Floristic composition, chorotypes and life form of the Musallata, natural reserve, Libya

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Abstract

The flora of Masalata Natural Reserve (MNR) in the north-Western section of Libya, 90 km east of the city of Tripoli was surveyed in terms of life forms and phytogeography. Distribution and abundance values of the recorded species were determined. A total 445 of flowering plants are identified, they are distributed in 249 genera and belonging 64 Families. Annuals are predominated life form (60.9%), while parasites are the lowest (0.22%). The mono-regional Mediterranean species constitute 62.02% of the other flora. Species which are primarily Mediterranean but in some cases bi-regional with 30.78% and pluri-regional account for 14.38%.

Keywords: Life forms, AL-shaafin reserve, vegetation and chorotypes

Introduction

Some arguments about the establishment of nature reserves and national parks in the world began about 140 years ago, when the United States of America created the first national park, Park «Yellowstone» in the state of «Wyoming» in 1872, but historical sources indicate that the idea of nature reserves in ancient history, thousands of years ago, some land in some countries were considered "sacred" areas, there were also sacred mountains have a special history and charm in both Australia and Europe, and in 252 BC. M, the Emperor of India «Asoka» passed a law to protect animals and fish.

In the historical information, also, during the Roman rule of Lebanon, about two thousand years ago, the Roman Emperor «Adrian», found that a large part of the forests of Lebanon had been cut off, and he determined the area of what remains with carved stones, declaring the ownership of the forest for the protection of the empire.

In Europe, the English King William I in 1084 ordered the preparation of a comprehensive survey of land, forests, fish areas, agricultural areas, fishing reserves and productive resources of the Kingdom to develop appropriate plans for development and management (Abaad Magazine, 1998) [1].

In the Arab world, protectorates have long been known, with each group of people or tribes protecting the water springs, pastures and trees around the tribe to graze their livestock and drink from the protected waters.

The various countries of the world resorted to the establishment of nature reserves of all kinds to reduce the risk of environmental degradation, and the disappearance of plant and animal species, where the number of protected areas in the world more than 35,000 thirty-five thousand reserves, covering more than 8% of the area of land, about 13.8 million Table (1) Arab countries have moved towards establishing nature reserves, but they are still few in need, and the names of the reserves vary from one Arab country to another. Among the designations adopted in the Arab countries are restricted areas or national sheds, desert reserves, wetland reserves, and pastoral fences. National or natural reserves Protected areas, wildlife reserves, etc. (Ani and Mufti, 2002) [6]
Libya is characterized by a vast land area of 1,670,000 km², which is predominantly desert, located between longitudes 9.58-25 east and latitude 20-33 north, and the number of plant species in Libya about 1800-2000 plant species, distributed over more 800 genera, belonging to more than 147 families (Jafri & El - Gadi, 1987) [16], a relatively small considered number compared to the vast area, and most of this area deserts are poor in vegetation, which calls for the preservation of what exists and work to maintain by Protected areas.

It is worth mentioning that nature reserves are only a natural extension to protect the environment and natural resources. The aim of establishing nature reserves is to protect animal and plant resources not only for the present but for the benefit of the generations of the coming future. On the local animal and plant genetic species that have scientific and economic dimensions, they serve as a laboratory and scientific research center in the field of conservation of endangered species, and work on their development and conservation with a view to natural rebalancing. An economic dimension lies in confronting desertification and halting its creeping. In addition, the protection of animal and plant life in the reserves is a unique and unique place for tourist attraction and support for the national economy (Daabas, 2002) [8].

When establishing a reserve, a list of wild flora and fauna must be available in order to the management of the reserve and its staff to know the components of the reserve, so that it can be monitored and assessed over the years. Life in order to be a reference for researchers and interested in the study of plants in the area of its obelisks in later studies, where the MNR with its obelisks was established by resolution No. 346/28 of 1998.

The aim of this study is to provide a description of the floristic composition and life form spectrum, and an analysis of the distribution pattern of plant species in MNR in the western Mediterranean coast of Libya. Such data are critically important for conservation planning since the area is being rapidly developed by urbanization.

### Materials and methods

#### Area of the Study

The area of Masalata is located in northwestern Libya, at the end of the north-eastern edge of the Nafusa Heights, between longitudes 49 13o - 14 14o east and two latitudes 25 32o – 36 32o north, bordered north by Al-Khums area, south of Tarhuna region while extending westward to Qara Bolly area. The area is about 15 km away from the Mediterranean coast. The area of Maslata area is estimated at 90 thousand hectares. Masalata Natural Reserve is located in the western part of the region, 20 km northwest of the central Kasbah, and about 90 km east of Tripoli. The terrain, punctuated by a number of valleys, estimated area of about 500 hectares T almost as part exploiter. (Public Authority for Environment, 2005) [13].

#### Methods of the studies

The majority of the territory of Libya, which dominates most of the northern part of the African continent, is subject to the Mediterranean and desert climate, the latter may prevail in some seasons, which increases the impact of the desert climate (Sharaf, 1996) [24], the study area is located within the transition zone between the Mediterranean climate prevailing in the strip The coastal and northern highlands climate is generally mild in winter, hot and dry in summer, and winter rains.

The soil strength of the study area is sandy (sandy loam) with about 25-30% of the area and about 70-75% rock stone PH soil ranges from 8.3 to 8.6. The total soluble salt content of soil extract ranges from very low organic matter content in the study area. Thus, the soil in the study area is characterized by its poor organic matter.

