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Investigations on the Flora of Hornworts (Anthocerotopsida) and Liverworts (Marchantiopsida) of Bafa Lake Natural Park (C11)

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Abstract: This study covers investigations on the hornworts and liverworts of Bafa Lake Natural Park, included in the C11th grid square. A total of 1 species belonging to a family of the class *Anthocerotopsida* and 26 species belonging to 15 families of the class *Marchantiopsida* of the division Bryophyta were collected and their habitat characteristics and taxonomical features were recorded. In addition, very rare collected species, as *Targionia lorbeeriana*, *Mannia androgyna*, *Oxymitra incrassata*, *Riccia gougetiana*, *Petalophyllum ralfsii* and *Gonylanthus ericetarum*, exist in this study.

Key words: Liverworts, hornworts, *Anthocerotopsida*, *Marchantiopsida*, Bafa Lake

INTRODUCTION

Hornworts and Liverworts are the members of classes *Anthocerotopsida* and *Marchantiopsida* (Hepaticae) of division Bryophyta, respectively. According to most recent references nearly 10,000 species of liverworts and hornworts occur in the world. Up to now, only 166 species were recorded in Turkey (Kürschner and Erdağ, 2005). However, this number does not reflect the real potential since Turkey possesses different climatic zones, diverse topographic features and rich vascular plants contents. It has been known that, a major part of taxonomic studies in Turkey were related with vascular plants meaning that cryptogrammic plants has been neglected owing to difficulty of studying and insufficiency of references.

A part of Liverworts Flora of Turkey became known with recent studies (Gökler, 1992, 1993a, b; Gökler and Öztürk, 1991; Kürschner, 2001; Özenoğlu and Gökler, 2001, 2002; Kürschner and Erdağ, 2005). However, native researchers believe that, recorded numbers of species does not reflect the real potential of our country.

There isn't a detailed investigation about liverworts flora of Bafa Lake Natural Park. Only a few liverworts species are recorded in some liverworts flora literatures (Crundwell and Nyholm, 1979; Gökler, 1992; 1993a; Gökler and Öztürk, 1986; Özenoğlu and Gökler, 2001) and a phytosociology study (Kürshner and Parolly, 1999) relating to Bafa Lake environment. Therefore, this study is the first investigation to concerned region.

We are of the opinion that, there are a lot of different liverworts species in the West Anatolia range because of included different ecological features.

The Bafa Lake Natural Park takes place the borders of Söke District of Aydın and Muğla Provinces in Aegean Region. The Bafa Lake is at the southeast of Great Menderes Delta. The Bafa Lake, which used to be a part of Aegean Sea, had turned to be a lake as result of geomorphologic development of Great Menderes Delta. The lake is one of the least spoiled watery areas at the shore in Turkey. The lake shelters the ecosystem characteristics of Great Menderes Delta. Because of that reason it provides a winter quarter and a place for reproduction for many bird species, which are under the danger of vanishing. There are 700 kinds of plankton in the lake and a variety of water plants. This causes many fish species to live in the lake. As the cultural and historical values of the Bafa Lake; Heraclia Antic City takes place within the borders of the lake, at the southwest foot of Beşparmak Mountains (1250 m.). In order to protect the historical and natural values of the area, at the date of 1994, 12281 hectares of it had been taken under the status of Natural Park. The maximum depth of the lake reaches to 25 m. The main water sources of the Bafa Lake are the water floods of Great Menders River and the underground waters coming from the mountains at the environment.

The region is under typical Mediterranean climatic influences. Mediterranean climate that is characterized by mild and rainy winters, warm and dry summers prevails in this region. The mean annual temperature changes between 14-20°C in the region. The mean January temperature varies between 5 and 10°C. The mean July temperature is over 25°C, the highest value attains 40°C. The mean annual precipitation is about 592 mm. The

relative humidity is over 60% during the summer period inthe region. Climatic soil type is reddish Mediterranean soil. Climatic vegetation of the region is red pine (*Pinus brutia* Ten.) forests. Maquis vegetation has developed as the result of the destruction of *Pinus brutia* forests. Olive and olive oil is mostly produced in the region. So in this area olive tree (*Olea europaea* L.) gardens are seen as an olive-tree forest. Also willow (*Salix* L. sp.), bulrush (*Typha* L. sp.) and tamarisk (*Tamarix* L. sp.) species are appearing especially in southwest region of lake (Atalay, 2002).

