VEGETATION OF ULUBEY CANYON (USAK, TURKEY)

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Abstract. The phytosociological and phytoecological features of the vegetation of Ulubey Canyon in Uşak (Turkey) were investigated. The vegetation of the area was analysed by Braun-Blanquet method. Two new associations from forest and shrub vegetation were determined. The nomenclatural, floristical, and ecological features of the identified associations were evaluated. The associations and their higher syntaxa are as below:
Quercetea-Pubescentis Doing-Kraft ex Scamoni and Passarage 1959
Querco-Cedretalia libani Barbéro, Loisel and Quézel 1974.
Abieto-Cedrion Akman, Barbéro and Quézel 1977
Forest vegetation
1. Thymo lycaonico-Pinetum brutiae ass.nova.
Shrub vegetation
2. Euphorbio dendroidi-Quercetum cocciferae ass.nova
Keywords: *Ulubey Canyon,Vegetation, Phytosociology, Uşak, Turkey.*

Introduction

The bioclimatic, geomorphological and pedological diversity of Turkey, support a different vegetation types (Parolly, 1998), and also makes the concerned area significant for vegetation investigations. The data related to vegetation studies is more recent according to the floristic studies in Turkey. In the beginning of the 20th century, Handel-Mazetti in the North Anatolia and Czeczott in the Northwest Anatolia were carried out the first phytosociological studies in Turkey (Çetik, 1985).

Many syntaxonomical studies were conducted in the localities close to the research area by Ocakverdi and Çetik (1982), Vural et al. (1985), Gemici (1988), Ekim and Akman (1991), Şanda and Küçüködük (2000), Kurt (2002), Şık and Gemici (2009) and Sağlam (2013). However, syntaxonomical investigation in this study area has not been reported in literature so far.

The aim of this study is to complete the phytosociological classification of the plant formations of Ulubey Canyon and to determine their potential based on environmental factors such as climate and soil structure, and also to provide recommendations for the protection of vegetation.

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Description of the study area

Research area was located in Usak province of the Aegean Region and the Southern West Anatolia *(Figure 1).* Ulubey Canyon was bordered Usak province, Ulubey and Karahallı district. Canyon to be opened to nature tourism and is a place to be protected.

