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Contribution to the knowledge of the endemic vascular flora of Iglesiente (SW Sardinia-Italy)

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ABSTRACT

BACCHETTA, G. & C. PONTECORVO (2005). Contribution to the knowledge of the endemic vascular flora of Iglesiente (South West Sardinia, Italy). *Candollea* 60: 481-501. In English, English and French abstracts.

The results of a survey on the endemic vascular flora of Iglesiente (SW Sardinia) are presented. This flora consists of 140 taxa, including 115 species, 18 subspecies, 4 varieties and 3 hybrids; 92 genera and 34 families are represented. The most represented genera are: *Asteraceae* (20 taxa), *Caryophyllaceae* (13) and the *Orchidaceae* (11). The most represented genera are: *Ophrys* (9 taxa), *Genista* (7), *Silene* and *Dianthus* (5). The analysis of biologic and chorologic data highlighted the environmental peculiarities of Iglesiente, given by the local evolution of a rich floristic contingent. Eighteen taxa exclusive endemics, together with an unique blend of geolithologic, geomorphologic, paleogeographic, bioclimatic and vegetation features, let to attribute the rank of biogeographic sector to the Sulcis-Iglesiente territory, whose northern part, with 9 exclusive endemics, can be seen as the Iglesiente subsector. From the surveyed taxa, 32 are included in the IUCN Red List and 5 in the EU 92/43 Habitat Directive. Moreover, 11 species (including all the *Orchidaceae*) are protected by the CITES (Convention on International Trade in Endangered Species of wild flora and fauna) and 1 species by the Bern Conventions.

RÉSUMÉ

BACCHETTA, G. & C. PONTECORVO (2005). Contribution à la connaissance de la flore vasculaire endemique de l'Iglesiente (sud ouest de la Sardaigne, Italie). *Candollea* 60: 481-501. En anglais, résumé en anglais et en français.

Les résultats d'une recherche relative à la flore vasculaire endémique de l'Iglesiente (SO de la Sardaigne) sont présentés. La flore étudiée se compose de 140 taxa et comprend 115 espèces, 18 sous-espèces, 4 variétés et 3 hybrides; 92 genres et 34 familles sont représentées. Les familles les plus représentées sont les *Asteraceae* (20 taxa), *Caryophyllaceae* (13) et *Orchidaceae* (11). Les genres les plus représentés sont *Ophrys* (9 taxa), *Genista* (7), *Silene* et *Dianthus* (5). Les analyses des données biologiques et chorologiques mettent en relief les caractéristiques environnementales de l'Iglesiente dues à l'évolution du riche contingent floristique local. La présence de 18 taxa endémiques exclusives en relation avec les particularités locales géomorphologiques, paléogéographiques, bioclimatiques et propres à la végétation permet d'attribuer le rang de secteur biogéographique à la région du Sulcis-Iglesiente dont la partie nord, avec 9 endémiques exclusives, constitue le sous-secteur Iglesiente. Parmi les taxa analysées, 32 figurent dans la liste rouge UICN, et 5 dans la Directive Habitat EU 92/43. De plus, 11 espèces (incluant toutes les *Orchidaceae*) sont protégées par la CITES et 1 par la Convention de Berne.

KEY-WORDS: Sardinia – Iglesiente – Endemic flora – Biogeography – Chorology – Conservation

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Introduction

The present study arose in the frame of researches about the flora and vegetation of the reliefs of Southern Sardinia started 10 years ago (MOSSA & al., 1996; SELVI & al., 1997; MOSSA & BACCHETTA, 1998; MOSSA & BACCHETTA, 1999; BACCHETTA & BRULLO, 2000; BACCHETTA & al., 2000a; BACCHETTA & al., 2000b; BOCCHIERI & al., 2000; SERRA & al., 2002; ANGIOLINI & BACCHETTA, 2003; BACCHETTA & al., 2003a; BACCHETTA & al., 2003b; BACCHETTA & PLAZZOTTA 2004). During these researches, particular attention was paid to the endemic entities.

Due to the isolation and the noteworthy ecosystems diversity, Sardinia is rich in endemic taxa, particularly on its mountains, as an effect of the orophytism. The mountains of Sardinia, even if lower than the Corsican ones and without any trace of the past glaciations, are high enough to host ecological niches that are absent in the lower bioclimatic belts. The ecologic isolation, together with the insularity of Sardinia, is therefore responsible for an hot spot effect (MÉDAIL & QUÉZEL, 1997) that becomes particularly strong on carbonatic massifs.

The relief of Iglesiente is one of the most interesting and less studied of Sardinia. In spite of the large amount of floristic literature, from which information can be drafted on Iglesiente, relatively few floristic studies are specifically focussing on this area, and most of them have been published in the last twenty years. After the peer investigation carried out by MORIS (1837-1859) and the subsequent Schmid's researches that drove to the discovery of several new species (SCHMID, 1933), fifty years went by before the publication of a new floristic contribution dealing with the flora of Mt. Linas (ANGIOLINO & CHIAPPINI, 1983). Later, further floristic studies took place in the lands of Marganai (BALLERO & ANGIOLINO, 1991), Capo Frasca (BOCCHIERI & MULAS, 1992) and Fluminese (BALLERO & al., 2000), even if a comprehensive study on the whole area is still missing.

As concerns the endemic vascular flora, it must be mentioned the important monographies about the endemic plants of Sardinia by ARRIGONI & al. (1977-1991) and, more recently, several papers devoted to the description of new endemic taxa (BIGAZZI & RICCERI, 1992; BRULLO, 1993; VALSECCHI, 1993; BRULLO & MARCO, 1995; ARRIGONI & DIANA, 1999; BACCHETTA & BRULLO, 2000; BACCHETTA & al., 2000b; BACCHETTA & al., 2003a) or to a better definition of their chorology (SCRUGLI, 1990; ANGIOLINI & BACCHETTA, 2003; BACCHETTA & al., 2003b; BACCHETTA & al., 2004).

Study Area

The Sulcis-Iglesiente territory (Fig. 1a-c), forming the SW part of Sardinia, is a geologic complex cutted off from the rest of the island by the Graben of Campidano. The Graben of Cixerri separates on its turn the Sulcis massif (south) from Iglesiente (north). The former, having a somewhat pentagonal shape, extends over ca. 2130 km^2; the latter, having a triangular shape, covers an area of ca. 1225 km^2.

Sulcis-Iglesiente includes the oldestmost geologic units of the island; those of Bithia e Mt. Settiballas date probably back to the Precambrian (CARMIGNANI & al., 2001). A wide part of the area (ca. 750 km^2) is formed by the units of Cabitza, Gonnesa and Nebida, consisting of sedimentary or metamorphic outcrops of carbonatic rocks, aged to the Cambrian and partially emerged since the Ordovician. Further units, exclusively found in Sulcis-Iglesiente, are the metamorphites of Puddinga and Monte Argentu, in Iglesiente, and the ortogneiss forming Capo Spartivento, in Sulcis, whose formation dates back to the Ordovician. All the mentioned units rest on the Sardo-Corsican Ercinic batholite, formed by intrusive volcanic rock of different origin and chemical composition.

A noteworthy variety of substrata represents the geological peculiarity of Sulcis-Iglesiente. Even if Iglesiente is dominated by Palaeozoic metamorphites, Carboniferous granitic units are also well represented, together with calcitic-alkaline Oligo-Miocenic volcanites and Palaeozoic limestones and dolomites.

The orography of Iglesiente is highly tectonised and fractured, the flat areas being confined to the foothill, joint to the grabens of Campidano and Cixerri. The main range stretches from NNW to SSE and therefore the rivers are latitudinally oriented, rather short and torrent-like. Main rivers are Riu Cixerri, Riu Leni and Riu Mannu. The highest point of Iglesiente is Punta Perda de sa Mesa (1236 m), belonging to the massif of Monte Linas. This is the highest point of S Sardinia: its primacy stands up to the southern slopes of Gennargentu.

