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Discovery of a second locality for the narrow endemic *Anthemis ismelia* (*Asteraceae*) in NW Sicily

Abstract

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A new population of *Anthemis ismelia* (*Asteraceae*) has been discovered on Mt Pecoraro (Cinisi, NW Sicily), a limestone headland at about 14 km from Mt Gallo (Palermo), the *locus classicus et unicus* of this species described in 1884. Taxonomic framework, distribution update, habitat characterisation, ecology and phytosociological framework are provided, as well as meta-population numerical estimates and risk status assessment.

Key words: chasmophyte, endangered flora, IUCN Direct Threats and assessment, phytosociology.

Introduction

In spring 2014, floristic field sampling in the mountains surrounding Palermo (NW Sicily) yielded the discovery of a new population of *Anthemis ismelia* Lojac. on the western side of Mt Pecoraro near the town of Cinisi. This species, ascribed to *Anthemis* sect. *Hiorthia*, was hitherto known only for the shady, north-facing limestone cliffs of Mt Gallo near Palermo, about 14 km far from the newly discovered population [Lojacono-Pojero 1884 (sub *A. punctata* Vahl), 1903; Bartolo & al. 1981]. In spring 2015 and 2016, some scattered plants were found in the northern side of Mt Pecoraro during field work to confirm and assess the consistency of the newly discovered population (Fig. 1).

The aim of the present contribution is to elucidate the taxonomic framework of the species, to update its distribution range, to provide information on the growing sites (habitat, geology, bioclimate, and phytosociological affiliation), to document the so far known metapopulations and to assess the risk status according to the IUCN criteria.

Materials and methods

The species was identified based on the diagnostic characters reported in the original description and in the Flora Sicula (Lojacono-Pojero 1888-1909), Flora d'Italia (Pignatti 1982),

