Atti e Convegni

3

Riccardo Guarino & Salvatore Pasta

Botanical Excursions in Central and Western Sicily

Field Guide for the 60th IAVS Symposium

Palermo, 20-24 June 2017

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Contents

Introduzione

Green landscapes of Sicily

R. Guarino

The physical setting

Sicily is the largest Mediterranean island, with an extension of nearly 26000 km^2. The Sicilian territory is predominantly hilly or mountainous: one fourth of the island is at more than 700 m a.s.l.; two thirds range between 300 and 700; one sixth below 300 m a.s.l.

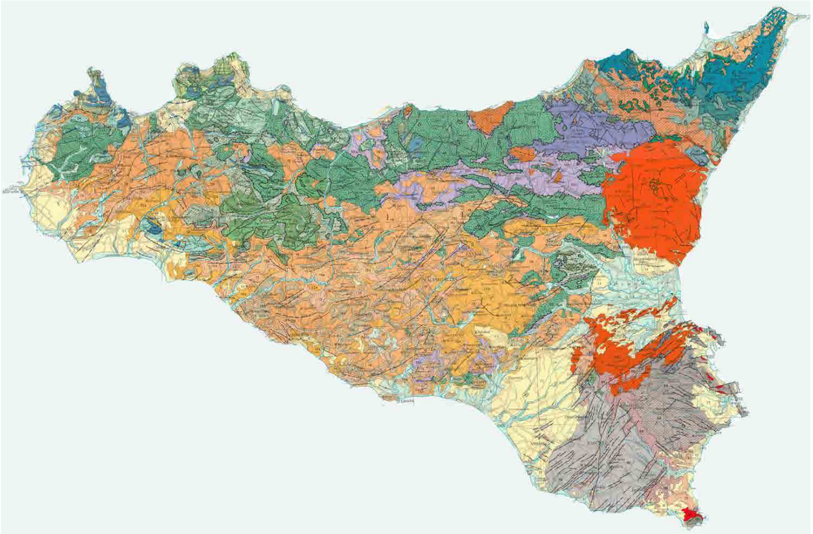


Fig. 1 Geological map of Sicily (simplified version of the 1:250.000 map published by ISPRA, UniCT and INGV), with the names of the main mountain districts of the island. The main geostratigraphic units are summarized in the map reported below

The geographical position of Sicily, its complex geological history and the high topographic diversity make the island one of the most heterogeneous Mediterranean territories, under the geo-morphologic, edaphic and climatic viewpoint (Fig. 1).

The single most relevant landmark of the island is Mt. Etna (currently standing 3329 m), the biggest volcano of the Mediterranean region. It dominates the Eastern side of Sicily, with multiple layers of erupted materials that cover an area of 1190 km^2, with a basal circumference of 140 km.

Apart from Etna, the main elevations of Sicily (ranging from 1400 to 1979 m) are aligned along the so-called Sicilian Apennine, ranging along the NE-coast from the Strait of Messina up to the valley of the Torto River. Three sectors can be recognized, from east to west: Peloritani-, Nebrodi- and Madonie Mountains. Peloritani are constituted by the oldest outcrops of Sicily: a complex of different metamorphic rocks (gneiss, schistose and phylladic alternations) partially covered by sedimentary sandstones and limestones. Nebrodi are mostly consisting of quartzose sandstone rocks, clayey and siltose depositions belonging to the Numidian Flysch. Madonie are formed by carbonatic, dolomitic and quartzitic outcrops, frequently interrupted by outcroppings of salty clay and layers of halite. Carbonatic and dolomitic rocks are forming, as well, the reliefs in the western part of Sicily, overlapping a basal complex constituted by carbonate sands and clays.

The central and southern parts of Sicily are characterized by the hilly complex of “normal” and “chaotic” depositions belonging to the Messinian evaporitic series (the “Gessoso-Solfifera” Formation), mixed with whitish marls of the late Pliocene and by yellowish Plio-Pleistocenic calcareous sandstones.

The south-Eastern corner of Sicily is formed by the carbonate platform named “Hyblaean Plateau”, a succession of horizontal layers of mesozoic limestones frequently interrupted by a radial system of deep canyons departing from the highest elevation (Mt. Lauro, 970 m a.s.l.) formed by alkaline basaltic flows and calcareous tuff that covered the northern portion of the plateau during the Pliocene. The Hyblaean and the Etnean region are divided by the largest alluvial plain of Sicily, the so-called “Piana di Catania”, created by the depositions of the main Sicilian river: the Simeto, collecting water from the southern side of Mt. Soro (*i.e.* the main elevation of Nebrodi Mts.) and all along the western flank of Mt. Etna. The plain of Catania is the single most important agricultural area in the region, consisting of 108,097 ha of arable land and 102,350 ha of permanent crops.

Simeto is the only river of Sicily whose flow is reaching the average of 18 m^3/sec., followed by the Alcantara- (8.8 m^3/sec.) and the Platani River (6.9 m^3/sec.). Most of the Sicilian rivers are modest (less than 1 m^3/sec.), with a pronounced seasonal gap during the summer months, due to the lack of rainfall, the short persistence of snow and the relatively small extension of the catchment basins.

Climate and bioclimates

The average annual temperatures recorded by the weather stations of Sicily are ranging between 17-18 °C at the sea level and 7-5 °C around 1800 m a.s.l. Trends of temperatures are greatly influenced not only by the elevations, but also by the distance from the sea and by the exposure: daily and seasonal temperature ranges are the lowest along the northern coast of the island (Zampino *et al.* 1997). The highest temperatures are recorded in July in the inner districts, with frequent peaks well above 40 °C. In the same areas, minimum temperatures go frequently below 0°C during the winter months. The coldest month is January, with average min. temperatures of 9-10 °C in the lowlands and 1-0 °C around 1800 m a.s.l.

According to the Rivas-Martínez's bioclimatic classification (Brullo *et al.*, 1996), the following thermotypes and ombrotypes are occurring in Sicily (abbreviations: T = Average year temperature, It = Index of thermicity):

- <u>Inframediterranean</u> (T = 18-20 °C, It = 500-450) upper semiarid (Lampedusa) and upper dry (Linosa and Pantelleria).
- <u>Lower Thermomediterranean</u> (T = 16-18 °C, It = 449-400) lower dry (coastal districts from Licata to Pachino), upper dry (Egadi Islands, coastal districts from St. Vito Lo Capo to Licata and from Pachino to Augusta), lower subhumid (coastal districts from St. Vito Lo Capo to Capo Gallo, Cefalù, from Augusta to Acireale, NE-Hyblaei, Aeolian Islands), upper subhumid (coastal districts from Cefalù to Messina).

- <u>Upper Thermomediterranean</u> (T = 16-18 °C, It = 399-350) lower dry (Piana di Catania), upper dry (hills of southern and SE-Sicily), subhumid (inlands of Trapani and Agrigento, hilly and coastal districts from Giardini to Messina), lower humid (Mts. surrounding Palermo, foothills of northern Peloritani and eastern flanks of Etna, from Acireale to Giardini).
- <u>Mesomediterranean</u> (T = 13-16 °C, It = 349-210) upper dry and lower subhumid (Mts. of western and central Sicily, southern flanks on Madonie and Nebrodi, southern Hyblaei), lower humid (northern flanks of Nebrodi and Peloritani, top of the Hyblaean plateau), upper humid (eastern flanks of Etna and Peloritani).
- <u>Supramediterranean</u> (T = 8-13 °C, It = 209-70) subhumid /lower humid (top of Madonie, Sicani, Nebrodi and western slopes of Etna), upper humid (top of Peloritani and eastern slopes of Etna).
- <u>Oromediterranean</u> (T = 4-8 °C, It = 69- -10) humid (Etna, between 2000 and 2800 m a.s.l.).
- <u>Cryo-oromediterranean</u> (T = 2-4 °C, It = -11- -100) upper humid (Etna, above 2800 m a.s.l.).

Distribution maps of the thermotypes and ombrotypes of Sicily are reported in Figg. 2-3.

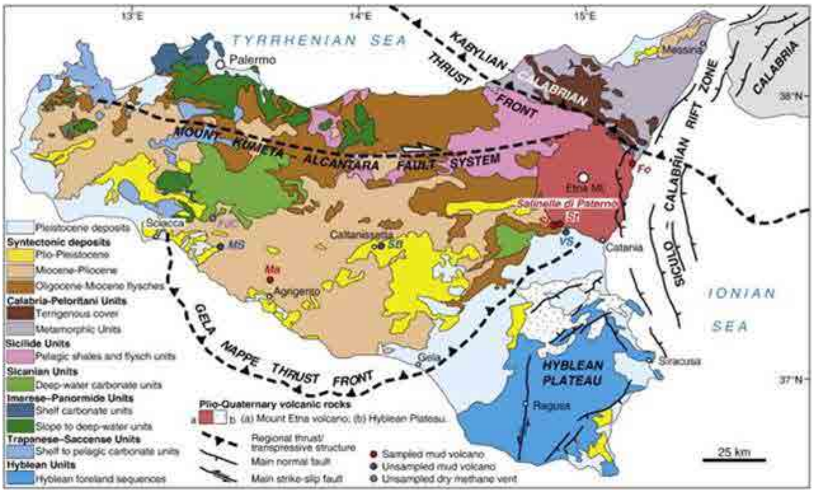


Fig. 2

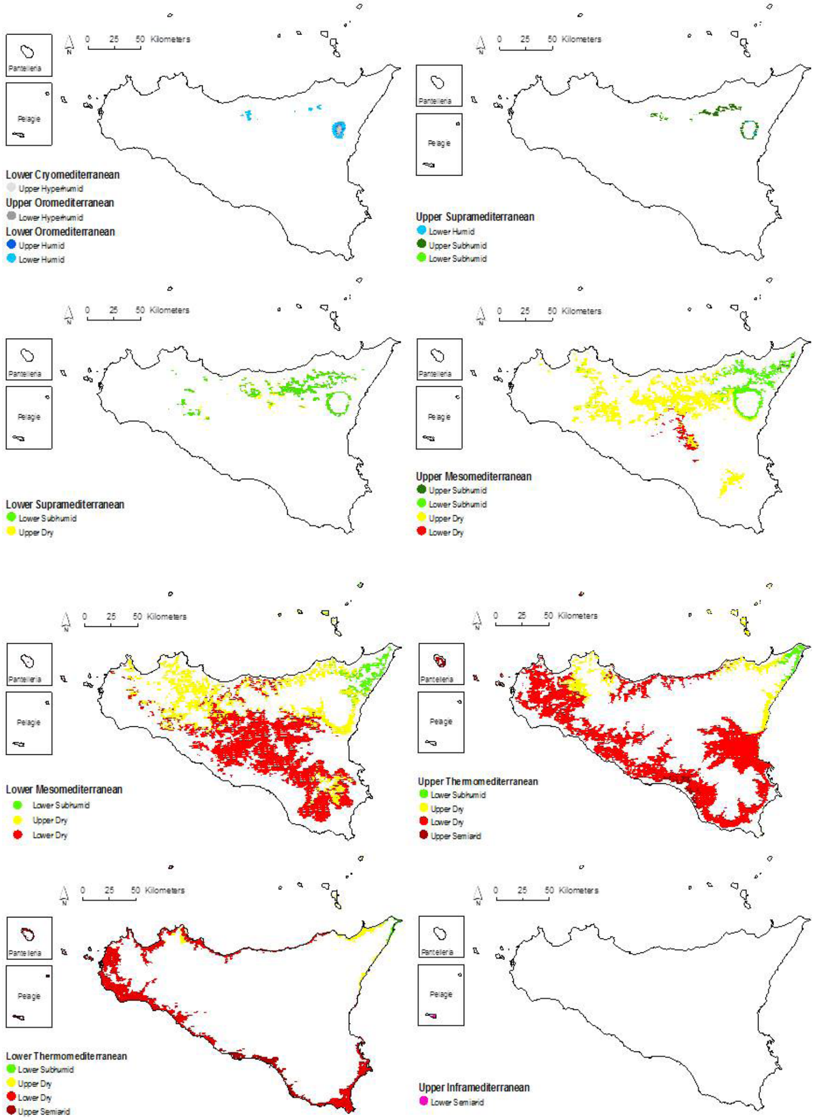


Fig. 3 Bioclimatic Units of Sicily (after Bazan G., et al. 2015: Bioclimatology and vegetation series in Sicily: a geostatistical approach. - Annales Botanici Fennici 52: 1-18).

Flora and Vegetation

The vascular flora of Sicily and surrounding islets is currently estimated in around 3000 species (Giardina et al., 2008): floristically, the Sicilian territory turns out to be one of the richest in the Mediterranean. The high diversity of species is primarily related to the previously mentioned high topographic and bioclimatic diversity of the island. Moreover, for its geographical position, Sicily can be defined the crossroad of the Mediterranean flora, as many species are reaching here the northern- (*Reaumuria vermiculata, Zyzyphus lotus, Rhus tripartita,* etc.), southern- (*Fagus sylvatica, Ferulago campestris, Allium ursinum* etc.), eastern- (*Chamaerops humilis, Ambrosina bassii, Cistus crispus* etc.), western- (*Fritillaria messanensis, Salvia fruticosa, Jasminum fruticans* etc.) limit of their distribution range. These occurrences testify ancient biogeographical connections with the mainland (starting from the Messinian Age), as well as the plant migrations driven by the Plio-Pleistocenic climate swings. Climate changes may locally lead to the severe reduction and splitting of plant populations. This is the case, for instance, of the disjoint Sicilian populations of *Heteropogon contortus, Artemisia alba, Sesleria nitida* ssp. *sicula, Koeleria splendens, Helictotrichon convolutum* that probably reached the island in the Pleistocene, during the dry interglacial periods (Guarino, 2006).

At the same time, the insularity and the geographical segregation of refuge areas (coastal capes and high mountain districts) promoted the survival of many biogeographical relics and the differentiation of a rich endemic flora, currently estimated in 338 species, among which the genera *Allium, Limonium, Astragalus, Anthemis, Erysimum, Centaurea, Brassica, Viola, Hieracium* display remarkable examples of schizo-endemics resulted from the splitting of ancient distribution ranges, combined with the efficient occupation of particular ecological niches.

In addition to the schizo-endemics, many Tertiary relics survived in Sicily, some of which are currently known as palaeo-endemics. This is the case, for example, of *Abies nebrodensis, Cytisus aeolicus, Erica sicula ssp. sicula, Petagnaea gussonei, Pseudoscabiosa limonifolia, Rhamnus lojaconoi, Zelkova sicula.*

As a whole, approximately 1/4 of the whole Sicilian flora (about 750 *taxa*) has got a remarkable biogeographical and systematic interest (Brullo *et al.* 1995). Many of these elements are currently threatened by the human activities.

Most natural communities have been degraded or permanently altered throughout Sicily and surrounding islets. The natural vegetation is threatened by continuing conversion to agriculture, pasture, and urban areas. Frequent fires, logging of remaining native woodlands, exotic species, intensive grazing are also common threats, as well as the touristic exploitation of the coastal districts. As Sicily has been a central crossroads of human activity for thousands of years, it offers a major perspective on all the problems and challenges of accommodating humans and nature in the much trampled Mediterranean basin.

The vegetation of the island shows almost everywhere the traces of a long-lasting exploitation of the land. The only well preserved patches of natural vegetation are limited to the most inaccessible places (cliffs, screes, rocky ledges, very steep slopes and windy ridges, plus the Etnean heights). In total, they cover a surface of about 7300 ha, i.e. 0.29% of the island (Bazan *et al.*, 2009).

With reference to the phytosociological classification of the Sicilian plant communities (Brullo *et al.* 2002), the best preserved natural plant communities of Sicily are those belonging to the following *syntaxa*: *Rumici-Astragaletea siculi* (orohopilous chamaephytic vegetation), *Scrophulario-Helichrysetea* (hemicryptophitic and chamaephytic vegetation of screes, talus slopes and riverbeds) *Saxifragion australis* (chasmophytic vegetation on alkaline rocks), *Dianthion rupicolae* (chasmophytic vegetation on acidic rocks) and, in part, *Crithmo-Limonietea* (halo-chasmophytic vegetation of rocky coasts).

The Sicilian woodlands can be also included in the relatively well preserved natural vegetation, although most of them are disturbed by husbandry and periodical coppicing. The following phytosociological units are represented (Brullo *et al.*, 2008): *Quercetalia ilicis* (holm-oak woods, cork-oak woods, plus a large number of different wood-types dominated by the turkey-oak and/or by the downy-oak: a rather intricate species-complex well-known for its extremely high variability in Sicily); *Querco-Fagetea* (beech-woods, riverside woods). In total, Sicilian woods are covering approx. 72000 ha, i.e. 2.9 % of the island.

The rest of the island is mostly colonized by secondary and synanthropic vegetation. The secondary vegetation includes chestnut-woods and reforestations, scrublands (*Quercetalia calliprini, Prunetalia spinosi*), garigues (*Cisto-Micromerietea, Cisto-Lavanduletea*), perennial semi-natural grasslands (*Molinio-Arrhenateretea, Lygeo-Stipetea*), covering in total 23.12% of the island. The synanthropic vegetation (*Onopordetea acanthii, Secalietea, Stellarietea mediae,* etc.) is widely distributed on 1,245,000 ha, i.e. nearly 50% of the island, wherever an extensive agriculture is performed (Brullo & Guarino, 2007; Brullo *et al.* 2007). Most of the Sicilian territory is occupied hard-wheat fields, but other dry-land farming, like olive groves and plantations of almond, pistachio, ash-tree, still characterizes a relevant part of the Sicilian rural landscape (Fig. 4).

Intensive agriculture covers around 25% of the island. Citrus groves, orchards, greenhouses and vineyard are included here. The impact of intensive agriculture is progressively increasing, together with the popularity of the Sicilian wines and early-fruits. Mechanized agricultural practices, chemical fertilizers and pesticides are drastically selecting the weedy plants, penalizing the Mediterranean plants and enhancing the chances of non-native weeds. Modern technology, like everywhere in the world, underpin the modern trend "from local to global". It is hard to believe that ubiquitous plants, like *Oxalis pes-caprae* or *Pennisetum setaceum,* arrived in Sicily such a short time ago. They belong to a process of "banalisation" of the landscape that is one of the newest form of global impact.

Trends at landscape scale, protected areas and management problems

As we have seen, the main feature of the Mediterranean region is a remarkable diversity of habitats, with hilly or mountainous inland and few alluvial plains in coastal sites. There is a tight coexistence of semi-natural and synanthropic ecosystems, with a great topographic and biological diversity, driven by ecological gradients of different intensity, highly influenced by the distance from the sea and by the orientation and altitude of the mountains.

The natural patchiness of the Sicilian landscapes has been often increased up to critical levels by the human activities. Land use and human demography have significantly changed during the last six decades, as a consequence of the mechanization of agriculture, the decline of the extensive land use and traditional agriculture, particularly on terraced fields (Barbera *et al.*, 2009). The development of new economic sectors, like services and infrastructures functional to the tourism, promoted the concentration of people within few miles from the coastline, with an ever increasing impact on coastal habitats. On the other hand, many lands used by agriculture or husbandry until recent times are currently abandoned, particularly in the mountain districts (Fig. 5).

One of the newest issues in the policy of the Sicilian administration is the protection of natural and cultural landscapes. The first three protected areas have been created in the year 1981 (regional law nr. 98), all three in coastal districts: Stagnone di Marsala, Vendicari, Lo Zingaro. In 1988, with the regional law nr. 14 1988, followed by the Regional Plan for wildlife preserves, issued in 1991, to the first three protected area, 79 new ones have been added. In addition to these protected areas, four regional parks were established: Etna in 1987, Madonie in 1989, Nebrodi in 1993 and Alcantara in 2001.

In more recent times, following the "Birds Directive" (79/409/EEC) and the "Habitats Directive" (92/43/EEC), the "Natura 2000 network" of Sicily includes 214 SCIs (Sites of Community Importance) and 47 SPZ (Special Protection Zone), many of which overlapping the previously mentioned regional parks and reserves. When the management plans of SCIs and SPZs will become operative, 8% of the Sicilian territory will be protected (Guarino, 2008).

Two main kinds of protected areas can be found in Sicily: those occurring on mountains are on average quite extended, the coastal ones, instead, are on average six times smaller. Many of them are just little spots that have been set to save the saveable, i.e. the few coastal traits escaped from the massive urbanization that took place in those districts in recent times. The conservation and management of the Sicilian coastal sites, exposed to the pressure of strong economical interests, is quite problematic and poses a number of specific themes (Guarino & Guglielmo, 2010).

To promote conservation strategies *in situ* for threatened habitats and species of Sicily, it is urgently needed a network of stakeholders, administrators and scientific experts which will support capacity building, management and policy actions. Unfortunately, these intentions are inevitably constrained by the lack of scientific knowledge on the ecosystem functioning and by the reality of limited economical resources. Conservation must therefore be based on the establishment of priorities, in order to determine how these limited resources could be best allocated (Guarino *et al*. 2011).

People's perception on protected areas is, in most of the cases, limited to the recreational or aesthetical function of biotopes and biodiversity: a kind of "playground for ecologists" that can be used for outdoor activities and experiential marketing. This limited view should be widened through the use of protected areas as living labs for the environmental education, to raise the public awareness on the function of ecosystems, but unfortunately managers and planners seem to be much more sensitive to the marketing and promotion of typical products and to the construction of infrastructures in order to improve accessibility and usability of these areas. This is not necessarily a negative aspect, but it can be so if it becomes the priority target for the development of protected areas. Environmental education is also education to a smart parsimony, to the reduction of waste, to the awareness of gestures. It is also education to the motion, to walk on natural terrains by adapting to the roughness of the pathways. Too many habitats and natural sceneries have been irreparably spoiled by senseless interventions to "improve" accessibility and usability. This is the case, for example, of the renowned Etnean "Rifugio Sapienza" and surrounding areas, where thousands of absent-mindedly tourists are brought on Mt. Etna "to walk on the lava", with best regards to the superficiality that already characterizes the average way of living of the urban people.

The only way to contrast these dangerous shortcuts is to look at the Natura 2000 network and, more in general, to every protected area, as a system with strong interactions with the non protected areas, i.e. part of the productive system at the basis of the economical development of the human societies. To preserve biodiversity on the long term, it would be probably more effective to reduce the energetic inputs around the protected areas, rather than to build infrastructures and to implement management plans and actions within them.

Bioclimatic Synthesis of Sicily (after Bazan G., et al. 2015: Bioclimatology and vegetation series in Sicily: a geostatistical approach. - Annales Botanici Fennici 52: 1-18)

1 Upper Cryomediterranean (UCme) - Tp=1-150
Distribution - - - Mt. Etna, at altitudes above 3000 m a.s.l.
Ombrotypes - - - Upper Hyperhumid (UHh) - - - 18<Io<24.0
Vegetation series - - - volcanic desert, without any visible vascular vegetation.

2 Lower Cryomediterranean (LCme) - Tp=150-450
Distribution - - - Mt. Etna, between 2400 and 3000 m a.s.l.
Ombrotypes - - - Lower Hyperhumid (UHh) - - - 12.0<Io<18.0
Vegetation series - - - Volcanic desert and recent lava flows with scattered pioneer vegetation of Rumici-Anthemidetum aetnensis (Brullo S. et al. 2006).

3 Upper Oromediterranean (UOme) - Tp=450-675
Distribution - - - Mt. Etna, between 2000 and 2400 m a.s.l.
Ombrotypes - - - Lower Hyperhumid (LHh) - - - 12.0<Io<18.0
Vegetation series - - - The vegetation is characterized by pulvinate shrubby communities of Astragaletum siculi (Rumici-Astragalion siculi). It forms a discontinuous formation of high phytogeographic interest with a set of endemic and rare species. Astragaletum siculi is physiognomically differentiated by the thorny pulvinate Astragalus siculus, growing together with Senecio aethnensis, Galium aetnicum, Festuca circummediterranea, Robertia taraxacoides, Tanacetum siculum and Viola aetnensis (Brullo S. et al. 2006).

4 Lower Oromediterranean (LOme) - Tp=675-900
Distribution - - - Madonie, Nebrodi, Etna between 1550 and 2000 m a.s.l.
Ombrotypes - - - Upper Humid (UHu) - - - 9.0<Io<12.0; Lower Humid (LHu) 6.0<Io<9.0
Vegetation series - - - Orophilous shrubby communities of highest peaks adapted to cold environmental conditions. The occurrence of several rare taxa with relict distribution has high phytogeographical and ecological significance. On Mt. Etna, the Astragaletum siculi becomes progressively denser and rich in taxa. In Nebrodi and Madonie Mts. the vegetation has a similar structure, but different floristic settlement, which is ascribed to the alliance Cerastio-Astragalion nebrodensis (Brullo S. et al. 2006).

5 Upper supramediterranean (USme) - It=(120)-150

Distribution - - - Madonie, Nebrodi, Etna between 1370 and 1550 m a.s.l.

Ombrotypes - - - Lower Humid (LHu) 6.0<Io<9.00; Upper Subhumid (USh) - - - 4.8<Io<6.0; Lower Subhumid (LSh) - - - 3.6<Io<4.8. The Upper Subhumid is widespread within this thermotypic horizon.

Vegetation series - - - the Upper supramediterranean thermotype is characterized by beech forests, floristically distinguished by different edaphic conditions. On Etna, in the Lower Humid horizon, the mature stage of vegetation is represented by the Epipactido meridionalis-Fagetum, floristically very poor and with a scarce shrub layer. Under the same ombrotype, the Etnean birch-woods (Cephalanthero longifoliae-Betuletum aetnensis) are also occurring, as edapho-xerophilous replacement of the Epipactido meridionalis-Fagetum sylvaticae (Brullo C. et al. 2012).

On the Sicilian Appennine, the most prevalent ombrotype in the Upper Subhumid. On carbonatic substrata of Madonie, beech woods are represented by the Luzulo siculae-Fagetum, while on siliceous substrata of Madonie and Nebrodi, the mature stage of vegetation series is Anemono-Apenninae-Fagetum. In the climatophilous belt of Luzulo siculae-Fagetum, narrow gorges with a microclimate characterized by a high degree of atmospheric moisture, on dolomites, are settled by Hieracio madoniensis-Fagetum sylvaticae. Additionally, Junipero hemisphaericae-Abietetum nebrodensis represents the edapho-xerophilous vegetation type, with a remarkable pioneer character, occurring on Madonie within the area potentially occupied by the acidophilous beech forest (Brullo S. et al. 2001).

On the northern slopes of Nebrodi, the beech forests of the Anemono apenninae-Fagetum sylvaticae are replaced by Taxus baccata forests (Ilici aquifolii-Taxetum baccatae) in stands characterized by colder and more humid and oceanic conditions. On rocky substrata, slightly acidic and well humified of Madonie, Nebrodi and Peloritani, the acidophilous holm oak forest named Geranio versicoloris-Quercetum ilicis is also found (Bazan et al. 2010).

The Lower subhumid ombrotype, on the north-eastern slopes of Etna, is characterized by mesophilous Quercus congesta woods (Agropyro panormitani-Quercetum congestae). This association in more xeric conditions is replaced by Daphno laureolae-Pinetum calabricae, and in eastern slopes of Etna at higher altitudes by Vicio cassubicae-Quercetum cerridis. In the sheltered and shady valleys, linked to more mesic conditions in comparison with the previous two associations, the Agropyro panormitani-Populetum tremulae is occurring.

6 Lower supramediterranean (LSme) - It=150-220

Distribution - - - Sicani Mts., Busambra Rock, Palermo Mts., San Calogero, Favara and Granza, Madonie, Nebrodi, Peloritani, Etna, between 960 and 1400 m a.s.l.

Ombrotypes - - - Lower subhumid. (LSh) - - - 3.6<Io<4.8; Upper dry (Udry) - - - 2.8<Io<3.6.

Vegetation series - - - Within Lower subhumid ombrotype, in the mountain ridges of Nebrodi, the most widespread type of wood is Arrhenathero nebrodensis-Quercetum cerridis. This association represents the mature stage of a vegetation series made up by the shrubby vegetation of Pruno-Rubion ulmifolii and mesophilous meadows of Plantaginion cupanii.

Arrhenathero nebrodensis-Quercetum cerridis is floristically well differentiated from other Turkey oak woods of Southern Apennines for the occurrence of several endemic species such as Arrhenatherum nebrodense, Aristolochia sicula, A. clusii.

On the northern slopes of the Nebrodi ridge, with a remarkably oceanic mesoclimate caused by the exposure to moisture condensation from the sea, the Arrhenathero nebrodensis-Quercetum cerridis is replaced by the Ilici aquifolii-Quercetum cerridis. This association is well differentiated from the floristic, ecological and syndynamic viewpoint.

Within the Arrhenathero nebrodensis-Quercetum cerridis distribution area, in the north-facing slopes of the valleys of Peloritani, with remarkably humid microclimatic conditions, the turkey oak vegetation is replaced by Melitto albidae-Fagetum sylvaticae, which has to be regarded as an extrazonal community (Brullo C. et al. 2012).

On the Madonie, on quartz sandstones and flysch, under oceanic mesoclimatic conditions, the Ilici aquifolii-Quercetum austrothyrrenicae is occurring. Within the same bioclimatic belt, on gently slopes less humid, this association is replaced by Ilici aquifolii-Quercetum leptobalani. Its physiognomy is given by the occurrence of many different oak species, such as Quercus leptobalanos, Q. congesta, Q. dalechampii and sometimes Q. ilex.

The Lower Supramediterranean Upper dry is quite a rare bioclimatic combination in Sicily, well identified by the series of the Teucrio siculi-Quercetum ilicis, limited to restricted areas of Madonie and western Nebrodi.

7 Upper mesomediterranean (UMme) - It=220-285

Distribution - - - Mountain areas between 620 and 1030 m a.s.l. This termotype is widespread on the mountain areas of Sicily: Palermo Mts., High Belice Corleonese, Sicani Mts., Madonie Mts., Upper Valley of the Salso River, Nebrodi, highest hills of Enna, Peloritani Mts., Erei Mts., Etna and Hybalean Mts.

Ombrotypes - - - Lower dry (Ldry) - Io= 2.0-2.8; Upper dry (Udry) - Io=2.8-3.6; Lower subhumid (Lsh) - Io=3.6-4.8; Upper subhumid (Ush) - Io=4.8-6.00.

Vegetation series - - - The subhumid ombrotype, occurring in the Peloritani and Etna areas is linked to acidophilous vegetation series. On Etna, it is outlined by the Agropyro panormitani-Quercetum congestae and by the Arabido turritae-Quercetum congestae. The last one is a basiphilous forest physiognomically characterized by the dominance of southern oaks, as Quercus congesta, Q. dalechampii and Q. ilex. In narrow impluvia, where there are particular environmental conditions, represented by elevated atmospheric moisture, the series of Aceri obtusati-Ostryetum carpinifoliae is found. On eastern slopes of Etna, the Doronico orientalis-Castanetum sativae is occurring: a chestnut wood that appears floristically and ecologically quite natural.

The Upper Dry ombrotype is localized on the south and western slopes of Etna, on the southern slopes of the Nebrodi and Madonie. The vegetation series is referred to the Festuco heterophyllae-Querceto congestae sigmetum, whose stationary state is a wood physiognomized by dominant Quercus congesta which grows together with other oaks, such as Q. dalechampii, Q. ilex and Q. amplifolia (Guarino et al., in press).

The Arrhenathero nebrodensis-Querco cerridis sigmetum, mainly linked to supramediterranean termotype, is gradually replaced by the Querco gussonei sigmetum in the Upper mesomediterranean belt, on siliceous sandy soils resulting from the weathering of quartz sandstones and flysch. The stands of Quercus gussonei are widespread along the northern slopes of the Nebrodi and Busambra, at elevations between 600 and 900 m a.s.l.

In the highest elevations of the Hybalean Mts. (600-900 m a.s.l.), this bioclimatic belt is correlated to Mespilo germanicae-Querco virgilianae sigmetum. The Quercus virgiliana forest represents a mesophilous plant community, strictly linked to basaltic substrata, differentiated from the other thermophilous oak woods by the occurrence of Mespilus germanica. Within this series, in localities characterized by a high degree of soil moisture, the Mespilo germanicae-Quercetum virgilianae is replaced by the edaphophilous vegetation of Lauro nobilis-Quercetum virgilianae.

The vegetation series of Teucrio siculi-Quercetum ilicis is widespread along the valleys and north-facing slopes of Sicilian mountains, on siliceous substrata (schists, granites, gneiss, vulcanites, quartz sandstones and flysch). This association is an acidophilous holm oak forest, characterized by the occurrence of calcifuge species such as Cytisus villosus, Erica arborea, Pulicaria odora, Festuca exaltata and Teucrium siculum.

On Sicani Mts. and Palermo Mts., the Sorbo torminalis-Querco ilicis sigmetum is occurring. The vegetation head o series is physiognomically characterized by the dominance Quercus virgiliana and other rare species in Sicily such as Sorbus torminalis, Physospermum verticillatum and Geocaryum cynapioides. Frequent trees in this vegetation are: Quercus ilex, Q. amplifolia, Fraxinus ornus, Acer campestre and Ostrya carpinifolia.

On calcareous and dolomitic rocks, stable screes and immature soils, the woody vegetation is usually represented by the Aceri campestris-Quercetum ilicis. It is an orophilous wood, characterized by Ilex aquifolium, Acer campestre, A. monspessulanum, Sorbus graeca and Ulmus glabra, floristically well differentiated from the other Quercus ilex woods of the Mediterranean Region.

8 Lower mesomediterranean (LMme) - It=285-350

Distribution - - - Palermo Mts, Sicani Mts., Erei Mts., uplands of the Gypsum-Sulphur Outcrops and Hybalean Mts. between 250 and 700 m a.s.l. It is the most widespread termotype of Sicily and covers the 33,9% of the regional surface.

Ombrotypes - - - Lower dry (Ldry) - Io= 2.0-2.8; Upper dry (Udry) - Io=2.8-3.6; Lower subhumid (Lsh) - Io=3.6-4.8; The distribution follow a geographical gradient, increasing from west to east and from south to north.

Vegetation series - - - The mature stands of vegetation are climatophilous forest ascribed to the orders Quercetea ilicis.

The Lower sub humid ombrotype is localized on Peloritani Mts. This thermotypic horizon is linked to the vegetation series of Erico arboreae-Quercetum virgilianae. The head of series is a forest physiognomically dominated by Quercus virgiliana with a dense shrubby layer characterized by many calcifuge species, such as Erica arborea, Cytisus villosus, Arbutus unedo, Teline monspessulana, etc. The Erico arboreae-Querco virgilianae sigmetum occur in all ombrotypes of the Lower Mesomediterranean vegetation belt, on siliceous substrata with deep and well humified soils, and is also widespread in the Nebrodi, Madonie and Eolie Islands.

The vegetation series most closely related to the Upper Dry ombrotype is Querco leptobalanae sigmetum. It is an acidophilus vegetation characterized by Quercus leptobalanos, together with Q. dalechampii, Q. congesta, Q. amplifolia.

On marl formation, in the Lower Dry ombrotype, the Pinus halepensis series is occurring. The mature stand of series is the Thymo capitati-Pinetum halepensis a pine wood with a rich shrubby layer, chiefly represented by Thymus capitatus and other sclerophyllous species such as Pistacia lentiscus, Chamaerops humilis, Phillyrea latifolia, Teucrium fruticans.

Within deep and mature soils on calcareous substrata, the most widespread vegetation series is the Oleo sylvestris-Querco virgilianae sigmetum that characterizes the whole Lower mesomediterranean belt and the Upper thermomediterranean. The different aspects of the series are connected by a catenal contact with series of Pistacio-Rhamno alaterni sigmion and Querco-Fago sigmetea.

The potential natural vegetation is a Quercus virgiliana forest which include other tree species, such as: Q. amplifolia Q. ilex, Fraxinus ornus, Acer campestre. This vegetation has more xeric requirements, as shown by the occurrence of Mediterranean species such as Olea europaea var. sylvestris, Pistacia lentiscus, Teucrium fruticans, Prasium majus, Asparagus albus.

The oak-woods of Oleo sylvestris-Querco virgilianae sigmetum are quite rare, in relation to their potential distribution, due the anthropization. These growing sites homed agricultural and pastoral activities dating back at least to the 2° Century b.C. The residual well preserved patches occur in areas owned by the church, or in private hunting reserves.

Lower Mesomediterranean and Upper Thermomediterranean thermotypes occur in 68,6% of regional area. This large surface could be probably not only linked to the Oleo sylvestris-Quercetum virgilianae. This association, and the related sigmetum should be considered sensu latu, because of the lack of knowledge on other vegetation types.

In the deep canyons of the Hyblean Plateau (Cave), the Doronico orientalis-Quercetum ilicis is found. This is a mesophilous association characterized by the dominance of Quercus ilex and sporadic deciduous oak, such as Quercus virgiliana and Q. amplifolia.

9 Upper thermomediterranean (UTme) - It=350-400

Distribution - - - Hills between 0 and 450 m a.s.l. The Termotype characterizes the hilly landscape of southern Sicily, the alluvial plains of Catania and along the Tyrrhenian coast, from Cape Zafferano to Cape of Orlando. It is a very representative bioclimatic belt of Sicily, covering 32,8% of the regional surface.

Ombrotypes - - - Upper semiarid (Usa) - Io=1.5-2.0; Lower dry (Ldry) - Io= 2.0-2.8; Upper dry (Udry) - Io=2.8-3.6; Lower subhumid (Lsh) - Io=3.6-4.8; The values of the Ombrothermic Index (Io) are increasing from south to north-east. The lowest values (Semiarid) are located in the Plain of Gela.

Vegetation series - - - The Lower dry ombrotype is linked, either to cork oak and holm oak woodlands. On the Tyrrhenian slopes of Madonie and Nebrodi, on siliceous sandy substrata, the most mature vegetation stand is represented by the Genisto aristatae-Quercetum suberis. It is a cork-oak wood dominated by Quercus suber and other trees belonging to the genera Quercus (Q. congesta, Q. dalechampii, Q. amplifolia, Q. ilex, Q. gussonei, Q. ×fontanesii) (Marino et al., 2012).

In Southern Sicily cork-oak woods are ascribed to the Stipo bromoides-Quercetum suberis. The related vegetation series is widespread in Caltagirone, Niscemi, Mazzarino territories (SE-Sicily), Menfi and Castelvetrano territories (SW-Sicily). The Stipo bromoidis-Quercetum suberis is a xerophilous association, localized on Pleistocenic sand deposits. On sandy soil of fossil dunes in SE Sicily, the Junipero turbinatae-Querco calliprini sigmetum is occurring. The series is localized between Gela and Marina di Ragusa, and around the Gulf of Castellammare.

The Junipero-Quercetum calliprini association represents a maquis with small trees of Quercus calliprinos and Juniperus turbinata growing together with Pistacia lentiscus, Phillyrea latifolia and Rhamnus alaternus.

On carbonatic substrata in the thermotype at issue, the Pistacio lentisci-Querco ilicis sigmetum and the Rhamno alaterni-Querco ilicis sigmetum are occurring. Both are Quercus ilex stands, rich in thermophilous species featuring the order Quercetalia calliprini such as: Pistacia lentiscus Rhamnus alaternus Pistacia terebinthus. The series of Pistacio lentisci-Quercetum ilicis is localized on shallow and rocky soils, widespread everywhere in the Island, Rhamno alaterni-Quercetum ilicis is localized on humid costal slopes in North-West Sicily. This association is rich of lauriphyll such as Rhamnus alaternus, Viburnum tinus, Laurus nobilis and climbers like Hedera helix, Smilax aspera, Rosa sempervirens, Rubia peregrina, etc. The more humid microclimatic conditions, due to sea breezes, determines the presence of this extrazonal vegetation linked to subhumid condition within the lower dry ombrotype horizon (Marino et al., 2013).

10 Lower thermomediterranean (LTme) - It=400-450

Distribution - - - Costal areas between 0 and 220 m a.s.l. The termotype unit characterizes the costal area of the whole Region and covers the 11,5% of its surface.

Ombrotypes - - - Upper semiarid (Usa) - Io=1.5-2.0; Lower dry (Ldry) - Io= 2.0-2.8; Upper dry (Udry) - Io=2.8-3.6; Lower subhumid (Lsh) - Io=3.6-4.8. The values of the Ombrothermic Index (Io) are increasing from south to north-east. The lowest values (Semiarid) are located in the Plain of Gela; the most humid (subhumid) along the coast of the Strait of Messina.

Vegetation series - - - The vegetation of Lower subhumid ombrotypes is characterized by the occurrence of Pinus pinea woodlands, with a shrub layer rich in acidophilus species belonging to Cisto-Lavanduletea such as: Cistus crispus, C. salvifolius, Tuberaria guttata, Erica arborea. The vegetion series of Cisto crispi-Pino pineae sigmetum is linked to sandy schistose soils of NE Peloritani, near Messina (Bartolo et al. 1994).

The Upper dry ombrotype is characterized by the occurrence of Oleo-Euphorbio dendroidis sigmetum. The head vegetation series, Oleo-Euphorbietum dendroidis, in most of the Island has to be considered an azonal community linked to the steepest rocky slopes. However, within the coastland of Etna and Peloritani, the coastland of Agrigento and the islands of Lipari, Vulcano, Ustica, this association represents a climatophilous community.

Lower dry obrotype is characterized by the occurrence of shrublands/maquis communities, chiefly dominated by evergreen sclerophyll and summer-deciduous shrub, belonging to the alliance Oleo-Ceratonion siliquae. The mature stand of vegetation series are: Chamaeropo humilis-Quercetum calliprini, Pistacio lentisci-Chamaeropetum humilis, Myrto communis-Pistacietum lentisci and Calicotomo infestae-Rhoetum tripartitae. These associations are widespread especially along the coastland of Sicily and are related to different substrata. These vegetation series are in catenal contact with the climatophilous series of Querco ilicis sigmetalia and halophilous communites of Chritmo-Limonietea.

11 Upper Inframediterranean (UIme) - It=450-515

Distribution - - - Lampedusa at from 0 to 30 m a.s.l.

Ombrotypes - - - Lower Semiarid (Sar) - Io=1.0-1.5. Localized on the East part of Lampedusa Island.

Vegetation series - - - Periploco-Juniperetum turbinatae sigmetum. The head of vegetation series is a termo-xerophilous maquis physiognomized by Juniperus turbinata and Periploca angustifolia. Abundant are some shrubs of Quercetalia calliprini such as: Pistacia lentiscus, Prasium majus, Olea europea var. sylvestris, Teucrium fruticans, Asparagus albus, etc.

ITINERARIES

Riccardo Guarino & Salvatore Pasta

PLEASE, NOTE: hiking time refers to the approximate time spent walking/moving on terrain in a very relaxed mood. You are supposed to make frequent stops along the trail, to observe vegetation/rare plant species/scenic views. The time spent in this way, as well as for lunch/technical breaks, is not included in the computation of the hiking time.

All the excursions are on hiking trails and cross terrain with exposed rock faces, where falls are possible. Hiking boots and outdoor wear for all temperatures between 12° and 35 °C will be needed. Be prepared to spend the whole day outside, including many hours in very sunny places, with no shade at all and temperatures up to 35°C (95°F), occasionally windy. The sites visited during the hikes are also home to wildlife that may be dangerous, including but not limited to snakes and disease-carrying invertebrates. A repellent could be used to spray your clothes before the hikes, however you should be aware that the byte protection cannot be guaranteed and the application of the repellent can cause mild skin irritation and burning.

The authors are not responsible any damage or personal injuries may result from the hikes discussed on this website. All outdoor activities are carried out at your own risk. **Please consider this before you go**!

I
The coastal capes around Palermo

Itinerary1 - Capo Gallo

Capo Gallo is a promontory closing the NW side of the Gulf of Palermo. We will walk along the north-western cliff of Mt. Gallo, a thick layer of Mesozoic limestone, 586 m high, shaped by the combined effect of karst processes and intense tectonic uplift. The botanical wealth of the reserve is ensured by the occurrence of three exclusive endemites (*Hieracium lucidum*, *Limonium panormitanum*, *Genista gasparrinii*) and one, *Anthemis ismelia*, in common with the nearby Mt. Pecoraro. They are found on the huge vertical cliffs (Dianthion rupicolae) and, occasionally, in the *Oleo-Euphorbietum dendroidis* fringing the steepest part of the pediment. The hike develops on the debris at the base of the cliff, which was terraced and cultivated since ancient times (olive tree, grapewine and sumac) and currently, after the abandonment, it is colonized by a perennial dry grassland dominated by *Ampelodesmos mauritanicus* and *Erica multiflora*. The vegetation dynamic along the hike is frequently affected by wildfires, that hamper the evolution towards an evegreen maquis (*Rhamno alaterni-Quercetum ilicis*), still occurring on the less accessible sites. In the second part of the trail we will enjoy the vegetation of rocky coasts (Crithmo-Limonietea), characterized by *Limonium bocconei*, endemic to the NW coast of Sicily.

Trail: Length: 4 km round trip, Hiking time: 1.5 hrs., Elevation range: 360 m

Itinerary2 - Capo Zafferano

Capo Zafferano is a promontory closing the SE side of the Gulf of Palermo. We will walk along the northern cliff of the cape, consisting of a 226 m high outcrop of dark microcrystalline limestones, dolomitized upwards. The rugged morphology preserved a vegetation of high naturalness and great scientific interest. The vertical cliffs are colonized by the endemite rich vegetation of *Scabioso creticae-Centauretum ucriae* (Diathion rupicolae), while on the debris at the base of the cliff, the vegetation dynamic is affected by a millennial husbandry and frequent wildfires, that hamper the evolution towards a thermoxerophilous maquis, here represented by the *Oleo-Euphorbietum dendroidis* on steep stony slopes and by the *Pistac-*

io-Chamaeropetum humilis in more gently sloping sites. As a consequence of frequent fires, the most abundant vegetation on Capo Zafferano are two perennial dry grasslands: the *Helictotricho-Ampelodesmetum mauritanici* on deeper soils and cooler sites and *Bothriochloo panormitanae-Hyparrhenietum hirtae* in drier sites, on stony-gravelly, partially eroded soils. At the end of the trail, next to the lighthouse of the cape, we will approach the rocky shoreline to observe the aerohaline vegetation described as *Limonietum bocconei limbardetosum crithmoidis* (Crithmo-Staticion).

In the afternoon, we will visit the archaeological site of Solunto, at 183 m a.s.l., on the SE side of Mt. Catalfano, near Capo Zafferano. Solunto was an Hellenistic town built in accordance with the urbanistic rules proposed by Hippodamus of Miletus. The Hippodamian plan is revealed by broad, straight streets, cutting one another at right angles and by the wide central area, which was intended to be the "*Agora*", i.e the centre of both the city and the society.

Trail: Length: 3km, Hiking time: 1 hr, Elevation range: 130 m

Itinerary3 - Solunto

Soluntum (in ancient Greek: Σολόεις or Σολοῦς, Solūs) is located about 16 km east of Palermo at 183 m a.s.l., on the SE side of Mt. Catalfano, where it was re-founded around IV century BC in a naturally protected area, after the destruction of the original homonymous Phoenician settlement (VII-VI century BC), located approximately 2 km southwards. The new Hellenistic town of Soluntum remained loyal to Carthaginians until the end of the First Punic War (265 BC). Under Roman dominion it became a municipal town of little importance; gradually abandoned, it was almost desert already in the II-III centuries AD, although the finding of some coins testifies the sporadic human presence in the site in the following centuries.

The excavations, started on 1825, have brought to light considerable remains of the Hellenistic and Roman period. Despite the unevenness of the ground, most of the streets were laid out regularly and intersected at right angles following the Hippodamian system. The traces of two ancient roads, paved with large blocks of stone, which led up to the city, may still be followed. A huge statue of Zeus-Jupiter found in this site is now conserved at the archaeological museum 'A. Salinas' of Palermo.

Trail: Length: 1.4 km round trip, Hiking time: 0.5 hours, Elevation range: 80 m

General Description

1.1. Physical setting

The Mounts of Palermo belong to the Sicilian-Maghrebid Foreland-Thrust belt connecting the NW African mountain ranges and the Apennines. Calcareous rocks (limestones and dolomias) are the most common rock outcrops, although marls, radiolarites and sandstones many prevail somewhere. These thick layers of calcareous rocks testify the long-lasting tropical conditions (from Upper Trias to mid Eocene, i.e. approximately 228-40 Ma BP) favouring the spread of coral reefs throughout Tethys, the ocean which separated Eurasia from present Africa and Oceania. The coastal plains are made of both marine and continental deposits accumulated between upper Pleistocene (1.81-0.78 Ma) and Holocene. Fairly all the coastal capes experienced repeated phases of insularity, as testified by paleontological data concerning the vertebrate fauna.

View of the the north-western cliff of Mt. Gallo, with the trail across a perennial dry prairie dominated by Ampelodesmos mauritanicus and Erica multiflora, colonizing the debris at the base of the cliff.

The Rhamno alaterni-Quercetum ilicis (Fraxino orni-Quercion ilicis) is confined to the most impervious places by the periodical fires affecting the basal areas of Mt. Gallo. Vertical cliffs are colonized by the endemite rich vegetation of Scabioso creticae-Centauretum ucriae (Diantion rupicolae).

While the innermost Mounts of Palermo frequently exceed 1,000 m a.s.l., the steep coastal capes hardly go beyond 600 m a.s.l.. Their harsh morphology, characterized by abrupt slopes, vertical and even overhanging cliffs and wide screes, has been shaped by the combined effect of karstic processes and local and regional intense tectonic uplift.

According to USDA soil taxonomy, the area hosts a combination of rock outcrops, lithic xerorthents (shallow soils with pH ≥7 and typic and/or lithic rhodoxeralphs ('terra rossa', pH <7).

According to Rivas-Martínez bioclimatic classification, the area is subject to lower Thermomediterranean thermotype and lower subhumid ombrotype. Yearly temperatures are of 17-18 °C, and the highest mean monthly temperatures never exceed 25 °C (August) and never go below 8 °C (January). Frost is a very rare event, occurring once every 20-30 years. The annual amount of rainfall is approximately 600-700 mm, with 4-5 months of drought stress between May and September.

As the calcareous rocks are intensely fractured and subject to karstic processes, most of the rainfall penetrates deep underground feeding a very complex aquifer. The only rivers which deserve to be mentioned are the Eleuterio (ca. 35 km long), flowing down from Rocca Busambra, the Oreto which crosses the Plain of Palermo (ca. 21 km) and the Nocella (ca. 18 km) in the Plain of Partinico.

The almost total lack of sand beaches (only few ones occur at Mondello, Arenella and Romagnolo near the city of Palermo) is due to ongoing tectonic uplift. In fact, most of the coastline is rocky and often bordered (e.g. at Sferracavallo and Isola delle Femmine) by living intertidal structures similar to coral reefs, called 'trottoirs' (= pavements in French), built up by two co-occurring calcium-accumulating organisms, red algae and molluscs, and/or delimited by steep and high costal cliffs (Capo Zafferano, Terrasini).

1.2. Flora and vegetation

The surroundings of Palermo probably are among the best studied areas of the whole Mediterranean. In fact, already at the end of XVII century S. Boccone and F. Cupane described lots of plants observed in this territory. Since the end of the XVIII (B. da Ucria) and the XIX century many good botanists, like A. Bivona-Bernardi, C. S. Rafinesque-Schmaltz, F. Parlatore, V. Tineo, G. Gussone, A. Todaro and M. Lojacono-Pojero, lived in Palermo and thoroughly explored its territory, which was an almost obligatory stop-over for many European scholars (e.g. C.B. Presl, C.F. Nyman, J.F. Schouw, etc.) who visited the island to become familiar with the Mediterranean plants. Hence, it is not surprising if this area is the 'locus classicus' of plenty of species described in that period.

According to Brullo et al. (1995), the whole area of the Mts. of Palermo belongs to the Drepano-Panormitan district, which figures among the species-richest areas of Sicily (>2000 taxa of vascular plants, more than 30 local or Sicilian endemics) and is listed among the Italian Important Plant Areas (hereinafter IPAs) with the code 'SIC 10 - Capo Gallo, Rilievi di Palermo e F. Oreto').

The coastal sector of the Mounts of Palermo hosts many endemic vascular plants. Some of theme are extremely localised, like *Hieracium lucidum*, *Limonium panormitanum*, *Genista gasparrinii* and *Anthemis ismelia* which only occur on Monte Gallo, and *Limonium poimenum*, endemic to M. Pecoraro. Other species with a wider distribution range are exclusive of this area: for instance, the population of *Aristida coerulescens* growing on the S-facing slopes of M. Gallo and that of *Lathyrus saxatilis* at Mt. Catalfano are the only ones of Italy and Sicily, respectively.

The southern slopes of Mt. Gallo are heavily invaded by Pennisetum setaceum, which outmatched the Bothriochloo panormitanae-Hyparrhenietum hirtae in the last four decades. This new neophytic vegetation has been described as Penniseto setacei-Hyparrhenietum hirtae.

Zonal vegetation

Due to the millenary impact of man on this area, no true forest assemblages occur. Some fragments of evegreen maquis (QUERCETEA and QUERCETEALIA ILICIS) occur on less accessible sites, enjoying the air humidity coming from the sea, like those on the E- and N-facing slopes of M. Pellegrino (Rotoli and Addaura), ascribed to *Rhamno alaterni-Quercetum ilicis* and rich in lauriphyllous (*Hedera helix*, *Laurus nobilis* *Rhamnus alaternus*, *Viburnum tinus*) and deciduous (*Fraxinus ornus* and *Pistacia terebinthus*) woody species. The margins of these woodlands are often covered by mantle communities (PRUNO SPINOSAE-RUBION ULMIFOLII) referred to *Clematido cirrhosae-Rubetum ulmifolii*, where C*eltis australis* and several alien woody species (*Ailanthus altissima*, *Asclepias fruticosa* and *Cercis siliquastrum*) frequently occur.

The steep, rocky and wind-exposed areas are characterised by *Euphorbietum dendroidis*, an open thermophilous scrub rich in both summer-deciduous species, like *Euphorbia dendroides*, *E. bivonae*, *Anagyris foetida*, and evergreen sclerophyllous plants typical to the alliance OLEO-CERATONION, like *Olea europaea* var. *sylvestris*, *Phillyrea latifolia*, *Pistacia lentiscus*, etc.

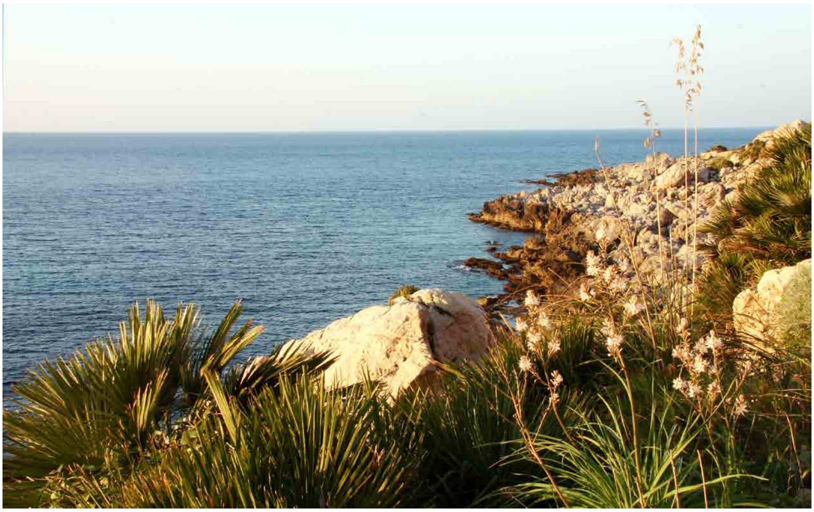
Along the NW slopes of Mt. Gallo, all seral stages of the Rhamno alaterni-Querceto ilicis sigmetum can be observed.

The nuclei of open maquis dominated by *Chamaerops humilis* which still occur near the coasts of M. Catalfano, Sferracavallo and Capo Rama probably issue from the degradation of other evergreen maquis assemblages, such as *Pistacio lentisci-Chamaeropetum humilis* (Mt. Pellegrino) and *Chamaeropo humilis-Quercetum calliprini* (Mt. Catalfano and Terrasini).

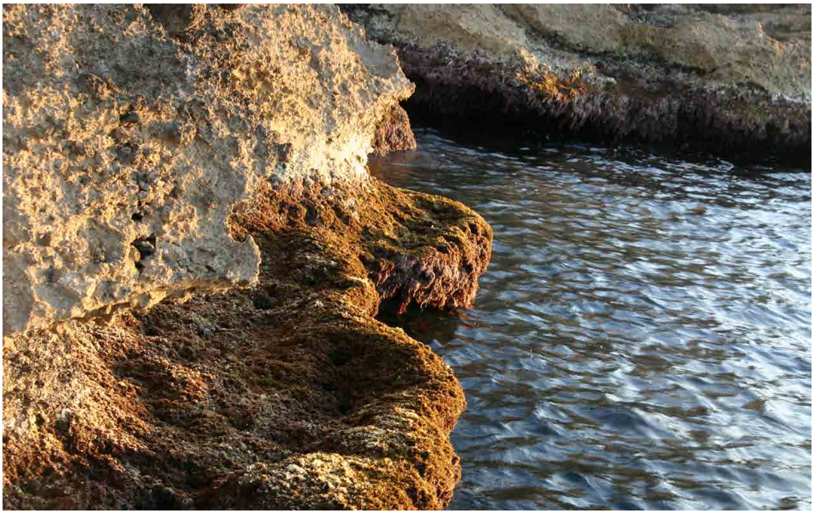
The scattered occurrence of *Ziziphus lotus* near the sea-shores on the E and NE slopes of M. Pellegrino (*Asparago acutifolii-Ziziphetum loti*) may issue from its past introduction of from Phoenicians or Romans. On the other hand, the past presence of some small spots of thermo-xerophilous summer-deciduous maquis (alliance PERIPLOCION ANGUSTIFOLIAE) on the edge of NW Sicilian promontories cannot be completely discarded. In fact, at the beginning of the XIX century other species with similar ecological requirements, were reported to thrive there, such as *Rhus pentaphylla* at Mt. Pellegrino and near Mt. Catalfano, and *Rhus tripartita* for Santa Flavia near Mt. Catalfano.

The base-rich or subacid (terra rossa) shallow soils host several typologies of garrigue. These subshrub communities are referred to the central-Mediterranean alliance CISTO ERIOCEPHALI-ERICION MULTIFLORAE and are represented by the associations *Micromerio fruticulosae-Ericetum multiflorae* (present at Mt. Catalfano and endemic to NW Sicily and Egadi Islands), *Brachypodio ramosi-Cistetum cretici* (endemic to NW Sicily) and *Genistetum gasparrinii* (endemic to the upper ridges of Mt. Gallo).

Due to millennia of deforestation, overgrazing and wildfires, most of the surface of the coastal capes near Palermo is covered with thermo-xerophilous grasslands referred to the order HYPARRHENIETALIA HIRTAE. More in detail, the association *Hyparrhenietum hirto-pubescentis* is rather common on the abandoned agricultural terraces of Mt. Gallo and Mt. Pellegrino. In suburban areas it is often substituted by a ruderal community dominated by the alien invasive *Boehravia coccinea* (*Boerhraavio viscosae-Oryzopsietum miliaceae*, BROMO-ORYZOPSION MILIACEAE). The exceptionally arid (S-facing and/or wind-exposed) sites host xerophilous grasslands referred to the alliance ARISTIDO COERULESCENTIS-HYPARRHENION HIRTAE (*Cenchro ciliari-Hyparrhenietum hirtae* and *Bothriochloo panormitanae-Hyparrhenietum hirtae* on the Mts. Pellegrino and Catalfano, *Heteropogono contorti-Hyparrhenietum hirtae* on Mt. Pellegrino). These communities host plenty of perennial grasses belonging to Pale-



The coastal maquis of Pistacio-Chamaeropetum humilis (Oleo-Ceratonion siliquae) and, in the background, the rocky coast colonized by the Limonietum bocconei (Crithmo-Staticion)



The coastline of Mt. Gallo is bordered by living intertidal structures similar to coral reefs, called 'trottoirs' (= pavements in French), built up by two co-occurring calcium-accumulating organisms: red algae and a molluscs (Dendropoma petraeum and Vermetus triquetrus).

otropical genera such as *Aristida caerulescens*, *Cenchrus ciliaris*, *Megathyrsus bivonianus*, *Heteropogon contortus*, *Bothriochloa insculpta* susbp. *panormitana*, as well as narrow endemics like *Allium panormitanum*. During last decades an invasive alien grass, *Pennisetum setaceum*, was able to invade these xeric communities and to turn them into species-poor assemblages (*Penniseto setacei-Hyparrhenietum hirtae*).

The top of the considered hills and their N-facing slopes are mostly covered by *Helictotricho convoluti-Ampelodesmetum mauritanici*, a species- (and endemic species-)rich community endemic to the calcareous lithosoils of NW Sicily.

Two associations (*Thapsio garganicae-Feruletum communis* and *Carlino siculae-Feruletum communis*) referred to the recently described alliance CHARYBDIDO PANCRATII-ASPHODELION RAMOSI occur in the area. These communities are perfectly adapted to stand overgrazing, frequent burning and soil erosion and are dominated by (mostly) poisonous geophytes (e.g. *Charybdis pancration*, *Mandragora autumnalis*, etc.) and/or spiny (e.g. *Carlina* spp.) hemicryptophytes.

The above-mentioned perennial grasslands are often intermingled with therophytic ephemeral prairies which may be referred to TRACHYNION DISTACHYAE. Although only two associations, i.e. *Vulpio ciliatae-Trisetarietum aureae* and *Thero-Sedetum caerulei*, have been reported for the territory, plenty of other species characteristic of this class may be encountered.

On the coastal areas influenced by salt-spray two associations (*Anthemido secundirameae-Desmazerietum siculae*) referred to the order STIPO-BUPLEURETALIA SEMICOMPOSITI have been detected. Among the numerous characteristic of the order and the alliance.

Vegetation of coastal ecosystems

Many endemics of the Drepano-Panormitan district (e.g. *Allium obtusiflorum*, *Desmazeria sicula*, *Limonium bocconei*, *Limonium flagellare*, *Romulea linaresii* subsp. *linaresii* and *Silene crassiuscula*) and other plants of high biogeographic and conservation interest (e.g. *Allium lehmanii*, *Anthemis secundiramea*, *Camphorosma monspeliaca*, *Galium verrucosum* subsp. *halophilum*, etc.) thrive on sea-facing cliffs and along rocky shores.

The halo-nitrophilous annual communities of sandy-loamy salted soils (SAGINETEA MARITIMAE and FRANKENION PULVERULENTAE) are ascribed to the local association *Anthemido secundirameae-Desmazerietum siculae*.

Two most common vegetation units of Capo Zafferano are the vegetation of Scabioso creticae-Centauretum ucriae (Diantion rupicolae) on the cliffs and the Helictotricho-Ampelodesmetum mauritanici (Avenulo ampelodesmion mauritanici) on the pediment under the cliffs. The Ampelodesmos-vegetation tends to evolve into the Pistacio-Chamaeropetum humilis (Oleo-Ceratonion siliquae) but the wildfires periodically restart the succession.

The vegetation of the rocky cliffs has direct sunlight only few hours a day and benefits from the humid sea breeze that buffers the summer aridity.

As for the litho-halophilous chasmophitic communities, the class CRITHMO-STATICETEA is locally represented by *Limonietum bocconei* (endemic to NW Sicily and Egadi Islands), *Limonietum flagellaris* (coasts of NW Sicily between Palermo and Mt. Cofano) on the rocky shores subject to marine salt-spray, and by *Hyoseridetum taurinae* on the rocky cliffs near the coast.

The rare (and often degraded) spots of halo-nitrophilous annual vegetation of the coastal strandlines (CAKILETEA MARITIMAE) may be referred to the alliance EUPHORBION PEPLIS and to the associations *Salsolo kali-Euphorbietum paraliae* and *Salsolo kali-Cakiletum maritimae*.

The halo-hygrophilous hemicryptophitic vegetation of brackish swamps (JUNCETEA MARITIMI) has disappeared along with the drainage of the retrodunal lagoon of Mondello, carried out at the end of the XIX century. Hence, no local communities may be ascribed to this class, with the exception of some pure stands of *Juncus maritimus* located in areas covered with marine water during winter storms (Capo Rama and Isola delle Femmine islet).

As for the halo-hygrophilous scrubland (SALICORNIETEA FRUTICOSAE), small nuclei of *Limoniastrum monopetalum* occur near Terrasini. Thanks to their tolerance to high nitrate and phosphate soil content, *Suaeda vera* and/or *Arthrocnemum glaucum* mostly occur on microinsular areas (e.g. Isola delle Femmine, Isolotto near Capo Zafferano) where they dominate species-poor chenopod scrubs in the nesting sites of the yellow-legged seagull (*Larus michahellis*).

Vegetation of cliffs, walls and screes

Several moss- and fern-rich communities linked to the humid and dripping cliffs (ADIANTETEA) are scattered in the territory: a good example of *Eucladio verticillati-Adiantetum capilli-veneris* can be observed in the XVI century sanctuary of Santa Rosalia, the patron saint of Palermo, on Mt. Pellegrino.

Also the chasmo-chomophytic and epiphytic moss- and fern-communities (POLYPODIETEA and POLYPODION SERRATI) are quite common.

The chasmophytic vegetation of local undisturbed base-rich rocky cliffs (DIANTHION RUPICOLAE) is ascribed to *Scabioso creticae-Centauretum ucriae*. Within this association two subassociations have been described, *helichrysetosum straminei* from Mt. Pellegrino westwards and *Centauretosum todari* from Mongerbino-Mt. Catalfano

The interstitial space of the perennial vegetation is colonized by species-rich annual communities (Trachynion distachyae. Their survival is ensured by disturbances, such as rockfalls, landslides, periodical fires. Their spatial pattern is influenced by the seed rearrangement and predation by ants. Preliminary data from a decennial monitoring of the species distribution patterns in the annual dry grasslands of Capo Zafferano suggest that there is a demographic fluctuation between Poaceae (essentially: Bromus and Trachynia) and dicots. Every three-four years the Poaceae became so dense and clumped that their seed productivity dramatically drops down and this benefits dicots in the following year.

eastwards. Plenty of interesting plants may co-occur on the same site, e.g. district endemics (*Asperula rupestris*, *Centaurea panormitana* subsp. *ucriae*, *C. panormitana* subsp. *umbrosa*, *Euphorbia bivonae* and *E. papillaris*, *Galium pallidum*, *Helichrysum panormitanum* subsp. *stramineum*), Sicilian endemics (*Centaurea panormitana* subsp. *todari*, *Cymbalaria pubescens*, *Helichrysum panormitanum* subsp. *latifolium*, *Odontites bocconei*, etc.), circum-Tyrrhenian endemics (*Asplenium petrarchae* subsp. *petrarchae*, *Brassica rupestris* subsp. *rupestris*, *Convolvulus cneorum*, *Dianthus rupicola* subsp. *rupicola*, *Glandora rosmarinifolia*, *Hyoseris taurina*, *Iberis semperflorens*, *Matthiola incana* subsp. *rupestris*, *Seseli bocconei*, etc.).

Several communities linked to rock crevices (ASPLENIETALIA LANCEOLATO-OBOVATI), such as *Phagnalo saxatilis-Cheilanthetum maderensis* and *Cosentinietum bivalentis* occur on Mt. Pellegrino and Mt. Gallo, while the chasmo-nitrophilous vegetation of disturbed rocky cliffs and stone walls (CYMBALARIO-PARIETARIETEA DIFFUSAE) is locally represented by numerous communities referred to CYMBALARIO-ASPLENION (e.g. *Sedo dasyphylli-Ceterachetum officinarum*) and ARTEMISION ARBORESCENTIS-CAPPARIDION SPINOSAE (*Capparidetum rupestris*, *Centranthetum rubri*, *Parietarietum judaicae* and *Antirrhinetum siculi*).

The pioneer community typical to local screes (*Sedo sediformis-Centranthetum rubri*) belongs to the endemic alliance EUPHORBION RIGIDAE.

Hydro-hygrophilous vegetation

There are no temporary ponds, with the exception of the few small ones on Mt. Pellegrino, like the Gorgo di Santa Rosalia (see Box 1.2), covered by the floating hydrophyte *Lemna minuta* (LEMNETEA MINORIS) in early spring and dominated by another alien plant, *Paspalum distichum* (PASPALO-AGROSTION VERTICILLATI) before complete drying up during summer season.

The embankements of local rivers and streams host some communities dominated by few rhizomatous helophites which belong to the alliance PHRAGMITION COMMUNIS. Some of these assemblages, linked to meso- and eutrophic slow flowing waters, are very common throughout Europe, like *Phragmitetum communis* and *Typhetum latifoliae*, while *Caricetum pendulo-panormitanae* is endemic of the river Oreto. The muddy and shallow river banks are often covered by *Helosciadetum nodiflori* and *Nasturtietum officinali* (GLYCERIO-SPARGANION).

Local streams and drainage canals are often covered by *Calystegio sylvaticae-Arundinetum donacis* a sciaphilous-nitrophilous megaphorb community ascribed to EPILOBIETEA ANGUSTIFOLII-CONVOLVULETALIA SEPIUM.

Anthropogenic vegetation

The chaotic urbanisation of the plains and coastal areas, the high number of abandoned infrastructures and the ongoing abandonment of agricultural practices explain the high frequency of winter-annual weedy and ruderal communities linked to man-made habitats (CHENOPODIETEA).

To CHENOPODION are referred several nutrient-demanding ruderal assemblages (*Lavateretum cretico-arboreae*, *Chenopodio muralis-Parietarietum diffusae*), while the winter-annual ruderal association *Hordeo leporini-Centauretum macracanthae* (HORDEION MURINI) occurs in disturbed xeric suburban areas on man-made and nutrient-rich soils like sheepfolds and landfills. To ECHIO-GALACTITION TOMENTOSAE should be ascribed the tall-herb ruderal vegetation occurring on calcareous nutrient-rich soils typical to abandoned crop fields and to fallows subject to frequent wildfires.

The plant communities of GERANIO PURPUREI-CARDAMINETALIA HIRSUTAE are linked to more mesic conditions due to tree canopy shade and water input. Dense olive groves are characterised by a nitro-sciaphilous geophyte-rich fringe community called *Acantho mollis-Smyrnietum olusatri* (ALLION TRIQUETRI). The alliance VALANTIO MURALIS-GALION MURALIS, including all the (sub)nitrosciaphilous winter-annual fringe and wall communities of the central-eastern Mediterranean, is locally represented by the *Valantio murali-Polycarpetum alsinifolii*, also found underneath garrigue and open maquis communities. The alliance VERONICO-URTICION URENTIS includes the subnitro-sciaphilous weed assemblages of the fertilized and irrigated *Citrus* groves on alluvial soils of the central Mediterranean; it is locally represented by *Bromo sterili-Brassicetum sylvestris*.

Together with irrigated annual crop fields, *Citrus* orchards also host thermophilous communities rich in summer-annual C4 plants (mostly thermo-cosmopolitan aliens such as *Amaranthus* spp., *Cyperus* spp., *Eragrostis* spp., *Setaria* spp., etc.) referred to DIGITARIO SANGUINALIS-ERAGROSTIETEA MINORIS, locally represented by *Setario glaucae-Echinochloëtum coloni*.

Steep stony slopes are colonized by the Oleo-Euphorbietum dendroidis (Oleo-Ceratonion siliquae), in which also many species of the vertical cliffs occur (for instance Convolvulus cneorum, in the left corner of the photo). These are the preferred nesting sites of sea gulls (Larus michahellis)

The local annual nitrophilous assemblages typical to trampled areas belong to *Polycarpo tetraphylli-Spergularietum rubrae* and *Trisetario aureae-Crepidetum bursifoliae* (POLYGONO-POËTEA, POLYCARPION TETRAPHYLLI:).

The overgrazed pastures host some (sub)xerophilous and hyper-nitrophilous ruderal communities dominated by perennial herbs (mostly thistles) referred to the order CARTHAMETALIA LANATI, and locally represented by the *Scolymetum maculato-grandiflori*.

Many suburban landfills and the banks of drainage and sewage canals are colonized by nitrophilous pioneer assemblages referred to the NICOTIANO GLAUCAE-RICINION COMMUNIS, dominated by many fast-growing alien thermo-cosmopolitan invasive species such as *Arundo donax*, *Nicotiana glauca*, *Ricinus communis*, *Tropaeolum majus* and *Parkinsonia aculeata*.

1.3. Landscape and land use history

The famous upper Paleolithic incisions and paintings of the caves of Mt. Gallo and Mt. Pellegrino testify at least 10,000 years of human presence and land use in the surroundings of Palermo. The early colonization of this area was probably due to many favourable factors such as high freshwater availability, abundant marine food resources, caves, high availability of preys (mammals, birds) to hunt, large and wind-sheltered docking sites. The settlements in the area increased in number and density during the Neolithic, the Copper and the Bronze age. Around VIII century BC Phoenicians founded two important *emporia* (markets) near M. Catalfano and Mt. Pellegrino, whose present names, i.e. Solunto and Palermo, do not derive from the original ones, i.e. 'Kfr' and 'Sys' (= flower), but from those given by Greek neighbours, i.e. 'Solūs' and 'Pánormos' (= all port). To underline the economic importance of Palermo also for the enemies, its cultivated plains were renowned in all the Mediterranean basin with the Greek name of 'ho kēpos' (= 'the' garden).

The area was of strategic importance during the first Punic war. Under Roman and Byzantine rule (c. 250 BC-850 AD) Panhormus was one of the most important cities of the island, but it became the capital only after the Arabs besieged and conquered Syracuse and destroyed its walls (878 AD). 'Balarm' was one of the wealthiest cities

The rocky shoreline is colonized by aerohaline vegetation (Limonietum bocconei limbardetosum crithmoidis, Crithmo-Staticion).

of the whole Muslim Empire. Having the opportunity of applying their hydraulic knowledge in an area full of springs, Arabs improved and diversified the local agricultural production by introducing new techniques, new engines, new species (e.g. date palms, eggplants, rice, sesame, sugar cane, etc.). The magnificent (and efficient) cultural landscape shaped by Arab farmers looked like a green mosaic of gardens, streams, natural and artificial ponds, crop fields, orchards, olive groves and wide wild areas used as hunting reserves. The so-called 'Genoard' (from the Arab 'Jannat al-ard' = the Garden – or Paradise - on Earth) was still admired by European travellers visiting the area under Norman kings and Swabian emperors (XI-XIII centuries).

A rapid change on local landscape occurred during the first decades of the XIV century, when sugar cane plantations covered most of the plain. Between 1320 and 1450 Palermo was the main sugar producer in the whole Mediterranean area. This monoculture probably had a deep impact on local ecosystems (e.g. drainage of many wetlands, canalisation of streams, exhaustion of springs) and blew up the remnant mountain forests, because wood was necessary to transport the row canes and to produce the heat to obtain the sugar. By the end of XV century, with the collapse of local sugar economy, the most common cultures became vineyards, cereal crops and fruit orchards on deeper soils, while stress-tolerant woody plants like *Olea europaea*, *Amygdalus communis*, *Ceratonia siliqua*, *Crataegus azerolus*, *Ficus carica*, *Fraxinus ornus*, *Olea europaea* and *Rhus coriaria* were cultivated in less suitable areas and also on the slopes of the mountains.

No significant changes occurred until the end of the XVIII century, when the plain and the slopes of the mountains were irrigated once again and converted into 'artificial woody agro-ecosystems' with *Citrus* spp., *Diospyros kaki* and *Eriobotrya japonica*.

No or few information is available on the land use history of the mountainous areas, which probably were subject to millenary overgrazing. As a matter of fact, many photos and postcards of the beginning of the XX century clearly show the total lack of woody cover on Mt. Pellegrino. Between 1930s and 1970s intensive reforestation with non-native trees (*Pinus halepensis*, *Cupressus sempervirens* and *Eucalyptus camaldulensis*) were carried out on the coastal hills near Palermo.

After the Word War II the combined effect of demographic boom and the crisis of citrus market induced another dramatic change of local landscape, an irreversible one. After two millennia the territory of Palermo has lost its agricultural identity, and nowadays it is almost completely covered with buildings and second houses from the foothills to the coastline. The city hosts nearly a million inhabitants and there is no gap between Terrasini and Bagheria.

The ecosystems coping with this overcrowded area are threatened with habitat fragmentation, soil and air pollution, freshwater pollution and salinisation. Also non native plant invasions pose a serious threat to local botanical heritage; not surprisingly, here many alien tropical plants became wild for the first time in Italy and Europe.

As concerns nature protection, Mt. Gallo, Mt. Pellegrino, Isola delle Femmine and Capo Rama are nature reserves, and the coastal capes fall almost entirely within the regional Natura 2000 network.

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Box 1.1. *Santa Rosalia heritage: blessing or curse?*

Mount Pellegrino is where Rosalia Sinibaldi, the patron saint of Palermo, is believed to have spent her last years during XIII century. Rosalia was also proposed as the patron saint of evolutionary studies and biodiversity by the American hydrobiologist G.E. Hutchinson (1959). His observations of the co-occurrence of several predators in a small temporary pond near the cave where the remains of the Norman noblewoman were found inspired him to write a very influential paper on niche width, disturbance regime and competition.

Today Mount Pellegrino is characterized by two co-occurring contrasting features: 1) it figures among the Italian Important Plant Areas because its vertical rock cliffs burst with endemic species, but 2) this large protected area is surrounded by an even larger city (c. 800,000 inhabitants) and is subject to habitat fragmentation, vehicular traffic, forest plantation, wildfires, etc. These disturbance factors favored the establishment and the spread of invasive alien plants, which are increasing in number, frequency and cover. As a consequence, native species have almost disappeared over large areas, and sound eradication-control strategies are urgently needed to preserve the identity and the function of the remnant fragments of the most interesting habitats (i.e. rocky cliffs, temporary ponds, maquis and grasslands).

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II
The northwestern corner

Itinerary1 - From Baglio Cofano to Cornino Bay

The western part of Sicily consists of carbonatic and dolomitic rocks, overlapping a basal complex constituted by metaquartzites or carbonatic sandstones and clays. One of the most attractive coastal capes of NW Sicily is Mt. Cofano, mostly formed by Triassic limestones and dolomites ascribed to the geolithological units Monte Sparacio-Monte Cofano and Monte Speziale-Monte Palatimone. Bioclastic calcarenites and conglomerates of arenitic type are bordering the carbonatic units of Mt. Cofano, reaching an elevation of 659 m.

The vascular flora of Mt. Cofano is currently estimated in 651 taxa (Gianguzzi et al. 2005). The remarkable species richness is primarily related to the topographic and bioclimatic diversity of Mt. Cofano. Moreover, its geographical segregation promoted the survival of many biogeographical relics and the differentiation of a rich endemic flora, currently estimated in 48 species, 7.4 % of the whole flora, including some interesting Tertiary relics. Unfortunately, in the same context, prickly pear (Opuntia ficus-barbarica) is today widespread thanks to anthropo- and zoochory. This species was imported in the Mediterranean basin after the discovery of America and it is now so widely naturalized that it is considered as an essential element of the Mediterranean coastal landscapes. As a matter of fact, most of the natural vegetation of Mt. Cofano have been spoiled or permanently altered by a millennial human activity. The vegetation of the promontory shows almost everywhere the traces of a long-lasting exploitation of the land. After the recent abandonment of agricultural activities, husbandry and fire are the only occasional disturbances in the area. Along the trail, we will observe many different vegetation types, including: Mediterranean temporary ponds (Luronio-Potametalia; Nanocyperetalia), annual and perennial dry grasslands (Thero-Brometalia, Trachynietalia distachyae, Hyparrhenietalia), vegetation of rocky cliffs (Asplenietalia glandulosi; Geranio-Cardaminetalia hirsutae), halo-petrophilous vegetation (Crithmo-Limonietalia; Frankenietalia pulverulentae), dwarf palm maquis (Pistacio-Rhamnetalia alaterni). On the way back, if not too late, we'll make a short visit at Bosco di Scorace (Quercetalia ilicis and reforestations).

Trail: Length: 5.2 km round trip, Hiking time: 3 hours, Elevation range: 280 m

General Description

2.1. The physical setting

The Mounts of Trapani and the Egadi islands represent the westernmost part of the Sicilian-Maghrebid Foreland-Thrust belt connecting the NW African mountain ranges and the Apennines. They issue from the tectonic overlap of limestones and dolomitic limestones (coral reefs of upper Triassic and lower Giurassic, i.e. c. 230-190 Ma) with clays and sandy marls dating back to lower Pliocene (c. 5.5 Ma).

The bays of Cornino and Màcari (W and E of Mt. Cofano), Capo San Vito and the Egadi islands are characterised by marine terraces made both of marine and continental deposits, i.e. calcarenites and calcareous sandstones of the lower Pleistocene (1.8-0.8 Ma), coarse marine conglomerates, screes and alluvial fans dating back to upper Pleistocene-Holocene (0.8 Ma onwards). These terraces are often bordered by steep and jagged sea cliffs, elsewhere are lower, intermingled with little pebble beaches and bordered by living biostructures called trottoirs. The only sand beaches of the area are located on the island of Favignana and in the bay of San Vito Lo Capo.

Mt. Cofano belongs to the Mt. Sparagio-Mt. Cofano Unit (limestones and dolomites), while the Mts. of Zingaro and San Vito Lo Capo belong four different lithological units mostly made up of limestones; among them, the unit Mt. Speziale-Mt. Palatimone is particularly rich in karst morphologies (deep fluvio-karstic canyons, vertical cliffs, sinkholes, etc.), while the unit Mt. Acci-Pizzo di Sella contains also marls, radiolarites and argillites, which occur in the four lithological units of Marettimo as well. Not surprisingly, most of the springs and dripping sites are concentrated in these latter lithological units.

Mt. Sparagio (1111 m a.s.l.) and Mt. Inici (1066) are the highest Mounts of Trapani; several peaks located in the Zingaro reserve go beyond 800 m (Mt. Speziale: 911, Mt. Passo del Lupo: 867, Mt. Acci: 829) and together with Mt. Cofano (657 m s.l.m.), Mt. Palatimone (595) and Mt. Monaco (529 m s.l.m.) dominate the small plains of Castelluzzo and San Vito.

Limonietum bocconei helichrysetosum cophanensis on coastal cliffs.

The Egadi Archipelago includes the islands of Favignana, Levanzo and Marettimo and few satellite islets (e.g. Formica) and stacks. The two coastal plains of Favignana are separated by a S-N spreading central ridge of rocky hills, the highest being Mt. Santa Caterina (314 m a.s.l.), Punta della Campana (296 m) and Punta Grossa (252 m); the highest hills of Levanzo are Pizzo del Monaco (278 m a.s.l.) and Pizzo del Corvo (201 m), separated from a little plain. Marettimo is a very steep island, rich of little canyons and screes; its highest peaks go beyond 600 m s.l.m. (e.g. Pizzo Falcone, 686).

The harsh morphology of most part of the area, characterized by abrupt slopes, steep cliffs and wide screes, is mainly shaped from the different response of the outcropping rocks to the combined effect of past and ongoing karstic and tectonic processes. In some cases selective erosion caused the collapse of calcareous cliffs, which in turn gave rise to wide landslides made of huge coarse blocks (e.g. at Firriato, above and below the village of Scopello, etc.).

As a consequence of intense karst processes affecting the calcareous and dolomitic rock outcrops, most of the rainfall penetrates deep underground feeding a very complex aquifer. The only true river of this territory is Fiume San Bartolomeo (E of Castellamare del Golfo,

Halo-tolerant annual dry grasslands on coastal rocky pavements (Anthemido secundirameae-Desmazerietum siculae)

38 km), then streams like Torrente Guidaloca (between Castellamare and the Zingaro reserve) and Torrente Forgia (13 km, W of Mt. Cofano), while only little gullies cross the steep slopes of the Zingaro reserve, Marettimo and the Peninsula of San Vito Lo Capo.

According to USDA soil taxonomy, the area hosts a combination of rock outcrops, lithic xerorthents (shallow soils with pH ≥7 and typic and/or lithic rhodoxeralphs ('terra rossa', pH <7). + typic e/o calcixerollic xerochrepts (calcic cambisols) on M. S. Giuliano (Erice).

If we consider the available thermo-pluviometric data coming from three stations encompassing the area and located at different altitudes, i.e. Erice, Castellamare del Golfo and San Vito Lo Capo, according to Rivas-Martínez bioclimatic classification the coastal sector of the Mounts of Trapani is subject to lower Thermomediterranean thermotype and upper dry and upper subhumid ombrotype. Yearly temperatures are of 13.5-19 °C, and the highest mean monthly temperatures reach 24-27.5 °C (July-August) and never go below 5-12 °C (January). The annual amount of rainfall ranges probably between 500 and 850 mm, with 4-5 months of drought stress between April-May and September.

2.2. Flora and vegetation

Part of the coastal sector of the Mts. of Trapani (San Vito Lo Capo, Scopello, Guidaloca) was visited by G. Gussone, A. Todaro and M. Lojacono-Pojero during the XX century, but most of the available information on this area issues from field investigations started in the Eighties of last century. As for Egadi islands, although some plants from Favignana were already reported by Boccone (1697) and Ucria (1789), the main islands have been explored between 1825 and 1895 and, after 60 years, since 1955 until today. More recently, also the vascular flora of tiny satellite islets has been studied.

According to Brullo et al. (1995), the Mts. of Trapani belong to the Drepano-Panormitan district. Among the species-richest of Sicily, this area is listed among the Sicilian IPAs with the code SIC8 'Capo S. Vito e Monti di Castellamare', and hosts at least 900 taxa of vascular plants and more than 200 taxa of biogeographic or conservation interest. Among them, there are extremely localised endemics, like *Hieracium cophanense*, *Limonium cophanense*, *Erica sicula* subsp. *sicula*, which only occur on Mt. Cofano, *Limonium todaroanum* and *Brassica villosa* subsp.

brevisiliqua, growing on few cliffs of the western part of the Peninsula of San Vito Lo Capo, *Ptilostemon greuteri*, endemic to M. Inici, *Centaurea erycina* and *Silene nefelites* endemic to Mt. San Giuliano.

Moreover, the Mts. of Trapani host many plants which are endemic (*Botriochloa panormitana*, *Brassica villosa* subsp. *bivoniana*, *Brassica villosa* subsp. *drepanensis*, *Brassica villosa* subsp. *villosa*, *Helichrysum panormitanum* subsp. *stramineum*, *Limonium flagellare*) too exclusive (*Convolvulus cneorum*, *Phagnalon metlesicsii*, etc.) of the Drepano-Panormitan district.

Each island of the Egadi archipelago has been included in the list of Sicilian IPAs (SIC4 'Favignana', SIC5 'Marettimo' and SIC7 'Levanzo'). Taking into account the very high number of narrow endemic or exclusive plants shared by Trapani Mts. and Egadi Islands (*Asperula rupestris*, *Centaurea panormitana* subsp. *ucriae*, *Centaurea panormitana* subsp. *umbrosa*, *Euphorbia bivonae*, *Euphorbia papillaris*, *Galium pallidum*, *Limonium bocconei*, *Limonium lojaconoi*, *Limonium ponzoi*, *Pseudoscabiosa limonifolia*, *Simethis mattiazzi*, etc.), the proposal of Brullo et al. (1995) to treat all the Egadi islands as a separate district appears questionable. In fact, the few original traits are two endemics to the archipelago (*Brassica macrocarpa* and *Senecio aegadensis*), two endemics of Favignana, i.e. the apomyctic *Limonium aegusae* and *Allium aethusanum* (probably nothing more than an ecotype of *A. lehmanii*), and the only known Sicilian populations of *Aristolochia navicularis* and *Ophrys holosericea* subsp. *apulica*. Yet Marettimo alone could be treated as a separate district: in fact, it is home of 7 narrow endemics (*Allium franciniae*, *Bupleurum dianthifolium*, *Helichrysum panormitanum* subsp. *messeriae*, *Limonium tenuiculum*, *Oncostema hughii*, *Prospero hierae* and *Thymus nitidus*) and of 4 species that occur nowhere else in Sicily (*Daphne sericea*, *Erodium maritimum*, *Lagurus ovatus* subsp. *vestitus*, *Thymelaea tartonraira*).

<u>*Zonal vegetation*</u>

Some fragments of evegreen maquis (QUERCETEA and QUERCETEALIA ILICIS) occur on steep, stony and less accessible sites, enjoying the air humidity coming from the sea. Those colonising the screes of Mt. Cofano are ascribed to *Rhamno alaterni-Quercetum ilicis* (*Rhamnus alaternus*, *Fraxinus ornus* and *Pistacia terebinthus*), while those occurring on the limestones and dolomias along the E- and N-facing slopes of Mt. Speziale, Mt. Cofano and Marettimo are referred to the *Pistacio lentisci-Quercetum ilicis*.

SW flank of Mt. Cofano, with Pistacio lentisci-Chamaeropetum humilis in the foreground, Helictotricho convoluti-Ampelodesmetum mauritanici on the talus slope and Scabioso-Centaureetum ucriae on vertical cliffs.

Husbandry is still performed along the eastern flank of Mt. Cofano: cattle grazing leads to the establishment of Carlino siculae-Feruletum communis, here beneath still surviving elements of the maquis (Chamaerops humilis and Pistacia lentiscus)

On the hills of the northern part of the Peninsula of San Vito Lo Capo, where acidic rocks outcrop, scattered nuclei of open *Quercus suber* woodland with *Arbutus unedo*, *Erica arborea* and *Cytisus villosus* (ERICO-QUERCION ILICIS) occur.

The margins of these woodlands are often covered by mantle communities (PRUNO SPINOSAE-RUBION ULMIFOLII) referred to *Clematido cirrhosae-Rubetum ulmifolii*.

The steep, rocky and wind-exposed areas are characterised by *Euphorbietum dendroidis*, an open thermophilous scrub rich in both summer-deciduous species, like *Euphorbia dendroides*, *E. bivonae*, *Anagyris foetida*, and sclerophyllous plants (OLEO-CERATONION). More complex and mature nuclei of evergreen maquis-forest can be observed in the localities Firriato e Cipollazzo and at Balata di Baida.

The nuclei of open maquis dominated by *Chamaerops humilis* which still occur along the coasts of Zingaro reserve, west of San Vito Lo Capo and west of Mt. Cofano (Cornino) are ascribed to *Pistacio lentisci-Chamaeropetum humilis*. Thermo-xerophilous summer-deciduous maquis (PERIPLOCION ANGUSTIFOLIAE) was probably present in the past on the edge of the promontories of the Mts. of Trapani and is still represent by the association *Periploco angustifoliae-Euphorbietum dendroidis* on the warmest sites of the main Egadi islands.

The base-rich or subacid (terra rossa) shallow soils host several typologies of garrigue. These subshrub communities are referred to the central-Mediterranean alliance CISTO ERIOCEPHALI-ERICION MULTIFLORAE and are represented by the associations *Micromerio fruticulosae-Ericetum multiflorae* (common on Egadi Islands and within Zingaro reserve) and *Brachypodio ramosi-Cistetum cretici* (Mt. Cofano, endemic to NW Sicily). Some probably native *Pinus halepensis* stands found on Marettimo have been referred to the association *Coridothymo capitati-Pinetum halepensis*.

As an issue of millennia of anthopogenic disturbance (deforestation, overgrazing and wildfires), more than half of the surface of the considered area is covered with thermo-xerophilous grasslands (HYPARRHENIETALIA HIRTAE). The association *Hyparrhenietum hirto-pubescentis* is rather common on the abandoned agricultural terraces of the lowlands, while *Sanguisorbo verrucosae-Magydaretum pastinaceae* occurs on stony ground in the moister sites of Favignana and Levanzo. A small spot of xerophilous grassland referred to

Western flank of Mt. Cofano, with mixed patches of Pistacio lentisci-Chamaeropetum humilis, Erico-Micromerietum fruticulosae, Helictotricho convoluti-Ampelodesmetum mauritanici. Vegetation dynamics and patchiness are strongly influenced by periodical fires.

Bothriochloo panormitanae-Hyparrhenietum hirtae (ARISTIDO COERULESCENTIS-HYPARRHENION HIRTAE) is localized near the eastern coast of the Peninsula of San Vito.

The top and the N-facing slopes of the local mountains are covered by *Helictotricho convoluti-Ampelodesmetum mauritanici*, a species-rich community endemic to the calcareous lithosoils of NW Sicily, often severely disturbed by the increasingly frequent wildfires and overgrazing and trampling due to domestic herbivores (mostly cows) and introduced wildboars.

The association *Coronillo glaucae-Brachypodietum retusi* described for Marettimo belongs to the alliance REICHARDIO MARITIMAE-DACTYLION HISPANICAE, including all the subhalophilous and wind-exposed perennial grasslands on calcareous soils of central and eastern Mediterranean area.

Two associations (*Thapsio garganicae-Feruletum communis* and *Carlino siculae-Feruletum communis*) referred to the alliance CHARYBDIDO PANCRATII-ASPHODELION RAMOSI occur in the area. These communities, very widespread on Mt. Palatimone and in Zingaro reserve, are perfectly adapted to stand overgrazing, frequent burning and soil erosion and are dominated by (mostly) poisonous geophytes.

The above-mentioned perennial grasslands are often intermingled with therophytic ephemeral prairies which may be referred to TRACHYNION DISTACHYAE (*Vulpio ciliatae-Trisetarietum aureae* and *Thero-Sedetum caerulei*) or to STIPION RETORTAE (*Ononido breviflorae-Stipetum capensis*). On the coastal areas influenced by salt-spray two associations (*Anthemido secundirameae-Desmazerietum siculae* and *Catapodio marini-Sedetum litorei*, STIPO-BUPLEURETALIA SEMICOMPOSITI) have been detected.

Vegetation of coastal ecosystems

Many endemics to NW Sicily (e.g. *Allium obtusiflorum*, *Desmazeria sicula*, *Limonium bocconei*, *Limonium flagellare*, etc.) and other plants of high biogeographic and conservation interest (e.g. *Allium lehmanii*, *Anthemis secundiramea*, *Galium verrucosum* subsp. *halophilum*, *Romulea linaresii* subsp. *linaresii*, etc.) thrive on sea-facing cliffs and along rocky shores.

Local halo-nitrophilous annual communities of sandy-loamy salted soils (SAGINETEA MARITIMAE and FRANKENION PULVERULENTAE) are ascribed to the Anthemido *secundirameae-Desmazerietum siculae* (Zingaro and San Vito peninsula), *Parapholido incurvae-Frankenietum pulverulentae* and *Frankenio pulverulentae-Anthemidetum secundirameae* (Egadi) and *Polypogonetum subspathacei* (Levanzo).

Hydrophytic vegetation surrounds the temporary pond near Baglio Cofano: Ranunculus baudotii (bottom left), Glyceria spicata (bottom right) and, in the background, Hordeo-Carduetum argiroae.

As for the litho-halophilous chasmophitic communities, the class CRITHMO-STATICETEA is locally represented by very well preserved communities referred to *Limonietum bocconei* (endemic to NW Sicily and Egadi Islands), *Limonietum tenuiculi* and *Senecioni bicoloris-Helichrysetum messerii* (both endemic to Marettimo) on the rocky shores subject to marine salt-spray, and by *Hyoseridetum taurinae* on the rocky cliffs near the coast.

The rare (and often degraded) spots of halo-nitrophilous annual vegetation of the coastal strandlines (CAKILETEA MARITIMAE) found on Egadi islands may be referred to the associations *Salsolo kali-Euphorbietum paraliae* and *Salsolo kali-Cakiletum maritimae* (EUPHORBION PEPLIS). Favignana also hosts some spots of grey dune vegetation (*Sporoboletum arenarii*, AMMOPHILETEA).

The halo-hygrophilous hemicryptophitic community *Inulo crithmoidis-Juncetum maritimi* (JUNCETEA MARITIMI) surrounds the brackish swamps of Favignana. This habitat also hosts *Ruppietum drepanensis* (RUPPIETEA) and several plant communites belonging to THERO-SALICORNIETEA (*Suaedetum spicatae*, *Salsoletum sodae* and *Cressetum creticae*).

Nuclei of halo-hygrophylous chenopod scrub (SALICORNIETEA FRUTICOSAE) occur along the coasts of Favignana and Marettimo exposed to intense marine salt-spray (*Agropyro scirpei-Inuletum crithmoidis*, INULION CRITHMOIDIS). To the same class should be ascribed the low-growing scrub with *Limonium aegusae* at Favignana and several pure stands of *Suaeda vera* and/or *Arthrocnemum glaucum* occurring on some satellite islets of Favignana and Levanzo, where this plants are able colonize the nutrient-rich and disturbed nesting sites of the yellow-legged seagull (*Larus michahellis*) due to their tolerance to high nitrate and phosphate soil content.

Vegetation of cliffs, walls and screes

Local rocky habitats cover a very wide surface and burst with richness of endemic species and species assemblages.

Several moss- and fern-rich communities linked to the humid and dripping cliffs (ADIANTETEA: *Adiantum capillus-veneris* and *Asplenium sagittatum*) are scattered in the territory: a very good example occurs in the picturesque rock blocks labyrinth of Firriato, other spots occur in the rock crevices of Marettimo, and in the natural caves of Zingaro reserve, Levanzo and Favignana.

Also the chasmo-chomophytic and epiphytic moss- and fern-communities (POLYPODIETEA) are well represented with the association *Anogrammo leptophyllae-Selaginelletum denticulatae* (POLYPODION SERRATI).

The chasmophytic vegetation of local undisturbed base-rich rocky cliffs (DIANTHION RUPICOLAE) is ascribed to *Bupleuro dianthifolii-Pseudoscabiosetum limonifoliae* at Marettimo and to *Scabioso creticae-Centauretum ucriae* elsewhere; several subassociations characterised by local narrow endemics are recorded in this area, i.e. *helichrysetosum straminei* at Zingaro, *ericetosum siculae* at Mt. Cofano, *brassicetosum drepanensis* on the top of Zingaro Mts., *brassicetosum macrocarpae* on Egadi Islands. Plenty of interesting plants may co-occur on the same site, not only the above-mentioned narrow endemics, but also Sicilian endemics like *Anthemis cupaniana*, *Cymbalaria pubescens*, *Helichrysum panormitanum* subsp. *latifolium*, etc., circum-Tyrrhenian endemics such as *Asplenium petrarchae* subsp. *petrarchae*, *Convolvulus cneorum*, *Dianthus rupicola* subsp. *rupicola*, *Glandora rosmarinifolia*, *Hyoseris taurina*, *Iberis semperflorens*, *Senecio cineraria* subsp. *bicolor*, *Seseli bocconei*, etc., and other very rare plants like *Phagnalon metlesicsii*, only occurring on Mt. Cofano and at Lanzarote in Canary islands.

Several communities linked to rock crevices (ASPLENIETALIA LANCEOLATO-OBOVATI), such as *Phagnalo saxatilis-Cheilanthetum maderensis* and *Cosentinietum bivalentis* occur at Levanzo and Marettimo, while the chasmo-nitrophilous vegetation of disturbed rocky cliffs and stone walls (CYMBALARIO-PARIETARIETEA DIFFUSAE) is locally represented by numerous communities referred to CYMBALARIO-ASPLENION (e.g. *Sedo dasyphylli-Ceterachetum officinarum*) and ARTEMISION ARBORESCENTIS-CAPPARIDION SPINOSAE (*Capparidetum rupestris*, *Centranthetum rubri*, *Hyoscyamo albi-Parietarietum judaicae* and *Antirrhinetum siculi*).

The pioneer assemblages typical to local screes (*Sedo sediformis-Centranthetum rubri*), rather common on Mt. Inici, Mt. Sparagio, Mt. Palatimone, Mt. Monaco, Marettimo island, belong to the endemic alliance EUPHORBION RIGIDAE.

Hydro-hygrophilous vegetation

The streamlets of the locality called 'Acci' (= Apium in Sicilian dialect) in the northern part of Zingaro reserve host several hygrophilous communities dominated by few rhizomatous helophites

(PHRAGMITO-MAGNOCARICETEA). These assemblages, linked to meso- and eutrophic slow flowing waters, are ascribed to *Phragmitetum communis* and *Typhetum latifoliae* (PHRAGMITION COMMUNIS) and MAGNOCARICION ELATAE (*Caricetum hispidae*). The muddy and shallow river banks are often covered by *Helosciadetum nodiflori* and *Nasturtietum officinali* (GLYCERIO-SPARGANION) and species-poor assemblages referred to MOLINIO-ARRHENATHERETEA and MENTHO LONGIFOLIAE-JUNCION INFLEXI.

Only few small temporary ponds occur in this area. Some of them host communities ascribed to POTAMETEA PECTINATI and RANUNCULION AQUATILIS. More in detail, *Ranunculetum baudotii* occurs at Favignana, while a little temporary pond located SE of Mt. Cofano hosts both *Ranunculetum peltati* and *Lemnetum gibbae* (LEMNETEA). As concerns ISOËTO-NANOJUNCETEA, some simplified aspects of ISOËTION occur on the Egadi Islands (Levanzo and Marettimo) and in the northern sector of Zingaro reserve, the association *Elatinetum macropodae* is recorded for Favignana, while species-poor assemblages ascribed to VERBENION SUPINAE are known for some disturbed ponds and rockpools of Marettimo, Favignana, and near the coast W of Mt. Cofano.

Several fragments of *Vitex agnus-castus*-dominated riparian scrub (NERIO-TAMARICETEA) occur along the stony seasonal streams between Castellamare del Golfo and San Vito Lo Capo (e.g. Guidaloca, near the village of Scopello, Zingaro reserve, near the touristic village of Cala 'mpiso). Most of these watercourses are covered with *Calystegio sylvaticae-Arundinetum donacis*, a sciaphilous-nitrophilous reed community ascribed to EPILOBIETEA ANGUSTIFOLII-CONVOLVULETALIA SEPIUM, often intermingled with dense and almost pure populations of *Rubus ulmifolius*.

Anthropogenic vegetation

Local arable crop fields on neutral sandy-loamy soils host plant communities ascribed to the alliance RIDOLFION SEGETI, that of base-rich soils to ROEMERION HYBRIDAE, the vegetation of vineyards, orchards and groves is represented by associations of the alliance FUMARION WIRTGENII-AGRARIAE (e.g. *Diplotaxietum vimineo-erucoidis* at Marettimo), while the annual crop cultures irrigated during summer (e.g. *Amarantho graecizanti-Cyperetum rotundi* at Favignana) belong to DIPLOTAXION ERUCOIDIS.

The slight urbanisation of the plains and coastal areas, and the ongoing abandonment of agricultural practices give rise to several winter-annual weedy and ruderal communities linked to man-made and nutrient-rich soils in suburban coastal areas (CHENOPODION MURALIS, MESEMBRYATHEMION CRYSTALLINI and HORDEION MURINI). To ECHIO-GALACTITION TOMENTOSAE should be ascribed the tall-herb ruderal vegetation occurring on calcareous nutrient-rich soils typical to abandoned crop fields and to fallows subject to frequent wildfires.

The plant communities of GERANIO PURPUREI-CARDAMINETALIA HIRSUTAE are linked to more mesic conditions due to tree canopy shade. Olive and abandoned manna-ash groves are characterised by a nitro-sciaphilous geophyte-rich fringe community called *Acantho mollis-Smyrnietum olusatri* (ALLION TRIQUETRI). The alliance VALANTIO MURALIS-GALION MURALIS, including all the (sub)nitro-sciaphilous winter-annual wall (*Parietario lusitanicae-Veronicetum cymbalariae*) or fringe communities of the central-eastern Mediterranean, occurs underneath garrigues (*Valantio murali-Polycarpetum alsinifolii* in NW Sicily, *Sedetum litoreo-stellati* on Egadi islands) or even underneath open woodlands (*Laguro vestiti-Erodietum maritimi* at Marettimo).

The local annual nitrophilous assemblages typical to trampled areas belong to *Euphorbio chamaesyci-Oxalidetum corniculatae*, *Polycarpo tetraphylli-Spergularietum rubrae* and *Trisetario aureae-Crepidetum bursifoliae* (POLYGONO-POËTEA, POLYCARPION TETRAPHYLLI).

The overgrazed pastures host some (sub)xerophilous and hyper-nitrophilous ruderal communities dominated by perennial herbs (mostly thistles) referred to the order CARTHAMETALIA LANATI, like *Glaucio flavi-Onopordetum horridi.*

The suburban area and the numerous abandoned stone quarries of Favignana are colonized by nitrophilous pioneer assemblages referred to the NICOTIANO GLAUCAE-RICINION COMMUNIS, dominated by many fast-growing alien thermo-cosmopolitan invasive species such as *Arundo donax* and *Nicotiana glauca*.

2.3. Landscape and land use history

The famous upper Palaeolithic paintings of the caves of Egadi islands (see box 2.2) testify at least 12,000 years of human presence and land use in the area. The sites of Uzzo, Isolidda, etc., on the NW coasts of the main

The Castle of Erice, surrounded by ruderal vegetation (Acantho-Smyrnietum olusatri) and, on vertical cliffs, by the Scabioso creticae-Centauretum ucriae, subass. Brassicetosum drepanensis.

island, where inhabited since Mesolithic (10-6 Ka), when local communities had to cope with the shortage of wild herbivores and to intensify-refine plant and fish exploitation techniques. Not surprisingly, the people living in the caves of Levanzo, Mt. Cofano and Uzzo were protagonists of the Neolithic revolution in Sicily, practising farming and agriculture.

An almost continuous human presence in the area during Copper Age (4000 BC: necropolis of Castelluzzo) and throughout the early Bronze age (c. 2500-1600 BC) is testified by numerous findings ascribed to different cultural steps. Traces of the so-called Thapsos culture (mid Bronze age, XV-XIII centuries BC), characterised by intense trade connections with eastern Mediterranean people coming from present Greece, Cyprus, Syria and Palestine, have been found at Mt. Cofano.

Between XII and IX century BC the Elymians, probably an Italic group coming from N Tuscany or Liguria, colonized the north-western part of Sicily and founded several cities, sharing the same territory and land resources with Phoenicians. The most important Elymian coastal centres were Eryx (Erice) and Segesta, which had their own emporia, Drepanon (now Trapani) and Emporium Segestanum (now Castellamare del Golfo), respectively. Although Elymians and

Phoenicians were allied during their century-long fights against the bellicose neighbouring Greek colonies, these three ethnic groups strongly influenced one each other: they shared the same alphabet, the same urbanistic style of their settlements and many toponyms of the Elymian area had (and still have) a clear Greek origin (e.g. Scopello and the Phoenician-Roman emporium of Cetaria, from the words 'skopeloi' = stacks, and 'kētos' = tuna fish, respectively).

Segesta and Eryx continued to play an important role for both fish and cereal crop production during the Roman dominion. After Vandals invaded N Africa and during all the Byzantine period (V-IX centuries AD) both NW Sicily and Egadi islands probably were almost desert, only hosting scattered monastic communities, as testified by the many toponyms 'Monaco' (= monk) spread all over this territory.

Once again, toponyms (Visicari, Guidaloca, Balata di Baida, Màcari, etc.) tell us how densely this territory was inhabited between IX and XII centuries by Arab-Berber farmers and shepherds, who re-populated many ancient towns such as Segesta, Kalathamet near the thermal springs of Castellammare and the Emporium Segestanum itself, called 'al-Madarig' (= tuna factory).

After blowing up the resistance of Arab-Berber communities in all western Sicily, the Swabian emperor Frederick II donated the whole Peninsula of San Vito to his northern Italian soldiers, who founded the village of Scopello (c. 1230 AD). Shortly after, this territory became a property of the town of San Giuliano (Erice).

Between XIII and XVI all the coasts of NW Sicily a dangerous place where to live, as they were subject to the continuous raids of pirates and corsairs coming from NW Africa or belonging to the so-called marine republics of Genoa and Pisa. Hence, the few local communities were located where they could enjoy some protection from the garrisons of the coastal towers. The massive structure of local farmhouses, called 'bagli' (e.g. Castello di Inici, Balata di Baida, Scopello, etc.) and tuna factories, called 'tonnare' (e.g. Favignana, Formica, Bonagia, Cofano, Scopello, Castellammare) remind us these period of uncertainty.

Between XVII and XIX centuries, after centuries of no or little human presence, Egadi were bought by the family Pallavicino who begun to populate them. Under the new owners the islands' landscape underwent strong changes: the Genoese tradesmen restarted agriculture, causing their almost total deforestation, and intensified stone quarrying and fishing activities. In the meanwhile, the NW part of Sicily experiences a significant demographic and economic increase: very wide sectors of the inland were cultivated (especially vineyards), while most of the coasts continued to be used as grazing area and hunting reserve until the end of Bourbon kingdom (1860). Only drought-resistant trees, such as *Olea europaea*, *Amygdalus communis*, *Fraxinus ornus*, *Olea europaea* and *Rhus coriaria* were cultivated in less suitable coastal areas and even on the slopes of the mountains.

On the mountains near Custonaci and on the island of Favignana stone quarrying became more and more intense: by the end of the XIX century there were 130 stone quarries and 550 workers involved in this activity and rock extraction reached the rhythm of c. 200,000 tons per year!

Between 1930s and 1970s intensive reforestation with non-native trees (mostly *Pinus halepensis* and *Eucalyptus camaldulensis*) have been carried out on Mt. Inici and Mt. Erice.

As concerns nature protection, Zingaro and Mt. Cofano are nature reserves, and the coastal capes fall almost entirely within the regional Natura 2000 network and within the SCA "Monte Cofano, Capo San Vito e Monte Sparagio", one of the widest in Sicily. Data issuing from a recent evaluation of land use patterns within this site highlight the exceptionally high rate of semi-natural landscape units. In fact, grasslands and abandoned fields cover 56% of this area, shrublands and maquis 17%, woodlands 9%, rocky and/or open areas (incl. coasts) 3%. Cultivated lands, i.e. vineyards, cereal crop fields, olive and almond groves and fruit orchards account for 8% of the whole surface, urban & industrial areas (incl. quarries) for 5%.

Several co-occurring factors, i.e. the small number and size of the main towns (Castellammare del Golfo, c. 15000 inhabitants; Custonaci c. 5500; San Vito Lo Capo c. 4500; Favignana c. 3500), the rather low rate of second houses along the coasts and the general trend of land abandonment on the foothills of the Mts. of Trapani make this coastal areas one of the best preserved of Sicily. Indeed, seasonal tourism is the most important economic resource and threat factor at once, because it has a heavy direct (pollution, disturbance and fragmentation, deliberate introduction of invasive alien plants, etc.) and indirect (enhancing illegal building) impact of local habitats, especially near the main towns, which are among the most attractive and crowded places of the whole NW Sicily.

Another severe threat to local environments is the intense soil erosion affecting the mountain slopes, due to overgrazing by cows and introduced boars and to increasingly frequent wildfires.

The top of Mt. Cofano (seen from Erice) emerging from orographic clouds arising from the sea. Moisture arising from the sea condensates very frequently on the top of the coastal mountains of NW Sicily, due to the steep thermic gradient which buffers the summer drought, promoting the growth of a luxuriant rock-dwelling vegetation (Asplenietalia glandulosi; Geranio-Cardaminetalia hirsutae). This condensation is frequently seen at dusk and lasts up to the early morning.

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Box 2.1 *The Zingaro nature reserve*

The 1650 hectares of Zingaro reserve are bordered by rocky shores and small pebbly beaches at sea level, while its innermost limit is a mountain ridge (maximum height: 913 m a.s.l.), shaped by the karstic processes affecting the calcareous outcrops. This steep area hosts a mosaic of natural habitats (rock and sea cliffs, screes) intermingled with secondary (grasslands, garrigues, open maquis) plant communities.

Humans have been there since Mesolithic, as testified by the data issuing from the excavations at Uzzo cave, and until mid XX century, cultivating cereal crops, grapevines, manna ash-, sumac-, olive- and fruit trees.

Zingaro represents a 'must' for nature lovers: in fact, it represents one of the last few traits of coastline (approximately 7 km) which cannot be reached by car. During the Seventies, Sicilian environmentalist ONGs carried out an intense campain to raise awareness about the naturalistic value of this site. This initiative culminated on May 1980, when 3000 people took part to a pacific march to stop the construction of a paved road aiming at connecting Castellammare del Golfo to San Vito Lo Capo. Few months later, by means of the Regional Law 98/81, the Zingaro became a protected area, the first in Sicily.

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Box 2.2 *Pre-historic hunter-gatherers, fishermen and painters*

Recent studies on the submarine morphology of the coasts between Trapani and the Egadi Islands and the very good knowledge on sea level changes confirmed that Favignana and Levanzo were connected to Sicily during the Holocene. Hence, the nomadic hunthers-gatherers inhabiting north-western Sicily were able to follow the big wild herbivores (oxes, boars, donkeys and deers) feeding on this area, which represented a peninsula and probably hosted a patchwork of woodland, shrubland and grassland. Not surprisingly, the human settlements found on the two islands (e.g. caves of Genovese, Grotta dei Porci at Levanzo, Grotta d'Oriente e Grotta Uccerie at Favignana) are among the oldest of Sicily (upper Paleolithic-Mesolithic: 11,900-6,800 BC).

As for the numerous caves spread along the NW coast of Sicily (Mt. Cofano, Isolidda, Uzzo, etc.), most of them have been inhabited since early Mesolithic (9,000 BC). On the main island hunting activities appear to be less important: the main food resources were plants and marine organisms (mostly molluscs but also fish). In the same period also at Favignana and Levanzo, again separated from the Sicily, a shift towards marine resources is recorded, testified from the famous tuna depicted at the cave of Genovese.

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III

Salt pans, salt marshes and lagoons of western Sicily

Itinerary1 - Saline di Trapani

Two short walks (approx. 2 km each) on flat terrain: both will be in the saltmarshes of western Sicily, an ecosystem domesticated and governed by man since the Phoenician colonization age. This landscape is featured by windmills, salt pans, hatched blocks, warehouses, among which the natural vegetation is still relatively well preserved (Sarcocornietalia fruticosae, Thero-Salicornietalia, Thero-Suaedetalia).
Trail: Hike **1** - Length: 2.3 km one way, Hiking time: 30 min., Elevation range: 0 m; Hike **2** - Length: 2.6 km one way, Hiking time: 35 min., Elevation range: 0 m;

General Description

3.1. Physical setting

The city of Trapani has been built on a complex of biocalcarenites and calcareous breccias called 'mischio' (= mixture), dating back to mid Miocene (16-11 Ma).

The coastline between Trapani and Marsala is characterised by a succession of marine terraces carved on a layer of Pleistocenic conglomerates and calcarenites called 'panchina' (= bench), which in turn lays on - sometimes outcropping - calcareous rocks dating back to the upper Triassic-Eocene (228-56 Ma).

The recent sandy-muddy alluvial sediments which cover wide surfaces between Trapani and Paceco and N of Marsala issue from the wandering beds of the streams Birgi and Lenzi-Bajata, respectively. The salt pans of Trapani, Paceco and Marsala were built exploiting these areas due to their impermeability.

The sea bottom near Trapani is particularly dangerous due to plenty of shoals, low islets and hardly surfacing stacks. Even the ancient

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town was founded on a bow-shaped (its ancient Greek name *Drepanon* means sickle) group of islets, some of them still recognizable until XV-XVI centuries AD. Other islets, like Sant'Antonio, Zavorra and Ronciglio, have been incorporated in the modern harbour of Trapani, other ones have been united to the main island by the salt pans built during last two centuries (e.g. Santa Margherita and Calcara).

The morphology of the coastal area of the lagoon located north of Marsala, the so-called 'Stagnone' (= big pond) is subject to continuous and rather fast changes, and the same occurs for the four islands forming the homonymous archipelago, i.e. San Pantaleo (= Mozia), Santa Maria, the tiny islet La Scuola and the biggest one, Isola Lunga or Isola Grande. The current form of the last one issues from the recent union of 3-4 islets which were still separated through managed canals until the XIX century.

Local coastal dynamic processes are ruled by at least four factors, always interconnected and often counteracting, i.e. 1) marine currents, 2) human activities (*in primis* the construction and the present management and use of salt pans and canals), 3) sediment intake and water regime of the local rivers, 4) distribution of three rooted marine plants, i.e. *Posidonia oceanica*, *Cymodocea nodosa* e *Zoosterella noltii*, whose colonies strongly affect the evolution of local shallow sea bottoms.

According to USDA soil taxonomy, the plane between Paceco and Marausa hosts a combination of lithic xerorthents (lithosols with pH ≥7), typic and/or lithic rhodoxeralphs ('terra rossa', pH <7), the in the area of Stagnone there are the same soil typologies with the addition of typic and/or calcixerollic xerochrepts (calcic cambisols). The alluvial sediments of the Birgi stream gives origin to a mixture of typic and/or vertic xerofluvents (eutric fluvisols) and typic and/or vertic xerochrepts (eutric and/or vertic cambisols) between Marausa and Birgi, while the area of the saline of Trapani and its surroundings host a soil assemblages originating from the alluvial sediments of the Bajata stream, i.e. typic and/or vertic xerofluvents (eutric fluvisols) + typic chromoxererts and/or typic pelloxererts (chromic and pellic cambisols).

If we consider the available thermo-pluviometric data coming from the nearest stations of Trapani, Spagnuola and Marsala, according to Rivas-Martínez bioclimatic classification the western coasts of Trapani Province are subject to lower Thermomediterranean thermotype and upper dry ombrotype. Yearly temperatures are of 17.5-18.5 °C, and the highest mean monthly temperatures reach 24.5-26 °C

(August) and never go below 11 °C (January). The annual amount of rainfall ranges between 480 and 520 mm, with approximately 5 months of drought stress between April-May and September-October.

As a result of the peculiar geology and geography (impermeable soils, flat plains, shallow sea, small freshwater input from local rivers and streams), local climate (strong solar radiation, low annual rainfall, frequent winds) and the millenary work of men, the coasts of western Sicily were shaped in order to produce salt. This area still is one the most important sites for marine salt production in the whole Mediterranean, and represents one of the most charming, yet vulnerable landscapes of the island.

The beauty of the coast between Trapani and Marsala, with its windmills, its wide waterbodies whose colours shift along with seasons, from blue to red to dazzling white, the canals, the mounds of salt covered with terracotta tiles, is the same since centuries.

3.2. Flora and vegetation

The natural and man-made coastal habitats near Trapani have been explored by botanists since XVII century, and they became one of the most frequent steps for Sicilian, Italian and European plant collectors and scholars during the XIX century. Not surprisingly, Trapani and its surroundings figure within the protologues and/or represent the *locus classicus* not only for narrow endemic species such as *Calendula maritima*, *Limonium densiflorum* ('Ronciglio islet'), *Limonium lojaconoi* ('Trapani near the windmills"), *Limonium ponzoi* ("rocky shores between Pizzolungo and Bonagia"), but also for many other taxa which have been described there as new to science and have been proved to occur in other Mediterranean countries, such as *Anthemis secundiramea*, *Atriplex tornabenei*, *Beta macrocarpa*, *Cynomorium coccineum*, *Euphorbia cupanii*, *Galium verrucosum* subsp. *halophilum*, *Halocnemum cruciatum*, *Ruppia drepanensis*, etc.

The botanical surveys on the coastal habitats between Paceco and Marsala, on the area of the Stagnone and its islets have started much later, around 1970s and 1990s, and the available information needs to be updated and improved.

The nature reserve 'Saline di Trapani e Paceco', managed from the NGO WWF-Italia, host approximately 500 plant taxa. As for the Stagnone area, Isola Lunga hosts ca. 430 taxa, Mozia almost 280, Santa

Maria 150 and 80 plants grow on La Scuola. Plant diversity is sharply uneven, the richest sites being the islets which contributed to form Isola Lunga, where lithosols and terra rossa give hospitality to many plant assemblages, and the ecotones between the salt marshes and the abandoned salt pans.

Flat but not monotonous, species-poor but rich of plants of extreme interest: this could be a good synthesis of the botanical heritage which may be encountered in the very complicated patchwork of abandoned and managed salt pans, brackish swamps, salty and muddy areas, sandy beaches, man-made canals and basins, etc., forming the landscape of this area shaped from human activities. The whole area in included in the Italian IPAs with the codes SIC 6 'Saline di Marsala e Isole dello Stanone' and SIC 9 'Saline di Trapani'.

This area hosts three narrow endemics, i.e. *Calendula maritima*, *Limonium lilybaeum* and *Solenopsis mothiana*, and the majority of the populations of two Drepano-Panormitan endemics, *Limonium densiflorum* (also occurring near Petrosino along the SW Sicilian coast) and *Limonium dubium* (also growing on Egadi islands). Moreover, here occur plenty of plants of very high biogeographic and conservation interest, often very

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rare in Sicily and Italy, such as *Aeluropus lagopoides*, *Althenia filiformis*, *Andrachne telephioides*, *Andryala tenuifolia*, *Anemone palmata*, *Anthemis maritima*, *Biscutella maritima*, *Capnophyllum peregrinum*, *Carlina sicula* subsp. *sicula*, *Centaurea solstitialis* subsp. *schouwii*, *Cicendia filiformis*, *Convolvulus tricolor* subsp. *cupanianus*, *Cressa cretica*, *Crypsis aculeata*, *Damasonium bourgaei*, *Damasonium polyspermum*, *Desmazeria sicula*, *Dorycnium hirsutum*, *Eryngium dichotomum*, *Halopeplis amplexicaulis*, *Hornungia revelierei* subsp. *revelierei*, *Hyoseris taurina*, *Hypericum pubescens*, *Isolepis cernua*, *Jacobaea delphinifolia*, *Limoniastrum monopetalum*, *Limonium* (*avei*, *dubium*, *narbonense*, *sinuatum*, *virgatum*), *Lotus conjugatus*, *Myriolimon ferulaceum*, *Oenanthe globulosa* subsp. *kunzei*, *Pallenis maritima*, *Parapholis marginata*, *Podospermum canum*, *Podospermum laciniatum* subsp. *decumbens*, *Salicornia emerici*, *Salicornia patula*, *Scorpiurus vermiculatus*, *Scorzonera undulata* subsp. *deliciosa*, *Sphenopus divaricatus*, *Tetragonolobus biflorus*, *Trifolium isthmocarpum* subsp. *jaminianum*, *Triglochin bulbosa* subsp. *barrelieri*, etc.

The scientific interest of this area goes far beyond species level: many local plant communities are rather common in similar habitats of S Mediterranean and Near and Middle East but turn to be very rare in Europe, especially the haloxerophilous assemblages dominated by annual and/or perennial Amaranthaceae (*Arthrocnemum*, *Atriplex* spp., *Halocnemum*, *Salicornia*, *Suaeda*), Plumbaginaceae (*Limonium* spp., *Limoniastrum*) and *Juncus* spp.

Zonal vegetation

Due to its very reduced altitudinal range, its harsh edapho-climatic conditions and its history of intense land use, the area hosts no woodlands at all, and very few fragments of zonal vegetation. A single nucleus of evegreen maquis, referred to *Chamaeropo humili-Quercetum calliprini* (QUERCETEA ILICIS, PISTACIO-RHAMNETALIA ALATERNI) occurs at Marausa. Another association belonging to OLEO-CERATONION, the *Pistacio lentisci-Chamaeropetum humilis*, has been described from a few nuclei of low and open maquis present on Isola Lunga.

The shallow soils Marausa also host some small nuclei of garrigue with *Erica multiflora*, *Thymbra capitata*, *Cistus salvifolius*, *Cistus creticus*, *Cachrys sicula*, *Dorycnium hirsutum*, etc. (CISTO ERIOCEPHALI-ERICION MULTIFLORAE).

Some spots of thermo-xerophilous grassland referred to *Hyparrhenietum hirto-pubescentis* (HYPARRHENIETALIA HIRTAE) occur in some abandoned agricultural lands of Isola Lunga, where some nuclei of geophyte-dominated herb communities (CHARYBDIDO PANCRATII-ASPHODELION RAMOSI) also occur and probably derive from the overgrazing from introduced rabbits. To *Euphorbietum cupanii* (BROMO-ORYZOPSION MILIACEAE) belong the subnitrophilous and thermoxerophilous grasslands, occurring on sandy-marly soils along the borders of roads and tracks and at the base of stonewalls in the coastal area of Birgi.The above-mentioned grassland communities are sometimes intermingled with therophytic ephemeral prairies which may be referred to STIPION RETORTAE.

Several annual prairies ascribed to HELIANTHEMETEA GUTTATAE occur on the sub-acid sandy and/or loamy soils of the area: the *Tuberario guttatae-Anemonetum palmatae* colonizes little raised surfaces around the brackish swamps of the coastal areas between Birgi and San Teodoro near the Stagnone of Marsala, while three different associations have been described for Isola Lunga: *Bellido annuae-Solenopsidetum laurentiae* is linked to the rather shaded and wet microclimatic conditions provided by the tufts of *Lygeum spartum*, while *Herniario cinereae-Crassuletum tilleae* occurs in sunny and open areas on compact soils partially covered with moss vegetation, and *Bupleuro gracili-Ononidetum reclinatae* is localised on sandy soils and prefers the flat and even surfaces of the inner part of the coastline.

<u>Vegetation of coastal ecosystems</u>

Locally intense and frequent anthropogenic pressure (dump, trampling, urbanisation, etc.) strongly affected the sandy beaches of the area. The short-lived nitrophilous communities of strandlines, referred to *Salsolo kali-Euphorbietum paraliae* (CAKILETEA MARITIMAE, EUPHORBION PEPLIS), are well represented only on the northern coast of Isola Lunga and in some sites of western Sicily (e.g. Marausa). Only few scattered nuclei of white and embryonic dunes (AGROPYRION JUNCEI) survived, with the association *Sporobolo arenarii-Agropyretum juncei* on the northern shores of Isola Lunga and near Marsala, and very few and small spots of the *Calendulo maritimae-Elytrigetum junceae* along the beaches of Trapani.

The ephemeral annual communities linked to salty and nutrient-rich soils subject to temporary (autumn-winter) submersion and dry up for the rest of the year (SAGINETEA MARITIMAE) are locally represented by plant communities belonging to the alliances FRANKENION PULVERULENTAE (*Parapholidetum filiformis* and *Polypogonetum subspathacei* at Isola Lunga) and LIMONION AVEI (*Spergulario rubrae-Limonietum avei*, *Limonio avei-Hymenolobetum procumbentis* and *Limonio avei-Parapholideum marginatae*).

Some spots of chasmo-halophitic vegetation (*CRITHMO-STATICETEA*) with *Thymelaea hirsuta*, *Pallenis maritima* and *Lotus cytisoides* occur on the rocky shores exposed to marine salt-spray along the W Sicilian coasts at San Teodoro, near the northern mouth of the Stagnone lagoon, and at San Cusumano near Trapani, as well as on the northern coast of Isola Lunga.

The class THERO-SALICORNIETEA includes the thermo-haloxerophilous plant communities dominated by pioneer annual succulents which during summer-autumn cover the borders of local saltmarshes. All the associations known for Sicily occur along the W coasts of Trapani province. More in detail, *Halopeplidetum amplexicaulis*, *Suaedo maritimae-Salicornietum patulae*, *Arthrocnemo glauci-Salicornietum emerici*, *Suaedetum maritimae* occur both near Trapani and in the area of Stagnone lagoon, *Salsoletum sodae* and *Cressetum creticae* only near Trapani.

The saltmarshes of W-Sicily are an ecosystem domesticated and governed by man since the Phoenician age.

The hyperhalophilous scrub communities which colonise the salty soils subject to seasonal and prolonged submersion with marine waters are referred to several alliances of the class SALICORNIETEA FRUTICOSAE, i.e. SALICORNION FRUTICOSAE (*Aeluropo lagopoidis-Sarcocornietum alpinii, Junco subulati-Sarcocornietum fruticosae, Cynomorio coccineae-Halimionetum portulacoidis*), ARTHROCNEMION GLAUCI (*Arthrocnemo glauci-Halocnemetum strobilacei* and *Sphenopodi varicati-Arthrocnemetum glauci* both occurring only in the salt pans of Trapani and Paceco), INULION CRITHMOIDIS (*Agropyro scirpei-Inuletum crithmoidis*), and LIMONION FERULACEI (*Sarcocornio fruticosae-Limonietum ferulacei, Limonio dubii-Lygetum spartii, Limoniastro monopetali-Limonietum lilybaei*, the latter endemic to the Stagnone lagoon).

The assemblages of THEROSALICORNIETEA and SALICORNIETEA FRUTICOSAE are often intermingled with salt-tolerant halo-hygrophilous communities dominated by tall rushes, ascribed to JUNCION MARITIMI, like *Limonio virgati-Juncetum acuti* and *Spartino junceae-Juncetum maritima*, the latter occurring only on Isola Lunga.

Vegetation of cliffs, walls and screes

The abandoned manufacts (canals, banks, stone walls, windmills, farmhouses) of the area host chasmo-nitrophilous communities referred to *Capparidetum rupestris* and *Hyoscyamo albi-Parietarietum judaicae* (CYMBALARIO-PARIETARIETEA DIFFUSAE, ARTEMISION ARBORESCENTIS-CAPPARIDION SPINOSAE).

Hydro-hygrophilous vegetation

The brackish waters of many abandoned salt pans of Isola Lunga and Trapani and Paceco are colonized by the rooted submerged plant *Ruppia drepanensis* (RUPPIETEA MARITIMAE).

As concerns the dwarf vegetation of temporary ponds (ISOËTO-NANOJUNCETEA), three different communities have been detected on Isola Lunga. *Pulicario graecae-Scirpetum savii* (NANOCYPERION) and *Elatinetum macropodae* (ELATINO MACROPODAE-DAMASONION ALISMATIS) occur respectively on the borders and in bottom of the ephemeral rockpools of the southern part of the island, while *Laurentio ?-Juncetum capitati* (CICENDION) occurs in shaded microhabitats within *Lygeum spartum* grassland colonizing little humid depressions on sub-acid soils (terra rossa) which are inundated in winter but dry up in early spring.

The final trait of the streams Bajata and Birgi host hygrophilous communities dominated by few rhizomatous helophites (PHRAGMITO-MAGNOCARICETEA). These assemblages, linked to meso- and eutrophic slow flowing waters, are ascribed to *Phragmitetum communis* and *Typhetum latifoliae* (PHRAGMITION COMMUNIS). Along the muddy and shallow river banks *Helosciadetum nodiflori* (GLYCERIO-SPARGANION) occurs.

Anthropogenic vegetation

Local arable crop fields on base-rich loamy and clayey soils are characterised by *Capnophyllo peregrini-Medicaginetum ciliaris* (ROEMERION HYBRIDAE), the vegetation of vineyards, orchards and groves is represented by *Diplotaxietum vimineo-erucoidis* (FUMARION WIRTGENII-AGRARIAE), while the vegetation of the annual crop cultures irrigated during summer of Birgi and Marsala is referred to *Chrozophoro tinctoriae-Kickxietum integrifoliae* (DIPLOTAXION ERUCOIDIS).

The massive urbanisation of the coastal areas, and the ongoing abandonment of agricultural practices and salt production give rise to several winter-annual weedy and ruderal communities linked to man-made

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and nutrient-rich soils in suburban and coastal areas referred to CHENOPODION MURALIS (*Lavateretum cretico-arboreae*), MESEMBRYATHEMION CRYSTALLINI (*Mesembryanthemetum crystallino-nodiflori*) and HORDEION MURINI (*Hordeo leporini-Sisymbrietum orientalis*).

The abandoned crop fields and fallows of clayey and nutrient-rich soils are covered with ruderal sub-nitrophilous herb communities belonging to FEDIO-CONVOLVULION, such as *Chamaemelo fuscati-Silenetum fuscatae* (Nubia, Trapani, Birgi, Marsala) and *Vulpio ligusticae-Tetragonolobetum biflori* (Marsala).

To VALANTIO MURALIS-GALION MURALIS belongs *Valantio murali-Solenopsidetum annuae*, a (sub)nitrosciaphilous fringe community which occurs underneath the low maquis of Isola Lunga.

The suburban area and many abandoned manufacts of Trapani and Marsala are colonized by nitrophilous pioneer assemblages referred to the NICOTIANO GLAUCAE-RICINION COMMUNIS, dominated by many fast-growing alien thermo-cosmopolitan invasive species such as *Nicotiana glauca* and *Arundo donax*.

3.3. Landscape and land use history

The most ancient traces of human presence in the area date back to Upper Paleolithic and are mostly located in the caves of Mt. San Giuliano. The surrounding hills hosted several small settlement also during Neolithic, Bronze and Iron ages.

The city of Drepanon (now Trapani) was founded between XII and IX century BC the Elymians, which probably were an Italic group coming from N Tuscany or Liguria. At first it was just the harbour and emporium of Eryx, but its military importance increased during the first Punic War (250 BC). When Motya was destroyed from Syracusans (IV century BC), the survivors escaped on the adjacent coasts of western Sicily founded Lilybaeum (= facing Libya, the ancient name for all N Africa).

Under Romans ‘Drepanum’ and Lilybaeum had different destinies: Trapani underwent decline (although many small rural communities were scattered in the inner countryside which was intensively cultivated), while Marsala became a very important centre, housing the quaestor of the Sicilian province; to underline its prominent role, during I century BC it was named *splendidissima urbs*.

After Vandals devastated the cities and the whole territory (V century AD) the area was poorly inhabited and exposed to continuous pirate raids until IX century. In that period only monastic communities may have occurred in the territory and even on the islets of the Stagnone, as suggested by several local toponyms like Santa Maria, San Teodoro and San Pantaleo.

The arrival of Arabs (IX) marks a recover of local economy and a strong increase of local human communities. Both 'Itrabinis' and 'Marsa All□h' (= the Harbour of Allah) were important trading centres and also benefited from intense cultivation of the neighbouring fertile inland areas. Salt pan expansion started in that period and spread all over the western coasts of Sicily. Norman monarchs (XII century) donated San Pantaleo (now Mozia) and probably the entire area of the Stagnone to the church of Santa Maria della Grotta of Marsala for this purpose.

Between XII and XVI centuries the city of Trapani became very wealthy thanks to the intense trade of fish, salt, corals and soda (obtained through intensive cultivation, drying out and burning of *Salsola soda*), and its harbour was one of the most important in the whole Mediterranean, representing an almost obligatory connection point between Europe and N Africa.

During XVII century the whole territory was subject to drastic demographic and economic decrease and social disorders due to poverty, famine, e pestilences and continuous raids of N African pirates.

By the end of the XVII century the Pallavicino, a Genoese family of tradesmen, took the control of the area. In the meanwhile, pirates' incursions became rarer and rarer, and the new owners induced strong improvements on local economy and rapid changes of the landscape by intensifying agriculture (mostly vineyards) and fishing activities. In the meanwhile the English family Woodhouse started (1773) to export the local wine 'Marsala' as a dry variant of Madera and Porto in order to bypass the embargo of Spain and Portugal: this event signed the explosion of local economy and caused the demographic increase and the urban development of the city Marsala.

After the cutting of Suez Canal (1871) the area became even more important: all the products travelling from Asia to Europe had to pass through the Strait of Sicily and usually stopped at its main harbour, Trapani.

With the exception of the wetland of Chinisia near Birgi and the final traits of both Bajata-Lenzi and Birgi streams, which have been respectively reclaimed and rectified at the beginning of the XX century, the territory remained almost unchanged until the end of the World War II, when many salt pans were destroyed and covered to give room to the chaotic (and often illegal) urban sprawl of Trapani and to the still ongoing development of port infrastructures.

Nowadays these area hosts more than 210000 people (200000 concentrated in the two main cities).

As for the Stagnone lagoon, local species and habitats benefit from the reduced human disturbance on the nearly uninhabited islets, where the most important impact is linked to the intense affleunza of visitors to the archaeological heritage of the islet of Mozia. Many salt pans are still exploited along the Sicilian coast of the Stagnone and in the northern sector of Isola Lunga.

The century-old patchwork of natural and artificial habitats issuing from salt production should be maintained to preserve local plant- and community-diversity. On the other hand, any intervention in and around the salt pans should take into account the eventual presence of rare and very localized plants (i.e. *Limonium densiflorum* and *L. lilybaeum*) or habitats (e.g. the partially man-made rock pools called ‘urghi’ which host interesting and rare ephemeral hygrophilous communities).

While agriculture is disappearing on all the islets, greenhouses are rapidly substituting traditional practices on the main island.

Current coastal dynamics are connecting both the northern and the southern edge of Isola Lunga with Sicily; for the same reasons the bottom of the Stagnone lagoon is getting more and more shallow year by year. As a consequence, the whole lagoon undergoes rapid warming, which in turn reduces oxygen availability. Hence, local marine ecosystems are expected to undergo dramatic changes within next decades, with the disappearance of marine plant beds.

Due to its long-lasting role of prominent crossroad of the Mediterranean trade routes, the port of Trapani harboured not only ships and goods but also many alien plants. Some of them were able to establish for a short time (this was the case of *Astragalus thermensis* Valsecchi and *Garidella nigellastrum* L., recorded here and nowhere else at the beginning of the XIX century) or until today (e.g. *Bassia laniflora*, still present locally, and *Heliotropium curassavicum*, now almost common in the whole area and also along the coasts of SW Sicily, Egadi and Pelagie islands). The protected areas of this territory are now subject to the invasion of other alien plants, such as *Carpobrotus edulis*, *Symphyotrichum squamatum*, *Oxalis pes-caprae*, while may other ones (e.g. *Ailanthus altissima*, *Arundo donax*, *Chasmanthe aethiopica*, *Erigeron bonariense*, *Datura wrightii*, *Myoporum insulare*, *Nicotiana glauca*, *Nothoscordum inodorum*, *Solanum linnaeanum*, *Tribulus terrestris*, etc.) are increasingly frequent in suburban and man-made habitats (incl. cultivated lands and fallows).

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Box 3.1: *Salt from sea, wind, sun and human care*

During the 1st millennium BC Phoenicians probably colonized western Sicily to produce salt. Between XV-XX century Trapani played a major role in the international export of this precious resource. The top of this golden period occurred shortly after the opening of the Suez Canal (1869). After the two world wars, the decline of the harbour and the urbanization caused the abandonment, the oblivion and the destruction and of many salt pans and windmills. Nowadays an increasing attention is paid on these manufacts because they represent a unique cultural heritage and they provide an example of sustainable exploitation of renewable resources.

Salt production requires time and skill: the sea water is repeatedly carried into basins with different width and depth, where it evaporates thanks to the combined effect of wind and heat, so that salt accumulates forming a thick crystal layer on the bottom of the pans. Each of the five different typologies of pans, interconnected by channels and accurately managed to obtain an increasingly saturated water, plays a specific role in the process and has its own name, from the largest one near the sea, called 'fridda' (= cold), to the ones where salt precipitation occurs, called 'caura' (= hot).

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Box 3.2 *Mothia*

Although some traces of human presence date back to 2500 B.C, the first settlement on the islet of Mozia (also called San Pantaleo) was founded during XV-XIII centuries BC, when local people and E Mediterranean partners shared an *emporion* (= market). At the end of VIII century the Carthaginians settled *Motye* (= textile manifactury), which in very short time became a big fortified city covering the whole surface of the islet. Mozia was one of the most important Punic colonies of Sicily until 397 BC, when Dionysius the Elder, tyrant of Syracuse, ordered its destruction after a victorious siege. Hereinafter, the islet never recovered its importance, and only few people lived there under Roman dominion and during Middle Age.

Between XI and XVI centuries AD the islet belongs to the monks of Marsala, who built and exploited a salt pan there. At the beginning of the XX century Joseph Whitaker, an English entrepreneur of Marsala, started the excavations. Once he correctly identified the site, he decided to acquire the whole islet to go on with his investigations (1906-1927). New field surveys, started on 1955 and still going on, shed light on the urban structure and the daily life of Mothia.

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IV
The south-western corner

Itinerary1 - Gorghi Tondi

the wildlife reserve "Gorghi Tondi and Preola Lake" includes dozens of eddies ("gorghi"): little karstic lakes originated from the erosion of a calcarenitic crust up to the chalky underground bank, which, when the structural support of the crust above is lost, collapses downward leaving small, but relatively deep (up to 80 m) depressions at the surface. The lakes are surrounded by Phragmitetalia vegetation, which abruptely shifts into a Quercus calliprinos maquis (Pistacio-Rhamnetalia alaterni) and allied degradation units. The upper ground level around the lakes is extensively cultivated (vineyards), with a very nice and colourful early-spring commensal vegetation (Fedio-Convolvulion cupaniani), of which we will observe perhaps the very late remnants.

Trail: Length: 3.5 km round trip, Hiking time: 1 hour, Elevation range: 30 m

General Description

4.1. Physical setting

The vernacular term 'sciara' seems to derive from the Arab 'sha'ra'. This word has been used with several meanings. As for the southern part of Trapani and the western part of Agrigento provinces, it indicates the local karst flatlands characterized by a mosaic of outcropping calcareous rocks, sandy-loamy shallow lithosols, perennial and annual dry grasslands, garrigues and low maquis, while it means 'hedge, shrubland' (see the Spanish terms 'jara', 'jaral') in NE Sicily, and 'volcanic ash/lava field or slope' on Etna Mt. and Aeolian islands. All these nuances lead to the same concept, as they all are 'sterile and uncultivated areas', either because agricultural activities have been abandoned or are reduced and difficult due to poor soil availability.

The whole area is characterised by lower Pleistocene (1.8-0.8 Ma) marine sediments (the so-called 'Calcareniti di Marsala'), which cover the so-called 'Formazione Marnoso-Arenacea della Valle del Belice' (= Marly-Sandstones formation of the Belice Valley), made of sandstones

Vegetation belts of Gorghi Tondi: Soncho-Cladietum marisci; Phragmitetum communis; Chamaeropo-Quercetum calliprini with interbedded clay layers which filled this sector of the Sicilian foredeep during mid-upper Pliocene (3.6-1.8 Ma). Below are the pelagic deposits of the lower Pliocene (ca. 5.3-3.6 Ma) (the so-called 'Trubi', marly calcilutites), followed by the limestones and gypsums belonging to the Messinian evaporitic series, which in turn lay on the conglomeratic and/or sandy or clayey-marly deposits of the so-called 'Cozzo Terravecchia formation' dating back to Tortonian (11.6-7.2 Ma). All these lithological units are carved by Pleistocene marine quaternary terraces, sometimes covered with sandy or gravelly deposits up to 10 m thick, ranging from 0 to 170 m a.s.l. Near the coasts palustrine or dune deposits occur, whilst along the main water courses, terraced alluvial sediments may outcrop.

From west to east, the main rivers of the area are the Màzaro (30 km), the Grande-Delia-Arena (47 km), the Modione (27 km), the Belìce, the 'Ypsas' of ancient Greeks (107 km), and the Tardàra-Carboj (30 km). All these water courses are now subject to important seasonal changes in water regime, but in historical times must have been much richer in water; for example, the river Modione hosted 14 watermills. Many of them have been transformed to make artificial water reservoirs (Lago di Piana degli Albanesi e Lago Gàrcia on Belìce river, Lago Trinità on Delia river, Lago Arancio on Carboj river).

As for wetlands, Capo Feto and the saltmarshes near Petrosino may be interpreted as retrodunal swamps, while the inner system of the permanent ponds of Lago Murana, Lago Preola and Gorghi Tondi occupies natural depressions issuing from to the collapse of calcareous sandstone layers due to the chemical dissolution of the underlying gypsum layers.

The coastline between Marsala and Petrosino and between Mazara del Vallo and Torretta Granitola is characterized by low rocky cliffs; the rest of the coastline is mainly occupied by sand beaches and more or less continuous dune systems.

According to USDA soil taxonomy, most of the coastal plain and low hills between Marsala and Menfi hosts different combinations of lithic xerorthents (lithosols with pH $\geq$7), typical and/or lithic rhodoxeralphs ('terra rossa', pH <7). Additionally, in the area of Torretta Granitola there are also typical haploxeralphs (orthic luvisols) and near Menfi also calcixerollic xerochrepts (calcic cambisols). The alluvial sediments of the river Grande-Delia-Arena give origin to a mixture of typical and/or vertic xerofluvents (eutric fluvisols) and typical and/or vertic xerochrepts (eutric and/or vertic cambisols) near Mazara del Vallo.

