University of Mazandaran

Journal of Genetic Resources
J Genet Resour 2017;3(2):113-129
http://sc.journals.umz.ac.ir
doi: 10.22080/jgr.2018.13639.1092

Iranian Biology Society

Floristic, Life Form, and Chorological Studies of Saldaran Protected Region, Chaharmahal and Bakhtiari Province, Iran

Fatemeh Hasanzadeh[1], Navaz Kharazian[1*], Mohammad Reza Parishani[2]

[1] Department of Botany, Faculty of Sciences, Shahrekord University, Shahrekord, Iran
[2] Department of Biology, Faculty of Sciences, Shahid Chamran University, Ahvaz, Iran

Corresponding Author: nkharazian@gmail.com
Received: 11 September 2017 Accepted: 25 October 2017

Abstract

Saldaran protected region with about 14,000 hectares is located at longitude 50º34′E and latitude 32º4′N at 115 km of southwest of Shahr-e Kord City. This area is one of the important genetic resources in the Zagros Mountains. In the present study, floristic elements, life forms, chorological analysis, protected status, pasture and poisonous plants were investigated. All specimens were collected during all vegetation seasons and in several stages from March 2015 to July 2017. A total of 267 species, 190 genera, and 56 families were identified. The results show that 11 families, 41 genera, 51 species were monocotyledon, 44 families, 148 genera, and 215 species were dicotyledon and 1 species belonged to Pteridophyta. Based on life form data, the species were hemicryptophyte (41%), therophyte (35%), geophyte (16%), phanerophyte (5%), chamaephyte (2%) and parasite (1%). In term of geographical distribution, Irano-Turanian chorotype was a major component (57%, 152 species) in this region. A total of 153 mono-regional, 61 bi-regional and 53 pluri-regional species were identified. In addition, 32 endemic, 106 pasture and 23 poisonous species were determined. In terms of protective status, the species were Near Threatened (47%) and Endangered (3%). The data obtained from the present study is reported for the first time for Iran.

Key words: Chorotype; Endemic; Irano-Turanian; Pasture; Endangered

Introduction

Vegetation is one of the most important units of natural ecosystems that is investigated for managing and conserving of natural resources (Nimis, 1985). Floristic studies are the first step to investigate the ecology and phytogeography, identify the new plant species, detect destructive factors in natural habitats, and preserve genetic resources (Naqipour Borj, 2011; Feyzi *et al*., 2014). Flora of each region is composed of response to the biological conditions, evolution of floristic elements and geographical situation in the past periods (Tavakoli & Mozaffarian, 2004).

Life form of each species, which is based on ecological adaptation to environmental conditions (Feyzi *et al*., 2014), is useful for estimating ecosystem function, displaying vegetation diversity and species richness patterns (Diaz & Cabido, 1997). The dominance of each life form also detects the biological conditions of habitats and ecological dependence of environment (Archibold, 1995). Additionally, the chorotype studies in different vegetation give valuable information to detect plant diversity (Yousefi, 2006). The plant species present the genetic resources in each country and world heritage. Consequently, studies of plant species are an appropriate context for ecology, pasture, watershed management, and plant gene pools. Moreover, identification of plant species facilitates other life form studies (Vaseqi *et al*., 2008; Abbasi *et al*., 2012).

Chaharmahal and Bakhtiari province with an area of 16,533 Km^2 is one of the high altitude areas in the central Iranian plateau from Zagros Mountains (Assadi *et al*., 2009). It is represented by different climate and various weather features resulting from Zagros Mountainous region with

special geography and topography conditions (Assadi *et al*., 2009).

Several floristic centers were recognized in this province due to microclimate diversity, various elevations, topography, and soil texture diversity (Shirmardi *et al*., 2011). Based on local floristic investigations, Assadi *et al.* (2009) reported floristic elements of Sabz-e Kouh protected region in the east of this province including 73 families, 285 genera and 433 species. Moreover, different life forms such as hemicryptophytes, therophytes, phanerophytes and geophytes were identified in the study area. In Karsanak protected region located in the northwest of Chaharmahal and Bakhtiari province, 43 families, 191 genera, and 276 species were identified. Of these species, 76.25% were Irano-Turanian elements and 53 species were in threatened position (Pairanj *et al*., 2011). In addition, Mozaffarian *et al.* (2014) determined 487 species from Qeisari region in this province (Chaharmahal and Bakhtiari). In Helen protected region (Chaharmahal and Bakhtiari), 56 endemic species were reported including Irano-Turanian elements (Shirmardi *et al*., 2014). There were previous reports from Gardan-e Rokh in the northeast (Arian Manesh *et al*., 2009), Kelar in the central area (Shahrokhi *et al*., 2011), Sheida protected region in the north (Vahabi *et al*., 2017), and Kouh-e Sheet in the northwest of Chaharmahal and Bakhtiari (Dehqani *et al*., 2016). These documents showed a high floristic diversity within the province. The permanency of a vegetative region is mostly concerned with the number of species and resistance to endangered status (Basiri *et al.*, 2011). The highest number of species belonged to Kelar region with 600 species from which 67 were endemic species. Furthermore, 12 species from this region were identified to be vulnerable (Shahrokhi *et al*., 2011).

In the case of applied plant species, there were different reports from the floristic elements of Chaharmahal and Bakhtiari province. A total of 190 species were identified as medicinal, pasture, poisonous and industrial specimens (Arian Manesh *et al*., 2009; Shahrokhi *et al*., 2011; Qasemi *et al*., 2015; Vahabi *et al*., 2017).

Since there is no report from Saldaran protected region, the present floristic study was conducted to 1) recognize the floristic elements 2) determine the life forms spectra, 3) identify the geographical distribution (chorology) based on the floristic components, and 4) detect the endemic, pasture, poisonous, and protected status of plants species. All data for the study area are reported for the first time.

Materials and Methods

The features of studied area

The Saldaran protected region is one of the high mountainous areas in the center of Chaharmahal and Bakhtiari province. This region with an area of 14,000 hectares is located at longitude 50º34′E and latitude 32º4′N at 115 km from the southwest of Shahr-e Kord and 140 km from the south of Farsan. The altitude of the region was ranged from 1469-3215 m. It is bordered with Alikouh, Qeisari, and Dashtak in the northwest, Jouneqan in the northeast, Qaleh Darvish and Rostamabad in the west, and Ardal and Tang-e Darkesh in the south (Fig. 1).

The climate conditions of this region were also estimated using the De Martonne aridity index (1926): I=P/T+10 where P is annual precipitation and T is annual mean temperature.

The climate information was provided by the meteorological station at Ardal. The climatic features were specified during four years. The high precipitation during six months of winter and spring showed the wet season. According to meteorological agency, during 2009-2013, the mean annual precipitation, mean annual temperature, and minimum and maximum of absolute temperatures were 482.4 mm, 15.1°C, -11°C and 39.8°C, respectively. The maximum of 24-hour rainfall was 53.6 mm, the number of frost days per year was 72 days, and average relative humidity was 56.1. De Martonne's (1926) coefficient was estimated to be 19.219. As presented in Fig. 2, the climate of this region is semi-arid. There are few geological reports on this protected region. According to environmental protection agency, this region belongs to Sanandaj-Sirjan zone and the highland plain of Zagros area. The geological formations of this area consist of Eocene-Oligocene calcareous sediments, which are comprised of nomolytic white limestone, marl lime, and dolomite limestone.