#### Results and Discussion

All plant species collected from the study area (appendix) were classified using Raunkairs classification analysis, whose method is based on the height of the growing peaks and buds from the surface (Raunkears 1934) [22]. Its natural obelisks are confined to six forms (Table 1) that differ in their proportions from one form to another. The dominance of annuals (Fig. 2) is as follows:

| Life form | N of Species | Percentage |
|-----------|-------------|------------|
| TH= Therophytes | 271 | 60.899 |
| CH= | 72 | 16.180 |
| HC= | 54 | 12.135 |
| GH= | 30 | 6.741 |
| PH= | 17 | 3.820 |
| FA= | 1 | 0.224 |
| Total | 445 | 100 |

#### 1. Therophytes

Therophytes represent the largest group in the reserve and represent the sovereignty is kept during inappropriate conditions in the form of a seed while active and complete its life cycle in the appropriate wet season, this section is the largest section in the study area, which represented 60.899%, and the most important annual plants are: Linum strictum, Lagurus ovatus, Scilla peruviana.

#### 2. Chamaephytes

It consists of a large group of shrubs and perennial grasses and the types of this category have perennial shoots growing on air parts close to the surface of the earth (the length of plants less than 2 m. The percentage represented 16.180%, the

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Table 1: Protected Areas by International Regions.

| Region                        | Number | Total area (million hectares) |
|-------------------------------|--------|-------------------------------|
| South and East Asia and the Pacific | 7250   | 300                           |
| Europe and Central Asia       | 16400  | 145                           |
| Africa                        | 3000   | 240                           |
| West Asia                     | 67     | 86                            |
| North America                 | 5500   | 250                           |
| Latin America                 | 2850   | 360                           |
| Total                         | 35067  | 1381                          |

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Fig 1: Map showing the study area (El Werfalyi and Hassan, 2018) [10]
The second category represented the study area, which are plants under the dendritic wood or semi-wood and most of them are existing and these plants: Crepis libyaca, Thymus capitatus, Stipa tenacissima.

3. Hemicryptophytes
This group is prostrate shrubs or herbaceous plants that dieback each year, the third largest group collected from the study area 12.135% such as Carduncellus erioceophalus, Carduncellus pinnatus, Carlina involucrata.

4. Geophytes
Plants of this category are characterized by their production of rhizomes or bulbs and are represented by 6.741%. These species are Asphodelus microcarpus, Urginea maritima, Allium longanum.

5. Phanerophytes
Represented by plants more than 15 meters, including pine and Acacia, and the plant species in this category have perennial shoots growing on the aerial parts and accounted for 3.82% of the total plants in MNR and represents the fifth largest group collected from the study area, which is large-sized plants and is represented in trees and shrubs. The most important are species are Pinus halepensis, Acacia cyanophylla, Olea europaea.

6. Parasites
A parasite is an organism that lives on or in a host and gets its food from or at the expense of its host. The percentage of 0.22%. The most common species is Cuscuta planiflora.

The life forms in the study area were compared with some previous studies. All of them agree that the prevalence of the yearly plants Therophytes with a slight difference in percentages between them, where the yearbooks in the study (Salem, 2008) (55%), and in the study (Al-Qamati, 2004) (54.3%), in the study (Almslati, 2013) (53.71%). In this study the rate of annuals (60.899%), also we found that plant life depends mainly on rain water, where the valleys in the region remain without water and dry almost two-thirds of the year. Chamaephytes represent 16.180% in the study area, while in (Al-Qamati, 2004), 9.5%. This helps to increase the prevalence of annual fire-resistant plants, and its consistent with the study of (Salem, 2008).

Chorotype analysis
The phytogeographic analysis of the recorded plant species are shown in (Table 2) and (Figure 3). The recorded taxa are either mono-regional (62.02%), Bi-regional (30.78%), Pluri-regional (7.19%).

| Chorotype | N of Species | Percentage |
|-----------|--------------|------------|
| Mono-regional |              |            |
| MD | 195 | 43.82 |
| SA | 45 | 10.11 |
| IT | 9 | 2.02 |
| AM | 1 | 0.22 |
| ES | 11 | 2.47 |
| PL | 13 | 2.92 |
| AU | 2 | 0.45 |
| Total | 276 | 62.02 |
| Bi-regional |              |            |
| MD – IT | 66 | 14.83 |
| MD – SA | 20 | 4.49 |
| MD – ES | 31 | 6.97 |
| MD – SU | 1 | 0.22 |
| IT – SA | 14 | 3.15 |
| ES – IT | 1 | 0.22 |
| SU – SA | 3 | 0.67 |
| ES – SA | 1 | 0.22 |
| Total | 137 | 30.78 |
| Pluri-regional |              |            |
| MD – ES – IT | 29 | 6.52 |
| MD – IT - SA | 3 | 0.67 |
| Total | 32 | 7.19 |
| TOTAL | 91 | 14.38 |

Libya has also received numerous studies in the past, including vegetation, and the environment in many areas, which are contained in the book (Duraand & Barratte, 1910) entitled Introduction to Libyan plants.
Also, many studies have been conducted in which many plant species and their life forms were recorded in the area of Ma salahata such as: (Pampinini, 1914; Corti, 1942; and Siddiqui et al., 1986) [20, 7, 25].