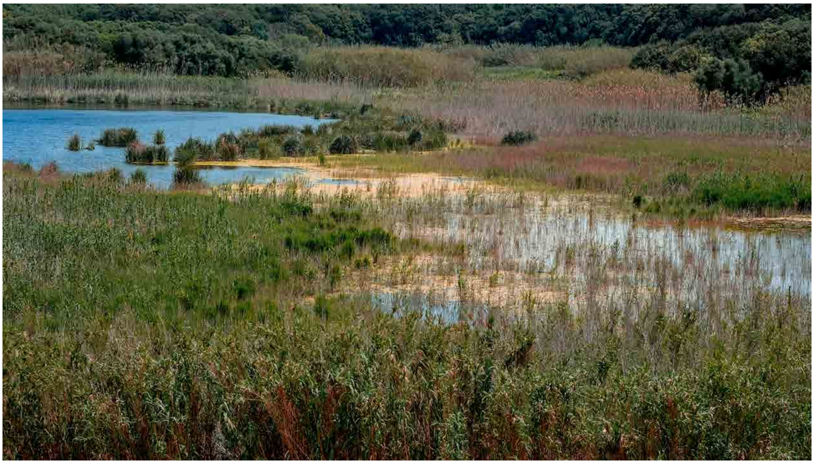
The soils association near Torretta Granitola, Tre Fontane and Partanna is made of typical xerorthents (regosols), typical xerochrepts (eutric cambisols) and typical haploxeralfs (orthic luvisols).

Near Selinunte and Porto Palo di Menfi also calcixerollic xerochrepts (calcic cambisols) and typical and/or lithic xerorthents (regosols and/or lithosols) occur, while the surrondings of Tre Fontane and W of Sciacca (Capo S. Marco) host a combination of typical xerochrepts (eutric cambisols), typical haploxeralfs (orthic luvisols) and typical and/or lithic xerorthents (regosols and/or lithosols). The soils associations change near the main rivers: near Mazara and Sciacca we find typical xerorthents (regosols) + typical and/or vertic xerochrepts (eutric and/or vertic cambisols) + typical and/or vertic xerofluvents (eutric fluvisols) and/or typical chromoxererts and/or typical pelloxerets (chromic and pellic cambisols). Moreover, the coastal plain beneath Menfi, also known as Lido Fiori, is characterized by typical xerorthents (regosols), typical and/or vertic xerofluvents (eutric fluvisols) and/or typical chromoxerets (chromic cambisols). The basin of Delia-Arena river is characterised by typical chromoxerets and/or typical pelloxerets (chromic and pellic cambisols), while the wetlands near Selinunte and Porto Palo di Menfi host the association typical and/or vertic xerochrepts (eutric and/or vertic cambisols) + typical chromoxerets and/or typical pelloxerets (chromic and pellic cambisols). The salt marshes near Petrosino and Capo Feto are characterized by typical psammaquents (gleyic arenosols), while the dune fields (typic xeropsamments) experienced a strong reduction during last decades.

If we consider the available thermo-pluviometric data coming from the stations of Castelvetrano. Mazara del Vallo and Sciacca, according to Rivas-Martínez bioclimatic classification the area at issue is subject to lower Thermomediterranean thermotype and upper dry ombrotype. Yearly temperatures range between 17.5 and 18.0 °C, and the highest mean monthly temperatures reach 25.5-26 °C (July-August) and never go below 11 °C (January-February). The annual amount of rainfall ranges between 540 and 610 mm, with approximately 4-5 months of drought stress between April and September.

4.2. Flora and vegetation

The available botanical knowledge on the territory at issue appears still incomplete and needs further updating and improvement.



Arundini-Convolvuletum sepium (foreground); Soncho-Cladietum marisci; Phragmitetum communis.

Scanty information on the coasts between Marsala and Sciacca and on the inner part of this territory (Castelvetrano, Partanna, etc.) dates back to the beginnings of the XIX century, when the area was explored by G. Gussone, V. Tineo, R. A. Philippi, and by Sicilian scholars such as M. Lojacono-Pojero, F. Fanales and A. Palumbo around the end of 1890s. Systematic botanical surveys, mostly concentrated on the coastal sites, started around 1970s.

According to Brullo et al. (1995), this area belongs to the Drepano-Panormitan district. It hosts as much has nine narrow endemics, i.e. *Centaurea saccensis*, *Galium litorale*, *Helichrysum preslianum*, *Isoetes todaroana*, *Limonium furnarii*, *Limonium halophilum*, *Limonium mazarae*, *Limonium melancholicum* and *Limonium selinuntinum*, and many vascular plants which occur only or mostly within the Drepano-Panormitan district, like *Cardopatum corymbosum*, *Erodium gruinum*, *Gagea granatellii*, *Hypericum tetrapterum*, *Ipomoea sagittata*, *Pycnocomon rutaefolia*, *Ranunculus isthmicus*, *Spergularia tunetana* subsp. *appendiculata*, *Stipa barbata* and *Trifolium physodes*. Morevoer, the territory hosts many species of high biogeographic interest, such as *Astragalus caprinus* subsp. *huetii*, *Crocus longiflorus*, *Crucianella rupestris*, *Desmazeria sicula*, *Eryngium bocconei*, *Euphorbia cupanii*, *Limonium densiflorum*, *Linaria multicaulis*, *Polygala preslii*, *Retama raetam* subsp. *gussonei*, *Romulea li-*

naresii subsp. *linaresii*, *Tragopogon porrifolius* subsp. *cupanii*, and many plants that are extremely rare and endangered in Italy and Sicily, like *Ambrosina bassii*, *Cachrys sicula*, *Ceratophyllum demersum*, *Coris monspeliensis*, *Cressa cretica*, *Cyperus laevigatus* subsp. *distachyus*, *Dorycnium hirsutum*, *Galium elongatum*, *Globularia alypum*, *Hormuzakia aggregata*, *Hypericum pubescens*, *Leucojum autumnale*, *Limonium avei*, *Lonas annua*, *Lotus biflorus*, *Lotus conjugatus*, *Micromeria microphylla*, *Micromeria nervosa*, *Ononis pendula*, *Ophioglossum lusitanicum*, *Ophrys apulica*, *Quercus calliprinos*, *Rhamnus oleoides*, *Scilla obtusifolia*, *Silene fruticosa*, etc. Due to its noteworthy botanical heritage, part of this area has been included into the Italian IPA SIC 27 'Litorale Petrosino-Selinunte, Laghetti di Preola e Gorghi Tondi'.

Zonal vegetation

The most mature woody communities which occur in this territory are ascribed to QUERCETALIA ILICIS. On base-rich and subacid soils we can find some isolated remnant spots of forest communities belonging to QUERCION ILICIS, enjoying the more favourable microclimatic conditions of karst depressions and canyon bottoms, i.e. thermophilous woodlands, dominated by pubescent oaks (*Oleo sylvestris-Quercetum virgilianae* near Menfi) or evergreen forest-maquis dominated by holm-oaks (*Pistacio lentisci-Quercetum ilicis*, Bosco del Cantaro near Gorghi Tondi). Some particularly shady and humid places near Menfi, Sciacca, Partanna and Sambuca di Sicilia host peculiar species-poor evergreen forest assemblages dominated by *Laurus nobilis*, ascribed to *Acantho mollis-Lauretum nobilis*.

In the past acidophilous maquis-forest (ERICO-QUERCION ILICIS) occurred on local enclaves of terra rossa, as testified by ancient documents and by the scattered presence of many small nuclei or single big trees of *Quercus suber* in the countrysides of Castelvetrano, Partanna, Menfi and Sciacca.

Many nuclei of evegreen low sclerophyllous maquis, referred to *Chamaeropo humili-Quercetum calliprini* (PISTACIO-RHAMNETALIA ALATERNI and OLEO-CERATONION SILIQUAE) occur near Petrosino, Mazara del Vallo and Campobello di Mazara. Scattered nuclei of *Pistacio lentisci-Chamaeropetum humilis*, *Myrto communis-Pistacietum lentisci*, and *Rhamno oleoidis-Pistacietum lentisci* occur in the area. The steep, rocky and wind-exposed areas are characterised by *Euphorbie-*

Cave di Cusa: the place where the columns of the Temples of Selinunte were quarried.

tum dendroidis, an open thermophilous scrub ascribed to the alliance OLEO-CERATONION. Few small nuclei of the thermo-xerophilous summer-deciduous maquis ascribed to *Asparago acutifolii-Zizyphetum loti* are found in sunny and extremely arid sites near Mazara del Vallo.

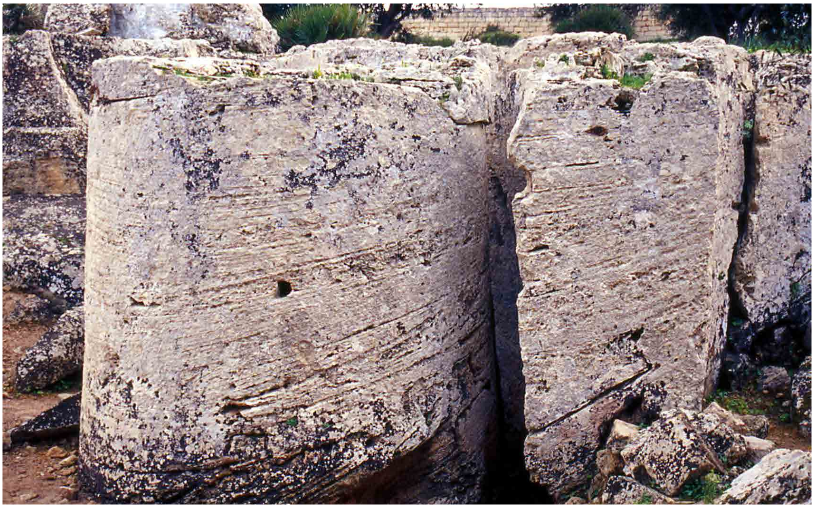
The shallow calcareous soils are mostly covered with low-growing garrigues dominated by several subshrubs such as *Erica multiflora*, *Thymbra capitata*, *Cistus* spp., *Fumana* spp., *Dorycnium hirsutum*, etc., referred to the alliance CISTO ERIOCEPHALI-ERICION MULTIFLORAE.

Thermo-xerophilous grasslands referred to *Hyparrhenietum hirto-pubescentis* (HYPARRHENIETALIA HIRTAE) are rather common on old fields, while geophyte-dominated herb communities such as *Carlino siculae-Feruletum communis*, *Thapsio garganicae-Feruletum communis* and *Ferulo communis-Hyparrhenietum hirtae* (CHARYBDIDO PANCRATII-ASPHODELION RAMOSI) prevail in the areas subject to frequent wildfires and overgrazing. The marly hills of the innermost part of this area are characterized by perennial grasslands ascribed to the association *Astragalo huetii-Ampelodesmetum mauritanici* (AVENULO-AMPELODESMION MAURITANICI).

As for annual dry grasslands (STIPO-TRACHYNIETEA DISTACHYAE), *Thero-Sedetum caerulei* is frequent on the shallow lithosols of rocky calcareous flatlands, while the most common therophytic communities may be referred to STIPION CAPENSIS (*Reichardio picroidis-Stipetum capensis* and *Ononido breviflorae-Stipetum capensis*). Leaching affecting the calcareous sandstones leads to the accumulation of sub-acid sandy-loamy soils which host many species (i.e. *Linaria multicaulis*, *Euphorbia terracina* and *Alkanna tinctoria*) typical to HELIANTHEMETEA GUTTATAE. The coastal areas influenced by salt-spray host subhalophilous annual grasslands (STIPO-BUPLEURETALIA SEMICOMPOSITI and PLANTAGINI-CATAPODION MARINI) ascribed to the association *Anthemido secundirameae-Desmazerietum siculae*.

Vegetation of coastal ecosystems

The dynamic evolution of sandy shores not only depends on the complex interaction between rivers, which provide fine-grained sediments, and marine currents, which shape and erode the coastline. Indeed, the extension and functioning of all the pioneer psammophilous communities which colonise beaches and regulate dune ecosystems is strongly connected with *Posidonia oceanica* sea-beds, which represent an 'underwater barrier' able to moderate and modulate both marine erosion and river sedimentation regimes. Not surprisingly, two local toponyms underline the paramount



Cave di Cusa: the place where the columns of the Temples of Selinunte were quarried.

importance of *Posidonia* for local coastal ecosystems. For instance, the coast near Selinunte is named 'Triscina', a Sicilian term of probable Arab origin referring to the stranded ribbon-like leaves of *Posidonia*, while the toponym Capo 'Feto' reminds the bad smell (from the Latin 'faetor') due to the huge brown mounds of rotting leaves accumulated along the coast.

The rocky coasts influenced by salt-spray host several chasmo-halophilous chamaephytic communities ascribed to CRITHMO-LIMONIETEA, like *Limonietum selinuntini* (exclusive to Selinunte), *Limonietum melancholici* (only occurring near Capo San Marco W of Sciacca) and *Limonietum mazarae* between Mazara del Vallo and Torretta Granitola. Additionally, the garrigue-like dense and low growing shrubberies occurring along the sunny and almost flat rocky calcareous coasts near Petrosino and between Mazara and Torretta Granitola are referred to the association *Thymelaeo hirsutae-Helichrysetum conglobati* (ANTHYLLIDION BARBAE-JOVIS).

The local halo-nitrophilous annual communities occurring on sandy-loamy salted soils (SAGINETEA MARITIMAE and FRANKENION PULVERULENTAE) are ascribed to the *Frankenio pulverulentae-Spergularietum bocconei*.

Some fragments of halo-nitrophilous scrub (class PEGANO HARMALAE-SALSOLETEA VERMICULATAE, alliance ARTEMISION ARBORESCENTIS), referred to *Atriplici halimi-Artemisietum arborescentis*, occur not only near the coast, but also on the salty marls of the innermost sector of this area, e.g. in the canyon of Castello della Pietra between Partanna and Castelvetrano.

The salt marshes of Capo Feto host a mosaic of halo-hygrophilous rush- and/or sedge-dominated assemblages framed into the alliance JUNCION MARITIMI. More in detail, *Juncetum maritimi* forms dense ad often wide helophytic communities on saline and permanently humid soils, while *Scirpetum compacti* occurs on clayey-loamy soils along the raised edges of swamps, and are able to stand long-lasting water stress due to the seasonal lowering of groundwater level. *Sporobolo pumili-Juncetum maritimi* is common on sandy and sandy-loamy soils and is often located between the coastal salt-marshes and the dune ecosystems. The halo-xerophilous shrubby vegetation ascribed to *Agropyro scirpei-Inuletum crithmoidis*, typical to areas subject to no or rare submersion events, occurs at Capo Feto, where it is linked to saltmarsh edges and canal banks.

PLANTAGINION CRASSIFOLIAE includes the halo-psammophilous perennial communities linked to sandy, sandy-loamy nutrient-rich soils of the raised areas located between dunes and brackish swamps, humid in winter, dry in summer. This alliance is locally represented by *Holoschoenetum globiferi*, *Schoeno nigricantis-Plantaginetum crassifoliae* (Capo Feto) and *Imperato cilyndricae-Juncetum littoralis* (between Capo Granitola e Selinunte).

The halo-hygrophilous chenopod scrub communities referred to SALICORNIETEA FRUTICOSAE are well represented in the salt marshes of Petrosino and Capo Feto. The association *Aeluropo lagopoidis-Sarcocornietum alpinii* prevails on rather hypoxic soils submerged by marine water during winter season. *Junco subulati-Arthrocnemetum glauci* is more common in the areas prone to short submersion periods and prefers well-drained and raised sites (e.g. edges of abandoned salt pans), on sandy-clayey salty and humid soils, forming a continuous belt surrounding the coastal salt marshes.

Several summer halo-nitrophilous pioneer communities dominated by annual succulent halophytes like *Cressetum creticae* and *Suaedo maritimae-Salicornietum patulae* (THEROSALICORNIETEA), occur in the tidal mud flats and edges of the coastal depressions seasonally flooded with saline waters at Capo Feto.

As for sand beaches, two species-poor pioneer psammo-nitrophilous summer annual communities (CAKILETEA MARITIMAE and EUPHORBION PEPLIS) occur in the area: *Salsolo kali-Euphorbietum paraliae* between Capo Granitola and Selinunte, *Atriplicetum hastato-tornabenii* along the shores of Capo Feto.

Perennial dune vegetation (AMMOPHILETEA and AMMOPHILION), once common and well-developed also at Menfi and Sciacca, is still well represented by *Cypero mucronati-Agropyretum juncei* and *Medicagini marinae-Ammophiletum australis* near Selinunte. The annual psammo-halophilous association *Scabiosetum rutifoliae* (ALKANNO-MARESION NANAE, HELIANTHEMETEA GUTTATI) co-occurs there.

The stabilized coastal grey hind dunes between C. Granitola e Selinunte are covered by dwarf shrubby vegetation ascribed to *Centaureo sphaerocephalae-Ononidetum ramosissimae* (HELICHRYSO ITALICI-CRUCIANELLETEA MARITIMAE and CRUCIANELLION MARITIMAE).

Vegetation of cliffs, walls and screes

The abandoned manufacts (stone walls, farmhouses) and quarries of the area host chasmo-nitrophilous communities referred to *Capparidetum rupestris* and *Hyoscyamo albi-Parietarietum judaicae*

(CYMBALARIO-PARIETARIETEA DIFFUSAE, ARTEMISION ARBORESCENTIS-CAPPARIDION SPINOSAE), *Oxalido corniculatae-Parietarietum judaicae* (PARIETARION JUDAICAE) and *Sedo dasyphylli-Ceterachetum officinarum* (CYMBALARIO-ASPLENION).

On the shady ledges and rock cliffs occur several moss- and fern-rich assemblages referred to ANOMODONTO-POLYPODIETEA and POLYPODION SERRATI.

Steep and high rock cliffs are not common in the area. The local impoverished nuclei of undisturbed chasmophytic vegetation, mostly found on calcareous rock faces and crevices, may be ascribed to DIANTHION RUPICOLAE. The rock cliffs of the canyon of Tardara, corresponding to the higher trait of the river Carboj, host the endemic association *Brassico rupestris-Centauretum saccensis*.

Hydro-hygrophilous vegetation

Where calcareous rocks meet marls the rich groundwater network gives rise to springs, home of several chomophytic and chasmophytic moss- and fern dominated communities (ADIANTETEA and ADIANTION) typical to shaded and water-splashed sites. Not surprisingly, both the toponyms 'Selinunte' and 'Petrosino' probably issue from the ancient Greek term 'selinon' which in tern refers to *Apium* spp. growing wild in such moist habitats.

The area is still rich in natural wetlands (salt marshes, permanent brackish ponds, etc.). Several written documents and maps testify that local wetlands were even wider and more common until the XVIII-XIX centuries. Also the artificial, disturbed, polluted and eutrophic lake of Pantano Leone near Campobello di Mazara has been made in a site previously occupied by a natural wetland.

The water bodies which totally dry up during summer season are called 'margi', from the Arab word 'marğ' (= temporary pond), which in turn has probably a very ancient Indo-European origin (see the Latin terms 'mare' and 'mergere' and the Anglo-Saxon 'marsh'), while the permanent ponds originating from karst processes are called 'urghi' (from the late Latin 'gurgum' = gorge, hollow). The flat landscape of the Sciare also hosts several small temporary ponds and rock pools rich in hygrophilous and aquatic communities linked to freshwaters.

The distribution of the hygrophilous vegetation surrounding the slightly brackish and eutrophic permanent ponds located between

Mazara del Vallo and Torretta Granitola, i.e. Lago Murana, Lago Preola, Gorgo Tondo and Gorgo Basso, clearly mirrors the different water requirements of the dominating plants, giving rise to concentric vegetation belts. If we trace an ideal transect from the water to the outer borders of the wetlands, the 0.5- to 2 m-deep bottoms of the waterbodies are characterised by a rooting submerged plant, *Potamogeton pectinatus*, forming a monophytic aquatic assemblage (*Potametum pectinati*, POTAMOGETONION and POTAMOGETONETEA), while the clayey-loamy alluvial soils at the borders of the ponds host several hygrophilous communities able to stand short drying periods during summer, dominated by big rhizomatous helophytes (PHRAGMITO-MAGNOCARICETEA and PHRAGMITION COMMUNIS), like *Scirpo lacustri-Phragmitetum australis*, *Typhetum angustifoliae* and *Iridetum pseudacori*. The rocky and steep raised banks of the karstic ponds host discontinuous nuclei of the thermo-hygrophilous association *Soncho maritimi-Cladietum marisci*, while *Caricetum hispidae* (MAGNOCARICION ELATAE) prevails on less steep outer banks.

Near the Gorghi Tondi the hygrophilous vegetation and the fringes of evergreen sclerophyllous maquis are interconnected by *Cirsio cretici-Dorycnietum recti* (DORYCNIO RECTI-RUMICION CONGLOMERATI, EPILOBIETEA ANGUSTIFOLII), a dense tall-herb community exploiting the nutrient-rich soils around the ponds.

Between late autumn and early spring the small depressions on terra rossa and the small rock pools interspersed in the territory (e.g. Partanna, Castelvetrano, Sambuca di Sicilia and Mazara del Vallo) host temporary ponds whose bottom is covered with rooted vegetation ascribed to RANUNCULION AQUATILIS (POTAMOGETONETEA), while their borders are colonized by several ephemeral dwarf annual swards ascribed to ISOETION and ELATINION MACROPODAE (ISOETO-NANOJUNCETEA).

Lemnetum minoris is a pioneer monophytic free-floating duckweed community belonging to LEMNETEA MINORIS, found in the still and eutrophic shallow freshwaters of Pantano Leone. During summer the slightly sloping and sunny shores of this artificial lake are covered with the ephemeral pioneer dwarf amphibious vegetation ascribed to *Glino mollis-Verbenetum supini* (VERBENION SUPINAE), typical to periodically submerged loamy and nutrient-rich soils of the water bodies subject to significant changes of water level.

As for local rivers and streams, fragments of open riparian woodland (SALICETEA PURPUREAE and SALICION PEDICELLATAE) still occur near the mouth of the Belice river (*Salicetum albo-pedicellatae*), while the mid course embankments of the main local rivers (Belice and Arena-Grande-Delia) host some nuclei of the hygrophilous association *Ulmo canescentis-Salicetum pedicillatae*, sometimes intermingled with thermo-hygrophilous pioneer thickets which may be referred to the class NERIO-TAMARICETEA.

Nowadays, the most common plant communities bordering the local fluvial network are some helophytic assemblages belonging to PHRAGMITO-MAGNOCARICETEA, such as *Helosciadetum nodiflori* (GLYCERIO-SPARGANION), growing in the thalweg of local streams, and *Cypero longi-Caricetum otrubae* (MAGNOCARICION ELATAE), adapted to stand seasonal drying periods. The brackish waters of Arena river mouth, east of Mazara del Vallo, host an almost intact nucleus of *Scirpetum compacto-littoralis* (SCIRPION MARITIMI).

The seasonally flooded nutrient-rich banks of Pantano Leone are covered with *Polygono lapathifolii-Xanthietum italici* (BIDENTETEA TRIPARTITAE and CHENOPODION RUBRI), while local riverbeds subject to intense mechanical disturbance host other summer-annual pioneer assemblages ascribed to PASPALO-AGROSTION VERTICILLATI, rich in thermo-hygrophilous species such as *Panicum repens*, *Paspalum paspaloides, Echinochloa crus-galli* and *Polypogon viridis*.

<u>*Anthropogenic vegetation*</u>

To *Diplotaxio tenuifoliae-Oryzopsietum miliaceae* (BROMO-ORYZOPSION MILIACEAE) belong the subnitrophilous and thermoxerophilous grasslands occurring on nutrient-rich soils along the borders of roads and tracks, at the base of stonewalls and in the fallows of the coastal area between Marsala and Mazara del Vallo.

Local crop cultures are characterized by *Capnophyllo peregrini-Medicaginetum ciliaris* (PAPAVERETEA RHOEADIS and RIDOLFION SEGETI), rather common on the clayey soils of W Sicily.

Viticulture is the most widespread (and often the only rentable) agricultural activity on the almost flat and sunny surfaces on this area. Local vineyards on terra rossa are characterized by *Diplotaxietum vimineo-erucoidis* (FUMARION WIRTGENII-AGRARIAE).

Chrozophoro tinctoriae-Kickxietum integrifoliae is a summer annual herb-rich heliophilous and nitrophilous association (DIPLOTAXION

ERUCOIDIS) linked to base-rich soils subject to regular seasonal agricultural practices. It is found on annual crop fields, vineyards, olive groves and almond orchards near Selinunte.

Other nitrophilous and ruderal communities linked to man-made habitats and suburban areas are ascribed to CHENOPODION MURALIS, like *Amarantho muricati-Chenopodietum ambrosiodis*, observed along the banks of Pantano Leone, rich in thermophilous alien plants such as *Mirabilis jalapa* e *Amaranthus blitoides*, and *Amarantho viridis-Chenopodietum muralis*, common around Mazara del Vallo.

HORDEION LEPORINI is locally represented by *Hordeo leporini-Sisymbrietum orientalis*, ruderal assemblage occurring long arid stony and suburban roadsides in the coastal areas (e.g. (Mazara del Vallo), whilst *Centauretum napifoliae* (Selinunte, Partanna, Partanna-Castelvetrano, Triscina, Campobello di Mazara), characterized by a high of liquorice, *Glycyrrhiza glabra*, is linked to the clayey and clayey-loamy soils of alluvial origin of the coastal plains, and is relatively frequent along roadsides, paths, tracks and canals.

The abandoned fields and fallowland is characterised by herb-rich communities ascribed to *Centauretum schouwii* (ECHIO-GALACTITION TOMENTOSAE), substituted by *Vulpio ligusticae-Tetragonolobe-*

Cave di Cusa: Huge pieces of future columns are lying scattered in the fields all along the way from Cusa to Selinunte.

tum biflori and *Chamaemelo fuscati-Silenetum fuscatae* (FEDIO GRACILIFLORAE-CONVOLVULION CUPANIANI) on the subacid and sandy soils of Mazzara and Castelvetrano.

Local *Citrus* orchards host nitro-sciaphilous assemblages which may be ascribed to GERANIO PURPUREI-CARDAMINETALIA HIRSUTAE.

The hygrophilous and nitro-sciaphilous megaphorb vegetation which forms tall hedges around several permanent ponds, such as the lakes Murana and Preola, is referred to EPILOBIETEA ANGUSTIFOLII and, more precisely, to the association *Calystegio sylvaticae-Arundinetum donacis* (CYNANCHO-CONVOLVULION SEPIUM).

The nitrophilous dwarf annual assemblages of trampled areas (POLYGONO-POËTEA ANNUAE and POLYCARPION TETRAPHYLLI) is locally represented by *Polycarpo tetraphylli-Spergularietum rubrae*.

The suburban areas and the numerous abandoned stone quarries of the Sciare of Petrosino, Mazara del Vallo and Campobello di Mazara are colonized by nitrophilous pioneer assemblages referred to the NICOTIANO GLAUCAE-RICINION COMMUNIS, dominated by many fast-growing alien thermo-cosmopolitan invasive species such as *Nicotiana glauca*.

4.3. Landscape and land use history

Several findings testify the continuous human presence in this territory since upper Palaeolithic and Mesolithic (Castelvetrano, Roccazzo and Gorghi Tondi near Mazara del Vallo, Tardara canyon, etc.), throughout Neolithic (Mt. Kronio near Sciacca, Castello della Pietra near Castelvetrano, Contrada Stretto near Partanna, etc.) and Bronze Age, when local communities started to build up villages (e.g. along the rivers Màzaro ad Arena near Mazara, near Partanna, Castelvetrano, Menfi, etc.). During Iron Age local communities (e.g. Partanna, Erbe Bianche near Campobello di Mazara, Montagnoli di Belice near Menfi) had intense trade relationships with East Mediterranean people. During the XI century BC Elymians settled there, and a significant increase of agro-pastoral activities occurred. In the same period Phoenicians used Mazara first as seaport to stop during their travels to or from their Iberian colonies and then as true emporium, as testified by many manufacts found between the mouth of the river Mazaro and Capo Feto. Later on, falling under Greek influence, Mazara continued to play the same role as emporium of Selinunte. After the destruction of Selinunte (409 BC), it was alternatively under Syracuse or Carthage influence until Romans conquered Sicily (241 BC) and populated the whole area (e.g. Menfi, Thermae Selinuntinae = Sciacca, etc.).

After the devastations caused by Vandals and Goths the whole area experienced a long-lasting period of socio-economic and demographic crisis. Local human community gradually increased under Byzantines, but the complete recover of the area coincided with the arrival of Tunisian Muslims (Capo Granitola, 827 AD). With approximately 30000 people Mazara became the second most important city of W Sicily after Palermo, and it played an important role also under Norman rule. In the meanwhile, plenty of rural villages were founded by Berbers who inhabited the inner part of W Sicily between X and XII centuries, like Partanna and Burgiomilluso (now Menfi). Also Castelvetrano, whose name seems to issue from the Latin *Castrum Veteranum*, perhaps a fortress or a watch tower built to defend and ancient crossroad, was probably founded around 1130 AD.

The whole area experienced strong depopulation between 1240 and 1280, i.e. after the persecution and the deportation of the whole Berber community carried out by the Swabian king Frederick II and during the short period of Anjou dominion. Under Aragon crown local human community experienced a new increase, and the Sciare were cultivated once again. Wide surfaces were still covered with trees, as suggested by the permission (1318) given by the kings to exploit and cut down the 'forests' of Berrybaida and Castelvetrano. Throughout the XV and XVI centuries Mazara del Vallo and Castelvetrano were wealthy centres, while the coastal areas remained almost desert and mostly exploited for quarrying, probably due to the high risk of contracting malaria near the coastal brackish swamps and because of the frequent incursions of north African pirates. Between XVII and XVIII centuries the Spanish government granted plots of land to farmers, promoted the construction of rural houses to support and host them during seasonal seeding and harvesting activities; in that period rural villages such as 'Menfrici' (now Menfi), Petrosino and Campobello di Mazara were founded, but real urbanisation of the territory started during the XVIII century, with the explosion of viticulture and olive culture, which changed forever local natural and rural landscape.

Between the end of the XIX and the first decades of the XX century a long-lasting period of economic depression induced many people to emigrate to USA, Australia and S America.

Until the 1950s the most rentable activities still were extensive grapevine and olive cultures and tuna fishing using millenary techniques (see the film of Rossellini 'contadini del mare', 1955). At that time the SW Sicilian coasts appeared one of the best preserved oasis of wilderness left in the whole island.

Very drastic changes have been shaping local landscape and land use during last half century. Mazara del Vallo became the biggest fishing port of the whole Mediterranean; in the meanwhile, the sand beaches and dune ecosystems, once widespread along the shores of all this area, underwent degradation, fragmentation and even total destruction due to touristic pressure and urban sprawl: previously uninhabited areas are now covered with thousands of private (and often illegal) houses forming ugly and chaotic 'summer villages' like those of Tre Fontane, Marinella di Selinunte, Torretta Granitola between Mazara del Vallo and Campobello di Mazara or those of Porto Palo and Lido Fiori near Menfi. The last well preserved sectors of the coast are the protected dune system near Selinunte, at the mouth of Belice river and the coastal saltmarshes within the nature reserve of 'Capo Feto', both managed from the Province of Trapani, and the nature reserve 'Gorghi Tondi and Lago Preola', managed by the NGO WWF-Italia. These remnant wetlands and coastal ecosystems still have a high naturalistic value, as they host many rare plants and plant communities and attract a very high number of migrating or nesting birds.

Also coastal wetlands underwent important changes: land reclamation carried out during the 1920-1930s in order to favour agricultural activities led to the drying up of a wide portion of them, and the water balance of the remnant coastal retrodunal lagoons, brackish swamps and saltmarshes (e.g. Margi di Milo near Petrosino and Capo Feto near Mazara del Vallo) was regulated through artificial canals and engines until the 1960s.

At the same time, the diffuse and intense capture and manumission of freshwater resources heavily haltered the regime and the chemical properties of local waterbodies, e.g. by facilitating the ingression of marine water and causing pollution. At the same time the intense and widespread anthropogenic disturbance linked with intensive agriculture, quarrying, urban sprawl, etc., facilitated the invasion of many ruderal and salt-tolerant plants.

On January 1968 'Belice earthquake' (Magnitudo 6.4) almost completely destroyed most of the towns of this area, and strongly affected local rural economy.

Today the area hosts approximately 170000 inhabitants (Mazara: 52000, Sciacca: 41000, Castelvetrano: 32000, Menfi: 13000, Campobello di Mazara: 12000, Partanna: 11000, Petrosino: 8000). Most of its hilly inland is currently covered with intensive, monotonous groves or vineyards, while carob trees and almonds have almost disappeared; on deeper soils and where water was available, *Citrus* orchards (mainly oranges) were made at the expense of the remnant nuclei of cork oak-dominated forests. Vineyards also covered wide surfaces of the coastal sector, but during last decades intensive green-house monocultures (tomatoes, strawberries, melons, etc.) are becoming the most widespread (and nature-unfriendly) land use.

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Box 4.1 *The Greek colony of Selinunte and the 'Cave di Cusa'*

Founded about 630 BC on a hill besides the sea surrounded by the rivers Modione (the ancient Σελινοῦς, Selinous) and Cottone, Selinunte was one of the most important Greek colonies in Sicily, expanding its influence to Halycus (= Platani) river to the east, to Mazarus river to the west. Around 420 BC the city walls enclosed an area of approximately 100 hectares and hosted more than 15,000 people. Being the westernmost Greek colony in Sicily, Selinunte soon came into contact with the Phoenicians and with Elymi, against whom disputes began as early as 580 BC, and culminated in 416 BC, when Selinunte and Segesta called Syracuse and Athens, respectively, as allies. Few years later (409 BC), when Segestans asked assistance from Carthage, a huge army of at least 100,000 Punic soldiers conquered Selinunte and wiped out most of its inhabitants. The stone quarry of Cave di Cusa, located 13 km SW of Selinunte, exploited for almost 150 years to construct the temples of the city, was suddenly abandoned after the defeat. Hereinafter Selinunte was under Punic control until the end of the First Punic War (250 BC): before pulling back, the Carthaginians removed all the inhabitants and destroyed the city.

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V

Evaporitic memories

Itinerary1 - Siculiana

The central part of the southern coast of Sicily is a classic ground for Messinian studies. Mio-Pliocene strata are folded and capped by only weakly deformed Pleistocene shallow-marine deposits. The Siculiana fold includes a 100 m thick massive-bedded selenitic gypsum (the 'Gessi di Cattolica Eraclea' Stratigraphic Unit), with synclines of commercially exploited halite deposits. The gypsum unit is underlain

by kilometre-thick mudstone-dominated successions, which include the Miocene Licata Formation and older claystones, and overlain by an upper Messinian succession chiefly comprising mudstones, with thin sandstone and sparse 1–4m thick gypsum beds, which pass abruptly up into chalks (Trubi Formation) and marls (Narbone Formation) of Pliocene–Pleistocene age. These soft, unstable and often salty substrata are colonized by a patchwork of scrublands (Salsolo vermiculatae-Peganetalia harmalae, Pistacio-Rhamnetalia alaterni) perennial (Lygeo-Stipetalia) and annual grasslands (Thero-Brometalia, Stipo-Bupleuretalia semicompositi) which shift into the psammophilous vegetation complexes of coastal sand dunes (Ammophiletalia australis, Helichryso stoechadis-Crucianelletalia maritimae, Malcolmietalia) towards the shoreline.
Trail: Length: 5 km round trip, Hiking time: 2 hours, Elevation range: 200 m

General Description

5.1. The physical setting

Nowadays this hilly landscape of inner Sicily is mostly characterised by steep marly, calcareous or gypsous hills, badlands and sunny braided streams, or gently sloping clayey slopes covered with cereal crop fields, vineyards or overgrazed pasturelands, while during Miocene this area was a marine basin. Up to date the most ancient rocks outcropping in this area belong to the 'Cozzo Terravecchia Formation' (upper Tortonian-lower Messinian, i.e. 7.5-6 Ma), which form a very thick layer of clays, marly clays interbedded with thin lenses of sands and conglomerates and are interpreted as a post-orogenic terrigenous sediment (i.e. issuing from the erosion of a close emerged continental area) which accumulated before the temporary closure of the Mediterranean basin. Nowadays this area is mainly characterised by the outcropping lithological units of the so-called 'Gessoso-Solfifera Evaporitic Series'. Within this series a first and a second sedimentary cycle have been recognized, interrupted by a phase of tectonic uplift. The different steps of the whole sedimentary process gave rise to the following lithological succession: 1) 'Tripoli': lightweight, porous, slightly laminated diatomites (= diatom shells) and snow-white marls, rich in plant and fish fossils, strongly bituminous at the base. This lithotype represents a 'prelude' of the Mediterranean salin-

The marly white coast of Siculiana (Suaedo-Salsoletum oppositifoliae; Asparago-Limoniastretum monopetali), with a sandy beach in the foreground (Medicagini marinae-Ammophyletum australis).

ity crisis, testifying the oingoing process of closure of the basin and the gradual shift to 'euxinic' (= oxygen poor water) environments; 2) 'Calcare di base': vacuolar, massive or stratified calcareous banks, interbedded with tiny pelitic intercalations; 3) 'Gypsums of the First Cycle' or 'Gessi di Cattolica': thick banks of selenitic (= macrocrystalline) gypsum, interbedded with laminated layers of microcrystalline gypsum ('balatino') and lenses of evaporitic limestones. The units 2 and 3 issue from the direct evaporation of Mediterranean sea waters; 4) Salts: the acme of the evaporitic process coincides with the precipitation of salts, which concludes the first sedimentary cycle; 5) 'Torbiditi gessose' (= gypseous turbidites): fine and coarse-grained gypseous sands interbedded with clays and bituminous diatomites, issuing from the dismantling of the outcropping evaporitic depositis due to inframessinian orogenesis; 6) 'Gypsums of the Second Cycle' or 'Gessi di Pasquasia': alternated selenitic, alabastrine (= saccaroid, i.e. sugar-grained) and microcrystalline ('balatino') gypsum layers interbedded with clays incorporating coarse blocks and fragments of gypsum crystals (gypsous clays). This formation issues from continental sedimentation processes; 7) 'Arenazzolo': arkosic sandstones.

This discontinuous terrigenous sediment closes the evaporitic series. The formations 2 to 7 date back to upper Messinian (5.96-5.33 Ma).

The revival of the connection between the Atlantic Ocean and the Mediterranean Sea during the lower Pliocene (5.3 Ma) is testified by another formation, the so-called 'Trubi', made of whitish stratified marly limestones and marls, rich in plankton foraminifers, with thick but irregular intercalations of clayey breccias. Later on the area was covered with a different type of pelagic sediments, the so-called 'Blue-grey clayey marls' (mid-upper Pliocene, 3.6-2.6 Ma), an extensive and well stratified pelitic sequence, somehwere showing a high sandy content and rich in fossils invertebrates (lamellibranches and gasteropodes).

Due its large size and its wide altitudinal range (from 0 to more than 900 m a.s.l.) the whole area is subject to a wide spectrum of bioclimates, ranging from lower thermomediterranean lower arid (Simeto river plain), to upper thermomediterranean on the inner hilly areas (lower and upper subhumid, Trapani and Agrigento provinces), to mesomediterranean on the highest hilly areas (upper arid and lower subhmid in Trapani, Agrigento and Caltanissetta provinces and on the southern slopes of Madonie Mts., upper subhumid in Enna province).

Selenitic gypsum colonized by the Rosmarino-Coridothymetum capitati and, in the background, perennial (Hyparrhenietum hirto-pubescentis) and annual (Ononido breviflorae-Stipetum capensis) dry grasslands.

Average annual rainfalls range between <550 mm (Riesi and Centuripe: 477, Adrano: 508, Vicari 539), 550-650 (Caltanissetta, Canicatti, Ciminna, Lercara Friddi, Mineo), >700 (Nicosia, Piazza Armerina and Racalmuto), and >800 (Bivona, Platani, Enna and Piano Leone). According to altitude, distance from sea or waterbodies and aspect the average values of mean yearly temperures range between 13.4 (Enna and Piano Leone), 16.5 (Riesi) and 16.8 °C (Bivona). The same trend is observed with the average minimum yearly temperatures (January), which range between 5 (Enna) and 9.0 °C (Riesi), and average maximum yearly temperatures (July and/or August) range between 22 (Piano Leone) and 26.6 °C (Mineo). In the whole area the water stress season last 4 to 5 months.

As concerns the more common soil associations occurring in this territory, the steep and almost bare top of the hills are classified as lithosols, the remaining part of gypsum-rich hills are characterised by an association of typical xerorthents and typical and/or vertic xerochrepts (= eutric regosols, eutric and/or vertic cambisols), while the valleys host a mixture of typical xerorthents, lithic xerorthents, typical and/or vertic xerochrepts (= calcareous regosols, lithosols, eutric and/or vertic cambisols) and somewhere also typical and/or vertic xerofluvents and/or typical chromoxerets and/or typical pelloxerets (= eutric fluvisols and/or chromic and/or pellic vertisols).

Scattered spots of an association with typical xerorthents, typical and/or vertic xerofluvents and/or typical chromoxerets and/or typical pelloxerets (= eutric regosols and eutric fluvisols and/or chromic and/or pellic vertisols) occur near Sommatino, Barrafranca, Racalmuto, Calascibetta, Valguarnera Caropepe and Leonforte).

The alluvial areas corresponding to local hydrographic network and to some scattered wetlands (e.g. Canicattì, Riesi, Resuttano, Serradifalco and San Cataldo) are characterised by a mixture of typical and/or vertic xerofluvents (eutric fluvisols), typical and/or vertic xerochrepts (eutric and/or vertic cambisols) and typical chromoxererts and/or typical pelloxerets (chromic and/or pellic vertisols).

An association of typical and vertic xerochrepts, typical chromoxererts and typical pelloxererts (= eutric and vertic cambisols, chromic and/or pellic vertisols) occur near Vicari, Aragona, Joppolo Giancaxio and Campobello di Licata.

On the southern slopes of Madonie Mts. and near Resuttano and San Cataldo occurs a combination of typical xerochrepts, typical haploxeralfs and typical and/or lithic xerorthents (= eutric cambisols, orthic luvisols and eutric regosols and/or lithosols).

Despite its often desertic landscape, this area hosts the endoreic brackish lake of Pergusa near Enna (1.2 km^2 the biggest natural lake of Sicily) and several permanent ponds like Lago Soprano near Serradifalco and Lago Sfondato near San Cataldo. The twin water pools of Palagonia, also known as Lago Naftia for their intense smell, issuing from the secondary activity of the Plio-Pleistocenic volcans of the Iblei Mts., have been destroyed during 1950s, when his site, sacred to Sicilian inhabitants for millennia, has been converted in an industrial site for the exploitation of carbon dioxide. Moreover, central Sicily is crossed by all the main rivers of the island, i.e. Imera meridionale or Salso (144 km), Simeto (113 km), Belìce (107 km), Platani (103 km), and many other important ones, like Disueri-Gela (c. 70 km), Sosio-Verdura (59 km), Imera settentrionale or Fiume Grande (35 km) and Naro (31 km).

Another geological highlight of this area are mud volcanoes. They occur in seven different sites of central-southern Sicily and at the base of Mt. Etna. All these localities are characterized by the co-occurrence of rapid sedimentation and intense neotectonic processes. The fluids and gases (mainly salty water, methane and carbon dioxide) incorporated in the pores of the clayey sediments are subject to extremely high pressure. Such pressure makes this mixture behave like a semi-liquid force it up through fissures in the crust, producing an outflowing mass of mud on the surface.

Already known and described by ancient scholars like Pliny the Elder, the Macalube di Aragona is the biggest mud volcanism site in Sicily. It covers an area of about 1.4 km^2 and hosts two c. 3 m-wide salsa lakes with water and gurgling gases and many cone-shaped structures called 'gryphons'. Local mud volcanoes alternate an almost continuous degassing activity and episodes with expulsion of large quantities of mud, blast and burning of gases. The onomatopeic Arab name 'Maglub' means 'overturned soil' and probably refer to the latter irregular, paroxysmal and dangerous events.

The Terrapelata site near Caltanissetta occupies an area of about 1.2 km^2 and is characterized by smaller gryphons emitting mud and gases. The morphology and the fluid emissions of other mud volca-

Saltmarsh colonized by the Junco subulati-Sarcocornietum alpini (reddish colour in the foreground) and by Agropyro scirpei-Inuletum crithmoidis (green meadow in the background).

noes, the so-called Salinelle of S. Biagio and Paternò, are prone to anthropogenic disturbance and are strongly affected by seismic events and any chemical change affecting the degassing activity of Mt. Etna.

5.2. Flora and vegetation

The available botanical knowledge on the territory at issue appears still incomplete and needs further updating and improvement. Scanty information on the innermost part of Sicily dates back to the beginnings of the XIX century, when the area was explored by G. Gussone, and by Sicilian scholars such as M. Lojacono-Pojero around the end of 1890s. Several botanical surveys, mostly concentrated on the humid areas, have been carried out around 1970s, while some recent investigations have ben focused on nature reserves and Natura 2000 sites. It worths to be underlined that currently uncultivated areas were almost certainly uncultivated also in pre- and proto-historical times; hence, this 'unexplored archipelago' of semi-natural surfaces scattered throughout the area (mostly rocky hills) may host many botanical treasures, such as neglected populations of rare and endemic species or even unknown species!

According to Brullo et al. (1995), this area belongs to the Agrigentine district, which on our opinion should include the very poorly distinct Catanese district, coinciding with the mid-low basin of Simeto river. It hosts as much as 13 narrow endemics, i.e. *Allium agrigentinum*, *Allium castellanense*, *Anthemis muricata* (also near Caltagirone), *Astragalus raphaelis*, *Lavatera agrigentina* (also badlands of Catania province), *Limonium calcarae*, *Limonium catanzaroi*, *Limonium optimae*, *Puccinellia gussonei* (probably extinct), *Salsola agrigentina* (also near Comiso), *Scabiosa parviflora* (also badlands of Catania province), *Senecio leucanthemifolius* subsp. *pectinatus*, *Tripolium sorrentinoi*, and many vascular plants which occur only or mostly within this district, such as *Avena insularis*, *Brassica villosa* subsp. *tinei*, *Cardopatium corymbosum*, *Chaenorrhinum rupestre*, *Cucubalus baccifer* (probably extinct), *Diplotaxis crassifolia*, *Echinophora tenuifolia* subsp. *tenuifolia*, *Erysimum metlesicsii*, *Gypsophila arrostii*, *Jacobaea lycopifolia*, *Klasea cichoracea*, *Nepeta apuleii*, *Ophrys mirabilis*, *Scorzoneroides muelleri* subp. *muelleri* (also badlands of Catania province), *Sedum gypsicola*, *Sedum ochroleucum* subsp. *mediterraneum*, *Trifolium congestum*, *Zannichellia peltata*, etc. As paradigmatic example of the strong underestimation of the botanical heritage of central Sicily we point out the fact that one single IPA, 'SIC 29 Rupi di Marianopoli', belongs to this area.

Zonal vegetation

Most of this area was probably exploited by farmers already during Neolithic times, and pristine shrublands and woodlands have been replaced by crop cultures many thousands of years ago. Not surprisingly, very small and extremely simplified examples of forest and pre-forest communities currently occur in this area, and assessing what local 'climax' looked like appears quite a hard task.

Nowadays we can distinguish at least two main vegetation series linked to the soils issuing from the different chemical properties of the Sicilian evaporitic outcropping rocks: one series typical to base-rich soils deriving from crystalline gypsum, gypsum sandstones and calcareous and marly-calcareous substrates and one series linked heavy and often nutrient-rich soils issuing from salty clays.

As for the series of the base-rich soils, the remnant forest assemblages (QUERCETEA ILICIS and FRAXINO ORNI-QUERCION ILICIS) are represented by few small nuclei of evegreen maquis on steep slopes which may be referred to *Rhamno alaterni-Quercetum ilicis* (e.g. Sant'Angelo Muxaro, Gibliscemi) and from some spots of thermophilous oak woodland which may be ascribed to *Oleo sylvestris-Quercetum virgilianae* (Milena, Sutera, Marianopoli, etc.).

Acantho mollis-Lauretum nobilis (ARBUTO UNEDONIS-LAURION NOBILIS) occurs along the thalweg of Santa Ninfa (Trapani province). Owing to the effective long-distance ornithochorous dispersal performed by laurels, the anthropogenic origin of this community cannot be discarded.

Dynamically and topographically connected with broadleaved woodlands are several shrubland 'mantle' communities dominated by brooms and spiny Rosaceae, like *Euphorbio characiae-Prunetum spinosae* (CRATAEGO-PRUNETEA and PRUNO SPINOSAE-RUBION ULMIFOLII).

On the steep and bare rocky hills of this area some summer-deciduous open maquis assemblages (OLEO-CERATONION SILIQUAE) occur, such as *Euphorbietum dendroidis* and *Euphorbio characiae-Anagyridetum foetidae* (e.g. near Lago Sfondato). The most common, yet poorly studied, woody communities occurring in such environmental conditions are the garrigues, dominated by low-growing subshrubs adapted to alkaline soils and to long-lasting drough periods (ONONIDO-ROSMARINETEA and CISTO ERIOCEPHALI-ERICION MULTIFLORAE).

As for perennial grasslands (LYGEO SPARTI-STIPETEA TENACISSIMAE), the areas subject to meso-mediterranean climate host several communites belonging to AVENULO-AMPELODESMION MAURITANICI, like *Astragalo huetii-Ampelodesmetum mauritanici* (Trapani, Agrigento and Enna provinces), *Helictotricho convoluti-Ampelodesmetum mauritanici* (Milena), *Avenulo cincinnatae-Stipetum barbatae* (Serre di Ciminna), *Avenulo cincinnatae-Stipetum siculae* (Enna and Caltanissetta provinces, e.g. Leonforte and Serre di Marianopoli) and *Seselio tortuosi-Ampelodesmetum mauritanici* (mostly Enna province, southern Madonie, but also Racalmuto, Canicattì, Serradifalco, etc.). The S-facing slopes of the hilly areas with base-rich lithosols located under thermo- and meso-mediterranean bioclimate are mostly covered with assemblages ascribed to HYPARRHENION HIRTAE (*Hyparrhenietum hirto-pubescentis*: widespread; *Dichanthio annulati-Hyparrhenietum hirtae* and *Imperato cylindricae-Hyparrhenietum hirtae*). Under severe overgrazing these perennial grasslands are often substituted by perennial assemblages such as *Thapsio garganicae-Fer-*

uletum communis, Ferulo communis-Hyparrhenietum hirtae, Carlino sicu-lae-Feruletum communis, and *Cachryo siculae-Hyparrhenietum hirtae*, all dominated by poisonous geophytes (ASPHODELETALIA RAMOSI and CHARYBDIDO PANCRATII-ASPHODELION RAMOSI).

All the above-mentioned perennial herb- and grass-dominated communities are intermingled with annual dry grasslands typical to alkaline substrates; more in detail, the therophytic swards occurring on alkaline loamy and clayey substrates are referred to STIPION RETORTAE, those linked to gypsum-rich substrates are framed into the alliance SEDO-CTENOPSION GYPSOPHILAE (currently *Filagini eriocephalae-Chaenorhinetum rubrifolii* is the only described association), those found on shallow skeletal base-rich soils (e.g. *Thero-Sedetum caerulei*) belong to TRACHYNION DISTACHYAE, while the xerophilous and subhalophilous swards like *Echinarietum todaroanae* (Santa Ninfa, Marianopoli, etc.) are framed into PLANTAGINI-CATAPODION BALEARICI).

Even if clayey soils probably were once covered with downy oak forests, most of the badlands are nowadays completely devoid of woody vegetation and are characterised by patchy and discontinuous annual and perennial grasslands. The most complex and 'mature'

Clayish outcrops colonized by the Phagnalo annotici-Lygeetum sparti..

communities of Sicilian badlands is currently represented by halo-nitrophilous scrub (PEGANO HARMALAE-SALSOLETEA VERMICULATAE and SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE) dominated by few species adapted to tolerate the hyperarid conditions of the inland, such as the *Salsoletum agrigentinae* (steep and eroded badlands of Macalube, Adrano, Enna and Caltanissetta provinces, southern side of Madonie and high basin of Simeto river), *Limonio calcarae-Suaedetum verae* (Agrigento and Caltanissetta provinces: Sant'Angelo Muxaro, Terrapilata, etc.). Four subnitrophilous plant communities framed into the alliance ARTEMISION ARBORESCENTIS occur in more humid areas subject to mesomediterranean bioclimate, i.e. *Coronillo valentinae-Artemisietum arborescentis* (Imera settentrionale river basin near Caltavuturo), *Limonio optimae-Salsoletum oppositifoliae* (Salso river basin near Resuttano), *Lycio europaei-Artemisietum arborescentis* (Alia along Imera settentrionale basin, Agira and elsewhere in Enna province), *Atriplici halimi-Artemisietum arborescentis* (coastal and inner badlands of Catania province).

Badlands host both xerophilous or hygrophilous grasslands which are adapted to cope with different edaphic stress factors (e.g. soil water eccess, soil water and oxygen shortage, soil summer cracking, etc.) with represent a severe bias for plant life.

As for the xerophilous perennial grasslands, they may be framed into LYGEO SPARTI-STIPETEA TENACISSIMAE and MORICANDIO-LYGEION SPARTI, an alliance dominated by stress-tolerant hemicryptophytes endemic to Sicily and southern Calabria, locally represented by three associations, i.e. *Eryngio dichotomi-Lygeetum sparti* (badlands of Agrigento, Caltanissetta and Catania subject to thermo-medietrranena climate), *Asteretum sorrentinii* (slightly mesophilous and nitrophilous, endemic to central-western Sicilian badlands) and *Lavatero agrigentinae-Lygeetum sparti* (species-rich assemblages occurring under mesomediterranean bioclimate between 350 and 550(800) m a.s.l. in Enna, Caltanissetta and Agrigento provinces). The tuffs of *Lygeum spartum* play a key role for the whole grassland ecosystem by providing a humid and shady microhabitat for plenty of terophytes and geophytes and preventing them from being grazed before flowering. Additionally this perennial rhizomatous grass actually represents the last defence against desertification, being able to colonize even 30-50° steep slopes, to promptly re-sprout after burning. On clayey or loamy compact soils, seasonally wet, then dry for long periods, *Lygeum*-dominated grasslands are often intermingled with halo-subnitrophilous discontinuous ephemeral swards framed into SAGINETEA MARITIMAE, such as *Polypogonetum subspathacei* (FRANKENION PULVERULENTAE), occurring on the slightly sloping margins of several temporary ponds, while the bare ridges and the steepiest and intensely eroded slopes of badlands are characterised by the uneven cover of annual dry grasslands such as *Podospermo cani-Parapholidetum pycnanthae*, *Chamaemelo fuscati-Leontodontetum muelleri* and *Sphenopodi-varicati-Spergularietum diandrae*; all these communities are framed into GAUDINIO FRAGILIS-PODOSPERMION CANI, an alliance endemic to Sicily and southern Calabria. On particurly nutrient-rich clays (e.g. Macalube of Aragona) also subnitrophilous assemblages ascribed to MESEMBRYANTHEMION CRYSTALLINI may occur.

Vegetation of cliffs, walls and screes

Chomophytic and chasmophytic moss- and fern dominated vegetation in shaded and water-splashed habitats (ADIANTETEA and ADIANTION) are represented by several associations like *Eucladio verticillati-Adiantetum capilli-veneris*, *Eucladio verticillati-Didymodontetum tophacei*, *Adianto capilli-veneris-Cratoneuretum commutati*.

The thermophilous fern-rich epilithic communities of shaded sites (POLYPODIETEA and POLYPODION SERRATI) are locally represented by several associations like *Anogrammo leptophyllae-Selaginelletum denticulatae*, *Polypodietum cambrici* and *Selaginello denticulatae-Cymbalarietum pubescentis*.

The sunny calcareous, marly or gypsum undisturbed cliffs and ledges of inner and southern Sicily (Agrigento, Caltanissetta and Enna provinces) are covered by chasmophilous communities ascribed to *Brassico tinei-Diplotaxietum crassifoliae* (ASPLENIETEA TRICHOMANIS and DIANTHION RUPICOLAE), while the stone walls and the disturbed cliffs host several thermophilous chasmo-nitrophilous assemblages framed into both CYMBALARIO-ASPLENION and PARIETARION JUDAICAE (CYMBALARIO-PARIETARIETEA DIFFUSAE).

Some spots of pioneer vegetation (DRYPIDETEA SPINOSAE and EUPHORBION RIGIDAE) occur on the calcareous and gypsum screes of this area; the former may be framed into *Sedo sediformis-Centranthetum rubri*, while the latter are still poorly studied. As for the

Landscape view of the cultivated fields behind the coast of Siculiana and, in the foreground, an outcrop of selenitic gypsum with therophytic vegetation (Atractylido-Neatostemetum apuli).

vegetation colonising the incoherent pebbly and sandy warps of local streams ad braided streams, it should be referred to *Ononido ramosissimae-Helichrysetum italici* (central Sicily: basins of the rivers Imera meridionale and Salso).

Hydro-hygrophilous vegetation

According to historical documents, many local rivers had a permanent water regime, and some of them were even navigable until Roman dominion, like, like Platani river. Both its name and that of one of its tributaries, called 'Turvoli' (from 'durbu', the Sicilian vernacular word for Platanus) unambiguously indicate the past presence of *Platanus orientalis*, never recorded by the botanists who have explored the area during last two centuries. Nowadays the entire area hosts only few, simplified nuclei of riparian gallery forests (ALNO GLUTINOSAE-POPULETEA ALBAE and POPULION ALBAE). The scattered distribution of these communities depends not only on stress factors, such as the high salinity and the strong seasonality of the water regime of local rivers and streams, but also on the intense disturbance caused by seasonal agricultural practices (e.g. ploughing and stubble burning). Additionally, most of local main rivers underwent strong manumissions for drinking or agricultural purposes: their springs have been captured, their courses were deviated and canalized, crossbars have been created to slow them down and dams to fill artificial water reservoirs, etc.

More common are the assemblages framed into SALICION PEDICELLATAE (SALICETEA PURPUREAE), a SW Mediterranean alliance including the riparian alluvial willow scrubs colonizing the alluvia of mineral-poor rivers, streams and braided-streams, locally represented by *Salicetum albo-pedicellatae* (rivers of central and southwestern Sicily: Verdura, Platani, Disueri, Gornalunga, etc.) and *Ulmo canescentis-Salicetum pedicillatae* (e.g. streams near Salemi and Santa Ninfa). Additionally, the beds and the banks of local braided-streams (the so-called 'fiumare') are frequently covered with thermo-hygrophilous pioneer thickets ascribed to *Tamaricetum gallicae* (NERIO-TAMARICETEA and TAMARICION AFRICANAE). These communities are adapted to widstand intense mechanical disturbance during the rainy season, when the water courses are full with mud and large stone blocks, and a very long-lasting period of water shortage, intense solar radiation and extremely high temperatures (during summer the surface of pebbly streambeds may reach 80 °C!).

The borders of permanent water bodies, riversides and streamsides are covered with three different types of perennial herbaceous vegetation, whose prevalence mostly depends on the level of salinity. The nutrient-rich deep soils of seasonally flooded enbankments of freshwater bodies are dominated by the perennial meso-hygrophilous pastures and meadows referred to MOLINIO-ARRHENATHERETEA and MENTHO LONGIFOLIAE-JUNCION INFLEXI, locally represented by *Phalarido coerulescentis-Agropyretum repentis*, salt-tolerant and summer drought-tolerant community common on the loamy-clayey flat and seasonally wet soils of inner Sicily (e.g. Salso river near Caltanissetta).

Slowly flowing fresh and brackish waterbodies and slow flowing streams are dominated by big rhizomatous helophytes (mostly reeds or sedges) framed into several alliances belonging to PHRAGMITO-MAGNOCARICETEA. More in detail, PHRAGMITION COMMUNIS is represented by *Scirpo lacustri-Phragmitetum australis* (e.g. at Lago Soprano and Lago Bosco between Serradifalco and San Cataldo, Caltanissetta province), *Phragmitetum communis* and *Typhetum* *angustifoliae* (widespread), and *Typho angustifoliae-Schoenoplectetum glauci* (e.g. within Platani river basin), GLYCERIO-SPARGANION by the associations *Helosciadetum nodiflori* (widespread) and *Apio nodiflori-Glycerietum plicatae* (Salso river near Pietraperzia), MAGNO-CARICION ELATAE by *Caricetum hispidae* (Platani river basin) and SCIRPION MARITIMI by *Scirpetum compacti* (wetlands and badlans of Enna and Caltanissetta provinces).

Under even higher salt concetrations the above mentioned plant communities are substituted by halo-hygrophilous hemicryptophitic sedge- and rush-dominated pastures which normally occur in coastal saltmarshes, like *Juncetum maritimi* (JUNCETEA MARITIMI and JUNCION MARITIMI) along the banks of the Lake of Pergusa. The associations *Puccinellietum gussonei* (Aragona, Racalmuto and Adrano), *Festuco arundinaceae-Juncetum subulati* (Adrano, Aragona, Pietraperzia, etc.) and *Festuco arundinaceae-Caricetum divisae* (Adrano) occur on the depressions at the base of the local badlands and are framed into AGROSTIO-ELYTRIGION ATHERICAE, an alliance including the central Mediterranean halo-nitrophilous grasslands of salty clayey-loamy coastal slopes and inland badlands.

During summer part of the humid shores of the lake of Pergusa is covered with *Suaedo maritimae-Salicornietum patulae*, a pioneer community of annual succulent halophytes (THEROSALICORNIETEA and THEROSALICORNION) which commonly occurs on the salty and sandy-clayey soils of abandoned salt pans and tidal mud flats but may occur on the raised edges of the irregularly flooded saline inland waters.

The hygrophilous ephemeral microphytic pioneer vegetation of temporary ponds (ISOETO-NANOJUNCETEA) is locally represented by the subnitrophilous association *Glino mollis-Verbenetum supinae* (VERBENION SUPINAE), quite common on the slightly sloping shores of many artificial water reservoirs prone to intense seasonal water level changes (e.g. Pozzillo, Ancipa, Fanaco, etc.).

As for aquatic vegetation, still and relatively nutrient-rich freshwater bodies host some free-floating duckweed assemblages (LEMNETEA and LEMNION MINORIS) like *Lemnetum gibbae* (Lago Soprano), while the sandy and slighty sloping banks of deep and clean running waters (Platani river, Morello stream, etc.) host submerged assemblages referred to *Ceratophylletum demersi* (STRATIOTION).

Local stagnant mesotrophic, eutrophic and brackish freshwater bodies are home of rooted floating or submerged macrophytic communities (POTAMOGETONETEA and POTAMOGETONION) like *Potametum pectinati* (e.g. Laghetto Bosco). Assemblages of rooted macrophytes typical to shallow stagnant freshwaters, probably belonging to RANUNCULION AQUATILIS, have been recorded ca. 40 years ago in some little ponds near Butera and need to be confirmed and better described. To ZANNICHELLION PEDICELLATAE belong the associations *Najadetum marinae*, recently recorded in some artificial basins of Caltanissetta province, and *Zannichellietum obtusifoliae*, widespread all over the area (e.g. Macalube di Aragona, Platani river, Morello stream, etc.).

Anthropogenic vegetation

Annual weed segetal communities (PAPAVERETEA RHOEADIS) represent the most widespread vegetation cover of the area.

Local arable crop fields on neutral sandy-loamy soils are characterised by *Capnophyllo peregrini-Medicaginetum ciliaris* (RIDOLFION SEGETI). This association is common in the coastal and inland areas of central and southern Sicily subject to thermomediterranean climate; on base-rich soils it is replaced by two communities framed into ROEMERION HYBRIDAE, i.e. *Legousio hybridae-Biforetum testiculatae* (inner Sicily: Palermo, Agrigento and Caltanissetta provinces) and *Valerianello dentatae-Medicaginetum scutellatae* (Enna province).

The vegetation of local vineyards, orchards and groves is represented by *Diplotaxietum vimineo-erucoidis* (FUMARION WIRTGENII-AGRARIAE), very common throughout southern Sicily.

The disturbed places of many towns and cities of the considered territory host ruderal communities typical to man-made habitats (CHENOPODIETEA and CHENOPODION MURALIS). *Malvo parviflorae-Chrysanthemetum coronarii* (HORDEION MURINI) is a wintergreen annual weedy and ruderal assemblage which occurs in the suburban areas subject to mesomediterranean climatic conditions of all southern and south-eastern Sicily.

The vegetation of abandoned crop fields and frequently burnt fallows occurring on the calcareous nutrient-rich soils is referred to the associations *Hedysaro coronarii-Lavateretum trimestris* (mid and lower plain of Simeto river), *Centauretum schouwii* (inner north-western and central Sicily: e.g. Fiuzza, Madonie Mts., Enna and Caltanis-

Folded layers of the Trubi formation.

setta provinces) and *Convolvuletum tricoloris* (mid and low basin of Simeto river). These tall-herb ruderal communities are framed into ECHIO-GALACTITION TOMENTOSAE and are substituted by *Ononido alopecuroidi-Vicietum siculae* (FEDIO GRACILIFLORAE-CONVOLVULION CUPANIANI) on the subacid and sandy soils of inner north-western and central Sicily (e.g. Ficuzza, Caltanissetta province).

The sciaphilous subnitrophilous geophyte-rich fringe vegetation typical to dense groves and orchards is framed into ALLION TRIQUETRI and is locally represented by *Delphinio staphisagriae-Stellarietum cupanianae* (e.g. abandoned olive groves of Mt. Mimiani).

The thermophilous grass-rich anthropogenic vegetation rich in summer-annual C4 species (DIGITARIO SANGUINALIS-ERAGROSTIETEA) which occurs in the annual crop cultures irrigated during summer may be ascribed to *Chrozophoro tinctoriae-Kickxietum integrifoliae* (DIPLOTAXION ERUCOIDIS).

The nitrophilous annual assemblages of local trampled areas (POLYGONO-POËTEA ANNUAE and POLYCARPION TETRAPHYLLI) are ascribed to *Crassulo tillaeae-Saginetum apetalae* (e.g. Adrano and Bronte) and *Trisetario aureae-Crepidetum bursifoliae* (e.g. Centuripe).

The thistle-dominated ruderal xerophilous communities of local overgrazed areas (ARTEMISIETEA VULGARIS, ONOPORDION IL-

LYRICI) are represented by *Onopordo illyrici-Cirsietum scabri* (Caltanissetta) and *Phlomido herba-venti-Nepetetum apuleii*; this latter community, previously reported only for the base-rich soils of the Sicani Mts., also occurs on the gypsum-rich soils of the hilly areas of Trapani province.

Two ruderal herb- and grass-dominated associations framed into Artemisietea vulgaris, i.e. *Centrantho rubri-Euphorbietum ceratocarpae* (BROMO-ORYZOPSION MILIACEAE) and *Euphorbio ceratocarpae-Arundinetum plinii* (ARUNDION PLINII), often replace the thickets of NERIO-TAMARICETA along the riversides and the riverbeds of the streams subject to intense and frequent natural and anthropogenic disturbance.

The tall-herb semi-natural perennial vegetation typical to nutrient-rich riparian fringes (EPILOBIETEA ANGUSTIFOLII and CYNANCHO-CONVOLVULION SEPIUM) is locally represented by *Calystegio sylvaticae-Arundinetum donacis*, frequently occurring on the disturbed banks of local rivers and water reservoirs under thermo-mediterranean bioclimatic conditions.

The seasonally flooded nutrient-rich and disturbed riverbeds and lacustrine banks host summer-annual pioneer communities ascribed to BIDENTETEA TRIPARTITAE and CHENOPODION RUBRI and, more in detail, to *Polygono lapathifolii-Xanthietum italici* (widespread, e.g. Platani, Verdura and Salso rivers) and *Polygono orientalis-Chenopodietum rubri* (artificial reservoirs of Caltanissetta province).

5.3. Landscape and land use history

The area has been densely inhabited at least since Neolithic, and even more during Bronze and Iron ages, as testified by of woody (and even grassland) cover and the spread of badlands are a consequence of the intense erosion affecting the clayey salty soils since millennia or viceversa. The current size of badland surfaces may be an issue of the intense deforestation which took place in this area since Neolithic times. Nowadays completely bare surfaces and wide landslips are very frequent, not only due to the hostile chemical and physical properties of the substrate, but also as the unavoidable consequence of too frequent wildfires of wheat fields and pasturelands, overgrazing, unsustainable ploughing techniques, etc.

The destruction of local vegetation triggers a negative chain reaction: no plant cover means more water runoff, linear erosion and landslips; the less the soil, the less the available water for plant roots, the more erosion unearths plant roots and destroys local plant communities.

In order to mitigate soil erosion and to stop desertification approximately 35000 ha of *Eucalyptus* forests (mostly *E. camaldulensis* and *E. occidentalis*) have been planted throughout central Sicily between the 1950s and the 1980s. Indeed the results of this activity in terms of soil protection were often far below expectation; moreover, *E. camaldulensis* is starting to invade the banks and the beds of local river and streams, which represent its primary habitat in Australia.

Between the 1950s and the 1980s many dams have been built on the rivers and the tributary streams of this territory; as a result, the hydrological and sedimentological regime of the whole area appears strongly compromised. The resulting articial lakes are used for various purposes, such as water supply for agriculture, drinking water (e.g. Naro, Ancipa, Pozzillo, Morello, Nicoletti, Olivo, Disueri, Comunelli, etc.) but also for industrial purposes (e.g. production of hydro-electric energy, cooling waters for industrial sites).

Seen as areas of no value, in recent times not only exhausted and abandones mines, but also many badlands have been heavily manumitted and even transformed in illegal waste dumps or tracks for 'sport' activities such as go-kart and motocross competitions, so that some rare endemics whose ancestors colonised Sicily during Messinian salinity crisis and had million years to evolve on the island, like *Puccinellia gussonei* and *Tripolium sorrentinoi*, are now threatened with rapid extinction due to another crisis, the crisis of legality, respect of nature, intelligence.

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Box 5.1 *Heracleа Minoa*

Heraclea Minoa (from the ancient Greek Ἡράκλεια Μινῴα = Hêrakleia Minôia) is located on the southern coast of Sicily, 25 km west of Akragas (= Agrigento). It was founded during 6th century BC as an outpost of the Greek colony of Selinus on the top of Capo Bianco, a steep marl cliff dominating the mouth of the river Halycus (= Platani).

After the treaty of 405 BC between Greeks and Carthaginians, it represented a border town of Akragas, mostly under Punic control until 202 BC. Heraclea Minoa probably was one of the main naval stations of the Carthaginians in Sicily during the first two Punic wars; we hear but little of the city under Roman dominion, and it was abandoned by the beginning of the 1st century AD.

The location of Heraclea Minoa was first identified in the 16th century from the Sicilian historian Tommaso Fazello, when the foundations of the walls could be distinctly traced, and the whole site still abounded with remains of pottery and brickwork. In the early 20th century, a VI-V century BC necropolis was discovered. A large-scale excavation led by Ernesto de Miro, begun in 1950, uncovered IV-I century BC dwellings and a IV century BC theatre.

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Box 5.2 *Do gypsophilous species really exist?*

Since 2016 an international research project led by the universities of Reggio Calabria (Italy) and Almería (Spain) is aimed at detecting plants linked to gypsum substrates.

According to a preliminary list already available, only three species occurring in Sicily, i.e. *Chaenorhinum exile*, *Sedum gypsicola* and *S. ochroleucum* subsp. *mediterraneum* appear to be exclusive of gypsum outcrops, while eight more (e.g. *Astragalus caprinus* subsp. *huetii*, *Brassica villosa* subsp. *tinei*, *Diplotaxis crassifolia*, *Echinaria capitata* var. *todaroana*, *Erysimum metlesicsii*, *Gypsophila arrostii* subsp. *arrostii*, *Scabiosa parviflora*, *Sternbergia lutea*) clearly prefer it.

Many other species frequently found on gypsum (e.g. *Andropogon distachyos*, *Athamanta sicula*, *Elaeoselinum asclepium* subsp. *asclepium*, *Erica multiflora* subsp. *multiflora*, *Hippomarathrum siculum*, *Ranunculus bullatus*, *Silene fruticosa*, *Teucrium polium*, *Thymbra capitata*, etc.) probably are totally indifferent to substrate chemistry: to colonize other bedrocks of the Gessoso-Solfifera Formation outcropping in the nearbies, such as limestones and marls, they only need to be calcium-tolerant, just as strict gypsophilous species are. Moreover, many species seem to have developed edaphic stress-tolerance to avoid competition on 'easier' substrates; interestingly, they belong to genera which occur not only on gypsum but also on other 'hostile' substrates such as serpetinites or dolomias (e.g. *Alyssum*, *Erysimum*, *Fumana*, *Helianthemum*, *Matthiola*, *Micromeria*, etc.).

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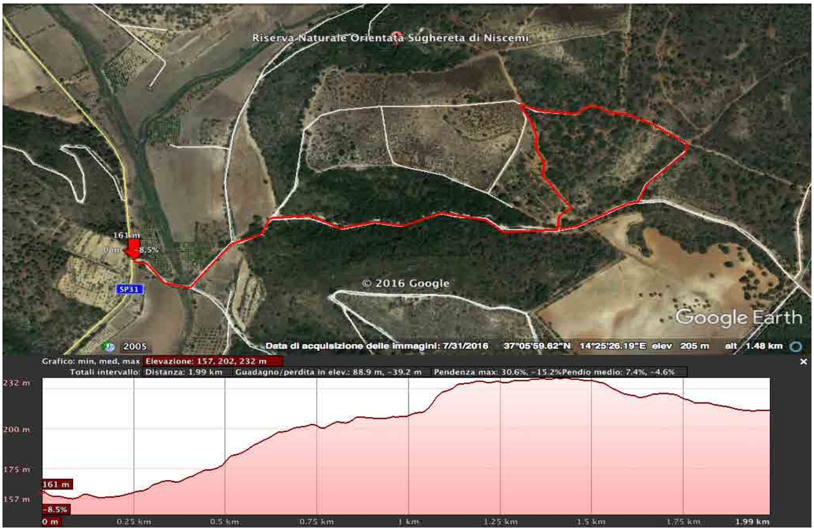
VI
Sandy hills

Itinerary1-SugheretadiNiscemi,MonteSanNicola,Manfria



Three short walks (approx. 2 km each) on flat or gently sloping terrain, in the surroundings of Gela: The site includes traits of sandy beaches and sandy hills, formed by quarzarenitic sands, interrupted by steep slopes, up to 80 m high, formed by Plio-Pleistocenic eveporitic outcrops, constituted by gypsum, clay and calcareous to calcarenitic conglomeratic rocks. The area is featured, as well, by some still preserved sand dunes, up to 120 m high, escaped by chance from being flattened when, in a recent past, the development of tourism, intensive agriculture and greenhouses for early fruit cultivations modified the landscape in most of southern Sicily. The occurrence of bronze age necropolises (culture of Castelluccio), scattered Greek, Roman and Bizantine farmhouses and villages and a fortification system built in the XVI Century contribute to the local archaeological heritage. The site is one of the driest of Sicily, the mean annual temperature being 18,3 °C, with an annual cumulative precipitation amounting to 409 mm. The coexistence of several lithological substrata, as well as the particular climatic conditions of this area, gives rise to a noteworthy floristic and vegetational biodiversity. As matter of fact, a set of N. African species are here localized, taking part to peculiar vegetation types, sometimes exclusive of this sicilian coast-stretch. The local vegetation includes psammophilous units (Cakiletalia maritimae, Ammophiletalia

australis, Helichryso stoechadis-Crucianelletalia maritimae, Malcolmietalia), salt-marshes (Sarcocornietea, Phragmito-Magnocericetea), petro-halophilous scrubs (Crithmo-Limonietea, Pegano-Salsoletea), spares woods (Quercetalia ilicis), different maquis-types (Pistacio lentisci-Rhamnetalia alaterni), garrigues (Cisto-Ericetalia), perennial dry grasslands (Lygeo-Stipetea), annual dry grasslands (Stipo-Bupleuretalia semicompositi, Trachynietalia distachyae, Tuberarietalia).
Trail: Hike **1** - Length: 2,5 km, Hiking time: 40 min., Elevation range: 80 m Hike **2** - Length: 2 km, Hiking time: 30 min., Elevation range: 60 m; Hike **3** - Length: 2 km, Hiking time: 40 min., Elevation range: 60 m.

General description

6.1. The physical setting

The study area is located in SE Sicily, representing the south-western border of the Hyblaean Plateau, and includes almost flat or gently sloping areas from sea-level up to 400 m a.s.l.

From a geological point of view, these area hosts a succession of sediments which filled the so-called Caltanissetta Basin, a Late Miocene-Quaternary foredeep basin located between the southern part of the Maghrebian-Apennine Chain and the western part of the Hyblaean Foreland, which has evolved in time and space following the advancing chain front, i.e. moving south-eastwards.

The hills of the area are made of 'Caltagirone sands' (Selinuntian, i.e. 1.8-1.6 Ma), littoral yellow silty sands with arenaceous lenses, passing in the upper parts to sands, gravels and red conglomerates, probably of continental origin, interbedded with travertine levels. At lower altitudes, in stratigraphical continuity with the above-mentioned sands, Mt. San Giorgio clays outcrop from Mt. S. Giorgio near Caltagirone to Licata. Going south-west towards Gela, along the valley of the stream Maroglio and up to present-day coastline, these clays are connected through a 50-200 cm-thick sandy-silty level with the clayey marls ascribed to Geracello Unit (Piacenzian to Selinuntian, i.e. 2.8-1.6 Ma).

The lowlands correspond to marine terraces and present-day marine and continental (fluvial) deposits dating back to mid Pleistocene-Holocene, like the medium to coarse-grained limestones called 'Biocalcareniti e calciruditi di Vittoria', semi-coherent riparian-lacustrine deposits (travertine-like calcarenites and marly limestones), and several Pleistocene marine terraces made of calcareous sandstones and conglomerates.

Three are the main water courses of this area are the rivers Dirillo (the ancient 'Achates' of Greeks, 54 km) and Ippari ('Hipparis', 28 km), and the stream Maroglio (26 km), a tributary of Gela river.

The coastline is almost entirely made of sandy beaches which give rise to complex dune systems particularly well developed near Scoglitti.

The most common and important pedological associations occurring in the area are 1) 'typical xerochrepts + haploxererts + typical and/or lithic xerorthents (eutric cambisols + orthic luvisols + eutric regosols and/or lithosols), characterising most of the hills of Niscemi and Caltagirone, and 2) 'typical haploxeralfs + typical and/or lithic rhodoxeralfs (orthic luvisols + chromic luvisols)' corresponding to the plain of Vittoria and the area of Santo Pietro near Caltagirone. Moreover, the pedological association 'typical xerorthents + typical xerochrepts + typical haploxeralfs (eutric regosols, eutric cambisols and orthic luvisols)' occurs in the foothills of the area of Niscemi just above Biviere di Gela coastal lagoon. Additionally, two main alluvial soil associations occur along local watersheds, i.e. 'typical and/or vertic xerofluvents + typ-

Coastal sand dunes of Manfria (Asparago stipularis-Retametum gussonei), currently heavily invaded by the W-Australian neophyte Acacia saligna (bottom-right corner).

ical and/or vertic xerochrepts (eutric fluvisols + eutric and/or vertic cambisols)' and 'typical xerofluvents + typical chromoxererts and/or typical pelloxererts (eutric fluvisols + chromic and/or pellic vertisols).

Considering the available data recorded in the nearest thermo-pluviometric stations, the mean annual temperatures of the area range between 16 °C (Caltagirone and Mazzarino), 17.5 °C (Vittoria) and 18 °C (Dissueri), while mean annual rainfalls range between 380 mm (Dissueri) and 630 mm (Mazzarino) mm, with 4.5-5 months of drought stress. The plain of Vittoria is characterized by upper thermo-mediterranean upper arid bioclimate, while the hilly areas of Niscemi and Caltagirone are subject to upper dry meso-mediterranean conditions.

6.2. Flora and vegetation

The first botanical investigations on this territory were carried out during the XIX century by V. Tineo, G. Gussone and two local naturalists, E. Taranto Rosso and X. Gerbino and by N. Citarda and M. Lojacono-Pojero few decades later. Many papers published between the 1960s and present day, mostly focused on local annual dry and perennial grasslands and woody communities (garrigues, maquis and forest assemblages) significantly improved the knowledge on local flora and vegetation.

According to Brullo et al. (1995) this area shall be included in the Kamarino-Pachynense district and hosts 10 narrow endemics. Among them, four are exclusive, i.e. *Astragalus kamarinensis*, *Limonium pachynense*, *Limonium pavonianum* and *Linaria multicaulis* subsp. *humilis*, while 8 more ones also occur in one or more other districts of S, SE and central Sicily, like *Avena insularis* (also Agrigentine district), *Helichrysum hyblaeum* (also Iblei Mts.), *Limonium hyblaeum* (also Favignana on Egadi islands), *Muscari gussonei* (also Agrigentine district), *Senecio glaucus* subsp. *hyblaeus* (also Iblei Mts.), *Serapias orientalis* subsp. *siciliensis* (also Gela and SW Sicily), *Stipa gussonei* (also SW Sicily), *Tuberaria villosissima* subsp. *sicula* (also Gela and SW Sicily). The local vascular flora counts at least 90 endemic, rare or endangered taxa: in this district grow approximately 40 different orchid taxa, i.e. nearly half of those occurring in the whole Sicilian territory, many Sicilian endemics, such as *Allium lehmannii* subsp. *lehmannii*, *Astragalus caprinus* subsp. *huetii*, *Bellevalia dubia* subsp. *dubia*, *Odontites rigidifolius*, *Ophrys archimedea*, *Ophrys caesiella* (also Iblei Mts. and Malta), *Ophrys calliantha*, *Ophrys discors*, *Ophrys explanata*, *Ophrys flammeola*, *Ophrys lunulata*, *Ophrys obaesa*, *Ophrys oxyrrhynchos*, *Ophrys panormitana*, *Salsola agrigentina*, and many species which are rare or absent in the other Sicilian districts, like *Anthemis abrotanifolia* (also Licata), *Cistus clusii* (also Gela), *Cyperus alopecuroides*, *Echinophora tenuifolia* subsp. *tenuifolia* (also Agrigentine district at Leonforte), *Filago asterisciflora* (also Butera and Agira), *Gagea trinervia* (also Marina di Noto and surroundings of Gela), *Helianthemum aegyptiacum*, *Helianthemum sanguineum*, *Helianthemum sessiliflorum*, *Hippocrepis ciliata*, *Klasea cichoracea* (also Agrigentine district), *Leptochloa fusca* subsp. *uninervia*, *Linum maritimum*, *Lobularia libyca*, *Loeflingia hispanica*, *Malcolmia africana*, *Nonea vesicaria* (also SW Sicily), *Retama raetam* subsp. *gussonei* (also SW Sicily and Licata), *Rhus pentaphylla* (once occurring along the coasts of NW and SW Sicily), *Rhus tripartita* (also Linosa), *Romulea melitensis*, *Seseli tortuosum*, *Stachys arenaria* (also Gela), etc.

Due to high concentration of species of biogeographical and conservation interest part of the area has been included within two nature reserves 'Sugherete di Niscemi' and 'Bosco di Santo Pietro', managed by the Regional Forest Department and within the regional Natura 2000 network. Moreover, the area overlaps with the Italian IPA 'SIC 19 Boschi di Niscemi e costa di Gela'.

Zonal vegetation

On the sandy soils between 50 and 250 m a.s.l. the most mature evergreen oak forest is represented by *Stipo bromoidis-Quercetum suberis* (ERICO-QUERCION ILICIS), an open acidophilous thermo-xerophilous assemblage dominated by cork oak - sometimes together with *Quercus coccifera* and *Quercus ilex* - and characterised by an often dense broom undergrowth, whose fragments (Niscemi, Caltagirone at Santo Pietro and Granieri, Mazzarino, etc.), appear quite poor and degraded from both a structural and a floristic point of view.

Even if thermophilous oak woodland (*Oleo sylvestris-Quercetum virgilianae*), which probably represented the final stage of succession on calcareous and marly substrates, has disappeared in the whole territory, many small spots occur in the nearby areas (Mazzarino, Piazza Armerina, Mazzarrone, Chiaramonte Gulfi, Monterosso Almo, etc.).

Pistacio lentisci-Quercetum ilicis (FRAXINO-QUERCION ILICIS), also known for W Sicily (Marettimo Island, Gorghi Tondi near Maz-

Coastal badlands of Manfria (Suaedo-Salsoletum oppositifoliae).

zara del Vallo), S Sicily and Iblei Mts., also occurs on the marls at Santo Pietro, exploiting the particularly humid microclimatic conditions provided by some canyons.

The area hosts a complex patchwork of evergreen sclerophyllous communities (OLEO-CERATONION SILIQUAE) issuing from the chaotic combination of both progressive and regressive succession processes issuing from land abandonment and fire disturbance: pure stands of *Chamaerops humilis* occur in the territory of Niscemi, while nuclei dominated by *Pistacia lentiscus*, *Phillyrea latifolia* and *Olea europea* var. *sylvestris* are a common feature in the whole area, especially within abandoned groves and afforestations. Two peculiar associations of thermophilous maquis have been recently described in the surroundings, i.e. *Cytiso infesti-Quercetum calliprini* near Acate and *Rhamno oleoidis-Pistacietum lentisci* at Poggio Racineci near Caltagirone, while at Cava Randello *Teucrio fruticantis-Rhamnetum alaterni* colonizes the steep rocky N-facing calcareous slopes and *Myrto communis-Pistacietum lentisci* occurs where the water table is very shallow.

Ephedro fragili-Lycietum europaei is a peculiar halo-nitrophilous assemblage which only occurs between 200 and 300 m a.s.l. It represents the final community on the steep marly slopes near Caltagirone, where it is often intermingled - and dynamically connected

- with the chenopod scrubs of SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE and the halo-xerophilous perennial grasslands of MORICANDIO-LYGEION SPARTI.

Thymbro capitatae-Pinetum halepensis (PISTACIO LENTISCI-PINION HALEPENSIS), a xerophilous pinewood typical to base-rich and shallow soils, has been detected in many localities of the plain of Vittoria, and it occurs between 80 and 300 m a.s.l. within Ippari river basin. Scattered spots of Aleppo pinewoods still also occurred until 1900s within the Dirillo river basin (Caltagirone, Licodia Eubea, Vizzini) and are still present in Tellaro river basin. The native status of these assemblages remains uncertain, as local Greek colonies may have introduced these conifers to satisfy their needs of timber for ship construction.

On lower part of this area, subject to thermo-mediterranean bioclimate, it is possible to observe several psammo-xerophilous maquis assemblages; once common on the consolidated dunes of S and SE Sicily from sea level up to 200 m a.s.l., these communities have been almost completely wiped out as a consequence of greenhouse cultivation. One of them, *Asparago horridi-Retametum gussonei*, framed to PERIPLOCION ANGUSTIFOLIAE, occurs between Licata and Gela, near Comiso and between Scoglitti and Punta Braccetto, while the other assemblages are referred to JUNIPERION TURBINATAE: *Junipero turbinatae-Quercetum calliprini* occurs at Santo Pietro, Passo Marinaro near Scoglitti and in the nature reserve 'Pineta di Vittoria', *Cytiso infesti-Juniperetum turbinatae* characterises the rocky slopes of the calcareous or calcareous marly hills of Cava Randello and occurs elsewhere in Sicily (Alcamo in NW Sicily, Torre Salsa and Capo Bianco in S Sicily), whilst *Piptathero coerulescentis-Juniperetum turbinatae* has been recently detected on extremely arid stands on sandy slopes near Dirillo river (Acate).

As a result of the high fragmentation and intense disturbance affecting forest, pre-forest and riparian communities, mantle communities are rather widespread. Among them, the most common may be ascribed to *Cytiso infesti-Pyretum spinosae* (CRATAEGO-PRUNETEA and PRUNO SPINOSAE-RUBION ULMIFOLII). Small pure stands of *Ulmus minor* and/or *Rubus ulmifolius* occur along local streamsides, too.

Local outcropping clayey marls give rise to steep and intensely eroded slopes which host halo-nitrophilous chenopod scrubs ascribed to *Salsoletum agrigentinae* (PEGANO-SALSOLETEA and SALSOLO

VERMICULATAE-PEGANION HARMALAE). This assemblage has been detected in the territory of Vittoria and Caltagirone and is rather common throughout the Agrigentine district (Biancavilla, Capodarso, Macalube di Aragona, Villarosa, Centuripe, etc.).

The coastal marly cliffs of Punta Braccetto host *Suaedo verae-Limoniastretum monopetali*. First described for Lampedusa island, this assemblage has also occurs along the S Sicilian coast (Realmonte and Porto Empedocle) and near Catania.

On the areas subject to frequent wildfires, cork oak woods are substituted by garrigues (ONONIDO-ROSMARINETEA and CISTO ERIOCEPHALI-ERICION MULTIFLORAE) ascribed to *Rosmarino officinalis-Thymbretum capitatae*. This association, first described at Santo Pietro near Caltagirone, also occurs elsewhere in SE Sicily (Scoglitti, near Capo Passero, Pachino), on Pantelleria island and on several gypsum-rich sites of S Sicily, while *Thymbro capitatae-Helichrysetum barrelieri* only occurs in SE Sicily (Caltagirone, Niscemi, Eloro, Marina di Noto and Vendicari). These assemblages often represent the edaphic climax wind-exposed ridges and are quite common in crop fieds abandoned since long time, too.

On the consolidated dunes of Ippari basin and Santo Pietro occurs *Hyparrhenio pubescenti-Helianthemetum sessiliflori*, a psammophilous garrigue issuing from the degradation of *Rosmarino officinali-Coridothymetum capitati* and *Junipero turbinatae-Quercetum calliprini*.

The perennial grasslands occurring on the steep, rocky and frequently disturbed slopes on the marls of Granieri near Caltagirone are ascribed to *Seselio tortuosi-Ampelodesmetum mauritanici*, widespread under mesomediterranean climatic conditions on the substrates of 'Gessoso-Solfifera' formation of the Agrigentine district and near Messina. Local impoverished examples of *Astragalo huetii-Ampelodesmetum mauritanici* occur under thermo-mediterranean bioclimate; this community obvious in S Sicily, mostly occurring on lithosols issuing from calcareous, marly and gypseous outcropping rocks and dynamically connected with both *Thymbro capitatae-Pinetum halepensis* and *Rhamno oleoidis-Pistacietum lentisci*.

The garrigues ascribed to *Cistetum salvifolio-clusii* often represent the edapho-xerophilous climax on the well-drained soils deriving from sandy limestones colonising the sunny and mostly S-facing slopes of the lower part of Ippari river basin.

Evaporitic hills with Moricandio-Lygeion sparti and Echio-Galactition vegetation.

Under thermomediterranean climate the perennial grasslands of AMPELODESMION MAURITANICI give room to HYPARRHENION HIRTAE, locally represented by the widespread association *Hyparrhenietum hirto-pubescentis* and by *Stipo gussonei-Hyparrhenietum hirtae* a community endemic to this area and to few localities of SW Sicily. *Eryngio dichotomi-Lygeetum sparti* (MORICANDIO-LYGEION SPARTI) is localised on marly clayeys slopes under thermo-mediterranean bioclimatic conditions. The above-mentioned perennial grasslands are often intermingled with therophytic ephemeral subnitrophilous prairies which may be referred to STIPION RETORTAE, reported for Cava Randello.

Under thermo-mediterranean bioclimatic conditions, overgrazing favours the prevalence of assemblages dominated by perennial Apiaceae and Poaceae and framed into ASPHODELETALIA RAMOSI and CHARYBDIDO PANCRATII-ASPHODELION RAMOSI, such as *Thapsio garganicae-Feruletum communis* (Vittoria and Caltagirone) common on the marly-clayey soils of southern, central-eastern and south-eastern Sicily, and *Cachryo pungentis-Hyparrhenietum hirtae*, on sandy soils between 100 and 400 m a.s.l.

As for annual dry psammophilous grasslands (HELIANTHEMETEA GUTTATAE), the ephemeral assemblages linked to consolidated fossil dunes sheltered from salt-spray are framed into the alliance

FILAGINI ASTERISCIFLORAE-LINARION HUMILIS, here represented by two associations. *Evaco asterisciflorae-Tuberarietum siculae*, which occurs in the gaps of *Stipo bromoidis-Quercetum suberis* (Piazza Armerina, Niscemi and Caltagirone), while *Alkanno tinctoriae-Nonetum vesicariae* has been observed at Vittoria, where it colonises the nutrient-rich and moderately disturbed flat gaps within *Junipero turbinatae-Quercetum calliprini*.

The therophytic vegetation occurring on coastal dunes under salt-spray influence (ALKANNO-MARESION NANAE) is referred to *Vulpio membranaceae-Leopoldietum gussonei*, strongly reduced due to the destruction of its habitat, now almost totally occupied by greenhouses, and it occurs (perhaps we should better say it used to occur) in the gaps of *Hyparrhenio pubescenti-Helianthemetum sessiliflori* (Macconi di Gela, basin of Ippari river, Scoglitti, Cava Randello, Marina di Ragusa, Donnalucata and Capo Passero).

On shallow skeletal base-rich soils (limestones and marly limestones) *Thero-Sedetum caerulei* (TRACHYNION DISTACHYAE) may be observed, often intermingles with HYPARRHENION HIRTAE xerophilous perennial grasslands.

On marly substrates, the gaps of Vittoria pinewood stands are frequently colonised by subhalophilous therophytic swards referred to *Onobrychido caput-galli-Psiluretum incurvi* (PLANTAGINI-CATAPODION BALEARICI).

Vegetation of cliffs, walls and screes

Neither published relevés nor any general information is available on the local plant communities occurring in those habitats.

Hydro-hygrophilous vegetation

The water quality, the morphology and the regular flux of the rivers and streams of the area are prone to huge human pressure. Most of the disturbance factors are connected with local agriculture (e.g. high input of fertilisers, pesticides, intense water pumping), and many illegal activities, such as waste dumping and land filling along the streamsides, sediment withdrawal and burning of the plastic materials of disused greenhouses in the streambeds, etc.

The riverbeds and the riverbanks of local water courses must have hosted riparian gallery forests (ALNO GLUTINOSAE-POPULETEA

ALBAE). Some remnant examples of such vegetation occur on the higher part of Dirillo river basin, not far from the considered area, and may be ascribed to two different associations, i.e. *Roso sempervirentis-Populetum nigrae* (POPULION ALBAE) and *Platano orientalis-Salicetum pedicellatae* (PLATANION ORIENTALIS). Alluvial willow-dominated scrub communities, ascribed to *Salicetum albo-pedicellatae* (SALICETEA PURPUREAE and SALICION PEDICELLATAE) have been recorded within Cava Randello and along Torrente Caltagirone.

Additionally, some fragments of pioneer open thermo-hygrophilous thickets ascribed to *Tamaricetum gallicae* (NERIO-TAMARICETEA and TAMARICION AFRICANAE), very common along the muddy streamsides and gravelly streambeds of central and southern Sicily, have been recorded in locality Zotte near Santo Pietro and along the Dirillo river. Due to the strong mechanical disturbance and frequent wildfires affecting local streams, the above-mentioned woody riparian communities are often substituted by ruderal communities characterised by the dominance of *Dittrichia viscosa*, *Hypericum triquetrifolium* and *Ononis natrix* subsp. *ramosissima* (BROMO-ORYZOPSION MILIACEAE), or by species-poor reed-dominated communities referred to *Phragmitetum communis* (PHRAGMITO-MAGNOCARICETEA and PHRAGMITION COMMUNIS) or to *Calystegio*

Mt. San Nicola badlands, a very important stratigraphic reference (Global Stratotype Section and Point -GSSP- of the Gelasian Stage/Age), colonized by the Phagnalo annotici-Lygeetum sparti.

sylvaticae-Arundinetum donacis (EPILOBIETEA ANGUSTIFOLII and CYNANCHO-CONVOLVULION SEPIUM). Another helophytic species-poor community occurring at cava Randello, to be referred to PHRAGMITION COMMUNIS, is dominated by *Sonchus maritimus*.

Although this area hosts several species commonly linked to temporary ponds, such as *Centaurium pulchellum*, *Juncus articulatus*, *Mentha pulegium*, *Ophioglossum lusitanicum*, etc., no vegetation data are so far available on the eventual presence of communities belonging to ISOETO-NANOJUNCETEA and ISOETION.

Anthropogenic vegetation

Raphano raphanistri-Erucetum sativae (FUMARION WIRTGENII-AGRARIAE) represents the most common weed assemblage of horticultural crop fields (mostly legumes), between 150 and 250 m a.s.l., while *Amarantho lividi-Eragrostietum barrelieri* (DIPLOTAXION ERUCOIDIS) characterises the sandy soils of the vineyards of Santo Pietro near Caltagirone.

As for the ruderal assemblages ascribed to HORDEION MURINI, *Hordeo leporini-Erodietum acaulis*, observed at Santo Pietro, occurs on clayey acid soils under meso-mediterranean bioclimatic conditions and it has been observed up to 1.000 m a.s.l. on Nebrodi and Iblei Mts., while *Hordeo leporini-Carduetum argyroae* prefers nutrient-rich soils at lower altitudes and has been observed at Gela and Niscemi, were it colonises arid and wind-exposed disturbed places such as roadsides or stone/rubble heaps. *Malvo parviflorae-Chrysanthemetum coronarii*, common on clayey soils between 50 and 350 m a.s.l., prefers the abandoned sunny areas previously subject to intense disturbance or overgrazing, has been observed at Santo Pietro and it also occurs on Lampedusa island and elsewhere in SE Sicily.

ECHIO-GALACTITION TOMENTOSAE is locally represented by two different associations. *Linario humilis-Euphorbietum terracinae* is a thermophilous community occurring on the sandy soils of the fossil dunes of Santo Pietro, Niscemi and Piazza Armerina; rich in ruderal and xero-nitrophilous herbs, it mostly occurs in fallows or undisturbed field margins. *Convolvulo pentapetaloidi-Carduetum corymbosi*, observed at Santo Pietro near Caltagirone and elsewhere on Iblei Mts., occurs on base-rich deep soils (between 100 and 550(700) m a.s.l., mostly on cereal crop fields subject to seasonal grazing.

Acantho mollis-Smyrnietum olusatri (ALLION TRIQUETRI) is linked to nutrient-rich soils and shady places, preferring particularly dense tree canopies. It frequently occurs in SE Sicilian carob groves and was found under dense, yet disturbed cork woodland at Niscemi.

Local sheepfolds and manure heaps are characterised by *Silybo mariani-Urticetum piluliferae* (SILYBO MARIANI-URTICION PILULIFERAE), a (sub)xerophilous and hypernitrophilous ruderal community recorded in the plain of Vittoria.

6.1. Landscape and land use history

The most ancient traces of human presence in this territory date back to upper Palaeolithic-early Mesolithic (locality Terrana near Caltagirone). Numerous findings testify the diffuse human presence in the whole area (Niscemi, Caltagirone, Comiso, Vittoria, Acate, Santa Croce Camerina, Pozzallo, etc.) during Bronze Age and during the so-called culture of Castelluccio (2200-1450 BC). Those people may be identified with Sicanians, who settled small villages made of straw huts and lived with hunting and agriculture. Around XIII BC they gradually turned their villages into fortified settlements, probably to protect themselves against Siculi, who pulled them back towards inner and higher areas.

Near Caltagirone the site of Sant'Ippolito seems to have been continuously inhabited from Neolithic times until the arrival of Greeks, whilst another pre-existing settlement, located at Monte San Mauro, was not abandoned and became a 'Siculo-Hellenic' village.

Many coastal sites of this area, like Pozzallo, may have played an important role as *emporia* both for Phoenicians traders and the first Greek settlers.

During VIII-V centuries BC, under the influence of the mighty Rhodian-Cretan colony of Gela, the countryside of Niscemi was densely inhabited and cultivated, hosting many farms and rural villages.

In the meanwhile (598 BC), Syracuse founded Kamarina on the hills close to the mouth of Hipparis (now Ippari) river, and transformed the pre-existing coastal swamp into a large canal port. Kamarina became soon an autonomous city, experiencing alternate phases of influence from Siracusa or Gela. Since 424 BC it received and exported to the whole Greek world the abundant products (barley, wheat, oil, wine, etc.) of the Siculo-Hellenic city of Morgantia.

Conflicts between Gela and Syracusa and between Greeks and Carthaginians lasted almost 250 years, and finally caused a significant decrease of human presence at Niscemi, were most of the farms were abandoned, and at Kamarina, weakened and frequently plundered and almost completely destroyed by Romans on 258 BC to punish its fidelity to Carthage. There still was a little village there during III-I centuries BC, but soon after the construction of the new port at Kaukana (Punta Secca) during Empire period, its inhabitants settled there or migrated towards the close inland areas.

A thermal bath close to the source of Diana near Comiso (II century BC) suggests the presence of a village in the surroundings, perhaps populated by people survived to the destruction of the Siculo-Hellenic town of *Kasmenai*, near Buscemi, in 212 BC, punished for its alliance with Carthage.

Roman presence if documented also near Caltagirone, Vittoria (II century AD) and Cava d'Ispica, whose ancient name, Spaccaforno, probably issued from a Roman farm called *Hyspicae fundus*.

Recent archaeological surveys suggest that the territory of Niscemi was continuously inhabited between III to IX centuries AD, as testified by the rural village of *Plaga Calvisiana* and by the findings of locality Pitrusa, hosting a 'mansio' (= horse-change station with resting rooms), a thermal complex and several food provisions stores (II-VII AD). Notwithstanding the diffuse presence of rural farms on the plains and buildings along the coast all over this territory, by the end of Roman dominion the hilly inland must have still appeared as a wide and almost continuous forested area, the so-called 'Saltus Kamarinesis', covering most of the western slopes of Erei and Iblei Mts. and the Ippari river basin.

Under Byzantines local people preferred to move away from the coastal areas, so that many abandoned Siculo-Hellenic villages and necropolis were 're-cycled' becoming troglodytic towns. The few remnant villages, like the rural settlement of *Comicio* (= Comiso) and the small coastal town of Kamarina, were besieged, destroyed and re-built by Arabs. Although the conquerors encountered a stronger opposition than in Vallis Mazarae (central-western Sicily), they founded many new rural villages like Odicrillo (near Acate), and fortresses, like *Fat al-Nascim* (= elm pass), now Niscemi, and *Qal'at al Jarún* (= the fortress of the jars), Caltagirone, and, above all, they achieved a profound revolution of both land property and cultivation practices: immense *latifundia* were divided into little lots, cereal crop cultivation and breeding were carried out only on suitable areas, oil production was enhanced, new tree cultures such as carob trees, mulberries, pistachios and hazelnuts were introduced, dry stonewall terraces were built in order to cultivate along slopes avoiding soil erosion, wide public areas were left untouched for wood regeneration, etc.

Between XI and XIII centuries, perhaps due to the earthquake of 1169 of Catania (Magnitudo 6.6), more probably as a consequence of increasingly humid climatic conditions, many villages near the coast and the rivers are abandoned, like Niscemi, Odicrillo near Acate, Kamarina and another one near Pozzallo. In the meanwhile, Caltagirone became more and more powerful, owning fertile and intensively cultivated lands and very large forested areas, donated by Norman kings as a reward for helping during the siege of the Arab fortress of Judica.

After more than a century of civil wars, conflicts and uncertainty, most of the area was included in the county of Modica, whose lords (Chiaramonte family: 1296-1392; Enriquez Cabrera family: 1392-1816) turned small rural villages, like Comiso and Casale di Biscari (now Acate), into towns, and the small port of Pozzallo into a 'caricatore', i.e. a commercial port provided with warehouses to store huge quantities of merchandise, with ditches able to contain hundreds of tons of wheat, with piers and slipways to ship all these products. Since 1550 the Enriquez Cabrera family undertakes the massive colonisation of the western part of the county: Vittoria is founded on 1607 in the locality Bosco Plano ('flat wood'). In that period Caltagirone reaches its economic and cultural acme: between XV-XVII it counted 20.000 inhabitants, 10% of them devoted to pottery production. In the meanwhile the Branciforte, lords of Niscemi and Mazzarino, promoted the resettlement of the site of Niscemi, whose town was officially founded on 1599 and populated during XVII century.

In the following centuries the close woodlands represented an important (if not the only) resource for many towns of this territory, namely Niscemi, Mazzarino and Caltagirone, and any use of forest goods (e.g. gathering of wood, mushrooms, wild vegetables and berries; coppice turns; cork bark harvesting timing and turn; game hunting season; amount of browsing domestic herbivores, etc.) was inspired to criteria of sustainability.

The period between XVI and XVII centuries was very hard for local people due to impressive series of fatalities such as recurrent out-

Views from Niscemi Cork-oakwoods (Sughereta di Niscemi), on Quaternary inland dunes: Stipo bromoidis-Quercetum suberis and Cisto-Ericion garrigues.

breaks of black plague, famine events, grasshopper invasions, floods, culminated on 1693 with the terrifying earthquake (Magnitudo 7.4) which shook the entire island destroying all the towns of SE Sicily.

Vittoria, born to produce wine, fulfilled for almost three centuries its vocation: its different qualities of 'black wine' are soon appreciated and exported, and Scoglitti becomes a commercial port from where wine an other agricultural products are sent to Malta.

As a result of the suppression of feudalism (1816) the county of Modica is abolished, and Vittoria and Pozzallo experience an even faster economic and demographic explosion. The permission to cultivate previously demanial lands, divided into small lots and assigned to privates, attracts lots of persons from the surrounding area. After centuries of complying with strict rules aimed at the sustainable use of forest resources, people felt free to find the most rentable way to use their own piece of land. As a result, local woodlands underwent rapid and severe reduction and fragmentation: within few decades large areas of *Quercus suber* or *Pinus halepensis* woodland were completely wiped out. As for the territory of Caltagirone, at the beginning of 1900s only 5000 ha of cork-oak woods remain.

At the end of XIX century viticulture experiences a deep crisis due to phylloxera and to the unfavourable international economic scenario. Local farmers are obliges to make difficult choices to survive: within a few decades they replaced vineyards with gardens, and by the end of 1950s they grew vegetables into greenhouses. With ups und downs, intensive and specialized agriculture (mostly tomatoes) opened a new phase of economic development, deeply modified the social structure and the welfare of the local community, and changed forever the natural and natural landscape of the area. The whole area is currently populated by nearly 190000 people (Vittoria: 60000, Caltagirone: 38000, Niscemi: 28000, Pozzallo: 19000, Mazzarino: 12000, Acate and Santa Croce Camerina: 11000). During last decades we record the recover of vineyards with the production of the famous red wine 'Cerasuolo di Vittoria', issuing from the mixture of two local vine races, Nero d'Avola (or 'Calaurisi') and Frappato.

Due to the deep crisis of Italian cork market, overwhelmed by Portuguese, Spanish and Moroccan production, by the end of 1950s cork oak woods definitely lost their economical importance. No more considered as a precious renewable resource and far less rentable than greenhouses, artichoke fields and vineyards, most of the remnant woods and shrub communities were converted into cultivated lands. The few nuclei left are currently fragmented, degraded and self-renovation impossible due to frequent arsons and overbrowsing, altered by *Eucalyptus camaldulensis* plantations, menaced with the spread of illegal activities (waste dumping, abusive building) even within officially strict protected areas.

The highest attention should be paid to preserve last spots of woodland, shrubland, perennial and the annual dry grassland, which are not only important for their noteworthy biological heritage, but for the ecological services they provide (air quality, carbon storage, regulation of hydro-geological cycles and food chains, mitigation of geo-morphological processes, etc.), significantly improving the quality of life of local people and preventing them from environmental disasters such as recent floods.

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Box 6.1 *Sicilian geology: a 'muse' for the interpretation of Neogene global changes*

Sicily represents a key site to understand what happened on the global scale during the Neogene, whose ages between 7.246 and 1.806 million years ago (Ma) are more or less intimately linked with island's geography.

The **Messinian** (after Messina, whose evaporites are of the same age) is the last age of the Miocene. Around 6 Ma, the Messinian salinity crisis brought about repeated desiccations of the Mediterranean Sea.

The **Zanclean** (after *Zancle*, the ancient Greek name for Messina) is the earliest age on the Pliocene. The Global Boundary Stratotype Section and Point (GSSP) for the Zanclean is located near the ruins of Heraclea Minoa in S Sicily.

The **Piacenzian** is the latest age of the Pliocene. The GSSP for the Piacenzian stage is at Punta Piccola in S Sicily.

The **Gelasian** is the earliest age of the Pleistocene. It is named after Gela: its GSSP is located at Monte Sant Nicola near the city. Here are recorded some key changes in Earth's climate, oceans, and biota: during the Gelasian the Northern Hemisphere ice sheets began to grow, glacations started and the last remnant populations of the warm temperate broadleaved mixed forests disappapeared (*Carya*, *Cathaya*, *Engelhardtia*, *Liquidambar*, *Pterocarya*, *Tsuga*, *Zelkova*, etc.).

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Box 6.2 *The end of cork exploitation and manufacturing in Sicily and its ecological consequences*

Probably *Quercus suber*, the cork oak, once formed mixed woodlands with *Q. pubescens* and became dominant only where it was favoured by men interested on cork production and on cork oak ecosystem services (fuelwood, grazing areas, mushrooms, game, etc.).

During last decades the global crisis of cork market induced the abandonment of most of the productive areas of the island (Nebrodi and Madonie Mts., Niscemi and Caltagirone in SE Sicily) after centuries of exploitation; along with the use, also specific know-how fades, and nowadays cork extraction is mostly done by Moroccan workers.

The yearly amount of cork production depends on both the natural rythms of the plant (the first extraction should be done when the trees are 16-20 years old, the following ones every 9-12 years) and on periodical human interventions on cork wood structure (coppices and stands with dense undergrowth produce less cork than periodically regularly managed high forest).

Hence, the survival of Sicilian cork forests depends on more adequate marketing strategies for cork products and on the re-adoption of sustainable management practices: during last decades too frequent cork gathering and wildfires severely compromised cork quality and exposed the trees to parasytic attacks and to extreme climatic events.

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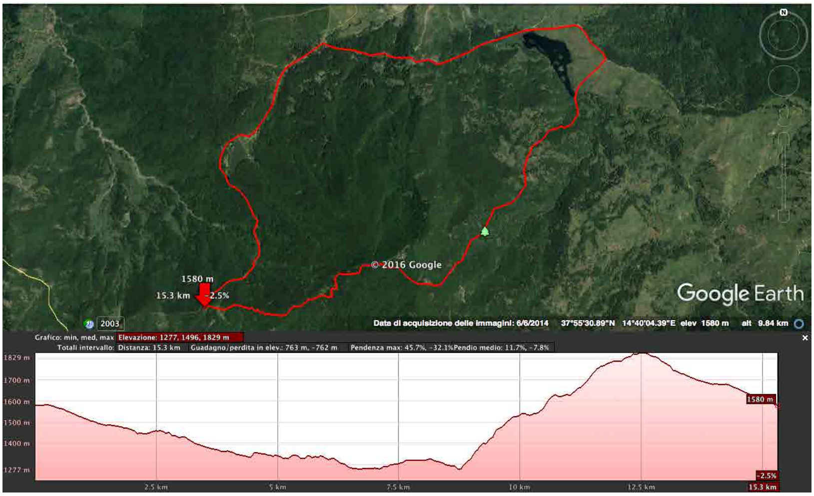
VII
Nebrodi Mts.

Itinerary1 - Monte Soro



The Nebrodi mountains consist of a series of reliefs, on average 1500 m high, aligned from east to west, with steep flanks and rounded peaks. Monte Soro (1847 m) is the highest elevation of Nebrodi Mts. and it is formed by Cretaceous flyschoid outcrops, subdivided into two members: a clayey-calcareous lower member and a clayey-arenaceous upper member. The elevation favours the condensation of moisture and the smooth morphology, along with the abundance of clay deposits, favours the development of luxuriant beechwoods and small wetlands, masking the "Mediterraneaneity" of the context and conferring to the landscape a temperate nuance. We will walk in a patchwork of beechwoods (Geranio striati-Fagion), mountain pasturelands (Cirsietalia vallis-demonis, Holoschoenetalia and Poetalia bulbosae) and small lakes (some of which artificially enlarged) colonized by helophytic and aquatic vegetation. Traces of traditional land uses are still very evident ("Hudelandschaft", influenced by large herbivores) and, every now and then, we will also enjoy scenic views on Mt. Etna and on the Tyrrhenian Sea, with the Aeolian Islands.

Trail: Length: 15 km round trip, Hiking time: 7 hours, Elevation range: 400 m.

General description

7.1. The physical setting

The Nebrodi Mts., also called Caronie, represent the central part of the northern Sicilian chain are located between the crystalline massif of Peloritani Mts., corresponding to the NE edge of the island, and the Madonie Mts. to the west. Geographers classically identify the river Pollina as the limit with Madonie, while to the east the limit with Peloritani Mts. il marked by two streams named Timeto and Roccella, the latter being a tributary of the Alcantara River (Picone et al. 2003).

They form a sinuous and almost regular and continuous and rather steep ridge facing the Tyrrhenian sea, with many peaks going beyond 1500 m a.s.l., like Serra di Baratta near Floresta (1395), Pojummoru or Monte del Moro (1433), Serra del Re (1754), Mt. Soro (1847), Poggio Tornitore (1571), Mt. Pelato (1567), Mt. Pomiere (1544), and Mt. Castelli (1566) near Mistretta. Many other peaks lay outside the above-mentioned ridge, such as Pizzo Fau (1686 m.), Serra Pignataro (1661), Mt. Treàrie (1609), Monte Sambuchetti (1558), Rocche del Crasto (1315) and Mt. Cuculo (1301).

Lago Maulazzo in early spring, surrounded by the Ilici aquifolii-Quercetum cerridis (Geranio striati-Fagion).

Nebrodi Mts. have a more gentle silhouette if compared with the harsh, roughed forms of the Peloritani Mts. In fact, they form a large, massive mountain range whose peaks are more rounded and reach higher elevations probably because they are more resistent to erosion. Another remarkable feature of local landscape is given by the almost regular occurrence of furrows separating into apparently regular sectors its northern slopes and giving origin to short streams flowing northwards down to Tyrrhenian Sea.

From a geologic point of view, Nebrodi Mts. are mostly made of acidic rocks belonging both to the Kabilian-Peloritan-Calabrian and the Apenninic-Maghrebian belts. The former belt includes imbricate sheets of Palaeozoic metamorphic and igneous rocks (Aspromonte and Mandanici Units) and Mesozoic sedimentary covers, which can be observed in the NE sector of the Nebrodi Mts., in the area between Capo d'Orlando and Patti. The Apenninic-Maghrebian belt formed during Miocene and is made up of imbricate sheets of Mesozoic-Tertiary rocks. Its structurally highest units are derived from the deformation of the distal pre-orogenic domain, the so-called 'Sicilide Unit', including the following geological formations: 1) 'Monte Soro' (early to late Cretaceous, 100-66 Ma) mostly made of marly clays, marls, argillites, slightly metamorphic sandstones and conglomerates, it is by far the most represented rock outcropping all over the highest part of the massif (e.g. Portella Femmina Morta, Portella Miraglia, Mt. Soro, Pizzo Antenna, Serra del Re, Poggio Tornitore, etc.); 2) 'Argille Scagliose Superiori' (early Cretaceous, 146-100 Ma): mainly consisting of marly clays and dark grey marls, also common on the top of the Nebrodi Mts.; 3) 'Troina' (late Cretaceous-early Miocene, 70-20 Ma), made of red or green varicoulour clays with intercalations of metamorphic pebbles, sands and marls, mostly occurring on the southern slopes of the massif.

During late Oligocene-early Miocene (30-20 Ma), the Kabilian-Peloritan-Calabrian belt started to trust over the underlying Apenninic-Maghrebian belt, as testified by the presence of Trubi and evaporitic sediments near Sambughetti. From this process issue other frequent outcropping rocks, which have been interpreted as early foredeep deposits, such as the following units: 4) 'Nicosia' (early Miocene, 23-16 Ma), mostly made of dark grey varicolour clays with coarse quartz blocks or stones, widespread on the southern part of the chain, 5) 'Numidian Flysch' (early Miocene, 23-16 Ma) and 6) 'Maragone' (late Oligocene-early Miocene, 30-20 Ma): siltites, argillites, quartz sandstones and, cropping out in NW Nebrodi, or as early thrust-top basin deposits, such as the following units: 7) 'Flysch of Reitano' (Langhian-Serravallian, 16-11.6): sandstones, shales and conglomerates, marls interpreted as turbidites; 8) 'Calcarenites of Floresta' (late Burdigalian-Langhian, 18-14 Ma) and 9) 'Stilo-Capo d'Orlando' (late Oligocene-early Burdigalian, 30-20 Ma): mixture of mostly acidic metamorphic rocks characterising wide surfaces of the NE and E part of the chain.

As concerns the water courses flowing on the northern slopes of Nebrodi Mts. (from west to east: Tusa, Santo Stefano, Caronia, Furiano, Inganno, Rosmarino - the longest, 30 km - Zappulla, Naso and Timeto), they all are streams subject to strong seasonality, while the majority of those which flow down from the southern slopes, like the rivers Simeto (113 km), Alcantara (53 km) and its main tributary Flascio, have an almost regular water flux. Plenty of springs, rivulets, montane lakes, permanent (called 'urii') and temporary (called 'margi') ponds, like Biviere di Cesarò, Treàrie, Pisciotto or Batessa, Quattrocchi, Campanito, Cartolari or Piperni, Zilio, Minchionzo (!) etc., positively affect local species- and habitat-richness. In the area also two artificial lakes occur: Maulazzo and Ancipa.

The most common soil association on the Tyrrhenian part of the chain is the following 'typical xerochrepts + typical haploxeralfs + typical and/or lithic xerorthents (= eutric cambisols + orthic luvisols + eutric regosols and/or lithosols)', while the mixture 'typical xerumbrepts + typical xerochrepts + typical haploxeralfs (= eutric cambisols + orthic luvisols)' is the most represented on the top of the massif. Moreover, The association 'typical xerorthents + typical and/or vertic xerochrepts (= eutric regosols + eutric and/or vertic cambisols)' is typical to flysch outcrops, while a soil assemblage with 'lithic xerorthents + typical and/or mollic haploxeralfs + typical xerochrepts (= lithosols + orthic luvisols + eutric cambisols)' characterises wide areas near Capizzi, Mistretta, Pettineo and Reitano.

A complex of 'typical xerorthents + typical and/or vertic xerochrept + typical and/or vertic xerofluvents and/or typical chrmomoxererts and /or typical pelloxererts (= eutric regosols + eutric and/or vertic cambisols + eutric fluvisols and/or chromic and/or pellic vertisols)' dominates the slopes located at the SW-S limit of the massif near Nicosia,, while 'typical xerochrepts + vertic xerochrepts +

Small lake colonized by the Ranunculo saniculifolii-Callitrichetum brutiae (Ranunculion aquatilis).

typical chromoxererts and/or typical pelloxererts (= eutric cambisols + vertic cambisols + chromic and/or pellic vertisols)' prevail at the S-SE limit of Nebrodi Mts.

Three soils assemblages occur on few scattered areas characterised by calcareous outcropping rocks, i.e. 'rock outcrop + xerorthents (= rock outcrop + lithosols)' near Alcara Li Fusi and San Fratello, 'lithic xerothents + rock outcrop + lithic haploxerolls (= lithosols + rock outcrop + eutric regosols)' at Cerami and 'lithic xerorthents + rock outcrop + typical and/or lithic xerochrepts (= lithosols + rock outcrop + eutric cambisols)' near Floresta.

The association 'typical xerorthents + andic xerochrepts + ultic haploxeralfs (= eutric regosols + eutric cambisols + orthic luvisols)' only occurs along the Flascio watershed, while a miaxture of 'typical and /or vertic xerofluvents + typical and/or vertic xerochrepts (= eutric fluvisols + eutric and/or vertic cambisols)' issues from alluvial sediments along the coast and in the bottom of some inner valleys.

Depending on altitude, the localities included in this area are subject to 3 to 5 months of drought stress. The southern sector appears less rainy (at Troina, Nicosia and Cesarò the mean values of annual rainfall amount are 633, 741 and 785 mm respectively vs. 948 mm at San

Fratello and 1273 mm at Floresta). Based on locally available climatic data, San Fratello is the warmest and Floresta the coldest recording station: the mean annual temperatures range between 10.0 and 15.0 °C, the mean values of the coldest month (January) between 2.0 and 7.5 °C, that of the warmest month (July or August) between 19.0 and 23.6.

The coastal sector of NE Sicily is subject to upper thermomediterranean lower to upper sub-humid bioclimate, while the Tyrrhenian slopes of Nebrodi Mts. are characterised by a steep gradient of humidity conditions, ranging from upper subhumid to lower humid mesomediterranean (300-750 m a.s.l.), to lower and upper subhumid supramediterranean (750-1100 m a.s.l.), to lower humid supramediterranean conditions on the top of the range. The southern slopes of the massif are drier and mostly exhibit an upper dry and lower subhumid mesomediterranean bioclimate.

7.2. Flora and vegetation

According to the phytogeographic subdivision proposed by Brullo et al. (1995), this area corresponds to Nebrodense District, and is home of several narrow endemics, such as *Carduus rugulosus* (probably extinct), *Fraxinus excelsior* subsp. *siciliensis*, *Malus crescimannoi*, *Petagnaea gussonei*, *Pyrus ciancioi*, *Pyrus vallis-demonis* and *Salix nebrodensis*. With the only outstanding exception of Petagnaea, belonging to a genus of probably ancient origin, all the other species should be considered as neo-endemics, confirming the common biogeographic pattern of low endemism-rate on siliceous substrates. On the other hand, the combination of high water input due to local rainfall regime and the prevalence clayey soils makes this area a cradle for many species which do not occur or are very rare elsewhere in Sicily, aquatic plants such as *Callitriche hamulata*, *Callitriche lenisulca*, *Persicaria amphibia*, *Potamogeton filiformis*, *Potamogeton perfoliatus*, *Spirodela polyrrhiza*, *Utricularia australis*, *Wolffia arrhiza*, or hygrophilous herbs and grasses taking part to the perennial communities colonizing the borders of local numerous permanent ponds, like *Alopecurus aequalis*, *Carex digitata*, *Carex intricata*, *Cerastium dubium* (probably extinct), *Epipactis palustris*, *Equisetum palustre*, *Sparganium emersum*, etc.. Also local forest communities host many exclusive or rare plants, such as *Arabis pseudoturritis*, *Aristolochia clematitis*, *Circaea lutetiana*, *Gagea lutea*, *Glechoma hirsuta*, *Polygonatum gussonei*, *Rhynchocorys elephas*, *Stachys sylvatica*, *Taxus baccata*, etc. More-

Biviere di Cesarò: The muddy borders of the montane lakes are colonized by the Eleocharido palustris-Sparganietum neglecti (Glycerio-Sparganion).

over, local meso-xerophilous pasturelands host the only known Sicilian populations of *Bupleurum rollii*, *Dianthus deltoides* subsp. *deltoides* and *Picnomon acarna*, while the last regional population of *Anthyllis barba-jovis* is located on the coastal cliffs near Tusa.

Zonal vegetation

In the following paragraphs, the main vegetation units of Nebrodi Mts. are presented starting from the highest peaks and going down to the seaside.

The chamaephytic orophilous assemblages referred to the endemic alliance CERASTIO-ASTRAGALION NEBRODENSIS and are locally represented by *Carduncello pinnati-Thymetum spinulosi*, dwelling the eroded soils deriving from argillites (= flaky clays), flysch, limestones. It characterises the wind-exposed gently sloping summits of the meso- and supra-mediterranean belt between 1100 and 1400 m a.s.l. on the Quacella rigdes and also occurs on Sicani and Nebrodi Mts., where it appears floristically impoverished.

All the mesic (and meso-hygrophilous) summergreen deciduous forests of the meso- to supra-mediterranean belts of the massif are framed into CARPINO-FAGETEA SYLVATICAE and GERANIO STRIATI-FAGION.

Ilici aquifolii-Quercetum austrotyrrhenicae occurs on acid soils issuing from Numidian Flysch outcropping rocks, in areas subject to humid supra-mediterranean bioclimate between 1250 and 1600 m a.s.l. The most representative examples of this forest community, linked to extremely cool and humid slopes enjoying an almost continuous supply of air humidity coming from N-NW, are found at Mt. Soro.

To *Anemono apenninae-Fagetum sylvaticae* belong most of the acidophilous beech forests ot Nebrodi Mts. subject to supra-mediterranean bioclimate between 1400 and 1800 m a.s.l., like those of Sambughetti (Nicosia), Bosco Medda and Mascellino (Mistretta), Fontana Mucciata and Bosco Bussonita (Cesarò), Bosco Collana and Bosco Muto (San Fratello), Solazzo Verde (Mt. Soro), Bosco Mangalaviti (Longi), Bosco Dugo (Capizzi), Bosco Tassita (Caronia), Mt. Scafi.

Arrhenathero nebrodensi-Quercetum cerridis mostly occurs on schistose substrates, in the supramediterranean subhumid-humid belt between 1.100 and 1.300(1.400) m a.s.l., above the downy oak- and below the beech-dominated forests on Nebrodi Mts. near Longi at Pizzo Mueli, San Fratello in Contrada dell'Occhio, Caronia at Pizzo Nido, and near Capizzi at Piano dei Daini, and at Malabotta, near Montalbano Elicona, on Peloritani Mts.

Biviere di Cesarò: Fringe communities with Paeonia mascula and Conopodio capillifolii-Quercetum congestae (Geranio striati-Fagion).

Another acidophilous forest assemblage, *Ilici aquifolii-Taxetum baccatae*, substitutes *Anemono apenninae-Fagetum sylvaticae* under particularly cool microclimatic conditions at 1400-1450 m a.s.l., subject to almost perennial water supply due to frequent fog. Its is located at Mt. Pomiere and in the woods of Lavanghi and Tassita near Caronia on siliceous substrates such as granites, gneiss and schists.

Ilici aquifolii-Quercetum cerridis occurs on acidic soils at 800-1300 m a.s.l. over the N-facing slopes of Nebrodi Mts. at Pizzo Luminaria within the watershed of Torrente Inganno between Poggio della Cattiva, north of Lago Maulazzo and the localities Pileci, Faitella, Laceroni and Cidara, and on N-facing slopes of Mt. Sambughetti (Bosco della Giumenta).

A montane holm-oakwood, the *Geranio versicoloris-Quercetum ilicis*, occurs on acid and well-humified soils issuing from flysch outcrops under lower supra-mediterranean humid bioclimate, between 900 and 1200 m a.s.l., as it happens in the surroundings of Monte Soro (Maniscalco & Raimondo 2003).

Local basiphilous thermophilous oak woods are referred to QUERCETEA ILICIS and FRAXINO ORNI-QUERCION ILICIS. The canyon named 'Stretta di Longi' hosts a fragments of *Ostryo carpinifoliae-Quercetum ilicis*, a forest assemblage linked to shaded and cool-humid microclimates on steep and stony slopes on calcareous substrates. The co-occurrence of *Vitis vinifera* subsp. *sylvestris* and *Laurus nobilis* confirms local high humidity.

The acidophilous forest and maquis communities are framed into ERICO-QUERCION ILICIS. As for the submontane mixed oakwoods, *Quercetum gussonei* only occurs in the wood of Cappelliere and on Nebrodi Mts. (Caronia and San Fratello) at (700)750-950(1.000) m a.s.l. and enjoys exceptionally high amounts of rainfall (probably 800-1110 mm), *Quercetum leptobalani* has been observed in some N-facing submontane areas of Madonie Mts. (Collesano and Piano Zucchi) at (700)750-900(1.400) and Ficuzza, where annual rainfall amount is approximately 800 mm, while *Teucrio siculi-Quercetum ilicis* is a mixed (mostly evergreen) oakwood linked to cool-humid montane microhabitats, shady slopes and valley bottoms, which occurs at (450)850-1200(1300) m a.s.l. It locally occurs at San Fratello. *Festuco heterophyllae-Quercetum congestae* and *Vicio elegantis-Quercetum congestae* are mixed oakwoods with *Q. congesta*, *Q. dalechampii* and *Q. ilex*, rich in nemoral species of the *Carpino-Fagetea*. They colonize the siliceous soils (mostly deriving from schists) of the montane areas of SW Nebrodi

Mts. (Cerami and Capizzi) between 800 and 1300 m a.s.l. under meso-mediterranean upper subhumid bioclimate, and are substituted by *Arrhenathero nebrodensis-Quercetum cerridis* at higher elevations (Brullo & Marcenò 1985). The degradation of the above-mentioned mixed forest communities leads to thorny shrublands (*Crataegetum laciniatae*) and - under intense overgrazing - to PLANTAGINION CUPANII.

Doronico orientali-Quercetum suberis enjoys the humid microclimatic conditions (e.g. bottom of valleys) of the watersheds of Caronia and San Fratello streams between 600 and 850 a.s.l., intermingled with *Quercetum gussonei* on less compact soils and substituted by *Arrhenathero nebrodensi-Quercetum cerridis* at higher altitudes.

To *Genisto aristatae-Quercetum suberis* are ascribed the cork-oak woods occurring on gently sloping areas between 500 and 800 m a.s.l. (San Fratello and Caronia), whilst *Erico arboreae-Quercetum virgilianae* mostly occurs in the southern part of the massif (e.g. Nicosia, Sperlinga, etc.), but also near Sant'Agata di Militello at (250)350-600(800) m a.s.l.

Dense species-poor spots of acidophilous tall shrubland ascribed to *Erico arboreae-Myrtetum communis* (ERICION ARBOREAE) are intermingled with *Quercetum gussonei* on the shallow soils of schistose steep slopes, close to the Buzza stream near Caronia.

The self-renovating stone pinewoods dwelling the sandy soils deriving from flysch rock outcrops on the coastal hills (200-400 m a.s.l.) near Cefalù and on some S-facing hillsides of the inner Madonie (Alia), Nebrodi (Nicosia) and Erei Mts. (Piazza Armerina) between 650 and 700 m a.s.l. have been ascribed to *Cisto cretici-Pinetum pineae* (PINION PINEAE), but their native status remains rather questionable and needs to be confirmed (or rejected) after a more accurate research based on historical documents.

The degradation of all the thermophilous forest and maquis communities framed into ERICO-QUERCION ILICIS leads to broom-dominated shrublands (SAROTHAMNION SCOPARII), garrigues (CISTO-LAVANDULETEA), perennial and annual dry grasslands (AVENULO-AMPELODESMION and HELIANTHEMION GUTTATI) and bracken (*Pteridium aquilinum*) pure stands.

Thermophilous scrub (OLEO-CERATONION SILIQUAE) is locally represent by *Euphorbietum dendroidis*, which occurs on the steep calcareous slopes of Rocche di Crasto near Alcara Li Fusi, while *Myrto communi-Pistacietum lentisci* occurs at Torre del Lauro near Sant'Agata di Militello, and probably issues from the degeneration of the cork oak woods which formed an almost continuous forest cover on the acidic substrates of the coastal area on both Madonie and Nebrodi Mts.

The shrublands which are topographically close and dynamically connected to local woodlands are ascribed to CRATAEGO-PRUNETEA. From 1000 up to 1200-1400 m a.s.l., *Crataegetum laciniatae* (ILICI-CRATAEGION LACINIATAE) occurs on the border or in the clearings of the acidophilous woodlands of ERICO-QUERCION ILICIS.

At lower altitudes (Caronia, San Fratello Reitano, Mistretta, Galati Mamertino, Pettineo, Castel di Lucio, Motta d'Affermo, etc.) the most widespread mantle communities belong to PRUNO SPINOSAE-RUBION ULMIFOLII, mostly represented by *Cytiso infesti-Pyretum spinosae* (from sea level up to 700-800 a.s.l.) and by *Spartio juncei-Bupleuretum fruticosi* and acidophilous shrublands colonizing the coastal hills of Madonie, Nebrodi and Peloritani Mts., mostly occurring on N-facing steep slopes and valleys under cool and shady microclimatic conditions within both thermo- and meso-meso-mediterranean belts (200-850 m a.s.l.).

Another frequent tall broom-dominated shrubland, *Cytiso infesti-Spartietum juncei*, should be better framed into CYTISETEA SCOPARIO-STRIATI and SAROTHAMNION SCOPARII.

The acidophilous garrigues (CISTO-LAVANDULETEA STOECHADIS and CYTISO VILLOSI-GENISTION TYRRHENAE) are widespread and locally represented by two associations: *Carlino nebrodensis-Genistetum cupanii* mostly issues from the degradation of the cork and downy oak woods of the meso-mediterranean belt of the Tyrrhenian side of the massif, but also occurs as disclimax under supra-mediterranean bioclimate from 800 to 1600 m a.s.l.; *Genisto aristatae-Cistetum salvifolii* recorded between 500 and 800 m a.s.l. near Caronia, Capizzi, San Fratello, Biviere di Cesarò.

As for perennial xerophilous grasslands (LYGEO SPARTI-STIPETEA TENACISSIMAE), *Hyparrhenietum hirto-pubescentis* (HYPARRHENION HIRTAE) is very common on base-rich lithosols under thermo-mediterranean bioclimate, while under meso- and supra-mediterrean bioclimate the destruction of woody assemblages ascribed to QUERCETALIA ILICIS probably favoured the spread of meso-xerophilous communities framed into AVENULO-AMPELODESMION MAURITANICI. On the N-facing Tyrrhenian slopes of Nebrodi Mts.

this alliance is represented by *Astragalo monspessulani-Ampelodesmetum mauritanici* occurring between 200-1000 m a.s.l., mostly on siliceous substrates, in areas subject to 900-1100 mm of annual rainfall and average yearly temperatures of 15-17 °C, e.g. Galati Mamertino, Reitano, near Caronia, Rocche del Crasto (Alcara Li Fusi), etc.

Most of the perennial rangelands occurring on siliceous soils are framed into POËTEA BULBOSAE and PLANTAGINION CUPANII, locally represented by *Cynosuro cristati-Plantaginetum cupanii* covers very wide surfaces of the flat siliceous areas near Mt. Soro. It is linked to leached acid-subacid (pH 6-6,5) non-permeable soils between (700)1100-1650(1.750) m a.s.l. It plays a key role as high quality pastureland, but overgrazing and excessive trampling may trigger its destruction and an almost irreversible soil degradation.

No detailed information is available on the annual dry grasslands occurring under thermo- and meso-mediterranean bioclimate ((HELIANTHEMETEA GUTTATI). The gaps and the degradation steps of local forest and pre-forest acidophilous assemblages are colonized by assemblages typical to nutrient-poor sandy soils (HELIANTHEMETEA GUTTATI and HELIANTHEMION GUTTATI).

Vegetation of coastal ecosystems

The central and eastern sectors on the coasts of northern Sicily are characterized by very few and narrow sandy or gravelly shores, and most of the coastline is made of steep acid rocky cliffs subject to intense salt-spray. Moreover, the wilderness of the coastal sites of Nebrodi Mts. has been strongly compromised by urban sprawl and any sort of manufacts (railways, roads, motorways, etc.).

Hence, it is not surprising if only few and often very disturbed spots of pioneer halo-nitrophilous short-lived vegetation occur on the strandlines of local sandy and shingle beaches (CAKILETEA MARITIMAE and EUPHORBION PEPLIDIS), mostly represented by *Salsolo kali-Cakiletum maritimae*, by *Cakilo maritimae-Xanthietum italici* in more humid areas near the disturbed mouths of local rivers and streams (e.g. Tusa stream) or *Salsolo kali-Euphorbietum peplis*.

Impoverished chamaephytic communities ascribed to CRITHMO-STATICETEA and CRITHMO-STATICION) where only *Limbarda crithmoides*, *Crithmum maritimum*, *Lotus cytsoides* and *Limonium virgatum* occur, may be observed on the salt-sprayed coastal cliffs near

Tusa, Caronia Marina, etc. The almost vertical salt-sprayed sea cliffs near Tusa host the only known nucleus of *Anthyllido barbae-jovis-Erucastretum virgati* a pioneer coastal shrubland framed into ANTHYLLIDION BARBAE-JOVIS.

Vegetation of cliffs, walls and screes

The moss- and fern-dominated assemblages typical to shaded and water-splashed habitats (ADIANTETEA and ADIANTION) are rather common on base-rich substrates under thermo-mediterranean climate: *Eucladio verticillati-Adiantetum capilli-veneris* mostly occurs on steep cliffs and walls (e.g. near Brolo and Naso).

Fern- and moss-rich epilithic and epiphytic communities of shaded sites (POLYPODIETEA and POLYPODION SERRATI) are rather common in the thermo- and meso-mediterranean bioclimatic belts.

Subject to thermo-mesomediterranean climate, the rock faces and crevices of the limestones of Alcara Li Fusi host a chasmophilous assemblage which may be interpreted as an impoverished pattern of *Scabioso creticae-Centauretum ucriae* (DIANTHION RUPICOLAE).

The local pioneer vegetation colonizing the incoherent pebbly and sandy warps of the alluvial terraces and the stream- and riverbeds (EUPHORBION RIGIDAE) may be ascribed to *Calendulo fulgidae-Helichrysetum italici*, endemic to the intermediate sector (650-750 m a.s.l.) of the streams of SW Nebrodi Mts. (e.g. Troina and Cerami streams) rich in loamy-clayey sediments deriving from the disgregation of metamorphic rocks.

Hydro-hygrophilous vegetation

Among the perennial meso-hygrophilous meadows and pastures on seasonally flooded and fertile soils (MOLINIO-ARRHENATHERETEA), those occurring on rather shallow soils are ascribed to CIRSIO VALLIS-DEMONIS-NARDION, and, more precisely, to *Cynosuro cristati-Leontodontetum siculi*, common on gently sloping soils issuing from Argille Scagliose and quartz sandstones between 1100 and 1400(1500) m a.s.l. (e.g. Flascio river watershed, near Floresta, Cesarò and Mt. Soro) in the belt dominated by acidophilous mixed oakwoods, and by *Genisto aristatae-Potentilletum calabrae* at the top of Mt. Soro above 1.400 m a.s.l., substituded by *Carduncello pinnati-Thymetum spinulosi* on steeper slopes.

The humid meadows of DACTYLORHIZO-JUNCION STRIATI are locally represented by three associations, *Dactylorhizo sacciferae-Juncetum effusi*, frequent on permanently humid clayey soils and near springs, between 1100 and 1350 m a.s.l. (Valle del Flascio, Pizzo Interleo and near Cesarò, Contrada Acquasanta, Floresta, Serra del Re), substituted by *Caricetum intricato-oëderi* at higher elevations - between (1300)1450 and 1700 m a.s.l. - along open streamsides and pond borders (Portella Maulazzo, Mt. Soro, Cesarò, Serra del Re).

Petagnaetum gussonei is a nemoral forb- and moss-rich assemblage which only occurs on the humid shady sides of montane stream flowing down along the N-facing slopes of the massif (Torrente Calanna, Contrada Acquasanta, etc.). According to some authors this assemblage, dominated by *Petagnaea gussonei*, the only species of a genus endemic to Sicily, should be better framed into *Epilobietea angustifolii* including all the herb-rich fringe communities typical to forest clearings and riversides.

The subnitrophilous assemblage *Kickxio commutatae-Trifolietum bocconei* (TRIFOLION MARITIMI) forms hygrophilous fringes on the borders of some ponds interespersed within within *Doronico orientalis-Quercetum suberis* at 500-650 m a.s.l., on the acid soild along the N-facing schistose slopes near Caronia.

Mesophilous riparian gallery forests (ALNO GLUTINOSAE-POPULETEA ALBAE) are very rare and fragmented. No field surveys confirm the presence of assemblages beloging to POPULION ALBAE, claimed by several authors for both Madonie and Nebrodi Mts. As for PLATANION ORIENTALIS, *Platano orientalis-Salicetum gussonei* actually occurs at 150-500 m a.s.l. in some deep gullies flowing in siliceous rocks (schists, gneiss, crystalline conglomerates, quartz sandstones, volcanites) in areas of NE Sicily SE Nebrodi Mts., Peloritani Mts. and Etna subject to 800-1300 mm of yearly rainfall and to an average annual temperature of 10-15 °C, within territories potentially dominated by mixed broadleaved summergren oakwoods of Erico-Quercion (*Erico arboreae-Quercetum virgilianae* and *Festuco heterophyllae-Quercetum congestae*).

Located in montane sites (1250-1300 m a.s.l.) and on siliceous substrates, *Osmundo regalis-Salicetum pedicellatae* (OSMUNDO-ALNION) forms dense riparian forests rich in meso-hygrophilous species within area potentially covered by *Ilici aquifolii-Quercetum austrotyrrhenicae* or *Anemono apenninae-Fagetum sylvaticae*.

The hygrophilous pioneer scrubs and low open forests colonizing the beds and the banks of local streams (SALICETEA PURPUREAE) are locally represented by few spots of *Salicetum albo-purpureae* (SALICION ALBAE), one of the most representative ones occurring just after the canyon of Longi.

The lower trait of most part of local streams and braided streams, the so-called 'fiumare' (e.g. at Santo Stefano di Camastra, Tusa and Furiano) is often characterised by thermo-hygrophilous pioneer thicket communities (NERIO-TAMARICETEA). The most common features of such disturbance- and stress-tolerant vegetation are mono-specific stands of *Tamarix africana* (TAMARICION AFRICANAE), and *Spartio juncei-Nerietum oleandri* (RUBO ULMIFOLII-NERION OLEANDRI), colonizing the alluvial sandy-gravelly fluvial terraces which are slightly raised with respect to the streambeds occupied by EUPHORBION RIGIDAE assemblages.

The montane ponds of Nebrodi Mts. host plenty of free floating assemblages linked to still and relatively nutrient-rich freshwater bodies (LEMNETEA and LEMNION MINORIS), such as *Lemnetum minoris* in the shallow waters of some ponds of Contrada Gilormo and San Giorgio below 800 m a.s.l.; *Wolffietum arrhizae* in the ponds of Zilio, Quattrocchi and Contrada Pantana ((900 to 1050 m a.s.l.); *Lemno minoris-Spirodeletum polyrrhizae* colonizing the central part of some ca. 3 m-deep montane meso-eutrophic ponds, located at 950 m a.s.l. in Contrada Pantana; *Lemnetum trisulcae* along the shallow sides of some meso-eutrophic, clear and poorly mineralized ponds located between 950 and 1250 m a.s.l. (Campanito and Contrada Pantana). Bladderwort-dominated assemblages typical to meso-eutrophic waters (UTRICULARION VULGARIS) like *Utricularietum australis* occur in many 0.5-2-m deep ponds (Urio Quattrocchi, Zilio, Contrada Pantana, Campanito, near Lago Biviere, Contrada Gilormo) located between 700 and 1300 m a.s.l., whilst *Utriculario vulgaris-Potamogetonetum natanti* has been recently described for two small and shallow (less than 1-m deep) temporary ponds located in the localities Sollazzo Verde and Pappanu on the northern slopes of Mt. Soro (1400-1450 m a.s.l.) within the climax belt of beech woods.

Also many assemblages dominated by rooted floating or submerged macrophytes (POTAMOGETONETEA and POTAMOGETONION) occur in the stagnant meso-eutrophic water bodies of Nebrodi

Mts., namely *Potametum perfoliati*, observed in the shallow (0.5-1 m deep), still waters of the pond of Piano Tannu (c. 100 m a.s.l.), whose bottom is rich in humus and loam; *Groenlandietum densae*, occurring in very small (max 2-3 m^2) and shallow (max10 cm deep) muddy and eutrophic ponds with no or very limited outflow, located at 1300-1350 m a.s.l. near Lago Biviere at Cesarò and at Serra del Re within the beech forest belt; *Myriophylletum verticillati* (NYMPHAEION ALBAE), linked to the deepest part of alkaline, meso-eutrophic, still, clear, 0.5-3 m-deep small ponds (Campanito, Contrada Pantana, Quattrocchi and Mt. Soro) located at 900-1250(1800) m a.s.l.

