بررسی فلور جنگل‌های در معرض خطر توسکای قشلاقی در مناطق پست خزری شمال ایران*

The flora of threatened black alder forests in the Caspian lowlands, northern Iran

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زون جنگلی جلگه‌ای در شمال ایران توسط باقیمانده‌های جنگلی بسیار کوچک توسکا که با غالبیت یا تقریبا غالبیت عنصر اگزینو- هیرکانی توسکای قشلاقی (*Alnus glutinosa* subsp. *barbata*) همراه است، اشغال شده است. اولین سیاهه گونه‌های موجود در این جنگل‌ها در ایران ارایه می‌شود. این لیست بر اساس برداشت ۱۳۳ قطعه نمونه در هشت منطقه جنگلی انتخاب شده و همچنین جمع‌آوری تکمیلی فلور از اطراف قطعات نمونه می‌باشد. در مجموع ۲۰۹ آرایه که از میان آن‌ها ۲۵ آرایه انحصاری ناحیه هیرکانی است جمع‌آوری و شناسایی شده است. تقسیم‌بندی اشکال زیستی گیاهان مورد مطالعه نشان می‌دهد که ژئوفیت‌ها و فانروفیت‌ها از بالاترین درصد گیاهان در تمامی مناطق مورد مطالعه برخوردارند. از دیدگاه پراکنش جغرافیایی بیشترین درصد پراکنش جغرافیایی متعلق به عناصر اروپا- سیبریایی و چند ناحیه‌ای می‌باشد. تنوع و اختلافات اشکال زیستی و پراکنش جغرافیایی

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واژه‌های کلیدی: مناطق پست خزری، *Alnus glutinosa* ssp. *barbata*، توسکا، فلور، کورولوژی، شکل زیستی، شاخص تشابه

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THE FLORA OF THREATENED BLACK ALDER FORESTS IN THE CASPIAN LOWLANDS, NORTHERN IRAN*

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Abstract

The Caspian (Hyrcanian) lowland forest zone in northern Iran is characterized by small remnant alder forest communities, dominated or subdominated with an Euxino-Hyrcanian element, *Alnus glutinosa* ssp. *barbata*. The first floristic inventory of these alder forests in northern Iran is presented. The floristic catalogue is based on the data of 133 phytosociological releves in eight different alder forest sites and on a supplementary floristic inventory of the same sites. Totally, 209 taxa were determined out of which 25 taxa are endemic of Hyrcanian district. Classification based on life form, indicates that the geophytes and phanerophytes make up the largest proportion of the plants in the studied flora.

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From the chorological point of view, the largest proportion of the flora belongs to the Euro-Siberian and pluriregional elements. In addition to the total assessment, variation of life forms and phytochoria between different study sites are discussed herewith.

There are some similarities and differences in the floristic composition between the study sites based on using similarity indices formula.

Key words: Caspian lowlands, *Alnus glutinosa* ssp. *barbata*, Black alder, Flora, chorology, Life form, Similarity index

Introduction

The Hyrcanian (Caspian) district of northern Iran, possesses a closed canopy deciduous forest, unlike the arid to semi-arid landscapes of most Iran. This forest is restricted to the southern Caspian lowlands and to the adjoining northern slopes of the Elborz mountains up to 2500 m.a.s.l. (FREY & PROBST 1986). Today, the lowest zone of these forests have been deforested and replaced largely by cultivated lands, human settlements and/or industry. Due to this land conversion, many plant species are restricted to isolated remnants of a formerly more widespread lowland habitat. Some of these remnant forests are characterized by high presence of threatened black alder [*Alnus glutinosa* (L.) Gaertn. ssp. *barbata* (C.A. Mey.) Yaltirik], a hygrophilous Euxino-Hyrcanian element [nomenclature according to Flora Iranica, No. 96 (1972), *In:* RECHINGER 1963-1998, YALTIRIK 1967, BROWICZ 1982]. This subspecies has been considered as a separate species, *A. barbata* C.A. Mey. by some authors such as KOMAROV (1934-1954).

To date, a few floristic inventories have been conducted exclusively in the forest habitats of northern Iran. Moreover, as the lowland forests including *Alnus glutinosa* are on the decline due to above-mentioned reasons, there is no exact information available on their vegetation and flora structure. There are only some vegetation studies such as RASTIN (1983) and partly DJAZIREI (1965),

TREGUBOV & MOBAYEN (1970), ZOHARY (1973), MOSSADEGH (1981) and ASSADOLLAHI *et al.* (1982). During 2002-2004, we studied the flora and vegetation of these remnant *Alnus glutinosa* ssp. *barbata* forests (NAQINEZHAD 2003). However, this paper emphasizes just on the flora of these lowland forests. The life forms of the taxa and their chorology are classified. The microhabitat of each taxon is presented. Similarities and differences between study sites as well as endemicity of taxa are also discussed.

Materials and Methods

Study sites

Eight remnant protected or subprotected sites dominated by *Alnus glutinosa* ssp. *barbata* that extend from west to east of Caspian shores (Gilan and Mazandaran Provinces) were selected (Table 1, Fig. 1). These sites are almost the best representative of habitats of this species in northern Iran. *Alnus glutinosa* ssp. *barbata* as a dominant or subdominant plant species, forms several communities with unique floristic composition in each of these sites.

Climate and Geology

All of the sites have obvious homogeneity in geomormology and climate. Geomorphologically, Caspian coastal plain varies greatly in width, ranging from less than one in Ramsar to 35 km in the Sefid-rud delta. Most parts of the plain are now considered as highly productive agricultural areas covered by rice fields, tea gardens and other crops. In contrast with Elborz ranges with Paleozoic and Mesozoic formations, the Caspian lowland is young and characterized by Quaternary deposits which designate a spectrum of conditions from completely continental (Inland zone) to coastal condition as well as intermediate environment. Quaternary formation consists of alluvial deposits as well as marine terraces strandlines, mudflats and fan-deposits distribute throughout the study areas. It is interesting that whole lowland

forests including study sites were formed after the last decrease in the Caspian sea level. In this time, the distance between the foothills of the Elborz ranges and the sea became recognizable (ANONYMOUS 1977, 1978).

In the Caspian area, annual precipitation, varies between 600 mm in the east to over 2000 mm in the west (e.g. Anzali). 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 that of the Atlantic coast of Europe (ZOHARY 1973).

In all sites with climatological stations (ANONYMOUS 1950-2000), most of the precipitation occurs from early autumn to early spring. The autumn months (Oct. to Dec.) are the most humid months of the year. There are two general peaks in precipitation (Fig. 2), first one in Oct. and the second in Jan. or Feb. There are no obvious differences in mean monthly temperature (between 15º C in Khorram-abad (Tonekabon) and 16.7º C in Lahijan) and the mean daily max. of the warmest month (differs from 29.1º C in Nowshahr to 30.4º C in Khorram-abad (Tonekabon) and Kelarabad). The mean daily min. temperature of the coldest month ranges from 1.9º C in Lahijan and Ramsar to 3.4º C in Nowshahr- the easternmost site of the study. The highest reported absolute max. temperature ranges between 34º C in Khoshkehdaran and 39.5º C in Lahijan. The lowest reported absolute min. temperature ranges between -2.5º C in Khoshkehdaran and -10º C in Ramsar. Mean annual precipitation differs from 1080.7 mm in Khorram-abad (Tonekabon) to 1469.7 mm in Kelarabad (Fig. 2).

Using GAUSSEN's method of climate classification (SABETI 1969), two different climatic types are present in the area, namely, 1) submediterranean climate in Ramsar, Khorram-abad (Tonekabon), Khoshkehdaran, Kelarabad, Nowshahr and 2) temperate xeric climate in Lahijan.

