

Forest Vegetation of Karagöl-Sahara National Park Artvin-Turkey

Özgür EMINAĞAOĞLU^{1*}, Rahim ANŞİN², Hamdi Güray KUTBAY³

¹ Artvin Çoruh University, Faculty of Forestry, Department of Forest Engineering, 08000 Artvin - TURKEY

² Karadeniz Technical University, Faculty of Forestry, Department of Forest Engineering, 61080 Trabzon - TURKEY

³ Ondokuz Mayıs University, Faculty of Arts and Sciences, Department of Biology, 55139 Kurupelit, Samsun - TURKEY

Received: 22.07.2005

Accepted: 28.03.2007

Abstract: This investigation was carried out between 1997 and 2002 in order to research the forest vegetation of Karagöl-Sahara National Park (Artvin). This vegetation was studied according to the traditional Braun-Blanquet approach. A total of 114 quadrats were examined. In the area under review, forest vegetation is represented by *Quercus petraea-Piceetum orientalis* ass. nov., *Fraxinetosum angustifoliae* subass. nov., *Crataegetosum microphyllae* subass. nov., *Junipero oxycedri-Pinetum sylvestris* ass. nov., *Fago orientalis-Abietum nordmannianae* ass. nov., *Pino sylvestris-Piceetum orientalis* ass. nov., *Abieti nordmannianae-Piceetum orientalis* ass. nov., *Abieti nordmannianae-Pinetum sylvestris* ass. nov., and *Junipero communi-Pinetum sylvestris* ass. nov. Seven associations and 2 subassociations are new syntaxa to science. The distribution of the associations in the investigation area and their brief ecologies are provided. Some soil samples taken from various plots representing different plant associations were analysed.

Key Words: Artvin, Lesser Caucasus, Colchic, forest vegetation, phytosociology, Syntaxonomy, Şavşat

Karagöl-Sahara Milli Parkı (Artvin) Orman Vegetasyonu

Özet: Bu çalışma 1997-2002 yılları arasında Karagöl-Sahara National Park (Artvin) orman vejetasyonunu araştırmak üzere yapılmıştır. Bu vejetasyon geleneksel Braun-Blanquet metoduna göre çalışılmıştır. 114 örneklik alan alınmıştır. Araştırma alanı orman vejetasyonu *Quercus petraea-Piceetum orientalis* ass. nov., *Fraxinetosum angustifoliae* subass. nov., *Crataegetosum microphyllae* subass. nov., *Junipero oxycedri-Pinetum sylvestris* ass. nov., *Fago orientalis-Abietum nordmannianae* ass. nov., *Pino sylvestris-Piceetum orientalis* ass. nov., *Abieti nordmannianae-Piceetum orientalis* ass. nov., *Abieti nordmannianae-Pinetum sylvestris* ass. nov. ve *Junipero communi-Pinetum sylvestris* ass. nov. birlikleriyle temsil edilmektedir. Yedi bitki birliği ve 2 altbirlik bilim dünyası için yenidir. Araştırma alanındaki bitki birliklerine ilişkin vejetasyon tabloları ve toprak analiz sonuçları verilmektedir.

Anahtar Sözcükler: Artvin, Aşağı Kafkasya, Kolşik, Orman vejetasyonu, Fitososyoloji, Sintaksonomi, Şavşat

Introduction

In this study, the phytosociological aspects of Karagöl-Sahara National Park, located in the western lesser Caucasus corridor in Turkey, were studied. The research area under review is located in the Colchic sector of the Euro-Siberian floristic area in the Holarctic region (Davis, 1965; Zohary, 1973). It is a transitional zone between the Euro-Siberian and Irano-Turanian phytogeographical regions and is situated in Artvin province in Turkey within the A9 square of Davis's grid system (Davis, 1965).

Although this area is one of the well-protected regions in Turkey, there has been no study on the vegetation of

the area. Several floristic and vegetation studies were carried out in localities close to the research area by Anşin (1979, 1983), Düzenli (1988), Vural (1996), Eminağaoğlu & Anşin (2003, 2004), and Eminağaoğlu et al. (2006). According to the *Flora of Turkey* (Davis, 1965-1985), many Turkish and foreign researchers have visited and collected plant specimens from this area. Albov, Andronakai, Anşin, Bornmüller, Davis, Düzenli, Grossheim, Güner, Handel-Mazetti, Henderson, Koch, Komarov, Krause, Louis, Maleev, Mirov, Radde, Sauer, Stainton, Vural, Vvedensky, and Woronow have collected specimens from around Artvin (Mirov, 1967; Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000).

* E-mail: eminağaoğlu@hotmail.com

The region was selected for this study for the following reasons:

- i. It is in the Caucasus, which is one of the world's 25 biologically richest and most endangered terrestrial ecoregions (WWF & IUCN, 1994).
- ii. It was identified as one of the world's 200 priority ecoregions by WWF.
- iii. It is a transitional zone between the Euro-Siberian and Irano-Turanian phytogeographical regions.
- iv. There has been no organised phytosociological investigation in Karagöl-Sahara National Park.

In addition, the Yalnızçam Mountains, including the research area, were designated as one of the 122 Important Plant Areas (IPA) of Turkey (Özhatay et al., 2003, 2005).

The goals of this research were to determine the phytosociological structure of forest vegetation of Karagöl-Sahara National Park and to evaluate the significance of this area for natural vegetation.

Study Area

The location of Karagöl-Sahara National Park and its immediate surroundings are shown in Figure 1. The research area was calculated by GIS techniques. This area is about 21,912 ha, and between 900 and 2700 m in altitude. Karagöl-Sahara National Park covers 3466 ha area in this watershed. The area includes Ciritdüzü, Cevizli, Veliköy, Pınarlı, Meşeli, Yukarıkoyunlu, Aşağıkoyunlu, Köprülü, Kirazlı, Karaköy, Kocabey, Yavuzköy villages, kışlas (low mountain pastures), and yaylas (high mountain pastures). There are many lakes, streams, mountains, and hills in the area.

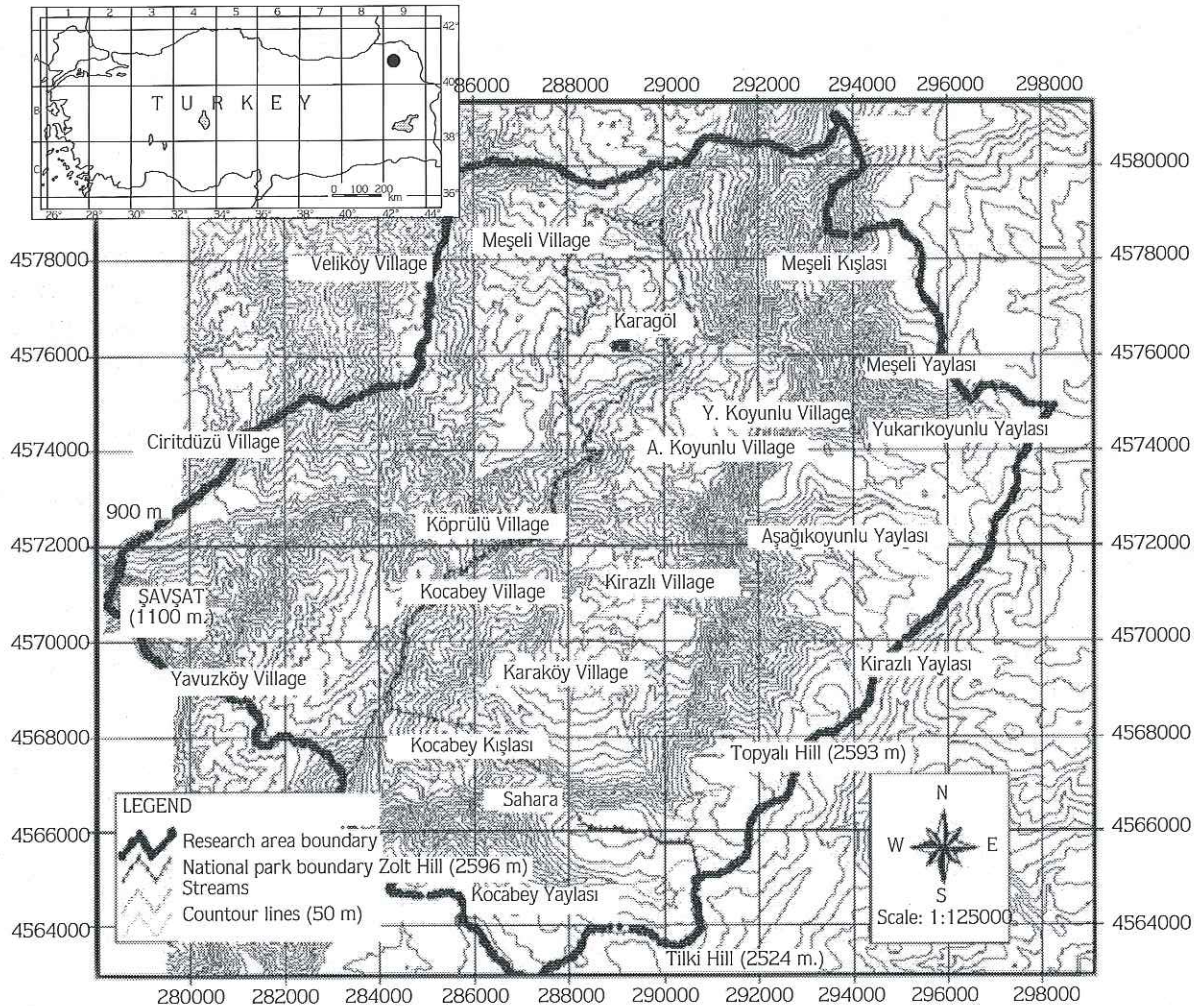


Figure 1. Topographical map of the study area (Eminağaoğlu & Anşın, 2004).

Meteorological data are only available from one station in the area, and were obtained between 1971 and 1996 in Şavşat (DMİ, 2001). The mean annual temperature is 9.8 °C and precipitation is 737.9 mm (Table 1). The rainfall regime of the study area is "summer-spring-winter-autumn" of semi-terrestrial origin (Akman, 1999).

There are 7 large soil groups in the study area, namely, brown forest soils, noncalcareous brown forest soils, alluvial soils, colluvial soils, red-yellow podzolic soils, and high mountain meadow soils. The most widespread of these is the brown forest soils (TKH, 1990).

In the area under review, 872 taxa belonging to 364 genera and 91 families were identified. Of the 872 taxa, 21 Pteridophytes and 851 Spermatophytes were detected. Spermatophytes also contained 7 *Gymnospermae* and 844 *Angiospermae* taxa. The richest 3 families are *Compositae* with 90 taxa (10.2%), *Leguminosae* with 77 taxa (8.9%) and *Gramineae* with 60 taxa (7.0%). The richest genus is *Astragalus* L. (21 taxa) followed by *Campanula* L. (15 taxa). The rates of taxa included in certain phytogeographical regions were as follows: 39.4% Euro-Siberian, 10.3% Irano-Turanian, 1.1% Mediterranean, and 50.9% multi-regional or of unknown phytogeographic origin. The endemism ratio is 6.3% (54 taxa) (Eminağaoğlu & Anşin, 2004).

All sociological units related to Black Sea (Euxine) forest vegetation are included in *Quercetea pubescentis* (Ober 1948) Doing Kraft. 1955 and *Quercu-Fagetea* (Braun-Blanquet et Vliegler 1937) Fukarek-Fabijanik 1968 classes. These classes include characteristic plant sociology units of deciduous forests found in the upper Mediterranean and less mountainous and mountainous Euro-Siberian, and some needle-leaved forests of Euro-Siberian region and the mountain level of Mediterranean regions. Plant associations found in the north-eastern

Anatolia forest vegetation are related to *Carpino-Acerion* Quézel et al., 1980 alliance of *Quercu-Carpinetalia orientalis* Akman et al., 1980 order in *Quercetea pubescentis* class, and *Veronica-Fagion* Quézel et al., 1980 and *Geranio-Pinion* Quézel et al., 1980 alliances of *Pino-Piceetalia orientalis* Quézel et al., 1980 order in *Quercu-Fagetea* (Braun-Blanquet et Vliegler 1937) Fukarek-Fabijanik 1968 class (Quézel et al., 1980; Vural, 1996).

Materials and Methods

The materials of this study included 2500 plant samples that were mainly identified using the *Flora of Turkey* (Davis, 1965-1985; Davis et al., 1988; Güner et al., 2000), and other floras (Komarov, 1934-1978; Grossheim, 1939-1967; Ketzkhoveli & Gagnidze, 1971-2001). Author abbreviations of plant names are given according to Brummitt & Powell (1992).

The vegetation studies were carried out according to the Braun-Blanquet (1932) method. For determination of the plant associations, sample plots were taken from forest formation, in sufficient numbers and suitable sizes. Then, the floristic compositions of the associations along with the dominancy and constancy of the species were determined. In total, 114 sample plots were taken, and 7 plant associations were distinguished by the analyses of these plots. The plant associations were named and classified according to International Code of Phytosociological Nomenclature (Weber et al., 2000). During the classification of the vegetation, previous studies were used (Akman, 1972, 1995; Akman et al., 1978, 1979a, 1979b; Kılınç, 1974, 1985; Quézel et al., 1980; Ketenoğlu et al., 1983; Yalırık et al., 1983; Akman & Ketenoğlu, 1986; Kılınç & Karakay, 1992; Kılınç & Karaer, 1995; Kutbay & Kılınç, 1995; Özen & Kılınç, 1995; Vural, 1996; Mayer & Aksoy, 1998; Karaer et al., 1999; Parolly, 2004). The distributions of the

Table 1. The average and extreme climatic values of Şavşat from 1971 to 1996.

Meteorological elements	Months												Annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Mean temperature (°C)	-1.7	-0.6	3.8	9.8	14.2	17.5	20.4	20.8	16.9	11.6	4.9	0.0	9.8
Max. mean temperature	3.6	5.1	10.5	17.2	21.8	25.3	28.3	29.3	25.8	19.3	10.6	5.0	16.8
Min. mean temperature	-6.5	-6.0	-2.6	2.8	6.9	10.0	13.3	13.3	9.6	5.0	-0.4	-4.6	3.4
Total rainfall (mm)	52.9	40.0	32.4	58.8	67.5	79.4	50.5	32.0	31.3	48.8	57.6	54.2	737.9

associations in the investigation area and their brief ecologies are given in the section entitled Vegetation. In order to compare associations with similar associations, we used Sorensen's index of similarity (Sorensen, 1948).

Some soil samples were taken from various sample plots representing different plant associations. These soil samples

were analysed by the Soil Research Institute of Karadeniz. Soil texture, pH, electrical conductivity (mmhos/cm), organic matter content (%), N content (%), and CaCO₃ content (%) were analysed by using standard methods (Bayraklı, 1987). The results of the soil analyses were explained according to Pirdal (1989) and are shown in Table 2.

Table 2. Soil analysis of associations.

	Quadrat no.	Soil depth (cm)	Sand (%)	Clay (%)	Silt (%)	Structure	pH	Electrical Conductivity (EC 25 °C) mmhos/cm	Organic matter	N (%)	CaCO ₃ (%)
<i>Quercus petraea</i> - <i>Piceetum orientalis</i>	30	0-20	82.6	5.4	12.0	SL	5.4	0.03	1.82	0.10	0.00
		20-40	80.6	7.4	12.0	SL	5.5	0.02	0.27	0.01	0.00
	163	0-20	84.6	5.4	10.0	SL	5.5	0.04	1.70	0.10	0.00
		20-40	78.6	9.4	12.0	SL	5.6	0.12	0.15	0.01	0.00
	323	0-20	81.5	6.5	12.0	SL	5.4	0.03	1.92	0.10	0.00
		20-40	80.5	5.5	15.0	SL	5.6	0.02	0.17	0.01	0.00
<i>Juniperus oxycedri</i> - <i>Pinetum sylvestris</i>	63	0-20	74.6	13.4	12.0	SL	5.8	0.05	3.68	0.18	0.00
		20-40	76.6	12.4	11.0	SL	5.9	0.04	2.14	0.11	0.00
	127	0-20	87.6	5.44	7.00	S	6.2	0.04	0.80	0.04	0.00
		20-40	88.6	4.44	7.00	S	6.2	0.04	0.38	0.02	0.00
	153	0-20	90.6	3.2	6.2	S	5.7	0.05	0.11	0.00	0.22
		20-40	91.6	7.1	2.2	S	6.0	0.01	0.10	0.00	0.00
<i>Pinus sylvestris</i> - <i>Piceetum orientalis</i>	35	0-20	56.5	23.4	20.0	SCL	7	0.21	2.19	0.11	15.97
		20-40	57.5	23.4	19.0	SCL	7.4	0.17	0.48	0.02	24.32
	151	0-20	58.6	17.4	24.0	SL	7.4	0.13	2.56	0.13	26.44
		20-40	64.6	15.4	20.0	SL	7.8	0.08	1.75	0.09	26.14
	333	0-20	54.5	25.4	20.0	SCL	7.2	0.20	1.19	0.07	18.77
		20-40	55.5	23.5	21.0	SCL	7.6	0.17	0.48	0.02	22.32
<i>Abies nordmanniana</i> - <i>Piceetum orientalis</i>	58	0-20	66.5	8.3	25.2	SL	5.1	0.05	3.14	0.16	1.51
		20-40	68.5	4.3	27.2	SL	5.0	0.07	8.15	0.41	0.70
	116	0-20	56.9	17.7	25.2	SL	5.5	0.04	7.65	0.38	0.00
		20-40	52.9	25.7	21.2	SCL	5.1	0.03	3.06	0.15	0.00
	314	0-20	59.6	12.3	28.0	SL	5.7	0.09	11.41	0.57	0.00
		20-40	55.6	18.3	26.0	SL	5.4	0.08	2.77	0.14	0.00
<i>Abies nordmanniana</i> - <i>Pinetum sylvestris</i>	73	0-20	68.5	4.4	27.0	SL	5.4	0.05	6.67	0.33	0.70
		20-40	66.5	7.5	26.0	SL	5.5	0.02	1.80	0.09	0.00
	100	0-20	70.5	2.4	27.1	SL	5.3	0.05	5.67	0.28	0.40
		20-40	75.5	2.5	22.0	SL	5.7	0.04	2.70	0.07	0.00
	327	0-20	72.5	2.4	25.1	SL	5.4	0.05	6.67	0.33	0.00
		20-40	67.5	7.5	25.0	SL	5.5	0.02	1.80	0.09	0.00
<i>Fagus orientalis</i> - <i>Abietum nordmanniana</i>	107	0-20	64.5	4.2	31.3	SL	5.4	0.06	7.61	0.43	0.00
		20-40	58.5	12.2	29.3	SL	5.4	0.04	1.30	0.13	0.00
	139	0-20	66.5	4.3	29.2	SL	5.4	0.06	8.61	0.41	0.00
		20-40	70.5	8.1	21.4	SL	5.5	0.02	2.30	0.10	0.00
	178	0-20	64.5	4.2	31.3	SL	5.3	0.08	6.61	0.36	0.00
		20-40	62.5	8.2	29.3	SL	5.5	0.03	3.30	0.09	0.00
<i>Juniperus communis</i> - <i>Pinetum sylvestris</i>	72	0-20	71.7	8.3	20.0	SL	5.1	0.20	2.00	0.14	0.00
		20-40	73.7	8.3	18.0	SL	5.4	0.05	5.08	0.25	0.00
	93	0-20	74.8	6.2	20.0	SL	5.2	0.18	3.10	0.11	0.00
		20-40	73.7	5.3	21.0	SL	5.3	0.06	5.08	0.25	0.00
	145	0-20	71.4	8.6	20.0	SL	5.1	0.12	2.11	0.12	0.00
		20-40	73.6	8.4	18.0	SL	5.1	0.04	5.08	0.28	0.00

Life-form categories were identified according to Raunkiaer's system of classification (Raunkiaer, 1934; Ellenberg & Mueller-Dombois, 1967).

