Commun. Fac. Sci. Univ. Ank. Ser. C
V, 4. pp. 9 - 24 1986)

# A PHYTOSOCIOLOGICAL STUDY IN THE VICINITIES OF ÇAMLIDERE ÇAMKORU AND PEÇENEK (ANKARA)

Y. AKMAN and M. AYDOĞDU

*Biology Dept. The University of Ankara Turkey*
(Recieved in June 1986, accepted in September 1986)

ABSTRACT

The study area, the vicinities of Çamlıdere-Peçenek and Çamkoru is situated within the boundaries of the Ankara province.

The vegetation in the area which is under the influences of the mediterranean climate, with small rainfaall, has a confirmity with this type of climate that was analysed according to the Braun-Blanquet's approach.

In the study area the sylvatic vegetation is dominant and it comprises the communities of *Quercus pubescens*, *Pinus nigra* subsp. *pallasiana*, *Pinus sylvestris* and *Abies nordmanniana* subsp. *bornmuelleriana*. All these communities are included in the class of Quercetea Pubescentis.

## INTRODUCTION

The study area is situated in the north-west of Ankara a distance of about 130–160 km. The villages of Aşağı Ovacık and Yukarı Ovacık forming the southern boundaries of the Gerede Aktaş forest are situated in the north, Kızılcahamam in the east, Çeltikçi in the south and Benli plateau (Beypazarı) in the west of the study area.

In the present work, the phytosociological structure and plant groups of the study area are described for the first time.

The geographical and climatical conditions of the area have entailed to form three different plant groups.

ISSN 0256 – 7865, A. Üniv. Basımevi

A semiarid-Very cold type of mediterranean climate is effective in the area.

The plant groups of *Quercus pubescens*, *Pinus nigra* subsp. *pallasiana*, *Pinus sylvestris* and *Abies nordmanniana* subsp. *bornmuelleriana* were developed corresponding to the climatical variation from north to south of the area.

## MATERIAL AND METHOD

The study was carried out in two years, between the periods of early Spring 1978 and Autumn 1979.

In the course of the study, the vegetation of the area was tried to be described by means of the quadrat laid out in the areas with a homogeneous plant cover.

A great number of plant specimens collected in the study area were identified by the author in the herbarium of the biology department of the Science faculty Ankara and some were sent to the other herbaria.

The geological data were obtained from the reports of the M.T.A. institute, while those of the climate came from the bulletins and records of the state meteorological service.

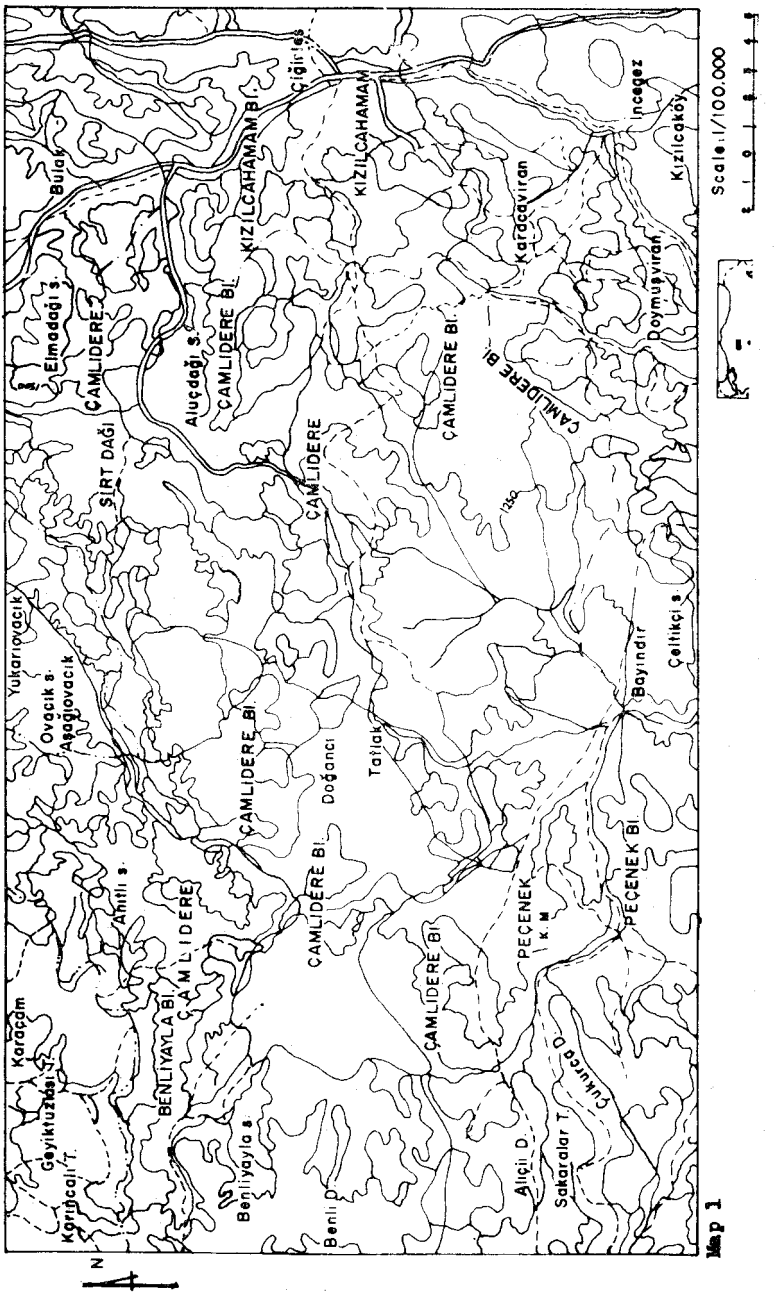
The gross limits of the area were drawn according to the forest maps of the Forestry Department.

