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Study of flora of Miandasht Wildlife Refuge in Northern Khorassan Province, Iran (a)

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A wide area of Iran is covered by arid and semiarid regions. In this survey, flora of an area of the Miandasht Wildlife Refuge, out of the safe part, was studied. This region covers 84435 Ha, situated in the west of Khorassan province in Iran. The climate of the area according to de Martone system is semiarid. The mean annual precipitation is 275 mm and the altitude varies from 931 to 1021 m above sea level. Plants were collected from 2008 to 2011. A total of 256 taxa belonging to 152 genera and 35 families from Angiospermae and Gymnospermae were found. Asteraceae, Chenopodiaceae, Brassicaceae and Fabaceae were the greatest families, respectively. Geraniaceae, Ixioliriaceae, Orobanchaceae, Plantaginaceae, Primulaceae, Resedaceae and Rosaceae, each included one species. Based on Raunkiaer life form classification system, majority of the species (55.86%) were therophytes. Other life forms in descending order were hemicryptophytes (15.62%), chamaephytes (10.16%), phanerophytes (8.6%) and geophytes (9.38%). Chorologicaly, most of the species were Irano-Turanian. Flora of Miandasht Wildlife Refuge include 20 low risk species and 29 (11.6%) endemic of Iran species. 67 pasture species and 38 medicinal species were distinguished. Most of the species were invasive plants. They are established in this area because of overgrazing and natural disturbance.

Key words: Flora, Miandasht Wildlife Refuge, Iran endemic, life form, chorotype.

INTRODUCTION

Iran in terms of topography, climate, vegetation and geographical features is one of the most important and unique countries in the Middle East. According to a recent study (Mozaffarian, 2007), flora of Iran includes 8000 species belonging to 1450 genera and 150 families. These families include 124 dicotyledons, 22 monocotyledons and 4 gymnosperms.

Some resources related to vegetation of Iran are as follows: Flora Orientalis (Boissier, 1936), Flora Keredjensis (Bornmuller and Gauba, 1935-1940), Flore de l'Iran (Parsa, 1948-1952), Flora Iranica (Rechinger, 1963-2005) Flora of Iran, Tracheophyta (Mobayen, 1975-1995), Colored Flora of Iran (Ghahreman, 1977-2007) and Flora of Iran (Assadi et al., 1988-2011).

One of the most extensive areas for speciation in holarctic kingdom is located in Iran (Akhani, 2006). Also, some studies in the field of semi deserts and deserts of Iran have been conducted. For instance, studies on the autumn plants of Kavir, Iran (Assadi, 1984), plants of the Kavir Protected Area, Iran (Rechinger and Wendelbo, 1976), Plants of the Touran Protected Area, Iran (Rechinger, 1977), Notes on the distribution, climate and flora of the sand deserts of Iran and Afghanistan (Freitag, 1986).

Some case studies have been performed in deserts of Iran, for example: A contribution to the vegetation and flora of Kavire Meyghan, Iran (Akhani, 1989), floristic and cartographic study of protected area of Ghamishloo

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(Yousofinajafabadi, 1996), study of the flora of the Kabar dam of Ghom (Tavakkoli and Mozaffarian, 2005) and flora of halophytes in Iran (Asri, 2007).

A fundamental role of government conservation agencies is to set priorities for the conservation and management of biodiversity (David and Kenneth, 2001). To evaluate the status of biodiversity and to determine how current conservation efforts can be improved, biodiversity monitoring is crucial (Kerstin et al., 2013). The nature and quality of vegetation cover is an important factor for soil conservation through its role in reducing the erosive impact of precipitation degraded areas in semi-arid regions (Turan and Filiz, 2011).

The objective of this study was to provide urgently needed scientific support for programs of biodiversity conservation. The Miandasht Wildlife Refuge (MWR) covers 84435 Ha, and is located in North Khorassan province (56°, 26′ to 56°, 57′ longitude and 47°, 30′, 36″ to 37°, 30′ latitude) Figure 1. The mean annual precipitation is 250 mm and the altitude varies from 912 to 1085 m above sea level. The climate is semiarid and chorologicaly located in the Irano-Turanian region. A wide area of MWR is rangeland. Early and uncontrolled grazing in these rangelands led to the decrease of the production by pastured plants, imbalances in the ecosystem, disruption in water and food cycles, increasing the unfavorable species and decreasing the quantity of vegetation and soil erosion. Also, a wide part of this region is covered by sand and saline soils. Totally, approximately 40 to 50% of critical points of erosion around of Jajarm city is located in this area, and the plants are permanently exposed to environmental stresses. MWR is habitat for important animal species, such as: the Asiatic cheetah which is rare worldwide and its survival is one of the most important goals of the Environmental Protection Agency, so the study of various environmental aspects of this area is essential for the balance and stability of the ecosystem, particularly vegetation which is the first loop of the animal food chains.

Aims of this study were to introduce the flora of MWR, to detect endemism, vulnerability and chorology of species, and to distinguish medicinal and pasture plants in 12000 Ha out of the safe part of the MWR. This study is intended as a useful tool for policy markers and scientists to advocate for modifications in national legislation and policy aimed at conservation and combating desertification. Analyzing species richness, extinction level and distribution drivers are important preliminary steps to set conservation priorities and to test environmental policies (Giuseppe, 2013).

