GEOLOGY

Stratigraphy

Paleozoic:

The crystalline schist series which outcrop at the south of Nallıhan probably belong to lower Paleozoic. A gneiss is found at the lowest part of the series. On the other hand, at some locations, slightly metamorphic crystalline schists can also be seen.

Mesozoic:

Jurassic: The lower parts of the widespread limestone series found at the environs of Nallıhan and Mudurnu are of the Jurassic age.

Cenozoic:

Eocene: It overlays the Maestrichtian sandstones with an angulat unconformity in the area. White and yellowish–coloured limestones are found on top of these series. At some parts of the area. Eocene is represented only by the limestone series.

Miocene–Pliocene:

The serie starts with a conglomerata at the lowest part and is then replaced by the yellow–coloured sandstones and marls at the upper parts, it includes coal beds at several levels.

In the area alluvial depositions are found around the rivers and smaller streams.

CLIMATE

The data of the stations, Nallıhan and Mudurnu were used to determine the climate of the region.

Precipitation (Table: I,II)

According to present data, the annual amount of precipitation in the district of Nallıhan–Uluhan is 440 mm, while it is 560 mm in the district of Mudurnu. It is seen that the annual amount of the precipitation increases towards the north; On the other word, the mean annual precipitation reachs up to 120 mm at a distance of 50 km.

This is an important ecological characteristic and affects the structure of vegetation. In fact, the sylvatic communities *Quercus pubes-*

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TURQUIE

The Phytosociological investigation in the district of Uluhan-Mudurnu

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ABSTRACT

In the study area, the region of Uluhan-Mudurnu in the north-west Anatolia, the following associations and subassociations which were included in the alliances Quercion anatolicae and Pino-Cistion laurifolii of the orders Querco-Carpinetalia and Querco-Cedretalia libani, were described.

— *Quercus pubescens-Pyrus elaeagnifolia* association.
— *Pinus nigra* subsp. *pallasiana-Sesleria argentea* association.
— *Pinus nigra* subsp. *pallasiana-Anthyllis vulneraria* subassociation.
— *Carpinus betulus-Scaligera tripartita* association.
— *Carpinus betulus-Quercus petraea* subsp. *iberica* subassociation.
— *Carpinus betulus-Acer hyrcanum* subsp. *hyrcanum* subassociation.

INTRODUCTION

In 1978, The Commitee for Basic Sciences of the Scientific and Technical Research Council of Turkey approved the project under no TBAG–358. We are thankful to the Committee for providing us this oppurtunity.

The investigation is a part of the continued work already done in the North–West Anatolia by Akman in the years of 1972, 1973, 1974, 1975 and 1976.

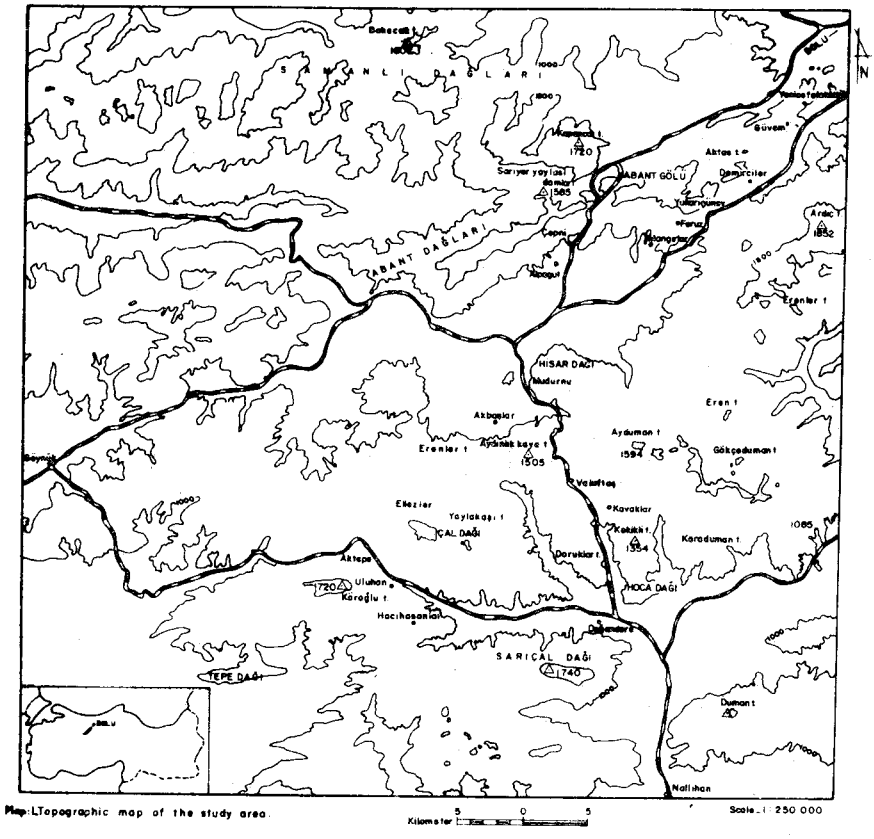
In the present work, the vegetation types and the plant communities in the study area were described for the first time.