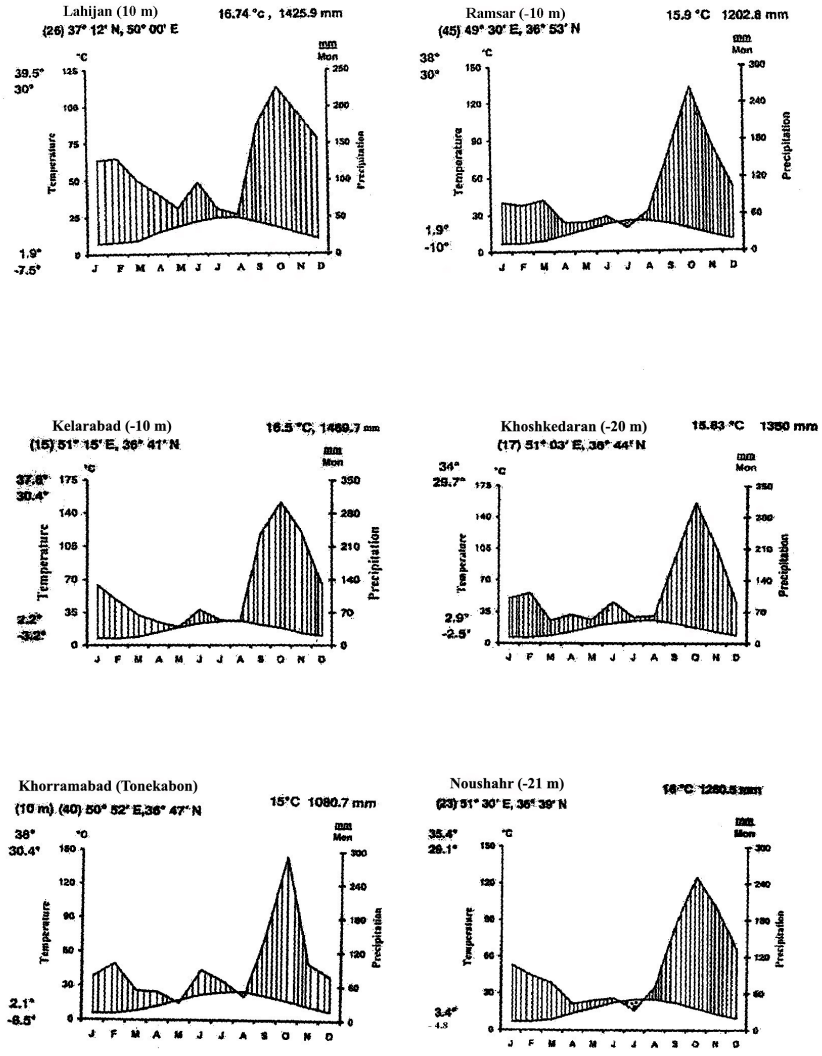

Fig. 2. Climatological curves from the study sites or neighbouring areas (ANON 1950-2000).

Methods

Data collection was performed in four seasons from 2002-2004. Vouchers of the collections are deposited in the Central Herbarium of Tehran University (TUH). Nomenclature is based on RECHINGER (1963-1998), ASSADI *et al.* (1988-2003), DAVIS (1965-1988), TUTIN *et al.* (1964-1980) and KOMAROV (1934-1954). For the determination of some ferns, we used PARSA (1978, FRASER-JENKINS (1980) and WENDELBO (1976). Some seedlings of forest plants have been determined based on AGHABEIGI (1997) and HANF (1983).

Life forms were named following the RAUNKIAER's classification (BRAUN-BLANQUET 1932). For detailed informations about phanerophytes, PEARS (1985) was used (Megaphanerophye= more than 30 m high, Mesophanerophyte= 8-30 m high, Microphanerophyte= 2-8 m high, Nano-phanerophyte= less than 2 m high, Climbing phanerophyte= no height restriction). The distributions of the species are based on the reviews, monographs and distribution information in the floras, particularly Flora Iranica, Flora of Turkey and Flora of Europaea. The terminology and delimitation of the main phytochoria (Irano-Turanian [IT], Mediterranian [M] and Euro-Siberian [ES]) is based on the known classical works particularly those of ZOHARY (1973) and partly (Irano-Turanian elements) by LÉONARD (1988). In our assessment, PL (pluriregional elements) are plants ranging in distribution over three phytogeographical regions and SCOS (subcosmopolitan elements) are plants ranging in distribution over most continents but not all of them. Also cosmopolitan elements are abbreviated by COS (cosmopolitan). For the microhabitats of aquatic species, we used the classification of COOK (1996). Floristic similarity indices were calculated for pair-wise comparisons between the eight sites. The index used is: $CC=c/(a+b-c) \times 100$ (%) JACCARD (1902) where a is the total number of taxa on one site, b is the total number of taxa on the other and c is the number of shared taxa.

Results and Discussion

A total of 209 species of native and naturalized vascular plants belonging to 79 families and 149 genera are known from Caspian lowland alder forest in the eight study sites (Table 2). Twelve families of Pteridophytes and 67 families of

Angiosperms (56 dicotyledons and 11 monocotyledon families) constitute the studied flora. Rosaceae, Papilionaceae, Asteraceae, Cyperaceae, Brassicaceae, Lamiaceae, Scrophulariaceae, Apiaceae, Ranunculaceae, Aspidiaceae, Polygonaceae and Liliaceae s.l., all exceed 5 taxa and show the highest species richness respectively.

Two families are represented by 4 taxa, 9 families with 3 taxa, 15 families with 2 taxa and 41 families have only one taxon.

Six families including Asteraceae (11 genera), Poaceae (10 genera), Rosaceae (9 genera), Lamiaceae (8 genera), Apiaceae (5 genera) and Liliaceae s.l. (5 genera), contain more than 5 genera. Six families have 3 genera, 17 families have 2 genera and the rest are unigeneric.

As it concerns the species richness of the genus, genera exceeding three species include *Carex* (9 spp.), *Rubus* (6 spp.), *Cardamine* (5 spp.), *Ranunculus* (5 spp.), *Veronica* (5 spp.), *Polystichum* (4 spp.), *Dryopteris* (3 spp.), *Equisetum* (3 spp.), *Geranium* (3 spp.), *Poa* (3 spp.) and *Solanum* (3 spp.). Eighteen genera are represented by 2 taxa and 120 genera only with one taxa.

The life form of a plant is an adaptative response to its environment and provides an ecological classification that may be indicative of habitat conditions (ARCHIBOLD 1995).

With total assessment, the geophytes are the dominant life form containing 30% of studied flora, followed by the phanerophyes (22%), therophytes (21%), hemicryptophytes (17%), hydrophytes (9%) and chamaephytes (1%) (Fig. 3). In the total geophytes (62 taxa), GB (bulbous geophyte) 3, GC (cormed geophyte) 3 and GR (rhizomatose geophyte) constitute 94 percent. In the total hydrophytes (20 taxa), Fl (floating hydrophytes), Su (submerged hydrophytes) and Em (emergent hydrophytes) constitute 25, 25 and 50 percent, respectively. Detailed classification of phanerophytes (46 taxa) are considered as Pha (pp) [36%], Pha (ps) [26%], Pha (pg) [17%], Pha (pn) [13%], Pha (pm) [5%] and Pha (epi) [3%].

