

New and noteworthy bryophyte records for Turkey and Southwest Asia

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Abstract

Sphagnum flexuosum Dozy & Molk. (Sphagnaceae, Bryophyta) and *Obtusifolium obtusum* (Lindb.) S.W.Arnell (Cephaloziellaceae, Marchantiophyta) are recorded in Turkey for the first time. The specimens were collected at Samanlı Mountains in north-west Turkey and Küre Mountains in the north of Turkey. Descriptions and illustrations of the two species, and notes on their distributions and ecological characteristics within Turkey are provided.

Introduction

Many less accessible regions of Turkey have yet to be visited by bryologists, and increasing collecting activities in these areas will likely result in new records. Two such regions are the Samanlı Mountains, which extend from the western edge of the Armutlu Peninsula in Yalova province to Geyve gorge of Sakarya province, and the Küre Mountains located close to the coastal areas of Turkey bordering the Black Sea (Fig. 1). Due to their climatic and geographical diversity, we expected many rare or biogeographically interesting bryophytes to be found in these areas.

The Samanlı Mountains, are transitional between temperate Mediterranean and temperate Oceanic climates, with warm to hot, moderately dry summers around July and August and cool to cold, wet winters. The mean annual temperature in the Sapanca region is 13.7°C, while the highest mean temperature is 23.0 °C (July), and lowest the mean minimum temperature is 6.1°C (January). The mean annual precipitation is 801.3 mm, the highest precipitations occur in December and the lowest in August (Fig. 2) (Akman 1999; TSMS 2016). Deciduous forest comprises the dominant vegetation in Samanlı Mountains (e.g. beech, hornbeam, chestnut, oak) in the northern slopes and conifers and maquis vegetation in the southern slopes and higher parts of the area. Similarly, northern and western parts of the Küre Mountains have an Oceanic climate, the central and southern parts of the area experience a sub-Mediterranean climate with warm, moist to dry summers and cool to cold, wet winters (Akman 1999). The main vegetation types in Küre Mountains consist of deciduous forests (beech, hornbeam, chestnut, oak, linden, poplar, alder, maple, cranberry) on the northern slopes, and evergreen (rhododendron, cherry laurel, boxwood, daphne) or coniferous forests (fir, larch, scots pine and yew) on higher and inner parts. (Atalay 1994; Akman 1995). Here we report two new bryophyte records from the Samanlı and Küre Mountains of Turkey.

