

## Diversity of Pteridophytes in the flora within the borders of Kaçkar Mountains National Park (Rize, Türkiye)

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**Abstract:** The Pteridophytes distributed within the borders of Kaçkar Mountains National Park are presented. Comparative diagnostic and microscopic studies showed that 49 ferns were distributed in the study area during different periods of the growing season. It has been determined that the region has a rich flora diversity, including Pteridophyta represented by 28 taxa, 11 families and 11 genera. The distribution of families according to the number of taxa within the boundaries of the research area are Dryopteridaceae (9), Aspleniaceae (5), Athyriaceae (3), Equisetaceae (2), Lycopodiaceae (2), Thelypteridaceae (2), Polypodiaceae (1), Ophioglossaceae (1), Pteridaceae (1), Cystopteridaceae (1), Dennstaedtiaceae (1) and 10 genera such as *Dryopteris* (7), *Asplenium* (5), *Athyrium* (2), *Equisetum* (2), *Polystichum* (1), *Polypodium* (1), *Cryptogramma* (1), *Phegopteris* (1), *Oreopteris* (1), *Lycopodium* (is in the form 1). The richest families are Dryopteridaceae (9), Aspleniaceae (5), and genera are *Dryopteris* (7) and *Asplenium* (5).

**Keywords:** comparative analysis, genera, family, features, ferns, KMNP, taxa

### INTRODUCTION

Kaçkar Mountains National Park (KMNP) is one of the 100 priority regions recognized by World Wildlife Fund for Nature (WWF) for the conservation due to its flora, fauna and rare ecosystems [Atamov, 2021]. The ferns are spore-forming plants, widely distributed in all climatic areas of the world, except the poles and arid desert habitats. These are the geologically oldest vascular plants characterised by veins in the trunk, root and leaf tissues which carry water and nutrients. Various studies covering fern species collected from Türkiye have been undertaken since the publication of the 1st volume of the Flora of Türkiye (1965) and the results have been documented in a number of publications

[Fraser-Jenkins, Corley, 1973; Donner 1990; Parris et al., 1980; Davis, 1965, 1988; Kaynak, Tuyji, 1991].

E. Wherry [1920] has analyzed the ferns from USA, from New Hampshire to Southern Virginia on the basis of pH content of the soil and divided the ferns into two groups: acidic and alkaline species. The cytological characteristics of the species of the *Polypodium* L. genus distributed in Europe have revealed that there are three different ploidies [Shivas, 2008]. It was pointed out that hybrid species have been obtained experimentally from species that naturally hybridize and three species epithets for these three ploidies were proposed. The distribution areas of these species in Europe are determined.

According to P.H. Davis [1965], a number of researches examined and many specimens of ferns were collected from different geographical regions within Türkiye at different times [Flora of Turkey Volume-1, 1965; Güner et al., 2000, 2012; Henderson 1965]. A. Baytop-Özocak [1970] has determined the distribution of fern materials collected from different areas of Türkiye, located in the Herbarium of Istanbul University, Faculty of Pharmacy. C.R. Fraser-Jenkins, Corley [1973] has evaluated three *Dryopteris* Adans. species growing in Northern Anatolia and the Caucasus according to their chromosome number and structure, they have presented the general characteristics of their habitats. H. Demiriz et al. [1990], G. Kaynak [1980, 1989, 1991], M. Joshkun [1978] have established a list of fern species distributed in Eastern Anatolia and Southeastern Anatolian regions together with their localities, and revealed the relationships between ecological factors and species. They observed ecosystem-dependent differences in the leaves of *Cystopteris fragilis* Chiov., *Asplenium ceterach* L., *Adiantum capillus-veneris* L., *Cheilanthes persica* (Bory) Mett. (currently, *Hemionitis persica* (Bory) Christenh.) and *Asplenium rutamuraria* L. species growing in different ecosystems. Evaluation of *Asplenium obovatum* species distributed in Türkiye according to its chromosome number, structure was conducted and its ecological characteristics were presented [Demiriz et al., 1990]. Later, in 1991 ferns growing around Balıkesir and Bursa province according to their distribution and ecosystems were classified [Kaynak-Tuyji, 1991].

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Plant diversity of Black sea region lists at least 2500 plant species [Gokler, Ozturk,1989], and approximately 300 of these are endemic species to Türkiye, 160 of which are endemic to the region. Forest vegetation is common in the Black Sea region (Ozturk et al., 1998). This vegetation starts from sea level and spreads towards subalpine areas. It is possible to come across forest communities extending up to 2000-2200 m. At higher elevations, subalpine and alpine meadow associations are common. The aim of the study was to evaluate the fern diversity of the KMNP.