Since the life form classification is based essentially on plant reaction to extremes of climate, the individual spectrum or the variation when two or more

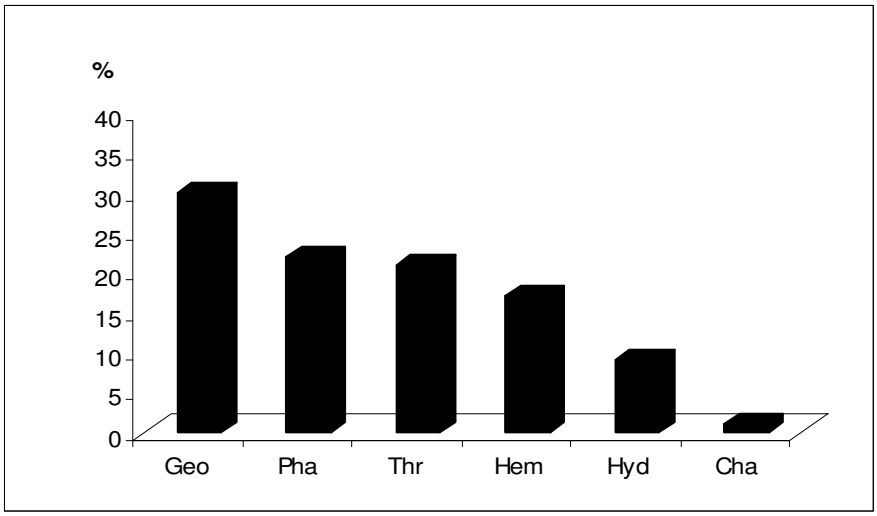

Fig. 3. Life form spectrum in the total sites [abbreviation according to Table 2]

spectra are compared should tell us much about macroclimatic patterns at the field sites (PEARS 1985). Analytical life form spectra for the each site, shows remarkable resemblance among them. This is probably due to similar climatic conditions as well as to approximately similar altitude. Almost, all the study sites, follow a nearly similar pattern of life form spectrum. Phanerophytes and geophytes have the highest proportion followed by therophytes, hemicryptophytes, hydrophytes and chamaephytes. The pattern of variation of each life form over the study sites has been demonstrated in Fig. 4. Some life forms such as hemicryptophytes, therophytes and phanerophytes do not demonstrate high variation between the sites. Therophytes show a peak of presence in Telecabin. This is due to the more affected faces of this site caused by human activities. Despite of a relatively constancy of above-mentioned life forms, hydrophytes and geophytes, show more variation between these sites. Hydrophytes are much limited to more humid sites i.e. Amirkelayeh, Mazga and Langerud where it shows the highest concentration. Occurrence of this life form decreases gradually toward Safrabasteh, Telecabin, Chaldarreh, Khoshkehdaran and Kelarabad where the lowest concentration of hydrophytes is known.

Also the highest concentration of geophytes is found in Chaldarreh, Kelarabad and Khoshkehdaran. It seems that, these concentrations are the best correspondence with a normal structure and flora of lowland Hyrcanian forest (ZOHARY 1973, RASTIN 1983). The occurrence of geophytes decreases toward the more humid and wet sites due to the dominance of other life forms such as hydrophytes.

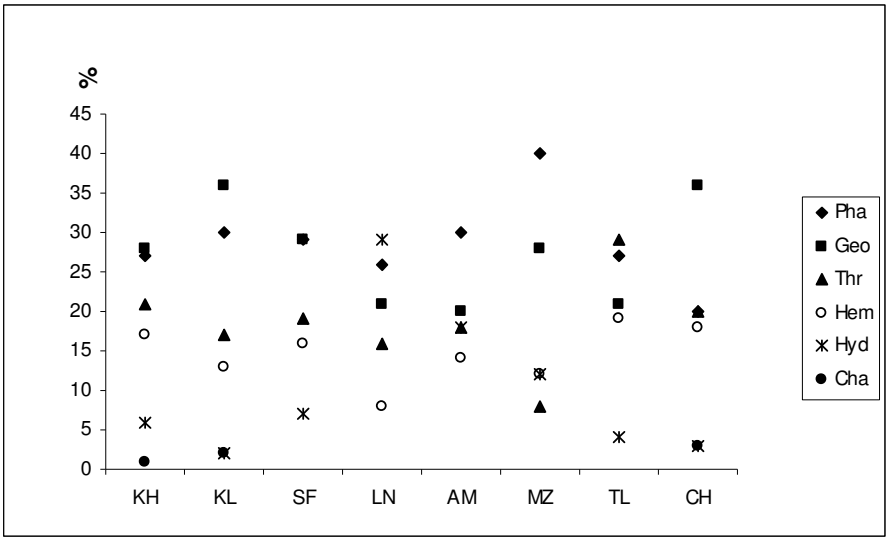

Fig. 4. Variation of each life form over the sites [abbreviation according to Tables 1 & 2]

Chorologically, the following taxa are endemic or nearly endemic to the Hyrcanian district: *Acer velutinum, Ilex spinigera, Hedera pastuchovii, Alnus subcordata, Lindelofia kandavanensis, Myosotis anomala, Buxus hyrcana, Campanula rapunculus* ssp. *lambertianus, Quercus castaneifolia* ssp. *castaneifolia, Parrotia persica, Scutellaria tournefortii, Teucrium hyrcanicum, Ruscus hyrcanus, Scilla hohenackeri, Gleditsia caspica, Epimedium pinnatum, Primula heterochroma, Ranunculus dolosus, Rubus hyrcanus, Rubus persicus, Rhynchocorys maxima, Scrophularia megalantha, Veronica francipetae, Viola alba* ssp. *sintenisii* and *Symphyandra odontosepala.* The species that are confined to Euxino-Hyrcanian sub-province (ZOHARY 1973) are: *Dryopteris caucasica, Polystichum worronowi,*

Acer cappadocicum, Willemetia tuberosa, Alnus glutinosa ssp. *barbata, Cardamine tenera, Sedum spurium, Diospyrus lotus, Pterocarya fraxinifolia, Danea racemosa, Glyceria caspica, Cyclamen coum* ssp. *caucasicum, Veronica crista-galli and Solanum persicum.* The presence of these endemic taxa reveals special ecologic and biogeographic importance to the area.

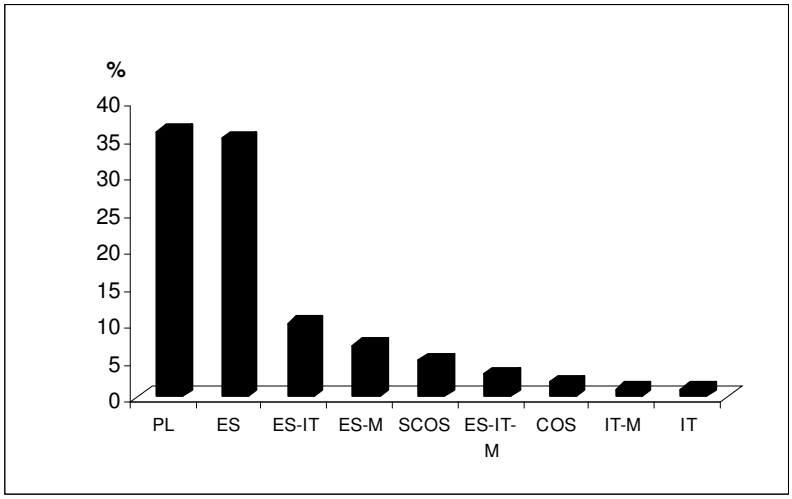

Fig. 5. Percent of phytochoria elements in the total sites [abbreviation according to Table 2]

Chorologically, in the total sites, the flora is much affected by Euro-Siberian and Pluriregional elements (totally 71%) (Fig. 5). This occurrence is due to three reasons. Firstly, a phytogeographical floristic link between our study sites (Hyrcanian district) and other areas in Euro-Siberian region. Secondly, humid or wet faces of most of these sites can be considered as habitats for the bulk of pluriregional plants adapted to wet places and thirdly, human activities responsible for the establishment of weeds.

