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Flora, Life forms and Chorotypes of Plants of Salok Protected Area (North Khorassan Province Iran)

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Abstract: Salok protected Area is located in the 37° 15' to 37° 08' of the North latitude and 57° 16' to 57° 06' of East longitude, in West North Esfarayen in North Khorassan province. In this research 52 families, 174 genera and 213 species were identified. The largest plant family is Asteraceae (34 species), Poaceae (18 species), Brassicaceae (17 species) and Fabaceae (17 species), respectively. Chief life forms are Hemicryptophytes (49.29%), Therophytes 23.47% and cryptophytes (12.67%). The most of plants chorotype with 62.91% is influenced by Irano-Touran elements. Among 213 identified species of this region and 15 species endemic of Iran contain 0.87% of total endemic species of Iran's flora.

Key words: Floristic, botany, chorology, salok, endemic species

INTRODUCTION

Recognize is introduction for every research. Study plant biodiversity is important for optimum using of plant species in the different fields such as Ecology, Agriculture, Medicine and many other aims that make life on earth possible and enjoyable.

As, man or other factors are effective on survive and distribution of plant species also study floristic need in different region of Iran to protect our natural habitat in the long term. Due to protect regions have special important. Therefore, we are studied the flora of Salok protected area in North Khorassan.

The beginning travel for floristic study in Iran can be dated to 1684 when Kaempfer (1651-1716) coming to the southern Caucasus, Esfahan, Shiraz and Gulf coast. He gathered a large collection of plants this area and transferred them to British Museum (Mood, 2008). Then, several European botanists and amateur plant collectors studied flora of Iran and collected plant species (Mood, 2008).

The important flora of oriental is flora Iranica. This flora have been published the since 1963 by Rechinger, (1963-2005). Other flora of Iran are flora orient ales (Boissier, 1810-1885), flora of Iran (Parsa, 1950), flora of Iran (Assadi *et al.*, 1988-2008) and Colorful flora of Iran (Ghahraman, 1979-1998).

Very little has been published on the plant communities of North Khorasan. Salok protected Area (Miri, 2003), Khorassan vegetation (Mohasel *et al.*, 1992).

In this research, a part of species in the Salok protected Area are collected, identified and nomenclature.

MATERIALS AND METHODS

In this research, plant species were collected of Salok protected Area during two years (2007-2009). Salok with and area of 170 km² is located West North of Esfarayen in North Khorassan province a the 57° 16' to 57° 6' Eastern latitude and 37° 15' to 37° 8' Northern longitude with an altitude of 1812 m.

The climate is arid and semiarid. According to available data from the nearest climatic station in Asadly during 1983- 2009, the average rain full is 332.5 mm. The mean maximum temperature of the warmest month (August) is 20.33°C and the mean minimum temperature of the coldest month (February) is -1.46 Plants were collected in growing season from May to November.

In order to investigation the flora of Salok at first related information such as: Meteorological statistics, Topographic maps were gathered. Specimens were collected using normal random collecting method. Florestic list of Salok protected area is provided. Life- form and chorology of plants are determined. The geological

position was registered using GPS for collecting locations. The plants were pressed, dried and transferred to herbarium of department of the environment of North Khorassan province then they were identified using available flora.

All identification specimens are labeled in according to time, place, geographical latitude, longitude and altitude of the habitat of plants and with the name of Family, species. The life form of plant species was determined using the Raunkier's method (Raunkier, 1934) and the endemic specimens with their character of IUCN (Jalili and Jamzad, 1999).

Chorology of each species was determined by using distribution data in floras. Spectrum of life-form and also geographical plant distribution were shown in Fig. 1 and 2.

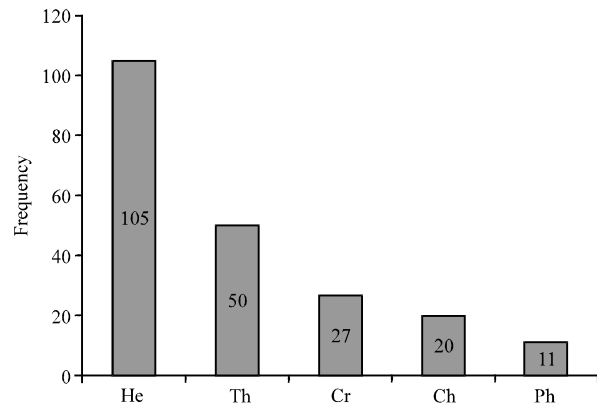


Fig. 1: Life form spectrum of plants in Salok region (He: Hemicryptophytes, Th: Therophytes, Cr: Cryptophytes, Ch: Chamaephytes, Ph: Phanerophytes)

