

Diversity in the genus *Hieracium* Linnaeus s. str. (Asteraceae) in Sicily

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ABSTRACT

The present taxonomic and floristic knowledges on *Hieracium* L. s. str. in Sicily are commented. In total, 11 taxa occur in this island, 10 of which are endemic and 1 has a wider range. For each of these taxa, biological form, phenology, distribution, ecology, chromosome number, conservation, and taxonomy are taken in consideration. A key to the taxa is also provided.

KEY WORDS

Apomixis; conservation; endemism; taxonomy; vascular plants.

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INTRODUCTION

Hieracium Linnaeus (1753) s. str. (Asteraceae) is well known as one of the most species-rich plant group in the world. It includes perennial herbs distributed predominantly in temperate regions of Europe, Asia and North America (Chrtek et al., 2006). *Hieracium* belongs to a group of genera in which diplosporous agamospermy and polyploidy seem to prevail (Chrtek et al., 2006). The great majority of *Hieracium* taxa are triploid ($2n=27$) or tetraploid ($2n=36$) apomicts (Mraz et al., 2001). Sexuality is extremely rare and confined to a few diploid species, mostly distributed in South Europe (Merxmüller, 1975; Chrtek et al., 2004).

Hybridization also appears as a very rare phenomenon and is most likely confined to crosses between diploid sexual species (Chrtek et al., 2006). Agamospermy together with sexuality and hybridization in the past have given rise to a very large number of variants that have been described as sub-

species, as has traditionally been the case in Central Europe (Zahn, 1921-1923), or at rank of species (British Isles, Scandinavia, East Europe) (Mraz et al., 2001; Chrtek et al., 2006).

The Sicilian taxa (Fig. 1) have recently been revised as for as taxonomy and distribution are concerned (Raimondo & Di Gristina, 2004, 2007a, b; Di Gristina et al., 2005, 2006; Geraci et al., 2007; Di Gristina et al., 2012; Gottschlich et al., 2013; Di Gristina et al., 2013; Caldarella et al., 2014).

These studies have already resulted in the description of five new taxa: *Hieracium racemosum* subsp. *pignattianum* (Raimondo & Di Gristina, 2004) Greuter (2007), *H. schmidtii* subsp. *madoninense* (Raimondo & Di Gristina, 2007b) Greuter (2007), *H. pallidum* subsp. *aetnense* Gottschlich, Raimondo & Di Gristina (2013), *H. hypochoeroides* subsp. *montis-scuderii* Di Gristina, Gottschlich, Galesi, Raimondo & Cristaudo (2013) and *H. busambarensis* Caldarella, Gianguzzi & Gottschlich (2014).

Furthermore, the names of four taxa described by Michele Lojacono (1903), *H. cophanense*, *H. crinitum* var. *caulescens*, *H. crinitum* var. *eristachyum* and *H. nebrodense*, have been typified by Aghababayan et al. (2008). The remaining five accepted taxa described from Sicily, *H. crinitum* Smith (1813), *H. lucidum* Gussone (1825), *H. atrovirens* Froelich (1838), *H. pallidum* Bivona-Bernardi (1838), *H. symphytifolium* Froelich (1838), and three other names usually treated as synonyms, *H. racemosum* subsp. *todaroanum* Zahn (1922), *H. siculum* Gussone (1844) and *H. siculum* var. *minus* Gussone (1844), have been typified by Di Gristina et al. (2012).

On the whole, at present, several taxonomic and chorological questions still remain open. Among these, several issues of biodiversity conservation are important especially for some strictly local apomictic endemics, that are often considered of

secondary relevance respect to sexual species (Rich et al., 2008) and, then overridden as for as conservation is concerned.

Presently, an extensive field survey on the Sicilian territory is carried. The programme includes: (1) field surveys in order to verify the occurrence of the taxa known only from old reports or herbarium data but not recently observed, (2) the collection of data of biological, ecological or phytogeographical interest for in situ and ex situ conservation.

