

Phytosociological and ecological structure of Mediterranean enclaves along the stream valleys in inner parts of black sea region

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Abstract: In this study, phytosociological structure of Mediterranean enclaves which occurred along the stream valleys in inner parts of Black sea region was investigated. *Pinus brutia* var. *brutia* and *Quercus coccifera* are the most widespread communities in the study area. *Pinus pinea*, *Arbutus andrachne*, *Arbutus unedo*, *Fontanesia philliraeoides* subsp. *philliraeoides* and *Olea europaea* L. var. *sylvestris* have a restricted distribution in inner parts of Black sea region as compared to *P. brutia* and *Q. coccifera*. The following associations were described in the study area. *Siderito dichotomae-Quercetum cocciferae*, *Spiraeo crenatae-Oleetum sylvestris* ass. nov., *Cotino coggyreae-Arbutetum andrachnes*, *Buxo sempervirenti-Arbutetum unedonis* ass. nov., *Paliuro spinae-christi-Fontanesietum philliraeoidis*, *Quercus infectoriae-Pinetum brutiae* and *Crucianello ponticae-Pinetum pinae*. The highest species diversity was found in *Crucianello ponticae-Pinetum pinae*, while the lowest species diversity was found in *Spiraeo crenatae-Oleetum sylvestris*. Evenness values were much similar to each other among all of the associations. According to CA *Paliurus spinae-christi-Fontanesietum philliraeoidis*, *Spiraeo crenatae-Oleetum sylvestris* and *Crucianello ponticae-Pinetum pinae* occurred in the negative zone. The other four associations occurred in the positive zone.

Key words: Black sea region, Enclaves, Maquis vegetation, Mediterranean climate, Numerical methods, Stream valleys

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Introduction

Turkey is the most complex country in the Middle East with regard to topographic structure. It is built up of comparatively narrow and long, variously oriented mountain chains separated by deep valleys and also high and medium plateaus (Zohary, 1973). Turkey has a quite rich flora and consists of various vegetation types. In addition to this, endemism rate is quite high and Turkey consists of three main phytogeographic regions as Euro-Siberian, Mediterranean and Irano-Turanian (Davis and Hedge, 1975).

Black sea region is situated on the northern part of Turkey. Although this region has a relatively homogeneous vegetation and composed of Euro-Siberian type vegetation, there were different communities especially around river valleys. A number of parallel mountain ranges tend west-east direction and the slopes facing the Black sea region are steep and almost shelterless. The regularity of these west-east ranges is very often upset by cross-faulting and by the formation of deep valleys through which some large water courses mainly the rivers Kizilirmak and Yesilirmak which cut their way into the Black sea (Sahin, 2005). North Anatolian Mountain ranges (NAMR), which lie in east-west direction are usually upset by cross-faulting between Inner Anatolia and Black sea region and deep valleys such as Kelkit, Coruh, Gokirmak and Yenice cay

(parallel to Black sea) and Kizilirmak, Devrez, Harsit and Yesilirmak (steeply to Black sea region) are formed.

The aim of the present study is to classify the Mediterranean enclaves occurring along the stream valleys in inner parts of Black sea region which are situated in the northern part of Turkey by Braun-Blanquet and numerical methods and to compare the associations in terms of floristic composition and species diversity.

Materials and Methods

Study area: Black sea region can be divided into three regions as East, Central and West (40°42' N; 31° 41' E). One of the most important topographic features in this area is the presence of NAMR. These mountain ranges can be divided into two parts as coastal and inner ranges. In the eastern part of Black sea region, NAMR reach at a height of 3800 m and Kelkit and Çoruh valleys extend parallel to NAMR. In the western part of Black sea region, NAMR cut their way into the Yenice valley and the branches of Kizilirmak (Gokirmak and Devrez river) are formed. However, in the central part of Black sea region, the height of NAMR is lower than that of the other parts and only reached to 1500 m and gradually rise from coastal line towards inner parts. Black sea region has been divided into different vegetation layers on the basis of altitudes and

biogeographic patterns by Quezel *et al.* (1980). Our study area belongs to "Etage Méditerranéen intra-pontique" and "Etage Méditerranéen prestéppique intra-pontique" zones. This study was carried out along the stream valleys (Devrez, Kelkit, Kizilirmak, Yenice and Yesilirmak) in inner parts of Black sea region.

Semi arid Mediterranean climate is seen in the study area. The mean annual temperature is extending from 10.7-14.2°C and the mean annual precipitation is extending from 406.0-589.5 mm in Kelkit valley. The precipitation regime is Sp.Wi.Au.Su (Sp: Spring; Wi: Winter; Au: Autumn; Su: Summer) in the study area (Korkmaz and Engin, 1996; Karaer *et al.*, 1999).

Vegetation: The study area includes mainly *Pinus brutia* Ten. var. *brutia* forests and maquis vegetation. *P. brutia* forests are widely distributed. However, they have been destroyed continuously mainly due to antropogenic factors (urbanization, fire, grazing, etc.). *P. brutia* forests mainly composed of *Quercus infectoria* Oliv. subsp. *infectoria*. (Fagaceae), *Pistacia terebinthus* L. subsp. *palaestina* (Boiss.) Engl. (Anacardiaceae), *Cistus creticus* L. (Cistaceae), *Ruscus aculeatus* L. var. *aculeatus* (Liliaceae), *Micromeria myrtifolia* Boiss. and Hohen. (Lamiaceae) and *Arbutus andrachne* L. (Ericaceae).

Maquis vegetation usually occurs on south-facing slopes of valleys and includes *Q. coccifera* (Fagaceae), *O. europaea* var. *sylvestris*, *A. unedo*, *A. andrachne* (Ericaceae) and *F. phylliraeoides* subsp. *phylliraeoides* (Oleaceae). The most common species of these communities are *Paliurus spina-christi* Mill. (Rhamnaceae), *Jasminum fruticans* L., *Phillyrea latifolia* L. (Oleaceae), *P. terebinthus* subsp. *palaestina*, (Anacardiaceae), *Styrax officinalis* L. (Styracaceae), *Clematis flammula* L. (Ranunculaceae), *Thymbra spicata* L. var. *spicata*, *Sideritis dichotoma* L. and *Salvia tomentosa* Mill. (Lamiaceae).

The cover values of all vascular species were estimated in each vegetation layer. The study area was divided into 250 floristically and structurally homogenous quadrats and all strata were estimated according to Braun-Blanquet cover-abundance scale (Braun-Blanquet, 1965; Mueller-Dumbois and Ellenberg, 1974). The size of quadrats were estimated by means of minimal area method and ranged from 300 to 800 m².

Life form spectra of the each association were also determined according to the scale of Raunkiaer (Mueller-Dumbois and Ellenberg, 1974).

Syntaxonomic nomenclature followed that of Quezel *et al.* (1992) and Weber *et al.* (2000). Taxonomic nomenclature followed that Flora of Turkey (Davis, 1965-1985) and Brummitt and Powell (2001).

The vegetation releves were classified by TWINSpan procedure also. Cover data of species were analysed according to

the Braun-Blanquet scale as proposed by van der Maarel (Hill, 1979). TWINSpan was also paired with the ordination technique Detrended Correspondence Analysis (DCA). Correspondence analysis (CA) provides a useful statistical tool for the ordination of sites and species and the correlation of species with site characteristics (Jongman *et al.*, 1995). TWINSpan, Detrended Correspondence Analysis (DCA) and Correspondence analysis (CA) were performed by using the CAP 1.5 version (Anonymous, 1999) and ECOM 1.33 version (Anonymous, 2001) software programmes.

Species diversity was calculated as the Shannon-Wiener index (Kent and Coker, 1992):

$$H' = - \sum_{i=1}^S P_i \log_2 P_i$$

where S is the total number of species and P_i is the relative cover of ith species. Evenness (Russell *et al.*, 1985) was calculated as:

$$J = H' / H_{\max}$$

$$\text{where } H_{\max} = \log_2 P_i$$

Results and Discussion

Maquis vegetation:

***Sideritis dichotomae-Quercetum cocciferae*:** This association occurs on south-facing slopes (350-800 m) between Erbaa-Niksar (Kelkit Valley) on calcareous parent rock (Karaer *et al.*, 1999). The diagnostic species of that association are *Q. coccifera*, *P. latifolia*, *Sideritis dichotoma* Huter. (Lamiaceae) and *Fumana thymifolia* (L.) Verlot (Cistaceae). This association exhibits two vegetation layer as shrub and herb layers. Total coverage of shrub layer ranged from 80-90%. Mean height of shrub layer is 0.5-3 m. The most common species of shrub layer are *Q. coccifera*, *J. fruticans*, *Cotinus coggyria* Scop. (Anacardiaceae), *P. latifolia*, *C. creticus*, *P. terebinthus* subsp. *palaestina* and *Juniperus oxycedrus* L. subsp. *oxycedrus* (Cupressaceae). Total coverage and the height of herb layer is 25-40% and 30-40 cm, respectively. Herb layer consists of *F. thymifolia*, *R. aculeatus* var. *aculeatus*, *S. dichotoma*, *S. tomentosa*, *M. myrtifolia* and *Euphorbia rigida* M.Bieb. (Euphorbiaceae). In degraded parts of that association steppic species such as *Ziziphora capitata* L., *Teucrium polium* L. (Lamiaceae), *Globularia trichosanhta* Fisch. and Mey. (Globulariaceae), and *Chrysopogon gryllus* (L.) Trin. subsp. *gryllus* (Poaceae) are observed (Table 1).

Quercetea (etalia) ilicis Br. Bl. 1947 class is represented by *Putoria calabrica* (L. fil.) DC., *Rubia tenuifolia* d'Urv. (Rubiaceae), *R. aculeatus* var. *aculeatus*, *P. terebinthus* subsp. *palaestina*, *T. spicata* var. *spicata*, *Q. infectoria* subsp. *boissieri* and *J. fruticans*.

Cisto-Micromerietea julianae Oberd. 1954 class is represented by *S. tomentosa*, *C. creticus*, *Psoralea bituminosa* L. (Fabaceae) and *M. myrtifolia*. In degraded parts, *Astragalo*

microcephali-Brometea tomentelli Quezel, 1978 and *Quercetea pubescentis* Doing Kraft 1955 are found.

Cotino coggyrae-Arbutetum andrachnes: This association occupies south-facing slopes (350-800 m) between Erbaa-Niksar (Kelkit Valley) on calcareous parent rock (Karaer *et al.*, 1999). The diagnostic species of this association are *A. andrachne* and *Cotinus coggyria* Scop. (Anacardiaceae). This association comprises two vegetation layers as shrub and herb layers and the total coverages of shrub and herb layers are 80-90% and 10-40%, respectively. The height of shrub layer is 0.5-3 m, whereas the height of herb layer is 30-45 cm. Shrub layer is characterized by *C. coggyria*, *A. andrachne*, *P. latifolia*, *P. terebinthus* subsp. *palaestina*, *T. spicata* var. *spicata* and *J. fruticans*. The common species of herb layer are *S. tomentosa*, *Linum hirsutum* L. var. *anatolicum* (Linaceae), *M. myrtifolia*, *Dorycnium graecum* (L.) Ser. (Fabaceae), *Fumana arabica* (L.) Spach (Cistaceae) and *Koeleria cristata* (L.) Pers (Poaceae). *Quercetea (etalia) ilicis* class is characterized by *T. spicata* var. *spicata*, *P. terebinthus* subsp. *palaestina*, *J. fruticans*, *P. latifolia* and *Anarrhinum orientale* Benth. (Scrophulariaceae). Characteristic species for *Cisto-Micromerietea julianae* are *Origanum vulgare* L. subsp. *viride* (Boiss.) Hayed (Lamiaceae), *P. bituminosa*, *F. arabica*, *C. creticus*, *S. tomentosa* and *M. myrtifolia*. Characteristic species belonging to the other upper syntaxa units are shown in Table 2.

Paliuro spinae-christi- fontanesietum philliraeoidis: *Paliuro spinae-christi- Fontanesietum philliraeoidis* occupies locally in Erbaa (Kelkit Valley). The diagnostic species of this association are *Fontanesia philliraeoides* subsp. *philliraeoides*, *P. spina-christi* and *R. aculeatus* var. *aculeatus*. This association exhibits two vegetation layers like the other associations (Karaer *et al.* 1999). Total coverage and height of shrub layer are 60-80% and 2-3 m, respectively. Total coverage and height of herb layer are 10-40% and 30-40 cm, respectively. Shrub layer is characterized by *F. philliraeoides* subsp. *philliraeoides*, *P. spina-christi*, *C. orientalis* subsp. *orientalis*, *J. oxycedrus* subsp. *oxycedrus*, *Crataegus monogyna* Jacq. subsp. *monogyna* (Rosaceae) and *J. fruticans*. The common species of herb layer are *Alyssum strigosum* Banks and Sol. (Brassicaceae), *Sanguisorba minor* subsp. *muricata* (Spach) Briq. Scop. (Rosaceae), *Centaurea triumfetti* All. and *Filago eriocephala* Guss. (Asteraceae) (Table 3).

