The Moss Flora of Çankırı Alparsı Pond, with a moss record
(Pterygoneurum crossidioides W. Frey, Herrnst. & Kürschner) from the Country

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Abstract

The Moss Flora of Çankırı Alparsı pond (Çankırı, Turkey) was studied. It was found that 332 moss specimen occurred in 73 taxa belonging to 31 genera and 15 families. In The richest 5 families by taxa number were Pottiaceae (26), Brachytheciaceae (10), Grimmiaaceae (7), Orthotrichaceae (6), Bryaceae (5) respectively. The richest species by taxa number were; Tortula (8), Orthotrichum (7), Syntrichia (7), Grimmia (6), and Bryum (5). While acrocarpous taxa (54) represented 75% of the whole flora, the ratio of pleurocarpous (18) was 25%. Funaria hygrometrica (Hedw.), Grimmia alpestris (F.Weber & D.Mohr) Schleich., Bryum pallens (Sw. ex anon.) were identified first time from Çankırı province; Ceratodon conicus (Hampe) Lindb., Weissia longifolia (Mitt.), Bryum intermedium (Brid.) Blandow, Grimmia crinita Brid, and Tomentypnum nitens (Hedw.) Loeske were identified first time from A2 grid square; and Pterygoneurum subsessile (Brid.) Jur. record was given for the second time in Turkey. In addition, P. crossidioides (W. Frey, Herrnst. & Is Kürschner) was reported for the first time in Turkey. The species which is rarely distributed in arid regions has been reported worldwide in Israel and Hungary.

Key words: Bryophyte, Flora, New record, Pterygoneurum crossidioides, Çankırı
1. Introduction

Turkey, which is in the transition zone of three biogeographical regions, the Mediterranean, European-Siberian, and Irano-Turanian, is one of richest countries between the Middle East and Europe in terms of biodiversity (Kaya and Raynal, 2001). However, knowledge of the Turkish bryoflora is still far from complete. In recent years there has been a considerable increase in the number of remarkable bryophyte records and bryofloristic papers for Turkey (Bryoerythropodium rubrum, Batan and Özdemir, 2012; Dicranella schreberiana, Dicranodontium asperulum, and Campylopus pyriformis, Batan and Özdemir, 2013; Didymodon tomaculosus, Canli and Çetin, 2012; Pseudocalliergon turgescens, Ezer and Kara, 2012; Didymodon icmadophilus, Conardia compacta, Zygodon gracilis, Diphysium foliosum, Pohlia obtusifolia and Oligotrichum hercynicum, Kirmaci et al., 2012; Crossidium aberrans Kirmaci and Avcagil, 2012; Seligeria trifaria and Pseudotaxiphyllum elegans, Ören et al., 2012; Conardia compacta, Özdemir et al., 2012; Seligeria domniana, Ursavas and Çetin 2012; Schistidium sordidum, Batan et al., 2013; Syntrichia caninervis var. abranchesii, Can et al., 2013; Sphagnum contortum, S. fallax, S. magellanicum, and S. rubellum, Kirmaci and Kürschner, 2013; Grimmia anomalata, Pohlia filum, and Hookeria acutifolia, Uyar and Ören, 2013; Sphagnum molle, Abay and Keçeli 2014; Brotherella erythrocaulis, and Encalypta pilifera, Batan et al., 2014; Rhizomnium striatum, Leucodon corenensis, and Leucobryum bowringii, Özdemir and Batan 2014; Acaulon fortquerianum, Kirmaci and Erdağ, 2014; Schistidium boreale, Batan and Özdemir, 2014; Syntrichia minor, Ören et al. 2015), and studies continue the bryoflora of many regions of Turkey are still continues. The total number of bryophyte species of Turkey has exceeded 970 according to Uyar and Çetin (2004); Kürschner and Erdağ (2005); Kürschner and Frey (2011) and with new records reported.

Despite all these studies compared to those in European countries, a bryofloristic study in Turkey is still inadequate. Therefore, more research is needed for more comprehensive characterization of bryophyte flora of Turkey. The aim of this study was contribute to the characterization of bryophyte flora of Turkey via studying moss flora at Alpsari site in Çankırı province of Turkey.

