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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 occured 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 phillıraeoides subsp. phillıraeoides 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 phillıraeoidis, Querco infectoriae-Pinetum brutiae and Crucianello ponticae-Pinetum pinae. The highest species diversity was found in Crucienello 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 phillıraeoidis, Spiraeo crenatae-Oleetum sylvestris and Crucienello ponticae-Pinetum pinae occured in the negative zone. The other four associations occured in the positive zone.*

Key words: *Black sea region, Enclaves, Maquis vegetation, Mediterranean climate, Numerical methods, Stream valleys*
PDF of full length paper is available online
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Introduction

Turkey is the most complex country in the Middle East with regard to topographic structure. It is build up of comparatively narrow and long, variously oriented mountain chains separated by deep valleys and also high and medium plateus (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-Turanien (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 occuring 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 Méditerraneen intra-pontique" and "Etage Mediterraneen presteppique 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. phillıraeoides* subsp. *phillıraeoides* (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 m^2.

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 *i* th species. Evenness (Russell *et al.,* 1985) was calculated as:

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

where $H_{max} = \log_2 P_i$

Results and Discussion

Maquis vegetation:

***Siderito 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. *aculaetus*, *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*, *Psorolea bituminosa* L. (Fabaceae) and *M. myrtifolia*. In degraded parts, *Astragalo*

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

Cotino coggyreae-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 *Koelaria 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 phillıraeoidis*:** *Paliuro spinae-christi- Fontanesietum phillıraeoidis* ocucpies locally in Erbaa (Kelkit Valley). The diagnostic species of this association are *Fontanesia phillıraeoides* subsp. *phillıraeoides*, *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. phillıraeoides* subsp. *phillıraeoides*, *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. triumfeii* and *Ziziphora capitata* L. (Lamiaceae).

Cotoneaster nummularia Fisch. and Mey. (Rosaceae), *J. oxycedrus* subsp. *oxycedrus*, *Coronilla scorpoides* (L.) Koch (Fabaceae), *C. orientalis* subsp. *orientalis*, *Alyssum strigosum* and *C. monogyna* subsp. *monogyna* are the characteristic species of *Quercetea pubescentis* Doing Kraft 1955. *Querco-Fagetea* (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 Asagisusuz-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.) Stearn (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 emerus* 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	Frequency	Presence
Size of quadrat (m²)	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														
Quercus coccifera	54	43	54	43	44	44	44	54	43	44	44	43	100	V
Phillyrea latifolia	11	22	11	22	11	11	11	+1	11	.	11	22	92	V
Sideritis dichotoma	12	+2	+1	+2	+2	.	12	.	.	+2	.	12	67	IV
Fumana thymifolia	+1	.	+1	11	.	.	+1	+1	11	.	+1	11	67	IV
Characteristic species of *Quercetea (etalia) ilicis*														
Pistacia terebinthus subsp. palaestina	+1	11	11	+1	+1	+1	+1	+1	+1	+1	+1	+1	100	V
Thymbra spicata var. spicata	+2	+2	+2	.	.	.	+2	.	.	+2	+2	+2	58	III
Quercus infectoria subsp. boissieri	.	+2	.	.	.	+2	+2	.	.	+2	.	.	39	II
Euphorbia rigida	+1	+1	+1	.	+1	.	.	.	+1	.	.	.	33	II
Jasminum fruticans	.	.	.	+1	.	.	.	+1	.	+1	.	+1	33	II
Ruscus aculeatus	+2	.	.	.	.	.	+2	.	.	.	+2	.	25	II
Arbutus andrachne	+1	.	+1	.	.	.	.	.	.	.	.	+1	25	II
Putoria calabrica	.	.	.	.	.	12	.	.	+2	.	.	.	16	II
Arbutus unedo	.	.	.	.	.	.	.	+1	+1	.	.	.	16	II
Rubia tenuifolia	.	.	.	.	.	.	+1	.	.	.	+1	.	16	II
Characteristic species of Cisto-Micromerietae														
Cistus creticus	+2	12	+2	+2	.	+2	.	+2	.	.	+2	+2	67	IV
Salvia tomentosa	+1	.	+1	.	.	.	+1	+1	+1	+1	+1	+1	67	IV
Psorolea bituminosa	+1	+1	+1	.	+1	+1	.	.	+1	+1	+1	.	67	IV
Micromeria myrtifolia	+1	+1	+1	.	.	.	+1	.	.	.	+1	+1	50	III
Fumana arabica	+1	.	.	.	.	+1	.	.	+1	.	.	.	25	II
Characteristic species of Querco-Cedretalia libani (*) and Quercetea pubescentis														
Juniperus oxycedrus subsp. oxycedrus	+2	.	+2	.	+2	+2	+2	.	.	+2	.	+2	58	III
(*) *Dorycnium pentaphyllum*	.	+2	.	.	.	.	+2	.	+2	+2	+2	.	42	III
(*) *Cotoneaster nummularia*	.	+1	+1	.	.	.	.	+1	.	.	.	.	25	II
(*) *Alyssum strigosum*	+1	.	.	+1	.	+1	.	.	.	.	+1	.	25	II
Polygala supina	.	+1	.	.	.	.	+1	.	+1	.	.	.	25	II
Cotinus coggyria	.	.	.	.	.	.	.	+1	.	.	+1	.	21	II
Quercus cerris var. cerris	+1	.	.	.	+1	.	.	.	.	.	.	.	16	I
Colutea cilicica	+1	.	.	.	+1	.	.	.	.	.	.	.	16	II
Coronilla scorpoides	.	.	.	.	.	.	+1	.	.	.	.	.	16	I
Characteristic species of Astragalo-brometea														
Ziziphora capitata	+1	+1	+1	+1	.	+1	.	.	+1	+1		+1	67	IV
Teucrium polium	.	+1	+2	+2	.	.	+2	+2	+2	+2	.	+2	67	IV
Globularia trichosantha	+1	+1	.	.	+1	+1	+1	.	+1	+1	+1	.	67	IV
Crysopogon gryllus subsp. gryllus	+1	.	+1	+1	.	+1	.	+1	.	+1	+1	+1	67	IV
Veronica multifida	.	+2	.	.	+1	+1	.	.	+2	+2	+2	+2	58	III
Helianthemum salicifolium	+1	+1	+1	.	+1	+1	.	+1	.	.	.	.	50	III
Koelaria cristata	.	.	+1	.	+1	.	.	+1	.	+1	+1	.	42	III
Teucrium chamaedrys	.	+1	.	+1	.	.	+1	.	.	.	+1	.	33	II
Linum hirsutum subsp. anatolicum	+1	.	.	+1	+1	.	.	.	+1	.	.	.	33	II
Hypericum origanifolium	.	+1	.	.	.	.	+1	.	.	.	+1	+1	33	II
Onosma armena	.	.	.	+1	+1	.	.	+1	.	.	+1	.	33	II
Sangiosorba minor subsp. muricata	.	.	+1	.	.	.	.	+1	.	+1	.	.	25	II
Centaurea triumfetii	.	.	.	.	.	.	.	.	+1	+1	+1	.	25	II

Table-1 Continued.....

