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A Contribution to the Liverwort Flora of Western Black Sea Region, Northern Turkey, and a new record (*Cephaloziella dentata*, Cephaloziellaceae) to Southwest Asia

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Résumé – A partir des 71 spécimens d'hépatiques et un d'anthocérote récoltés par T. Keçeli dans diverses localité de la région occidentale de la Mer Noire (Nord de la Turquie), les auteurs ont dressé un inventaire de 50 taxa reconnus. *Cephaloziella dentata* est récolté pour la première fois en Turquie.

Flore des Hépatique / Région occidentale de la Mer Noire / Turquie / Nouveau Report / *Cephaloziella dentata*

Abstract – A total of 71 liverworts and one hornwort collections made by T. Keçeli from various localities in the Western Black Sea Region of Turkey have been identified. An inventory of the 50 taxa represented in these collections is presented. Among them *Cephaloziella dentata* is firstly recorded from the investigated area for bryophyte flora of Turkey.

Liverwort Flora / Western Black Sea Region / Turkey / New Record / *Cephaloziella dentata*

INTRODUCTION

Although, a few researchers investigated the liverwort flora in Black Sea region in Turkey, these studies focused only on a small localized area. This is the first detailed study which was made on the liverwort flora of Western Black Sea Region of Turkey in respect to the study area (Bolu, Kastamonu, Bartin, Zonguldak).

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Recent contributions to the Turkish liverwort flora from north and north-west Anatolia, such as *Riccia crozalsii* Levier (Gökler, Özenoğlu & Kiremit, 2000); *Riccardia latifrons* (Lindb.) Lindb. (Keçeli, Çetin & Uyar, 2004); *Harpanthus scutatus* (F.Web. et D.Mohr) Spruce, *Nardia scalaris* S. F. Gray and *Scapania subalpina* (Nees ex Lindenb.) Dumort. (Papp, 2004); *Pedinophyllum interruptum* (Nees) Kaal. (Keçeli, 2004), *Ptilidium pulcherrimum* (Weber) Vain. (Keçeli & Çetin, 2005) and *Eremonotus myriocarpus* (Carrington) Lindb. & Kaal. ex Pearson (Kürschner & Parolly, 2006) reflect that our knowledge about the liverwort flora of Turkey is still incomplete. The number of liverwort taxa in Turkey may increase significantly with further investigations.

MATERIALS AND METHODS

The liverwort flora of western Black Sea region was extensively surveyed between 1999-2003. Field notes on individual species and vegetation were compiled in various field studies. Most of the important mountains in the area were visited and different habitat types were investigated. Materials collected from the study area, are deposited in the herbarium of University of Ankara, Faculty of Science, and Department of Biology (ANK). The plants list was enumerated according to the nomenclature follows Grolle & Long (2000).

Following keys were used for identification and nomenclature of the specimens; Schuster (1966, 1969, 1974), Landwehr *et al.* (1980), Arnell (1981), Watson (1981), Hallingbäck & Holmåsen (1985), Frey *et al.* (1995), Smith (1996), Paton (1999), Kürschner (2001). Author names of the plants were written according to Brummit & Powell (1992).

THE INVESTIGATED AREA

The area investigated (Fig. 1) is western part of the Black Sea Region of North Anatolia (A2, A3 in the grid system of Henderson (1961). It includes the provinces of Bolu, Kastamonu, Bartin and Zonguldak. The study area is surrounded in the west by Duzce province, in the south-western by Bolu province, in the south by Ankara province, in south-eastern Cankiri province and in the east by Sinop province and in the north by the Black Sea costs. The altitude of the study area ranges between 0-2000 meters. The region lies approximately at the latitude between 42˚00'N and 41˚00'N, longitude 31˚45'E and 33˚45'E. The terminal borders of the study area are at north Doganyurt (Kastamonu) (42˚00'N, 33˚26'E), at west Yeniyer (Duzce) (40˚58'N, 31˚22'E), at south between Yigilca and Seven Lakes National Park (Bolu) (40˚54'N, 31˚41'E), at east Yaraligoz Mountain (Kastamonu) (41˚47'N, 34˚05'E).

