



Moss



Liverwort



Hornwort

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The Bryophyte Flora of Upper Gerede Valley (Bolu-Turkey)

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Abstract

In this study, the bryophyte flora of Upper Gerede Valley (Bolu-Turkey) was investigated. The field trips were conducted between 2011 and 2012, specimens collected from 23 sites. As a result, 89 taxa belong to 28 families were determined. Among them, *Campylium stellatum* (Hedw.) Lange & C. E. O. Jensen and *Hedwigia ciliata* (Hedw.) P. Beauv. var. *leucophaea* Bruch & Schimp. are new records for A2 square according to Henderson's grid system. Also, 17 taxa are new to bryodiversity of Bolu province.

Key words: Bryophyte, Diversity, Flora, Bolu, Turkey.

Yukarı Gerede Vadisi Briyofit Florası (Bolu- Türkiye)

Özet

Bu çalışmada Yukarı Gerede Vadisi'nin (Bolu-Türkiye) briyofit florası araştırılmıştır. 2011-2012 yıllarında gerçekleştirilen arazi çalışmalarında 23 lokaliteden örnekler toplanmıştır. Çalışma sonucunda 28 familyaya ait 89 takson tespit edilmiştir. Bunlar arasından *Campylium stellatum* (Hedw.) Lange & C. E. O. Jensen ve *Hedwigia ciliata* (Hedw.) P. Beauv. var. *leucophaea* Bruch & Schimp. Henderson kareleme sistemi için yeni kayıttır. Ayrıca, 17 takson Bolu ili briyofit biyoçeşitliliği için yenidir.

Anahtar Kelimeler: Briyofit, Çeşitlilik, Flora, Bolu, Türkiye.

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1. Introduction

Turkey consists of three phytogeographic regions (Euro-Siberian, Mediterranean and Irano-Turanian) and their transition zones, each with its own rare and delicate habitats. Together with climatic and edaphic diversity, these different habitats cause a high endemism rate; approximately one third of Turkish vascular plant species (34%) are endemic to Turkey and nearby Aegean Islands (Bulut and Yılmaz, 2010).

Although there are many researches about Turkey's vascular flora, bryofloristic studies are not sufficient enough to constitute the Turkish Bryophyte Flora. Investigations on rare habitats that not studied bryofloristically have a great potential of revealing interesting records. The bryophyte flora of Upper Gerede Valley wasn't completely investigated before, but there are some researches nearby area, such as bryophyte flora of Aktaş Forests (Çetin and Yurdakulol, 1985; 1986), Yedigöller National Park (Çetin and Yurdakulol, 1986, 1988), Akçakoca Mountains (Uyar, 2003), Kaplandede Mountain (Cangül and Ezer, 2010), Western Küre

Mountains (Ören et al, 2012), Abant Mountain (Alataş and Uyar, 2015) and Liverwort flora of Bolu Mountains (Şimşek, 2012).

1.1. Study Area

Upper Gerede Valley (Bolu-Turkey) covers 1451 hectares; located around water sources that born at south slopes of Gökçeler Mountain and sustain Gerede River. This area situated in A2 square according to Henderson's grid system (1961) and in the boundaries of Black Sea Region, Western Black Sea Section. Upper Gerede Valley has a rich phanerogam diversity and inhabits some nationally rare vascular plant taxa, such as *Carex lasiocarpa* Ehrh., *C. limosa* L., *Pedicularis palustris* L. subsp. *opsiantha* (E L. Ekman) Almq., *Ranunculus lingua* L. and *Utricularia minor* L. (Özhatay et al., 2005). According to data obtained from Bolu meteorological station, the area shows the characteristics of Mediterranean climate. The rainfall pattern for the area is Winter/Spring/Autumn/Summer and there is a dry season between July and September (Akman, 2011) (Figure 1).