Phytogeographical elements include Pl (36%), ES (35%), ES/IT (10%), ES/M (7%), SCOS (5%), ES/IT/M (3%), COS (2%), IT (1%) and IT/M (1%) (Fig. 5). Two peaks in phytochoria curves are recognizable, one in Euro-Siberian and another one in Pluriregional elements (Fig. 6). The detailed assessment of phytogeographical elements in each site demonstrates that some phytogeographical elements such as ES/IT, ES/IT/M, COS, ES/M, IT, IT/M and SCOS are relatively

constant in all sites, while ES and PL elements show more variation between the sites (Fig. 6). The highest presence of Euro-Siberian elements can be found in Kelarabad while the fewest one are in Langerud. Alternatively, Amirkelayeh show the lowest and Chaldarreh demonstrates the highest amount of pluriregional elements. It seems that Kelarabad forest has the highest correspondence with a common Euro-Siberian forest.

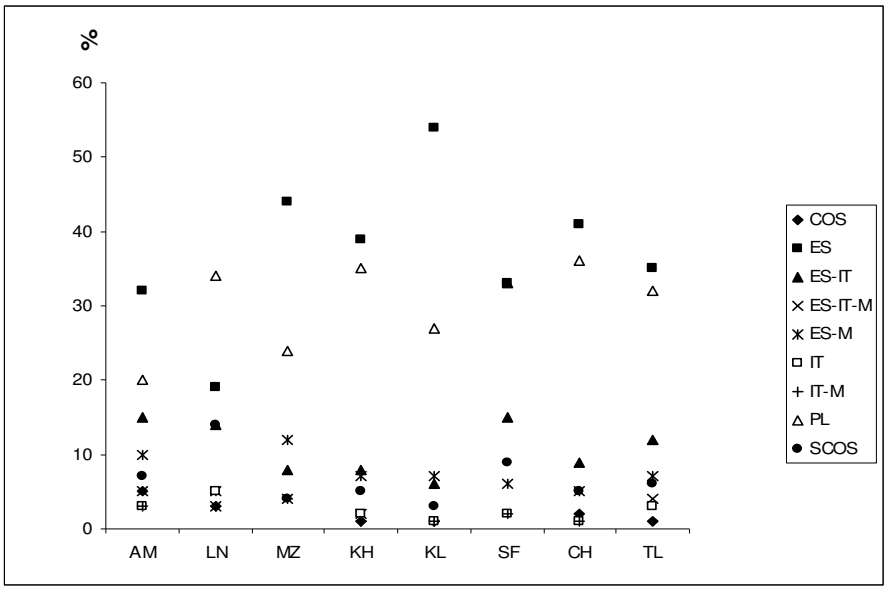

Fig. 6. Variation of each phytochoria over the sites [abbreviation according to Tables 1 & 2].

Occurrence or non-occurrence of 209 taxa is scored for the eight study sites. They include Amirkelayeh (40 taxa), Chaldarreh (112 taxa), Kelarabad (84 taxa), Khoshkehdaran (132 taxa), Langerud (38 taxa), Mazga (25 taxa), Safrabasteh (52 taxa) and Telecabin (70 taxa). Species number reflects differnces in altitude, area and biotope diversity of the sites. JACCARD's similarity coefficient varies from 11 % to 46 % (Fig. 7). The highest similarity is observed between Kh & Kl and the lowest index is calculated between Ln and Kl. It seems that, we are able to classify our sites into two main ecological groups with more floristic similarity in each of

them i.e. wet or humid sites (Langerud, Amirkelayeh, Mazga and Telecabin) and dryer ones (Khoshkehdaran, Kelarabad, Chaldarreh and Safrabasteh).

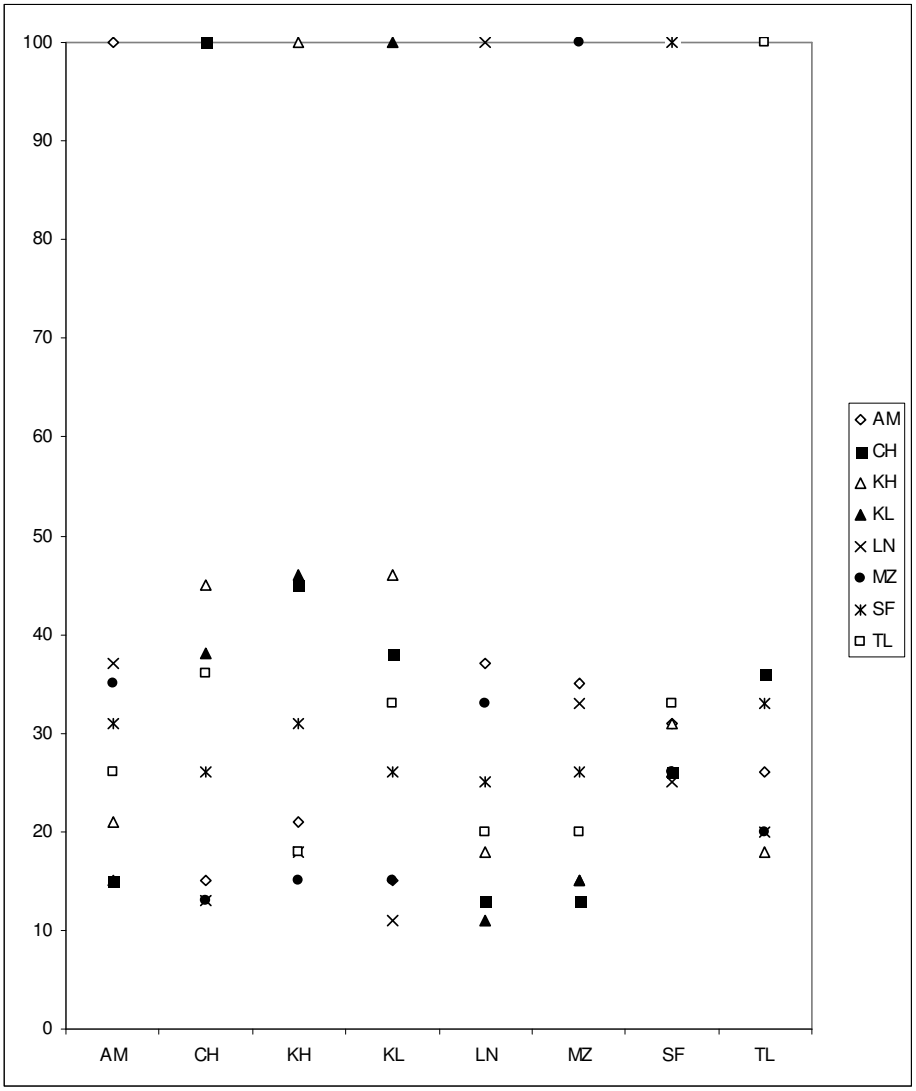

Fig. 7. Percent of similarity between study sites based on JACCARD's (1902) Similarity Index [abbreviation according to Tables 1 & 2].

