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Floristic, life form and chorological studies of the Abshar protected area, Shirgah, Mazandaran Province, north of Iran

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ABSTRACT

The Abshar protected area with 3639 ha and an altitude ranging from 400-855 m a.s.l. is one of the forest areas that due to its topography is covered by *Carpinus betulus*, *Parrotia persica* and *Diospyros lotus* speices. The floristic study of this area is long with sampling plots. The floristic-physiognomic investigation showed that flora of this region included 99 plant species which belonged to 81 genera and 49 families. The largest family was Rosaceae with 10 species. Classification based on life form spectrum indicated that geophytes (31.31%), phanerophytes (29.29%), hemicryptophytes (25.25%) and therophytes (14.14%) comprise the plants in the studied area. The results of chorological studies showed that the chorotype form Euro-Siberian elements (32 taxa, 32.32%) were the most important phytochorion in this area. Long period of wetness during the growing season and relatively high annual precipitation are the reasons of the high proportion of geophytes existence in the studied area. Phytogeographical comparison of the Abshar protected forest and the other forests in north of Iran identified two peaks in phytochoria curves, one in Euro-Siberian and the other one is in the Pluriregional elements.

Key words: The Abshar protected area, Shirgah, transect, Floristic, Chorological.

INTRODUCTION

The Hyrcanian forests are the most important relicts of the so-called Arcto-Tertiary forests and many tree genera like *Pterocarya*, *Albizia*, *Parrotia* and *Gleditsia* survived the last ice age only in this area (Scharnweber *et al.* 2007). Only the northern section of the Alborz mountain ranges in Iran, that is the Hyrcanian area, is located in the Euro-Siberian phytogeographical region (sensu Zohary 1973; Léonard 1989; Akhani 1998) and includes deciduous forests and forest-steppe ecotones, unlike the arid and semiarid landscapes throughout most of Central and Southern Iran (Naqinezhad *et al.* 2008). The forests are one of the few remnants of natural closed-canopy deciduous forests in the world (Bobek, 1951) and are located in four northern provinces of Iran, namely, Guilan, Mazandaran, Golestan and northern Khorasan, with approximately 1000 km in length, 70 km in width and a total surface area of 1.84 million ha (Naqinezhad *et al.* 2015). These forests, in terms of genetic resources and plant diversity, have unique characteristics. Survey and analysis of the flora of each region including: determination of species list, biological spectrum and chorology of species are important in terms of recognizing biodiversity and natural resource management (Esmailzadeh *et al.* 2004). The plant life form is a genetic attribute that will provide useful information on the habitat climate for someone who cannot visualize the form of species from the name (Asri & Bakhshi Khaniki 2011). There have been a number of floristic and vegetation researches on Hyrcanian forests in the past; a floristic survey of the Hyrcanian forests in Northern Iran, using two lowland-mountain transects yielded identification of 395 plant taxa belonging to 78 families (Naqinezhad *et al.* 2015). Akhani & Jafari (2008) studied plant world view protected area in Golestan with an approximate area of 34340 ha. This study identified 807 species of 85 families and floristic survey of Hyrcanian high-lowland rock and Irano-Turanian of Golestan National Park, herbaceous communities, and specific trees were introduced by Akhani (1998) and also Akhani & Ziegler (2002). The Abshar protected area is one of the forest areas that due to its topography is covered with *Carpinus betulus*, *Parrotia persica* and *Diospyros lotus* species. However, a detailed study has not been done to determine the floristic composition of the Abshar area, although it is important to study and identify its vegetation.

The aim of the present study is to present a complete and updated checklist of all plant species, determining the flora of Hyrcanian forests as well as comparing the flora of these areas with the others studied in the Hyrcanian ones.

MATERIALS AND METHODS

Study area

The Abshar protected area with 3639 ha is located on the Central Alborz Mountains, 6 km to the southern part of Shirgah, Mazandaran Province, Iran between 52º55'-53º50'E and 36º12'-36º18'N, with an altitude ranging from 400 to 855 m a.s.l (Fig. 1).

The topography of Savadkooh has consisted of an organization of Cretaceous, Jurassic, Triassic periods related to the Mesozoic Era and is mainly made of sandstone, limestone, marl, siltstone, shale, argillite and conglomerate (Unknown, 1998).

The area metrological characteristics are based on information and charts due to temperature and precipitation, provided by Meteorological Synoptic Station in Gharakheil, Qaemshahr City, Iran (time period: 1984-2005) which are closest to the calculated and provided transect (Fig. 2).

The mean monthly temperature is the lowest in January and February, while the highest in July and August.

Mean total annual precipitation in Gharakhil is 738.7 mm with the highest precipitation in October (100.6 mm).

Climatically, the Caspian lowland may be regarded, on the whole, as a region of rainy summers and mild winters which are reminiscent of a typical oceanic climate, not unlike to that of the Atlantic coast of Europe (Zohary, 1973).

