

Flora and vegetation of Mt Damavand in Iran

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Abstract. With its 5671 meters of height, Mt Damavand is a dormant volcano and the highest peak in Iran and is located in the Central Alborz Range. It is the highest point in the Middle East and the highest volcano in all Asia and, as compared to other parts of the Alborz Range, botanically is relatively unknown. Plant species were identified and their chorology and life forms were determined by laboratory examinations and by reference to botanical literature. Floristic surveys were conducted during the active growth periods in 2010 and 2012. They resulted in identification of 370 plant species belonging to 206 genera and 56 families. Of the latter, *Asteraceae* with 56 species, *Papilionaceae* with 35 species, *Poaceae* with 35 species, *Lamiaceae* with 30 species, *Brassicaceae* with 23 species, *Caryophyllaceae* with 20 species, and *Rosaceae* with 19 species were the most abundant plant families. Among the life forms, hemicryptophytes, therophytes, geophytes, chamaephytes, and phanerophytes accounted for 62.7%, 14.9%, 10.8%, 8.1%, and 3.5% of all species, respectively. Chorological characteristics of the recorded flora have shown that Irano-Turanian and common Irano-Turanian and Mediterranean areas accommodated the most important ecological groups in the region and the other chorotypes were far from them in importance. Dominance of hemicryptophytes and therophytes can be referred to the simultaneous impact of climate fluctuations and livestock grazing on the flora of Mt Damavand.

Key words: Alborz Range, chorotypes, Iran, life form, Mt Damavand, plants

Introduction

Iran is a mountainous country and four-fifths of its surface lies at altitudes above 1000 m (Zohary 1973). Iran is also one of the centers of plant diversity in the Old World and so nearly 22% of the 8000 plant species of its flora are endemic (Ghahraman 1994). The Alborz Range is the second largest mountain range in Iran, with the highest peak in the country, and stretches over an area 650 km in length and 150–500 km in width. This west-east axis gives rise to dramatically different environments on the northern and southern slopes of the mountains (Klein 2001). The northern slopes of the ridges are dominated by a humid-temperate to warm-temperate climate (at lower altitudes), while the southern slopes have a dry

steppe climate. The Alborz Range cuts in between the Hindu Kush and Himalayas in the east, and Anatolia and the Caucasus in the west. Therefore, this transition area has some very important historical, evolutionary, phytogeographical and biogeographical aspects. There are many mountain peaks in the Alborz Range with an elevation higher than 4000 m. The alpine zone in Alborz is *ca.* between 3000 m and 4000–4200 m, and the nival zone is above 4000 m, depending on the geographical position, slope and exposure (Noroozi & al. 2010).

Mt Damavand is a dormant volcano located in the Alborz Range in Iran. With its 5671 m high summit, it is the highest peak in Iran and the Middle East and the highest volcano in all Asia.

Many studies of the flora and vegetation ecology of the Alborz Range in the subalpine and alpine zones have been carried out by Kotschy (1861), Gilli (1939), Klein (1982, 2001), Klein & Lacoste (1994), Naqinezhad & al. (2009), Noroozi & al. (2010), and Kamrani & al. (2011). With the exception of the latter study, detailed floristic accounts are still scarce, particularly of the alpine zone in Mt Damavand. The present study is aimed at identifying the floristic composition, life forms and chorology of the Damavand summit flora.

Material and methods

Study area

The study area (Mt Damavand) is in the Central Alborz Range, located between 51°59' and 52°16' E and between 35°49' and 36°05' N. The area covers 40 000 hectares, including the subalpine, alpine and nival zones, with the highest and lowest points ranging from 2200 m to 5671 m a.s.l. Mt Damavand is situated in the high Haraz valley of Mazandaran, on a line with the crests of the Central Alborz. Damavand is a young dormant volcano which was formed during the Holocene, and its last eruption was about 6–10 thousand years ago. According to data provided by the Lar Station, the mean annual temperature at 2450 m is 9°C. The mean annual temperature in this area is 24.2°C in August and –4°C in January. The climatic data show that the higher altitudes of Mt Damavand are affected by a northwesterly flow of polar air (Khalili 1973). Precipitation is more abundant on the northern slopes influenced by the Caspian Sea, than on the more continental southern slopes. At 2450 m, the mean annual rainfall is 533.2 mm; in September it is 36.5 mm and in March is 75 mm. A strong negative correlation exists between elevation and temperature, and all temperature values decrease with altitude. Unfortunately, no meteorological data is available for the high elevations.

Data collection

The investigation was carried out in the period 2010–2012. The transect method was used for inventory of the flora. Plant species were identified by reference to botanical literature (Komarov & al. 1963–1974; Tutin & al. 1964–1980; Davis 1965–1988; Rechinger 1968–2005; Townsend & al. 1985; Assadi & al. 1988–2010;), as well as by botanical identification at the Agriculture and Natural Resources Centre of Mazandaran. In the

vascular plant inventory, the families, genera and species are arranged in an alphabetical order. Plant chorotypes were also determined for each plant species, by using botanical references (Komarov & al., 1963–1974; Tutin & al. 1964–1980; Davis 1965–1988; Rechinger 1968–2005; Zohary & al. 1980–1994; Townsend & al. 1985; Assadi & al. 1988–2010; Akhiani 2005). The life forms of plants were determined by the Raunkiaer (1934) method. Plant chorotypes were identified after Zohary (1973).

