

Flora, Life Form and Chorology of Winter and Rural Range Plants in the Northern Khorasan Province, Iran

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Manuscript Received: 05/04/2011

Manuscript Accepted: 01/06/2011

Abstract. Floristic studies are fundamental for the applied sciences such as rangeland management and conservation. Unique ecological and climatic conditions in the Northern Khorasan Province (NKP) make it a remarkable habitat for the floristic studies. Plant species were collected from 50 field sites, representing major habitats of winter and rural rangelands. Surveys were conducted during active growth periods in 2007 and 2008. Plant species were identified and their chorology and life form determined through laboratory examinations and by using reference books. Floristic surveys resulted in identification of 534 plant species, belonged to 315 genus and 68 families. Asteraceae, Poaceae and Fabaceae were respectively the most abundant plant families. Among the life forms, Hemicryptophytes, Therophytes, Chamaephytes, Phanerophytes and Geophytes included 45, 32, 9, 7 and 7% of the total species, respectively. Irano-Turanian was the most dominant (65%) Chorotypes. The dominance of Hemicryptophytes and Therophytes, as well as vast distribution of Chamaephytes, can be referred to the simultaneous effects of climate fluctuations and livestock grazing on the flora of winter and rural rangelands in NKP.

Keywords: Floristic composition, Rangeland, Northern Khorasan, Iran.

Introduction

Iran is known as one of the most appealing places for studying plant diversity, as 22% of its 8000 plant species are endemic (Asri 2000). Identifying flora of each region is fundamental for accomplishing other pure and applied researches in biology. Especially in the Northern Khorasan Province (NKP), unique ecological and climatic conditions make it a remarkable habitat for the floristic studies. Winter and rural rangelands comprise a large fraction of NKP area. People in this region are highly dependent on rangelands; they use range plants as sources for food, medicine, livestock production etc. Therefore, identifying floristic list of rural and winter rangelands of NKP is beneficial for protecting the endangered plants, and for planning a sustainable use of forage, ornamental and medicinal plants.

Several reference books (e.g. Rechinger 1967-2010; Boissier 1867-1888; Assadi *et al.*, 1988-2010) provide valuable information on the native and exotic plants of NKP. However, they are mainly adopted from the large-scale studies and do not provide detailed information on the flora of this region. On the other hand several studies have been conducted on the flora of NKP (e.g. Shaad and Sanjari 2001; Aydani 2004; Sobhani *et al.*, 2007) but they only represent information on the flora small areas (usually less than 10000 hectares). Akhani (2005) have studied flora of Golestan National Park, in which small parts of Germeh and Maneh-o-Samalghan counties (NKP) were also included. Other researchers have studied geographic distribution of plant species for only one family or one genus in Khorasan Provinces, e.g. Compositae (Sobhani and Rajamand, 2007), (Cupressaceae Sadeghalnejat 2007), and genus of *Bromus* L. (Memariani and Joharchi, 2007).

Accordingly, a lack of comprehensive information on the flora rural and winter rangelands of NKP was the most important reason behind this research. The main aim was to do a survey the flora and to identify

the major plant phenotype and chorotypes of the winter and rural rangelands in NKP. Result of this study can also be used for the applied researches such as rangeland management and conservation.

Materials and Methods

Northern Khorasan Province is located between 55° 53' to 58° 20' eastern longitude and 36° 37' to 38° 17' northern latitude. It is located in the northeast of Iran, and comprised of six counties i.e. Bojnourd, Shirvan, Esfarayen, Maneh, Samalghan, Germeh, Jajarm, and Farroj (Fig. 1). Rangelands contain 55.82% of NKP area, which is about 1.72 million hectares, from which 1.31 million hectares are used as winter and rural rangelands (Jankju *et al.*, 2009).

Main bioclimatic region in NKP is Irano-Turanian that is distinguished by hot and dry summers, wet and cold winters. The region is also influenced by cold and dry winds from Siberia (north) and wet and mild climate from the Caspian Sea (west). Therefore the flora of NKP are affected by sever climate fluctuations, because of interaction between the three major climatic regimes. Average yearly rainfall varies from the lowest (<200 mm) in Jajarm to the highest (420 mm) in the northwest of Maneh and Samalghan. Average annual temperature also varies from a maximum (17-18 °C) in Jajarm to the minimum (8-10 °C) values in Farroj.

Many places of NKP winter and rural rangelands confer similar climate, geology and topography conditions. Therefore, site selection was conducted by using geology, topography, soil and seasonal livestock migration (Kooch) maps. Information provided by the local experts was also implemented. A new site was selected, where the environmental conditions or land use history varied. Accordingly, 50 rangeland sites were selected from which 30 were located in rural and 20 in winter rangelands.

Geographic distribution of rural rangeland sites were: 4 in Germeh and Jajarm, 9 in

Bojnourd, 7 in Shirvan, 5 in Maneh and Samalghan and 2 in Farroj. Sites of winter rangelands were scattered as 9 in Germeh, Jajarm, 8 in Esfarayen, 2 in Maneh, Samalghan, and one in Bojnourd. Soil textures of most sites were silty loam, but in some places it was clay-loam or silty-clay-loam, pH was about 7-8, soil fertility was low to medium; nitrogen was highly limited whereas potassium was high nearly in all sites (Jankju *et al.*, 2009).

Plant species were identified by using some reference books (Akhani 2005; Assadi *et al.*, 1988-2010; Davis 1965–1988; Komarov *et al.*, 1963-1974; Rechinger 1967-2010; Townsend *et al.*,

1985; Tutin *et al.*, 1964-1980); also by botanical identification in the Botanical Research Center of Ferdowsi University of Mashhad. Plant chorotypes were also determined for each plant species, by using several reference books (Akhani 2005; Assadi *et al.*, 1988-2010; Davis 1965 – 1988; Komarov *et al.*, 1963-1974; Rechinger 1967-2010; Townsend *et al.*, 1985; Tutin *et al.*, 1964-1980; Zohary *et al.*, 1980). Plant phenotypes were determined according to the Raunkiaer's life form specifications (Asri 2000). Plant chorotypes were identified based on Zohary (1973).