The vegetation was analysed according to Braun-Blanquet method by means of 45 quadrats, the size of which was estimated before.

## GEOGRAPHICAL AND GEOLOGICAL CONDITIONS OF THE AREA

The town of Çamlıdere which constitutes the study area is situated within the boundaries of the Ankara province and those of Peçenek and Çamkoru within the boundaries of the town Çamlıdere.

The study area is bounded by the villages of Aşağı Ovacık and Yukarı Ovacık in the north and by the Çeltikçi village in the south, the Benli plateau in the west and by the İstanbul-Ankara higway in the east (map, 1).

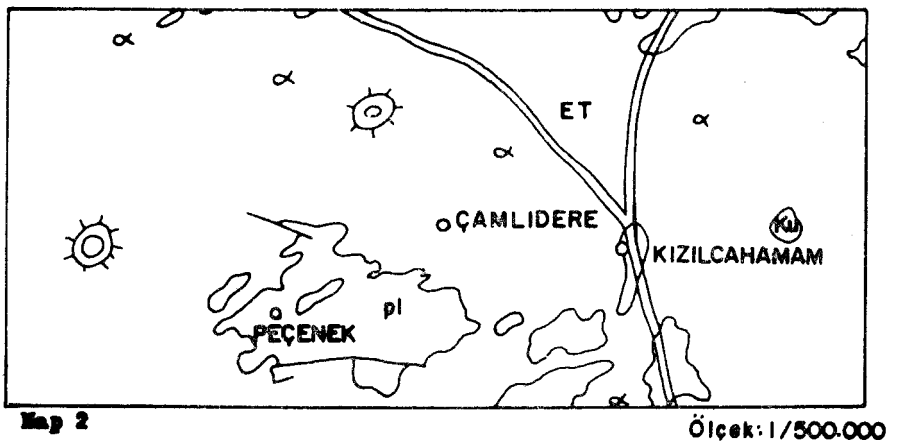



Map 1– The topographic map of the study area

The highest point in the area, the average altitude of which is over 1000 m, is elmadağ (Çamkoru) with an altitude of 1500–1600 m.

The study area situated in the middle of a volcanic region extending towards north-west.

The metamorphic structure in the area is in form of an old ridge, with the direction of NE-SW, There occur intrisuve rocks in the horizones, while the chalks are on the ridges. The upper units is the alluvia sediments of quaternary (map, 2).




pl Pliocene
α Andesite-spilte-pesphsite
ET Volcanic tuffe-Aglomera
Ku Quaternary
Volcano-cone

Map 2– The geology map of the study area

The metamorphic ouftcrops, belonging to paleozoic in the south of the study area, are usually in mixture of marble, graphite, serisite, schist, quarsit, amphibolite.

A conglemarata of 3–6 m at the base and chalks of jurassic units on the mesosoic sequence are not widespread in the area.

While the sand stones, volcanic stones and lava flows belong to Crataceus.

Paleocene is represented in the area by chalks, which are not so thick and widespread.

Eocene can be observed in the area as conglomerates in the upper and as marns and sand stones in the lower leves. The effective volcanism is seen from Eocene to Pliocene.

The structure, belonging to oligocene-miocene is seen in the south and east of the area.

Alluvial sediments of quaternary are seen only in the deltas and along the streams.

Tectonic is under the effects of alp orogeny. Therefore the closed anticlines, seen particularly in the jurasic and cretaceus units, were developed well.

## CLIMATE

The data, obtained from the meteorological stations of Kızılcahamam, Çamkoru and Peçenek were used to determine the climate of the region.

*Precipitation* (Table I, II)

According to data, the mean annual preicipitation is 564 mm in in Kızılcahamam, 650.5 mm in Çamkoru and 589.1 mm in Peçenek the amount of rainfall markedly increases towards the north of the study area. This climatic variation can also be seen on the structure of vegetation. In fact the scrubs of *Quercus pubescens* are replaced by *Pinus nigra* subsp. *pallasiana* and *Pinus sylvestris* in the north of the area. The communities of *Pinus sylvestris* and *Abies bornmuelleriana* reach to the pontic region in the north-west, in the vicinities of Peçenek.

The most rainy months are December, January and February in each three station.

*Temperatures* (Table III, IV, V)

The mean annual temperatures are fairly different in all stations in the region. Çamkoru is at an altitude of 300 m and Peçenek is at 500 m more than Kızılcahamam. So the temperatures of the two stations are lower than these of Kızılcahamam. The snowfall is more in Peçenek and Çamkoru. The mean annual temperatures are 10.2 °C in Kızılcahamam, 6.5 °C in Çamkoru, 6.4 °C in Peçenek.

TABLE I

| Stations | Altitude (m) | Monthly Precipitation (mm) | | | | | | | | | | | | Annual Mean precipi. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | 80.5 | 69.4 | 57.1 | 45.8 | 62.6 | 41.0 | 17.8 | 14.9 | 18.5 | 27.2 | 44.3 | 85.3 | 564.4 |
| Çamkoru or. Araştırma | 1300 | 81.8 | 76.6 | 72.7 | 65.4 | 79.5 | 50.6 | 24.7 | 9.4 | 26.5 | 34.9 | 36.1 | 102.3 | 660.5 |
| Peçenek | 1500 | 11.0 | 58.4 | 73.4 | 53.0 | 48.3 | 36.7 | 21.3 | 17.0 | 19.6 | 25.3 | 32.2 | 85.8 | 589.1 |

Table I– Monthly and annual mean precipitation

Table II.