Quercetea (etalia) ilicis class is characterized by several species like the other associations. However, different syntaxonomic units are represented on the contrary to the other associations mainly due to antropogenic effects (most common of them are intensive grazing and disturbance).

Astragalo microcephali-Brometea tomentelli Quezel 1978 class is represented by several species such as *Koeleria cristata* (L.) Pers. (Poaceae), *Melica ciliata* L. (Poaceae), *Centaurea urvillei* DC. (Asteraceae), *C. triumfetti* and *Ziziphora capitata* L. (Lamiaceae).

Cotoneaster nummularia Fisch. and Mey. (Rosaceae), *J. oxycedrus* subsp. *oxycedrus*, *Coronilla scorpioides* (L.) Koch (Fabaceae), *C. orientalis* subsp. *orientalis*, *Alyssum strigosum* and *C. monogyna* subsp. *monogyna* are the characteristic species of *Quercetea pubescentis* Doing Kraft 1955. *Quercetea pubescentis* Doing Kraft 1955. *Quercetea pubescentis* (Br. – Bl. Et Vlieger, 1937) Fuk et Fab 1968 class is represented by *Moehringia trinervia* (L.) Clairv. (Caryophyllaceae), *Lapsana communis* L. (Asteraceae) and *Clinopodium vulgare* L. (Lamiaceae). That class is not represented in the other associations.

Cisto-Micromerietea julianae is characterized by *Dictamnus albus* L. (Rutaceae), *J. oxycedrus* subsp. *oxycedrus*, *Carpinus orientalis* Mill. subsp. *orientalis* (Corylaceae), *Clematis vitalba* L. (Ranunculaceae) and *Ligustrum vulgare* L. (Oleaceae) are the characteristic species of *Quercetea pubescentis* Doing Kraft class.

Spiraeo crenatae-Oleetum sylvestris: (Karaer *et al.* ass.nova hoc loco) This association is firstly described from the study area (Holotype Table 4; Quadrat number 39) and occurs on south-facing slopes of Kizilirmak valley (400-450 m) between Asagisuz-Ardiçtepe region (Vezirkopru-Samsun) and Kepez gorge (Duragan-Sinop) on calcareous parent rock.

The diagnostic species of this association are *O. europaea* var. *sylvestris*, *Spiraea crenata* L. (Rosaceae) and *Juniperus excelsa* M. Bieb. (Cupressaceae). This association comprises of two vegetation layers as shrub and herb layers like the first association. Total coverage and height of of shrub layer ranged from 80-90% and 3-4 m, respectively. Shrub layer consists of *P. latifolia*, *P. terebinthus* subsp. *palaestina*, *J. excelsa* and *J. fruticans*. Total coverage and the height of herb layer 20-30% and 80-90 cm, respectively. The most common species of herb layer are *C. gryllus* subsp. *gryllus*, *Iberis taurica* DC. (Brassicaceae) and *Sedum pallidum* M. Bieb. var. *pallidum* (Crassulaceae) Table 4.

Quercetea (etalia) ilicis class is represented by *P. terebinthus* subsp. *palaestina*, *J. fruticans*, *Ephedra major* Host (Ephedraceae), *Allium scorodoprasum* L. subsp. *rotundum* (L.) Steam (Liliaceae), *S. montana*. *Cisto-Micromerietea julianae* and *Astragalo microcephali-Brometea tomentelli* classes are represented by low number of species.

Buxo sempervirenti-Arbutetum unedonis: (Karaer *et al.* ass.nova hoc loco) This association is firstly described from the study area (Holotype Table 5; Quadrat number 4) occurs locally on south-west facing slopes between 300-400 m on calcareous parent rock. It is located around Kepez Bogazi-Duragan (Kizilirmak Valley).

The diagnostic species of this association are *A. unedo*, *Buxus sempervirens* L. (Buxaceae), *Thalictrum flavum* L. (Ranunculaceae) and *Coronilla emeris* subsp. *emeroides* (Boiss. and Spruner) Hrabitova (Fabaceae). This association comprises

Table - 1: Characteristics of *Siderito dichotomae*-*Quercetum cocciferae* association

Quadrat no.	1	2	3	4	5	6	7	71	73	75	76	77	F r e q u e n c y	P r e s e n c e
Size of quadrat (m ²)	400	400	400	400	400	400	400	400	400	400	400	400		
Altitude (m)	450	470	400	400	450	430	500	350	400	450	450	350		
Exposure	S	S	S	S	S	SW	SW	SW	S	S	S	S		
Inclination (%)	20	25	30	30	20	40	40	40	30	40	30	40		
Height of the shrub layer (m)	2	2	2	3	3	2	3	2	3	2	2	2		
Coverage of the shrub layer (%)	90	80	90	80	80	80	80	90	85	90	80	80		
Height of the herb layer (cm)	40	30	30	40	40	40	40	30	40	40	40	40		
Coverage of the herb layer (%)	40	40	30	40	40	30	30	25	40	40	30	40		
Characteristic and differential species of the association														
<i>Quercus coccifera</i>	54	43	54	43	44	44	44	54	43	44	44	43	100	V
<i>Phillyrea latifolia</i>	11	22	11	22	11	11	11	+1	11	.	11	22	92	V
<i>Sideritis dichotoma</i>	12	+2	+1	+2	+2	.	12	.	.	+2	.	12	67	IV
<i>Fumana thymifolia</i>	+1	.	+1	11	.	.	+1	+1	11	.	+1	11	67	IV
Characteristic species of <i>Quercetea (etalia) ilicis</i>														
<i>Pistacia terebinthus</i> subsp. <i>palaestina</i>	+1	11	11	+1	+1	+1	+1	+1	+1	+1	+1	+1	100	V
<i>Thymra spicata</i> var. <i>spicata</i>	+2	+2	+2	.	.	.	+2	.	.	+2	+2	+2	58	III
<i>Quercus infectoria</i> subsp. <i>boissieri</i>	.	+2	.	.	.	+2	+2	.	.	+2	.	.	39	II
<i>Euphorbia rigida</i>	+1	+1	+1	.	+1	.	.	.	+1	.	.	.	33	II
<i>Jasminum fruticans</i>	.	.	.	+1	.	.	.	+1	.	+1	.	+1	33	II
<i>Ruscus aculeatus</i>	+2	.	.	.	.	.	+2	.	.	.	+2	.	25	II
<i>Arbutus andrachne</i>	+1	.	+1	.	.	.	.	.	.	.	.	+1	25	II
<i>Putoria calabrica</i>	.	.	.	.	.	12	.	.	+2	.	.	.	16	II
<i>Arbutus unedo</i>	.	.	.	.	.	.	.	+1	+1	.	.	.	16	II
<i>Rubia tenuifolia</i>	.	.	.	.	.	.	+1	.	.	.	+1	.	16	II
Characteristic species of Cisto-Micromerietae														
<i>Cistus creticus</i>	+2	12	+2	+2	.	+2	.	+2	.	.	+2	+2	67	IV
<i>Salvia tomentosa</i>	+1	.	+1	.	.	.	+1	+1	+1	+1	+1	+1	67	IV
<i>Psoralea bituminosa</i>	+1	+1	+1	.	+1	+1	.	.	+1	+1	+1	.	67	IV
<i>Micromeria myrtifolia</i>	+1	+1	+1	.	.	.	+1	.	.	.	+1	+1	50	III
<i>Fumana arabica</i>	+1	.	.	.	.	+1	.	.	+1	.	.	.	25	II
Characteristic species of <i>Querco-Cedretalia libani</i> (*) and <i>Quercetea pubescentis</i>														
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+2	.	+2	.	+2	+2	+2	.	.	+2	.	+2	58	III
(*) <i>Dorycnium pentaphyllum</i>	.	+2	.	.	.	.	+2	.	+2	+2	+2	.	42	III
(*) <i>Cotoneaster nummularia</i>	.	+1	+1	.	.	.	.	+1	.	.	.	.	25	II
(*) <i>Alyssum strigosum</i>	+1	.	.	+1	.	+1	.	.	.	.	+1	.	25	II
<i>Polygala supina</i>	.	+1	.	.	.	.	+1	.	+1	.	.	.	25	II
<i>Cotinus coggyria</i>	.	.	.	.	.	.	.	+1	.	.	+1	.	21	II
<i>Quercus cerris</i> var. <i>cerris</i>	+1	.	.	.	+1	.	.	.	.	.	.	.	16	I
<i>Colutea cilicica</i>	+1	.	.	.	+1	.	.	.	.	.	.	.	16	II
<i>Coronilla scorpioides</i>	.	.	.	.	.	.	+1	.	.	.	.	.	16	I
Characteristic species of Astragalo-brometea														
<i>Ziziphora capitata</i>	+1	+1	+1	+1	.	+1	.	.	+1	+1	.	+1	67	IV
<i>Teucrium polium</i>	.	+1	+2	+2	.	.	+2	+2	+2	+2	.	+2	67	IV
<i>Globularia trichosantha</i>	+1	+1	.	.	+1	+1	+1	.	+1	+1	+1	.	67	IV
<i>Cryspogon gryllus</i> subsp. <i>gryllus</i>	+1	.	+1	+1	.	+1	.	+1	.	+1	+1	+1	67	IV
<i>Veronica multifida</i>	.	+2	.	.	+1	+1	.	.	+2	+2	+2	+2	58	III
<i>Helianthemum salicifolium</i>	+1	+1	+1	.	+1	+1	.	+1	.	.	.	.	50	III
<i>Koelaria cristata</i>	.	.	+1	.	+1	.	.	+1	.	+1	+1	.	42	III
<i>Teucrium chamaedrys</i>	.	+1	.	+1	.	.	+1	.	.	.	+1	.	33	II
<i>Linum hirsutum</i> subsp. <i>anatolicum</i>	+1	.	.	+1	+1	.	.	.	+1	.	.	.	33	II
<i>Hypericum origanifolium</i>	.	+1	.	.	.	.	+1	.	.	.	+1	+1	33	II
<i>Onosma amena</i>	.	.	.	+1	+1	.	.	+1	.	.	+1	.	33	II
<i>Sangisorba minor</i> subsp. <i>muricata</i>	.	.	+1	.	.	.	.	+1	.	+1	.	.	25	II
<i>Centaurea triumfettii</i>	.	.	.	.	.	.	.	.	+1	+1	+1	.	25	II

Table-1 Continued....



<i>Helianthemum nummularium</i>	.	.	.	.	.	+1	.	.	.	+1	.	.	16	I
<i>Convolvulus cantabica</i>	+1	+1	.	+1	.	+1	+1	+1	+1	.	+1	.	67	I
<i>Crucianella bithynica</i>	+1	.	+1	+1	.	.	+1	.	+1	+1	+1	.	67	I
<i>Dactylis glomerata</i>	.	.	+1	+1	.	.	+1	+1	+1	.	+1	.	50	II
<i>Muscari aucheri</i>	+1	+1	.	.	.	.	+1	+1	+1	+1	.	.	50	II
<i>Vincetoxicum fuscum subsp. boissieri</i>	.	.	.	.	+1	12	.	+2	+2	+2	.	+2	50	II
<i>Thesium billardieri</i>	+1	+1	+1	+1	.	+1	.	.	.	.	.	.	42	II
<i>Scabiosa columbaria</i>	.	.	.	.	.	.	.	+1	+1	+1	+1	.	33	II
<i>Johrenia tortuosa</i>	.	+1	.	+1	.	+1	.	+1	.	.	.	.	33	II
<i>Silene otites</i>	.	.	.	.	+1	.	.	.	+1	.	+1	+1	33	II
<i>Dianthus orientalis</i>	.	+2	.	+2	+2	.	.	.	.	.	.	.	25	II
<i>Scutellaria salviifolia</i>	+1	.	+1	.	.	.	.	.	+1	.	.	.	25	II
<i>Medicago xvaria</i>	.	+1	.	.	.	.	.	.	+1	+1	.	.	25	II
<i>Ptercephalus plumosus</i>	+1	.	.	.	.	+1	.	.	.	.	+1	.	25	II
<i>Crepis alpina</i>	+1	.	+1	.	.	+1	.	.	.	.	.	.	25	II
<i>Trifolium campestre</i>	.	+1	.	.	.	.	.	+1	.	+1	.	.	25	II
<i>Galium margaceum</i>	.	.	.	+1	.	.	+1	+1	.	.	.	.	25	II
<i>Crepis foetida</i>	+1	.	.	.	.	.	.	.	.	.	+1	.	25	II
<i>Digitaria sanguinea</i>	+1	.	.	.	.	.	.	.	.	.	+1	.	25	I
<i>Legosia falcata</i>	.	.	+1	.	.	.	+1	.	.	.	.	.	25	I
<i>Andrachne telephioides</i>	+1	.	.	.	.	.	.	.	.	.	.	+1	25	I
<i>Stepitorhamphus tuberosus</i>	.	.	.	.	+1	.	.	.	.	+1	.	.	25	I
<i>Rostraria cristata</i>	.	.	.	.	.	.	.	+1	.	.	.	+1	25	I
<i>Medicago minima</i>	.	.	.	+1	.	+1	.	.	.	.	.	.	25	I

Source: Karaer *et al.*, 1999, * = Character species of Quercetalia libani, The number stands for Braun-Blanquet cover abundance and sociability classes

of two vegetation layers as the other associations. The total coverages of shrub and herb layers are 70-80% and 20-25%, respectively. The height of shrub layer is 0.5-4 m, whereas the height of herb layer is 30-60 cm. *P. terebinthus* subsp. *palaestina*, *Rhus coriaria* L. (Anacardiaceae), *J. oxycedrus* subsp. *oxycedrus*, *C. creticus* and *T. polium*. *S. tomentosa*, *Thesium billardieri* Boiss. (Santalaceae), *Teucrium chamaedrys* L. subsp. *chamaedrys* (Lamiaceae) and *Medicago minima* (L.) Bartl. var. *minima* (Fabaceae) are the most common species of herb layer (Table 5).

