The Bryophyte Flora of Erdek, Bandırma, Manyas Districts (Balıkesir, Turkey)

1Muhammet Ören, 1Güray Uyar and 2Tamer Keçeli
1Department of Biology, Faculty of Sciences and Arts, Zonguldak Karadeniz University, Zonguldak, Turkey
2Department of Biology, Faculty of Sciences and Arts, Kirikkale University, Kirikkale, Turkey

Abstract: This study was carried out in Erdek, Bandırma and Manyas districts in Balıkesir province in order to contribute to the bryophyte flora of northwest Turkey. In this study, 134 taxa (at species and infraspecific ranks) belonging to 40 families and 77 genera were identified. Among them 25 taxa were defined as new records for the A1 grid-square, which was adopted by Henderson. In the floristic list, all taxa with their Turkish distributions are given. In addition, some aspects of their biogeography and ecology are discussed.

Key words: Bryophyte Flora, Erdek, Bandırma, Manyas, Balıkesir, Turkey

INTRODUCTION

Bryophytes contain approximately 18,500 species in nearly 1,050 genera worldwide. The division Bryophyta is generally divided into three classes: Hepaticae (liverworts and scale-mosses), Anthocerotae (hornworts) and Musci (mosses). Although these names are used traditionally, the International Rules of Botanical Nomenclature would recommend Hepaticopsida, Anthocerosopsida and Bryopsida (Schefield, 2001).

The Turkish bryoflora, in total, comprises 726 species, subspecies and varieties including 164 genera of Bryopsida in 59 genera and 166 species of Hepaticopsida and Anthocerosopsida (Uyar and Çetin, 2004; Kürşchner and Erdağ, 2005). Nevertheless, the total number has been increased by native and foreign bryologists with the latest additions to the Turkish bryoflora such as: Pedinophyllum interruptum (Nees) Kaal. (Keçeli, 2004), Riccardia latifrons (Lindb.) Lindb. (Keçeli et al., 2004), Orthotrichum lebbeckii Erdag, Kürşchner and Parolly (Erdag et al., 2004), Harpanthus scutatus (F. Weber and D. Mohr) Spruce, Nardia scalaris Gray, Scapania subalpina (Nees ex Lindenb.) Dumort., Blindia caespitiosa (F. Weber and D. Mohr) Müll. Hal., Taxiphyllum densifolium (Lindb. ex Broth.) Reimers (Papp, 2004), Ptilidium pulcherrimum (Weber) Hampe (Keçeli and Çetin, 2005), Isothecium holitii Kindb. (Uyar and Oren, 2005), Dihydromon bistratatus Hebr. and R.B. Pierrut (Erdag and Kürşchner, 2005), Cephalozia dentata (Raddi) Mig. (Keçeli and Çetin, 2006), Eremoccius myriocarpus (Carrington) Lindb. and Kaal. ex Pearson (Kürşchner and Parolly, 2006a), Warnstorfia sarmentosa (Wahlenb.) Hedenäs. (Kürşchner and Parolly, 2006b). This situation reveals that our knowledge about the bryophyte flora of Turkey is still incomplete.

Study area is situated in the southwest of the Sea of Marmara in Balıkesir province. The region is surrounded by Çanakkale in the west, Bursa in the east and Balıkesir in the south. The research area is located between 40° 05'N–40° 29'N and 027° 45'E - 028° 56'E in Balıkesir province (Fig. 1). In addition, the area is included in the Sub-Eucline province of the Euro-Siberian floristic region (Zohary, 1973) and in the A1 square in Henderson grid system (Henderson, 1961a).

There are only two published studies carried out in the nearby area (Erdağ and Yayıtçağ, 1999; Abay and Ünsavas, 2005). However, no detailed study has yet been conducted to date on the bryophyte flora of Erdek, Bandırma and Manyas districts in Balıkesir. The aim of this study was to contribute to the knowledge about Balıkesir bryoflora.

The geological features of the area are typical with a representation of granite, gneiss, micaschist, partly diorite and occasionally limestone mass and volcanic rocks that belong to Paleozoic age (Erceen et al., 1990). The soils are generally alluvial regosol, brown forest, non-calcareous brown forest, vertisol and non-calcareous brown type originating from conglomerate and sandstone (Atalay, 1989). The altitude of the area varies between sea level and 782 m. The region has the little rainy Mediterranean climate at the lower altitudes of the study area. Nevertheless, at higher altitudes of the area, the influence of the oceanic climate can be seen. The annual rainfall in the region is 528–705 mm, but hills above 700 m (i.e.,

Corresponding Author: Güray Uyar, Department of Biology, Faculty of Sciences and Arts, Zonguldak Karadeniz University, 67100, Incirce/Zonguldak, Turkey
Kese Hill), take up to 1300 mm and the annual average temperatures are between 14 and 15.2 °C according to the data obtained from Bandırma and Erdék meteorology stations in, respectively. The seasonal precipitation regime for a year is as follows: Winter (W), Autumn (A), Spring (S) and Summer (S)-(WASS) (Akman, 1999).


**MATERIALS AND METHODS**

The moss flora of study area was thoroughly and extensively surveyed between 2003 and 2004. Field notes on individual species and vegetation were made in various field tours. Most of the important altitudes in the area were visited and different habitats were investigated. In the floristic list for each taxon, the numbers of the sites where they have been found are given, followed by the description of the habitat occupied in the study area. Table 1 lists the sites sampled, all of which belong to the study region.