Results and discussion

A total of 370 plant species belonging to 206 genera and 56 families were identified (Appendix 1). The major plant families presented in the studied area were *Asteraceae* (56 species), *Papilionaceae* (35), *Poaceae* (35), *Lamiaceae* (30), *Brassicaceae* (23), *Caryophyllaceae* (20), and *Rosaceae* (19). Most families, 41 (71.2%), were represented by one to four species and only 15 (19.8%) families were represented by five or more species.

The specific phytogeographical region determines the considerable diversity of floristic elements. Six types of floristic elements have been identified: Irano-Turanian 211 taxa (57%), Irano-Turanian/Mediterranean 73 taxa (19.7%), pluriregional 33 taxa (8.9%), Euro-Siberian/ Irano-Turanian/Mediterranean 23 taxa (6.4%), Euro-Siberian/Irano-Turanian 21 taxa (5.6%), Irano-Turanian/ Pontic 9 taxa (2.4%).

Distribution of the taxa according to classification of life forms (Raunkiaer 1934) is as follows: hemicryptophytes 232 (62.7%), therophytes 55 (14.9%), geophytes 40 (10.8%), chamaephytes 30 (8.1%), and phanerophytes 13 (3.5%).

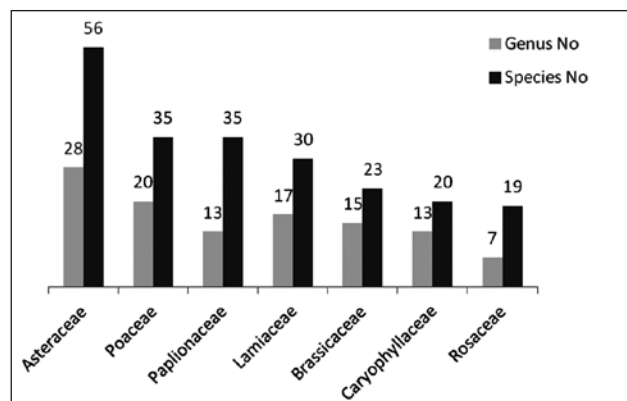


Fig. 1. The largest plant families across Mt Damavand.

Life form analysis is a widely used and useful tool for describing vegetation (Raunkiaer 1934). Hemicryptophytes are the dominant life form in this study and account for 212 taxa of the flora, followed by therophytes (545) and geophytes (52). The chorotypes are classified into the following groups:

Irano-Turanian species (IT)

Some examples of these species are: *Taraxacum syriaceum*, *Onosma demavendica*, *Draba pulchella*, *Prangos uloptera*, and *Veronica paderotae*.

Euro-Siberian/Irano-Turanian species (ES-IT)

Examples of the species of this group in the Damavand flora are: *Salvia chloroleuca*, *Euphorbia helioscopia*, *Papaver dubium*, *Plantago atrata*, *Potentilla gelida*, and *Urtica dioica*.

Irano-Turanian/Mediterranean species(IT-M)

Examples of these species on Mt Damavand are: *Salsola dendroides*, *Achillea setacea*, *Jurinella frigida*, and *Cerastium cerastoides*.

Euro-Siberian/Irano-Turanian/Mediterranean species(ES-IT-M)

Examples of these species are: *Poa pratensis*, *Hordeum bulbosum* and *Lotus corniculatus*.

Irano-Turanian/Pontic species (IT-PO)

Examples of these species are: *Hypericum scabrum*, *Epilobium angustifolium* and *Cirsium congestum*.

Pluriregional species (PL)

Examples of these species on Mt Damavand are: *Cirsium vulgare*, *Cichorium intybus*, *Sisymbrium loeselii*, and *Cardaria draba*.

Chorological characteristics of the Damavand flora have shown that hemicryptophytes are the most abundant life form in that area. Occurrence of a high proportion of hemicryptophytes in the studied site is typical of the cold mountain climate (Klimes 2003). Similar results have been obtained for hemicryptophytes on the other mountains in Central Asia, such as Hindu Kush (Agakhanjanz & Breckle 1995) and Nanga Parbat (Dickore & Nusser 2000). Other studies in the Khorasan Province have also reported higher abundance of hemicryptophytes. Amiri & al. (2008) studied the flora of Tiregan in the Hezar Masjed Mts. Memariani & al. (2009) also studied floristically Fer-eizi in Chenaran and both have found higher abundance of hemicryptophytes as compared to other life forms. The higher frequency of hemicryptophytes in Damavand can be related to their high adaptation to the Mediterranean climate conditions (Zohary

1973). Poor representation of phanerophytes in the study site indicates very adverse climatic conditions that do not support this type of life form. Although therophytes generally decrease with the increase of altitude and become quite rare at higher altitudes (Korner 1999), here, in contrast, they are evenly distributed across the elevation gradients. Although the proportion of geophytes recorded in the subalpine or alpine steppe areas in the Alborz Range is 6% (No-roozi & al. 2008), occurrence of a relatively high proportion of geophytes (14.5%) in the studied area reflects a long period of humidity during the growing season and frequent snow cover (Danin & Orshan 1990). However, geophytes can occur in many habitats (Esler & al. 1999; Procheş & al. 2006). Geophytes manifested the strongest presence after hemicryptophytes and therophytes. This can be partly explained by the seasonal character of water supply that supports the annual plants (Archibald 1995; Naqinezhad & al. 2010).

In addition to climate, intense grazing can also be a determinant factor for the relative abundance and geographic distribution of different life forms (Heitschmidt & Stuth 1991). Furthermore, thorny shrubs (e.g. *Astragalus* spp., *Acantholimon* spp., and *Acanthophyllum* spp.), poisonous plants (e.g. *Euphorbia helioscopia* and *Goebelia alopecuroides*), spiny forbs (e.g. *Cirsium vulgare*, *Cousinia commutata*), and annual plants (such as *Bromus danthoniae* and *Bromus tectorum*) dominate in some rangelands on Mt Damavand.