Myriophylletum alterniflori (POTAMOGETONION GRAMINEI) occurs in some eutrophic ponds (Contrada Pantana, San Nicola and Quattrocchi) with shallow muddy bottom located at (600)900-1050 m a.s.l.

Some small depressions along the border of deeper and almost permanent waterbodies located at Portella Maulazzo, Mt. Soro, Cesarò and Portella Femmina Morta between 850 and 1000 m a.s.l. host *Ranunculo lateriflori-Antinorietum insularis* (ISOETO-NANOJUNCETEA and PRESLION CERVINAE), a slightly subnitrophilous ephemeral microphytic pioneer amphibious assemblage typical of temporary ponds.

Wooded pasture (Anemono apenninae-Fagetum sylvaticae) are traditionally obtained by thinning out the density of the trees, in order to ensure the growth of meadows in the clearings. The basal sprouts of the beech provide additional fodder available throughout the summer.

Glino mollis-Verbenetum supini (VERBENION SUPINAE) is a summer annual pioneer nitrophilous and heliophilous assemblage colonizing the seasonally submerged, nutrient-rich soils of local artificial basins (Lago Ancipa and Pozzillo) subject to strong water level fluctuations.

Several local communities linked to still, fresh and brackish waterbodies dominated by big rhizomatous helophytes are framed into PHRAGMITO-MAGNOCARICETEA and PHRAGMITION COMMUNIS, like *Phragmitetum communis* along stream- and riversides or on the border on natural ponds and artificial basins, and *Scirpetum lacustris*, forming dense, often unrooted populations in the standing waters or on muddy and deep soils, at 750-1300 m a.s.l. (e.g. Lago Biviere and ponds of Campanito, Serra della Testa and San Giorgio); *Typhetum latifoliae* observed at 800-1300 m a.s.l. along the borders of shallow eutrophic ponds disturbed by grazing animals (e.g. Lago Pisciotto); *Iridetum pseudacori* on the muddy borders of some shallow temporary ponds (Contrada Pantana, Piano Pomaro, Contrada Sorba, San Giorgio); *Typhetum dominguensis* occurring between 100 and 720 m a.s.l. on muddy-peaty bottoms of several temporary ponds (Contrada Gilormo, Contrada San Nicola and Piano Tannu); *Typhetum angustifoliae* growing on the muddy bottoms of the shallow mesotrophic ponds of San Giorgio at ca. 800 m a.s.l.

Three different communties framed into GLYCERIO-SPARGANION, including the herblands occurring along the freshwater streams and on the borders of shallow water bodies of temperate Europe and sub-montane and montane Mediterranean Europe, are reported for this territory: *Sparganietum erecti* prefers still, clear and rather cold waters, colonizing the shallow bottom of permanent ponds between 10 and 950 m a.s.l. (Contrada Pantana, Contrada Sorba and Pizzo Michele), while *Eleocharido palustris-Alismetum lanceolati* occurs on the muddy borders of many local temporary ponds located at (600)850-1050 m a.s.l. (Quattrocchi, Campanito, Contrada Pantana, Serra della Testa, Contrada Gilormo, Contrada San Nicola); *Eleocharido palustris-Sparganietum neglecti* mostly occurs on the muddy, submerged and shallow bottoms of montane waterbodies (e.g. Lago Biviere, 1280 m a.s.l.); *Cyperetum longi* (MAGNOCARICION ELATAE) forms discontinuous communities between 250 and 950 m a.s.l. along the raised borders of some ponds (e.g. Contrada Pantana and San Giorgio), subject to short periods of submersion.

The vegetation of the Sicilian hygrophilous herblands linked to shallow montane pools subject to seasonal watertable fluctuations are framed into ALOPECURO-GLYCERION SPICATAE, locally represented by *Oenantho fistulosae-Glycerietum spicatae* dwelling the muddy-peaty shallow bottoms subject to short periods of drying up on some meso-eutrophic ponds located between 1.450 and 1.700 m a.s.l. (e.g. Biviere di Cesarò, Portella Maulazzo, Mt. Soro), substituted by *Glycerio spicatae-Oenanthetum aquaticae* in the ponds with a shorter hydroperiod (Contrada Pantana, Serra della Testa and Zilio) located in warmer sites (900-1250 m a.s.l.), and by *Glycerio spicatae-Callitrichetum obtusangulae*, linked to extremely shallow (10 to 20 cm-deep) and frequently eutrophic pools located at 780-1770 m a.s.l. (Contrada Pantana, near Mt. Soro, San Giorgio, near Lago Biviere, Contrada Scagliola, Serra della Testa), whose bottom remains humid even after drying up.

Anthropogenic vegetation

Local arable crops (mostly cereal fields) are characterised by two annual weed assemblages occurring in different seasons. The wintergreen one, *Valerianello dentatae-Medicaginetum scutellatae*, is framed into ROEMERION HYBRIDAE (PAPAVERETEA RHOEADIS) and has been observed on the clayey soils of the southern part of the massif (e.g. Troina, Nicosia and Cerami), while the summergreen, C4 species-rich vegetation occurring after crop harvest belongs to *Chrozophoro tinctoriae-Kickxietum integrifoliae* (DIGITARIO SANGUINALIS-ERAGROSTIETEA MINORIS and DIPLOTAXION ERUCOIDIS).

Concerning the wintergreen annual weedy and ruderal vegetation belonging to CHENOPODIETEA, the hypernitrophilous and xerophilous vegetation of local sheepfolds is referred to HORDEION MURINI, whilst many fallows occurring between 200 and 800 m a.s.l. on the marly and clayey soils of the southern sector of the massif are characterized by *Centauretum schouwii* (ECHIO-GALACTITION TOMENTOSAE), dynamically linked with PLANTAGINION CUPANII overgrazed and trampled communities and with PRUNO SPINOSAE-RUBION ULMIFOLII thorny woody mantle communities.

A single sub-nitrophilous and sciaphilous community (VALANTIO MURALIS-GALION MURALIS) is reported for the area, i.e. *Galio muralis-Sedetum cepaeae* dwelling the the siliceous stone walls of

Tortorici between 50 and 550 m a.s.l. mostly under the cover of ERICO-QUERCION ILICIS forest and pre-forest communities and rather common elsewhere in NE Sicily (Eolie islands, Peloritani Mts.).

The nitrosciaphilous vegetation growing under the tree canopy of local *Citrus* orchards probably belongs to VERONICO-URTICION URENTIS.

No data are available on the therophytic nitrophilous dwarf vegetation typical to local trampled (mostly urban and suburban) areas (POLYGONO-POËTEA ANNUAE and POLYCARPION TETRAPHYLLI).

As for geophytic and hemicryptophytic ruderal nitrophilous vegetation (ARTEMISIETEA VULGARIS), the intensive breeding activities mostly carried out in this territory give rise to several (sub)xerophilous assemblages framed into ONOPORDION ILLYRICI, like the thistle-dominated *Onopordo illyrici-Cirsietum scabri*, rather common in the sheepfolds and manure heaps located at 700-900(1000) m a.s.l. on clayey soils in areas subject to an average annual rainfall 700-1100 mm (e.g. Troina). *Pteridio aquilini-Tanacetum siculi*, an extremely dense and tall herbland occurs at 800-1250 m a.s.l. on coarse skeleton-rich acidic soils which occurs in overgrazed areas subject to very frequent arsons (even twice a year!) and along roadsides, tracks and paths (Cerami, Capizzi, Mt. Polverello near Floresta); *Phlomido herba-venti-Salvietum sclareae*, recorded between 550 and 800 m a.s.l. in rocky disturbed sites such as sheepfolds and rural farms in areas subject to an average annual rainfall of 700 mm (e.g. Alcara Li Fusi).

Under thermo- and meso-mediterranean bioclimate disturbed fallows, roadsides and ladfills are often characterized by perennial herb-dominated ruderal communities framed into BROMO-ORYZOPSION MILIACEAE, such as *Centrantho rubri-Euphorbietum ceratocarpae* rather common from 100 up to 600(750) m a.s.l. in the inner part of NE Sicily.

Under thermo-mediterranean bioclimate the most common assemblage of EPILOBIETEA ANGUSTIFOLII dwelling the nutrient-rich and disturbed riverbanks and water bodies of the territory is a thermophilous reedbed referred to *Calystegio sylvaticae-Arundinetum donacis* (CYNANCHO-CONVOLVULION SEPIUM).

Under cooler bioclimates, several tall-herb plant communities form forest fringes on nutrient-rich and often deep soils, such as *Anthrisco nemorosae-Chaerophylletum temuli* (ANTHRISCION NEMOROSAE) occurring in shady disturbed sites (e.g. rural farms) on deep acid soils between 1450-1600 m a.s.l., or *Anthrisco nemorosae-Heracletum cordati* with falda freatica più superficiale in the paths within the beechwoods of Capizzi at 1350-1500 m a.s.l., while *Lepidio nebrodensis-Smyrnietum perfoliati* characterises more xeric but less disturbed areas at 1410-1520 m of altitude (Portella Femmina Morta, Capizzi, Cesarò, etc.).

The montane areas host some mesic nitrophilous communities ascribed to ARCTION LAPPAE, like *Urtico dioicae-Cirsietum italici* a markedly xerophilous and heliophilous assemblage dwelling coarse metamorphic skeleton-rich soils, often near sheepfolds and rural farms at 1150-1450 m a.s.l. (Serra del Re, Floresta).

Several artificial water basins and the lake Ancipa host some summer-annual pioneer communities typical to seasonally flooded nutrient-rich riverbeds, lacustrine banks and heavily nutrient-loaded anthropogenic habitats (BIDENTETEA TRIPARTITAE and CHENOPODION RUBRI).

7.3. Landscape and land use history

The toponym 'Nebrodes', once used to indicate all the high mountains located NW of Mt. Etna, i.e. both the current Nebrodi and Madonie massifs, derives from the ancient Greek *nebros* (= deer) and clearly evocates the past spread of forest ecosystems suitable for these wild ungulates. There is no doubt that men strongly affected local woddlands by destroying and altering large part of them. Nevertheless, Nebrodi Mts. still host the widest and most continuous fragments of forest cover of all Sicily.

This area hosts the most ancient and famous traces of upper Paleolithic settlement of the whole Sicily, located at the cave of San Teodoro, near Acquedolci, where many exceptionally well-conserved human skeletons dating back to c. 14000 years ago have been found. The good quality of flintstone and quartz tools testify that those people, probably forming a matriarchal society, were devoted to hunting, fishing and rudimental breeding.

Furthermore, the presence of the mid Neolithic 'Stentinello culture' (V millennium BC) has been recorded near Tripi, upper Neolithic sites (c. 4000 BC) have been discovered in the territories of Troina and Basicò, while stone tools and ceramics dating back to ancient Copper Age ('Castelluccio Culture', ca. XXII century BC) have been found at Grotta Scodonì near Torrenova and at Alcara Li Fusi. Additionally, an Iron Age settlement (IX century BC) occurred on the foothills of Mt. Scurzi near Militello Rosmarino.

Between VIII-III centuries BC, all the indigenous cities of the territory, like 'Amistraton' (now Mistretta), 'Abakainon-Abacaenum' (now Tripi), 'Imachara' (probably near Nicosia), 'Traina' (now Troina), became one by one Siculo-Hellenic. Between V and IV Greek occupied not only the coastal areas, founding or re-founding 'Kalé Akté-Calacta' (= beautiful shore, near Caronia) and 'Halaesa Arkonidea' (near Tusa), but also the hills and the mountains, building cities like 'Halontion-Aluntium' (now San Marco d'Alunzio) and 'Apollonia' (near San Fratello), the latter provided with a sea-way at Acquedolci, and small villages at Cerami, 'Helikone' (now Montalbano Elicona), 'Kapition' (now Capizzi), etc.

Under Roman dominion Aluntium, Halaesa and Troina were florid towns, especially during Republican (II BC to I AD) and late Imperial (IV-V AD) period; Calactae exported wine to Rome, Amistraton represented an important trade centre managing and exporting the wheat harvest coming from inner Sicily. Near Acquedolci, Motta d'Affermo and Torrenova several resting houses and rural farms dating back to II-III century AD have been found near the Via Valeria, the consular road build along the Tyrrhenian coast to connect Panhormus with Messana. Romans also built some inland rural villages like the one of 'Sinus aggeri' (= curve of the riverbank, now Sinagra) and near Ucria.

Under Byzantines most of the population concentrated in the villages of the hilly and montane area. The main centres (i.e. Apollonia renamed San Filadelfio, Calacta, Halaesa, San Marco d'Alunzio, Troina, Ucria, Mistretta and Nicosia) became fortresses, and many other villages were founded, like Sparto (now Motta d'Affermo), Piraino, Sant'Angelo di Brolo, Castania (now Castell'Umberto), San Salvatore di Fitalia. Additionally, many basilian monasteries spread in the territory, mostly on strategic places and/or near to wide forested areas, and some of them give origin to new settlements, like the ones of Raccuja and Frazzanò. Almost certainly this period coincides with a strong intensification of anthropogenic pressure on local forest ecosystems (grazing and browsing, wood gathering, etc.).

As a matter of fact, almost 1500 years after the settlement of the first Greek colonies, the inhabitants of the perched villages of north-eastern Sicily still formed a Greek-speaking community. The strong cultural and religious identity of local population, together with the inaccessibility of many towns, explain why Arabs achieved to conquer most of (not all!) this area only around mid X century, i.e. one hundred years after their arrival on the SW coasts of the island. Unlike western and central Sicily, Arabs seem not to have densely occupied the countryside, and they preferred to strengthen the pre-existing villages and rural farms, like Cerami, Migaido near Pettineo, Nicosia, Piraino, San Salvatore di Fitalia, Ucria and San Marco d'Alunzio, which became the administrative centre of the 'Magna Divisa Vallis Demonis', corresponding to the NE part of the island. The present name or the foundation of other local villages is linked with Arabs: this is the case of Alcara Li Fusi and Galati Mamertino (probably both deriving from al 'Qala'at' = fortress), Cesarò (perhaps from 'Kasr', castle), Raccuja (perhaps from 'Rahal Kuddya' = rural farm on the big hill), while the ancient Calacta became 'al Qarunia' (now Caronia). Lowlands appear almost desert: only near Acquedolci sugar cane is cultivated and harvested.

Under Normans the territory remains almost unchanged, although they founded or re-inforced some villages (Acquedolci, Alcara Li Fusi, Brolo, Capizzi, Cerami, Frazzanò, Montalbano Elicona, San Fratello, San Salvatore di Fitalia, San Filadefo, re-named San Fratello,

Cesarò: free-ranging black porks in the Cynosuro cristati-Leontodontetum siculi (Cirsio vallis-demonii-Nardion). Black porks are kept on Nebrodi mountains since medieval times. Nowadays the popularity of this product is increasing, the market is enlarging and the black pork became a major source of environmental impact in many oakwoods of Nebrodi Mts.

Santo Stefano di Mistretta near Tusa, Sparto, which becomes Motta d'Affermo). Part of the territory remains a state property, other lands were donated to local aristocracy and became small fiefs or Basilian monks were entrusted of their management. Many towns are populated with people coming from other regions ruled by Normans. The so-called 'Lombardi', actually coming from W Liguria and W Piedmont, form a peculiar cultural and linguistic enclave until present day, giving origin to the so-called 'Gallo-Italic' dialects.

Under Frederick II Hohestaufen (XIII century) Nicosia became the fourth city of Sicily after Palermo, Messina and Catania. The Swabian emperor donated part of these lands to relatives and allies (e.g. Brolo, Sinagra, Piraino to Lancia family, Cesarò to Colonna Romano family). During XIV century the kings of Aragon did exactly the same, donating many forest-rich areas to nobles (Caronia, Naso and Tusa to the family Ventimiglia, Pettineo to the counts of Geraci, etc.) or to the church: Floresta is property of the archbishop of Patti until XIV century, while the monastery of Sant'Anastasia at Castelbuono manages the lands of Santo Stefano di Mistretta until XVII century.

As the biggest forested surface of Nebrodi Mts., including the woods of Mangalavite, Troina, Grappidà, Foresta vecchia and Petrosino, belonged to territory of Caronia, the name 'Caronie' started to be commonly used to indicate the whole mountain range.

Most of local fiefs were small, hence the sustainable management of local forest resources was probably the only way to survive, not only for local inhabitats but also for the owners. Overexploitation allowed local lords to climb the Sicilian noble hierarchy (from baron to count, to marquis, to prince, to duke) as often as let them see their properties confiscated due to bankrupt. Only the most important centres, like Troina, Nicosia and Mistretta, playing a key role for the trade of both local forest goods and agro-pastoral products coming from the crop fields and pasturelands of the Erei Mts., maintained a high level of welfare until XVIII century, when Nicosia counted more than 260 noble families, 84 churchs, 6 convents and 4 monasteries. Other minor centres developed thanks to their vicinity to the main regional transhumance tracks (Cesarò, Floresta, Capizzi, Montalbano Elicona, etc.), or enjoyed the managerial qualities of their owners, like Raccuja and Sant'Angelo di Brolo, rich and famous between XVI and XVII century thanks to silk production and export.

With the end of feudalism (1812) the area did not experience the fast and irreversible changes that affected the natural landscape of many other areas of Sicily. Indeed, downy oakwoods were cutted to give more room to fruit orchards, vineyards, pure cork oak stands and olive groves, while chestnut and hazelnut (Longi, Frazzanò, Galati Mamertino, Raccuja, San Salvatore di Fitalia, Ucria, Sinagra, Mirto, Montalbano Elicona, Basicò, Sant'Angelo di Brolo) groves were further developed at the expense of Turkey oak forests; but in most cases these changes were slow and slight because local communities were used to comply with the chronic shortage of resources. Natural facts - namely local geography, geo-pedology, climate - more than human choices, explain the extremely high number of small municipalities, the everlasting low demographic density, the endurance of land uses since at least Middle Ages. In fact, the adjacent coasts have always been difficult to reach due to the steepness of N-facing slopes, and they do not offer comfortable and secure harbours: conversely, they are almost completely exposed to winter storms. Local streams are not navigable and dangerous to cross during winter. Additionally, Nebrodi Mts., together with Peloritani and S Calabrian Mts. act as a natural 'dam' able to intercept most of the air humidity released by the winds which encounter these ridges after having crossed the SE Tyrrhenian. The high frequency of extreme rainfall events triggers the natural tendency to slip down of local clayey and marly-clayey soils, and soil erosion not only still biases the transport of men and goods due to continuous damages to local road network, but has had impressive consequences on the private lives of many local communities. On 1682, a disastrous landslide destroyed Santo Stefano di Mistretta and the inhabitants have to move and re-found elsewhere a new town, now called Santo Stefano di Camastra; the same happened to San Fratello, subject to three huge landslides on 1754, 1922 and 2010, and to Castell'Umberto between XIX and XX centuries, while Sinagra was almost completely destroyed by two floods occurred within a decade (1827 and 1837). Also the seismic asset of the area is hostile: during Middle Ages (perhaps on 856 AD) Halaesa was probably abandoned due to an earthquake and re-founded on another site; at the end of I century AD also Calacta was probably destroyed by an earthquake; the survivors decided to move and founded a new settlement on the coast, near to present-day Caronia Marina, but just 300 years after (mid IV century AD) also the new settlement was struck by earthquake or a tsunami.

The majority of the local hilly-montane villages currently counts less than 3000 people, and only few of them more than 5000 (Nicosia: 13900; Troina: 9400; Tortorici: 6500; Brolo: 5900; Mistretta: 5000). At present the main income for local communities is provided by pastoral activites (pigs left to wild pasture in the woodlands, cows and horses in the grasslands, goats and sheep in open degraded cork- and downy oakwoods). In many cases current breeding practices appear unsustainable, with severe consequences on local ecosystems. In particular, the excessive number of pigs hampers the renovation of local forests due to overgrazing and trampling, and the increasing frequency of arsons by shepherds has caused the spread of monotonous broom heaths, mantle shrublands, degraded bracken-dominated herblands, etc., compromising not only local forest communities, but even the perennial and annual dry grassland assemblages.

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Box 7.1 *Petagnaea gussonei unveiled*

Petagnaea gussonei (Sprengel) Rauschert is endemic to the Nebrodi Mountains (NE Sicily). The subpopulations of this species are scattered over c. 56 km^2 from 240 to 1450 m a.s.l., and they grow together with other hygrophilous tall herbs typical to shaded forest edges and nutrient-rich fringes located along permanent mountain streams or near freshwater springs, ascribed to the phytosociological class *Epilobietea angustifolii*.

Petagnaea is a rather isolated genus within the tribe Saniculoideae. The nearest genus is *Astrantia*, which has a South and East European-Caucasian distribution range. Together with *Siculosciadium*, another Apiaceae, it represents the only endemic genus of the whole Sicilian vascular flora.

Due to the gradual decline of both the area of occupancy and habitat quality, and considering the low number of known locations (22), often subject to several threats (e.g. disturbance of groundwater regime, ecosystem and soil degradation due to alien tree plantations, livestock trampling), this species has been categorized as Vulnerable by IUCN. Moreover, the species is listed in Appendix I of the Bern Convention and in Annexes II and IV of the EC ‘Habitats’ Directive.

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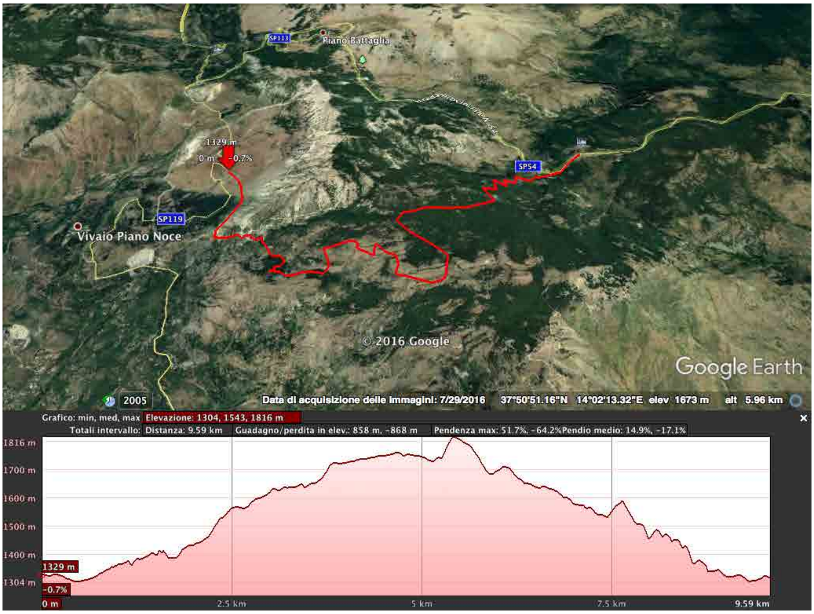
VIII
Madonie Mts

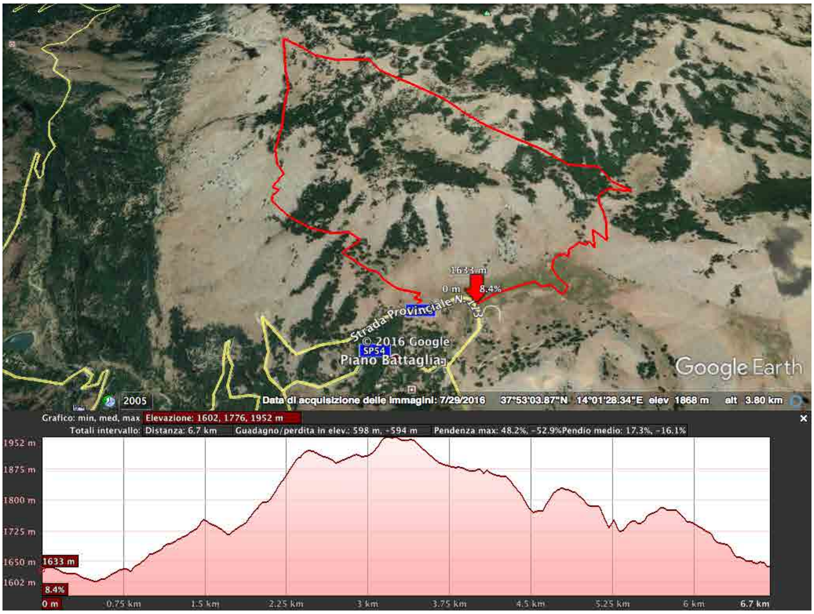
Itinerary1-From"PianidiQuacella"to"ContradaPomieri", through Vallone Madonna degli Angeli



On Madonie Mts., many different geological units are represented, creating a wide variety of substrata, from alkaline to acidic, from loose and sandy to compact and clayish. Our hike will develop along the contact area between limestone and metaquartzites, giving us the chance to appreciate most of the local endemites, including the most famous one: *Abies nebrodensis*, currently limited to a small valley (1440-1600 m a.s.l.) subjected to periodical fogs, where it colonizes initial soils with an arenaceous-quartzitic matrix. The Madonian fir is one of the last representatives of a Tertiary climactic vegetation, that has been displaced by the arrival of the beech in Sicily, during the cold phases of the Quaternary. Once arrived in the summit areas of Mt. San Salvatore, we will appreciate the acidophilous pulvinate communities of Arm-

erion nebrodensis. Walking back along the ridge up to the limestone outcrops, we will observe the transition between these communities and the basiphilous ones ascribed to the alliance Cerastio-Astragalion nebrodensis, before descending towards Contrada Pomieri across the contactzonebetweenthe *Anemonoapenninae-Fagetumsylvaticae* andthe *Ilici aquifolii-Quercetum austrotyrrhenicae*.
Trail: Length: 9.5 km. Hiking time: 5 hours, Elevation range: 800 m.

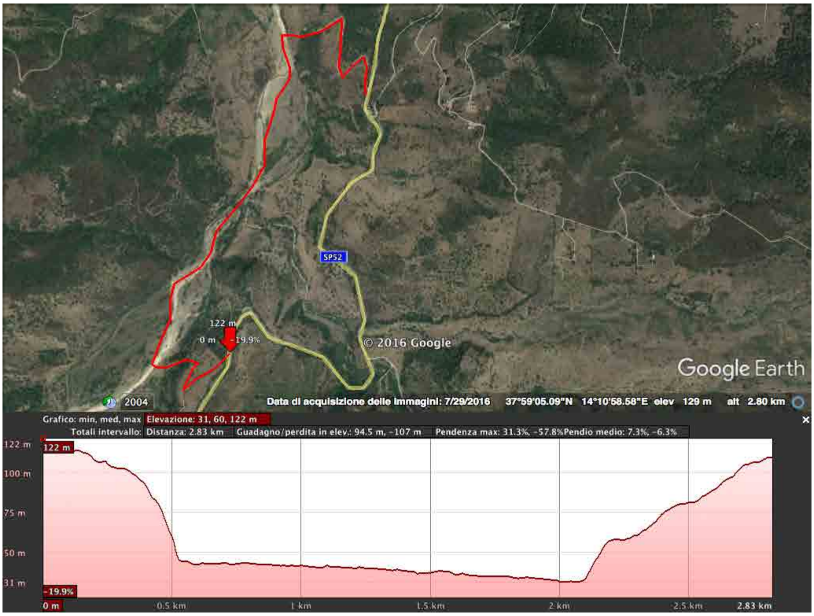
Itinerary2 - Dolines of Piano Battaglia and Mt. Carbonara



The carbonatic summits of Madonie are spotted by thousands of closed hollows, known as sinkholes or dolines. These are generally small but can be up to 40 m in depth and 500 m or more in diameter. Sinkholes develop by a variety of karstic processes: collapse, suffosion or solution, depending on the land morphology and on the proximity with loose material originating from the neighbouring quartzitic sandstones. We will wander amidst the dolines and observe the how the vegetation adapts to the gradient summit-flank-hollow, in a land-

scape dominated by mountain pasturelands (Cirsietalia vallis-demonis, Holoschoenetalia and Poetalia bulbosae), mostly obtained by millennial stockbreeding to the detriment of beechwoods. After reaching the top of Mt. Carbonara (1979 m), the second highest peak of Sicily, we will descend a carbonatic, south facig slope with vegetation of Cerastio-Astragalion nebrodensis.
Trail: Length: 6.7 km, Hiking time: 4.5 hours, Elevation range: 450 m

Itinerary3 - Fiumara di Pollina



"Fiumara"(from Latin *flumen*, from Classical Latin *flue*□*re*-alternative names: *jumara, rieral, rambla*) is the name given to wide, intermittently dry riverbed, with a large sediment load during the flood peak, causing a braided course and the frequent rearrangement of warp deposits. Most of the rivers of Northern and North-Eastern Sicily display a fiumara in the terminal trait of their course. We will descend through olive groves up to the fiumara of the river Pollina, where we will see thermo-hygrophilous pioneer thicket communities (Nerio-Tamaricetea). The most

common aspect of such disturbance- and stress-tolerant vegetation are mono-specific stands of *Tamarix africana* (Tamaricion africanae), and *Spartio juncei-Nerietum oleandri* (Rubo - Nerion oleandri), colonizing the alluvial sandy-gravelly fluvial terraces which are slightly raised above the streambeds occupied by Euphorbion rigidae assemblages.
Trail: Length: 3km, Hiking time: 1 hr, Elevation range: 100 m

Itinerary4 - Promontory of Cefalù

The promontory of Cefalù consists of an huge mass of carbonatic rock rising 268 metres a.s.l., which the town moved up to for protection against pirate raids after the fall of the Roman empire. Thanks to water reservoirs of karstic origin, the local people could withstand long sieges up on the Rocca, which was offering adequate water supply from 19 wells or cisterns excavated all over the promontory. The headland overlaps a basal complex constituted by fossil-rich "Oligocene flysches and Silicide pelagic shales and flysches".

The vegetation of the promontory shows almost everywhere the traces of a long-lasting exploitation of the land. After the recent abandonment of agricultural activities, husbandry and fire are the only occasional disturbances in the area. Along the trail, we will observe

many different vegetation types, including: Mediterranean annual and perennial dry grasslands (Thero-Brometalia, Trachynietalia distachyae, Hyparrhenietalia), vegetation of rocky cliffs (Asplenietalia glandulosi; Geranio-Cardaminetalia hirsutae), *Pinus halepensis* reforestation replacing the former Pistacio-Rhamnetalia vegetation (*Myrto-Lentiscetum*; *Oleo-Euphorbietum dendroidis*), of which only very few remains are still occurring in the most impervious places.
Trail: Length: 6.7 km round trip (it can be shortened, depending on the exigencies), Hiking time: 3 hours, Elevation range: 268 m.

General Description

8.1. The physical setting

The name 'Madonie' (an Italian corruption of the Sicilian name 'Marunìa') issues from Mons Maronis, the site where Gangi was rebuilt at the beginnings of XIV century AD. For centuries scholars have been claiming that this peak was the property of a Roman noble named Maro; according to a more recent hypothesis it could issue from an ancient Indo-European name given from Siculi: in fact, in other Italic dialects 'mor/mar' means 'big', hence *Maroneus mons* could simply mean 'the big, high mountain'. A third hypothesis links the name to the noble family Ventimiglia, coming from Maro in Liguria: arrived in Sicily by mid XIII century, they became the most powerful family of the area between XIV and XIX centuries.

The massif of Madonie represents the central sector of the northern Sicilian mountain range; its calcareous core rises up abruptly within just 20 km from the Tyrrhenian coast; its highest peaks nearly reach 2000 m of elevation, like Pizzo Carbonara (1979 m a.s.l.), Mt. San Salvatore (1912), Mt. Ferro (1906), Mt. Quacella (1869), Mt. Mufara (1865), Mt. Daino (1796), Mt. dei Cervi (1794), Pizzo Antella or Pizzo della Principessa (1697), Pizzo Catarineci (1660), Pizzo Dipilo (1365), etc.

The calcareous-dolomitic highlands are shaped by karst erosion, which originated a complex patchwork of dolines, poljes, sink holes, karren fields, etc., intermingled with rocky cliffs, bare stone surfaces, deep canyons and screes laying on the Palaeogenic siliceous deposits made of marls.

Piani di Quacella, seen from the crest. The rangelands (Carduncello pinnati-Thymetum spinulosi) are replacing the beechwood (Luzulo siculae-Fagetum sylvaticae), but the beech still occurs on screes and on the rocky limestone ridges (Hieracio madoniensis-Fagetum sylvaticae), ready to recover the lost ground. The dirt road curving on the left leads to the Vallone Madonna degli Angeli.

Madonie play a key role to understand the sequence of geologic events which involved the so-called ' palaeo-domains' (Sicilid, Panormid, Imerese, etc.) corresponding to small fragments of the African plate which were dismembered, displaced and then subjected to complex vertical and lateral tectonic movements, whose deformation may be divided in three main steps:

1) Lias-lower Trias (251-200 Ma): submarine muddy deposits accumulated along the northern margin of African plate start consolidating. In the meanwhile, huge coral reefs - typical to shallow, warm and oxygen-rich waters like those still occurring on northern Antilles - border the emerged lands close to a deep trench filled with a mixture of calcareous and clayey muds and with diffuse distensive volcanism. At the NW limit of this area there was a microplate corresponding to current northern Algeria, Peloritani Mts. and S Calabria; even further in the same direction, Corsica, Sardinia and Baleares are still united to form the margin of the European plate.

2) Between Jurassic and Cretaceous and the beginning of Palaeogene all the sediments and the calcareous platforms disappear due to

an intense and wide process of submersion of the whole area, which causes the prevalence of deep-sea muddy deposits and Ammonites; as a consequence of extensive tectonic movements the previous basins deepen and become oceans, as testified by the presence of radiolarites and effusive volcanic products. The Kabylian-Calabrian microplate separates from 'Sicily' and another deep trench gradually opens in the southeastern side originating the Ionian Sea.

3) From the end of Miocene to Pleistocene (23.0-1.8 Ma) all the area between Europe and Africa undergoes a deep revolution. In this period both the Apennines and the north African chain form, while foredeep submarine environments are covered with conglomerates, clays, sandy clays and quartz sandstones originating from the erosion dismantling the rising mountains (e.g. Castellana Sicula and Terravecchia formations, outcropping near Castellana Sicula, Scillato, Collesano and Polizzi Generosa).

All these changes are due to a strong compression which causes the overlap of previously separated (partly emerged) 'palaeodomains'. During upper Pliocene (ca. 2.6 Ma) this process reaches the acme with the frequent overturning of the geological layers: for example, on the top of Madonie Mts. we can observe Panormide mesozoic coral reefs laying over the pliocenic calcareous marls called 'Trubi'.

The rock outcrops deriving from the deformation of the Sicilid palaeodomain represent the majority of the rock outcropping on the top of the massif: they are represented by the following formations: 'Argille varicolori', i.e. clays and clayey marls, mostly occurring in the territories of Polizzi, Collesano and Caltavuturo, 'Tufiti di Tusa' (marls with microinclusions of sandy debris of metamorphic and volcanic origin) and 'Polizzi' (marly limestones).

The deformed rock of the Imerese palaeodomain are mostly Mesozoic calcareous or siliceous-carbonatic overturned layers like those of the 'Mufara' formation (marls, marly limestones and flaky clays), 'Scillato' and 'Fanusi' (mostly carbonates), 'Crisanti' and 'Caltavuturo' (both siliceous and calcareous).

The deformed rocks once belonging to the Panormid palaeodomain are well represented on Pizzo Dipilo and Pizzo Carbonara and derive form coral reefs and continental shelf sediments accumulated between Trias and Eocene-Oligocene (200-20 Ma).

Some evaporitic rocks (compact limestones, salt, macrocrystalline gypsum and trubi) formed during the Messinan crisis occurring

Due to the combination of anthropic disturbance and competition with the beech, Abies nebrodensis behaves like a markedly pioneer species, limited to stony places, where it grows together with Juniperus hemisphaerica (Junipero hemisphaericae-Abietetum nebrodensis).

around 5.3 Ma, belonging to the so-called ‘Gessoso-Solfifera’ formation, occur near Petralia Sottana (were a salt mine is still working), Polizzi Generosa and Castellana Sicula.

As a consequence of geology, the association ‘rock outcrop + xerorthents (= rock outcrop + lithosols)`characterises the wide bare areas of the top of the mountains, as well as the association ‘lithic xerothents + rock outcrop + lithic haploxerolls (= lithosols + rock outcrop + eutric regosols)’ mostly occurring on the main peaks. The soil combination ‘lithic xerorthents + rock outcrop + typical and/or lithic xerochrepts (= lithosols + rock outcrop + eutric cambisols)’ is the most common of the calcareous core of the massif and SW of Polizzi and Castellana.

The association ‘typical xerochrepts + typical haploxeralfs + typical and/or lithic xerorthents (= eutric cambisols + orthic luvisols + eutric regosols and/or lithosols)’ is the most common on the Tyrrhenian side of the massif, whilst ‘typical xerorthents + typical and/or vertic xerochrept + typical and/or vertic xerofluvents and/or typical chrmomoxererts and /or typical pelloxererts (= eutric regosols + eutric and/or vertic cambisols + eutric fluvisols and/or chromic and/or pellic vertisols)' prevail on the clayey slopes of the southern side of the massif (e.g. near Blufi and Bompietro).

A mixture of 'typical xerorthents + typical and/or vertic xerochrepts (= eutric regosols + eutric and/or vertic cambisols) ̀is the most frequent on local flysch outcrops.

The alluvial sediments along the coast and in the bottom of some inner valleys are characterised by 'typical and /or vertic xerofluvents + typical and/or vertic xerochrepts (= eutric fluvisols + eutric and/or vertic cambisols)', while a combination of typic xerorthents + lithic xerorthents + typical and/or vertic xerochrepts (= calcaric regosols + lithosols + eutric and/or vertic cambisols)' only occurs near Petralia Sottana.

Depending on altitude and distance from sea, the localities included in this area are subject to 4 to 5 months of drought stress. Even if no data are available for the southern sector of the massif, almost certainly it is less rainy (the mean value of annual rainfall of the montane locality of Gangi is 630 mm, vs. 1004 of Geraci, 857 of San Mauro Castelverde, 819 of Isnello, 810 of Petralia Sottana, 798 of Castelbono, 788 of Polizzi Generosa, 740 of Borrello - located in the valley beneath San Mauro,

Abies nebrodensis: branches with cones.

726 of Caltavuturo and 693 at Cefalù). Based on locally available climatic data, Scillato is the warmest and Petralia the coldest recording station, even they cover a very narrow altitudinal range with respect to the whole area: the mean annual temperatures range between 13.5 and 16.5 °C, the mean values of the coldest month (January) between 4.8 (Petralia Sottana) and 9.2 °C (Scillato), that of the warmest month (July or August) between 23.0 (Gangi) and 24.9 (Scillato).

Based on several interpolation models, the coastal sector is subject to upper thermomediterranean lower to upper sub-humid bioclimate, while the Tyrrhenian slopes of Madonie Mts. are characterised by a steep gradient of humidity conditions, ranging from upper subhumid to lower humid mesomediterranean (300-750 m a.s.l.), to lower and upper subhumid supramediterranean (750-1100 m a.s.l.), to lower humid supramediterranean conditions on the top of the range. The southern slopes of the massif are drier and mostly experience by upper dry and lower subhumid mesomediterranean bioclimate.

The main water courses flowing in this territory are the rivers Torto (64 Km) and Imera settentrionale or Grande (35 Km) which also represent the western limit of the massif, Imera meridionale or Salso (144 Km) flowing towards the Strait of Sicily along its the southern sector, and the river Pollina, which represents the eastern border of the area.

8.2. Flora and vegetation

According to the phytogeographic subdivision of Sicily proposed by Brullo et al. (1995), the Madonie Mts. belong to the Drepano-Panormitan district. This area is by far the richest and most distinc of the whole region, hosting 45 narrow endemics, i.e. *Abies nebrodensis*, *Adenostyles nebrodensis*, *Allium castellanense*, *Allium nebrodense*, *Alyssum nebrodense*, *Arabis madonia*, *Armeria nebrodensis*, *Asperula gussonei*, *Astragalus nebrodensis*, *Aubrieta deltoidea* subsp. *sicula*, *Bellardiochloa variegata* subsp. *nebrodensis*, *Bupleurum elatum*, *Campanula marcenoi*, *Dianthus minae*, *Draba olympicoides*, *Epipactis cupaniana*, *Evacidium discolor*, *Festuca pignattiorum*, *Genista cupanii* (in common with Nebrodi Mts.), *Genista demarcoi*, *Genista madoniensis*, *Helianthemum nebrodense*, *Helichrysum nebrodense*, *Hesperis cupaniana*, *Hieracium murorum* subsp. *atrovirens*, *Hieracium racemosus* subsp. *pignattianum*, *Hieracium schmidtii* subsp. *madoniense*, *Hieracium schmidtii* subsp. *nebrodense*, *Jurinea bocconei*, *Laserpitium siculum*, *Leucojum nebrodense*, *Linum punctatum*,

In the foreground: Plantagini-Armerietum nebrodensis (Armerion nebrodensis) on the arkosic oligocenic sandstones of Mt. San Salvatore; in the background: Luzulo siculae-Fagetum sylvaticae, and Cerastio-Astragalion nebrodensis on the mesozoic carbonates of Mt. Quacella.

Ophrys cephalodaetana, *Pimpinella tragium* subsp. *glauca*, *Pyrus castribonensis*, *Rhamnus lojaconoi*, *Rosa strobliana*, *Senecio candidus*, *Siculosciadium nebrodense* (only species of a strictly endemic genus!), *Sideritis sicula*, *Silene minae*, *Silene saxifraga* subsp. *lojaconi*, *Sorbus madoniensis*, *Sternbergia exscapa* and *Viola nebrodensis*. Moreover, Madonie Mts. host the only known Sicilian population of 47 taxa, i.e. *Allium permixtum*, *Amelanchier ovalis* subsp. *embergeri*, *Anthemis cretica* subsp. *columnae*, *Asplenium ruta-muraria*, *Asplenium lepidum*, *Buglossoides incrassata*, *Campanula marcenoi*, *Cardamine monteluccii*, *Carex laevigata*, *Carex pallescens*, *Carex paniculata*, *Carex tumidicarpa*, *Cerinthe auriculata*, *Chenopodium bonus-henricus*, *Colchicum triphyllum*, *Corydalis intermedia*, *Cotoneaster nebrodensis*, *Cynoglossum nebrodense*, *Daphne oleoides*, *Dianthus gasparrinii*, *Eleocharis nebrodensis*, *Ferulago campestris*, *Gagea fistulosa*, *Galium bernardii*, *Helianthemum canum*, *Iberis carnosa*, *Lotus corniculatus*, *Juncus compressus*, *Minuartia condensata*, *Minuartia graminifolia*, *Myosotis stricta*, *Myosurus minimus*, *Ornithogalum comosum*, *Orthilia secunda*, *Potentilla inclinata*, *Ptilostemon niveus*, *Rhamnus infectorius*, *Ribes uva-crispa*, *Rosa serafinii*, *Scleranthus marginatus*, *Silene monachorum*, *Scrophularia vernalis*, *Sorbus nebrodense*, *Thesium parnassi*, *Thlaspi rivale*, *Verbascum rotundifolium* and *Vicia glauca*.

Mt. San Salvatore: contact between the Anemono apenninae-Fagetum sylvaticae and Plantagini-Armerietum nebrodensis, colonizing the summit windy ridges.

Additionally, dozens of district and island endemics and plenty of regionally rare and endangered plants occur not only on the top of the massif but also within the forest ecosystems of the foothills, e.g. *Artemisia alba* subsp.*alba*,*Ephedranebrodensis*,*Herniariapermixta*,*Lomelosiacrenata*,*Plantagohumilis*,*Quercusleptobalanos*,*Saponariasicula*,*Teucriummontanum*,etc.

The territory of Madonie Mts. Figures among the Italian Important Plant Areas with the code SIC13 'Madonie'.

Many scholars stated that both the species richness (more than 2000 taxa, i.e 2/3 of the whole Sicilian vascular flora!) and the high endemism rate of Madonie Mts. testifies the paramount role played by these mountains as a 'Tertiary' refugium for local flora. This hypothesis must be discarded for ever for at least two good reasons. First of all, during 'Tertiary' (a term which has been rejected by geologists and should be substituted with 'Palaeogene') and, more precisely, until lower Pliocene (between 5.3 and 3.6 Ma) most of the western Sicily (and also Madonie Mts.!) was still under the seawater, and the only emerged lands which could exist before that time are nowadays under the Tyrrhenian sea or have been covered due to the overlap of the geological units shifting from NW to SE during the above-mentioned compression which originated the massif. Second, geologists have pointed out that during the glacial events occurred during Holocene, even the last ended 18000-12000 years ago, the top of the massif was repeatedly subject to periglacial processes, hence completely devoid of vegetation. Hence, all local oro-mediterranean endemics colonized the top of the massif much more recently as expected.

Modern climatic models show that glacial events the Mediterranean realm was strongly affect by aridity. The only suitable places for plants to escape from frost damages and drought stress was the full availability of N-facing valleys and canyons, providing cooler and milder microclimates and acting as major refugia giving plant the chance to survive and then to re-colonize the top of the mountains during warmer and more humid interglacial periods. Hence, the N-facing sector of the Madonie Mts. could enjoy both the warmer climate and the humid winds coming from N and NW.

The 'limestone effect', a pattern observed worldwide, should also be invoked to explain the species and endemic species-richness of Madonie Mts. Indeed, the shallow and base-rich soils deriving from limestones and dolomias are the ideal location for evolution, especially under supra- and oro-mediterranean conditions.

The top of Madonie Mts. played the role of 'calcareous island' for the supra-mediterranean flora, which only occurs there and has evolved there due to isolation.

Summarizing, three factors seem to better explain the particularly valuable botanical heritage of Madonie Mts.: favourable microclimatic conditions during Holocene, substrate and isolation. Without the favourable combination of these factors the area would have been as poor of endemics as the almost similar and close massif of Nebrodi Mts.

Zonal vegetation

In the following the main vegetation units of Madonie Mts. are presented starting from the highest peaks and going down to the seaside.

The relict oro-mediterranean conifer woodlands and shrubberies are framed into JUNIPERO-PINETEA SYLVESTRIS and BERBERIDO AETNENSIS-PINION LARICIONIS.

Juniperohemisphaericae-Abietetumnebrodensis is localized in the Vallone Madonna degli Angeli, enjoying the water supply due to frequent fogs, occurs on initial soils deriving from flysch quartzites. Last Sicilian firs occurring there have been unanimously considered the last remnants of the recent destruction of a previously widespread montane climax, although recent paleobotanical surveys point out that *Abies nebrodensis* was probably very rary in historical times and that the fir species belongig to *Abies alba* group used to occur also under supra-mediterranean bioclimate intermingled with deciduous broadleaved species such as beeches and deciduous oaks.

Cerastio tomentosi-Juniperetum hemisphaericae is a prostrate shrubland occurring on limestones, dolomites and quartzites able to colonize initial soils on sunny and windy places between 1300 and 1900 m a.s.l.

The hemicryptophytic and chaemaephytic patchy and mostly thorny cushion vegetation of the upper meso-, supra- and oro-mediterranean belts of Sicily and Calabria is ascribed to the endemic class RUMICI-ASTRAGALETEA SICULI. Its alliance ARMERION NEBRODENSIS includes *Plantagini humili-Armerietum nebrodensis*, a community dominated by small pulvinate chamaephytes and caespitose hemicryptophytes occurring on eroded, leached and extremely acid (pH 4-6) soils, often altered by cryoturbation. It occurs in the oro-mediterranean belt, between 1700-1900 m a.s.l., on the sunny plateaux and windy ridges on the siliceous peaks of Madonie Mts. (Mt. San Salvatore and Vallone Madonna degli Angeli), very stony due to overgrazing and wind erosion.

The assemblages dwelling base-rich soils are referred to the endemic alliance CERASTIO-ASTRAGALION NEBRODENSIS, locally represented by *Astragaletum nebrodensis*, a species-poor pioneer assemblage colonizing eroded soils rich in skeleton, stony and eroded slopes and windy ridges. The thorny cushions of *Astragalus nebrodensis* dominate this community, provide a shelter (against wind and overbrowsing) to the few co-occurring plants and allow slow pedogenesis. It also occurs under supra- and oro-mediterranean bioclimate between 1400 and 1900 m a.s.l., on soils deriving from carbonates and flaky clays (e.g. Mt. Mufara and Quacella ridge).

The sub-nitrophilous *Cachryetum ferulaceae* is rather common on the N-facing gently sloping karstic sites (Pizzo Carbonara, Mt. Mufara and Monte dei Cervi) covered with quite deep but primitive soils which remain humid up to late summer but linked between 1600 and 1900 m a.s.l.

Lino punctati-Seslerietum siculae is a xerophilous, discontinuous community colonizing the lithosols and rocky slopes on eroded sites of the supra-mediterranean belt between 1200 and 1800 m a.s.l.

To *Carduncello pinnati-Thymetum spinulosi* is ascribed the chamaephytic vegetation dwelling the eroded soils deriving from argillites (= flaky clays),

The massif of Mt. Carbonara, here seen from the opposite crest of Mt. Quacella, is spotted by hundreds of dolines. Hollows were traditionally used as summergreen pasturelands.

flysch, limestones. It characterises the wind-exposed gently sloping summits of the meso- and supra-mediterranean belt between 1100 and 1400 m a.s.l. on the Quacella rigdes and also occurs on Sicani and Nebrodi Mts.

On the oro-mediterranean belt of Pizzo Carbonara three different assemblages occur: on the stony and steep (50°) slopes between 1500 and 1900 m a.s.l. *Siderito siculae-Artemisietum albae* prevails, substituted by *Seslerio siculae-Melicetum cupanii* on the highest slopes and on windy the ridges (1800-1950 m a.s.l.). The inner N-facing and wind-sheltered slopes and the bottom of dolines, where the snowbed lasts for at least 2 months and the loam- and nutrient-rich soil remains humid up to late summer, are covered by *Siculosciadetum nebrodensis* (e.g. Fosse di San Gandolfo).

All the mesic (and meso-hygrophilous) summergreen deciduous forests of the meso- to supra-mediterranean belts of the massif are framed into CARPINO-FAGETEA SYLVATICAE and GERANIO STRIATI-FAGION.

Ilici aquifolii-Quercetum austrotyrrhenicae is mostly common on acid soils issuing from Numidian Flysch outcropping rocks, in areas subject to humid supra-mediterranean bioclimate between 1250 and 1600 m a.s.l. The most representative examples of this forest community, linked to extremely cool and humid slopes enjoying an almost continuo-

View of the dolines of Piano Battaglia, with Cachryetum ferulaceae in the foreground Cynosuro cristati-Plantaginetum cupanii in the flattened part of the doline.

us supply of air humidity coming from N-NW, are found on the Madonie Mts. at Contrada Pomieri and some scattered spots are interspersed in the Pollina watershed (Portella Mandarini, near Pizzo Canna and Piano Simpria, at Passo Canale and Piano Farina, Mt. Antenna Piccola), Pizzo Catarineci, Mt. Giummeti and near Castelbuono.

With *Anemono apenninae-Fagetum sylvaticae* belong most of the acidophilous beech forests ot Nebrodi Mts. subject to supra-mediterranean bioclimate between 1400 and 1800 m a.s.l., like those of Mt. Daino, Mt. San Salvatore, Portella Colla, Pizzo di Fao, Pizzo Scalonazzo, Zottafonda, Piano Principessa, Pizzo Catarineci.

Ilici aquifolii-Quercetum leptobalani occurs on acidic soils between 1000 and 1200 m a.s.l. at Gonato, Serre di Corco and Vicaretto.

On the eastern part of Madonie Mts., a montane holm-oakwood, the *Geranio versicoloris-Quercetum ilicis*, occurs on acid and well-humified soils issuing from flysch outcrops under lower supra-mediterranean humid bioclimate, between 900 and 1200 m a.s.l.

Luzulo siculae-Fagetum sylvaticae includes most of the basiphilous beech forest of Madonie Mts. colonizing dolomites and limestones between 1500-1900 m a.s.l. in the supra-mediterranean humid bioclimate, like those of Bosco Madonia (Isnello), Mt. Mufara (Petralia

Sottana), Pizzo Antenna Grande, Monte dei Cervi, Mt. Spina Puci, while *Hieracio madoniensis-Fagetum sylvaticae* only occurs in the narrow gorges of Passo della Botte, between 1350 and 1500 m a.s.l.

The steep and gravelly slopes of the calcareous part of the Madonie massif, subject to supramediterranean mesoclimate, host a pioneer assemblage ascribed to *Sorbo graecae-Aceretum pseudoplatani* (CARPINO-FAGETEA SYLVATICAE and TILIO-OSTRYON CARPINIFOLIAE).

Local basiphilous thermophilous oak woods are referred to QUERCETEA ILICIS and FRAXINO ORNI-QUERCION ILICIS, and are locally represented by *Oleo sylvestris-Quercetum virgilianae*, almost frequent in the territories of Polizzi Generosa, Pollina, San Mauro Castelverde, Scillato. Interestingly, the area where this forest community occurs is the same where olives and manna ash trees have been planted during past centuries, so that nowadays it is often hard to say if these forest stands are the result of the secondary succession processes going on in abandoned groves or are the remnant nuclei of a previously wide thermophilous oak forest.

This evergreen forest *Aceri campestris-Quercetum ilicis* rich in deciduous trees and many herbaceous species of the *Carpino-Fagetea* colonises poorly developed base-rich soils issuing from limestones and dolomias, consolidated screes and even semi-rupestrial habitats under supramediterranean bioclimatic conditions subject to more than 1000 of annual rainfall, between 1000 and 1400(1700) m a.s.l., like Piano Zucchi, Mt. Balatelli and Pizzo Carbonara, Volpignano, Mt. Cucullo, Vallone Madonna degli Angeli, southern slopes of Mt. Quacella. It is dynamically connected with CERASTIO-ASTRAGALION NEBRODENSIS communities; at lower altitudes it is substituted by thermophilous oakwoods (*Oleo sylvestris-Quercetum virgilianae*), while around 1400-1500 m a.s.l. it is gradually substituted by *Luzulo sylvaticae-Fagetum sylvaticae*.

Rhamno lojaconoi-Lauretum nobilis occurs on the N-facing slopes and within the thalwegs of the streams Cava and Vicaretto (municipalities of Castelbuono and Geraci Siculo) both on calcareous and quartzitic substrates under upper meso-mediterranean subhumid-humid bioclimate. The co-occurrence of *Vitis vinifera* subsp. *sylvestris* confirms local high humidity.

The acidophilous forest and maquis communities are framed into ERICO-QUERCION ILICIS. As for the submontane mixed oakwoods, *Quercetum gussonei* only occurs in the wood of Cappelliere and on Ne-

Cachryetum ferulaceae develops on the overgrazed slopes of the dolines.

brodi Mts. (Caronia and San Fratello) at (700)750-950(1.000) m a.s.l. and enjoys exceptionally high amounts of rainfall (probably 800-1110 mm), *Quercetum leptobalani* has been observed in some N-facing submontane areas of Madonie Mts. (Collesano and Piano Zucchi) at (700)750-900(1.400) and Ficuzza, where annual rainfall amount is approximately 800 mm, while *Teucrio siculi-Quercetum ilicis* is a mixed (mostly evergreen) oakwood linked to cool-humid montane microhabitats, shady slopes and valley bottoms, which occurs at (450)850-1200(1300) m a.s.l. During last centuries some of these forest communities have been substituted by hazelnut or chestnut groves (e.g. near Polizzi Generosa).

The degradation of the four above-mentioned mixed forest communities leads to thorny shrublands (*Crataegetum laciniatae*) and - under intense overgrazing - to PLANTAGINION CUPANII.

To *Genisto aristatae-Quercetum suberis* are ascribed the cork-oak woods occurring on gently sloping areas between 500 and 800 m a.s.l. (Collesano, Pollina, Castelbuono, Mongiarrati, Bosco Guarneri near Cefalù, Finale di Pollina, Geraci Siculo).

Dense species-poor spots of acidophilous tall shrubland ascribed to *Erico arboreae-Arbutetum unedonis* (ERICION ARBOREAE) occur in the coastal sector of the massif at Finale di Pollina and Sant'Ambrogio near Cefalù.

The deepest part of the active dolines hosts hygrophytic perennial meadows of Holoschoenetalia (here: Eleocharito nebrodensi-Juncetum compressi and the annual vegetation of temporary ponds (here: Myosurus minimus, Spergularia madoniaca, Ranunculus ficaria subsp. bulbilifer, Ranunculus lateriflorus, Thlaspi rivale and Barbarea sicula).

The self-renovating stone pinewoods dwelling the sandy soils deriving from flysch rock outcrops on the coastal hills (200-400 m a.s.l.) near Cefalù have been ascribed to *Cisto cretici-Pinetum pineae* (PINION PINEAE), but their native status remains rather questionable and needs to be confirmed (or rejected) after a more accurate research based on historical documents.

The degradation of all the thermophilous forest and maquis communities framed into ERICO-QUERCION ILICIS leads to broom-dominated shrublands (SAROTHAMNION SCOPARII), garrigues (CISTO-LAVANDULETEA), perennial and annual dry grasslands (AVENULO-AMPELODESMION and HELIANTHEMION GUTTATI) and bracken (*Pteridium aquilinum*) pure stands.

Thermophilous scrub (OLEO-CERATONION SILIQUAE) is locally represent by *Euphorbietum dendroidis*, which occurs on the steep calcareous slopes of the Rocca di Cefalù, while *Myrto communi-Pistacietum lentisci* occurring in locality Settefrati near Lascari probably issues from the degeneration of the cork oak woods which formed an almost continuous forest cover on the acidic substrates of the coastal area on both Madonie and Nebrodi Mts.

The shrublands which are topographically close and dynamically connected to local woodlands are ascribed to CRATAEGO-PRUNETEA. From 1000 up to 1200-1400 m a.s.l., *Crataegetum laciniatae* (ILICI-CRATAEGION LACINIATAE) occurs on the border or in the clearings of the acidophilous woodlands of ERICO-QUERCION ILICIS. M Piano Battaglia, Pomieri, Portella Colla, Monte di Mele, Vallone Madonie, Pizzo Antenna, etc.).

Three different basiphilous assemblages occur on the highest part of Madonie Mts.: *Clematido vitalbae-Prunetum cupanianae* occurs at 1250-1500 m a.s.l. on N-facing sites up to 1800 m a.s.l. on S-facing slopes (e.g. Macchia dell'Inferno, Piano Zucchi, Fosse di San Gandolfo, SW slopes of Mt. Spina Puci); *Lonicero xylostei-Prunetum cupanianae* colonizes the thiny colluvial soils of some consolidated debris cones on the NW slopes of Carbonara massif, Mt. Mufara, Monte dei Cervi and Quacella ridge (ca. 1350 m a.s.l.), while *Junipero hemisphaericae-Prunetum cupanianae* characterises the consolidated dolomitic scree on the NE-facing side of Quacella between 1350 and 1450 m a.s.l.

At lower altitudes (e.g. Gibilmanna) the most widespread mantle communities belong to PRUNO SPINOSAE-RUBION ULMIFOLII, mostly represented by *Cytiso infesti-Pyretum spinosae* (from sea level up to 700-800 a.s.l.) and by *Spartio juncei-Bupleuretum fruticosi* and acidophilous shrublands colonizing the coastal hills of Madonie, Nebrodi and Peloritani Mts., mostly occurring on N-facing steep slopes and valleys under cool and shady microclimatic conditions within both thermo- and meso-meso-mediterranean belts (200-850 m a.s.l.).

Another frequent tall broom-dominated shrubland, *Cytiso infesti-Spartietum juncei*, should be better framed into CYTISETEA SCOPARIO-STRIATI and SAROTHAMNION SCOPARII **N**

The only basiphilous garrigue community (ONONIDO-ROSMARINETEA and POLYGALO PRESLII-ERICION MULTIFLORAE) described for the area is *Genistetum demarcoi*, only occurring on the shallow soils issuing from calcareous rock outcrops on the SE-facing slopes of Pizzo Dipilo near Isnello, between 400 and 900 m a.s.l., while the acidophilous garrigues (CISTO-LAVANDULETEA STOECHADIS and CYTISO VILLOSI-GENISTION TYRRHENAE) are much more widespread and are locally represented by three associations: *Carlino nebrodensis-Genistetum cupanii* mostly issues from the degradation of the cork and downy oak woods of the meso-mediterranean belt of the Tyrrhenian side of Madonie (Brullo 1984), but also occurs as disclimax under supra-mediterranean bioclimate from 800 up to 1600 m a.s.l.; *Cisto salviifolii-Genistetum madoniensis* is found on the foot-hills of northern Madonie between (200)250 and 650 (800) m a.s.l. (Gratteri, Lascari, Pollina, Cefalù and San Mauro Castelverde), and *Genisto aristatae-Cistetum salvifolii* between 500 and 800 m a.s.l. on the Tyrrhenian slopes of Madonie (Collesano, Lascari, Isnello and Geraci Siculo) and Nebrodi Mts.

As for perennial xerophilous grasslands (LYGEO SPARTI-STIPETEA TENACISSIMAE), *Hyparrhenietum hirto-pubescentis* (HYPARRHENION HIRTAE) is very common on base-rich lithosols under thermo-mediterranean bioclimate, while under meso- and supra-mediterrean bioclimate the destruction of woody assemblages ascribed to QUERCETALIA ILICIS probably favoured the spread of meso-xerophilous communities framed into AVENULO-AMPELODESMION MAURITANICI. On the Madonie massif this alliance is represented by three species-rich communities. *Helictotricho convoluti-Ampelodesmetum mauritanici*, common between 100-800(1100) m a.s.l. on the calcareous steep slopes in areas subject to 600-1000 mm of annual rainfall and average yearly temperatures of 11-18 °C (Polizzi Generosa,

Patches of Fagus sylvatica colonize the upper part of this doline (named Fossa di San Gandolfo). These patches were preserved for charcoal production and to shelter the livestock during the hottest hours of the day. In the foreground, summergeen pasturelands of Cynosuro cristati-Plantaginetum cupanii in the flattened part of the doline and Siculosciadetum nebrodensis in the stony hollows

The summit peaks of Pizzo Carbonara, colonized by the Asperulo gussonei-Potentilletum nebrodensis (Saxifragion australis) on vertical cliffs and by the Seslerio siculae-Melicetum cupanii (Cerastio-Astragalion nebrodensis) on steep stony slopes.

Piano Zucchi, Quacella, Gratteri, Isnello). *Seselio tortuosi-Ampelodesmetum mauritanici* occurs in central Sicily, namely on Erei Mts. and southern Madonie Mts. (e.g. Alimena) between 350-800(1.000) m a.s.l. on soils issuing from calcarenites, chalks and marls in areas subject to 700-900 mm of annual rainfall and average yearly temperatures of 14-17 °C. *Avenulo cincinnatae-Stipetum siculae* occurs in windy, sunny and rocky habitats, dweling the shallow soils of the ridges and flattened plateaux under meso-mediterranean humid bioclimate between 700 and 900 m a.s.l. at Gangi.

Overgrazed areas are characterised by the prevalence of *Carlino siculae-Feruletum communis* CHARYBDIDO PANCRATII-ASPHODELION RAMOSI on base-rich soils, while the perennial rangelands occurring on siliceous soils are framed into POËTEA BULBOSAE and PLANTAGINION CUPANII, locally represented by *Cynosuro cristati-Plantaginetum cupanii* which covers very wide surfaces of the flat siliceous areas at Piano Battaglia and Piano Battaglietta, Mt. Ferro, Mt. San Salvatore and Mt. Cervi. It is linked to leached acid-subacid (pH 6-6,5) non-permeable soils between (700)1100-1650(1.750) m a.s.l. It plays a key role as high quality pastureland, but overgrazing and excessive trampling may trigger its destruction and an almost irreversible soil degradation.

At higher elevations (1.500-1.750 m a.s.l.), within the potential belt of GERANIO-FAGION, it is often substituted by *Armerio nebrodensi-Plantaginetum cupanii*, a species-rich herbland occurring on seasonally submerged almost flat areas (Vaddi du Vuosco near Castelbuono, Zubbio near Pizzo Catarineci, Piano Cervi, Contrada Pomieri, etc.).

No detailed information is available on the annual dry grasslands occurring under thermo- and meso-mediterranean bioclimate (HELIANTHEMETEA GUTTATI). The gaps and the degradation steps of local forest and pre-forest acidophilous assemblages are colonized by assemblages typical to nutrient-poor sandy soils (HELIANTHEMETEA GUTTATI and HELIANTHEMION GUTTATI). The annual the dry grasslands occurring on alkaline loamy substrates should be ascribed to STIPION RETORTAE, while those dwelling shallow skeletal base-rich soils belong to TRACHYNION DISTACHYAE and are locally represented by *Thero-Sedetum caerulei*.

Some halo-nitrophilous assemblages framed into PEGANO HARMALAE-SALSOLETEA VERMICULATAE occur on the southern sector of Madonie Mts. *Salsoletum agrigentinae* (SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE) occurs on the badland system of Contrada Lavanche near Castellana Sicula, where this chenopod scrub is intermingled with halo-xerophilous perennial grassland referred to *Asteretum sorrentinii* (MORICANDIO-LYGEION SPARTI), and subhalo-nitrophilous annual dry assemblages referred to *Podospermo cani-Parapholidetum pycnanthae* (SAGINETEA MARITIMAE and GAUDINIO FRAGILIS-PODOSPERMION CANI).

To ARTEMISION ARBORESCENTIS belong two associations recorded near Caltavuturo, i.e. *Coronillo valentinae-Artemisietum arborescentis*, occurring on intensely eroded marly slopes, subject to herbivore disturbance under thermo-mediterranean subhumid bioclimate, between 400 and 500 m a.s.l., and *Lycio europaei-Artemisietum arborescentis*, halo-nitrophilous shrubland occurring on the S-facing clayey slopes in rather disturbed sites (suburban areas, rural settlements, sheepholds, roadsides, tracks, etc.) subject to meso-mediterranean dry to subhumid bioclimate between 500 and 700 m a.s.l.

Vegetation of coastal ecosystems

The central and eastern sectors on the coasts of northern Sicily are characterized by very few and narrow sandy or gravelly shores,

Fiumara di Pollina: Tamarici africanae-Viticetum agni-casti, growing in the terminal part of the fiumara, on slightly saline sediments.

and most of the coastline is made of steep acid rocky cliffs subject to intense salt-spray. Moreover, the wilderness of the coastal sites of Madonie Mts. has been strongly compromised by urban sprawl, industrial sites (like that of the Gulf of Termini Imerese) and every sort of manufacts (railways, roads, motorways, etc.).

Hence, it is not surprising if only few and often very disturbed spots of pioneer halo-nitrophilous short-lived vegetation occur on the strandlines of local sandy and shingle beaches (CAKILETEA MARITIMAE and EUPHORBION PEPLIDIS), mostly represented by *Salsolokali-Cakiletummaritimae*,by*Cakilomaritimae-Xanthietumitalici* in more humid areas near the disturbed mouths of local rivers and streams (e.g. Imera settentrionale river; Roccella and Pollina streams, etc.) or *Salsolo kali-Euphorbietum peplis*.

Even less frequent and very impoverished and discontinuous are the tall-grass perennial swards typical to mobile coastal dunes (AMMOPHILETEA and AMMOPHILION AUSTRALIS), occurring in the area, i.e. *Cyperomucronati-Agropyretumjuncei*atSettefratinearLascari,*Sporoboletumarenarii*and*Medicaginimarinae-Ammophiletumaustralis*nearCefalù, and the dwarf scrub and grasslands linked to stabilized coastal grey hind dunes (HELICHRYSO ITALICI-CRUCIANELLETEA MARITIMAE and

Fiumara di Pollina: Spartio juncei-Nerietum oleandri growing in the intermediate part of the fiumara.

CRUCIANELLION MARITIMAE), represented by few small nuclei of *Centaureo sphaerocephalae-Ononidetum ramosissimae* (Gorgo Lungo near Campofelice di Roccella, Settefrati near Lascari, Cefalù).

Impoverished chamaephytic communities ascribed to CRITHMO-STATICETEA and CRITHMO-STATICION) where only *Limbarda crithmoides*, *Crithmum maritimum*, *Lotus cytsoides* and *Limonium virgatum* occur, may be observed on the salt-sprayed coastal cliffs near Settefrati near Lascari, Cefalù, Finale di Pollina, etc.

Vegetation of cliffs, walls and screes

The moss- and fern-dominated assemblages typical to shaded and water-splashed habitats (ADIANTETEA and ADIANTION) are rather common on base-rich substrates under thermo-mediterranean climate: *Eucladio verticillati-Adiantetum capilli-veneris* mostly occurs on steep cliffs and walls (e.g. near Cefalù and Castelbuono), while *Eucladio verticillati-Didymodontetum tophacei* prefers the man-made habitats (walls, water tanks, drinking troughs, etc.) of coastal sites (e.g. Kalura, Finale di Pollina, etc.).

Fern- and moss-rich epilithic and epiphytic communities of shaded sites (POLYPODIETEA and POLYPODION SERRATI) are rather common in the thermo- and meso-mediterranean bioclimatic belts.

The gravelly riverbeds of most of the Sicilian fiumaras are currently invaded by Eucalyptus camaldulensis, which spreads particularly well into the Spartio juncei-Nerietum oleandri

The oro-litophilous vegetation colonizing the rock faces and crevices of local limestones or dolomites cliffs between (1300)1500 and 1850 m a.s.l., subject to 2-3 months of snow bed cover and strong summer drought stress, is ascribed to *Asperulo gussonei-Potentilletum nebrodensis* (SW side of Mt. Quacella and Pizzo Carbonara), which in turn is framed into SAXIFRAGION AUSTRALIS (ASPLENIETEA TRICHOMANIS), an alliance endemic to the carbonatic massifs of Apennines, Calabria and Sicily. At lower elevations, between (500)800 and 1500(1600) m a.s.l., *Anthemido cupanianae-Centauretum busambarensis* characterises the mid-altitude calcareous cliffs of Isnello, Valle Trigna, Mt. Balatelli, NW slopes of Mt. Carbonara, Mt. Milocco, Pizzo Antenna Piccola, Mt. Cucullo, Cozzo Castellazzo, etc.

Subject to thermo-mesomediterranean climate, the rock faces and crevices of the Mesozoic limestones of Rocca di Cefalù host a chasmophilous assemblage which may be interpreted as an impoverished pattern of *Scabioso creticae-Centauretum ucriae* (DIANTHION RUPICOLAE).

The fern- and moss-rich vegetation of the rock crevices and shady and moist ledges of the siliceous cliffs of the supra- and oro-Mediterranean belt (POHLIO CRUDAE-ASPLENION SEPTENTRIONALIS) still waits to be investigated.

Several thermophilous chasmo-nitrophilous communities belonging to the class CYMBALARIO-PARIETARIETEA DIFFUSAE, such a *Centrantho rubri-Parietarietum judaicae*, *Sedo dasyphylli-Ceterachetum officinarum* and *Asplenio trichomanis-Umbilicetum horizontalis* (CYMBALARIO-ASPLENION) and *Oxalido corniculatae-Parietarietum judaicae* (PARIETARION JUDAICAE) occur on the disturbed cliffs, the stone walls and the old monuments of this area.

Two pioneer assemblages colonize local calcareous screes (DRYPIDETEA SPINOSAE and LINARION PURPUREAE) at different altitudes: *Arenario grandiflorae-Rumicetum scutati* occurs above 1400 m a.s.l., in areas potentially covered by beech forests, while *Rumici scutati-Cardaminetum graecae* dominates the debris cones at lower altitudes (1000-1400 m a.s.l.) in areas where *Aceri campestris-Quercetum ilicis* occurs.

The local pioneer vegetation colonizing the incoherent pebbly and sandy warps of the alluvial terraces and the stream- and riverbeds (EUPHORBION RIGIDAE) may be ascribed to *Ononido ramosissimae-Helichrysetum italici*, typical to heterogeneous alluvial deposits between 200 and 450 m a.s.l., and endemic to central-northern Sicily (e.g. Imera settentrionale river), where the annual main rainfall amount is 500-700 mm and the average annual temperatures are 14-16 °C.

Hydro-hygrophilous vegetation

Among the perennial meso-hygrophilous meadows and pastures on seasonally flooded and fertile soils (MOLINIO-ARRHENATHERETEA), those occurring on rather shallow soils are ascribed to CIRSIO VALLIS-DEMONIS-NARDION, and, more precisely, to *Cynosuro cristati-Leontodontetum siculi*, common on bare sunny slopes with soils issuing from Flysch rock outcrops between 1000 and 1500 m a.s.l. (e.g. Portella Mandarini, Pizzo Catarineci, etc.) in the belt dominated by acidophilous mixed oakwoods.

Eleocharito nebrodensi-Juncetum compressi (MENTHO LONGIFOLIAE-JUNCION INFLEXI) forms linear and narrow tall-herb fringes along thalwegs and near some montane springs (e.g. Piano Battaglia).

Mesophilous riparian gallery forests (ALNO GLUTINOSAE-POPULETEA ALBAE) are very rare and fragmented. No field surveys confirm the presence of assemblages beloging to POPULION ALBAE, claimed by several authors for both Madonie and Nebrodi Mts. Located in montane sites (1250-1300 m a.s.l.) and on siliceous substrates, *Osmundo regalis-Sal-*

icetum pedicellatae (OSMUNDO-ALNION) forms dense riparian forests rich in meso-hygrophilous species within area potentially covered by *Ilici aquifolii-Quercetum austrotyrrhenicae* or *Anemono apenninae-Fagetum sylvaticae* (between Pomieri and Geraci Siculo, Piano Pomo).

The hygrophilous pioneer scrubs and low open forests colonizing the beds and the banks of local streams (SALICETEA PURPUREAE) are locally represented by two assemblages framed into SALICION PEDICELLATAE, i.e. *Ulmo canescentis-Salicetum pedicillatae*, mostly occurring in the deep valleys and gullies at 400-700 m a.s.l., like Vallone San Nicola near Polizzi, and *Agropyro panormitani-Salicetum pedicellatae*, occurring between 1050 and 1150 m a.s.l. at Vallone Canna.

The lower trait of most part of local streams and braided streams, the so-called 'fiumare' (e.g. Pollina and Castelbuono streams, Imera settentrionale river) is often characterised by thermo-hygrophilous pioneer thicket communities (NERIO-TAMARICETEA). The most common features of such disturbance- and stress-tolerant vegetation are mono-specific stands of *Tamarix africana* (TAMARICION AFRICANAE), and *Spartio juncei-Nerietum oleandri* (RUBO ULMIFOLII-NERION OLEANDRI), colonizing the alluvial sandy-gravelly fluvial terraces which are slightly raised with respect to the streambeds occupied by EUPHORBION RIGIDAE assemblages.

The hygrophilous and aquatic communities linked to permanent and temporary ponds underwent a very strong and fast shrink during last decades due to road construction or to irrational water uptake affecting many montane springs, causing not only the extinction of many plant species, but even of entire habitats. The past frequency of these wetlands is also testified by the different (and specific) vernacular names assigned by local people to differentiate them: 'trièmule' (= trembling sites, i.e. *Sphagnum*-dominated peat bogs) and 'margi filiciari' (= 'fern-rich temporary ponds') only occurred on siliceous substrates with low pH values, while the 'margi quacinari' (= 'lime temporary ponds', rich in calcium-tolerant *Juncus* and *Carex* species) were located on calcareous rock outcrops. At present all these peculiar habitats, rare or absent in the rest of Sicily, have almost completely disappeared or are strongly compromised, so that only 'urghi' (= permanent ponds) survive, albeit often disturbed by overgrazing and trampling due to domestic and wild herbivores, altered or reduced in terms of surface due to human activities.

Salix purpurea subsp. lambertiana is colonizing the upper part of the Fiumara di Pollina, where the riverbed is widening but the energy of the flowing water is still relatively high.

As for the assemblages dominated by rooted floating or submerged macrophytes (POTAMOGETONETEA) only *Myriophylletum alterniflori* (POTAMOGETONION GRAMINEI) occurs on the shallow muddy bottom of Gorgo di Pietra Giordano.

Some temporary ponds occurring on the high mountains at (1200)1400-1650 m a.s.l. (Piano Battaglia, Pizzo Catarineci, Piano Dalla near Geraci Siculo, Portella Colla, Urgo di Pollicino) host *Ranunculo lateriflori-Antinorietum insularis* (ISOETO-NANOJUNCETEA and PRESLION CERVINAE), a hygrophilous and subnitrophilous ephemeral microphytic pioneer assemblage linked to very shallow (max 35 cm-deep) impermeable depressions located on karstic plains. The hydroperiod of these ponds is strongly affected by snow bed cover timing and endurance. The life-cycle of the species of this community starts with snow melting and ends by the first decade of June, when a species turnover occurs and the depressions are colonized by several nitrophilous species. As a consequence of natural filling processes, these depressions are gradually colonized by *Eleocharito nebrodensi-Juncetum compressi*, then covered with *Cynosuro cristati-Plantaginetum cupanii* grasslands.

Several local communities linked to still, fresh and brackish waterbodies dominated by big rhizomatous helophytes are framed into PHRAGMITO-MAGNOCARICETEA and PHRAGMITION COMMUNIS, like *Phragmitetum communis* along stream- and riversides or on the border on natural ponds and artificial basins; *Typhetum angustifoliae* growing on the muddy bottoms of the shallow mesotrophic ponds of Castellana Sicula.

The vegetation of the Sicilian hygrophilous herblands linked to shallow montane pools subject to seasonal watertable fluctuations are framed into ALOPECURO-GLYCERION SPICATAE, locally represented by *Glycerio spicatae-Callitrichetum obtusangulae*, linked to extremely shallow (10 to 20 cm-deep) and frequently eutrophic pools located at 780-1770 m a.s.l. (still occurring near the sink hole of Piano Battaglia, destroyed elsewhere), whose bottom remains humid even after drying up.

Anthropogenic vegetation

Local arable crops (mostly cereal fields) are characterised by two annual weed assemblages occurring in different seasons. The wintergreen one, *Legousio hybridae-Biforetum testiculatae*, is framed into ROEMERION HYBRIDAE (PAPAVERETEA RHOEADIS) and has been observed on the clayey soils of both the Tyrrhenian sector (e.g. Collesano and Campofelice di Roccella) and the southern part of the massif (e.g. Castellana Sicula), while the summergreen, C4 species-rich vegetation occurring after crop harvest belongs to *Chrozophoro tinctoriae-Kickxietum integrifoliae* (DIGITARIO SANGUINALIS-ERAGROSTIETEA MINORIS and DIPLOTAXION ERUCOIDIS).

Concerning the wintergreen annual weedy and ruderal vegetation belonging to CHENOPODIETEA, the hypernitrophilous and xerophilous vegetation of local sheepfolds is referred to HORDEION MURINI, whilst many fallows occurring between 200 and 800 m a.s.l. on the marly and clayey soils of the southern sector of the massif are characterized by *Centauretum schouwii* (ECHIO-GALACTITION TOMENTOSAE), dynamically linked with PLANTAGINION CUPANII overgrazed and trampled communities and with PRUNO SPINOSAE-RUBION ULMIFOLII thorny woody mantle communities.

A single sub-nitrophilous and sciaphilous community (VALANTIO MURALIS-GALION MURALIS) is reported for the area, i.e. *Valerianello carinatae-Cerastietum luridi* occurring between (700)750-950(1000) m a.s.l. on the siliceous shaded stony areas covered by mantle communities (CRATAEGO-PRUNETEA) deriving from the degradation of the mesophilous mixed oakwoods of ERICO-QUERCION ILICIS.

The nitrosciaphilous vegetation growing under the tree canopy of *Citrus* orchards (Campofelice di Roccella, Scillato, etc.) probably belongs to VERONICO-URTICION URENTIS.

No data are available on the therophytic nitrophilous dwarf vegetation typical to local trampled (mostly urban and suburban) areas (POLYGONO-POËTEA ANNUAE and POLYCARPION TETRAPHYLLI).

As for geophytic and hemicryptophytic ruderal nitrophilous vegetation (ARTEMISIETEA VULGARIS), the intensive breeding activities mostly carried out in this territory give rise to several (sub)xerophilous assemblages framed into ONOPORDION ILLYRICI, like the thistle-dominated *Onopordo illyrici-Cirsietum scabri*, rather common in the sheepfolds and manure heaps located at 700-900(1000) m a.s.l. on clayey soils in areas subject to an average annual rainfall 700-1100 mm (e.g. Caltavuturo) and *Bonannietum graecae*, common in disturbed places such as roadsides, tracks and paths between (800)950 and 1250 a.s.l. on base-rich soils deriving from mostly carbonatic (rarely metamorphic) rock outcrops.

View of Cefalù, with the headland (“Rocca”) overlooking the town.

Under thermo- and meso-mediterranean bioclimate disturbed fallows, roadsides and ladfills are often characterized by perennial herb-dominated ruderal communities framed into BROMO-ORYZOPSION MILIACEAE, such as *Dittrichio graveolentis-Ferulaginetum campestris*, a species-poor community occurring on the marly-clayey and sunny slopes between 1000 and 1150 m a.s.l., or to *Euphorbio ceratocarpae-Arundinetum plinii*, a subhygrophilous assemblage referred to ARUNDION PLINII, both recorded in the the territory of Polizzi Generosa.

Under thermo-mediterranean bioclimate the most common assemblage of EPILOBIETEA ANGUSTIFOLII dwelling the nutrient-rich and disturbed riverbanks and water bodies of the territory is a thermophilous reed bed referred to *Calystegio sylvaticae-Arundinetum donacis* (CYNANCHO-CONVOLVULION SEPIUM).

Under cooler bioclimates, several tall-herb plant communities form forest fringes on nutrient-rich and often deep soils, such as *Anthrisco nemorosae-Chaerophylletum temuli* (ANTHRISCION NEMOROSAE) occurring in shady disturbed sites (e.g. rural farms) on deep acid soils between 1450-1600 m a.s.l. (Contrada Pomieri, Contrada Canna, Mt. San Salvatore), or *Anthrisco nemorosae-Heracleetum cordati* along the paths within the beechwoods at 1350-1500 m a.s.l. with surfacing groundwater.

The montane areas host some mesic nitrophilous communities ascribed to ARCTION LAPPAE, like *Urtico dioicae-Arrhenatheretum elatioris*, occurring on the loamy-clayey soils deriving from flysch and filling some small karstic depressions of the massif (Piano Battaglia, Piano Battaglietta, Carbonara massif, Màrcatu di Marrabilici near Polizzi, Mt. Cervi and Mt. Daino) at (1200)1400-1600(1850) m a.s.l., where it represents the last step of the degradation of local pasturelands (*Plantaginion cupanii* and *Cerastio-Astragalion nebrodensis*); *Cerintho auriculatae-Chenopodietum boni-henrici*, occurring in some dolines of Pizzo Carbonara at (1700)1810-1880 m a.s.l. which are subject to strong nitrogen input and intense slope erosion due to overgrazing and trampling by cows; *Verbasco rotundifolii-Sambucetum ebuli* a markedly xerophilous and heliophilous assemblages dwelling soils which are poor in humus but rich in coarse calcareous skeleton, mostly occurring along the paths at 1400-1500 m a.s.l. (Piano Battaglia, Portella Arena, Mt. Daino).

Several man-made water basins such and the artificial lake near Blufi host some summer-annual pioneer communities typical to seasonally flooded nutrient-rich riverbeds, lacustrine banks and heavily nutrient-loaded anthropogenic habitats (BIDENTETEA TRIPARTITAE and CHENOPODION RUBRI).

8.3. Landscape and land use history

Human presence in the area since upper Palaeolithic-Mesolithic (i.e. approximately 12-10000 years ago) is documented by the archaeological findings made in several caves, i.e. near Cefalù, Geraci Siculo and Castelbuono. Neolithic sites (IV-III millennium BC) have been discovered in the territories of Petralia and Castelbuono, while stone tools and ceramics dating back to ancient Copper Age ('Castelluccio Culture', ca. XXII century BC) have been found near Gangi. Additionally, Iron Age settlements (IX century BC) occurred near Gratteri, Aliminusa and on the top of the Rocca of Cefalù. There is a perfect match between archaeological findings and the results of recent palaeobotanical investigations, which point out that the forest ecosystems of the whole area were repeatedly opened for agricultural purposes. Fire activity was closely associated with farming, and burning activities intensified during the Early Neolithic (around 5000 BC), at early Bronze Age (c. 2500 BC) and early Iron Age (800 BC), when due to the overexploitation of local fertile clayey soils, most part of the southern side of the massif probably started to look like now, i.e. almost completely devoid of woody vegetation and characterised by pasturelands, fallows and cereal crop fields.

Between VII and V centuries BC, all the autochthonous towns and villages of this area were influenced and contented by Phoenicians and Greeks, who wanted to take the full control of the northern Sicilian coast. In this framework the Greek colony of Himera played a major role. Founded from Zancle (now Messina) on 648 BC, thanks to its position it became soon very powerful because it controlled the main connection route between the northern and the southern Sicilian coast, roughly corresponding to the valleys of the two rivers Imera settentrionale and Imera meridionale. On 480 BC the plain of Himera was the theatre of a bloody battle won by the allied armies of Akragas and Syracusai: after this defeat, Carthage will never try to expand eastwards and will need almost 80 years to recover the control of W Sicily by destroying both Selinous and Himera (409 BC). Soon after the battle of Himera, between V and IV Greeks occupied not only the coastal areas, founding or re-founding 'Kephaloidion' (= 'head shaped', now Cefalù), but also the hills and the mountains, building cities and/or emporia like 'Kraterios' (probably corresponding to Gratteri), 'Engyon' (probably corresponding to Gangivecchio or to Alburchia, localities close to Gangi), 'Hyerax' (now Geraci Siculo), 'Petra' (now Petralia), 'Polis' (now Polizzi Generosa), etc.

Under Romans most of the Greek settlements, namely Engium, Hyerax, Petra and Polis, still played an important role as trade centres for the agro-pastoral products coming from the inner southern side of Madonie, whose lands were probably already deforested and mostly devoted to cereal crop culture. All the area was probably densely inhabited, as suggested by the finding of a wide necropolis dating back to III-II century BC on Mt. Riparato near Scillato, and many rural farms and villages were interspersed in the territory, namely near Castelbuono and Cephaloedium.

Ruling Byzantines Sicily experienced strong insecurity: most of the old main centres became fortresses, and many people decided to move towards more protected sites. For example, the people of Cephaloedium re-built the village on top of the mountain and many rural villages were founded in the hilly and montane area, such as Caltavuturo, Ypsygro (= high humid place, now Castelbuono), and probably also San Mauro Castelverde, Scillato and Sclafani Bagni. These new settlements were often connected with monasteries and shrines (e.g. Gibilmanna) and close to wide forested areas, and almost certainly this period coincided with a strong intensification of anthropogenic pressure on local forest ecosystems (grazing and browsing, wood gathering, etc.).

Arabs (IX-XI centuries AD) probably founded or re-founded many villages (Alimena, Aliminusa, Collesano, Gratteri, Isnello) in the countryside. In the meanwhile, lowlands appeared almost desert, probably as a consequence of increasingly humid climatic conditions, and in order to avoid malaria.

Under Normans (XI-XII centuries AD) the whole territory experienced one of its wealthiest periods. Cefalù was re-founded on the plain and became an important centre. Part of the territory remained a state property and Basilian monks were entrusted of the management of forest goods, other lands were donated to local aristocracy and became small fiefs, while wide surfaces became property of the most important bishops of Valdemone, i.e. Troina, Messina and Cefalù.

During XIII century AD Swabians donate to the family Ventimiglia the lands of Castrum Bonum (now Castelbuono), Pollina, Geraci and San Mauro. The counts of Geraci gradually became the lords of a state within a state, provided with own laws, allowed to produce own coins and owners of almost all of the forested areas of the Madonie and Nebrodi Mts. until XVI century. In fact, during XIV century AD the kings of Aragon gave them the lands of Caronia, Naso, Pettineo and Tusa on Nebrodi Mts. and they acquired the lands of Collesano and Petralia, and during the following century the also obtain the lands of Gratteri and Isnello. The capital of the county was Geraci during XIII-XIV centuries, then Castelbuono since 1419. This town will play a leading role between XIV and XVIII centuries. The success of Castelbuono was also favoured by the gradual decline of almost all the ancient centres of Madonie. Engyon-Engium was destroyed in 1299 during the war of Sicilian Vespers and the new Gangi will never recover its role. Together with Geraci, Polizzi and Petralia its economy will be increasingly focused on the trade of agro-pastoral products coming from the exploitation of the wide latifundia characterising the southern side of the massif. Other fiefs, like that of Cefalù, never had the same power because they passed through too many hands. Also the county of Sclafani had considerable dimensions between XIV and XVII century, including the current territories of Aliminusa, Scillato, Sclafani Bagni and Valledolmo. According to documents of the XVI century mentioning the 'forest of Aliminusa', at least part of this county was still covered with forest patches at that time.

With the exception of Cefalù, the coast continue to be poorly inhabited at last until the end of XVI century, even if some humid areas are intensely exploited for sugar cane production, such as the area of Garbinogara, near the mouth of the Imera settentrionale river.

Some other centres enjoyed the managerial qualities of local communities, like Pollina, Castelbuono, San Mauro and Scillato, wealthy between XVII and XIX centuries thanks to oil and manna production and export.

Under increasing pressure of other noble families, during XVIII century the Ventimiglia started to loose their power and were obliged to sale part of their lands (e.g. Collesano and Petralia).

Most of the remnant nuclei of forest vegetation - evergreen or summer-green oak woods on the foothills and beech woods on the top - are concentrated on the N-facing slopes of the massif, not only because this area was more properly managed in historical times but more probably because of the more favourable bioclimatic conditions.

The majority of the local hilly-montane villages currently counts less than 3000 people, and only two of them more than 5000 (Castelbuono: 8800, and Gangi: 6700). Nowadays the century-long exploitation of forest ecosystems, along with the knowledge connected with coppicing, charcoal production, etc., is disappeared and the main income for local communities is provided by pastoral activities (pigs left to wild pasture in the woodlands, goats and sheep in open degraded cork- and downy oakwoods and grasslands) and tourism. In many cases current breeding practices appear unsustainable, with severe consequences on local ecosystems. In particular, the increasing number of pigs and introduced herbivores, such as boars and fallow deer, hampers the renovation of local forests due to overgrazing and trampling, so that many old forest stands show a park-like structure with no renovation at all, and not only local forest communities, but even the perennial and annual dry grassland assemblages are often compromised.

The Cefalù cathedral was erected in 1131 and is one of the treasures of the recently promoted UNESCO-Arab-Norman itinerary.

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Box 8.1 *The once endemic Pleurotus nebrodensis (Inzenga) Quél.*

Until few years ago *Pleurotus nebrodensis* was thought to be strictly endemic to northern Sicily. The historical Sicilian collection sites of 'Canna' and 'Dragonara', located in the Vallone Faguare, a canyon of the Madonie Mts., were retraced thanks to recently rediscovered documents and through interviews with local people. The species is linked to *Cachrys ferulacea* (L.) Calest. (*Prangos ferulacea* (L.) Lindl.), a perennial herb belonging to the family Apiaceae, which dominates the mountain pastures subject to overgrazing. The recent discovery of *P. nebrodensis* in two different Greek mountain ranges in northern Peloponnese and in Central Greece suggests the need of further field surveys throughout the whole distribution range of *Cachrys ferulacea* (i.e. from Italy to Azerbaijan) in order to verify the distribution of this endangered mushroom.

Pleurotus nebrodensis and its habitat are not protected by 92/43 EU 'Habitats' Directive. Hence, a stronger awareness of politicians, scientists and local stakeholders is urgently needed in order to implement appropriate conservation strategies.

As the cultivated mushrooms present the same organoleptic characteristics of the wild type, *ex situ* cultivation may provide additional income for local farmers, who could offer a cheaper product; this could significantly reduce the pressure on wild populations due to overharvesting.

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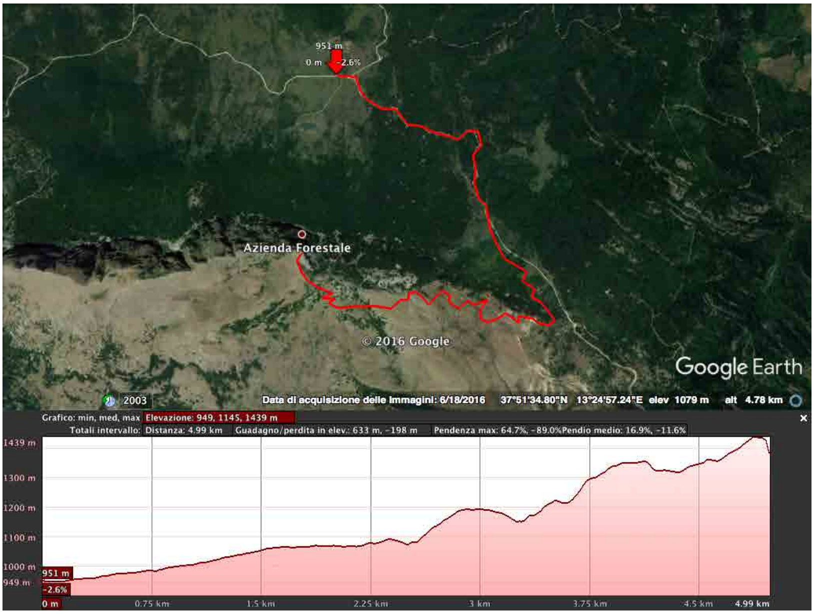
IX
The wood of Ficuzza and Rocca Busambra

Itinerary1 - From Alpe Cucco to Rocca Busambra



Rocca Busambra (1613 m a.s.l.) is the highest and most isolated peak of western Sicily and it is characterized by N-facing vertical cliffs, rising 350 m over a dense wood. The hike will start on the clayey and acidic soils at the foothill of the cliffs, where we will cross a patchwork of woods (Erico-Quercion ilicis), mountain rangelands (*Cynosuro-Leontodontetum siculi*) and fringe communities (*Crategetum laciniatae*), still maintained by traditional stockbreeding. As we will get closer to the impressive cliff, we will observe some spots of the endemite rich vegetation of the *Anthemido-Centauretum busambarensis*. The cliff originated from the combined action of intense tectonic and karst processes, but our climb on the top of the mountain will be along a more convenient trail, developing on its southern slope, amidst perennial dry grasslands, partially influenced by the human disturbance (frequent fires,

overgrazing, etc.). These grasslands are arranged along the altitudinal gradient: from the communities dominated by *Helictotrichon convolutum* (Hyparrhenietalia) at lower elevations up to the Cerastio-Astragalion nebrodensis communities in the summit areas.
Trail: Length: 10 km. Hiking time: 5 hours, Elevation range: 600 m

GENERAL DESCRIPTION

9.1. The physical setting

The rocky body of Rocca Busambra (1613 m a.s.l.) represents the highest and most isolated peak of western Sicily. It has been traditionally treated by geographers as the northernmost outpost of Sicani Mts., the mountain area connecting the provinces of Palermo and Agrigento. Many features make it unique: the unmistakable silhouette and the breathtaking extension (ca. 15 km) of its N-facing vertical cliffs, rising 350 m over a dense wood cover and almost perfectly orientated from West to East. The mountain has been shaped by the combined action of intense tectonic and

Westward view of Busambra. On the top, the hemicrypto-chamaephytic vegetation of Carduncello-Thymetum spinulosi karst processes. Its southern slopes appear mostly bare, while the clayey and acidic soils gently sloping along its northern foothills favoured the development of an almost continuous forest cover, whose different tonalities of green (or yellow, orange and red during autumn) make a sharp and fascinating contrast with the white or grey of the calcareous rocks. The contact between calcareous rocks and impermeable soils gave rise to plenty of springs and originated many creeks and temporary or even permanent ponds, too. The main faults of the N-facing cliffs of Rocca Busambra are covered with huge stone blocks, coarse pebbly and sandy debris, which form several active scree systems.

The ridge of Rocca Busambra issues from a long and complex history of deformation of several lithological units. To the Trapanese carbonate pelagic-platform unit belong the most ancient outcropping rocks, massive layers of the so-called ‘white dolomitic limestones’ (upper Trias-lower Lias, i.e. 200-185 Ma), which overlay reddish fossil-rich limestones famous for their Ammonites (Jurassic, 170-135 Ma), and white to pink marly limestones, the so-called ‘scaglia’ (Cretaceous-Eocene, 120-50 Ma).

Other outcropping rocks belong to the Cretaceous-Miocene Sicani Basin, like the marls and marly clays of Case Pirrello and locality Lavanche (lower Aquitanian-Chattian, 28-23 Ma), while both reddish to whitish limestones and marly limestones (upper Cretaceous to lower Oligocene, 100-34 Ma) and the grey blackish limestones (lower Cretaceous, 125 Ma) characterise the SE part of Rocca Busambra.

The so-called Sicilide units, issuing from the deformation of the Imerese Basin, are locally represented by several rock oucrops, i.e. varicoloured silicified clays, shales and marls (late Cretaceous, 100 Ma), white pelagic limestones (middle-late Eocene, 49-37 Ma) and the so-called ‘Numidian Flysch’, made of clays and shales with quartz sandstones and pebbly conglomerates intercalations (Oligocene to lower Miocene, 28-15 Ma).

The late orogenic foredeep sediments of ‘Terravecchia’ Formation are deltaic quartz conglomerates, sandstones and clays dating back to upper Tortonian-lower Messinian (8-7 Ma). Due to their fertility, the soils deriving from ‘Numidian Flysch’ and ‘Terravecchia’ formations were intensely cultivated.

Local bioclimate changes along with the remarkable altitudinal range of the whole areas. The interpolation of data coming from the nearest stations of Risalaimi, Lupo, Ficuzza, Mezzojuso, Campofelice di Fitalia and Tagliavia, provides the following simplified picture: the areas located under 600 m a.s.l. are subject to thermo-mediterranean lower subhumid bioclimate, with mean annual temperatures (T) = 16-18 °C and annual rainfall (P) = 600-800 mm, between 600 and 900 m a.s.l. mesomediterranean (T = 13-16 °C) lower (600-800 mm) and upper (800-1000 mm) subhumid, between 900 and 1300 m a.s.l. supramediterranean (T = 8-13 °C) upper subhumid (800-1000 mm) to lower humid (> 1000 mm).

The three associations 'rock outcrop + lithic xerorthents (= rock outcrop + lithosols)', 'lithic xerorthents + rock outcrop + lithic haploxerolls (= lithosols + rock outcrop + eutric and/or calcic cambisols)' and 'typical xerochrepts + calcixerollic xerochrepts + lithic xerorthents (= eutric cambisols + calcic cambisols + lithosols)' characterise the top and the highest bare slopes of Rocca Busambra, while almost all the area covered by forest lays on the association 'typical xerochrepts + typical haploxeralfs + typical and/or lithic xerorthents (= eutric cambisols + orthic luvisols + eutric regosols and/or lithosols).

Eastward view of Busambra, emerging from the woodlands of Bosco Ficuzza. From the left, Quercetum leptobalani on flyshoid-loamy soils, Aceri campestris-Quercetum ilicis on carbonatic debris and Sorbo graecae-Aceretum pesudoplatani on the topmost rocky ledges.

The sediments of the alluvial plains of local watersheds give rise to three different associations, i.e. 'typical and/or vertic xerofluvents + typical and/or vertic xerochrepts (= eutric fluvisols + eutric and/or vertic cambisols)', typical and/or vertic xerofluvents + typical chromoxererts and/or typical pelloxererts (= eutric fluvisols + chromic and/or pellic vertisols)' and 'typical chromoxererts and/or typical pelloxererts (= chromic and/or pellic vertisols)'.

The association 'typical xerorthents + typical and/or vertic xerofluvents and/or typical chromoxererts and/or pelloxererts (= eutric regosols + eutric fluvisols and/or chromic and/or pellic vertisols)' correspond to the highest part of San Leonardo river basin on the southern slopes of Rocca Busambra, while the soils association 'typical xerorthents + typical and/or vertic xerochrepts (= eutric regosols + eutric and/or vertic cambisols)' is rather frequent at lower altitudes all around Rocca Busambra. The association 'typical xerochrepts, vertic xerochrechrepts + typial chromoxererts and/or typical pelloxererts (= eutric cambisols, vertic cambisols + chormic and/or pellic vetisols)' occurs just out the nature reserve, west of Rocca Busambra, i.e. near Tagliavia, and near the dam of Scanzano reservoir.

Rocca Busambra and the adiacent woodlands also give origin to the left tributary of Belìce river, called Frattina or Belìce sinistro (57 Km), and to two rivers which flow into the Tyrrhenian sea, the Milicia (27 Km), and the Eleuterio (30 Km), once navigable and full of watermills, interrupted with a dam in 1950s to build up the Scanzano artificial water reservoir.

9.2. Flora and vegetation

Sicily Since more than three centuries, Ficuzza and Rocca Busambra has been among the favourite destinations for Italian and European botanist visiting. On the XVIII century P. Arduino, probably the first foreign botanist to visit the area, sent some plant specimens coming from Rocca Busambra to Linnaeus himself. During the following century the knowledge on local botanical heritage strongly improved, thanks to the systematic exploration of the area carried out by V. Tineo G. Gussone, G. Gasparrini, F. Parlatore in the first half of the century, and by A. Todaro, M. Lojacono-Pojero, and several plant collectors such as E. and A. Huet du Pavillon an H. Ross, working on behalf of the Swiss University of Geneva. Between the 1970s and the

1980s and once again in the last ten years many researches focused on hydro-hydrophilous plants and communities have been carried out. The most recent floristic census of local vascular plants points out that this area hosts more than 1000 taxa, i.e. nearly one third of the whole Sicilian vascular flora!

According to the biogeographical subdivision of Sicilian territory proposed by Brullo et al. (1995), this area represents the southernmost part of the Drepano-Panormitan district, grouping all the (mostly) calcareous massifs of NW Sicily, from Madonie Mts. to Egadi Islands, and hosts five narrow endemics (only occurring on Rocca Busambra), i.e. *Armeria gussonei*, *Dianthus borbonicus*, *Hieracium busambarense*, *Sorbus busambarensis*, *Viola tineorum*, many district endemics, such as *Alyssum siculum*, *Anthyllis busambarensis*, *Brassica rupestris* subsp. *hispida*, *Brassica villosa* subsp. *villosa*, *Centaurea busambarensis*, *Centaurea panormitana* subsp. *ucriae*, *Centaurea panormitana* subsp. *umbrosa*, *Delphinum emarginatum*, *Dianthus busambrae*, *Gagea chrysantha*, *Galium pallidum*, *Helichrysum panormitanum*, *Muscari lafarinae*, etc., Sicilian endemics such as *Anthemis cupaniana*, *Crepis sprengeli*, *Oncostema cupanii*, *Onosma canescens*, *Quercus gussonei*, *Quercus leptobalanos*, *Thymus paronychioides*, *Trifolium bivonae*, *Valantia deltoidea*, etc., and many plants that are rare at regional and national level, such as *Asplenium scolopendrium*, *Celtis tournefortii*, *Centaurea parlatoris*, *Cerastium lacaitae*, *Echinops ritro* subsp. *siculus*, *Gagea bohemica*, *Gagea longifolia*, *Gagea mauritanica*, *Geocaryum capillifolium*, *Geocaryum cynapioides*, *Heracleum pyrenaicum* subsp. *cordatum*, *Jonopsidium albiflorum*, *Minuartia verna* subsp. *verna*, *Nectaroscordum siculum*, *Ophrys pallida*, *Osmunda regalis*, *Trifolium brutium*, *Verbascum siculum*, etc.

Local permanent and temporary ponds host a remarkable number of aquatic and hygrophilous plants of extreme biogeographical and conservation interest due to their rarity on the regional and even the national level (*Callitriche brutia*, *Callitriche obtusangula*, *Ceratophyllum demersum*, *Epilobium tetragonum* subsp. *tournefortii*, *Potamogeton pusillus*, *Ranunculus aquatilis*, *Ranunculus omiophyllus*, *Ranunculus peltatus*, *Ranunculus trilobus*, *Trifolium michelianum*, *Trifolium micranthum*, etc.). Many of these habitats are severely threatened or have already disappeared along with noteworthy plants like *Barbarea vulgaris*, *Eryngium pusillum*, *Isoetes hystrix*, *Myosotis sicula*, *Ranunculus lateriflorus*, *Utricularia vulgaris*, etc., while many others currently occur only in one

North-eastward view from Busambra with the reddish canopies and rangelands of the Querceto leptobalani sigmetum and in the back, the Genisto aristatae-Quercetum suberis, growing on quartzitic sandstone ridges.

Husbandry is still performed along the southern flank of Busambra, which exibits all the seral stages of the Aceri campestris-Querceto ilicis sigmetum.

(*Antinoria insularis*, *Ceratophyllum demersum*, *Corrigiola littoralis*, *Isoetes duriei*, *Isolepis cernua*, *Montia fontana* subsp. *amporitana*, *Neoschischkinia pourretii*, *Peplis portula*, etc.) or two sites (*Alopecurus bulbosus*, *Alopecurus aequalis*, *Sparganium erectum*, etc.).

Due to its key role in the framework of regional plant conservation strategies, the whole area falls within a nature reserve managed by the Regional Forest Department, is part of the regional Natura 2000 network and has been included within the national list of Important Plant Areas with the code ‘SIC11 Bosco Ficuzza e Cappellerie e Rocca Busambra’.

Zonal vegetation

The N-facing side of the steep and fractured ridge of Rocca Busambra offers plenty of suitable niches to many rupicolous and scree species. Additionally, it provides a very wide area laying beneath its cliffs with long-lasting shadow, and it represents a formidable barrier for the cool and humid winds coming from north and north-west, capturing most of the air humidity coming from the Tyrrhenian, and

Coppiced holm oakwood (Aceri campestris-Quercetum ilicis), traditionally used for charcoal production.

causing rainstorms and fog accumulation even in sunny summer days. In also provides local vegetation with additional water supply by releasing it through the numerous springs issuing from its komplex karstic system. All these factors explain why the woodlands on the northern foothills of the massif have survived. Conversely, S-facing slopes appear mostly bare, eroded and devoid of vegetation, not only due to the occurrence of less suitable soil types, but also because exposed to the warm and dry winds coming from Africa and to an almost continuous solar radiation. No historical document mentions the past presence of woods on the southern slopes of Rocca Busambra, suggesting not only that deforestation must have happened long time ago, but also that under unfavourable edapho-climatic conditions overexploited forests had no chance to recover like they almost certainly did many times on the northern side.

On the steep and gravelly slopes of the uppermost part of Rocca Busambra, subject to supramediterranean mesoclimate, some spots of deciduous forest occur. These pioneer assemblages are ascribed to *Sorbo busambarensis-Aceretum pseudoplatani* (CARPINO-FAGETEA SYLVATICAE and TILIO-OSTRYON CARPINIFOLIAE).

The shallow and stony soils of the wind-exposed top of the ridge (above 900 m of altitude) is dominated by several hemicryptophytic and chaemaephytic oromediterranean assemblages, framed into the association *Carduncello pinnati-Thymetum spinulosi* (RUMICI-ASTRAGALETEA SICULI and CERASTIO-ASTRAGALION NEBRODENSIS).

This evergreen forest *Aceri campestris-Quercetum ilicis* (QUERCETEA ILICIS and FRAXINO ORNI-QUERCION ILICIS) colonises poorly developed base-rich soils issuing from limestones and dolomias, consolidated screes and even semi-rupestrial habitats under supramediterranean bioclimatic conditions, between 1000 and 1400 m a.s.l. It is dynamically connected with CERASTIO-ASTRAGALION NEBRODENSIS communities, while at lower altitudes it is substituted by thermophilous oakwoods (*Oleo silvestri-Quercetum virgilianae*).

On the sandy permeable soils deriving from siliceous rock outcrops such as quartz sandstones, conglomerates and shales, several oak forest assemblages (ERICO-QUERCION ILICIS) occur at different elevations. *Teucrio siculi-Quercetum ilicis* is a mixed (mostly evergreen) oakwood linked to cool-humid montane microhabitats, shady slopes and valley bottoms, which occurs between (450)850 and

1200 m a.s.l. Its degradation leads to garrigues (CISTO-LAVANDULETEA), perennial and annual dry grasslands (AVENULO-AMPELODESMION and HELIANTHEMION GUTTATI, respectively) or to PLANTAGINION CUPANII under intense overgrazing. The submontane mixed oak woods of *Quercetum gussonei* and *Quercetum leptobalani* are localized between 700 and 1000 m a.s.l. The first only occurs in the wood of Cappelliere and on Nebrodi Mts. and enjoys exceptionally high amounts of rainfall (probably 800-1110 mm), the second has been observed in some N-facing submontane areas of Madonie Mts. and Ficuzza, where annual rainfall amount is approximately 800 mm; if disturbed, both communities are connected to mantle communities ascribed to *Crataegetum laciniatae*. Some old private chestnut groves occurring near Mezzojuso, located between 600 and 1000 m a.s.l., have been grown at the expense of the above-mentioned oak woods in order to obtain several products, such as timber, fruits, etc.

Local cork-oak wood mostly occurs on gently sloping areas between 500 and 800 m a.s.l. Often degraded due to overgrazing and wildfires, local assemblages are considered as an impoverished pattern of the *Genisto arista-*

Mantle vegetation (Crataegetum laciniatae) and, in the foreground, the Cachryetum ferulaceae, two seral stages of the Aceri campestris-Querceto ilicis sigmetum. In the background a cliff colonized by the Anthemido-Centauretum busambarensis.

tae-Quercetum suberis. Sometimes it appears intermingled with fragments of other acidophilous forest (*Erico arboreae-Quercetum virgilianae*) or pre-forest (*Erico arboreae-Myrtetum communis*, ERICION ARBOREAE) communities whose degradation leads to broom-dominated shrublands (SAROTHAMNION SCOPARII), garrigues (CISTO-LAVANDULETEA), perennial and annual dry grasslands (AVENULO-AMPELODESMION and HELIANTHEMION GUTTATI) and bracken (*Pteridium aquilinum*) pure stands.

At lower attitudes, some thermo-thermophilous communities framed into OLEO-CERATONION SILIQUAE occur, like *Euphorbietum dendroidis* dominated by the tree spurge and wild olive and colonising the steep slopes of calcareous outcropping rocks, and *Pistacio terebinthi-Celtidetum aetnensis*, dominated by deciduous Balkan species but also rich in sclerophylls and lianas.

Both the degradation or the ongoing expansion of local broadleaved woodlands gives rise to mantle communities ascribed to CRATAEGO-PRUNETEA. From 1000 up to 1200-1400 m a.s.l., *Crataegetum laciniatae* (ILICI-CRATAEGION LACINIATAE) occurs on the border or in the clearings of the acidophilous woodlands of ERICO-QUERCION ILICIS. At lower altitudes more common are *Cytiso infesti-Pyretum spinosae* and *Roso sempervirentis-Rubetum ulmifolii* (PRUNO SPINOSAE-RUBION ULMIFOLII) and broom-dominated shrublands (SAROTHAMNION SCOPARII).

The endemic-rich garrigue referred to *Polygalo preslii-Ericetum multiflorae* (ONONIDO-ROSMARINETEA and POLYGALO PRESLII-ERICION MULTIFLORAE) occurs on the alkaline soils deriving from limestones and dolomias in several windy and sunny areas of the SE sector of Rocca Busambra (e.g. Portella del Vento).

The perennial grasslands on base-rich and shallow soils (LYGEO SPARTI-STIPETEA TENACISSIMAE) are represented by *Hyparrhenietum hirto-pubescentis* (HYPARRHENION HIRTAE) in the warmest and driest sites of the territory, while under meso-mediterranean bioclimate prevails *Helictotricho convoluti-Ampelodesmetum mauritanici* (AVENULO-AMPELODESMION MAURITANICI), a species-rich tussock grassland.

Overgrazed areas are characterised by the prevalence of assemblages framed into PLANTAGINION CUPANII (POËTEA BULBOSAE) on acid substrates, to *Thapsio garganicae-Feruletum communis* and *Carlino siculae-Feruletum communis* CHARYBDIDO PANCRATII-ASPHODELION RAMOSI on base-rich soils.

The ephemeral annual dry grasslands occurring on local nutrient-poor sandy substrates are referred to HELIANTHEMETEA GUTTATI and HELIANTHEMION GUTTATI, while the annual dry grasslands occurring on base-rick soils belong to STIPO-TRACHYNIETEA DISTACHYAE and are locally represented by assemblages referred to STIPION RETORTAE or to *Thero-Sedetum caerulei* (TRACHYNION DISTACHYAE) on shallow skeletal base-rich soils.

The marls and clayey marls outcropping on the southern slopes of Rocca Busambra could have hosted halo-nitrophilous chenopod scrub communities referred to PEGANO HARMALAE-SALSOLETEA VERMICULATAE and SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE). Nowadays the badlands of this area still host fragments of halo-xerophilous perennial grassland referred to *Asteretum sorrentinii* (MORICANDIO-LYGEION SPARTI), intermingled with subhalo-nitrophilous annual dry assemblages referred to *Podospermo cani-Parapholidetum pycnanthae* (SAGINETEA MARITIMAE and GAUDINIO FRAGILIS-PODOSPERMION CANI).

Vegetation of cliffs, walls and screes

The thermo-hygrophilous *Eucladio verticillati-Adiantetum capilli-veneris* (ADIANTETEA and ADIANTION) occurs on the shady, water-splashed, base-rich rocks along the traits of the stream of Vallone Arciera at Ficuzza.

The fern- and moss-rich epilithic or epiphytic communities of shaded sites (POLYPODIETEA and POLYPODION SERRATI) are locally represented by *Homalothecio sericei-Poetum bivonae*, *Selaginello denticulatae-Cymbalarietum pubescentis* on the rock faces and crevices of the northern cliffs of Rocca Busambra and by *Polypodietum cambrici* on the branches of old trees in the woodland.

The undisturbed rocky ledges and cliffs of Rocca Busambra are colonised by an extremely endemite-rich chasmophytic community, the *Anthemido cupanianae-Centauretum busambarensis* (ASPLENIETEA TRICHOMANIS and DIANTHION RUPICOLAE), which only occurs in the calcareous and dolomitic mountains of the central-western Sicily up to 1600 m a.s.l. (Madonie Mts., Palermo Mts., Sicani Mts., etc.). The most representative examples occur on the submontane and montane cliffs, while under thermo-mediterranean bioclimate (e.g. on the steep and sunny slopes surrounding the canyon of Frattina river and at Rocche di Rao) it undergoes gradual floristic improverishment.

The stony habitats along the ridge of the southern slope are colonized by the hemicrypto-chamaephytic vegetation of Carduncello-Thymetum spinulosi (Cerastio-Astragalion nebrodensis).

The stone walls of the area host some thermophilous chasmo-nitrophilous assemblges (CYMBALARIO-PARIETARIETEA DIFFUSAE) which could be referred to *Sedo dasyphylli-Ceterachetum officinarum* (CYMBALARIO-ASPLENION) and *Oxalido corniculatae-Parietarietum judaicae* (PARIETARION JUDAICAE).

The pioneer assemblages which colonise local calcareous screes are ascribed to *Scutellario rubicundae-Melicetum cupanii* (DRYPIDETEA SPINOSAE and LINARION PURPUREAE).

Hydro-hygrophilous vegetation

The perennial meso-hygrophilous pastures and meadows linked to nutrient-rich deep soils (MOLINIO-ARRHENATHERETEA), flooded during winter and heavily grazed, are ascribed to *Cynosuro cristati-Leontodontetumsiculi*(CIRSIOVALLIS-DEMONIS-NARDION),also occurring on Nebrodi Mts., while several assemblages belonging to MENTHO LONGIFOLIAE-JUNCION INFLEXI occur on the borders of local ponds and streamlets and formed a continuous ring of vegetation surrounding Gorgo del Drago (Godrano) until 40 years ago.

The area hosts several dozens of natural and artificial ponds. Some of them are covered by free-floating duckweed vegetation ascribed to

Lemnetum gibbae and *Lemnetum trisulcae* (LEMNETEA and LEMNION MINORIS), other ones host communities dominated by rooted floating or submerged macrophytes (POTAMOGETONETEA) which may be framed to POTAMOGETONION (*Potametum pectinati* and *Potametum perfoliati*), to NYMPHAEION ALBAE (*Potamogeton natans* aggregate) and to RANUNCULION AQUATILIS (*Ranunculetum peltati*).

As for the pioneer vegetation of temporary ponds (ISOETO-NANOJUNCETEA), many spots of the precious ephemeral microphytic communities ascribed to ISOETION and to PRESLION CERVINAE have occurred in the past around the temporary ponds interspersed in the forestland but have almost completely disappeared during recent times. During summer *Glino mollis-Verbenetum supinae* (VERBENION SUPINAE), typical to seasonally submerged nutrient-rich soils, covers the gently sloping and sunny banks of the artificial lake Scanzano, subject to strong water level fluctuations.

The reed- and sedge-dominated bed and herbland vegetation (PHRAGMITO-MAGNOCARICETEA and PHRAGMITION COMMUNIS) which occasionally covers (or used to cover) the sides of local freshwater bodies and streams is referred to *Phragmitetum communis*, *Typho angustifoliae-Phragmitetum australis* and *Scirpetum lacustris*. *Helosciadetum*

Summit doline, colonized by the Seslerio siculae-Helictotrichetum convoluti in the hollowed part and by the Carduncello-Thymetum spinulosi on the stony slopes surrounding the depression (both associations belong to the alliance Cerastio-Astragalion nebrodensis).

nodiflori and *Sparganietum erecti* (GLYCERIO-SPARGANION) are helophytic communities dominated by small hygrophilous and heliophilous hemicriptophytes which perform dense covers along some streams and around some ponds of this area, respectively. The seasonally inundated banks of the river Frattina host some spots of *Cypero longi-Caricetum otrubae* (MAGNOCARICION ELATAE). In the past also another association framed into this alliance, *Caricetum divisae*, may have occurred in this territory. *Glycerio spicatae-Oenanthetum aquaticae* (ALOPECURO-GLYCERION SPICATAE) colonises the muddy peat soils bordering the pond of Gorgo Lungo, located within the forest of Ficuzza.

Although currently absent, riparian gallery forests (ALNO GLUTINOSAE-POPULETEA ALBAE and POPULION ALBAE) might have been rather well-represented in the territory, as the co-occurrence of several species linked to humid and shady riparian habitats (e.g. *Vitis vinifera* subsp. *sylvestris*, *Osmunda regalis* and *Asplenium scolopendrium*) at Vallone Arcera suggests.

Ulmo canescentis-Salicetum pedicillatae (SALICETEA PURPUREAE and SALICION PEDICELLATAE), occurring in NW Sicily below 800-900 m a.s.l., forms linear and narrow dense assemblages along some deep gullies of Eleuterio river near Ficuzza, while fragments of thermo-hygrophilous pioneer thicket (NERIO-TAMARICETEA and TAMARICION AFRICANAE) occur on the sides and the bed of Frattina river and on the banks of Scanzano lake.

<u>*Anthropogenic vegetation*</u>

Local arable crops (mostly cereal fields) are characterised by two annual weed assemblages occurring in different seasons. The wintergreen one, *Legousio hybridae-Biforetum testiculatae* is framed into ROEMERION HYBRIDAE (PAPAVERETEA RHOEADIS), while the summergreen, C4 species-rich vegetation occurring after crop harvest belongs to *Chrozophoro tinctoriae-Kickxietum integrifoliae* (DIGITARIO SANGUINALIS-ERAGROSTIETEA MINORIS and DIPLOTAXION ERUCOIDIS).

Concerning the wintergreen annual weedy and ruderal vegetation belonging to CHENOPODIETEA, the hypernitrophilous and xerophilous vegetation of local sheepfolds is referred to *Malvo parviflorae-Chrysanthemetum coronarii* (HORDEION MURINI), whilst many fallows are characterized by *Hedysaro coronarii-Lavateretum trimestris* and *Centauretum schouwii* (ECHIO-GALACTITION TOMENTOSAE), dynamically linked with PLANTAGINION CUPANII overgrazed and trampled communities and with PRUNO SPINOSAE-RUBION ULMIFOLII thorny woody mantle communities.

As for the acidophilous assemblages typical to the vineyards and fallows occurring on the marly and clayey soils of inner central-western Sicily (FEDIO GRACILIFLORAE-CONVOLVULION CUPANIANI), many of them have been described in the area between Marineo and Ficuzza, like *Ononido alopecuroidi- Vicietum siculae* (550-800 m a.s.l.), *Chamaemelo fuscati-Silenetum fuscatae* and *Vulpio ligusticae-Tetragonolobetum biflori* (50-650 m a.s.l.), *Hedysaro coronarii-Lathyretum hirsuti* linked to steep, humid and shady slopes between (200)500 and 600 m a.s.l, and *Lotetum angustissimo-conimbricensis* (600-700 m a.s.l.). Due to progressive succession processes, these communities are often substituted by *Arundo plinii*-dominated reed beds on the steepest slopes, by *Festuca arundinacea* meadows on flat areas.

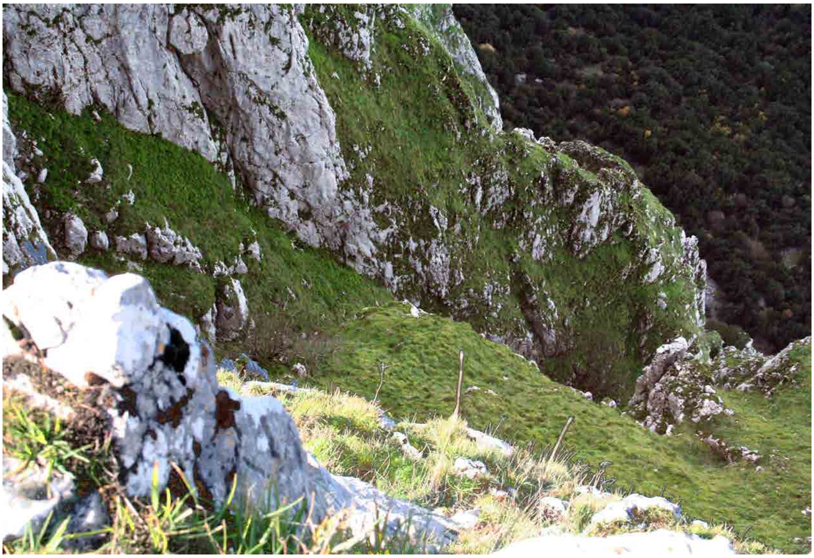
No information is yet available on the sciaphilous subnitrophilous geophyte-rich fringe communities (VALANTIO MURALIS-GALION MURALIS) occurring within and beneath local woody pre-forest vegetation.

The trampled areas of the village of Ficuzza host two therophytic nitrophilous dwarf coomunities, i.e. *Euphorbio chamaesyci-Oxalidetum corniculatae* and *Trisetario aureae-Crepidetum bursifoliae* (POLYGONO-POËTEA ANNUAE and POLYCARPION TETRAPHYLLI).

The thistle-dominated ruderal (sub)xerophilous nitrophilous assemblage occurring on the base-rich soils along the roadsides and the tracks of Rocca Busambra are ascribed to *Bonannietum graecae* (ONOPORDION ILLYRICI and ARTEMISIETEA VULGARIS), endemic to the disturbed areas of central-western Sicilian montane areas (Madonie and Sicani Mts., Mts. of Palermo) subject to meso- and supramediterranean bioclimate (800-1250 m a.s.l.).

To *Euphorbio ceratocarpae-Arundinetum plinii* (ARUNDION PLINII) are ascribed the tall subhygrophilous fringes frequently occurring on clayey soils along the humid borders of fallowlands and cereal crop fields or along the streamlets.

On the disturbed edges and clearings of the forest communities located at higher altitudes, some isolated pure stands of *Atropa belladonna* and the more widespread *Anthrisco nemorosae-Heracleetum cordati* occur. These tall-herb assemblages are framed into EPILOBIETEA ANGUSTIFOLII and ANTHRISCION NEMOROSAE.



The vertical cliffs of the north facing slope are colonized by the Anthemido-Centauretum busambarensis (Dianthion rupicolae) and the steep rocky ledges by the Festuco rubrae-Seslerietum siculae (Cerastio-Astragalion nebrodensis).

The riparian fringes growing on nutrient-rich riverbanks are ascribed to *Calystegio sylvaticae-Arundinetum donacis* (CYNANCHO-CONVOLVULION SEPIUM) or to *Cirsio cretici-Dorycnietum recti* (DORYCNIO RECTI-RUMICION CONGLOMERATI).

The seasonally flooded nutrient-rich banks of Lago Scanzano host summer-annual pioneer plant communities belonging to BIDENTETEA TRIPARTITAE and CHENOPODION RUBRI.

9.3. Landscape and land use history

The archaeological findings of several sites near Corleone, at Cutrupia cave on Rocca Busambra and at Pizzo Chiarastella near Cafalà Diana testify the human presence in the territory since Neolithic times (Stentinello culture, ca. VI millennium BC). The first traces of settlements belong to the so-called 'bell beaker' culture, probably of middle European origin, which reached Sicily from Sardinia during the III millennium BC. However, the set up and expansion and local human communities did not occur before ancient Bronze age (first half of the II millennium BC).

The Royal Palace of Ficuzza in the sunset light, surrounded by the woodlands of Bosco Ficuzza and crowned by the Busambra. The palace, intended as hunting lodge, was commissioned by Ferdinand I of Bourbon and built between 1802 and 1810

For millennia the Belìce and Eleuterio valleys represented the main connecting route between the southern and the northern coast of W Sicily. Between XI and VIII century BC, with the establishment of the Elymians in the western inland (Segesta, Entella, Nakone near Poggioreale), the foundation of the Greek colonies (Selinous, Herakleia and Akragas) along SW Sicilian coasts and of the Phoenician ones (Panormos and Solous) on the Tyrrhenian ones, this route became even more important, and the indigenous settlements gradually fell under Elymian (e.g. La Montagnola near Marineo, probably corresponding to *Makella*), Greek (Mt. Chiarastella, and Pizzo di Casa at the easternmost edge of Rocca Busambra, etc.) and Punic influence (VIII BC: Pizzo Nicolosi on the westernmost tip of Rocca Busambra). The toponyms 'Eleutherios' (= free, now Eleuterio), 'Kefalé (= head, top, now Cefalà) and 'Phytalia' (= fertile ground, vegetated area, now Campofelice di Fitalia) were more probably given by Greek settlers than from Byzantines one thousand years later.

The intricate medieval network of rural farms (e.g. 'Case Nicolosi', II century BC; 'Case Bifarera di sopra' and 'Case Bifarera di sotto', V century AD), villages (e.g. Alpe Ramosa, VII-XI AD, perhaps the 'Al Khazan' mentioned by Arab travellers; 'Buchinene or Bicchinello-Casale di sopra' and 'Masseria Casale', IX-XI AD) probably retraces the location of the settlements of the Elymian-Greek-Punic-Roman period. For example, the Arab-Norman 'Chasum' (XI-XIII AD), giving the name to Pizzo di Casa, was built on the ruins of a Greek town, and the thermal waters of the magnificent Arab-Norman bath of Cefalà Diana were already used under Roman dominion.

With no doubt Arabs densely occupied and shaped this territory with their agro-pastoral activities, as confirmed by plenty of toponyms, such as 'Qal'at abu Samar' (= the fortress of Samar/Samir, now Rocca Busambra), Pizzo Morabito (from 'murabit' = the Peak of the monk, the preacher), 'Jabal Zurara' (probably corresponding to the wood of Cappelliere), 'al Gidran' (= swamp or fenced area, now Godrano), 'Manzil el Emir' (= house, estate of the emir, now Misilmeri), 'Manzil Jusuf' (= house of Jusuf, Joseph, now Mezzojuso), 'Ras al Ayn' (= head of the water, now Risalaimi, one of the main springs of Eleuterio), etc.

After conquering Sicily (XI century AD), Norman kings donated these lands to several fellows of the Sicilian aristocracy. Between XII and XIII most of local woodlands were included into two big feuds, Cefalà an Chasum, and the churches of Monreale, Palermo and Agrigento were allowed to manage the forest goods of part of these wide territories, inducing the people living in local rural communities, the so-called 'casali', to increase land exploitation. Nonetheless, a very wide forested area, fenced and protected as hunting reserve for the delight (*solatium*) of Arab emirs since X century, remains untouched by will of the Norman and Swabian kings until mid XIII century. The so-called 'Parco Vecchio' (= old park) was just immense, spanning with almost no interruption from Rocca Busambra to the plain of Palermo throughout the territories now belonging to the municipalities of Marineo, Misilmeri, Belmonte Mezzagno, Santa Cristina Gela and Altofonte.

Between XIII and XIV centuries, the feud of Cefalà passes through the hands of several noble families, while several churches are entrusted to exploit Chasum, the and the forest appears more and more discontinuous and degraded, also due to the increasing demand of firewood to fulfil the needs of the sugar cane plantations located near the mouth of Eleutero river. Notwithstanding several *licentiae populandi* (permissions to found new villages), the nobles ruling Cefalà did not succeed to populate the lands, and during XV century they started to dismember and sell their own properties. In that period entire sectors of the Parco Vecchio vanished forever, turned into cereal crop fields and pasturelands. At the beginning of XVI century, the rise of wheat price changed the socio-economic scenario of the area: in fact, during the following 200 years the new owners earn much more than in past, found or re-found a number of rural villages, like Mezzojuso and Marineo during XVI century and Ogliastro (now Bolognetta), Godrano and Villafrati during XVII century. Forest exploitation went on with neither rules nor limits until the end of XVIII century, when Ferdinand I of Bourbon, exile in Sicily, decided to transform the whole forest in a private hunting reserve, forbidding the public use of forest goods and building a royal palace in the new-born village of Ficuzza. This fact probably changed the destiny of the last wide forested area of western Sicily preventing it from total destruction.

Ficuzza is a less wild and more disturbed wood than it seems. Indeed, only small and localised spots of local woodlands (like the one of locality Fanuso) show structural features similar to old growth conditions. During last two centuries the forest underwent severe damages at least three times: during a rebellion on 1820, when Ferdinand had to

The Royal Palace of Ficuzza in the sunset light, surrounded by the woodlands of Bosco Ficuzza and crowned by the Busambra. The palace, intended as hunting lodge, was commissioned by Ferdinand I of Bourbon and built between 1802 and 1810

temporarily escape from Sicily and part of the woodland was destroyed and burnt, after the death of his son Francesco (1830), when nearly 3/4 of its tree cover was almost destroyed, and during the two World Wars, when wide surfaces were subject to clear-cuts and burning. Fortunately, most of the following forestation activities, started around the 1950s, were carried out by using autochthonous woody species grown in local nurseries, and this allowed a very fast recover of local forest ecosystems.

As for artificial plantations, some of them have been carried out with *Fraxinus* spp. (mostly *F. angustifolia* but sometimes also *F. ornus*). On the clayey soils of the localities Lavanche and Pirrello (S of Rocca Busambra) almost pure stands of *Eucalyptus* spp. (*E. camaldulensis*, *E. gomphocephala* and *E. trabutii*) deeply impacted soil biochemistry and groundwater level, while *Pinus* spp. (mostly *P. pinea*, *P. halepensis* and *P. pinaster*) altered the landscape surrounding the (once permanent) pond of ‘Gorgo del Drago’ near Godrano.

Ficuzza still hosts the traces of the past exploitation of the forest such as charcoal hips; the wide spectrum of activities carried out there is testified by plenty of stone wall structures: the 'neviere', where the snow was gathered and covered with straw to last and to be used during summer; the 'pagghiari' (small thatched huts built to host shepherds and lumberjacks); the 'calcare' (kilns where calcareous rocks were burnt to obtain lime); the 'chirchiari' or 'cunzarri' (stone heaps created to ease plowing activities), the 'mannare' (stone-wall sheepfolds were flocks were protected against the wolves), the 'girati' (stone-fenced hunting areas were fallow deers and boars were introduced), the 'peschiera' (fishery) near Gorgo del Drago at Godrano, etc.

The area surrounding Ficuzza and Rocca Busambra is not densely inhabited. The only villages which are really close to the forest are Mezzojuso (3000 inhabitants) and Godrano (1000), while Corleone (12000 inhabitants), Marineo (7000), Bolognetta (4000), Villafrati (3500), Cefalà Diana (1000) and Campofelice di Fitalia (500) are nowadays quite far from it.

Nowadays the main challenge is the real involvement of local communities and stakeholders, trying to figure out together the best policies to combine the survival of cattle breeders with the main goals for the conservation of local nature heritage, i.e. the maintenance of all the dynamic steps of local vegetation through a more sustainable use of pasturelands, the undisturbed evolution of the most endangered and/or mature sectors of local forest, the improvement or even the restoration of local temporary and permanent ponds, the gradual removal and substitution of the alien trees' stands covering some sectors of the area.

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Box 9.1. *Ficuzza: the last forest of western Sicily*

The presence and even the survival of Ficuzza is intimately linked with Rocca Busambra, whose steep northern cliffs dominate (and provide shadow and humidity to) a wide spectrum of forest communities, mostly dominated by evergreen (*Quercus ilex* and *Q. suber*) and deciduous (*Q. pubescens s.l.* and *Q. cerris s.l.*) thermophilous oaks. Forest borders and abandoned pastures host shrubberies dominated by brooms, like *Cytisus infestus*, *C. villosus* and *Spartium junceum*, and thorny Rosaceae (*Crataegus*, *Prunus*, *Pyrus*, *Rosa* and *Rubus*).

The survival of Ficuzza also issued from human choices. In fact, it was protected as private hunting reserve of the Sicilian kings from Frederick II Hohenstaufen (XIII century) to Ferdinand IV of Bourbon (XIX century). Additionally, since the XII century it was part of the *Provincia Monrealensis*, a very wide territory assigned by Norman kings to the archibishops of the town of Monreale near Palermo, whose rational management of local woodlands, used to produce fuelwood, charcoal, and as pasturelands let them survive throughout centuries.

In order to satisfy the urgent need of fuelwood wide sectors of the forest were cutted down during the World War II, but many of them promptly recovered through succession or were successfully restored just after the end of the conflict by using native species grown in local nurseries.

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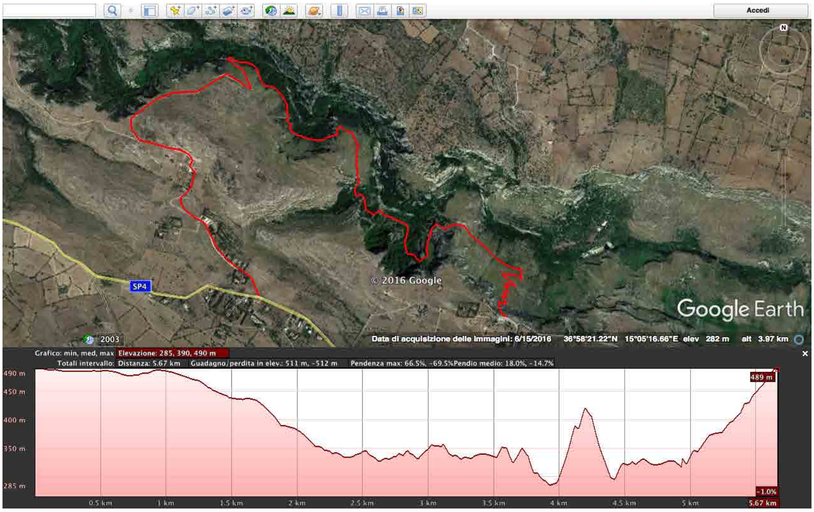
Other itineraries

Even if our botanical excursions focus on Central and western Sicily, we have not been able to resist the temptation to overcome the East, to briefly suggest you four magnificent hikes: two in the Hyblaean and two in the Etnean territory. In the hopeful await of a second volume of botanical excursions, focussed on Eastern Sicily, we hope you will appreciate our effort!

Riccardo & Salvo

Itinerary1 - Cavagrande del Cassibile



The south-eastern corner of Sicily consists of a carbonate platform named "Hyblaean Plateau": a succession of horizontal layers of Miocenic marls and limestones, crossed by a complex network of deep canyons. We will visit one of these canyons, Cava Grande del Cassibile, in the eastern sector of the Hyblaean Plateau. The lithostratigraphic succession of Cava Grande del Cassibile includes, at the bottom, an alternation of marly limestones with a thickness of about 150 m, upwards followed by multi-layered banks of whitish – yellowish calcarenites, also about 150 m thick, topped by more compact limestones ascribed to the Climiti Unit, 100 m thick.

Moisture coming from the sea is forced by the sea breeze into the valleys excavated by waterways; so that in the inner part of the valleys quite a regular regimen of moisture condensation occurs, forming nocturnal fogs which even in summer stagnate very often until 9 a.m. Hidden precipitations are likely to be even more intense in summer, when the thermic differences between the coastal sites and inland valleys are greater.

The vegetation with highest biomass are the holm-oak woods (Quercetalia ilicis) and the riverine forests (Populetalia albae), although they are now rather rare due to fires, clearings, reforestation with *Pinus halepensis* and citrus plantations. Disturbance (mainly due to fire) allows bushes and perennial grasses to dominate the landscape of the Hyblaean canyons. More in detail, a large part of the sloping faces is covered by a low maquis (Pistacio lentisci-Rhamnetalia alaterni). When fire events are more frequent, the maquis is replaced by a garigue (Cisto-Ericetalia), in the Hyblaean plateau featured by two very frequent East-Mediterranean species, *Sarcopoterium spinosum* and *Salvia fruticosa*, which have in SE-Sicily the most western outpost of their distribution range. The further stage of degradation of the series is represented by perennial dry grasslands (Hyparrhenietalia hirtae), at present the commonest vegetation in the Hyblaean corner of Sicily.

Trail: Length: 5.7 km one-way trip, Hiking time: 3 hours, Elevation range: 500 m.

Cavagrande del Cassibile, extensive rangeland on stony slopes (Ferulago nodosae-Hyparrhenietum hirtae).

Annual dry grassland on a rocky ledge (Trigonello monspeliacae-Stipetum capensis).

Pothole along the Cassibile river, surrounded by riverine vegetation units (Polygono salicifolii-Phragmitetum communis; Arundini-Convolvuletum sepium; Platano-Salicetum pedicellatae).

Eastward view of the canyon (Cavagrande del Cassibile); valley slopes are extensively colonized by the Helichryso-Ampelodesmetum mauritanici and vertical cliffs by the Putorio calabricae-Micromerietum microphyllae.

Intensively exploited rangeland, affected by ruderalization processes (Carlino siculae-Feruletum communis; Thapsio-Feruletum communis).

The holm-oakwood (Doronico-Quercetum ilicis), potentially the most common vegetation unit in the hyblaean canyons, is now relegated in the most impervious sites.

Itinerary2 - From Eloro to Vendicari

The peculiar morphology of the coast of Vendicari (SE Sicily) originated from the interaction of karst and marine processes. The site is a 6.8 km long microtidal, wave-dominated and bedrock-confined coastal ecosystem, with many evidences of Pleistocenic karst processes in a Quaternary carbonate shore-platforms. A karst polje formed during the Late Pleistocene sea level lowstand. The postglacial sea level rise had drowned most part of the original polje, which can be still recognized in the inner continental shelf. Sea level stabilization after the Holocene eustatic maximum favoured the development of a beach barrier, which generated additional coastal lakes of lagoons. The current physical setting is characterized by horizontal sedimentary layers, alternating with sandy dune systems and coastal saltmarshes and lacustrine systems (locally called "Pantani") with three presently flooded coastal lakes and four ancient coastal wetlands.

The area is characterized by the occurrence of several plant communities, mainly represented by low maquis (Pistacio lentisci-Rhamnetalia alaterni), chamaephytic thermo-xerophilous garigues (Cisto-Ericetalia), perennial dry grasslands (Hyparrhenietalia), petro-halophilous scrubs (Crithmo-Limonietea), vegetation of rocky cliffs (Asplenietalia glandulosi; Geranio-Cardaminetalia hirsutae) and of temporary ponds (Isoeto-Nanojuncetea, Juncion maritimi, Scirpion compacti) and ephemeral meadows (Stipo-Trachynietea distachyae and Saginetea maritimae), which shift into the psammophilous vegetation complexes of coastal sand dunes (Ammophiletalia australis, Helichryso stoechadis-Crucianelletalia maritimae, Malcolmietalia) towards the shoreline.

Trail: Length: 9 km one-way trip, Hiking time: 3 hours, Elevation range: 50 m

Vendicari, spring view of a coastal garrigue (Chamaeropo-Sarcopoterietum spinosi) colonizing sandstone banks, with intestitial space colonized by annual dry grasslands (Vulpio-Romuletum rollii)

The same vegetation, in summer. Green patches are, either, Pistacia lentiscus, Chamaerops humilis or Thymbra capitata, the only species, in this context, which keep green during the dry season.

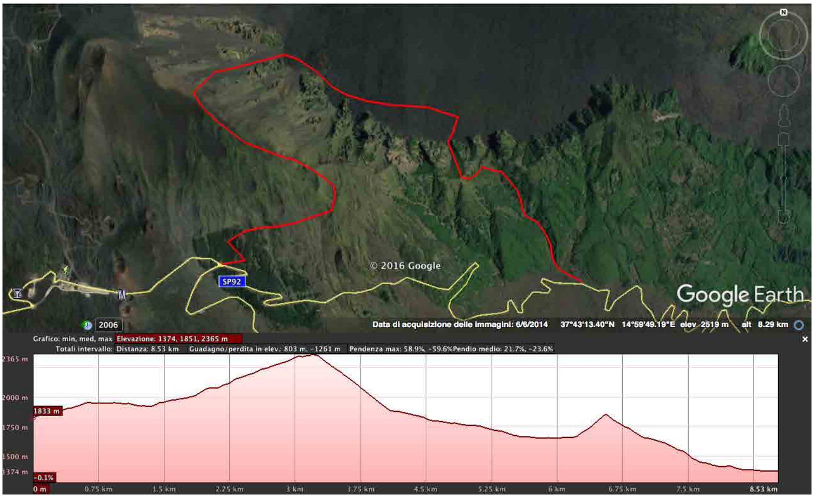
Vendicari, the lacustrine system of Pantano Grande: plant species assemblages are driven by gradients in soil texture, salinity and humidity. In the foreground, Imperato-Juncetum littoralis, empty depressions are seasonally colonized by Salicornietum emerici; upper elevations in the middle of the lake are covered by Arthrocnemo-Juncetum subulati, landward shores are colonized by Phragmitetum communis.

Similar view, from the landward shores.

Vendicari, dunal system colonized by the Ephedro-Juniperetum macrocarpae.

Vendicari, early spring ephemeral vegetation in the dune slacks (Vulpio-Romuletum rollii).

Itinerary 3 - Etna - southern side (From "Schiena dell'Asino" to "Piano del Vescovo", through Valle del Bove)



The single most relevant landmark of the island is Mt. Etna (currently standing 3329 m), the biggest volcano of the Mediterranean region. It dominates the Eastern side of Sicily, with multiple layers of erupted materials that cover an area of 1190 km^2, with a basal circumference of 140 km.

The origin of the name Etna is exciting, as it comes from the ancient Greek '(H)Aithna', whose Indo-European root is the some of 'Heat', 'Hot', 'Heiss': what an appropriate name for a mountain bursting with lava and hot gasses! Even funnier was the name of the mountain until last century, 'Mongibello', issuing from 'Mons' (mount in Latin) and 'Djabal' (mount in Arab), so a reiteration of the concept to indicate 'THE' mountain by antonomasia.

While the dangerous and unpredictable volcano Stromboli is called 'iddu' (him) by local people, the name of the highest active volcano of Europe, dominating the eastern coast of Sicily is feminine… As a matter of fact, it appears to be kinder than other volcanoes, and it only rarely caused fatalities during its long and continuous activity.