Keystones along the history and evolution of the endemic flora of Iglesiente are the fall Tertiary geological events, that were responsible for the current position of Sardinia, the end of the subtropical Tertiary Flora and the origin of the actual one. Among them, the forming of Campidano, Cixerri and Funtanazza tectonic trenches started in the Mid-Eocene (COCOZZA & al., 1974), while the rotation of the Sardo-Corsican microplate from the Provençal coast to the mid Thyrrenian Sea occurred between Oligo-and Miocene (COCOZZA & al., 1974; FADDA, 1986; SPERANZA & al., 2002).

The Oligo-Miocenic calcitic-alkaline volcanic activity is related to these events, being its effusive units most abundant along the above-mentioned grabens (CHERCHI & MONTADERT, 1982). In Iglesiente, such units are represented by the effusive rocks of Mt. Arcuentu (CARMIGNANI & al., 2001).

At the end of Miocene, the Messinian salinity crisis (HSÜ & al., 1977) put together the floristic components of N Africa, Sardinia and Corsica. The climatic variations, caused by the Messinian Age, quitted the subtropical elements of the Tertiary flora, triggering an evolutive radiation that drove to the actual flora (BOCQUET & al., 1978). These events were up to recent time ascribed to the Quaternary glaciations (PIGNATTI, 1976). However, the eustatic variations during the Ice Ages, together with strong winds blowing from the west, are responsible for the formation of pre-würmian fossil dunes that are scattered in W Iglesiente, and mainly in Ingurtosu, Portixeddu and Fontanamare (COCOZZA & al., 1974).

The climatic records, processed by the method proposed by RIVAS-MARTÍNEZ & al. (2002) let to classify the study area within the Mediterranean bioclimatic unit, with thermotypes ranging between the upper thermo- and the lower supramediterranean and ombrotypes between the upper dry and the lower humid (BACCHETTA, 2000).

The above-mentioned lithologic, geomorphologic and bioclimatic features enriched the Sulcis-Iglesiente with peculiar vegetation-types, such as the endemic series of *Rusco aculeati-Querco calliprini* Σ (MOSSA, 1990), occurring on sandy soils both inland and along the coasts, within the thermomediterranean dry bioclimatic unit.

Even the land management of Sulcis-Iglesiente shows some differences from the rest of the island; the main economical activity was up to a recent past the mining activity. The agriculture represented an important economical resource just in the lowlands, while on the mountains it was practised for subsistence only, together with the wild cattle-breeding, mainly of goats. Sheeps are up to now much less than elsewhere in Sardinia and this indirectly benefited the wood cover, traditionally exploited for the charcoal production.

There are only few towns, especially in Sulcis, and chiefly located along the foothills. The exploitation of natural resources in Iglesiente differs from that of Sulcis because of an intensive and millennial mining activity (GREGORIO, 1985).

The periodical burnover to get better pasturelands is less common in Sulcis-Iglesiente than in other parts of the island. This is testified by the occurrence, in this area, of the biggest woods of Sardinia, that, in spite of the intensive felling during the last 150 years, are still well preserved.

Material and methods

This paper is based on peer bibliographic and herbarium surveys, integrated by several field trips carried out in different seasons.

The bibliographic survey focussed on all the reports dealing with the flora of Iglesiente, and mainly on floristic contributions referring, either to the whole island (ALLIONI, 1759; GENNARI, 1866; BARBEY, 1885; MARTELLI, 1896-1904; CAVARA, 1901; FALQUI, 1905; TERRACIANO, 1914, 1915, 1930; MORIS, 1827, 1837-1859; FIORI, 1913; SCHMID, 1933; ARRIGONI & al., 1977-1991) or to Iglesiente (ANGIOLINO & CHIAPPINI, 1983; BALLERO & ANGIOLINO, 1991; BOCCHIERI & MULAS, 1992; BALLERO & al., 2000).

The herbarium survey was carried out at the Universities of Cagliari (CAG), Catania (CAT), Firenze (FI), Sassari (SS and SASSA), Torino (TO) and Valencia (VAL).

The field trips let to observe and collect specimens in many stands. Particular attention was paid to the collection of germplasm and cultivation of critical taxa, in order to study their life cycle. The taxonomic problems arisen from such observations have been tackled in cooperation with research units in plant systematic of the Universities of Catania, Florence, Pisa, Trieste, Valencia and Zurich.

To identify the collected specimens, the following works were consulted: *Med-Checklist* (GREUTER & al., 1984-1989), *Flora Europaea* (TUTIN & al., 1964-1980, 1993), *Nuova flora analitica d'Italia* (FIORI, 1923-1929), *Flora Italica* (ZÁNGHERI, 1976), *Flora d'Italia* (PIGNATTI, 1982), *Flora dels Päisos Catalans* (BOLÒS & VIGO, 1984-2001), *Flora Iberica* (CASTROVIEJO, 1986-2003) and the monograph "*Le piante endemiche della Sardegna*" (ARRIGONI & al., 1977-1991). Moreover, the classification of ferns followed FERRARINI & al. (1986) and SALVO TIERRA (1990), while that of orchids was based on SCRUGLI (1990), SCRUGLI & COGONI (1998) and GRÜNANGER (2000).

All the collected specimens have been stored in CAG and CAT.

Attributes coding of the surveyed taxa

Different attributes have been chosen to characterize the surveyed taxa. These are:

- the biologic forms; these were checked in the field and expressed by the abbreviations reported in PIGNATTI (1982), basing on the Raunkiaer's classification (RAUNKIAER, 1934);
- the chorology; the general chorologic classification followed chiefly ARRIGONI & al. (1977-1991) and *Atlas Florae Europaeae* (JALAS & SUOMINEN, 1972-1994; JALAS & al., 1996-1999; KURTTO & al., 2004). The following abbreviations are adopted (abbreviations used in brackets): Algeria (AG), Tuscan Archipelago (AT), Calabria (CAL), Corsica (CO), France (GA), Hyeres Islands (H), Spain (HS), Italy (IT), North Italy (ITS), Sardinia (SA), Sicily (SI), Tunisia (TN). We also referred to the papers of authors that previously focussed on such theme for Sardinia, Corsica and other W-Mediterranean islands (ARRIGONI & al., 1977-1991; CARDONA & CONTANDRIOPOULOS, 1977; CONTANDRIOPOULOS, 1962, 1964, 1980, 1990; CONTANDRIOPOULOS & CARDONA, 1979; CORRIAS & DIANA Corrias, 1980; FAVARGER & CONTANDRIOPOULOS, 1961; GAMISANS & MARZOCCHI, 1996; GARBARI, 1990). For the chorology of the endemics, the ranks proposed by ARRIGONI & TOMMASO (1991) were adopted (abbreviations used in brackets): "W-Mediterranean endemics" (EMO) (including BL, CO, GA, H, SA), "Sardinian endemics" (ESA) (including SA), "Sardo-Corsican endemics" (ESC) (including CO, SA), "Tyrrhenian endemics" (ET) (including ITS, SI), "Thyrrenian insular endemics" (ETI) (including AT, CO, SA, SI). In addition, the following ones were also adopted: "W-Mediterranean insular endemics" (EMOI) (including AT, BL, CO, H, SA), "Sardinia and Sicily endemics" (ESS) (including SA, SI), "Tyrrhenian Islands and N-Africa endemics" (ETI-NA) (including Tyrrhenian islands territory).
- the biogeographic units; these follow the classification of LADERO ALVAREZ & al. (1987). For these units, the following abbreviations (in brackets) are adopted: "W-Mediterranean subregion" (W-Medit.), "Italo-Tyrrhenian superprovince" (Ital.-Tyrr.), "Sardo-Corsican

province" (Sardo-Cors.), "Sardinian subprovince" (Sard.), "Sulcis-Iglesiente sector" (Sulc.-Igl.); "Iglesiente subsector" (Igl.). In addition to the taxa endemic to this province or to more restricted area, we considered worthy to examine in this paper also the taxa having a distribution range centred on insular areas of the W-Mediterranean subregion;

– the risk classes for endangered and protected taxa; these are quoted from IUCN (IUCN, 1994, 2001, 2003; CONTI & al., 1997; PIGNATTI & al., 2001), CITES (CITES, 1973; CE, 2001), Berne Convention (CEE, 1982), Habitat Directive 92/43 (CE, 1992) and from the PRLPSF ("Proposed Regional Law for the Protection of Sardinian Flora") (BACCHETTA & al., 1999). Basing on the results of field investigation and consulted literature, it is here proposed to change the risk class of some of the surveyed taxa, according to the IUCN procedures (IUCN, 2001, 2003).