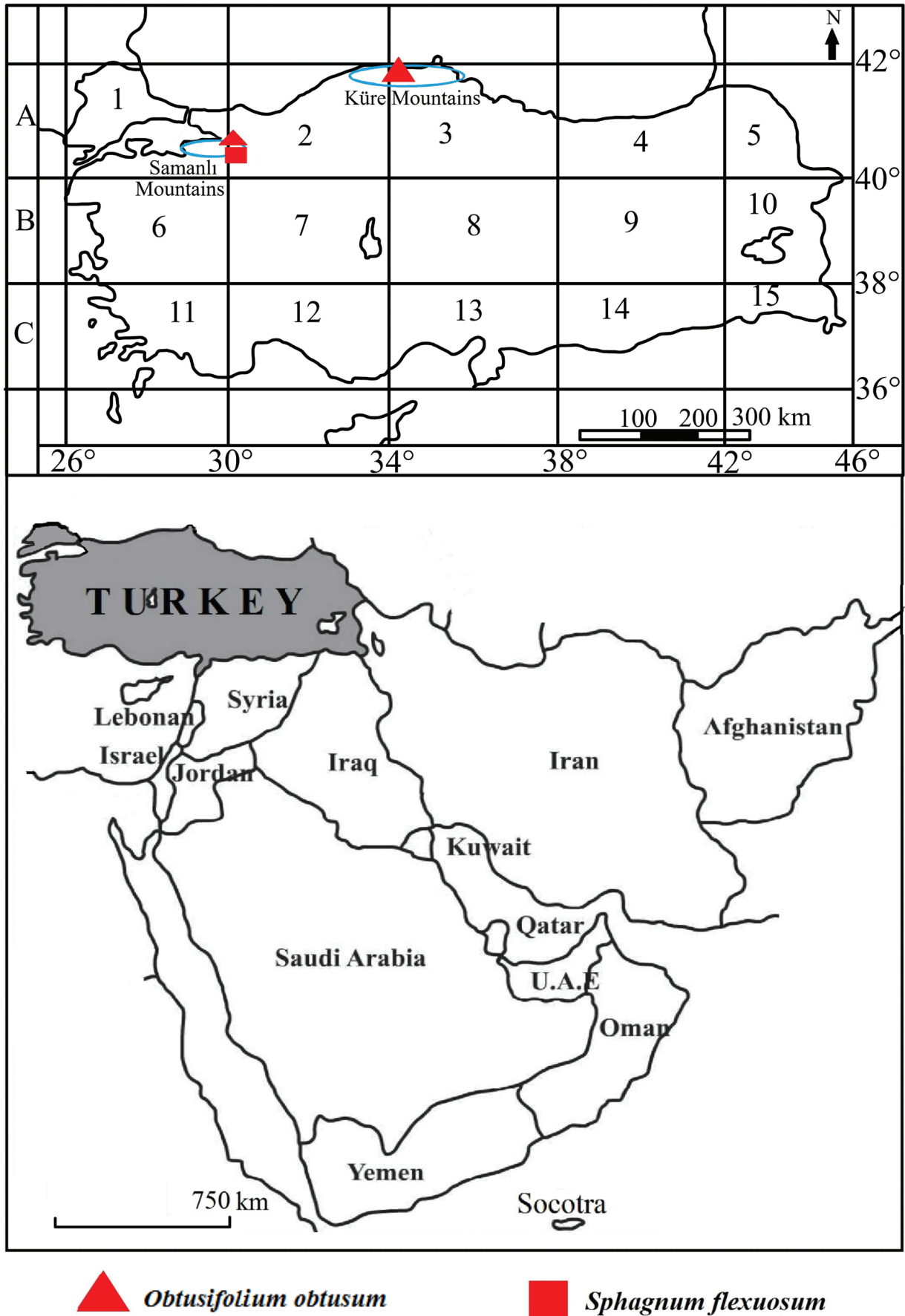


Fig. 1. Distribution of the new bryophyte records in Turkey and Southwest Asia.

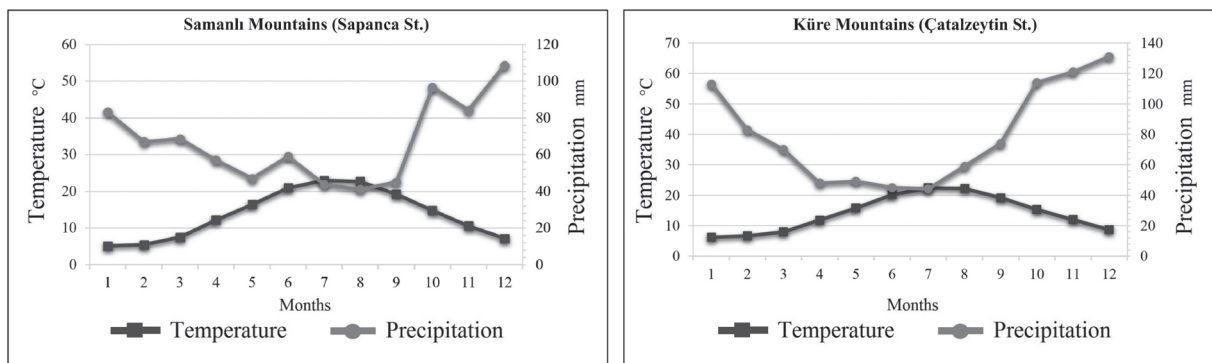


Fig. 2. Average monthly precipitation and temperature for the two collection sites.

