared (Sparacio, 2023)

Luigioni & Tirelli (1912) found *Cicindela campestris siculorum* in Passo di Rigano, which today is entirely included in the urban centre of Palermo.

Raniero Alliata, an entomologist from Palermo, has documented in his collection (Aliquò, 1992; Arnone, 1994) the occurrence of seven species of Cicindelidae collected in the Palermo plain and in the immediate surroundings (see also Lo Valvo, 2020). Among these, we highlight the findings of *Cicindela campestris siculorum* at Malaspina (1928) and Torrente Malaspina (1930), of *Myriochile melancholica* at Villa Alliata (1929) that currently lies in the town of Palermo, and of *Lophyra flexuosa sardea* (1927), *Calomera lunulata nemoralis* and *M. melancholica* in the beach of Isola delle Femmine (1927-1938). Nothing remains of both these populations and their biotopes (Fig. 48).

More recently, Aliquò et al. (1973) have detected the occurrence of large communities of beetles, including some Cicindelidae, on the Buonfornello coast: this site was completely destroyed later, due to the building of an industrial settlement.

Failla Tedaldi (1887) has reported *Calomera lunulata* for Lampedusa, for a long time the only European site of this North African species. The species has not been seen since 1975 and it is most likely extinct (see also Vigna Taglianti, 1995).

Lapiana & Sparacio (2008) selected some insect species (Coleoptera and Orthoptera) to evaluate the status of the coastal dunes in Sicily, using their number and consistence at different times. They obtained useful information on the environmental quality of five sites (coast of Buonfornello, Mondello, beach of Isola delle Femmine/Capaci, beach of Balestrate, dunes of Capo Feto near Mazara del Vallo, mouth of the Belice river). The results indicate an alarming decrease of the occurrence of the species and in some case their disappearance. Concerning Cicindelidae, the populations of *Lophyra circumflexa*, *Calomera littoralis nemoralis* and *C. panormitana panormitana* were selected for this study.

Calomera panormitana panormitana was considered for long time as a rare and endangered species (Vitale, 1913), most likely due to the lack of information on its biology. After many years, Aliquò & Romano (1975) provided new data on the habitat occupied by this species, namely the rocky coast (see also Cassola, 1982).

These new data allowed us to better define the presence of *C. panormitana panormitana* (Romano & Sparacio, 2018; Sparacio & Surdo, 2021): it is quite widespread in Sicily even if critically endangered, as shown by its disappearance from some historical sites and considering how strong the anthropic impact has been on the other ones. If compared with other coastal enviromnents, the rocky coasts seem to be however less threatened; furthermore, the species is recorded for several circum-Sicilian islands that are used as refuge area (Sparacio & Surdo, 2021).

From these data and our information, tiger beetles are generally endangered in the whole regional territory. Their rarefaction is highlighted and documented by the available bibliographic data, by the findings in public and private entomological collections, and by the field observations performed through a detailed monitoring of fauna and flora of these areas.

The loss of biodiversity, now irreversible, is perceived not only on the basis of the local extinctions, but especially from the decline of many populations, by the disappearance of many of them in several environments for which their occurrence has been previously recorded, and lastly from the degradation or the destruction of many natural biotopes.

This phenomenon reflect a global trend. Despite the insects being "*numerically the single most conspicuous feature of life on Earth*" (Adler & Foottit, 2018) and being constantly increasing thanks to the discovery of new species (Santos et al., 2021), there is a significant decline - up to the disappearance - of a large number of the known species (Sánchez-Bayo & Wyckhuys 2019; Wagner et al., 2021).