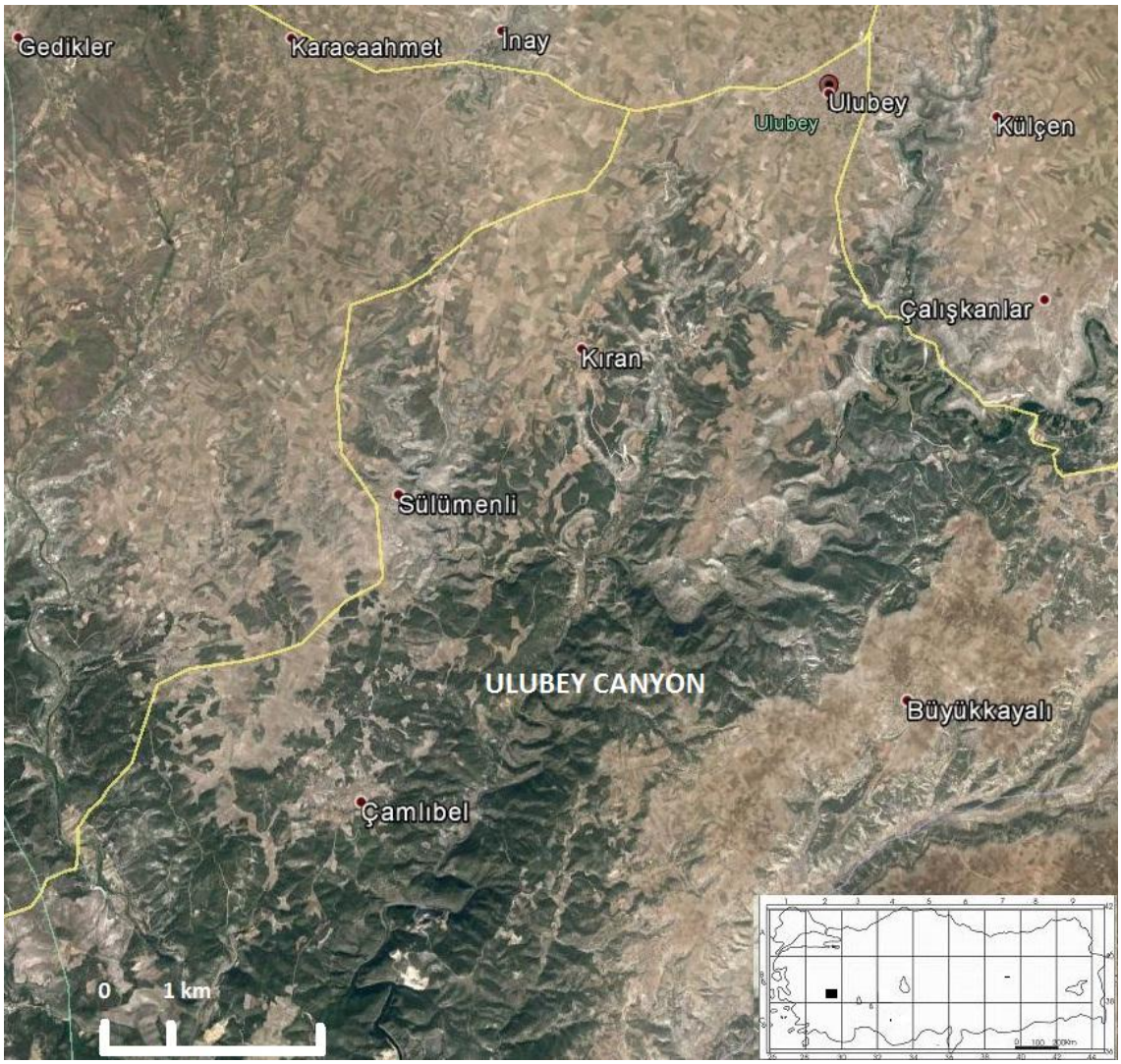

Figure 1.*Topographic map of the study area (revised from Google Earth data)*

Dokuz Sele Stream (Gain Stream) and Ulubey River canyon formed by the outer height of 750-900 meters altitude. Canyons are 100-500 meters wide, 75 km long and 135-170 meters deep. The shape of the limestone canyon system had been occured before 4.5 million by chemical and mechanical effects (Atalay, 2005).

The study area is located in B2 square according to the grid system adopted in the Flora of Turkey by Davis (Davis, 1965-1985; Davis and et al, 1988). This area is situated in the Euro-Siberian region both geographically and phytogeographically (Akman, 1993). Ulubey Canyon formation, with the collapse of the Büyük Menderes, karstic formations are associated with the process. The host rock of the area is limestone and travertine (Çetik, 1985). There are brown forest soil in area. The geographical

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location of the study area is under the influence of a typical Mediterranean climate in terms of natural flora and vegetation. Mediterranean climate is extratropical climate, of which has daily and seasonal photoperiodism, and collected its precipitation in the cold season (Akman,1990). Area has the type of rainy and upper cool of Mediterranean climate, and the precipitation regime of Winter-Autumn-Spring-Summer (W. A. Sp. Sm.) according to the climate data of the study area (*Table 1*). The research area has "Winter cold, semi-arid Mediterranean climate" as climatic data. Climatic data and biclimatic diagram of research area are represented in *Table 2* and *Figure 2.*

Table 1. *Meteorological data of Usak Province*

DATA	MONTHS												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
Mean temperature	2	2.9	5.7	10.7	15.6	19.9	23.2	23.3	18.7	13.1	8	4	12.3
High temperature	6.5	7.8	11.4	16.7	21.7	26.1	29.9	30.3	26.1	20.1	13.9	8.5	18.3
Low temperature	-1.5	-1	0.8	4.7	8.7	12.1	14.5	14.7	11.2	7.2	3.6	0.7	6.3
Rainfall	76.6	65.2	57.8	42.9	49.2	24.8	15.2	.9.1	16	36.4	57.7	83.5	534.4