| Stations | Altitude (m) | W | | S | | S | | A | | Annual Mean Precipitation (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | % | | % | | % | | % | |
| Kızılcahamam | 1002 | 235.2 | 41.6 | 165.5 | 29.2 | 73.7 | 12.9 | 90.0 | 15.9 | 564.4 |
| Çamkoru Or. Araştırma | 1300 | 260.7 | 39.3 | 217.6 | 32.8 | 84.7 | 12.7 | 97.5 | 14.7 | 660.5 |
| Peçenek | 1500 | 260.2 | 44.1 | 174.7 | 29.9 | 75.0 | 12.7 | 47.1 | 7.9 | 589.1 |

Table II– Seosınal mean precipitation

Table III

| Stations | Altitude (m) | Monthly Mean Temperature | | | | | | | | | | | | Annual mean (C) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | -0.2 | -0.3 | 4.0 | 9.9 | 14.2 | 17.7 | 21.1 | 21.0 | 16.0 | 10.1 | 6.1 | 2.5 | 10.2 |
| Çamkoru or. araştırma | 1300 | -3.6 | -3.8 | -0.6 | 5.9 | 11.1 | 14.2 | 17.1 | 17.2 | 11.6 | 6.9 | 2.9 | -0.6 | 6.5 |
| Peçenek | 1500 | -5.2 | -4.2 | 0.6 | 5.6 | 9.6 | 15.2 | 17.3 | 17.3 | 12.8 | 7.6 | 2.0 | -2.6 | 6.4 |

Table III– Monthly and annual mean temperature

Table IV

| Stations | Altitude (m) | Monthly Maximum Mean Temperature | | | | | | | | | | | | Annual mean (C) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | 4.9 | 5.3 | 10.8 | 17.4 | 21.9 | 25.6 | 29.3 | 30.0 | 25.4 | 19.2 | 13.9 | 7.1 | 17.6 |
| Çamkoru or. araştırma | 1300 | 0.7 | 0.7 | 4.7 | 11.9 | 16.9 | 20.1 | 23.5 | 24.6 | 20.4 | 14.5 | 9.9 | 3.0 | 12.6 |
| Peçenek | 1500 | 0.4 | -1.0 | 6.6 | 13.9 | 19.4 | 21.8 | 25.7 | 26.9 | 20.9 | 15.3 | 9.3 | 2.4 | 13.5 |

Table IV– Monthly and annual maximum mean temperature

Table V

| Stations | Altitude (m) | Monthly Minimum Mean Temperature | | | | | | | | | | | | Annual mean (C) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | -4.1 | -5.0 | -1.6 | 3.0 | 6.8 | 9.3 | 12.3 | 11.6 | 7.5 | 3.2 | 0.4 | -0.9 | 3.5 |
| Çamkoru orman araştırma | 1300 | -7.8 | -8.5 | -5.4 | -0.8 | 3.4 | 5.9 | 8.2 | 7.5 | 3.7 | 0.3 | -2.2 | -4.0 | 0.0 |
| Peçenek | 1500 | -9.5 | -10.3 | -7.9 | -0.4 | 3.3 | 6.1 | 9.5 | 8.7 | 3.9 | 0.0 | -2.9 | -5.0 | 0.3 |

Table V- Monthly and annual minimum mean temperature

Table VI

| Stations | Altitude (m) | Monthly | | | | | | | | | | | | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | 76 | 76 | 68 | 64 | 64 | 61 | 54 | 51 | 57 | 65 | 72 | 77 | 65 |
| Çamkoru orm. araştırma | 1300 | 83 | 82 | 79 | 74 | 69 | 64 | 60 | 57 | 64 | 72 | 78 | 85 | 75 |

Table VI– Mean relative humidity %

Table VII

| Stations | Altitude (m) | Monthly | | | | | | | | | | | | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| Kızılcahamam | 1002 | SE | SE | SE | SE | NW | NW | NE | NW | NW | SE | SE | SE | SE |
| Çamkoru orm. araştırma | 1300 | S | S | S | NW | NW | NW | NW | NW | NW | NW | S | S | NW |
| Peçenek | 1500 | N | SW | N | N | N | N | N | N | N | N | N | N | N |

Table VII– The dominanth winds

The mean maximum temperature (M) of the hottest month August, is 30 °C in Kızılcahamam, 24.6 °C in Çamkoru and 26.9 °C in Peçenek, the mean minimum temperature (m) of the coldest month, February, is –5 °C in Kızılcahamam, –8.5 °C in Çamkoru and –10.3 °C in Peçenek.

*Mean Relative Humidity* (Table VI)

The mean annual relative humidity in Kızılcahamam and Çamkoru is about (65–72 %). The most humid months are December, January and February (77–80 %). The minimum amount of the relative humidity is about (51–61 %) in summer.

Winds (Table VII)

As seen on the table, the direction of the dominant winds is SE and NW in the region of Kızılcahamam. It is NW in Çamkoru while it is N in Peçenek.

*Bioclimatic Synthesis*

The pluviothermic quotient (Q2) of Emberger and the values (m) are as follows:

| Stations | Q | m | M | PE | S | Climate |
|---|---|---|---|---|---|---|
| Kızılcahamam | 56.4 | –5°C | 30.0°C | 73.7 | 2.5 | Mediterranean semi-arid superior very cold |
| Çamkoru | 71.8 | –8.5°C | 24.6°C | 60.6 | 2.5 | Mediterranean sub-humid extremly cold |

As a result of the above table Kızılcahamam is under the influence of semiarid superior, very cold and Çamkoru Sub-humid, extremly cold types of the mediterranean climate.