A molecular approach using “DNA barcoding”, in order to define the phylogenetic and systematic relationships among the Sicilian taxa, and a cyto-geographical analyses at population level, are also in full progress. Waiting for a comprehensive update account of the genus, the framework of present knowledge is here summarized for each taxon.

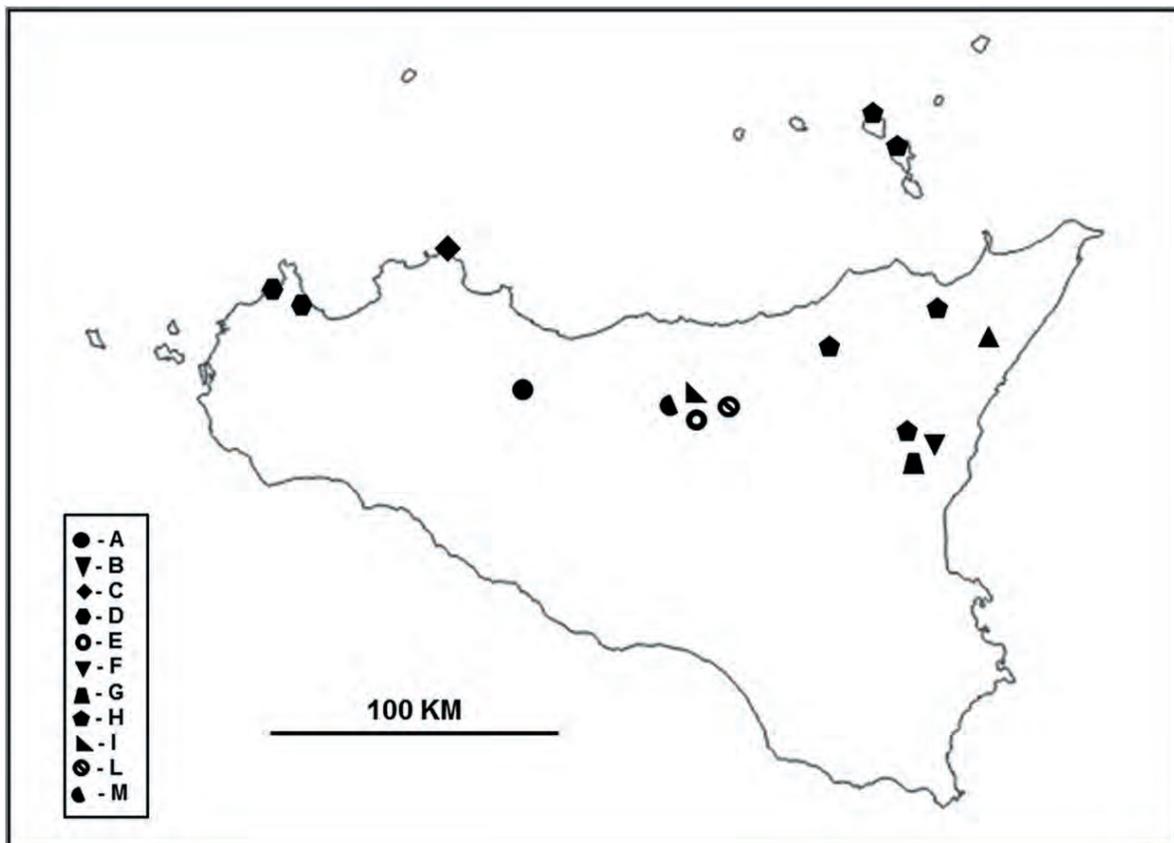


Figure 1. Distribution of the Sicilian *Hieracium* taxa. A) *Hieracium busambarense*; B) *H. hypochoeroides* subsp. *montiscuderii*; C) *H. lucidum*; D) *H. lucidum* subsp. *cophanense*; E) *H. murorum* subsp. *atrovirens*; F) *H. pallidum*; G) *H. pallidum* subsp. *aetnense*; H) *H. racemosum* subsp. *crinitum*; I) *H. racemosum* subsp. *pignattianum*; L) *H. schmidtii* subsp. *madonense*; M) *H. symphytifolium*.