Large parts of the mountain are covered by *Astragalus microcephalus*, *Onobrychis cornuta*, *Bromus stenostachyus*, *Festuca ovina*, *Thymus pubescens* communities (2400–3500 m a.s.l.). Other dominant species of these vegetation types on Mt Damavand are *Chaerophyllum*, *Polygonum molliaeforme*, *Cru-ciata taurica*, *Lappula microcarpa*, *Rumex scutatus*, *Astragalus aegobromus*, *Elymus hispidus* var *hispidus*, *E. hispidus* var. *tomentosus*, and *Thymus pubescens*.

At 3500–3900 m the vegetation cover contains large thorn-cushion plants, mainly with a traganth growth form. The important components of these communities are *Astragalus*, *Acantholimon*, *Onobrychis*, *Cousinia* and some other genera. The high alpine xerophytic areas which are located on hill tops, ridges, and windswept spots are covered by graminoids such as *Poa araratica* and *Alopecurus*

textilis, and cushion-forming species such as *Astragalus jodotropis*, *Acantholimon demavendicum*, *Asragalus macrosemius*, *Asperula glomerata*, and *Jurinella frigida*. *Astragalus iodotropis* is the dominant species in these communities. The most important vegetation cover in the nival zone (3900–4400 m) is formed by *Senecio iranicus*, *Androsace villosa*, *Cerastium cerastoides*, *Potentilla argentea*, *Corydalis rupestris*, *Paraquilegia caespitosa*, and *Veronica kurdica* var. *kurdica*.

Annual species decrease with the increase of altitude and become quite rare at high altitudes (Körner 1999). Some examples of alpine and subalpine annuals in Mt Damavand are: *Bromus tectorum*, *B. danthoniae*, *Chenopodium foliosum*, *Polygonum molliaeforme*, *Cerastium purpurascens* var. *elbursense*, *Veronica biloba*, *Rosularia sempervivum*, and *Senecio vulcanicus*.

Alpine zones on Mt Damavand have been affected less by humans, as compared to the subalpine zones. Overgrazing leads to destruction of vegetation, loss of biological diversity and erosion of soil (Noroozi & al. 2007). Therefore, protection and management of rangelands in this zone needs to be considered. High percentage of endemic and rare species in the alpine zone and fragile ecosystems are good arguments for stopping the future loss of biodiversity in the high mountain regions (Noroozi & al. 2007).

Overgrazing by livestock, disregarding the seasons unsuitable for grazing, mining, road construction, and converting rangelands are the main causes of degradation in Mt Damavand. The roads not only destroy large parts of the area but also facilitate access to the high altitudes both for mass climbing and for grazing animals.

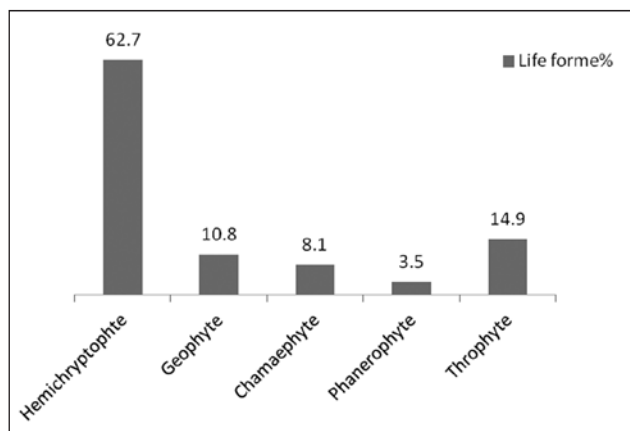


Fig. 2. Life form spectrum across Mt Damavand.

Appendix 1. Plant checklist of Mt Damavand flora. Species (life form – chorotype). Abbreviations: Life forms – Cha = Chamaephyte, Geo = Geophyte, Hem = Hemichryptophyte, Pha = Phanerophyte, Cry = Cryptophyte, Thr = Therophyte; ES = Euro-Siberian, IT = Irano-Turanian, M = Mediterranean, PON = Pontic, PL = Pluriregional.

