



The moss flora of Ihlara Valley (Aksaray/Turkey)

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Abstract

This study presents to the moss flora of the Ihlara Valley, situated in B8 square in the grid system adopted by Henderson 1961. 60 taxa were identified with the examination of 156 moss specimens collected from eleven localities, July in 2010. Of these, 47 taxa are new to the area, 23 taxa are new for B8 square. So, the number of mosses reported from Ihlara Valley reached to 67 with former records.

Key words: Bryophyta, mosses, flora, Ihlara Valley, Aksaray

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Ihlara Vadisi (Aksaray/Türkiye) karayosunu florası

Özet

Bu çalışma, Henderson 1961 tarafından benimsenen karaleme sistemine göre B8 Karesi içerisinde yer alan Ihlara Vadisi'nin karayosunu florasını sunmaktadır. Haziran 2010'da on bir lokaliteden toplanan yüz elli altı karayosunu örneğinin incelenmesi ile altmış takson tespit edilmiştir. Bu taksonlardan 47'si alan, 23 tanesi B8 karesi için yenidir. Böylece, eski kayıtlarla birlikte Ihlara Vadisi'nden bildirilen karayosunlarının sayısı 67'e ulaşmıştır.

Anahtar kelimeler: Bryophyta, karayosunları, flora, Ihlara Vadisi, Aksaray

1. Introduction

In recent years, the studies on moss biodiversity of Turkey have increased, and is enriched with many new findings. Some additions to the moss flora of Turkey in the last years: *Didymodon tomaculosus* (Blockeel) M.F.V. Corley (Canlı and Çetin, 2012), *Schistidium sordidum* Hagen. (Batan et al., 2013), *Bryoerythrophyllum rubrum* (Jur. ex Geh.) P.C. Chen (Batan and Özdemir, 2012), *Seligeria donniana* (Sm.) Müll. Hal. (Ursavaş and Çetin, 2012), *Conardia compacta* (Drumm. ex Mull.Hal.) H. Rob., *Didymodon icmadophilus* (Schimp. ex Mull.Hal.) K.Saito, *Pohlia obtusifolia* (Vill. ex Brid.) L.F.Koch, *Zygodon gracilis* Wilson (Özdemir et al., 2012; Kırmacı et al., 2012), *Seligeria trifaria* (Brid.) Lindb. and *Pseudotaxiphyllum elegans* (Brid.) Z.Iwats.(Ören et al., 2012), *Dicranella schreberiana* (Hedw.) Dixon, *Dicranodontium asperulum* (Mitt.) Broth. and *Campylopus pyriformis* (Schultz) Brid. (Batan and Özdemir, 2013), *Grimmia anomala* Schimp., *Pohlia filum* (Schimp.) Mårtensson, and *Hookeria acutifolia* Hook. & Grev. (Uyar and Ören, 2013), *Syntrichia caninervis* Mitt. var. *abrancheisii* (Luisier) R.H.Zander (Can et al., 2013), *Sphagnum contortum* K.F.Schultz, *Sphagnum fallax* (H.Klinggr.) H.Klinggr., *Sphagnum magellanicum* Brid., *Sphagnum rubellum* Wilson (Kırmacı and Kürschner, 2013), *Rhabdoweisia crispata* (Dicks. ex With.) Lindb., *Tortula guepinii* (Bruch & Schimp.) Broth. and *Tortella bambergeri* (Schimp.) Broth. (Kırmacı et al., 2013), *Sphagnum molle* Sull. (Abay and Keçeli, 2014).

Study area, Ihlara valley (Güzelyurt, Aksaray) is in "Ihlara Special Environmental Protection Area" (TKV, 2012) and it has very interesting geomorphological features as result of the volcanic activity of Hasan and Erciyes Mountains in Miocene and Pliocene age. Main rocks types are tuff, ignimbrite and volcanic ash in this region. There are widely depositing travertine masses around the Ihlara Valley. Main soil type of the valley is alluvial soils, the other

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colluvial brown soils. It's volcanic, hydrothermal activity, historical and cultural features make it unique and thus this area was declared Specially Protected Area in 21.11.1990 (Biler and Şahin, 2012; ÇOB, 2013; Sarı et al., 2005; Karabacak, 2007).

