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## The Liverwort Flora of the Boraboy Lake (Amasya)

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### Abstract

Boraboy Lake, located in Amasya province, lies within square A3, according to the Henderson grid system. As a result of studies done around the lake in 2024, researchers found 17 liverwort species from 11 different families in the division Marchantiophyta among the 237 samples they collected. Fourteen species represent new records for the Amasya province, and *Plagiochasma rupestre* (J.R.Forst. & G.Forst.) Steph. is a new record for square A3. Additionally, *Jungermannia atrovirens* Dumort., *Mesoptychia turbinata* (Raddi) L. Söderstr. & Váňa, *Bazzania trilobata* (L.) Gray, and *Chiloscyphus polyanthos* (L.) Corda were recorded from square A3 for the second time. Of the specimens, three are thalloid and fourteen are leafy in form.

**Keywords:** Marchantiophyta, Liverwort, Amasya, Boraboy Lake, Flora

### Boraboy Gölü (Amasya) Ciğerotu Florası

#### Öz

Amasya ilinde yer alan Boraboy Gölü, Henderson kareleme sistemine göre A3 karesi içerisinde bulunmaktadır. 2024 yılında göl çevresinde yürütülen arazi çalışmaları sonucunda, Marchantiophyta şubesine ait 11 farklı familyadan toplam 17 ciğerotu (liverwort) türü, toplanan 237 örnek arasında teşhis edilmiştir. Bu türlerden 14'ü Amasya ili için yeni kayıttır. Ayrıca *Plagiochasma rupestre* (J.R.Forst. & G.Forst.) Steph. türü A3 karesi için yeni bir kayıttır. *Jungermannia atrovirens* Dumort., *Mesoptychia turbinata* (Raddi) L.Söderstr. & Váňa, *Bazzania trilobata* (L.) Gray ve *Chiloscyphus polyanthos* (L.) Corda türleri ise A3 karesinden ikinci kez kaydedilmiştir. Örneklerin üçü tallus (yassı gövdeli), on dördü ise yapraklı formdadır.

**Anahtar kelimeler:** Marchantiophyta, Ciğerotları, Amasya, Boraboy Gölü, Flora

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## 1. Introduction

The study area, Boraboy Lake, is located in the Amasya province within the Central Black Sea Region of Turkey. The lake is situated at an elevation of 800 meters, approximately 15 km from the Taşova district. Formed as a landslide-dammed lake—a common type in the Black Sea Region—it has a maximum depth of about 20 meters. Due to its clear waters, it is also locally known as “Aynalı Göl” (Mirror Lake) (Doğu et al., 1994). Due to its geographical features, the area has a harsher climate compared to other provinces in the Black Sea Region. Its proximity to the Anatolian Diagonal and its location at the intersection of the Irano-Turanian and Euro-Siberian phytogeographical regions classify it within the so-called Xeric-Euxinic belt. As a result, the region is remarkably rich in terms of floristic diversity. It is referred to in this way because it harbors both elements of the Central Anatolian steppe and Euxinic forest/shrub vegetation (Cansaran et al., 2010). The forest vegetation consists of mixed forests dominated by species such as *Pinus brutia* L. (Turkish Pine), *Pinus sylvestris* L. (Scots Pine), *Fagus orientalis* Lipsky (Oriental Beech), *Acer platanoides* L. (Norway Maple), *Carpinus betulus* L. (European Hornbeam), *Pyrus communis* L. (Wild Pear), *Quercus pubescens* (Downy Oak), and *Quercus cerris* (Turkey Oak) (Alataş et al., 2017).

The study area is located within the square A3 according to Henderson's (1961) grid system (Figure 2). Photographs of the area are also provided at Figure 1. Liverworts, which are classified among non-vascular land plants, are represented by approximately 5,000 taxa worldwide. The species *Marchantia polymorpha* L. and, mentioned in Wettstein (1889) “Beiträge zur Flora des Orients” (“Contributions to the Flora of the East”), is the first recorded liverwort species for Turkey. Following this initial record, foreign researchers conducted botanical expeditions in various regions of Turkey and documented 132 species. Since the 1980s, field studies carried out by Turkish researchers have led to numerous investigations focusing on the division Hepaticae. The first liverwort species recorded by a Turkish researcher was *Pellia neesiana* (Gottsche) Limpr., reported by Gökler et al. (1984). To date, the number of liverwort species recorded in Turkey has reached 210 (Erdağ & Kürschner, 2024). The only previous liverwort study conducted at Boraboy Lake focused on epiphytic species around the lake (Alataş et al., 2017). The aim of our study is to conduct a detailed investigation and documentation of the liverwort flora in and around Boraboy Lake, located within square A3, which is part of Amasya province and known for its rich bryophyte diversity.