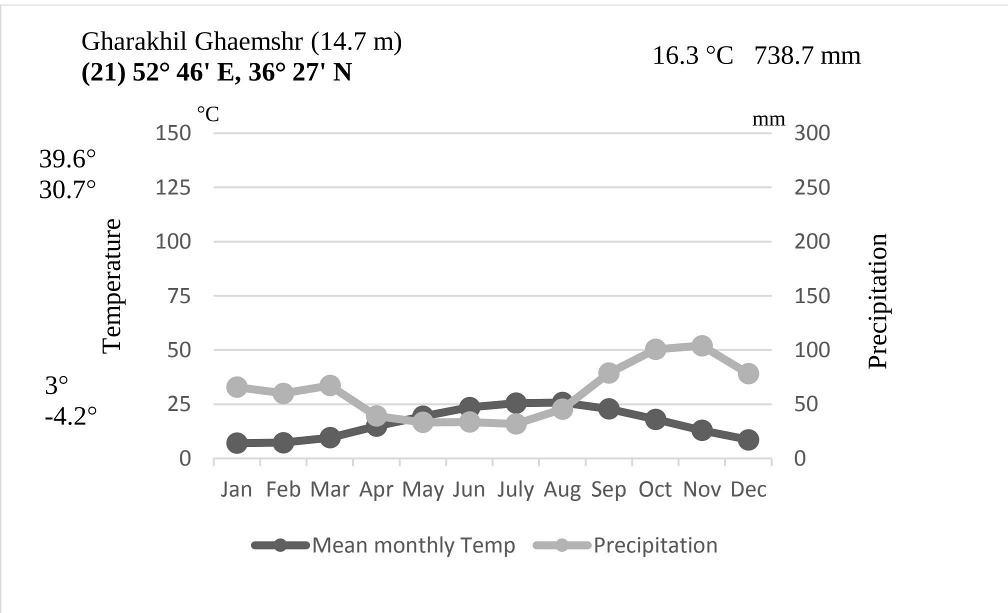

Fig. 2. Climatological diagram from Gharakhil Qaemshahr Station (1984-2005).

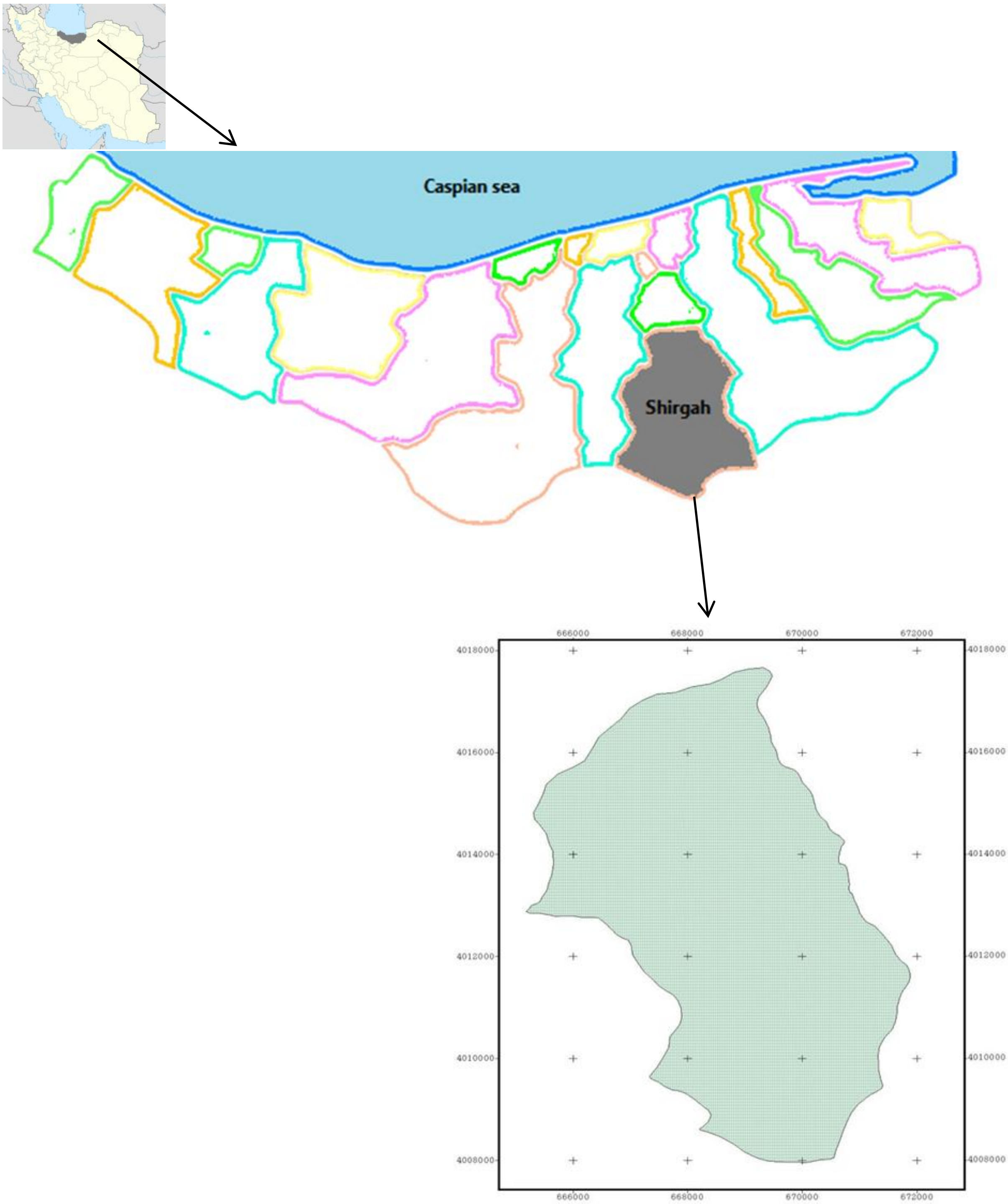

Fig. 1. Location of the Abshar protected area in Mazandaran Province, Iran.

Data collection and analyses

Data was collected during spring and summer 2014 - 2015. The voucher specimens were deposited in the Herbarium of Guilan University (GUH).