In order to determine the influence of protection from grazing on diversity of plant species, flora of the safe part was studied which will be written in another article.

MATERIALS AND METHODS

Basic information on MWR was obtained using geological and topographical maps 1/50000 and aerial photos of this area. Then, by scrolling in the area, its boundaries were determined using handheld Garmin's GPS map76CS. All plants were photographed by means of a digital camera (Nikon D70S). Plants were identified using stereomicroscope, keys and descriptions in available scientific resources, specially flora Iranica (Rechinger, 1963-2005), Flora of Iran (Assadi et al., 1988-2011) and flora of the adjacent countries, namely flora of Turkey and the East Aegean Island (Davis, 1965-1985). Flora of U.S.S.R (Komarov, 1934-1957), Flora of West Pakistan (Nasir and Qaser, 1970-2001) and Flora of Iraq (Townsend and Guest, 1966-1986).

Finally, names of all plants were confirmed by taxonomists in the research institute of forests and rangelands of Iran. The life forms of species were distinguished according to the life form classification (Raunkiaer, 1934). The geographical distribution of each species was assessed from reviews, monographs and distributional data in the floras, particularly Flora Iranica (Rechinger, 1963-2005). The terminology and delimitation of the main phytogeographic areas, that is, Euro-Siberian (ES), Irano-Turanian (IT), Mediterranean (M) and within Euro-Siberian region relate to standard works of reference, particularly those of Zohary (1973), Takhtajan(1986) and flora Iranica (Rechinger, 1963-2005). The IUCN Red List Categories (Jalili and Jamzad, 1999) are used to designate the threat categories.

Pasture plants were detected by asking the villagers by direct observations, and by using the Codes of Pasture Plants (Publication Committee and Propaganda of the Research Institute of Forestsand Rangelands of Iran 1982).

Medicinal plants were determined using the available scientific resources, for example: Amin (1991), Zargary (1999) and Javidtalesh (2001).

RESULTS AND DISCUSSION

Totally, 256 taxa belonging to 152 genera and 35 families of Angiospermae and Gymnospermae were determined in the study area (Table 1, Figure 5-12). These families consist of 1 Gymnospermae, 29 Dicotyledons and 5 Monocotyledons.

According to Table 1, the following families had the highest number of species: 43 (16.8%) Asteraceae, 41 (16.02%) Chenopodiaceae, 32 (12.5%) Brassicaceae and 22 (8.59%) Fabaceae (Figure 2). These results are consistent with the results of most studies in similar areas (Rechinger and Wendelbo, 1977; Asri, 2003; Yousofinajafabadi, 1996).

Presumably uncontrolled grazing caused the maximum number of Asteraceae species (Tavakkoli and Mozaffarian, 2005). Since the studied area is at risk due to early and excessive grazing, the maximum number of Asteraceae species is justifiable. In the study of halophytes of Iran (Asri, 2007), the numbers of Chenopodiaceae species were large. The large number of this taxon species can be explained by saline soils which are widely spread in this region.

The large number of Chenopodiaceae, Asteraceae and Brassicaceae are indicator of desert conditions (Saberamoli et al., 2001). Table 1 illustrates that the genera of *Astragalus, Salsola, Atriplex* and *Valerianella* have the highest number of species with 17, 9, 6 and 6 species, respectively. Irano-Turanian region is the major origin of *Astragalus*, and 91% of *Astragalus* species Iran, grow in

Table 1. List of plants in the Miandasht Wildlife Refuge (out of the safe part) and some of their features.

Scientific name of taxon	L.F	Chor	Pa	Me	En	Vu
Apiaceae						
Cuminum setifolium L.	Th	IT		*		
Dorema aitchisonii Korov. ex M. Pimen.	Hem	IT				
Ducrosia anetifolia (DC.) Boiss.	Hem	IT-SS	*	*		
Eryngium bungei Boiss.	Hem	IT	*			
Psammogeton canescens (DC.) V.	Th	IT				LR
Schumannia karelinii (Bunge) Korov.	G.t	IT-SS				
Asteraceae						
Acantholepis orientalis Less.	Th	IT	*			
Acroptilon repens (L.) DC.	Hem	IT		*		
Amberboa turanica Lljin	Th	IT				
Amberboa nana (Boiss.) Lljin.	Th	IT				
Anthemis austero-iranica Rech. f., Aell. & Esfand.	Th	IT-SS			*	LR
Anthemis rhodocentra Iranshahr	Th	IT-SS				
Artemisia scoparia Waldst. & Kit.	Ch	IT-ES	*	*		
Artemisia sieberi Besser.	Ch	IT	*	*		
Carthamus oxyacantha M. B.	Th	IT-M-SS				
Centaurea bruguieriana (DC.)Hand.	Th	IT				
Centaurea pulchella Ledeb.	Th	IT				
Cousinia lasiandra Bunge.	Hem	IT			*	LR
Cousinia neurocentra Bunge.	Hem	IT			*	LR
Cousinia piptocephala Bunge.	Hem	IT			*	LR
Cousinia prolifera Jaub. & Spach.	Th	IT				
Cousinia turkmenorum Bornm	Th	IT				
Crepis sancta (L.) Babcock.	Th	IT-M				
Dipterocome pusilla Fisch & C. A. Mey.	Th	IT				
Echinops leucographus Bunge	Hem	IT				
Echinops pungens Trautv.	Hem	IT				
Epilasia acrolasia (Bunge.) C. B. Clarke.	Th	IT				
Epilasia hemilasia (Bunge.) C. B. Clarke.	Th	IT				
Filago arenaria L.	Th	IT				
Gymnarrhena micrantha Desf.	Th	IT-SS				
Heteroderis pusilla (Bunge) Boiss.	Th	IT				
Koelpinia linearis Pall.	Th	IT-SS				
Koelpinia tenuissima Pavl. & Lipsch	Th	IT				
Lactuca serriola L.	Hem	IT	*	*		
Lasiopogon muscoides (Desf.) DC.	Th	IT-SS				
Launaea acanthodes (Boiss.)	Hem	IT		*	DD	
Mausolea eriocarpa (Bge.) Poljak. ex Podl.						
Microcephala lamellata (Bunge) Pobed.	Th	IT				
Oligochaeta minima (DC.) C. koch.	Th	IT				
Pulicaria gnaphalodes (Vent.) Boiss.	Hem	IT-SS				
Senecio glaucus L.	Th	IT-M-SS				
Scariola orientalis (Boiss.) Sojak.	Hem	IT				
Scorzonera lituisinowa Fisch. & C.A.Mey.	G.t	IT				
Scorzonera paradoxa Fisch. & C.A. Mey.	G.t	IT				
Scorzonera pusilla Pall.	G. t	IT				
Scorzonera raddeana C. Winkl.	G. t	IT				
Scorzonera rigida Auch.	G. t	IT				
Thevenotia persica DC.	Th	IT				

