

AN INTRODUCTION TO THE FOREST ASSOCIATIONS OF ELIKA ECOTON AREA, N. IRAN

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Abstract

Eco-phytosociological method with emphasis on physiognomic-floristic-ecologic criteria have been employed to study the vegetation of Elika ecoton area. The establishment places of releves were determined at random in each determined endogenic milieus. The concerned floristic-ecologic data of each releve was entered in the forms related to releves, using Braun-Blanquet's Composition Coefficients A-D and S. The data analysis was performed by using Anaphyto Software in F.C.A. and A.H.C. methods. The following four formations were specified: (1) Linear arborescent formation in the river margin (class *Salicetea*) with *Salicetum aegyptiacae* association; (2) Forest formation that includes two classes which consist of class *Quercetea* with associations *Aceretum cappadocicii*, *Quercus petraeae* ssp. *ibericae*-*Carpinetum betulii*, *Pyro mazanderanicae*-*Carpinetum orientalis*, *Pruno spinosae*-*Crataeginetum meyeri*, *Ulmum minoris*, and sub association *Ulmum minoris*-*Hippophaetosum rhamnoidis*, and class *Quercetea macrantherae* with association *Quercetum macrantherae*; (3) Calciphilous scrub formation (class *Ephedreteae*) with *Rhamno pallasii*-*Ephedretum majoris* association; (4) Orophilous and coniferous wood formation (class *Juniperetea*) with *Juniperetum communis* ssp. *hemisphaericae* association, and *Aceretum monspessulanii* ssp. *ibericii* sub association. The phytosociological table was prepared and the ecological factors of syntaxa were presented.

Introduction

During studies on the phytogeography of forest N. Iran (Bobek, 1951), geobotany of Iran (Zohary, 1963, 1973), Bioclimate of Iran (Sabeti, 1969), vegetation map of Iran (Mobayen & Tregubov, 1970), forests of Gorgan (Dorostkar & Noirfalise, 1976), vegetation of East of Hyrcanian Province (Frey, 1980), forest associations of Hyrcanian Province (Rastin, 1980), forest associations of Assalem (Assadollahi, 1980), forest associations of N. Iran (Mossadegh, 1981), forest ecosystems of Iran (Assadollahi *et al.*, 1982), communities of Kheiroodkenar (Assadi, 1985), classification of vegetation of Iran (Frey & Probst, 1986), associations of Central Alborz (Klein, 1994), associations of Lessakuti forests (Hamzee, 1994), phytogeography of Hyrcanian Province (Shahsavari, 1997) and floristic study of Golestan National Park (Akhani, 1998), the floristic and phytosociologic data on such communities have been described. In the present study ecophytosociological method with emphasis on physiognomic floristic ecologic criteria have been employed to study the vegetation of Elika Ecoton Area of N. Iran.

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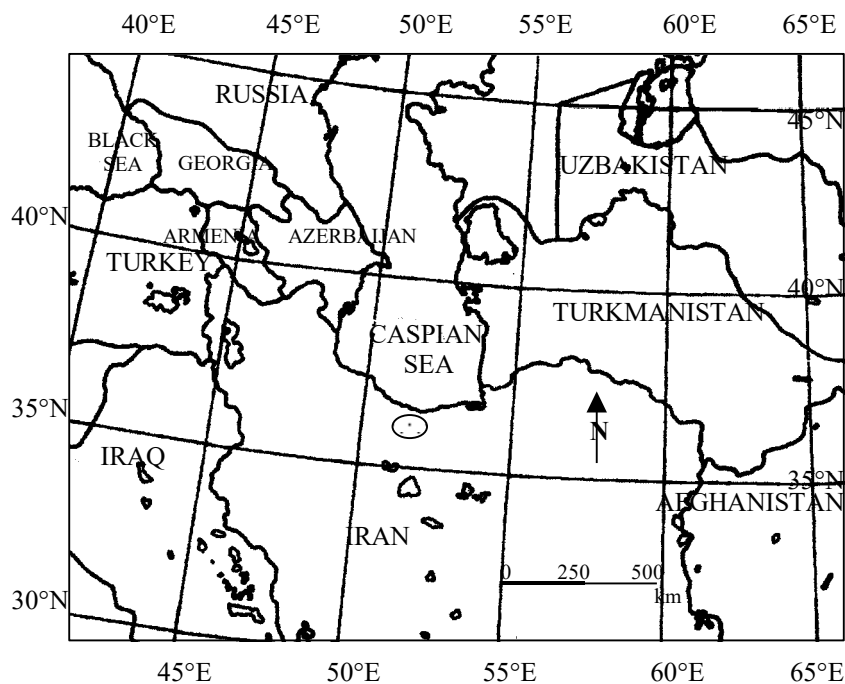


Fig. 1. Situation and map of N. Iran with the study area.
The study area is shown by .

The study area

The ecoton area is situated in the middle of Irano Turanian and Euro Siberian Regions, in the Central Alborz Mountain Chains, between 36°, 9', 20" to 36°, 16', 35" northern latitudes and 51°, 18' to 51°, 23' eastern longitudes (Fig. 1). The lowest altitude from sea level is 1860 meters and the highest is 3935 m. The average annual rainfall is 572.02 mm. The highest amount of rainfall is observed in autumn, winter and spring seasons and summer has the lowest rainfall (Fig. 2). The average day time temperature is 11.2°C. The maximum day time temperature in August is 25.7°C and the minimum temperature in February is -7°C (Anon., 1975-2002). According to the Emberger Climatographical Method, the area has cold sub-humid climate. About 79% of the geological structure of the region belongs to Jurassic Period which is related to Shemshak Formation and the other formations of the region belong to Terrias, Permian and Carboniferous Periods. Shale, sandstone, siltstone, limestone, claystone, quartzite, conglomerate, coal seams and lenses are of the most important formations of the region (Anon., 1991).