Quercetea (etalia) ilicis class is characterized by *P. latifolia*, *P. calabrica*, *A. andrachne*, *R. coriaria* and *P. terebinthus* subsp. *palaestina*. *Cisto-Micromerietea julianae* is represented by *P. bituminosa*, *M. myrtifolia*, *S. tomentosa*, *F. arabica* and *O. vulgare* subsp. *viride*.

Astragalo microcephali-Brometea tomentelli class is represented by several species such as *T. polium*, *T. chamaedrys* subsp. *chamaedrys*, *Ziziphora taurica* M. Bieb. (Lamiaceae), *Convolvulus cantabrica* L., *C. holosericus* M. Bieb. (Convolvulaceae), *Helianthemum nummularium* (L.) Mill., *Fibigia eriocarpa* (DC.) Boiss. (Brassicaceae), *Coronilla scorpioides* L. Koch (Fabaceae), *C. orientalis* subsp. *orientalis* and *Pilosella hoppeana* (H.Schult.) C.H. and F.W.Schultz (Asteraceae).

Characteristic species of *Quercetea pubescentis* are *C. nummularia*, *Paliurus spina-christi*, *Quercus cerris* L. var. *cerris* (Fagaceae), *Tanacetum poteriifolium* (Ledeb.) Grierson (Asteraceae), *Dorycnium graecum*, *Colutea cilicica* Boiss. and Bal

(Leguminosae), *Juniperus excelsa*, *J. oxycedrus* subsp. *oxycedrus* and *Polygala supina* Schreib. (Polygalaceae).

Crucianello ponticae- Pinetum piniae: This association occurs on Artvin (Fistikli village) and Trabzon (Kalenima River). It consists of two subassociations as *chamaecytisetosum hirsutae* and *alyssetosum murelae* (Table 6).

The diagnostic species of this association are *Pinus pinea* L. (Pinaceae) and *Crucianella gilanica* Trin. subsp. *pontica* (Ehrend.) Ehrend (Rubiaceae). The diagnostic species of *chamaecytisetosum hirsutae* and *alyssetosum murelae* are *Alyssum murale* Waldst. and Kit. var. *murale* (Brassicaceae), *Spartium junceum* L. (Fabaceae), *Satureja spicigera* (C. Koch) Boiss. (Lamiaceae) and *Chamaecytisus hirsutus* (L.) Link (Fabaceae), *Punica granatum* L. (Punicaceae), *Sempervivum glabrifolium* Boiss. (Crassulaceae) and *Silene armeria* L. (Caryophyllaceae), respectively.

This association exhibits three vegetation layers as tree, shrub and herb layers. Total coverage and height of tree and shrub layers are 40-70%, 50-70% and 8-15 m, 1-2 m, respectively. Total coverage and height of herb layer are 50-60% and 30-40 cm, respectively. Most common species in shrub layer are *A. andrachne*, *Rhus coriaria*, *J. oxycedrus* subsp. *oxycedrus* and *C. salviifolius*. *T. polium*, *Teucrium chamaedrys* subsp. *chamaedrys* and *Dorycnium graecum* are the most common species of herb layer.

Quercetea (etalia) ilicis class is characterized by *A. andrachne*, *R. coriaria*, *P. terebinthus* subsp. *palaestina*, *C. salviifolius*, *R. aculeatus* var. *aculeatus*, *E. rigida* and *Vitis sylvestris*

Table - 2: Characteristics of Cotino coggyriae-Arbutetum andrachnes association

Quadrat no.	128	129	130	131	132	133	134	135	136	137	138	F r e q u e n c y	P r e s e n c e
Size of quadrat (m ²)	400	400	400	400	400	400	400	400	400	500	500		
Altitude (m)	400	400	450	450	500	500	400	400	400	500	500		
Exposure	S	S	S	S	SE	SE	S	S	S	SE	SE		
Inclination (%)	40	30	30	30	40	40	40	40	30	40	40		
Height of the shrub layer (m)	3	3	3	3	4	4	3	3	3	2	3		
Coverage of the shrub layer (%)	90	80	80	80	90	80	90	90	80	90	90		
Height of the herb layer (cm)	40	30	30	30	45	45	30	40	40	30	30		
Coverage of the herb layer (%)	30	10	20	20	40	30	20	20	20	10	10		
Characteristic and differential species of the association													
<i>Arbutus andrachne</i>	43	44	44	44	44	43	44	43	43	44	44	100	V
<i>Cotinus coggyria</i>	12	12	22	12	12	+2	12	22	+2	12	12	100	V
Characteristic species of Qercetea (etalia) ilicis													
<i>Pistacia terebinthus subsp. palaestina</i>	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	91	V
<i>Phillyrea latifolia</i>	.	.	+1	.	+1	+1	+1	+1	.	+1	+1	64	IV
<i>Anarrhinum orientale</i>	+1	+1	+1	.	.	.	+1	.	.	.	+1	45	III
<i>Rubia tenuifolia</i>	+1	.	.	.	+1	.	+1	+1	.	.	.	36	II
<i>Thymbra spicata var. spicata</i>	.	.	.	+2	.	.	.	.	+2	.	.	27	II
<i>Jasminum fruticans</i>	.	.	+2	.	.	+2	.	.	.	.	+2	27	II
<i>Pinus brutia</i>	.	+1	.	.	.	.	+1	.	.	.	.	18	I
Characteristic species of Cisto-Micromerietae													
<i>Psoralea bituminosa</i>	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	91	V
<i>Cistus creticus</i>	+2	+2	.	+2	+2	+2	+2	12	+2	.	+2	82	V
<i>Origanum vulgare subsp. viride</i>	+1	.	+1	+1	.	+1	+1	+1	.	+1	+1	73	IV
<i>Fumana arabica</i>	+1	+1	.	.	.	.	+1	.	+1	+1	+1	55	III
<i>Salvia tomentosa</i>	.	+1	.	.	.	.	.	+1	+1	+1	+1	45	III
<i>Micromeria myrtifolia</i>	.	.	+1	.	+1	.	+1	.	.	.	.	27	II
												27	II
Characteristic species of Quercetea pubescentis													
<i>Quercus infectoria subsp. boissieri</i>	+1	+2	.	+2	.	+1	.	+2	+2	+2	+2	73	IV
<i>Dorycnium graecum</i>	+2	+2	+2	.	+2	.	.	+2	+2	+2	+2	73	IV
<i>Polygala supina</i>	.	+1	.	.	+1	.	.	+1	+1	+1	+1	55	III
<i>Coronilla scorpioides</i>	.	+1	.	+1	.	+1	+1	.	+1	.	+1	45	III
<i>Acinos rotundifolia</i>	+1	.	.	+1	.	+1	.	.	.	.	.	27	II
<i>Colutea cilicica</i>	.	.	.	.	.	.	+1	.	+1	+1	.	27	II
<i>Alyssum strigosum</i>	.	.	+1	.	+1	.	.	.	+1	.	.	27	II
Characteristic species of Astragalo-Brometea													
<i>Teucrium polium</i>	+2	.	+1	+2	+1	+1	+2	+2	.	+1	+1	82	V
<i>Linum hirsutum subsp. anatolicum</i>	11	11	.	.	11	+1	+1	+1	+1	+1	+1	82	V
<i>Cryspogon gryllus subsp. gryllus</i>	+1	+1	+1	+1	+1	+1	+1	.	+1	.	+1	82	V
<i>Teucrium chamaedrys</i>	.	.	.	+1	+1	+1	+1	.	+1	+1	+1	64	V
<i>Hedysarum varium</i>	.	+2	.	+2	+2	.	+2	.	+2	+2	.	55	III
<i>Anthemis tinctoria</i>	+1	+1	+1	.	.	.	.	+1	.	+1	.	45	III
<i>Helianthemum nummularium</i>	+1	.	+1	+1	.	+1	.	.	.	.	.	36	II
<i>Veronica multifida</i>	.	.	.	.	+2	.	+2	.	.	+2	.	27	II
<i>Koelaria cristata</i>	.	.	.	+1	.	.	.	+1	.	.	+1	27	II
<i>Filago eriocephala</i>	.	+1	.	.	.	.	+1	.	+1	.	.	27	II
<i>Globularia trichosantha</i>	.	.	+1	+1	.	.	.	+1	.	.	.	27	II
<i>Centaurea consanguinea</i>	.	.	+1	.	.	.	.	.	.	+1	+1	27	II
Companions													
<i>Linum tenuifolium</i>	+1	+1	+1	.	+1	+1	.	+1	.	+1	+1	73	IV
<i>Genista albida</i>	+1	+1	+1	.	+1	.	+1	.	+1	.	+1	64	II
<i>Pterocephalus plumosus</i>	+1	.	+1	+1	.	+1	.	.	+1	.	+1	55	III
<i>Astragalus supruneri</i>	+1	.	+1	.	.	+1	+1	+1	.	.	+1	55	III
<i>Linum corymbulosum</i>	.	+1	+1	.	+1	+1	.	.	+1	+1	.	55	III
<i>Ononis viscosa subsp. brevifolia</i>	.	+1	.	.	.	.	.	+1	+1	+1	+1	45	III

Table - 2 Continued...



<i>Verbascum oocarpum</i>	+1	+1	.	.	+1	.	.	.	+1	+1	.	45	III
<i>Astragalus sigmoideus</i>	+1	.	+1	.	+1	+1	.	.	.	.	.	36	II
<i>Myosotis ramosissima</i>	.	.	.	+1	.	+1	+1	+1	.	.	.	36	II
<i>Andrachne telephioides</i>	.	.	.	.	+1	.	.	.	+1	.	+1	27	II
<i>Scutellaria salviifolia</i>	.	.	.	.	.	+1	+1	.	+1	.	.	27	II
<i>Muscari aucheri</i>	+1	.	+1	.	+1	.	.	.	.	.	.	27	II
<i>Johrenia tortuosa</i>	.	.	.	+1	.	.	+1	+1	.	.	.	27	II
<i>Silene otites</i>	.	.	.	+1	.	.	+1	.	.	+1	.	27	II
<i>Trigonella lunata</i>	.	.	+1	.	+1	.	.	.	+1	.	.	27	II
<i>Trifolium campestre</i>	.	+1	.	.	.	+1	.	.	.	.	+1	27	II
<i>Lens ervoides</i>	+1	.	.	.	.	.	.	+1	.	.	+1	27	II
<i>Tragopogon aureus</i>	.	+1	.	.	.	+1	.	.	.	.	+1	27	II
<i>Galium margaceum</i>	+1	+1	.	.	.	.	.	.	.	.	.	18	I
<i>Medicago minima</i>	.	.	.	+1	.	.	.	.	.	+1	.	18	I
<i>Legousia falcata</i>	.	.	+1	.	.	.	+1	.	.	.	.	18	I

Source: Karaer et al., 1999, The number stands for Braun-Blanquet cover abundance and sociobility classes