Vegetation

The vegetation structure of Karagöl-Sahara National Park and its immediate surroundings is shown in Figure 2. In the Black Sea region, forest vegetation includes *Picea orientalis* (L.) Link, *Abies nordmanniana* (Stev.) Spach subsp. *nordmanniana*, *Pinus sylvestris* L., *Quercus petraea* (Mattuchka) Liebl. subsp. *iberica* (Stewen ex. Bieb.) Krassiln., *Fagus orientalis* Lipsky, *Alnus glutinosa* (L.) Gaertn. subsp. *barbata* (C.A.Mey.) Yalt., and *Carpinus betulus* L. forest.

In this investigation, 7 plant associations belonging to forest vegetation types have been determined; all of these are new syntaxa to science (Figure 3). Syntaxonomical interpretation of these associations is shown below:

Class: *Quercetea pubescentis* (Ober 1948) Doing Kraft. 1955

Order: *Quercu-Carpinetalia orientalis* Akman et al., 1980

Alliance: *Carpino-Acerion* Quézel et al., 1980

1. *Quercu petraea-Piceetum orientalis* Eminağaoğlu, Anşin & Kutbay ass. nov.

1a. *Fraxinetosum angustifoliae* Eminağaoğlu & Kutbay subass. nov.

1b. *Crataegetosum microphyllae* Eminağaoğlu & Kutbay subass. nov.

2. *Junipero oxycedri- Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

Class: *Quercu-Fagetea* (Braun-Blanquet et Vliegler 1937) Fukarek-Fabijanik 1968

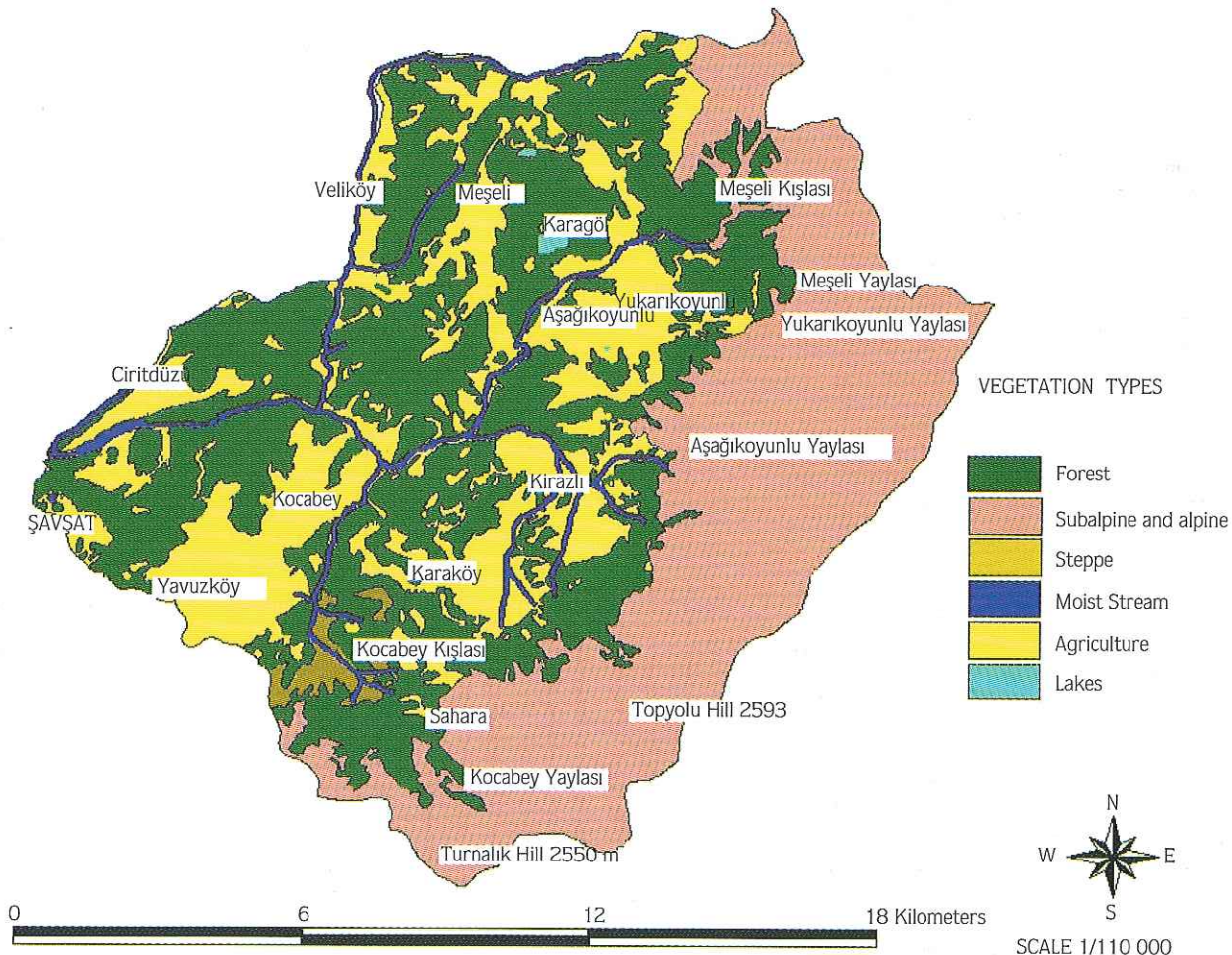


Figure 2. Vegetation map of the study area.

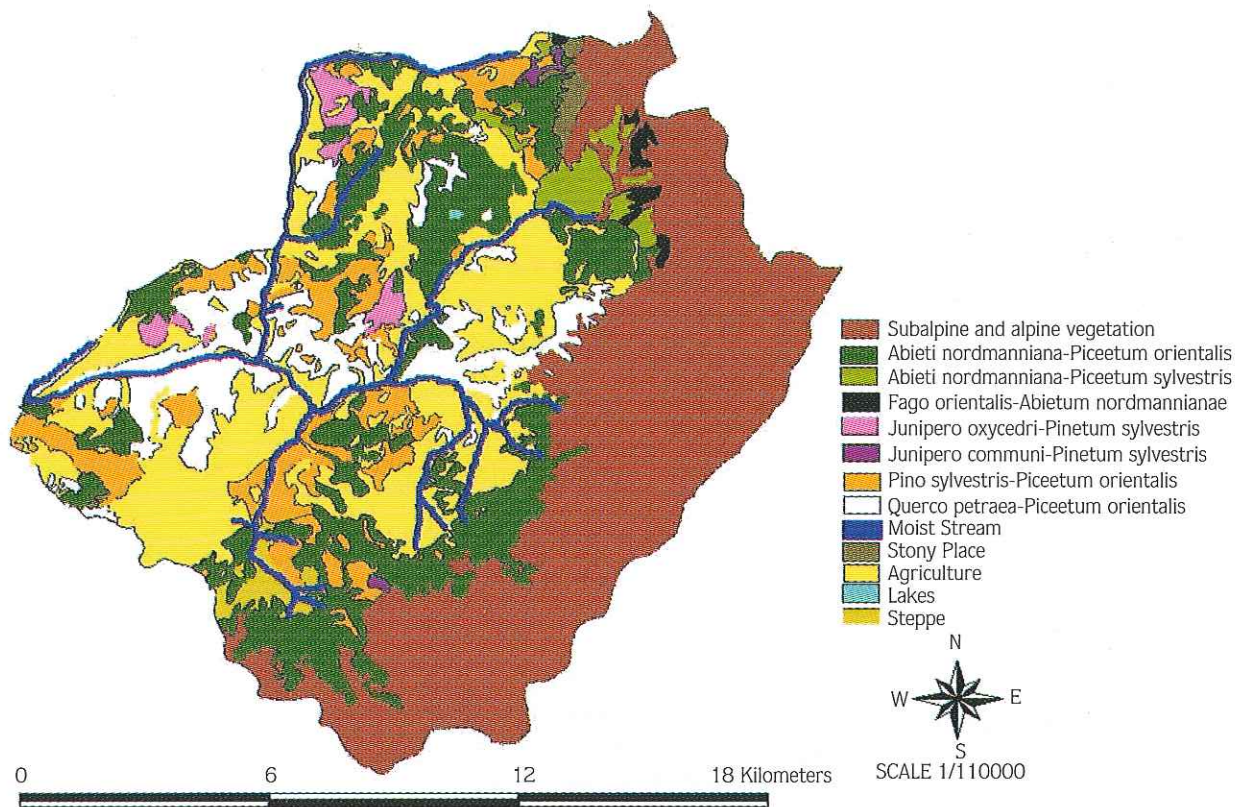


Figure 3. Plant association map of the study area.

Order: *Pino-Piceetalia orientalis* Quézel et al., 1980

Alliance: *Veronica-Fagion* Quézel et al., 1980

3. *Fago orientalis-Abietum nordmannianae* Eminağaoğlu & Anşin ass. nov.

Alliace: *Geranio-Pinion* Quézel et al., 1980

4. *Pino sylvestris-Piceetum orientalis* Eminağaoğlu & Anşin ass. nov.

5. *Abieti nordmannianae-Piceetum orientalis* Eminağaoğlu & Anşin ass. nov.

6. *Abieti nordmannianae-Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

7. *Junipero communi-Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

1. *Quercus petraea-Piceetum orientalis* Eminağaoğlu, Anşin & Kutbay ass. nov.

This association (Holotype Table 3, quadrat number 30) is scattered at an altitude of 1100-1500 m on the south, west and south-west facing slopes (Table 3). The

soil of the association is sandy-loamy in texture, acidic (pH 5.1-6.09), has an organic matter content of 0.39%-2.76% and N of 0.02%-0.19% (Table 2). Characteristic and differential species of the association are *Quercus petraea* subsp. *iberica* and *Picea orientalis*. The association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is 65%-90%, reaching 25-35 m in height and characterised by *Picea orientalis*, *Quercus petraea* subsp. *iberica*, and *Carpinus betulus*. Total coverages of the shrub and herb layers are between 20% and 40% and 10% and 40%, respectively, and they are between 3 and 4 m and 30 and 40 cm in height, respectively. The shrub layer is characterised by *Crataegus microphylla* and *Fraxinus angustifolia* subsp. *oxycarpa*.

The most common species in the herb layer are *Lithospermum purpureocaeruleum*, *Lapsana communis* subsp. *intermedia*, *Clinopodium vulgare* subsp. *vulgare*, *Epilobium montanum*, *Geranium robertianum*, *Poa nemoralis*, and *Teucrium chamaedrys* subsp. *trapezuntinus*. *Carpino-Acerion* alliance is characterised

Table 3. *Quercus petraea-Piceetum orientalis* Eminagaoglu, Anşin & Kutbay ass. nov.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Number of quadrat in table	23	26	36	30*	40	2000	2000	2000	2000	2000	2000	101	102	163*	164	322	326
Field number of quadrat	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Year	30.06	30.06	30.06	30.06	01.07	01.07	01.07	02.07	02.07	02.07	02.07	16.07	16.07	26.07	26.07	10.08	10.08
Day & Month	1000	500	500	1000	500	500	500	500	1000	1000	1000	500	500	1000	1000	1000	1000
Size of Quadrat (m ²)	1100	1130	1250	1150	1200	1350	1250	1200	1300	1250	1500	1500	1400	1550	1370	1400	1550
Altitude (m)	W	W	W	W	W	W	W	W	W	SW	NW	N	N	NW	N	N	N
Exposure	60	70	70	60	70	70	70	60	60	60	40	50	50	50	50	50	50
Inclination (%)	40	20	20	40	30	20	20	30	40	40	30	30	40	40	40	40	40
Soil depth (cm)	30	30	30	25	35	30	30	30	25	20	25	30	30	30	30	30	30
Height of tree layer (m)	80	90	90	80	90	85	80	80	90	80	70	75	70	70	65	75	70
Coverage of the tree layer (%)	3	4	4	4	3	4	3	3	4	3	4	4	3	3	3	3	3
Height of the shrub layer (m)	30	40	50	30	30	40	25	30	50	30	40	50	30	25	30	20	30
Coverage of the shrub layer (%)	30	40	40	40	40	40	40	30	40	40	30	30	30	30	40	40	30
Height of the herb layer (cm)	20	10	20	20	10	20	30	10	30	20	40	40	40	30	10	30	40
Coverage of the herb layer (%)																	
Presence																	
Characteristic and differential species of the association																	
<i>Picea orientalis</i>	33	33	33	32	33	33	32	33	32	33	43	43	43	44	33	42	43
<i>Quercus petraea</i> subsp. <i>iberica</i>	11	11	11	11	11	11	11	11	21	11	11	11	11	11	11	11	11
Characteristic and differential species of the <i>fraxinetosum angustifoliae</i>																	
<i>Fraxinus angustifolia</i> subsp. <i>oxycarpa</i>	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
<i>Euphrasia hirtella</i>	+1	+1	+1	+1	+2	+2	+2	+2	+	+	+	+	+	+	+	+	+
<i>Trigonella spicata</i>	+	+2	+2	+	+2	+2	+2	+2	+	+	+	+	+	+	+	+	+
<i>Lathyrus tuberosus</i>	+	+2	+1	+	+	+2	+1	+	+	+	+	+	+	+	+	+	+
Characteristic and differential species of the <i>cratagetosum microphylla</i>																	
<i>Crataegus microphylla</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Characteristic species of <i>Carpino-Acerion</i>																	
<i>Carpinus betulus</i>	+	+1	+	+	+1	+1	+	+1	+1	+	+1	+	+1	+	+1	+	+
<i>Helleborus orientalis</i>	+2	+	+2	+2	+	+2	+2	+	+	+	+	+	+2	+2	+	+	+
<i>Cornus sanguinea</i> subsp. <i>australis</i>	+	+	+	+	+	+1	+1	+	+1	+1	+2	+	+	+	+	+	+
<i>Lonicera caucasica</i> subsp. <i>orientalis</i>	+	+	+	+	+	+	+1	+	+	+1	+	+	+	+	+	+	+
Characteristic species of <i>Alnion barbatæ</i>																	
<i>Frangula alnus</i> subsp. <i>alnus</i>	+1	+	+	+	+1	+2	+	+	+	+1	+2	+2	+	+1	+	+1	+
<i>Helleborus orientalis</i>	+2	+	+	+2	+1	+	+	+1	+1	+	+	+	+	+1	+	+	+
<i>Gentiana asclepiadea</i>	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Characteristic species of <i>Quercus-Carpinetalia orientalis</i>																	
<i>Ostrya carpinifolia</i>	+1	+1	+	+1	+1	+1	+	+1	+1	+1	+	+	+	+	+1	+	+
<i>Mespilus germanica</i>	+1	+	+1	+	+	+1	+1	+1	+2	+2	+	+	+	+2	+	+2	+
<i>Tanacetum parthenium</i>	+	+1	+1	+	+1	+2	+2	+1	+	+	+2	+	+	+	+	+	+
<i>Pyracantha coccinea</i>	+1	+	+	+2	+	+	+	+	+	+1	+	+	+	+1	+1	+1	+
<i>Polygala supina</i>	+1	+	+	+2	+	+	+	+	+	+	+	+	+	+	+	+	+

Characteristic species of *Quercetalia pubescentis*

<i>Cotinus coggygria</i>	+1	.	.	+1	.	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	IV
<i>Euonymus latifolius</i> subsp. <i>latifolius</i>	.	+1	+1	.	+1	.	.	+1	+1	.	.	.	.	.	+1	IV
<i>Clematis vitalba</i>	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III
<i>Acer campestre</i> var. <i>campestre</i>	.	+1	+1	.	+1	.	.	+1	+1	.	.	.	.	.	.	III
<i>Coronilla varia</i> subsp. <i>varia</i>	.	+2	+2	.	.	.	.	.	+2	.	.	.	.	.	.	II
<i>Lithospermum purpurocaeruleum</i>	.	+1	+1	.	.	.	.	+1	+1	.	.	.	.	+2	.	II
<i>Cornus mas</i>	+1	.	.	.	.	.	.	.	.	.	.	.	.	+1	+1	II

Characteristic species of *Pino-Piceetalia orientalis*

<i>Dryopteris dilatata</i>	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	II
<i>Cardamine impatiens</i> var. <i>pectinata</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	12	II
<i>Pinus sylvestris</i>	.	.	.	+1	.	.	.	+1	+1	.	.	.	.	.	.	I
<i>Sedum stoloniferum</i>	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	I

Characteristic species of *Fagetalia sylvatica*

<i>Calamintha grandiflora</i>	.	+2	.	.	.	.	.	.	.	.	.	.	.	.	+1	II
<i>Galium odoratum</i>	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	II
<i>Sanicula europaea</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	I
<i>Cardamine impatiens</i> var. <i>impatiens</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	I

Characteristic species of *Quercio-Fagetalia*

<i>Carex sylvatica</i>	.	+1	+2	+1	.	.	.	.	.	.	.	.	.	.	.	III
<i>Veronica officinalis</i>	+1	+1	.	.	+1	.	.	.	.	.	.	.	.	.	+1	III
<i>Athyrium filix-foemina</i>	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	II
<i>Mycelis muralis</i>	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	+1	II
<i>Populus tremula</i>	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	II

Characteristic species of *Molinio-Arrhenatheretea*

<i>Cynosurus cristatus</i>	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	+1	III
<i>Lolium perenne</i>	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	II
<i>Lotus corniculatus</i> var. <i>corniculatus</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	II
<i>Trifolium pratense</i> var. <i>pratense</i>	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	II
<i>Cynodon dactylon</i> var. <i>dactylon</i>	+2	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	I
<i>Epilobium hirsutum</i>	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

Companions

<i>Cynosurus echinatus</i>	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	.	V
<i>Corylus avellana</i> var. <i>avellana</i>	+1	.	+1	+2	.	.	.	.	.	.	.	.	.	.	+1	IV
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	+1	+1	+1	.	.	+1	.	.	.	.	.	.	.	.	.	III
<i>Capsella bursa-pastoris</i>	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	+2	III
<i>Scabiosa columbaria</i>	+2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III
<i>Carex sylvatica</i>	.	+1	+2	+1	+1	.	.	.	.	.	.	.	.	.	.	III
<i>Dorycnium graecum</i>	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	+2	III

*Type of subassociations: Quadrat 30, 163

by *Lonicera caucasica* subsp. *orientalis* and *Helleborus orientalis*. The components of *Quercus-Carpinetalia orientalis* are represented by *Ostrya carpinifolia*, *Tanacetum parthenium*, *Mespilus germanica*, and *Polygala supina*. *Quercetea pubescentis* is characterised by *Cornus mas*, *Cotinus coggygia*, *Acer campestre* var. *campestre*, *Clematis vitalba*, *Coronilla varia* subsp. *varia*, *Euonymus latifolius* subsp. *latifolius*, *Lithospermum purpureocaeruleum*, and *Trifolium medium* var. *medium*. Characteristic species of *Molinio-Arrhenatheretea*, *Fagetalia sylvatica*, *Rhododendro-Fagetalia orientalis*, *Alnion barbatae*, and *Crataego-Fagion* are shown in Table 3. The components of the alliance *Carpino-Acerion* and order *Quercus-Carpinetalia orientalis* are well represented in this association.