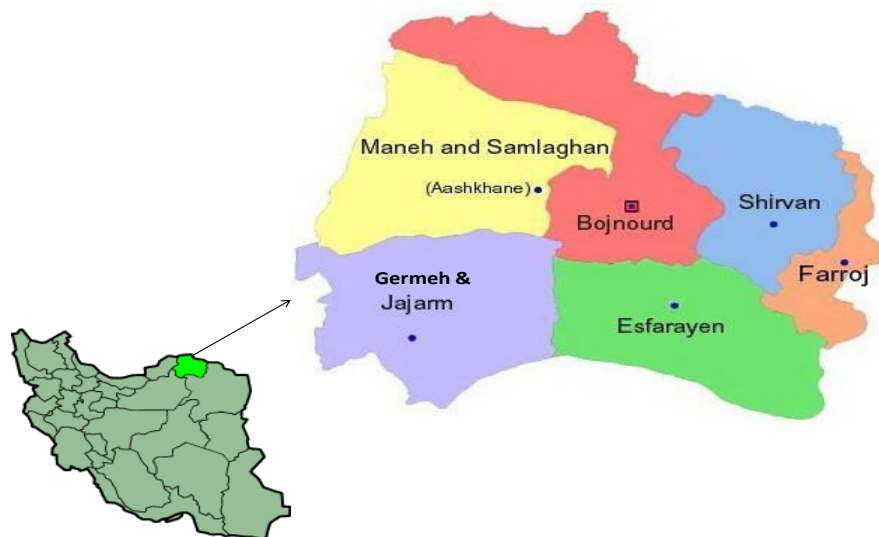


Fig. 1. Northern Khorasan province in the northeast of Iran, and its counties

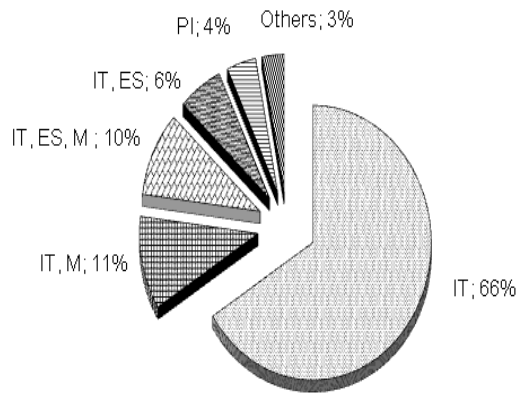
Results

Floristic surveys on the winter and rural rangelands of Northern Khorasan Province (NKP) resulted in identification of 534 plant species, belonged to 315 genera, 68 families. Family name, Chorotype and Phenotype of each plant species are compared in the appendix. About 65% of the total plant species in NKP were belonged to the Irano-Turanian Chorotype, whereas Irano-Turanian-Mediterranean, Irano-Turanian-Mediterranean-Euro-Siberian, Irano-Turanian-Euro-Siberian and Pluriregional plant species respectively contained 11, 10, 6, and 5 percent of all plant species. Less than 3% of total plant

species were belonged to the other Chorotypes like cosmopolitans and Subcomopolitans (Fig. 2).

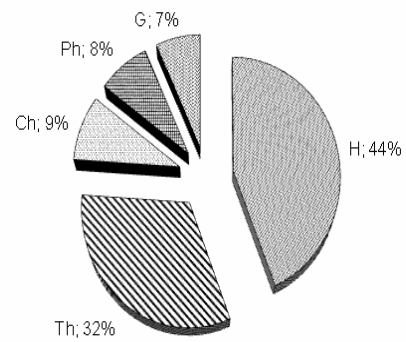
Plant classification, based on Raunkiaer's life forms revealed Hemicryptophytes as the most abundant (45% of total) species. Therophytes, Chamaephytes, Phanerophytes and Geophytes, only contained 32, 9, 7 and 7 percents of total plant species, respectively (Fig. 3).

Among the 68 plant families found in the NKP, Asteraceae, Poaceae and Fabaceae were the most abundant. These families respectively contained 70 (13%), 61 (11%) and 50 (9%) species (Fig. 4).



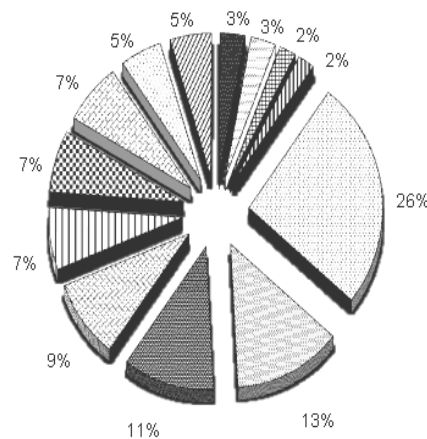
IT: Irano-Turanian,
M: Mediterranean,
ES: Euro-Siberian,
Pl: Pluriregional).

Fig. 2. Plant chorotypes and their relative percentage in flora of winter and rural rangelands in Northern Khorasan province



H: Hemicryptophytes,
Th: Therophytes,
Ch: Chamaephytes,
Ph: Phanerophytes,
G: Geophytes

Fig. 3. Plant life forms and their relative contribution (percent) in flora of winter and rural rangelands in Northern Khorasan Province



Asteraceae Poaceae Fabaceae
Brassicaceae Chenopodiaceae Lamiaceae
Boraginaceae Rosaceae Apiaceae
Caryophyllaceae Ranunculaceae Rubiaceae
Others

Fig. 4. Proportional contribution of plant families in flora of winter and rural rangelands in Northern Khorasan Province; Others: families less than 2% abundance

Discussion and Conclusions

There was high species richness in the winter and rural rangelands of Northern Khorasan Province (NKP). We identified 534 plant species, belonged to 315 genus and 68 families. Nearly the whole NKP region is affected by the arid Mediterranean climate, therefore the vast majority of its flora were belonged to the Irano-Turanian floristic region. Nevertheless, there were some shrubs e.g. *Juniperus excelsa*, *Berberis integerrima*, *Cotoneaster* spp., *Crataegus* spp., which are typical flora of Armeno-Iranian Phytochorion (Zohary 1973). Armeno-Iranian Phytochorion is one of Irano-Turanian's subdivisions. The presence of plants from other Phytochorions, are mainly due to interaction between three climate conditions; i.e. Mediterranean, Caspian Seas and Euro-Siberian.