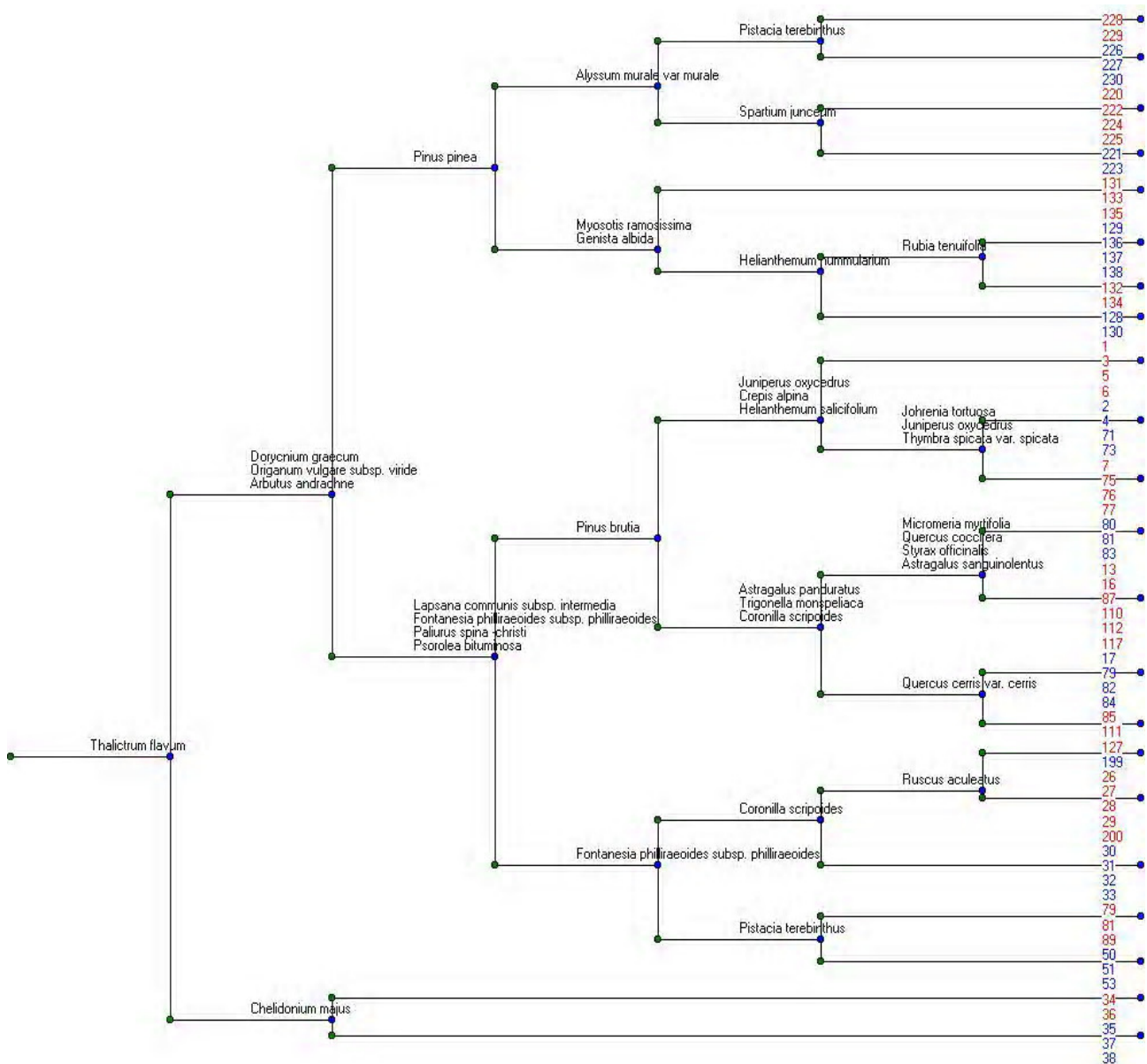


Fig. 1: TWINSpan clusters of studied quadrats. Indicator species are shown on the dendrogramme branches

Table - 3: Characteristics of *Paliuro spinae-christi* - *Fontanesietum philliraeoidis* association

Quadrat no.	26	27	28	29	30	31	32	33	199	200	Frequency	Presence
Size of quadrat (m ²)	400	400	400	400	400	400	300	300	400	400		
Altitude (m)	300	360	370	350	350	300	250	250	420	420		
Exposure	—	S	S	—	—	—	—	—	SW	SW		
Inclination (%)	—	5	5	—	—	—	—	—	10	10		
Height of the shrub layer (m)	2	2,5	2,5	2	2	2	2	2	3	3		
Coverage of the shrub layer (%)	70	60	80	60	70	70	70	60	80	60		
Height of the herb layer (cm)	30	30	25	30	20	30	20	20	30	40		
Coverage of the herb layer (%)	40	30	30	40	40	40	30	30	10	20		
Characteristic and differential species of the association												
<i>Fontanesia philliraeoides</i> subsp. <i>philliraeoides</i>	43	23	43	33	43	33	33	32	43	23	100	V
<i>Paliurus spina-christi</i>	12	32	22	32	12	23	32	22	12	33	100	V
<i>Ruscus aculeatus</i> var. <i>aculeatus</i>	12	22	12	12	12	.	12	12	.	22	90	V
<i>Nigella nigellastrum</i>	.	.	.	+1	+1	+1	.	+1	.	.	40	II
Characteristic species of Quercetea (Etalia) Ilicis												
<i>Pistacia terebinthus</i> subsp. <i>palaestina</i>	+1	11	+1	11	.	11	11	11	+1	11	90	V
<i>Jasminum fruticans</i>	+2	12	+2	+1	+1	.	.	.	+1	12	70	IV
<i>Thymbra spicata</i> var. <i>spicata</i>	.	+2	.	.	.	.	+2	.	.	+2	30	II
<i>Anarrhinum orientale</i>	.	.	.	.	.	+1	+1	.	.	.	20	II
<i>Phillyrea latifolia</i>	.	.	.	.	.	.	.	.	+1	+1	20	II
<i>Origanum vulgare</i> subsp. <i>viride</i>	+1	+1	.	.	.	.	.	.	.	.	20	II
<i>Salvia tomentosa</i>	.	.	.	+1	.	+1	.	.	.	.	20	II
Characteristic species of Quercetea Pubescentis												
<i>Juniperus oxycedrus</i> subsp. <i>oxycedrus</i>	+1	12	.	11	.	11	11	11	+1	12	80	IV
<i>Coronilla scripoides</i>	+1	+1	+1	+1	.	.	.	.	+1	+1	60	III
<i>Carpinus orientalis</i> subsp. <i>orientalis</i>	.	+1	+1	.	+1	.	.	.	+1	+1	40	II
<i>Cephalanthera rubra</i>	.	.	.	.	.	+1	+1	+1	+1	.	40	II
<i>Crataegus monogyna</i>	.	.	.	.	.	+1	.	.	+1	+1	30	II
<i>Alyssum strigosum</i>	.	+1	+1	+1	.	.	.	.	.	.	30	II
<i>Acinos rotundifolia</i>	.	.	.	.	+1	+1	+1	.	.	.	30	II
Characteristic species of Querco-Fagetea												
<i>Moehringia trinerva</i>	+1	+1	.	+1	+1	+1	+1	+1	.	.	70	IV
<i>Lapsana communis</i> subsp. <i>intermedia</i>	+1	+1	+1	.	+1	+1	+1	+1	.	.	70	IV
<i>Clinopodium vulgare</i> subsp. <i>vulgare</i>	.	.	+1	+1	.	.	+1	+1	+1	+1	60	III
<i>Agrimonia eupatoria</i>	.	+1	+1	.	.	.	.	.	+1	+1	40	II
Characteristic species of Astragalo-Brometea												
<i>Sangiosorba minor</i> subsp. <i>muricata</i>	+1	.	+1	+1	.	.	+1	+1	.	+1	60	III
<i>Centaurea triumfetii</i>	.	+1	+1	+1	.	.	.	+1	.	+1	50	III
<i>Teucrium polium</i>	.	12	12	.	12	+2	.	.	+2	.	50	III
<i>Ziziphora capitata</i>	.	.	+1	+1	+1	.	.	.	+1	.	40	II
<i>Cryspogon gryllus</i> subsp. <i>gryllus</i>	+1	.	+1	.	.	.	+1	.	.	+1	40	II
<i>Koelaria cristata</i>	+1	.	.	+1	+1	.	+1	.	.	.	40	II
<i>Paronychia kurdica</i> subsp. <i>kurdica</i>	.	.	+2	+2	.	.	+2	.	.	.	30	II
<i>Centaurea urvillei</i> subsp. <i>armata</i>	.	.	.	.	.	+1	.	+1	+1	.	30	II
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	.	+1	.	.	.	.	.	+1	.	+1	30	II
<i>Trifolium stellatum</i>	.	.	.	.	+1	.	+1	+1	.	.	30	II
<i>Veronica multifida</i>	+1	.	.	.	.	+1	.	.	.	+1	30	II
<i>Ajuga chamaepithys</i> subsp. <i>chia</i>	.	.	+1	+1	.	.	.	+1	.	.	30	II
<i>Filago eriocephala</i>	.	.	+1	.	.	.	+1	.	+1	.	30	II
<i>Anthemis tinctoria</i>	.	+1	.	.	+1	.	.	.	.	+1	30	II
Companions												
<i>Geranium molle</i>	+1	+1	.	+1	+1	+1	+1	+1	.	+1	80	IV
<i>Medicago minima</i>	+1	+1	+1	+1	.	+1	.	.	+1	+1	70	IV

Table - 3 Continued.....

<i>Trifolium campestre</i>	+1	+1	+1	+1	.	+1	.	.	+1	+1	70	IV
<i>Potentilla recta</i>	+1	.	.	+1	+1	.	+1	+1	.	+1	60	III
<i>Cynosurus cristatus</i>	+1	+1	+1	+1	.	+1	+1	.	.	60	III	
<i>Silene alba</i>	.	.	+1	+1	+1	.	.	+1	.	+1	60	III
<i>Trifolium physodes</i>	.	+1	.	.	.	+1	+1	+1	+1	+1	60	III
<i>Bromus diandrus</i>	+1	+1	.	+1	.	+1	.	.	+1	+1	60	III
<i>Lathyrus aphaca</i> var. <i>aphaca</i>	.	.	+1	+1	+1	.	+1	.	+1	.	50	III
<i>Cerastium glomeratum</i>	+1	+1	.	+1	.	.	.	+1	.	+1	50	III
<i>Allium scrodoprasum</i> subsp. <i>jajlei</i>	.	.	+1	+1	+1	+1	.	.	.	+1	50	III
<i>Crepis foetida</i> subsp. <i>foetida</i>	.	+1	.	.	+1	+1	+1	+1	.	.	50	III
<i>Senecio vernalis</i>	.	.	.	.	+1	+1	+1	+1	+1	.	50	III
<i>Dactylis glomerata</i>	.	.	+1	.	.	.	+1	+1	+1	+1	50	III
<i>Pteroccephalus plumosus</i>	+1	+1	.	.	.	+1	.	.	+1	+1	50	III
<i>Crepis alpina</i>	+1	+1	.	.	+1	+1	.	.	.	+1	50	III
<i>Rubus canescens</i>	.	+2	.	.	.	.	+2	+2	.	+2	40	II
<i>Plantago lanceolata</i>	.	.	.	.	+1	.	+1	+1	+1	.	40	II
<i>Torilis arvensis</i>	.	+1	.	+1	.	+1	.	.	.	+1	40	II
<i>Centaurea erythraea</i> subsp. <i>turcica</i>	+1	.	+1	+1	.	.	.	.	.	+1	40	II
<i>Lepidium campestre</i>	.	+1	+1	+1	.	.	.	.	+1	.	40	II
<i>Mellilotus officinalis</i>	+1	+1	.	.	.	.	+1	.	+1	.	40	II
<i>Bellis perennis</i>	+1	+1	.	.	+1	+1	.	.	.	.	40	II
<i>Scabiosa columbaria</i> subsp. <i>columbaria</i>	.	.	+1	+1	+1	.	.	+1	.	.	40	II
<i>Rosa canina</i>	.	.	.	+1	.	+1	.	.	.	+1	40	II
<i>Poa trivialis</i>	.	+2	.	.	.	.	+2	.	+2	.	30	II
<i>Reseda lutea</i>	+1	.	+1	.	.	.	.	.	+1	.	30	II
<i>Verbascum orientale</i>	.	.	.	+1	+1	.	.	.	.	+1	30	II
<i>Briza media</i>	.	+1	.	+1	.	+1	.	.	.	.	30	II
<i>Setaria viridis</i>	+1	.	+1	.	.	.	.	+1	.	.	30	II
<i>Orchis tridentata</i>	.	.	.	.	+1	+1	+1	.	.	.	30	II
<i>Parietaria lusitanica</i>	.	.	.	+1	.	.	.	.	+1	+1	30	II
<i>Erodium cicutarium</i>	.	.	.	.	.	+1	.	+1	.	+1	30	II
<i>Lolium perenne</i>	+2	+2	+2	.	.	.	.	.	.	.	30	II
<i>Cynoglossum creticum</i>	.	.	.	+1	+1	.	+1	.	.	.	30	II
<i>Prunella orientalis</i>	.	+1	.	+1	.	.	.	.	+1	.	30	II

Source: (Karaer *et al.*, 1999), The number stands for Braun-Blanquet cover abundance and sociobility classes

C.C.Gmel. (Vitaceae). *Cisto-Micromerietea julinae* is represented by *C. creticus*, *O. vulgare* subsp. *viride*, *P. bituminosa* and *F. arabica*.

Astragalo microcephali-Brometea tomentelli class is represented by several species such as *T. polium*, *T. chamaedrys* subsp. *chamaedrys*, *Trifolium stellatum* L., *Onobrychis armena* Boiss. and Huet (Fabaceae), *Pilosella hoppeana*, *Helianthemum nummularium* and *Sanguisorba minor* subsp. *muricata*.

Characteristic species of *Quercetea pubescentis* are *C. orientalis* subsp. *orientalis*, *C. coggyria*, *C. nummularia*, *Dorycnium graecum* and *D. pentaphyllum*.

Quercetea (etalia) ilicis class is characterized by *R. aculeatus* var. *aculeatus*, *P. terebinthus* subsp. *palaestina*, *J. fruticans*, *P. latifolia* and *E. rigida*.