Materials and Methods

The field trips to the Samanlı Mountains and Küre Mountains have been undertaken in different seasons since May 2015. The various habitat types were searched carefully (e.g. shaded rocks, crevices and exposed rocks, tree bark, decaying logs and stream sides, marshy lan, and also subalpine meadows). Numerous bryophyte samples were collected from the study areas. Among them were included *Sphagnum flexuosum* Dozy & Molk. and *Obtusifolium obtusum* (Lindb.) S.W.Arnell which were recognized as new records for the bryophyte flora of Turkey. The identification of these samples was made using relevant literature (Bastien and Garneau 1997; Daniels and Eddy 1985; Paton 1999; Casas et al. 2009; Laine et al. 2011). Voucher specimens were deposited in the private herbarium of Uyar (Ankara) and ZNG. Liverwort nomenclature follows Grolle and Long (2000), Rós et al. (2007) and Söderström et al. (2016) and also nomenclature for the mosses follows Hill et al. (2006) and Rós et al. (2013). The status of new records for Turkey and Southwest Asia was evaluated using the relevant literature (Uyar and Çetin 2004; Kürschner and Erdağ 2005; Özenoğlu Kiremit and Keçeli 2009; Kürschner and Frey 2011; Tonguç Yayıntaş 2013; Kirmacı and Kürschner 2013; Abay and Keçeli 2014; Rós et al. 2007; Rós et al. 2013). In this study, photographs of diagnostic characters of these new records and comparisons with other related species are given. When the geographical distribution of *Sphagnum* L. in Turkey was mapped on Turkish grid system, which was adopted by Henderson (1961), it was seen that, this report provided a remarkable contribution to Turkish distribution of *Sphagnum* (Fig. 1).

Results

***Sphagnum flexuosum* Dozy & Molk.** Prodr. Florae Batavae 2(1): 76. f. 3. 1851.

Synonyms: *Sphagnum flexuosum* var. *recurvum* Dozy & Molk., Prodr. Fl. Bat. 2(1): 77 1851., *S. recurvum* var. *majus* (Angstr. ex Warnst.) Warnst., Flora 66: 374. 1883., *S. recurvum* var. *limprichtii* Schlieph. ex Warnst., Hedwigia 23: 121. 1884., *S. recurvum* var. *amblyphyllum* (Russ.) Warnst. Botanical Gazette 15: 219. 1890., *S. amblyphyllum* (Russow) Zick. Bulletin de la Société Impériale des Naturalistes de Moscou, n.s. 14(3): 278. 1901., *S. flexuosum* var. *ramosissimum* R.E. Andrus, Bryologist 91: 365 1988.

Description: Plants small and slender up to 12 cm long in mesotrophic bogs. Capitulum compact with short branches, having a small knot-like appearance. The colour of stem and capitulum pale green to olive green (Fig. 3a, b). Plants dioicous. Stem leaves triangular to lingulate and have an obtuse apex that is usually eroded, border strong, widely expanded below (Fig. 3c). Hyaline cells in stem leaves not or rarely fibrillose and rarely divided on leaf tip. The leaves appressed to the stem. Branch leaves from ovate to broadly ovate to lanceolate; the leaves undulate when dry and not in 5-ranked rows, but spirally arranged (Fig 3d). Pores up to 10 µm on concave surface (Fig. 3e), without on convex surface (Fig 3f). The cross section shows triangular photosynthetic cells that can be as wide as the hyaline cells and exposed from both sides (Fig. 3g). Cortex not distinguishable from internal cylinder (Fig. 3h).

Specimen examined: TURKEY: A2, SAKARYA: Samanlı Mountains, Geyve district, Soğucak Plateau, in peatland near alpine meadow, alt. c. 1075 m, (40° 36' 21" N, 30° 11' 27" E), Ören 407/15, Gazi Bry/1168, 28 May 2015.