Up to now, many bryophyte studies were done in Çankırı. These are; The Moss Flora of Çankırı-Eldivan Mountain (Keçeli and Çetin, 2000); The moss Flora (Muscil) of Ilgaz Mountain National Park (Abay and Çetin, 2003); Contributions to the Moss Flora (Muscil) of Çankırı Province (Eldivan-Karadere) (Abay, 2005); Contributions to the moss (Muscil) Flora of Çankırı (Yapraklı) (Abay, 2008); The moss (Muscil) Flora and Ecology of Çankırı research Forest (Abay and Ursavas, 2009); Contributions to the Bryoflora of Ilgaz Mountain, Yenice Forests, Turkey (Ursavas and Abay, 2009); Contributions to the Moss Flora (Muscil) of Gürgenli Mountain (Bayramören/Çankırı) (Şahin and Abay, 2009); Contributions to the Liverwort (Marchantiophyta) flora of Ilgaz Mountain (Turkey) (Şimşek, et. al., 2011); Barbilophozia lycopodioides (Wallr.) Loeske, new to the liverwort flora of Turkey (Keçeli et. al., 2011); Substratum properties and Mosses in semi-arid environments. Acase study from North Turkey (Abay et al., 2014); Spatial variation, mapping, and
classification of moss families in semi-arid landscapes in NW Turkey (Abay, et. al., 2015); The Moss (Musci) Flora In The Urban Area of Çankırı and Surroundings (Yavuz, 2015).

Considering the above bryophyte studies in Çankırı province. Up to now; Çankırı-Alpsar Pond and around have not been any studies on the flora of mosses. This study; was undertaken to determine the flora of mosses of Çankırı-Alpsar Pond and its near environment.

1. Site Description
Çankırı, located in A2 square of the Henderson (1961) grid system. Study area comprised villages in Alpsarı, Gümüşdüven, Kayaçiç, Yolkaya, Ortayaka, Akcahi, Yenice and Korgun district (Figure 1).

![Map of research area](image)

Figure 1. Map of research area

For this study Alpsarı Pond district, of the city of Çankırı, was chosen as the research area. Alpsarı Pond and surroundings in the northwest part of Çankırı are distributed along 44,000 ha and includes open areas, grasslands, agriculture and Anatolian pine plantation area. The study area, about 21 km NW of Çankırı and 10 km SW of Korgun, is situated between 40° 46' N and 33° 48' E (Anonymous, 2011). Alpsarı Pond and district is located in the A2 grid square according to the system adopted by Henderson (1961) (Fig. 2).

Data from meteorological station of Eldivan district were used. Based on 34 years of climatic data (1977-2010), the mean annual temperature is 10.5 °C, the mean minimum and maximum average temperature range from -0.7 °C (January) to 22.6 °C (August); the average annual precipitation is 486 mm, with the maximum monthly precipitation (54.6 mm) in December and minimum (24.8 mm) in July (Fig. 2). The most abundant vascular plants in the study area are shrubs of *Paliurus spin-christi* Mill., *Berberis vulgaris* L., *Rosa canina* L. and trees are *Pinus nigra* Arnold subsp. *pallasiana* (Lamb.) Holmboe, *Quercus infectoria* Oliver, *Populus nigra* L., *Salix alba* L., and *Crataegus monogyna* Jaq. (Anonymus, 2011).

Main soil great groups are alluvial and colluvial soils, chestnut brown forest soils, lime deficient brown forest and brown soils (Göl and Dengiz, 2007). The predominant rocks of the study area are sandstone, clay stone, precipitated limestone (Anonymus, 2011).

2. **Materials and Methods**

Moss samples were collected between 2013-2014 in different times of the vegetation. The stations, where the 332 mosses were collected, were discriminated by differences in plant communities, the geographical conditions and the elevation from the sea level (Table 1).


*Pterygoneurum crosodioides* has been approved by Richard H. Zander on 10/01/2014. The species was put into the herbarium at Missouri Botanical Garden in USA by Zander.

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Table 1. Site No (SN), Date of moss collection, elevation from the sea level (m), locations and geographic coordinates, Trees, and some shrubs in the study area.

