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## Liverworts (*Marchantiopsida*) of the Dilek Peninsula National Park

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**Abstract:** In this study, the distribution of liverworts in the Dilek Peninsula National Park was investigated. The study area is near Kuşadası in Aydın and within the C11 square of Turkey. Twenty-six species were determined from this plant group belonging to the class *Marchantiopsida* (*Hepaticae*) of the division *Bryophyta*. These species are collected into 18 families. Of these, *Pellia neesiana* (Gott.) Limpr., *Gymnocolea acutiloba* (Schiffn.) K.Müll., *Jungermannia hyalina* Lyell, *Calypogeia sphagnicola* (H.Arn. & J.Perss.) Warnst. & Loeske, *Radula lindenberiana* Gott & Hartm. and *Lejeunea lamacerina* (Steph.) Schiffn. are reported for the first time from the C11 square of Turkey.

**Key Words:** Liverworts, *Marchantiopsida*, Dilek Peninsula National Park

### Dilek Yarımadası Milli Parkı Ciğerotları (*Marchantiopsida*)

**Özet:** Bu çalışmada Dilek Yarımadası Milli Park'ında yayılış gösteren ciğerotları araştırılmıştır. Çalışma alanı Aydın İli, Kuşadası İlçesi ve C11 karesi sınırları içerisinde yer almaktadır. Çalışma sonunda, *Bryophyta* divizyonuna ait *Marchantiopsida* (*Hepaticae*) sınıfında yer alan 26 tür tayin edilmiştir. Bu türler 18 familyada toplanmıştır. Bunlardan *Pellia neesiana* (Gott.) Limpr., *Gymnocolea acutiloba* (Schiffn.) K. Müll., *Jungermannia hyalina* Lyell, *Calypogeia sphagnicola* (H. Arn. & J. Perss.) Warnst. & Loeske, *Radula lindenberiana* Gott & Hartm. ve *Lejeunea lamacerina* (Steph.) Schiffn. türleri C11 karesinden ilk defa rapor edilmektedirler.

**Anahtar Sözcükler:** Ciğerotları, *Marchantiopsida*, Dilek Yarımadası Milli Parkı

### Introduction

The Dilek Peninsula National Park is located in the western Anatolian part of Turkey and is surrounded by Kuşadası to the north-east, Söke to the east and the Menderes Delta to the south-east (Figure 1). The study area is in the C11 grid square of the system adopted by Henderson (1961).

The peninsula has Mediterranean climate and vegetation characteristics. *Pinus brutia* Ten., *P. nigra* (Lamb) Holmboe., *Arbutus andrachne* L., *Fraxinus ornus* L., *Pistacia lentiscus* L., *Ceratonia siliqua* L., *Platanus orientalis* L., *Quercus ilex* L., *Q. coccifera* L., *Q. pubescens* Willd., *Olea europaea* L. and *Populus alba* L. are the most common species seen in the national park. In the north of the park we can also see unusual plants. In particular, the bay tree (laurel) and chestnut are the most extreme examples of these rare plants for Mediterranean macchie.

This area was declared a national park on 19.05.1966 because of its special features. The park covers an area of 10,985 ha. Investigators have usually studied the flowering plants in the park. Our main aim in this study was to determine the hepatic flora of the national park and to provide more data about the liverwort flora of Turkey.

### Materials and Methods

The specimens of hepatics were collected during excursions carried out in 1998 and 2000, when a survey of localities with ecological conditions suitable for the growth of liverworts was undertaken.

Determinations were carried out using different previously reported lists as well as flora books (Smith, 1991; Frey & Kürschner, 1991; Kürschner, 2001; Çetin, 1988; Gökler & Öztürk, 1991) and some other relevant