MATERIAL AND METHODS

Floristic, herbarium, and literature research carried out between 1999 and 2014 are surveyed here. Specimens collected in the respective loci classici and some other Sicilian localities are stored in PAL. Zahn's species and subspecies concept (Zahn, 1921-1923) has been adopted for taxonomic nomenclature. Biological forms, following Raunkiaer's classification (1934), are abbreviated as proposed by Pignatti (1982). Chromosome numbers come from our karyological analyses and other literature data. Conservation status follows the IUCN (2010) criteria.

RESULTS AND DISCUSSION

In Sicily *Hieracium* s. str. is so far represented by 11 taxa. 10 of them (*H. busambarense*, *H. hypochoeroides* subsp. *montis-scuderii*, *H. lucidum*, *H. lucidum* subsp. *cophanense*, *H. murorum* subsp. *atrovirens*, *H. pallidum*, *H. pallidum* subsp. *aetnense*, *H. racemosum* subsp. *pignattianum*, *H. schmidtii* subsp. *madoniense* and *H. symphytifolium*) are endemic to the island; the remaining (*H. racemosum* subsp. *crinitum*) has a wider range. These taxa are well differentiated from morphological point of view and belong to sections Bifida (Arv.-Touv.) Clapham, Grovesiana Gottschl., Italica (Fr.) Arv.-Touv., *Hieracium* (Pulmonaria Monnier), Oreadea (Fr.) Arv.-Touv. Most of them are chasmophytes confined to vertical cliffs or rocky slopes. Their chorology and ecology testify the relict state of the genus *Hieracium* in Sicily.

The island is indeed situated at the southern border distribution of the genus (see map in Bräutigam, 1992) and its climatic conditions are suitable for only a few taxa of *Hieracium* (Gottschlich et al., 2013). However, among them, the diploid *H. lucidum*, according to Pignatti (1979, 1982, 1994), ascribes the interesting role of likely differentiation centre of the genus to Sicily.

Most of the taxa are endemic to restricted areas (one population with an estimated area of occupancy less than 10 km²) in which periodical wildfires occur. Therefore, according to the IUCN (2010) criteria for the conservation status assessment, they should be classified as "Critically Endangered" (CR). Their phytogeographical and

taxonomical relevance, together with the extreme conservation status require special protection measures. Unfortunately, the current status and priorities for conservation of the *Hieracium* taxa, as for many other Sicilian endemics, are poorly known, and consequently they are neglected by local administrations.

Taxonomic list

Hieracium busambarense Caldarella, Gianguzzi et Gottschl., Pl. Biosystems, 148: 439. 2014.

H. sect. Grovesiana Gottschl.

BIOLOGICAL FORM. H ros/ H scap.

PHENOLOGY. Flowering from second half of June to first decade of July; fruiting in July (Caldarella et al., 2014).

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to Rocca Busambra (PA) (CW-Sicily) (Fig. 2). Calcareous-dolomite vertical cliffs between 1500 and 1600 m a.s.l, in shaded localities (Caldarella et al., 2014).

CHROMOSOME NUMBER. Unknown.

CONSERVATION STATUS. "Critically Endangered" (CR): C2ab(i) (Caldarella et al., 2014).

TAXONOMICAL NOTES. *H. busambarense* belongs to the H. Sect. Grovesiana, recently described from Italy (Gottschlich, 2009). Its distribution area is located at the extreme southern limit of the Apennines range of that section, therefore it could be interpreted as an endemo-vicariant unit, probably originated after the long geographical isolation of the population on Rocca Busambra (Caldarella et al., 2014). Among the taxa of H. Sect. Grovesiana, *H. busambarense* appears very close to the Calabrian endemic *H. terraccianoii* Di Gristina, Gottschlich & Raimondo (2014), but it differs from this species in having no spotted leaves, more acute involucre bracts and in the bract indumentum (less stellate hairs and more glandular hairs) (Di Gristina et al., 2014).

Hieracium hypochoeroides subsp. *montis-scuderii* Di Grist., Gottschl., Galesi, Raimondo et Cristaudo, Fl. Mediterr., 23: 49. 2013.