Methods

The delimitation map was prepared by using satellite and aerial photos as well as topographical and geological maps. Then necessary corrections were made by referring to the region and the base map was drawn accordingly.

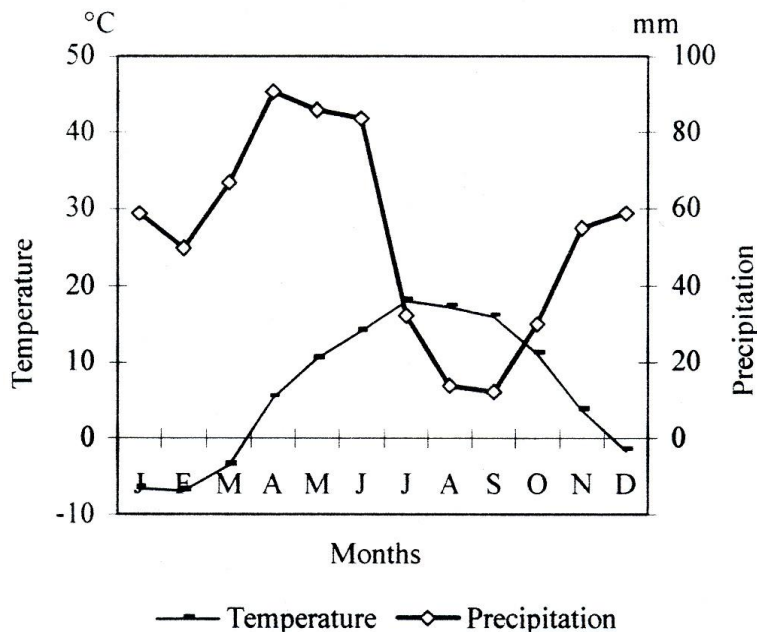
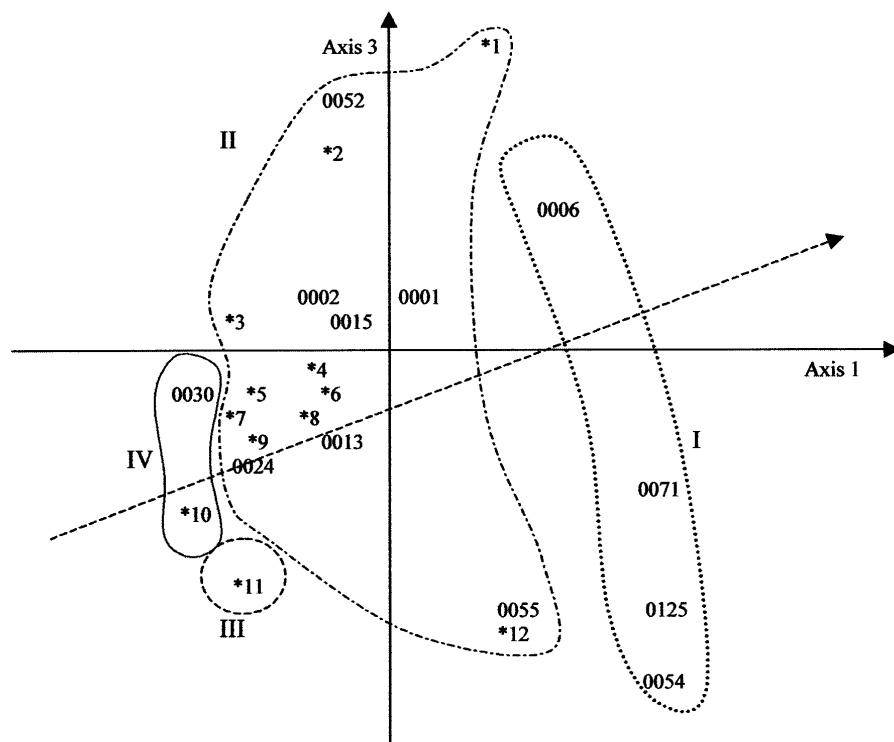


Fig. 2. The ombro-thermic diagram of polour meteorological station.

To determine the place of the relevés establishment, the eco-phytosociological method was used with emphasis on physiognomic-floristic-ecologic criteria [Atri 1996]. In this method, by employing physiognomic criterion, the existing formations (principal and secondary formations) were specified. The homogenic areas were determined and were specified as association individuals by employing the floristic composition in each formation. Then, by using ecological criterion in each association individuals, based on observing any changes in one or more ecological factors, the existing endogenic milieu(s) (Atri 1996) a vegetation surface with floristic-ecologic homogeneity could be determined, and their ranges were specified at the base map. The relevés were established at random in each determined endogenic milieus. To determine the minimal area of each releve, by using the Area-Species Method on the basis of area-species curve and Cain Method were applied (Cain 1959).

The necessary floristic-ecologic information and data (including plant species, texture class, percentage of organic material, pH, EC, moisture, percentage of lime of soil, altitude, exposition and slope degree) by Braun-Blanquet's Composition Coefficients (A-D and S [Mueller-Dombois & Ellenberg 1974]), were collected for each relevés and written in the related forms. In the next stage, the species and samples of soil were identified and duly studied so that they would be prepared to be analyzed by computer software after labeling and coding of the relevés.