All specimens are deposited in the personal herbarium of UYAR (Zonguldak). For each taxon, only one collector number was given to avoid repetition in the
<table>
<thead>
<tr>
<th>Site No.</th>
<th>Altitude in metres above sea level (m)</th>
<th>Provinces and geographic coordinates</th>
<th>The list of forest trees and shrubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>Bandirana, 40°13'N-028°02'E</td>
<td>SA, RP, CSE</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>Bandirana, 40°13'N-028°02'E</td>
<td>SA, PA</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>Bandirana, 40°14'N-028°02'E</td>
<td>FOR</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>Bandirana, 40°13'N-028°03'E</td>
<td>CSE, PB, PD</td>
</tr>
<tr>
<td>5</td>
<td>24</td>
<td>Bandirana, 40°14'N-028°04'E</td>
<td>QI, QC, RC, CM, RCA</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>Manyas, 40°07'N-028°92'E</td>
<td>SA</td>
</tr>
<tr>
<td>7</td>
<td>16</td>
<td>Manyas, 40°07'N-028°56'E</td>
<td>SA, PA</td>
</tr>
<tr>
<td>8</td>
<td>80</td>
<td>Manyas, 40°05'N-027°55'E</td>
<td>QI, QC, CM, SO, OSI, CC</td>
</tr>
<tr>
<td>9</td>
<td>34</td>
<td>Manyas, 40°06'N-027°58'E</td>
<td>PO</td>
</tr>
<tr>
<td>10</td>
<td>200</td>
<td>Erdek, 40°22'N-027°47'E</td>
<td>PO, PB, QC, RC, RE</td>
</tr>
<tr>
<td>11</td>
<td>120</td>
<td>Erdek, 40°22'N-027°48'E</td>
<td>PO, CB, TO, CS</td>
</tr>
<tr>
<td>12</td>
<td>210</td>
<td>Erdek, 40°22'N-027°49'E</td>
<td>PO, CT, CS, EA</td>
</tr>
<tr>
<td>13</td>
<td>175</td>
<td>Erdek, 40°22'N-027°47'E</td>
<td>AG, PO, FO</td>
</tr>
<tr>
<td>14</td>
<td>335</td>
<td>Erdek, 40°22'N-027°46'E</td>
<td>OE, QCE</td>
</tr>
<tr>
<td>15</td>
<td>29</td>
<td>Erdek, 40°22'N-027°46'E</td>
<td>CS, QCE, MG</td>
</tr>
<tr>
<td>16</td>
<td>350</td>
<td>Erdek, 40°22'N-027°45'E</td>
<td>CS, QCE, MG, PE</td>
</tr>
<tr>
<td>17</td>
<td>310</td>
<td>Erdek, 40°22'N-027°45'E</td>
<td>EA, QI, AA, AU</td>
</tr>
<tr>
<td>18</td>
<td>545</td>
<td>Erdek, 40°22'N-027°50'E</td>
<td>FO, QP</td>
</tr>
<tr>
<td>19</td>
<td>730</td>
<td>Erdek, 40°27'N-027°49'E</td>
<td>FO</td>
</tr>
<tr>
<td>20</td>
<td>715</td>
<td>Erdek, 40°28'N-027°50'E</td>
<td>FO, QP, CS</td>
</tr>
<tr>
<td>21</td>
<td>395</td>
<td>Erdek, 40°28'N-027°51'E</td>
<td>FO, CS, TA</td>
</tr>
<tr>
<td>22</td>
<td>448</td>
<td>Erdek, 40°28'N-027°50'E</td>
<td>FO, CS, TA</td>
</tr>
<tr>
<td>23</td>
<td>488</td>
<td>Erdek, 40°28'N-027°52'E</td>
<td>FO, CS, QCE</td>
</tr>
<tr>
<td>24</td>
<td>455</td>
<td>Erdek, 40°28'N-027°53'E</td>
<td>FO, QP</td>
</tr>
<tr>
<td>25</td>
<td>203</td>
<td>Erdek, 40°28'N-027°54'E</td>
<td>FO, QP, CS</td>
</tr>
<tr>
<td>26</td>
<td>400</td>
<td>Erdek, 40°28'N-027°53'E</td>
<td>EA, QCE</td>
</tr>
<tr>
<td>27</td>
<td>25</td>
<td>Manyas, 40°04'N-028°02'E</td>
<td>SA, PA</td>
</tr>
<tr>
<td>28</td>
<td>24</td>
<td>Manyas, 40°06'N-028°03'E</td>
<td>PS</td>
</tr>
<tr>
<td>29</td>
<td>310</td>
<td>Erdek, 40°28'N-027°48'E</td>
<td>PO</td>
</tr>
<tr>
<td>30</td>
<td>469</td>
<td>Erdek, 40°28'N-027°49'E</td>
<td>QN, QC</td>
</tr>
<tr>
<td>31</td>
<td>464</td>
<td>Erdek, 40°28'N-027°49'E</td>
<td>QCE</td>
</tr>
<tr>
<td>32</td>
<td>400</td>
<td>Erdek, 40°27'N-027°50'E</td>
<td>FO, QP</td>
</tr>
<tr>
<td>33</td>
<td>145</td>
<td>Erdek, 40°26'N-027°52'E</td>
<td>FO, CB, CS</td>
</tr>
<tr>
<td>34</td>
<td>255</td>
<td>Erdek, 40°26'N-027°49'E</td>
<td>PB, QC, EA, AA, SJ, PT</td>
</tr>
<tr>
<td>35</td>
<td>325</td>
<td>Erdek, 40°26'N-027°48'E</td>
<td>AG, PO, QCE</td>
</tr>
<tr>
<td>36</td>
<td>248</td>
<td>Erdek, 40°26'N-027°47'E</td>
<td>PO, AG, PB</td>
</tr>
<tr>
<td>37</td>
<td>231</td>
<td>Erdek, 40°27'N-027°45'E</td>
<td>CS, PB, QG, EA</td>
</tr>
<tr>
<td>38</td>
<td>83</td>
<td>Erdek, 40°27'N-027°46'E</td>
<td>CB, CS, TT, EA, FA, AU</td>
</tr>
<tr>
<td>39</td>
<td>275</td>
<td>Erdek, 40°28'N-027°45'E</td>
<td>QCE, CS, EA, MG</td>
</tr>
<tr>
<td>40</td>
<td>50</td>
<td>Erdek, 40°26'N-027°45'E</td>
<td>EA, AA</td>
</tr>
<tr>
<td>41</td>
<td>50</td>
<td>Erdek, 40°26'N-027°53'E</td>
<td>PB, PP</td>
</tr>
<tr>
<td>42</td>
<td>394</td>
<td>Erdek, 40°26'N-027°53'E</td>
<td>QP</td>
</tr>
<tr>
<td>43</td>
<td>156</td>
<td>Erdek, 40°27'N-027°54'E</td>
<td>FO, CB, CS</td>
</tr>
<tr>
<td>44</td>
<td>110</td>
<td>Erdek, 40°28'N-027°54'E</td>
<td>FO, QP, CS, TT</td>
</tr>
<tr>
<td>45</td>
<td>60</td>
<td>Erdek, 40°28'N-027°54'E</td>
<td>PB, PO, CSE</td>
</tr>
<tr>
<td>46</td>
<td>450</td>
<td>Erdek, 40°27'N-027°50'E</td>
<td>FO, CS, QP</td>
</tr>
<tr>
<td>47</td>
<td>520</td>
<td>Erdek, 40°28'N-027°50'E</td>
<td>FO, TT</td>
</tr>
<tr>
<td>48</td>
<td>780</td>
<td>Erdek, 40°28'N-027°50'E</td>
<td>FO</td>
</tr>
<tr>
<td>49</td>
<td>655</td>
<td>Erdek, 40°28'N-027°50'E</td>
<td>FO, CB</td>
</tr>
<tr>
<td>50</td>
<td>199</td>
<td>Erdek, 40°28'N-027°51'E</td>
<td>FO, PO</td>
</tr>
<tr>
<td>51</td>
<td>70</td>
<td>Erdek, 40°29'N-027°51'E</td>
<td>PT, FO, EA, QI</td>
</tr>
<tr>
<td>52</td>
<td>22</td>
<td>Erdek, 40°28'N-027°54'E</td>
<td>PQ</td>
</tr>
</tbody>
</table>