H. sect. Bifida (Arv.-Touv.) Clapham

BIOLOGICAL FORM. H ros.

PHENOLOGY. Flowering June; fruiting from June to the first decade of July.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to Mt Scuderi (ME) (NE-Sicily) (Fig. 3). NW-facing carbonate rocks and vertical cliffs between 1145 and 1180 m a.s.l.

CHROMOSOME NUMBER. Unknown.

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. *H. hypochoeroides* s.l. is a young aggregate of apomictic microtaxa with often local distribution, that have evolved during the post-glacial period. The map given by Bräutigam (1992, under the name *H. wiesbaurianum*) indicates a very disjunct area. Only in southern France an extensive closed area exists. In southern Europe one can only find local populations, most of them seem to be relict (Di Gristina et al., 2014). *H. hypochoeroides* subsp. *montis-scuderii* is also such relict endemic taxon.

Hieracium lucidum Guss., Index Sem. Hort. Boccadifalco 1825: 6. 1825.

H. sect. Italica (Fr.) Arv.-Touv.

BIOLOGICAL FORM. Ch suffr.

PHENOLOGY. Flowering from October to November; fruiting in November.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to Mt Gallo (PA) (NW-Sicily) (Fig. 4). NW-facing calcareous rocks and vertical cliffs between 220 and 310 m a.s.l.

CHROMOSOME NUMBER. $2n = 18$ (Merxmüller, 1975; Brullo & Pavone, 1978; Brullo et al., 2004).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. *H. lucidum* is one of the few diploid species in the whole genus. Therefore it could be considered as a probable ancestor for many European *Hieracium* taxa (Pignatti 1979, 1982, 1994).

Hieracium lucidum subsp. *cophanense* (Lojac.) Greuter, Willdenowia, 37: 164. 2007.

≡ *H. cophanense* Lojac., Fl. Sic. 2(1): 218. 1903.

H. sect. Italica (Fr.) Arv.-Touv.

BIOLOGICAL FORM. Ch suffr.

PHENOLOGY. Flowering from October to November; fruiting in November.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to Mt Cofano and Mt Passo del Lupo (TP) (NW-Sicily) (Fig. 5). NW-facing calcareous rocks and vertical cliffs between 220-280 and 670-710 m a.s.l.

CHROMOSOME NUMBER. $2n = 18$ (Brullo et al., 2004; Geraci et al., 2007).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. It differs from *H. lucidum* in having few to moderately dense simple hairs on the stem and on the margin, along the midrib at the lower surface of the basal and cauline leaves.

Hieracium murorum subsp. *atrovirens* (Froel.) Raimondo et Di Grist., Willdenowia, 37: 165. 2007.

≡ *H. atrovirens* Froel., in Candolle, Prodr. 7: 231. 1838.

H. sect. Hieracium (Pulmonaria Monnier)

BIOLOGICAL FORM. H scap/ H ros.