MATERIALS AND METHODS

The specimens of these plants were collected during the excursions carried out 1997 and 2006 years, when a survey of localities with ecological conditions suitable for the growth of liverworts and hornworts were undertaken. Coordinates of the collected area of plants are determined by Garmin e-trex Vista GPS. The map, which is drowned owing to, the locality coordinates are showing to Fig. 1. Black point is showing the localities of hornwords and liverworts in the map. A lot of plants collected every locality in general.

Determinations were carried out using different previously reported lists as well as flora book (Paton, 1999; Smith, 1991; Frey and Kürschner, 1991; Kürschner, 2001; Gökler, 1986; Gökler and Öztürk, 1986, 1991) and some other relevant lit erature (Gökler, 1992, 1993a, b; Gökler and Özenoğlu, 1999; Özenoğlu and Gökler, 2001, 2002; Kürshner and Parolly, 1999; Kürshner and Erdağ, 2005). The plant list is shown accordance with the system described by Grolle (1983). The study area is in the C11 grid square of the system adopted by Henderson (1961).

RESULTS AND DISCUSSION

Bryophyta
Anthocerotopsida
Anthoceratales
Anthocerotaceae

Phaeoceros laevis **(L.) Proskauer, 1951**

Muğla: Milas, Kapkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Fossombronia angulosa, F. pusilla* and *Gonglanthus ericetorum*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).

Muğla: Milas, Kapıkırı Village, a olive (*Olea* sp.) grove near village, on soil ground, with *Corsinia coriandrina*, *Riccia gougetiana*, *Riccia michelii* and *Fossombronia pusilla*. 60 m, 37°30'131" N-27°31'752" E, 21.02.2005 (C11/215).

Distribution: Turkey (A1, A4, B6, C11, C12), Europe, SW Asia and many Mediterranean Countries.

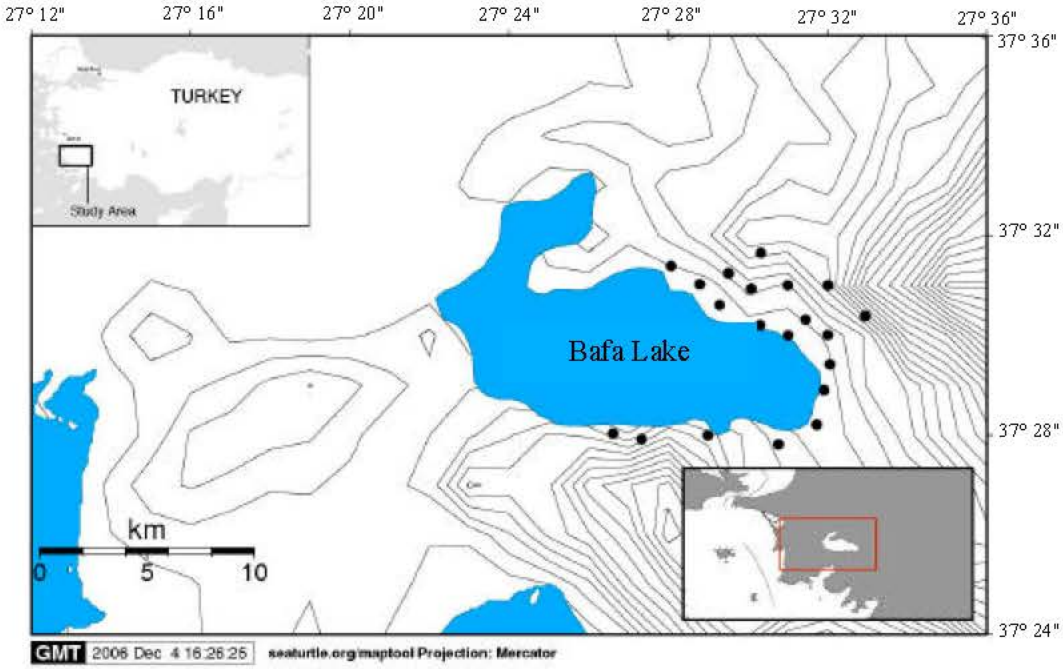

Fig. 1: Geographic map of the study area. Locality coordinates are indicated by black point