Ihlara valley is subject to semi-arid and very cold Mediterranean climate type. Melendiz Stream lies along the Ihlara Valley, so the area is more humid than around.

Ihlara valley is located phytogeographically in the Irano-Turanian region. 32 (approximately 12.5%) of 256 seedy plants taxa known from the area are endemic for Turkey. Of these, 18 taxa are endemic for Inner Anatolia and *Onobrychis stenostachya* Freyn subsp. *krausei* (Sirj.) Hedge is known from only Sivas province, except the area. While steppe vegetation is seen upper part of the valley, riparian vegetation is dominant along Melendiz Stream. Predominant tree species consist of *Salix alba* L., *Populus thevestina* Dode and *P. nigra* L. subsp. *italica* Koehne. in Ihlara Valley (Biler and Şahin, 2012).

2. Materials and methods

Study area are situated in Güzelyurt District (Aksaray) and B8 square according to the Turkish grid system adopted by Henderson (1961) (Fig. 1). Samples were collected from 11 stations containing different habitats, July in 2010. Field notes were made in detail for each sample collection station in localities list. Because the study area was located within Güzelyurt (Aksaray) borders, Aksaray and Güzelyurt were not written in the locality list in order to avoid repetition. All specimens were deposit Bryophyte Herbarium of Bülent Ecevit University (ZNG).

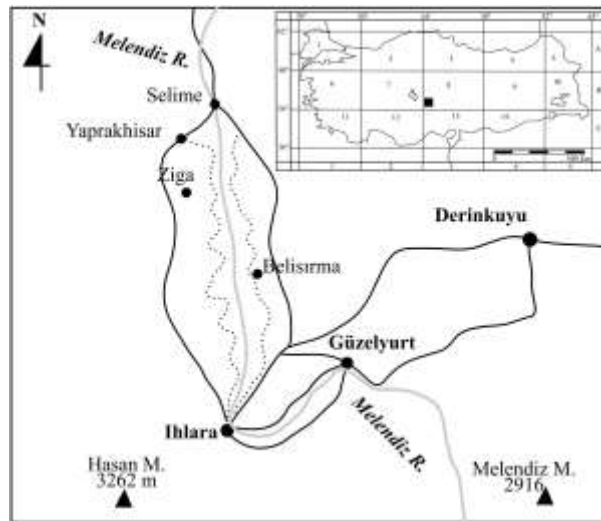


Figure 1. The map of the study area.

The following references were used for identification and nomenclature of moss specimens: Lewinsky (1993), Zander (1993); Smith (2004), Pedrotti (2001, 2006), Greven (2003), Heyn and Herrnstadt (2004), Frey et al. (2006), Guerra et al. (2006), Guerra & Cros (2007).

2.1. Detailed Locality List:

1. Ihlara Valley, Belisırma Village, Bezirhane Church vicinity, 38° 16.179'N 034° 17.346'E, *Rhamnus*, *Ulmus*, *Rosa*, *Amygdalus*, *Scrophularia*, *Alkanna*, *Reseda*, *Achillea*, *Marrubium*, *Hordeum*, *Lactuca*, *Dianthus*, *Thymus*, *Verbascum*, *Scabiosa*, *Xeranthemum*, *Malva*, *Eryngium*, *Stipa*, *Astragalus*, *Euphorbia*, *Alium*, steppe vegetation, 1218 m, 13.07.2010.
2. Ihlara Valley, Belisırma Village around 38° 16.125'N 034° 17.356'E, *Populus*, *Salix*, *Juglans*, *Ulmus*, *Eleagnus*, *Galium*, *Urtica*, *Marrubium*, *Chenopodium*, *Verbascum*, *Plantago*, *Mentha*, *Trifolium*, 1181 m, 13.07.2010.
3. Ihlara Town, main entrance of Ihlara Valley, 38° 15.212'N 034° 18.221'E, *Populus*, *Salix*, *Pistacia*, *Ulmus*, *Eleagnus*, *Rosa*, 1175 m, 14.07.2010.
4. Ihlara Valley, Pürenliseki Church vicinity, 38° 15.244'N 034° 18.384'E, *Salix*, *Pistacia*, *Tamarix*, *Populus*, *Rhamnus*, *Ulmus*, *Rubus*, 1180 m, 14.07.2010.
5. Ihlara Town vicinity, 38° 14.739'N 034° 18.653'E, *Salix*, *Populus*, *Pistacia*, *Ulmus*, *Celtis*, 1202 m, 14.07.2010.
6. Ihlara Town, Şelale vicinity, 38° 14.627'N 034° 18.476'E, *Salix*, *Populus*, *Pistacia*, *Ulmus*, *Celtis*, *Ephedra*, 1206 m, 14.07.2010.
7. Ihlara Valley, between Belisırma and Yaprakhisar village, 38° 16.372'N 034° 17.047'E, *Salix*, *Populus*, *Rubus*, 1177 m, 15.07.2010.

