



Flora of Akyamaç Waterfall natural park and environs (Rize/Turkey)

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Abstract

The purpose of the study is to determine the vascular flora of Akyamaç Waterfall Natural Park, a protected area in Rize, Turkey. During the years 2016-2017, 970 plant materials were collected through comprehensive surveys. 229 taxa belonging to 170 genera and 58 families were determined. Among these, 13 *Pteridophytes*, one *Gymnosperm*, 177 *Dicotyledones*, and 38 *Monocotyledones* were identified. *Poaceae* (20 taxa), *Asteraceae* (17 taxa), *Fabaceae* (14 taxa), *Rosaceae* (13 taxa) and *Lamiaceae* (12 taxa) are the richest families of the Natural Park. The phytogeographic spectrum of the taxa are as follows; Euro-Siberian 100 (43.7%), Mediterranean 7 (3.1%), Irano-Turanian 1 (0.4%), and multiregional or of unknown phytogeographic origin 121 (52.8%), respectively. The life form of the taxa is as follows: hemicryptophytes 97 (42.4%), cryptophytes 53 (23.1%), therophytes 41 (17.9%), phanerophytes 28 (12.2%), chamaephytes 10 (4.4%). The endemism ratio is 0.4%.

Key words: flora, protected area, natural park, Akyamaç Waterfall, Turkey

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Akyamaç Şelalesi tabiat parkı ve çevresinin florası (Rize/Türkiye)

Özet

Çalışmanın amacı, Türkiye'nin Rize ilinde koruma altındaki Akyamaç Şelalesi Tabiat Parkı'nın damarlı bitki florasını tespit etmektir. 2016-2017 yılları boyunca gerçekleştirilen detaylı arazi çalışmaları sonucu 970 bitki materyali toplanmıştır. 170 cins ve 58 familyaya ait 229 bitki taksonu belirlenmiştir. Tespit edilen taksonlardan 13 tanesinin *Pteridophyte*, 1 tanesinin *Gymnosperm*, 177 tanesinin *Dicotyledon* ve 38 tanesinin *Monocotyledon* olduğu tespit edilmiştir. *Poaceae* (20 takson), *Asteraceae* (17 takson), *Fabaceae* (14 takson), *Rosaceae* (13 takson) ve *Lamiaceae* (12 takson) Tabiat Parkının en zengin familyalardır. Araştırma alanındaki taksonların fitocoğrafik spektrumları sırası ile Avrupa-Sibirya 100 (%43.7), Akdeniz 7 (%3.1), İran-Turan 1 (%0.4), ve çok ya da bilinmeyen bölgesi 121 (%52.8) şeklindedir. Taksonların hayat formlarına göre dağılımı şu şekildedir: hemikriptofitler 97 (%42.4), kriptofitler 53 (%23.1), terofitler 41 (%17.9), fanorofitler 28 (12.2%), kamefitler 10 (4.4%). Endemizm oranı %0.4'tür.

Anahtar kelimeler: flora, korunan alan, tabiat parkı, Akyamaç Şelalesi, Türkiye

1. Introduction

1.1. Geographical Features of the Study Area

Akyamaç Waterfall Natural Park is in Hemşin district of Rize, 56 km away from city centre and 18 km away from the Blacksea coast, Turkey (Figure 1). It lies between the latitudes 41° 05' 321 and 41° 04' 169 and the longitudes 40° 90' 136 and 40° 91' 088. Akyamaç Waterfall Natural Park is at A8 square [1] in Colchic floristic sector of Euro-Siberian phytogeographical region.

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1.2. Geology and Edaphic Features

There are 6 geological formations (Hemşindere, Rize, Kaplıca, Melyat, Pazar and Hamidiye) within the generalized columnar section of Rize. Akyamaç and environs, totally composed of Hemşindere formation of upper Cretaceous age, which comprise basic and acid volcanic such as basaltic andesite, dacite, rhyolite and rarely some andesitic intermediate volcanoes [2].

Even though 5 main soil types, called alluvial, colluvial, red-yellow podzol, grey-brown podzol, non-calcareous forest and high mountain meadow soils, are in Rize only two of them, alluvial and red-yellow podzol, are present within Akyamaç and environs [3].

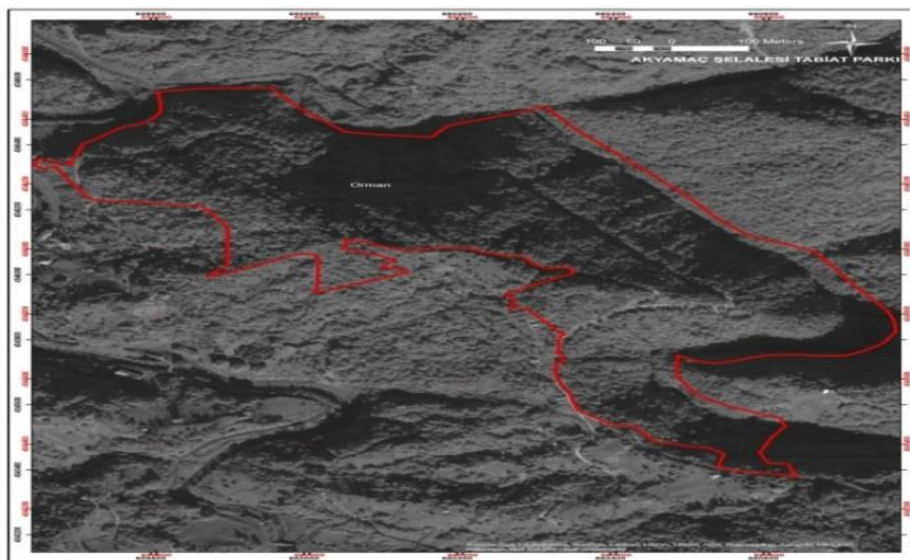


Figure 1. Akyamaç Waterfall Natural Park.

1.3. Climatological Features

The climatic data of Pazar station [4] were interpolated for the altitude of 540 m. and Walter climate diagram was drawn for the research area. The climate within Akyamaç and environs is very-humid, mesothermal without any dry season. The precipitation regime is as autumn, winter, spring and summer (Au.Wi.Su.Si.). There is not any frosty or probable frosty month in the study area (Figure 2).