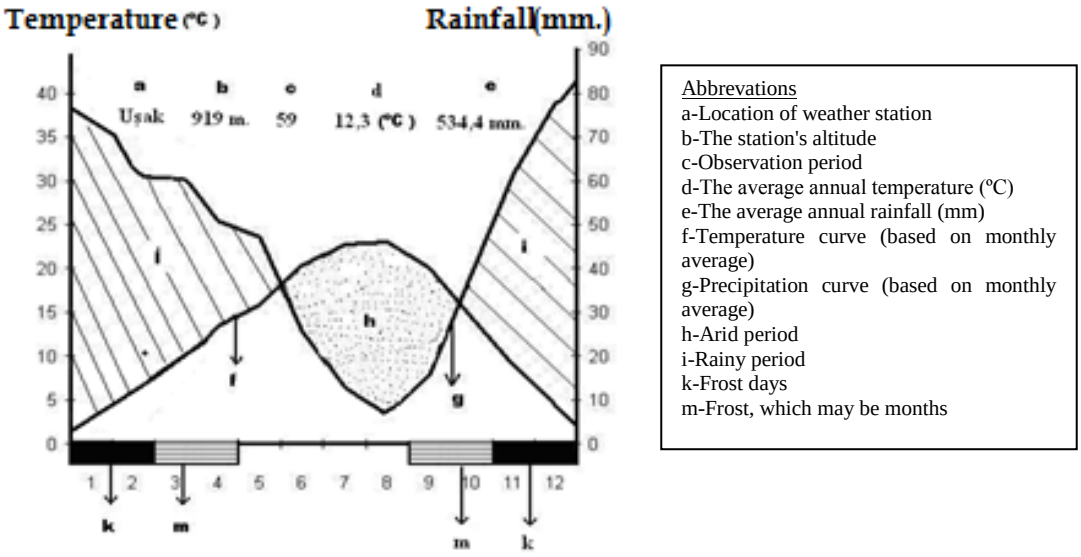

Figure 2*. Bioclimatic ombrotermic diagram of Usak province*

Material and Methods

The vegetation was carried out during vegetation periods from 2010 to 2012 using Zurich-Montpellier approach (Braun-Blanquet, 1932). 80 homogenous quadrat were sampled to determine the interaction between plant communities and environmental factors. The size of the releves was determined according to the minimal area method, which was chosen 1000 m^2 for *Pinus brutia* community, 600 m^2 for *Quercus coccifera* community. Taxonomic nomenclature followed Davis (1965-1985), Davis et al. (1988),

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Tutin et al. (1964-1980), Güner et al. (2000, 2012), and Özhatay et al. (2009, 2011). The plant specimens collected from the quadrat were stored in the Uşak University. The new syntaxa were named by the International Code of Phytosociological Nomenclature (Weber et al., 2000). Syntaxonomical interpretations of taxa for the forest vegetation were made according to Quézel (1973), Akman et al. (1978a, 1979), Barbéro et al. (1979), and Quézel et al. (1978, 1980). The associations that contains same dominant taxon in previous studied publications on near the research area were compared by Sorensen's similarity index (1948).

The climate of the area was examined using the datas comprising the average of many years from the meteorology stations in Uşak (Anonymous, 1984). The climatic datas were applied to Emberger's formula of rain and temperature factors.

The soil samples were collected from the top 0-20 cm and 20-40 cm of the profile of the vegetation type. Soil samples were analysed in Laboratory of Soil Department, Agriculture Faculty, Ege University.

Results

Vegetation Types of Research Area

Two new associations belonging to forest and shrub vegetation have been described. The results of the analysis of soil samples from different releves are given in *Table 2* in order to give comparative details about the soils where the plant associations have developed.

The forest vegetation is the most common vegetation type in the area, and is represented by community of *Pinus brutia* between 600 and 700 meters altitude.

The shrub vegetation is represented by community of *Quercus coccifera* between 700 and 900 meters altitude.

Table 2. *Physical and chemical properties of soil samples*

		Thymo lyacaonico-Pinetum brutiae		*Euphorbio dendroidi-Quercetum cocciferae*	
Physical values	Depth	0-20 cm	20-40 cm	0-20 cm	20-40 cm
	Clay (%)	13.04	15.04	19.04	33.24
	Silt (%)	22.72	18.72	28.72	12.72
	Sand (%)	64.24	66.24	52.24	54.24
	Texture (Structure)	Sandy-Tin	Sandy-Tin	Sandy-Tin	Sandy-Clay-Loam
Chemical values	Electrical conductivity (ECx103 25 C)	367	320	269	232
	Total salt (Mikro s/ cm.)	0.023	0.020	0.017	0.015
	Lime (CaCO) %	75.50	69.79	77.66	60.22
	Phosphorus (kg/dek)	0.44	0.31	0.40	0.26
	Organic matter %	5.83	2.73	0.98	0.77
	pH	7.87	7.77	7.76	7.95

Thymo lyacaonico-Pinetum brutiae Şahin and Şanda ass. nova.

