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A syntaxonomical study on the scrub, forest, and steppe vegetation of the Kızılırmak valley

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Abstract: The scrub, forest, and steppe vegetation of the Kızılırmak valley situated between Kepez gorge and Devrez stream was investigated based on the traditional Braun-Blanquet method, and mainly new associations and subassociations were identified and classified. The syntaxonomic scheme was as follows:

Quercetea ilicis Br.-Bl. ex A. de Bolòs Y Vayreda 1950
Quercetalia ilicis Br.-Bl. 1947
1-*Cotino coggyriae-Pinetum brutiae* ass. nova
2-*Buxo sempervirentis-Arbutetum unedonis* Karaer et al. 2010
3-*Spiraeo crenatae-Oleetum sylvestris* Karaer et al. 2010
4-*Rubo sancti-Viticetum agni-casti* ass. nova
Quercetea pubescentis Doing-Kraft ex Scamoni & Passarage 1959
Querco cerridis-Carpinetalia orientalis Akman, Quézel & Barbéro 1980
Carpino betuli-Acerion hyrcani Quézel, Barbéro & Akman 1978
5-*Corno mari-Quercetum cerridis* ass. nova
loniceretosum etrusco subass. nova
lathyretosum rosei subass. nova
6-*Trifolio canescentis-Pinetum caramanicae* ass. nova
7-*Galio odorati-Fagetum orientalis* Özen & Kılınç 2002
abietetosum bornmuellerianae subass. nova
vicietosum croceo subass. nova
8-*Rumi scutati-Pinetum hamatae* ass. nova
Astragalo microcephali-Brometea tomentelli Quézel 1973 em. Parolly
Onobrychido armenae-Thymetalia leucostomi Akman, Ketenoğlu, Quézel & Demirörs 1984
9-*Daphno oleoidis-Astragaletum angustifolii* ass. nova
Astragalo karamasici-Gypsophilion eriocalycis Ketenoğlu, Quézel, Akman & Aydoğdu 1983
10-*Scutellario pinnatifidae-Juniperetum excelsae* ass. nova

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11-*Linario corifoliae-Astragaletum microcephali* ass. nova
stipetosum arabico subass. nova
alyssetosum desertorum subass. nova

Key words: Black Sea region, Kızılırmak, syntaxonomy, Turkey, vegetation

Kızılırmak vadisinin çalı, orman ve step vejetasyonu üzerine sintaksonomik bir araştırma

Özet: Bu çalışmada Kızılırmak vadisinin Kepez Boğazı ile Devrez Çayı arasında kalan kesiminin çalı, orman ve step vejetasyonu geleneksel Braun-Blanquet yöntemine göre araştırılarak, başlıca yeni birlik ve altbirlikler belirlenmiş ve aşağıdaki gibi sınıflandırılmıştır.
Quercetea ilicis Br.-Bl. ex A. de Bolòs Y Vayreda 1950
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stipetosum arabico subass. nova
alyssetosum desertorum subass. nova

Anahtar sözcükler: Karadeniz Bölgesi, Kızılırmak, sintaksonomi, Türkiye, vejetasyon

Introduction

The floristic structure of Turkey, which formed during the Tertiary, was greatly affected by climatic changes that occurred during the Pleistocene and was ultimately shaped by human activities during the Holocene (Gemici, 1993; Kılınç & Kutbay, 2007). As a result of these processes areal fragmentation and mixing of phytogeographical regions were observed (Pignatti, 1978; Gemici, 1993). Although the study area extended in the Euxine province of the Euro-Siberian phytogeographical region (Davis, 1965-1985), Mediterranean type vegetation is very widespread. The special position of the Kızılırmak valley, just as other river valleys (Sakarya, Filyos, Yeşilırmak, Çoruh), plays an important role in the infiltration of Mediterranean floral elements from the Black Sea coast extending to the interior of North Anatolia (Davis, 1965-1985; Tel et al., 2010).

Anthropogenic degradation of the natural vegetation of Turkey has continued for the last 7000

years (Kayacık & Aytuğ, 1968; Stewart, 1976; Vermoere et al., 2002). As a result of continuous degradation, the natural structure of climax vegetations has been degraded and changed to steppic or substitute vegetation (Gemici & Seçmen, 1987; Korkmaz & Engin, 1997). Anthropogenic degradation was also seen around the Kızılırmak valley till the known human settlement in 7th century A.D. (Yılmaz, 2007). Today, in addition to continuous anthropogenic degradation, hydroelectric dam construction leads to a different aspect to destruction of the natural vegetation in the Kızılırmak valley. The natural aspect of the study area is threatened by the construction of Boyabat (Sinop) Dam Lake and so it is necessary to find out the phytosociological and ecological traits of the area (Korkmaz & Engin, 1995).

This study was conducted between Kepez Gorge and Devrez River situated in Kızılırmak river valley (Figure 1). The study area will be flooded in the near future when the hydroelectric dams start to actively operate. The main aim of this study was to determine phytosociological and ecological properties of the forest, shrub, and steppe communities. The climatic, topographic, geological, and phytogeographical properties of the study area were given in a previous study (Korkmaz & Engin, 2001).

Materials and methods

The vegetation of the study area was studied according to the concept of the French-Swiss School of Phytosociology (Braun-Blanquet, 1964). One hundred and thirty sample plots were selected from floristically and structurally homogeneous places according to the minimal area concept (Westhoff & van Der Maarel, 1973). A quadrat was established for each of these plots, and for each quadrat cover/abundance and sociability data for all vascular plants were recorded using the Braun-Blanquet (1964) scale. Plant associations were arranged by diagnostic species (Braun-Blanquet, 1964) and named according to Weber et al. (2000).

The defined associations in the present study were compared with related associations by using Sørensen's (1948) similarity formula and classified by the help of published studies. The identification and phytogeographical designation and life forms of the vascular plants recorded in the quadrats were done according to Davis (1965-1985) and other sources (Tutin & Heywood, 1965-1980; Davis et al., 1988; Güner et al., 2000; Kılınç et al., 2006; Özhatay et al., 2009).

The climatic, topographic, and geological properties of the study area were given in a previous study (Korkmaz & Engin, 2001). The environmental data obtained from each plot were altitude (m), inclination (%), exposure, geological substratum, and soil properties. From each plot, soil samples were taken at a depth of 0-30 cm from the topsoil, and texture, pH, organic matter (%), available phosphorus, total nitrogen (Bayraklı, 1987), $CaCO_3$ (%) (Hızalan & Ünal, 1996), salinity, available microelements (Fe, Mn, Zn, Cu), and exchangeable cations (Ca, Mg, Na, K) (Sağlam, 1997) were determined by standard methods.

Results

The associations belonging to scrub, forest, and steppe vegetation occur in different bioclimatic strata of the Kızılırmak valley depending on local topographic, climatic, and edaphic factors (Sternberg & Shoshany, 2001; Doležal & Šrůtek, 2002; Janišová, 2005) and may be separated ecologically and phytosociologically into 4 main groups: sclerophyllous, mesophilous, xerophilous, and hygrophilous.

A-Scrub Vegetation

The associations belonging to maquis (sclerophyllous scrubs), riparian (hygrophilous scrubs), and degraded scrub vegetation occurred in Mediterranean bioclimatic strata of the Kızılırmak valley due to local topographic, climatic, and edaphic factors (Sternberg & Shoshany, 2001; Doležal & Šrůtek, 2002; Janišová, 2005).

1-Maquis Vegetation

Sclerophyllous maquis vegetation of the Kızılırmak valley occurred especially on decarbonated calcareous substrata at 300-400 m on the Mediterranean bioclimatic belt (Akman, 1990), appearing as 2 associations under effect of different local environmental factors.

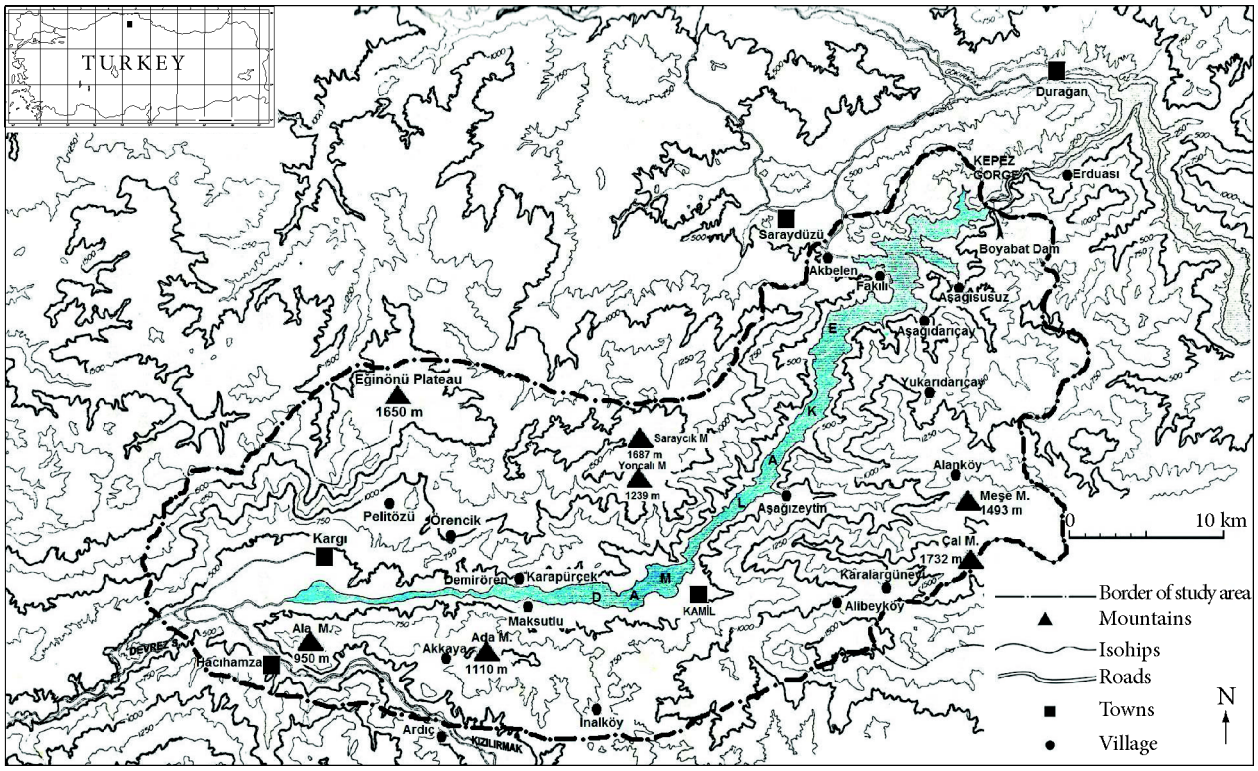

Figure 1. Topographical map of the study area.

Buxo sempervirentis-Arbutetum unedonis Karaer et al. 2010 (Table 1)

The association occurred on decarbonated calcareous substrata and north-western slopes and steep slopes having an inclination of 30%-50% around Kepez Gorge. This association is distributed on shallow Brown forest soils that have a loamy texture, are rich in organic matter and slightly alkaline (pH 7.8) (Table 2).

Some 22% of the species in the floristic composition of association belong to the Mediterranean phytogeographical region, while 8% and 3% of the species belong to the Euro-Siberian and Irano-Turanian phytogeographical regions, respectively (Figure 2).

Endemic species are *Vincetoxicum fuscatum* (Hornem.) Reicb. subsp. *boissieri* (Kusn.) Browicz, *Veronica multifida* L., *Aubrieta canescens* Boiss. & Bornm. subsp. *canescens*, and *Haplophyllum armenum* Spach, and the endemism rate is 6.7%. The life form spectrum of the association is composed of hemicryptophytes (54%), chamaephytes (18%), phanerophytes (15%), therophytes (10%), and geophytes (3%) (Figure 4).

Floristic composition mainly consists of the diagnostic species of *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa, and the species belonging to *Quercetea pubescentis* and *Astragalo microcephali-Brometea tomentelli* classes are rarely represented. All the quadrats were taken from Kepez Gorge, on 23 June 1993.

Spiraeo crenatae-Oleetum sylvestris Karaer et al. 2010 (Table 3)

The association occurred on decarbonated calcareous substrata and southern, south-eastern, and south-western slopes, and it has an inclination of 30%-40% around Kepez Gorge, Zeytintürbe, and Ardıçtepe districts. Red-yellow podsolic soils are present under this association and the soils are rather shallow and have a sandy-clay-loamy texture. The soil has medium organic matter and is slightly alkaline (pH 7.7) (Table 2).

Table 1. *Buxo sempervirentis-Arbutetum unedonis* Karaer et al. 2010.

Quadrat no.		1	2	3	4	5	6	7	8	9	10	
Quadrat size (m^2)		400	400	400	400	400	400	400	400	400	400	
Altitude (m)		300	300	310	350	350	350	300	400	400	400	
Inclination (%)		40	45	50	50	40	30	30	30	30	30	
Direction		NW	NW	N	NW	NW	NW	N	NW	NW	NW	
Height of shrub layer (m)		3	4	4	3	4	4	3	3	4	4	
Coverage of shrub layer (%)		80	70	80	80	80	80	80	80	80	70	
Height of herb layer (cm)		60	70	60	70	60	60	50	40	45	25	
Coverage of herb layer (%)		20	20	20	25	25	20	25	20	20	25	
Number of taxa		30	24	26	26	22	23	25	27	22	26	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Arbutus unedo*	33	33	43	43	44	33	33	33	33	43	V
Ph	*Ligustrum vulgare*	+1	+1	+1	+1	+1	.	.	+1	+1	+1	IV
H	*Coronilla emerus* subsp. *emeroides*	.	.	+1	+1	.	+1	+1	+1	+1	+1	IV
Ch	*Vincetoxicum fuscatum* subsp. *boissieri*	.	+1	+1	+1	.	+1	.	+1	+1	+1	IV
H	*Sedum album*	+1	+1	+1	+1	+1	.	+1	.	+1	.	IV
	Diagnostic taxa of *Quercion ilicis*, Quercion callibrini, Quercetalia ilicis*, and *Quercetea ilicis***											
Ch	*Ruscus aculeatus* var. *angustifolius*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
Ph	*Phillyrea latifolia*	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	V
Ph	*Pistacia terebinthus* subsp. *palaestina***	+1	.	.	+1	+1	+1	.	+1	.	+1	III
Ph	*Jasminum fruticans**	+1	+1	+1	+1	+1	.	+1	.	.	.	III
Ch	*Juniperus oxycedrus* subsp. *oxycedrus*	+1	+1	+1	+1	.	.	.	.	.	+1	III
Ch	*Ephedra major*	+2	+2	.	.	+2	+2	.	.	.	+2	III
H	*Euphorbia rigida*	+1	.	.	+1	.	.	+1	.	+1	+1	III
Ph	*Olea europaea* var. *sylvestris*	+1	+1	+1	.	.	.	.	.	+1	.	II
H	*Geranium purpureum*	.	.	.	.	.	.	.	+1	+1	.	I
Ph	*Pinus brutia* var. *brutia*	.	+1	.	.	.	.	.	.	.	.	I
	Diagnostic taxa of *Carpino betuli- Acerion hirkani*, Querco cerridis-Carpinetalia orientalis, Querco pseudocerridis- Cedretalia libani****, and *Quercetea pubescentis***											
Ph	*Buxus sempervirens*	22	22	22	22	22	22	22	22	22	22	V
H	*Dictamnus albus*	+2	+2	+1	+2	+2	+1	+1	+1	.	+1	V
H	*Silene alba* subsp. *eriocalycina*	+1	.	.	.	+1	+1	.	+1	+1	+1	III
H	*Teucrium chamaedrys* subsp. *chamaedrys*	+2	.	.	+2	.	.	+2	.	+2	+2	III
H	*Chelidonium majus*	.	.	.	.	+1	.	+1	+1	+1	+1	III
Ch	*Juniperus excelsa* subsp. *excelsa****	+1	+1	+1	+1	.	.	.	.	.	.	II
Ph	*Carpinus orientalis* subsp. *orientalis**	.	.	+1	+1	.	.	.	.	.	+1	II
Ch	*Euonymus verrucosus*	+1	.	+1	.	.	.	.	.	.	.	I
Ch	*Clematis vitalba***	.	.	.	.	+1	.	.	+1	.	.	I
Ch	*Amelanchier rotundifolia* subsp. *rotundifolia*	.	.	+1	+1	.	.	.	.	.	.	I
G	*Cyclamen coum* var. *coum**	+1	+1	.	.	.	.	.	.	.	.	I
Ch	*Sorbus torminalis* var. *torminalis***	.	.	+1	.	.	.	.	.	.	+1	I
H	*Galium rivale*	+1	.	.	.	.	.	.	+1	.		I
	Diagnostic taxa of *Querco-Fagetea*											
H	*Athyrium filix-foemina*	+1	+1	.	+1	.	+1	+1	.	+1	+1	IV
Ch	*Hedera helix*	.	.	.	.	+1	.	.	+1	+1	.	II
	Diagnostic taxa of *Astragalo microcephali-Brometea tomentelli*											
H	*Centaurea inermis*	+1	.	+1	.	.	+1	+1	+1	.	.	III
G	*Alyssum sibiricum*	.	.	+1	.	.	.	+1	+1	.	+1	II
H	*Veronica multifida*	.	+1	.	.	.	+1	.	.	.	.	I
H	*Chrysopogon gryllus* subsp. *gryllus*	.	+1	.	.	.	.	.	.	.	.	I
H	*Thymus spyleus* subsp. *rosulans*	.	.	.	.	.	+1	.	.	.	.	I
	Companion taxa											
H	*Asplenium trichomanes*	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Galium verticillatum*	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
T	*Parietaria lusitanica*	+1	+1	.	+1	+1	+1	.	+1	+1	+1	IV
H	*Sideritis taurica*	.	+1	+1	+1	.	.	+1	+1	.	+1	III
H	*Polygonatum orientale*	.	.	+1	.	.	+1	+1	+1	+1	+1	III
T	*Arabis turrita*	+1	.	.	.	+1	+1	+1	.	+1	.	III
H	*Bothriochloa ischaemum*	+1	.	.	+1	.	+1	.	+1	.	+1	III
H	*Geranium molle* subsp. *molle*	+1	.	.	.	.	+1	+1	.	.	.	II
H	*Fumaria officinalis*	.	.	.	.	+1	.	+1	+1	.	.	II
T	*Papaver rhoeas*	.	.	.	.	+1	.	+1	+1	.	.	II
T	*Crucianella latifolia*	+1	+1	.	.	.	.	+1	.	.	.	II
T	*Aubrieta canescens* subsp. *canescens*	.	.	+1	+1	.	.	.	+1	.	.	II
G	*Allium atrovioleucum*	.	+1	+1	.	.	+1	.	.	.	.	II
H	*Valeriana dioscoridis*	.	.	.	.	+1	.	.	.	+1	.	I
H	*Haplophyllum armenum*	+1	.	.	.	.	.	+1	.	.	.	I
H	*Trachynia distachya*	.	.	.	+1	.	.	.	.	.	+1	I
H	*Aristolochia parvifolia*	+1	.	.	.	.	.	.	+1	.	.	I
Ch	*Rosa canina*	.	+1	.	.	.	.	.	.	.	.	I
H	*Polypodium australe*	.	.	.	.	+1	.	.	.	.	.	I
H	*Galium floribundum* subsp. *floribundum*	.	.	+1	.	.	.	.	.	.	.	I
H	*Geranium lucidum*	.	.	.	.	.	+1	.	.	.	.	I
H	*Linaria kurdica* subsp. *kurdica*	.	.	.	.	.	.	.	.	+1	.	I
H	*Minuartia micrantha*	.	.	.	+1	.	.	.	.	.	.	I
H	*Cheilanthes persica*	+1	.	.	.	.	.	.	.	.	.	I
H	*Linaria simplex*	.	.	.	.	.	.	+1	.	.	.	I

Table 2. Physical and chemical analysis of the soils belonging to the associations. *1. *Arbutetum unedonis*, 2. *Oleetum europaeae*, 3. *Pinetum brutiae*, 4. *Juniperetum excelsae*, 5. *Viticetum agni-casti*, 6a. *Carpinetum orientalis; loniceretosum etruscae*, 6b. *Carpinetum orientalis, lathyretosum rosei*; 7. *Pinetum nigrae*, 8a. *Fagetum orientalis; vicietosum croceo*, 8b. *abietetosum bornmuellerianae*, 10. *Pinetum sylvestris*, 11a. *Astragaletum microcephali; alyssetosum desertorum*, 11b. *stipetosum arabico*, 12. *Astragaletum angustifolii*. **S: sandy, C: clay, L: loamy

Number of syntaxa*	Depth (cm)	Soil texture class **	Chemical analysis													
			P_2O_5 (kg/ha)	Salt % (Mmhos/cm)	pH (mud of saturation)	Total $CaCO_3$ (%)	Total N (%)	Organic matter (%)	Available microelements (ppm)				Exchangeable cations (meq/100g)			
									Fe	Mn	Zn	Cu	Ca	Mg	Na	K
1	0-20	L	4.22	2.55×10^2	7.83	17.08	0.75	14.91	16.56	4.74	3.32	0.14	19.45	2.95	0.08	0.83
2	0-15	SCL	0.77	2.42×10^2	7.76	4.57	0.17	3.34	23.40	5.38	0.92	0.14	13.42	0.43	0.09	0.64
3	0-20	SL	1.64	2.85×10^2	7.40	0.60	0.21	4.21	19.40	14.05	1.42	0.36	7.24	0.78	0.16	0.49
4	0-20	L	0.88	2.45×10^2	7.67	0.70	0.20	3.94	9.94	4.32	0.58	1.46	7.47	13.17	0.08	0.77
5	0-20	L	0.79	4.25×10^2	7.85	4.02	0.04	0.87	6.92	68.37	0.36	0.66	5.57	14.18	0.99	1.11
6a	0-30	SCL	0.88	0.76×10^2	5.69	0.30	0.29	5.74	64.76	6.00	1.82	1.00	6.08	1.35	0.17	0.72
6b	0-30	CL	0.99	3.20×10^2	6.76	1.44	0.19	3.74	53.82	18.28	1.12	0.48	10.70	1.13	0.19	0.83
7	0-30	L	1.06	1.15×10^2	6.32	0.60	0.16	3.25	51.80	27.15	0.46	1.26	9.54	8.69	0.16	0.75
8a	0-40	L	0.88	2.30×10^2	6.55	0.25	0.07	1.31	32.76	9.18	0.20	1.04	7.57	4.67	0.11	0.49
8b	0-40	SCL	0.79	0.85×10^2	6.41	0.50	0.10	1.4	23.46	15.52	1.42	1.90	8.76	6.85	0.21	0.96
10	0-30	L	1.47	1.35×10^2	6.20	1.24	0.27	5.39	62.34	18.28	2.62	2.60	7.74	1.65	0.11	0.66
11a	0-20	SL	0.79	1.00×10^2	8.10	5.07	0.02	0.46	4.52	5.38	1.46	0.24	7.18	7.44	0.09	0.64
11b	0-20	L	0.70	1.65×10^2	8.21	7.85	0.05	0.93	7.02	17.00	0.66	0.02	10.70	0.33	0.09	0.49
12	0-20	L	1.28	1.30×10^2	7.80	30.69	0.36	7.11	16.16	9.61	1.42	0.60	19.97	0.94	0.10	0.66