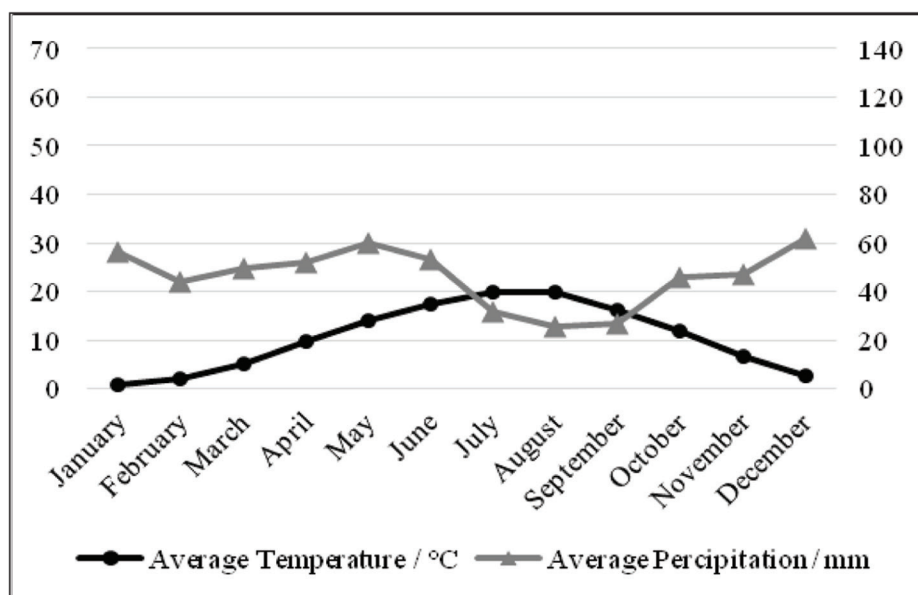


Figure 1. Ombrothermic climate diagram for Bolu Province

2) Materials and Methods

Between 2011 and 2012, field trips were conducted to the study area. 23 collecting sites were determined considering their vegetational and geographical characteristics (Table 1). Collected specimens from the field firstly air dried and then temporarily packaged. Macroscopic examination and preparation of microscopic slides are done with Olympus SZ61 stereo microscope. Slides were investigated with Olympus BX51 light microscope and specimens were identified using relevant literature (Zander, 1993; Frey et al., 1995; Greven, 1995; Smith, 1996, Paton, 1999; Cortini Pedrotti, 2001; Greven, 2003; Heyn and Herrnstadt, 2004; Smith, 2004; Cortini Pedrotti, 2006; Guerra et al., 2006; Brugues et al., 2007; Casas et al., 2009). The status of taxa were checked with current check-lists (Uyar and Çetin, 2004; Kürschner and Erdağ, 2005; Ros et al., 2007; Özenoğlu Kiremit and Keçeli, 2009; Ros

et al., 2013). After identification process, specimens were deposited at Bülent Ecevit University Bryophyte Herbarium (ZNG).

3) Results

As a result of this study, 89 taxa belong to 28 families was determined in total. Among them, 7 families and 8 taxa belong to Marchantiophyta (liverworts) and 21 families and 81 taxa belong to Bryophyta (mosses). There aren't any specimens collected from the research area, belonging to Anthocerotophyta (hornworts). The bryofloristic list was arranged according to Goffinet and Shaw (2009). At the list, collection sites were abbreviated as "loc.", and for each taxon, only one collector number was given for avoiding repetition. Also, new records for A2 square were indicated with an asterisk (*) and new records for Bolu province were indicated with a dagger (†).

Table 1. Detailed information about collecting sites.

Site Number	Location	Coordinates	Altitude (m a.s.l)	Vegetation
1	Gerede	N 40° 47.704' E 032° 10.585'	1308	<i>Pinus nigra</i> Arnold <i>P. sylvestris</i> L.
2	Gerede Lake distric	N 40° 47.884' E 032° 10.362'	1305	<i>Pinus sylvestris</i> L.
3	Gerede Lake distric	N 40° 47.807' E 032° 10.136'	1300	<i>Populus</i> sp., <i>Salix</i> sp.
4	Yeniçağa Lake distric	N 40° 46.422' E 032° 01.872'	981	<i>Populus</i> sp., <i>Salix</i> sp.
5	Yeniçağa Lake distric	N 40° 46.860' E 032° 01.172'	976	<i>Populus</i> sp., <i>Salix</i> sp.
6	Yeniçağa Lake distric	N 40° 46.371' E 032° 01.469'	991	<i>Populus</i> sp.,
7	Yeniçağa Lake distric	N 40° 46.393' E 032° 00.486'	977	<i>Salix</i> sp.
8	Kapaklı Lake distric	N 40° 50.752' E 032° 26.778'	1240	<i>Populus</i> sp., <i>Salix</i> sp., <i>Typha</i> sp., <i>Phragmites</i> sp.
9	Between Kurugöl and Kapaklı Lake	N 40° 50.487' E 032° 26.240'	1230	<i>Salix</i> sp., <i>Typha</i> sp., <i>Phragmites</i> sp.
10	Keçi Lake distric	N 40° 50.049' E 032° 26.575'	1226	<i>Salix</i> sp., <i>Phragmites</i> sp.
11	Esentepe district	N 40° 48.379' E 032° 11.427'	1446	<i>Pinus nigra</i> Arnold, <i>P. sylvestris</i> L., <i>Rhododendron</i> sp., <i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus</i> <i>oxycedrus</i> L.