Table 1. Contd.

Xanthium stromarium L.	Th	IT		*		
Boraginaceae						
Arnebia decumbens (Vent.) Coss. & Kral.	Th	IT-SS	*			
Arnebia linearifolia DC.	Th	IT-SS				
Gastrocotyle hispida (Forssk.) C. B. Clarke	Th	IT-SS				
Heliotropium aucheri DC.	Hem	IT				
Heliotropium europaeum L.	Th	IT -ES	*	*		
Heliotropium dasycarpum Ledeb.	Hem	IT				
Heterocaryum subsessile Vatke, Zeitschr. Gesammt.	Th	IT-SS				
Lappula ceratophora (M. Pop.) M. Pop.	Th	IT				
Lappula semiglabra (Ledeb.) Gurke	Th	IT				
Lappula sesiliflora (Boiss.) Gurke	Th	IT				
Lappula spinocarpus (Forssk.) Ascherson & O. Kuntze	Th	IT-SS				
Microparacary bungei (Boiss.) Khatamsaz, comb .Nov.	Th	IT-SS				
Nonnea caspica (Willd.) G. Don	Th	IT				
Brassicaceae						
Aethionema carneum (Banks & Soland.) B. Fedtsch.	Th	IT				
Alyssum dasycarpum Steph. ex Willd.	Th	IT	*	*		
Alyssum linifolium Steph. ex Willd.	Th	IT-ES-M	*	*		
Alyssum marginatum Steud. ex Boiss.	Th	IT		*		
Arabidopsis pumila (Steph.) N. Bosch.	Th	IT				
Cardaria draba (L.) Desv.	G. r	IT	*	*		
Cryptospora falcata Kar. & Kir.	Th	IT				
Descurainia sophia Webb. & Berth.	Th	IT-M-ES	*	*		
Erysimum crassicaule (Boiss.) Boiss.	Hem	IT	*		*	LR
Euclidium syriacum (L.) R. Br.	Th	IT	*			
Goldbachia laevigata DC.	Th	IT	*	*		
Goldbachia verrucosa DC.	Th	IT				
Isatis buschiana Schischk.	Hem	IT				
Isatis emarginata Kar. & Kir.	Th	IT				
Isatis minima Bge.	Th	IT				
Lepidium perfoliatum L.	Th	IT-M-ES	*			
Lepidium vesicarium L.	Th	IT				
Leptaleum filifolium (Willd.) DC.	Th	IT	*			
Malcolmia africana (L.) R. Br.	Th	IT-M-SS	*			
Malcolmia turkestanica Litw.	Th	IT				
Matthiola chenopodifolia Fisch. & C. A. Mey	Th	IT				
Matthiola dumulosa Boiss. & Buhse.	Ch	IT			*	LR
Octoceras lehmannianum Bunge.	Th	IT				
Sameraria armena (L.) Desv.	Th	IT				
Sameraria elegans Boiss.	Th	IT			*	DD
Sinapis arvensis L.	Th	ES-IT-M-SS	*	*		
Sisymbrium septolatum DC.	Th	IT-SS				
Sterigmostemum acanthocarpum Fish. & C. A. Mey.	Th	IT				
Sterigmostemum rhodanthum Rech. f.	Th	IT			*	DD
Tetracme recurvata Bge.	Th	IT				
Thlaspi perfoliatum L.	Th	IT				
Torularia torulosa (Desf.) O. E. Schulz.	Th	IT-SS				

Table 1. Contd.