Hemicryptophytes and Therophytes were the most abundant life form in NKP. Several other studies in Khorasan Province have also reported higher abundance of Therophytes and Hemicryptophytes. Amiri *et al.* (2008) studied floristic of Tiregan in Hezar Masjed Mts. Memariani *et al.*, (2009) also studied floristic of Fereizi in Chenaran, and both found higher abundance of Hemicryptophytes as compared to other life forms.

In studies conducted at other parts of Iran, also higher fractions of Therophytes and Hemicryptophytes have been reported for the rangeland flora. In Genu at Hormozgan Nadjafi *et al.*, (2006) and Garmsar at Semnan (Iranbakhsh *et al.*, 2008) Therophytes were the most abundant life forms. In Fereizi at Khorasan Razavi, Therophytes and Hemicryptophytes were commonly the most abundant life forms (Memariani *et al.*, 2009); in Khabr National Park and Rouchoun wildlife refuge (Irannezhad Parizi *et al.*, 2001) and in Meimand (Vakili Shahrabaki *et al.*, 2001) both in Kerman, and in Kalat highlands of Gonabad in Khorasan Razavi

(Vaseghi *et al.*, 2009) Hemicryptophytes were the most abundant plant life forms.

Higher frequency of Therophytes and Hemicryptophytes in NKP can be related to their high adaptation to the Mediterranean climate conditions (Zohary 1973). The active growth periods of these life forms are concurrent with the rainy season in late winter and early spring (Tavili *et al.*, 2009). During most of the summer and all winter times, Hemicryptophytes lose their aboveground parts while Therophytes remain as seed. Therefore, these plants avoid summer drought and winter cold stresses (Barbour *et al.*, 1987). Chamaephytes are also Xerophytes plant and are geographically distributed within the whole NKP region. On the other hand, the mesic Phanerophytes and Geophyte species were less abundant in the rural and winter rangelands of NKP; mainly found in the northern slope aspects or at the bank of seasonal water streams.

In addition to the climate, intense grazing pressure can also be a determinant factor for the relative abundance and geographic distribution of different life forms (Heithschmidt and Stuth, 1991). Nearly the whole area of NKP is dominated by different species of *Artemisia* L., which contain lots of aromatic materials and essential oils (Cumming and Reid, 2008). Furthermore, thorny shrubs (e.g. *Astragalus* spp., *Acantholimon* spp., and *Acanthophyllum* spp.), poisonous plants (for instance *Euphorbia* spp and *Peganum harmala*) spiny forbs (e.g. *Cirsium* spp., and *Cousinia* spp.) and annual plants (such as *Eremopyron* spp. *Aegilops* spp. and *Bromus tectorum*) dominate vast areas of winter and rural rangelands in NKP. Aromatic and poisonous materials, and spines, or short life cycles are also plant adaptations to livestock grazing (Grime, 2001).

In conclusion, winter and rural rangelands of NKP confer a relatively rich floristic composition, which is a result of plant

responses to Mediterranean climate as well as intense livestock grazing. A combination of climate and land use impact has led to dominance of Hemicryptophytes and Therophytes, as well as vast distribution of Chamaephytes in the winter and rural rangelands of NKP. Climate has significant effect on the flora of all habitats in the NKP, whereas human impact is only significant on flora of rural rangeland.

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Appendix: Checklist of vascular plant taxa in winter and rural rangelands in Northern Khorasan province, Iran.

Life form	Chorotype	Scientific name of plant species in its family
		Aceraceae
Ph.	IT	<i>Acer monspessulanum</i> L. subsp. <i>turcomanicum</i>
		Apiaceae (Umbelliferae)
Th.	IT, M	<i>Ammi majus</i> L.
Th.	IT	<i>Bunium cylindricum</i> (Boiss. & Hohen.) Drude
G.	IT	<i>Bunium persicum</i> (Boiss.) B. Fedtsch.
H.	PI	<i>Conium maculatum</i> L.
H.	IT, ES, M	<i>Falcaria vulgaris</i> Bernh.
H.	IT	<i>Ferula gumosa</i> Boiss.
H.	IT	<i>Ferula ovina</i> (Boiss.) Boiss.
H.	IT, M	<i>Prangos ferulacea</i> (L.) Lindl.
H.	IT	<i>Prangos latiloba</i> Korov.
G.	IT	<i>Elaeosticta allioides</i> (Regel & Schmalh.) Kljuyk. & al.
Th.	IT, M	<i>Scandix stellata</i> Banks & Soland.
Th.	IT, ES, M	<i>Torilis heterophylla</i> Guss.
Th.	PL	<i>Turgenia latifolia</i> (L.) Hoffm.
H.	IT	<i>Zosimia absinthifolia</i> (Vent.) Link.
		Asclepiadaceae
H.	IT	<i>Vincetoxicum pumilum</i> Decne.
		Asteraceae (Compositae)
H.	IT, ES	<i>Achillea biebersteinii</i> Afan
H.	IT, ES	<i>Achillea wilhelmsii</i> C. Koch
G.	IT	<i>Acroptilon repens</i> (L.) DC. subsp. <i>australe</i>
H.	IT, ES	<i>Arctium lappa</i> L.
Ch.	IT, M	<i>Artemisia absinthium</i> L.
Th.	IT, M	<i>Artemisia annua</i> L.
Ch.	IT	<i>Artemisia deserti</i> Krasch.
Ch.	IT	<i>Artemisia kopetdaghensis</i> Krasch., M. Pop. & Lincz. ex Poljak.
H.	IT, ES, M	<i>Artemisia scoparia</i> Waldst. & Kit
Ch.	IT	<i>Artemisia sieberi</i> Besser
Ch.	IT	<i>Artemisia turanica</i> Krasch.
Th.	IT, ES	<i>Callicephalus nitens</i> (M. B. ex Willd.) C. A. Mey.
Th.	IT, ES	<i>Carduus lanatus</i> L. subsp. <i>turkestanicus</i> (M. Pop.)
Th.	IT, M	<i>Carduus pycnocephalus</i> L.
Th.	IT, ES	<i>Carduus transcaspicus</i> Gandog.
Th.	IT	<i>Carthamus oxyacantha</i> M. B.
H.	IT	<i>Centaurea balsamita</i> Lam.
Th.	IT	<i>Centaurea depressa</i> M. B.
H.	IT, ES	<i>Centaurea iberica</i> Trev. ex Spreng.
H.	IT	<i>Centaurea solstitialis</i> L.
G.	IT	<i>Cephalorrhynchus kossinskyi</i> (Krasch.) Kirp.
Th.	IT	<i>Chardinia orientalis</i> (L.) O. Kuntze
H.	IT, ES, M	<i>Chondrilla juncea</i> L.
H.	IT, ES, M	<i>Cichorium intybus</i> L.
H.	PI	<i>Cirsium arvense</i> (L.) Scop. var. <i>incanum</i>
H.	IT	<i>Cirsium bornmulleri</i> Sint. ex. Bornm.
Th.	IT, M	<i>Cnicus benedictus</i> L.
H.	IT	<i>Codonocephalum peacockianum</i> Aitch. & Hemsl.
H.	IT	<i>Cousinia arida</i> C. Winkl.
H.	IT	<i>Cousinia congesta</i> Bunge
H.	IT	<i>Cousinia decipiens</i> Boiss. & Buhse
H.	IT	<i>Cousinia komarowii</i> (O. Kuntze) C. Winkl.
H.	IT	<i>Cousinia lasiandra</i> Bunge
H.	IT	<i>Cousinia microcarpa</i> Boiss.
H.	IT	<i>Cousinia turcomanica</i> C. Winkl.
Th.	IT	<i>Crepis turcomanica</i> Krasch.
H.	IT	<i>Gundelia tournefortii</i> L.
H.	IT	<i>Helichrysum graveolens</i> (M. B.) Sweet
H.	IT	<i>Helichrysum oocephalum</i> Boiss.
H.	IT, ES	<i>Heteropappus altaicus</i> (Willd.) Novopokr
G.	IT, ES, M	<i>Inula oculus-christi</i> L.
G.	IT, ES, M	<i>Inula salicina</i> L.
G.	ES	<i>Inula thapsoides</i> (M. B. ex Willd.) Spreng.
G.	IT	<i>Jurinea monocephala</i> Aitch. & Hemsl.
Th.	IT, SS	<i>Koelpinia linearis</i> Pall.