<table>
<thead>
<tr>
<th>SN</th>
<th>Date</th>
<th>Altitude (m)</th>
<th>Localities and geographic coordinates</th>
<th>Trees and some shrubs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18.07.2013</td>
<td>849</td>
<td>Marif stream, 40° 41' 33.111&quot; N – 33° 31' 40.782&quot; E</td>
<td>CM, PN, RC, SA,</td>
</tr>
<tr>
<td>2</td>
<td>19.07.2013</td>
<td>896</td>
<td>Alpsari village, 40° 41' 17.131&quot; N – 33° 31' 31.624&quot; E</td>
<td>A, BV, JO, PNP, SA</td>
</tr>
<tr>
<td>3</td>
<td>24.07.2013</td>
<td>992</td>
<td>Yukari hill, 40° 40' 24.904&quot; N – 33° 31' 55.792&quot; E</td>
<td>A, JO, PNP, QI</td>
</tr>
<tr>
<td>4</td>
<td>25.07.2013</td>
<td>902</td>
<td>Yukari stream, 40° 40' 29.647&quot; N – 33° 32' 1.026&quot; E</td>
<td>PNP, JO, RA, RC, PN, PA, BV, E</td>
</tr>
<tr>
<td>5</td>
<td>30.07.2013</td>
<td>1114</td>
<td>Alibey, 40° 40' 0.385&quot; N – 33° 32' 16.935&quot; E</td>
<td>QL, PNP, JO, A</td>
</tr>
<tr>
<td>6</td>
<td>30.07.2013</td>
<td>1117</td>
<td>Alpsari hill, 40° 40' 23.641&quot; N – 33° 32' 30.284&quot; E</td>
<td>PNP, QI JO</td>
</tr>
<tr>
<td>7</td>
<td>30.07.2013</td>
<td>1046</td>
<td>Düzmeçeli hill, 40° 41' 9.500&quot; N – 33° 32' 43.820&quot; E</td>
<td>PNP, QI JO</td>
</tr>
<tr>
<td>8</td>
<td>31.07.2013</td>
<td>1088</td>
<td>Alpsari hill, 40° 40' 42.698&quot; N – 33° 33' 7.201&quot; E</td>
<td>PNP, QI JO</td>
</tr>
<tr>
<td>9</td>
<td>31.07.2013</td>
<td>1173</td>
<td>Sıkçağal, 40° 39' 35.689&quot; N – 33° 32' 27.298&quot; E</td>
<td>PNP, QI JO, BV</td>
</tr>
<tr>
<td>10</td>
<td>12.09.2013</td>
<td>793</td>
<td>Tatlı stream, 40° 40' 54.574&quot; N – 33° 34' 25.599&quot; E</td>
<td>PNP, JO, PN, RA, TP</td>
</tr>
<tr>
<td>11</td>
<td>13.09.2013</td>
<td>992</td>
<td>Yenice village, 40° 39' 30.846&quot; N – 33° 33' 44.212&quot; E</td>
<td>PNP, JO A</td>
</tr>
<tr>
<td>12</td>
<td>13.09.2013</td>
<td>1140</td>
<td>Plantation area, 40° 40' 23.641&quot; N – 33° 32' 30.284&quot; E</td>
<td>PNP, JO A</td>
</tr>
<tr>
<td>13</td>
<td>21.03.2014</td>
<td>1270</td>
<td>Sarıağaci hill, 40° 39' 02.898&quot; N – 33° 32' 48.536&quot; E</td>
<td>PNP, QI JO</td>
</tr>
<tr>
<td>14</td>
<td>21.03.2014</td>
<td>1252</td>
<td>Çamolukparma, 40° 39' 14.246&quot; N – 33° 32' 26.315&quot; E</td>
<td>PNP, JO</td>
</tr>
<tr>
<td>15</td>
<td>21.03.2014</td>
<td>1220</td>
<td>Sıkçağal, 40° 39' 28.303&quot; N – 33° 32' 24.768&quot; E</td>
<td>PNP, JO</td>
</tr>
<tr>
<td>16</td>
<td>21.03.2014</td>
<td>1174</td>
<td>Ardeleye hill, 40° 39' 28.303&quot; N – 33° 32' 24.768&quot; E</td>
<td>JO, QI A</td>
</tr>
<tr>
<td>17</td>
<td>22.03.2014</td>
<td>886</td>
<td>Karadere village, 40° 40' 18.620&quot; N – 33° 31' 10.889&quot; E</td>
<td>JO, RC, BV, AC</td>
</tr>
<tr>
<td>18</td>
<td>22.03.2014</td>
<td>941</td>
<td>Alpsari pond, 40° 40' 06.924&quot; N – 33° 29' 54.643&quot; E</td>
<td>RC, A, O</td>
</tr>
<tr>
<td>19</td>
<td>22.03.2014</td>
<td>1072</td>
<td>Düzmeçeli hill, 40° 40' 15.722&quot; N – 33° 28' 35.696&quot; E</td>
<td>QL, RC, CM, G, O</td>
</tr>
<tr>
<td>20</td>
<td>22.03.2014</td>
<td>947</td>
<td>Panuklar hill, 40° 39' 44.805&quot; N – 33° 31' 15.482&quot; E</td>
<td>PNP, JO, QI, BV, A</td>
</tr>
<tr>
<td>21</td>
<td>11.06.2014</td>
<td>882</td>
<td>Alpsari pond, 40° 40' 44.392&quot; N – 33° 29' 59.523&quot; E</td>
<td>PNP, JO, QI, RC, PN, CB</td>
</tr>
<tr>
<td>22</td>
<td>10.07.2014</td>
<td>1027</td>
<td>Yolkaya village, 40° 40' 35.068&quot; N – 33° 27' 43.567&quot; E</td>
<td>A, O, RP</td>
</tr>
<tr>
<td>23</td>
<td>10.07.2014</td>
<td>1200</td>
<td>Marif village, 40° 38' 39.343&quot; N – 33° 38' 00.944&quot; E</td>
<td>PNP, QI, RC, QI, BV, PN</td>
</tr>
</tbody>
</table>


