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Research article

Contributions to the Bryophyte Flora of Altındere Valley (Trabzon, Turkey)

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Abstract: In this study, the bryophyte flora of Altındere Valley were investigated. As a result of identification of the bryophyte specimens collected from the Altındere Valley in 2020, a total 170 taxa (138 are mosses, 32 are liverworts) were determined, belonging to 55 families and 106 genera. The present study adds 71 new mosses and 12 new liverworts to bryophyte flora of Altındere Valley. And also 6 taxa (3 liverworts, 3 mosses) are new to A4 grid-square. Brachytheciaceae (21 taxa) and Pottiaceae (16 taxa) two richest families in the study area. While the largest genus is *Plagiothecium* with 7 species, *Mnium*, *Hypnum* and *Plagiomnium* are second largest genera with six taxa each in the Altındere Valley.

Keywords: Altındere Valley, Bryophytes, Liverworts, Mosses, Trabzon.

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Introduction

Altındere Valley is located in the Colchis sector of the Euro-Siberian Phytogeographic Region of the Holarctic Flora Regnum (Palabaş Uzun & Anşin, 2006). Altındere Valley, which is within the borders of Trabzon province in the Eastern Black Sea Region, was declared a national park in 1987 (Fig. 1). The study area, which has approximately 4800 hectares, is located in A4 grid-square according to Henderson (1961)'s Turkey bryophytes grid-square system (Fig. 2). The valley, which extends to a distance of approximately 20 km in the southeast direction from the Maçka (Trabzon) district center, has the character of narrow and deep canyon geographically. As a geological structure; the study area consists of three layers belonging to Mesozoic Era, Eocene and Oligocene Epochs. The bedrock is trachea andesite and basalt (OGM, 2015).

Forest vegetation and alpine vegetation constitute two main vegetation types in Altındere Valley. While the forest vegetation in the area reaches a height of 1900-2000 meters, the alpine vegetation, comprising of subalpine bushes and alpine meadows, above the forest border is seen above 2000 meters.

Forest vegetation consists of pure spruce forests, mixed forests consisting of spruce-leafy species and mixed forests formed by leafy species such as *Alnus glutinosa* (L.), *Carpinus betulus* L., *Tilia tomentosa* Moench., *Ulmus minor* Mill., *Castanea sativa* Miller. (Batan et al., 2021).

On the other hand, alpine vegetation in the study area is dominated by Asteraceae, Rosaceae and Poaceae (Spermatophyta) members (Palabaş Uzun & Anşin, 2006).

The annual average rainfall is 771 mm and the average temperature is 13 °C in the area. The climate type of the area is very humid (URL, 1; Çepel, 1995).

The soil structure of the study area, in the Podzolic soil group, changes depending on elevation. While gray-brown podzolic soils in the study area are seen between 1600 and 1750 meters, high mountain meadow soils are seen between 1750 and 2000 meters (Palabaş Uzun & Anşin, 2006).

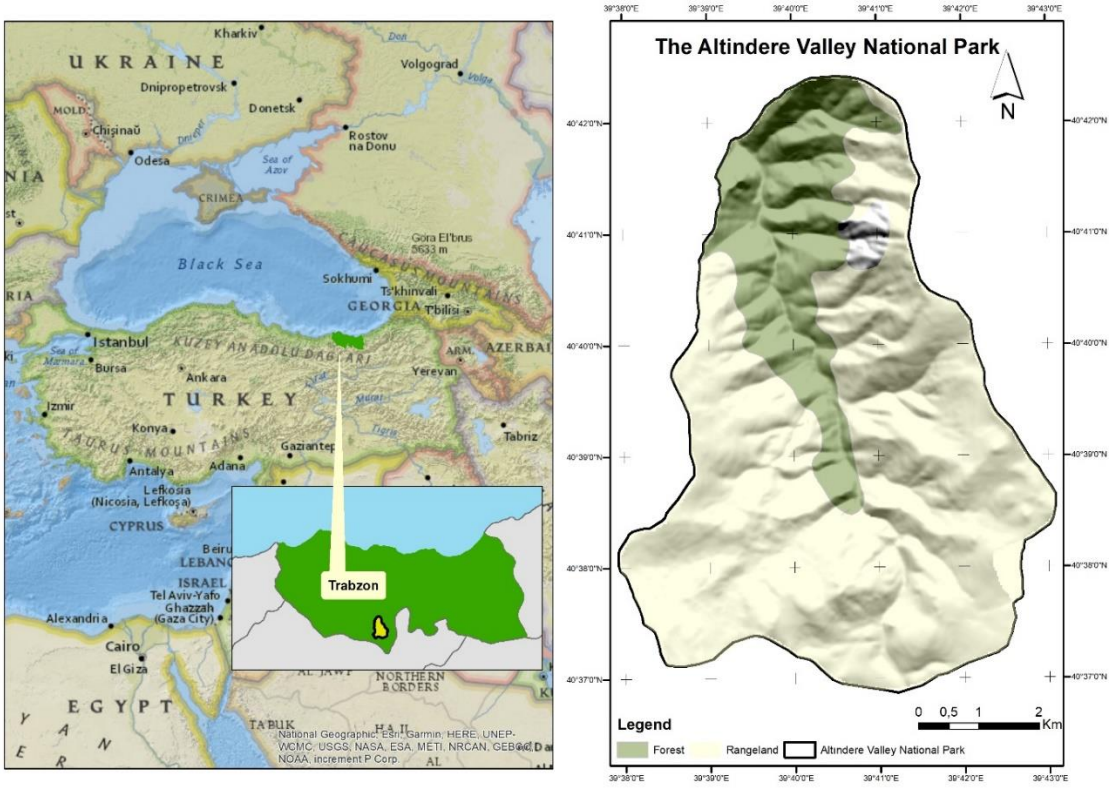

Figure 1. Location of the study area.