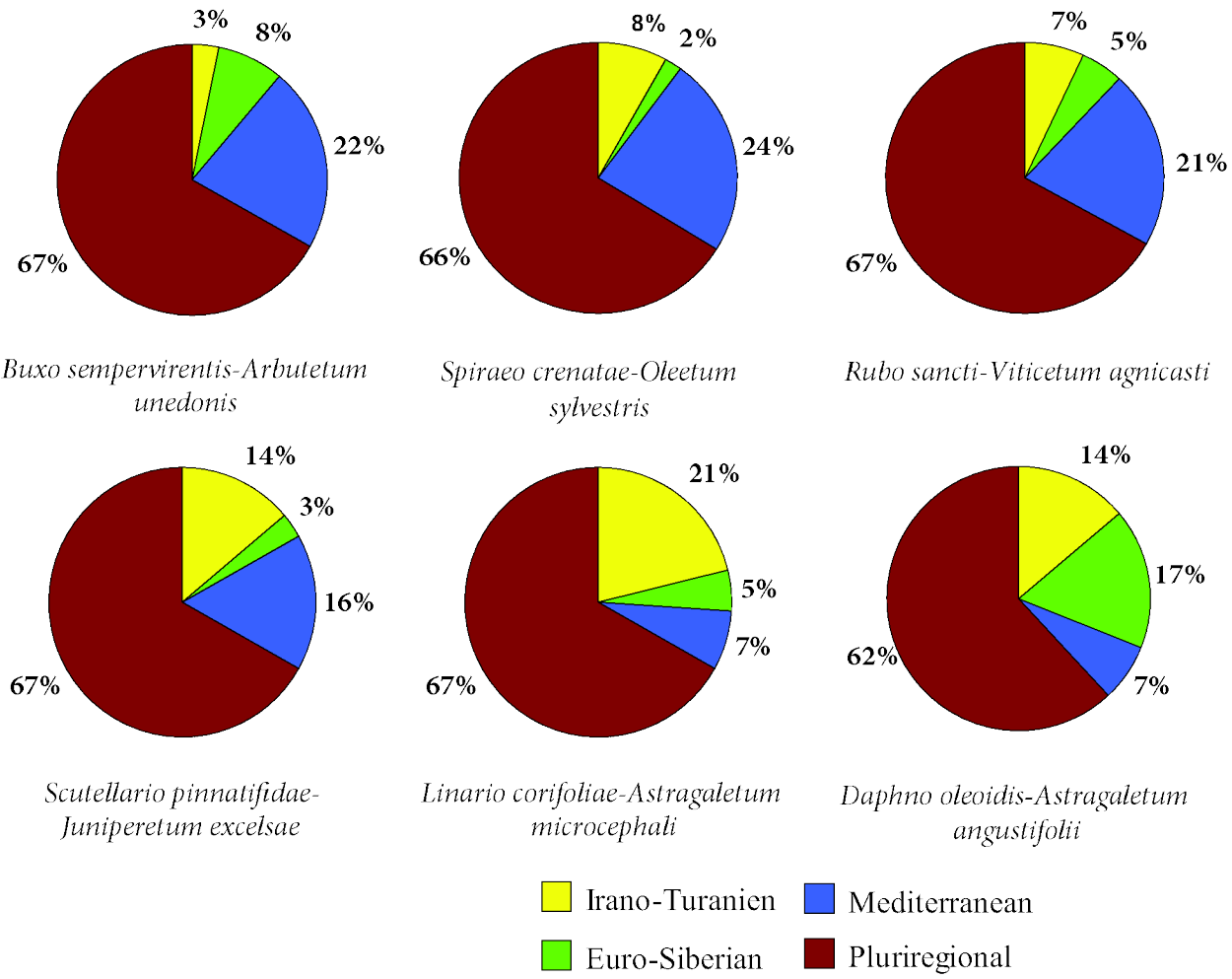

Figure 2. Chorological spectra of the associations in the Kızılırmak valley.

Some 24% of the species in the association belong to the Mediterranean phytogeographical region, while 8% and 2% of these species belong to the Irano-Turanian and Euro-Siberian phytogeographical regions, respectively (Figure 2). *Asyneuma limonifolium* (L.) Janch. subsp. *pestalozzae* (Boiss.) Damboldt, *Hypericum aviculariifolium* Jaub. & Spach subsp. *depilatum* (Freyn & Bornm.) Robson var. *depilatum*, *Alyssum pateri* Nyár. subsp. *pateri*, *Linum flavum* L. subsp. *scabrinerve* (P.H.Davis) P.H.Davis, and *Aubrieta canescens* subsp. *canescens* species in the flora of the association are endemic and the endemism rate is 5.8%. The life form spectrum of the association is made up of hemicryptophytes (65%), therophytes (10%), chamaephytes (10%), phanerophytes (8%), and geophytes (7%) (Figure 4).

Diagnostic species of *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa are well represented in the floristic composition of this association. The species belonging to *Quercetea pubescentis* and *Astragalo microcephali-Brometea tomentelli* classes are comparatively rare. *Spiraeo crenatae-Oleetum sylvestris* is described by 10 quadrats taken from Kepez Gorge on 23 June 1993.

2-Riparian Scrub Vegetation

Hygrophilous scrub vegetation dominated by *Vitex agnus-castus* are formed on alluvial soils near little streams having low flow rates that were remarkably decreased during summer and drained into Kızılırmak River.

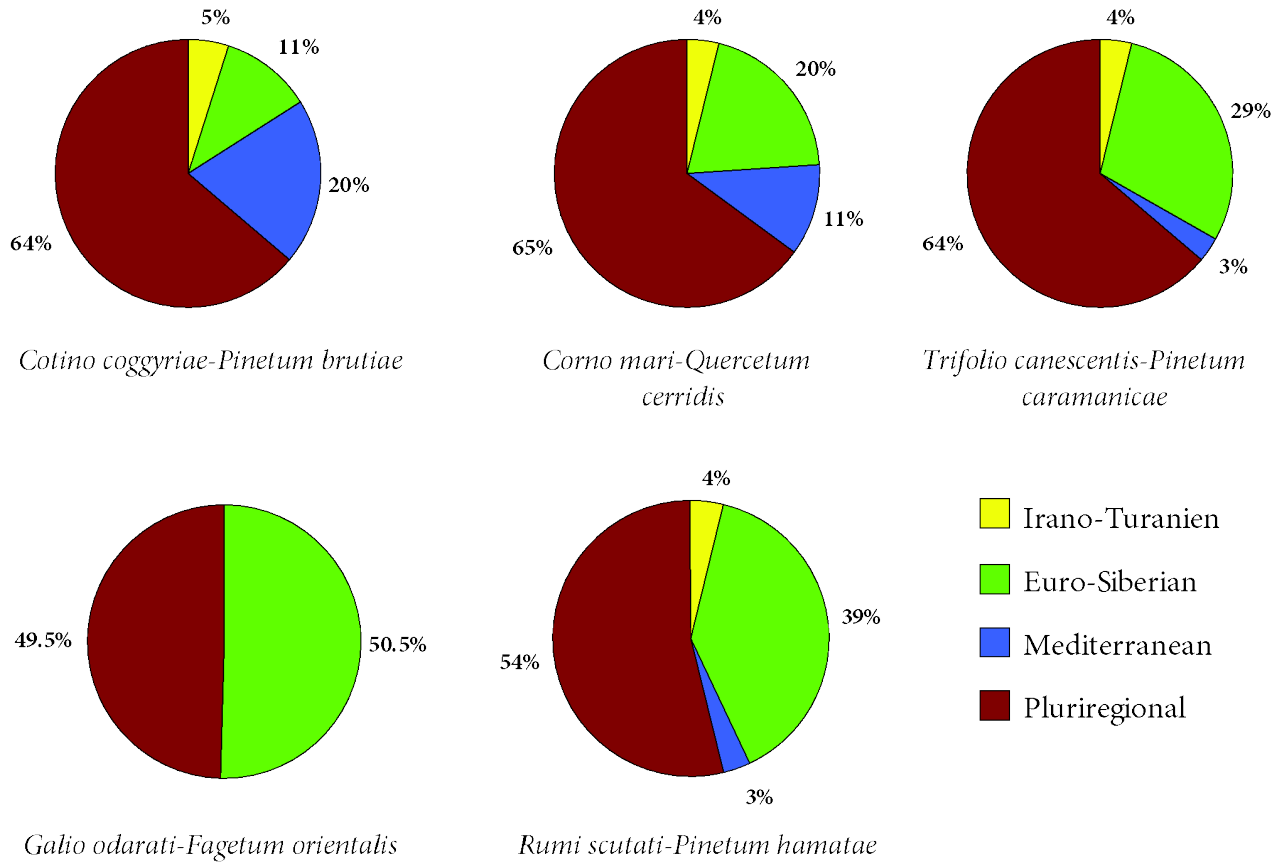

Figure 3. Chorological spectra of the associations in the Kızılırmak valley.

***Rubo sancti-Viticetum agni-casti* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 4)

The association occurred on azonal alluvial soils along stream banks and eastern and western slopes of the Kızılırmak valley, which has a low inclination (5%) around Asar district of Fakılı village (Saraydüzü, Sinop) and Kamil town (Osmancık, Çorum), on graphitic schist parent rock. They may also exist naturally on gravel beds of seasonally dried streams. Alluvial soils have loamy texture and low organic matter, and are slightly alkaline (pH 7.8) (Table 2).

Furthermore, 21%, 7%, and 5% of the species in the floristic composition of the association belong to the Mediterranean, Irano-Turanian, and Euro-Siberian phytogeographical regions, respectively (Figure 2). Hemicryptophytes (74%), chamaephytes (12%), therophytes (5%), phanerophytes (5%), and geophytes (4%) are components of the life form spectrum (Figure 4).

Floristic composition mainly consists of the species of *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa. The species of *Cisto-Micromerietea julianae* Oberd. 1954, *Quercetea pubescentis*, and *Astragalo microcephali-Brometea tomentelli* classes are rare. The records of localities and dates of the 10 sampling plots representing *Rubo sancti-Viticetum agni-casti* are as follows: quadrats 65, 222, 223: Kamil village, 22 June 1993; quadrat 276-282: Fakılı village, Asar district on 23 June 1993.

3-Degraded Scrub Vegetation

A degraded scrub community was dominated by *Juniperus excelsa* subsp. *excelsa* on stony and well-drained stands along summer-dried stream banks and around the Kızılırmak River on decarbonated

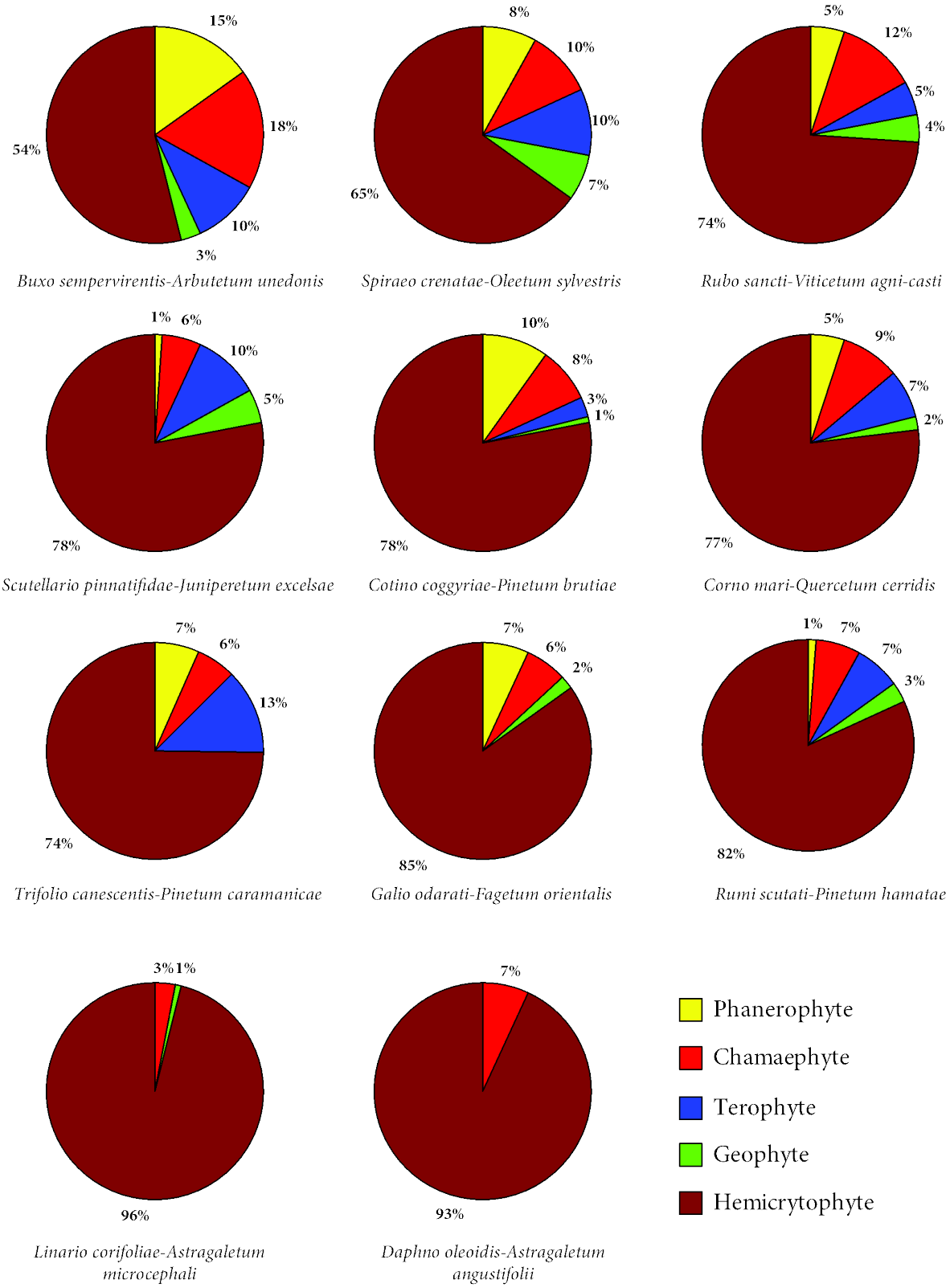

Figure 4. Life form spectra of the associations.

Table 3. *Spiraeo crenatae-Oleetum sylvestris* Karaer et al. 2010.

Quadrat no.		39	40	41	42	43	45	48	50	53	89	
Size of quadrat (m^2)		400	400	400	400	400	400	400	400	400	400	
Altitude (m)		300	350	400	400	400	380	400	350	350	350	
Inclination (%)		30	40	40	40	30	30	40	30	30	40	
Direction		SE	SE	SE	SE	SE	SE	S	SE	S	SW	
Height of shrub layer (m)		4	4	3	4	4	4	4	4	4	4	
Coverage of shrub layer (%)		80	80	80	80	80	80	80	80	80	90	
Height of herb layer (cm)		70	60	70	70	60	70	70	50	50	80	
Coverage of herb layer (%)		20	25	25	20	20	30	20	20	20	25	
Number of taxa		34	33	34	34	35	33	32	28	29	30	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Olea europaea* var. *sylvestris*	33	33	33	33	33	33	33	33	33	43	V
H	*Sedum pallidum* var. *pallidum*	+1	+1	+1	+1	+1	+1	+1	+2	+2	+2	V
H	*Linum corymbulosum*	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	V
H	*Micromeria nervosa*	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	V
H	*Spiraea crenata*	+1	+1	+1	.	+1	+1	+1	.	+1	.	IV
	Diagnostic taxa of *Quercion ilicis*, Quercion callibrini,Quercetalia ilicis*, and *Quercetea ilicis***											
Ph	*Phillyrea latifolia*	22	22	22	22	22	22	22	22	22	+1	V
Ph	*Jasminum fruticans**	+1	.	+1	+1	+1	+1	.	+1	.	+1	IV
Ph	*Pistacia terbinthus* subsp. *palaestina***	+1	+1	.	+1	+1	.	.	+1	+1	.	III
Ch	*Ephedra major*	+2	+2	+2	.	.	+2	+2	.	.	.	III
Ch	*Ruscus aculeatus* var. *angustifolius*	+2	.	.	+2	.	.	+2	.	.	+2	II
H	*Geranium purpureum*	.	+1	+1	.	.	.	.	.	+1	.	II
Ph	*Pinus brutia* var. b*rutia*	.	.	.	.	+1	.	.	.	+1	.	I
Ph	*Arbutus unedo*	+1	.	.	.	.	.	+1	.	.	.	I
Ch	*Paliurus spina-christi*	.	.	.	.	.	.	.	.	.	+1	I
	Diagnostic taxa of *Cisto-Micromerietea julianae*											
Ch	*Micromeria myrtifolia*	+1	.	+1	.	+1	+1	+1	+1	.	.	III
Ch	*Cistus creticus*	.	+2	.	.	.	.	.	.	.	+2	I
T	*Fumana thymifolia* var. *thymifolia*	+2	.	.	+2	.	.	.	.	.	.	I
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani*, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis***											
Ch	*Juniperus excelsa* subsp. *excelsa**	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	V
Ph	*Buxus sempervirens*	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	V
H	*Lapsana communis* subsp. *intermedia*	.	+1	.	.	+1	+1	.	+1	.	.	II
H	*Brachypodium sylvaticum*	.	+1	.	.	.	+1	.	.	+1	.	II
H	*Asyneuma limonifolium* subsp. *pestalozzae**	.	.	.	+1	.	.	+1	.	.	+1	II
H	*Asyneuma rigidum* subsp. *rigidum***	+1	.	+1	.	.	.	.	.	+1	.	II
Ch	*Clematis vitalba***	+1	.	.	.	+1	.	.	.	.	.	I
H	*Silene alba* subsp. *eriocalycina*	.	.	+1	.	.	.	+1	.	.	.	I
G	*Allium stamineum*	.	.	.	.	.	+1	.	.	.	+1	I
	Diagnostic taxa of *Onobrychido armenae-Thymetalia leucostomi and *Astragalo microcephali-Brometea tomentelli***											
H	*Iberis taurica*	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	V
H	*Chrysopogon gryllus* subsp. *gryllus*	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
G	*Allium scrodoprasum* subsp. *rotundum**	.	.	.	+1	+1	+1	+1	+1	+1	.	III
H	*Sideritis montana* subsp. *remota*	.	.	.	+1	+1	.	+1	.	+1	+1	III
H	*Thymus sipyleus* subsp. *rosulans*	+2	+2	.	.	.	.	.	.	.	+2	II
H	*Ziziphora capitata*	+1	.	.	.	.	.	.	+1	.	+1	II
H	*Hypericum avicularifolium* subsp. *depilatum**	+1	+1	.	.	.	.	.	.	.	.	I
H	*Asyneuma limonifolium* subsp. *limonifolium*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Ziziphora taurica* subsp. *taurica**	.	.	+1	.	.	+1	.	.	.	.	I

Table 3. Continued

Quadrat no.		39	40	41	42	43	45	48	50	53	89	Presence
H	*Ajuga chamaepitys* subsp. *chia* var. *chia*	.	+1	.	+1	.	.	.	.	.	.	I
T	*Melica ciliata* subsp. *ciliata*	+1	.	.	.	+1	.	.	.	.	.	I
H	*Jurinea consanguinea**	.	.	+1	.	.	.	.	.	+1	.	I
H	*Lappula barbata*	+1	.	.	.	.	+1	.	.	.	.	I
H	*Erysimum smyrnaeum**	.	+1	.	.	.	.	.	+1	.	.	I
H	*Alyssum pateri* subsp. *pateri**	.	.	.	+1	.	.	.	.	.	+1	I
H	*Potentilla recta*	.	.	.	.	.	+1	.	.	.	.	I
H	*Scabiosa micrantha*	.	.	+1	.	.	.	.	.	.	.	I
	Companion taxa											
H	*Crucianella latifolia*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Parietaria lusitanica*	+1	.	+1	+1	+1	+1	+1	.	.	+1	IV
H	*Asplenium ruta-muraria*	.	+2	+2	+2	+2	+2	.	+2	+2	.	IV
H	*Ornithogalum pyrenaicum*	.	+1	.	+1	+1	+1	.	+1	+1	+1	IV
H	*Galium floribundum* subsp. *floribundum*	+1	+1	+1	+1	.	.	+1	+1	+1	.	IV
H	*Ornithogalum comosum*	.	.	+1	+1	.	+1	+1	.	+1	+1	III
H	*Galium verticillatum*	+1	+1			+1			+1	+1	+1	III
H	*Legousia falcata*	.	.	+1	+1	.	+1	+1	+1	.	.	III
H	*Pimpinella peregrina*	+1	+1	.	.	+1	+1	.	.	+1	.	III
H	*Crucianella angustifolia*	.	.	+1	+1	.	.	+1	.	.	+1	II
H	*Turgeniopsis foeniculata*	+1	.	.	.	+1	.	+1	.	+1	.	II
H	*Galium tenuissimum* subsp. *tenuissimum*	.	+1	.	+1	.	.	.	+1	.	.	II
H	*Inula aschersoniana*	.	.	+2	.	+2	.	.	.	+2	.	II
H	*Centaurea kilea*	.	+2	.	+2	.	.	+2	.	.	.	II
H	*Ceterach officinarum*	.	.	+2	.	.	.	.	+2	+2	.	II
H	*Asplenium trichomanes*	+2	.	.	.	+2	+2	.	.	.	.	II
H	*Catapodium rigidum* subsp. *rigidum*	.	+1	.	+1	.	.	+1	.	.	.	II
H	*Trigonella spicata*	+1	.	.	.	.	+1	.	.	.	+1	II
H	*Buglossoides arvensis*	.	+1	.	.	+1	.	+1	.	.	.	II
G	*Steptorhamphus tuberosus*	.	.	+1	+1	.	.	.	.	+1	.	II
G	*Allium paniculatum* subsp. *paniculatum*	+1	.	.	.	.	+1	.	+1	.	.	II
H	*Alyssum hirsutum* var. *hirsutum*	.	+1	.	.	+1	.	.	.	.	+1	II
H	*Melilotus alba*	.	.	+1	+1	.	.	.	.	.	.	I
T	*Papaver lacerum*	.	.	.	.	.	+1	.	+1	.	.	I
H	*Pterocephalus plumosus*	.	+1	.	+1	.	.	.	.	.	.	I
Ch	*Ononis pusilla*	.	.	.	.	+1	.	.	.	.	+1	I
H	*Xeranthemum annuum*	.	.	.	.	+1	.	.	.	.	+1	I
H	*Linum flavum* subsp. *scabrinerve*	.	.	.	.	+1	.	.	.	.	+1	I
H	*Hirschfeldia incana*	.	.	.	+1	.	.	+1	.	.	.	I
H	*Artedia squamata*	.	.	+1	.	.	.	.	+1	.	.	I
G	*Muscari armeniacum*	+1	.	.	.	.	.	.	.	+1	.	I
H	*Crupina vulgaris*	.	+1	.	.	.	+1	.	.	.	.	I
H	*Astrodaucus orientalis*	.	.	.	.	+1	.	.	.	.	+1	I
H	*Verbascum orientale*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Minuartia intermedia*	.	.	.	+1	.	.	.	+1	.	.	I
H	*Trigonella monspeliaca*	.	.	.	.	.	.	.	.	+1	+1	I
T	*Aubrieta canescens* subsp. *canescens*	.	.	.	.	.	+2	.	.	.	.	I
H	*Polygonum convolvulus*	+1	.	.	.	.	.	.	.	.	.	I
H	*Thesium billardieri*	.	.	.	.	+1	.	.	.	.	.	I
H	*Zosima absinthifolia*	.	.	.	.	.	.	+1	.	.	.	I
H	*Dactylis glomerata* subsp. *hispanica*	.	.	+1	.	.	.	.	.	.	.	I
H	*Minuartia micrantha*	.	.	.	.	.	.	.	+1	.	.	I