We will climb 700 m of altitudinal range along the southern rim of Valle del Bove, an huge horse-shoe shaped caldera on the eastern flank of the volcano, resulting from a progressive collapse of older volcanic edifices, which took place (with distinct phases) between 60,000 and 9,000 years ago. From the top of the rim (a rocky ridge called "Schiena dell'Asino"), we will have an impressive view over the caldera: a 5 km wide and 7 km long depression surrounded by steep slopes (between 400 and 1,000 m high), where several magmatic dikes and rocky ridges emerge in consequence of selective erosive processes. The name Valle del Bove means "Valley of the Ox" and it seems to recall the time when (until 1991), the valley bottom was covered by lush pastures, freely grazed by herds of cows and sheep. Nowadays, Valle del Bove is the place where much of Etna's lava flows are converging, making it the only place of stunning wilderness in Sicily. We will walk through the thorny cushions of the *Astragalus siculus* dominated vegetation (Rumici-Astragaletea siculi) and, after a couple of km bordering the southern side of the valley floor (making nice observations on the recolonization patterns on recent lavas), we will escape from Valle del Bove through the beechwoods above Piano del Vescovo, i.e. the extreme southern limit of the distribution range of the European beech (*Fagus sylvatica*).

Trail: Length: 8.7 km. Hiking time: 4.5 hours, Elevation range: 740 m uphill and 1200 m downslope.

Astragaletum siculi is the dominant vegetation in the oromediterranean belt of Mt. Etna.

The thorny cushions of Astragalus siculus shelter many plant species (here Anthemis aetnensis and Viola aethnensis), whose presence is manifested with brilliant colours at flowering time. For their strategy, these plants have been defined as Polstergäste (literally: the guests of the cushion), a pun for the world Poltergeist, that is a ghost supposed to manifest its presence by occasional noises.

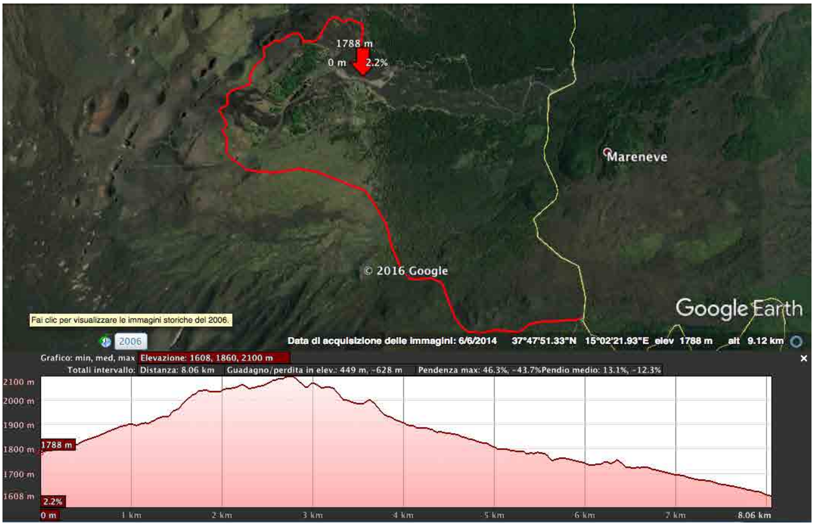
Valle del Bove seen from its southern rim: the crest named Schiena dell'asino. The yellow flowers on the left belong to Hypochaeris robertia, the most ancestral and isolated clade of its genus

It's only one, but it is living there, next to the middle point of Valle del Bove. The most heroic Festuca circummediterranea in the world (bottom right of the pic).

The last survivors of a woodland erased by the eruption December 1991 - February (?) 1993. The dykes help in the retention of the organic matter and route some extra water to the trees

In the bottom part of the dykes poplar (Populus tremula) and beech (Fagus sylvatica) are very frequent. In the upper part, instead, Acer campestre, Sorbus sp.pl. and Genista aetnensis tend to prevail.

Itinerary4-Etna-North-Easternside(From“PianoProvenzana” to “Monti Sartorius”)



Downslope from the central cone, Etna displays several hundred minor cones, the so-called “temporary” cones, shaping this huge mountain as one of the world’s largest polygenic volcanoes. We will start our walk from the eruptive vents of 2002, near Piano Provenzana, and, after a short climb across Rumici-Astragaletea siculi vegetation, we will walk along a gently sloping diagonal descending towards Monti Sartorius, a complex of small cones dating back to 1865.

We will see beautiful Calabrian pine forests, exploited since ancient times for timber and resin (pitch) production. The Calabrian pine forest (*Pinus calabrica*) represents the zonal vegetation in the N-NW flank of Mt Etna, but most often it represents a seral stage of oak- or beechwoods (depending on elevation). At the end of the trail, ending up in the East-facing flank of the Volcano, i.e. the moistest and coolest part of the oro-mediterranean vegetation belt on Mt. Etna, we will cross the Aetnean birchwood (*Betula aetnensis*), which has its optimal stands right in the tableland surrounding Monti Sartorius.

Trail: Length: 8 km. Hiking time: 4 hours, Elevation range: 280 m uphill and 670 m downslope.

The Calabrian pine (Pinus calabrica) forest of Piano Provenzana has been crossed by a large lava flow in 2002. Many pines hit by the lava are still standing and their skeletal silhouettes contrast with the green pines in the background.

The Calabrian pine forests have been exploited since ancient times for timber and resin (pitch) production. Resin extraction was a local economic activity until a recent past. Many pines with the typical "fishbone" carving, adopted for this ancient practice, are still alive.

Springtime view of Monti Sartorius (1865), with a fringe of Betula aetnensis and the Calabrian pinewood in the background.

Dormient Astragaletum siculi, with patches of Juniperus hemisphaerica and Berberis cretica subsp. aetnensis.

Betula etnensis is a close relative of Betula pendula, The light woods dominated by Betula pendula, with Adenocarpus bivonae in the understorey, are limited to the NE flank of Mt. Etna and have been described as Cephalanthero longifoliae-Betuletum etnensis (Pino-Quercion congestae).

Genista aetnensis, endemic to very restricted areas of Sardinia, Corsica and Sicily is a very important biomass producer on recent lava flows, where it can grow relatively fast, thanks to the symbiosis with nitrogen-fixing bacteria.

Syntaxonomic list of the vegetation units

R. Guarino, D. Cusimano, V. Ilardi, S. Pasta

> "Antiochus, when he was Ephor, hearing that Philip had given Messenians their land, asked if he had also provided them with the power to prevail in fighting to keep it"
>
> (Plutarch, Sayings of Spartans)

This syntaxonomical list represents a first attempt to adapt - sometimes *obtorto collo* - to the pan-European framework proposed by Mucina *et al*. (2016) the bulk of phytosociological knowledge so far available on the Sicilian vascular vegetation, up to the association level. The aim was to promote and support - as much as possible - the nomenclatural stability and the coherence of classes, orders and alliances with the EuroVegChecklist (Mucina et al, 2016), which was adopted as baseline. We are aware that many phytosociological associations described for Sicily are superfluous and their autonomy is not supported by numerical ordination analyses (particularly in the case of forests), however a formalized review and ordination of the associations so far described from Sicily was outside of our purposes.

In spite of our best intentions, a few discrepancies remain between our view and the work by Mucina *et al*. (2016), in all those cases in which there is a clear need for the realignment of syntaxonomy to phytogeographic, geo-ecological and systematic issues. All the reassessments or disagreements proposed here are commented in red notes; "*" refers to *syntaxa* here corrected or reseated; "**" refers to first records from Sicily; "†" refers to *syntaxa* reported from Sicily by Mucina et al. (2016) but, basing on the current state of knowledge, their occurrence on the island is not proven.

CARPINO-FAGETEA SYLVATICAE Jacuks & Passarge 1968

Mesic (and meso-hygrophilous) summergreen deciduous forests

Indicator species in Sicily: *Acer campestre, Acer monspessulanum, Acer opalus subsp. neapolitanum, Acer pseudoplatanus, Aquilegia sicula, Aremonia agrimonoides, Arum italicum, Asperula odorata, Blechnum spicant, Brachypodium sylvaticum, Calamintha grandiflora, C. sylvatica, Campanula trichocalycina, Cardamine chelidonia, Castanea sativa, Cephalanthera rubra, Cephalanthera damasonium, Chaerophyllum temulum, Clematis vitalba, Corydalis solida, Daphne laureola, Dactylorhiza maculata subsp. saccifera, Digitalis micrantha, Dryopteris filix-mas, Epipactis helleborine, E. microphylla, Fagus sylvatica, Drymochloa drymeia, Festuca heterophylla, Fragaria vesca, Galanthus reginae-olgae, Galium rotundifolium, Geranium robertianum, Geum urbanum, Hieracium pignattianum, H. symphytifolium, Hypericum androsaemum, Hypopitys monotropa, Lathraea squamaria, Lathyrus pratensis, L. venetus, Luzula sicula, Malus sylvestris, Melica uniflora, Mercurialis perennis, Milium effusum, Milium vernale subsp. montianum, Moehringia trinervia, Mycelis muralis, Neottia nidus-avis, Poa sylvicola, Polystichum aculeatum, P. setiferum, Potentilla micrantha, Primula vulgaris, Prunus avium, Pyrola secunda, Quercus petraea subsp. austrotyrrhenica, Ranunculus lanuginosus, Rubus canescens, Sanicula europaea, Scilla bifolia, Scutellaria columnae, Symphytum gussonei, Taxus baccata, Veronica montana, Viola reichenbachiana*.

FAGETALIA SYLVATICAE Pawłowski in Pawłowski et al. 1928

Basiphilous beech and mixed fir-beech forests in the nemoral zone and in the montane belt of the submediterranean regions of temperate Europe

Indicator species in Sicily: *Acer campestre, A. pseudoplatanus, Allium ursinum, Anthriscus nemorosa, Aquilegia sicula, Arum cylindraceum, Conopodium capillifolium, Corydalis solida, Dryopteris filix-mas, Epilobium montanum, Epipactis helleborine, Galium odoratum, Geranium robertianum, Ilex aquifolium, Malus sylvestris, Melica uniflora, Melittis albida, Neottia nidus-avis, Platanthera chlorantha, Polygonatum multiflorum, Polystichum setiferum, Potentilla micrantha, Rubus canescens, R. hirtus, Saxifraga rotundifolia, Tamus communis, Ulmus glabra, Veronica officinalis.*

GERANIO STRIATI-FAGION Gentile 1970

Refugial basiphilous beech and mixed fir-beech forests of Southern Italy and the southwestern Balkans

Indicator species in Sicily: *Allium pendulinum, Anemone apennina, Galium odoratum subsp. scabrum (=Galium scabrum), Geranium versicolor, Euphorbia meuselii, Lamium flexuosum, Polygonatum gussonei, Ranunculus velutinus.*

Ilici aquifolii-Quercetum austrotyrrhenicae Brullo & Marcenò in Brullo 1984
Anemono apenninae-Fagetum sylvaticae (Gentile 1969) Brullo 1984 *em.* Ubaldi *et al.* 1987
Arrhenathero nebrodensi-Quercetum cerridis Brullo, Minissale & Spampinato 1996
Ilici aquifolii-Taxetum baccatae Brullo, Minissale & Spampinato 1996
Luzulo siculae-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spampinato 1999
Rubo aetnici-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spampinato 1999
Epipactido meridionalis-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spampinato 1999
Melitto albidae-Fagetum sylvaticae Brullo, Guarino, Minissale, Siracusa & Spampinato 1999
Geranio versicoloris-Quercetum ilicis Maniscalco & Raimondo 2003
Ilici aquifolii-Quercetum leptobalani Maniscalco & Raimondo 2009
Ilici aquifolii-Quercetum cerridis Raimondo, Schicchi & Bazan 2009
Conopodio capillifolii-Quercetum congestae Maniscalco & Raimondo 2009
Hieracio madoniensis-Fagetum sylvaticae C. Brullo *et al.* 2012

TILIO-OSTRYON CARPINIFOLIAE Brullo, Scelsi & Spampinato 2001

Note - This alliance, not mentioned by Mucina *et al.* (2016), is to be considered a southern vicariant of *Tilio-Acerion* Klika 1955: sub-montane centro-Mediterranean hop-hornbeam and lime forests on steep slopes with a mild and humid mesoclimate.

Indicator species in Sicily: *Acer pseudoplatanus, Athyrium filix-foemina, Phyllitis scolopendrium, Corylus avellana, Ostrya carpinifolia, Sambucus nigra, Tilia platyphyllos, Ulmus glabra*.

Aceri obtusati-Ostryetum carpinifoliae Brullo & Marcenò 1985b
Ostryo carpinifoliae-Quercetum congestae Brullo & Marcenò 1985b
Sorbo graecae-Aceretum pseudoplatani Gianguzzi & La Mantia 2004
Hieracio criniti-Aceretum aetnensis C. Brullo et al. 2012

QUERCETEA PUBESCENTIS Doing-Kraft ex Scamoni & Passarge 1959

Thermophilous forests with deciduous oaks of sub-Mediterranean regions
Indicator species in Sicily: *Asperula laevigata, Betula aetnensis, Crepis leontodontoides, Euonymus europaeus, Limodorum abortivum, Luzula forsteri, Oenanthe pimpinelloides, Quercus cerris, Q. congesta, Q. dalechampii, Pinus nigra subsp. calabrica, Poa sylvicola, Tamus communis, Viola alba subsp. dehnhardtii*.

QUERCETALIA PUBESCENTI-PETRAEAE Klika 1933

Oak forests of the warm cool-temperate regions in the nemoral zone of Central and Southern Europe and relic supramediterranean fir-pine and oak forests of the Mediterranean
Indicator species in Sicily: *Acer monspessulanum, Agropyron panormitanum, Buglossoides purpurocaerulea, Castanea sativa, Cephalanthera longifolia, Katapsuxis silaifolia, Limodorum abortivum, Lonicera etrusca, Populus tremula, Ruscus aculeatus, Teucrium siculum, Vicia cassubica*.

PINO CALABRICAE-QUERCION CONGESTAE Brullo, Scelsi, Siracusa & Spampinato 1999

Submediterranean montane Siculo-Calabrian pine-oak woods
Indicator species in Sicily: *Acer obtusatum subsp. aetnense, Betula aetnensis, Epipactis meridionalis, Pinus nigra subsp. calabrica, Quercus congesta, Q. dalechampii, Q. leptobalanos, Rubus aetnicus*.

Vicio cassubicae-Quercetum cerridis Brullo & Marcenò 1985b
Agropyro panormitani-Quercetum congestae Brullo, Scelsi, Siracusa & Spampinato 1999
Doronico orientalis-Castanetum sativae C. Brullo *et al.* 2012
Agropyro panormitani-Populetum tremulae C. Brullo *et al.* 2012
Daphno laureolae-Pinetum calabricae C. Brullo *et al.* 2012
Cephalanthero longifoliae-Betuletum aetnensis C. Brullo *et al.* 2012

CRATAEGO-PRUNETEA R. Tx. 1962

Shrubland vegetation seral or marginal to broadleaved woodlands ("mantle")
Indicator species in Sicily: *Berberis vulgaris, Calystegia sylvatica, Clematis flammula, Clematis cirrhosa, Clematis vitalba, Cornus sanguinea, Crataegus monogyna, Crataegus oxyacantha, Ligustrum vulgare, Pyracantha coccinea, Prunus spinosa, Rhamnus catharticus, Rosa canina, Rubus glandulosus, Sambucus nigra, Viburnum lantana.*

PRUNETALIA SPINOSAE R. Tx. 1952

Scrub and mantle vegetation seral or marginal to broad-leaved forests in the nemoral zone of Europe
Indicator species in Sicily: *Crataegus monogyna, Euonymus europaeus, Prunus spinosa, Rhamnus catharticus, Rosa pouzinii, Rubia peregrina subsp. peregrina, Rubus ulmifolius, Smilax aspera, Tamus communis.*

ILICI-CRATAEGION LACINIATAE Ubaldi 2011

Note - This alliance is ascribed by Mucina *et al.* (2016) to *Paliuretalia* Trinajstić 1978. We esteem more appropriate to respect the Ubaldi's view: montane Calabrian and Sicilian mantle vegetation, seral or marginal to broad-leaved forests, with many species in common with the mantle vegetation of the nemoral zone of Europe (descended into the Mediterranean region through the Apennine temperate corridoir) and virtually no diagnostic species in common with the pseudomaquis and šibljak fringing oak forests of the submediterranean regions of southeastern Europe.

Indicator species in Sicily: *Crataegus rhipidophylla, Euonymus europaeus, Prunus cocomilia, P. cupaniana, Rhamnus catharticus, Ribes uva-crispa subsp. austro-europaeum, Rosa montana, R. pulverulenta, R. spinosissima, Rubus acheruntinus*.

Crataegetum laciniatae Brullo & Marcenò in Brullo 1984

**Clematido vitalbae-Prunetum cupanianae* Raimondo, Marino & Schicchi 2010

**Junipero hemisphaericae-Prunetum cupanianae* Raimondo, Marino & Schicchi 2010 *nom. invers. propos*.

Note - In the original description, the two latter associations were framed into the *Juniperetalia hemisphaericae* Rivas-Mart. & J.A. Molina in Rivas-Mart. *et al*. 1999 but, due to the dominant species and the vegetation structure, they would fit better into *Ilici-Crataegion laciniatae*.

Lonicero xylostei-Prunetum cupanianae Gianguzzi, Caldarella, Cusimano & Romano 2011

Roso siculae-Prunetum spinosae Gianguzzi, Cuttonaro, Cusimano & Romano 2016

PYRO SPINOSAE-RUBETALIA ULMIFOLII Biondi, Blasi & Casavecchia in Biondi *et al*. 2014

<u>Spiny bramble scrub on nutrient-rich soils of the winter-mild Atlantic seaboards, the Mediterranean, the Macaronesian Archipelago and the Azores</u>

Indicator species in Sicily: *Pyrus spinosa, Rubus ulmifolius, Lonicera etrusca, Rosa sempervirens*.

PRUNO SPINOSAE-RUBION ULMIFOLII O. de Bolòs 1954

<u>Spiny bramble scrub of the winter-mild Atlantic seaboards and the Western Mediterranean</u>

Indicator species in Sicily: *Asparagus acutifolius, Clematis cirrhosa, Crataegus monogyna, Cytisus infestus, Euphorbia characias, Origanum vulgare, Pyrus pyraster, Rosa canina, Rubus ulmifolius, Rubia peregrina, Smilax aspera, Spartium junceum, Tamus communis*.

Rubo ulmifolii-Tametum communis Tx. in Tx. & Oberd. 1958
Rubo ulmifolii-Crataegetum brevispinae O. de Bolòs 1962
Pyro amygdaliformi-Paliuretum spinae-christi O. de Bolòs 1962
Rubo ulmifolii-Dorycnietum recti S. Brullo, Minissale, Scelsi & Spampinato 1993
Scutellario linnaeanae-Urticetum rupestris Brullo, Minissale, Scelsi & Spampinato 1993
Rubo ulmifolii-Aristolochietum altissimae Brullo, Minissale, Scelsi & Spampinato 1993
Roso sempervirentis-Rubetum ulmifolii Blasi, Cutini, Di Pietro & Fortini 2001
Clematido cirrhosae-Rubetum ulmifolii Gianguzzi & La Mantia 2008
**Cytiso infesti-Pyretum spinosae* Gianguzzi & La Mantia 2008 *nom. mut. et inv. propos.*
Note - In the original description, this association was framed into the *Pistacio lentisci-Rhamnetalia alaterni* Rivas-Mart. 1975, but due to the dominant species and the vegetation structure, it would fit better into the *Pruno spinosae-Rubion ulmifolii.*
Spartio juncei-Bupleuretum fruticosi Raimondo & Ilardi 2009
Roso corymbiferae-Rubetum ulmifolii Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Euphorbio characiae-Prunetum spinosae Gianguzzi, Cuttonaro, Cusimano & Romano 2016

LAURO NOBILIS-SAMBUCETALIA NIGRAE Biondi, Blasi, Casavecchia, Galdenzi & Gasparri 2014 in Biondi *et al.* 2014

Mesic scrub in shady habitats on nutrient-rich soils of the Central Mediterranean

Indicator species in Sicily: *Sambucus nigra, Laurus nobilis, Rubus ulmifolius, Rhamnus alaternus, Rubia peregrina, Ulmus minor.*

Lauro nobilis-Sambucion nigrae Biondi, Blasi, Casavecchia, Galdenzi & Gasparri 2014 in Biondi *et al.* 2014

Mesic scrub in shady habitats on nutrient-rich soils of the Central Mediterranean

Indicator species in Sicily: *Sambucus nigra, Laurus nobilis, Rubus ulmifolius, Rhamnus alaternus, Rubia peregrina, Ulmus minor*.

Hyperico majoris-Rubetum ulmifolii Gianguzzi, Cuttonaro, Cusimano & Romano 2016

**ROBINIETEA Jurko *ex* Hadač & Sofron 1980

Seral forest-clearing and anthropogenic successional scrub and thickets on nutrient-rich soils of temperate Europe

Note - Even if there are no published data on the occurrence of this vegetation in Sicily, the black locust is widely replacing the former holm oak woods in the northern end of Sicily, particularly in the area of Dinnammare shrine, near Messina.

Frequent species in Sicily: *Arum italicum, Robinia pseudoacacia, Sambucus nigra, Humulus lupulus, Galium aparine, Chaerophyllum temulum, Fallopia convolvulus, F. dumetorum, Smyrnium olusatrum, Stellaria media, Urtica membranacea*.

†TRIFOLIO-GERANIETEA SANGUINEI T. Müller 1962

Thermophilous forest fringe and tall-herb vegetation in nutrient-poor sites in the submediterranean to subboreal zones of Europe and the Macaronesia

†ASPHODELETALIA MACROCARPAE Biondi & Allegrezza in Biondi *et al*. 2014

Meso-xerophilous fringe and tall-herb vegetation on deep oligotrophic soils in the meso- and supratemperate belts of the Southern European peninsulas

†HYPERICO CALABRICAE-ASPHODELION MACROCARPI Biondi, Gangale & Uzunov in Biondi, Casavecchia, Pesaresi, Gangale & Uzunov 2014

Meso-xerophilous fringe and tall-herb vegetation on deep oligo-trophic soils over siliceous substrates in the meso- and supratemperate belts of the Southern Apennine Peninsula and Sicily

Note - This alliance includes meso-xerophilous fringe and tall-herb vegetation on deep soils with siliceous pedogenetic matrices in the meso- and supratemperate belts. Even if Biondi *et al*. (2014), and, accordingly, Mucina *et al*. (2016), state that representatives of this alliance, from the Southern Apennine and crystalline massifs of Calabria, stretch up to Sicily, no character species or published data about these communities are so far known from the island, apart from the following taxa, which in Sicily are not typical of fringe communities: *Brachypodium rupestre, Centaurea ambigua, Cirsium vallis-demonis, Knautia purpurea, Potentilla calabra, Trifolium ochroleucum, Viola aethnensis subsp. messanensis*.

MOLINIO-ARRHENATHERETEA R.Tx. 1937

Perennial meso-hygrophilous pastures and meadows on fertile deep soils at low and mid-altitudes (rarely also high altitudes) of Europe

Indicator species in Sicily: *Agropyron repens, Agrostis castellana, Anthoxanthum odoratum, Cynosurus cristatus, Dactylis glomerata, Bromus mollis, B. racemosus, Bellis perennis, Daucus carota, Gaudinia fragilis, Juncus articulatus, J. fontanesii, Scirpoides holoschoenus subsp. australis, Lolium perenne, Lotus corniculatus, Oenanthe pimpinelloides, Plantago lanceolata, Poa trivialis, Prunella vulgaris, Pulicaria dysenterica, Rumex crispus, Senecio erraticus, Trifolium pratense, Trifolium repens, Trifolium squarrosum*.

POTENTILLO-POLYGONETALIA AVICULARIS Tx. 1947

Temporarily flooded and heavily grazed zoo-anthropogenic nutrient-rich meadows and pastures of the temperate and Mediterranean regions of Europe

Indicator species in Sicily: *Agrostis stolonifera, Festuca arundinacea, Plantago major, Polygonum aviculare, Trifolium resupinatum, Verbena officinalis*.

POTENTILLION ANSERINAE Tx. 1947

Temporarily flooded and heavily grazed nutrient-rich pastures experiencing variable wet-dry or brackish-fresh alternating conditions of temperate Europe

Indicator species in Sicily: See class.

Lolio perenni-Plantaginetum majoris (Linkola 1921) Berger 1930

TRIFOLION MARITIMI Br.-Bl. ex Br.-Bl. *et al.* 1952

Temporarily flooded heavily grazed nutrient-rich grasslands and herblands on subsaline soils of the Mediterranean

Indicator species in Sicily: *Cichorium pumilum, Plantago coronopus, Paspalum distichum, P. dilatatum*.

Kickxio commutatae-Trifolietum bocconei Brullo & Marcenò 1985a

CIRSIETALIA VALLIS-DEMONII Brullo & Grillo 1978

Note - This order is framed by Mucina *et al.* (2016) into the class *Nardetea strictae* Rivas Goday & Borja Carbonell in Rivas Goday & Mayor Lopez 1966. Even if Nardus stricta occurs in very few relictual stands on the summit plateaux of the Calabrian and NE-Sicilian crystalline massifs, the endemite-rich meadows of Calabrian and Sicilian mountains have no ecological and floristic affinities with the secondary mat-grass swards on nutrient-poor soils of the temperate, boreal and subarctic regions of Europe. Therefore, they should be framed into *Molinio-Arrhenatheretea*, as in the opinion of the authors of the original description of the order at issue.

Indicator species in Sicily: *Centaurea ambigua, Cirsium vallis-demonis, Crepis leontodontoides, Hypochoeris neapolitana, Knautia purpurea, Potentilla calabra, Trifolium phleoides, T. pratense subsp. semipurpureum, T. squarrosum, T. striatum, Viola aethnensis subsp. messanensis.*

CIRSIO VALLIS-DEMONII-NARDION Giacomini & Gentile *ex* Di Pietro & Theurillat in Di Pietro *et al.* 2015

Siculo-Calabrian supramediterranean mesic seasonal perennial pastures on siliceous substrates

Indicator species in Sicily: *Cirsium vallis-demonii, Potentilla calabra, Viola aethnensis subsp. messanensis*.

Hypochoerido hispidae-Lotetum conimbricensis Brullo, Grillo & Terrasi 1976

Cynosuro cristati-Leontodontetum siculi Brullo & Grillo 1978

Genisto aristatae-Potentilletum calabrae Brullo & Grillo 1978

HOLOSCHOENETALIA Br.-Bl. *ex* Tchou 1948

Humid grass-rush meadows of the Mediterranean
Indicator species in Sicily: *Carex distans, Cirsium creticum, Cyperus longus subsp. badius, Galium elongatum, Jacobaea aquatica, Juncus articulatus, J. effusus, Lythrum junceum, Oenanthe globulosa, Potentilla reptans, Rumex conglomeratus.*

DACTYLORHIZO-JUNCION STRIATI Brullo & Grillo 1978

Relict humid swards of high altitudes of Calabria and Sicily
Indicator species in Sicily: *Oenanthe lachenalii, Juncus acutiflorus, Scirpoides romanus.*

Dactylorhizo sacciferae-Juncetum effusi Brullo & Grillo 1978
Caricetum intricato-oederi Brullo & Grillo 1978
*Petagnietum gussonei Brullo & Grillo 1978 nom. mut. propos.

FILIPENDULO ULMARIAE-LOTETALIA ULIGINOSI Passarge 1975

Tall-herb wet meadow fringe vegetation on mineral soils of temperate Europe
Indicator species in Sicily: *Mentha pulegium Potentilla reptans, Pulicaria dysenterica, Rumex crispus.*

MENTHO LONGIFOLIAE-JUNCION INFLEXI T. Müller & Görs ex De Foucault 2009

Tall-herb temporarily flooded lightly-grazed nutrient-rich meadow fringes in riparian and alluvial habitats of temperate Europe
Indicator species in Sicily: *Agropyron repens, Agrostis castellana, Juncus inflexus, Mentha longifolia, M. suaveolens, Ranunculus pratensis, R. sardous subsp. xatardii, Teucrium scorodonia subsp. crenatifolium, Trifolium fragiferum subsp. bonannii.*

Junco inflexi-Menthetum longifoliae Lohmeier 1953
Eleocharito nebrodensi-Juncetum compressi Raimondo 1983

Teucrio scorodoniae-Cirsietum italici Brullo & Marcenò 1985a
Teucrio scorodoniae-Lotetum tenuis Brullo & Marcenò 1985a
Carici otrubae-Juncetum inflexi Minissale & Spampinato 1987
Epilobio hirsuti-Agropyretum repentis Minissale & Spampinato 1986
Cirsio triumfettii-Eupatorietum cannabini Brullo & Spampinato 1991
Phalarido coerulescentis-Agropyretum repentis Brullo & Spampinato 1991
Equiseto palustris-Juncetum effusi Minissale & Spampinato 1991
Kickxio commutatae-Teucrietum scordioidis Minissale, Musumarra & Sciandrello 2006

*JUNIPERO-PINETEA SYLVESTRIS Rivas-Mart. 1965 nom. invers. propos.

Relict oromediterranean conifer woodlands and shrubberies
Indicator species in Sicily: *Juniperus hemisphaerica, Cotoneaster nebrodensis, Rosa sicula, Daphne oleoides*.

BERBERIDO CRETICAE-JUNIPERETALIA EXCELSAE Mucina in Mucina et al. 2016

Relict submediterranean supramediterranean dry pine forests and juniper woods of the Central and Eastern Mediterranean
Indicator species in Sicily: *Berberis aetnensis, Pinus calabrica, Allium nebrodense, Prunus cupaniana* (diff.), *Sorbus graeca* (diff.).

BERBERIDO AETNENSIS-PINION LARICIONIS (Brullo, Giusso & Guarino 2001) Mucina & Theurillat 2016

Acidophilous dry pine and juniper vegetation in the supra-mediterranean belt of Corsica, Sardinia, Sicily and Calabria
Indicator species in Sicily: See order.

Cerastium tomentosi-Juniperetum hemisphaericae Pignatti & Nimis in Pignatti-Wikus et al. 1980
Bellardiochloo aetnensis-Juniperetum hemisphaericae Brullo & Siracusa in Brullo, Giusso & Guarino 2001

Junipero hemisphaericae-Abietetum nebrodensis Brullo & Giusso in Brullo, Giusso & Guarino 2001
Junipero hemisphaericae-Pinetum calabricae Brullo & Siracusa in Brullo, Giusso & Guarino 2001

Quercetea ilicis Br.-Bl. ex A. Bolòs y Vayreda & O. de Bolòs in A. Bolòs y Vayreda 1950

Mediterranean evegreen maquis and thermophilous oak woods
Indicator species in Sicily: *Arisarum vulgare, Aristella bromoides, Asparagus acutifolius, Carex halleriana, Cyclamen repandum, Cytisus infestus, Daphne gnidium, Erica arborea, Laurus nobilis, Lonicera implexa, Melica minuta, Olea europaea, Osyris alba, Phillyrea latifolia, Pistacia terebinthus, Pulicaria odora, Pyrus spinosa, Rhamnus alaternus, Rubia peregrina subsp. longifolia, Smilax aspera*.

QUERCETALIA ILICIS Br.-Bl. *ex* Molinier 1934 *em*. Rivas-Mart. 1975

Evergreen and semi-deciduous thermo- to supramediterranean oak and relict laurel forests of the Central and Western Mediterranean
Indicator species in Sicily: *Asperula laevigata, Aristolochia navicularis, A. rotunda, Carex distachya, Cyclamen hederifolium, Euphorbia characias, Fraxinus ornus, Laurus nobilis, Lonicera etrusca, Loranthus europaeus, Luzula forsteri, Paeonia mascula, Pimpinella peregrina, Quercus ilex, Q. amplifolia, Q. virgiliana, Rosa sempervirens, Tamus communis, Thalictrum calabricum, Viburnum tinus, Viola alba subsp. dehnhardtii, Helleborus bocconei subsp. intermedius, Huetia cynapioides, Mespilus germanica, Physospermum verticillatum*.

FRAXINO ORNI-QUERCION ILICIS Biondi, Casavecchia & Gigante in Biondi *et al*. 2013

Evergreen and semideciduous calciphilous holm oak forests of the Central Mediterranean

Indicator species in Sicily: *Asplenium onopteris, Fraxinus ornus, Carpinus orientalis, Cercis siliquastrum, Cyclamen hederifolium, C. repandum, Drymochloa drymeia, Emerus major subsp. emeroides, Lonicera etrusca, Thalictrum calabricum, Viola alba subsp. dehnhardtii*.

Lauro nobilis-Quercetum ilicis (Br.-Bl. 1967) Rivas-Mart. 1975
Ostryo carpinifoliae-Quercetum ilicis Lapraz 1975
Doronico orientali-Quercetum ilicis Barbagallo, Brullo & Fagotto 1979
Oleo sylvestris-Quercetum virgilianae Brullo 1984
Aceri campestris-Quercetum ilicis Brullo 1984
Rhamno alaterni-Quercetum ilicis Brullo & Marcenò 1985b
Pistacio lentisci-Quercetum ilicis Brullo & Marcenò 1985b
Celtido aetnensis-Quercetum virgilianae Brullo & Marcenò 1985b
Sorbo torminalis-Quercetum virgilianae Brullo et al. 1996
Lauro nobilis-Quercetum virgilianae Brullo, Costanzo & Tomaselli 2001
Bupleuro fruticosi-Quercetum ilicis Sciandrello, D'Agostino & Minissale 2013
Rhamno lojaconoi-Lauretum nobilis Marino, Castiglia, Bazan, Domina & Guarino 2014
Ampelodesmo mauritanici-Quercetum ilicis Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Sorbo torminalis-Quercetum ilicis Gianguzzi, Cuttonaro, Cusimano & Romano 2016

ERICO ARBOREAE-QUERCION ILICIS Brullo, Di Martino & Marcenò 1977

<u>Evergreen and semideciduous acidophilous holm oak forests of the Central Mediterranean</u>

Indicator species in Sicily: *Clinopodium vulgare subsp. orientale, Cytisus villosus, Erica arborea, Quercus leptobalanos, Poa sylvicola, Pulicaria odora, Teline monspessulana, Teucrium siculum*.

Erico arboreae-Quercetum ilicis Brullo, Di Martino & Marcenò 1977
Stipo bromoidis-Quercetum suberis Barbagallo 1983
Quercetum leptobalani Brullo 1984
Genisto aristatae-Quercetum suberis Brullo 1984
Teucrio siculi-Quercetum ilicis Gentile 1969 *em.* Brullo & Marcenò 1985b
Erico arboreae-Quercetum virgilianae Brullo & Marcenò 1985b
Mespilo germanicae-Quercetum virgilianae Brullo & Marcenò 1985b

Arabido turritae-Quercetum congestae Brullo & Marcenò 1985b
Festuco heterophyllae-Quercetum congestae Brullo & Marcenò 1985b
Vicio elegantis-Quercetum congestae Brullo & Marcenò 1985b
Quercetum gussonei Brullo & Marcenò 1985b
Doronico orientali-Quercetum suberis Brullo, Minissale & Spampinato 1995
Carici serrulatae-Quercetum suberis Cirino, Ferrauto & Longhitano 1999
Sorbo graecae-Quercetum ilicis Brullo, Gianguzzi, La Mantia & Siracusa 2009

ARBUTO UNEDONIS-LAURION NOBILIS Rivas-Mart., Fernández-González & Loidi 1999

Relict Mediterranean laurel forests
Indicator species in Sicily: *Laurus nobilis, Arbutus unedo*.

Hedero helicis-Lauretum nobilis Bueno & Fernándes Prieto 1991
Acantho mollis-Lauretum nobilis Gianguzzi, D'Amico & Romano 2010

PISTACIO LENTISCI-RHAMNETALIA ALATERNI Rivas-Mart. 1975

Thermo-mesomediterranean low-grown matorral, macchia and garrigue of the Mediterranean Basin
Indicator species in Sicily: *Anagyris foetida, Asparagus albus, A. aphyllus, A. horridus, Bupleurum fruticosum, Ceratonia siliqua, Clematis cirrhosa, Emerus major subsp. emeroides, Jasminum fruticans, Myrtus communis, Phillyrea angustifolia, Pinus halepensis, Pistacia lentiscus, Prasium majus, Quercus calliprinos, Rhamnus oleoides, Teucrium fruticans, Ziziphus lotus*.

OLEO-CERATONION SILIQUAE Br.-Bl. 1936 *ex* Guinochet & Drouineau 1944 *em.* Rivas-Mart. 1975

Thermomediterranean calcicolous macchia of the Liguro-Tyrrhenian seaboards
Indicator species in Sicily: *Artemisia arborescens, Asparagus horridus, Chamaerops humilis, Euphorbia dendroides, Teucrium flavum, Ziziphus lotus*.

Euphorbietum dendroidis Guinochet in Guinochet & Drouineau 1944
Myrto communis-Pistacietum lentisci (Molinier 1954 *em.* O. de Bolós 1962) Rivas-Mart. 1975
Salvio trilobae-Phlomidetum fruticosae Barbagallo, Brullo & Fagotto 1979
Chamaeropo humilis-Sarcopoterietum spinosi Barbagallo, Brullo & Fagotto 1979
Cytiso infesti-Rhoetum tripartitae Bartolo, Brullo & Marcenò 1982 *nom. mut. propos.*
Pistacio lentisci-Chamaeropetum humilis Brullo & Marcenò 1985b
Chamaeropo humilis-Quercetum calliprini Brullo & Marcenò 1985b
Ephedro fragilis-Lycietum europaei Brullo & Marcenò 1985b
Hippocrepido emeri-Bupleuretum fruticosi Brullo, Minissale, Scelsi & Spampinato 1993
Teucrio fruticantis-Rhamnetum alaterni Brullo, Minissale, Scelsi & Spampinato 1993
Asparago acutifolii-Ziziphetum loti Gianguzzi, Ilardi & Raimondo 1996
Asparago stipularis-Retametum gussonei Brullo, Guarino & Ronsisvalle 2000
Ephedro fragilis-Pistacietum lentisci Brullo, Guarino & Ronsisvalle 2000
Cytiso villosi-Artemisietum arborescentis Ferro 2005 *nom. mut. propos.**
Rhamno oleoidis-Pistacietum lentisci Minissale, Musumarra & Sciandrello 2006
Cytiso infesti-Quercetum calliprini Minissale & Sciandrello 2012 *nom. mut. propos.**
Cisto salviifolii-Cytisetum infesti Sciandrello, D'Agostino & Minissale 2013 *nom. mut. propos.**
Micromerio consentinae-Phlomidetum fruticosae Sciandrello, D'Agostino & Minissale 2013
Pistacio terebinthi-Celtidetum aetnensis Gianguzzi, Cusimano & Romano 2014
Asparago albi-Artemisietum arborescentis Gianguzzi, Cuttonaro, Cusimano & Romano 2016
Euphorbio characiae-Anagyridetum foetidae Gianguzzi, Cuttonaro, Cusimano & Romano 2016

PERIPLOCION ANGUSTIFOLIAE Rivas-Mart. 1975

Thermomediterranean semiarid deciduous relict low matorral of the coastal regions of southeastern Spain, Sicily and the eastern regions of North Africa

Indicator species in Sicily: *Periploca angustifolia, Lycium intricatum, Rhus pentaphylla, Rhus tripartita*.

Periploco angustifoliae-Euphorbietum dendroidis Brullo, Di Martino & Marcenò 1977

Periploco angustifoliae-Juniperetum turbinatae S. Bartolo, Brullo, Minissale & Spampinato 1990

Periploco angustifoliae-Rhoetum tripartitae Brullo, Gianguzzi, La Mantia & Siracusa 2009

JUNIPERION TURBINATAE Rivas-Mart. 1975 *corr.* 1987

Thermomediterranean tall juniper scrub on coastal dune systems of the Western Mediterranean seaboards

Indicator species in Sicily: *Ephedra fragilis, Juniperus macrocarpa, J. phoenicea subsp. turbinata*.

Ephedro fragili-Juniperetum macrocarpae Bartolo, Brullo & Marcenò 1982

Junipero turbinatae-Quercetum calliprini Bartolo, Brullo & Marcenò 1982

**Cytiso infesti-Juniperetum turbinatae* Brullo, Gianguzzi, La Mantia & Siracusa 2009 *nom. mut. propos.*

Piptathero coerulescentis-Juniperetum turbinatae Minissale & Sciandrello 2012

Ampelodesmo mauritanici-Juniperetum turbinatae Gianguzzi *et al.* 2012

ERICION ARBOREAE (Rivas-Mart. ex Rivas-Mart., Costa & Izco 1986) Rivas-Mart. 1987

Thermo-mesomediterranean neutrophilous to acidophilous mesic matorral of the Mediterranean Basin

Indicator species in Sicily: *Erica arborea, Arbutus unedo*.

Erico arboreae-Arbutetum unedonis Molinier 1937
Erico arboreae-Myrtetum communis Quézel et al. 1988

PINETALIA HALEPENSIS Biondi, Blasi, Galdenzi, Pesaresi & Vagge in Biondi et al. 2014

Thermo-mesomediterranean pine forests of the Central and Eastern Mediterranean
Indicator species in Sicily: *Pinus halepensis, Pinus pinea, Juniperus phoenicea subsp. turbinata*.

PISTACIO LENTISCI-PINION HALEPENSIS Biondi, Blasi, Galdenzi, Pesaresi & Vagge in Biondi *et al*. 2014

Thermo-mesomediterranean Aleppo pine forests on calcareous substrates of the Central Mediterranean
Indicator species in Sicily: See order.

Pistacio lentisci-Pinetum halepensis De Marco, Veri & Caneva 1984
Erico arboreae-Pinetum halepensis De Marco & Caneva 1985
Thymbro capitatae-Pinetum halepensis De Marco & Caneva 1985
Genisto aspalathoidis-Pinetum hamiltonii Brullo, Di Martino & Marcenò 1977 corr. Gianguzzi 1999
Note - In the original description, this association, characterized by the SW Mediterranean endemic *Pinus pinaster* subsp. *hamiltonii*, was framed into the *Erico-Quercion ilicis*. Even if the growing stands are influenced by intense moisture condensation, due to the edaphic conditions imposed by the volcanic scoriae of Pantelleria, the overall species assemblage is more similar to that of *Pistacio-Pinion halepensis*. However, some doubts remain on the most appropriate syntaxonomical treatment for the association at issue.

PINION PINEAE Feinbrun 1959

Thermomediterranean stone pine forests on leached sandy soils of ancient coastal dunes and inland alluvia of the Central and Eastern Mediterranean

Indicator species in Sicily: *Cistus crispus, Pinus pinea*.

**Cisto crispi-Pinetum pineae* Bartolo, Brullo & Pulvirenti 1994

**Cisto cretici-Pinetum pineae* Brullo, Minissale, Siracusa, Scelsi & Spampinato 2002

ONONIDO-ROSMARINETEA Br.-Bl. in A. Bolòs y Vayreda 1950

Mediterranean garrigues growing on alkaline to neutrocline soils

Indicator species in Sicily: *Argyrolobium zanonii, Asperula cynanchica, Astragalus monspessulanus, Cistus clusii, Coris monspeliensis, Fumana thymifolia, Globularia alypum, Lotus dorycnium, Rhaponticum coniferum, Rosmarinus officinalis, Thesium divaricatum, Thymelaea hirsuta*.

ROSMARINETALIA OFFICINALIS Br.-Bl. *ex* Molinier 1934

Western Mediterranean thermo-supramediterranean dry- subhumid calcicolous scrub

Indicator species in Sicily: *Fumana laevipes, F. laevis, Helianthemum apenninum, H. cinereum subsp. rotundifolium, H. croceum, Ononis minutissima, O. pusilla*.

POLYGALO PRESLII-ERICION MULTIFLORAE Guarino & Pasta *all. nova hoc loco. Holosyntypus: Polygalo preslii-Ericetum multiflorae* Marcenò & Colombo 1982 *nom. invers. propos.*

Note - In the light of the new syntaxonomical framework proposed by Mucina *et al.* (2016), the endemite-rich garrigues of W-Sicily on limestone talus slopes and base-rich soils deserve to be framed into a distinct alliance, as it happens for the Sardinian (two alliances), Corsican and Balearic basiphilous garrigues belonging to the same order.

Indicator species in Sicily: *Eryngium tricuspidatum subsp. bocconei, Galium pallidum, Genista gasparrinii, G. demarcoi, Helichrysum nebrodense, Matthiola fruticulosa, Micromeria fruticulosa, Muscari lafarinae, Polygala preslii*.

Polygalo preslii-Ericetum multiflorae Marcenò & Colombo 1982 *nom. invers. propos.*
Micromerio fruticulosae-Ericetum multiflorae Brullo & Marcenò 1983 *nom. invers. propos.*
Genistetum gasparrinii Gianguzzi, Cusimano, Ilardi & Romano 2015
Genistetum demarcoi Gianguzzi, Cusimano, Ilardi & Romano 2015

CISTO-MICROMERIETALIA JULIANAE Oberd. 1954

Thermo-mesomediterranean phrygana of the continental Greece and the Adriatic and Ionian coasts
Indicator species in Sicily: *Cistus creticus subsp. creticus, Coris monspeliensis, Coronilla valentina, Cytinus ruber, Helianthemum sessiliflorum, Helictotrichon convolutum, Teucrium luteum, Fumana juniperina, F. laevipes, F. procumbens, F. thymifolia, Phagnalon rupestre, Micromeria nervosa.*

CISTO ERIOCEPHALI-ERICION MULTIFLORAE Biondi 2000

Thermo-mesomediterranean calcicolous garrigue of the central and southern regions of the Adriatic and Ionian seaboards of the Apennine Peninsula
Indicator species in Sicily: *Cistus creticus subsp. creticus, Lotus dorycnium, Erica multiflora subsp. multiflora, Fumana arabica, Micromeria graeca, Micromeria nervosa.*

Rosmarino officinalis-Thymbretum capitatae Furnari 1965
Thymbro capitatae-Helichrysetum stoechadis Barbagallo 1983
Hyparrhenio pubescentis-Helianthemetum sessiliflori Brullo, Giardina, Minissale & Spampinato 1989
Cistetum salvifolio-clusii Bartolo, Giardina, Minissale & Spampinato 1989
Thymbro capitatae-Cistetum parviflori Bartolo, Brullo, Minissale & Spampinato 1990
Helichryso scandentis-Ericetum multiflorae Brullo, Minissale, Scelsi & Spampinato 1993
Thymelaeo hirsutae-Rosmarinetum officinalis Brullo, Minissale & Spampinato 1997

Sileno siculae-Helichrysetum hyblaei Brullo, Scelsi, Siracusa & Tomaselli 1998
Diplotaxio crassifoliae-Reaumurietum vermiculatae Brullo, Guarino & Ronsisvalle 2000
Coronillo valentinae-Thymbretum capitatae Brullo, Guarino & Ronsisvalle 2000
Brachypodio ramosi-Cistetum cretici Gianguzzi & La Mantia 2008

CISTO-LAVANDULETEA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940

Mediterranean scrub on acidocline, siliceous and ultramafic substrates
Indicator species in Sicily: *Cistus salviifolius, C. crispus, C. monspeliensis, Cytinus hypocistis, C. ruber, Lavandula stoechas, Pulicaria odora, Teline monspessulana*.

LAVANDULETALIA STOECHADIS Br.-Bl. in Br.-Bl., Molinier & Wagner 1940 em. Rivas-Mart. 1968

Western Mediterranean garrigue and other scrub on hard acidic siliceous and ultramafic bedrocks
Indicator species in Sicily: See class.

*CYTISO VILLOSI-GENISTION TYRRHENAE Biondi 2000 nom. mut. propos.

Thermomediterranean acidophilous coastal garrigue of the southwestern Tyrrhenian seaboards
Indicator species in Sicily: *Cytisus villosus, Genista madoniensis, G. aristata, G. cupanii, Trifolium bivonae, Micromeria consentina*.

Genistetum tyrrhenae (Brullo, Di Martino & Marceno 1977) Brullo in Brullo & Furnari 1994
Genisto aspalathoidis-Rosmarinetum officinalis Gianguzzi 1999
Cisto salviifolii-Genistetum madoniensis Marino, Guarino & Bazan 2012
Genisto aristatae-Cistetum salvifolii Gianguzzi, Cusimano, Ilardi & Romano 2015

NERIO-TAMARICETEA Br.-Bl. & O. de Bolòs 1958

Thermo-hygrophilous pioneer thicket of intermediate and terminal riverbeds and braided-streams ("fiumaras")

Indicator species in Sicily: *Nerium oleander, Tamarix africana, T. gallica, Vitex agnus-castus*.

TAMARICETALIA AFRICANAE Br.-Bl. & O. de Bolòs 1958

Circummediterranean and Macaronesian riparian scrub

Indicator species in Sicily: See class.

TAMARICION AFRICANAE Br.-Bl. & O. de Bolòs 1958

Infra- to supramediterranean tamarisk riparian scrub in temporarily flooded freshwater habitats of the Western Mediterranean

Indicator species in Sicily: *Tamarix arborea, Glycyrrhiza glabra*.

- *Tamaricetum gallicae* Br.-Bl. & O. de Bolòs 1958
- *Tamarici africanae-Viticetum agni-casti* Brullo & Spampinato 1997

RUBO ULMIFOLII-NERION OLEANDRI O. de Bolòs 1985

Thermo- to supramediterranean oleander riparian scrub of the Western Mediterranean

Indicator species in Sicily: *Rubus ulmifolius, Nerium oleander*.

- *Rubo ulmifolii-Nerietum oleandri* O. de Bolòs 1956
- *Spartio juncei-Nerietum oleandri* Brullo & Spampinato 1991

CYTISETEA SCOPARIO-STRIATI Rivas-Mart. 1974

Central-western Mediterranean and Atlantic acidophilous tall broomlands

Indicator species in Sicily: *Cytisus scoparius, Erica arborea, Orobanche rapum-genistae subsp. rapum-genistae, Pteridium aquilinum*.

CYTISETALIA SCOPARIO-STRIATI Rivas-Mart. 1974

Western and Central Mediterranean thermo- to supramediterranean and submediterranean broomy cytisoid scrub
Indicator species in Sicily: See class.

*VIOLO MESSANENSIS-adenocarpion Brutii Mucina in Mucina et al. 2016 nom. mut. propos. (= Violo messanensis-Adenocarpion complicati Mucina in Mucina et al. 2016 nom. inval., Art. 2b)

Siculo-Calabrian meso-supramediterranean broom heath
Indicator species in Sicily: *Adenocarpus commutatus, Helianthemum nummularium subsp. obscurum, Thymus longicaulis, Viola aethnensis subsp. messanensis*.

**Cytiso infesti-Adenocarpetum commutati* Bartolo, Brullo & Pulvirenti 1994 *nom. mut. propos.*
Pteridio aquilini-Euphorbietum corallioidis Guarino 1999 nom. inval.

LYGEO SPARTI-STIPETEA TENACISSIMAE Rivas-Mart. 1978

Circum-Mediterranean perennial grasslands and pseudosteppes on rocky substrates and clayey soils
Indicator species in Sicily: *Allium sphaerocephalon subsp. arvense, Anthyllis vulneraria subsp. maura, Asperula aristata, Asphodeline lutea, Asphodelus ramosus, Bituminaria bituminosa, Calamintha nepeta, Calendula suffruticosa subsp. fulgida, Carlina hispanica subsp. globosa, Carlina sicula, Centaurea sicula, Charybdis pancration, Convolvulus cantabrica, C. elegantissimus, Dactylis hispanica, Elaeoselinum asclepium, Galium lucidum, Hypericum perfoliatum, H. perforatum, Lobularia maritima, Ornithogalum gussonei, Piptatherum miliaceum, Pallenis spinosa, Petrorhagia illyrica subsp. haynaldiana, Reichardia picroides, Sanguisorba minor subsp. verrucosa, Sedum sediforme, Sixalix atropurpurea, Thapsia garganica, Verbascum sinuatum*.

LYGEO-STIPETALIA TENACISSIMAE Br.-Bl. & O. de Bolòs 1958

Relict Mediterranean edaphic steppes on deep clayey soils
Indicator species in Sicily: *Carlina gummifera, Lygeum spartum, Polygonum tenorei, Reichardia intermedia, Scorzonera undulata subsp. deliciosa*.

MORICANDIO-LYGEION SPARTI Brullo, De Marco & Signorello 1990

Relict Southern Italian and Ionian thermo-mesomediterranean edaphic steppes on deep clayey soils
Indicator species in Sicily: *Eryngium dichotomum, E. triquetrum, Moricandia arvensis, Capparis sicula*.

Eryngio dichotomi-Lygeetum sparti Gentile & Di Benedetto 1961 *corr.* C. Brullo *et al.* 2010
* *Tripolietum sorrentinoi* Venturella, Ottonello & Raimondo 1984 *nom. mut. propos.*
Lavatero agrigentinae-Lygeetum sparti Brullo 1985 *corr.* C. Brullo *et al.* 2010
Phagnalo annotici-Lygeetum sparti Biondi & Mossa 1993

CYMBOPOGONO-BRACHYPODIETALIA RAMOSI Horvatić 1963

Circum-Mediterranean thermo- to supramediterranean perennial grasslands on base-rich lithosols
Indicator species in Sicily: *Andropogon distachyos, Carlina gummifera, Cachrys libanotis, Convolvulus althaeoides, Echinophora tenuifolia, Ferula communis, Foeniculum piperitum, Heteropogon contortus, Hyoseris radiata, Hyparrhenia hirta, Kundmannia sicula, Hyparrhenia sinaica, Lathyrus articulatus, Micromeria graeca, Phagnalon saxatile*.

HYPARRHENION HIRTAE Br.-Bl., P. Silva & Rozeira 1956

Thermo-mesomediterranean pseudosteppes on calcareous sandy soils of the Western Mediterranean and southern regions of the Central Mediterranean

Indicator species in Sicily: See order.

Hyparrhenietum hirto-pubescentis A. Bolòs y Vayreda & O. de Bolòs & Br.-Bl. in A. Bolòs y Vayreda 1950

Oryzopsio pauciflorae-Hyparrhenietum hirtae Bartolo, Brullo, Minissale & Spampinato 1990

Cenchro ciliari-Hyparrhenietum hirtae Wildpret & Rodriguez in Rivas-Mart. *et al.* 1993

Euphorbio terracinae-Hyparrhenietum hirtae Brullo & Siracusa 1996

Penniseto setacei-Hyparrhenietum hirtae Gianguzzi, Ilardi & Raimondo 1996

Tricholaeno teneriffae-Hyparrhenietum hirtae Brullo, Scelsi & Spampinato 1997

Bothriochloo panormitanae-Hyparrhenietum hirtae Brullo, Scelsi & Spampinato 1997

Heteropogono contorti-Hyparrhenietum hirtae Brullo, Scelsi & Spampinato 1997

Imperato cylindricae-Hyparrhenietum hirtae Brullo & Siracusa 2000

Dichanthio annulati-Hyparrhenietum hirtae Brullo & Siracusa 2000

Hyparrhenio hirtae-Festucetum humifusae Brullo & Guarino in C. Brullo *et al.* 2010

Stipo gussonei-Hyparrhenietum hirtae Brullo & Scuderi in C. Brullo et al. 2010

Phalarido coerulescentis-Hyparrhenietum hirtae Scuderi in C. Brullo et al. 2010

AVENULO-AMPELODESMION MAURITANICI Minissale 1995

Note - Mucina *et al.* (2016) consider this alliance a synonym of *Hyparrhenion hirtae* Br.-Bl. *et al.* 1956, but there are ecological, physiognomic and floristic reasons to frame into an own alliance the grasslands dominated by *Ampelodesmos mauritanicus*: these latter are thermo- to supramediterranean very distinctive grasslands occurring on calcium-rich deep soils on stony slopes. They host plenty of exclusive, rare or endemic species and the vegetation structure is that of a dense tussock mat. The *Hyparrhenia*-dominated stands are, instead, infra- to mesomediterranean grasslands with a different, mostly saharo-sindic or south-Mediterranean floristic settlement. They occur on gravelly to sandy soils on a wide array of physio-chemical conditions (from acidic to markedly alkaline) and the vegetation structure is that of a tufted, discontinuous grassland.

Indicator species in Sicily: *Ampelodesmos mauritanicus, Avenula cincinnata, Dianthus graminifolius, Eryngium tricuspidatum subsp. bocconei, Gypsophila arrostii, Helminthotheca aculeata, Pimpinella anisoides, Scorzonera villosa subsp. columnae*.

Helichryso hyblaei-Ampelodesmetum mauritanici Minissale 1995
Helictotricho convoluti-Ampelodesmetum mauritanici Minissale 1995
Seselio tortuosi-Ampelodesmetum mauritanici Minissale 1995
Galio aetnici-Ampelodesmetum mauritanici Minissale 1995
Astragalo huetii-Ampelodesmetum mauritanici Minissale 1995
Astragalo monspessulani-Ampelodesmetum mauritanici Minissale 1995
Arrhenathero nebrodensis-Helictotrichetum convoluti Brullo, Scelsi, Siracusa & Tomaselli 1998
Avenulo cincinnatae-Stipetum siculae Brullo, Minissale, Siracusa & Spampinato in C. Brullo *et al.* 2010
Avenulo cincinnatae-Stipetum barbatae Brullo, Minissale, Siracusa & Spampinato in C. Brullo *et al.* 2010
Avenulo cincinnatae-Brachypodietum phoenicoidis Brullo, Minissale & Spampinato in C. Brullo *et al.* 2010

REICHARDIO MARITIMAE-DACTYLIDION HISPANICAE Biondi, Filigheddu & Farris 2001

Thermomediterranean subhalophilous perennial grasslands in wind-swept habitats on calcareous soils of the Tyrrhenian, Ionian and Aegean coasts

Indicator species in Sicily: *Brachypodium retusum, Dactylis glomerata subsp. maritima, Reichardia picroides*.

Pulicario odorae-Brachypodietum retusi Ferro & Ladero-Alvárez 1999
Helminthotheco aculeatae-Brachypodietum retusi C. Brullo, Brullo, Giusso & Tomaselli 2007
Coronillo glaucae-Brachypodietum retusi C. Brullo, Brullo, Giusso & Tomaselli 2007

**ASPHODELETALIA RAMOSI Biondi in Biondi et al. 2016

Note - The authors of this order propose a new class (*Charybdido pancratii-Asphodeletea ramosi* Biondi in Biondi *et al.* 2016) for the overgrazed wintergreen Mediterranean pastures dominated by poisonous geophytes and hemicriptophytes. This vegetation is in topographic and seral connection with the thermo-xerophilous Mediterranean perennial grasslands and the few thermophilous sub-Apenninic associations described by the same authors can be considered the northernmost, heterotopic and impoverished examples of a vegetation having its optimum in the thermomediterranean bioclimate. For these reasons, we propose to frame the *Asphodeletalia ramosi* into the class *Lygeo sparti-Stipetea tenacissimae*, even if its authonomy from *Hyparrhenietalia hirtae* remains questionable.

Indicator species in Sicily: *Asphodelus ramosus subsp. ramosus, A. fistulosus, A. tenuifolius, Charybdis pancration, Thapsia garganica, Asparagus acutifolius, Ornithogalum gussonei, Anemone hortensis, Carlina corymbosa, Hypochoeris radicata, Iris planifolia, Ferula communis, Hermodactylus tuberosus, Thapsia garganica*.

**CHARYBDIDO PANCRATII-ASPHODELION RAMOSI Biondi et al. 2016 (incl. Asphodelo ramosi-Ferulion communis Biondi et al. 2016)

Overgrazed wintergreen Mediterranean pastures dominated by poisonous geophytes and hemicriptophytes

Indicator species in Sicily: See order.

Thapsio garganicae-Feruletum communis Brullo 1984
Sanguisorbo verrucosae-Magydaretum pastinaceae Bartolo, Brullo, Minissale & Spampinato 1990
Ferulo communis-Hyparrhenietum hirtae Brullo & Siracusa 1996
Carlino siculae-Feruletum communis Gianguzzi, Ilardi & Raimondo 1996
Ferulago nodosae-Hyparrhenietum hirtae Brullo et al. 2005 ex Minissale, Sciandrello & Spampinato 2008
Cachryo siculae-Hyparrhenietum hirtae Brullo, Minissale, Siracusa & Spampinato in C. Brullo *et al.* 2010

Cachryo pungentis-Hyparrhenietum hirtae Brullo, Minissale & Sciandrello in C. Brullo *et al.* 2010
Cachryo siculae-Brachypodietum retusi Brullo, Giusso & Scuderi 2010
Thapsietum pelagicae C. Brullo & Brullo in C. Brullo *et al.* 2010

**ASPHODELION FISTULOSI Biondi *et al.* 2016

Note - Even if there are no validly published data on the occurrence of this vegetation in Sicily, assemblages which could be referred to this alliance are quite common on roadsides and old fields in the coastal thermomediterranean areas of Sicily and satellite islands.
Indicator species in Sicily: *Asphodelus fistulosus, Isatis canescens*.

POETEA BULBOSAE Rivas Goday & Rivas-Mart. in Rivas-Mart. 1978

Mediterranean and Maghrebian perennial rangelands rich in annual species, from the thermo- to the oromediterranean belts
Indicator species in Sicily: *Bellis annua subsp. microcephala, B. sylvestris, Leontodon tuberosus, Moraea sisyrinchium, Poa bulbosa*.

POETALIA BULBOSAE Rivas Goday & Rivas-Mart. in Rivas Goday & Ladero 1970

Mediterranean and Maghrebian seasonal perennial and ephemeroid pastures in the thermo- to oromediterranean belts
Indicator species in Sicily: *Erodium botrys, Herniaria glabra, Parentucellia latifolia, Paronychia argentea, Ranunculus paludosus, Romulea ramiflora, Scorpiurus vermiculatus, Taraxacum obovatum, Trifolium nigrescens, T. pallidum, T. subterraneum, T. suffocatum, T. tomentosum*.

TRIFOLIO SUBTERRANEI-PERIBALLION MINUTAE Rivas Goday 1964

Central and Western Iberian heavily grazed seasonal perennial pastures on acidic substrates in the thermo- to oromediterranean belts

Indicator species in Sicily: *Onobrychis aequidentata, Ranunculus millefoliatus, Trifolium glomeratum, Trifolium subterraneum subsp. subterraneum*.

Poo bulbosae-Trifolietum subterranei Rivas Goday 1964

*PLANTAGINION CUPANII Brullo & Grillo 1978

Note - In the original description, this alliance was framed into class *Molinio-Arrhenatheretea* and included some mesophilous meadows that, in the light of the proposal made by Di Pietro *et al*. (2015), should be framed into the alliance *Cirsio vallis-demonii-Nardion* Giacomini & Gentile ex Di Pietro & Theurillat in Di Pietro et al. 2015. Nevertheless, some of the associations traditionally ascribed to *Plantaginion cupanii* consist of trampled and overgrazed hemicryptophytic acidophilous communities, dominated by rosulate and pulvinate species. Hence, in accordance with Mucina et al. (2016), they should be framed into the class *Poetea bulbosae*. In this sense, Plantaginion cupanii can be considered a Calabrian and Sicilian supra and oro-mediterranean alliance related to flyschoid or acidic compacted soils.

Indicator species in Sicily: *Plantago cupanii, Vulpia sicula, Anthemis arvensis subsp. sphacelata, Trifolium bivonae, Crepis bivoniana, Tolpis virgata subsp. sexaristata*.

Cynosuro cristati-Plantaginetum cupanii Raimondo 1983

Armerio nebrodensi-Plantaginetum cupanii Brullo & Marcenò in Brullo 1984

HELIANTHEMETEA GUTTATI Rivas Goday & Rivas-Mart. 1963

<u>Mediterranean and submediterranean-atlantic ephemeral dry grasslands on leached or sandy substrates</u>

Indicator species in Sicily: *Acinos arvensis, Alyssum minutum, A. simplex, Arenaria conimbricensis, Arenaria leptoclados, A. serpyllifolia, Asterolinon linum-stellatum, Cerastium brachypetalum, Cerastium pumilum, C. semidecandrum, Crucianella angustifolia, Erophila verna subsp. spathulata, Filago pygmaea, Galium parisiense, Helianthemum ledifolium, H. salicifolium, Herniaria cinerea, Hippocrepis ciliata, H. multisiliquosa, Lathyrus se-*

tifolius, Leontodon hispidus, Medicago coronata, M. littoralis, M. minima, Minuartia hybrida, Petrorhagia dubia, Scleranthus annuus subsp. verticillatus, Sedum rubens, Silene colorata, S. conica, Trifolium campestre, T. stellatum, Valerianella dentata, Veronica praecox, V. verna, Vicia lathyroides.

HELIANTHEMETALIA GUTTATI Br.-Bl. in Br.-Bl. & Wagner 1940

Mediterranean and submediterranean-atlantic inland ephemeral vegetation on nutrient-poor shallow acidic soils
Indicator species in Sicily: *Aira caryophyllea subsp. caryophyllea, A. cupaniana, A. elegantissima, Andryala integrifolia, Anthoxanthum gracile, Astragalus pelecinus, Briza maxima, Briza minor, Filago lutescens, Helianthemum aegyptiacum, Hymenocarpos circinnatus, Jasione montana, Lathyrus sphaericus, Festuca bromoides, F. myuros, Filago gallica, Filago minima, Lotus conimbricensis, Micropyrum tenellum, Moenchia erecta, Molineriella minuta, Ornithopus compressus, Psilurus incurvus, Rumex bucephalophorus, Teesdalia nudicaulis, Trifolium arvense, T. striatum, T. strictum, Tuberaria guttata*.

HELIANTHEMION GUTTATI Br.-Bl in Br.-Bl. & Wagner 1940

Thermo- to supramediterranean annual dry grasslands on nutrient-poor sandy soils of the central-western Mediterranean
Indicator species in Sicily: *Aira tenorei, Airopsis tenella, Corynephorus divaricatus, Festuca muralis, Galium divaricatum, Helianthemum sanguineum, Hypochaeris glabra, Linum trigynum, Onobrychis caput-galli, Ornithopus pinnatus, Paronychia echinulata, Plantago bellardii, Sedum caespitosum, Teesdalia coronopifolia, Tolpis umbellata*.

Trifolio dolichodonti-Andryaletum cosyrensis Brullo, Di Martino & Marcenò 1977
Tolpidetum grandiflorae Brullo & Furnari in Barbagallo et al. 1982
Bupleuro semicompositi-Tuberarietum guttatae Bartolo, Brullo & Marcenò 1982
Tuberario guttatae-Aphanetum microcarpae Barbagallo, Brullo & Signorello 1983
Tuberario guttatae-Senecionetum lividi Barbagallo, Brullo & Signorello 1983

Coleostephomyconidi-Trisetarietumaureae Brullo, Minissale, Scelsi & Spampinato 1993
Tuberarioguttatae-Anemonetumpalmatae Brullo, Scelsi & Siracusa 1994
Trifolio bocconei-Tuberarietum guttatae Brullo et al. 1998
Lotoconimbricensis-Tuberarietumplantagineae Sciandrello, D'Agostino & Minissale 2013

**CRASSULO TILLAEAE-SEDION CAESPITOSI de Foucault 1999

Ephemeral microphytic vegetation with succulent plants on seasonally wet sandy or loamy debris on horizontal rocky layers
Indicator species in Sicily: *S. andegavense, Sedum caespitosum, S. hispanicum, Tillaea alata, T. basaltica, T. campestris T. muscosa*.

Crassulo tillaeae-Erodietum botrytis Ferro & Furnari 1970
Crassulo tillaeae-Sedetum cossyrensis Brullo, Di Martino & Marcenò 1977
Radiolo linoidis-Kickxietum cirrhosae Brullo, Di Martino & Marcenò 1977
Bellidoannuae-Solenopsidetumlaurentiae Brullo, Scelsi & Siracusa 1994
Herniariocinereae-Crassuletumtilleae Brullo, Scelsi & Siracusa 1994
Rumicibucephalophori-Ophioglossetumlusitanici Médail, Pavon, Lo Cascio & Pasta 2016

*VULPIETALIA Pignatti 1953

Mediterranean and Ibero-Atlantic ephemeral therophytic vegetation on coastal sand dunes under influence of salt spray
Indicator species in Sicily: *Cutandia maritima, Chamaemelum fuscatum, Coronilla repanda, Corynephorus articulatus, Erodium chium, Festuca membranacea, Lotus hispidus, Ononis diffusa, O. serrata*.

ALKANNO-MARESION NANAE Rivas Goday in Rivas Goday & Rivas-Mart. 1963 *corr*. Díez Garretas *et al*. 2001

Central-western-Mediterranean ephemeral therophytic vegetation on coastal dunes, under salt-spray influence

Indicator species in Sicily: *Cutandia divaricata, Malcolmia ramosissima, Maresia nana, Muscari gussonei, Ononis variegata, Pycnocomon rutifolium, Rostraria litorea, Romulea rollii, R. melitensis, Wahlenbergia nutabunda*.

Vulpio membranaceae-Leopoldietum gussonei Brullo & Marcenò 1974
Scabiosetum rutifoliae Brullo, Di Martino & Marcenò 1974
Onobrychido caput-galli-Cerastietum gussonei Brullo & Grillo 1986
Anthemido tomentosae-Centaureetum conocephalae Brullo & Grillo 1986
**Malcomio africanae-Wahlenbergietum nutabundae* Brullo & Grillo 1986 *nom. mut. propos.*
Loto peregrini-Ononidetum serratae Brullo & Grillo 1986
Sileno coloratae-Ononidetum variegatae Géhu & Géhu-Franck 1986
Sileno nicaeensis-Chamaemeletum mixti Brullo in Brullo *et al.* 1988
Cutandio maritimae-Parapholietum marginatae S. Bartolo, Brullo, Minissale & Spampinato 1990
Bupleuro gracili-Ononidetum reclinatae Brullo, Scelsi & Siracusa 1994
Vulpio membranaceae-Cutandietum divaricatae Brullo & Scelsi 1998
Vulpio membranaceae-Romuleetum rollii Brullo & Scelsi 1998
Vulpio membranaceae-Hormuzakietum aggregatae Brullo, Guarino & Ronsisvalle 2000
Centrantho calcitrapae-Catapodietum hemipoae Brullo, Guarino & Ronsisvalle 2000

MALCOLMIETALIA Rivas Goday 1958

Mediterranean ephemeral therophytic vegetation on near-coastal and inland deep sandy soils outside the salt-spray influence

Indicator species in Sicily: *Agrostis tenerrima, Avellinia festucoides, Echium arenarium, Filago asterisciflora, Lagurus ovatus subsp. nanus, Loeflingia hispanica, Nonea vesicaria, Sulla spinosissima*.

FILAGINI ASTERISCIFLORAE-LINARION HUMILIS Minissale & Sciandrello 2015

Thermomediterranean ephemeral therophytic vegetation on fossil dunes of Southern Sicily

Indicator species in Sicily: *Linaria multicaulis subsp. humilis, Senecio glaucus subsp. hyblaeus, Tuberaria villosissima var. sicula, Tuberaria praecox*.

***Filago asterisciflorae-Tuberarietum siculae* Brullo & Grillo 1986 *corr.*
Alkanno tinctoriae-Noneetum vesicariae Brullo & Scelsi 1998
Filagini asterisciflorae-Loeflingietum hispanicae Minissale & Sciandrello 2015
Rostrario litoreae-Tuberarietum villosissimae Minissale & Sciandrello 2015
Astragalo kamarinensis-Coronilletum repandae Minissale & Sciandrello 2015

STIPO-TRACHYNIETEA DISTACHYAE Brullo in Brullo, Scelsi & Spampinato 2001

Mediterranean annual dry grasslands on alkaline substrates
Indicator species in Sicily: *Anisantha rubens, Asterolinon linum-stellatum, Campanula erinus, Crupina crupinastrum, Euphorbia falcata, Filago pygmaea, Filago pyramidata, Hedypnois rhagadioloides, Herniaria cinerea, Hippocrepis ciliata, Hymenocarpus circinnatus, Hyoseris scabra, Lathyrus sphaericus, Linaria simplex, Linum corymbulosum, L. decumbens, L. strictum, Lotus edulis, Medicago minima, Minuartia mediterranea, Neatostema apulum, Onobrychis caput-galli, Ononis reclinata, Parentucellia latifolia, Romulea columnae, Sagina apetala, Saxifraga tridactylites, Sedum caeruleum, S. caespitosum, S. rubens, Sideritis romana, Silene nocturna, S. neglecta, Stipellula capensis, Trachynia distachya, Trifolium angustifolium, T. scabrum, T. stellatum, Tripodion tetraphyllum, Valantia muralis*.

BRACHYPODIETALIA DISTACHYI Rivas-Mart. 1978

Central and Western Mediterranean ephemeral winter pastures on shallow sandy and loamy soils overlaying limestone, dolomite and gypsum outcrops
Indicator species in Sicily: *Arenaria leptoclados, Catapodium rigidum, Hypochaeris achyrophorus, Medicago minima, Minuartia mediterranea, Plantago afra, Polygala monspeliaca*.

**STIPION RETORTAE O. de Bolòs 1957

Central and Western Mediterranean annual dry grasslands and winter rangelands on alkaline loamy and clayey substrates
Indicator species in Sicily: *Asteriscus aquaticus, Bellis annua, Anisantha fasciculata, Echium parviflorum, Filago eriocephala, Moraea sisyrinchium, Lagurus ovatus, Matricaria aurea, Medicago littoralis, Ononis sieberi, Paronychia argentea, Plantago coronopus, Trigonella maritima*.

***Trigonello monspeliacae-Stipetum capensis* Tomaselli 1999
**Ononido breviflorae-Stipetum capensis* Brullo, Guarino & Ronsisvalle 2000

SEDO-CTENOPSION GYPSOPHILAE Rivas Goday & Rivas-Mart. ex Izco 1974

Note - Central and Western Mediterranean annual dry grasslands on gypsum-rich substrates. Mucina *et al*. (2016) state that this vegetation is restricted to the Iberian Peninsula. The possibility to include the gypsophylous annual assemblages of Sicily in a separate alliance could be considered.

Indicator species in Sicily: *Sedum gypsicola, Chaenorhinum rubrifolium, Erodium laciniatum, Festuca gypsophila*.

Filagini eriocephalae-Chaenorhinetum rubrifolii Brullo, Marcenò, Minissale & Spampinato 1989

TRACHYNION DISTACHYAE Rivas-Mart. 1978

<u>Central-Western Mediterranean annual dry grasslands on shallow skeletal base-rich soils</u>

Indicator species in Sicily: *Astragalus sesameus, Euphorbia exigua, Medicago polymorpha, M. rigidula, Melilotus neapolitanus, Sagina apetala, Trisetaria aurea*.

Vulpio ciliatae-Trisetarietum aureae Brullo 1975
Thero-Sedetum caerulei Brullo 1975
Astragalo sesamei-Medicaginetum rectae Sciandrello, D'Agostino & Minissale 2013

†ONOBRYCHIDO-PTILOSTEMONION STELLATI Brullo, Scelsi & Spampinato 2001

Note - According to the original description, this alliance should include markedly thermo-xerophilous annual dry grasslands on base-rich clayey, marly, conglomeratic to sandy soils in the Thermomediterranean bioclimate. Even if Brullo *et al*. (2001) state that representatives of this alliance are found from southern Calabria to NE Sicily, no published data about these communities are so far known from the island. It has to be noted that, in the original description, this alliance was framed within the *Stipo-Bupleuretalia semicompositi*, whereas Mucina *et al.* (2016) moved it into the *Brachypodietalia distachyi*. As a matter of fact, this alliance is weakly characterized by a pool of wide ranging species (such as *Crucianella angustifolia, Hippocrepis ciliata, Melilotus neapolitanus, Onobrychis caput-galli*). Moreover, all the Sicilian populations of *Ptilostemon stellatus* occur in the submontane belt under relatively mesic conditions. Therefore, the alliance at issue could be considered a synonym of *Trachynion distachyae*.

STIPO-BUPLEURETALIA SEMICOMPOSITI Brullo in Brullo, Scelsi & Spampinato 2001

Southern Mediterranean xerophilous and subhalophilous therophytic swards

Indicator species in Sicily: *Asteriscus aquaticus, Atractylis cancellata, Bupleurum semicompositum, Catapodium zwierleinii, Convolvulus lineatus, Desmazeria sicula, Echinaria capitata, Eryngium dichotomum, Herniaria cinerea, Hippocrepis biflora, Reichardia intermedia, R. tingitana, Scorzonera undulata subsp. deliciosa*.

*PLANTAGINI-CATAPODION BALEARICI Brullo 1985 nom. mut. propos.

Tyrrhenian subhalophilous xerophilous therophytic swards

Indicator species in Sicily: see order

Anthemido secundirameae-Desmazerietum siculae Brullo 1985
Filagini cossyrensi-Daucetum lopadusani Brullo 1985
Sileno sedoidis-Bellietum minuti Brullo 1985
Oglifetum lojaconoi Brullo 1985
Plantagini zwierleinii-Erodietum linosae Brullo 1985
Sedo litorei-Valantietum calvae Brullo 1985
**Catapodio balearici-Sedetum litorei* Bartolo, Brullo, Minissale & Spampinato 1990 *nom. mut. propos.*

Paronychio longisetae-Crassuletum tillaeae Bartolo, Brullo, Minissale & Spampinato 1990
Desmazerio pignattii-Senecionetum pygmaei Brullo & Scelsi 1998
Atractylido cancellatae-Neatostemetum apuli Brullo, Scelsi & Siracusa 1994
**Catapodio balearici-Valantietum intricatae* Brullo & Siracusa 1996 *nom. mut. propos.*
Anthemido secundirameae-Allietum lehmannii Brullo & Scelsi 1998
Onobrychido caput-galli-Psiluretum incurvi Brullo & Scelsi 1998
Echinarietum todaroanae Brullo, Scelsi, Siracusa & Tomaselli 1998
Podospermo cani-Plantaginetum deflexae Brullo, Guarino & Ronsisvalle 2000
Parapholido incurvae-Asphodeletum tenuifolii Brullo, Guarino & Ronsisvalle 2000
Sagino maritimae-Crassuletum tillaeae Ferro & Furnari 1970 ex Brullo, Guarino & Ronsisvalle 2000

PEGANO HARMALAE-SALSOLETEA VERMICULATE Br.-Bl. & O. de Bolòs 1958

<u>Mediterranean and Macaronesian semi-desertic halo-nitrophilous scrub in hyperarid coastal habitats</u>
Indicator species in Sicily: *Asparagus horridus, Lycium intricatum, Atriplex halimus, Capparis sicula, Moricandia arvensis*.

SALSOLO VERMICULATAE-PEGANETALIA HARMALAE Br.-Bl. & O. de Bolòs 1954

<u>Mediterranean halo-nitrophilous scrub of semi-desertic inland regions and hyperarid seaboards</u>
Indicator species in Sicily: see class.

SALSOLO OPPOSITIFOLIAE-SUAEDION FRUTICOSAE Rigual 1972

<u>Infra and thermomediterranean halo-nitrophilous scrub on clayey soils of arid regions of the Western Mediterranean and the southern regions of the Central Mediterranean</u>

Indicator species in Sicily: *Salsola oppositifolia, Salsola vermiculata, Suaeda vera.*

Limonio opulenti-Salsoletum oppositifoliae Brullo, Grillo & Scalia 1980
Limonio catanzaroi-Salsoletum oppositifoliae Brullo, Guglielmo & Pavone 1986
Salsoletum agrigentinae Brullo, Guglielmo & Pavone 1986
Salsolo oppositifoliae-Suaedetum pelagicae Bartolo, Brullo, Minissale & Spampinato 1990
Suaedo verae-Limoniastretum monopetali Bartolo, Brullo, Minissale & Spampinato 1990
Halimiono portulacoidis-Salsoletum oppositifoliae Brullo, Guarino & Ronsisvalle 2000
Asparago albi-Salsoletum oppositifoliae Brullo et al. 2012
Atriplici halimi-Halimionietum portulacoidis Brullo et al. 2012
Capparido siculae-Salsoletum oppositifoliae Brullo et al. 2012
Limonio calcarae-Suaedetum verae Brullo et al. 2012
Thapsio pelagicae-Salsoletum oppositifoliae Brullo et al. 2012

ARTEMISION ARBORESCENTIS Géhu & Biondi in Géhu *et al.* 1986

Thermo-mesomediterranean subnitrophilous coastal scrub of the Southern Apennine Peninsula and Sicily

Indicator species in Sicily: *Artemisia arborescens, Anagyris foetida* (diff.).

Atriplici halimi-Artemisietum arborescentis Biondi 1988
Coronillo valentinae-Artemisietum arborescentis Brullo et al. 2012
Limonio optimae-Salsoletum oppositifoliae Brullo et al. 2012
Lycio europaei-Artemisietum arborescentis Brullo et al. 2012
Lycio intricati-Salsoletum oppositifoliae Brullo et al. 2012
Medicagini arboreae-Salsoletum oppositifoliae Brullo *et al.* 2012

**NICOTIANO GLAUCAE-RICINETALIA COMMUNIS Rivas-Mart., Fernández-González & Loidi 1999

Infra-mesomediterranean halo-nitrophilous chamaephytic scrub

Indicator species in Sicily: *Datura innoxia, Medicago arborea, Nicotiana glauca, Ricinus communis, Parkinsonia aculeata, Solanum torvum, S. sodomaeum, Withania somnifera.*

**NICOTIANO GLAUCAE-RICINION COMMUNIS Rivas-Mart., Fernández-González & Loidi 1999

Indicator species in Sicily: see order
Note - Mediterranean and Canarian infra-thermomediterranean arid neophyte-dominated tall scrub. Even if there are no published data on the occurrence of this vegetation in Sicily, consortia of fast-growing pioneer thermoxerophilous tall neophytes are very common all over the thermomediterranean Sicily, especially in suburban man-made ecosystems.

RUMICI-ASTRAGALETEA SICULI Pignatti & Nimis in Pignatti-Wikus *et al.* 1980

Sicilian and Calabrian hemicryptophytic and chaemaephytic thorny cushion oromediterranean vegetation
Indicator species in Sicily: *Arabis rosea, Bellardiochloa variegata, Bunium petraeum, Carlina nebrodensis, Centaurea parlatoris, Cerastium tomentosum, Clinopodium alpinum subsp. aetnensis, Galium aetnicum, Herniaria nebrodensis, Pilosella hoppeana subsp. macrantha, Petrorhagia saxifraga subsp. gasparrinii, Rumex acetosella subsp. angiocarpus, Saponaria sicula, Scleranthus marginatus, Silene sicula, Tragopogon crocifolius subsp. nebrodensis, Valeriana tuberosa.*

RUMICI-ASTRAGALETALIA SICULI Pignatti & Nimis in Pignatti-Wikus *et al.* 1980

Upper meso- to oromediterranean xeric scrub on siliceous volcanic substrates of Sicily
Indicator species in Sicily: *Anthemis aetnensis, Astragalus siculus, Bellardiochloa variegata subsp. aetnensis, Centaurea giardinae, Erysimum etnense, Hypochaeris robertia, Rumex aetnensis, Senecio aetnensis, S. chrysanthemifolius, Tanacetum vulgare subsp. siculum, Viola aethnensis subsp. aetnensis.*

RUMICI-ASTRAGALION SICULI Poli 1965

Oromediterranean xeric pulvinate scrub on siliceous volcanic substrates of Etna (Sicily)
Indicator species in Sicily: see order.

Senecioni glabri-Anthemidetum aetnensis Frei 1940
Festuco circummediterraneae-Bellardiochloetum aetnensis Frei 1940 *nom. mut. propos.*
Astragaletum siculi (Frei 1940) Gilli 1943
Phleo ambigui-Secaletum stricti Siracusa 1998
Festuco circummediterraneae-Populetum tremulae Brullo & Siracusa 2005
Cerastio tomentosi-Hieracietum pallidi Brullo & Siracusa 2005

ARMERION NEBRODENSIS Brullo 1984

Upper meso-oromediterranean silicicolous pulvinate scrub and related grasslands of Madonie Mts. (Sicily)
Indicator species in Sicily: *Armeria nebrodensis, Genista cupanii, Avenella flexuosa*.

Genistetum cupanii Pignatti & Nimis in Pignatti-Wikus *et al.* 1980
Note - This association, designating the supra- and oromediterranean vegetation dominated by *Genista cupanii*, growing on quartzitic arenaceous substrata of Madonie, has been recently framed into the class *Lavanduletalia stoechadis* (alliance: *Calicotomo villosae-Genistion tyrrhenae* Biondi 1997) and re-designated as *Carlino nebrodensis-Genistetum cupanii* Pignatti & Nimis corr. Gianguzzi, Cusimano, Ilardi & Romano 2015. Here it is preferred to respect the original syntaxonomical framework.
Plantagini humili-Armerietum nebrodensis Pignatti & Nimis in Pignatti-Wikus *et al.* 1980

ERYSIMO-JURINEETALIA BOCCONEI Brullo 1984

Note - In the original description, this order includes the xeric calcicolous hemicrypto- chaemaephytic oromediterranean vegetation of the Madonie massif in Northern Sicily. Mucina *et al.* (2016) include this order within the class *Festuco hystricis-Ononideteastriatae* Rivas-Mart. *et al.* 2002. Owing to the rich number of local endemites, as well as to the remarkable regional floristic affinities between the acidophilous and basiphilous assemblages of the oro-mediterranean vegetation of Sicilian and Calabrian high mountains, it is questionable to separate this vegetation in two different classes. Moreover, the number of local endemites is higher in the carbonatic part of Madonie

mountains than in any other high mountain ecosystem of Sicily, so the opportunity to include the Sicilian basiphilous oromediterranean vegetation into an Iberian class and to keep the Calabrian-Sicilian silicicolous oromediterranean vegetation into an autonomous class is unacceptable from the biogeographic and phylogenetic viewpoint. Nearly all the Etnean oromediterranean endemites have their closest relatives on the Madonie Mts. and clearly derived from a recent adaptive radiation. Some edaphic indifferent species occur in both Madonie and Etna (this is the case of: *Bellardiochloa violacea, Carlina nebrodensis, Centaurea parlatoris, Cerastium tomentosum, Galium aetnicum, Herniaria nebrodensis, Petrorhagia saxifraga subsp. gasparrinii and Saponaria sicula*). Instead, none of the character species of *Festuco hystricis-Ononidetea striatae* occurs on the Sicilian and Calabrian high mountains.
Indicator species in Sicily: *Allium cupanii, Asperula cynanchica var. canescens, Bunium petraeum, Dianthus arrostii, Clinopodium alpinum subsp. nebrodensis, Erysimum bonannianum, Galium bernardii, Helianthemum croceum, Jurinea bocconei, Minuartia verna subsp. kabylica, Polycarpon polycarpoides, Bellardiochloa variegata subsp. nebrodensis, Lomelosia crenata, Trisetaria flavescens subsp. splendens*.

CERASTIO-ASTRAGALION NEBRODENSIS Pignatti & Nimis in Pignatti-Wikus *et al.* *ex* Brullo 1984

<u>Oromediterranean xeric open calciphilous grasslands on rocky soils of Sicily (Madonie Mts.)</u>
Indicator species in Sicily: *Astragalus nebrodensis, Alyssum nebrodense, Avenula cincinnata, Cachrys ferulacea, Colchicum triphyllum, Euphorbia myrsinites, Helianthemum cinereum subsp. rotundifolium, Knautia calycina, Inula montana, Linum punctatum, Onosma canescens, Petrorhagia saxifraga subsp. gasparrinii, Pimpinella tragium subsp. glauca, Polycarpon polycarpoides, Sesleria nitida subsp. sicula, Sideritis sicula, Viola nebrodensis*.

Astragaletum nebrodensis Pignatti & Nimis in Pignatti-Wikus *et al.* 1980
Cachryetum ferulaceae Raimondo 1983
Lino punctati-Seslieretum siculae Pignatti & Nimis in Pignatti-Wikus *et al.* 1980 em. Brullo 1984
Carduncello pinnati-Thymetum spinulosi Brullo & Marcenò in Brullo 1984
Siderito siculae-Artemisietum albae (Raimondo 1983) Brullo & Giusso 2005

Seslerio siculae-Melicetum cupanii Brullo & Giusso 2005
**Siculosciadetum nebrodensis* Brullo & Giusso 2005 *nom. mut. propos.*
Seslerio siculae-Helictotrichetum convolutae Brullo & Cormaci 2005
Festuco rubrae-Seslerietum siculae Brullo & Cormaci 2005
Helichryso-Onosmetum canescentis Brullo & Guarino 2005
**Plantagini humilis-Asperuletum peloritanae* Brullo & Guarino 2005 *corr.*

ALNO GLUTINOSAE-POPULETEA ALBAE P. Fukarek & Fabijanić 1968

Riparian gallery forests of the Eurosiberian and Mediterranean regions
Indicator species in Sicily: *Alnus glutinosa, Arum italicum, Carex pendula, C. remota, Equisetum telmateia, Ficus carica, Fraxinus angustifolia, Hypericum hircinum subsp. majus, Populus alba, P. nigra, Salix alba, S. pedicellata, Sambucus nigra, Solanum dulcamara, Symphytum bulbosum, Tamus communis, Ulmus minor, Vinca minor, Vitis vinifera subsp. sylvestris*.

POPULETALIA ALBAE Br.-Bl. ex Tchou 1949

Mediterranean and submediterranean riparian gallery forests
Indicator species in Sicily: see class.

POPULION ALBAE Br.-Bl. ex Tchou 1949

Riparian forests of the submediterranean regions of Southern France and the Iberian Peninsula
Indicator species in Sicily: see class.

Roso sempervirentis-Populetum nigrae Pedrotti & Gafta 1992

PLATANION ORIENTALIS I. Kárpáti & V. Kárpáti 1961

Platanus riparian gallery forests of the Eastern Mediterranean
Indicator species in Sicily: *Platanus orientalis, Melissa romana, Daucus carota subsp. maximus, Myrtus communis, Rosa sempervirens, Salix gussonei.*

Platano orientalis-Salicetum pedicellatae Barbagallo, Brullo & Fagotto 1979
Platano orientalis-Salicetum gussonei Brullo & Spampinato 1991

OSMUNDO-ALNION GLUTINOSAE (Br.-Bl., P. Silva & Rozeira 1956) Dierschke & Rivas-Mart. in Rivas-Mart. 1975

Alder and willow riparian forests of the Western Mediterranean
Indicator species in Sicily: *Osmunda regalis, Athyrium filix-femina, Lonicera periclymenum.*

Osmundo regalis-Salicetum pedicellatae Brullo & Spampinato 1991

SALICETEA PURPUREAE Moor 1958

Eurasian hygrophilous pioneer scrub and low open forests of riverbeds, riverbanks and braided streams
Indicator species in Sicily: *Salix purpurea subsp. lambertiana*.

SALICETALIA PURPUREAE Moor 1958

Willow scrub and low open forests of riparian habitats in the temperate to arctic zones of Europe
Indicator species in Sicily: see class.

SALICION ALBAE Soó 1951

Willow and poplar low open forests of lowland to submontane river alluvia in the nemoral zone of Europe and at high altitudes of the Mediterranean
Indicator species in Sicily: *Salix alba subsp. vitellina, Saponaria officinalis*.

Salicetum albo-purpureae (I. Karpáti & V. Karpáti 1961) Barbagallo, Brullo & Fagotto 1979

SALICION PEDICELLATAE Rivas-Mart. *et al.* 1984

Southern Iberian, Maghrebian and Calabro-Sicilian thermo- to supramediterranean riparian alluvial willow scrub on the alluvia of mineral-poor rivers
Indicator species in Sicily: *Salix pedicellata, Ulmus canescens*.

Salicetum albo-pedicellatae Brullo & Spampinato 1991
Ulmo canescentis-Salicetum pedicillatae Brullo & Spampinato 1991
Agropyro panormitani-Salicetum pedicellatae Brullo & Spampinato 1991

SAGINETEA MARITIMAE Westhoff, van Leeuwen & Adriani 1962

Atlantic and Mediterranean halo-subnitrophilous ephemeral vegetation on clayey or loamy substrates, seasonally wet

Indicator species in Sicily: *Bellis annua, Bupleurum semicompositum var. glaucum, Catapodium balearicum, C. pauciflorum, Frankenia pulverulenta, Galium verrucosum subsp. halophilum, Juncus hybridus, Hordeum marinum, Hornungia procumbens subsp. revelierei, Parapholis incurva, Plantago coronopus subsp. humilis, Polypogon monspeliensis, P. subspathaceus, Sagina maritima, Senecio leucanthemifolius subsp. crassifolius and subsp. mauritanicus, Spergularia maritima, Spergularia salina, Sphenopus divaricatus*.

FRANKENIETALIA PULVERULENTAE Rivas-Mart. *ex* Castroviejo & Porta 1976

Ephemeral vegetation on clayey and silty saline soils of the Mediterranean and Macaronesia

Indicator species in Sicily: see class.

FRANKENION PULVERULENTAE Rivas-Mart. *ex* Castroviejo & Porta 1976 (incl. Polypogonion subspathacei Gamisans 1992)

Ephemeral vegetation on clayey saline soils of the Western Mediterranean

Indicator species in Sicily: see class.

- *Parapholido incurvae-Frankenietum pulverulentae* Rivas-Mart. *ex* Castroviejo & Porta 1976
- *Isolepido cernuae-Saginetum maritimae* Brullo in Brullo *et al.* 1988
- *Parapholidetum filiformis* Brullo, Scelsi & Siracusa 1994
- *Frankenio pulverulentae-Anthemidetum secundirameae* Brullo & Scelsi 1998
- *Frankenio pulverulentae-Spergularietum bocconei* Brullo & Scelsi 1998
- *Desmazerio pignattii-Senecionetum pygmaei* Brullo & Scelsi 1998
- *Hordeo maritimi-Spergularietum salinae* Sciandrello 2005
- *Sphenopo divaricati-Spergularietum maritimae* Sciandrello 2007
- *Polypogonetum subspathacei* Gamisans 1992

LIMONION AVEI Brullo in Brullo *et al.* 1988

Note - Ephemeral aerohaline vegetation on fine-grained soils of the Central and Eastern Mediterranean seaboards. This alliance is considered by Mucina *et al.* (2016) a synonym of *Pholiuro-Spergularion* Pignatti 1952. This synonymization is unclear for two reasons: (1) on its turn, in the same paper (Mucina *et al.* 2016) the *Pholiuro-Spergularion* is listed among the synonyms of *Junco ranarii-Plantaginion commutatae* Horvatić 1934; (2) *Limonium avei* is a south-Mediterranean species, whose ecological context is quite different, in terms of salinity and climate, from that of the North-Adriatic coasts, where the Pignatti's alliance was described.

Indicator species in Sicily: *Limonium avei, Parapholis marginata*.

Spergulario rubrae-Limonietum avei Brullo & Di Martino 1974 *corr.* Brullo in Brullo *et al.* 1988

**Limonio avei-Hornungietum procumbentis* Brullo, Scelsi & Siracusa 1994 *nom. mut. propos.*

Limonio avei-Parapholideum marginatae Brullo, Scelsi & Siracusa 1994

GAUDINIO FRAGILIS-PODOSPERMION CANI Brullo & Siracusa 2000

<u>Ephemeral vegetation on clayey saline soils of the Siculo-Calabrian badlands</u>

Indicator species in Sicily: *Chamaemelum fuscatum, Gaudinia fragilis, Parapholis pycnantha, Podospermum canum, Romulea ramiflora*.

Podospermo cani-Parapholidetum pycnanthae Brullo & Siracusa 2000

Chamaemelo fuscati-Leontodontetum muelleri Brullo & Siracusa 2000

Sphenopo divaricati-Spergularietum diandrae Brullo & Siracusa 2000

MESEMBRYANTHEMION CRYSTALLINI Rivas-Mart. *et al.* 1993

<u>Ephemeral Western Mediterranean and Macaronesian subhalophilous alien succulent therophytic vegetation</u>

Indicator species in Sicily: *Beta macrocarpa, Heliotropium curassavicum, Mesembryanthemum crystallinum, M. nodiflorum*.

Mesembryanthemetum crystallino-nodiflori O. de Bolòs 1957
Mesembryanthemetum crystallini Sunding 1972
Mesembryanthemo crystallini-Paronychietum argenteae Brullo & Siracusa 1996
Mesembryanthemo crystallini-Hyoscyametum albi Brullo & Siracusa 1996

CRITHMO-STATICETEA Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Rupicolous vegetation of salt-sprayed coastal cliffs of the Atlantic and Mediterranean seaboards of Europe, North Africa and Middle East
Indicator species in Sicily: *Allium commutatum, Anthemis secundiramea, Crithmum maritimum, Daucus gingidium, Daucus carota subsp. drepanensis, Frankenia hirsuta, Jacobaea maritima, Limbarda crithmoides, Limonium virgatum, Lotus cytisoides, Plantago macrorhiza, Silene sedoides*.

CRITHMO-STATICETALIA Molinier 1934

Rupicolous vegetation of salt-sprayed cliffs of the Atlantic and Mediterranean coasts of Europe, North Africa and Middle East
Indicator species in Sicily: see class.

CRITHMO-STATICION Molinier 1934

Rupicolous dwarf-herb vegetation of salt-sprayed limestone cliffs of the Tyrrhenian and Ligurian coasts
Indicator species in Sicily: see class.

Limonietum cosyrensis Brullo, Di Martino & Marcenò 1977
Limonietum secundiramei Brullo, Di Martino & Marcenò 1977
Limonietum bocconei Barbagallo, Brullo & Guglielmo 1979
Asparago stipulari-Limoniastretum monopetali Bartolo, Brullo & Marcenò 1982
Limonietum hyblaei Bartolo, Brullo & Marcenò 1982
Limonietum syracusani Bartolo, Brullo & Marcenò 1982
Limonietum tenuiculi Brullo & Marcenò 1982

Limonietum minutiflori Barbagallo, Brullo & Signorello 1983
Crithmo maritimi-Limonietum virgati Géhu *et al.* 1992
Limonietum algusae Bartolo & Brullo 1993
Limonietum flagellaris Bartolo & Brullo 1993
Limonietum jonici Bartolo & Brullo 1993
Limonietum pavoniani Bartolo & Brullo 1993
Limonietum selinuntini Bartolo & Brullo 1993
Limonietum tauromenitani Bartolo & Brullo 1993
Crithmo maritimi-Limonietum melancholici Brullo, Marcenò & Romano 1997
Hyoseridetum taurinae Brullo, Minissale, Siracusa & Spampinato 1997

HELICHRYSETALIA ITALICI Biondi & Géhu in Géhu & Biondi 1994

Sub-aerohaline coastal dwarf scrub on inland edges of saltsprayed cliffs of the Mediterranean seaboards
Indicator species in Sicily: *Camphorosma monspeliaca, Dactylis glomerata subsp. hackelii, Lotus cytisoides, Pallenis maritima, Reichardia picroides var. maritima, Sonchus asper subsp. glaucescens, Thymelaea hirsuta, T. tartonraira.*

CRUCIANELLION RUPESTRIS Brullo & Furnari 1990

Subaerohaline dwarf scrub on salt-sprayed cliffs of the European and North African coasts of the Lybian Sea
Indicator species in Sicily: *Crucianella rupestris, Hypericum aegypticum, Cichorium spinosum, Frankenia hirsuta subsp. revoluta*.

Triadenio aegyptiacae-Chiliadenetum lopadusani Bartolo, Brullo, Minissale & Spampinato 1990
Limonietum lopadusani Bartolo, Brullo, Minissale & Spampinato 1990
Limonietum albidi Bartolo & Brullo 1993
Limonietum mazarae Bartolo & Brullo 1993

ANTHYLLIDION BARBAE-JOVIS Brullo & De Marco 1989

Subaerohaline coastal dwarf scrub on salt-sprayed cliffs of the eastern Tyrrhenian Sea

Indicator species in Sicily: *Anthyllis barba-jovis, Matthiola incana* (subsp. pulchella and subsp. rupestris)

Matthiolo pulchellae-Helichrysetum errerae Brullo, Di Martino & Marcenò 1977

Thymelaeo hirsutae-Helichrysetum conglobati Bartolo, Brullo & Marcenò 1982 *corr.* Minissale et al. 2011

Senecioni cinerariae-Helichrysetum messeriae Brullo & Marcenò 1983

Senecioni bicoloris-Helichrysetum litorei Barbagallo, Brullo & Signorello 1983

Anthyllido barbae-jovis-Erucastretum virgati Brullo & Minissale 1987

Senecioni bicoloris-Lycietum intricati Brullo & Siracusa 1996

Limbardo crithmoidis-Dianthetum rupicolae Minissale, Santo & Sciandrello 2011

CAKILETEA MARITIMAE Tx. & Preising in Br.-Br. & Tx. 1952

Pioneer halo-nitrophilous short-lived vegetation in strandlines of sandy and shingle beaches of the coasts of the North Atlantic and Arctic Oceans, the Mediterranean and the Black Sea

Indicator species in Sicily: *Atriplex prostrata subsp. latifolia and subsp. triangularis), Beta vulgaris subsp. maritima, Cakile maritima, Euphorbia peplis, Glaucium flavum, Kali tragus, Kali turgidum, Xanthium strumarium subsp. italicum*.

THERO-ATRIPLICETALIA Pignatti 1953

Pioneer halo-nitrophilous strandline vegetation of the CantabroAtlantic, the Mediterranean and the Black Sea coasts

Indicator species in Sicily: see class.

EUPHORBION PEPLIDIS Tx. *ex* Oberd. 1952

Pioneer halo-nitrophilous strandline vegetation of the CantabroAtlantic and the Mediterranean coasts

Indicator species in Sicily: see class.

Salsolo kali-Euphorbietum paraliae Pignatti 1952

Cakilo maritimae-Xanthietum italici Pignatti 1953

Atriplicetum hastato-tornabenii O. de Bolós 1962
Glaucio flavi-Matthioletum tricuspidatae Blasi, Fascetti, Veri & Bruno 1983
Salsolo kali-Cakiletum maritimae Costa & Mansanet 1981 *corr.* Rivas-Mart., Costa & Loidi 1992
Salsolo kali-Euphorbietum peplis Géhu *et al.* 1984

AMMOPHILETEA Br.-Bl. & Tx. ex Westhoff, Dijk & Passchier 1946

Tall-grass perennial swards on mobile coastal dunes of the seaboards of Europe, North America, Greenland, North Africa, Middle East and the Caspian Sea
Indicator species in Sicily: *Euphorbia terracina, Launaea fragilis, Lotus creticus, Ononis variegata, Pancratium maritimum, Polygonum maritimum, Pseudorlaya pumila, Scolymus hispanicus, Seseli tortuosum var. maritimum, Silene nicaeensis, Sonchus bulbosus, Sporobolus virginicus.*

AMMOPHILETALIA Br.-Bl. & Tx. ex Westhoff, Dijk & Passchier 1946

Tall-grass perennial swards on mobile white and embryonic coastal dunes of the warm-temperate to boreo-atlantic coasts of the Mediterranean and the Black and Caspian Seas
Indicator species in Sicily: *Achillea maritima, Ammophila arenaria subsp. arundinacea, Calystegia soldanella, Cyperus capitatus, Echinophora spinosa, Elytrigia juncea, Eryngium maritimum, Euphorbia paralias, Medicago marina, Otanthus maritimus, Pancratium maritimum.*

AMMOPHILION Br.-Bl. 1921

Tall-grass perennial swards on mobile white and embryonic coastal sand dunes of the Mediterranean
Indicator species in Sicily: see order

Cypero mucronati-Agropyretum juncei (Kühnholtz-Lordat 1923) Br.-Bl. 1933
Medicagini marinae-Ammophiletum australis Br.-Bl. 1921 corr. Prieto & Diaz 1991

Sporoboletum arenarii (Arènes 1924) Géhu & Biondi 1994
Pancratietum angustifolii Brullo & Siracusa 1996
Calendulo maritimae-Elytrigietum junceae Brullo, Giusso, Siracusa & Spampinato 2002

HELICHRYSO-CRUCIANELLETEA MARITIMAE Géhu, Rivas-Mart. & R.Tx 1973 in Sissingh 1974

Atlantic, Mediterranean and Euxinian dwarf scrub and grasslands on stabilized coastal grey hind dunes
Indicator species in Sicily: *Anthemis maritima, Crucianella maritima, Helichrysum italicum subsp. siculum, H. stoechas* (subsp. *stoechas* and subsp. *barrelieri*), *Pycnocomon rutifolium, Lobularia maritima* subsp. *maritima, Ephedra distachya*.

CRUCIANELLETALIA MARITIMAE Sissingh 1974

Mediterranean and Cantabro-Francoatlantic dwarf scrub and grasslands on stabilized coastal hind dunes
Indicator species in Sicily: *Centaurea sphaerocephala, Ononis ramosissima, Scrophularia ramosissima, Stachys arenaria*.

CRUCIANELLION MARITIMAE Rivas Goday & Rivas-Mart. 1958

Western and Central Mediterranean dwarf scrub on stabilized coastal hind dunes
Indicator species in Sicily: see order.

Crucianelletum maritimae Br.-Bl. 1933
Centaureo sphaerocephalae-Ononidetum ramosissimae Br.-Bl. & Frei in Frei 1937
Seselio tortuosi-Crucianelletum maritimae Brullo, Di Martino & Marcenò 1972 *ex* Biondi & Géhu 1994
Seselio maritimi-Crucianelletum maritimae Brullo, Minissale & Siracusa 1998
Centaureo sphaerocephalae-Anthemidetum maritimae Brullo, Giusso, Siracusa & Spampinato 2002

ADIANTETEA Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Relict chomophytic and chasmophytic moss- and fern dominated vegetation in shaded and water-splashed habitats of the Mediterranean, the Atlantic islands, North Africa and Middle East

Indicator species in Sicily: *Adiantum capillus-veneris, Conocephalum conicum, Eucladium angustifolium, E. verticillatum, Pellia calycina, P. endiviifolia, Pholia wahlenbergii var. calcarea, Samolus valerandi.*

ADIANTETALIA Br.-Bl. *ex* Horvatić 1934

Relict chomophytic and chasmophytic vegetation in shaded and water-splashed habitats of the Mediterranean, the Atlantic islands, North Africa and Middle East

Indicator species in Sicily: see class.

ADIANTION Br.-Bl. *ex* Horvatić 1934

Relict fern-rich chasmophytic communities in shaded and water-splashed habitats of the Mediterranean, the Atlantic islands, North Africa and Middle East

Indicator species in Sicily: see class.

Eucladio verticillati-Adiantetum capilli-veneris Br.-Bl. ex Horvatić 1934
Eucladio verticillati-Didymodontetum tophacei Hébrard 1973
Adianto capilli-veneris-Cratoneuretum commutati Privitera & Lo Giudice 1986
Adianto capilli-veneris-Cratoneuretum filicini Brullo, Lo Giudice & Privitera 1989
Adianto capilli-veneris-Osmundetum regalis Brullo, Lo Giudice & Privitera 1989
Adianto capilli-veneris-Pteridetum vittatae Brullo, Lo Giudice & Privitera 1989
Conocephalo conici-Woodwardietum radicantis Brullo, Lo Giudice & Privitera 1989
Thamnobryo alopecuri-Phyllitidetum scolopendrium Brullo, Privitera & Puglisi 1993
Homalio lusitanicae-Adiantetum capilli-veneris Puglisi 1994

Polypodietea Jurko & Peciar *ex* Boşcaiu, Gergely & Codoreanu in Raţiu *et al*. 1966

Chomophytic, chasmophytic and epiphytic vegetation of fern- and moss-rich communities in crevices and rocky ledges of temperate and mediterranean Europe

Indicator species in Sicily: *Anogramma leptophylla, Asplenium obovatum (subsp. obovatum and subsp. lanceolatum), Cheilanthes pteridioides, Cymbalaria pubescens, Polypodium cambricum, Ranunculus rupestris, Selaginella denticulata, Umbilicus horizontalis*.

ANOMODONTO-POLYPODIETALIA SERRATI O. de Bolòs & Vives in O. de Bolòs 1957

Mediterranean and Madeirean-Azorean fern- and moss-rich chomophytic and chasmophytic vegetation of shaded rock faces and epiphytic on branches of old trees

Indicator species in Sicily: see class.

POLYPODION SERRATI Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Circum-Mediterranean fern-rich epilithic communities of shaded rock faces and crevices and epiphytic on branches of old trees within the thermo- and meso-Mediterranean

Indicator species in Sicily: see class.

Anogrammo leptophyllae-Selaginelletum denticulatae Molinier 1937

**Polypodietum cambrici* Br.-Bl. in Br.-Bl., Roussine & Nègre 1952 *nom. mut. propos.*

**Polypodio cambrici-Ranunculetum rupestris* Barbagallo, Brullo & Signorello 1983 *nom. mut. propos.*

Homalothecio sericei-Poetum bivonae Brullo, Marcenò & Siracusa 2004

Selaginello denticulatae-Cymbalarietum pubescentis Brullo, Marcenò & Siracusa 2004

**Cheilantho pteridioidis-Polypodietum cambrici* Brullo, Marcenò & Siracusa 2004 *nom. mut. propos.*

**Bartramio strictae-Polypodietum cambrici* Brullo & Siracusa in Brullo, Marcenò & Siracusa 2004 *nom. mut. propos.*

Bartramio strictae-Dryopteridetum pallidae Brullo & Siracusa in Brullo, Marcenò & Siracusa 2004
Scorpiuro circinnati-Anogrammetum leptophyllae Brullo & Siracusa in Brullo, Marcenò & Siracusa 2004

POHLIO CRUDAE-ASPLENION SEPTENTRIONALIS Brullo & Siracusa in Brullo, Marcenò & Siracusa 2004

Note - Fern- and moss-rich chomophytic and epilithic vegetation of siliceous rock crevices and shady and moist ledges in the supra- and oro-Mediterranean belt of Sicily and Calabria. In the original description, this alliance was ascribed to the *Anomodonto-Polypodietalia serrati*. Mucina *et al.* (2016), instead, ascribed it to the *Asplenietalia septentrionalo-cuneifolii* Mucina & Theurillat 2015, an order of *Asplenietea trichomanis* which groups the vegetation of siliceous and ultramafic rock crevices at low altitudes of temperate and boreal Europe. This proposal deserves to be adequately supported by phytogeographic and ecological evidences before being accepted.
Indicator species in Sicily: *Asplenium septentrionale subsp. septentrionale, Cystopteris dickieana, Pohlia cruda.*
Pohlio crudae-Cystopteridetum dickieanae Brullo et al. 2001

ASPLENIETEA TRICHOMANIS (Br.-Bl. in Meier & Br.-Bl. 1934) Oberd. 1977

Chasmophytic vegetation of undisturbed crevices, rocky ledges and faces of rocky cliffs and walls of Europe, North Africa, Middle East, the Arctic archipelagos and Greenland
Indicator species in Sicily: *Arabis collina, Asplenium trichomanes, Athamanta sicula, Ballota hispanica, Ceterach officinarum, Cheilanthes acrostica, Cystopteris fragilis, Sedum dasyphyllum, Umbilicus rupestris*.

POTENTILLETALIA CAULESCENTIS Br.-Bl. in Br.-Bl. & Jenny 1926

Chasmophytic vegetation of sunny calcareous rock faces and crevices at high altitudes of the nemoral and boreal mountain ranges of Europe

Indicator species in Sicily: *Asplenium ruta-muraria, Potentilla caulescens subsp. nebrodensis, Silene saxifraga subsp. parnassica*.

SAXIFRAGION AUSTRALIS Biondi & Ballelli ex Brullo 1984

Chasmophytic vegetation of calcareous rock faces and crevices in the subalpine and alpine belts of the Apennines and Calabrian Sicilian carbonatic massifs

Indicator species in Sicily: *Edraianthus graminifolius subsp. siculus, Minuartia graminifolia subsp. rosani, Saxifraga callosa*.

Asperulo gussonei-Potentilletum nebrodensis Raimondo 1983

ASPLENIETALIA GLANDULOSI Br.-Bl. in Meier & Br.-Bl. 1934

Thermo-mesomediterranean chasmophytic vegetation of sunny calcareous rock faces and crevices of the Western Mediterranean

Indicator species in Sicily: *Athamanta sicula, Capparis spinosa, Ficus carica var. caprificus, Hypochaeris laevigata, Melica minuta, Lomelosia cretica, Teucrium flavum, Umbilicus horizontalis*.

DIANTHION RUPICOLAE Brullo & Marcenò 1979

Note - In the original description, this alliance groups the endemite-rich thermophilous chasmophytic vegetation of Calabrian, Sicilian and Maltese rock faces, dwelling conglomeratic, sedimentary, schistose and crystalline rocky outcrops, on both calcareous and siliceous matrices. As a matter of fact, in Sicily and Maltese Islands, nearly all the so far described associations are on limestone or dolomite, so it is questionable that *Dianthion rupicolae* groups the "chasmophytic vegetation of siliceous rock crevices of the Siculo-Calabrian Tyrrhenian coasts", as stated by Mucina *et al* (2016), who improperly include this alliance within the acidophilous order *Asplenietalia lanceolato-obovati* (Loisel 1970) Theurillat & Mucina in Mucina & Theurillat 2015.

Indicator species in Sicily: *Antirrhinum siculum, Asperula rupestris, Brassica incana, B. macrocarpa, B. rupestris (subsp. rupestris and subsp. hispida), Dianthus rupicola (subsp. rupicola, subsp. aeolicus and subsp.*

lopadusanus), Erucastrum virgatum, Glandora rosmarinifolia, Iberis semperflorens, Odontites bocconei (subsp. bocconei and subsp. angustifolia), Pimpinella anisoides, Phagnalon saxatile, Pseudoscabiosa limonifolia, Seseli bocconei, Silene fruticosa.

Scabioso creticae-Centauretum ucriae Brullo & Marcenò 1979
Bupleuro dianthifolii-Scabiosetum limonifoliae Brullo & Marcenò 1979
Anthemido cupanianae-Centauretum busambarensis Brullo & Marcenò 1979
Putorio calabricae-Micromerietum microphyllae Brullo & Marcenò 1979
Brassico tinei-Diplotaxietum crassifoliae Brullo & Marcenò 1979
Brassico rupestris-Centauretum saccensis Bazan, Raimondo & Ilardi 2006
Erucastretum virgati Brullo & Marcenò 1979
Diantho aeolici-Centauretum aeolicae Barbagallo, Brullo & Signorello 1983

CHEILANTHETALIA MARANTO-MADERENSIS Sáenz de Rivas & Rivas-Mart. 1979

Mediterranean and Macaronesian thermophilous fern-rich chasmophytic vegetation of siliceous and ultramafic rock crevices

Indicator species in Sicily: *Cheilanthes maderensis*.

PHAGNALO SAXATILIS-CHEILANTHION MADERENSIS Loisel 1970 corr. Pérez-Carro et al. 1989

Central-Western Mediterranean fern-rich chasmophytic vegetation of ultramafic rock crevices in subhumid to humid regions in the infra- to mesomediterranean belts

Indicator species in Sicily: *Asplenium balearicum, Cheilanthes acrostica, C. maderensis Cosentinia vellea* (subsp. *vellea*, subsp. *bivalens* and subsp. *rivas-martinezii*).

**Phagnalo saxatilis-Cheilanthetum maderensis* Loisel 1970 corr. Pérez-Carro et al. 1989
**Cosentinietum bivalentis* Brullo in Brullo, Marcenò & Siracusa 2004
**Sedo dasyphylli-Cheilanthetum maderensis* Sciandrello, D'Agostino & Minissale 2013
**Sedo albi-Cosentinietum velleae* Sciandrello, D'Agostino & Minissale 2013

Cymbalario-Parietarietea diffusae Oberd. 1969

Thermophilous chasmo-nitrophilous vegetation of stone walls and disturbed cliffs in the Mediterranean and winter-mild atlantic to subcontinental regions of Europe, Middle East and North Africa
Indicator species in Sicily: *Antirrhinum majus, Ceterach officinarum, Erysimum cheiri, Cymbalaria muralis, Erigeron karvinskianus, Parietaria judaica.*

TORTULO-CYMBALARIETALIA Segal 1969

Thermophilous chasmophytic vegetation of walls of the Mediterranean and the winter-mild atlantic to subcontinental regions of temperate Europe, Middle East and North Africa
Indicator species in Sicily: see class.

CYMBALARIO-ASPLENION Segal 1969

Fern-rich chasmophytic vegetation of sunny walls of the atlantic to subcontinental regions of cool-temperate Europe
Indicator species in Sicily: *Anomodon viticulosus, Barbula unguiculata, Bryum caespiticium, Ceratodon purpureus, Didymodon rigidulus var. gracilis, D. vinealis, Grimmia pulvinata, Homalothecium sericeum, Hypnum cupressiforme, Scorpiurum circinatum, Tortula muralis.*

Cheirantho cheiri-Parietarietum judaicae Oberd. 1957
Centrantho rubri-Parietarietum judaicae Oberd. 1957
Asplenio-Parietarietum judaicae Segal 1969
Sedo dasyphylli-Ceterachetum officinarum Hruska ex Brullo & Guarino 1998
Asplenio trichomanis-Umbilicetum horizontalis Brullo & Guarino 2002

PARIETARION JUDAICAE Segal 1969

Note - In the original description, this alliance groups the thermophilous chamaephytic and hemicryptophytic wall vegetation, poor in ferns and mosses, chiefly linked to the Mediterranean bioclimate but occurring, as well, in the temperate bioclimate under edaphoxeric conditions. In addition to the *Parietarion judaicae*, Biondi *et al.* (2014) described the alliance *Artemisio arborescentis-Capparidion spinosae* Biondi, Blasi & Galdenzi in Biondi et al. 2014 to outline the shrub-dominated halo-tolerant vegetation on walls and rocky slopes in thermo- and infra-Mediterranean coastal districts. The decision, by Mucina et al. (2016), to lump everything together in a single central-western-Mediterranean alliance makes sense but, if so, priority should be given to the name *Parietarion judaicae*.

Indicator species in Sicily: *Anthirrhinum siculum, Centranthus ruber, Hyoseris radiata, Sonchus tenerrimus, Trachelium caeruleum.*

Centranthetum rubri Oberd. 1969
Cymbalario muralis-Trachelietum caerulei Rivas-Mart. 1969
Cymbalario muralis-Erigeronetum karwinskiani Segal 1969
Oxalido corniculatae-Parietarietum judaicae (Br.-Bl. 1952) Segal 1969
Cymbalario muralis-Crithmetum maritimi Segal 1969
Antirrhinetum siculi Bartolo & Brullo 1986
Centrantho rubri-Hypericetum majoris Rivas-Mart. 1969 *corr.* Brullo & Guarino 1999

ARTEMISIO ARBORESCENTIS-CAPPARIDION SPINOSAE Biondi, Blasi & Galdenzi in Biondi *et al.* 2014

Nanophanerophytic halo-tolerant vegetation on walls and rocky slopes in thermo- and infra-Mediterranean coastal districts

Indicator species in Sicily: *Hyosciamus albus, Capparis spinosa, Ficus carica var. caprificus, Nicotiana glauca*.

Capparidetum rupestris O. de Bolòs & Molinier 1958 ex O. de Bolòs 1962
Hyoscyamo albi-Parietarietum judaicae Segal 1969

DRYPIDETEA SPINOSAE Quézel 1964

Pioneer vegetation of screes and incoherent pebbly and sandy warps in the Central and Eastern Mediterranean and the Black Sea seaboards

Indicator species in Sicily: *Aethionema saxatile, Artemisia campestris* subsp. *variabilis, Centranthus ruber, Helichrysum italicum, Lactuca viminea, Scrophularia canina* subsp. *bicolor*.

SCROPHULARIO-HELICHRYSETALIA Brullo 1984

Vegetation of thermophilous low and mid-altitudes (sub)mediterranean screes and riverine gravel banks of Sardinia, Calabria and Sicily
Indicator species in Sicily: see class.

LINARION PURPUREAE Brullo 1984

Montane scree vegetation of the Southern Apennines and Sicily
Indicator species in Sicily: *Arrhenatherum nebrodense, Linaria purpurea, L. simplex, Ptilostemon niveus, Rumex scutatus, Secale strictum.*

Arenario grandiflorae-Rumicetum scutati Raimondo 1983
Senecionetum siculi Brullo & Marcenò in Brullo 1984
Centrantho rubri-Senecionetum ambigui Brullo & Marcenò in Brullo 1984
Rumici scutati-Cardaminetum graecae Brullo, Scelsi & Spampinato 1998
Scutellario rubicundae-Melicetum cupanii Brullo, Scelsi & Spampinato 1998

EUPHORBION RIGIDAE Brullo & Spampinato 1991

Siculo-Calabrian low-altitude pioneer vegetation on riverine gravel banks
Indicator species in Sicily: *Micromeria graeca, Dittrichia viscosa, Euphorbia rigida.*

Loto commutati-Helichrysetum italici Brullo & Spampinato 1991
Ononido ramosissimae-Helichrysetum italici Brullo & Spampinato 1991
Calendulo fulgidae-Helichrysetum italici Brullo & Spampinato 1991
Senecioni gibbosi-Helichrysetum italici Brullo & Spampinato 1991
Echinopo spinosissimi-Helichrysetum italici Brullo, Scelsi & Spampinato 1998
Scrophulario bicoloris-Senecionetum bicoloris Brullo, Scelsi & Spampinato 1998
Sedo sediformis-Centranthetum rubri Gianguzzi & La Mantia 2008

ZOSTERETEA Pignatti 1954

Perennial sea-grass meadows on muddy, sandy or gravelly submerged substrates of the Mediterranean, temperate and subarctic seas of Europe
Indicator species in Sicily: *Zostera marina.*

ZOSTERETALIA Béguinot 1941 *ex* Pignatti 1954

Vegetation of sea-grass meadows of the sandy-muddy sublittoral of the temperate seas surrounding Europe
Indicator species in Sicily: see class.

ZOSTERION MARINAE Br.-Bl. & Tx. *ex* Pignatti 1954

Vegetation of perennial sea-grass meadows of the sandy-muddy sea sublittoral of the cold- and cool-temperate seas surrounding Europe
Indicator species in Sicily: see class.

Zosteretum marinae Harmesen 1936

NANOZOSTERION NOLTII Den Hartog *ex* Mucina in Mucina *et al.* 2016

Vegetation of short-lived sea grass meadows of the sandy-muddy sea sublittoral of the cold-temperate and cool-temperate seas surrounding Europe
Indicator species in Sicily: *Zostera noltii*.

Zosteretum noltii Pignatti 1954

POSIDONIETALIA OCEANICAE Den Hartog 1976 *ex* Mucina in Mucina *et al.* 2016

Perennial sea-grass meadows of sandy-rocky sublittoral of the Mediterranean Sea
Indicator species in Sicily: *Posidonia oceanica*.

POSIDONION OCEANICAE Br.-Bl. *ex* Molinier 1960

Vegetation of perennial sea-grass meadows of the sandy-rocky sublittoral of the warm-temperate waters of the Mediterranean Sea
Indicator species in Sicily: see order.

Posidonietum oceanicae Funk 1927

HALODULO WRIGHTII-THALASSIETEA TESTUDINUM Den Hartog *ex* Rivas-Mart., Fernández-González & Loidi 1999

Mediterranean-Atlantic eel-grass swards on muddy and sandy substrates of subtropical and tropical marine shallow water
Indicator species in Sicily: *Cymodocea nodosa, Halophila stipulacea*.

THALASSIO-SYRINGODIETALIA FILIFORMIS Knapp ex Borhidi, Muñiz & Del Risco in Borhidi 1996

Vegetation of eel-grass swards on muddy and sandy substrates of the sublittoral of subtropical and tropical seas fringing Atlantic Ocean
Indicator species in Sicily: see class.

CYMODOCEION NODOSAE Den Hartog *ex* Mucina in Mucina *et al*. 2016

Vegetation of eel-grass swards on muddy and sandy substrates of the sublittoral of the subtropical Atlantic Ocean and the Mediterranean Sea
Indicator species in Sicily: *Cymodocea nodosa*.

Cymodoceetum nodosae Feldmann 1937

RUPPIETEA MARITIMAE J. Tx. 1960 *ex* Den Hartog & Segal 1964

Submerged rooted herbaceous vegetation of brackish waters of the world
Indicator species in Sicily: *Ruppia maritima*.

RUPPIETALIA J. Tx. 1960 *ex* Den Hartog & Segal 1964

Submerged rooted herbaceous vegetation of temperate brackish waters of Europe
Indicator species in Sicily: see class.

RUPPION MARITIMAE Br.-Bl. 1931 *ex* Westhoff in Bennema, Sissingh & Westhoff 1943

Submerged rooted herbaceous vegetation of temperate brackish waters of Europe

Indicator species in Sicily: *Ruppia maritima, R. drepanensis, R. spiralis.*

Ruppietum maritimae (Hocq. 1927) Iversen 1934
Ruppietum spiralis Hocquette 1927 corr. Iversen 1936
**Ulvo intestinalis-Ruppietum maritimae* Westhoff *ex* Tx. & Böcklemann 1957 *nom. mut. propos.*
Ruppietum drepanensis Brullo & Furnari 1977
Riellietum notarisii Cirujano, Velayos & P. Garcia 1993

Therosalicornietea Tx. in Tx. & Oberd. 1958

Pioneer vegetation of annual succulent halophytes on tidal mud flats and edges of the irregularly flooded saline inland waters of Eurasia

Indicator species in Sicily: *Salicornia sp. pl., Suaeda maritima, Bassia laniflora, B. scoparia, Salsola soda, Atriplex prostrata subsp. latifolia, Cressa cretica*.

THEROSALICORNIETALIA Pignatti 1952

Pioneer vegetation of annual succulent halophytes of tidal mud flats and edges of the irregularly flooded saline inland waters of the Mediterranean, and temperate, boreal and subarctic Europe

Indicator species in Sicily: see class.

THEROSALICORNION Br.-Bl. 1933

Mediterranean and thermo-atlantic pioneer vegetation of annual succulent plants of tidal flats and irregularly flooded inland depressions

Indicator species in Sicily: *Salicornia patula, S. emerici, Puccinellia festuciformis subsp. lagascana.*

Suaedetum maritimae (Conrad 1933) Pignatti 1953
Salsoletum sodae Pignatti 1953
Cressetum creticae Brullo & Furnari 1976

Suaedo maritimae-Salicornietum patulae Brullo & Furnari 1977 *ex* Géhu & Géhu-Franck 1984
**Salicornio emerici-Arthrocnemetum glauci* O. de Bolòs 1962 ex Brullo & Furnari 1977 *nom. mut. propos.*

MICROCNEMION CORALLOIDIS Rivas-Mart. & Géhu in Rivas-Mart. 1984

Central-W-Mediterranean inland and coastal vegetation of annual succulent halophytes on solonchak soils of temporarily wet salt pans
Indicator species in Sicily: *Halopeplis amplexicaulis*.

Halopeplidetum amplexicaulis Burollet 1927

Note - Even if Mucina *et al.* (2016) state that this vegetation is restricted to the inland salt pans of the Iberian Peninsula, the *Halopeplidetum amplexicaulis* has been repeatedly recorded in Tunisia and Sicily, in coastal districts. The possibility to include this association in a separate alliance could be considered.

JUNCETEA MARITIMI Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Halo-hygrophilous hemicryptophitic vegetation of brackish swamps of the Mediterranean Sea and the Atlantic and Arctic Oceans
Indicator species in Sicily: *Aeluropus littoralis, Juncus maritimus, Limonium narbonense*.

JUNCETALIA MARITIMI Br.-Bl. ex Horvatić 1934

Mediterranean and thermo-atlantic tall-rush saline wetland vegetation
Indicator species in Sicily: *Aeluropus littoralis, Carex extensa, Centaurium spicatum, Centaurium tenuiflorum, Lotus preslii, Panicum repens, Schoenus nigricans*.

JUNCION MARITIMI Br.-Bl. ex Horvatić 1934

Mediterranean and thermo-atlantic coastal saline rush marsh vegetation under a prolonged flooding regime

Indicator species in Sicily: *Juncus acutus, Scirpoides holoschoenus* (subsp. *holoschoenus* and subsp. *australis*).

Caricetum divisae Br.-Bl. 1933
Juncetum maritimo-acuti Horvatič 1934
Juncetum maritimi Rübel 1930 *ex* Pignatti 1953
**Sporobolo pumili-Juncetum maritimi* O. de Bolòs 1962 *nom. mut. propos.*
Limonio virgati-Juncetum acuti Brullo & Di Martino *ex* Brullo & Furnari 1977
Juncetum subulati Caniglia *et al.* 1984
Agropyro scirpei-Inuletum crithmoidis Brullo in Brullo *et al.* 1988
Inulo crithmoidis-Juncetum maritimi Brullo in Brullo *et al.* 1988

PLANTAGINION CRASSIFOLIAE Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Western Tyrrhenian and Provencal saline swards of margins of lagoons and damp dune-slacks, on sandy-loamy substrata.

Indicator species in Sicily: *Blackstonia acuminata, Daucus carota subsp. maritimus, Tripidium ravennae, Juncus littoralis, Imperata cylindrica, Plantago crassifolia.*

Schoeno nigricantis-Plantaginetum crassifoliae Br.-Bl. in Br.-Bl., Roussine & Nègre 1952
Holoschoenetum globiferi Pirola 1959
Imperato cilyndricae-Juncetum littoralis Brullo & Furnari 1977

AGROPYRETALIA PUNGENTIS Géhu 1968

Halo-nitrophilous grasslands of salt-sprayed sandy-loamy shores of the winter-mild atlantic and mediterranean regions of Europe

Indicator species in Sicily: *Carex distans*

AGROPYRO-ARTEMISION COERULESCENTIS Pignatti 1953

Tyrrhenian-Adriatic (sub)halo-nitrophilous salt-sprayed grassy scrub of the edges of coastal lagoons

Indicator species in Sicily: *Elymus elongatus.*

Elytrigio elongatae-Inuletum crithmoidis Br.-Bl. (1931) 1952 *nom. mut. propos.*

AGROSTIO-ELYTRIGION ATHERICAE Brullo & Siracusa 2000

Central-Mediterranean halo-nitrophilous grasslands of salty clayey-loamy coastal slopes and inland badlands
Indicator species in Sicily: *Agrostis scabriglumis, Elymus acutus, Juncus subulatus*.

Festuco arundinaceae-Elytrigietum athericae Brullo in Brullo *et al.* 1988
Puccinellietum gussonei Brullo & Siracusa 2000
Festuco arundinaceae-Juncetum subulati Brullo & Siracusa 2000
Festuco arundinaceae-Caricetum divisae Brullo & Siracusa 2000

SALICORNIETEA FRUTICOSAE Br.-Bl. & Tx. *ex* A. Bolòs y Vayreda & O. de Bolòs in A. Bolòs y Vayreda 1950

Mediterranean and thermo-atlantic perennial halo-hygrophilous vegetation (chenopod scrub)
Indicator species in Sicily: *Halimione portulacoides, Puccinellia festuciformis subsp. lagascana, Sarcocornia fruticosa*.

SALICORNIETALIA FRUTICOSAE Br.-Bl. 1933

Mediterranean and thermo-atlantic halophilous coastal tidal and inland temporarily flooded succulent chenopod scrub
Indicator species in Sicily: see class.

SALICORNION FRUTICOSAE Br.-Bl. 1933

Mediterranean and thermo-atlantic intertidal succulent dwarf chenopod scrub
Indicator species in Sicily: see class.

Junco subulati-Sarcocornietum fruticosae Brullo in Brullo & Furnari 1988 (=*Junco subulati-Sarcocornietum alpinii* Sciandrello 2005)
***Cynomorio coccineae-Halimionetum portulacoidis* Biondi 1992
Aeluropo lagopoidis-Sarcocornietum alpinii Brullo in Brullo, De Santis, Furnari, Longhitano & Ronsisvalle 1988 *corr.* Barbagallo *et al.* 1990

SUAEDION VERAE Br.-Bl. & O. de Bolòs 1958 *nom. mut. prop.* (Bas.: Suaedion brevifoliae Br.-Bl. & O. de Bolòs 1958)

Mediterranean and Cantabro-Atlantic subnitrophilous supratidal succulent chenopod scrub on loamy-sandy soils

Indicator species in Sicily: *Suaeda vera subsp. vera, Elymus elongatus.*

Halimiono portulacoidis-Suaedetum verae Molinier & Tallon 1970 *em.* Géhu in Géhu *et al.* 1984

ARTHROCNEMION GLAUCI Rivas-Mart. & Costa M. 1984

Mediterranean hypersaline coastal supratidal succulent chenopod scrub on sandy and rocky soils

Indicator species in Sicily: *Aeluropus lagopoides, Triglochin bulbosa subsp. barrelieri, Spergularia salina.*

Arthrocnemo glauci-Juncetum subulati Brullo & Furnari 1977
Sphenopo divaricati-Arthrocnemetum glauci Br.-Bl. 1933 *em.* Géhu 1977
Aeluropo lagopoidis-Limonietum intermedii Bartolo, Brullo, Minissale & Spampinato 1990

LIMONIASTRETALIA GUYONIANI Guinochet 1951

Mediterranean Sea-lavender hypersaline scrub in supratidal non-inundated sandy habitats of the semi-desert regions of the Southern Mediterranean islands and North Africa

Indicator species in Sicily: *Limonium densiflorum, L. ferulaceum, L. dubium, L. glomeratum, Limoniastrum monopetalum, Lygeum spartum.*

LIMONIASTRION MONOPETALI Pignatti 1952

Sea-lavender hypersaline scrub in supratidal non-inundated sandy habitats of the Western and Central Mediterranean and North Africa

Indicator species in Sicily: see order.

Sarcocornio fruticosae-Limonietum ferulacei Pignatti 1952
Limonio dubii-Lygeetum spartii Brullo & Di Martino 1974 *corr.* Brullo & Furnari 1988
Limoniastro monopetali-Limonietum lilybaei Brullo & Di Martino 1974 *corr.* Brullo & Furnari 1988

HALOCNEMION CRUCIATI Biondi *et al.* 2013

Hypersaline chenopod supratidal scrub of arid and hyperarid marginal regions of the Mediterranean
Indicator species in Sicily: *Arthrocnemum macrostachyum, Halocnemum cruciatum*

**Arthrocnemo-Halocnemetum cruciati* Oberd. 1952 *nom. corr. hoc loco*

LEMNETEA O. de Bolòs & Masclans 1955

Free-floating duckweed vegetation of still and relatively nutrient-rich freshwater bodies of the Holarctic
Indicator species in Sicily: *Lemna minor, L. gibba, L. trisulca, Wolffia arrhiza, Spirodela polyrhiza*.

LEMNETALIA MINORIS O. de Bolòs & Masclans 1955

Vegetation of free-floating vegetation of still and relatively nutrient-rich freshwater bodies of temperate Europe
Indicator species in Sicily: *Lemna minor*.

LEMNION MINORIS O. de Bolòs & Masclans 1955

Vegetation of free-floating duckweed vegetation of still and relatively nutrient-rich freshwater bodies of the temperate Europe
Indicator species in Sicily: see order.

Lemnetum gibbae (W. Koch 1954) Miyawaki & J. Tx. 1960
Lemnetum minoris Oberd. 1957 *ex* Müller & Görs 1960
Wolffietum arrhizae Miyawaki & J. Tx. 1960
Lemno minoris-Spirodeletum polyrrhizae (Kelhofer 1915) W. Koch 1954 *em.* Müller & Görs 1960
Lemnetum trisulcae (Kelhofer 1915) Knapp & Stöffers 1962

UTRICULARION VULGARIS Passarge 1964

Vegetation of free-floating bladderworts in mesotrophic and eutrophic waters of Europe

Indicator species in Sicily: *Utricularia australis, U. vulgaris.*

Utricularietum australis Müller & Görs 1960

Utriculario vulgaris-Potamogetonetum natanti Raimondo, Marino & Schicchi 2011

Stratiotion Den Hartog & Segal 1964

Vegetation of free-floating macrophytes in fairly nutrient-rich shallow waters of Europe

Indicator species in Sicily: *Myriophyllum verticillatum, Zannichellia palustris, Potamogeton crispus, P. natans, Ceratophyllum demersum, C. submersum.*

Ceratophylletum demersi Hild 1956

POTAMOGETONETEA Klika in Klika & Novák 1941

Vegetation of rooted floating or submerged macrophytes of stagnant mesotrophic, eutrophic and brackish freshwater bodies and slowly flowing shallow streams of Eurasia

Indicator species in Sicily: *Apium inundatum, Berula erecta, Callitriche stagnalis, Myriophyllum verticillatum, Potamogeton crispus, P. nodosus, P. pectinatus, P. polygonifolius, Ranunculus trichophyllus.*

POTAMOGETONETALIA Koch 1926

Vegetation of rooted floating or submerged macrophytes of mesotrophic and eutrophic freshwater bodies of Eurasia

Indicator species in Sicily: see class.

POTAMOGETONION Libbert 1931

Vegetation of rooted and floating macrophytes of freshwater bodies at low and mid-altitudes of temperate Eurasia

Indicator species in Sicily: see class.

Potametum pectinati Carstensen 1955

Potametum perfoliati W. Koch 1926 *em.* Passarge 1964

Groenlandietum densae (Oberd. 1962) Segal 1965

NYMPHAEION ALBAE Oberd. 1957

Vegetation of rooted floating-leaf macrophytes of sheltered nutrient-rich freshwaters of Western and Central Europe

Indicator species in Sicily: *Callitriche obtusangula, Myriophyllum spicatum, Potamogeton natans, P. pusillus, Ranunculus omiophyllus*.

Myriophylletum spicati Soó 1927
Myriophylletum verticillati Gaudet 1924
Polygono amphibii-Potametum natantis Soó 1964

POTAMOGETONION GRAMINEI Westhoff & Den Held 1969

Vegetation of rooted macrophytes of nutrient-poor shallow freshwaters at mid-altitudes of Europe

Indicator species in Sicily: *Potamogeton gramineum, Myriophyllum alterniflorum.*

Myriophylletum alterniflori Lemée 1937 em. Sissingh 1943

CALLITRICHO-HAMULATAE-RANUNCULETALIA AQUATILIS Passarge *ex* Theurillat in Theurillat *et al*. 2015

Vegetation of crosswort, crowfoot and milfoil rooted macrophytes in shallow and intermittent freshwater streams of Europe

Indicator species in Sicily: *Callitriche truncata subsp. occidentalis, C. hamulata, C. lenisulca, P. filiformis, Ranunculus aquatilis, R. peltatus*.

BATRACHION FLUITANTIS Neuhäusl 1959

Vegetation of crowfoot and milfoil rooted macrophytes in shallow moving freshwaters of Europe

Indicator species in Sicily: *Ranunculus penicillatus*

Ranunculetum penicillati Brullo & Spampinato 1991

Ranunculion aquatilis Passarge 1964 *ex* Theurillat in Theurillat *et al*. 2015

Vegetation of crosswort rooted macrophytes in shallow stagnant freshwaters of temperate Europe

Indicator species in Sicily: see order.

Ranunculetum peltati Segal 1967
Ranunculetum baudotii (Br.-Bl. 1951) *em.* Molinier & Tallon 1969
Ranunculo saniculifolii-Callitrichetum brutiae Brullo, Grillo & Terrasi 1976

Zannichellietalia pedicellatae Schaminée, Lanjouw & Schipper *ex* Mucina & Theurillat in Mucina *et al.* 2016

Vegetation of rooted macrophytes in meso-eutrophic brackish waters of Western and Central Europe
Indicator species in Sicily: Zannichellia pedunculata

ZANNICHELLION PEDICELLATAE Schaminée, Lanjouw & Schipper 1990 *ex* Passarge 1996

Vegetation of rooted macrophytes in meso-eutrophic brackish waters of Western and Central Europe
Indicator species in Sicily: see order.
Najadetum marinae Fukarek 1961
Zannichellietum obtusifoliae Brullo & Spampinato 1991

ISOETO-NANOJUNCETEA Br.-Bl. & Tx. in Br.-Bl. *et al.* 1952

Eurasian hygrophilous ephemeral microphytic pioneer vegetation of temporary ponds
Indicator species in Sicily: *Antinoria insularis, Gaudinia fragilis, Juncus bufonius, J. capitatus, J. hybridus, J. tenageia, Lythrum hyssopifolia, L. junceum, L. portula, L. tribracteatum, Lotus angustissimus (subsp. angustissimus and subsp. hispidus), L. parviflorus, Mentha pulegium, Myosurus minimus, Oenanthe silaifolia, Polypogon subspathaceus, Poa infirma, Pulicaria vulgaris, Veronica anagalloides, Spergularia rubra*.

ISOETETALIA Br.-Bl. 1935

Pioneer ephemeral dwarf-herb vegetation on periodically flooded soils of the Mediterranean

Indicator species in Sicily: *Airopsis tenella, Briza minor, Catabrosa aquatica, Centaurium maritimum, C. pulchellum, Damasonium alisma* (subsp. *alisma* and subsp. *bourgaei*), *D. polyspermum, Isoetes velata subsp. velata, Isoetes setacea, Isolepis cernua, Juncus pygmaeus, Lythrum borysthenicum, Marsilea strigosa, Myosotis sicula, Pilularia minuta, Polypogon maritimus, Ranunculus muricatus, Romulea ramiflora, Trifolium micranthum, Veronica acinifolia*.

ISOETION Br.-Bl. 1935

Pioneer ephemeral quillwort vegetation of temporary pools and seasonally wet depressions of the Mediterranean

Indicator species in Sicily: *Aira elegantissima, Isoetes duriei, I. histrix, L. conimbricensis, Ranunculus trilobus.*

Isoetetum durieui Br.-Bl. 1936
Isoeto durieui-Ranunculetum parviflori Brullo, Di Martino & Marcenò 1977

PRESLION CERVINAE Br.-Bl. *ex* Moor 1936

Pioneer ephemeral herb-rich vegetation of temporary pools on sandy soils of the Central Mediterranean

Indicator species in Sicily: *Callitriche brutia, C. platycarpa, Baldellia ranunculoides, Ranunculus lateriflorus, Veronica anagalloides.*

Ranunculo lateriflori-Antinorietum insularis Brullo, Grillo & Terrasi 1976
Ranunculo lateriflori-Callitrichetum brutiae Brullo & Minissale 1998
Callitricho brutiae-Crassuletum vaillantii Brullo, Scelsi, Siracusa & Tomaselli 1998
Kickxio cirrhosae-Solenopsietum laurentiae Brullo & Minissale 1998
Anagallido parviflorae-Molinerielletum minutae Brullo, Scelsi, Siracusa & Tomaselli 1998

CICENDION (Rivas Goday in Rivas Goday & Borja 1961) Br.-Bl. 1967

Pioneer ephemeral herb-rich vegetation of oligotrophic temporarily flooded depressions of the Western Mediterranean

Indicator species in Sicily: *Anagallis arvensis subsp. parviflora, Centunculus minimus, Cicendia filiformis, Hypericum australe, Kickxia cirrhosa, Ophioglossum lusitanicum, Radiola linoides, Solenopsis laurentia.*

Junco capitati-Isoetetum hystricis Br.-Bl. 1935
Laurentio-Juncetum capitati Rivas Goday & Borja 1968
Archidio-Isoetetum velatae Brullo & Minissale 1998

NANOCYPERETALIA Klika 1935

Pioneer ephemeral herb- and graminoid-rich late-season vegetation on periodically flooded soils of temperate Europe
Indicator species in Sicily: *Coronopus squamatus, Cyperus fuscus, C. michelianus, Eryngium pusillum, Hordeum marinum subsp. gussoneanum, Plantago intermedia, Ranunculus sardous subsp. xatardii.*

NANOCYPERION Koch 1926

Pioneer dwarf cyperaceous vegetation on moist calcium rich substrates of the submediterranean and Atlantic regions of Europe
Indicator species in Sicily: see order.
Pulicario graecae-Scirpetum savii Brullo & Di Martino 1974
Plantago intermediae-Cyperetum fusci Sciandrello, D'Agostino & Minissale 2013

VERBENION SUPINAE Slavnić 1951

Pioneer ephemeral herb-rich vegetation in periodically flooded nutrient-rich habitats in the nemoral zone of Central and southeastern Europe
Indicator species in Sicily: *Glinus lotoides, Heliotropium supinus, Sisymbrella dentata, Sporobolus alopecuroides, Teucrium campanulatum, Verbena supina.*
Heliotropio supini-Heleochloetum schoenoidis Rivas Goday 1956
Glino mollis- Verbenetum supini Rivas Goday 1964
Verbeno supinae-Gnaphalietum luteo-albi Rivas Goday1970
Damasonio alismatis-Crypsietum aculeatae Rivas-Mart. & Costa in Rivas-Mart. *et al.* 1980
Coronopo squamati-Sisymbrelletum dentatae Minissale & Spampinato 1986
Ranunculo trilobi-Lythretum tribracteati Sciandrello 2005
Cresso creticae-Damasonietum bourgaei Sciandrello 2007
Pulicario graecae-Damasonietum bourgaei Minissale, Santo & Sciandrello 2011

**ELATINO MACROPODAE-DAMASONION ALISMATIS de Foucalt 1988

Pioneer ephemeral herb-rich vegetation of temporary flooded mesotrophic depressions of the winter-mild submediterranean and atlantic regions of Europe

Indicator species in Sicily: *Buillardia vaillantii, Elatine gussonei, E. macropoda.*

Elatinetum macropodae Br.-Bl. 1936

**Buillardio vaillanti-Elatinetum gussonei* Bartolo, Brullo, Minissale & Spampinato 1990 *nom. mut. propos.*

PHRAGMITO-MAGNOCARICETEA Klika in Klika & Novák 1941

Eurasian reed swamp, sedge bed and herbland vegetation of fresh and brackish waterbodies and streams dominated by big rhizomatous helophytes

Indicator species in Sicily: *Agrostis stolonifera (subsp. stolonifera and subsp. scabriglumis), Alisma lanceolatum, A. plantago-aquatica, Carex acutiformis, C. ovalis, Cladium mariscus, Cyperus laevigatus subsp. laevigatus, Eleocharis palustris, Epilobium parviflorum, Galium debile, G. palustre, Glyceria fluitans, Lycopus europaeus, Lythrum salicaria, Mentha aquatica, Mentha longifolia, Phragmites australis subsp. australis, Persicaria decipiens, Samolus valerandi, Rumex sanguineus.*

PHRAGMITETALIA W. Koch 1926

Reed swamps, sedge beds and herblands of mesotrophic and eutrophic stagnating or slowly flowing freshwater or brackish water bodies of Eurasia

Indicator species in Sicily: *Schoenoplectus lacustris subsp. lacustris, Bolboschoenus maritimus subsp. maritimus, Typha angustifolia, T. domingensis, T. latifolia, Oenanthe aquatica, Phragmites australis subsp. australis, Schedonorus arundinaceus subsp. arundinaceus.*

PHRAGMITION COMMUNIS W. Koch 1926

Reed swamp vegetation of mesotrophic and eutrophic standing freshwater bodies or gently moving streams of boreo-temperate Eurasia

Indicator species in Sicily: see order.

