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in the west black sea region**

by

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A phytosociological research on the Maquis formation in the west black sea region

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ABSTRACT

Apart from the typical Mediterranean maquis, the maquis communities of north Anatolia which are the relic stands of Old Mediterranean region form a mixed formation called Pseudomaquis on the coastal zone of Black Sea region in consequence of penetration of Euxinian species. In the western sector of Euxine territory, three different plant associations were described within the formation which was tried to investigate from the viewpoint of phytosociology. Although they were mixed with the Euxinian species, the Mediterranean components play more important role here. Therefore, the associations were conveniently considered in the class *Quercetea ilicis* and *Cisto-Micromerietea* which include the communities teranean region.

INTRODUCTION

The maquis vegetation shows a variation in structure for it has a wider geographical distribution. It is widespread in the Mediterranean, Aegean and Marmara region and fragmentarily spread on the coastal zone of Black Sea region in Turkey. In the study area, the typical maquis components of Mediterranean region form a mixed formation called Pseudomaquis resulting from penetration of deciduous Euxinian species. Therefore, it exhibits an interesting phytosociological structure. In the present work we aimed to research the phytosociological traits of its associations differing from the typical Mediterranean maquis and to reveal the differences between its associations and the ones described in the works carried out before.

METHODS

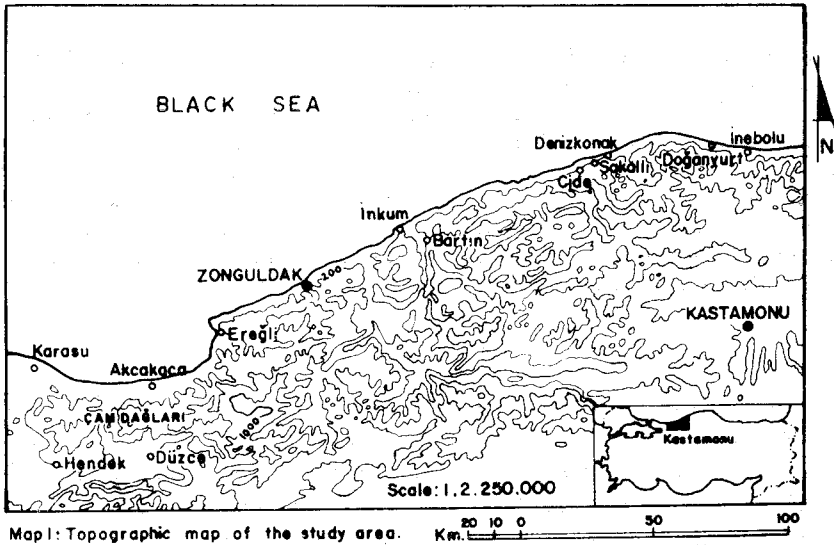
The plants of the area were collected in 1979-1981 and identified in the herbarium of the department of Biology, Science Faculty, Uni-

versity of Ankara. The collection has been kept in the herbarium of Ankara.

The climatic characteristics were estimated depending on the data of Meteorological bulletins of State Meteorological Service of Turkey. The information about geology was obtained from MTA institute.

The vegetative analysis of the maquis formation was carried out according to Braun-Blanquet's method.

BRIEF DESCRIPTION OF THE STUDY AREA (Map: 1)



From Harita Gn.Md.

In the study area, the coastal zone of the Western Black Sea region where the mountains steeply go down to the sea, an oceanic type of climate prevails. The amount of the rainfall increases in the middle part of the area, the surroundings of Zonguldak, Bartın and Cide, exposed to the humid winds from the west. The precipitation regimes of the stations of Doğanyurt and İnebolu bordering the study area in the east, characterize the different types of the Mediterranean climate. The total annual rainfall decreases in the vicinities of Karasu, the western

border of the area. The mean annual temperatures of all stations on the coastal zone of the region are above 10°C. The total rainfalls and mean temperatures of the stations are as follows;

Station	Total annual rainfall (mm)	Mean annual temperature (C)
İnebolu	976.3	13.1
Doğanyurt	948.7	14.9
Cide	1176.9	14.7
Bartın	1071.7	13.1
Zonguldak	1242.9	13.5
Akçakoca	973.0	12.7
Karasu	889.0	14.9

Of the stations, in those of Doğanyurt, Cide and Karasu only the amount of precipitation has been observed. The mean annual temperatures of the stations cited above, were interpolated depending on the relation between temperature and altitude.