Floristic data were collected by using 43 relevés with the surface area of 400 m^2. The identification of specimens was performed by Rechinger (1963-2010), Assadi *et al*. (1988-2011), Davis (1965-1988) and Ghahreman (1979-2003). The classification of flowering plants was based on the APGIII (2009) and the name of taxon authors was coordinated using IPNI (2012). Some references (Khoshravesh *et al.* 2009; Smith *et al.* 2006) were used for determination of Monilophytes species. The life form of each species followed Raunkiaer's classification system (Raunkiaer, 1934). The species distribution was based on their views, monographs and floras, particularly the Flora Iranica (Rechinger, 1963-2010), Flora of Turkey (Davis, 1965-1988). The terminology and delimitation of the main phytochoria were based on the concepts applied by Zohary (1973), Léonard (1988) and Takhtajan (1986). We used the following abbreviations in the present study: ES (plants distributed in the Euro-Siberian region), IT (plants distributed in the Irano-Turanian region), M (plants distributed in the Mediterranean region), PL (pluri-regional elements, referring to plants ranging over three phytogeographical regions) and COS (cosmopolitan, referring to plants that have a broad worldwide distribution). Threatened categories were proposed for the endemic and rare taxa in the study area according to the IUCN risk categories (Jalili & Jamzad, 1999; IUCN, 2001).

The following abbreviations were also used: EN, endangered; VU, vulnerable; LR, lower risk; and DD, data deficient.

RESULTS AND DISCUSSION

Flora

The floristic-physiognomic investigation showed that flora of this region included 99 plant species which belonged to 81 genera and 49 families (Appendix 1).

Seven families of monilophytes (pteridophytes) and 42 families of Angiosperms constitute the studied flora. Eudicots with 36 families, 60 genera, and 69 species are the richest group, while monocots have 6 families, 13 genera and 18 species in the studied flora (Table 1). The largest families in terms of a number of genera were Rosaceae, Poaceae, Dryopteridaceae, Asteraceae, Lamiaceae, and Cyperaceae, respectively. In addition to these families, four families are represented in 3 taxa, 12 families with 2 taxa and 27 families with only a single taxon. Four families, including Rosaceae with 8 genera, Poaceae, and Asteraceae with 5 genera and Lamiaceae with 4 genera are the richest families in terms of genera (Fig. 3).

The genera with the largest number of species were *Carex* with 5 species, while *Veronica*, *Viola*, *Rubus* and *Polystichum* with 3 species. The varied and rich vegetation in this area is due to considerable ecological and topographic diversity and also high rates of precipitation and humidity. In this study, species richness increased with increasing altitude; this increase may be due to dominance of hemicryptophytes and geophytes (especially pteridophytes). In altitude, the relative numbers of non-tree species precedes to tree species. Table 2 shows classification of vegetation composition individually based on species growth form, such as herbs, woods, grasses, ferns, orchids and horsetails.

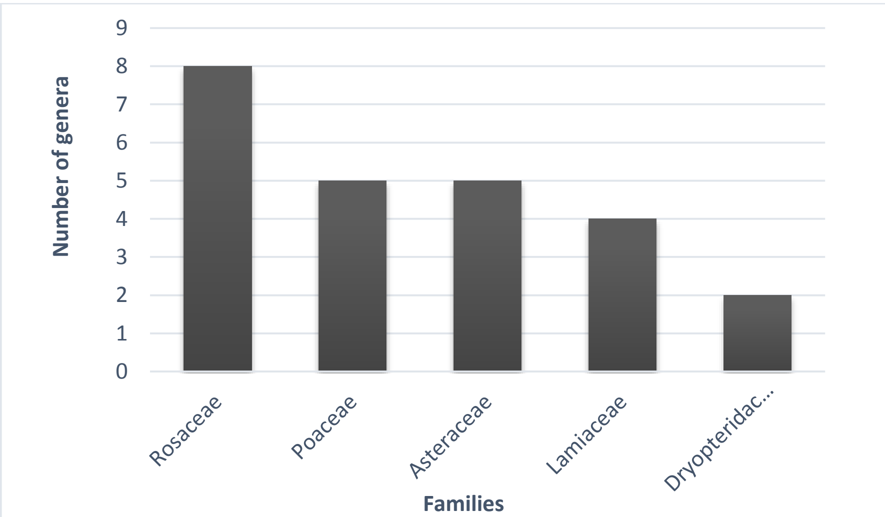

Fig. 3. The richest families in terms of number of genera.

Table 1. Number of families, genera and species of main plant groups in Abshar forests.

Plant Groups	Families	Genera	Species
Eudicots	36	60	69
Monocots	6	13	18
Monilophytes	7	8	12
Total	49	81	99

Table 2. Classification of plant species based on the growth form.

Growth form	Species number	Rate (%)
Herbs	43	43.4%
Woods	31	31.3%
Grasses	11	11.1%
Ferns	11	11.1%
Orchids	2	2%
Horsetails	1	1%
Total	99	100%

Life form and chorotype spectrum

The study of plant life forms is important because it provides the basic structural components of vegetation stands (Box, 1981). It is also indicative of habitat conditions (Archibold, 1995) and is widely used as a criterion for describing it (Raunkiaer, 1934). Raunkiaer's system is still the simplest and, in many ways, the most satisfying classification system for plant life-forms (Begon *et al.* 1996). In the present study, geophytes with 31 taxa, rhizomatous geophytes (23 taxa, 23.23%), stoloniferous geophytes (3 taxa, 3.03%), bulbiferous geophytes and parasite geophytes (2 taxa, 2.02%) and also corm geophytes (1 taxa, 1.01%) are the dominant life form, constituting 31.31% of studied flora, followed by the phanerophytes (29 taxa, 29.29%), hemicryptophytes (25 taxa, 25.25%) and therophytes (14 taxa, 14.14%, see Fig. 4). In this study, life form is in contact with altitude, therefore, hemicryptophytes and geophytes increase with increasing elevation, while phanerophytes decrease. The high proportion of geophytes in the studied area primarily reflects the long period of wetness during the growing season and relatively high annual precipitation (Danin & Orshan 1990). The high occurrence of geophytes is consistent with the results of some floristic studies in some other forest areas in the Hyrcanian region (Akbarinia *et al.* 2004; e.g. Ghahreman *et al.* 2006; Razavi, 2008; Siadati *et al.* 2010). It seems that these concentrations exhibit the best correspondence with a normal structure and flora of lowland Hyrcanian forests (Zohary, 1973; Rastin, 1983). The reason for high phanerophytes is the low altitude of studied area which prevents extreme cold winter. Therophyte elements were often accounted for part of the ruderal plants due to the high light requirements. So that, they rarely attended in the mass forest and also often are indicators of open field and destruction. Another studies ha shown that with increasing elevation, therophytes pass from the lowlands to foothills and mountains areas with a significant increase, reflecting the increased destruction and grazing in the Caspian lowlands (Naqinezhad *et al.* 2010; Siadati *et al.* 2010).