Scirpo lacustri-Phragmitetum australis W. Koch 1926
Bolboschoenetum maritimi Eggler 1933
Phragmitetum communis (W. Koch 1926) Schmale 1939
Scirpetum, Schmale 1939
Typhetum angustifoliae (Allorge 1921) Pignatti 1953
Typho angustifoliae-Schoenoplectetum glauci Br.-Bl. & O. de Bolòs 1958
Typhetum latifoliae (Soó 1927) Lang 1973
Iridetum pseudacori Krzywanski 1974
Polygono salicifolii-Phragmitetum communis Barbagallo, Brullo & Furnari 1979
Soncho maritimi-Cladietum marisci (Br.-Bl. & O. de Bolòs 1957) Cirujano 1980
Typho domingensis-Phragmitetum maximi Costa, Boira, Peris & Stübing 1986
Typhetum domingensis Brullo, Minissale & Spampinato 1994
Typho angustifoliae-Phragmitetum australis (Tx. & Preising 1942) Rivas-Mart. *et al.* 1991
Caricetum pendulo-panormitanae Gianguzzi, Cusimano, Ilardi & Romano 2013

NASTURTIO-GLYCERIETALIA Pignatti 1953

Herblands and sedge-beds of well-oxygenated freshwater flowing streams of the temperate and mediterranean regions of Europe and Madeira
Indicator species in Sicily: *Apium nodiflorum, Cyperus longus* (subsp. *longus* and subsp. *badius*), *Glyceria notata, G. spicata, Iris pseudacorus, Nasturtium officinale, Sparganium erectum* (subsp. *erectum* and subsp. *neglectum*), *Veronica anagallis-aquatica.*

GLYCERIO-SPARGANION Br.-Bl. & Sissingh in Boer 1942

Herbland vegetation of small freshwater streams and in shallow water bodies of temperate Europe
Indicator species in Sicily: see order.

Helosciadetum nodiflori Br.-Bl. (1931) 1952
Nasturtietum officinalis (Seib. 1962) Oberd. *et al.* 1967

Sparganietum erecti (Roll 1938) Philippi 1973
Eleocharido palustris-Alismetum lanceolati Minissale & Spampinato 1987
Apio nodiflori-Glycerietum plicatae Brullo & Spampinato 1991
Eleocharido palustris-Sparganietum neglecti Brullo, Minissale & Spampinato 1994

MAGNOCARICETALIA Pignatti 1953

Sedge-bed marsh vegetation of boreal and temperate Eurasia
Indicator species in Sicily: *Althaea officinalis, Carex cuprina, C. elata, C. hispida, C. riparia* (subsp. *riparia* and subsp. *retusa*), *Cirsium creticum subsp. triumphettii, Cyperus longus subsp. longus, Epilobium parviflorum, Euphorbia hirsuta, Galium palustre var. elongatum, Rumex conglomeratus, Teucrium scordium subsp. scordioides*.

MAGNOCARICION ELATAE W. Koch 1926

Sedge-bed marsh vegetation on oligotrophic to mesotrophic organic sediments of temperate Europe
Indicator species in Sicily: see order.

Cyperetum longi Micevski 1957
Cypero longi-Caricetum otrubae Tx. in Tx. & Oberd. 1958
Caricetum ripariae Knapp & Stoffer 1962
Caricetum hispidae Brullo & Ronsisvalle 1975
Carici distantis-Schoenetum nigricantis Brullo, Minissale, Scelsi & Spampinato 1993

BOLBOSCHOENETALIA MARITIMI Hejný in Holub *et al.* 1967

Meso-eutrophic brackish swamp reeds of European temperate coasts and the subcontinental inland regions of Central and Southern Europe
Indicator species in Sicily: *Bolboschoenus maritimus subsp. maritimus, Cyperus laevigatus subsp. distachyos, Phragmites australis var. stenophylla, Scirpoides holoschoenus subsp. australis, Schoenoplectus tabernaemontani, S. litoralis, Sonchus maritimus subsp. maritimus.*

SCIRPION MARITIMI Dahl & Hadač 1941

Meso-eutrophic brackish swamp reeds of European temperate coastal regions
Indicator species in Sicily: see order.

Cypero laevigati-Schoenoplectetum thermalis Brullo, Di Martino & Marcenò 1977

Scirpetum compacto-littoralis (Br.-Bl. in Br.-Bl. *et al.* 1952) O. de Bolòs 1962 *corr.* Rivas-Mart., Costa, Castroviejo & Valdés-Bermejo 1980

Cyperetum distachyi Barbagallo, Brullo & Furnari 1990

Scirpetum compacti van Langendonck 1931 *corr.* Bueno & F. Prieto in Bueno 1997

OENANTHETALIA AQUATICAE Hejný *ex* Balátová-Tuláčková *et al.* 1993

Vegetation of emergent helophytes in shallow waters with fluctuating water table of temperate and boreal Eurasia
Indicator species in Sicily: *Alopecurus bulbosus, Oenanthe aquatica, O. fistulosa, Rorippa amphibia*.

ALOPECURO-GLYCERION SPICATAE Brullo, Minissale & Spampinato 1994

Vegetation of hygrophilous herblands of shallow montane pools characterized by large water-depth fluctuations at high altitudes of Sicily
Indicator species in Sicily: *Alopecurus aequalis, A. rendlei, Glyceria spicata, Lythrum portula*.

Oenantho fistulosae-Glycerietum spicatae Brullo & Grillo 1978

Glycerio spicatae-Oenanthetum aquaticae Brullo, Minissale & Spampinato 1994

Glycerio spicatae-Callitrichetum obtusangulae Brullo, Minissale & Spampinato 1994

PAPAVERETEA RHOEADIS Brullo, Scelsi & Spampinato 2001

Annual weed segetal vegetation of arable crops, orchards and vineyards in the temperate and boreal zones of Eurasia

Indicator species in Sicily: *Papaver rhoeas, Scandix pecten-veneris (subsp. pecten-veneris and subsp. brachycarpa), Torilis nodosa subsp. nodosa, Lolium rigidum (subsp. rigidum and subsp. lepturoides), Papaver dubium.*

APERETALIA SPICAE-VENTI J. Tx. & Tx. in Malato-Beliz, J. Tx. & Tx. 1960

Weed vegetation of cereal fields and gardens on acidic and nutrient-poor soils in the cool-temperate and boreal zones of Eurasia
Indicator species in Sicily: *Arenaria serpyllifolia, Bunias erucago, Cerastium glomeratum, Cladanthus mixtus, Legousia speculum-veneris, Raphanus raphanistrum subsp. landra, Veronica arvensis, Vicia sativa.*

SCLERANTHION ANNUI (Kruseman & Vlieger 1939) Sissingh in Westhoff, Dijk & Passchier 1946

Weed segetal vegetation of winter cereal crops on neutral to acidic loamy and sandy-loamy soils of the (sub)atlantic regions in the nemoral zone of Europe
Indicator species in Sicily: *Anthemis arvensis subsp. arvensis, Legousia falcata, Scleranthus annuus* (subsp. *annuus* and subsp. *verticillatus*).

Legousio falcatae-Brizetum minoris Brullo & Furnari 1982

GLADIOLO ITALICI-RIDOLFIETALIA SEGETI Mucina ex Mucina et al. 2016

Mediterranean winter-annual weed segetal vegetation of arable crops
Indicator species in Sicily: *Adonis microcarpa, Coronilla scorpioides, Galium verrucosum subsp. verrucosum, Gladiolus italicus, Lathyrus cicera, L. ochrus, Muscari comosum, Nigella damascena, Papaver hybridum, Rhagadiolus stellatus, Ridolfia segetum, Silene turbinata.*

FUMARION WIRTGENII-AGRARIAE Brullo in Brullo & Marcenò 1985a

Weed segetal vegetation of vineyards, orchards and hoed crops in the thermomediterranean belt of the Western and Central Mediterranean

Indicator species in Sicily: *Fumaria agraria, F. densiflora, F. gaillardotii, F. officinalis subsp. wirtgenii, F. parviflora, Linaria reflexa subsp. reflexa, Rumex bucephalophorus subsp. gallicus, Veronica hederifolia, Veronica cymbalaria subsp. cymbalaria.*

Diplotaxietum vimineo-erucoidis Brullo & Marcenò 1985a
Fumario densiflorae-Veronicetum hederifoliae Brullo & Marcenò 1985a
Fumario parviflorae-Geranietum tuberosi Brullo & Marcenò 1985a
Sileno coloratae-Lobularietum libycae Brullo & Marcenò 1985a
Raphano raphanistri-Erucetum sativae Brullo & Marcenò 1985a
Ammio majoris-Torilidetum nodosae Brullo & Marcenò 1985a
Herniario glabrae-Sperguletum arvensis Brullo & Marcenò 1985a
Loto subbiflori-Anthemidetum incrassatae Brullo & Marcenò 1985a
Fumarietum parvifloro-bastardii Bartolo, Brullo, Minissale & Spampinato 1990
Fumario parviflorae-Resedetum luteae Bartolo, Brullo, Minissale & Spampinato 1990

ROEMERION HYBRIDAE Rivas-Mart., Fernández-González & Loidi in Loidi *et al.* 1997

Weed segetal vegetation of arable crops on basic substrates in the meso- and supramediterranean belts of the Mediterranean

Indicator species in Sicily: *Bifora testiculata, Melilotus infestus, Silene fuscata.*

Legousio hybridae-Biforetum testiculatae Di Martino & Raimondo 1976
Adonido cupanianae-Anthemidetum incrassatae Bartolo, Brullo, Fagotto & Grillo 1983
Vicio bithynicae-Ranunculetum arvensis Bartolo, Brullo, Fagotto & Grillo 1983
Rapistro rugosi-Melilotetum infestae Bartolo, Brullo, Fagotto & Grillo 1983
Valerianello dentatae-Medicaginetum scutellatae Ferro 1988
Lolio rigidi-Raphanetum raphanistri Ferro 2005

RIDOLFION SEGETI Nègre *ex* Rivas-Mart., Fernández-González & Loidi 1999

Weed segetal vegetation of arable crops on neutral loamy-clayey soils in the thermo- and mesomediterranean belts of North Africa and the Southern Mediterranean

Indicator species in Sicily: *Adonis annua subsp. cupaniana, Bupleurum lancifolium, Geropogon hybridus, Phalaris brachystachys.*

Capnophyllo peregrini-Medicaginetum ciliaris Di Martino & Raimondo 1976
Calendulo tripterocarpae-Hypecoetum procumbentis Bartolo, Brullo, Minissale & Spampinato 1990

CHENOPODIETEA Br.-Bl. in Br.-Bl. *et al.* 1952

Wintergreen annual weedy and ruderal vegetation of man-made habitats of the Mediterranean, mild-winter Atlantic seaboards and Macaronesia

Indicator species in Sicily: *Carduus nutans subsp. siculus, C. pycnocephalus, Centaurea calcitrapa, Cichorium intybus, Erodium cicutarium, Erodium malacoides, Eryngium campestre, Hyoscyamus niger, Lactuca serriola, Marrubium vulgare, Picris hieracioides (subsp. setulosa and subsp. spinulosa), Silybum marianum, Spergula arvensis, Verbascum pulverulentum, V. sinuatum, V. thapsus.*

CHENOPODIETALIA MURALIS Br.-Bl. in Br.-Bl. *et al.* 1936

Winter-annual ruderal herb-rich vegetation on nutrient-rich disturbed soils of the Mediterranean and the Macaronesia

Indicator species in Sicily: *Chenopodium murale, Chondrilla juncea, Erigeron bonariensis, E. sumatrensis, Ecballium elaterium, Emex spinosa, Heliotropium curassavicum, Sisymbrium irio, Solanum sodomaeum.*

CHENOPODION MURALIS Br.-Bl. in Br.-Bl. et al. 1936

Mediterranean nutrient-demanding ruderal vegetation dominated by low-grown non-succulent herbs

Indicator species in Sicily: *Amaranthus deflexus, A. muricatus, Atriplex rosea, A. tatarica, Carthamus lanatus, Chenopodium ambrosioides, C. murale, C. opulifolium, C. vulvaria, Cynoglossum creticum, Notobasis syriaca, Scolymus hispanicus, Silybum marianum, Xanthium spinosum.*

Lavateretum cretico-arboreae Br.-Bl. & Molinier 1935
Malvetum parvifloro-nicaeensis Br.-Bl. & Maire *ex* Br.-Bl. 1936
Chenopodietum muralis Br.-Bl. in Br.-Bl. *et al.* 1936
Amarantho muricati-Chenopodietum ambrosioidis O. de Bolòs 1967

Amarantho viridis-Chenopodietum muralis Bartolo, Brullo, Minissale & Spampinato 1990
Chenopodio muralis-Parietarietum diffusae Brullo & Marcenò 1985a

BROMETALIA RUBENTI-TECTORUM (Rivas Goday & Rivas-Mart. 1973) Rivas-Mart. & Izco 1977

Winter-annual ruderal vegetation of summer-dry man-made habitats of the Mediterranean, the mild-winter Atlantic seaboards and Macaronesia
Indicator species in Sicily: *Aegilops geniculata, Anisantha madritensis, A. rubens, A. sterilis, A. tectorum, Astragalus hamosus, A. sesameus, Avena barbata, Avena sterilis, Bromus hordeaceus (subsp. hordeaceus and subsp. molliformis), Catapodium rigidum subsp. majus, Dasypyrum villosum, Galactites tomentosus, Hedypnois cretica, Lolium rigidum (subsp. rigidum and subsp. lepturoides), Lotus edulis, L. ornithopodioides, Lupinus angustifolius, Medicago ciliaris, M. doliata, M. orbicularis, M. polymorpha, M. truncatula, Stipellula capensis, Sulla coronaria, Tordylium apulum, Trifolium angustifolium, Trifolium stellatum, Vicia villosa*.

HORDEION MURINI Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

Mediterranean ruderal winter-annual grasslands
Indicator species in Sicily: *Anacyclus clavatus, Bromus scoparius, Echium plantagineum, Erodium ciconium, Glebionis coronaria, Hirschfeldia incana, Hordeum murinum subsp. leporinum, Plantago lagopus, Reseda alba, Rostraria cristata, Sisymbrium officinale*.

Hordeo leporini-Sisymbrietum orientalis Oberd. 1954
Malvo parviflorae-Chrysanthemetum coronarii Ferro 1980
Hordeo leporini-Vulpietum ligusticae Brullo 1983
Carduetum australis Brullo 1983
Hypochoerido hispidae-Plantaginetum serrariae Brullo 1983
Centauretum napifoliae Brullo 1983
Hordeo leporini-Senecionetum squalidi Brullo 1983
Hordeo leporini-Erodietum acaulis Brullo 1983
Senecioni cosyrensis-Hordetum leporini Brullo 1983

Hordeo leporini-Centauretum macracanthae Brullo 1983
Chrysanthemo coronarii-Silybetum mariani Brullo 1983
Hordeo leporini-Onopordetum illyrici Brullo & Marcenò 1985a
Hordeo leporini-Carduetum argyroae Brullo & Marcenò 1985a
Filago asterisci florae-congestae Bartolo, Brullo, Minissale & Spampinato 1990 *corr.**
Volutario lippii-Hordeetum leporini Brullo & Siracusa 1996
Hordeo leporini-Sisymbrietum erysimoidis Brullo & Scelsi 1988
Lavatero creticae-Chrysanthemetum coronarii Ferro 2005

ECHIO-GALACTITION TOMENTOSAE O. de Bolòs & Molinier 1969

<u>Mediterranean tall-herb ruderal vegetation on calcareous nutrient-rich disturbed man-made soils</u>

Indicator species in Sicily: *Centaurea diluta, Hypochaeris achyrophorus, Lotus ornithopodioides, Reichardia intermedia, R. picroides, Tordylium apulum, Urospermum picroides.*

Hedysaro coronarii-Lavateretum trimestris Maugeri 1975
Eruco sativae-Chamaemeletum mixti Brullo 1983
Galactito tomentosae-Isatidetum canescentis Brullo 1983
Galactito tomentosae-Knautietum hybridae Brullo 1983
**Linario multicaulis-Euphorbietum terracinae* Brullo 1983 *nom. mut. propos.*
Meliloto messanensis-Hordeetum marini Brullo 1983
Senecioni delphinifolii-Stachyetum hirtae Brullo 1983
Theligono cynocrambe-Smyrnietum rotundifolii Brullo 1983
Trifolio glomerati-Vicietum bithynicae Brullo 1983
Vicio villosae-Echietum pustulati Brullo 1983
Centauretum schouwii Brullo 1983
Convolvuletum tricoloris Brullo 1983
Convolvulo pentapetaloidi-Carduetum corymbosi Brullo 1983
Plantagini afrae-Carrichteretum annuae Bartolo, Brullo, Minissale & Spampinato 1990
Hippocrepido ciliatae-Astragaletum epiglottis Bartolo, Brullo, Minissale & Spampinato 1990
Phleo echinati-Silenetum tenuiflorae Bartolo, Minissale, Sorbello & Spampinato 1990

Chrysanthemo coronarii-Hippocrepidetum multisiliquosae Brullo & Siracusa 1996
Achilleo ligusticae-Galactitetum tomentosae Ferro 2005
Bromo hordeacei-Galactitetum tomentosae Ferro *et al.* 2003
Plantago afrae-Galactitetum tomentosae Ferro & Privitera 2010

FEDIO GRACILIFLORAE-CONVOLVULION CUPANIANI Brullo & Spampinato 1986

Weed segetal vegetation of vineyards, abandoned fields and roadsides in the thermo- and mesomediterranean belts of Sicily
Indicator species in Sicily: *Brassica rapa subsp. sylvestris, Cerinthe major, Convolvulus tricolor subsp. cupanianus, Fedia graciliflora, Geranium dissectum, Lotus purpureus, Medicago intertexta, S. leucanthemifolius subsp. mauritanicus, Scorpiurus vermiculatus, Silene bellidifolia, Trisetaria segetum, Vicia sicula.*

Ononido alopecuroidi-Vicietum siculae Brullo & Marcenò 1985
Chamaemelo fuscati-Silenetum fuscatae Brullo & Spampinato 1986
Vulpio ligusticae-Tetragonolobetum biflori Brullo & Spampinato 1986
Hedysaro coronarii-Lathyretum hirsuti Brullo & Spampinato 1986
Lotetum angustissimo-conimbricensis Brullo & Spampinato 1986

GERANIO PURPUREI-CARDAMINETALIA HIRSUTAE Brullo in Brullo & Marcenò 1985a

Winter-annual fringe vegetation in shaded mesic habitats of the Mediterranean, winter-mild temperate (sub)atlantic and submediterranean regions of temperate Europe and the Macaronesia
Indicator species in Sicily: *Cardamine hirsuta, Centranthus calcitrapae, Galium spurium, Geranium lucidum, G. purpureum, G. rotundifolium, Myosotis ramosissima, Parietaria lusitanica, Theligonum cynocrambe, Torilis nodosa subsp. nodosa.*

ALLION TRIQUETRI O. de Bolòs 1967

Sciaphilous subnitrophilous geophyte-rich fringe vegetation of the Central-Western Mediterranean region

Indicator species in Sicily: *Allium triquetrum, Cynoglossum creticum, Dephinium staphisagria, Smyrnium olusatrum, Stellaria cupaniana, Succowia balearica.*

Acantho mollis-Smyrnietum olusatri Brullo & Marcenò 1985a
Delphinio staphisagriae-Stellarietum cupanianae Brullo & Marcenò 1985a
Succowio balearicae-Smyrnietum olusatri Bartolo, Brullo, Minissale & Spampinato 1990
Fumario flabellatae-Parietarietum judaicae Bartolo, Brullo, Minissale & Spampinato 1990
Succowio balearicae-Castellietum tuberculosae Brullo & Siracusa 1996
Geranio purpurei-Smyrnietum olusatri Ferro 2005

VALANTIO MURALIS-GALION MURALIS Brullo in Brullo & Marcenò 1985a

Mesic subnitrophilous winter-annual fringe and wall vegetation of the Central and Eastern Mediterranean

Indicator species in Sicily: *Arabidopsis thaliana, Arabis verna, Arenaria leptoclados, Campanula dichotoma, C. erinus, Draba muralis, Erophila verna, Galium murale, Parietaria lusitanica, P. mauritanica, Phedimus stellatus, Sedum cepaea, Theligonum cynocrambe, Valantia muralis.*

Torilido nemorali-Cerastietum pentandri Brullo & Marcenò 1985a
Galio muralis-Sedetum cepaeae Brullo & Marcenò 1985a
Cruciato pedemontanae-Buglossoidetum splitgerberi Brullo & Marcenò 1985a
Parietario lusitanicae-Veronicetum cymbalariae Brullo & Marcenò 1985a
Sedetum litoreo-stellati Brullo & Marcenò 1985a
Laguro vestiti-Erodietum maritimi Brullo & Marcenò 1985a
Ranunculo parviflori-Senecionetum lividi Brullo & Marcenò 1985a
Valantio murali-Polycarpetum alsinifolii Brullo & Marcenò 1985a
Valerianello eriocarpae-Cerastietum glomerati Brullo & Marcenò 1985a
Valerianello carinatae-Cerastietum luridi Brullo & Marcenò 1985a
Geranio purpurei-Saxifragetum bulbiferae Brullo & Marcenò 1985a
Galio murali-Catapodietum zwierleinii Bartolo, Brullo, Minissale & Spampinato 1990
Valantio murali-Solenopsidetum annuae Brullo, Scelsi & Siracusa 1994
Valerianello puberulae-Galietum calvescentis Brullo & Siracusa 1996

VERONICO-URTICION URENTIS Brullo in Brullo & Marcenò 1985a

Mesic subnitrophilous sciaphilous weed vegetation of fertilized and irrigated citrus groves on alluvial soils of the Central Mediterranean

Indicator species in Sicily: *Stellaria neglecta, Urtica urens, Veronica persica.*

Fumario parviflorae-Stellarietum neglectae Maugeri *ex* Brullo & Marcenò 1985a

Bromo sterili-Brassicetum sylvestris Brullo & Marcenò 1985a

DIGITARIO SANGUINALIS-ERAGROSTIETEA MINORIS Mucina, Lososová & Šilc in Mucina *et al*. 2016

Thermophilous grass-rich anthropogenic vegetation rich in summer-annual C4 species in the southern nemoral, Mediterranean, steppe and semi-desert zones of Europe

Indicator species in Sicily: *Amaranthus albus, A. blitoides, A. blitum, A. graecizans subsp. sylvestris, A. viridis, Bassia scoparia, Corispermum intermedium, Cynodon dactylon, Digitaria ischaemum, D. sanguinalis, Diplotaxis muralis, D. tenuifolia, Dysphania ambrosioides, Echinochloa colona, E. crus-galli, Eleusine indica, Eragrostis barrelieri, E. minor, Erigeron bonariensis, Euphorbia chamaesyce, E. humifusa, E. maculata, E. prostrata, Heliotropium europaeum, Lepidium densi orum.*

ERAGROSTIETALIA J. Tx. ex Poli 1966

Thermophilous grass-rich anthropogenous vegetation rich in C4 species on summer-dry sandy soils of Southern and Central Europe

Indicator species in Sicily: *Amaranthus cruentus, A. hybridus, A. hypocondriacus, A. retroflexus, Aristolochia clematitis, Chenopodium opulifolium, Cyperus rotundus, Eragrostis E. cilianensis, E. pilosa, Euphorbia segetalis, Galinsoga parviflora, Misopates orontium, Persicaria maculosa, P. lapathifolia, Portulaca oleracea, Setaria adhaerens, S. verticillata, Solanum villosum, Sorghum halepense, Tribulus terrestris.*

ERAGROSTION Tx. in Oberd. 1954

Thermophilous late-summer weed vegetation on sandy soils of southeastern Central Europe and the Balkan Peninsula

Indicator species in Sicily: see order.

Setario glaucae-Echinochloëtum coloni A. Bolòs y Vayreda & O. de Bolòs ex O. de Bolòs 1956
Setario ambiguae-Cyperetum rotundi Brullo, Scelsi & Spampinato 2001
Amarantho graecizantis-Setarietum verticillatae Ferro 2005

DIPLOTAXION ERUCOIDIS Br.-Bl. in Br.-Bl., Gajewski, Wraber & Walas 1936

Weed vegetation on neutral to basic soils in the thermo- and mesomediterrannean belts of the Central and Western Mediterranean
Indicator species in Sicily: *Visnaga daucoides, Diplotaxis erucoides, Chrozophora tinctoria, Euphorbia chamaesyce subsp. massiliensis, Helminthotheca echioides, Hypericum triquetrifolium, Silene turbinata.*

Chrozophoro tinctoriae-Kickxietum integrifoliae Brullo & Marcenò 1980
Amarantho lividi-Eragrostietum barrelieri Brullo & Marcenò 1985
Chrozophoro tinctoriae-Heliotropietum dolosi Bartolo, Brullo, Minissale & Spampinato 1990

CHENOPODION BOTRYOS Brullo & Marcenò 1980

Weed vegetation on sandy acidic and nutrient-poor soils in the thermo- and mesomediterrannean belts of Sicily
Indicator species in Sicily: *Brassica fruticulosa, Dysphania botrys, D. multi da, Heliotropium suaveolens subsp. bocconei.*

Heliotropietum bocconei Brullo & Marcenò 1980
Heliotropietum dolosi Brullo & Marcenò 1980
Heliotropio dolosi-Brassicetum fruticulosae Ferro 2005

POLYGONO-POETEA ANNUAE Rivas-Mart. 1975

Subcosmopolitan therophytic nitrophilous dwarf vegetation of trampled areas
Indicator species in Sicily: *Poa annua, Polygonum arenastrum, Sclerochloa dura*

POLYGONO ARENASTRI-POETALIA ANNUAE Tx. in Géhu, Richard & Tx. 1972 corr. Rivas-Mart. *et al.* 1991

Subcosmopolitan therophyte-rich dwarf-herb vegetation of trampled habitats
Indicator species in Sicily: Amaranthus deflexus.

POLYCARPION TETRAPHYLLI Rivas-Mart. 1975

Herb-rich vegetation in trampled sunny habitats of the Mediterranean
Indicator species in Sicily: *Coronopus didymus, Polycarpon tetraphyllum, Plantago coronopus subsp. humilis, Sagina apetala, Spergularia rubra.*

Euphorbio chamaesyci-Oxalidetum corniculatae Lorenzoni 1964
Crassulo tillaeae-Saginetum apetalae Rivas-Mart. 1975
Polycarpo tetraphylli-Spergularietum rubrae Brullo & Marcenò 1976 *em.* Brullo 1980
Trisetario aureae-Crepidetum bursifoliae Brullo 1980
Arabidopsio thalianae-Cardaminetum hirsutae Brullo 1980

ARTEMISIETEA VULGARIS Lohmeyer, Preising & R. Tx in Tx. ex von Rochow 1951

Perennial (sub)xerophilous geophytic and hemicryptophytic ruderal eutrophilic vegetation of the temperate and Mediterranean regions of Europe
Indicator species in Sicily: *Arctium minus, Ballota nigra, Barbarea bracteosa, Carduus nutans subsp. nutans, Cerinthe minor subsp. auriculata, Chaerophyllum, Cirsium vulgare subsp. vulgare, Conium maculatum, Dipsacus fullonum, Geranium pyrenaicum, Lapsana communis, Malva moschata, Rumex obtusifolius, Silene latifolia, Sinapis pubescens, Smyrnium perfoliatum, Taraxacum gasparrinii.*

CARTHAMETALIA LANATI Brullo in Brullo & Marcenò 1985a

Thistle-dominated ruderal vegetation on disturbed calcareous substrates of the submediterranean regions of Southern Europe
Indicator species in Sicily: *Carthamus lanatus, Centaurea aspera, Cynoglossum cheirifolium, C. creticum, Echium vulgare subsp. pustulatum, Nicotiana glauca, Notobasis syriaca, Picnomon acarna, Scolymus hispanicus, S. maculatus.*

SILYBO MARIANI-URTICION PILULIFERAE Sissing *ex* Br.-Bl. & O. de Bolòs 1958

Hypernitrophilous thistle-dominated vegetation of the Mediterranean sheepfolds and manure heaps
Indicator species in Sicily: *Carduus tenuiflorus, C. acicularis, C. argyroa, Cirsium vulgare subsp. crinitum, Notobasis syriaca, Silybum marianum, Urtica pilulifera.*

Silybo mariani-Urticetum piluliferae Br.-Bl. in Br.-Bl. et al. 1936

ONOPORDION ILLYRICI Oberd. 1954

Thistle-dominated ruderal xerophilous vegetation of Sicily, Mediterranean and submediterranean regions of the Balkan and Italian peninsulas
Indicator species in Sicily: *Carthamus caeruleus subsp. caeruleus, Carlina gummifera, Cirsium echinatum, Cynara cardunculus, Eryngium campestre, Onopordum illyricum* (subsp. *illyricum* and subsp. *horridum*), *Phlomis herba-venti, Scolymus hispanicus, Tyrimnus leucographus*.

Scolymetum maculato-grandiflori Brullo & Marcenò 1985a
Onopordo illyrici-Cirsietum scabri Brullo & Marcenò 1985a
Pteridio aquilini-Tanacetum siculi Brullo & Marcenò 1985a
Bonannietum graecae Brullo & Marcenò 1985a
Phlomido herba-venti-Salvietum sclareae Brullo & Marcenò 1985a
Phlomido herba-venti-Nepetetum apuleii Brullo & Marcenò 1985a
Glaucio flavi-Onopordetum horridi Brullo & Marcenò 1985a
Glaucio flavi-Scolymetum hispanici Bartolo, Brullo, Minissale & Spampinato 1990

ELYTRIGIO REPENTIS-DITTRICHIETALIA VISCOSAE Mucina in Mucina et al. 2016

Anthropogenic sub-ruderal and ruderal grasslands and herblands of submediterranean and mediterranean Southern Europe
Indicator species in Sicily: *Boerhavia repens, Dittrichia viscosa, Euphorbia ceratocarpa, Lepidium graminifolium, Piptatherum miliaceum subsp. miliaceum, Plumbago europaea.*

BROMO-ORYZOPSION MILIACEAE O. de Bolòs 1970

Thermomediterranean sub-ruderal perennial grasslands on disturbed road verges of the Mediterranean
Indicator species in Sicily: see order.

Dauco maximi-Oryzopsietum miliaceae O. de Bolòs & Vigo 1972
Boerhraavio viscosae-Oryzopsietum miliaceae Brullo 1984
Centrantho rubri-Euphorbietum ceratocarpae Brullo 1984
Diplotaxio tenuifoliae-Oryzopsietum miliaceae Brullo 1984
Dittrichio graveolentis-Ferulaginetum campestris Brullo 1984
Euphorbietum cupanii Brullo 1984
Sinapio pubescenti-Oryzopsietum miliaceae Brullo 1984

Tricholaeno teneriffae-Oryzopsietum miliaceae Brullo 1984
Mantisalco salmanticae-Oryzopsietum miliaceae Bartolo, Brullo, Minissale & Spampinato 1990
Lathyro sphaerici-Oryzopsietum miliaceae Brullo & Siracusa 1996
Centauretum sonchifoliae Brullo & Siracusa 2005

*ARUNDION PLINII Brullo, Giusso, Guarino & Sciandrello in C. Brullo et al. 2010 nom. mut. propos.

Thermomediterranean sub-ruderal perennial terrestrial reed on wet clayey soils of the Southern Apennine Peninsula, Sicily, Hellas and Crete
Indicator species in Sicily: *Arundo plinii*.

**Euphorbio ceratocarpae-Arundinetum plinii* Brullo, Giusso, Guarino & Sciandrello 2010 *nom. mut. propos.*

EPILOBIETEA ANGUSTIFOLII R.Tx. & Preising ex von Rochow 1951

Tall-herb semi-natural perennial vegetation on disturbed forest edges, nutrient-rich riparian fringes and forest clearings of Eurasia
Indicator species in Sicily: *Anthriscus nemorosa, Chaerophyllum temulum, Epilobium angustifolium, Galium aparine, Geranium robertianum, Heracleum sphondylium subsp. elegans, Lamium flexuosum, Poa trivialis, Sambucus ebulus.*

CONVOLVULETALIA SEPIUM Tx. ex Moor 1958

Semi-natural fringe vegetation on banks of rivers and other water bodies of temperate Europe and the Mediterranean
Indicator species in Sicily: *Anthoxanthum odoratum, Calystegia sepium, Pastinaca sativa* subsp. *urens*.

CYNANCHO-CONVOLVULION SEPIUM Rivas Goday & Rivas-Mart. ex Rivas-Mart. 1977

Western Mediterranean tall-herb vegetation in nutrient-rich riparian habitats
Indicator species in Sicily: *Arundo donax, Cynanchum acutum.*

Calystegio sylvaticae-Arundinetum donacis Brullo, Scelsi & Spampinato 2001

**DORYCNIO RECTI-RUMICION CONGLOMERATI Gradstein & Smittenberg 1977

Central and Eastern Mediterranean tall-herb vegetation in nutrient-rich riparian habitats

Indicator species in Sicily: *Lotus rectus, Mentha suaveolens, Petasites hybridus, Rumex conglomeratus.*

Rubo ulmifolii-Dorycnietum recti Brullo, Minissale, Scelsi & Spampinato 1993

Cirsio cretici-Dorycnietum recti (Brullo & Ronsisvalle 1975) J.M. Géhu & Biondi 1988

BALLOTO-CONION MACULATI Brullo in Brullo & Marcenò 1985a

Tall-herb perennial ruderal vegetation in mesic habitats in the submontane and montane belts of submediterranean Europe

Indicator species in Sicily: *Artemisia verlotiorum, Ballota nigra subsp. uncinata, Chelidonium majus, Conium maculatum, Melissa romana, Silene latifolia, Urtica dioica.*

Urtico dioicae-Sambucetum ebuli (Br.-Bl. in Br.-Bl. et al. 1936) Br.-Bl., Roussine & Nègre 1952

Galio aparines-Conietum maculati Rivas-Mart. *ex* Lopez 1978

Angelico sylvestris-Urticetum dioicae Minissale & Spampinato 1991

Balloto uncinatae-Melissetum romanae Brullo, Minissale, Scelsi & Spampinato 1993

GALIO APARINES-ALLIARIETALIA PETIOLATAE Oberd. in Görs & T. Müller 1969

Ruderal and semi-natural thermophilous fringe vegetation of short-lived herbs on nutrient-rich soils in the submontane and montane belts of submediterranean Europe

Indicator species in Sicily: *Alliaria petiolata, Bryonia cretica subsp. dioica, Cruciata laevipes, Galium aparine, Glechoma hirsuta.*

ANTHRISCION NEMOROSAE Brullo in Brullo & Marcenò 1985a

Ruderal and semi-natural thermophilous fringe vegetation of short-lived herbs on nutrient-rich soils in the submontane and montane belts of submediterranean Europe

Indicator species in Sicily: *Allium ursinum, Anthriscus nemorosa, Lamium bifidum, Ranunculus lanuginosus var. umbrosus, Symphytum bulbosum, Thlaspi alliaceum*.

Anthrisco nemorosae-Chaerophylletum temuli (Hruska 1981) Brullo, Scelsi & Spampinato 2001
Lepidio nebrodensis-Smyrnietum perfoliati Brullo & Marcenò 1985a
Anthrisco nemorosae-Heracletum cordati Brullo & Marcenò 1985a

ARCTIO LAPPAE-ARTEMISIETALIA VULGARIS Dengler 2002

Ruderal vegetation dominated by short-lived perennials on mesic loamy soils of the low-altitude cool-temperate Europe and mountains of Mediterranean Europe

Indicator species in Sicily: *Carduus nutans subsp. nutans, Cerinthe minor subsp. auriculata, Chaerophyllum temulum, Malva moschata, Rumex obtusifolius, Sinapis pubescens, Urtica dioica.*

ARCTION LAPPAE Tx. 1937

Ruderal vegetation of short-lived perennials on mesic loamy soils of cool-temperate Europe mountains of Mediterranean Europe

Indicator species in Sicily: *Arctium minus, Chenopodium bonus-henricus, Geranium pyrenaicum, Verbascum rotundifolium*.

Urtico dioicae-Arrhenatheretum elatioris Raimondo 1983 *em.* Brullo & Marcenò 1985a
Cerintho auriculatae-Chenopodietum boni-henrici Brullo & Marcenò 1985a
Verbasco rotundifolii-Sambucetum ebuli Brullo & Marcenò 1985a
Urtico dioicae-Cirsietum italici Brullo & Marcenò 1985a

BIDENTETEA Tx., Lohmeyer & Preising *ex* von Rochow 1951

Summer-annual pioneer vegetation of seasonally flooded nutrient-rich riverbeds, lacustrine banks and heavily nutrient-loaded anthropogenic habitats of Europe and North Africa
Indicator species in Sicily: *Bidens aurea, B. frondosa, B. tripartita.*

BIDENTETALIA Br.-Bl. & Tx. *ex* Klika & Hadač 1944

Summer-annual pioneer vegetation of seasonally flooded nutrient-rich riverbeds, lacustrine banks and heavily nutrientloaded anthropogenic habitats of boreo-temperate Europe
Indicator species in Sicily: *Bidens tripartita, Echinochloa crus-galli, Persicaria hydropiper.*

BIDENTION TRIPARTITAE Nordhagen ex Klika & Hadač 1944

Summer-annual pioneer vegetation of periodically nutrient-rich river banks and drained muddy bottoms of eutrophic lakes of boreo-temperate Europe
Indicator species in Sicily: *Cyperus fuscus, Paspalum distichum, Polypogon viridis.*
Bidentetum tripartitae Koch 1926

CHENOPODION RUBRI (Tx. in Poli & J. Tx. 1960) Hilbig & Jage 1972

Summer-annual pioneer vegetation in heavily nutrient-loaded and saline ruderal habitats of temperate Europe
Indicator species in Sicily: *Amaranthus retroflexus, Cyperus fuscus, Persicaria lapathifolia, Polypogon viridis, Xanthium strumarium* subsp. *italicum.*

Polygono lapathifolii-Xanthietum italici Pirola & Rossetti 1974
Polygono orientalis-Chenopodietum rubri Sciandrello 2009

PASPALO-HELEOCHLOETALIA Br.-Bl. *ex* Rivas Goday 1956

Summer-annual pioneer vegetation of periodically flooded nutrient-rich river alluvia of the Mediterranean regions of Europe and North Africa
Indicator species in Sicily: *Corrigiola littoralis, Dysphania anthelmintica, Panicum repens, Persicaria lapathifolia, Sporobolus schoenoides,, Tagetes minuta.*

Paspalo-Agrostion SEMIverticillati Br.-Bl. in Br.-Bl., Roussine & Nègre 1952

Summer-annual pioneer vegetation of periodically flooded subsaline nutrient-rich river alluvia of the mediterranean regions of Europe and North Africa

Indicator species in Sicily: see order

Paspalo-Polypogonetum viridis Br.-Bl. 1936

Lippio nodiflorae-Panicetum repentis O. Bolòs 1957

FLORAE SICULAE SYNOPSIS

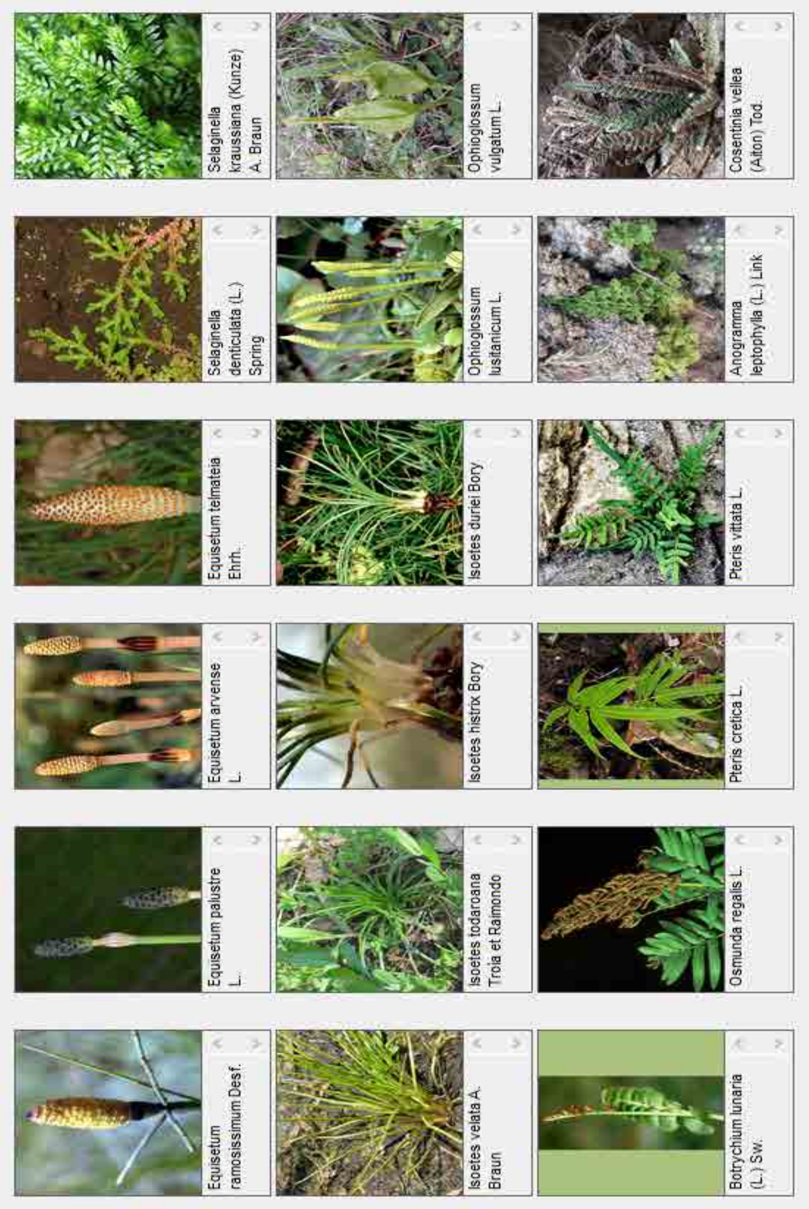
Riccardo Guarino & Marco La Rosa

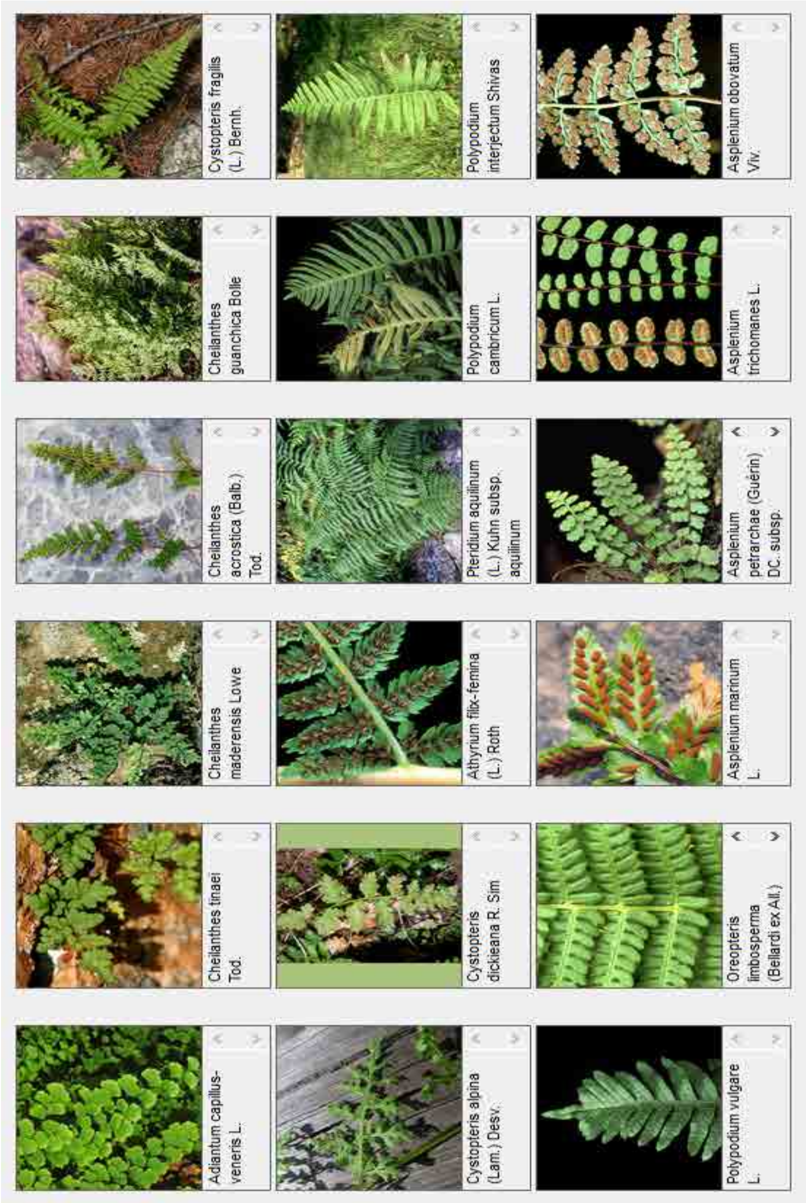
The flora of Sicily counts 3111 species: around 40% of our national flora. The tables included here illustrate 3081 of these species. Tables are taken from the Flora d'Italia Digitale (Digital Flora of Italy), which will bundle the second edition of Pignatti's Flora d'Italia. It will include more than 90000 pics of 7620 species, a data base on plant traits and an interactive identification tool.

We committed ourselves to the flora because we would like to inspire a true love for the plant life, for their ecosystems. We wanted to show everyone the colourful variety of our flowering plants, we wanted to invite everyone to go hiking to see and experience what is shown in our photographs. Plant are a marvellous synthesis of discreet beauty and laborious productivity. They offer those who suffer from the depletion of vital energies the reward of an aesthetic catharsis, the exhilaration of contemplative stunning. In short: a botanical excursion cheers up!

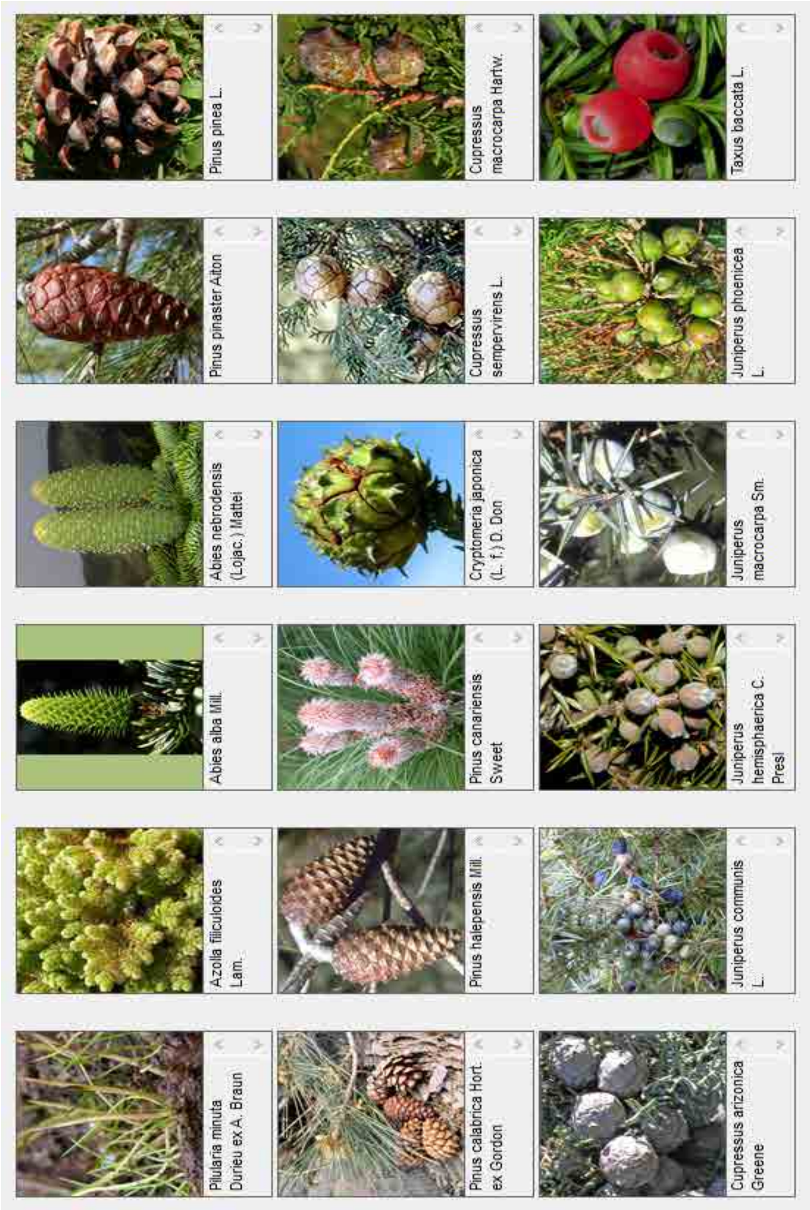
Plants invite us to take the measures of ourselves and to resize our problems. If you think that the quality of life is not determined by what you have, but by what you know, the ability to recognize and name the organisms that make possible our very existence, is a way to live better.

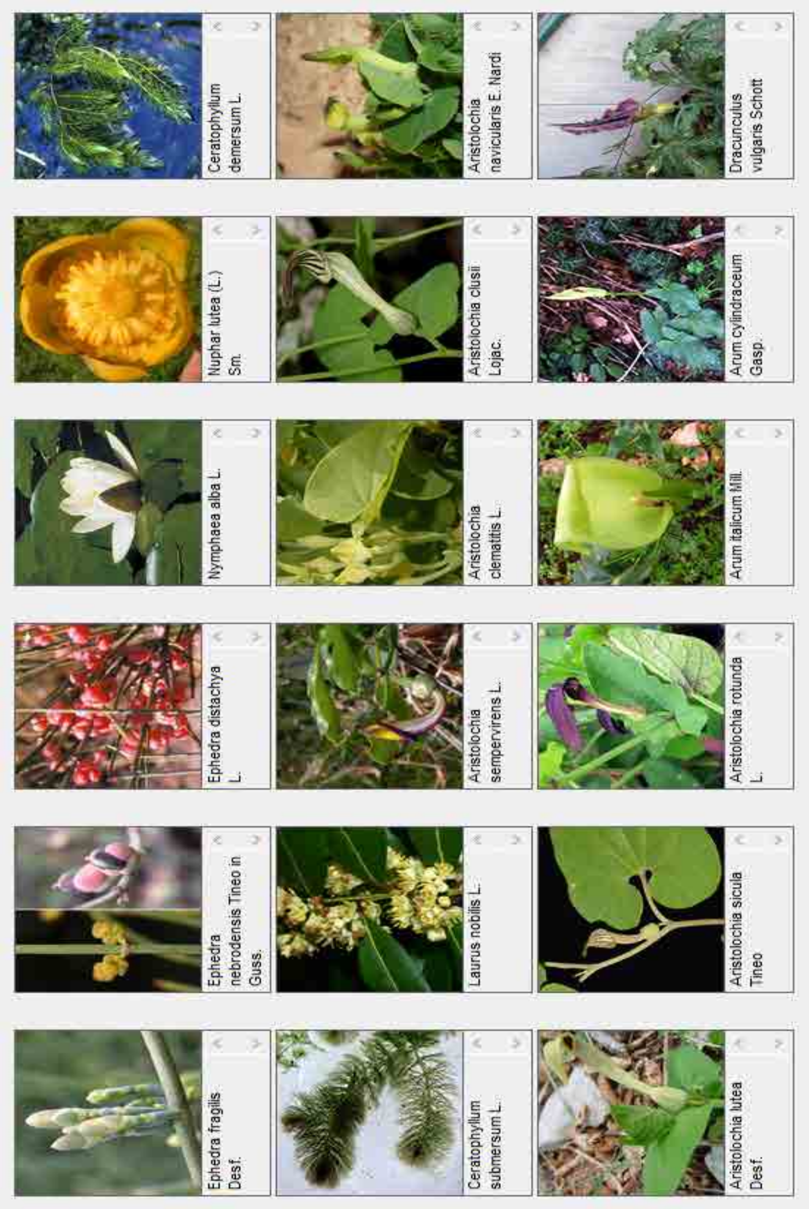
Plants have an essential smartness, a simplicity lived with serene grace. Silently passing their time on the earth, they glamorize without clamour, they give without demanding. He who loves plants can see how gross it is to hoard without limits; how illusory it is to claim pre-emption over what, in reality, belongs to everyone; how vain it is to spend time just to satisfy needless needs, believing that this is the right way to escape from a status that looks like "poverty" to our blinded eyes. He who really loves plants realizes that we are getting poorer and poorer while we continue this vast and violent exploitation of our planet.

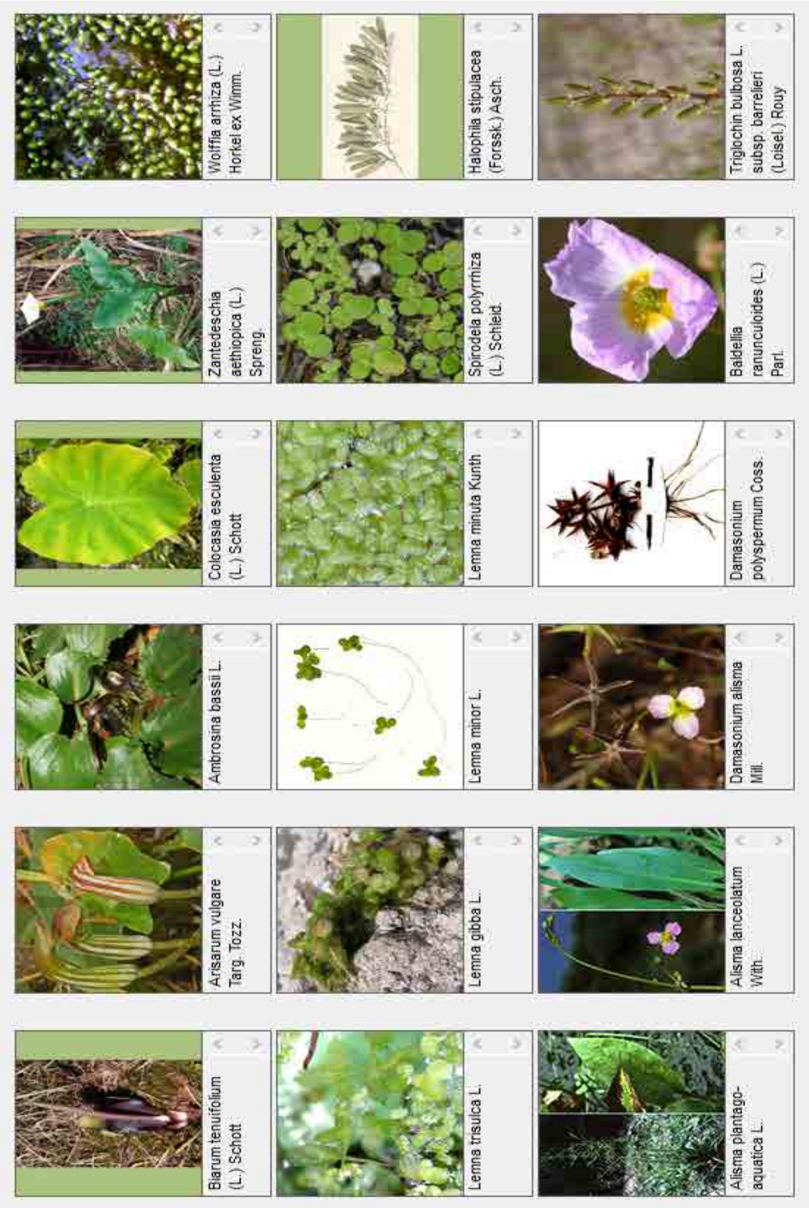

Equisetum ramosissimum Desf.
Equisetum palustre L.
Equisetum arvense L.
Equisetum telmateia Ehrh.
Selaginella denticulata (L.) Spring
Selaginella kraussiana (Kunze) A. Braun
Isoetes velata A. Braun
Isoetes todaroana Troia et Raimondo
Isoetes histrix Bory
Isoetes duriei Bory
Ophioglossum lusitanicum L.
Ophioglossum vulgatum L.
Botrychium lunaria (L.) Sw.
Osmunda regalis L.
Pteris cretica L.
Pteris vittata L.
Anogramma leptophylla (L.) Link
Cosentinia vellea (Aiton) Tod.

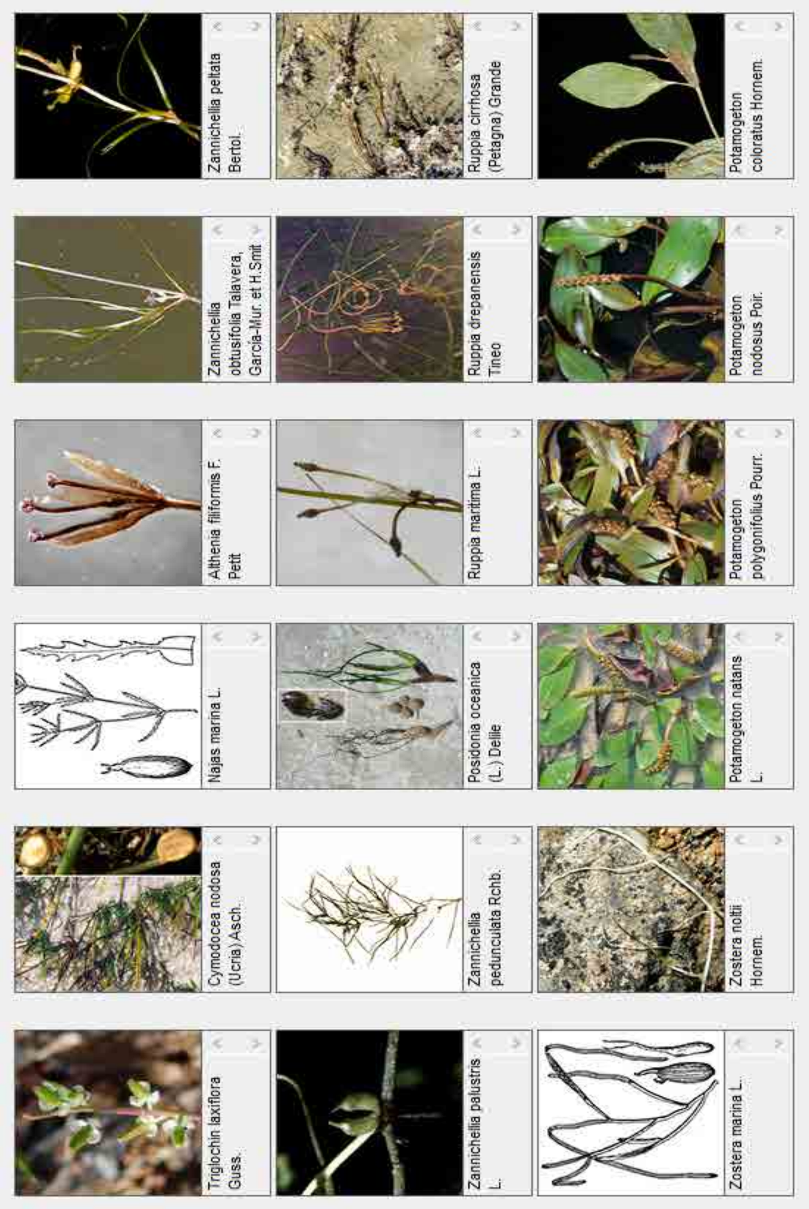

Adiantum capillus-veneris L.
Cheilanthes tinaei Tod.
Cheilanthes maderensis Lowe
Cheilanthes acrostica (Balb.) Tod.
Cheilanthes guanchica Bolle
Cystopteris fragilis (L.) Bernh.
Cystopteris alpina (Lam.) Desv.
Cystopteris dickieana R. Sim
Athyrium filix-femina (L.) Roth
Pteridium aquilinum (L.) Kuhn subsp. aquilinum
Polypodium cambricum L.
Polypodium interjectum Shivas
Polypodium vulgare L.
Oreopteris limbosperma (Bellardi ex All.)
Asplenium marinum L.
Asplenium petrarchae (Guérin) DC. subsp.
Asplenium trichomanes L.
Asplenium obovatum Viv.


Asplenium balearicum Shivas
Asplenium onopteris L.
Asplenium septentrionale (L.) Hoffm. subsp.
Asplenium ruta-muraria L.
Asplenium lepidum C. Presl subsp. lepidum
Ceterach officinarum Willd.
Phyllitis scolopendrium (L.) Newman subsp.
Phyllitis sagittata (DC.) Guinea et Heywood
Polystichum setiferum (Forssk.) Moore ex Woyn.
Cyrtomium falcatum (L. f.) C. Presl
Dryopteris filix-mas (L.) Schott
Dryopteris affinis (Lowe) Fraser-Jenk. subsp. affinis
Dryopteris borreri (Newman) Newman ex Oberh. et Tavel
Dryopteris cambrensis (Fraser-Jenk.) Beitel
Dryopteris pallida (Bory) C. Chr. ex Maire et Petitm.
Nephrolepis cordifolia (L.) C. Presl
Blechnum spicant (L.) Roth
Woodwardia radicans (L.) Sm.

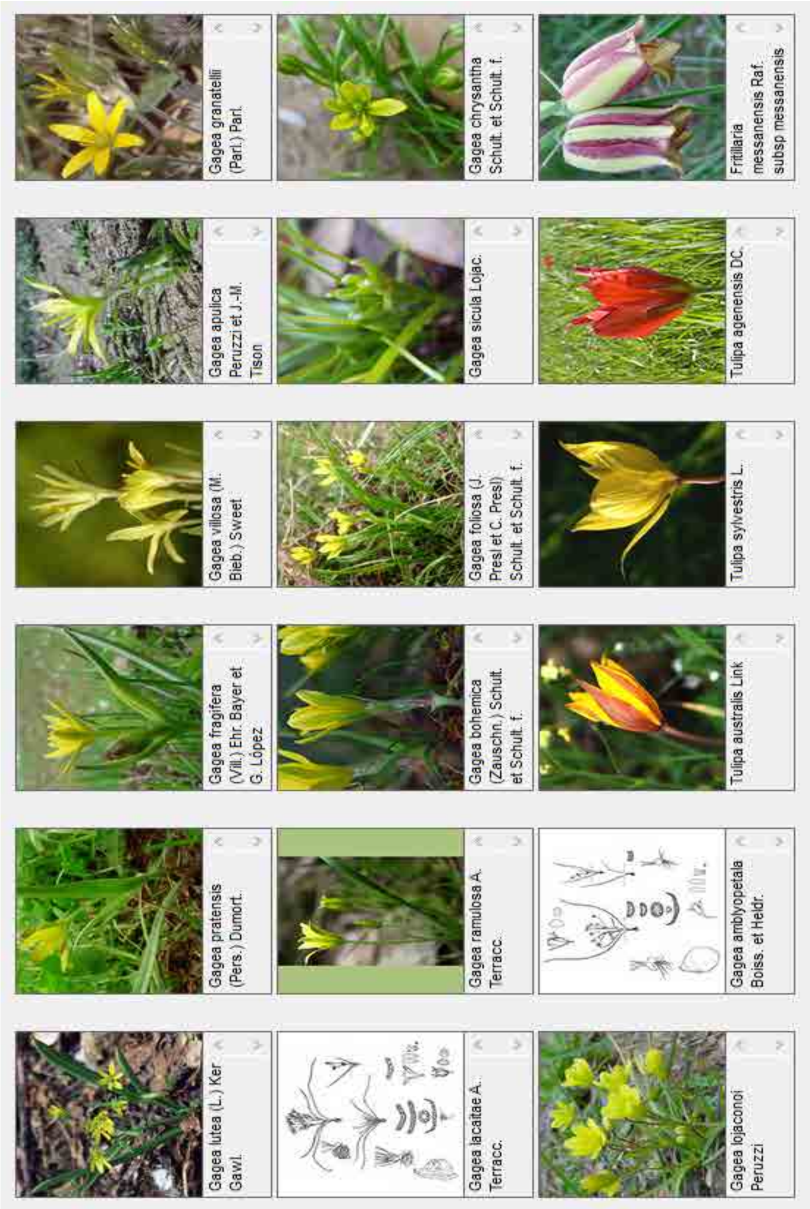

Pilularia minuta Durieu ex A. Braun
Azolla filiculoides Lam.
Abies alba Mill.
Abies nebrodensis (Lojac.) Mattei
Pinus pinaster Aiton
Pinus pinea L.
Pinus calabrica Hort. ex Gordon
Pinus halepensis Mill.
Pinus canariensis Sweet
Cryptomeria japonica (L. f.) D. Don
Cupressus sempervirens L.
Cupressus macrocarpa Hartw.
Cupressus arizonica Greene
Juniperus communis L.
Juniperus hemisphaerica C. Presl
Juniperus macrocarpa Sm.
Juniperus phoenicea L.
Taxus baccata L.

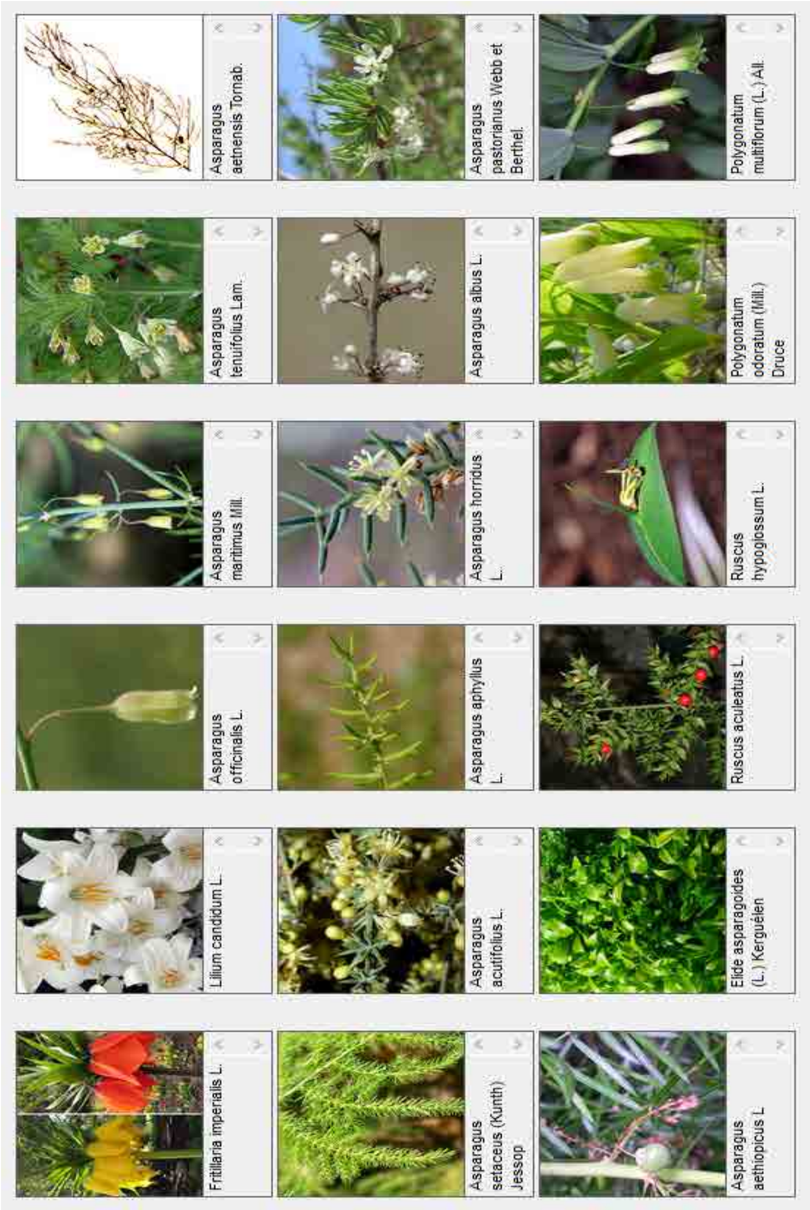

Ephedra fragilis Desf.
Ephedra nebrodensis Tineo in Guss.
Ephedra distachya L.
Nymphaea alba L.
Nuphar lutea (L.) Sm.
Ceratophyllum demersum L.
Ceratophyllum submersum L.
Laurus nobilis L.
Aristolochia sempervirens L.
Aristolochia clematitis L.
Aristolochia clusii Lojac.
Aristolochia navicularis E. Nardi
Aristolochia lutea Desf.
Aristolochia sicula Tineo
Aristolochia rotunda L.
Arum italicum Mill.
Arum cylindraceum Gasp.
Dracunculus vulgaris Schott


Biarum tenuifolium (L.) Schott
Arisarum vulgare Targ. Tozz.
Ambrosina bassii L.
Colocasia esculenta (L.) Schott
Zantedeschia aethiopica (L.) Spreng.
Wolffia arrhiza (L.) Horkel ex Wimm.
Lemna trisulca L.
Lemna gibba L.
Lemna minor L.
Lemna minuta Kunth
Spirodela polyrrhiza (L.) Schleid.
Halophila stipulacea (Forssk.) Asch.
Alisma plantago-aquatica L.
Alisma lanceolatum With.
Damasonium alisma Mill.
Damasonium polyspermum Coss.
Baldellia ranunculoides (L.) Parl.
Triglochin bulbosa L. subsp. barrelieri (Loisel.) Rouy


Triglochin laxiflora Guss.
Cymodocea nodosa (Ucria) Asch.
Najas marina L.
Althenia filiformis F. Petit
Zannichellia obtusifolia Talavera, García-Mur. et H.Smit
Zannichellia peltata Bertol.
Zannichellia palustris L.
Zannichellia pedunculata Rchb.
Posidonia oceanica (L.) Delile
Ruppia maritima L.
Ruppia drepanensis Tineo
Ruppia cirrhosa (Petagna) Grande
Zostera marina L.
Zostera noltii Hornem.
Potamogeton natans L.
Potamogeton polygonifolius Pourr.
Potamogeton nodosus Poir.
Potamogeton coloratus Hornem.

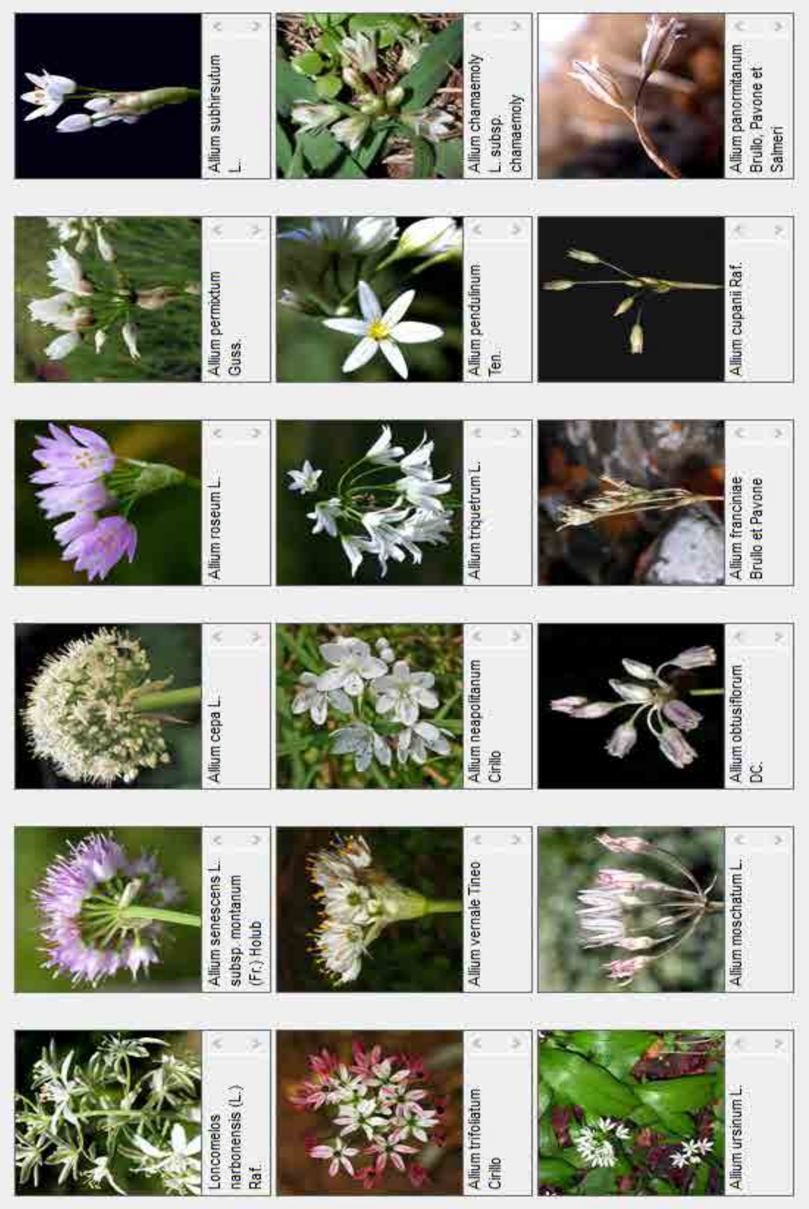

Potamogeton subflavus Loret et Barrandon
Potamogeton gramineus L.
Potamogeton lucens L.
Potamogeton perfoliatus L.
Potamogeton crispus L.
Potamogeton pusillus L.
Potamogeton trichoides Cham. et Schltdl.
Potamogeton pectinatus L.
Potamogeton filiformis Pers.
Groenlandia densa (L.) Fourr.
Tamus communis L.
Colchicum cupanii Guss.
Colchicum triphyllum Kunze
Colchicum alpinum Lam. et DC.
Colchicum bivonae Guss.
Colchicum neapolitanum Ten.
Smilax aspera L.
Gagea trinervia (Viv.) Greuter


Gagea lutea (L.) Ker. Gawl.
Gagea pratensis (Pers.) Dumort.
Gagea fragifera (Vill.) Ehr. Bayer et G. López
Gagea villosa (M. Bieb.) Sweet
Gagea apulica Peruzzi et J.-M. Tison
Gagea granatellii (Parl.) Parl.
Gagea lacaitae A. Terracc.
Gagea ramulosa A. Terracc.
Gagea bohemica (Zauschn.) Schult. et Schult. f.
Gagea foliosa (J. Presl et C. Presl) Schult. et Schult. f.
Gagea sicula Lojac.
Gagea chrysantha Schult. et Schult. f.
Gagea lojaconoi Peruzzi
Gagea amblyopetala Boiss. et Heldr.
Tulipa australis Link
Tulipa sylvestris L.
Tulipa agenensis DC.
Fritillaria messanensis Raf. subsp messanensis

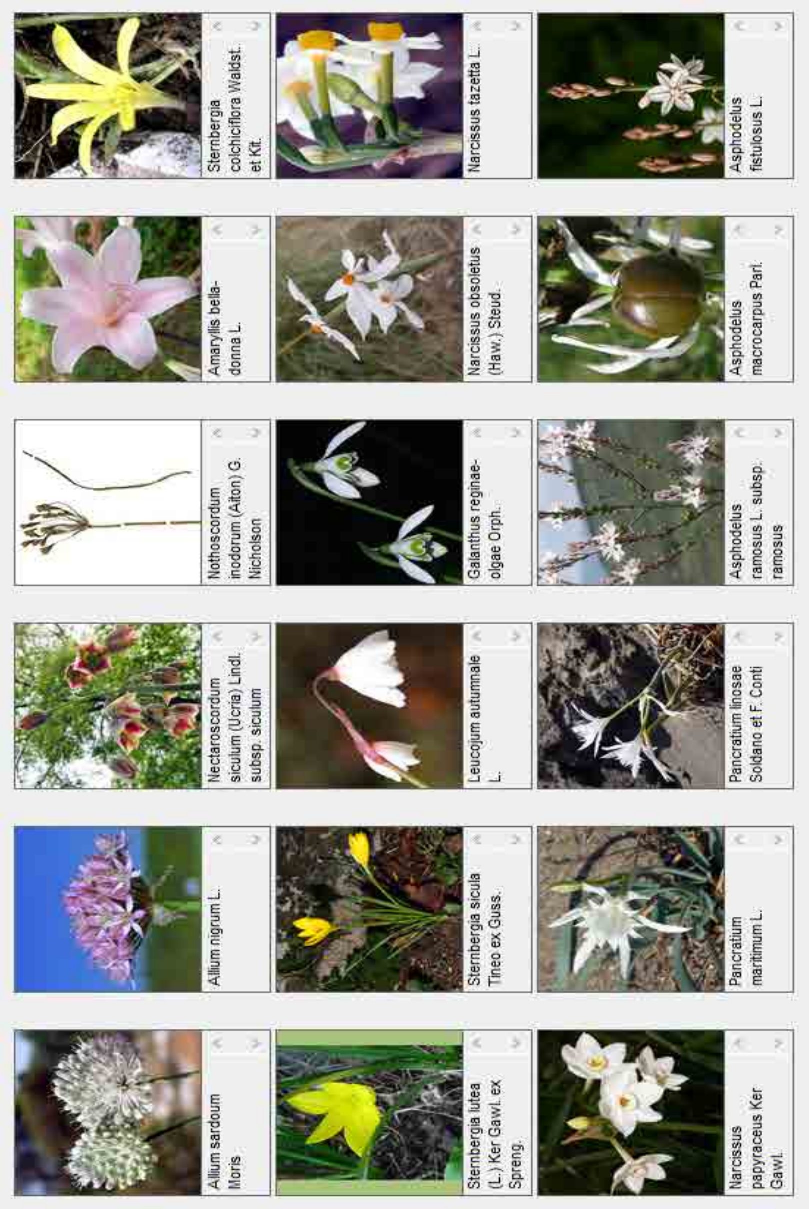

Fritillaria imperialis L.
Lilium candidum L.
Asparagus officinalis L.
Asparagus maritimus Mill.
Asparagus tenuifolius Lam.
Asparagus aetnensis Tornab.
Asparagus setaceus (Kunth) Jessop
Asparagus acutifolius L.
Asparagus aphyllus L.
Asparagus horridus L.
Asparagus albus L.
Asparagus pastorianus Webb et Berthel.
Asparagus aethiopicus L
Elide asparagoides (L.) Kerguélen
Ruscus aculeatus L.
Ruscus hypoglossum L.
Polygonatum odoratum (Mill.) Druce
Polygonatum multiflorum (L.) All.

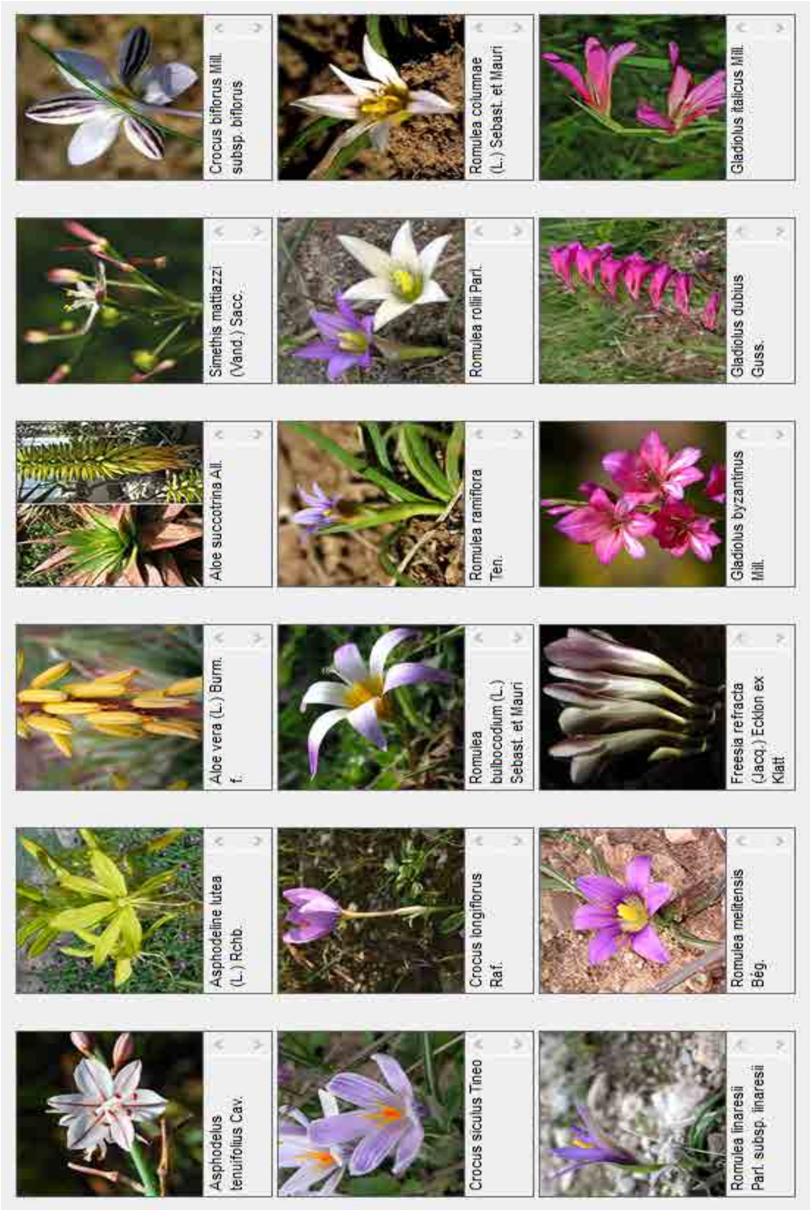

Agave americana L.
Agave salmiana Otto ex Salm-Dyck
Agave sisalana Perrine
Agave vivipara L.
Yucca aloifolia L.
Yucca gloriosa L.
Scilla bifolia L.
Prospero autumnale (L.) Speta
Prospero hierae C. Brullo, Brullo, Giusso, Pavone et
Prospero obtusifolium (Poir.) Speta subsp.
Oncostema sicula (Tineo ex Guss.) Speta
Oncostema dimartinoi (Brullo et Pavone) F. Conti et
Oncostema hughii (Tineo ex Guss.) Speta
Oncostema cerulea (Raf.) Speta
Oncostema elongata (Parl.) Speta
Brimeura amethystina (L.) Salisb.
Bellevalia romana (L.) Sweet
Bellevalia pelagica C. Brullo, Brullo et Pasta

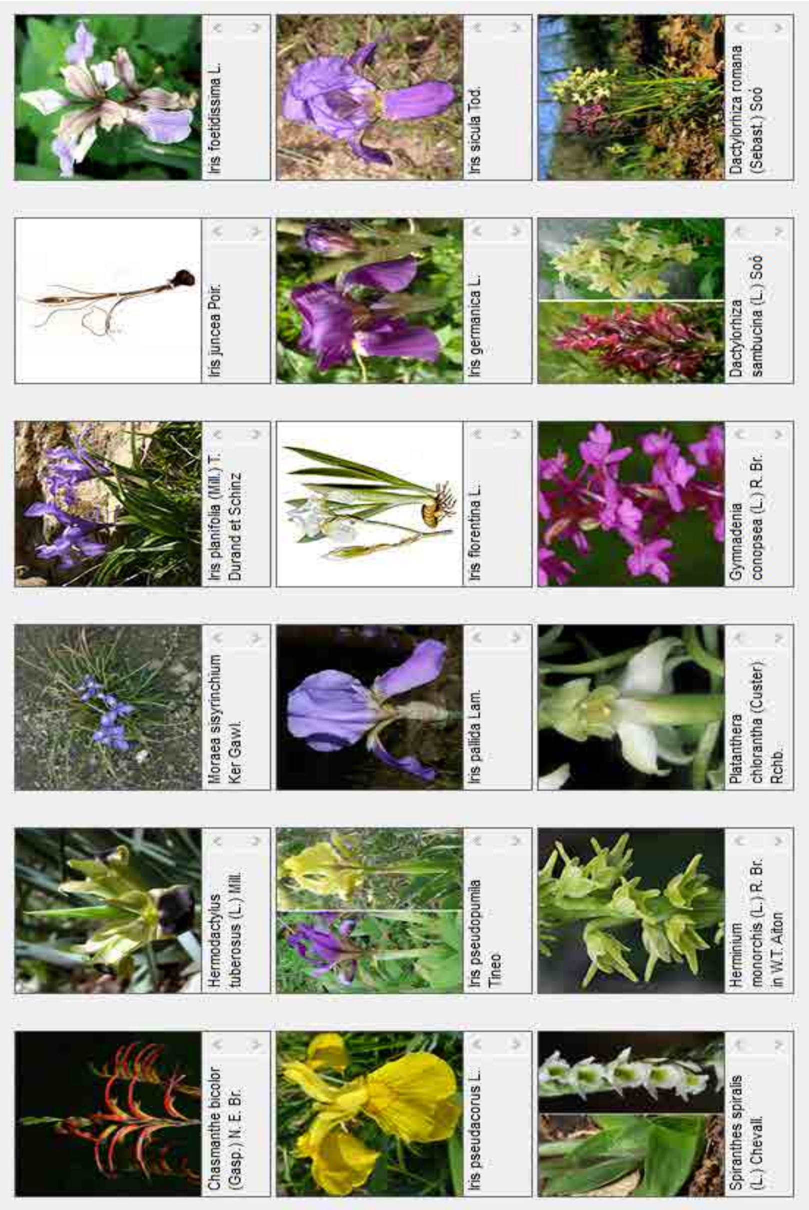

Bellevalia dubia (Guss.) Kunth
Muscari parviflorum Desf.
Muscari commutatum Guss.
Muscari lafarinae (Lojac.) Garbari
Muscari neglectum Guss. ex Ten.
Muscari comosum (L.) Mill.
Muscari gussonei (Parl.) Tod.
Muscarimia macrocarpa (Sweet) Garbari
Muscarimia muscari (L.) Losinsk.
Charybdis pancration (Steinh.) Speta
Ornithogalum comosum L.
Ornithogalum montanum Cirillo
Ornithogalum gussonei Ten.
Ornithogalum collinum Guss. subsp. collinum
Ornithogalum exscapum Ten.
Ornithogalum divergens Boreau
Ornithogalum refractum Kit. ex Willd.
Melomphis arabica (L.) Raf.


Loncomelos narbonensis (L.) Raf.
Allium senescens L. subsp. montanum (Fr.) Holub
Allium cepa L.
Allium roseum L.
Allium permixtum Guss.
Allium subhirsutum L.
Allium trifoliatum Cirillo
Allium vernale Tineo
Allium neapolitanum Cirillo
Allium triquetrum L.
Allium pendulinum Ten.
Allium chamaemoly L. subsp. chamaemoly
Allium ursinum L.
Allium moschatum L.
Allium obtusiflorum DC.
Allium franciniae Brullo et Pavone
Allium cupanii Raf.
Allium panormitanum Brullo, Pavone et Salmeri


Allium pelagicum Brullo, Pavone et Salmeri
Allium lopadusanum Bartolo, Brullo et Pavone
Allium flavum L.
Allium nebrodense Guss.
Allium pallens L.
Allium oleraceum L.
Allium dentiferum Webb et Berthel.
Allium aethnense Brullo, Pavone et Salmeri
Allium lehmannii Lojac.
Allium agrigentinum Brullo et Pavone
Allium castellanense (Garbari, Miceli et Raimondo) Brullo,
Allium sativum L.
Allium ampeloprasum L.
Allium commutatum Guss.
Allium hemisphaericum (Sommier) Brullo
Allium sphaerocephalon L.
Allium vineale L.
Allium amethystinum Tausch


Allium sardoum Moris
Allium nigrum L.
Nectaroscordum siculum (Ucria) Lindl. subsp. siculum
Nothoscordum inodorum (Aiton) G. Nicholson
Amaryllis bella-donna L.
Sternbergia colchiciflora Waldst. et Kit.
Sternbergia lutea (L.) Ker Gawl. ex Spreng.
Sternbergia sicula Tineo ex Guss.
Leucojum autumnale L.
Galanthus reginae-olgae Orph.
Narcissus obsoletus (Haw.) Steud.
Narcissus tazetta L.
Narcissus papyraceus Ker Gawl.
Pancratium maritimum L.
Pancratium linosae Soldano et F. Conti
Asphodelus ramosus L. subsp. ramosus
Asphodelus macrocarpus Parl.
Asphodelus fistulosus L.


Asphodelus tenuifolius Cav.
Asphodeline lutea (L.) Rchb.
Aloe vera (L.) Burm. f.
Aloe succotrina All.
Simethis mattiazzi (Vand.) Sacc.
Crocus biflorus Mill. subsp. biflorus
Crocus siculus Tineo
Crocus longiflorus Raf.
Romulea bulbocodium (L.) Sebast. et Mauri
Romulea ramiflora Ten.
Romulea rollii Parl.
Romulea columnae (L.) Sebast. et Mauri
Romulea linaresii Parl. subsp. linaresii
Romulea melitensis Bég.
Freesia refracta (Jacq.) Ecklon ex Klatt
Gladiolus byzantinus Mill.
Gladiolus dubius Guss.
Gladiolus italicus Mill.


Chasmanthe bicolor (Gasp.) N. E. Br.
Hermodactylus tuberosus (L.) Mill.
Moraea sisyrinchium Ker Gawl.
Iris planifolia (Mill.) T. Durand et Schinz
Iris juncea Poir.
Iris foetidissima L.
Iris pseudacorus L.
Iris pseudopumila Tineo
Iris pallida Lam.
Iris florentina L.
Iris germanica L.
Iris sicula Tod.
Spiranthes spiralis (L.) Chevall.
Herminium monorchis (L.) R. Br. in W.T. Aiton
Platanthera chlorantha (Custer) Rchb.
Gymnadenia conopsea (L.) R. Br.
Dactylorhiza sambucina (L.) Soó
Dactylorhiza romana (Sebast.) Soó

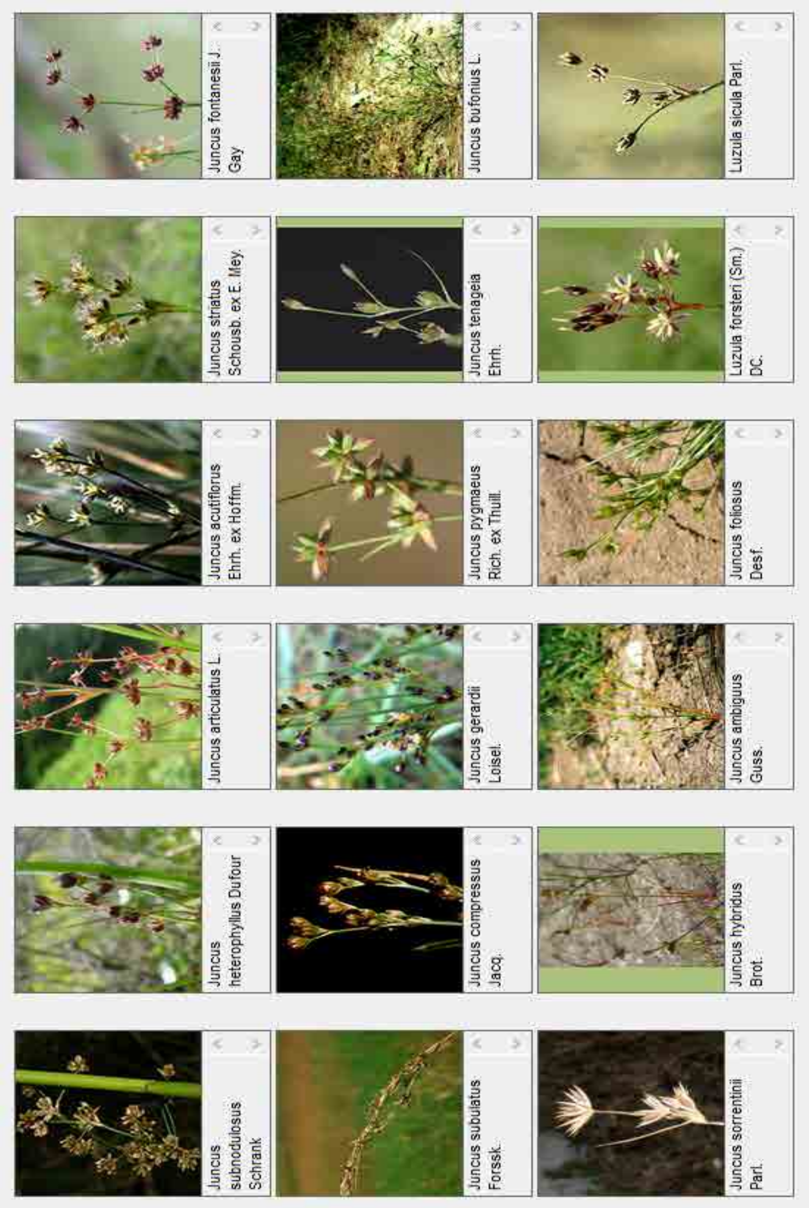

Dactylorhiza insularis (Sommier) Landwehr
Dactylorhiza maculata (L.) Soó
Orchis anthropophora (L.) All.
Orchis brancifortii Biv.
Orchis patens Desf.
Orchis provincialis Balb. ex Lam. et DC.
Orchis mascula (L.) L.
Orchis italica Poir.
Orchis simia Lam.
Anacamptis collina (Banks et Sol. ex Russell) R. M.
Anacamptis papilionacea (L.) R. M. Bateman,
Anacamptis pyramidalis (L.) Rich.
Anacamptis laxiflora (Lam.) R. M. Bateman, Pridgeon
Anacamptis palustris (Jacq.) R. M. Bateman, Pridgeon
Anacamptis longicornu (Poir.) R. M. Bateman,
Anacamptis morio (L.) R. M. Bateman, Pridgeon et M. W.
Anacamptis coriophora (L.) R. M. Bateman, Pridgeon
Neotinea maculata (Desf.) Stearn

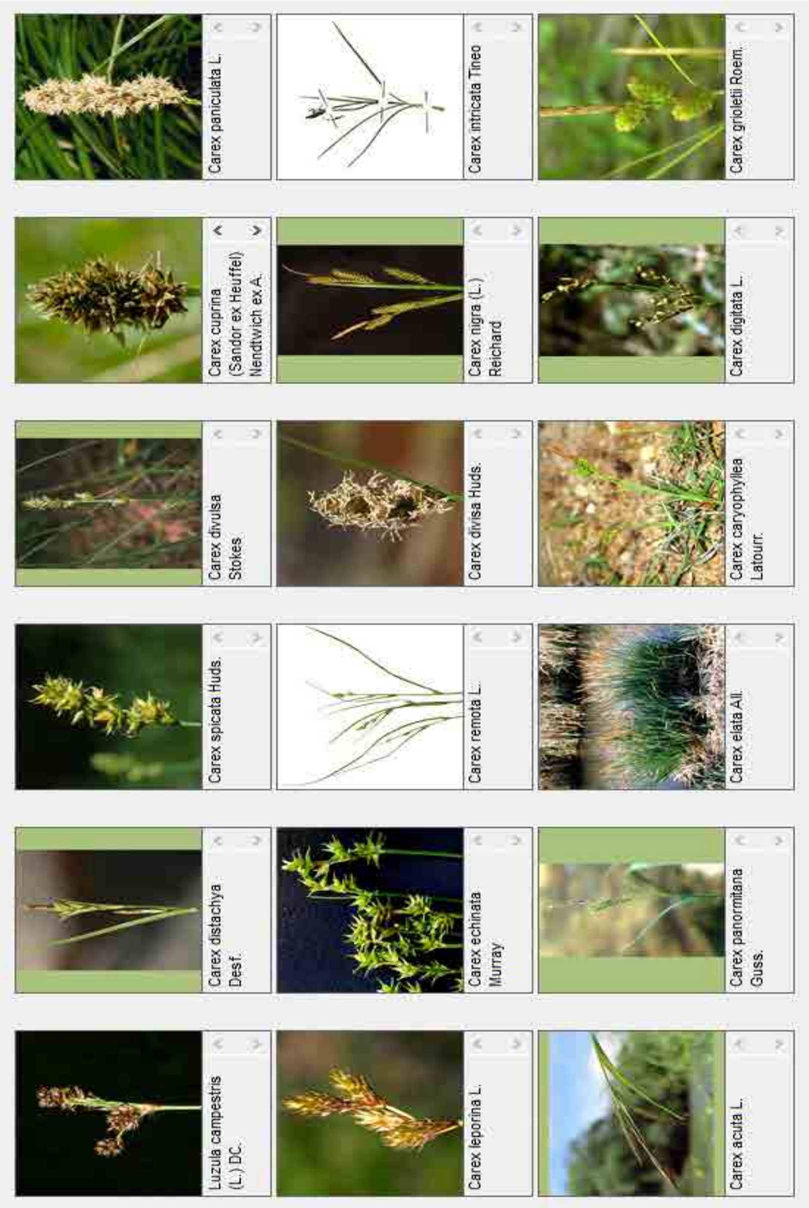

Neotinea lactea (Poir.) R. M. Bateman, Pridgeon
Neotinea commutata (Tod.) R. M. Bateman
Barlia robertiana (Loisel.) Greuter
Himantoglossum hircinum (L.) Spreng.
Serapias lingua L.
Serapias nurrica Corrias
Serapias parviflora Parl.
Serapias cordigera L.
Serapias vomeracea (Burm. f.) Briq.
Serapias bergonii E. G. Camus
Serapias orientalis E. Nelson
Ophrys lutea Cav.
Ophrys subfusca (Rchb. f.) Hausskn. (pro hybr.)
Ophrys mirabilis Geniez et Melki
Ophrys pallida Raf.
Ophrys fusca Link
Ophrys speculum Link
Ophrys bombyliflora Link


Ophrys tenthredinifera Willd.
Ophrys apifera Huds.
Ophrys bertolonii Moretti
Ophrys scolopax Cav.
Ophrys holosericea (Burm. f.) Greuter
Ophrys lacaitae Lojac.
Ophrys oxyrrhynchos Tod.
Ophrys lunulata Parl.
Ophrys exaltata Ten.
Ophrys sphegodes Mill.
Ophrys passionis Sennen ex Devillers-Tersch. et
Ophrys incubacea Bianca
Cephalanthera rubra (L.) Rich.
Cephalanthera longifolia (L.) Fritsch
Cephalanthera damasonium (Mill.) Druce
Epipactis palustris (L.) Crantz
Epipactis microphylla (Ehrh.) Sw.
Epipactis helleborine (L.) Crantz

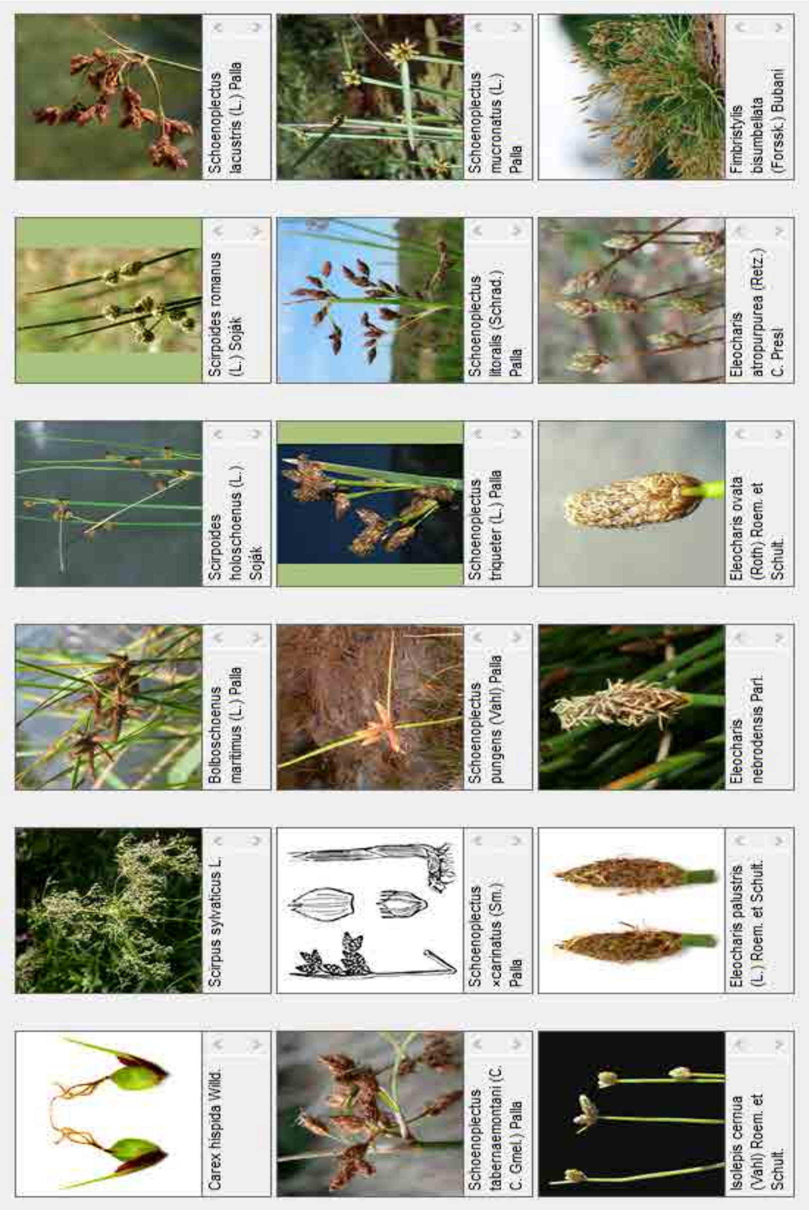

Epipactis meridionalis H. Baumann et R.
Epipactis schubertiorum Bartolo, Pulv. et
Epipactis cupaniana C. Brullo, D'Emerico and Pulv.
Epipactis placentina Bongiorni et Grünanger
Limodorum abortivum (L.) Sw.
Limodorum trabutianum Batt.
Neottia nidus-avis (L.) Rich.
Listera ovata (L.) R. Br.
Listera cordata (L.) R. Br.
Chamaerops humilis L.
Phoenix dactylifera L.
Phoenix canariensis Chabaud
Washingtonia filifera (Linden) H. Wendl.
Washingtonia robusta H. Wendl.
Sabal palmetto (Walter) Lodd.
Rhapis excelsa (Thunb.) A. Henry
Brahea edulis H. Wendl. ex S. Watson
Livistona australis (R. Br.) Mart.

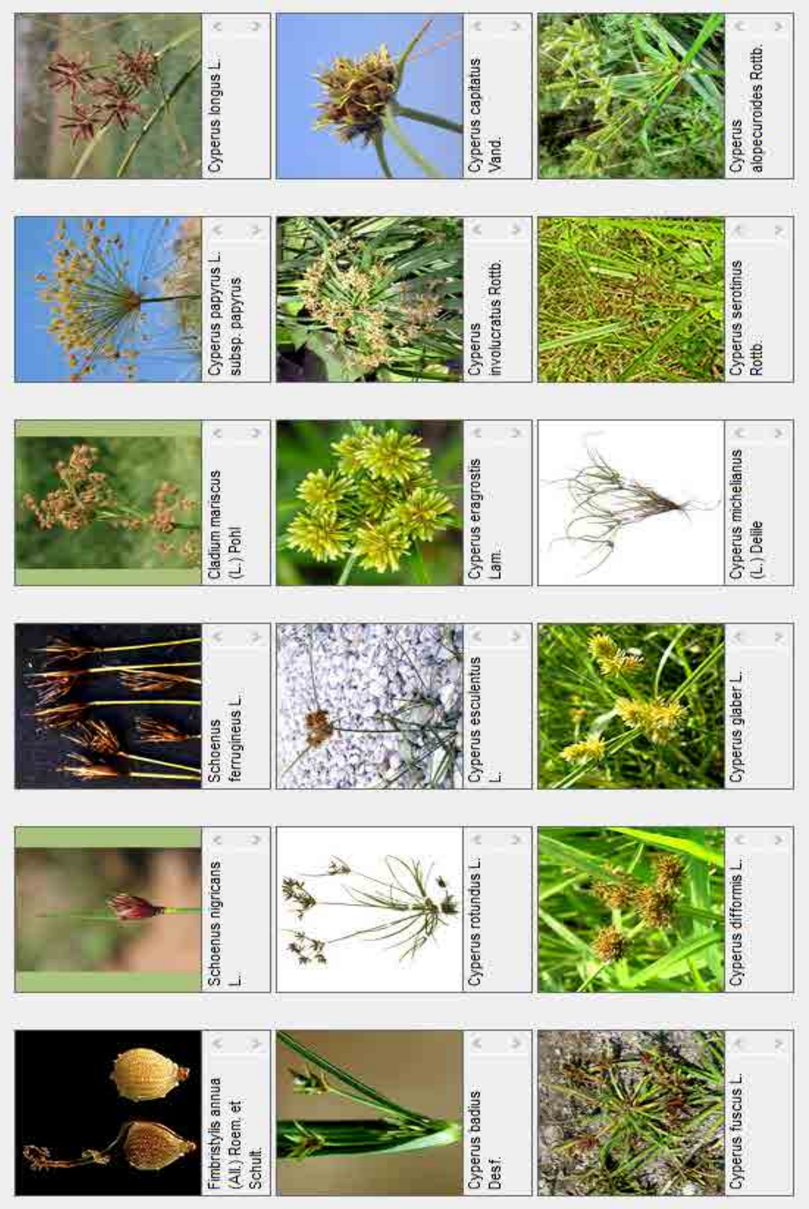

Livistona chinensis (Jacq.) R. Br.
Butia capitata (Mart.) Becc.
Jubaea chilensis (Molina) Baillon
Arecastrum romanzoffianum (Cham.) Becc.
Sparganium erectum L.
Sparganium emersum Rehmann
Typha latifolia L.
Typha angustifolia L.
Typha domingensis Pers.
Juncus maritimus Lam.
Juncus rigidus Desf.
Juncus acutus L.
Juncus littoralis C. A. Mey.
Juncus multibracteatus Tineo
Juncus effusus L.
Juncus conglomeratus L.
Juncus inflexus L.
Juncus capitatus Weigel

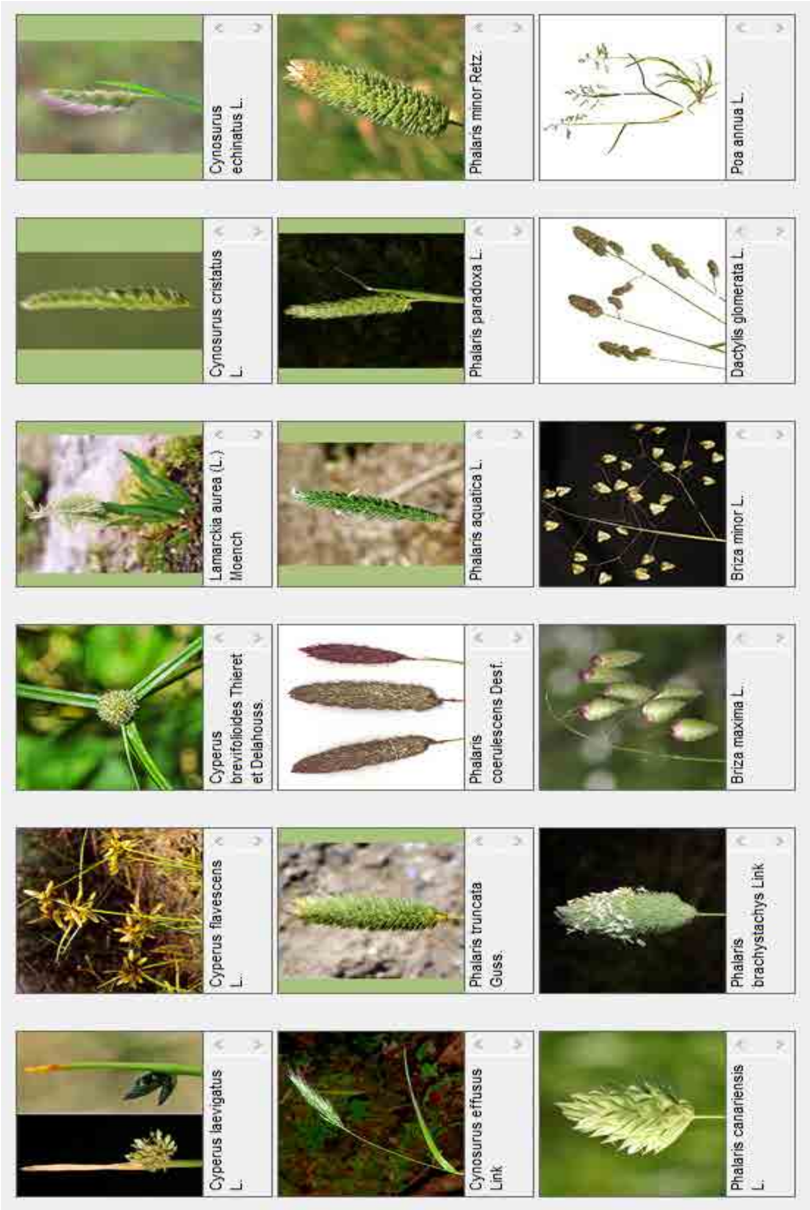

Juncus subnodulosus Schrank
Juncus heterophyllus Dufour
Juncus articulatus L.
Juncus acutiflorus Ehrh. ex Hoffm.
Juncus striatus Schousb. ex E. Mey.
Juncus fontanesii J. Gay
Juncus subulatus Forssk.
Juncus compressus Jacq.
Juncus gerardii Loisel.
Juncus pygmaeus Rich. ex Thuill.
Juncus tenageia Ehrh.
Juncus bufonius L.
Juncus sorrentinii Parl.
Juncus hybridus Brot.
Juncus ambiguus Guss.
Juncus foliosus Desf.
Luzula forsteri (Sm.) DC.
Luzula sicula Parl.

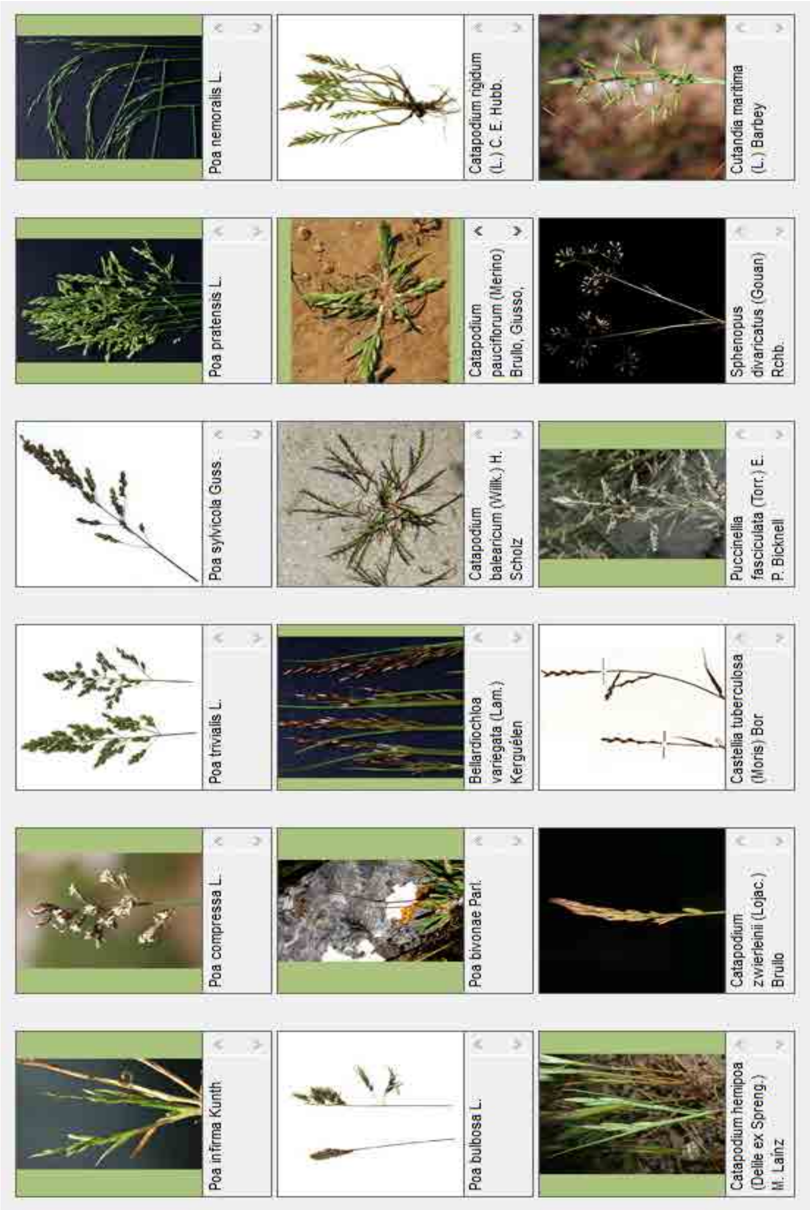

Luzula campestris (L.) DC.
Carex distachya Desf.
Carex spicata Huds.
Carex divulsa Stokes
Carex cuprina (Sandor ex Heuffel) Nendtwich ex A.
Carex paniculata L.
Carex leporina L.
Carex echinata Murray
Carex remota L.
Carex divisa Huds.
Carex nigra (L.) Reichard
Carex intricata Tineo
Carex acuta L.
Carex panormitana Guss.
Carex elata All.
Carex caryophyllea Latourr.
Carex digitata L.
Carex grioletii Roem.

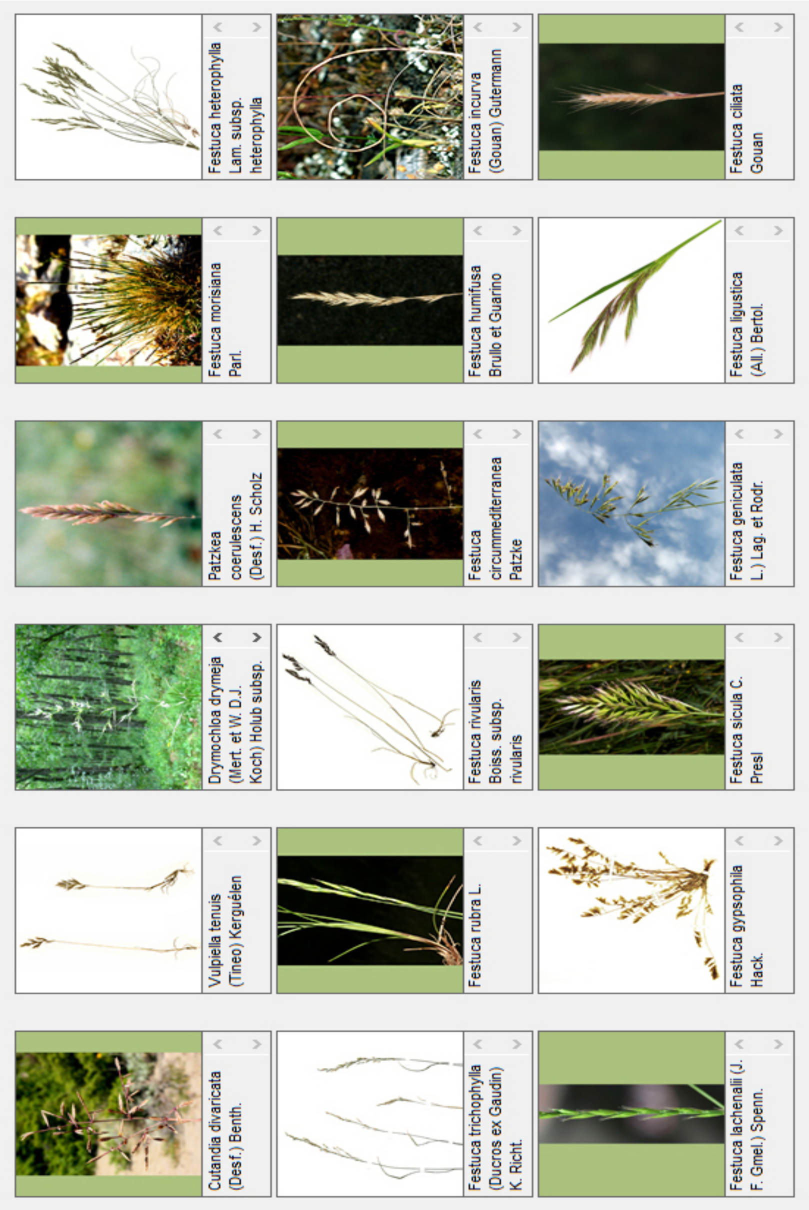

Carex illegitima Ces.
Carex halleriana Asso
Carex laevigata Sm.
Carex punctata Gaudin
Carex extensa Gooden.
Carex distans L.
Carex olbiensis Jord.
Carex depauperata Gooden.
Carex pallescens L.
Carex viridula Michx.
Carex demissa Hornem.
Carex sylvatica Huds.
Carex flacca Schreb.
Carex pseudocyperus L.
Carex riparia Curtis
Carex pendula Huds.
Carex vesicaria L.
Carex acutiformis Ehrh.


Carex hispida Willd.
Scirpus sylvaticus L.
Bolboschoenus maritimus (L.) Palla
Scirpoides holoschoenus (L.) Soják
Scirpoides romanus (L.) Soják
Schoenoplectus lacustris (L.) Palla
Schoenoplectus tabernaemontani (C. C. Gmel.) Palla
Schoenoplectus ×carinatus (Sm.) Palla
Schoenoplectus pungens (Vahl) Palla
Schoenoplectus triqueter (L.) Palla
Schoenoplectus litoralis (Schrad.) Palla
Schoenoplectus mucronatus (L.) Palla
Isolepis cernua (Vahl) Roem. et Schult.
Eleocharis palustris (L.) Roem. et Schult.
Eleocharis nebrodensis Parl.
Eleocharis ovata (Roth) Roem. et Schult.
Eleocharis atropurpurea (Retz.) C. Presl
Fimbristylis bisumbellata (Forssk.) Bubani

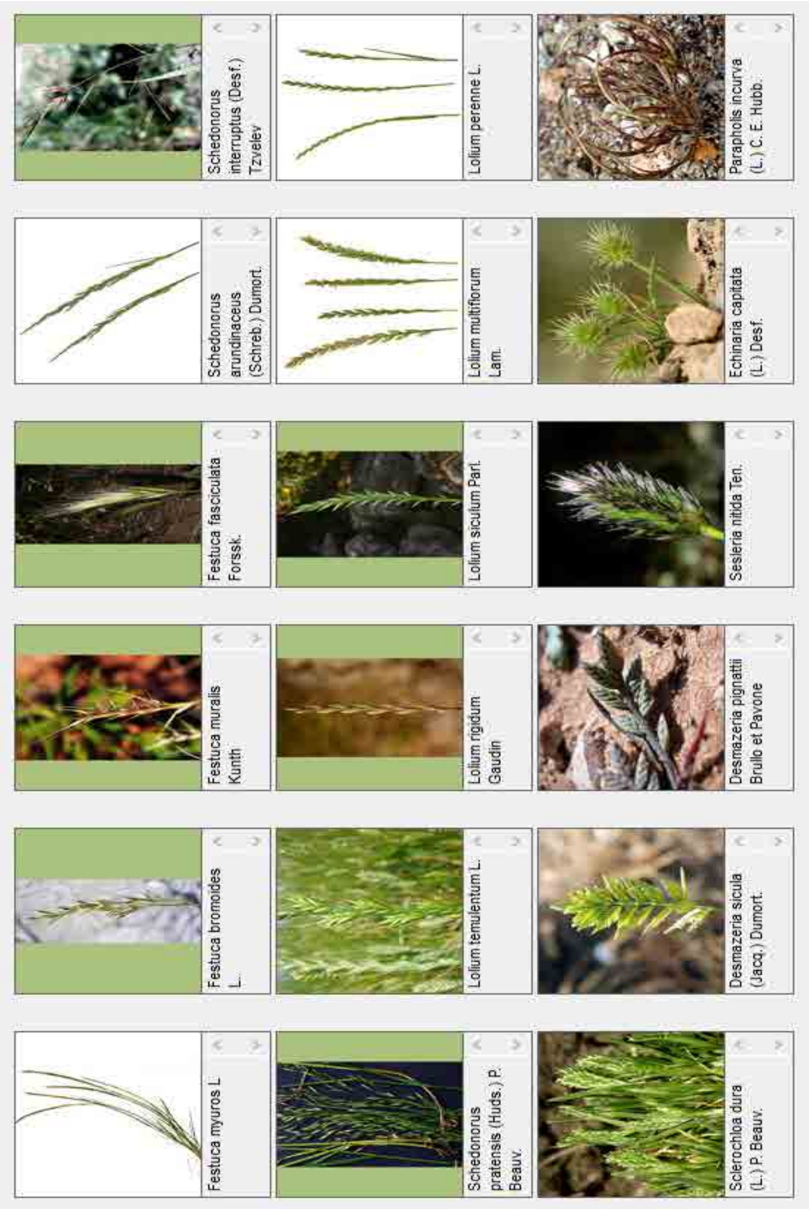

Fimbristylis annua (All.) Roem. et Schult.
Schoenus nigricans L.
Schoenus ferrugineus L.
Cladium mariscus (L.) Pohl
Cyperus papyrus L. subsp. papyrus
Cyperus longus L.
Cyperus badius Desf.
Cyperus rotundus L.
Cyperus esculentus L.
Cyperus eragrostis Lam.
Cyperus involucratus Rottb.
Cyperus capitatus Vand.
Cyperus fuscus L.
Cyperus difformis L.
Cyperus glaber L.
Cyperus michelianus (L.) Delile
Cyperus serotinus Rottb.
Cyperus alopecuroides Rottb.

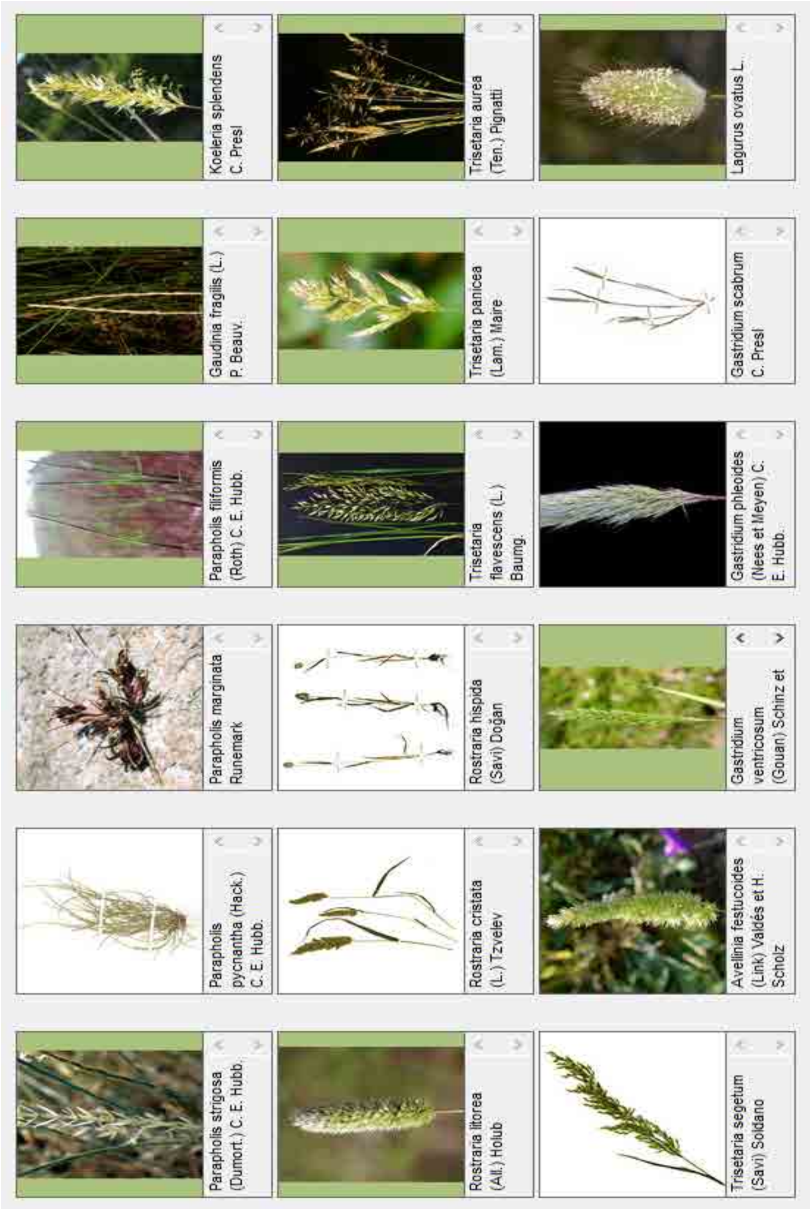

Cyperus laevigatus L.
Cyperus flavescens L.
Cyperus brevifolioides Thieret et Delahouss.
Lamarckia aurea (L.) Moench
Cynosurus cristatus L.
Cynosurus echinatus L.
Cynosurus effusus Link
Phalaris truncata Guss.
Phalaris coerulescens Desf.
Phalaris aquatica L.
Phalaris paradoxa L.
Phalaris minor Retz.
Phalaris canariensis L.
Phalaris brachystachys Link
Briza maxima L.
Briza minor L.
Dactylis glomerata L.
Poa annua L.

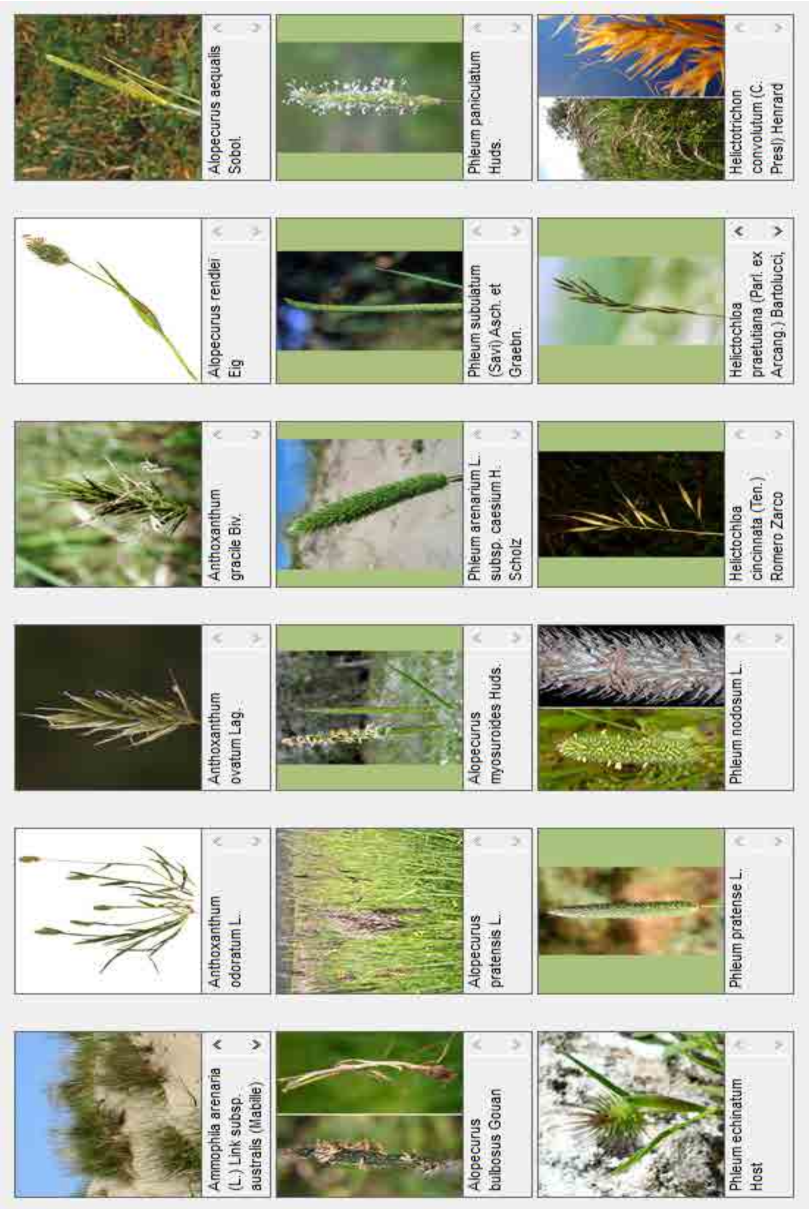

Poa infirma Kunth
Poa compressa L.
Poa trivialis L.
Poa sylvicola Guss.
Poa pratensis L.
Poa nemoralis L.
Poa bulbosa L.
Poa bivonae Parl.
Bellardiochloa variegata (Lam.) Kerguélen
Catapodium balearicum (Willk.) H. Scholz
Catapodium pauciflorum (Merino) Brullo, Giusso,
Catapodium rigidum (L.) C. E. Hubb.
Catapodium hemipoa (Delile ex Spreng.) M. Laínz
Catapodium zwierleinii (Lojac.) Brullo
Castellia tuberculosa (Moris) Bor
Puccinellia fasciculata (Torr.) E. P. Bicknell
Sphenopus divaricatus (Gouan) Rchb.
Cutandia maritima (L.) Barbey

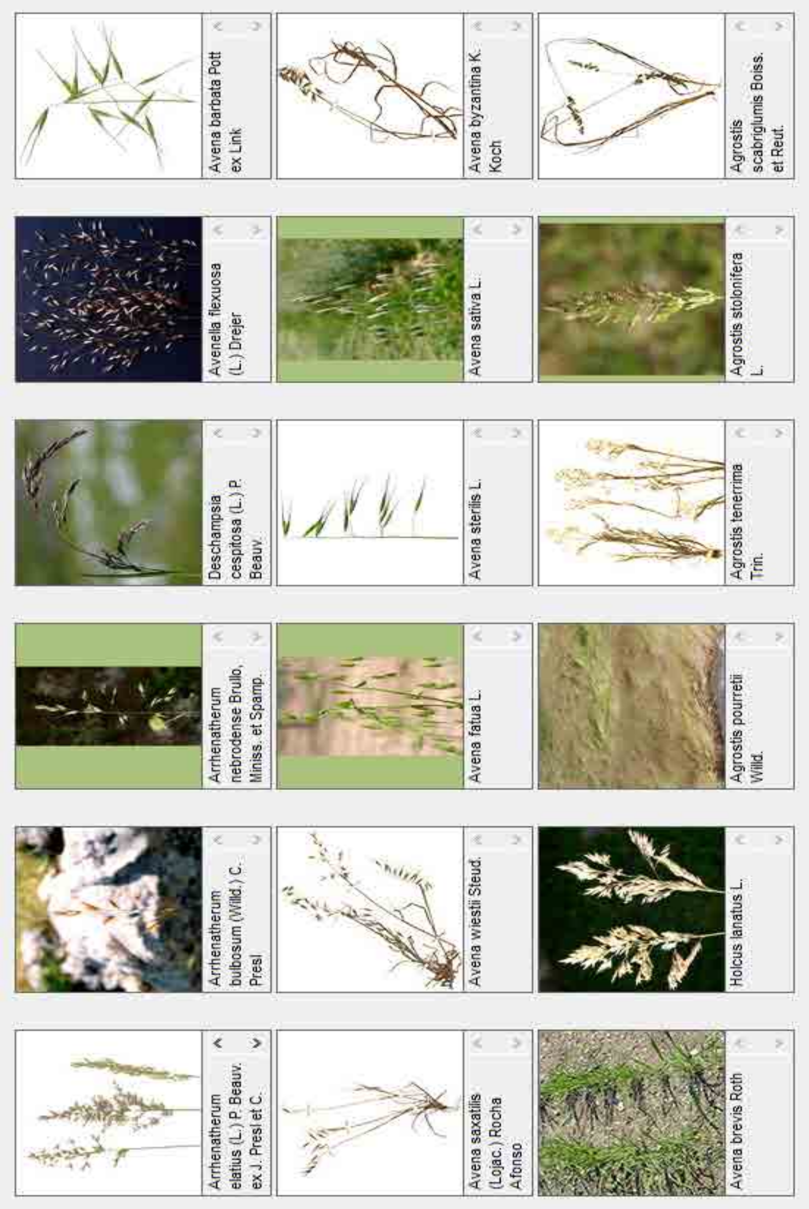


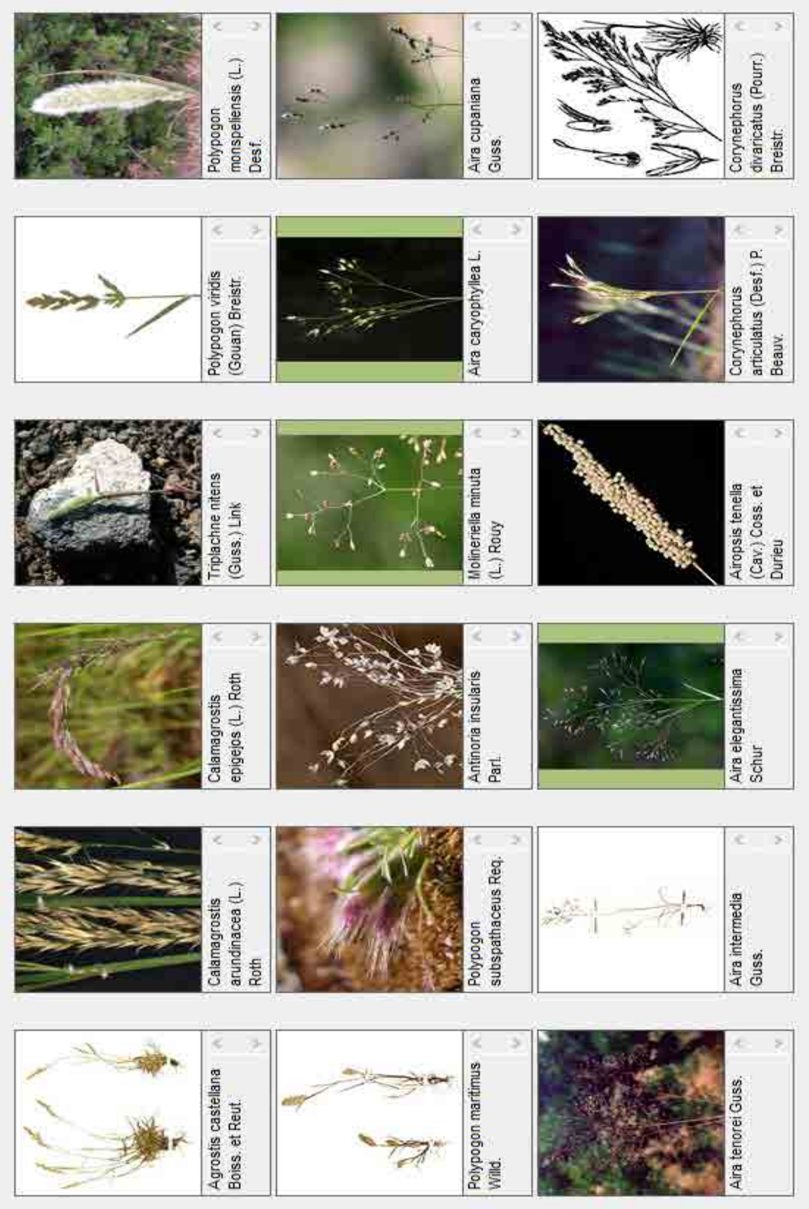
Cutandia divaricata (Desf.) Benth.
Vulpiella tenuis (Tineo) Kerguélen
Drymochloa drymeja (Mert. et W. D.J. Koch) Holub subsp.
Patzkea coerulescens (Desf.) H. Scholz
Festuca morisiana Parl.
Festuca heterophylla Lam. subsp. heterophylla
Festuca trichophylla (Ducros ex Gaudin) K. Richt.
Festuca rubra L.
Festuca rivularis Boiss. subsp. rivularis
Festuca circummediterranea Patzke
Festuca humifusa Brullo et Guarino
Festuca incurva (Gouan) Gutermann
Festuca lachenalii (J. F. Gmel.) Spenn.
Festuca gypsophila Hack.
Festuca sicula C. Presl
Festuca geniculata L.) Lag. et Rodr.
Festuca ligustica (All.) Bertol.
Festuca ciliata Gouan

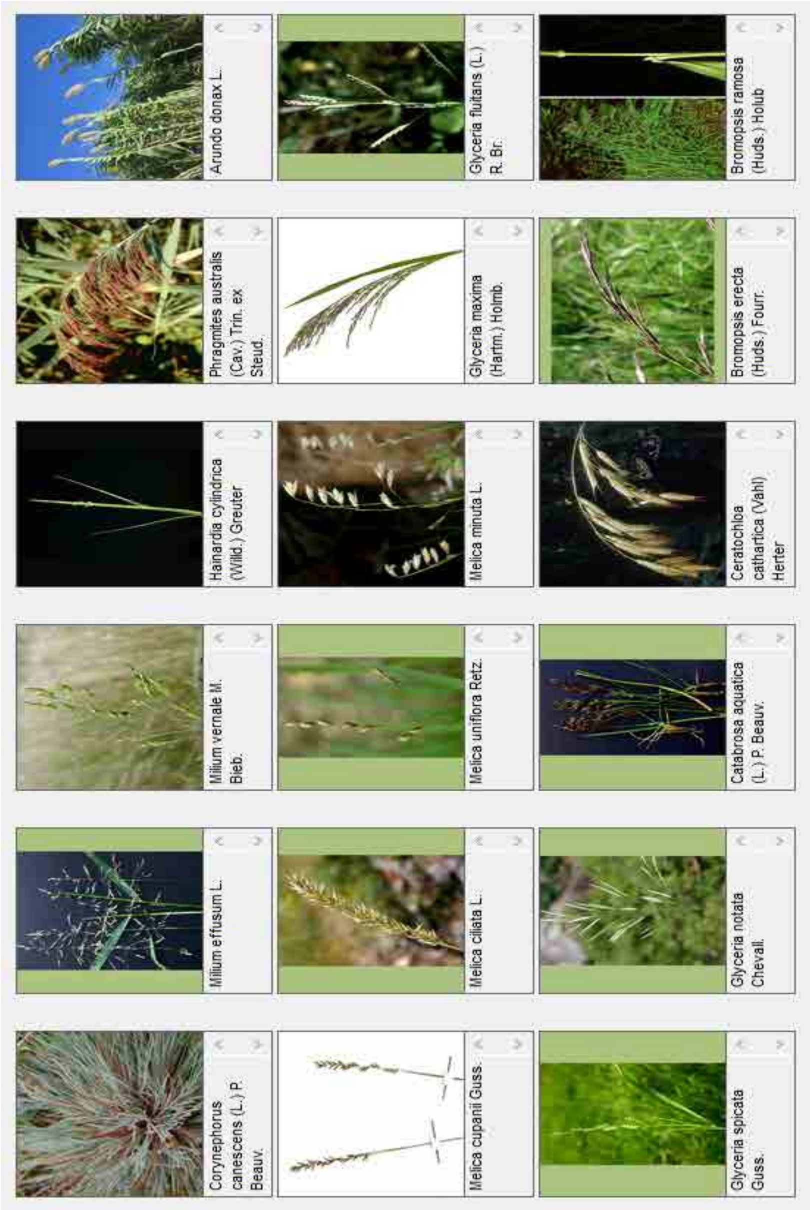

Festuca myuros L.
Festuca bromoides L.
Festuca muralis Kunth
Festuca fasciculata Forssk.
Schedonorus arundinaceus (Schreb.) Dumort.
Schedonorus interruptus (Desf.) Tzvelev
Schedonorus pratensis (Huds.) P. Beauv.
Lolium temulentum L.
Lolium rigidum Gaudin
Lolium siculum Parl.
Lolium multiflorum Lam.
Lolium perenne L.
Sclerochloa dura (L.) P. Beauv.
Desmazeria sicula (Jacq.) Dumort.
Desmazeria pignattii Brullo et Pavone
Sesleria nitida Ten.
Echinaria capitata (L.) Desf.
Parapholis incurva (L.) C. E. Hubb.


Parapholis strigosa (Dumort.) C. E. Hubb.
Parapholis pycnantha (Hack.) C.E. Hubb.
Parapholis marginata Runemark
Parapholis filiformis (Roth) C. E. Hubb.
Gaudinia fragilis (L.) P. Beauv.
Koeleria splendens C. Presl
Rostraria litorea (All.) Holub
Rostraria cristata (L.) Tzvelev
Rostraria hispida (Savi) Doğan
Trisetaria flavescens (L.) Baumg.
Trisetaria panicea (Lam.) Maire
Trisetaria aurea (Ten.) Pignatti
Trisetaria segetum (Savi) Soldano
Avellinia festucoides (Link) Valdés et H. Scholz
Gastridium ventricosum (Gouan) Schinz et
Gastridium phleoides (Nees et Meyen) C. E. Hubb.
Gastridium scabrum C. Presl
Lagurus ovatus L.