1a. *fraxinetosum angustifoliae* Eminağaoğlu & Kutbay subass. nov.

This subassociation (Holotype Table 3, quadrat number 30) generally prefers the south-west and west slopes with an inclination of 60%-70% at 1100-1350 m. The general coverage ranges between 80% and 90%. Characteristic species of this subassociation are *Fraxinus angustifolia* subsp. *oxycarpa*, *Euphrasia hirtella*, *Trigonella spicata*, and *Lathyrus tuberosus*.

1b. *crataegetosum microphyllae* Eminağaoğlu & Kutbay subass. nov.

This subassociation (Holotype Table 3, quadrat number 163) generally prefers the north and north-west slopes with an inclination of 40%-50% at 1370-1550 m. The general coverage ranges between 65% and 75%. Characteristic species of this subassociation is *Crataegus microphylla*.

2. *Junipero oxycedri-Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

This association (Holotype Table 4, quadrat number 63) is at an altitude of 1300-1400 m on south, west and south-west facing slopes. The textures of these soils are sandy-clayey with a pH ranging from 5.7 to 6.2, organic matter content varies from 0.10% to 3.68%, and N is between 0.01% and 0.18% (Table 2). Characteristic and differential species are *Pinus sylvestris*, *Juniperus oxycedrus* subsp. *oxycedrus*, *Lathyrus roseus*, and *Hieracium varigatisquamum*. This association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is between 80% and 90%, reaching between 15 and 20 m in height and characterized by *Pinus sylvestris*.

Total coverages of the shrub and herb layers are between 50% and 60% and 5% and 20%, respectively, and they are between 2 and 3 m and 5 and 20 cm in height, respectively. The shrub layer is characterised by *Juniperus oxycedrus* subsp. *oxycedrus*. The herb layer is dominated by *Lathyrus roseus*, *Hieracium varigatisquamum*, *Tanacetum parthenium*, *Aconitum orientale*, and *Geranium psilostemon*. *Carpino-acerion* alliance is characterised by *Quercus petraea* subsp. *iberica*, *Helleborus orientalis*, and *Carpinus betulus*. The components of *Quercus-Carpinetalia orientalis* are represented by *Ostrya carpinifolia*, *Tanacetum parthenium*, *Mespilus germanica*, and *Polygala supina*. In addition to these syntaxonomic units, *Quercetea pubescentis* and *Quercus-Fagetea* class, *Fagetalia sylvatica*, *Rhododendro-Fagetalia orientalis* and *Pino-Piceetalia orientalis* orders, *Alnion barbatae* and *Geranio-Pinion* alliances are also represented (Table 4). The floristic composition of this association includes the characteristic species of the alliance *Carpino-Acerion* and order *Quercus-Carpinetalia orientalis*. Owing to these reasons, this association should be included in these syntaxa units.

3. *Fago orientalis-Abietum nordmannianae* Eminağaoğlu & Anşin ass. nov.

This association (Holotype Table 5, quadrat number 107) is usually dominant on the north and north-west facing slopes and at an altitude of 1800-1950 m. The soils of this association have sandy-loamy structure, pH values extending from 5.3 to 5.5, the organic matter content varied from 1.30% to 8.61%, while N content varied from 0.09% to 0.43% (Table 2). Characteristic and differential species of this association are *Abies nordmanniana* subsp. *nordmanniana*, *Fagus orientalis*, *Daphne mezereum*, *Ranunculus caucasicus* subsp. *subleiocarpus*, and *Astragalus imbricatus*. This association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is between 60% and 90%, reaching between 30 and 35 m in height and characterised by *Abies nordmanniana* subsp. *nordmanniana* and *Fagus orientalis*. Total coverages of the shrub and herb layers are between 1% and 30% and 30% and 60%, respectively, and they are between 1 and 3 m and 40 and 60 cm in height, respectively. The shrub layer is characterised by *Daphne mezereum*, *Viburnum orientale*, *Ilex colchica*, *Hedera colchica*, *Acer trautvetteri*, and *Vaccinium arctostaphylos*. The most common species in the herb layer are *Ranunculus caucasicus* subsp.

Table 4. *Junipero oxycedri-Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

Number of quadrat in table	18	19	20	21	22	23	24	25	26	27	28	29	30	Presence
Field number of quadrat	62	63*	85	86	89	90	127	128	150	153	158	173	69	
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Day & Month	14.07	14.07	15.07	15.07	15.07	15.07	25.07	25.07	26.07	26.07	26.07	29.07	14.07	
Size of Quadrat (m2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1300	1330	1350	1350	1370	1370	1300	1350	1350	1350	1350	1350	1350	
Exposure	S	S	S	SW	SW	SW	W	W	W	SW	SW	SW	SW	
Inclination (%)	10	10	20	20	10	10	20	20	20	10	10	20	20	
Soil depth (cm)	40	40	40	40	40	40	40	40	50	40	30	40	40	
Height of tree layer (m)	20	20	20	15	15	15	20	20	20	15	15	20	20	
Coverage of the tree layer (%)	80	90	80	80	90	90	80	80	80	90	90	80	80	
Height of the shrub layer (m)	3	3	3	2	3	3	3	3	2	2	3	3	3	
Coverage of the shrub layer (%)	60	60	60	50	60	60	60	60	50	50	60	60	60	
Height of the herb layer (cm)	30	30	40	40	30	30	30	30	40	30	40	40	40	
Coverage of the herb layer (%)	15	15	15	20	20	5	20	20	10	10	20	20	20	
Characteristic and differential species of the association														
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	11	11	11	11	+1	11	+1	11	11	11	11	11	11	V
<i>Pinus sylvestris</i>	44	44	44	43	54	44	54	44	43	33	43	33	43	V
<i>Lathyrus roseus</i>	+1	+1	.	+1	+1	+1	.	+1	+1	+1	.	+2	+1	IV
<i>Hieracium variegatisquamum</i>	.	+1	+1	+1	.	+2	+2	.	.	+1	+1	.	+1	IV
Characteristic species of <i>Carpino-Acerion</i>														
<i>Quercus petraea</i> subsp. <i>iberica</i>	+1	.	+1	.	.	.	.	+1	+1	.	+1	.	.	II
<i>Helleborus orientalis</i>	.	.	.	+1	.	.	+1	.	.	.	.	+1	+1	II
<i>Carpinus betulus</i>	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
Characteristic species of <i>Alnion barbatae</i>														
<i>Frangula alnus</i> subsp. <i>alnus</i>	+1	.	+1	.	.	.	.	.	+1	.	+1	.	+2	II
Characteristic species of <i>Geranio-Pinion</i>														
<i>Aconitum orientale</i>	.	.	.	.	.	+1	+2	.	.	.	.	.	.	I
<i>Astrantia maxima</i> subsp. <i>maxima</i>	.	.	+1	.	.	.	.	.	.	.	+1	.	.	I
<i>Geranium psilostemon</i>	.	.	+1	.	.	.	.	.	+1	.	.	.	.	I
Characteristic species of <i>Querceto-Carpinetalia orientalis</i>														
<i>Tanacetum parthenium</i>	+1	.	+1	+1	.	+1	+1	+1	.	.	+1	+1	.	IV
<i>Mespilus germanica</i>	+1	.	.	+1	.	+1	+1	.	+1	+1	.	+1	.	III
<i>Polygala supina</i>	.	+2	.	.	+1	+1	.	.	+1	+2	.	.	.	II
<i>Ostrya carpinifolia</i>	.	+1	.	.	.	.	.	.	.	+1	.	.	.	I
Characteristic species of <i>Quercetea pubescentis</i>														
<i>Cornus mas</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
<i>Cotinus coggygria</i>	+1	+1	11	+1	+1	+1	11	+1	+1	11	+1	+1	+1	V
<i>Acer campestre</i> var. <i>campestre</i>	.	+1	+1	.	.	+1	.	+1	.	+1	+1	.	+1	III
<i>Clematis vitalba</i>	+1	+2	.	.	+2	.	.	+2	+1	+2	.	.	+2	III
<i>Coronilla varia</i> subsp. <i>varia</i>	.	.	.	.	.	+2	.	.	+2	.	+2	+2	+2	II
<i>Lithospermum purpureocaeruleum</i>	.	.	+1	+1	.	.	.	.	.	.	+1	+1	.	II
<i>Trifolium medium</i> var. <i>medium</i>	.	.	.	+1	.	.	+1	.	+1	.	.	.	.	I
<i>Euonymus latifolius</i> subsp. <i>latifolius</i>	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
Characteristic species of <i>Pino-Piceetalia orientalis</i>														
<i>Picea orientalis</i>	.	+1	+1	.	+1	+1	+1	.	+1	+1	+1	.	+1	III
<i>Abies nordmanniana</i> subsp. <i>nordmanniana</i>	.	.	.	.	+1	+1	.	+1	.	.	+1	.	.	II

Characteristic species of *Fagetalia sylvatica*

<i>Calamintha grandiflora</i>	.	.	+1	+1	+1	.	+1	.	+1	.	+1	+1	+1	IV
<i>Galium odoratum</i>	+1	.	+1	.	41	.	.	+1	.	.	+1	.	.	III

Characteristic species of *Quercus-Fagetalia*

<i>Athyrium filix-foemina</i>	+1	+1	.	.	.	+2	.	.	+2	+1	.	.	+1	III
<i>Carex sylvatica</i>	.	+1	.	+1	+1	.	.	.	.	.	.	+1	+1	II
<i>Mycelis muralis</i>	.	+1	+1	.	+1	.	.	.	.	+1	+1	.	.	II
<i>Veronica officinalis</i>	.	.	.	.	.	+1	.	+1	.	.	.	.	+1	II

Companions

<i>Rhus coriaria</i>	+1	+1	+1	+1	+1	+2	+1	+1	+1	+1	+2	+1	+1	V
<i>Argyrolobium biebersteinii</i>	.	11	.	.	+1	+1	+1	+1	+1	.	+2	+1	+2	IV
<i>Capsella bursa-pastoris</i>	+2	+1	.	.	+1	+2	.	.	+1	+1	+1	+1	+2	IV
<i>Origanum rotundifolia</i>	+2	+2	.	.	+2	+2	+2	+2	+2	.	.	+2	+2	IV
<i>Rubus platyphyllos</i>	.	.	+2	+2	+2	.	+2	+2	+2	.	+2	+2	+2	IV
<i>Sorbus torminalis</i> var. <i>torminalis</i>	+1	.	+2	+1	+1	+1	.	.	.	+1	+1	+1	+1	IV
<i>Silene compacta</i>	+1	.	+1	.	.	+1	+1	.	.	+1	+1	+1	+1	IV
<i>Xeranthemum annuum</i>	.	+1	+1	+1	.	+1	+1	.	+1	+1	.	+1	.	IV
<i>Petrorhagia saxifraga</i>	.	+1	+1	+2	.	.	+1	+1	+1	+1	+1	.	.	IV
<i>Rosa canina</i>	+1	.	.	+1	.	.	+1	+1	.	.	+1	+1	.	III
<i>Trifolium arvense</i>	+1	.	.	.	.	.	.	+1	+1	.	+2	+1	+2	III
<i>Cynosurus echinatus</i>	+1	.	+2	.	.	.	+1	+2	.	.	+1	.	.	II
<i>Dorycnium graecum</i>	+2	.	.	.	.	+2	.	+2	.	.	.	+2	+1	II
<i>Melilotus officinalis</i>	.	.	.	+2	+1	+2	.	.	+1	.	.	.	+1	II
<i>Scabiosa columbaria</i>	.	.	.	+2	+1	.	.	.	+1	.	+1	+2	.	II
<i>Sedum spurium</i>	.	+1	+1	.	+1	.	.	.	+1	.	.	.	+1	II
<i>Viola canina</i>	+2	.	.	+2	.	.	+1	+1	.	.	.	.	+1	II
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	+1	.	.	+1	+1	.	+1	.	.	.	.	+1	.	II
<i>Medicago lupulina</i> var. <i>perennans</i>	.	+1	.	.	.	.	+1	.	.	.	+1	.	.	II
<i>Euphrasia hirtella</i>	.	.	.	+2	.	.	.	.	+1	.	.	.	+2	II
<i>Teucrium orientale</i> var. <i>glabrescens</i>	+2	.	.	+1	.	.	.	.	.	.	.	.	+2	II
<i>Rubus discolor</i>	.	.	.	+1	.	.	+1	.	.	.	.	.	.	I
<i>Linaria armeniaca</i>	.	.	.	.	.	.	+1	.	+1	.	.	.	.	I
<i>Euphorbia szovitsii</i> var. <i>szovitsii</i>	.	.	.	.	+2	.	.	.	+1	.	.	.	.	I
<i>Sedum pilosum</i>	.	.	.	.	+2	.	.	.	.	.	.	.	.	I
<i>Trigonella spicata</i>	.	.	+2	.	.	.	.	.	.	.	.	.	.	I
<i>Vicia villosa</i> subsp. <i>villosa</i>	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
<i>Viola sieheana</i>	.	.	.	.	.	.	+2	.	.	.	.	.	.	I
<i>Genista tinctoria</i>	.	.	.	.	.	.	+2	.	.	.	.	.	.	I
<i>Euphorbia orientalis</i>	+1	.	.	.	.	.	.	.	.	.	.	.	.	I

*Type: Quadrat 63

Localities of Quadrats

	62	63*	85	86	89	90	127	128	150	153	158	173	69
x	282115	282660	287506	287620	287936	287735	286402	286258	286760	286072	286115	286688	283348
y	4573447	4573648	4573763	4574092	4574049	4574551	4577762	4578436	4578637	4579210	4579683	4579268	4573390

Table 5. *Fago orientalis*-*Abietum nordmannianae* Eminagaoglu & Anşin ass. nov.

Number of quadrat in table	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Field number of quadrat	97	98	99	105	106	107*	132	133	134	135	139	140	141	175	176	177	178	179
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Day & Month	16.07	16.07	16.07	16.07	16.07	16.07	25.07	25.07	25.07	25.07	25.07	25.07	25.07	29.07	29.07	29.07	29.07	29.07
Size of Quadrat (m2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Altitude (m)	1850	1860	1870	1870	190	1900	1900	1900	1900	1910	1920	192	1950	1950	1900	1930	1930	1950
Exposure	W	W	W	W	W	NW	NW	NW	NW	W	W	W	NW	NW	NW	N	N	N
Inclination (%)	80	80	70	80	80	80	70	70	80	70	70	70	80	80	70	70	60	60
Soil depth (cm)	50	50	50	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Height of tree layer (m)	35	35	35	30	30	30	35	35	35	35	35	35	35	25	30	25	20	30
Coverage of the tree layer (%)	80	80	80	70	90	80	60	60	70	70	60	65	80	70	60	60	60	60
Height of the shrub layer (m)	2	3	2	2	2	2	1	1	1	2	2	2	2	1	1	2	2	2
Coverage of the shrub layer (%)	5	1	1	1	5	1	10	10	10	30	20	25	20	10	10	10	20	20
Height of the herb layer (cm)	50	50	60	50	60	50	40	50	50	60	60	60	50	40	50	50	50	50
Coverage of the herb layer (%)	50	60	50	50	60	60	50	40	50	50	60	60	50	60	60	30	50	30
Presence																		
Characteristic and differential species of the association																		
<i>Fagus orientalis</i>	11	22	32	22	22	22	22	11	11	11	21	11	11	21	11	11	11	22
<i>Abies nordmanniana</i> subsp. <i>nordmanniana</i>	44	32	22	32	32	32	22	22	32	32	32	22	32	32	32	22	22	22
<i>Daphne mezereum</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+2	+1	+2	+1	+2	+1	+1	+1
<i>Ranunculus caucasicus</i> subsp. <i>subleucocarpus</i>	+1	+1	+1	+	+1	+1	+1	+1	+	+1	+2	+	+	+2	+	+1	+1	+
<i>Astragalus imbricatus</i>	+	+2	+	+2	12	+	+	+	+2	+2	+2	+1	+	+2	+	+	+	+2
Characteristic species of <i>Veronica-Fagion</i>																		
<i>Veronica peduncularis</i>	+1	+	+1	+1	+	+	+1	+1	+	+	+1	+1	+1	+	+	+	+1	+1
<i>Luzula campestris</i>	+1	+1	+	+	+1	+1	+	+	+	+	+	+	+1	+	+	+	+1	+1
Characteristic species of <i>Geranio-Prinion</i>																		
<i>Geranium ibericum</i> subsp. <i>ibericum</i>	+1	+1	+	+1	+2	+	+	+	+	+	+	+2	+2	+1	+	+	+	+
<i>Astrantia maxima</i> subsp. <i>maxima</i>	+	+	+	+	+1	+	+	+1	+	+	+	+1	+1	+	+	+	+1	+1
<i>Aquilegia olympica</i>	+	+	+	+	+	+	+	+1	+	+1	+	+	+	+1	+1	+	+	+
<i>Aconitum orientale</i>	+	+	+1	+1	+	+	+	+1	+	+1	+	+	+	+	+	+	+	+
<i>Geranium psilostemon</i>	+	+	+	+2	+	+	+	+1	+	+1	+	+1	+	+	+	+	+	+
Characteristic species of <i>Alnion barbatæ</i>																		
<i>Gentiana asclepiadea</i>	+	+	+	+1	+	+	+	+	+	+1	+1	+	+1	+	+	+	+	+
Characteristic species of <i>Carpino-Acerion</i>																		
<i>Lonicera caucasica</i> subsp. <i>orientalis</i>	+	+	+	+	+	+	+	+	+	+2	+	+2	+2	+	+	+	+2	+2
<i>Helleborus orientalis</i>	+	+	+	+	+	+	+	+1	+	+1	+	+	+	+	+1	+	+	+
Characteristic species of <i>Pino-Piceetalia orientalis</i>																		
<i>Viburnum orientale</i>	+1	+1	+	+1	+	+1	+1	+	+1	+1	+1	+	+	+1	+1	+	+1	+1
<i>Dryopteris filix-mas</i>	+1	+1	+	+1	+	+1	+1	+	+1	+	+1	+1	+	+1	+	+	+	+
<i>Cardamine impatiens</i> var. <i>pectinata</i>	+2	+	+	+2	+	+	+2	+	+2	+2	+	+2	+	+	+2	+	+	+
<i>Dryopteris dilatata</i>	+	+	+1	+	+1	+	+	+1	+1	+	+	+	+	+	+1	+	+	+
<i>Picea orientalis</i>	+	+	+1	+	+1	+	+	+1	+	+	+	+	+1	+	+1	+	+	+
<i>Pinus sylvestris</i>	+	+	+	+	+1	+	+	+	+	+1	+	+	+	+	+1	+	+	+

