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Geophytes and evolution in the Sicilian Archipelago

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ABSTRACT Geophytes occurring in the Sicilian archipelago are examined with respect to their distribution and evolution, and also taking into account correlations with the inner parts of this territory and other regions in the central Mediterranean.

KEY WORDS Biogeography; geophytes; endemism; insularity.

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INTRODUCTION

According to Raimondo et al. (2010) the vascular flora of Sicily and surrounding islands is made of 3252 taxa of specific and lower ranks, among which Angiosperms are 3173, including 2463 dicotyledons and 710 monocotyledons.

Several comprehensive works on such plant heritage have been carried out since the seventeenth century (Boccone, 1674; Cupani, 1696-1697; Ucria, 1789; Gussone, 1842-1845; Lojacono Pojero, 1888-1909; Giardina et al., 2007; Raimondo & Spadaro, 2009), together with a large number of other contributions (cfr. Raimondo et al., 1982) mainly dealing with the most important fields of traditional botanical interest like floristics, taxonomy, history, etc., and, in addition, relationships with other Mediterranean countries (Lojacono Pojero, 1888-1909), general characteristics of biology and chorology (Di Martino & Raimondo, 1979), phytogeographical delimitation of the Sicilian floristic domain ("Dominio siculo") (Brullo et al., 1995), etc. More recently Raimondo & Spadaro (2011) analyzed critically this flora and listed 502 endemics, 322 of which are exclusive to the archipelago. Owing to these studies, Sicily is nowadays considered among the better surveyed in the Mediterranean basin (Raimondo, 1988; Brullo et al., 1995) as far as flora, taxonomy and biogeography are concerned. The knowledge of this plant richness and diversity can be still more improved by correlating endemism, karyology, insularity and other heterogeneous factors possibly suitable (when taken together into account) to clarify specific problematic aspects of biogeographical nature. Some remarks referring to geophytes are presented here with respect to their evolution.

MATERIALS AND METHODS

In order to mark connections or isolation phases in which the archipelago was involved, plants with a geophyte life form have been selected since they are perennial and their ranges apparently vary slowly. The taxa taken in consideration belong to the families Orchidaceae and Liliaceae s.l.. They are in part endemic to the whole archipelago (including Malta, in some cases) and in part to small islands

or to circumscribed areas of Sicily that were islands in the past. These latter partly correspond to the floristic subdivision provided by Brullo et al. (1995).

Besides distribution outlines, for each taxon, when possible, karyological data, mostly deduced from literature, are also taken into account. Nomenclature follows Giardina et al. (2007).

SICILY

The above quoted 322 exclusive endemics, mark a significant evidence of the whole Sicilian archipelago insularity; while in the total of 502 there are also included other taxa whose ranges show contacts happened with other Mediterranean areas. In addition to such general information, from the analysis of single taxa some evidence on their actual insular endemic condition is deduced and, besides, on the relevant evolution processes. In particular, those endemics exclusive to Sicily and there spread everywhere show their insular condition.

Among these there are several orchids like *Ophrys oxyrrhynchos* Tod., *O. lunulata* Parl. and *Orchis commutata* Tod. (Fig. 1) which, occurring throughout the region, is likely a good example of a neo-endemic tetraploid (2n = 84) vicariance with respect to *O. tridentata* Scop., diploid (2n = 42), whose range covers Central and S-Europe up to the region of Calabria (Mazzola, 1984) where is its southernmost distribution limit lies. *O. tridentata* is indeed missing in Sicily. Apart from some slight differences in size, these two taxa are almost indistinguishable. *O. lunulata* (2n = 36) occurs throughout Sicily, but it is more frequent in the extreme SE, the Iblei Mountains (the Iblei District, according to Brullo et al., 1995), where *O. biancae* (Tod.) Macch. (2n = 36), *O. caesiella* P. Delforge, and several other more or less distinct taxa belonging to the *O. lutea* and *O. fusca* groups occur frequently.