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

Source: Karaer *et al*., 1999, * = Character species of Querco-cedretalia libani, The number stands for Braun-Blanquet cover abundance and sociobility 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. chamedrys* 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 pinae* :** 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		
Size of quadrat (m²)	400	400	400	400	400	400	400	400	400	500	500	Frequency	Presence
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													
Arbutus andrachne	43	44	44	44	44	43	44	43	43	44	44	100	V
Cotinus coggyria	12	12	22	12	12	+2	12	22	+2	12	12	100	V
Characteristic species of Qercetea (etalia) ilicis													
Pistacia terebinthus subsp. palaestina	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	91	V
Phillyrea latifolia	.	.	+1	.	+1	+1	+1	+1	.	+1	+1	64	IV
Anarrhinum orientale	+1	+1	+1	.	.	.	+1	.	.	.	+1	45	III
Rubia tenuifolia	+1	.	.	.	+1	.	+1	+1	.	.	.	36	II
Thymbra spicata var. spicata	.	.	.	+2	.	.	.	.	+2	.	.	27	II
Jasminum fruticans	.	.	+2	.	.	+2	.	.	.	.	+2	27	II
Pinus brutia	.	+1	.	.	.	.	+1	.	.	.	.	18	I
Characteristic species of Cisto-Micromerietae													
Psorolea bituminosa	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	91	V
Cistus creticus	+2	+2	.	+2	+2	+2	+2	12	+2	.	+2	82	V
Origanum vulgare subsp. viride	+1	.	+1	+1	.	+1	+1	+1	.	+1	+1	73	IV
Fumana arabica	+1	+1	.	.	.	.	+1	.	+1	+1	+1	55	III
Salvia tomentosa	.	+1	.	.	.	.	.	+1	+1	+1	+1	45	III
Micromeria myrtifolia	.	.	+1	.	+1	.	+1	.	.	.	.	27	II
												27	II
Characteristic species of Quercetea pubescentis											27	II	
Quercus infectoria subsp. boissieri	+1	+2	.	+2	.	+1	.	+2	+2	+2	+2	73	IV
Dorycnium graecum	+2	+2	+2	.	+2	.	.	+2	+2	+2	+2	73	IV
Polygala supina	.	+1	.	.	+1	.	.	+1	+1	+1	+1	55	III
Coronilla scorpoides	.	+1	.	+1	.	+1	+1	.	+1	.	+1	45	III
Acinos rotundifolia	+1	.	.	+1	.	+1	.	.	.	.	.	27	II
Colutea cilicica	.	.	.	.	.	.	+1	.	+1	+1	.	27	II
Alyssum strigosum	.	.	+1	.	+1	.	.	.	+1	.	.	27	II
Characteristic species of Astragalo-Brometea													
Teucrium polium	+2	.	+1	+2	+1	+1	+2	+2	.	+1	+1	82	V
Linum hirsutum subsp. anatolicum	11	11	.	.	11	+1	+1	+1	+1	+1	+1	82	V
Crysopogon gryllus subsp. gryllus	+1	+1	+1	+1	+1	+1	+1	.	+1	.	+1	82	V
Teucrium chamaedrys	.	.	.	+1	+1	+1	+1	.	+1	+1	+1	64	V
Hedysarum varium	.	+2	.	+2	+2	.	+2	.	+2	+2	.	55	III
Anthemis tinctoria	+1	+1	+1	.	.	.	.	+1	.	+1	.	45	III
Helianthemum nummularium	+1	.	+1	+1	.	+1	.	.	.	.	.	36	II
Veronica multifida	.	.	.	.	+2	.	+2	.	.	+2	.	27	II
Koelaria cristata	.	.	.	+1	.	.	.	+1	.	.	+1	27	II
Filago eriocephala	.	+1	.	.	.	.	+1	.	+1	.	.	27	II
Globularia trichosantha	.	.	+1	+1	.	.	.	+1	.	.	.	27	II
Centaurea consanguinea	.	.	+1	.	.	.	.	.	.	+1	+1	27	II
Companions													
Linum tenuifolium	+1	+1	+1	.	+1	+1	.	+1	.	+1	+1	73	IV
Genista albida	+1	+1	+1	.	+1	.	+1	.	+1	.	+1	64	II
Pterocephalus plumosus	+1	.	+1	+1	.	+1	.	.	+1	.	+1	55	III
Astragalus supruneri	+1	.	+1	.	.	+1	+1	+1	.	.	+1	55	III
Linum corymbulosum	.	+1	+1	.	+1	+1	.	.	+1	+1	.	55	III
Ononis viscosa subsp. brevifolia	.	+1	.	.	.	.	.	+1	+1	+1	+1	45	III

Table - 2 Continued....