## VEGETATION

The vast part of the study area is covered by the sylvatic vegetation. In the vicinities of Kızılsamam and Çamkoru, the scrubs of *Quercus pubescens* occur between 1000–1200 m and they are replaced by the *Pinus nigra* subsp. *pallasiana* forest above 1300, m, between Çamlıdere and Peçenek.

The forest of *Pinus sylvestris* is widespread in the surroundings of Çamkoru, particularly in the southern and eastern slopes at the

altitudes of 1400–1600 m *Abies nordmanniana* subsp. *bornmuelleriana* is the dominant species of the forest, in the Tataralan district of Peçenek, the north-west of the area.

According to recent works, the vegetation in north-west Anatolia has been included in the orders Quercо-Carpinetalia and Quercо-Cedretalia libani of the class Quercetea pubescentis (Akman, Quézel and Barbéro, 1978).

The analysis of quadrats carried out in the study area confirms that the vegetation in the surroundings of Çamkoru is similar above.

*Quercus pubescens-Trifolium pannonicum Association (Table 1)*

The decidious forest *(Carpinus betulus, Quercus petraea* subsp. *iberica)* in the Anatolian plataeu is replaced in a short distance by another decidious plant group *(Quercus pubescens)* on the supramediterranean zone. Of the factors, effecting this variation, the climatic and edaphic ones are of great importance.

The floristic composition of these forests are fairly homogeneous in the region of Beypazarı-Karaşar, which is under the effect of a semi-arid very cold mediterranean climate (Akman, 1974). In some works, carried out in the northwestern Anatolia (Akman and İlarslan, 1979; Ketenoğlu, 1974), it was pointed out, that the *Quercus pubescens* scrub was widespread in the areas, which have a rainfall less than 500 m and in which the continentality increased.

In the study area the scrubs of *Quercus pubescens* were exploited due to the overgrazing and they are in the form of relicts.

In the north and north-west Anatolia, the floristic composition of the *Quercus pubescens* scrub were recently investigated in detail (Akman, 1972; 1974; Akman and Ketenoğlu, 1976). These formations were included in the alliance Quercion anatolicae, owing to their ecological and bioclimatical features. In the study area this association is characterized by the species such as *Quercus pubescens, Trifolium pannonicum* subsp. *elongatum, Vicia cracca* var. *stenophylla, Coronilla varia* subsp. *varia, Cistus laurifolius,* which are at the same time components of this alliance.

*Pinus nigra subsp. pallasiana-Anthyllis vulneraria Association (Table 2)*

The black pine association covers a small area in the vicinities of Çamlıdere and Peçenek and it occurs in patches due to exploitation

Table I

| Quadrat no | 59 | 9 | 36 | 55 | 27 | 56 | 37 | 58 | 15 | 35 | 26 | 57 | Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area of the Quadrat (m2) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| Altitude (m) | 1100 | 1200 | 1200 | 1200 | 1150 | 1200 | 1100 | 1000 | 1230 | 1200 | 1150 | 1000 | |
| Direction | E | E | E | S | S | S | W | S | S | S | S | S | |
| Slope (%) | 15 | 15 | 20 | 20 | 5 | 20 | 15 | 20 | 10 | 20 | 5 | 15 | |
| Quercus pubescens | 44 | 33 | 34 | 44 | 44 | 33 | 44 | 44 | 44 | 34 | 44 | 44 | V |
| Characteristic and differantial species: | | | | | | | | | | | | | |
| Trifolium pannonicum subsp. elongatum | +1 | 12 | . | ++ | 11 | +1 | ++ | +1 | . | +1 | +1 | +1 | V |
| Vicia cracca var. stenophylla | . | . | 12 | +1 | . | +1 | 12 | . | . | 11 | . | +1 | III |
| Coronilla varia subsp. varia | 11 | . | . | . | . | ++ | +1 | . | . | . | . | +1 | II |
| Cistus laurifolius | . | . | . | . | ++ | . | . | . | . | . | 11 | . | I |
| The Characteristic of the QUERCETEA PUBESCENTIS: | | | | | | | | | | | | | |
| Juniperus oxycedrus subsp. oxycedrus | . | +1 | +1 | . | ++ | ++ | . | . | +1 | . | +1 | . | III |
| Teucrium chamaedrys subsp. syspirense | . | . | . | +1 | . | . | . | +1 | . | +1 | . | +1 | II |
| Polygala supina | . | +1 | . | . | +1 | . | . | . | +1 | . | . | . | II |
| Campanula rapunculoides | +1 | . | . | . | . | +1 | +1 | . | . | . | . | . | II |
| Trifolium medium var. medium | +1 | . | +1 | . | . | . | . | +1 | . | . | . | . | II |
| Silene italica | 11 | . | ++ | . | . | . | ++ | . | . | . | . | . | II |
| Cephalanthera rubra | ++ | . | . | . | . | . | . | . | ++ | . | ++ | . | II |
| Dorycnium penthapyllum subsp. anatolicum | . | . | . | . | ++ | . | . | . | . | ++ | . | . | I |
| Galium longifolium | +2 | . | . | +1 | . | . | . | . | . | . | . | . | I |
| Vicia truncatula | +1 | . | +1 | . | . | . | . | . | . | . | . | . | I |
| The Characteristic of the QUERCO-FAGEA: | | | | | | | | | | | | | |
| Clinopodium vulgare | 11 | . | +1 | +1 | . | +1 | ++ | . | . | . | . | . | III |
| Rubus idaeus | . | . | . | . | . | . | . | . | +1 | . | . | ++ | I |
| Poa nemoralis | 12 | . | . | . | . | . | . | 12 | . | . | . | . | I |
| Other species: | | | | | | | | | | | | | |
| Dactylis glomerata | +1 | . | 12 | 12 | +1 | +1 | 11 | . | . | 11 | +1 | +1 | IV |
| Stachys cretica subsp. anatolica | . | +1 | . | +1 | . | +1 | ++ | +1 | . | ++ | . | . | III |
| Trifolium arvense | . | . | . | +1 | 11 | +1 | . | . | +1 | +1 | 11 | . | III |
| Anthemis tinctoria | +1 | . | +1 | . | . | +1 | . | +1 | . | ++ | . | . | III |
| Alyssum murale | . | . | . | +1 | +1 | . | . | +1 | . | . | +1 | . | II |
| Salvia grandiflora | +1 | . | +1 | . | . | . | +1 | +1 | . | . | . | . | II |
| Dianthus ancyrensis | +1 | . | . | . | +1 | . | . | . | 12 | . | . | . | II |
| Rosa canina | . | +1 | . | . | . | . | . | ++ | . | . | . | . | I |
| Malabaila secacul | . | +1 | . | . | . | ++ | . | . | . | . | . | . | I |
| Lotus corniculatus | . | 12 | . | . | +1 | . | . | . | . | . | . | . | I |
| Galium lucidum | . | +1 | . | +1 | . | . | . | . | . | . | . | . | I |
| Hypericum perforatum | . | . | . | . | +1 | . | . | . | . | . | +1 | . | I |