Ammophila arenaria (L.) Link subsp. australis (Mabille)
Anthoxanthum odoratum L.
Anthoxanthum ovatum Lag.
Anthoxanthum gracile Biv.
Alopecurus rendlei Eig
Alopecurus aequalis Sobol.
Alopecurus bulbosus Gouan
Alopecurus pratensis L.
Alopecurus myosuroides Huds.
Phleum arenarium L. subsp. caesium H. Scholz
Phleum subulatum (Savi) Asch. et Graebn.
Phleum paniculatum Huds.
Phleum echinatum Host
Phleum pratense L.
Phleum nodosum L.
Helictochloa cincinnata (Ten.) Romero Zarco
Helictochloa praetutiana (Parl. ex Arcang.) Bartolucci,
Helictotrichon convolutum (C. Presl) Henrard

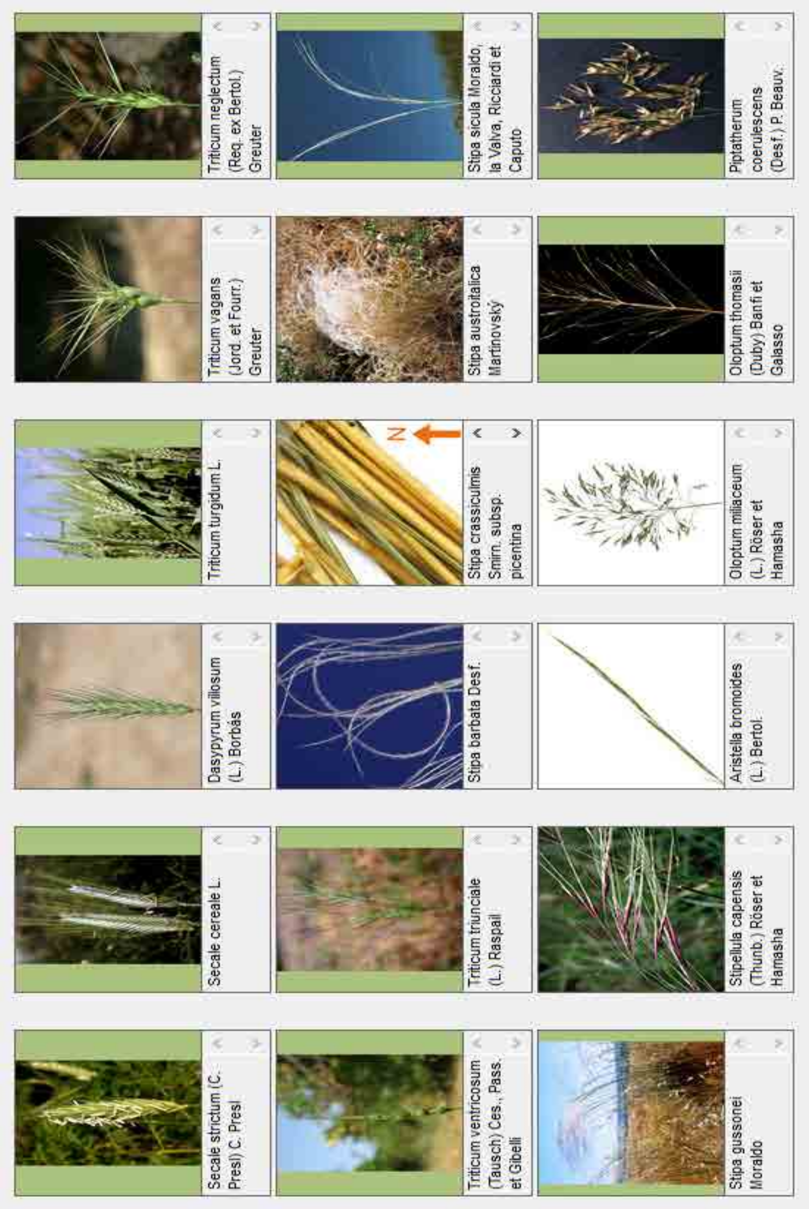

Arrhenatherum elatius (L.) P. Beauv. ex J. Presl et C. Presl
Arrhenatherum bulbosum (Willd.) C. Presl
Arrhenatherum nebrodense Brullo, Miniss. et Spamp.
Deschampsia cespitosa (L.) P. Beauv.
Avenella flexuosa (L.) Drejer
Avena barbata Pott ex Link
Avena saxatilis (Lojac.) Rocha Afonso
Avena wiestii Steud.
Avena fatua L.
Avena sterilis L.
Avena sativa L.
Avena byzantina K. Koch
Avena brevis Roth
Holcus lanatus L.
Agrostis pourretii Willd.
Agrostis tenerrima Trin.
Agrostis stolonifera L.
Agrostis scabriglumis Boiss. et Reut.

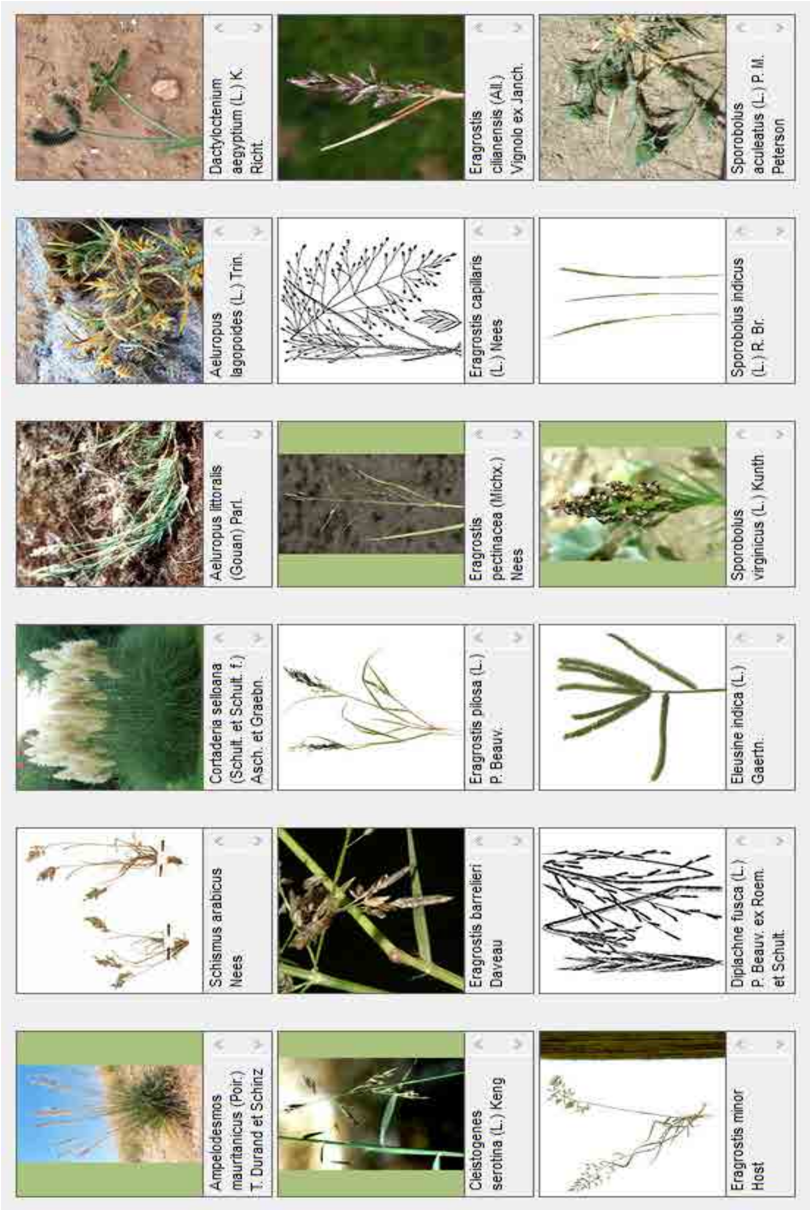

Agrostis castellana Boiss. et Reut.
Calamagrostis arundinacea (L.) Roth
Calamagrostis epigejos (L.) Roth
Triplachne nitens (Guss.) Link
Polypogon viridis (Gouan) Breistr.
Polypogon monspeliensis (L.) Desf.
Polypogon maritimus Willd.
Polypogon subspathaceus Req.
Antinoria insularis Parl.
Molineriella minuta (L.) Rouy
Aira caryophyllea L.
Aira cupaniana Guss.
Aira tenorei Guss.
Aira intermedia Guss.
Aira elegantissima Schur
Airopsis tenella (Cav.) Coss. et Durieu
Corynephorus articulatus (Desf.) P. Beauv.
Corynephorus divaricatus (Pourr.) Breistr.

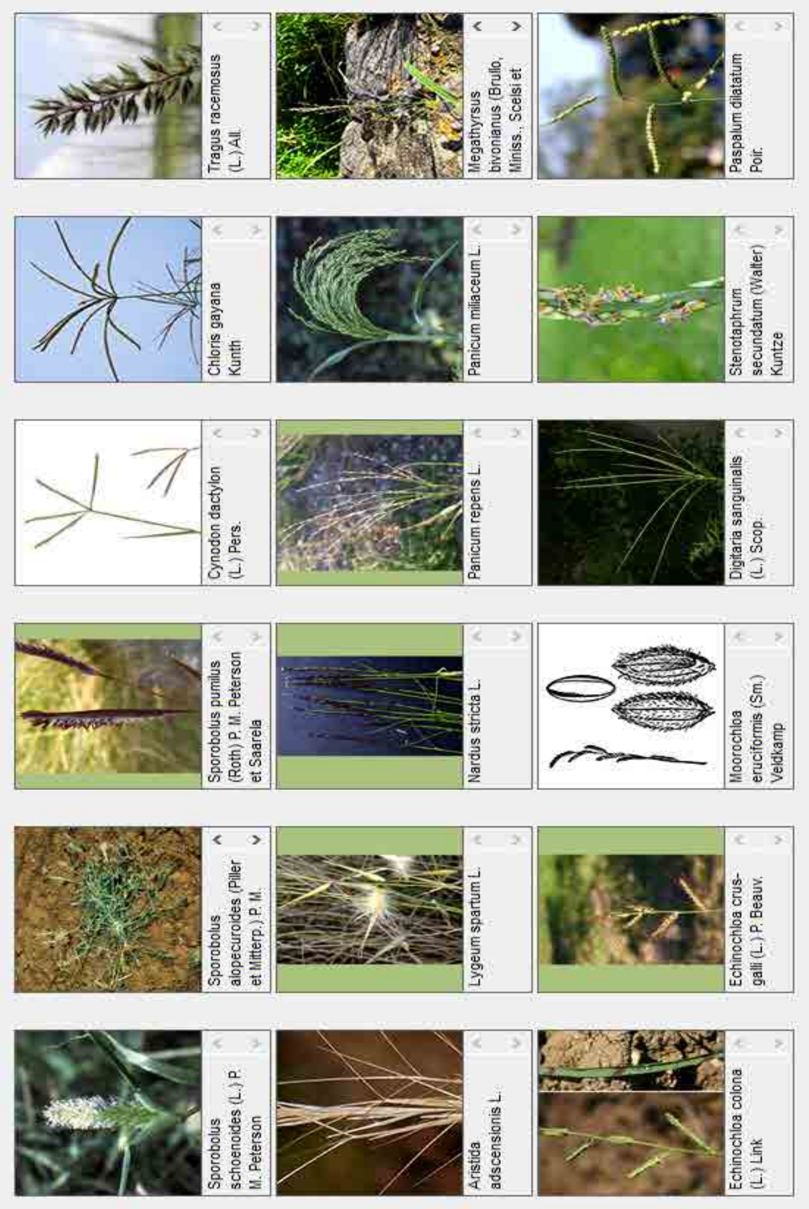

Corynephorus canescens (L.) P. Beauv.
Milium effusum L.
Milium vernale M. Bieb.
Hainardia cylindrica (Willd.) Greuter
Phragmites australis (Cav.) Trin. ex Steud.
Arundo donax L.
Melica cupanii Guss.
Melica ciliata L.
Melica uniflora Retz.
Melica minuta L.
Glyceria maxima (Hartm.) Holmb.
Glyceria fluitans (L.) R. Br.
Glyceria spicata Guss.
Glyceria notata Chevall.
Catabrosa aquatica (L.) P. Beauv.
Ceratochloa cathartica (Vahl) Herter
Bromopsis erecta (Huds.) Fourr.
Bromopsis ramosa (Huds.) Holub

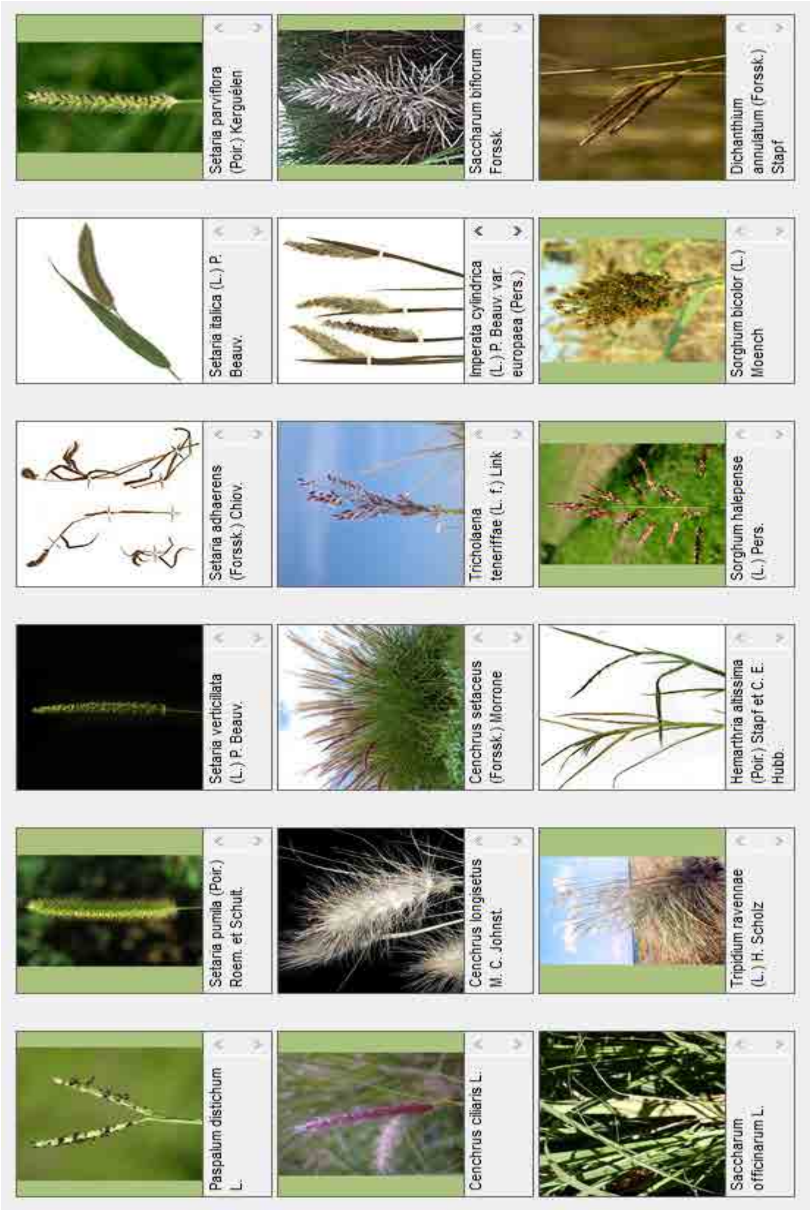

Bromopsis benekenii (Lange) Holub
Anisantha rubens (L.) Nevski
Anisantha fasciculata (C. Presl) Nevski
Anisantha tectorum (L.) Nevski
Anisantha sterilis (L.) Nevski
Anisantha madritensis (L.) Nevski
Anisantha rigida (Roth) Nevski
Anisantha diandra (Roth) Tutin ex Tzvelev
Bromus scoparius L.
Bromus alopecuros Poir.
Bromus lanceolatus Roth
Bromus intermedius Guss.
Bromus hordeaceus L.
Bromus racemosus L.
Brachypodium retusum (Pers.) P. Beauv.
Brachypodium phoenicoides (L.) Roem. et Schult.
Brachypodium rupestre (Host) Roem. et Schult.
Brachypodium sylvaticum (Huds.) P. Beauv.

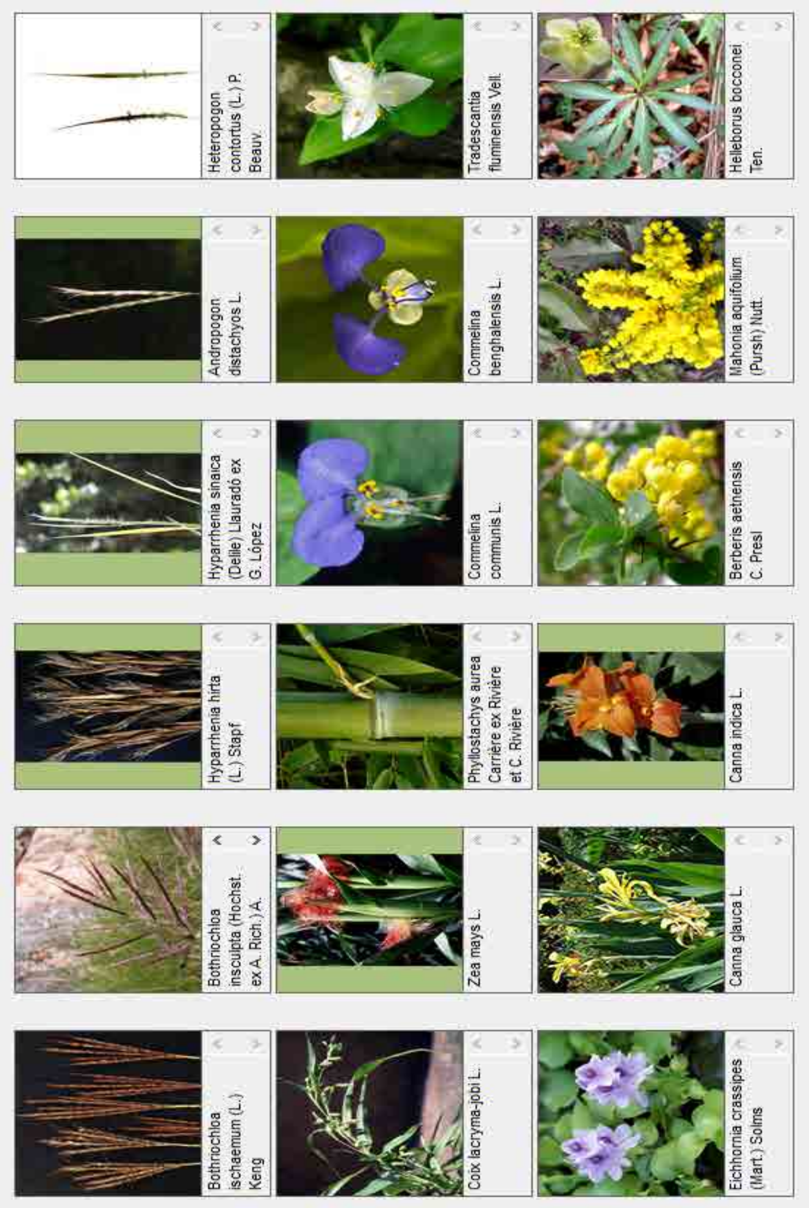

Trachynia distachya (L.) Link
Hordelymus europaeus (L.) Harz
Taeniatherum asperum (Simonk.) Nevski
Hordeum secalinum Schreb.
Hordeum bulbosum L.
Hordeum marinum Huds.
Hordeum murinum L.
Hordeum zeocriton L.
Hordeum distichon L.
Hordeum vulgare L.
Hordeum hexasticon L.
Elymus caninus (L.) L.
Elymus panormitanus (Parl.) Tzvelev
Elymus flaccidifolius (Boiss. et Heldr.) Melderis
Elymus farctus (Viv.) Runemark ex Melderis
Elymus repens (L.) Gould
Elymus acutus (DC.) M.-A. Thiébaud
Elymus hispidus (Opiz) Melderis

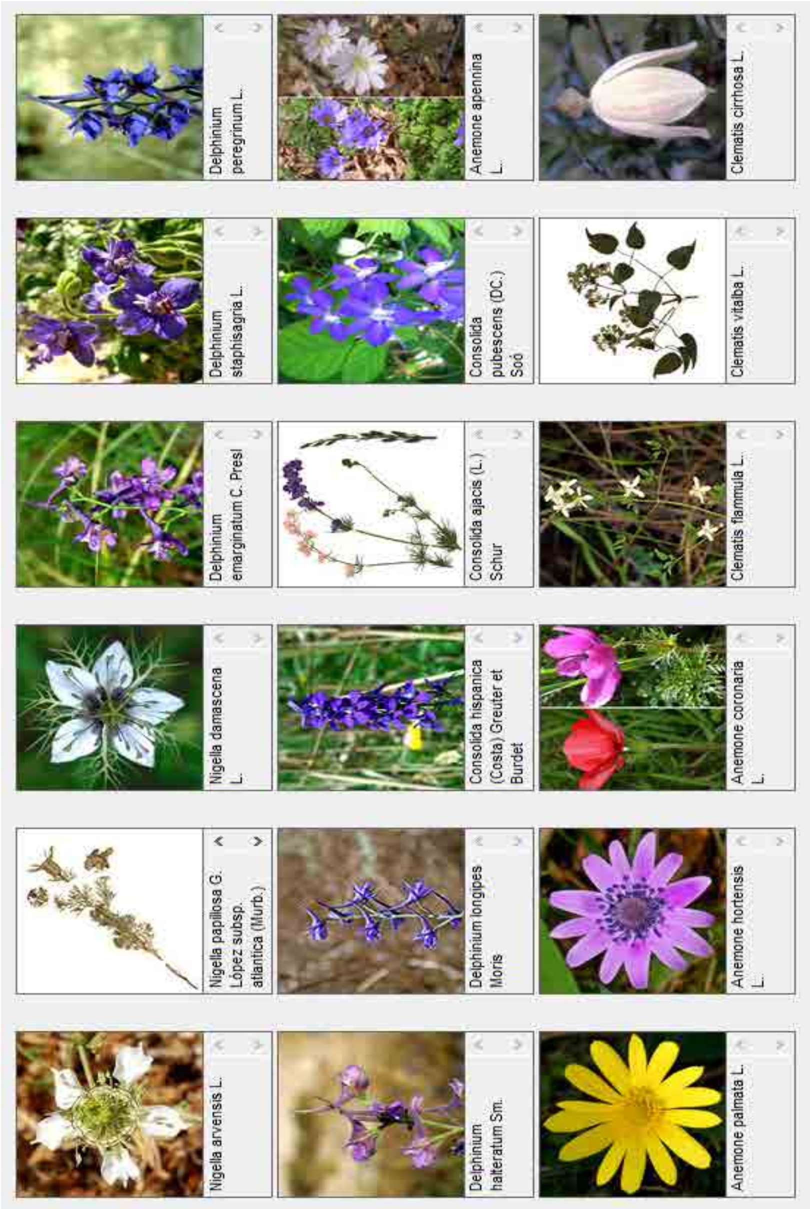

Secale strictum (C. Presl) C. Presl
Secale cereale L.
Dasypyrum villosum (L.) Borbás
Triticum turgidum L.
Triticum vagans (Jord. et Fourr.) Greuter
Triticum neglectum (Req. ex Bertol.) Greuter
Triticum ventricosum (Tausch) Ces., Pass. et Gibelli
Triticum triunciale (L.) Raspail
Stipa barbata Desf.
Stipa crassiculmis Smirn. subsp. picentina
Stipa austroitalica Martinovský
Stipa sicula Moraldo, la Valva, Ricciardi et Caputo
Stipa gussonei Moraldo
Stipellula capensis (Thunb.) Röser et Hamasha
Aristella bromoides (L.) Bertol.
Oloptum miliaceum (L.) Röser et Hamasha
Oloptum thomasii (Duby) Banfi et Galasso
Piptatherum coerulescens (Desf.) P. Beauv.


Ampelodesmos mauritanicus (Poir.) T. Durand et Schinz
Schismus arabicus Nees
Cortaderia selloana (Schult. et Schult. f.) Asch. et Graebn.
Aeluropus littoralis (Gouan) Parl.
Aeluropus lagopoides (L.) Trin.
Dactyloctenium aegyptium (L.) K. Richt.
Cleistogenes serotina (L.) Keng
Eragrostis barrelieri Daveau
Eragrostis pilosa (L.) P. Beauv.
Eragrostis pectinacea (Michx.) Nees
Eragrostis capillaris (L.) Nees
Eragrostis cilianensis (All.) Vignolo ex Janch.
Eragrostis minor Host
Diplachne fusca (L.) P. Beauv. ex Roem. et Schult.
Eleusine indica (L.) Gaertn.
Sporobolus virginicus (L.) Kunth
Sporobolus indicus (L.) R. Br.
Sporobolus aculeatus (L.) P. M. Peterson

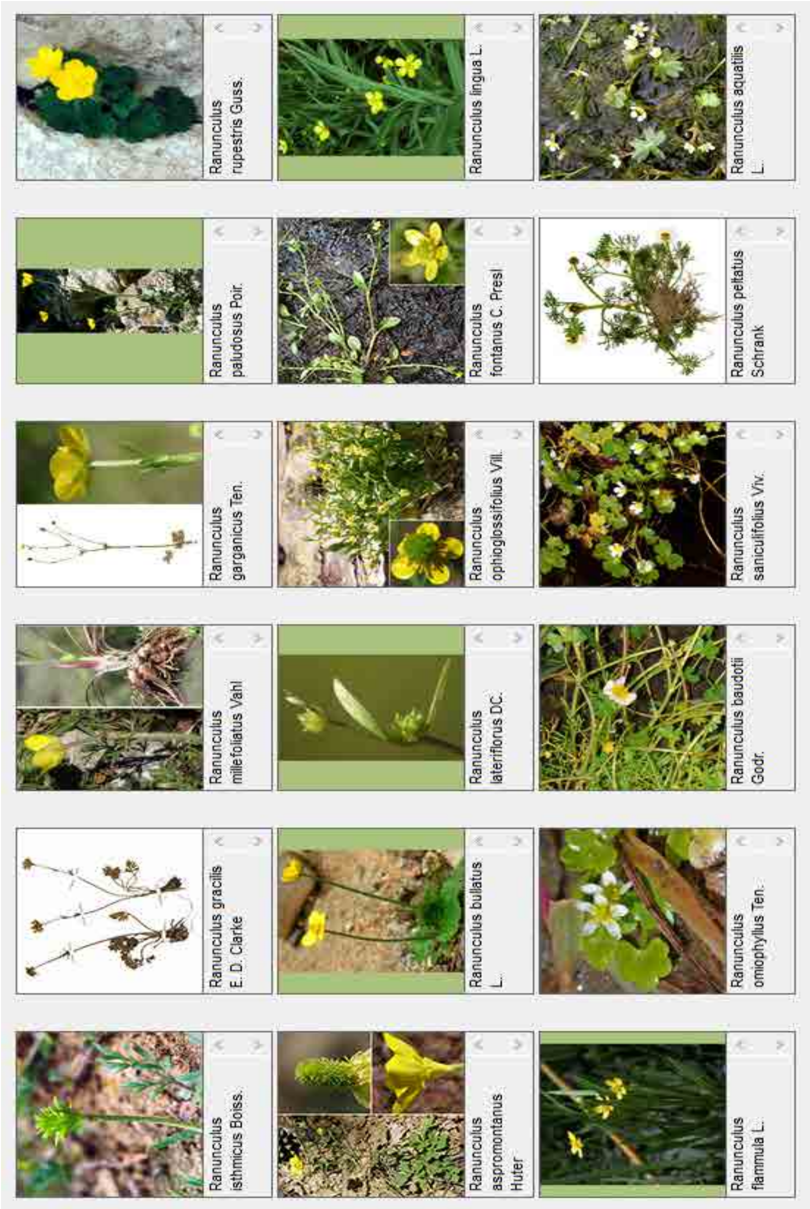

Sporobolus
schoenoides (L.) P.
M. Peterson
Sporobolus
alopecuroides (Piller
et Mitterp.) P. M.
Sporobolus pumilus
(Roth) P. M. Peterson
et Saarela
Cynodon dactylon
(L.) Pers.
Chloris gayana
Kunth
Tragus racemosus
(L.) All.
Aristida
adscensionis L.
Lygeum spartum L.
Nardus stricta L.
Panicum repens L.
Panicum miliaceum L.
Megathyrsus
bivonianus (Brullo,
Miniss., Scelsi et
Echinochloa colona
(L.) Link
Echinochloa crus-
galli (L.) P. Beauv.
Moorochloa
eruciformis (Sm.)
Veldkamp
Digitaria sanguinalis
(L.) Scop.
Stenotaphrum
secundatum (Walter)
Kuntze
Paspalum dilatatum
Poir.

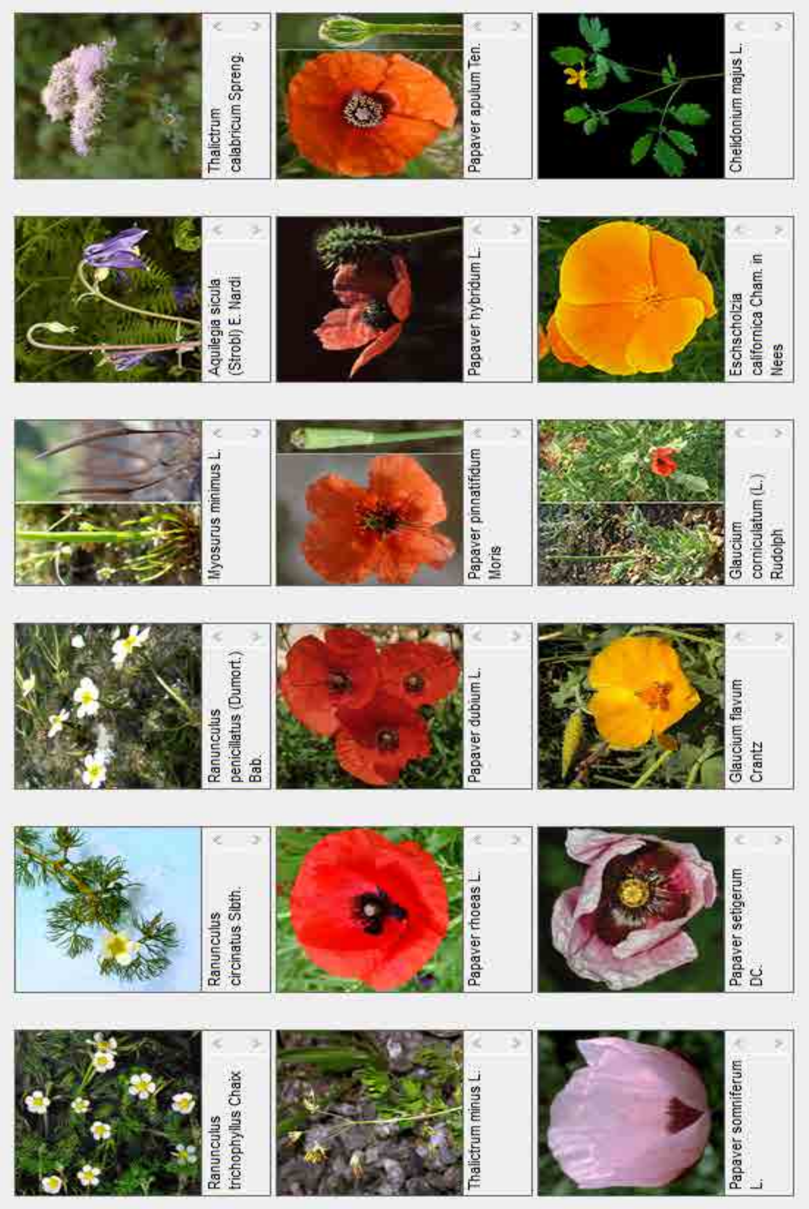

Paspalum distichum L.
Setaria pumila (Poir.) Roem. et Schult.
Setaria verticillata (L.) P. Beauv.
Setaria adhaerens (Forssk.) Chiov.
Setaria italica (L.) P. Beauv.
Setaria parviflora (Poir.) Kerguélen
Cenchrus ciliaris L.
Cenchrus longisetus M. C. Johnst.
Cenchrus setaceus (Forssk.) Morrone
Tricholaena teneriffae (L. f.) Link
Imperata cylindrica (L.) P. Beauv. var. europaea (Pers.)
Saccharum biflorum Forssk.
Saccharum officinarum L.
Tripidium ravennae (L.) H. Scholz
Hemarthria altissima (Poir.) Stapf et C. E. Hubb.
Sorghum halepense (L.) Pers.
Sorghum bicolor (L.) Moench
Dichanthium annulatum (Forssk.) Stapf

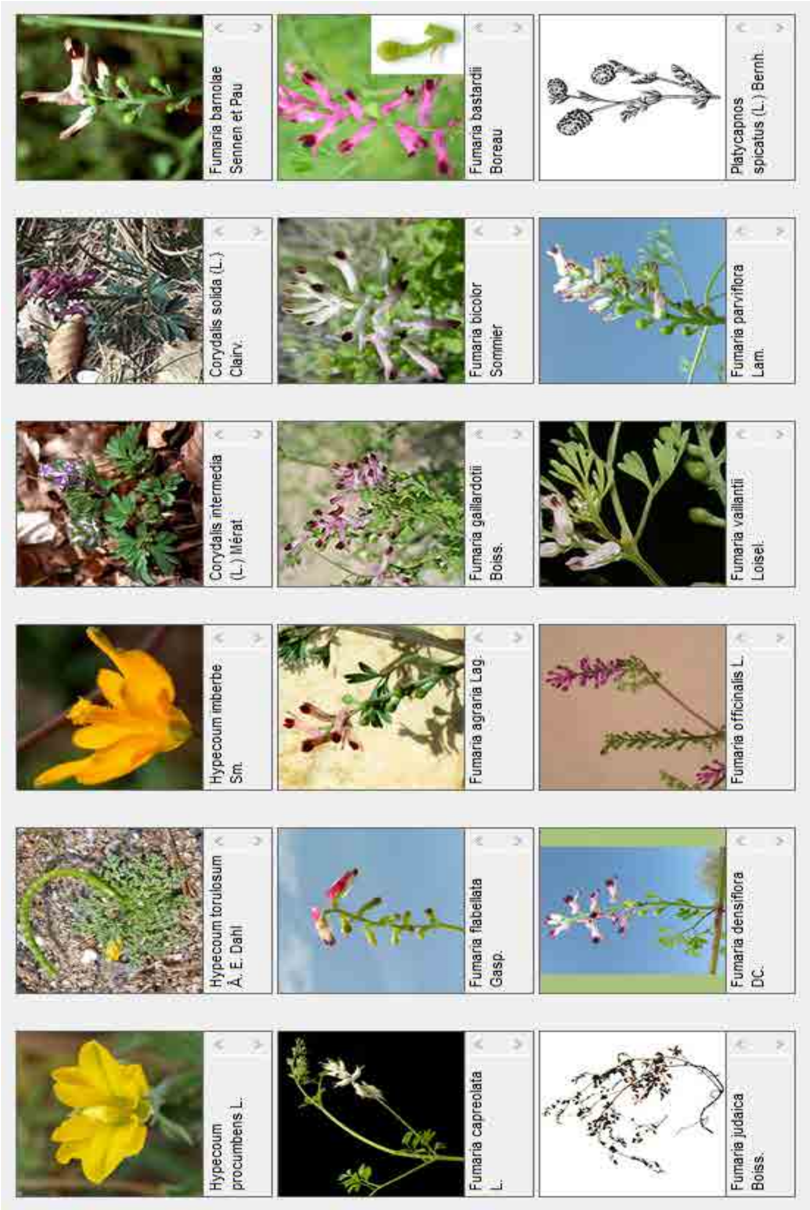

Bothriochloa ischaemum (L.) Keng
Bothriochloa insculpta (Hochst. ex A. Rich.) A.
Hyparrhenia hirta (L.) Stapf
Hyparrhenia sinaica (Delile) Llauradó ex G. López
Andropogon distachyos L.
Heteropogon contortus (L.) P. Beauv.
Coix lacryma-jobi L.
Zea mays L.
Phyllostachys aurea Carrière ex Rivière et C. Rivière
Commelina communis L.
Commelina benghalensis L.
Tradescantia fluminensis Vell.
Eichhornia crassipes (Mart.) Solms
Canna glauca L.
Canna indica L.
Berberis aetnensis C. Presl
Mahonia aquifolium (Pursh) Nutt.
Helleborus bocconei Ten.

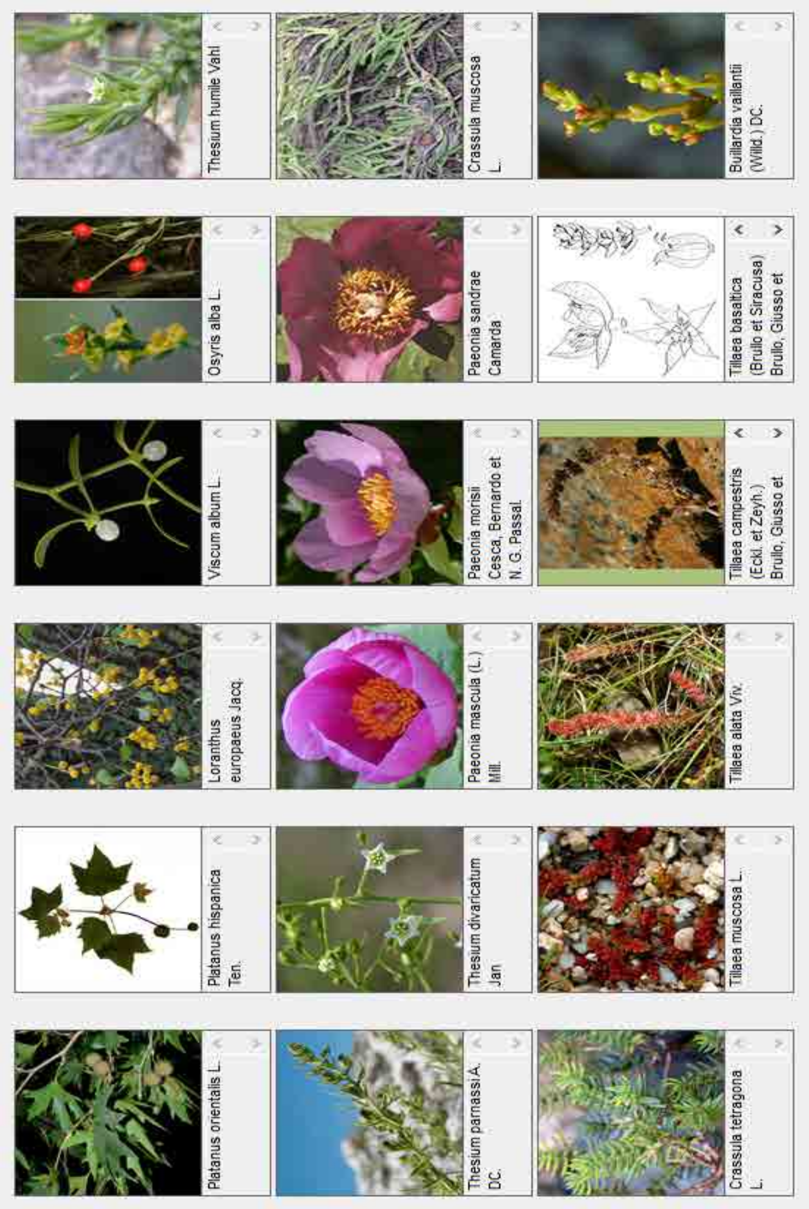

Nigella arvensis L.
Nigella papillosa G. López subsp. atlantica (Murb.)
Nigella damascena L.
Delphinium emarginatum C. Presl
Delphinium staphisagria L.
Delphinium peregrinum L.
Delphinium halteratum Sm.
Delphinium longipes Moris
Consolida hispanica (Costa) Greuter et Burdet
Consolida ajacis (L.) Schur
Consolida pubescens (DC.) Soó
Anemone apennina L.
Anemone palmata L.
Anemone hortensis L.
Anemone coronaria L.
Clematis flammula L.
Clematis vitalba L.
Clematis cirrhosa L.

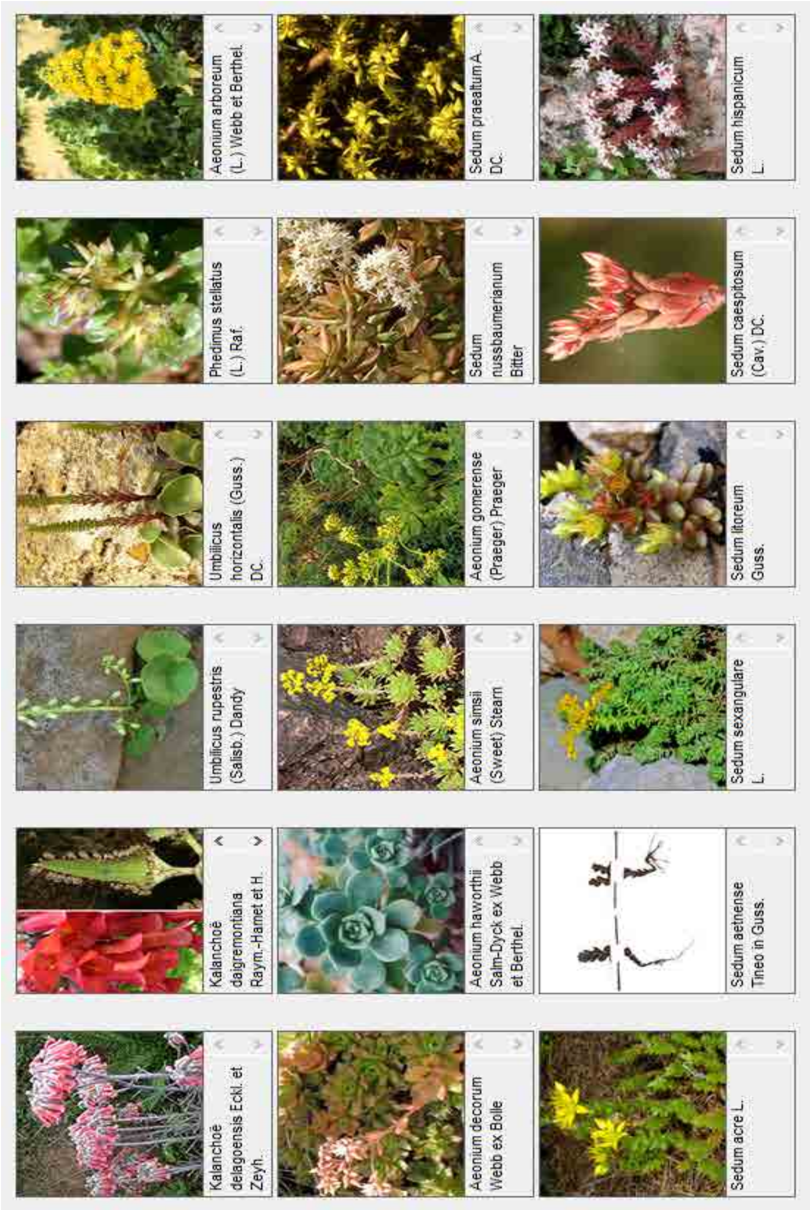

Adonis annua L.
Adonis microcarpa DC.
Ficaria verna Huds.
Ranunculus lanuginosus L.
Ranunculus velutinus Ten.
Ranunculus macrophyllus Desf.
Ranunculus bulbosus L.
Ranunculus neapolitanus Ten.
Ranunculus pratensis C. Presl
Ranunculus repens L.
Ranunculus sardous Crantz
Ranunculus angulatus C. Presl
Ranunculus trilobus Desf.
Ranunculus parviflorus L.
Ranunculus muricatus L.
Ranunculus arvensis L.
Ranunculus sceleratus L.
Ranunculus monspeliacus L.

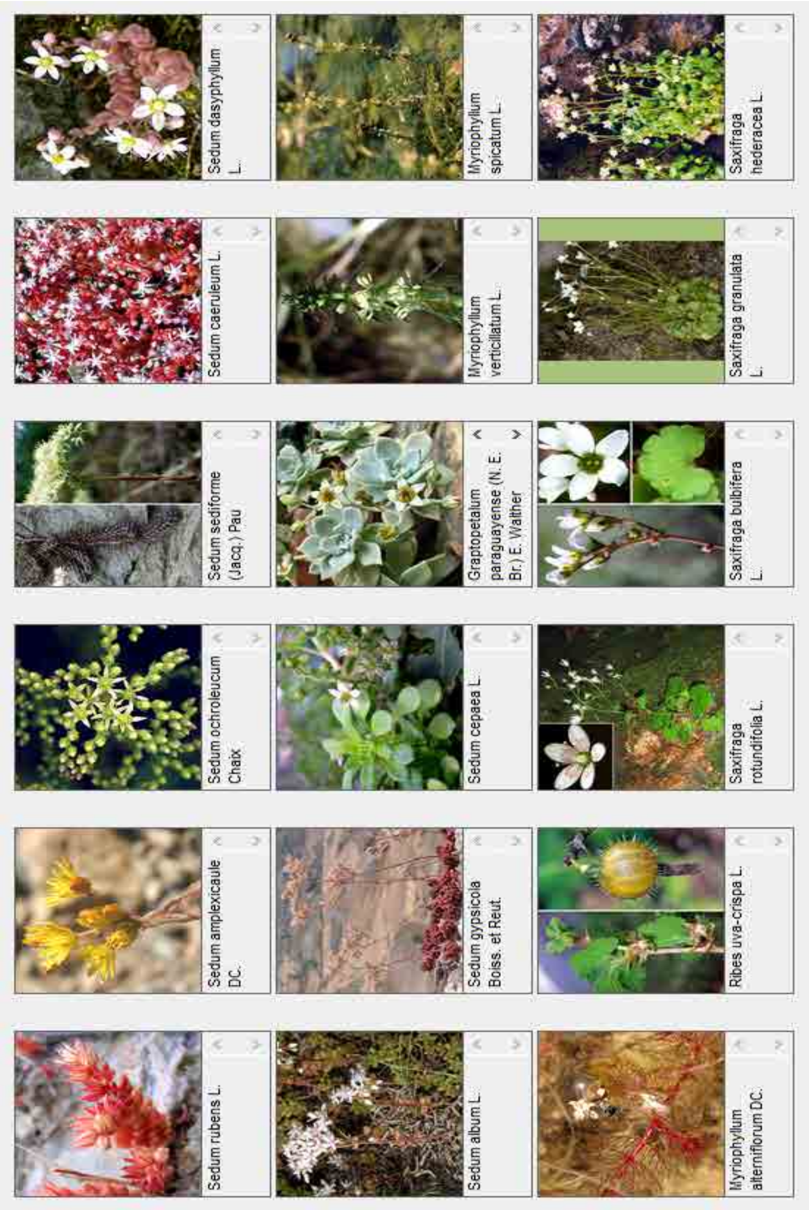

Ranunculus isthmicus Boiss.
Ranunculus gracilis E. D. Clarke
Ranunculus millefoliatus Vahl
Ranunculus garganicus Ten.
Ranunculus paludosus Poir.
Ranunculus rupestris Guss.
Ranunculus aspromontanus Huter
Ranunculus bullatus L.
Ranunculus lateriflorus DC.
Ranunculus ophioglossifolius Vill.
Ranunculus fontanus C. Presl
Ranunculus lingua L.
Ranunculus flammula L.
Ranunculus omiophyllus Ten.
Ranunculus baudotii Godr.
Ranunculus saniculifolius Viv.
Ranunculus peltatus Schrank
Ranunculus aquatilis L.


Ranunculus trichophyllus Chaix
Ranunculus circinatus Sibth.
Ranunculus penicillatus (Dumort.) Bab.
Myosurus minimus L.
Aquilegia sicula (Strobl) E. Nardi
Thalictrum calabricum Spreng.
Thalictrum minus L.
Papaver rhoeas L.
Papaver dubium L.
Papaver pinnatifidum Moris
Papaver hybridum L.
Papaver apulum Ten.
Papaver somniferum L.
Papaver setigerum DC.
Glaucium flavum Crantz
Glaucium corniculatum (L.) Rudolph
Eschscholzia californica Cham. in Nees
Chelidonium majus L.

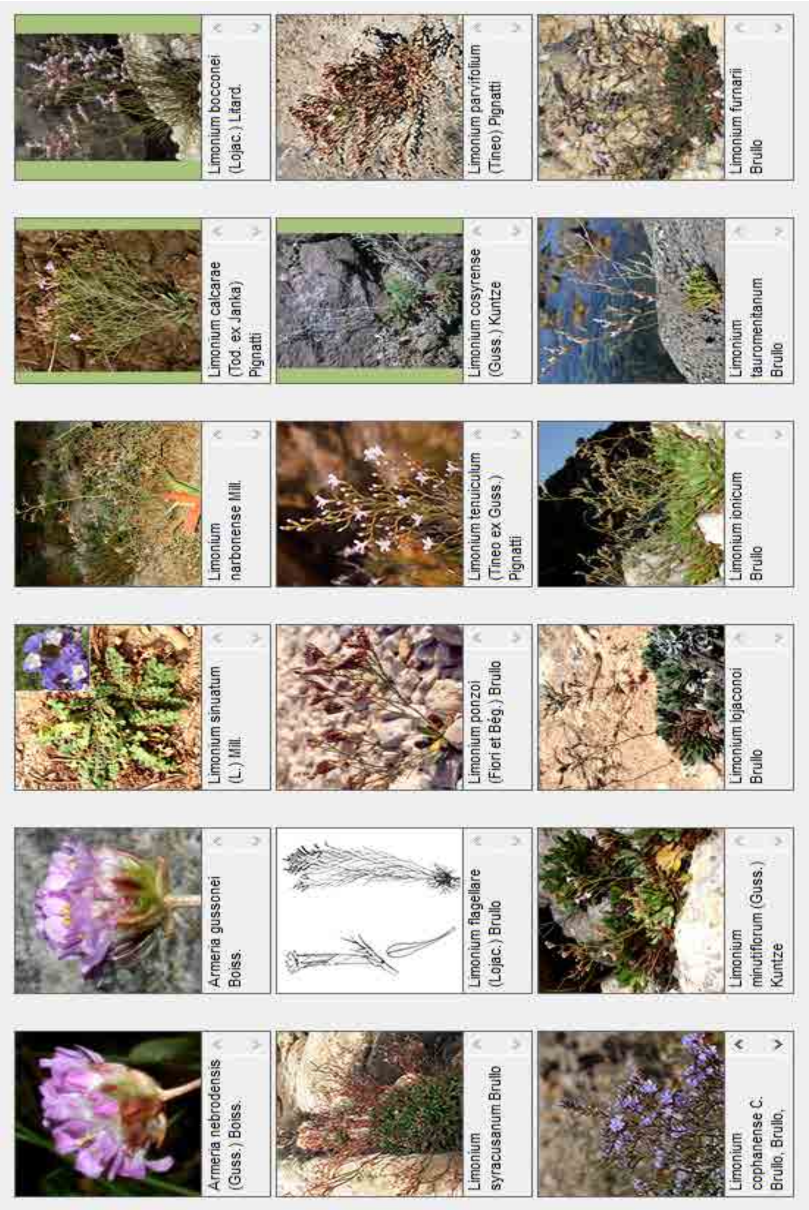

Hypecoum procumbens L.
Hypecoum torulosum Å. E. Dahl
Hypecoum imberbe Sm.
Corydalis intermedia (L.) Mérat
Corydalis solida (L.) Clairv.
Fumaria barnolae Sennen et Pau
Fumaria capreolata L.
Fumaria flabellata Gasp.
Fumaria agraria Lag.
Fumaria gaillardotii Boiss.
Fumaria bicolor Sommier
Fumaria bastardii Boreau
Fumaria judaica Boiss.
Fumaria densiflora DC.
Fumaria officinalis L.
Fumaria vaillantii Loisel.
Fumaria parviflora Lam.
Platycapnos spicatus (L.) Bernh.

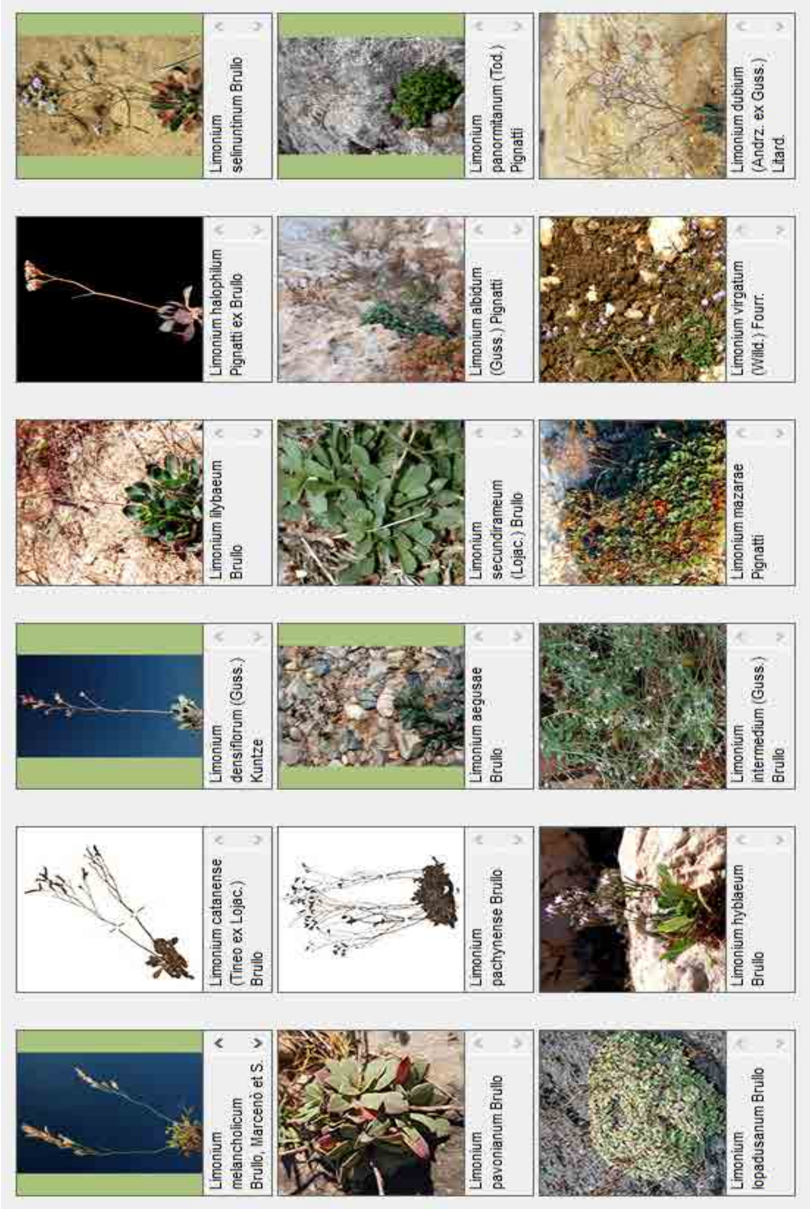

Platanus orientalis L.
Platanus hispanica Ten.
Loranthus europaeus Jacq.
Viscum album L.
Osyris alba L.
Thesium humile Vahl
Thesium parnassi A. DC.
Thesium divaricatum Jan
Paeonia mascula (L.) Mill.
Paeonia morisii Cesca, Bernardo et N. G. Passal.
Paeonia sandrae Camarda
Crassula muscosa L.
Crassula tetragona L.
Tillaea muscosa L.
Tillaea alata Viv.
Tillaea campestris (Eckl. et Zeyh.) Brullo, Giusso et
Tillaea basaltica (Brullo et Siracusa) Brullo, Giusso et
Bulliardia vaillantii (Willd.) DC.

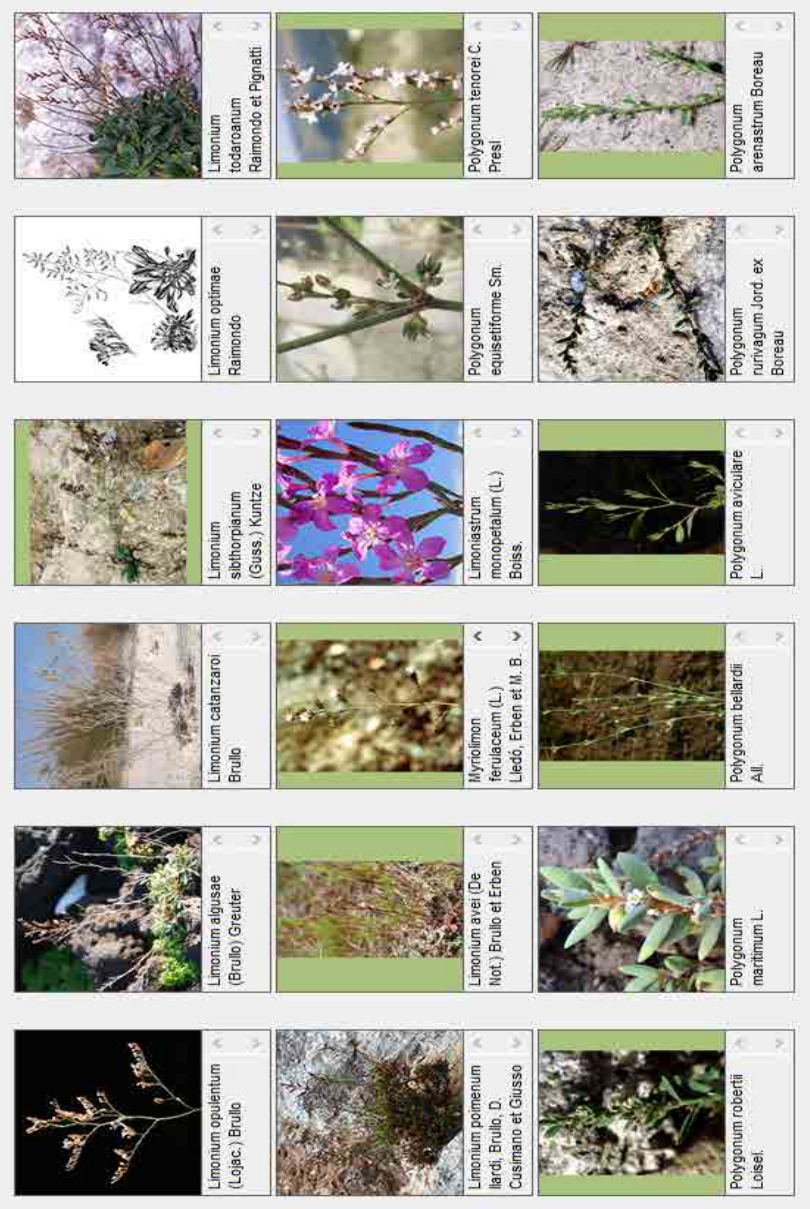

Kalanchoë delagoensis Eckl. et Zeyh.
Kalanchoë daigremontiana Raym.-Hamet et H.
Umbilicus rupestris (Salisb.) Dandy
Umbilicus horizontalis (Guss.) DC.
Phedimus stellatus (L.) Raf.
Aeonium arboreum (L.) Webb et Berthel.
Aeonium decorum Webb ex Bolle
Aeonium haworthii Salm-Dyck ex Webb et Berthel.
Aeonium simsii (Sweet) Stearn
Aeonium gomerense (Praeger) Praeger
Sedum nussbaumerianum Bitter
Sedum praealtum A. DC.
Sedum acre L.
Sedum aethnense Tineo in Guss.
Sedum sexangulare L.
Sedum litoreum Guss.
Sedum caespitosum (Cav.) DC.
Sedum hispanicum L.

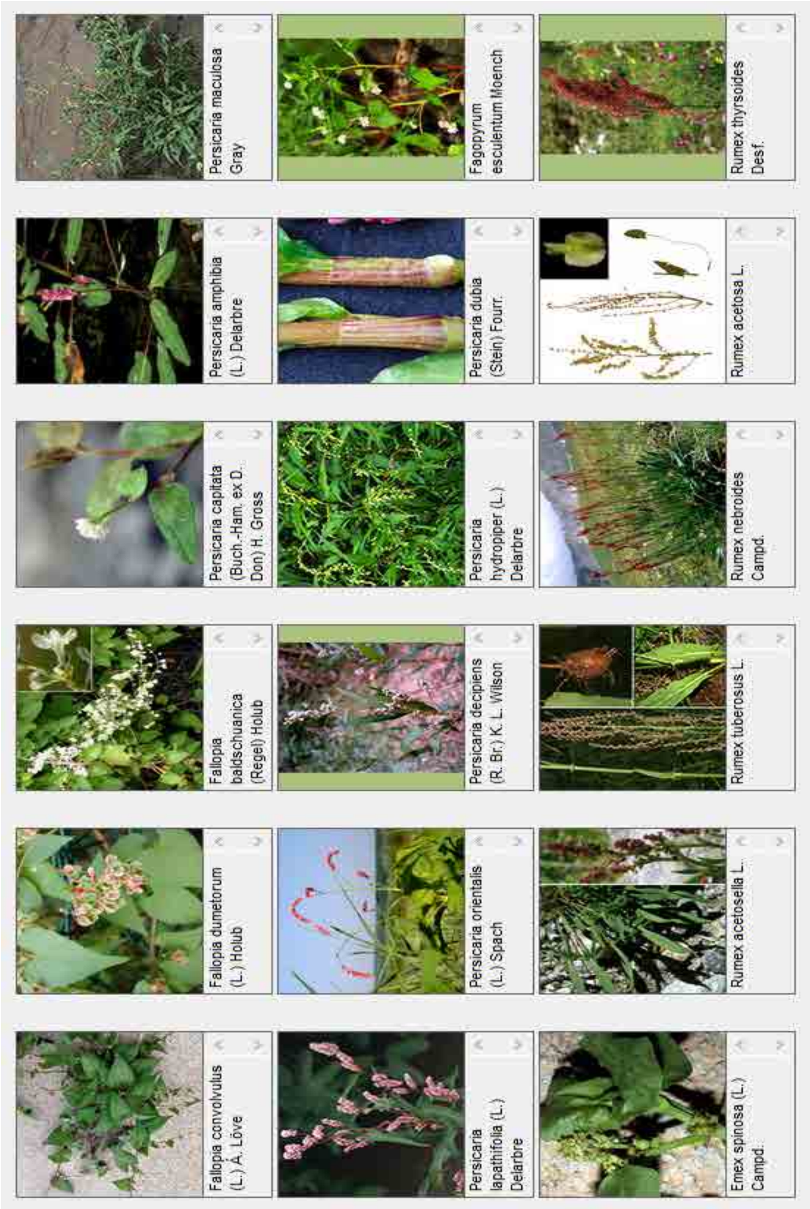

Sedum rubens L.
Sedum amplexicaule DC.
Sedum ochroleucum Chaix
Sedum sediforme (Jacq.) Pau
Sedum caeruleum L.
Sedum dasyphyllum L.
Sedum album L.
Sedum gypsicola Boiss. et Reut.
Sedum cepaea L.
Graptopetalum paraguayense (N. E. Br.) E. Walther
Myriophyllum verticillatum L.
Myriophyllum spicatum L.
Myriophyllum alterniflorum DC.
Ribes uva-crispa L.
Saxifraga rotundifolia L.
Saxifraga bulbifera L.
Saxifraga granulata L.
Saxifraga hederacea L.

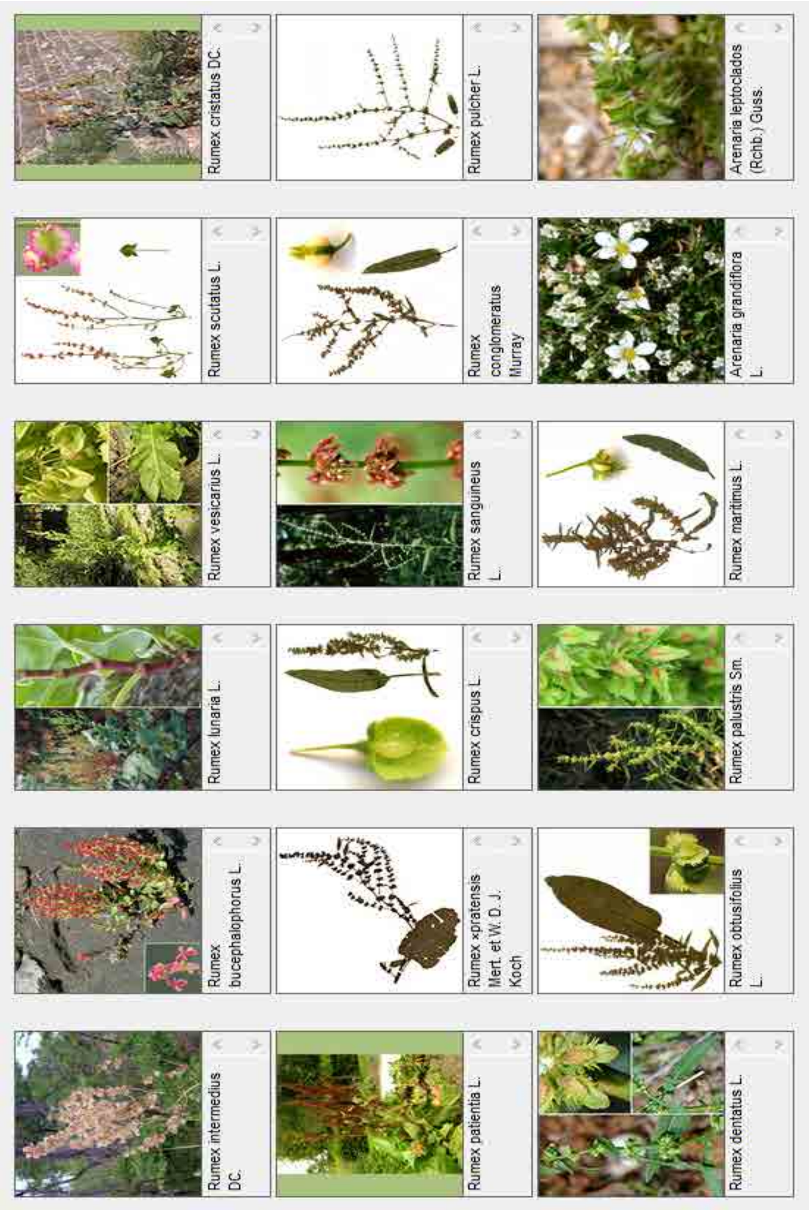

Saxifraga tridactylites L.
Saxifraga adscendens L.
Saxifraga callosa Sm. p. p.
Reaumuria vermiculata L.
Tamarix parviflora DC.
Tamarix tetrandra Pall. ex M. Bieb.
Tamarix africana Poir.
Tamarix dalmatica B. R. Baum
Tamarix hampeana Boiss. et Heldr.
Tamarix rosea Bunge
Tamarix tetragyna Ehrenb.
Tamarix canariensis Willd.
Tamarix gallica L.
Tamarix arborea Ehrenb. ex Bunge
Tamarix chinensis Lour.
Frankenia pulverulenta L.
Frankenia hirsuta L.
Plumbago europaea L.


Armeria nebrodensis (Guss.) Boiss.
Armeria gussonei Boiss.
Limonium sinuatum (L.) Mill.
Limonium narbonense Mill.
Limonium calcarae (Tod. ex Janka) Pignatti
Limonium bocconei (Lojac.) Litard.
Limonium syracusanum Brullo
Limonium flagellare (Lojac.) Brullo
Limonium ponzoi (Fiori et Bég.) Brullo
Limonium tenuiculum (Tineo ex Guss.) Pignatti
Limonium cosyrense (Guss.) Kuntze
Limonium parvifolium (Tineo) Pignatti
Limonium cophanense C. Brullo, Brullo,
Limonium minutiflorum (Guss.) Kuntze
Limonium lojaconoi Brullo
Limonium ionicum Brullo
Limonium tauromenitanum Brullo
Limonium furnarii Brullo

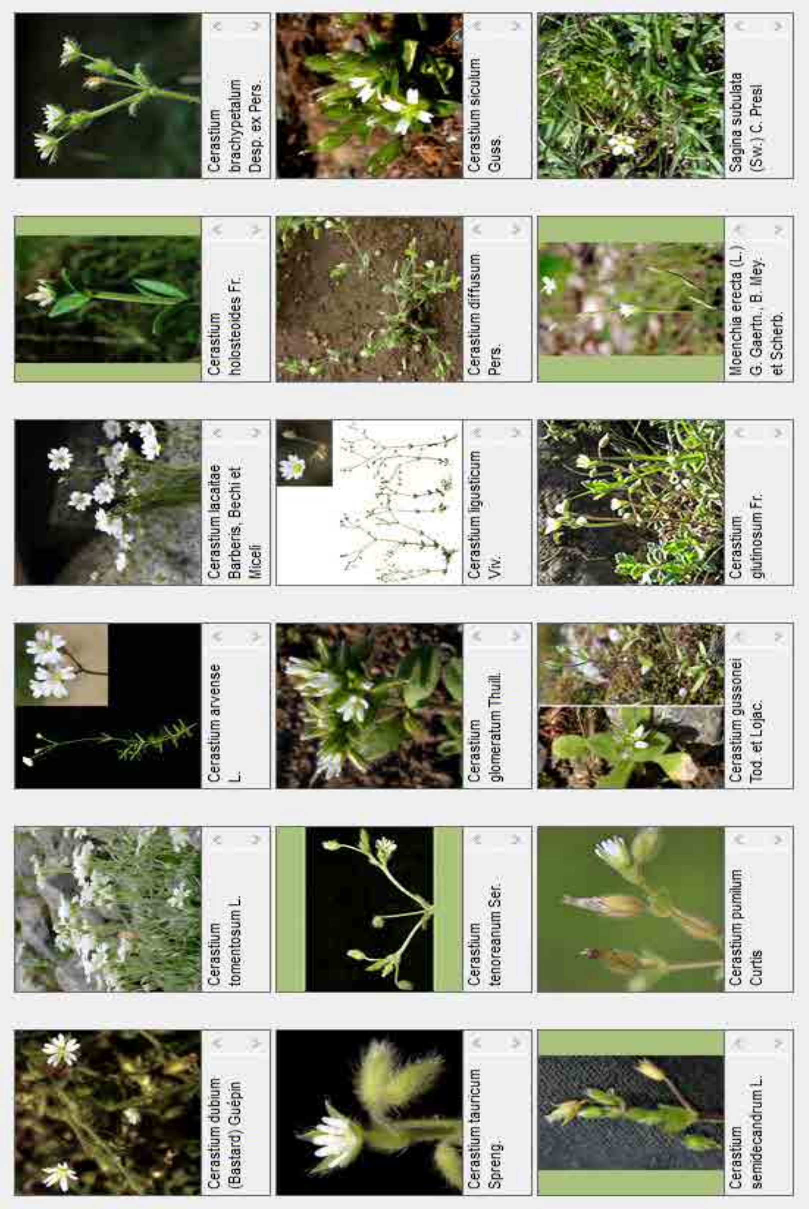

Limonium melancholicum Brullo, Marcenò et S.
Limonium catanense (Tineo ex Lojac.) Brullo
Limonium densiflorum (Guss.) Kuntze
Limonium lilybaeum Brullo
Limonium halophilum Pignatti ex Brullo
Limonium selinuntinum Brullo
Limonium pavonianum Brullo
Limonium pachynense Brullo
Limonium aegusae Brullo
Limonium secundirameum (Lojac.) Brullo
Limonium albidum (Guss.) Pignatti
Limonium panormitanum (Tod.) Pignatti
Limonium lopadusanum Brullo
Limonium hyblaeum Brullo
Limonium intermedium (Guss.) Brullo
Limonium mazarae Pignatti
Limonium virgatum (Willd.) Fourr.
Limonium dubium (Andrz. ex Guss.) Litard.


Limonium opulentum (Lojac.) Brullo
Limonium algusae (Brullo) Greuter
Limonium catanzaroi Brullo
Limonium sibthorpianum (Guss.) Kuntze
Limonium optimae Raimondo
Limonium todaroanum Raimondo et Pignatti
Limonium poimenum Ilardi, Brullo, D. Cusimano et Giusso
Limonium avei (De Not.) Brullo et Erben
Myriolimon ferulaceum (L.) Lledó, Erben et M. B.
Limoniastrum monopetalum (L.) Boiss.
Polygonum equisetiforme Sm.
Polygonum tenorei C. Presl
Polygonum robertii Loisel.
Polygonum maritimum L.
Polygonum bellardii All.
Polygonum aviculare L.
Polygonum rurivagum Jord. ex Boreau
Polygonum arenastrum Boreau

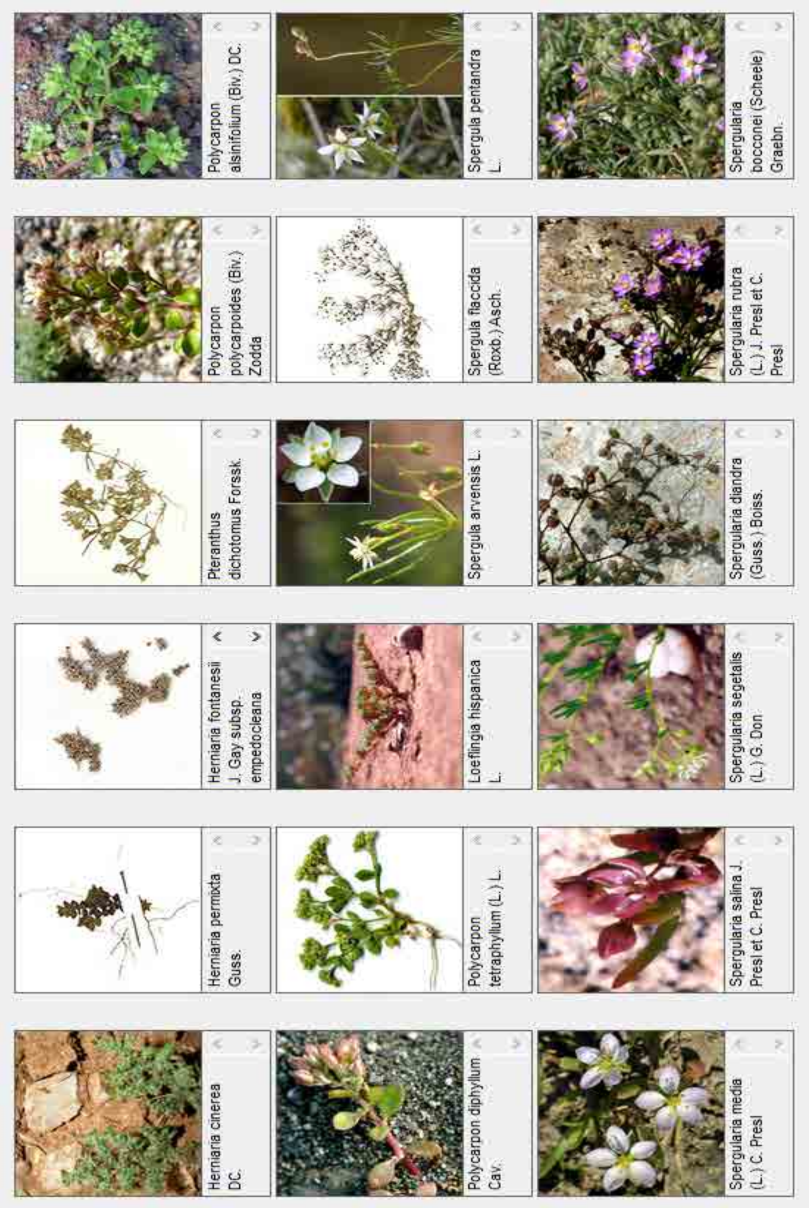

Fallopia convolvulus (L.) Á. Löve
Fallopia dumetorum (L.) Holub
Fallopia baldschuanica (Regel) Holub
Persicaria capitata (Buch.-Ham. ex D. Don) H. Gross
Persicaria amphibia (L.) Delarbre
Persicaria maculosa Gray
Persicaria lapathifolia (L.) Delarbre
Persicaria orientalis (L.) Spach
Persicaria decipiens (R. Br.) K. L. Wilson
Persicaria hydropiper (L.) Delarbre
Persicaria dubia (Stein) Fourr.
Fagopyrum esculentum Moench
Emex spinosa (L.) Campd.
Rumex acetosella L.
Rumex tuberosus L.
Rumex nebroides Campd.
Rumex acetosa L.
Rumex thyrsoides Desf.

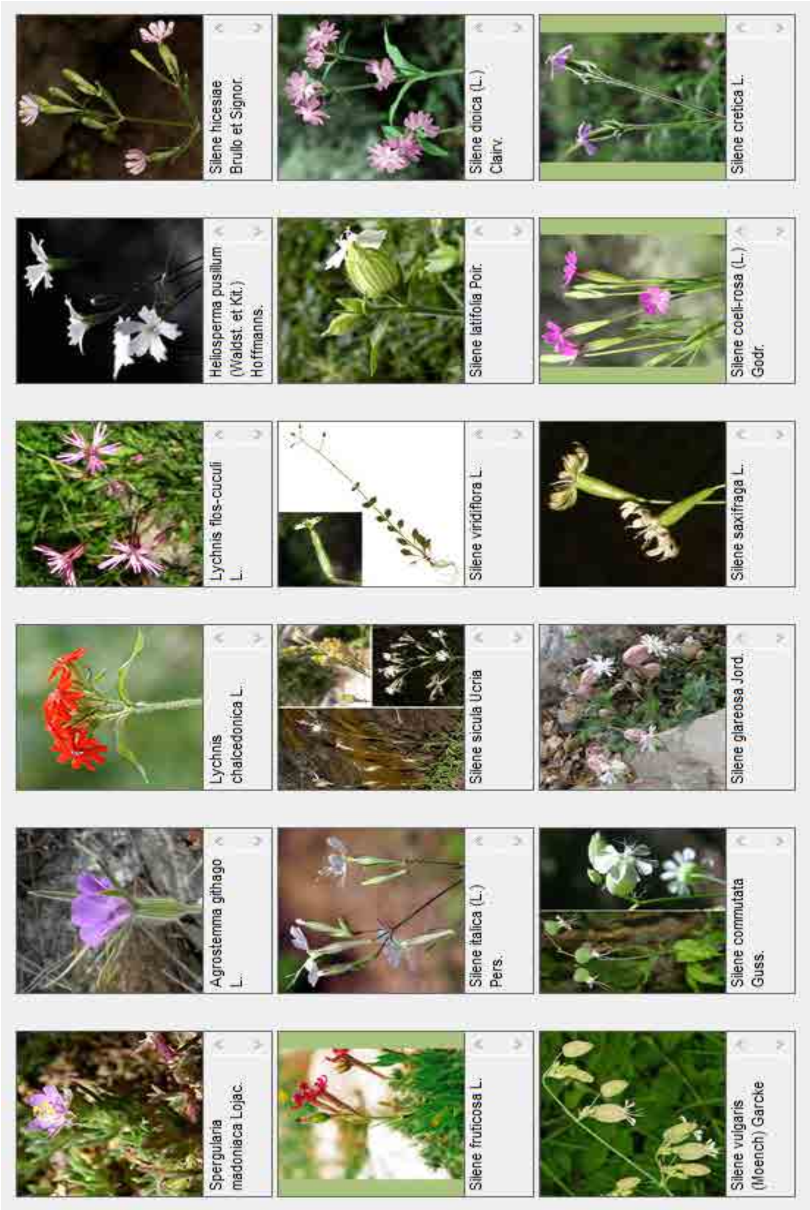

Rumex intermedius DC.
Rumex bucephalophorus L.
Rumex lunaria L.
Rumex vesicarius L.
Rumex scutatus L.
Rumex cristatus DC.
Rumex patientia L.
Rumex ×pratensis Mert. et W. D. J. Koch
Rumex crispus L.
Rumex sanguineus L.
Rumex conglomeratus Murray
Rumex pulcher L.
Rumex dentatus L.
Rumex obtusifolius L.
Rumex palustris Sm.
Rumex maritimus L.
Arenaria grandiflora L.
Arenaria leptoclados (Rchb.) Guss.


Arenaria serpyllifolia L.
Arenaria bertolonii Fiori et Paol.
Moehringia muscosa L.
Moehringia trinervia (L.) Clairv.
Moehringia pentandra J. Gay
Minuartia hybrida (Vill.) Schischk.
Minuartia mediterranea (Link) K. Malý
Minuartia recurva (All.) Schinz et Thell.
Minuartia verna (L.) Hiern
Minuartia graminifolia Jáv.
Minuartia clandestina (Port.) Trinajstić
Rhodalsine geniculata (Poir.) F. N. Williams
Stellaria media (L.) Vill.
Stellaria neglecta Weihe
Stellaria pallida (Dumort.) Piré
Stellaria cupaniana (Jord. et Fourr.) Bég.
Stellaria aquatica (L.) Scop.
Holosteum umbellatum L.

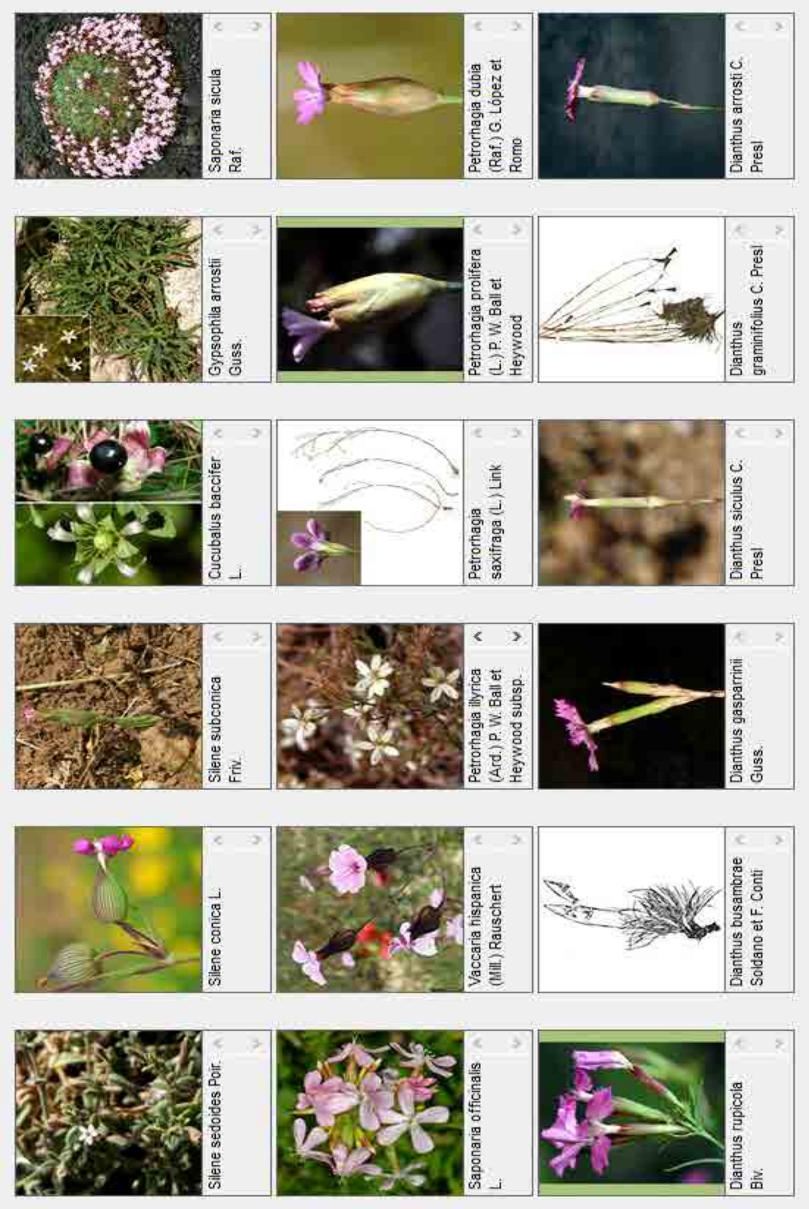

Cerastium dubium (Bastard) Guépin
Cerastium tomentosum L.
Cerastium arvense L.
Cerastium lacaitae Barberis, Bechi et Miceli
Cerastium holosteoides Fr.
Cerastium brachypetalum Desp. ex Pers.
Cerastium tauricum Spreng.
Cerastium tenoreanum Ser.
Cerastium glomeratum Thuill.
Cerastium ligusticum Viv.
Cerastium diffusum Pers.
Cerastium siculum Guss.
Cerastium semidecandrum L.
Cerastium pumilum Curtis
Cerastium gussonei Tod. et Lojac.
Cerastium glutinosum Fr.
Moenchia erecta (L.) G. Gaertn., B. Mey. et Scherb.
Sagina subulata (Sw.) C. Presl

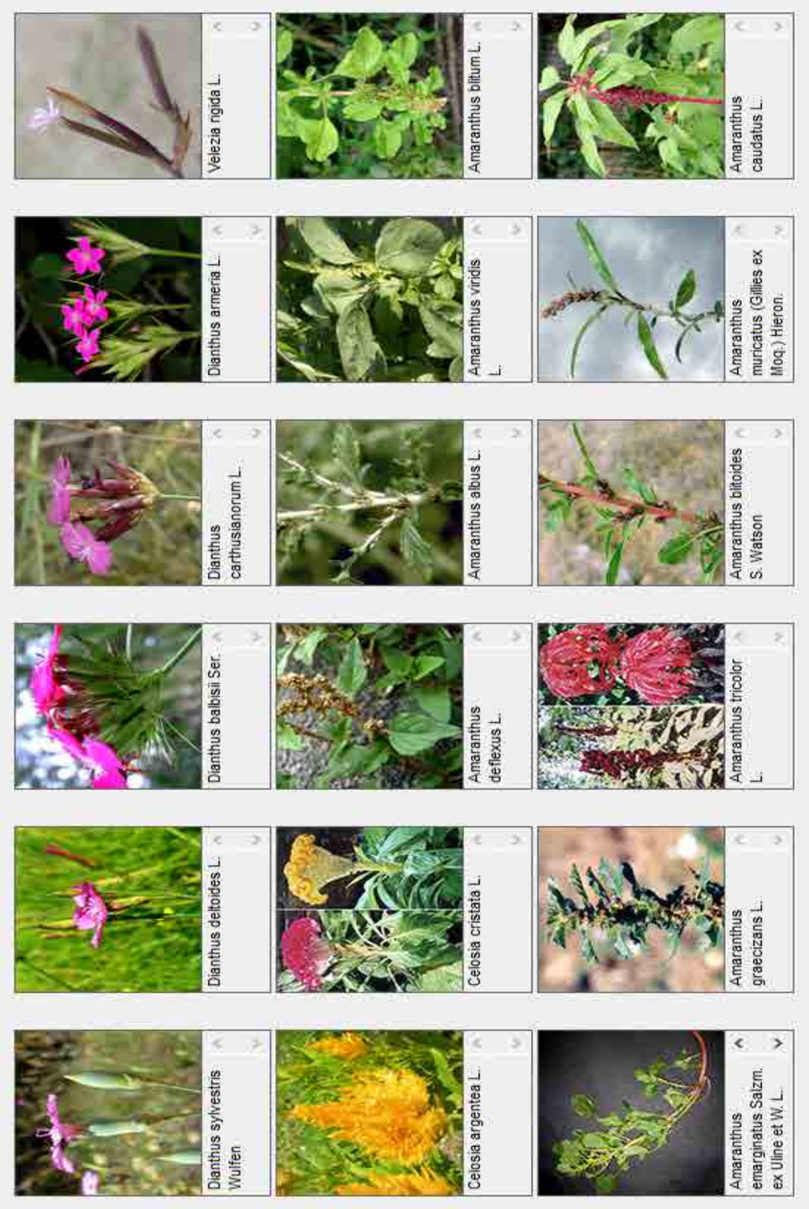

Sagina procumbens L.
Sagina apetala Ard.
Sagina maritima G. Don
Scleranthus perennis L.
Scleranthus vulcanicus Strobl
Scleranthus marginatus Guss.
Scleranthus annuus L.
Scleranthus aetnensis Strobl
Scleranthus polycarpos L.
Corrigiola litoralis L.
Paronychia echinulata Chater
Paronychia argentea Lam.
Paronychia polygonifolia (Vill.) DC.
Paronychia arabica (L.) DC. subsp. longiseta Batt.
Paronychia macrosepala Boiss.
Herniaria glabra L.
Herniaria nebrodensis Jan
Herniaria hirsuta L.


Herniaria cinerea DC.
Herniaria permixta Guss.
Herniaria fontanesii J. Gay subsp. empedocleana
Pteranthus dichotomus Forssk.
Polycarpon polycarpoides (Biv.) Zodda
Polycarpon alsinifolium (Biv.) DC.
Polycarpon diphyllum Cav.
Polycarpon tetraphyllum (L.) L.
Loeflingia hispanica L.
Spergula arvensis L.
Spergula flaccida (Roxb.) Asch.
Spergula pentandra L.
Spergularia media (L.) C. Presl
Spergularia salina J. Presl et C. Presl
Spergularia segetalis (L.) G. Don
Spergularia diandra (Guss.) Boiss.
Spergularia rubra (L.) J. Presl et C. Presl
Spergularia bocconei (Scheele) Graebn.

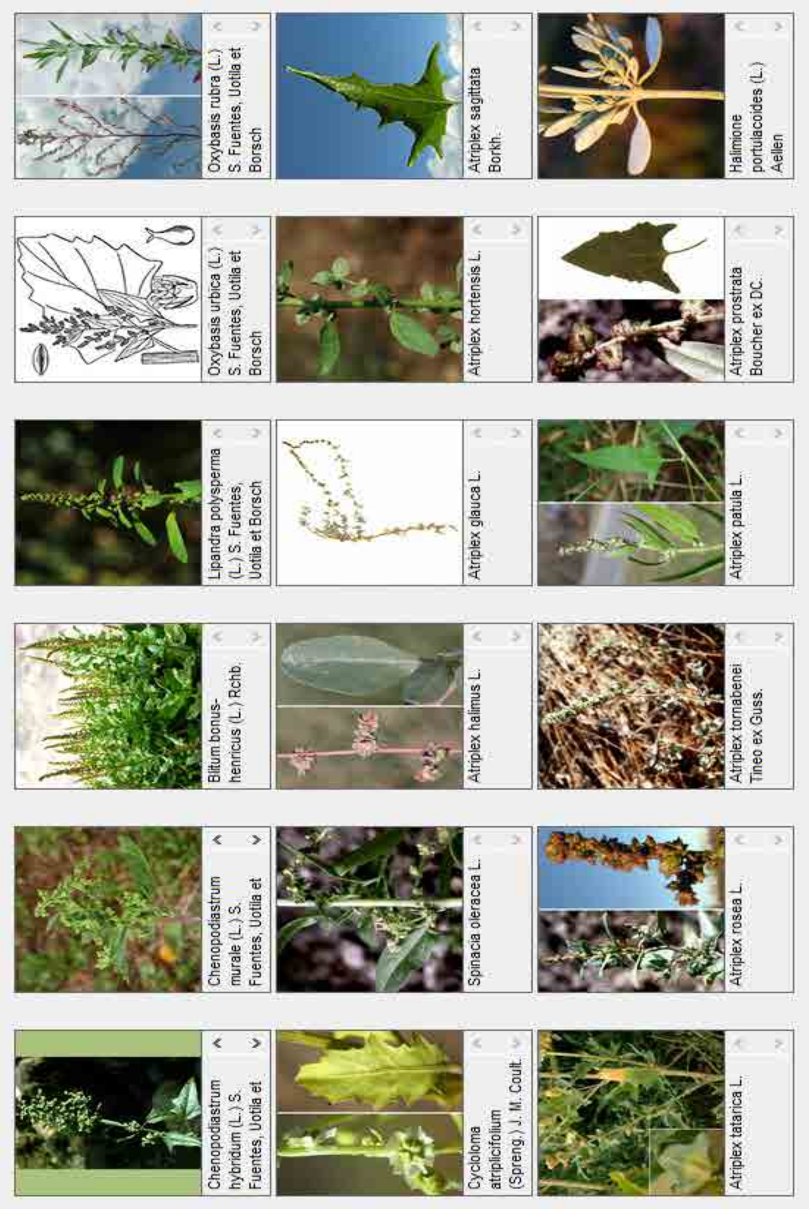

Spergularia madoniaca Lojac.
Agrostemma githago L.
Lychnis chalcedonica L.
Lychnis flos-cuculi L.
Heliosperma pusillum (Waldst. et Kit.) Hoffmanns.
Silene hicesiae Brullo et Signor.
Silene fruticosa L.
Silene italica (L.) Pers.
Silene sicula Ucria
Silene viridiflora L.
Silene latifolia Poir.
Silene dioica (L.) Clairv.
Silene vulgaris (Moench) Garcke
Silene commutata Guss.
Silene glareosa Jord.
Silene saxifraga L.
Silene coeli-rosa (L.) Godr.
Silene cretica L.

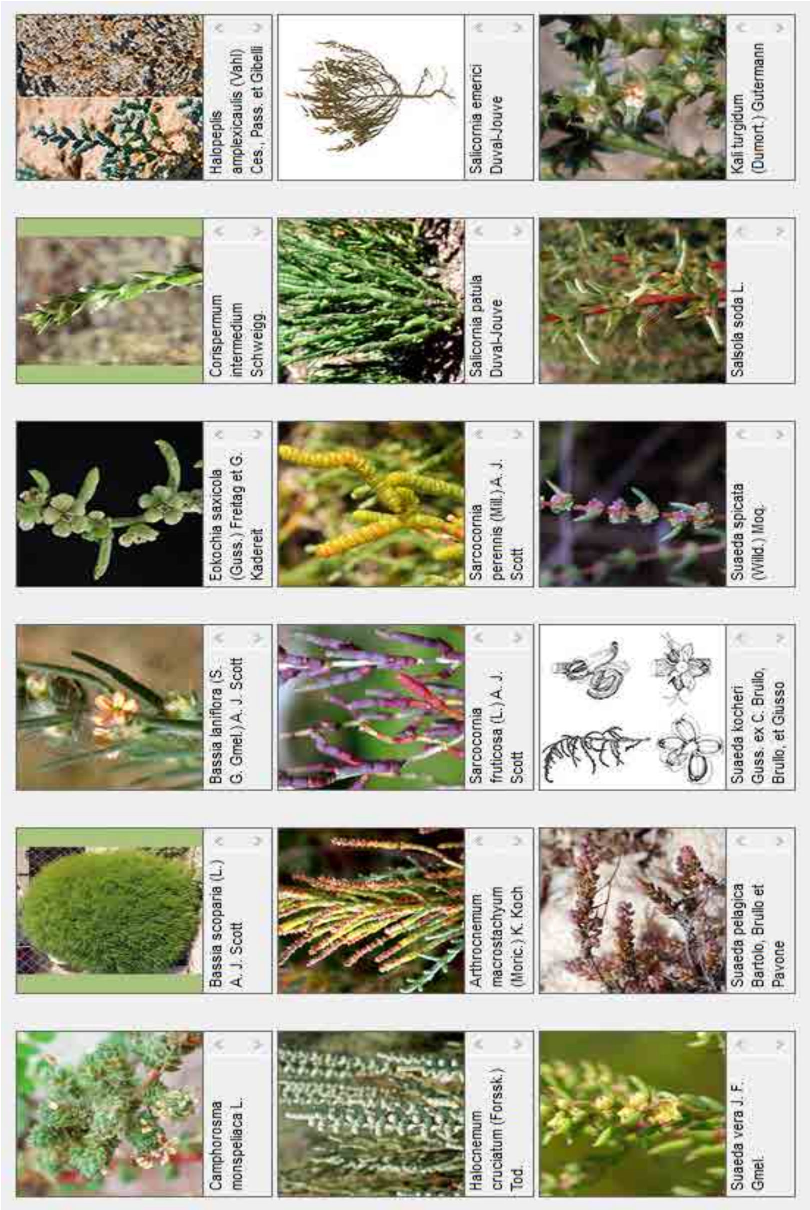

Silene annulata Thore
Silene muscipula L.
Silene behen L.
Silene bellidifolia Jacq.
Silene nicaeensis All.
Silene fuscata Link ex Brot.
Silene colorata Poir.
Silene arghireica Vals.
Silene crassiuscula Brullo, C. Brullo, Cambria, Bacchetta,
Silene nefelites C. Brullo, Brullo, Giusso et Ilardi
Silene peloritana C. Brullo, Brullo, Giusso, Miniss. et
Silene kemoniana C. Brullo, Brullo, Giusso, Ilardi et
Silene apetala Willd.
Silene nocturna L.
Silene neglecta Ten.
Silene gallica L.
Silene pendula L.
Silene turbinata Guss.

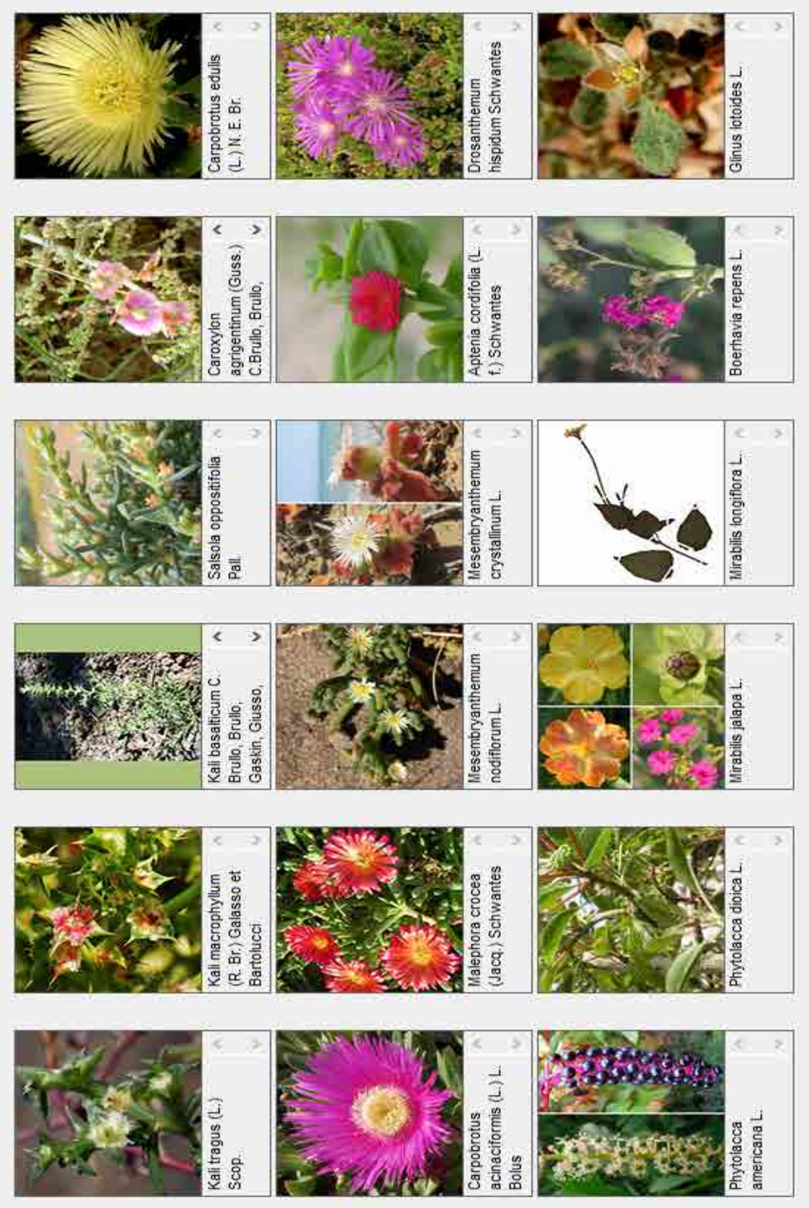

Silene sedoides Poir.
Silene conica L.
Silene subconica Friv.
Cucubalus baccifer L.
Gypsophila arrostii Guss.
Saponaria sicula Raf.
Saponaria officinalis L.
Vaccaria hispanica (Mill.) Rauschert
Petrorhagia illyrica (Ard.) P. W. Ball et Heywood subsp.
Petrorhagia saxifraga (L.) Link
Petrorhagia prolifera (L.) P. W. Ball et Heywood
Petrorhagia dubia (Raf.) G. López et Romo
Dianthus rupicola Biv.
Dianthus busambrae Soldano et F. Conti
Dianthus gasparrinii Guss.
Dianthus siculus C. Presl
Dianthus graminifolius C. Presl
Dianthus arrosti C. Presl

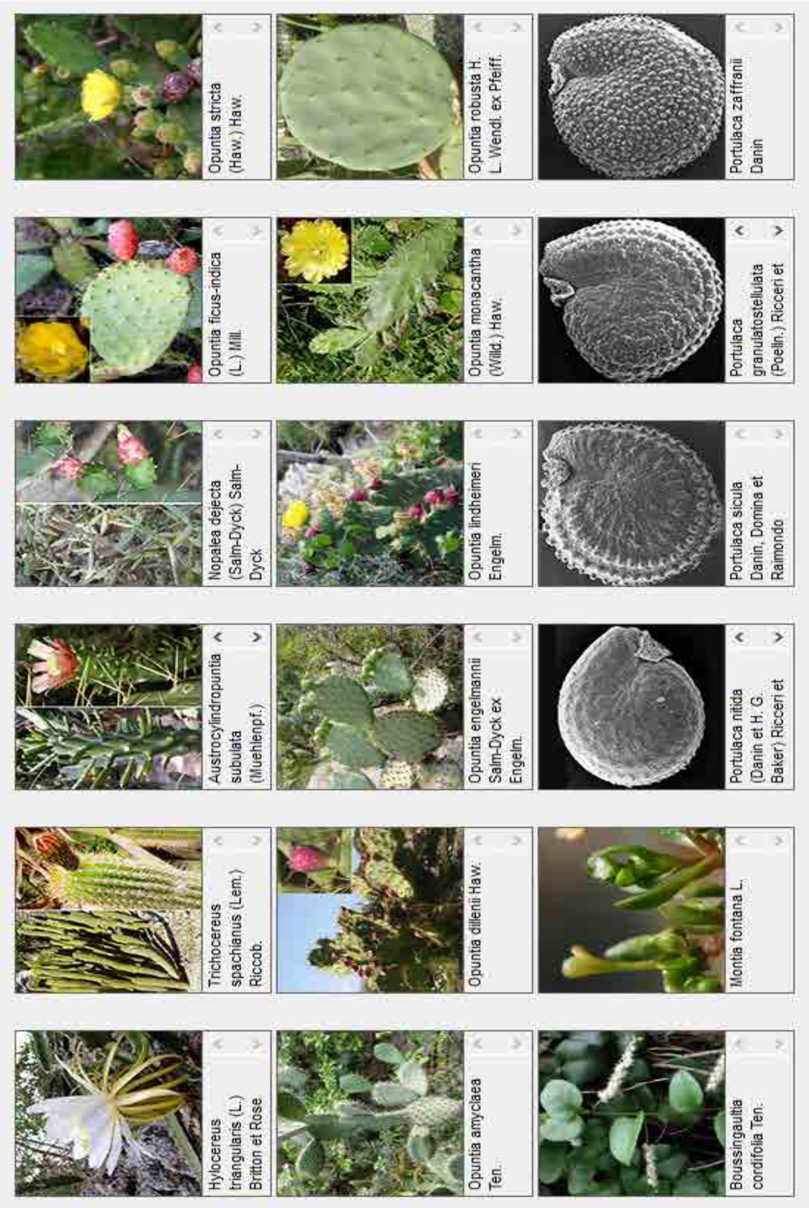

Dianthus sylvestris Wulfen
Dianthus deltoides L.
Dianthus balbisii Ser.
Dianthus carthusianorum L.
Dianthus armeria L.
Velezia rigida L.
Celosia argentea L.
Celosia cristata L.
Amaranthus deflexus L.
Amaranthus albus L.
Amaranthus viridis L.
Amaranthus blitum L.
Amaranthus emarginatus Salzm. ex Uline et W. L.
Amaranthus graecizans L.
Amaranthus tricolor L.
Amaranthus blitoides S. Watson
Amaranthus muricatus (Gillies ex Moq.) Hieron.
Amaranthus caudatus L.

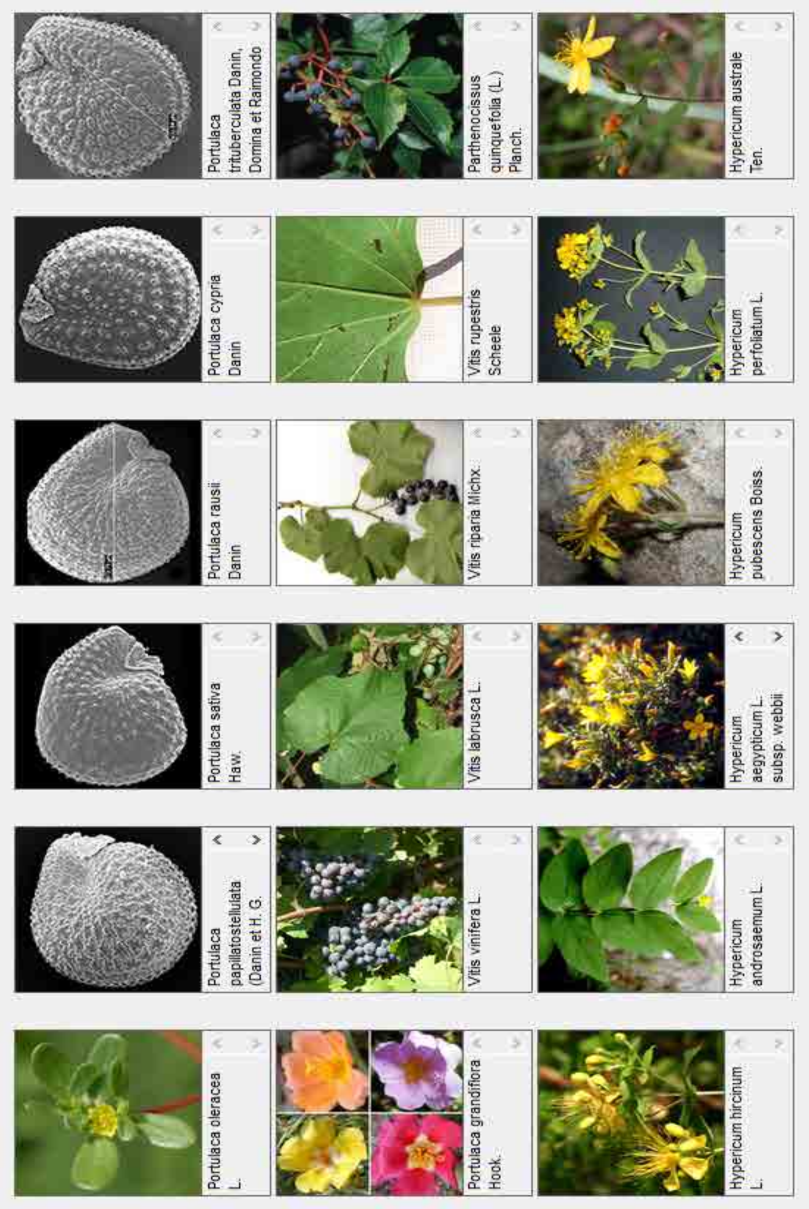

Amaranthus retroflexus L.
Amaranthus cruentus L.
Amaranthus hybridus L.
Amaranthus hypochondriacus L.
Achyranthes aspera L.
Achyranthes sicula (L.) All.
Polycnemum arvense L.
Beta vulgaris L.
Beta macrocarpa Guss.
Patellifolia procumbens (C. Sm.) A. J. Scott.,
Dysphania multifida (L.) Mosyakin et Clemants
Dysphania botrys (L.) Mosyakin et Clemants
Dysphania pumilio (R. Br.) Mosyakin et Clemants
Dysphania ambrosioides (L.) Mosyakin et
Dysphania anthelmintica (L.) Mosyakin et
Chenopodium vulvaria L.
Chenopodium opulifolium Schrad. ex W. D. J. Koch et
Chenopodium album L.

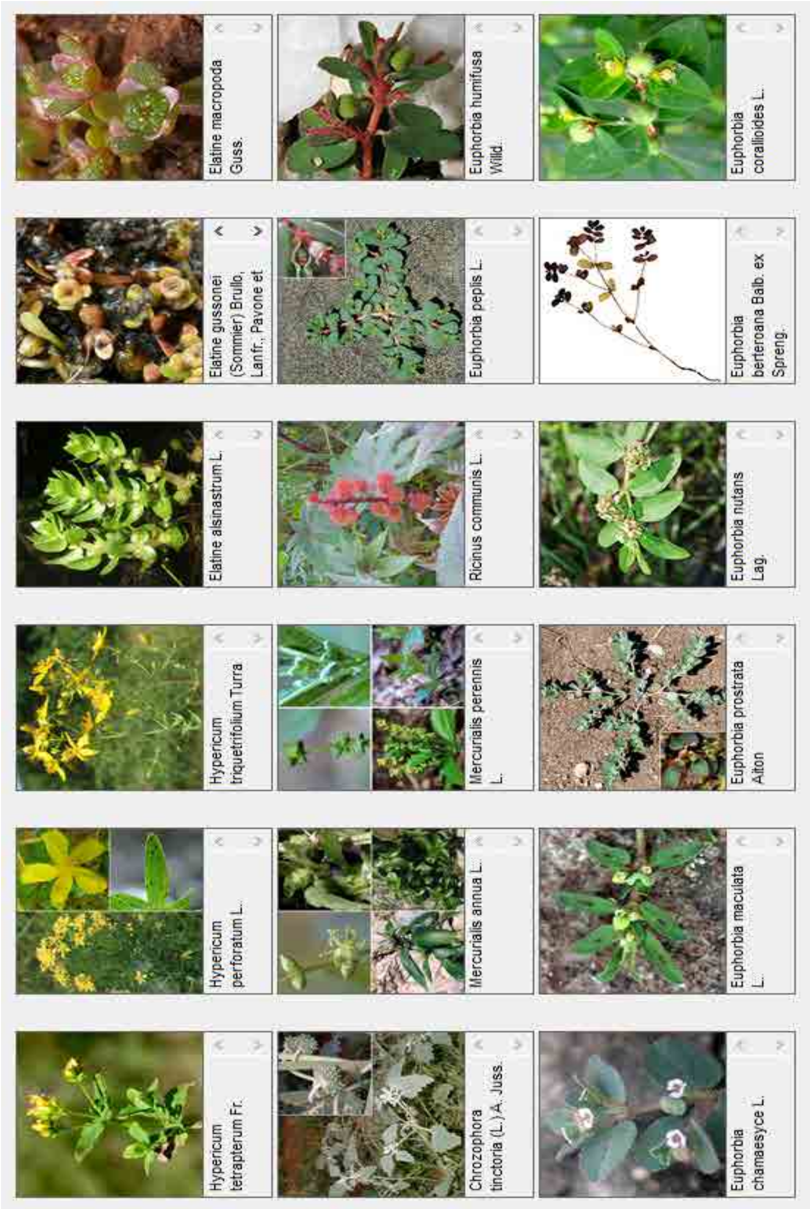

Chenopodiastrum hybridum (L.) S. Fuentes, Uotila et
Chenopodiastrum murale (L.) S. Fuentes, Uotila et
Blitum bonus-henricus (L.) Rchb.
Lipandra polysperma (L.) S. Fuentes, Uotila et Borsch
Oxybasis urbica (L.) S. Fuentes, Uotila et Borsch
Oxybasis rubra (L.) S. Fuentes, Uotila et Borsch
Cycloloma atriplicifolium (Spreng.) J. M. Coult.
Spinacia oleracea L.
Atriplex halimus L.
Atriplex glauca L.
Atriplex hortensis L.
Atriplex sagittata Borkh.
Atriplex tatarica L.
Atriplex rosea L.
Atriplex tornabenei Tineo ex Guss.
Atriplex patula L.
Atriplex prostrata Boucher ex DC.
Halimione portulacoides (L.) Aellen


Camphorosma monspeliaca L.
Bassia scoparia (L.) A. J. Scott
Bassia laniflora (S. G. Gmel.) A. J. Scott
Eokochia saxicola (Guss.) Freitag et G. Kadereit
Corispermum intermedium Schweigg.
Halopeplis amplexicaulis (Vahl) Ces., Pass. et Gibelli
Halocnemum cruciatum (Forssk.) Tod.
Arthrocnemum macrostachyum (Moric.) K. Koch
Sarcocornia fruticosa (L.) A. J. Scott
Sarcocornia perennis (Mill.) A. J. Scott
Salicornia patula Duval-Jouve
Salicornia emerici Duval-Jouve
Suaeda vera J. F. Gmel.
Suaeda pelagica Bartolo, Brullo et Pavone
Suaeda kocheri Guss. ex C. Brullo, Brullo, et Giusso
Suaeda spicata (Willd.) Moq.
Salsola soda L.
Kali turgidum (Dumort.) Gutermann


Kali tragus (L.) Scop.
Kali macrophyllum (R. Br.) Galasso et Bartolucci
Kali basalticum C. Brullo, Brullo, Gaskin, Giusso,
Salsola oppositifolia Pall.
Caroxylon agrigentinum (Guss.) C.Brullo, Brullo,
Carpobrotus edulis (L.) N. E. Br.
Carpobrotus acinaciformis (L.) L. Bolus
Malephora crocea (Jacq.) Schwantes
Mesembryanthemum nodiflorum L.
Mesembryanthemum crystallinum L.
Aptenia cordifolia (L. f.) Schwantes
Drosanthemum hispidum Schwantes
Phytolacca americana L.
Phytolacca dioica L.
Mirabilis jalapa L.
Mirabilis longiflora L.
Boerhavia repens L.
Glinus lotoides L.


Hylocereus triangularis (L.) Britton et Rose
Trichocereus spachianus (Lem.) Riccob.
Austrocylindropuntia subulata (Muehlenpf.)
Nopalea dejecta (Salm-Dyck) Salm-Dyck
Opuntia ficus-indica (L.) Mill.
Opuntia stricta (Haw.) Haw.
Opuntia amyclaea Ten.
Opuntia dillenii Haw.
Opuntia engelmannii Salm-Dyck ex Engelm.
Opuntia lindheimeri Engelm.
Opuntia monacantha (Willd.) Haw.
Opuntia robusta H. L. Wendl. ex Pfeiff.
Boussingaultia cordifolia Ten.
Montia fontana L.
Portulaca nitida (Danin et H. G. Baker) Ricceri et
Portulaca sicula Danin, Domina et Raimondo
Portulaca granulatostellulata (Poelln.) Ricceri et
Portulaca zaffranii Danin

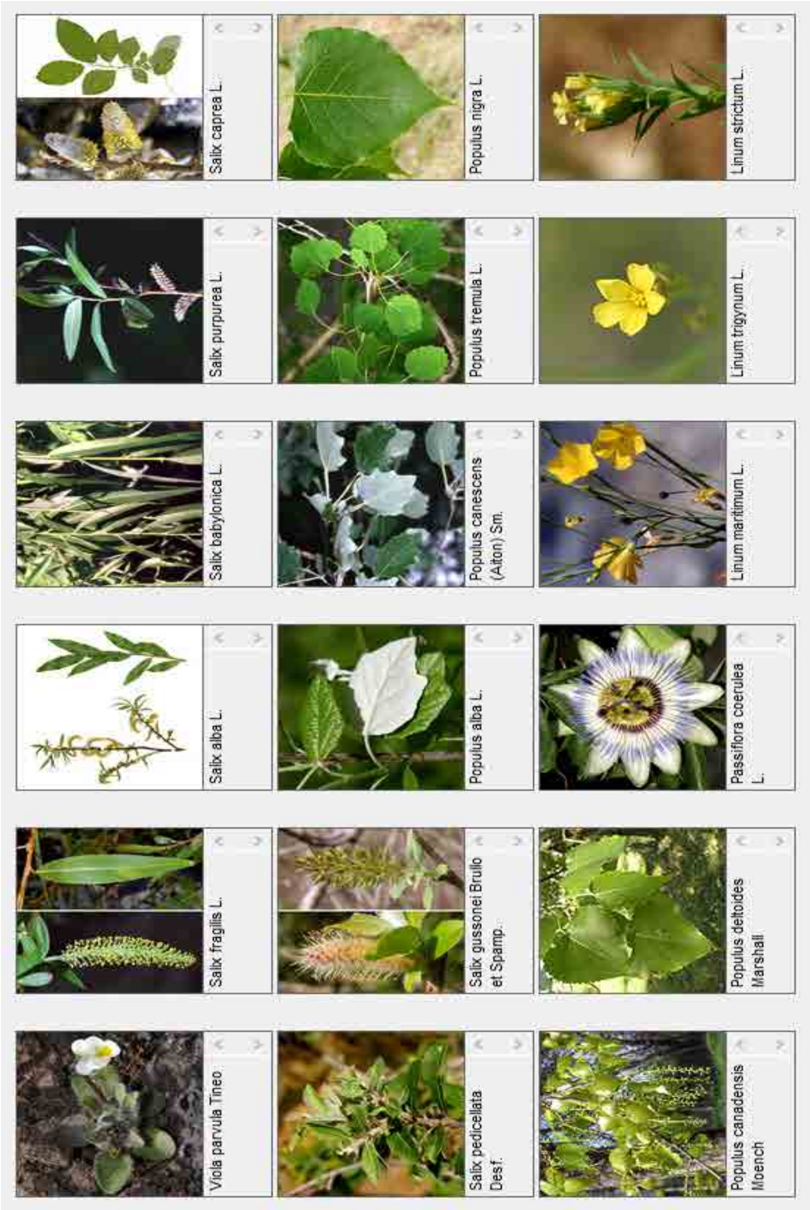

Portulaca oleracea L.
Portulaca papillatostellulata (Danin et H. G.
Portulaca sativa Haw.
Portulaca rausii Danin
Portulaca cypria Danin
Portulaca trituberculata Danin, Domina et Raimondo
Portulaca grandiflora Hook.
Vitis vinifera L.
Vitis labrusca L.
Vitis riparia Michx.
Vitis rupestris Scheele
Parthenocissus quinquefolia (L.) Planch.
Hypericum hircinum L.
Hypericum androsaemum L.
Hypericum aegypticum L. subsp. webbii
Hypericum pubescens Boiss.
Hypericum perfoliatum L.
Hypericum australe Ten.

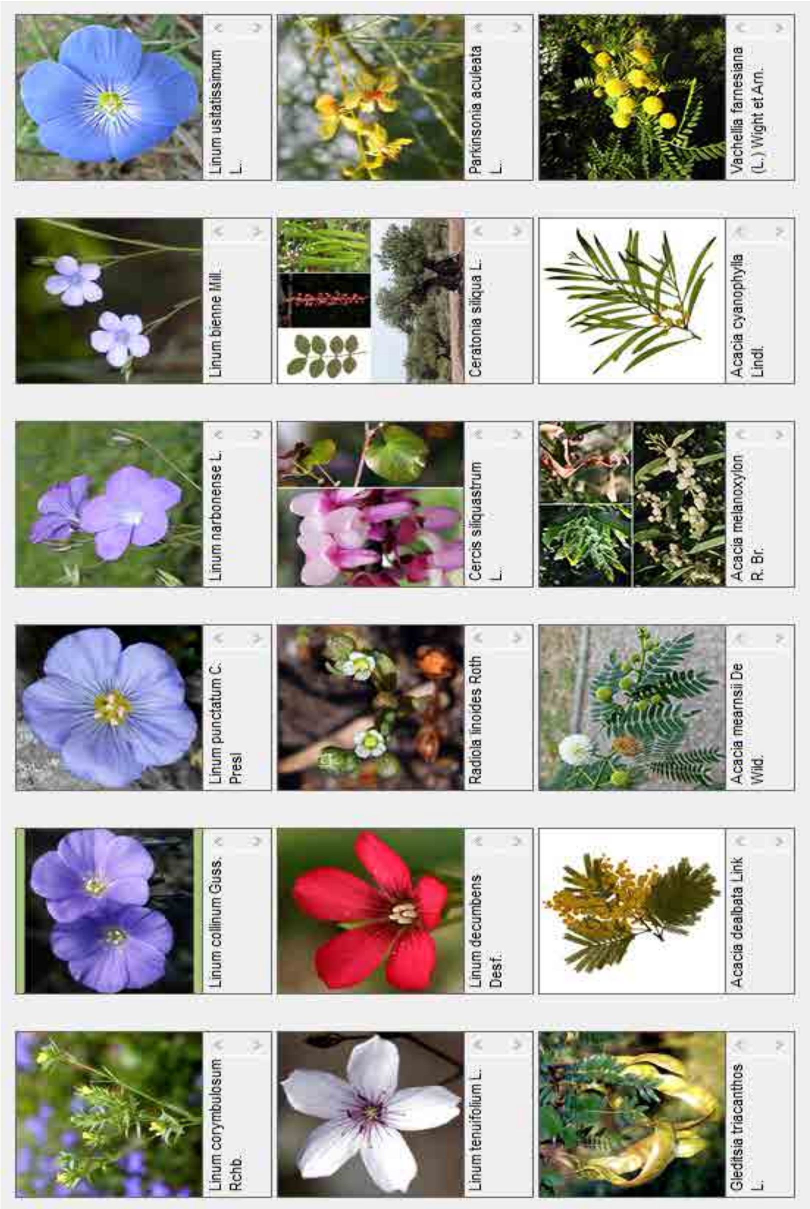

Hypericum tetrapterum Fr.
Hypericum perforatum L.
Hypericum triquetrifolium Turra
Elatine alsinastrum L.
Elatine gussonei (Sommier) Brullo, Lanfr., Pavone et
Elatine macropoda Guss.
Chrozophora tinctoria (L.) A. Juss.
Mercurialis annua L.
Mercurialis perennis L.
Ricinus communis L.
Euphorbia peplis L.
Euphorbia humifusa Willd.
Euphorbia chamaesyce L.
Euphorbia maculata L.
Euphorbia prostrata Aiton
Euphorbia nutans Lag.
Euphorbia berteroana Balb. ex Spreng.
Euphorbia corallioides L.

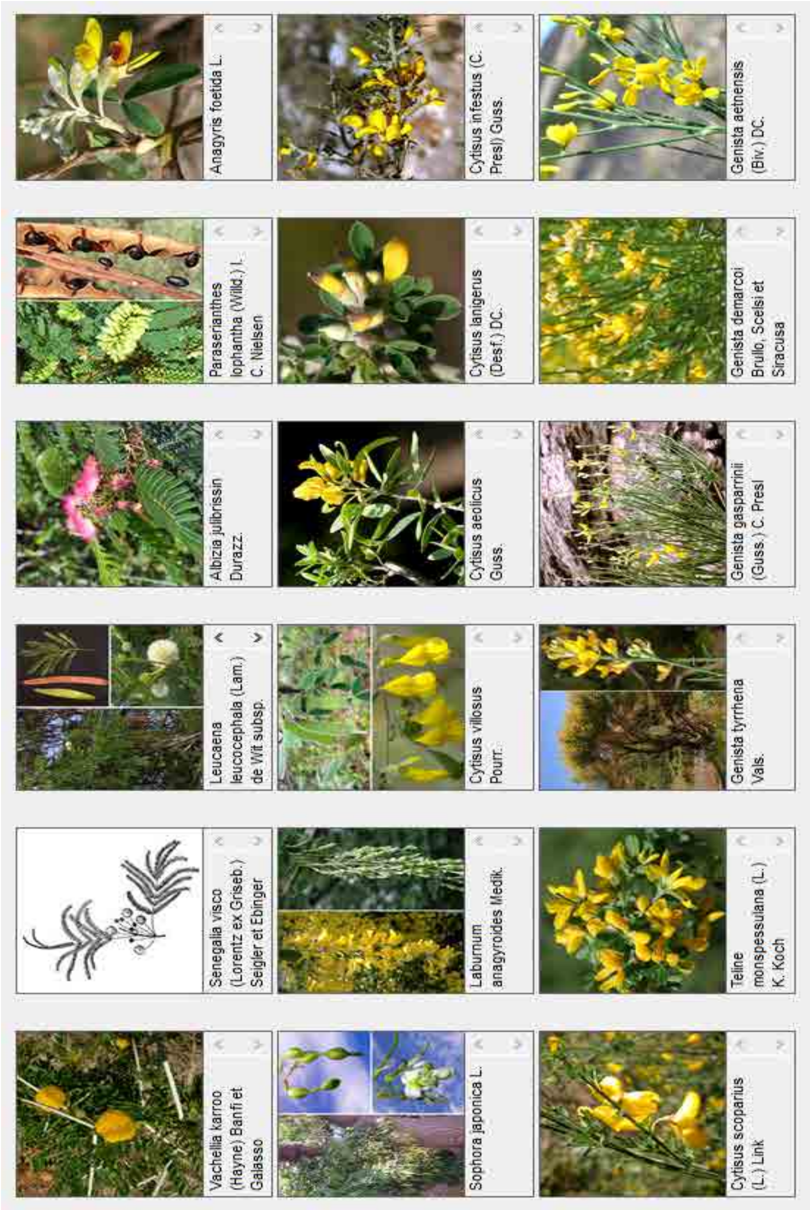

Euphorbia hirsuta L.
Euphorbia dendroides L.
Euphorbia serrata L.
Euphorbia pterococca Brot.
Euphorbia helioscopia L.
Euphorbia lagascae Spreng.
Euphorbia akenocarpa Guss.
Euphorbia platyphyllos L.
Euphorbia stricta L.
Euphorbia cuneifolia Guss.
Euphorbia ceratocarpa Ten.
Euphorbia gasparrinii Boiss.
Euphorbia melapetala Gasp.
Euphorbia bivonae Steud.
Euphorbia papillaris (Boiss.) Raffaelli et Ricceri
Euphorbia amygdaloides L.
Euphorbia meuselii Mazzola et Raimondo
Euphorbia characias L.


Euphorbia biumbellata Poir.
Euphorbia myrsinites L.
Euphorbia pinea L.
Euphorbia pithyusa L.
Euphorbia cupanii Guss. ex Bertol.
Euphorbia rigida M. Bieb.
Euphorbia paralias L.
Euphorbia terracina L.
Euphorbia exigua L.
Euphorbia aleppica L.
Euphorbia segetalis L.
Euphorbia peplus L.
Euphorbia peploides Gouan
Euphorbia falcata L.
Phyllanthus tenellus Roxb.
Andrachne telephioides L.
Oxalis corniculata L.
Oxalis purpurea L.

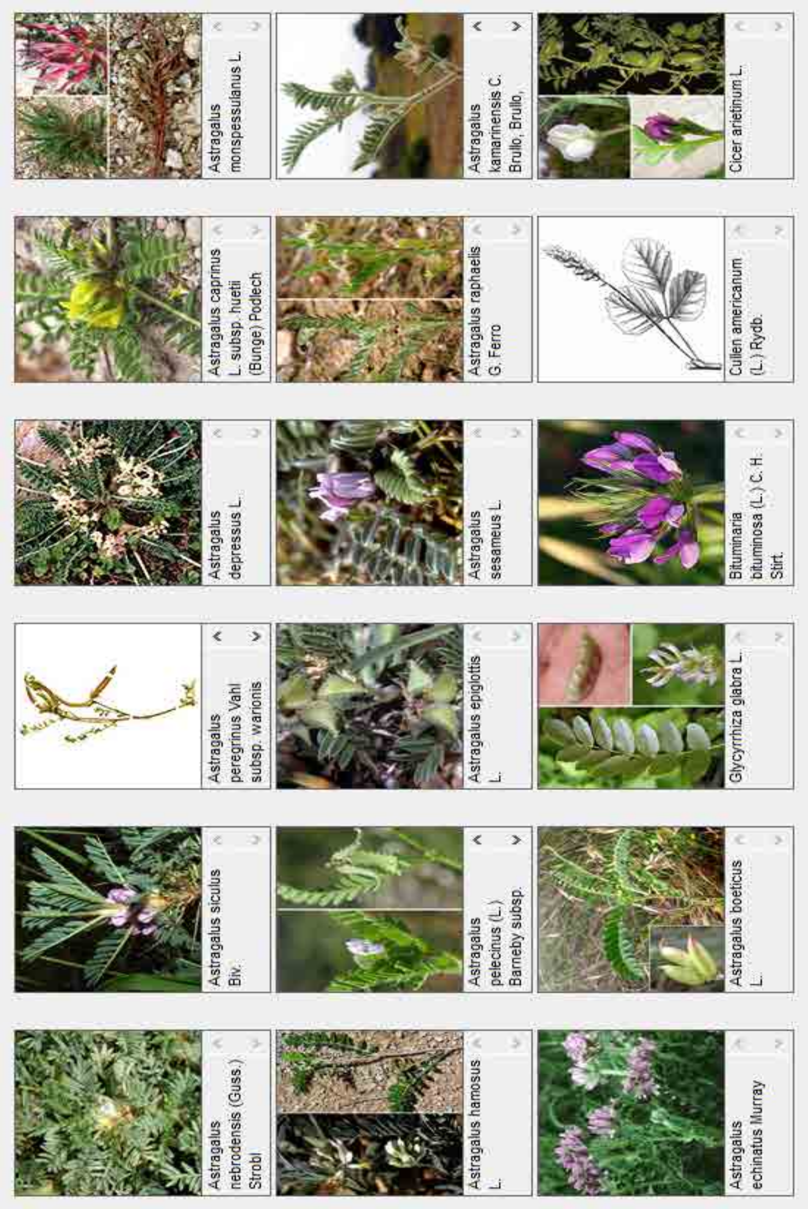

Oxalis pes-caprae L.
Oxalis articulata Savigny
Oxalis latifolia Kunth
Oxalis purpurata Jacq.
Fagonia cretica L.
Tribulus terrestris L.
Euonymus europaeus L.
Viola odorata L.
Viola alba Besser
Viola reichenbachiana Jord. ex Boreau
Viola riviniana Rchb.
Viola aethnensis (DC.) Strobl
Viola nebrodensis C. Presl
Viola tineorum Erben et Raimondo
Viola ucriana Erben et Raimondo
Viola arvensis Murray
Viola kitaibeliana Schult.
Viola hymettia Boiss. et Heldr.

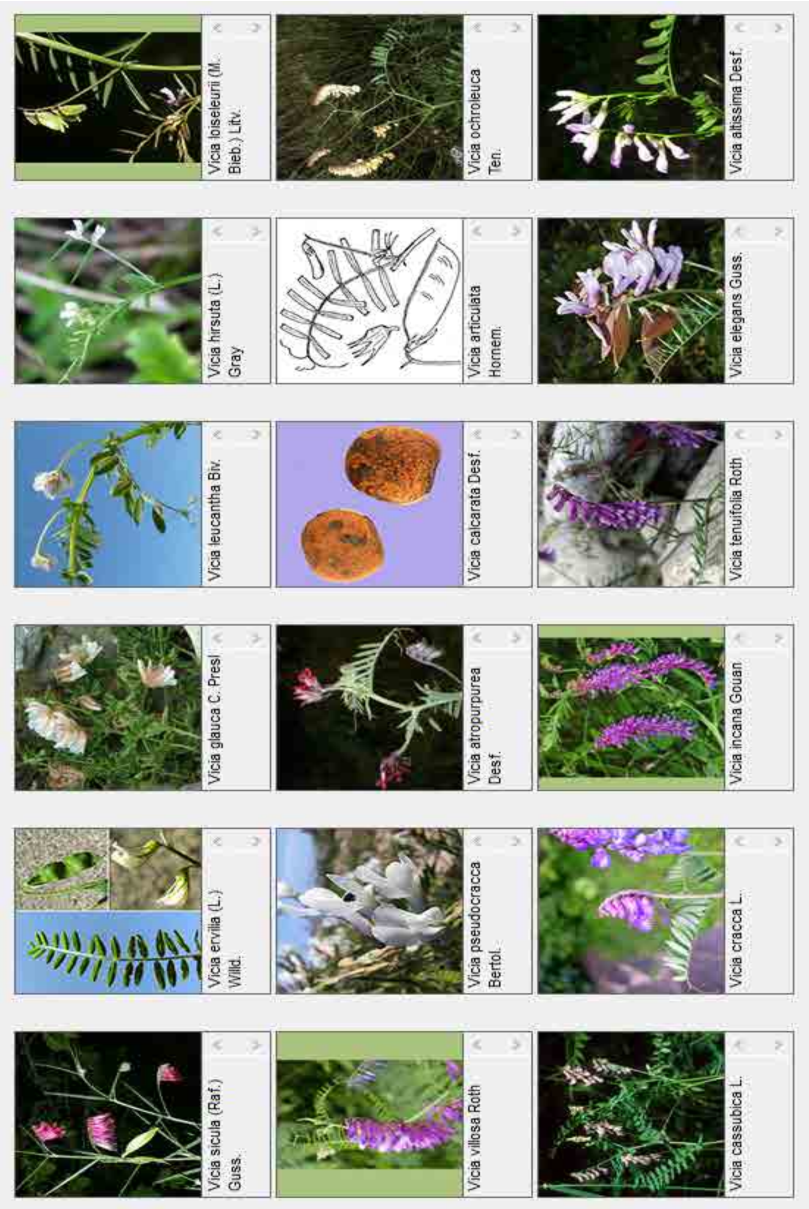

Viola parvula Tineo
Salix fragilis L.
Salix alba L.
Salix babylonica L.
Salix purpurea L.
Salix caprea L.
Salix pedicellata Desf.
Salix gussonei Brullo et Spamp.
Populus alba L.
Populus canescens (Aiton) Sm.
Populus tremula L.
Populus nigra L.
Populus canadensis Moench
Populus deltoides Marshall
Passiflora coerulea L.
Linum maritimum L.
Linum trigynum L.
Linum strictum L.

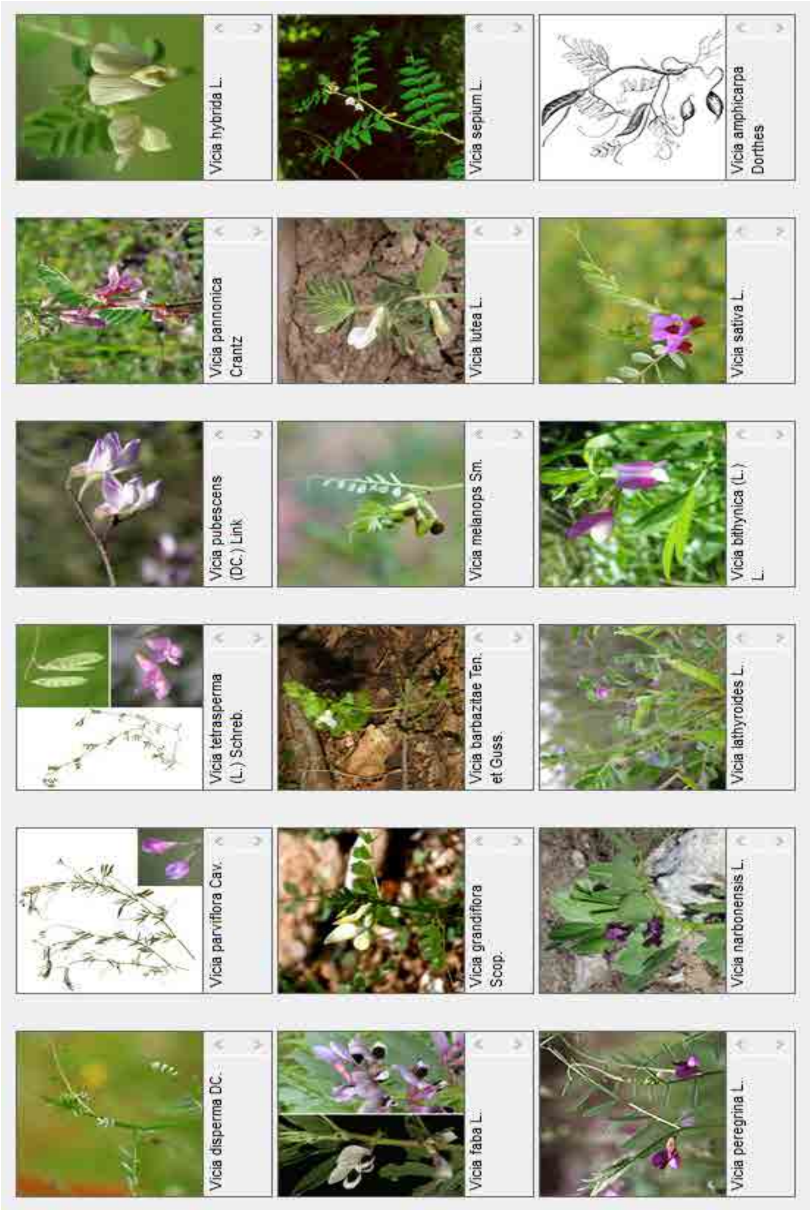

Linum corymbulosum Rchb.
Linum collinum Guss.
Linum punctatum C. Presl
Linum narbonense L.
Linum bienne Mill.
Linum usitatissimum L.
Linum tenuifolium L.
Linum decumbens Desf.
Radiola linoides Roth
Cercis siliquastrum L.
Ceratonia siliqua L.
Parkinsonia aculeata L.
Gleditsia triacanthos L.
Acacia dealbata Link
Acacia mearnsii De Wild.
Acacia melanoxylon R. Br.
Acacia cyanophylla Lindl.
Vachellia farnesiana (L.) Wight et Arn.

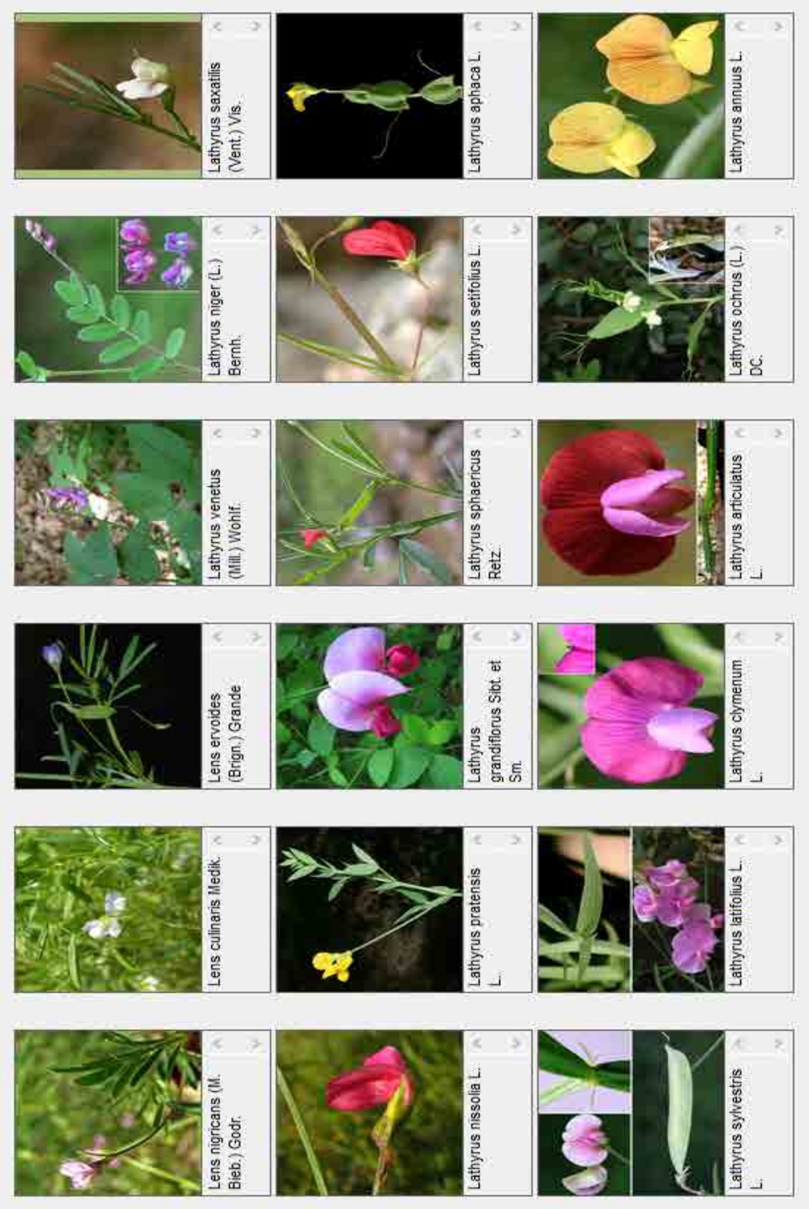

Vachellia karroo (Hayne) Banfi et Galasso
Senegalia visco (Lorentz ex Griseb.) Seigler et Ebinger
Leucaena leucocephala (Lam.) de Wit subsp.
Albizia julibrissin Durazz.
Paraserianthes lophantha (Willd.) I. C. Nielsen
Anagyris foetida L.
Sophora japonica L.
Laburnum anagyroides Medik.
Cytisus villosus Pourr.
Cytisus aeolicus Guss.
Cytisus lanigerus (Desf.) DC.
Cytisus infestus (C. Presl) Guss.
Cytisus scoparius (L.) Link
Teline monspessulana (L.) K. Koch
Genista tyrrhena Vals.
Genista gasparrinii (Guss.) C. Presl
Genista demarcoi Brullo, Scelsi et Siracusa
Genista aetnensis (Biv.) DC.

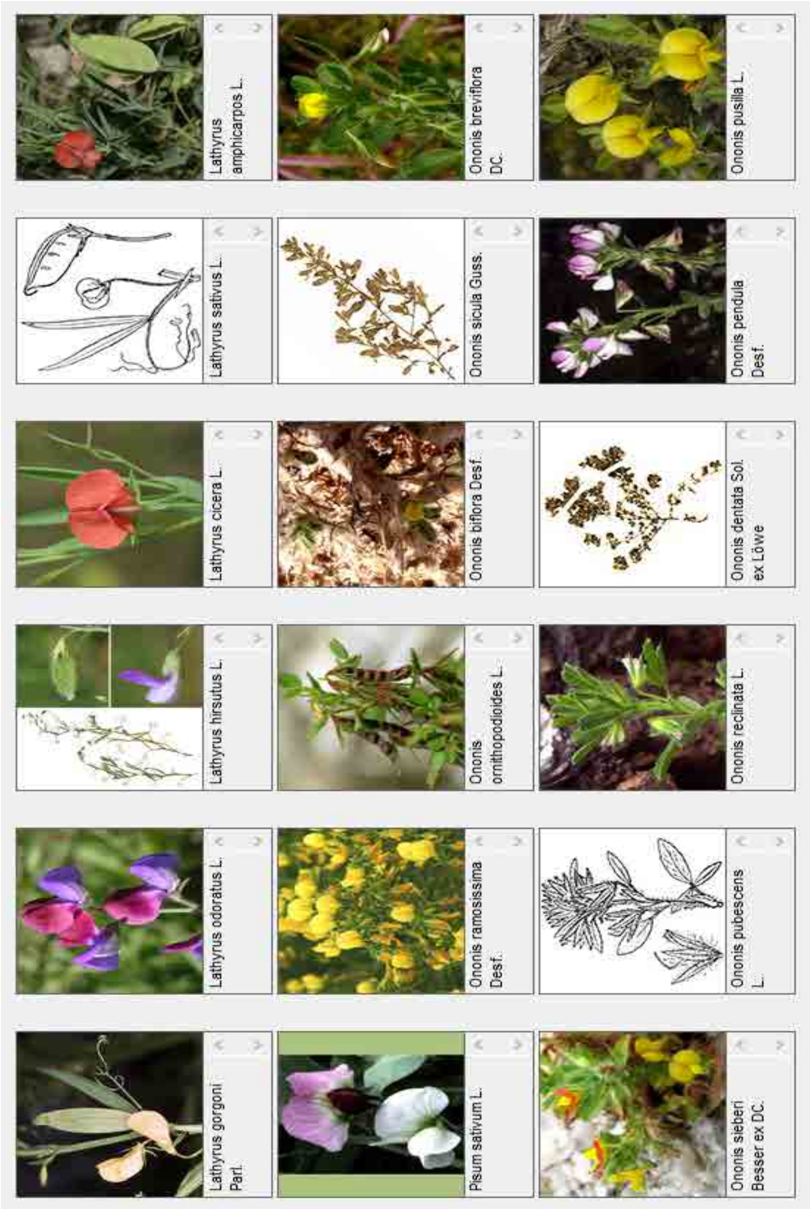

Genista aspalathoides Lam.
Genista aristata C. Presl
Genista cupanii Guss.
Genista madoniensis Raimondo
Retama raetam (Forssk.) Webb et Berthel. subsp.
Spartium junceum L.
Adenocarpus bivonii C. Presl
Adenocarpus commutatus Guss.
Argyrolobium zanonii (Turra) P. W. Ball
Lupinus luteus L.
Lupinus angustifolius L.
Lupinus gussoneanus J. Agardh
Lupinus albus L.
Lupinus graecus Boiss. et Spruner
Lupinus cosentinii Guss.
Robinia pseudoacacia L.
Sesbania punicea (Cav.) Benth.
Colutea arborescens L.