We hereby appreciably acknowledge the helps rendered during the work particularly for the identification of the plants to Prof. Dr. A. BAYTOP, Doç. Dr. T. EKİM, Dr. P.H. DAVIS and his colleagues, A. HUBER–MORATH, and we are also thankful to Dr. P. QUEZEL for his assistance in establishment of the phytosociological tables.

THE GEOGRAPHICAL SITUATION OF THE AREA

(Map: 1)

The study area is situated 180 km., in North-West of Ankara and covers the surroundings of Uluhan and Mudurnu. The area is generally mountainous one with the highest peaks being the Ayduman hill 1594



m and Aydınlıkkaya 1505 m at the north, and Sarıçal mountain 1740 m in the south. Particularly Nallıhan, Uluhan and the district of Mongoşlar are in the character of a valley and they are open to the west.

Table I. Monthly and annual mean precipitation

Stations	Altitude (m)	MONTHLY PRECIPITATION (mm)												Annual Precipi
		01	02	03	04	05	06	07	08	09	10	11	12	
Nallıhan	650	69.2	53.7	44.2	54.8	45.5	50.6	30.4	11.5	11.5	14.5	20.1	35.5	441.6
Mudurnu	840	80.6	63.2	64.2	54.5	58.3	45.9	22.0	12.1	18.4	21.4	33.4	85.0	559.2

Table II. Seasonal mean precipitation

Stations	Altitude (m)	W		S		S		A		Annual Mean Precipitation (mm)
			%		%		%		%	
Nallıhan	650	167.1	37.9	151.2	34.3	53.2	12.9	70.1	17.0	441.1
Mudurnu	840	208.8	38.3	177.0	32.6	79.1	15.1	73.2	14.0	559.2

cens and *Pinus nigra* subsp. *pallasiana* in surroundings of Uluhan were replaced by those of *Capinus betulus* and *Quercus petraea* subsp. *iberica* in the districts of Mudurnu. In the further norh the pontic region in which the communities of *Pinus sylvestris*, *Abies bornmuelleriana* and *Fagus orientalis* are dominant, is arrived.

The most rainy months (December, January and February) in the each station are those of winter (167.1 mm for Nallıhan and 208.8 mm for Mudurnu). In winter, Nallıhan has a rain fall of 37.9 % and Mudurnu 38.8 % of total amonth. The next rainy season is spring.

As to summer, the rainfall conditions in each district (Nallıhan–Uluhan and Mudurnu) are not same. The summer drought in the district of Nallıhan–Uluhan is more conspicous while the summer precipitation in Mudurnu is quite more.

In fact the precipitation regime confirms this. The precipitation regime is an East Mediterranean one in the station of Nallıhan–Uluhan while a transitory type of Mediterranean in surroundings of Mudurnu. Therefore, the north of the study area is situated in the region confronted by two type of climate (Mediterranean and Oceanic).

The next rainy season is autumn in the district of Nallıhan–Uluhan while it is less rainy in Mudurnu.

Temperature (Table: III. IV. V)

The mean annual temperature in Nallıhan is 12.6°C, while it is 10.1 'C in Mudurnu. The mean maximum temperatures of the hottest mounth, August, 30.6 'C in Nallıhan, and 27.4°C in Mudurnu.

The mean minimum temperatures of the coldest month, February, are –1.6 'C in Nallıhan and –4.2°C in Mudurnu.

It is seen that Mudurnu is 3°C colder than Uluhan and it is possible to observe this for all mean temperatures.

The mean relative humidity (Table: VI)

The mean annual relative humidity is around 66–67 % in each district. The higher amount of the relative humidity is in the winter months, while the lower amounts are in the summer months.

Wind (Table: VII)

The dominant wind is of western origin in the district of Nallıhan, Uluhan, while the northern and north–western winds are dominant in Mudurnu.

Table III. Monthly and annual mean temperature

Stations	Altitude (m)	MONTHLY MEAN TEMPERATURE												Annual Mean (c)
		01	02	03	04	05	06	07	08	09	10	11	12	
Nallıhan	650	2.1	2.3	6.6	11.8	16.9	20.6	23.4	23.0	19.1	12.8	7.4	4.4	12.6
Mudurnu	840	0.4	0.8	4.4	9.4	13.9	17.0	19.3	19.3	15.8	10.6	7.3	2.9	10.1

Tablo IV. Monthly and annual maximum mean temperature

Stations	Altitude (m)	MONTHLY MEAN TEMPERATURE												Annual Mean (c)
		01	02	03	04	05	06	07	08	09	10	11	12	
Nallıhan	650	5.9	6.4	12.6	18.4	24.1	27.2	30.5	30.6	26.7	20.0	13.6	7.5	18.6
Mudurnu	840	4.4	6.0	10.2	16.0	20.9	24.5	27.0	27.4	24.3	18.6	13.6	6.5	16.6

Table V. Monthly and annual minimum mean temperature

Stations	Altitude (m)	MONTHLY MEAN TEMPERATE												Annual Mean (C)
		01	02	03	04	05	06	07	08	09	10	11	12	
Nallıhan	650	–1.6	–1.6	1.7	6.3	10.3	13.4	15.9	15.7	11.8	6.5	3.0	0.4	6.8
Mudurnu	840	–3.6	–4.2	–1.0	2.9	6.8	9.2	11.1	11.2	8.0	3.8	1.3	–1.1	3.7