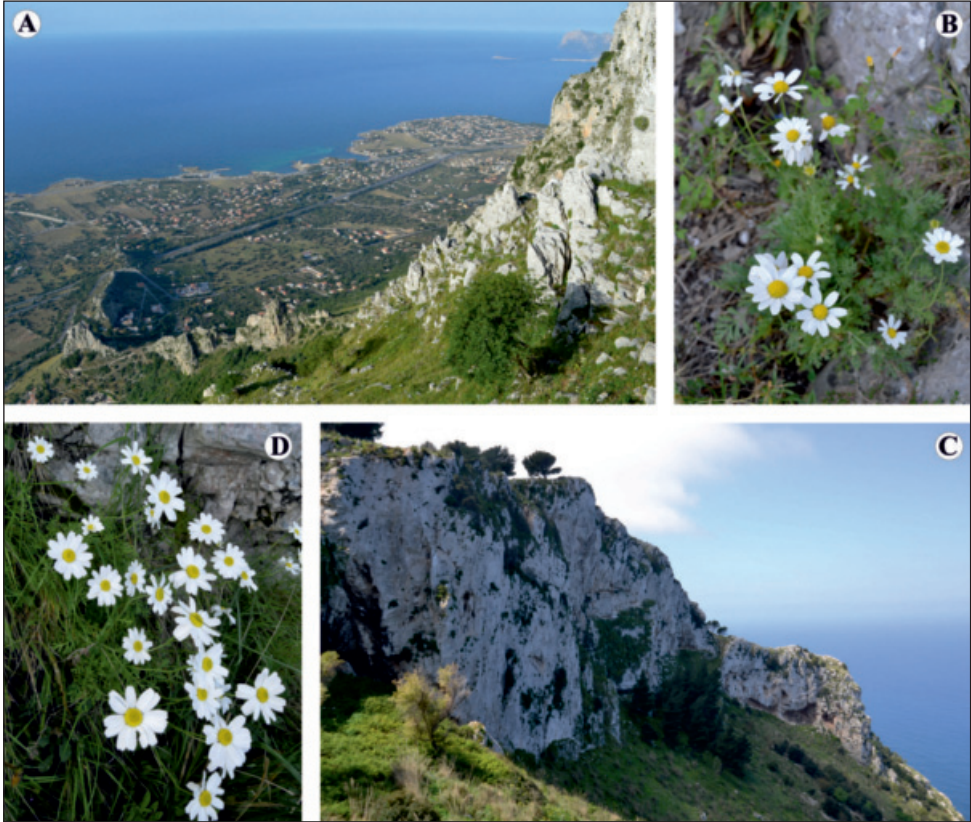


Fig. 1. Natural habitat and flowering stems of *Anthemis ismelia*: **A-B** at Mt Pecoraro (from which on the horizon right you can glimpse Mt Gallo); **C-D** at Mt Gallo.

and Flora Europaea (Tutin & al. 1976), as well as on the comparative analysis of herbarium specimens and of living plants collected in Mt Pecoraro and Mt Gallo. The specimens collected during the field research have been dried and stored in the *Herbarium Mediterraneum Panormitanum* (PAL). Taxonomic nomenclature follows Giardina & al. (2007).

For the climatic characterization of the growing sites, reference was made to rainfall and temperature measurements of weather stations next to the surveyed sites, according to the data provided by the Hydrographic Service of the Sicilian Region (Ministero dei LL. PP. 1926-85) and processed by Duro & al. (1996). The bioclimatic classification follows Rivas-Martínez (2008), and the spatial analysis of the bioclimatic units of Sicily reported in Bazan & al. (2015) and in the Climatological Atlas of Sicily (Drago 2005).

In order to update the risk status of the species, after the discovery of this new population at Mt Pecoraro, the entire surface of the sites was surveyed for current threats (IUCN-CMP 2012), extent of occurrence (EOO) and area of occupancy (AOO) – calculated by the 1×1 km Universal Transverse Mercator (UTM) grid – and effective AOO, according to the IUCN Red list category and criteria (IUCN Standards and Petitions Subcommittee 2017).

Results

Taxonomic framework and morphological traits

The *Anthemis punctata* group was recorded in Sicily already by pre-Linnaean botanists, such as Cupani [1696: 48 (sub *Chamaemelum montanum*, *flore magno*, *Absinthii vulgaris foliis et odore*, *licet remisso*); 1713, vol. 1: plate 195 (sub *Chamaemelum Absinthii folio*, *Parthenii odore*); 1713, vol. 3: plate 12 (sub *Buphtalmum argenteum flore albo*)] and Boccone [1697: 120 (sub *Bellis incana Chrysanthemi cretici foliis*)]. The first post-Linnaean botanist mentioning *A. punctata* in Sicily was Presl (1826), followed by Gussone (1843), who confirmed the occurrence in Sicily of two varieties of *A. punctata*: a typical, glabrous one, and the variety “b” *incana*, therefore confirming the Cupani’s recognition of two forms of “*Chamaemelum*” from W Sicily. Later on, these two varieties were interpreted by Lojacono-Pojero (1884) as expressions of the morphological variability of *A. cupaniana* Nyman. The same author (Lojacono-Pojero 1884) discovered the *A. ismelia* population of Mt Gallo, near Palermo, which was provisionally referred to *A. punctata* Vahl (“Symb. bot. 2, p. 9, non Guss. nec Alior.! Desf. fl. Atl. 2, p. 285, tab. 239!!”), providing evidence that this population was different from *A. cupaniana*, particularly in the morphologic features of the achenes (continuous corona and markedly tuberculate ribs).

To circumvent interpretation problems arising from the comparison with the diagnosis provided by Gussone (1843), Lojacono-Pojero (1884) wrote a taxonomic *notula* on the interpretation and nomenclatural vicissitudes of *Anthemis punctata* s.l. from Sicily here translated: “On this beautiful species, that should not be confused with the forms of *A. Cupaniana* Tod. (*A. punctata* Guss.), and on the group of *A. montana*, I have written extensively in a monographic work still unpublished. I say for now that Gussone has wrongly referred the Sicilian species of our more or less high mountains to this northern African species, which I discovered few years ago in the aforesaid places, where it luxuriates in a singular way and grows copious in grassy and shaded places among the ledges of Mount Gallo overlooking the sea. If Gussone had known this species, he would have better clarified the specific forms of the Sicilian *Anthemis* species, since it is from the knowledge of *A. punctata* that the connection between *A. cupaniana* and *A. montana* can be figured out; it is very intimate in a few cases, but never to the point of making ambiguous the knowledge of the two types, because it can be said that in Sicily, except for the high mountains of Nebrodi, the subspecies *cupaniana* occurs everywhere with its innumerable forms, whereas *A. montana* assumes that form I have seen common in all of Italy, which is *A. columnae* Ten.”.