Marchantiopsida (hepaticae)
Marchantiales
Sphaerocarpaceae

***Sphaerocarpos texanus* Austin, 1877**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground, North, 20 m, 37°29'911" N-27°31'659" E, 21.03.1998 (C11/13).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil bank and rocks near pathway side lake bank, with *Corsinia coriandrina*, *Oxymitra incrassata*, *Riccia gougetiana*, *R. nigrella*, *R. sorocarpa* and *Fossombronia pusilla*. 10 m, 37°30'188" N-27°31'315" E, 20.02.2005 (C11/206-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Fossombronia angulosa, F. pusilla* and *Gonglanthus ericetorum*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).
Distribution: Turkey (C11), S and C Europe, SW Asia, N Africa, N and S America and Australia.

Targioniaceae

***Targionia hypophylla* L., 1753**

Muğla: Milas, Pınarcık Village, in the streambed, on soil ground under the shrubs, 45 m, 37°26'701" N-27°32'512" E, 02.05.1998 (C11/25).
Muğla: Milas, Pınarcık Village, on soil bank and rocks, especially under *Seleginella* sp., 85 m, 37°27'174" N-27°30'725" E, 02.05.1998 (C11/27).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, theater area, on rocks, with *Lunularia cruciata*, *Corsinia coriandrina* and *Riccia michelii*. 70 m, 37°30'255" N-27°31'739" E, 21.02.2005 (C11/211-1).
Distribution: Turkey (A1, A2, B6, B7, C11, C12, C13), a common species in Mediterranean Region. SW Asia, S Europe, N and S Africa, Australia, N and S America.

***Targionia lorbeeriana* Müll. Frib., 1940**

Muğla: Milas, Pınarcık Village, on shaded soil in stream bank, 45 m, 37°26'701" N-27°32'512" E, 02.05.1998 (C11/24).
Distribution: Turkey (B6, C11), Mediterranean region, S Europe.

Aytoniaceae

***Plagiochasma rupestre* (J.R. Forst and G. Forst) Steph, 1898**

Muğla: Milas, Pınarcık Village, on shaded soil in stream bank, 45 m, 37°26'701" N-27°32'512" E, 02.05.1998 (C11/26).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, theater area, on rocks and soil ground. 70 m, 37°30'255" N-27°31'739" E, 21.02.2005 (C11/211-2).
Distribution: Turkey (A2, B6, B7, C11, C12), S Europe and Mediterranean Countries.

***Reboulia hemisphaerica* (L.) Raddi, 1818**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on thin soil covered rocks near lake. 20 m, 37°30'579" N-27°31'051" E, 20.02.2005 (C11/202).
Distribution: Turkey (A2, A4, B6, B7, B8, C11, C12, C13), more or less cosmopolitan species except for arctic and sub arctic regions. Especially very common Mediterranean Region.

***Mannia androgyna* (L.) A. Evans, 1938**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks and soil bank near roadside, with *Lunularia cruciata*, *Corsinia coriandrina*, *Oxymitra incrassata*, *Fossombronia angulosa* and *F. pusilla*. 30 m, 37°30'490" N-27°31'285" E, 20.02.2005 (C11/206-1).
Distribution: Turkey (C12), Europe, Middle East.

Lunulariaceae

***Lunularia cruciata* (L.) Dumortier ex Lindb., 1868**

Muğla: Pınarcık, Bafa Lake bank, on soil under damp rocks, 10 m, 37°29'879" N-27°31'920" E, 10.05.1997 (C11/12).
Muğla: Milas road, Kocaorman, Çakaliçi Mevkii, on thin soil covered stonewalls, 75 m, 37°28'045" N-27°29'397" E, 02.05.1998 (C11/18,19).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on shaded soil ground under a big rock block near roadside, with *Corsinia coriandrina*, *Riccia sorocarpa* and *Fossombronia angulosa*. 30 m, 37°30'362" N-27°31'320" E, 20.02.2005 (C11/207).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, theater area, on rocks, with *Targionia hypophylla*, *Corsinia coriandrina* and *Riccia michelii*. 70 m, 37°30'255" N-27°31'739" E, 21.02.2005 (C11/211-1).