Forest vegetation:

Quercus infectoria-Pinetum brutiae: This association is widespread around Erbaa-Resadiye (Kelkit Valley), Osmancik-

Corum (Kizilirmak valley), Tasova (Yesilirmak Valley), Karabük (Yenice Valley) and Tosya-Corum (Devrez Valley).

This association consists of two subassociations as *cistetosum cretici* and *styracetosum officinalis* (Table 7). The diagnostic species of this association are *P. brutia* L. var. *brutia*, *Quercus infectoria* subsp. *infectoria* and *C. creticus*. The diagnostic species of *cistetosum cretici* and *styracetosum officinalis* are *C. creticus*, *Astragalus sanguinolentus* M. Bieb., *Astragalus viciifolius* DC., *Chamaecytisus supinus* (L.) Link (Fabaceae) and *S. officinalis* (Oleaceae), respectively. This association exhibits three vegetation layers as tree, shrub and herb layers. Total coverage and height of tree and shrub layers are 60-90,10-50% and, 5-12 m, 2-3 m, respectively. Total coverage and height of herb layer are 10-60% and 10-60 cm, respectively. Most common species in shrub layer are *Q. infectoria* subsp. *infectoria*, *J. fruticans*, *P. latifolia*, *A. andrachne*, *crenatae-Oleetum sylvestris* were related to each other according to TWINSpan. The main reason of the similarity between these

Table - 4: Characteristics of *Spiraeo crenatae* -*Oleetum sylvestris* association (Karaer et al. ass.nova)

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	F r e q u e n c y	P r e s e n c e		
Exposure	SE	SE	SE	SE	SE	SE	SE	SE	S	SW				
Inclination (%)	30	40	40	40	30	30	40	30	30	40				
Height of the shrub layer (m)	4	4	3	4	4	4	4	3	4	4				
Coverage of the shrub layer (%)	80	80	80	80	80	80	80	80	80	90				
Height of the herb layer (cm)	70	60	70	70	60	70	70	50	50	80				
Coverage of the herb layer (%)	20	25	25	20	20	30	20	20	20	25				
Characteristic and differential species of the association														
<i>Olea europae</i> var. <i>sylvestris</i>	33	33	33	33	33	33	33	33	33	43			100	V
<i>Sedum pallidum</i> var. <i>pallidum</i>	+1	+1	+1	+1	+1	+1	+1	+2	+2	+2			100	V
<i>Linum corymbulosum</i>	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	90	V		
<i>Micromeria nervosa</i>	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V		
<i>Spiraea crenata</i>	+1	+1	+1	.	+1	+1	+1	.	+1	.	70	IV		
Characteristic species of <i>Quercion calliprini</i> (*), <i>Quercion ilicis</i> (**) and <i>Quercetea ilicis</i>														
<i>Phillyrea latifolia</i>	22	22	22	22	22	22	22	22	22	22	100	V		
(*) <i>Jasminum fruticans</i>	+1	.	+1	+1	+1	+1	.	+1	.	+1	70	IV		
(*) <i>Pistacia terebinthus</i> subsp. <i>palaestina</i>	+1	+1	.	+1	+1	.	.	+1	+1	.	60	III		
<i>Ephedra major</i>	+2	+2	+2	.	.	+2	+2	.	.	.	50	III		
<i>Ruscus aculeatus</i> var. <i>angustifolius</i>	+2	.	.	+2	.	.	+2	.	.	+2	40	II		
<i>Geranium purpureum</i>	.	+1	+1	.	.	.	.	.	+1	.	30	II
<i>Pinus brutia</i> var. <i>brutia</i>	.	.	.	.	+1	.	.	.	+1	.	20	I
<i>Arbutus unedo</i>	+1	.	.	.	.	.	+1	.	.	.	20	I
Characteristic species of <i>Cisto-Micromerietea Julianae</i>														
<i>Micromeria myrtifolia</i>	+1	.	+1	.	+1	+1	+1	+1	.	.	60	III		
<i>Cistus creticus</i>	.	+2	.	.	.	.	.	.	.	+2	20	I
<i>Fumana thymifolia</i> var. <i>thymifolia</i>	+2	.	.	+2	.	.	.	.	.	.	20	I
Characteristic species of <i>Querco Pseudocerridis-Cedretalia libani</i> (*), <i>Querco - Carpinetalia Orientalis</i> (**) and <i>Quercetea Pubescentis</i>														
(*) <i>Juniperus excelsa</i> subsp. <i>excelsa</i>	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V		
<i>Buxus sempervirens</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	90	V		
<i>Lapsana communis</i> subsp. <i>intermedia</i>	.	+1	.	.	+1	+1	.	+1	.	.	40	II		
<i>Brachypodium sylvaticum</i>	.	+1	.	.	.	+1	.	.	+1	.	30	II		
(*) <i>Asyneuma limonifolium</i> subsp. <i>pestalozze</i>	.	.	.	+1	.	.	+1	.	.	+1	30	II		
(**) <i>Asyneuma rigidum</i> subsp. <i>rigidum</i>	+1	.	+1	.	.	.	.	.	+1	.	30	II
(**) <i>Clematis vitalba</i>	+1	.	.	.	+1	.	.	.	.	.	20	I
<i>Silene alba</i> subsp. <i>ericalycina</i>	.	.	+1	.	.	.	+1	.	.	.	20	I		
(*) <i>Allium stamineum</i>	.	.	.	.	.	+1	.	.	.	+1	20	I
<i>Paliurus spina-christii</i>	.	.	.	.	.	.	.	.	.	+1	10	I
Characteristic species of <i>Onobrychido armeni - Thymetalia Leucostomi</i> (*) and <i>Astragalo microcephali - Brometetea tomentelli</i>														
<i>Iberis taurica</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	90	V		
<i>Chrysopogon gryllus</i> var. <i>gryllus</i>	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	90	V		
(*) <i>Allium scrodoprasum</i> subsp. <i>rotundum</i>	.	.	.	+1	+1	+1	+1	+1	+1	.	60	III		
<i>Sideritis montana</i> subsp. <i>remota</i>	.	.	.	+1	+1	.	+1	.	+1	+1	50	III		
<i>Thymus spyleus</i> subsp. <i>rosulans</i>	+2	+2	.	.	.	.	.	.	.	+2	30	II
<i>Ziziphora capitata</i>	+1	.	.	.	.	.	.	+1	.	+1	30	II
(*) <i>Hypericum avicularifolium</i> subsp. <i>depilatum</i>	+1	+1	.	.	.	.	.	.	.	.	20	I
<i>Asyneuma limonifolium</i> subsp. <i>limonifolium</i>	.	.	+1	.	.	.	+1	.	.	.	20	I		
(*) <i>Ziziphora taurica</i> subsp. <i>taurica</i>	.	.	+1	.	.	+1	.	.	.	.	20	I
<i>Ajuga chamaeptytis</i> subsp. <i>chia</i> var. <i>chia</i>	.	+1	.	+1	.	.	.	.	.	.	20	I
<i>Melica ciliata</i> subsp. <i>ciliata</i>	+1	.	.	.	+1	.	.	.	.	.	20	I
(*) <i>Jurinea consanguinea</i>	.	.	+1	.	.	.	.	.	.	+1	20	I
<i>Lappula barbata</i>	+1	.	.	.	.	.	+1	.	.	.	20	I

Table - 4 Continued....



(*) <i>Erysimum smyrnaeum</i>	.	+1	.	.	.	.	.	.	.	+1	.	20	I
(*) <i>Alyssum pateri</i> subsp. <i>pateri</i>	.	.	.	+1	.	.	.	.	.	.	+1	20	I
<i>Potentilla recta</i>	.	.	.	.	.	.	+1	.	.	.	.	10	I
<i>Scabiosa micrantha</i>	.	.	+1	.	.	.	.	.	.	.	.	10	I
Companions													
<i>Crucianella latifolia</i>	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	100	V
<i>Parietaria lusitanica</i>	+1	.	+1	+1	+1	+1	+1	.	.	.	+1	70	IV
<i>Asplenium ruta-muraria</i>	.	+2	+2	+2	+2	+2	.	+2	+2	.	.	70	IV
<i>Ornithogalum pyrenaicum</i>	.	+1	.	+1	+1	+1	.	+1	+1	+1	.	70	IV
<i>Galium floribundum</i> subsp. <i>floribundum</i>	+1	+1	+1	+1	.	.	+1	+1	+1	.	.	70	IV
<i>Ornithogalum comosum</i>	.	.	+1	+1	.	+1	+1	.	+1	+1	.	60	III
<i>Galium verticillatum</i>	+1	+1	.	.	+1	.	.	+1	+1	+1	.	60	III
<i>Leugosia falcata</i> subsp. <i>falcata</i> var. <i>falcata</i>	.	.	+1	+1	.	+1	+1	+1	.	.	.	50	III
<i>Pimpinella peregrina</i>	+1	+1	.	.	+1	+1	.	.	+1	.	.	50	III
<i>Crucianella angustifolia</i>	.	.	+1	+1	.	.	+1	.	.	.	+1	40	II
<i>Turgeniopsis foeniculata</i>	+1	.	.	.	+1	.	+1	.	+1	.	.	40	II
<i>Galium tenuissimum</i> subsp. <i>tenuissimum</i>	.	+1	.	+1	.	.	.	.	+1	.	.	30	II
<i>Inula aschersoniana</i>	.	.	+2	.	+2	.	.	.	.	+2	.	30	II
<i>Centaurea kilea</i>	.	+2	.	+2	.	.	+2	.	.	.	.	30	II
<i>Ceterach officinarum</i>	.	.	+2	.	.	.	.	+2	+2	.	.	30	II
<i>Asplenium trichomanes</i>	+2	.	.	.	+2	+2	.	.	.	.	.	30	II
<i>Catapodium rigidum</i> subsp. <i>rigidum</i>	.	+1	.	+1	.	.	+1	.	.	.	.	30	II
<i>Trigonella spicata</i>	+1	.	.	.	.	+1	.	.	.	.	+1	30	II
<i>Buglossoides arvensis</i>	.	+1	.	.	+1	.	+1	.	.	.	.	30	II
<i>Stectorhamphus tuberosus</i>	.	.	+1	+1	.	.	.	.	.	+1	.	30	II
<i>Allium paniculatum</i> subsp. <i>paniculatum</i>	+1	.	.	.	.	+1	.	+1	.	.	.	30	II
<i>Alyssum hirsutum</i> var. <i>hirsutum</i>	.	+1	.	.	+1	.	.	.	.	.	+1	30	II
<i>Melilotus alba</i>	.	.	+1	+1	.	.	.	.	.	.	.	20	I
<i>Papaver lacerum</i>	.	.	.	.	.	+1	.	+1	.	.	.	20	I

* = Holotype quadrat number, The number stands for Braun-Blanquet cover abundance and sociobility classes

associations is the representation of *Astragalo microcephali-Brometea tomentelli* class (Pignatti, 1978; Quezel *et al.*, 1980). The representation of this class is indicated the influences of antropogenic factors in the study area. *Sideritio dichotomae - Quercetum cocciferae*, *Paliuro spinae-christi- Fontanesietum philliraeoidis* and *Spiraeo crenatae -Oleetum sylvestris* are formed as a result of the destruction of *Quercus infectoriae-Pinetum brutiae* (Karaer *et al.*, 1999). However, according to TWINSPAN, DCA and CA *Buxo sempervirenti-Arbutetum unedonis* association was not related to the other associations. This association is occurred very locally in the study area and species diversity was a bit low as compared to other associations. The results of DCA were agreed with TWINSPAN (Fig. 1, 2). According to CA *Paliurus spinae-christi-Fontanesietum philliraeoidis*, *Spiraeo crenatae -Oleetum sylvestris* and *Crucianello ponticae-Pinetum pinae* were occurred in the negative zone. The other four associations were occurred in the positive zone (Fig. 3).

The associations described in this study should be included in *Quercetea (etalia) ilicis* class due to the floristic composition of these associations and in the light of other studies (Akman *et al.*, 1978; Quézel *et al.*, 1978; Quezel *et al.*, 1980; Karaer *et al.*, 1999; Varol *et al.*, 2003). However, in degraded parts the components of steppic *Astragalo microcephali-Brometea tomentelli* class were highly represented. The destruction of *P. brutia* forests leads to the

formation of maquis communities firstly and further destruction leads to the formation of phrygana communities. The destruction of phrygana communities was resulted in the formation of steppic communities. Maquis and phrygana communities are proclimatic vegetation phases which can be interpreted as disclimaxes (Pignatti, 1978).