Based on Lojacono-Pojero’s (1884) *notula* and on his direct knowledge of the morphological traits of the North African populations of *A. punctata* Vahl, Fiori (in Fiori & Paoletti 1903) highlighted the distinctive and peculiar characters of the Sicilian population of Mt Gallo and dedicated it to the Sicilian botanist Lojacono-Pojero through the nomenclatural combination *Anthemis punctata* Vahl var. b *Lojaconi* Fiori in Fiori & Paoletti. Almost simultaneously, Lojacono-Pojero (1903), in his *Flora Sicula*, described as a new species, *Anthemis ismelia*, the population of the “... northern slopes overlooking the sea in wild shady and stony places on arable stony soil or on the cliffs at Mount Gallo, on the side of Sferracavallo at Malo Passo”. Afterwards, Fiori (1926) refers *Anthemis ismelia* Lojac. to *Anthemis punctata* var. γ *Lojaconi* Fiori.

Anthemis ismelia Lojac., Flora Sicula 2(1): 78 (1903) [Syn.: *Anthemis punctata* Vahl, Symb. Bot. 2: 91 (1791); *Anthemis punctata* f. b *lojaconi* Fiori in Fiori & Paoletti, Fl. Analitica Ital. 3: 258 (1903)]. Lectotype [designated by Aghababayan & al. (2008: 517)]: “Flora selecta exsiccata, Publié par Ch. Magnier. 1463. – *Anthemis Ismelia* Lojacono Sp. nova. – *A. punctata* Loj olim in contrib. fl sic. in Nat. sic. (Guss. ex parte! an Vahl ??) – *A. Cupaniana* Tod. ex parte! Sicile: rochers ombragés, mont Gallo. Avril-Mai 1887. M. Lojacono.”

Currently, according to Greuter (2008), the *Anthemis punctata* aggregate includes *A. cupaniana*, *A. ismelia*, and *A. punctata* [with subsp. *punctata* and subsp. *kabylica* (Batt.) Oberpr.], to which is to be added *A. pignattiorum* Guarino, Raimondo & Domina, an isolated species recently described for the Hyblean Plateau (SE Sicily) by Guarino & al. (2013).

According to the chromosomal analysis, *A. ismelia* is diploid ($2n = 18$; Bartolo & al. 1981), and, therefore, it could be a possible ancestor of *A. cupaniana* that is tetraploid (Brullo & al. 1978). All representatives of the *A. punctata* aggregate are suffruticose or herbaceous perennials with very limited vegetative reproduction, typically forming scattered populations of caespitose individuals up to 70 cm tall, with dissected leaves and showy inflorescences (Oberprieler 1998). Plants flower from April to June, but extra-seasonal flowering of few individuals from September to December is not a rare event. Capitula are pollinated mainly by native bees and are likely to be self-incompatible, even if incompatibility was not tested. The fruits, epappus achenes, are dispersed by gravity and through mirmecochory.

Distribution and habitat

Anthemis ismelia is a rare endemic chasmophyte restricted to two sites in NW Sicily (Fig. 2), where it grows on north- to west-facing vertical cliffs at an elevation of 10–500 m a.s.l. at Mt Gallo, near Palermo, and 400–650 m a.s.l. at Mt Pecoraro, near Cinisi. Both sites fall within Meso-Cenozoic calcareous rocks of the Panormide Units, a carbonate platform constituting the skeleton of the northernmost sector of Palermo Mountains. These are part of the Sicilian “Fold and Thrust Belt”, which, at the boundary between the African and the European plates, links the African Maghrebides to the Calabrian arc subduction complex and to the Southern Apennines (Catalano & al. 2013).