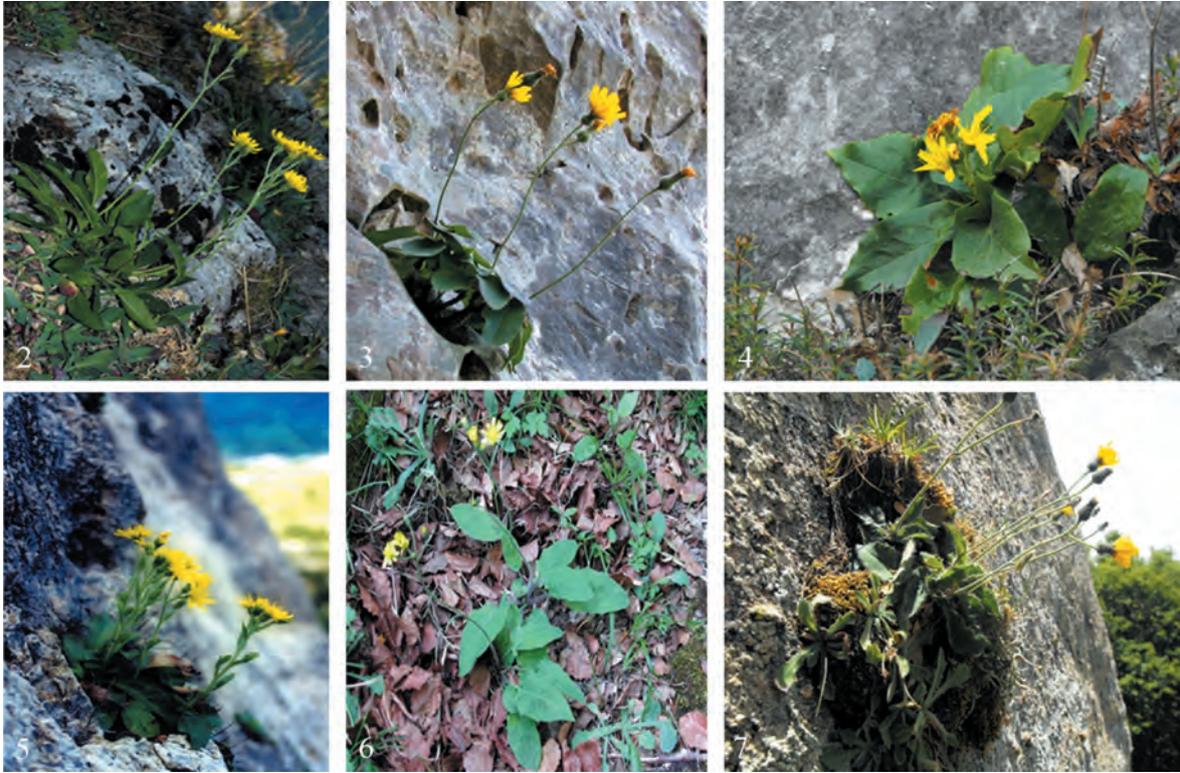
PHENOLOGY. Flowering June; fruiting from June to first decade of July.

DISTRIBUTION AND ECOLOGY. Endemic to the Madonie Mountains (PA) (N-Sicily) (Fig. 6), along the NW-facing carbonate rocks and stony slopes of the Passo della Botte and Rocca di Mele (Petralia Sottana, PA), in clearings of the beech forest, between 1350 and 1580 m a.s.l.

CHROMOSOME NUMBER. $2n = 3x = 27$ (Geraci et al., 2007).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. In the past, the taxonomic rank has been rather controversial. It was described as a species (Froelich, 1838), but it was sub-



Figures 2–7. Blooming individuals in nature of: Fig. 2) *Hieracium busambarense* (from Caldarella et al., 2014); Fig. 3) *H. hypochoeroides* subsp. *montis-scuderii*; Fig. 4) *H. lucidum*; Fig. 5) *H. lucidum* subsp. *cophanense*; Fig. 6) *H. murorum* subsp. *atrovirens*; Fig. 7) *H. pallidum*.

sequently considered as synonym of *H. murorum* Linnaeus (1753) (Fries, 1862; Belli, 1904) or of *H. glaucinum* Jordan (1848) (Zahn, 1921; Fiori, 1928). Recently, the Sicilian population has been considered distinct and treated at subspecific rank of *H. murorum* (Raimondo & Di Gristina, 2007).

Hieracium pallidum Biv., in Bivona-Bernardi, Nuove piante: 11. 1838.

H. sect. Grovesiana Gottschl.

BIOLOGICAL FORM. H ros/ H scap.

PHENOLOGY. Flowering from second half of June to first decade of July; fruiting in July.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to Mt Etna (CT) (E-Sicily) (Fig. 7). Shaded volcanic rocks and stony slopes of Mt. Pomiciaro, Mt Zoccolaro and Serra del Salifizio facing the Valle del Bove (Zafferana Etnea, CT),

between 1550 and 1900 m a.s.l.