The common rock bottom types in the study area are granodioritic, granitic and volcanic rocks, which belong to Paleozoic age. As for the common soil types in the region are brown forest and red-yellow podzolic soils which are richest soils as organic matter. In the study area, at higher altitudes and north-west localities, such as Bartin and Zonguldak provinces, are under the oceanic

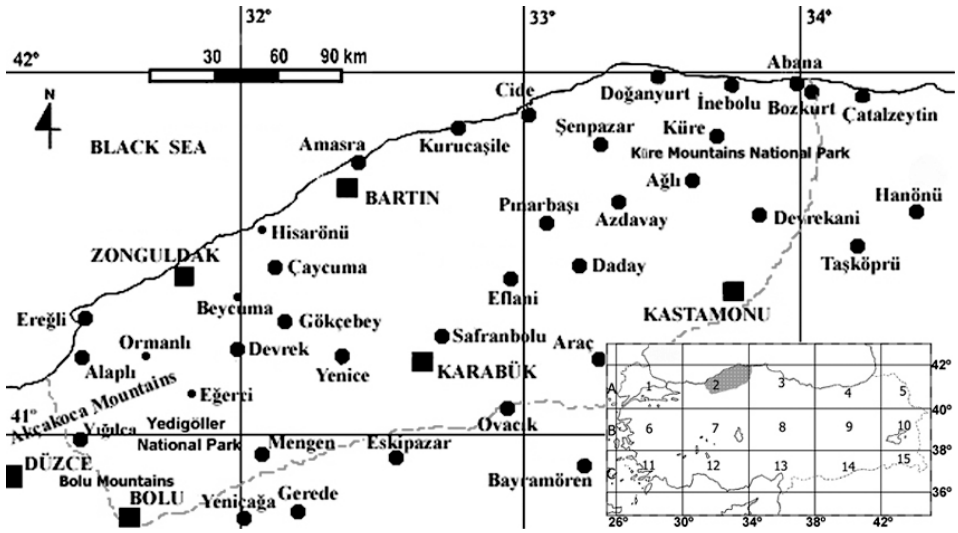


Fig. 1. The map of the investigated area.

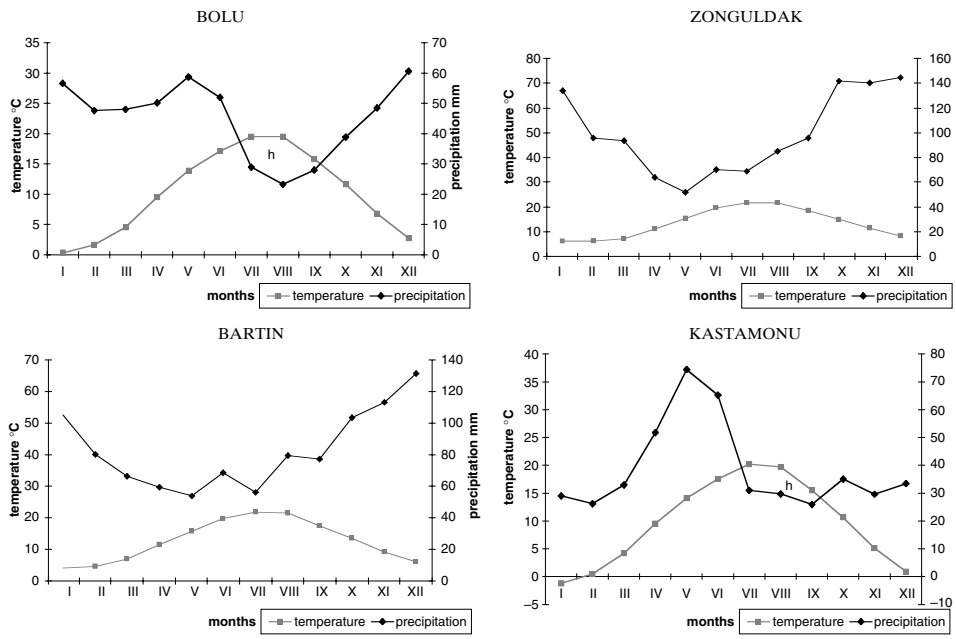


Fig. 2. Ombro-thermic diagrams for four provinces in the study area, h: arid season (prepared according to bioclimatic datas of DMİGM (1929-2001).

influence, nevertheless south and south-east localities such as, Kastamonu and Bolu provinces are characterized by a sub-arid moderate climate (Fig. 2). The study area has an average rainfall of 300-1185 mm (Akman, 1999; DMİGM, 1929-2001).