(Ali & Jafari, 1977) [16], He studied the Mesayid area, (El-Gadi, 1978) [11], He studied the Al-Qasabat, (Enayet & El-Gadi, 1985) [11], studied the Quraym and Sindara region, (Erteeb & Sherif, 1985) [14], Studied the Zafaraniya Wadi, (Alavi, 1983; Keith, 1965) [2] studied the Al-Qasabat, (Labani & El-Gadi, 1980) [11], He studied Hafs, (Jafari, 1980) [17], He studied the Al-amoud area, (Qaiser, 1984) [21], He studied the Al-Qasabat and (Saad, 2013) [23] A taxonomic study of the components of vegetation cover in Wadi Ghadou in the Jaffara plain.

**Recommendations**

A fence must be constructed for the reserve, and specific areas and areas for visitors should be defined. The rest of the area should be used as a reserve, which and must be entered only by specialists in the conduct of scientific studies. The management of the reserve should follow up and control the rare plant species, in order to protect them from extinction or any other unintended work, by preparing local and external training courses for the staff of the reserve, to raise their efficiency and scientific expertise.

The fire extinguishing unit must be provided in the reserve, so that its personnel can control fires caused by lightning, or fires resulting from any acts. Recommend taxonomic studies of the reserve to preserve rare or threatened species. Prohibit any activities that may destroy or damage the natural environment or affect its aesthetic level in the protected area.

Waste of all kinds, in the protected area or surrounding areas, must not be discharged. Preventing the construction of roads in the reserve in all its forms and for any reason. Prevent logging or grazing in any way.

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**Appendix:** Floristic list of plant species recorded of Msellata Natural Reserve, Libya.