CHROMOSOME NUMBER. $2n = 4x = 36$ (Brullo et al., 2004; Di Gristina et al., 2005).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. According to Greuter (2008), it should be placed in the “collective species” (Zahn, 1921-1923) *H. schmidtii*. Nevertheless, the presence of 2 cauline leaves with winged petioles (in *H. schmidtii* s.l. 0-1 not winged leaf per stalk) allow to treat it as a local endemic species to Sicily belonging to H. sect. Grovesiana (Gottschlich et al., 2013).

Hieracium pallidum subsp. *aetnense* Gottschl., Raimondo et Di Grist., Pl. Biosystems, 147: 826. 2013.

H. sect. Grovesiana Gottschl.

BIOLOGICAL FORM. H scap.

PHENOLOGY. Flowering from second half of June to first decade of July; fruiting in July.

DISTRIBUTION AND ECOLOGY. Endemic to Mt Etna (CT) (E-Sicily) (Fig. 8). Volcanic soil, on the border and in clearings of scrubland in a very restricted area on Mt Pomiciaro (Zafferana Etnea, CT), between 1580 and 1650 m a.s.l.

CHROMOSOME NUMBER. $2n = 4x = 36$ (Di Gristina et al., 2014).

CONSERVATION STATUS. "Critically Endangered" (CR): B2ab(iii, v); C2a(ii), D.

TAXONOMICAL NOTES. Closely related to *H. pallidum*, but different by morphology of basal leaves (more lanceolate and dentate), number of cauline leaves (up to 3) and by peduncles and bracts indumentum (more simple hairs and stellate hairs only at the margin of the bracts).

Hieracium racemosum subsp. *crinitum* (Smith) Rouy, Fl. France, 9: 410. 1905.

≡ *H. crinitum* Sm., Fl. Graec. Prodr., 2: 134. 1813.

= *H. crinitum* var. *caulescens* Lojac., Fl. Sic., 2(1): 219. 1903; *H. crinitum* var. *eristachyum* Lojac., Fl. Sic., 2(1): 219. 1903; *H. racemosum* subsp. *todaroanum* Zahn, in Engler, Pflanzenr., 79: 979. 1922.

H. sect. Italica (Fr.) Arv.-Touv.

BIOLOGICAL FORM. H scap/ H ros.

PHENOLOGY. Flowering from second half of August to first decade of November; fruiting from September to second decade of November.

DISTRIBUTION AND ECOLOGY. Corsica, Italy, Balkan Peninsula and Turkey (Fiori, 1928; Pignatti, 1982). In Sicily (Fig. 9), the taxon frequently occurs in shaded stony slopes and in clearings of woods on the main mountains of north-east (Nebrodi, Peloritani and Etna) and on the islands of Salina and Lipari (Lojacono, 1903), between 350 and 1750 m a.s.l.

CHROMOSOME NUMBER. $2n = 3x = 27$ (Brullo et al., 1997, 2004; Geraci et al., 2007).

CONSERVATION STATUS. "Least Concern" (LC).

TAXONOMICAL NOTES. Taxon highly polymorphous. Sicilian and southern Italy populations appear very differentiated and need critical revision.

Hieracium racemosum subsp. *pignattianum* (Raimondo et Di Grist.) Greuter, Willdenowia, 37: 171. 2007.

≡ *H. pignattianum* Raimondo & Di Grist., Pl. Biosystems, 17: 314. 2004.

H. sect. Italica (Fr.) Arv.-Touv.

BIOLOGICAL FORM. H scap/ H ros.

PHENOLOGY. Flowering from second half of August to October; fruiting from September to first decade of November.

DISTRIBUTION AND ECOLOGY. Endemic to the Madonie Mountains (PA) (N-Sicily) (Fig. 10), along the NW-facing carbonate rocks and stony slopes of Mt Mufara (Isnello, Polizzi Generosa, Petralia Sottana, PA), Mt Quacella (Polizzi Generosa, PA), Mt Daino, Cozzo del Filatore, Pizzo dell'Inferno and Rocca di Mele (Petralia Sottana, PA), in clearings of the beech forest, between 1300 and 1700 m a.s.l.

CHROMOSOME NUMBER. $2n = 3x = 27$ (Raimondo & Di Gristina, 2004).