Phytogeographical elements of the studied area include ES (31 species, 31.31%), followed by PL and ES-IT (15 species, 15.15%), ES-IT-M and ES-M (12 species, 12.12%) and COS (11 species, 11.11%, see Fig. 5). Similar to previous investigations (Naqinezhad *et al.* 2010; Siadati *et al*. 2010; Asadi *et al*. 2011), Euro-Siberian species constitute a remarkable proportion of the studied flora. The occurrence of these elements reflects the phytogeographical link of the studied area with the Euro-Siberian region (e.g. Zohary, 1973; Takhtajan, 1986; Akhani *et al.* 2010). The northern forests in terms of chorology belong to the Euro-Siberian region, Pontic subregion from the Euxino-Hyrcanian domain, hence the high percentage of Euro-Siberian elements reveal the associated floristic of northern forests with Euro-Siberian forests.

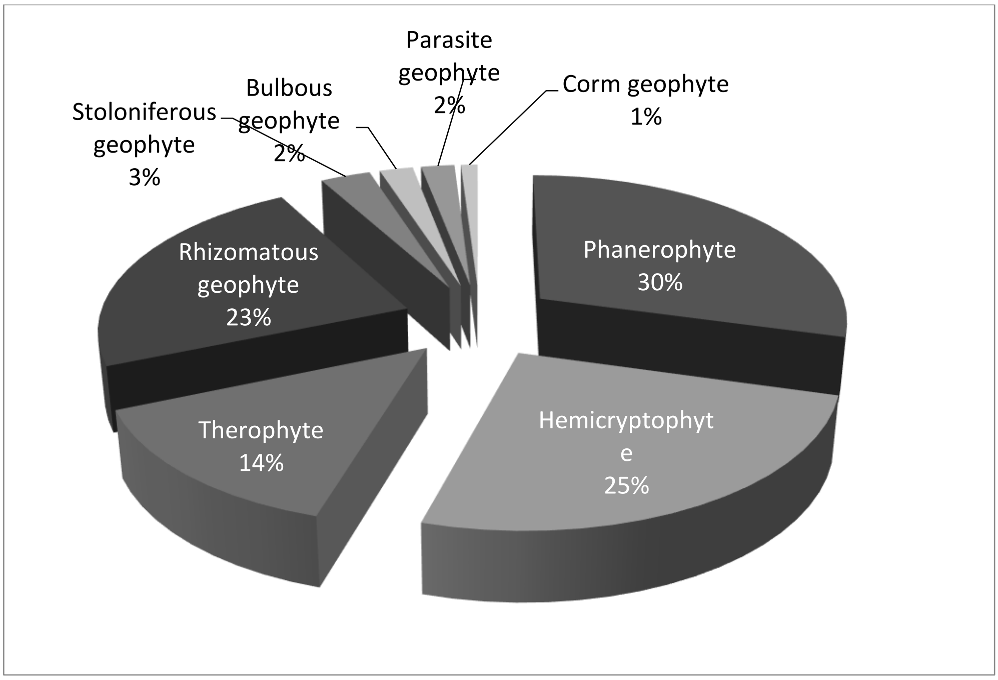

Fig. 4. Life form spectrum of plants studied in Abshar forests.

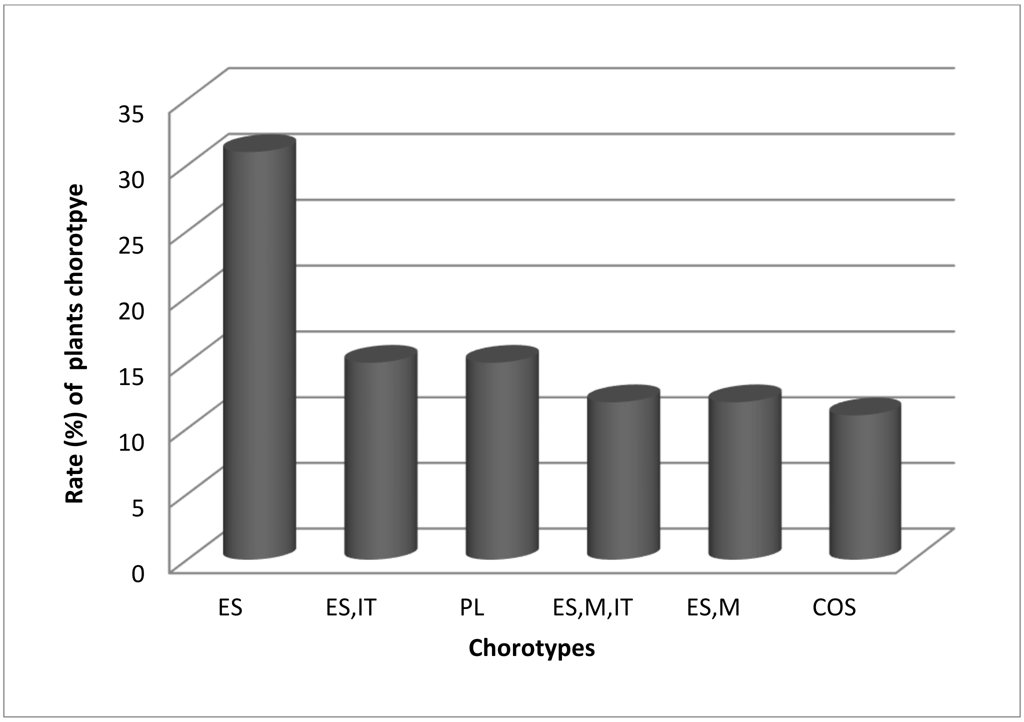

Fig. 5. Rate (%) of main chorotypes of plants studied in Abshar forests.

