RESEARCH ON THE URBAN FLORA OF MESSINA

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ABSTRACT - The study of the urban flora of Messina has brought to light an ecosystem rich in species. Despite the abundance of plants widely distributed and with a short life cycle the importance of Mediterranean species has been confirmed. They play a vital part in urban landscape, determing the physiognomy of several areas. The strong ties among the urban flora, the anthropic activity and the climatic conditions of the territory were ascertained. The positive role of the winds for the flow of species from natural ecosystems of the surroundings and for the renewal of the urban flora has been observed.

KEY WORDS - Messina, Sicily, urban flora, dynamics, renewal.

INTRODUCTION

The floristic lists of the entire territory of one city permit to carry out a detailed ecological study of the urban vegetal component remaining at the same time a valid record of its evolution. Since, in the past, the data published were prevalently related to certain parts of several Italian cities (old city centres, boundary walls), a need was felt for complete floristic research covering the whole territory.

A study of the urban flora of Messina has recently been conducted as a first step in getting acquainted with the vegetal component of this city. The data obtained were necessary not only to explain the dynamic relationships that exist between the city and its surroundings but also to check the flows of species important for the renewal of the urban flora. Due to the steady increase in urbanized areas it has become essential to know the characteristics of this urban ecosystem so as to deal with it on ecological grounds and prevent the interactions between the plants and inhabitants.

MATERIALS AND METHODS

The research on the flora of Messina began in 1996 and continued in the years that followed proceeding with the collection of samples from various habitats, the identification of the species and the completion of a floristic list which was analysed for chorotypes and life types. The results obtained were compared with the data from literature pertaining to southern Italian cities and the islands with particular attention given to the urban flora of Bari (Zodda, 1942), Catania (Poli Marchese et al., 1989), Naples (De Rosa, 1905; La Valva e De Natale, 1994), Cagliari and Palermo (Celesti et al., 1996).

Furthermore it was the intention to establish the relationship between the frequency and the abundance of each species in different urban biotopes so as to explain both the influence of climatic conditions and the possible presence of ecological urban corridors. This part of the research had the aim of evaluating at the later time, not only the quality of the urban environment in Messina but also the effects of the urban flora on its inhabitants. The climatic data (Duro et al., 1993) were useful for carrying out the ecological analysis of the urban flora under investigation. The study was supported by demographic informations on the inhabitants processed by ISTAT (1991).

RESULTS AND DISCUSSION

FLORISTIC ANALYSIS

As can be deduced from the list enclosed to this paper, 277 species and two subspecies belonging to 69 different families were verified in the city of Messina (cfr. Appendix). The most frequent family is that of *Compositae* ((14%) follwed by *Graminaceae* (11 %) and *Leguminosae* (9 %). These families are present in the entire urban area with a greater concentration in the old city centre.

The species with a large distribution (cosmopolitan and subcosmopolitan, 38 %) prevail (Fig. 1), followed by stenomediterranean (26 %) and eurimediterranean (23 %). The abundance of Mediterranean species (49 %) is due to the city's geographical position and to the climatic conditions of the territory. In fact, the climate is characterized by an average annual temperature of 18,3 °C and 918 mm of annual rainfall with a prolonged period of drought which goes from May to October (Duro et al., 1993).

The flora of this city is particularly abbundant in the following neophytes: *Aster squamatus* (Sprengel) Hieron., *Ailanthus altissima* (Miller) Swingle, *Conyza albida* Willd., *Conyza bonariensis* (L.) Cronq., *Conyza canadensis* (L.) Cronq., *Mirabilis jalapa* L., *Nicotiana glauca* Graham, *Oxalis pes-caprae* L., *Euphorbia humifusa* Willd. Several of them escaped from the gardens of patrician villas where they had been planted for ornamental purposes. These species often form very dense populations that prove to be important for the renewal of the urban flora.