Life form	Chorotype	Scientific name of plant species in its family
H.	IT, ES, M	<i>Lactuca serriola</i> L.
H.	IT	<i>Lactuca undulata</i> Ledeb.
H.	IT	<i>Launaea acanthodes</i> (Boiss.) O. Kuntze
H.	IT, ES	<i>Leontodon asperrimus</i> (Willd.) Boiss. ex Ball.
H.	IT	<i>Nikitinia leptoclada</i> (Bornm. & Sint.) Iljin
H.	IT	<i>Onopordon heteracanthum</i> C. A. Mey.
H.	IT	<i>Onopordon leptolepis</i> DC.
H.	IT	<i>Picnomon acarna</i> (L.) Cass.
H.	IT	<i>Picris strigosa</i> M. B.
H.	IT, ES, M	<i>Pulicaria dysenterica</i> (L.) Bernh.
H.	IT	<i>Pulicaria gnapholodes</i> (Vent.) Boiss.
H.	IT	<i>Scariola orientalis</i> (Boiss.) Sojak
G.	IT	<i>Scorzonera leptophylla</i> (DC.) Krasch. & Lipsch.
Th.	IT, M	<i>Senecio paulsenii</i> O. Hoffm.
H.	IT	<i>Serratula latifolia</i> Boiss.
H.	IT, M	<i>Sonchus asper</i> (L.) Hill
H.	PI	<i>Tanacetum parthenium</i> (L.) Schultz-Bip.
H.	IT	<i>Tanacetum polycephalum</i> Schultz-Bip.
H.	IT	<i>Taraxacum syriacum</i> Boiss.
H.	IT	<i>Tragopogon graminifolius</i> DC.
Th.	IT	<i>Tripleurospermum disciforme</i> (C. A. Mey.) Schultz-Bip.
G.	IT, ES, M	<i>Tussilago farfara</i> L.
Th.	IT, M	<i>Xanthium spinosum</i> L.
Th.	IT, M	<i>Xanthium strumarium</i> L.
		Berberidaceae
Ph.	IT	<i>Berberis integerrima</i> Bunge
		Boraginaceae
H.	IT, SS	<i>Anchusa italica</i> Retz.
H.	IT	<i>Anchusa ovata</i> Lehm.
Th.	IT	<i>Arnebia decumbens</i> (Vent.) Coss. & Karl
Th.	IT	<i>Arnebia linearifolia</i> DC.
Th.	PI	<i>Asperugo procumbens</i> L.
Th.	IT	<i>Buglossoides tenuifolia</i> (L. f.) Johnston.
Th.	IT	<i>Caccinia macranthera</i> (Banks & Soland.) Brand.
H.	IT, M	<i>Echium italicum</i> L.
H.	IT	<i>Heliotropium europaeum</i> L.
H.	IT	<i>Heliotropium lasiocarpum</i> Fisch. & Mey.
Th.	IT	<i>Heterocaryum subsessile</i> Vatke
Th.	IT	<i>Lappula barbata</i> (M. B.) Gurke
Th.	IT	<i>Lappula ceratophora</i> (M. Pop.) M. Pop.
Th.	IT	<i>Lappula microcarpa</i> (Ledeb.) Gurke
Th.	IT	<i>Lappula sinaica</i> (DC.) Ascherson ex Schweinf.
Th.	IT	<i>Nonnea caspica</i> (Willd.) G. Don.
Th.	IT	<i>Nonnea lutea</i> (Desr.) Reichenb.
H.	IT	<i>Onosma dichroanthum</i> Boiss.
H.	IT	<i>Onosma longilobum</i> Bge.
H.	IT	<i>Paracaryum intermedium</i> (Fresen.) Lipsky
H.	IT	<i>Paracaryum turcomanicum</i> Bornm. et Sint.! ex Bornm.
Th.	IT	<i>Rindera lanata</i> (Lam.) Bunge
Th.	IT	<i>Rochelia disperma</i> (L. f.) C. Koch
H.	IT	<i>Solenanthus circinnatus</i> Ledeb.
H.	IT, M	<i>Solenanthus stamineus</i> (Desf.) Wettst.
H.	IT	<i>Trichodesma incaium</i> (Bge.) A. DC.
		Brassicaceae (Cruciferae)
Th.	IT	<i>Aethionema carneum</i> (Banks & Soland.) B. Fedtsch.
H.	IT, ES, M	<i>Alliaria petiolata</i> (M. B.) Cavara & Grande
Th.	IT	<i>Alyssum dasycarpum</i> Steph. ex Willd.
Th.	IT	<i>Alyssum inflatum</i> Nyarady
Th.	IT	<i>Alyssum linifolium</i> Steph. ex Willd.
Th.	IT, M	<i>Alyssum minus</i> (L.) Rothm.
Th.	IT	<i>Alyssum szowitsianum</i> Fisch. & C. A. Mey.
H.	IT, ES, M	<i>Arabis nova</i> Vill.
H.	IT	<i>Brassica elongata</i> Ehrh.
Th.	IT	<i>Camelina rumelica</i> Velen. subsp. <i>rumelica</i>
Th.	Cos	<i>Capsella bursa-pastoris</i> (L.) Medicus
G.	IT, M	<i>Cardaria draba</i> (L.) Desv.
Th.	IT, SS	<i>Clypeola aspera</i> (Grauer) Turrill