Comparison of life forms spectrum in the Hyrcanian forests

Comparison among the life forms in Abshar forests and those in other forests of Northern Iran are shown in Fig. 6. The highest concentration of phanerophytes and hemicryptophytes in Khybus forests represent the typical flora in the temperate forests (Kent & Coker 2002). According to De Martonne Aridity index, the studied area was considered as a mountain of cold climate (Unknown, 1998). Hemicryptophytes show a peak of presence in Ramsar (Bazdid Vahdati *et al.* 2014). The occurrence of a high proportion of hemicryptophytes in Ramsar is typical of a temperate climate (Naqinezhad *et al.* 2010). The high percentage of geophytes is found in Savadkooh, Ata-Kuh and Kheyrud. Likewise, increasing geophytes were considered to be related to increasing in altitudinal bands.

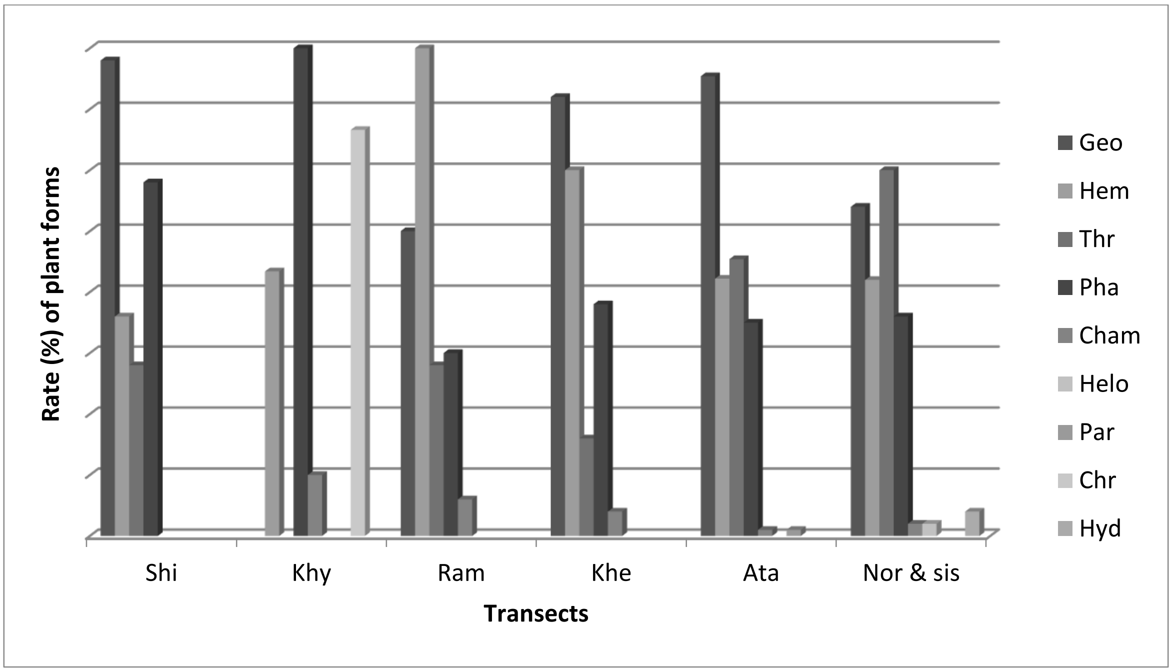

Fig 6. Variation of each life form over the sites Khybus forest (Asadi *et al.* 2011); Ramsar forest (Naqinezhad *et al*. 2010); Kheyrud forest (Siadati *et al.* 2010); Ata Kuh (Bazdid Vahdati *et al.* 2014); Nor & Sisangan (Naqinezhad *et al*. 2012). Abbreviations: Cha = chamaephyte, Geo = geophyte, Hel = helophyte, Hem = hemicryptophyte, Hyd = hydrophyte, Pha = phanerophyte, Par = parasite, Thr = therophyte, Chr = cryptophyte.

Comparison of chorotype spectrum in the Hyrcanian forests

Phytogeographical comparison of Abshar protected forests and the other forests in north of Iran are demonstrated in Fig. 7. Two peaks are identified in phytochoria curves, one in Euro-Siberian and the other in the Pluriregional elements. Some phytogeographical elements such as ES-M-IT, ES-IT, ES-M, SCOS, COS, M-IT, IT, M-IT-PON, M do not demonstrate high variations among the sites, while ES and PL show more variations. The highest proportion of Euro-Siberian elements presents in Khybus, while the lowest is seen in Nor and Sisangan forests. Likewise, the Ata-Kuh forests demonstrate the highest amount of Pluriregional elements. These elements can be observed in the lower altitudes of some mountainous systems (Hegazy *et al.* 1998). Khybus and Sisangan forests are some of the best and the most intact habitats of box trees (*Buxus hyrcana* Pojark.), although Sisangan is a kind of the lowland box tree forests and also the mountainous of Khybus forests affected species richness and chorotype spectrum. There are more Euro-Siberian elements exist in Khybus than in Sisangan forests, since Khybus is mountainous. Furthermore, the low altitude of Sisangan forests and direct human effects on this region is the reason for the high species richness, compared to Khybus forests.