Results

The integration of literature data with the resultrs of our field investigation raises the flora of Iglesiente to 140 endemic taxa (Table 1), belonging to 92 genera and 34 families (Fig. 2-3). As specified below, however, six records from literature cannot be confirmed, so the previous number must be reduced to 134. The surveyed taxa include 115 species, 18 subspecies, 4 varieties and 3 hybrids. In Table 1, the following fields are filled per each taxon: family, biologic form, geographic distribution, current protection estate, proposed regional protection estate.

Almost all the vascular endemics of Iglesiente are *Angiospermae*, with 111 *Dicotyledones* and 28 *Monocotyledones*. There is any endemic *Gymnospermae* and just one *Pteridophyta* (*Isoëtes velata* subsp. *tegulensis*). Families counting the highest number of endemics are: *Asteraceae* (20), *Caryophyllaceae* (13) and *Orchidaceae* (11) (Fig. 2). The most represented genera are: *Ophrys* (with 9 taxa), *Genista* (with 7 taxa), *Silene* and *Dianthus* (with 5 taxa) (Fig. 3).

The biologic spectrum of the endemic flora of Iglesiente (Fig. 4) is dominated by the hemicryptophytes (35%), followed by chamaephytes (25%), geophytes (21.4%), therophytes (10.7%), nanophanerophytes (5.7%), phanerophytes (1.4%) and hydrophytes (0.7%).

The high number of hemicryptophytes and chamaephytes can be related both to the Mediterranean climatic conditions and to the abundance of natural habitats, mainly rupestrian, of Iglesiente. The richness in geophytes confirms the remarkably Mediterranean climate, even if such abundance is strongly influenced by the orchids, counting for the 36.6%.

The low percentage of nanophanerophytes and phanerophytes can be explained by the slow speciation rate of such entities, due to their longevity. Moreover, the scanty occurrence of high elevations, particularly with carbonatic substrata, does not offer favourable conditions for the speciation of such growth forms.

The low incidence of therophytes in the endemic flora of Iglesiente could be given by the high efficiency of the dispersal strategies of therophytes, particularly for anthropochory or zoochory (MOSSA & al. 2003).

Hygrophytes are represented by *Isoëtes velata* subsp. *tegulensis,* the only endemic waterplant of Sardinia. Generally speaking, water acts as an homogenising factor on floras, and the study area does not offer many ecological niches suitable for hydrophytes.

Nine of the surveyed taxa, are endemic to Iglesiente: *Astragalus verrucosus, Bellium crassifolium* var. *canescens, Dianthus morisianus*, *Genista arbusensis*, *Genista sulcitana*, *Limonium merxmuelleri*, *Limonium sulcitanum*, *Linum muelleri*, *Sesleria insularis* subsp. *morisiana*. It must be noted that three of them (*Genista sulcitana*, *Limonium merxmuelleri* and *Linum muelleri*) are mainly growing on mine dumps, an artificial habitat that characterizes the Iglesiente territory since ancient times. The evolution, that drove these species towards such an extreme ecological specialisation, began from taxa adapted to salted or mineral substrata. This is the case of *Limonium merxmuelleri*, exclusively occurring in the mining district of Monteponi (ARRIGONI & DIANA, 1999); such species is well adapted to dumps rich in Pb- and Zn-sulphides (FANFANI & al., 2000).

In addition to the above mentioned *taxa*, those endemic to Sulcis-Iglesiente are also very important from the biogeographic viewpoint. They are: *Anchusa littorea*, *Armeria sulcitana*, *Borago morisiana*, *Delphinium longipes, Dianthus mossanus, Helichrysum montelinasanum*, *Limonium sulcitanum*, *Ophrys* x*maremmae* nothosubsp. *woodii*, *Verbascum plantagineum*. These taxa confirm the noteworthy floristic autonomy of the massifs at issue, that are isolated from the other mountains of Sardinia by the Graben of Campidano.

In addition to the *taxa* known from literature, the following ones must be added to the endemic flora of Iglesiente: *Buphthalmum inuloides* (Punta Suecci, Fluminimaggiore), *Colchicum actupii* (Pranu Sartu, Buggerru), *Cuscuta epithymum* subsp. *corsicana* (Mt. Arcuentu, Arbus), *Dianthus cyatophorus* (Punta S. Michele, Domusnovas), *Orchis* x*laconensis* (Ingurtosu, Arbus), *Phalaris arundinacea* subsp. *rotgesii* (Canali Mau, Gonnosfanadiga), *Scilla autumnalis* var. *corsica* (Pardu Atzei, Gonnosfanadiga) and *Verbascum plantagineum* (Ingurtosu, Arbus). On the other hand, it cannot be confirmed the occurrence of *Borago morisiana*, that was recorded by MORIS (1837-1859) as *Buglossites laxiflora* var. *parviflora* Moris and, subsequently, quoted by BALLERO & al. (2000). It must be noted that any herbarium specimen for such species, but those of the Moris' collection, is available for the surveyed territory. Even *Armeria morisii*, *Dianthus arrosti, Festuca morisiana*, *Genista salzmannii*, *Saxifraga cervicornis*, *Silene velutinoides* and *Thlaspi brevistylum* should be excluded from the flora of Iglesiente, in spite of the records quoted by ANGIOLINO & CHIAPPINI (1983).

The chorology of the surveyed taxa is reported in Fig. 5. It can be noted that the Sardinian endemics (35%), together with the Sardo-Corsican (32.9%), count for the 67.9% of the total. As highlighted by ARRIGONI & TOMMASO (1991) and by MOSSA & BACCHETTA (1998), most of the Sardinian endemics are linked to carbonatic substrata, while the sardo-corsican ones to crystalline and metamorphic. Within the 9.3% taxa whose distribution range includes some continental territories, 7 are Tyrrhenian insular endemics stretching up to N-Africa, 4 are Tyrrhenian endemics *sensu strictu* and 2 are W-Mediterranean endemics. These data provide a further proof for the strong floristic autonomy of the Sardo-Corsican flora, and particularly of Sulcis-Iglesiente, in particular due to the evolution *in situ* of its original elements, descending from the Tertiary Mediterranean flora (BRAUN-BLANQUET, 1926; CONTANDRIOPOULOS, 1962; FAVARGER, 1975; ARRIGONI, 1983). This hypothesis is not only confirmed by the high number of exclusive taxa and by the low number of species in common with continental areas, but also by the low number of subspecies (18) in comparison with the number of species (115).

The taxa, whose ranging is limited to insular areas, count for the 90.7% of the total. Among them, 49 taxonomic units are endemic to Sardinia, 46 are Sardo-Corsican endemics, 14 are also occurring in the Tyrrhenian islands, 10 range over the all W-Mediterranean islands and further 8 stretch up to Sicily (Fig. 6).

Concerning the conservation measures (Fig. 7), the present survey recorded for Iglesiente 32 *taxa* included in the IUCN red lists, 17 of them considered at lower risk (LR), 5 vulnerable (VU), 9 endangered (EN), and 1 critically endangered (CR C).

Five taxa are included in the Habitat Directive CEE 92/43 and subsequent updates: two of them are priorities (*Astragalus verrucosus* and *Linum muelleri*) and three are not (*Brassica insularis*, *Linaria flava* subsp. *sardoa, Rouya polygama*).

The CITES Convention includes all the *Orchidaceae* in its annexe 2 and *Astragalus verrucosus* is quoted in the Berne Convention.

The "Proposed Regional Law for the Protection of Sardinian Flora" (BACCHETTA & al., 1999) includes 76 of the surveyed taxa, 31 of which are considered at a very high risk of extinction (A), 23 at high risk (B), 16 at medium risk (C) and 6 at low risk (D).