The oceanic climate prevailing in the region may cause the deciduous Euxinian species to penetrate into the maquis formation developing under the influences of Mediterranean climate characterized by a dry period.

In general, brown and noncalcerous brown forest soils were spread out in the area which was mainly formed from the flysches and volcanic bedrocks.

VEGETATION

The maquis is a characteristic and natural type of Mediterranean vegetation developing on the siliciferous bedrocks. It forms very dense and sometimes impenetrable thickets of tall shrubs, 2 m or more high with stiff densely twiggy branches and small dark green sclerophyll leaves. They may grow well on the sites with shallow and stony soils through their deeper root systems. The ecological importance of the maquis is due to its formation of the species with small leaves which reduce transpiration, and its adaptation to the Mediterranean climate characterized by a dry period.

It is quite difficult whether the maquis is the highest expression of vegetative development, or climax under certain conditions in the

Mediterranean region. In some cases it probably is, in which case it is known as "Primary Maquis", but in most cases it is undoubtedly the results of man's activity of the evergreen forest, and is consequently called "Secondary Maquis" (Pollunin and Huxley, 1978).

As a result of destruction of the maquis, phrygana vegetation composed of the bushes of about 50 cm, and Mediterranean steppes developed successively.

Though the maquis vegetation in the study area forms a narrow belt in the coastal parts of the region at an altitude of 10-150 (200) m., it can be seen in the inner parts of about 140-400 m such as in the west of Zonguldak (Çam dağları).

The vegetation of the North Anatolia has been veritcally divided into four zones in the north-south direction from the viewpoint of bi-geography, by Quézel, Barbéro and Akman (1980): Mediterranean zone, Mountanious Euxine zone, Supramediterranean prepontic zone and Prepontic mountain zone. A mediterranean intrapontic area is also locally situated in the prepontic zone in addition to the others.

According to division above, on the Mediterranean zone, the coastal belt, three associations were described depending on the constant and dominant species.

1- *Arbutus andrachne-Phillyrea latifolia* association

(Table no: 1)

A part of the maquis vegetation scattering in fragments along the coastal zone of the study area at an altitude of 10-200 meters has been composed of the associations, the dominants of which are *Arbutus andrachne* and *Phillyrea latifolia*. In this region, the association is usually located in the vicinities of Sakallı, Denizkonak, Çayüstü and Uğurlu villages among Cide and Doğanyurt, in the further west we see them in the surroundings of İnkum-Bartın, Doğantepe, Çayırtepe and Soğuksu villages, while it is located at the higher elevations of Kocatöngel village and Cumhuriyettepe on the southern slopes of Çam mountains.

The association is spread on the soils developed from the calcerous or volcanic mainrock. The association occupying the slopes with an inc-

mination of 30-40 % and having a total coverage of 70-90 % comprises of three layers; brush layer of 2 meters, tree layer of 3-4 meters and a herb layer of about 10-50 cm.

Arbutus andrachne and *Phillyrea latifolia* are the dominant components of tree layer harbouring *Arbutus unedo* as co-dominant usually on the soils developed from the volcanic mainrocks.

As seen on the table no: 1, in the association in which *Arbutus andrachne* and *Phillyrea latifolia* are the constant and dominant species, a subassociation differentiating by *Arbutus unedo*, *Osyris alba*, *Asparagus acutifolius* and *Rubia tinctoria* is formed.

The sclerophyll plants of the association are mixed with the various Euxinian species. Floristic composition of the association is usually composed of these deciduous plants of Euxinian territory along with the components of Mediterranean maquis. The maquis species including the characteristics and differentials belong to the class *Quercetea ilicis*. However, the species of the class *Cisto-Micromerietea* which comprises of the Mediterranean phrygana communities are represented well in the association.

The Euxinian species within the association are the characteristics of the order *Quercocarpinetales* and the class *Quercofagetea*. Some of the species belong to the class *Quercetea pubescentis* and the superclass *Quercofagea*.

2- *Laurus nobilis-Myrtus communis* association

(Table no: 2)

Apart from the former one, on the coastal zone of the study area, this association was described by the helps of quadrats laid out in the surroundings of İnebolu, Doğanıyurt, İnkum-Bartın, Akçakoca, and Karasu at an altitude of about 10-150 m.

The association, total coverage of which varies between 60-90 % exhibits two vegetational layers; a bushy layer reaching 4 m in height and a herbaceous layer, the height of them very between 10-50 cm.

