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Classification and Syntaxonomic Analysis of Plant Communities in the Yenice Wildlife Conservation Area, Northwestern Türkiye

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Abstract

Aim of study: The aim of the study is to reveal the vegetation structure of the study area, which is a conservation area.

Area of study: The study area is the Yenice Wildlife Conservation Area in Karabük which is located in the western Black Sea region in Türkiye.

Material and method: In order to determine the relationship of the plants in the area with their environment, 120 relevés were determined by taking into account the habitat, vegetation and floristic composition from different vegetation types. The tables were evaluated by using the "Braun-Blanquet method" in the interpretation of the vegetation of the study area. In addition, the JUICE 7.0 program was used to determine the diagnostic, constant and dominant species objectively. The naming of the determined sociological units was made according to the “International Code of Phytosociological Nomenclature”.

Main results: The dominant vegetation type of the study area which includes many ecosystems such as forest, pseudomaquis, and riparian ecosystem due to its biogeographic location, is forest formation. According to the Braun-Blanquet method, 4 plant associations belonging to forest vegetation were determined.

Research highlights: Corno mas-Quercetum ibericae ass. nova and *Saniculo-Abietum equi-trojani* ass. nova are new to the plant science.

Keywords: Plant Sociology, Syntaxonomy, Vegetation

Kuzeybatı Türkiye'de Yenice Yaban Hayatı Geliştirme Alanı'ndaki Bitki Topluluklarının Sınıflandırılması ve Sintaksonomik Analizi

Öz

Çalışmanın amacı: Çalışmanın amacı, korunan bir alan olan çalışma alanının bitki örtüsü yapısını ortaya koymaktır.

Çalışma alanı: Çalışma alanı, Türkiye'nin Batı Karadeniz Bölgesi'nde yer alan Karabük'teki Yenice Yaban Hayatı Geliştirme Alanı'dır.

Materyal ve yöntem: Alandaki bitkilerin çevreleriyle ilişkilerini belirlemek amacıyla, farklı bitki örtüsü tiplerinden habitat, bitki örtüsü ve floristik kompozisyon dikkate alınarak 120 örnek alan belirlenmiştir. Tablolar, çalışma alanının bitki örtüsünün yorumlanmasında "Braun-Blanquet yöntemi" kullanılarak değerlendirilmiştir. Ayrıca, diagnostik, konstant ve dominant türleri objektif bir biçimde belirlemek için JUICE 7.0 programı kullanılmıştır. Belirlenen sosyolojik birimlerin isimlendirilmesi "Uluslararası Fitososyolojik Adlandırma Kodu"na göre yapılmıştır.

Temel sonuçlar: Biyocoğrafik konumu nedeniyle orman, pseudo-maki ve nehir ekosistemi gibi birçok ekosistemi bünyesinde barındıran çalışma alanının baskın bitki örtüsü türü orman formasyonu'dur. Braun-Blanquet yöntemine göre orman bitki örtüsüne ait 4 bitki topluluğu belirlenmiştir.

Araştırma vurguları: *Corno mas-Quercetum ibericae* ass. nova ve *Saniculo-Abietum equi-trojani* ass. nova bilim dünyası için yenidir.

Anahtar Kelimeler: Bitki Sosyolojisi, Sintaksonomi, Vejetasyon

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Introduction

Türkiye is one of the richest countries in the world in terms of floristics with its geographical location, paleogeography, geomorphological structure, being under the influence of different climate types and soil diversity. The studies have revealed that 12 975 plant taxa are found within the borders of Türkiye which of 4157 (32%) are endemic (Özhatay et al., 2013; 2015; 2017; 2019). This number is increasing day by day with studies such as flora, vegetation, plant sociology, revision, and monograph. These differences in the flora of Türkiye bring along very different vegetation types besides the rich flora (Karaköse & Terzioğlu 2019, 2021). Plants with the same ecological requirements due to biotic and abiotic effects form different vegetation types and different plant groups (Eren, 2006). Therefore, the more life conditions for plants in a region, the more different vegetation types.

The aim of plant sociology studies is to investigate and classify the characteristics of plant communities, their unique structures, species compositions, distribution and relations with the environment. Such research contributes to our knowledge of long-term vegetation dynamics, the recovery processes of forests affected by various disturbances, and the categorization of habitats (Chytrý et al., 2020). From the vegetation tables obtained, a great deal of information can be reached about the floristic and ecological structure and successional development of the vegetation unit (Özalp, 1993). The vegetation maps created are important bases where we can see a lot of information on a single page. Researching plant communities in this way is closely related to the problems of long-term preservation, evaluation or use of natural resources in order to benefit from vegetation and meet the needs of the rapidly increasing population (Akman et al., 2011).

The “Rio Convention” on the conservation of biological diversity obliges each country to draw up its biological inventory and take the necessary measures to protect them. In order to protect and maintain our biological diversity, knowing the floristic and faunistic structure of important areas and taking an inventory is a prerequisite for full protection. In the habitat classification of the EUNIS (European Nature Information System), which continues at the scale of the European Union, Phytosociological studies carried out in Europe so far are used to determine the terrestrial habitats in which plants are located. Because each plant association defines a different habitat (Chytrý et al., 2020). For these reasons, flora and vegetation studies are needed to reveal plant biodiversity.

Among the "Areas to be Protected Absolutely" determined by the "World Forestry Organization FAO", 9 of the 100 hot spots are located in Türkiye, one of which is Yenice forests. Yenice Forests, which are largely composed of moist forest communities, are one of the most important natural resource values and one of the 122 important Plant Areas in Türkiye (Özhatay et al., 2003). Yenice Forests, one of Türkiye's most untouched and widest forest areas, is one of the 305 Important Natural Areas. Today, a part of Yenice Forests is taken under protection as "Kavaklı Nature Protection Area", "Çitdere Nature Protection Area" and "Yenice Wildlife Conservation Area". Two research forests, namely “Karabük-Büyükdüz Research Forest” and “Yaylacık Research Forest”, were established in order to carry out forestry studies in the region (Eken et al., 2006). For these reasons, Yenice forests were chosen as the study area, based on the need to examine the unique flora and vegetation of the region in detail.

Material and Methods

In order to investigate the Yenice Wildlife Conservation Area in terms of plant sociology, floristic studies were carried out in 2015-2017, taking into account the vegetation periods of the plants. Information such as location, habitat characteristics, elevation, aspect, collection date, GPS coordinates were recorded for the collected plant samples and their photographs were taken. Plant specimens dried in accordance with herbarium techniques were identified in the Bilgehan Bilgili Herbarium of Kastamonu University by making use of the flora of Türkiye (Davis, 1965-1985) and various nearby flora and various herbarium collections.

The 1/25000 scaled topographic map of the area was digitized to form a basis for the studies. The boundaries of the study area were

transferred to the topographic map. After the stand types map of the area was scanned and digitized, it was overlapped with the topographic map and used in field trips. The geological data of the study area were obtained from the 1/100000 scaled geological maps belonging to the General Directorate of MTA and the geological study reports made in the region.

To investigate the relationships between the plants in the area and their environment, 120 relevés were established, considering habitat characteristics, vegetation structure, and floristic composition across different vegetation types. In order to facilitate the study, these relevés were combined with the topographic map and a map of the area was created at the scale of 1/25000. Vegetation type clusters were identified based on the dominant species, corresponding to the principal vegetation types at the alliance level. Accordingly, sites characterized by the dominance of the same tree species, occurring under comparable ecological conditions and representing identical vegetation types, were recognized. While taking the relevés, attention was paid to take from the smallest areas, from the homogeneous areas that best represent the vegetation. While determining the size of the relevés, the smallest area method was used and it was determined as 1000 m^2 for forest formations, 400 m^2 for maquis vegetation, and 50m^2 for step formation. Data on plant- cover abundance and sociability values of phyto-sociological units in the area were collected. For each relevé; the information such as date, number, location of the relevé, elevation, aspect, slope were noted separately.

The tables were evaluated by using the "Braun-Blanquet method" in the interpretation of the vegetation of the study area (Braun-Blanquet, 1964). In addition, after the vegetation units were determined, the JUICE 7.0 program was used to determine the diagnostic, constant and dominant species objectively. For each vegetation type, diagnostic species were identified by assessing the fidelity of species to that type (Chytrý et al., 2020). Species exhibiting a cover greater than 25% in at least 10% of the plots within a given vegetation type were regarded as dominant species. Principal Component Analysis (PCA) was used in Past 3.14 program to reveal the multidimensional relationship between species compositions and habitat variables in the relevés. In the classification of syntaxa belonging to forest formations, "Kavgacı et al. (2023) and Çoban and Willner (2019)" and previous studies close to the study area were used. Naming of the phytosociological units was done according to the International Code of Phytosociological Nomenclature (ICPN; Theurillat et al., 2021). The tables of the plant associations were compared with associations with at least one similar character species in related studies conducted in nearby regions using "Sorensen (1948)'s similarity formula Is= (2 x W x 100) / (A+B)", floristic, ecological and sociological similarities were tried to be revealed. The tables of the plant associations identified are given together with their alliances, orders and classes.