floristic list. Thus, the same taxa collected from different localities were represented with the first collector number, i.e., Orthotrichum affine Brid. was collected from localities 3, 5, 10, 16, 30 and 39 was identified by the collector number OREN 12.

Kürschner (2001), Söderström et al. (2002), Heyn and Herrnhadt (2004) and Hallingbäck et al. (2006) in order to identification and nomenclature of the samples.

The new taxa for the A1 grid square are indicated with an asterisk (*) and the second records taxa for the bryophyte flora of Turkey are indicated with two asterisks (**) in the floristic catalogue. In addition, the status of the taxa for Turkey was determined by reviewing the related literature (Uyar and Çetin, 2004; Kürschner and Erdag, 2005). Information about new taxa for the A1 grid square was obtained from the literature (Walther, 1967, 1970; Henderson, 1961b, 1963; Henderson and Prentice, 1969; Yayintaş and Iwatsuki, 1988; Yayintaş et al., 1990, 1994, 1996; Yayintaş and Tonguç, 1994, 1996; Çetin, 1999a, 1999b, Papp and Sabovljević, 2003, Abay and Ursavš, 2005).

Ecological characteristics (acidity, water requirements and necessity of light) have been assessed using Dierßen (2001). The life forms of the bryophytes in this area have been evaluated using Magdefrau (1982) and Schofield (2001).

Floristic List
Anthocerotopsida
Anthocerotaceae

Distribution in Turkey: A1, A3, A4, B6, C11, C12.
Marchantopsida

Distribution in Turkey: A2, A4, B6, B7, B8, C11, C12, C13.
Conocephalaceae

3. Conocephalum conicum (L.) Dumort. -12, 76 and 78: Near stream bank, TK3524.
Distribution in Turkey: A1, A2, A3, A4, A5, B6, B8, C11, C12.
Lunulariaceae

Distribution in Turkey: A1, A2, A3, A4, A5, B6, B9, C11, C12.
Marchantiaceae

Distribution in Turkey: A1, A2, A4, A5, B6, B8, B9, C11, C12, C13, C15.
Metzgeriaceae

Pottiaceae

7. Pellia endiviifolia (Dicks.) Dumort. -76, 78: On wet soil near stream bank, TK3525.
Distribution in Turkey: A1, A2, A3, A4, B6, B7, B9, C11, C12.
Fossombroniaceae

Distribution in Turkey: A1, A2, A3, A4, B6, C11, C12.
Geocalyaceae

Radulaceae

Distribution in Turkey: A1, A2, A4, A5, B6, C11.
Porellaceae

11. Radula complanata (L.) Dumort. -11, 12: On the barks
and 15: on rocks near stream bank, TK3506.
Porellaceae

Porellaceae

Frullaniaceae

Lejeuneaceae

Distribution in Turkey: A1, A2, A3, A4, B6, B7, C11.