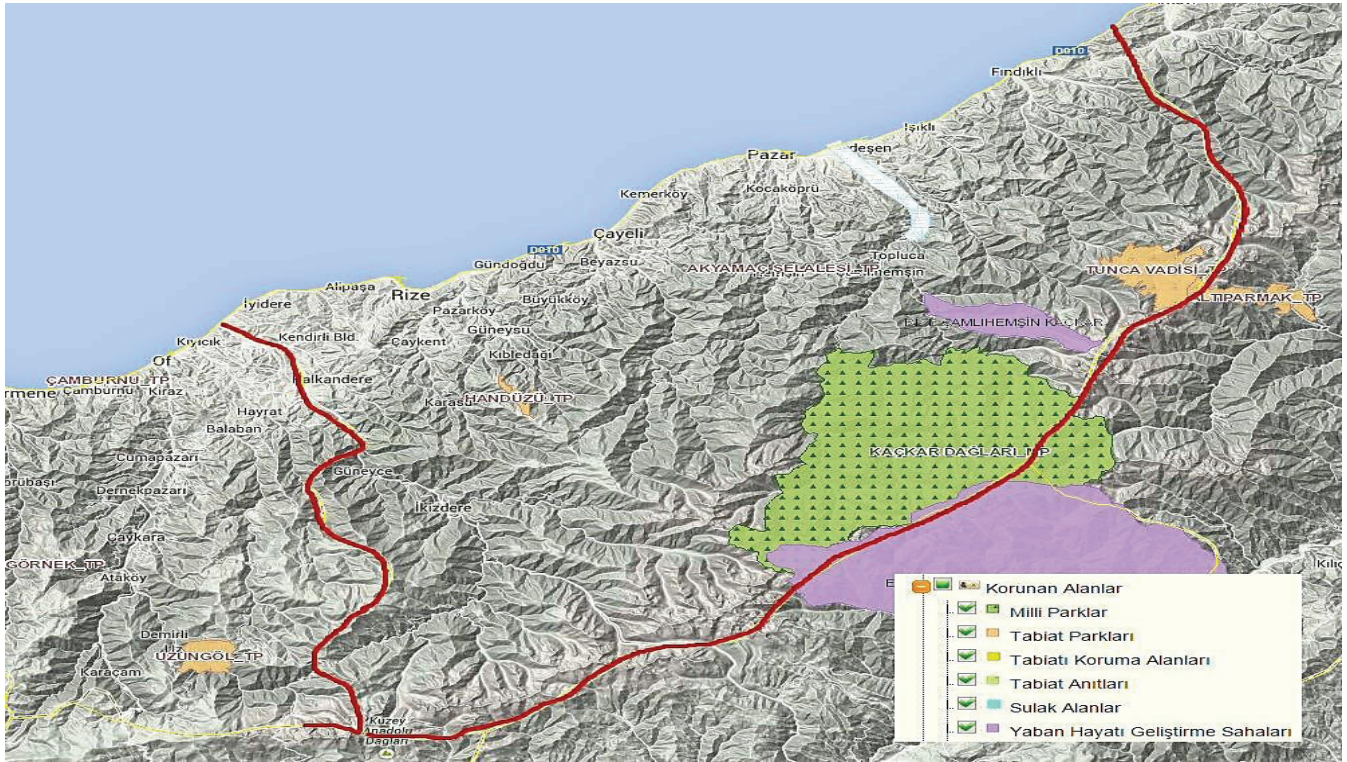
#### MATERIAL AND METHODS

The research area lies in Northeastern Anatolia, located in the east of the Eastern Black Sea coastline, between longitudes 40°-22' E and 41°-28' E and latitudes 40°-20' N and 41°-20' N. The surface area of Rize Province, excluding lakes, is 3920 km<sup>2</sup>, surrounded by Of (Trabzon) from the west, İspir (Erzurum) from south, Yusufeli (Artvin) and Arhavi districts from the east, and the Black Sea from the north. The research area together with Kaçkar Mountains was declared as a national park in 1994. A large part of the national park is located within

the borders of Çamlıhemşin (Rize province) and a small part is within the borders of Yusufeli district of Artvin province. Kaçkar Mountains National Park (KMNP) is located within the geographical coordinates of 40° 57' 49" - 40° 42' 10" northern latitudes, 41° 14' 45" - 40° 51' 27" eastern longitudes, and total protected area is 52,970 hectares. KDMP consists of 3 large mountain masses of the Eastern Black Sea Mountains. These are Üçdoruk (Verçenik), Göller (Hunut) and Kaçkar mountains, respectively, from west to east. The northern part of the Kaçkar Mountain National Park area constitutes the upper part of the Fırtına Creek basin. The southern part remains within the Çoruh basin.

This study was carried out within the borders of the KMNP, once a month between 2017 and 2018. KMNP was divided into four regions and field studies undertaken in these regions: North – Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; south - Sıraköyler (Palovit-Trovit-Elevit), Apivanak; East – Kavron, Çeymakçur and West – Verçenik (Figure 1). The relief of area is ecologically diverse and represents different altitudes.