Description of The Study Area

The study area is Yenice Wildlife Conservation Area (WCA) with an area of 26687.78 ha located within the borders of Karabük province. Karabük is located in the western part of the Black Sea Region of Türkiye. This province is also surrounded by the following provinces; Bartın, Bolu, Çankırı, Kastamonu and Zonguldak. Yenice WCA, which is located within the study area, is 35 km from the city center in Yenice, which is the westernmost district of Karabük.

Yenice WCA is composed of different geological structures that developed in the period from Quaternary to Mesozoic. This formation of Upper Jurassic age of Mesozoic age has a calcareous and karstic pitted and rugged terrain consisting entirely of limestone and dolomitic limestone bedrock in the upper part of the valley (Alataş, 2006).

There are three groups of soils in Yenice WCA. These are "Grey Brown Podzolic Soil", "Brown Forest Soil" and "Red Yellow Podzolic Soil". The surface areas and percentages of these soil groups within Yenice WCA are given in Table 1.

Table 1. Surface areas of large soil groups in Yenice WCA

Soil groups	Areas (ha)	Percentage (%)
Gray Brown Podzolic Soils	182994785.507	68.53
Brown Forest Soils	83269758.358	31.18
Red Yellow Podzolic Soils	757956.898	0.28
Total	267022500.762	100.00

The climate data of the study area were obtained from the observation records of the General Directorate of State Meteorology Yenice Station between 1989 and 2009.

Black Sea climate is seen mostly in Karabük Province. Since it is located far from the sea and inland, it cannot benefit sufficiently from the humid air of the Black Sea and therefore exhibits the characteristics of a partially continental climate. Karabük province actually reflects both climates as it is located in the transition zone between the Black Sea climate and the continental climate.

Although the study area is rainy in four seasons due to the Black Sea climate, it receives less precipitation than the coastal cities in the vicinity and a dry period is observed in July and August.

According to the data obtained between 1989 and 2009, the total annual precipitation in Yenice is 533.3 mm.

According to the annual seasonal precipitation data of Yenice Meteorology Station; the precipitation regime is distributed into four main seasons: Autumn, Winter, Spring and Summer (AWSS). The major rainy (wet) seasons are in autumn and winter, respectively. The lowest precipitation of the season is seen in the summer times, while the highest precipitation is seen in June. Accordingly, it can be said that the Western Mediterranean precipitation regime type is observed in the study area.

The annual average humidity is 73.6%. The lowest humidity is observed in July with 3%, and the highest average humidity is observed in November with 77.7%.

Considering the total number of blows for 20 years at Karabük Yenice Station, the prevailing wind direction is West (W), followed by North (N) and Northwest (NW), respectively.

According to the temperature values of Yenice District of Karabük Province, the annual average temperature is 13.7 °C. The monthly average temperature is the highest in July-August with 23.5 °C, and the lowest average temperature is in January with 4.8 °C. The hottest month is August, the average maximum temperature is 31.4 °C, the coldest month is January, and the average minimum temperature is 1.2 °C.

In order to define the bioclimate of the study area, the drought index and precipitation temperature equivalent values were calculated using the data of Yenice station. and the evaluations were made according to the results obtained from Akman (1999).

The precipitation regime type at 150 m of Yenice station is AWSS and it is the Western Mediterranean Type from the Mediterranean Rainfall Regime types. The Emberger (1954) drought index (S=P/M) is 5.2. Since this value is between 5-7, the climate can be considered as Sub-Mediterranean. The total precipitation of Yenice station in the summer months (June, July and August) is 121.7 mm and is below 200 mm. According to the precipitation-temperature precedent (Q=61.04) and the minimum temperature average of the coldest month (m=1.2), the Mediterranean Climate's Semi-Arid Winter Cool variant is dominant. Emberger (1954) used the following formula (Eq. 1) to determine the degree of drought in the Mediterranean climate:

$$Q = \frac{2000\ x\ P}{(M+m+546{,}4)\ x\ (M-m)} \quad (1)$$

Where:
P: Average annual precipitation (mm)
M: Mean maximum temperature in the warmest month (°C)
m: Mean minimum temperature in the coldest month (°C)
PE: The sum of the rainfall (mm)
S: Drought index =PE/M

According to Akman (1995), the bioclimate type of Yenice station was determined as Precipitous Sub-Cool Mediterranean Climate and it was stated that

these stations were located under the coastal influence and in the pre-Black Sea region. He stated that the winter precipitation is quite high in the stations under coastal influence, and the spring precipitation is high in some stations. Due to this heterogeneity, four different precipitation regime types have been determined in the pre-Black Sea region, namely Eastern Mediterranean precipitation regime 2nd type, Sub-mediterranean precipitation regime, Eastern Mediterranean precipitation regime 1st type, Central Mediterranean precipitation regime.

The precipitation regime type of Yenice station is AWSS (Western Mediterranean Precipitation Regime). When the climate data of the study area is evaluated; the study area can be defined as a transition zone between the pre-Black Sea region and the Main Black Sea region.

In order to determine the dry period, the precipitation-temperature (ombrothermic) diagram of the station where the area is located was drawn according to the Gaussen method (Figure 1). According to this method, if the precipitation value (P) seen in any month is equal to or less than twice the temperature value in the same month (P≤2t), it is considered as a dry month. As can be seen from the Figure 1, a dry period is observed in Yenice, albeit a little, between July and August. Due to the geographical location of the study area, the total precipitation decreases from north to south and there is a dry period that increases in duration and intensity in parallel. This situation is in harmony with the distribution of vegetation spread in the region.

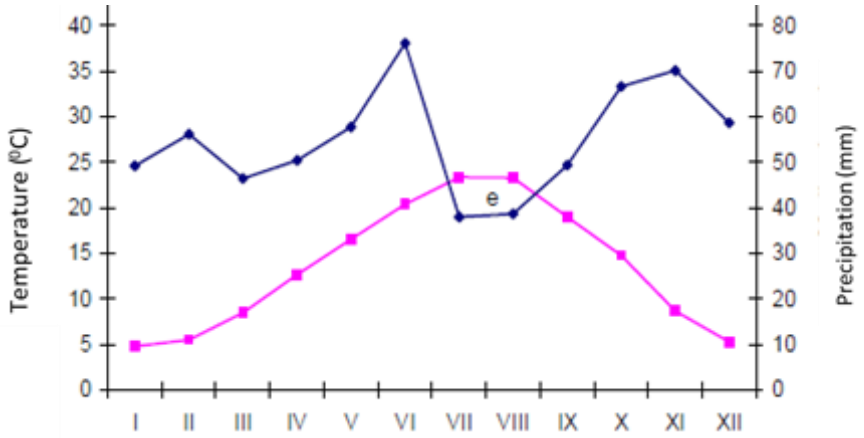

Figure 1. Precipitation-temperature (ombrothermic) diagram of Yenice station (e:dry period)

Results

Due to its biogeographic location, the study area includes many ecosystems such as forest, pseudomaquis and riparian ecosystems, rich plant communities and various habitats. The relevés of the plant associations determined in the study area were placed on the axes and an orientation chart was created. The relevés within the same plant association are grouped on axes (Figure 2).

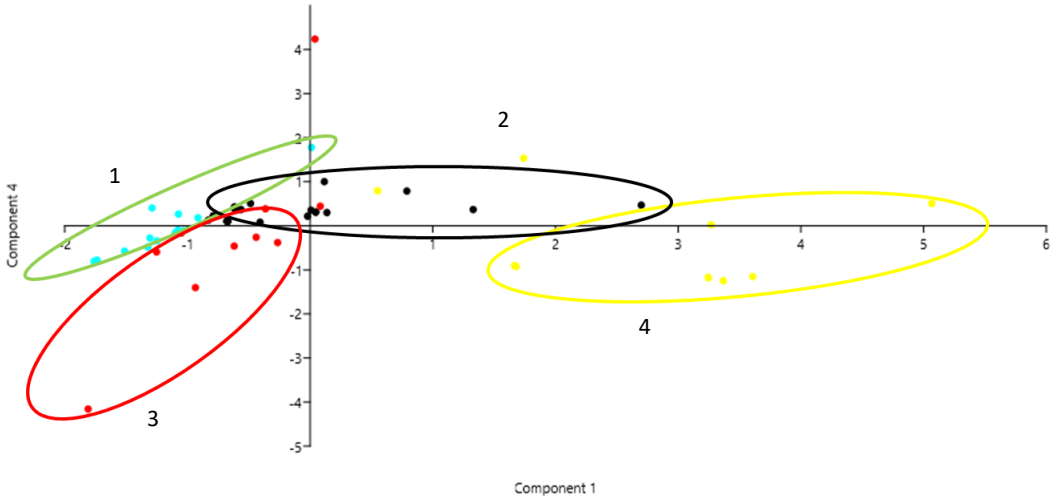

Figure 2. Ordination graph of the plant associations in forest vegetation 1: *Corno mas-Quercetum ibericae* ass. nova, 2: *Rhododendro ponticum-Fagetum orientalis*, 3: *Lathyro tukhtensis Pinetum pallasianae*, 4: *Saniculo-Abietum equitrojani* ass. nova

Rhododenro ponticum-Fagetum orientalis ass.