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

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

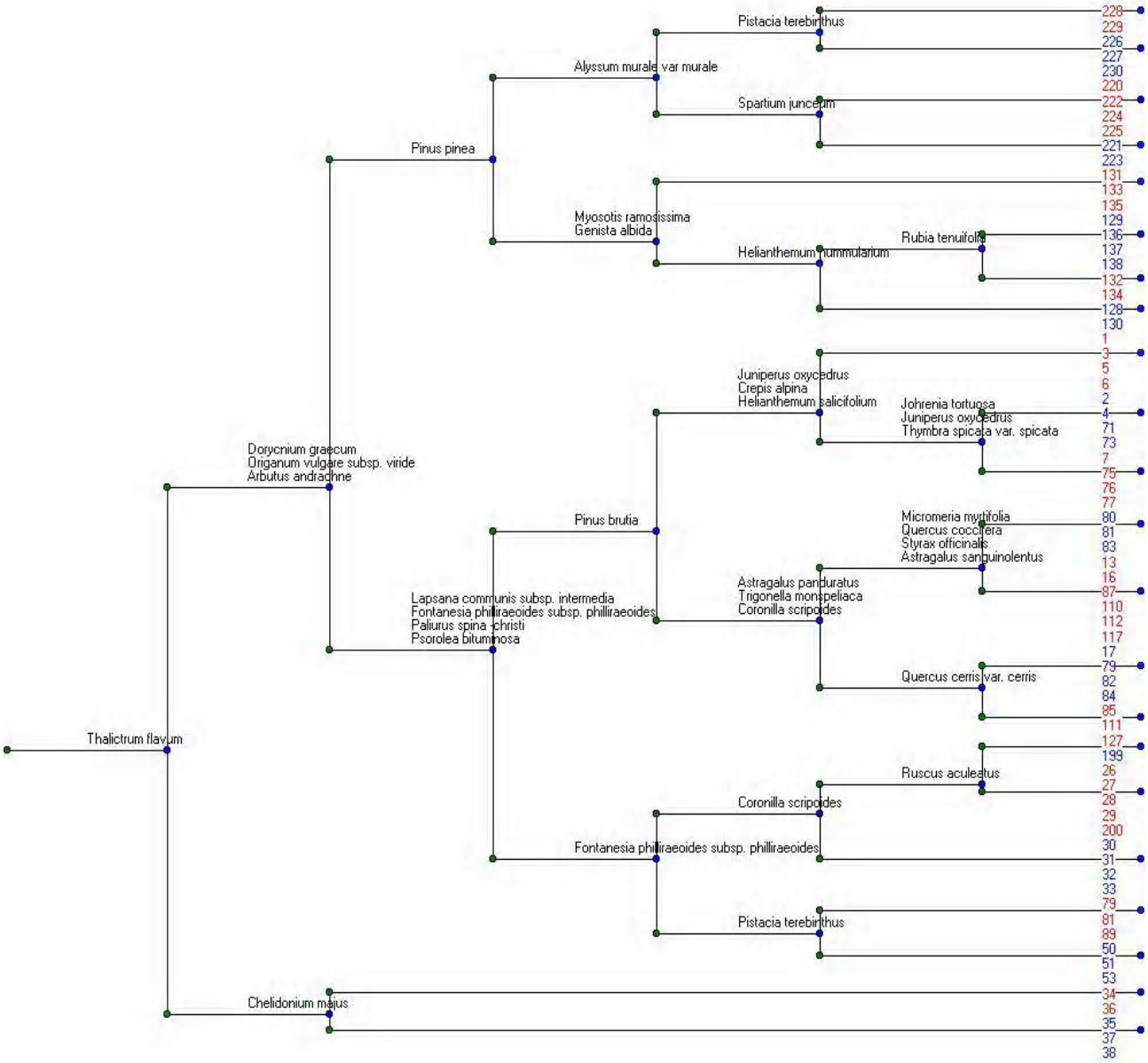

Fig. 1: TWINSPAN clusters of studied quadrats. Indicator species are showed on the dendrogramme branches

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 (m²)	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												
Fontanesia phillyraeoides subsp. phillyraeoides	43	23	43	33	43	33	33	32	43	23	100	V
Paliurus spina -christi	12	32	22	32	12	23	32	22	12	33	100	V
Ruscus aculeatus var. aculeatus	12	22	12	12	12	.	12	12	.	22	90	V
Nigella nigellastrum	.	.	.	+1	+1	+1	.	+1	.	.	40	II
Characteristic species of Quercetea (Etalia) Ilicis												
Pistacia terebinthus subsp. palaestina	+1	11	+1	11	.	11	11	11	+1	11	90	V
Jasminum fruticans	+2	12	+2	+1	+1	.	.	.	+1	12	70	IV
Thymbra spicata var. spicata	.	+2	.	.	.	.	+2	.	.	+2	30	II
Anarrhinum orientale	.	.	.	.	.	+1	+1	.	.	.	20	II
Phillyrea latifolia	.	.	.	.	.	.	.	.	+1	+1	20	II
Origanum vulgare subsp. viride	+1	+1	.	.	.	.	.	.	.	.	20	II
Salvia tomentosa	.	.	.	+1	.	+1	.	.	.	.	20	II
Characteristic species of Quercetea Pubescentis												
Juniperus oxycedrus subsp. oxycedrus	+1	12	.	11	.	11	11	11	+1	12	80	IV
Coronilla scripoides	+1	+1	+1	+1	.	.	.	.	+1	+1	60	III
Carpinus orientalis susbsp. orientalis	.	+1	+1	.	+1	.	.	.	+1	+1	40	II
Cephalanthera rubra	.	.	.	.	.	+1	+1	+1	+1	.	40	II
Crataegus monogyna	.	.	.	.	.	+1	.	.	+1	+1	30	II
Alyssum strigosum	.	+1	+1	+1	.	.	.	.	.	.	30	II
Acinos rotundifolia	.	.	.	.	+1	+1	+1	.	.	.	30	II
Characteristic species of Querco-Fagetea												
Moehringia trinerva	+1	+1	.	+1	+1	+1	+1	+1	.	.	70	IV
Lapsana communis subsp. intermedia	+1	+1	+1	.	+1	+1	+1	+1	.	.	70	IV
Clinopodium vulgare subsp. vulgare	.	.	+1	+1	.	.	+1	+1	+1	+1	60	III
Agrimonia eupatoria	.	+1	+1	.	.	.	.	.	+1	+1	40	II
Characteristic species of Astragalo-Brometea												
Sangiosorba minor subsp. muricata	+1	.	+1	+1	.	.	+1	+1	.	+1	60	III
Centaurea triumfetii	.	+1	+1	+1	.	.	.	+1	.	+1	50	III
Teucrium polium	.	12	12	.	12	+2	.	.	+2	.	50	III
Ziziphora capitata	.	.	+1	+1	+1	.	.	.	+1	.	40	II
Crysopogon gryllus subsp. gryllus	+1	.	+1	.	.	.	+1	.	.	+1	40	II
Koelaria cristata	+1	.	.	+1	+1	.	+1	.	.	.	40	II
Paronychia kurdica subsp. kurdica	.	.	+2	+2	.	.	+2	.	.	.	30	II
Centaurea urvillei subsp. armata	.	.	.	.	.	+1	.	+1	+1	.	30	II
Teucrium chamaedrys subsp. chamaedrys	.	+1	.	.	.	.	.	+1	.	+1	30	II
Trifolium stellatum	.	.	.	.	+1	.	+1	+1	.	.	30	II
Veronica multifida	+1	.	.	.	.	+1	.	.	.	+1	30	II
Ajuga chamaepithys subsp. chia	.	.	+1	+1	.	.	.	+1	.	.	30	II
Filago eriocephala	.	.	+1	.	.	.	+1	.	+1	.	30	II
Anthemis tinctoria	.	+1	.	.	+1	.	.	.	.	+1	30	II
Companions												
Geranium molle	+1	+1	.	+1	+1	+1	+1	+1	.	+1	80	IV
Medicago minima	+1	+1	+1	+1	.	+1	.	.	+1	+1	70	IV

Table - 3 Continued.....