Table 1– Quercus pubescens – Trifolium pannonicum Association

Table II

| Quadrat no | 54 | 34 | 49 | 47 | 33 | 32 | 48 | 46 | 25 | 18 | 53 | Presence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area of the Quadrat (m2) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| Altitude (m) | 1200 | 1350 | 1200 | 1300 | 1300 | 1300 | 1200 | 1350 | 1250 | 1350 | 1200 | |
| Direction | W | W | N | N | S | S | N | N | E | N | W | |
| Slope (%) | 10 | 5 | 7 | 10 | 8 | 15 | 7 | 10 | 5 | 20 | 10 | |
| Pinus nigra subsp. pallasiana | 44 | 44 | 44 | 34 | 44 | 44 | 44 | 34 | 44 | 44 | 44 | V |
| Charasteristic and differantial species: | | | | | | | | | | | | |
| Anthyllis vulneraria subsp. boissieri | +1 | +1 | +1 | . | . | +1 | . | +1 | 12 | +1 | +1 | IV |
| Chamaecytisus pygmaeus | +1 | +1 | . | . | +1 | 11 | . | . | +1 | 12 | +1 | IV |
| Cistus laurifolius | 12 | 12 | 12 | . | 12 | . | 12 | . | . | . | 12 | II |
| The Characteristic of the QUERCETEA PUBESCENTIS: | | | | | | | | | | | | |
| Juniperus oxycedrus subsp. oxycedrus | ++ | ++ | ++ | ++ | ++ | . | ++ | ++ | ++ | . | . | IV |
| Vicia cracca var. stenophylla | 12 | 11 | 12 | +1 | 12 | . | . | +1 | 12 | . | 12 | IV |
| Quercus pubescens | +1 | ++ | . | +1 | ++ | . | ++ | . | . | . | +1 | IIII |
| Trifolium medium var. medium | 12 | ++ | . | +1 | . | +1 | ++ | . | . | 12 | . | III |
| Silene italica | . | +1 | . | ++ | ++ | +1 | . | ++ | . | . | . | III |
| Populus tremula | ++ | ++ | ++ | . | . | . | . | . | +1 | . | . | II |
| Teucrium chamaedrys subsp. syspirense | +1 | +1 | . | . | . | . | ++ | . | . | . | . | II |
| Coronilla varia subsp. varia | . | . | . | +1 | ++ | ++ | . | . | . | . | . | II |
| Doreycnium penthaphyllum subsp. anatolicum | +1 | . | . | . | +1 | . | . | . | . | . | +1 | II |
| Pimpinella trageum subsp. polyclada | . | . | . | +1 | . | . | ++ | +1 | . | . | . | II |
| Trifolium pannonicum subsp. elongatum | +1 | . | . | . | . | . | ++ | . | . | . | +1 | II |
| Lathyrus laxiflorus subsp. laxiflorus | 12 | . | . | +1 | . | . | . | +1 | . | . | . | II |
| Dorycnium graecum | . | +1 | +1 | . | . | +1 | . | . | . | . | . | II |
| Digitalis orientalis | . | . | . | . | . | . | . | . | . | . | . | I |
| The Characteristic of the QUERCO-FAGEA: | | | | | | | | | | | | |
| Rubus idaeus | . | . | ++ | ++ | . | ++ | ++ | ++ | +1 | . | . | III |
| Poa nemoralis | 12 | . | . | 11 | . | . | +1 | 11 | . | . | 12 | III |
| Brachypodium sylvaticum | . | +1 | . | . | +1 | +1 | . | . | . | . | . | II |
| Veronica chamaedrys | . | . | . | . | . | . | . | . | . | +1 | . | I |
| Other species: | | | | | | | | | | | | |
| Dactylis glomerata | . | 11 | +1 | 12 | 11 | 12 | +1 | 12 | 12 | . | . | IV |
| Helianthemum nummularium | . | . | ++ | . | . | . | ++ | . | . | +2 | . | II |
| Lotus corniculatus | . | . | . | . | . | ++ | . | . | . | 12 | . | I |
| Trifolium arvense | . | . | . | . | ++ | . | . | . | . | +1 | . | I |
| Scutellaria orientalis | ++ | . | . | . | . | . | . | . | . | +1 | . | I |
| Alyssum murale | . | . | ++ | . | . | . | ++ | . | . | . | . | I |
| Globularia trichosantha | +1 | +1 | . | . | . | . | . | . | . | . | . | I |

Table 2– Pinus nigra subsp. pallasiana-Anthyllis vulneraria Association

by the biotic interferences and it is replaced by the plant group of *Quercus pubescens*. But its northern limits are continous along with the *Pinus sylvestris*.