Figure-1 Boraboy Lake landscape photos

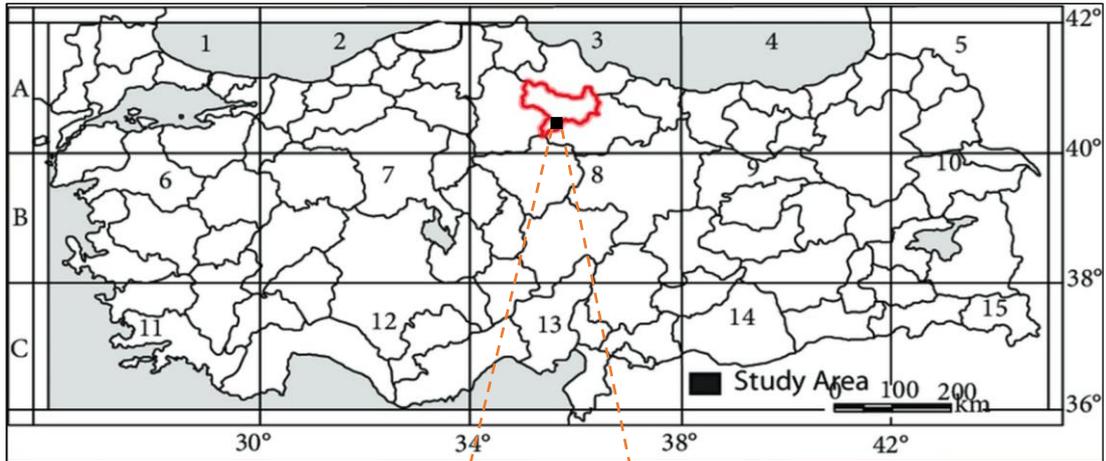


Figure-2 Location of Amasya province according to Henderson (1961) quadrature system



Figure-3 Map representation of sampling sites in the field study (© earth.google.com)

## 2. Material and Method

The specimens used in this study were collected from square A3 (Henderson, 1961) during a field expedition conducted in October 2024. GPS coordinates of the study area are also provided (Figure 2). Liverworts were collected in November, when environmental conditions are most favorable for their growth. Considering the importance of natural coloration in species identification, photographs were taken from multiple angles during fieldwork. Additionally, images reflecting the geological and sociological features of the area were also included. For each collected specimen, GPS coordinates, collection date, and altitude were recorded in the field notebook (Table 1). In order to preserve the structural integrity of the specimens, they were collected in sealed plastic bags and stored with ice packs during fields. For thalloid specimens, broad-surfaced scraping tools were used to facilitate

removal from the substrate, while fine-tipped forceps were employed to carefully detach leafy specimens from their epiphytic surfaces (Yücel et al., 2024). During the laboratory phase, priority was given to the identification of thalloid specimens in order to prevent potential structural degradation. Leafy specimens were dried using a drying oven and subsequently transferred into temporary storage envelopes. In order to determine the distribution of the specimens both globally and within Türkiye according to the Henderson Grid System (Henderson, 1961), as well as to identify diagnostic characteristics, fundamental European floras and various floristic publications were consulted (Watson, 1981; Smith, 1996; Paton, 1999; Atherton et al., 2010; Kürschner & Erdağ, 2020; Glime, 2009). The species list was organized according to the classification system proposed by Hodgetts et al. (2020).

Table 1. Taxa identification codes, GPS records and habitat characteristics

<u>HKA1</u>	GPS: 40°48'9.06"K/ 36° 9'12.87"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA2</u>	GPS: 40°48'10.81"K/ 36° 9'9.41"D - 40°48'9.99"K/ 36° 9'21.99"D <b>Habitat: Detected as epiphyte on tree trunks and dead bark.</b>
<u>HKA3</u>	GPS: 40°48'16.69"K/ 36° 9'22.97"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA4</u>	GPS: 40°48'10.03"K/ 36° 9'15.64"D <b>Habitat: Detected on calcimorphic soil.</b>
<u>HKA5</u>	GPS: 40°48'8.66"K/ 36° 9'19.84"D - 40°48'12.04"K/ 36° 9'26.76"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA6</u>	GPS: 40°48'10.03"K/ 36° 9'15.64"D <b>Habitat: Detected on wet rocky ground.</b>
<u>HKA7</u>	GPS: 40°48'10.25"K/ 36° 9'4.00"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA8</u>	GPS: 40°48'8.36"K/ 36° 9'17.39"D - 40°48'11.43"K/ 36° 9'24.71"D <b>Habitat: Detected as epiphyte on tree trunks and dead bark.</b>
<u>HKA9</u>	GPS: 40°48'9.63"K/ 36° 9'10.37"D <b>Habitat: Detected on siliceous rocky ground.</b>
<u>HKA10</u>	GPS: 40°48'9.67"K/ 36° 9'1.54"D - 40°48'8.11"K/ 36° 9'14.18"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA11</u>	GPS: 40°48'10.43"K/ 36° 9'7.18"D - 40°48'10.81"K/ 36° 9'9.41"D <b>Habitat: Detected as epiphyte on tree trunks and dead bark.</b>
<u>HKA12</u>	GPS: 40°48'10.81"K/ 36° 9'9.41"D - 40°48'11.43"K/ 36° 9'24.71"D <b>Habitat: Detected as epiphyte on tree trunk and dead bark.</b>
<u>HKA13</u>	GPS: 40°48'8.11"K/ 36° 9'14.18"D - 40°48'9.99"K/ 36° 9'21.99"D <b>Habitat: Detected as epiphyte on dead bark and dead leaves.</b>
<u>HKA14</u>	GPS: 40°48'17.99"K/ 36° 9'17.44"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA15</u>	GPS: 40°48'17.16"K/ 36° 9'12.55"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA16</u>	GPS: 40°48'8.36"K/ 36° 9'17.39"D <b>Habitat: Detected on the floor of deciduous forests.</b>
<u>HKA17</u>	GPS: 40°48'17.00"K/ 36° 9'7.49"D <b>Habitat: Detected in a rocky grotto.</b>