Characteristic species of Quercus-Fagetum																
<i>Carex sylvatica</i>	+1	-	+1	-	+1	-	+1	+1	-	-	+1	+1	-	-	+1	III
<i>Myrica muralis</i>	+1	-	+1	-	-	-	+1	-	-	-	+1	+1	-	-	+1	III
<i>Veronica officinalis</i>	-	+1	-	-	+1	-	-	+2	-	-	+2	-	+2	-	+2	III
<i>Aruncus vulgaris</i>	+1	-	+1	-	-	-	+1	-	-	-	+1	-	-	-	+1	II
<i>Athyrium filix-foemina</i>	+1	-	+1	-	-	-	-	+1	-	-	+1	-	-	-	-	II
<i>Stellaria holostea</i>	+1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	II
Characteristic species of Quercus-Carpinetum orientalis																
<i>Tanacetum parthenium</i>	+1	-	-	+1	-	-	+1	-	-	-	-	+1	-	-	+1	II
<i>Astragalus glycyphyllos</i> subsp. <i>glycyphylloides</i>	-	-	-	-	-	-	+2	+1	-	-	+2	-	-	-	-	II
<i>Mespilus germanica</i>	-	-	-	-	-	-	-	+1	-	-	-	-	-	-	-	I
Characteristic species of Rhododendro-Fagetum orientalis																
<i>Hedera colchica</i>	+1	+1	-	+1	-	+1	-	+1	-	+1	-	+1	-	+1	-	IV
<i>Ilex colchica</i>	+2	+2	-	-	+2	-	+2	-	-	-	+2	-	+2	-	+2	III
<i>Acer trautvetteri</i>	+1	+1	-	+1	-	+1	+1	-	-	-	+2	-	+1	-	-	III
<i>Rhododendron luteum</i>	-	-	-	+2	-	+2	-	+2	-	-	+2	-	+2	-	+2	III
<i>Trachystemon orientalis</i>	-	+1	-	-	-	-	+1	-	-	-	+1	-	-	-	+1	III
<i>Acer cappadocicum</i> var. <i>cappadocicum</i>	+1	-	+1	-	-	-	+1	+1	-	-	-	-	-	-	-	II
<i>Tilia rubra</i> subsp. <i>caucasica</i>	-	-	+1	-	-	-	-	+1	-	-	-	-	+1	-	+1	II
<i>Achillea biserrata</i>	-	-	+1	-	-	-	-	-	-	-	-	-	+1	-	-	II
<i>Vaccinium arctostaphylos</i>	-	-	-	-	-	-	+1	-	-	-	-	-	-	-	-	II
<i>Rhododendron ponticum</i>	-	-	-	-	-	-	-	+2	-	-	-	-	-	-	-	I
Characteristic species of Fagetum sylvatica																
<i>Sanicula europaea</i>	+1	21	+1	+2	+1	11	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
<i>Cardamine impatiens</i> var. <i>impatiens</i>	-	-	+1	-	+1	+2	+1	-	+1	-	-	+1	+1	-	+2	III
<i>Calamintha grandiflora</i>	+1	-	-	+1	-	+1	+1	-	-	-	-	+1	-	-	-	II
<i>Galium odoratum</i>	-	-	-	-	-	-	-	+1	+2	-	-	+1	-	+1	-	II
<i>Oxalis acetosella</i>	-	-	-	-	-	-	-	-	+1	-	-	-	+2	-	-	II
Characteristic species of Quercetum pubescentis																
<i>Euonymus latifolius</i> subsp. <i>latifolius</i>	-	-	-	-	-	-	-	+1	-	-	+1	-	-	-	+1	II
<i>Lithospermum purpureoaeuleum</i>	-	-	-	-	-	+2	-	-	+2	-	-	-	-	-	-	II
<i>Trifolium medium</i> var. <i>medium</i>	-	-	-	-	-	-	+1	-	-	-	+1	-	-	-	-	II
Companions																
<i>Geum urbanum</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	-	-	-	-	+1	+1	V
<i>Fragaria vesca</i>	+2	+2	+1	-	+1	+2	+1	+2	+1	-	+1	+1	+1	+1	+2	IV
<i>Populus tremula</i>	-	-	+1	+1	-	-	+1	-	+1	-	+1	-	-	-	+1	IV
<i>Brachypodium sylvaticum</i>	+1	+1	+1	-	+1	-	+1	-	+1	-	+1	-	+1	-	+1	IV
<i>Poa diversifolia</i>	+1	+1	+1	+1	-	+1	+1	+1	+1	-	+1	+1	-	+1	+1	IV
<i>Silene alba</i> subsp. <i>divaricata</i>	+2	+1	-	+2	+1	-	-	+1	-	+2	-	-	-	-	+1	IV
<i>Campanula glomerata</i>	+1	+1	-	-	+1	+1	-	-	-	+1	-	+1	-	+1	+1	III
<i>Lapsana communis</i> subsp. <i>intermedia</i>	-	-	+1	+1	-	-	+1	-	+1	-	+1	-	-	-	+1	III
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	-	-	+1	-	-	-	-	+1	-	+2	-	+1	-	-	-	III
<i>Torilis japonica</i>	-	-	-	-	+1	-	-	-	+1	-	-	+1	-	-	-	III
<i>Calyptegia silvatica</i>	+2	+1	-	+2	+1	-	-	+2	+1	-	+1	+1	-	+1	-	III
<i>Lolium rigidum</i> var. <i>rigidum</i>	-	-	+1	+1	-	-	-	-	+1	-	+1	+1	-	-	+1	III
<i>Geranium purpureum</i>	-	-	+1	+1	-	-	-	+1	-	-	-	-	-	-	-	III
<i>Heracleum antasiaticum</i>	+2	+1	-	-	+1	+2	+1	-	-	-	-	-	-	+2	+1	III
<i>Poa nemoralis</i>	+1	+1	-	-	-	+1	-	-	-	+2	+1	+1	-	-	-	II

[illegible]

#Type: Quadrat 107

Localities of Quadrats

Locality of Quadrants	97	98	99	105	106	107*	132	133	134	135	139	140	141	175	176	177	178	179
Y	4575115	4575443	4576030	4576194	4576455	4576628	4576628	4576763	4577438	4577457	4577640	4577659	4577900	4578189	4578016	4578430	4578585	4580377
X	294304	294401	293427	293649	293717	293611	293938	293765	293919	293697	293582	293717	293620	293861	294092	293447	293659	291789

subleiocarpus, *Astragalus imbricatus*, *Veronica peduncularis*, *V. officinalis*, *Luzula campestris*, *Carex sylvatica*, *Mycelis muralis*, and *Aruncus vulgaris*. The components of *Veronico-Fagion* alliance are *Veronica peduncularis*, and *Luzula campestris*. *Pino-Piceetalia orientalis* order is characterised by *Viburnum orientale*, *Dryopteris liliata*, *D. dilatata*, *Cardamine impatiens* var. *pectinata*, *Picea orientalis*, and *Pinus sylvestris*. *Querco-Fagetea* class is represented by *Carex sylvatica*, *Mycelis muralis*, *Veronica officinalis*, *Aruncus vulgaris*, *Athyrium filix-foemina*, and *Stellaria holostea*. *Quercetea pubescentis* class, *Fagetalia sylvatica*, *Rhododendro-Fagetalia orientalis* and *Querco-Carpinetalia orientalis* orders, and *Geranio-Pinion*, *Alnion barbatae*, and *Carpino-Acerion* alliances are also represented (Table 5). Due to the fact mentioned above, this association must be included in the *Veronico-Fagion* alliance and *Pino-Piceetalia orientalis* order.

4. *Pino sylvestris-Piceetum orientalis* Eminağaoğlu & Anşin ass. nov.

This association (Holotype Table 6, quadrat number 35) is usually dominant on the south and south-west facing slopes and at an altitude of 1400-1600 m. The soils of this association are sandy and clayey-loamy in texture, and have a basic character (pH 7-7.8), lime content varied from 15.97% to 26.44%, and organic matter and N content was between 0.48% and 2.56% and 0.02% and 0.13%, respectively (Table 2). Characteristic and differential species of this association are *Picea orientalis*, *Pinus sylvestris*, and *Limodorum abortivum*. This association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is between 85% and 100%, reaching between 25 and 35 m in height and characterised by *Picea orientalis* and *Pinus sylvestris*. Total coverages of the shrub and herb layers are between

Table 6. *Pino sylvestris-Piceetum orientalis* Eminağaoğlu & Anşin ass. nov.

Number of quadrat in table	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	Presence
Field number of quadrat	34	35*	59	60	61	149	151	152	188	307	308	309	310	311	312	
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Day & Month	01.07	01.07	14.07	14.07	14.07	26.07	26.07	26.07	29.07	10.08	10.08	10.08	10.08	10.08	10.08	
Size of Quadrat (m2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1400	1400	1500	1530	1570	1570	1600	1600	1400	1500	1530	1550	1550	1600	1600	
Exposure	S	S	SW	W	W	W	S	S	S	SW	W	W	W	S	S	
Inclination (%)	70	70	20	20	20	40	20	20	70	20	20	20	40	20	20	
Soil depth (cm)	40	40	50	50	40	40	50	50	40	50	50	40	40	50	50	
Height of tree layer (m)	30	30	35	35	30	30	35	35	30	35	35	30	30	35	35	
Coverage of the tree layer (%)	90	90	100	95	85	90	95	95	90	100	95	85	90	95	95	
Height of the shrub layer (m)	2	2	2	2	2	3	3	3	2	2	2	2	3	3	3	
Coverage of the shrub layer (%)	5	5	1	1	5	5	5	1	5	1	1	5	5	5	1	
Height of the herb layer (cm)	30	30	30	30	40	40	30	30	30	30	30	40	40	30	30	
Coverage of the herb layer (%)	15	15	25	20	20	15	10	20	15	25	20	20	15	10	20	
Characteristic and differential species of the association																
<i>Pinus sylvestris</i>	22	11	22	21	22	21	11	11	11	22	21	22	21	11	11	V
<i>Picea orientalis</i>	33	44	33	32	33	33	44	43	44	33	32	33	33	44	43	V
<i>Limodorum abortivum</i>	.	+1	+1	.	.	+1	+1	.	+1	+1	.	.	+1	+1	.	III
Characteristic species of <i>Geranio-Pinion</i>																
<i>Geranium psilostemon</i>	.	.	+2	+2	.	+2	+1	.	.	+2	+2	.	+2	+1	.	III
<i>Astrantia maxima</i> subsp. <i>maxima</i>	+1	.	.	+1	+1	.	.	+1	.	.	+1	+1	.	.	+1	III
<i>Geranium ibericum</i> subsp. <i>ibericum</i>	.	.	.	.	+1	+1	.	.	.	.	+2	+1	+1	.	.	II
<i>Hypericum bithynicum</i>	.	.	.	.	+1	.	.	.	+1	.	+1	+1	.	.	+1	II
<i>Aconitum orientale</i>	.	+2	.	.	+1	.	.	.	+2	.	+1	+1	.	.	.	II
Characteristic species of <i>Carpino-Acerion</i>																
<i>Helleborus orientalis</i>	.	+2	.	.	.	+2	+2	.	+2	.	.	.	+2	+2	.	II
<i>Quercus petraea</i> subsp. <i>iberica</i>	.	+1	+1	.	.	.	+1	.	+1	+1	.	.	.	+1	.	II
<i>Carpinus betulus</i>	+1	.	.	.	.	.	.	+1	.	.	.	.	.	.	+1	I
<i>Lonicera caucasica</i> subsp. <i>orientalis</i>	.	.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	I

Characteristic species of *Pino-Piceetalia orientalis*

<i>Cardamine impatiens</i> var. <i>pectinata</i>	.	+2	12	+2	.	+2	.	+2	+2	12	+2	.	+2	.	+2	IV
<i>Sedum stoloniferum</i>	.	+1	+1	+1	.	+1	.	.	+1	+1	.	.	+1	+1	.	III
<i>Viburnum orientale</i>	.	.	.	+1	+1	.	.	+1	+1	.	+1	.	.	+1	+1	III
<i>Dryopteris lilliana</i>	+1	+1	.	.	+1	.	+1	.	+1	.	.	+1	.	+1	.	III
<i>Dryopteris dilatata</i>	.	+1	.	+1	+1	.	.	.	+1	.	+1	+1	.	.	.	II

Characteristic species of *Quercus-Fagetalia*

<i>Mycelis muralis</i>	.	+1	+1	.	+1	.	+1	+1	+1	+1	.	+1	.	+1	+1	IV
<i>Veronica officinalis</i>	+2	+2	.	.	.	.	+2	+2	+2	.	.	.	.	+2	+2	III
<i>Sanicula europaea</i>	.	.	.	+1	.	21	+1	.	.	21	+1	.	21	+1	.	III
<i>Aruncus vulgaris</i>	+1	+1	+1	.	.	+1	.	.	+1	+1	.	.	+1	.	.	III
<i>Stellaria holostea</i>	.	+1	.	+1	.	+1	.	.	.	+1	.	.	+1	.	.	II
<i>Carex sylvatica</i>	.	+1	+1	.	.	+1	.	.	+1	+1	.	.	.	.	.	II
<i>Blechnum spicant</i>	.	.	+1	.	.	+1	.	.	+1	+1	+1	.	.	.	.	II
<i>Athyrium filix-foemina</i>	.	.	.	+1	.	.	+1	.	.	.	.	+1	+1	.	.	II

Characteristic species of *Quercus-Carpinetalia orientalis*

<i>Polygala supina</i>	.	.	.	.	.	.	.	+1	.	+2	.	.	.	.	+1	I
<i>Ostrya carpinifolia</i>	.	.	.	.	.	.	.	+1	.	+1	.	.	.	.	+1	I
<i>Tanacetum parthenium</i>	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	+1	I

Characteristic species of *Rhododendro-Fagetalia orientalis*

<i>Rhododendron ponticum</i>	.	+2	.	.	.	.	+2	+2	+2	.	.	.	.	+2	+2	II
<i>Ilex colchica</i>	.	+2	12	.	.	.	+2	.	+2	12	.	.	.	+2	.	II
<i>Trachystemon orientalis</i>	+1	.	.	.	+1	.	.	+1	.	.	.	+1	.	.	+1	II
<i>Rhododendron luteum</i>	.	+2	+2	.	.	.	.	.	+2	+2	.	.	.	.	.	II
<i>Hedera colchica</i>	.	.	.	.	+1	+1	.	.	.	.	.	+1	+1	.	.	II
<i>Achillea biserrata</i>	+1	.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	I
<i>Vaccinium arctostaphylos</i>	.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	I

Characteristic species of *Fagetalia sylvatica*

<i>Calamintha grandiflora</i>	+1	.	.	.	+1	.	+2	.	+1	.	.	+1	.	+2	+1	III
<i>Galium odoratum</i>	+1	.	.	.	.	.	+1	.	+1	.	.	+1	.	+1	.	II
<i>Oxalis acetosella</i>	+1	.	.	.	.	.	11	.	11	.	.	.	.	11	11	II
<i>Cardamine impatiens</i> var. <i>impatiens</i>	.	+1	+2	.	.	.	.	.	+1	+2	.	.	.	.	.	II

Characteristic species of *Quercetalia pubescentis*

<i>Cotinus coggygria</i>	+1	+1	+1	+1	.	+1	.	.	.	+1	+1	.	+1	+1	.	III
<i>Cornus mas</i>	.	+1	.	.	+1	.	.	+1	+1	.	.	+1	.	.	+1	II
<i>Acer campestre</i> var. <i>campestre</i>	.	+1	.	.	+1	.	+1	.	+1	.	.	.	+1	+1	.	II
<i>Coronilla varia</i> subsp. <i>varia</i>	.	.	.	.	+2	.	+2	.	+2	+2	+2	.	.	+2	.	II
<i>Clematis vitalba</i>	.	+1	.	.	+2	.	.	.	.	.	.	+2	.	.	.	I
<i>Euonymus latifolius</i> subsp. <i>latifolius</i>	.	.	.	.	.	+1	.	+1	.	.	.	.	.	+1	.	I
<i>Lithospermum purpureoaeeruleum</i>	.	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	I
<i>Trifolium medium</i> var. <i>medium</i>	.	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	I

Characteristic species of *Pistacio-Rhamnetalia alterni*

<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+1	+1	+1	.	.	.	+1	+1	.	.	.	+1	+1	.	+1	IV
--	----	----	----	---	---	---	----	----	---	---	---	----	----	---	----	----