Both growing sites fall into the Mediterranean pluvisesonal oceanic bioclimate (Rivas-Martínez & al. 2004), with lower subhumid ombrotypic and upper thermomediterranean (Mt Gallo) and lower mesomediterranean (Mt Pecoraro) thermotype (Bazan & al. 2013). These bioclimatic conditions, however, are buffered and cooled by a daily moisture condensation, often forming a very dense fog, due to the humid sea breeze arising from the Tyrrhenian Sea, right off the limestone cliffs where *A. ismelia* grows. The outstanding floristic value of the huge vertical cliffs of Mt Gallo and Mt Pecoraro is emphasised by a long list of endemic or subendemic species like *Brassica rupestris* Raf., *Centaurea panormitana* Lojac. (see Domina & al. 2016, 2017 for the use of the name), *Cymbalaria pubescens* (C. Presl) Cufod., *Dianthus rupicola* Biv. subsp. *rupicola*, *Euphorbia bivonae* Steud., *E. melapetala* Gasparr., *Galium pallidum* C. Presl, *Glandora rosmarinifolia* (Ten.) D.C. Thomas, *Helichrysum panormitanum* Guss. subsp. *panormitanum* (on Mt Pecoraro) and subsp. *stramineum* (Guss.) C. Brullo & Brullo (on Mt Gallo), *Iberis semperflorens* L., *Lomelosia cretica* (L.) Greuter & Burdet, *Micromeria graeca* subsp. *fruticulosa* (Bertol.) Guinea, *Odontites bocconei* (Guss.) Walp. subsp. *bocconei*, *Pseudoscabiosa limonifolia*

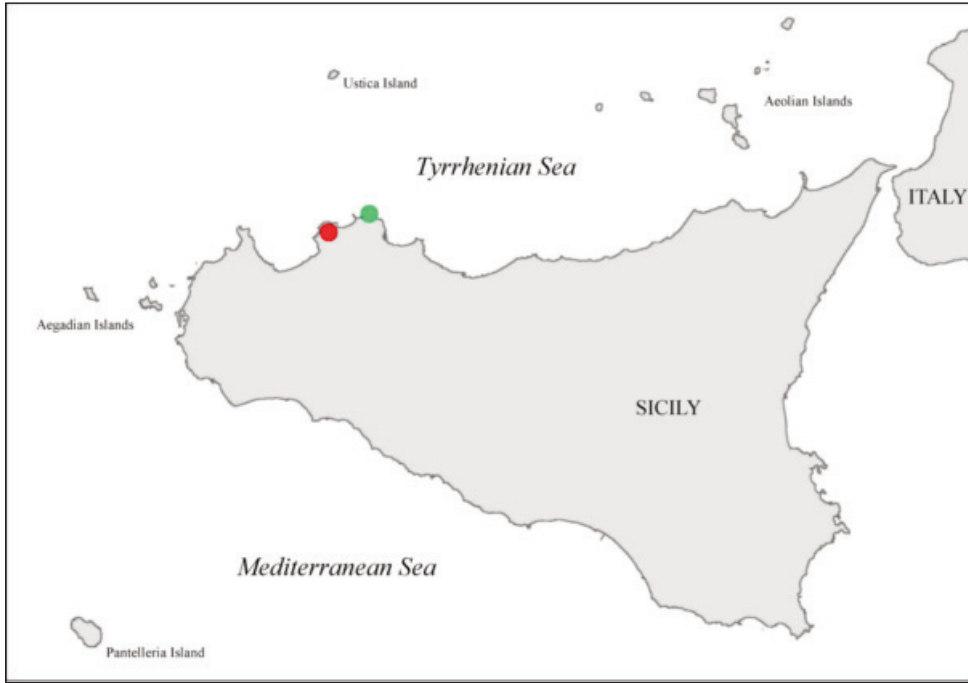


Fig. 2. Geographical range of *Anthemis ismelia*: the new population at Mt Pecoraro (red dot) and the single hitherto known location at Mt Gallo (green dot) in NW Sicily.

