











Discovering hidden treasures: unveiling a new population of the narrow endemic *Hieracium lucidum* Guss. (Asteraceae) on the Mounts of Palermo (NW Sicily, Italy)

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Ključne besede: botanične raziskave, diploidni *Hieracium*, endemizem, varstvo rastlin, rastlinska geografija, model razširjenosti vrst.

Abstract

The authors discovered a new population of *Hieracium lucidum* Guss., a species hitherto considered strictly endemic to Monte Gallo. Useful elements for the ecological characterisation of the new population are provided. The stretch of carbonate coastline between the Egadi Islands and the western portion of the Province of Palermo displays a very high wealth of valuable floristic elements and represents an unicum in terms of both phytogeography and ecology. Considering the extreme fragmentation of the distribution pattern of many endemic and exclusive species that characterise this district, as in the case of *H. lucidum*, the authors suggest upgrading the strategies to protect the local botanical heritage, going beyond the species approach and thinking on a wider territorial scale.

Izveček

Avtorji so odkrili novo populacijo vrste *Hieracium lucidum* Guss., ki so jo dosedaj za območje Monte Gallo obravnavali kot ozko endemično. Za ekološki opis nove populacije so prikazali pomembne značilnosti. Odsek karbonatne obale med Egadskimi otoki in zahodnim delom province Palermo kaže zelo veliko bogastvo dragocenih florističnih elementov in predstavlja posebnost tako v fitogeografskem kot ekološkem smislu. Glede na izjemno razdrobljenost vzorca razširjenosti številnih endemičnih in posebnih vrst, ki so značilne za to območje, kot v primeru *H. lucidum*, avtorji predlagajo nadgradnjo strategij za zaščito lokalne botanične dediščine, ki presega vrstni pristop in upošteva širši teritorialni obseg.

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Introduction

The few so far known populations of diploid ($2n=18$) *Hieracium* species have long captivated the attention of evolutionary biologists, due to their central role in the evolution of polyploid complexes that are currently widespread throughout Europe and beyond (Pignatti, 1979; Mráz & Zdvorák, 2019). These complexes, usually reproducing by apomixis to various degrees, consist of numerous more or less isolated populations with distinctive morphological variation, whose taxonomic interpretation does not always lead to satisfactory results (Fehrer, 2009). Consequently, the molecular study of species relationships within such groups faces significant challenges, and diploid populations play a crucial role in reconstructing the evolutionary history of these complexes (Mráz et al., 2019; Chrtek et al., 2020). Sexually reproducing diploid *Hieracium* species are very rare and occur mainly in refugial areas of southern Europe, especially on the Balkan and Iberian Peninsulas (Merxmüller, 1975).

In Sicily, the hitherto known diploid populations of *Hieracium* are recorded from the limestone cliffs of the NW sector of the island (Di Gristina et al., 2015). In his original description Gussone (1825) did not mention the exact location of *Hieracium lucidum*. He later (Gussone, 1844) reported its occurrence at “Monte Gallo”, a promontory located in the northern sector of the Palermo Mountains (Basilone & Di Maggio, 2016), where it grows on N- to W-facing cliffs between 180 and 500 m a.s.l. (Brullo & Brullo, 2021), and “Vallone di Sferracavallo”. The exact location of this valley remains unclear, and even assuming that it represents a distinct (second) location separated from Monte Gallo, it seems unlikely that it coincides with Vallone Cala, which currently falls within the municipality of Torretta. A third locality, Monte Cofano, i.e. 58 km further west of Monte Gallo, was mentioned by Gussone (1844) and ascribed to the same species. This population was subsequently referred to a closely related taxon, described as *H. cophanense* by Lojacono-Pojero (1903), based on slight morphological differences: while *H. lucidum* is glabrous, *H. cophanense* has eglandular trichomes along the edge and the midrib of the leaf. Later on, a second population of *H. cophanense* was discovered by Ottonello & Catanzaro (1986) at about 700 m a.s.l. on Monte Passo del Lupo, 9 km away from Monte Cofano.