This associations is highly succesful in the mediterranean climate and it is spread out between 1000–1400 m.

The tree layer is composed of the type species along with the *Quercus pubescens* and *Populus tremula*.

The species such as *Anthyllis vulneraria*, *Chamaecytisus pygmaeus* and *Cistus laurifolius* were distinguished as characteristic and differantial species.

In the study area, these forests Were considered in the class Quercetea pubescentis, which is characterized by the following species: *Juniperus oxycedrus*, *Trifolium medium* subsp *medium*, *Populus tremula*, *Coronilla varia*, *Silene italica*, *Teucrium chamaedrys* etc.

*Pinus sylvestris-Orthilia secunda Association (Table 3)*

The scots pine plays a restricted role in north-western Anatolia and thus in the study area. It has a wide distribution particularly in northern Anatolia and in the inner parts of the pontic region.

*Pinus sylvestris* is encountered above the *Pinus nigra* subsp. *pallasiana* plant group in the region under the effects of the mediterranean climate.

Although it forms pure stand, particularly on the northest and eastern slopes of 1500–1600 m in the surroundings of Peçenek, it usually forms mixed stand with *Abies nordmanniana* subsp. *bornmuelleriana*, although the compenents of the class Quercetea pubescentis are considerably rich in number. The species, characterizing the association, belong to the order Fagetalia sylvaticae, which is originated from middle europe. But the association isincuuded in the class Quercetea pubescentis of the mediterranaan region, due to its ecological and floristic pecularities.

*Abies nordmanniana* subsp. *bornmuelleriana* which is an endemic species for Turkey, forms a subassociation within this association. It is wide spread in the western Black-Sea region from the Kızılırmak basin towards Uludağ and it develops well under the same climatical conditions as *Pinus sylvestris*.

Table 3.