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil in streambed between olive (*Olea* sp.) groves near village, with *Corsinia coriandrina*, *Oxymitra incrassata* and *Fossombronia angulosa*. 35 m, 37°30'042" N-27°31'447" E, 21.02.2005 (C11/214).
Distribution: Turkey (A1, A2, A3, A4, A5, B6, B9, C11, C12), Europe, Mediterranean Region, SW Asia, N and S Africa, N and S America and Australia.

Corsiniaceae
***Corsinia coriandrina* (Spreng.) Lindb., 1877**

Muğla: Milas, Pınarcık Village, on soil bank and rocks, especially under *Seleginella* sp., 85 m, 37°27'174" N-27°30'725" E, 02.05.1998 (C11/28).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on shaded soil ground under a big rock block near roadside, with *Lunularia cruciata*, *Riccia sorocarpa* and *Fossombronia angulosa*. 30 m, 37°30'362" N-27°31'320" E, 20.02.2005 (C11/207).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, theater area, on rocks, with *Targionia hypophylla*, *Lunularia cruciata* and *Riccia michelii*. 70 m, 37°30'255" N-27°31'739" E, 21.02.2005 (C11/211-1).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Riccia sorocarpa* and *Cephaloziella divaricata*. 35 m, 37°30'073" N-27°31'527" E, 21.02.2005 (C11/212-1).
Muğla: Milas, Kapıkırı Village, olive (*Olea* sp.) grove near village, on soil ground, with *Phaeoceros laevis*, *Riccia gougetiana*, *Riccia michelii* and *Fossombronia pusilla*. 35 m, 37°30'042" N-27°31'447" E and 60 m, 37°30'131" N-27°31'752" E, 21.02.2005 (C11/214,215).
Distribution: Turkey (B6, C11, C12), a common species especially in Mediterranean Region, Europe, W Asia, Africa, N and S America and Japan.

Oxymitriaceae
***Oxymitra incrassata* (Brotero) Sergio and Sim-Sim, 1989**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil bank and rocks near pathway side lake bank, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Riccia gougetiana*, *R. nigrella*, *R. sorocarpa* and *Fossombronia pusilla*. 10 m, 37°30'188" N-27°31'315" E, 20.02.2005 (C11/206-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Riccia gougetiana*, *R. nigrella* and *Fossombronia angulosa*. 20 m, 37°30'076" N-27°31'399" E, 21.02.2005 (C11/212-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil in streambed between olive (*Olea* sp.) groves near village, with *Lunularia cruciata*, *Corsinia coriandrina* and *Fossombronia angulosa*. 35 m, 37°30'042" N-27°31'447" E, 21.02.2005 (C11/214).
Distribution: Turkey (B6, C11, C12), a common species in N Hemisphere and S America.

Ricciaceae
***Riccia glauca* L., 1753**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil ground between Agora Archaic Ruins in village, 40 m, 37°30'110" N-27°31'571" E, 19.03.2006 (C11/216).
Distribution: Turkey (C11), Mediterranean Countries and islands, Europe, Asia, Japan, N Africa, N America, Brazil and New Zealand.

***Riccia gougetiana* Durieu and Mont., 1849**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks and soil bank near roadside, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Oxymitra incrassata, Riccia nigrella*, *R. sorocarpa* and *Fossombronia pusilla*. 10 m, 37°30'188" N-27°31'315" E, 20.02.2005 (C11/206-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Oxymitra incrassata*, *Riccia nigrella* and *Fossombronia angulosa*. 20 m, 37°30'076" N-27°31'399" E, 21.02.2005 (C11/212-2).
Distribution: Turkey (B6, C11), Europe, Mediterranean Region.

***Riccia michelii* Raddi, 1818**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, theater area, on rocks, with *Targionia hypophylla*, *Lunularia cruciata* and *Corsinia coriandrina*. 70 m, 37°30'255" N-27°31'739" E, 21.02.2005 (C11/211-1).
Muğla: Milas, Kapıkırı Village, olive (*Olea* sp.) grove near village, on soil ground, with *Phaeoceros laevis*, *Corsinia coriandrina*, *Riccia gougetiana* and *Fossombronia pusilla*. 60 m, 37°30'131" N-27°31'752" E, 21.02.2005 (C11/215).
Distribution: Turkey (C11, C12), Atlantic Europe, Mediterranean Region and Caucasus.