Companions

<i>Lathyrus lactiflorus</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
<i>Galium rotundifolium</i>	+1	+1	+1	+1	.	.	+1	+1	+1	+1	+1	.	.	+1	+1	IV
<i>Origanum rotundifolia</i>	.	+2	+2	+2	+2	.	+2	.	+2	+2	+2	.	+2	+2	.	IV
<i>Fragaria vesca</i>	+1	+1	.	.	+1	.	.	.	+1	+2	.	+1	+1	.	+1	III
<i>Lapsana communis</i> subsp. <i>intermedia</i>	+1	+1	.	+1	.	+1	.	.	+1	.	+1	.	+1	+1	.	III
<i>Brachypodium sylvaticum</i>	+1	.	+1	.	+1	+1	+1	.	+1	.	.	+1	.	+1	.	III
<i>Vicia balansae</i>	.	+1	+1	.	.	+1	+1	.	+1	+1	.	.	+1	+1	.	III
<i>Lathyrus roseus</i>	.	.	.	+1	+1	+1	.	+1	.	.	+1	+1	+1	.	+1	III
<i>Medicago sativa</i> subsp. <i>sativa</i>	+1	+2	.	.	.	+2	.	+1	+2	+2	.	.	+2	.	+1	III
<i>Medicago lupulina</i> var. <i>perennans</i>	.	.	+1	+1	+1	.	+1	.	.	+1	+1	+1	.	+1	.	III

<i>Rubus discolor</i>	.	+1	+1	.	+1	.	+1	.	+1	.	+1	.	+1	.	III	
<i>Populus tremula</i>	.	+1	+1	.	.	+1	+1	.	+1	.	.	.	+1	+1	III	
<i>Capsella bursa-pastoris</i>	.	+1	.	.	+1	.	+1	+2	+1	.	.	.	.	+1	+2	III
<i>Torilis japonica</i>	.	+1	.	+1	+1	.	.	.	+1	.	+1	+1	.	.	+1	III
<i>Viola sieheana</i>	.	.	.	+1	+1	.	.	+1	+1	.	.	+1	+1	.	+1	III
<i>Xeranthemum annuum</i>	.	.	+1	+1	.	.	.	+1	+1	.	+1	.	.	+1	+1	III
<i>Poa nemoralis</i>	.	+1	+1	.	.	+1	+1	.	+1	.	.	.	.	+1	.	II
<i>Pyrus communis</i> subsp. <i>caucasica</i>	.	.	.	+1	+1	.	+1	.	+1	.	+1	.	.	+1	.	II
<i>Rosa canina</i>	.	.	+1	+1	.	.	+1	.	.	.	+1	+1	.	.	+1	II
<i>Corylus avellana</i> var. <i>avellana</i>	+1	.	.	.	+1	.	.	+1	.	.	+2	.	.	.	+1	II
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	+1	.	+2	.	.	.	.	+1	.	+2	.	.	.	.	+1	II
<i>Geranium robertianum</i>	+2	.	.	+2	.	.	+2	.	.	.	+2	.	.	+2	.	II
<i>Rhus coriaria</i>	+1	.	+1	+1	.	.	.	.	.	+1	.	+1	.	.	.	II
<i>Rubus platyphyllos</i>	+2	.	.	+2	.	.	.	+2	.	.	.	+2	.	.	+2	II
<i>Symphytum longipetiolatum</i>	+1	.	.	.	.	+1	.	+1	.	.	.	+1	.	.	+1	II
<i>Silene compacta</i>	+1	.	.	+1	.	.	.	+1	.	+1	.	.	+1	.	.	II
<i>Holosteum marginatum</i>	+1	.	.	+1	.	.	.	+1	.	+1	.	.	+1	.	.	II
<i>Vicia cracca</i> subsp. <i>tenuifolia</i>	.	+1	.	.	.	.	.	+2	+1	.	.	.	+2	+2	.	II
<i>Silene vulgaris</i> var. <i>vulgaris</i>	.	+2	+2	.	.	+2	.	.	.	.	.	.	+2	+2	.	II
<i>Stachys iberica</i> subsp. <i>stenostachya</i>	.	+1	+1	.	.	+1	.	.	.	.	.	.	+1	+1	.	II
<i>Vicia villosa</i> subsp. <i>villosa</i>	.	+2	+2	.	.	+1	.	.	.	.	.	.	+1	+1	.	II
<i>Cerasus avium</i>	.	.	.	+1	.	+1	.	.	.	+1	.	+1	.	.	.	II
<i>Epilobium montanum</i>	.	.	+2	+1	.	.	.	.	.	+2	+1	.	.	.	.	II
<i>Linaria armeniaca</i>	.	.	.	.	+1	.	+1	.	.	.	.	+1	.	+1	.	II
<i>Platanthera chlorantha</i>	.	.	.	.	+1	.	+1	.	.	.	.	+1	.	+1	.	II
<i>Corylus avellana</i> var. <i>pontica</i>	+1	.	.	+1	.	.	.	.	.	.	+1	.	.	.	+2	II
<i>Heracleum antasiaticum</i>	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	I
<i>Symphytum asperum</i>	.	.	.	.	.	.	.	.	.	+2	.	.	.	.	.	I
<i>Atropa belladonna</i>	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	I
<i>Bromus racemosus</i>	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
<i>Festuca drymeja</i>	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	I
<i>Geranium purpureum</i>	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	I
<i>Calystegia silvatica</i>	+2	.	.	.	.	.	.	.	.	+2	+1	.	.	.	.	I
<i>Crepis paludosa</i>	+1	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	I
<i>Echium vulgare</i>	.	.	.	+1	.	.	.	.	.	.	+1	+1	.	.	.	I
<i>Coronilla orientalis</i> var. <i>orientalis</i>	.	+2	+2	.	.	.	.	.	.	.	.	.	+2	.	.	I
<i>Fumaria microcarpa</i>	.	+1	.	.	.	.	+1	.	.	.	.	.	+1	.	.	I
<i>Argyrolobium biebersteinii</i>	.	.	.	+2	.	.	.	.	.	.	.	+2	.	.	+2	I
<i>Cynosurus echinatus</i>	.	.	.	+1	.	.	.	.	.	.	+1	+1	.	.	.	I
<i>Alopecurus aequalis</i>	.	+1	.	.	.	.	.	.	+1	.	.	+1	.	.	.	I
<i>Dorycnium graecum</i>	.	+1	.	.	.	.	.	.	+1	.	.	+1	.	.	.	I
<i>Campanula glomerata</i>	.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	I
<i>Geum urbanum</i>	.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	I

*Type: Quadrat 35

Localities of Quadrats

	34	35*	59	60	61	149	151	152	188	307	308	309	310	311	312
x	279880	281039	286174	287051	287897	288429	287740	285047	289431	288429	286769	291341	290496	291529	285235
y	4570852	4570226	4574109	4573138	4571666	4571071	4570257	4569380	4575330	4578023	4579651	4577271	4579589	4579870	4567846

1% and 10% and 10% and 25%, respectively, and they are between 2 and 3 m and 30 and 40 cm in height, respectively. The shrub layer is characterised by *Quercus petraea*, *Lonicera caucasica*, *Ostrya carpinifolia*, and *Acer campestre*. The herb layer is characterised by *Geranium psilostemon*, *Aconitum orientale*, *Sedum stoloniferum*, *Lathyrus lactiflorus*, and *Galium rotundifolium*. The floristic composition of this association includes the characteristic species of the class *Querco-Fagetea* and *Quercetea pubescentis*, and the orders *Fagetalia sylvatica*, *Rhododendro-Fagetalia orientalis*, *Pistacio-Rhamnetalia alterni*, and *Querco-Carpinetalia orientalis*, and the alliances *Alnion barbatae* and *Carpino-Acerion*. The important components of the alliance *Geranio-Pinion* are *Aconitum orientale*, *Geranium ibericum* subsp. *ibericum*, *G. psilostemon*, *Hypericum bithynicum*, and *Astrantia maxima* subsp. *maxima*, and those of the order *Pino-Piceetalia orientalis* are *Sedum stoloniferum*, *Viburnum orientale*, *Dryopteris dilatata*, *D. liliana*, and *Cardamine impatiens* var. *pectinata*. This association was included in the *Geranio-Pinion* alliance and *Pino-Piceetalia orientalis* order when the floristic composition was examined.

5. *Abieti nordmannianae-Piceetum orientalis* Eminağaoğlu & Anşin ass. nov.

This association (Holotype Table 7, quadrat number 58) is usually dominant on the east, south-east and north-west facing slopes and at an altitude of 1600-1750 m. The texture of this soil is sand-clayey, pH varied from 5.0 to 5.7, and organic matter and N contents were 2.77%-11.41% and 0.14%-0.57%, respectively (Table 2). Characteristic species of this association are *Abies nordmanniana* subsp. *nordmanniana*, *Picea orientalis*, *Vicia crocea*, *Solidago virgaurea* subsp. *virgaurea*, *Symphytum longipetiolatum*, *Crepis paludosa*, *Digitalis ferruginea* subsp. *schischkinii*, and *Symphytum asperum*.

This association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is between 80% and 100%, reaching 35 m in height and characterised by *Abies nordmanniana* subsp. *nordmanniana* and *Picea orientalis*. Total coverages of the shrub and herb layers are between 1% and 5% and 10% and 25%, respectively, and they are between 2 and 3 m and 30 and 40 cm in height, respectively. The shrub layer is characterised by *Rhamnus ibericus*, *Frangula alnus*, *Viburnum orientale*, *Rhododendron ponticum*, and *R. luteum*. The herb layer is dominated by *Geranium ibericum*, *Gentiana asclepiadea*, *Carex sylvatica*, and

Veronica officinalis. The components of the *Geranio-Pinion* alliance are *Astrantia maxima* subsp. *maxima*, *Hypericum bithynicum*, *Geranium psilostemon*, *G. ibericum* subsp. *ibericum*. Those of the *Pino-Piceetalia orientalis* order are *Dryopteris liliana*, *Cardamine impatiens* var. *pectinata*, *Viburnum orientale*, *Sedum stoloniferum*, *Pinus sylvestris*, and *Ranunculus cappadocicus*, while those of the *Querco-Fagetea* class are *Carex sylvatica*, *Veronica officinalis*, *Athyrium filix-foemina*, *Aruncus vulgaris*, *Mycelis muralis*, *Stellaria holostea*, and *Blechnum spicant*. Characteristic species of the *Quercetea pubescentis* class, of the *Querco-Carpinetalia orientalis*, *Rhododendro-Fagetalia orientalis*, and *Fagetalia sylvatica* orders, and of the *Castaneo-Carpinion*, *Alnion barbatae*, and *Carpino-Acerion* alliances are shown in Table 7. From this point of view, the syntaxonomic explanation of the *Abieti nordmannianae-Piceetum orientalis* is not easy. However, all characteristic and differential species of this association are typical for the order *Pino-Piceetalia orientalis* and the alliance *Geranio-Pinion*. Therefore, it should be considered in the syntaxa cited above.

6. *Abieti nordmannianae-Pinetum sylvestris* Eminağaoğlu & Anşin ass. nov.

This association (Holotype Table 8, quadrat number 73) is usually dominant on the south and south-west facing slopes and at an altitude of 1750-1850 m. These soils are of acidic character (pH 5.3-5.7) and sandy and clayey-loamy texture; organic matter content was extending from 1.15% to 6.67%, while N content was extending from 0.03% to 0.33% (Table 2). Characteristic species of this association are *Abies nordmanniana* subsp. *nordmanniana*, *Pinus sylvestris*, and *Delphinium albiflorum*. This association exhibits tree, shrub, and herb layers. Total coverage of the tree layers is between 70% and 90%, reaching 35 m in height and characterised by *Abies nordmanniana* subsp. *nordmanniana* and *Pinus sylvestris*. Total coverages of the shrub and herb layers are between 1% and 5% and 20 and 60%, respectively, and they are between 2 and 3 m and 40 and 60 cm in height, respectively. The dominant species of the bush layer are *Viburnum orientale*, *Salix caprea*, *Rhododendron luteum*, and *Vaccinium arctostaphylos*. The most common species in the herb layer are *Geranium psilostemon*, *Tanacetum parthenium*, and *Achillea biserrata*. *Abieti nordmannianae-Pinetum sylvestris* includes various

Table 7. *Abieti nordmannianae-Piceetum orientalis* Eminağaoğlu & Anşın ass. nov.

Number of quadrat in table	64	65	66	67	68	69	70	71	72	73	74	75	
Field number of quadrat	44	58*	87	88	112	113	116	117	119	129	314	324	
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Day & Month	02.07	02.07	15.07	15.07	16.07	20.07	20.07	20.07	20.07	25.05	10.08	10.08	
Size of Quadrat (m ²)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1650	1650	1670	1680	1700	1730	1730	1750	1550	1650	1650	1650	
Exposure	SE	SE	NW	NW	SE	SE	SE	E	N	N	N	NW	
Inclination (%)	70	70	80	80	60	70	70	70	30	30	30	60	
Soil depth (cm)	30	40	40	40	30	30	40	40	30	30	30	40	
Height of tree layer (m)	35	35	35	35	35	35	35	35	30	30	30	25	
Coverage of the tree layer (%)	100	90	90	80	100	100	90	80	90	80	90	80	
Height of the shrub layer (m)	3	2	2	2	3	2	3	3	3	2	2	2	
Coverage of the shrub layer (%)	1	1	5	5	5	5	1	1	1	10	5	10	
Height of the herb layer (cm)	40	40	40	40	30	40	40	40	30	40	40	40	
Coverage of the herb layer (%)	25	20	20	20	20	20	20	20	25	5	5	20	Presence
Characteristic and differential species of the association													
<i>Abies nordmanniana</i> subsp. <i>nordmanniana</i>	11	11	11	22	22	21	22	22	11	11	11	11	V
<i>Picea orientalis</i>	43	32	43	33	32	32	22	32	54	54	54	54	V
<i>Vicia crocea</i>	.	+1	+1	.	.	+1	+1	+1	+1	+1	+1	+1	IV
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	.	+2	.	.	.	+1	+1	+2	+1	+1	+1	+1	IV
<i>Symphytum longipetiolatum</i>	.	+1	.	.	.	.	.	.	+1	+1	+1	+1	III
<i>Crepis paludosa</i>	.	+1	.	.	.	.	.	.	+1	+1	+1	+1	III
<i>Digitalis ferruginea</i> subsp. <i>schischkinii</i>	.	.	.	+1	.	.	.	.	+1	+1	.	.	II
<i>Symphytum asperum</i>	.	.	.	.	.	.	.	.	+1	+2	.	.	I
Characteristic species of <i>Geranio-Pinion</i>													
<i>Astrantia maxima</i> subsp. <i>maxima</i>	+1	+1	.	.	+1	.	.	.	+1	+1	+1	.	III
<i>Geranium psilostemon</i>	.	+1	+2	.	+1	.	.	+1	+2	.	+2	.	III
<i>Hypericum bithynicum</i>	.	.	+1	.	.	.	.	.	.	+1	.	.	I
<i>Geranium ibericum</i> subsp. <i>ibericum</i>	.	+1	.	.	.	.	.	.	+1	.	.	.	I
Characteristic species of <i>Castaneo-Carpinion</i>													
<i>Rubus platyphyllos</i>	+2	.	.	.	+2	+2	.	+2	+2	.	.	+2	III
<i>Rhamnus imeretinus</i>	+1	+1	.	.	+1	.	.	.	+1	+1	.	.	III
<i>Carpinus betulus</i>	+1	.	.	+1	.	+1	+1	.	.	.	.	.	II
Characteristic species of <i>Alnion barbatae</i>													
<i>Gentiana asclepiadea</i>	.	.	.	.	+1	+2	.	+1	+2	.	+1	.	III
<i>Frangula alnus</i> subsp. <i>alnus</i>	.	.	.	.	.	.	+1	.	.	+1	.	.	II
Characteristic species of <i>Carpino-Acerion</i>													
<i>Helleborus orientalis</i>	.	+1	.	.	.	+1	.	+1	.	.	.	.	II
<i>Quercus petraea</i> subsp. <i>iberica</i>	+1	.	.	.	.	+1	.	.	.	.	.	.	I
<i>Lonicera caucasica</i> subsp. <i>orientalis</i>	+1	.	.	.	.	.	.	.	.	.	.	.	I
Characteristic species of <i>Pino-Piceetalia orientalis</i>													
<i>Dryopteris lilliana</i>	+1	+1	.	+1	+1	+1	.	+1	+1	.	+1	+1	IV
<i>Cardamine impatiens</i> var. <i>pectinata</i>	+2	12	12	.	+1	.	.	+1	.	+2	+1	.	III
<i>Viburnum orientale</i>	.	+1	.	+1	+1	.	.	+1	+1	.	+1	+1	III
<i>Sedum stoloniferum</i>	+1	+2	.	+2	.	.	+2	.	.	.	.	+2	III
<i>Pinus sylvestris</i>	.	.	.	+1	.	.	+1	.	.	+1	.	+1	II
<i>Ranunculus cappadocicus</i>	.	+1	.	.	+1	.	.	+1	+1	.	.	.	II
Characteristic species of <i>Quercus-Fagetalia</i>													
<i>Carex sylvatica</i>	.	+1	+1	+1	.	+1	+1	.	+1	+1	.	+1	IV
<i>Veronica officinalis</i>	+2	.	+2	+2	.	+2	+1	.	+2	+1	.	+2	IV
<i>Athyrium filix-foemina</i>	+1	.	.	.	+1	.	+1	+1	.	+1	+1	.	III
<i>Aruncus vulgaris</i>	+1	.	.	.	.	+1	.	.	+1	.	.	+1	II
<i>Mycelis muralis</i>	+1	.	+1	.	.	.	+1	.	.	.	+1	.	II
<i>Stellaria holostea</i>	.	.	+1	.	+1	.	.	+1	.	.	.	.	I
<i>Blechnum spicant</i>	.	.	.	.	+1	.	.	.	.	.	.	+1	I
Characteristic species of <i>Quercus-Carpinetalia orientalis</i>													
<i>Tanacetum parthenium</i>	.	+1	.	.	.	.	.	.	.	.	+1	.	I
Characteristic species of <i>Rhododendro-Fagetalia orientalis</i>													
<i>Hedera colchica</i>	.	.	+1	+1	+1	+1	.	+1	+1	.	+1	+1	IV