In recent literature, the taxonomic treatment of these two species has been rather controversial. Some authors, including Geraci et al. (2007), Greuter in Greuter & Raab-Straube (2007), Aghababayan et al. (2008), and Di Gristina et al. (2015), propose treating them at the subspecies level, while others, such as Gottschlich (2018) and

Brullo & Brullo (2021), prefer to treat them as distinct species. Molecular analyses, carried out by Mráz et al. (2019), demonstrated that these two taxa have two ETS variants in strongly unequal amounts, but the dominant variant in *H. cophanense* corresponds to the underrepresented variant in *H. lucidum* and vice versa. However, the same authors deem more appropriate to treat all the aforementioned populations as belonging to one single species, believing that sexually reproducing diploid taxa within the genus *Hieracium* deserve the application of a broader species concept, because the gene flow (either current or very recent) maintains intraspecific cohesion and hampers morphological and ecological divergence of closely related sexual lineages (Mráz et al., 2019).

In this short note, we report the discovery of a new population of *Hieracium lucidum* Guss., located approximately 3.5 km away from the population of Monte Gallo, a finding that points out the importance of the calcareous-dolomitic mountain systems of north-western Sicily for the conservation of many endemic and/or exclusive plant species with an extremely fragmented distribution. We discuss the consequences of our discovery on the assessment of the species risk level, as well as the need to extend conservation strategies from single biotopes to the level of large landscape units.

Results

The new population of *H. lucidum* was discovered in the municipality of Torretta (Palermo), within the Natura 2000 site ITA020023 “Raffo Rosso, Monte Cuccio e Vallone Sagana” and includes two nuclei.

A first subpopulation, counting five individuals, was found in December 2023 at 220 m a.s.l. in a canyon called Vallone Cala. Four of these individuals, including the only flowering one (Figure 1) grow on a large block of rock that is part of a rockfall deposit on the canyon floor, partly spared by the fire. Here, *H. lucidum* forms a very discontinuous herbaceous assemblage, together with other Asteraceae such as *Hypochoeris laevigata* (L.) Ces., Pass. & Gibelli, *Hyoseris baetica* Sch. Bip. ex Nyman and *Reichardia picroides* (L.) Roth. The fifth individual grows instead in a cliff-dwelling community co-occurring with many rupicolous species typical of the Palermo Mountains, such as *Seseli bocconei* Guss. subsp. *bocconei*, *Silene fruticosa* L., *Asperula rupestris* Tineo, *Dianthus rupicola* Biv. subsp. *rupicola*, *Iberis semperflorens* L., *Euphorbia bivonae* Steud., *Brassica rupestris* Raf., *Centaurea panormitana* Lojac., etc. (see Brullo & Marcenò, 1979), and several more trivial and generalist chasmophilous plants such as *Centranthus ruber* (L.) DC., *Polypodium cambricum* L., *Capparis spinosa* L. subsp. *rupestris* (Sm.) Nyman, etc.



Figure 1: Three individuals of the new population of *Hieracium lucidum* (left); view of Vallone Cala with Monte Gallo in the background (right).
Slika 1: Trije osebki iz nove populacije vrste *Hieracium lucidum* (levo); pogled na Vallone Cala z Monte Gallo v ozadju (desno).

After this finding, a systematic exploration of the cliffs and ledges of the surrounding area was launched in order to assess the overall size of the new population. Although a vast portion of the site appeared suitable for hosting the species, the whole area was severely damaged by a devastating fire that broke out during the night of 24–25 July 2023. This may explain why the field surveys carried out during the following weeks and until the end of December 2023 allowed us to observe one single living adult (yet not flowering) plant growing at c. 350 m a.s.l. on the huge ver-

tical cliff hanging over the first nucleus. Nevertheless, we managed to find a second subpopulation, probably located in the uppermost suitable site of Raffo Rosso at 440 m a.s.l. Here *H. lucidum* grows on almost vertical (80–90°) N-facing cliffs together with other chasmophytes like *Iberis sempervirens*, *Asperula rupestris*, *Glandora rosmarinifolia* (Ten.) D.C. Thomas, *Dianthus rupicola* subsp. *rupicola* and *Hypochoeris laevigata*. This group of individuals occupied a very restricted area (c. 100 m²) and counted 5 adult and 2 young individuals. Our discovery happened in winter, i.e.