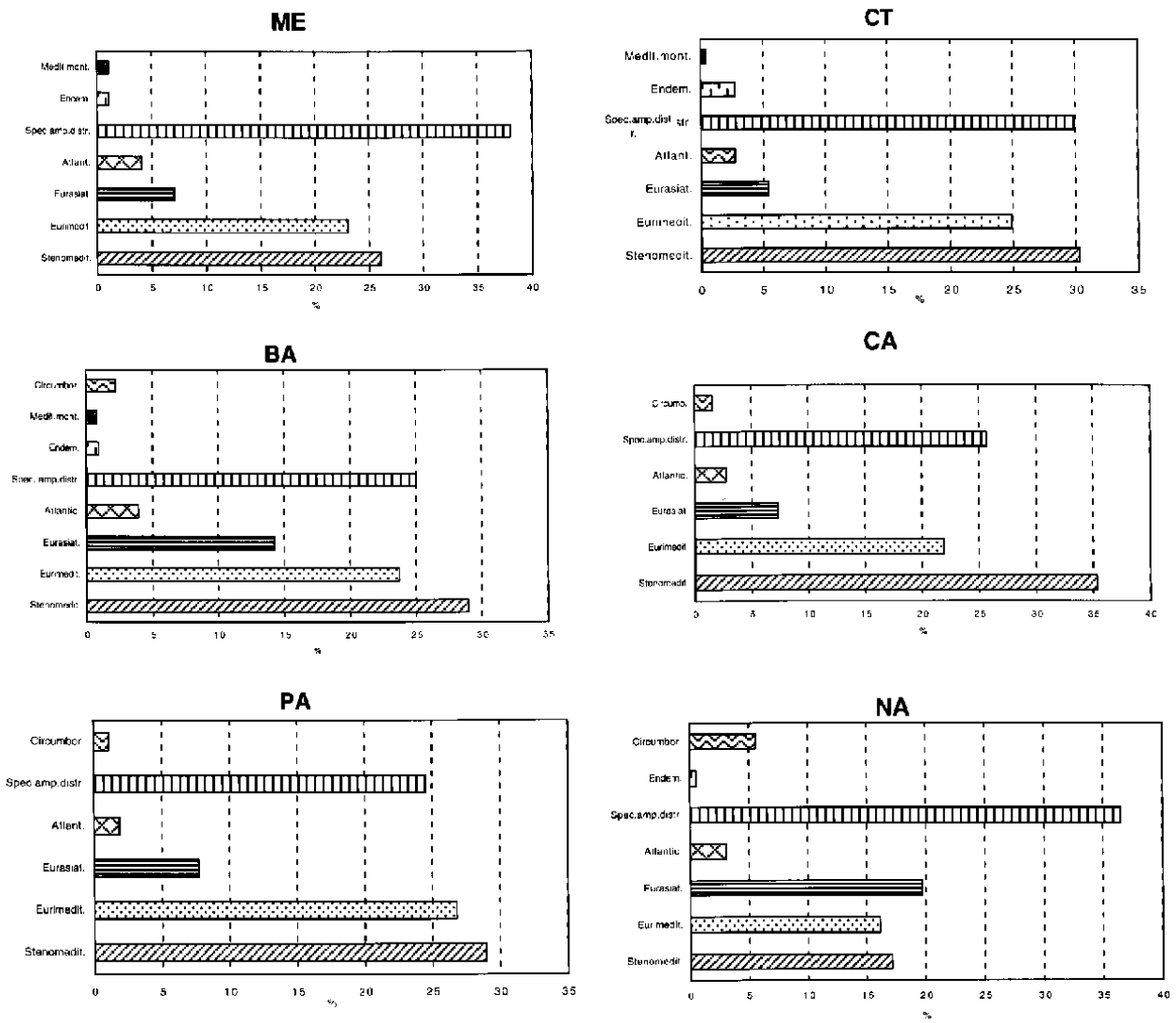

Fig. 1 - Chorological types (%) of the urban flora of Messina compared with those of other italian cities (ME=Messina, CT=Catania, BA=Bari, CA=Cagliari, PA= Palermo, NA= Naples)

The analysis of life types shows a prevalence of therophytes (50 %) followed by hemicryptophytes (21 %), geophytes (13 %) and phanerophytes (13 %) as seen in Fig. 2. The abundancc of species with a short life cycle is particularly evident in the highly anthropized urban habitats. The biennial and perennial species grow mainly on abandoned sites where the anthropic impact turns to be more moderate.