The characterictic and diagnostic species of the association are *Rhododenron ponticum*, *Fagus orientalis*. Habitat and structural features: It is generally seen on the west, north, northeast and northwest slopes where the slope is 5-100%. The mean height of the tree layer is 30 m and the degree of coverage is between 60-100%, the mean height of the shrub layer is 2 m and the degree of coverage is between 20-100%, the height of the grass layer is 30 cm and the degree of coverage is between 0-30%. Consisting of a three-layered vertical structure, this association is located between 580-1215 meters above the sea level. The association spreads over soils developed from metagranite, gneiss, schistmigmatite, amphibolite and carbonate bedrock.

Rhododenron ponticum and *Fagus orientalis* dominate the general appearance of the association. There is also *Pinus sylvestris* and *Abies nordmanniana* subsp. *equi-trojani*, characteristic of the class *Carpino-Fagetea sylvaticae* (*Querco-Fagetea* nom. invalid). There is also *Pinus sylvestris* var. *hamata* and *Abies nordmanniana* subsp. *equi-trojani*, characteristic of the class *Carpino-Fagetea sylvaticae*, shows high repetition in the association. Order *Rhododendro ponticiFagetalia orientalis (Fagetalia sylvaticae* nom. invalid) is represented by the taxa of *Fagus orientalis, Abies nordmanniana* subsp. *equi-trojani, Pinus sylvestris* var. *hamata, Cardamine bulbifera, Cardamine impatiens* subsp. *pectinata* ve *Moehringia trinervia*. Order *Rhododendro-Fagetalia orientalis* is represented by the taxa of *Acer heldreichii* subsp. *trautvetteri, Fagus orientalis, Rhododendron ponticum, Salvia forskahlei, Quercus petraea* subsp. *iberica* ve *Trachystemon orientalis.* Order *Querco cerridis-Carpinetalia orientalis* is represented by the taxa of *Pyracantha coccinea, Staphylea pinnata* ve *Tanacetum parthenium*.

The association spreads on the upper sides of Oluca Hill, Pelitli Hill, Alaboğa Hill, Gölet Hill, Kertilağıl Hill, Dibektaş Hill and Sinekliağzı Hill, on the north facing slopes and Acısu locality.

Rhododendro-Fagetum orientalis association detected in the research area was syntaxonomically linked to the *Carpino-Fagetea sylvaticae* class, *Rhododendro pontici-Fagetalia orientalis* order and *Fagion orientalis* alliance.

Lathyro tukhtensis-Pinetum pallasianae ass.

The characterictic and diagnostic species of the association are *Pinus nigra* subsp. *pallasiana* var. *pallasiana* and *Lathyrus tukhtensis*. The aspect of the relevés where the association is represented is south-west, south, north-west and west. In terms of

physiognomy, it consists of tree, shrub and grass layers, and the tree layer has 10-90% coverage, the shrub layer has 10-80%, and the grass layer has 5-80% coverage. The relevés where the association spreads show a slope of 5-90% and the height varies between 518-1180 m. The association spreads over soils developed from metagranite and carbonate bedrock.

Pinus nigra subsp. *pallasiana* var. *pallasiana* dominates the general appearance of the association. *Sorbus torminalis* var. *torminalis,* a characteristic of the class *Quercetea-pubescentis,* shows high repetition in the association. *Querco-Carpinetalia orientalis* order is represented by *Pyracantha coccinea, Mespilus germanica, Staphylea pinnata* and *Tanacetum parthenium* species. *Carpino-Acerion* alliance is represented by *Carpinus betulus, Quercus petraea* subsp. *iberica, Cornus sanguinea* subsp. *australis* and *Cirsium hypoleucum* taxa.

The association spreads on the northwest of Aksu Mevkii, on the southern slopes of Küçükasar Hill and Gelininmez Hill, and on the upper sides of the western slopes of Danaoyrağı Hill.

There are the character species of *Quercetea pubescentis* class, *Quercetalia pubescenti-petraeae* order and *Carpino-Acerion* alliance in the association. Therefore, this association can be syntaxonomically linked to the class *Quercetea pubescentis* and the order *Quercetalia pubescenti-petraeae* and the *Carpino-Acerion* alliance.

Saniculo-Abietum equi-trojani ass. nova

The characterictic and diagnostic species of the association are *Abies nordmanniana* subsp. *equi-trojani* and *Sanicula europaea.* It is generally seen on the west, north, southeast and southwest slopes where the slope is 20-100%. The physiognomy is 3-layered and the degree of coverage is 75-100% in the tree layer, 5-80% in the shrub layer, and 0-35% in the grass layer. The tree layer has a height of 15-25 m and *Abies nordmanniana* subsp. *equi-trojani* and *Fagus orientalis* are dominant species. *Carpinus betulus, Pinus nigra* subsp. *pallasiana* var. *pallasiana, Acer campestre* subsp. *campestre, Ulmus glabra* and *Acer heldreichii* subsp. *trautvetteri* species also participate in this layer from time to time. The height of the shrub layer varies between 0.5-1 m and the dominant species of this layer are *Rubus hirtus* and *Rhododendron ponticum*. The grass layer has a height ranging from 0-25 cm and the most common species of the association are *Sanicula europaea, Galium odoratum, Euphorbia amygdaloides* subsp. *amygdaloides, Geranium robertianum* and *Petasites hybridus*. The *Saniculo-Abietum equi-trojani* association spreads between 500-1550 meters (a.s.l.) in the study area. The association spreads over soils developed from carbonate and metagranite bedrock.

Abies nordmanniana subsp. *equi-trojani* and *Sanicula europaea* species dominate the general appearance of the association. In addition, *Fagus orientalis, Carpinus betulus, Carex sylvatica* subsp. *sylvatica, Myosotis sylvatica* subsp. *cyanea* taxa which are characteristic of the class *Carpino-Fagetea sylvaticae,* show high repetition in the association. In the floristic composition of *Saniculo-Abietum equi-trojani* association, *Rhododendro pontici-Fagetalia orientalis* order is represented by *Fagus orientalis, Abies nordmanniana* subsp. *equi-trojani, Galium odoratum, Cardamine bulbifera, Moehringia trinervia* taxa (Table 2). The association is described with 11 quadrats. Holotypus: Table 2, quadrat no: 35.