Th.	IT	<i>Clypeola dichotoma</i> Boiss.
Th.	IT	<i>Conringia orientalis</i> (L.) Andrz.
Th.	IT	<i>Conringia perfoliata</i> (C. A. Mey.) Busch
H.	IT	<i>Crambe kotschyana</i> Boiss.
Th.	IT, ES, M	<i>Descurainia Sophia</i> (L.) Schur
Th.	IT	<i>Eruca sativa</i> Lam.
H.	IT	<i>Erysimum aitchisonii</i> O. E. Schulz
H.	IT	<i>Erysimum ischnostylum</i> Freyn & Sint.
Th.	IT, M	<i>Euclidium syriacum</i> (L.) R. Br.
Th.	IT, M	<i>Euclidium tenuissimum</i> (Pall.) B. Fedtsch.
H.	IT	<i>Fibigia suffruticosa</i> (Vent.) Sweet
Th.	IT, M	<i>Goldbachia laevigata</i> (M. B.) DC.
H.	IT	<i>Graellsia integrifolia</i> (Rech. f.) Rech. f.
H.	IT, ES, M	<i>Isatis leuconeura</i> Boiss. & Buhse
H.	IT	<i>Lepidium latifolium</i> L.
H.	IT	<i>Leptaleum filifolium</i> (Willd.) DC.
Th.	IT	<i>Malcolmia africana</i> (L.) R. Br.
Th.	IT	<i>Malcolmia strigosa</i> Boiss.
Th.	IT	<i>Matthiola chenopodifolia</i> Fisch. & C. A. Mey.
Th.	IT	<i>Matthiola farinosa</i> Bge. ex Boiss.
H.	IT	<i>Peltaria turkmena</i> Lipsky
Th.	IT, ES, M	<i>Rapistrum rugosum</i> (L.) All.
Th.	IT, ES, M	<i>Sisymbrium altissimum</i> L.
Th.	IT	<i>Thlaspi kotschyannum</i> Boiss. & Hohen.
Th.	IT, ES, M	<i>Thlaspi perfoliatum</i> L.
		Caesalpinaceae
Ph.	IT, M	<i>Cercis griffithii</i> Boiss.
		Campanulaceae
H.	IT, ES	<i>Campanula glomerata</i> L.
		Capparidaceae
Ph.	IT, SS, M	<i>Capparis spinosa</i> L.
H.	IT	<i>Cleome heratensis</i> Bunge & Boiss.
H.	IT	<i>Cleome Khorasanica</i> Bunge & Bien. ex Boiss.
		Caprifoliaceae
Ph.	IT, ES	<i>Lonicera floribunda</i> Boiss. & Buhse
Ph.	IT, M	<i>Lonicera nummularifolia</i> Jaub. & Spach
H.	IT, M	<i>Sambucus ebulus</i> L.
		Caryophyllaceae
Ch.	IT	<i>Acanthophyllum bracteatum</i> Boiss.
Ch.	IT	<i>Acanthophyllum glandulosum</i> Bunge ex Boiss.
Ch.	IT	<i>Acanthophyllum microcephalum</i> Boiss.
H.	IT	<i>Buffonia oliveriana</i> Ser.
H.	IT	<i>Buffonia sintenisii</i> Freyn
H.	IT	<i>Dianthus crinitus</i> Sm. subsp. <i>turcomanicus</i> (Schischk.) Rech. f.
H.	IT	<i>Dianthus orientalis</i> Adams subsp. <i>stenocalyx</i> (Boiss.) Rech. f.
Ch.	IT	<i>Gypsophila aretioides</i> Boiss.
H.	IT	<i>Gypsophila bicolor</i> (Freyn & Sint.) Grossh.
Th.	IT	<i>Holosteum glutinosum</i> (M. B.) Fisch. & C. A. Mey.
H.	IT	<i>Minuartia meyeri</i> (Boiss.) Bornm.
Ch.	IT	<i>Saponaria bodeana</i> Boiss.
H.	IT	<i>Silene bupleuroides</i> L.
H.	IT, ES	<i>Silene conoidea</i> L.
H.	IT, M	<i>Vaccaria oxyodonta</i> Boiss.
		Chenopodiaceae
Th.	IT	<i>Anabasis aphylla</i> L.
Ch.	IT	<i>Atriplex canescens</i> James
Th.	IT	<i>Atriplex flabellum</i> Bge.
Th.	IT	<i>Atriplex moneta</i> Bge.
Th.	IT	<i>Atriplex tatarica</i> L.
Ch.	IT	<i>Atriplex verrucifera</i> M. B.
Th.	IT	<i>Ceratocarpus arenarius</i> L.
Th.	IT	<i>Chenopodium album</i> L.
Th.	IT, M	<i>Chenopodium botrys</i> L.
Th.	IT	<i>Chenopodium foliosum</i> (Moench) Asch.
Th.	IT	<i>Gamanthus gamocarpus</i> (Moq.) Bge.
Th.	IT	<i>Halimocnemis pilifera</i> Moq.
Ch.	IT	<i>Halocnemum strobilaceum</i> M. B.
Ch.	IT	<i>Halothamnus subaphyllus</i> (C. A. Mey.) Botsch.
Ch.	IT	<i>Holostachys caspica</i> (Pall.) C. A. Mey.