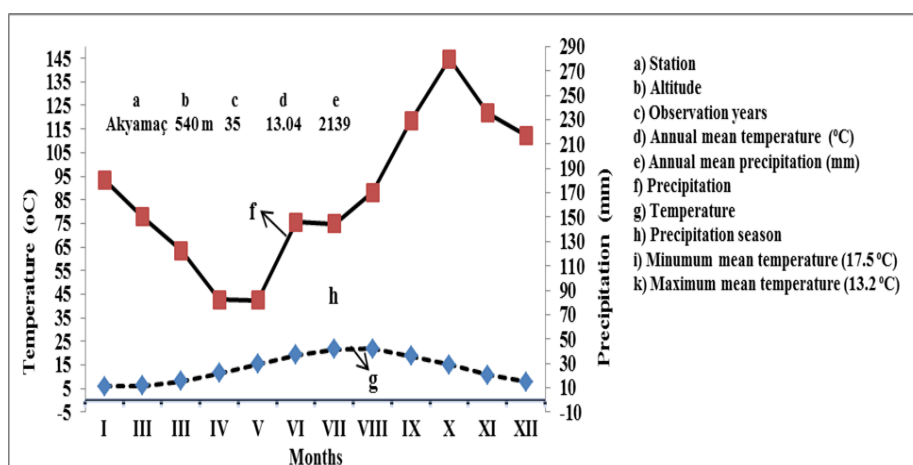


Figure 2. Climate diagram of Akyamaç Waterfall Natural Park

2. Materials and methods

The materials of the study are consisting of the vascular plant taxa collected from Akyamaç Waterfall Natural Park and environs during the vegetation seasons of 2016-2017. The samples for each taxon were dried and stuck according to herbarium rules and preserved in the herbarium of Biology Department, Faculty of Arts and Sciences, Recep Tayyip Erdoğan University. The taxa were identified using The Flora of Turkey and the Aegean Islands [1], [5], and [6]. The

family name, taxon name, author [7] and locations are given correspondingly. The endemism status [7], threatened categories [8], phytogeographical regions [1], [5] and life forms were also given. The study was compared with the studies in adjoining areas [9-15].

Abbreviations

m.: meter

Euro-Sib: Euro-Siberian element

Medit: Mediterranean element

Ir-Tur: Irano-Turanian element

Eux: Euxine element

Hyrç-Eux: Hyrcano-Euxine element

EN: Endangered

NE: Not evaluated

NT: Near threatened

LC: Least concern

VU: Vulnerable

HB: Hüseyin Baykal

VH: Vagif ATAMOV

Crp: Cryptophytes

Hcrp: Hemicryptophytes

Chp: Chamaephytes

Php: Phanerophytes

Thp: Therophytes

Vp: Vascular parasite

CS.: Current study

3. Results

The Floristic List

PTERIDOPHYTA

LYCOPODIACEAE

Lycopodium clavatum L., among *Rhododendron* shrub communities, 350 m, 20.06.2016, HB 1256, Hcrp.

POLYPODIACEAE

Polypodium australe Fee, shady and rocky surfaces, 350 m, 27.06.2017, HB 1799, Crp.

EQUISETACEAE

Equisetum palustre L., streamsides, 550 m, 20.06.2016, HB 1251, Crp.

E. telmeteia Ehrh., damp shady places, 20.06.2016, HB 1263, Crp.

ASPLENIACEAE

Asplenium adiantum-nigrum L., on rocky surfaces, 370 m, 06.07.2016, HB 1442, Crp.

A. ceterach L., on rocks, 500 m, 15.06.2017, VH 4438, Crp.

A. scolopendrium L., shady rocky surfaces, 340 m, 06.07.2016, HB 1404, Crp.

A. trichomanes L., on rocky surfaces, 450 m, 20.06.2016, HB 1275, Crp.

ASPIDIACEAE

Dryopteris affinis (Lowe) Fraser-Jenkins subsp. *affinis*, close to streamsides, 370 m, 06.07.2016, HB 1399, Crp.

D. carthusiana (Vill.) H. P. Fuchs, among rocks, 550 m, 20.07.2016, HB 1501, Crp.

HYPOLEPIDACEAE

Pteridium aquilinum (L.) Kuhn in Decken, under forest, 450 m, 20.06.2016, HB 1262, Crp.

ATHYRIACEAE

Athyrium filix-foemina (L.) Roth., among shrubs, 470 m, 20.07.2016, HB 1495, Crp.

OSMUNDACEAE

Osmunda regalis L., damp streamsides, 540 m, 06.07.2016, HB 1429, Crp.

SPERMATOPHYTA

GYMNOSPERMAE

PINOPSIDA

PINACEAE

Picea orientalis L., mixed forest, 560 m, 20.06.2016, HB 1259, Eux, Php.

ANGIOSPERMAE

MAGNOLIOPSIDA

RANUNCULACEAE

Adonis aestivalis L. subsp. *aestivalis*, rocky slopes, 560 m, 06.07.2016, HB 1410, Thp.

Consolida orientalis (Gay.) Schrod., roadsides, 480 m, 20.07.2016, HB 1503, Ir-Tur, Thp.

Ranunculus arvensis L., under forest, 560 m, 20.06.2016, HB 1269, Thp.

R. cappadocicus Willd., under forest, 470 m, 12.07.2017, VH 4462, Hcrp.

R. constantinopolitanus (DC.) Da Urv., damp meadows, 420 m, 06.07.2016, HB 1397, Hcrp.

R. marginatus Da'Urv., damp places, 380 m, 07.08.2016, HB 1686, Thp.
R. repens L., damp places, 540 m, 20.07.2016, HB 1498, Hcrp.
Thalictrum minus L. var. *majus* (Crantz) Crepin, damp meadows, 540 m, 21.08.2016, HB 1725, Euro-Sib, Hcrp.