Table 2. Floristic catalogue of studied lowland forests

Name of Taxa	Life Form	Chorology	Habitat	Locality	Herb. No. (TUH)
Pteridophyta					
Adiantaceae					
Adiantum capillus-veneris L.	GR	SCO	CF	Ch, Hz	30874
Aspidiaceae					
Dryopteris affinis (Lowe) Fraser-Jenkins	GR	ES	CF	Ch, Kh, Kl, Hz	30869
Dryopteris caucasica (A. Braun) Fraser-Jenkins & Corley	GR	ES (EH)	CF	Kl	30863
Dryopteris sp.	GR		CF	Kh	s.n.
Polystichum aculeatum (L.) Roth	GR	PL	CF	Kh	30872
Polystichum worrnowi Fom. *in* Mon.	GR	ES (EH)	CF	Ch, Kh, Kl	30851
Polystichum cf. brauni (Spenner) Fee	GR	ES	CF	Ch, Kh	30870
Polystichum sp.	GR		CF	Kh	s.n.
Aspleniaceae					
Asplenium adiantum-nigrum L.	GR	PL	CF	Ch, Kh, Ln, Kl	30857
Asplenium trichomanes L.	GR	PL	CF	Ch, Hz	30855
Phyllitis scolopendrium (L.) Newm.	GR	PL	CF	Ch, Kh, Kl	s.n.
Athyriaceae					
Athyrium filix-femina (L.) Roth.	GR	PL	CF	Ch, Kh, Kl, Ln, Mz	30881
Cystopteris fragilis (L.) Bernh.	GR	SCO	CF	Kh	s.n.
Matteuccia struthiopteris (L.) Tod.	GR	PL	CF	Ch, Kl, Mz	30890
Azollaceae					
Azolla filiculoides Lam.	Hyd (fl)	PL	HCF (HYD)	Ln	s.n.
Equisetaceae					
Equisetum arvense L. var. *alpestre* Wahlenb.	GR	PL	CF	Kl	30876
Equisetum ramosissimum Desf.	GR	PL	MCF	Ch	30879
Equisetum telmatia Ehrh.	GR	PL	CF	Ch, Kh, Kl, Tl	30877
Hypolepidaceae					
Pteridium aquilinum (L.) Kuhn *in* Kersten	GR	COS	MCF (HYG)	Ch	30885
Ophioglossaceae					
Ophioglossum vulgatum L.	GR	PL	CF	Kh, Kl	30889
Polypodiaceae					
Polypodium vulgare L.	GR	PL	CF	Ch, Kh, Kl, Mz, Sf, Tl	s.n.
Pteridaceae					
Pteris cretica L.	GR	PL	CF	Ch, Kh, Kl, Sf	30886
Pteris dentata Forsskahl ssp. *flabellata* (Forrsk.) Runem.	GR	PL (Africa) [HYR]	CF	Kh, Kl	30887
Salviniaceae					
Salvinia natans (L.) All.	Hyd (fl)	PL	HCF (HYD)	Ln	31529
Thelypteridaceae					
Thelypteris limbosperma (All.) Fuchs *in* Amer.	GR	PL	HCF (HEL)	Am, Kh, Ln, Mz, Sf	30862

Table 2. (contd.)

Spermatophyta					
Angiospermae - Dicotyledoneae					
Aceraceae					
Acer cappadocicum Gled.	Pha (pn)	ES (EH) [Pakistan]	CF	Ch	s.n.
Acer velutinum Boiss.	Pha (pg)	**EN**-(ES) (HYR)	CF	Ch, Kh, Kl, Tl	30606
Amaranthaceae					
Alternanthera sessilis (L.) R. Br.	Thr	PL (S. Asia)	HCF (HYG)	Ch, Kh, Sf	s.n.
Apiaceae					
Berula angustifolia (L.) Mertens & W.D. Koch	Hyd (em)	PL	HCF (HEL)	Am, Ch, Kh, Ln, Sf	30608
Hydrocotyle ranunculoides L.	Hyd (em)	PL	HCF (HEL)	Ln	s.n.
Hydrocotyle vulgaris L.	GR	ES	HCF (HYG)	Am, Ln, Mz, Sf	30604
Pimpinella affinis Ledeb.	Hem	ES (EH)-IT2	MCF	Ch, Hz	30602
Sanicula europaea L.	Hem	PL	CF	Kh	30771
Torilis arvensis (Huds.) Link	Thr	PL	MCF	Kh, Kl, Sf	30769
Aquifoliaceae					
***Ilex spinigera* (Loes.) Loes.	Pha (pp)	**EN**-(ES) (HYR)	CF	Ch, Kh, Kl	30607
Araliaceae					
**Hedera pastuchovii* Woron *ex* Grossh.	Pha (ps)	**EN**-(ES) (HYR)	CF	Kh, Kl, Mz, Sf, Tl	30662
Asclepiadaceae					
Asclepias cf. currasavica L.	GR	PL	CF	Sf	31431
Periploca graeca L.	Pha (ps)	ES (EH)-M	CF	Am, Kh, Sf	s.n.
Vincetoxicum scandens Sommier & Levier	Cha	ES (EH & SE Russia)	CF	Ch, Kl	30762
Asteraceae					
Artemisia annua L.	Thr	ES-M-IT2, 3	MCF	Tl	s.n.
Bidens biternate (Loureiro) Merrill & Scherff	Thr	PL	MCF	Tl	31400
Bidens tripartita L.	Thr	PL	HCF (HYG)	Ch, Kh, Sf, Tl	31408
Carpesium abrotanoides L.	Hem	PL (ES, SW Asia)	CF	Ch, Kh, Sf, Tl	31402
Cirsium vulgare (Savi) Ten.	Hem	ES-IT [N. Africa]	CF	Sf	30897
Conyza bonariensis (L.) Cronq.	Thr	SCO	CF-MCF	Am, Ch, Hz, Kh, Kl, Ln, Mz, Sf, Tl	30893
Eclipta prostrata (L.) L.	Thr	PL (Asia)	HCF (HYG)	Kh, Ln	31409
Myriactis wallichi DC.	Thr	ES (HYR)-IT3, 4	CF	Ch, Hz	30898
Sigesbeckia orientalis L.	Thr	PL (warm regions)	CF-MCF	Ch, Hz	31405
Sonchus oleraceus L.	Thr	COS	MCF	Am	31563
Willemetia tuberosa Fisch. & C.A. Mey. *ex* Dc.	Hem	ES (EH)	MCF	Kl	30896
Xanthium sp.	Thr		CF	Kh	s.n.
Betulaceae					
Alnus glutinosa (L.) Gaertn. subsp. *barbata* (C.A. Mey) Yaltrik	Pha (pg)	ES (EH)	CF	Am, Ch, Kh, Kl, Mz, Sf, Tl	31525
**Alnus subcordata* C.A. Mey.	Pha (pg)	**EN**- (ES) (HYR)	CF	Ch, Kh, Kl, Sf	s.n.
Boraginaceae					
**Lindelofia kandavanensis* Bornm. & Gauba	Hem	**EN**-(ES) (HYR)	CF	Kh, Kl, Sf	31508
**Myosotis anomala* Riedl.	Hem	**EN**-(ES) (HYR)	CF	Kh	31510
Myosotis caespitosa Schultz, Syn.: *M. scorpioides* L. subsp. *caespitosa* (Schultz) Hermann	Hem	PL	CF	TL	30785

Table 2. (contd.)