The decline of the Sicilian Cicindelidae can certainly be slowed down with several and easy measures such as: constant research activity, long-term monitoring of their populations, the acquisition and protection of the sites where they currently live, the removal of all disruptive factors

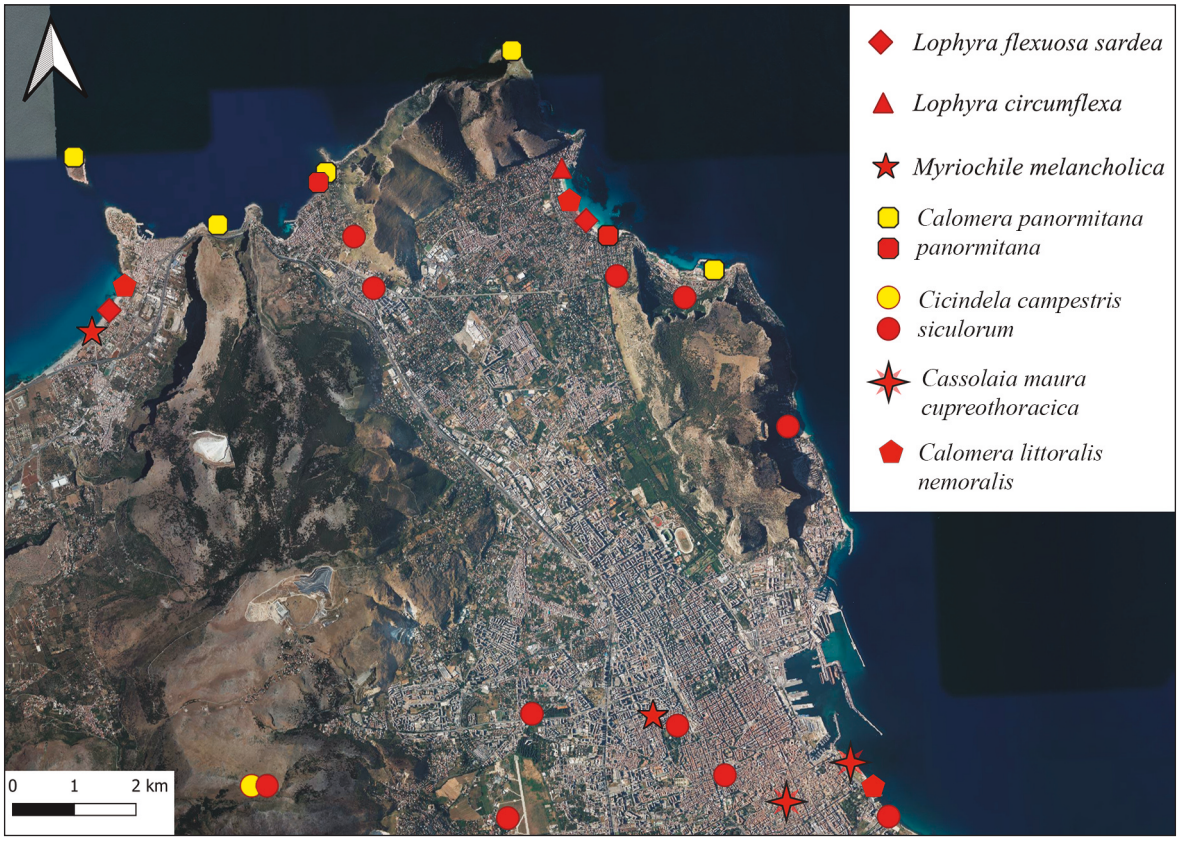

Figure 48. Biodiversity loss in the Palermo plain and immediate surroundings (Mondello beach, Oreto river, Isola delle Femmine beach, etc.). The red color indicates the records before 1980, the yellow color indicates those after 1981.

that can occur in these environments, the use of captive breeding to increase these populations and/or the targeted relocation of existing populations. These methods have already been used successfully in some countries and should be applicable everywhere due to the similar biological characteristics of almost all Cicindelidae (Knisley & Gwiazdowski, 2020).

Unfortunately, the conservation and protection of the Sicilian Cicindelidae, but more generally of all the fauna and flora inhabiting the regional territory, is part of the much more complex topic about the management of its natural heritage, which seems really difficult to resolve.