When comparing the floristic data of other cities of southern Italy and of the islands with that of Messina no great differences emerge. The only exception was the urban flora of Naples where a qualitative decrease of life forms was observed. This fact could be related to the high human population density per square kilometre and to the ensuing decrease in suitable habitats for the growth of chamacphytes, which were not at all present.

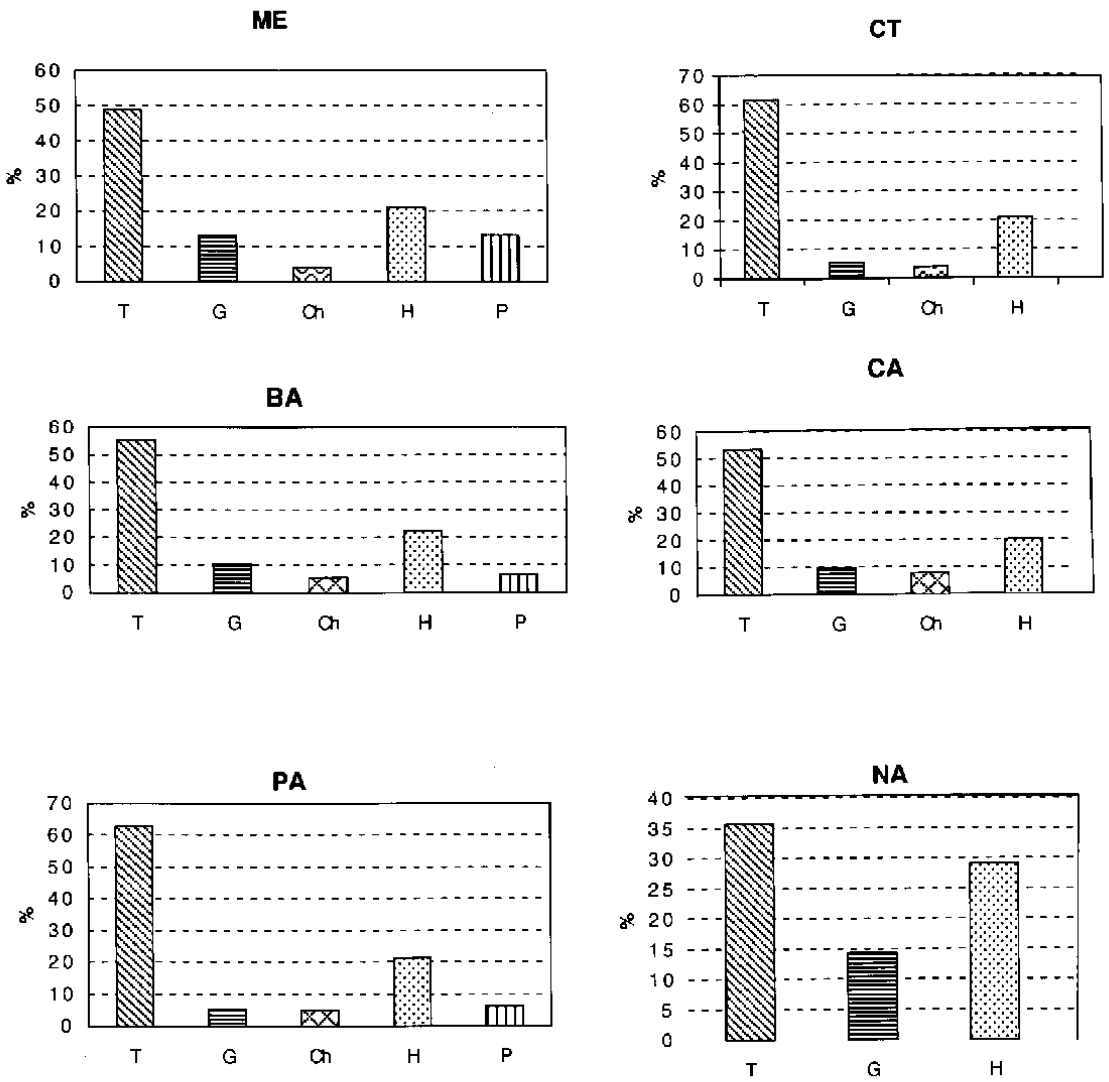

Figure 2 - Life forms (%) of the urban flora of Messina compared with those of other italian cities (T=therophytes, G=geophytes, Ch=chamaephytes, H=hemicryptophytes, P=phanerophytes; ME=Messina; CT=Catania, BA=Bari, CA=Cagliari, PA= Palermo, NA= Naples)

