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A Phytosociological Research on the Vegetation of Ahırdağı (Afyonkarahisar)

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Abstract: This phytosociological study was carried out to determine the vegetation of Ahırdağı. The study distinguished four plant communities distributed among three different types of vegetation. The vegetation tables are included. Relevant types and associated syntaxa are as follows: Forest and shrub vegetation [*Quercetea pubescentis* (Oberd, 1948) Doing Kraft, 1955; *Querceto-Cedretalia libani* Barbero, Loisel et Quézel, 1974; *Carpino-Acerion* Quézel, Barbero and Akman, 1978; 1- *Ferulagini macrosciadiae-Pinetum caramanicae* ass. Kargioğlu; 2- *Quercetum vulcanicae-cerridis* ass. Kargioğlu; 3- *Stachyo tmoleae-Cistetum laurifolii* ass. Kargioğlu) and Thorn-cushion vegetation (*Astragalo-Brometea* Quézel, 1973; *Onobrychido-Thymetalia leucostomi* Akman, Ketenoglu, Quézel et Demirörs, 1985; *Phlomido armeniaca-Astragalion microcephali* Akman *et al.*, 1984; 4-*Euphorbio seguierianae-Astragaletum microcephali* ass. Kargioğlu].

Key words: Afyonkarahisar, Ahırdağı, phytosociology, vegetation, Western Anatolia, Turkey

INTRODUCTION

Ahırdağı is located in the southwest of Afyonkarahisar province bordered by Sinanpaşa and Hocalar districts. The study area is surrounded by the Akdağ and Kumalar mountains in the south, Murat mountain in the north with Afyon Kocatepe National Park

in the east. The area is also an intersection zone of the Mediterranean, the Irano-Turanian and the Euro-Siberian phytogeographic regions. According to the grid square system, the south part of Hocalar is located in square B2 and the other part in B3. The lowest elevation point is 800 m in the vicinity of Hocalar, while the highest altitude point is Büyükkavuşak hill (Fig. 1) peaking at 2000 m.

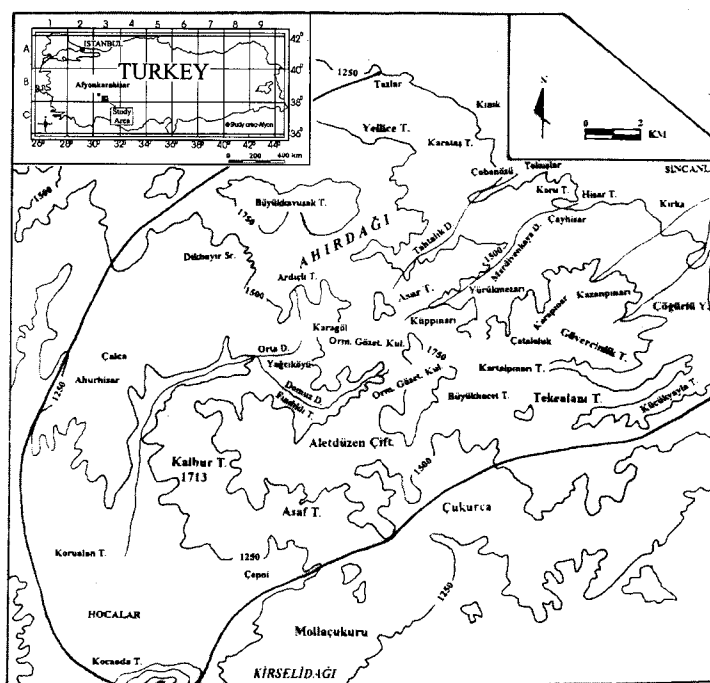


Fig. 1: Location map of study area

The region chosen as study area shows intersectional features. Widely extended forests consist of *Pinus nigra* J.F. Arnold subsp. *nigra* var. *caramanica* (Loudon) Rehder trees which are sturdy and 20-25 m tall and grow in the vicinity of Çataloluk and Karapınar and south of Yağcı, Yürükmezari, Çobanözü villages. The Tazlar village area hosts a community of monumental trees, *P. nigra* subsp. *nigra* var. *caramanica* which makes it a popular picnic area. In the places where *P. nigra* subsp. *nigra* var. *caramanica* have been damaged by biotic factors, community formations of *Quercus cerris* L. var. *cerris* and *Cistus laurifolius* L. are evident. In addition a section of Çataloluk district hosts *Cedrus libani* A. Rich. and *Pinus sylvestris* L. var. *hamata* Steven plantation area, where the plants reach up to 10-12 m in height. The local microclimate is not limited only to the northern slopes of Fındıklı and Güvercinlik hills but is also evident in the environs of Tahtalık and Merdivenkaya streams. These areas contain a considerable amount of Euro-Siberian elements. The plants include *Corylus avellana* L. var. *avellana*, *Pyracantha coccinea* Roem., *Populus tremula* L., *Cornus sanguinea* L. subsp. *australis* (C. A. Mey.) Jav., *Tilia rubra* DC. subsp. *caucasica* (Rupr.) V. Engl., *Acer platanoides* L., *Euonymus latifolius* (L.) Mill. subsp. *latifolius*, *Viburnum opulus* L., *V. lantana* L., *Sambucus nigra* L., *S. ebulus* L., *Salix alba* L. There are loose communities of *Pinus brutia* L. at the southern part of the research region located at el 800-1000 m of Kocaada hill. There are some *Artemisia campestris* L. communities in the northern part of the research region: in the environs of Tokuşlar, Çobanözü and Çayhisar villages, the regions where Tahtalık and Merdivenkaya streams reach the plain and in the gravelly and sandy areas. These regions also form the starting point of Akarçay Basin which is 80 km in length and descends to Eber Lake.

MATERIALS AND METHODS

The vegetation in the study area was investigated in accordance with the Braun-Blanquet (1964) Method. Sample plots were taken from each plant formation in sufficient number and suitable size to enable determination of plant association. Thus, the floristic composition of the associations, dominance and consistence of the species were determined. Soil samples were taken from various sample plots to represent the different plant formations. These soil samples were analyzed by the Soil and Fertilizer Research Institute. The methods of Bouyoucos (1962), Black *et al.* (1965) and Smith and Weldon (1941) were used to analyze the soil samples. The results of the soil analyses shown in Table 1 give comparative details about the soils where the plant associations have developed. The facts pertinent to the geology of the research area have been established with the aid of a 1/500,000 scale map. The

distributions of the associations in the investigation area and their brief ecologies are given in the vegetation section. The floristic composition and structure of plant associations exhibiting a certain appearance was established and they were identified and classified by the aid of differential, dominant and constant species Weber *et al.* (2000). The flora of Turkey was used in specimen identification (Davis, 1965-1985, 1988; Güner *et al.*, 2000). In order to compare associations, we used Sorensen's index of similarity. Author abbreviations follow Brummitt and Powell (1992). The climatic data for the area was obtained from Anonymous (2000). The climatic data are given in Table 2a and b. The study area has a Mediterranean climate and its precipitation regime is East Mediterranean Type 2 SWAS (spring, winter, autumn, summer) (Akman, 1982).

Vegetation: The vegetation of Ahırdağı belongs to both the Supra-Mediterranean belt and Mediterranean mountain belt. Three vegetation formations were observed in the study area: a) forest vegetation mainly consisting of *P. nigra* subsp. *nigra* var. *caramanica* and *Q. cerris* var. *cerris*; b) Shrub vegetation and thorn-cushion vegetation.