PAPAVERACEAE

Chelidonium majus L., under forest, 380 m, 20.06.2016, HB 1257, Euro-Sib, Hcrp.
Roemeria refracta DC., close to streamsides, 330 m, 20.06.2016, HB 1265, Thp.
Papaver dubium L. subsp. *dubium*, roadsides, 500 m, 06.07.2016, HB 1393, Thp.
P. rhoeas L., roadsides, 410 m, 07.08.2016, HB 1677, Hcrp.

BRASSICACEAE

Alliaria petiolata (Bieb.) Cavara et Grande, under shrubs, 370 m, 20.06.2016, HB 1283, Hcrp.
Alyssum murale Waldst et Kit. var. *murale*, roadsides, 480 m, 06.07.2016, HB 1412, Hcrp.
Aethionema arabicum (L.) Andr. ex DC., stony slopes, 550 m, 20.06.2016, HB 1278, Cosmopolite, Thp.
Capsella bursa-pastoris (L.) Medik., roadsides, 320 m, 07.08.2016, HB 1682, Cosmopolite, Thp.
Cardamine bulbifera (L.) Crantz, streamsides, 410 m, 20.06.2016, HB 1253, Crp.
C. impatiens L. var. *pectinata* (Pallas) Trautv., damp spaces, 560 m, 07.08.2016, HB 1678, Euro-Sib, Crp.
Nasturtium officinale R.Br., streamsides, 470 m, 05.06.2016, HB 1193, Crp.
Rapistrum rugosum (L.) All., roadsides, 340 m, 20.06.2016, HB 1247, Hcrp.
Rorippa sylvestre (L.) Bess., damp places, 380 m, 21.08.2016, HB 1721, Hcrp.
Thlaspi arvense L., ridgeways, 450 m, 05.06.2016, HB 1175, Cosmopolite, Thp.

POLYGALACEAE

Polygala major Jacq., close to streamsides, 430 m, 06.07.2016, HB 1394, Euro-Sib, Hcrp.

VIOLACEAE

Viola alba Besser subsp. *dehnhardtii* (Ten.) Becker, under shrubs, 430 m, 08.05.2016, HB 1116, Hcrp.
V. sieheana W. Becker, under shrubs, 470 m, 05.06.2016, HB 1183, Hcrp.
V. tricolor L., streamsides, 380 m, 20.06.2016, HB 1255, Thp.

CARYOPHYLLACEAE

Agrostemma githago L., roadside, 380 m, 06.07.2016, HB 1420, Thp.
Cerastium glomeratum Thuill., under shrubs, 520 m, 05.06.2016, HB 1182, Thp.
Dianthus calocephalus Boiss., close to forests, 430 m, 07.08.2016, HB 1688, Hcrp.
Moenchia mantica (L.) Bartl., roadsides, 410 m, 05.06.2016, HB 1173, Thp.
Silene alba (Miller) Krause subsp. *divaricata* (Reichb.) Walters, under shrubs, 480 m, 06.07.2016, HB 1435, Thp.
S. italica (L.) Pers., streamsides, 320 m, 12.07.2017, VH 4457, Hcrp.
S. vulgaris (Moench) Garcke var. *vulgaris*, under shrubs, 470 m, 07.08.2016, HB 1683, Hcrp.
Stellaria holostea L., under shrubs, 350 m, 05.06.2016, HB 1191, Euro-Sib, Thp.
S. media subsp. *media*, meadows, 470 m, 05.06.2016, HB 1176, Thp.

OXALIDACEAE

Oxalis acetosella L., under forest, 450 m, 08.05.2016, HB 1117, Hcrp.

POLYGONACEAE

Polygonum arenastrum Bor., grainy soils, 430 m, 09.10.2016, HB 1775, Thp.
P. hydropiper L., under forest, 380 m, 07.08.2016, HB 1675, Thp.
P. perfoliatum L., streamsides, 340 m, 21.08.2016, HB 1727, Hcrp.
Rumex acetosella L., edge of shrubs, 430 m, 14.08.2017, VH 4483, Cosmopolite, Hcrp.
R. pulcher L., roadsides, 340 m, 06.07.2016, HB 1400, Hcrp.
R. scutatus L., edge of shrub communities, 380 m, 06.07.2016, HB 1395, Chp.

HYPERICACEAE

Hypericum calycinum L., damp forests, 380 m, 06.07.2016, HB 1433, Eux, Php.
H. bithynicum Boiss., under forest, 370 m, 06.09.2016, HB 1762, Eux, Hcrp.
H. xylosteifolium (Spach) Robson, under forest, 430 m, 06.07.2016, HB 1440, Eux, Php.

GERANIACEAE

Geranium pyrenaicum Burm. Fil., under forest, 370 m, 20.06.2016, HB 1282, Crp.
G. purpureum Vill., damp places, 460 m, 22.05.2016, HB 1151, Thp.
G. robertianum L., under forest, 350 m, 26.08.2017, VH 4494, Thp.
G. sanguineum L., under forest, 380 m, 06.07.2016, HB 1418, Hcrp.

ACERACEAE

Acer cappadocicum Gleditsch. var. *cappadocicum*, mixed forest, 570 m, 08.05.2016, HB 1120, Hyrc-Eux, Php.
A. platanoides L., mixed forest, 530 m, 08.05.2016, HB 1123, Euro-Sib, Php.

RHAMNACEAE

Frangula alnus Miller. subsp. *alnus*, mixed forest, 530 m, 22.05.2016, HB 1146, Euro-Sib, Php.

AQUIFOLIACEAE

Ilex colchica Pojark, forest, 440 m, 20.06.2016, HB 1260, Eux, Php.