| Family   | Species                                | Life form | Chorotype |
|----------|----------------------------------------|-----------|-----------|
| Pteridophytes |                                        |           |           |
| Sinopteridaceae  | Chelanthes vellea Ait.                  | HC        | MD        |
| Gymnospermae     |                                        |           |           |
| Cupressaceae     | Juniperus phoenicea L.                  | PH        | MD        |
| Ephedraceae      | Ephedra alata Decne.                   | CH        | SA        |
| Pinaceae         | Pinus halepensis Mill.                 | PH        | MD        |
| Angiospermae     |                                        |           |           |
| Dicotyledones    |                                        |           |           |
| Araceae          | Arisarum vulgare Targ.                 | GH        | MD        |
| Anacardiaceae    | Pistacia lentiscus L.                  | PH        | MD        |
| Apiaceae         | Rhus tripartita Ucria.                 | CH        | IT        |
| Bupleurum gibraltaricum Lam.       | Bupleurum lancifolium Hornem           | TH        | MD, IT    |
| Bupleurum odoritces L.             | Bupleurum semisocompositum L.          | TH        | MD, IT, SA|
| Bupleurum trichopodium Boiss.      | Daucus capillifolius Gilli.            | TH        | MD        |
| Daucus jordanicus Bost.             | Daucus sahariensis Murb.               | TH        | MD, IT    |
| Daucus syrticus Nurb.               | Ferula tingitana L.                    | CH        | MD        |
| Pimpinella peregrina L.             | Scandix australis L.                   | TH        | MD, ES    |
| Scandix pectin-veneris L.           | Torilis leptophylla L.                 | TH        | MD, IT    |
| Torilis nodosa L.                   | Torilis tenella Del.                   | TH        | MD, IT    |
| Aizoaceae         |                                        |           |           |
| Asclepiadaceae    | Mesembryanthemum crystallinum L.       | TH        | MD, ES    |
| Caralluma europaea Guss.            | Periploca angustifolia Labill.         | CH        | IT        |
| Asteraceae        | Amberboa libyca Viv.                   | CH        | SA        |
| Amberboa lippii DC.                 | Anacyclus clavatus Desf.               | TH        | MD        |
| Anacyclus monanthos L.              | Anacyclus integrifolia L.              | HC        | MD        |
| Andryala integrifolia L.            | Anthemis secundiramea Biv.             | TH        | MD, SA    |
| Asteriscus pygmaeus DC.             | Atractylis cancellata L.               | TH        | MD        |
| Atractylis delicatula Batt.         | Atractylis serratuloides Sieb.         | CH        | SA        |
| Bombycilaenc discolor Pers.         | Calendula arvensis L.                  | TH        | MD, IT    |
| Carduncellus eriophalus Boiss.      | Carduncellus eriophalus Boiss.         | HC        | SA        |
| Family            | Species                                      | Herbarium | MD    |
|-------------------|----------------------------------------------|-----------|-------|
| **Amaranthaceae** | Carduncellus pinnatus Desf.                  | HC        | MD    |
|                   | Carlina involucrata Point.                   | HC        | MD    |
|                   | Carlina sica D. Ten.                         | TH        | MD    |
|                   | Carthamus lanatus L.                         | TH        | MD. ES|
|                   | Camilla aurea L.                             | HC        | MD    |
|                   | Centaurea alexandrina Delill.               | TH        | MD    |
|                   | Centaurea dimorpha Viv.                      | HC        | MD    |
|                   | Centaurea glornera Vahl.                     | HC        | MD    |
|                   | Centaurea maroccal Ball.                     | HC        | MD. IT|
|                   | Centaurea meliennis L.                       | HC        | IT    |
|                   | Centaurea spherocephala L.                   | HC        | MD    |
|                   | Centaurea africana Lam.                      | TH        | MD    |
|                   | Chrysanthemum carinatum Sch.                 | TH        | MD    |
|                   | Chrysanthemum coronarium L.                  | TH        | MD    |
|                   | Chrysanthemum segetum L.                     | TH        | MD    |
|                   | **Boraginaceae**                             |           |       |
|                   | Cichorium pumilum Jacq.                      | TH        | MD. IT|
|                   | Conyza aegyptiaca L.                         | TH        | MD. SA|
|                   | Conyza bonariensis L.                        | TH        | MD. SA|
|                   | Conyza Canadensis L.                         | TH        | AM    |
|                   | Crepis libuca Pamp.                          | CH        | SA    |
|                   | Crepis senecioides Delile.                   | TH        | SA    |
|                   | Crepis vesicaria L.                          | HC        | ES    |
|                   | Cynara cardunculus L.                        | HC        | MD    |
|                   | Crupina crucinastraum Moris.                 | TH        | MD. IT|
|                   | Crupina vulgaris Cass.                       | TH        | MD. IT|
|                   | Echinops galalensis Schwein.                 | HC        | MD    |
|                   | Echinops spinosisimus Freyn.                 | HC        | IT    |
|                   | Filago desertorum Pomel.                     | TH        | IT. SA|
|                   | Filago pyramidata L.                         | TH        | MD    |
|                   | Hedynpnois cretica L.                        | TH        | MD    |
|                   | Hedynpnois rhaeadioloides L.                 | TH        | MD    |
|                   | Helichrysum stoechas L.                      | CH        | MD    |
|                   | Helianthus multiflorus L.                    | PH        | MD    |
|                   | Hyoseris radiata L.                          | HC        | MD    |
|                   | Hyoseris scarca L.                           | TH        | MD    |
|                   | Hypochaeris alychrophorus L.                 | TH        | MD. ES. IT|
|                   | Hypochaeris glabara L.                       | TH        | MD. ES|
|                   | Koelpinia linearis Pallas.                   | TH        | ES. IT|
|                   | Lactuca sativa L.                            | HC        | MD. IT|
|                   | Lactuca serriola L.                          | TH        | MD. ES. IT|
|                   | Launaea nudicaulis L.                        | HC        | IT. SA|
|                   | Launaea procumbens Roxb.                     | TH        | MD    |
|                   | Launaea resedifolia L.                       | CH        | MD    |
|                   | Leontodon simplex Viv.                       | TH        | MD. ES|
|                   | Leontodon hispidulum Delile.                 | HC        | IT. SA|
|                   | Leontodon tuberosus L.                       | HC        | MD    |
|                   | Nolletia chrysocomoides Desf.                | TH        | SA    |
|                   | Notobasis syriaca L.                         | TH        | MD    |
|                   | Onopordum arenarium Desf.                    | TH        | SA    |
|                   | Onopordum espinae Cosson.                    | TH        | SA    |