Forest vegetation: Forests of *P. nigra* subsp. *nigra* var. *caramanica* and *Q. cerris* var. *cerris* prevail in the area. These forests grow on Hisar hill, Güvercinlik hill, Kartalpınarı hill, Asar hill and Ardıçlı hill. *P. nigra* subsp. *nigra* var. *caramanica* is usually intermingled with *C. laurifolius*, *Juniperus oxycedrus* L. subsp. *oxycedrus*, *Q. cerris* var. *cerris* and *P. tremula* in the area.

Ferulagini macrosciadiae-Pinetum caramanicae ass.

Kargıoğlu: This community, which is widely distributed in Turkey, is widespread in the subject area between the altitudes 1340-1600 m, on 10-40% inclined slopes. *P. nigra* subsp. *nigra* var. *caramanica*, the basic constituent of the association, forms an expansive cover on the Mediterranean mountain layer. The other characteristic species of the association are *Astragalus baibutensis* Bunge and *Ferulago macrosciadia* Boiss. et Bal. This association sampled in ten plots, grows on calcareous bedrock and brown forest soils. Results of the physical and chemical analysis of the soils of the related associations are given in Table 1. This soil has a loamy and sandy-loamy structure, pH 7.9-8.1 and contains organic matter between 2.1-4.6%.

Ferulagini macrosciadiae-Pinetum caramanicae association is composed of three vegetation layers; trees, shrubs and herbaceous layers. In addition to featuring the dominant species of the tree layer, *P. nigra* subsp. *nigra* var. *caramanica* also remains the characteristic plant distinguishing the association. The general cover of the tree layer ranges from 80 to 100% and heights range from

Table 1: Data of the physical and chemical analysis of the soils from the associations' plots

Species	Quad. No.	Soil Dept. cm	Satur. (%)	pH	Total Salt (%)	CaCO ₃ (%)	Org. Matt. (%)	P ₂ O ₅	K ₂ O kg	Sand (%)	Silt (%)	Clay (%)	Text.
<i>Ferulagini macrosciadiae-Pinetum caramanicae</i>	31	0-30	66	7.9	0.02	22.6	2.1	1.2	25.7	50.5	35.8	13.7	L
		30-50	72	7.9	0.03	16.4	4.0	1.4	37.9	48.2	36.0	15.8	L
	34	0-30	70	8.1	0.02	2.5	4.6	2.3	44.7	54.4	29.9	15.8	SL
<i>Quercetum vulcanicae-cerridis</i>	14	0-30	63	8.1	0.02	9.6	3.3	2.0	33.9	54.5	25.7	19.8	SL
		30-50	61	6.0	0.02	0.9	1.9	1.8	50.1	39.9	36.1	24.0	L
	20	0-30	59	5.8	0.02	0.7	3.8	1.2	61.0	56.7	25.6	17.7	SL
<i>Stachyo tmoleae-Cistetum laurifolii</i>	6	0-30	55	5.6	0.01	1.0	0.7	2.0	52.8	58.8	19.5	21.7	SCL
		30-50	50	6.3	0.01	1.4	2.4	0.5	65.0	66.8	22.9	10.3	SL
	12	0-30	50	6.0	0.01	1.4	0.5	1.8	52.8	68.9	16.8	14.3	SL
<i>Euphorbio seguierianae-Astragaletum microcephali</i>	40	0-30	63	8.3	0.02	12.0	3.0	1.8	50.1	52.2	33.3	14.5	SL
		30-50	59	8.1	0.03	5.5	1.3	1.2	61.0	45.5	33.6	20.8	L
	45	0-15	57	7.7	0.02	3.9	3.2	0.2	48.8	75.3	17.7	7.0	SL
		15-30	57	7.8	0.02	9.4	2.7	1.2	37.9	69.2	19.7	11.1	SL
		0-15	61	7.8	0.02	2.0	3.0	0.2	46.0	57.0	31.9	11.1	SL
		15-30	59	7.8	0.02	2.1	1.9	0.2	48.8	54.9	27.9	17.3	SL

C: Clayey, L: Loamy, S: Sandy

Table 2a: Average and extreme climatic values of Afyonkarahisar from 1928 to 2000

Meteorological Elements	Obs. Per. (Year)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ann.
Mean temp. (°C)	72	0.2	1.6	5.0	10.4	14.9	18.8	21.9	21.8	17.5	12.1	6.9	2.3	11.1
Max. Mean temp. (°C)	72	17.4	20.2	26.4	28.6	33.0	35.5	37.3	38.0	24.6	31.3	25.3	20.3	38.0
Min. Mean temp. (°C)	72	-27.0	-25.3	-17.0	-7.5	-3.1	1.0	4.0	2.4	-3.2	-7.9	-23.1	-27.2	-27.2
Mean rainfall (mm)	72	43.0	40.4	44.8	44.7	57.8	40.1	20.8	10.0	20.1	32.7	33.8	46.9	435.1

Table 2b: Seasonal distribution of rainfall values of Afyonkarahisar from 1928 to 2000

Station	Observation periods (years)	Spring total (mm)	%	Summer total (mm)	%	Autumn total (mm)	%	Winter total (mm)	%	Annual (mm)
Afyonkarahisar	72	147.3	33.85	70.9	16.29	86.6	19.90	130.3	29.94	435.1

15 to 20 m. The shrub stratum is comprised of a species of *C. laurifolius* and *J. oxycedrus* subsp. *oxycedrus*. *C. laurifolius*, 0.5-1 m in height and covering 5 and 10% of the vegetation; they are also the dominant species of the shrub layer. The general cover of the herb layer is between 30-60%, 20-35 cm in height (Table 3).

Characteristic species of the alliances *Pino-Cistion laurifolii* and *Carpino-Acerion* of the order *Querceto-Cedretalia libani* and class *Quercetea pubescentis* were observed in this association.

Sample plots for the table were made on Ardıçlı, Asar, Güvercinlik and Fındıklı hills.

Quadrant no: locality and date:

30-33: Ardıçlı hill and Fındıklı hill, 16.07.1998.

34-37: Asar hill, 16.07.1998.

38-39: Güvercinlik hill, 16.07.1998.

Holotype: Table 3, quadrant no: 32

***Quercetum vulcanicae-cerridis* ass. Kargoğlu:** This association develops on calcareous bedrock and brown forest soils. Physical and chemical properties of the related soils are given in Table 1. This soil has a loamy, sandy-loamy and sandy-clayey-loamy structure, pH 5.6-6.0 and organic matter between 0.7-3.8%. This plant association has been described in eleven sample quadrants.

Structurally, the association is composed of three strata. In addition to being the dominant species of the tree layer, *Q. cerris* var. *cerris* and *Q. vulcanica* (Boiss. et Heldr. ex) Kotschy appear to be the community's typical and distinguishing species. The tree stratum varies between 6-10 m in height and generally covers 80-90%.

The shrub stratum is comprised of the species of *C. laurifolius* and *J. oxycedrus* subsp. *oxycedrus*. *C. laurifolius*, they are 1-1.5 m in height and cover 20 and 40% of the vegetation in addition to being the dominant species of the shrub layer. The herb layer consists of herbaceous plants, with heights ranging from 30 to 60 cm and generally cover 30 to 60% (Table 4).

In the association, the class *Quercetea pubescentis* the order *Querceto-Cedretalia libani* and the alliance *Carpino-Acerion* are represented by many species. Therefore, this association is placed into the above mentioned upper divisions.

Sample plots of the table were established on Hisar hill and Karataş hill.

Quadrant no: Locality and date:

13-14: Hisar hill, 14.07.1998.