Specimens of ferns distributed within the borders of the national park were collected during the full



**Figure 1.** The map showing Kaçkar Mountains National Park Area in the Rize Province. (ArgCIS program).

maturation period of the sporangia, dried and labeled according to the generally accepted rules. Taxa were identified following the P.H. Davis [1965]. The Fern taxa collected during field studies were photographed showing their morphological characteristics and structural features important in the identification of these taxa. Field samples of fern species kept in Recep Tayyip Erdoğan University Herbarium (RTEUB).

The climate data of the research area was taken from the database of the General Directorate of Meteorology. The temperature graphs of the national park were created based on data from Pazar (Rize) Meteorology Station (Figure 2) on Excel, Microsoft. The flora resources related to the systematic, morphological, geographical and ecological characteristics of 28 species identified. The research area has a climate type with mild winters, cool summers and abundant rainfall in all seasons. The meteorological observations covering 50 years show that the average temperature is around 14°C, minimum temperature -7°C and the maximum temperature 38.2°C. January is the coldest month with an average temperature of 6.7°C whereas July has an average temperature of 22.2°C and the average temperature is felt above 5°C throughout the year.

The temperature is felt below 10°C for only 4 months. The average temperature exceeds 20°C for only 2 months, with annual rainfall over 2300 mm. In Rize, in the months when the temperature drops below 0°C, some of the precipitation is seen as snow. Although there is no frosty month according to the data obtained from the Pazar Meteorological Station. January, February, March and December are based on the data of 1850 m altitude of the national park. It was determined that the months

were frosty (Figure 2). The climate diagram of KMNP was drawn according to H. Walter (1957), based on the data of Pazar (Rize) Meteorology Station. The climate diagram data obtained from Pazar Meteorological Station shows that as the altitude increases, precipitation increases, temperature decreases and there is no dry period

The vegetation shows the characteristics of karst forest vegetation, and ferns are found both in the forest flora and in the subalpine flora above the forest. One of the rare places in Türkiye is Kaçkar Mountains which keeps the traces of glaciers from the Pleistocene (ice age). The effects of Alpine Orogeny (3rd Geological Period) are observed on the geological structure, which generally consists of granite and granitic rocks. Kaçkar Mountains have a value related to plateau culture and social life. All valleys where biological diversity is concentrated, especially Fırtına and Hemşin Streams, are among the regions with a rich diversity of plants, including ferns. Among the soil groups in the area, there are Crystalline Schist, which is of the intrazonal soil type, and sandy soils on Acid Intrusives.

## RESULTS AND DISCUSSION

The data published on the fern flora of KMNP was screened and the findings obtained from the field studies were compared. The leaves and stems of the fern taxa collected during field studies were photographed in order to follow their morphological characteristics (Figure 3).

The distribution of taxa within the borders of the national park were indicated on the location map that was created based on the GPS data (Figure 4). Location map of the taxa was made using the ArgCIS program.

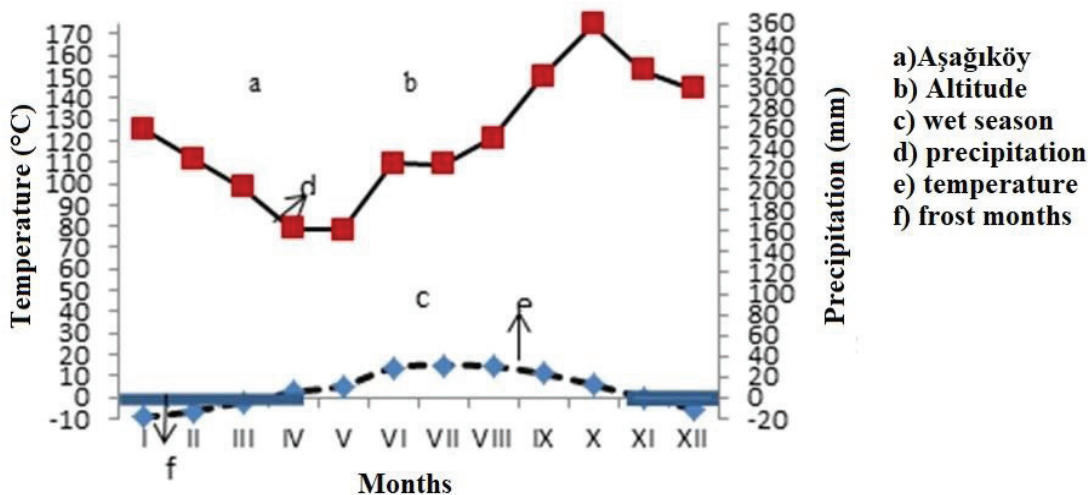


Figure 2. Kaçkar Mountains National Park climate diagram (Walter, 1957). (Excel, Microsoft).