***Riccia nigrella* DC., 1815**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil bank and rocks near pathway side lake

bank, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Oxymitra incrassata, Riccia gougetiana*, *R. sorocarpa* and *Fossombronia pusilla*. 10 m, 37°30'188" N-27°31'315" E, 20.02.2005 (C11/206-2).

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Oxymitra incrassata*, *Riccia gougetiana* and *Fossombronia angulosa*. 20 m, 37°30'076" N-27°31'399" E, 21.02.2005 (C11/212-2).
Distribution: Turkey (B6, C11), Mediterranean Region, SW Asia and N America.

***Riccia sorocarpa* Bisch., 1835**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on soil bank and rocks near pathway side lake bank, with *Sphaerocarpos texanus*, *Corsinia coriandrina*, *Oxymitra incrassata, Riccia gougetiana*, *R. nigrella* and *Fossombronia pusilla*. 10 m, 37°30'188" N-27°31'315" E, 20.02.2005 (C11/206-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on shaded soil ground under a big rock block near roadside, with *Lunularia cruciata*, *Corsinia coriandrina* and *Fossombronia angulosa*. 30 m, 37°30'362" N-27°31'320" E, 20.02.2005 (C11/207).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Corsinia coriandrina* and *Cephaloziella divaricata*. 35 m, 37°30'073" N-27°31'527" E, 21.02.2005 (C11/212-1).
Distribution: Turkey (B6, C11, C12), Mediterranean Region, Europe, Africa, N America and Australia.

Metzgeriales
Metzgeriaceae
***Metzgeria furcata* (L.) Dumortier, 1835**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks in the streambed, with *Porella platyphylla*. 50 m, 37°30'132" N-27°31'911" E, 19.03.2006 (C11/217).
Distribution: Turkey (A1, A2, A3, A4, A5, B6, B7, C11, C12, C13), Europe, Mediterranean Countries and islands, Asia, N Africa, N America, Australia and New Zealand.
Pelliaceae

***Pellia endiviifolia* (Dicks.) Dumortier, 1835**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213-2).
Distribution: Turkey (A1, A2, A3, A4, A5, B6, B7, B9, C11, C12), Europe, Mediterranean Region, N Africa, Asia and N America.

Codoniaceae
***Fossombronia angulosa* (Dicks.) Raddi, 1820**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in archaic rock graves, 15 m, 37°30'255" N-27°31'739" E, 21.03.1998 (C11/14).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on shaded soil ground under a big rock block near roadside, with *Lunularia cruciata*, *Corsinia coriandrina* and *Riccia sorocarpa*. 30 m, 37°30'362" N-27°31'320" E, 20.02.2005 (C11/207).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Oxymitra incrassata*, *Riccia gougetiana* and *R. nigrella*. 20 m, 37°30'076" N-27°31'399" E, 21.02.2005 (C11/212-2).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Phaeoceros laevis*, *Sphaerocarpos texanus*, *Fossombronia pusilla* and *Gonglanthus ericetorum*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).
Distribution: Turkey (A2, A4, B6, C11), Mediterranean Region, Europe, W Asia, N Africa, S and E America.

***Fossombronia pusilla* (L.) Nees, 1838**

Muğla: Pınarcık, Bafa Lake bank, on soil under shaded rocks near lake bank, 10 m, 37°29'879" N-27°31'920" E, 10.05.1997 (C11/11).
Muğla: Milas road, Kocaorman, Çakaliçi Mevkii, in a stone canal, 75 m, 37°28'045" N-27°29'397" E, 02.05.1998 (C11/21).
Muğla Milas, Pınarcık Village, on soil bank and rocks, especially under *Seleginella* sp., 85 m, 37°27'174" N-27°30'725" E, 02.05.1998 (C11/29).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Phaeoceros laevis*, *Sphaerocarpos texanus*, *Fossombronia angulosa* and *Gonglanthus ericetorum*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).
Muğla: Milas, Kapıkırı Village, olive (*Olea* sp.) grove near village, on soil ground, with *Phaeoceros laevis*, *Corsinia coriandrina*, *Riccia gougetiana* and *Riccia michelii*. 35 m, 37^0 30. 042' N 27^0 31. 447' E and 60 m, 37°30'131" N-27°31'752" E, 21.02.2005 (C11/214, 215).
Distribution: Turkey (A1, A2, A3, A4, B6, C11, C12), Europe, Mediterranean Region, N and S Africa, N America, Australia and New Zealand.