Table VI. Mean relative humidity %

Stations	Altitude (m)	MONTHLY PRECIPITATION												Annual Precipi
		01	02	03	04	05	06	07	08	09	10	11	12	
Nalhhan	650	81	80	74	66	65	68	56	53	54	57	69	79	67
Mudurnu	840	77	78	75	64	61	57	54	54	58	64	68	78	66

Table VII. The dominanth winds

Stations	Altitude (m)	MONTHLY												Annual Precipi
		01	02	03	04	05	06	07	08	09	10	11	12	
Nalhhan	650	W	W	W	W	W	W	W	W	W	W	W	W	W
Mudurnu	840	NW	NW	SW	SW	NW	NW	NW	NW	N	N	N	N	NW

Bioclimatic synthesis

The districts of Nallıhan–Uluhan and Mongoşlar in the study area are under the influences of Mediterranean climate, but the Mudurnu districts has a character of transitory of Mediterranean climate. The different precipitation regime in the districts of Nallıhan and Mudurnu confirms this.

The pluviothermic quoitent of Emberger (Q_2) is 47.7 for Nallıhan and 63 for Mudurnu.

The values of Q, P, M and m in the each station and their bioclimates are shown in the following table.

Stations	P	M	m	Q_2	Bioclimatic zone
Nallıhan	441.1	30.5	–1.6	47.7	Superior semi-dry, cold
Mudurnu	559.2	27.0	–4.2	63.0	Less rainy very cold

Consequently it may be said that the districts of Nallıhan–Uluhan cold Mediterranean climate, while the districts of Mudurnu on the north are under the effective control of a transitory climate with a character of less rainy very cold Mediterranean one.

VEGETATION

The vast part of the study area is dominated by a sylvatic vegetation. The communities of *Quercus pubescens* occur among Nallıhan and Uluhan at an altitude of 900–1000 m. Above this altitude up to 1500–1600 m. *Pinus nigra* subsp. *pallasina* forest are dominant.

In the vicinities of Mudurnu, *Carpinus betulus* forest occurs in patches on the slopes facing the north and in the talvegs on levels which black pine is spread. Towards the north, among Mudurnu, and Abant *Quercus petraea* subsp. *iberica* communities are dominated. After a very short distance these communities are replaced by the forest of *Fagus orientalis*, *Abies bornmuelleriana* or the same species mixed along with *Pinus slvestris*.

According to the recent researchs (Akman, Quézel and Barbero 1977, 1978) the vegetation of the North–Western Anatolia has been

included in the class Quercetea pubescentis and its order Querco-Carpinetalia and Querco-Cedretalia libani.

The quadrats carried out in the study area reveal that the vegetation in the districts of Mudurnu and Uluhan could be included in the class Quercetea pubescentis and its order Querco-Carpinetalia. But, however the plants groups originated from pontic and prepontic region also occur in the vicinities of Mudurnu-Abant and Abant-Bolu.

Carpinus betulus - Scaligera tripartita association

(Table no: VIII)

The decidious formations of *Carpinus betulus* have been individualized on the levels of black pine, on the northern slopes of 900-1400 m in the district of Mudurnu. The same vegetational zone also occurs in the Sündiken and Türkmen mountains, Eskişehir (Ekim, 1978) and Mezit valley in the Marmara region (Akman, Quézel, Barbéro, 1978)

The plant group of Carpino-Acerion has been individualized on the supramediterranean biogeographical of the rainy bioclimatic area in the North-West Anatolia and expands towards the southern limits of pontic region.

An association and two subassociation were described in the *Carpinus betulus* plant group in the district of Mudurnu.

Carpinus betulus-Scaligera tripartita association.

1- *Carpinus betulus- Quercus petraea* subsp. *iberica* subassociation.

2- *Carpinus betulus-Acer hyrcanum* subsp. *hyrcanum* subassociation.

The second subassociation has a apperance of forest in the vicinities of Mudurnu and is composed of the trees of *Carpinus betulus* in midle height, but *Acer hyrcanum*, *Lonicera orientalis* and *Cryllus avellana* play an important role in the tree layer. The subassociation is characterized by a very rich floristic structure. For example: *Astrantia maxima* subsp. *haradjianii*, Scaligera *tripartita*, *Polygonatum multiflorum*, *Saponaria glutinosa*. Therefore it comprises many species of the higher unit.

The bedrock plays an effective role here, but however, many of the quadrats were laid out on the calcerous bedrock with marn, in the vicinities of Mudurnu. This type of subassociation occurs in the area where the cold parameter of a rainy bioclimate is efective.

The first subassociation is a part of the above mentioned plant group and is individualized in the further north of the second one.

Its floristic composition is not so rich on the level of characteristics. But however, it is possible to see all the components of the alliance Carpino-Acerion,

Quercus pubescens association

(Table no: IX)

The decidious forest previously cited in Anatolian plateau are replaced by the another type of decidious forests of *Quercus pubescens* on the supramediterranean zone in a very short distance. The most important factors on this variation are climatic and edaphic ones.

As a matter of fact, *Quercus pubescens* are usually seen on the semi -dry bioclimatic zone having a rainfall less than 500 mm and in the continental area.

In the North-West Anatolia, the *Quercus pubescens* scrubs were exploited due to overgrazing, therefore it forms very loose communities in patches and their heights vary between 50 cm to 2 m. So it is impossible to talk about a real forest. Reforestation is quite hard in case that the biotic factors are effective. However, its floristic composition comprises many sylvatic species.