Plant taxa	Life form	Chorotype
Adiantaceae		
<i>Adiantum capillus-veneris</i> L.	Hem	IT
Amaryllidaceae		
<i>Ixiolirion tataricum</i> (Pall.) Herb.	Geo	IT
Apiaceae		
<i>Bupleurum rotundifolium</i> L.	Thr	IT, M
<i>Chaerophyllum macrospermum</i> (Spreng.) Fisch. & C.A. Mey	Thr	IT, M
<i>Eryngium caucasicum</i> Trautv.	Hem	IT
<i>Ferula galbaniflua</i> Boiss. & Buhse	Geo	IT
<i>F. ovina</i> (Boiss.) Boiss.	Geo	IT
<i>Heracleum anisactis</i> Boiss. & Hohen.	Hem	IT
<i>H. persicum</i> Fischer	Hem	IT
<i>Pimpinella affinis</i> Ledeb.	Thr	IT
<i>P. tragiium</i> subsp. <i>lithophila</i> (Schischk.) Tutin	Hem	ES, IT, M
<i>Prangos ferulacea</i> (L.) Lindl.	Hem	IT, M
<i>P. uloptera</i> DC.	Hem	IT, M
<i>Scandix stellata</i> Banks & Soland.	Thr	IT, M
<i>Torilis arvensis</i> (Huds.) Link	Thr	PL
Asteraceae		
<i>Achillea biebersteinii</i> Afan.	Hem	IT
<i>A. millefolium</i> subsp. <i>elbursensis</i> Hub.-Mor.	Hem	ES, IT
<i>A. setacea</i> Waldst. & Kit.	Hem	IT, M
<i>A. vermicularis</i> Trin.	Hem	IT, M
<i>A. wilhelmsii</i> K. Koch	Hem	ES, IT
<i>Anthemis altissima</i> L.	Hem	IT
<i>A. tinctoria</i> L.	Hem	IT
<i>Artemisia absinthium</i> L.	Cha	IT, M
<i>A. chamaemelifolia</i> Vill.	Cha	IT
<i>A. fragrans</i> Willd.	Cha	IT
<i>A. melanolepis</i> Boiss.	Hem	IT
<i>A. scoparia</i> Waldst. & Kit.	Hem	IT, M
<i>Centaurea iberica</i> Spreng.	Hem	IT, M
<i>C. pulchella</i> Ledeb.	Hem	IT, M
<i>C. virgata</i> Lam.	Cha	ES, IT, M
<i>Chondrilla juncea</i> L.	Hem	IT
<i>Cichorium intybus</i> L.	Hem	PL
<i>Cirsium congestum</i> DC.	Hem	IT, PON
<i>C. hygrophyllum</i> Boiss.	Hem	IT
<i>C. lappaceum</i> var. <i>forex</i> Boiss.	Hem	IT
<i>C. vulgare</i> (Savi) Ten.	Hem	PL
<i>Cousinia behboudiana</i> Rech.f. & Esfand.	Hem	IT
<i>C. calocephala</i> Jaub. & Spach.	Hem	IT
<i>C. commutata</i> Bunge	Hem	IT
<i>C. xiphiolepis</i> Boiss.	Hem	IT
<i>Crepis demavendi</i> Bornm.	Thr	IT, M
<i>C. multicaulis</i> Ledeb.	Thr	IT, M

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>Echinops elbursensis</i> Rech.f.	Hem	IT
<i>Erigeron uniflorus</i> subsp <i>elbursensis</i> (Boiss.) Rech.f.	Hem	IT
<i>Helichrysum plicatum</i> DC.	Cha	IT,M
<i>H. psychrophilum</i> Boiss.	Cha	IT,M
<i>Hetropappus altaicus</i> (Willd.) Novopokr.	Hem	IT,M
<i>Hieracium procerum</i> Fr.	Hem	IT
<i>Inula oculus-chirsti</i> L.	Hem	PL
<i>I. britannica</i> L.	Hem	IT
<i>Iranecio oligolepis</i> (Boiss.) B. Nord.	Hem	IT
<i>Jurinella frigida</i> (Boiss.) Wagentiz	Hem	IT, M
<i>Leontodon asperrimus</i> (Willd.) Boiss.	Hem	IT
<i>Ligularia persica</i> Boiss.	Hem	IT
<i>Myopordon damavandica</i> Mozaff.	Hem	IT
<i>Psychogeton amorphoglossus</i> (Boiss.) Novopokr.	Hem	IT
<i>Scariola orientalis</i> (Boiss.) Sojak	Hem	IT
<i>Scorzonera persica</i> Boiss.	Hem	IT
<i>S. phaeopappa</i> (Boiss.) Boiss.	Hem	IT
<i>Senecio iranicus</i> B. Nord.	Hem	IT
<i>S. vulcanicus</i> Boiss.	Hem	IT
<i>Tanacetum parthenium</i> (L.) Sch.Bip.	Geo	PL
<i>T. polycephalum</i> Sch.Bip.	Hem	IT
<i>Taraxacum brevirostre</i> Hand.-Mazz.	Hem	IT
<i>T. syriacum</i> Boiss.	Hem	IT
<i>Tragopogon bupththalmoides</i> (DC.) Boiss.	Hem	IT, PON
<i>T. graminifolius</i> DC.	Hem	IT
Berberidaceae		
<i>Berberis integerrima</i> Bunge	Pha	ES, IT, M
Boraginaceae		
<i>Alkanna bracteosa</i> Boiss.	Hem	IT
<i>Anchusa strigosa</i> Labill.	Hem	PL
<i>Cynoglossum creticum</i> Mill.	Hem	IT
<i>Echioides longiflorum</i> (K. Koch) I.M. Johnst.	Hem	IT
<i>Lappula microcarpa</i> (Ledeb.) Gürke.	Thr	IT
<i>Lithospermum purpurocaeruleum</i> L.	Hem	IT, M
<i>Myosotis olympica</i> subsp <i>demavendica</i> (Vestergr.) Riedl	Hem	IT
<i>Onosma demavendica</i> Riedl	Hem	IT
<i>O. dicroanthum</i> Boiss.	Hem	ES, IT
<i>Solenanthes circinatus</i> Ledeb.	Hem	IT
Brassicaceae		
<i>Alyssum contemptum</i> Schott & Kotschy	Hem	IT
<i>A. linifolium</i> Willd.	Thr	IT, M
<i>A. minus</i> (L.) Rothm.	Thr	IT, M
<i>A. murale</i> Waldst. & Kit.	Thr	IT
<i>A. polycladum</i> Rech.f.	Hem	IT
<i>A. szowitsianum</i> Fischer & C.A. Mey.	Hem	IT
<i>Anchonium elichrysfolium</i> (DC.) Boiss.	Hem	IT
<i>Arabis caucasica</i> Willd.	Hem	IT
<i>Capsella bursa-pastoris</i> (L.) Medik.	Hem	PL
<i>Cardaria draba</i> (L.) Desv.	Thr	PL