TIGER BEETLES IN THE CIRCUM-SICILIAN ISLANDS

Island ecosystems have always interested naturalists and scholars due to the numerous and complex evolutionary processes that involve their organisms (Zunino & Zullini, 2004). In particular, for their abundance and diversity, arthropods represent a group particularly suitable for studying the phenomena related to the colonisation, the evolution and the extinction among the island population (Gillespie & Kipling 2018; Gillespie & Roderick, 2002), as well as to evaluate the effect of climate change on these environments and the loss of biodiversity due to anthropogenic impact (Andow et al., 2008). The territory geographically belonging to Sicily includes a hundred smaller islands (www.dxawards.com/Lists/sicilianisawd.htm [accessed 24 August 2023]) which overall constitute approximately 3% of the whole regional surface. These islands host 11 out of the 14 Cicindelidae taxa recorded for the main island (Tables 1, 2). The largest islands (19) can be grouped into 4 archipelagos: the Aeolian islands (of volcanic origin) on the north-eastern side of Sicily, the Aegadian Archipelago at the western end, the

Pelagie islands and the Maltese islands (geographically belonging to Sicily) both in the Sicilian Channel. The remaining two major islands, Ustica and Pantelleria, both of volcanic origin, are found far from the coast respectively to the north of Sicily and in the Strait of Sicily. Furthermore, there are numerous rocks or tiny where the ecological characteristics ostacolate the occurrence of Cicindelidae populations. The only exceptions are the islands of Isola Lunga (Stagnone di Marsala, Trapani), Isola delle Femmine (Palermo) and the island of Capo Passero (Siracusa).

These islands are very heterogeneous in terms of morphology, habitat, geographical position, altitude, surface area, paleogeography, and distance from the coast. These different characteristics have influenced the diversity and number of endemics of the floristic (Mazzola et al., 2001) and faunal communities (Muscarella & Baragona, 2010). In general, the different approaches to island biogeography (cf. Losos & Ricklefs, 2010), despite their diversity of views, have underlined a correlation between island populations and the physiographic parameters of the islands, in particular underlining the close link between the surface of the island and number of species present. This concept is summarized in the well-known equation $S=cAz1$ by Arrhenius (1921), subsequently explored further by various authors (cf. Mitchell & Ryan, 1998). The species-area relationship or species-area curve describes the relationship between the surface area of a biological isolate and the number of species found within it (Balletto, 1995). Larger areas tend to contain a greater number of species as also indicated for the circum-Mediterranean islands by Balletto (1998).

However, in the case of the Cicindelidae of the circum-Sicilian islands this link does not seem to be so evident. Correlating the number of known species per single island with their surface area revealed only a moderate and apparently insignificant correlation between these two variables (Fig. 49, Table 1, 2) and no correlation emerged between the number of species and distance from the nearest continental mass and altitude.

The colonization of islands by living organisms is a complex phenomenon. To be able to complete it, they must present particular characteristics that allow them to reach the island and favor its settlement (Zunino & Zullini, 2004).

Cicindelidae are generally skilled fliers who, with favorable winds, are able to cover long distances but their settlement on an island is hindered by their particular and selective ecology (Pearson & Vogler, 2001). As has already been said (see before) this group lives exclusively in particular habitats which on small islands are fragmented and very small. This drastically lowers its capacity for settlement and also resilience in the event of environmental alterations, even of anthropic origin. This phenomenon is even more accentuated in the case of species which, for intrinsic reasons, tend to form numerically small populations.

It is known that extinction on islands is related to the size of the population and the size of the habitat (Balletto, 1995) and is a fairly frequent natural phenomenon, even compared to what happens on the continents (MacArthur & Wilson, 1967). Furthermore, when a species becomes extinct on a small island it is more difficult for it to be replaced through dispersal phenomena (Zunino & Zullini, 2004). Comparing previous knowledge with current data, it emerges that over the course of about a century, the local extinction of various Cicindelidae species occurred in the circum-Sicilian