The occurrence of these geophytes, together with a special terrestrial vertebrate palaeofauna, and other local endemic or rare plant species (Brullo et al., 1995) show that the Iblei Mountains were an island during the Middle Pleistocene (Guglielmo & Marra, 2011). In that period, the rest of the present Sicily was in part submerged, and in part, northwards, occupied by another large island, including the mountainous ranges between Messina and Trapani. The western part of this palaeo-island is characterized by several other endemic geophytes. Among these, *O. pallida* Raf. (Fig. 2) occurs between the Madonie Mountains (here very rare) and the mountains around and south of Palermo, especially in the Monte Busambra zone, and in the Monte S. Calogero west of the town of Termini Imerese, one of past coastal islands having been incorporated in the northern Sicilian littoral (Raimondo et al., 2001).

Figure 1. *Orchis commutata*, a tetraploid vicariant of *O. tridentata*; distribution: Sicily.

In western Sicily, *Oncostema ceruleum* (Raf.) Speta occurs with a range similar to *O. pallida*, together with many other (not only) exclusive endemics like *Colchicum gussonei* Lojac. (related to *C. cupanii* Guss. and there included by Giardina et al. (2007)), and several endemic *Gagea* species such as *G. busambarensis* (Tineo) Parl., *G. longifolia* Lojac., *G. sicula* Lojac. *G. lacaitae* A. Terracc., *G. ramulosa* A. Terracc. that virtually refer to the above mentioned western side of the northern Middle Pleistocene island, i.e. the District Drepano-Panormitano by Brullo et al. (1995). *Gagea* also occurs on the Madonie Mountains with several spe-

Figure 2. *Ophrys pallida*, endemic to Sicily from the Madonie Mountains to westwards.

Figure 3. *Orchis brancifortii*, endemic to Sicily, S-Calabria and Sardinia.

cies as *G. chrysantha* A. Terracc., *G. nebrodensis* (Tod. ex Guss) Nyman, *G. granatelli* (Parl.) Parl. *G. dubia* A. Terrracc., and with *G. pratensis* (Pers.) Dumort., *G. lutea* (L.) Ker-Gawl. in the Nebrodi and Peloritani Mountains (the northeastern district together with the Madonie and the Etna Mountains, (Brullo et al., 1995), while *G. trinervia* (Viv.) Greuter is found in South-Eastern Sicily.

About this incomplete list, it is to be noted that most taxa have not been confirmed recently (Peruzzi & Tison, 2005). This, neither from the taxonomical point of view, nor as far as distribution aspects are concerned. It is, nevertheless, interesting to state that there are at least two localities, on the Busambra and surrounding mountains and on the top of the Madonie, where individual morphological diversity is so intensive that they could be considered as true centres of local variation. Regarding the Madonie Mountains (the "Pizzo delle Case", at 1850 m a.s.l.), such high variation has skilfully been illustrated by the nineteenth naturalist Francesco Minà Palumbo (2011). On the other hand, the genus, being largely distributed, refers to the general insularity of Sicily. As far as the Nebrodi and Peloritani Mountains are concerned (in spite of these areas are characterized by several noteworthy local endemics like *Petagnaea gussonei* (Spreng.) Rauschert, the unique representative of a monospecific genus, besides *Carduus rugulosus* Guss., *Cirsium vallis-demonii* Lojac. etc. in the Nebrodi; *Centaurera seguenzae* (Lacaita) Brullo, *Centaurea tauromenitana* Guss., etc.), geophytes generally mark repeated contacts with Italy through the southern Calabria. Some of these are the orchids *Dactylorhiza sambucina* (L.) Soó, *Orchis morio* L., *Polygonatum gussonei* Parl. (Convallariaceae), *Fritillaria messanensis* Raf. (Liliaceae), *Aristolochia lutea* Desf. (Aristolochiaceae) (2n = 8), *A. clematitis* L. (2n = 14).

Indeed, as Nardi (1984) pointed out, the genus *Aristolochia* can clarify some taxonomic and phytogeographical relationships between Sicily and other surrounding regions. In particular, apart from the two above mentioned species and *A. sicula* Tineo (2n = 16), a taxonomically isolated endemic to the Madonie, Nebrodi, Peloritani mountains and

the Etna, *A. navicularis* Nardi (2n = 24), is distributed in Sardinia, the Egadi Islands and in the northern Algeria and Tunisia; *A. altissima* Desf. marks contacts between SE Sicily and Algeria; *A. clusii* Lojac. (2n = 12) occurs in S-Italy, Sicily and Malta. From a more general point of view, there are several other geophytes showing similar correlations in the Central Mediterranean.