8. Ihlara Valley, between Belisırma and Yaprahisar village, 38° 16.552'N 034° 16.989'E, *Populus*, *Eleagnus*, *Verbascum*, *Salix*, 1175 m, 15.07.2010.
9. Ihlara Valley, between Belisırma and Yaprahisar village, 38° 17.008'N 034° 16.691'E, *Salix*, *Populus*, *Rubus*, *Celtis*, 1157 m, 15.07.2010.
10. Ihlara Valley, between Belisırma village and Selime town arası, Yaprahisar Köyü mevkii, Melendiz Çayı kenarları, 38° 17.263'N 034° 16.474'E, *Populus*, *Salix*, *Juglans*, *Rubus*, *Crataegus*, *Geranium*, 1165 m, 16.07.2010.
11. Ihlara Valley, between Yaprahisar village and Selime town, Türbe district, 38° 17.986'N 034° 15.619'E, *Salix*, *Tamarix*, *Rubus*, *Cyperus*, *Xeranthemum*, *Mentha*, 1139 m, 16.07.2010.

2.2. Floristic List

The floristic list is arranged according to the system proposed by Goffinet and Shaw (2009). In addition, the new records for B8 square were determined by reviewing the related literature (Uyar and Çetin, 2004; Kürschner and Erdağ, 2005; Ursavaş et al., 2009; Can et al., 2013; Ros et al., 2013). For each taxon, only one collection number (i.e. ÖREN 145/10) was given in order to avoid repetition and the locality number was shortened as loc. in the floristic list. New addition for Ihlara valley was indicated with an asterisk (*) and for B8 square was indicated two asterisks (**).

Bryophyta

Bryopsida (Limpr.) Rothm.

Encalyptaceae Schimp.

**Encalypta vulgaris* Hedw. – Loc.: 2, on rocks, ÖREN 120/10.

Funariaceae Schwägr.

Funaria hygrometrica Hedw. – Loc.: 2, 3, 4, 8, 9, on rocks and soil, ÖREN 36/10.

Grimmiaceae Arn.

***Grimmia dissimulata* E.Maier – Loc.: 6, on rocks, ÖREN 134/10.

**Grimmia laevigata* (Brid.) Brid. – Loc.: 1, 4, 6, 8, on rocks, ÖREN 70/10.

Grimmia ovalis (Hedw.) Lindb. – Loc.: 1, 4, 8, on rocks, ÖREN 12/10.

Grimmia plagiopodia Hedw. – Loc.: 1, 10, on rocks, ÖREN 79/10.

Grimmia pulvinata (Hedw.) Sm. – Loc.: 3, 4, 7, 10, on rocks, soil and soil covered roots, ÖREN 37/10.

Ditrichaceae Limpricht

**Ceratodon purpureus* (Hedw.) Brid. – Loc.: 1, on soil, ÖREN 86/10.

Pottiaceae Schimp.