**Figure 3.** General view of fern taxa collected within the borders of the study area: 1. *Asplenium adiantum-nigrum* L., 2. *Asplenium onopteris* L., 3. *Phyllitis scolopendrium* (L.) Newman, Sin. *Asplenium scolopendrium* L., 4. *Asplenium septentrionale* (L.) Hoffm., 5. *Asplenium trichomanes* L., 6. *Athyrium filix-femina* (L.) Roth, 7. *Athyrium distentifolium* Tausch ex Opiz, 8. *Gymnocarpium dryopteris* (L.) Newman. 9. *Cystopteris fragilis* (L.) Bernh., 10. *Pteridium aquilinum* (L.) Kuhn, 11. *Dryopteris dilatata* (Hoffm.) Gray, 12. *Dryopteris remota* (A. Braun) Hayek, 13. *Dryopteris affinis* subs. *borreri* (Newman) Fraser-Jenk, 14. *Dryopteris carthusiana* (Vill.) H. P. Fuchs, 15. *Dryopteris x initalis*, 16. *Dryopteris filix – mas*, 17. *Dryopteris expansa* (C. Presl) Fraser-Jenk. & Jermy, 18. *Polystichum aculeatum* (L.) Roth, 19. *Polystichum lonchitis* (L.) Roth, 19. *Equisetum arvense* L., 20. *Equisetum palustre* L., 21. *Lycopodium alpinum* L., 22. *Huperzia selago* (L.) Bernh., 23. *Botrychium lunaria* L., 25. *Polypodium vulgare* L., 26. *Cryptogramma crispera* (L.) R. Br. Ex Hook, 27. *Thelypteris* (*Oreopteris*) *limbosperma* (All.) Fuchs, 28. *Phegopteris connectilis* (L.) Sloss.

Detailed information about the taxa shown on the map is given below.

1. *Asplenium adiantum-nigrum* L. is non-endemic taxon has rhizomatous – herbaceous stems, spread on rocks, on walls, roadsides, in shady habitats from 10 to 1700 m above sea level. It is also distributed among the coastal areas in Türkiye and in a wide area from Europe, Western Asia to the Himalayas and North Africa. During field studies, the species was mainly encountered in the Southern Region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

2. *Asplenium onopteris* L. Rhizomatous – herbaceous type found on rocks, walls, roadsides, shaded areas, from 10-1900 m, also on the Anatolian Coast in Türkiye and on a wide area from Southwestern Europe to the Mediterranean. During field studies, the species was mainly encountered in the Southern Region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

3. *Phyllitis scolopendrium* (L.) Newman, (Sin. *Asplenium scolopendrium* L (Geyikdili) - a rhizome-herbaceous, found on the rocks, in the shady area, within the Abies-Fagus and Ostrya forest, cliff edge habitats, at altitudes between 2100 m above sea level, on the Anatolian coasts of Türkiye, and also widespread in the Northern Temperate feqions of the world. During field studies, the species was mainly encountered in the Southern Region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

4. *Asplenium septentrionale* (L.) Hoffm. - non-endemic, rhizomatous-herbaceous plant, habitat is rocky cracks, 200-2200 m on limestone. It is distributed at altitudes between 1000 and 1500 meters, in Anatolia and in a wide area from temperate Eurasia to North Africa

and Japan in the world. In field studies, this species was mainly encountered in the southern region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

5. *Asplenium trichomanes* L. is rhizomatous with herbaceous stem, found on rock cracks and calcareous wall habitats at altitudes from 20 to 2000 m; distributed all over Türkiye and in the northern and southern temperate regions of the world. During field studies, this species was mainly encountered in the southern region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

6. *Athyrium filix-femina* (L.) Roth. has a rhizomatous herbaceous stem, and is distributed among pine and broad-leaved mixed forest units in moist streams. This non-endemic species is found in mountainous regions in the northern, western and southern parts of Türkiye; 100-1700 m from the sea and in north temperate countries of the world. During field studies, the species was mainly encountered in the Southern Region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak

7. *Athyrium distentifolium* Tausch ex Opiz. is a non-endemic, rhizomatous plant with herbaceous stem; 2000-2700 m above sea level, on rocky mountainous areas. It is distributed at altitudes between 1000 and 1500 m, in the northeastern Anatolia region of Türkiye and in the northern temperate countries of the world. In the field studies, the species was mainly found in the southern region; in the village rows (Palovit-Trovit-Elevit), Apivanak and Verçenik in the Western parts.