Discussion

Basing on the field investigation carried out in the present survey, it is here proposed to change the IUCN rank of the 18 taxa exclusively occurring in the Sulcis-Iglesiente biogeographic sector (Table 2): 4 are proposed as critically endangered (CR), 3 as endangered (EN), 5 as vulnerable (VU), 2 as near threatened (NT), 3 as least concern (LC) and *Anchusa littorea* as extinct (EX) because it has been non collected in the last 24 years.

Due to the relatively high number of exclusive endemics of Iglesiente and Sulcis-Iglesiente, it is here proposed a new biogeographic classification for such territories. This is also justified by their palaeogeographic, geologic and geomorphologic peculiarities.

For the individualization of the floristic territories, the criteria proposed by BOLÒS (1962, 1963), BRAUN-BLANQUET (1951), TAKHTAJAN (1969, 1986) and ARRIGONI (1974) have been considered, while, to single out the biogeographic districts, those proposed by RIVAS-MARTÍNEZ (2002), ALCARAZ-ARIZA (1996) and BERASTEGUI & al. (1997) have been followed.

PELLETTIER (1960) recognized for Sardinia six biogeographic and geomorphologic units, among which a "SW-Region: Iglesiente and Sulcis". ARRIGONI (1983) divided Sardinia into three biogeographic sub sectors, within which the lower parts of Sulcis-Iglesiente are considered as a "SW District" of the "coastal and hilly sub sector", while the mountains are included in the "sub sector of siliceous mountains".

The biogeographic division of Italy by GIACOMINI (1958) recognizes a Ligurian-Tyrrhenian biogeographic province, including a Sardo-Corsican biogeographic district, on its turn splitted into a Sardinian and a Corsican biogeographic sectors. The biogeographic division of the Mediterranean region by RIVAS-MARTÍNEZ & al. (2002) recognizes an Italo-Tyrrhenian Province, composed by three sub provinces: the Sardinian, the Corsican and the Tuscano-Calabrian. Manifold similarities, not only concerning floristic aspects, suggest to consider Sardinia and Corsica as a province belonging to an Italo-Tyrrhenian Superprovince, as formerly proposed by LADERO ALVAREZ & al. (1987). The Sardo-Corsican Province, on its turn, should be firtherly divided into a Sardinian and a Corsican Subprovinces. In the frame of such division, by considering the already mentioned abiotic and biotic peculiarities, it is here proposed to confer the rank of biogeographic sector to the Sulcis-Iglesiente territory and the rank of sub sector to Iglesiente (Fig. 1c).

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Table 1. – List of the taxonomic units endemic to Iglesiente, with "*" those that haven't been found during out field investigations. Abbreviations of the author's names followed BRUMMITT & POWELL (1992). See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.

No	Taxonomic Units	Biological forms	Chorology	Biogeographic Unit	Risk class				
					IUCN	Habitat	CITES	Berne convent.	PRLPSF
1	*Allium parciflorum* Viv.	G	SA-CO	Sardo-Cors.					
2	*Allium roseum* var. *insulare* Gennari	G	SA-CO	Sardo-Cors.					
3	*Anchusa littorea* Moris	H	SA	Sulc.-Igl.	EN				A
4	*Anthemis arvensis* subsp. *acrochordona* Briq. & Cavill.	T	SA-SI	Ital.-Tyrr.					
5	*Arenaria balearica* L.	H	SA-CO-AT-BL	W-Medit.					
6	*Aristolochia insularis* Nardi & Arrigoni	G	SA-CO	Sardo-Cors.					
7	*Aristolochia navicularis* Nardi	G	SA-SI-TN-AG	W-Medit.					
8	*Aristolochia tyrrhena* Nardi & Arrigoni	G	SA	Sard.					
9	**Armeria morisii* Boiss.	H	SA	Sard.					B
10	*Armeria sulcitana* Arrigoni	H	SA	Sulc.-Igl.	LR				A
11	*Arum pictum* L. f. subsp. *pictum*	G	SA-CO	Sardo-Cors.					
12	*Astragalus verrucosus* Moris	H	SA	Igl.	CR C	P		X	A
13	*Barbarea rupicola* Moris	H	SA-CO	Sardo-Cors.					B
14	*Bellium bellidioides* L.	H	SA-CO-BL	W-Medit.					
15	*Bellium crassifolium* Moris	Ch	SA	Sard.	LR				A
16	*Bellium crassifolium* var. *canescens* Gennari	Ch	SA	Igl.					
17	*Biscutella morisiana* Raffaelli	T	SA-CO	Sardo-Cors.					
18	*Bituminaria morisiana* (Pignatti & Metlesics) Greuter	Ch	SA	Sard.					
19	**Borago morisiana* Bigazzi & Ricceri	H	SA	Sulc.-Igl.	EN				A
20	*Borago pygmaea* (DC.) Chater & Greuter	H	SA-CO-AT	Ital.-Tyrr.	LR				B
21	*Brassica insularis* Moris	Ch	SA-CO-SI-TN	W-Medit.	EN	NP			D
22	*Bryonia marmorata* Petit	G	SA-CO	Sardo-Cors.					
23	*Bunium corydalinum* DC. subsp. *corydalinum*	G	SA-CO	Sardo-Cors.					
24	*Buphthalmum inuloides* Moris	Ch	SA	Sard.	LR				A
25	*Carduus sardous* DC.	H	SA-CO-AT	Ital.-Tyrr.					
26	*Carex microcarpa* Bertol.	H	SA-CO-AT	Ital.-Tyrr.					
27	*Cephalaria mediterranea* (Viv.) Szabo	Ch	SA-CO-BL	W-Medit.					B
28	*Colchicum actupii* Fridlender	G	SA	Sard.					A
29	*Colchicum corsicum* Baker	G	SA-CO	Sardo-Cors.	EN				C
30	*Crepis caespitosa* Gren. & Godr.	H	SA-CO	Sardo-Cors.					
31	*Crepis vesicaria* subsp. *hyemalis* (Biv.) Babc.	T	SA-SI	Ital.-Tyrr.					

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No	Taxonomic Units	Biological forms	Chorology	Biogeographic Unit	Risk class				
					IUCN	Habitat	CITES	Berne convent.	PRLPSF
32	*Crocus minimus* DC.	G	SA-CO-AT	Ital.-Tyrr.					
33	*Cuscuta epithymum* subsp. *corsicana* (Yunk.) Lambinon	T	SA-CO	Sardo-Cors.					
34	*Cymbalaria aequitriloba* (Viv.) A. Chev. subsp. *aequitriloba*	Ch	SA-CO-AT-BL	W-Medit.					
35	*Delphinium longipes* Moris	H	SA	Sulc.-Igl.					A
36	*Delphinium pictum* Willd. subsp. *pictum*	H	SA-CO-BL-H	W-Medit.	LR				D
37	*Delphinium requienii* DC.	H	SA-CO-H	W-Medit.					
38	**Dianthus arrosti* C. Presl	Ch	SA-SI	Ital.-Tyrr.					B
39	*Dianthus arrosti* subsp. *sardous* Bacch., Brullo, Casti & Giusso	Ch	SA	Sard.					
40	*Dianthus cyathophorus* Moris	Ch	SA-SI	Ital.-Tyrr.					A
41	*Dianthus morisianus* Vals.	Ch	SA	Igl.	VU				A
42	*Dianthus mossanus* Bacch. & Brullo	Ch	SA	Sulc.-Igl.					B
43	*Digitalis purpurea* var. *gyspergerae* (Rouy) Fiori	H	SA-CO	Sardo-Cors.					D
44	*Dipsacus ferox* Loisel.	H	SA-CO	Sardo-Cors.					
45	*Echium anchusoides* Bacch., Brullo & Selvi	H	SA	Sard.					B
46	*Eupatorium cannabinum* subsp. *corsicum* (Loisel.) P. Fourn.	H	SA-CO	Sardo-Cors.					
47	*Euphorbia amygdaloides* subsp. *arbuscula* Meusel	Ch	SA-SI-CAL	Ital.-Tyrr.					D
48	*Euphorbia cupanii* Bertol.	G	SA-CO-SI	Ital.-Tyrr.					
49	*Euphorbia semiperfoliata* Viv.	Ch	SA-CO	Sardo-Cors.					B
50	*Evax rotundata* Moris	T	SA-CO	Sardo-Cors.	LR				A
51	*Ferula arrigonii* Bocchieri	H	SA-CO	Sardo-Cors.	LR				B
52	**Festuca morisiana* Parl.	H	SA	Sard.					A
53	*Galium corsicum* Sprengel	H	SA-CO	Sardo-Cors.					
54	*Galium glaucophyllum* Em. Schmid	H	SA	Sard.	LR				A
55	*Genista arbusensis* Vals.	NP	SA	Igl.					B
56	*Genista corsica* (Loisel.) DC.	NP	SA-CO	Sardo-Cors.					
57	*Genista morisii* Colla	NP	SA	Sard.	LR				A
58	**Genista salzmannii* DC.	NP	SA-CO-AT-ITS	Ital.-Tyrr.					B
59	*Genista sardoa* Vals.	NP	SA	Sard.					A
60	*Genista sulcitana* Vals.	NP	SA	Igl.					A