16, 19-20, 23: Karataş hill, 14.07.1998.

Holotype: Table 4, quadrant no: 13

Table 3: *Ferulagini macroscladiæ-Pinetum caramanicæ* ass., Type: Quadrat 32

Quadrat No.	30	31	32	33	34	35	36	37	38	39	
Area (m ²)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
Altitude (m)	1500	1500	1340	1580	1540	1600	1560	1500	1560	1480	
Inclination (%)	30	40	30	30	30	20	20	40	30	10	
Exposition	SE	W	W	SE	NE	S	S	SE	S	N	
Cover of the tress (%)	90	100	80	100	90	100	100	80	80	90	
Cover of the shrubs (%)	20	20	30	10	-	10	20	20	40	10	
Cover of the herbs (%)	30	60	40	60	60	60	60	60	60	40	
Bedrock	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Presence
Characteristic species of association	The degree of covering and sociability in the sample plots of species										
<i>Pinus nigra</i> subsp. <i>nigra</i> var. <i>caramanica</i>	54	55	44	55	54	55	55	44	44	54	10
<i>Ferulago macroscladia</i>	.	+1	+1	.	.	.	.	+1	.	.	3
<i>Astragalus baibuteusis</i>	+2	.	.	.	.	.	.	.	.	.	1
Characteristic species of <i>Pino-Cistion laurifolii</i>											
<i>Cistus laurifolius</i>	12	+1	+1	.	.	+2	+1	+1	12	+1	8
Characteristic species of <i>Carpino-Acerion</i>											
<i>Trifolium caudatum</i>	.	+1	+1	.	.	.	+1	.	.	.	3
<i>Viola sieheana</i>	.	.	.	.	+1	.	.	.	.	.	1
Characteristic species of <i>Cisto-Micromerietea</i>											
<i>Salvia tomentosa</i>	+1	.	.	.	.	.	+1	+2	+1	.	4
Characteristic species of <i>Quercus-Cedretalia libani</i>											
<i>Pimpinella tragioides</i> subsp. <i>polyclada</i>	.	.	.	.	+1	+1	.	+1	+1	+1	5
<i>Galium peplidifolium</i>	.	.	+1	.	.	.	.	.	.	+1	2
<i>Cerastium fragillimum</i>	.	.	+1	.	.	.	.	.	.	.	1
<i>Dorcyinium pentaphyllum</i> subsp. <i>anatolicum</i>	+1	.	.	.	.	.	.	.	.	.	1
<i>Quercus cerris</i> var. <i>cerris</i>	.	.	+1	.	.	.	.	.	.	.	1
<i>Doronicum orientale</i>	.	.	.	.	+1	.	.	.	.	.	1
Characteristic species of <i>Quercetia pubescentis</i>											
<i>Brachypodium sylvaticum</i>	+2	22	12	22	.	22	12	22	22	22	9
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+1	+1	+1	+1	.	+1	+1	+1	+1	.	8
<i>Coronilla varia</i> subsp. <i>varia</i>	+1	+1	+1	+1	.	.	.	+1	+1	.	6
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	.	+1	11	+1	11	.	11	.	.	+1	6
<i>Lathyrus digitatus</i>	.	.	+1	+1	.	11	11	.	+1	.	5
<i>Digitalis ferruginea</i> subsp. <i>ferruginea</i>	.	.	.	+1	+1	+1	+1	.	.	+1	5
<i>Fragaria vesca</i>	.	.	.	.	+1	.	.	+1	.	+1	3
<i>Silene italica</i>	.	.	+1	.	11	.	.	.	.	11	3
<i>Lathyrus laxiflorus</i> subsp. <i>laxiflorus</i>	.	.	.	.	11	.	+1	.	.	+1	3
<i>Petrorhagia alpina</i> subsp. <i>olympica</i>	.	.	.	.	11	.	.	.	.	+1	2
<i>Vicia cracca</i> subsp. <i>stenophylla</i>	.	.	+1	.	.	.	.	.	.	.	1
<i>Trifolium medium</i> subsp. <i>medium</i>	.	.	.	.	.	.	.	.	+1	.	1
<i>Hypericum perforatum</i>	.	.	.	.	.	.	.	+1	.	.	1
<i>Crataegus monogyna</i> subsp. <i>monogyna</i>	+1	.	.	.	.	.	.	.	.	.	1
<i>Epilobium lanceolatum</i>	.	.	.	.	+1	.	.	.	.	.	1
Characteristic species of <i>Quercus-Fagea</i>											
<i>Briza media</i>	+1	+1	+1	+1	11	.	+1	.	.	+1	7
<i>Geum urbanum</i>	.	.	.	.	.	.	.	.	+1	.	1
<i>Veronica chamaedrys</i>	.	.	.	.	+1	.	.	.	.	.	1
<i>Poa nemoralis</i>	.	.	.	.	+2	.	.	.	.	.	1
<i>Cephalanthera damasonium</i>	+1	.	.	.	.	.	.	.	.	.	1
Characteristic species of the order <i>Onobrychido-Thymetalia leucostomi</i> and class <i>Astragalo-Brometea</i>											
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	+1	+1	+1	+1	.	+1	+1	+1	+1	.	8
<i>Euphorbia macroclada</i>	+1	+1	+1	+1	.	+1	+1	+1	.	.	7
<i>Polygala pruinosa</i> subsp. <i>pruinosa</i>	+1	11	+1	.	.	+1	+1	+1	+1	.	7
<i>Silene supina</i> subsp. <i>pruinosa</i>	.	.	.	.	.	.	.	+1	+1	.	2
<i>Anthemis tinctoria</i> var. <i>tinctoria</i>	.	.	+1	.	.	.	.	.	.	.	1
Companions											
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	.	+1	+1	+1	+1	+1	+1	.	.	+1	7
<i>Carex panacea</i>	+2	+2	+2	+2	.	.	.	+2	+2	.	6
<i>Rubus canescens</i> var. <i>canescens</i>	.	.	.	.	+1	+1	+1	+1	+1	+1	6
<i>Trifolium alpestre</i>	.	.	+1	+1	+1	.	+1	.	.	+1	5
<i>Lotus corniculatus</i> var. <i>corniculatus</i>	+1	+1	.	.	.	+1	+1	.	+1	.	5
<i>Sedum amplexicaule</i>	.	.	+1	.	.	.	+1	+1	+1	.	4
<i>Plantago lanceolata</i>	.	.	.	+1	.	+1	+1	.	.	+1	4
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	+1	+1	.	+1	+1	.	.	.	4
<i>Pilosella piloselloides</i>	.	+1	.	.	+1	.	+1	.	.	+1	4
<i>Thymus longicaulis</i> subsp. <i>chaubardii</i> var. <i>alternatus</i>	.	.	.	+2	12	.	+2	.	.	12	4
<i>Agrimonia eupatoria</i>	.	+1	+1	.	.	.	.	+1	.	.	3
<i>Medicago sativa</i>	+1	.	+1	+1	.	.	.	.	.	.	3