8. *Gymnocarpium dryopteris* (L.) Newman. is non-endemic taxon belongs to the *Gymnocarpium* genus of the Athyriaceae family. It is rhizomatous with a herbaceous stem, on rocky mountainous areas, between 2000-2700 m from the sea; distributed at altitudes

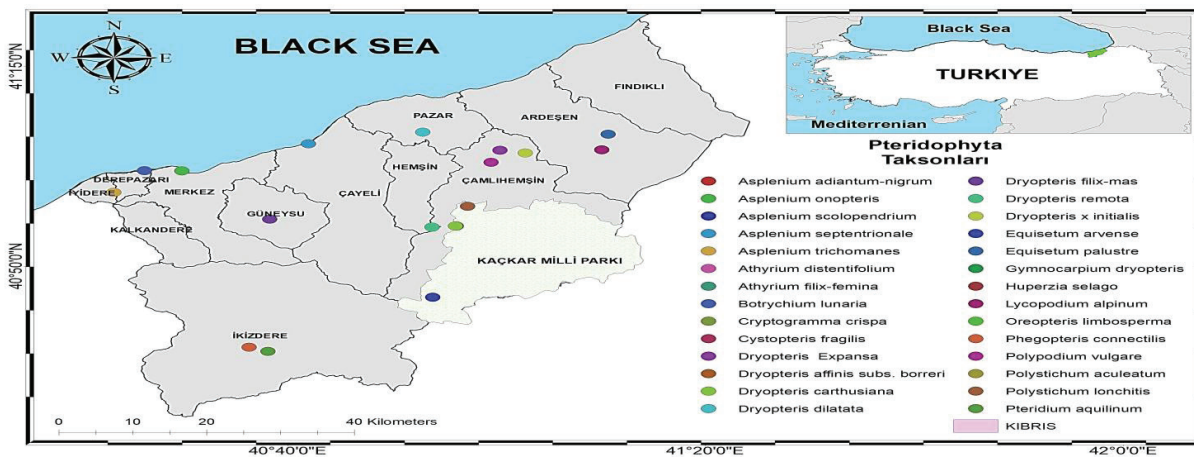


Figure 4. Location of Pteridophyta taxa within the borders of Rize.

upto 2000 meters, in the northeastern Anatolian region of Türkiye; northern temperate Countries. During the field studies, the species was mainly found in the southern region; near Sıraköyler (Palovit-Trovit-Elevit), Apivanak and Verçenik in the western region.

9. *Cystopteris fragilis* Chiov. belongs to the *Cystopterium* genus of the Cystopteridaceae family; it is a rhizomatous-herbaceous plant, likes habitats like basic rock cracks, shady rocks, and mountain cracks, distributed in the areas up to 3000 m above sea level; distributed in all regions of Türkiye, in mountainous regions, in the northern and southern hemispheres throughout the world. During field studies, the species was found mainly in Sıraköyler (Palovit-Trovit-Elevit), Apivanak in the southern region, Verçenik in the western region, and Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal in the northern region.

10. *Pteridium aquilinum* (L.) Kuhn belongs to the Dennstaedtiaceae family, genus *Pteridium*. The rhizomatous herbaceous species is not endemic and is distributed in forest areas starting from sea level up to 1900 m altitude. It is spread on the Anatolian coasts of Türkiye and all over the world. This taxon is distinguished from other fern taxa by being distributed in forest clearings, having a dense population, forming a unity especially in forest clearings where taxa such as *Picea orientalis*, *Fagus orientalis*, *Alnus glutinosa* ssp *barbata* are rare, *Pterideto aquilinumae-Picetum orientalisae*, *Pterideto aquilinumae-Fagetum orientalisae* and *Pterideto aquilinumae-Alnetum glutinosum barbatae* associations form. In the field studies, the species is mainly concentrated in the Northern part of Rize: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; Sıraköyler (Palovit-Trovit-Elevit), Apivanak; South: Kavron, Çeymakçur; in the western parts: It was found in the Verçenik plateau.

11. *Dryopteris dilatata* (Hoffm.) Gray belongs to the Dryopteridaceae family, *Dryopteris* genus. This non-endemic taxon is spread on rocks and roadsides, has a herbaceous stem with rhizomes; distributed in mountainous areas between 1100-2000 m above sea level; in northern Anatolia in Türkiye and in the northern temperate countries in the world. The field studies, have revealed that the species is mainly found in the northern parts of Rize: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; in the southern parts it occurs in Sıraköyler (Palovit-Trovit-Elevit), Apivanak; in the eastern parts at Kavron, Çeymakçur; in the west around Verçenik.

12. *Dryopteris remot* (A. Braun) Hayek belongs to the Dryopteridaceae family, genus *Dryopteris*. It has

a rhizomatous, herbaceous body, distributed between 1100-2000 m above sea level, prefers habitats on rocks and roadsides. In Türkiye it is distributed in northeastern Anatolia, globally in the world in northwest and central Europe, southern Russia and the Caucasus. The species mainly found in the northern parts of Rize: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; in the southern parts in Sıraköyler (Palovit-Trovit-Elevit), Apivanak; in the east in Kavron, Çeymakçur; in the west in the Verçenik plateau.