Capparidaceae						
Buhsea trinervia (DC.) Stapf.	G.r	IT				
Capparis spinosa L.	Ch	IT-M-SS	*	*		
Caryophyllaceae						
Acanthophyllum acerosum Sosn.	Ch	IT				
Acanthophyllum crassifolium Boiss.	Ch	IT				
Acanthophyllum glandulosum Bunge ex. Boiss	Ch	IT				
Gypsophila linearifolia (Fisch. & C. A. Mey.) Boiss.	Th	IT				
Holosteum umbellatum L.	Th	IT-SS				
Chenopodiaceae						
Anabasis annua Bge.	Th	IT	*			
Anabasis setifera Moq.	Ch	IT-SS	*	*		
Atriplex dimorphostegia var. *dimorphostegia* Kar & Kir.	Th	IT-SS	*			
Atriplex dimorphostegia var. *sagitiformis* Allen.	Th	IT	*			
Atriplex leucoclada (Boiss.) Allen.	Hem	IT-SS	*			
Atriplex moneta Bge.	Th	IT				
Atriplex tatarica L.	Th	IT-M				
Atriplex verrucifera M. B.	Hem	IT	*			
Ceratocarpus arenarius L.	Th	IT	*			
Gamanthus gamocarpus (Moq.) Bge.	Th	IT	*			
Girgensohnia oppositiflora (Pall.) Fenzel in Ledb.	Th	IT				
Halimocnemis mamamensis (Bge.) Assadi, comb. nov.	Th	IT-ES			*	DD
Halimocnemis pilifera Moq.	Th	IT				
Halocharis sulphurea Moq.	Th	IT	*			
Halocharis violaceus Bge.	Th	IT				
Halocnemum strobilaceum (Pall.) M. B.	Ch	IT-SS-M	*			
Halostachys belangeriana (Moq.) Botsch.	Ph	IT	*			
Halothamnus glaucus subsp. *cinerascens* (Moq.) Assadi.	Ch	IT			*	LR
Halothamnus glaucus subsp. *vestitus* (Allen.) Assadi, comb. nov.	Ch	IT			*	LR
Halothamnus subaphyllus Botsch.	Ph	IT				
Haloxylon ammodendron (C. A. Mey.) Bge.	Ph	IT	*			
Haloxylon persicum Bge. & Boiss. et Buhse.	Ph	IT-SS	*			
Horaninowia anomala (C. A. Mey.) Moq.	Th	IT				
Kalidium caspicum (L.) Ung-Sterb.	Ch	IT	*			
Kalidium foliatum (Pall.) Moq.	Ch	IT				
Kochia stellaris Moq.	Th	IT	*			
Petrosimonia glauca (Pall.) Bge.	Th	IT				
Salsola arbuscula Pall.	Ph	IT				
Salsola arbusculiformis Drob.	Ph	IT				
Salsola crasaa M. B.	Th	IT	*			
Salsola dendroides Pall.	Ch	IT	*			
Salsola kali L.	Th	IT	*	*		
Salsola kerneri (Wol.) Botsch.	Ch	IT				
Salsola orientalis S. Gmelin.	Ch	IT	*			
Salsola tomentosa (Moq.) Spach.	Ch	IT				
Salsola turcomanica litw.	Th	IT-SS	*			
Seidlitzia florida (M. B.) Boiss.	Th	IT	*			
Seidlitzia rosmarinus (Ehrh.) Bge.	Ph	IT-SS	*			

Table 1. Contd.

Suaeda acuminata (C. A. Mey.) Moq.	Th	IT				
Suaeda microphylla Pall.	Ph	IT-ES				
Suaeda microsperma (C. A. Mey.) Fenzel in Ledeb.	Th	IT				
Convolvulaceae						
Convolvulus eremophilus Boiss. et Buhse.	Ch	IT-SS			*	DD
Convolvulus pilosellaefolius Desr.	Hem	IT-SS	*			
Cressa cretica L.	Hem	IT-M-SS		*		
Cyperaceae						
Carex physodes Bieb.	G.r	IT				
Scirpus maritimus L.	G.r	IT				
Dipsaceae						
Scabiosa olivieri Coult.	Th	IT-SS-ES				
Scabiosa rotata M. B.	Th	IT				
Ephedraceae						
Ephedra sarcocarpa Aitch. et Hemsl.	Ph	IT		*		
Ephedra strobilacea Bge. ex Lehm.	Ph	IT		*		
Euphorbiaceae						
Chrozophora tinctoria (L.) Juss.	Th	IT-M		*		
Euphorbia cheirolepioides Rech. f.	Th	IT			*	DD
Euphorbia densa Schrenk.	Th	IT				
Euphorbia heteradenia Iaub. & Spach.	Hem	IT				
Euphorbia sororia Schrenk	Th	IT				
Euphorbia turcomanica Boiss.	Th	IT				
Fumariaceae						
Fumaria parviflora Lam.	Th	IT-SS		*		
Geraniaceae						
Erodium oxyrrhynchum M. B.	Th	IT-SS-ES				
Iridaceae						
Iris kopetdaghensis (Vved.) Mathew & Wendelbo.	G. b	IT-ES				
Iris songarica Schrenk	G. r	IT-ES				
Ixioliriaceae						
Ixiolirion tataricum Fisch. ex Herb.	G. b	IT-SS-ES	*			
Lamiaceae						
Eremostachys hyoscyamoides Boiss & Buhse.	Hem	IT			*	LR
Lallemantia royleana (Benth. In Walt.) Benth.	Hem	IT	*	*		
Salvia reuterana Boiss.	Hem	IT		*	*	DD
Stachys trinervis Aitch &Hemsl.	Ch	IT				
Thuspeinanta persica (Boiss.) Briq.	Th	IT				
Ziziphora tenuir L.	Th	IT	*	*		
Liliaceae						
Allium borszczowii Regel.	G. b	IT				

Table 1. Contd.