Table 2. *Saniculo-Abietum equi-trojani* ass. Nova *association*

Quadrat no	1	2	3	9	21	35	36	41	107	109	117			
Size of quadrat (m^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
Altitude (m)	1265	1260	1400	1000	1122	1447	1539	1408	490	600	1500			
Inclination (%)	35	30	40	80	100	60	35	65	30	20	65			
Exposure	W	W	N	N	SE	W	SW	SW	N	SE	SW			
Parent rock	KKa	KKa	KKa	KKa	KKa	KKa	KKa	KKa	MGr	MGr	KKa			
Tree cover (%)	85	90	80	90	75	85	85	85	100	80	85			
Shrub cover (%)	8	10	5	35	40	10	80	80	5	80	80			
Herb cover (%)	5	5	5	0	35	5	5	5	5	15	5			
Characteristic species of association														
Abies nordmanniana subsp. *equi-trojani*	34	34	33	34	32	34	34	34	11	+1	33	11	V	Ph
Sanicula europaea	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	+1	11	V	HCr
Rhododendro pontici-Fagetalia orientalis														
Fagus orientalis	44	44	44	33	33	44	44	44	44	54	44	11	V	Ph
Galium odoratum	+1	+1	+1	+1	11	+1	+1	+1	.	.	+1	9	IV	Cr
Cardamine bulbifera	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	Cr
Moehringia trinervia	+1	+1	+1	.	.	+1	.	.	.	.	.	4	II	Th
Carpino-Fagetea sylvaticae														
Carpinus betulus	.	.	.	.	12	+1	11	11	33	23	12	7	IV	Ph
Myosotis sylvatica subsp. *cyanea*	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	HCr
Carex sylvatica subsp. *sylvatica*	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	HCr
Fragaria vesca	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Lactuca muralis	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Cerasus avium	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Quercetea-Pubescentis														
Euphorbia amygdaloides subsp. *amygdaloides*	+1	+1	+1	.	+1	+1	+1	+1	+1	.	+1	9	IV	Ch
Lapsana communis subsp. *intermedia* var. *intermedia*	.	.	.	.	.	.	+1	+1	+1	+1	+1	5	III	HCr
Pinus nigra subsp. *pallasiana* var. *pallasiana*	.	.	.	.	.	.	11	11	.	.	11	3	II	Ph
Acer campestre subsp. *campestre*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Clematis vitalba	.	.	.	.	.	.	.	.	+1	.	.	1	I	SPh
Vicia cracca subsp. *cracca*	.	.	.	.	11	.	.	.	.	.	.	1	I	HCr
Dictamnus albus	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Veronica chamaedrys	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ge
Ligustrum vulgare	.	.	.	+1	.	.	.	.	.	.	.	1	I	Ph
Populus tremula subsp. *tremula*	.	.	.	.	.	+1	.	.	.	.	.	1	I	Ph
Companions														
Petasites hybridus	+1	+1	+1	+1	11	+1	+1	+1	+1	.	+1	10	V	Cr
Geranium robertianum	+1	+1	+1	+1	+1	+1	+1	+1	+1	.	+1	10	V	Th
Trachystemon orientalis	+1	+1	+1	+1	+1	+1	.	.	+1	.	.	7	IV	Cr
Veronica serpyllifolia	+1	+1	+1	+1	11	+1	.	.	.	+1	.	7	IV	Ch
Alliaria petiolata	+1	+1	+1	+1	+1	+1	.	.	+1	.	.	7	IV	HCr
Rubus hirtus	+1	+1	+1	+1	11	+1	+1	+1	.	.	+1	9	IV	Ph
Plantago major subsp. *major*	+1	+1	+1	.	+1	+1	.	.	.	+1	.	6	III	HCr
Urtica dioica subsp. *dioica*	+1	+1	+1	+1	11	+1	.	.	.	.	.	6	III	HCr
Briza media	.	.	.	.	+1	.	+1	+1	.	+1	+1	5	III	HCr
Trifolium repens var. *repens*	+1	+1	+1	.	+1	+1	.	.	+1	.	.	6	III	HCr
Euphorbia stricta	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	Th
Ranunculus constantinopolitanus	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	HCr
Cardamine hirsuta	+1	+1	+1	+1	+1	+1	.	.	.	.	.	6	III	Th
Chaerophyllum aureum	.	.	+1	.	+1	+1	+1	+1	.	.	+1	6	III	HCr
Geranium pyrenaicum	.	.	.	+1	+1	.	.	.	+1	.	.	3	II	HCr
Asperula taurina	.	.	.	+1	+1	.	.	.	+1	+1	.	4	II	HCr
Poa trivialis	+1	+1	+1	.	.	+1	.	.	.	.	.	4	II	HCr
Polystichum aculeatum	.	.	.	+1	+1	.	.	.	+1	.	.	3	II	Cr
Equisetum hyemale	.	.	.	.	11	.	+1	+1	.	.	+1	4	II	Cr
Rumex obtusifolius subsp. *subalpinus*	+1	+1	+1	.	.	+1	.	.	.	.	.	4	II	HCr
Ulmus glabra	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	Ph
Festuca drymeja	.	.	.	+1	+1	.	.	.	.	+1	.	3	II	HCr
Epipactis pontica	.	.	.	+1	+1	.	.	.	.	+1	.	3	II	Ge
Peucedanum longifolium	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	HCr
Cystopteris fragilis	+1	+1	+1	.	.	+1	.	.	.	.	.	4	II	Cr
Dioscorea communis	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	Ge
Pedicularis condensata	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	HCr
Iris kerneriana	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	Ge
Cirsium hypoleucum	.	.	.	+1	.	.	+1	+1	.	.	+1	4	II	HCr
Cephalanthera damasonium	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	Ge
Dactylorhiza saccifera subsp. *saccifera*	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	Ge
Euphorbia macroclada	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	HCr
Carlina vulgaris	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	HCr
Valeriana alliariifolia	.	.	.	.	.	.	+1	+1	.	.	+1	3	II	HCr
Cyclamen coum subsp. *coum*	.	.	.	+1	+1	.	.	.	.	+1	.	3	II	Ge

Repetition | Presence | Life form

Table 2. (Continued)

Acer heldreichii subsp. *trautvetteri*	.	.	.	.	.	+1	+1	+1	.	.	+1	4	II	Ph
Rhododendron ponticum	.	.	.	33	12	.	.	.	+1	44	.	4	II	Ph
Rosa canina	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Carex remota subsp. *remota*	.	.	.	.	.	.	.	.	+1	+1	.	2	I	HCr
Daphne pontica subsp. *pontica*	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Euphorbia seguieriana subsp. *niciciana*	.	.	.	.	.	.	.	.	+1	+1	.	2	I	HCr
Trifolium pratense var. *pratense*	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Galium paschale	.	.	.	.	.	.	.	.	.	+1	.	1	I	HCr
Poa angustifolia	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Galium album subsp. *prusense*	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Dactylis glomerata subsp. *hispanica*	.	.	.	.	.	.	.	.	.	+1	.	1	I	Cr
Rumex gracilescens	.	.	.	+1	+1	.	.	.	.	.	.	2	I	HCr
Crataegus monogyna var. *monogyna*	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Lathyrus laxiflorus subsp. *laxiflorus*	.	.	.	.	+1	.	.	.	.	+1	.	2	I	HCr
Peucedanum caucasicum	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Veronica persica	.	.	.	+1	+1	.	.	.	.	.	.	2	I	Th
Scrophularia scopolii var. *scopolii*	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Lamium purpureum var. *purpureum*	.	.	.	+1	+1	.	.	.	.	.	.	2	I	Th
Cota tinctoria var. *discoidea*	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Festuca heterophylla	.	.	.	.	+1	.	.	.	.	+1	.	2	I	HCr
Bellis perennis	.	.	.	+1	+1	.	.	.	.	.	.	2	I	HCr
Saxifraga cymbalaria	.	.	.	+1	+1	.	.	.	.	.	.	2	I	Th
Vicia sativa subsp. *nigra* var. *segetalis*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Th
Moenchia mantica	.	.	.	.	.	.	.	.	+1	.	.	1	I	Th
Pteridium aquilinum	.	.	.	.	+1	.	.	.	+1	.	.	2	I	Cr
Taraxacum macrolepium	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Telekia speciosa	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Sambucus nigra	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Platanthera chlorantha	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ge
Thymus longicaulis subsp. *longicaulis*	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ch
Dactylis glomerata subsp. *glomerata*	.	.	.	.	+1	.	.	.	.	.	.	1	I	Cr
Cerastium pumilum subsp. *pumilum*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Th
Bromus sterilis	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Scutellaria albida subsp. *velenovskyi*	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Rubus ibericus	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Barbarea plantaginea	.	.	.	.	+1	.	.	.	.	.	.	1	I	Th
Lonicera orientalis	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Cirsium arvense	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Limodorum abortivum var. *abortivum*	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ge
Physospermum cornubiense	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Dipsacus fullonum	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Galium rotundifolium	.	.	.	.	+1	.	.	.	.	+1	.	2	I	HCr
Ranunculus brutius	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Phlomis russeliana	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Pulicaria odora	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Aristolochia pontica	.	.	.	+1	+1	.	.	.	.	.	.	2	I	HCr
Orchis pallens	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ge
Pyrola chlorantha	.	.	.	.	.	.	.	+1	.	.	.	1	I	Ch
Monotropa hypopithys	.	.	.	.	+1	.	.	.	.	.	.	1	I	Cr
Epilobium lanceolatum	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Polygonatum orientale	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ge
Salix caprea	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Platanus orientalis	.	.	.	.	.	+1	.	.	.	.	.	1	I	Ph
Helianthemum nummularium subsp. *nummularium*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ch
Pastinaca sativa subsp. *urens*	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Juglans regia	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Hypericum bithynicum	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Fraxinus excelsior subsp. *excelsior*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Sambucus ebulus	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Dorycnium graecum	.	.	.	.	.	+1	.	.	.	.	.	1	I	Ph
Pyrus elaeagnifolia subsp. *elaeagnifolia*	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Cytisus pygmaeus	.	.	.	.	.	+1	.	.	.	.	.	1	I	Ch
Castanea sativa	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Asperula involucrata	.	.	.	.	.	.	.	.	.	+1	.	1	I	HCr
Doronicum orientale	.	.	.	.	+1	.	.	.	.	.	.	1	I	Cr
Acer platanoides	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Laurocerasus officinalis	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Corylus colurna	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ph
Salvia forskahlei	.	.	.	.	+1	.	.	.	.	.	.	1	I	HCr
Hedera colchica	.	.	.	.	+1	.	.	.	.	.	.	1	I	SPh
Ilex colchica	.	.	.	.	11	.	.	.	.	.	.	1	I	Ph

Table 2. (Continued)

Quercus petraea subsp. *iberica*	.	.	.	.	+1	.	.	.	.	12	.	2	I	Ph
Vaccinium arctostaphylos	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph

Abbreviations: Ph, phanerophytes; Ch, chamaephytes; H, hemicryptophytes; Th, therophytes; G, geophytes; Gsa= Gneiss, Schistmigmatite, Amphibolite; MGr= Metagranite; KKa Clastic carbonate; N=North; W=West; S= South; E= East; NW= Nort-west; NE=North-east; SW= South-west; SE=South-east; . = not present; r = 1 individual; + = 2–5 individuals, cover <5%; 1 = 6–50 individuals, cover <5% or few larger individuals (often given as 1–5) with a cover up to 5%; 3 = cover 26%–50%; 4 = cover 51%–75%; and 5 = cover 76%–100%.