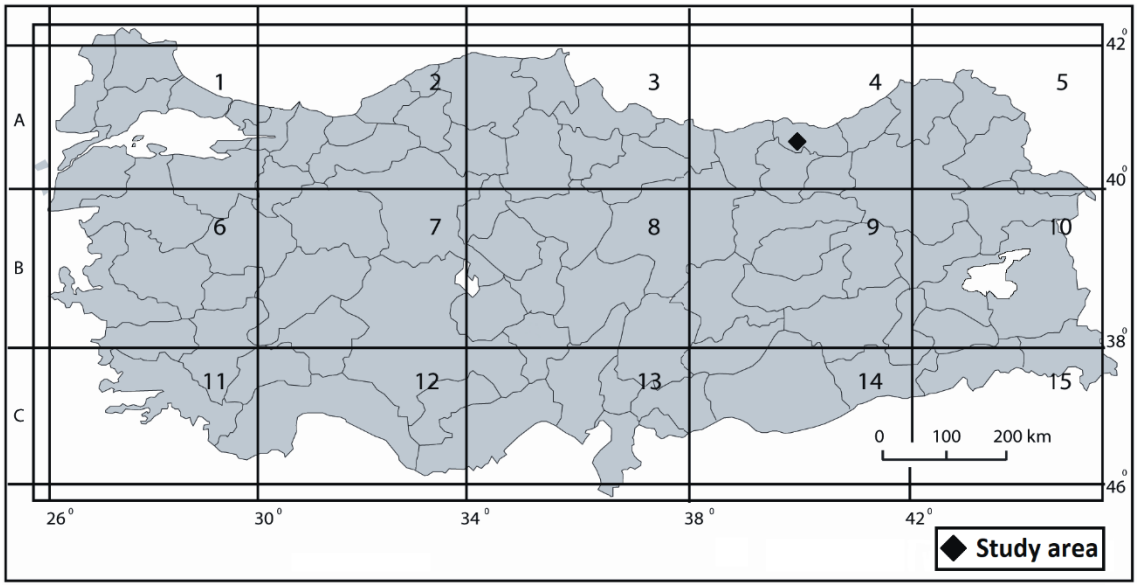

Figure 2. The location of the Altındere Valley according to the grid system of Turkey (Henderson, 1961).

The first bryofloristic studies in the Altındere Valley National Park was carried out by Baydar & Özdemir (1996). In this study, mosses of the area were investigated and 40 taxa belonging to 31 genera and 15 families were determined as a result of the study. In another bryofloristic study carried out in the area, the liverworts of the Altındere Valley National Park was investigated by Gökler (1998). Results of the study, 33 species belonging to 18 genera and 6 families were determined. Moreover, some studies were carried out by Özdemir & Çetin (1999) and Papp (2004) in which some bryophyte records were given from Altındere Valley. And also, the epiphytic bryophytes and ecological characteristics of Altındere Valley (Maçka-Trabzon) were investigated by Batan et al.

(2021) and, a total of 55 epiphytic bryophyte taxa were determined, 36 of which are new for the Altındere Valley. As a results of these studies, in a total 149 bryophyte taxa were determined in the Altındere Valley.

Although these studies have been done on the bryophytes of Altındere Valley National Park (Baydar & Özdemir, 1996; Gökler, 1998; Özdemir & Çetin, 1999; Papp, 2004; Batan et al., 2021), the Altındere Valley has not been studied in detail in terms of bryofloristics. Therefore, the present study aimed to revise and to reveal the bryophyte flora of Altındere Valley in detail and to contribute to the Turkish bryoflora.

Materials and Methods

The bryophyte specimens, materials of the present study, were collected from various habitats and substrates in 12 different localities of the research area in 2020 (Table). The collected specimens were identified using relevant literatures (Zander, 1993; Greven, 1995; 2003; Munoz, 1999; Paton, 1999; Cortini Pedrotti, 2001, 2006; Heyn & Herrnstadt, 2004; Smith, 2004; Guerra et al., 2006, Brugués et al., 2007). Voucher specimens are deposited in the Herbarium of Karadeniz Technical University.

Table. Locality details (L. N. – locality number).

L. N.	Localities	GPS Coordinates	Altitude (m)	Date
1	**Altındere Valley:** Altındere Valley National Park-1	(37T) 0555515 E, 450527 N,	1020	22.06.2020
2	**Altındere Valley:** Altındere Valley National Park-2, picnic area	(37T) 0555524 E, 4505280 N,	1042	22.06.2020
3	**Altındere Valley:** Altındere Valley National Park-3	(37T) 0555584 E, 4505416 N,	1083 m	22.06.2020
4	**Altındere Valley:** Exit of National Park, pathway-1	(37T) 0556046 E, 4503902 N,	1317-1330	23.06.2020
5	**Altındere Valley:** Monastery entrance, Ayavarvara church and its surroundings	(37T) 0555704 E, 4504382 N,	1250-1290	23.06.2020
6	**Altındere Valley:** Behind the social facilities of National Park	(37T) 0555640 E, 450396 N,	1120	23.06.2020
7	**Altındere Valley:** Taşköprü Plateau-1, above the Altındere Valley	(37T) 0558062 E, 4499985 N,	1602	23.06.2020
8	**Altındere Valley:** Taşköprü Plateau-2, above the Altındere Valley	(37T) 0557045 E, 450964 N,	1644	23.06.2020
9	**Altındere Valley:** Sumela Monastery entrance	(37T) 0555668 E, 4504580 N,	1304	23.06.2020
10	**Altındere Valley:** Karadağ Waterfall	(37T) 0555926 E, 4504548 N,	1330	23.06.2020
11	**Altındere Valley:** above the Samandıra road	(37T) 0554514 E, 4506129 N,	1270	24.06.2020
12	**Altındere Valley:** Samandıra road-2	(37T) 0554845 E, 4505175 N,	1134	24.06.2020

The latest taxonomic and distributional status of the bryophyte taxa in Turkey were determined according to the recent literature (Erdağ & Kürschner, 2017; Kürschner & Frey, 2020; Hodgetts et al., 2020). Nomenclature of the floristic list was arranged according to Hodgetts et al. (2020). In the floristic list, the new records for A4 grid-square are indicated with (▲) and, the new records for Altındere Valley are indicated with (*). The taxa, recorded in previous studies but not detected in the present study are also given in the floristic list.

Results and Discussion

As a results of the identification of bryophyte specimens collected from various habitats and substrats in the different localities of Altındere Valley, in a total 170 taxa were determined, belonging to 55 families and 106 genera. Of these, 32 taxa belonging to 18 families and 25 genera are liverworts, 138 taxa belonging to 37 families and 82 genera are mosses. With the present paper, the total bryophyte flora of Altındere Valley has reached 62 families, 128 genera and 232 taxa.

Bryofloristic list (with together previously records)

Marchantiophyta (Liverworts)

Anastrophyllaceae L.Söderstr., De Roo & Hedd.

Barbilophozia Loeske

**Barbilophozia barbata* (Schmidel ex Schreb.) Loeske – Loc.: 1, 5, 7, 8, 10; on rock, on soil.

Sphenolobus (Lindb.) Berggr.

▲**Sphenolobus minutus* (Schreb.) Berggr. (Syn: *Anastrophyllum minutum* (Schreb.) Schust.) – Loc.: 9; on soil.

Cephaloziaceae Mig.

Obtusifolium S.W.Arnell

▲**Obtusifolium obtusum* (Lindb.) S.W.Arnell (*Lophozia obtusa* (Lindb.) A.Evans) – Loc.: 8; on soil.