Allium capsicum (Pall.) M. B.	G. b	IT				
Eremorus inderiensis Stev.)Boiss.	G. t	IT				
Gagea reticulata (Pall.) Schultes	G. b	IT				
Tulipa biflora Pall.	G. b	IT				
Tulipa montana Lindl. var.*montana*	G. b	IT		*	*	DD
Orobanchaceae						
Orobanch picridis FW. Schultz.	Par	IT				
Papaveraceae						
Glaucium elegans Fisch. & C. A. Mey.	Th	IT				
Hypecoum pendulum L.	Th	IT-M-SS	*			
Romeria hybrida (L.) DC.	Th	IT-SS				
Papilionaceae						
Alhagi persarum Boiss. & Buhse.	Hem	IT	*	*		
Astragalus angustatus Boiss.	Hem	IT	*		*	LR
Astragalus argyroides G. Beck.	Hem	IT	*			
Astragalus arpilobus (Boiss.) Podl.	Th	IT-SS				
Astragalus bakaliensis Bunge.	Th	IT				
Astragalus campylorrhyncus F. & M.	Th	IT				
Astragalus commixtus Bunge	Th	IT				
Astragaluscorronilla Gazer & Podl.	Th	IT				
Astragalus crenatus Schultes	Th	IT-SS				
Astragalus dactylocarpus Emend. Ott.	Ch	IT				
Astragalus eremophilus subsp*. eremophilus* Emend. Podlech	Th	IT-SS				
Astragalus eremophilus subsp. *makranicus* Podlech	Th	IT-SS				
Astragalus kahiricus DC.	Hem	IT-SS		*		
Astragalus macrobotrys Bunge	Ch	IT				
Astragalus nigricans Barneby	P	IT				
Astragalus oxyglottis Bieb.	Th	IT				
Astragalus pellitus Bunge	Hem	IT				
Astragalus podolobus Boiss. & Hohen.	Ch	IT				
Astragalus tribuloides Delile	Th	IT-SS				
Ophiocarpus sp.	Th	IT				
Sophora pachycarpa C. A. Mey.	Hem	IT				
Trigonella calliceras Fisch.	Th	IT	*			
Plantaginaceae						
Plantago evacina Boiss.	Th	IT			*	
Plumbaginaceae						
Acantholimon acmostegium Boiss. & Buhse.	Ch	IT			*	LR
Acantholimon scorpius (Jaub. & Spach)	Ch	IT			*	LR
Acantholimon acerosum (Wild.) Boiss.	Ch	IT				
Poaceae						
Aeluropus littoralis (Gouan) Parl.	G. r	IT-M-SS	*			
Boissiera squarrosa Hochst. ex Steud.	Th	IT	*			
Bromus danthoniae Trin.	Th	IT	*			
Bromus sericeus Drobv.	Th	IT				

Table 1. Contd.

Bromus tectorum L.	Th	Cosm	*	*		
Eremopyrum bonaepartis (Speng.) Nevski	Th	IT	*			
Eremopyrum distans (C. Koch.) Nevski	Th	IT				
Hordeum glaucum Steud.	Th	IT-M	*			
Nardurus subulatus (Banks & Soland.) Bor.	Th	IT				
Phalaris minor Retz.	Th	IT-M	*			
Poa bulbosa L.	G. b	IT-M-ES	*			
Schismus arabicus Nees.	Th	IT-M-SS				
Stipa caucasica Schmalh.	Hem	IT-ES				
Stipa lessingiana Trin. & Rupr.	Hem	IT-Es	*			
Stipagrostis pennata (Trin.) De. Winter	G. r	IT	*			
Stipagrostis plumosa (L.) Munro. ex. T. Anders	Hem	IT-SS	*			
Polygonaceae						
Atraphaxis spinosa L.	Ph	IT-M		*		
Calligonum denticulatum Bge. ex Boiss.	Ph	IT			*	
Calligonum junceum (Fisch. &C.A.Mey.) Litw.	Ph	IT				
Polygonum hyrcanicum Rech. f.	Th	IT-ES			*	LR
Polygonum olivascens Rech. f. & Schiman- Czeika	Th	IT-SS			*	
Polygonum patulum M. B.	Th	IT-M				
Pteropyrum aucheri Jaub. & Spach.	Ph	IT	*		*	
Primulaceae						
Anaghalis arvensis L.	Th	IT-M-ES	*	*		
Ranunculaceae						
Ceratocephalus falcatus (L.) Pers.	Th	IT-M				
Consolida rugulosa (Boiss.) Schrod.	Th	IT				
Resedaceae						
Reseda buhseana Mull-Arg. var. *buhseana* Mull- Arg.	Hem	IT				
Rosaceae						
Rosa persica Michx.ex Juss.	Ph	IT				
Rubiaceae						
Callipeltis cucullaria Stev.	Th	IT				
Leptunis trichodes (J. Gay) Schischk	Th	IT				
Gaillonia brungieri A. Rich.	G. r	IT-SS			*	LR
Rutaceae						
Haplophyllum glaberrimum Bge. ex Boiss.	Hem	IT			*	LR
Haplophyllum sp.	Hem	IT				
Solanaceae						
Hyoscyamus pusillus L.	Th	IT				
Lycium ruthenicum Murr.	Ph	IT				
Tamaricaceae						
Reaumuria cistoides Adam.	Ch	IT-ES				
Reaumuria oxiana (Ledeb.) Boiss var. *persica* (Boiss.) Assadi	Ch	IT			*	LR

Table 1. Contd.