If the first recorded taxa were from Çankırı, they were indicated by one asterisk (*), if the first recorded taxa were from A2 they were indicated by two asterisk (**), if the second recorded taxa were from Turkey, they were indicated by three asterisk (***) and, if the first recorded taxa were from Turkey, they were indicated by diamond (♦).

For definitions of habitats in the Study area: s: on soil, r: on rock, src: on soil trunk, cw: on concrete wall in rock crevices, t: on bark of tree trunk and branch, dt: on dead

In the definitions of specimens: The first number represents locality number, the bold abbreviation represents the habitat, U and K abbreviations represent legit and determination (Serhat URSAVAŞ and Nermin Gündüz KESİM), and the last number represents the collections number.
3. Floristic List

Mosses

Encalyptaceae Schimp.

1. Encalypta streptocarpa Hedw. – 3:dt, U 1286; 3:dt, K 2; 3:s, U 1287; 15:r, U 1285; 15:r, K 1, 15:s, U 1288; 17:s, U 1286; 17:s, K 3.

2. E. rhapontica Schwägr. – 6:s, U 1290.

3. E. vulgaris Hedw. – 20:s, U 1291.

Funariaceae Schwägr.

4. *Funaria hygrometrica* Hedw. – 4:s, U 1292; 17:s, U 1293; 17:s, K 91.

Grimmiaceae Arn.


7. **G. crinita** Brid. – 21:r, U 1302.

8. G. funalis (Schwägr.) Bruch & Schimp – 3:r, U 1303; 8:r, U 1304; 8:r, K 17.


Ditrichaceae Limpr.

12. **Ceratodon conicus** (Hampe) Lindlb. – 4:s, U 1332; 18:s, U 1333; 18:s, K 20.

13. C. purpureus (Hedw.) Brid. – 2:s, U 1325; 3:s, U 1326; 4:r, U 1327; 4:r, K 18; 7:src, U 1514; 8:s, U 1328; 8:s, K 19; 15:r, U 1329; 15:s, U 1342; 17:s, U 1330; 17:s, K 20; 20:s, U 1331.

14. Ditrichium flexicaule (Schwägr.) Hampe – 3:r, U 1334; 4:s, U 1335; 4:s, K 22; 10:s, U 1336; 10:s, K 23; 11:s, U 1337; 20:s, U 1338.

15. Dichranum scoparium Hedw. – 14:s, U 1339; 14:t, U 1340; 14:t, K 24.


Pleurochaete Lindlb.

17. Pleurochaete squarrosa (Brid.) Lindlb. – 3:src, U 1343; 10:s, U 1344; 10:s, K 47; 17:s, U 1345.

18. Tortella inclinata (R. Hedw.) Limpr. var. densa (Lorentz & Molendo) Limpr. – 3:s, U 1346; 3:src, U 1347; 3:src, K 36; 8:s, U 1348; 8:s, K 37; 11:s, U 1349; 12:s, U 1350; 12:s, K 54.