|                   | Pallenis cyrenaica Alavi.                    | TH        | MD    |
|                   | Pahlenis spinosa L.                          | HC        | MD    |
|                   | Phagnalon rupestre L.                        | CH        | MD. IT|
|                   | Reichardia tingitana L.                      | TH        | MD. IT|
|                   | Scorzonera undulata L.                       | TH        | MD    |
|                   | Senecio gallicus L.                          | TH        | IT. SA|
|                   | Silvyam marianus L.                          | TH        | MD. IT|
|                   | Sonichus asper L.                            | TH        | MD. IT|
|                   | Sonichus oderaeus L.                         | TH        | MD. ES. IT|
|                   | Sonichus tenerimus L.                        | CH        | MD. ES. IT|
|                   | Urospernum dalsechampii L.                   | TH        | MD. IT|
|                   | Urospernum picroides L.                      | TH        | MD. IT|
|                   | **Amaranthaceae**                            |           |       |
|                   | Alkanna tinctoria L.                         | HC        | MD    |
|                   | Arnebia decumbens Vent.                      | TH        | IT. SA|
|                   | Bufofolioides tenuiflorra L.                 | TH        | MD. IT|
|                   | Cerinthe major L.                            | TH        | MD    |
|                   | Cynoglossum cheirolatum L.                   | TH        | SA    |
|                   | Cynoglossum clandestum Desf.                 | TH        | MD    |
| Family         | Species                                           | Distribution |
|---------------|---------------------------------------------------|--------------|
| Brassicaceae   | Echium angustifolium Mill.                        | CH MD        |
|               | Echium italicum L.                                | TH MD        |
|               | Elizalda calycina Roem.                           | TH MD. SA    |
|               | Heliotropium europaeum L.                         | TH MD. IT    |
|               | Lappula spinocarpos Forsk.                        | TH IT SA     |
|               | Nonea micrantha Boiss.                            | TH MD        |
|               | Biscutella didyma L.                              | TH MD. IT    |
|               | Brassica tournefortii Gouan.                      | TH MD. SA    |
|               | Capsella bursa L.                                 | TH PL        |
|               | Cardaria draba L.                                 | HC MD. IT    |
|               | Carrichtera annua L.                              | TH SA        |
|               | Clypeola jonhlaspi L.                             | TH MD. IT    |
|               | Didymus aegyptius L.                              | TH MD        |
|               | Didymus bipinnatus DC.                            | TH MD        |
|               | Diplotaxis harra Forsk.                           | HC SA        |
|               | Ophioglossum vulgare Forsk.                        | TH MD        |
| Caesalpiniaeae | Eanarthrocarpus clavatus Delile.                  | TH SA        |
|               | Erucia longirostris Uecht.                        | TH MD. IT    |
|               | Eruca sativa Mill.                                | TH MD. IT    |
|               | Eruca sativa Boiss.                               | TH SA        |
|               | Lepidium sativum L.                               | TH PL        |
|               | Lobularia libyca Viv.                            | TH SA        |
|               | Lobularia maritima L.                             | CH MD        |
|               | Lonchophora kralikii Pomeil.                      | TH MD        |
|               | Matthiola longipetala Vent.                       | TH MD. IT    |
|               | Rapistrum rugosum L.                              | TH MD. IT    |
|               | Sinapis flexuosa Poir.                            | TH MD        |
|               | Sinapis pubescens L.                              | TH MD        |
|               | Sisymbrium erisimoides Desf.                      | TH MD. SA    |
|               | Sisymbrium irio L.                                | TH MD. IT    |
| Caryophyllaceae| Ceratonia siligua L.                              | PH MD        |
|               | Capparis spinosa L.                               | PH MD        |
|               | Cleome amblyocarpa Barr.                          | TH SU. SA    |
|               | Arenaria serpyllifolia L.                         | TH MD. IT    |
|               | Cerastium glomeratum Thuill.                      | TH MD. ES. IT|
|               | Cerastium pumilum Curtis.                         | TH ES        |
|               | Minuartia hybrida Vill.                           | TH MD. IT    |
|               | Polycarpon tetraphyllum L.                        | TH MD. ES    |
|               | Silene bohen L.                                   | TH MD        |
|               | Silene cerasoides L.                              | TH MD        |
|               | Silene apetala Auct.                              | TH MD. IT    |
|               | Silene articulata L.                              | TH MD IT     |
|               | Silene colorata Poir.                             | TH MD        |
|               | Silene gallica L.                                 | TH MD. ES    |
|               | Silene tridentata Desf.                           | TH IT        |
|               | Silene viviani Steud.                             | TH SA        |
|               | Spergularia bocconii Scheerl.                     | CH MD. SA    |
| Chenopodiaceae | Atriplex halimus L.                               | PH PL        |
|               | Chenopodium album L.                              | TH PL        |
|               | Chenopodium ambrostoides L.                        | TH PL        |
|               | Chenopodium murale L.                             | TH PL        |
|               | Kochia indica Wight.                              | TH IT. SA    |
|               | Cistus parviflorus Lam.                           | CH MD        |
|               | Cistus salvifolius L.                             | CH MD. IT    |
|               | Fumana arabica L.                                 | CH MD        |
|               | Fumana laevipes L.                                | CH MD        |
|               | Fumana thymifolia L.                              | CH MD        |
|               | Helianthemum ciliatum Desf.                       | CH SA        |
|               | Helianthemum hirtum L.                            | CH SA        |
|               | Helianthemum kahircum Delile.                     | CH SA        |
|               | Helianthemum leefolium L.                         | TH MD        |
|               | Helianthemum stipulatum Forsk.                    | CH SA        |
|               | Helianthemum lippii L.                            | CH SA. SU    |
|               | Helianthemum virgatum Desf.                       | CH SA. SU    |
|               | Tubervaria guttata L.                             | TH MD. ES    |
| Convulvulaceae | Convolvulus albaeoides L.                         | HC MD        |
|               | Convolvulus arvensis L.                           | GH PL        |
|               | Convolvulus dorycyanum L.                          | HC MD        |
|               | Convolvulus oleifolius Desf.                      | CH MD        |