H.	IT	<i>Kochia prostrata</i> (L.) Schrad.
Th.	IT	<i>Kochia scoparia</i> (L.) Schrad.
Ch.	IT	<i>Krascheninnikowia ceratoides</i> (L.) Gueldenst.
H.	IT	<i>Noaea mucronata</i> (Forsk.) Asch. et Schweinf.
Ch.	IT	<i>Salsola arbusculiformis</i> Drob.
Ch.	IT	<i>Salsola aucheri</i> (Moq.) Bge.
Ch.	IT	<i>Salsola dendroides</i> Pall.
Th.	IT	<i>Salsola gossypina</i> Bge.
Th.	IT	<i>Salsola kali</i> L.
Th.	IT	<i>Salsola nitraria</i> Pall.
Ch.	IT	<i>Salsola orientalis</i> S. G. Gmel.
Th.	IT	<i>Salsola sclerantha</i> C. A. Mey.
Th.	IT	<i>Seidlitzia florida</i> (M. B.) Boiss.
Th.	IT, M	<i>Seidlitzia rosmarinus</i> (Ehrh.) Bge.
Th.	IT	<i>Spinacia oleracea</i> L.
Th.	IT	<i>Spinacia turkestanica</i> Iljin
Th.	IT	<i>Suaeda altissima</i> (L.) Pall.
Th.	IT	<i>Suaeda microphylla</i> Pall.
Th.	IT	<i>Suaeda microsperma</i> (C. A. Mey.) Fenzl
Cistaceae		
Ch.	IT, ES, M	<i>Fumana procumbens</i> (Dun.) Gren. & Godron
Th.	IT, SS, M	<i>Helianthemum ledifolium</i> (L.) Miller
Convolvulaceae		
G.	Sco	<i>Convolvulus arvensis</i> L.
H.	IT	<i>Convolvulus commutatus</i> Boiss.
H.	IT, M	<i>Convolvulus dorycnium</i> L.
H.	IT	<i>Convolvulus fruticosus</i> Pall.
H.	IT	<i>Convolvulus pseudocantabrica</i> Schrenk
Crassulaceae		
H.	IT	<i>Rosularia paniculata</i> (Regel & Schmalh.) Berger
Cuscutaceae		
Th.	IT	<i>Cuscuta approximata</i> Babingt.
Th.	IT	<i>Cuscuta monogyna</i> Vahl
Cupressaceae		
Ph.	IT	<i>Juniperus excelsa</i> M. B.
Cyperaceae		
G.	IT, M	<i>Carex physodes</i> M. B.
G.	IT, M	<i>Cyperus longus</i> L.
Dipsacaceae		
H.	IT	<i>Cephalaria kotschyi</i> Boiss. & Hohen.
H.	IT	<i>Cephalaria microcephala</i> Boiss.
H.	IT	<i>Dipsacus laciniatus</i> L.
H.	ES	<i>Dipsacus strigosus</i> Willd. ex Roemer & Schultes
Th.	IT	<i>Scabiosa olivieri</i> Coult.
Th.	IT	<i>Scabiosa rotata</i> M. B.
Elaeagnaceae		
Ph.	IT	<i>Elaeagnus angustifolia</i> L.
Ephedraceae		
Ph.	IT, ES, M	<i>Ephedra major</i> Host
Euphorbiaceae		
Th.	IT	<i>Chrozophora hierosolymitana</i> Spreng.
H.	IT	<i>Euphorbia aucheri</i> Boiss.
Th.	IT	<i>Euphorbia bungei</i> Boiss.
Th.	IT	<i>Euphorbia falcata</i> L.
Th.	IT	<i>Euphorbia inderiensis</i> Less. ex Kar. & Kir.
Th.	IT	<i>Euphorbia szovitsii</i> Fisch. & C. A. Mey.
Fumariaceae		
Th.	IT, ES, M	<i>Fumaria asepala</i> Boiss.
Th.	IT	<i>Fumaria indica</i> (Hausskn.) Pugsley
Th.	IT	<i>Fumaria vaillantii</i> Loisel.
Fabaceae		
H.	IT	<i>Alhagi persarum</i> Boiss. & Buhse
H.	IT	<i>Astragalus ankylotus</i> Fisch. & C. A. Mey.
Th.	IT	<i>Astragalus bakaliensis</i> Bunge
H.	IT	<i>Astragalus brevidens</i> Freyn & Sint.
H.	IT	<i>Astragalus bassineri</i> Boiss. & Haussk. ex Boiss.
Th.	IT	<i>Astragalus campylorrhynchus</i> Fisch. & Mey.
H.	IT	<i>Astragalus cercidophacos</i> Podlech & Maassoumi