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

***Querco infectoriae-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 (m²)	400	400	400	400	400	400	400	400	400	400		
Altitude (m)	300	350	400	400	400	380	400	350	350	350		
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		
											Frequency	Presence
Characteristic and differential species of the association												
Olea europae var. sylvestris	33	33	33	33	33	33	33	33	33	43	100	V
Sedum pallidum var. pallidum	+1	+1	+1	+1	+1	+1	+1	+2	+2	+2	100	V
Linum corymbulosum	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	90	V
Micromeria nervosa	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V
Spirea crenata	+1	+1	+1	.	+1	+1	+1	.	+1	.	70	IV
Characteristic species of Quercion calliprini (*), Quercion ilicis (**) and Quercetea ilicis												
Phillyrea latifolia	22	22	22	22	22	22	22	22	22	22	100	V
(*) *Jasminum fruticans*	+1	.	+1	+1	+1	+1	.	+1	.	+1	70	IV
(*) *Pistacia terebinthus subsp. palaestina*	+1	+1	.	+1	+1	.	.	+1	+1	.	60	III
Ephedra major	+2	+2	+2	.	.	+2	+2	.	.	.	50	III
Ruscus aculeatus var. angustifolius	+2	.	.	+2	.	.	+2	.	.	+2	40	II
Geranium purpureum	.	+1	+1	.	.	.	.	.	+1	.	30	II
Pinus brutia var. brutia	.	.	.	.	+1	.	.	.	+1	.	20	I
Arbutus unedo	+1	.	.	.	.	.	+1	.	.	.	20	I
Characteristic species of Cisto-Micromerietea Julianae												
Micromeria myrtifolia	+1	.	+1	.	+1	+1	+1	+1	.	.	60	III
Cistus creticus	.	+2	.	.	.	.	.	.	.	+2	20	I
Fumana thymifolia var. thymifolia	+2	.	.	+2	.	.	.	.	.	.	20	I
Characteristic species of Querco Pseudocerridis-Cedretalia libani (*), Querco - Carpinetalia Orientalis (**) and Quercetea Pubescentis												
(*) *Juniperus excelsa subsp. excelsa*	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V
Buxus sempervirens	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	90	V
Lapsana communis subsp. intermedia	.	+1	.	.	+1	+1	.	+1	.	.	40	II
Brachypodium sylvaticum	.	+1	.	.	.	+1	.	.	+1	.	30	II
(*) *Asyneuma limonifolium subsp. pestalozze*	.	.	.	+1	.	.	+1	.	.	+1	30	II
(**) *Asyneuma rigidum subsp. rigidum*	+1	.	+1	.	.	.	.	.	+1	.	30	II
(**) *Clematis vitalba*	+1	.	.	.	+1	.	.	.	.	.	20	I
Silene alba subsp. eriocalycina	.	.	+1	.	.	.	+1	.	.	.	20	I
(*) *Allium stamineum*	.	.	.	.	.	+1	.	.	.	+1	20	I
Paliurus spina -christii	.	.	.	.	.	.	.	.	.	+1	10	I
Characteristic species of Onobrychido armeni - Thymetalia Leucostomi (*) and Astragalo microcephali - Brometea tomentelli												
Iberis taurica	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	90	V
Chrysopogon gryllus var. gryllus	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	90	V
(*) *Allium scrodoprasum subsp. rotundum*	.	.	.	+1	+1	+1	+1	+1	+1	.	60	III
Sideritis montana subsp. remota	.	.	.	+1	+1	.	+1	.	+1	+1	50	III
Thymus spyleus subsp. rosulans	+2	+2	.	.	.	.	.	.	.	+2	30	II
Ziziphora capitata	+1	.	.	.	.	.	.	+1	.	+1	30	II
(*) *Hypericum avicularifolium subsp. depilatum*	+1	+1	.	.	.	.	.	.	.	.	20	I
Asyneuma limonifolium subsp. limonifolium	.	.	+1	.	.	.	+1	.	.	.	20	I
(*) *Ziziphora taurica subsp. taurica*	.	.	+1	.	.	+1	.	.	.	.	20	I
Ajuga chamaepytis subsp. chia var. chia	.	+1	.	+1	.	.	.	.	.	.	20	I
Melica ciliata subsp. ciliata	+1	.	.	.	+1	.	.	.	.	.	20	I
(*) *Jurinea consanguinea*	.	.	+1	.	.	.	.	.	.	+1	20	I
Lappula barbata	+1	.	.	.	.	.	+1	.	.	.	20	I

Table - 4 Continued.....