The fact that the ratio of species with low repetition is high and the ratio of species with high repetition is low in *Saniculo-Abietum equi-trojani* association shows that the association has a heterogeneous structure in terms of floristic composition.

The association spreads in west, north and south-east aspects around the Kocaoluk hill, Meşeliburun hill and Kayadibi hill, in the southwest of Birlik Gelintaş hill and Karacapınar hill.

This association was detected by Ozen and Kilinc (1995) however it is published in contravention of Article 5. Consequently, this association has detected using the same name as a new association in this study. The characteristic species of the classes *Carpino-Fagetea sylvaticae* and *Quercetea pubescentis* are included in the association. *Carpino-Fagetea sylvaticae* class dominates the association. *Saniculo-Abietum equi-trojani* association detected in the study area was syntaxonomically linked to *Carpino-Fagetea sylvaticae* class, *Rhododendro pontici-Fagetalia orientalis* order and *Fagion sylvaticae* alliance.

Corno mas-Quercetum ibericae ass. nova

The characterictic and diagnostic species of the association are *Quercus petraea* subsp. *iberica* and *Cornus mas.* It is generally seen on the west, north and south slopes where the slope is 5-95%. In terms of physiognomy, it consists of tree shrub and grass layers, and the tree layer has 40-90% coverage, the shrub layer 5-60%, the grass layer 1-80% coverage. The association spreads on soils developed from metagranite bedrock.

Quercus petraea subsp. *iberica* and *Cornus mas* dominate the general appearance of the association. In addition, *Carpinus betulus* which is a characteristic of the *Carpino-Fagetea sylvaticae* class, shows high repetition in the association. In the floristic composition of the association, *Carpino-Fagetea sylvaticae* class is represented by *Clinopodium vulgare* subsp *vulgare*, *Corylus avellana* var. *avellana, Epilobium montanum, Geum urbanum, Hedera helix, Fragaria vesca, Lapsana communis* subsp. *intermedia* var. *intermedia, Veronica chamaedrys, Fagus orientalis, Carpinus betulus, Sanicula europaea* taxa. *Rhododendro-Fagetalia orientalis* order is represented by *Daphne pontica* subsp. *pontica, Fagus orientalis, Rhododendron ponticum, Quercus petraea* subsp. *iberica, Smilax excelsa* taxa. *Crataego pentagynae-Fagion orientalis* alliance is represented by *Fagus orientalis, Carpinus betulus, Rhododendron ponticum, Rubus hirtus* taxa.

When the frequency of the association is examined; the number of species with few repetitions is high and the association shows heterogeneity in terms of floristics.

The association spreads on the western slopes of Küçükasar hill in Aksu locality, Sarıot hill, Burçluburun hill, Kelsivrisi hill and Alaboğa hill south-facing slopes and around Tarlabaşı hill (Table 3). The association is described with 13 quadrats. Holotypus: Table 3, quadrat no: 112.

Table 3. *Corno mas-Quercetum ibericae* ass. nova

Quadrat no	26	83	85	86	87	90	92	93	94	96	97	98	112			
Size of quadrat (m^2)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
Altitude (m)	530	530	500	500	498	536	500	524	568	552	432	425	511			
Inclination (%)	70	50	40	70	95	35	80	75	40	80	90	50	5			
Exposure	W	W	N	S	N	N	S	W	S	W	S	S	S			
Parent rock	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	MGr	Repetition	Presence	Life Form
Tree cover (%)	80	80	90	80	90	85	90	40	40	40	45	60	70			
Shrub cover (%)	5	50	15	35	10	10	40	60	5	60	40	35	60			
Herb cover (%)	5	5	5	1	5	5	5	80	50	80	65	30	25			
Characteristic species of association																
Quercus petraea subsp. *iberica*	43	33	23	33	23	33	54	44	33	43	33	43	22	13	V	Ph
Cornus mas	32	21	21	32	21	11	32	21	11	21	21	32	21	13	V	Ph
Castaneo sativa-Carpinion orientalis																
Carpinus betulus	22	.	11	12	.	.	11	.	12	.	.	11	33	7	III	Ph
Crataego pentagynae-Fagion orientalis																
Fagus orientalis	.	12	55	11	55	.	.	.	.	.	.	.	44	5	II	Ph
Rhododendron ponticum	.	.	.	.	.	.	.	.	.	.	.	.	12	1	I	Ph
Rubus hirtus	.	.	.	.	11	.	.	.	.	.	.	.	.	1	I	Ph
Rhododendro pontici-Fagetalia orientalis																
Daphne pontica subsp. *pontica*	.	.	.	.	21	.	.	.	.	.	.	.	+1	2	I	Ph
Smilax excelsa	.	.	+1	.	+1	.	.	.	.	.	.	.	.	2	I	Ph
Carpino-Fagetea sylvaticae																
Hedera helix	.	.	21	.	21	.	.	.	.	.	.	+1	.	3	II	SPh
Clinopodium vulgare subsp. *vulgare*	.	.	.	.	11	.	11	21	.	21	.	.	.	4	II	HCr
Lapsana communis subsp. *intermedia* var. *intermedia*	.	.	.	.	.	.	.	11	+1	11	.	.	+1	4	II	HCr
Geum urbanum	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	II	HCr
Corylus avellana var. *avellana*	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Ph
Epilobium montanum	.	.	.	.	.	.	.	11	.	11	.	.	.	2	I	HCr
Sanicula europaea	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Fragaria vesca	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Veronica chamaedrys	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Ge
Companions																
Sorbus torminalis var. *torminalis*	+1	11	.	11	11	+1	11	+1	11	+1	+1	21	.	11	V	Ph
Crataegus monogyna var. *monogyna*	.	21	21	+1	11	.	.	.	+1	.	.	21	.	6	III	Ph
Rosa canina	11	.	.	.	.	.	.	21	+1	21	.	.	+1	5	II	Ph
Galium paschale	.	12	12	.	.	+1	.	.	.	.	.	.	.	3	II	HCr
Erica arborea	.	11	.	.	.	+1	.	33	.	33	.	.	.	4	II	Ph
Festuca heterophylla	.	.	.	.	.	+1	.	+1	.	+1	.	.	.	3	II	HCr
Cistus creticus	.	.	.	.	.	.	.	21	+1	21	21	.	.	4	II	Ph
Hordelymus europaeus	11	.	.	.	.	.	.	11	.	11	.	.	.	3	II	HCr
Melissa officinalis subsp. *officinalis*	54	.	.	.	.	.	.	22	.	22	33	.	.	4	II	Ch
Dorycnium graecum	.	.	.	11	.	+1	.	.	+1	.	.	.	+1	4	II	Ph
Pinus nigra subsp. *pallasiana* var. *pallasiana*	.	43	.	43	43	32	32	.	.	.	.	.	.	5	II	Ph
Mespilus germanica	.	.	.	.	.	+1	+1	+1	.	+1	.	.	.	4	II	Ph
Acer campestre subsp. *campestre*	11	.	.	.	11	.	.	.	.	.	.	+1	21	4	II	Ph
Lathyrus laxiflorus subsp. *laxiflorus*	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Geranium pyrenaicum	+1	.	.	.	.	.	.	.	+1	.	.	.	.	2	I	HCr
Trifolium repens var. *repens*	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Euphorbia seguieriana subsp. *niciciana*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Galium album subsp. *prusense*	.	.	.	.	.	.	11	.	.	.	.	.	.	1	I	HCr
Dactylis glomerata subsp. *hispanica*	.	.	.	.	.	.	.	.	+1	.	32	.	.	2	I	Cr
Eragrostis collina	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th
Veronica persica	11	.	.	.	.	.	.	.	.	.	.	.	+1	2	I	Th
Verbascum speciosum	.	.	.	.	.	.	.	11	.	11	.	.	.	2	I	HCr
Lamium purpureum var. *purpureum*	.	.	.	.	.	.	.	.	+1	.	.	.	+1	2	I	Th
Cynosurus cristatus	.	.	.	.	.	.	.	11	.	11	.	.	.	2	I	HCr
Heracleum sphondylium subsp. *montanum*	+1	.	.	.	.	.	.	.	.	.	.	.	.	1	I	HCr
Crocus speciosus subsp. *speciosus*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Ge
Cystopteris fragilis	.	.	.	.	.	.	.	.	.	.	.	11	.	1	I	Cr
Galium aparine	.	.	.	.	.	.	.	.	.	.	.	+1	.	1	I	Th
Sedum pallidum	.	.	.	.	.	.	.	.	+2	.	.	.	.	1	I	Th
Dianthus giganteus	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Salvia tomentosa	.	.	.	.	.	.	.	.	.	.	+1	.	.	1	I	Ch
Eryngium giganteum	.	.	.	.	.	.	.	+1	.	+1	.	.	.	2	I	HCr
Carex remota subsp. *remota*	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Agrostis stolonifera	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Vicia sativa subsp. *nigra* var. *segetalis*	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Th
Moenchia mantica	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th