The data analysis was performed by Aanaphyto Software (Briane, 1995) in both F.C.A. and A.H.C., methods. In the F.C.A. method, the relevés were estimated and grouped together and at the same time based on the species available in them and the species in turn grouped on the relevés basis. The results obtained by F.C.A. were grouped by employing C.A.H. method. The results obtained by data analysis in F.C.A. method,



*1: 0133-0161-0162-0033; *2: 0051-0079; *3: 0053-0034; *4: 0014-0016; *5: 0003-0027; *6: 0018-0132; *7: 0131-0118; *8: 0119-0120-0165-0035-0122-0123-0127-0124-0126-0129-0130-0163-0164; *9: 0121-0026; *10: 0147-0029-0146-0025-0028; *11: 0128-0138; *12: 0050-0135

Fig. 3. Relevés ordination based on F.C.A. (axes 1-3)

were presented on the multiplex coordinate axes in various compositions, such as (1, 2), (1, 3), (1, 4), (3, 4)... axes. The study and comparison of the results on the multiplex coordinates, as obtained in F.C.A. and C.A.H. methods, made it possible to group the relevés and making phytosociologic determination. The names of the syntaxa were corresponded with the codes of phytosociological nomenclature (Barkman *et al.*, 1976) as well as other sources.

The ecological factors of each syntaxa were specified and presented, accordingly. Also, the chorotypes of each species were determined on the basis of methods presented by Zohary (1963 & 1973) and Takhtajan (1986), and the chorotypes percentage of the area were specified.

Results

A study and comparison of the multiplex coordinate axes resulted from F.C.A. and C.A.H., led to identification of vegetation formations of the study area as well as preparing the phytosociological table and identification of existing syntaxa and related ecological factors.

1. The vegetation formations of the study area: The results obtained from F.C.A. method were studied and four formations were specified in the study area, viz., (I) Linear arborescent formation in the river margin, (II) Forest formation, (III) Calciphilous scrub formation and (IV) Orophilous and coniferous wood formation (Fig. 3). Similarly, four species and releve clusters have been distinguished in the dendrograms obtained with C.A.H. method (Fig. 4).

2. The syntaxa of the study area: The phytosociological table was prepared in three stages; raw, processed and final (presentation), leading to identification of following syntaxa.

Class *Salicetea*

This class has *Salicetalia excelsae* order, *Salicion albae* alliance and *Salicetum aegyptiacae* association in the study area (Table 2). The characteristic species of this association are *Salix aegyptiaca* L., *Salix excelsa* S. G. Gmelin., *Populus nigra* L., ssp. *caudina* (Ten.) Bug., *Epilobium dodonaei* Vill., *Rorippa sylvestris* (L.) Besser and *Glyceria plicata* Fries (Table 1). This hydrophilic association is settled in the river margins of the area in linear form.

Class *Quercetea*

There are three orders in this class:

Order *Quercetalia*: This order has *Acerion cappadocicii* and *Ulmion minoris* alliances. *Acerion cappadocicii* alliance including *Aceretum cappadocicii* association in the study area (Table 2). The characteristic species of this association are *Acer cappadocicum* Gled., *Poa masenderana* Freyn. & Sint., *Libanotis transcaucasica* Schischk., *Vincetoxicum scandens* Sommier & Levier, *Cystopteris fragilis* (L.) Bernh (Table 1). This hygrophilic association is located in the low altitude and in the northern exposition of the area (Table 2). *Ulmion minoris* alliance includes *Ulmietum minoris* association (Table 2). The characteristic species of this association is *Ulmus minor* Miller (Table 1). This association is located between linear arborescent formation in the river margin and range formation. This association including *Hippophaetosum rhamnoidis* sub association. The differential species of this sub association is *Hippophae rhamnoides* L. The sub association has more soil moisture than the main association (Table 2).

Order *Quercu petraeae* ssp. *ibericae-Carpinetalia betulii*: This order includes the *Quercu petraeae* ssp. *ibericae-Carpinion betulii* alliance and *Quercu petraeae* ssp. *ibericae-Carpinetum betulii* association in the study area (Table 2). The characteristic species of this association are *Carpinus betulus* L. var. *betulus*, *Quercus petraea* L. ex Liebl. ssp. *iberica* (Stev.) Krassilin., *Acer hyrcanum* Fisch. & C. A. Mey., *Evonymus latifolia* (L.) Mill. (Table 1). This association is located in the northern exposition and in 1860 to 2400 m altitudes of the study area, in form of a dense forest.

Order *Quercu-Carpinetalia orientalis*: This order includes the *Carpinion orientalis* alliance and *Pyro mazanderanicae-Carpinetum orientalis* association in the study area (Table 2). The characteristic species of this association are *Carpinus orientalis* Miller. ssp. *orientalis*, *Pyrus mazanderanica* Schonbeck-Temesy, *Onobrychis masanderanica* Rech. f., *Lonicera floribunda* Boiss. & Buhse (Table 1). This association is located in the southern exposition of the study area.