Table 3: Continued

<i>Ononis pusilla</i>	+1	+1	.	.	.	.	.	.	+1	.	3
<i>Astragalus paecilanthus</i>	+1	+1	.	.	.	.	.	.	.	.	2
<i>Hypericum avicularifolium</i> subsp. <i>depilatum</i> var. <i>depilatum</i>	+1	.	.	.	.	.	.	+1	.	.	2
<i>Moenchia mantica</i> subsp. <i>mantica</i>	.	.	.	.	11	.	.	.	.	+1	2
<i>Trifolium ochroleucum</i>	.	.	+1	.	.	.	.	+1	.	.	2
<i>Medicago lupulina</i>	.	.	.	.	.	+1	.	.	+1	.	2
<i>Lotus aegaeus</i>	.	.	+1	+1	.	.	.	.	.	.	2
<i>Allium stamineum</i>	.	.	.	.	+1	.	.	.	+1	.	2
<i>Sedum pallidum</i> subsp. <i>bithynicum</i>	.	.	.	.	+1	.	.	.	.	.	1
<i>Arenaria serpyllifolia</i>	.	.	.	.	+1	.	.	.	.	.	1
<i>Epipactis helleborine</i>	.	.	.	+1	.	.	.	.	.	.	1
<i>Trifolium nigrescens</i> subsp. <i>petrisavii</i>	.	.	.	.	.	.	.	+1	.	.	1
<i>Hedysarum varium</i>	+1	.	.	.	.	.	.	.	.	.	1
<i>Origanum sipyleum</i>	+1	.	.	.	.	.	.	.	.	.	1
<i>Orobanche minor</i>	+1	.	.	.	.	.	.	.	.	.	1
<i>Astragalus gymmolobus</i>	.	.	+2	.	.	.	.	.	.	.	1
<i>Scorzonera cana</i> var. <i>cana</i>	.	.	+1	.	.	.	.	.	.	.	1
<i>Prunella laciniata</i>	.	.	.	+1	.	.	.	.	.	.	1
<i>Ranunculus brutius</i>	.	.	.	.	+1	.	.	.	.	.	1
<i>Phleum preteuse</i>	.	.	.	.	.	.	.	+2	.	.	1
<i>Euphorbia stricta</i>	.	.	.	.	.	.	.	.	.	+1	1

I = Species is present in the 1-20% of sample plots, II = Species is present in the 20-40% of sample plots, III = Species is present in the 40-60% of sample plots, IV = Species is present in the 60-80% of sample plots, V = Species is present in the 80-100% of sample plots. "+" = Covering degree is very low in the sample plots of species. "." = This species is not present in the sample plots

Table 4: *Quercetum vulcanicae-cerridis* ass., Type: Quadrat 13

Quadrat No.	13	14	16	19	20	23	
Area (m ²)	400	400	400	400	400	400	
Altitude (m)	1420	1380	1310	1400	1380	1380	
Inclination (%)	20	30	30	20	30	20	
Exposition	N	NE	E	NE	E	N	
Cover of the tress (%)	90	80	90	90	90	90	
Cover of the shrubs (%)	20	20	40	20	20	40	
Cover of the herbs (%)	40	60	40	60	40	60	
Bedrock	Calc	Calc	Calc	Calc	Calc	Calc	Presence
Characteristic species of association	The degree of covering and sociability in the sample plots of species						
<i>Quercus cerris</i> var. <i>cerris</i>	44	44	54	44	54	54	6
<i>Quercus vulcanica</i>	+1	.	.	.	.	+1	2
Characteristic species of <i>Pino-Cistion laurifolii</i>							
<i>Cistus laurifolius</i>	+2	+1	+2	+1	11	+2	6
Characteristic species of <i>Quercion frainetto</i>							
<i>Chamaecytisus hirsutus</i>	+1	.	.	.	+1	.	2
Characteristic species of <i>Carpino-Acerion</i>							
<i>Viola sieheana</i>	+1	+1	.	.	+1	+1	4
<i>Trifolium caudatum</i>	.	+1	+1	.	.	.	2
<i>Asperula involucre</i>	+1	.	.	.	.	.	1
Characteristic species of <i>Quercio-Cedretalia libani</i>							
<i>Pimpinella tragus</i> subsp. <i>polyclada</i>	.	.	+1	+1	+1	.	3
<i>Cotoneaster nummularia</i>	.	.	.	+1	.	+1	2
<i>Pinus nigra</i> subsp. <i>nigra</i> var. <i>caramanica</i>	+1	.	.	.	.	.	1
<i>Cerastium fragillimum</i>	.	+1	.	.	.	.	1
<i>Dorcyinium pentaphyllum</i> subsp. <i>anatolicum</i>	.	.	+1	.	.	.	1
<i>Juniperus foetidissima</i>	.	.	.	.	.	+1	1
<i>Sorbus umbellata</i> var. <i>umbellata</i>	+1	.	.	.	.	.	1
Characteristic species of <i>Quercete pubescentis</i>							
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+2	+1	+1	+1	.	+2	5
<i>Fragaria vesca</i>	+1	+1	.	.	+1	+1	4
<i>Silene italica</i>	+1	+1	.	.	+1	+1	4
<i>Digitalis ferruginea</i> subsp. <i>ferruginea</i>	.	+1	.	+1	.	+1	3
<i>Filipendula vulgaris</i>	.	.	.	+1	.	+1	2
<i>Coronilla varia</i> subsp. <i>varia</i>	.	.	+1	+1	.	.	2
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	+1	.	.	.	.	11	2
<i>Brachypodium sylvaticum</i>	.	.	.	.	+2	+2	2
<i>Campanula lyrata</i> subsp. <i>lyrata</i>	+1	.	+1	.	.	.	2
<i>Petrorragia alpina</i> subsp. <i>olympica</i>	+1	+1	.	.	.	.	2
<i>Lathyrus laxiflorus</i> subsp. <i>laxiflorus</i>	+1	.	.	.	.	.	1
<i>Crataegus monogyna</i> subsp. <i>monogyna</i>	.	.	+1	.	.	.	1

Table 4: Continued

Characteristic species of <i>Quercus-Fagea</i>							
<i>Geum urbanum</i>	+1	+1	+1	+1	+1	+1	6
<i>Veronica chamaedrys</i>	+1	.	.	.	.	.	1
<i>Cephalanthera damasonium</i>	.	+1	.	.	.	.	1
<i>Poa nemoralis</i>	.	.	+2	.	.	.	1
Characteristic species of the order <i>Onobrychido-Thymetalia leucostomi</i> and class <i>Astragalo-Brometea</i>							
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	.	+1	.	.	+1	+1	3
<i>Hypericum origanifolium</i>	+1	+1	.	.	.	.	2
<i>Galium verum</i> subsp. <i>verum</i>	.	.	.	+1	.	.	1
<i>Nepeta nuda</i> subsp. <i>albiflora</i>	.	+1	.	.	.	.	1
<i>Allium scoropdorasum</i> subsp. <i>rotundum</i>	.	.	.	.	+1	.	1
<i>Anthemis tinctoria</i> var. <i>tinctoria</i>	+1	.	.	.	.	.	1
Companions							
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	+1	+1	+1	+1	+1	+1	6
<i>Thymus longicaulis</i> subsp. <i>chaubardii</i> var. <i>alternatus</i>	+2	.	.	12	12	12	4
<i>Agrimonia eupatoria</i>	.	+1	+1	+1	.	+1	4
<i>Vicia villosa</i> subsp. <i>dasycarpa</i>	.	+1	.	.	+1	+1	3
<i>Rosa pulverulenta</i>	.	.	+1	+1	+1	.	3
<i>Moenchia mantica</i> subsp. <i>mantica</i>	+1	+1	.	.	.	+1	3
<i>Pilosella piloselloides</i> subsp. <i>megalomastix</i>	.	+1	.	+1	.	+1	3
<i>Trifolium alpestre</i>	+1	.	.	+1	+1	.	3
<i>Rubus canescens</i> var. <i>canescens</i>	+1	.	+1	.	.	+1	3
<i>Galium aparine</i>	+1	+1	.	.	+1	.	3
<i>Vicia hirsute</i>	.	.	+1	.	+1	.	2
<i>Origanum vulgare</i> subsp. <i>hirtum</i>	.	+1	.	.	.	+1	2
<i>Sedum complexicaule</i>	+1	.	.	.	.	.	1
<i>Trifolium ochroleucum</i>	.	.	.	+1	.	.	1
<i>Lotus corniculatus</i> var. <i>corniculatus</i>	.	.	.	.	.	+1	1
<i>Rumex acetosella</i>	.	.	.	.	.	+1	1
<i>Dianthus lycus</i>	.	.	+1	.	.	.	1
<i>Arrhenatherum elatius</i> subsp. <i>elatius</i>	.	.	.	+2	.	.	1
<i>Phleum preteuse</i>	.	.	.	.	.	+2	1
<i>Medicago x varia</i>	.	.	.	.	+1	.	1
<i>Arabis sagittata</i>	.	+1	.	.	.	.	1
<i>Hypericum orientale</i>	.	+1	.	.	.	.	1
<i>Medicago lupulina</i>	.	.	+1	.	.	.	1
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	.	.	+1	.	1
<i>Astragalus paeccilanthus</i>	.	.	.	.	+1	.	1
<i>Allium guttatum</i> subsp. <i>sardoum</i>	.	.	.	.	.	+1	1