Table 4. *Rubo sancti-Viticetum agni-casti* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 281

Quadrat no.		65	222	223	276	277	278	279	280	281*	282	
Quadrat size (m²)		400	400	400	400	400	400	400	400	400	400	
Altitude (m)		450	350	350	300	300	300	300	300	300	300	
Inclination (%)		10	5	5	5	5	5	5	5	5	5	
Direction		E	W	W	E	E	E	E	E	E	E	
Height of shrub layer (m)		2	2	2	3	3	3	3	3	3	3	
Coverage of shrub layer (%)		90	80	80	90	90	90	90	90	90	90	
Height of herb layer (cm)		30	40	40	30	25	30	30	30	25	25	
Coverage of herb layer (%)		30	20	20	20	20	25	20	25	20	20	
Number of taxa		28	23	27	27	32	27	30	27	32	25	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Vitex agnus-castus*	44	44	44	44	44	44	44	44	44	44	V
Ch	*Rubus sanctus*	+1	.	+1	.	+1	+1	+1	+1	+1	+1	IV
H	*Torilis japonica*	.	.	+1	.	+1	.	+1	+1	+1	+1	III
H	*Pterocephalus plumosus*	.	+1	+1	+1	.	.	+1	.	+1	.	III
H	*Trifolium angustifolium* var. *angustifolium*	.	.	.	.	+1	+1	.	+1	+1	+1	III
Ph	*Ficus carica* var. *carica*	.	.	+1	.	.	.	+1	.	+1	.	II
	Diagnostic taxa of *Quercion ilicis, *Quercion callibrini***, *Quercetalia ilicis*, and *Quercetea ilicis***											
H	*Euphorbia rigida*	+2	+2	+2	+2	+1	+1	+1	+2	+2	+1	V
Ph	*Phillyrea latifolia*	+1	.	.	11	11	11	11	11	11	11	IV
Ph	*Juniperus oxycedrus* subsp. *oxycedrus*	.	+1	.	+1	+1	+1	+1	+1	+1	+1	IV
Ph	*Paliurus spina-christi*	+1	.	+1	.	+1	.	+1	+1	+1	+1	IV
Ph	*Pistacia terebinthus* subsp. *palaestina***	.	+1	.	+1	.	+1	.	+1	+1	.	III
Ph	*Jasminum fruticans**	+1	.	+1	.	+1	.	+1	.	+1	+1	III
Ch	*Ruscus aculeatus* var. *angustifolius*	.	+2	.	+2	.	+2	.	.	.	.	II
	Diagnostic taxa of *Cisto-Micromerietea julianae*											
Ch	*Cistus creticus*	+2	.	.	+2	.	+2	.	.	+2	.	II
H	*Psorolea bituminosa*	.	+1	.	.	+1	.	+1	.	.	+1	II
H	*Trifolium arvense* var. *arvense*	.	.	+1	.	.	.	.	+1	.	.	I
H	*Origanum vulgare* subsp. *vulgare*	.	.	.	+1	.	.	+1	.	.	.	I
H	*Origanum vulgare* subsp. *viride*	.	.	.	+1	.	.	.	.	+1	.	I
H	*Micromeria myrtifolia*	.	+1	.	.	.	.	+1	.	.	.	I
	Diagnostic taxa of *Querco-Carpinetalia orientalis and *Quercetea pubescentis***											
Ph	*Crataegus monogyna* subsp. *monogyna**	+1	.	.	+1	.	+1	.	.	.	.	II
Ph	*Juniperus excelsa* subsp. *excelsa*	.	+1	.	.	.	.	.	.	.	+1	II
H	*Lapsana communis* subsp. *intermedia*	+1	.	.	.	.	.	+1	.	.	.	II
H	*Hypericum perforatum*	.	.	+1	.	.	.	.	+1	.	.	II
	Diagnostic taxa of *Querco-Fagetea*											
H	*Moehringia trinervia*	.	+1	.	.	+1	.	+1	.	.	.	II
H	*Clinopodium vulgare* subsp. *vulgare*	.	.	.	.	+1	.	.	.	+1	.	I
	Diagnostic taxa of *Onobrychido armenae-Thymetalia leucostomi and *Astragalo microcephali-Brometea tomentelli***											
H	*Teucrium polium**	+2	.	+2	+2	+2	+1	+1	.	+1	+1	IV
H	*Teucrium chamaedrys* subsp. *chamaedrys*	+2	.	+2	.	+2	.	.	+1	+1	.	III
H	*Potentilla recta*	.	+1	.	+1	.	+1	.	+1	+1	.	III
H	*Ziziphora capitata*	+1	.	+1	.	+1	.	+1	.	.	.	II
H	*Eryngium campestre* var. *virens*	.	+1	+1	+1	.	.	.	.	.	.	II
H	*Logfia arvensis*	+1	+1	.	.	.	.	.	+1	+1	.	II
H	*Melica ciliata* subsp. *ciliata*	.	.	.	.	+1	.	.	+1	.	.	I
T	*Taeniatherum caput-medusa* subsp. *crinitum*	.	.	.	.	.	+1	.	.	+1	.	I
H	*Polygala pruinosa* subsp. *pruinosa**	.	.	.	.	.	.	.	+1	.	+1	I

Table 4. Continued

Quadrat no.		65	222	223	276	277	278	279	280	281*	282	Presence
H	*Centaurea urvillei* subsp. *urvillei*	.	.	+1	.	.	.	+1	.	.	.	I
G	*Allium scorodoprasum* subsp. *rotundum**	+1	.	.	.	+1	.	.	.	.	.	I
H	*Herniaria incana*	.	.	.	+1	.	.	.	.	.	.	I
H	*Ziziphora taurica* subsp. *taurica*	.	.	.	.	.	.	.	+1	.	.	I
	Companion taxa											
H	*Trifolium campestre*	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	V
H	*Bothriochloa ischaemum*	+2	.	+2	.	+2	+2	.	+2	+2	+2	IV
H	*Medicago minima* var. *minima*	.	+1	.	+1	+1	+1	+1	.	+1	+1	IV
H	*Plantago lanceolata*	+1	.	.	.	+1	+1	.	+1	.	+1	III
H	*Euphorbia falcata* subsp. *falcata* var. *falcata*	+1	+1	.	.	.	.	+1	.	+1	+1	III
H	*Trachynia distachya*	.	.	+1	.	+1	+1	+1	.	.	.	II
G	*Muscari armeniacum*	.	.	.	+1	+1	+1	+1	.	.	.	II
H	*Prunella vulgaris*	.	.	+2	.	.	+2	.	.	.	+2	II
Ch	*Alhagi pseudoalhagi*	.	.	.	.	+2	.	.	+2	.	+2	II
H	*Bromus sterilis*	+1	.	.	+1	.	.	.	.	.	+1	II
H	*Minuartia intermedia*	+1	.	.	.	+1	.	+1	.	.	.	II
H	*Senecio vernalis*	+1	.	+1	.	.	.	.	.	+1	.	II
H	*Bromus japonicus* subsp. *japonicus*	.	+1	.	+1	+1	.	.	.	.	.	II
H	*Peganum harmala*	.	.	+1	.	.	.	+1	.	+1	.	II
H	*Sideritis dichotoma*		.	.	.	.	+1	.	+1	.	+1	II
H	*Astrodaucus orientalis*	.	+1	.	.	+1	.	+1	.	.	.	II
H	*Torilis arvensis* var. *arvensis*	.	.	+1	.	.	+1	.	+1	.	.	II
H	*Alyssum minus* var. *minus*	.	.	.	+1	.	.	.	.	+1	+1	II
H	*Caucalis platycarpos*	+1	.	.	.	+1	.	.	+1	.	.	II
H	*Ononis viscosa* subsp. *breviflora*	.	.	+1	.	.	.	+1	.	+1	.	II
H	*Dactylis glomerata* subsp. *hispanica*	.	+1	.	+1	.	+1	.	.	.	.	II
H	*Xanthium spinosum*	+1	.	.	+1	.	.	.	.	+1	.	II
H	*Xeranthemum annuum*	.	.	+1	.	+1	.	.	+1	.	.	II
H	*Achillea millefolium* subsp. *millefolium*	+1	.	.	.	.	+1	.	.	.	+1	II
H	*Centaurium tenuiflorum* subsp. *tenuiflorum*	.	+1	.	+1	.	.	+1	.	.	.	II
H	*Sanguisorba minor* subsp. *muricata*	+2	+2	+1	.	.	.	.	.	.	.	II
H	*Polygonum convolvulus*	.	.	.	.	+1	.	.	.	+1	.	II
H	*Myosotis arvensis* subsp. *arvensis*	.	.	+1	.	.	+1	.	+1	.	.	II
Ch	*Rosa canina*	+1	.	.	+1	.	.	.	.	.	.	I
H	*Convolvulus cantabrica*	.	.	.	.	+2	.	+2	.	.	.	I
H	*Verbascum mucronatum*	.	+2	.	.	.	.	.	.	.	.	I
H	*Helychrisum arenarium* subsp. *aucheri*	.	.	.	.	.	.	.	.	+1	.	I
H	*Echinops pungens* var. p*ungens*	.	.	+1	.	.	.	.	.	.	.	I
H	*Salvia verbenaca*	.	.	.	.	.	+1	.	.	.	.	I
H	*Asteriscus aquaticus*	+1	.	.	.	.	.	.	.	.	.	I
H	*Parietaria lusitanica*	.	.		+1	.	.	.	.	.	.	I
H	*Catapodium rigidum* subsp. *rigidum* var. *rigidum*	.	.	.	.	+1	.	.	.	.	.	I
T	*Aegilops geniculata*	.	+1	.	.	.	.	.	.	.	.	I
H	*Linaria kurdica* subsp. *kurdica*	.	.	.	.	.	.	.	.	+1	.	I
H	*Satureja hortensis*	.	.	.	.	.	.	+1	.	.	.	I
H	*Centaurea solstitialis* subsp. *solstitialis*	.	.	.	.	.	.	.	.	.	+1	I
H	*Neatostema apulum*	.	.	+1	.	.	.	.	.	.	.	I
G	*Ornithogalum comosum*	+1	.	.	.	.	.	.	.	.	.	I
H	*Crucianella angustifolia*	.	.	.	.	.	+1	.	.	.	.	I
H	*Pennisetum orientale*	.	.	.	+1	.	.	.	.	.	.	I
H	*Picnomon acarna*	.	.	.	.	.	.	.	+1	.	.	I

calcareous substrata locally. Owing to heavy anthropogenic degradation the natural structure of these communities is degraded. *Juniperus excelsa* subsp. *excelsa* has been greatly affected and turned into degraded scrub.

***Scutellario pinnatifidae-Juniperetum excelsae* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 5)

This association occurred in the Kızılırmak valley at 350-600 m on decarbonated calcareous substrata around river banks and has an inclination of 5%-10% around Demirören and İnal villages (Kargı, Çorum). Stony and well-drained azonal alluvial soils are found under the association with a loamy texture and low organic matter and are slightly alkaline (pH 7.6) (Table 2).

This association has a feature of degraded scrub as a result of heavy degradation that consists of shrub and herb layers.

Some 16% of the species in the association belong to Mediterranean phytogeographical region, while 14% and 3% of the species belong to the Irano-Turanian and Euro-Siberian phytogeographical regions, respectively (Figure 2). *Onobrychis armena* Boiss. & Huet, *Thymus leucostomus* Hausskn. & Velen. var. *leucostomus*, *Bupleurum sulphureum* Boiss. & Bal, *Marrubium globosum* Montbret & Aucher ex Bent. subsp. *globosum*, *Dianthus kastembeluensis* Freyn & Sint., and *Astragalus campylosema* Boiss. subsp. *atropurpureus* (Boiss.) Chamb. are endemic and the endemism rate is 6.8%. The life form structure of the association mainly consists of hemicryptophytes (78%), therophytes (10%), chamaephytes (6%), geophytes (5%), and phanerophytes (1%) (Figure 4).

The floristic and ecological structure of the association was considerably destroyed due to heavy degradation. Floristic composition of the association mainly consists of the species of *Astragalo karamasici-Gypsophilion eriocalycis, Onobrychido armenae-Thymetalia leucostomi*, and *Astragalo microcephali-Brometea tomentelli*, whereas the species belonging to *Quercetea ilicis* and *Quercetea pubescentis* were rarely represented. The records of localities and dates of the 10 sampling plots representing *Scutellario pinnatifidae-Juniperetum excelsae* are as follows: quadrats 188, 189, 191, 192, 194-196: Inal village, on 28 June 1993; quadrats 203, 205, 206: Demirören village, 29 June 1993.

B-Forest Vegetation

Forest associations stratified depending on elevation in slopes of the Kızılırmak valley can be grouped as sclerophilous and mesophilous associations due to ecological and phytosociological characteristics**.** However, the association that occurred on the eastern slopes (left) is *Rumi scutati-Pinetum hamatae*, while the association on the western slopes (right) is *Trifolio canescentis-Pinetum caramanicae*. *Galio odorati-Fagetum orientalis, Cotino coggyriae-Pinetum brutiae*, and *Corno mari-Quercetum cerridis* occurred on both slopes of the Kızılırmak valley (Figure 5).

1-Sclerophyllous Forest Association

Sclerophyllous forest vegetation was formed at 300-600 m in lower parts of the Kızılırmak valley in which a semi-arid Mediterranean climate (Akman, 1990) is observed.

***Cotino coggyriae-Pinetum brutiae* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 6)

This association occurred as a continuous belt (even widely destroyed in some parts) along both sides of the Kızılırmak valley between Kepez Gorge and Devrez River. It has a continuous distribution and canopy cover is remarkably high in the Kızılırmak valley although it is destroyed in some parts on different slopes on graphitic schist parent rock. This association was distributed on slopes that have different aspects and the litter layer under this association is very thick, especially in the parts where the association was completely developed. However, the numbers of species in the shrub and herb layers are higher than those of the other associations. Many companion species are found in the floristic composition of this association, especially in the destroyed parts of the tree layer as a result of anthropogenic degradation**.** This association constitutes climatically climax vegetation of Mediterranean bioclimatic strata. *Cotino coggyriae-Pinetum brutiae* occupies sandy-loamy soils that are alkaline (pH 7.4) and medium in organic matter (Table 2).

The distribution by phytogeographical elements of the 97 taxa recorded in 10 quadrats of this association

Table 5. *Scutellario pinnatifidae-Juniperetum excelsae* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 189

Quadrat no.		188	189*	191	192	194	195	196	203	205	206	
Quadrat size (m^2)		400	400	400	400	400	400	400	400	400	400	
Altitude (m)		350	350	350	350	350	350	350	600	600	600	
Inclination (%)		10	10	10	10	10	10	10	5	5	5	
Direction		SE	SE	SE	SE	SE	SE	SE	S	S	S	
Height of shrub layer (m)		4	4	4	4	4	4	4	4	4	4	
Coverage of shrub layer (%)		80	80	80	90	90	80	90	90	80	80	
Height of herb layer (cm)		60	60	60	50	50	60	45	50	45	45	
Coverage of herb layer (%)		20	20	25	25	20	20	25	20	25	20	
Number of taxa		30	33	30	31	29	32	31	28	30	27	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Juniperus excelsa* subsp. *excelsa*	44	33	43	43	33	44	44	44	44	44	V
H	*Scutellaria orientalis* subsp. *pinnatifida*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Velezia rigida*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Hippocrepis ciliata*	+1	+1	.	+1	.	+1	.	.	+1	.	III
G	*Allium scorodoprasum* subsp. *rotundum*	+1	+1	.	.	+1	.	+1	.	+1	.	III
	Diagnostic taxa of *Astragalo karamasici-Gypsophilion eriocalycis, *Onobrychido armenae-Thymetalia leucostomi*** , **and *Astragalo microcephali-Brometea tomentelli***											
H	*Teucrium polium***	+2	+2	+2	+2	+2	+2	+2	+1	+1	+1	V
H	*Eryngium campestre* var. *virens*	+1	+1	+1	.	+1	+1	+1	.	+1	+1	IV
G	*Poa bulbosa*	+2	.	+2	+2	.	+2	.	+2	.	+2	IV
H	*Alyssum sibiricum***	+2	.	+2	+2	.	+2	+2	.	.	.	III
H	*Herniaria incana*	.	+1	.	+1	+1	.	+1	.	+1	.	III
H	*Teucrium chamaedrys* subsp. *chamaedrys*	+1	+1	.	+1	.	.	+1	.	+1	.	III
H	*Onobrychis armena***	.	+1	.	+1	+1	.	.	+1	.	.	II
H	*Paranonchya kurdica* subsp. *kurdica* var. *kurdica***	.	+1	.	.	.	+1	.	+1	.	+1	II
Ch	*Acantholimon acerosum* var. *acerosum***	+3	.	+3	.	.	.	+3	.	.	.	II
H	*Chrysopogon gryllus* subsp. *gryllus*	.	+2	.	.	.	+2	.	.	+2	.	II
H	*Onosma aucheranum***	+1	.	.	.	+1	.	.	.	.	+1	II
H	*Scabiosa argentea***	.	+1	.	+1	.	+1	.	.	.	.	II
H	*Clypeola jonthlaspi***	.	.	+1	.	.	.	+1	+1	.	.	II
H	*Sideritis montana* subsp. *montana*	+1	.	+1	.	.	+1	.	+1	.	.	II
H	*Ziziphora capitata***	.	+1	.	.	+1	.	+1	.	.	+1	II
H	*Ziziphora taurica* subsp. *taurica**	.	+1	.	+1	.	.	.	.	+1	.	II
H	*Lappula barbata**	+1	.	.	+1	.	.	.	+1	.	.	II
H	*Alkanna orientalis* var. *orientalis*	.	.	.	.	.	.	+1	.	+1	+1	II
H	*Logfia arvensis*	+1	.	.	+1	+1	.	.	+1	.	.	II
H	*Helianthemum nummularium* subsp. *nummularium***	.	.	.	.	+2	.	.	.	+2	.	I
H	*Thymus leucostomus* var. *leucostomus***	.	+2	.	.	.	.	.	.	.	+2	I
H	*Jurinea consanguinea***	.	.	.	+1	.	.	+1	.	.	.	I
H	*Potentilla recta*	.	.	.	+1	.	.	.	+1	.	.	I
H	*Acinos rotundifolius*	.	.	.	.	.	+1	.	.	.	.	I
	Diagnostic taxa of *Quercion ilicis,*Quercion callibrini***, *Quercetalia ilicis*, and *Quercetea ilicis***											
Ch	*Paliurus spina-christi*	11	11	11	11	11	11	11	+1	+1	+1	V
Ch	*Pistacia terebinthus* subsp. *palaestina***	+1	+1	+1	.	+1	+1	+1	.	+1	.	IV
Ph	*Jasminum fruticans**	.	+1	+1	+1	.	+1	+1	+1	.	+1	IV
H	*Euphorbia rigida*	.	+1	+1	.	+1	.	+1	.	+1	.	III
	Diagnostic taxa of *Quercetea pubescentis*											
H	*Berberis crataegina*	+1	.	+1	.	.	+1	.	12	.	12	III
H	*Minuartia multinervis*	.	.	+1	.	+1	.	.	.	.	.	I

Table 5. Continued

Quadrat no.		188	189*	191	192	194	195	196	203	205	206	Presence
	Companion taxa											
H	*Medicago minima* var. *minima*	+1	.	+1	+1	.	+1	+1	+1	+1	+1	IV
H	*Cynodon dactylon* var. *villosus*	.	+2	.	+2	+2	+2	.	+2	.	+2	III
H	*Bothriochloa ischaemum*	+2	+2	+2	.	+2	.	+2	.	+2	.	III
H	*Trigonella monspeliaca*	+1	.	+1	+1	.	+1	.	+1	.	+1	III
H	*Alyssum hirsutum* var. *hirsutum*	.	+1	+1	.	+1	.	+1	+1	.	.	III
H	*Galium floribundum* subsp. *floribundum*	.	.	+1	+1	.	+1	.	+1	.	+1	III
H	*Crepis sancta*	+1	+1	.	.	+1	.	+1	.	+1	.	III
H	*Euphorbia falcata* subsp. *falcata* var. *falcata*	.	.	+1	+1	.	+1	.	+1	.	.	II
H	*Bromus sterilis*	+1	.	.	.	+1	.	+1	.	.	+1	II
H	*Linaria simplex*	.	+1	+1	.	.	+1	.	.	+1	.	II
H	*Petrorhagia cretica*	+1	.	.	+1	.	.	+1	+1	.	.	II
T	*Poa annua*	.	.	.	.	+1	+1	.	.	+1	+1	II
H	*Bromus japonicus* subsp. *japonicus*	.	+1	.	+1	.	.	.	+1	.	+1	II
H	*Senecio vernalis*	.	.	.	.	+1	.	+1	.	+1	+1	II
H	*Tragus rasemosus*	+2	.	.	+2	.	.	.	.	.	+2	II
H	*Eragrostis minor*	.	+2	.	.	+2	.	+2	.	.	.	II
H	*Helychrisum arenarium* subsp. *aucheri*	.	.	+2	.	.	+2	.	.	+2	.	II
H	*Parietaria lusitanica*	+1	.	.	.	.	.	+1	.	+1	.	II
H	*Geranium molle* subsp. *molle*	.	.	+1	.	+1	.	.	+1	.	.	II
H	*Viola kitaibeliana*	.	+1	.	.	.	+1	.	.	+1	.	II
H	*Trachynia distachya*	.	.	+1	.	.	+1	.	.	+1	.	II
H	*Minuartia micrantha*	.	+1	.	.	.	+1	.	.	.	+1	II
H	*Bupleurum sulphureum*	+1	.	.	+1	.	.	.	+1	.	.	II
H	*Veronica triphyllos*	.	.	+2	.	.	.	+2	.	.	.	I
H	*Scabiosa micrantha*	.	.	.	.	+1	.	.	.	+1	.	I
H	*Achillea biebersteinii*	.	+1	.	.	.	.	.	.	.	+1	I
G	*Allium hirtovaginatum*	+1	.	.	.	.	+1	.	.	.	.	I
H	*Medicago coronata*	.	.	.	+1	.	.	.	+1	.	.	I
H	*Neatostema apulum*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Marrubium globosum* subsp. *globosum*	.	.	.	.	.	.	.	.	+2	.	I
H	*Dianthus kastembeluensis*	.	.	.	.	+2	.	.	.	.	.	I
H	*Verbascum glomeratum*	.	+1	.	.	.	.	.	.	.	.	I
H	*Astragalus campylosema* subsp. *atropurpureus*	.	.	.	.	.	+1	.	.	.	.	I
H	*Xeranthemum annuum*		.	.	.	.	.	.	.	.	+1	I
H	*Nigella arvensis* var. *glauca*	+1	.	.	.	.	.	.	.	.	.	I
H	*Trigonella brachycarpa*	.	.	.	+1	.	.	.	.	.	.	I
H	*Medicago rigidula* var. *rigidula*	.	.	.	.	.	.	+1	.	.	.	I
G	*Muscari armeniacum*	.	.	.	.	.	.	.	+1	.	.	I
H	*Crucianella latifolia*	.	.	+1	.	.	.	.	.	.	.	I
H	*Telephium imperati* subsp. *orientale*	.	.	.	.	+1	.	.	.	.	.	I
H	*Aegilops geniculata*	.	.	.	.	.	.	.	.	+1	.	I
H	*Trifolium arvense* var. *arvense*	.	.	.	.	.	+1	.	.	.	.	I
H	*Thesium billardieri*	.	+1	.	.	.	.	.	.	.	.	I
H	*Trigonella spicata*	+1	.	.	.	.	.	.	.	.	.	I
H	*Steptorhamphus tuberosus*	.	.	.	.	.	.	.	.	.	+1	I
H	*Myosotis arvensis* subsp. *arvensis*	.	.	.	+1	.	.	.	.	.	.	I
H	*Anagallis arvensis* var. *arvensis*	.	.	.	.	.	.	+1	.	.	.	I
H	*Pterocephalus plumosus*	.	.	.	.	.	.	.	+1	.	.	I
H	*Carthamus lanatus*	.	.	.	.	+1	.	.	.	.	.	I
H	*Caucalis platycarpos*	.	.	+1	.	.	.	.	.	.	.	I
H	*Capsella bursa-pastoris*	.	.	.	.	.	.	.	.	+1	.	I
H	*Adonis aestivalis* subsp. *aestivalis*	.	+1	.	.	.	.	.	.	.	.	I
H	*Andrachne telephioides*	.	.	.	.	.	+1	.	.	.	.	I