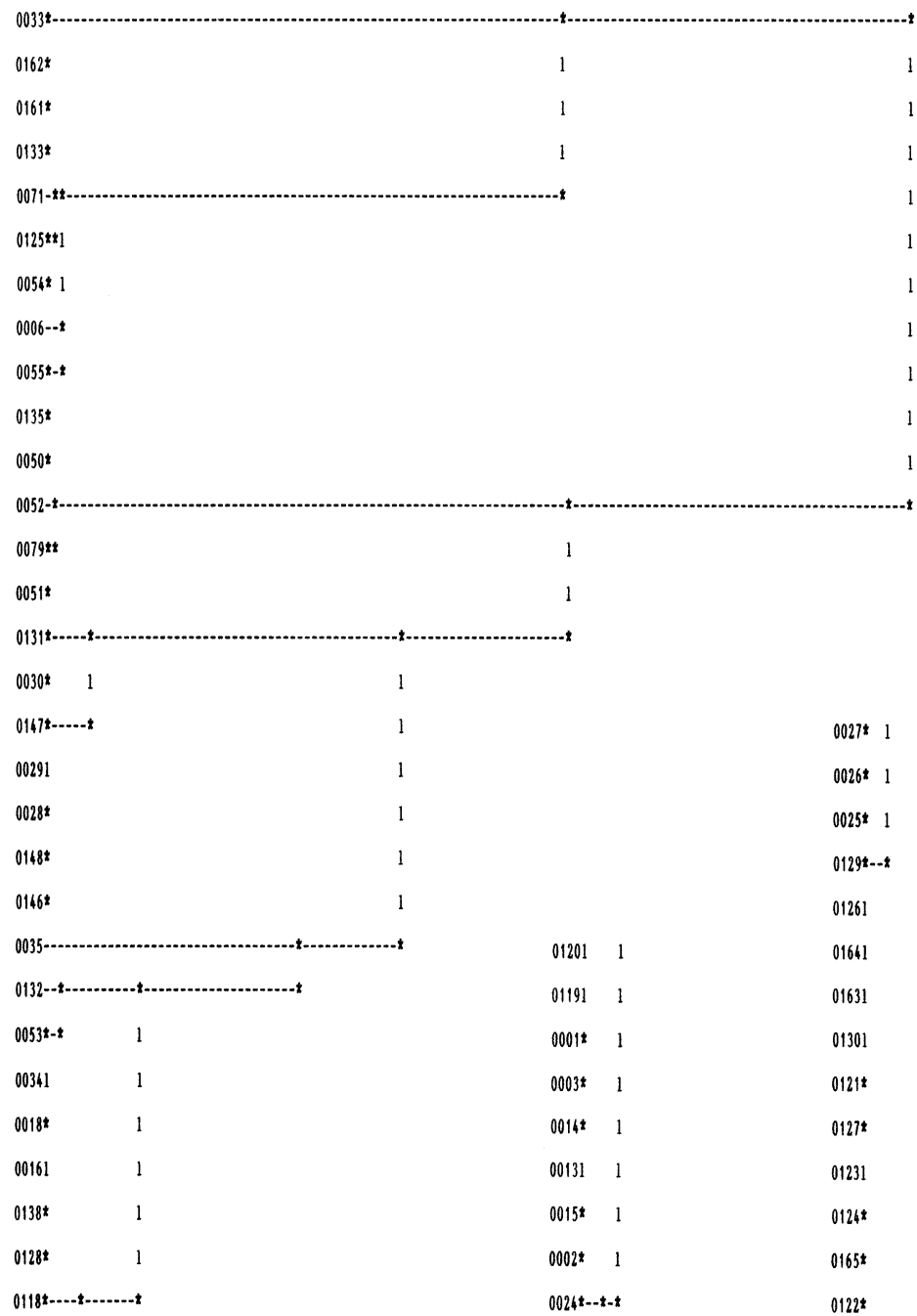


Fig. 4. Dendrogram produced from A.H.C. clustering.

Table 1. (Cont' d.)

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Table 1. (Cont' d)