<i>Acer cappadocicum</i> var. <i>cappadocicum</i>	+1	.	.	+1	.	+1	.	+1	+1	.	.	+1	III
<i>Vaccinium arctostaphylos</i>	+1	.	.	+1	.	+1	.	.	+1	.	.	+1	III
<i>Rhododendron ponticum</i>	.	+2	.	.	+2	.	+2	.	.	+2	.	.	II
<i>Rhododendron luteum</i>	.	.	.	.	+2	.	.	.	.	+2	+2	.	II
<i>Ilex colchica</i>	+2	+2	.	.	.	.	.	.	.	+2	.	.	II
<i>Achillea biserrata</i>	.	+1	.	.	.	.	.	.	.	+1	.	.	II
<i>Acer trautvetteri</i>	.	.	.	.	+1	.	.	.	.	+1	.	.	I
<i>Tilia rubra</i> subsp. <i>caucasica</i>	+1	.	.	.	.	.	.	.	.	.	.	.	I
<i>Trachystemon orientalis</i>	.	.	.	.	.	.	.	+1	.	.	.	.	I
Characteristic species of <i>Fagetalia sylvatica</i>													
<i>Sanicula europaea</i>	+1	+1	+1	.	+1	+1	+1	+1	+1	.	+1	+1	V
<i>Cardamine impatiens</i> var. <i>impatiens</i>	.	+1	+2	.	+1	+1	.	+1	+1	.	+1	+1	IV
<i>Oxalis acetosella</i>	11	.	.	.	+2	.	.	.	12	+2	12	.	III
<i>Calamintha grandiflora</i>	+1	.	.	+1	.	.	+1	.	.	+1	.	.	II
<i>Galium odoratum</i>	.	.	.	+1	.	.	.	.	.	.	.	+1	I
Characteristic species of <i>Quercetea pubescentis</i>													
<i>Clematis vitalba</i>	.	.	+2	.	.	.	.	.	.	.	.	.	I
<i>Acer campestre</i> var. <i>campestre</i>	.	+1	.	.	.	.	.	.	.	.	.	.	I
<i>Trifolium medium</i> var. <i>medium</i>	.	+1	.	.	.	.	.	.	.	.	.	.	I
Companions													
<i>Fragaria vesca</i>	+1	+2	+1	+2	+1	.	+1	+1	.	+1	+1	+2	V
<i>Lathyrus lactiflorus</i>	+1	+1	+1	.	+1	.	+1	+1	.	.	+1	+1	V
<i>Digitalis ferruginea</i> subsp. <i>schischkini</i>	.	+1	+1	.	+1	.	.	+1	+1	.	+1	+1	IV
<i>Populus tremula</i>	+1	+1	.	+1	.	+1	+1	.	.	.	.	+1	III
<i>Poa nemoralis</i>	+1	.	.	+1	+1	.	.	+1	+1	.	.	.	III
<i>Salix caprea</i>	+1	.	.	+1	+1	.	.	.	+1	+1	.	.	III
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	+1	.	.	.	.	+1	+2	.	+1	+2	.	.	III
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	+1	.	.	.	+1	.	.	.	.	.	+1	.	II
<i>Cerasus avium</i>	+1	.	.	.	+1	.	.	.	.	.	+1	.	II
<i>Lapsana communis</i> subsp. <i>intermedia</i>	.	+1	+1	.	.	+1	.	.	.	.	.	.	II
<i>Salvia glutinosa</i>	.	.	+1	.	.	+1	.	.	.	+1	.	.	II
<i>Heracleum antasiaticum</i>	.	.	.	+1	.	+1	+2	.	+1	.	.	.	II
<i>Rosa canina</i>	.	+1	.	.	.	.	+1	.	.	.	+1	.	II
<i>Viola sieheana</i>	.	+1	.	.	.	.	+1	.	.	.	+1	.	II
<i>Bromus racemosus</i>	+1	.	.	.	.	.	.	+1	.	.	.	.	II
<i>Geranium robertianum</i>	.	.	+2	.	.	.	.	+2	.	.	.	.	I
<i>Corylus avellana</i> var. <i>avellana</i>	.	.	.	.	+1	.	.	+1	.	.	.	.	I
<i>Epilobium montanum</i>	.	.	.	.	.	.	+1	.	+1	.	.	.	I
<i>Campanula glomerata</i>	.	+1	.	.	.	.	.	.	+1	.	.	.	I
<i>Corylus avellana</i> var. <i>pontica</i>	.	+2	.	.	.	.	.	.	.	.	+1	.	I
<i>Silene vulgaris</i> var. <i>vulgaris</i>	+1	.	.	.	.	.	.	+1	.	.	.	.	I
<i>Acer campestre</i> var. <i>leiocarpum</i>	.	.	+1	.	.	.	.	+1	.	.	.	.	I
<i>Dorycnium graecum</i>	.	.	+1	.	.	.	.	.	.	.	.	.	I
<i>Tamus communis</i> subsp. <i>communis</i>	.	.	.	.	.	.	.	.	.	.	.	+1	I
<i>Vicia villosa</i> subsp. <i>villosa</i>	.	.	.	.	.	.	.	.	.	.	.	+1	I
<i>Calystegia silvatica</i>	.	.	.	.	+2	.	.	.	.	.	.	.	I
<i>Medicago sativa</i> subsp. <i>sativa</i>	.	.	.	.	+2	.	.	.	.	.	.	.	I
<i>Pyrus communis</i> subsp. <i>caucasica</i>	.	.	.	.	+1	.	.	.	.	.	.	.	I
<i>Viola canina</i>	.	.	.	.	.	.	.	.	.	+1	.	.	I
<i>Lolium rigidum</i> var. <i>rigidum</i>	.	.	.	.	.	+1	.	.	.	.	.	.	I
<i>Poa diversifolia</i>	.	.	.	.	.	+1	.	.	.	.	.	.	I

*Type: Quadrat 58

Localities of Quadrats

	44	58*	87	88	112	113	116	117	119	129	314	324
x	282041	284202	286394	287239	289807	289588	291404	292876	291404	288896	289020	291382
y	4574077	4573639	4578086	4578712	4577397	4578962	4578806	4575361	4578806	4576580	4577823	4573680

Table 8. *Abieti nordmannianae-Pinetum sylvestris* Eminağaoğlu & Anşın ass. nov.

Number of quadrat in table	76	77	78	79	80	81	82	83	84	85	
Field number of quadrat	70	71	73*	78	138	65	100	103	104	327	
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Day & Month	14.07	14.07	14.07	15.07	25.07	14.07	16.07	16.07	16.07	10.08	
Size of Quadrat (m2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1750	1760	1760	1750	1750	1800	1800	1830	1850	1850	
Exposure	S	S	S	S	S	SW	SW	SW	SW	SW	
Inclination (%)	70	70	60	60	60	70	70	60	60	60	
Soil depth (cm)	40	50	50	50	40	40	40	40	40	40	
Height of tree layer (m)	35	35	35	35	35	35	35	35	35	35	
Coverage of the tree layer (%)	80	70	80	70	70	70	80	90	85	85	
Height of the shrub layer (m)	3	3	2	2	2	3	2	2	2	2	Presence
Coverage of the shrub layer (%)	5	5	5	5	1	5	5	5	5	5	
Height of the herb layer (cm)	40	40	40	50	50	50	60	60	60	60	
Coverage of the herb layer (%)	40	40	50	50	60	40	20	60	60	60	
Characteristic and differential species of the association											
<i>Abies nordmanniana</i> subsp. <i>nordmanniana</i>	21	32	11	22	21	32	22	32	22	22	V
<i>Pinus sylvestris</i>	22	33	43	32	33	22	32	22	32	32	V
<i>Delphinium albiflorum</i>	+1	+1	+1	.	.	+1	+1	+1	.	.	III
Characteristic species of <i>Geranio-Pinion</i>											
<i>Geranium psilostemon</i>	.	.	.	.	+2	+1	.	.	+2	+2	II
<i>Geranium ibericum</i> subsp. <i>ibericum</i>	.	+1	.	.	.	.	.	.	.	.	I
<i>Hypericum bithynicum</i>	.	+1	.	.	.	.	.	.	.	.	I
Characteristic species of <i>Veronico-Fagion</i>											
<i>Luzula campestris</i>	.	+1	+1	.	.	+1	+1	.	.	.	II
Characteristic species of <i>Pino-Piceetalia orientalis</i>											
<i>Dryopteris liliانا</i>	.	+1	+1	+1	+1	.	+1	+1	+1	+1	IV
<i>Picea orientalis</i>	.	.	+1	+1	+1	.	+1	+1	+1	+1	IV
<i>Viburnum orientale</i>	.	+1	+1	.	+1	.	+1	.	+1	+1	III
<i>Dryopteris dilatata</i>	.	+1	.	.	.	+1	+1	.	.	.	II
<i>Cardamine impatiens</i> var. <i>pectinata</i>	+2	.	.	.	.	+2	.	+2	.	.	II
<i>Sedum stoloniferum</i>	+2	.	.	.	.	+2	.	+2	.	.	II
Characteristic species of <i>Quercu-Fagetea</i>											
<i>Carex sylvatica</i>	+1	+1	.	+1	.	.	.	+1	+1	+1	III
<i>Athyrium filix-foemina</i>	+1	.	.	+1	+1	.	.	+1	.	.	II
<i>Stellaria holostea</i>	+1	.	.	.	.	+1	.	+1	.	+1	II
<i>Veronica officinalis</i>	+1	.	+1	.	.	+1	.	.	.	.	II
<i>Aruncus vulgaris</i>	.	.	+1	.	.	+1	+1	.	.	.	II
<i>Mycelis muralis</i>	.	.	+1	.	.	.	+1	.	.	.	I
Characteristic species of <i>Quercu-Carpinetalia orientalis</i>											
<i>Astragalus glycyphyllos</i> subsp. <i>glycyphylloides</i>	.	.	.	.	.	+2	+2	.	.	.	I
Characteristic species of <i>Rhododendro-Fagetalia orientalis</i>											
<i>Hedera colchica</i>	.	.	.	+1	+1	.	+1	+1	+1	+1	III

<i>Rhododendron luteum</i>	.	.	+2	.	.	+2	.	+2	+2	+2	III
<i>Acer cappadocicum</i> var. <i>cappadocicum</i>	.	+1	.	+1	+1	.	.	+1	.	.	II
<i>Rhododendron ponticum</i>	.	+2	+2	.	.	.	+2	.	.	.	II
<i>Acer trautvetteri</i>	.	+1	+1	.	.	+1	.	.	.	.	II
<i>Ilex colchica</i>	.	.	+2	.	.	.	+2	.	.	.	I
<i>Trachystemon orientalis</i>	+1	.	.	.	.	.	+1	.	.	.	I
<i>Vaccinium arctostaphylos</i>	.	.	.	.	.	+1	.	.	.	.	I
Characteristic species of <i>Populetales albae</i>											
<i>Sambucus ebulus</i>	.	.	.	+1	.	+1	.	.	.	.	I
Characteristic species of <i>Fagetales sylvatica</i>											
<i>Sanicula europaea</i>	.	+1	.	+1	+1	11	+1	.	+1	+1	IV
<i>Calamintha grandiflora</i>	+1	+1	+1	.	+1	.	+1	+1	.	.	III
<i>Oxalis acetosella</i>	.	.	+2	12	.	.	+2	.	.	.	II
<i>Cardamine impatiens</i> var. <i>impatiens</i>	.	.	+2	.	.	+2	.	+2	.	.	II
<i>Galium odoratum</i>	.	.	.	+1	.	+1	.	.	.	.	I
Companions											
<i>Silene vulgaris</i> var. <i>vulgaris</i>	+2	+2	.	.	+2	+1	.	.	+2	+2	III
<i>Medicago sativa</i> subsp. <i>sativa</i>	+2	.	+1	+2	.	.	+2	.	.	.	II
<i>Lathyrus lactiflorus</i>	+1	.	.	+1	.	.	.	.	+1	.	II
<i>Acer cappadocicum</i> var. <i>stenocarpum</i>	+1	.	.	+1	.	+1	.	.	.	.	II
<i>Geranium purpureum</i>	.	.	.	+1	.	+1	.	+2	.	.	II
<i>Lathyrus roseus</i>	.	+1	.	.	+1	+1	.	.	.	.	II
<i>Heracleum antasiaticum</i>	.	.	+2	.	+2	+1	.	.	.	.	II
<i>Salix caprea</i>	.	.	+1	.	+1	.	.	.	+1	.	II
<i>Silene compacta</i>	.	.	+1	.	+1	.	.	.	+2	.	II
<i>Vicia cracca</i> subsp. <i>tenuifolia</i>	.	.	+2	.	.	.	.	+2	+2	.	II
<i>Astragalus imbricatus</i>	.	+2	.	.	+2	.	.	+2	.	.	II
<i>Acer campestre</i> var. <i>leiocarpum</i>	.	.	.	.	+1	.	+1	.	.	.	I
<i>Viola sieheana</i>	.	.	.	.	.	.	+1	+1	.	.	I
<i>Epilobium angustifolium</i> subsp. <i>angustifolium</i>	.	+1	.	.	.	.	.	.	.	.	I
<i>Calystegia silvatica</i>	.	+2	.	.	.	.	.	.	.	+1	I
<i>Platanthera chlorantha</i>	.	.	.	.	.	.	.	.	.	+1	I
<i>Rubus discolor</i>	.	.	.	.	.	.	.	.	.	+1	I
<i>Viola canina</i>	.	.	.	.	.	+2	.	.	.	.	I
<i>Solidago virgaurea</i> subsp. <i>virgaurea</i>	+2	.	.	.	.	.	.	.	.	.	I

*Type: Quadrat 73

Localities of Quadrats

	70	71	73*	78	138	65	100	103	104	327
x	293834	293308	291785	292588	290803	293723	293045	293515	290595	291453
y	4575823	4576404	4576764	4577124	4578770	4577040	4578092	4578272	4578231	4580210

species belonging to various syntaxa units. Important components of the alliance *Geranio-Pinion* are *Hypericum bithynicum*, *Geranium psilostemon* and *G. ibericum* subsp. *ibericum*. The order *Pino-Piceetalia Orientalis* is characterised by *Picea orientalis*, *Dryopteris liliana*, *D. dilatata*, *Cardamine impatiens* var. *pectinata*, *Viburnum orientale*, *Sedum stoloniferum*, and *Ranunculus cappadocicus*. The alliance *Veronica-Fagion* is represented only by *Luzula campestris*. The floristic composition of this association includes the characteristic species of the classes *Quercetea pubescentis* and the orders *Querco-Carpinetalia orientalis*, *Rhododendro-Fagetalia orientalis*, *Populetales albae*, and *Fagetalia sylvatica*. The components of the *Geranio-Pinion* alliance and *Pino-Piceetalia orientalis* order are well represented in this association. Therefore, this association must be considered in those syntaxa units.

7. *Junipero communi-Pinetum sylvestris* Eminağaoğlu & Anşın ass. nov.

This association (Holotype Table 9, quadrat number 72) is usually dominant on the south facing slopes and at an altitude of 1900-2000 m. The soils of the associations have a slightly acidic character (pH 5.1-5.4) and are sandy-loamy in structure. Organic matter and N contents were 2.11%-5.08% and 0.11%-0.28%, respectively (Table 2). Characteristic species of this association are *Pinus sylvestris*, *Juniperus communis* subsp. *saxatilis*, *Tripleurospermum melanolepis*, *Muscari caucasicum*, *Phleum exaratum* subsp. *exaratum*, *Centaurea triumfettii*, *Daphne glomerata*, *Campanula sibirica* subsp. *hohenackeri*, *Echium russicum*, and *Pilosella x auriculoides*. This association exhibits tree, shrub, and herb layers. The tree layer is only characterised by *Pinus*

Table 9. *Junipero communi-Pinetum sylvestris* Eminağaoğlu & Anşın ass. nov.

Number of quadrat in table	86	87	88	89	90	91	92	93	94	95	96	97	
Field number of quadrat	72*	74	75	91	92	93	142	143	144	145	146	156	
Year	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Day & Month	14.07	14.07	14.07	15.07	16.07	16.07	25.07	26.07	26.07	26.07	26.07	26.07	
Size of Quadrat (m ²)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1900	1910	1910	1920	1920	1950	1950	1960	1960	1950	190	1950	
Exposure	S	S	S	S	S	S	S	S	S	S	S	S	
Inclination (%)	40	50	50	40	50	50	60	60	70	80	70	70	
Soil depth (cm)	20	20	20	20	20	20	20	20	20	20	20	20	
Height of tree layer (m)	15	15	15	15	15	15	15	15	15	15	15	15	
Coverage of the tree layer (%)	70	70	60	60	70	70	70	80	80	70	60	60	
Height of the shrub layer (m)	2	2	1	1	1	1	1	2	1	1	1	1	Presence
Coverage of the shrub layer (%)	20	40	40	30	30	30	40	20	10	20	20	30	
Height of the herb layer (cm)	40	40	40	40	30	40	40	40	40	40	40	40	
Coverage of the herb layer (%)	20	20	20	10	10	20	10	10	20	20	30	10	
Characteristic and differential species of the association													
<i>Juniperus communis</i> subsp. <i>saxatilis</i>	22	12	22	12	12	12	22	12	22	12	12	12	V
<i>Pinus sylvestris</i>	44	53	44	43	44	44	43	43	44	43	44	44	V
<i>Tripleurospermum melanolepis</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
<i>Phleum exaratum</i> subsp. <i>exaratum</i>	+1	+1	+1	+1	+2	+1	+1	+1	+1	+1	+2	+1	V
<i>Daphne glomerata</i>	+1	+2	.	+2	+1	.	+1	+2	.	+2	+1	+2	V
<i>Centaurea triumfettii</i>	+1	+1	+1	.	+2	+2	.	.	+2	.	+2	+2	V
<i>Echium russicum</i>	+1	+1	.	.	+1	.	.	.	.	+1	+1	+4	III
<i>Campanula sibirica</i> subsp. <i>hohenackeri</i>	.	.	+2	+1	.	+1	+1	+1	.	.	.	+3	III
<i>Pilosella x auriculoides</i>	.	.	.	+1	+1	+1	.	.	.	.	+1	+5	III
Characteristic species of <i>Geranio-Pinion</i>													
<i>Geranium psilostemon</i>	+2	+1	.	+2	+2	+1	+2	+1	.	+2	+2	+1	V
<i>Hypericum bithynicum</i>	+1	.	+1	+1	+1	.	+1	.	+1	+1	+1	.	IV
<i>Geranium ibericum</i> subsp. <i>ibericum</i>	+1	.	.	+2	+2	.	+1	.	.	+2	.	.	III
<i>Aconitum orientale</i>	.	+1	+1	.	.	.	.	+1	+1	.	.	.	III
<i>Aquilegia olympica</i>	.	.	.	.	+1	.	.	.	.	.	+1	.	I
Characteristic species of <i>Pino-Piceetalia orientalis</i>													
<i>Dryopteris liliana</i>	+1	.	.	+1	.	.	+1	+1	.	+1	+1	.	III