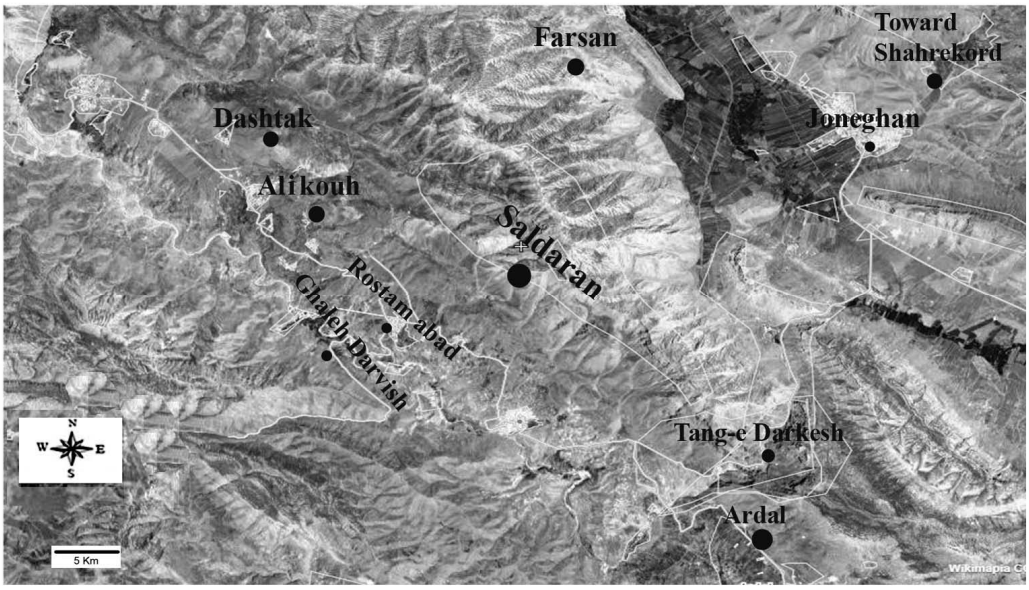

Fig. 1. The geographical position of Saldaran protected region in Chaharmahal and Bakhtiari province.

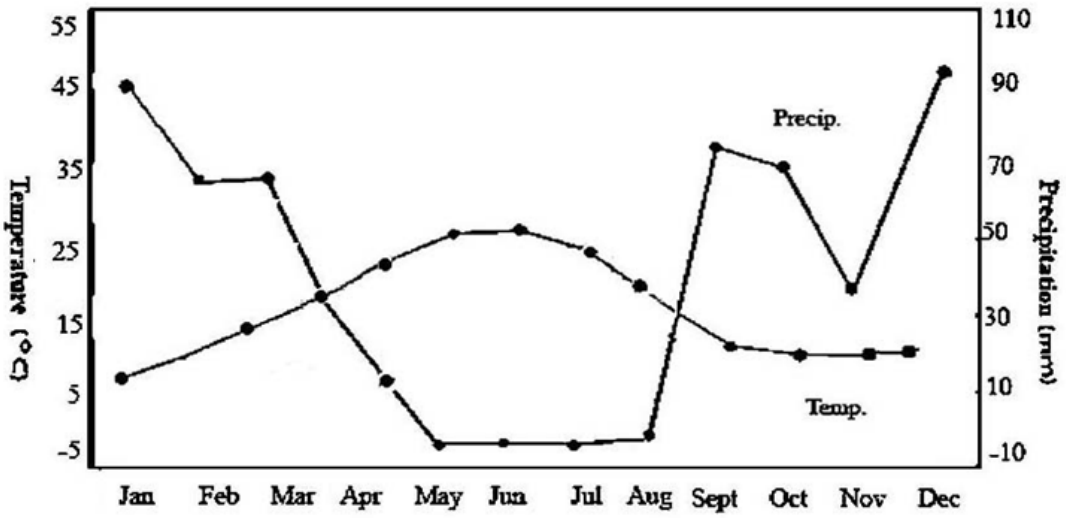

Fig. 2. Climatic diagram from meteorological station from Ardal covering the years 2009-2013.

The formations can be followed by the prevailing trend of the Zagros trust at the northwest-southeast and the slope to the northeast (Bahraminia *et al.*, 2013). Soil texture of this region is not recognized. The adjacent regions such as Farsan and Jouneqan contain non-dense clay, clay loam, and silty loam (Afrouzi & Mohammadzade, 2011). The synclines have been influenced by a large-scale erosion system that produced Saldaran heights (Feyznia *et al*., 2017). Moreover, the gypsum, silica, and sandy soils are reported in Ardal region (Feyznia *et al*., 2017).

Research method

To collect the specimens of Saldaran protected region, the geographical maps (scale: 1/25000) were first investigated. Furthermore, the field visits and collecting the specimens were carried out from March 2015 to July 2017 during all vegetation seasons and in several stages.

Flora Iranica (Rechinger, 1963-2005), Flora of Iran (Qahreman, 1982-2008; Assadi *et al.*, 1988-2012), vegetation of Iran (Mobayen, 1975-1996) and Flora of Turkey (Davis, 1965-1988) were used to identify and determine the collected specimens. The herbarium specimens were confirmed by the herbarium sheet of Agriculture Research Center of Shahr-e Kord. All the collected specimens were deposited in the Herbarium of Shahr-e Kord University. All identified species were also confirmed by International Plant Name Index (IPNI, 2017), the plant list (www.theplantlist.org), and Qaremaninezhad & Nezhad Falatoury (2016).

The life forms of the species were determined by Raunkiaer's method (1934). The chorotype of each floristic elements was identified using Zohary (1973) and Flora of Iran (Assadi *et al.*, 1990-2002). The conservation status was also defined by Red Data Book and IUCN website (Jalili and Jamzad 1999; www.iucn.org). Moreover, reliable references (Asri, 2011-2012; Mozaffarian, 2015) were applied to identify the pasture and poisonous values of each species.

Results

The results of floristic studies are presented by a total of 267 species, 190 genera, and 56 families identified in Saldaran protected region. There were 11 families, 41 genera, 51 species of monocotyledon, followed by 44 families, 148 genera, 215 species of dicotyledon, and 1 species of Pteridophyta (Table 1). The highest number of species and genera belongs to Asteraceae with 26 genera and 33 species (19%), Fabaceae with 12 genera and 32 species (18%), Poaceae with 21 genera and 26 species (15%), Brassicaceae with 15 genera and 18 species (10%), Lamiaceae with 10 genera and 18 species (10%), Caryophyllaceae with 10 genera and 13 species (7%), and Apiaceae with 9 genera and 10 species (6%) (Table 2). The largest genera were *Astragalus* L. (8 species), *Euphorbia* L. (7 species), *Vicia* L. (6 species), *Medicago* L. (6 species), *Galium* L. (5 species) and *Stachys* L. (5 species) (Table 2). Additionally, there were 149 monotypic genera including Asteraceae (21 genera), Poaceae (18 genera), Brassicaceae (12 genera), Apiaceae (8 genera) and Caryophyllaceae (8 genera) (Table 2). In addition, a total of 22 sub-species and 2 varieties were identified. The highest number of sub-species was observed in Fabaceae (5 subspecies), Asteraceae (3 subspecies), and Caryophyllaceae (3 subspecies) (Table 1).