Other species: 1703-*Bromus sterilis* L. (162, 161, 133, 33, 124, 132, 165, 127, 122, 123, 33); 6016-*Rhynchospora maxima* C. Richter. (125, 6, 71, 54, 162, 161, 133, 33, 27, 1); 5472-*Phalaris arundinacea* L. (125, 71, 54, 162, 161, 133, 33, 55, 135, 50); 4414-*Lapsana communis* L. (125, 71, 54, 162, 161, 133, 33, 55, 135, 50); 3258-*Equisetum arvense* L. var. *alpestre* Wahlenb. (125, 71, 54, 162, 161, 133, 33, 55, 135, 50); 7150-*Thymus fedtschenkoi* Romäger (14, 2, 18, 79, 51, 147, 29, 28, 148, 146); 2463-*Cotoneaster nummularioides* Pokr. (121, 118, 120, 119, 79, 51, 131, 147, 29, 30); 5078-*Onobrychis cornuta* (L.) Desv. (16, 79, 51, 131, 147, 29, 30, 28, 148, 146); 5491-*Phlomis cancellata* Bunge. (121, 118, 120, 119, 55, 34, 79, 51, 52); 4174-*Hypericum scabrum* L. (121, 118, 120, 119, 1, 13, 14, 18, 51); 4802-*Mesophragma germanica* L. (163, 130, 164, 124, 132, 165, 127, 122, 123, 33); 4682-*Malus orientalis* Ugl. (163, 130, 164, 124, 132, 165, 127, 122, 123, 33); 4682-*Malus orientalis* Ugl. (163, 130, 164, 124, 132, 165, 127, 122, 123, 33); 4173-*Hypericum perforatum* L. (54, 14, 13, 18, 55, 135, 50, 131, 30); 7285-*Trifolium pratense* L. (125, 36, 71, 54, 162, 161, 133, 33, 55, 135, 50); 5902-*Ranunculus brachylobus* Boiss. & Hohen. (125, 6, 71, 54, 162, 161, 133, 33); 666-*Anthriscus nemorosus* (M.B.) Spreng. (162, 161, 133, 33, 27, 28, 148, 146); 6138-*Rumex obtusifolius* L. (125, 6, 71, 54, 162, 161, 133, 33); 5752-*Pratinus excelsior* L. ssp. *cartarifolia* (Scheele) E. Murray Boiss. & Hohen. (125, 6, 71, 54, 162, 161, 133, 33); 4971-*Veronica racemosa* Lam. (135, 18, 79, 51, 52, 131, 30); 7514-*Verbascum speciosum* Schrader. (163, 130, 164, 24, 132, 28, 148, 146); 4511-*Leucophaea sclerophylla* (Boiss. & Hohen.) V. Krecz. & Bobrov. (121, 118, 120, 119, 3, 165, 122, 123); 4271-*Juglans regia* L. (163, 130, 164, 121, 132, 123, 35); 170-Achillea *vermicularis* Trin. (118, 120, 119, 2, 35, 52, 131, 30); 2227-*Cirsium ciliatum* (Murray) Moench. (125, 71, 54, 162, 161, 133, 33); 6829-*Stachys lavandulifolia* Vahl. (3, 13, 35, 79, 51, 131, 30); 7639-*Vicia truncatula* Fischer. ex M.B. (6, 3, 14, 2, 35, 55, 15, 16); 3455-*Euphrasia pectinata* Ten. (125, 71, 54, 162, 161, 133, 33); 1874-*Capsella bursa pastoris* (L.) Medicus. (125, 71, 54, 162, 161, 133, 33, 55, 135, 50); 2215-*Cichorium intybus* (L.) Desf. (125, 54, 132, 35, 55, 135, 50); 5483-*Phleum paniculatum* Koel. (125, 54, 132, 35, 55, 135, 50); 745-*Ariemisia absinthium* L. (125, 54, 132, 35, 55, 135, 50); 1778-*Calamagrostis pseudophragmites* (Hall.) f. *Cardamine uliginosa* M.B. (125, 71, 54, 162, 161, 133, 33); 1874-*Capsella bursa pastoris* (L.) Medicus. (125, 71, 54, 162, 161, 133, 33, 55, 135, 50); 5554-*Pimpinella tragioides* Vill. (13, 18, 131, 147, 29, 30); 5615-*Poa arvensis* L. (125, 6, 71, 54, 162, 161, 133, 33); 6023-*Ribes vicia-crispa* L. (124, 24, 26, 25, 132); 6256-*Salvia staminea* Moench. & Auch. ex Benth. (125, 54, 55, 135, 50); 6772-*Senecio caper* (L.) Hill. ssp. *glaucescens* (Jordan) Ball. (125, 54, 55, 135, 50); 5956-*Rapistrum rugosum* (L.) All. (125, 54, 55, 135, 50); 5720-*Potentilla canescens* Besser. (125, 54, 55, 135, 50); 4782-*Mellonius officinalis* (L.) Pall. (125, 54, 55, 135, 50); 8003-*Hypericum elongatum* Ledeb. (125, 54, 55, 135, 50); 2948-*Deschampsia caespitosa* (L.) P. Beauv. (125, 54, 55, 135, 50); 1704-*Bromus tectorum* L. (125, 54, 55, 135, 50); 2175-*Chenopodium foliosum* Aschers ssp. *montanum* Uotila (147, 29, 28, 148, 146); 3957-*Helianthemum nummularium* (L.) Miller (162, 161, 133, 33, 24); 4991-*Neslia apiculata* Fisch. & C.A. Mey. & Ave-Lalle. (162, 161, 133, 33); 3744-*Geum kokanicum* Regel. & Schmalh. ex Regel. (162, 161, 133, 33, 24); 6481-*Scrophularia variegata* M.B. ssp. *rupestris* (M.B.) Graeb. (162, 161, 133, 33); 6109-*Rubus hirtus* Waldst. & Kit. (162, 161, 133, 33); 7205-*Tragopogon graminifolius* DC. (162, 161, 133, 33); 8007-*Rumex scutellus* L. (125, 71, 15, 16); 8001-*Cephalaria kotschy* Boiss. & Hohen. (25, 28, 148, 146); 223-*Aethionema grandiflorum* Boiss. & Hohen. (131, 147, 29, 30); 2789-*Cruciatia laevipes* Opaz. (53, 34, 131, 30); 4769-*Melica jacquemontii* Deane. ex Jacquem. ssp. *Jacquemontii* (79, 51, 52, 30); 2987-*Dianthus orientalis* Adams. ssp. *stenocalyx* (Boiss.) Rech.f. (3, 79, 51, 52); 1751-*Bupleurum exaltatum* M.B. (53, 34, 79, 51); 2358-*Consolida orientalis* (Gay) Schrad. (124, 