Brassicaceae					
Alliaria petiolata (M.B.) Cavara & Grande	Hem	PL (temperate Eurasia & N. Africa)	CF-MCF	Kh, Kl, Tl	30803
Cardamine flexousa With. (Naqinezhad *et al*. 2005)	Thr	PL	HCF(HYG)	Kh, Tl	30807
Cardamine hirsuta L.	Thr	COS	HCF (HYG)	Am, Ch, Kh, Kl, Tl	30799
Cardamine impatiens L.	Thr	PL	CF	Ch, Kh, Kl	30800
Cardamine parviflora L.	Thr	PL (Europe & Asia)	CF	Sf, Tl	30796
Cardamine tenera Gmel. Jun. *in* C.A. Mey.	Hem	ES (EH)	HCF (HYG)	Kh, Kl, Tl	30804
Nasturtium microphyllum Boenn. *ex* Reichenb	Hem	PL (Europaea & Asia)	MCF-HCF (HYG)	Kh	30835
Nasturtium officinale R. Br.	Hem	PL (Europaea & temperate Asia)	MCF-HCF (HYG)	Ch, Kh, Tl	30830
Buxaceae					
**Buxus hyrcana* Pojark.	Pha (pp)	**EN**-(ES) (HYR) [Tur]	CF	Kh, Kl	s.n.
Callitrichaceae					
Callitriche brutia Petagna	Hyd (su)	ES [N Africa]	HCF (HYD)	Kh, Kl, Sf	30614
Campanulaceae					
**Symphyandra odontosepala* (Boiss.) Esfand. (Esfandiari 1980)	Hem	**EN**-(ES) (HYR)	CF	Ch, Hz, Kh, Kl	30611
**Campanula rapunculus* L. subsp.*lambertianus* (Dc.) Rech. f.	Hem	**EN**-(ES) (Hyr) [Transcaucasica]	MCF	Ch	30610
Cannabaceae					
Humulus lupulus L.	Thr	PL	CF	Am	30609
Caprifoliaceae					
Lonicera sp.	Pha (ps)		CF-introduced	Kh, Kl	30793
Sambucus ebulus L.	GR	ES-IT [N. Africa]	MCF-CF	Am, Kh, Kl, Ln, Sf, Tl	s.n.
Caryophyllaceae					
Cerastium glomeratum Thull.	Thr	SCO	CF	Ch, Kh	30767
Stellaria media (L.) Vill.	Thr	SCO	CF	Ch, Kh, Kl, Ln, Sf, Tl	30680
Convolvulaceae					
Calystegia silvestris (Willd.) Roem. *et* Schult.	GR	ES [NE Africa]	MCF-CF	Am, Ch, Kh, Kl, Tl	30812
Cornaceae					
Cornus australis C.A. Mey.	Pha (pp)	ES-IT1,2	CF	Kh, Tl	30759
Corylaceae					
Carpinus betulus L. var. *betulus*	Pha (pg)	ES	CF	Ch, Kh, Kl, Tl	31520
Crassulaceae					
Sedum spurium M.B.	Hem	ES (EH)	CF	Ch	30856
Ebenaceae					
Diospyrus lotus L.	Pha (pp)	ES (EH) [disjuncted in Himalaya]	CF	Ch, Kl, Tl	s.n.
Euphorbiaceae					
Acalypha australis L.	Thr	PL (Jap. Ch., America)	CF	Ch, Kh, Tl	30627
Euphorbia amygdaloides L.	Cha	ES [Algeria]	CF	Ch, Kh, Kl	30632
Euphurbia peplus L.	Thr	ES-M	MCF	Kh, Kl	30626
Mercurialis perennis L.	GR	ES [N. Africa]	CF	Kl	30633
Fagaceae					
**Quercus castaneifolia* C.A. Mey. subsp. *castaneifolia*	Pha (pg)	**EN**-(ES) (HYR)	CF	Tl, Kl	s.n.
Geraniaceae					
Geranium dissectum L.	Thr	PL	MCF	Kl	30619

Table 2. (contd.)

Geranium purpureum Vill.	Thr	ES-M	MCF	Kl	30617
Geranium robertianum L.	Thr	SCOS	MCF	Ch	30618
Hamamelidaceae					
**Parrotia persica* (DC.) C.A. Mey	Pha (pm)	**EN**-(ES) (HYR)	CF	Kh, Kl	s.n.
Hypericaceae					
Hypericum tetrapterum Fries	Hem	ES-M (E) [Iraq]	CF	Ch, Kl, Tl	30773
Hypericum androsaemum L.	Cha	ES [N. Syria, Tur-Ammanus]	CF	Ch	30775
Juglandaceae					
Pterocarya fraxinifolia (Poir.) Spach	Pha (pg)	ES (EH)	CF	Ch, Kh, Kl, Sf	30656
Lamiaceae					
Clinopodium umbrosum (M.B.) C. Koch	Hem	ES (HYR)-IT2, 4 [Assam & Burma]	CF	Ch, Hz, Sf	30640
Lamium album L.	GR	PL	CF	Ch, Hz, Kh, Kl	30634
Lycopus europaeus L.	Hem	PL	HCF (HYG)	Am, Ch, Hz, Kh, Ln, Mz, Sf, Tl	30637
Mentha aquatica L.	GR	ES	HCF (HYG)	Am, Ch, Hz, Kh, Kl, Mz, Sf, Tl	30642
Prunella vulgaris L.	GR	PL	CF	Ch	30644
Salvia glutinosa L.	Hem	ES	CF	Ch, Hz	30635
**Scutellaria tournefortii* Benth.	GR	**EN**-(ES) (HYR)	CF	Ch, Hz, Kh	30639
**Teucrium hyrcanicum* L.	GR	**EN**-(ES) (HYR)	CF	Ch	30638
Loranthaceae					
Viscum album L.	Pha(Epi)	PL	CF (Epiphyte, Parasite)	Kl	30679
Lythraceae					
Lythrum salicaria L.	Hem	PL	HCF (HYG)	Am, Ch, Kh, Hz, Ln, Mz, Tl	30683
Mimosaceae					
**Gleditsia caspica* Desf.	Pha (pm)	**EN**-(ES) (HYR) [Tur]	CF	Ch, Kh, Kl, Sf, Tl	s.n.
Moraceae					
Ficus carica L.	Pha (pp)	IT2, 3-M [ES (EH)]	CF	Am, Ch, Kh, Kl, Ln, Mz, Sf	30672
Morus alba L.	Pha (pp)	IT2, 3 [HYR]	CF	Ch, Kh, Ln, Sf, Tl	30670
Onagraceae					
Circaea lutetiana L. subsp. *lutetiana*	GR	PL (ES-W. Asia & N. Africa)	CF	Ch, Kh, Kl, Tl	30668
Ludwigia palustria (L.) Elliott	Thr	PL	HCF (HYG)	Kh, Tl	30665
Oxalidaceae					
Oxalis corniculata L.	Thr	PL	MCF	Ch, Kh, Sf, Tl	31446
Papaveraceae					
Chelidonium majus L.	Hem	PL	MCF	Ch	31444
Papilionaceae					
Trifolium campestre Schreb. *in* Sturm	Thr	ES-IT-M	MCF	Tl	30622
Vicia tetrasperma (L.) Schreb.	Thr	ES-IT [NW Africa]	CF	Kh	30624
Phytolacaceae					
Phytolacca americana L.	Hem	SCOS (originated from N. America)	MCF-CF	Am, Ln, Sf, Tl	31535
Plantaginaceae					
Plantago maior L.	Hem	PL	MCF	Ch, Kh, Tl	31443
Podophyllaceae					

Table 2. (contd.)