13. *Dryopteris filix-mas* (L.) Schott (Erkek eğrelti). is non-endemic taxon belongs to the Dryopteridaceae family, genus *Dryopteris* genus, found in Abies-Fagus forest, with rhizomatous, herbaceous stems, grows on rocky mountainous areas, at altitudes between 1100-2000 m. In Türkiye it is found in northern and central Anatolia, and in the north temperate countries in the world. The species is mainly found in the northern parts of Rize: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; Sıraköyler (Palovit-Trovit-Elevit), Apivanak in the south; in the east: Kavron, Çeymakçur; also found in the west, around Verçenik.

14. *Dryopteris affinis* subs. *borreri* (Newman) Fraser-Jenk (Geyik Piluncu). This non-endemic taxon has a rhizome with herbaceous stem, belongs to the Dryopteridaceae family and the genus *Dryopteris*, spread between 1100-2000 m above sea level, prefers deciduous and shady under-rock habitats, distributed in the northern parts of Türkiye, and in northern Europe, Norway and the Caucasus. During field studies, the species was encountered in small numbers in the southern region, near Sıraköyler (Palovit-Trovit-Elevit) and Apivanak.

15. *Dryopteris carthusiana* (Vill.) H.P. Fuchs has a rhizome, with herbaceous stem, belongs to the Dryopteridaceae family and the genus *Dryopteris*. The habitats of this species are rocks, roadsides and forests, distributed at altitudes between 1100-2000 m above sea level; found in northern Anatolia in Türkiye, and in Europe and Western Asia. During field studies, the species was found in a small population in the Verçenik plateau.

16. *Dryopteris x initalis* - non-endemic, rhizomatous plant with herbaceous stem, belonging to the Dryopteridaceae family, and genus *Dryopteris*, habitat is rocky areas, roadsides and forests, distributed at altitudes between 1000-1500 m above sea level.; in Türkiye in northern Anatolia and in the Caucasus in the world. This species was encountered in small numbers in the north of the research area: Çat, Zilkale, Ayder, Hazindak,

Amlakit, Samistal.

17. *Dryopteris expansa* (C. Presl) Fraser-Jenk. & Jermy. This non-endemic taxon has a rhizome with herbaceous stem, belonging to the Dryopteridaceae family, *Dryopteris* genus. The habitat is the Piceto-Fagetum orientalisae forest, distributed at altitudes between 1000-1800 m above sea level; in northeastern Anatolia in Türkiye and in the northern temperate countries in the world. During field studies, the species was encountered in small numbers in the north of the research area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal plateaus.

18. *Polystichum aculeatum* (L.) Roth. This non-endemic species belongs to the Dryopteridaceae family, *Polystichum* genus. This species is rhizomatous, with herbaceous stems and prefers rocky and roadside forest habitats, ranges from sea level to 1500 m altitude. In Türkiye it is distributed in the northern, western and southern Anatolia regions, and in Eurasia in the world. During field studies, the species was found in small numbers in the north of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal plateaus.

19. *Polystichum lonchitis* (L.) Roth. is non-endemic plant belongs to Dryopteridaceae family, *Polystichum* genus. It prefers forested habitats with rhizomatous habit, has a herbaceous stems and is found on shaded rocks, distributed at altitudes of 400-2700 m above sea level. In Türkiye it is distributed in north Anatolian region, and in the northern temperate mountainous countries in the world. During field studies, the species was found in small numbers in the north of Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal plateaus.

20. *Equisetum arvense* L. is non-endemic taxon belongs to the Dryopteridaceae family, genus *Polystichum*. It prefers forested habitats, is rhizomatous, with herbaceous stems, found on shaded rocks, at altitudes from 400-2700 m above sea level. In Türkiye it is distributed in the north Anatolian region, and in the northern temperate mountainous countries in the world. During field studies, the species was found in small numbers in the north of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal plateaus.

21. *Equisetum palustre* L. belongs to the Equisetaceae family, *Equisetum* genus. This species is non-endemic species, rhizomatous with herbaceous stems, which prefer forest areas on waterside rocks, spreading up to 1400 m above sea level, distributed in the northern anatolian region of Türkiye, and in Eurasia and North America in the world. During field studies, the species was encountered in small numbers in the north

of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal.

22. *Lycopodium alpinum* L. belongs to the Lycopodiaceae family, genus *Lycopodium*; a non-endemic species, rhizomatous, with herbaceous stems, distributed on mountainous slopes and grasslands at altitudes between 1800-2300 m; distributed in north Anatolia in Türkiye, and in the Arctic and northern temperate mountain zone parts of the world. During field studies, the species was found in small numbers in the Verçenik plateau, in the western parts of Rize.

23. *Huperzia selago* (L.) Bernh. has a rhizomatous herbaceous stem belonging to the *Huperzi* genus of the Lycopodiaceae family, distributed on rocky and mountainous areas at altitudes of 1800-2300 m above sea level; distributed in the Northern Anatolia region of Türkiye, and in the Arctic and northern temperate mountain zones in the world. During field studies, the species was encountered in small numbers in the Verçenik plateau, west of Rize.