132, 123, 35); 1912-*Carex divulsa* Stokes (27, 24, 26, 25); 824-*Asplenium trichomanes* L. (27, 24, 26, 25); 4369-*Lactuca scariola* L. (121, 165, 122, 123); 3015-*Digitalis nervosa* Steud. & Hochst. ex Benth. (121, 120, 119); 499-*Alyssum polycladum* Rech.f. (24, 118, 25); 4239-*Isatis buchariana* Schischk. (35, 53, 34); 2374-*Convolvulus cantabrica* L. (35, 53, 34); 6972-*Tanacetum abrotanifolium* (L.) Druce. (79, 51, 52); 5795-*Psathyrostachys fragilis* (Boiss.) Nevski (79, 51, 52); 2509-*Cousinia chamaepeuce* Boiss. (79, 51, 52); 1384-*Astragalus (Lageropsis) subsecundus* Boiss. (79, 51, 131); 7425-*Urtica dioica* L. (71, 53, 34); 2130-*Cerasus pseudoprostata* Pokr. (18, 131, 30); 6134-*Rumex elburensis* Boiss. (27, 147, 29); 6891-*Slipa krascheninikovii* Roshev. (131, 30); 3359-*Erysimum cuspidatum* (M.B.) DC. (131, 30); 7717-*Ziziphora clinopodioides* Lam. ssp. *pseudodasyantha* (Rech.f.) Rech.f. (131, 30); 4087-*Hippomarathrum microcarpum* (M.B.) B. Fedtsch. (79, 51); 3131-*Echinops elburensis* Rech. f. (79, 51); 2790-*Cruciatia taurica* (Pallas ex Willd.) Ehrend. (79, 51); 1701-*Bromus squarrosus* L. (79, 51); 254-*Elymus hispidus* (Opiz) Melderis var. *podperae* (Nab.) Assadi (79, 51); 181-*Acropitium repens* (L.) DC. (79, 51); 6856-*Stellaria media* (L.) Vill. (132, 35); 4200-*Imula salicina* L. ssp. *aspera* (Poir.) Hayek (132, 35); 3175-*Echium amoenum* Fisch. & C.A. Mey. (132, 35); 2758-*Crepas sancta* (L.) Babcock (132, 35); 7403-*Tussilago farfara* L. (132, 35); 1670-*Bromus briziformis* Fisch. & C.A. Mey. (132, 35); 4760-*Medicago sativa* L. (1, 135); 6331-*Scabiosa columbaria* L. ssp. (118, 35); 656-*Anthemis trianfetii* (L.) All. ssp. *khovanica* (Rech.f.) Transshahr. (35, 18); 2032-*Centaurea kotschy* (Boiss.) Hayek. ex Heldr. (Boiss.) Wagentin. (53, 16); 2803-*Cuscuta approximata* Babington. (53, 34); 3761-*Glancium fimbriatum* Boiss. (15, 16); 3099-*Dryopteris filix mas* (L.) Schott. (27, 26); 5984-*Rexeda lutea* L. (118, 120); 704-*Arenaria gypsophilioides* L. (1, 12); 5511-*Phragmites australis* (Cav.) Trin. ex Steud. (125, 54); 4895-*Myricaria germanica* (L.) Desv. (125, 54); 1578-*Rubus platinifolia* DC. (125, 54); 7691-*Xanthoxylum purpureum* (Ave-Lall.) Boiss. (71); 6300-*Saponaria viscosa* C.A. Mey. (71); 6166-*Salix elburensis* Boiss. (71); 3062-*Dodardia orientalis* L. (71); 2369-*Convolvulus arvensis* L. (71); 693-*Arctium lappa* L. (71); 4785-*Mentha longifolia* (L.) Huds. (54); 4284-*Lonicera inflata* (L.) Huds. (54); 5776-*Primula auriculata* Lam. (54); 7530-*Veronica anagallis aquatica* L. ssp. *oxycarpa* (Boiss.) A. Jelen. (54); 1902-*Carex caucasica* Stev. (54); 3240-*Epilobium hirsutum* L. (125); 521-*Amaranthus retrofractus* L. (125); 4829-*Mimulus lineata* Bonm. (28); 6882-*Myosotis lithospermifolia* (Wall.) Hornem. (52); 4033-*Hemerocallis glabra* L. var. *glaberrima* Fenzl (52); 2564-*Cousinia gmelini* C. Winkl. (52); 3415-*Euphorbia helioscopia* L. (35); 2950-*Descurainia sophia* (L.) Webb & Berth. (35); 2697-*Crambe orientalis* L. (35); 2229-*Cirsium congestum* Fisch. & C.A. Mey. ex DC. (35); 6730-*Silbum maritimum* (L.) Gaertn. (11); 378-*Allium capitellatum* Boiss. (11); 186-*Adonis aestivalis* L. ssp. *provincialis* (DC.) C. Steinb. (11); 6708-*Silene schaffii* Gmel. Jun. ex Hohen. (11); 4201-*Imula thapsoides* (M.B. ex Willd.) Spreng. (11); 2135-*Ceratocephalus falcata* (L.) Pers. (11); 1976-*Caucalis platycarpus* L. (11); 1964-*Carthamus lanatus* L. ssp. *turkestanicus* (M. Pop.) Hanelt (11); 1650-*Bongardia chrysogonum* (L.) Spach (11); 7537-*Veronica ancheta* Boiss. (18); 8009-*Taraxacum* ssp. (18); 1310-*Astragalus (Caprini) pinnatifidus* (L.) DC. (25); 4075-*Hieracium procerum* Fries. (25); 392-*Allium Gauba* (2); 2622-*Cousinia nekmanica* Rech.f. (14); 2849-*Cynoglossum creticum* Müller. (16); 5524-*Physospermum cornubiense* (L.) DC. (25); 4075-*Hieracium procerum* Fries. (25); 392-*Allium elburensis* C. Koch. (25); 6981-*Tanacetum coccineum* (Willd.) Grierson. (27); 251-*Elymus longearistatus* (Boiss.) Tzevelev (26); 7110-*Thalictrum minus* L. (24); 4606-*Lonicera bracteolaris* Boiss. & Buhse. (24); 790-*Asparagus persicus* Baker (126); 5648-*Polygonum arenastrum* Boreau. (121); 3431-*Euphorbia myrsinites* L. (118); 2068-*Centaurea virgata* Lam. ssp. *squarrosa* (Willd.) Gugler. (118); 7256-*Trifolium campestre* Schreb. (13); 5172-*Onosma microcarpum* DC. (13).