A total of 34 species were reported for the first time from Chaharmahal and Bakhtiari province. Some of these species are *Bupleurum croceum* Fenzl. (Apiaceae), *Ornithogalum cuspidatum* Bertol. (Asparagaceae), *Cousinia onopordioides* Ledeb. (Asteraceae), *Erysimum koelzii* Polatschek & Rech.f. (Brassicaceae), *Arenaria serpyllifolia* L. (Caryophyllaceae), *Sedum nanum* Boiss. (Crassulaceae), *Valerianella tuberculata* Boiss. (Caprifoliaceae), *Bryonia aspera* Steven ex Ledeb. (Cucurbitaceae), *Euphorbia esula* L. (Euphorbiaceae), *Astragalus perpexus* Maassoumi. (Fabaceae), *Piptatherum laterale* (Regel) Nevski. (Poaceae), *Viola occulta* Lehm. (Violaceae) and *Orobanche hirtiflora* (Reut.) Tzvelev (Orobanchaceae) (Table 1). The life form of each species was also identified. The results showed that hemicryptophyte (41%) and therophyte (35%) contain the highest proportion of life form spectra followd by geophyte (16%), phanerophyte (5%) and chamaephyte (2%) (Table 3). Asteraceae (20%), Fabaceae (16%) and Lamiaceae (13%) represented the highest percent of hemicryptophytes, followed by Poaceae (13%), Brassicaceae (13%) and Fabaceae (12%) with the highest proportion of terophytes.

In terms of geographical distribution, the Irano-Turanian elements were in a high proportion (57%; 152 species). Other chorotypes such as Irano-Turanian/Euro-Siberian (15%), Irano-Turanian/Euro-Siberian/Mediterranean (9%), Pluri-regional (6%), Irano-Turanian/ Mediterranean (5%), Irano-Turanian/ Euro-Siberian/Saharo-Sindian (3%), Cosmopolite (3%) and Irano-Turanian/ Saharo-Sindian (2%) were in low percent (Table 4). The highest amounts of Irano-Turanian elements were found to be Asteraceae (13%), Fabaceae (12%), Lamiaceae (9%) and Poaceae (9%). The rest of the families were in low range (1-7%). Moreover, mono-regional (57%), bi-regional (23%) and pluri-regional (20%) were also detected in this region.

Table 1. The list of collected species from Saldaran protected region. Ph: phanerophyte, Ch: chamaephyte, G: geophyte, H: hemicryptophyte, T: therophyte, Cosm: cosmopolite, IT: Irano-Turanian, M: Mediterranean, Pl: pluri-regional, IT-ES-M: Irano-Turanian/ Euro-Siberian/ Mediterranean, IT-M: Irano-Turanian/ Mediterranean, IT-ES: Irano-Turanian/ Euro-Siberian, IT-SS: Irano-Turanian/ Saharo-Sindian, IT-ES-SS: Irano-Turanian/ Euro-Siberian/ Saharo-Sindian, *: reported for the first time in Chaharmahal and Bakhtiari province, No: herbarium number.

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Amaranthaceae								
Noaea mucronata (Forssk.) Asch. & Schweinf.	Ch	IT-M			+		2345	1001
Amaryllidaceae								
Allium atroviolaceum Boiss.	G	IT					2230	1002
Allium rubellum M.Bieb.	G	IT					2150	1003
Anacardiaceae								
Pistacia atlantica Desf.	Ph	IT					1895	1004
Apiaceae								
Bunium elegans (Fenzl) Freyn	G	IT					2120	1005
Bupleurum croceum Fenzl.*	H	M					2653	1006
Chaerophyllum macropodum Boiss.	H	IT	DD				2331	1007
Falcaria vulgaris Bernh.	H	IT-ES-M					2489	1008
Grammosciadium Scabridum Boiss.	H	IT					1950	1009
Lisaea heterocarpa Boiss.	T	IT					2985	1010
Scandix iberica M.Bieb.	T	IT			+		2400	1011
Scandix stellata Banks & Sol.	T	IT-ES-M	DD		+		2130	1012
Torilis leptophylla (L.) Rchb.f.	T	IT-M					1943	1013
Turgenia latifolia (L.) Hoffm.	H	IT					1720	1014
Araceae								
Arum rupicola Boiss.	G	IT-ES					2990	1015
Asparagaceae								
Bellevalia cyanopoda Wendelbo	G	IT		+			1790	1016
Muscari neglectum Guss. ex Ten.	G	IT					2753	1017
Ornithogalum arcuatum Steven	G	IT					1820	1019
Ornithogalum cuspidatum Bertol.*	G	IT					1860	1018
Zagrosia persica (Hausskn.) Speta	G	IT					1756	1020
Asteraceae								
Achillea santolinoides Lag. subsp. *wilhelmsii* (K.Koch) Greuter	H	IT			+		2984	1021
Anthemis odontostephana Boiss. var. *tubicina* Boiss. & Hausskn.	T	IT	DD	+	+		2796	1022
Carduus pycnocephalus L.	T	IT-M					2534	1023
Carthamus oxyacantha M.Bieb.	T	IT	DD		+		2331	1024
Centaurea iberica Trevir. ex Spreng.	H	IT-ES			+		1980	1025
Centaurea solstitialis L.	H	IT-SS			+	+	1750	1026
Centaurea virgata Lam. subsp. *squarrosa* (Boiss.) Gugler	H	IT-ES	DD		+		1846	1027
Chardinia orientalis (L.) Kuntze	H	IT					2480	1028
Cichorium intybus L.	H	PL			+		1890	1029
Cirsium arvense (L.) Scop.	G	PL	DD		+	+	2648	1030
Cousinia onopordioides Ledeb.*	H	IT			+		3215	1031
Crepis sancta (L.) Bornm.	T	IT-ES-M					1975	1032
Crupina crupinastrum (Moris) Vis.	T	IT-M					2649	1033
Cyanus depressus (M.Bieb.) Soják	H	IT	DD		+		1894	1034
Gundelia tournefortii L.	H	IT-ES-M	DD		+		2675	1035
Hedypnois rhagadioloides (L.) F.W.Schmidt.	T	IT					2364	1036
Helichrysum oligocephalum DC.	H	IT	NT	+			1780	1037
Jurinea berardioides (Boiss.) O.Hoffm.	H	IT					2562	1038
Lactuca microcephala DC.	G	IT		+			1980	1039
Lactuca persica Boiss.	H	IT	DD				1963	1040
Lasiopogon muscoides (Desf.) DC.	T	IT-ES-M					2300	1041
Rhaponticum repens (L.) Hidalgo	H	IT-ES				+	2654	1042
Scorzonera rupicola Hausskn.	H	IT	NT	+			2986	1043