The percentages of Raunkiaer's life forms were shown in Table 8. The percentage of the therophytes was higher as compared to the other life forms in *Cotino coggyrae-Arbutetum andrachnes* and *Paliuro spinae-christi- Fontanesietum philliraeoidis*. Hemicryptophytes were dominant in *Buxo sempervirenti-Arbutetum unedonis* and *Quercus infectoriae-Pinetum brutiae*. The percentages of cryptophytes were higher in *Sideritio dichotomae-Quercetum cocciferae* and *Crucianello ponticae- Pinetum pinae*. *Spiraeo crenatae-Oleetum sylvestris* was higher in phanerophytes. Raunkiaer's life forms are based on bud position in respect to overwintering strategies. However, the current use of life forms does not reflect the original assumptions of the Raunkiaer buds position typology; in fact life forms are largely applied to the definition of plant dimensions, growth patterns and regeneration strategies (Blasi *et al.*, 1990). Life forms show a clear and continuous gradient of variation within the frame of Mediterranean sclerophyllous forests. No geographical pattern can be detected and the physiological differences have to be related mainly to the dynamical status (Blasi

Table - 5: Characteristics of *Buxo sempervirenti*-*Arbutetum unedonis* association (Karaer et al.ass.nova)

Quadrat no.	1	2	3	4 *	5	6	7	8	9	10	Frequency	Presence
Size of quadrat (m ²)	400	400	400	400	400	400	400	400	400	400		
Altitude (10 m)	300	300	310	350	350	350	300	400	400	400		
Exposure	NW	NW	N	NW	NW	NW	N	NW	NW	NW		
Inclination (%)	40	45	50	50	40	30	30	30	30	30		
Height of the shrub layer (m)	3	4	4	3	4	4	3	3	4	4		
Coverage of the shrub layer (%)	80	70	80	80	80	80	80	80	80	70		
Height of the herb layer (cm)	60	70	60	70	60	60	50	40	45	25		
Coverage of the herb layer (%)	20	20	20	25	25	20	25	20	20	25		
Characteristic and differential species of the association												
<i>Arbutus unedo</i>	33	33	43	43	44	33	33	33	33	43	100	V
<i>Ligustrum vulgare</i>	+1	+1	+1	+1	+1	.	.	+1	+1	+1	80	IV
<i>Coronilla emerus subsp. emeroides</i>	.	.	+1	+1	.	+1	+1	+1	+1	+1	70	IV
<i>Vincetoxicum fuscum subsp. boissieri</i>	.	+1	+1	+1	.	+1	.	+1	+1	+1	70	IV
<i>Sedum album</i>	+1	+1	+1	+1	+1	.	+1	.	+1	.	70	IV
Characteristic species of Quercion calliprini (*), Quercion ilicis (**), Quercetalia ilicis and Quercetea ilicis												
<i>Ruscus aculeatus var. angustifolius</i>	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	100	V
(*) <i>Phillyrea latifolia</i>	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V
(*) <i>Pistacia terebinthus subsp. palaestina</i>	+1	.	.	+1	+1	+1	.	+1	.	+1	60	III
(**) <i>Jasminum fruticans</i>	+1	+1	+1	+1	+1	.	+1	.	.	.	60	III
<i>Juniperus oxycedrus subsp. oxycedrus</i>	+1	+1	+1	+1	.	.	.	.	.	+1	50	III
<i>Ephedra major</i>	+2	+2	.	+2	+2	.	.	.	.	+2	50	III
<i>Euphorbia rigida</i>	+1	.	.	+1	.	.	+1	.	+1	+1	50	III
<i>Olea europaea var. sylvestris</i>	+1	+1	+1	.	.	.	.	.	+1	.	40	II
<i>Geranium purpureum</i>	.	.	.	.	.	.	.	+1	+1	.	20	I
<i>Pinus brutia</i>	.	.	+1	.	.	.	.	.	.	.	10	I
Characteristic species of Carpino betuli - Acerion hyrcani (*), Quercus Cerridis - Carpinetalia orientalis (**), Quercus pseudocerridis - Cedretalia libani (***) and Quercetea pubescentis												
<i>Buxus sempervirens</i>	22	22	22	22	22	22	22	22	22	22	100	V
<i>Dictamnus albus</i>	+2	+2	+1	+2	+2	+1	+1	+1	.	+1	90	V
<i>Silene alba subsp. eriocalycina</i>	+1	.	.	.	+1	+1	.	+1	+1	+1	60	III
<i>Chelidonium majus</i>	.	.	.	+1	.	+1	+1	+1	+1	50	III	
(***) <i>Juniperus excelsa subsp. excelsa</i>	+1	+1	+1	+1	.	.	.	.	.	.	40	II
(*) <i>Carpinus orientalis subsp. orientalis</i>	.	.	+1	+1	.	.	.	.	.	+1	30	II
<i>Euonymus verrucosus</i>	+1	.	+1	.	.	.	.	.	.	.	20	I
(**) <i>Clematis vitalba</i>	.	.	.	.	+1	.	.	+1	.	.	20	I
<i>Amelanchier rotundifolia subsp. rotundifolia</i>	.	.	+1	+1	.	.	.	.	.	.	20	I
(*) <i>Cyclamen coum var. coum</i>	+1	+1	.	.	.	.	.	.	.	.	20	I
(**) <i>Sorbus torminalis var. torminalis</i>	.	.	+1	.	.	.	.	.	.	+1	20	I
<i>Galium rivale</i>	+1	.	.	.	.	.	.	+1	.	.	20	I
Characteristic species of Quercus-fagerea												
<i>Athyrium filix-foemina</i>	+1	+1	.	+1	.	+1	+1	.	+1	+1	70	IV
<i>Hedera helix</i>	.	.	.	.	+1	.	.	+1	+1	.	30	II
Characteristic species of Astragalo microcephali - Brometea tomentelli												
<i>Centaurea inermis</i>	+1	.	+1	.	.	+1	+1	+1	.	.	50	III
(**) <i>Teucrium chamaedrys subsp. chamaedrys</i>	+2	.	.	+2	.	.	+2	.	+2	+2	50	III
<i>Alyssum sibiricum</i>	.	.	+1	.	.	.	+1	+1	.	+1	40	II
<i>Veronica multifida</i>	.	+1	.	.	.	+1	.	.	.	.	20	II
<i>Chrysopogon gryllus var. gryllus</i>	.	+1	.	.	.	.	.	.	.	.	10	I
<i>Thymus spylaeus subsp. rosulans</i>	.	.	.	.	.	+1	.	.	.	.	10	I
Companions												
<i>Asplenium trichomanes</i>	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	90	V
<i>Galium verticillatum</i>	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	90	V
<i>Parietaria lusitanica</i>	+1	+1	.	+1	+1	+1	.	+1	+1	+1	80	IV

Table - 5 Continued....



<i>Sideritis taurica</i>	.	+1	+1	+1	.	.	+1	+1	.	+1	60	III
<i>Polygonatum orientale</i>	.	.	+1	.	.	+1	+1	+1	+1	+1	60	III
<i>Arabis turrata</i>	+1	.	.	.	+1	+1	+1	.	+1	.	50	III
<i>Botriochloa ischaemum</i>	+1	.	.	+1	.	+1	.	+1	.	+1	50	III
<i>Geranium molle</i> subsp. <i>molle</i>	+1	.	.	.	.	+1	+1	.	.	.	30	II
<i>Fumaria officinalis</i>	.	.	.	.	+1	.	+1	+1	.	.	30	II
<i>Papaver rhoeas</i>	.	.	.	.	+1	.	+1	+1	.	.	30	II
<i>Crucianella latifolia</i>	+1	+1	.	.	.	.	+1	.	.	.	30	II
<i>Aubretia canescens</i> subsp. <i>canescens</i>	.	.	+1	+1	.	.	.	+1	.	.	30	II
<i>Allium atrovioleucum</i>	.	+1	+1	.	.	+1	.	.	.	.	30	II
<i>Valeriana dioscoridis</i>	.	.	.	.	+1	.	.	.	+1	.	20	I
<i>Haplophyllum armenum</i>	+1	.	.	.	.	.	+1	.	.	.	20	I
<i>Trachynia distachya</i>	.	.	.	+1	.	.	.	.	+1	.	20	I
<i>Aristolochia parvula</i>	+1	.	.	.	.	.	.	.	+1	.	20	I
<i>Rosa canina</i>	.	+1	.	.	.	.	.	.	.	.	10	I
<i>Polypodium australe</i>	.	.	.	.	+1	.	.	.	.	.	10	I
<i>Galium floribundum</i> subsp. <i>floribundum</i>	.	.	+1	.	.	.	.	.	.	.	10	I
<i>Geranium lucidum</i>	.	.	.	.	.	+1	.	.	.	.	10	I
<i>Linaria kurdica</i> subsp. <i>kurdica</i>	.	.	.	.	.	.	.	.	+1	.	10	I
<i>Minuartia micrantha</i>	.	.	.	+1	.	.	.	.	.	.	10	I

* = Holotype quadrat number, The number stands for Braun-Blanquet cover abundance and sociability classes