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>Didymorphys aucheri</i> Boiss.	Hem	IT
<i>Descurainia sophia</i> (L.) Prantl	Thr	ES, IT, M
<i>Draba nemorosa</i> L.	Thr	ES, IT
<i>D. pulchella</i> Willd.	Thr	IT
<i>D. siliquosa</i> M. Bieb.	Thr	IT
<i>Erysimum cuspidatum</i> (M. Bieb.) DC.	Hem	IT
<i>Isatis kotschyana</i> Boiss. & Hohen.	Hem	IT
<i>Lepidium draba</i> L.	Hem	ES, IT, M
<i>L. latifolium</i> L.	Geo	PL
<i>Matthiola farinosa</i> Boiss.	Thr	IT
<i>Physoptachys gnaphalodes</i> (DC.) Boiss.	Hem	IT
<i>Sisymbrium loeselii</i> L.	Thr	PL
<i>Thlaspi stenocarpum</i> (Boiss.) Hedge	Thr	PL
Campanulaceae		
<i>Asyneuma amplexicaule</i> (Willd.) Hand.-Mazz.	Thr	IT
<i>Campanula lyricea</i> Boiss.	Hem	IT, M
<i>Campanula stevenii</i> M. Bieb.	Hem	ES, IT
<i>Minidium laevigatum</i> (Vent.) Rech.f. & Schiman-Czeika	Hem	IT, M
Caprifoliaceae		
<i>Lonicera iberica</i> M. Bieb.	Pha	ES, IT
Caryophyllaceae		
<i>Acanthophyllum crassifolium</i> Boiss.	Cha	IT
<i>Arenaria gypsophiloides</i> L. var. <i>gypsophiloides</i>	Hem	ES, IT
<i>Bufonia koelzii</i> Rech.f.	Hem	IT
<i>Cerastium cerastoides</i> (L.) Britton	Thr	IT, M
<i>C. purpurascens</i> Adams	Thr	IT, M
<i>Dianthus libanotis</i> Labill.	Cha	IT
<i>D. orientalis</i> subsp <i>stenocalyx</i> (Boiss.) Rech.f.	Cha	IT
<i>Gypsophila aretioides</i> Boiss.	Hem	IT
<i>G. bicolor</i> (Freyn & Sint.) Grossh.	Hem	IT
<i>Minuartia lineata</i> (Boiss.) Bornm.	Thr	IT
<i>Sagina micrantha</i> Bunge	Hem	IT
<i>Scleranthus orientalis</i> Rössler	Hem	IT
<i>Silene aucheriana</i> Boiss.	Cha	IT
<i>S. cyri</i> Schischk.	Hem	IT
<i>S. marschallii</i> C.A. Mey.	Hem	IT
<i>S. odontopetala</i> Fenzl subsp. <i>odontopetala</i>	Hem	IT
<i>S. palinotricha</i> Boiss.	Hem	IT
<i>Stellaria scaturiginella</i> Rech.f.	Thr	IT
<i>Tunica saxifraga</i> (L.) Scop.	Hem	IT, M
Chenopodiaceae		
<i>Camphorosma monspeliaca</i> L.	Hem	IT
<i>Chenopodium album</i> L.	Thr	PL
<i>Ch. foliosum</i> (Moench) Asch.	Thr	PL
<i>Eurotia ceratoides</i> (L.) C.A. Mey.	Cha	IT, M
<i>Kochia prostrata</i> L.	Cha	IT
<i>Salsola dendroides</i> Pall.	Cha	IT, M
<i>S. canescens</i> (Moq.) Boiss.	Cha	IT, M
Cistaceae		
<i>Helianthemum nummularium</i> L.	Hem	ES, IT

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
Convolvulaceae		
<i>Convolvulus arvensis</i> L.	Hem	PL
<i>C. cantabrica</i> L.	Hem	IT
Crassulaceae		
<i>Rosularia sempervivum</i> (M. Bieb.) A. Berger	Cha	IT
Cupressaceae		
<i>Juniperus excelsa</i> M. Bieb.	Pha	IT, M
Cyperaceae		
<i>Carex songarica</i> Kar. & Kir.	Geo	PL
Dipsacaceae		
<i>Scabiosa rotata</i> M. Bieb.	Hem	IT, M
Ephedraceae		
<i>Ephedra distachya</i> L.	Cha	IT, M
Euphorbiaceae		
<i>Euphorbia helioscopia</i> L.	Hem	ES, IT
<i>E. microsciadia</i> Boiss.	Hem	IT
<i>E. seguieriana</i> Neck.	Thr	IT, M
<i>E. petiolata</i> Banks & Soland.	Thr	IT, M
Fumariaceae		
<i>Corydalis rupestris</i> Boiss.	Hem	IT
<i>Fumaria vaillantii</i> Loisel.	Thr	IT, M
Gentianaceae		
<i>Gentiana olivieri</i> Griseb.	Hem	IT, M
Geraniaceae		
<i>Erodium cicutarium</i> (L.) Aiton	Hem	IT, M
<i>Geranium collinum</i> Willd.	Hem	IT
<i>G. pyrenaicum</i> Burnm.f.	Hem	IT
<i>Biebersteinia multifida</i> DC.	Geo	IT, M
Hyacinthaceae		
<i>Bellevalia pycnantha</i> (K. Koch.) Losinsk.	Geo	IT
Hypericaceae		
<i>Hypericum scabrum</i> L.	Hem	IT, M
<i>H. hyssopifolium</i> subsp. <i>elongatum</i> (Ledeb.) Woron.	Hem	IT, PON
Iridaceae		
<i>Crocus biflorus</i> Mill.	Geo	IT
<i>Iris barnumae</i> subsp. <i>demavandica</i> (Bornm.) Mathew & Wendelbo	Geo	IT
Juncaginaceae		
<i>Triglochin palustris</i> L.	Hem	IT, M
Lamiaceae		
<i>Ajuga chamaecistus</i> Benth.	Cha	IT
<i>A. comata</i> Stapf	Hem	IT
<i>Betonica nivea</i> subsp. <i>mazanderana</i> (Bornm.) Rech.f.	Hem	IT
<i>Dracocephalum aucheri</i> Boiss.	Hem	IT
<i>D. multicaule</i> Montbret & Aucher	Hem	IT
<i>Eremostachys laciniata</i> (L.) Bunge	Hem	IT
<i>Lamium album</i> L.	Thr	ES, IT
<i>L. tomentosum</i> Willd.	Hem	IT
<i>Leonurus cardiaca</i> L.	Hem	IT