BRYOPHITA
Polytrichaceae Schwägr.


Distribution in Turkey: A1, A2, A3, A4, A5.

18. *Polytrichum juniperum* (Hedw.) - 22, 26, 43 and 51: Sandy gravelly in woodland, ÖREN 68.
Distribution in Turkey: A1, A2, A4, B7, B8, B10.

Distribution in Turkey: A1, A2, A4, B7, B8, C11.
Funariaceae Schwägr.

Distribution in Turkey: A1, A2, A4, B6, C11, C12, C13, C14.

Grimmiaceae Amn.


*22. G. disisimula* E. Maier - 18, 21, 24 and 49: On rocks near stream bed, ÖREN 57.
Distribution in Turkey: A2.

Distribution in Turkey: A1, A2, A4, B6, B7, B8, B9, C11, C13, C15.


Distribution in Turkey: A1, A2, A3, A4, B6, B7, B8, B9, C11, C12, C13, C14.


Distribution in Turkey: A1, A2, A3, A4, B6, B7, B8, B9, C11, C12, C13, C14.

Distribution in Turkey: A1, A2, A4, B6, B8, B9, C13, C14.

Fissidentaceae Hedw.

Distribution in Turkey: A1, A2, B6, C11.

Distribution in Turkey: B6, C11.

Distribution in Turkey: B6, C11.

*32. F. rivularis* (Spruce) Schimp. - 24, 33, 35, 38 and 50: On wet or submerged rock, ÖREN 69.

33. *F. taxifolius* (Hedw.) Smith - 8: On soil in woods, 11, 18, 21, 38 and 46: on soil on bank in woodland, ÖREN 16.
Distribution in Turkey: A1, A2, A3, A4, B6, C11.

Distribution in Turkey: A1, A2, B6, C11, C12, C13.

Ditrichaceae Limpr.

35. *Ceratodon purpureus* (Hedw.) Brid. - 16, 29 and 40: On soil in woods and woodland, ÖREN 43.
Distribution in Turkey: A1, A2, A4, A5, B6, B7, B8, C14.


Dicranaceae Schimp.


38. *Dicranum scoparium* (Hedw.) - 22, 26, 43 and 49: On humus soil in woodland, ÖREN 73.
Pottiaceae Schimp.

Distribution in Turkey: A2, B6, C11.

40. Trichostomum brachyodontium Bruch -34: On calcareous soil, ÖREN 92.

41. Weissia controversa (Hedw.) var. controversa -11, 14: on sandy soil near roadside, 10, 45: on rock crevices, ÖREN 32.
Distribution in Turkey: A1, A2, A4, B6, B7, C11.

42. W. controversa (Hedw.) var. crispa (Nees and Hornsch.) Nyholm -34: On rock crevices, ÖREN 86.
Distribution in Turkey: A1, A2, A3, A4, B6, B9, C11, C12.

**43. W. levi (Limpr.) Kindb. -5: On soil amongst limestone rock, ÖREN 27.
Distribution in Turkey: B6.

44. W. longifolia Mitt. -8: On bare soil near woods, ÖREN 7.

45. Barbula convoluta (Hedw.) var. convoluta -46: On soil in woods, ÖREN 123.

*46. B. convoluta (Hedw.) var. commutata (Jur.) Husn. -42: On soil in woods, ÖREN 116.
Distribution in Turkey: B6, C11.

47. B. unguiculata Hedw. -5, 8, 32, 34 and 38: On soil in deciduous forest, ÖREN 6.

48. Diphymdon fallax (Hedw.) R.H. Zander -26, 41: On soil near road side, ÖREN 70.

49. D. insulam (De Not.) M.O.Hil (D. insulam (De Not.) M.O.Hil) -16: On soil shady places, ÖREN 67.

Distribution in Turkey: A1, A2, A4, B6, B8, C11.

51. D. vinealis (Brid.) R.H. Zander -1, 4: on mortar walls, on rocks in woods, ÖREN 1.
Distribution in Turkey: A1, A2, A3, B6, B7, B8, B9, C11, C12, C13, C14.

52. Phascum cuspidatum Hedw. -8: On bare soil, ÖREN 60.
Distribution in Turkey: A1, A2, B6, B7, C11.


54. S. laevipila Brid. -9, 27 and 52: On bark of trees, ÖREN 10.
Distribution in Turkey: A1, A2, B6, C11.

Distribution in Turkey: A1, A2, A3, A4, B6, B7, B8, B9, C12, C13, C14.

56. T. muralis Hedw. var. aestiva Brid. ex Hedw. -2, 42: On shaded rocks, ÖREN 117.
Distribution in Turkey: A1, A2, C11, C14.

57. T. schimperi M.J. Cano, O. Werner and J. Guerra (T. subulata Hedw. var. angustata (Schimp.) Limpr.) -11, 32:
On soil in woodland ÖREN 61.
Distribution in Turkey: A1, A2, B6, B8, C11.