Tamarix gallica L.	Ph	IT-SS		*	
Tamarix macrocarpa (Ehrenberg.) Bge.	Ph	IT-SS			
Valerianaceae					
Valerianella cymbicarpa C. A. Mey.	Th	IT			
Valerianella dufresnia Bge. ex Boiss.	Th	IT			
Valerianella oxyrrhynca Fisch & C. A. Mey.	Th	IT			
Valerianella szwitsiana Fisch. & C. A. Mey.	Th	IT			
Valerianella triplaris Boiss & Buhse.	Th	IT			
Valerianella turkestanica Regel & Schmalh. ex Regel.	Th	IT			LR
Zygophyllaceae					
Nitraria schoberi L.	Ph	IT	*		
Peganum harmala L. var *harmala*	Hem	IT-M-SS		*	
Tribulus macropterus Boiss.	Th	IT-SS			
Tribulus terrestris L. var *terrestris*	Th	IT-SS-ES		*	
Zygophyllum atriplicoides Fisch. & C. A. Mey.	Ph	IT-SS	*		
Zygophyllum eurypterum Boiss. & Buhse.	Ph	IT-SS-M			
Zygophyllum miniatum Cham. & Schlechtend.	Hem	IT	*		

L.F: Life form, Chor: chorotype, Pa: pasture, Me: medicinal, En: endemic, Vu: vulnerability, Th: therophyte; Hem: hemicryptophyte, Ch:Chamaephyte, Ph:phanerophyte, G.t geophyte tuberous, G.b: geophytes bulbous; G.r: geophytes rhizomous, IT: Irano-Turanian, M :Mediterranian, SS: Sahara-Sindian, ES: Europa-Siberian, DD: data deficiency, LR: lowrisk, Par: parasite.

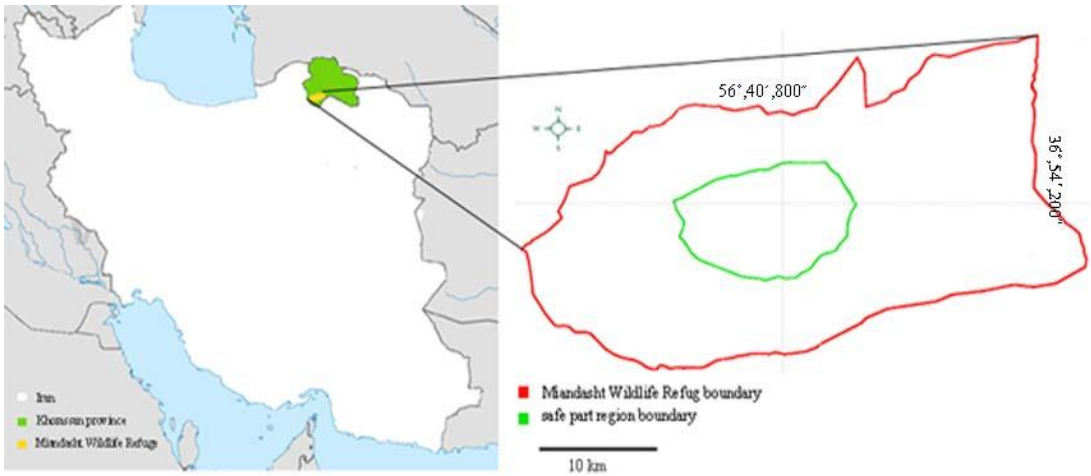

Figure 1. Location of Miandasht Wildlife Refuge on Iran map (drawn using Adobe Photoshop CS4).

this region (Maassoumi, 1986-2005). Hence, the maximum number of *Astragalus* species was expected in Miandasht because it is situated in the Irano-Turanian region.

The floristic composition of the vegetation expressed the climatical and edaphical conditions of this region. In this composition, relatively high presence of certain groups of plants, that each of them grows *in* specific environmental conditions, could be observed. These groups include the desert plants (*Artemisia sieberi, Cousinia neurocentra, Heliotropium aucheri, Acantholimon crassifolium*), psammophytes (*Carex physodes, Calligonum junceum, Schomannia karelinii, Psammogeton canescens*), desert halophytes (*Anabasis annua*, *Atriplex moneta*, *atriplex dimorphostegia, Halimocnemis pilifera*, *Halocharis sulphurea*, *Seidlitzia rosmarinus, Salsola turcomanica*), marsh halophytes (*Kalidium capsicum, Halocnemum strobilaceum,*