H.	IT	<i>Astragalus chrysostachys</i> Boiss.
H.	IT	<i>Astragalus citrinus</i> Bge. subsp. <i>citrinus</i>
H.	IT	<i>Astragalus curvipes</i> Trautv.
H.	IT	<i>Astragalus hermannii</i> Freitag & Podl.
H.	IT	<i>Astragalus khoshjailensis</i> Sirj. & Rech. f.
H.	IT	<i>Astragalus kopetdaghi</i> Boriss. var. <i>orientikoptdghensis</i>
H.	IT	<i>Astragalus siversianus</i> Pall.
Th.	IT	<i>Astragalus maymanensis</i> Podl.
H.	IT	<i>Astragalus mazandranus</i> Bge.
H.	IT	<i>Astragalus pseudoszovitsii</i> Sirj. & Rech. f.
Th.	IT	<i>Astragalus raddei</i> N. Basil.
H.	IT	<i>Astragalus rawlinsianus</i> Aitch. & Baker
Ch.	IT	<i>Astragalus siliquosus</i> Boiss. subsp. <i>siliquosus</i>
H.	IT	<i>Astragalus squarosus</i> Bunge
Ph.	IT, ES	<i>Astragalus suluklensis</i> Freyn & Sint.
Ph.	IT	<i>Colutea buhsei</i> (Boiss.) Shap.
H.	IT, ES	<i>Colutea porphyrogramma</i> Rech. f.
G.	IT, ES, M	<i>Coronilla varia</i> L. subsp. <i>varia</i>
H.	IT	<i>Glycyrrhiza glabra</i> L.
H.	IT	<i>Hedysarum kopetdaghi</i> Boriss.
H.	IT	<i>Hedysarum wrightianum</i> Aitch. & Baker
Th.	IT, M	<i>Lathyrus cicera</i> L.
Th.	IT, ES, M	<i>Lathyrus sativus</i> L.
H.	PI	<i>Lotus corniculatus</i> L.
H.	PI	<i>Medicago lupulina</i> L.
H.	IT, ES, M	<i>Medicago sativa</i> L.
H.	IT, ES, M	<i>Melilotus albus</i> Desr.
H.	IT, ES, M	<i>Melilotus officinalis</i> (L.) Desr.
H.	IT	<i>Meristotropis xanthioides</i> Vassilez.
Th.	IT	<i>Onobrychis aucheri</i> Boiss.
Ch.	IT	<i>Onobrychis cornuta</i> (L.) Desv.
H.	IT	<i>Onobrychis sintenisii</i> Bornm.
Ch.	IT	<i>Ononis spinosa</i> L.
Ch.	IT	<i>Prosopis farcta</i> (Banks & Soland.) Macbr.
H.	IT	<i>Sophora alopecuroides</i> L.
H.	IT	<i>Sophora pachycarpa</i> C. A. Mey.
H.	IT, ES, M	<i>Trifolium pratense</i> L.
H.	IT, ES, M	<i>Trifolium repens</i> L.
Th.	IT	<i>Vicia monantha</i> Retz.
Th.	IT, ES, M	<i>Vicia sativa</i> L.
Th.	IT	<i>Vicia subvillosa</i> (Ledeb.) Boiss.
H.	IT	<i>Vicia variabilis</i> Freyn & Sint.
Th.	IT, ES, M	<i>Vicia villosa</i> Roth
		Gentianaceae
Th.	IT, ES, M	<i>Centaurium pulchellum</i> (Swartz) Druce
		Geraniaceae
G.	IT	<i>Biebersteinia multifida</i> DC.
Th.	IT, ES, M	<i>Erodium cicutarium</i> (L.) L'Her.
Th.	IT, ES, M	<i>Geranium rotundifolium</i> L.
		Hypericaceae
H.	IT, M	<i>Hypericum perforatum</i> L.
H.	IT	<i>Hypericum scabrum</i> L.
		Iridaceae
G.	IT	<i>Iris acutiloba</i> C. A. Mey. subsp. <i>lineolata</i> (Trautv.) Mathew.
G.	IT	<i>Iris fosterana</i> Aitch. & Baker
G.	IT	<i>Iris kopetdagensis</i> (Vved.) Mathew & Wendelbo
G.	IT	<i>Iris songarica</i> Schrenk
		Juglandaceae
Ph.	IT, ES, M	<i>Juglans regia</i> L.
		Juncaceae
G.	PI	<i>Juncus fontanesii</i> Gay
		Lamiaceae (Labiatae)
H.	IT, ES	<i>Ajuga comata</i> Stapf
Ch.	IT	<i>Dracocephalum subcapitatum</i> (O. Kuntze) Lipsky
H.	IT	<i>Eremostachys boissieriana</i> Regel
H.	IT	<i>Eremostachys labiosiformis</i> (M. Pop.) Knorring
Ch.	IT	<i>Hymenocrater calycinus</i> (Boiss.) Benth.
H.	IT	<i>Hymenocrater elegans</i> Bge.
Ch.	IT	<i>Lagochilus aucheri</i> Boiss.

Ch.	IT	<i>Lagochilus cabulicus</i> Benth.
Th.	IT, M	<i>Lallemantia iberica</i> (Stev.) Fisch. & C. A. Mey.
Th.	IT, M	<i>Lamium album</i> L. subsp. <i>crinitum</i> (Montbr. & Auch. ex Benth.) Mennema
H.	IT, M	<i>Marrubium anisodon</i> C. Koch
H.	Pl	<i>Marrubium vulgare</i> L.
H.	IT	<i>Mentha longifolia</i> (L.) Hudson
H.	IT, ES, M	<i>Nepeta cataria</i> L.
H.	IT	<i>Nepeta glomerulosa</i> Boiss.
Th.	IT	<i>Nepeta saccharata</i> Bunge
H.	IT	<i>Nepeta ucrainica</i> L. subsp. <i>Kopetdaghensis</i> (Pojark.) Rech. f.
Ch.	IT	<i>Perovskia abrotanoides</i> Karel.
H.	IT	<i>Phlomis cancellata</i> Bunge
H.	IT	<i>Phlomis herba-venti</i> L.
H.	IT	<i>Salvia atropatana</i> Bge.
H.	IT	<i>Salvia ceratophylla</i> L.
H.	IT	<i>Salvia chloroleuca</i> Rech. f. & Aell.
H.	IT, M	<i>Salvia sclarea</i> L.
H.	IT, M	<i>Salvia virgata</i> Jacq.
Ch.	IT	<i>Scutellaria litwinowii</i> Bornm. & Sint. ex Bornm.
Ch.	IT	<i>Scutellaria pinnatifida</i> A. Hamilt.
H.	IT, ES	<i>Stachys byzanthina</i> C. Koch
G.	IT	<i>Stachys lavandulifolia</i> Vahl
H.	IT	<i>Stachys pubescens</i> Ten.
H.	IT	<i>Stachys setifera</i> C. A. Mey.
Ch.	IT	<i>Stachys subaphylla</i> Rech. f.
Ch.	IT	<i>Stachys trinervis</i> Aitch. & Hemsl.
H.	IT	<i>Stachys turcomanica</i> Trautv.
H.	IT, ES, M	<i>Teucrium chamaedrys</i> L.
H.	IT, M	<i>Teucrium polium</i> L.
Ch.	IT	<i>Thymus transcaspicus</i> Klokov
Ch.	IT	<i>Thymus trautvetteri</i> Klokov & Desj.-Shost
Ch.	IT	<i>Ziziphora clinopodioides</i> Lam.
Th.	IT	<i>Ziziphora tenuir</i> L.
		Linaceae
Th.	IT, M	<i>Linum glaucum</i> Boiss. & Nöe
Th.	-	<i>Linum</i> sp.
		Liliaceae
G.	IT	<i>Colchicum robustum</i> (Bunge) Stef.
G.	IT	<i>Eremurus olgae</i> Regel
G.	IT	<i>Eremurus stenophyllus</i> (Boiss. & Buhse) Baker
G.	IT	<i>Fritillaria gibbosa</i> Boiss.
G.	IT, ES, M	<i>Muscari neglectum</i> Guss.
G.	IT	<i>Tulipa montana</i> Lindl.
		Lythraceae
H.	IT	<i>Lythrum hyssopifolium</i> L.
H.	Pl	<i>Lythrum salicaria</i> L.
		Malvaceae
H.	IT, M	<i>Althaea cannabina</i> L.
Th.	IT, M	<i>Althaea hirsuta</i> L.
H.	IT	<i>Althaea officinalis</i> L.
Th.	IT	<i>Hibiscus trionum</i> L.
H.	IT, ES, M	<i>Malva neglecta</i> Wallr.
H.	IT	<i>Malva sylvestris</i> L.
		Moraceae
Ph.	IT, M	<i>Ficus carica</i> L.
Ph.	IT, M	<i>Ficus rupestris</i> (Hauskn. ex Boiss.) Azizian
		Oleaceae
Ph.	IT, ES, M	<i>Jasminum fruticans</i> L.
		Onagraceae
G.	Pl	<i>Epilobium hirsutum</i> L.
G.	Pl	<i>Epilobium minutiflorum</i> Hauskn.
		Oxalidaceae
H.	Pl	<i>Oxalis corniculata</i> L.
		Papaveraceae
Th.	IT, M	<i>Glaucium paucilobum</i> Freyn
Th.	IT, M	<i>Hypecoum pendulum</i> L.
Th.	IT	<i>Papaver dubium</i> L.
Th.	IT	<i>Roemeria refracta</i> DC.