Tritomaria Loeske

**Tritomaria exsecta* Schmidel ex. Schrad.) Loeske. – Loc.: 1; on dead tree trunk.

Scapaniaceae Mig.

Diplophyllum (Dumort.) Dumort.

Diplophyllum albicans (L.) Dumort. – Loc.: 1, 3, 7, 9; on wet soil.

Scapania (Dumort.) Dumort.

Scapania aequiloba (Schwägr.) Dumort. (Papp, 2004).

**S. aspera* M.Bernet & Bernet. – Loc.: 5, 9, 10; on wet soil.

S. nemorea (L.) Grolle – Loc.: 3, 11; on wet soil.

▲**S. obscura* (Arnell & C.E.O.Jensen) Schiffn. – Loc.: 7; on wet soil.

S. undulata (L.) Dumort. (Gökler, 1998).

Calypogeiaceae Arnell

Calypogeia Raddi

Calypogeia arguta Nees & Mont. (Gökler, 1998).

C. azurea Stotler & Crotz (Gökler, 1998).

**C. fissa* (L.) Raddi. – Loc.: 7; on wet soil.

Solenostomataceae Stotler & Crand.-Stotl.

Solenostoma Mitt. emend. Zerov

**Solenostoma sphaerocarpum* (Hook.) Steph. Sp. Hepat (Syn: *Jungermannia sphaerocarpa* Kanca.) – Loc.: 12; on wet soil,

Blepharostomataceae W.Frey & M.Stech

Blepharostoma (Dumort. Emend. Lindb.) Dumort.

**Blepharostoma trichophyllum* (L.) Dumort. – Loc.: 1, 7, 12; on dead tree trunk.

Lepidoziaceae Limpr.

Bazzania Gray

**Bazzania flaccida* (Dumort.) Grolle – Loc.: 1, 5, 10; on rock.

B. tricrenata (Wahlenb.) Lindb. (Gökler, 1998).

B. trilobata (L.) Gray (Gökler, 1998).

Lepidozia (Dumort.) Dumort.

**Lepidozia reptans* (L.) Dumort. – Loc.: 3, 9; on rock, on soil.

Lophocoleaceae Vanden Berghen

Chiloscyphus Corda

Chiloscyphus pallescens (Ehrh. ex Hoffm.) Dumort. – Loc.: 2, 12; on wet soil.

C. polyanthos (L.) Corda – Loc.: 8; on wet soil.

Lophocolea (Dumort.) Dumort.

Lophocolea bidentata (L.) Dumort. – Loc.: 8; on wet soil.

L. heterophylla (Schrad.) Dumort. (Gökler, 1998; Batan et al., 2021).

Plagiochilaceae Müll. Frib.

Pedinophyllum (Lindb.) Lindb.

Pedinophyllum interruptum (Nees) Kaal. – Loc.: 3, 11, 12; on wet soil, on wet rock.

Plagiochila (Dumort.) Dumort.

Plagiochila asplenioides (L. emend. Taylor) Dumort. – Loc.: 1, 2, 3, 7, 8, 10; on soil, on rock.

P. porelloides (Torrey ex Nees) Lindenb. – Loc.: 1, 2, 3, 4, 6, 7, 8, 9, 10, 12; on soil, on rock.

Frullaniaceae Lorch

Frullania Raddi

Frullania dilatata (L.) Dumort. – Loc.: 5, 8, 9, 10, 11; on rock, on tree trunk.

F. jackii Gottsche (Papp, 2004).

F. tamarisci (L.) Dumort. – Loc.: 1, 2, 4, 5; on rock, on tree trunk.

Jubulaceae H.Klinggr.

Jubula Dumort.

**Jubula hutchinsiae* (Hook.) Dumort. subsp. *caucasica* Konstant. & Vilnet – Loc.:1, 11; on rock

Lejeuneaceae Cavers

Cololejeunea (Spruce) Steph.

Cololejeunea rossettiana (C.Massal.) Schiffn. (Papp, 2004).

Lejeunea Lib.

Lejeunea cavifolia (Ehrh.) Lindb. – Loc: 1, 5, 6, 9, 10, 12; on rock.

L. lamacerina (Steph.) Schiffn. (Gökler, 1998).

Porellaceae Cavers

Porella L.

Porella arboris-vitae (With.) Grolle – Loc.: 2, 10; on tree trunk.

P. cordaeana (Huebener) Moore (Gökler, 1998).

P. obtusata (Taylor) Trevis. (Gökler, 1998).

P. platyphylla (L.) Pfeiff. – Loc.: 1, 3, 5, 6, 11, 12; on rock, on tree trunk.

Radulaceae Müll. Frib.

Radula Dumort.

Radula complanata (L.) Dumort. – Loc.: 4, 5; on rock, on tree trunk.

R. lindenbergiana Gottsche ex C. Hartm. – Loc.: 1, 2, 5, 6, 7, 8, 9, 10, 11, 12; on rock, on tree trunk.

Metzgeriaceae H. Klinggr.

Metzgeria Raddi

Metzgeria conjugata Lindb. – Loc.: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12; on rock.