| Quadrat no | 52 | 44 | 30 | 62 | 43 | 61 | 28 | 45 | 29 | 50 | 42 | 20 | 64 | 22 | 21 | 19 | 63 | 3 | 39 | 41 | 38 | 40 | Prence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area of the Quadrat (m2) | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | |
| Altitude (m) | 1500 | 1600 | 1500 | 1500 | 1600 | 1500 | 1400 | 1600 | 1500 | 1500 | 1600 | 1500 | 1500 | 1400 | 1400 | 1400 | 1500 | 1600 | 1400 | 1550 | 1500 | 1600 | |
| Direction | E | E | S | E | E | S | E | S | S | E | E | E | E | E | E | E | E | NE | E | E | NE | NE | |
| Slope (%) | 20 | 15 | 20 | 8 | 15 | 10 | 5 | 15 | 20 | 15 | 15 | 20 | 20 | 20 | 20 | 25 | 15 | 15 | 20 | 20 | 15 | 20 | |
| **Characteristic and Differantial species:** | | | | | | | | | | | | | | | | | | | | | | | |
| Pinus sylvestris | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | 44 | +1 | +1 | +1 | +1 | +1 | +1 | +1 | +1 | . | . | . | V |
| Hieracium medianiforme | ++ | +1 | ++ | +1 | +1 | +1 | . | +1 | +1 | +1 | +1 | ++ | +1 | +1 | +1 | . | +1 | . | +1 | +1 | . | +1 | V |
| Orthilia secunda | 12 | +1 | . | . | . | . | . | 12 | . | . | . | +2 | 12 | +1 | +1 | +2 | 12 | +1 | +1 | 11 | . | 11 | III |
| Pirola media | . | . | . | +1 | . | +1 | . | . | . | . | . | . | . | ++ | . | . | . | . | . | . | ++ | . | I |
| Abies nordmanniana subsp. bornmuelleriana | . | . | . | . | . | . | . | . | . | . | . | 34 | 34 | 44 | 44 | 34 | 44 | 34 | 44 | 44 | 44 | 44 | III |
| Saxifraga rotundifolia | . | . | . | . | . | . | . | . | . | . | . | +1 | . | . | . | . | . | . | +1 | +1 | +1 | +1 | II |
| Lathyrus czeczottianus | . | . | . | . | . | . | . | . | . | . | . | 12 | . | . | 12 | 12 | . | . | . | . | 12 | . | I |
| Ranunculus brutius | . | . | . | . | . | . | . | . | . | . | . | . | . | +1 | +1 | . | +1 | . | . | +1 | . | . | I |
| Monotropa hypopithys | . | . | . | . | . | . | . | . | . | . | . | ++ | ++ | . | . | . | . | . | . | ++ | . | . | I |
| **The Characteristic of QUERCETEA PUBESCENTIS:** | | | | | | | | | | | | | | | | | | | | | | | |
| Trifolium medium var. medium | 12 | +1 | +1 | 12 | +1 | +1 | +1 | +1 | 11 | +1 | 12 | 12 | 11 | . | 11 | 12 | 22 | ++ | 12 | +1 | +1 | +1 | V |
| Lathyrus laxiflorus subsp. laxiflorus | +1 | +1 | +1 | +1 | +1 | . | +1 | +1 | . | +1 | . | . | . | +2 | +2 | 12 | 12 | . | +1 | +1 | +1 | +1 | IV |
| Dorycnium graecum | 11 | ++ | +1 | . | ++ | . | 11 | +1 | +1 | +1 | ++ | . | 11 | +1 | +1 | . | 11 | . | . | . | . | . | IV |
| Vicia cracca var. stenophylla | +1 | 11 | . | +1 | . | . | +1 | 11 | 12 | +1 | . | . | 12 | 12 | . | 12 | 12 | 12 | . | . | . | . | III |
| Vicia truncatula | +1 | +1 | . | . | +1 | . | . | +1 | +1 | . | . | +1 | . | . | +1 | . | . | 12 | 12 | 121 | . | . | III |
| Silene italica | +1 | . | 11 | . | +1 | . | 12 | . | +1 | 11 | . | . | +1 | . | . | . | +1 | . | . | . | . | . | II |
| Jniuperus oxycedrus | . | ++ | +1 | +1 | . | +1 | ++ | . | . | ++ | . | . | ++ | . | . | . | ++ | . | . | . | . | . | II |
| Coronilla varia subsp. varia | +1 | . | +1 | . | . | +1 | . | +1 | +1 | . | . | . | +1 | +1 | . | . | +1 | +1 | . | . | . | . | II |
| Astragalus glycyphyllos ssp. glycyphylloides | +1 | . | . | . | +1 | . | +1 | . | . | . | . | +1 | ++ | ++ | . | . | . | . | . | . | +1 | . | II |
| Cirsium hypoleucum | . | . | . | +1 | . | +1 | . | +1 | . | . | . | +1 | . | . | +1 | . | . | 12 | ++ | . | ++ | . | II |
| Galium longifolium | . | +1 | +1 | . | ++ | . | . | . | . | . | ++ | . | . | . | ++ | . | . | . | . | ++ | . | ++ | II |
| Turritis laxa | . | . | +1 | . | . | . | . | . | . | . | . | ++ | . | ++ | ++ | ++ | . | . | . | +1 | . | . | II |
| Lathyrus aureus | ++ | . | ++ | . | ++ | . | . | . | . | . | . | ++ | ++ | . | . | . | . | . | . | . | ++ | . | II |
| Trifolium pannonicum subsp. elongatum | . | +1 | . | . | . | +1 | . | . | . | . | . | . | +1 | +1 | . | +1 | . | . | . | +1 | . | . | II |
| Chamaecytisus pygmaeus | . | . | +1 | . | . | . | +1 | +1 | +1 | . | . | . | . | . | . | . | . | . | . | . | . | . | I |
| Pimpinella trageium subsp. polyclada | +1 | . | . | +1 | . | . | . | . | . | . | . | . | . | . | +1 | +1 | . | . | . | . | . | . | I |
| Anthyllis vulneraria subsp. boissieri | +1 | . | . | . | . | . | ++ | . | . | . | . | . | . | ++ | . | . | . | . | . | . | . | . | I |
| Lathyrus digitatus | . | . | +1 | . | . | . | +1 | . | . | . | . | . | . | . | . | +1 | . | . | . | . | . | . | I |
| Dorycnium penthaphyllum subsp. anatolicum | ++ | . | . | . | . | . | ++ | . | . | . | . | . | ++ | . | . | . | . | . | . | . | . | . | I |
| Berberis crataegyna | . | . | ++ | . | . | . | . | ++ | . | . | . | . | . | . | . | . | . | . | . | . | ++ | . | I |
| Limodorum abortivum | ++ | . | . | . | . | . | . | . | . | . | . | . | ++ | . | . | . | . | . | . | . | . | . | I |
| **The Characteristic of the QUERCO-FAGEA:** | | | | | | | | | | | | | | | | | | | | | | | |
| Veronica chamaedrys | 12 | +1 | +1 | +1 | . | +1 | +1 | . | ++ | . | . | +2 | +1 | +1 | +1 | +2 | +1 | +1 | +1 | +1 | +1 | +1 | IV |
| Poa nemoralis | 12 | +1 | . | 11 | +1 | 11 | . | 12 | . | 12 | +1 | . | +1 | . | . | . | . | . | +1 | 12 | +1 | 12 | IV |
| Populus tremula | +1 | +1 | . | +1 | +1 | +1 | ++ | +1 | . | ++ | +1 | . | . | ++ | . | . | . | . | . | . | . | ++ | III |
| Rubus idaeus | ++ | ++ | ++ | +1 | . | +1 | . | ++ | ++ | ++ | . | . | . | . | . | . | . | +1 | . | +1 | . | . | III |
| Lapsana communis subsp. intermedia | +1 | . | +1 | . | +1 | . | . | . | . | . | . | +1 | . | +1 | +1 | . | . | . | . | ++ | . | ++ | II |
| Fragaria vesca | . | . | . | . | . | . | . | . | ++ | . | . | . | ++ | . | ++ | . | . | . | . | . | . | . | I |
| Clinopodium vulgare | . | . | . | +1 | . | +1 | . | . | . | . | . | . | . | . | . | . | . | . | +1 | . | . | . | I |
| Brachypodium sylvaticum | . | . | 12 | +1 | . | . | . | 12 | . | . | . | . | . | . | . | . | . | . | . | . | . | . | I |
| Geranium robertianum | . | . | . | . | ++ | . | . | ++ | . | . | . | . | . | . | ++ | . | . | . | . | . | . | . | I |
| **Other Species:** | | | | | | | | | | | | | | | | | | | | | | | |
| Campanula rapunculoides | +1 | . | +1 | . | +1 | . | . | . | . | . | . | +1 | . | +1 | +1 | . | . | . | . | ++ | . | ++ | II |
| Trifolium nigrescens | . | . | . | . | . | . | +1 | . | +1 | . | . | +1 | . | . | . | . | . | . | . | . | +1 | +1 | II |
| Galium aperine | . | . | +1 | . | . | . | . | . | . | +1 | . | . | . | . | +1 | . | . | . | . | . | . | . | I |
| Scrophularia variegata | . | . | . | . | . | . | . | . | . | . | . | . | +1 | . | . | . | . | . | . | +1 | +1 | . | I |
| Lathyrus pratensis | . | . | +1 | . | . | . | . | . | +1 | . | . | . | . | . | . | +1 | . | . | . | . | . | . | I |
| Epilobium montanum | . | . | . | . | . | . | +1 | . | . | . | . | . | . | +1 | . | . | . | . | . | . | . | . | I |
| Campanula persicifolia | . | . | ++ | . | . | . | ++ | . | . | . | . | . | . | . | . | . | . | . | . | . | . | . | I |

Table 3– Pinus Sylvestris – Orthilia Secunda Association and Abies nordmannina Subsp. barnmuelleriana Subassociation.