Table 1. Continue

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Scorzonera songorica (Kar. & Kir.) Lipsch. & Vassilcz.	H	IT					3150	1044
Senecio leucanthemifolius Poir. subsp. *vernalis* (Waldst. & Kit.) Greuter	T	IT-ES-M					2564	1045
Tanacetum pinnatum Boiss.*	H	IT					2986	1046
Tanacetum polycephalum Sch.Bip.	H	IT	NT	+			2890	1047
Taraxacum pseudodissimile Soest.	H	IT			+		1900	1048
Tragopogon acanthocarpus Boiss.	H	IT		+	+		1786	1049
Tragopogon pterocarpus DC.	H	IT-ES-M			+		1855	1050
Tragopogon vaginatus Ownbey & Rech.f.	H	IT			+		1946	1051
Tripleurospermum disciforme (C.A.Mey.) Sch.Bip.	H	IT					2648	1052
Xanthium spinosum L.	T	IT-ES					1800	1053
Biebersteiniaceae								
Biebersteinia multifida DC.	G	IT-ES-M					2790	1054
Boraginaceae								
Anchusa azurea Mill.	H	IT-ES					1790	1055
Asperugo procumbens L.	H	IT-ES					2940	1056
Buglossoides incrassata (Guss.) I.M.Johnst.	H	IT-ES					2456	1057
Myosotis ramosissima Rochel.	H	IT-M					2450	1058
Onosma bodeana Boiss.	H	IT		+			1985	1059
Rochelia cardiosepala Bunge.	T	IT					2460	1060
Rochelia persica Bunge ex Boiss.	T	IT-ES					2345	1061
Brassicaceae								
Alyssum linifolium Stephan ex Willd.	T	IT	DD	+			2100	1062
Alyssum strictum Willd.*	T	IT-ES					2325	1063
Arabis nova Vill.	T	IT-ES					2765	1064
Aubrieta parviflora Boiss.	H	IT	DD				2795	1065
Clypeola jonthlaspi L.	T	IT					2655	1066
Descurainia sophia (L.) Webb ex Prantl	T	PL	DD		+		1850	1067
Diplotaxis hara (Forssk.) Boiss.	H	IT-ES					2875	1068
Erophila minima C.A.Mey.	G	IT-ES					2940	1069
Erysimum koelzii Polatschek & Rech.f.*	T	IT		+			2300	1070
Erysimum repandum L.	T	IT		+			2146	1071
Fibigia clypeata (L.) Medik.	H	IT-ES-M	DD		+		2790	1072
Fibigia umbellata (Boiss.) Boiss.	H	IT		+			2990	1073
Lepidium draba L. subsp. *chalpensis* (L.) P.Fourn.	T	IT-M	DD		+		1780	1074
Neslia paniculata (L.) Desv. subsp. *thracica* (Velen.) Bornm.	T	IT					1643	1075
Neurotropis platycarpa (Fisch. & C.A.Mey.) F.K.Mey.*	T	IT					1995	1076
Peltaria angustifolia DC.	T	IT					2560	1077
Sameraria stylophora Boiss.	T	IT	NT				2845	1078
Thlaspi perfoliatum L.	H	IT-ES					2760	1079
Butomaceae								
Butomus umbellatus L.*	G	IT					1850	1080
Campanulaceae								
Michauxia laevigata Vent.	H	IT					2100	1081
Cannabaceae								
Celtis iguanaea (Jacq.) Sarg.	Ph	IT					3120	1082
Caprifoliaceae								
Cephalaria dichaetophora Boiss.	H	IT					2462	1084
Cephalaria syriaca (L.) Schrad. ex Roem. & Schult.	T	IT					2160	1083
Morina persica L.	H	IT					2563	1085
Pterocephalus canus Coult. ex DC.	H	IT					2410	1088
Pterocephalus papposus (L.) Coult.	T	IT					2367	1087
Scabiosa crinita Kotschy & Boiss in Boiss.Fl *	H	IT					2456	1086
Valerianella dactylophylla Boiss. & Hohen.	T	IT					2368	1090
Valerianella tuberculata Boiss.*	T	IT					2148	1089
Caryophyllaceae								
Acanthophyllum mucronatum C.A.Mey.	Ch	IT			+		2560	1091
Arenaria serpyllifolia L.*	T	IT					2361	1092

Table 1. Continue

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Cerastium dichotomum L. subsp. *inflatum* Cullen	T	IT					2145	1093
Gypsophila linearifolia (Fisch. & C.A.Mey.) Boiss.	Ch	IT			+		2846	1094
Holosteum umbellatum L. subsp. *glutinosum* (M.Bieb.) Nyman	T	IT-ES					2545	1095
Mesostemma kotschyana (Fenzl ex Boiss.) Vved.	H	IT-ES					2641	1096
Minuartia hamata (Hausskn.) Mattf.	H	IT-ES					2760	1097
Minuartia meyeri (Boiss.) Bornm.	T	IT	DD		+		2460	1098
Silene brahuica Boiss.	H	IT-M			+		2864	1099
Silene chlorifolia Sm.	H	IT	DD		+		2750	1100
Silene conoidea L.	T	IT-ES-M			+		2630	1101
Vaccaria hispanica (Mill.) Rauschert subsp. *oxyodonta* (Boiss.) Greuter & Burdet	H	IT-ES-M					1946	1102
Velezia rigida L.	T	IT-M					2645	1103
Chenopodiaceae								
Chenopodium album L.	T	Cosm			+	+	1875	1104
Cistaceae								
Helianthemum salicifolium (L.) Mill.	T	IT-SS					2645	1105
Cleomaceae								
Cleome iberica DC.	T	IT-M			+		1790	1106
Convolvulaceae								
Convolvulus arvensis L.	H	PL				+	1953	1107
Crassulaceae								
Rosularia persica (Boiss.) A. Berger	G	IT			+		2765	1108
Rosularia sempervivum (M. Bieb.) A. Berger	H	IT-M					2364	1109
Sedum nanum Boiss.*	T	IT					2875	1110
Umbilicus heylandianus Webb & Berthel.	G	IT		+			2760	1111
Cucurbitaceae								
Bryonia aspera Steven ex Ledeb.*	H	IT					3140	1112
Cyperaceae								
Bolboschoenus glaucus (Lam.) S.G.Sm.	H	IT-ES					2156	1113
Carex distans L.	G	IT			+		2130	1114
Carex divisa Huds.*	G	IT-ES-M			+		2231	1115
Carex stenophylla Wahlenb.	G	IT-ES-SS	DD		+		2461	1116
Cyperus longus L.	G	IT-ES-SS			+		1980	1117
Eleocharis palustris (L.) Roem. & Schult.	G	IT-ES-SS					1895	1118
Scirpoides holoschoenus (L.) Soják	G	IT-ES-SS					1874	1119
Equisetaceae								
Equisetum ramosissimum Desf.	G	IT					1750	1120
Euphorbiaceae								
Chrozophora tinctoria (L.) A.Juss.	T	IT-ES-SS					1895	1121
Euphorbia cheiradenia Boiss. & Hohen.	H	IT		+		+	2348	1123
Euphorbia esula L. *subsp. *tommasiniana* (Bertol.) Kuzmanov	H	IT-ES-M		+		+	2120	1124
Euphorbia falcata L.*	T	IT				+	2450	1127
Euphorbia gorenflotii Mobayen	H	IT				+	2460	1125
Euphorbia hebecarpa Boiss.	H	IT		+		+	2178	1128
Euphorbia iberica Boiss.	T	IT				+	2645	1122
Euphorbia inderiensis Less. ex Kar. & Kir.*	T	IT				+	2334	1126
Fabaceae								
Astragalus baba-alliar Parsa	Ph	IT		+			2670	1129
Astragalus cyclophyllon Beck.	H	IT	EN	+	+		2368	1130
Astragalus fragiferus Bunge	Ch	IT		+			2846	1131
Astragalus kirrindicus Boiss.	H	IT					2840	1132
Astragalus muschiana (Kotschy & Boiss.) Podlech	H	IT	NT				2475	1133
Astragalus ovinus Boiss.	H	IT	DD		+		2360	1134
Astragalus perpexus Maassoumi*	H	IT	NT				2420	1135
Astragalus reichei Speg.	Ch	IT-ES		+			2563	1136
Lathyrus vinealis Boiss. & Noe	T	IT-ES	NT		+		1945	1137
Lens culinaris Medik. subsp. *orientalis* (Boiss.) Ponert	H	IT					2163	1138
Lotus corniculatus L.	H	PL			+	+	1795	1139
Medicago lupulina L.	H	PL			+		1960	1140