Order *Pruno spinosae-Crataeginetalia meyeri*: This order includes the *Pruno spinosae-Crataeginion meyeri* alliance and *Pruno spinosae-Crataeginetum meyeri* association. The characteristic species of this association are *Crataegus meyeri* A. Pojark., *Prunus spinosa* L., *Prunus divaricata* Ledeb. ssp. *divaricata*, *Colutea buhsei* (Boiss.) Shap., *Crataegus turkestanica* A. Pojark., *Stachys byzantina* C. Koch., *Cotoneaster multiflorus* Bge.. This association is expanded between the forest and range formations in the southern exposition.

Class *Quercetea macrantherae*

This Class includes the *Quercetalia macrantherae* order, *Quercion macrantherae* alliance and *Acero campestris-Quercetum macrantherae* association (Table 2). The characteristic species of this association are *Quercus macranthera* Fisch. & Mey. ex Hohen., *Acer campestre* L., *Poa nemoralis* L., *Trisetum flavescens* (L.) P. Beauv., *Sedum stoloniferum* S. G. Gmel., *Ornithogalum orthophyllum* Ten., *Vicia variabilis* Freyn. & Sint., (Table 1). This association prefers northern exposition to other expositions (Table 2).

Class *Ephedreteae*

This Class includes the *Ephedretalia* order, *Ephedrion majoris* alliance and *Rhamno pallasii-Ephedretum majoris* association in the study area (Table 2). The characteristic species of this association are *Ephedra major* Host., *Rhamnus pallasii* Fisch. & Meyer. ssp. *pallasii* (Table 1). This thermophilic association is established on lime soil and in the southern exposition (Table 2).

Class *Juniperetea*

This Class includes the *Juniperetalia* order, *Juniperion communis* ssp. *hemisphaericae* alliance and *Juniperetum communis* ssp. *hemisphaericae* association in the study area (Table 2). The characteristic species of this association are *Juniperus communis* L. ssp. *hemisphaerica* (Presl.) Nyman., *Astragalus (Alopecuroidei) kirrindicus* Boiss., *Salvia staminea* Montbr. & Auch. ex Benth. This orophilous association is established on lime soil and in the southern exposition (Table 2). This association has *Aceretosum monspessulanii* ssp. *ibericii* sub association. The differential species of this sub association is *Acer monspessulanum* L. ssp. *ibericum* (M.B.) Yaltirik. This sub association is located in the northern exposition against the main association.

3. The ecological factors of identified syntaxa: The ecological factors subject of study of existing syntaxa in the area were specified as shown in Table 2.

4. The Chorotypes of the study area: The percentages of the chorotypes of species of the study area were specified on the basis of the methods presented by Zohary (1963 & 1973) and Takhtajan (1986). The results are shown in Fig. 5.

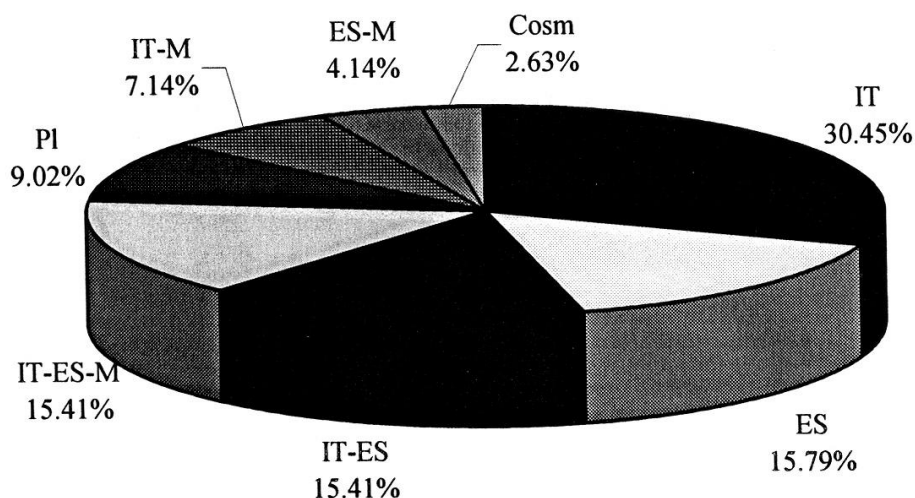


Fig. 5. Plant chorotypes of the Elik ecotone forest.

IT: Irano-Turanian Region, ES: Euro-siberian Region,
M: Mediterranean Region, Pl: Pluriregional, Cosm: Cosmopolite

Discussion

Guinoche & Vilmore (1973) have pointed out the alliance *Salicion albae* (Tx. 1955) Muller et Gors (1958), of order *Salicetalia purpureae* Moor (1958) and class *Salicetea purpureae* Moor (1958). Also *Anemono-Salicetum richardsonii*, *Valeriano-Salicetum pulchrae* and *Epilobio-Salicetum alaxensis* associations are introduced by Sichckhoff *et al.*, (2002) for Alaska, when class *Salicetea purpureae* is proposed for them. From syntaxonomic point of view, with respect to the existence of characteristic species *Salix excelsa* S. G. Gmelin. (syn. *Salix fragilis* auct. fl. orient. non L.), *Populus nigra* L. and *Salix alba* L., in the alliance, order and class, and the presence of these species in *Salicetum aegyptiacae* association in the study area, can accept *Salicion albae* alliance from Muller & Gors (1958). With respect to the high dispersion of species *Salix excelsa* S.G. Gmelin. in Iran, *Salicetalia excelsae* order and *Salicetea excelsae* class are suggested for superior syntaxa..