In should be noted that the some communities are encountered as relics in many places of Anatolian plateau.

Phytosociological interpretation:

The *Quercus pubescens* forest were recently investigated well in respect to floristic structure in the Northern and Western Anatolia (Akman 1972, 1974, 1976, Akman and Ketenoğlu 1976). In the North -Western Anatolia two associations were described according to different climatic conditions and soil situations.

1- *Quercus pubescens–Trifolium medium* association.

2- *Quercus pubescens–Pyrus elaeagnifolia* association.

The first was formerly described in surroundings of Çanılbalâ village on the southern slopes of Işık mountain. Here, *Quercus pubescens* develops well and has a better climatic condition. Therefore it is possible to find many hygrophilous and sciophilous species. Among them, *Trifolium medium*, *Primula vulgaris*, *Viburnum lantana* and were cited as differential characteristics.

The second one is wildespread in Central Anatolia and was more exploited. Therefore the hygrophilous and the sciophilous species in the former association are not seen here.

Of the characteristics, the species which are dominant in the semi –dry regions such as *Pyrus elaeagnifolia*, *Colutea cilicica*, *Coronilla varia*, *Paliurus australis*, *Vicia cracca*, *Jasminum fruticans*, *Fraxinus oxycarpa* and *Prunus domestica* subsp. *insititia* are seen.

Of the species belonging to the order Q u e r c o–C e d r e t a l i a, *Crataegus orientalis*, *Cotoneaster nummularia*, *Berberis crataegyna* occur in our quadrats as well. Because the Nallıhan–Uluhan valley is under the influences of Mediterranean climate due to exposing to Göynük and Geyve. We had cited in the previous works that we had encountered the *Pinus brutia* forests in the Nallıhan and Aladağ valleys.

The second association is more spread in the degraded areas and it characterizes a drier climate than the first in respect to ecology. The annual total amount of the rainfall is between 350–400 m (Akman 1976, 1978). The second association belongs to a semi–dry zone from the bioclimatical point of view (Q = 40–55) and was more exploited in the areas near steppe. This situation provides us to describe its regressive succession after exploitation of *Pinus nigra* subsp. *pallasiana* forests (Akman 1974).

The association undoubtely belonging to the Mediterranean world has a wider distribution on the supramediterranean zone of West and North–West Anatolia. Because, some species along with the climax forest species are from Mediterranean region. But however the areas extensively exploited near steppe were occupied by the components of Irano–Turanian region.

Pinus nigra subsp. pallasiana association

(Table no: x)

The black pine, the distribution of which was cited in the previous works (Akman, Quézel and Barbéro 1978) is seen among Nallıhan -Uluhan and Uluhan–Mudurnu in the study area.

We mentioned in our recent works (Akman, Quézal, Barbero 1978) that the black pine forest have a fairly different floristic structure and may be included in the orders *Querco–Carpinetalia* and *Querco–Cedretalia libani*. Thus, the plant group of black pine having a wide distribution in Turkey may be distinguished as fallows according to our recent knowledge.

— Black pine forests in the North–West Anatolia

— Black pine forests in the Aegean region,

— Black pine forests in the Amanus and Taurus mouatains in Mediterranean region.

Here the black pine forests in the North–West Anatolia are under consideration.

The black pine forests in the vicinities of Mudurnu have been included in the order *Querco–Carpinetalia* as well. At the same time we had also included the black pine forests in surroundings of Ankara, Beypazarı, Kırşehir, Balıkesir and Uşak (Akman, Quézel, Barbéro 1978).

Ecological and Phytosociological interpretation of the black pine forests in the region of Mudurnu:

Although the black pine prefers the bedrocks of erruptive and metamorphic, flisch and chalk, it can be seen on the various bedrocks. It isn't almost seen on the hard chalks, The rendzina type of soils, upper horizons of which became brown are widespread in the areas around Mudurnu in which the black pine is spread.

From the climatic point of view, the black pine develops in a continental environment. The cold and very cold parameter is important here (m = 1°C–4°C). Precipitation is not so much (440–560 mm). The climate reflects the vegetation well. East Mediterranean precipitation regime prevails around Nallıhan–Uluhan, while a transitory type of precipitation regime around Mudurnu.

Thus, bioclimate extends from the semi–dry upper zone towards rainy zone in the north–south direction and here the black pine plant group has been replaced by the communities of *Carpinus betulus* and *Quercus petraea* sunsp. *iberica*.

In respect to altitude, the black pine forests in the vicinities of Uluhan–Mudurnu develop on the Mediterranean mountain zone and cover whole region from 900–1000 m up to 1500 m.

The floristic composition of the black pine forests in the district of Uluhan–Mudurnu has been included in the alliance Pino–Cistion laurifolii and the order Querco–Carpinetalia. The alliance is the vicariant of Pino–Chamaecytision which was determined in Greece. The black pine forest around Uluhan–Mudurnu resemble those in Greece due to the effects of Balkans on Anatolia.

The black pine forests in the study area can be investigated in two categories.

The formers those in the vicinities of Nallıhan–Uluhan–Mongoşlaı which have a xerophytic character extending to the peak and the latters is the black pine forest around Mudurnu which are more Mesophytic than the first.