Table 1. Continue

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Medicago monantha (C.A.Mey.) Trautv.	T	IT-SS			+		1854	1141
Medicago persica (Boiss.) E.Small *	H	IT			+		1680	1142
Medicago polymorpha L.	T	IT-ES			+		1790	1143
Medicago rigidula (L.) All. var. *submitis* (Boiss.) Ponert	T	IT			+		1785	1144
Medicago sativa L.	H	IT-ES			+	+	1750	1145
Melilotus albus Medik.*	H	IT-ES-M			+	+	1750	1146
Melilotus indicus (L.) All.*	T	IT					1845	1147
Onobrychis melanotricha Boiss.	H	IT	NT		+		1940	1148
Ononis spinosa L. subsp. *leiosperma* (Boiss.) Sirj.	H	IT					2130	1149
Securigera varia (L.) Lassen	H	IT-ES					2145	1150
Trifolium nigrescens Viv. subsp. *petrisavii* (Clementi) Holmboe	H	IT-ES			+	+	1985	1151
Trifolium pratense L.	H	IT-ES-M			+	+	1875	1152
Trigonella elliptica Boiss.	H	IT	NT	+	+		1860	1153
Trigonella spruneriana Boiss.	T	IT					1795	1154
Vicia assyriaca Boiss.*	T	IT	NT		+		1784	1155
Vicia ervilia (L.) Willd.	T	IT-ES-SS			+		1952	1156
Vicia michauxii Spreng.*	T	IT			+		1846	1157
Vicia narbonensis L.	T	IT-ES			+		1792	1158
Vicia sativa L. subsp. *nigra* (L.) Ehrh.	H	IT-ES			+	+	1865	1159
Vicia tenuifolia Roth subsp. *variabilis* (Freyn & Sint.) Dinsm.	T	IT			+		1790	1160
Gentianaceae								
Gentiana olivieri Griseb.	T	IT-SS					2146	1161
Geraniaceae								
Erodium circutarium (L.) L'Hér.	H	IT-ES				+	2130	1162
Geranium persicum Schönb.-Tem.	G	IT-ES					2650	1164
Geranium rotundifolium L.	T	IT-ES-M					2680	1163
Geranium tuberosum L.	G	IT-M					2165	1165
Iridaceae								
Gladiolus italicus Mill.	G	IT					1950	1166
Ixioliriaceae								
Ixiolirion tataricum (Pall.) Schult. & Schult.f.	G	IT-ES	DD				2460	1167
Juncaceae								
Juncus inflexus L.	G	Cosm			+		1985	1168
Lamiaceae								
Lamium amplexicaule L.	T	Cosm					1845	1169
Marrubium cuneatum Banks & Sol.	H	IT					2560	1170
Nepeta kotschyi Boiss.	H	IT	NT	+			2145	1171
Phlomis olivieri Benth.	H	IT		+			2678	1172
Phlomis persica Boiss.	H	IT	NT	+			2490	1173
Salvia multicaulis Vahl	H	IT			+		2850	1174
Salvia nemarosa L.	H	IT-ES			+		2150	1175
Salvia syriaca L.	H	IT			+		2642	1176
Sideritis montana L.	T	IT			+		2846	1177
Stachys inflata Benth.	H	IT			+		2150	1178
Stachys kurdica Boiss. & Hohen.	H	IT			+		2683	1179
Stachys lavandulifolia Vahl	H	IT-ES			+		2946	1180
Stachys pilifera Benth.	H	IT	NT	+	+		2794	1181
Stachys setifera C.A.Mey. subsp. *iranica* (Rech.f.) Rech.f.	H	IT			+		2655	1182
Teucrium orientale L. subsp. *glabrescens* (Hausskn. ex Bornm.) Rech.f.	H	IT					2160	1183
Thymus daenensis Celak.	H	IT	NT	+	+		2250	1184
Ziziphora capitata L.	T	IT			+		2485	1185
Ziziphora tenuior L.	T	IT-ES			+		2360	1186
Liliaceae								
Fritillaria imperialis L.	G	IT					3150	1187
Gagea chomutovae (Pascher) Pascher.	G	IT					1985	1188
Gagea gageoides (Zucc.) Vved.	G	IT					2465	1189
Tulipa micheliana Hoog.	G	IT					2785	1190
Linaceae								
Linum album Boiss.	H	IT	NT	+		+	2250	1191
Malvaceae								
Alcea kurdica Alef.	H	IT					1965	1192
Moraceae								
Ficus carica L. subsp. *rupestris* (Hausskn.) Browicz	Ph	IT-ES-M					2865	1193

Table 1. Continue

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Onagraceae								
Epilobium hirsutum L.	H	PL					2146	1194
Orobanchaceae								
Orobanche hirtiflora (Reut.) Tzvelev.*	Parasite	IT					2640	1195
Papaveraceae								
Fumaria asepala Boiss.	T	IT-ES					2100	1196
Papaver argemone L.	T	IT			+		1985	1197
Papaver decaisnei Hochst. & Steud. ex Elkan	T	IT			+		1786	1198
Papaver dubium L.	T	IT			+		1850	1199
Roemeria refracta DC.	T	IT			+		1795	1200
Plantaginaceae								
Plantago lanceolata L.	H	Cosm					1856	1201
Veronica oxycarpa Boiss.	H	Cosm					1850	1202
Veronica orientalis Mill.	H	IT					2365	1203
Veronica persica Poir.	T	PL					2450	1204
Poaceae								
Aegilops triuncialis L.	T	IT			+		2450	1205
Alopecurus pratensis L.*	H	PL			+		2145	1206
Boissiera squarrosa (Sol.) Nevski	T	IT			+		2350	1207
Bromus brachystachys Hornung *	T	IT			+		2840	1208
Bromus tectorum L.	T	Cosm			+		2456	1209
Bromus tomentellus Boiss.	G	IT			+		2400	1210
Elymus repens (L.) Gould.	G	IT-ES-M			+		2164	1211
Eremopoa persica (Trin.) Roshev.	T	IT			+		2354	1212
Festuca ovina L.	H	IT-ES			+		2469	1213
Heteranthelium piliferum (Sol.) Hochst. ex Jaub. & Spach	T	IT			+		2350	1214
Hordeum brevisubulatum (Trin.) Link *	H	IT			+		1975	1215
Hordeum bulbosum L.	G	IT			+		2460	1216
Hordeum marinum Huds. subsp. *gussoneanum* (Parl.) Thell.	T	IT-SS			+		2325	1217
Lolium rigidum Gaudin	T	IT-ES-M			+	+	1978	1218
Melica persica Kunth.	G	IT			+		2680	1219
Phragmites australis (Cav.) Trin. ex Steud.	G	Cosm			+		1790	1220
Piptatherum laterale (Regel) Nevski *	H	IT			+		1785	1221
Poa bulbosa L.	G	IT-ES-M			+		2230	1222
Polypogon fugax Nees ex Steud. *	H	PL			+		2156	1223
Polypogon monspeliensis (L.) Desf.	G	IT			+		2150	1224
Psathyrostachys fragilis (Boiss.) Nevski	G	IT-ES			+		2450	1225
Setaria viridis (L.) P.Beauv.	T	PL			+		1875	1226
Stipa barbata Desf.	H	IT			+		2648	1227
Taeniatherum caput-medusae (L.) Nevski	T	IT			+		2145	1228
Trisetaria cavanillesii Maire *	T	IT-M					1950	1229
Triticum dicoccon (Schrank) Schübl.	T	PL			+		1780	1230
Polygonaceae								
Polygonum aridum Boiss. & Hausskn.	H	IT		+	+		2650	1231
Polygonum patulum M.Bieb.	T	IT-ES-M			+		2325	1232
Rumex crispus L.	Ph	IT			+		1975	1233
Primulaceae								
Anagallis arvensis L.	T	IT-ES-M				+	2230	1234
Ranunculaceae								
Adonis dentata Delile *	T	IT-ES-M					1986	1235
Anemone biflora DC.	G	IT		+			2650	1236
Ceratocephalus falcata Pers.	T	IT					2160	1237
Delphinium hohenackeri Boiss.	T	IT					1986	1238
Ranunculus arvensis L.	T	IT				+	1945	1239
Ranunculus aucheri Boiss.	G	IT					1976	1240
Ranunculus trichophyllus Chaix ex Vill.	T	IT-SS					1873	1241
Thalictrum isopyroides C.A. Mey.	H	IT					2648	1242
Thalictrum sultanabadense Stapf. *	H	IT		+			2650	1243
Resedaceae								
Reseda lutea L.	T	IT-M			+		2150	1244
Rhamnaceae								
Rhamnus persica P. Lawson	Ph	IT	NT	+			2460	1245
Rosaceae								

