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Tiger beetles (Coleoptera Cicindelidae) of Capo Passero Island (Southeastern Sicily, Italy)

Ignazio Sparacio[1], Calogero Muscarella[2], Amedeo Falci[3] & Salvatore Surdo[4,*]

1via Principe di Paternò 3, 90144 Palermo, Italy; e-mail: edizionidanaus@gmail.com
2Cooperativa Silene a.r.l., Via D'Ondes Reggio, 8A Scala G, 90127 Palermo, Italy; calogero@silenecoop.org
3via Libertà 200, 93100 Caltanissetta; e-mail: gegenes@gmail.com
4Dipartimento di Scienze agrarie, alimentari e forestali, Viale delle Scienze Edificio 4, 90128 Palermo, Italy; e-mail: salvatore.surdo@unipa.it - Orcid: https://orcid.org/0000-0002-0300-837X
*Corresponding author

ABSTRACT Capo Passero Island, at the southern tip of Sicily, hosts a distinctive assemblage of tiger beetles (Coleoptera Cicindelidae). This study provides updated records for the island, reporting five species - *Calomera littoralis nemoralis*, *Calomera panormitana panormitana*, *Myriochile melancholica*, *Cephalota litorea goudotii* and *Lophyra flexuosa sardea* - newly documented for this locality. Field surveys were conducted through direct observation and net collection across the main habitats, including sandy beaches, rocky shores, and saline soils. The island, covering only 0.37 km², serves as an important refuge for halophilous, psammo-halophilous, and rock-dwelling species. The Poisson regression analysis revealed no statistically significant effects of island area, distance from the mainland, or altitude on species richness. These results indicate that local ecological conditions, rather than general geographic gradients, primarily drive the distribution of tiger beetles in the circum-Sicilian islands. The findings emphasize the conservation value of small islands and the need to preserve specific habitats to maintain Cicindelidae populations.

KEY WORDS Cicindelidae; Capo Passero Island; Insular biodiversity; Biogeography; Species richness.

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INTRODUCTION

Tiger beetles (Coleoptera Cicindelidae) are predatory insects of high ecological importance, widely used as bioindicators due to their habitat specificity and sensitivity to environmental changes (Pearson & Vogler, 2001; Knisley & Schultz, 1997). Their distribution is closely linked to substrate type, vegetation cover, and microclimatic conditions, making them ideal models for studies on insular biogeography and conservation ecology.

Sicily and its surrounding islands host a diverse Cicindelidae fauna, occupying a wide range of habitats including sandy beaches, salt pans, rocky cliffs, and halophilous soils (Surdo, 2016; Sparacio & Surdo, 2021; Sparacio et al., 2023a, b). Small islands, despite their limited area, often function as refugia for rare, endemic, or specialized species and can act as stepping-stones for dispersal in the central Mediterranean.

Capo Passero Island, located at the South-eastern tip of Sicily (Italy), remains poorly investigated, with the last entomological survey was conducted by Angelini (1999). Preliminary observations suggest the presence of previously unreported species, emphasizing the need for updated surveys.

This study aims to provide new records of Cicindelidae from Capo Passero Island, to describe their habitat preferences, and to assess the ecological factors influencing species distribution. The results contribute to understanding the biogeography of tiger beetles in the circum-Sicilian islands and highlight the conservation value of small insular habitats.

MATERIAL AND METHODS

Study area and field research

The Island of Capo Passero (ITA090001) is a Special Area of Conservation (SAC) located at the southernmost tip of Sicily, Italy (36.683527°N, 15.143621°E). It consists of a slightly sloping limestone platform covering 37 hectares and resting on a basaltic base, with a maximum elevation of 21 meters. The climate is classified as lower dry thermo-Mediterranean (Fig. 1).

The landscape is mostly rocky, with steep coastal cliffs, while the western part features sandy shores. The vegetation is mainly composed of Mediterranean scrub with *Chamaerops humilis* L. and *Sarcopoterium spinosum* (L.) Spach halophilous rupicolous vegetation with *Crithmum maritimum* L. and *Limonium hyblaeum* Brullo and ephemeral grasslands. There are also small areas of psammophilous (sandy) formations.