58. T. subulata Hedw. -14, 16, 20 and 39: On soil and rock in woodland, ÖREN 44.
Orthotrichaceae Amn.

59. Orthotrichum affine Schrad. ex Brid. (O. fastigiatum Bruch ex Brid.) -3, 5, 10, 16, 30 and 39: on bark, ÖREN 12.

60. O. anomalous Hedw. -34: on rocks in woodland, ÖREN 84.

61. O. diaphanum Schrad. ex Brid. -1, 8 and 9: on bark, ÖREN 3.

Distribution in Turkey: A1, A2, A3.
63. *O. pumilum* Sw. ex. anon. -5, 25 and 35: on bark, ÖREN 15.  
Distribution in Turkey: A1, A3, B6, C12.

64. *O. rupestris* Schleich. ex Schwägr. -14: on bare rocks, ÖREN 36.  

65. *Zygadon rupestris* Schimp. ex Lorentz-35, 45: on bark, ÖREN 120.  
Distribution in Turkey: A1, B6, C11, C12.  
Hedwigiaeaceae Schimp.

Distribution in Turkey: A1, A2, A4, A5, B6, B7, C11.  
Bartramiaeaceae Schwägr.

Distribution in Turkey: A1, B6, A4, C11, C14.

*68. Philonotis arenii* Husn. -44: on shaded rocks near waterfall, ÖREN 104.  
Bryaceae Schwägr.

Distribution in Turkey: A1, A2, A3, B6, B7, B8, C11, C13.

70. *B. argenteum* Hedw. (*B. argenteum* var. *lanatum* (P. Beauv.) Hampe-14): on rocks in open area, ÖREN 34.  
Distribution in Turkey: A1, A2, A4, A5, B6, B8, B9, C13, C14.

71. *B. caespiticium* Hedw. -2: on rocks, 10: on soil in open areas, ÖREN 23.  
Distribution in Turkey: A1, A2, A3, A4, B6, B7, B8, B9, C11, C13, C15.

72. *B. capillare* Hedw. -4, 14: on rocks, 1, 8: on tree trunk, 10, 17: on soil in open or shaded habitats, ÖREN 8.  
Distribution in Turkey: A1, A2, A4, A5, B6, B7, B8, B9, C11, C12, C13.

*73. B. gymniparum* De Not. -2: on rocks crevices near water leakage, ÖREN 119.  
Distribution in Turkey: B6, C11.


Distribution in Turkey: A1, A2, B6, B8, C11, C12.  
Mielichhoferiaceae Schimp.


*77. Pohlia elongata* Hedw. -5: on wet soil in woodland, ÖREN 25.  

Distribution in Turkey: A2, A3, C11, C12.  
Mniaceae Schwägr.


80. *M. hornum* Hedw. -19, 21 and 33: on wet rocks near stream bed, 43, 48: on soil stream bank, ÖREN 64.  

Cinclidiaeaceae Kindb.

82. *Rhizomnium punctatum* (Hedw.) T.J.Kop. -21, 42: on soil stream bank, ÖREN 93.  
Distribution in Turkey: A1, A2, A3, A4, B6, B8.  
Plagiommniaceae T.J.Kop.

83. *Plagiommnium affine* (Blandow ex Funck) T.J.Kop. -18, 24, 33 and 45: on soil stream bank, ÖREN 33.  
Distribution in Turkey: A1, A2, A4, B6, B8.

*84. P. elatum* (Bruch and Schimp.) T.J.Kop. -46: on soil stream bank, ÖREN 78.  


89. *Cratoneuron filicium* (Hedw.) Spruce var. atroviridis (Brid.) Ochyra-18: on wet rocks in woodland, ÖREN 50. Distribution in Turkey: A1, A2, A4, B6, B7, B10, C11, C12.


95. *Platyhypnidium riparioides* (Hedw.) Dixon-12, 13, 15, 18, 21, 24, 35, 36, 43 and 44: attached to rocks in moving water, ÖREN 45. Distribution in Turkey: A1, A2, A4, A5, B6, B8, B9, C11.


*99. R. teneriffae* (Mont.) Dirkse and Bouman-12, 13 and 35: on wet rocks near stream bed, ÖREN 47. Distribution in Turkey: A2, B6.


108. B. rivulare Schimp. -20, 33, 44 and 45: on submerged or wet rocks in stream bed, ÖREN 56.
Distribution in Turkey: A1, A2, A4, A5, B6, B8, B9, B10, C11, C12.

109. B. rataulum (Hedw.) Schimp. -5: on tree trunk, ÖREN 17.
Distribution in Turkey: A1, A2, A3, A4, B6, B8, C11, C14.


111. Scleropodium tourretii (Brd.) L.F.Koch-8, 10, 11, 12, 13, 42, 43 and 51: on damp soil in shaded habitats, ÖREN 5.
Distribution in Turkey: A1, A2, A3, B6, C11.

112. Eriophyceastrum pulchellum (Hedw.) Ignatov andHuttunen (Eriophyceastrum pulchellum (Hedw.) Jenm.)-24: on rocks in water leakage, 42: on soil in stream banks, ÖREN 81.
Distribution in Turkey: A1, A2, A4, A5, B6, B8, B10.