In the vicinities of Uluhan–Mudurnu an association and a subassociation were described;

— *Pinus nigra* subsp. *pallasiana–Sesleria argentea* association.

— *Pinus nigra* subsp. *pallasiana–Anthyllis vulneraria* subassociation.

The association is encountered on the calcerous marn bedrocks at an elevation of 1300–1500 m in the region of Mudurnu. Sometimes green rocks can be seen in patches. The area is situated on the south of pontic region, therefore the black pine forests are in the normal limits of distribution. Extending towards the northern slopes, the decidious formations of Carpino–Acerion is started to be seen.

The black pine communities in this group develop well and quite denser. Some species of the orders Querco–Carpinetalia and Querco–Fagetalia such as *Sorbus torminalis*, *Cornus mas*, *Viburnum lantana*, *Coryllus avellana* and *Crateaeus monogyna* are harboured within the tree layer along with the *Quercus pubescens*.

The herb layer is fairly denser and compries the grasses such as *Sesleria argentea* and *Brachypodium pinnatum*. These species play quite important role here.

Of the characteristics of the association, the species such us *Sesleria argentea*, *Tanacetum poteriifolium*, *Polygala supina*, *Iris sintenisii* and *Helleborus orientalis* can be given.

Another important point is that *Quercus cerris* and some calcifuge species such as *Cistus laurifolius* and *Hypericum montbretii* are never seen in the study area.

Although some components of the order Querco-Cedretalia libani are seen in this plant group, those of the order Querco-Carpinetalia are more in number.

The subassociation of *Anthyllis vulneraria* are seen in the districts of Nallıhan, Uluhan, Mongoşlar and Karacasu village in which the climate is relatively dries and are dominant on the brown calcerous forest soils derived from the calcerous marn.

The differential species of the subassociation are; *Anthyllis vulneraria*, *Bupleurum falcatum*, *Carex halleriana*.

DISCUSSION and CONCLUSION

The districts of Nallıhan–Uluhan in the study area is under the influences of Mediterranean climate while those of Mudurnu the vegetation exhibits a different structure in the north and south of the region.

In the districts of Nallıhan–Uluhan–Mongoşlar in the south of region, the forests of *Quercus pubescens* and *Pinus nigra* subsp. *pallasiana* occur. These forests were included in the class Quercetea pubescentis and its orders Querco-Carpinetalia and Querco-Cedretalia libani and the alliances Quercion anatolicae and Pino-Cistion (Akman, Quézel, Barbero 1978).

In the districts of Mudurnu–Bolu in the north of the region, the forests of *Carpinus betulus* and *Quercus petraea* subsp. *iberica* were included in the alliance, Carpino-Acerion of the order Querco-Carpinetalia.

Quercus pubescens–Pyrus elaeagnifolia association was described in the alliance Quercion anatolicae.

The association of *Pinus nigra* subsp. *pallasiana–Sesleria argentea* and its subassociation, *Pinus nigra* subsp. *pallasiana–Anthyllis vulneraria* were described in the aliance Pino – Cistion laurifoliii. Barbéro 1978).

In the district of Mudurnu and Abant in the north of the region, an association along with its subassociation belonging to the alliance Carpino–Acerion, were described.

— *Capinus betulus–Scaligera tripartita* association,

— *Carpinus betulus–Quercus petraea* subsp. *iberica* subassociation

— *Carpinus betulus–Acer hyrcnum* subsp. *hyrcanum* subassociation.

The associations and the subassociations belonging to the each alliance develop on the supramediterranean zone of Mediterranean region. Though the south of the region is under the effects of Meditterranean climate, the north has a oceanic climate, Therefore, in the district of Nallıhan-Uluhan and Mongoşlar, the Mediterranean climate and vegetation are dominant, while in the districts of Mudurnu and Bolu in the north have a mixed vegetation type of Pontic and Mediterranean origin.

ÖZET

Kuzeybatı Anadolu'da Uluhan-Mudurnu bölgelerinin bitki sosyolojisi yönünden ilk defa araştırılması sonucunda QUERCETALIA PUBESCENTIS ve QUERCO-CEDRETALIA LIBANI ordoları ile bunun QUERCION-ANATOLICAE ve PINO-CISTION LAURIFOLII alyanslarına bağlı aşağıdaki birlik ve alt birlikler bulunmuştur.

— *Quercus pubescens* ve *Pyrus elaeagnifolia* birliği.

— *Pinus nigra* subsp. *pallasiana* ve *Sesleria argentea* birliği.

— *Pinus nigra* subsp. *pallasiana-Anthyllis vulneraria* alt birliği.

— *Carpinus betulus* ve *Scaligera tripartita* birliği.

— *Carpinus betulus-Quercus petraea* subsp. *iberica* alt birliği.

— *Carpinus betulus-Acer hyrcanum*subsp. *hyrcanum* alt birliği.