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No	Taxonomic Units	Biological forms	Chorology	Biogeographic Unit	Risk class				
					IUCN	Habitat	CITES	Berne convent.	PRLPSF
61	*Genista valsecchiae* Brullo & De Marco	NP	SA	Sulc.-Igl.					A
62	*Helichrysum montelinasanum* Em. Schmid	Ch	SA	Sulc.-Igl.	LR				A
63	*Helichrysum saxatile* subsp. *morisianum* Bacch., Brullo & Mossa	Ch	SA	Sard.					A
64	*Hyoseris taurina* (Pamp.) Martinoli	Ch	SA-SI-TN	W-Medit.	LR				B
65	*Hypericum hircinum* L. subsp. *hircinum*	NP	SA-CO-AT	Ital.-Tyrr.					
66	*Hypochaeris sardoa* Bacch., Brullo & Terrasi	H	SA	Sard.					A
67	*Iberis integerrima* Moris	Ch	SA	Sard.					A
68	*Isoëtes velata* subsp. *tegulensis* (Gennari) Batt. & Trab.	I	SA-TN	W-Medit.					A
69	*Leucanthemum flosculosum* (L.) P. Giraud	Ch	SA-CO-AT	Ital.-Tyrr.					
70	*Limonium glomeratum* (Tausch) Erben	Ch	SA-SI	Ital.-Tyrr.					
71	*Limonium merxmuelleri* Erben	Ch	SA	Igl.	VU				B
72	*Limonium sulcitanum* Arrigoni	Ch	SA	Igl.					C
73	*Linaria flava* subsp. *sardoa* (Sommier) Arrigoni	T	SA-CO	Sardo-Cors.	EN	NP			A
74	*Linum muelleri* Moris	Ch	SA	Igl.	EN C2 a (i)	P			A
75	*Lotus cytisoides* subsp. *conradiae* Gamisans	Ch	SA-CO	Sardo-Cors.					D
76	*Mentha insularis* Req. subsp. *insularis*	H	SA-CO-AT	Ital.-Tyrr.					
77	*Mentha requienii* Benth. subsp. *requienii*	H	SA-CO	Sardo-Cors.	LR				A
78	*Mercurialis corsica* Cosson	Ch	SA-CO	Sardo-Cors.					B
79	*Minuartia verna* subsp. *grandiflora* (C. Presl) Hayek	H	SA-SI	Ital.-Tyrr.	LR				C
80	*Nananthea perpusilla* (Loisel.) DC.	T	SA-CO	Sardo-Cors.	LR				A
81	*Odontites corsicus* (Loisel.) G. Don	T	SA-CO	Sardo-Cors.	VU				B
82	*Oenanthe lisae* Moris	H	SA	Sard.					C
83	*Orchis mascula* subsp. *ichnusae* Corrias	G	SA-BL	W-Medit.			X		C
84	*Orchis xpenzigiana* subsp. *sardoa* Scrugli & Grasso	G	SA	Sard.			X		B
85	*Ophrys annae* Devillers-Terschuren	G	SA-CO	Sardo-Cors.			X		
86	*Ophrys chestermanii* (Wood) Gölz & Reinhard	G	SA	Sard.			X		C
87	*Ophrys conradiae* Melki & Deschâtres	G	SA-CO	Sardo-Cors.			X		D
88	*Ophrys eleonorae* J. Devillers-Terschuren & P. Devillers	G	SA-CO-TN	W-Medit.			X		
89	*Ophrys funerea* Viv.	G	SA-CO	Sardo-Cors.			X		B
90	*Ophrys morisii* (Martelli) Soo	G	SA-CO	Sardo-Cors.			X		

Table 1. – List of the taxonomic units endemic to Iglesiente, with "*" those that haven't been found during out field investigations. Abbreviations of the author's names followed BRUMMITT & POWELL (1992). See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.

No	Taxonomic Units	Biological forms	Chorology	Biogeographic Unit	Risk class				
					IUCN	Habitat	CITES	Berne convent.	PRLPSF
91	*Ophrys scolopax* subsp. *sardoa* H. Baumann, Giotta, Lorenz, Künkele & Piccitto	G	SA	Sard.			X		C
92	*Ophrys xlaconensis* Scrugli & Grasso	G	SA	Sard.			X		C
93	*Ophrys xmaremmae* nothosubsp. *woodii* Corrias	G	SA	Sulc.-Igl.			X		A
94	*Ornithogalum biflorum* Jord. & Fourr.	G	SA-CO	Sardo-Cors.					
95	*Orobanche rigens* Loisel.	G	SA-CO	Sardo-Cors.					
96	*Paeonia morisii* Cesca, Passalacqua & Bernardo	G	SA-CO-SI	Ital.-Tyrr.					
97	*Pancratium illirycum* L.	G	SA-CO-AT	Ital.-Tyrr.					C
98	*Petrorhagia saxifraga* subsp. *bicolor* (Jord. & Fourr.) Gamisans	H	SA-CO	Sardo-Cors.					
99	*Phalaris arundinacea* subsp. *rotgesii* (Husnot) Kerguélen	H	SA-CO	Sardo-Cors.					
100	*Phleum sardoum* (Hackel) Hackel	T	SA	Sard.	EN				A
101	*Poa balbisii* Parl.	G	SA-CO	Sardo-Cors.					
102	*Polygala sardoa* Chodat	H	SA	Sard.					C
103	*Polygonum scoparium* Loisel.	Ch	SA-CO	Sardo-Cors.					
104	*Ptilostemon casabonae* (L.) Greuter	Ch	SA-CO-H-AT	W-Medit.					
105	*Ranunculus cordiger* subsp. *diffusus* (Moris) Arrigoni	H	SA-CO	Sardo-Cors.					
106	*Ranunculus revelieri* Boreau	T	SA-CO-GA	W-Medit.	LR				
107	*Romulea requieni* Parl.	G	SA-CO	Sardo-Cors.					
108	*Rouya polygama* (Desf.) Coincy	H	SA-CO-TN	W-Medit.	EN	NP			A
109	*Robertia taraxacoides* (Loisel.) DC.	H	SA-CO-SI-IT	Ital.-Tyrr.					
110	*Rumex scutatus* subsp. *glaucescens* (Guss.) Brullo, Scelsi & Spampinato	H	SA-SI-CAL	Ital.-Tyrr.					
111	*Rumex suffocatus* Bertol.	H	SA	Sard.	VU				C
112	*Salix arrigonii* Brullo	P	SA	Sard.					C
113	*Santolina insularis* (Fiori) Arrigoni	NP	SA	Sard.					C
114	**Saxifraga cervicornis* Viv.	Ch	SA-CO	Sardo-Cors.					C
115	*Saxifraga corsica* (Duby) Gren. & Godr.	H	SA-CO	Sardo-Cors.					
116	*Scilla autumnalis* var. *corsica* (Boullu) Briq.	G	SA-CO	Sardo-Cors.					
117	*Scorzonera callosa* Moris	H	SA	Sard.					B
118	*Scrophularia canina* subsp. *bicolor* (Sibth. & Sm.) Greuter	H	SA-SI	Ital.-Tyrr.					