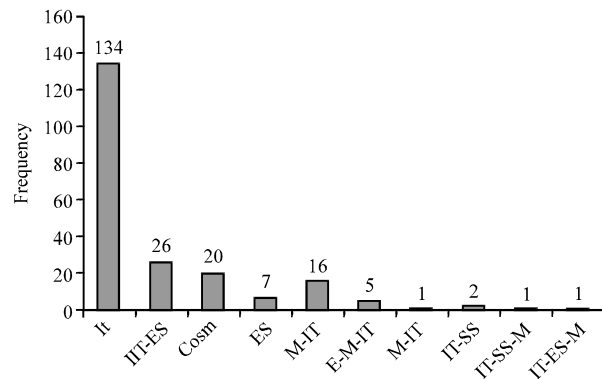


Fig. 2: Chorological types spectrum in flora Salok region (IT: Irano-Turanian, ES: Euro-Siberian, SS: Sahara-Sindian, Cosm: Cosmopolitan, M: Mediterranean)

RESULTS AND DISCUSSION

In this study a total number of 213 species has been identified belong to 174 genera and 52 families. In appendix of the paper a checklist of all species collected in Salok protected area is shown with information about their life forms and chorological types (Table 1).

Collection species are belong to Angiosperm expect two genera *Juniperus excelsa* and *Equisetum ranosissimum*. Among identified families of Angiospermae, six families are monocotyledone and other belong to dicotyledonous.

The most important and biggest families are Asteraceae (34 species), Poaceae (18 species), Brassicaceae (17 species), Fabaceae (17 species), Apiaceae (13 species), Lamiaceae (11 species) and Liliaceae (10 species).

In this research, we obtain the percentages of life forms phanerophytes 5.16%, chamaephytes 9.38%, hemicryptophytes 49.29%, therophytes 23.47%, cryptophytes 12.67% of the flora of the area.

Based on the life form spectrum of the Salok had a more proportion hemicryptophytes and therophytes. According to Arcihold (1995) the frequency of Hemicryptophyte plants is due to cold and to altitude climate. Hemicryptophytes can be survived by their buds. that they laied below and near soil surface or in the dried rosette leaves at soil surface. The high proportion of therophytes in the Salok protected Area show the arid condition of summer and the cold winter (Memariani *et al.*, 2009). This points an effective strategy for them survive. Therophytes complete their life cycle during favorable season and survive in the form of seed. Due to shortage of humidity and water (Rooyen *et al.*, 1990). The results represent a semi-arid climate. Therefore, the geographical distribution of plant species depending on life condition of area and adaption of plants to area (Asri, 2003).

The low percentage of Phanerophyte, Chamaephyte and Cryptophyte shows that they are not adapted to climate and edaphically situations area.

A considerable number of species (62.91%) belong to Irano-Turanian (IT). Other percentages of chorology are IT-ES (12.20%), Cosm (9.38%), ES (3.28%), M-IT (7.51%), E-M-IT (2.34%) M, IT-SS-M, IT-ES-M each one 0.46%, IT-SS 0.93%.

According to analysis of phytogeographical has shown that the most species belong to Irano-Touranian floral element.

Data point out correlation between climate, plant cover and chorology. Only 15 species were endemic of Iran are identified (Table 2). Total endemic species of Iran