(Vahl) Devesa, *Seseli bocconeii* Guss., *Silene fruticosa* L. Besides of these species, occurring on both sites and exhibiting a broader distribution range, other ones are narrowly endemic to one of the two sites: *Genista gasparrini* (Guss.) C. Presl, *Hieracium lucidum* Guss. subsp. *lucidum* and *Limonium panormitanum* (Tod.) Pignatti are endemic to Mt Gallo; *Limonium poimenum* Ilardi, Brullo, D. Cusimano & Giusso is endemic to Mt Pecoraro (Ilardi & al. 2014).

This endemic-rich chasmophytic vegetation has been described as *Scabioso creticae-Centaureetum ucriae* Brullo & Marcenò 1979 *anthemidetosum ismeliae* (Brullo & Marcenò 1979) Brullo, Marcenò & Siracusa 1998, belonging to the alliance *Dianthion rupicolae* Brullo & Marcenò 1979, to the order *Asplenetalia glandulosi* Br.-Bl. in Meier & Br.-Bl. 1934 and to the class *Asplenetea trichomanis* (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977 (Brullo & Marcenò 1979; Brullo & al. 1998).

Conservation status

Anthemis ismelia was previously assessed as Vulnerable: VU (Walter & Gillett 1998), and after as Critically Endangered: CR (criteria B1+2c, D; Buord & Lesouëf 2006; Council of Europe 2012). Even if the habitat of the species should represent a stable environment and the discovery of a new population doubled the overall population size, when applying the IUCN-CMP Unified Classification of Direct Threats (IUCN-CMP 2012), some threats

for the species were detected, mainly ascribable to the following categories: 2.3.1 *Nomadic Grazing* (especially the goat grazing in the wildness); 6.1 *Recreational activities* (especially rock climbing); 7.1.1 *Increase in Fire Frequency/Intensity* (arsons affect both sites almost yearly, especially that of Mt Gallo); 12.1 *Other Threat* (risk factors intrinsic to the species are related to the relictual nature of the sites, to the habitat fragmentation and to the exiguous numerical consistency of the metapopulations). Overall, these threats represent undoubtedly a barrier to the dispersal of the species, affecting its current distribution and the number of mature individuals. Therefore, although the two metapopulations fall within Sites of Community Importance (SCI ITA 020006 “*Capo Gallo*” and SCI ITA 020021 “*Montagna Longa e Pizzo Montanello*”), a Special Protection Area (SPA ITA 020049 “*Monte Pecoraro e Pizzo Cirina*”) and a regional wildlife preserve (Oriented Natural Reserve “*Capo Gallo*”), their exiguity (the population size is in both cases fewer than 100 mature individuals), restricted localization (extent of occurrence estimated in 22 km², with an area of occupancy of 9 km² and an effective area of occupancy of about 0.38 km²) and fluctuation in the number of mature individuals, allow, according to the IUCN Red list category and criteria (IUCN Standards and Petitions Subcommittee 2017), to confirm *Anthemis ismelia* as Critically Endangered: CR [criteria B1ab(iii,v)c(iv)+2ab(v)c(iv); C2b], as also stated by other authors (Raimondo & al. 2011).

In both sites the protection measures are not effective in preserving the integrity of this species, because nothing is known about its reproductive fitness and seed bank status, nor about its genetic variability within and among populations. These factors are very important for defining functional populations (those with members that exchange genes), for identifying potential targets to ensure the conservation of the species domains and evaluating opportunities for *in situ* and *ex situ* conservation programs. Reduced pollen exchange due to inbreeding, localized pollination, very limited dispersal of seeds are likely to affect the two existing populations, but nothing has been done so far to assess it properly.

Even if the population size is monitored *in situ* and some living specimens are grown in the Botanical Garden of Palermo, this species requires intensive investigation efforts and stronger conservation measures, including specific and more effective *in situ* and *ex situ* conservation programmes.

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