Table 1: Continue

Name of taxa	Life form	Chorotype	Protected status	Endemic	Pasture	Poisonous	Altitude	No.
Potentilla reptans L.	H	IT-ES			+		1975	1246
Prunus orientalis (Mill.) Koehne.	Ph	IT			+		2450	1247
Rosa canina L.	Ph	IT-ES-M			+		2150	1248
Sanguisorba minor Scop. subsp. *balearica* (Bourg. ex Nyman) Munoz Garm. & C.Navarro	H	IT-ES	DD		+		1795	1249
Rubiaceae								
Asperula setosa Jaub. & Spach.	T	IT					2140	1250
Crucianella gilanica Trin.	H	IT					2320	1251
Galium aparine L.	T	IT					2180	1252
Galium setaceum Lam.	T	PL					2150	1253
Galium spurium L. subsp. *ibicinum* (Boiss. & Hausskn.) Ehrend.	H	IT-ES					2145	1254
Galium tricornutum Dandy	T	IT-M	NT				2460	1255
Galium verum L.	T	PL			+		1987	1256
Salicaceae								
Salix alba L.	Ph	IT-ES-SS					1780	1257
Sapindaceae								
Acer monospessulanum L. subsp. *turcomanicum* (Pojark.) Rech.f.	Ph	IT	NT	+			2985	1258
Scrophulariaceae								
Scrophularia variegata M.Bieb.	H	IT					2160	1259
Verbascum sinuatum L.	H	IT-ES					1850	1260
Tamaricaceae								
Tamarix ramosissima Ledeb.	Ph	PL					1953	1261
Thymelaeaceae								
Daphne mucronata Royle	Ph	IT					2360	1262
Typhaceae								
Sparganium erectum L.* subsp. *neglectum* (Beeby) K.Richt.	G	IT-ES					1975	1263
Typha angustifolia L.	Ph	IT					1975	1264
Urticaceae								
Parietaria judaica L.	H	IT					2350	1265
Violaceae								
Viola occulta Lehm. *	T	IT-ES					2325	1266
Vitaceae								
Ampelopsis vitifolia (Boiss.) Planch.	Ph	IT					1850	1267

Table 2. The number of genus and species in each family, the maximum number of species in each genus and the maximum number of monotypic genus in each family.

Family	Number of genus	Number of species	Genus	Maximum number of species	Family	Maximum number of monotypic genus
Asteraceae	26	33	*Astragalus*	8	Asteraceae	21
Poaceae	21	26	*Euphorbia*	7	Poaceae	18
Brassicaceae	15	18	*Vicia*	6	Brassicaceae	12
Fabaceae	12	32	*Medicago*	6	Apiaceae	8
Lamiaceae	10	18	*Gallium*	5	Caryophyllaceae	8
Caryophyllaceae	10	13	*Stachys*	5	Fabaceae	6
Apiaceae	9	10	*Bromus*	3	Lamiaceae	6
Ranunculaceae	6	9	*Centaurea*	3	Boraginaceae	5
Boraginaceae	6	7	*Geranium*	3	Cyperaceae	4
Caprifoliaceae	5	8	*Hordeum*	3	Ranunculaceae	4
Cyperaceae	5	7	*Papaver*	3	Rosaceae	4
Asparagaceae	4	5	*Ranunculus*	3	Asparagaceae	3
Rosaceae	4	4	*Salvia*	3	Caprifoliaceae	2
Rubiaceae	3	7	*Silene*	3	Crassulaceae	2
Papaveraceae	3	5	*Tragopogon*	3	Liliaceae	2
Crassulaceae	3	4			Papaveraceae	2
Liliaceae	3	4			Rubiaceae	2
Euphorbiaceae	2	8			Scrophulariaceae	2
Geraniaceae	2	4			Typhaceae	2
Plantaginaceae	2	4				
Polygonaceae	2	3				
Scrophulariaceae	2	2				
Typhaceae	2	2				
Amaryllidaceae	1	2				

A total of 32 endemic species were identified in this region. The highest number of endemic species belongs to Asteraceae (19%), Fabaceae (16%), Lamiaceae and Brassicaceae (13%). Other families were ranged from 3-9% (Tables 1 and 5).

Some of the important endemic species include *Helichrysum oligocephalum* DC. (Asteraceae), *Lactuca microcephala* DC. (Asteraceae), *Scorzonera rupicola* Hausskn. (Asteraceae), *Tragopogon acanthocarpus* Boiss. (Asteraceae), *Onosma bodeana* Boiss. (Boraginaceae), *Alyssum linifolium* Stephan ex Willd. (Brassicaceae), *Erysimum koelzii* (Brassicaceae), *Fibigia umbellata* (Boiss.) Boiss. (Brassicaceae), *Umbilicus heylandianus* Webb & Berthel. (Crassulaceae), *Astragalus cyclophyllon* Beck. (Fabaceae), *Astragalus fragiferus* Bunge. (Fabaceae), *Astragalus reichei* Speg. (Fabaceae), *Polygonum aridum* Boiss. & Hausskn. (Polygonaceae), *Bellevalia cyanopoda* Wendelbo (Asparagaceae) and *Thalictrum sultanabadense* Stapf. (Ranunculaceae).

The application of plant species was also determined. The pasture plants were found to be 106 species. The families such as Poaceae (23%), Fabaceae (20%), Asteraceae (14%), and Lamiaceae (11%) were the most prevalent while the most scare ones had a prevalence of 1-6% (Tables 1 and 6). A total of 23 poisonous species were known in the current protected region. The highest proportions belonged to Euphorbiaceae (32%), Fabaceae (27%), Asteraceae (13%), and other families 4% (Tables 1 and 6).

In the case of protected status, there were Endangered (1 species, 3%), near Threatened (19 species, 47%), and Data Deficient (20 species, 50%) species. The families such as Fabaceae (6 species), Lamiaceae (4 species), and Asteraceae (3 species) were found to need more protection (Fig. 3B). Besides, 7% of the endemic species were endangered, followed by 80% at Near Threatened, while there is much less data for 13% of the endemic species (Fig. 3C).