The island preserves rare natural habitats due to the heavy human impact on the nearby Sicilian coast, and hosts endemic and rare species of great phytogeographical interest. The fauna includes species adapted to arid (xeric) environment sand. The island serves as an important foraging, resting, and wintering area for numerous bird species.

Field surveys were conducted in the Island in June and August 2025. Tiger beetles were observed directly in their environments and photographed or collected with the aid of an entomological net. The specimens are preserved in the private collection

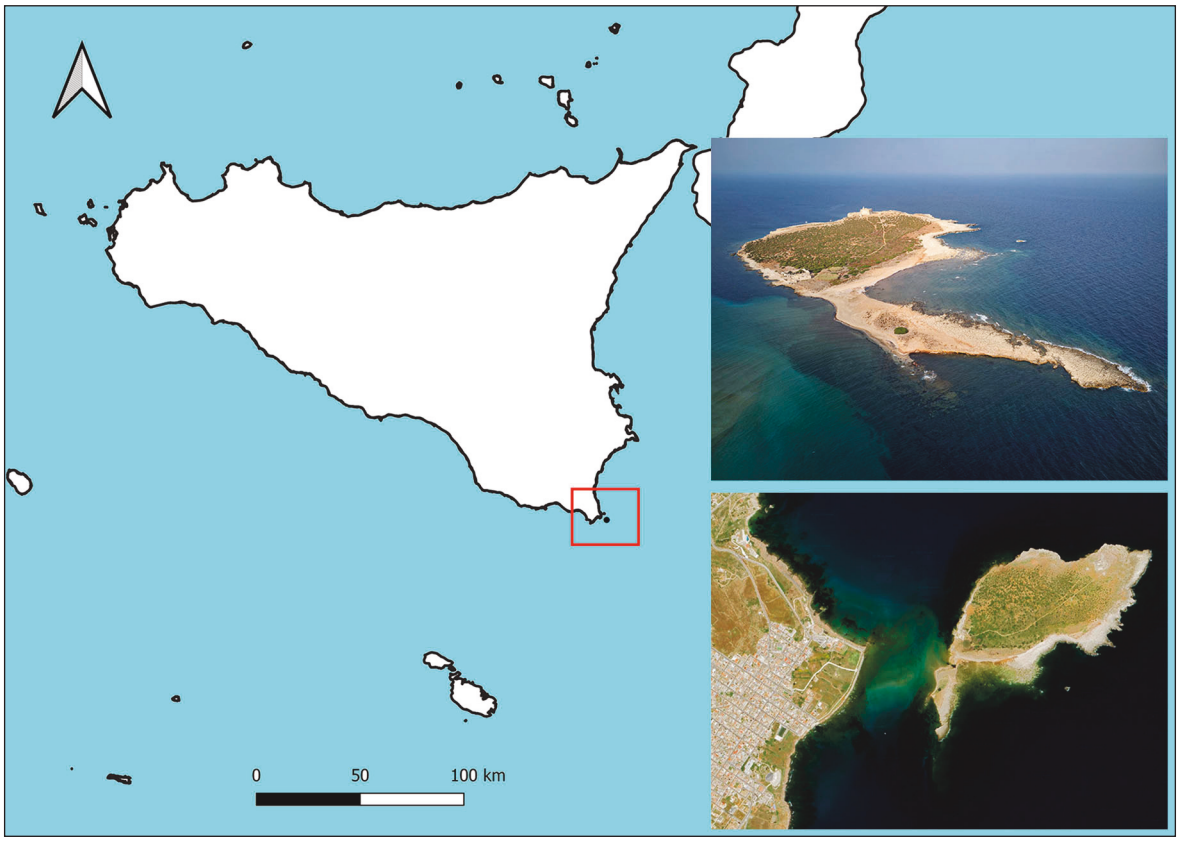


Figure 1. Capo Passero Island (South-eastern Sicily, Italy).

of Calogero Muscarella (CM, Palermo, Italy), Ignazio Sparacio (CS, Palermo, Italy) and Oscar Maoglio (OM, Asti, Italy). The map was made with QGIS 3.38 (QGIS, 2024). The analysis was performed on a dataset of 15 circum-Sicilian and Maltese islands, each characterized by four variables: island area (km²), distance from the mainland (km), maximum altitude (m), and number of recorded species. All variables were compiled into a single matrix, and species richness was treated as count data. Because the response variable (number of species) is a count, a Poisson regression with a log link function was applied. The statistical analysis was performed with Past 5.3, an open-source software package for statistical data analysis (Hammer et al., 2001).