FABACEAE

- Lathyrus aureus* (Stev.) Brandza, under shrubs, 390 m, 06.07.2016, HB 1431, Eux, Hcrp.
L. hirsutus L., damp shrubs, 420 m, 15.06.2017, VH 4435, Thp.
Lotus corniculatus L. var. *corniculatus* (Bieb.) Arc., meadows, 390 m, 06.07.2016, HB 1423, Hcrp.
Medicago lupulina L., under shrubs, 480 m, 06.07.2016, HB 1427, Crp.
M. sativa L. subsp. *sativa*, under forest, 520m, 21.08.2016, HB 1722, Hcrp.
Psoralea bituminosa L., under forest, 450 m, 12.07.2017, VH 4466, Medit, Hcrp.
Securigera varia (L.) Lassen subsp. *varia*, under forest, 510 m, 21.08.2016, HB 1726, Medit, Hcrp.
Trifolium arvense L., meadows, 340 m, 22.05.2016, HB 1154, Thp.
T. aureum Poll., rocky slopes, 530 m, 12.07.2017, VH 4453, Euro-Sib, Thp.
T. canescens Willd., treasides, 370 m, 06.07.2016, HB 1406, Hyrc-Eux, Hcrp.
T. repens L. var. *repens*, meadows, 450 m, 06.07.2016, HB 1396, Hcrp.
Vicia cracca L. subsp. *cracca* L., among shrub communities, 470 m, 06.07.2016, HB 1401, Euro-Sib, Hcrp.
V. cracca L. subsp. *stenophylla* Vel., under shrub communities, 380 m, 28.07.2017, HB 1859, Hcrp.
V. villosa Roth subsp. *villosa*, damp places, 530 m, 27.06.2017, HB 1800, Thp.

ROSACEAE

- Aruncus vulgaris* Rafin., streamsides, 450 m, 06.07.2016, HB 1416, Euro-Sib, Hcrp.
Crataegus microphylla C. Koch, forest, 420 m, 20.06.2016, HB 1246, Php.
Fragaria vesca L., damp places, 340 m, 20.06.2016, HB 1279, Euro-Sib, Hcrp.
Filipendula vulgaris Moench, roadsides, 350 m, 06.07.2016, HB 1414, Euro-Sib, Hcrp.
Geum urbanum L., streamsides, 550 m, 06.07.2016, HB 1430, Euro-Sib, Crp.
Laurocerasus officinalis Roemer., forest, 400 m, 05.06.2016, HB 1179, Php.
Potentilla recta (L.) Rauschel., damp meadows, 450 m, 26.08.2017, VH 4485, Eux, Crp.
Rosa canina L., edge of forest, 475 m, 12.07.2017, VH 4464, Php.
Rubus discolor Weihe et Nees., forest, 430 m, 06.07.2016, HB 1398, Chp.
R. sanctus Scheber, among shrub communities, 400 m, 06.07.2016, HB 1424, Euro-Sib, Chp.
R. hirtus Waldst. et Kit., mixed forest, 370 m, 20.06.2016, HB 1261, Euro-Sib, Chp.
Sanguisorba minor Scop. subsp. *muricata* (Spach) Briq., forest, 375 m, 20.06.2016, HB 1248, Hcrp.
Sorbus umbellata (Desf.) Fritsch var. *umbellate*, forest, 440 m, 20.06.2016, HB 1281, Php.

ONAGRACEAE

- Circaea lutetiana* L., under forest, 510 m, 20.07.2016, HB 1493, Hcrp.

APIACEAE

- Conium maculatum* L., streamsides, 470 m, 20.07.2016, HB 1506, Thp.
Heracleum platytaenium Boiss., streamsides, 380 m, 20.07.2016, HB 1510, LR (Ic), Eux, Hcrp.
H. sphondylium L. subsp. *cyclocarpum* (C.Koch.) Davis., streamsides, 530 m, 20.07.2016, HB 1496, Eux, Hcrp.
Scaligeria lazica Boiss., under forest, 520 m, 12.07.2017, VH 4452, Hcrp.
Sanicula europaea L., forest, 470 m, 06.07.2016, HB 1438, Euro-Sib, Hcrp.
Torilis arvensis (Huds.) Link, rocky surfaces, 530, 07.08.2016, HB 1681, Hcrp.

ARALIACEAE

- Hedera helix* L., on trees and rocky surfaces, 330 m, 05.06.2016, HB 1181, Php.

CAPRIFOLIACEAE

- Lonicera caucasica* Pallas. subsp. *orientalis*, shrub communities, 550 m, 12.07.2017, VH 4459, Endemic, LR (Ic), Chp.
Scabiosa columbaria L. subsp. var. *intermedia* (Post) Matthews, among shrubs, 450 m, 06.07.2016, HB 1447, Hcrp.

ADOXACEAE

- Sambucus ebulus* L., forest, 500 m, 20.07.2016, HB 1500, Euro-Sib, Chp.
Viburnum orientale Pallas, shrub communities, 510 m, 06.07.2016, HB 1444, Eux, Php.

RUBIACEAE

- Asperula involuocrata* Wahlenb., under forest, 420 m, 07.08.2016, HB 1685, Eux, Crp.
Crucianella gilanica Trin. subsp. *pontica* (Ehrend.) Ehrend., on rocky surfaces, 450 m, 27.06.2017, HB 1796, Eux, Crp.
Cruciata laevipes Opiz, under shrubs, 370 m, 06.07.2016, HB 1407, Euro-Sib, Hcrp.
Galium palustre L., damp places, 380 m, 15.06.2017, VH 4440, Euro-Sib, Hcrp.
G. rotundifolium L., under forest, 480 m, 12.07.2017, VH 4461, Euro-Sib, Hcrp.
G. verum L. subsp. *verum*, streamsides, 330 m, 07.08.2016, HB 1679, Euro-Sib, Hcrp.

ASTERACEAE

- A. millefolium* L. subsp. *millefolium*, meadows, 480 m, 20.06.2016, HB 1264, Euro-Sib, Hcrp.
Bellis perennis L., under forest, 330 m, 06.07.2016, HB 1417, Euro-Sib, Hcrp.
Bidens tripartita L., streamsides, 450 m, 07.08.2016, HB 1674, Thp.
Cirsium arvense (L.) Scop. subsp. *vestitum* (Wimmer et Grab.) Petrak, roadsides, 430 m, 20.07.2016, HB 1492, Hcrp.
Crepis foetida L. subsp. *foetida*, forest, 520 m, 06.07.2016, HB 1437, Crp.
Inula salicina L., among shrubs, 470 m, 06.07.2016, HB 1421, Euro-Sib, Hcrp.
Lactuca serriola L., roadsides, 380 m, 12.07.2017, VH 4467, Euro-Sib, Hcrp.
Leontodon hispidus L. var. *hispidus*, under shrubs, 400 m, 20.07.2016, HB 1499, Euro-Sib, Crp.