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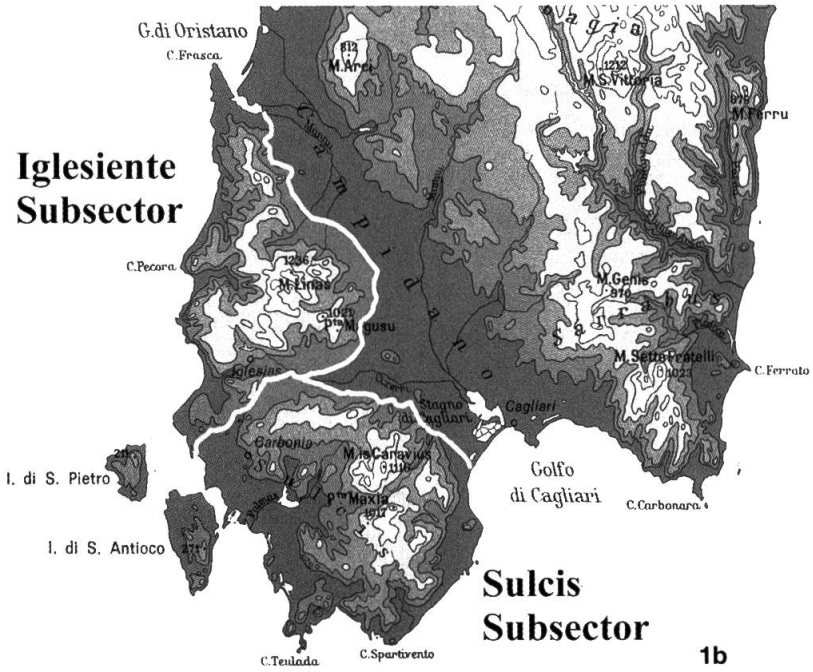
No	Taxonomic Units	Biological forms	Chorology	Biogeographic Unit	Risk class				
					IUCN	Habitat	CITES	Berne convent.	PRLPSF
119	*Scrophularia trifoliata* L.	H	SA-CO-AT	Ital.-Tyrr.					
120	*Seseli bocconi* subsp. *praecox* Gamisans	Ch	SA-CO	Sardo-Cors.					
121	*Sesleria insularis* subsp. *morisiana* Arrigoni	H	SA	Igl.	LR				A
122	*Silene beguinotii* Vals.	T	SA	Sard.					
123	*Silene corsica* DC.	T	SA-CO	Sardo-Cors.					
124	*Silene morisiana* Bég. & Rav.	T	SA	Sard.					B
125	*Silene nodulosa* Viv.	H	SA-CO	Sardo-Cors.					
126	**Silene velutinoides* Pomel	H	SA-AG	W-Medit.					B
127	*Soleirolia soleirolii* (Req.) Dandy	H	SA-CO-BL-AT	W-Medit.	VU				A
128	*Stachys corsica* Pers.	H	SA-CO	Sardo-Cors.					
129	*Stachys glutinosa* L.	Ch	SA-CO-AT	Ital.-Tyrr.					
130	*Teucrium marum* L.	Ch	SA-CO-BL-AT-H-(GA)-(HS)	W-Medit.					
131	*Teucrium spinosum* Loisel.	Ch	SA-BL	W-Medit.					B
132	**Thalapsi brevistylum* Jord.	H	SA-CO	Sardo-Cors.	EN				B
133	*Thymus catharinae* Camarda	Ch	SA	Sard.					
134	*Torilis nodosa* subsp. *nemoralaris* Brullo	T	SA-SI	Ital.-Tyrr.					
135	*Urtica atrovirens* Req. subsp. *atrovirens*	H-Ch	SA-CO-AT	Ital.-Tyrr.					
136	*Verbascum conocarpum* Moris	H	SA-CO-AT	Ital.-Tyrr.					
137	*Verbascum plantagineum* Moris	H	SA	Sulc.-Igl.					B
138	*Veronica brevistyla* Moris	T	SA-CO	Sardo-Cors.	LR				C
139	*Vinca sardoa* (Stearn) Pignatti	Ch	SA	Sard.					
140	*Viola corsica* subsp. *limbarae* Merxm. & Lippert	H	SA	Sard.					C

Table 2. – Proposed changes for the IUCN ranks of the taxa endemic to the Sulcis-Iglesiente Biogeographic Sector. Abbreviations of the author's names followed Brummitt & Powell (1992). See the main text ('Attributes coding of the surveyed taxa') for the other abbreviations.

		Risk classes	
Nr.	**Taxonomic Units**	**Current IUCN rank**	**Proposed IUCN rank**
1	*Anchusa littorea* Moris	EN	EX
2	*Armeria sulcitana* Arrigoni	LR	NT
3	*Astragalus verrucosus* Moris	CR C	CR B1ab(i,ii,iii)
4	*Bellium crassifolium* var. *canescens* Gennari		VU D1 + 2
5	*Borago morisiana* Bigazzi & Ricceri	EN	CR C1
6	*Delphinium longipes* Moris		EN B1ab(i,ii,iii,iv,v) + 2ab(i,ii,iii,iv,v)
7	*Dianthus morisianus* Vals.	VU	CR B1ab(i,ii,iii) + 2b(i,ii,iii)
8	*Dianthus mossanus* Bacch. & Brullo		LC
9	*Genista arbusensis* Vals.		EN B1ab(i,ii,iii) + 2ab(i,ii,iii)
10	*Genista sulcitana* Vals.		VU B1ab(i,ii,iii,iv,v) + 2ab(i,ii,iii,iv,v)
11	*Genista valsecchiae* Brullo & De Marco		LC
12	*Helichrysum montelinasanum* Em. Schmid	LR	VU D2
13	*Limonium merxmuelleri* Erben	VU	CR B1ab(i,ii,iii,iv,v) + 2ab(i,ii,iii,iv,v)
14	*Limonium sulcitanum* Arrigoni		LC
15	*Linum muelleri* Moris	EN C2 a (i)	EN B1ab(i,ii,iii,iv,v) + 2ab(i,ii,iii,iv,v)
16	*Ophrys xmaremmae* nothosubsp. *woodii* Corrias		VU B1ac(iii, iv) + 2ac(iii, iv)
17	*Sesleria insularis* subsp. *morisiana* Arrigoni	LR	VU B1ab(i,ii,iii,iv,v) + 2ab(i,ii,iii,iv,v)
18	*Verbascum plantagineum* Moris		NT



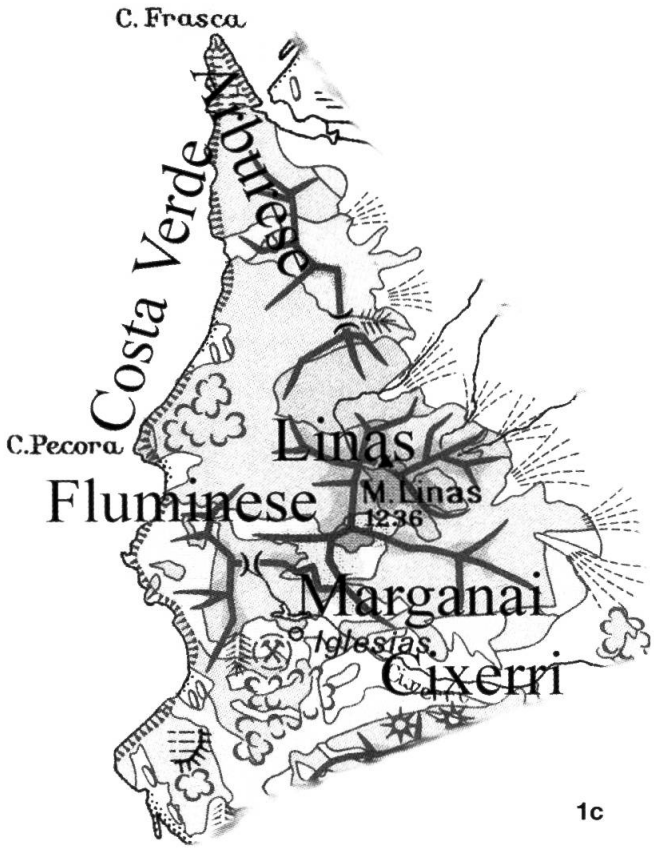


Fig. 1a. – The Sardo-Corsican biogeographic province, with Iglesiente pointed out.