24. *Botrychium lunaria* L. belongs to the Ophioglossaceae family and *Botrychium* genus. It has a rhizomatous herbaceous stem, distributed among the shrubs, meadows and grass unions in the high mountain areas, where *Rhododendron caucasicum* is dominant, at altitudes between 2000-2200 m above sea level. In the north and east Anatolian regions of Türkiye and in the world, in the north temperate countries. It is widespread in Australia and Asia. During field studies, the species was found in small numbers in the northern parts of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal plateaus.

25. *Polypodium vulgare* L. belongs to the *Polypodium* genus of the Polypodiaceae family, with a creeping rhizome, herbaceous body, and prefers rocky habitats among birch and pine forests; distributed in areas between 1100-1500 m above sea level, is spread in the northern Anatolian region in Türkiye and in the northern temperate countries in the world. During field studies, the species was found in small numbers in the north of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal.

26. *Cryptogramma crispa* (L.) R. Br. Ex Hook is non-endemic taxon belongs to the Pteridaceae family, *Cryptogramma* genus. The plant has rhizomes, with herbaceous stems, spread in the mountainous areas at altitudes between 1000-2000 m above sea level; also distributed in the northeastern and northwestern Anatolia regions of Türkiye and Europe, western Siberia and the Caucasus in the world. In the field studies, the

species was found mainly locally with a small number of population, in the north of area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal and in the western parts: Verçenik plateau.

27. *Thelypteris (Oreopteris) limbosperma* (All.) Fuchs belongs to the genus *Thelypteris* of the Thelypteridaceae family. It is a non-endemic species with a herbaceous stem, found in Fageto-Piceae forests at altitudes between 1000-1700 m above sea level; distributed in the northeast and northern Anatolia regions of Türkiye, and in the world: central and southern Europe, Japan, western and north America. In the field studies, the species is mainly found in the north as small numbers in the areas like: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal and in the east; It was found in Kavron and Çeymakçur plateaus.

28. *Phegopteris connectilis* (L.) Sloss. (Papra) is a non-endemic species has herbaceous stem, belonging to the *Phegopteris* genus of the Thelypteridaceae family. It prefers bush, forest and rocky habitats, from 1800-2500 m. In Türkiye it is distributed in the northeastern Anatolian region, and in the north temperate countries in the world. In field studies, the species are mainly found in the northern parts of the area: Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal; found in the eastern parts: Kavron, Çeymakçur and in the western parts: Verçenik plateau. The climate of the area is mild in winters, cool in summers, and receives abundant rainfall in all seasons. The southern slopes of the study area are under the influence of a more arid and semi-arid climate in summer, and the northern slopes are under the influence of an oceanic climate. Accordingly, on the northern slopes, after 1000 meters, the vegetation is rich in euxine elements.

According to P.H. Davis, the number of taxa of ferns in Türkiye is 93, but as per the research conducted in the country the number of taxa has increased to 101. At present only two species are recognized as endemics. According to the latest research 1460 vascular flowering plant taxa, including 50 ferns are reported in the flora of the region. An evaluation of the literature review and field studies related to Rize province, regarding ferns has revealed that there are 27 families and 77 species in KMNP, terrestrial and inland water ecosystems [Atamov, 2021]. It is estimated that ferns in the Polypodiopsida group include 12000 species. It is known that there are 101 species in Türkiye [Davis, 1965]. While ferns are widely distributed on earth, most preferred habitat is moist and shady habitats. During this study conducted in the KMNP, no new species

was recorded among the fern specimens that was collected. Dryopteridaceae family occurs in high forests and shady areas, Aspleniaceae family in shady forest areas on rocks and walls, Athyriaceae family in rocky mountainous areas, Equisetaceae family in wetland edges, Lycopodiaceae family in meadows and pasture ecosystems, Thelypteridaceae family in bushes and forest areas, Polypodiaceae family in rocky mountainous areas, on rocks and in shady forest areas, the Ophioglossaceae family together with *Rhododendron caucasicum* on rocky lands with high acidity, the Pteridaceae family in cut-down forest areas, the Cystopteridaceae family in rocky mountainous -humid areas, and the Dennstaedtiaceae family in cut-down forest areas.

Comparison of information among regions demonstrates that Aspleniaceae, Dryopteridaceae, Athyriaceae and Pteridaceae species are distributed in the northern (Çat, Zilkale, Ayder, Hazindak, Amlakit, Samistal) and southern (Palovit-Trovit-Elevit, Apivanak) regions, Lycopodiaceae, Thelypteridaceae species are concentrated in the western (Verçenik) region, Cystopteridaceae, Dennstaedtiaceae, Ophioglossaceae in the eastern (Kavron, Çeymakçur) region. A comparison of the phylogenetic status of ferns worldwide and in Türkiye depicts that the floristic status within the borders of KMNP have a rich species diversity in the region.