The study area belongs to western sector of the Euxine province of the Euro-Siberian floristic region. The vegetation in the investigated area contains Euro-Siberian, Euxine, Mediterranean and Irano-Turanian elements (Ketenoğlu & Güney, 1997). The general vegetation is made up forest and pseudo-maquis. The deforested parts of the study area have been represented by a steppe vegetation of Irano-Turanian origin. Steppe vegetation composed of mostly chamaephytes, hemicryptophytes and annual and perennial grasses has been observed. The main vegetation type in the study area is Euxine broadleaf deciduous forests (belongs to temperate broadleaf and mixed forests biome). This vegetation consist mainly *Fagus orientalis* Lipsky, *Castanea sativa* Mill., *Quercus petraea* (Matt.) Liebl. subsp. *iberica* (Steven ex M. Bieb.) Krassiln., *Acer* spp., and *Tilia* spp. Additionally this formation including the evergreen but mesomorphic broadleaf understory species such as *Ilex aquifolium* L., *Rhododendron ponticum* L., *Laurocerasus officinalis* M. Roem., *Hedera helix* L., *Buxus sempervirens* L. and *Ruscus* spp. In the humid lowland forests (up to 1,000 m) they are generally dominated by *Castenea sativa* Mill., *Carpinus betulus* L., *C. orientalis* Mill. and above this belt *Fagus orientalis* Lipsky tends to be dominant. Another characteristic formation in this vegetation is *Alnus glutinosa* (L.) Gaertn. forest along streams.

Mediterranean formation is apparent on the Western Black Sea coasts, it is characterized by sclerophyllus shrubs but it is a deciduous formation (pseudo maquis vegetation). *Arbutus andrachne* L., *A. unedo* L., *Erica arborea* L., *Laurus nobilis* L., *Spartium junceum* L. and *Phillyrea latifolia* L. are the main species of this vegetation. Mediterranean conifer and mixed forests (belongs to temperate coniferous forests biome) includes *Pinus brutia* Ten., *Taxus baccata* L., *Sorbus* spp., *Acer* spp., *Prunus* spp., *Populus tremula* L., *Lonicera etrusca* Santi, *Ilex aquifolium* L., *Smilax aspera* L., *Hedera helix* L. in the study area.

Another vegetation type in the investigated area is Northern Anatolian conifer and deciduous forests (belongs to temperate coniferous forests biome). This ecoregion is mountainous and the ridges act as a barrier between Central Anatolia continental climate and the Black Sea oceanic climate. While the northern, more humid slopes of the coastal mountains support broadleaf deciduous humid forests, the southern slopes support drier needle-leaf coniferous forests. To the west, *Abies bornmulleriana* Mattf. is the dominant species, forming mixed stands with *Fagus orientalis* Lipsky and/or *Pinus sylvestris* L. In the southern areas, *Pinus* species are more widespread as they are better-adapted to the steppic conditions that prevail here. To the west, *Pinus nigra* Arn. is more widespread while to the east *P. sylvestris* L. is dominant. Various other species also contribute to the forest cover, such as: *Quercus robur* L., *Q. petraea* (Matt.) Liebl., *Q. pubescens* Willd., *Q. ilex* L., *Q. frainetto* Ten.., *Q. infectoria* Oliver, *Q. cerris* L., *Acer* spp., and *Sorbus* spp. At high altitudes *Juniperus communis* L. and *J. oxycedrus* L. form open scrub or small closed patches. The most noteworthy feature of this ecoregion is its intact forest cover (Mayer & Aksoy, 1986). Another vegetation type in the research area is Anatolian conifer and deciduous mixed forests (belongs to Mediterranean Forests, Woodlands, and Scrub biome). As Euro-Siberian formations tend to dominate the Black Sea region to the north and Irano-Turanian formations dominate the adjacent central plateau to the east, this ecoregion can be considered a transitional zone or bridge ecoregion among the diverse formations of Anatolia. *Pinus nigra* Arn., *Pinus brutia* Ten. and mixed *Quercus* spp. woodlands and shrublands dominate the vegetation. Other common plants of the study area are *Ostrya carpinifolia* Scop., *Corylus colurna* L., *Corylus avellana* L., *Sambucus ebulus* L., *Cornus mas* L.,