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>Marrubium astracanicum</i> Jacq.	Hem	IT
<i>M. vulgare</i> L.	Hem	IT
<i>Mentha longifolia</i> (L.) Huds.	Hem	PL
<i>Nepeta crassifolia</i> Boiss. & Buhse	Hem	IT
<i>Phlomis olivieri</i> Benth.	Hem	IT
<i>Prunella vulgaris</i> L.	Hem	PL
<i>Salvia atropatana</i> Bunge	Hem	ES, IT
<i>S. chloroleuca</i> Rech.f. & Aellen	Hem	ES, IT
<i>S. sclarea</i> L.	Hem	IT
<i>S. verticillata</i> L.	Hem	IT
<i>Scutellaria glechomoides</i> Boiss.	Hem	IT
<i>Stachys byzantina</i> K. Koch	Hem	ES, IT, M
<i>S. inflata</i> Benth.	Hem	IT, M
<i>S. lavandulifolia</i> Vahl	Hem	IT, M
<i>S. laxa</i> Buhse	Hem	IT, M
<i>Teucrium polium</i> L.	Hem	IT
<i>T. chamaedrys</i> L.	Hem	IT, M
<i>Thymus fallax</i> Fisch. & C.A. Mey.	Cha	IT, M
<i>T. pubescens</i> Čelak.	Cha	IT, M
<i>Ziziphora clinopodioides</i> subsp. <i>elbursensis</i> (Rech.f.) Rech.f.	Hem	IT, M
<i>Z. tenuir</i> L.	Thr	IT, M
Liliaceae		
<i>Allium atroviolaceum</i> Boiss.	Geo	IT
<i>A. bodeanum</i> Regel	Geo	IT
<i>Colchicum kotschyi</i> Boiss.	Geo	IT
<i>Eremurus spectabilis</i> M. Bieb.	Geo	IT
<i>Gagea confusa</i> A. Terracc.	Geo	IT
<i>G. caroli-kochii</i> Grossh.	Geo	IT
<i>G. lutea</i> (L.) Ker.Gawl.	Geo	IT
<i>Muscari caucasicum</i> (Griseb.) Baker	Geo	IT
<i>M. neglectum</i> Guss. ex Ten.	Geo	IT
<i>Ornithogalum sintenisii</i> Freyn	Geo	IT
<i>Tulipa montana</i> var. <i>chrysantha</i> (Boiss.) Wendelbo	Geo	IT
<i>T. montana</i> Lindl. var. <i>montana</i>	Geo	IT
Lythraceae		
<i>Lithrum salicaria</i> L.	Hem	PL
Malvaceae		
<i>Alcea sulphurea</i> (Boiss. & Hohen.) Alef.	Hem	ES, IT
<i>Malva sylvestris</i> L.	Thr	IT
Onagraceae		
<i>Epilobium angustifolium</i> L.	Geo	IT, PON
<i>E. hirsutum</i> L.	Geo	PL
Orchidaceae		
<i>Orchis mascula</i> L.	Geo	IT, M
Papaveraceae		
<i>Glaucium fimbriigerum</i> Boiss.	Hem	IT
<i>Papaver bracteatum</i> Lindl.	Hem	IT
<i>P. dubium</i> L.	Thr	ES, IT
<i>P. fugax</i> Poir.	Hem	IT