Recognition: *Sphagnum* can be distinguished from other moss species by stem colour, the shape of branch and stem leaves, and the shape of the green cells. *Sphagnum flexuosum* is characterized by the pale stems, undifferentiated stem cortex, none fibrillose cortical cells, small notched obtuse-rounded stem leaf, chlorophyllose cells as wide as hyaline cells at abaxial surface upper part of the branch leaf (Bastien and

Garneau 1997; Daniels and Eddy 1985). *Sphagnum flexuosum* is morphologically similar to *S. angustifolium* (Russow) C.E.O.Jensen, *S. fallax* (H.Klinggr.) H.Klinggr., *S. recurvum* P. Beauv. and *S. obtusum* Warnst., but differs in the shape and size of its leaves and leaf cell pores.

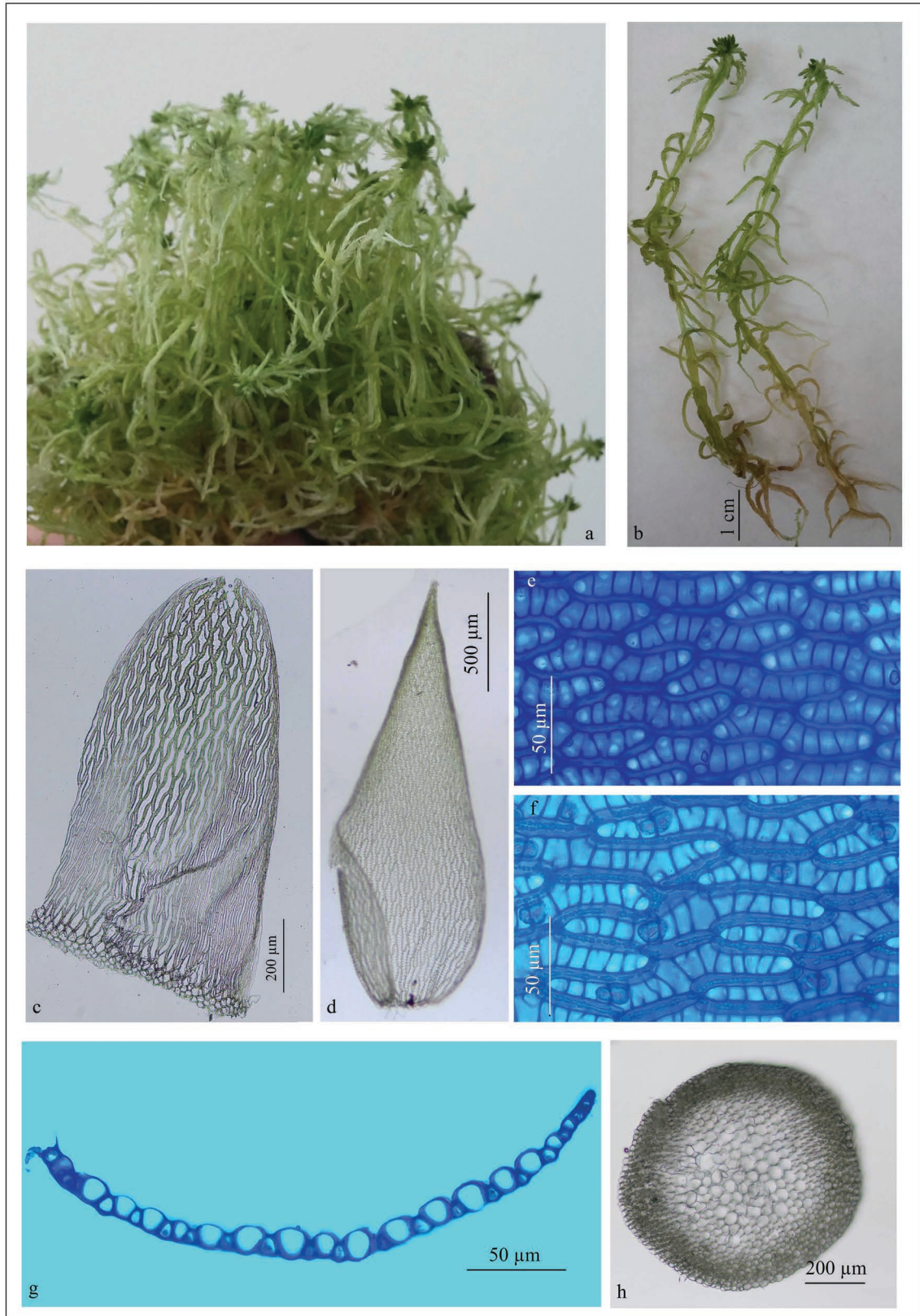


Fig. 3. *Sphagnum flexuosum*. **a–b.** habit (when moist); **c.** stem leaf; **d.** branch leaf; **e.** concave cells of branch leaf; **f.** convex cells of branch leaf; **g.** branch leaf cross section; **h.** stem cross section. From Ören 407/15 and Gazi Bry/1168.

Ecology: *Sphagnum flexuosum* often occurs in moderately wet parts of fens or damp woods, or in flushed grass communities on sloping ground over mineral soils with a high organic fraction in the circumboreal region. Around the Mediterranean its range is restricted to montane areas. (Daniels and Eddy 1985; Dierßen 2001). In Turkey, *Sphagnum* peat lands occur largely in the eastern Black Sea region. However, this species was collected in the Mediterranean area from peatland near to alpine meadows at an altitude of 1075 m. Accompanying moss species were; *Sphagnum inundatum* Russow, *Sphagnum palustre* L., *Aulacomnium palustre* (Hedw.) Schwaegr. and *Calliergonella cuspidata* (Hedw.) Loeske.