19. T. tortuosa (Hedw.) Limpr. – 3:s, U 1351; 7:s, U 1352; 7:s, K 38; 8:src, U 1353; 9:s, U 1354; 9:s, K 39; 11:s, U 1355; 12:s, U 1356; 20:s, U 1357; 20:s, K 40.

20. Weissia brachycaarpa (Nees & Hornsch.) Jur. – 10:s, U 1358; 20:s, U 1359; 20:s, K 56.

21. Weissia controversa Hedw. – 12:s, U 1360.

22. **Weissia longifolia** Mitt. – 10:s, U 1361.

23. Barbula convoluta Hedw. – 1:tw, U 1362; 2:s, U 1363; 7:s, U 1364; 7:s, K 41; 8:s, U 1365; 10:s, U 1366; 10:s, K 42; 10:src, U 1367; 10:src, K 43.

24. Barbula unguiulata Hedw. – 1:dt, U 1368; 2:s, U 1369; 5:s, U 1370; 5:s, K 44; 6:s, U 1371; 6:s, K 45; 7:s, U 1372; 7:tw, U 1373; 23:s, U 1374; 23:s, K 46.
29. *D. vinealis* Brid. – 17:s, U 1378.
   (This sample was confirmed by Dr. Richard H. Zander).
31. *P. ovatum* (Hedw.) Dixon – 16:s, U 1379; 17:s, U 1380; 17:s, K 34; 19:s, U 1381; 19:s, K 35.
32. *** *P. subsessile* (Brid.) Jur. – 18:s, U 1382.
33. *Syntrichia caninervis* (Mitt.) var. *gypsophila* (J. J. Amannex G. Roth) Ochyra – 2:s, U 1383; 6:s, U 1384; 8:s, U 1385; 8:s, K 51.
34. *S. montana* Nees (S. intermedia Brid.) – 14:s, U 1424.
35. *S. princeps* (De Not.) Mitt. – 12:r, U 1386.
38. *Syntrichia virescens* (De Not.) Ochyra – 12:s, U1399; 14:s, U1400; 17:s, U1401; 17:s, K 53.
42. *Tortula subulata* Hedw. – 3:s, U1421; 17:r, U1422; 23:r, U1423; 23:r, K 52.

**Orthotrichaceae** Arn.
43. *Orthotrichum cupulatum* Hoffm. ex Brid. – 23:r, U1425.
47. *O. speciosum* Nees – 5:t, U1444.

**Bryaceae** Schwägr.
50. *B. caespiticium* Hedw. – 2:s, U1448.
52. *** *B. intermediate* (Brid.) Blandow – 2:s, U1454.
53. *B. pallens* Sw. exanon. – 17:s, U1455.

**Mielichhoferiaceae** Schimp.

54. *Pohlia elongata* Hedw. – 1:s, U1456.

**Amblystegiaceae** Kindb.,

55. *Amblystegium serpens* (Hedw.) Schimp. – 1:dt, U1457; 2:dt, U1458; 14:dt, U1459; 14:s, U1460; 14:s, K68; 19:t, U1461; 19:t, K69.

56. *Hygroamblystegium tenax* (Hedw.) Jenn. – 1:r, U1462; 1:t, U1463; 1:t, K71.


58. **Tomentypnum nitens** (Hedw.) Loeske – 4:s, U1513.

**Leskeaceae** Schimp.

59. *Pseudoleskea catenulata* (Brid. ex Schrad.) Kindb. – 2:r, U1467.

**Thuidiaceae** Schimp.

60. *Abietinella abietina* (Hedw.) M. Fleisch. var. *abietinella* (Hedw.) M. Fleisch – 5:s, U1468; 9:s, U1469; 23:s, U1470; 23:s, K72.

**Brachytheciaceae** Schimp.


62. *Brachythecium albicans* (Hedw.) Schimp. – 5:s, U1471; 9:s, U1472; 14:s, U1473; 14:s, K80; 20:s, U1474; 20:s, K81.

63. *B. erythrorrhizon* Schimp. – 5:s, U1475; 7:s, U1476; 8:s, U1477; 8:s, K77; 9:s, U1478; 13:s, U1479; 13:s, K78; 21:t, U1480; 21:t, K79.

64. *B. rivulare* Schimp. – 21:t, U1481.