The species, differentiating the subassociation of *Abies nordmanniana* subsp. *bornmuelleriana*, are as follows: *Lathyrus czeczottianus*, *Ranunculus brutius*, *Monotropa hypopithys*.

The species in this association such as: *Trifolium medium* subsp. *medium*, *Veronica chamaedrys*, *Lathyrus laxiflorus* subsp. *laxiflorus*, *Poa nemoralis*, *Coronilla varia*, *Silene italica*, *Populus tremula*, *Campanula rapunculoides*, *Lapsana communis* subsp. *intermedia*, *Anthyllis vulneraria*, *Juniperus oxycedrus* are the components of the class Quercetea pubescentis.

## DISCUSSION AND CONCLUSION

The northern boundaries of the study area are formed by the Gerede-Aktaş forest, the southern by the Kızılcahamam-Çeltikçi area. The mediterranean climate prevails in the south of the study area, but towards north the mediterranean climate with a transitory character, along with a continental one, becomes dominant. In this study it was aimed to point out the syntaxonomical character of the communities in this transitory area.

Three associations and a subassociations, located between 1000–1600 m, were described in the study area.

1– *Quercus pubescens-Trifolium pannonicum* association

2– *Pinus nigra* subsp. *pallasiana-Anthyllis vulneraria* association

3– *Pinus sylvestris-Orthilia secunda* association and *Abies nordmanniana* subsp. *bornmuelleriana* subassociation

The association of *Quercus pubescens-Trifolium pannonicum* develops on the lower level of the black pine forests, or in the areas, where the black pine was exploited. This association was dominated by the *Quercus pubescens* trees, not more than 2 m in height and was formarly described in the Beynam forest (1972) and around Beypazarı (1974) by Akman. The association exhibits a floristic similarity with that described by Ketenoğlu (1974) in the region of Kızılcahamam, due to the regional proximity and both associations have been effected by the biotic interferences.

Another exploited plant group in the study area is that of *Pinus nigra* subsp. *pallasiana*, which is spread out below *Pinus sylvestris* forest, at the altitudes of 1200–1400 m. The stands, in which *Pinus nigra* subsp, *pallasiana* was exploited, were occupieb by *Quercus pubescens*.

The wide spread association in the study area is that of *Pinus sylvestris* and its subassociation, *Abies nordmanniana* subsp. *bornmuellerіana*. This association is well developed and has a high coverage. The two species occupy almost the same habitats in the region. Although *Pinus sylvestris* forms pure stands in the vicinities of Çamkoru, it is mixed with the trees of *Abies nordmanniana* subsp. *bormnuelleriana* which is differentiated as a subassociation in the region of Tataralan.

All the ossociations described here are included in the class of Quercetea Pubescentis belonging to super class Querco-Fagea.

REFERENCES

AKMAN, Y. 1972. The vegetation of Beynam Forest. *Com. de la Fac. Sc. d'Ank.* Serie C. Tome 16, C: 29–53

AKMAN, Y. 1974. Etude phytosociologique de la region de Beypazarı, Karaşar et Nallıhan, *Com. de la Fac. Sc. d'Ank.*, Serie C, Tome 18 C: 51–113

AKMAN, Y. and KETENOĞLU, O. 1976. The phytosociological and phytoecological investigation on the Ayaş Mountain. *Com. de la Fac. Sc. d'Ank.* Serie C, Tome 20, Suppl 1: 1–43

AKMAN, Y. and İLARSLAN, R. 1983. The phytosociological investigation in the district of Uluhan-Mudurnu. *Com. de la Fac. Sc. d'Ank.* Serie C, Tome 1

AYDOĞDU, M. 1982. Çam dağlarının (Akçakoca-Düzce) fitososyolojik yönden araştırılması. *TÜBİTAK*, TBAG-476

BRAUN-BLANQUET, 1932. Plant sociology (Translated by Fuller and Conard) Newyork and Londan.

KETENOĞLU, O. and AKMAN, Y. 1982. The phytosociological investigation of Quercus pubescens formation in Kızılcahamam-Kargasekmez region in Central Anatolia. *Com. de la Fac. Sc. d'Ank.* Serie C Tome 25 C: 1–9

KETENOĞLU, O. 1983. The phytosociological and phytoecological investigation of the Gerede-Aktaş forest, *Com. de la Fac. Sc. d'Ank.*, Seric C Tome 1 C: 21–38

KETENOĞLU, O., QUEZEL, P. AKMAN, Y. AYDOĞDU, M. 1983. New syntaxa on the gypsaceous formations in the Central Anatolia. *Ecologia Mediterranea*, IX (3/4)

Meteoroloji bülteni, 1974. TC. Tarım ve Orman Bakanlığı Meteoroloji iişleri Genel Müdürlüğü. Ankara

ZOHARY, M. 1973. Geobotanical foundations of the Middle East Vol. I-II Gustav. *Fischer Verlag. Stuttgart.*