*113. E. pulchellum (Hedw.) Ignatov and Huttunen var. diversifolium (Schimp.) Odhaya andŻy armowiec (Eriophyceastrum pulchellum var. diversifolium (Schimp.) C.E.O.Jensen)-42: on rocks in water leakage, ÖREN 65.
Distribution in Turkey: A2.

114. Brachythecium velutinum (Hedw.) Ignatov and Huttunen (Brachythecium velutinum (Hedw.) Schimp.)-5, 18 and 32: on tree trunk, ÖREN 18.

Distribution in Turkey: A1, A2, A3, A4, A5, B6, B7, B8, B9, B10, C11, C12, C13, C14.

Hypnaeaceae Schimp.

116. Ctenidium molluscum (Hedw.) Mitt. -33: on wet rocks in woodland, ÖREN 122.


118. H. cupressiforme Hedw. var. cupressiforme-3, 5, 8, 11, 26, 30 and 36: on tree trunk, 10: on rocks, ÖREN 9.

119. H. cupressiforme Hedw. var. lacunosum Brid. (H. lacunosum (Brid.) Hoffm. ex Brid.)-1, 8 and 9: on tree trunk, 25, 28: on rocks, ÖREN 4.

120. H. cupressiforme Hedw. var. resupinatum (Taylor) Schimp. (H. resupinatum (Taylor)-30: on tree barks, ÖREN 94.
Distribution in Turkey: A1, A2, B6, A4, C11.

121. Pylaisia poyantha (Hedw.) Schimp. -8, 11, 16 and 21: on tree trunk, ÖREN 30.

Pterigynandraceae Schimp.

122. Pterigynandrum filiforme Hedw. -20, 21 and 47: on rocks in shaded habitat, ÖREN 53.
Distribution in Turkey: A1, A2, A3, B6, C11.

Hylomaeaceae (Broth.) M.Fleisch.

*123. Rhytidideiphysetrustr (Hedw.) Wramst. -22: on damp soil in woodland, ÖREN 42.
Plagiotheciaceae (Broth.) M.Fleisch.

Distribution in Turkey: A1, A2.

125. P. nemorale (Mitt.) A.Jaeger-21, 25 and 45: on damp soil in stream banks, ÖREN 82.


Pylaisiadelphaceae Goffinet and W.R. Buck

127. Platygryium repens (Brd.) Schimp. -3: on tree trunk, 37: on rocks in shaded habitats, ÖREN 11.
Distribution in Turkey: A1, A2, A4, B6, C11.
Leucodontaceae Schimp.


**RESULTS AND DISCUSSION**

In this study, a total of 134 taxa belonging to the *Bryopsida* (119 taxa), *Anthocerotopsida* (1 taxon) and *Marchantiopsida* (14 taxa) were determined. According to the grid system described by Henderson (1961.a) the number of new records in the study area (A1 square) is 25. These species are; *Reboulia hemiaspheaica*, *Fissidens crassipes*, *F. exilis*, *F. rivularis*, *Barbula convoluta* var. *commutata*, *Hymenosystum recurvirostrum*, *Grimmia dissimulata*, *Pothia elongata*, *P. wahlenbergii* var. *calcarea*, *Bryum gemmiparum*, *Plagiomnium elatum*, *Philonitis arenellii*, *Campylium protensum*, *Hygroamblystegium fluitatile*, *H. tenax*, *Brachytheicum mildeanum*, *Scuro hypnum oedipodium*, *Eurynchias trim pulchellum* var. *diversifolium*, *Plasteurhynchnium striatum*, *Rhynchostegiella teneriffae*, *Hypnum callichroma*, *Rhytidadiaphlus triquetrus*, *Fontinalis antipyretica* var. *gracilis*, *Isotheicum myosuroides* var. *brachytheichioides* and *Weissa levieri* (indicated as a rare species in Red Data Book of European Bryophytes) (Schumacker et al., 1995). In addition, *Fontinalis antipyretica* var. *gracilis* which has been only known from Köprüli Kanyon National Park in Antalya province (Çetin, 1989) and *Isotheicum myosuroides* var. *brachytheichioides* which has been newly reported from Yiğile district in Düzce province (Uyar and Çetin, 2004), were secondly recorded from Balıkesir province, Erdek town, Kapıdağ peninsula.

The distribution of the bryophyte taxa according to the families are shown in order below (Table 2). As it is clearly seen in Table 2, Brachytheciaceae is the richest family in the species. Pottiaceae, Grimmiaaceae, Orthotrichaceae, Bryaceae, Fissidentaceae Hylocomaceae and Amblystegiaceae, are other foremost components of the flora. Nevertheless, 18 families are represented monotypically in the area.