This association (holotypus: *Table 3*, quadrat number: 47) spreads locally on the Dutluca Village, Ulubey-Karahallı highway, Kazancı Stream Bridge, Hasköy hire and

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Clandras hire from the canyon between 600 and 700 m altitude. This association is thought to occur by the effect of the micro-climate depends on the topography. The soil of this association has basic character (7.77-7.87), organic matter (2.73-5.33%), and clayey (13.04-15.04%) in texture. While there is no lime in the soil at a depth of 0-20 cm, the soil in depth of 20-40 cm has 69.79-75.50% of lime (*Table 2*). This association exhibits tree, shrub and herb layers. Total coverage of tree, shrub and herb layers are 80-85%, 10-15%, 30-40%, and 29-50 m, 1.2-2 m, 50–90 cm in the maximum lengths in quadrats, respectively.

The characteristic and differential species of the association are *Pinus brutia*, *Thymus zygioides var.lycaonicus* and *Teucrium chamaedrys* subsp.*tauricolum*.

Table 3. *Thymo lyacaonico-Pinetum brutiae Şahin and Şanda ass.nova.*

(Holotypus: Quadrat number: 47)

Quadrat Number	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	
Altitude (m)	600	600	600	500	500	500	500	600	600	600	700	700	600	500	600	
Quadrat size (m²) x10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Exposure	E	E	E	E	NE	NE	NE	NW	NW	NW	S	S	S	SW	SW	
Inclination (°)	30	30	30	30	20	25	20	30	35	30	10	10	15	30	35	
General cover (%)	100	90	90	90	85	90	95	100	90	95	90	100	90	95	90	
Tree cover (%)	85	85	80	80	85	85	85	80	80	85	85	85	80	80	85	
Tree Length (m)	25	25	20	25	25	25	20	20	25	25	20	20	25	25	25	**Presence**
Shrub cover (%)	10	10	15	10	15	10	10	15	10	10	10	10	10	15	15	
Shrub Length (m)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
Herb cover (%)	40	30	30	40	40	30	30	40	30	40	40	30	30	40	30	
Herb Length (cm)	80	90	80	80	70	50	60	80	70	80	80	70	80	50	60	
Rock								**LIMESTONE**								
Characteristic and differantial taxa of association																
Pinus brutia	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	V
Thymus zygioides var.lycaonicus	13	13	13	13	.	13	13	13	13	13	13	13	13	.	13	V
Teucrium chamaedrys subsp.*tauricolum*	1	1	1	1	1	.	1	1	1	1	.	1	1	1	1	V
Characteristic taxa of *Abieto-Cedrion*																
Cyclamen cilicium var. *cilicium*	11		11	1	1	11	.	1		11		1		1	1	IV
Thlaspi perfoliatum	1	1	1			1	.	1	1		1	1	1		1	IV
Vicia cracca subsp. *stenophylla*	1	1	1	1	1	.	1	.	.	1	1	.	1	1	.	IV
Dorynium pentaphyllum subsp. *anatolicum*	.	1	1	1	1	.	1	.	1	1	1	.	.	1	1	III
Bunium microcarpum subsp. *microcarpum*	.	11	.	11	.	11	11	11	.	.	.	11	11	11	.	III
Juniperus excelsa	33	.	34	.	.	.	33	.	33	.	.	33	33	.	.	III
Characteristic taxa of *Quercetea pubescentis*																
Quercus pubescens	13	14	13	13	13	14	13	13	13	13	13	14	13	13	14	V
Crataegus monogyna	13	13	23	23	13	23	.	13	23	.	13	13	23	23	13	V
Trifolium physodes var. *physodes*	1	.	1	.	1	1	.	1	1	1	.	1	1	.	1	IV
Coronilla varia subsp. *varia*	1	.	1	1	.	1	1	1	.	.	1	1	1	.	1	IV
Briza humilis	.	1	1	.	1	1	1	1	.	1	1	.	1	1	1	III
Thesium bergeri	.	1	.	1	.	1	1	1	.	1	1	.	.	1	1	III
Populus tremula	44	44	34	.	.	44	44	.	44	.	.	44	.	.	44	III
Paronchia argyroloba	.	1	1	.	.	1	1	1	.	.	1	1	.	.	1	III
Alyssum sitrigosum subsp. *cedrorum*	1	1	.	.	1	.	.	1	1	1	1	1	.	.	1	III
Galium peplidifolium	.	1	.	1	.	.	1	1	1	.	.	1	1	.	.	III
Buxus sempervirens	44		44		34			34		34			44	44		III
Scilla bifolia	1	1	.	.	1	.	.	1	1	.	.	1	.	1	.	III
Prunus divariaca subsp. *divariaca*	44	.	.	44	.	44	.	.	44	.	.	44	.	.	.	III
Teucrium chamaedrys subsp. *chamaedrys*	1	1	1	1	1	.	.	1	.	1	.	1	1	1	.	III
Pyrus elaegnifolia	14	14	.	.	14	.	.	14	.	.	.	14	.	14	.	II
Characteristic taxa of *Quercetea ilicis*																
Quercus coccifera	33	33	33	33	33	23	13	33	33	23	13	33	13	13	13	V
Pistacia terebinthus	11	11	12	12	2	11	11	12	.	.	11	11	.	12	12	IV
Jasmium fruticans	11	21	11	11	11	.	.	21	21	11	2	11	11	.	11	IV
Rhus coriaria	11	11	.	11	.	12	.	.	2	11	.	11	.	11	12	IV
Crataegus aronia var. *aronia*	13	13	13	.	.	13	.	.	13	13	.	.	.	.	.	III
Characteristic taxa of *Onobrychido armenea - Thymetalia leucostomi*																
Acantholimon acerosum	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	V
Ziziphora tenuior	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Scabiosa argentea	1	.	1	1	.	.	1	1	.	1	1	1	.	.	.	III
Anthemis tinctoria var. *tinctoria*	.	1	1	.	1	1	.	.	1	.	.	.	1	1	.	III
Characteristic taxa of *Astragalo-Brommetea*																
Dianthus zonatus var. *zonatus*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Globularia trichosantha	12	12	12	.	.	12	.	12	12	.	12	12	.	12	12	IV
Asyeneuma limonifolium subsp. *limonifolium*	.	.	1	1	.	1	1	1	1	.	1	1	.	1	1	IV
Astragalus ongustifolius subsp. *angustifolius*	12	12	12	.	12	.	12	.	.	.	.	12	.	.	12	III