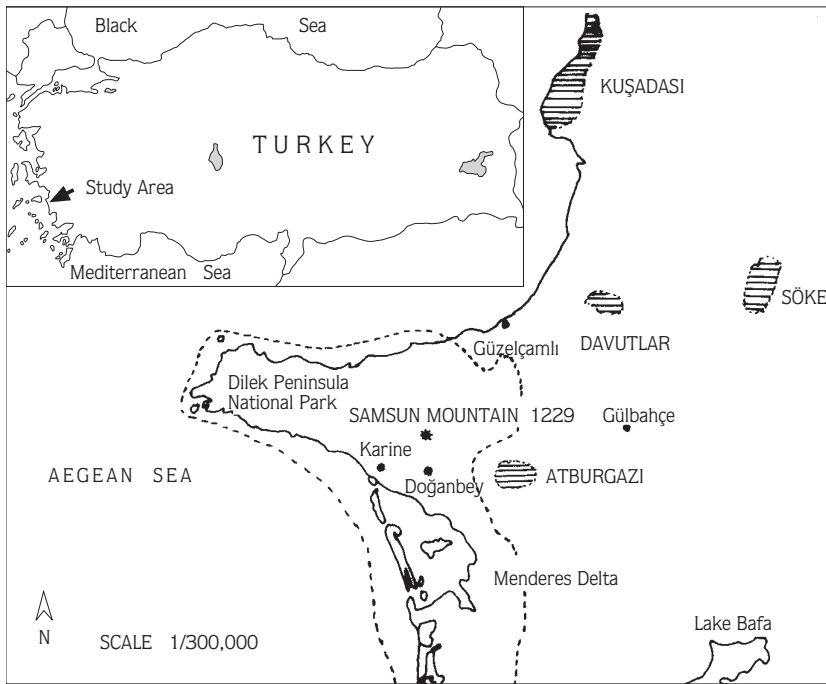


Figure 1. Map showing the geographical position of the Dilek Peninsula National Park.

literature (Öztürk & Gökler, 1988; Gökler, 1992; Gökler, 1993a; 1993b; Gökler & Aysel, 1998; Gökler & Özenoğlu, 1999). The plant list is shown according to the system described by Grolle (1983). All the specimens were deposited in the herbarium of the Department of Biology, Buca Faculty of Education, Dokuz Eylül University. The species new for grid square C11 are marked with an asterisk.

## Results and Conclusion

### BRYOPHYTA

### MARCHANTIOPSIDA (HEPATICA)

### MARCHANTIALES

### Targioniaceae

#### 1. *Targionia hypophylla* L.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, West, 620 m. 01. 11. 1998, Özenoğlu C11/42.

Turkey (A1, A2, B6, B7, C11, C12, C13). A common species in the Mediterranean region. S. Europe, Africa, Australia and America.

#### 2. *Targionia lorbeeriana* K.Müll.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, entry of Canyon, on soil bank along the road, 50 m, 29. 10. 1998, Özenoğlu C11/37.

Turkey (B6, C11) and S. Europe.

### Aytoniaceae

#### 3. *Plagiochasma rupestre* (R. & G.Forst.) Steph.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, 380 m, 29. 10. 1998, Özenoğlu C11/39.

Turkey (A2, B6, B7, C11, C12). S. Europe and Mediterranean countries.

#### 4. *Reboulia hemisphaerica* (L.) Raddi

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, 140 m, 01. 11. 1998, Özenoğlu C11/40.

Turkey (A2, A4, B6, B7, B8, C11, C12, C13). More or less cosmopolitan species except for arctic and subarctic regions.

### Conocephalaceae

#### 5. *Conocephalum conicum* (L.) Underw.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, entry of Canyon, in the streambed, 60 m, 29. 10. 1998, Özenoğlu C11/50.

Turkey (A1, A2, A3, A4, A5, B6, B8, C11, C12). Europe, Asia and N. America.

### Lunulariaceae

#### 6. *Lunularia cruciata* (L.) Lindb.

C11. Aydın: Kuşadası, Dilek Peninsula National Park,

Canyon, on stream banks, 60 m, 22. 05. 1998, Özenoğlu C11/32.

Turkey (A1, A2, A3, A4, A5, B6, B9, C11, C12). Europe, Mediterranean region, Africa, America and Australia.

Corsiniaceae

**7. Corsinia coriandrina** (Spreng.) Lindb.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Samsun Mountain, on soil between flat rocks, 520 m, 30. 10. 1998, Özenoğlu C11/74.

Turkey (B6, C11, C12). A common species in the Mediterranean region. Europe, Africa, America and Japan.

Oxymitriaceae

**8. Oxymitra paleacea** Bisch. ex Lindenb.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Samsun Mountain, around Şarлак, under rocks, on soil, South, 500 m, 30. 10. 1998, Özenoğlu C11/72.

Turkey (B6, C11, C12). A common species in N. Hemisphere and S. America.

Ricciaceae

**9. Riccia crozalsii** Levier

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Samsun Mountain, around Şarлак, under rocks, on soil, South, 500 m, 30. 10. 1998, Özenoğlu C11/73.

Turkey (C11). Atlantic Europe, Mediterranean region, S. Africa, Australia and New Zealand.