Fig. 1b. – The biogeographic sector of Sulcis-Iglesiente, formed by the subsector Iglesiente (to the north) and Sulcis (to the south).

Fig. 1c. – The "zones" traditionally recognized within the subsector Iglesiente (Arburese, Costa Verde, Linas, Fluminese, Marganai, Cixerri).

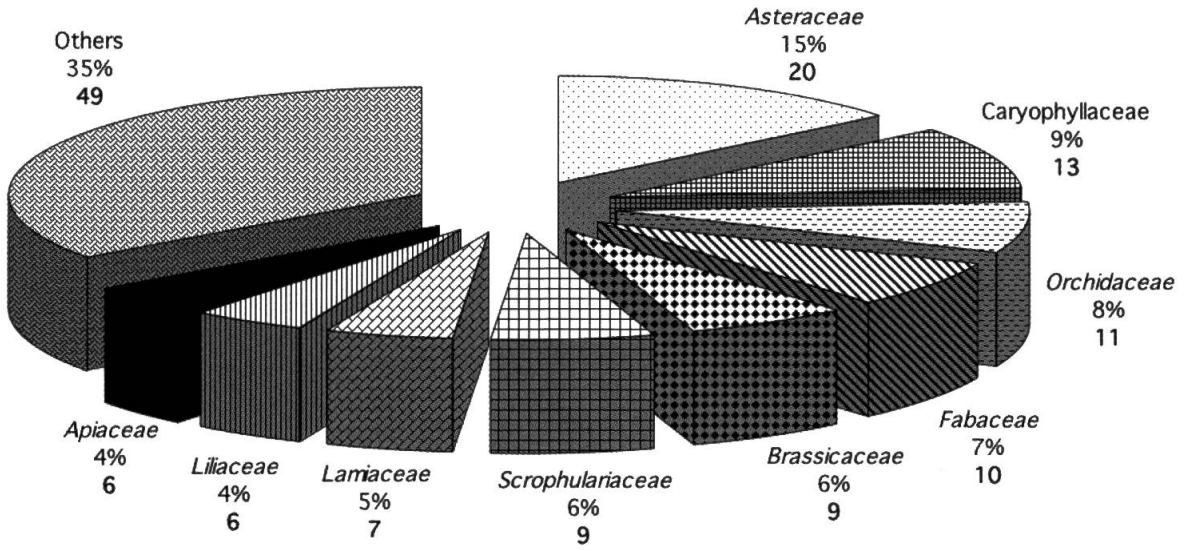


Fig. 2. – The most represented families (with the number of taxa they include) in the endemic flora of Iglesiente.

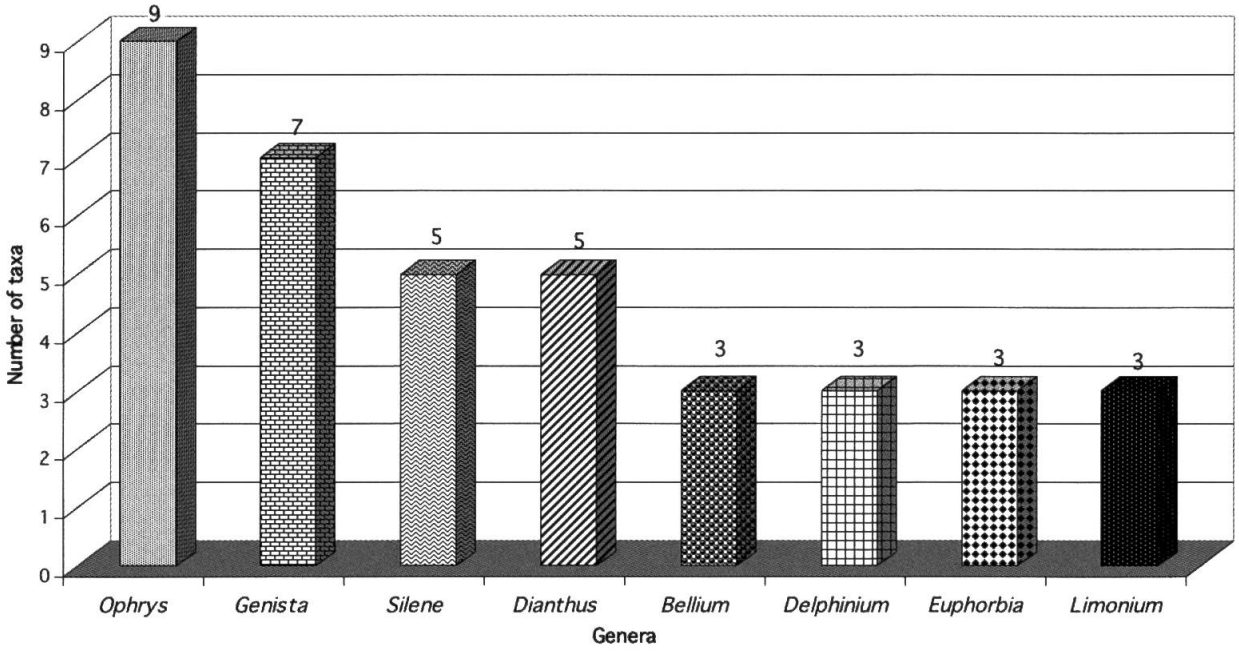


Fig. 3. – The most represented genera (with the number of taxa they include) in the endemic flora of Iglesiente.

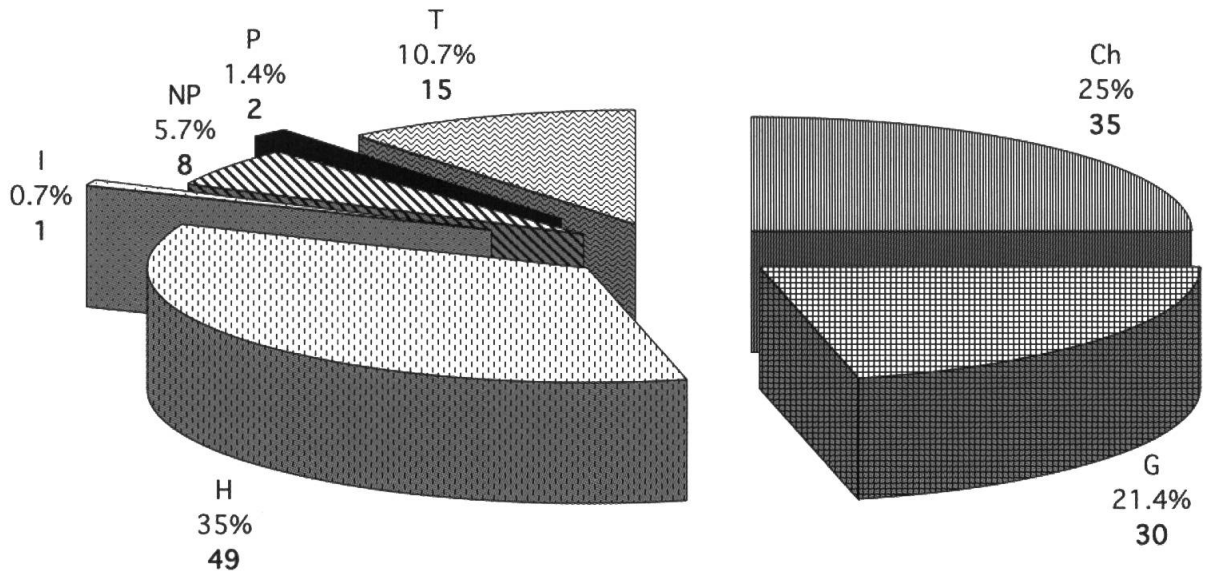


Fig. 4. – Biologic spectrum of the endemic flora of Iglesiente. See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.