In the association locally occupying the slopes with an inclination hing 40 %, *Laurus noblis* and *Myrtus communis* are the constant and dominant species. The components of the association are, in general, characteristics of the class *Quercetea ilicis* which includes the maquis communities of Mediterranean region. The class *Cisto-Micromerietea* is represented less in this association. However, the other species participating in the association belong to the class *Querceto-Fagetea* and the class *Quercetea pubescentis* which are the syntaxonomical units of Euxinian territory.

3- *Erica arborea-Lathyrus clymenum* association

(Table no: 3)

Throughout the coastal belt of the study area, *Erica arborea* is usually dominated on the hot sites where the maquis vegetation were exploited due to the human activities. The bushy *Ericas* with the height reaching a few meters sporadically from communities along with the species such as *Cistus salvifolius*, *C. creticus* and *Spartium junceum*.

The association characterized by *Erica arborea* and *Lathyrus clymenum* are encountered usually in surroundings of Çayüstü and Sakallı villages among Cide and İnebolu and further west on the southern slopes of Çam mountains at an altitude of 150-460 m.

Erica arborea usually spreading on the acidic soils, is the dominant species of the association. The sclerophyll species here are mixed with the deciduous Euxinian ones. The majority of components forming the floristic composition are the characteristics of the class *Cisto-Micromerietea* in which the degraded communities of Mediterranean region are included. Here, the class *Quercetea ilicis* is not represented well.

In the association usually occupying the hot and dry sites, the species of the higrophilous Euxinian forests decrease in number.

DISCUSSION

The occurrence of Mediterranean arboreal vegetation on the shores of the Black Sea and the adjacent hills may be considered as a compa-