(*) *Erysimum smyrnaeum*	.	+1	.	.	.	.	.	.	+1	.	20	I
(*) *Alyssum pateri subsp. pateri*	.	.	.	+1	.	.	.	.	.	+1	20	I
Potentilla recta	.	.	.	.	.	+1	.	.	.	.	10	I
Scabiosa micrantha	.	.	+1	.	.	.	.	.	.	.	10	I
Companions												
Crucianella latifolia	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	100	V
Parietaria lusitanica	+1	.	+1	+1	+1	+1	+1	.	.	+1	70	IV
Asplenium ruta-muraria	.	+2	+2	+2	+2	+2	.	+2	+2	.	70	IV
Ornithogalum pyrenaicum	.	+1	.	+1	+1	+1	.	+1	+1	+1	70	IV
Galium floribundum subsp. floribundum	+1	+1	+1	+1	.	.	+1	+1	+1	.	70	IV
Ornithogalum comosum	.	.	+1	+1	.	+1	+1	.	+1	+1	60	III
Galium verticillatum	+1	+1	.	.	+1	.	.	+1	+1	+1	60	III
Leugosia falcata subsp. falcata var. falcata	.	.	+1	+1	.	+1	+1	+1	.	.	50	III
Pimpinella peregrina	+1	+1	.	.	+1	+1	.	.	+1	.	50	III
Crucianella angustifolia	.	.	+1	+1	.	.	+1	.	.	+1	40	II
Turgeniopsis foeniculata	+1	.	.	.	+1	.	+1	.	+1	.	40	II
Galium tenuissimum subsp. tenuissimum	.	+1	.	+1	.	.	.	+1	.	.	30	II
Inula aschersoniana	.	.	+2	.	+2	.	.	.	+2	.	30	II
Centaurea kilea	.	+2	.	+2	.	.	+2	.	.	.	30	II
Ceterach officinarum	.	.	+2	.	.	.	.	+2	+2	.	30	II
Asplenium trichomanes	+2	.	.	.	+2	+2	.	.	.	.	30	II
Catapodium rigidum subsp. rigidum	.	+1	.	+1	.	.	+1	.	.	.	30	II
Trigonella spicata	+1	.	.	.	.	+1	.	.	.	+1	30	II
Buglossoides arvensis	.	+1	.	.	+1	.	+1	.	.	.	30	II
Steptorhamphus tuberosus	.	.	+1	+1	.	.	.	.	+1	.	30	II
Allium paniculatum subsp. paniculatum	+1	.	.	.	.	+1	.	+1	.	.	30	II
Alyssum hirsutum var. hirsutum	.	+1	.	.	+1	.	.	.	.	+1	30	II
Melilotus alba	.	.	+1	+1	.	.	.	.	.	.	20	I
Papaver lacerum	.	.	.	.	.	+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. *Sidertito dichotomae - Quercetum cocciferae, Paliuro spinae-christi- Fontanesietum phillraeoidis* and *Spiraeo crenatae -Oleetum sylvestris* are formed as a result of the destruction of *Querco 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 occured 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 phillraeoidis*, *Spiraeo crenatae -Oleetum sylvestris* and *Crucienello ponticae-Pinetum pinae* were occured in the negative zone. The other four associations were occured 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 therophytes was higher as compared to the other life forms in *Cotino coggyreae-Arbutetum andrachnes* and *Paliuro spinae-christi- Fontanesietum phillraeoidis*. Hemicryptophytes were dominant in *Buxo sempervirenti-Arbutetum unedonis* and *Querco infectoriae-Pinetum brutiae*. The percentages of cryptophytes were higher in *Siderito 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 over-wintering 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 physionomical 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		
Size of quadrat (m²)	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		
											Frequency	Presence
Characteristic and differential species of the association												
Arbutus unedo	33	33	43	43	44	33	33	33	33	43	100	V
Ligustrum vulgare	+1	+1	+1	+1	+1	.	.	+1	+1	+1	80	IV
Coronilla emerus subsp. emeroides	.	.	+1	+1	.	+1	+1	+1	+1	+1	70	IV
Vincetoxicum fuscum subsp. boissieri	.	+1	+1	+1	.	+1	.	+1	+1	+1	70	IV
Sedum album	+1	+1	+1	+1	+1	.	+1	.	+1	.	70	IV
Characteristic species of Quercion calliprini (*), Quercion ilicis (**), Quercetalia ilicis and Quercetea ilicis												
Ruscus aculeatus var. angustifolius	+2	+2	+2	+2	+2	+2	+2	+2	+2	+2	100	V
(*) *Phillyrea latifolia*	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	90	V
(*) *Pistacia terebinthus subsp. palaestina*	+1	.	.	+1	+1	+1	.	+1	.	+1	60	III
(**) *Jasminum fruticans*	+1	+1	+1	+1	+1	.	+1	.	.	.	60	III
Juniperus oxycedrus subsp. oxycedrus	+1	+1	+1	+1	.	.	.	.	.	+1	50	III
Ephedra major	+2	+2	.	+2	+2	.	.	.	.	+2	50	III
Euphorbia rigida	+1	.	.	+1	.	.	+1	.	+1	+1	50	III
Olea europaea var. sylvestris	+1	+1	+1	.	.	.	.	.	+1	.	40	II
Geranium purpureum	.	.	.	.	.	.	.	+1	+1	.	20	I
Pinus brutia	.	.	+1	.	.	.	.	.	.	.	10	I
Characteristic species of Carpino betuli - Acerion hyrcani (*), Querco Cerridis - Carpinetalia orientalis (**), Querco pseudocerridis - Cedretalia libani (***) and Quercetea pubescentis												
Buxus sempervirens	22	22	22	22	22	22	22	22	22	22	100	V
Dictamnus albus	+2	+2	+1	+2	+2	+1	+1	+1	.	+1	90	V
Silene alba subsp. eriocalycina	+1	.	.	.	+1	+1	.	+1	+1	+1	60	III
Chelidonium majus	.	.	.	+1	.	+1	+1	+1	+1	50	III	
(***) *Juniperus excelsa subsp. excelsa*	+1	+1	+1	+1	.	.	.	.	.	.	40	II
(*) *Carpinus orientalis subsp. orientalis*	.	.	+1	+1	.	.	.	.	.	+1	30	II
Euonymus verrucosus	+1	.	+1	.	.	.	.	.	.	.	20	I
(**) *Clematis vitalba*	.	.	.	.	+1	.	.	+1	.	.	20	I
Amelanchier rotundifolia subsp. rotundifolia	.	.	+1	+1	.	.	.	.	.	.	20	I
(*) *Cyclamen coum var. coum*	+1	+1	.	.	.	.	.	.	.	.	20	I
(**) *Sorbus torminalis var. torminalis*	.	.	+1	.	.	.	.	.	.	+1	20	I
Galium rivale	+1	.	.	.	.	.	.	+1	.	.	20	I
Characteristic species of Querco-fagerea												
Athyrium filix-foemina	+1	+1	.	+1	.	+1	+1	.	+1	+1	70	IV
Hedera helix	.	.	.	.	+1	.	.	+1	+1	.	30	II
Characteristic species of Astragalo microcephali - Brometea tomentelli												
Centaurea inermis	+1	.	+1	.	.	+1	+1	+1	.	.	50	III
(**) *Teucrium chamaedrys subsp. chamaedrys*	+2	.	.	+2	.	.	+2	.	+2	+2	50	III
Alyssum sibiricum	.	.	+1	.	.	.	+1	+1	.	+1	40	II
Veronica multifida	.	+1	.	.	.	+1	.	.	.	.	20	II
Chrysopogon gryllus var. gryllus	.	+1	.	.	.	.	.	.	.	.	10	I
Thymus spylaeus subsp. rosulans	.	.	.	.	.	+1	.	.	.	.	10	I
Companions												
Asplenium trichomanes	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	90	V
Galium verticillatum	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	90	V
Parietaria lusitanica	+1	+1	.	+1	+1	+1	.	+1	+1	+1	80	IV

Table - 5 Continued.....