Petasites albus L., damp places, 380 m, 08.05.2016, HB 1119, Euro-Sib, Crp.
P. hybridus (L.) Gaertner Mey. et Scherb., streamsides, 450 m, 05.06.2016, HB 1187, Euro-Sib, Crp.
Senecio vulgaris L., grainy soils, 470 m, 06.07.2016, HB 1403, Thp.
Sigesbeckia orientalis L., edge of forest, 430 m, 06.07.2016, HB 1402, Hcrp.
Tanacetum macrophyllum (Waldst. et Kit.) Schultz Bip., streamsides, 540 m, 20.07.2016, HB 1508, Euro-Sib, Hcrp.
Telekia speciosa (Schreber.) Baumg., stony meadows, 360 m, 06.07.2016, HB 1443, Euro-Sib, Hcrp.
Tripleurospermum oreades Boiss. var. *tchihatchewii* (Boiss.) E. Hossain, streamsides, 320 m, 06.07.2016, HB 1432, Crp.

Tragopogon reticulatus Boiss., damp places, 480 m, 06.07.2016, HB 1411, Hcrp.
Tussilago farfara L., damp slopes, 410 m, 08.05.2016, HB 1122, Euro-Sib, Crp.

CAMPANULACEAE

Campanula collina Sims., rocky surfaces, 530 m, 06.07.2016, HB 1434, Eux, Crp.
C. lactiflora Bieb., forest, 400 m, 20.07.2016, HB 1494, Eux, Hcrp.
C. latifolia L., forest, 540 m, 12.07.2017, VH 4463, Euro-Sib, Hcrp.
C. rapunculus L. var. *rapunculus*, forest, 480 m, 20.06.2016, HB 1285, Hcrp.

ERICACEAE

Rhododendron luteum Sweet, under forest, 480 m, 05.06.2016, HB 1194, Eux, Php.
R. ponticum L. subsp. *ponticum*, under forest, 410 m, 05.06.2016, HB 1177, Eux, Php.
Vaccinium arctostaphylos L., among shrubs, 500 m, 20.07.2016, HB 1505, Eux, Php.

PRIMULACEAE

Cyclamen coum Miller var. *coum*, under forest, 370 m, 22.05.2016, HB 1149, Crp.
Lysimachia verticillaris Sprengel, wet places under forest, 470 m, 22.05.2016, HB 1144, Eux, Hcrp.
Primula vulgaris Huds. subsp. *vulgaris*, damp slopes, 490 m, 15.06.2017, VH 4434, Eux, Hcrp.

OLEACEAE

Osmanthus decorus (Boiss. Et Bal.) Kasaplıgil, mixed forest, 450 m, 20.06.2016, HB 1266, Eux, Php.

GENTIANACEAE

Gentiana asclepiadea L., under forest, 360 m, 20.06.2016, HB 1258, Euro-Sib, Hcrp.

CONVOLVULACEAE

Calystegia silvatica (Kit.) Griseb., edge of forest, 400 m, 05.06.2016, HB 1185, Hcrp.
Convolvulus arvensis L., roadsides, 350 m, 12.07.2017, VH 4465, Cosmopolite, Hcrp.

BORAGINACEAE

Asperugo procumbens L., roadsides, 380 m, 15.06.2017, VH 4439, Euro-Sib, Thp.
Echium vulgare L., roadsides, 420 m, 20.07.2016, HB 1509, Euro-Sib, Crp.
Lithospermum officinale L., shady places, 390 m, 20.06.2016, HB 1249, Hcrp.
Heliotropium supinum L., roadsides, 370 m, 06.07.2016, HB 1405, Thp.
Myosotis laxa Lehm. subsp. *caespitosa* (Schutz) Hyl. ex Nordh., shady places, 360 m, 06.07.2016, HB 1419, LR (1c), Thp.
Omphalodes cappadocica DC., stony slopes, 390 m, 05.06.2016, HB 1196, Eux, Hcrp.
Symphytum ibericum Steven., shady meadows, 490 m, 06.07.2016, HB 1422, Eux, Hcrp.
Trachystemon orientalis (L.) G. Don., forest, 370 m, 05.06.2016, HB 1192, Eux, Hcrp.

OROBANCHACEAE

Euphrasia rostkoviana Hayne subsp. *rostkoviana*, forest, 380 m, 05.06.2016, HB 1178, Euro-Sib, Thp.
Melampyrum arvense L. var. *elatius* Boiss., among shrubs, 420 m, 20.06.2016, HB 1276, Euro-Sib, Thp.
Rhynchosorys elephas (L.) Griseb. subsp. *elephas* Under forest, 440 m, 12.07.2017, VH 4460, Euro-Sib, Hcrp.

PHYTOLACCACEAE

Phytolacca americana L., roadsides, 430 m, 21.08.2016, HB 1723, Hcrp.

SOLANACEAE

Atropa belladonna L., shady paces, 490 m, 05.06.2016, HB 1195, Euro-Sib, Hcrp.
Solanum luteum Miller, edge of forest, 330 m, 20.06.2016, HB 1268, Thp.
S. nigrum L. subsp. *schultesii* (Opiz) Wessely, roadsides, 450 m, 20.06.2016, HB 1274, Cosmopolite, Thp.

SCROPHULARIACEAE

Scrophularia kotschyana Benth., roadsides, 540 m, 06.07.2016, HB 1413, Hcrp.
S. capillaris Boiss et Ball., stony slopes, 530 m, 27.06.2017, HB 1797, Eux, Hcrp.
S. scopoli Hoppe ex Pers. var. *scopoli* (Hoppe Ex) Pers., streamsides, 320 m, 12.07.2017, VH 4454, Hcrp.