Table 2. Is continue

12	Esentepe district	N 40° 52.405' E 032° 09.195'	1661	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus oxycedrus</i> L.
13	Rumşah Plateau	N 40° 49.848' E 032° 08.367'	1638	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus oxycedrus</i> L.
14	Kırklar Plateau	N 40° 54.135' E 032° 12.569'	1726	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., Silba, <i>Juniperus oxycedrus</i> L.
15	Sungurlar Plateau	N 40° 55.802' E 032° 12.80'	1733	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus oxycedrus</i> L.
16	Gerede-Eskipazar road district	N 40° 51.662' E 032° 14.504'	1628	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus oxycedrus</i> L.
17	Esentepe Plateau	N 40° 46.726' E 032° 21.767'	1374	<i>Pinus sylvestris</i> L.
18		N 40° 52.027' E 032° 16.852'	1494	<i>Pinus sylvestris</i> L., <i>Astragalus</i> sp., <i>Juniperus</i> sp., <i>P. nigra</i> Arnold
19	Rumşah Plateau	N 40° 52.939' E 032° 16.101'	1690	Meadow
20	Between Sungurlar Plateau and Eskipazar	N 40° 51.614' E 032° 33.902'	1756	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen.,
21	Gerede-Eskipazar roadside	N 40° 55.428' E 032° 18.515'	1784-1855	<i>Abies nordmanniana</i> (Steven) Spach subsp. <i>equi-trojani</i> (Asch. & Sint. ex Boiss.) Coode & Cullen., <i>Juniperus oxycedrus</i> L.
22	Gerede-Eskipazar roadside	N 40° 51.275' E 032° 16.016'	1720	<i>Salix</i> sp., <i>Pinus</i> sp.
23	Gerede-Eskipazar roadside	N 40° 53.079' E 032° 15.714'	1622	<i>Pinus</i> sp.

The Bryofloristic List

Marchantiophyta

Marchantiopsida Gonquist, Takht & W. Zimm.

Marchantiaceae (Bisch.) Lindl.

Marchantia polymorpha L.; loc. 7, 15; on soil; KARABURUN 22/12.

Jungermanniopsida Stotler & Crand.-Stotl.

Aneuraceae H. Klinggr.

Aneura pinguis (L.) Dumort.; loc. 7; on soil; KARABURUN 91/11.

Pelliaceae H. Klinggr.

Pellia endiviifolia (Dicks.) Dumort.; loc. 15, 22; near stream bed, on wet soil; KARABURUN 10/12.

Radulaceae Müll. Frib.

Radula complanata (L.) Dumort.; loc. 12; on tree; KARABURUN 30/12.

Frullaniaceae Lorch

Frullania dilatata (L.) Dumort.; loc. 12; on tree; KARABURUN 15/12.

Ptilidiaceae H. Klinggr.

†*Ptilidium pulcherrimum* (Weber) Vain.; loc. 20; on tree; KARABURUN 31/12.

Lophocoleaceae Vanden Berghen

Lophocolea bidentata (L.) Dumort.; loc. 20; on soil; KARABURUN 27/12.

Lophocolea heterophylla (Schrad.) Dumort.; loc. 20; on soil; KARABURUN 29/12.

Bryophyta

Polytrichopsida Doweld.

Polytrichaceae Schwägr.

Polytrichum juniperinum Hedw.; loc. 12, 21; on soil; KARABURUN 11/12.