CONSERVATION STATUS. "Vulnerable" (VU): B1a + 2a.

TAXONOMICAL NOTES. Similar to subsp. *crinitum* but the two subspecies show marked differences regarding indumentum, leaf morphology and size of the bracts (Raimondo & Di Gristina, 2004).

Hieracium schmidtii subsp. *madoniense* (Raimondo & Di Grist.) Greuter, Willdenowia, 37: 173. 2007.

≡ *H. madoniense* Raimondo & Di Grist., Bocconea, 141: 86. 2007.

H. sect. Oreadea (Fr.) Arv.-Touv.

BIOLOGICAL FORM. H ros.

PHENOLOGY. Flowering second half of June; fruiting from June to first decade of July.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to the Madonie Mountains (PA) (N-Sicily) (Fig. 11). NW-facing carbonate rocks and stony

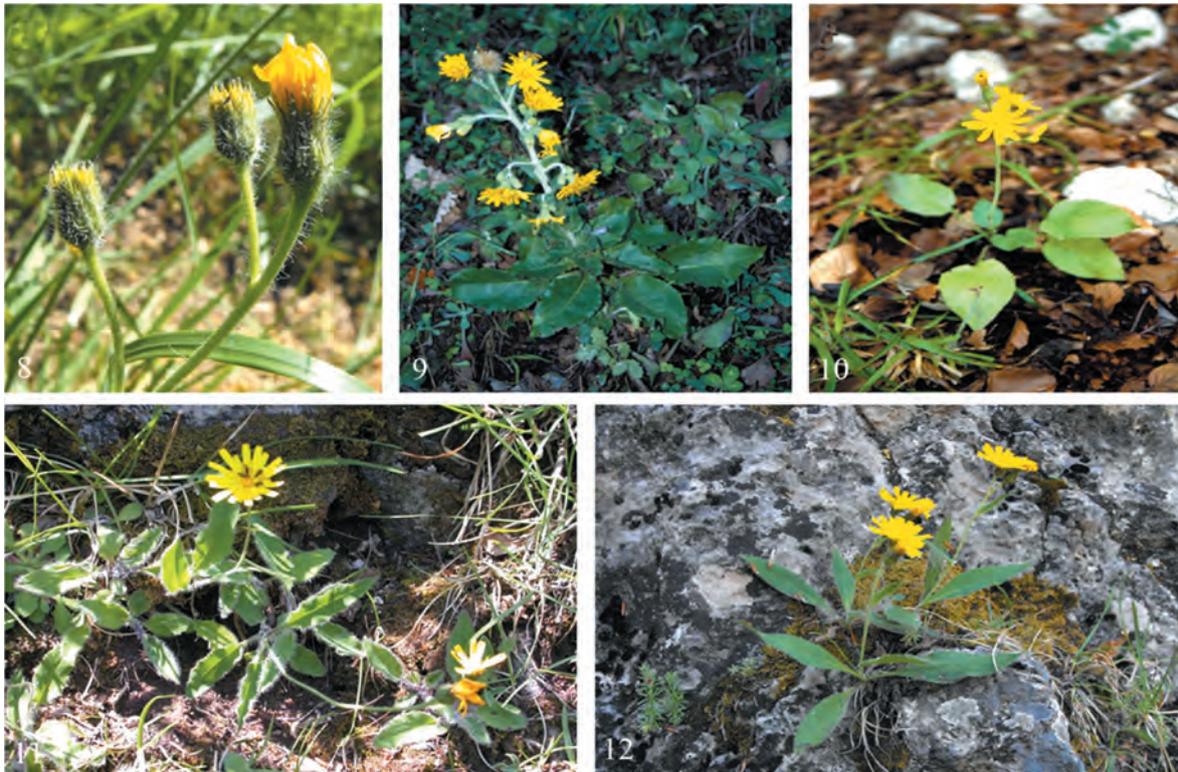


Figure 8–12. Blooming individuals in nature of: Fig. 8) *Hieracium pallidum* subsp. *aetnense*; Fig. 9) *H. racemosum* subsp. *crinitum*; Fig. 10) *H. racemosum* subsp. *pignattianum*; Fig. 11) *H. schmidtii* subsp. *madoniense*; Fig. 12) *H. symphytifolium*.

slopes of Rocca di Mele (Petralia Sottana, PA), in clearings of the beech forest, between 1520 and 1700 m a.s.l.