| Family          | Species                                      | Country | Type |
|-----------------|----------------------------------------------|---------|------|
| Convolvulaceae  | *Convolvulus siculus* L.                     | TH      | MD   |
|                 | *Convolvulus supinus* Coss.                  | HC      | MD   |
| Coriaceae       | *Coris monspeliensis* L.                     | CH      | MD   |
| Cucurbitaceae   | *Bryonia laciniosa*                           | HC      | MD   |
|                 | *Ecballium elaterium* L.                     | TH      | MD, IT |
| Crassulaceae    | *Crassula alata* Viva.                       | TH      | MD   |
|                 | *Sedum album* L.                             | CH      | MD, ES |
|                 | *Sedum sediforme* Jacq.                      | CH      | MD   |
|                 | *Umbilicus horizontalis* Guss.               | GH      | MD   |
|                 | *Umbilicus rupestris* Salisb.                | HC      | MD, IT |
| Cuscutaceae     | *Cuscuta planifolia* Ten.                     | PA      | MD, SA |
| Dipsaceae       | *Scabiosa arenaria* Forskal.                  | TH      | SA   |
| Euphorbiaceae   | *Scabiosa monspeliensis* Jacq.               | TH      | MD   |
|                 | *Euphorbia exigua* L.                        | TH      | MD, ES |
|                 | *Euphorbia falcata* L.                       | TH      | MD, IT |
|                 | *Euphorbia helioscopia* L.                   | TH      | MD, ES |
|                 | *Euphorbia bivonae* Ten.                     | PA      | MD, SA |
|                 | *Euphorbia peplus* L.                        | TH      | MD, ES, IT |
|                 | *Euphorbia terracina* L.                     | CH      | MD   |
|                 | *Mercurialis annua* L.                       | TH      | MD, ES |
|                 | *Anagyrus foetida* L.                        | PH      | MD, IT |
|                 | *Anthyllis tetraphylla* L.                   | TH      | MD   |
|                 | *Anthyllis vulneraria* L.                    | HC      | MD   |
|                 | *Argyrolobium uniflorum* Decne.              | CH      | SA   |
|                 | *Astragalus asterias* Stev.                  | TH      | MD, SA, SA |
|                 | *Astragalus boeticus* L.                     | TH      | MD   |
|                 | *Astragalus caprinus* L.                     | CH      | SA   |
|                 | *Astragalus hamosus* L.                      | TH      | MD   |
|                 | *Astragalus sinicus* Boiss.                  | TH      | MD   |
|                 | *Astragalus stella* Gouan.                   | TH      | MD   |
|                 | *Astragalus tribuloides* Del.                | TH      | IT, SA |
|                 | *Calcitome villosa* poir.                    | CH      | MD   |
|                 | *Coronilla repanda* Poir.                    | TH      | MD   |
|                 | *Coronilla scorpionoides* L.                 | TH      | MD   |
|                 | *Ebenus pinnata* Ait.                        | TH      | MD   |
|                 | *Genista acanthoclada* DC.                   | TH      | MD   |
|                 | *Genista microcephala* Coss.                 | TH      | MD   |
|                 | *Hedysarum spinosissimum* L.                 | TH      | MD   |
|                 | *Hippocrepis ciliata* Willd.                 | TH      | MD   |
|                 | *Hippocrepis multisiliquosa* L.              | TH      | MD   |
|                 | *Hippocrepis scabra* DC.                     | TH      | MD   |
|                 | *Hydrocarpus crenatus* L.                    | TH      | MD   |
|                 | *Lathyrus cicera* L.                         | TH      | MD, ES |
|                 | *Lotus creticus* L.                          | CH      | MD   |
|                 | *Lotus Cytisoides* L.                        | CH      | MD   |
|                 | *Lotus edulis* L.                            | TH      | MD   |
|                 | *Lotus halophilus* Boiss.                    | TH      | MD   |
|                 | *Lotus ornithopodoides* L.                   | TH      | MD   |
|                 | *Lotus suaveolens* Pers.                     | TH      | MD   |
|                 | *Medicago minima* L.                         | TH      | MD, ES |
|                 | *Medicago laciniata* L.                      | TH      | SA   |
|                 | *Medicago polymorpha* L.                     | TH      | MD, ES, IT |
|                 | *Medicago secundiflora* Dur.                 | TH      | MD   |
|                 | *Medicago tornata* L.                        | TH      | MD   |
|                 | *Melilotus indicus* L.                       | TH      | MD   |
|                 | *Melilotus sucatus* Desf.                    | TH      | MD   |
|                 | *Ononis angustissima* Lam.                   | CH      | MD   |
|                 | *Ononis natrix* L.                           | CH      | MD   |
|                 | *Ononis ornithopodoides* L.                  | TH      | MD   |
|                 | *Ononis reclinata* L.                        | TH      | MD   |
|                 | *Ononis serra* Forsk.                         | TH      | MD   |
|                 | *Ononis sicula* Guss.                        | TH      | MD   |
|                 | *Ononis variegata* L.                        | TH      | MD   |
|                 | *Ononis viscosa* L.                          | TH      | MD   |
|                 | *Pseudaena bituminosa* L.                    | HC      | MD   |
|                 | *Retama raetam* Forsk.                       | CH      | MD, ES |
|                 | *Scorpius maritimus* L.                      | TH      | MD, ES |
|                 | *Scorpius subvillosus* L.                    | TH      | MD, ES |
| Family          | Species                                      | Distribution |
|-----------------|----------------------------------------------|--------------|
| Tetragonolobus  | purpureus Moench.                            | TH MD ES     |
| Trifolium       | campestre Schreb.                            | TH MD ES     |
| Trifolium       | stellatum L.                                 | TH MD ES     |
| Trigonella      | tomentosum L.                                | TH MD ES     |
| Vicia           | laxiflora Brot.                              | TH MD        |
| Vicia           | lutea L.                                     | TH MD        |
| Vicia           | monantha Retz.                               | TH MD        |
| Vicia           | sativa L.                                    | TH MD        |
| Vicia           | villosa Roth.                                | TH MD        |
| Fumariaceae     | Fumaria gaillardottii Boiss.                 | TH MD ES IT  |
| Fumariaceae     | Fumaria parviflora Lam.                     | TH MD ES IT  |
| Fumariaceae     | Fumaria vaillantii Loois.                   | TH MD ES IT  |
| Erodium         | arborescens Desf.                           | HC SA        |
| Erodium         | cicatianum L.                               | TH MD ES IT  |
| Geraniaceae     | Erodium glaucophyllum L.                    | HC SA        |
| Geraniaceae     | Erodium hirtum L.                           | HC SA        |
| Geraniaceae     | Erodium laciniatium Cav.                    | TH MD        |
| Geraniaceae     | Geranium mollie L.                           | TH MD ES     |
| Geraniaceae     | Geranium robertianum L.                     | TH MD        |
| Globulariaceae  | Globularia alypum Linn.                     | PH ES        |