Bryopsida Rothm.

Encalyptaceae Schimp.

†*Encalypta alpina* Sm.; loc. 21; on rock; KARABURUN 58/12.

Encalypta streptocarpa Hedw.; loc. 11; on rock; KARABURUN 7/11.

Funariaceae Schwägr.

Funaria hygrometrica Hedw.; loc. 1, 3; on soil; KARABURUN 79/11.

†*Physcomitrium pyriforme* (Hedw.) Brid.; loc. 3; near stream bed, on soil; KARABURUN 101/11.

Grimmiaceae Arn.

†*Grimmia anodon* Bruch & Schimp.; loc. 2, 11; on rock and stone; KARABURUN 47/11.

Grimmia pulvinata (Hedw.) Sm.; loc. 6, 10, 17, 19, 20, 23; on rock and stone; KARABURUN 141/12.

Schistidium confertum (Funck) Brunch & Schimp.; loc. 21, 23; on stone; KARABURUN 162/12.

Fissidentaceae Schimp.

Fissidens taxifolius Hedw.; loc. 11, 13, 15; on soil; KARABURUN 122/12.

Dicranaceae Schimp.

Dicranella varia (Hedw.) Schimp.; loc. 20; near stream bed, on wet soil; KARABURUN 123/12.

Dicranum scoparium Hedw.; loc. 11, 12, 13, 20, 23; on tree and soil; KARABURUN 135/12.

Dicranum tauricum Sapjegin; loc. 11; on tree; KARABURUN 62/11.

Pottiaceae Schimp.

Barbula convoluta Hedw.; loc. 12; on soil; KARABURUN 192/12.

Barbula unguiculata Hedw.; loc. 7; on soil; KARABURUN 2/11.

Didymodon tophaceus (Brid.) Lisa; loc. 10; on soil; KARABURUN 82/11.

Eucladium verticillatum (With.) Brunch & Schimp.; loc. 22; near stream bed, on wet rock; KARABURUN 89/12.

†*Syntrichia calcicola* J.J.Amann; loc. 6; on rock; KARABURUN 9/11.

Syntrichia norvegica F. Weber; loc. 12, 13; on soil; KARABURUN 112/12.

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr.; loc. 8, 12, 16, 17, 18, 20; on soil and rock; KARABURUN 117/12.

†*Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr var. *ruraliformis* (Besch.) Delogne; loc. 10, 12, 17; on soil; KARABURUN 157/12.

Tortella tortuosa (Hedw.) Limpr.; loc. 11, 12, 12, 18, 23; on rock and soil; KARABURUN 151/12.

Tortula acaulon (With.) R.H.Zander.; loc. 4; on soil; KARABURUN 40/11.

†*Tortula inermis* (Brid.) Mont; loc. 2, 23; on stone and soil, KARABURUN 65/12.

Tortula muralis Hedw.; loc. 4, 6, 17; on rock and stone; KARABURUN 58/11.

Tortula subulata Hedw.; loc. 2, 12, 13, 20; on stone and soil; KARABURUN 147/12.

Weissia brachycarpa (Voit) Lindb.; loc. 11; on rock; KARABURUN 100/11.

Bryaceae Schwägr.

Bryum argenteum Hedw.; loc. 4, 21; on stone and soil; KARABURUN 109/12.

†*Bryum turbinatum* (Hedw.) Turner; loc. 1; on soil; KARABURUN 85/11.

Imbribryum alpinum (Huds. ex With.) N. Pedersen; loc. 21; on soil; KARABURUN 52/12.

Ptychostomum capillare (Hedw.) Holyoak & N. Pedersen; loc. 13, 17; on soil; KARABURUN 140/12.

Ptychostomum imbricatulum (Müll. Hal.) Holyoak & N. Pedersen; loc. 18, 20; on soil; KARABURUN 230/12.

Ptychostomum moravicum (Podp.) Ros & Mazimpaka; loc. 5, 15, 17; on tree and soil; KARABURUN 139/12.

Ptychostomum torquescens (Bruch & Schimp.) Ros & Mazimpaka; loc. 13; on soil; KARABURUN 45/12.

Mniaceae Schwägr.

Mnium spinosum Bruch & Schimp.; loc. 13, 14; on tree and soil; KARABURUN 12/12.