Platanus orientalis L., *Fraxinus ornus* L., *Rhus coriaria* L., *Rosa canina* L., *Prunus spinosa* L., *Ficus carica* L., *Juglans regia* L., *Cotinus coggyria* Scop., *Paliurus spina-christi* Mill., *Colutea cilicica* Boiss. et Balansa, *Helleborus orientalis* Lam., *Pyracantha coccinea* M.Roem., *Rubus canescens* DC., *Ruscus aculeatus* L., *Urtica dioica* L., *Fragaria vesca* L., *Tussilago farfara* L., *Pteridium aquilinum* (L.) Kuhn, *Asplenium trichomanes* L., *Equisetum arvense* L., *Polypodium vulgare* L. (Atalay, 1994).

THE LIST OF LOCALITIES IN THE RESEARCH AREA

The studied localities are given following the list. Among them 44th and 47th localities are belonging to A3 grid square. The other localities are belonging to A2 grid square according to Henderson's (1961) system.

1. A2; The triangle of Araç–Safranbolu counties and Bartın province, 620-950 m.
2. A2; Between Amasra-Cide counties, 100-300 m.
3. A2; Kastamonu province, in the vicinities of Cide-Şenpazar and Ağlı, 780-910 m.
4. A2; Trigone of Mengen-Yenice and Devrek counties, 180-740 m.
5. A2; Between Bartın–Safranbolu, between 0-20. km after Bartın, 100-140 m.
6. A2; Between Cide-Şenpazar 15 km after Cide, 900 m.
7. A2; Between Araç-Yenice, in the vicinities of Kayaboğazı-Pirinçlik, 270-590 m.
8. A2; Between Yenice and Zonguldak, 130-160 m.
9. A2; Between Zonguldak-Bartın, 10 km after Zonguldak, stream bank, 180 m.
10. A2; Between Devrek and Mengen, Karasu Brook, 310-650 m.
11. A2; Between Kastamonu-İnebolu, in the vicinity of Küre county, Ersizlerdere district, 570-1340 m.
12. A2; Between İnebolu and Cide, in the vicinities of Erkekarpa, Özlüce and Köroğlu villages, near stream banks, 110-200 m.
13. A2; Between Daday and Azdavay counties, Ballıdağ Mountain, Küre Mountains National Park, 1100-1560 m.
14. A2; Between Azdavay, Ağlı and Şenpazar, 6 km before from Ağlı, 640-1100 m.
15. A2; Kastamonu, triangle of Daday-Araç and Boyalı, 920-1330 m.
16. A2; Between İnebolu and Cide counties, Doğanyurt district, south facing cliffs of limestone, basalt, 120-150 m.
17. A2; Between Safranbolu county and Bartın province, 100-950 m.
18. A2; Between Bartın and Amasra, around Kuşkayasi district, 295 m.
19. A2; Between Zonguldak province-Devrek county, around of Beycuma, 160-360 m.
20. A2; Zonguldak, in the vicinity of Ilıksu district, 35 m.
21. A2; Between Zonguldak and Ereğli, Sakaköy, Bayat and Terzi villages, 200-550 m.
22. A2; Between Zonguldak and Devrek, abouts of Beycuma-Karacaören, 200-420 m.
23. A2; Between Zonguldak and Bartın provinces, crossroads to Bartın, 40 m.
24. A2; Between Zonguldak-Karabuk, in the vicinities of Gökçebey, Üçburgu and Yenice, 100-200 m.
25. A2; Zonguldak, Çatalağzı county, between Muslu and Şirinkoy districts, 40-160 m.
26. A2; Between Devrek and Ereğli, İsabeyli, Vakıf and Düzpelit districts, 300-720 m.
27. A2; Zonguldak, between Beycuma and Güneşli, 300 m.
28. A2; Between Ormanlı and Alaplı, 20 km before reaching to Alaplı, 400 m.
29. A2; Çaycuma county, Perşembe, Kızılbey and Dağdemirciler district, 120-500 m.
30. A2; Between Düzce and Yığılca, around Orhangazi village, 150-360 m.
31. A2; Climbing up to Bacaklıyayla high plateau, 450 m.
32. A2; Between Yığılca and Yedigöller National Park, 25 km after Yığılca, 900 m.
33. A2; Between Ereğli county and Gülüç district, 100 m.
34. A2; Between Alaplı and Yığılca counties, about of Kabalar village, 175-500 m.