M. furcata (L.) Dumort. – Loc.: 1, 2, 3, 4, 6, 9, 10; on rock.

M. pubescens (Schrank) Raddi (Papp, 2004).

Fossombroniaceae Hazsl.
Fossombronia Raddi
Fossombronia pusilla (L.) Nees (Gökler, 1998).
Pelliaceae H. Klinggr
Apopellia (Grolle) Nebel & D.Quandt
Apopellia endiviifolia (Dicks.) Nebel & D.Quandt. (Syn: *Pellia endiviifolia* (Dicks.) Dumort) – Loc.: 1, 11; on wet soil.
Pellia Raddi
Pellia epiphylla (L.) Corda (Gökler, 1998).
Lunulariaceae H.Klinggr.
Lunularia Adans.
Lunularia cruciata (L.) Dumort. ex Lindb. (Gökler, 1998).
Aytoniaceae Cavers
Reboulia Raddi
Reboulia hemisphaerica (L.) Raddi (Gökler, 1998).
Conocephaleaceae Müll. Frib. Ex Grolle
Conocephalum Hill
Conocephalum conicum (L.) Dumort. – Loc.: 3, 10, 11; on wet soil.
Marchantiaceae Lindl.
Marchantia L.
Marchantia paleacea Bertol. (Gökler, 1998).
M. polymorpha L. – Loc.: 7; on wet soil.
Bryophyta (Mosses)
Polytrichaceae Schwagr.
Atrichum P.Beauv.
▲**Atrichum tenellum* (Röhling) Bruch & Schimper. – Loc.: 8; on soil.
A. undulatum (Hedw.) P. Beauv. – Loc.: 3, 6, 7, 9; on soil.
Pogonatum P.Beauv.
Pogonatum aloides (Hedw.) P.Beauv. (Özdemir & Çetin, 1999).
P. urnigerum (Hedw.) P.Beauv. (Baydar & Özdemir, 1996; Özdemir & Çetin, 1999; Papp, 2004).
Polytrichastrum Hedw.
**Polytrichastrum alpinum* (Hedw.) G.L.Sm. – Loc.: 1, 6, 7, 9, 10; on soil, on rock.
Polytrichum Hedw.
Polytrichum commune Hedw. (Baydar & Özdemir, 1996; Özdemir & Çetin, 1999).
**P. formosum* Hedw. – Loc.: 2, 7, 8, 10, 12; on soil.
P. juniperinum Hedw. – Loc.: 8; on soil.
Tetraphidaceae Schimp.
Tetraphis Hedw.
**Tetraphis pellucida* Hedw. – Loc.: 12; on dead tree trunk.
Encalyptaceae Schimp.
Encalypta Dixon
**Encalypta ciliata* Hedw. – Loc.: 7; on rock.
**E. streptocarpa* Hedw. – Loc.: 10; on rock.
**E. vulgaris* Hedw. – Loc.: 9; on rock.
Leucobryaceae Schimp.
Campylopus Brid.
**Campylopus brevipilus* Bruch & Schimp. – Loc.: 5, 10; on rock.
Dicranodontium Bruch & Schimp.
**Dicranodontium denudatum* (Brid.) E. Britton. – Loc.: 1, 2, 3, 9, 10, 12; on dead tree trunk.
Leucobryum Hampe
Leucobryum glaucum (Hedw.) Ångstr. – Loc.: 1, 2, 3, 9, 10; on rock, on soil.
Amphidiaceae M.Stech
Amphidium Schimp.
Amphidium mougeotii (Schimp.) Schimp. (Papp, 2004).
Aongstroemiaceae De Not.
Dichodontium Schimp.
Dichodontium pellucidum (Hedw.) Schimp. – Loc.: 11; on soil.
Dicranellaceae M.Stech
Dicranella (Müll.Hal.) Schimp.
**Dicranella heteromalla* (Hedw.) Schimp. – Loc.: 8, 12; on soil.
**D. varia* (Hedw.) Schimp. – Loc.: 7; on soil.
Fissidentaceae Schimp.
Fissidens Hedw.
**Fissidens adianthoides* Hedw. – Loc.: 4, 5; on soil, on rock crack.
F. dubius P. Beauv. – Loc.: 1, 6, 9, 10; on soil, on rock crack.
F. taxifolius Hedw. (Batan et al., 2021).
Dicranaceae Schimp.
Dicranum Hedw.
Dicranum fuscescens Sm. (Baydar & Özdemir, 1996; Özdemir & Çetin, 1999).
D. majus Turner. – Loc.: 9; on soil.
D. scoparium Hedw. – Loc.: 2, 3, 5, 7, 8, 9, 10, 11; on rock, on soil.
D. tauricum Sapjegin (Batan et al., 2021).
Ditrichaceae Limpr.
Ditrichum Timm ex Hampe
Ditrichum heteromallum (Hedw.) E.Britton (Baydar & Özdemir, 1996).
Pottiaceae Schimp.
Anoectangium Schwägr.
**Anoectangium aestivum* (Hedw.) Mitt. – Loc.: 7, 9, 10, 11; on rock.

Chionoloma Dixon
Chionoloma tenuirostre (Hook. & Taylor) M.Alonso, MJCano & JAJiménez (Syn: *Oxystegus tenuirostris* (Hook. & Taylor) A.J.E.Sm.) – Loc.: 1, 5, 7, 11; on rock.
Crossidium Jur.
Crossidium squamiferum (Viv.) Jur. (Papp, 2004).
Didymodon Hedw.
Didymodon ferrugineus (Schimp. ex Besch.) M.O.Hill. – Loc.: 2; on rock.
D. luridus Hornsch. (Papp, 2004).
D. rigidulus Hedw. (Papp, 2004).
Tortula Hedw.
Tortula atrovirens (Sm.) Lindb. (Papp, 2004).
T. muralis Hedw. (Baydar & Özdemir, 1996; Papp, 2004).
Gymnostomum Nees & Hornsch.
**Gymnostomum aeruginosum* Sm – Loc.: 5; on rock.
**G. calcareum* Nees & Hornsch. – Loc.: 2; on rock.
Gyroweisia Schimp.
Gyroweisia tenuis (Hedw.) Schimp. (Papp, 2004).
Streblotrichum P.Beauv.
**Streblotrichum convolutum* (Hedw.) P.Beauv. (Syn: *Barbula convoluta* Hedw.) – Loc.: 5; on rock.
Tortella (Müll.Hal.) Limpr.
Tortella fragilis (Drumm.) Limpr. (Baydar & Özdemir, 1996).
T. squarrosa (Brid.) Limpr. [*Pleurochaete squarrosa* (Brid.) Lindb.] (Papp, 2004).
T. tortuosa (Hedw.) Limpr. – Loc.: 2, 4, 6, 9, 10, 11; on rock, on soil.
Weissia Hedw.
Weissia controversa Hedw. – Loc.: 4; on rock.
Saelaniaceae Ignatov & Fedosov
Saelania Lindb.
**Saelania glaucescens* (Hedw.) Broth. – Loc.: 7; on rock crack.
Grimmiaceae Arn.
Grimmia Hedw.
**Grimmia elatior* Bruch ex Bals.-Criv. & De Not. – Loc.: 4, 9, 10; on rock.
▲**G. funalis* (Schwaegr.) Bruch & Schimp. – Loc.: 8; on rock.
**G. hartmannii* Schimp. – Loc.: 1, 2, 3, 4, 5, 6, 8, 9, 10, 12; on rock.
**G.longirostris* Hook. – Loc.: 7; on rock.
G. trichophylla Grev. (Baydar & Özdemir, 1996).
Racomitrium Brid.
**Racomitrium aquaticum* (Brid. ex Schrad.) Brid. – Loc.: 2, 3, 5, 9, 10; on rock.
R. canescens (Hedw.) Brid. – Loc.: 7, 8; on rock.
**R. sudeticum* (Funck) Bruch & Schimp. – Loc.: 2; on rock.
Schistidium Bruch & Schimp.
Schistidium apocarpum (Hedw.) Bruch & Schimp. – Loc.: 6; on rock.
**S. elegantulum* H.H.Blom – Loc.: 6; on rock.
**S. helveticum* (Schkuhr) Deguchi – Loc.: 5; on rock.
**S. papillosum* Culm. – Loc.: 2, 4, 7, 8, 10; on rock.
S. trichodon (Brid.) Poelt. (Batan et al., 2021).
Hedwigiaceae Schimp.
Hedwigia P.Beauv.
**Hedwigia ciliata* (Hedw.) P.Beauv.– Loc.: 5; on rock.
Bartramiaceae Schwagr.
Bartramia Hedw.
Bartramia halleriana Hedw. – Loc.: 2, 5, 9, 10, 11; on rock, on rock crack.
B. pomiformis Hedw. (Özdemir & Çetin, 1999).
Philonotis Brid.
Philonotis fontana (Hedw.) Brid. – Loc.: 7; on wet soil.
Bryaceae Schwagr.
Bryum Hedw.
**Bryum argenteum* Hedw. – Loc.: 7; on soil.
Imbribryum Pedersen
**Imbribryum alpinum* (Huds. ex With.) N.Pedersen (Syn: *Bryum alpinum* Huds. ex With.) – Loc.: 9; on wet soil.
Ptychostomum Hornsch.
Ptychostomum capillare (Hedw.) Holyoak & N. Pedersen. – Loc.: 8; on soil.
P. elegans (Nees.) D.Bell & Holyoak (Papp, 2004).
P. moravicum (Podp.) Ros & Mazimpaka. – Loc.: 2, 3, 5, 6, 9, 11; on soil, on tree trunk.
P. pallens (Sw. ex anon.) J.R.Spence [*Bryum pallens* Sw. ex anon., *Bryum sibiricum* Lindb. & Arnell] (Papp, 2004).
**P. pseudotriquetrum* (Hedw.) J.R. Spence & H.P. Ramsay – Loc.: 7; on wet soil.
Rhodobryum (Schimp.) Limpr.
**Rhodobryum ontariense* (Kindb.) Kindb. – Loc.: 2, 3, 4, 7; on soil.
R. roseum (Hedw.) Limpr. (Baydar & Özdemir, 1996).
Mniaceae Schwagr.
Mnium Hedw.
**Mnium hornum* Hedw. – Loc.: 2, 3, 4, 5, 10, 11; on wet soil.
M. lycopodioides Schwägr. (Papp, 2004).