Among these, *Orchis brancifortii* Biv. (Fig. 3) occurs in Sardinia, Sicily, and probably in some calcareous sites scattered in the southernmost Calabria. *O. longicornu* (Poir.) occurs in Sicily, Sardinia and Corsica; S*erapias nurrica* Corrias, first described as endemic to Sardinia (Corrias, 1982) is presently known occurring scattered in several localities of Sicily (Giardina et al., 2007), Calabria, Corsica (Grünanger, 2001) and Tunisia (Véla et al., 2012). As regards other regions, in comparison with *O. quadripunctata* Cirillo ex Ten., *O brancifortii* can be considered as an interesting case of vicariance relating to southeastern European taxa. Similar correlation with SE European flora can be found in several other taxa (*Galanthus*, for instance).

CIRCUMSICILIAN ISLANDS

In addition to the above outlined relations, most of the instances concerning distribution and evolution of the endemic pattern are inside the Sicilian archipelago itself. Here only some cases are taken into account.

The orchid genus *Anacamptis* Rich., whose wide range includes most of Europe and the Mediterranean, in Sicily is represented by *A. pyramidalis* (L.) Rich. (2n = 36), wich is widespread generally on limestone ground. This species is also found in the Maltese islands there bearing the tetraploid 2n = 72 number. Furthermore in the same islands another local diploid endemic species is confined, *A. urvilleana* (Sommier) Caruana (2n = 36), being morphologically, karyologically and phenologically quite distinct from *A. pyramidalis*. The occurrence of these two isolated taxa has been considered as the result of contacts happened between Sicily and Malta and consequent evolution processes that have been repeated at least two times (Del Prete et al., 1991).

Another example in the family of Hyacinthaceae refers to *Oncostema*, a genus with a central and W-Mediterranean range, which in Sicily is represented by 4 native species endemic to the Archipelago (Fig. 4) and 1 naturalized there (*Oncostema peruvianum* (L.) Speta, from SW Iberian peninsula). The native taxa are: *O. siculum* (Tineo ex Guss.) Speta (2n = 28) (Fig. 5) which occurs in several, scattered localities of NW and SE Sicily, and in Malta where aneuploid elements have also been recorded; *O. hughii* (Tineo ex Guss.) Speta (2n = 28) (Fig. 6), which is confined in Egadi Island of Marettimo, west of Sicily; *O. dimartinoi* (Brullo et Pavone) F. Conti et Soldano (Fig. 7), confined in the islet of Lampedusa, located between Sicily and Malta. Finally *O. ceruleum* (Raf.) Speta, distributed in the central and western part of Sicily. This fragmented distribution at the species level generally agrees with some possible evolution happened in a rather far past. Therefore, some small areas where *O. siculum* and *O. ceruleum* occurr can presently be considered as having had an insular status like the coastal more evident ones shown by Raimondo et al. (2001).

Considering the complex surrounding Sicily, in general each island denotes its own insular condition through some local representatives whose neo- or palaeo- endemic nature refers to the volcanic or calcareous geological origins. Among these, *Allium* is represented by several species localized in very small islets (cfr. Giardina et al., 2007). In particular, in the Egadi islands, *A. aethusanum* Garbari and *A. franciniae* Brullo et Pavone, are endemic to Favignana and Marettimo, respectively.

In addition, *A. lopadusanum* Bartolo et al., is a rare endemic to Lampedusa (Pelagie islands); *A. longispatum* Lojac., of uncertain value, is located in the past islet of Capo Catalfano (Raimondo et al., 2001). Regarding other families showing similar distributions, in the Amarylidaceae family, *Pancratium linosae* Soldano et Conti is confined in the Linosa islet (Pelagie islands); and among the orchids, *Serapias cossyrensis* B. et H. Baumann, related to *S. cordigera* L., is endemic to Pantelleria (Pelagie islands). Finally, *Ophrys scolopax* Cav. s.l. is cited owing to it occasionally occurs in the islets of the Archipelago without any constant localization. This is another characteristic of geophytes, especially orchids, and their occurrence in the islands.