Table 3. (Continued)

Pteridium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Cr
Platanthera chlorantha	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Ge
Thesium arvense	.	.	.	.	.	+1	.	.	.	.	.	.	.	1	I	HCr
Polygala anatolica	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Ch
Tanacetum poteriifolium	.	.	.	.	.	+1	.	.	.	.	.	.	.	1	I	HCr
Cynoglossum montanum	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Odontites vulgaris	.	.	.	.	.	.	.	21	.	21	.	.	.	2	I	Th
Microthlaspi perfoliatum	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th
Malva neglecta	.	.	.	.	.	.	.	+1	.	+1	.	.	.	2	I	Th
Silene latifolia	.	.	.	.	.	.	.	21	.	21	.	.	.	2	I	HCr
Myosotis ramosissima	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th
Origanum vulgare subsp. *viridulum*	.	.	.	.	.	.	.	.	.	.	32	.	.	1	I	HCr
Centaurium erythraea subsp. *erythraea*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Caucalis platycarpos	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th
Muscari neglectum	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Ge
Crataegus microphylla subsp. *microphylla*	.	.	.	.	.	+1	.	.	.	.	.	.	+1	2	I	Ph
Geranium columbinum	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Th
Polygonum persicaria	11	.	.	.	.	.	.	.	.	.	.	.	.	1	I	Th
Cirsium ligulare	.	.	.	.	.	.	.	21	.	21	.	.	.	2	I	HCr
Inula ensifolia	.	.	.	.	+1	.	.	.	.	.	.	.	.	1	I	HCr
Smilax aspera	.	.	+1	.	+1	.	.	.	.	.	.	.	.	2	I	Ph
Phleum montanum subsp. *montanum*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Asplenium adiantum-nigrum	.	.	.	.	.	.	.	.	.	.	11	.	.	1	I	Cr
Asplenium trichomanes	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Cr
Potentilla argentea	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Alyssum trichostachyum	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Galium verum subsp. *verum*	.	.	.	.	22	.	.	.	.	.	.	.	.	1	I	HCr
Sherardia arvensis	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Th
Galeopsis bifida	11	.	.	.	.	.	.	.	.	.	.	.	.	1	I	Th
Leonurus quinquelobatus	11	.	.	.	.	.	.	.	.	.	.	.	.	1	I	HCr
Melampyrum arvense var. *arvense*	.	11	.	.	.	.	.	.	.	.	.	.	.	1	I	Th
Orlaya daucoides	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Th
Arctium minus	.	.	.	.	.	.	.	.	.	.	+1	.	.	1	I	HCr
Leontodon hispidus subsp. *hispidus*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Cr
Clematis viticella	.	.	.	.	.	.	.	.	.	+1	.	.	.	1	I	SPh
Calepina irregularis	.	.	.	.	.	.	.	.	.	+1	.	.	.	1	I	Th
Aegonychon purpurocaeruleum	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	HCr
Seseli resinosum	.	+1	.	.	.	.	.	.	.	.	.	.	.	1	I	HCr
Gentiana asclepiadea	.	.	.	.	.	.	.	.	.	.	.	+1	.	1	I	HCr
Neottia nidus-avis	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Ge
Clinopodium grandiflorum	32	.	.	.	.	.	.	.	.	.	.	.	.	1	I	HCr
Cardamine bulbifera	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Cr
Cyclamen coum subsp. *coum*	.	.	.	.	.	.	.	.	.	.	.	+1	.	1	I	Ge
Phillyrea latifolia	.	.	.	.	.	.	.	33	.	33	.	.	.	2	I	Ph
Pistacia palaestina	.	.	.	.	.	.	.	22	.	22	.	.	.	2	I	Ph
Arbutus andrachne	.	22	.	.	.	+1	.	.	.	.	.	.	.	2	I	Ph
Genista januensis subsp. *lydia*	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	Ph
Euonymus latifolius subsp. *latifolius*	.	.	.	.	.	.	+1	.	.	.	.	.	.	1	I	Ph
Staphylea pinnata	.	.	.	.	.	.	.	.	.	.	.	+1	.	1	I	Ph
Corylus colurna	.	.	.	.	21	.	.	.	.	.	.	.	.	1	I	Ph
Tanacetum parthenium	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Pyrus elaeagnifolia subsp. *elaeagnifolia*	.	.	.	.	.	.	.	.	+1	.	.	.	21	2	I	Ph
Hypericum montbretii	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Helleborus orientalis	.	.	11	.	.	.	.	.	.	.	.	+1	.	2	I	Cr
Asperula involucrata	.	.	.	.	.	.	.	.	.	.	.	.	+1	1	I	Hcr
Cirsium hypoleucum	11	.	.	.	.	.	.	.	.	.	.	.	.	1	I	Hcr
Oenanthe pimpinelloides	.	.	.	.	.	.	.	.	+1	.	.	.	.	1	I	HCr
Digitalis ferruginea subsp. *ferruginea*	.	.	.	.	.	.	.	.	.	.	+1	21	.	2	I	HCr
Brachypodium pinnatum	.	23	.	.	.	.	.	.	.	.	.	.	.	1	I	HCr

There are the character species of *Carpino-Fagetea sylvaticae* class, *Rhododendro-Fagetalia orientalis* order and *Crataego pentagynae-Fagion orientalis* alliance in this association. Therefore, this association can be syntaxonomically attributed to *Carpino-Fagetea sylvaticae* class, *Rhododendro-Fagetalia orientalis* order and *Crataego pentagynae-Fagion orientalis* alliance.

Habitat types included in Yenice WCA according to EUNIS are given in Table 4. The associations identified in Yenice Wildlife Conservation Area and the upper units they belong to are given in Table 5.

Table 4. Habitat classes of Yenice WCA

Habitat Types	Area
E2.7. Unmanaged mesic grassland	945.14
G1.6. *Fagus* woodland	15349.11
G1.7. Thermophilous deciduous woodland	197.27
G1.8. Acidophilous *Quercus*-dominated woodland	7852.85
G3.1. *Abies* and *Picea* woodland	397.70
G3.4. *Pinus sylvestris* woodland south of the taiga	122.32
G3.5. *Pinus nigra* woodland	1155.25
G3.7. Lowland to montane Mediterranean *Pinus* woodland (excluding *Pinus nigra*)	30.77
G3.F. Highly artificial coniferous plantations	111.28
G4.5. Mixed *Pinus sylvestris* - *Fagus* woodland	43.66
G4.6. Mixed *Abies* - *Picea* - *Fagus* woodland	562.76
J2.2. Rural public buildings	8.91
Total	26777.01

Table 5. The associations identified in Yenice WCA and their upper uni

Associations	Alliance	Order	Class
Rhododendro ponticum-Fagetum orientalis Kutbay and Kilinc 1995.	*Fagion orientalis* Soó 1964	*Rhododendro pontici-Fagetalia orientalis* Passarge 1981	*Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968
Corno mas-Quercetum ibericae ass. nova	*Crataego pentagynae-Fagion orientalis* Quézel, Barbéro and Akman 1980.	*Rhododendro pontici-Fagetalia orientalis* Passarge 1981	*Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968
Lathyro tukhtensis Pinetum pallasianae Yıldırım and Kılınç 2011.	*Carpino-Acerion* Quézel, Barbéro and Akman 1978.	*Quercetalia pubescenti-petraeae* Klika 1933.	*Quercetea-Pubescentis* Doing-Kraft ex Scamoni and Passarge 1959
Saniculo-Abietum equi-trojani ass. nova	*Fagion sylvaticae* Quézel, Barbéro and Akman 1980.	*Rhododendro pontici-Fagetalia orientalis* Passarge 1981	*Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968

Discussion and Conclusion

The study area is predominantly covered with forest vegetation and there is no settlement in it. Since it is a protected area, it is not exposed to any serious effects other than forestry activities, and and there is no deterioration in its natural structure.