M. spinosum (Voit) Schwägr. – Loc.: 2, 3, 5, 8, 9, 12; on wet soil.
**M. spinulosum* Bruch & Schimp. – Loc.: 4, 5, 6; on wet soil.
**M. stellare* Hedw. – Loc.: 11; on wet soil.
**M. thomsonii* Schimp. – Loc.: 9; on wet soil.
Plagiomnium T.J.Kop.
Plagiomnium affine (Blandow ex Funck) T.J.Kop. – Loc.: 1, 2, 3; on soil, on wet soil.
P. cuspidatum (Hedw.) T.J.Kop. – Loc.: 2, 3, 6, 10, 12; on soil.
P. elatum (Bruch & Schimp.) T.J. Kop. – Loc.: 1, 4, 9; on soil.
P. ellipticum (Brid.) T.J.Kop. – Loc.: 1, 2, 3, 10, 11; on soil.
P. medium (Bruch & Schimp.) T.J.Kop. – Loc.: 3; on soil.
P. undulatum (Hedw.) T.J.Kop. – Loc.: 1, 2, 4, 6, 8, 10, 11, 12; on soil.
Pohlia Hedw.
**Pohlia nutans* (Hedw.) Lindb. – Loc.: 7; on wet soil.
Rhizomnium (Broth.) T.J.Kop.
Rhizomnium punctatum (Bruch & Schimp.) T.J.Kop. – Loc.: 2, 7, 10, 11, 12; on wet soil.
Orthotrichaceae Arn.
Lewinskya F.Lara, Garilleti & Goffinet
**Lewinskya rupestris* (Schleich. Ex Schwägr.) F.Lara, Garilleti & Goffinet. – Loc.: 7; on rock.
**L. striata* (Hedw.) F.Lara, Garilleti & Goffinet – Loc.: 11; on tree trunk.
Orthotrichum Hedw.
Orthotrichum anomalum Hedw. (Papp, 2004).
O. pallens Bruch ex Brid. (Batan et al., 2021).
O. pumilum Sw. ex anon. (Batan et al., 2021).
Ulota D.Mohr
Ulota crispa Bruch. – Loc.: 2, 8, 11; on tree trunk.
Zygodon Hook. & Taylor
Zygodon rupestris Schimp. ex Lorentz – Loc.: 8; on tree trunk.
Hookeriaceae Schimp.
Hookeria J.E.Sm.
Hookeria lucens (Hedw.) Sm. – Loc.; on wet soil.
Fontinalaceae Schimp.
Fontinalis Hedw.
**Fontinalis antipyretica* Hedw. – Loc.: 8; submerged.
Plagiotheciaceae (Broth.) M.Fleisch.
Herzogiella Broth.
**Herzogiella seligeri* (Brid.) Z.Iwats. – Loc.: 5, 12; on dead tree trunk.
Isopterygiopsis Z.Iwats.
Isopterygiopsis pulchella (Hedw.) Z.Iwats. – Loc.: 2, 3, 12; on soil.
Plagiothecium Schimp.
**Plagiothecium cavifolium* (Brid.) Z. Iwats. – Loc.: 2, 3; on soil.
P. curvifolium Schlieph. ex Limpr. (Batan et al., 2021).
P. denticulatum (Hedw.) Schimp. – Loc.: 3, 9, 12; on soil.
P. laetum Schimp. (Papp, 2004).
**P. latebricola* Schimp. – Loc.: 3, 4, 5, 9, 11; on soil, on tree trunk.
P. nemorale (Mitt.) A.Jaeger – Loc.: 1, 2, 4, 8; on soil.
P. succulentum (Wilson) Lindb. – Loc.: 1, 2, 3, 4, 9, 10; on soil.
Pterigynandraceae Schimp.
Pterigynandrum Hedw.
Pterigynandrum filiforme Hedw. (Papp, 2004; Batan et al., 2021).
Climaciaceae Kindb.
Climacium F. Weber & D. Mohr.
**Climacium dendroides* (Hedw.) F. Weber & D. Mohr. – Loc.: 8; on wet soil.
Amblystegiaceae Kindb.
Amblystegium Schimp.
Amblystegium serpens (Hedw.) Schimp. – Loc.: 2; on soil.
Campylium (Sull.) Mitt.
**Campylium stellatum* (Hedw.) Lange & C.E.O.Jensen – Loc.: 7; on wet soil.
**C. protensum* (Brid.) Kindb. – Loc.: 7; on wet soil.
Campylophyllopsis W.R.Buck
Campylophyllopsis calcarea (Crundw. & Nyholm) Ochyra [*Campylidium calcareum* (Crundw. & Nyholm) Ochyra, *Campylophyllum calcareum* (Crundw. & Nyholm) Hedenäs] (Papp, 2004).
Drepanium (Schimp.) C.E.O.Jensen
**Drepanium fastigiatum* (Hampe) C.E.O.Jensen *(Syn: Hypnum recurvatum (*Lindb. & Arnell) Kindb. – Loc.: 1, 6, 8, 9, 10; on rock, on soil.
Hygrohypnum Lindb.
**Hygrohypnum luridum* (Hedw.) Jenn. – Loc.: 8; near stream, on wet soil.
Pseudoamblystegium Vanderp. & Hedenäs
Pseudoamblystegium subtile (Hedw.) Vanderp. & Hedenäs [*Amblystegium subtile* (Hedw.) Schimp. (Batan et al., 2021).
Calliergonaceae Vanderp., Hedenäs, C.J.Cox & A.J.Shaw
Sarmentypnum Tuom. & T.J.Kop.