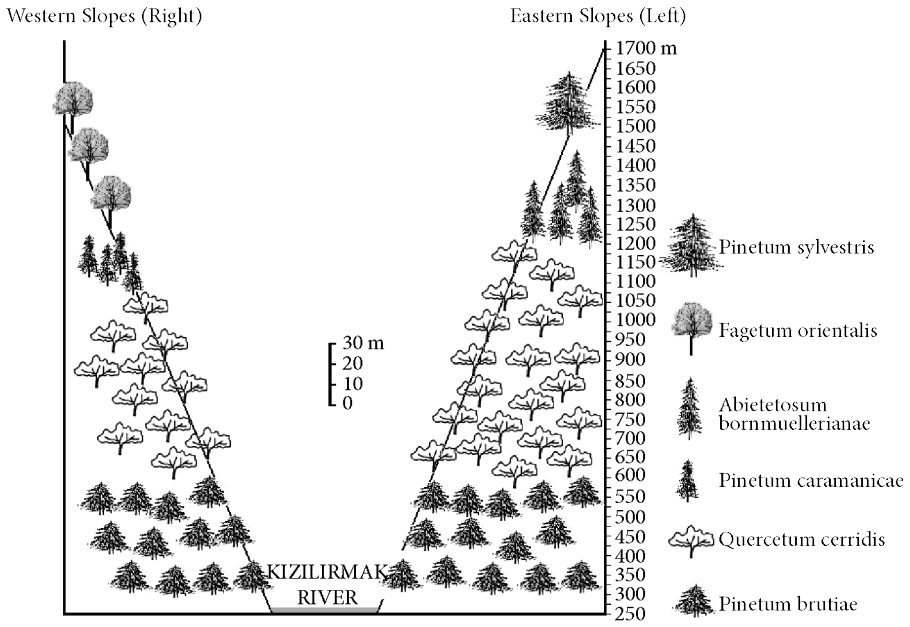

Figure 5. The distribution of forest associations at right and left slopes along an altitudinal gradient in the Kızılırmak valley.

is as follows: Mediterranean: 20%; Euro-Siberian: 11%, Irano-Turanian 5% (Figure 3). *Genista aucheri* Boiss., *Astragalus lydius* Boiss., *Onobrychis armena*, *Astragalus campylosema* subsp. *atropurpureus*, *Erysimum eginense* Hausskn. ex Bornm., and *Verbascum cheiranthifolium* Boiss. var. *asperulum* (Boiss.) Murb. are endemic and the endemism rate is 6.1%. The life form structure of the association is dominated by hemicryptophytes (78%), phanerophytes (10%), chamaephytes (8%), therophytes (3%), and geophytes (1%) (Figure 4).

The ratio of diagnostic species that belong to *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa is high, while the ratio of the species belonging to *Cisto-Micromerietea julianae*, *Quercetea pubescentis*, and *Astragalo microcephali-Brometea tomentelli* classes is low. The records of localities and dates of 10 quadrats representing *Cotino coggyriae-Pinetum brutiae* are as follows: quadrats 15, 16, 19-25: environs of Kepez Gorge, 23 June 1993; quadrat 68: around İnal village, 30 June 1993.

2-Mesophilous Forest Associations

Mesophilous associations are formed at 600-1650 m in the Kızılırmak valley compatible with the cool and rainy transitional Mediterranean climate (Akman, 1990).

***Corno mari-Quercetum cerridis* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 7)

This association has meso-sclerophyllous properties and occurs on the eastern and western slopes of the Kızılırmak valley and just the upper parts of *Cotino coggyriae-Pinetum brutiae*. This association has a distribution in Aşağıdarıçay village-Doğanyuvası (Vezirköprü, Samsun), Yukarıdarıçay village-Dere district (Vezirköprü), and Alibeyköy village-Akdeşdere district (Osmancık, Çorum) on graphitic schist parent rock and north and north-west facing slopes. This association occurs on sandy-clay-loam and clay-loam texture and organic matter concentrations are comparatively high in these soils and the soils are slightly acidic (pH 5.6-6.7) (Table 2).

This association includes 2 subassociations named *loniceretosum etruscae*, which occurs at 750-850 m (comparatively sclerophyllous), and *lathyretosum rosei*, which exists at 1100-1250 m (comparatively mesophilous) (Table 7). Diagnostic species of the *loniceretosum etruscae* subassociaton are *Lonicera etrusca* Santi var. *etrusca*, *Tanacetum parthenium* (L.) A.Schultz, and *Alliaria petiolata* (M.Bieb.) Cavara &

Table 6. *Cotino coggyriae-Pinetum brutiae* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 19

Quadrat no.		15	16	19*	20	21	22	23	24	25	68	
Quadrat size (×10m²)		100	100	100	100	100	100	100	100	100	100	
Altitude (m)		400	400	450	450	400	450	400	500	550	600	
Inclination (%)		30	30	20	25	30	30	40	20	30	30	
Exposure		SW	SW	W	W	NW	SW	SW	SW	N	SW	
Height of tree layer (m)		15	15	15	10	10	15	15	10	15	10	
Coverage of tree layer (%)		90	90	90	80	80	80	80	90	90	80	
Height of shrub layer (m)		3	3	3	3	4	4	4	3	3	4	
Coverage of shrub layer (%)		30	30	25	30	30	10	10	10	20	20	
Height of herb layer (cm)		60	60	70	60	60	50	50	50	50	70	
Coverage of herb layer (%)		25	25	20	20	25	30	30	10	20	20	
Number of taxa		36	39	39	37	41	40	39	40	37	38	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Pinus brutia* var. *brutia*	44	44	44	44	44	44	44	44	44	44	V
Ph	*Cotinus coggyria*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Ch	*Genista aucheri*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Fumana arabica* var. *arabica*	+1	.	+1	.	+1	+1	+1	.	.	+1	III
	Diagnostic taxa of *Quercion ilicis*, Quercion callibrini, Quercetalia ilicis*, and *Quercetea ilicis***											
Ph	*Phyllirea latifolia*	11	11	11	11	+1	11	+1	11	+1	+1	V
Ph	*Pistacia terebinthus* subsp. *palaestina***	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Ph	*Arbutus unedo*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Ph	*Juniperus oxycedrus* subsp. *oxycedrus*	+1	+1	+1	.	+1	.	+1	+1	+1	+1	IV
Ch	*Ruscus aculeatus* var. *angustifolius*	.	+2	+2	+2	.	+2	.	+2	+2	.	III
Ph	*Jasminum fruticans**	+1	.	.	.	+1	.	+1	.	.	+1	II
H	*Geranium purpureum*	.	+1	.	+1	.	.	.	+1	+1	.	II
	Diagnostic taxa of *Cisto-Micromerietea julianae*											
Ch	*Cistus creticus*	+1	+2	+1	+1	+1	+1	+2	+2	+2	11	V
H	*Psorolea bituminosa*	.	.	+1	.	+1	+1	.	+1	+1	+1	III
H	*Salvia tomentosa*	+1	+1	.	+1	+1	.	+1	.	.	+1	III
H	*Trifolium arvense* var. *arvense*	.	+1	+1	+1	.	+1	.	.	+1	.	III
H	*Origanum vulgare* subsp. *viride*	+1	.	.	.	+1	.	+1	+1	.	+1	III
H	*Origanum vulgare* subsp. *vulgare*	.	+1	.	+1	.	+1	.	.	+1	.	II
H	*Micromeria myrtifolia*	.	.	+1	.	.	.	+1	.	.	.	I
	Diagnostic taxa of *Carpino betuli-Acerion hyrcani and *Querco cerridis-Carpinetalia orientalis***											
Ph	*Quercus cerris* var. *cerris*	.	+1	+1	.	+1	+1	+1	.	+1	.	III
H	*Dorycnium graecum**	+2	.	+2	+2	.	.	+2	+2	.	+2	III
H	*Tanacetum poteriifolium**	+1	.	+1	+1	+1	.	+1	.	.	+1	III
H	*Brachypodium pinnatum*	.	+1	.	.	.	+1	.	+1	+1	+1	III
Ph	*Carpinus orientalis* subsp. *orientalis**	.	.	+1	.	+1	.	+1	.	+1	.	II
H	*Argyrolobium biebersteini**	+2	.	.	+2	.	+2	.	+2	.	.	II
H	*Dictamnus albus*	.	+2	+2	.	+2	.	+2	.	.	.	II
H	*Asperula involucrata**	+2	.	+2	.	.	+2	.	.	.	+2	II
H	*Genista tinctoria*	.	+2	.	+2	+2	.	.	+2	.	.	II
H	*Coronilla varia* subsp. *varia*	+1	.	.	.	.	.	.	.	.	+1	I
Ph	*Crataegus monogyna* subsp. *monogyna*	.	.	.	.	.	+1	.	.	.	.	I
Ph	*Colutea cilicica*	.	.	.	+1	.	.	.	.	.	.	I
H	*Lathyrus laxiflorus* subsp. *laxiflorus**	.	.	.	.	.	.	+1	.	.	.	I
H	*Laser trilobum*	.	+1	.	.	.	.	.	.	.	.	I
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani and *Quercetea pubescentis***											
Ph	*Quercus pubescens**	+1	+1	.	+1	+1	.	+1	+1	+1	+1	IV
H	*Brachypodium sylvaticum*	.	+1	+1	.	+1	+1	.	+1	.	.	III
H	*Silene italica*	+1	.	.	+1	.	+1	+1	.	.	.	II
H	*Limodorum abortivum*	.	+1	+1	.	.	.	.	+1	+1	.	II
H	*Pilosella* x *auriculoides**	+1	.	.	.	+1	.	.	.	+1	+1	II
H	*Hypericum perforatum*	.	+1	.	+1	.	+1	+1	.	.	.	II
H	*Lapsana communis* subsp. *intermedia*	.	.	+1	.	+1	+1	.	+1	.	.	II

Table 6. Continued

Quadrat no.		15	16	19*	20	21	22	23	24	25	68	Presence
H	*Minuartia multinervis**	+1	.	.	+1	.	.	.	.	+1	.	II
Ch	*Juniperus excelsa**	.	+1	.	.	.	+1	.	.	.	.	I
H	*Campanula lyrata* subsp. *lyrata*	.	.	+1	.	.	.	.	+1	.	.	I
H	*Cephalorrhynchus tuberosus*	.	.	.	.	+1	.	.	.	.	.	I
	Diagnostic taxa of *Onobrychido armenae-Thymetalia leucostomi and *Astragalo microcephali–Brometea tomentelli***											
H	*Teucrium chamaedrys* subsp. *chamaedrys*	.	+2	.	+2	+2	+2	.	+2	+2	.	III
H	*Teucrium polium**	+1	.	+1	.	+1	.	+1	.	.	+1	III
H	*Veronica orientalis* subsp. *orientalis*	+1	+1	.	+1	.	.	.	+1	.	.	III
H	*Chrysopogon gryllus* subsp. *gryllus*	.	.	+1	.	.	+1	.	.	+1	.	II
H	*Galium verum* subsp. *verum**	.	+1	.	.	+1	.	.	.	.	+1	II
H	*Ziziphora taurica* subsp. *taurica**	.	.	.	+1	.	.	+1	.	.	+1	II
H	*Jurinea consanguinea**	.	.	+1	.	.	+1	.	+1	.	.	II
H	*Helianthemum nummularium* subsp. *nummularium*	.	+2	.	.	.	.	.	.	.	+2	I
H	*Scabiosa argentea**	.	.	.	.	+1	.	.	+1	.	.	I
H	*Onosma aucheranum**	.	.	.	+1	.	.	.	.	.	.	I
H	*Hypericum origanifolium*	.	.	.	.	.	.	+1	.	.	.	I
Ch	*Astragalus lydius**	.	.	.	.	.	.	.	.	.	+2	I
H	*Ajuga chamaepitys* subsp. *chia* var. *ciliata*	.	.	+2	.	.	.	.	.	.	.	I
H	*Eryngium campestre* var. *virens*	.	.	.	.	+1	.	.	.	.	.	I
H	*Onobrychis armena**	.	.	.	.	.	+1	.	.	.	.	I
H	*Hedysarum varium*	+1	.	.	.	.	.	.	.	.	.	I
	Companion taxa											
H	*Trigonella monspeliaca*	+1	.	+1	.	+1	+1	+1	+1	+1	+1	IV
H	*Trifolium campestre*	.	+1	.	+1	+1	+1	+1	+1	+1	+1	IV
H	*Lens ervoides*	+1	.	+1	+1	.	.	+1	+1	+1	.	III
H	*Dactylis glomerata* subsp. *hispanica*	.	+1	.	+1	+1	+1	.	+1	.	+1	III
H	*Ononis pusilla*	+1	.	+1	.	+1	.	+1	.	+1	.	III
H	*Thesium billardieri*	.	+1	.	+1	.	+1	.	+1	.	+1	III
H	*Dianthus capitatus*	+1	.	+1	.	+1	.	+1	.	+1	.	III
H	*Ononis viscosa* subsp. *breviflora*	.	+1	.	+1	.	+1	.	+1	.	+1	III
H	*Medicago coronata*	+2	.	+2	.	+1	.	.	.	+1	+1	III
H	*Ononis reclinata*	.	+1	.	.	.	+1	+1	+1	+1	.	III
H	*Medicago minima* var. *minima*	+1	.	.	+1	+1	.	.	+1	.	+1	III
H	*Vicia sativa* subsp. *nigra* var. *segetalis*	.	.	.	.	.	+2	+2	.	+2	+2	II
H	*Trigonella spicata*	.	+1	.	.	.	+1	+1	.	+1	.	II
H	*Crucianella latifolia*	.	.	+1	.	+1	.	.	+1	.	+1	II
Ch	*Astragalus campylosema* subsp. *atropurpureus*	+1	.	.	+1	.	.	.	.	+1	+1	II
H	*Vicia narbonensis* var. *narbonensis*	.	+1	.	.	+1	+1	+1	.	.	.	II
H	*Onosma roussaei*	+1	.	+2	.	.	.	.	+1	.	.	II
H	*Onobrychis oxyodonta*	.	+1	.	+1	.	+1	.	.	.	.	II
H	*Lathyrus setifolius*	.	.	+1	.	.	.	+1	.	+1	.	II
H	*Vicia sativa* subsp. *sativa*	+1	.	.	.	+1	.	.	+1	.	.	II
H	*Trigonella brachycarpa*	.	+1	.	.	.	+1	+1	.	.	.	II
H	*Asplenium trichomanes*	.	.	.	+2	.	.	.	.	.	+2	I
H	*Velezia rigida*	.	.	+1	.	.	.	.	.	+1	.	I
H	*Prunella vulgaris*	+1	.	.	.	.	.	.	+1	.	.	I
H	*Erysimum eginense*	.	+1	.	.	+1	.	.	.	.	.	I
H	*Legousia falcata* subsp. *falcata* var. *falcata*	.	.	.	+1	.	.	+1	.	.	.	I
H	*Bothriochloa ischaemum*	.	.	+1	.	.	.	.	.	+1	.	I
H	*Steptorhamphus tuberosus*		.	.	.	.	+1	.	.	.	+1	I
H	*Verbascum cheiranthifolium* var. *asperulum*	+1	.	.	.	.	.	.	+1	.	.	I
H	*Solanum nigrum* subsp. *schultesii*	.	+1	.	.	+1	.	.	.	.	.	I
H	*Cerastium glomeratum*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Anthemis tinctoria* var. *discoidea*	.	.	.	.	.	+1	.	.	+1	.	I
H	*Picris pauciflora*	.	.	.	+1	.	.	.	+1	.	.	I
H	*Minuartia micrantha*	+1	.	.	.	.	.	.	.	.	+1	I
H	*Trigonella monantha* subsp. *monantha*	.	+1	.	.	+1	.	.	.	.	.	I
H	*Medicago* x *varia*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Catapodium rigidum* subsp. *rigidum* var. *rigidum*	.	.	.	.	.	+1	.	.	+1	.	I
H	*Muscari armeniacum*	.	.	.	+1	.	.	.	+1	.	.	I

Table 7. *Corno mari-Quercetum cerridis* Korkmaz, Engin, Kutbay & Yalçın. *Typus: *loniceretosum etruscae* subass. nova, Quadrat 138; *lathyretosum rosei* subass. nova, Quadrat 228

Quadrat no.		136	137	138*	139	143	226	227	228**	229	230	
Quadrat size (m²)		800	800	800	800	800	800	800	800	800	800	
Altitude (m)		800	750	850	850	800	1100	1100	1200	1250	1250	
Inclination (%)		30	40	30	30	30	40	40	40	40	40	
Exposure		NW	NW	NW	NW	NW	NW	NW	NW	S	N	
Height of tree layer (m)		10	10	15	10	10	10	10	12	10	10	
Coverage of tree layer (%)		90	90	90	90	90	80	80	80	80	80	
Height of shrub layer (m)		3	3	3	3	3	4	4	3	4	3	
Coverage of shrub layer (%)		10	5	10	5	10	10	10	15	10	10	
Height of herb layer (cm)		60	60	70	60	50	40	40	40	40	40	
Coverage of herb layer (%)		20	15	20	15	20	20	20	20	20	20	
Number of taxa		36	36	37	35	35	31	39	34	34	31	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Quercus cerris* var. *cerris*	11	11	11	11	11	44	44	44	44	44	V
Ph	*Carpinus orientalis* subsp. *orientalis*	44	44	44	44	44	+1	+1	+1	+1	+1	V
Ph	*Cornus mas*	11	22	22	22	22	+1	+1	+1	+1	+1	V
H	*Scutellaria velenovsky*	+1	+1	.	+1	.	+1	.	+1	.	.	III
	Differential taxa of *loniceretosum etruscae* (typus subassociation)											
Ch	*Lonicera etrusca* var. *etrusca*	+1	+1	+1	+1	+1	.	.	.	.	.	III
H	*Alliaria petiolata*	+1	+1	+1	+1	+1	.	.	.	.	.	III
H	*Tanacetum parthenium*	+1	+1	+1	+1	+1	.	.	.	.	.	III
	Differential taxa of *lathyretosum rosei*											
H	*Lathyrus roseus*	.	.	.	.	.	+2	+2	+2	+2	+2	III
H	*Nepeta nuda* subsp. *albiflora*	.	.	.	.	.	+2	+2	+2	+2	+2	III
H	*Campanula rapunculoides* subsp. *rapunculoides*	.	.	.	.	.	+1	+1	+1	+1	+1	III
	Diagnostic taxa of *Carpino betuli-Acerion hyrcani and *Querco cerridis-Carpinetalia orientalis***											
H	*Lathyrus laxiflorus* subsp. *laxiflorus**	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Sorbus torminalis* var. *torminalis*	.	+1	.	+1	+1	+1	+1	+1	+1	+1	IV
H	*Asperula involucrata**	.	+2	+2	.	+2	+2	+2	+2	+2	+2	IV
H	*Lathyrus tukhtensis*	.	.	.	.	.	+2	+2	+2	+2	+2	III
G	*Cyclamen coum* var. *coum**	+1	+1	.	+1	.	+1	+1	.	+1	.	III
H	*Tanacetum poteriifolium**	.	.	+1	.	+1	.	+1	+1	+1	+1	III
H	*Campanula rapunculoides* subsp. *rapunculoides*	.	.	.	.	.	+1	+1	+1	+1	+1	III
H	*Coronilla varia* subsp. *varia*	.	.	.	+1	.	+1	.	+1	+1	+1	III
H	*Asyneuma rigidum* subsp. *sibthorpianum **	.	.	+1	.	+1	.	+1	.	+1	.	II
H	*Brachypodium pinnatum*	+1	+1	.	+1	.	+1	.	.	.	.	II
H	*Vicia truncatula**	.	.	.	.	.	.	+2	.	+2	+2	II
Ph	*Colutea cilicica*	+1	.	+1	.	.	.	.	.	.	.	I
H	*Trifolium pannonicum* subsp. *elongatum**	.	+1	.	.	+1	.	.	.	.	.	I
H	*Cirsium hypoleucum**	.	.	.	+1	.	+1	.	.	.	.	I
H	*Aristolochia pallida*	.	.	.	.	.	.	.	+1	.	+1	I
H	*Trifolium medium* var. *medium*	.	.	+1	.	.	.	+1	.	.	.	I
H	*Viola sieheana**	+1	.	.	.	.	.	.	.	.	.	I
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani and *Quercetea pubescentis***											
H	*Lapsana communis* subsp. *intermedia*	+1	.	+1	+1	+1	.	+1	.	+1	+1	IV
H	*Sorbus umbellata* var. *umbellata*	.	.	.	.	.	+1	+1	+1	+1	+1	III
H	*Cephalanthera rubra*	.	+1	.	+1	.	+1	+1	+1	+1	.	III
H	*Doronicum orientale**	+1	+1	+1	+1	+1	.	.	+1	.	.	III
H	*Silene italica*	+1	+1	.	.	.	+1	+1	.	+1	+1	III
H	*Vicia cracca* subsp. *stenophylla**	.	.	.	.	.	+1	+1	+1	+1	+1	III
T	*Poa nemoralis*	.	.	.	.	.		+2	+2	+2	+2	II
H	*Geum urbanum*	+1	.	+1	.	+1	.	.	.	.	.	II
H	*Epipactis condensata*	.	+1	.	.	.	.	.	+1	.	.	I
H	*Crepis reuterana* subsp. *reuterana*	.	.	.	+1	.	.	.	.	.	.	I