World distribution: *Sphagnum* includes approximately 120 species, commonly known from boggy wetland habitats (Daniels and Eddy 1985; Kırmacı and Kürschner 2013). Currently, 23 taxa in *Sphagnum* have been recorded for Turkey, this new record brings the total to 24 (Abay et al. 2009; Kırmacı and Kürschner 2013; Tonguç Yayıntaş 2013; Abay and Keçeli 2014).

Records of *Sphagnum flexuosum* for the Northern Hemisphere are known from the following countries: EUROPE: Finland, Norway, Sweden, Switzerland, Denmark, Netherlands, Estonia, Belarus, Ukraine, Latvia, Lithuania, Luxembourg, Belgium, Germany, Poland, Czech Republic, Slovakia, Romania, Hungary, Austria, Slovenia, Croatia, Bosnia-Herzegovina, Serbia, Montenegro, Bulgaria, Italy, France, Spain, Portugal, Great Britain, Ireland, Faeroe Islands, Iceland. ASIA: Russia, Georgia, Kazakhstan, China and Japan. NORTH AMERICA: United States of America, Canada, in peat bogs and moist tundra areas (Ignatov et al. 2006; McQueen and Andrus 2007; Rós et al. 2013; Hodgetts 2015; Vellak et al. 2015).

***Obtusifolium obtusum* (Lindb.) S.W.Arnell**, Illustrated Moss Flora of Fennoscandia, I. Hepaticae 133. 1956.

Synonyms: *Jungermannia obtusa* Lindb., Musci Scandinavici 7. 1879., *Lophozia obtusa* (Lindb.) A. Evans. Proceedings of the Washington Academy of Sciences 2: 303. 1900., *Leiocolea obtusa* (Lindb.) H. Buch. Memoranda Societatis pro Fauna et Flora Fennica 8: 288. 1932., *Barbilophozia obtusa* (Lindb.) H. Buch. Memoranda Societatis pro Fauna et Flora Fennica 17: 289. 1942., *Schistochilopsis obtusa* (Lindb.) Potemkin, Arctoa 12: 65. 2003.