Plagiomnium affine (Blandow ex Funck) T.J.Kop.; loc. 11, 13; on damp soil; KARABURUN 63/12.

Plagiomnium undulatum (Hedw.) T.J.Kop.; loc. 11; on damp soil; KARABURUN 90/11.

Rhizomnium punctatum (Hedw.) T.J.Kop.; loc. 13, 20; on damp soil; KARABURUN 42/12.

Bartramiaceae Schwägr

Philonotis calcarea (Bruch & Schimp.) Schimp.; loc. 15; on damp soil; KARABURUN 26/12.

Philonotis fontana (Hedw.) Brid.; loc. 19; on soil; KARABURUN 146/12.

Orthotrichaceae Arn.

†*Nyholmiella obtusifolia* (Brid.) Holmen & Warncke; loc. 5; on tree; KARABURUN 96/11.

Orthotrichum affine Schrad. ex Brid.; loc. 1, 5, 10, 12, 20; on tree; KARABURUN 98/12.

Orthotrichum cupulatum Hoffm. ex Brid.; loc. 6, 11; on rock; KARABURUN 48/11.

Orthotrichum diaphanum Schrad. ex Brid.; loc. 5; on tree; KARABURUN 22/11.

Orthotrichum lyellii Hook. & Taylor; loc. 10; on tree bark; KARABURUN 39/11.

Orthotrichum pumilum Sw. ex anon.; loc. 1, 8, 17; on tree and rock; KARABURUN 129/12.

†*Orthotrichum rupestre* Schleich. ex Schwägr.; loc. 7, 17; on stone; KARABURUN 160/12.

Orthotrichum speciosum Nees; loc. 1, 3, 10, 12, 17; on tree; KARABURUN 144/12.

Hedwigiaceae Schimp.

**Hedwigia ciliata* (Hedw.) P.Beauv. var. *leucophaea* Bruch & Schimp.; loc. 10; on soil; KARABURUN 154/12.

Amblystegiaceae Kindb.

**Campylium stellatum* (Hedw.) Lange & C. E. O. Jensen; loc. 8; on soil; KARABURUN 88/11.

Cratoneuron filicinum (Hedw.) Spruce; loc. 2, 8, 15, 22; on soil, stone and rock; KARABURUN 155/12.

†*Drepanocladus aduncus* (Hedw.) Warnst.; loc. 2, 3, 8, on soil; KARABURUN 74/11.

†*Hygroamblystegium varium* (Hedw.) Mönk. var. *humile* (P.Beauv.) Vanderp. & Hedenäs; loc. 8, 10; on soil; KARABURUN 75/11.

Leptodictyum riparium (Hedw.) Warnst.; loc. 3; in water; KARABURUN 16/11.

†*Pseudoamblystegium subtile* (Hedw.) Vanderp. & Hedenäs; loc. 5; on soil; KARABURUN 72/11.

Palustriella commutata (Hedw.) Ochyra; loc. 8, 22; on soil; KARABURUN 81/11.

Sanionia uncinata (Hedw.) Loeske; loc. 13, 15; on soil; KARABURUN 96/12.

Thuidiaceae Schimp.

Abietinella abietina (Hedw.) M.Fleisch.; loc. 2, 10, 12, 21; on soil and rock; KARABURUN 145/12.

†*Thuidium assimile* (Mitt.) A. Jaeger; loc. 13; on soil; KARABURUN 153/12.

Brachytheciaceae Schimp.

Brachythecium albicans (Hedw.) Schimp.; loc. 12; on soil; KARABURUN 88/12.

Brachythecium glareosum (Bruch ex Spruce) Schimp.; loc. 12; on soil; KARABURUN 118/12.

Brachythecium mildeanum (Schimp.) Schimp.; loc. 2, 3, 8; on soil and rock; KARABURUN 56/11.

Brachythecium rivulare Schimp.; loc. 13, 15, 20; on damp soil; KARABURUN 125/12.

Brachythecium salebrosum (Hoffm. ex F.Weber & D.Mohr) Schimp.; loc. 5, 10, 12, 13, 17; on soil and tree trunk; KARABURUN 114/12.

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen; loc. 2, 12, 13, 14, 17, 20, 23; on soil, stone and tree; KARABURUN 133/12.