<i>Dryopteris dilatata</i>	.	+1	.	.	+1	+1	.	.	.	.	+1	+1	III
<i>Viburnum orientale</i>	.	.	+1	+1	.	.	.	.	+1	+1	.	.	II
<i>Abies nordmanniana</i> subsp. <i>nordmanniana</i>	.	.	+1	.	.	.	.	.	+1	.	.	.	I
<i>Ranunculus cappadocicus</i>	.	+1	.	.	.	.	.	+1	.	.	.	.	I
<i>Picea orientalis</i>	.	.	.	+1	.	.	.	.	.	.	.	.	I
Characteristic species of <i>Quercus-Fagetum</i>													
<i>Carex sylvatica</i>	+1	+1	.	+1	+1	.	+1	+1	.	+1	+1	.	IV
<i>Stellaria holostea</i>	.	+1	.	.	.	+1	+1	+1	.	.	+1	+1	III
<i>Mycelis muralis</i>	.	.	+1	.	.	+1	.	+1	+1	.	.	+1	III
<i>Veronica officinalis</i>	.	+2	+2	.	.	.	.	+2	.	.	.	.	II
<i>Athyrium filix-foemina</i>	.	+1	.	.	+1	.	.	+1	.	.	.	.	II
Characteristic species of <i>Quercus-Carpinetalia orientalis</i>													
<i>Tanacetum parthenium</i>	.	.	.	.	.	+1	.	.	.	.	.	+1	I
Characteristic species of <i>Rhododendro-Fagetalia orientalis</i>													
<i>Rhododendron luteum</i>	.	+2	12	.	.	+2	.	+2	12	.	.	+2	III
<i>Hedera colchica</i>	.	.	.	+1	+1	.	.	.	.	+1	+1	+1	III
<i>Rhododendron ponticum</i>	.	.	+2	.	.	+1	.	.	+2	.	.	+1	II
<i>Acer trautvetteri</i>	.	.	.	+1	+1	.	.	.	.	+1	+1	.	II
Characteristic species of <i>Fagetalia sylvatica</i>													
<i>Sanicula europaea</i>	.	.	+1	+1	.	.	.	+1	+1	+1	.	.	III
<i>Oxalis acetosella</i>	+1	.	.	.	.	.	.	.	.	.	+1	+1	II
<i>Calamintha grandiflora</i>	.	.	.	+1	.	.	.	.	.	+1	.	.	I
<i>Galium odoratum</i>	.	+1	.	.	.	.	.	+1	.	.	.	.	I
Characteristic species of <i>Caricetea curvulae</i>													
<i>Carex caucasica</i>	+1	.	.	.	.	+1	+1	.	.	.	+1	+2	III
<i>Polygala alpestris</i>	+1	.	+1	+1	.	.	.	+1	.	.	.	.	II
<i>Veronica gentianoides</i>	.	+1	.	.	+1	+2	.	.	+1	.	.	.	II
<i>Trifolium ambiguum</i>	.	+1	.	.	.	.	+1	.	+1	.	.	.	II
<i>Gentiana septenifida</i>	.	.	.	+1	.	.	+1	.	+1	.	.	.	II
<i>Gentianella caucasea</i>	.	.	+1	.	.	.	.	.	.	+1	.	.	I
<i>Phleum alpinum</i>	.	.	.	.	.	.	.	.	.	+1	.	.	I
Companions													
<i>Populus tremula</i>	.	+1	.	+1	+1	+1	.	.	+1	+1	+1	+1	IV
<i>Vicia balansae</i>	.	+1	.	+1	.	+1	.	.	.	+1	+1	+1	III
<i>Echium vulgare</i>	.	.	.	.	.	+1	.	+1	.	.	+1	+1	II
<i>Geranium purpureum</i>	+1	.	.	.	.	+2	.	+2	.	.	.	.	II
<i>Bromus racemosus</i>	+1	.	.	.	.	.	.	+1	.	.	+1	.	II
<i>Poa diversifolia</i>	+1	+1	.	.	.	.	.	.	.	.	+1	.	II
<i>Rubus discolor</i>	.	.	+1	.	.	+1	.	.	.	.	.	+1	II
<i>Salix caprea</i>	.	.	+1	.	.	+1	.	.	.	.	.	+1	II
<i>Sedum spurium</i>	.	+1	.	.	.	+1	.	.	.	.	.	+2	II
<i>Cephalaria aristata</i>	.	+1	.	.	.	.	.	.	+1	.	.	.	I
<i>Cynosurus echinatus</i>	.	.	.	.	+1	.	.	.	+1	.	.	.	I
<i>Erysimum leptophyllum</i>	.	.	.	+1	.	.	.	.	.	+1	.	.	I
<i>Platanthera chlorantha</i>	.	.	.	+1	.	.	.	.	.	+1	.	.	I
<i>Pyrus communis</i> subsp. <i>caucasica</i>	.	.	.	+1	.	.	.	.	.	.	.	.	I
<i>Sedum pilosum</i>	.	.	+1	.	.	.	.	.	.	.	.	.	I
<i>Alchemilla sericea</i>	.	.	+1	.	.	.	.	.	.	.	.	.	I
<i>Lolium rigidum</i> var. <i>rigidum</i>	.	.	.	.	.	.	+1	.	.	.	.	.	I
<i>Vicia cracca</i> subsp. <i>tenuifolia</i>	.	.	.	.	.	.	.	.	.	+2	.	.	I

*Type: Quadrat 72

Localities of Quadrats

	72*	74	75	91	92	93	142	143	144	145	146	156
x	287338	287587	287455	287631	290868	291218	291108	291347	291209	291637	291876	291816
y	4567489	4567451	4567346	4567284	4579432	4579382	4579602	4579607	4579865	4579731	4579713	4579989

sylvestris having a total coverage of between 60% and 80% and reaching 15 m in height. Total coverages of the shrub and herb layers are between 20% and 40% and 10% and 30%, respectively, and they are between 1 and 2 m and 10 and 30 cm in height, respectively. The dominant species of the shrub layer are *Juniperus communis* subsp. *saxatilis*, *Daphne glomerata*, and *Populus tremula*. The herb layer is characterised by *Tripleurospermum melanolepis*, *Muscari caucasicum*, *Phleum exaratum* subsp. *exaratum*, *Centaurea triumphettii*, *Campanula sibirica* subsp. *hohenackeri*, *Echium russicum*, and *Pilosella x auriculoides*. The *Geranio-Pinion* alliance is represented by *Geranium psilostemon*, *G. ibericum* subsp. *ibericum*, *Hypericum bithynicum*, *Aconitum orientale*, and *Aquilegia olympica*. The *Pino-Piceetalia orientalis* order is characterised by *Dryopteris liliiana*, *D. dilatata*, *Cardamine impatiens* var. *pectinata*, *Abies nordmanniana* subsp. *nordmanniana*, *Ranunculus cappadocicus*, and *Picea orientalis*. The components of the *Caricetea curvulae* class, and *Quercu-Carpinetalia orientalis*, *Rhododendro-Fagetalia orientalis*, and *Fagetalia sylvatica* orders are shown in Table 9. This association was included in the *Geranio-Pinion* alliance and *Pino-Piceetalia orientalis* order when the floristic composition was examined.

Results and Discussion

In the study area, 7 plant associations and 1 subassociation belonging to forest vegetation were determined.

When the flora of the area was analysed by Raunkiaer's life form system (Figure 4), it was found that the most represented classes in the floristic spectrum were hemicryptophytes 82 (41.6%) and cryptophytes 36 (18.3%), whereas the least represented class was therophytes 23 (11.7%). Chamaephytes and

phanerophytes were found to be 30 (15.2%) and 26 (13.2%), respectively. Özen & Kılınc (2002) also stated that chamaephytes were the most represented class in the floristic spectrum in Kunduz Forests. Since the importance of trees and shrubs increases from open to closed physiognomies, the proportion of hemicryptophytes and phanerophytes also increases in this direction (Batalha & Martins, 2004).

Almost half of the taxa belonging to Euro-Siberian, Euxine and Hyrcano-Euxine phytogeographical regions and most of the other taxa were pluriregionals (Table 10). This is not a surprising result when the transitional position of the study area between Euro-Siberian and Irano-Turanian phytogeographical regions was taken into account. Similar results were found in some previous studies involving regions with similar ecological conditions. For example, Kutbay & Kılınc (1995) and Özen & Kılınc (2002) found that the percentage of the species belonging to Euro-Siberian phytogeographical region was higher than that of any other species belonging to other phytogeographical regions. However, in the other studies mentioned, the percentage of the species belonging to Mediterranean phytogeographical region was higher than that of the present study because they were carried out in regions influenced by the Mediterranean climate (Kutbay & Kılınc, 1995; Özen & Kılınc, 2002). However, the study area was not remarkably influenced by the Mediterranean climate, and therefore the percentage of Mediterranean elements was low.

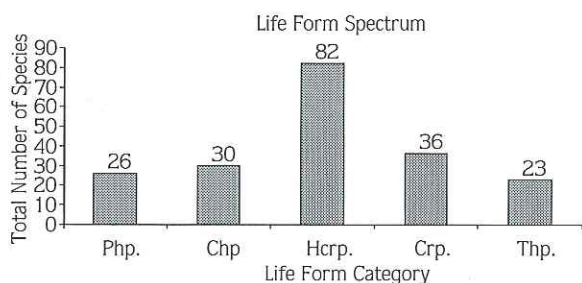


Figure 4. Life form spectrum of the vascular flora of forest vegetation.

Table 10. The distribution of the taxa according to phytogeographical regions in the present study.

Phytogeographical Region	Percentage
Euro-Sib	25.88
Euro-Sib. (mt.)	0.50
Euxine	16.24
Euxine (mt.)	2.03
Hyr-Eux.	4.06
Hyr-Eux. (mt.)	1.52
Ir-Tur.	3.55
Medit.	2.53
E. Medit.	1.52
Pluriregionals	42.13

The similarity percentage between the associations described in the present study and similar associations was rather low and below 50%. The highest similarity percentage of 34.07% was found between *Quercus petraea-Piceetum orientalis* and *Quercus cerris-Astragalus glycyphylloides*. However, these 2 associations were from very different altitudes and habitats. In addition, codominant species of the associations described in the present study were different from those of similar studies. For example, endemic species like *Hieracium varigatisquamum* (*Junipero-oxycedri-Pinetum sylvestris*) and *Astragalus imbricatus* (*Fago orientalis-Abietum nordmannianae*), and remarkable species mostly restricted to high mountains like *Delphinium albiflorum* (*Abieti nordmannianae-Pinetum sylvestris*) and *Echium russicum* (*Junipero communi-Pinetum sylvestris*) are characteristic and differential species of the associations in the study area. Moreover, the transitional character of the study area (from humid to arid climatic conditions) is one of the most important reasons for dissimilar floristic composition between the associations in the study area and the neighbouring areas. Therefore, the associations in the

present study were described as new associations. The lowest similarity percentage of 5.33% was found for *Quercus petraea-Piceetum orientalis* association in the study area and *Paeonia peregrinae-Quercetum cerridis* association described by Ekim & Akman (1991) (Table 11).

Sand content in all of the associations was high and most of the associations occur on sandy-loamy soils, while *Pino sylvestris-Piceetum orientalis* and *Junipero oxycedri-Pinetum sylvestris* occur on sandy clay loamy and sandy soils, respectively. Other than *Pino sylvestris-Piceetum orientalis*, all of the associations occur on medium and slightly acidic soils. *Pino sylvestris-Piceetum orientalis* association occur on neutral soils (Table 2). Electrical conductivity (mmhos/cm) was rather low in all of the associations (Pirdal, 1989; Kutbay, 1997).

Quercus petraea-Piceetum orientalis, *Junipero-oxycedri-Pinetum sylvestris*, *Pino sylvestris-Piceetum orientalis*, and *Junipero communi-Pinetum sylvestris* associations occur on the soils that are poor in nitrogen. Especially nitrogen was not detected in the deeper horizons of the *Junipero oxycedri-Pinetum sylvestris*

Table 11. The comparison of the associations with similar associations by Sorensen's (1948) formula.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
<i>Quercus petraea-Piceetum orientalis</i>	7.87		34.07	19.83		5.33					14.08	9.37			
<i>Junipero-oxycedri-Pinetum sylvestris</i>							9.58							14.19	
<i>Fago orientalis-Abietum nordmannianae</i>		32.43						16.76		23.45			11.53		
<i>Pino sylvestris-Piceetum orientalis</i>															
<i>Abieti nordmannianae-Piceetum orientalis</i>															
<i>Abieti nordmannianae-Pinetum sylvestris</i>					27.20				6.29						
<i>Junipero communi-Pinetum sylvestris</i>															10.16

A *Quercus pubescens* (Akman, 1974)

B *Fagus orientalis-Ilex colchica* (Quézel et al., 1980)

C *Quercus cerris-Astragalus glycyphylloides* (Quézel et al., 1980)

D *Carpinus orientalis-Lathyrus rotundifolius* (Quézel et al., 1980)

E *Abies bornmuelleriana* (Quézel et al., 1980)

F *Paeonia peregrinae-Quercetum cerridis* (Ekim & Akman, 1991)

G *Hyperico conferti-Pinetum sylvestris* (Ekim & Akman, 1991)

H *Fago-Abietum nordmannianae* (Kutbay & Kiliç, 1995)

I *Abieti nordmannianae-Pinetum sylvestris* (Kutbay & Kiliç, 1995)

J *Carpino-Fagetum orientalis* (Kutbay & Kiliç, 1995)

K *Carpino-Quercetum cerridis* (Kutbay & Kiliç, 1995)

L *Carpino-Quercetum cerridis* Kutbay & Kiliç 1995 (Özen & Kiliç, 2002).

M *Gallio-Fagetum orientalis* (Özen & Kiliç, 2002)

N *Daphno-Pinetum sylvestris* (Özen & Kiliç, 2002)

O *Daphno-Pinetum sylvestris* (Özen & Kiliç, 2002)

association. The soils under the other associations were rich in nitrogen and the highest nitrogen content was found in *Abieti nordmanniana-Piceetum orientalis*, which also had the highest organic matter content (Table 2).

CaCO₃ (%) was not detected under the soils of *Quercus petraea-Piceetum orientalis*, *Juniperus oxycedrus-Pinetum sylvestris*, *Fagus orientalis-Abietum nordmannianae*, or *Juniperus communis-Pinetum sylvestris* associations. The other associations were rich in CaCO₃ in the upper horizons; however, the CaCO₃ content was decreased in lower horizons. On the other hand, soils of the *Pinus sylvestris-Piceetum orientalis* association were quite rich in CaCO₃. Moreover, soils of the same association show an alkaline character (Table 2). CaCO₃ content and pH are inherently interrelated and Ca ions cause alkalinity (Kutbay, 1997).

The study area is the one of the most significant refuge and relict areas of the Tertiary forests of Western Eurasia. Deciduous temperate forests have been in

existence in this region since the Tertiary period. The largest natural forest ecosystems of Europe and mid-Asia are found in this region.

The biodiversity and ecological integrity of the forests in the area are severely threatened by various factors such as overgrazing and other unsustainable agricultural practices, unsustainable use of forests, and conversion of forest habitats to agricultural or residential uses. The forests in the region need to be formally protected to ensure the long-term survival of the region's biodiversity. A transborder protected area is to be set up between Turkey and Georgia to initiate a collaborative action to maintain the ecoregion conservation of the Caucasus.

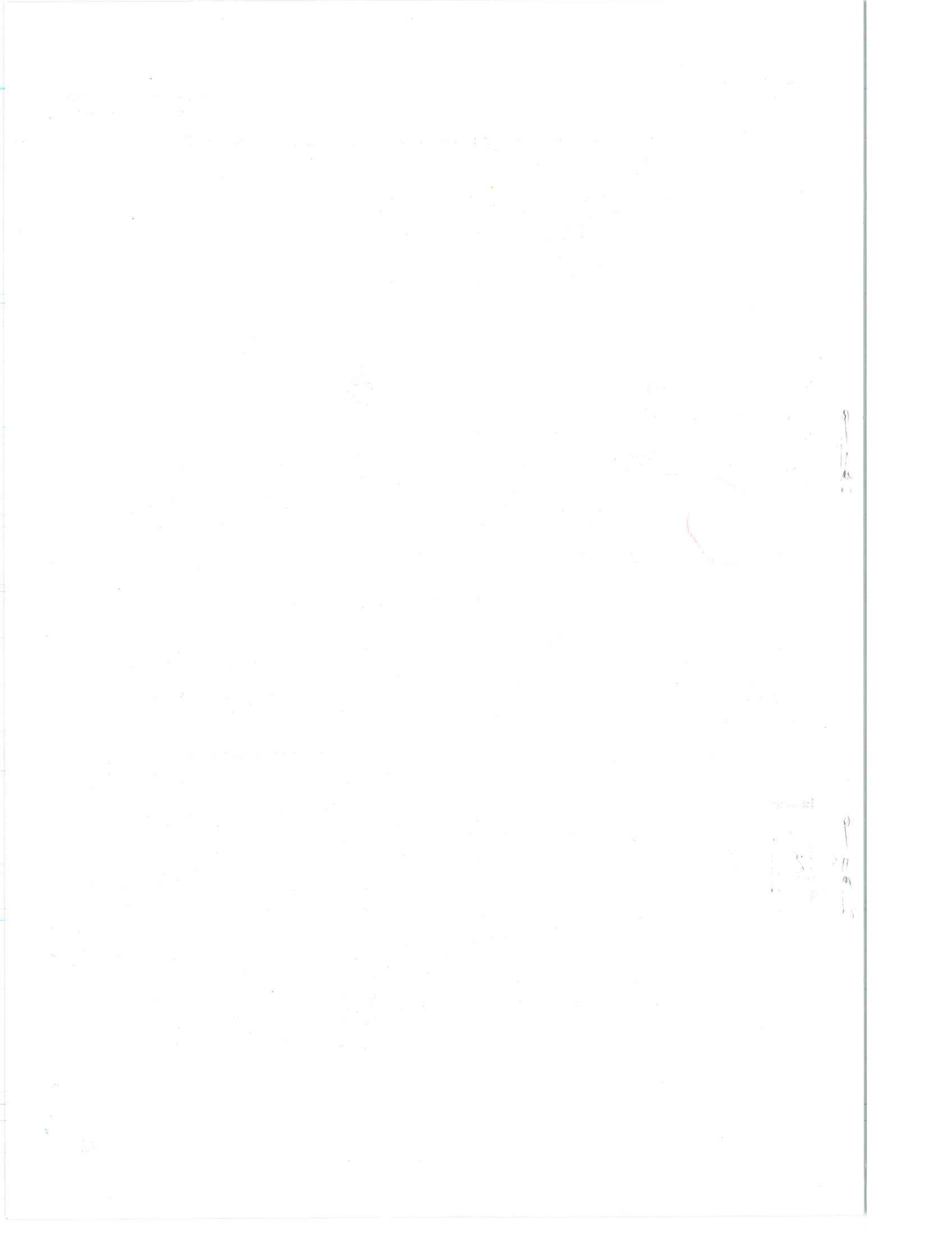
Acknowledgements

We would like to thank the Scientific and Technological Research Council of Turkey (TÜBİTAK) for its financial support (TARP-2339).