35. A2; Kastamonu province, between Daday and Eflani counties, 950-995 m.
36. A2; Kastamonu, between Eflani-Pinarbaşı, northwest slopes of Esentepe, 1000 m.
37. A2; Kastamonu, between Pınarbaşı and Azdavay counties, Karafasıl and Suğla high plateau, northeast slopes, 990-1000 m.
38. A2; Alaplı county, climb up to the summit of Bacaklıyayla high plateau, Fındıkağılı district, 700-1400 m.
39. A2; Between Gümeli district and Alaplı county, northeast slopes, 260 m.
40. A2; Between Azdavay and Pınarbaşı, 4 km after Azdavay, Çatak bridge, southeast slopes, 420 m.
41. A2; Between Pınarbaşı and Şenpazar counties, around Ilıca waterfall, 400 m.
42. A2; Pınarbaşı county, Valla canyon, around of Bakacakkaya district, 450 m.
43. A2; Between Azdavay and Ağlı, 1 km after Azdavay, stream bed, 870 m.
44. A3; Between Devrekani and Abana, Yaralıgöz Mountain, around Bıngıldayık and Isırganlık, 4 km before reaching to Bozkurt, 1180-1350 m.
45. A2; Zonguldak, Çatalağzı, Cumayanı dam lake, southeast and northwest slopes, 50-60 m.
46. A2; Between Zonguldak and Ereğli, Kızılcapınar dam lake, Ovaköy village, 110-120 m.
47. A3; Between Devrekani and Abana, Yaralıgoz Mountain, Kuzköy village, southwest and northeast slopes, 1320-1400 m.
48. A2; Between Zonguldak and Çatalağzı, around Çatalağzı Power Plant, 95-190 m.
49. A2; Erdemir county, in the vicinity of Erdemir Iron-Steel Factory, 145 m.
50. A2; Between Devrek and Eğerci, in the vicinity of Yedigöller National Park, 330-470 m.
51. A2; Zonguldak, between Koscağız-Kumluca, before reaching to Yenikışla, 195 m.
52. A2; Zonguldak, between Çaycuma and Hisarönü, after Çömlekçi district, 10 m.
53. A2; Zonguldak province in the vicinity of Gökgöl Cave, 180 m.
54. A2; Between Devrek and Mengen, 6 km after Devrek, northwest slopes, 430-780 m.
55. A2; Between İnebolu and Doğanyurt counties, in the vicinities of Yaztepe and Köroğlu villages, 140-190 m.
56. A2; Between Daday and Azdavay, Ballıdağ Mountain, northeast and southwest slopes, 1480-1730 m.