Brachytheciastrum velutinum (Hedw.) Ignatov & Huttunen var. *salicinum*

(Schimp.) Ochyra & Żarnowiec; loc. 3, 5, 17; on tree and soil; KARABURUN 131/12.

Homalothecium lutescens (Hedw.) H.Rob.; loc. 2, 5, 6, 7, 8; on soil, rock and decaying wood; KARABURUN 87/11.

Homalothecium sericeum (Hedw.) Schimp.; loc. 2; on stone; KARABURUN 14/11.

†*Oxyrrhynchium schleicheri* (R. Hedw.) Röhl; loc. 7; on soil; KARABURUN 95/11.

Hypnaceae Schimp.

Calliergonella cuspidata (Hedw.) Loeske.; loc. 8, 9, 19; on damp soil; KARABURUN 94/11.

Hypnum cupressiforme Hedw. var. *lacunosum* Brid.; loc. 11; on tree root; KARABURUN 38/11.

Hypnum jutlandicum Holmen & Warncke; loc. 14; on stone; KARABURUN 83/12.

Herzogiella seligeri (Brid.) Z. Iwats.; loc. 12, 13, 19, 20; on tree; KARABURUN 134/12.

Pterigynandraceae Schimp.

Pterigynandrum filiforme Hedw.; loc. 11, 12, 14, 15; on tree and stone; KARABURUN 84/12.

4) Discussion

As a result of this study, two taxa (*Campylium stellatum* and *Hedwigia ciliata* var. *leucophaea*.) are new records for A2 square. Also, 17 taxa (*Ptilidium pulcherrimum*, *Encalypta alpine*, *Physcomitrium pyriforme*, *Grimmia anodon*, *Syntrichia calcicola*, *Syntrichia ruralis* var. *ruraliformis*, *Tortula inermis*, *Bryum turbinatum*, *Nyholmiella obtusifolia*, *Orthotrichum rupestre*, *Drepanocladus aduncus*, *Hygroamblystegium varium* var. *humile*, *Pseudoamblystegium subtile*, *Thuidium assimile*, *Oxyrrhynchium schleicheri*, *Pleurozium schreberi* and

Hylocomiaceae (Broth.) M.Fleisch.

Hylocomium splendens (Hedw.) Schimp.; loc. 11, 13; on soil; KARABURUN 93/11.

†*Pleurozium schreberi* (Willd. ex Brid.) Mitt.; loc. 11; on soil; KARABURUN 92/11.

Rhytidiadelphus triquetrus (Hedw.) Warnst.; loc. 11, 12, 13, 20; on soil; KARABURUN 6/12.

Plagiotheciaceae (Broth.) M.Fleisch.

Plagiothecium curvifolium Schlieph. ex Limpr.; loc. 20, on tree root; KARABURUN 156/12.

Plagiothecium denticulatum (Hedw.) Schimp.; loc. 13, 20; on tree; KARABURUN 99/12.

†*Plagiothecium laetum* Schimp.; loc. 14; on decaying wood; KARABURUN 81/12.

Leucodontaceae Schimp.

Leucodon sciuroides (Hedw.) Schwägr.; loc. 12, 22; on tree; KARABURUN 111/12.

Lembophyllaceae Broth.

Isothecium alopecuroides (Lam. ex Dubois) Isov.; loc. 13; on soil; KARABURUN 150/12.

Plagiothecium laetum) are new records for Bolu province.

As can be seen on bryofloristic list, there are more moss taxa (91%) than liverwort taxa (9%) in the study area. 62.5% of liverwort taxa are leafy and 37.5% are thalloid. Also 59% of moss taxa are acrocarpous and 41% are pleurocarpous. When mosses and liverworts were approached together; the most dominant families are Pottiaceae (16%) and Brachytheciaceae (11%) (Figure 2). Pottiaceae and Brachytheciaceae are cosmopolitan families; there are great deals of highly

adaptive taxa classified under them. So, like Mediterranean and Southwest Asian countries, these two families are

the richest ones in Turkey (Kürschner and Frey, 2011; Ros et al., 2013).