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TABLE: VIII

Carpinus betulus association

Quadrat no	57	56	121	41	30	27	42	43	28	46	47	18	16	44	29	40	45	17	19	20	196	195	26	31	15	39	Presence
Inclination (%)	10	10	15	25	25	15	25	30	20	15	10	20	20	25	25	30	10	20	20	20	25	10	15	20	20	20	
Altitude (m)	1000	1000	1200	1400	1450	1400	1470	1450	1500	1370	1400	1350	1300	1400	1500	1350	1350	1350	1350	1350	900	850	1450	1450	1300	1300	
Exposition	W	W	W	NW	NW	N	NW	NW	N	NW	N	N	N	NW	N	NW	N	N	N	N	N	N	N	N	N	N	
Carpinus betulus	44	44	44	55	44	44	55	55	44	44	44	45	45	55	44	55	44	45	45	45	44	44	44	44	45	44	V
The characteristics and differential species:																											
Coryllus avellana	.	.	22	12	12	12	12	12	12	+1	++	.	.	12	12	12	+1	.	.	.	.	.	12	12	.	12	IV
Polygonatum multiflorum	+1	+1	.	.	++	++	.	.	++	.	+1	++	++	.	++	.	.	++	++	++	.	.	++	++	++	.	III
Lonicera orientalis	+1	+1	.	12	.	11	12	12	.	12	12	.	.	12	.	12	12	.	.	.	.	.	.	.	.	.	III
Scaligera tripartita	.	.	.	.	.	.	.	.	+1	.	.	+1	+1	.	.	.	.	+1	+1	+1	.	.	.	.	+1	.	II
Astrantia maxima subsp. haradjianii	.	.	.	12	++	.	.	12	12	.	.	.	.	.	12	.	12	.	.	.	.	.	.	.	.	12	II
Saponaria glutinosa	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	.	.	++	.	.	.	.	+1	.	I
The Characteristics of the alliance CARPINO—ACERION:																											
Helleborus orientalis	12	.	11	12	12	12	12	12	12	12	12	22	22	12	12	12	12	22	22	22	++	.	12	12	22	12	V
Physospermum aquilegifolium	23	23	12	22	12	12	12	22	12	22	22	.	12	22	12	22	22	.	.	.	.	.	12	12	.	12	IV
Acer hyrcanum subsp. hyrcanum	.	.	+1	+1	.	.	+1	+1	.	.	.	11	11	+1	.	+1	.	11	11	11	+1	.	.	.	.	22	III
Lathyrus laxiflorus	.	.	11	.	.	.	.	+1	12	+1	+1	+1	+1	.	.	.	+1	+1	+1	+1	.	.	.	.	11	12	III
Cirsium hypoleucum	.	.	++	.	+1	+1	+1	.	+1	+1	.	.	.	.	+1	.	.	12	.	.	++	.	+1	+1	.	.	III
Lathyrus aureus	22	22	.	.	.	.	+1	.	.	.	.	++	++	.	.	.	.	++	++	++	++	.	.	.	.	.	II
Galium longifolium	.	.	+1	+1	++	++	.	.	++	.	.	11	11	.	++	.	.	.	.	++	.	.	++	.	.	.	II
Asperula cymulosa	12	12	.	.	+1	.	.	.	.	++	++	12	.	.	.	.	++	.	.	.	.	.	.	.	++	.	II
Asyneuma limonifolium	.	.	.	.	++	++	.	.	+1	.	.	.	.	.	++	.	.	.	.	.	.	.	.	.	.	.	II
Digitalis orientalis	.	.	.	.	++	++	.	.	++	.	.	.	.	.	++	.	.	.	.	.	.	.	+1	++	.	.	II
Phlomis samia	.	.	.	.	.	.	.	.	.	12	12	.	.	.	.	.	12	.	++	.	.	.	++	++	.	.	II
Dorycnium graecum	12	12	++	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	++	.	.	.	.	33	I
Quercus petraea subsp. iberica	22	22	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Laser trilobum	11	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	I
Anthriscus nemorosa	++	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Viola sieheana	++	.	+1	.	.	.	.	.	.	.	.	.	12	.	.	.	.	.	.	.	.	.	.	++	.	.	I
Vicia truncatula	22	22	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Lathyrus rotundifolius. var. minuatus	34	34	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Trifolium pannonicum subsp. elongatum	12	12	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Astragalus glycophyllos subsp. glycophylloides	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Polygala supina	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	+1	.	.	.	.	.	.	++	.	.	.	.	I
Lathyrus undulatus	++	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
The characteristics of the superclass QUERCO—FAGEA:																											
Euphorbia amygdaloides	.	.	.	12	12	12	12	12	12	.	.	.	.	12	12	12	.	.	.	.	++	++	12	12	.	.	III
Primula vulgaria subsp. vulgaris	.	.	.	11	.	.	.	.	.	.	22	22	++	++	.	.	22	++	++	++	.	.	.	.	.	23	II
Veronica chamaedrys	+1	+1	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	++	++	++	.	.	.	.	++	.	II
Clematis vitalba	.	.	.	.	+1	+1	.	.	+1	.	.	.	.	.	+1	.	.	.	.	.	.	.	+1	+1	.	.	II
Evonymus europaeus	.	.	.	+1	.	+1	+1	+1	.	.	.	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	II
Clinopodium vulgare	.	.	++	.	.	.	.	.	.	.	+1	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	II
Poa nemoralis	.	.	.	.	.	+1	.	.	+1	.	.	.	.	.	+1	.	.	+1	.	.	++	++	.	.	.	++	I
Rubus idaeus	.	.	.	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	+1	.	.	.	I