In all the cities compared there was a well-balanced relationship between stenomediterranean and eurimediterranean species, which are generally very important for the structure, physiognomy and the dynamics of the Italian vegetal urban component. The comparison with the data of the urban floras of cities in northern Italy further confirms the importance of the north/south geographical gradient for their formation. In fact the percentage of Mediterranean species is much lower in northern cities (Hruska, 1994a). This gradient has to be taken into consideration when dealing with the urban vegetal component during the restoration work and the renewal of urban green areas.

THE DYNAMICS OF URBAN FLORA

The ecological analysis of the urban flora showed a remarkable presence of species with multiple ecological strategies. These are numerous in highly anthropized areas, as checked by Hruska (1994 b) and Hruska & Bruschetti (1995). They are able to adapt their life cycle to the ecological conditions of the habitats by shortening it when the anthropic disturbance is strong and lengthening it in the presence of moderate anthropization. In fact species like: *Chenopodium ambrosioides* L., *Aster squamatus* (Sprengel) Hieron., *Sonchus asper* (L.) Hill, *Sonchus oleraceus* L., *Erodium moschatum* (L.) L'Hér., *Echium plantagineum* L., *Lactuca saligna* L., *Crepis vesicaria* L., etc. possess a double strategy: as therophytes they can become hemicryptophytes and vice versa. A shortening of life cycle from biennial to annual is observed in some plants such as: *Reseda alba* L., *Reseda lutea* L., *Malva sylvestris* L., *Daucus carota* L., *Carduus pycnocephalus* L., *Lactuca serriola* L., etc. The species with this type of strategy can even colonize areas which are highly disturbed by man. For these reasons they can be seen, in fact, throughout the urban territory.

THE RENEWAL OF URBAN FLORA

The dynamic relationsbip between the urban flora of Messina and the natural ecosystem of the surrounding areas is confirmed by the presence of species belonging to the class *Quercetea ilicis* (cf.Appendix). It has been observed that tree and shrub species from this class are not at all very abundant owing to the high density of human population and the subsequent scarcity of areas free of buildings. It should be pointed out that a strong anthropic factor negatively affects the flow of the species along the gradient od anthropization going from the natural to the semi-natural and anthropized habitats.

The renewal of Messina's urban flora is much more frequent from inside the city itself due to the spread of different cultivated species which man introduced from North, Central and South America or Africa and which later became wild and grew spontaneously. Some African species are:

- *Acacia karoo* Hayne, up to now seen only in Palermo (Celesti et al., 1996):
- *Oxalis purpurea* Jacq., indicated as wild in some Sicilian botanical gardens and city parks in Messina and surrounding areas (Castiglia et al., 1977)
- *Oxalis latifolia* Kunth, found recently in this urban area (Villari et al., 1998);
- *Antholiza aethiopica* L., an ornamental plant which has the tendency to adapt to the climate of the area;
- *Zanthedeschia aethiopica* (L.) Sprengel, very frequent and indicated by Pignatti (1982) as sporadically naturalized.

Some other species elude cultivation such as:

- *Parthenocissus quinquefolia* (L.) Planchon, very often grown in gardens and villas;
- *Passiflora coerulea* L., found to be wild on city boundary walls;
- *Washingtonia* sp., newly introduced adventitious plant;
- *Boussingaltia cordifolia* Ten., a species present already in most urban areas of Sicily (Walters, 1993).