		Plantaginaceae
H.	IT, M	<i>Plantago lanceolata</i> L.
H.	Sco	<i>Plantago major</i> L.
		Platanaceae
Ph.	IT, M	<i>Platanus orientalis</i> L.
		Plumbaginaceae
Ch.	IT	<i>Acantholimon avenaceum</i> Bunge
Ch.	IT	<i>Acantholimon erinaceum</i> (Jaub. & Spach) Lincz.
Ch.	IT	<i>Acantholimon pterostegium</i> Bunge
H.	IT	<i>Limonium gmelini</i> (Willd.) O. Kuntze
H.	IT	<i>Limonium reniforme</i> (Girard) Lincz.
H.	IT, ES, M	<i>Plumbago europaea</i> L.
		Podophyllaceae
G.	IT	<i>Bongardia chrysogonum</i> (L.) Boiss.
G.	IT	<i>Leontice leontopetalum</i> L.
		Primulaceae
Th.	Pl	<i>Anagallis arvensis</i> L. var. <i>coerulea</i> L.
Ch.	IT	<i>Dionysia tapetodes</i> Bge.
		Poaceae (Gramineae)
Th.	IT	<i>Aegilops tauschii</i> Cosson
Th.	IT	<i>Aegilops triuncialis</i> L.
H.	IT	<i>Aeluropus littoralis</i> (Gouan) Parl.
H.	IT	<i>Agropyron intermedium</i> (Host) P. Beauv.
H.	IT	<i>Agropyron pectiniforme</i> Roemer & Schultes
H.	IT	<i>Agropyron podperae</i> Nab.
H.	IT	<i>Agropyron trichophorum</i> (Link) Richter
H.	IT	<i>Agrostis olympica</i> (Boiss.) Bor
H.	IT	<i>Agrostis stolonifera</i> L.
H.	IT, M	<i>Alopecurus apiatus</i> Ovcz.
H.	IT	<i>Arrhenatherum kotschyi</i> Boiss.
Th.	Pl	<i>Avena eriantha</i> Durieu
Th.	Pl	<i>Avena fatua</i> L.
Th.	IT	<i>Boissiera squarrosa</i> (Banks & Soland.) Nevski
H.	Pl	<i>Bothriochloa ischaemum</i> (L.) Keng
H.	Pl	<i>Brachypodium sylvaticum</i> (Huds.) P. Beauv.
Th.	IT	<i>Bromus briziformis</i> Fisch. & C. A. Mey.
Th.	IT	<i>Bromus danthoniae</i> Trin.
H.	IT	<i>Bromus kopetdaghensis</i> Drobov
Th.	IT, ES, M	<i>Bromus scoparius</i> L.
Th.	IT, ES, M	<i>Bromus sterilis</i> L.
Th.	IT, SS, M	<i>Bromus tectorum</i> L.
H.	IT	<i>Calamagrostis epigejos</i> (L.) Roth
H.	IT	<i>Calamagrostis pseudophragmites</i> (Hall. f.) Koel.
G.	IT	<i>Cynodon dactylon</i> (L.) Pers.
H.	IT	<i>Dactylis glomerata</i> L.
Th.	IT, M	<i>Digitaria sanguinalis</i> (L.) Scop.
Th.	IT, M	<i>Echinaria capitala</i> (L.) Desf
Th.	IT	<i>Echinochloa crus-galli</i> (L.) P. Beauv.
H.	IT	<i>Elymus baldschuanicus</i> Roshev.
Th.	IT	<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski
Th.	IT	<i>Eremopyrum distans</i> (C. Koch) Nevski
H.	IT, ES	<i>Festuca arundinacea</i> Schreb.
H.	IT, ES	<i>Festuca ovina</i> L.
H.	IT, ES	<i>Festuca sulcata</i> (Hack.) Beck
Th.	IT	<i>Heterantherium piliferum</i> (Banks & Soland.) Hochst.
H.	IT, M	<i>Hordeum bulbosum</i> L.
H.	IT, ES, M	<i>Hordeum violaceum</i> Boiss. et Huet
H.	IT	<i>Lolium persicum</i> Boiss. & Hohen. ex Boiss.
Th.	IT, ES, M	<i>Lolium rigidum</i> Guadin
H.	IT, ES, M	<i>Melica ciliata</i> L.
H.	IT	<i>Melica persica</i> Kunth
Th.	IT	<i>Nardurus subulatus</i> (Banks & Soland.) Bor
H.	IT, SS	<i>Pennisetum orientale</i> L. C. Rich.
Th.	IT, M	<i>Phalaris minor</i> Retz.
H.	IT	<i>Phleum paniculatum</i> Hudson
H.	IT, ES, M	<i>Phleum pratense</i> L.
G.	IT, ES, M, SS	<i>Phragmites australis</i> (Cav.) Trin. ex Steud.
H.	IT, ES, M	<i>Poa bulbosa</i> L.
Th.	Pl	<i>Polypogon fugax</i> Nees ex Steud.