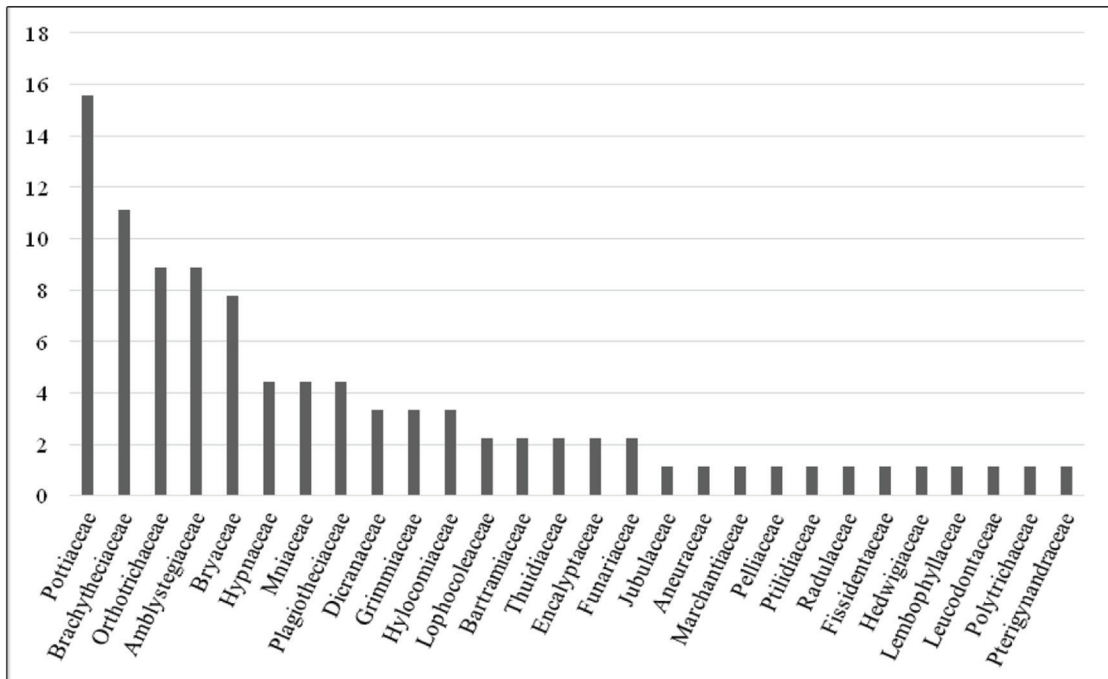


Figure 2. Percentage of bryophyte families

Turkey is well known with its rich vascular flora and high endemism rate. Like spermatophytes, bryophytes have a great potential in terms of biodiversity. Further bryofloristic studies will reveal bryodiversity of Turkey, and will be great basis for a complete “Turkish Bryophyte Flora”.

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References

- Akman Y. 2011. İklim ve Biyoiklim (Biyoiklim metodları ve Türkiye İklimleri). Palme Yayıncılık. Ankara.
- Alataş M. Uyar G. 2015. The Bryophyte flora of Abant Mountains (Bolu/Turkey). *Biological Diversity and Conservation*. 8(1): 35-43.
- Brugués M. Cros R.M. Guerra J. 2007. Flora Briofítica Ibérica, Volume I. Universidad de Murcia, Murcia.
- Bulut Z. Yılmaz H. 2010. The Current Situation of Threatened Endemic Flora In Turkey: Kemaliye (Erzincan) Case. *Pakistan Journal of Botany*, 42(2): 711-719.
- Cangül C. Ezer T. 2010. The Bryophyte Flora of Kaplandede Mountain (Düzce, Turkey). *Folia Cryptogamica Estonica*. 47:3-12.
- Casas C. Brugués M. Cros M.R. Sérgio C. Infante M. 2009. Handbook of Liverworts and Hornworts of the Iberian Peninsula and the Balearic Islands. Institut D'estudis Catalans, Barcelona.
- Cortini Pedrotti C. 2001. Flora dei muschi d'Italia, Sphagnopsida, Andreaopsida, Bryopsida (I parte). The Israel Academy of Sciences and Humanities, Jerusalem.
- Cortini Pedrotti C. 2006. Flora dei muschi d'Italia, Bryopsida (II parte). Antonia Delfino Editore Medicina- Scienze, Roma.