| Illecebraceae   | Hypocyamus desender Forsk.                  | CH SA        |
| Illecebraceae   | Herniaaria cinerea DC.                      | HC MD IT     |
| Illecebraceae   | Herniaaria fontanensis J Gay.               | HC MD IT     |
| Illecebraceae   | Herniaaria hemistemo J Gay.                 | CH SA        |
| Illecebraceae   | Paronychia canaee Lam.                      | CH MD        |
| Illecebraceae   | Paronychia capitata L.                      | CH MD        |
| Illecebraceae   | Paronychia chlorophyta Murb.                | CH MD        |
| Lamiaceae       | Ajuga iva L.                                | CH MD        |
| Lamiaceae       | Lamium amplexicaule L.                      | TH MD ES IT  |
| Lamiaceae       | Lavandula multifida L.                      | CH MD ES IT  |
| Lamiaceae       | Marrubium vulgare L.                         | CH MD IT     |
| Lamiaceae       | Micromeria nervosa Desf.                    | CH MD        |
| Lamiaceae       | Prasium majus L.                            | CH MD        |
| Lamiaceae       | Rosmarinus officinalis L.                   | CH ES        |
| Lamiaceae       | Salvia lamigeru Poir.                        | CH MD SA     |
| Lamiaceae       | Salvia verbenaca L.                         | CH MD        |
| Lamiaceae       | Sideritis montana L.                        | TH MD        |
| Lamiaceae       | Teucrium polium L.                          | CH MD IT     |
| Lamiaceae       | Thymus algeriensis Boiss.                   | CH MD        |
| Lamiaceae       | Thymus capitatus L.                         | CH MD        |
| Lamiaceae       | Linum decumbens Desf.                       | TH MD        |
| Lamiaceae       | Linum strictum L.                           | TH MD        |
| Lamiaceae       | Linum usitatissimum L.                      | TH MD        |
| Malvaceae       | Lavatera cretica L.                          | CH MD        |
| Malvaceae       | Malva aegyptia L.                            | TH SA        |
| Malvaceae       | Malva parviflora L.                         | TH SA        |
| Malvaceae       | Malva sylvestris L.                          | HC SA        |
| Mimosaceae      | Acacia cyanophylla Lindley.                 | PH AU        |
| Moraceae        | Ficus carica L.                             | PH MD IT     |
| Myrtaceae       | Eucalyptus cosmophylla F. Muell.             | PH AU        |
| Oleaceae        | Olea europaea L.                            | PH MD        |
| Orchidaceae     | Ophrys spectum Link.                        | GH MD ES     |
| Orchidaceae     | Orchis coriophora Linn.                     | GH MD IT     |
| Oxalidaceae     | Oxalis articulata Savigny.                  | GH ES        |
| Oxalidaceae     | Oxalis pes-caprae L.                        | GH PI        |
| Orobanchaceae   | Orobanche coelestis Boiss.                  | CH MD        |
| Papaveraceae    | Glaucoma flavum Cranitz.                    | HC MD        |
| Papaveraceae    | Papaver hybridum L.                         | TH MD IT     |
| Papaveraceae    | Papaver rhoas L.                            | TH ES        |
| Papaveraceae    | Plantago afra L.                            | TH MD IT     |
| Papaveraceae    | Plantago albicans L.                        | TH MD SA     |
| Papaveraceae    | Plantago anthesis Car.                      | TH SA        |
| Plantaginaceae  | Plantago arenaria Waldst.                   | TH MD ES IT  |
| Plantaginaceae  | Plantago coronopus L.                       | HC MD        |
| Plantaginaceae  | Plantago lagopus L.                         | TH MD        |
| Plantaginaceae  | Plantago lanceolata L.                      | HC MD ES IT  |
| Family                | Scientific Name                               | Distribution |
|----------------------|-----------------------------------------------|--------------|
| Plumbaginaceae       | Planta nonato Lag.                            | TH           |
|                      | Plantago ovata Forskal.                       | TH           |
|                      | Plantago phaeostoma Boiss.                   | TH           |
| Polygonaceae         | Limonium thountii Viv.                        | TH           |
|                      | Limonium echoides L.                          | TH           |
|                      | Calligonum azel Maire.                        | CH           |
|                      | Emex spinosa L.                               | TH           |
|                      | Polygonum equisetiforme Sm.                   | CH           |
|                      | Rumex bucephaloporus L.                       | TH           |
|                      | Rumex tingitanus L.                           | TH           |
|                      | Rumex vesicatorius L.                         | TH           |
| Primulaceae          | Anagallis arvensis L.                         | TH MD ES IT  |
|                      | Adonis aestivis L.                            | TH MD ES IT  |
|                      | Delphinium halteratum Sibth.                  | TH           |
|                      | Nigella damaseana L.                          | TH MD ES IT  |
|                      | Ranunculus asiaticus L.                       | TH MD IT     |
| Ranunculaceae        | Asterolinum linum – stellatum L.              | TH MD IT     |
|                      | Reseda alba L.                                | TH MD IT     |
|                      | Rhamnus alaternus L.                          | CH MD        |
|                      | Ziziphus lotus L.                             | CH MD        |
| Resedaceae           | Callipeltis cucullaris L.                     | HC MD        |
|                      | Cruceanella aegyptiaca L.                     | TH MD        |
|                      | Galium aparine L.                             | TH MD ES IT  |
|                      | Galium murale L.                              | TH MD        |
|                      | Galium setaceum Lam.                          | TH IT        |
|                      | Galium tricormutum Dandy.                     | TH MD IT     |
|                      | Galium verrucosum Huds.                       | TH MD        |
|                      | Sherardia arvensis L.                         | TH MD IT     |
|                      | Valantia hispida L.                           | TH MD        |
|                      | Valantia lanata Delile.                       | TH MD        |
| Rhamnaceae           | Amygdelus communis L.                         | PH MD IT     |
|                      | Sanguisorba minor Scop.                       | HC MD        |
| Rosaceae             | Callipeltis cucularis L.                      | HC MD        |
|                      | Cruciannella aegyptiaca L.                    | TH MD        |
|                      | Galium aparine L.                             | TH MD ES IT  |
| Rubiaceae            | Galium murale L.                              | TH MD        |
|                      | Sherardia arvensis L.                         | TH MD IT     |
| Santalaceae          | Valantia hispida L.                           | TH MD        |
|                      | Valantia lanata Delile.                       | TH MD        |
| Scrophulariaceae     | Kickxia aegyptiaca L.                         | CH MD SA     |
|                      | Linaria simplex (Wild) DC.                    | TH MD IT     |
|                      | Linaria tarhunensis Pamp.                     | TH MD IT     |
|                      | Misopates orontian L.                         | TH MD        |
|                      | Scrophularia arguta Aiten.                    | TH MD        |