Sarmentypnum exannulatum (Schimp.) Hedenäs [*Warnstorfia exannulata* (Schimp.) Loeske (Özdemir & Çetin, 1999).

Scorpidiaceae Ignatov & Ignatova

Sanionia Loeske

**Sanionia uncinata* (Hedw.) Loeske. – Loc.: 7; on soil.

Scorpidium (Schimp.) Limpr.

Scorpidium revolvens (Sw. ex anon.) Rubers (Baydar & Özdemir, 1996).

Serpoleskea (Limpr.) Loeske

**Serpoleskea confervoides* (Brid.) Schimp. (Syn: *Amblystegium confervoides* (Brid.) Schimp.) – Loc.: 3, 6; on tree trunk, on dead tree trunk.

Pseudoleskeellaceae Ignatov & Ignatova

Pseudoleskeella **Kindb.**

Pseudoleskeella catenulata (Brid. ex Schrad.) Kindb. (Batan et al., 2021).

P. nervosa (Brid.) Nyholm. – Loc.: 16, 11, 12; on tree trunk.

Thuidiaceae Schimp.

Abietinella Müll.Hal.

Abietinella abietina (Hedw.) M.Fleisch. (Baydar & Özdemir, 1996; Papp, 2004).

**Abietinella abietina* (Hedw.) M.Fleisch. var. *hystricosa* (Mitt.) Sakurai. – Loc.: 7, 9; on soil.

Thuidium Schimp.

**Thuidium assimile* (Mitt.) A.Jaeger. – Loc.: 3, 4, 5, 6, 8, 9, 10, 12; on soil, on rock.

T. delicatulum (Hedw.) Schimp. – Loc.: 6; on soil.

**T. recognitum* (Hedw.) Lindb. – Loc.: 1, 3, 5; on soil.

T. tamariscinum (Hedw.) Schimp. – Loc.: 1, 2, 3; on soil, on rock.

Brachytheciaceae Schimp.

Brachythecium Schimp.

Brachythecium albicans (Hedw.) Schimp. – Loc.: 7; on soil.

B. glareosum (Bruch ex Spruce) Schimp. – Loc.: 2; on soil.

B. rivulare Schimp. – Loc.: 7, 12 near stream, on wet soil.

B. rutabulum (Hedw.) Schimp. – Loc.: 2, 9, 10, 11, 12; near stream, on wet soil.

Eurhynchium Schimp.

Eurhynchium angustirete (Broth.) T.J.Kop. – Loc.: 1, 2, 3, 4, 5, 6, 8, 9, 10, 11; on soil.

Eurhynchiastrum Ignatov & Huttunen

Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen (Baydar & Özdemir, 1996).

Homalothecium Schimp.

Homalothecium lutescens (Hedw.) H.Rob. – Loc.: 5; on rock

**H. philippeanum* (Spruce) Schimp. – Loc.: 3, 5, 6; on soil, on rock.

H. sericeum (Hedw.) Schimp. – Loc.: 9; on rock.

Kindbergia Ochyra

**Kindbergia praelonga* (Hedw.) Ochyra – Loc.: 1, 2, 8, 9; on soil.

Oxyrrhynchium (Schimp.) Warnst.

**Oxyrrhynchium hians* (Hedw.) Loeske. – Loc.: 1; on soil.

**O. schleicheri* (R.Hedw.) Röll – Loc.: 10, 12; on soil.

**O. speciosum* (Brid.) Warnst. – Loc.: 3; on soil.

Brachytheciastrum Ignatov & Huttunen

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen (Papp, 2004).

Palamocladium M.Fleisch.

Palamocladium euchloron (Müll.Hal.) Wijk & Margad. – Loc.: 4, 5, 9; on rock.

Plasteurhynchium M.Fleisch.

Plasteurhynchium striatulum (Spruce) M.Fleisch. (Baydar & Özdemir, 1996; Batan et al., 2021).

Pseudoscleropodium (Limpr.) M.Fleisch.

Pseudoscleropodium purum (Hedw.) M.Fleisch. (Baydar & Özdemir, 1996).

Rhynchostegium Schimp.

Rhynchostegium riparioides (Hedw.) Cardot – Loc.: 11, 12; on soil.

**R. megapolitanum* (Blandow ex F.Weber & D.Mohr) Schimp. – Loc.: 2; on soil.

**R. murale* (Hedw.) Schimp. – Loc.: 2.

R. rotundifolium (Scop. ex Brid.) Schimp. (Papp, 2004).

Sciuro-hypnum Hampe

Sciuro-hypnum flotowianum (Sendtn.) Ignatov & Huttunen – Loc.: 1, 2, 3, 5, 6, 11, 12; on soil.

**S. plumosum* (Hedw.) Ignatov & Huttunen – Loc.: 2, 10; on rock.

S. populeum (Hedw.) Ignatov & Huttunen – Loc.: 2, 3, 6, 11; on rock.

Hypnaceae Schimp.

Hypnum Hedw.

Hypnum andoi A.J.E.Sm. – Loc.: 2, 12; on rock.