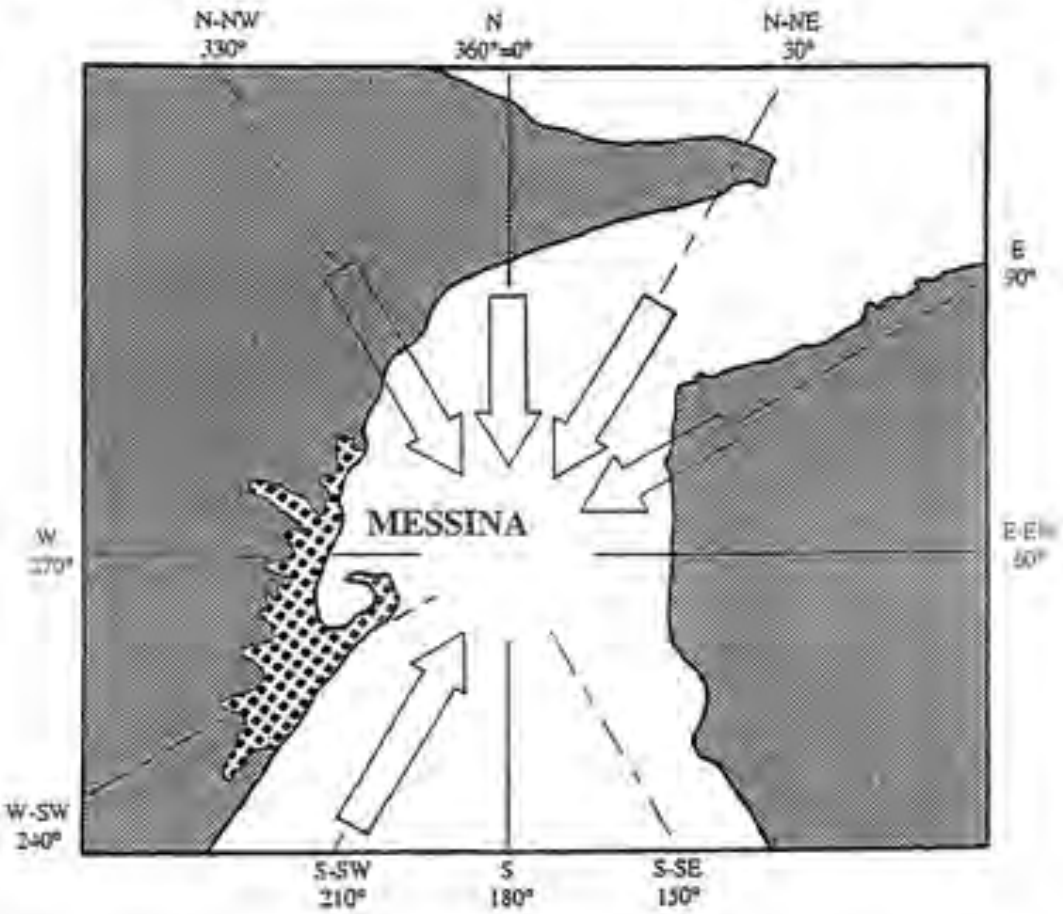

Figure 3 - Directions of the winds which are important for the renewal of the urban flora of Messina

Related to the Asia neophyte contingent very interesting is *Justicia hatoda* L., which, in all of Europe, seems to be naturalized only in Messina (Tutin, 1972).

A comparison of the floristic data obtained in various urban areas confirm the importance of climatic factors for the renewal of urban flora. The directions of the most important winds which blow from the north and the northeast crossing Sicily and southern Italy, turned out to be determinative (Fig. 3). Strong and constant at the end of spring and the beginning of summer, they become carriers of a large group of anemochorous species, especially those deriving from dry pastures and rocky hillsides (*Lagurus ovatus* L., *Scolymus hispanicus* L., *Mathiola incana* (L.) R.Br., *Phagnalon rupestre* (L.) DC., *Urospermum* sp.). These plants are able to settle and to grow on the city boundary walls and on the supporting walls along the coast.

The importance of the urbanistic trim of a city for the formation of ecological corridors has been verified especially along the principal communication routes which connect the coast with the entire urban territory. These favour the distribution of neophytes such as *Aster squamatus* (Sprengel) Hieron, *Eleusine indica* (L.) Gaertner, together with different common plants (*Amaranthus lividus* L., *Parietaria diffusa* M.

et K., *Chenopodium album* L., *Sonchus oleraceus* L., etc.). The distribution of these species can be associated with the remarkably high human population density (1097 inhabitants per square kilometre).

Conclusions

From the floristic and ecological analyses of the urban flora of Messina the prevailing role of man can be seen from the presence of numerous foreign species, some of which characterize this ecosystem. A regression of species from nearby natural ecosystems, due to the lack of suitable habitats, has been observed in highly anthropized areas.