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

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

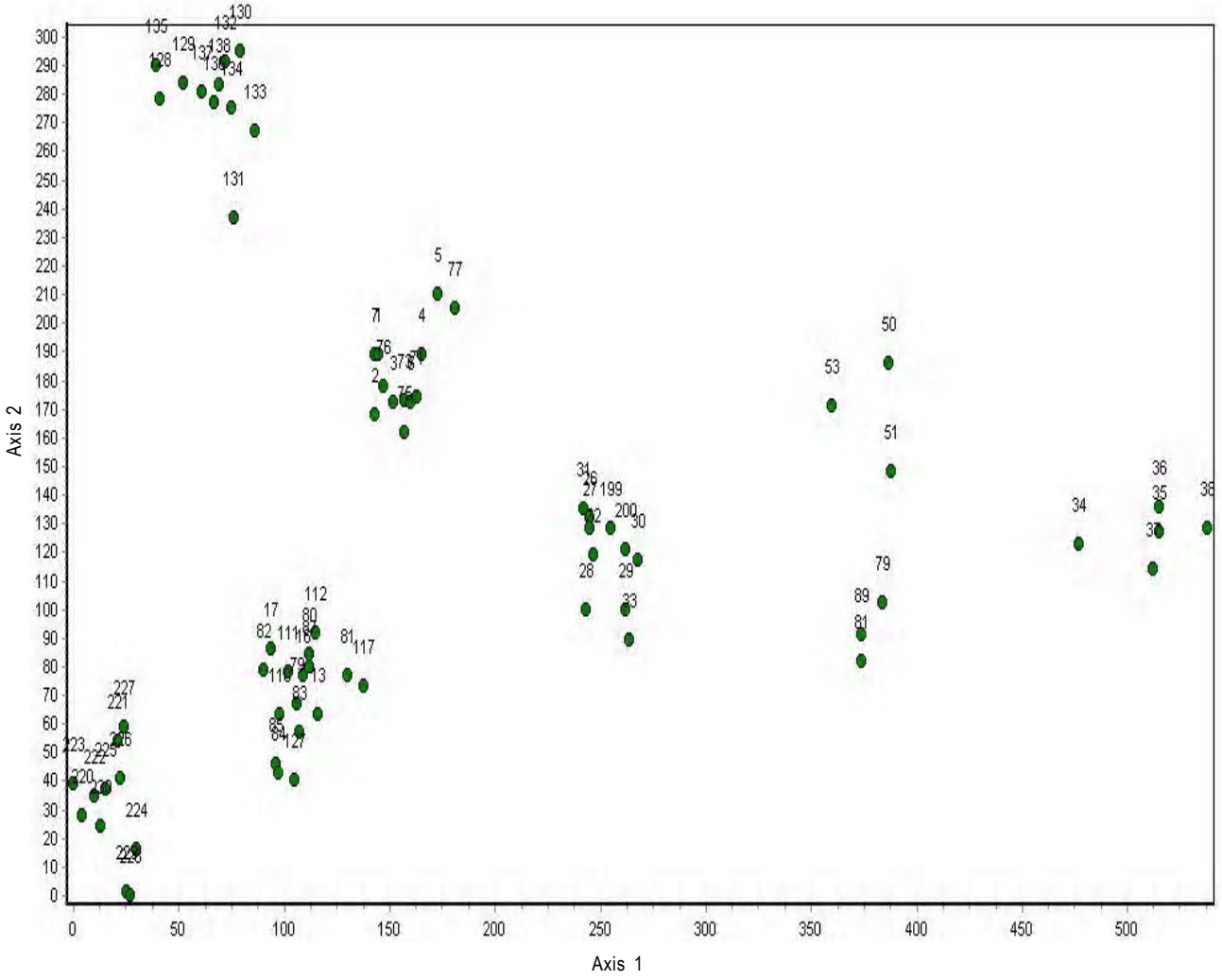

Fig. 2: DCA ordination diagram of the studied quadrats

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 (m²)	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													
Pinus pineae	23	23	23	23	33	33	23	23	33	33	22	100	V
Crucianella gillani subsp. pontica	21	21	21	.	22	.	11	11	11	11	11	91	V
	alyssetosum murelae						chamaecytisetosum hirsutae						
Alyssum murale var. murale	22	+2	22	12	12	12	.	.	.	.	.	55	III
Spartium junceum	12	.	12	.	12	12	.	.	.	.	.	37	II
Satureja spicigera	+2	+2	.	+2	+2	.	.	.	.	.	.	37	II
Chamaecytisus hirsutus	.	.	.	.	.	.	+1	+1	+1	+1	+1	46	III
Punica granatum	.	.	.	.	.	.	+1	.	+1	+1	+1	37	II
Sempervivum glabrifolium	.	.	.	.	.	.	+1	+1	.	.	+1	28	II
Silene armeria	.	.	.	.	.	.	+1	.	+1	.	+1	28	II
Characteristic species of Quercetea (etalia) ilicis													
Arbutus andrachne	+2	+2	+1	+2	.	+2	22	22	12	12	+1	73	IV
Rhus coriaria	.	+1	+1	+1	+1	+1	+1	.	+1	.	+1	73	IV
Juniperus oxycedrus	.	+2	+2	.	+1	+2	+1	.	+2	+1	+2	73	IV
Pistacia terebinthus	.	+1	+1	.	+1	+1	.	.	+1	+1	.	55	III
Cistus salviifolius	.	+2	+2	+2	.	.	+2	.	12	+2	.	55	III
Ruscus aculeatus	+2	.	+1	.	+1	.	+1	+2	.	.	.	46	III
Euphorbia rigida	.	.	.	.	.	.	+1	+1	.	+1	+1	37	II
Vitis sylvesrtris	.	.	.	.	.	.	.	.	+1	+1	+1	28	II
Characteristic species of Cisto-Micromerietae													
Cistus creticus	22	22	32	22	22	21	23	23	23	22	22	100	V
Origanum vulgare subsp. viride	+1	+1	+1	+1	+1	+1	+1	+1	.	.	+1	82	V
Psorolea bituminosae	.	+1	+1	+1	+1	+1	+1	+1	.	.	+1	73	IV
Fumana arabica	+1	+1	+1	.	.	+1	+1	+1	.	.	+1	64	IV
Characteristic species of Astragalo-Brometea													
Teucrium polium	+2	+2	+2	+2	+2	+2	.	+2	+2	+2	+2	91	V
Teucrium chamaedrys subsp. chamaedrys	+2	+2	+2	+2	+2	+2	+2	+2	.	.	+2	82	V
Trifolium stellatum	+1	+1	+1	+1	.	+1	+1	.	+1	+1	.	73	IV
Pilosella hoppeana	+1	+1	+1	+1	.	.	+1	.	+1	+1	.	64	IV
Helianthemum nummularium	.	.	.	+1	.	.	+1	.	+1	+1	.	55	III
Onobrychis armena	.	.	.	+1	+1	+1	.	.	+1	+1	.	46	III
Sanguisorba minor	+1	+1	.	.	+1	.	+1	+1	.	.	.	46	III
Characteristic species of Quercetea pubescentis													
Dorycnium graecum	+1	+1	+1	+1	+1	+1	+1	+1	.	.	.	73	IV
Coronilla orientalis	+1	+1	+1	.	+1	+1	.	.	+1	+1	.	64	IV
Cotinus coggyria	.	+1	+1	.	.	.	+1	+1	.	.	+1	46	III
Cotoneaster nummularia	.	.	.	.	+1	.	+1	+1	.	.	+1	37	II
Dorycnium pentaphyllum	.	+1	+1	+1	.	.	.	.	.	+1	.	37	II
Carpinus orientalis	.	.	.	.	+1	.	+1	.	+1	.	.	28	II
Companions													
Petrorhagia saxifraga	+1	.	+1	+1	+1	+1	+1	+1	+1	+1	+1	91	V
Sedum pallidum	+1	+1	+1	+1	+1	+1	+1	.	+1	+1	.	82	V