***Petalophyllum ralfsii* (Wilson) Nees and Gottsche, 1844**

Muğla: Milas road, Bafa Lake bank, on soil ground under the *Olea* sp. near lake bank, 15 m, 37°28'471" N-27°29'103" E, 19.03.2006 (C11/218).
Distribution: Turkey (B6, C11, C12), Mediterranean Region included N Africa and Turkey, Europe and N America.

Jungermanniales
Lophoziaceae
***Leiocolea turbinata* (Raddi) H. Buch, 1937**

Muğla: Milas road, Kocaorman, Çakaliçi Mevkii, in a stone canal, 75 m, 37°28'045" N-27°29'397" E, 02.05.1998 (C11/15,17,20).
Distribution: Turkey (B6, C11, C12), a common species in Mediterranean Region. Europe and N America.

Jungermanniaceae
***Jungermannia atrovirens* Dumortier, 1831**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, near archaic city wall, on soil ground. 60 m, 37°30'161" N-27°31'772" E, 21.02.2005 (C11/209).
Distribution: Turkey (A4, C11, C12), Europe, Mediterranean Region, Caucasus, Asia, Japan and N America.

Arnelliaceae
***Southbya tophacea* (Spruce) Spruce, 1849**
Muğla: Milas road, Kocaorman, Çakaliçi Mevkii, in a stone canal, 75 m, 37°28'045" N-27°29'397" E, 02.05.1998 (C11/20).
Muğla: Milas, Pınarcık Village, on soil bank and rocks, especially under *Seleginella* sp., 85 m, 37°27'174" N-27°30'725" E, 02.05.1998 (C11/30).
Distribution: Turkey (B6, C11, C12), a common species in Mediterranean Countries and Islands, Asia and Africa.

***Gonylanthus ericetorum* (Raddi) Nees, 1836**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Phaeoceros laevis*, *Sphaerocarpos texanus*, *Fossombronia angulosa* and *F. pusilla*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).
Distribution: Turkey (C11), Mediterranean Countries and Islands of Europe, SW Asia, and Africa.

Cephaloziellaceae
***Cephaloziella divaricata* (Sm.) Schiffn., 1893**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks between archaic ruins near lake bank, with *Corsinia coriandrina* and *Riccia sorocarpa*. 35 m, 37°30'073" N-27°31'527" E, 21.02.2005 (C11/212-1).
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, in streambed, on soil ground near wet rocks, with *Phaeoceros laevis*, *Sphaerocarpos texanus*, *Fossombronia angulosa, F. pusilla* and *Gonglanthus ericetorum*. 75 m, 37°30'222" N-27°31'936" E, 21.02.2005 (C11/213).
Distribution: Turkey (A4, B6, C11), Europe, Mediterranean islands, N Africa, N and S America, Asia.
26. *Cephaloziella hampeana* (Nees) Schiffner, 1903
Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on well wall and soil ground pathway side, with *Sphaerocarpos texanus* and *Corsinia coriandrina*. 30 m, 37°30'690" N-27°30'990" E, 20.02.2005 (C11/203).
Distribution: Turkey (C11), C and N Europe, Asia, C and N America.

Porellaceae
***Porella platyphylla* (L.) Pfeiff., 1855**

Muğla: Milas, Kapıkırı Village, Heraklea Archaic City Ruins, on rocks in the streambed, with *Metzgeria furcata*. 50 m, 37°30'132" N-27°31'911" E, 19.03.2006. (C11/217).
Distribution: Turkey (A1, A2, A3, A4, A5, B6, B7, C11, C12, C13), Europe, Mediterranean Countries, Asia, N Africa and N America.

The diagnosis of the class *Anthocerotopsida* also defines this single order. A completely isolated group of plants are in terms of the unique morphological features. Differ from all other liverworts the members of *Anthocerotales* order each chlorophyllous cell contains only a single very large chloroplast. *Phaeoceros laevis* is characteristics solid thalli, the non-tiered anteridial wall and the yellow spinulose-papillose spores. This species is the first time collected from Bafa Lake environment in this study.