**Gymnostomum calcareum* Nees & Hornsch. – Loc.: 3, 4, 9, 10, on wet rocks near stream bed, ÖREN 26/10.

**Gymnostomum aeruginosum* Sm. – Loc.: 2, 9, on wet rocks near stream bed, ÖREN 103/10.

***Gyroweisia tenuis* (Hedw.) Schimp. – Loc.: 10, on rocks, ÖREN 129/10.

**Cinclidotus riparius* (Host ex Brid.) Arn. – Loc.: 6, on submerged rocks, ÖREN 11/10.

***Didymodon insulanus* (De Not.) M.O.Hill – Loc.: 3, 10, on rocks, ÖREN 99/10.

***Didymodon luridus* Hornsch. – Loc.: 2, 3, on rocks, ÖREN 67/10.

***Didymodon nicholsonii* Culm. – Loc.: 6, on rocks, ÖREN 136/10.

***Didymodon tophaceus* (Brid.) Lisa – Loc.: 3, on soil, ÖREN 121/10.

**Didymodon vinealis* (Brid.) R.H.Zander – Loc.: 2, 3, 6, 7, on rocks, ÖREN 03/10.

**Phascum cuspidatum* Hedw. var. *piliferum* (Hedw.) Hook. & Taylor – Loc.: 1, on soil covered rocks, ÖREN 45/10.

**Syntrichia ruralis* (Hedw.) F.Weber & D.Mohr (*Tortula ruralis* (Hedw.) P.Gaertn., B.Mey. & Scherb.) – Loc.: 1, 3, 7, on rocks and soil covered roots, ÖREN 64/10.

Syntrichia ruralis (Hedw.) F.Weber & D.Mohr var. *ruraliformis* (Besch.) Delogne (*S. ruraliformis* (Besch.) Cardot) – Loc.: 7, on soil covered *Salix* roots, ÖREN 156/10.

**Syntrichia virescens* (De Not.) Ochyra – Loc.: 2, 7, on *Salix* barks, ÖREN 15/10.

**Tortula brevissima* Schiffn. – Loc.: 9, on rocks, ÖREN 23/10.

**Tortula inermis* (Brid.) Mont. – Loc.: 1, on soil, ÖREN 122/10.

***Tortula muralis* Hedw. *aestiva* Brid. ex Hedw. – Loc.: 1, 3, on rocks, ÖREN 51/10.

Tortula muralis Hedw. var. *muralis* – Loc.: 2, 3, 11, ÖREN 140/10.

***Tortula muralis* Hedw. subsp. *obtusifolia* (Schwägr.) Culm. (Syn: *Tortula obtusifolia* Schwägr.) – Loc.: 2, 3, 4, on rocks at stream slope, ÖREN 27/10.

Tortula subulata Hedw. – Loc.: 1, on soil covered rocks, ÖREN 80/10.

Meesiaceae Schimp.

***Leptobryum pyriforme* (Hedw.) Wilson – Loc.: 9, on rocks near stream bed, ÖREN 03/10.

Orthotrichaceae Arn.

***Orthotrichum affine* Schrad. ex Brid. – Loc.: 3, 7, on *Salix* bark, ÖREN 91/10.

**Orthotrichum anomalum* Hedw. – Loc.: 4, on rocks, ÖREN 34/10.

Orthotrichum cupulatum Hoffm. ex Brid. – Loc.: 3, 10, on rocks, ÖREN 02/10.

**Orthotrichum diaphanum* Schrad. ex Brid. – Loc.: 7, on *Salix* bark, ÖREN 38/10.

**Orthotrichum pumilum* Sw. ex anon. – Loc.: 3, 7, on *Salix* bark and logs, ÖREN 75/10.

Orthotrichum rupestre Schleich. ex Schwägr. – Loc.: 4, 7, on rocks and *Salix* barks, ÖREN 69/10.

***Orthotrichum tenellum* Bruch ex Brid. – Loc.: 2, on *Salix* barks, ÖREN 44/10.

Bartramiaceae Schwagr.

***Philonotis capillaris* Lindb. . – Loc.: 3, on soil covered rocks near stream bed, ÖREN 116/10.

Bryaceae Schwägr.