Decreasing the dominancy of box tree forests in the region under Sisangan forest tourism management, provide the presence of other plant species and their establishment, hence approving their pluriregional elements. The highest proportion of PL elements is related to moist and humid environments. Also, human activities increase this phytogeographical element by increasing ruderal plants (Saeidi Mehrvarz *et al*. 2015).

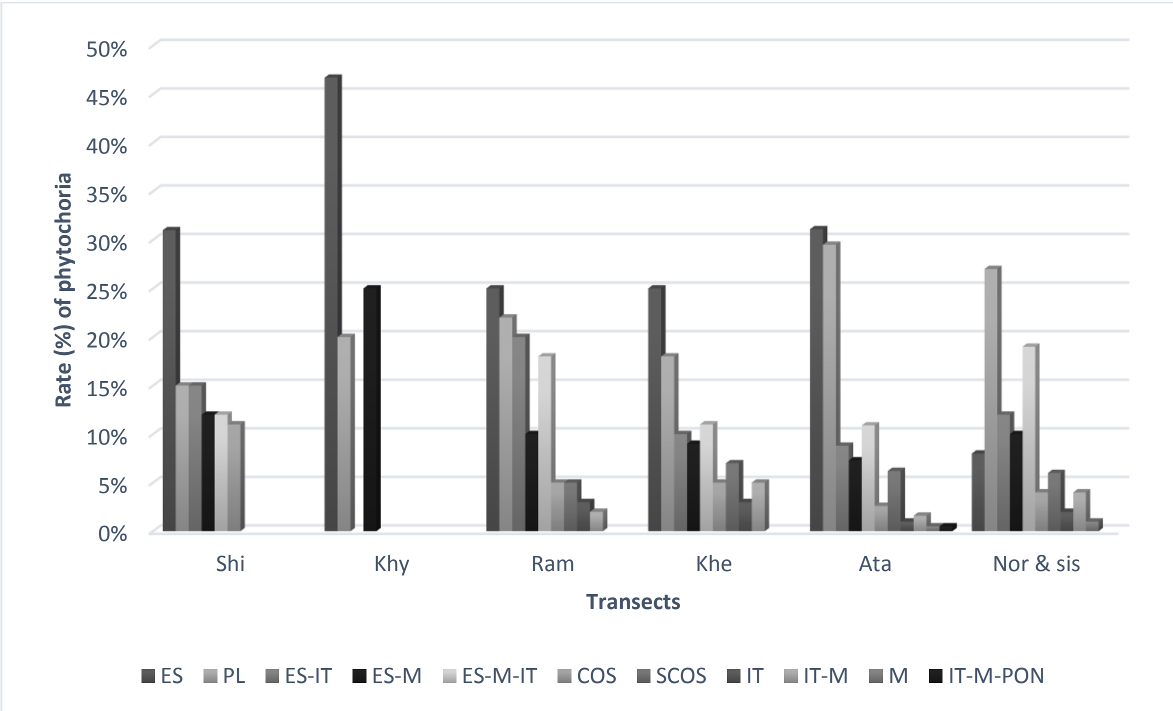

Fig. 7. Variation of each phytochoria over the sites. Abbreviations: Shi = Shirgah, Khy = Khybus, Ram = Ramsar, Khe = Kheyrud, Ata = Ata-Kuh, Nor & Sis = Nor and Sisangan, ES = Euro-Siberian, PL = pluriregional, M = Mediterranean, IT = Irano-Turanian, COS = Cosmopolitan, SCOS = Sub-cosmopolitan.

IUCN categories and threatened plants

Various contaminants, are changing the application of agricultural lands to residential areas on natural forests. Wildlife trade and unsustainable exploitation of natural resources are the most important factors threatening biodiversity.

Among all plants listed as threatened species in the paper (Table 3), some have been under massive economic uses and thus considered within red data list of Iran, of which, two endangered species are harvested for economic gain (e.g. *Buxus hyrcana*) and ornamental purposes (*Danae racemosa*).

A total of 7 endemic and rare taxa were identified by IUCN including 5 lower risks (LR) and two endangered (EN) taxa. *Parrotia persica* is sub endemic, while *Polygala platyptera* is endemic in Iran.

Iranian endemics

The Hyrcanian forests are known as a refuge for many Arcto-Tertiary relict elements (Zohary 1973; Leestmans 2005).

These species are grouped into Hyrcanian and Euxino-Hyrcanian elements (Akhani *et al.* 2010). A total of 99 species and 24 taxa are endemic and/or sub endemic in Iran.

In the present study, Hyrcanian endemic and sub endemic elements decreased with increasing altitude which in turn, justified the presence endemism at lower altitude. Some species are endemic or nearly endemic to Hyrcanian area, such as *Ilex spinigera, Hedera pastuchovii, Alnus subcordata, Cynoglossum* *officinale, Buxus hyrcana, Gleditsia caspica, Parrotia persica, Pterocarya fraxinifolia, Polygala platyptera, Primula heterochroma, Rubus hyrcanus, Rubus dolichorcarpus, Ruscus hyrcanus.*

Table 3. The threatened flora of the study area and its IUCN Red Data List categories.

Families	Taxa	Conservation status
Buxaceae	*Buxus hyrcana*	EN
Asparagaceae	*Danae racemosa*	EN
Lamiaceae	*Mentha longifolia*	LR
Hamamelidaceae	*Parrotia persica*	LR Subendem
Polygalaceae	*Polygala platyptera*	LR Endem (Hyr)
Juglandaceae	*Pterocarya fraxinifolia*	LR
Violaceae	*Viola alba*	LR

EN: endangered; *LR;* lower risk; *Hyr:* hyrcanian area.