**10. Riccia sorocarpa** Bisch.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, entry of canyon, 1-1.5 km along the road, on soil banks, 60 m, 08. 11. 2000, Özenoğlu C11/148.

Turkey (B6,C11,C12). Mediterranean region, Europe, Africa, N. America and Australia.

METZGERIALES

Pelliaceae

**11. Pellia endiviifolia** (Dicks.) Dum.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on calcareous soil and wet rocks in the stream, 200 m, 30. 10. 1998, Özenoğlu C11/43, C11/45.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, end of the canyon, on soil around the spring, 770 m, 01. 11. 1998, Özenoğlu C11/66.

Turkey (A1, A2, A3, A4, A5, B6, B7, B9, C11, C12). Europe, Asia, Mediterranean region and N. America.

**\*12. Pellia neesiana** (Gott.) Limpr.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on wet rocks in the stream, 08. 11. 2000, Özenoğlu C11/150.

Turkey (A4,B6). Europe, Siberia, Japan and N. America.

Codoniaceae

**13. Fossombronia angulosa** (Dicks.) Raddi

C11. Aydın: Kuşadası, Dilek Peninsula National Park, entry of canyon, on the oak (*Quercus* sp.) bark covered with soil, 100 m, 29. 11. 1998, Özenoğlu C11/61.

Turkey (A2, A4, B6, C11). Mediterranean region, Africa and America.

**14. Fossombronia pusilla** (L.) Nees

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on the soil between tree roots, 120 m, 01. 11. 1998, Özenoğlu C11/63.

Turkey (A1, A2, A3, A4, B6, C11, C12). Europe, Mediterranean region, Africa and N. America.

JUNGERMANNIALES

Lophoziaaceae

**15. Lophozia turbinata** (Raddi) Steph.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on rocks in the stream, 08. 11. 2000, Özenoğlu C11/152.

Turkey (B6, C11, C12). A common species in Mediterranean region. Europe and N. America.

**\*16. Gymnocolea acutiloba** (Schiffn.) K.Müll.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on rocks with *Pellia endiviifolia* in the stream, 270 m, 30. 10. 1998, Özenoğlu C11/51, C11/151.

Turkey (A4). Europe, Asia and N. America.

Jungermanniaceae

**17. Jungermannia gracillima** Sm.

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, cavities of rocks, North-east, 500 m, 29. 10. 1998, Özenoğlu C11/71.

Turkey (A2, A4, B6). Europe, N. Africa, Asia and N. America.

**\*18. *Jungermannia hyalina* Lyell**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on soil banks in the stream, 190 m, 01. 11. 1998, Özenoğlu C11/75, C11/76.

Turkey (A1, A4). A common species in Europe. N. Africa, Asia and N. America.

Arnellaceae

**19. *Southbya nigrella* (De Not.) Henriques**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on steep rocks along the streambed, 08. 11. 2000, Özenoğlu C11/161.

Turkey (B6, C11, C12). African, Asian and European Mediterranean coasts and islands.

**20. *Southbya tophaceae* (Spruce) Spruce**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on soil banks in the streambed, 190 m, 08. 11. 2000, Özenoğlu C11/70, C11/156.

Turkey (B6, C11, C12). A common species in Mediterranean countries and islands, Asia and Africa.

Cephaloziellaceae

**21. *Cephaloziella hampeana* (Nees) Schiffn.**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on soil bank in the streambed, 190 m, 01. 11. 1998, Özenoğlu C11/69, C11/77.

Turkey (C11). Europe, Asia and N. America.

Calypogeiaceae

**\*22. *Calypogeia sphagnicola* (H.Arn. & J.Perss.) Warnst. & Loeske**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on wet mosses near roadside, 08. 11. 2000, Özenoğlu C11/157.

Turkey (A1). Europe, N. America, Greenland and New Zealand.

Radulaceae

**\*23. *Radula lindenberiana* Gott. & Hartm.**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on the rocks, 300 m, 01. 11. 1998, Özenoğlu C11/48, C11/53.

Turkey (A1, A2, A3, A4, B6). Europe and Africa.

Porellaceae

**24. *Porella platyphylla* (L.) Pfeiff.**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on rocks and on tree barks near the stream, 280 and 300 m, 01. 11. 1998, Özenoğlu C11/55, C11/60.

Turkey (A1, A2, A3, A4, A5, B6, B7, C11, C12, C13). Europe, Mediterranean countries, Asia, Africa and America.