**Bryum argenteum* Hedw. – Loc.: 2, 5, 6, on soil covered rocks, ÖREN 52/10.

**Bryum dichotomum* Hedw. (*B. balticum* Nyholm & Hedenäs, *B. barnesii* J.B.Wood ex Schimp., *B. bicolor* Dicks., *B. dunense* A.J.E.Sm. & H.Whitehouse, *B. excurrens* Lindb., *B. versicolor* A.Braun ex Bruch & Schimp.) – Loc.: 2, 6, on rocks, ÖREN 41/10.

***Ptychostomum archangelicum* (Bruch & Schimp.) J.R.Spence (*Bryum archangelicum* Bruch & Schimp., *B. amblyodon* Mü ll.Hal., *B. curvatum* Kaurin & Arnell, *B. imbricatum* auct. non? (Schwägr.) Bruch & Schimp., *B. inclinatum* (Brid.) Turton, hom. illeg. non (Hedw.) Dicks., *B. stenotrichum* Müll.Hal.) . – Loc.: 8, on soils, ÖREN 21/10.

***Ptychostomum compactum* Hornsch. (Syn: *Bryum algovicum* Sendtn.) – Loc.: 8, on soils, ÖREN 130/10.

Ptychostomum imbricatum (Müll. Hal.) Holyoak & N. Pedersen (Syn: *Bryum caespiticium* Hedw.) – Loc.: 8, on soils, ÖREN 146/10.

***Ptychostomum moravicum* (Podp.) Ros & Mazimpaka (Syn: *Bryum moravicum* Podp.) – Loc.: 10, on soils, ÖREN 143/10.

Mielichhoferiaceae Schimp.

***Pohlia wahlenbergii* (F.Weber & D.Mohr) A.L.Andrews var. *wahlenbergii* – Loc.: 3, 10, on soils and soil covered rocks near stream bed, ÖREN 138/10.

***Pohlia wahlenbergii* (F.Weber & D.Mohr) A.L.Andrews var. *calcareae* (Warnst.) E.F.Warb. – Loc.: 4, 9, on soil covered rocks near stream bed, ÖREN 112/10.

Fontinalaceae Schimp.

***Fontinalis antipyretica* Hedw. – Loc.: on submerged rock at waterfall, ÖREN 13/10.

Amblystegiaceae Kindb.

**Conardia compacta* (Drumm. ex Mü ll.Hal.) H.Rob. – Loc.: 2, 4, 8, 10, on soil and rocks, near stream bed, ÖREN 78/10.

**Cratoneuron filicinum* (Hedw.) Spruce – Loc.: 2, 4, 10, on rocks and rotten logs near stream bed, ÖREN 55/10.

***Hygroamblystegium varium* (Hedw.) Mönk. var. *humile* (P.Beauv.) Vanderp. & Hedenäs (*Amblystegium humile* (P. Beauv.) Lindb.) – Loc.: 10, on soil near stream bed, ÖREN 56/10.

**Leptodictyum riparium* (Hedw.) Warnst. – Loc.: 9, on submerged rocks, ÖREN 54/10.

Brachytheciaceae Schimp.

**Platyhypnidium riparioides* (Hedw.) Dixon – Loc.: 2, 3, 5, 6, 9, on rocks near stream bed and submerged rocks, ÖREN 62/10.

***Rhynchostegium megapolitanum* (Blandow ex F.Weber & D.Mohr) Schimp. – Loc.: 4, on rocks near stream bed, ÖREN 42/10.

***Rhynchostegiella curviseta* (Brid.) Lindb. – Loc.: 4, on rocks near stream bed, ÖREN 126/10.

***Oxyrrhynchium speciosum* (Brid.) Warnst. – Loc.: 2, 10, on rocks and soil, ÖREN 76/10.

***Brachythecium albicans* (Hedw.) Schimp. – Loc.: 4, on rocks at stream slope, ÖREN 39/10.

**Brachythecium rivulare* Schimp. – Loc.: 2, 3, 4, 7, on rocks and soil near stream bed, ÖREN 93/10.

**Homalothecium aureum* (Spruce) H.Rob. – Loc.: 3, on rocks at stream slope, ÖREN 92/10.

**Homalothecium lutescens* (Hedw.) H.Rob. – Loc.: 3, on rocks at stream slope, ÖREN 43/10.

Homalothecium philippeanum (Spruce) Schimp. – Loc.: 3, on rocks, ÖREN 35/10.