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
Papilionaceae		
<i>Alhagi pseudalhagi</i> Shap.	Cha	IT, M
<i>Astragalus aegobromus</i> Boiss. & Hohen.	Hem	IT
<i>A. apricus</i> Bunge	Hem	IT
<i>A. bounophilus</i> Boiss. & Hohen.	Hem	IT
<i>A. brevidens</i> Freyn & Sint.	Hem	IT
<i>A. capax</i> Maassoumi	Hem	IT
<i>A. caraganae</i> Hohen.	Hem	IT
<i>A. demavendicus</i> Boiss. & Buhse subsp. <i>demavendicus</i>	Hem	IT
<i>A. gossypinus</i> Fisch.	Cha	IT
<i>A. grammocalyx</i> Boiss. & Hohen.	Hem	IT
<i>A. jodotropis</i> Boiss.	Cha	IT
<i>A. leptycticus</i> Maassoumi	Hem	IT
<i>A. lilacinus</i> Boiss.	Hem	IT
<i>A. lineatus</i> Lam.	Hem	IT
<i>A. macrosemius</i> Boiss. & Hohen.	Hem	IT
<i>A. patrius</i> Maassoumi	Hem	IT
<i>A. retamocarpus</i> Boiss.	Hem	IT
<i>A. sciureus</i> Boiss. & Hohen.	Hem	IT
<i>A. sieversianus</i> Pall.	Hem	IT
<i>A. vulcanicus</i> Bornm.	Hem	IT
<i>Colutea buhsei</i> (Boiss.) Shap.	Pha	IT, M
<i>Coronilla varia</i> L.	Hem	ES, IT, M
<i>Goebelia alopecuroides</i> (L.) Boiss.	Hem	IT
<i>Lotus corniculatus</i> L.	Hem	ES, IT, M
<i>Medicago lupulina</i> L.	Thr	PL
<i>M. minima</i> (L.) Bartal.	Thr	PL
<i>M. sativa</i> L.	Hem	IT
<i>Melilotus officinalis</i> L.	Hem	PL
<i>Onobrychis altissima</i> Grossh.	Hem	ES, IT
<i>O. cornuta</i> (L.) Desv. subsp. <i>cornuta</i>	Cha	IT
<i>Ononis spinosa</i> subsp. <i>leiosperma</i> (Boiss.) Širj.	Hem	IT, M
<i>Oxytropis kotschyana</i> Boiss. & Hohen.	Hem	IT
<i>O. szovitsii</i> Boiss. & Buhse.	Hem	IT
<i>Trifolium pratense</i> L.	Hem	PL
<i>T. repens</i> L. var. <i>repens</i>	Geo	ES, IT, M
<i>Vicia persica</i> Boiss.	Hem	IT, PON
Plantaginaceae		
<i>Plantago atrata</i> Hoppe	Hem	IT
<i>P. lanceolata</i> L.	Hem	ES, IT, M
Plumbaginaceae		
<i>Acantholimon demavendicum</i> Bornm.	Cha	IT
<i>A. erinaceum</i> (Jaub. & Spach) Lincz.	Cha	IT
Poaceae		
<i>Aegilops triuncialis</i> L.	Thr	IT, M
<i>Agropyron elongatiforme</i> Drobow	Geo	IT, M
<i>A. intermedium</i> (Host) P. Beauv.	Geo	ES, IT, M
<i>A. pectiniforme</i> Roem. & Schult.	Geo	ES, IT, M
<i>Alopecurus himalaicus</i> Hook.f.	Geo	IT
<i>A. textilis</i> Boiss.	Geo	IT

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>Bromus briziformis</i> Fisch. & C.A. Mey.	Thr	IT, M
<i>B. danthoniae</i> C.A. Mey.	Thr	PL
<i>B. gracillimus</i> Bunge	Hem	IT
<i>B. stenostachyus</i> Boiss.	Geo	IT
<i>B. tectorum</i> L.	Thr	PL
<i>B. tomentellus</i> Boiss.	Geo	IT
<i>Calamagrostis pseudophragmites</i> (Haller f.) Koeler	Geo	IT, M
<i>Cynodon dactylon</i> (L.) Pers.	Geo	PL
<i>Dactylis glomerata</i> L.	Hem	ES, IT, M
<i>Deschampsia cespitosa</i> (L.) P. Beauv.	Geo	IT
<i>Dichanthium annulatum</i> (Forssk.) Stapf.	Hem	ES, IT
<i>Elymus hispidus</i> (Opiz.) Melderis var. <i>hispidus</i>	Geo	IT, M
<i>E. hispidus</i> var. <i>villosus</i> (Hack.) Asadi	Geo	IT
<i>E. longearistatum</i> (Boiss) Tzvelev		
<i>Festuca ovina</i> L.	Geo	IT
<i>Hordeum bulbosum</i> L.	Geo	ES, IT, M
<i>H. marinum</i> Hunds.	Thr	ES, IT, M
<i>H. violaceum</i> Boiss. & Hohen.	Hem	IT
<i>Melica jacquemontii</i> Decne subsp. <i>jacquemontii</i>	Hem	IT, M
<i>M. persica</i> Kunth	Hem	ES, IT, M
<i>Pennisetum orientale</i> Rich.	Hem	IT, M
<i>Phleum alpinum</i> L.	Geo	IT
<i>Poa araratica</i> Trautv.	Geo	IT, M
<i>P. bulbosa</i> L.	Geo	ES, IT
<i>P. pratensis</i> L.	Geo	ES, IT, M
<i>Psathyrostachys fragilis</i> (Boiss.) Nevski	Hem	IT, M
<i>Secale montanum</i> Guss.	Geo	IT, M
<i>Stipa hohenackeriana</i> Trin. & Rupr.	Hem	IT
<i>Trisetum rigidum</i> (M. Bieb.) Roem. & Schult.	Hem	IT
Podophyllaceae		
<i>Bongardia chrysogonum</i> Boiss.	Geo	IT
Polygonaceae		
<i>Oxyria digyna</i> (L.) Hill	Hem	IT
<i>Pteropyrum aucheri</i> Jaub. & Spach	Cha	IT, M
<i>Polygonum aviculave</i> L.	Thr	PL
<i>P. molliaeforme</i> Boiss.	Hem	IT
<i>P. serpyllaceum</i> Jaub. & Spach.	Hem	IT
<i>Rumex scutatus</i> L.	Hem	IT
Primulaceae		
<i>Androsace villosa</i> L.	Hem	IT
<i>Dionysia aretioides</i> (Lehm.) Boiss.	Hem	ES, IT
<i>Primula macrocalyx</i> Bunge	Hem	IT
Ranunculaceae		
<i>Adonis aestivalis</i> L.	Thr	PL
<i>Anemone biflora</i> DC.	Thr	IT
<i>Clematis ispahana</i> Boiss.	Hem	IT
<i>Delphinium aquilegifolium</i> (Boiss.) Bornm.	Hem	IT
<i>Ficaria kochii</i> (Ledeb.) Iranshahr & Rech.f.	Geo	IT, M
<i>Paraquilegia caespitosa</i> (Boiss. & Hohen.) J.R. Drumm. & Hutch.	Hem	IT, M
<i>Ranunculus bulbiferus</i> Boiss. & Hohen.	Geo	IT, M