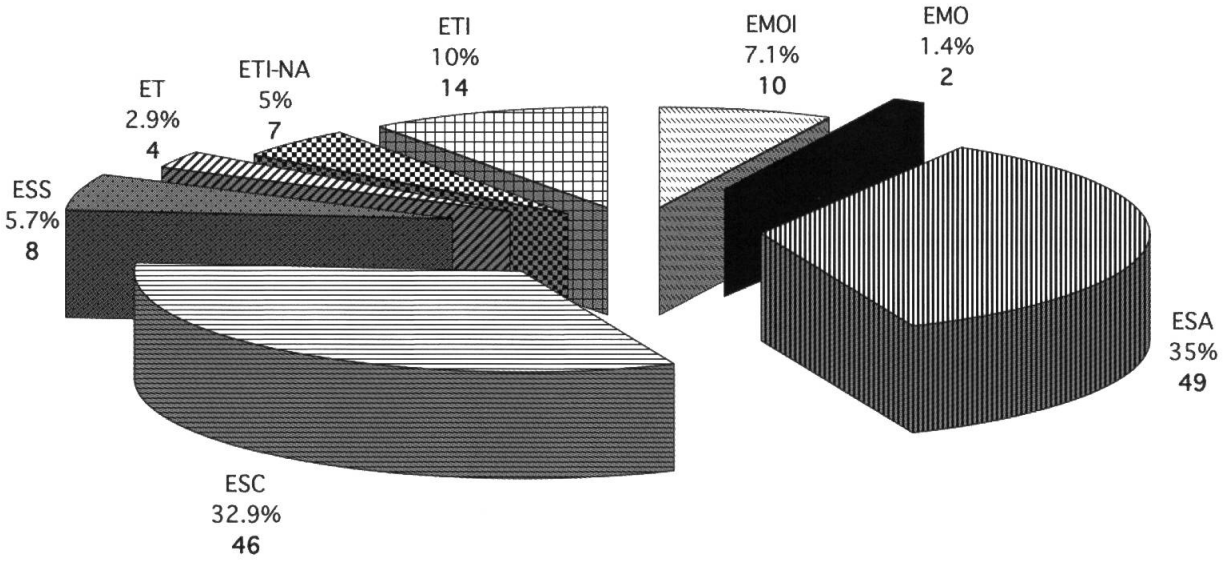


Fig. 5. – Chorologic spectrum of the taxa endemic to Iglesiente. See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.

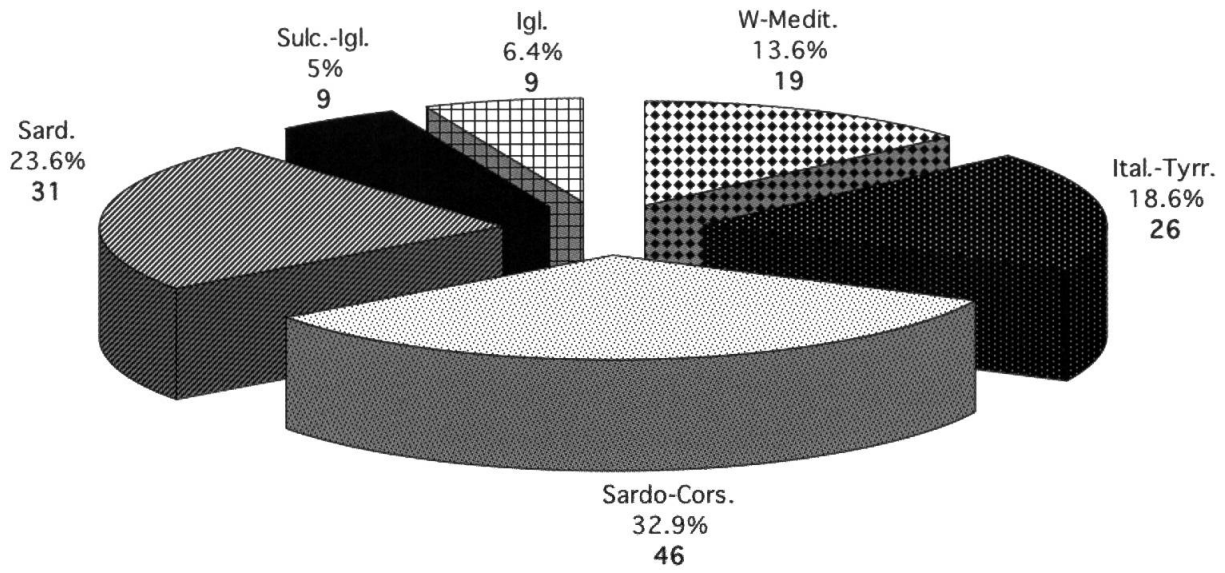


Fig. 6. – Biogeographic spectrum of the endemic flora of Iglesiente. See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.

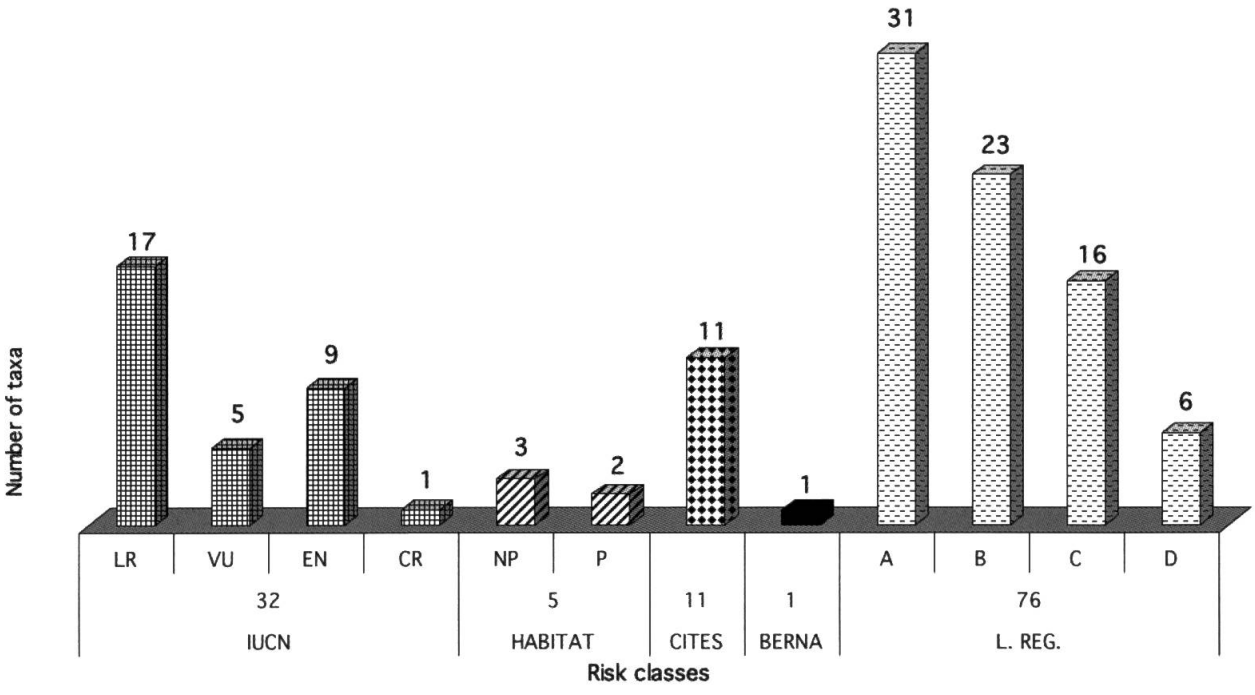


Fig. 7. – Protection measures of the taxa endemic to Iglesiente. See the main text (§ 'Attributes coding of the surveyed taxa') for the other abbreviations.