As a result of the evaluations, a total of 4 plant associations were identified, 2 of which belong to deciduous forests of forest vegetation and 2 of which belong to coniferous forests. Two of these four plant associations are new for the plant science. Syntaxa and their phyto-sociological units are as follows:

Class : *Carpino-Fagetea sylvaticae* Jakucs ex Passarge 1968

Order: *Rhododendro pontici-Fagetalia orientalis* Passarge 1981.

Alliance: *Fagion orientalis* Soó 1964

Association: *Rhododendro-Fagetum orientalis* Kutbay and Kilinc 1995.

Alliance: *Fagion sylvaticae* Quézel, Barbéro and Akman 1980.

Association: *Saniculo-Abietum equi-trojani* ass. nova

Order: *Rhododendro pontici-Fagetalia orientalis* Quézel, Barbéro and Akman 1980.

Alliance: *Crataego pentagynae-Fagion orientalis* Quézel, Barbéro and Akman 1980.

Association: *Corno mas-Quercetum ibericae* ass. nova

Class: *Quercetea-Pubescentis* Doing-Kraft ex Scamoni and Passarge 1959.

Order: Quercetalia pubescenti-petraeae Klika 1933.

Alliance: *Carpino-Acerion* Quézel, Barbéro and Akman 1978 nom. inval.

Association: *Lathyro tukhtensis-Pinetum pallasianae* Yıldırım and Kılınç 2011.

Similar plant associations detected in nearby regions and associations in the research area were compared in terms of floristic, syntaxonomic and ecological evaluations.

Plant Associations Belong to Deciduous Forests

Rhododendro ponticum-Fagetum orientalis was previously defined in Elmacık Mountain (Düzce) by Aksoy (2006), in Çam Mountains (Düzce-Akçakoca) by Aydoğdu (1983), in Zonguldak-Bartın and Karabük regions by Demirörs (1986), and in the region between Demirköy and Pinarhisar by Yarcı (2000).

This association spreads mostly in northern aspects between the elevations of 580-1215 m of the study area. When similar units in which *Fagus orientalis* is dominant are examined, it is seen that it spreads in a wide elevation step, with the lowest 200 m in Demirköy-Pinarhisar region (Yarcı, 2000), the highest 1900 m in Sisdağı (Palabaş Uzun, 2009).

In the study area, *Rhododendro-Fagetum orientalis* association spreads on metagranite, gneiss, schistmigmatite, amphibolite and carbonate bedrocks, while in other studies, it spreads on bedrocks such as marble, andesite, basalt, granite, limestone, rhyolite, schist, limestone and flysch, gneiss, sandstone and marl. It is seen that its tolerance in terms of bedrock is wide.

The floristic similarity of the plant associations identified in this present study with those in previous studies ranged from 8% to 37.3% (Table 6). The low floristic similarity (14.3) with the study of Yarcı (2000) can be explained by the fact that the region where the study was conducted is less suitable for the development of this plant association in terms of soil and climate. As a matter of fact, a climate similar to the oceanic climate in the north-facing parts of the said region and a cold Mediterranean climate in the south-facing parts showed itself as a difference in the floristic composition of the vegetation.

The *Rhododendro-Fagetum orientalis* association detected with this study in the research area was syntaxonomically linked to the *Carpino-Fagetea sylvaticae* class, *Rhododendro pontici-Fagetalia orientalis* order and *Fagion orientalis* alliance.

Some researchers evaluated the *Fagus orientalis* dominated forests under the orders *Querco cerridis-Carpinetalia orientalis, Querco pseudocerridis-Cedretalia libani,* and *Quercetalia pubescentis* in the *Quercetea pubescentis* class. Others evaluated them under the orders *Rhododendro pontici-Fagetalia orientalis, Pino-Piceetalia orientalis,* and *Fagetalia sylvaticae* in the *Querco-Fagetea* class (Akman et al., 1979; Quézel et al., 1980; Varol & Tatlı, 2001; Tatlı et al., 2005; Özen & Kılınç, 2002; Eminağaoğlu et al., 2007). Previous studies classified the *Fagus orientalis* forests in under many alliances such as *Quercion frainetto, Carpino betuli-Acerion hyrcani, Staphylleo-Buxion, Geranio-Cedrion libani, Crataego pentagynae-Fagion orientalis, Veronico-Fagion orientalis, Fagion sylvaticae* (Karaköse, 2019).

When we look at the studies previously defined in the nearby regions; Akman et al. (1983a) included the *Fagus-Rhododendron ponticum* association in *Fagetalia sylvaticae* order in their studies in Bolu Mountains, Sunnice Mountain, Yedigöller and its surroundings. Aksoy (2006), in his study conducted in Elmacık Mountain (Düzce), this association was associated with the *Querco-Fagetea* class, *Fagetalia sylvaticae* order, and *Fagion orientale* alliance. Yarcı (2000) linked it to the *Rhododendro-Fagetalia orientalis* order in her study in the Demirköy-Pınarhisar region. Recently comprehensive studies have been conducted using modern technologies and the nomenclature of some syntaxonomic units has been changed as the synonym (Çoban & Willner, 2019; Karaköse & Terzıoğlu, 2023; Kavgacı et al., 2023) For example, the order *Rhododendro pontici–Fagetalia orientalis* described by Quézel et al. (1980) is currently treated as a synonym of *Rhododendro pontici–Fagetalia orientalis* established by Passarge (1981) (Mucina et al., 2016). Similarly, alliances such as *Crataego pentagynae–Fagion orientalis* and *Fagion orientalis* (Quézel et al., 1992) were considered synonyms of *Fagion orientalis* Soó (1964) in the European vegetation framework proposed by Mucina et al. (2016). According to the EuroVegChecklist Expert

System and the study conducted by Karaköse in Esenli (Giresun), *Fagus orientalis*-dominated forests were included in the class *Carpino-Fagetea sylvaticae* and the order *Rhododendro pontici-Fagetalia orientalis* when the floristic composition was examined (Mucina et al., 2016; Karaköse, 2019).

Corno mas-Quercetum ibericae spreads on metagranite bedrock between 425-570 meters in the study area. When the plant associations of *Quercus petraea* subsp. *iberica* are examined in the nearby regions; it is seen that it spreads up to elevation of 1280-1700 meters, the highest in Yenice Forests (Ilgaz-Çankırı) (Öner & Abay, 2005). It spreads in Kasatura Bay (Oral, 2010) with the lowest 36-188 m and in the Çam Mountains (Düzce-Akçakoca) (Aydoğdu, 1983) with an elevation of 50-100 meters.

In the study area, the *Corno mas-Quercetum ibericae* association spreads on metagranite bedrocks, while in other studies it spreads on different bedrocks such as basalt, granite, rhyolite, marl, silt, clay, gneis, sandstone and flysch.

Corno mas-Quercetum ibericae association defined in the research area was compared floristically with the associations belong to *Q. petraea* subsp. *iberica* defined by other researchers. According to Sorensen's similarity ratios; *Festuco heterophyllae-Quercetum ibaricae* association, which spreads on granite and rhyolite bedrocks between 850-1300 meters in Yaylacık Research Forest (Karabük) (Arslan, 2008), is the closest association to the association determined with this study and its similarity ratio is 39%. The association described by Arslan (2008) has a high floristic similarity due to its proximity to the study area and similar bedrock. However, the tree height differences of the two identified associations caused the characteristic species to differ as well. Due to *Pinus nigra* that enters the mixture at a ratio of 20%, the association was evaluated as a broad-leaved-coniferous forest formation. The association includes mesophyll plants as well as species with xerophilic properties, and since it represents *Quercetalia pubescenti-petraeae (Querco-Carpinetalia orientalis* Quézel, Barbéro et Akman 1980 nom. inval.) order in terms of character species, it has been evaluated in this order.