- Çetin B. Yurdakulol E. 1985. Gerede-Aktaş (Bolu) ormanlarının karayosunları (Musci) florası. Doğa Bilim Dergisi 9(1): 29–38.
- Çetin B. Yurdakulol E. 1986. Bolu çevresi (Gerede-Aktaş Ormanı Yedigöller Milli Parkı) ciğerotları (Hepaticae). Doğa Türk Biyoloji Dergisi. 10(1): 53-56.
- Çetin B. Yurdakulol E. 1988. Yedigöller milli parkının karayosunları florası. Doğa Türk Botanik Dergisi. 12: 128-146.
- Frey W. Frahm J.P. Fischer E. Lobin W. 1995. Kleine Kryptogamenflora, Band 4, Die Moos – und Farnpflanzen Europas. Gustav Fischer Verlag, Stuttgart.
- Goffinet B. Shaw, A.J. 2009. Bryophyte Biology (Second Edition). Cambridge University Press, Cambridge.
- Greven H.C. 1995. *Grimmia* Hedw. (Grimmiaceae, Musci) in Europe. Backhuys Publishers, Leiden.
- Greven H.C. 2003. *Grimmias* of the World. Backhuys Publishers, Leiden.
- Guerra J. Cano M.J. Cros R.M. 2006. Flora Briofítica Ibérica. Volume 3. Uniersidad de Murcia, Murcia.
- Henderson D. M. 1961. Contribution to the Bryophyte Flora of Turkey: IV. Notes from 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 Sciences and Humanities, Jerusalem.
- Kürschner H. Erdağ A. 2005 Bryophytes of Turkey: An Annotated Reference List of the Species with Synonyms from the Recent Literature and an Annotated List of Turkish Bryological Literature. Turkish Journal of Botany. 29: 95-154.
- Kürschner H. Frey W. 2011. Liverworts, mosses and hornworts of Southwest Asia. (Marchantiophyta, Bryophyta, Anthocerotophyta). Nova Hedwigia. 139: 1–240.
- Ören M. Uyar G. Keçeli T. 2012. The bryophyte flora of the western part of the Küre Mountains (Bartın, Kastamonu), Turkey. Turkish Journal of Botany. 36: 538-557.
- Özenoğlu Kiremit H. Keçeli T. 2009. An Annotated Check-list of the Hepaticae and Anthocerotae of Turkey. Cryptogamie Bryologie. 30 (3): 343-356.
- Özhatay N. Byfield A. Atay S. 2005. Türkiye'nin 122 Önemli Bitki Alanı. WWF Turkey. İstanbul.
- Paton J. 1999. The Liverworts Flora of the British Isles. Harley Books, Essex.
- Ros R. M. Mazimpaka V. Abou-Salama U. Aleffi M. Blockeel T.L. Brugués M. Cano M.J. Cros R.M. Dia M.G. Dirkse G.M. et al. 2007. Hepatics and Anthocerotes of the Mediterranean, an annotated checklist. Cryptogamie Bryologie. 28(4): 351-437.
- Ros R. M. Mazimpaka V. Abou-Salama U. Aleffi M. Blockeel T.L. Brugués M. Cano M.J. Cros R.M. Dia M.G. Dirkse G.M. et al. 2013. Mosses of the Mediterranean, an annotated checklist. Cryptogamie Bryologie. 34 (2): 99-283.
- Smith A.J.E. 1996. The Liverworts of Britain and Ireland. Cambridge University Press, Cambridge.
- Smith A.J.E. 2004. The Moss Flora of Britain and Ireland (Second Edition). Cambridge University Press, Cambridge.
- Şimşek Ö. 2012. Liverwort (Hepaticae) Flora of Bolu Mountains, Phd thesis, Ankara University, Graduate School of Natural and Applied Sciences, p. 154.
- Uyar G. 2003. The Moss Flora of Düzce - Akçakoca Mountains. OT Sistematik Botanik Dergisi. 10:77-95.
- Uyar G. Çetin B. 2004. A New Check-List of the Mosses of Turkey. Journal of Bryology. 26: 203- 220.
- Zander R.H. 1993. Genera of the Pottiaceae: Mosses of Harsh Enviroments. Bulletin of the Buffalo Society of Natural Sciences. Buffalo.