H. cupressiforme var. *cupressiforme* Hedw. – Loc.: 2, 3, 4, 11, 12; on soil, on rock, on dead tree trunk.

H. cupressiforme var. *filiforme* Brid. – Loc.: 1, 3, 8, 12; on soil, on tree trunk.

**H. cupressiforme* var. *lacunosum* Brid. – Loc.: 4, 7, 8, 9, 10, 11; on soil, on rock.
**H. jutlandicum* Holmen & E.Warncke. – Loc.: 10, 12; on soil.
H. resupinatum Taylor (Syn: *Hypnum cupressiforme* var. *resupinatum* (Taylor) Schimp. – Loc.: 4, 7, 11; on soil,on rock.
Taxiphyllaceae Ignatov
Taxiphyllum M.Fleisch.
Taxiphyllum densifolium (Lindb. ex Broth.) Reimers (Papp, 2004).
T. wissgrillii (Garov.) Wijk & Margad – Loc.: 9; on rock.
Pylaisiadelphaceae Goffinet & W.R.Buck
Platygyrium Schimp.
Platygyrium repens (Brid.) Schimp. – Loc.: 12; on soil.
Pylaisiaceae Schimp.
Calliergonella Loeske
Calliergonella cuspidata (Hedw.) Loeske – Loc.: 8, 10; near stream, on wet soil.
**C. lindbergii* (Mitt.) Hedenäs. – Loc.: 7; on wet soil.
Pseudohygrohypnum Kanda
**Pseudohygrohypnum eugyrium* (Schimp.) Kanda (Syn: *Hygrohypnum eugyrium* (Schimp.) Broth.) – Loc.: 2; near stream, on wet soil.
Roaldia P.E.A.S.Câmara & Carv.-Silva
**Roaldia revoluta* (Mitt.) P.E.A.S.Câmara & M.Carvalho-Silva (Syn: *Hypnum revolutum* (Mitt.) Lindb. – Loc.: 1; on soil.
Hylocomiaceae M. Fleisch.
Hylocomiadelphus Ochyra & Stebel
Hylocomiadelphus triquetrus (Hedw.) Ochyra & Stebel (Syn: *Rhytidiadelphus triquetrus* (Hedw.) Warnst.) – Loc.: 5, 7, 8, 10; on soil.
Hylocomium Schimp.
**Hylocomium splendens* (Hedw.) Schimp. – Loc.: 3, 4, 5, 6, 7, 8, 10; on soil, on rock.
Loeskeobryum Broth.
**Loeskeobryum brevirostre* (Brid.) M.Fleisch. – Loc.: 2, 3, 10; on soil, on rock.
Pleurozium Mitt.
Pleurozium schreberi (Willd. ex Brid.) Mitt. (Baydar & Özdemir, 1996).
Rhytidiadelphus (Limpr.) Warnst.
Rhytidiadelphus squarrosus (Hedw.) Warnst. – Loc.: 8, 10; on soil.
Rhytidiaceae Broth.
Rhytidium (Sull.) Kindb.
**Rhytidium rugosum* (Ehrh. ex Hedw.) Kindb. – Loc.: 4, 7, 9, 10; on soil, on rock.
Entodontaceae Kindb.
Entodon Müll. Hal.
**Entodon concinnus* (De Not.) Paris. – Loc.: 2, 9; on soil.
**E. schleicheri* (Schimp.) Demet. – Loc.: 2, 3, 6, 9, 12; on soil.
Leucodontaceae Schimp.
Leucodon Schwägr.
Leucodon immersus Lindb. (Papp, 2004; Batan et al., 2021).
L. sciuroides (Hedw.) Schwägr. – Loc.: 1, 2, 3, 5, 6, 8, 9, 10, 11; on rock, on tree trunk.
Neckeraceae Schimp.
Alleniella S.Olsson, Enroth & D.Quandt
Alleniella besseri (Lobarz.) S.Olsson, Enroth & D.Quandt (Syn: *Neckera besseri* (Lobarz.) Jur.) – Loc.: 2, 5, 6, 9, 11, 12; on rock, on tree trunk.
A. complanata (Hedw.) S.Olsson, Enroth & D.Quandt. – Loc.: 1, 2, 4, 8, 12 on tree trunk.
Exsertotheca S.Olsson, Enroth & D.Quandt
Exsertotheca crispa (Hedw.) S.Olsson, Enroth & D.Quandt (Syn: *Neckera crispa* Hedw.) – Loc.: 1, 2, 3, 4, 5, 6, 10, 12; on rock, on tree trunk.
Homalia (Brid.) Bruch & Schimp
Homalia trichomanoides (Hedw.) Brid. – Loc.: 1, 2, 3, 4, 6, 10, 12; on rock, on tree trunk.
Thamnobryum Nieuwl.
Thamnobryum alopecurum (Hedw.) Gangulee. – Loc.: 1, 2, 4, 5, 6, 11, 12; on wet soil, on wet rock.
Pseudanomodon (Limpr.) Ignatov & Fedosov
Pseudanomodon attenuatus (Hedw.) Ignatov & Fedosov (Syn: *Anomodon attenuatus* (Hedw.)
Huebener) – Loc.: 1, 2, 3, 6, 9, 11, 12; on rock, on tree trunk.
Lembophyllaceae Broth.
Heterocladium Bruch & Schimp
▲**Heterocladium heteropterum* (Brid.) Schimp. – Loc.: 1; on soil.
Isothecium Brid.
Isothecium alopecuroides (Lam. ex Dubois) Isov. – Loc.: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
I. myosuroides Brid. – Loc.: 1; on soil, on rock.
Myuriaceae M.Fleisch
Ctenidium (Schimp.) Mitt.
Ctenidium molluscum (Hedw.) Mitt. – Loc.: 1, 3, 6, 7, 9, 10, 11, 12; on soil, on rock.
Anomodontaceae Kindb.

Anomodon Hook. & Taylor
Anomodon rugelii (Müll.Hal.) Keissl. (Papp, 2004).
A. viticulosus (Hedw.) Hook. & Taylor – Loc.: 2, 4, 5, 6, 10, 11; on soil, on rock.

Brachytheciaceae with 21 taxa in 12 genera and Pottiaceae with 16 taxa in 10 genera are the most species-rich families in the total bryoflora of Altındere Valley. Brachytheciaceae which includes pleurocarpous mosses constitutes one of the largest families of mosses. Its members grow in almost all substrates such as on soil, on rock, on tree bases and tree trunks, on decaying wood and also submerged in running water (Ignatov, 1998). In addition, pleurocarpous mosses are more sensitive to drought than acrocarpous mosses (Schofield, 2001). It is not surprising that the Brachtheciaceae is the largest family in the study area which has a very humid climate type. Because, forests floor where have more humid habitats provided shelters for colonisation of the hygrophytic Brachytheciaceae members in the study area.

The second large family in the bryoflora of Altındere Valley is Pottiaceae. This result is not surprising. Because, the acrocarpous moss family, comprising more than 1400 species, is characteristic of variable or harsh environments and is a dominant in several ecosystems such as mountain, alpine or arctic regions from moist to arid areas of the earth (Zander, 1993).

While *Plagiothecium* is the most species-rich genera with 7 species*, Mnium, Hypnum* and, *Plagiomnium* are second largest genera in the Altındere Valley with six taxa each. Scapaniaceae with 6 species that all of them grow on wet soil are the most species-rich liverwort family in the study area.