LAMIACEAE

Ajuga reptans L., forests, 350 m, 20.06.2016, HB 1271, Euro-Sib, Crp.
Ballota nigra L. subsp. *nigra*, among shrubs, 510 m, 20.07.2016, HB 1497, Euro-Sib, Hcrp.
Calamintha grandiflora (L.) Moench, damp stony surfaces, 320 m, 06.07.2016, HB 1446, Euro-Sib, Hcrp.
Clinopodium umbrosum (Bieb.) C. Koch, damp places, 400 m, 06.07.2016, HB 1425, Hcrp.

- Lamium garganicum* L. subsp. *reniforme* (Montbret et Aucher ex Bentham) R. Mill, damp places, 410 m, 07.08.2016, HB 1676, Hcrp.
L. purpureum L. var. *purpureum*, streamsides, 500 m, 05.06.2016, HB 1188, Euro-Sib, Thp.
Mentha longifolia (L.) L. subsp. *longifolia*, streamsides, 520 m, 06.07.2016, HB 1415, Eux, LR (lc), Crp.
M. aquatica L., streamsides, 330 m, 26.08.2017, VH 4486, Hcrp.
Origanum vulgare L. subsp. *viridulum* (Martin Donos) Nyman, roadsides, 430 m, 06.07.2016, HB 1441, Hcrp.
Prunella vulgaris L., streamsides, 480 m, 06.07.2016, HB 1428, Euro-Sib, Hcrp.
Stachys sylvatica L., forest, 440 m, 26.08.2017, VH 4484, Eux, Hcrp.
Teucrium chamaedrys L. subsp. *trapezunticum* Rech. Fil., streamsides, 440 m, 20.06.2016, HB 1250, Euro-Sib, Chp.

PLANTAGINACEAE

- Plantago major* L. subsp. *major*, streamsides, 340 m, 20.06.2016, HB 1270, Hcrp.
Veronica anagallis-aquatica L., streamsides, 330 m, 20.06.2016, HB 1280, LR (lc), Hcrp.
V. peduncularis M. Bieb., forest, 470 m, 05.06.2016, HB 1174, Eux, Crp.
V. serpyllifolia L., shady forest, 490 m, 20.06.2016, HB 1267, Crp.

THYMELAEACEAE

- Daphne pontica* L., forest, 540 m, 20.06.2016, HB 1254, Eux, Php.

EUPHORBIACEAE

- Euphorbia squamosa* Willd., among shrubs, 360 m, 15.06.2017, VH 4436, Hycr-Eux, Hcrp.
Mercurialis annua L., forest, 460 m, 20.07.2016, HB 1502, Thp.

ULMACEAE

- Ulmus minor* Miller. subsp. *minor* Miller, streamsides, 340 m, 20.06.2016, HB 1252, Medit, Php.
U. glabra Huds., mixed forest, 510 m, 22.05.2016, HB 1147, Euro-Sib, Php.

FAGACEAE

- Castanea sativa* Miller., mixed forests, 450 m, 20.06.2016, HB 1277, Euro-Sib, Php.
Fagus orientalis Lipsky., mixed forests, 500 m, 22.05.2016, HB 1152, Euro-Sib, Php.

BETULACEAE

- Alnus glutinosa* L. subsp. *barbata* (C.A. Meyer.) Yaltirik, mixed forest, 350 m, 22.05.2016, HB 1150, Euro-Sib, Php.

CORYLACEAE

- Carpinus betulus* L., mixed forest, 650 m, 22.05.2016, HB 1153, Euro-Sib, Php.
Corylus avellana L. var. *avellana* L., mixed forest, 500 m, 22.05.2016, HB 1148, Euro-Sib, Php.

SALICACEAE

- Salix caprea* L., streamsides, 350 m, 15.05.2017, VH 4417, Euro-Sib, Php.
Populus tremula L., mixed forests, 370 m, 22.05.2016, HB 1155, Euro-Sib, Php.

URTICACEAE

- Parietaria judaica* L., on rocky surfaces, 540 m, 07.08.2016, HB 1684, Hcrp.
Urtica dioica L. subsp. *dioica*, forest, 330 m, 21.09.2016, HB 1772, Euro-Sib, Hcrp.

LILIOPSIDA**ASPARAGACEAE**

- Scilla autumnalis* L., damp places, 400 m, 05.06.2016, HB 1180, Medit, Crp.

LILIACEAE

- Paris incompleta* Bieb., under forest, 480 m, 26.05.2017, VH 4423, Crp.
Ruscus colchicus P. F. Yeo, mixed forest, 430 m, 08.05.2016, HB 1124, Eux, Hcrp.
Smilax excelsa L., on trees, 460 m, 08.05.2016, HB 1121, Medit, Php.

ORCHIDACEAE

- Cephalanthera longifolia* (L.) Fritsch., forest, 450 m, 15.05.2017, VH 4418, Euro-Sib, Crp.
Listera ovata (L.) R. Br., under forest, 350 m, 05.06.2016, HB 1184, Euro-Sib, Hcrp.
Orchis tridentata Scop., under shrubs, 540 m, 08.05.2016, HB 1128, Medit, Crp.

JUNCACEAE

- Luzula multiflora* (Ehrh. Ex Retz.) Lej., under forest, 390 m, 05.06.2016, HB 1190, Hcrp.
L. forsteri (Sm.) DC., under forest, 460 m, 15.06.2017, VH 4441, Euro-Sib, Hcrp.
Juncus inflexus L., damp places, 330 m, 20.07.2016, HB 1507, Hcrp.
J. effusus L. subsp. *effusus*, damp meadows, 480 m, 06.07.2016, HB 1439, Cosmopolite, Hcrp.
J. tenageia Ehrh., damp places, 420 m, 05.06.2016, HB 1186, Euro-Sib, Hcrp.