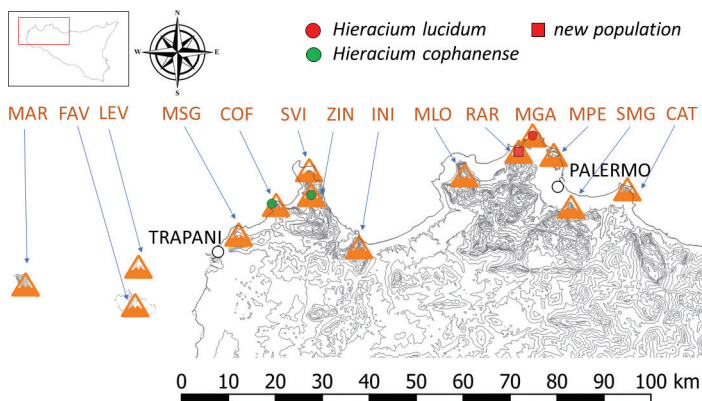


Figure 2: Location of the narrow endemic plant taxa (see Table 1) occurring in the north-western coastal sector of the Drepano-Panormitano district. MAR = Marettimo Island; FAV = Favignana Island; LEV = Levanzo Island; MSG = Mt. San Giuliano (= Erice) and rocky shores near Trapani and Bonagia; COF = Mt. Cofano; SVI = Capo San Vito; ZIN = Zingaro; INI = Mt. Inici; MLO = Montagna Longa-Mt. Pecoraro-Mt. Palmeto; RAR = Raffo Rosso in Pizzo Manolfo; MGA = Mt. Gallo; MPE = Mt. Pellegrino; SMG = foothills of Mt. Grifone; Santa Maria di Gesù, Pizzo Sferrovecchio, Pizzo Crocchiola, Chiarandà; CAT = Mt. Catalfano, Capo Zafferano and Mongerbino. In brackets: local extinctions.

Slika 2: Lokacije ozko endemičnih rastlinskih taksonov, ki jih najdemo na severozahodnem obalnem sektorju Drepano-Panormitanskega distrikta. MAR = otok Marettimo; FAV = otok Favignana; LEV = otok Levanzo; MSG = Mt. San Giuliano (= Erice) in skalnate obale pri mestih Trapani in Bonagia; COF = Mt. Cofano; SVI = Capo San Vito; ZIN = Zingaro; INI = Mt. Inici; MLO = Montagna Longa-Mt. Pecoraro-Mt. Palmeto; RAR = Raffo Rosso in Pizzo Manolfo; MGA = Mt. Gallo; MPE = Mt. Pellegrino; SMG = vznožja Mt. Grifone; Santa Maria di Gesù, Pizzo Sferrovecchio, Pizzo Crocchiola, Chiarandà; CAT = Mt. Catalfano, Capo Zafferano in Mongerbino. V oklepajih: lokalna izumrtja.

not the best season to perform vegetation surveys. However, a preliminary check on the structure, composition and ecology of the plant community hosting the new population of *H. lucidum* lead us to refer it to the same association described for the population of Monte Gallo, i.e. *Scabioso creticae-Centauretum ucraiae* (Brullo & Marcenò 1979). An updated distribution map of *Hieracium lucidum* s.l. is provided in Figure 2.