The present study adds 71 new mosses and 12 new liverworts to bryoflora of Altındere Valley. And also 6 taxa (3 liverworts, 3 mosses) are new to A4 grid-square. Thus, the number of taxa in the bryoflora of Altındere Valley reached 232 with the present paper. However, 44 mosses and 18 liverworts which are recorded in previous studies from the study area were not detected in this study.

Altındere Valley has quite a variety of habitats such as mixed or pure forests of coniferous and broad-leaved trees, wet sites along rivers and streams. Habitat diversity and the variety of microhabitats in the study area has brought bryofloristic richness. These habitats in the study area could be damaged by human activities, which will result in decreasing of biodiversity. The most important human activities observed are road, touristic facility and housing construction, tourism and recreation activities in the study area where Sumela Monastery is located. Every year, thousands of visitors come to the Sumela Monastery, and it is constantly increasing. While approximately one hundred thousand visitors came to Sumela Monastery a year before 2000, this number has increased to approximately seven hundred thousand recently (DKMG, 2019). Therefore, 44 mosses and 18 liverworts which are previously recorded the study area, which were not detected in the present study, may have overlooked during field studies or disappeared.

Eventually, richness the bryoflora of Altındere Valley which is a protected area reflected the typical very humid climate conditions and typical vegetation of the Black Sea Region in Turkey.

Ethical Approval
The authors declare that no need to ethical approval.

Conflicts of Interest
The authors declare that they have no conflict of interest.

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References
Batan, N., Alataş, M., Ezer, T. & Erata, H. (2021). Altındere Vadisi (Maçka, Trabzon) Briyofit Florasına Epifitik Katkılar. *Anatolian Bryology,* 7(1), 8-16.

Baydar, S. & Özdemir, T. (1996). Altındere Vadisi Milli Parkı Karayosunları (Musci). *Turkish Journal of Botany,* 20, 53-57.

Brugués, M., Cros, R. M. & Guerra, J. (2007). *Flora Briofitica Ibérica.* Volume I, Uniersidad de Murcia, ISBN: 978-84-611-8462-0. Sociedad Espanola de Briyologia Murcia. Murcia.

Cortini-Pedrotti, C. (2001). *Flora dei muschi d'Italia. Sphagnosida, Andreaeopsida, Bryopsida (I parte).* Roma, Antonio Delfino Editore. 1-817p.

Cortini-Pedrotti, C. (2006). *Flora dei muschi d'Italia. Bryopsida (II parte).* Roma: Antonia Delfino Editorea. 827-1235p.

Çepel, N. (1995). *Forest Ecology*. Istanbul University, Faculty of Forestry Printing, İstanbul, 536 p.

Doğa Koruma ve Milli Parklar Genel Müdürlüğü (2019). Altındere Vadisi Milli Parkı Uzun Devreli Gelişme Planı.

Erdağ, A. & Kürschner, H. (2017). *Türkiye Bitkilerinin Listesi (Karayosunları)*. Ali Nihat Gökyiğit Vakfı Bas. İstanbul.

Gökler, İ. (1998). Liverworts (Marchantiopsida) of the Altındere Valley National Park. *Turkish Journal of Botany,* 22, 409-412.

Greven, H. C. (1995). *Grimmia Hedw. (Grimmiaceae, Musci) in Europe*. pp 159, Backhuys Publishers, Leiden, The Netherlands.

Greven, H. C. (2003). *Grimmias of the World*. pp 247, Backhuys Publishers, Leiden

Guerra, J. Cano, M. J. & Cros, R. M. (2006). *Flora Briofitica Ibérica*. VoI. 3, Murcia: Universidad de Murcia Sociedad Española de Briología.

Henderson, D. M. (1961). Contribution to the Bryophyte Flora of Turkey: IV. *Royal Botanic Garden Edinburgh,* 23, 263-278.

Heyn, C. C. & Herrnstadt, I. (2004). *The Bryophyte Flora of Israel and Adjacent Regions*. The Israel Academy of Science and Humanities Jaursalem. Israel.

Hodgetts, N. G. Söderström, L., Blockeel T. L., Caspari, S., Ignatov, M. S., Konstantinova, N. A., Lockhart, N., Papp, B., Schröck, C., Sim-Sim, M., Bell, D., Bell, N. E., Blom, H. H., Bruggeman Nannenga, M. A., Brugués, M., Enroth, J., Flatberg, K. I., Garilleti, R., Hedenäs, L., Holyoak, D. T., Hugonnot, V., Kariyawasam, I., Köckinger, H., Kučera, J., Lara, F. & Porley, R. D. (2020). An annotated checklist of bryophytes of Europe, Macaronesia and Cyprus. *Journal of Bryology,* 42(1), 1-116.

Ignatov, M. S. (1998). Bryophyte Flora of Altai Mountains. VIII. Brachytheciaceae. *Arctoa,* 7, 85-152.

Kürschner, H. & Frey, W. (2020). Liverworts, mosses and hornworts of Southwest Asia (Marchantiophyta, Anthoceratophyta, Bryophyta). *Nova Hedwigia,* 149, 1-267.

Munoz, J. (1999). A Revision of *Grimmia* (Musci, Grimmiaceae) in The Americas, 1: Latin America. *Annales Missouri Botanical Garden,* 86, 118-191.

OGM (2015). Maçka-Altındere Vadisi Ormanlarında Ölü Ağaç Miktarının Belirlenmesi Projesi. Orman Genel Müdürlüğü. Ankara.

Özdemir, T. & Çetin, B. (1999). The Moss Flora of Trabzon and Environs. *Turkish Journal of Botany,* 23, 391-404.

Palabaş Uzun, S. & Anşin, R. (2006). Subalpine and Alpine Flora of Altındere Valley (Maçka, Trabzon). *Turkish Journal of Botany,* 30, 381-398.

Papp, B. (2004). Contributions to the Bryophyte Flora of the Pontic Mts, North Anatolia, Turkey. *Studia Botanica Hungarica,* 35, 81-89.

Paton, J. (1999). *The Liverworts Flora of the British Isles.* 626. Harley Books. England.

Schofield, W. B. (2001). *Introduction to Bryology*. Caldwell, US: The Blackburn Press.

Smith, A. J. E. (2004). *The Moss Flora of Britain and Ireland*. (Second Edition) Cambridge Univ. Press.

URL 1. Climate Date. 2020. Website: https://tr.climatedata.org/asya/tuerkiye/trabzon/macka8552/ [Erişim: 13 Ekim 2020].

Zander, R. H. (1993). *Genera of the Pottiaceae: Mosses of Harsh Environments*. New York: Bulletin of the Buffalo Society of Natural Sciences Vol. 32.