Table 7. Continued

Quadrat no.		136	137	138*	139	143	226	227	228**	229	230	Presence
	Diagnostic taxa of *Fagetalia sylvaticae, *Querco-Fagetea***, and *Querco-Fagea***											
H	*Viola odorata***	+1	+1	+1	+1	+1	+1	.	+1	.	.	IV
H	*Clinopodium vulgare* subsp. *vulgare*	+1	+1	+1	+1	.	+1	+1	.	.	.	III
H	*Stellaria holostea***	.	.	.	.	+1	+1	+1	+1	+1	+1	III
H	*Stachys officinalis* subsp. *officinalis*	+1	+1	+1	+1	.	.	.	.	.	.	II
H	*Athyrium filix-foemina***	.	+2	.	+2	.	.	+2	.	.	.	II
H	*Fragaria vesca*	.	.	+1	.	.	+1	.	.	+1	.	II
Ch	*Hedera helix*	.	.	.	.	.	.	.	+1	.	+1	II
T	*Cardamine bulbifera**	.	.	.	.	+1	.	.	.	.	.	I
	Diagnostic taxa of *Quercetea ilicis*											
Ph	*Juniperus oxycedrus* subsp. *oxycedrus*	+1	+1	+1	.	.	+1	+1	+1	+1	.	IV
Ch	*Ruscus aculeatus* var. *angustifolius*	+2	+2	+2	+2	+2			.	.	.	III
H	*Geranium purpureum*	+1	+1	+1	+1	+1	.	.	.	.	.	III
Ph	*Jasminum fruticans*	.	.	.	+1	.	.	.	.	.	.	I
H	*Teucrium chamaedrys* subsp. *chamaedrys*	.	+2	+2	.	+2	.	+2	.	+2	.	III
H	*Galium verum* subsp. *verum*	+1	+1	.	.	+1	.	.	+1	.	.	II
H	*Digitalis lamarckii*	+1	.	.	+1	+1	.	+1	.	.	.	II
H	*Hedysarum varium*	.	.	.	.	+1	.	.	+1	.	+1	II
G	*Poa bulbosa*	.	.	+1	.	.	+1	.	.	.	.	I
H	*Sideritis montana* subsp. *montana*	.	+1	.	.	.	.	.	.	+1	.	I
H	*Onobrychis armena*	.	.	.	.	.	.	+1	.	.	+1	I
H	*Veronica orientalis* subsp. *orientalis*	.	.	.	+1	.	.	.	.	.	.	I
	Companion taxa											
H	*Campanula rapunculus* var. *lambertiana*	.	+1	+1	.	+1	.	.	.	+1	.	II
H	*Geranium lucidum*	+1	.	.	+1	.	.	+1	.	.	+1	II
H	*Asplenium trichomanes*	+2	.	.	+2	+2	.	.	.	.	.	II
H	*Salvia verticillata* subsp. *verticillata*	.	.	+1	.	.	.	+1	.	+1	.	II
H	*Leontodon hispidus* var. *hispidus*	.	.	.	+1	.	+1	.	.	.	+1	II
H	*Campanula involucrata*	+1	.	.	.	+1	.	.	+1	.	.	II
H	*Vicia hirsuta*	.	+1	+1	.	.	.	+1	.	.	.	II
H	*Trifolium pratense* var. *pratense*	.	+1	.	.	.	+1	.	+1	.	.	II
H	*Geranium molle* subsp. *molle*	.	.	.	+1	.	.	.	.	+1	+1	II
H	*Epipactis helleborine*	+1	.	+1	.	+1	.	.	.	.	.	II
H	*Dianthus calocephalus*	.	.	.	+1	.	.	+1	+1	.	.	II
H	*Anthemis kotschyana* var. *kotschyana*	.	.	.	.	+2	.	.	+2	.	.	I
H	*Vicia sativa* subsp. *nigra* var. *segetalis*	.	.	+2	.	.	.	+2	.	.	.	I
H	*Ononis pusilla*	+2	.	.	.	.	.	.	+2	.	.	I
H	*Epipactis pontica*	.	.	+1	.	.	.	+1	.	.	.	I
Ch	*Rosa canina*	.	.	.	+1	.	.	.	.	+1	.	I
Ch	*Rubus canescens* var. *canescens*	+1	.	.	.	.	.	.	+1	.	.	I
Ch	*Astragalus leucothrix*	.	+1	.	.	.	.	.	.	+1	.	I
Ch	*Astragalus ponticus*	.	.	.	.	.	+1	.	.	.	+1	I
H	*Erysimum cuspidatum*	.	+1	.	.	+1	.	.	.	.	.	I
H	*Lathyrus nissolia*	.	.	+1	.	.	.	+1	.	.	.	I
T	*Poa annua*	+1	.	.	.	.	.	.	+1	.	.	I
Ch	*Astragalus ornithopodioides*	.	.	.	.	.	+1	.	.	+1	.	I
H	*Vicia cracca* subsp. *intermedia*	.	.	.	+1	.	.	.	.	.	.	I
H	*Melilotus officinalis*	.	+1	.	.	.	.	.	.	.	.	I
H	*Legousia speculum-veneris*	.	.	+1	.	.	.	.	.	.	.	I
H	*Trifolium ochroleucum*	.	.	.	.	+1	.	.	.	.	.	I
H	*Erysimum pulchellum*	.	.	+1	.	.	.	.	.	.	.	I
H	*Thalictrum minus* var. *minus*	+1	.	.	.	.	.	.	.	.	.	I
H	*Rhagadiolus stellatus* var. *stellatus*	.	.	.	.	.	+1	.	.	.	.	I
H	*Centaurea depressa*	.	.	.	.	.	.	+1	.	.	.	I
H	*Aristolochia parvifolia*	.	.	.	.	.	.	.	.	.	+1	I
H	*Trachynia distachya*	.	.	.	+1	.	.	.	.	.	.	I
H	*Polygonum convolvulus*	.	+1	.	.	.	.	.	.	.	.	I
H	*Medicago* x *varia*	.	.	.	.	+1	.	.	.	.	.	I

Grande, and diagnostic species of the *lathyretosum rosei* subassociaton are *Lathyrus roseus* Stev., *Campanula rapunculoides* L. subsp. *rapunculoides*, and *Nepeta nuda* L. subsp. *albiflora* (Boiss.) Gams.

The distribution by phytogeographical elements of the 95 taxa recorded in the 10 quadrats of this association is as follows: Euro-Siberian: 20%; Mediterranean: 11%; Irano-Turanian: 4% (Figure 3). Endemic species are *Lathyrus tukhtensis* Czeczott, *Asyneuma rigidum* (Willd.) Gross subsp. *sibthorpianum* (Roem & Schult.) Damboldt., *Trifolium pannonicum* Jacq. subsp. *elongatum* (Willd.) Zohary, *Digitalis lamarckii* Ivan, *Onobrychis armena*, and *Astragalus leucothrix* Freyn & Bornm. and the endemism rate is 6.3%. The life form spectrum of the association is composed of hemicryptophytes (77%), chamaephytes (9%), therophytes (7%), phanerophytes (5%), and geophytes (2%) (Figure 4).

Diagnostic species of *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa play a very important role in the floristic composition of the association. The species of *Quercetea ilicis* and *Astragalo microcephali-Brometea tomentelli* classes are rarely found. The records of localities and dates of the 10 quadrats representing *Corno mari-Quercetum cerridis* are as follows: quadrats 136-139, 143: Aşağıdarıçay village-Doğanyuvası district, on 27 June 1993; quadrats 226-230: Alibeyköy-Akdeşdere district, on 28 June 1993.

***Trifolio canescentis-Pinetum caramanicae* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 8)

This association occurs on the right slopes of the Kızılırmak valley and the upper parts of *Corno mari-Quercetum cerridis*. This association is distributed in Alanköyü (Vezirköprü) and Karalargüney village (Osmancık) on graphitic schist parent rock and on north and north-west facing slopes. The soils under this association are loamy textured and high in organic matter and slightly acidic (pH 6.3) (Table 2).

The chorological spectrum (%) of the 70 taxa recorded in the 10 quadrats of this association is as follows: Euro-Siberian: 29%; Irano-Turanian: 4%; Mediterranean: 3%. (Figure 3). The endemism rate is 5.7% and the endemic species are *Lathyrus tukhtensis, Lonicera caucasica* Pall. subsp. *orientalis* (Lam.) Chamb. & Long, *Digitalis lamarckii*, and *Scutellaria salviifolia* Bent. The life form spectrum shows a dominancy of hemicryptophytes (74%), therophytes (13%), phanerophytes (7%), and chamaephytes (6%) (Figure 4).

Floristic composition of this association mainly consists of diagnostic species belonging to *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa. The species belonging to *Querco-Fagetea* (Br.-Bl. et Vliegler 1937) Fuk. et Fab. 1968 and *Astragalo microcephali-Brometea tomentelli* classes are also found in the association. *Trifolio canescentis-Pinetum caramanicae* is described by 10 quadrats taken from Alan village on 27 June 1993.

***Galio odorati-Fagetum orientalis* Özen & Kılınç 2002** (Table 9)

This association occupies the left slopes of the Kızılırmak valley Eğinönü Plateau (Kargı, Çorum) and the right slopes of Karalargüney village-Gölbel district (Osmancık) on schist parent rock and rather moist north, northwest, and northeast facing slopes. The soils under this association are loamy and sandy-clay-loamy texture and they are high in organic matter and the soils are slightly acidic (pH 6.5) like the previous 2 associations (Table 2).

This association include 2 subassociations named *abietetosum bornmuellerianae*, which occurs on the left slopes of the Kızılırmak valley Eğinönü Plateau (Kargı, Çorum) at 1250-1350 m, and *vicietosum croceo*, which occupies the right slopes of the Kızılırmak valley Karalargüney village-Gölbel district (Osmancık) at 1400-1500 m. Diagnostic species of *abietetosum bornmuellerianae* are *Abies nordmanniana* (Stev.) Spach subsp. *bornmuelleriana* (Mattf.) Coode & Cullen, *Pyrola media* Sw., *Moneses uniflora* (L.) Gray, and *Orthilia secunda* (L.) House, and diagnostic species of *vicietosum croceo* are *Vicia crocea* (Desf.) B.Fedtsch., *Poa pratensis* L., and *Astragalus glycyphyllos* L. subsp. *glycyphylloides* (DC.) Matthews.

Furthermore, 50.5% of the species belong to the Euro-Siberian phytogeographical region in the floristic composition of the 95 taxa recorded in 20

Table 8. *Trifolio canescentis-Pinetum caramanicae* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 115

Quadrat no.		112	113	114	115*	118	119	120	121	122	123	
Quadrat size (× 10 m²)		100	100	100	100	100	100	100	100	100	100	
Altitude (× 10 m)		125	125	120	120	110	110	115	110	110	110	
Inclination (%)		20	20	20	20	10	20	30	20	20	30	
Exposure		NE	NE	E	NE	NE	NE	NE	N	N	NE	
Height of tree layer (m)		15	20	15	15	20	15	20	20	20	20	
Coverage of tree layer (%)		90	90	90	90	90	90	90	80	80	80	
Height of shrub layer (m)		4	3	3	4	3	4	3	2	3	3	
Coverage of shrub layer (%)		20	10	20	20	10	20	10	10	30	20	
Height of herb layer (cm)		60	40	45	40	40	45	60	40	60	60	
Coverage of herb layer (%)		20	10	30	20	10	20	25	20	25	30	
Number of taxa		35	31	31	34	31	32	30	28	26	29	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Pinus nigra* subsp. *pallasiana* var. *caramanica*	54	54	43	44	54	54	54	54	44	44	V
Ph	*Quercus pubescens*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Trifolium canescens*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
Ch	*Rubus canescens* var. *canescens*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
Ch	*Cistus laurifolius*	12	.	12	12	.	12	.	12	12	12	IV
H	*Polygala anatolica*	+2	+2	.	+2	+2	+2	+2	.	+2	+2	IV
	Diagnostic taxa of *Carpino betuli-Acerion hyrcani and *Querco cerridis-Carpinetalia orientalis***											
H	*Lathyrus tukhtensis**	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Asperula involucrata**	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Lathyrus laxiflorus* subsp. *laxiflorus**	+1	+1	+1	+1	+1	+1	.	.	.	+1	IV
H	*Dorycnium graecum**	.	+2	+2	+2	+2	+2	+2	+2	.	.	IV
H	*Campanula rapunculoides* subsp. *rapunculoides*	+1	.	+1	.	+1	+1	+1	+1	+1	.	IV
H	*Tanacetum poteriifolium**	+1	+1	+1	.	+1	+1	+1	.	.	.	III
H	*Dorycnium pentaphyllum* subsp. *anatolicum*	+1	.	.	+1	.	.	+1	.	.	+1	II
H	*Brachypodium pinnatum*	+1	.	+1	.	.	+1	.	.	+1	.	II
Ph	*Crataegus monogyna* subsp. *monogyna*	.	+1	.	+1	.	.	.	+1	.	.	II
Ph	*Colutea cilicica*	.	.	.	+1	.	.	.	.	.	+1	I
Ph	*Carpinus betulus**	.	.	.	.	.	.	+1	.	.	.	I
Ch	*Lonicera caucasica* subsp. *orientalis*	.	.	+1	.	.	.	.	.	.	.	I
H	*Cirsium hypoleucum**	.	.	.	.	.	+1	.	.	.	.	I
H	*Viola sieheana*	.	.	.	+1	.	.	.	.	.	.	I
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani and *Quercetea pubescentis***											
H	*Luzula forsteri*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+1	V
H	*Vicia cracca* subsp. *stenophylla**	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Cephalenthera rubra*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Doronicum orientale**	+1	+1	+1	+1	.	+1	+1	.	+1	+1	IV
H	*Epipactis condensata*	+1	+1	+1	+1	+1	.	.	+1	.	+1	IV
H	*Lapsana communis* subsp. *intermedia*	.	.	+1	.	+1	+1	+1	+1	+1	.	III
H	*Limodorum abortivum*	+1	+1	.	+1	.	+1	.	.	.	+1	III

Table 8. Continued

Quadrat no.		112	113	114	115*	118	119	120	121	122	123	Presence
H	*Silene italica*	.	.	+1	.	+1	.	+1	.	+1	+1	III
H	*Sorbus umbellata* var. *umbellata**	+1	.	.	+1	.	+1	.	+1	.	.	II
H	*Genista lydia* var. *lydia**	+2	.	.	.	+2	.	.	.	.	.	I
H	*Veronica chamaedrys*	.	.	.	.	+2	.	.	.	.		I
H	*Potentilla micrantha*	.	.	.	.	.	.	.	.	+1	.	I
	Diagnostic taxa of *Fagetalia sylvaticae, *Querco-Fagetea***, and *Querco-Fagea***											
H	*Stellaria holostea***	+1	+1	.	.	+1	.	.	+1	+1	.	III
H	*Viola odorata***	+1	.	+1	+1	.	+1	+1	.	.	+1	III
H	*Sanicula europaea***	.	.	+2	.	.	+2	.	.	.	+2	II
H	*Clinopodium vulgare* subsp. *vulgare*	+1	.	.	+1	.	.	+1	.	.	.	II
H	*Polygonatum multiflorum**	.	.	.	.	+1	.	.	.	.	.	I
H	*Neottia nidus-avis**	.	.	.	.	.	.	.	+1	.	.	I
	Diagnostic taxa of *Astragalo microcephali-Brometea tomentelli*											
H	*Teucrium chamaedrys* subsp. *chamaedrys*	.	+2	.	+2	+2	.	.	+2	.	.	II
H	*Anthemis tinctoria* var. *pallida*	.	+1	.	.	.	.	+1	.	.	.	I
H	*Galium verum* subsp. *glabrescens*	.	.	.	+1	.	.	.	.	+1	.	I
H	*Potentilla recta*	+1	.	.	.	.	.	.	.	.	.	I
H	*Koeleria cristata*	.	.	.	.	.	+1	.	.	.	.	I
H	*Veronica orientalis* subsp. *orientalis*	.	.	+1	.	.	.	.	.	.	.	I
H	*Erysimum smyrnaeum*	.	.	.	.	+1	.	.	.	.	.	I
H	*Digitalis lamarckii*	.	.	.	.	.	.	.	+1	.	.	I
H	*Alyssum murale* var. *murale*	.	.	.	.	.	.	.	.	.	+1	I
	Companion taxa											
H	*Dactylis glomerata* subsp. *hispanica*	+1	+1	+1	+1	.	+1	+1	+1	+1	+1	V
H	*Origanum vulgare* subsp. *vulgare*	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	V
Ch	*Rosa canina*	+1	+1	.	+1	.	+1	+1	+1	+1	+1	IV
H	*Scabiosa columbaria* subsp. *ochroleuca*	+1	+1	+1	.	+1	+1	+1	.	+1	.	IV
H	*Crepis paludosa*	.	.	+1	+1	+1	.	+1	+1	.	+1	III
H	*Leontodon hispidus* var. *hispidus*	+1	+1	+1	+1	.	+1	.	.	+1	.	III
H	*Cerastium glomeratum*	.	+1	.	.	+1	.	+1	+1	.	+1	III
H	*Myosotis lithospermifolia*	.	+1	.	.	+1	.	+1	.	.	+1	II
H	*Chamaecytisus austriacus*	+2	.	.	+2	.	.	.	+2	.	.	II
H	*Thesium procumbens*	.	.	+2	.	.	+2	.	.	+2	.	II
H	*Anthyllis vulneraria* subsp. *boissieri*	.	+2	.	.	+2	.	+2	.	.	.	II
H	*Lotus corniculatus* var. *corniculatus*	+1	.	.	+1	.	.	.	.	.	+1	II
H	*Agrimonia eupatoria*	.	.	+1	.	.	+1	.	+1	.	.	II
H	*Campanula rapunculus* var. *lambertiana*	.	+1	.	.	+1	.	.	.	+1	.	II
H	*Campanula involucrata*	+1	.	.	.	.	.	+1	.	.	.	I
H	*Scutellaria salviifolia*	.	.	.	+1	.	.	.	.	.	+1	I
H	*Coronilla scorpioides*	.	+1	.	.	.	+1	.	.	.	.	I
H	*Epipactis helleborine*	.	.	+1	.	.	.	.	+1	.	.	I
T	*Poa annua*	+1	.	.	.	+1	.	.	.	.	.	I
H	*Melilotus officinalis*	.	.	.	.	.	.	+2	.	.	.	I
H	*Prunella laciniata*	.	.	.	+2	.	.	.	.	.	.	I
H	*Eryngium giganteum*	.	+1	.	.	.	.	.	.	.	.	I
H	*Vicia hirsuta*	+1	.	.	.	.	.	.	.	.	.	I

Table 9. *Galio odorati-Fagetum orientalis* Özen & Kılınç 2002. *Typus: *abietetosum bornmuellerianae* subass. nova, Quadrat 147, *vicietosum croceo* subass. nova, Quadrat 249

Quadrat no.		144	145	146	147*	148	149	150	151	152	156	248	249**	250	251	252	253	254	256	257	259	
Quadrat size (× 10 m²)		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Altitude (×10 m)		125	125	125	130	130	125	130	130	130	125	140	140	145	145	140	145	150	140	145	150	
Inclination (%)		30	30	20	20	30	30	20	30	10	20	20	20	40	20	20	30	30	30	20	20	
Exposure		N	N	NW	NW	NW	NW	NW	NW	NW	N	N	N	NE	NE	NE	N	N	NE	NE	N	
Height of tree layer (m)		30	30	30	30	25	30	30	25	30	30	20	20	20	20	25	20	20	20	25	25	
Coverage of tree layer (%)		90	90	80	90	90	90	90	90	90	90	90	90	80	90	90	90	90	90	90	90	
Height of shrub layer (m)		4	4	4	2	2	2	2	2	2	2	3	3	3	2	3	3	2	3	3	2	
Coverage of shrub layer (%)		20	20	20	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	
Height of herb layer (cm)		80	80	80	60	60	80	80	40	80	70	80	80	70	60	60	50	40	40	50	70	
Coverage of herb layer (%)		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
Number of taxa		38	41	35	35	40	31	36	36	33	29	28	25	23	21	25	26	22	23	26	22	Presence
Life form	**Diagnostic taxa of association**																					
Ph	*Fagus orientalis*	22	11	11	11	11	11	11	11	11	11	54	54	44	44	44	44	44	54	44	44	V
H	*Lathyrus aureus*	+1	+1	.	+1	.	+1	+1	.	+1	+1	11	11	11	11	11	11	11	11	11	11	V
H	*Galium odoratum*	+1	+1	.	+1	+1	+1	+1	.	+1	.	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	IV
H	*Melica uniflora*	+2	+2	.	+2	+2	.	+2	.	+2	.	+2	+2	.	+2	.	+2	+2	.	+2	+2	IV
	Differential taxa of *abietetosum bornmuellerianae*																					
Ph	*Abies nordmanniana* subsp. *bornmuelleriana*	43	44	44	54	54	44	44	44	44	54	.	.	.	.	.	.	.	.	.	.	III
H	*Pyrola media*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Moneses uniflora*	.	+1	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Orthilia secunda*	+1	.	+1	+1	+1	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
	Differential taxa of *vicietosum croceae*																					
H	*Vicia crocea*	.	.	.	.	.	.	.	.	.	.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
H	*Poa pratensis*	.	.	.	.	.	.	.	.	.	.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
H	*Astragalus glycyphyllos* subsp. *glycyphylloides*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
	Diagnostic taxa of *Carpino betuli-Acerion hyrcani and *Querco cerridis-Carpinetalia orientalis***																					
H	*Lathyrus laxiflorus* subsp. *laxiflorus**	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Cirsium hypoleucum**	+2	+2	+2	+1	+1	+2	+2	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	.	+1	+1	V
G	*Cyclamen coum* var. *coum**	+1	.	.	.	+1	.	.	.	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	IV
H	*Asperula involucrata**	+2	+2	+2	+2	+2	.	+2	+2	.	+2	+2	.	+2	.	.	+2	.	.	+2	.	III
Ch	*Lonicera caucasica* subsp. *orientalis**	+1	+1	+1	.	+1	+1	.	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Primula vulgaris* subsp. *vulgaris*	.	+1	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Vicia truncatula**	+1	+1	.	+1	+1	.	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Viola sieheana**	.	.	+1	.	+1	.	.	+1	.	.	+1	+1	.	.	+1	.	.	+1	.	.	II
H	*Dorycnium graecum**	.	.	+2	+2	+2	.	.	+2	+2	.	.	.	.	.	+2	.	.	.	.	.	II
Ph	*Carpinus betulus**	+1	+1	.	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Dorycnium pentaphyllum* subsp. *herbaceum*	.	+2	.	+2	+2	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	I