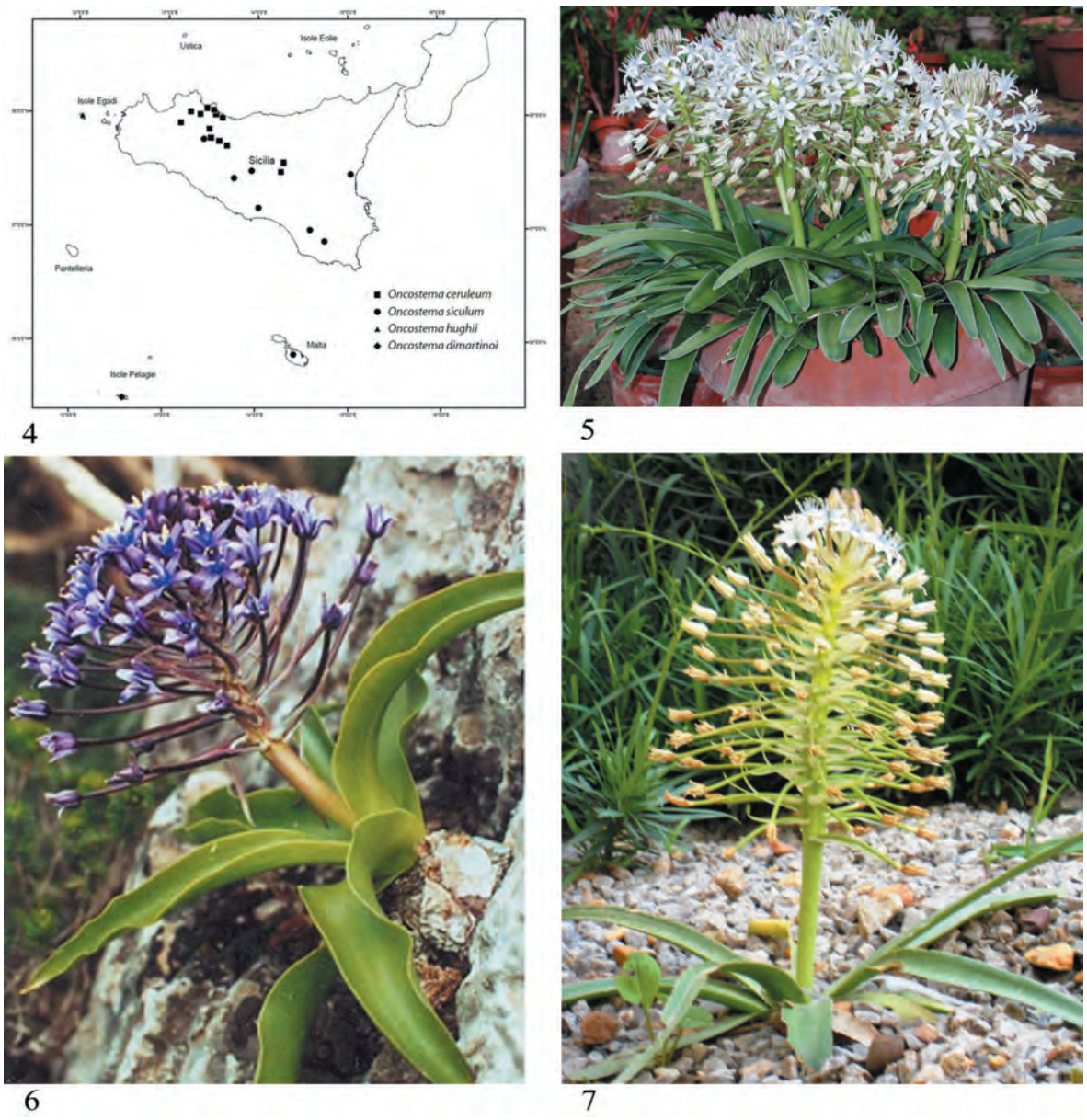

Figure 4. Distribution of *Oncostema* in the Sicilian Archipelago, showing its probable Pleistocenic origin. Figure 5. *O. siculum*, distribution Sicily and Malta; specimen from Corleone (NW-Sicily) cultivated in the Botanical Garden of Palermo. Figure 6. *O. hughii*, confined in the Marettimo island. Figure 7. *O. dimartinoi*, confined in the Lampedusa island.

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