CYPERACEAE

- Carex echinata* Murray subsp. *echinata*, streamsides, 360 m, 28.07.2017, HB 1860, Euro-Sib, Crp.
C. muricata L., edge of forest, 350 m, 06.07.2016, HB 1445, Euro-Sib, Crp.
C. pendula Hudson, streamsides, 320 m, 21.08.2016, HB 1724, Euro-Sib, Crp.
Cyperus longus L., streamsides, 340 m, 21.09.2016, HB 1773, Crp.
Isoplepis setacea (L.) R. Br., damp forest, 430 m, 20.06.2016, HB 1284, Crp.
Pycneus flavescens (L.) Reichb., streamsides, 360 m, 06.09.2016, HB 1761, Crp.

POACEAE

- Agrostis capillaris* L. var. *capillaris*, edge of forest, 450 m, 28.07.2017, HB 1861, Crp.
Alopecurus arundinaceus Poir., roadsides, 320 m, 07.08.2016, HB 1680, LR (lc), Euro-Sib, Crp.
Brachypodium sylvaticum (Hudson) P.Beauv., forest, 3600 m, 12.07.2017, VH 4455, Euro-Sib, Crp.
Briza maxima L., forest, 360 m, 22.05.2016, HB 1145, Thp.
Bromus japonicus Thunb. subsp. *japonicas*, meadows, 480 m, 20.06.2016, HB 1273, Thp.
B. lanceolatus Roth, edge of forest, 370 m, 20.07.2016, HB 1504, Crp.
Cynosurus cristatus L., forest, 480 m, 09.10.2016, HB 1776, Euro-Sib, Hcrp.
C. echinatus L., forest, 380 m, 06.07.2016, HB 1426, Medit, Thp.
Digitaria sanguinalis (L.) Scop., forest, 380 m, 26.08.2017, VH 4488, Thp.
Elymus repens (L.) Gould subsp. *repens*, roadsides, 460 m, 12.07.2017, VH 4458, Crp.
Festuca gigantea (L.) Vill., forest, 480 m, 27.06.2017, HB 1798, Euro-Sib, Chp.
F. drymeja Mertens et Koch, forest, 320 m, 26.08.2017, VH 4489, Chp.
Glyceria plicata Fries., meadows close to streams, 510 m, 06.07.2016, HB 1436, Hcrp.
Lolium perenne L., roadsides, 700 m, 06.07.2016, HB 1408, Euro-Sib, Hcrp.
Melica uniflora Retz., forest, 380 m, 12.07.2017, VH 4456, Euro-Sib, Crp.
Paspalum paspalodes (Michx.) Scribner, streamsides, 380 m, 09.10.2016, HB 1777, Crp.
Phleum pratense L., forest, 450 m, 07.08.2016, HB 1687, Euro-Sib, Chp.
Poa trivialis L., under forest, 390 m, 20.06.2016, HB 1272, Crp.
P. pratensis L., under forest, 450 m, 06.07.2016, HB 1409, Crp.
Rostraria cristata (L.) Tzvelev, under forest, 360 m, 15.06.2017, VH 4437, Thp..

4. Conclusions and discussion

The results of the vascular flora of Akyamaç Waterfall and environs are summarized below. These results, discussed with some studies carried out in the adjoining areas [9-15].

For each taxon, three or four samples were collected from Akyamaç Waterfall Natural Park and environs, between the years 2016-2017 in vegetation seasons. As a result of identifications and verifications it is determined that the vascular flora of Akyamaç Waterfall consists of 229 taxa belonging to 170 genera and 58 families. 13 *Pteridophytes*, 1 *Gymnosperm*, 177 *Dicotyledones*, and 38 *Monocotyledones* were determined (Table 1). The total number of taxa in Akyamaç Natural Park and environs is fewer than the compared studies (Table 2). The taxa number is related with the geographical size, diversity of habitat, and edaphic factors etc. The study area is totally covered with the forest vegetation, so the vegetation types and habitat diversity is very low. In addition, the extent of the study area is smaller than the other study areas. These factors can explain the reason of low number of taxa in the study area.

Table1. The taxa within upper taxonomical groups

Systematic categories	Families	Genera	Species	Subsp.	Var.	Taxa	Endemics
<i>Pteridophyta</i>	8	8	12	1	-	13	-
<i>Spermatophyta</i>	50	162	159	39	18	216	1
<i>Gymnospermae</i>	1	1	1	-	-	1	-
<i>Angiospermae</i>	49	161	158	39	18	215	1
<i>Magnoliopsida</i>	43	131	125	35	17	177	1
<i>Liliopsida</i>	6	30	33	4	1	38	-
Total	58	170	171	40	18	229	1

The endemism ratio of the current study and compared studies are given in table 2. The endemism ratio of [9] and [12] are between 7.7% and 6.3% while [10], [11] and [14] are between 4.9% and 2.3%. In the study area endemism ratio is lower (0.4%) than the other studies (Table 2). The reasons of low endemism are of course related with homogeneity of climate and environment but especially abundance of tree species in the study area.

Table 2. The phytogeographical spectra and endemism ratio of the studies compared

Studies	Taxa	Endemic	Euro-Sib.	Ir-Tur.	Medit.	Cosmopolite and other
CS.	229	0.4	43.7	0.4	3.1	52.8
[9]	853	6.3	39.4	10.3	1.2	49.1
[10]	990	2.3	48.2	3.5	1.9	46.9
[11]	517	4.3	47.2	2.1	3.3	47.4

[12]	518	7.0	43.2	4.1	2.1	50.6
[14]	408	4.9	58.1	3.4	1.2	37.3

The phytogeographical element status of taxa are Euro-Siberian (including Eux and Hyrc-Eux) 100 (43.7%), Mediterranean 7 (3.1%), Irano-Turanian 1 (0.4%), and multiregional or of unknown phytogeographic origin 121 (52.8%), respectively (Table 2). Akyamaç Waterfall Natural Park is in the borderlines of Euro-Siberian floristical province and it clarifies the dominance of Euro-Siberian elements and it is compatible with the compared studies (Table 3). The presence of Mediterranean and Irano-Turanian elements is due to the microclimates in the study area.