RESULTS

Systematics

Ordo COLEOPTERA Linnaeus, 1758
Subordo ADEPHAGA Schellenberg, 1806
Familia CICINDELIDAE Latreille, 1806
Genus *Cephalota* Dokhtourov, 1883
Subgenus *Taenidia* Rivalier, 1950

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

Halobiont species, with habitat restricted to the salty soils of the open edges of ponds and lagoons or near salt pans. Reported for Syracuse (Ghiliani, 1842), the surroundings of Termini Imerese (Ciofalo, 1886 sub *Cicindela littorea*), Vendicari (Sturani, 1981), Selinunte, Trapani (Facchini & Baviera, 2004), the salt pans of Trapani and Marsala, including Isola Lunga (Surdo, 2016; Sparacio et al., 2023b).

Recorded from Capo Passero Island by Angelini (1999).

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

Lophyra (Lophyra) flexuosa sardea (Dejean, 1831)

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

Distributed along the coastline from Termini Imerese to Catania, heading westwards. Never recorded in north-eastern Sicily (Sparacio et al., 2023b).

Recorded from Capo Passero Island by Angelini (1999).

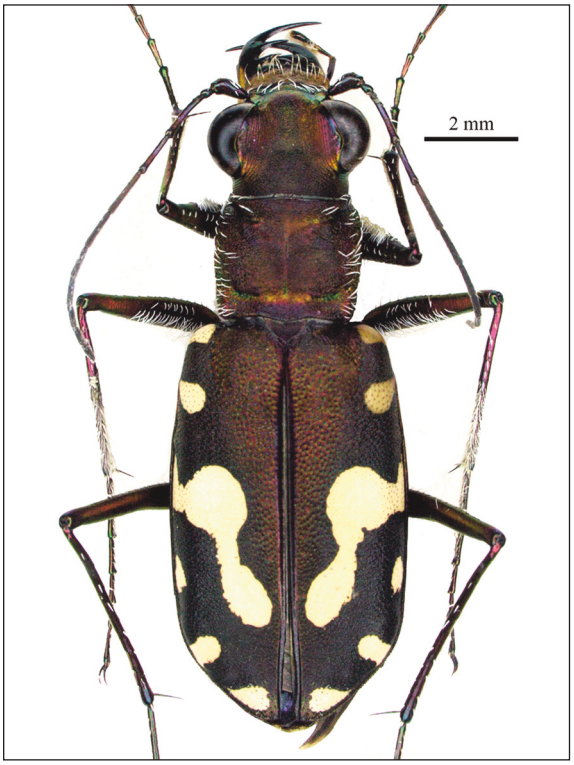


Figure 2. *Calomera panormitana panormitana* from Capo Passero Island (Sicily, Italy). Photo by G. Allegro.

Genus *Calomera* Motschulsky, 1862

Calomera littoralis nemoralis (Olivier, 1790*)*

Species of broad ecological significance (Mazzei et al., 2014), widely distributed in Sicily, where it prefers sandy coasts, the shores of coastal lagoons, and river mouths. It is also recorded in inland areas, along the banks of lakes, rivers, and streams although in regression and having disappeared from some now destroyed locations, still retains numerous presences along the Sicilian coasts with often abundant populations (Sparacio et al., 2023b).

New report for Capo Passero Island collected on August 14, 2025 by Calogero Muscarella (CM).

Calomera panormitana panormitana (Ragusa, 1906)

This species lives in the particular environment of rocky coasts, which in Sicily are almost always characterized, along the tide line, by the presence of a vermiform "trottoir", which protects them from sea waves and favours their biology (Sparacio & Surdo, 2021).