Table 1: List of species, life form and phytocorya from Salok protected area

Phytocorya	Life form	Family/species
Aceraceae		
IT	Ph	<i>Acer mouspessulanum subspture comanilum</i>
Amaranthaceae		
IT-ES	Th	<i>Amaranthus chlorostachys</i> Willd.
Amaryllidaceae		
Cosm	Cr	<i>Ixiolirion tataricum</i> (Pall.) Herb.
Asclepiadaceae		
IT	He	<i>Vincetoxicum pumilum</i> Decne.
Berberidaceae		
IT	Ph(mr)	<i>Berberis integerrima</i> Bunge
Boraginaceae		
IT-ES	Th	<i>Anchusa italica</i> Retz.
ES	Th	<i>Asperugo procumbens</i> L.
IT	Th	<i>Heliotropium lasiocarpum</i> Fisch and Mey.
IT	He	<i>Paracaryum crista-galli</i>
IT	He	<i>Paracaryum turcomanicum</i>
IT	He	<i>Solenanthes circinnatus</i> Ledeb.
Capparidaceae		
M-IT	He	<i>Capparis spinosa</i> L.
IT	He	<i>Cleome coluteoides</i> Boiss.
Caprifoliaceae		
IT	Ph	<i>Lonicera bracteolaris</i> Bioss and Buhse
Caryophyllaceae		
IT	Ch	<i>Acanthophyllum squarrosum</i> Boiss.
IT	Ch	<i>Dianthus orientalis</i> subsp. <i>stenocalyx</i> (Boiss.) Rech.f.
IT	Ch	<i>Diaphanoptera khorasanica</i> Rech.f.
IT	Th	<i>Holosteum umbellatum</i> L.
ES	He	<i>Mirnartia lineate</i> Bomm.
E-M-IT	He	<i>Silene latifolia</i> Poir
Chenopodiaceae		
IT	Th	<i>Atriplex tatarica</i> L.
IT-ES	He	<i>Chenopodium album</i> L.
Cosm	Th	<i>Chenopodium foliosum</i> (Moench) Aschers.
IT	Th	<i>Halimocnemis pilifera</i> Moq.
IT	Th	<i>Halocharis sulphurea</i> Moq.
IT	Ch	<i>Halothamnus glaucus</i> subsp. <i>glaucus</i> (Bieb.) Botsch.
IT	He	<i>Salsola Montana</i>
Compositae/Asteraceae		
M-IT	He	<i>Achillea biebersteinii</i> Afan
IT	He	<i>Achillea vermicularis</i> Trin.
IT-ES	Cr	<i>Achillea millefolium</i> L.
IT	He	<i>Acroptilon repens</i> (L.) DC.
IT, ES	Ch	<i>Anthemis altissima</i> L.
M-IT	He	<i>Centaurea behen</i> L.
IT	Th	<i>Centanrea bruguierana</i> (DC.) Hond. Mzt.
IT-ES	Th	<i>Centanrea depressa</i> M.B.
IT	He	<i>Centanrea virgata</i> Lam.
Cosm	He	<i>Chondrilla juncea</i> L.
Es	He	<i>Cichorium intybus</i> L.
Cosm	He	<i>Cirsium arvense</i> (L.) Scop.
IT	He	<i>Cousinia deserti</i>
IT	Ch	<i>Cousinia lasiantra</i>
IT	Ch	<i>Cousinia smirnowii</i>
M-IT	Th	<i>Crepis sancta</i> (L.) Babcock
IT	Cr	<i>Crepis turcomanica</i> Krasck.
IT	Th	<i>Erigeron acer</i>
IT	He	<i>Erigeron acer</i> subsp. <i>pycnotrichus</i>
IT	He	<i>Gnmdelia tournefortii</i> L.
IT, Es	He	<i>Inula rhizocephala</i> Schrenk
IT	He	<i>Iranecio paniculatus</i>
IT	Th	<i>Koelipinia tenuissima</i> Pavl.
E-M-IT	Th	<i>Lactuca serriola</i> L.
IT-ES	He	<i>Pulicaria dysenterica</i> L. Bernh.
IT	He	<i>Scorzonera laciniata</i> L.
IT	Th	<i>Senecio glaucus</i> L.
IT	He	<i>Senecio paulsenii</i> subsp. <i>khorasanicus</i> (Rech.f.8 Aell.) B.Nord