***Stachyo tmoleae- Cistetum laurifolii* ass. Kargioğlu:**

The association spreads at altitudes between 1300-1510 m, on calcareous bedrock, with an inclination of 10-40%. It develops on relatively shallow brown forest soils. Results of physical and chemical analysis are given in Table 1. The soil has a loamy and sandy-loamy structure, pH 6.0-8.3 and organic matter between 0.5-3.0%.

Comprised of the shrub and herb layers, this community has been described on twelve sample quadrants. In addition to being the dominant species of the shrub layer, *C. laurifolius* is also the distinguishing and typical species of the association. The shrub layer varies between 150-180 cm in height and comprises 80-100% of the vegetation cover. The herb layer is 40-60 cm in height, with a cover of 5-80% (Table 5). *C. laurifolius* and *Stachys tmolea* Boiss. are characteristic and the distinctive species of the association. *P. nigra* subsp. *nigra* var. *caramanica* and *Q. cerris* var. *cerris* are included in this association. The association consists of the class *Quercetea pubescentis*, the order *Quercus-Cedretalia libani*, the alliance *Carpino-Acerion* and are represented by numerous species.

Sample plots were selected in the vicinity of Hisar hill, environs of Ortadere stream, Ardıçlı hill and Güvercinlik hill.

Quadrant no: Locality and date:

2: Hisar hill, 28.06.1998.

3-6: Ardıçlı hill, 28.06.1998.

7-8: Güvercinlik hill, 28.06.1998.

9-10, 12: Environs of Ortadere stream, 14.07.1998.

Holotype: Table 5, quadrant no: 2

Euphorbio seguierianae-Astragaletum microcephali

ass. Kargioğlu: This association thrives on calcareous bedrock and brown forest soils, with an inclination of 10-40%. Results of physical and chemical analysis of the soils from the habitat are given in Table 1. This soil has a sandy-loamy structure, pH 7.7-7.8 and organic matter between 1.9-3.2%. Spreading in places at altitudes of 1660-1760 m, the association has been described in eleven sample quadrants.

Reaching heights of 30-60 cm, the association formed by the semi-shrub *Astragalus microcephalus* Willd.,

Table 5: *Stachyo tmoleae-Cistetum laurifolii* ass., Type: Quadrat 2

Quadrat No.	2	3	4	5	6	7	8	9	10	12	
Area (m ²)	400	400	400	400	400	400	400	400	400	400	
Altitude (m)	1380	1350	1400	1350	1300	1380	1340	1480	1470	1510	
Inclination (%)	40	30	20	30	30	20	10	15	10	30	
Exposition	N	S	SE	S	SW	NE	SE	E	S	NE	
Cover of the shrubs (%)	80	90	100	90	90	90	100	90	90	90	
Cover of the herbs (%)	10	5	60	80	60	5	5	20	40	40	
Bedrock	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Presence
Characteristic species of association	The degree of covering and sociability in the sample plots of species										
<i>Cistus laurifolius</i>	54	55	55	55	55	55	55	54	55	55	10
<i>Stachys tmolea</i>	+1	.	.	.	+1	.	.	.	.	.	2
Characteristic species of <i>Quercion fraietto</i>											
<i>Chamaecytisus hirsutus</i>	+1	.	.	.	.	.	.	+1	.	+1	3
Characteristic species of <i>Carpino-Acerion</i>											
<i>Lathyrus laxiflorus</i> subsp. <i>laxiflorus</i>	+1	.	.	.	.	.	+1	+1	+1	.	4
<i>Trifolium caudatum</i>	.	.	.	.	.	.	.	+1	+1	+1	3
<i>Asperula involucrate</i>	+1	.	.	.	.	.	.	.	.	.	1
Characteristic species of <i>Cisto-Micromerietea</i>											
<i>Salvia tomentosa</i>	.	+1	.	.	.	.	.	+2	+1	+2	4
Characteristic species of <i>Quercio-Cedretalia libani</i>											
<i>Quercus cerris</i> var. <i>cerris</i>	+1	+1	.	+1	+1	.	+1	11	11	+1	8
<i>Pinus nigra</i> subsp. <i>nigra</i> var. <i>caramanica</i>	+1	.	+1	+1	+1	+1	+1	.	.	.	6
<i>Vicia cracca</i> subsp. <i>stenophylla</i>	.	.	+1	+1	+1	+1	+1	.	+1	.	6
<i>Cerastium fragillimum</i>	.	.	.	.	+1	.	.	+1	.	.	2
<i>Dorcyinium pentaphyllum</i> subsp. <i>anatolicum</i>	.	+1	.	.	.	.	.	.	.	.	1
<i>Silene compacta</i>	.	.	.	.	.	.	+1	.	.	.	1
<i>Galium peplidifolium</i>	.	.	.	.	.	.	.	.	.	+1	1
Characteristic species of <i>Quercetea pubescentis</i>											
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+1	.	+1	+1	.	11	+1	+1	+1	+1	8
<i>Coronilla varia</i> subsp. <i>varia</i>	.	+1	+1	.	.	.	.	+1	+1	+1	5
<i>Hypericum perforatum</i>	+1	.	+1	.	+1	+1	.	.	.	.	4
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	+1	.	.	.	.	.	+1	+1	+1	.	4
<i>Lathyrus digitatus</i>	+1	.	.	.	.	.	.	.	+1	+1	3
<i>Crataegus monogyna</i> subsp. <i>monogyna</i>	.	.	+1	.	+1	.	+1	.	.	.	3
<i>Campanula lyrata</i> subsp. <i>lyrata</i>	+1	.	.	.	.	.	+1	+1	.	.	3
<i>Digitalis ferruginea</i> subsp. <i>ferruginea</i>	.	.	.	.	.	.	.	+1	.	+1	2
<i>Petrorhagia alpina</i> subsp. <i>olympica</i>	+1	.	.	.	.	+1	.	.	.	.	2
<i>Ulmus glabra</i>	+1	.	.	.	.	.	.	.	.	.	1
Characteristic species of <i>Quercio-Fagea</i>											
<i>Cephalanthera damasonium</i>	.	+1	+1	.	.	.	.	.	.	.	2
Characteristic species of the order <i>Onobrychido-Thymetalia leucostomi</i> and class <i>Astragalo-Brometea</i>											
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	.	+1	+1	.	.	+1	.	.	.	+1	4
<i>Euphorbia macroclada</i>	.	+1	+1	+1	+1	.	.	.	.	.	4
<i>Ziziphora tenuior</i>	.	.	.	.	.	.	.	+1	.	+1	2
<i>Onosma tauricum</i> var. <i>tauricum</i>	.	+1	+1	.	.	.	.	.	.	.	2
<i>Hypericum organifolium</i>	.	.	.	.	.	.	+1	.	+1	.	2
<i>Asyneuma limonifolium</i> subsp. <i>pestalozzae</i>	.	.	+1	.	.	.	.	.	.	.	1
<i>Scabiosa argentea</i>	.	.	.	.	.	.	.	.	+1	.	1
Companions											
<i>Rubus canescens</i> var. <i>canescens</i>	+1	.	+1	+1	+1	+1	+1	+1	.	+1	8
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	+1	.	+1	+1	.	+1	.	+1	+1	+1	7
<i>Trifolium arvense</i> var. <i>arvense</i>	.	.	.	.	.	+1	+1	+1	+1	+1	5
<i>Poa bulbosa</i>	+2	.	.	.	.	.	.	+2	+2	+2	4
<i>Trifolium campestre</i>	.	.	.	+1	.	+1	+1	.	+1	.	4
<i>Pilosella piloselloides</i> subsp. <i>Megalomastix</i>	+1	.	.	.	.	+1	.	+1	+1	.	4
<i>Onobrychis pisdica</i>	.	+2	+1	+1	+1	.	.	.	.	.	4
<i>Anthyllis vulneraria</i> subsp. <i>boissieri</i>	.	+1	+1	+1	+1	.	.	.	.	.	4
<i>Trifolium alpestre</i>	+1	.	.	+1	.	+1	.	.	.	.	3
<i>Moenchia mantica</i> subsp. <i>mantica</i>	.	.	.	.	.	.	.	+1	+1	+1	3
<i>Alyssum desertorum</i> var. <i>desertorum</i>	.	.	.	.	.	.	.	+1	+1	+1	3
<i>Carex panacea</i>	.	+1	.	+1	.	.	+1	.	.	.	3
<i>Medicago sativa</i> subsp. <i>sativa</i>	.	+1	+1	.	.	.	.	.	.	.	2
<i>Vicia hirsute</i>	.	.	.	.	.	.	.	+1	.	+1	2
<i>Origanum vulgare</i> subsp. <i>hirtum</i>	.	.	.	.	.	.	.	+1	+1	.	2
<i>Thymus longicaulis</i> subsp. <i>chaubardii</i> var. <i>alternatus</i>	12	.	.	.	.	.	.	.	.	+2	2