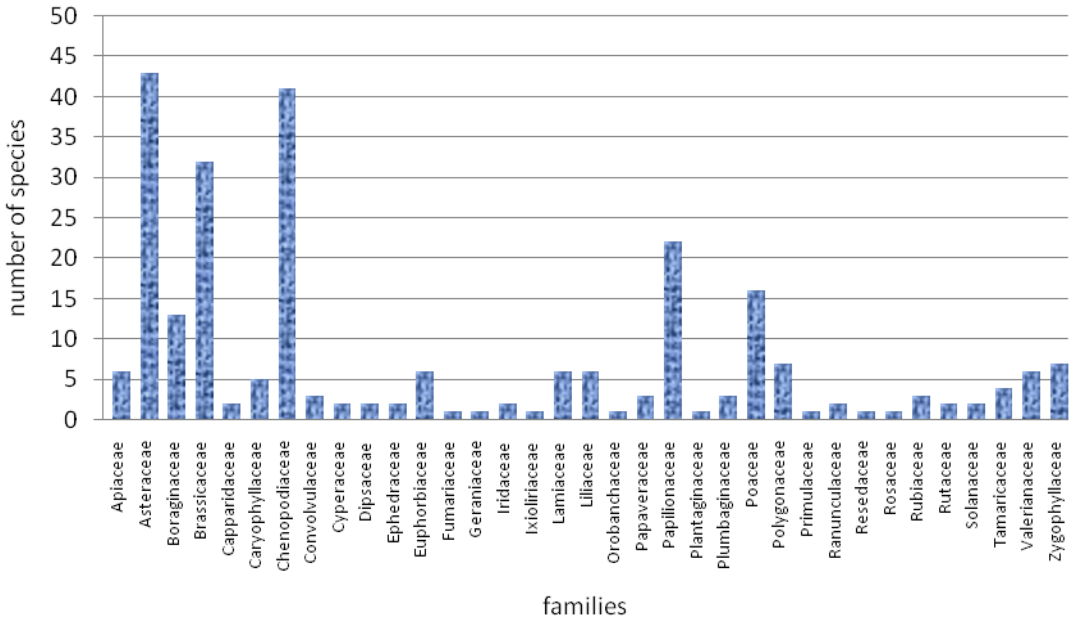

Figure 2. Chart of the number of species belonging to families in flora of Miandasht Wildlife Refuge (out of the safe part).

Aeloropus littoralis, Phragmites australis) and a large number of ruderals, for example: *Buhsea trinervia, Cardaria draba, Launaea acanthodes,Peganum harmala, Sophora Pachycarpa, Acantholepis orientalis*. Thelarge number of annual and perennial anthropogenicand ruderal plants in this area indicate excessive degradation, especially as a result of overgrazing and undermining by livestock. If rangelands are allowed to regenerate properly and grazing controlled in selected area, conservation can be achieved and the long term stability of the pastural life-style can be enhanced (Shahina and Ghazanfar, 1998).

Figure 3 illustrates that the therophytes with 143 species (55.86%) were the maximum number of life form on the flora of this area, then there were 42 (15.62) hemicryptophytes, 26 (10.16%) chamephytes, 23 (8.6%) phanerophytes and totally 20 (9.38%) geophytes.

The *Orobanch picridis* is a parasitic species that grows in this area. Among the geophytes, 8 (3.125%) rhizomous species, 8 (3.125%) tuberous species and 8 (3.125%) bulbous species were found. Therophytes are reproduced by the seeds. Compatibility of this procedure for reproduction in arid areas is more than other ways, because seeds are reproduced in small size and large number. So, they are distributed very easily. Seeds usually survived on unfavorable conditions. Also, genetic diversity of seeds which are produced through sexual reproduction leads to genetic flexible populations (Neishabouri, 1995). Most of the therophytes that grow in MWR are adapted with short duration of precipitation and high temperature, and they complete the life cycle and produce the seeds. Saberamoli (2001) said that when the numbers of therophytes exceed the other life forms it shows desert conditions.

According to Table 1, 29 (11.33%) Iran endemic species grow in MWR. The presence of endemic species is among the fundamental criteria for characterizing biodiversity of a territory (Giuseppe, 2013). On the other hand, there are no obvious correlation between modern climate and endemism (Linder, 2001). Iran is one of the main centers of endemism in the world (Saberamoli, 2001). Totally 2000 endemic species grow in Iran and Irano-Turanian region contain 85% of endemic plant species of Iran (Dehshiri, 2005). The results of this research show that in the MWR which is located in Irano-Turanian region grow 1.45% of all endemic species of Iran. Since extent of this area is much less than the Irano-Turanian region in Iran, the above result was justifiable. Chamephytes, for example *Artemisia* and some species of *salsola*, are relatively big shrubs and their production is more than that of therophytes. Also, they are significant component of vegetation in a long period of the year. By increasing drought trend from spring to late summer, also by decreasing temperature until autumn, dominance of the chenopodiaceae in the plant formation of the study area was clearly evident. They are resistant to salinity and drought. Therefore, they grow very well in spite of intense environmental conditions (Saberamoli, 2001). Chamephytes and Phanerophytes are resistant to drought and they are morphologically adapted instead of adaptation in life cycle (Saberamoli, 2001). Although these two groups were not large in the life form spectrum of MWR, they were the main component of vegetation. Also, most of them are