Table 1: Continued

Phytocorya	Life form	Family/species
Cosm	He	<i>Sonchus oleraceus</i> L.
IT	He	<i>Tanacetum turcomanicum</i> (Krasch.) Tzvel.
IT	He	<i>Taraxacum syriacum</i> Boiss.
IT	He	<i>Tragopogon graminifolius</i> DC.
IT	He	<i>Tripleurospermum disciforme</i> (C.A.Mey.) Schultz-Bip.
IT	Th	<i>Xeranthemum longipapposum</i> Fisch and C.A. Mey
Convolvulaceae		
IT	Ch	<i>Convolvulus calvertii</i> Boiss.
Cruciferae/Brassicaceae		
IT	He	<i>Aethionema trinervium</i> (DC.) Boiss ver. <i>Apterotheca</i>
IT	He	<i>Alyssum inflatum</i> Nyarady
IT	He	<i>Barbarea plantaginea</i> DC.
IT-ES	Th	<i>Camelina rumelica</i> Valen.
M	He	<i>Cardaria draba</i> (L.) Desv.
IT	He	<i>Chalcanthus renifolius</i> (Boiss and Hohen.) Boiss.
M-IT	Th	<i>Chypeola jonhthaspi</i> L.
IT	He	<i>Crambe kotschyana</i> Boiss.
IT	He	<i>Erysimum aitchisonii</i>
IT	He	<i>Graellsia integrifolia</i> (Rech.f) Rech.f
IT	Ch	<i>Graellsia saxifragifolia</i> (DC.) Boiss subsp. <i>Saxifragifolia</i>
Es ? IT	He	<i>Isatis tinctoria</i> L.
IT-ES	He	<i>Lepidium latifolium</i> L.
IT	Th	<i>Malcolmia africana</i> (L.) R. Br.
IT	Th	<i>Peltaria turkmena</i> Lipsky
IT	He	<i>Pseudoclasia turkestanica</i>
IT-ES	He	<i>Sisymbrium altissimum</i> L.
Cuprecaee		
IT	He	<i>Huniperus excels</i>
Cucurbitaceae		
IT	He	<i>Bryonia aspera</i> stev.ex Ledeb.
Cyperaceae		
IT	Cr	<i>Carex stenophylla</i> subsp. <i>stenophylloides</i> Wahlerb.
IT	He	<i>Scirpoides holoschoenus</i> (L.) Sojak
Equisetaceae		
Cosm	Cr	<i>Equisetum ramosissimum</i> Desf.
Euphorbiaceae		
IT	He	<i>Euphorbia microsciadia</i> Boiss.
Fabaceae		
IT	Ch	<i>Alhagi camelorum</i> Fisch.
IT	He	<i>Astragalus ackerbergensis</i>
IT	He	<i>Astragalus citrinus</i> Bunge. subsp. <i>citrinus</i>
IT	He	<i>Astragalus kurdicus</i> DC.
IT	He	<i>Astragalus macropelmatus</i> Boiss.
IT	He	<i>Astragalus remotijugus</i> Boiss.
IT	He	<i>Astragalus siliquosus</i>
IT	He	<i>Astragalus siliquosus</i> subsp. <i>siliquosus</i>
SS, IT	He	<i>Astragalus verus</i>
IT	He	<i>Cicer tragacanthoides</i> . ver. <i>tragacanthoides</i> Jaub and Spach
IT	Ch	<i>Glycyrrhiza glabra</i> L.
Cosm	He	<i>Lotus corniculatus</i> L.
M-IT	Th	<i>Medicago radiata</i> L.
E-M-IT	He	<i>Trifolium pratense</i> L.
IT-ES	He	<i>Vicia peregrina</i> L.
IT-ES	He	<i>Vicia subvillosa</i> (leded.) Trautv
IT-ES	He	<i>Vicia villosa</i> Roth.
Fumariaceae		
IT	Th	<i>Fumaria vaillantii</i> Loisel.
Gentianaceae		
IT-ES	Th	<i>Centanrium pulchellum</i> (Swartz) Druce
Geraniaceae		
IT	Cr	<i>Biebersteinia multifida</i> DC.
IT	Th	<i>Erodium cicutarium</i> (L.) L' Her.
ES	Cr	<i>Geranium collinum</i> Steph.ex Willd.
Graminae/poaceae		
IT	Th	<i>Aegilops tauschii</i> Cosson
M-IT	Th	<i>Boissiera squarrosa</i> Hochst.ex. Steud