Guinoche & Vilmore (1973) have pointed out the alliance *Acerion pseudoplatani* Oberd. (1957), of order *Fagetalia sylvaticae* Pawl.(1928), and class *Querco-Fagetea* Br. Bl. et Viegler (1937). Also, Quezel *et al.*, (1980) have introduced *Carpino-Acerion* alliance of *Fagetalia sylvaticae* order and *Quercetea pubescentis* class for the vegetation of Anatolia of Turkey. Therefore, *Acerion cappadocicii* alliance, *Quercetalia* order and *Quercetea* class are suggested for the *Aceretum cappadocicii* association in the study area.

Guinoche & Vilmore (1973) have pointed out the alliance *Alno-Ulmion* Br. Bl. & Tx. (1943), for Europe. In this study *Ulmion minoris* alliance, *Quercetalia* order and *Quercetea* class are suggested for the *Ulmum minoris* association in the study area.

Guinoche & Vilmore (1973) have pointed out the alliance *Quercion robori-petraeae* (Malcuit 1929) Br. Bl. (1931), of order *Quercetalia robori-petraeae* Br. Bl. et Tx. (1943), for Europe. *Quercus petraeae* ssp. *ibericae*-*Carpinion betulii* alliance, *Quercus petraeae* ssp. *ibericae*-*Carpinetalia betulii* order and *Quercetia* class are suggested for the *Quercus petraeae* ssp. *ibericae*-*Carpinetum betulii* association in the study area.

Quezel *et al.*, (1980) have introduced order *Quercus-Carpinetalia orientalis* of class *Quercus-Fagetia* for the vegetation of Anatolia of Turkey, and no alliance have been introduced for it. No syntaxon has been presented in the Iranian sources for the association *Pyro mazanderanicae-Carpinetum orientalis*. With respect to the specifications of the *Pyro mazanderanicae-Carpinetum orientalis* association, *Quercus-Carpinetalia orientalis* order could be accepted from Quezel *et al.*, (1980), and *Carpinion orientalis* alliance, and *Quercetia* class are suggested for the association in the study area.

Guinoche & Vilmore (1973) have pointed out the class *Quercus-Fagetia* Br. Bl. et Viegler (1937) with characteristic species *Crataegus monogyna* Jacq., *Crataegus oxyantha* L., *Prunus spinosa* L., *Rhamnus cathartica* L., *Rosa* sp., and order *Prunetalia spinosae* Tx. (1952). *Pruno spinosae-Crataeginion meyeri* alliance is suggested for *Pruno spinosae-Crataeginetum meyeri* association in the study area. With respect to the similarity between the aforementioned association and class *Quercus-Fagetia* Br. Bl. et Viegler (1937) and order *Prunetalia spinosae* Tx. (1952), in some of species, *Pruno spinosae-Crataeginetalia meyeri* order and *Quercetia* class are suggested for the study area. It has to be explained that, there is no *Fagus* in the floristic composition of the study area.

Djazirei (1965) and Dorostkar & Noirfalise (1976) have introduced *Quercion macrantherae* alliance for Iran; however they have not introduced any other syntaxa for it. With respect to the high dispersion of species *Quercus macranthera*, the *Quercion macrantherae* alliance, *Quercetalia macrantherae* order and *Quercetia macrantherae* class are suggested for the *Acereto campestris-Quercetum macrantherae* association of the study area.

Kojima (1990) for Nepal has introduced the *Ephedretum gerardianae* association. No superior syntaxon has been observed in the sources subject of study for the *Rhamno pallasii-Ephedretum majoris* association in the study area. Therefore, *Ephedron majoris* alliance, *Ephedretalia* order and *Ephedreteia* class are suggested for the study area.

Klein (1994) has reported its *Juniperetosum excelsae* sub-association from *Helichrysetum oligocephalii* association and *Prangetia* class for Iran. Also Guinoche & Vilmore (1973) have pointed out the alliance *Juniperion nanae* Br. Bl. 1939 of order *Vaccinio-Piceetalia* Br. Bl. 1939 and class *Vaccinio-Piceetalia* Br. Bl. 1939 for Europe. The *Juniperetum communis* ssp. *hemisphaericae* association and *Aceretosum monspessulanii* ssp. *ibericii* sub-association have been identified in the study area for which, the *Juniperion communis* ssp. *hemisphaericae* alliance, *Juniperetalia* order and *Junipereteia* class are suggested.

The gradient indicated in Fig. 3 can be interpreted ecologically as an overall soil moisture gradient ranging from xerophilous to hydrophilous formations. The study and comparison of the other ecological factors subject of study, such as pH, EC and lime of soil (Table 2), made it possible to interpret the gradient of these ecological factors.

Studying the chorotypes of species in the area shows that chorotypes Irano Turanian (30.45%), Euro Siberian (15.79%), Irano Turanian-Euro Siberian (15.41%) and Irano

Turanian-Euro Siberian-Mediterranean Regions are more than the other chorotypes. The higher values of these chorotypes reveal the special ecological conditions of the area. This shows the fact that the study area is located in the ecoton zone, and the reason is that the zone is situated at the end of vegetation of Euro Siberian Region (Hyrcanian Province) and its range is related to Irano Turanian Region.

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