Homalothecium sericeum (Hedw.) Schimp. – Loc.: 3, on rocks, ÖREN 66/10.

Leucodontaceae Schimp.

Leucodon sciuroides (Hedw.) Schwägr. – Loc.: 4, on rocks, ÖREN 110/10.

3. Results and discussion

Sixty taxa belonging to 14 families and 29 genera were identified with the examination of 156 specimens collected from eleven localities, July in 2010. Of these, 47 taxa are new to the area, 23 taxa are new for B8 square. So, the number of mosses reported from Ihlara Valley reached to 67 with former records. During field trips, the liverwort *Marchantia polymorpha* L. was found in the study area. Thus the floristic list is formed for only mosses.

Some mosses reported from the Ihlara valley by Yayıntaş ve Erdağ (1995), but they could not be recorded in this paper. These species are, *Rhynchostegium alopecuroides* (Brid.) A.J.E.Sm., *Leucodon immersus* Lindb., *Amblystegium serpens* (Hedw.) Schimp., *Didymodon fallax* (Hedw.) R.H.Zander (*Barbula fallax* Hedw.), *Tortula schimperii* M.J. Cano, O. Werner & J. Guerra (*T. subulata* var. *angustata* (Schimp.) Kindb.), *Grimmia trichophylla*

Grev. and *G. pulvinata* var. *africana* (Hedw.) Wilson. Of these *Rhynchostegium alopecuroides* (Brid.) A.J.E.Sm. (*Rhynchostegium lusitanicum* (Schimp.) A.J.E.Sm.) was reported from the area as a new moss record for Turkey.

The richness of families in terms of species in the research area for mosses is as follows: Pottiaceae (19), Brachytheciaceae (10), Orthotrichaceae (7), Bryaceae (6), Grimmiaceae (5), Amblystegiaceae (4), Mielichhoferiaceae (2) and the others include only one taxa (Encalyptaceae, Funariaceae, Ditrichaceae, Meesiaceae, Bartramiaceae, Fontinalaceae, Leucodontaceae). These results are not surprise for bryofloristical studies in Turkey and Mediterranean area. Because, the first two families including the most species are Pottiaceae and Brachytheciaceae in these area. Furthermore, these families have got many members adapted to different ecological habitats (Ören et al., 2012; Batan and Özdemir, 2013; Can et al., 2013 etc.).

The most species-rich genera are *Orthotrichum* (7), *Tortula* (6), *Grimmia* (5), *Didymodon* (5), *Ptychostomum* (4), *Homalothecium* (4), *Syntrichia* (2), *Gymnostomum* (2), *Bryum* (2), *Pohlia* (2) and *Brachythecium* (2). The others have only one taxa. The genera including mostly epiphytic and saxicolous taxa are predominant in research area.

Two interesting taxa (*Conardia compacta* (Drumm. ex Müll.Hal.) H.Rob. and *Tortula muralis* Hedw. subsp. *obtusifolia* (Schwägr.) Culm.) were also recorded from research area.

Conardia compacta (Drumm. ex Müll.Hal.) H.Rob. newly reported from Uzandıdere-Niğde and Zor Mountain-Iğdır widely spreads on rocks and soil near stream bed in the research area. This species very resembles *Ablystegium* species, especially *A.serpens*. But, It's leaves very denticulate at base and costa reaching the leaf tip. It has sometimes gemma bearing leaves on leaf tips (common at us specimens). This character makes it easy to identification (Kırmacı et al., 2012; Özdemir et al. 2012).

Tortula muralis Hedw. subsp. *obtusifolia* (Schwägr.) Culm. found in study area is other interesting taxon. It's recurved leaf margins have a border not occurring mostly other areas. This taxon resembles the *T. lingulata* with this characters, but ploidy level and sporophytic characters separate these two taxa (Ignatova and Ignatov, 2009; Košnar and Kučera, 2010).

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