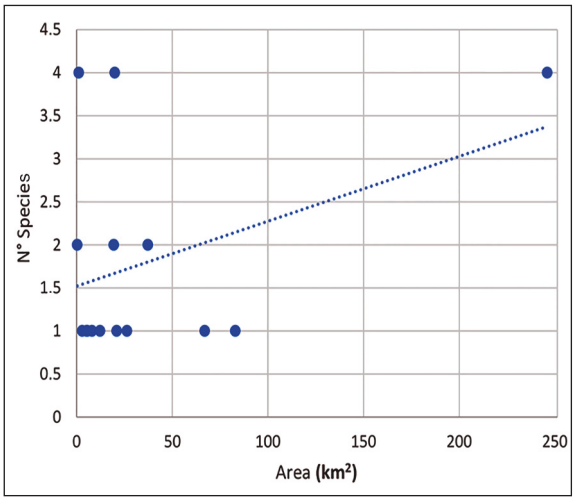

Figure 49. Regression curve for the relationship between island area in km^2 (A) - number of taxa (species and subspecies) present (S). Data from the linear function model are shown: $y = 0.0075x + 1.5204$; $r = 0.3911$. $p = 0.1493$. The exponential function and power function models produced similar results.

TAXON	Lipari	Salina	Vulcano	I. delle Femmine	Ustica	Favignana	Levanzo	Marettimo	I. Lunga	Gozo	Malta	Pantelleria	Lampedusa	Linosa	Capo Passero
Cephalota (Taenidia) circumdata imperialis									X						
Cephalota (Taenidia) litorea goudotii									X						X
Cicindela (Cicindela) campestris didyme	X	X													
Cicindela (Cicindela) campestris siculorum											X				
Cylindera (Eugrapha) trisignata siciliensis											X		X*	X*	
Lophyra (Lophyra) flexuosa sardea									X				X		X
Lophyra (Lophyra) circumflexa														X*	
Calomera lunulata													X*		
Calomera littoralis nemoralis			X							X	X				
Calomera panormitana panormitana				X		X	X		X						
Myriochile (Myriochile) melancholica	X				X	X		X	X		X	X	X		

Table 1. Cicindelidae recorded in the circum-Sicilian islands. X* indicate presumably extinct populations.

DISTRICT	ISLAND	AREA (km^2)	DISTANCE (km)	ALTITUDE m	N. SPECIES
Peloritani	Lipari	37.3	27	602	2
Peloritani	Salina	26.4	38	962	1
Peloritani	Vulcano	21	20	499	1
Palermitano	Isola delle Femmine	3	0.4	35	1
Palermitano	Ustica	8.1	51	266	1
Trapanese	Favignana	19.5	8	302	2
Trapanese	Levanzo	5.6	13	278	1
Trapanese	Marettimo	12.3	35	686	1
Trapanese	Isola Lunga	1.2	0.45	0	5
Canale di Sicilia	Gozo	67	80	190	1
Canale di Sicilia	Malta	246	80	253	4
Canale di Sicilia	Pantelleria	83	67	836	1
Canale di Sicilia	Lampedusa	20	120	133	4
Canale di Sicilia	Linosa	5.4	165	195	1
Iblei	Capo Passero	0.37	0.2	0	2

Table 2. Main characteristics of the circum-Sicilian islands inhabited by Cicindelidae and number of reported taxa.

islands. In particular, the extinctions of *Cylindera trisignata siciliensis* and *Lophyra circumflexa* in Linosa and of *C. trisignata siciliensis* and *Calomera lunulata* in Lampedusa should be recorded (Vigna Taglianti, 1995; Lo Cascio, 2002). In the case of *C. trisignata siciliensis* and *L. circumflexa* on Linosa, the extinction may have been caused by natural phenomena linked to the fact that the only suitable habitat present on the island is the small beach of Cala Pozzolana di Ponente, a strip of lava sand of about a hundred meters located on the western side of the island. Furthermore, their presumed disappearance occurred, as suggested by the few available data (Luigioni, 1929; Gridelli, 1944, 1960; Vigna Taglianti, 1995), in the first half of the last century when the anthropic impact on the island was still very modest. The case of *C. trisignata siciliensis* and *Calomera lunulata* on Lampedusa is

different, whose extinction, however, should be referred to the anthropic impact and destruction of the original habitats.