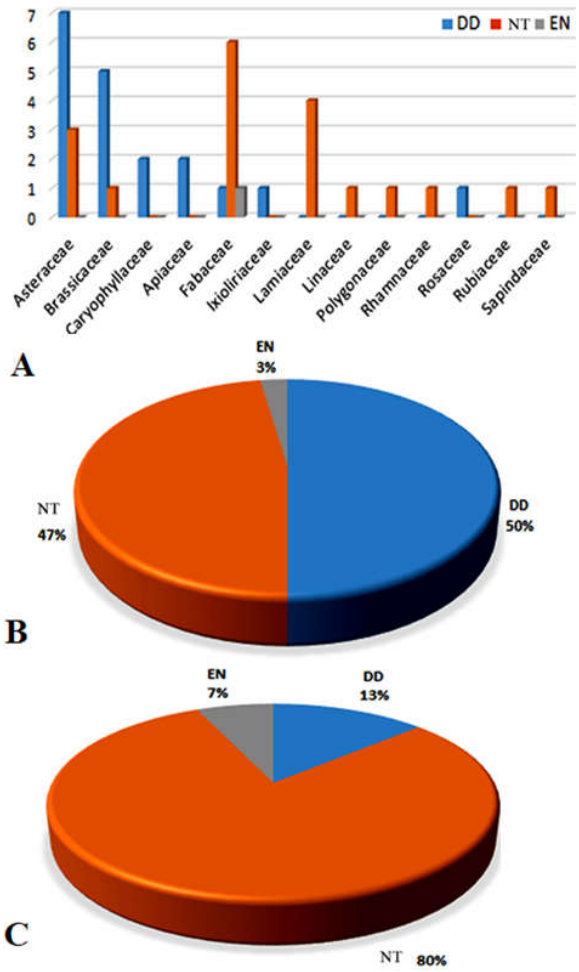

Fig. 3. Family analysis: A) The protected status of families, B) the percentage of protected status, C) the protected status of endemic plants. DD: Data Deficient, NT: Near Threatened, EN: Endangered.

Table 3. The percentage of life forms. *

Life form	Number of species	Percent (%)
Hemicryptophyte	110	41
Therophyte	94	35
Geophyte	43	16
Phanerophyte	14	5
Chamaephyte	5	2
Parasite	1	1

*H: hemicryptophyte. T: therophyte, G: geophyte, Ph: phanerophyte, Ch: chamaephyte, Pa: parasite

Table 4. The percentage of chorotypes*

Chorotype	Number of species	Percent (%)
IT	152	57
IT-ES	41	15
IT-ES-M	24	9
PL	15	6
IT-M	14	5
IT-ES-SS	7	3
Cosm	7	3
IT-SS	6	2

* IT: Iran-Turanian, IT-ES: Irano-Turanian/Euro-Siberian, IT-ES-M: Irano-Turanian/Euro-Siberian/Mediterranean, IT-ES-SS: Irano-Turanian/Euro-Siberian/Saharo-Sindian, IT-M: Irano-Turanian/Mediterranean, IT-SS: Irano-Turanian/ Saharo-Sindian, PL: Pluri-regional, Cosm: Cosmopolite

Table 5. The percentage of endemic species.

Family	Number of species	Percent (%)
Asteraceae	6	19
Fabaceae	5	16
Lamiaceae	5	16
Brassicaceae	4	13
Euphorbiaceae	3	9
Ranunculaceae	2	6
Crassulaceae	1	3
Boraginaceae	1	3
Asparagaceae	1	3
Linaceae	1	3
Polygonaceae	1	3
Rhamnaceae	1	3
Sapindaceae	1	3

Table 6. The percentage of pasture and poisonous species.

Family	Number of pasture species	Percent (%)	Family	Number of poisonous species	Percent (%)
Poaceae	25	23	Euphorbiaceae	7	32
Fabaceae	21	20	Fabaceae	6	27
Asteraceae	15	14	Asteraceae	3	13
Lamiaceae	12	11	Chenopodiaceae	1	4
Caryophyllaceae	6	6	Convolvulaceae	1	4
Rosaceae	4	4	Geraniaceae	1	4
Cyperaceae	4	4	Linaceae	1	4
Papaveraceae	4	4	Poaceae	1	4
Polygonaceae	3	3	Primulaceae	1	4
Brassicaceae	3	3	Ranunculaceae	1	4
Apiaceae	2	2			
Other families	6	6			

Discussion

Based on available literature, the edaphic, topographic, and climatic conditions are the main components affecting the vegetation of natural resources (Moqadam, 1998). The mean annual precipitation and semi-arid climate caused a high number of species and genera in the study area. Based on our results, the highest diversity in terms of the number of species was found at lower altitudes, probably because of favoring environmental conditions (Mirzaei *et al.*, 2007). Compared to other floristic regions of Chaharmahal and Bakhtiari province, there is a low number of species dependent on severe precipitation drop during recent years, altitude uniformity, degradation rates, and overgrazing of the region (Kharazian *et al*., 2017). The number of dicotyledon species was more than that of monocotyledon species relating the unfavorable conditions for monocotyledons and a high proportion of annual herbs (Dolatkhahi & Nabipour, 2013). In the present study, a total of 34 identified species were reported for the first time in Chaharmahal and Bakhtiari province.

The highest number of species belonged to Asteraceae and Fabaceae. It is known that Asteraceae members possess the high potential to adapt the harsh mountainous conditions and distribute the seeds. Moreover, the destruction and grazing pastures do not affect this family (Jafari, 2011). The presence of Asteraceae family in Irano-Turanian region displays the range of demolition (Yousefi, 2006) which is consistent with our results. Obviously, the members of this family possess high secondary metabolites and the appendages such as thorns, which avoid grazing (Heydari *et al*., 2013; Mehrnia & Ramak, 2014). The other families such as Fabaceae and Poaceae with high forage value and soil conservation are also of importance (Heydari *et al*., 2013).

Astragalus is one of the largest genera of this protected region. It is observed with other genera such as *Stachys* L., *Bromus tomentellus* Boiss., *Hordeum bulbosum* L., *Poa bulbosa* L., and *Melica persica* Kunth. The distribution of *Astragalus* exhibits the high altitude and cold climate in Saldaran region (Safikhani *et al*., 2006). Its species are not desirable for grazing and are not under the threat of grazing (Jafari, 2011). Moreover, *Euphorbia* species display the trend of degradation in rangeland and human interference in the natural areas (Yousefi, 2006) confirming our results.

It is known that the life forms of each area display the type of climate, precipitation rates, and extent of dry seasons (Khajedin & Yeganeh, 2012). In this research, a high proportion of hemicryptophyte was observed (41%, 110 species). The existence of hemicryptophyte also initiated via adaptation to cold mountainous climate and grazing (Archibold, 1995; Sharifi *et al.*, 2012; Kharazian *et al.*, 2017), which confirms our results. Additionally, soil stabilization and refuge for the founding of therophytes were provided by hemicryptophytes (Batouli, 2003). Different mechanisms such as decreasing growth, maintaining the water resources, and supplying the underground parts were developed by hemicryptophytes (Heydari *et al.*, 2013). These aspects cause the formation of the most resistant species in the Saldaran protected region. The high proportion of this life form was also reported from different areas of Chaharmahal and Bakhtiari province (Assadi *et al*., 2009; Mozaffarian *et al*., 2014; Shirmardi *et al*., 2014; Vahabi *et al*., 2017).