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Thymus spyleus subsp. *spyleus*	12	.	12	12	12	.	12	.	.	12	12	.	.	12	.	III
Globularia orientalis	1	1	1	.	.	1	1	1	.	.	1	.	1	1	.	III
Euphorbia macroclada	11	11	.	11	.	11	11	.	11	.	11	.	.	11	.	III
Sideris montana	1	1	.	.	1	.	.	1	.	.	.	1	.	.	.	III
Polygala anatolica	1	1	1			1		1		1	1			1		III
Koelaria cristata	.	1	1	.	.	1	1	.	.	.	1	1	.	.	.	III
Companions																
Wiedamanniana orientalis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Capsella bursa pastoris	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Aegilops triuncialis	1	1	1	1	1	1	1	1	1	1	1	1	1	.	1	V
Papaver rhoedas	1	1	1	1	1	1	1	1	1	1	.	.	1	1	1	IV
Scorzonera eriophora	1	1	1	1	.	1	1	1	1	1	.	1	.	1	.	IV
Bromus joponicus	1	1	1	1	1	1	1	1	1	1	1	.	.	1	.	IV
Erygium campestre	12	.	12	12	.	12	12	.	12	12	.	12	12	.	12	IV
Anchusa officinalis	.	1	1	1	.	1	1	1	.	1	1	.	1	.	1	IV
Carex flacca subsp. *serulata*	1	.	1	1	1	.	1	1	.	1	.	1	.	.	1	IV
Poa bulbosa var. *vivipara*	.	1	.	1	1	.	1	1	1	1	.	1	.	1	1	IV
Carex flacca subsp. *serulata*	1	.	1	1	1	.	1	1	.	1	.	1	.	.	1	IV
Poa pratensis	1	.	1	.	1	1	1	.	1	1	.	1	1	.	1	IV
Adonis flammea	1	.	1	1	.	1	1	1	1	1	.	1	1	.	1	IV
Centaurea solstitialis subsp. *solstitialis*	1	.	1	1	1	1	1	1	.	.	1	1	.	.	1	IV

Note: Because of the table's size, taxa of I-II presence in companions are not presented here. See the full version of Table 3 in the Electronic Appendix.

Other trees and shrubs of the associarions are as follows; *Pyrus elaegnifolia, Quercus pubescens, Juniperus excelsa, Populus tremula, Buxus sempervirens, Prunus divaricata* subsp.*divaricata, Quercus coccifera, Crataegus aronia* var.*aronia, Jasmium fruticans, Pistacia terebinthus, Rhus coriaria, Ulmus glabra (Table 3).*

Euphorbio dendroidi-Quercetum coccifera Şahin and Şanda ass. nova.