The floristic diversity of the Pteridophyta subsection located within the borders of KMNP (Rize) has been enlightened here for the first time. Somewhat accurate listing of the families richest in terms of number of taxa within the research area are: Dryopteridaceae (9), Aspleniaceae (5), Athyriaceae (3), Equisetaceae (2), Lycopodiaceae (2), Thelypteridaceae (2), Polypodiaceae (1), Ophioglossaceae (1), Pteridaceae (1), Cystopteridaceae (1), and Dennstaedtiaceae (1). The order of genera from rich to poor in terms of species is as follows: *Dryopteris* (7), *Asplenium* (5), *Athyrium* (2), *Equisetum* (2), *Polystichum* (2), *Polypodium* (1), *Cryptogramma* (1), *Phegopteris* (1), *Oreopteris* (1), and *Lycopodium* (1). A comparative diagnosis and microscopic examinations of 49 fern specimens collected from the area during different vegetation periods has revealed that in all 28 taxa were determined.

Most of the taxa found in the flora of the area are sparsely distributed. *Pteridium aquilinum* species, on the other hand, differs from other fern taxa in that it is spread in forest clearings and has a dense population that forms a community. Especially in forest clearings where taxa such as *Picea orientalis* (L.) Peterm., *Fagus orientalis* Lipsky, *Alnus glutinosa* ssp. *barbata* (C.A. Mey.) Yalt.



are rare, which form associations such as *Pterideto aquilunumae-Picetum orientalisae*, *Fagetum orientalisae* and *Pterideto aquilunumae-Alnetum glutinosa baratae*.

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## Kaçkar Dağları Milli Parkı (Rize, Türkiyə) sərhədlərində Pteridofit floranın müxtəlifliyi

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Kaçkar Dağları Milli Parkı sərhədləri daxilində yayılmış pteridofitlər təqdim edilir. Aparılan müqayisəli diaqnostika və mikroskopik müayinələr zamanı müəyyən edilmişdir ki, tədqiqat sahəsində müxtəlif vegetasiya dövrlərinə aid 49 qıjı yayılmışdır. Regionun zəngin flora müxtəlifliyinə malik olduğu, o cümlədən Pteridophyta qrupunun 11 fəsiləyə və 11 cinsə aid 28 taksonla təmsil olunması müəyyən edilmişdir. Tədqiqat sahəsinin sərhədləri daxilində taksonların sayına görə ailələrin paylanması aşağıdakı kimidir – Dryopteridaceae (9), Aspleniaceae (5), Athyriaceae (3), Equisetaceae (2), Lycopodiaceae (2), Thelypteridaceae (2), Polypodiaceae (1), Ophioglossaceae (1), Pteridaceae (1), Cystopteridaceae (1), Dennstaedtiaceae (1) və 10 cins yəni, *Dryopteris* (7), *Asplenium* (5), *Athyrium* (2), *Equisetum* (2), *Polystichum* (1), *Polypodium* (1), *Cryptogramma* (1), *Phegopteris* (1), *Oreopteris* (1), *Lycopodium* (1-ci formadadır). Ən zəngin ailələr Dryopteridaceae (9), Aspleniaceae (5) və cinslər *Dryopteris* (7) və *Asplenium*dur (5).

**Açar sözlər:** müqayisəli təhlil, cins, fəsilə, əlamətlər, qıjılar, KDMP, takson

## Разнообразие флоры птеридофитов в границах Национального Парка Качкарских гор (Ризе, Турция)

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Представлены птеридофиты, распространенные в пределах национального парка Качкарские горы. Проведенные сравнительные диагностические и микроскопические исследования показали, что на территории исследований в разные периоды вегетации распространено 49 папоротников. Установлено, что регион обладает богатым разнообразием флоры, в том числе Pteridophyta, представленная 28 таксонами, принадлежащими к 11 родам и 11 семействам. Распределение семейств по числу таксонов в границах района исследований представлено Dryopteridaceae (9), Aspleniaceae (5), Athyriaceae (3), Equisetaceae (2), Lycopodiaceae (2), Thelypteridaceae (2), Polypodiaceae (1), Ophioglossaceae (1), Pteridaceae (1), Cystopteridaceae (1), Dennstaedtiaceae (1) и 10 родов, таких как *Dryopteris* (7), *Asplenium* (5), *Athyrium* (2), *Equisetum* (2), *Polystichum* (1), *Polypodium* (1), *Cryptogramma* (1), *Phegopteris* (1), *Oreopteris* (1), *Lycopodium* (находится в форме 1). Наиболее богатые семейства Dryopteridaceae (9), Aspleniaceae (5), роды *Dryopteris* (7) и *Asplenium* (5).

**Ключевые слова:** сравнительный анализ, роды, семейство, особенности, папоротники, НКПГ, таксоны