Table 5: Continued

<i>Pilosella hoppeana</i> subsp. <i>troica</i>	.	.	.	+1	.	.	.	.	.	+1	.	2
<i>Astragalus paecilanthus</i>	.	+1	+1	.	.	.	.	.	.	.	.	2
<i>Lotus aegaeus</i>	.	+1	+1	.	.	.	.	.	.	.	.	2
<i>Acinos rotundifolius</i>	.	.	.	.	.	.	+1	.	.	.	.	1
<i>Hypericum aviculariifolium</i> subsp. <i>depilatum</i> var. <i>depilatum</i>	.	.	.	.	.	.	.	+1	.	.	.	1
<i>Galium aparine</i>	+1	.	.	.	.	.	.	.	.	.	.	1
<i>Sanguisorba minor</i> subsp. <i>muricata</i>	.	.	.	.	.	.	.	+1	.	.	.	1
<i>Sedum amplexicaule</i>	.	.	.	.	.	.	.	.	.	.	+1	1
<i>Myosotis lithospermifolia</i>	.	.	.	.	.	.	.	.	.	.	+1	1
<i>Rumex acetosella</i>	+1	.	.	.	.	.	.	.	.	.	.	1
<i>Hedysarum varium</i>	.	+2	.	.	.	.	.	.	.	.	.	1
<i>Valerianella coronata</i>	.	.	.	.	.	.	+1	.	.	.	.	1
<i>Trifolium dubium</i>	.	.	.	.	.	.	.	+1	.	.	.	1
<i>Veronica multifida</i>	.	.	.	.	.	.	.	.	+1	.	.	1
<i>Euphrasia pectinata</i>	.	.	.	.	.	.	.	.	.	+1	.	1

Table 6: *Euphorbia seguierianae*-*Astragalum microcephali* ass., Type: Quadrat 44

Quadrat No.	40	41	42	43	44	45	46	47	48	49	50	
Area (m ²)	40	40	40	40	40	40	40	40	40	40	40	
Altitude (m)	1700	1700	1680	1660	1700	1720	1720	1680	1760	1700	1660	
Inclination (%)	10	10	20	40	40	30	30	40	40	40	30	
Exposition	SW	SE	E	NE	S	NW	S	N	N	W	SE	
Cover of the herbs (%)	100	100	100	100	100	100	100	100	100	100	100	
Bedrock	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Calc	Presence
Characteristic species of association	The degree of covering and sociability in the sample plots of species											
<i>Astragalus microcephalus</i>	44	44	45	44	44	44	55	44	44	44	44	11
<i>Astragalus angustifolius</i> subsp. <i>angustifolius</i> var. <i>angustifolius</i>	22	22	12	12	12	+2	12	+2	+2	12	22	11
<i>Acantholimon puberulum</i> var. <i>puberulum</i>	12	+1	+1	.	.	12	.	+2	+2	+2	+2	8
<i>Euphorbia seguieriana</i> subsp. <i>seguieriana</i>	+2	+2	+1	11	+1	11	11	.	.	.	.	7
Characteristic species of <i>Phlomido-Astragalion microcephali</i>												
<i>Phlomis armeniacae</i>	.	+1	+1	+1	+1	+1	.	+1	+1	.	+1	8
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	.	+1	+1	.	+1	+1	+1	.	.	+1	+1	7
<i>Dianthus zonatus</i> var. <i>zonatus</i>	.	.	+1	.	+1	.	+1	.	.	.	+1	4
Characteristic species of <i>Onobrychido-Thmetalia leucostomi</i>												
<i>Minuartia hamata</i>	+1	+1	+1	.	+1	.	.	.	.	.	.	4
<i>Ziziphora taurica</i> subsp. <i>cleonioides</i>	+1	.	.	+1	+1	.	.	.	.	.	.	3
<i>Ziziphora tenuior</i>	.	.	.	.	+1	.	.	.	.	+1	.	2
<i>Allium scorodoprasum</i> subsp. <i>rotundum</i>	.	.	.	.	+1	.	.	.	.	.	.	1
<i>Silene supina</i> subsp. <i>pruinosa</i>	.	.	.	.	.	.	+1	.	.	.	.	1
Characteristic species of <i>Astragalo-Brometea</i>												
<i>Festuca valesiaca</i>	+2	.	12	+2	+2	+2	+2	+2	+2	12	+2	10
<i>Bromus tomentellus</i>	+2	+2	12	12	12	+2	+2	12	12	12	.	10
<i>Marrubium astracanicum</i> subsp. <i>macrodon</i>	.	+1	+1	+1	+1	.	+1	+1	.	+1	.	7
<i>Asyneuma limonifolium</i> subsp. <i>limonifolium</i>	.	+1	.	.	.	+1	.	+1	+1	.	+1	5
<i>Arenaria acerosa</i>	.	.	.	+1	.	+1	.	+1	+1	+1	.	5
<i>Thymus sipyleus</i> subsp. <i>sipyleus</i> var. <i>sipyleus</i>	.	+2	.	.	.	+2	+2	.	.	+1	.	4
<i>Teucrium polium</i>	.	.	.	+2	+1	.	+1	.	.	.	.	3
<i>Marrubium astracanicum</i> subsp. <i>anisodon</i>	+1	.	.	.	.	.	.	.	.	.	+1	2
<i>Leontodon asperrimus</i>	+1	.	.	.	.	.	+1	.	.	.	.	2
<i>Draba bruniifolia</i> subsp. <i>bruniifolia</i>	.	+1	+2	.	.	.	.	.	.	.	.	2
<i>Minuartia juniperina</i>	.	.	.	+2	.	.	.	.	.	.	.	1
<i>Galium iucanum</i> subsp. <i>elatus</i>	.	.	.	+1	.	.	.	.	.	.	.	1
<i>Acanthus hirsutus</i>	.	.	.	.	+1	.	.	.	.	.	.	1
<i>Stipa holosericea</i>	.	.	.	.	+2	.	.	.	.	.	.	1
Characteristic species of <i>Querceto-Cedretalia libani</i>												
<i>Cerastium fragillimum</i>	.	.	.	+1	.	.	.	.	.	.	.	1
<i>Galium peplidifolium</i>	.	.	.	.	+1	.	.	.	.	.	.	1
Companions												
<i>Thymus longicaulis</i> subsp. <i>longicaulis</i> var. <i>subisophyllus</i>	.	+2	+2	+2	+2	+2	+2	+2	12	12	12	10
<i>Minuartia anatolica</i> var. <i>phrygia</i>	+1	+1	+1	+1	.	+1	.	.	+1	.	+1	8
<i>Bromus squarrosus</i>	+2	+2	+2	.	+2	+2	+1	.	.	+2	.	7
<i>Phleum exaratum</i> subsp. <i>exaratum</i>	+2	+2	+2	+2	.	.	+2	.	.	.	+2	6
<i>Plantago holosteum</i>	11	.	11	.	.	+1	.	+1	+1	+1	.	6
<i>Plantago lanceolata</i>	+1	+1	+1	.	.	.	.	+1	.	+1	+1	6
<i>Sedum album</i>	.	.	.	+1	.	+1	.	+1	+1	+1	+1	6
<i>Myosotis stricta</i>	+1	.	.	+1	.	+1	.	+1	+1	.	.	5
<i>Ajuga chamaepitys</i> subsp. <i>chia</i> var. <i>chia</i>	.	+1	.	.	+1	.	+1	.	.	+1	+1	5