Table no: 3 - Erica arborea - Lathyrus clymenum association

Quadrat no	34	35	36	37	38	104	71	31	70	69	30	68	29	67	28	108	114	115	116	Presence
Altitude (m)	150	150	150	150	150	150	150	75	150	150	75	150	75	150	150	460	450	450	450	
Slope (%)	30	25	20	25	25	15	40	30	30	40	0	20	30	30	20	15	15	15	15	
Direction	SE	S	SE	S	S	SE	NE	NE	N	NW	NW	NW	NW	NE	NE	SW	SW	SW	SW	
Characteristic and differential species of the association																				
Erica arborea	34	34	34	34	34	33	44	34	44	45	34	45	34	45	34	44	44	44	44	V
Lathyrus clymenum .....	.	.	.	.	.	.	+1	+1	+1	+1	.	+1	.	+1	.	.	.	.	.	II
Characteristic of the class CISTO-MICROMERIETEA																				
Cistus creticus	12	12	12	12	12	12	+1	22	+1	+	22	+1	+1	+1	33	.	.	.	.	IV
Origanum vulgare	+1	+1	+1	+1	+1	+1	.	+1	+1	+1	+1	+	+1	++	+1	.	.	.	.	IV
Pteridium aquilinum	12	12	12	12	12	12	+1	11	.	.	+1	.	11	.	.	.	.	.	.	III
Cistus salviifolius	12	12	12	.	12	.	.	+1	.	.	+1	.	11	.	.	.	.	.	.	III
Spartium junceum .....	.	.	.	.	.	.	22	+	23	+1	11	.	.	.	+1	.	.	.	.	II
Psoralea bituminosa	12	12	.	.	.	.	22	.	22	11	.	+1	.	+1	.	.	.	.	.	II
Teucrium polium .....	.	.	.	.	.	.	.	.	+1	+1	.	+1	.	+1	.	.	.	.	+1	II
Aira elegans .....	.	.	.	.	.	.	+1	.	+1	.	.	+1	.	.	.	.	.	.	.	I
Salvia tomentosa .....	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	I
Characteristics of the class QUERCETEA ILICIS																				
Arbutus unedo	12	12	12	12	12	12	.	.	.	.	.	+1	+1	.	.	12	11	11	11	IV
Phillyrea latifolia	12	12	12	12	12	12	.	.	.	.	.	+1	+1	.	.	11	.	.	.	IV
Pistacia terebinthus .....	.	.	.	.	.	.	+1	.	+1	+1	.	+1	.	+1	.	.	.	.	.	II
Ruscus aculeatus	11	11	11	11	11	11	.	.	.	.	.	.	.	.	.	.	.	.	.	II
Cynosorus echinatus .....	.	.	.	.	.	.	+1	.	11	11	.	+1	.	.	.	.	.	.	.	II
Osyris alba .....	.	.	.	.	.	.	+1	.	22	+1	.	+1	.	.	.	.	.	.	.	II
Myrtus communis .....	.	.	.	.	.	.	.	.	.	.	+1	.	+1	.	+1	.	.	.	.	I
Arbutus andrachne .....	.	.	.	.	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	.	I
Cynosorus cristatus .....	.	.	++	.	.	++	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Characteristics of the order QUERCO-CARPINETALIA and the alliance CARPINO-ACERION*																				
Chamaecytisus hirsutus	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	.	++	12	12	12	III
Doryenium pentaphyllum	++	++	++	++	++	.	+1	+1	+1	+1	.	.	.	.	.	.	.	.	.	III
* Quercus petraea subsp.iberica .....	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	II
Oenanthe pimpinelloides .....	++	++	++	++	++	++	.	.	.	.	.	.	.	.	.	.	.	++	.	II
Viola sieheana .....	.	.	.	.	.	.	.	+1	.	.	+1	.	+1	.	+1	.	.	.	.	II
* Asperula involucreta	+1	+1	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	II
* Cornus sanguinea subsp.australis .....	.	.	.	.	.	.	.	+1	.	+1	+1	.	.	.	.	.	.	.	.	I
Argyrolobium biebersteini .....	.	.	.	.	.	.	+1	.	+1	+1	.	.	.	.	.	.	.	.	.	I
Characteristics of the class QUERCETEA PUBESCENTIS																				
Hypericum perforatum	++	++	++	++	++	.	+1	.	+1	+1	.	+1	.	.	.	.	.	.	.	III
Genista lydia	+1	+1	+1	+1	+1	12	22	.	.	.	.	.	.	.	.	12	.	.	.	II
Genista tinctoria	+1	.	+1	.	.	.	+1	.	++	.	.	++	.	.	.	.	.	.	.	II
Trifolium medium var.medium .....	.	.	.	++	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Cotinus coggyria .....	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	I
Characteristics of the order RHODH-DENDRO-FAGETALIA ORIENTALIS																				
Hypericum calycinum	12	12	12	12	12	22	.	.	.	.	.	.	.	.	.	22	22	12	12	III
Characteristics of the super class QUERCO-FAGEA																				
Clinopodium vulgare	++	++	++	++	++	++	+1	++	+1	+1	++	++	+1	++	++	++	.	.	+1	V
Teucrium chamaedrys	12	12	12	12	12	+1	+1	.	+1	+1	.	+1	.	+1	.	.	.	.	.	III
Rubus idaeus .....	++	++	++	++	++	++	.	.	.	.	.	.	.	.	.	++	11	.	.	III
Brachypodium sylvaticum	+1	.	12	.	+1	.	+1	.	+1	+1	.	.	.	+1	.	12	.	.	.	III
Fragaria vesca .....	.	.	.	.	.	++	++	.	.	.	.	.	.	.	.	.	.	.	.	I
Companions																				
Briza media	++	++	++	++	++	++	.	11	.	.	+1	.	++	.	+1	.	.	.	.	III
Anthemis tinctoria var.pallida .....	.	.	.	++	++	.	++	++	++	.	++	++	++	++	.	.	.	.	.	III
Blackstonia perfoliata .....	.	.	.	.	.	.	+	++	+1	.	+1	.	+1	.	+1	.	.	.	.	II
Dactylis glomerata .....	.	.	.	.	.	.	.	+1	++	.	+1	.	+1	.	.	.	.	.	.	II
Rosa canina .....	++	++	++	++	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	II
Scabiosa columbaria .....	.	.	++	.	.	+1	.	++	.	++	.	+1	.	.	.	.	.	.	.	II
Poa trivialis .....	.	.	.	.	.	.	11	.	+1	11	.	+1	.	++	.	.	.	.	.	II
Pilosella piloselloides subsp.piloselloides .....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	++	++	II
Trifolium angustifolium .....	.	.	.	.	.	.	+1	.	+1	.	.	+1	.	+1	.	.	.	.	.	II
Scutellaria albida .....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	++	++	I
Galium album subsp.prusense .....	.	.	.	.	.	.	+1	.	.	+1	.	+1	.	.	.	.	.	.	.	I
Centaurium erythraea .....	.	.	.	.	.	.	+1	+1	.	.	+1	.	.	.	.	.	.	.	.	I
Rubus discolor .....	.	.	.	.	.	.	.	+1	.	.	+1	.	+1	.	.	.	.	.	.	I
Sedum pallidum .....	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	I

ratively recent penetration, resulting from the destruction of the original Euxinian forests. This assumption is supported by the fact that in several places the Euxinian vegetation reaches sea level, so that primarily there could hardly have been room to accommodate Mediterranean vegetation in the Euxinian territory. The occurrence of the species such as *Pteridium aquilinum* and *Paliurus spina-christi* in the communities recognized in the study area indicates the human activities on the Euxinian forests in the past.