Table 9. Continued

Quadrat no.		144	145	146	147*	148	149	150	151	152	156	248	249**	250	251	252	253	254	256	257	259	Presence
H	*Euonymus latifolius* subsp. *latifolius*	+1	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Tanacetum poteriifolium**	.	+1	.	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	I
H	*Hypericum montbretii*	.	.	.	+1	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
Ph	*Crataegus tanacetifolia**	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Lathyrus tukhtensis**	.	+2	.	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Ph	*Sorbus torminalis* var. *torminalis*	.	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Asyneuma rigidum* subsp. *rigidum**	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Knautia involucrata*	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani and *Quercetea pubescentis***																					
H	*Veronica chamaedrys*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	.	+2	+2	.	+2	.	.	+2	.	IV
H	*Lapsana communis* subsp. *intermedia*	.	.	+1	.	.	+1	.	+1	.	+1	+1	+1	+1	.	+1	+1	.	+1	+1	+1	III
H	*Cephalanthera rubra*	+1	.	.	+1	.	.	.	.	+1	.	.	+1	+1	.	+1	.	+1	+1	.	.	II
H	*Luzula forsteri*	.	.	+2	+2	.	+2	+2	+2	.	+2	.	.	.	.	.	.	.	.	.	.	II
H	*Vicia cracca* subsp. *gerardi**	.	+2	.	.	+2	.	+2	.	.	.	.	+2	.	.	.	.	.	.	+2	.	II
H	*Campanula persicifolia*	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	.	.	+1	+1	.	+1	II
Ph	*Sorbus umbellata* var. *umbellata**	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	+1	.	.	+1	.	I
H	*Poa nemoralis*	+2	+2	.	.	+2	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	I
H	*Geranium robertianum*	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	.	.	+1	.	.	.	I
H	*Doronicum orientale**	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	.	.	I
H	*Geum urbanum*	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
	Diagnostic taxa of *Fagetalia sylvaticae*,Rhododendro pontici-Fagetalia orientalis* and *Querco-Fagetea***																					
H	*Fragaria vesca*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	.	.	+2	+2	+2	.	+2	+2	+2	V
Ch	*Rubus idaeus***	+1	.	+1	.	+1	.	+1	+1	+1	.	+1	.	+1	.	.	+1	.	+1	+1	.	III
H	*Sanicula europaea*	+2	+2	+2	.	+2	.	+2	+2	.	+2	+2	.	+2	.	+2	.	.	+2	.	.	III
H	*Cardamine bulbifera**	.	+1	.	.	+1	.	.	.	.	.	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	III
H	*Viola odorata*	.	.	+1	+1	+1	+1	+1	.	+1	.	.	+1	+1	+1	.	.	+1	.	+1	.	III
H	*Mycelis muralis*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Festuca drymeja***	+2	+2	.	+2	.	+2	.	+2	.	.	.	+2	.	+2	.	.	+2	.	+2	.	III
H	*Campanula rapunculoides* subsp. *rapunculoides*	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Polygonatum multiflorum**	+1	+1	+1	.	+1	+1	.	+1	.	+1	.	+1	.	.	.	+1	.	.	.	.	III
H	*Neottia nidus-avis**	.	.	+1	.	+1	.	+1	.	+1	.	+1	.	.	.	+1	+1	.	+1	.	+1	III
H	*Clinopodium vulgare* subsp.*vulgare*	.	+1	.	+1	.	.	+1	+1	.	.	+1	.	+1	.	+1	+1	.	.	.	+1	III
Ch	*Rubus hirtus***	+1	+1	.	+1	+1	+1	.	.	.	+1	.	.	.	.	+1	.	.	.	.	.	II
H	*Epilobium montanum*	+1	.	+1	+1	+1	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
G	*Arum euxinum*	.	.	+1	.	.	.	.	.	+1	.	.	+1	.	+1	.	+1	.	.	+1	.	II
H	*Galium rotundifolium***	.	+1	+1	+1	.	.	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	.	II
H	*Valeriana alliarifolia*	+2	.	+2	.	+2	+2	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	II

Table 9. Continued

Quadrat no.		144	145	146	147*	148	149	150	151	152	156	248	249**	250	251	252	253	254	256	257	259	Presence
H	*Stellaria holostea*	.	+1	+1	+1	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	II
H	*Polypodium vulgare* subsp. *vulgare*	+1	.	+1	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	I
H	*Saxifraga rotundifolia*	.	+1	.	.	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	I
Ch	*Daphne pontica***	.	+1	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Cardamine impatiens* var. *pectinata**	.	.	.	+1	.	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Sambucus ebulus*	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Aristolochia pontica***	.	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Salvia forskahlei***	.	.	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
	Companion taxa																					
H	*Crepis macropus*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Chaerophyllum aureum*	.	.	+1	.	.	.	.	+1	.	.	+1	.	+1	.	+1	.	+1	+1	+1	+1	III
H	*Luzula multiflora*	+1	+1	.	+1	+1	.	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Silene vulgaris* var. *vulgaris*	+1	.	+1	.	.	+1	+1	+1	+1	.	.	.	.	.	+1	.	.	.	+1	.	II
Ch	*Rosa canina*	+1	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	.	+1	.	+1	+1	II
Ph	*Crataegus curvisepala*	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	.	+1	+1	+1	II
H	*Platanthera chlorantha*	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	.	+1	+1	.	II
H	*Campanula sibirica* subsp. *hoenackeri*	.	+1	.	+1	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Teucrium chamaedrys* subsp. *chamaedrys*	+2	.	+2	.	+2	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	I
H	*Saxifraga cymbalaria* var. *cymbalaria*	+2	.	.	+2	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Origanum vulgare* subsp. *viride*	+1	.	.	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Dactylis glomerata* subsp. *hispanica*	.	.		.	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	.	.	I
H	*Verbascum eriocarpum*	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	.	.	+1	.	.	.	I
H	*Cephalanthera longifolia*	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	.	+1	I
H	*Astrantia maxima* subsp. *haradjiani*	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	.	.	+1	.	.	.	I
H	*Trifolium pratense* var. *pratense*	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	+1	.	.	I
H	*Epipactis pontica*	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	.	I
H	*Urtica dioica*	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Sambucus nigra*	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Ranunculus lanuginosus*	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Trifolium resupinatum* var. *microcephalum*	.	.	.	.	.	.	.	+1	.	.											I
H	*Alchemilla pseudocartalinica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	I
H	*Conium maculatum*	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	I
H	*Cruciata laevipes*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	I
H	*Moenchia mantica* subsp. *mantica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	I
H	*Euphorbia helioscopia*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	I
H	*Agrimonia eupatoria*	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	I
H	*Lamium amplexicaule*	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	I

quadrats of this association (Figure 3). Endemic species are *A. nordmanniana* subsp. *bornmuelleriana, Lonicera caucasica* subsp. *orientalis, Crataegus tanacetifolia* (Lam.) Pers., *Lathyrus tukhtensis, Arum euxinum* R.Mill, *Crepis macropus* Boiss. & Heldr., *Verbascum eriocarpum* (Freyn & Sint.) Bornm., *Astrantia maxima* Pall. subsp. *haradjiani* (Grint.) Rech., and *Epipactis pontica* Taub. and the endemism rate is 9.4%. Hemicryptophytes (85%), phanerophytes (7%), chamaephytes (6%), and geophytes (2%) are components of the life form spectrum of the association (Figure 4).

Diagnostic species belonging to *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa play an important role in the floristic composition of this association. The species belonging to the *Querco-Fagetea* class originate from regional ecological and phytogeographical properties also found in it. Quadrats were taken from Eğinönü plateau on 28 June 1993 and Karalargüney village-Gölbel district on 30 June 1993.

***Rumi scutati-Pinetum hamatae* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 10)

This association occurs on the left slopes and highest parts of the Kızılırmak valley and the upper parts of *Galio odorati-Fagetum orientalis*. This association occupies the southern and south-eastern slopes of Eğinönü plateau on schist parent rock and loamy soils that are slightly acidic (pH 6.2) and organic matter concentrations are at medium level (Table 2).

The floristic composition of this association consists of 39% Euro-Siberian, 4% Irano-Turanian, and 3% Mediterranean species (Figure 3). The endemism rate is 8.3% and the endemic species are *Lathyrus tukhtensis, Arum euxinum, Astragalus squalidus* Boiss. & Noë, *Digitalis lamarckii, Silene olympica* Boiss., and *Verbascum bithynicum* Boiss. Hemicryptophytes (82%), chamaephytes (7%), therophytes (7%), geophytes (3%), and phanerophytes (1%) are components of the life form spectrum (Figure 4).

Diagnostic species belong to *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa. The species belonging to *Querco-Fagetea* due to local phytogeographical properties and *Astragalo microcephali-Brometea tomentelli* due to narrow distribution of subalpine and alpine pastures are also represented. All the quadrats were taken from Eğinönü plateau on 28 June 1993.

C-Steppe vegetation

As a result of complete destruction of *Pinus brutia* var. *brutia, Quercus cerris* var. *cerris, Pinus nigra* subsp. *nigra* var. *caramanica*, and *Pinus sylvestris* var. *hamata* forests in different bioclimatic belts of the Kızılırmak valley, steppe vegetation that consists of several associations owing to local environmental factors appeared.

***Linario corifoliae-Astragaletum microcephali* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 11)

This association has a distribution in Maksutlu village-Haftın çeşme district (Kargı, Çorum), and Karalargüney village (Osmancık, Çorum). The association occurred on schist parent rock on which *P. brutia* var. *brutia, Q. cerris* var. *cerris*, and *P. nigra* subsp. *nigra* var. *caramanica* forests were completely degraded and on southern and south-western slopes. The soils under this association have a loamy texture. The soil has low organic matter concentrations and is extremely alkaline (pH 8.1-8.2) (Table 2).

This association includes 2 subassociations namely *stipetosum arabico*, which occurs in Maksutlu village-Haftın çeşme district (Kargı, Çorum) at 550-650 m, and *alyssetosum desertorum*, which occupies Karalargüney village (Osmancık, Çorum) at 1250-1300 m. Diagnostic species of the *stipetosum arabico* subassociation are *Stipa arabica* Trin. & Rupr., *Onosma isauricum* Boiss. & Heldr., *Erysimum crassipes* Fisch. & C.A.Mey., and *Silene subconica* Friv., and diagnostic species of the *alyssetosum desertorum* subassociation are *Alyssum desertorum* Stapf. var. *desertorum, Morina persica* L. var. *persica, Bromus benekenii* (Lange) Trimen and *Cruciata pedemontana* (Bellardi) Ehrend.

The chorological spectrum (%) based on a total of 87 taxa recorded in 20 quadrats is as follows: Irano-Turanian: 20.6%; Mediterranean: 6.8%; Euro-Siberian: 4.5% (Figure 2). *Onosma isauricum, Linaria corifolia* Desf., *Digitalis lamarcki* Ivan., *Onobrychis armena*,

Table 10. *Rumi scutati-Pinetum hamatae* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 176

Quadrat no.		164	165	167	168	170	172	173	175	176*	177	
Quadrat size (× 10 m²)		100	100	100	100	100	100	100	100	100	100	
Altitude (× 10 m)		160	160	165	165	160	160	165	165	165	165	
Inclination (%)		20	10	20	10	20	20	10	20	20	20	
Exposure		SE	SE	S	S	SE	SE	S	S	SE	SE	
Height of tree layer (m)		25	25	30	30	25	25	30	30	30	30	
Coverage of tree layer (%)		90	90	80	90	90	90	90	90	90	90	
Height of shrub layer (m)		2	2	3	3	3	3	2	2	3	3	
Coverage of shrub layer (%)		30	30	30	20	30	30	20	20	30	30	
Height of herb layer (cm)		80	80	60	60	50	70	50	60	50	70	
Coverage of herb layer (%)		20	20	20	20	20	20	20	20	20	20	
Number of taxa		27	29	30	30	28	32	29	30	30	28	Presence
Life form	**Diagnostic taxa of association**											
Ph	*Pinus sylvestris* var. *hamata*	44	54	54	44	44	54	44	54	54	44	V
Ch	*Juniperus communis* var. *saxatilis*	23	23	33	23	23	33	33	33	33	23	V
H	*Myosotis lithospermifolia*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Rumex scutatus*	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	V
H	*Potentilla speciosa* subsp. *speciosa*	+1	+1	+1	+1	.	+1	.	.	+1	+1	IV
	Diagnostic taxa of *Carpino betuli-Acerion hyrcani* * and *Querco cerridis-Carpinetalia orientalis*											
H	*Chamaecytisus pygmaeus*	+2	+2	.	+2	+2	.	+2	+2	+2	+2	IV
H	*Lathyrus laxiflorus* subsp. *laxiflorus**	+1	.	+1	+1	.	+1	+1	.	+1	+1	IV
H	*Digitalis ferruginea* subsp. *ferruginea**	.	+1	+1	.	+1	+1	.	+1	+1	.	III
H	*Ranunculus illyricus* subsp. *illyricus*	+1	.	.	+1	+1	.	+1	.	+1	.	III
H	*Cirsium hypoleucum**	+1	.	.	+1	.	.	+1	.	+1	.	II
H	*Lathyrus tukhtensis**	.	+1	.	.	+1	.	.	+1	.	+1	II
	Diagnostic taxa of *Querco pseudocerridis-Cedretalia libani and *Quercetea pubescentis***											
H	*Bunium microcarpum* subsp. *bourgaei**	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Doronicum orientale**	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Geranium macrostylum**	+1	.	+1	+1	.	+1	+1	+1	.	+1	IV
H	*Veronica chamaedrys*	.	+2	.	+2	+2	.	.	.	+2	+2	III
H	*Genista lydia* var. *lydia**	.	.	+2	.	.	+2	.	.	+2	.	II
H	*Lapsana communis* subsp. *intermedia*	+1	.	.	.	.	+1	.	+1	.	.	II
Ch	*Rubus canescens* var. *glabratus*	.	.	+1	.	.	.	.	.	+1	.	I
H	*Geum urbanum*	.	+1	.	.	.	.	+1	.	.	.	I
H	*Myosotis alpestris* subsp. *alpestris*	.	.	.	+1	.	+1	.	.	.	.	I
H	*Silene italica*	.	.	.	.	+1	.	.	+1	.	.	I
H	*Brachypodium sylvaticum*	.	.	+1	.	.	.	+1	.	.	.	I
	Diagnostic taxa of *Rhododendro pontici-Fagetalia orientalisand *Fagetalia sylvaticae*** and *Querco-Fagetea***											
H	*Daphne pontica**	.	+1	+1	+1	.	+1	.	+1	+1	.	III
G	*Arum euxinum**	+1	.	.	+1	+1	.	+1	.	.	+1	III
H	*Viola odorata*	.	+1	.	+1	+1	.	+1	.	+1	.	III
H	*Fragaria vesca***	+1	.	+1	.	.	+1	.	+1	.	+1	III

Table 10. Continued

Quadrat no.		164	165	167	168	170	172	173	175	176*	177	Presence
Ch	*Rubus hirtus**	.	+1	.	.	.	+1	.	.	.	.	I
H	*Clinopodium vulgare* subsp. *vulgare***	.	.	.	.	+1	.	.	.	+1	.	I
H	*Galium rotundifolium**	.	.	+1	.	.	.	.	+1	.	.	I
H	*Cardamine impatiens* var. *pectinata**	.	.	.	+1	.	.	+1	.	.	.	I
	Diagnostic taxa of *Onobrychido armenae-Thymetalia leucostomi and *Astragalo microcephali–Brometea tomentelli***											
H	*Thymus praecox* subsp. *jankae* var. *jankae*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
G	*Poa bulbosa*	+1	+1	+1	.	+1	+1	+1	.	+1	+1	IV
Ch	*Astragalus squalidus*	+2	.	+2	+2	.	+2	.	+2	+2	.	III
H	*Digitalis lamarckii**	.	+1	.	+1	+1	.	+1	+1	.	+1	III
H	*Teucrium chamaedrys* subsp. *chamaedrys*	.	+2	+2	.	.	+2	.	.	.	+2	II
H	*Nepeta nuda* subsp. *albiflora**	.	+2	.	.	.	.	.	+2	.	.	I
H	*Stachys iberica* subsp. *iberica* var. *iberica*	.	.	+1	.	.	.	.	.	+1	.	I
H	*Cynoglossum montanum*	.	.	+1	.	.	.	.	.	.	.	I
H	*Hypericum linarioides*	.	.	.	.	+1	.	.	.	.	.	I
H	*Potentilla recta*	.	.	.	.	.	.	+1	.	.	.	I
H	*Melica ciliata* subsp. *ciliata*	.	.	.	+1	.	.	.	.	.	.	I
	Companion taxa											
H	*Luzula multiflora*	.	+1	.	+1	+1	+1	+1	+1	.	+1	IV
H	*Viola parvula*	.	.	+1	.	+1	+1	+1	+1	+1	.	III
H	*Cruciata laevipes*	.	+2	+2	.	+2	.	.	+2	.	+2	III
H	*Trifolium repens* var. *repens*	+2	.	.	+2	.	+2	+2	.	+2	.	III
H	*Ajuga orientalis*	+1	.	.	+1	.	.	+1	.	+1	+1	III
H	*Silene olympica*	.	+1	.	.	+1	+1	.	+1	.	+1	II
H	*Dactylis glomerata* subsp. *hispanica*	+1	.	+1	+1	.	.	.	.	+1	.	II
H	*Arrhenatherum elatius* subsp. *elatius*	.	+1	.	.	+1	.	+1	+1	.	.	II
H	*Lamium crinitum*	.	.	+1	.	.	+1	.	.	+1	+1	II
H	*Plantago lanceolata*	+1	.	.	+1	+1	.	.	+1	.	.	II
H	*Tripleurospermum oreades* var. *oreades*	.	+1	.	.	.	+1	+1	.	.	+1	II
H	*Poa longifolia*	.	+2	.	.	.	+2	.	.	.	+2	II
H	*Erophila verna* subsp. *verna*	+1	.	.	+1	.	.	.	+1	.	.	II
H	*Verbascum pyramidatum*	.	.	+1	.	+1	.	.	+1	.	.	II
H	*Phleum pratense*	+1		.	.	.	+1	+1	.	.	.	II
H	*Verbascum bithynicum*	.	+1	.	+1	.	.	.	.	.	+1	II
H	*Pilosella hoppeana* subsp. *testimonalis*	.	.	+1	.	.	+1	.	.	+1	.	II
H	*Senecio vernalis*	+1	.	.	.	+1	.	.	+1	.	.	II
H	*Cardamine hirsuta*	.	+2	.	.	.	.	+2	.	.	.	I
H	*Arabidopsis thaliana*	.	.	.	+2	.	.	.	.	.	+2	I
H	*Veronica gentianoides*	.	.	+2	.	.	.	.	.	+2	.	I
H	*Platanthera chlorantha*	+1	.	.	.	.	+1	.	.	.	.	I
H	*Urtica dioica*	.	.	.	.	+1	.	.	+1	.	.	I
H	*Inula graveolens*	.	+1	.	.	.	.	+1	.	.	.	I
H	*Sanguisorba minor* subsp. *muricata*	+1	.	.	.	.	+1	.	.	.	.	I
Ch	*Rubus canescens* var. *canescens*	.	.	.	.	.	.	.	.	.	+1	I
H	*Veronica triphyllos*	.	.	.	+2	.	.	.	.	.	.	I
H	*Ranunculus lanuginosus*	.	.	.	.	.	+1	.	.	.	.	I
H	*Anthoxanthum odoratum*	.	.	.	.	.	.	.	.	+1	.	I
H	*Sideritis lanata*	.	.	+1	.	.	.	.	.	.	.	I
H	*Bromus variegatus* subsp. *variegatus*	.	.	.	.	.	.	.	+1	.	.	I

Table 11. *Linario corifoliae-Astragaletum microcephali* Korkmaz, Engin, Kutbay & Yalçın. *Typus: *stipetosum arabico* subass. nova, Quadrat 218, *alyssetosum desertorum* subass. nova, Quadrat 272

Quadrat no.		208	209	210	211	212	213	214	216	217	218*	264	265	267	268	269	271	272*	273	274	275	
Quadrat size (m²)		50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Altitude (m)		550	550	550	600	600	600	600	550	650	650	1250	1250	1300	1300	1300	1300	1200	1250	1250	1300	
Inclination (%)		40	40	40	40	40	30	40	40	40	40	40	40	40	30	40	30	30	40	40	30	
Direction		SE	SE	SE	SE	SW	S	S	S	S	SW	S	S	SW	S	SE	S	S	S	S	S	
Height of herb layer (cm)		70	70	70	60	70	70	70	70	70	70	40	40	40	40	40	40	40	40	40	40	
Coverage of herb layer (%)		80	70	80	80	80	80	80	80	90	90	90	90	90	90	90	90	90	90	90	90	
Number of taxa		28	25	27	26	26	27	28	29	24	32	32	32	32	35	34	35	36	33	36	31	Presence
Life form	**Diagnostic taxa of association**																					
Ch	*Astragalus microcephalus*	33	33	33	33	33	33	33	33	33	33	44	44	44	44	54	54	44	44	54	44	V
H	*Callipeltis cucullaria*	+1	.	+1	+1	.	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Linaria corifolia*	.	+1	.	+1	+1	.	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	.	V
	Differential taxa of *stipetosum arabico* (typus subassociation)																					
H	*Stipa arabica*	12	12	12	12	12	+2	+2	12	12	12	.	.	.	.	.	.	.	.	.	.	III
H	*Onosma isauricum*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Erysimum crassipes*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	III
H	*Silene subconica*	.	+1	+1	+1	.	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	II
	Differential taxa of *alyssetosum desertorum*																					
H	*Alyssum desertorum* var. *desertorum*	.	.	.	.	.	.	.	.	.	.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
H	*Morina persica* var. *persica*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Bromus benekenii*	.	.	.	.	.	.	.	.	.	.	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Cruciata pedemontana*	.	.	.	.	.	.	.	.	.	.	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	III
	Diagnostic taxa of *Astragalo karamasici-Gypsophilion eriocalycis and *Onobrychido armenae-Thymetalia leucostomi***																					
H	*Lappula barbata**	.	.	+2	.	+2	.	+2	.	.	.	+2	+2	.	+2	+2	+2	+2	.	+2	+2	III
H	*Teucrium polium*	+2	+2	.	+2	.	+2	.	.	+2	+2	.	+1	+1	.	.	.	+1	+1	.	+1	III
H	*Ziziphora capitata*	.	.	.	.	+1	.	+1	.	.	+1	+1	.	+1	+1	.	+1	+1	+1	+1	+1	III
H	*Ziziphora tenuior**	+1	+1	.	.	+1	.	+1	+1	+1	.	+1	.	.	+1	+1	.	+1	.	+1	.	III
H	*Digitalis lamarckii*	.	.	+1	.	.	+1	.	.	.	.	+1	+1	+1	.	+1	+1	.	+1	+1	+1	III
H	*Alyssum sibiricum*	+2	.	+2	+2	.	+2	.	+2	.	+2	.	.	+2	.	.	+2	.	.	.	.	II
H	*Taeniatherum caput-medusae* subsp. *crinitum**	.	+1		+1	.	.	+1	.	+1	+1	+1	.	.	+1	.	.	+1	.	.	.	II
H	*Onobrychis armena*	+1	.	.	.	+1	.	.	.	.	.	.	+1	.	.	+1	+1	.	+1	+1	+1	II
H	*Scabiosa argentea*	+1	.	.	+1	.	+1	.	+1	.	+1	.	.	.	+1	.	.	+1	.	.	.	II
H	*Ziziphora taurica* subsp. *taurica**	.	.	+1	.	.	+1	.	.	+1	.	.	.	.	.	.	.	+1	.	+1	.	II
Ch	*Astragalus leucothrix*	+2	.	.	.	.	.	.	.	.	+2	.		.	.	.	.	.	.	.	.	I
Ch	*Acantholimon acerosum* var. *acerosum*	.	.	.	.	.	.	.	+3	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Nepeta nuda* subsp. *albiflora*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+2	.	.	.	.	.	I
	Diagnostic taxa of *Astragalo microcephali–Brometea tomentelli*																					
H	*Bromus tectorum*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Logfia arvensis*	+1	.	.	+1	.	+1	+1	.	+1	+1	+1	.	.	+1	.	+1	+1	+1	+1	+1	IV
H	*Eryngium campestre* var. *virens*	+1	+1	.	.	.	+1	+1	.	.	.	.	+1	+1	.	+1	+1	.	+1	+1	+1	III
H	*Alkanna orientalis* var. *orientalis*	+1	+1	.	.	+1	.	+1	+1	+1	+1	.	+1	.	.	+1	.	.	+1	.	.	III
H	*Erysimum smyrnaeum*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Herniaria incana*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Hypericum origanifolium*	.	.	.	.	.	.	.	.	.	.	+1	.	+1	+1	+1	+1	+1	.	+1	+1	II
H	*Apera intermedia*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	.	+1	+1	+1	.	II
H	*Chrysopogon gryllus* subsp. *gryllus*	+2	.	+2	+2	+2	+2	+2	.	+2	+2	.	.	.	.	.	.	.	.	.	.	II
H	*Sideritis montana* subsp. *montana*	.	+1	.	+1	.	+1	+1	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Centaurea urvillei* subsp. *urvillei*	+1	.	+1	.	.	.	.	+1	.	.	.	.	+1	.	.	+1	.	.	.	+1	II
H	*Centaurea triumfetti* var. *cana*	.	+1	.	.	+1	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Veronica orientalis* subsp. *orientalis*	.	.	.	.	.	.	.	.	.	.	+1	.	.	+1	.	+1	.	.	+1	.	I