The same disturbance factors that negatively impact continental cicindele populations have a much greater impact on small islands. Phenomena such as climate change (Radomir & Płóciennik, 2020), the unsustainable use of beaches (Arndt et al., 2005) and, more generally, the alteration of natural habitats (Knisley & Hill, 1992: Knisley, 2011), are much more incisive in island environments by virtue, as seen, of the smaller size of the environments and the greater fragility of the populations who live there. The disruption of coastal environments and coastal ecosystems, as underlined in the previous paragraph, has affected not only insular Sicily but, albeit to a lesser extent, also its satellite islands. In particular, starting from the seventies of the last century, the renewed interest in small islands as a tourist destination of choice has heavily and irreversibly altered the landscape through uncontrolled overbuilding culminating in the construction of some questionable and impactful infrastructures.

From this point of view, an example is the presence of *Calomera lunulata* on Lampedusa, a species reported in Europe exclusively on this island and in some localities in southern Spain (López-Pérez & García Casas 2007, Márquez-Rodríguez & Vega Maqueda , 2014). The first report for the island was by Failla Tedaldi (1887 sub *Cicindela littoralis*), who found it in great numbers in the small beaches of Cala Guitgia ("Wilgia") and Cala Grande located near the port. It was an extremely interesting biotope formed by a depressed area and an inlet onto which the Imbriacola valley flowed and which took on the typical characteristics of a North African sebka. The presence of this population was subsequently confirmed by several authors (Ragusa, 1992; Vitale, 1912; Luigioni, 1929; Schatzmayr, 1926; Gridelli, 1960). The last known finds date back to the first half of the seventies of the last century (Vigna Taglianti, 1995; Lo Cascio, 2002), the moment in which its decline and probable extinction began. In this period, in fact, a football field was built in Lampedusa and the tourist port was strengthened, both in the area near the port where the bulk of the population was concentrated (Massa, 1995; Lo Cascio, 2002; Domina et al., 2015) (Fig. 50). These works have caused the disappearance not only of *C. lunulata* but also of other psammo-alobia species once present such as the Carabidae *Eurynebria complanata* (Linnaeus, 1767) and *Parallaelomorphus laevigatus* (Fabricius, 1792) (Vigna Taglianti, 1995, Massa, 1995) and tiger beetle *C. trisignata siciliensis*, species that Ragusa (1892), in that locality, found "rather abundant". Among the plant species typical of this environment, there was also the *Limonium intermedium* Guss., a halophyte currently extinct in nature (Pasta, 2001; Bartolucci et al., 2018; Sparacio, 2022) surviving only in cultivation in the botanical gardens of Catania (Domina et al., 2015).

Calomera panormitana panormitana has been recently reported for Isola delle Femmine, Isola Lunga and Levanzo island (Sparacio & Surdo, 2021) and has also been found by us in Favignana island and in the circum-Sicilian islands, in particular Isola Lunga and Isola delle Femmine. These places could act as refuge areas to recolonise the nearby coasts more subject to anthropic disturbance (Sparacio & Surdo, 2021). In the case of the *Cephalota circumdata imperialis*, Isola Lunga seems to represet the last Sicilian station considering that the old finds for the hinterland (cf. Surdo, 2016) have not been confirmed by recent data.

It should be underlined that, in addition to these last two species, the Isola Lunga (Stagnone di Marsala) hosts three other species of Cicindelidae: *Cephalota litorea goudotii*, *Lophyra flexuosa sardea* and *Myriochile melancholica* (Table 2).

In the *Cicindela campestris didyme* populations of Salina and Lipari islands (Aeolian Archipelago), we observe a general tendency towards darkening of the colour pattern, that is fully responding to the mimetic requirements imposed by soils of volcanic origin

Geographic isolation is certainly the determining factor in these micro-evolutionary processes, on which, however, local adaptive phenomena play also a role and may emphasize recessive traits not frequent in the populations of origin (Balletto, 1995) as occurs in the insular phenomena known as "founder effect" and "bottleneck".

On the other hand, in recent years the expansion of *Myriochile melancholic*a has been observed, which in this work was reported for the first time in

Figure 50. Lampedusa island, the ancient port of Cala Salina, a naturalistic biotope that has now disappeared.

Ustica, Pantelleria, Favignana and Marettimo. A species with strong dispersive capabilities apparently expanding in the Mediterranean coasts (Lo Cascio, 2002; Ponel et al., 2018).

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