The flora of this city, in general, is affected by the climatic conditions of the territory, which influence the direction of the dominant winds, thus favoring the arrival of species from dry pastures and maquis. The relationship between the two main ecological corridors, the one facilitated by man through the principal communication routes and the natural one derived from the geographical position of the city, seems to be well balanced. It can be therefore inferred as follows:

- the floristic reachness of this ecosystem depends on both the prevailing anthropic activities and on the climatic factors of the territory, with species from America being privileged;
- the renewal of the urban flora from neighbouring areas is determined by the topographical characteristics of the region; there is a continual flow of the anemochorous species from natural ecoystems of the surroundings;
- the diffusion of foreign species, especially those introduced in the past for ornamental reasons and naturalized subsequently, affect positively the physiognomy of this ecosystem.

Riassunto

Le ricerche sulla flora urbana di Messina hanno messo in evidenza un ecosistema ricco di specie vegetali. Nonostante l'abbondanza di specie ad ampia distribuzione ed a ciclo vitale breve è stata confermata l'importanza di specie mediterranee. Queste giocano un ruolo importante nel paesaggio urbano determinando la fisionomia di alcune zone. Sono stati accertati i forti legami tra la flora urbana, l'attività antropica e le condizioni climatiche del territorio. Viene indicato il ruolo positivo dei venti per il flusso delle specie dagli ecosistemi naturali delle zone circostanti.

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APPENDIX

Elenco sistematico della flora urbana di Messina

Adiantum capillus-veneris L.
Gymnogrammaceae
Anogramma leptophylla (L) Linch.
Hypolepidaceae
Pteridium aquilinum (L.) Kuhn
Polypodiaceae
Polypodium australe Fèe
Pinaceae
Pinus pinea L.
Moraceae
Ficus carica L.
Cannabaceae
Cannabis sativa L.
Urticaceae
Parietaria diffusa M. et K.
Parietaria lusitanica L.
Urtica dioica L.
Urtica membranacea Poiret
Urtica urens L.
Cactaceae
Opuntia ficus-indica (L.) Miller
Polygonaceae
Emex spinosa (L.) Campd.
Polygonum aviculare L.
Polygonum equisetiforme S et S.
Polygonum maritimum L.
Rumex conglomeratus Murray
Rumex crispus L.
Rumex pulcher L.
Chenopodiaceae
Chenopodium ambrosioides L.
Chenopodium murale L.
Chenopodium album L.
Salsola kali L. subsp. kali
Amaranthaceae
Amaranthus cruentus L.
Amaranthus retroflexus L.
Amaranthus viridis L.
Amaranthus lividus L.
Nyctaginaceae
Mirabilis jalapa L.
Phytolaccaceae
Phytolacca americana L.
Portulacaceae
Portulaca oleracea L.
Caryophyllaceae
Cerastium siculum Guss.
Dianthus carthusianorum L.
Polycarpon tetraphyllum L.
Silene coeli-rosa (L.) Godron
Silene gallica L.
Stellaria media (L.) Vill. subsp. media
Ranunculaceae
Delphinium halteratum S. et S.
Ranunculus muricatus L.
Guttiferae
Hypericum perfoliatum L.
Hypericum perforatum L. subsp. perforatum
Papaveraceae
Fumaria capreolata L.
Fumaria officinalis L.
Glaucium flavum Crantz
Papaver dubium L.
Papaver hybridum L.
Papaver rhoeas L.
Capparidaceae
Capparis spinosa L.
Cruciferae
Brassica fruticulosa Cyr
Brassica napus L.
Cakile maritima Scop.
Capsella bursa pastoris (L.) Medicus
Capsella rubella Reuter
Coronopus didymus L.
Diplotaxis viminea (L.) DC.
Lobularia maritima (L.) Desv.
Matthiola incana (L) R. Br. subsp. incana
Matthiola tricuspidata (L.) R. Br.
Raphanus raphanistrum L. subsp. maritimus
Raphanus raphanistrum L. subsp. raphanistrum
Rapistrum rugosum (L.) All.