Description: Plants medium-sized, rather flaccid, yellowish green, in loose patches; shoots procumbent, up to 3 cm long, 2.5–3.0 mm wide, sparsely branching (Fig. 4a). Stems often reddish on the ventral side, and flattened, average 350 µm wide. Rhizoids rather numerous, colourless. Leaves 1.8 mm long × 1.5 mm wide, almost longitudinally attached, bilobed with rounded lobes and decurrent sinus (Fig. 4b, c). Cells of the leaf apex 12–22 µm of the middle 18–25 µm of the base 16–25 × 25–35 µm, walls thin, hyaline; trigones minute but distinct; cuticle smooth to papillose (Fig. 4d). Underleaves 250 µm with 2-lobes bearing cilia (Fig. 4e). Gemmae absent.

Specimen examined: TURKEY: A2, KOCAELI: Samanlı Mountains, Kartepe district, Sisli Valley vicinity, on rock, near stream bank, alt., c. 900 m., (40° 39' 25" N, 30° 07' 09" E), 26 May 2015; *Gazi Bry/859*; A3, Kastamonu: Çatalzeytin, Küre Mountains, Koru Plateau, fir forest on soil, alt., c. 1480 m., 41°46'34"N, 34°14'05"E), 16 Oct 2015, *Ören 781/15*.

Recognition: Some forms of *O. obtusum* have frequently been confused with lax forms of species belonging to *Gymnocolea* and *Schistochilopsis*. However, *O. obtusum* is readily identified by its horizontal bilobed leaves with rounded lobes, a gibbous sinus, and its possession of leaf cells with several small oil bodies (Paton 1999).

Ecology: This species is distributed mainly in northern parts of the taiga zone, but rarely found in tundra. It often occurs on soil and rocky edges of creeks, rarely on tree, in lowland to alpine zones, in deciduous forests within moist Mediterranean areas (Paton 1999; Bischler 2004). In this study, this species was found to occur on moist soil and rocks near streams in deciduous and fir forests at between 900 and 1480 m altitude under the Mediterranean climates. It was found together with the moss species *Hygrohypnum luridum* (Hedw.) Jenn, *Rhynchostegium riparioides* (Hedw.) Cardot, *Dicranum scoparium* Hedw., *Sanionia uncinata* (Hedw.) Loeske, *Pogonatum urnigerum* (Hedw.) P. Beauv. and the liverworts *Pedinophyllum interruptum* (Nees) Kaal. and *Mesoptychia bantriensis* (Hook.) L.Söderstr. et Váňa.

World distribution: The Cephaloziellaceae is a large (c. 170 taxa), globally distributed family of leafy liverworts (Söderström et al. 2016). *Obtusifolium* S.W.Arnell is a monotypic genus containing only *Obtusifolium obtusum*. This species has been recorded for Europe and North America, and now its range is extended to Turkey, where the plants were collected twice at subalpine stations in the above localities.

EUROPE: Norway, Sweden, Finland, Britain, European parts of Russia, Latvia, Estonia, Poland, Austria, Germany, Switzerland, Czech Republic, Belgium, Bulgaria, Greece, Romania, Serbia, Hungary, France, Spain, Italy, Slovakia, Corsica, Ukraine, Faeroes, Iceland. ASIA: Russia and Japan. NORTH AMERICA: United States of America, Canada, Greenland, Mexico. (Kitagawa 1967; Paton 1999; Söderström et al. 2002; Bischler 2004; Rós et al. 2007; Konstantinova et al. 2009; Bakalin 2011; Vellak et al. 2015).