<table>
<thead>
<tr>
<th>Table 2: The distribution of the bryophyte taxa according to the families</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>Brachytheciaceae</td>
</tr>
<tr>
<td>Pottiaceae</td>
</tr>
<tr>
<td>Grimmiaaceae</td>
</tr>
<tr>
<td>Orthotrichaceae</td>
</tr>
<tr>
<td>Bryaceae</td>
</tr>
<tr>
<td>Fissidentaceae</td>
</tr>
<tr>
<td>Hylocomaceae</td>
</tr>
<tr>
<td>Amblystegiaceae</td>
</tr>
<tr>
<td>Polytrichaceae</td>
</tr>
<tr>
<td>Mielichhoferiaceae</td>
</tr>
<tr>
<td>Mniumace</td>
</tr>
<tr>
<td>Pliogoniaceae</td>
</tr>
<tr>
<td>Plagiotheciacae</td>
</tr>
<tr>
<td>Ditrichaceae</td>
</tr>
<tr>
<td>Dicranaceae</td>
</tr>
<tr>
<td>Barbanniaceae</td>
</tr>
<tr>
<td>Fontinaliaceae</td>
</tr>
<tr>
<td>Leucodontaceae</td>
</tr>
<tr>
<td>Niedersace</td>
</tr>
<tr>
<td>Lembophyllaceae</td>
</tr>
<tr>
<td>Gastrocarpinaceae</td>
</tr>
<tr>
<td>Porellaceae</td>
</tr>
<tr>
<td>Pnumariace</td>
</tr>
<tr>
<td>Hedwigiaace</td>
</tr>
<tr>
<td>Cindeliace</td>
</tr>
<tr>
<td>Pterigynandraceae</td>
</tr>
<tr>
<td>Hylocomiaceae</td>
</tr>
<tr>
<td>Pylaisiadelphaceae</td>
</tr>
<tr>
<td>Anomodontaceae</td>
</tr>
<tr>
<td>Atyoniace</td>
</tr>
<tr>
<td>Conosiphulaceae</td>
</tr>
<tr>
<td>L Fuckhariseae</td>
</tr>
<tr>
<td>Marchantiaceae</td>
</tr>
<tr>
<td>Metzgeriaceae</td>
</tr>
<tr>
<td>Pellaceae</td>
</tr>
<tr>
<td>Fossosbrunieaceae</td>
</tr>
<tr>
<td>Raddiaceae</td>
</tr>
<tr>
<td>Frullaniace</td>
</tr>
<tr>
<td>Lejeuneace</td>
</tr>
<tr>
<td>Anthocerotaceae</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Table 3: Comparison of the largest families in the study area and neighbouring and distance areas (taxa numbers and percentage)

<table>
<thead>
<tr>
<th>Largest families</th>
<th>MBE. (134)</th>
<th>Mdr.-C. V. (130)</th>
<th>Snp. (131)</th>
<th>WBS. (238)</th>
<th>Cont. Th. (142)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryophytales</td>
<td>23 (17.2)</td>
<td>15 (11.3)</td>
<td>23 (17.6)</td>
<td>31 (13)</td>
<td>19 (3.4)</td>
</tr>
<tr>
<td>Potentiales</td>
<td>20 (14.9)</td>
<td>35 (26.3)</td>
<td>12 (9.2)</td>
<td>29 (12.5)</td>
<td>46 (3.2)</td>
</tr>
<tr>
<td>Gramiaceae</td>
<td>8 (6.0)</td>
<td>7 (5.3)</td>
<td>3 (2.3)</td>
<td>11 (4.6)</td>
<td>4 (2.8)</td>
</tr>
<tr>
<td>Orthotrichaceae</td>
<td>7 (5.2)</td>
<td>8 (6.0)</td>
<td>5 (3.8)</td>
<td>12 (5)</td>
<td>10 (7.0)</td>
</tr>
<tr>
<td>Bryaceae</td>
<td>7 (5.2)</td>
<td>13 (10)</td>
<td>4 (3.1)</td>
<td>12 (5)</td>
<td>11 (7.7)</td>
</tr>
<tr>
<td>Fissidentaceae</td>
<td>6 (4.5)</td>
<td>3 (2.3)</td>
<td>2 (1.5)</td>
<td>4 (1.7)</td>
<td>10 (7.0)</td>
</tr>
<tr>
<td>Hypnaceae</td>
<td>6 (4.5)</td>
<td>2 (1.5)</td>
<td>8 (6.1)</td>
<td>13 (5.5)</td>
<td>3 (2.1)</td>
</tr>
<tr>
<td>Amblystegiaceae</td>
<td>5 (3.7)</td>
<td>9 (6.9)</td>
<td>6 (2.9)</td>
<td>1 (0.7)</td>
<td>4 (2.8)</td>
</tr>
<tr>
<td>Polystichaceae</td>
<td>4 (3)</td>
<td>2 (1.5)</td>
<td>3 (2.3)</td>
<td>5 (2.1)</td>
<td>10 (7.0)</td>
</tr>
</tbody>
</table>

Abbreviations: MBE: Manyas, Bandırma and Erdi (Bafkşaz); Mdr.-C. V.: Madras Mountain and Çine Valley (Yata); Snp.: Sinop and its environs (Ayganc, Boyakab and Gorçeş (Çetin & Uyar, 1997; Çetin, 1999b); WBS.: Western Black Sea Region (Uyar and Çetin 2006; Keçeli and Çetin, 2006); Cont. Th.: Contribution to the Bryophyte Flora of Turkish Thrace (Papp and Sabol, 2003)

Table 4: Comparison of the largest genera in the study area and neighbouring and distance areas (taxa numbers and percentage)