Table 11. Continued

Quadrat no.		208	209	210	211	212	213	214	216	217	218*	264	265	267	268	269	271	272*	273	274	275	Presence
H	*Potentilla recta*	+1	.	+1	+1	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Poa bulbosa* var. *vivipara*	.	.	.	.	.	.	.	.	.	.	+2	.	.	+2	.	.	+2	.	.	.	I
H	*Ajuga chamaepitys* subsp. *chia* var. *chia*	.	+1	.	.	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Asperula glomerata* subsp. *glomerata*	.	.	.	.	+1	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	I
H	*Melica ciliata* subsp. *ciliata*	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	I
H	*Acinos rotundifolius*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	I
	Companion taxa																					
H	*Senecio vernalis*	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	V
H	*Myosotis arvensis* subsp. *arvensis*	.	+1	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	+1	V
H	*Xeranthemum annuum*	+1	.	+1	+1	.	+1	.	+1	+1	.	.	+1	+1	.	+1	.	+1	+1	+1	+1	IV
H	*Veronica arvensis*	.	+1	+1	.	+1	.	+1	+1	.	+1	+1	.	+1	.	+1	.	+1	+1	.	+1	III
H	*Euphorbia seguieriana* subsp. *seguieriana*	.	.	.	.	.	.	.	.	.	.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
H	*Bothriochloa ischaemum*	.	.	.	.	.	.	.	.	.	.	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	III
H	*Sanguisorba minor* subsp. *muricata*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Arenaria serpyllifolia*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Plantago lanceolata*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	III
H	*Medicago lupulina*	.	.	.	.	.	.	.	.	.	.	.	+1	+1	.	+1	+1	+1	+1	+1	+1	II
H	*Alyssum hirsutum* var. *hirsutum*	.	.	.	.	.	.	.	+2	.	.	.	+2	.	+2	.	+2	.	+2	+2	+2	II
H	*Tripleurospermum oreades* var. *oreades*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	+1	+1	.	+1	.	.	II
H	*Galium floribundum* subsp. *floribundum*	+1	.	+1	+1	.	+1	+1	.	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Crepis sancta*	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	+1	.	+1	+1	.	+1	.	II
H	*Torilis leptophylla*	.	+1	.	+1	+1	.	+1	.	+1	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Viola kitaibeliana*	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	+1	.	+1	+1	II
H	*Euphorbia falcata* subsp. *falcata* var. *falcata*	.	+1	+1	.	+1	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Valerianella lasiocarpa*	+1	.	+1	.	.	.	+1	.	+1	.	.	.	.	.	+1	.	.	.	.	.	II
H	*Heliotropium europaeum*	+1	.	.	.	.	.	.	.	.	+1	.	.	+1	.	+1	.	.	.	+1	.	II
H	*Aegilops geniculata*	+1	.	+1	.	+1	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
H	*Euprasia pectinata*	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	+1	.	+1	.	II
H	*Bromus sterilis*	+1	+1	.	.	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	II
H	*Dactylis glomerata* subsp. *hispanica*	.	+2	.	+2	+2	.	+2	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Tragopogon buphthalmoides* var. *buphthalmoides*	+2	.	+2	.	.	+2	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	I
H	*Hordeum murinum* subsp. *glaucum*	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	+1	.	.	.	I
H	*Cnicus benedictus* var. *kotschyi*	.	.	+1	+1	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Tragus rasemosus*	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	.	+1	.	.	I
H	*Turgeniopsis foeniculacea*	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	+1	.	+1	I
H	*Linum corymbulosum*	.	+1	.	.	.	.	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	I
H	*Stachys annua* subsp. *annua* var. *lycaonica*	.	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Chenopodium botrys*	.	.	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	+1	.	I
H	*Erodium hoefftianum*	.	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	+1	.	.	I
G	*Allium pseudoflavum*	.	.	+1	.	.	+1	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	I
H	*Arabis nova*	.	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	I
H	*Linaria simplex*	.	.	+1	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	I
H	*Minuartia micrantha*	.	+2	.	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Carthamus lanatus*	.	.	.	+2	.	.	.	.	.	+2	.	.	.	.	.	.	.	.	.	.	I
H	*Dianthus orientalis*	.	.	.	.	.	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	I
H	*Arabis verna*	+1	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Erophila verna* subsp. *verna*	+1	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	I
H	*Pterocephalus plumosus*	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	I
H	*Petrorhagia cretica*	.	+1	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	I
H	*Medicago minima* var. *minima*	.	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I
H	*Geropogon hybridus*	.	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	I

and *Astragalus leucothrix* are endemic in the flora of the association and the endemism rate is 5.7%. The life form structure of the association consists of hemicryptophytes (96%), chamaephytes (3%), and geophytes (1%) (Figure 4).

The floristic composition of the association is mainly composed of diagnostic species of *Astragalo karamasici-Gypsophilion eriocalycis*, *Onobrychido armenae-Thymetalia leucostomi*, and *Astragalo microcephali-Brometea tomentelli* upper syntaxa and a high number of companion species were also found. *Linario corifoliae-Astragaletum microcephali* is described by 20 quadrats taken from Maksutlu village-Haftın çeşme district (Kargı, Çorum) on 29 June 1993 and Karalargüney village (Osmancık, Çorum) on 30 June 1993.

***Daphno oleoidis-Astragaletum angustifolii* Korkmaz, Engin, Kutbay & Yalçın, ass. nova** (Table 12)

The association occurs on decarbonated calcareous substrata on southern slopes around Eğinönü pasture (Kargı, Çorum) on which *P. sylvestris* var. *hamata* forests were completely degraded. The soils under this association are silty textured. The soil has high organic matter and is slightly acidic (pH 7.8) (Table 2).

Moreover, 17%, 14%, and 7% of the species in the association belong to the Euro-Siberian, Irano-Turanian, and Mediterranean phytogeographical regions, respectively (Figure 2). *Marrubium cephalanthum* Boiss. & Noë, *Euphorbia erythrodon* Boiss. & Heldr., *E. anacampseros* Boiss. var. *anacampseros*, *Asperula nitida* Sm. subsp. *subcapitellata* Ehrend., *Astragalus hirsutus* Vahl, and *Taraxacum revertens* G.E.Haglund are endemic and the endemism rate is 14.2%. The life form structure of the association consists of hemicryptophytes (93%) and chamaephytes (7%) (Figure 4).

The floristic composition mainly consists of the diagnostic species of *Onobrychido armenae-Thymetalia leucostomi* and *Astragalo microcephali-Brometea tomentelli* upper syntaxa. The species of *Quercetea pubescentis* were rarely represented. All the quadrats were taken from Eğinönü plateau on 28 June 1993.

Discussion

Arbutus unedo is one of the most widespread species of maquis vegetation around the Mediterranean basin and numerous associations belonging to different upper syntaxa are formed there. Although Loidi et al. (1994) and Torres et al. (2002) in the Iberian Peninsula reported that *A. unedo* associations should be included in *Pistacio lentisci-Rhamnetalia alaterni* Rivas-Martínez 1975, it was stated by Varol (2003), Özen and Kılınç (1995a), Korkmaz et al. (2008), and Karaer et al. (2010) that *A. unedo* associations in the East Taurus and Black Sea region in Turkey should be included in *Quercetalia ilicis*. It is a natural phenomena that there are ecological, floristic, and phytosociological differences between *A. unedo* associations in the Iberian Peninsula and Turkey.

There were many ecological and floristic differences between the *A. unedo* association in the Kızılırmak valley formerly described by Karaer et al. (2010) and previously described associations (Kılınç et al., 1992; Özen & Kılınç, 1995a; Varol, 2003; Korkmaz et al., 2008). Thus floristic similarity between *Buxo sempervirentis-Arbutetum unedonis* in the Mediterranean Intrapontic belt (Quézel et al., 1980) of the Kızılırmak valley and previously described *A. unedo* associations was 7.5%-17.3% (Table 13). This association should be included in *Quercetalia ilicis* and *Quercetea ilicis* because diagnostic species belonging to these syntaxa units have high cover-abundance and presence values.

One of the quite peculiar elements of sclerophyllous maquis vegetation around the Mediterranean basin is natural formations of *Olea europea* var. *sylvestris* (Loidi et al., 1994), and these formations were gradually decreased due to cultivation activities (Escarré et al., 1983; Akman, 1995; Di Pietro & Blasi, 2002; Baldoni et al., 2006). Therefore, it is too difficult to determine natural ecological, floristic, and phytosociological properties of these formations. Likewise a natural *Olea europea* var. *sylvestris* association outside the Mediterranean basin was reported by Karaer et al. (2010) for the first time.

It has been reported that *Olea europea* var. *sylvestris* associations in Mediterranean region of

Table 12. *Daphno oleoidis-Astragaletum angustifolii* Korkmaz, Engin, Kutbay & Yalçın. *Typus: Quadrat 179

Quadrat no.		178	179*	180	181	182	183	184	185	186	187	
Quadrat size (m^2)		50	50	50	50	50	50	50	50	50	50	
Altitude (× 10 m)		160	160	165	161	160	160	165	161	167	167	
Inclination (%)		20	20	20	20	20	20	20	20	20	20	
Direction		S	S	S	S	S	S	S	S	S	S	
Height of shrub layer (cm)		30	40	40	30	30	30	40	30	30	30	
Coverage of shrub layer (%)		50	50	50	50	50	50	50	50	50	50	
Height of herb layer (cm)		10	10	10	15	20	10	10	20	10	10	
Coverage of herb layer (%)		50	50	50	50	50	50	50	50	50	50	
Number of taxa		23	22	22	25	23	21	25	24	25	23	Presence
Life form	**Diagnostic taxa of association**											
Ch	*Astragalus angustifolius* subsp. *angustifolius* var. *angustifolius*	33	33	33	33	33	43	43	43	33	43	V
H	*Daphne oleoides* subsp. *oleoides*	23	23	23	23	23	23	23	23	23	23	V
H	*Marrubium cephalanthum*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Euphorbia erythrodon*	+2	+2	+2	+2	12	12	12	+2	+2	+2	V
H	*Euphorbia anacampseros* var. *anacampseros*	+2	+2	+2	+2	+2	+2	12	+2	+2	+2	V
H	*Polygala alpestris*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
	Diagnostic taxa of *Onobrychido armenae-Thymetalia leucostomi*											
H	*Helianthemum nummularium* subsp. *tomentosum*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Thymus spyleus* subsp. *rosulans*	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	V
H	*Teucrium chamaedrys* subsp. *chamaedrys*	.	+2	.	+2	+2	+2	+2	+2	+2	+2	IV
H	*Myosotis alpestris* subsp. *alpestris*	+1	.	.	.	+1	.	+1	.	+1	.	II
H	*Poa alpina* subsp. *fallax*	.	+1	.	.	.	.	.	+1	.	.	I
	Diagnostic taxa of *Astragalo microcephali–Brometea tomentelli*											
H	*Asperula nitida* subsp. *subcapitellata*	+2	+2	+2	+2	+2	+2	.	+2	+2	+2	V
H	*Plantago holosteum*	+2	+2	.	.	.	.	+2	+2	+2	+2	III
H	*Hypericum orientale*	.	+1	+1	+1	.	.	+1	+1	.	.	III
H	*Veronica orientalis* subsp. *orientalis*	+1	.	+1	.	.	+1	.	.	+1	.	II
H	*Hypericum linarioides*	.	.	.	+1	+1	.	+1	.	.	.	II
H	*Erysimum smyrnaeum*	.	+1	.	.	+1	.	.	+1	.	.	II
H	*Iberis taurica*	.	.	+1	.	.	+1	.	.	.	+1	II
H	*Ajuga chamaepitys* subsp. *chia* var. *chia*	+2	.	.	.	.	.	.	.	+2	.	I
H	*Helianthemum canum*	.	.	.	+1	.	.	+1	.	.	.	I
	Diagnostic taxa of *Quercetea pubescentis*											
H	*Bunium microcarpum* subsp. *bourgaei*	+1	+1	+1	+1	+1	+1	.	+1	.	+1	IV
H	*Carex halleriana*	+1	.	+1	+1	.	.	.	+1	+1	+1	III
Ch	*Rubus canescens* var. *glabratus*	.	+1	.	.	.	+1	.	.	.	.	I
	Companion taxa											
H	*Minuartia erythrosepala* var. *erythrosepala*	+2	.	+2	.	+2	+2	+2	+2	+2	+2	IV
H	*Sesleria alba*	+1	.	+1	+1	+1	+1	+1	.	+1	+1	IV
H	*Pilosella hoppeana* subsp. *testimonalis*	.	+1	.	+1	+1	.	+1	+1	.	+1	III
H	*Medicago* x *varia*	.	+1	+1	+1	.	.	+1	.	+1	+1	III
Ch	*Astragalus hirsutus*	+2	.	.	+2	+2	.	.	+2	+2	.	III
H	*Cruciata laevipes*	.	.	.	+2	+2	.	+2	+2	.	+2	III
H	*Alchemilla caucasica*	+2	+2	.	+2	.	+2	.	.	+2	.	III
H	*Stachys iberica* subsp. *iberica* var. *densipilosa*	+1	.	.	+1	+1	.	+1	.	.	+1	III
H	*Sanguisorba minor* subsp. *muricata*	.	+2	+2	.	.	+2	+2	.	+2	+2	III
H	*Arabis nova*	+1	.	.	+1	+1	+1	.	+1	.	.	III
H	*Veronica gentianoides*	.	.	+2	.	.	.	+2	.	+2	+2	II
H	*Poa timoleontis*	.	+2	.	.	+2	.	+2	+2	.	.	II
H	*Neotestema apulum*	+2	.	+2	.	.	.	.	.	+2	.	II
H	*Sedum hispanicum* var. *hispanicum*	.	.	+2	.	.	+2	.	.	+2	.	II
H	*Erophila verna* subsp. *verna*	.	.	.	.	.	.	.	+2	+2	+2	II
H	*Euphorbia eriophora*	+1	.	.	+1	.	.	+1	.	.	.	II
H	*Taraxacum revertens*	.	+1	.	.	+1	.	.	+1	.	.	II
H	*Urtica urens*	.	.	.	+1	.	+1	.	.	.	.	I
H	*Crepis foetida* subsp. *rhoeadifolia*	.	.	+1	.	.	.	+1	.	.	.	I

Table 13. Similarity percentages between associations in the study area and some studies, according to Sørensen's similarity formula (Sørensen, 1948).

Described associations in the study area	*Arbutetum unedonis*	*Oleetum europaeae*	*Juniperetum excelsae*	*Viticetum agni-casti*	*Pinetum brutiae*	*Quercetum cerridis*	*Pinetum caramanicae*	*Fagetum orientalis*	*Pinetum hamatae*	*Astragaletum microcephali*	*Astragaletum angustifolii*
Other investigations done	**Similarity percentages (%)**										
Akman & Ketenoğlu (1978) Köroğlu Mountain	–	–	–	–	–	–	14.4	–	10.2	–	–
Akman et al. (1978) Mediterranean Region	–	9.8	–	–	8.4-18.0	–	–	–	–	–	–
Akman et al. (1979a) Mediterranean Region	–	–	–	–	–	–	13.9-17.6	19.5	–	–	–
Akman et al. (1979b) Mediterranean Region	–	–	5.5-8.0	–	–	20.8	10.3-12.6	12.0-30.2	17.4	–	–
Quezél et al. (1980) Black Sea Region	–	–	9.6	–	22.3	26.2	18.5	21.3-33.3	4.2-7.0	–	–
Yurdakulol (1981) Pos Forest	–	–	–	–	14.8	–	–	–	–	–	8.6
Akman et al. (1983) Ilgaz Mountain	–	–	–	–	–	–	26.4	–	17.6-18.5	15.3	–
Akman et al. (1984) Central Anatolia	–	–	–	–	–	–	–	–	–	6.7	–
Tatlı (1985) Gavur Mountain	–	–	–	–	–	–	–	4.1	11.7	–	
Kılınç (1985) Between Devrez and Kızılırmak	–	–	18.0	–	23.4	–	18.7	–	21.1	9.3	15.2
Kılınç (1987) Devrez Valley	–	–	16.9	–	16.8	–	–	–	–	–	–
Bekat (1987) Barla Mountain	–	–	16.5	–	–	–	13.3	–	–	–	5.7
Ocakverdi & Çetik (1987) Seydişehir	–	–	13.8	–	–	–	14.0	–	–	–	–
Tatlı (1987) Allahuekber Mountains	–	–	–	–	–	–	–	–	6.9	8.1	–
Ekim & Akman (1990) Sündiken Mountain	–	–	–	–	11.9	22.9	25.6	–	20.1	–	–
Ocakverdi & Ünal (1991) Karadağ (Karaman)	–	–	–	–	–	–	–	–	–	18.4	4.1
Akman et al (1991) Antitaurus	–	–	–	–	–	–	–	–	–	14.7	10.0
Gümüş (1992) Tahir Mountain	–	–	–	–	–	–	–	–	–	10.2	–
Kılınç et al. (1992) Black Sea Coast	11.9	–	–	–	–	–	–	–	–	–	–
Tatlı et al. (1994) Kızılören, Çal and Loras Mountains	–	–	–	–	–	5.9	6.9	–	–	11.4	–
Serin & Eyce (1994) Hadim, Aladağ and Environs	–	–	13.0	–	18.0	–	8.0	–	–	–	–

Table 13. Continued.

Described associations in the study area	*Arbutetum unedonis*	*Oleetum europaeae*	*Juniperetum excelsae*	*Viticetum agni-casti*	*Pinetum brutiae*	*Quercetum cerridis*	*Pinetum caramanicae*	*Fagetum orientalis*	*Pinetum hamatae*	*Astragaletum microcephali*	*Astragaletum angustifolii*
Other investigations done	**Similarity percentages (%)**										
Kutbay & Kılınç (1995) Nebyan Mountain	–	–	–	–	20.9	13.3	17.2	26.9-27.3	12.9	–	–
Özen & Kılınç (1995a, 1995b) Alaçam-Gerze and Boyabat	17.3	–	–	26.9	26.2	16.0	24.8	30.2	22.2	13.6	11.7
Vural et al. (1995) Köyceğiz-Dalyan (Muğla)	–	10.2	–	–	14.1	–	–	–	–	–	–
Kılınç & Karaer (1995) Sinop Peninsula	–	–	–	–	–	11.2	–	18.8	–	–	–
Ocakverdi & Oflas (1999) The Upper Göksu	–	–	8.7	–	–	–	5.8	–	–	12.5	–
Karaer et al. (1999) Kelkit Valley	–	–	21.5	–	29.0	28.4	10.2	19.8	18.3	–	–
Yarcı (2000) Demirköy (Istranca Mount.)	–	–	–	–	–	–	–	13.9	–	–	–
Cansaran & Aydoğdu (2001) Eğerli Mountain	–	–	–	–	–	–	24.2	–	19.0	13.4	–
Varol & Tatlı (2001) Çimen Mountain	–	–	–	–	17.4	13.8	–	11.6	–	–	–
Özen & Kılınç (2002) Kunduz Mountain	–	–	–	–	–	11.7	15.6	35.5	18.8	–	–
Yarcı (2002) Istranca Mountains (Thrace Region)	–	–	–	–	–	16.5	–	21.2	–	–	–
Yurdakulol et al. (2002) Kastamonu	–	–	–	–	9.5	–	–	36.6	–	–	–
Varol (2003) Başkonuş Mountain	14.9	–	–	–	–	–	–	–	–	–	5.5
Tatlı et al. (2005) Gümüş Mountain	–	–	–	–	–	12.6	8.7	13.9	13.8	–	–
Hamzaoğlu (2005) Dinek Mountain	–	–	–	–	–	–	–	–	–	22.9	–
Türe et al. (2005) Bithynia	–	–	17.7	–	–	23.7	18.8	30.6	11.0	–	–
Hamzaoğlu (2006) East Anatolia	–	–	–	–	–	–	–	–	–	16.4	–
Vural et al. (2007) Büyükhemit stream	–	–	–	–	–	18.7	–	–	–	22.5	–
Korkmaz et al. (2008) North Anatolia	7.5	–	–	–	–	–	–	–	–	–	–
Geven et al. (2009) Central Anatolia	–	–	–	–	–	–	–	–	–	19.6	–
Kaya et al. (2009) Karacadağ	–	–	–	6.4	–	–	–	–	–	–	–

Turkey were included in *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa (Akman et al., 1978; Vural et al., 1995; Karaer et al., 2010). Hoda & Mersinllari (1996) has stated that *Olea europea* var. *sylvestris* association on Sazani island (Albania) were included in *Pistacio lentisci-Rhamnetalia alaterni*, whereas Bacchetta et al. (2003) reported that these associations on Sardinia island (Italy) were included in *Quercetalia ilicis* and *Pistacio lentisci-Rhamnetalia alaterni* and *Quercetea ilicis* upper syntaxa.

The distribution of the *Olea europea* var. *sylvestris* association formerly described by Karaer et al. (2010) is rather restricted on decarbonated calcareous substrata and it is highly probable that this association is a relic community. There were many differences between this association and previously described associations and this association highly isolated topographically, geographically, and climatically from the others. Due to this fact, environmental conditions around these associations are also rather different. As a result of this, floristic similarity between some previously described *Olea europea* var. *sylvestris* associations and *Spiraeo crenatae-Oleetum sylvestris* association in the Mediterranean Intrapontic belt of the Kızılırmak valley varies between 9.8% and 10.2% (Table 13). Diagnostic species of *Quercetalia ilicis* and *Quercetea ilicis* have high cover-abundance and presence values and *Spiraeo crenatae-Oleetum sylvestris* should be included in *Quercetalia ilicis* and *Quercetea ilicis*.