Sisymbrium irio L.
Sisymbrium officinale (L.) Scop.
Resedaceae
Reseda alba L.
Reseda lutea L.
Crassulaceae
Kalanchoe sp.
Sedum album L.
Sedum cepaea L.
Sedum rubens L.
Sedum stellatum L.
Umbilicus rupestris (Salisb.) Dandy
Rosaceae
Rubus ulmifolius Schott
Leguminosae
Acacia karoo Hayne
Anthyllis vulneraria L.
Calicotome spinosa Link
Hedysarum coronarium L.
Lathyrus clymenum L.
Lotus cytisoides L.
Lotus ornithopodioides L.
Lupinus angustifolius L.
Lupinus luteus L.
Medicago lupulina L.
Medicago orbicularis (L.) Bartal.
Medicago rigidula (L.) All.
Melilotus indica (L.) All.
Melilotus sulcata Desf.
Ornithopus compressus L.
Psoralea bituminosa L.
Spartium junceum L.
Trifolium arvense L.
Trifolium campestre Schreb.
Trifolium nigrescens Viv. subsp. nigrescens
Trifolium pratense L.
Trifolium repens L.
Trifolium resupinatum L.
Trigonella corniculata (L.) L.
Vicia pseudocracca Bertol.
Vicia villosa Roth.
Oxalidaceae
Oxalis corniculata L.
Oxalis pes caprae L.
Oxalis purpurata Jach.
Oxalis latifolia H.B.
Geraniaceae
Erodium malacoides (L.) L'Hèr
Erodium moschatum (L.) Lher.
Geranium brutium Gasparr.
Geranium molle L.
Geranium robertianum L.
Geranium rotundifolium L.
Tropeolaceae
Tropaeolum majus L.
Zygophyllaceae
Tribulus terrestris L.
Linaceae
Linum narbonense L.
Linum bienne Miller
Euphorbiaceae
Euphorbia chamaesyce L.
Euphorbia dendroides L.
Euphorbia helioscopia L.
Euphorbia humifusa Willd.
Euphorbia maculata L.
Euphorbia peplis L.
Euphorbia peplus L.
Euphorbia terracina L.
Mercurialis annua L.
Ricinus communis L.
Rutaceae
Ruta chalepensis L.
Simaroubaceae
Ailanthus altissima (Miller) Swingle
Rhamnaceae
Rhamnus alaternus L.
Vitaceae
Partenocissus quinquefolia (L.) Planchon
Malvaceae
Alcea rosea L.
Lavatera cretica L.
Malva parviflora L.
Malva sylvestris L.
Passifloraceae
Passiflora coerulea L.
Tamaricaceae
Tamarix gallica L.
Cucurbitaceae
Ecballium elaterium (L.) Richard
Onagraceae
Epilobium tetragonum L.

Araliaceae
Hedera helix L.
Umbelliferae
Crithmum maritimum L.
Daucus carota L. subsp. carota
Daucus carota L. subsp. maritimus (Lam.) Batt.
Eryngium maritimum L.
Ferula communis L. subsp. communis
Foeniculum vulgare Miller.
Smyrnium olusatrum L.
Primulaceae
Anagallis arvensis L.
Oleaceae
Olea europea L.
Gentianaceae
Blackstonia perfoliata (L.) Hudson
Blackstonia grandiflora (Viv.) Pau
Centaurium erythraea Rafn
Apocynaceae
Nerium oleander L.
Rubiaceae
Galium spurium L.
Galium aparine L.
Galium tricornutum Dandy
Convolvulaceae
Calystegia soldanella (L.) R. Br:
Calystegia sepium (L.) R. Br.
Convolvulus arvensis L.
Convolvulus althaeoides L.
Ipomoea acuminata (Vahl) R.et S.
Borraginaceae
Borago officinalis L.
Cerinthe major L.
Echium parviflorum Moench.
Echium plantagineum L.
Heliotropium europaeum L.
Verbenaceae
Verbena officinalis L.
Labiatae
Ajuga iva (L.) Schreber
Ballota nigra L.
Calamintha nepeta (L.) Savi
Micromeria graeca (L.) Bentham subsp. graeca
Salvia verbenaca L.
Solanaceae
Hyosciamus albus L.
Nicotiana glauca Graham
Solanum luteum Miller subsp. luteum
Solanum nigrum L.
Solanum sodomaeum L.
Scrophulariaceae
Antirrhinum tortuosum Bosc.
Cymbalaria muralis Gaert. M. et Sch.
Linaria reflexa (L.) Desf.
Misopates orontium (L.) Rafin.
Scrophularia peregrina L.
Verbascum sinuatum L.
Veronica arvensis L.
Veronica cymbalaria Bodard
Orobanchaceae
Orobanche ramosa L. subsp. nana (Reuter) Coutinho
Acanthaceae
Acanthus mollis L.
Justicia adhatoda L.
Plantaginaceae
Plantago major L.
Plantago coronopus L.
Plantago serraria L.
Plantago lanceolata L.
Plantago lagopus L.
Caprifoliaceae
Lonicera japonica Thumb
Sambucus ebulus L.
Valerianaceae
Centranthus ruber (L.) Dc.
Dipsacaceae
Knautia integrifolia (L.) Bertol.
Scabiosa maritima L.
Campanulaceae
Campanula dichotoma L.
Campanula erinus L.
Compositae
Achillea ligustica All.
Andryala integrifolia L.
Anthemis cotula L.
Aster squamatus (Sprengel) Hieron
Bidens frondosa L.
Calendula arvensis L.
Carduus pycnocephalus L.
Carlina corymbosa L.
Centaurea napifolia L.