Alternatively, one may look on the scattered patches of the Mediterranean maquis along the coastal region of Northern Anatolia as relic stands of the Old Mediterranean region. This view could perhaps, be supported by the fact that some plants, closely related to the present Mediterranean flora are found in the Hyrcanian area of Northern Iran. Because the Tethys which was the origin of present Mediterranean Sea at the beginning of Tertiary had a connection with the Aral and Caspian Seas. At the end of Tertiary, the Tethys strongly decreased in its Asiatic part and expanded westwards occupying the present site of the Mediterranean Sea.

Czeczott (1938) supports the second view by the work carried out in the vicinities of İnebolu, and emphasizes that the maquis here forms a Pseudomaquis in consequence of penetration of Euxinian species at higher altitudes. This assumption supported by the fact that the maquis formations are the relic stands of the Old Mediterranean region is conveniently confirmed by the absence of the deeper valleys northwards and the location of maquis as scattered patches in the coastal zone of the study area.

Apart from the typical Mediterranean maquis, in this mixed formation, called Pseudomaquis, three associations were described according to constant and dominant species. The two of them have been usually located in the inner parts of further west of the area except for *Laurus nobilis-Myrtus communis* association which has been located in the coastal belt. *Erica arborea-Lathyrus clymenum* form associations in the relatively hot habitats of the coastal region where the maquis was exploited and on the mild habitats of inner parts in the further west where they were mixed with the deciduous species. In the association, the class Cisto-Micromerietea which includes the degraded Mediterranean communities is represented well, while the class Querc-

t e a i l i c i s is represented quite well in the others. Therefore, all the associations should have been considered in the syntaxa cited above. However, the Euxinian components of the associations belong to the classes *Q u e r c o - F a g e t e a* and *Q u e r c e t e a p u b e s c e n t i s*.

The associations mentioned here, had been described before under the different titles by several authors generally in the Mediterranean and Aegean regions of Turkey. For example; as *Arbutus andrachne* and *Laurus nobilis-Cerantonia siliqua* associations in the work of Uslu in the vicinities of Mersin-Silifke and Aydın province; as *Arbutus andrachne*, *Philyrea latifolia* and *Laurus nobilis* subassociations of *Quercus coccifera* association on the Nif mountain, İzmir, and *Arbutus andrachne-Quercus coccifera* association on the islands of Gökçeada and Bozcaada by Seçmen (1977) and Seçmen-Leblebici (1978).

There have not been resemblances in floristic composition, except for the Mediterranean components, between the associations described here and those in the Mediterranean and Aegean regions. At the same time, in the north Anatolia the similiar associations had been described in the past, in surroundings of Zonguldak, Akçakoca, Hendek and İnebolu by Czeetzott (1938) and in those of Trabzon-Giresun by Akman et al. (1980) and of Sinop by Zohary (1973). The associations described in the surroundings cited above had been included in different phytosociological units due to the local conditions. The Mediterranean components play a more important role in the associations described in the western sector of Euxinian territory. Though they were influenced by the Euxinian forest it is convenient to consider the two associations in the class *Q u e r c e t e a i l i c i s* and the other one in the class *C i s t o - M i c r o m e r i t e a* considering that they are in the case of the relics of the Old Mediterranean region.

ÖZET

Karadeniz Bölgesinde eski Akdeniz bölgesinin rölükleri halinde bulunan maki toplulukları kıyı kesimde Öksin türlerle karışarak tipik akdeniz makisinden farklı Psödomaki denilen bir formasyon oluşturmaktadır. Öksin bölgenin batı sektöründe fitososyolojik açıdan incelemeye çalıştığımız bu formasyon tipinde üç bitki birliği tanımlanmıştır. Öksin türlerin karışmış olmasına rağmen, Akdeniz elemanları burada daha önemli bir rol oynamaktadır. Bu nedenle tanımlanan birlikler Akdeniz topluluklarını içine alan *Q u e r c e t e a i l i c i s* ve *C i s t o - M i c r o m e r e t e a* sınıfları içinde değerlendirilmiştir.

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