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>R. constantopolitanus</i> (DC.) D'Urv.	Hem	IT
<i>R. elbursensis</i> Boiss.	Hem	IT
<i>R. kotschyi</i> Boiss.	Hem	IT
<i>R. macrorrhynchus</i> Boiss.	Hem	IT
<i>R. polyanthemus</i> L.	Hem	IT
<i>Thalictrum foetidum</i> L.	Geo	PL
Resedaceae		
<i>Reseda lutea</i> L.	Hem	ES, IT, M
Rosaceae		
<i>Alchemilla pectiniloba</i> Forhner	Geo	IT
<i>A. rechingeri</i> Rothm.	Geo	IT
<i>Cerasus pseudoprostrata</i> Pojark.	Cha	IT
<i>Cotoneaster nummularioides</i> Pojark.	Pha	IT, M
<i>Potentilla argentea</i> L.	Hem	IT
<i>P. argyroloma</i> Boiss & Hohen.	Hem	IT
<i>P. aucheriana</i> Bornm.	Hem	IT
<i>P. bungei</i> Boiss.	Hem	IT
<i>P. canescens</i> Besser	Hem	IT
<i>P. gelida</i> C.A.Mey	Hem	IT
<i>P. hololeuca</i> Lehm.	Hem	IT
<i>P. mallota</i> Boiss.	Hem	IT
<i>P. meyeri</i> Boiss.	Hem	IT
<i>P. multifida</i> L.	Hem	IT
<i>P. nuda</i> Boiss.	Hem	IT
<i>P. polyschista</i> Boiss. & Hohen	Hem	IT
<i>Rosa canina</i> L.	Pha	ES, IT, M
<i>Rubus anatolicus</i> (Focke) Hausskn.	Cha	ES, IT
<i>Sanguisorba minor</i> Scop.	Hem	PL
Rubiaceae		
<i>Asperula glomerata</i> (M. Bieb.) Griseb.	Hem	IT
<i>Crucianella gilanica</i> subsp. <i>demavendica</i> (Vest.) Riedl	Hem	IT
<i>Cruciata taurica</i> (Willd.) Ehrend.	Hem	IT
<i>Galium aparine</i> L.	Thr	PL
<i>G. verum</i> L. subsp. <i>verum</i>	Geo	PL
Rutaceae		
<i>Haplophyllum perforatum</i> (M. Bieb.) Kar. & Kir.	Hem	IT, M
Salicaceae		
<i>Salix aegyptiaca</i> L.	Pha	ES, IT, M
<i>S. elbursensis</i> Boiss.	Pha	IT
<i>S. excelsa</i> S.G.Gmel.	Pha	ES, IT, M
<i>S. wilhelmsiana</i> M. Bieb.	Pha	IT
Saxifragaceae		
<i>Saxifraga iranica</i> Bornm.	Hem	IT
Scrophulariaceae		
<i>Linaria lineolata</i> Boiss.	Hem	IT
<i>Pedicularis caucasica</i> M. Bieb.	Hem	IT, PON
<i>Scrophularia pruinosa</i> Boiss.	Hem	IT
<i>S. variegata</i> M. Bieb.	Hem	IT
<i>Verbascum agrimonifolium</i> (K. Koch) Hub.-Mor.	Hem	IT, PON
<i>V. aucheri</i> (Boiss.) Hub.-Mor.	Hem	IT, M

Appendix 1. Continuation.

Plant taxa	Life form	Chorotype
<i>Veronica anagalloides</i> subsp. <i>heureka</i> M.A. Fisch.	Thr	IT
<i>V. aucheri</i> Boiss.	Thr	IT
<i>V. biloba</i> L.	Thr	IT
<i>V. chionantha</i> Bornm.	Thr	IT
<i>V. kurdica</i> Benth. subsp. <i>kurdica</i> .	Thr	IT
<i>V. paederotae</i> Boiss.	Thr	IT
Solanaceae		
<i>Solanum dulcamara</i> L.	Hem	IT, M
<i>Soalanum nigrum</i> L.	Thr	ES, IT, M
<i>Hyoscyamus senecionis</i> Willd.	Hem	IT, M
Tamaricaceae		
<i>Tamarix ramosissima</i> Ledeb.	Pha	IT
Ulmaceae		
<i>Celtis caucasica</i> Willd.	Pha	IT
Urticaceae		
<i>Urtica dioica</i> L.	Hem	ES, IT
Valerianaceae		
<i>Valeriana sisymbriifolia</i> Vahl	Thr	IT
Violaceae		
<i>Viola occulta</i> Lehm.	Thr	IT
Zigophyllaceae		
<i>Zygophyllum fabago</i> L.	Hem	IT, M

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