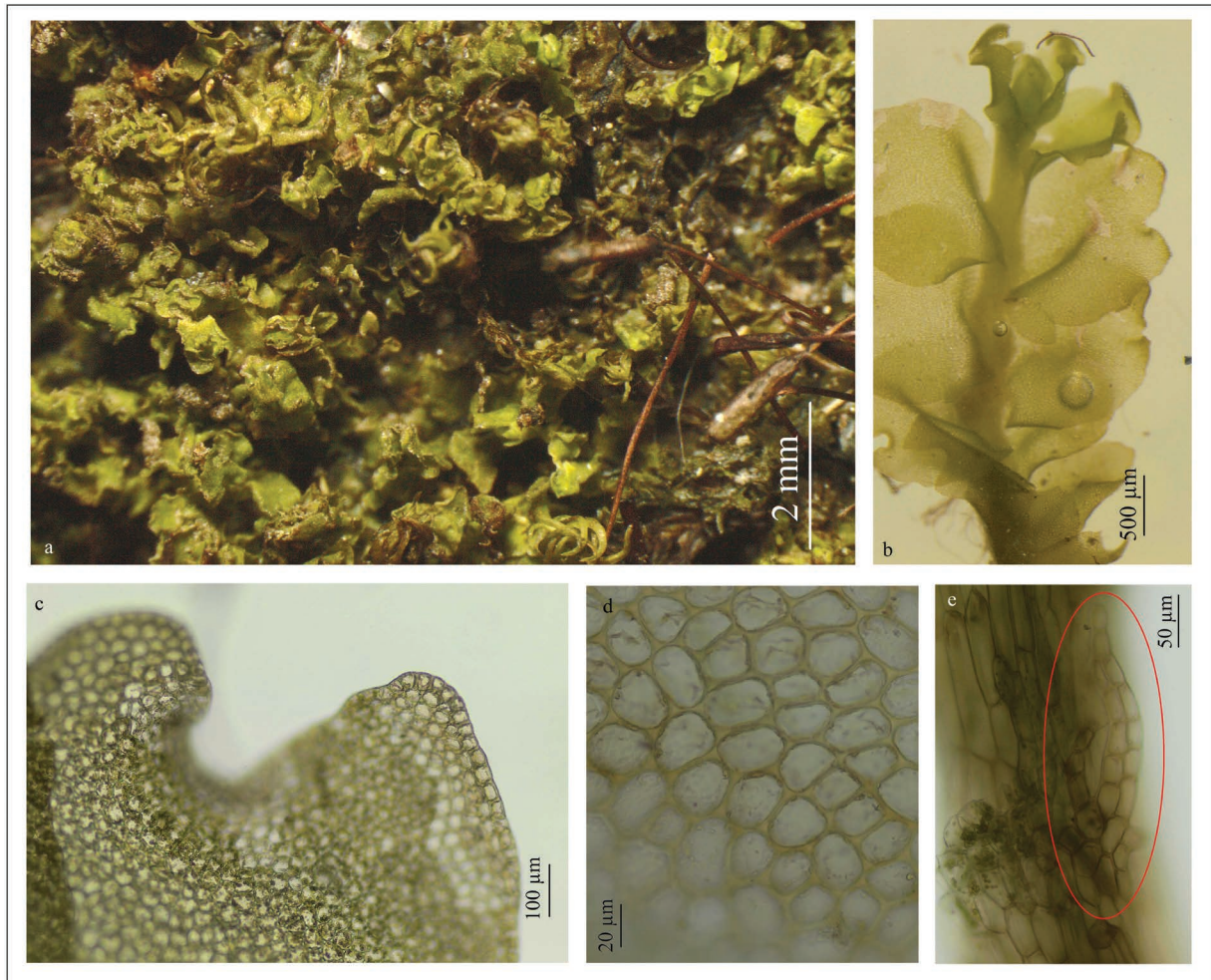


Fig. 4. *Obtusifolium obtusum*. **a.** habit (when dry); **b.** leaves; **c.** gibbous sinus; **d.** central cells; **e.** leaf adaxial surface. From Ören 781/15 and Gazi Bry/859.

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