**Epimedium pinnatum* Fisch.	GR	**EN**-(ES) (HYR)	CF	Ch	31507
Polygonaceae					
Polygonum cf. barbatum L.	GR	PL	HCF (HYG)	Am, Kh, Ln	31496
Polygonum hydropiper L. subsp. *hydropiper*	Thr	ES-IT	HCF	Am, Ch, Hz, Kh, Tl, Sf, Ln, Mz	31499
Polygonum persicaria L.	Thr	PL	MCF	Hz, Ln, Tl	31505
Rumex conglomeratus Murr.	Hem	ES-IT	CF	Am	31547
Rumex sanguineus L.	Hem	ES	CF	Am, Ch, Kh, Kl, Mz, Tl, Sf	30758
Primulaceae					
Cyclamen coum Miller subsp. *caucasicum* (K. Koch) O. Schwarz	GC	ES (EH)	CF	Ch, Kl	s.n.
**Primula heterochroma* Stapf	Hem	**EN**-(ES) (HYR) [Iran, Semnan]	CF	Ch, Kh	30826
Samolus valerandi L.	Hem	PL	MCF (HYG)	Ch, Kh	30829
Punicaceae					
Punica granatum L.	Pha (pp)	PL	MCF	Kh	30825
Ranunculaceae					
Batrachium trichophyllum (Chaix) Bosch	Hyd (su)	SCOS	HCF (HYD)	Kh, Sf	30821
Ranunculus ophioglossifolius Vill.	Thr	ES-M	HCF (HYG)	Kh, Tl	30820
**Ranunculus dolosus* Fisch. & C.A. Mey.	Thr	**EN**-(ES) (HYR)	HCF (HYG)	Ch, Kh, Kl, Tl	30816
Ranunculus lingua L.	Hyd (em)	ES [IT3], rare in M regions	HCF (HEL)	Am	31521
Ranunculus marginatus d'Urv. var. *trachycarpus* (Fisch.& C.A. Mey.) Aznavour	Thr	ES (S)-M [Afghanistan]	MCF	Kh	30819
Ranunculus repens L.	GR	PL	HCF (HYG)	Ch, Kh	30755
Rhamnaceae					
Frangula alnus Miller	Pha (pn)	ES [NW Africa, IT3]	CF	Ln, Mz	31532
Paliurus spina-christi Miller	Pha (pp)	ES-IT2, 3-M	MCF	Kh	31448
Rosaceae					
Crataegus microphylla C. Koch	Pha (pp)	ES (EH)	CF	Kh, Kl, Ch, Tl	30693
Crataegus pentagyna Waldst. & Kit. *ex* Wild.= Syn.: *C. melanocarpa* M.B. subsp. *elbursensis* (Rech. f.) Riedl	Pha (pp)	ES	CF	Kh	30689
Geum urbanum L.	Hem	ES [IT2, 3 + N. Africa]	CF	Am, Ch, Kh, Kl, Tl	30692
Laurocerasus officinalis Roemer	Pha (pp)	ES	HCF (HYG)	Mz	s.n.
Mespilus germanica L.	Pha (pp)	ES [Tur]	MCF	Ch, Mz, Kh, Kl	30690
Potentilla reptans L.	Hem	ES-IT2 [N. Africa]	CF	Ch, Kh, Sf, Tl	s.n.
Prunus divaricata Ledeb.	Pha (pp)	ES (E)-IT2,3	CF	Am, Ch, Ln, Kh, Kl, Sf, Tl	30691
Rosa sp.	Pha (pp)		CF	Kh	30688
Rubus caesius L.	Pha (ps)	ES-IT	CF	Am, Ch, Kh, Kl, Ln, Mz, Tl, Sf	30708
Rubus cf. karakalensis Freyn	Pha (ps)	ES-IT	CF	Am	s.n.
Rubus discolor Weihe & Nees	Pha (ps)	ES [Libanon]	CF	Ch, Tl	30723

Table 2. (contd.)

**Rosaceae* *Rubus hyrcanus* Juz.	Pha (ps)	**EN**- (ES) (HYR)	CF	Ch, Kh, Kl, Mz, Sf, Tl	30727
**Rubus persicus* Boiss.	Pha (ps)	**EN**-(ES) (HYR)	CF	Am, Ch, Kh, Kl	30719
Rubus sanctus Willd.	Pha (ps)	IT2, 3, 4 [EH-Balkan peninsula]	CF	Am, Kh, Kl, Ln, Tl	30718
Sanguisorba minor Scop.	Hem	ES-M	CF	Kh	s.n.
Rubiaceae					
Galium elongatum C. Presl	GR	ES	HCF (HEL)	Am, Ln, Kh, Sf	31551
Salicaceae					
Populus caspica Bornm.	Pha (pg)	ES (EH)-IT2,3	CF	Sf	s.n.
Salix sp.	Pha (pp)		HCF (HYG)	Ln	s.n.
Scrophulariaceae					
**Rhynchocorys maxima* C. Richter	Hem	**EN**-(ES) (HYR)	MCF	Kh	31513
**Scrophularia megalantha* Rech. f.	GR	**EN**-(ES) (HYR)	CF (on rockc)	Ch, Kh	30760
Veronica anagallis-aquatica L.	Hyd (em)	PL	HCF (HEL)	Kh, Kl, Tl	31511
Veronica beccabunga L. subsp. *abscondita* M.A. Fischer	Hyd (em)	ES (EH)-M	HCF (HEL)	Ch	s.n
Veronica crista-galli Stev.	Thr	ES (EH)	CF	Kh, Kl	30787
**Veronica francipetae* M.A. Fischer	Thr	**EN**-(ES) (HYR)	CF	Ch, Kh, Kl, Tl	30788
Veronica sp.	Thr		HCF (HYG)	Tl	31519
Simarobiaceae					
Ailantus altissima (Mill.) Swingle	Pha (pg)	PL (E. Asia)	MCF (introduced)	Kh	s.n.
Solanaceae					
Physalis alkekengi L.	GR	ES-IT3, 4	CF-MCF	Kh	30749
Solanum dulcamara L. Syn.: *S. persicum* Willd. *ex* Roemer & Schultes subsp. *pseudopersicum* (Pojark.) Schonbeck-Temesy	Pha (ps)	ES	HCF (HEL)	Am, Kh, Ln, Mz, Sf, Tl	30756
Solanum nigrum L.	Thr	SCOS	MCF-CF	Am, Ch, Hz, Kh, Ln, Sf, Tl	30750
Solanum persicum Willd. *ex* Roemer & Schultes Syn.: *S. persicum* Willd. *ex* Roemer & Schultes subsp. *persicum*	Pha (ps)	ES (EH) [IT]	MCF-CF	Am	34146
Tiliaceae					
Tilia platyphyllos Scop.	Pha (pn)	ES	CF	Kh	s.n.
Ulmaceae					
Celtis cf. australis L.	Pha (pn)	ES [W. Afghanistan]	CF	Kh, Kl, Ln	30735
Ulmus glabra Hudson	Pha (pp)	ES	CF	Kh, Tl	30736
Ulmus minor Miller	Pha (pp)	ES [IT2-N. Africa]	CF	Am, Ch, Kh, Sf, Tl	30737
Urticaceae					
Parietaria officinalis L.	Hem	ES	CF	Ch, Kh, Kl, Tl	30743
Urtica dioica L. subsp. *dioica*	Hem	PL	MCF	Kh, Kl, Sf	30745
Verbenaceae					
Phyla nodiflora (L.) Greene	GR	PL	HCF (HYG)-MCF	Sf	s.n.
Violaceae					
Viola sieheana W. Becker	GR	ES [Cyprus]	CF	Ch, Kl, Kh, Sf, Tl	30776
**Viola alba* Bess. subsp. *Sintenisii* (W. Becker) W. Becker	Hem	**EN**-(HYR) [Tur-Uzbek]	CF	Ch, Kl, Kh, Tl	30778

Table 2. (contd.)