RESULTS

The study was carried out field surveys in different seasons in Western Black Sea Region (Bolu, Kastamonu, Bartin and Zonguldak). After identification of the specimens, 49 liverwort (Hepaticae) taxa belonging to 23 families and 31 genera, and one hornwort (Anthocerotae) species were determined. A list of the species was given below. Among these species *Cephaloziella dentata* (Raddi) Steph. is a new record for the bryophyte flora of Turkey. Additionally, *Scapania aspera* Bernet et M.Bernet is second record for the liverwort flora of Turkey. 17 taxa are new records for the A2 grid square and 2 taxa are new records for the A3 grid square according to the system of Henderson (1961).

In the statements of specimens: the first number shows the locality no.; the bold abbreviation shows the habitat; *TK* abbr. shows legit and determinavit (the first author: Tamer Keçeli); and the last number shows the collection no. New records for the A2. or A3. grid squares are marked with an asterisk (*).

Habitats in the study area: s: on soil; **ws:** on wet soil; **r:** on rock; **wr:** on wet rock; **t:** on the bark of tree trunk and branch; **dt:** on dead tree trunk; **rsw:** on rock submerged in water.

FLORISTIC LIST
MARCHANTIOPSIDA (HEPATICAE)

Aytoniaceae

Reboulia hemisphaerica (L.) Raddi — 26:**s**, *TK*1746, 51:**s**, *TK*2249.
Mannia androgyna (L.) A. Evans — 48:**s**, *TK*2202*

Conocephalaceae

Conocephalum conicum (L.) Dumort. — 20:**r**, *TK*1772, 46:**ws**, *TK*1983.

Lunulariaceae

Lunularia cruciata (L.) Lindb. — 3:**ws**, *TK*1036, 31:**s**, *TK*1740.

Marchantiaceae

Marchantia polymorpha L. — 7:**wr**, *TK*1092.

Corsiniaceae

Corsinia coriandrina (Spreng.) Lindb. — 45:**ws**, *TK*1981*.

Metzgeriaceae

Metzgeria furcata (L.) Dumort. —11:**dt**, *TK*2082, 43:**t**, *TK*1913, 53:**t**, *TK*2273,
Metzgeria conjugata Lindb. — 9:**t**, *TK*1168.
Apometzgeria pubescens (Schrank) Kuwah. — 13:**t**, *TK*1846*.

Pelliaceae

Pellia epiphylla (L.) Corda — 16:**r**, *TK*1532.
Pellia endiviifolia (Dicks.) Dumort. — 2:**wr**, *TK*1043, 6:**r**, *TK*1019.

Fossombroniaceae

Fossombronia angulosa (Dicks.) Raddi — 25:**ws**, *TK*1722.
Fossombronia pusilla (L.) Nees — 19:**ws**, *TK*1295.

Lophoziaceae

Barbilophozia barbata (Schmidel ex Schreb.) Loeske —15:**s**, *TK*1310*.
Lophozia ventricosa (Dicks.) Dumort. — 56:**r**, *TK*2320*.
Leiocolea turbinata (Raddi) H. Buch — 10:**s**, *TK*1007*.
Tritomaria quinquedentata (Huds.) H. Buch — 14:**r**, *TK*1591*.

Jungermanniaceae

Jungermannia atrovirens Dumort. — 14:**r**, *TK*1572*.
Jungermannia gracillima Sm. — 38:**wr**, *TK*1656.
Jungermannia hyalina Lyell — 38:**r**, *TK*2144*.

Arnelliaceae

Southbya tophacea (Spruce) Spruce — 25:**r**, *TK*1749*, 27:**s**, *TK*1721.

Plagiochilaceae

Plagiochila asplenioides (L. *emend*. Taylor) Dumort. — 5:**r**, *TK*1055.
Plagiochila porelloides (Torrey *ex* Nees) Lindenb. — 13:**t**, *TK*1609.

Geocalycaceae

Lophocolea bidentata (L.) Dumort. — 24:**s**, *TK*1788, 30:**t**, *TK*1784.
Lophocolea heterophylla (Schrad.) Dumort. — 16:**dt**, *TK*1225.
Lophocolea minor Nees — 29:**t**, *TK*1748, 35:**dt**, *TK*1536.
Chiloscyphus polyanthos (L.) Corda — 4:**r**, *TK*1005.
Chiloscyphus pallescens (Ehrh. *ex* Hoffm.) Dumort. — 13:**r**, *TK*1556*.