Table - 6 Continued.....

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

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

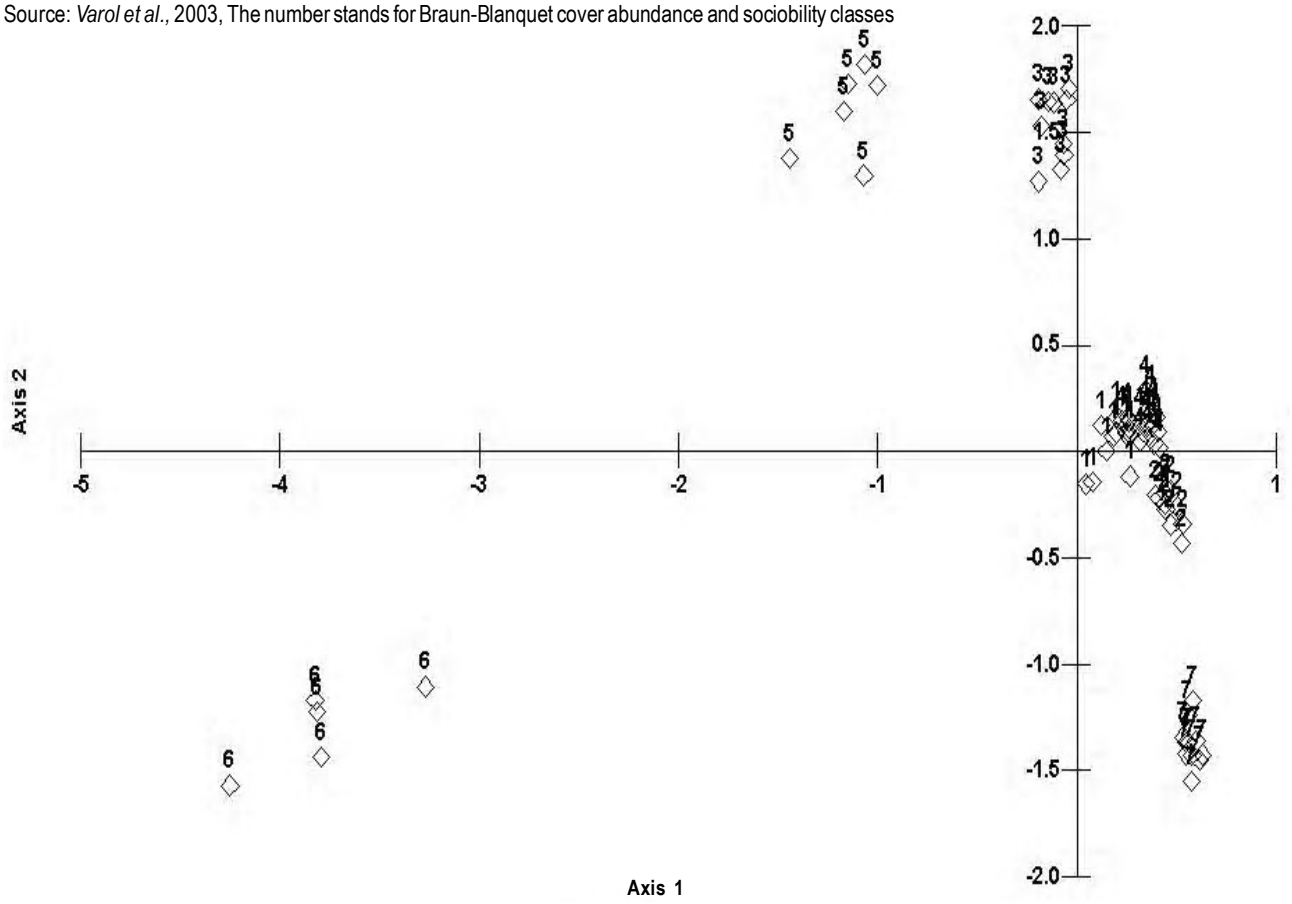

Fig. 3: Evaluation of associations by correspondence analysis
(1= Siderito dichotomae-Quercetum cocciferae, 2= Spiraeo crenatae-Oleetum sylvestris, 3= Cotino coggyriae-Arbutetum andrachnes, 4= Buxo sempervirenti-Arbutetum unedonis, 5= Paliuro spinae-christi-Fontanesietum phillyraeoidis, 6= Querco infectoriae-Pinetum brutiae, 7= Crucianello 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 coggyreae-Arbutetum andrachnes* and *Paliuro spinae-christi- Fontanesietum phillyraeoidis* and hemicryptophytes in climax associations like *Querco infectoriae-Pinetum brutiae* and *Crucionello ponticae- Pinetum pinae,* 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 heterogenity (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 heterogenity 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 pinae*, 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 Querco infectoriae-Pinetum brutiae association