This association (holotypus: *Table 4*, quadrat number: 1) spreads locally on the Kazancı Stream Bridge, Hasköy and Calıskanlar village from the canyon between 700 and 900 m altitude. The soil of this association has basic character (7.76-7.95), organic matter (0.77-0.98%), and clayey (19.04-33.24%) in texture. While there is no lime in the soil at a depth of 0-20 cm, the soil in depth of 20-40 cm has 69.22-77.66% of lime (*Table 2*). This association exhibits shrub and herb layers. Total coverage of shrub and herb layers are 40-60%, 10-35% and 2-2.5 m, 40–80 cm in the maximum lengths in quadrats, respectively.

The characteristic and differential taxa of the association are *Quercus coccifera, Euphorbia dendroides, Dranculus vulgaris, Phlomis viscosa, Capparis ovata* var. *herbacea.*

Q.coccifera of the association after the dominant trees and shrubs; *Pyrus elaegnifolia, Quercus pubescens*. Association travertine bedrock is located on brown soil. Herb least because of the amount of overlap, the association is suitable for erosion .

Discussion

Pinus brutia community

The dominant species of the association is *Pinus brutia* and widely occured in the Mediterranean and Aegean regions of Turkey. Phytogeographically, plant associations belong to the forest vegetation that spreads along West and South Anatolia were included within the classes of *Quercetea pubescentis* and *Quercetea ilicis.* According to Akman et al., 1978a,b (*P. brutia* communities that occur in the Supra-Mediterranean zone of North-west Anatolia have been included in *Querco-Carpinetalia orientalis* and

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Quercetea pubescentis. According to Akman (1995), the *Quercetea ilicis* class is represented by many xerophilic and deciduous forest species in the Mediterranean region of Turkey. The forest formations belong to 0-1000 meters Mediterranean Vegetation Zone are included in *Quercetea ilicis* class. This association should be included in *Quercetea pubescentis* Doing-Kraft 1955 class, *Querco-Cedretalia libani* Barbéro, Loisel, Quézel, 1974 order, Abieto-Cedrion alliance 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. Bioclimatic terms, pine, semi-arid mediterranean climate on the floor (which is quite rare here), rainy and very wet floors in the Mediterranean climate of hot, cool and cold types spread. This kind in Turkey, may develop on different parent material. Generally, marl and marly limestone rocks are dominant over, but Amanos and ophiolitic rocks in the Toros Mountains (serpentine, gabbro, peridotite) also develop on. Hard limestones, sandstones and shales, do not develop (Akman, 1995).

Also, *Pinus brutia* communities in Turkey are connected to different plant sociology.

1. Red pines are located in a warm and genuine Mediterranean are connected to **Quercetalia ilicis,**

2. Located in the upper Mediterranean red pines are connected to **Querco-Cedretalia libani** and **Querco-Carpinetalia orientalis**.

Table 4. *Euphorbio dendroidi-Quercetum cocciferae Şahin and Şanda ass. nova*

(Holotypus: Quadrat number: 1)