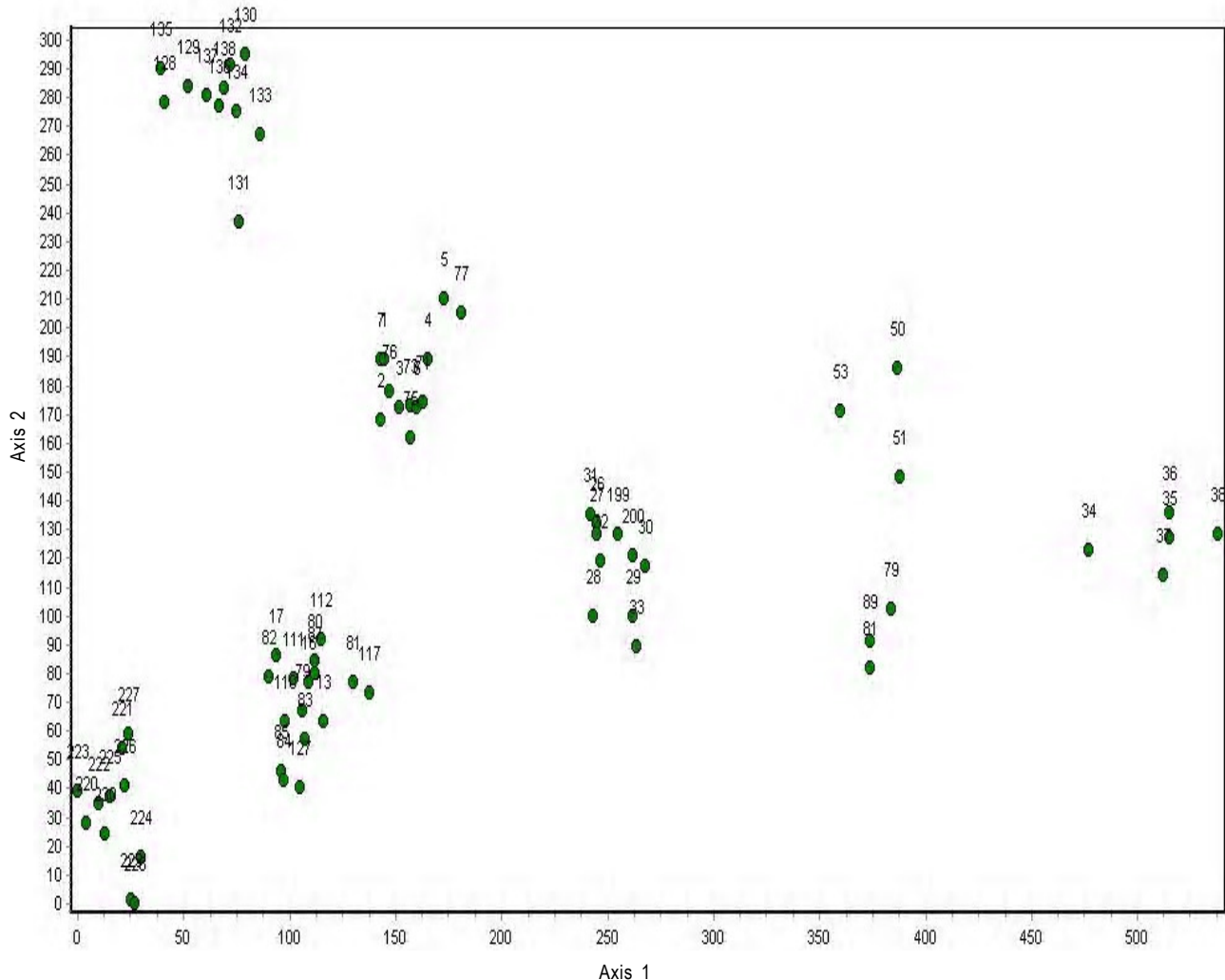


Fig. 2: DCA ordination diagram of the studied quadrats

Table - 6: Characteristics of *Crucianello ponticae-Pinetum pineae* association

Quadrat no.	220	221	222	223	224	225	226	227	228	229	230	Frequency	Presence	
Size of quadrat (m ²)	300	300	400	400	400	400	400	400	400	400	400			
Altitude (m)	450	430	410	410	350	350	350	350	330	330	350			
Exposure	S	S	S	SE	SE	SE	E	SE	E	E	E			
Inclination (%)	45	40	30	30	40	45	50	50	60	60	80			
Height of the tree layer (m)	8	8	10	10	10	10	15	15	15	15	15			
Coverage of the tree layer (%)	40	45	55	55	65	65	60	60	70	70	40			
Height of the shrub layer (m)	1	1	1	1	1	1	1	2	2	2	2			
Coverage of the shrub layer (%)	60	60	70	70	60	50	60	60	70	70	50			
Height of the herb layer (cm)	30	40	50	40	40	40	30	40	40	30	40			
Coverage of the herb layer (%)	60	60	60	50	60	60	50	50	50	50	50			
Characteristic and differential species of the association														
<i>Pinus pineae</i>	23	23	23	23	33	33	23	23	33	33	22	100	V	
<i>Crucianella gillani</i> subsp. <i>pontica</i>	21	21	21	.	22	.	11	11	11	11	11	91	V	
	alyssetosum murelae						chamaecytisetosum hirsutae							
<i>Alyssum murale</i> var. <i>murale</i>	22	+2	22	12	12	12	.	.	.	.	.	55	III
<i>Spartium junceum</i>	12	.	12	.	12	12	.	.	.	.	.	37	II
<i>Satureja spicigera</i>	+2	+2	.	+2	+2	.	.	.	.	.	.	37	II
<i>Chamaecytisus hirsutus</i>	.	.	.	.	.	.	+1	+1	+1	+1	+1	46	III
<i>Punica granatum</i>	.	.	.	.	.	.	+1	.	+1	+1	+1	37	II
<i>Sempervivum glabrifolium</i>	.	.	.	.	.	.	+1	+1	.	.	+1	28	II
<i>Silene armeria</i>	.	.	.	.	.	.	+1	.	+1	.	+1	28	II
Characteristic species of Quercetea (etalia) ilicis														
<i>Arbutus andrachne</i>	+2	+2	+1	+2	.	+2	22	22	12	12	+1	73	IV	
<i>Rhus coriaria</i>	.	+1	+1	+1	+1	+1	+1	.	+1	.	+1	73	IV	
<i>Juniperus oxycedrus</i>	.	+2	+2	.	+1	+2	+1	.	+2	+1	+2	73	IV	
<i>Pistacia terebinthus</i>	.	+1	+1	.	+1	+1	.	.	+1	+1	.	55	III	
<i>Cistus salviifolius</i>	.	+2	+2	+2	.	.	+2	.	12	+2	.	55	III	
<i>Ruscus aculeatus</i>	+2	.	+1	.	+1	.	+1	+2	.	.	.	46	III	
<i>Euphorbia rigida</i>	.	.	.	.	.	.	+1	+1	.	+1	+1	37	II
<i>Vitis sylvestrtris</i>	.	.	.	.	.	.	.	.	+1	+1	+1	28	II
Characteristic species of Cisto-Micromerietae														
<i>Cistus creticus</i>	22	22	32	22	22	21	23	23	23	22	22	100	V	
<i>Origanum vulgare</i> subsp. <i>viride</i>	+1	+1	+1	+1	+1	+1	+1	+1	.	.	+1	82	V	
<i>Psoralea bituminosae</i>	.	+1	+1	+1	+1	+1	+1	+1	.	.	+1	73	IV	
<i>Fumana arabica</i>	+1	+1	+1	.	.	+1	+1	+1	.	.	+1	64	IV	
Characteristic species of Astragal-Brometea														
<i>Teucrium polium</i>	+2	+2	+2	+2	+2	+2	.	+2	+2	+2	+2	91	V	
<i>Teucrium chamaedrys</i> subsp. <i>chamaedrys</i>	+2	+2	+2	+2	+2	+2	+2	+2	.	.	+2	82	V	
<i>Trifolium stellatum</i>	+1	+1	+1	+1	.	+1	+1	.	+1	+1	.	73	IV	
<i>Pilosella hoppeana</i>	+1	+1	+1	+1	.	.	+1	.	+1	+1	.	64	IV	
<i>Helianthemum nummularium</i>	.	.	.	+1	.	.	+1	.	+1	+1	.	55	III	
<i>Onobrychis armena</i>	.	.	.	+1	+1	+1	.	.	+1	+1	.	46	III	
<i>Sanguisorba minor</i>	+1	+1	.	.	+1	.	+1	+1	.	.	.	46	III	
Characteristic species of Quercetea pubescentis														
<i>Dorycnium graecum</i>	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	73	IV	
<i>Coronilla orientalis</i>	+1	+1	+1	.	+1	+1	.	.	+1	+1	.	64	IV	
<i>Cotinus coggyria</i>	.	+1	+1	.	.	.	+1	+1	.	.	+1	46	III	
<i>Cotoneaster nummularia</i>	.	.	.	.	+1	.	+1	+1	.	.	+1	37	II
<i>Dorycnium pentaphyllum</i>	.	+1	+1	+1	.	.	.	.	.	+1	.	37	II
<i>Carpinus orientalis</i>	.	.	.	.	+1	.	+1	.	+1	.	.	28	II
Companions														
<i>Petrorhagia saxifraga</i>	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	91	V	
<i>Sedum pallidum</i>	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	.	82	V	

Table - 6 Continued....

<i>Trifolium campestre</i>	+1	.	+1	+1	+1	+1	.	+1	+1	+1	+1	82	V
<i>Galium odoratum</i>	+1	.	+1	+1	+1	+1	+1	+1	.	.	+1	73	IV
<i>Brachypodium pinnatum</i>	11	.	+1	+1	+1	+1	+1	+1	.	.	+1	73	IV
<i>Arceuthobium oxycedri</i>	.	+2	+2	.	+2	+2	+2	.	+2	+2	+2	73	IV
<i>Dactylis glomerata</i>	+1	.	+1	+1	+1	+1	.	.	+1	+1	.	64	IV
<i>Scabiosa columbaria</i>	+1	+1	+1	+1	+1	.	+1	+1	.	.	.	64	IV
<i>Medicago xvaria</i>	.	+1	+1	+1	+1	+1	.	.	+1	+1	.	64	IV
<i>Trifolium arvense</i>	.	+1	.	+1	+1	.	.	.	+1	+1	+1	55	IV
<i>Convolvulus cantabrica</i>	+1	11	11	.	+1	+1	.	.	.	.	+1	55	III
<i>Rosa canina</i>	.	.	+2	+2	+2	.	.	+2	.	+2	.	46	III

Source: Varol *et al.*, 2003, The number stands for Braun-Blanquet cover abundance and sociobility classes

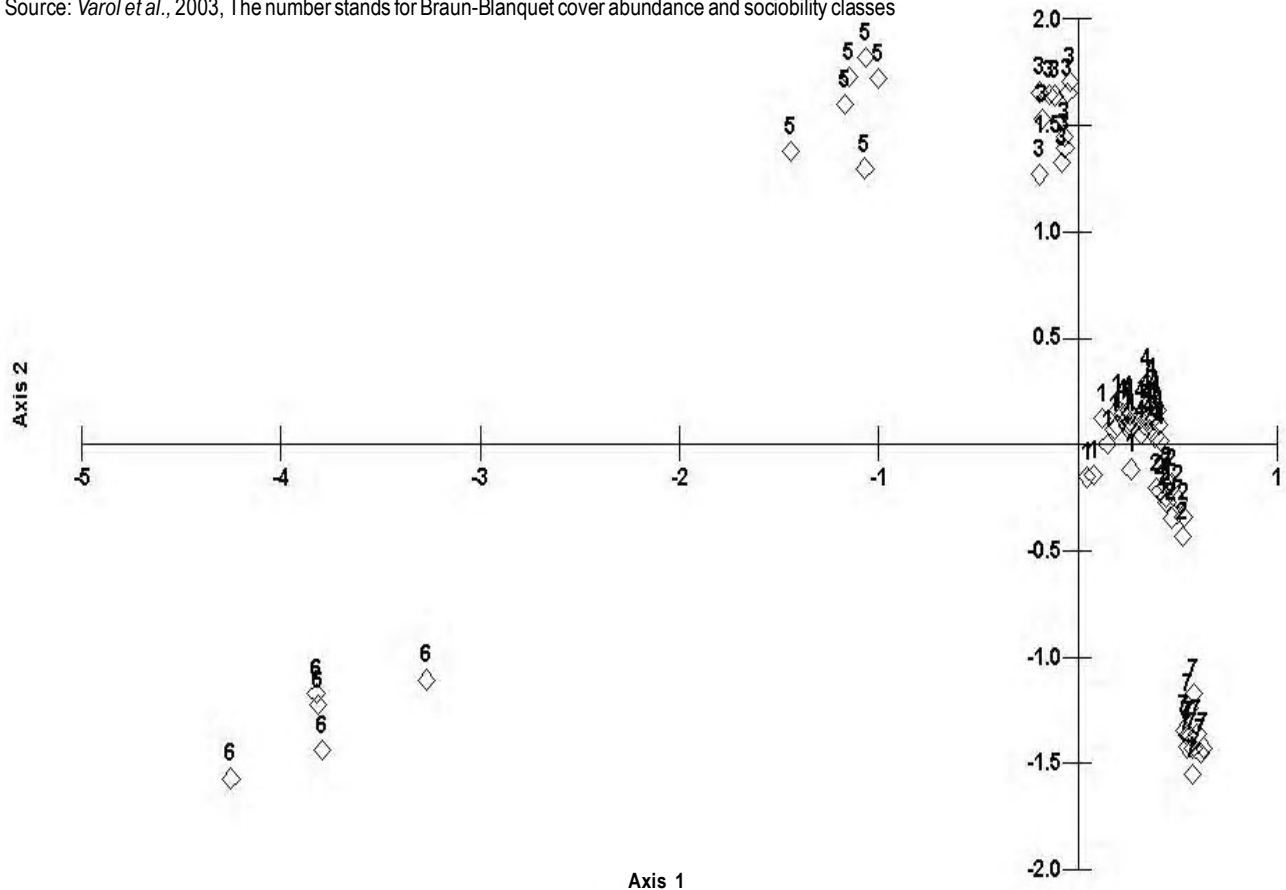


Fig. 3: Evaluation of associations by correspondence analysis

(1= *Siderito dichotomae-Quercetum cocciferae*, 2= *Spiraeo crenatae-Oleetum sylvestris*, 3= *Cotino coggyrae-Arbutetum andrachnes*, 4= *Buxo sempervirenti-Arbutetum unedonis*, 5= *Paliuro spiniae-christi-Fontanesietum philliraeoidis*, 6= *Quercu infectoriae-Pinetum brutiae*, 7= *Crucienello ponticae-Pinetum pineae*)

et al., 1990). It was stated that higher representation of hemicryptophytes was related to forest maturation and higher representation of therophytes indicating the canopy openness (Barbero *et al.*, 1989). Our results were agreed with the results of Barbero *et al.* (1989) because of the higher representation of therophytes in very disturbed associations like *Cotino coggyrae-Arbutetum andrachnes* and *Paliuro spiniae-christi-Fontanesietum philliraeoidis* and hemicryptophytes in climax associations like *Quercu infectoriae-Pinetum brutiae* and *Crucienello ponticae-Pinetum pineae*, respectively. The higher representation of cryptophytes and phanerophytes in *Siderito dichotomae-Quercetum cocciferae* and *Spiraeo crenatae-Oleetum sylvestris*, respectively may be explained on the basis of the effect of long term disturbances or the permanent-

community characteristics such as topographic and site heterogeneity (Blasi *et al.*, 1990). In general, species diversity is high in all of the associations (Dooley and Collins, 1984) and this may be due to long term disturbances or the permanent-community characteristics such as topographic and site heterogeneity and canopy openness may lead to the increase in the number of light-tolerant species (Burrows, 1990).