References

- Akman Y (1972). The vegetation of Beynam forest. *Comm Fac Sci Ank C* 16: 29-53.
- Akman Y (1974). Phytosociologie de la Region de Beypazarı-Karaşar et Nallıhan. *Comm Fac Sci Ank* 18: 51-113.
- Akman Y (1995). *Türkiye Orman Vegetasyonu*. Ankara: Ankara Üniversitesi Fen Fakültesi Botanik Anabilim Dalı. 450 pp.
- Akman Y (1999). *İklim ve Biyoiklim (Biyoiklim Metotları ve Türkiye İklimleri)*. Ankara: Kariyer Press, 350 pp.
- Akman Y, Barbero M & Quezel P (1978). Contribution à l'étude de la végétation forestière d'Anatolie méditerranéenne I. *Phytocoenologia* 5: 1-79.
- Akman Y, Barbero M & Quezel P (1979a). Contribution à l'étude de la végétation forestière d'Anatolie méditerranéenne II. *Phytocoenologia* 5: 189-276.
- Akman Y, Barbero M & Quezel P (1979b). Contribution à l'étude de la végétation forestière d'Anatolie méditerranéenne III. *Phytocoenologia* 5: 277-346.
- Akman Y & Ketenoğlu O (1986). The Climate and Vegetation of Turkey. *Proc Royal Soc Edin B-Bi* 89: 123-134.
- Anşin R (1979). *Flore de la forêt de Recherches de Meryemana-Trabzon et Les Recherches Floristiques Dans les Peuplements Puraux D'Epicea (Trabzon-Meryemana Araştırma Ormanı Florası ve Saf Ladin Meşcerelerinde Floristik Araştırmalar)*. Trabzon: Karadeniz Gazetecilik ve Matbaacılık Press, 234 pp.
- Anşin R (1983). The Floristic Regions and the Major Vegetation Types of Turkey. *J For Fac Kar Tech Univ* 6: 318-339.
- Batalha MA & Martins FR (2004). Floristic, frequency, and vegetation life-form spectra of a Cerrado Site. *Braz J Biol* 64: 203-209.
- Bayraklı F (1987). *Toprak ve Bitki Analizleri*, No. 17. Samsun: Ondokuz Mayıs University Press.
- Braun-Blanquet J (1932). *Plant Sociology*. New York and London: McGraw-Hill.
- Brummitt RK & Powell CE (eds) (1992). *Authors of Plant Names*. Kew: Royal Botanic Gardens, Kew, 732 pp.
- Davis PH (ed) (1965-1985). *Flora of Turkey and the East Aegean Islands*. Vols. 1-9. Edinburgh: Edinburgh University Press.
- Davis PH, Mill RR & Tan K (eds) (1988). *Flora of Turkey and the East Aegean Islands* (supplement). Vol. 10. Edinburgh: Edinburgh University Press.
- DMİ (2001). *Ortalama Ekstrem ve Yağış Değerleri Bülteni Artvin İli Verileri*. Ankara: Devlet Meteoroloji İşleri Genel Müdürlüğü Press.
- Düzenli A (1988). Neuf aux Syntaxons Phytosociologies pour la Végétation de Turquie. *Ecol Med* 14: 143-148.
- Ekim T & Akman Y (1991). Eskişehir İli Sündiken Dağlarındaki Orman Vegetasyonunun Bitki Sosyolojisi Bakımından Araştırılması. *Türk J Bot* 15: 28-40.

- Ellenberg H & Mueller-Dombois D (1967). A key to Raunkiaer plant life forms with revised subdivisions. *Ber Geobot Inst ETH Stifftg Rübel Zürich* 37: 56-73.
- Eminağaoğlu Ö & Anşin R (2003). The Flora of Hatila Valley National Park and its Close Environs (Artvin). *Turk J Bot* 27: 1-27.
- Eminağaoğlu Ö & Anşin R (2004). Flora of the Karagöl-Sahara National Park (Artvin) and Its Environs. *Turk J Bot* 28: 557-590.
- Eminağaoğlu Ö, Kutbay HG, Bilgin A & Yalçın E (2006). Contribution to the phytosociology and conservation of tertiary relict species in northeastern Anatolia (Turkey). *Belg J Bot* 139: 124-130.
- Grossheim AA (1939-1967). *Flora Kavkaza*. Vol. 1-7. Baku and Leningrad.
- Güner A, Özhatay N, Ekim T & Başer KHC (eds.) (2000). *Flora of Turkey and the East Aegean Islands*. Vol. 11. Edinburgh: Edinburgh University Press.
- Karaer F, Kılınc M & Kutbay HG (1999). The woody vegetation of the Kelkit Valley. *Turk J Bot* 23: 319-344.
- Ketenöğlu O, Akman Y & Aydoğdu M (1983). A phytosociological research on the maquis formation in the west Black Sea region. *Comm Fac Sci Ank C* 2: 10-19.
- Ketzkhoveli NN & Gagnidze RI (eds.) (1971-2001). *Georgian Flora (Flora of Georgia)*. Vol. 1-13. Metsniereba, Tbilisi.
- Kılınc M (1974). Kırıkkale-Kalecik ve Elmadağ Arasındaki Serpantin Formasyonunun Vejetasyonu Üzerinde Ekolojik ve Sosyolojik Bir Araştırma. *Bitki* 1: 479-521.
- Kılınc M (1985). İç Anadolu-Batı Karadeniz Geçiş Bölgesi'nde Devrez Çayı ile Kızılırmak Arasında Kalan Bölgenin Vejetasyonu. *Doğa Bilim Dergisi* A2 9: 315-357.
- Kılınc M & Karaer F (1995). The vegetation of Sinop Peninsula. *Turk J Bot* 19: 107-124.
- Kılınc M & Karakay H (1992). A phytosociological investigation on the subalpine and alpine vegetation of Çambaşı Plateau (Ordu). *Doğa - Turk J Bot* 16: 195-206.
- Komarow VL (ed) (1934-1978). *Flora of the USSR*. Leningrad. (English translation by IPST, Vol. 1-24, Jerusalem: Israel).
- Kutbay HG (1997). Some physical and chemical properties of soil in Central Black Sea region during different successional stages. *Fac Art Sci OMU J Sci* 8: 95-108.
- Kutbay HG & Kılınc M (1995). A phytosociological and ecological investigation of Bafra Nebyan Mountain (Samsun) and its environs. *Turk J Bot* 19: 41-63.
- Mayer H & Aksoy H (1998). *Wälder der Türkei*. Bolu: The Western Black Sea Forestry Research Institute Press. 291 pp.
- Mirov NT (1967). *The Genus Pinus*. New York: The Ronald Press Company.
- Özen F & Kılınc M (1995). The vegetation of the regions between Alaçam-Gerze and Boyabat-Durağan: II-forest and degraded forest vegetations. *Turk J Bot* 19: 87-105.
- Özen F & Kılınc M (2002). The flora and vegetation of Kunduz Forests (Vezirköprü / Samsun). *Turk J Bot* 26: 371-393.
- Özhatay N, Byfield A & Atay S (2003). *Türkiye'nin Önemli Bitki Alanları (Important Plant Areas of Turkey)*. İstanbul: WWF Turkey. 88 pp.
- Özhatay N, Byfield A & Atay S (2005). *Türkiye'nin 122 Önemli Bitki Alanı*. İstanbul: WWF Turkey. 476 pp.
- Parolly G (2004). The High Mountain Vegetation of Turkey – a State of the Art Report, Including a First Annotated Conspectus of the Major Syntaxa. *Turk J Bot* 28: 39-63.
- Pirdal M (1989). *Asphodelus aestivus* Brot'un autokolojisi üzerinde bir araştırma. *DOĞA TU J Botany* 13: 89-100.
- Quezel P, Barbéro M & Akman Y (1980). Contribution à l'étude de la végétation forestière d'Anatolie septentrionale. *Phytocoenologia* 8: 365-519.
- Raunkiaer C (1934). *The Life Form of Plants and Statistical Plant Geography*. London: Oxford University Press.
- Sorensen TA (1948). Method of establishing groups of equal amplitude in plant sociology based on similarity of species content. *Biol Skr Dan Vid Sel* 5: 1-34.
- TKH (1990). *Artvin İli Arazi Varlığı*. Ankara: Tarım ve Köy Hizmetleri Genel Müdürlüğü Press.
- Vural M (1996). High mountain vegetation of Rize. *Turk J Bot* 20: 83-102.
- Weber HE, Moravec J & Theurillat JP (2000). International Code of Phytosociological Nomenclature. *J Veg Sci* 11: 739-768.
- WWF & IUCN (1994). *Centres of Plant Diversity. A Guide and Strategy for their Conservation*. Vol. 1. Cambridge: IUCN Publications Unit, UK.
- Yaltırık F, Akman Y & Ketenöğlu O (1983). A Phytosociological Research in the Belgrad Forest. *Comm Fac Sci Ank* 1: 1-9.
- Zohary M. (1973): *Geobotanical Foundations of the Middle East*. Vols 1-2. Amsterdam: Gustav Fischer Verlag.



VOLUME 31 • NUMBER 5 • 2007

TURKISH JOURNAL OF BOTANY

TÜRK BOTANİK DERGİSİ

<http://journals.tubitak.gov.tr/botany/>



TURKISH JOURNAL OF BOTANY

VOLUME 31 NUMBER 5 2007

EDITOR

Hayri DUMAN

Gazi Üniversitesi,
Fen-Edebiyat Fakültesi, Biyoloji Bölümü, Botanik Anabilim Dalı,
Ankara - TURKEY

ASSOCIATE EDITORS

Zeki KAYA

(Plant Molecular Biology)
Orta Doğu Teknik Üniversitesi,
Fen-Edebiyat Fakültesi,
Biyoloji Bölümü,
Ankara - TURKEY
kayaz@metu.edu.tr

Asım KADIOĞLU

(Plant Physiology)
Karadeniz Teknik Üniversitesi,
Fen-Edebiyat Fakültesi,
Biyoloji Bölümü,
Trabzon - TURKEY
kadioglu@ktu.edu.tr

Stephan HELFER

(Fungi)
Herbarium
Royal Botanic Garden
20A Inverleith Row
Edinburgh EH3 5LR, U.K.
s.helfer@rbge.org.uk

Harald KÜRSCHNER

(Bryophytes)
Freie Universität Berlin
Institut für Biologie
Systematische Botanik und
Pflanzengeographie, Altensteinstr. 6
D-14195 Berlin, GERMANY
hkurschner@zedat.fu-berlin.de

Gerald PAROLLY

(Plant Sociology & Vegetation)
Freie Universität Berlin
Institut für Biologie
Systematische Botanik und
Pflanzengeographie, Altensteinstr. 6
D-14195 Berlin, GERMANY
gparolly@zedat.fu-berlin.de

John A. RAVEN

(Algology)
Division of Environmental and
Applied Biology,
School of Life Sciences
University of Dundee
Dundee DD1 4HN U.K.
j.a.raven@dundee.ac.uk

ADVISORY BOARD

Ahmet AKSOY, Kayseri
Kerim ALPINAR, İstanbul
Ahmet ASAN, Edirne
Güler AYKULU, İstanbul
Veyysel AYSEL, Çanakkale
Zeki AYTAÇ, Ankara
M. Tekin BABAÇ, Bolu
Mehmet BABAOĞLU, Konya
K. Hüsnü C. BAŞER, Eskişehir
Mark W. CHASE, Kew, U.K.
Semra CİRİK, İzmir
Brian J. COPPINS, Edinburgh, U.K.
Kemal ÇELİK, Balıkesir
Cumhur ÇÖKMÜŞ, Ankara
Musa DOĞAN, Ankara
Ahmet DURAN, Konya
Atabay DÜZENLİ, Adana
Tuna EKİM, İstanbul
Aljos FARJON, Kew, U.K.
Jan-Peter FRAHM, Bonn, GERMANY
Ralphreed A. GASANOV, Baku, AZERBAIJAN
Yusuf GEMİCİ, İzmir
İsa GÖKLER, İzmir
Arif GÖNÜLÖL, Samsun
Nermin GÖZÜKIRMIZI, İstanbul
Fahrettin GÜCİN, İstanbul
Gürçan GÜLERYÜZ, Bursa
Ekrem GÜREL, Bolu
Madeline HARLEY, Kew, U.K.
Rüştü HATİPOĞLU, Adana
Ian C. HEDGE, Edinburgh, U.K.
Nicholas HIND, Kew, U.K.
Peter P. HOEN, Utrecht, THE NETHERLANDS
Yoichiro HOSHIND, Hokkaido, JAPAN

Kâni IŞIK, Antalya
Volker JOHN, Dürkheim, GERMANY
Margaret A.T. JOHNSON, Kew, U.K.
Stephen L. JURY, Reading, U.K.
Harald KEHL, Berlin, GERMANY
Osman KETENOĞLU, Ankara
Sabri KILINÇ, Sivas
Tufan KORAY, İzmir
Mehmet KOYUNCU, Van
David G. LONG, Edinburgh, U.K.
Hulusi MALYER, Bursa
Brian MATHEW, Kew, U.K.
Robert R. MILL, Edinburgh, U.K.
Mark NESBITT, Kew, U.K.
Olca OBALI, Ankara
Yener OKATAN, Tokat
Sebahattin ÖZCAN, Ankara
Ayşen ÖZDEMİR-TÜRK, Eskişehir
Neriman ÖZHATAY, İstanbul
Fâtima SALES, Coimbra, PORTUGAL
Ertuğrul SESLİ, Trabzon
Brian C. SUTTON, Surrey, U.K.
Bülent ŞEN, Elazığ
Kit TAN, Copenhagen, DENMARK
Ertan TUZLACI, İstanbul
Narçin P. ÜNSAL, İstanbul
Mecit VURAL, Ankara
Mark F. WATSON, Edinburgh, U.K.
Bayram YILDIZ, Malatya
Jerzy ZIELINSKI, Körnik, POLAND

Production Information

Publisher: (TÜBİTAK) The Scientific and
Technological Research Council of Turkey

Owner

(On behalf of TÜBİTAK) Nüket YETİŞ (President)

Head of the Department Mustafa Ertan ATAKAN

Deputy Head Adnan BAHADIR

Journal Administrator Hülya GÖNENÇ

English Editors Russell FRASER, Scott EVANS,
Osman TOPAÇ

Typing & Abdullah CAN, Meral EŞİ,

Figure Preparation Cemal İÇÖZ, Hayriye ÖZKAN

Printing Sistem Ofset

(0312 229 18 81) Ankara

Correspondence Address

(Yazışma Adresi):

TÜBİTAK Akademik

Yayınlar Müdürlüğü

Atatürk Bulvarı, No: 221,

Kavaklıdere, 06100 Ankara-TURKEY

E-mail: bot@tubitak.gov.tr

All articles in this journal are available
free of charge at

<http://journals.tubitak.gov.tr/>

Tel: +90 312 468 53 00/1127

Fax: +90 312 427 04 93

ISSN 1300-008X

CONTENTS

Research Articles

- Determination of Phylogenetic Relationships among Isoetes Species Using Random Primers 367
Y. K. TRIPATHI, P. GURHA, D. GHOSH, R. V. KUMAR, V. PRAKASH

- A Morphological Investigation of *Colchicum* L. (Liliaceae) Species in the Mediterranean
Region in Turkey 373
O. DİNÇ DÜŞEN, H. SÜMBÜL

- Forest Vegetation of Karagöl-Sahara National Park Artvin-Turkey 421
Ö. EMİNAĞAOĞLU, R. ANŞİN, H. G. KUTBAY

- Floral Biology, Breeding System, and Pollination Ecology of *Cucurbita moschata*
(Duch. ex Lam) Duch. ex Poir. Varieties (Cucurbitaceae) from Parts of the Niger Delta, Nigeria . . . 451
I. O. AGBAGWA, B. C. NDUKWU, S. I. MENSAH

- Phenological Variations in the Surface Flavonoids of *Artemisia vulgaris* L.
and *Artemisia absinthium* L. 459
M. NIKOLOVA, D. VELIČ KOVIĆ

Research Notes

- The Original Material of Two Turkish Species of *Erica* (Ericaceae) Described and
Named by Richard Anthony Salisbury (1761-1829) 463
E. C. NELSON

- Three New Records for *Myxomycetes* of Turkey 467
D. YAĞIZ, A. AFYON

- New Records for the Macrofungi of Turkey 471
A. TÜRKOĞLU, G. KAŞIK, C. ÖZTÜRK, H. H. DOĞAN

- A New Alien Species for the Flora of Turkey: *Bidens frondosa* L. (Asteraceae) 477
K. COŞKUNÇELEBİ, S. TERZİOĞLU, V. VLADIMIROV

- Solanum sisymbriifolium* Lam. (Solanaceae): A New Record for Turkey 481
F. KARAER, H. G. KUTBAY

The first part of the paper is devoted to a general discussion of the problem of the origin of life. It is shown that the problem is not only a scientific one, but also a philosophical one. The scientific aspect of the problem is concerned with the question of how life arose from non-living matter. The philosophical aspect is concerned with the question of whether life is a necessary consequence of the laws of nature, or whether it is a contingent event.

The second part of the paper is devoted to a discussion of the various theories of the origin of life. These theories include the theory of spontaneous generation, the theory of biogenesis, the theory of abiogenesis, and the theory of panspermia. Each theory is discussed in detail, and its strengths and weaknesses are pointed out.

The third part of the paper is devoted to a discussion of the evidence for the origin of life. This evidence includes the fossil record, the study of the chemical evolution of life, and the study of the distribution of life in the universe. Each line of evidence is discussed in detail, and its implications for the origin of life are pointed out.

The fourth part of the paper is devoted to a discussion of the future of research on the origin of life. It is shown that there are many important questions that remain to be answered, and that a great deal of work must be done in order to solve these questions.