Discussion

Drone-assisted field surveys are needed for less accessible areas looking suitable for hosting the species and may allow a better assessment of the distribution and size of the local population of *H. lucidum* and an update of the concerned risk assessment. On this purpose, during the last two decades *H. lucidum* has been evaluated as CR (Critically Endangered) by Gianguzzi & La Mantia (2006) and by Di Gristina et al. (2015), based on the IUCN criteria B1ab(i,ii,iii,v)+2ab(i,ii,iii,v) and B1a+2a and C2a(ii), respectively. Then its risk level has been downgraded to EN (Endangered) by Gianguzzi & La Mantia (2017). However, to go beyond a simple update of the EOO and AOO, reproductive fitness surveys should also be conducted.

The karyological investigations carried out on *H. lucidum* (Merxmüller, 1975; Brullo & Pavone, 1979; Brullo et al., 2004) and *H. cophanense* (Geraci et al., 2007) pointed out that both taxa are diploid with $2n = 18$, so it is most likely that the new population, indistinguishable from *H. lucidum* s.str., is also diploid with $2n = 18$. Further investigations should be carried out to analyse the genetic homogeneity within and between the four known populations and test whether or not, given the remarkable genetic and morphological affinity, the intrapopulation distribution of some allelic variants suggests ongoing microevolutionary processes, due to the current isolation, genetic drift and possibly founder effect.

The finding of the new population of *H. lucidum* is a fortunate but not entirely random event. In fact, the area of Vallone Cala was identified by a species distribution model (SDM) aimed at pinpointing the most suitable sites for the translocation of *Ptilostemon greuteri* (Gristina et al., 2023), another narrow endemic species known from two populations in NW Sicily (Pasta et al., 2022). It is not surprising that a model based on occurrences of *P. greuteri* has led to the discovery of another narrow endemic species, as most of these species are often associated with microtopographic conditions that maintain a sufficient level of humidity, enabling them to withstand the harsh conditions of the Mediterranean summer (Marcenò et al., 2022). As a matter of fact, the idiosyncratic distribution pattern of these narrow endemic plant taxa, scat-

tered on the coastal mountains of NW Sicily (see Table 1 and Figure 2), could be linked more to the scattered occurrence of stable climatic refugia (e.g., Harrison & Noss, 2017; Keppel et al., 2018; Garfi et al., 2021; Finocchiaro et al., 2023) than to palaeogeographic causes.

Conclusions

The discovery of a second population of *H. lucidum* highlights once more the “puzzling puzzle” represented by the calcareous-dolomitic mountain system of north-western Sicily, including the Egadi Islands, the coastal mountain ranges of the Trapani province and those of the western-most portion of Palermo province (Brullo et al., 1995; Raimondo et al., 2002; Guarino & Pasta, 2017, 2018). This new record confirms the ecological and phytogeographical unity of this area, whose promontories host a conspicuous number of endemic and/or exclusive species characterised by an extremely fragmented distribution, such as *Erica sicula* Guss. subsp. *sicula* (Pasta et al., 2023), *Pseudoscabiosa limonifolia* (Vahl) Devesa (Romano et al., 1994; de Simone, 2020), *Ptilostemon greuteri* (Pasta et al., 2022), *Euphorbia papillaris* (Boiss.) Raffaelli et Ricceri (Bajona & Spadaro, 2022), plus several closely related populations treated by taxonomists as vicariant species issuing from ongoing microevolutionary processes, as in the already mentioned case of *Hieracium lucidum* and *H. cophanense* or in the case of *Limonium todaroanum* Raimondo & Pignatti and *L. poimenum* Ilardi et al. (Ilardi et al., 2014), *Anthemis* spp. (Cusimano et al., 2017; Raimondo et al., 2021), *Brassica* spp. (Raimondo et al., 1991; Geraci et al., 2001; 2004), *Centaurea* spp. (Scuderi, 2006; Domina et al., 2017), *Helichrysum panormitanum* s.l. (Iamónico et al., 2016; Maggio et al., 2016).