It has already been reported on some islands around Sicily, such as Isola Lunga, Levanzo, Isola delle Femmine and Favignana (Sparacio & Surdo, 2021; Sparacio et al., 2023b).

This species has been newly reported on Capo Passero Island, having been collected on June 30, 2025 by Oscar Maoglio (OM, CS) (Fig. 2).

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

Myriochile (Myriochile) melancholica (Fabricius, 1798)

Myriochile melancholica lives mainly in the muddy edges of lakes, rivers and coastal marsh environments. It is the most widespread tiger beetle in the circum-Sicilian islands.

New report for Capo Passero Island collected on June 30, 2025 by Oscar Maoglio (OM) and 14 August 2025 by Calogero Muscarella (CM).

DISCUSSION AND CONCLUSIONS

To assess the relationships between island geography, species richness, and local extinction patterns, both regression analyses and Spearman's rank correlation tests were applied (Figs. 3–5). The Poisson regression analysis revealed no statistically significant effects of island area, distance from the mainland, or altitude on species richness. All models exhibited very low pseudo-R^2 values and only

Island	Area (Km^2)	Distance to Mainland (Km)	Altitude (m)	N° species
Lipari	37.3	27	602	1
Salina	26.4	38	962	1
Vulcano	21	20	499	1
Isola delle Femmine	3	0.4	35	1
Ustica	8.1	51	266	1
Favignana	19.5	8	302	2
Levanzo	5.6	13	278	1
Marettimo	12.3	35	686	1
Isola Lunga	1.2	0.45	3	5
Gozo	67	80	190	1
Malta	246	80	253	4
Pantelleria	83	67	836	1
Lampedusa	20	120	133	4
Linosa	5.4	165	195	2
Isola Capo Passero	**0.37**	**0.2**	**21**	**5**

Table 1. Main characteristics of the circum-Sicilian islands inhabited by Cicindelidae. The island covered in this work (Capo Passero) is in bold. Geographical parameters derived from Muscarella & Baragona (2017).

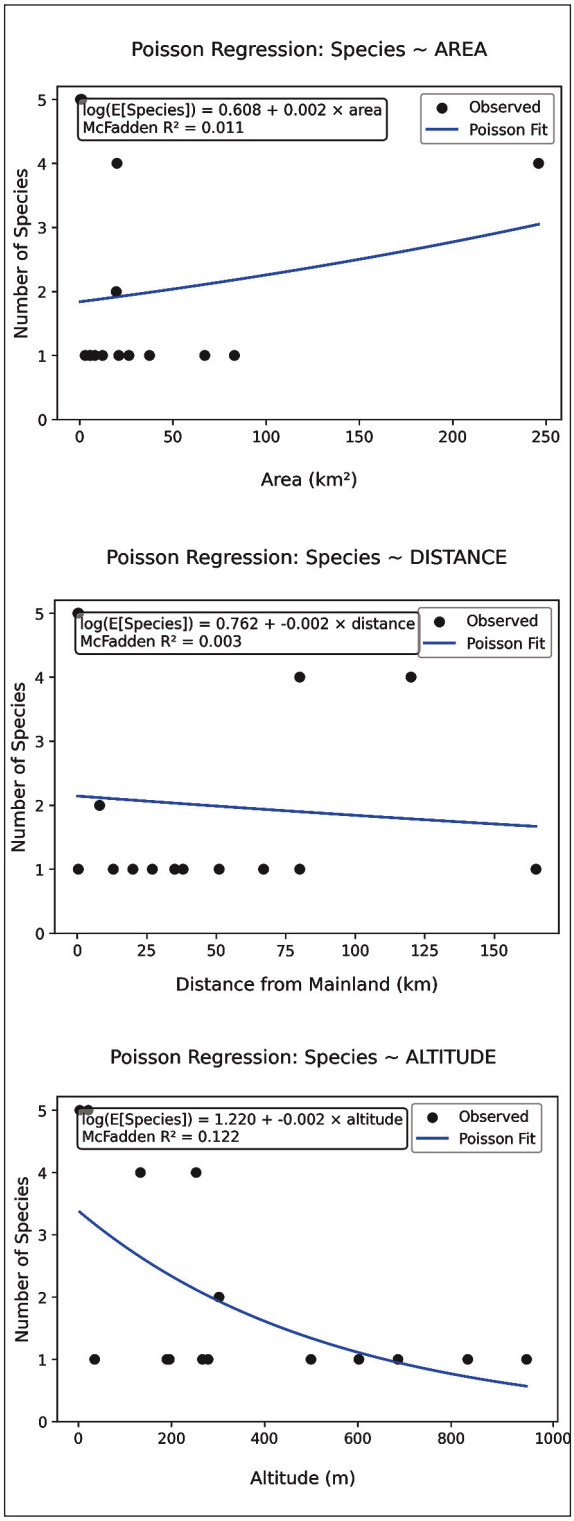
TAXON	Lipari	Salina	Vulcano	Isola d. Femmine	Ustica	Favignana	Levanzo	Marettimo	Is. Lunga	Gozo	Malta	Pantelleria	Lampedusa	Linosa	**Is. Capo Passero**
Cicindela campestris siculorum											X				
Cicindela campestris didyme	X	X													
Cephalota (Taenidia) circumdata imperialis									X					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