Fragaria vesca	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	12	I
Vicia cracca subsp. stenophylla	23	23	12	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	I
Crataegus monogyna	.	.	11	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Hedera helix	.	.	.	.	.	.	.	+1	+1	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	I
Lapsana communis subsp. intermedia	.	.	.	.	.	11	.	.	.	+1	.	11	.	.	.	.	.	.	.	.	.	++	.	.	.	.	I
Tamus communis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
The characteristics of the class QUERCO—FAGATEA:																											
Doronicum orientale	.	.	++	12	+1	+1	12	12	+1	12	12	.	.	12	+1	12	12	.	.	.	.	.	+1	+1	.	.	III
Festuca heterophylla	.	.	.	.	.	.	.	.	.	.	.	11	11	.	.	.	.	11	11	11	.	.	.	.	11	.	II
Myosotis sylcatica	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	++	++	++	.	.	.	.	++	.	II
Sanicula europea	.	.	.	.	.	.	.	+1	.	.	.	+1	.	.	.	.	.	.	.	.	.	++	.	.	.	.	I
Salvia forskahlei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	I
Daphne pontica	.	.	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	I
Actea spicata	23	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	.	.	.	.	I
The characteristics of the unit QUERCETEA PUBESCENTIS:																											
Sorbus torminalis	.	.	+1	12	++	++	12	12	++	11	11	11	11	12	++	12	11	11	11	11	.	.	++	++	11	.	V
Cornus mas	11	11	++	22	12	12	22	22	12	.	.	.	.	22	12	22	.	.	+1	.	+1	.	12	12	.	.	IV
Potentilla micrantha	.	.	.	+1	.	.	+1	+1	.	+1	+1	++	++	+1	.	++	++	+1	++	.	.	.	.	.	++	.	IV
Acer campestre	.	.	.	11	11	11	11	11	11	.	.	.	.	11	11	11	.	.	.	.	++	++	11	11	.	.	III
Viburnum lantana	.	.	.	22	.	11	12	12	.	.	+1	.	.	12	.	12	.	.	.	.	.	.	.	.	.	12	II
Quercus pubescens	.	.	.	.	+1	.	.	.	.	.	.	12	12	.	.	.	.	12	.	12	.	.	.	.	12	.	II
Brachypodium pinnatum	.	.	.	.	.	.	.	.	.	.	.	12	12	+1	.	.	.	12	12	12	.	.	.	.	12	.	II
Ligustrum vulgare	.	.	.	11	.	.	11	11	.	.	.	.	.	11	.	11	.	.	.	.	.	++	.	.	.	.	II
Cephalanthera rubra	.	.	.	+1	.	.	+1	+1	.	.	.	.	.	+1	.	+1	.	.	.	.	++	.	.	.	.	.	II
Silene italica	12	12	++	.	+1	.	.	.	.	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Sesleria argentea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	22	.	.	.	++	.	.	.	.	12	I
Campanula rapunculoides	.	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	++	+1	.	.	.	.	I
Coronilla varia	.	.	.	.	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Trifolium medium	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	++	.	.	.	.	I
Lithospermum purpureo-coeruleum	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+1	++	.	.	.	.	.	I
Cerasus mahalep var. mahalep	.	.	.	.	.	.	.	.	.	++	++	.	.	.	11	.	++	.	.	.	.	.	.	.	.	.	I
Campanula persicifolia	.	.	++	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Bupleurum falcatum	.	.	11	.	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
The characteristics of the order QUERCO—CEDRETALIA LIBANI:																											
Sorbus umbellata	.	.	.	11	++	++	11	11	++	+1	+1	.	.	11	++	11	+1	.	.	.	.	.	++	++	.	.	III
Milium vernale	.	.	.	.	.	.	.	.	.	++	++	.	.	.	.	.	++	.	.	.	.	.	.	.	.	12	I
Companions:																											
Populus tremula	.	.	.	.	.	.	.	.	.	12	12	12	12	.	11	.	12	12	12	12	.	.	.	.	12	.	II
Dactylis glomerata	.	.	++	.	.	.	.	.	.	.	++	++	.	.	.	.	.	++	++	++	.	.	.	.	++	.	II
Pteridium aquilinum	12	12	.	.	.	.	.	.	.	22	22	.	.	.	.	.	22	.	.	.	.	.	.	.	.	.	I
Polygala anatolica	.	.	.	+1	.	.	+1	+1	.	.	.	.	.	+1	.	+1	.	.	.	.	.	.	.	.	.	.	I
Melampyrum arvense subsp. pseudobarbatum	.	.	.	++	.	.	++	++	.	.	.	.	.	++	.	++	.	.	.	.	.	.	.	.	.	.	I
Trifolium boissieri	.	.	.	.	.	.	.	.	.	11	11	.	.	.	.	.	11	.	.	.	.	.	.	.	.	.	I
Trifolium nigrescens	12	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Specularia speculum-veneris	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Geranium pyrenaicum	+1	+1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Moenchia mantica	++	++	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Galium aparine	12	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Festuca ovina	12	12	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