Vitex agnus-castus occurs along river banks around the Mediterranean basin, forming riparian communities. Natural communities of *Vitex agnus-castus* are separately distributed in Northern Anatolia and West Caucasica along river banks and coasts outside the Mediterranean basin, which can be considered as its natural distribution area (Davis, 1965-1985). Although many *Vitex agnus-castus* associations were included in *Nerio oleandri-Tamaricetea africanae* Br.-Bl. et Bolós 1958 and *Tamaricetalia africanae* Br.-Bl. et Bolós 1958 upper syntaxa (Boteva et al., 2004; Paradis, 2006), Özen and Kılınç (1995a) stated that the *Euphorbio-Vitetum agni-casti* association in the Mediterranean Intarpontic belt in Northern Anatolia should be included in *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa. It is inevitable that there were floristic, ecological, and syntaxonomic differences between *Vitex agnus-castus* communities in Crete (Greece) (Boteva et al., 2004) and Corsica (France) (Paradis, 2006) and the Kızılırmak valley due to difference in geographic regions. No species belong to *Nerio oleandri-Tamaricetea africanae* in the floristic composition of *Rubo sancti-Viticetum agni-casti* association. Floristic similarity between *Rubo sancti-Viticetum agni-casti* in the Mediterranean Intarpontic belt of the Kızılırmak valley and other *Vitex agnus-castus* associations (Özen & Kılınç, 1995a; Kaya et al., 2009) was 6.4%-26.9% (Table 13). Owing to these facts, *Rubo sancti-Viticetum agni-casti* ass. nova (Table 4) in the Kızılırmak valley should be treated as a new association. Diagnostic species of *Quercetalia ilicis* and *Quercetea ilicis* have high cover-abundance and presence values, and *Rubo sancti-Viticetum agni-casti* should be included in *Quercetalia ilicis* and *Quercetea ilicis*.

There were some floristic and phytosociological differences between associations belonging to sclerophyllous vegetation of the Mediterranean region of Turkey and sclerophyllous scrub and forest associations in the Kızılırmak valley. As a matter of fact, *Quercion ilicis* Br.-Bl. ex Molinier 1934 and *Quercion callibrini* Zohary 1962 were well represented in the associations belonging to maquis vegetation around the Mediterranean basin, *Quercion ilicis* is represented by only *Jasminum fruticans*, and *Quercion callibrini* is represented by only *Pistacia terebinthus* subsp. *palaestina* in the associations around the Kızılırmak valley. Although it is rather difficult to assemble the associations into an alliance in the Kızılırmak valley, the species belonging to the *Quercetalia ilicis* order and *Quercetea ilicis* class were quite well represented. This is mainly due to the duration and severity of aridity (8-10 months vs. only 3 months), and mean annual temperature was lower in the Kızılırmak valley compared to the Mediterranean region (18-20 °C vs. 12-14 °C) and additionally precipitation regime was also different (Wi. Au. Sp. Su. vs. Sp. Wi. Au. Su.).

The representation of *Cisto-Micromerietea julianae* and *Astragalo microcephali-Brometea tomentelli* classes in the floristic composition of maquis associations in the Kızılırmak valley indicated the adaptation of Irano-Turanian xerophytic species to

these stands owing to severe anthropogenic degradation (Pignatti, 1978; Kumar & Ram, 2005). The representation of diagnostic species of *Quercetea pubescentis* class is due to regional ecological and phytogeographical traits.

Juniperus excelsa is very widespread all around the world (Davis, 1965-1985). However, it is found as substitute communities in Turkey in forest-steppe transition zone and usually formed as a result of the destruction of climax forests. Many ecological, floristic, and syntaxonomic differences naturally occurred in *Juniperus excelsa* subsp. *excelsa* communities in different parts of Turkey. The natural ecosystem feature of the *Scutellario pinnatifidae-Juniperetum excelsae* association was highly degraded, and many steppic species penetrated the floristic structure in the Kızılırmak valley.

It has been reported that previously described *Juniperus excelsa* subsp. *excelsa* associations in the Eu-Mediterranean zone were included in *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa (Akman et al., 1979b; Ayaşlıgil, 1987). The associations of the Upper-Mediterranean Belt and Mountainous Mediterranean Belt in the Mediterranean, Aegean, Central Anatolia, and North-west Anatolia regions were included in *Querco pseudocerridis-Cedretalia libani* Barbéro, Loisel and Quézel 1974 (Akman et al., 1979b; Ayaşlıgil, 1987; Bekat, 1987; Ocakverdi & Çetik, 1987; Gemici, 1988; Serin & Eyce, 1994; Ocakverdi & Oflas, 1999), *Querco cerridis-Carpinetalia orientalis* (Türe et al., 2005), and *Quercetea pubescentis* upper syntaxa. However, the associations in the Mediterranean Presteppic Intra-pontic Belt of Northern Anatolia were included in *Quercetea ilicis* (Quézel et al., 1980) and *Astragalo microcephali-Brometea tomentelli* upper syntaxa (Karaer et al., 1999).

Owing to local ecological differences *Scutellario pinnatifidae-Juniperetum excelsae* association is rather different from the other *Juniperus excelsa* communities. Thus floristic similarity between *Scutellario pinnatifidae-Juniperetum excelsae* association, which is in the Mediterranean Presteppic Intra-pontic Belt of the Kızılırmak valley, and the other *Juniperus excelsa* subsp. *excelsa* associations varies between 5.5% and 21.5% (Table 13). As a result of high degradation, canopy openness increased and so aridity also increased and severe erosion occurred. Thus, numerous steppic, xerophilous species penetrated the floristic structure of this association (Pignatti, 1978; Kumar & Ram, 2005). While the number of the steppic species belonging to *Astragalo microcephali-Brometea tomentelli* increased, forest species belonging to *Quercetea ilicis* and *Quercetea pubescentis* classes decreased. For this reason, *Juniperus excelsa* communities gained some steppic features. Thus we thought that *Scutellario pinnatifidae-Juniperetum excelsae* ass. nova (Table 5) in the Kızılırmak valley should be treated as a new association.

The classification of forest-steppe transitional associations is quite difficult due to the high number of steppic species (Akman et al., 1978). As a result of this, the mentioned association should be included in *Astragalo karamasici-Gypsophilion eriocalycis, Onobrychido armenae-Thymetalia leucostomi* and *Astragalo microcephali-Brometea tomentelli* because diagnostic species belonging to these syntaxa units have high cover-abundance and presence values.

The distribution of the forest associations in the study area belonging to the Euxine province of the Euro-Siberian phytogeographical region is highly affected by elevation and exposure (Kurt et al., 1983; Bergmeier, 2002; Doležal & Šrůtek, 2002). In conclusion, while the sclerophyllous *Cotino coggyriae-Pinetum brutiae* association occurred at 300-600 m, which is under the influence of the semi-arid Mediterranean climate, mesophilous associations occupy *Corno mari-Quercetum cerridis*: 700-1250 m; *Trifolio canescentis-Pinetum caramanicae*: 1100-1250 m; *Galio odorati-Fagetum orientalis*: 1200-1500 m; *Rumi scutati-Pinetum hamatae*: 1500-1650 m heights under the influence of cool and rainy climate.

As stated by Quézel et al. (1980), due to the climatic, edaphic, and floristic properties of Black Sea forest vegetation, *Cotino coggyriae-Pinetum brutiae* occupies the Mediterranean intrapontic zone. *Corno mari-Quercetum cerridis* and *Trifolio canescentis-Pinetum caramanicae* occur in the Supra-Mediterranean prepontic zone. Moreover, *Galio odorati -Fagetum orientalis* occupies the Montagnard Euxinien zone, while *Rumi scutati-Pinetum hamatae* occurs in the Montagnard prepontic zone.

Several different *P. brutia* associations occur in stands under different climatic, topographic, and edaphic conditions and they are included in different upper syntaxa units. Likewise it has been reported that *P. brutia* associations that occur in the Thermo-Mediterranean and Eu-Mediterranean zones of Mediterranean and Aegean regions (Akman et al., 1978; Uslu, 1985; Akman & Ekim, 1988; Varol & Tatlı, 2001; Varol et al., 2006; Sağlam, 2007) and Mediterranean intra-pontique (Quézel et al., 1980; Kılınç, 1985; Kılınç, 1987; Özen & Kılınç, 1995b; Kutbay & Kılınç, 1995; Karaer et al., 1999) and Mediterranean littoral zones (Quézel et al., 1980; Yurdakulol et al., 2002) of Northern Anatolia have been included in *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa.

In addition, it has been stated that *P. brutia* associations in the Supra-Mediterranean zone of the Mediterranean region have been included in *Querco pseudocerridis-Cedretalia libani* (Akman et al., 1978; Akman et al., 1979b; Bekat & Görk, 1987; Serin & Eyce, 1994; Varol et al., 2006), whereas *P. brutia* associations that occur in the Supra-Mediterranean zone of North-west Anatolia have been included in *Querco cerridis-Carpinetalia orientalis* and *Quercetea pubescentis* upper syntaxa (Akman et al., 1978). Ekim and Akman (1990) reported that *P. brutia* association in their study area belongs directly to the *Quercetea pubescentis* class.

This association occurs along the Mediterranean intra-pontic zone and semi-arid stands of the Kızılırmak valley. Floristic similarity among *Cotino coggyriae-Pinetum brutiae* association and previously described *P. brutia* associations ranges between 8.4% and 29.0% (Table 13). Therefore, the *P. brutia* community in the Kızılırmak valley should be distinguished as a new association, namely *Cotino coggyriae-Pinetum brutiae* ass. nova (Table 6).

This association should be included in *Quercetalia ilicis* and *Quercetea ilicis* upper syntaxa due to environmental conditions of the stands occupied by this association, because of floristic properties like high cover and presence values of diagnostic species of these upper syntaxa units. The environmental conditions are characterised by a clear summer drought in these stands.

Additionally, this association also included the diagnostic species belonging to *Cisto-Micromerietea julianae* and *Astragalo microcephali-Brometea tomentelli* classes. This is probably due to rapid adaptation of xerophytic Irano-Turanian species to the stands under severe anthropogenic disturbance (Pignatti, 1978; Kumar & Ram, 2005). The occurrence of diagnostic species of the *Quercetea pubescentis* class may be explained on the basis of local ecological and phytogeographical properties.

Mesophilous associations occupy the cool and rainy bioclimatic zone of the Kızılırmak valley. One of them, *Quercus cerris* var. *cerris*, which is a Mediterranean origin species, occurs in Supra-Mediterranean and Sub-Mediterranean zones of Turkey. Likewise, *Quercus cerris* var. *cerris* associations which occur at more arid Mediterranean and Central Anatolian regions are compatible with the floristic, ecological, and phytogeographical properties of the *Querco pseudocerridis-Cedretalia libani* order (Akman et al., 1979b; Tatlı et al., 1994; Varol & Tatlı, 2001; Tatlı et al., 2005; Sağlam, 2007), while *Quercus cerris* var. *cerris* associations, which occur in more moist places in Northern Anatolia, are compatible with the floristic, ecological, and phytogeographical properties of the *Querco cerridis-Carpinetalia orientalis* order (Akman et al., 1979b; Quézel et al., 1980; Ekim & Akman, 1990; Kılınç & Karaer, 1995; Kutbay & Kılınç, 1995; Özen & Kılınç, 1995b; Karaer et al., 1999; Özen & Kılınç, 2002; Hamzaoğlu & Duran, 2004; Türe et al., 2005; Vural et al., 2007).

Floristic similarity between the *Corno mari-Quercetum cerridis* association at comparatively hot and moist stands of the Supra-Mediterranean Prepontic zone of the Kızılırmak valley and the other *Q. cerris* var. *cerris* associations is found to range from 5.9% to 28.4% (Table 13). The study area is a refuge area for most species and so different species are found under canopy species as compared to the other *Quercus* associations (Pignatti 1978). Thus we thought that *Corno mari-Quercetum cerridis* ass. nova (Table 7) in the Kızılırmak valley should be treated as a new association.

This association should be included in *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa

due to high cover and presence values of diagnostic species of these upper syntaxa units.

Pinus nigra subsp. *nigra* var. *caramanica* associations in the Mediterranean, West Anatolian, and southern parts of the Central Anatolian regions of Turkey belong to the *Querco pseudocerridis-Cedretalia libani* order (Akman et al., 1979a, 1979b; Yurdakulol, 1981; Uslu, 1985; Bekat & Görk, 1987; Bekat, 1987; Ocakverdi & Çetik, 1987; Ayaşlıgil, 1987; Ekim & Akman, 1990; Serin & Eyce, 1994; Tatlı et al., 1994; Duman, 1995; Ocakverdi & Oflas, 1999; Tatlı et al., 2005; Sağlam, 2007), whereas *Pinus nigra* subsp. *nigra* var. *caramanica* associations that occur in comparatively moist stands of the Northern Anatolian, Central Anatolian, and West Anatolian regions belong to the *Querco cerridis-Carpinetalia orientalis* order (Akman & Ketenoğlu, 1978; Akman et al., 1979a; Quézel et al., 1980; Akman et al., 1983; Akman & Yurdakulol, 1984; Kılınç, 1985; Vural et al., 1985; Gemici, 1988; Adıgüzel & Vural, 1995; Kutbay & Kılınç, 1995; Özen & Kılınç, 1995b; Karaer et al., 1999; Cansaran & Aydoğdu, 2001; Özen & Kılınç, 2002; Türe et al., 2005).

Floristic similarity among *Trifolio canescentis-Pinetum caramanicae* association at cool and rainy stands of the Supra-Mediterranean Prepontic zone of the Kızılırmak valley and the other *P. nigra* subsp. *nigra* var. *caramanica* associations is found to range from 5.8% to 26.4% (Table 13). The low similarity between the *Trifolio canescentis-Pinetum caramanicae* association and the other *P. nigra* subsp. *nigra* var. *caramanica* associations may be explained on the basis of the differences among environmental traits due to microclimatic differences. Owing to these, *Trifolio canescentis-Pinetum caramanicae* ass. nova (Table 8) in the Kızılırmak valley can be defined as a new association. The floristic composition of this association includes the diagnostic species of *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa and this association should be included in these upper syntaxa units due to high cover and presence values of diagnostic species.

Fagus orientalis associations mainly occupy the cool and moist stands of northern and north-western Turkey. However, they also occur in the Amanos Mountains of the Mediterranean region of Turkey locally. It has been reported that *Fagus orientalis* associations in the Montagnard Mediterranean zone of the Amanos Mountains belong to *Fagetalia sylvaticae* Pawlowsky 1928 and *Querco-Fagetea* upper syntaxa (Akman et al., 1979a, 1979b), while *Fagus orientalis* associations in the Supra-Mediterranean zone belong to *Querco pseudocerridis-Cedretalia libani* and *Quercetea pubescentis* upper syntaxa (Varol & Tatlı, 2001; Tatlı et al., 2005) phytosociologically.

However, it has been reported that *F. orientalis* associations in the Collinen Euxinien zone of Northern Anatolia belong to *Rhododendro pontici-Fagetalia orientalis* Quézel, Barbéro and Akman 1980 (Quézel et al., 1980; Kutbay & Kılınç, 1995; Özen & Kılınç, 1995b; Kılınç & Karaer, 1995; Yarcı, 2000; Yurdakulol et al., 2002; Özen & Kılınç, 2002; Türe et al., 2005) and *Quercetalia pubescentis* Doing Kraft, 1955 (Yarcı, 2002), whereas some of the *F. orientalis* associations occurring in the higher Montagnard Euxinien zone belong to *Fagetalia sylvaticae* and *Pino sylvestri-Piceetalia orientalis* Quézel, Barbéro & Akman 1980, while some of them belong to the *Querco cerridis-Carpinetalia orientalis* order (Quézel et al., 1980; Karaer et al., 1999).

Floristic similarity between the *Galio odorati-Fagetum orientalis* association that occurred in moist and rainy stands of the Montagnard Euxinien zone and other *F. orientalis* associations similarity ranges from 11.6% to 35.5% (Table 13). This association should be included in *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa due to the fact that diagnostic species of these syntaxa units play an important role in the phytosociological structure of this association. Moreover, ecological and phytosociological effects of *Fagetalia sylvaticae* and *Rhododendro pontici-Fagetalia orientalis* orders on the association can also be observed.

It has been reported that *Pinus sylvestris* var. *hamata* associations that occurred in comparatively mesophilous stands of the Black Sea region and Northern Anatolia should be included in *Rhododendro pontici-Fagetalia orientalis* (Quézel et al., 1980; Özen & Kılınç, 1995b; Özen & Kılınç, 2002), *Fagetalia sylvaticae* (Akman et al., 1979a), *Pino sylvestri-Piceetalia orientalis* (Quézel et al., 1980; Eminağaoğlu et al., 2007), and *Querco-Fagetea* upper syntaxa, whereas the associations that occur in less

mesophilous stands are included in *Querco cerridis-Carpinetalia orientalis* (Akman et al., 1983; Kılınç, 1985; Tatlı, 1985; Tatlı, 1987; Adıgüzel & Vural 1995; Kutbay & Kılınç, 1995; Karaer et al., 1999; Cansaran & Aydoğdu, 2001; Tatlı et al., 2005; Türe et al., 2005; Eminağaoğlu et al., 2007) and *Querco pseudocerridis-Cedretalia libani* (Ekim & Akman, 1990) and *Quercetea pubescentis* upper syntaxa.

Floristic similarity between the *Rumi scutati-Pinetum hamatae* association that occurs in the cool and rainy of Montagnard prepontic belt of the Kızılırmak valley and previously described *P. sylvestris* associations ranges from 4.1% to 22.2% (Table 13). *Pinus sylvestris* associations in Turkey are distributed widely in regions that have rather different environmental traits and so the percentage similarity is found to be low. Therefore, we thought that *Rumi scutati-Pinetum hamatae* ass. nova (Table 10) in the Kızılırmak valley should be treated as a new association.

This association should be included in *Carpino betuli-Acerion hyrcani, Querco cerridis-Carpinetalia orientalis*, and *Quercetea pubescentis* upper syntaxa due to the high cover and presence values of diagnostic species of these upper syntaxa units. The existence of diagnostic species belonging to other classes originates from local ecological and phytogeographical properties.

Astragalus microcephalus is one of the most widespread and dominant species in the floristic composition of steppic vegetation in Turkey, and *Astragalus microcephalus* associations were included in the *Onobrychido armenae-Thymetalia leucostomi* (Akman et al., 1984; Behçet & Tatlı, 1989; Cansaran & Aydoğdu, 2001 Hamzaoğlu, 2005; Kurt et al., 2006; Vural et al., 2007; Geven et al., 2009) and *Festuco oreophilae-Veronicetalia orientalis* Hamzaoğlu 2006 (Hamzaoğlu 2006) order and *Astragalo microcephali-Brometea tomentelli* class.

Due to local ecological traits and occupied forest-steppe transition zone, *Astragalus microcephalus* associations in the Black Sea region of Turkey have remarkable ecological and floristic differences from the other *Astragalus microcephalus* associations. Thus floristic similarity between *Linario corifoliae-Astragaletum microcephali* in the Mediterranean Prestepic Intra-pontic Belt in the Kızılırmak valley and the other *Astragalus microcephalus* associations varied between 6.7% and 22.9% (Table 13). We thought that *Linario corifoliae-Astragaletum microcephali* ass. nova (Table 11) in the Kızılırmak valley should be treated as new associations.

Diagnostic species of *Astragalo karamasici-Gypsophilion eriocalycis*, *Onobrychido armenae-Thymetalia leucostomi*, and *Astragalo microcephali-Brometea tomentelli* syntaxa were well represented due to the floristic composition of the *A. microcephalus* association, and so it should be included in these syntaxa units.

It has been reported that *Astragalus angustifolius* subsp. *angustifolius* var. *angustifolius* associations distributed along the high mountain steppic vegetation of Turkey should be included in *Onobrychido armenae-Thymetalia leucostomi* and *Astragalo microcephali-Brometea tomentelli* (Bekat, 1987; Akman et al., 1991; Ocakverdi & Ünal, 1991; Gümüş, 1992; Özen & Kılınç, 1995a; Varol, 2003) and *Daphno-Festucetalia* Quézel 1964 and *Daphno-Festucetea* Quézel 1977 (Gemici, 1988) upper syntaxa units.

Daphno oleoidis-Astragaletum angustifolii has rather different characters from the other *Astragalus angustifolius* subsp. *angustifolius* var. *angustifolius* associations floristically and phytogeographically due to its local ecological traits. Floristic composition of the association mainly is composed of Euro-Siberian species (Figure 2) and followed by sylvatic species originating from *P. sylvestris* forests and belonging to the *Quercetea pubescentis* class. We consider that this may indicate that this association formed as a result of the complete degradation of *Pinus sylvestris* var. *hamata* forests. The floristic similarity between *Daphno oleoidis-Astragaletum angustifolii* association in the Montainous Prepontic Belt (Quézel et al., 1980) in the Kızılırmak valley and the other *Astragalus angustifolius* subsp. *angustifolius* var. *angustifolius* associations varied between 4.1% and 15.2% (Table 13). *Daphno oleoidis-Astragaletum angustifolii* ass. nova (Table 12) can be defined as a new association.

Although the floristic composition of association is not represented on the level of alliance, diagnostic species of *Onobrychido armenae-Thymetalia*

leucostomi and *Astragalo microcephali-Brometea tomentelli* syntaxa were well represented in the floristic composition of *Daphno oleoidis-Astragaletum angustifolii* and this association should be included in these syntaxa units.

The syntaxonomical scheme we propose is:

Quercetea ilicis Br.-Bl. ex A. de Bolòs Y Vayreda 1950

Quercetalia ilicis Br.-Bl. 1947

1- *Cotino coggyriae-Pinetum brutiae* ass. nova

Nomenclatural type: Quadrat 19 (holotypus)

2- *Buxo sempervirentis-Arbutetum unedonis* Karaer, Kılınç, Korkmaz, Kutbay, Yalçın & Bilgin 2010

3- *Spiraeo crenatae-Oleetum sylvestris* Karaer, Kılınç, Korkmaz, Kutbay, Yalçın & Bilgin 2010

4- *Rubo sancti-Viticetum agni-casti* ass. nova

Nomenclatural type: Quadrat 281 (holotypus)

Quercetea pubescentis Doing-Kraft ex Scamoni et Passarage 1959

Querco cerridis-Carpinetalia orientalis Akman, Quézel & Barbéro 1980

Carpino betuli-Acerion hyrcani Quézel, Barbéro & Akman 1978

5- *Corno mari-Quercetum cerridis* ass. nov.

Nomenclatural type: Quadrat 138 (holotypus)

loniceretosum etrusco subass. nova

lathyretosum rosei subass. nova

6- *Trifolio canescentis-Pinetum caramanicae* ass. nova

Nomenclatural type: Quadrat 115 (holotypus)

7- *Galio odorati-Fagetum orientalis* Özen and Kılınç 2002

abietetosum bornmuellerianae subass. nova

vicietosum croceo subass. nova

8- *Rumi scutati-Pinetum hamatae* ass. nova

Nomenclatural type: Quadrat 176 (holotypus)

Astragalo microcephali-Brometea tomentelli Quézel 1973 em. Parolly

Onobrychido armenae-Thymetalia leucostomi Akman, Ketenoğlu, Quézel & Demirörs 1984

9- *Daphno oleoidis-Astragaletum angustifolii* ass. nova

Nomenclatural type: Quadrat 179 (holotypus)

Astragalo karamasici-Gypsophilion eriocalycis Ketenoğlu, Quézel, Akman & Aydoğdu 1983

10- *Scutellario pinnatifidae-Juniperetum excelsae* ass. nova

Nomenclatural type: Quadrat 189 (holotypus)

11- *Linario corifoliae-Astragaletum microcephali* ass. nova

Nomenclatural type: Quadrat 218 (holotypus)

stipetosum arabico subass. nova

alyssetosum desertorum subass. nova

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