<table>
<thead>
<tr>
<th>Largest genera</th>
<th>MBE</th>
<th>Mdr.-C. V.</th>
<th>Snp</th>
<th>WBS</th>
<th>Cont. Th.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bryum</td>
<td>7 (5.2)</td>
<td>11 (8.3)</td>
<td>4 (3.1)</td>
<td>12 (5)</td>
<td>11 (7.7)</td>
</tr>
<tr>
<td>Fissidens</td>
<td>6 (4.5)</td>
<td>3 (2.3)</td>
<td>2 (1.5)</td>
<td>4 (1.7)</td>
<td>10 (7.0)</td>
</tr>
<tr>
<td>Orthotrichum</td>
<td>6 (4.5)</td>
<td>7 (5.3)</td>
<td>5 (3.8)</td>
<td>8 (3.4)</td>
<td>9 (6.3)</td>
</tr>
<tr>
<td>Grimmia</td>
<td>5 (3.7)</td>
<td>7 (5.3)</td>
<td>1 (0.8)</td>
<td>5 (2.1)</td>
<td>3 (2.1)</td>
</tr>
<tr>
<td>Brachythecium</td>
<td>4 (3)</td>
<td>2 (1.5)</td>
<td>9 (6.9)</td>
<td>5 (2.1)</td>
<td>3 (2.1)</td>
</tr>
<tr>
<td>Didymodon</td>
<td>4 (3)</td>
<td>6 (4.5)</td>
<td>3 (2.3)</td>
<td>6 (2.3)</td>
<td>8 (5.6)</td>
</tr>
<tr>
<td>Hypnum</td>
<td>4 (3)</td>
<td>2 (1.5)</td>
<td>4 (3.1)</td>
<td>7 (2.9)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>Oxyrrhynchum</td>
<td>4 (3)</td>
<td>3 (2.3)</td>
<td>1 (0.8)</td>
<td>2 (0.8)</td>
<td>2 (1.4)</td>
</tr>
<tr>
<td>Tortula</td>
<td>4 (3)</td>
<td>7 (5.3)</td>
<td>1 (0.8)</td>
<td>4 (1.7)</td>
<td>6 (4.2)</td>
</tr>
<tr>
<td>Weisia</td>
<td>4 (3)</td>
<td>2 (1.5)</td>
<td>-</td>
<td>2 (0.8)</td>
<td>4 (2.8)</td>
</tr>
</tbody>
</table>

* Abbreviations are below Table 3*

In Table 3, the largest 9 families according to taxa number in the study compared with studied carried out in the Black Sea region (Uyar and Çetin 2006; Keçeli and Çetin, 2006; Çetin and Uyar, 1997), the Marmara region (Çetin, 1999b, 1999c; Papp and Sabol, 2003) and Aegean region (Erdi, 2002). The major families’ order in present study is similar to Western Black Sea Region and Sinop. This situation can be explained by the similarities of vegetation types and climatic conditions between especially Kapıdağ peninsula in the study area and studies in Black Sea region.

Concerning the taxa number of ratios, the major genera in this region are as follows: Bryum Hedw. (7), Fissidens Hedw. (6), Orthotrichum Hedw. (6), Grimmia Hedw. (5), Brachythecium Schenck. (4), Didymodon Hedw. (4), Hypnum Hedw. (4), Oxyrrhynchia (Scheuck.) Warnst., Tortula Hedw. (4) and Weisia Hedw. (4) (Table 4).

Their sum comprise 35.9 percent of total species in the area. Thirty-nine genera are represented monotypically. According to major pleurocarpous genera order in our study is similar to Western Black Sea region. Nevertheless, in respect to major acrocarpous genera order in our study is parallel to Madras Mountain and Çine Valley. A comparison between acrocarpous taxa and pleurocarpous taxa shows that the numbers of taxa acrocarpous families are higher than pleurocarpous families’ taxa members in this study area. These values indicate that the investigated area is usually semi-arid but sometimes it is relatively humid.

As might be expected from the climate, mesophytic and xerophytic mosses (64.9 %) are dominant in the investigated area. These are followed by hygrophytes (29.1 %), others (5.9 %) occurred in the region (Fig. 2).

According to the light availability for the bryophytes in this region, with a majority of votes are sciophytic (64%). The rest of taxa are photophytic (36%). The first preference habitats of the bryophytes in the studied region are subneutrophyc in sequence acidophytic and basiphytic (Fig. 3).

In respect of the life forms of bryophytes in this region, predominant form is short turf (24.6%) and then in sequence mat and weft (7.9%), tall turf (11.9%), cushion (11.1%), fan (8.9%) tail (5.2%) and annual (2.2%) (Fig. 4).

As a result the bryophytes in the life forms such as wefts, mats, fans and tails are pleurocarpous species (50%) and other bryophyte life forms as short turfs, cushions, tall turfs and annuals are acrocarpous species (50%). Since acrocarpous species have quill-edged leaves and grow in cushion form, they can endure longer periods of heat and dryness better than pleurocarpous species. As for pleurocarpous mosses generally cover rocks or other substrata in more humid habitats. However,
and northwest of this region especially in Kapıdağ peninsula. Northern and western zones of the area are exposed to the oceanic climate of Northern Anatolia. On the other hand, its south and southeast regions are exposed little rainy Mediterranean climate of Western Anatolia. This feature seems to have an effect upon the vegetation occurring in these areas. Therefore, pleurocarpic mosses densely occur in north and northwest regions of the area. Besides, the south and southeast parts of the study area is less rugged than its western and northwest parts, the parts cleared of plants or trees have been harnessed as agricultural areas. Hence, there is a spare distribution of mosses here.

ACKNOWLEDGMENTS

We would like to thank the Research Fund of Zonguldak Karadeniz University for its financial support (Project Code No: 2003-13-06-03).

REFERENCES