Ecosystem threats and management

Forests are the most important, sensitive and vulnerable natural ecosystems in the world. Nowadays, preserved forests, nature, and environment are indicators of development. These forests are regarded as habitats for some of the most endangered endemic plants like *Gleditsia caspica*. Among the major threats to these tree species are habitat loss, fragmentation and even hybridization with introduced species (*G. triacanthos*) (Schnabel & Krutovskii 2004). Also, *Gleditsia caspica* and *Parrotia persica* play an important role on the stability of soil (Bibalani *et al.* 2006). Because of good soil, suitable temperature, high humidity and high species diversity, these forests have mostly been destroyed in these areas due to the agricultural activities and road building, therefore, conservation policies in these areas should be applied seriously in order to decrease further problems.

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Appendix 1

Floristic list of the Abshar protected areas.
Symbols and abbreviation used: 1. Life form: C (Chamaephyte), G-B (Bulbiferous geophyte), G-C (Geophyte with corm), G-P (Parasiteous geophyte), G-R (Rhizomatous geophyte), G-S (Stoloniferous geophyte), H (Hemicryptophyte), P (Phanerophyte), T (Therophyte). 2. Chorotype: COS (Cosmopolitan), End (Endemism), ES (Euro-Siberian), Hyr (Hyrcanian), IT (Irano-Turanian), M (Mediterranean), PL (Pluri-regional). GUH= Guilan University Herbarium. * = Collection of incomplete species.

Taxa	Life form	Chorotype	Hb. No. (GUH)
Pteridophytes			
Aspleniaceae			
Asplenium adiantum-nigrum L.	G-R	PL	5742
Asplenium scolopendrium L.	G-R	PL	5743
Dennstaediaceae			
Pteridium aquilinum (L.) Kuhn	G-R	COS	5744
Dryopteridaceae			
Dryopteris affinis Newman	G-R	ES	5745
Dryopteris pallida (Bory)Fomin	G-R	ES, M	5746
Polystichum aculaticum (L.) Roth	G-R	PL	5747
Polystichum braunii (Spenn.) Fee	G-R	ES	5748
Polystichum woronowii Fomin	G-R	ES (Euxino-Hyr)	5749
Equisetaceae			
Equisetum sp.	H		5750
Polypodiaceae			
Polypodium vulgare L.	G-R	PL	5751
Pteridaceae			
Pteris certica L.	G-R	PL	5752
Woodsiaceae			
Athyrium filix-femina (L.) Roth.	G-R	PL	5753
Angiosperms			
Eudicots			
Aceraceae (Sapindaceae)			
Acer cappodocicum Gled.	P	ES, IT	5754
Acer velutinum Bioss.	P	ES (Hyr)	5755
Apiaceae			
Pimpinella affinis Ledeb.	H	ES (Euxin-Hyr), IT	5756
Sanicula europaea L.	H	PL	5757
Aquifoliaceae			
Ilex spinigera (Loes.) Loes.	P	ES (End-Hyr)	5758
Araliaceae			
Hedera pastuchovii Woron. ex Grossh.	P	ES (End-Hyr)	5759

Asteraceae			
Artemisia annua L.	T	ES-M-IT	5760
Carpesium cernuum L.	H	PL	5761
Conyza canadensis (L.) Cronquist	T	COS	5762
Traxacum sp.	H		5763
Wilhemetia tuberosa Fisch.& C.A.Mey.ex DC.	H	ES (Hyr)	5764
Betulaceae			
Alnus subcordata C.A.Mey.Var. *Villosa* (Regel) H.Winkl.	P	ES (Hyr)	5765
Carpinus betulus L. Var.*betulus*	P	ES	5766
Boraginaceae			
Cynoglossum officinale L.	T	ES (Hyr)	5767
Brassicaceae			
Capsella bursa-pastoris (L.) Medik.	H	COS	5768
Cardamine impatiens L.var.*pectinata* (Pall.) Trautv	T	ES (Euxino-Hyr), M	5769
Buxaceae			
Buxus hyrcana Pojark.	P	ES (Hyr)	5770
Campanulaceae			
Campanula odontosepala Bioss.	H	ES (Hyr), IT	5771
Caryophyllaceae			
Cerastium glomeratum Thuill.	T	COS	5772
Stellaria media Cirillo.	T	COS	5773
Celastraceae			
Evonymus latifolia (L.) Mill.	P	ES, M	5774
Ebenaceae			
Diospyrus lotus L.	P	ES (Hyr), IT	5775
Euphorbiaceae			
Euphorbia amygdaloides L.	G-R	ES, M	5776
Fabaceae			
Albizia julibrissin Durazz.	P	PL	5777
Gleditsia caspica Desf.	P	ES (Hyr),TUR	5778
Trifulium campestre Schreb.	T	ES,IT,M	5779
Fagaceae			
Fagus orientalis Lipsky	P	ES, M	5780
Querqus castaneifolia C.A.Mey.	P	ES (Hyr), IT	5781
Geraniaceae			
Geranium molle L.	T	ES-IT	5782
Hamamelidaceae			
Parrotia persica C.A.Mey.	P	ES (Hyr)	5783
Hypericaceae			
Hypericum androsaemum L.	P	ES, IT, M	5784
Juglandaceae			
Pterocarya fraxinifolia (Poir.) Spach.	P	ES	5785
Lamiaceae			
Clinopodium umbrosum (M.B) C. Koch	H	PL	5786
Lamium album L. subsp.*album*	G-R	ES, IT	5787
Mentha aquatica L.	G-S	ES	5788