67. *Homalotheccium aureum* (Spruce) H. Rob. – 3:s, U1484.

68. *H. lutescens* (Hedw.) H. Rob – 3:s, U1485; 4:s, U1486; 8:s, U1487; 9:s, U1488; 9:s, K82; 23:s, U1489; 23:s, K83.

69. *H. philippianum* (Spruce) Schimp. – 7:r, U1490.

70. *H. sericeum* (Hedw.) Schimp. – 1:dt, U1491; 2:s, U1492; 2:t, U1493; 2:t, K73; 6:s, U1494; 8:s, U1495; 8:s, K74; 12:s, U1496; 14:s, U1497; 14:s, K75; 23:s, U1498; 23:s, K76.

**Hypnaceae** Schimp.

71. *Hypnum cupressiforme* (Hedw.) var. *cupressiforme* Hedw. – 9:s, U1499; 12:s, U1500; 12:s, K84; 21:s, U1501; 23:s, U1502; 23:s, K85; 23:r, U1503; 23:r, K86.

72. *H. cupressiforme* var Hedw. *lacunosum* Brid. – 3:r, U1506; 3:s, U1505; 4:r, K87; 4:r, K87; 8:s, U1507; 9:s, U1508; 9:s, K88; 10:s, U1509; 10:s, K89; 14:s, U1510; 16:t, U1511; 16:t, K90.

**Pterigynandraceae** Schimp.

73. *Pterigynandrum filiforme* Hedw. – 14:t, U1512.

4. Results and Discussion

In this study, 332 moss specimen, the moss species were collected from neighborhood of Alpsarı pond in different vegetation periods between 2013 and 2014, were classified in 73 taxa belonging to 31 genera and 15 families. *Funaria hygrometrica, Grimmia alpestris*, and *Bryum pellens* were recorded for the first time from Çankırı. *Grimmia crinita, Ceratodon conicus, Weissia longifolia, Bryum intermedium*, and *Tomentypnum nitens* were recorded also for the first time in A2 grid square.

*Pterigoneurum subsessile* was recorded for the second time in Turkey in the

present study. This first species was known from only one locality in Niğde-Çamardi: Emli Valley, near the village of Çamardi, from 670 m a.s.l., on open, dry soil (Tonguç Yayıntaş, 2009).

*Pterygoneurum crossidioides* was recorded for the first time for Turkey bryophyte flora. Specimen details:

Turkey, Square A2, between Çankırı to Korgun district, on the western slope of the Alpsar pond, 941 m above the sea level, 40° 40’ 06,9’’ N; 33° 29’ 54,6’’ E, on gypsum and calcareous soil, associated with *P. ovatum* (Hedw.) Dixon and *P. subsessile* (Brid.) Jur. 22 March 2014, S. URŞAVAŞ 1284. *P. crossidioides* is characterized by the well-developed lamellae with filamentous outgrowths (8-12 cells high), strongly branched and smooth, conical terminal cell of the filaments.

A closely related species, *Pterygoneurum ovatum*, was collected from three different localities from Alpsar pond in Çankırı. The main differences between the two species (*P. crossidioides* and *P. ovatum*) *P. crossidioides* Lamellae: Reaching the leaf base to apex, Filaments: Apical cell smooth, strongly branched and generally conic, 8-12 cells high. Hair-point: of outer leaves reaching until the end of capsules and twice the length of the lamella, up to half slightly denticulate, some inner leaves brown. *Pterygoneurum ovatum* Lamellae: extends up to half the leaf tip, Filaments: Apical cell smooth, weakly branched and generally conic, 5-8 cells high. Hair-point: as long as the lamella, not reaching until the end of capsules and slightly denticulate from base to up, inner leaves hyaline.

The first record of *P. crossidioides* was from the desert areas near the Dead Sea (Frey et al., 1990). *P. crossidioides* has been found six localities Haifa, Jerusalem, Tel Aviv, Northern, Southern and Central in Israel (URL 1). It is also located on the checklist and the red list of Hungary bryophytes (Papp et al., 2010).