Scapaniaceae

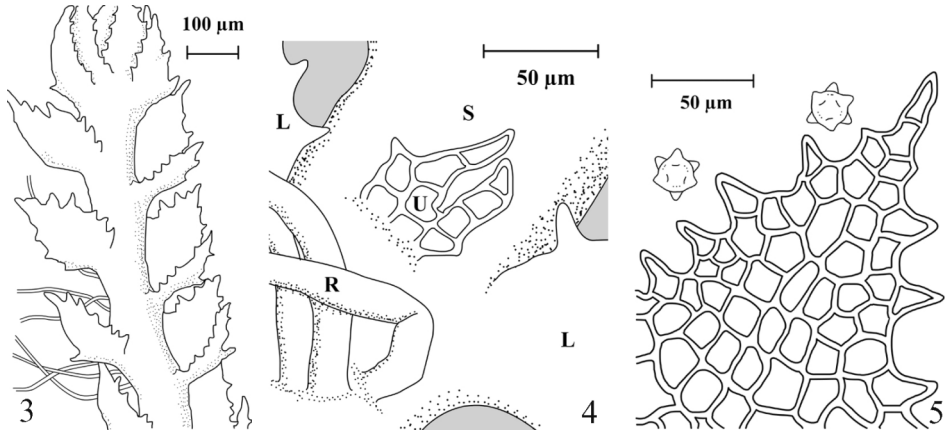
Diplophyllum albicans (L.) Dumort. — 21:**s**, *TK*1801.
Scapania irrigua (Nees) Nees — 5:**r**, *TK*1061*, 11:**r**, *TK*2049.
Scapania undulata (L.) Dumort. — 13:**r**, *TK*1555.
Scapania nemorea (L.) Grolle — 39:**r**, *TK*2128.
Scapania aequiloba (Schwägr.) Dumort. — 42:**s**, *TK*1937.
34. Scapania aspera Bernet et M. Bernet — 36:**r**, *TK*1628*, 37:**r**, *TK*1584, 47:**r**, *TK*2045*.
Scapania verrucosa Heeg — 42:**r**, *TK*1887*.

Cephaloziellaceae

Cephaloziella dentata (Raddi) Steph. — 45:**ws**, *TK* 2170, 45:**s**, *TK* 2175.
Cephaloziella dentata (Raddi) Steph., *Bull. Herb. Boiss.* 5: 78, 1897 antedates *C. dentata* (Raddi) Mig., *Krypt.-Fl. Deutschl.* 1: 472, 1904 (Grolle & Long, 2000). Basionym: *Jungermannia dentata* Raddi, *Jungerm. Etruska, Mem. Mat. Fisica in Modena* 18:32, 1820 (Arnell, 1981).

Cephaloziella dentata belongs to the genus *Cephaloziella* (Spruce) Schiffn. and the subgenus *Evansia* (Douin et Schiffn.) Müll. Frib..

The new locality of *Cephaloziella dentata* : A2 grid-square adopted by Henderson (1961), Zonguldak, Catalagzi, in the vicinity of Cumayani dam lake (41°29′N-41°30′N, 31°53′E-31°55′E), altitude: 60 m, coll. date: 30 August 2002, collector: Tamer Keçeli (TK2170, TK2175). The specimens were collected on soil, associated with *Conocephalum conicum* (L.) Dumort., *Lejeunea cavifolia* (Ehrh.) Lindb., *Diplophyllum albicans* (L.) Dumort., *Scapania nemorea* (L.) Grolle and



Figs 3-5. *Cephaloziella dentata*, **3.** dorsal view of sterile shoot. **4.** Ventral view of steril shoot (L: leaf, R: rhizoids, S: stem, U: underleaf). **5.** Leaf lobe and two gemmae (*TK*-2170/01, 02, 03).