Table 6: Continued

<i>Arenaria serpyllifolia</i>	.	.	+1	+1	+1	+1	+1	.	.	.	.	5
<i>Alyssum desertorum</i> var. <i>desertorum</i>	+1	.	+1	.	.	+1	.	+1	.	.	.	4
<i>Paronychia dudleyi</i>	.	+1	+1	+1	.	.	.	.	+1	.	.	4
<i>Dactylis glomerata</i> subsp. <i>hispanica</i>	.	+1	.	.	.	.	+1	+1	.	+1	.	4
<i>Veronica pectinata</i> var. <i>glandulosa</i>	.	.	.	+1	.	+1	.	+1	.	+1	.	4
<i>Scdum laconicum</i>	.	.	.	+1	.	.	+1	+1	+1	.	.	4
<i>Ornithogalum armeniacum</i>	.	.	.	+1	.	+1	.	.	+1	.	.	3
<i>Centaurea cariensis</i> subsp. <i>longipapposa</i>	.	.	+1	.	.	.	+1	.	+1	.	.	3
<i>Medicago lupulina</i>	+1	.	.	+1	.	.	.	.	.	.	.	2
<i>Scandix macrorhyncha</i>	.	.	.	+1	+1	.	.	.	.	.	.	2
<i>Aubrieta pinardii</i>	.	.	.	+1	.	.	.	.	.	.	.	1
<i>Bromus tectorum</i>	+2	.	.	.	.	.	.	.	.	.	.	1
<i>Acroptilon repens</i>	.	.	.	.	+1	.	.	.	.	.	.	1
<i>Rochelia disperma</i> var. <i>disperma</i>	+1	.	.	.	.	.	.	.	.	.	.	1
<i>Briza humilis</i>	.	.	.	.	.	.	11	.	.	.	.	1
<i>Sanguisorba minor</i>	.	.	.	.	.	.	+1	.	.	.	.	1
<i>Logfia arvensis</i>	.	.	.	.	.	.	+1	.	.	.	.	1
<i>Thlaspi perfoliatum</i>	.	.	.	.	+1	.	.	.	.	.	.	1
<i>Galium spurium</i> subsp. <i>spurium</i>	.	.	.	.	+1	.	.	.	.	.	.	1

A. angustifolius Lam. subsp. *angustifolius* var. *angustifolius* and *Acantholimon puberulum* Boiss. et Bal. subsp. *puberulum* holds a vegetation cover of 70-90% (Table 6). Typical and distinguishing species of the association are *A. microcephalus*, *A. angustifolius* subsp. *angustifolius* var. *angustifolius*, *A. puberulum* var. *puberulum* and *Euphorbia seguieriana* Neck. subsp. *seguieriana*. Characteristic species of the order *Onobrychido-Thymetalia leucostomi*, class *Astragalo-Brometea*, maintain the majority in this community.

Sample plots for the table were established on Büyükkavuşak hill and Büyükhacet hill.

Quadrant no: Locality and date:

40-46: Büyükkavuşak hill, 16.07.1998.

47-50: Büyükhacet hill, 16.07.1998.

Holotype: Table 6, quadrant no: 44

DISCUSSION

In the study area, four plant associations consisting of forest, shrub and thorn-cushion vegetation types have been determined. Two of these belong to forest, one to shrub and one to thorn-cushion vegetation. The high elevation regions of the research area host thorn-cushion vegetation and at elevation 1200-1700 m *P. nigra* subsp. *nigra* var. *caramanica* communities occur. However, *Q. cerris* var. *cerris* ve *C. laurifolius* plant communities have become dominant in areas where *P. nigra* subsp. *nigra* var. *caramanica* communities have been destroyed by anthropogenic effects.

Ferulagini macrosciadae-Pinetum caramanicae ass.

Kargitoğlu: Covering a major part of the study area, forests of *P. nigra* subsp. *nigra* var. *caramanica* occur

frequently. Akman *et al.* (1978) have phytosociologically categorized Turkey's *P. nigra* subsp. *nigra* var. *caramanica* forests in *Quercus-Carpinetalia orientalis* Quézel, Barbéro and Akman (1980) and *Quercus-Cedretalia libani* orders into: a) *P. nigra* subsp. *nigra* var. *caramanica* forests of northwestern Anatolia, b) of western Anatolia, c) of Amanos and Taurus mountains in southern Anatolia.

P. nigra subsp. *nigra* var. *caramanica* forests grow in the Taurus mountains, which has a highly varied precipitation rate. These forests grow not only in areas with 1000 mm or even 1500 mm of precipitation but also on the slopes facing inner Anatolia, where precipitation may not exceed 400-500 mm (Akman *et al.*, 1979).

In the study area, they thrive on land with mean annual precipitation ranging from 435.1 to 930 mm. That is to say, they start in places where little or moderate precipitation and cold or very cold Mediterranean climate types prevail.