Sphaerocarpos texanus is characteristic with swollen involucrums. *Targionia hypophylla* is common species in the study area. The species easily recognized with sporogonium is enclosed by dark purple, swollen involucre. *Targionia lorbeeriana* is thought to be a triploid genotype with 27 chromosomes. *Plagiochasma rupestre* and *Reboulia hemisphaerica* are xerotropical and belongs to the *Aytoniaceae* family. Lunar-shaped gemma cups for *Lunularia cruciata* are the main

distinctive characters that can be easily observed by a lens in the field. This species is very common species in the study area and Turkey. *P. rupestre* and *L. cruciata* are recorded from Söke which the most near area to study region (Gökler, 1986) *T. lorbeeriana* is collected from a few localities in Muğla (Crundwell and Nyholm, 1979). And *S. texanus*, *M. androgyna* and *L. cruciata* are recorded from areas near the Bafa Lake (Kürshner and Parolly, 1999). *T. hypophylla* and *R. hemisphaerica* are the first time collected from Bafa Lake environment in this study.

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 incrassata* was included in the *Ricciaceae*, a separate family, *Oxymitraceae*, is now recognized. Morphologically *O. incrassata* 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. *C. coriandrina* is the first time recorded from Muğla in Turkey (Crundwell and Nyholm, 1979). Besides this species is recorded from areas near the Bafa Lake (Kürshner and Parolly, 1999). *O. incrassata* is the first time collected from Bafa Lake environment in this study.

Ricciaceae differs from the other *Marchantiales* members in having the sex organs borne in a sagittal strip extending the entire length of a thallus and column-shaped air chambers. The family is also the only one in which the sporophyte consist solely of a capsule. 5 *Riccia* species collected to study area. *R. gougetiana*, *R. michelii* and *R. nigrella* are the first time recorded from Muğla in Turkey (Crundwell and Nyholm, 1979). *R. sorocarpa* is recorded from Söke-Milas road (Gökler, 1992; 1993a). *R. glauca* and *R. sorocarpa* species are collected from a few localities near the Bafa Lake (Kürshner and Parolly, 1999).

The thallus of Metzgeriales members not difference to fotosentetic and parancimatic area. The thallus consists of one-tip parancimatic cells. The flattened, yellowish green or mid-green patches formed by *Metzgeria furcata* are common on tree-trunks in woodland. *Pellia endiviifolia* have narrow 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 recognizable in the field by its violet-purple rizoids. The species of *Fossombronia is* separated from other species in terms of the features of spor. In the *Petalophyllum ralfsii* tuberous portion of thallus embedded obliquely in substrate, prostrate portion winged, simple or once or twice dichotomously branched; upper surface of wings with erect unistratose lamellae radiating from midrib to margin. The oblique, cylindrical part of the stem embedded in the substrate serves as a perennating structure. *P. endiviifolia* and *F. pusilla* are recorded from area near the Bafa Lake and Söke (Gökler and Öztürk, 1986). *F. angulosa*, *F. pusilla* and *P. ralfsii* species are collected from a few localities in Muğla (Crundwell and Nyholm, 1979).

Leicolea turbinata is minute, leafy liverworts which creeping through other bryophytes. A dingy olive green liverwort, *Jungermannia atrovirens*, is which forms close-knit, rather flat or loose straggling patches in moist rocky situations. The cell structure of *J. atrovirens* is marked by the presence of quite minute, but perceptible trigones. *Gonylanthus ericetorum* is likely to be confused with *Southbya tophaceae* and distinguished by the non calcareous habitat, the distribution of the rizoids, often more distinct region of elongate postical leaf cells. *Cephaloziella hampeana* and *C. divaricata* are very small leafy liverworts. *Porella platyphylla* is a common species in sheltered tree boles, walls, rocks, soil and stones on banks. *S. tophacea* and *P. platyphylla* are collected from a few localities in Muğla (Gökler and Öztürk, 1986; Crundwell and Nyholm, 1979). *G. ericetorum* is the first time recorded from Muğla in Turkey (Crundwell and Nyholm, 1979). In addition to, *C. divaricata* is the first time recorded from Bafa Lake environment in Turkey too (Crundwell and Nyholm, 1979). *L. turbinate*, *J. atrovirens* and *C. hampeana* are the first time collected from Bafa Lake environment in this study.

In this investigation, 27 species belonging to Bryophyta division were collected from Bafa Lake Natural Park, which is included in the C11 grid-square of Henderson (1961) system. Of 27 species one of them is belonging to family of *Anthocerotopsida* and rests of them are belonging to 15 families of *Marchantiopsida*.