Fossombronia angulosa (Dicks.) Raddi.. The dominant trees, shrubs and the other plants in the area are *Castanea sativa* Mill., *Carpinus betulus* L., *Alnus glutinosa* (L.) Gaertn., *Fagus orientalis* Lipsky, *Corylus avellana* L., *Laurus nobilis* L., *Rhododendron ponticum* L., *Erica arborea* L., *Ilex aquifolium* L., *Cornus mas* L., *Rubus canescens* DC., *Arbutus andrachne* L. and *Pteridium aquilinum* (L.) Kuhn. Plant dioicus; scattered shoots or small patches, shoots yellowish-brown to dark green, stems irregularly branched, to 5 mm long. It has very small size and unattractive habit, especially when dry. Stem leaves on the sterile plants distant-approximate, ± transversely inserted, spreading, concave, 160-300 µm long, 120-240 (– 320) µm wide, bilobed to 1/2, sinus acute-angled; leaf lobes somewhat different in size, triangular, acute, 4-8 cells wide at base, cells 14-25 µm wide, with equally thickened walls, without trigones, cuticle smooth; margin irregularly and spinosely dentate. Underleaves present on sterile stems, small, erecto-patent, frequently 2-3 lobed, lingulate-lanceolate, ± toothed, 70-130 µm long. Gemmae frequent, reddish-brown, irregularly angular-spherical, densely and obtusely papillose, 1-2 celled, 16-20 µm diameter. On damp soils, tracks and in hollows, very rare (Arnell, 1981; Smith, 1996).

Only sterile plants found in Turkey (Figs 3-5). The spinose-dentate concave leaves, presence of underleaves, large cells (with smooth cuticle) and coarsely papillose rotundate-stellate gemmae distinguish *C. dentata* from other *Cephaloziella* species. *C. dentata* is a rare species in many country.

The distribution of C. dentata: Denmark, Sweden (regionally extinct), Britain (critically endangered), Austria, France, Italy (rare), Sicily (rare), Croatia, Azores, Madeira, (Schumacker, 2003; Söderström et al., 2002). Until now, the C. dentata was unknown from Turkey (Çetin, 1988; Kürschner & Erdağ, 2005) and Southwest Asia (Bischler & Jovet-Ast, 1986; Frey, 1986; Long, 1987; Kürschner, 2001). This study shows that this species also is present in Turkey and Southwest Asia.

Cephaloziaceae

Cephalozia bicuspidata (L.) Dumort. — 21:**s**, *TK*1802.

Calypogeiaceae

Calypogeia fissa (L.) Raddi — 1:**s**, *TK*1149*, 23:**r**, *TK*1799.

Pseudolepicoleaceae

Blepharostoma trichophyllum (L.) Dumort. — 1:**r**, *TK*1021.

Radulaceae

Radula complanata (L.) Dumort. — 18:**t**, *TK*1217, 33:**t**, *TK*1820.
Radula lindenbergiana Gottsche *ex* C. Hartm. f. — 12:**r**, *TK*1466, 50:**r**, *TK*2236.

Porellaceae

Porella arboris-vitae (With.) Grolle — 11:**r**, *TK*2063.
Porella cordaeana (Huebener) Moore — 44:**r**, *TK*1903*.
Porella platyphylla (L.) Pfeiff. — 8:**t**, *TK*1115, 32:**r**, *TK*1764, 40:**r**, *TK*1881.

Frullaniaceae

Frullania tamarisci (L.) Dumort. — 17:**r**, *TK*1277, 22:**dt**, *TK*1750.
Frullania dilatata (L.) Dumort. — 28:**t**, *TK*1763, 54:**t**, *TK*2211.

Jubulaceae

Jubula javanica Steph. — 9:**r**, *TK*1137*, 49:**s**, *TK*2219.

Lejeuneaceae

Lejeunea cavifolia (Ehrh.) Lindb. — 52:**t**, *TK*2215.
Cololejeunea rosettiana (C. Massal.) Schiffn. — 41:**r**, *TK*1910, 55:**r**, *TK*2337.

ANTHOCEROTOPSIDA (ANTHOCEROTAE)

Anthocerotaceae

Anthoceros punctatus L. — 34:**s**, *TK*1729*.

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