The *P. nigra* subsp. *nigra* var. *caramanica* forest of the research area is one of the best developing *P. nigra* subsp. *nigra* var. *caramanica* forests on the Afyonkarahisar boundary. Yet this forest gives way to *Q. cerris* var. *cerris* and *C. laurifolius* communities because of fires in some areas of the research area and some kind of anthropogenic effects. Under the forest canopy and in the glades, there are two common shrub species, *C. laurifolius* and *J. oxycedrus* subsp. *oxycedrus*. Quézel *et al.* (1978) placed *P. nigra* subsp. *nigra* var. *caramanica* forests, on the basis of their sundry floristic structures, into two orders of class *Quercetea pubescentis*. These orders are *Quercus-Cedretalia libani* and *Quercus-Carpinetalia orientalis*. According to them (Akman *et al.*, 1978), while *P. nigra* subsp. *nigra* var. *caramanica* forests in northern west

Anatolia are included in the order of *Quercus-Carpinetalia orientalis*, those in the Taurus mountains fall into the order of *Quercus-Cedretalia libani*. Likewise, in the association that we have described, the order of *Quercus-Cedretalia libani* has been placed into the above mentioned upper divisions since it includes a considerable amount of characteristic species from class *Quercetea pubescentis*.

The association of *P. nigra* subsp. *nigra* var. *caramanica* has been described in many locations in Turkey by various researchers. Areas close to our study area like Sultan mountains and Maden district of Seydişehir (Ocakverdi and Çetik, 1982, 1987), Afyon Başkomutanlık National Park (Vural *et al.*, 1985), on Barla (Bekat, 1987) and Akdağ (Gemici, 1988) mountains and The East Region of Dedegöl (Anamas) Mountain and Kurucuova-Yeşil dağ (Serin, 1996) have been sampled.

***Quercetum vulcanicae-cerridis* ass. Kargioğlu:** *Q. cerris* var. *cerris* is one of the most widespread species of the 18 oak species that are naturally spread in Turkey. This species can be observed starting from sea level and continuing until 1500-1900 m elevation. In the area, the association of *Q. cerris* var. *cerris*, adjacent to populated localities, has lost its normal floristic composition due to an intensive anthropogenic influence. Therefore, the ground flora is composed, to a large extent, of steppe plants of various upper divisions.

In nearby regions, this association has been described on Hasan mountain (Düzenli, 1976), Erciyes mountain (Çetik, 1981), Sultan mountains (Ocakverdi and Çetik, 1982) and Afyon Başkomutan Milli Parkı (Vural *et al.*, 1985), Sündiken Mountains (Ekim and Akman, 1991). In the association we have distinguished that dominant and characteristic species from the alliance of *Carpino-Acerion*, order *Quercus-Cedretalia libani* and class *Quercetea pubescentis*, are widespread. As a result the association has been inserted into the above named alliance, class and order. This association which is also determined in the vicinity of our research region, is included into the *Quercus-Cedretalia libani* order, on Sultan mountains, whereas in Afyon Kocatepe National Park and on Sündiken Mountains it is included into *Quercus-Carpinetalia orientalis* order due to the dominant species that are represented within. While this community is included into the *Carpino-Acerion* alliance according to the alliance classification on Sultan mountains, it is not included into any alliance elsewhere.

Quercus vulcanica which is a characteristic and distinguished species of the alliance, does not have a large spreading, but forms communities on Türkmen dağı,

Karadağ, Kovado-Gökbelenköy, Kumalar Mountain and Sultan Mountains (Ekim and Akman, 1991; Kurt *et al.*, 1996; Kargioğlu, 2001; Ünal, 1991). However, it has formed major communities in the environs of Sultan mountains and Kovado-Gökbelenköy areas. The total area of kasnak oak in Turkey is 10-12 thousand hectares. An association (*Dianthus cibrarii-Quercetum vulcanicae*) similar to our's was sampled by Kurt *et al.* (1996) at Gökbelenköy-Isparta. At the time it was situated in the order *Quercus-Cedretalia libani*, class *Quercetea pubescentis*.

***Stachyo tmoleae-Cistetum laurifolii* ass. Kargioğlu:** Communities of *C. laurifolius* usually emerge in transition belts from inner Anatolia region to Marmara, Aegean and Mediterranean regions, as a result of large scale destruction of *P. nigra* subsp. *nigra* var. *caramanica* (Ocakverdi and Çetik, 1982; Vural *et al.*, 1985; Gemici, 1988; Çetik and Vural, 1979). In the association we have distinguished that dominant and characteristic species from the alliance of *Carpino-Acerion*, order *Quercus-Cedretalia libani* and class *Quercetea pubescentis* are widespread. As a result, the association has been inserted into the above named alliance, class and order.

C. laurifolius association was first sampled in Ayaş mountains (Akman and Ketenöğlu, 1976). In the neighbouring regions, it has been determined on Koroğlubeli (Çetik and Vural, 1979), in Afyon Başkomutan National Park (Vural *et al.*, 1985), in Sultan mountains (Ocakverdi and Çetik, 1982), on Kızılören, Çal and Loras mountains (Tatlı *et al.*, 1994) and on Akdağ (Gemici, 1988). This association which was also determined near our research region, has been included to the *Quercus-Cedretalia libani* order on Sultan mountains, whereas in Afyon Kocatepe National Park and on Akdağ Mountains it has been included into the *Quercus-Carpinetalia orientalis* order due to the dominant species represented within. While this community has been included to *Pino-Cistion laurifolii* Quézel, Barbéro and Akman (1977) alliance in accordance with the alliance classification in Afyon Kocatepe National Park, the community determined on Akdağ Mountains has been included into the *Carpino-Acerion* alliance.

The percentage of similarities in the defined floristic compositions of described alliances in areas near our study area are; for *P. nigra* subsp. *nigra* var. *caramanica*: in Başkomutan Milli Parkı 37.0%, in Akdağ 29.1%. in Sultan mountains 25.4 and 18.2% in Barla mountain and for *Q. cerris* var. *cerris*: 31.2% in Başkomutan Milli Parkı and 20.3% in Sultan mountains; for *C. laurifolius*: 32.3% in Başkomutan Milli Parkı, 31.1% in Akdağ, 22.1% in Sultan mountains and 20.2% on Koroğlu Beli.

It is evident that the ratio of similarities described for Başkomutan Milli Park, which is closest to our study area, has the highest ratio of similar alliances described in our study. This can be explained by the similarities of the ecological specifics of regions in a close geographical location.

***Euphorbio seguierianae-Astragaletum microcephali* ass. Kargıoğlu:** This association forms large communities at Buyuk Hacettepe and Buyuk Kavusak Hills which have the highest elevations of the research area. The *Astragalus* community spreading across our research region's upper forest boundary was defined by Çetik for the first time in Turkey (Çetik, 1963). It was defined again by Akman and Ketenöglü (1976), Düzenli (1976) and Kılınç (1985), respectively. At the same time this association is defined as a sub association in *Thymo longicaulis-Astragaletum flavescens* association that represents the steppe and spreads in Afyon Kocatepe National Park in the environs of our research area. Kurt (2002) described a similar alliance in Emirdağ, which is in close proximity to our study area. At the time, it was situated in the alliance *Phlomidio nissolii-Onobrychidion tournefortii* Kurt all. nova 2002, from the order *Onobrychido-Thymetalia leucostomi*, class *Astragalo-Brometea*. In the association we have distinguished dominant and characteristic species from the alliance of *Phlomidio-Astragalion microcephali*, order *Onobrychido-Thymetalia leucostomi* and class *Astragalo-Brometea* are widespread. That is why the association has been inserted into the above named alliance, class and order.

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