CHROMOSOME NUMBER. $2n = 3x = 27$ (Di Gristina et al., 2005).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. For a long time confused with *H. pallidum* but easily distinct by leaf, stem, bract indumentum (short simple crisp hairs) and more lanceolate and dentate leaves (Raimondo & Di Gristina, 2007).

Hieracium symphytifolium Froel., in Candolle, 7: 232. 1838.

= *H. siculum* Guss., Fl. Sicul. Syn., 2(1): 404. 1844; *H. siculum* var. *minus* Guss., Fl. Sicul. Syn., 2(1): 404. 1844.

H. sect. Italica (Fr.) Arv.-Touv.

BIOLOGICAL FORM. H ros/ H scap.

PHENOLOGY. Flowering from end of June to July; fruiting in July.

DISTRIBUTION AND ECOLOGY. Chasmophyte endemic to the Madonie Mountains (PA) (N-Sicily) (Fig. 12). NW-facing carbonate rocks and stony slopes of the highest reliefs, between 1250 and 1800 m a.s.l.

CHROMOSOME NUMBER. $2n = 4x = 36$ (Brullo et al., 2004; Di Gristina et al., 2006).

CONSERVATION STATUS. “Critically Endangered” (CR): B1a+2a; C2a(ii).

TAXONOMICAL NOTES. The status of this plant has only recently been clarified. According to Zahn (1921–1923), the taxon represented an “intermediate species” between *H. lucidum* and *H. crinitum* (*Hieracium racemosum* subsp. *crinitum*). However, morphological and genetic studies showed that it is not a hybrid, but an independent species (Di Gristina et al., 2006).

Key of the Sicilian taxa

1. Achenes dark when mature. Flowering June-July.....2
 - Achenes pale when mature. Flowering end of August-November.....3
2. Bracts with rather dense glandular hairs and sparse or no simple hairs*H. murorum* subsp. *atrovirens*
 - Bracts with few to moderately dense glandular hairs and moderately dense to rather dense simple hairs.....4
4. Cauline leaves 3-6. Bracts 0.9-1.3 mm wide*H. symphytifolium*
 - Cauline leaves 0-3. Bracts 0.4-1 mm wide5
5. Plants with 1-4 mm long, denticulate soft or crisp simple hairs.....6
 - Plants with 4-10 mm long, denticulate rigid simple hairs.....7
6. Basal leaves unspotted; cauline leaves 1-2(3)*H. busambarensis*
 - Basal leaves few to intensely dark spotted; cauline leaves 0-1.....8
8. Leaves denticulate above, on the margin and along the midrib with crisp simple hairs.....*H. hypochoeroides* subsp. *montis-scuderii*
 - Leaves dentate to serrate-dentate only on the margin and along the midrib with crisp simple hairs.....*H. schmidtii* subsp. *madoniense*
7. Basal leaves ovate, denticulate, truncate or cuneate at base; cauline leaves 2.....*H. pallidum*
 - Basal leaves lanceolate, denticulate or serrate-dentate, long attenuate at base; cauline leaves up to 3.....*H. pallidum* subsp. *aetnense*
3. Leaves coriaceous, glabrous or with few to moderately dense simple hairs.....9
 - Leaves soft with moderately dense to rather dense simple hairs.....10
9. Leaves glabrous.....*H. lucidum*
 - Leaves with few to moderately dense simple hairs on the margin and along the midrib*H. lucidum* subsp. *cophanense*
10. Basal leaves with moderately dense stellate hairs on both surfaces. Bracts 0.7-1 mm wide*H. racemosum* subsp. *pignattianum*
11. Basal leaves without stellate hairs on both surfaces. Bracts 0.8-1.3 mm wide.....*H. racemosum* subsp. *crinitum*

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