Quadrat Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Altitude (m)	750	750	750	800	800	850	750	800	850	900	700	750	750	900	850	
Quadrat size (m²) x10	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	
Exposure	E	E	E	NE	NE	NE	W	W	W	W	NE	NE	NE	S	S	
Inclination (°)	30	30	40	60	60	60	45	45	45	45	30	30	30	15	20	**Presence**
General cover (%)	60	60	60	60	65	65	60	60	65	70	60	60	70	80	85	
Shrub cover (%)	50	50	40	50	50	50	60	50	55	50	40	40	50	60	50	
Shrub Length (m)	2	2,5	2	2	2,5	2	2	2	2,5	2	2	2,5	2,5	2	2	
Herb cover (%)	10	10	20	10	15	10	10	10	10	20	20	20	20	20	35	
Herb Length (cm)	40	45	50	80	80	75	80	80	70	75	80	85	70	60	70	
Rock	**TRAVERTINE**															
Charactaristic and differential taxa of association																
Quercus coccifera	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	V
Euphorbia dendroides	12	22	13	22	12	13	12	12	12	12	22	13	13	22	22	V
Dranculus vulgaris	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	V
Phlomis viscosa	11	11	1	1	11	11	12	12	12	1	1	11	12	12	1	V
Capparis ovata var. *herbacea*	1	1	1	1	.	1	1	1	1	.	1	1	1	1	1	V
Characteristic taxa of *Abieto-Cedrion*																
Asyneuma amplexicaule	1		1		1	1	1		1		1	1		1		III
Thlaspi perfoliatum	1	1		1	1	1	1	1		1		1		1		III
Euphorbia macrostegia	13	13			12			12	12		12		12			III
Characteristic taxa of *Querco - Cedralia libani*																
Bunium microcarpum subsp. microcarpum	11	11	11	11	11	11	11	11	11	11	11	11	.	.	.	IV
Dorynium pentaphyllum subsp. *anatolicum*	1	1	1	1	1	1	1	.	.	.	.	1	1	.	.	III
Vicia cracca subsp. *stenophylla*	1	.	1	.	1	.	.	1	.	.	1	.	1	.	1	III
Viola modesta	1	1		1		1			1			1				III
Characteristic taxa of *Querctea pupescentis*																
Quercus pubescens	44	34	33	33	34	44	.	34	34	34	44	33	44	.	34	V
Pyrus elaeagnifolia	14	14	.	13	14	13	14	13	14	.	14	13	13	13	.	V
Coronilla varia subsp. *varia*	1	.	1	.	1	1	1	.	1	1	1	.	1	1	1	V
Paliurus spina-christi	33	34	34	44	34	44	34	34	34	33	34	44	34	44	.	V
Alyssum sitrigosum subsp. *cedrorum*	1	1	1	1	1	1	1	1	1	1	.	.	1	.	.	IV
Briza humilis	.	1	.	1	1	1	1	1	.	.	1	1	1	.	.	IV
Trifolium physodes var. *physodes*	1	1	1	.	.	1	.	1	.	1	.	1	1	1	1	III
Thesium bergeri	1	1	1	.	.	1	1	.	.	1	1	.	1	1	.	III
Scilla bifolia	1	1	.	.	.	1	1	1	.	.	1	1	.	.	.	III
Paronchia argyroloba	.	.	1	.	1	.	.	.	1	.	.	.	1	1	.	II

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Galium peplidifolium	1	.	.	1	.	.	1	.	.	1	1	.	1	.	.	II
Teucrium chamaedrys subsp. *chamaedrys*	1	.	1	.	1	1	.	.	1	1	.	.	.	.	.	II
Cotinus coggygria	34	.	.	34	.	.	.	34	.	.	.	.	.	34	.	I
Characteristic taxa of Onobrychido armenea - *Thymetalia leucostomi*																
Acantholimon acerosum	12	12	12	12	12	12	12	12	12	12	.	.	.	12	.	IV
Hedisarum varium	.	1	1	1	.	1	1	.	1	1	1	.	1	1	1	IV
Anthemis tinctoria var. *tinctoria*	1	1	1	1	.	.	1	1	.	1	1	1	.	1	1	IV
Onosma aucheranum	1	1		1	1			1	1		1	1	1		1	IV
Scabiosa argentea	1	1	.	.	1	.	1	.	.	1	.	1	.	.	1	III
Phlomis armeniaca	.	1	.	1	.	.	.	1	.	.	.	.	1	.	.	III
Characteristic taxa of Astragalo- Brometea																
Dianthus zonatus var. *zonatus*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Ziziphora tenuior	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Lappula barbata	1		1	1	1		1		1		1	1		1	1	IV
Ziziphora capitata	1	1		1		1	1		1	1		1	1	1		IV
Globularia orientolis	1	.	1	.	.	.	1	1	.	.	1	.	.	1	.	III
Anthemis cretica subsp. *albida*	1	.	.	1	.	1	.	1	.	.	1	.	.	.	1	II
Companions																
Rosa canina	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	V
Verbascum cheiranthifolium	23	23	23	23	23	23	23	23	23	23	23	23	23	23	23	V
Globularia trichosantha	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	V
Valerianella alliarifolia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Wiedamanniana orientalis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Moenchia mantica subsp. *mantica*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Capsella bursa pastoris	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Knautia integrifolia var. *bidens*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Poa bulbosa var. *vivipara*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Carduus nutans	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Euphorbia macroclada	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	V
Lotononis genistoides	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	V
Dactylus glomerata	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	V
Crataegus monogyna	13	13	13	13	13	.	.	13	13	13	13	13	13	13	13	IV
Centaurea solstitialis subsp. *solstitialis*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	.	IV
Adonis flammea	1	.	1	1	1	1	1	.	.	.	1	1	1	1	1	IV
Erygium campestre	12	.	12	12	.	12	.	12	12	.	12	12	12	.	.	IV
Anchusa officinalis	1	1	1	.	.	1	1	.	.	.	1	.	.	1	1	IV
Geranium robertianum	1	.	1	.	1	1	1	1	.	.	1	1	1	.	.	IV
Hypericum cerastoidea subsp. *confertum*	1	.	.	1	.	.	1	.	1	1	1	1	1	.	.	IV
Hordeum bulbosum	1	.	.	1	1	1	.	.	1	1	1	.	1	1	1	IV