Table: IX Quercus pubescens association

Quadrat no	7	6	8	9	5	49	117	118	50	48	116	171	Presence
Inclination (%)	2	1	1	2	1	10	10	10	10	5	10	10	
Altitude (m)	750	700	800	800	700	1250	850	850	1250	1200	800	1100	
Exposition	W	W	W	SW	W	NW	S	S	NW	N	S	S	
Quercus pubescens	45	45	45	45	45	33	44	44	33	33	44	45	V
The characteristics and differential species:													
Coronilla varia	11	11	11	11	11	+1	+1	+1	+1	+1	+1	++	V
Vicia cracca var. stenophylla	12	12	12	12	12	.	.	.	.	33	.	+1	III
Paliurus australis	11	11	11	11	11	.	.	.	.	.	.	+1	III
Colutea cilicica	+1	+1	+1	+1	+1	.	++	.	.	.	.	.	III
Fraxinus oxycarpa	11	11	11	11	11	.	.	.	.	.	.	.	II
Jasminum fruticans	11	11	11	11	11	.	.	.	.	.	.	.	II
Lathyrus digitatus	.	.	.	.	.	++	.	.	++	++	.	.	II
Prunus domestica subsp. insititia	.	.	.	.	.	+1	.	.	+1	+1	.	.	II
Pyrus elaeagnifolia	.	.	.	.	.	+1	.	.	+1	+1	.	.	II
The characteristics of unit QUERCETEA PUBESCENTIS:													
Juniperus oxycedrus	22	22	22	22	22	.	+	+1	.	.	+1	++	IV
Geum urbanum	++	++	++	++	++	+1	.	.	+1	+1	.	.	III
Teucrium chamaedrys	11	11	11	11	11	.	.	.	.	.	.	++	III
Carex halleriana	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	II
Cornus mas	.	.	.	.	.	.	12	12	.	.	12	12	II
Acer campestre	.	.	.	.	.	.	+1	+1	.	.	+1	.	II
Lithospermum purpureo-coeruleum	.	.	.	.	.	.	12	12	.	.	12	.	II
Ligustrum vulgare	.	.	.	.	.	.	.	12	.	.	12	.	I
The characteristics of the order QUERCO—CEDRETALIA LIBANI:													
Berberis crataegyna	+1	+1	+1	+1	+1	.	.	.	.	.	.	11	III
Cotoneaster nummularia	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	II
Dorycnium pentaphyllum subsp. anatolica	.	.	.	.	.	+1	.	.	+1	+1	.	.	II
Crataegus orientalis	.	.	.	.	.	12	.		12	12	.	.	II
The characteristics of the order QUERCO--CARPINETALIA and the alliance CARPINO—ACERION:													
Lonicera orientalis	+1	+1	+1	+1	+1	.	+1	+1	.	.	+1	.	III
Asperula cymulosa	.	.	.	.	.	++	12	12	++	++	12	.	III
Cornus sanguinea subsp. australis	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	II
Dorycnium graecum	.	.	.	.	.	.	+1	+1	.	.	+1	++	II
Astrantia maxima subsp. haradjianii	.	.	.	.	.	12	.	.	12	12	.	.	II
Acer hyrcanum subsp. hyrcanum	.	.	.	.	.	+1	.	.	+1	+1	.	.	II
The characteristics of the superclass QUERCO—FAGEA:													
Clinopodium vulgare	.	++	.	.	.	+1	12	12	+1	+1	12	++	III
Fragaria vesca	.	.	.	.	.	.	+1	+1	.	.	+1	.	II
Lapsana communis subsp. intermedia	.	.	.	.	.	.	+1	+1	.	.	+1	.	II
Tamus communis	.	.	.	.	.	.	+1	+1	.	.	+1	.	II
Companions:													
Galium verum	+1	+1	+1	+1	+1	+1	.	.	+1	+1	.	.	III
Rosa canina	+1	+1	+1	+1	+1	+1	.	.	+1	+1	.	.	III
Poterium sanguisorba	++	++	++	++	++	.	.	.	.	.	.	.	II
Malabaila secacul	++	++	++	++	++	.	.	.	.	.	.	.	II
Poa pratensis	+1	+1	+1	+1	+1	.	.	.	.	.	.	.	II
Helianthemum nummularium	+1	+1	+1	+1	+1	.		.	.	.	.	.	II
Scutellaria salviifolia	++	++	++	++	++	.	.	.	.	.	.	.	II
Achillea nobilis subsp. heldreichii	++	++	++	++	++	.	.	.	.	.	.	.	II
Eryngium campestre	++	++	++	++	++	.	.	.	.	.	.	.	II
Dactylis glomerata	.	.	.	.	.	+1	.	.	+1	+1	.	++	II
Salvia grandiflora	.	.	.	.	.	.	+1	+1	.	.	+1	++	II
Digitalis ferruginea	.	.	.	.	.	.	+1	+1	.	.	+1	.	II
Aristolochia sp.	.	.	.	.	.	.	11	11	.	.	11	.	II
Polygala anatolica	.	++	.	.	.	+1	.	.	+1	+1	.	.	II
Phlomis armeniaca	.	.	.	.	.	12	.	.	12	12	.	.	II
Pteridium aquilinum	.	.	.	.	.	22	.	.	22	22	.	.	II
Origanum vulgare	.		.	.	.	.	.	+1	.	.	.	+1	I
Onobrychis armena	11		.	.	.	.	.	.	.	.	.	.	II

TABLE X Pinus nigra subsp. pallasiana association

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