There isn't a detailed investigation about liverworts flora of Bafa Lake Natural Park. Only a few liverworts species are recorded in some liverworts flora literatures (Crundwell and Nyholm, 1979; Gökler, 1992; 1993a; Gökler and Öztürk, 1986; Özenoğlu and Gökler, 2001) and a phytosociology study (Kürshner and Parolly, 1999) relating to Bafa Lake environment. Therefore, this study is the first investigation to concerned region.

In addition to, very rare collected species as *Targionia lorbeeriana*, *Mannia androgyna*, *Oxymitra incrassata*, *Riccia gougetiana*, *Petalophyllum ralfsii* and *Gonylanthus ericetarum* exist in this study (Crundwell and Nyholm, 1979; Kürshner and Parolly 1999). So distribution areas of these species are expanded. *P. laevis*,

T. hypophylla, *R. hemisphaerica*, *O. incrassata*, *M. furcata*, *L. turbinate*, *J. atrovirens* and *C. hampeana* are the first time collected from Bafa Lake environment in this study.

We believe that Turkish liverwort and hornwort flora can be enriched only through detailed investigation surveys of localities with ecological conditions suitable for the growth of these plants.

REFERENCES

Atalay, I., 2002. Ecological regions of Turkey. Ministry of Environment and Forestry Publication, Ankara.

Crundwell A.C. and E. Nyholm, 1979. Some additions to the bryophyte flora of Turkey I. Hepaticae, J. Bryol., 10: 479-789.

Frey, W. and H. Kürschner, 1991. An annotated catalogue of the bryophytes of Southwest Asia. Bryophytorum Bibliotheca, 39, Berlin-Stuttgart.

Gökler, I., 1986. Taxonomical investigations on the some turkish liverworts (hepaticae) II. Marchantiales ve Anthocerotales. Doğa TU. Biol. Der., 10: 354-361.

Gökler, I. and M. Öztürk, 1986. Taxonomical investigations on the some turkish liverworts (hepaticae) I. Jungermanniales anacrogynae ve J. Acrogynae. Doğa Tr. Biol. Der., 10: 163-170.

Gökler, I. and M. Öztürk, 1991. Liverworts of Turkey and their position in South-West Asia. Candollea, 46: 359-366.

Gökler, I., 1992. An Investigation of West Anatolia Liverworts. Doğa Tr. J. Bot., 16: 1-8.

Gökler, I. 1993a. Taxonomic and ecologic investigations of west anatolia liverworts. D.E.Ü. Eğit. Bil. Der. 2: 79-85.

Gökler, I., 1993b. A taxonomical investigation on the liverworts of aegean region. D.E.Ü. Eğit. Bil. Der. 2: 33-44.

Gökler, I. and H. Özenoğlu, 1999. Taxonomy and ecology of liverworts of kazdağı national park and its environs. Ekoloji Çevre Der., 8: 22-26.

Grolle, R., 1983. Hepatics of europe including the azores, an annotated list of species, with synonyms from recent literature. J. Bryol., 12: 403-459.

Henderson, D.M., 1961. Contributions to the bryophyte flora of turkey IV. Notes, R.B.G. Edinb., 23: 263-278.

Kürschner, H., 2001. Towards a bryophyte flora of the near and middle east 3. An artificial key to the anthocerotophytina and hepaticophytina of the near and Middle East. Nova Hedwigia, 72: 161-200.

Kürshner, H. and A. Erdağ, 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. Turk. J. Bot., 29: 95-154.

Kürshner, H. and G. Parolly, 1999. The *Epipterygio-riccietum frostii* ass., nov: Ecology and life strategies of an ephemeral bryophyte community in Western Turkey. Lindbergia, 24: 84-92.

Özenoğlu, H. and I. Gökler, 2001. Liverworts of muğla provinces. IV. National ecology and environment congress 5-8 October 2001 Bodrum, pp: 299-306.

Özenoğlu, H. and I. Gökler, 2002. Liverworts (Marchantiopsida) of the Dilek Peninsula National Park. Tr. J. Bot. 26: 297-301.

Paton, J., 1999. The Liverworts Flora of the British Isles. Harley Books, Horkesley, Colchester, Essex CO6 4 AH, England.

Smith, A.J.E., 1991. The Liverworts of Britain and Ireland. Cambridge Univ. Press, London.