The genus *Pterygoneurum* Jur. is widely distributed both in arid and semi-arid climatic regions of five continents (Cano et al., 1994). *Pterygoneurum* includes ten species, seven of which have been reported in the Mediterranean area (Cano, et al., 1994; Guerra, et al., 1995; Cano, 2006; Hill, et al., 2006; Rose, et al., 2013). Nonetheless, Spanish (Guerra, et al., 1995) records of *P. crossidioides* (Pócs, et al., 2002; Erzberger and Papp, 2004) apparently may have been confused with forms of *P. ovatum* which has short filaments on the distal part of the lamellae (Cano, 2006).

Although there are some morphological differences between the two species (Table 2), it is necessary to investigate whether there is a significant different genetic discrimination or not.

*Pterygoneurum* are represented by seven taxa in Mediterranean countries and five taxa in Russian. It is represented by four taxa (*P. ovatum*, *P. subsessile*, *P. squamosum*, *P. crossidioides*) in Turkey,
Figure 3. Appearance of *Pterygoneurum crossidioides* in the natural environment and Capsule.

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>Pterygoneurum crossidioides</em></th>
<th><em>Pterygoneurum ovatum</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lamellae</td>
<td>Lamellae on ventral side of costa starting from the base to up.</td>
<td>Lamellae on ventral side of costa only in upper half, not brearing filaments.</td>
</tr>
<tr>
<td>Filaments</td>
<td>Upper cell flat, usually conical and makes strong branching.</td>
<td>Upper cell flat, usually conical and makes weak branching.</td>
</tr>
<tr>
<td>Filament cell number</td>
<td>8–12 cell</td>
<td>5–8 cell</td>
</tr>
<tr>
<td>Hair-point</td>
<td>Hyaline hair-point longer than twice of lamella to equal, weak serrulation only half to upper.</td>
<td>Hyaline hair-point 2/3 the length of lamina to equal, weak serrulation base to apex.</td>
</tr>
</tbody>
</table>

The richest families and the first 15 genera are shown in Table 3. The first 6 families (Pottiaceae, Brachytheciaceae, Grimmia, Orthotrichaceae, Bryaceae, and Amblystegiaceae) make up 79.2% of the total taxa in the study area and the other 9 families constitute 20.86%. These first 11 genera (Grimmia, Syntrichia, Orthotrichum, Bryum, Tortula, Brachythecium, Homalothecium, Encalypta, Weissia, Didymodon, and Pterygoneurum) make up 65% of the total taxa in the study area and the other 20 genera constitute 35%.

<table>
<thead>
<tr>
<th>Family</th>
<th>NT</th>
<th>(%)</th>
<th>Genera</th>
<th>NT</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pottiaceae</td>
<td>26</td>
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<td>Grimmia</td>
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</tr>
<tr>
<td>Brachytheciaceae</td>
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<td>Syntrichia</td>
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<td>Orthotrichum</td>
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</tr>
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<td>2.7</td>
</tr>
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<td>1.4</td>
<td>Barbula</td>
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</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>73</td>
<td>100</td>
<td><strong>TOTAL</strong></td>
<td>73</td>
<td>100</td>
</tr>
</tbody>
</table>

(NT): Number of taxa, (%): Percentage of taxa according to the total number of taxa

In the study area, taxa distributions are shown by substrata in Figure 18. The openings in the study area, a large agricultural and pasture lands, led to be more growing in terms of the number of moss species on soil. The small number of tree species, composed of young plantation areas, the lack of natural forests has played an influential role in relatively low number of epiphyte species.

Result from Keçeli and Çetin (2000), Abay and Çetin (2003) and Abay (2005) and Ursavaş and Abay (2009) showed that Pottiaceae and Brachytheciaceae families had the largest number of taxa the same as we found our study. Pottiaceae family members are frequently found in landscapes with semi-arid climate. These landscapes are common in Çankırı. On the contrary, in Ilgaz Mountain National Park, some parts of the south slopes of which are located in the boundaries of Çankırı province, Pottiaceae and Brachytheciaceae families have the same rations sharing the first row. In conclusion, results obtained in this study had a significant contribution to the database of moss flora in Çankırı Province. In addition, a new taxon (Pterygoneurum crosnidioides) was introduced to bryophytes Flora of Turkey.

Figure 18. Taxa distribution by the substrate

Table 4. The comparison of the taxa distribution according to the families

<table>
<thead>
<tr>
<th>Families</th>
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<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td></td>
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<td>%</td>
<td>NT</td>
<td>%</td>
<td>NT</td>
<td>%</td>
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<tr>
<td><strong>Pottiaceae</strong></td>
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