Table 1: Continued

Phytocorya	Life form	Family/species
Cosm	Th	<i>Bromus danthoniae</i> Trin.
Cosm	Th	<i>Bromus tectorum</i> L.
IT	Cr	<i>Cynodon dactylon</i> (L.) Perv. 202
IT	He	<i>Elymus elongatus</i> (Host) Runemark
ES-M, IT	He	<i>Elymus hispidus</i> (Opiz) Melderis
IT	Th	<i>Eremopyrum bonaepartis</i> (Spreng.) Nevski
Cosm	He	<i>Festuca ovina</i> L.
IT-ES	He	<i>Festuca pratensis</i> Hudson
IT	Th	<i>Heterantherium piliferum</i> (Banks and Soland.) Hochst
Cosm	He	<i>Koeleria macrantha</i>
IT	He	<i>Melica persica</i> Kunth.
Cosm	Cr	<i>Poa bulbosa</i> L.
Cosm	He	<i>Rostraria cristata</i>
IT	Th	<i>Setaria viridis</i> (L.) P. Beauv.
IT	He	<i>Stipa barbata</i> Desf.
M-IT	Th	<i>Taeniatherum crinitum</i> (Schreb.) Nevski.
Hyacinthaceae		
IT	He	<i>Hyacinthus litwinowii</i> E. Czern.
Hypericaceae		
IT	He	<i>Hypericum helianthemoides</i> (Spach) Boiss
Iridaceae		
IT	Cr	<i>Iris kopetdagensis</i> Mathew and Wendelbo.
Juncaceae		
Cosm	Th	<i>Juncus bufonius</i> L.
Cosm	He	<i>Juncus gerardi</i> Loisel
Cosm	He	<i>Juncus inflexus</i> L.
Labiatae/Lamiaceae		
ES	He	<i>Eremostachys labiosiformis</i> (M.pop.) Knorring
IT	Ch	<i>Lagochilus cabulicus</i> Benth
M-IT	Th	<i>Lallemantia iberica</i> Fisch. et Mey.
IT	He	<i>Leonurus cardiaca</i> subsp. <i>turkestanicus</i>
IT	He	<i>Marrubium vulgare</i> L.
ES	Cr	<i>Mentha longifolia</i> (L.) Huds.
IT	Ch	<i>Perovskia abrotanoides</i> Karel.
IT, ES	He	<i>Phlomis pungens</i> Willd
IT	He	<i>Salvia limbata</i> C.A.Mey.
IT	He	<i>Stachys lavandulifolia</i> Vahl.
IT-ES	He	<i>Ziziphora tenuior</i> L.
Liliaceae		
IT	Th	<i>Allium cristophii</i> Trautv.
IT	Th	<i>Allium kopetdagense</i> Vved.
IT	Th	<i>Allium</i> subgen: <i>melanocrommyum</i>
IT	Cr	<i>Allium xiphopetalum</i> Aitch. and Boker
IT	Cr	<i>Eremurus stenophyllus</i> subsp. <i>stenophyllus</i> (Boiss and Buhse) Boker
IT	Cr	<i>Gagea chomutowae</i> Pocher
IT	Cr	<i>Rhinopetalum gibbosum</i>
IT	Cr	<i>Scilla khorassanica</i> Meikle
IT	Cr	<i>Tulipa micheliana</i> Hoog
IT	Cr	<i>Tulipa montana</i> Lindl.
Lythraceae		
Cosm	Th	<i>Lythrum hyssopifolium</i> L.
Malvaceae		
M-IT	Th	<i>Hibiscus trionum</i> L.
IT-ES	He	<i>Malva neglecta</i> Wallr.
Moraceae		
IT	Ph	<i>Ficus carica</i> L.
IT	Ph	<i>Ficus carica</i> L. subsp. <i>Rupestris</i> (Hausskn. ex Boiss.) Browicz.
Oleaceae		
IT	Ph	<i>Fraxinus angustifolia</i>
Onagraceae		
M-IT	Cr	<i>Epilobium hirsutum</i> L.
IT	Cr	<i>Epilobium minutiflorum</i> Hausskn.
Papaveraceae		
IT	He	<i>Glaucium leiocarpum</i> Boiss.
IT	Th	<i>Roemeria refracta</i> DC.
Plantaginaceae		
IT	He	<i>Plantago boissieri</i> Hausskn. and Bomm
ES	He	<i>Plantago lanceolata</i> L.