Chondrilla juncea L.
Chrysanthemum coronarium L.
Coleostephus myconis (L.) Cass.
Conyza albida Willd.
Conyza bonariensis (L.) Cronq.
Conyza canadensis (L.) Cronq.
Crepis bursifolia L.
Crepis vesicaria L.
Filago pyramidata L.
Galactites tomentosa Moench.
Galinsoga parviflora Cav.
Gnaphalium luteo-album L.
Hyoseris radiata L.
Inula viscosa (L.) Aiton
Lactuca saligna L.
Lactuca serriola L.
Matricaria chamomilla L.
Phagnalon rupestre (L.) Dc.
Phagnalon saxatile (L.) Cass.
Picris hieracioides L.
Reichardia picroides (L.) Roth.
Scolymus hispanicus L.
Senecio vulgaris L.
Sonchus asper (L.)Hill.
Sonchus oleraceus L.
Sonchus tenerrimus L.
Urospermum dalechampii (L.) Schmidt
Urospermum picroides (L.) Schmidt
Xantium strumarium L.

Basellaceae

Boussingaltia cordifolia Ten.

Liliaceae

Allium subhirsutum L.
Allium trifoliatum Cyr.
Nothoscordon fragrans Kunth
Smilax aspera L.

Amaryllidaceae

Pancratium maritimum L.

Iridaceae

Antholiza aethiopica L.
Crocus biflorus Miller
Freesia refracta (Jacq.) Klatt

Graminaceae

Agrostis salmatica (Lag.) Kunth
Ampelodesmos mauritanicus (Poiret) Dur. et Sch.
Arundo donax L.
Arundo pliniana Turra
Avena barbata Potter
Brachypodium distachyum (L.) Beauv.
Briza maxima L.
Bromus fasciculatus Presl
Bromus madritensis L.
Bromus rigidus Roth
Bromus sterilis L.
Catapodium rigidum (L.) Hubbard
Cymbopogon hirtus (L.) Janchen
Cynodon dactylon (L.) Pers.
Cynosurus echinatus L.
Dactylis glomerata L.
Dactylis hispanica Roth.
Dasypyrum villosum (L.) Borbas
Digitaria sanguinalis (L.) Scop.
Eleusine indica (L.) Gaertner
Hordeum leporinum Link
Lagurus ovatus L. subsp. ovatus
Lophochloa hispida (Savi) Pign.
Oryzopsis miliacea (L.) Asch. et Schweinf
Phalaris canariensis L.
Phalaris minor Retz.
Poa annua L.
Setaria verticillata (L) Beauv.
Sorghum halepense (L.) Pers.
Tricholeana teneriffae (L.) Link
Trisetaria aurea (Ten.) Pign.

Palmae

Washingtonia sp.

Araceae

Arum italicum Miller
Zantedeschia aethiopica Speng.

Cyperaceae

Cyperus longus L.