The *Corno mas-Quercetum ibericae* association detected with this study in the research area was syntaxonomically linked to the *Carpino-Fagetea sylvaticae* class, *Rhododendro pontici-Fagetalia orientalis* order and *Crataego pentagynae-Fagion orientalis* alliance. Arslan (2008), in his study conducted in Yaylacık Research Forest (Karabük), *Festuco heterophyllae-Quercetum ibaricae* ass. since it has more character species, it has been included in the *Querceta pubescentis* class, *Querco-Carpinetalia orientalis* order, and *Carpino acerion* alliance. *Hyperico calycinum-Quercetum petraea* association described by Aksoy (2006) in Elmacık Mountain (Düzce), *Daphne ponticae-Quercetum ibericae* described in northernregions of Kastamonu (Daday Azdavay) by association described by Aydoğdu (1983) in Çam mountain (Düzce-Akçakoca) are linked to *Quercetea pubescentis* class *Querco-Carpinetalia orientalis* order and *Carpino-Acerion* alliance. Although *Quercus petraea* subsp. *iberica* shows differences in terms of height and bedrock in the associations to which Quercus petraea subsp. iberica participates dominantly, it is seen that it is generally associated with *Carpino-Acerion* Quézel et al. (1980), *Quercus petraea* subsp. *iberica-Viola suavis* described by Akman et al. (1983b) in Bolu-Semen mountain, *Carpino-Quercetum petrae* association identified in Devrekani, İnebolu, Abana (Kastamonu) (Yurdakulol et al., 2002), *Erico arboreo-Quercetum ibericae* (Özel, 1998) association identified in Kazdağları and *Quercus petraeae* subsp. *iberica-Verbascum bugilifolius* alliance and upper syntaxonomic units. *Quercus petraea* subsp. *iberica-Lathyrus niger* association described by Yaltırık in the Belgrad Forest was connected to the classes *Quercetea pubescentis* and *Querco-Fagetea* and to *Rhododendro-Fagetalia orientalis* order.

Table 6. The comparison of the vegetation types with similar associations by Sorensen similarities.

Defined associations in the study area	*Rhododendro ponticum-Fagetum orientalis*	*Cornomas-Quercetum ibericae*	*Lathyro tukhtensis Pinetum pallasianae*	*Saniculo-Abietum equi-trojani*
Related previous studies	Sorensen similarity rates (%)			
Elmacık Mountain (Düzce) (Aksoy, 2006)	32	30	21, 10.3, 14.6	29.4
Yaylacık Research Forest (Arslan, 2008)	37.3	39	28	
Bolu-Semen Mountains (Akman et al., 1983a)		25	18	30. 3
Belgrad Forest (Yaltirik et al., 1983)	14	23.2		
Kazdağları (Özel, 1998)	22.4	15.6	21	
Devrekani, İnebolu, Abana, Kastamonu (Yurdakulol et al., 2002)	25.6	34.2		33.7
Kasatura Bay (Oral, 2010)		19		
Yenice Forest (Ilgaz-Çankırı) (Öner & Abay, 2005)		8		6.7, 7
Yeniköy (Bursa) (Özen, 2010)	15.9			
İnegöl Mountain (Gümüşhacıköy-Amasya) (Yıldırım, 2009)	11.3, 15.8		19	
Sisdağı (Palabaş Uzun, 2009)	19.3			
Boyabat (Sinop) Dam (Korkmaz, 1994)	11		15	22
Bolu Mountains (Akman et al., 1983)	32		23.7	33
Bafra Nebyan Mountain (Samsun) (Kutbay & Kılınç, 1995)	27.2			
Vezirköprü-Kunduz Mountain (Özen & Kılınç, 2002)	16			
Bursa-Bilecik (Mezit, Sulhiye and Kozpınar villages) (Türe et al., 2005)	27.5		13	20
Demirköy-Pınarhisar (Yarcı, 2000)	14.3			
Uzungöl Trabzon Çaykara (Terzioğlu, 1998)	15.8			
Bafra Nebyan Mountain (Kutbay, 1993)	28.8			26
Kelkit valley (Karaer et al., 1999)	15.4		7	
Kızılırmak valley (Korkmaz et al., 2011)	22.2		15.9	
Gümüş Mountain (Kütahya) (Tatlı et al., 2005)	8		15.6	
Uluhan-Mudurnu (Akman & İlarslan, 1983)			22.4	
Gerede-Aktaş Forest (Ketenoğlu, 1983)			13	27.3
Çamlıdere Çamkoru-Peçenek (Akman & Aydoğdu, 1986)			16	
Çankırı-Çorum Sungurlu (Ketenoğlu & Aydoğdu, 1986)			12.9	
Bafra Nebyan Mountain (Kutbay & Kılınç, 1995)			20	
Eğerli Mountain (Cansaran & Aydoğdu, 2001)			23.4	
Kunduz Forest (Özen & Kılınç, 2002)			14.3	
Yandağ-Isparta (Kargıoğlu & Tatlı, 2005)			6.2	
Yaralıgöz Education and Observation Forest (Karaköse & Terzıoglu, 2023)				5.2

Associations Belong to Coniferous Forests

Lathyro tukhtensis-Pinetum pallasianae spreads between the elevations of 518-1180 meters in the research area. In Türkiye, it was first described by Schwarz (1935) and later by Czeczott (1938) in the Eldiven Mountains and Büyük Ilgaz Mountain in the south of Çankırı, and by Yıldırım (2009) on the İnegöl Mountain in Gümüşhacıköy-Amasya.

When the plant associations belonging to *P. nigra* subsp. *pallasina* and close regions are examined; it is seen that it spreads at the lowest 26 m in Kasatura Bay (Oral, 2010), and the highest at 1850 m in Engizek Mountain (Duman, 1995). It can be said that it shows ecological compatibility between very different elevation steps.

While *Pinus nigra* subsp. *pallasiana-Lathyrus tukhtensis* association spreads over metagranite and carbonate bedrocks in the research area, it spreads on bedrocks such as andesite, schist, sandstone, limestone, gneiss, gypsum, basalt, serpentine, basalt, lime-cemented bres and limestone in the other studies. It is seen that its tolerance in terms of bedrock is wide.

Pinus nigra subsp. *pallasiana-Lathyrus tukhtensis* association is compared with *P.nigra* subsp. *pallasina* associations defined by other researchers in terms of floristics. According to Sorenson's (1948) similarity ratios; similarity varies between 6.2-28% (Table 6). The association with the highest similarity ratio is the association identified by Arslan (2008) in the Yaylacık Research Forest, which is closest to the study area.

Lathyro tukhtensis-Pinetum pallasianae association detected with this study in the research area was syntaxonomically linked to the *Quercetea-Pubescentis* class, *Quercetalia pubescenti-petraeae* order and *Carpino-Acerion* alliance. Yıldırım (2009) included the same asociation that he described on Mount İnegöl in the *Quercetea-Pubescentis* class, *Querco-Carpinetalia orientalis* order and *Carpino Acerion* alliance.

The Saniculo-Abietum equi-trojani association, which occurs between the elevations of 500 and 1550 meters in the study area, was previously described by Özen (1993) in the region between Alaçam-Gerze and Boyabat-Durağan. However this association was published in contravention of Article 5. When the plant associations belonging to *Abies nordmanniana* subsp. *equi-trojani* near the research area are examined, it is observed that they demonstrate ecological compatibility across a wide range of elevations from 100 to 2040 meters.

In the study area, the *Saniculo-Abietum equi-trojani* association primarily occurs on carbonate bedrocks and metagranite. In similar associations identified previously, it has been found on bedrocks such as limestone, phyllite, andesite, metamorphic schist, clay, serpentine, conglomerate, and limestone.

The Saniculo-Abietum equi-trojani association is floristically compared with associations of *Abies nordmanniana* subsp. *equi-trojani* identified by other researchers. According to Sorensen's (1948) similarity ratios; floristic compositions of the associations defined in this present study show similarity ratios ranging from 5.2% to 33.7% with those defined by other researchers, and are most similar to the association identified by Yurdakulol et al. (2002) in the Devrekani, İnebolu, Abana, and Kastamonu region (Table 6). However, the nomenclature of this association was applied inappropriately according to the rules of ICPN (Art. 5) (Theurillat et al., 2021).

The Saniculo-Abietum equi-trojani association identified in the present study is syntaxonomically linked to the *Carpino-Fagetea sylvaticae* class, *Rhododendro pontici-Fagetalia orientalis* order, and the *Fagion sylvaticae* alliance. This is similar to previously described in the region between Alaçam-Gerze and Boyabat-Durağan by Özen (1993). *Rubo hirtus-Abietum bornmuleriana* association identified by Aksoy (2006) in Elmacık Mountain (Düzce) and *Fago orientalis-Abietetum bornmuellerianae* associations defined by Korkmaz (1994) in Boyabat (Sinop) Dam and its surroundings, were included *Quercetea pubescentis* class, *Querco-Carpinetalia orientalis* order and *Carpino-Acerion* alliance. *Fago-Abietum nordmannianae* association which described by Kutbay (1993) in Bafra Nebyan Mountain, included *Querco-Fagea* class and *Rhododendro-Fagetalia orientalis* order as it is represented by more species.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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