Quadrat no.	13	16	17	85	87	110	111	112	127	79	80	81	82	83	84	117		
Size of quadrat (m²)	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		
																	Frequency	Presence
Characteristic and differential species of the association																		
Pinus brutia	33	33	43	44	44	44	43	44	44	44	33	43	43	43	44	33	100	V
Quercus infectoria subsp. infectoria	+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								
Cistus creticus	22	12	12	12	.	12	12	.	+2	.	.		+2	.	.	.	50	III
Astragalus sanguinolentus	11	+2	.	11	+2	11	.	+1	+1	.	.	.	.	.	.	.	44	III
Astragalus viciifolius	11	+1	+1	.	.	.	11	11	+1	.	.	.	.	+1	.	.	44	III
Styrax officinalis	.	.	.	.	.	.	.	.	.	12	22	22	22	22	22	22	44	III
Chamaecytisus supinus	.	.	.	.	+2	.	.	.	.	.	12	12	.	12	.	+2	31	II
Pistacia terebinthus subsp. palaestina	+1	11	11	+1	11	+1	11	11	+1	11	.	11	11	11	.	11	88	IV
Rubia tenuifolia	+1	.	+1	.	+1	+1	.	.	+1	.	.	.	+2	.	+2	.	44	III
Phillyrea latifolia	.	+1	.	.	.	.	.	+1	.	.	11	11	.	.	.	11	31	II
Ruscus aculeatus	.	.	.	.	+2	.	.	.	12	12	.	.	.	.	12	12	31	II
Thymbra spicata var. spicata	+2	+2	+2	.	.	.	.	.	.	.	+2	.	.	.	.	.	25	II
Arbutus andrachne	.	.	.	.	.	+1	.	+1	.	.	.	.	.	.	.	+1	19	I
Putoria calabrica	.	.	.	+2	.	.	+2	.	.	.	.	.	.	.	.	.	13	I
Quercus coccifera	.	.	.	.	.	.	.	.	.	.	.	+2	.	+2	.	.	13	I
Characteristic species of Cisto-micromerietae																		
Salvia tomentosa	11	11	.	.	+1	.	11	+1	+1	.	11	+1	+1	+1	+1	.	69	IV
Psorolea bituminosa	+1	.	.	+1	+1	+1	+1	+1	.	+1	.	.	+1	+1	+1	+1	69	IV
Fumana arabica	.	.	+1	+1	.	.	+1	.	+1	.	+1	+1	.	.	.	.	38	II
Micromeria myrtifolia	+1	+1	+1	.	+1	.	.	.	.	.	.	.	+1	.	.	+1	38	II
Characteristic species of Querco-cedretalia libani																		
Coronilla scripoides	.	.	+1	+1	.	.	+1	+1	.	+1	.	.	+1	.	+1	.	44	III
Dorycnium pentaphyllum	.	.	.	.	+2	.	12	.	+1	.	12	.	.	.	.	12	31	II
Cotoneaster nummularia	+2	.	.	.	.	+2	.	.	.	.	+2	.	.	+2	.	.	25	II
Alyssum strigosum	.	.	+1	.	.	.	+1	+1	.	.	.	.	.	.	+1	.	25	II
Bunium microcarpum subsp. bourgaei	.	.	.	.	.	.	.	+1	.	.	.	+1	.	.	.	.	13	I
Characteristic species of Querco-carpinetalia orientalis (*) and Quercetea pubescentis																		
Juniperus oxycedrus subsp. oxycedrus	12	+2	.	.	+2	12	12	.	12	12	12	.	+2	.	.	12	63	IV
Tanacetum poteriifolium	+1	.	+1	.	.	.	.	.	+1	+1	+1	.	.	+1	+1	.	44	III
(*) *Quercus cerris var. cerris*	12	.	.	+1	.	.	+1	.	+1	.	.	.	.	+1	.	.	31	II
Polygala supina	.	+1	.	.	+1	+1	.	.	.	.	+1	.	+1	.	.	.	31	II
Acinos rotundifolia	.	.	.	+1	.	.	+1	+1	.	.	.	+1	.	.	+1	.	31	II
Cotinus coggyria	.	.	.	.	.	.	+1	+1	.	.	.	+1	.	.	.	+1	25	II
Colutea cilicica	.	.	+1	+1	.	.	.	.	.	+1	.	.	.	+1	.	.	25	II
(*) *Carpinus orientalis*	+1	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	+1	19	I
Paliurus spina -christi	.	.	.	.	.	.	+1	+1	.	.	.	.	.	.	.	+1	19	I
Characteristic species of Astragalo-brometea																		
Teucrium polium	11	11	12	.	+2	+2	+2	12	+2	.	+1	+1	+1	.	.	+1	75	IV
Crysopogon gryllus subsp. gryllus	+1	+1	+1	+1	.	.	.	.	+1	.	+1	+1	.	+1	.	.	50	III
Helianthemum nummularium	+1	+1	+1	.	+1	.	.	.	.	+1	+1	.	+1	.	.	+1	50	III

Table - 7 Continued.....

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

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

Associations	Ph	Ch	H	Cr	Th	G
Phillyreo latifoliae-Quercetum cocciferae	21.53	7.69	16.92	30.76	18.46	4.61
Spiraeo crenatae -Oleetum sylvestris	28.57	7.14	25.00	10.71	10.71	17.85
Cotino coggyriae-Arbutetum andrachnes	20.00	9.09	20.00	21.81	27.27	1.81
Buxo sempervirenti-Arbutetum unedonis	26.47	8.82	29.41	8.82	17.64	8.82
Paliuro spinae-christi- Fontanesietum phillíraeoidis	16.43	6.84	26.02	17.80	27.39	5.47
Querco infectoriae-Pinetum brutiae	16.41	11.94	28.35	23.88	11.94	7.46
Crucianello ponticae-Pinetum pineae	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'
Siderito dichotomae-Quercetum cocciferae	4.54	4.67	0.97
Catino coggyriae-Arbutetum andrachnes	4.55	4.67	0.97
Paliurus spinae -christi-Fontanesietum phillíraeoidis	4.90	5.01	0.97
Querco infectoriae-Pinetum brutiae	4.57	4.69	0.97
Spiraeo crenatae -Oleetum sylvestris	3.73	3.90	0.95
Buxo sempervirenti-Arbutetum unedonis	4.24	4.38	0.96
Crucianello ponticae-Pinetum pineae	4.98	5.06	0.98

Oleetum sylvestris. This association occurs on very shallow soils and surface run-off was increased due to seasonal run-off processess. 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, termophilic 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.* Occurence 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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