This prompts further research into these cliff habitats and suggests to consider this district as a continuum (Brullo et al., 1995), a fact that makes it not only ecologically plausible but also biologically sound and even desirable to create new metapopulations of the most endangered species in suitable sites within the same district. Such a strategy would increase the chances of dispersal and survival of plants that often have a very narrow distribution range, exhibit a low reproductive fitness and are increasingly threatened by climate change and the intensification of disturbance factors like summer fires frequency.











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Taxon	MAR	FAV	LEV	MSG	COF	SVI	ZIN	INI	MLO	RAR	MAG	MPE	SMG	CAT
<i>Allium francinae</i> Brullo & Pavone	X													
<i>Allium panormitanum</i> Brullo, Pavone & Salmeri											X	X		
<i>Anthemis ismelia</i> Lojac.									X		X			
<i>Anthemis parlatoresana</i> Raimondo, Bajona, Spadaro & Di Grist.								X						
<i>Asperula rupestris</i> Tineo	X	X			X	X	X			X	X	X		X
<i>Brassica villosa</i> Biv. subsp. <i>drepanensis</i> (Caruel) Raimondo & Mazzola				X	X		X							
<i>Brassica macrocarpa</i> Guss.	X	X												
<i>Brassica rupestris</i> Raf. subsp. <i>rupestris</i>					X	X			X	X	X	X	X	X
<i>Brassica villosa</i> Biv. subsp. <i>brevisiliqua</i> (Raimondo & Mazzola) Raimondo & Geraci							X							
<i>Bupleurum dianthifolium</i> Guss.	X													
<i>Calendula maritima</i> Guss.		X		X	(X)	(X)								
<i>Centaurea aegusae</i> Domina, Greuter & Raimondo		X												
<i>Centaurea erycina</i> Raimondo & Bancheva				X			X1							
<i>Centaurea panormitana</i> Lojac.	(X)	(X)	X	X		X		X		X	X	X		
<i>Centaurea todaroi</i> Lacaíta													X	X
<i>Centaurea tyrrhena</i> C. Brullo, Brullo & Giusso			X	X ¹		X				X	X	X	X	X
<i>Erica sicula</i> Guss. subsp. <i>sicula</i>	(X)		(X)	X										
<i>Euphorbia papillaris</i> (Boiss.) Raffaelli & Ricceri	X	X	X	X		X								
<i>Genista gasparrinii</i> (Guss.) C. Presl											X			
<i>Helichrysum panormitanum</i> Tineo ex Guss. s.l.	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Hieracium cophanense</i> Lojac.					X	X								
<i>Hieracium lucidum</i> Guss..										X	X			
<i>Limonium aegusae</i> Brullo		X												
<i>Limonium bocconei</i> (Lojac.) Litard.		X	X	X	X	X	X			X	X	X		X
<i>Limonium cophanense</i> C. Brullo, Brullo, Cambria, Giusso & Ilardi					X									
<i>Limonium flagellare</i> (Lojac.) Brullo							X	X						
<i>Limonium lojaconoi</i> Brullo		X	X	X										
<i>Limonium panormitanum</i> (Tod.) Pign.											X			
<i>Limonium poimenum</i> Ilardi, Brullo, D. Cusimano & Giusso									X					
<i>Limonium ponzoii</i> (Fiori & Bég.) Brullo		X	X	X										
<i>Limonium tenuiculium</i> (Guss.) Pign.	X													
<i>Limonium todaroanum</i> Raimondo & Pignatti							X							
<i>Oncostema ughii</i> (Tineo) Speta	X													
<i>Phagnalon metlesicii</i> Pignatti					X									
<i>Prospero hierae</i> Brullo, C. Brullo, Giusso, Pavone & Salmeri	X		X											
<i>Pseudoscabiosa limonifolia</i> (Vahl) Devesa	X				X				X		X			
<i>Prilostemon greuteri</i> Raimondo & Domina								X						
<i>Ranunculus rupestris</i> Guss.	X			X	X		X	X						
<i>Thymus nitidus</i> Guss.	X													

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