Table 3. Life-form of taxa compared studies

Studies	Hcrp.	Crp.	Thp.	Php.	Chp.	Hd.	Vp.	NanoPhp.
CS.	97	53	41	28	10	-	-	-
[11]	252	47	81	83	54	-	-	-
[12]	229	145	62	17	57	1	2	3
[14]	196	110	46	28	28	-	1	-
[15]	94	34	38	29	6	-	-	-

The life spectra of the taxa are given in table 3; Hemicryptophytes 97 (42.4%), cryptophytes 53 (23.1%), therophytes 41 (17.9%), phanerophytes 28 (12.2%), chamaephytes 10 (4.4%). In all studies hemicryptophytes are dominant and there are small differences in the order of the other life categories in the compared studies which can be explained by difference and diversity of habitats and vegetation types.

Table 4. The richest families in terms of number of taxa

Families	Number of taxa	Ratio(%)
<i>Poaceae</i>	20	8.7
<i>Asteraceae</i>	17	7.4
<i>Fabaceae</i>	14	6.1
<i>Rosaceae</i>	13	5.7
<i>Lamiaceae</i>	12	5.2
<i>Brassicaceae</i>	10	4.4
<i>Caryophyllaceae</i>	9	3.9
<i>Boraginaceae</i>	8	3.5
<i>Ranunculaceae</i>	8	3.5
<i>Apiaceae</i>	6	2.6
<i>Cyperaceae</i>	6	2.6
<i>Polygonaceae</i>	6	2.6
Total	129	56.2

The richest families regarding the number of taxa are *Poaceae* (20), *Asteraceae* (17), *Fabaceae* (14), *Rosaceae* (23), *Lamiaceae* (12), *Brassicaceae* (10), *Caryophyllaceae* (9), *Boraginaceae* (8), *Ranunculaceae* (8), *Apiaceae* (8), *Cyperaceae* (6), and *Polygonaceae* (6) (Table 4). The richest genera according to total taxa numbers are *Ranunculus*, *Trifolium*, *Geranium*, *Asplenium*, and *Campanula* (Table 5).

Table 5. The richest genera in taxa

Genera	Number of taxa	Ratio(%)
<i>Ranunculus</i>	5	2.9
<i>Trifolium</i>	4	2.4
<i>Geranium</i>	4	2.4
<i>Asplenium</i>	4	2.4
<i>Campanula</i>	4	2.4
Total	21	12.5

The richest genera in terms of number of taxa are differs in studies. For example in in [10] *Veronica* (15), *Campanula* (15), and *Geranium* (13)), in [11] *Carex* (7), *Allium* (6) and *Campanula* (4), and in [15], *Trifolium* (6), *Ranunculus* (6) and *Poa* (5) are in first 3 rank. In current study the richest 5 genera are also different from the others such as *Ranunculus*

(5), *Trifolium*, *Geranium*, *Asplenium* and *Campanula* (4). Thus it is hard to find a correlation between the genera about the total taxa numbers..

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References

- [1] Davis, P.H. (1965-1985). *Flora of Turkey and the East Aegean Islands, Vol 1-9*. Edinburgh, UK: Edinburgh University Press.
- [2] Gedik, A., Ercan, T., Korkmaz, S., & Karataş, S. (1992). Rize-Fındıklı-Çamlıhemşin arasında (Doğu Karadeniz) yer alan magmatik kayaların petrolojisi ve doğu pontitlerdeki bölgesel yayılımları. *Türkiye Jeoloji Bülteni*, 35(1), 15-38.
- [3] *Rize ili arazi varlığı*. (2005). Ankara, Türkiye: Tarım ve Köy İşleri Bakanlığı Köy Hizmetleri Genel Müdürlüğü Yayını.
- [4] *1975-2010 dönemi Pazar meteoroloji istasyonuna ait rasat değerleri*. (2011). Ankara, Türkiye: Devlet Meteoroloji İşleri Genel Müdürlüğü Yayınları.
- [5] Davis, P.H., Mill, R.R., & Tan, K. (1988). *Flora of Turkey and the East Aegean Islands, Vol 10*. Edinburgh, UK: Edinburgh University Press.
- [6] Güner, A., Özhatay, N., Ekim, T., & Başer, K.H.C. (2000). *Flora of Turkey and the East Aegean Islands. Vol. 11*. Edinburgh, UK: Edinburgh University Press.
- [7] Güner, A., Aslan, S., Ekim, T., Vural, M., & Babaç, M.T. (2012). *Türkiye Bitkileri Listesi (Damarlı Bitkiler)*. İstanbul, Türkiye: Türkiye Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını.
- [8] *The IUCN red list of threatened species* (2017). <http://www.iucnredlist.org/> (Accessing date:10.26.2017).
- [9] Eminağaoğlu, Ö., & Ansin, R. (2004). Flora of Karagöl-Sahara National Park (Artvin) and its Environs. *Turkish Journal of Botany*, 28, 557-590.
- [10] Eminağaoğlu, Ö., Kutbay, H.G., Özkan, Z.C., & Ergül, A. (2008). Flora of The Camili Biosphere Reserve Area (Borçka, Artvin, Turkey). *Turkish Journal of Botany*, 32, 43-90.
- [11] Çobanoğlu, M., Demir, E., & Atamov, V. (2012). *Hazdüzü ve Çağrankaya yaylaları (Rize) Florası*. Paper presented at the 21th National Biology, Turkey.
- [12] Baykal, H., & Atamov, V. (2016). Floristic diversity in Başhemşin valley of Kaçkar Mountains National Park of Rize, Turkey. *Pakistan Journal of Botany*, 48 (5), 1871-1876.
- [13] Hüseyinoğlu, R., Yalçın, E., & Macar, O. (2017). Flora of alpine grasslands of the Eğribel pass in the Giresun mountains (Turkey). *Biological Diversity and Conservation*, 10(1), 6-17.
- [14] Baykal, H., Atamov, V., & Yüksek, T. (2018). Flora of Tunca Valley Natural Park and Environs (Ardeşen-Rize/Turkey). *Biological Diversity and Conservation*, 11(3), 9-24.
- [15] Baykal H., & Atamov V. (2018). Isırlık Doğa Parkı ve Çevresinin Florası. *The herb Systematic Botany (Ot Sistematik Botanik)*, 25(2): 151-170.

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