Note: Because of the table ‘s size, taxa of I-II presence in companions are not presented here. See the full version of Table 4.in the Electronic Appendix.

Accordingly, the Mediterranean and Aegean regions red pine communities, **Quercetalia ilicis**, Aydin-Eskişehir-Adapazari passing over the line in the northwest red pine communities, **Querco-Carpinetalia orientalis** and that line the southeast with the high areas red pine communities, the **Querco-Cedretalia libani** is connected to.

Real Mediterranean cypress floor, the top floor of the Mediterranean to the red pine trees, crossing six major changes in the flora forest manifests itself. Chamaephytes nanofonerofit and the characteristics of the Mediterranean gariga (except *Juniperus oxycedrus* subsp. *oxycedrus* and *Quercus coccifera*) in place to gradually leaves quite abundant herbaceous species.

Thymo lyacaonico-Pinetum brutiae should be included in *Quercetea pubescentis* Doing-Kraft 1955 class, *Querco-Cedretalia libani* Barbéro, Loisel, Quézel, 1974 order, Abieto-Cedrion alliance 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. Floristic similarity between the ***Thymo lyacaonico-Pinetum brutiae*** association and previously described *P. brutia* associations ranges from 5% to 18%. The highest similarity percentage (18%) was found in the study by Gemici (1986) due to its proximity to the research area. (*Table 5*). *P. brutia* community in the Ulubey Canyon should be distinguished as a new association, namely ***Thymo lyacaonico-Pinetum brutiae*** ass. nova (*Table 3*).

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Table 5. *The comparison of the associations with the similar studies according to Sorensen's similarity (Is) formula [Is = 2W100 / (A + B)]. W, number of species in both sites; A, number of species in first site; B, number of species in second site.*

Previous investigations	Associations	
	Thymo lyacaonico-Pinetum brutiae	*Euphorbio dendroidi-Quercetum cocciferae*
Seçmen(1977) Nif Mountain(İzmir)	5	
Gemici (1986) Akdağ (Çivril-Sandıklı-Dinar)	18	
Şık (1992) Yunt Mountain (Manisa)	8	
Aksoy (1992) Mahmut Mountain (Kemalpaşa)	7	
Serin ve Eyce(1994) Aladağ (Hadim-Konya)	6	5
Oluk (1999) Babadağ (Denizli)	13.5	9
Serin (1996) Dedegöl (Anamas)		8.3

Quercus coccifera community

Quercus coccifera (kermes, pirnal oak) wide spread on Mediterranean maquis with a wide distribution across the Mediterranean Basin. The structure and the floristic composition of *Q. coccifera* have been identified in Mediterranean shrublands of Greece by climate and the anthropogenic factors (Tsiourlis et al., 2009). *Quercus coocifera* community of Ulubey Canyon is wide spread, particularly in travertine areas of the research area. Numerous steppic and xerophilous species penetrated into this association. *Quercus coocifera* belonging to *Quercetalia ilicis* from Eumediterranean and *Quercetalia pubescentis* from Submediterranean zone. *Q. coccifera* associations described in Aladağ (Serin and Eyce, 1994), in the east of Dedegöl (Anamas) Mountain (Serin, 1996), in Babadağ (Oluk, 1999) were categorised under the *Querco-Cedretalia libani* order. The floristic composition of ***Euphorbio dendroidi-Quercetum coccifera*** is well presented by the characteristic species of the order *Querco-Cedretalia libani* and the class *Quercetea pubescentis*. For these reasons, the association should be belonged to order *Querco-Cedretalia libani* and the class *Quercetea pubescentis*. The similarity percentages between the associations described in the present study and those of the other, previously defined areas (*Table 5*) range from 5% to 9%. The highest similarity percentage (9%) was found in the study by Oluk (1999) due to its proximity to the research area.

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APPENDIX

Electronic Appendix: Full versions of Table 3 and Table 4

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