### 3. Findings

[Single asterisk (\*): Second record from square A3]

[Double asterisk (\*\*): New record for square A3]

[Plus sign (+): New record for Amasya province]

#### MARCHANTIOPHYTA

#### JUNGERMANNIOPSISIDA

##### Jungermanniales H.Klinggr.

Scapaniaceae Mig.

- *Scapania irrigua* (Nees) Nees + (HKA1)
- *Scapania undulata* (L.) Dumort. + (HKA2)

Jungermanniaceae Rchb.

- *Jungermannia atrovirens* Dumort. \*/+ (HKA3)
- *Mesoptychia turbinata* (Raddi) L.Söderstr. & Váňa \*/+ (HKA4)

Lepidoziaceae Limpr.

- *Bazzania trilobata* (L.) Gray \*/+ (HKA5)

Lophocoleaceae Vanden Berghen

- *Chiloscyphus polyanthos* (L.) Corda \*/+ (HKA6)

Plagiochilaceae Müll.Frib

- *Plagiochila asplenioides* (L.) Dumort. + (HKA7)

#### Porellales Schljakov

Frullaniaceae Lorch

- *Frullania dilatata* (L.) Dumort. (HKA8)
- *Frullania tamarisci* (L.) Dumort. + (HKA9)

Porellaceae Cavers

- *Porella cordaeana* (Huebener) Moore + (HKA10)
- *Porella platyphylla* (L.) Pfeiff. (HKA11)

Radulaceae Müll.Frib.

- *Radula complanata* (L.) Dumort. (HKA12)
- *Radula lindenbergiana* Gottsche ex C.Hartm. + (HKA13)

#### Ptilidiales Schljakov

Ptilidiaceae H.Klinggr.

- *Ptilidium pulcherrimum* (Weber) Vain. + (HKA14)

#### Metzgeriales Chalaud

Metzgeriaceae H.Klinggr.

- *Metzgeria conjugata* Lindb. + (HKA15)
- *Metzgeria furcata* (L.) Corda + (HKA16)

**MARCHANTIOPSIDA CRONQUIST,  
TAKHT. & W.ZIMM.  
Marchantiales Limpr.**

Aytoniaceae Cavers

*Plagiochasma rupestre* (J.R.Forst. & G.Forst.)

Steph. \*\*/+ (HKA17)

**4. Discussion and Conclusion**

As a result of the identification of specimens collected during the fieldwork, 17 liverwort species belonging to 11 families within the division Marchantiophyta were identified. Among these, 3 species exhibit thalloid form, while 14 species display leafy morphology.

The species *Plagiochasma rupestre* is reported here as a new record for square A3. The species *Jungermannia atrovirens*, *Mesoptychia turbinata*, *Bazzania trilobata* and *Chiloscyphus polyanthos* have been recorded for the second time within square A3. The following species are recorded for the first time from Amasya province: *Scapania irrigua*, *Scapania undulata*, *Jungermannia atrovirens*, *Mesoptychia turbinata*, *Bazzania trilobata*, *Chiloscyphus polyanthos*, *Plagiochila asplenoides*, *Frullania tamarisci*, *Porella cordaeana*, *Radula lindenbergiana*, *Ptilidium pulcherrimum*, *Metzgeria conjugata*, *Metzgeria furcata* and *Plagiochasma rupestre*.

Square A3 is located within the Black Sea Region and encompasses highly suitable habitat conditions for bryophytes. Compared to coastal provinces, Amasya has a relatively drier climate, which has resulted in fewer cryptogamic studies being conducted in the area. Our study has revealed that Amasya province possesses a remarkably rich diversity of liverworts. It is anticipated that future liverwort research in the province will contribute new data and insights to the field.

**Declaration**

**Author Contributions:** Conceptualization, KMY, İG; Design, KMY; Supervision and consultancy, İG; Resources, KMY, HT; Materials, KMY, HT; Data collection and/or processing, KMY, HT, İG; Analysis and/or interpretation, KMY, İG; Literature review, KMY, HT; Writing – original draft, KMY, HT, İG; Critical review, İG.

**Conflict of Interest:** The authors declare that there are no competing interests related to the content of this manuscript.

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**Ethical Approval:** This study does not involve human or animal subjects and therefore does not require ethical approval.

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