Frullaniaceae

**25. *Frullania dilatata* (L.) Dum.**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on tree barks and on rocks near the stream, 90 m and 300 m, 01. 11. 1998, Özenoğlu C11/47, C11/58.

Turkey (A1, A2, A3, A4, A5, B6, C11, C12). Mediterranean countries, Europe, Asia.

Lejeuneaceae

**\*26. *Lejeunea lamacerina* (Steph.) Schiffn.**

C11. Aydın: Kuşadası, Dilek Peninsula National Park, Canyon, on straight rocks and on tree roots along the stream, 190 m and 220 m, 29. 10. 1998 and 08. 11. 2000, Özenoğlu C11/54, C11/154.

Turkey (A1, A2, A3, A4, B6). Europe.

Twenty-six species of hepatics belonging to 18 families of *Marchantiopsida* (*Hepaticae*) were collected in the present investigation. Out of these, *Pellia neesiana*, *Gymnocolea acutiloba*, *Jungermannia hyalina*, *Calypogeia sphagnicola*, *Radula lindenberiana* and *Lejeunea lamacerina* are recorded for the first time from the C11 grid square in Turkey.

Most species were collected from near the stream substrata, whereas some species were found on thin soils covering rock or rock crevices in the canyon. *T. lorbeeriana* is distinguished from *T. hypophylla* on basis of various cell dimensions and its characteristic smell. *Plagiochasma rupestre* is xerotropical and belongs to the large *Marchantiales*, colonising rock crevices. Thallus of *Conocephalum conicum* 6-12 mm wide, up to 10-15 cm long and pores visible to the naked eye. Lunar-shaped gemma cups for *Lunularia cruciata* is the main distinctive character that can be easily observed by a lens in the field. Gametophytes of *Corsinia coriandrina* have air chambers with simple pores and bear sex organs in a linear series of receptacles which lie somewhat removed from one

another along the dorsal surface. The sporophytes, which lie in depressions on the dorsal surface, are differentiated into capsule and foot. Although at one time *Oxymitra paleacea* was included in the *Ricciaceae*, a separate family, *Oxymitraceae*, is now recognised. Morphologically *O. paleacea* is distinguished by the conspicuous, conical or triangular-pyramidal involucre surrounding each archegonium, by the presence of bracts and by distinctive pores which appear stellate due to the greatly thickened walls radiating from them. *Riccia crozalsii* and *R. sorocarpa* differ from Marchantiales in having the sex organs borne in a sagittal strip extending the entire length of a thallus. The family is also the only one in which the sporophyte consists solely of a capsule. *Pellia neesiana* and *Pellia epiphylla* cannot be separated when sterile but the flap-like involucre of the latter species is very different in appearance from the shortly cylindrical toothed involucre of *P. neesiana* and can usually be found. *P. endiviifolia* differs in the narrower thallus lacking thickening bands in the cells, the production of repeatedly dichotomously branched, fragile shoots and in its occurrence in basic habitats. Generally, species of *Fossombronia* are easily recognisable in the field by their violet-purple rhizoids. *Lophozia turbinata* and *Gymnocolea acutiloba* are minute, leafy liverworts creeping through other bryophytes. Marginal cells of

*Jungermannia gracillima* are thicker-walled and 1.5-3 times as wide as the submarginal row, forming a distinct border. Perigynium of *J. hyalina* bear one pair of bracts and leaves with rhizoids at base. The leaves of *Southbya nigrella* are dark brown at the back and when dry the incurved leaves give the plant a dark brown to blackish appearance not found in *S. tophaceae*. *Cephaloziella hampeana* has very slender, green to brownish patches or scattered shoots with underleaves lacking on sterile stems. Leaves of *Calypogeia sphagnicola* are distant to contiguous, mostly widest at the base, apex acute to obtuse or bilobed. *Radula lindenberiana* forms green patches, mainly on wet rocks and the leaf margins frequently bear abundant gemmae. *Porella platyphylla* is a common species in sheltered tree boles, walls, rocks, soil and stones on banks. One of the remarkable leafy liverworts in the area on trees and rocks is *Frullania dilatata*. Its ventral lobe is helmet-shaped, wide mouthed and as wide as or wider than underleaves. *Lejeunea lamacerina* usually grows over other bryophytes on damp shaded rocks, especially where base-rich, occasionally on sheltered stream banks and tree trunks.

We believe that Turkish liverwort flora can be enriched only through detailed surveys of localities with ecological conditions suitable for the growth of hepatics.

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