The highest species diversity was found in *Crucienello ponticae-Pinetum pineae*, while the lowest species diversity was found in *Spiraeo crenatae-Oleetum sylvestris*. Evenness values were much similar to each other in all of the associations (Table 9). The lowest species diversity was found in *Spiraeo crenatae -*

Table - 7: Characteristics of Quercus infectoria-Pinetum brutiae association

Quadrat no.	13	16	17	85	87	110	111	112	127	79	80	81	82	83	84	117		
Size of quadrat (m ²)	400	400	400	600	600	400	400	400	400	400	400	800	800	800	800	400		
Altitude (m)	350	400	400	400	400	450	450	450	500	400	400	450	450	450	450	550		
Exposure	S	S	S	SW	SW	S	S	S	S	S	S	S	S	S	S	SE		
Inclination (%)	40	45	30	25	30	20	40	40	10	20	25	30	20	20	30	30		
Height of the tree layer (m)	5	8	7	6	10	10	10	12	12	8	10	10	10	8	8	10		
Coverage of the tree layer (%)	60	70	80	85	90	80	90	80	90	90	70	80	80	80	85	70		
Height of the shrub layer (m)	2	2	3	2	2	3	3	2	3	2	3	3	2	2	3	2		
Coverage of the shrub layer (%)	30	20	10	20	10	20	20	20	10	20	30	30	20	30	50	30		
Height of the herb layer (cm)	30	30	20	30	25	30	30	20	25	30	25	30	40	30	20	30		
Coverage of the herb layer (%)	20	30	25	20	20	20	30	20	30	20	30	30	25	30	25	20		
Characteristic and differential species of the association																		
<i>Pinus brutia</i>	33	33	43	44	44	44	43	44	44	44	33	43	43	43	44	33	100	V
<i>Quercus infectoria subsp. infectoria</i>	+2	22	12	+2	12	12	22	.	12	12	+2	12	12	12	+2	22	94	V
Characteristic species of subass.																		
	cistetosum cretici								styracetosum officinalis									
<i>Cistus creticus</i>	22	12	12	12	.	12	12	.	+2	.	.	.	+2	.	.	.	50	III
<i>Astragalus sanguinolentus</i>	11	+2	.	11	+2	11	.	+1	+1	.	.	.	.	.	.	.	44	III
<i>Astragalus viciifolius</i>	11	+1	+1	.	.	.	11	11	+1	.	.	.	.	+1	.	.	44	III
<i>Styrax officinalis</i>	.	.	.	.	.	.	.	.	.	12	22	22	22	22	22	22	44	III
<i>Chamaecytisus supinus</i>	.	.	.	.	+2	.	.	.	.	.	12	12	12	12	.	+2	31	II
<i>Pistacia terebinthus subsp. palaestina</i>	+1	11	11	+1	11	+1	11	11	+1	11	.	11	11	11	.	11	88	IV
<i>Rubia tenuifolia</i>	+1	.	+1	.	+1	+1	.	.	+1	.	.	.	+2	.	+2	.	44	III
<i>Phillyrea latifolia</i>	.	+1	.	.	.	.	.	+1	.	.	11	11	.	.	.	11	31	II
<i>Ruscus aculeatus</i>	.	.	.	.	+2	.	.	.	12	12	.	.	.	.	12	12	31	II
<i>Thymbra spicata var. spicata</i>	+2	+2	+2	.	.	.	.	.	.	.	+2	.	.	.	.	.	25	II
<i>Arbutus andrachne</i>	.	.	.	.	.	+1	.	+1	.	.	.	.	.	.	.	+1	19	I
<i>Putoria calabrica</i>	.	.	.	+2	.	.	+2	.	.	.	.	.	.	.	.	.	13	I
<i>Quercus coccifera</i>	.	.	.	.	.	.	.	.	.	.	.	+2	.	+2	.	.	13	I
Characteristic species of Cisto-micromerietae																		
<i>Salvia tomentosa</i>	11	11	.	.	+1	.	11	+1	+1	.	11	+1	+1	+1	+1	.	69	IV
<i>Psoralea bituminosa</i>	+1	.	.	+1	+1	+1	+1	+1	.	+1	.	.	+1	+1	+1	+1	69	IV
<i>Fumana arabica</i>	.	.	+1	+1	.	.	+1	.	+1	.	+1	+1	.	.	.	.	38	II
<i>Micromeria myrtifolia</i>	+1	+1	+1	.	+1	.	.	.	.	.	.	.	+1	.	.	+1	38	II
Characteristic species of Quercus-cedretalia libani																		
<i>Coronilla scripoides</i>	.	.	+1	+1	.	.	+1	+1	.	+1	.	.	+1	.	+1	.	44	III
<i>Dorycnium pentaphyllum</i>	.	.	.	.	+2	.	12	.	+1	.	12	.	.	.	.	12	31	II
<i>Cotoneaster nummularia</i>	+2	.	.	.	.	+2	.	.	.	.	+2	.	.	+2	.	.	25	II
<i>Alyssum strigosum</i>	.	.	+1	.	.	.	+1	+1	.	.	.	.	.	.	+1	.	25	II
<i>Bunium microcarpum subsp. bourgaei</i>	.	.	.	.	.	.	.	+1	.	.	.	+1	.	.	.	.	13	I
Characteristic species of Quercus-carpinetalia orientalis (*) and Quercetea pubescentis																		
<i>Juniperus oxycedrus subsp. oxycedrus</i>	12	+2	.	.	+2	12	12	.	12	12	12	.	+2	.	.	12	63	IV
<i>Tanacetum poteriifolium</i>	+1	.	+1	.	.	.	.	.	+1	+1	+1	.	.	+1	+1	.	44	III
(*) <i>Quercus cerris var. cerris</i>	12	.	.	+1	.	.	+1	.	+1	.	.	.	.	+1	.	.	31	II
<i>Polygala supina</i>	.	+1	.	.	+1	+1	.	.	.	.	+1	.	+1	.	.	.	31	II
<i>Acinos rotundifolia</i>	.	.	.	+1	.	.	+1	+1	.	.	.	+1	.	.	+1	.	31	II
<i>Cotinus coggyria</i>	.	.	.	.	.	.	+1	+1	.	.	.	+1	.	.	.	+1	25	II
<i>Colutea cilicica</i>	.	.	+1	+1	.	.	.	.	.	+1	.	.	.	+1	.	.	25	II
(*) <i>Carpinus orientalis</i>	+1	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	+1	19	I
<i>Paliurus spina-christi</i>	.	.	.	.	.	.	+1	+1	.	.	.	.	.	.	.	+1	19	I
Characteristic species of Astragalo-brometea																		
<i>Teucrium polium</i>	11	11	12	.	+2	+2	+2	12	+2	.	+1	+1	+1	.	.	+1	75	IV
<i>Cryspogon gryllus subsp. gryllus</i>	+1	+1	+1	+1	.	.	.	.	+1	.	+1	+1	.	+1	.	.	50	III
<i>Helianthemum nummularium</i>	+1	+1	+1	.	+1	.	.	.	.	+1	+1	.	+1	.	.	+1	50	III

Table - 7. Continued....



<i>Teucrium chamaedrys</i>	.	.	.	.	+1	+1	+1	.	+1	.	+1	+1	+1	.	.	+1	50	III
<i>Ziziphora capitata</i>	+1	.	+1	+1	.	+1	+1	+1	.	.	.	.	+1	.	+1	.	50	III
<i>Koeleria cristata</i>	+1	.	.	.	.	.	.	+1	.	+1	.	.	.	+1	.	+1	31	II
<i>Sangisorba minor</i>	+1	+1	.	.	.	.	.	.	.	.	.	.	.	+1	+1	+1	31	II
<i>Dianthus zonatus</i>	.	.	.	+1	+1	.	.	.	+1	.	.	+1	.	.	+1	.	31	II
<i>Fibigia eriocalycina</i>	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	+1	19	I
<i>Paronychia kurdica subsp. kurdica</i>	+2	.	+2	.	.	.	.	+2	.	.	.	.	.	.	.	.	19	I
<i>Hypericum origanifolium</i>	.	.	.	.	.	+1	.	.	.	.	.	.	.	+1	.	+1	19	I
<i>Ajuuga chamaepithys subsp. chia</i>	.	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	+1	19	I
<i>Veronica multifida</i>	.	.	.	.	.	.	+1	.	.	+1	+1	.	.	.	.	.	19	I
<i>Globularia trichosantha</i>	+1	+1	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	19	I
Companions																		
<i>Dactylis glomerata</i>	+1	.	+1	+1	+1	+1	+1	+1	.	+1	.	.	+1	+1	+1	.	69	IV
<i>Thesium billardierei</i>	+1	+1	+1	+1	+1	+1	.	+1	+1	.	.	.	.	+1	+1	+1	69	IV
<i>Medicago minima</i>	+1	+1	+1	.	.	+1	+1	+1	+1	.	.	+1	.	.	.	+1	56	III
<i>Crucianella bithynica</i>	+1	+1	.	+1	+1	.	.	+1	.	+1	+1	+1	.	+1	.	+1	56	III
<i>Ononis pusilla subsp. leiocarpa</i>	+1	+1	.	.	.	+1	+1	.	.	+1	+1	.	+1	+1	.	+1	56	III
<i>Trifolium campestre</i>	.	+1	.	+1	+1	+1	+1	+1	+1	.	.	.	.	.	+1	.	56	III
<i>Sideritis montana</i>	+1	.	.	+1	.	+1	+1	.	.	.	+1	+1	.	+1	.	+1	50	III
<i>Convolvulus cantabica</i>	.	+1	.	+1	.	.	+1	.	+1	+1	.	+1	.	.	+1	.	44	III
<i>Coronilla orientalis</i>	.	.	+2	.	.	+2	.	+2	.	.	.	.	+2	.	+2	+2	38	II
<i>Trigonella monspeliaca</i>	+1	.	.	.	+1	+1	.	+1	.	.	+1	.	.	+1	.	.	31	II
<i>Muscari aucheri</i>	.	+1	+1	.	.	.	+1	.	.	+1	.	.	+1	.	.	.	31	II
<i>Pterocephalus plumosus</i>	+1	.	.	.	+1	.	.	+1	.	.	+1	.	.	.	+1	.	31	II
<i>Carthamus lanatus</i>	.	+1	.	.	.	.	+1	.	+1	.	.	+1	.	.	+1	.	31	II
<i>Trigonella lunata</i>	+1	.	.	.	+1	.	.	.	.	.	+1	.	.	+1	.	+1	31	II
<i>Callipetis cucullaria</i>	+1	+1	+1	+1	.	.	.	.	+1	.	.	.	.	.	.	.	31	II
<i>Crepis foetida</i>	.	.	.	.	+1	+1	.	.	.	.	.	+1	.	+1	.	.	25	II
<i>Astradaucus orientalis</i>	.	+1	.	+1	.	.	.	.	.	+1	.	.	+1	.	.	.	25	II
<i>Scabiosa columbaria</i>	+1	.	+1	.	.	+1	.	.	.	.	+1	.	.	.	.	.	25	II
<i>Astragalus panduratus</i>	.	.	.	+1	.	.	+1	.	+1	.	.	.	.	.	+1	.	25	II
<i>Sideritis taurica</i>	+1	+1	.	.	.	.	.	.	.	.	.	+1	.	.	.	+1	25	II
<i>Allium erubescens</i>	+1	+1	.	.	.	+1	.	+1	.	.	.	.	.	.	.	.	25	II

Table - 8: The percentages of life forms under different plant associations

Associations	Ph	Ch	H	Cr	Th	G
<i>Phillyreo latifoliae-Quercetum cocciferae</i>	21.53	7.69	16.92	30.76	18.46	4.61
<i>Spiraeo crenatae-Oleetum sylvestris</i>	28.57	7.14	25.00	10.71	10.71	17.85
<i>Cotino coggyriae-Arbutetum andrachnes</i>	20.00	9.09	20.00	21.81	27.27	1.81
<i>Buxo sempervirenti-Arbutetum unedonis</i>	26.47	8.82	29.41	8.82	17.64	8.82
<i>Paliuro spinae-christi-Fontanesietum philliraeoidis</i>	16.43	6.84	26.02	17.80	27.39	5.47
<i>Quercu infectoriae-Pinetum brutiae</i>	16.41	11.94	28.35	23.88	11.94	7.46
<i>Crucianello ponticae-Pinetum pineae</i>	21.73	23.91	30.43	13.04	6.52	2.17

Ph = Phanerophytes, Ch = Chamaephytes, H = Hemicryptophytes, Cr = Cryptophytes, Th = Therophytes, G = Geophytes

Table - 9: The results of Shannon wiener bio-diversity index

Associations	H'	Hmax	J'
<i>Siderito dichotomae-Quercetum cocciferae</i>	4.54	4.67	0.97
<i>Catino coggyriae-Arbutetum andrachnes</i>	4.55	4.67	0.97
<i>Paliurus spinae-christi-Fontanesietum philliraeoidis</i>	4.90	5.01	0.97
<i>Quercu infectoriae-Pinetum brutiae</i>	4.57	4.69	0.97
<i>Spiraeo crenatae-Oleetum sylvestris</i>	3.73	3.90	0.95
<i>Buxo sempervirenti-Arbutetum unedonis</i>	4.24	4.38	0.96
<i>Crucianello ponticae-Pinetum pineae</i>	4.98	5.06	0.98



Oleatum sylvestris. This association occurs on very shallow soils and surface run-off was increased due to seasonal run-off processes. In Black Sea Region Euxinian deciduous elements are usually mixed with Mediterranean elements and it is called as "shiblyak". However, in the study area the percentage of Euxinian deciduous elements were rare comparatively due to erosion on high slopes, crests, ridges and mainly on step slopes with road constructions, increasing meso- to β -hemerobic sites which will be occupied by Mediterranean species with a large amplitude of site requirements and at least deterioration of site conditions for Euxinian deciduous elements (Kehl, 1995; Korkmaz and Engin, 1996; Kehl, 1998; Karaer et al., 1999; Varol et al., 2003).

Mediterranean enclaves are very widespread in coastal regions and around stream valleys of Black sea region (Akman and Ketenoglu, 1986; Kutbay and Kilinc, 1995; Kilinc and Karaer, 1995; Korkmaz and Engin, 1996; Korkmaz and Engin, 2001). The main cause of penetrance of Mediterranean enclaves into the Black sea region is climatic and geomorphological changes during Quaternary. As a result of these changes, thermophilic vegetation of Tertiary was scattered and different floristic elements were mixed. Over the last 5000-6000 years their distribution areas were reduced due to antropogenic factors mainly grazing, fire, urbanization, etc. Occurrence of Mediterranean enclaves at present is related to their high tolerance and occupation marginal habitats which are suitable for their survival (Karaer et al., 1992).

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