Table 1: Continued

Phytocorya	Life form	Family/species
Plumbaginaceae		
IT	Ch	<i>Acantholimon erinaceum</i> (Jaub. and Spach) Lincz.
Podophyllaceae		
M-IT	Cr	<i>Bongardia chrysogonum</i> (L.) Boiss.
Polygonaceae		
IT	He	<i>Polygonum hyrcanicum</i> L.
M-IT	He	<i>Rumex pulcher</i> L.
Primulaceae		
IT	He	<i>Glaux maritima</i> L.
IT	He	<i>Primula anriculata</i> Lam.
Ranunculaceae		
IT-ES	Th	<i>Ceratocephalus falcata</i> (L.) pers.
Cosm	Th	<i>Delphinium persic</i> Boiss.
IT	He	<i>Ficaria kochii</i> (Ledeb.) Iran shahr and Rech f.
IT	Th	<i>Nigella integrifolia</i> Regel
IT, SS, M	Th	<i>Ranunculus afghanicus</i> Aitch. and Hemsl.
M-IT	Th	<i>Ranunculus sceleratus</i> L.
Rosaceae		
IT	Ph	<i>Amygdalus communis</i> L.
IT	Ph	<i>Cotoneaster nummularius</i> Pojark
IT	He	<i>Geum kokanicum</i> Regel and Schmalh. ex Regel
IT-ES	He	<i>Potentilla inclinata</i> Willd.
IT	Ch	<i>Rosa persica</i> Michx. ex Juss.
IT-ES	Ph	<i>Rubus sanctus</i> Schreber.
IT-ES	Ch	<i>Sanguisorba minor</i> Scop.
Rubiaceae		
IT	Th	<i>Asperula setosa</i> Joub. and Spach
IT	He	<i>Galium verum</i> L.
IT	Ch	<i>Rubia florida</i> Boiss.
Rutaceae		
IT	He	<i>Haplophyllum perforatum</i> (M.B.) Kar. and Kir.
Salicaceae		
IT-ES	Ph	<i>Salix aegyptiaca</i> L.
Scrophulariaceae		
IT	He	<i>Scrophularia amplexicanlis</i> Benth.
IT	Ch	<i>Scrophularia frigida</i> Boiss.
IT	He	<i>Scrophularia striata</i> Boiss.
M-IT	Cr	<i>Veronica anagallis-aquatica</i> L.
IT	Th	<i>Veronica argute-serrata</i> Regel and Schmalh.
Cosm	He	<i>Veronica beccabunga</i> L. subsp. <i>muscosa</i>
Solanaceae		
IT	He	<i>Hyoscyamus arachnoideus</i> Pojark.
Umbelliferae/Apiaceae		
IT	Cr	<i>Bunium cylindricum</i> (Boiss. and Hohen) Drude
IT	He	<i>Bupleurum exaltatum</i> M.B.
IT	He	<i>Chaerophyllum khorassanicum</i> Czern. ex Schischk.
IT	He	<i>Eryngium bungei</i> Boiss.
E-M-IT	He	<i>Falcaria vulgaris</i> Bernh.
IT	He	<i>Ferula gumosa</i> Boiss.
IT	He	<i>Ferulago angulata</i> (Schlecht.) Boiss.
IT	He	<i>Johrenia platycarpa</i>
IT	He	<i>Malabaila isfahanica</i> Alava.
IT	He	<i>Malabaila secacul</i> subsp. <i>secacul</i> (Miller) Boiss
IT	He	<i>Pimpinella tragium</i> subsp. <i>lithophila</i> (Schischk.) Tutin
IT	Th	<i>Psammogeton canescens</i> (DC.) Vatke
M-IT	Th	<i>Scandix stelata</i> Banks and Soland
Urticaceae		
E-M-IT	Ch	<i>Parietaria judaica</i> L.
IT-ES	He	<i>Urtica dioica</i> L.
Valerianaceae		
IT	He	<i>Valeriana sisymbriifolia</i> Vahl.
Verbenaceae		
Cosm	He	<i>Verbena officinalis</i> L.
Zygophyllaceae		
IT	Ch	<i>Peganum harmala</i> L.

Table 2: Endemic taxa in the flora of salok area

Family/Taxa	Status
Caryophyllaceae	
<i>Diaphanoptera khorasanica</i> Rech.f.	VU
Compositae/Asteraceae	
<i>Achillea millefolium</i> L.	LR
<i>Cousinia lasiandra</i>	LR
Cruciferae/Brassicaceae	
<i>Aethionema trinervium</i> (DC.) Boiss ver. <i>apterocarpum</i>	LR
<i>Graellisia integrifolia</i> (Rech.f) Rech.f	LR
Fumariaceae	
<i>Fumaria vaillantii</i> Loisel.	LR
Labiatae/Lamiaceae	
<i>Mentha longifolia</i> (L.) Huds.	LR
Liliaceae	
<i>Allium kopetdagheuse</i> Vved.	LR
<i>Eremurus stenophyllus</i> subsp. <i>stenophyllus</i> (Boiss and Buhse) Boker	LR
<i>Scilla khorassanica</i> Meikle	DD
Rubiaceae	
<i>Rubia florida</i> Boiss.	LR
Scrophulariaceae	
<i>Scrophularia frigida</i> Boiss.	LR
Umbelliferae/Apiaceae	
<i>Ferulago angulata</i> (Schlecht.) Boiss.	LR
<i>Malabaila isfahanica</i> Alava.	DD
<i>Psammogeton canescens</i> (DC.) Vatke	LR

VU: Vulnerable, LR: Lower risk, DD: Data deficient

are 1727 (Jalili and Jamzad, 1999), then the results show 0.86 % of endemic species related to the Iran's flora.

This study was the first research in protected Salok region therefore we cannot able to compare with the previous study.

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