Mentha longifolia (L.) HUDSON	G-S	ES	5789
Teucrium hyrcanicum L.	G-R	ES (Euxino - Hyr)	5790
Loranthaceae			
Viscum album L.	P	PL	5791
Moraceae			
Ficus carica L.	P	ES, IT, M	5792
Onagraceae			
Circaea lutetiana L.	G-R	ES, IT, M	5793
Orobanchaceae			
Orobanche hederae Duby	G-P	ES, M	5794
Oxalidaceae			
Oxalis cornicolata L.	T	COS	5795
Polygalaceae			
Polygala platyptera Bornm. & Gauba	H	ES (End-Hyr)	5796
Polygonaceae			
Polyganum cf. hydropiper L.subsp.*hydropiper*	T	ES, IT	5797
Rumex sanguineus L.	H	ES, M	5798
Primulaceae			
Cyclamen coum Miller subsp. *Caucasicum* (K.Koch) Meikle	G-C	ES	5799
Primula heterochroma Stapf	H	ES (Hyr), IT	5800
Ranunculaceae			
Ranunculus constantinopolitanus (DC.) d'Urv.	H	ES (Euxino - Hyr), IT	5801
Rosaceae			
Cerasus avium (L.) Moench	P	ES	5802
Crataegus microphylla K. Koch	P	ES, IT, M	5803
Fragaria vesca L.	G-S	ES, IT	5804
Geum urbanum L.	H	ES, IT, M	5805
Mespilus germanica L.	P	ES, M, IT	5806
Potentilla reptans L.	H	ES-IT	5807
Prunus divaricata Ledeb. subsp. *divaricata*	P	ES, IT, M	5808
Rubus hirtus Waldst. & Kit.	P	ES	5809
Rubus hyrcanus Juz.	P	ES (Hyr)	5810
Rubus dolichorcarpus Juz.	P	ES (Hyr)	5811
Rubiaceae			
Galium odoratum (L.) Scop.	G-R	PL	5812
Galium ghilanicum Stapf	T	PL	5813
Scorophulariaceae			
Veronica ceratocarpa C.A. Mey.	T	COS	5814
Veronica persica Poir.	T	COS	5815
Veronica polita Fries	T	COS	5816
Tiliaceae			
Tilia platyphyllos Scop.*caucasica* (Ruper.) Loria	P	ES	5817
Ulmaceae			
Ulmus glabra Hudson	P	ES	5818
Zelkova carpinifolia (Pallas) C.KOCH. Linnaea	P	ES	5819
Urticaceae			

Urtica dioica L. subsp. *dioica*	G-R	COS	5820
Violaceae			
Viola alba Besser	G-R	ES	5821
Viola caspia (Rupr.) Freyn subsp. *caspia*	G-R	ES	5822
Viola sintenisii W. Becher	G-R	ES	5823
Monocots			
Araceae			
Arum maculatum L.	G-R	ES, IT	5824
Asparagaceae			
Danae racemota Moench.	P	ES (Euxino-Hyr), M	5825
Ruscus hyrcanus Woronow.	P	ES (Hyr)	5826
Scilla sp.	G-B		5827
Cypraceae			
Carex digitata L.	H	ES	5828
Carex divulsa Stokes subsp. *divulsa*	H	ES, IT, M	5829
Carex remota L.subsp.remota	H	ES, M	5830
Carex strigosa Willd.ex Kunth	H	COS	5831
Carex sylvatica Huds.	H	ES, M	5832
Dioscoreaceae			
Tamus communis L.	G-B	ES, IT, M	5833
Orchidaceae			
Epipactis persica (Soo) Nannfeldt	G-R	ES, IT	5834
Neottia nidus-avis (L.) L. C. Rich.	G-P	ES, M	5835
Poaceae			
Brachypodium sylvaticum (Hudson) P.Beauv	H	PL	5836
Bromus benekenii (Lange) Trimen	G-R	ES, IT, M	5837
Microstegium vimineum (Trin.) A. Camus	H	PL	5838
Oplismenus undolatifolius (Ard.) P. Beauv.	H	ES, M	5839
Poa nemoralis L.	H	ES, IT	5840
Poa trivialis L.	H	PL	5841

مطالعات فلوریستیک، فرم رویشی و کورولوژی منطقه حفاظت شده آبشار، شیرگاه، استان مازندران

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چکیده

منطقه حفاظت شده آبشار با ۳۶۳۹ هکتار و دامنه ارتفاعی ۸۰۰-۴۰۰ متر یکی از مناطق جنگلی است که با توجه به توپوگرافی مناسب با گونه های *Parrotia persica*، *Carpinus betulus* و *Diospyrus lotus* پوشیده شده است. مطالعه فلوریستیک منطقه با پلات‌های نمونه برداری آمیخته شده است. مطالعه فلوریستیک-فیزیونومیک منطقه نشان داد که فلور این ناحیه شامل ۹۹ گونه گیاهی که متعلق به ۸۱ جنس، ۴۹ خانواده است. بزرگترین خانواده Rosaceae با ۱۰ گونه بود. طبقه بندی بر اساس طیف شکل رویشی نشان می‌دهد که ژئوفیت‌ها (۳۹/۳۹٪)، فانروفیت‌ها (۲۹/۲۹٪)، همی‌کریپتوفیت‌ها (۱۸/۱۸٪) و تروفیت‌ها (۱۴/۱۴٪) بخشی از گیاهان منطقه مورد مطالعه را در بر می‌گیرند. نتایج مطالعات کورولوژی نشان داد که عناصر اروپا-سیبری (۳۲ گونه، ۳۲,۳۲٪) مهمترین فیتوکوریون در منطقه بوده است. حضور میزان بالای ژئوفیت‌ها منعکس کننده دوره طولانی رطوبت در طول فصل رشد و بارش سالیانه نسبتا بالاست. مقایسه فیتوجغرافیایی جنگل حفاظت شده آبشار با دیگر جنگل‌های شمال ایران نشان داد که دو قله‌ی منحنی فیتوکوریونی یکی در عناصر اروپا-سیبری و دیگری در عناصر چند ناحیه‌ای شناسایی شدند.

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