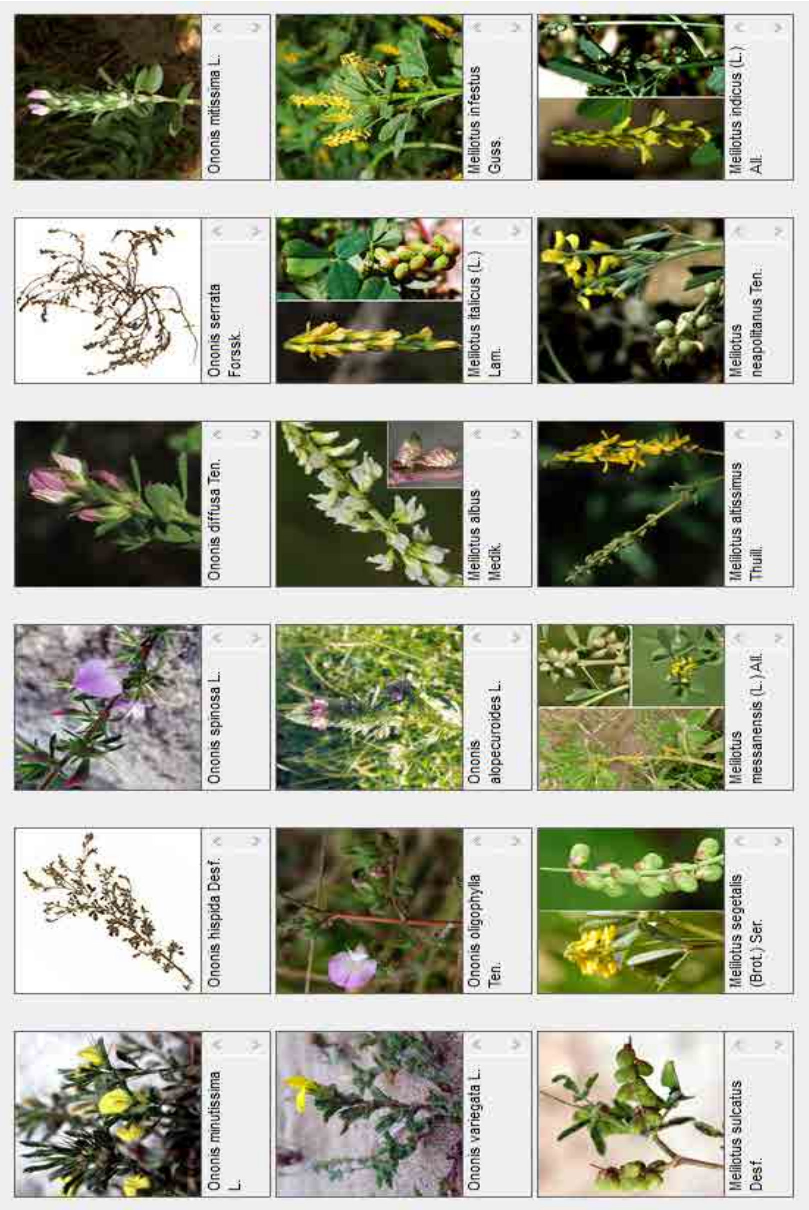

Astragalus nebrodensis (Guss.) Strobl
Astragalus siculus Biv.
Astragalus peregrinus Vahl subsp. warionis
Astragalus depressus L.
Astragalus caprinus L. subsp. huetii (Bunge) Podlech
Astragalus monspessulanus L.
Astragalus hamosus L.
Astragalus pelecinus (L.) Barneby subsp.
Astragalus epiglottis L.
Astragalus sesameus L.
Astragalus raphaelis G. Ferro
Astragalus kamarinensis C. Brullo, Brullo,
Astragalus echinatus Murray
Astragalus boeticus L.
Glycyrrhiza glabra L.
Bituminaria bituminosa (L.) C. H. Stirt.
Cullen americanum (L.) Rydb.
Cicer arietinum L.


Vicia sicula (Raf.) Guss.
Vicia ervilia (L.) Willd.
Vicia glauca C. Presl
Vicia leucantha Biv.
Vicia hirsuta (L.) Gray
Vicia loiseleurii (M. Bieb.) Litv.
Vicia villosa Roth
Vicia pseudocracca Bertol.
Vicia atropurpurea Desf.
Vicia calcarata Desf.
Vicia articulata Hornem.
Vicia ochroleuca Ten.
Vicia cassubica L.
Vicia cracca L.
Vicia incana Gouan
Vicia tenuifolia Roth
Vicia elegans Guss.
Vicia altissima Desf.


Vicia disperma DC.
Vicia parviflora Cav.
Vicia tetrasperma (L.) Schreb.
Vicia pubescens (DC.) Link
Vicia pannonica Crantz
Vicia hybrida L.
Vicia faba L.
Vicia grandiflora Scop.
Vicia barbazitae Ten. et Guss.
Vicia melanops Sm.
Vicia lutea L.
Vicia sepium L.
Vicia peregrina L.
Vicia narbonensis L.
Vicia lathyroides L.
Vicia bithynica (L.) L.
Vicia sativa L.
Vicia amphicarpa Dorthes

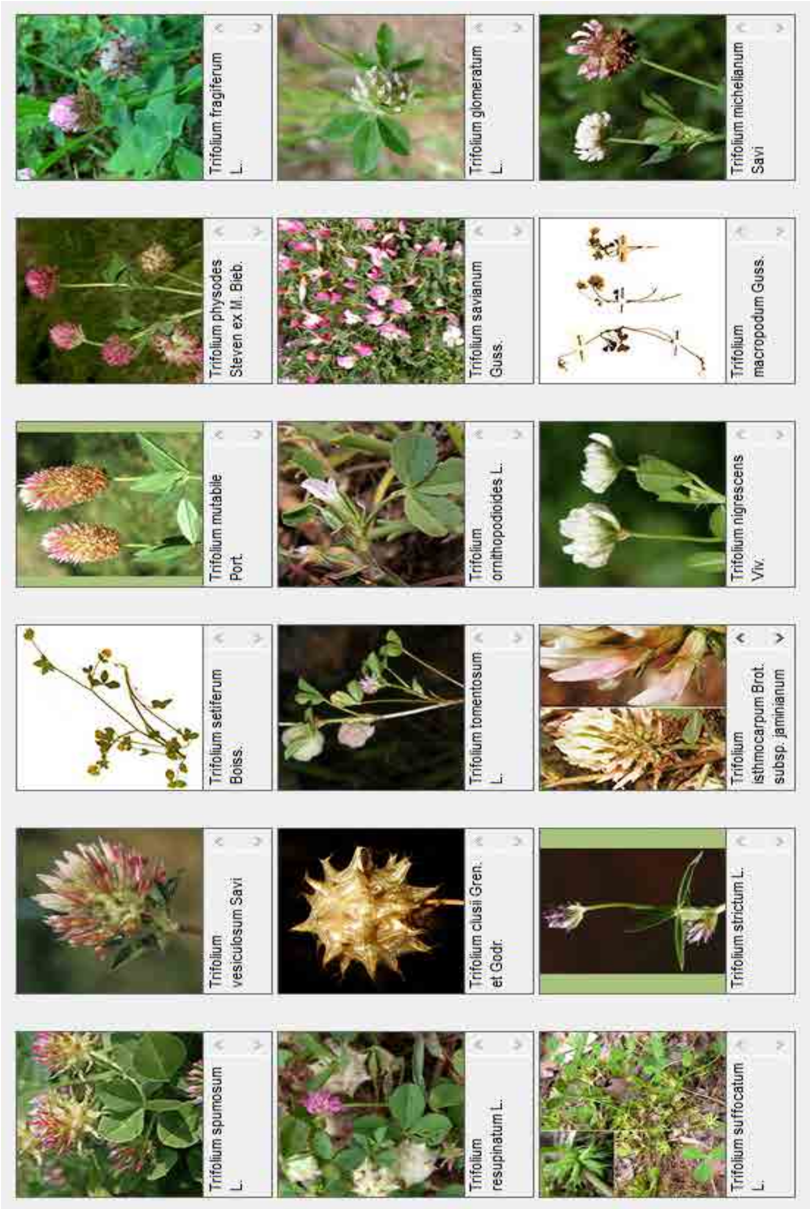

Lens nigricans (M. Bieb.) Godr.
Lens culinaris Medik.
Lens ervoides (Brign.) Grande
Lathyrus venetus (Mill.) Wohlf.
Lathyrus niger (L.) Bernh.
Lathyrus saxatilis (Vent.) Vis.
Lathyrus nissolia L.
Lathyrus pratensis L.
Lathyrus grandiflorus Sibt. et Sm.
Lathyrus sphaericus Retz.
Lathyrus setifolius L.
Lathyrus aphaca L.
Lathyrus sylvestris L.
Lathyrus latifolius L.
Lathyrus clymenum L.
Lathyrus articulatus L.
Lathyrus ochrus (L.) DC.
Lathyrus annuus L.

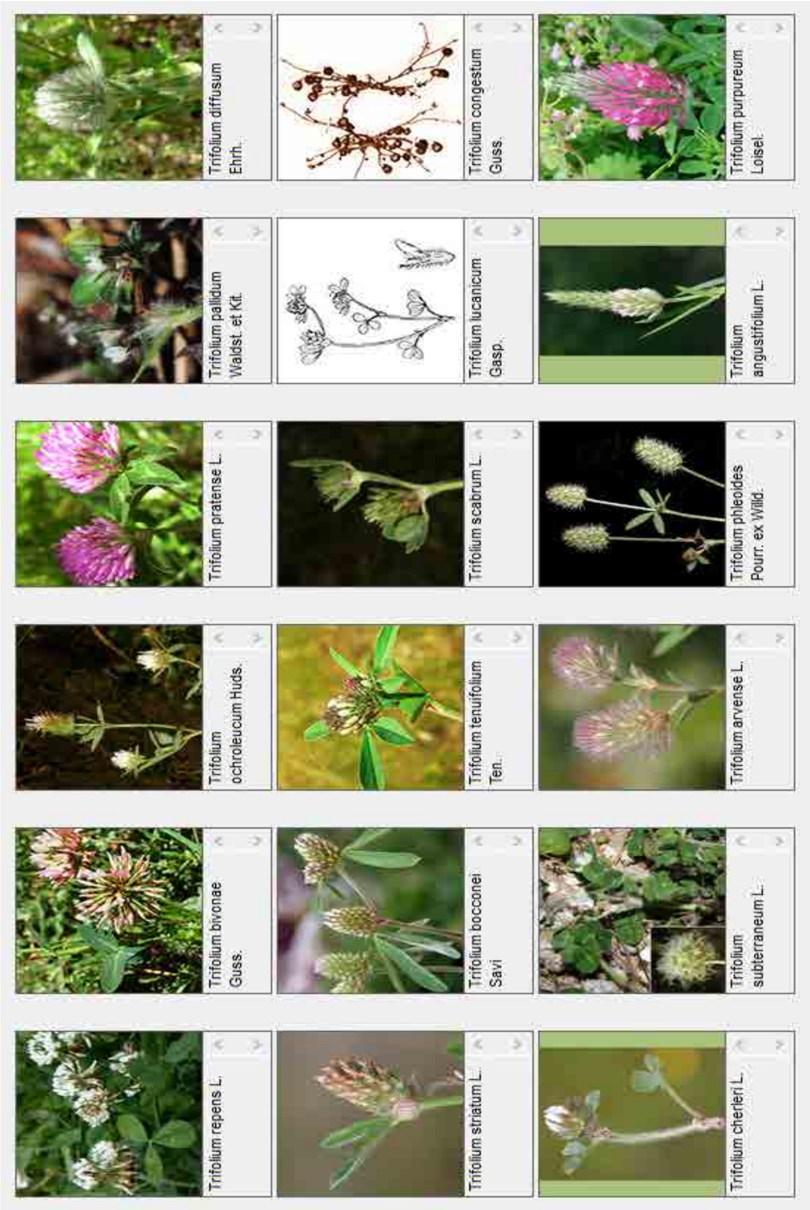

Lathyrus gorgoni Parl.
Lathyrus odoratus L.
Lathyrus hirsutus L.
Lathyrus cicera L.
Lathyrus sativus L.
Lathyrus amphicarpos L.
Pisum sativum L.
Ononis ramosissima Desf.
Ononis ornithopodioides L.
Ononis biflora Desf.
Ononis sicula Guss.
Ononis breviflora DC.
Ononis sieberi Besser ex DC.
Ononis pubescens L.
Ononis reclinata L.
Ononis dentata Sol. ex Löwe
Ononis pendula Desf.
Ononis pusilla L.

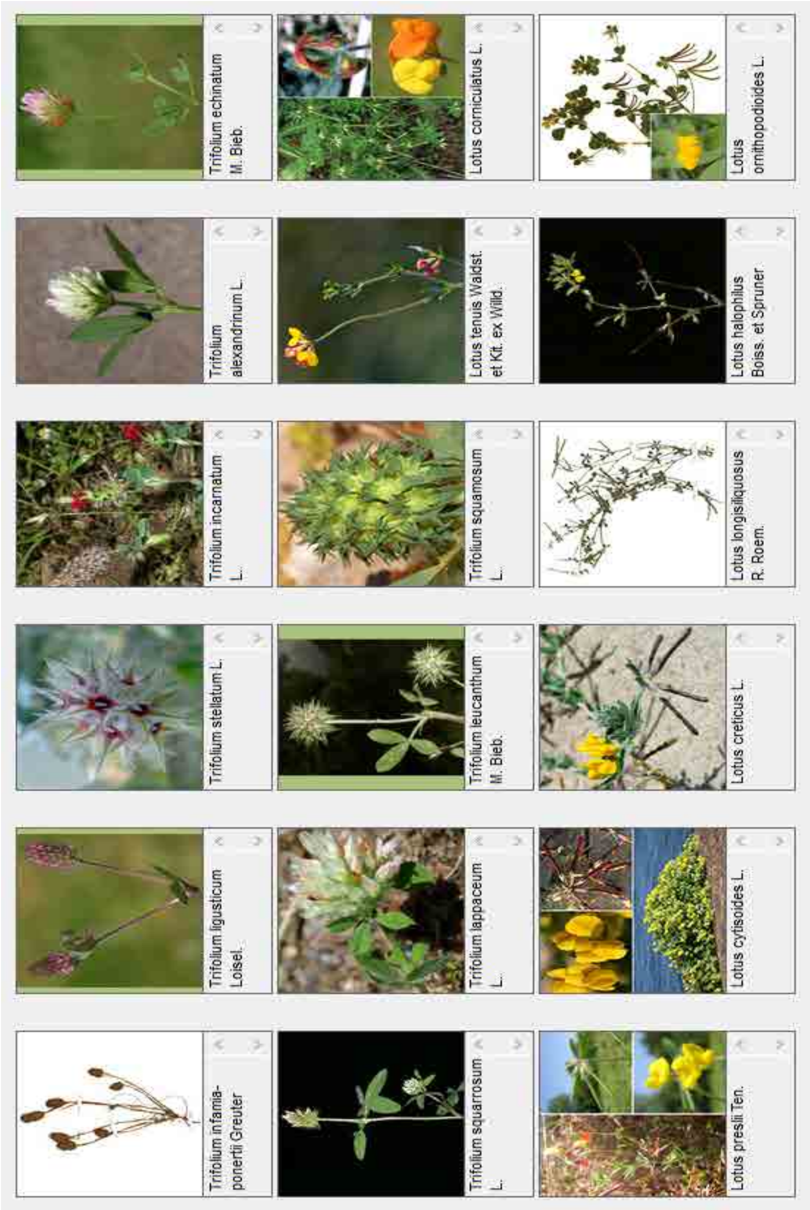

Ononis minutissima L.
Ononis hispida Desf.
Ononis spinosa L.
Ononis diffusa Ten.
Ononis serrata Forssk.
Ononis mitissima L.
Ononis variegata L.
Ononis oligophylla Ten.
Ononis alopecuroides L.
Melilotus albus Medik.
Melilotus italicus (L.) Lam.
Melilotus infestus Guss.
Melilotus sulcatus Desf.
Melilotus segetalis (Brot.) Ser.
Melilotus messanensis (L.) All.
Melilotus altissimus Thuill.
Melilotus neapolitanus Ten.
Melilotus indicus (L.) All.

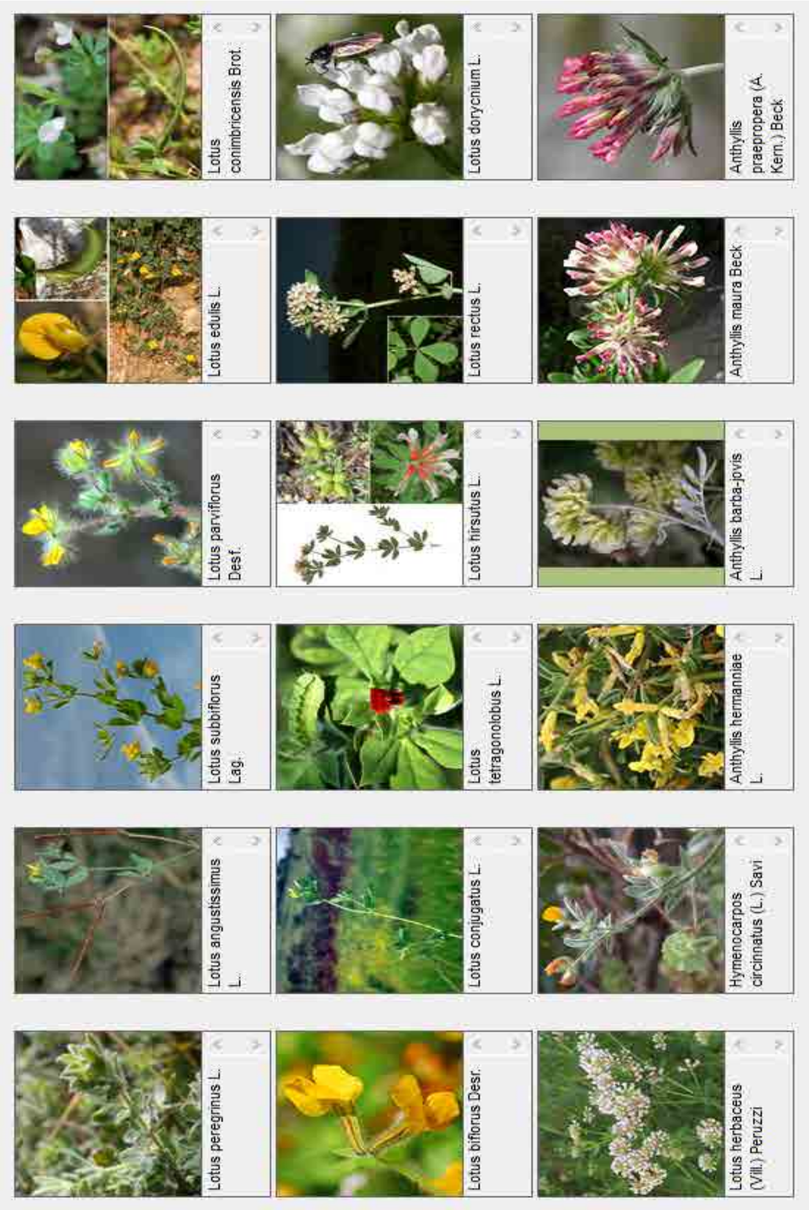

Melilotus elegans Salzm. ex Ser.
Trigonella maritima Delile
Trigonella esculenta Willd.
Trigonella monspeliaca L.
Trigonella gladiata Steven
Trigonella foenum-graecum L.
Medicago lupulina L.
Medicago sativa L.
Medicago falcata L.
Medicago arborea L.
Medicago marina L.
Medicago secundiflora Durieu
Medicago scutellata (L.) Mill.
Medicago rugosa Desr.
Medicago orbicularis (L.) Bartal.
Medicago minima (L.) Bartal.
Medicago coronata (L.) Bartal.
Medicago disciformis DC.

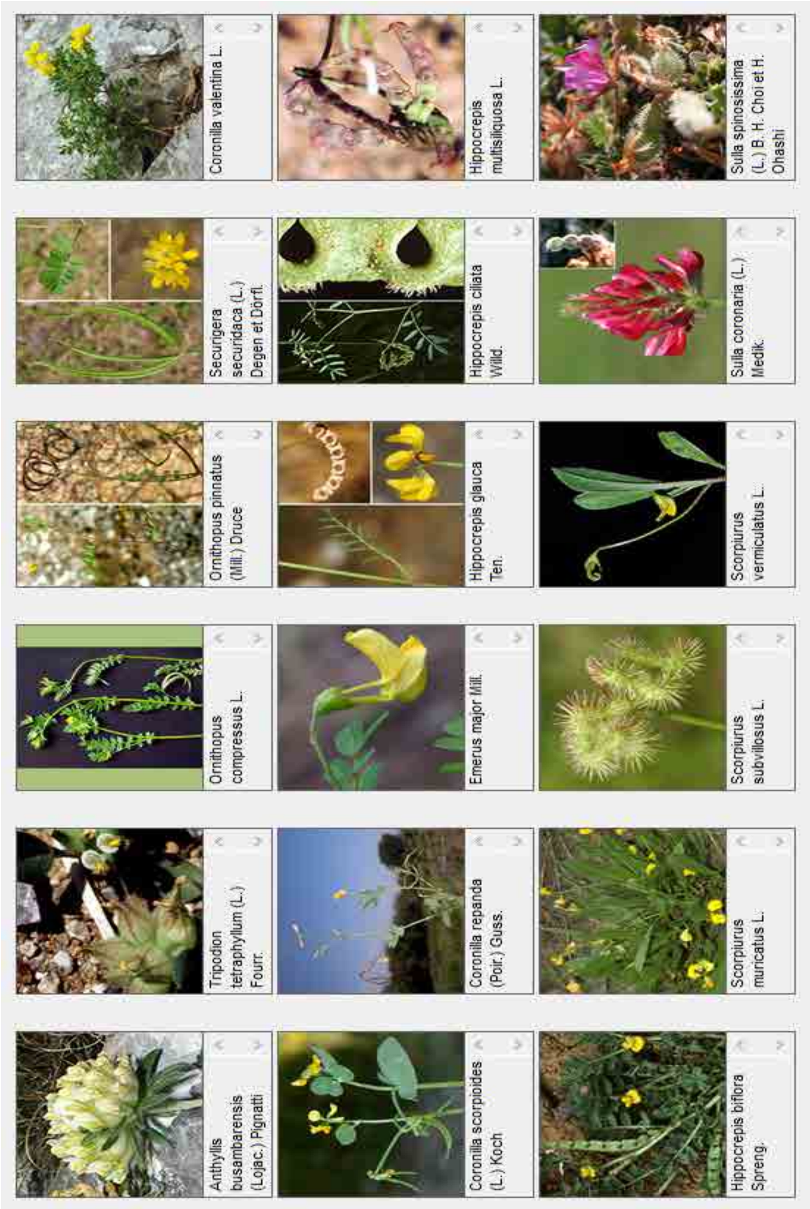

Medicago tenoreana Ser.
Medicago aculeata Willd.
Medicago turbinata (L.) All.
Medicago murex Willd.
Medicago rigidula (L.) All.
Medicago littoralis Rohde ex Loisel.
Medicago italica (Mill.) Grande
Medicago intertexta (L.) Mill.
Medicago muricoleptis Tineo
Medicago ciliaris (L.) All.
Medicago arabica (L.) Huds.
Medicago polymorpha L.
Medicago truncatula Gaerth.
Trifolium grandiflorum Schreb.
Trifolium brutium Ten.
Trifolium sebastianii Savi
Trifolium micranthum Viv.
Trifolium campestre Schreb.


Trifolium spumosum L.
Trifolium vesiculosum Savi
Trifolium setiferum Boiss.
Trifolium mutabile Port.
Trifolium physodes Steven ex M. Bieb.
Trifolium fragiferum L.
Trifolium resupinatum L.
Trifolium clusii Gren. et Godr.
Trifolium tomentosum L.
Trifolium ornithopodioides L.
Trifolium savianum Guss.
Trifolium glomeratum L.
Trifolium suffocatum L.
Trifolium strictum L.
Trifolium isthmocarpum Brot. subsp. jaminianum
Trifolium nigrescens Viv.
Trifolium macropodum Guss.
Trifolium michelianum Savi

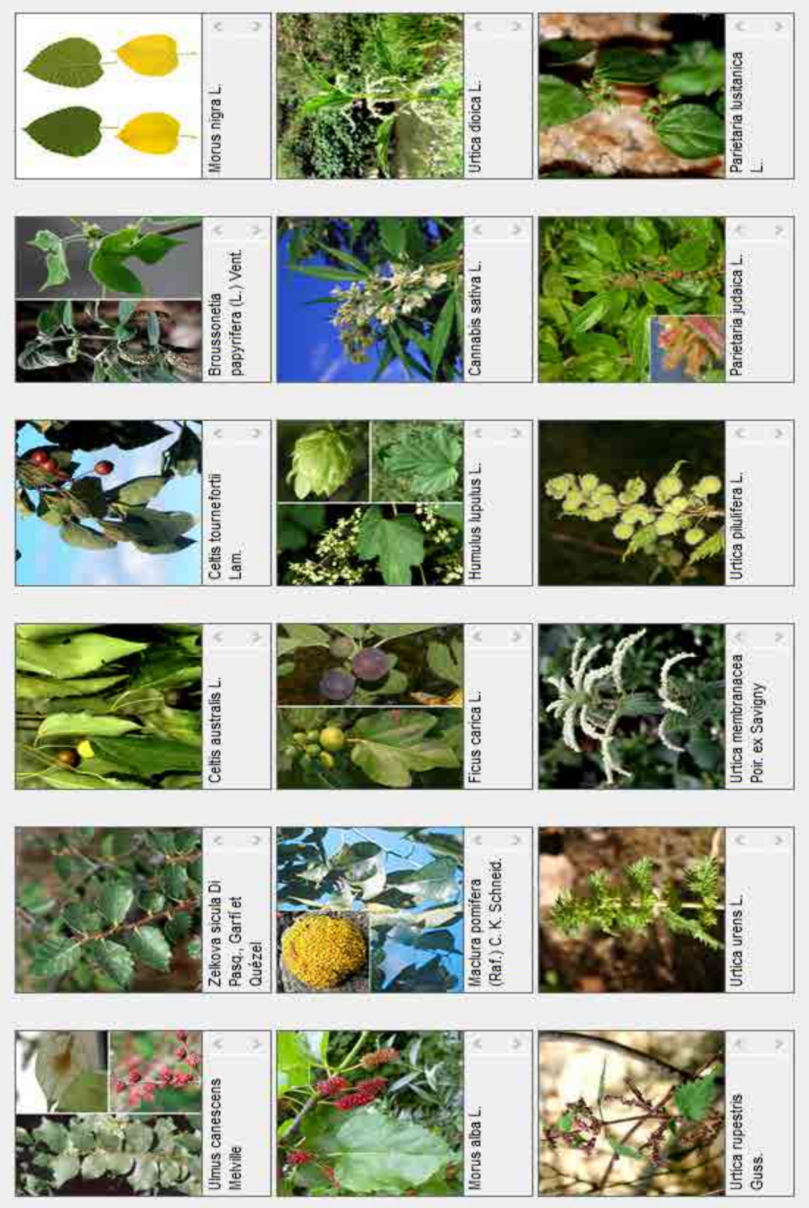

Trifolium repens L.
Trifolium bivonae Guss.
Trifolium ochroleucum Huds.
Trifolium pratense L.
Trifolium pallidum Waldst. et Kit.
Trifolium diffusum Ehrh.
Trifolium striatum L.
Trifolium bocconei Savi
Trifolium tenuifolium Ten.
Trifolium scabrum L.
Trifolium lucanicum Gasp.
Trifolium congestum Guss.
Trifolium cherleri L.
Trifolium subterraneum L.
Trifolium arvense L.
Trifolium phleoides Pourr. ex Willd.
Trifolium angustifolium L.
Trifolium purpureum Loisel.

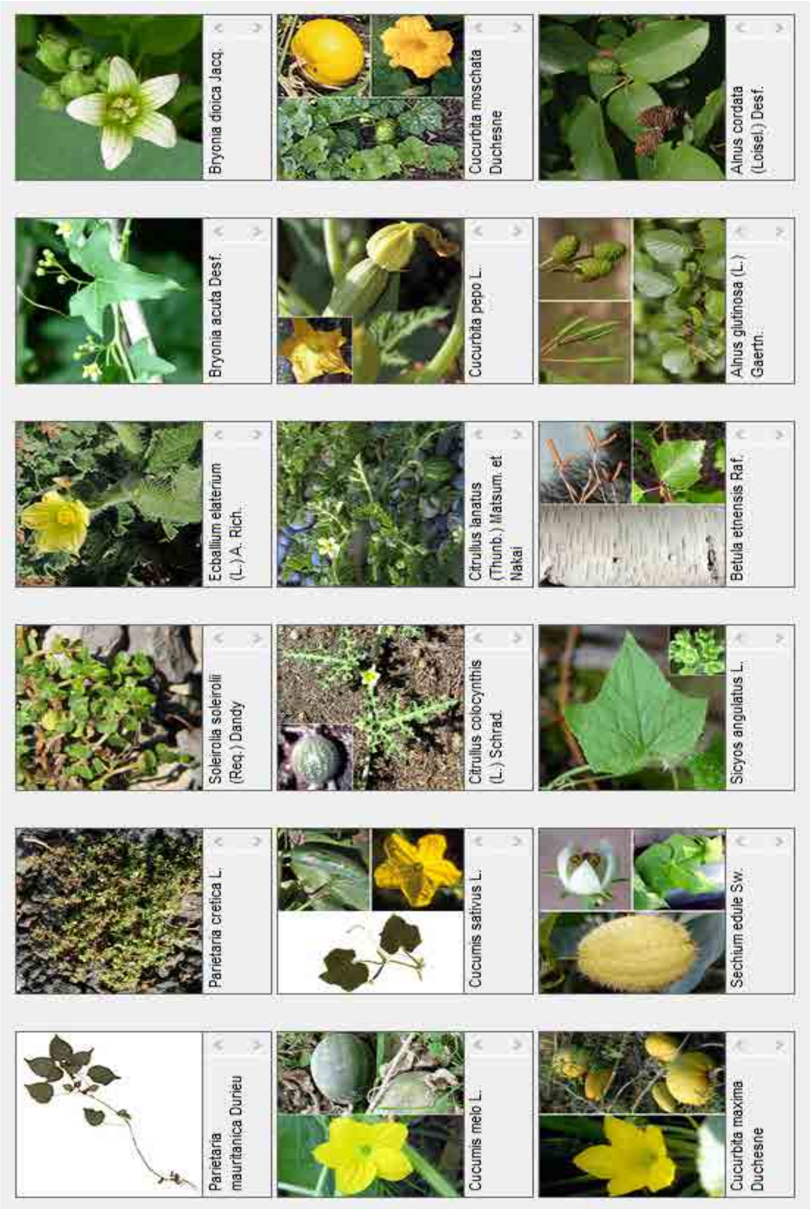

Trifolium infamia-ponertii Greuter
Trifolium ligusticum Loisel.
Trifolium stellatum L.
Trifolium incarnatum L.
Trifolium alexandrinum L.
Trifolium echinatum M. Bieb.
Trifolium squarrosum L.
Trifolium lappaceum L.
Trifolium leucanthum M. Bieb.
Trifolium squamosum L.
Lotus tenuis Waldst. et Kit. ex Willd.
Lotus corniculatus L.
Lotus preslii Ten.
Lotus cytisoides L.
Lotus creticus L.
Lotus longisiliquosus R. Roem.
Lotus halophilus Boiss. et Spruner
Lotus ornithopodioides L.

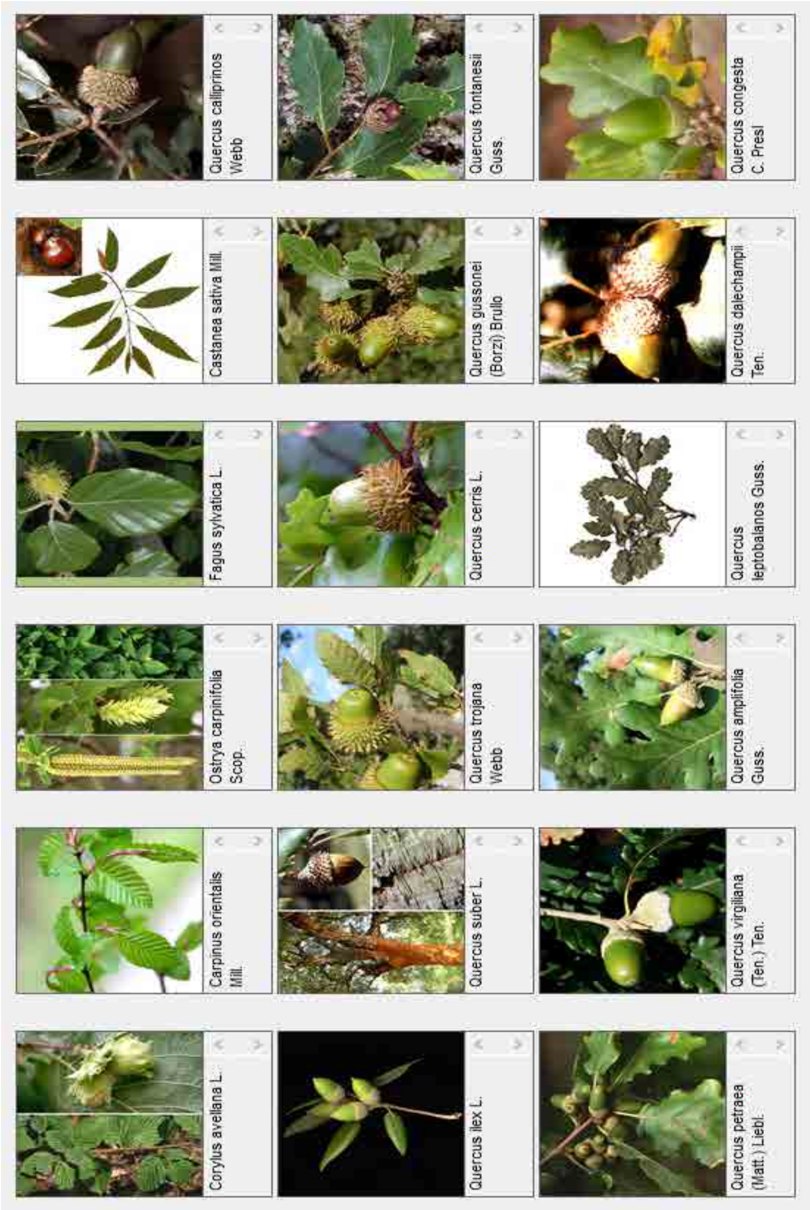

Lotus peregrinus L.
Lotus angustissimus L.
Lotus subbiflorus Lag.
Lotus parviflorus Desf.
Lotus edulis L.
Lotus conimbricensis Brot.
Lotus biflorus Desr.
Lotus conjugatus L.
Lotus tetragonolobus L.
Lotus hirsutus L.
Lotus rectus L.
Lotus dorycnium L.
Lotus herbaceus (Vill.) Peruzzi
Hymenocarpos circinnatus (L.) Savi
Anthyllis hermanniae L.
Anthyllis barba-jovis L.
Anthyllis maura Beck
Anthyllis praepropera (A. Kern.) Beck

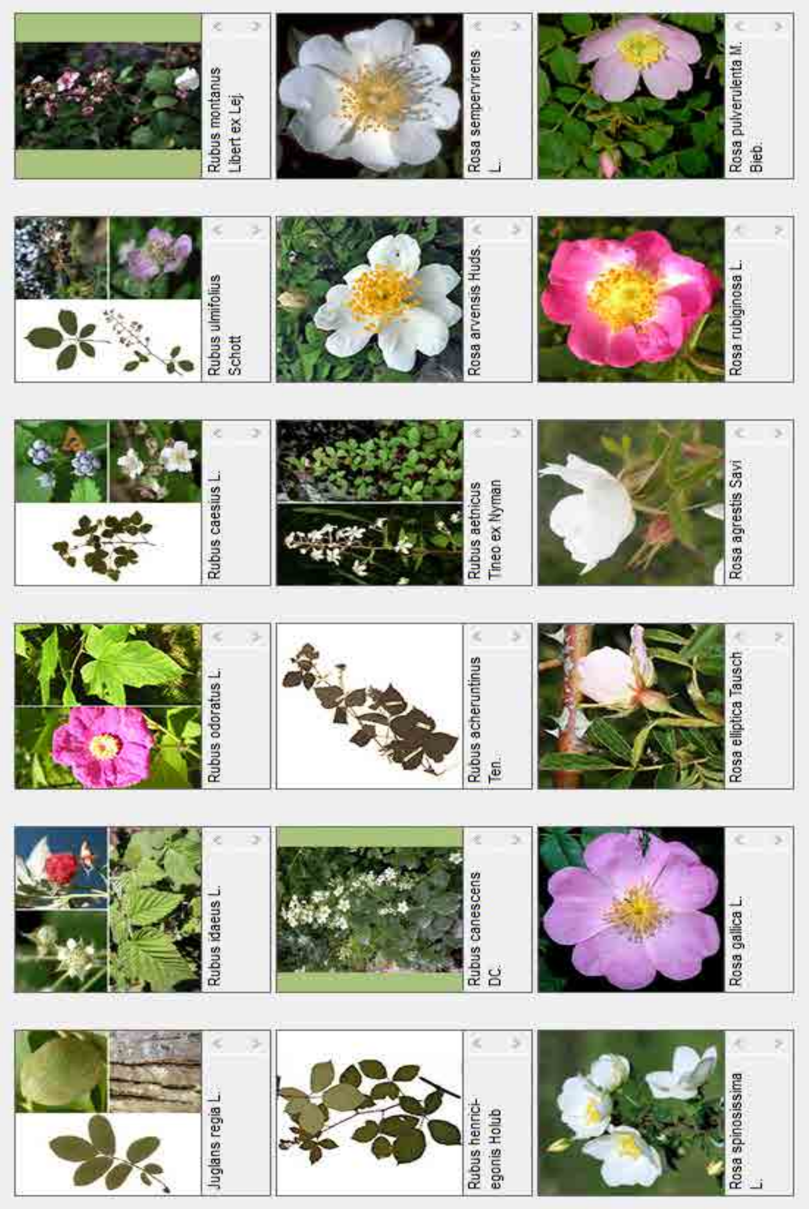

Anthyllis busambarensis (Lojac.) Pignatti
Tripodion tetraphyllum (L.) Fourr.
Ornithopus compressus L.
Ornithopus pinnatus (Mill.) Druce
Securigera securidaca (L.) Degen et Dörfl.
Coronilla valentina L.
Coronilla scorpioides (L.) Koch
Coronilla repanda (Poir.) Guss.
Emerus major Mill.
Hippocrepis glauca Ten.
Hippocrepis ciliata Willd.
Hippocrepis multisiliquosa L.
Hippocrepis biflora Spreng.
Scorpiurus muricatus L.
Scorpiurus subvillosus L.
Scorpiurus vermiculatus L.
Sulla coronaria (L.) Medik.
Sulla spinosissima (L.) B. H. Choi et H. Ohashi

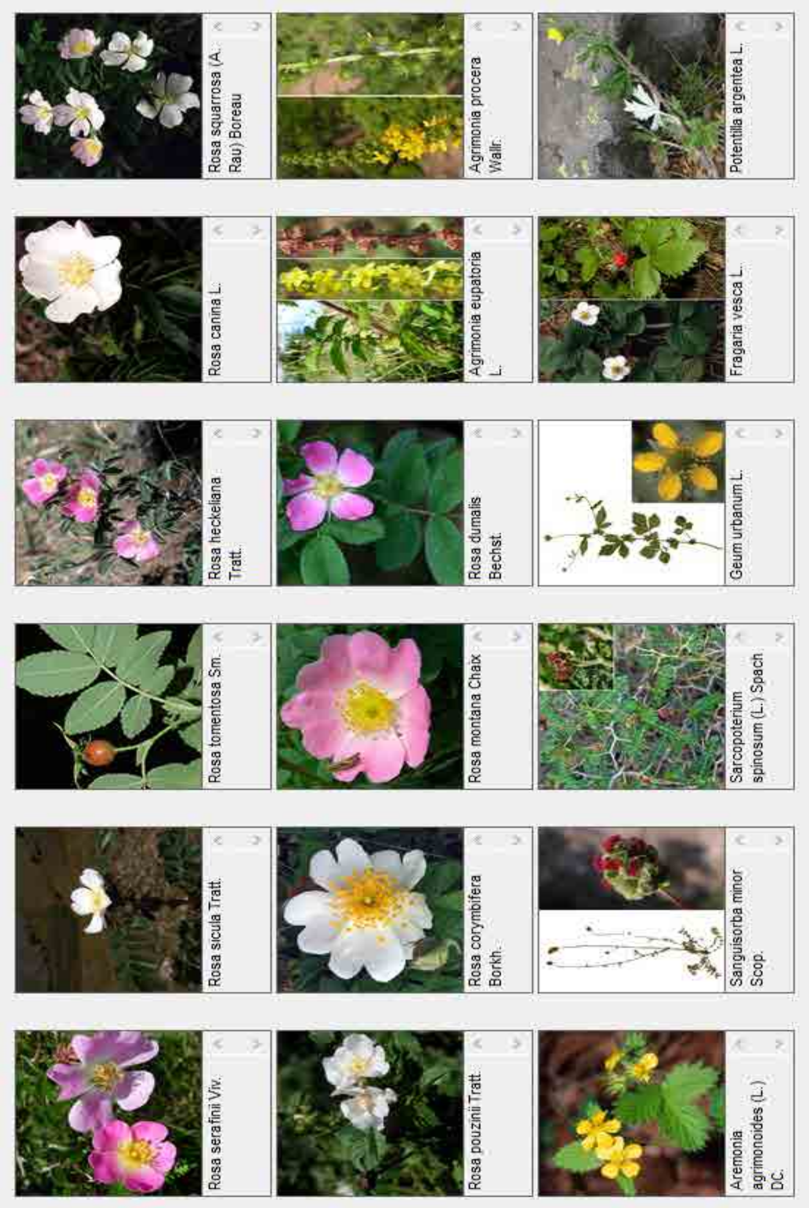

Sulla capitata (Desf.) B. H. Choi et H. Ohashi
Onobrychis viciifolia Scop.
Onobrychis caput-galli (L.) Lam.
Onobrychis aequidentata (Sm.) d'Urv.
Polygala myrtifolia L.
Polygala monspeliaca L.
Polygala preslii Spreng.
Polygala vulgaris L.
Paliurus spina-christi Mill.
Ziziphus zizyphus (L.) Meikle
Ziziphus lotus (L.) Lam.
Rhamnus alaternus L.
Rhamnus lojaconoi Raimondo
Rhamnus oleoides L.
Rhamnus saxatilis Jacq.
Rhamnus cathartica L.
Ulmus glabra Huds.
Ulmus minor Mill.

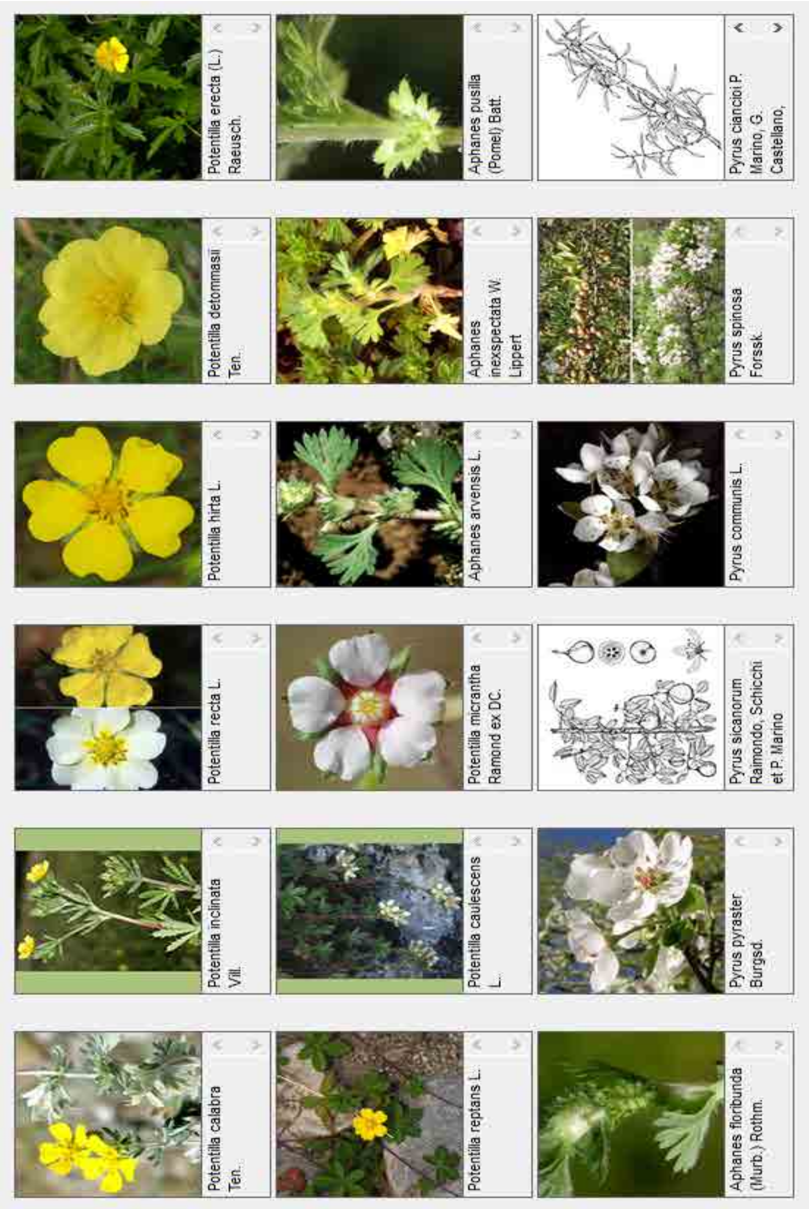

Ulmus canescens Melville
Zelkova sicula Di Pasq., Garfì et Quézel
Celtis australis L.
Celtis tournefortii Lam.
Broussonetia papyrifera (L.) Vent.
Morus nigra L.
Morus alba L.
Maclura pomifera (Raf.) C. K. Schneid.
Ficus carica L.
Humulus lupulus L.
Cannabis sativa L.
Urtica dioica L.
Urtica rupestris Guss.
Urtica urens L.
Urtica membranacea Poir. ex Savigny
Urtica pilulifera L.
Parietaria judaica L.
Parietaria lusitanica L.

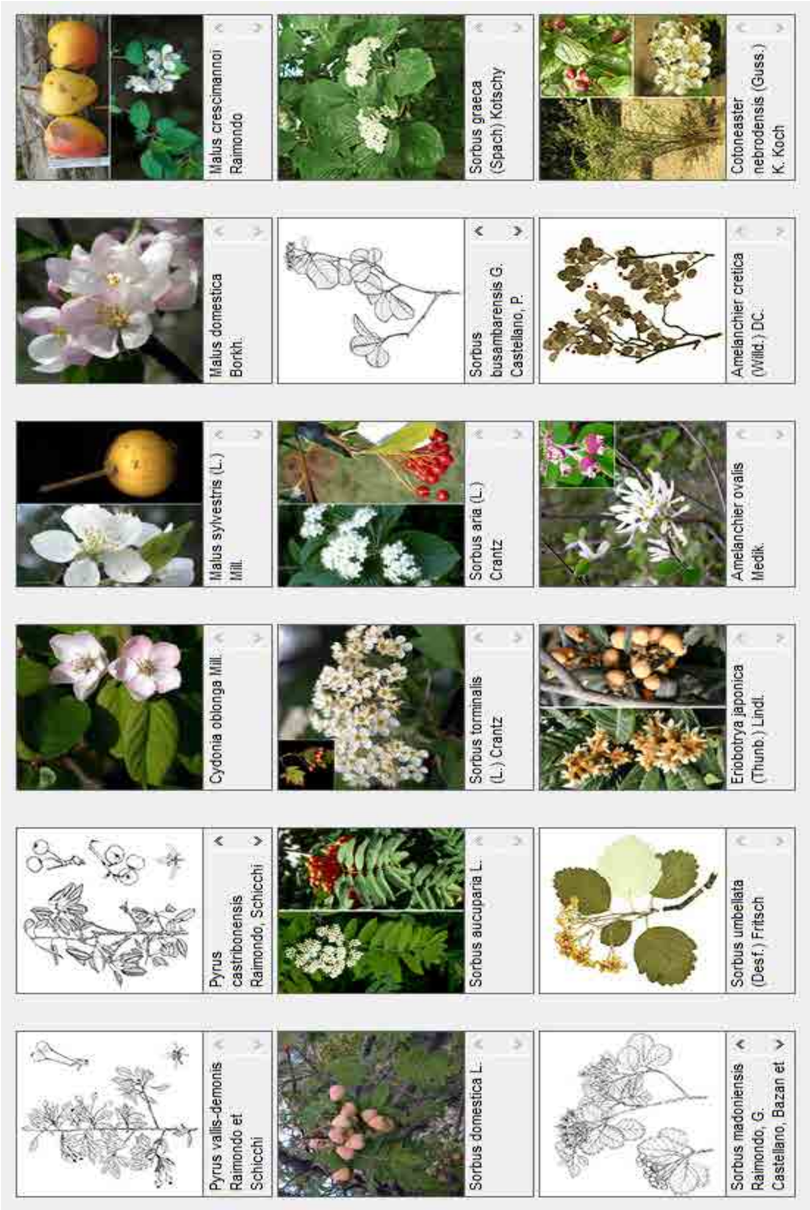

Parietaria mauritanica Durieu
Parietaria cretica L.
Soleirolia soleirolii (Req.) Dandy
Ecballium elaterium (L.) A. Rich.
Bryonia acuta Desf.
Bryonia dioica Jacq.
Cucumis melo L.
Cucumis sativus L.
Citrullus colocynthis (L.) Schrad.
Citrullus lanatus (Thunb.) Matsum. et Nakai
Cucurbita pepo L.
Cucurbita moschata Duchesne
Cucurbita maxima Duchesne
Sechium edule Sw.
Sicyos angulatus L.
Betula etnensis Raf.
Alnus glutinosa (L.) Gaertn.
Alnus cordata (Loisel.) Desf.


Corylus avellana L.
Carpinus orientalis Mill.
Ostrya carpinifolia Scop.
Fagus sylvatica L.
Castanea sativa Mill.
Quercus calliprinos Webb
Quercus ilex L.
Quercus suber L.
Quercus trojana Webb
Quercus cerris L.
Quercus gussonei (Borzi) Brullo
Quercus fontanesii Guss.
Quercus petraea (Matt.) Liebl.
Quercus virgiliana (Ten.) Ten.
Quercus amplifolia Guss.
Quercus leptobalanos Guss.
Quercus dalechampii Ten.
Quercus congesta C. Presl

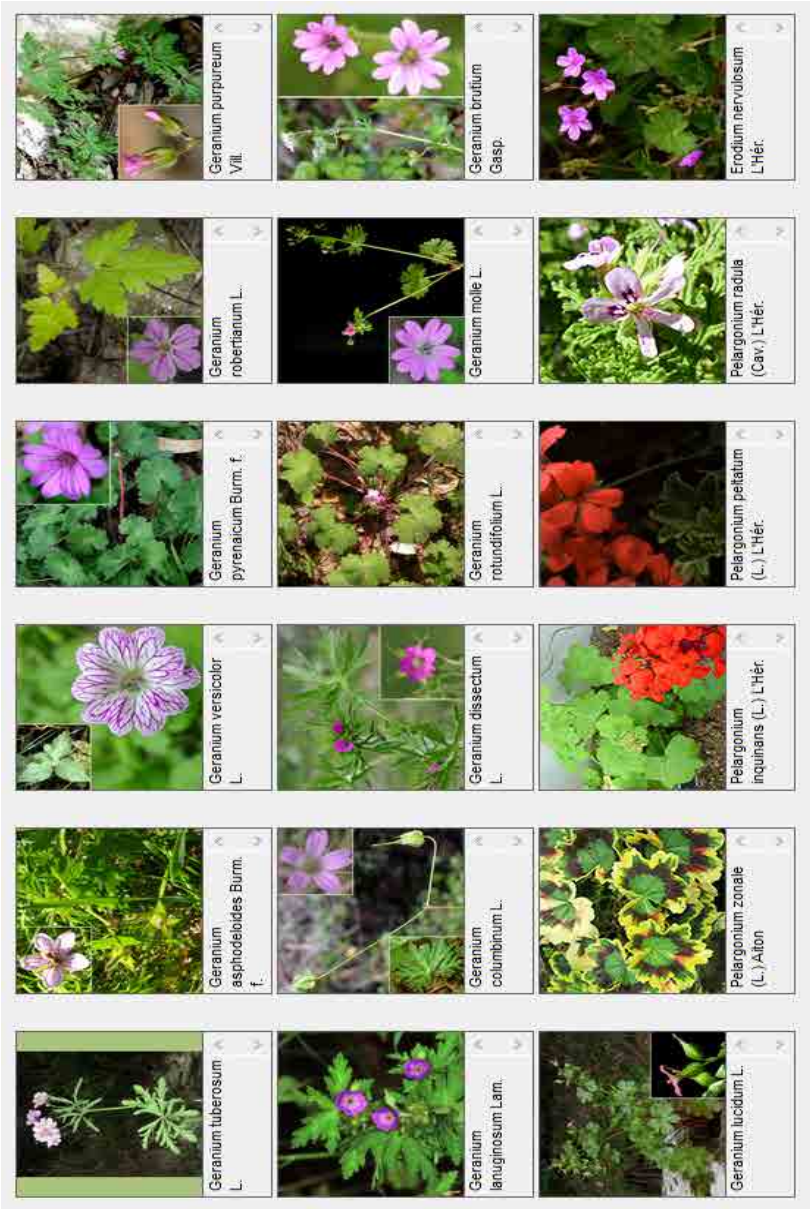

Juglans regia L.
Rubus idaeus L.
Rubus odoratus L.
Rubus caesius L.
Rubus ulmifolius Schott
Rubus montanus Libert ex Lej.
Rubus henrici-egonis Holub
Rubus canescens DC.
Rubus acheruntinus Ten.
Rubus aetnicus Tineo ex Nyman
Rosa arvensis Huds.
Rosa sempervirens L.
Rosa spinosissima L.
Rosa gallica L.
Rosa elliptica Tausch
Rosa agrestis Savi
Rosa rubiginosa L.
Rosa pulverulenta M. Bieb.

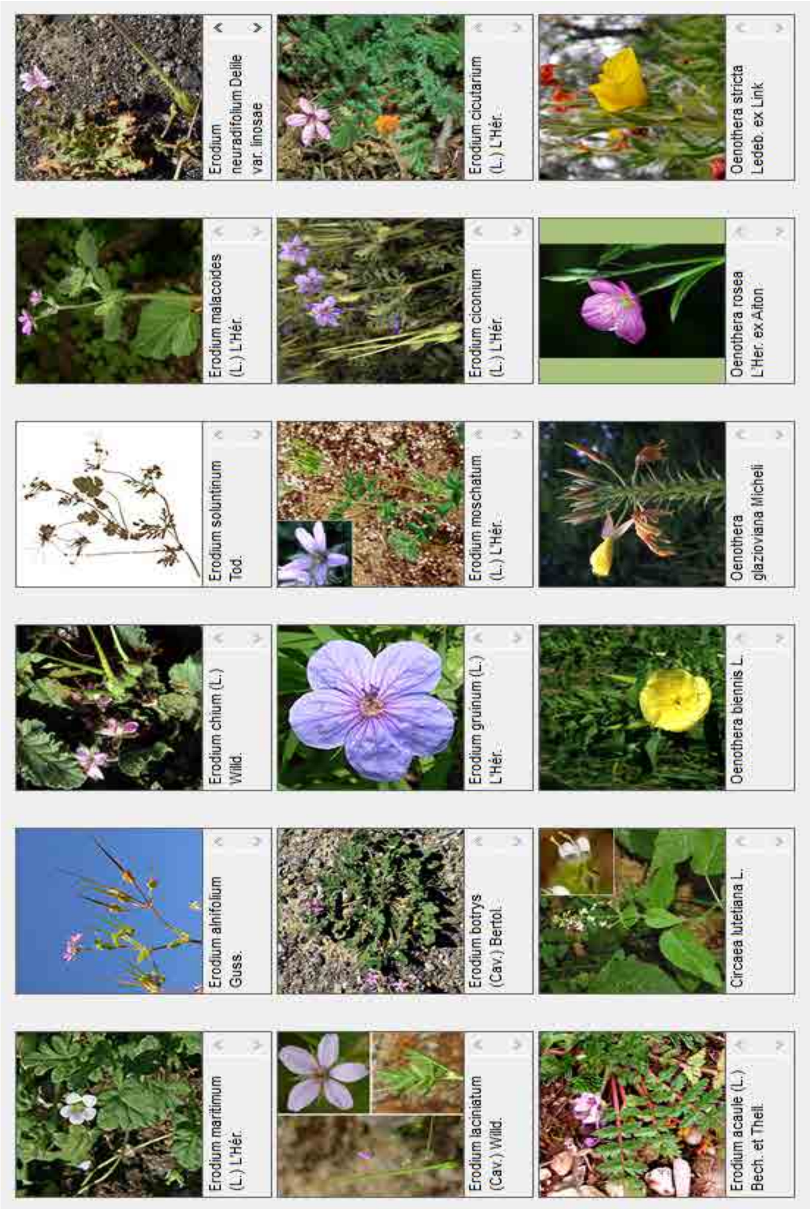

Rosa serafinii Viv.
Rosa sicula Tratt.
Rosa tomentosa Sm.
Rosa heckeliana Tratt.
Rosa canina L.
Rosa squarrosa (A. Rau) Boreau
Rosa pouzinii Tratt.
Rosa corymbifera Borkh.
Rosa montana Chaix
Rosa dumalis Bechst.
Agrimonia eupatoria L.
Agrimonia procera Wallr.
Aremonia agrimonoides (L.) DC.
Sanguisorba minor Scop.
Sarcopoterium spinosum (L.) Spach
Geum urbanum L.
Fragaria vesca L.
Potentilla argentea L.


Potentilla calabra Ten.
Potentilla inclinata Vill.
Potentilla recta L.
Potentilla hirta L.
Potentilla detommasii Ten.
Potentilla erecta (L.) Raeusch.
Potentilla reptans L.
Potentilla caulescens L.
Potentilla micrantha Ramond ex DC.
Aphanes arvensis L.
Aphanes inexspectata W. Lippert
Aphanes pusilla (Pomel) Batt.
Aphanes floribunda (Murb.) Rothm.
Pyrus pyraster Burgsd.
Pyrus sicanorum Raimondo, Schicchi et P. Marino
Pyrus communis L.
Pyrus spinosa Forssk.
Pyrus ciancioi P. Marino, G. Castellano,

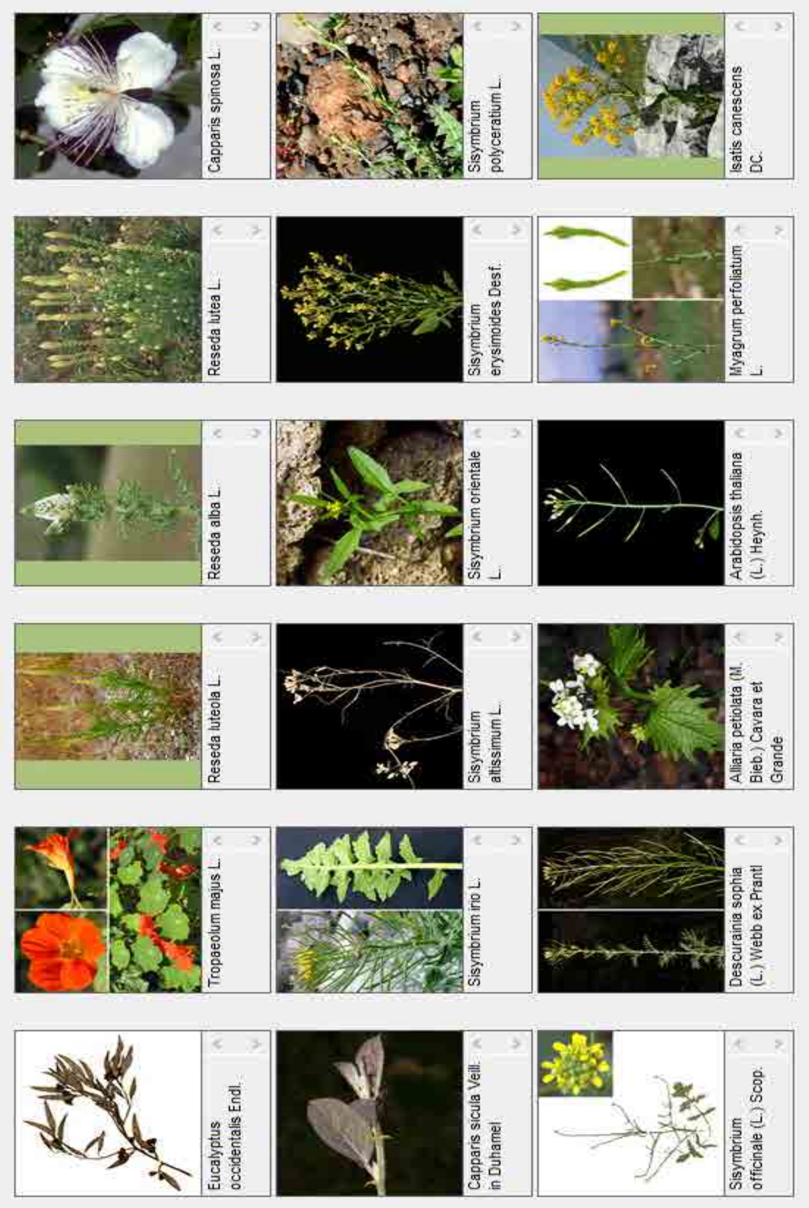

Pyrus vallis-demonis Raimondo et Schicchi
Pyrus castribonensis Raimondo, Schicchi
Cydonia oblonga Mill.
Malus sylvestris (L.) Mill.
Malus domestica Borkh.
Malus crescimannoi Raimondo
Sorbus domestica L.
Sorbus aucuparia L.
Sorbus torminalis (L.) Crantz
Sorbus aria (L.) Crantz
Sorbus busambarensis G. Castellano, P.
Sorbus graeca (Spach) Kotschy
Sorbus madoniensis Raimondo, G. Castellano, Bazan et
Sorbus umbellata (Desf.) Fritsch
Eriobotrya japonica (Thunb.) Lindl.
Amelanchier ovalis Medik.
Amelanchier cretica (Willd.) DC.
Cotoneaster nebrodensis (Guss.) K. Koch

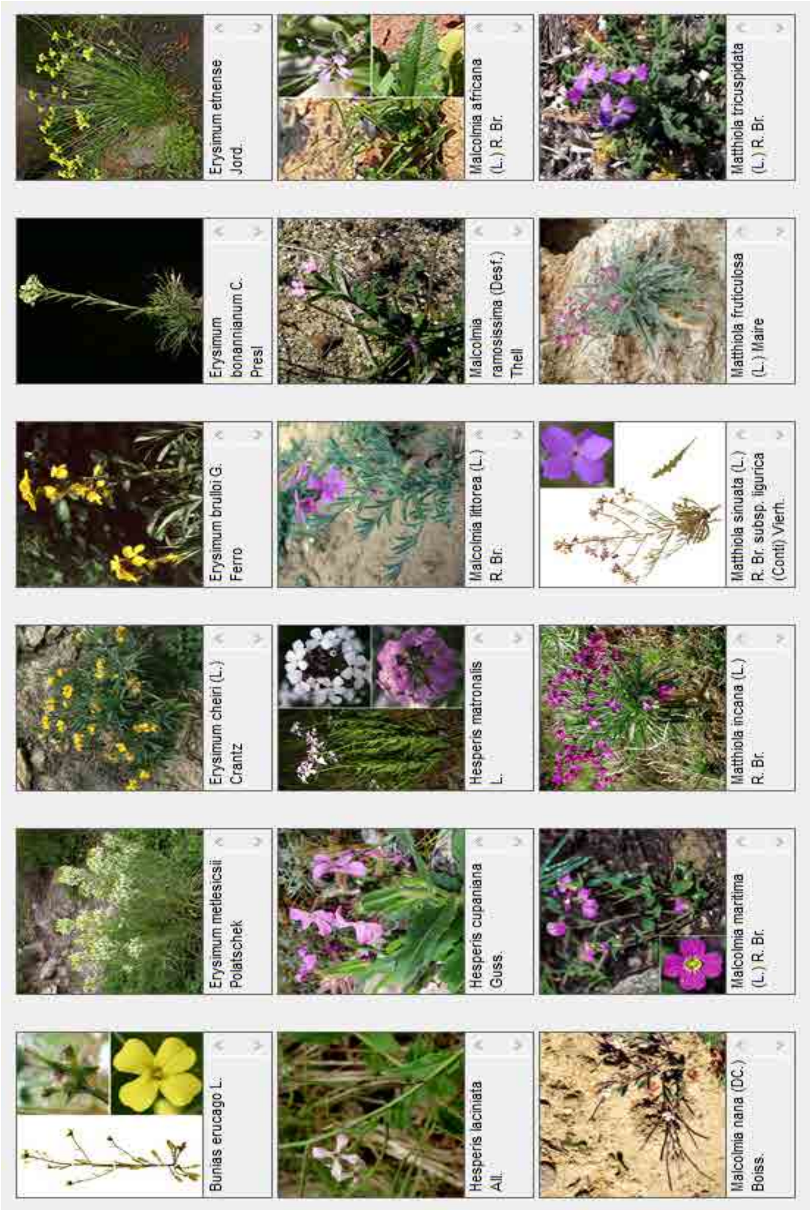

Pyracantha coccinea M. Roem.
Mespilus germanica L.
Crataegus laevigata (Poir.) DC.
Crataegus monogyna Jacq.
Crataegus rhipidophylla Gand.
Crataegus azarolus L.
Crataegus orientalis M. Bieb. subsp. presliana K. I. Chr.
Prunus avium (L.) L.
Prunus cerasus L.
Prunus mahaleb L.
Prunus cupaniana Guss. ex Nyman
Prunus persica (L.) Batsch
Prunus dulcis (Mill.) D. A. Webb
Prunus webbii (Spach) Vierh.
Prunus spinosa L.
Prunus domestica L.
Prunus cocomilia Ten.
Geranium sanguineum L.

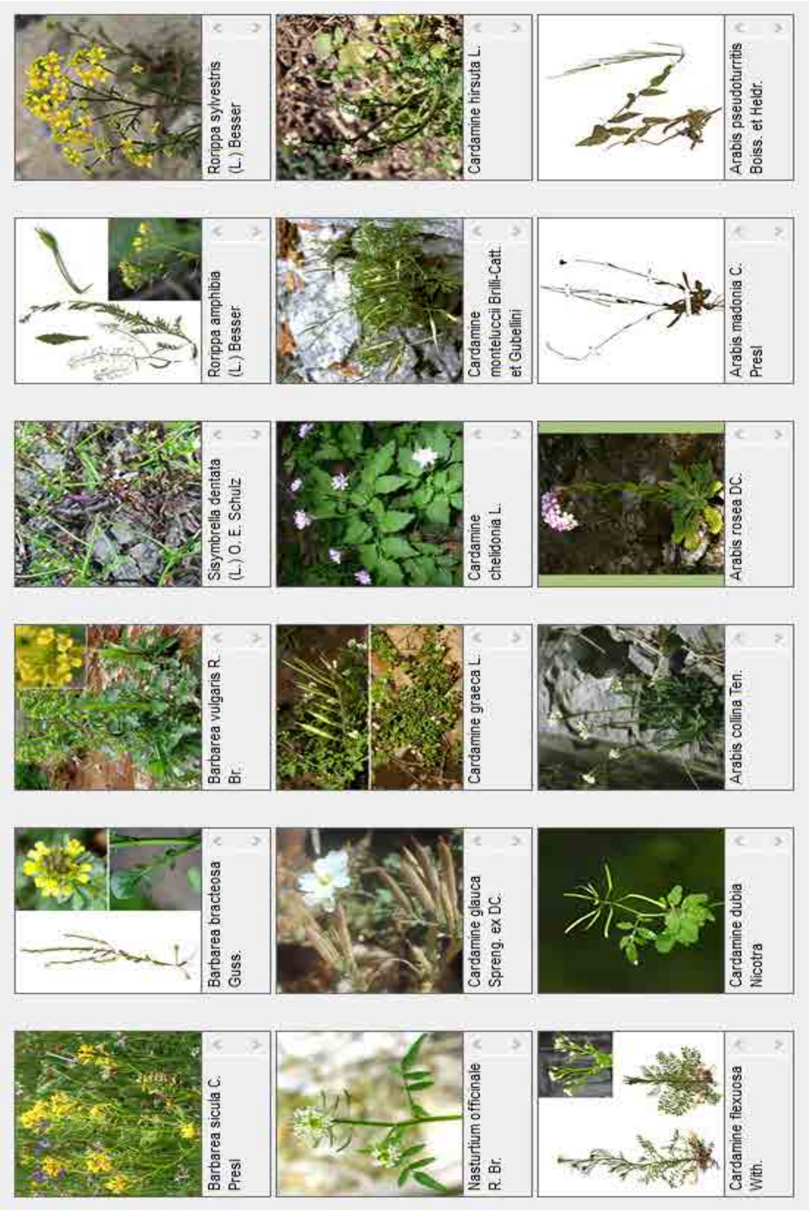

Geranium tuberosum L.
Geranium asphodeloides Burm. f.
Geranium versicolor L.
Geranium pyrenaicum Burm. f.
Geranium robertianum L.
Geranium purpureum Vill.
Geranium lanuginosum Lam.
Geranium columbinum L.
Geranium dissectum L.
Geranium rotundifolium L.
Geranium molle L.
Geranium brutium Gasp.
Geranium lucidum L.
Pelargonium zonale (L.) Aiton
Pelargonium inquinans (L.) L'Hér.
Pelargonium peltatum (L.) L'Hér.
Pelargonium radula (Cav.) L'Hér.
Erodium nervulosum L'Hér.

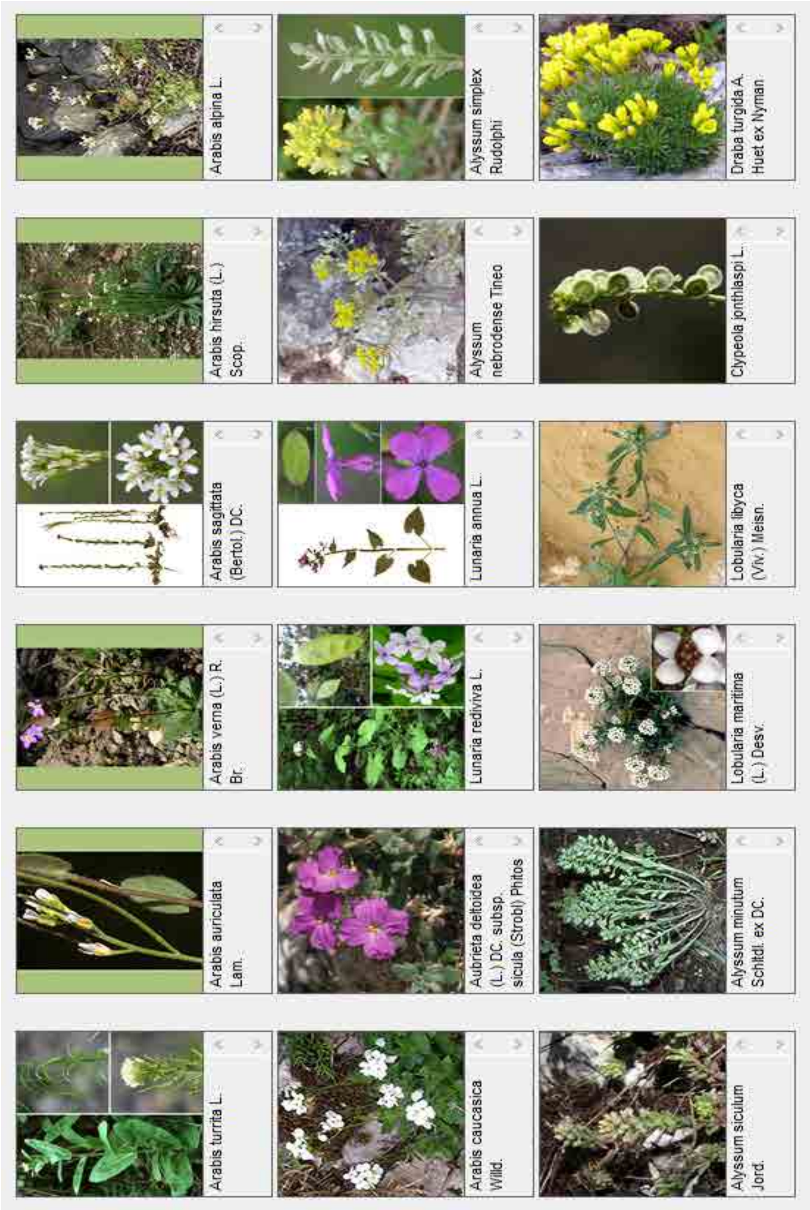

Erodium maritimum (L.) L'Hér.
Erodium alnifolium Guss.
Erodium chium (L.) Willd.
Erodium soluntinum Tod.
Erodium malacoides (L.) L'Hér.
Erodium neuradifolium Delile var. linosae
Erodium laciniatum (Cav.) Willd.
Erodium botrys (Cav.) Bertol.
Erodium gruinum (L.) L'Hér.
Erodium moschatum (L.) L'Hér.
Erodium ciconium (L.) L'Hér.
Erodium cicutarium (L.) L'Hér.
Erodium acaule (L.) Bech. et Thell.
Circaea lutetiana L.
Oenothera biennis L.
Oenothera glazioviana Micheli
Oenothera rosea L'Her. ex Aiton
Oenothera stricta Ledeb. ex Link


Oenothera indecora Cambess.
Epilobium angustifolium L.
Epilobium dodonaei Vill.
Epilobium hirsutum L.
Epilobium parviflorum Schreb.
Epilobium montanum L.
Epilobium lanceolatum Sebast. et Mauri
Epilobium tetragonum L.
Lythrum salicaria L.
Lythrum junceum Banks et Sol.
Lythrum acutangulum Lag.
Lythrum tribracteatum Salzm. ex Ten.
Lythrum hyssopifolia L.
Middendorfia borysthenica (Schrank) Trautv.
Punica granatum L.
Myrtus communis L.
Eucalyptus globulus Labill.
Eucalyptus camaldulensis Dehnh.


Eucalyptus occidentalis Endl.
Tropaeolum majus L.
Reseda luteola L.
Reseda alba L.
Reseda lutea L.
Capparis spinosa L.
Capparis sicula Veill. in Duhamel
Sisymbrium irio L.
Sisymbrium altissimum L.
Sisymbrium orientale L.
Sisymbrium erysimoides Desf.
Sisymbrium polyceratium L.
Sisymbrium officinale (L.) Scop.
Descurainia sophia (L.) Webb ex Prantl
Alliaria petiolata (M. Bieb.) Cavara et Grande
Arabidopsis thaliana (L.) Heynh.
Myagrum perfoliatum L.
Isatis canescens DC.

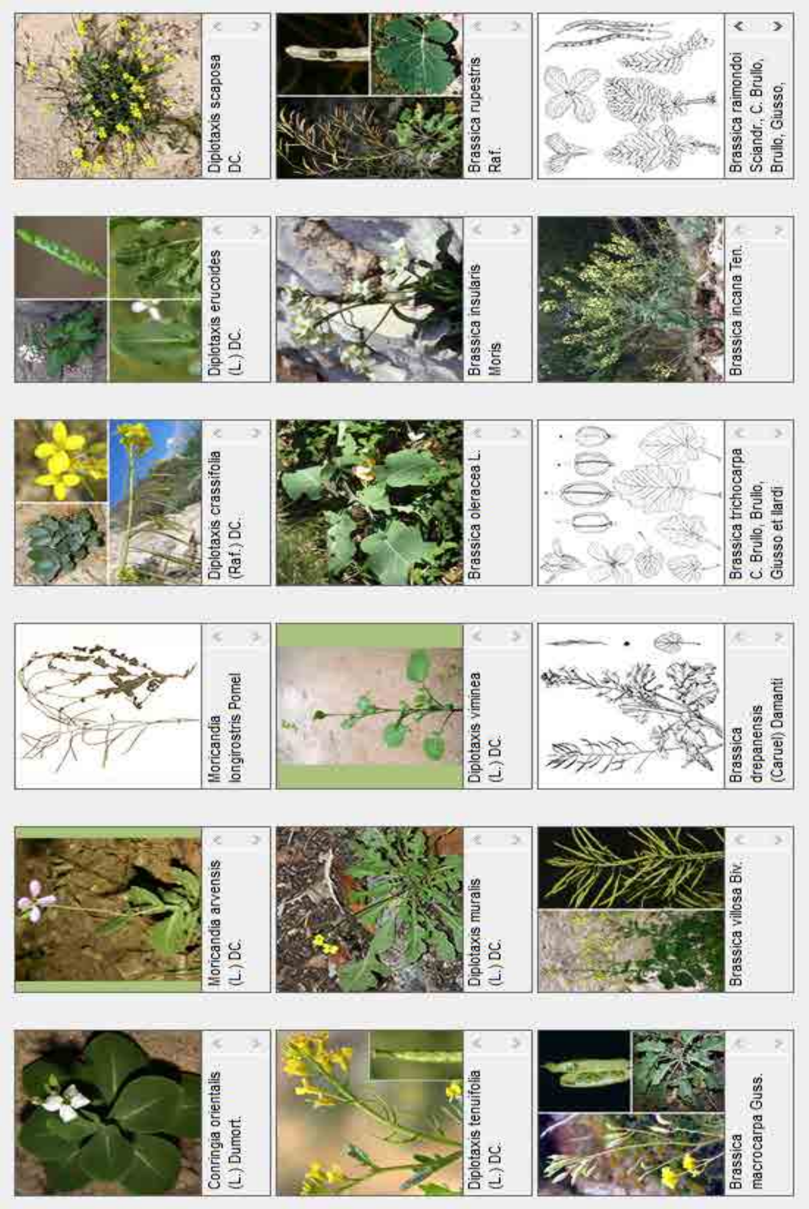

Bunias erucago L.
Erysimum metlesicsii Polatschek
Erysimum cheiri (L.) Crantz
Erysimum brulloi G. Ferro
Erysimum bonannianum C. Presl
Erysimum etnense Jord.
Hesperis laciniata All.
Hesperis cupaniana Guss.
Hesperis matronalis L.
Malcolmia littorea (L.) R. Br.
Malcolmia ramosissima (Desf.) Thell
Malcolmia africana (L.) R. Br.
Malcolmia nana (DC.) Boiss.
Malcolmia maritima (L.) R. Br.
Matthiola incana (L.) R. Br.
Matthiola sinuata (L.) R. Br. subsp. ligurica (Conti) Vierh.
Matthiola fruticulosa (L.) Maire
Matthiola tricuspidata (L.) R. Br.

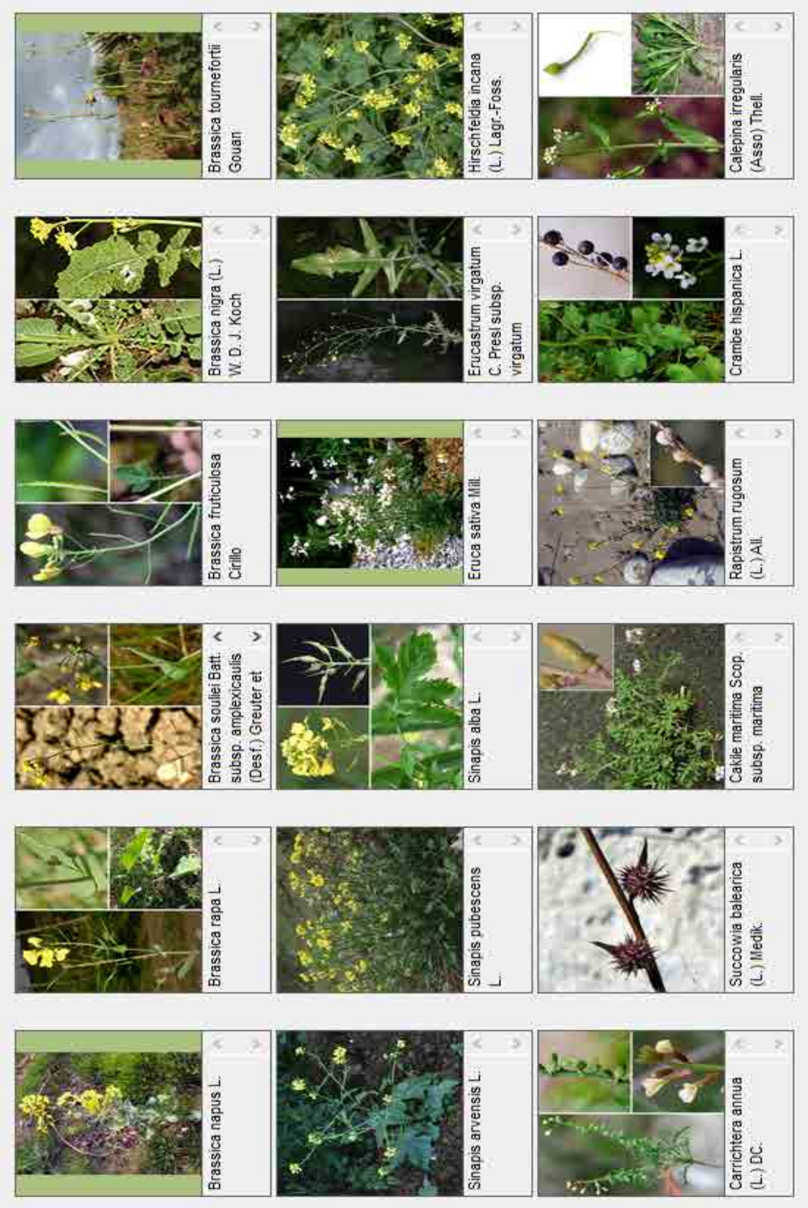

Barbarea sicula C. Presl
Barbarea bracteosa Guss.
Barbarea vulgaris R. Br.
Sisymbrella dentata (L.) O. E. Schulz
Rorippa amphibia (L.) Besser
Rorippa sylvestris (L.) Besser
Nasturtium officinale R. Br.
Cardamine glauca Spreng. ex DC.
Cardamine graeca L.
Cardamine chelidonia L.
Cardamine monteluccii Brilli-Catt. et Gubellini
Cardamine hirsuta L.
Cardamine flexuosa With.
Cardamine dubia Nicotra
Arabis collina Ten.
Arabis rosea DC.
Arabis madonia C. Presl
Arabis pseudoturritis Boiss. et Heldr.

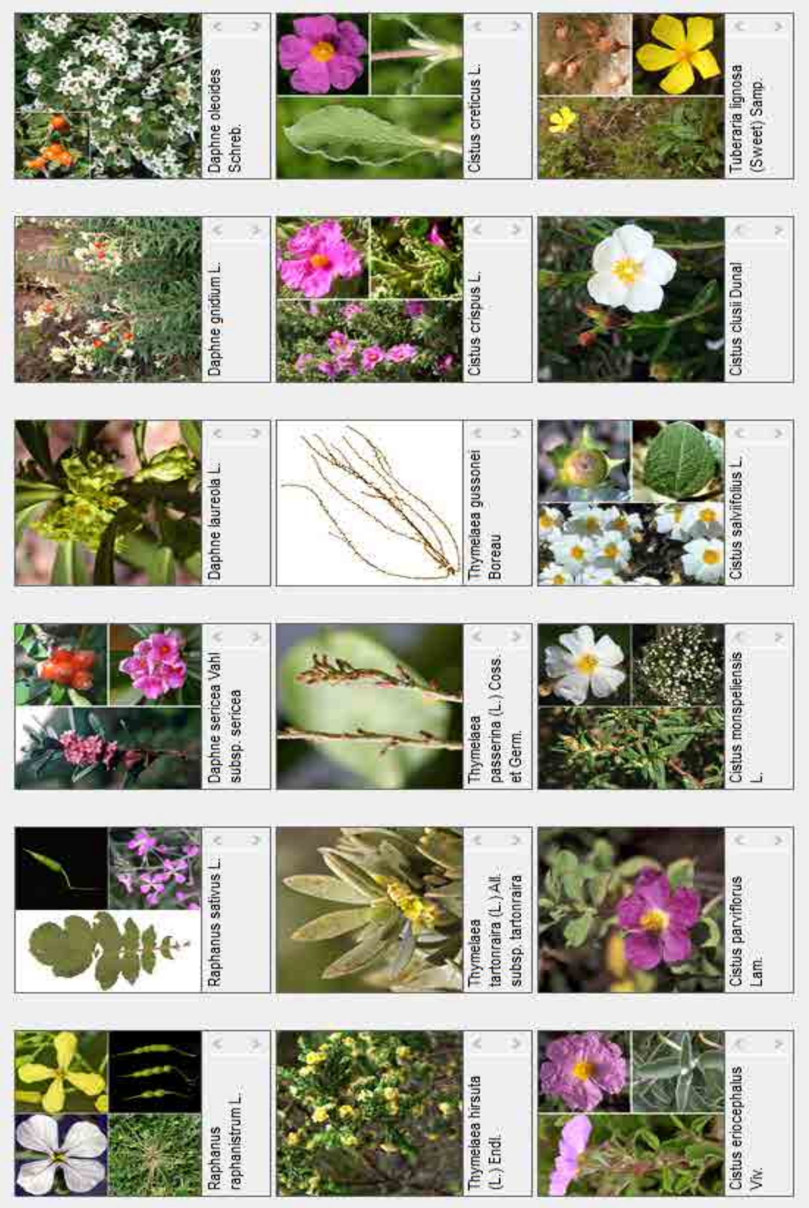

Arabis turrita L.
Arabis auriculata Lam.
Arabis verna (L.) R. Br.
Arabis sagittata (Bertol.) DC.
Arabis hirsuta (L.) Scop.
Arabis alpina L.
Arabis caucasica Willd.
Aubrieta deltoidea (L.) DC. subsp. sicula (Strobl) Phitos
Lunaria rediviva L.
Lunaria annua L.
Alyssum nebrodense Tineo
Alyssum simplex Rudolphi
Alyssum siculum Jord.
Alyssum minutum Schltdl. ex DC.
Lobularia maritima (L.) Desv.
Lobularia libyca (Viv.) Meisn.
Clypeola jonthlaspi L.
Draba turgida A. Huet ex Nyman

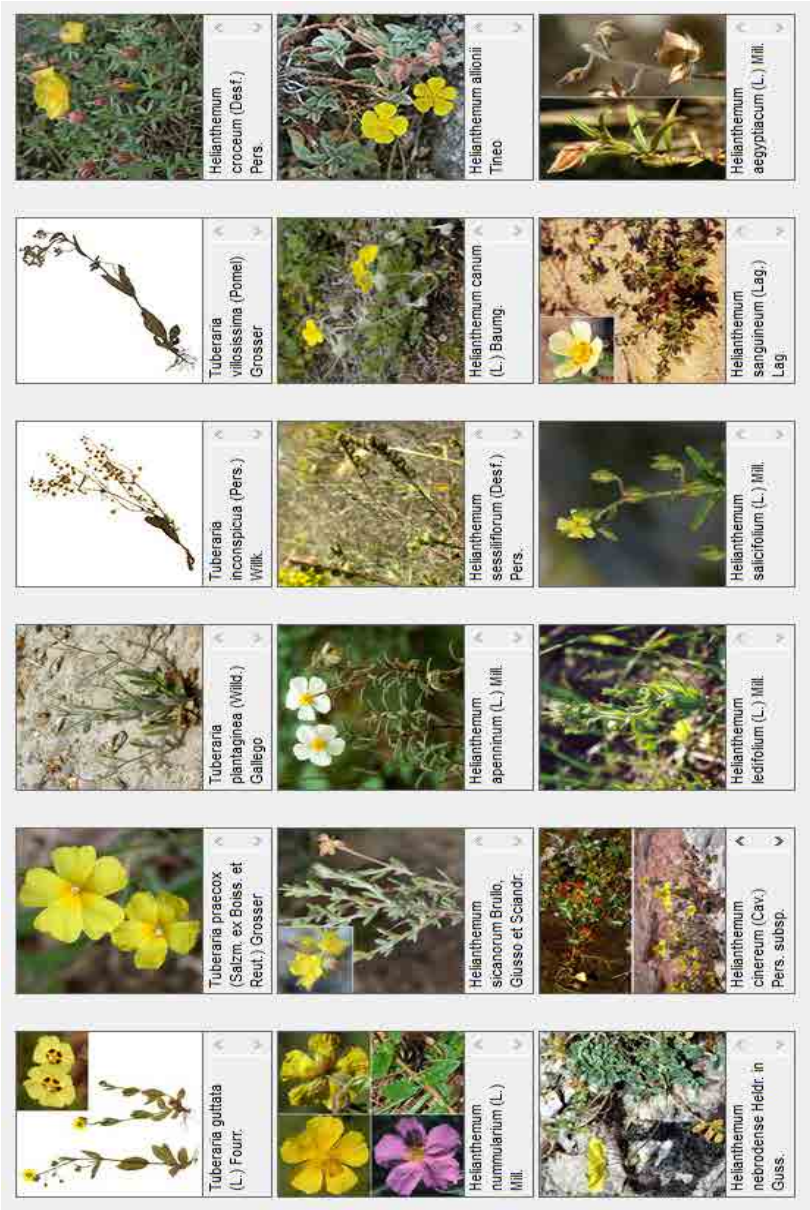

Draba muralis L.
Draba verna L. s.s.
Draba praecox Steven
Camelina sativa (L.) Crantz
Neslia paniculata (L.) Desv.
Capsella bursa-pastoris (L.) Medik.
Capsella rubella Reut.
Hornungia procumbens (L.) Hayek
Hornungia revelierei (Jord.) Soldano, F. Conti, Banfi et
Hornungia pauciflora (W. D. J. Koch) Soldano, F. Conti,
Hornungia petraea (L.) Rchb.
Jonopsidium albiflorum Durieu
Bivonaea lutea (Biv.) DC.
Teesdalia nudicaulis (L.) W. T. Aiton
Teesdalia coronopifolia (J. P. Bergeret) Thell.
Noccaea rivalis (C. Presl) F. K. Mey.
Thlaspi arvense L.
Thlaspi alliaceum L.

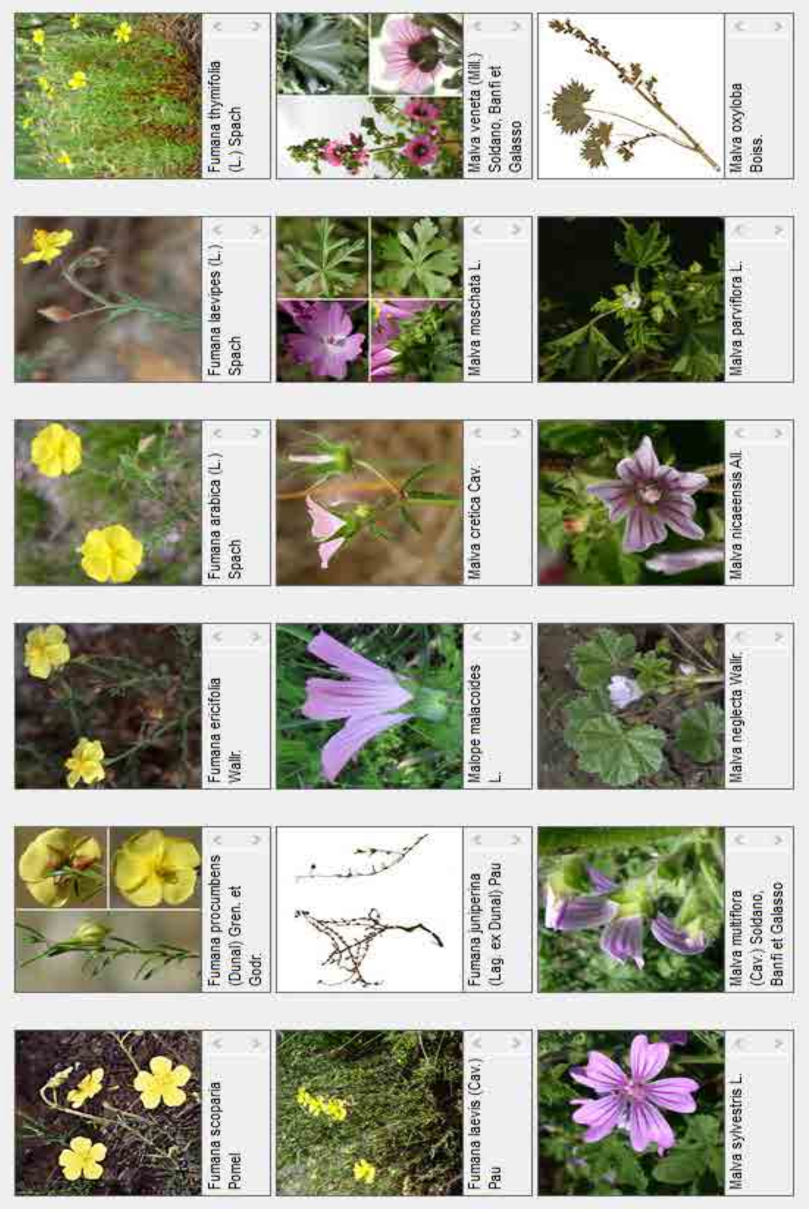

Microthlaspi perfoliatum (L.) F. K. Mey.
Aethionema saxatile (L.) R. Br.
Iberis semperflorens L.
Iberis violacea W. T. Aiton
Iberis umbellata L.
Iberis pinnata L.
Biscutella maritima Ten.
Lepidium campestre (L.) R. Br.
Lepidium hirtum (L.) Sm.
Lepidium nebrodense (Raf.) Guss.
Lepidium draba L.
Lepidium sativum L.
Lepidium virginicum L.
Lepidium graminifolium L.
Lepidium densiflorum Schrad.
Lepidium latifolium L.
Coronopus squamatus (Forssk.) Asch.
Coronopus didymus (L.) Sm.


Conringia orientalis (L.) Dumort.
Moricandia arvensis (L.) DC.
Moricandia longirostris Pomel
Diplotaxis crassifolia (Raf.) DC.
Diplotaxis erucoides (L.) DC.
Diplotaxis scaposa DC.
Diplotaxis tenuifolia (L.) DC.
Diplotaxis muralis (L.) DC.
Diplotaxis viminea (L.) DC.
Brassica oleracea L.
Brassica insularis Moris
Brassica rupestris Raf.
Brassica macrocarpa Guss.
Brassica villosa Biv.
Brassica drepanensis (Caruel) Damanti
Brassica trichocarpa C. Brullo, Brullo, Giusso et Ilardi
Brassica incana Ten.
Brassica raimondoi Sciandr., C. Brullo, Brullo, Giusso,

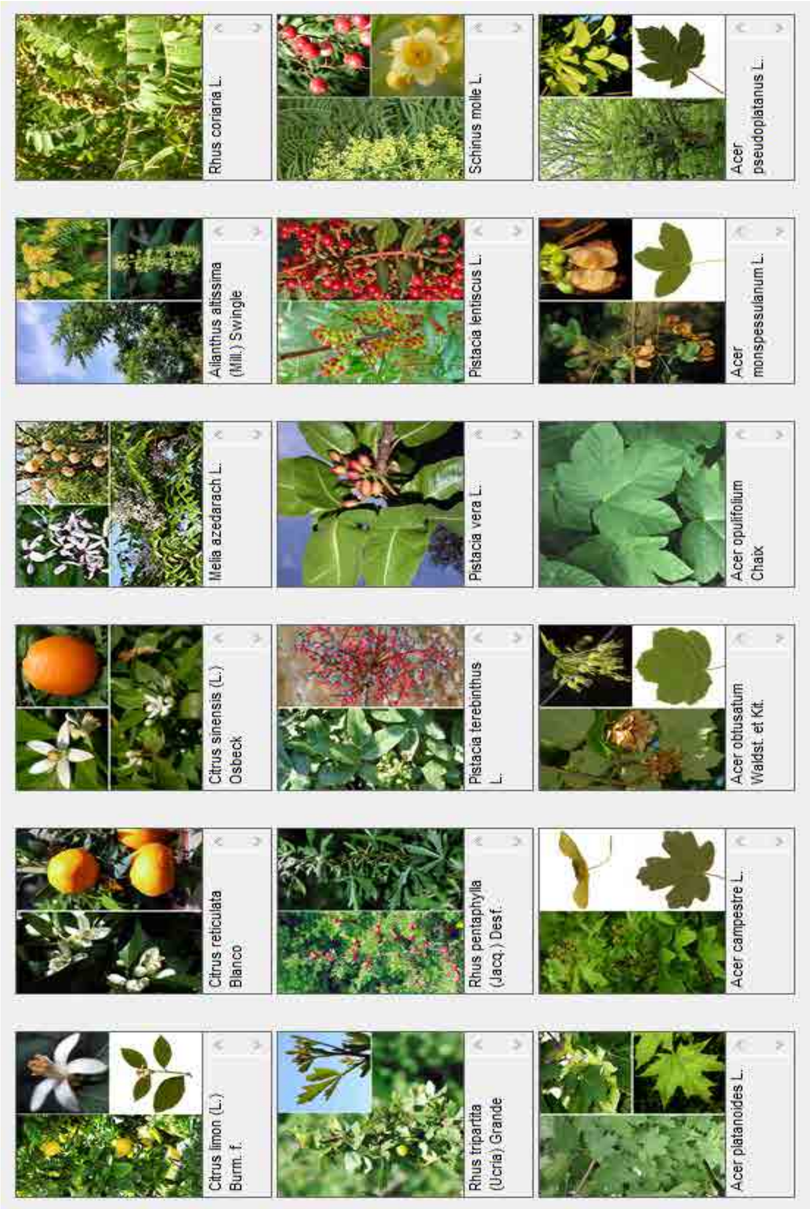

Brassica napus L.
Brassica rapa L.
Brassica souliei Batt. subsp. amplexicaulis (Desf.) Greuter et
Brassica fruticulosa Cirillo
Brassica nigra (L.) W. D. J. Koch
Brassica tournefortii Gouan
Sinapis arvensis L.
Sinapis pubescens L.
Sinapis alba L.
Eruca sativa Mill.
Erucastrum virgatum C. Presl subsp. virgatum
Hirschfeldia incana (L.) Lagr.-Foss.
Carrichtera annua (L.) DC.
Succowia balearica (L.) Medik.
Cakile maritima Scop. subsp. maritima
Rapistrum rugosum (L.) All.
Crambe hispanica L.
Calepina irregularis (Asso) Thell.


Raphanus raphanistrum L.
Raphanus sativus L.
Daphne sericea Vahl subsp. sericea
Daphne laureola L.
Daphne gnidium L.
Daphne oleoides Schreb.
Thymelaea hirsuta (L.) Endl.
Thymelaea tartonraira (L.) All. subsp. tartonraira
Thymelaea passerina (L.) Coss. et Germ.
Thymelaea gussonei Boreau
Cistus crispus L.
Cistus creticus L.
Cistus eriocephalus Viv.
Cistus parviflorus Lam.
Cistus monspeliensis L.
Cistus salviifolius L.
Cistus clusii Dunal
Tuberaria lignosa (Sweet) Samp.

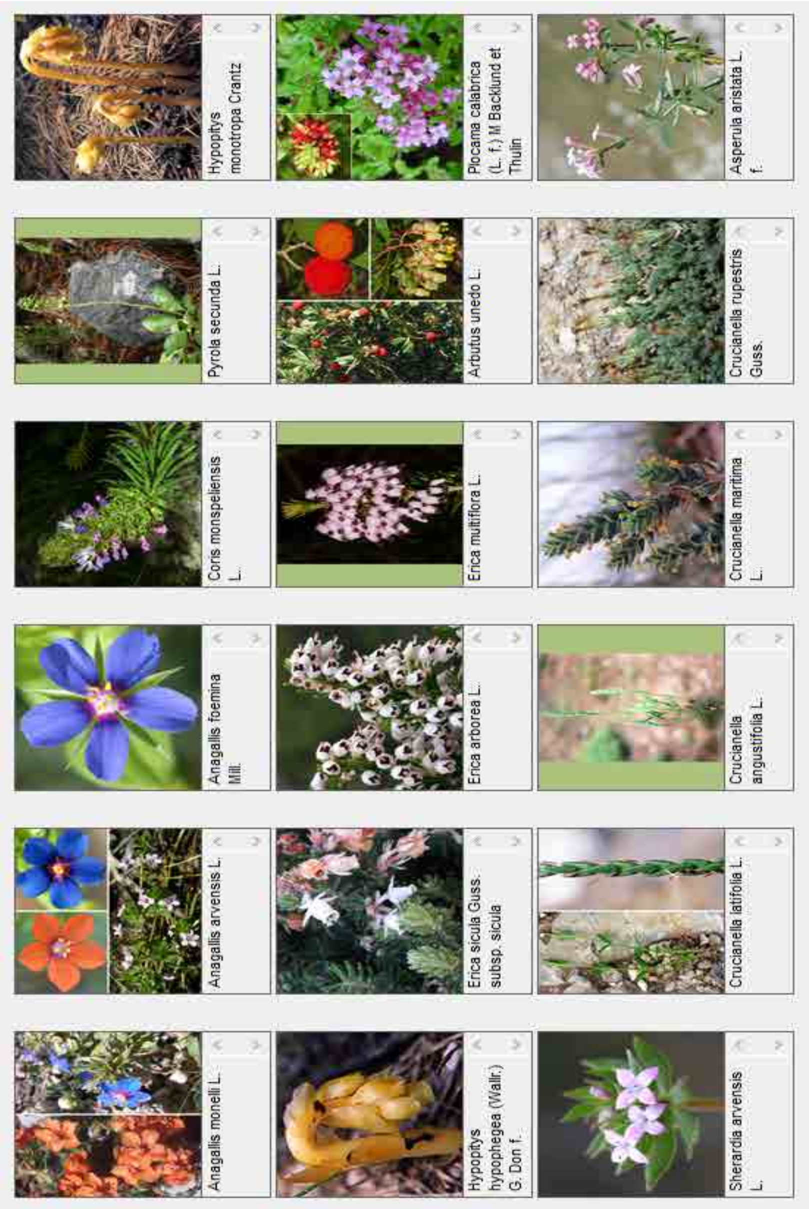

Tuberaria guttata (L.) Fourr.
Tuberaria praecox (Salzm. ex Boiss. et Reut.) Grosser
Tuberaria plantaginea (Willd.) Gallego
Tuberaria inconspicua (Pers.) Willk.
Tuberaria villosissima (Pomel) Grosser
Helianthemum croceum (Desf.) Pers.
Helianthemum nummularium (L.) Mill.
Helianthemum sicanorum Brullo, Giusso et Sciandr.
Helianthemum apenninum (L.) Mill.
Helianthemum sessiliflorum (Desf.) Pers.
Helianthemum canum (L.) Baumg.
Helianthemum allionii Tineo
Helianthemum nebrodense Heldr. in Guss.
Helianthemum cinereum (Cav.) Pers. subsp.
Helianthemum ledifolium (L.) Mill.
Helianthemum salicifolium (L.) Mill.
Helianthemum sanguineum (Lag.) Lag.
Helianthemum aegyptiacum (L.) Mill.

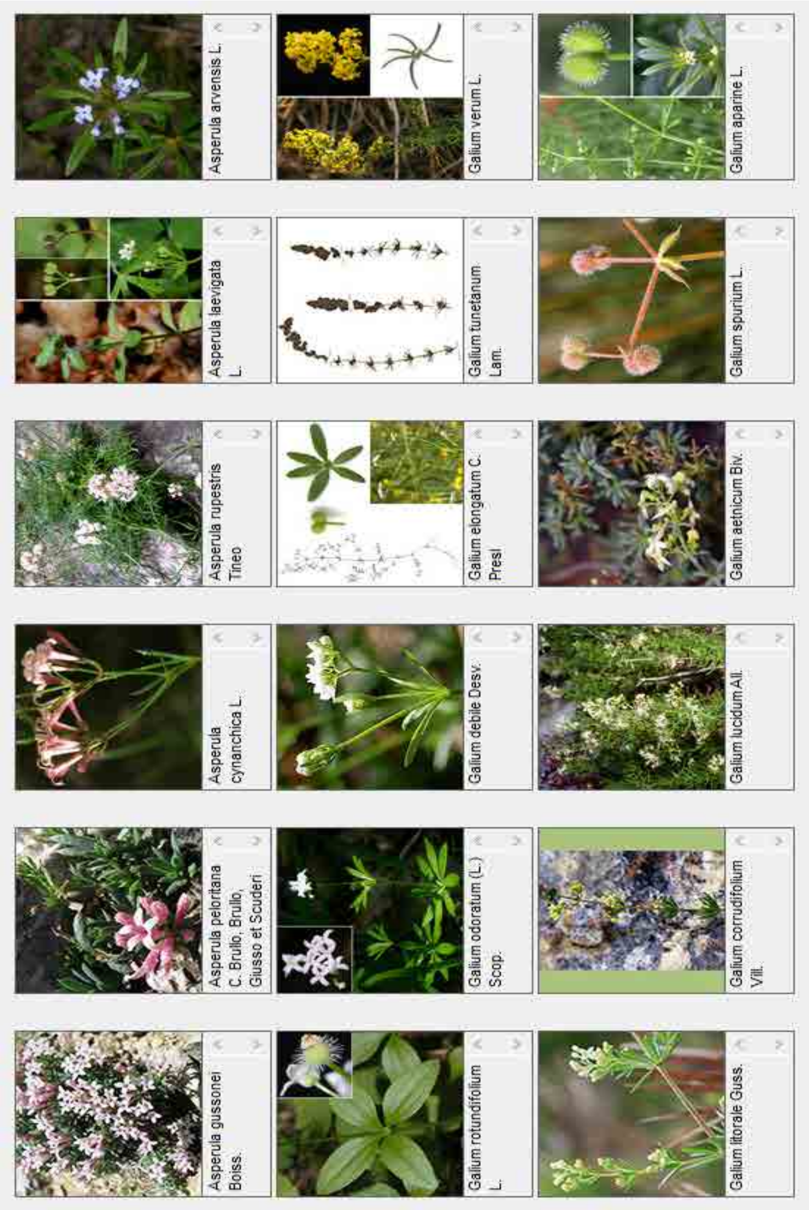

Fumana scoparia Pomel
Fumana procumbens (Dunal) Gren. et Godr.
Fumana ericifolia Wallr.
Fumana arabica (L.) Spach
Fumana laevipes (L.) Spach
Fumana thymifolia (L.) Spach
Fumana laevis (Cav.) Pau
Fumana juniperina (Lag. ex Dunal) Pau
Malope malacoides L.
Malva cretica Cav.
Malva moschata L.
Malva veneta (Mill.) Soldano, Banfi et Galasso
Malva sylvestris L.
Malva multiflora (Cav.) Soldano, Banfi et Galasso
Malva neglecta Wallr.
Malva nicaeensis All.
Malva parviflora L.
Malva oxyloba Boiss.

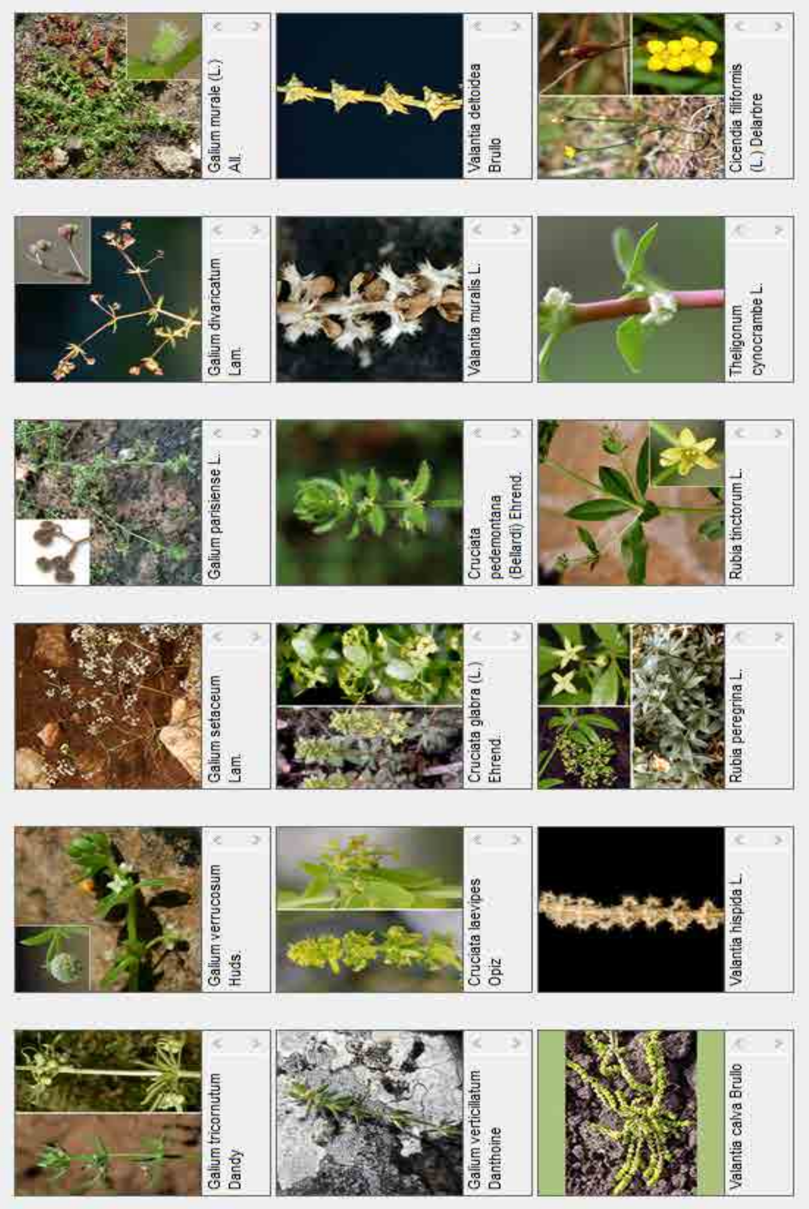

Lavatera olbia L.
Lavatera bryoniifolia Mill.
Lavatera punctata All.
Lavatera trimestris L.
Lavatera agrigentina Tineo
Althaea hirsuta L.
Althaea cannabina L.
Althaea officinalis L.
Alcea rosea L.
Abutilon theophrasti Medik.
Sida spinosa L.
Gossypium herbaceum L.
Gossypium hirsutum L.
Hibiscus syriacus L.
Hibiscus trionum L.
Tilia platyphyllos Scop.
Ruta angustifolia Pers.
Ruta chalepensis L.

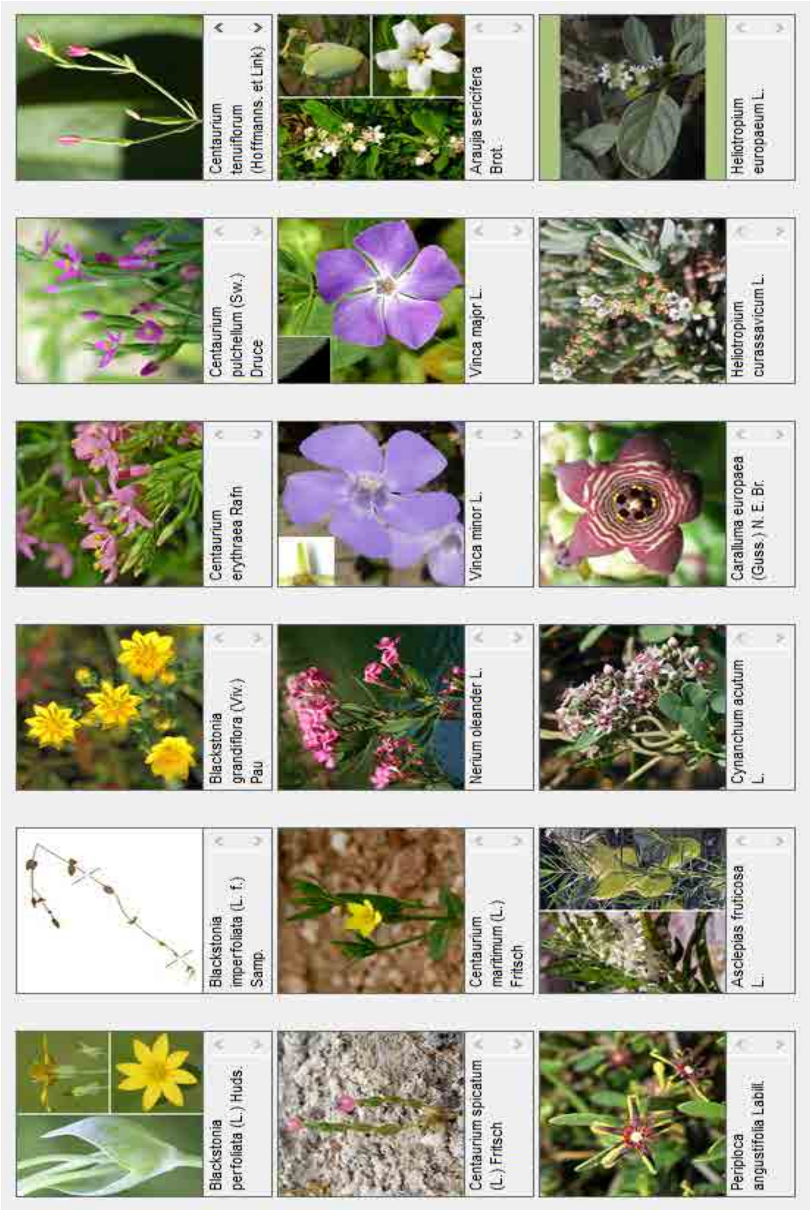

Citrus limon (L.) Burm. f.
Citrus reticulata Blanco
Citrus sinensis (L.) Osbeck
Melia azedarach L.
Ailanthus altissima (Mill.) Swingle
Rhus coriaria L.
Rhus tripartita (Ucria) Grande
Rhus pentaphylla (Jacq.) Desf.
Pistacia terebinthus L.
Pistacia vera L.
Pistacia lentiscus L.
Schinus molle L.
Acer platanoides L.
Acer campestre L.
Acer obtusatum Waldst. et Kit.
Acer opulifolium Chaix
Acer monspessulanum L.
Acer pseudoplatanus L.


Aesculus hippocastanum L.
Cardiospermum grandiflorum Sw.
Cardiospermum halicacabum L.
Koelreuteria paniculata Laxm.
Cytinus hypocistis (L.) L.
Cytinus ruber (Fourr.) Kom.
Cynomorium coccineum L.
Cornus mas L.
Cornus sanguinea L.
Diospyros kaki L. f.
Samolus valerandi L.
Primula vulgaris Huds.
Androsace elongata L. subsp. breistrofferi (Charpin
Cyclamen hederifolium Aiton
Cyclamen repandum Sm. subsp. repandum
Lysimachia nemorum L.
Lysimachia vulgaris L.
Asterolinon linum-stellatum (L.) Duby

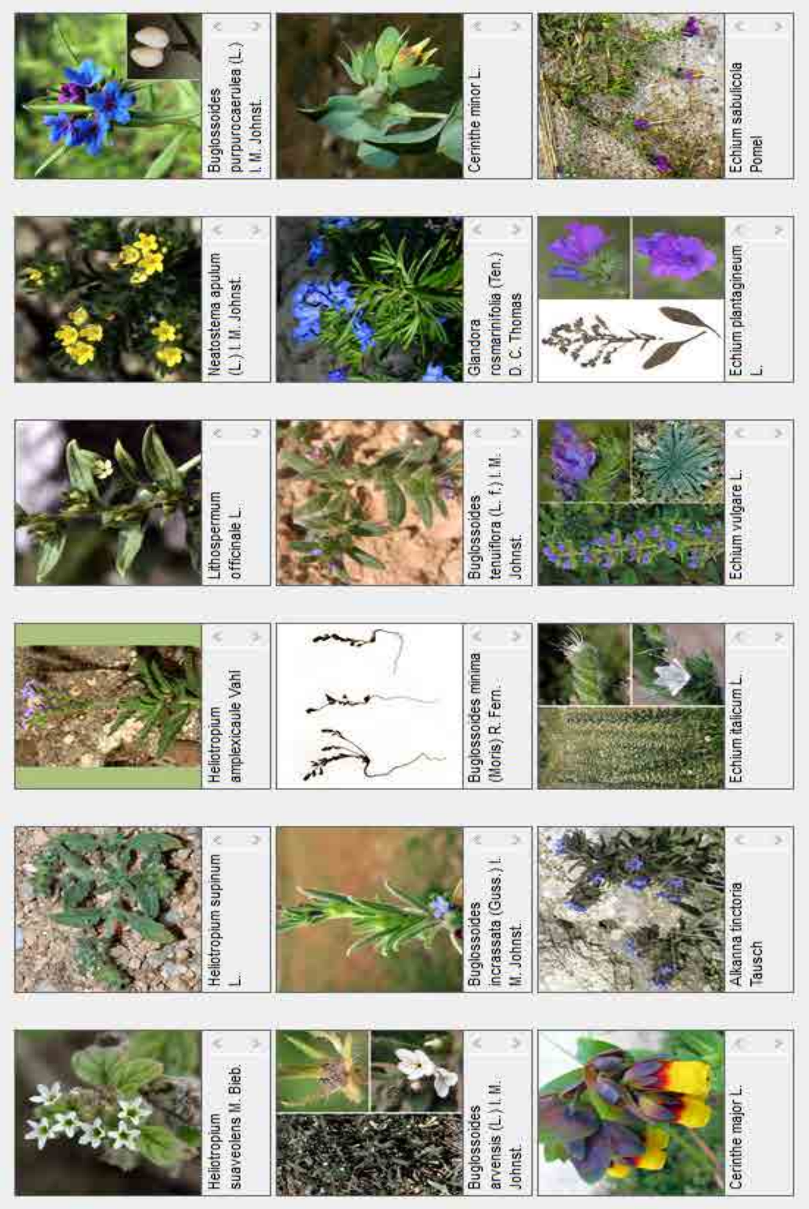

Anagallis monelli L.
Anagallis arvensis L.
Anagallis foemina Mill.
Coris monspeliensis L.
Pyrola secunda L.
Hypopitys monotropa Crantz
Hypopitys hypophegea (Wallr.) G. Don f.
Erica sicula Guss. subsp. sicula
Erica arborea L.
Erica multiflora L.
Arbutus unedo L.
Plocama calabrica (L. f.) M. Backlund et Thulin
Sherardia arvensis L.
Crucianella latifolia L.
Crucianella angustifolia L.
Crucianella maritima L.
Crucianella rupestris Guss.
Asperula aristata L. f.

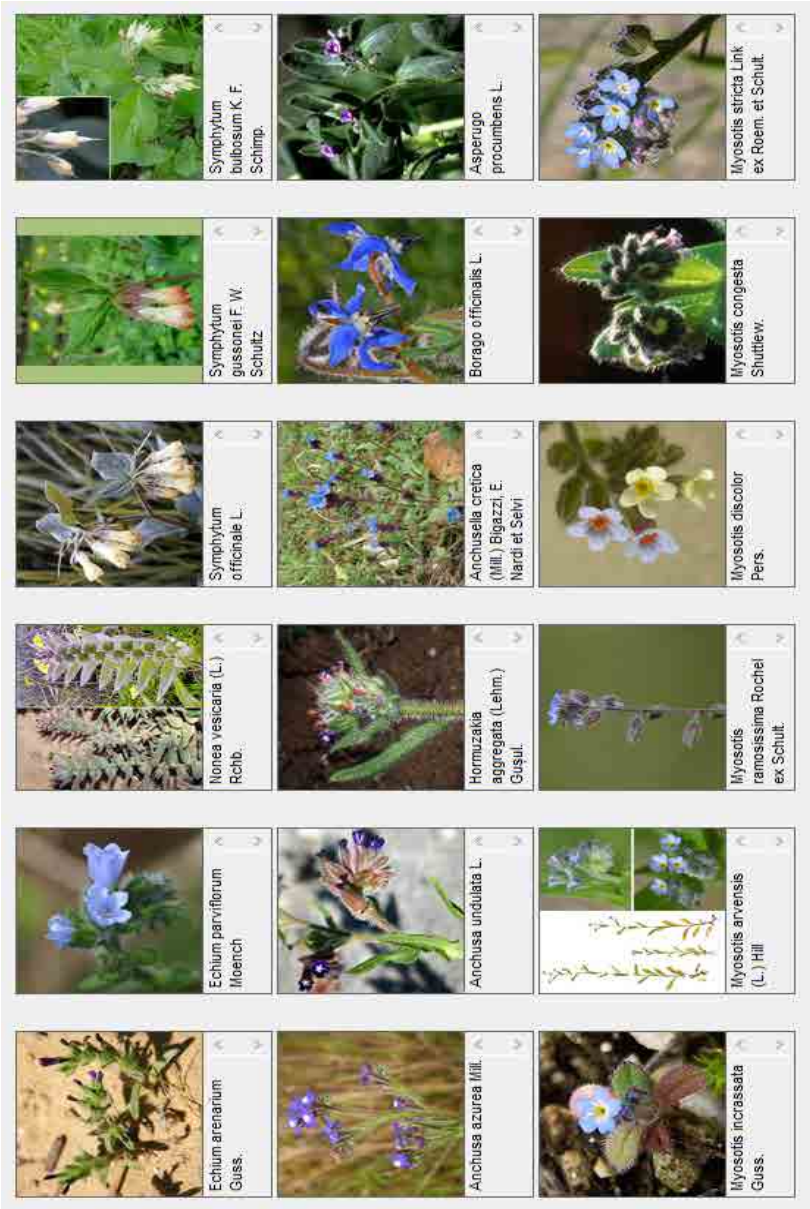

Asperula gussonei Boiss.
Asperula peloritana C. Brullo, Brullo, Giusso et Scuderi
Asperula cynanchica L.
Asperula rupestris Tineo
Asperula laevigata L.
Asperula arvensis L.
Galium rotundifolium L.
Galium odoratum (L.) Scop.
Galium debile Desv.
Galium elongatum C. Presl
Galium tunetanum Lam.
Galium verum L.
Galium littorale Guss.
Galium corrudifolium Vill.
Galium lucidum All.
Galium aetnicum Biv.
Galium spurium L.
Galium aparine L.

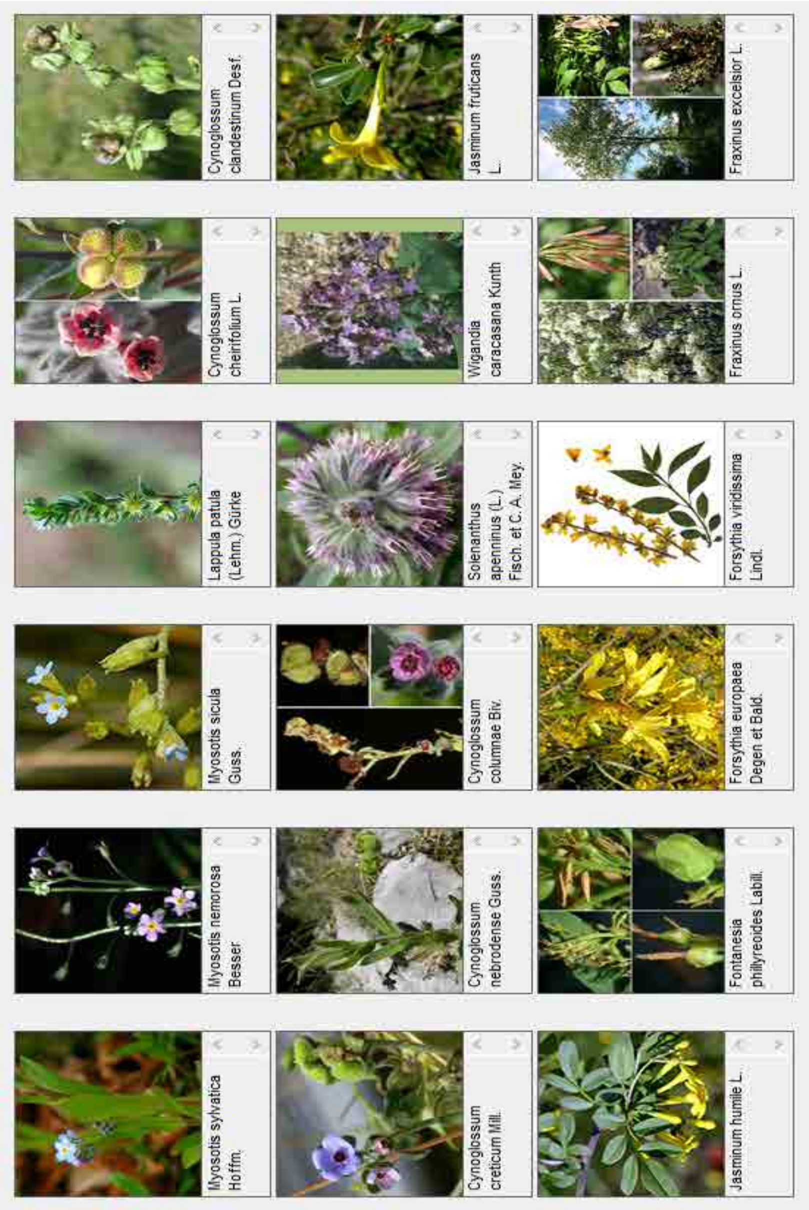

Galium tricornutum Dandy
Galium verrucosum Huds.
Galium setaceum Lam.
Galium parisiense L.
Galium divaricatum Lam.
Galium murale (L.) All.
Galium verticillatum Danthoine
Cruciata laevipes Opiz
Cruciata glabra (L.) Ehrend.
Cruciata pedemontana (Bellardi) Ehrend.
Valantia muralis L.
Valantia deltoidea Brullo
Valantia calva Brullo
Valantia hispida L.
Rubia peregrina L.
Rubia tinctorum L.
Theligonum cynocrambe L.
Cicendia filiformis (L.) Delarbre

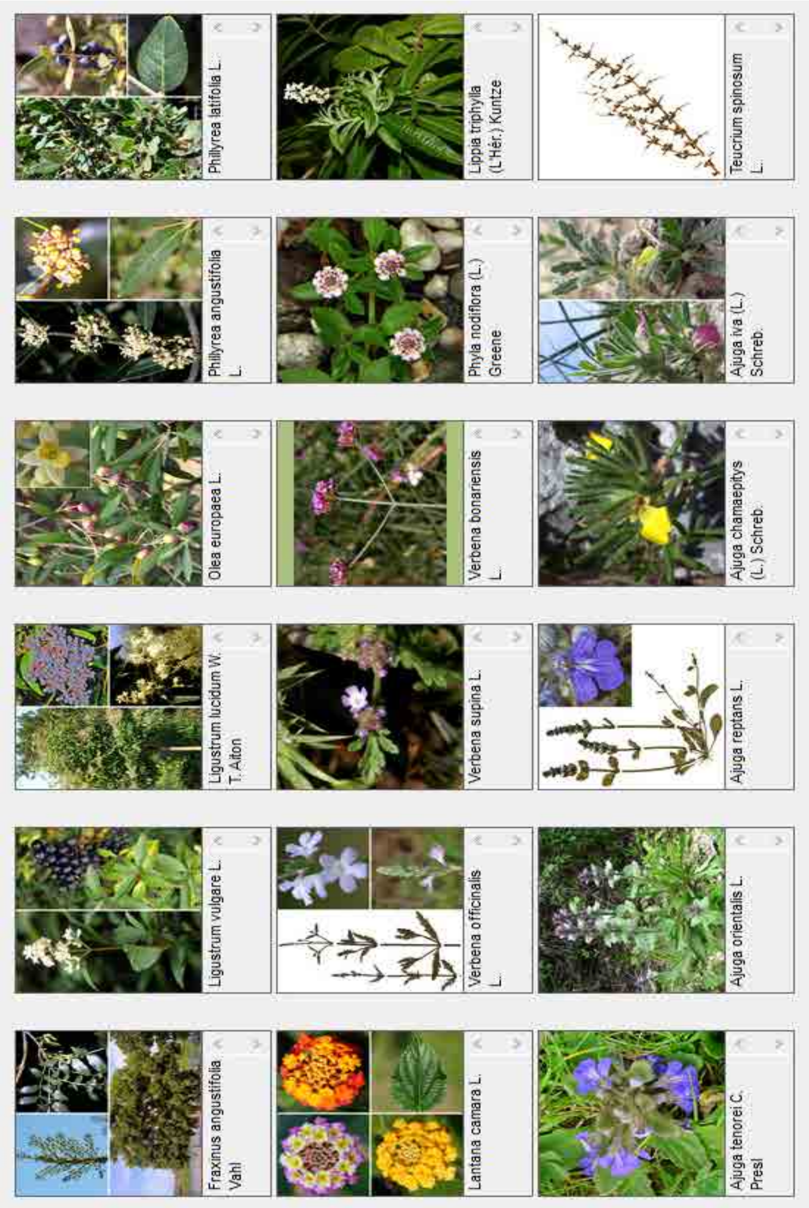


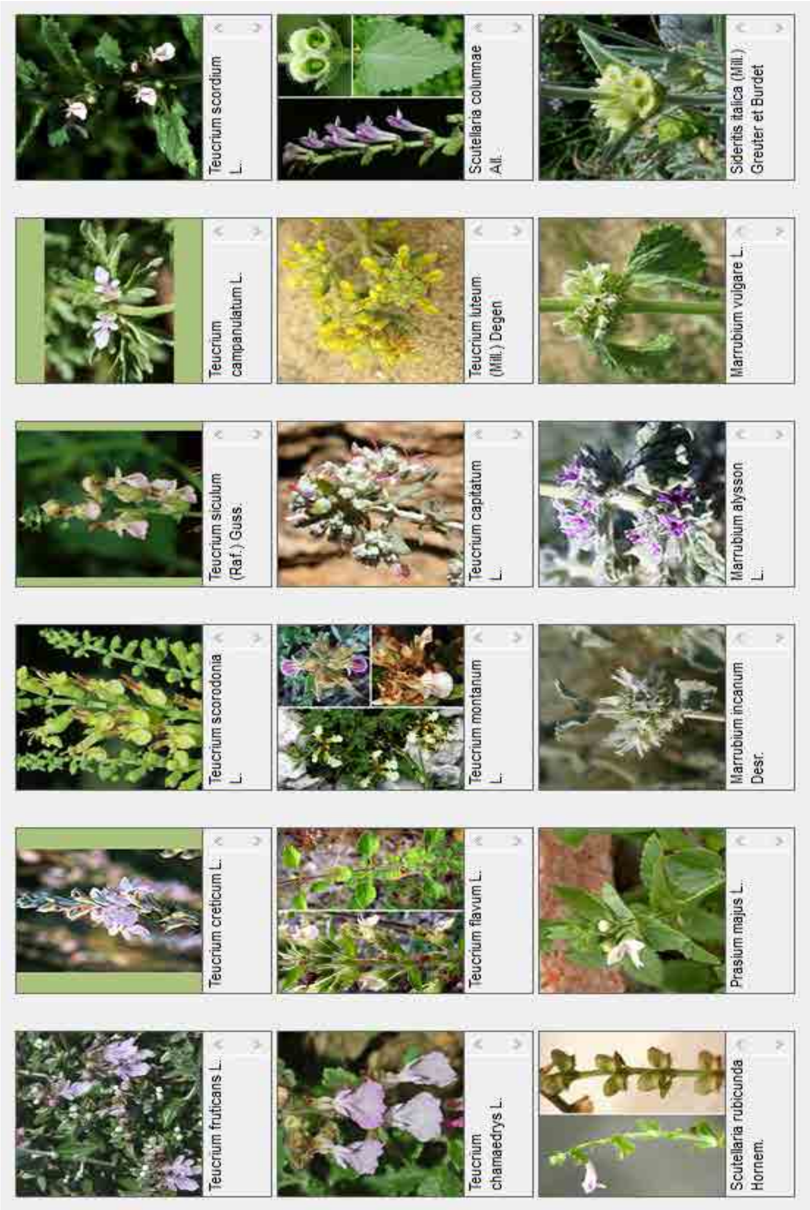
Blackstonia perfoliata (L.) Huds.
Blackstonia imperfoliata (L. f.) Samp.
Blackstonia grandiflora (Viv.) Pau
Centaurium erythraea Rafn
Centaurium pulchellum (Sw.) Druce
Centaurium tenuiflorum (Hoffmanns. et Link)
Centaurium spicatum (L.) Fritsch
Centaurium maritimum (L.) Fritsch
Nerium oleander L.
Vinca minor L.
Vinca major L.
Araujia sericifera Brot.
Periploca angustifolia Labill.
Asclepias fruticosa L.
Cynanchum acutum L.
Caralluma europaea (Guss.) N. E. Br.
Heliotropium curassavicum L.
Heliotropium europaeum L.

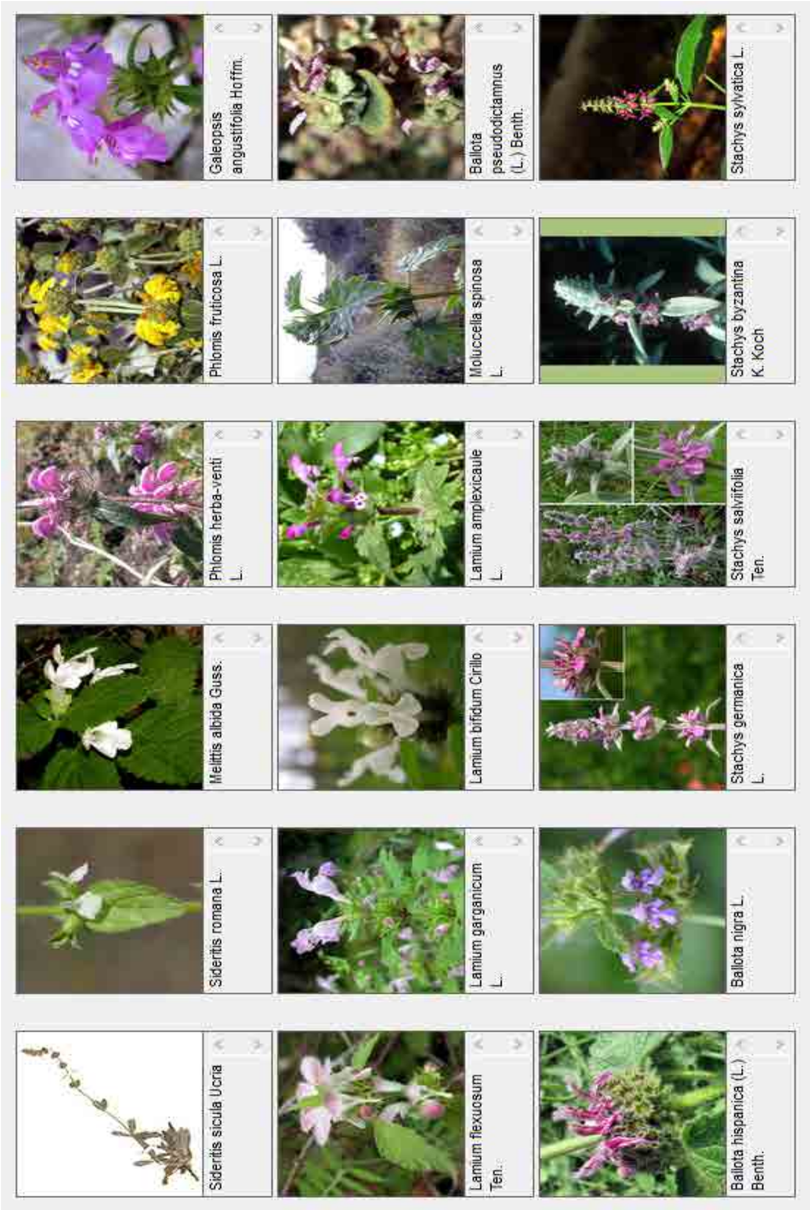

Heliotropium suaveolens M. Bieb.
Heliotropium supinum L.
Heliotropium amplexicaule Vahl
Lithospermum officinale L.
Neatostema apulum (L.) I. M. Johnst.
Buglossoides purpurocaerulea (L.) I. M. Johnst.
Buglossoides arvensis (L.) I. M. Johnst.
Buglossoides incrassata (Guss.) I. M. Johnst.
Buglossoides minima (Moris) R. Fern.
Buglossoides tenuiflora (L. f.) I. M. Johnst.
Glandora rosmarinifolia (Ten.) D. C. Thomas
Cerinthe minor L.
Cerinthe major L.
Alkanna tinctoria Tausch
Echium italicum L.
Echium vulgare L.
Echium plantagineum L.
Echium sabulicola Pomel

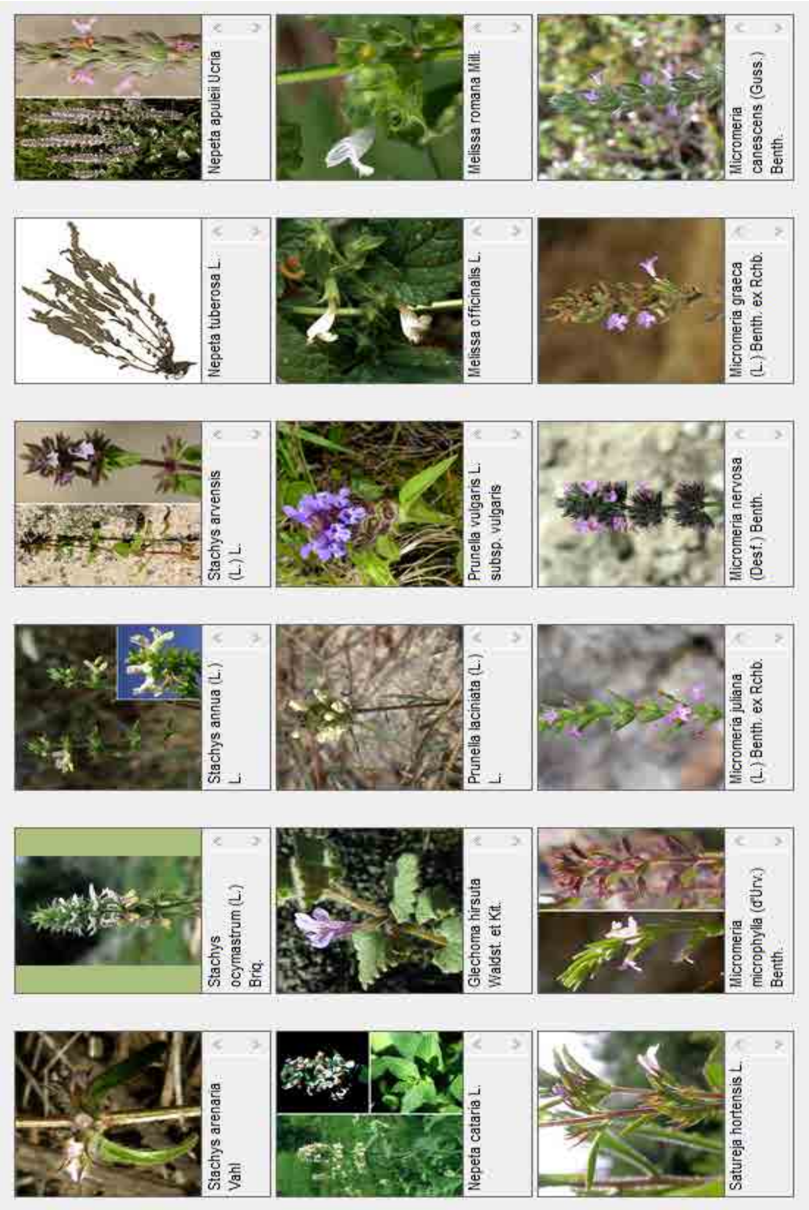

Echium arenarium Guss.
Echium parviflorum Moench
Nonea vesicaria (L.) Rchb.
Symphytum officinale L.
Symphytum gussonei F. W. Schultz
Symphytum bulbosum K. F. Schimp.
Anchusa azurea Mill.
Anchusa undulata L.
Hormuzakia aggregata (Lehm.) Guşul.
Anchusella cretica (Mill.) Bigazzi, E. Nardi et Selvi
Borago officinalis L.
Asperugo procumbens L.
Myosotis incrassata Guss.
Myosotis arvensis (L.) Hill
Myosotis ramosissima Rochel ex Schult.
Myosotis discolor Pers.
Myosotis congesta Shuttlew.
Myosotis stricta Link ex Roem. et Schult.

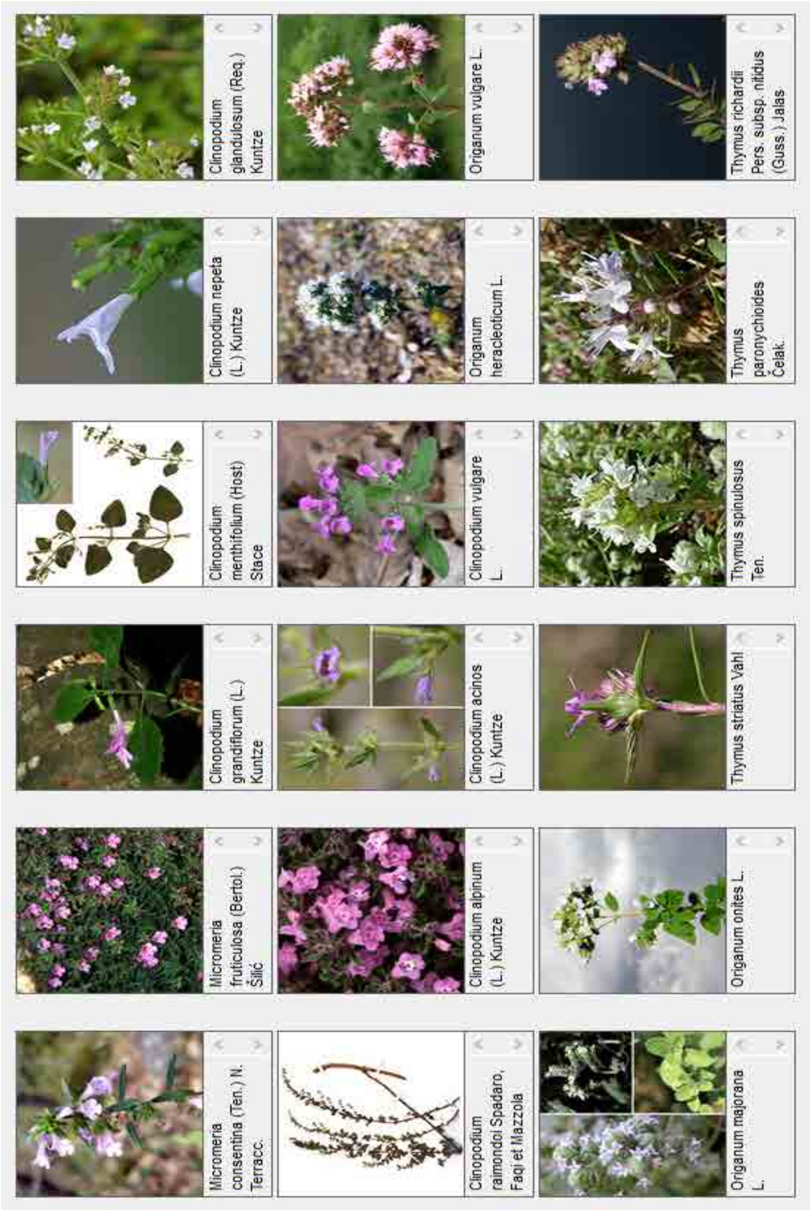

Myosotis sylvatica Hoffm.
Myosotis nemorosa Besser
Myosotis sicula Guss.
Lappula patula (Lehm.) Gürke
Cynoglossum cheirifolium L.
Cynoglossum clandestinum Desf.
Cynoglossum creticum Mill.
Cynoglossum nebrodense Guss.
Cynoglossum columnae Biv.
Solenanthus apenninus (L.) Fisch. et C. A. Mey.
Wigandia caracasana Kunth
Jasminum fruticans L.
Jasminum humile L.
Fontanesia phillyreoides Labill.
Forsythia europaea Degen et Bald.
Forsythia viridissima Lindl.
Fraxinus ornus L.
Fraxinus excelsior L.