Therophytes display unfavorable environmental conditions, destruction of the region, and human pressures (Asri, 2003). A high proportion of therophytes (35%, 94 species) is expected by low precipitation and short growth seasons (Asri, 2003). Its life cycle is completed in a short time, and vegetative phases are accomplished in the form of seed (Asri, 2003). The dominance of therophytes in Zagros region was reported by previous investigations (Sanandaji & Mozaffarian, 2010; Taqipour *et al*., 2012; Mehrnia & Ramak, 2014; Vahabi *et al*., 2017), in agreement with our results.

The presence of geophytes (16%) showed the tolerance to inappropriate environmental conditions and grazing. Their bulbs and rhizomes retain in the soil throughout cold weather (Parishani, 2005; Naqinezhad *et al.*, 2010). The low existence of geophytes is confirmed by previous results in Chaharmahal and Bakhtiari province (Assadi *et al*., 2009; Pairanj *et al*., 2011; Shirmardi *et al.*, 2011, 2014). Geophytes will decrease in highland regions to the benefit of hemicryptophytes (Naqinezhad *et al.*, 2010).

Soil stabilization was induced by the presence of chamaephytes (Batouli, 2003). Flood and surface water prevention and severe water erosion were created by chamaephytes (Batouli, 2003). The chamaephytes generally preserve soil cover (Assadi *et al*., 2009; Pairanj *et al*., 2011).

In this protected region, there were a low proportion of phanerophytes, which is due to unsuitable conditions to establish trees and shrubs. The central sub-province of Iran rarely displays trees (Zohary, 1973). The low presence of phanerophytes (14 species) was associated to the high temperature variation, and high altitude (He *et al.*, 2007; Sanandaji & Mozaffarian, 2010). It was observed that phanerophytes (5%) resulted from flood and water erosion (Eshqi Malayeri *et al.*, 2013; Kharazian *et al.*, 2017). This life form was confirmed for the cold highlands and semiarid regions (Assadi *et al*., 2009; Pairanj *et al*., 2011; Gurgin Karaji *et al.*, 2013).

Based on chorology point of view, Saldaran protected region is located at Irano-Turanian region. Consequently, there were a high proportion of Irano-Turanian elements (57%) in this region. Due to high altitude, this region has not been mainly influenced by other chorotypes. Consequently, the chrorotypes were mostly represented by Irano-Turanian elements (Assadi *et al*., 2009; Shirmardi *et al*., 2014; Mozaffarian *et al*., 2015). It is known that the richest Irano-Turanian region is related to Iranian Plateau (Yousefi, 2006). Moreover, the presence of *Acanthophyllum* C.A.Mey, *Achillea* L., *Allium* L., *Anthemis* L., *Silene* L., *Phlomis* L., *Astragalus* L., *Cousinia* Cass., *Centaurea* L. and *Stachys* L. exhibits the high distribution of Irano-Turanian elements (Hedge & Wendelbo, 1978) that confirm our results. The special climatic conditions of this region resulted in the less influential elements. Therefore, the Irano-

Turanian chorotype dominates the study area (Pairanj *et al*., 2011). Since there were high Irano-Turanian elements in the area, it needs to be conserved. Other chorotypes (Irano-Turanian/Euro-Siberian, Irano-Turanian/Euro-Siberian/Mediterranean, Irano-Turanian/Mediterranean and Irano-Turanian/Euro-Siberian/ Saharo-Sindian) of this protected region were also determined (Assadi *et al*., 2009; Shirmardi *et al*., 2011, 2014; Mozaffarian *et al*., 2014). In line with our results, a total of 20-80% belongs to monoregional, bi-regional, and pluri-regional (Zohary, 1973); which is due to the connectional pathways among different zones of Iran (Yousefi, 2006).

Based on influential chorotypes, the species such as *Pistacia atlantica* Desf., *Daphne mucronata* Royle*, Acer monospessulanum* L., and *Michauxia laevigata* Vent. were reported in Kurdistan-Zagros sub-province (Zohary, 1999; Yousefi, 2006), which support our results. The other influential elements such as *Nepeta kotschyi* Boiss*., Acanthophyllum mucronatum* C.A.Mey, and *Tulipa michelian* Hoog. were also connected with Khorasan sub-province (Zohary, 1999). It is known that *Ornithogalum arcuatum* Steven generated from Armenia-Kurdestan sub-province, which is distributed in different areas of Iran (Zohary, 1999). *Euphorbia inderiensis* Less. ex Kar. & Kir. is one of the psammophyte plants located in Irano-Turanian with limited distribution (Zohary, 1999). The Euro-Siberian elements such as *Ficus carica* L. and *Festuca ovina* L., which grows in wet and deep soils, were also identified in this region (Yousefi, 2006).

It is known that the floristic units were separated using the endemic species (Yousefi, 2006). Irano-Turanian region is one of the richest areas with 85% endemism rates. A total of 32 endemic species were reported for Saldaran protected region. It shows the presence of valuable genetic resources. The important endemic genera in Irano-Turanian region are *Astragalus, Onobrychis* Adans., *Trigonella* L., *Tanacetum* L. and *Cousinia* (Zohary, 1999; Yousefi, 2006). *Tulipa micheliana* is one of the endemic species in Khorasan sub-province from Irano-Turanian region. This species is associated with other floras such as central Asia and Alborz (Yousefi, 2006). Moreover, the families such as Asteraceae, Apiaceae, Boraginaceae, Fabaceae, Lamiaceae, Plumbaginaceae, Rubiaceae and Scrophulariaceae produced 60% of endemic species in Irano-Armenia province (Zohary, 1999; Yousefi, 2006; Yousefi *et al*., 2011; Kharazian *et al*., 2017). It is noted that endemism rates exhibit geographical position, ecological conditions, flora evolution, and valuable vegetation (Yousefi, 2006).

Based on climatology, the study area has a semi-arid and cold climate. It is detected that the floristic elements from different zones of these climates (Table 1) were covered by special species (Assadi *et al*., 2009; Yousefi *et al*., 2011; Ghayormand & Saeidi Mehrvarz, 2014; Sabaghi *et al*., 2014; Mozaffarian *et al*., 2014; Jafari & Zarifian, 2015; Kanani 2016; Tabad *et al*., 2016). Moreover, the pasture plants in this region (106 species) belong to Poaceae, Fabaceae, Asteraceae, and Lamiaceae (Assadi *et al*., 2009; Heydari *et al*., 2013). It is revealed that overgrazing of the pastures exhibits the poisonous species (23 species) such as *Euphorbia* (Noroozi *et al*., 2008).

Based on protected status, most of the species were identified as Data Deficient (50%) and Near Threatened (47%). In the case of endemic species, Near Threatened (80%), Data Deficient (13%), and Endangered (7%) protected status were identified in the present study. The biological limits and human interferences are the main factors to produce the endangered species. Extinction and destruction of species were due to industrials activities, pathogen factors, drainage, soil erosion, harsh competition, and hard environmental conditions (Karimi, 2009). The presence of Near Threatened status was the result of overgrazing and destruction of pastures (Abdi, 2008).

Conclusion

Saldaran protected region with remarkabele endemic species is a precious natural heritage in Iran. Therefore, it is recommended putting the floristic elements of the area under more strict protection (Akhani *et al*., 2010). As the most important conservation approaches, it is proposed inhibiting plant harvest and furrow, protecting pastures, preventing livestock entry,

establishing seed banks, domesticating the wild species, improving the protection quality, and propagating endemic species in each area (Abdi, 2008). It has been proved that such factors contribute to the regeneration of the vegetation.

Acknowledgement

The authors appreciate the Research Deputy of Shahrekord University for providing financial support.

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