Angiospermae-Monocotyledoneae					
Araceae					
Arum maculeatum L.	GR	ES	CF	Ch, Kh, Kl	30663
Cyperaceae					
Carex acutiformis Ehrh.	GR	PL	HCF (HEL)	Ch,Tl	30849
Carex divulsa Stokes *in* Withering	GR	ES-IT2, 3 [N. Africa]	CF	Ch, Kh, Tl	30844
Carex pallescens L.	Hem	PL	CF	Ch	30848
Carex pendula Huds.	GR	ES-M	HCF	Kl	31425
Carex remota L. subsp. *remota*	GR	ES-M	HCF	Am, Ch, Sf, Kh, Kl, Mz, Tl	31432
Carex riparia Curtis	Hyd (em)	ES-IT2, 3-M	HCF (HEL)	Am, Kh, Ln, Mz, Tl	30846
Carex sp.	GR		CF	Ch	31413
Carex strigosa Huds.	GR	ES	CF	Ch, Kh, Kl, Ln, Sf, Tl	31426
Carex sylvatica Huds.	GR	ES [N. Africa, disjunct local in Altai Mts.]	CF	Ch, Kh, Kl, Sf, Tl	31412
Cladium mariscus (L.) Pohl subsp. *mariscus*	Hyd (em)	ES-IT2, 3-M [Saudi Arabia]	HCF (HEL)	Am	s.n.
Dioscoreaceae					
Tamus communis L.	GC	ES-M [IT2]	CF	Ch, Kh	30621
Hydrocharitaceae					
Hydrocharis morsus-ranae L.	Hyd (fl)	ES-IT [NW Africa]	HCF (HYD)	Ln	31530
Iridaceae					
Iris pseudacorus L.	Hyd (em)	ES-M	HCF (HEL)	Am, Kh, Ln, Mz, Tl	30620
Juncaceae					
Juncus effusus L.	GR	PL	HCF (HYG)	Ch, Tl	30781
Lemnaceae					
Lemna minor L.	Hyd (fl)	PL	HCF (HYD)	Hz, Ln	30651
Lemna trisulca L.	Hyd (su)	COS	HCF (HYD)	Ln	s.n.
Spirodela polyrhiza (L.) Schleiden	Hyd (fl)	SCOS	HCF (HYD)	Ln	31526
Liliaceae					
Danae racemosa (L.) Moench	Pha (pn)	**ES** (EH) [Syria]	CF	Ch, Kh	30675
Ornithogalum sp.	GB		CF	Kl	30677
**Ruscus hyrcanus* Woron.	Pha (pn)	**EN**-(ES) (HYR)	CF	Ch, Kh, Kl	s.n.
**Scilla hohenackeri* Fisch. & C.A. Mey. *in* Hohen.	GB	**EN**-(ES) (HYR)	CF	Kl	30678
Smilax excelsa L.	Pha (ps)	ES-M	CF-HCF	Am, Ch, Kh, Kl, Ln, Mz, Sf, Tl	30676
Orchidaceae					
Listera ovata (L.) R. Br.	GR	PL	CF	Kh	31445
Poaceae					
Brachypodium sylvaticum (Hudson) P. Beauv.	GR	ES-IT	CF	Ch	31483
Echinochloa cruss-galli (L.) P. Beauv. var. *submutica* Neilr.	Thr	PL	MCF	Ch, Kh	31473
Echinochloa cruss-galli (L.) P. Beauv. var. *cruss-galli*	Thr	PL	MCF	Am	31472
Glyceria caspica Trin.	GR	ES (EH)	HCF (HEL)	Ch	30838
Microstegium vimineum (Trin.) A. Camus	Thr	PL (Indochinese-Malesian) [N. Iran]	CF	Am, Ch, Hz, Kh, Kl, Sf, Tl	31475

Table 2. (contd.)

Milium vernale M.B.	Thr	ES-IT2, 3	CF	Kh, Kl, Ch	30839
Oplismenus undulatifolius (Ard.) P. Beauv.	GR	PL	CF	Ch, Hz, Kh, Kl, Sf, Tl	31484
Paspalum dilatatum Poir.	GR	PL	MCF	Hz	31454
Paspalum paspaloides (Michx.) Scribner	GR	PL (tropic & subtropic regions)	MCF	Hz, Tl	31453
Phragmites australis (Cav.) R Trin. *ex* Steud.	Hyd (em)	PL	HCF (HEL)	Am	s.n.
Poa trivialis L.	GR	PL	HCF (HYG)	Ch, Kh, Kl, Sf, Tl	30841
Poa annua L.	Thr	PL	MCF	Ch, Kh	31463-31467
Poa nemoralis L.	Thr	ES-IT2, 3, 4	CF	Kh, Kl, Tl	31480
Polypogon semiverticillatus (Forssk.) Hyl.	Thr	PL	CF	Ch	30840
Potamogetonaceae					
Potamogeton crispus L.	Hyd (su)	PL	HCF (HYD)	Kh	31489
Potamogeton lucens L.	Hyd (su)	PL	HCF (HYD)	Kh	31488
Sparganiaceae					
Sparganium neglectum Beeby	Hyd (em)	ES [N. Africa]	MCF-HCF (HEL)	Am, Kh, Ln, Mz	30754

Symbols and abbreviations used in the floristic catalogue:

1. Site names
Am= Amirkelayeh, Cha=Chaldarreh, Kh= Khoshkehdaran, Kl=Kelarabad, Ln= Langerud, Mz= Mazga, Sf= Safrabasteh, Tl= Telecabin (detailed addresses have been presented in Table 1).

2. Life forms
Cha= Chamaephyte, Geo= Geophyte [GB (bulbose geophyte), GC (corm geophyte), GR (rhizomatose geophyte)], Hem= Hemicryptophyte, Hyd= Hydrophyte [em= emergent, fl= floating, su= submerged], Pha= Phanerophyte [pg= megaphanerophyte, pm=mesophanerophyte, pp= microphanerophyte, pn= nano-phanerophyte, ps= climbing phanerophytes], Thr= Therophyte.

3. Chorological types
COS= Cosmopolitan, ES= Euro-Sibirian (EH= Euxino-Hyrcanian, Hyr= Hyrcanian, En= endemic), IT= Irano-Turanian ($IT_{1,2,3,4}$= classifiacation of Irano-Turanian according to LÉONARD (1988) M= Mediteranian, PL= Pluriregional, SCOS= Subcosmopolitan.
[]= transgressive into other areas or demonstrative of disjuncted phytogeographical area.

4. Habitat and Ecology
CF= closed forest, HCF= Humid closed forest, HEL= Helophyte, HYG= Hygrophyte, MCF= Margin of closed forest.

5. Notes
s.n.: Plants without herbarium number
$*$ = Endemic plants of Hyrcanian
TUH= Central Herbarium of Tehran University

Threatening notes

Among the Caspian forests, the lowland forest zone is the one to which serious attention must be paid. Today, there remain only a few fragments of these forests in the plains of Gilan, Mazandaran and Golestan Provinces. One of these forests surveyed in this study is in Khoshkehdaran Natural National Monument, one of four categories of conservation in Iran. Khoshkehdaran forest show the highest dominance of *Alnus glutinosa* ssp. *barbata* and probably the best representative of a lowland alder forest in northern Iran or even in the Euxino-Hyrcanian province. This forest faces some critical problems. Rice fields and human settlements in the east, south and west make a destroying pressure on the forest. On the other hand, the availability of the forest for a lot of domestic livestocks is easy. They produce a remarkable disturbance especially in south of the forest. It is, therefore, suggested that, this forest must be more isolated with the possession of neighboring lands by the Department of Environment.

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