| Solanaceae           | Lycium europaeum L.                           | CH MD        |
|                      | Solanum nigrum L.                             | TH MD ES IT  |
| Urticaceae           | Parietaria maurnitica Durieu.                 | TH MD ES IT  |
|                      | Urtica pilalifera L.                          | TH MD ES IT  |
|                      | Urtica urens L.                               | TH MD ES IT  |
| Valerianaceae        | Centranthus calcitropa L.                     | TH MD        |
|                      | Valerianella chlorodonata Cosson.             | TH MD        |
|                      | Valerianella discoidea L.                     | TH MD        |
|                      | Valerianella petrovihi Ashern.                | TH MD        |
| Zygophyllaceae       | Fagonia cretica L.                            | CH SA        |
|                      | Fagonia tenafillia Steud.                     | CH SA        |
| Monocotyledones      | Allium ampeloprasum L.                        | GH MD IT     |
| Alliaceae            | Allium leucanthum C.                          | GH MD IT     |
|                      | Allium longanum Pamp.                         | GH MD IT     |
|                      | Allium nigrum L.                              | GH MD        |
|                      | Allium roseum L.                              | GH MD        |
| Arecaceae            | Phoenix dactylifera L.                        | PH SA        |
| Amaryllidaceae       | Pancratium foetidum Pommel.                   | GH MD        |
| Iridaceae            | Iris sisyrichium L.                           | GH MD IT     |
|                      | Iris germanica L.                             | GH MD IT     |
| Liliaceae                                      | Poaceae                                      |
|-----------------------------------------------|----------------------------------------------|
| Gladiolus byzantinus Miller.                  | GH                                           |
| Androcymbium gramineum Cav.                   | MD, IT                                       |
| Asparagus stipularis Forsk.                   | SA                                           |
| Asphodelus fistulosus L.                      | SA                                           |
| Asphodelus tenuifolius L.                     | SA                                           |
| Asphodelus microcarpus Salzm.                 | SA                                           |
| Bellevalia sessiliflora Viv.                  | MD                                           |
| Dipcadi serotinum L.                         | MD                                           |
| Gagea fibrosa Desf.                           | MD                                           |
| Muscaria comosum L.                           | ES                                           |
| Ornithogalum arabicum L.                      | MD                                           |
| Ornithogalum pyrenaicum L.                    | MD, ES                                       |
| Scilla peruviana L.                           | MD, SA                                       |
| Urginea autunnalis L.                         | MD                                           |
| Urginea maritime L.                           | MD                                           |
| Aegilops leucocyhi Boiss.                     | IT, SA                                       |
| Aegilops geniculata Roth.                     | MD                                           |
| Aeluropus lagopoides L.                       | CH, IT                                       |
| Avena barbata Pott.                           | MD                                           |
| Avena longiglumis Durieu.                     | MD, SA                                       |
| Avena sativa L.                               | ES                                           |
| Avena sterilis L.                             | MD, IT                                       |
| Briza maxima L.                               | MD                                           |
| Bromus alopecuoros Poir.                      | MD                                           |
| Bromus diandrus Roth.                         | MD                                           |
| Bromus madritensis L.                         | MD                                           |
| Bromus rigidus Roth.                          | MD                                           |
| Bromus rubens L.                              | MD                                           |
| Catapodium marinum L.                         | MD                                           |
| Catania dichotoma Forsk.                      | IT, SA                                       |
| Cynodon dactylon L. Pers.                     | PL                                           |
| Cynosurus cloratus Lehm.                      | PL                                           |
| Cynosurus elegans Desf.                       | MD, IT                                       |
| Dactylis glomerata L.                         | MD, ES, IT                                   |
| Eleusine indica L.                            | ES                                           |
| Gastridium ventricosum Gouan.                 | MD                                           |
| Hordeum marinum L.                            | MD, ES                                       |
| Hordeum spontaneum C. Koch.                   | MD, IT                                       |
| Hordeum vulgare L.                            | ES                                           |
| Hyparrhenia hirta L.                          | MD, IT, SA                                   |
| Lagurus ovatus L.                             | MD                                           |
| Lamarchia aurea L.                            | MD, IT                                       |
| Lolium loliaceum Bory.                        | MD                                           |
| Lolium multiflorum Lam.                       | MD                                           |
| Lolium rigidum Gaud.                          | MD, IT                                       |
| Lophochroa punii Desf.                        | MD, ES                                       |
| Lophochroa salzmannii Boiss.                  | MD                                           |
| Lygeum spartum L.                             | MD, ES                                       |
| Pennisetum setaceum Forssk.                   | SA                                           |
| Phalaris minor Retz.                          | MD, IT                                       |
| Phragmites australis Cav.                     | PL                                           |
| Piptatherum miliaitum L.                      | MD                                           |
| Poa sicaia Steud.                             | IT                                           |
| Polypogon monspeliensis L.                    | MD, IT, SA                                   |
| Psilurus incursus Gouan.                      | MD, IT                                       |
| Stipa capensis Thunb.                         | IT, SA                                       |
| Stipa parviflora Desf.                        | IT                                           |
| Stipa tenacissima L.                          | ES, SA                                       |
| Trachynia distachya L.                        | MD, IT                                       |

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