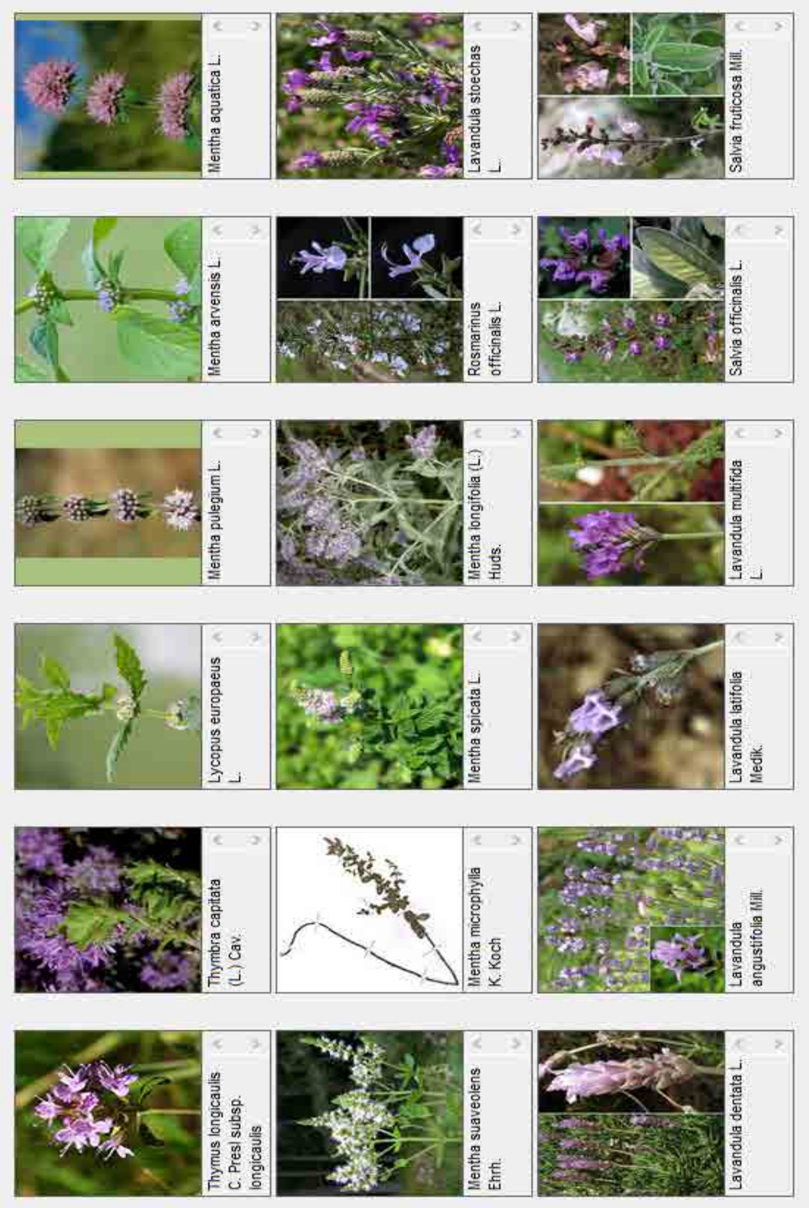

Fraxinus angustifolia Vahl
Ligustrum vulgare L.
Ligustrum lucidum W. T. Aiton
Olea europaea L.
Phillyrea angustifolia L.
Phillyrea latifolia L.
Lantana camara L.
Verbena officinalis L.
Verbena supina L.
Verbena bonariensis L.
Phyla nodiflora (L.) Greene
Lippia triphylla (L'Hér.) Kuntze
Ajuga tenorei C. Presl
Ajuga orientalis L.
Ajuga reptans L.
Ajuga chamaepitys (L.) Schreb.
Ajuga iva (L.) Schreb.
Teucrium spinosum L.

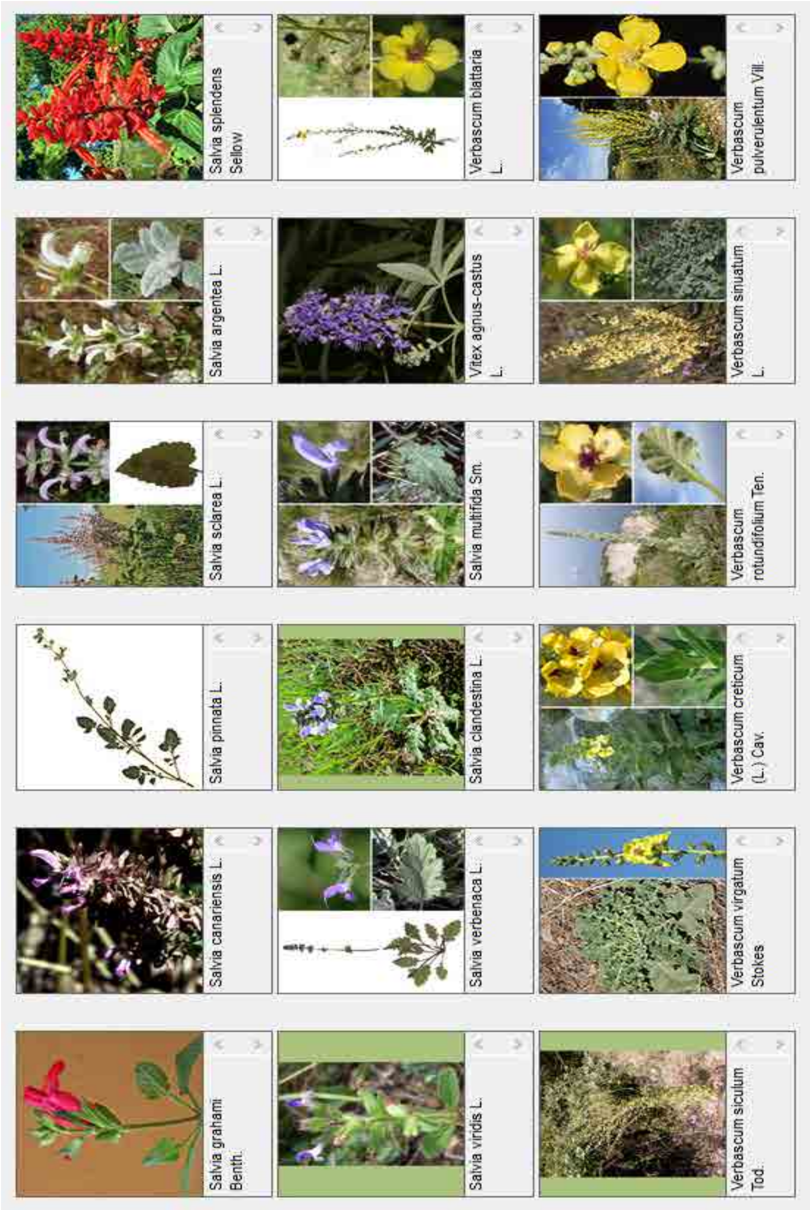

Teucrium fruticans L.
Teucrium creticum L.
Teucrium scorodonia L.
Teucrium siculum (Raf.) Guss.
Teucrium campanulatum L.
Teucrium scordium L.
Teucrium chamaedrys L.
Teucrium flavum L.
Teucrium montanum L.
Teucrium capitatum L.
Teucrium luteum (Mill.) Degen
Scutellaria columnae All.
Scutellaria rubicunda Hornem.
Prasium majus L.
Marrubium incanum Desr.
Marrubium alysson L.
Marrubium vulgare L.
Sideritis italica (Mill.) Greuter et Burdet


Sideritis sicula Ucria
Sideritis romana L.
Melittis albida Guss.
Phlomis herba-venti L.
Phlomis fruticosa L.
Galeopsis angustifolia Hoffm.
Lamium flexuosum Ten.
Lamium garganicum L.
Lamium bifidum Cirillo
Lamium amplexicaule L.
Moluccella spinosa L.
Ballota pseudodictamnus (L.) Benth.
Ballota hispanica (L.) Benth.
Ballota nigra L.
Stachys germanica L.
Stachys salviifolia Ten.
Stachys byzantina K. Koch
Stachys sylvatica L.

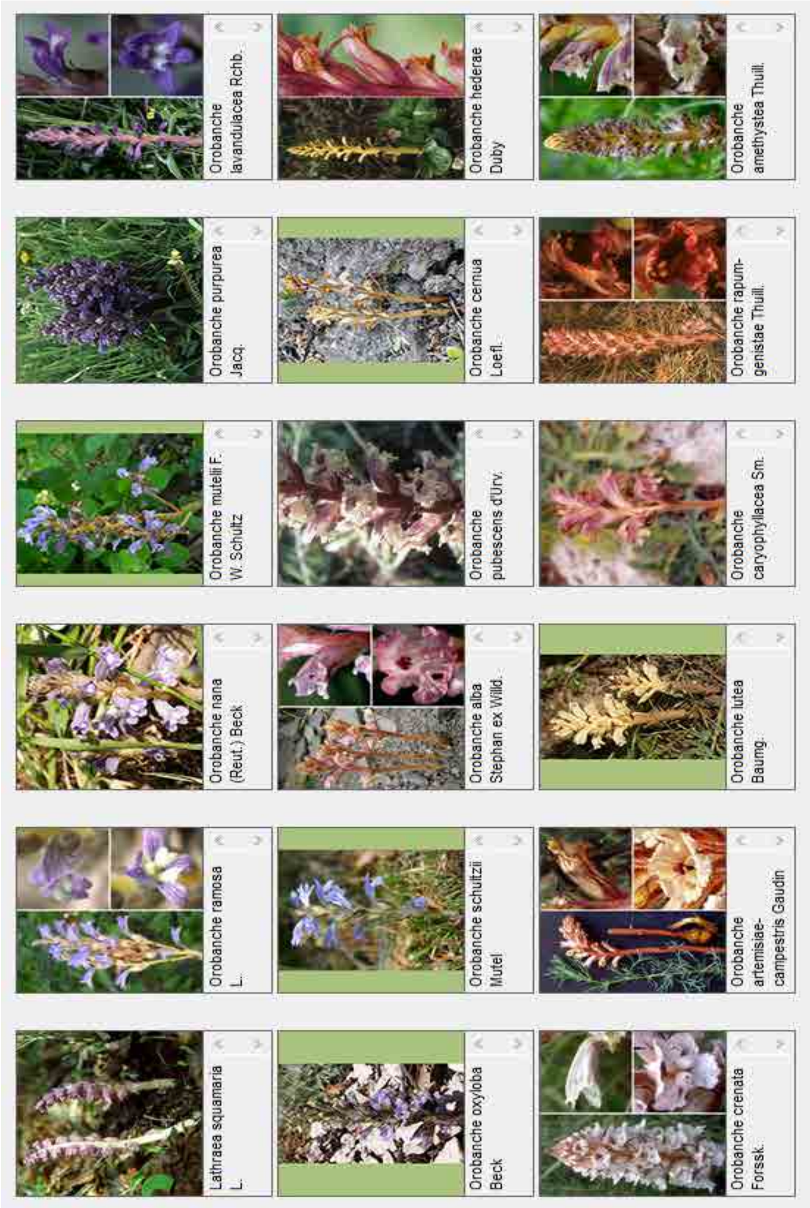

Stachys arenaria Vahl
Stachys ocymastrum (L.) Briq.
Stachys annua (L.) L.
Stachys arvensis (L.) L.
Nepeta tuberosa L.
Nepeta apuleii Ucria
Nepeta cataria L.
Glechoma hirsuta Waldst. et Kit.
Prunella laciniata (L.) L.
Prunella vulgaris L. subsp. vulgaris
Melissa officinalis L.
Melissa romana Mill.
Satureja hortensis L.
Micromeria microphylla (d'Urv.) Benth.
Micromeria juliana (L.) Benth. ex Rchb.
Micromeria nervosa (Desf.) Benth.
Micromeria graeca (L.) Benth. ex Rchb.
Micromeria canescens (Guss.) Benth.

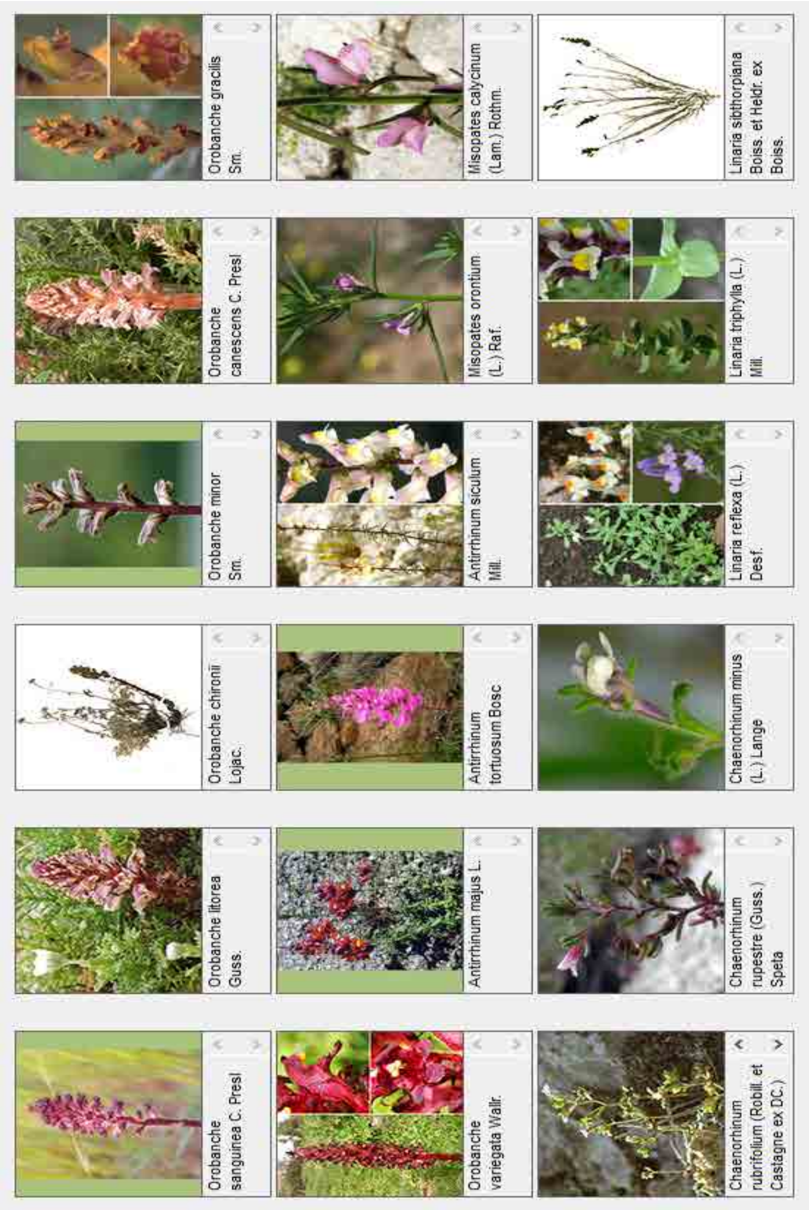

Micromeria consentina (Ten.) N. Terracc.
Micromeria fruticulosa (Bertol.) Šilić
Clinopodium grandiflorum (L.) Kuntze
Clinopodium menthifolium (Host) Stace
Clinopodium nepeta (L.) Kuntze
Clinopodium glandulosum (Req.) Kuntze
Clinopodium raimondoi Spadaro, Faqi et Mazzola
Clinopodium alpinum (L.) Kuntze
Clinopodium acinos (L.) Kuntze
Clinopodium vulgare L.
Origanum heracleoticum L.
Origanum vulgare L.
Origanum majorana L.
Origanum onites L.
Thymus striatus Vahl
Thymus spinulosus Ten.
Thymus paronychioides Čelak.
Thymus richardii Pers. subsp. nitidus (Guss.) Jalas

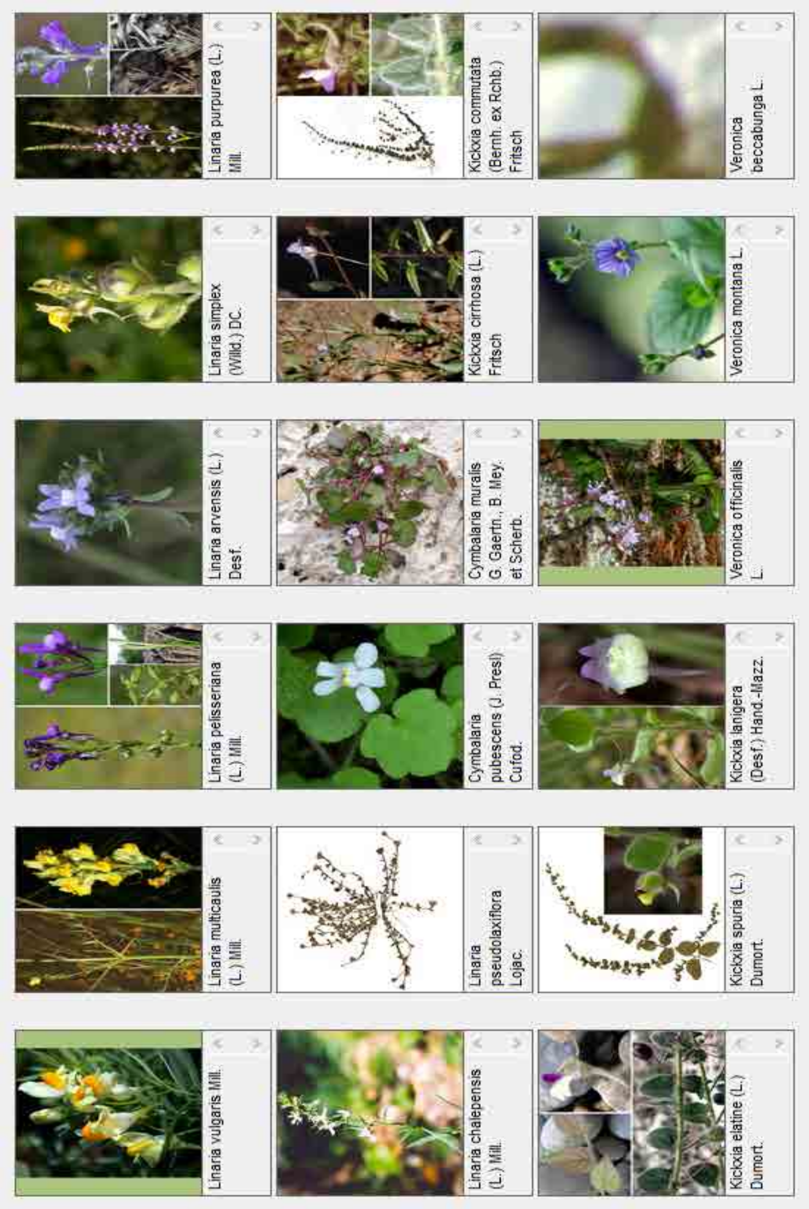

Thymus longicaulis C. Presl subsp. longicaulis
Thymbra capitata (L.) Cav.
Lycopus europaeus L.
Mentha pulegium L.
Mentha arvensis L.
Mentha aquatica L.
Mentha suaveolens Ehrh.
Mentha microphylla K. Koch
Mentha spicata L.
Mentha longifolia (L.) Huds.
Rosmarinus officinalis L.
Lavandula stoechas L.
Lavandula dentata L.
Lavandula angustifolia Mill.
Lavandula latifolia Medik.
Lavandula multifida L.
Salvia officinalis L.
Salvia fruticosa Mill.

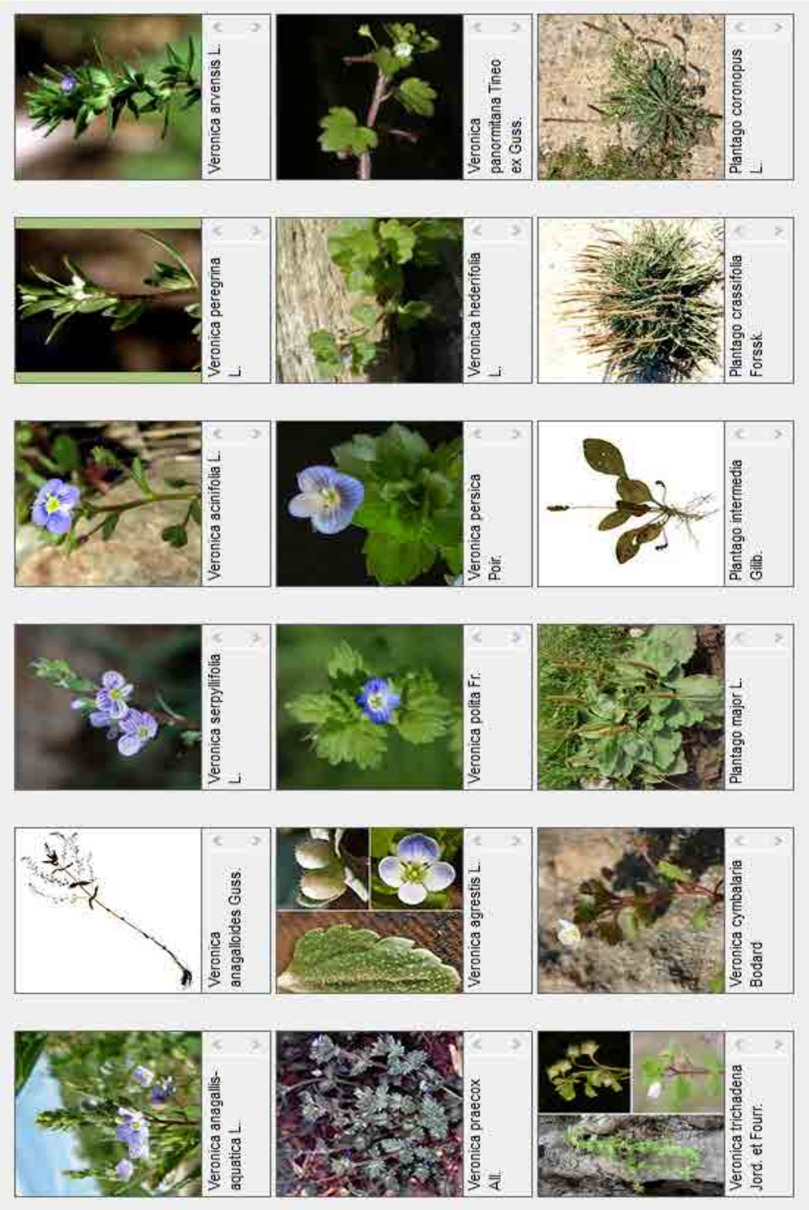

Salvia grahami Benth.
Salvia canariensis L.
Salvia pinnata L.
Salvia sclarea L.
Salvia argentea L.
Salvia splendens Sellow
Salvia viridis L.
Salvia verbenaca L.
Salvia clandestina L.
Salvia multifida Sm.
Vitex agnus-castus L.
Verbascum blattaria L.
Verbascum siculum Tod.
Verbascum virgatum Stokes
Verbascum creticum (L.) Cav.
Verbascum rotundifolium Ten.
Verbascum sinuatum L.
Verbascum pulverulentum Vill.


Verbascum phlomoides L.
Verbascum macrurum Ten.
Verbascum thapsus L.
Scrophularia vernalis L.
Scrophularia peregrina L.
Scrophularia scopolii Hoppe ex Pers.
Scrophularia auriculata L.
Scrophularia umbrosa Dumort.
Scrophularia canina L.
Scrophularia frutescens L.
Odontites bocconei (Guss.) Walp.
Odontites luteus (L.) Clairv.
Odontites rigidifolius (Biv.) Benth.
Odontites vulgaris Moench
Bartsia trixago L.
Parentucellia viscosa (L.) Caruel
Parentucellia latifolia (L.) Caruel
Rhynchocorys elephas (L.) Griseb.

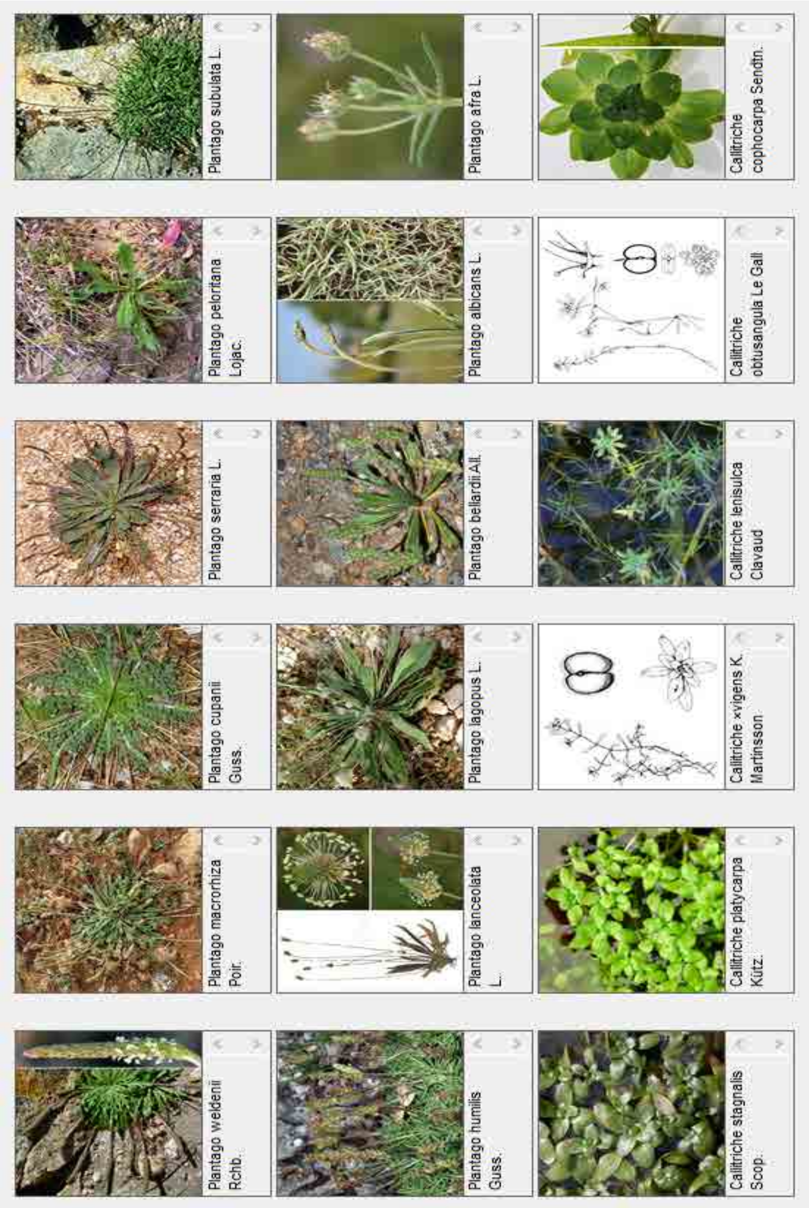

Lathraea squamaria L.
Orobanche ramosa L.
Orobanche nana (Reut.) Beck
Orobanche mutelii F. W. Schultz
Orobanche purpurea Jacq.
Orobanche lavandulacea Rchb.
Orobanche oxyloba Beck
Orobanche schultzii Mutel
Orobanche alba Stephan ex Willd.
Orobanche pubescens d'Urv.
Orobanche cernua Loefl.
Orobanche hederae Duby
Orobanche crenata Forssk.
Orobanche artemisiae-campestris Gaudin
Orobanche lutea Baumg.
Orobanche caryophyllacea Sm.
Orobanche rapum-genistae Thuill.
Orobanche amethystea Thuill.

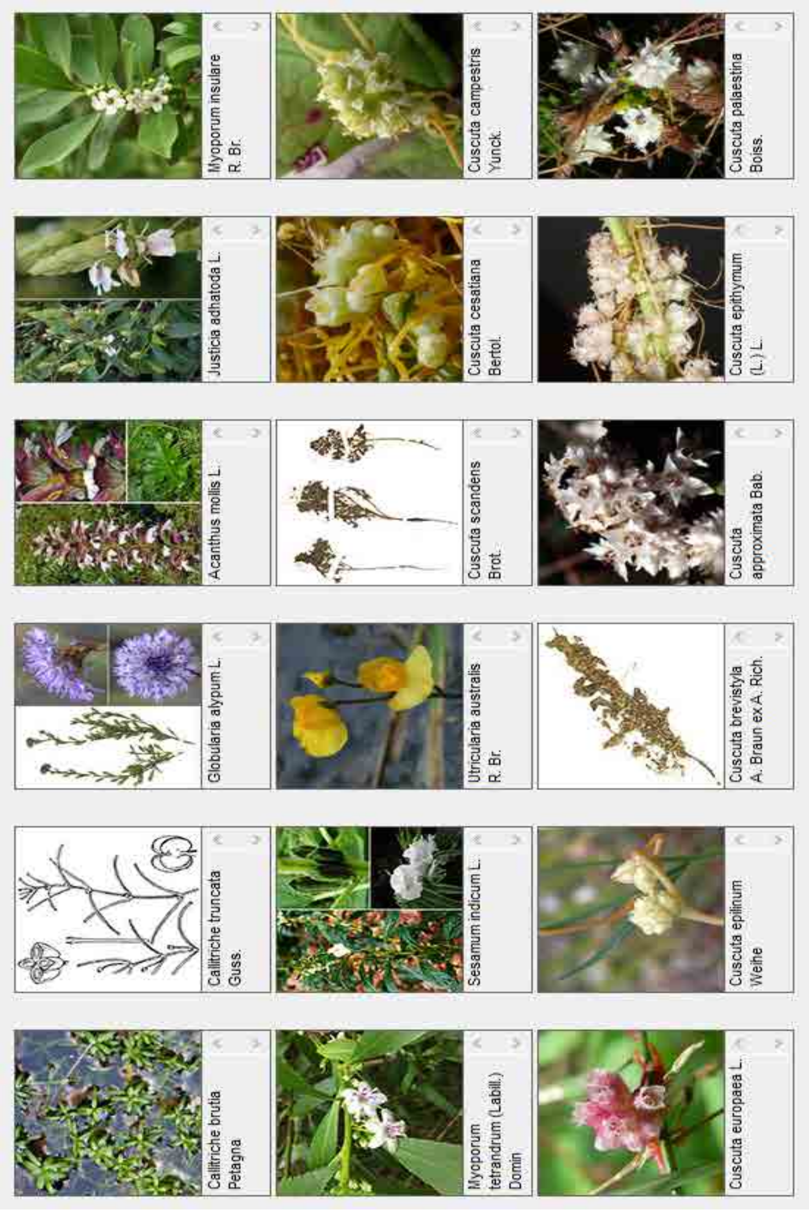

Orobanche sanguinea C. Presl
Orobanche litorea Guss.
Orobanche chironii Lojac.
Orobanche minor Sm.
Orobanche canescens C. Presl
Orobanche gracilis Sm.
Orobanche variegata Wallr.
Antirrhinum majus L.
Antirrhinum tortuosum Bosc
Antirrhinum siculum Mill.
Misopates orontium (L.) Raf.
Misopates calycinum (Lam.) Rothm.
Chaenorhinum rubrifolium (Robill. et Castagne ex DC.)
Chaenorhinum rupestre (Guss.) Speta
Chaenorhinum minus (L.) Lange
Linaria reflexa (L.) Desf.
Linaria triphylla (L.) Mill.
Linaria sibthorpiana Boiss. et Heldr. ex Boiss.

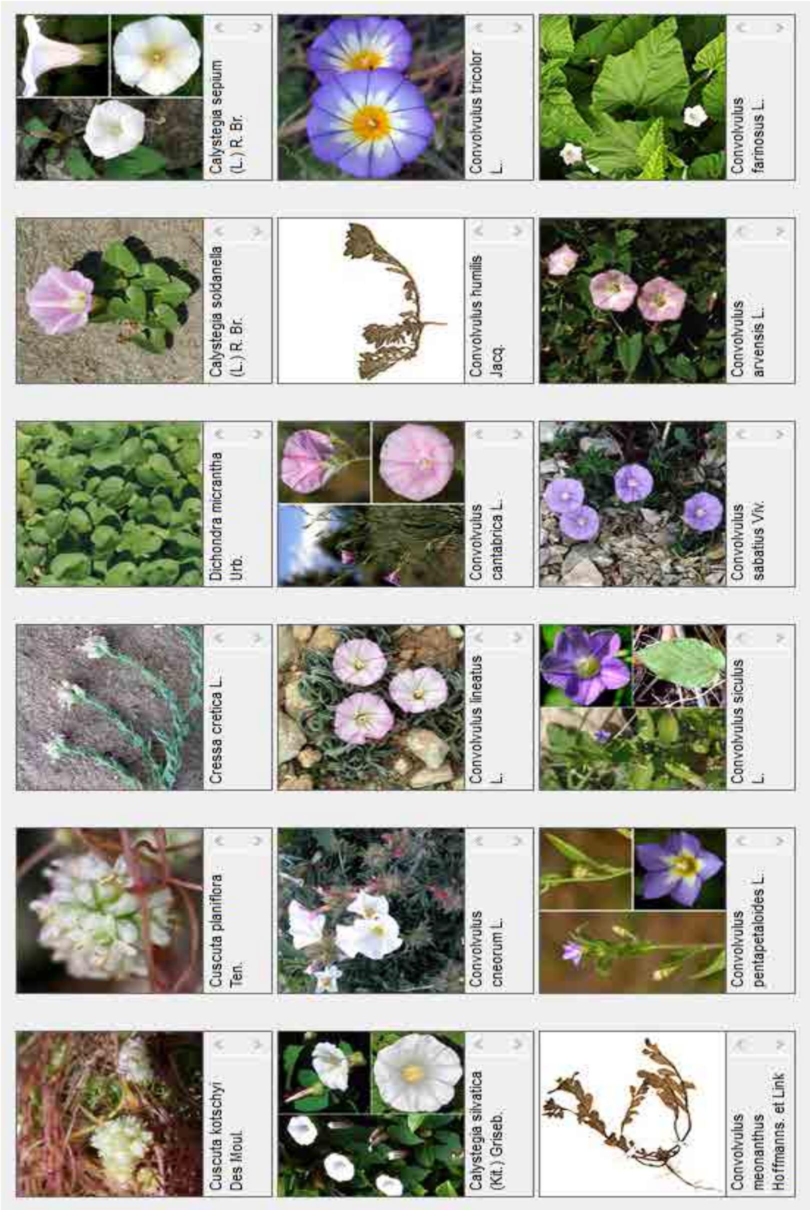

Linaria vulgaris Mill.
Linaria multicaulis (L.) Mill.
Linaria pelisseriana (L.) Mill.
Linaria arvensis (L.) Desf.
Linaria simplex (Willd.) DC.
Linaria purpurea (L.) Mill.
Linaria chalepensis (L.) Mill.
Linaria pseudolaxiflora Lojac.
Cymbalaria pubescens (J. Presl) Cufod.
Cymbalaria muralis G. Gaertn., B. Mey. et Scherb.
Kickxia cirrhosa (L.) Fritsch
Kickxia commutata (Bernh. ex Rchb.) Fritsch
Kickxia elatine (L.) Dumort.
Kickxia spuria (L.) Dumort.
Kickxia lanigera (Desf.) Hand.-Mazz.
Veronica officinalis L.
Veronica montana L.
Veronica beccabunga L.



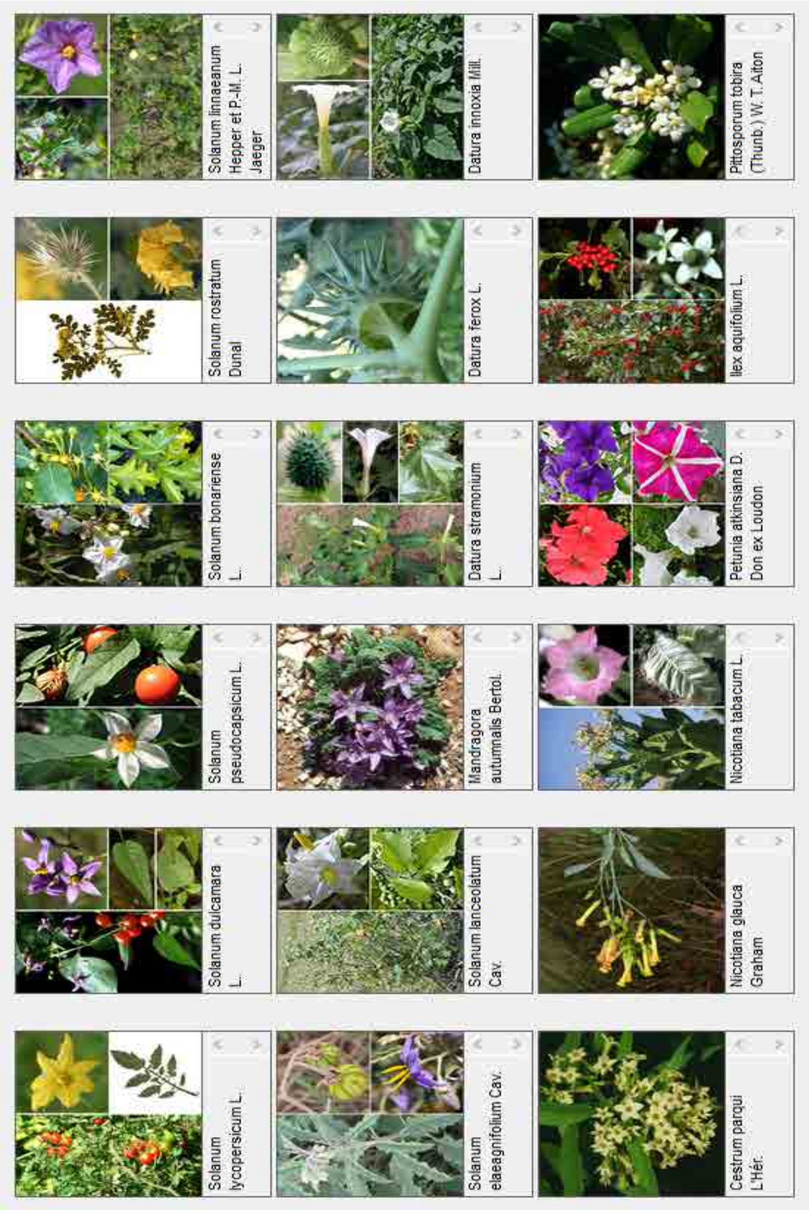
Veronica anagallis-aquatica L.
Veronica anagalloides Guss.
Veronica serpyllifolia L.
Veronica acinifolia L.
Veronica peregrina L.
Veronica arvensis L.
Veronica praecox All.
Veronica agrestis L.
Veronica polita Fr.
Veronica persica Poir.
Veronica hederifolia L.
Veronica panormitana Tineo ex Guss.
Veronica trichadena Jord. et Fourr.
Veronica cymbalaria Bodard
Plantago major L.
Plantago intermedia Gilib.
Plantago crassifolia Forssk.
Plantago coronopus L.


Plantago weldenii Rchb.
Plantago macrorhiza Poir.
Plantago cupanii Guss.
Plantago serraria L.
Plantago peloritana Lojac.
Plantago subulata L.
Plantago humilis Guss.
Plantago lanceolata L.
Plantago lagopus L.
Plantago bellardii All.
Plantago albicans L.
Plantago afra L.
Callitriche stagnalis Scop.
Callitriche platycarpa Kütz.
Callitriche ×vigens K. Martinsson
Callitriche lenisulca Clavaud
Callitriche obtusangula Le Gall
Callitriche cophocarpa Sendtn.

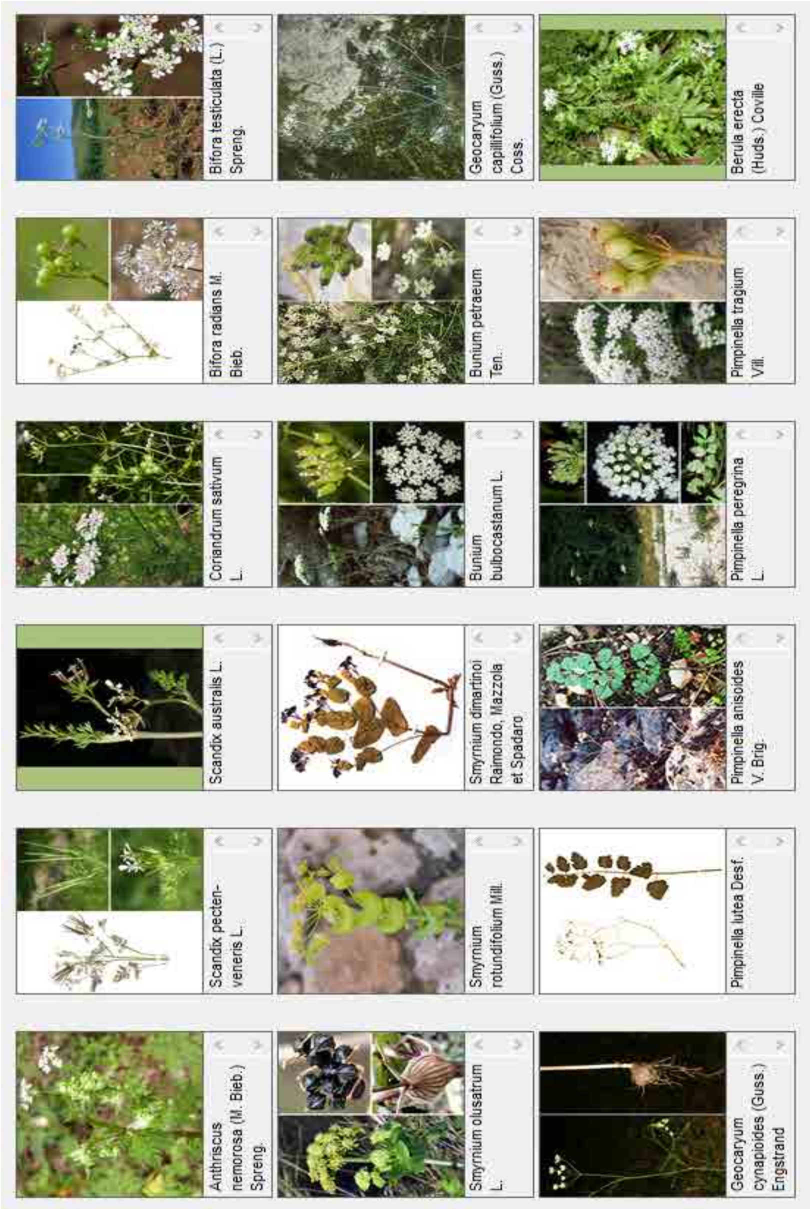

Callitriche brutia Petagna
Callitriche truncata Guss.
Globularia alypum L.
Acanthus mollis L.
Justicia adhatoda L.
Myoporum insulare R. Br.
Myoporum tetrandrum (Labill.) Domin
Sesamum indicum L.
Utricularia australis R. Br.
Cuscuta scandens Brot.
Cuscuta cesatiana Bertol.
Cuscuta campestris Yunck.
Cuscuta europaea L.
Cuscuta epilinum Weihe
Cuscuta brevistyla A. Braun ex A. Rich.
Cuscuta approximata Bab.
Cuscuta epithymum (L.) L.
Cuscuta palaestina Boiss.

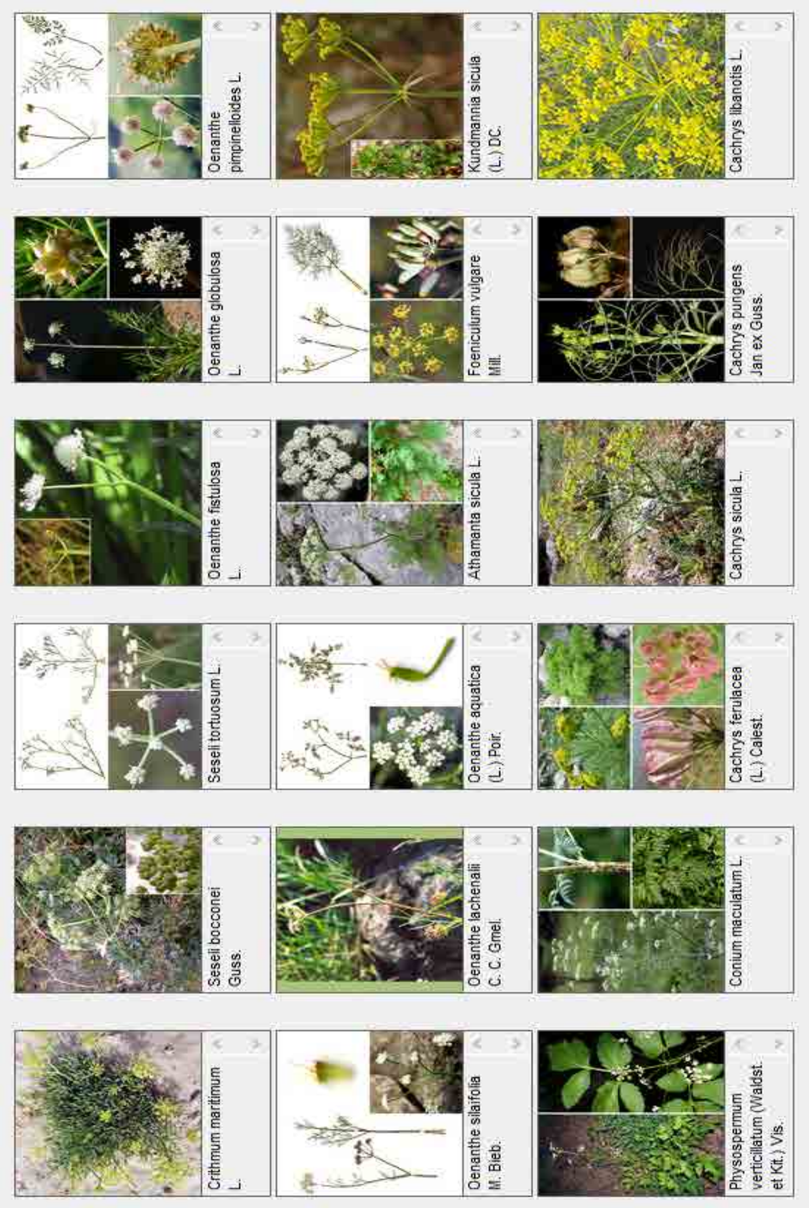

Cuscuta kotschyi Des Moul.
Cuscuta planiflora Ten.
Cressa cretica L.
Dichondra micrantha Urb.
Calystegia soldanella (L.) R. Br.
Calystegia sepium (L.) R. Br.
Calystegia silvatica (Kit.) Griseb.
Convolvulus cneorum L.
Convolvulus lineatus L.
Convolvulus cantabrica L.
Convolvulus humilis Jacq.
Convolvulus tricolor L.
Convolvulus meonanthus Hoffmanns. et Link
Convolvulus pentapetaloides L.
Convolvulus siculus L.
Convolvulus sabatius Viv.
Convolvulus arvensis L.
Convolvulus farinosus L.

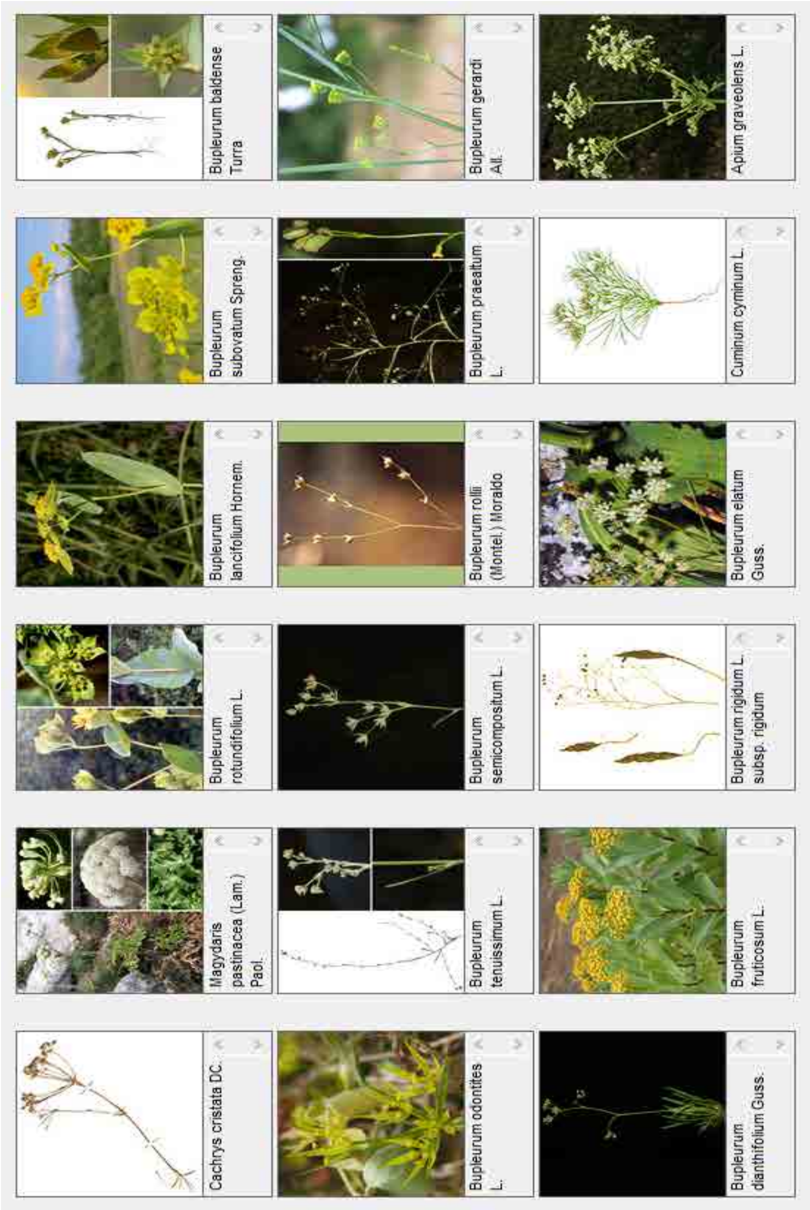

Convolvulus althaeoides L.
Convolvulus elegantissimus Mill.
Ipomoea imperati (Vahl) Griseb.
Ipomoea sagittata Poir.
Ipomoea purpurea Roth
Nicandra physalodes (L.) Gaertn.
Lycium europaeum L.
Lycium intricatum Boiss.
Atropa bella-donna L.
Hyoscyamus niger L.
Hyoscyamus albus L.
Withania somnifera (L.) Dunal
Physalis peruviana L.
Salpichroa origanifolia (Lam.) Baill.
Solanum nigrum L.
Solanum villosum Mill.
Solanum tuberosum L.
Solanum melongena L.

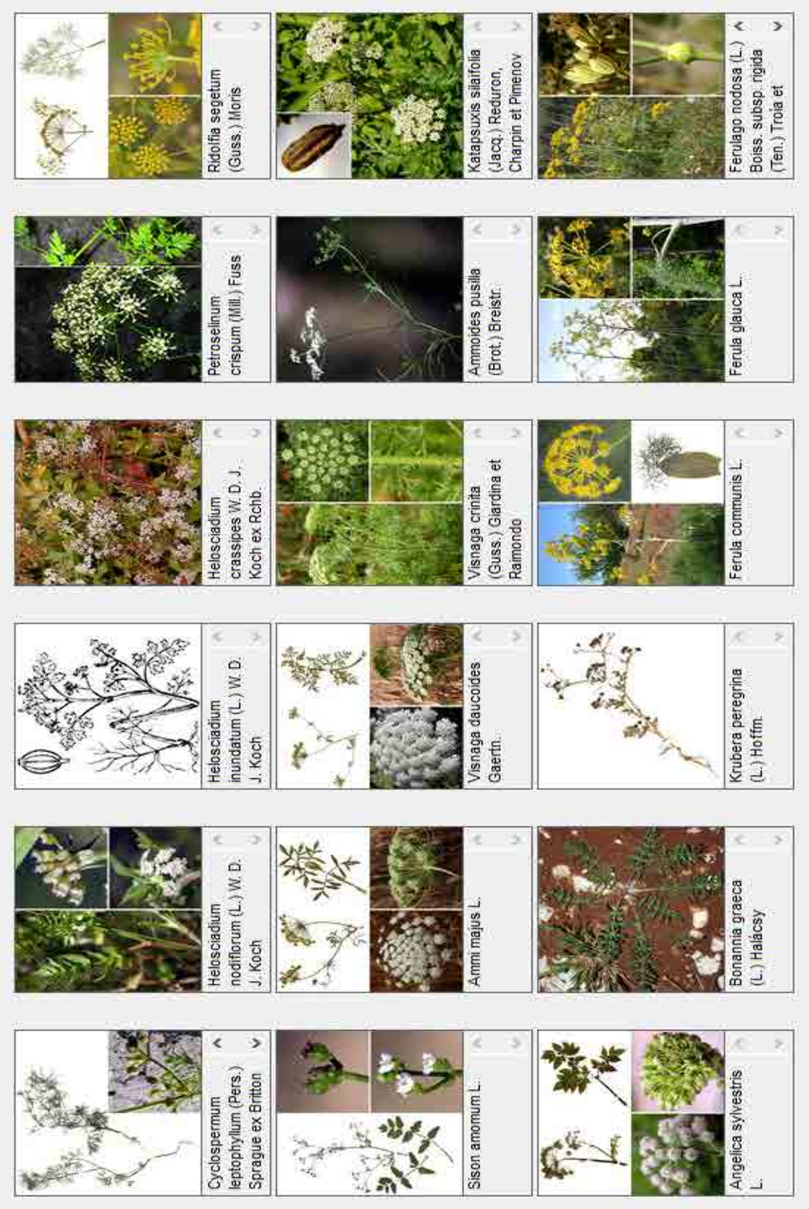

Solanum lycopersicum L.
Solanum dulcamara L.
Solanum pseudocapsicum L.
Solanum bonariense L.
Solanum rostratum Dunal
Solanum linnaeanum Hepper et P.-M. L. Jaeger
Solanum elaeagnifolium Cav.
Solanum lanceolatum Cav.
Mandragora autumnalis Bertol.
Datura stramonium L.
Datura ferox L.
Datura innoxia Mill.
Cestrum parqui L'Hér.
Nicotiana glauca Graham
Nicotiana tabacum L.
Petunia atkinsiana D. Don ex Loudon
Ilex aquifolium L.
Pittosporum tobira (Thunb.) W. T. Aiton

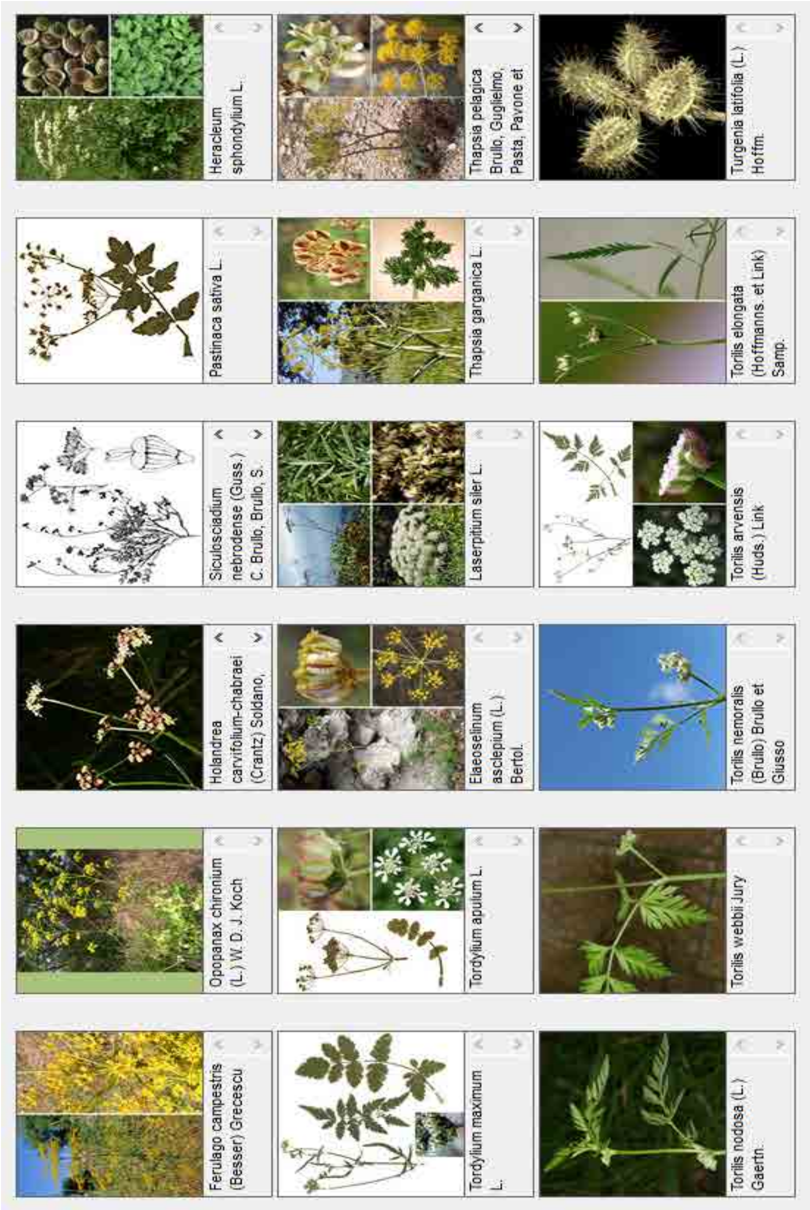

Hedera helix L.
Hedera canariensis Willd.
Hydrocotyle ranunculoides L. f.
Hydrocotyle vulgaris L.
Sanicula europaea L.
Eryngium pusillum L.
Eryngium maritimum L.
Eryngium dichotomum Desf.
Eryngium tricuspidatum L.
Eryngium triquetrum Vahl
Eryngium campestre L.
Eryngium amethystinum L.
Eryngium crinitum C. Presl
Petagnaea gussonei (Spreng.) Rauschert
Echinophora spinosa L.
Echinophora tenuifolia L. subsp. tenuifolia
Myrrhoides nodosa (L.) Cannon
Chaerophyllum temulum L.

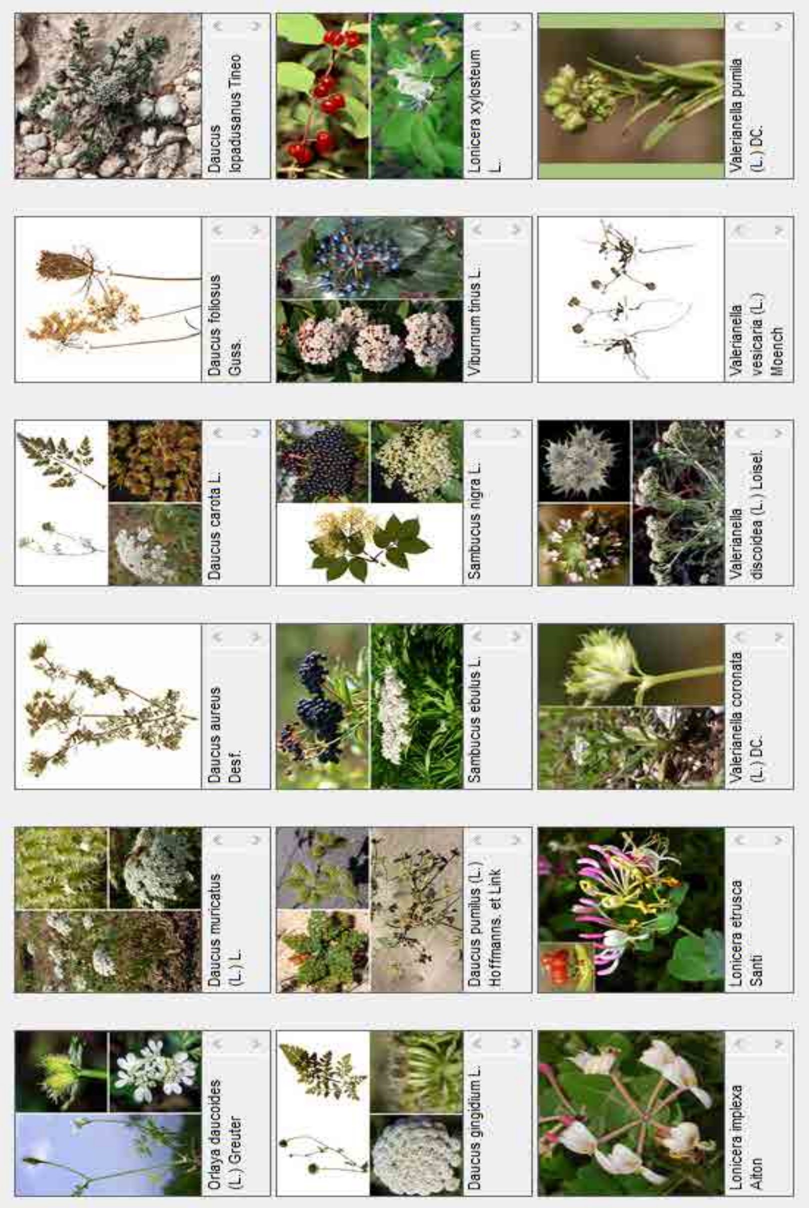

Anthriscus nemorosa (M. Bieb.) Spreng.
Scandix pecten-veneris L.
Scandix australis L.
Coriandrum sativum L.
Bifora radians M. Bieb.
Bifora testiculata (L.) Spreng.
Smyrnium olusatrum L.
Smyrnium rotundifolium Mill.
Smyrnium dimartinoi Raimondo, Mazzola et Spadaro
Bunium bulbocastanum L.
Bunium petraeum Ten.
Geocaryum capillifolium (Guss.) Coss.
Geocaryum cynapioides (Guss.) Engstrand
Pimpinella lutea Desf.
Pimpinella anisoides V. Brig.
Pimpinella peregrina L.
Pimpinella tragium Vill.
Berula erecta (Huds.) Coville

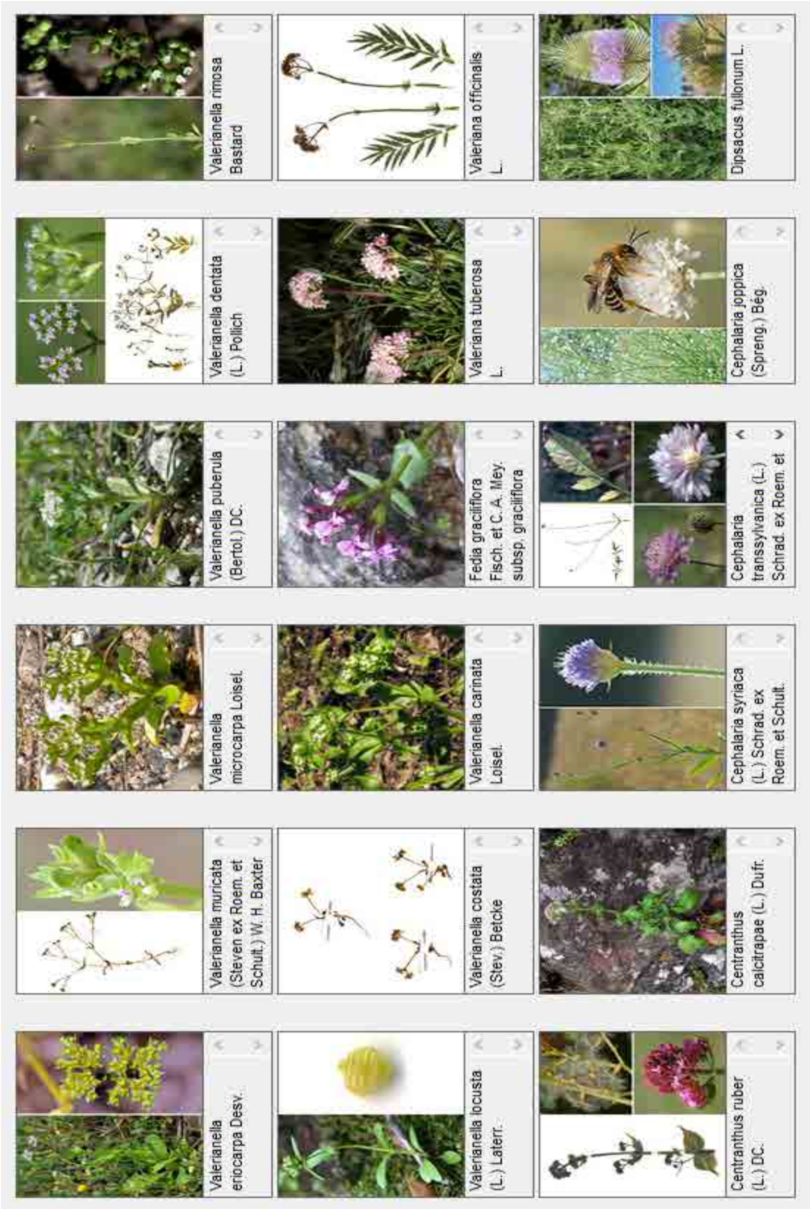

Crithmum maritimum L.
Seseli bocconei Guss.
Seseli tortuosum L.
Oenanthe fistulosa L.
Oenanthe globulosa L.
Oenanthe pimpinelloides L.
Oenanthe silaifolia M. Bieb.
Oenanthe lachenalii C. C. Gmel.
Oenanthe aquatica (L.) Poir.
Athamanta sicula L.
Foeniculum vulgare Mill.
Kundmannia sicula (L.) DC.
Physospermum verticillatum (Waldst. et Kit.) Vis.
Conium maculatum L.
Cachrys ferulacea (L.) Calest.
Cachrys sicula L.
Cachrys pungens Jan ex Guss.
Cachrys libanotis L.

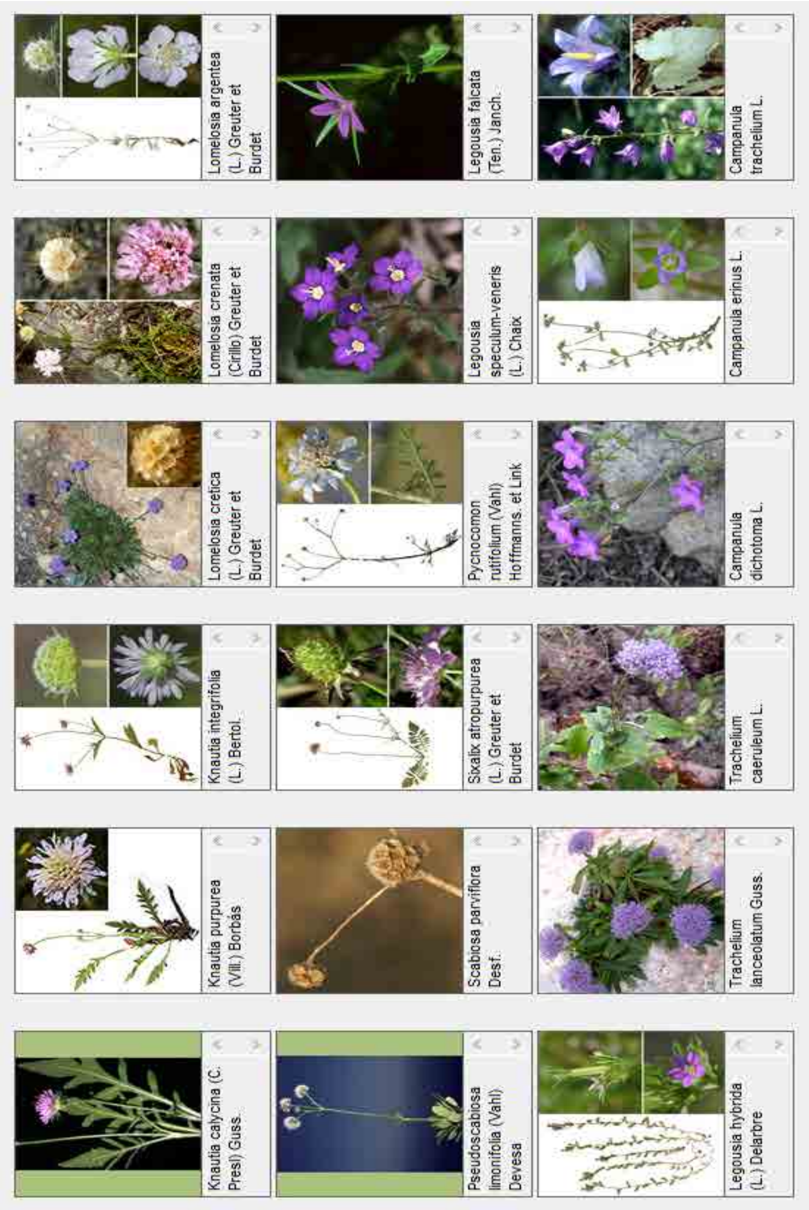

Cachrys cristata DC.
Magydaris pastinacea (Lam.) Paol.
Bupleurum rotundifolium L.
Bupleurum lancifolium Hornem.
Bupleurum subovatum Spreng.
Bupleurum baldense Turra
Bupleurum odontites L.
Bupleurum tenuissimum L.
Bupleurum semicompositum L.
Bupleurum rollii (Montel.) Moraldo
Bupleurum praealtum L.
Bupleurum gerardi All.
Bupleurum dianthifolium Guss.
Bupleurum fruticosum L.
Bupleurum rigidum L. subsp. rigidum
Bupleurum elatum Guss.
Cuminum cyminum L.
Apium graveolens L.

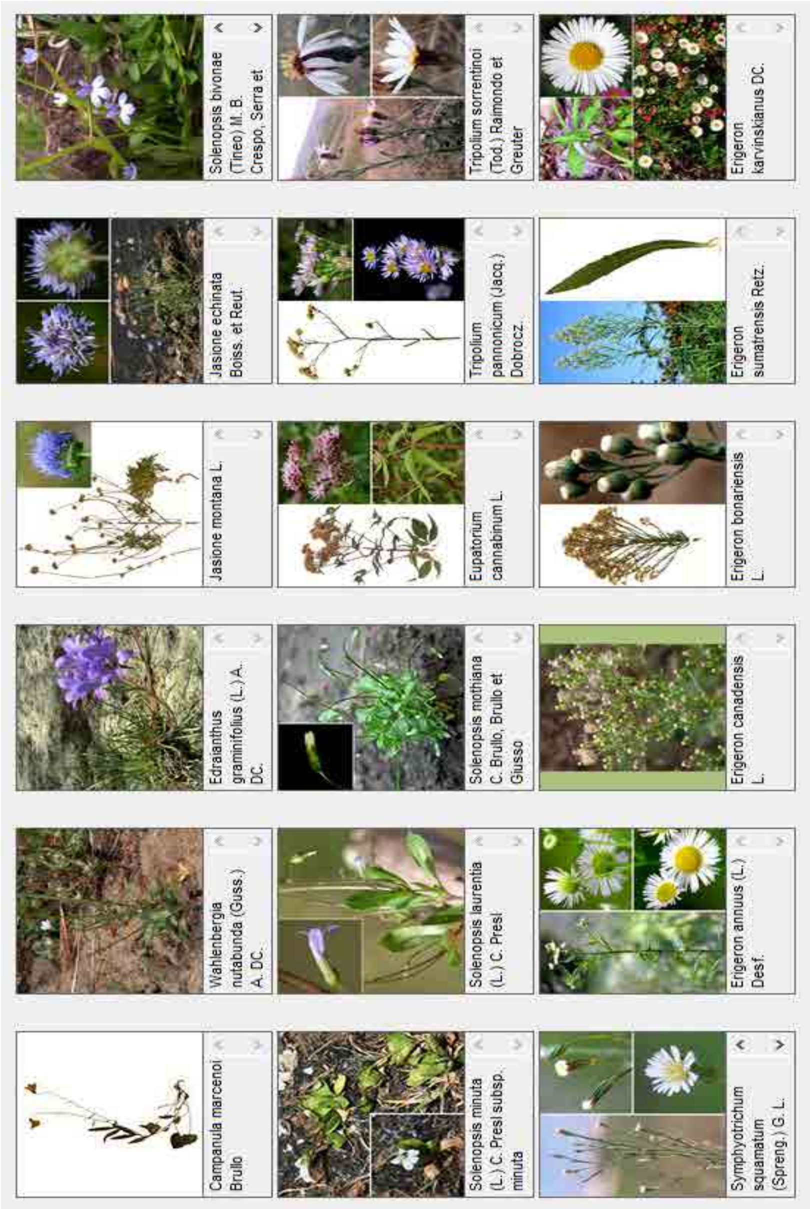

Cyclospermum
leptophyllum (Pers.)
Sprague ex Britton
Helosciadium
nodiflorum (L.) W. D.
J. Koch
Helosciadium
inundatum (L.) W. D.
J. Koch
Helosciadium
crassipes W. D. J.
Koch ex Rchb.
Petroselinum
crispum (Mill.) Fuss
Ridolfia segetum
(Guss.) Moris
Sison amomum L.
Ammi majus L.
Visnaga daucoides
Gaertn.
Visnaga crinita
(Guss.) Giardina et
Raimondo
Ammoides pusilla
(Brot.) Breistr.
Katapsuxis silaifolia
(Jacq.) Reduron,
Charpin et Pimenov
Angelica sylvestris
L.
Bonannia graeca
(L.) Halácsy
Krubera peregrina
(L.) Hoffm.
Ferula communis L.
Ferula glauca L.
Ferulago nodosa (L.)
Boiss. subsp. rigida
(Ten.) Troia et

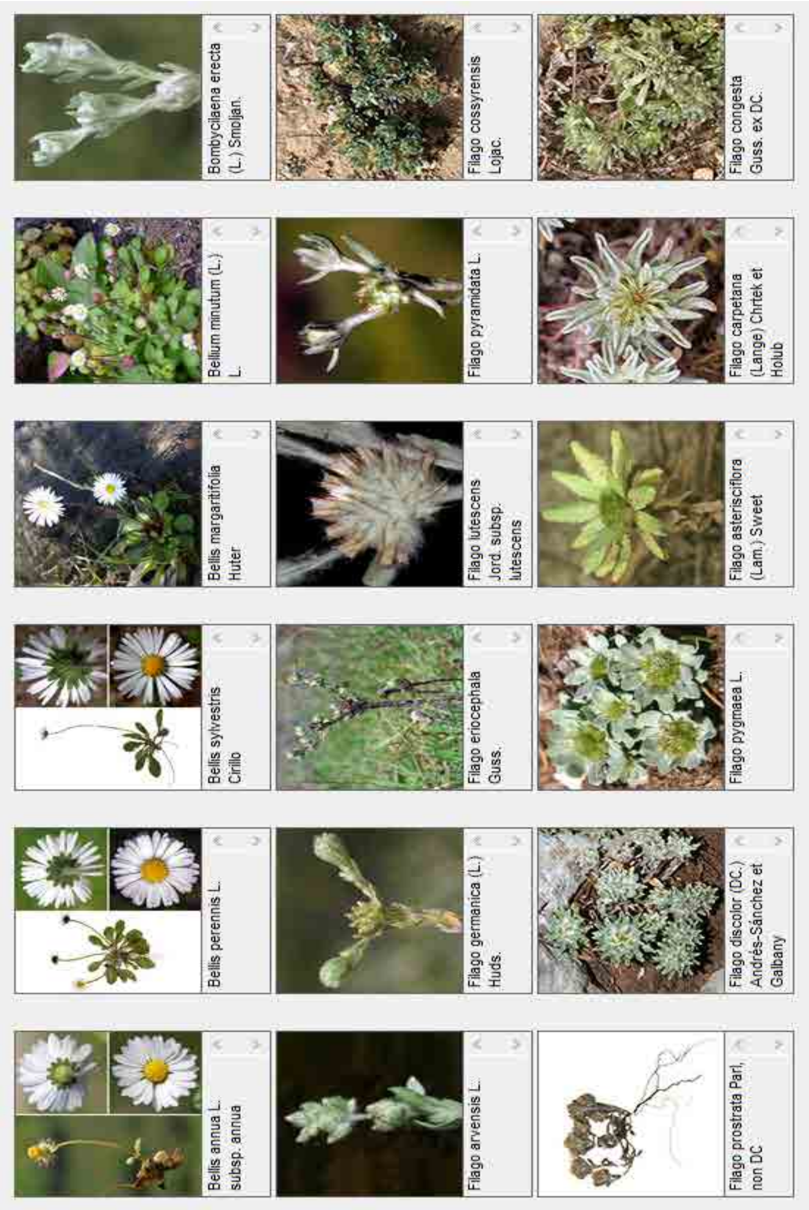

Ferulago campestris (Besser) Grecescu
Opopanax chironium (L.) W. D. J. Koch
Holandrea carvifolium-chabraei (Crantz) Soldano,
Siculosciadium nebrodense (Guss.) C. Brullo, Brullo, S.
Pastinaca sativa L.
Heracleum sphondylium L.
Tordylium maximum L.
Tordylium apulum L.
Elaeoselinum asclepium (L.) Bertol.
Laserpitium siler L.
Thapsia garganica L.
Thapsia pelagica Brullo, Guglielmo, Pasta, Pavone et
Torilis nodosa (L.) Gaerth.
Torilis webbii Jury
Torilis nemoralis (Brullo) Brullo et Giusso
Torilis arvensis (Huds.) Link
Torilis elongata (Hoffmanns. et Link) Samp.
Turgenia latifolia (L.) Hoffm.

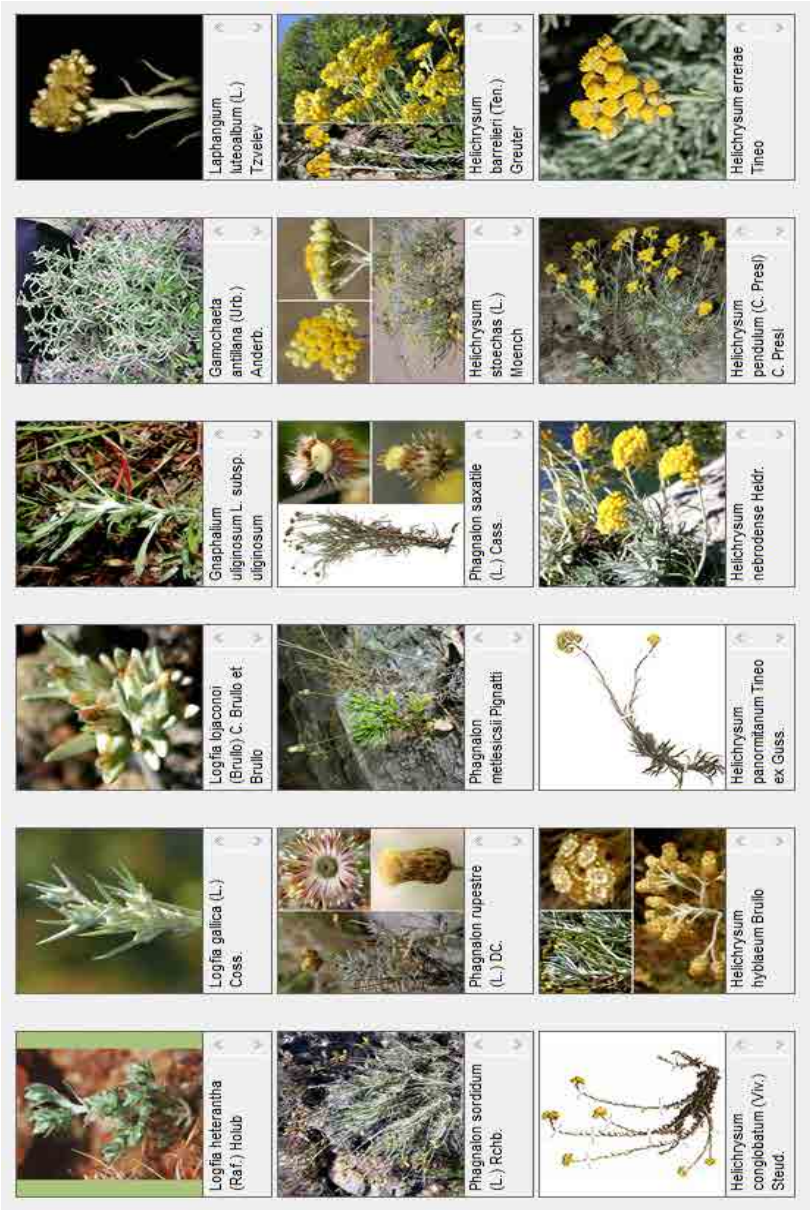

Orlaya daucoides (L.) Greuter
Daucus muricatus (L.) L.
Daucus aureus Desf.
Daucus carota L.
Daucus foliosus Guss.
Daucus lopadusanus Tineo
Daucus gingidium L.
Daucus pumilus (L.) Hoffmanns. et Link
Sambucus ebulus L.
Sambucus nigra L.
Viburnum tinus L.
Lonicera xylosteum L.
Lonicera implexa Aiton
Lonicera etrusca Santi
Valerianella coronata (L.) DC.
Valerianella discoidea (L.) Loisel.
Valerianella vesicaria (L.) Moench
Valerianella pumila (L.) DC.

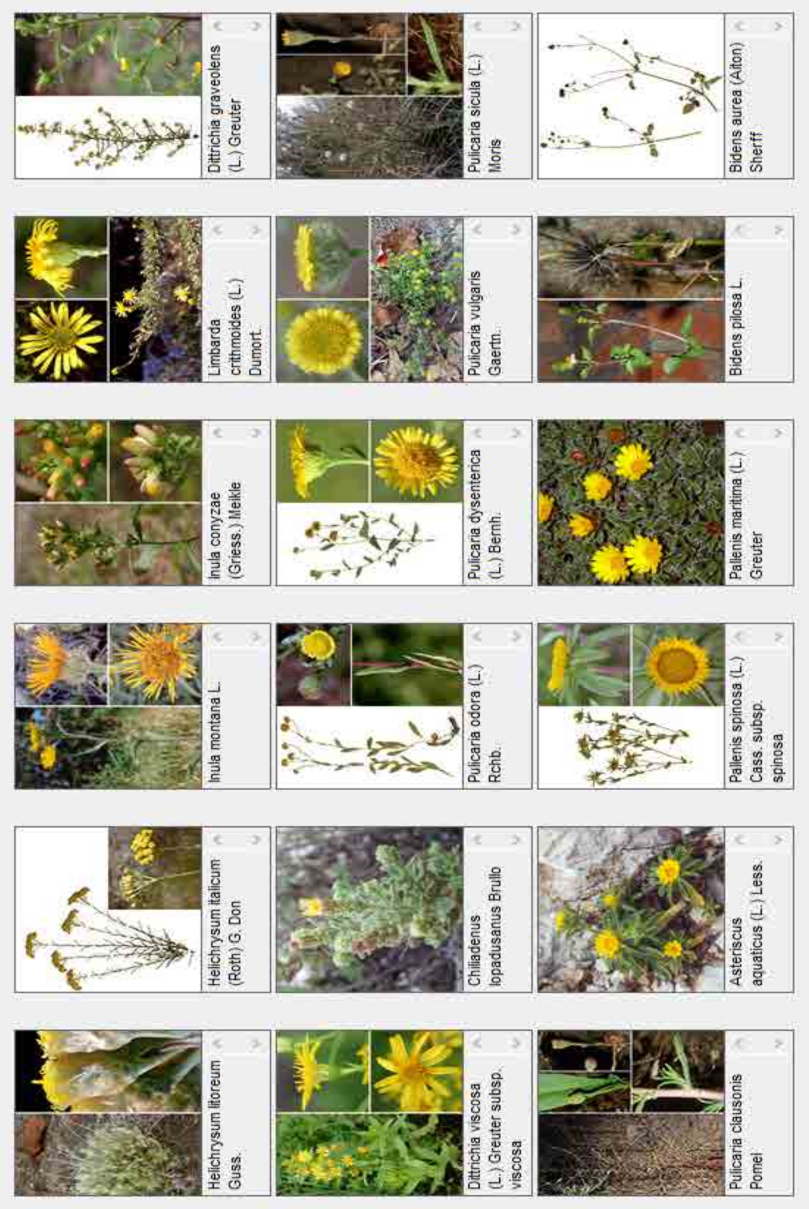

Valerianella eriocarpa Desv.
Valerianella muricata (Steven ex Roem. et Schult.) W. H. Baxter
Valerianella microcarpa Loisel.
Valerianella puberula (Bertol.) DC.
Valerianella dentata (L.) Pollich
Valerianella rimosa Bastard
Valerianella locusta (L.) Laterr.
Valerianella costata (Stev.) Betcke
Valerianella carinata Loisel.
Fedia graciliflora Fisch. et C. A. Mey. subsp. graciliflora
Valeriana tuberosa L.
Valeriana officinalis L.
Centranthus ruber (L.) DC.
Centranthus calcitrapae (L.) Dufr.
Cephalaria syriaca (L.) Schrad. ex Roem. et Schult.
Cephalaria transsylvanica (L.) Schrad. ex Roem. et
Cephalaria joppica (Spreng.) Bég.
Dipsacus fullonum L.

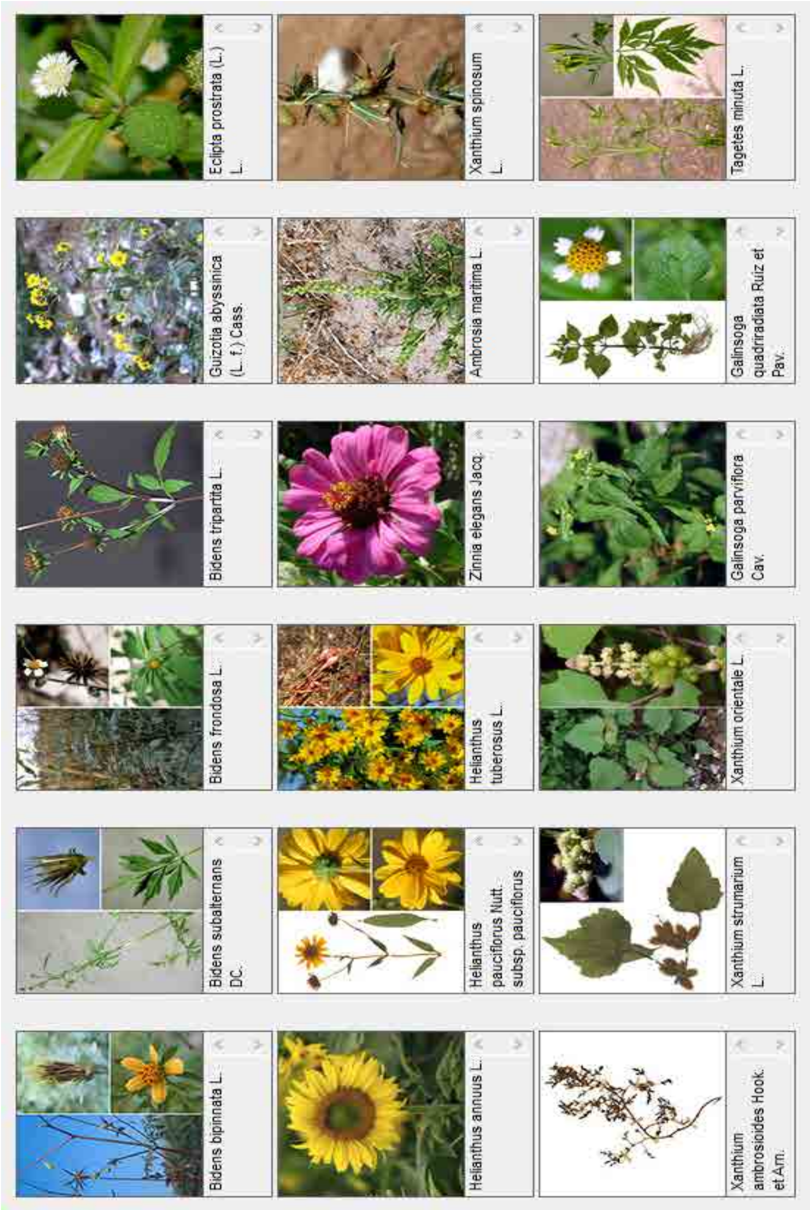

Knautia calycina (C. Presl) Guss.
Knautia purpurea (Vill.) Borbás
Knautia integrifolia (L.) Bertol.
Lomelosia cretica (L.) Greuter et Burdet
Lomelosia crenata (Cirillo) Greuter et Burdet
Lomelosia argentea (L.) Greuter et Burdet
Pseudoscabiosa limonifolia (Vahl) Devesa
Scabiosa parviflora Desf.
Sixalix atropurpurea (L.) Greuter et Burdet
Pycnocomon rutifolium (Vahl) Hoffmanns. et Link
Legousia speculum-veneris (L.) Chaix
Legousia falcata (Ten.) Janch.
Legousia hybrida (L.) Delarbre
Trachelium lanceolatum Guss.
Trachelium caeruleum L.
Campanula dichotoma L.
Campanula erinus L.
Campanula trachelium L.


Campanula marcenoi Brullo
Wahlenbergia nutabunda (Guss.) A. DC.
Edraianthus graminifolius (L.) A. DC.
Jasione montana L.
Jasione echinata Boiss. et Reut.
Solenopsis bivonae (Tineo) M. B. Crespo, Serra et
Solenopsis minuta (L.) C. Presl subsp. minuta
Solenopsis laurentia (L.) C. Presl
Solenopsis mothiana C. Brullo, Brullo et Giusso
Eupatorium cannabinum L.
Tripolium pannonicum (Jacq.) Dobrocz.
Tripolium sorrentinoi (Tod.) Raimondo et Greuter
Symphyotrichum squamatum (Spreng.) G. L.
Erigeron annuus (L.) Desf.
Erigeron canadensis L.
Erigeron bonariensis L.
Erigeron sumatrensis Retz.
Erigeron karvinskianus DC.

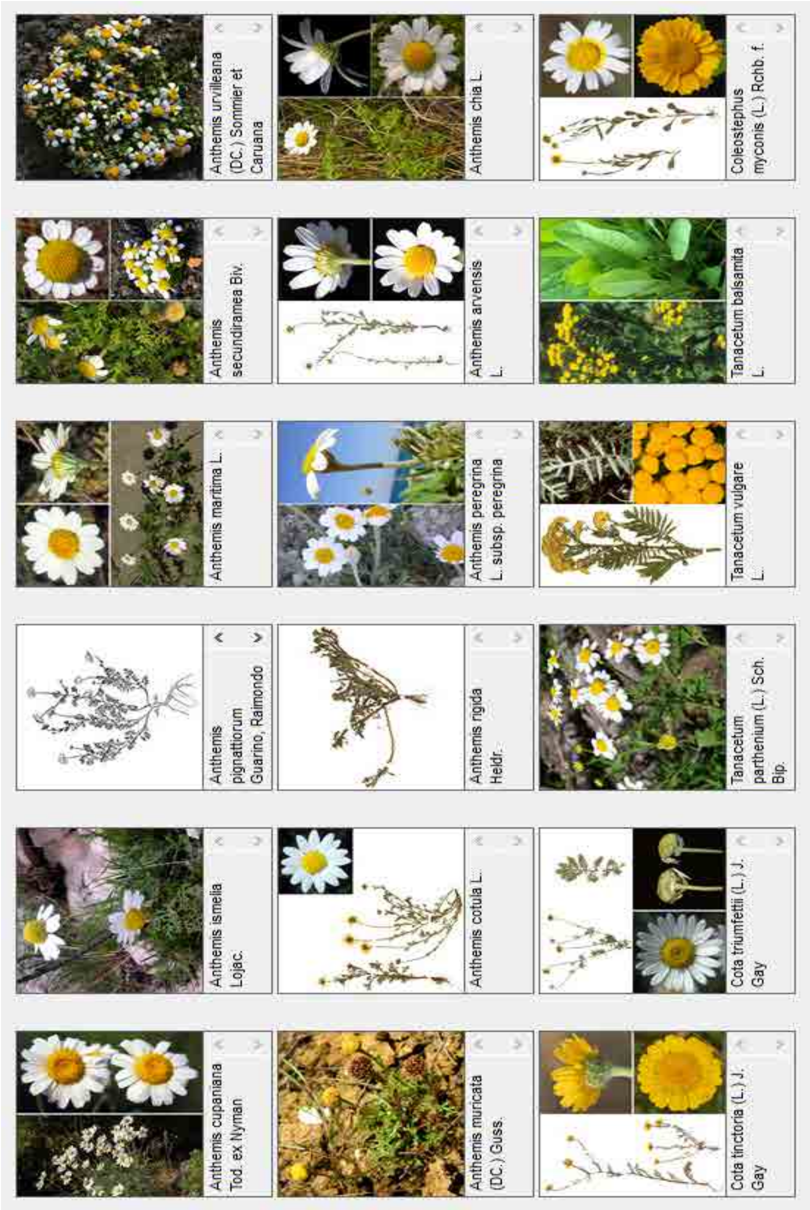

Bellis annua L. subsp. annua
Bellis perennis L.
Bellis sylvestris Cirillo
Bellis margaritifolia Huter
Bellium minutum (L.) L.
Bombycilaena erecta (L.) Smoljan.
Filago arvensis L.
Filago germanica (L.) Huds.
Filago eriocephala Guss.
Filago lutescens Jord. subsp. lutescens
Filago pyramidata L.
Filago cossyrensis Lojac.
Filago prostrata Parl. non DC
Filago discolor (DC.) Andrés-Sánchez et Galbany
Filago pygmaea L.
Filago asterisciflora (Lam.) Sweet
Filago carpetana (Lange) Chrtek et Holub
Filago congesta Guss. ex DC.

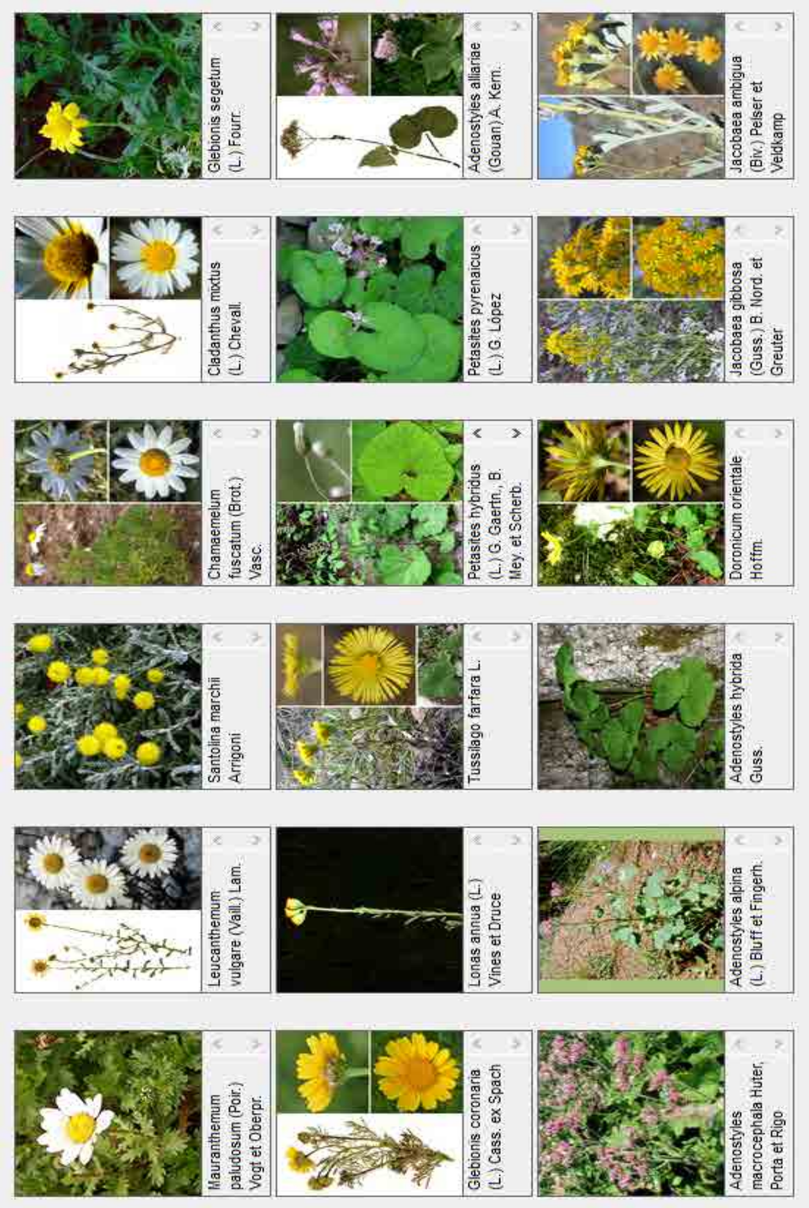

Logfia heterantha (Raf.) Holub
Logfia gallica (L.) Coss.
Logfia lojaconoi (Brullo) C. Brullo et Brullo
Gnaphalium uliginosum L. subsp. uliginosum
Gamochaeta antillana (Urb.) Anderb.
Laphangium luteoalbum (L.) Tzvelev
Phagnalon sordidum (L.) Rchb.
Phagnalon rupestre (L.) DC.
Phagnalon metlesicsii Pignatti
Phagnalon saxatile (L.) Cass.
Helichrysum stoechas (L.) Moench
Helichrysum barrelieri (Ten.) Greuter
Helichrysum conglobatum (Viv.) Steud.
Helichrysum hyblaeum Brullo
Helichrysum panormitanum Tineo ex Guss.
Helichrysum nebrodense Heldr.
Helichrysum pendulum (C. Presl) C. Presl
Helichrysum errerae Tineo

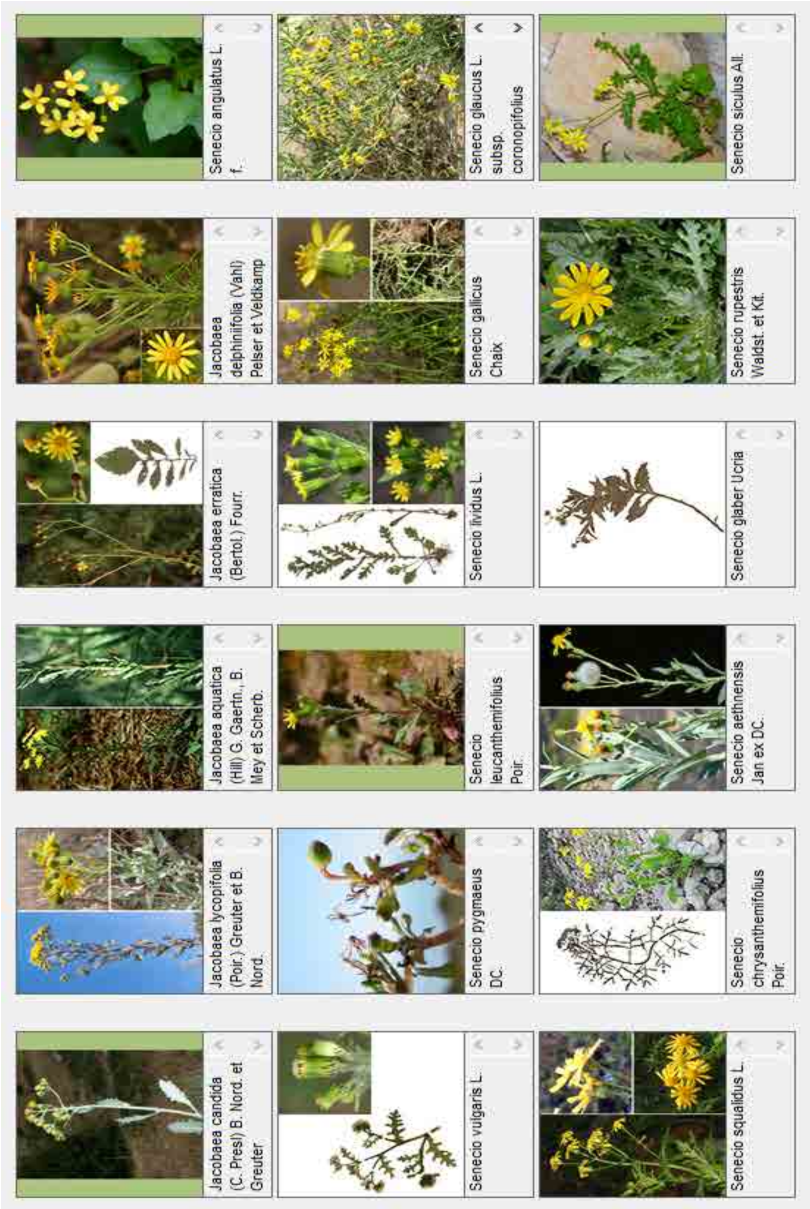

Helichrysum litoreum Guss.
Helichrysum italicum (Roth) G. Don
Inula montana L.
Inula conyzae (Griess.) Meikle
Limbarda crithmoides (L.) Dumort.
Dittrichia graveolens (L.) Greuter
Dittrichia viscosa (L.) Greuter subsp. viscosa
Chiliadenus lopadusanus Brullo
Pulicaria odora (L.) Rchb.
Pulicaria dysenterica (L.) Bernh.
Pulicaria vulgaris Gaertn.
Pulicaria sicula (L.) Moris
Pulicaria clausonis Pomel
Asteriscus aquaticus (L.) Less.
Pallenis spinosa (L.) Cass. subsp. spinosa
Pallenis maritima (L.) Greuter
Bidens pilosa L.
Bidens aurea (Aiton) Sherff

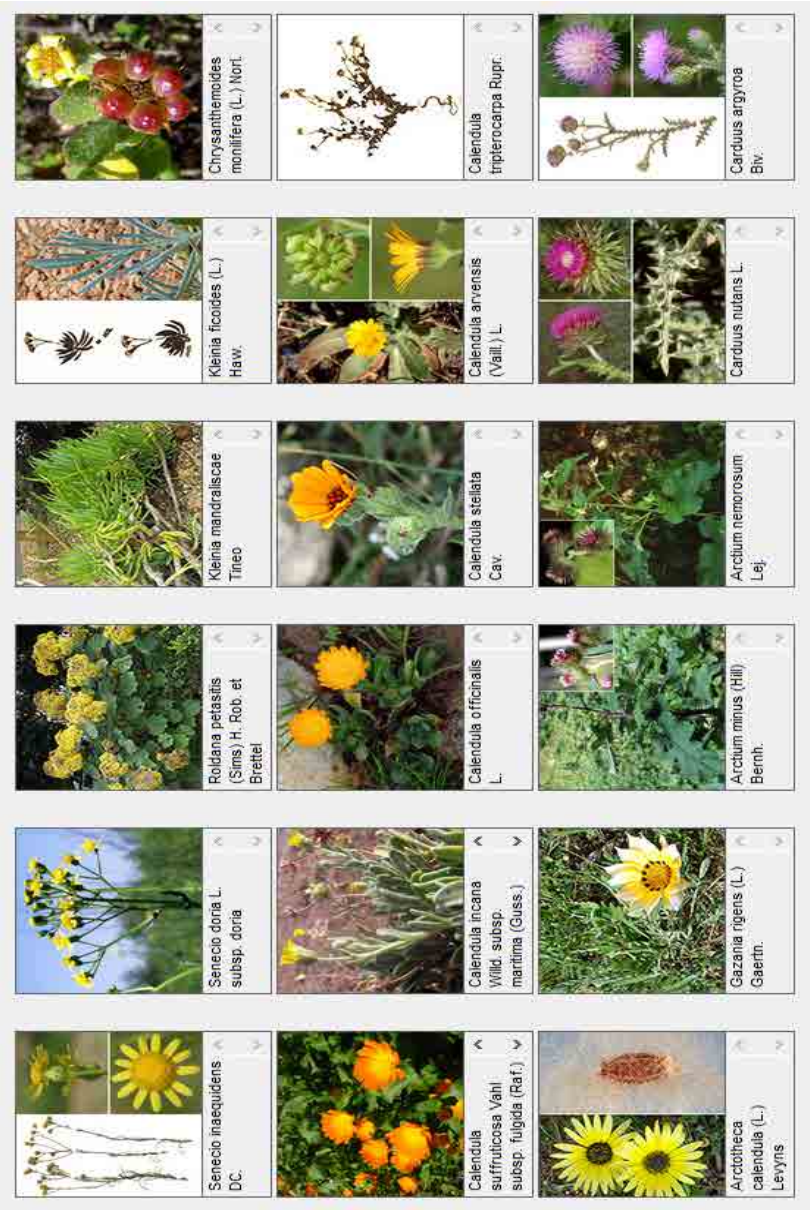

Bidens bipinnata L.
Bidens subalternans DC.
Bidens frondosa L.
Bidens tripartita L.
Guizotia abyssinica (L. f.) Cass.
Eclipta prostrata (L.) L.
Helianthus annuus L.
Helianthus pauciflorus Nutt. subsp. pauciflorus
Helianthus tuberosus L.
Zinnia elegans Jacq.
Ambrosia maritima L.
Xanthium spinosum L.
Xanthium ambrosioides Hook. et Arn.
Xanthium strumarium L.
Xanthium orientale L.
Galinsoga parviflora Cav.
Galinsoga quadriradiata Ruiz et Pav.
Tagetes minuta L.


Artemisia arborescens L.
Artemisia annua L.
Artemisia verlotiorum Lamotte
Artemisia vulgaris L.
Chrysanthemum indicum L.
Soliva stolonifera (Brot.) R. Br.
Achillea collina Becker ex Rchb.
Anacyclus clavatus (Desf.) Pers.
Anacyclus radiatus Loisel.
Artemisia dracunculus L.
Artemisia campestris L.
Artemisia alba Turra subsp. alba
Anthemis aetnensis Schouw
Anthemis cretica L.
Matricaria aurea (Loefl.) Sch. Bip.
Matricaria chamomilla L.
Achillea maritima (L.) Ehrend. et Y. P. Guo
Achillea ligustica All.

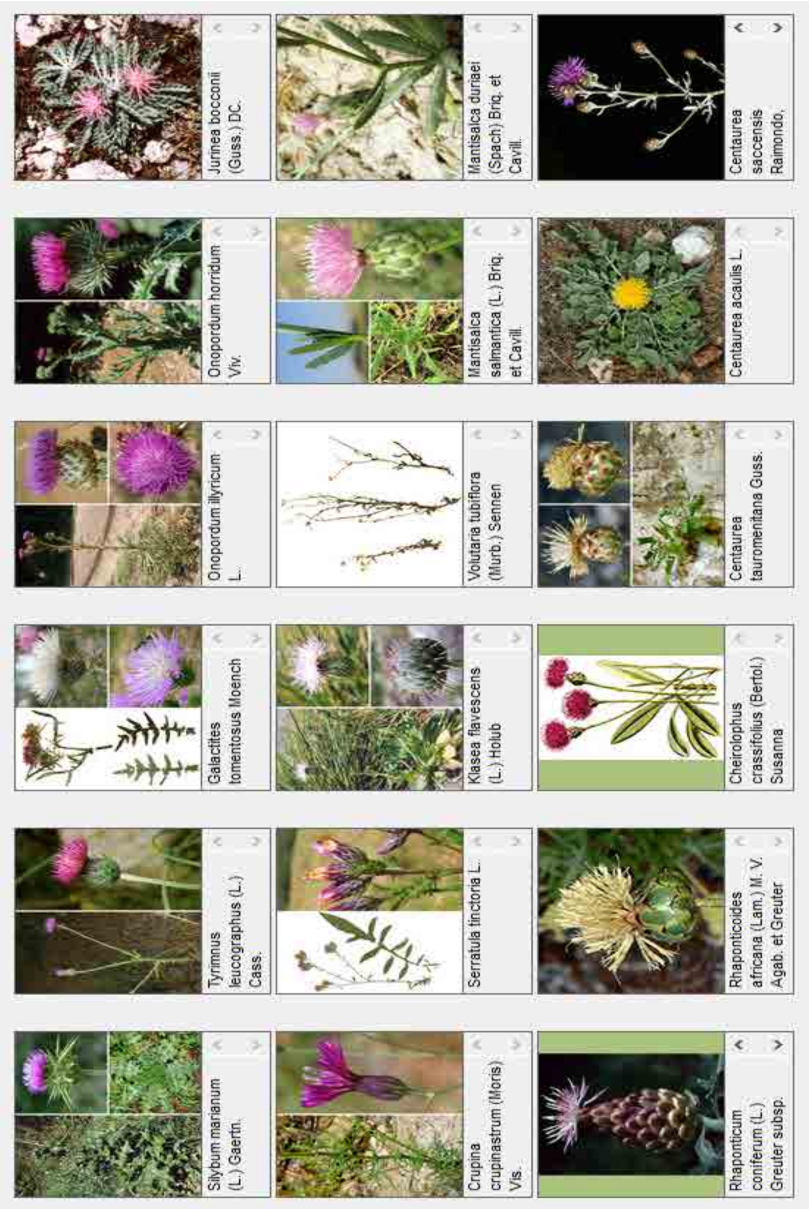

Anthemis cupaniana Tod. ex Nyman
Anthemis ismelia Lojac.
Anthemis pignattiorum Guarino, Raimondo
Anthemis maritima L.
Anthemis secundiramea Biv.
Anthemis urvilleana (DC.) Sommier et Caruana
Anthemis muricata (DC.) Guss.
Anthemis cotula L.
Anthemis rigida Heldr.
Anthemis peregrina L. subsp. peregrina
Anthemis arvensis L.
Anthemis chia L.
Cota tinctoria (L.) J. Gay
Cota triumfettii (L.) J. Gay
Tanacetum parthenium (L.) Sch. Bip.
Tanacetum vulgare L.
Tanacetum balsamita L.
Coleostephus myconis (L.) Rchb. f.

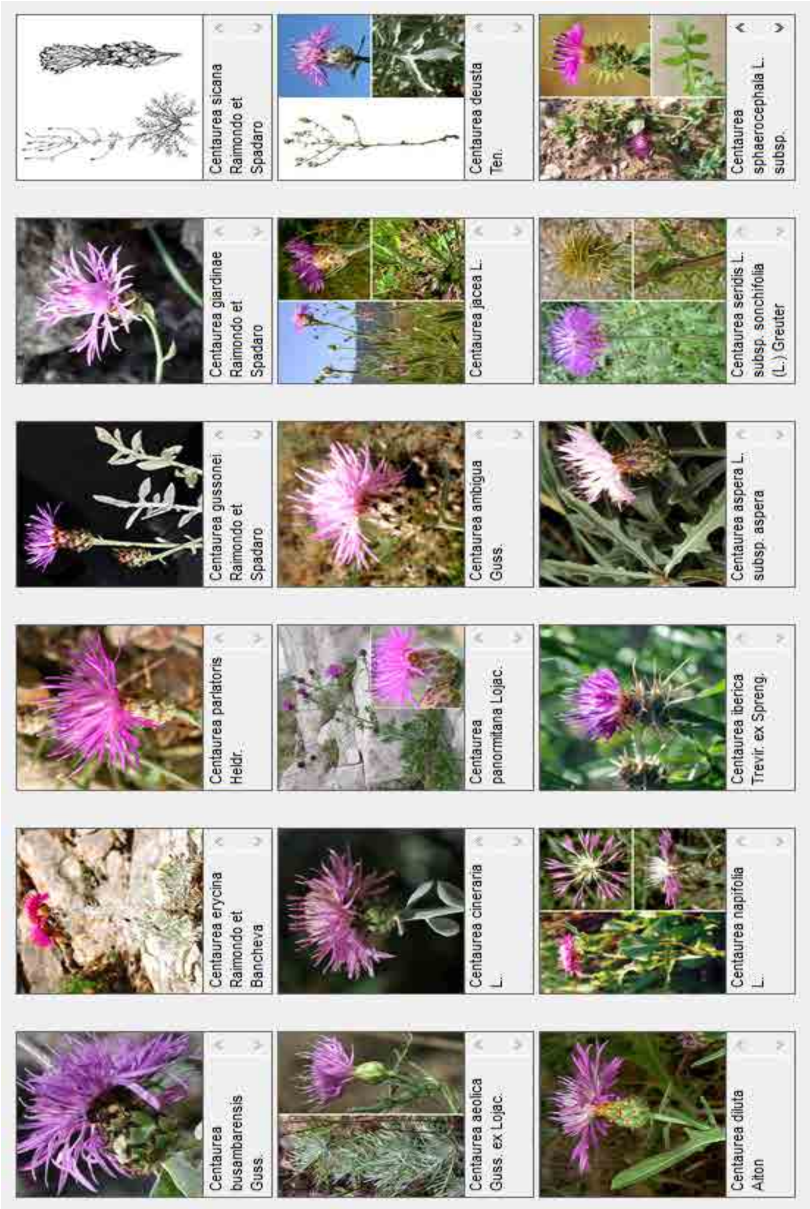

Mauranthemum paludosum (Poir.) Vogt et Oberpr.
Leucanthemum vulgare (Vaill.) Lam.
Santolina marchii Arrigoni
Chamaemelum fuscatum (Brot.) Vasc.
Cladanthus mixtus (L.) Chevall.
Glebionis segetum (L.) Fourr.
Glebionis coronaria (L.) Cass. ex Spach
Lonas annua (L.) Vines et Druce
Tussilago farfara L.
Petasites hybridus (L.) G. Gaertn., B. Mey. et Scherb.
Petasites pyrenaicus (L.) G. López
Adenostyles alliariae (Gouan) A. Kern.
Adenostyles macrocephala Huter, Porta et Rigo
Adenostyles alpina (L.) Bluff et Fingerh.
Adenostyles hybrida Guss.
Doronicum orientale Hoffm.
Jacobaea gibbosa (Guss.) B. Nord. et Greuter
Jacobaea ambigua (Biv.) Pelser et Veldkamp

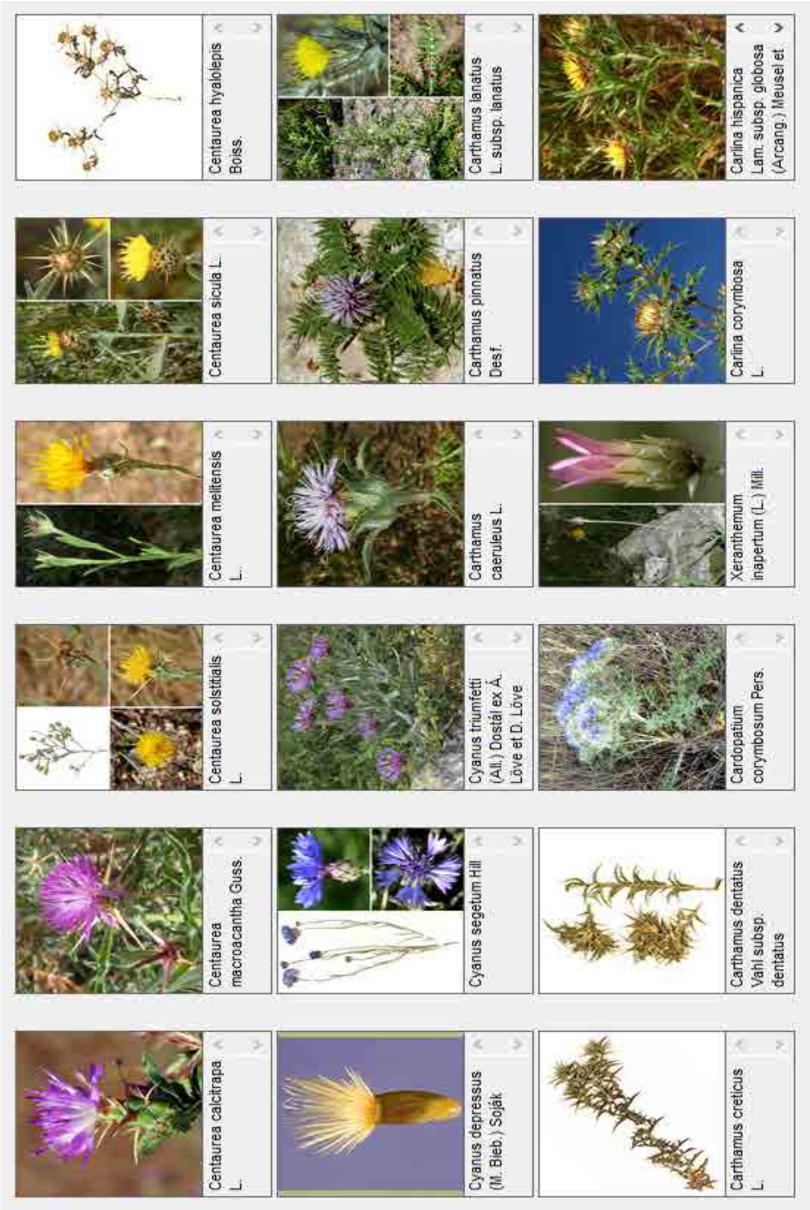

Jacobaea candida (C. Presl) B. Nord. et Greuter
Jacobaea lycopifolia (Poir.) Greuter et B. Nord.
Jacobaea aquatica (Hill) G. Gaertn., B. Mey et Scherb.
Jacobaea erratica (Bertol.) Fourr.
Jacobaea delphiniifolia (Vahl) Pelser et Veldkamp
Senecio angulatus L. f.
Senecio vulgaris L.
Senecio pygmaeus DC.
Senecio leucanthemifolius Poir.
Senecio lividus L.
Senecio gallicus Chaix
Senecio glaucus L. subsp. coronopifolius
Senecio squalidus L.
Senecio chrysanthemifolius Poir.
Senecio aethnensis Jan ex DC.
Senecio glaber Ucria
Senecio rupestris Waldst. et Kit.
Senecio siculus All.


Senecio inaequidens DC.
Senecio doria L. subsp. doria
Roldana petasitis (Sims) H. Rob. et Brettel
Kleinia mandraliscae Tineo
Kleinia ficoides (L.) Haw.
Chrysanthemoides monilifera (L.) Norl.
Calendula suffruticosa Vahl subsp. fulgida (Raf.)
Calendula incana Willd. subsp. maritima (Guss.)
Calendula officinalis L.
Calendula stellata Cav.
Calendula arvensis (Vaill.) L.
Calendula tripterocarpa Rupr.
Arctotheca calendula (L.) Levyns
Gazania rigens (L.) Gaertn.
Arctium minus (Hill) Bernh.
Arctium nemorosum Lej.
Carduus nutans L.
Carduus argyroa Biv.


Carduus corymbosus Ten.
Carduus acicularis Bertol.
Carduus cephalanthus Viv.
Carduus pycnocephalus L.
Carduus tenuiflorus Curtis
Picnomon acarna (L.) Cass.
Notobasis syriaca (L.) Cass.
Ptilostemon greuteri Raimondo et Domina
Ptilostemon niveus (C. Presl) Greuter
Ptilostemon stellatus (L.) Greuter
Cirsium vulgare (Savi) Ten.
Cirsium italicum DC.
Cirsium vallis-demonis Lojac.
Cirsium scabrum (Poir.) Bonnet et Barratte
Cirsium echinatum (Desf.) DC.
Cirsium creticum (Lam.) d'Urv.
Cirsium arvense (L.) Scop.
Cynara cardunculus L.


Silybum marianum (L.) Gaertn.
Tyrimnus leucographus (L.) Cass.
Galactites tomentosus Moench
Onopordum illyricum L.
Onopordum horridum Viv.
Jurinea bocconii (Guss.) DC.
Crupina crupinastrum (Moris) Vis.
Serratula tinctoria L.
Klasea flavescens (L.) Holub
Volutaria tubiflora (Murb.) Sennen
Mantisalca salmantica (L.) Briq. et Cavill.
Mantisalca duriaei (Spach) Briq. et Cavill.
Rhaponticum coniferum (L.) Greuter subsp.
Rhaponticoides africana (Lam.) M. V. Agab. et Greuter
Cheirolophus crassifolius (Bertol.) Susanna
Centaurea tauromenitana Guss.
Centaurea acaulis L.
Centaurea saccensis Raimondo.


Centaurea busambarensis Guss.
Centaurea erycina Raimondo et Bancheva
Centaurea parlatoris Heldr.
Centaurea gussonei Raimondo et Spadaro
Centaurea giardinae Raimondo et Spadaro
Centaurea sicana Raimondo et Spadaro
Centaurea aeolica Guss. ex Lojac.
Centaurea cineraria L.
Centaurea panormitana Lojac.
Centaurea ambigua Guss.
Centaurea jacea L.
Centaurea deusta Ten.
Centaurea diluta Aiton
Centaurea napifolia L.
Centaurea iberica Trevir. ex Spreng.
Centaurea aspera L. subsp. aspera
Centaurea seridis L. subsp. sonchifolia (L.) Greuter
Centaurea sphaerocephala L. subsp.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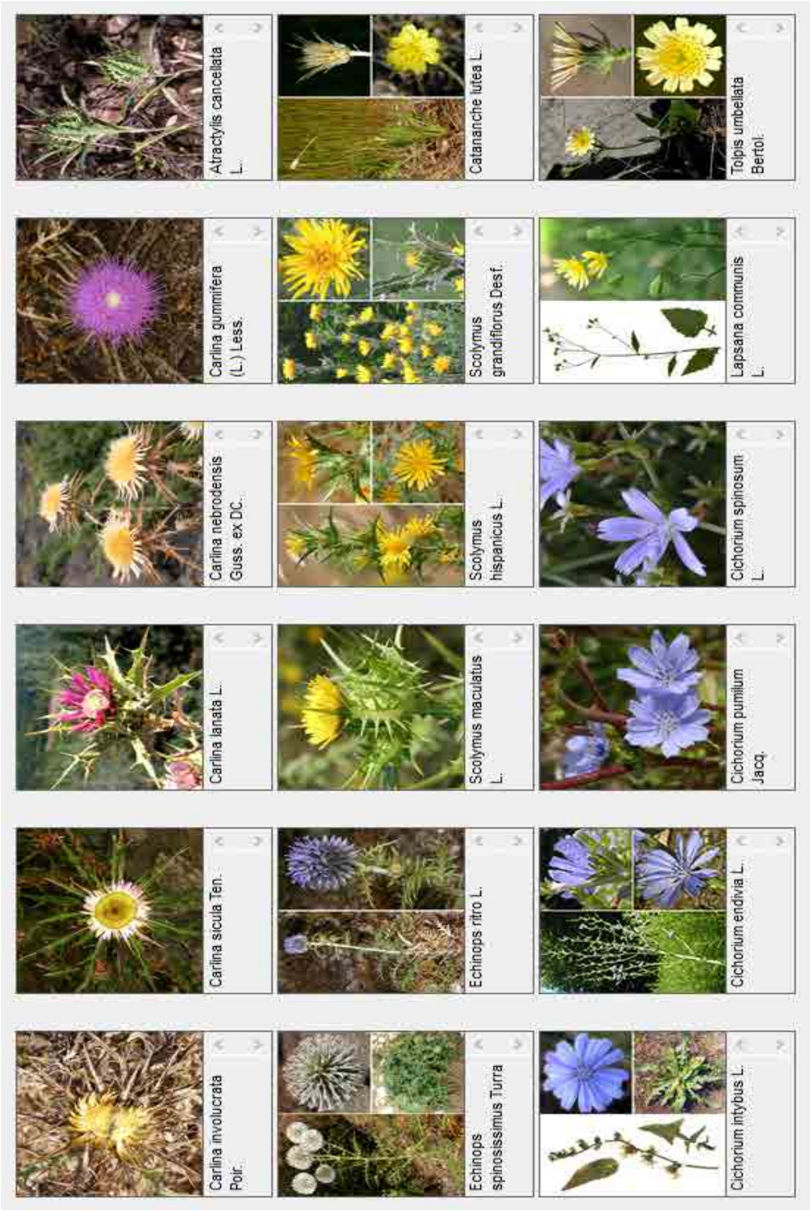
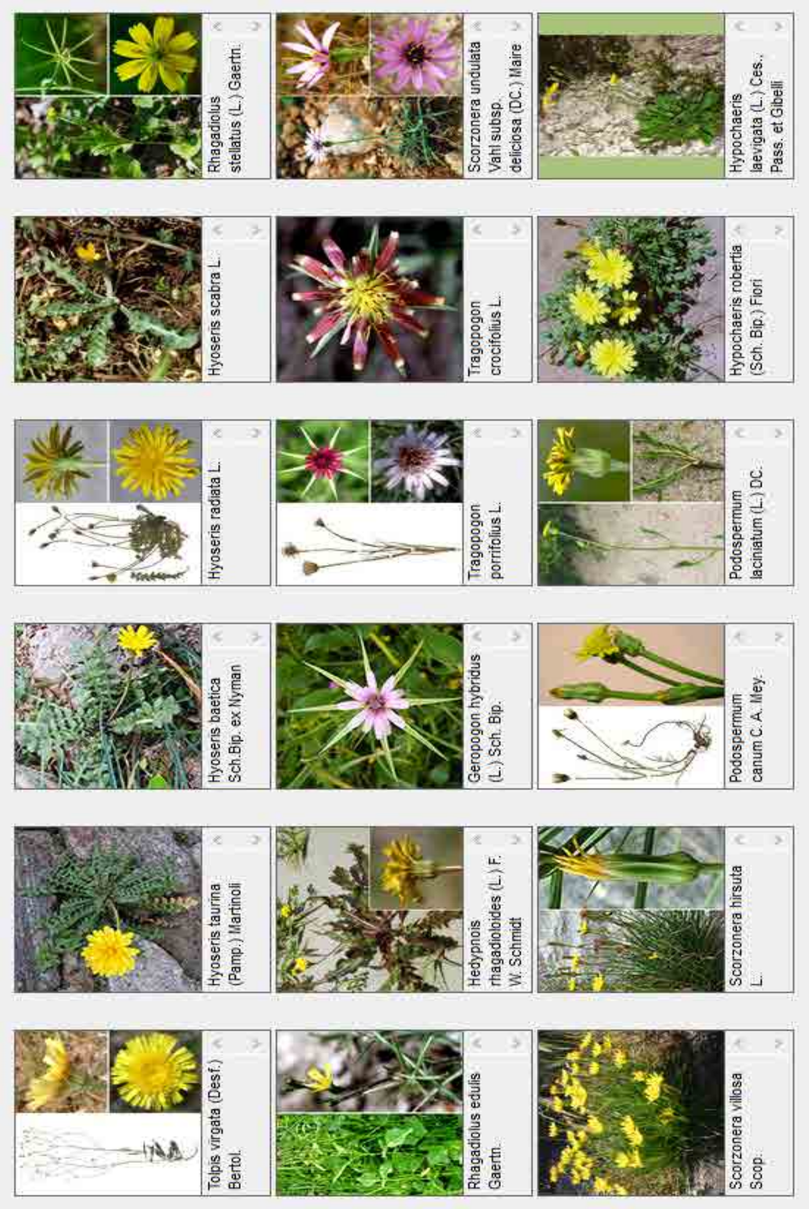
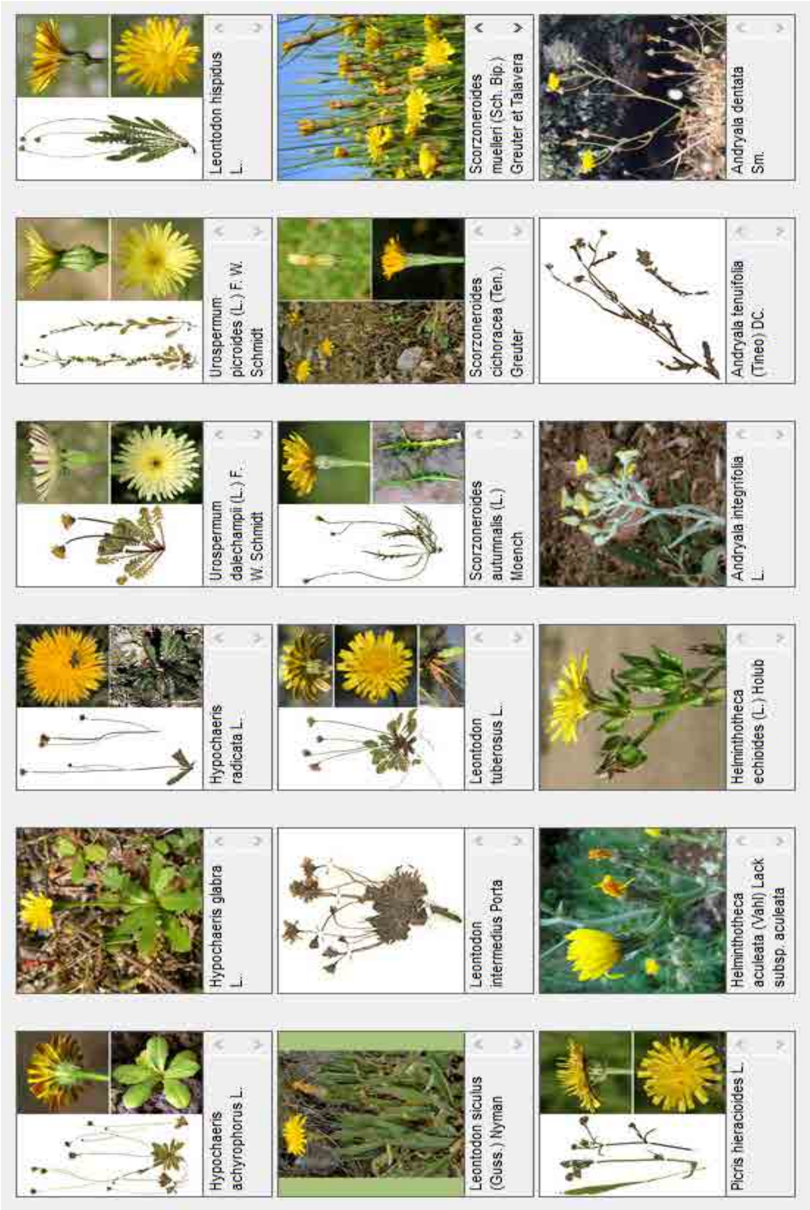
Centaurea macroacantha Guss.
Centaurea solstitialis L.
Centaurea melitensis L.
Centaurea sicula L.
Centaurea hyalolepis Boiss.
Cyanus depressus (M. Bieb.) Soják
Cyanus segetum Hill
Cyanus triumfetti (All.) Dostál ex Á. Löve et D. Löve
Carthamus caeruleus L.
Carthamus pinnatus Desf.
Carthamus lanatus L. subsp. lanatus
Carthamus creticus L.
Carthamus dentatus Vahl subsp. dentatus
Cardopatium corymbosum Pers.
Xeranthemum inapertum (L.) Mill.
Carlina corymbosa L.
Carlina hispanica Lam. subsp. globosa (Arcang.) Meusel et


Carlina involucrata Poir.
Carlina sicula Ten.
Carlina lanata L.
Carlina nebrodensis Guss. ex DC.
Carlina gummifera (L.) Less.
Atractylis cancellata L.
Echinops spinosissimus Turra
Echinops ritro L.
Scolymus maculatus L.
Scolymus hispanicus L.
Scolymus grandiflorus Desf.
Catananche lutea L.
Cichorium intybus L.
Cichorium endivia L.
Cichorium pumilum Jacq.
Cichorium spinosum L.
Lapsana communis L.
Tolpis umbellata Bertol.


Tolpis virgata (Desf.) Bertol.
Hyoseris taurina (Pamp.) Martinoli
Hyoseris baetica Sch.Bip. ex Nyman
Hyoseris radiata L.
Hyoseris scabra L.
Rhagadiolus stellatus (L.) Gaertn.
Rhagadiolus edulis Gaertn.
Hedypnois rhagadioloides (L.) F. W. Schmidt
Geropogon hybridus (L.) Sch. Bip.
Tragopogon porrifolius L.
Tragopogon crocifolius L.
Scorzonera undulata Vahl subsp. deliciosa (DC.) Maire
Scorzonera villosa Scop.
Scorzonera hirsuta L.
Podospermum canum C. A. Mey.
Podospermum laciniatum (L.) DC.
Hypochaeris robertia (Sch. Bip.) Fiori
Hypochaeris laevigata (L.) Ces., Pass. et Gibelli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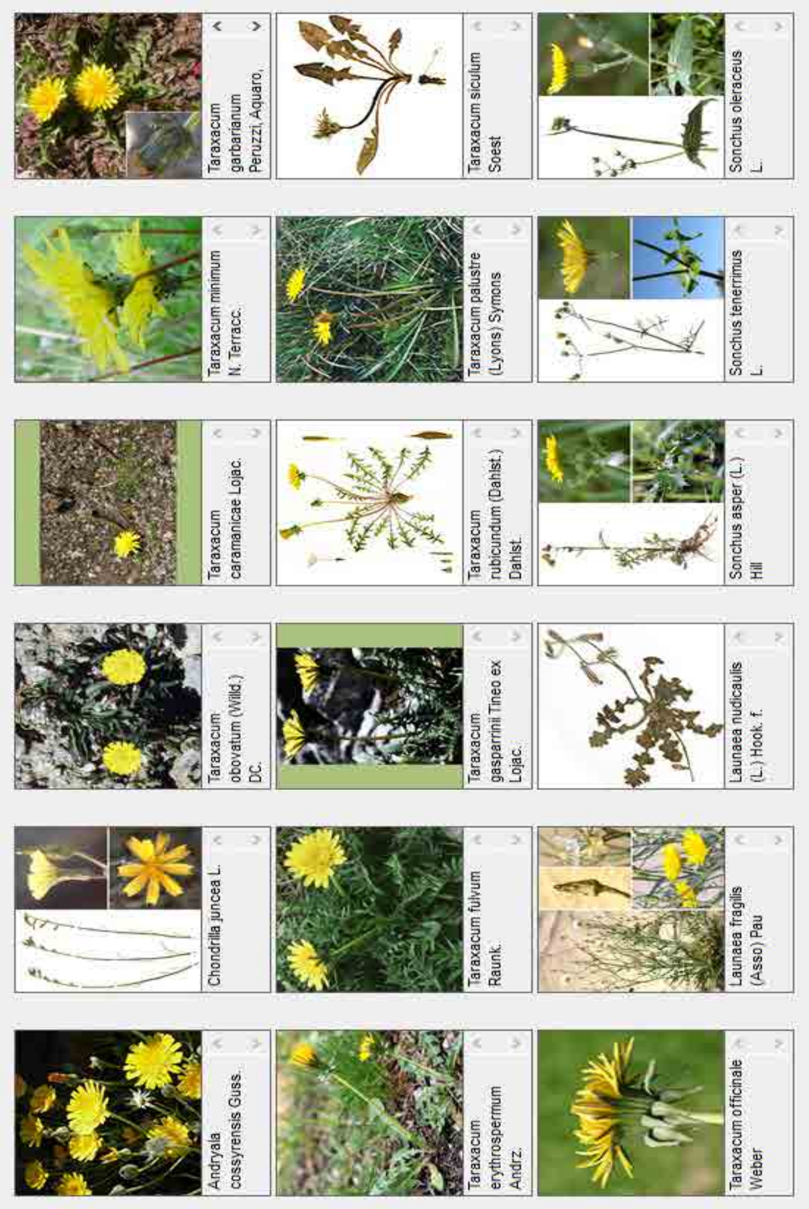
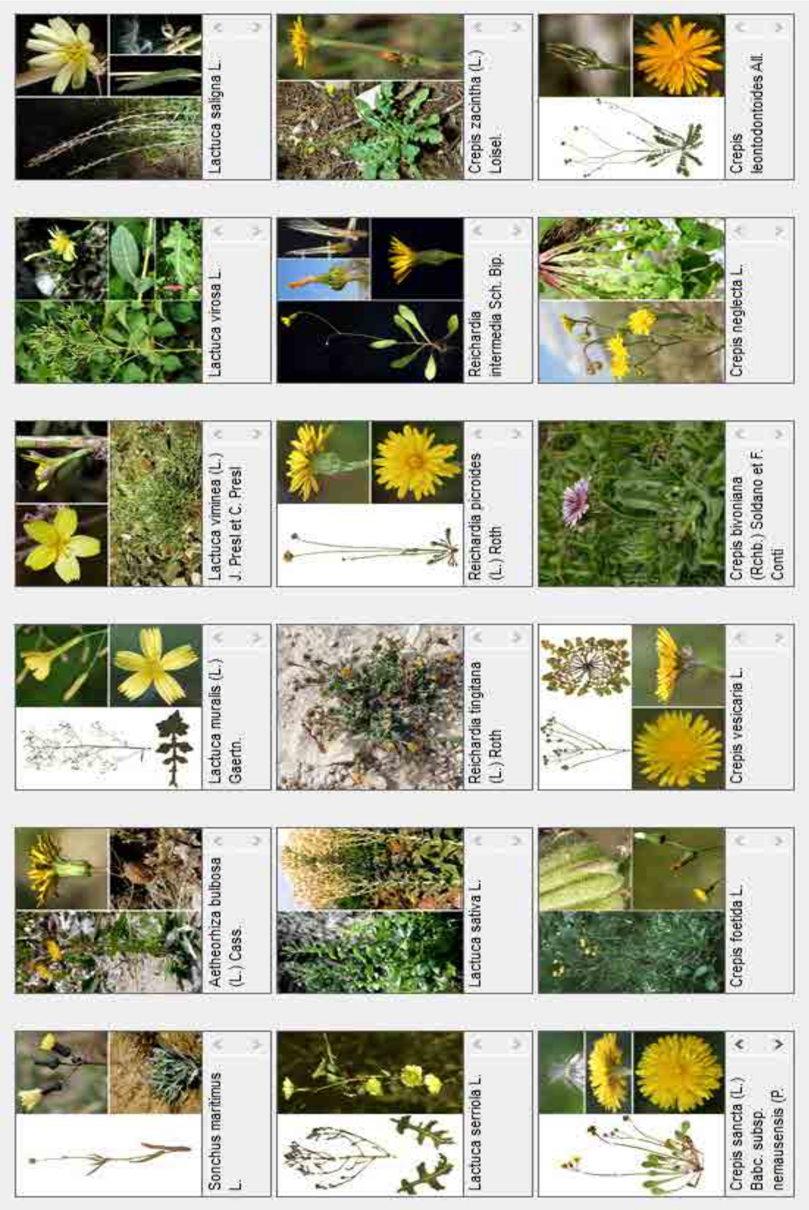
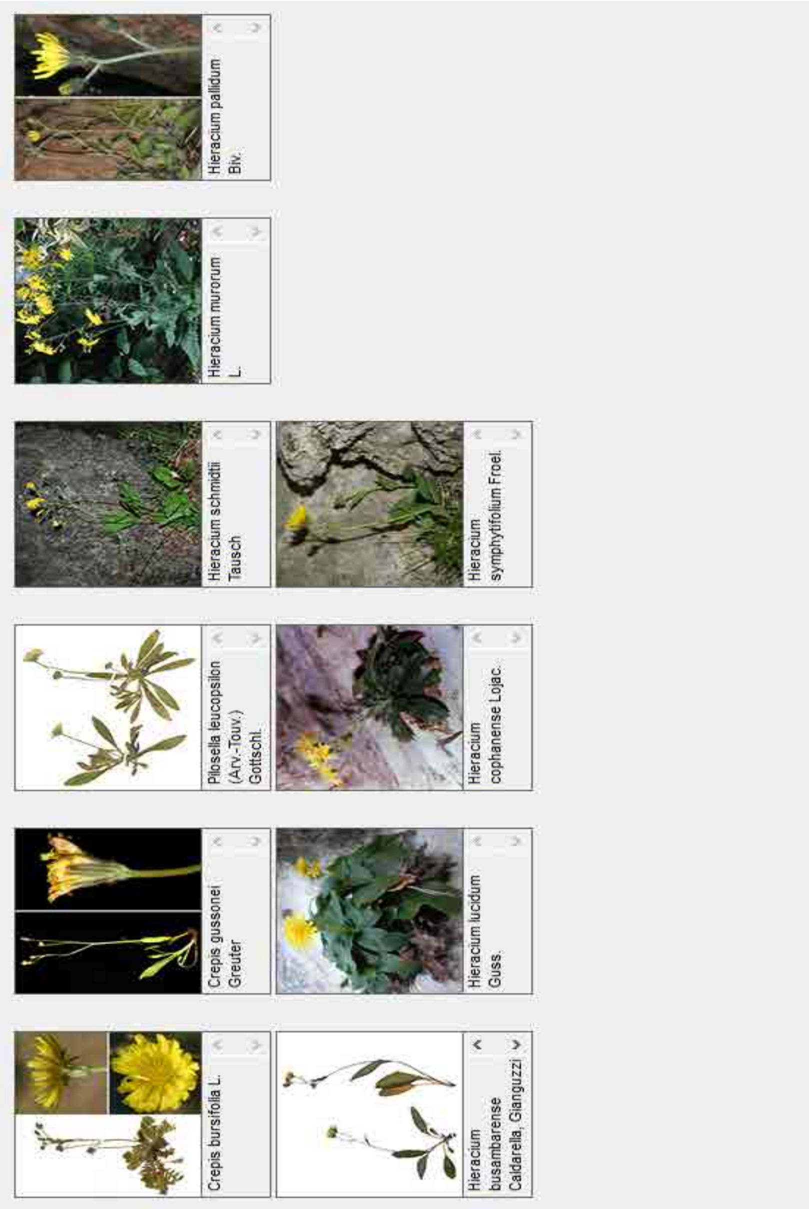
Hypochaeris glabra L.
Hypochaeris radicata L.
Urospermum dalechampii (L.) F. W. Schmidt
Urospermum picroides (L.) F. W. Schmidt
Leontodon hispidus L.
Leontodon siculus (Guss.) Nyman
Leontodon intermedius Porta
Leontodon tuberosus L.
Scorzoneroides autumnalis (L.) Moench
Scorzoneroides cichoracea (Ten.) Greuter
Scorzoneroides muelleri (Sch. Bip.) Greuter et Talavera
Picris hieracioides L.
Helminthotheca aculeata (Vahl) Lack subsp. aculeata
Helminthotheca echioides (L.) Holub
Andryala integrifolia L.
Andryala tenuifolia (Tineo) DC.
Andryala dentata Sm.


Andryala cossyrensis Guss.
Chondrilla juncea L.
Taraxacum obovatum (Willd.) DC.
Taraxacum caramanicae Lojac.
Taraxacum minimum N. Terracc.
Taraxacum garbarianum Peruzzi, Aquaro.
Taraxacum erythrospermum Andrz.
Taraxacum fulvum Raunk.
Taraxacum gasparrinii Tineo ex Lojac.
Taraxacum rubicundum (Dahlst.) Dahlst.
Taraxacum palustre (Lyons) Symons
Taraxacum siculum Soest
Taraxacum officinale Weber
Launaea fragilis (Asso) Pau
Launaea nudicaulis (L.) Hook. f.
Sonchus asper (L.) Hill
Sonchus tenerrimus L.
Sonchus oleraceus L.


Sonchus maritimus L.
Aetheorhiza bulbosa (L.) Cass.
Lactuca muralis (L.) Gaertn.
Lactuca viminea (L.) J. Presl et C. Presl
Lactuca virosa L.
Lactuca saligna L.
Lactuca serriola L.
Lactuca sativa L.
Reichardia tingitana (L.) Roth
Reichardia picroides (L.) Roth
Reichardia intermedia Sch. Bip.
Crepis zacintha (L.) Loisel.
Crepis sancta (L.) Babc. subsp. nemausensis (P.
Crepis foetida L.
Crepis vesicaria L.
Crepis bivoniana (Rchb.) Soldano et F. Conti
Crepis neglecta L.
Crepis leontodontoides All.


Crepis bursifolia L.
Crepis gussonei Greuter
Pilosella leucopsilon (Arv.-Touv.) Gottschl.
Hieracium schmidtii Tausch
Hieracium murorum L.
Hieracium pallidum Biv.
Hieracium busambarense Caldarella, Gianguzzi
Hieracium lucidum Guss.
Hieracium cophanense Lojac.
Hieracium symphytifolium Froel.

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Index of species

Index of families

Index of families

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