Table 2. Cicindelidae recorded in the circum-Sicilian islands. X* indicate presumably extinct populations. The species added in this work from Capo Passero Island are in bold (by Sparacio et al., 2023b modified).

minor reductions in deviance relative to the null models, indicating limited explanatory power. Although altitude showed a weak negative trend, it did not reach statistical significance. Overall, these findings suggest that the observed variation in species richness is not adequately explained by the single environmental predictors considered here. Additional factors not included in the dataset - such as habitat heterogeneity, biogeographic history, human disturbance, or ecological interactions - may play a more substantial role in shaping species richness patterns across the circum-Sicilian islands. This interpretation is supported by the relatively high species richness observed on small coastal islands, such as Capo Passero and Isola Lunga, where habitat heterogeneity remains relatively high despite their limited area. Comparisons between historical and recent data indicate the disappearance of several species over the last century; however, part of this apparent extinction signal may also be influenced by uneven sampling effort and differences in survey intensity through time.

To investigate potential relationships between island geographic characteristics and local extinction levels, a Spearman's rank correlation analysis was performed between the number of extinct species recorded on each island and three geographic variables: island area, distance from the mainland, and maximum elevation. This non-parametric approach was chosen because it does not require assumptions of normality and is suitable for small sample sizes. Possible collinearity among geographic variables was not explicitly controlled for and should be considered when interpreting the results.

The Spearman's rank correlation between island area and the number of extinct species revealed a weak, positive, but non-significant relationship ($\rho = +0.267$, $p > 0.05$), indicating that island size alone does not show a detectable influence on local extinction levels in the study area.



Figures 3–5. Poisson regression models relating species richness to island area, distance and altitude. Panels show observed values, fitted curves and pseudo-R^2. None of the predictors exhibits a significant association with species richness.

In contrast, the correlation between distance from the mainland and the number of extinct species was positive and statistically significant (ρ = +0.670, $p < 0.05$, two-tailed test, critical ρ = 0.521), suggesting that more isolated islands tend to exhibit higher numbers of local extinctions. This pattern is consistent with the hypothesis that increasing isolation may reduce recolonization rates following local extirpations. Nevertheless, distance from the mainland may also act as a proxy for other ecological or historical factors, including differences in habitat continuity, anthropogenic disturbance, and historical sampling intensity.

Finally, the Spearman's rank correlation between maximum island elevation and the number of extinct species was weak and non-significant (ρ = +0.130, $p > 0.05$; two-tailed test, N = 15, critical ρ = 0.521). Accordingly, the null hypothesis could not be rejected, and no statistically supported relationship between island elevation and local extinction levels was detected. Overall, these results suggest that isolation, rather than island size or elevation, may play a more relevant role in shaping long-term extinction patterns of Cicindelidae on the circum-Sicilian islands, although local ecological conditions and historical factors are likely to be equally important contributors.

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