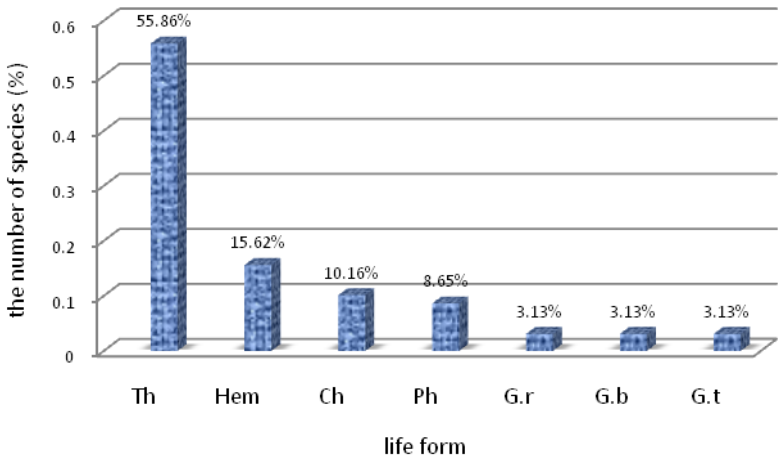

Figure 3. Life form spectrum of flora of Miandasht Wildlife Refuge (out of the safe part). Th: therophyte, Hem: hemicryptophyte, Ch: chamephyte, Ph: phanerophyte, G.r: geophyte with rhizome, G.b: geophyte with bulb, G.t: geophyte with tuber.

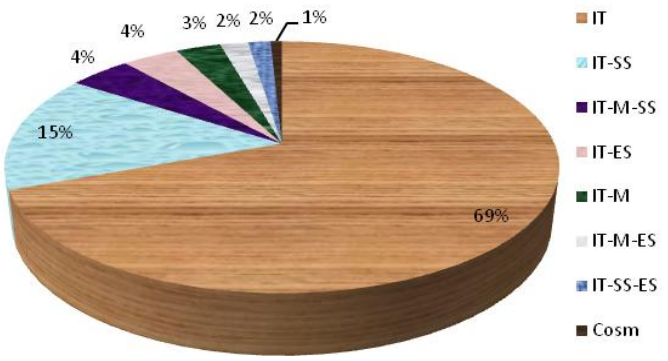

Figure 4. Weight of chorotype on flora of Miandasht Wildlife Refuge (out of the safe part).

Figure 5. *Salsola turcomanica.* Litw.

effective in preventing erosion. In addition to these, majority of them are pasture plants and provide food for wildlife. Therefore, these facts should be considered in management of this area. Because geophytes have underground organs like tubers, bulbs and rhizomes, they need suitable soil depth. Relatively high presence of geophytes showed that this area had capability of pedogenes.

Figure 4 show that the majority of species were Irano-Turanian elements. The remaining plants were common elements between Irano-Turanian and other regions. Ascending order were Irano-Turanian and Sahara-Sindian, Irano-Turanian and Euro-Siberian, Irano-Turanian and Mediterranian and Sahara–Sindian, Irano-Turanian and Euro-Siberian, Irano-Turanian and Mediterranian, Irano-Turanian and Mediterranian and Euro-Siberian, and Cosmopolitan and Irano-Turanian and Sahara-Sindianand Euro-Siberian.

Table 1 shows that from the 256 species, 64 were pasture plants and 38 were medicinal. Shrubs like *Artemisia*, especially different shrub and herbal *Chenopodiaceae* species have high forage value. They were widely distributed in this area, and they had high production. Therefore, MWR is a good pasture.

As the number of rare and threatened species has multiplied, it has become increasingly important to select species for conservation management and to provide information on the causes of decline (Perrine et al., 2013). Fortunately, this study showed that any of the species existing in MWR were not at risk or vulnerable. The current picture of extinction risk is still incomplete because many species in flora of MWR were never assessed.

We concluded on the plant diversity of MWR, in spite of environmental stresses such as drought, salinity, erosion

Figure 6. *Halocnemum strobilaceum* (Pall)M. B.

Figure 7. *Atriplex moneta* Bge.

Figure 8. *Tamarix macrocarpa* (Ehrenberg.) Bge.

Figure 9. *Nitraria schoberi* L.

Figure 10. *Lycium ruthenicum* Murr.

Figure 11. *Acantholimon acmostegium* Boiss. & Buhse.

and uncontrolled grazing by livestock is high. Moreover, this diversity is manifested not only in number of species but also in terms of the chorotype and life-form presents.

In this region, the diversity of microclimates and the

Figure 12. *Anabasis setifera* Moq.

physiographic units of dry and saline areas as hillsides plains, sandy deserts, seasonal streamlets and Kavir areas have made many different local edaphic conditions.

Among the plants, Chenopodiaceae species are very important for providing the food for wildlife. Specially, the shrubs which have large amounts of proteins and minerals are important. These plants are a valuable source of food for wildlife. Overall, the flora consists of plants that have adapted to climatic and edaphic conditions of the region in life-form or morphology or life cycle. Also, many plants are invasive. These plants are distributed in this area due to the natural erosion and degradation resulting from human interventions. So, proper management and protection of the existing sources can increase species richness.

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