www.biodicon.com Biological Diversity and Conservation

ISSN 1308-8084 Online; ISSN 1308-5301 Print 9/3 (2016) 78-83

Research article/Araştırma makalesi

Novelties to the bryophyte flora from Uludağ (Bursa/Turkey)

Mesut KIRMACI [*1], Adnan ERDAĞ [1], Harald KÜRSCHNER [2]

[1] Adnan Menderes Üniversitesi, Fen Edebiyat Fakültesi, Biyoloji Bölümü, 09010 Kepez-Aydın, Türkiye
[2] Freie Universität Berlin, Institut für Biologie, Systematische Botanik und Pflanzengeographie, Altensteinstr. 6, D-14195 Berlin, Germany

Abstract

During a short visit to the upper montane and subalpine belt of Uludağ (Bursa), 15 liverworts and 16 mosses are added to the bryophyte flora of this mountain. Outstanding among the new records are *Dicranum leioneuron* and *Sphagnum auriculatum,* until the present time only known from a single record in Turkey.

Key words: Bryophyte diversity, flora, liverworts, mosses, *Dicranum*

---------- * ----------

Uludağ'ın (Bursa/Turkey) biryofit florasına yeni kayıtlar

Özet

Uludağ (Bursa)' ın alpin ve sub alpin kusağına yapılan kısa arazi çalışması sonunda, 15 ciğerotu ve 16 karayosunu Uludağ'ın florasına eklenmiştir. Bunların arasında *Dicranum leioneuron* ve *Sphagnum auriculatum* şimdiye kadar Türkiye'de sadece tek lokaliteden bilinen karayosunlarıdır.

Anahtar kelimeler: Biryofit çeşitliliği, flora, ciğerotları, karayosunları, *Dicranum, Sphagnum*

1. Introduction

An outstanding scientific tool important for nature conservation is to provide access to species diversity and taxonomic information to achieve a checklist of all known plants, regardless if on a small local, regional or wider scale. Beside a step to scientific understanding of biodiversity, it is a mandatory for treasuring natural plant resources and preserving plant richness. This holds true also for the Turkish National Parks and the Important Plant Areas (IPA) of Turkey, where the Uludağ National Park represents a "flagship of biodiversity" in western Anatolia.

Whereas the vascular flora of the area is known to botanists since a long time, the bryophyte flora of Uludağ National Park was only sporadically in the focus of botanists and bryological interest. First hints can be found in Schiffner (1901), who recorded a small collection by J. Bornmüller (Iter Anatolicum III, s.n., Olymp bei Brussa). These records were published again by Bornmüller (1931). Later on, Henderson (1959) and Henderson and Prentice (1969) summarize the state of knowledge of the late 1950'ies, mainly based on previous collections and collections of H. Walter, carried out 1955. Among these records, also *Sphagnum inundatum* is given from the boggy grounds around Bakacak area. First comprehensive studies followed by Walther (1967) and Çetin (1999 a, b). The latter mentioned 23 liverworts and 85 mosses from the mountain. After this period, no work was carried out in this interesting mountain range and it is therefore not astonishing that new records can be expected in this large and ecological highly diverse area when re-collecting starts there again.

Our study, carried out in June 2015, adds 15iverworts and 16 mosses to the bryophyte flora of the Uludağ National Park, indicating the floristic capability of the area, obviously far of being complete at present. It is, however, a further step to integrate Turkey into the Global Network of floristic knowledge and the tools of Conservation on Biological Diversity (Target 1: Global Strategy for Plant Conservation).

* *Corresponding author* / Haberleşmeden sorumlu yazar: Tel.: +902562128498; Fax.: +902562128498; E-mail: mkirmaci@gmail.com
 BioDiCon. 554-0516

The Uludağ, about 36 km southeast of Bursa and known in ancient times as "Olympos Misios" or "Bithynian Olympus", is the highest mountain range in the Marmara region (Güney Marmara Bölümü) of western Turkey. The mountain range, with the highest peak, Kartaltepe (2543 m) is stretching in northwest-southeast direction and is about 40 km long and 15-20 km wide. In the northern part it includes many plateaus between 1900-2100 m (Sarıalan Yaylası, Kirazlıyayla, Kadıyayla, Sobra Yaylası), making the area to one of the favourite Turkish winter sports centres (skiing resort). Since 1961 the high plateaus and upper mountain part are protected as Uludağ National Park by Turkish law (Çetin, 1999 a,b; Öztürk and Güvenç, 2010).

Geologically, the mountain range is a granite Batholith, consisting mainly of granite, gneiss and marble of Palaeozoic age, and Mesozoic ophiolite. Its today's appearance is the result from tectonic movements which uplift the whole area during more recent geological periods.

Due its location between the Mediterranean and the European-Siberian (Euxine) floristic regions it harbours a rich vascular vegetation with many endemics. More than 2/3 of the area is covered by forests. The lower montane belt (700-1500 m) is characterized by pure or mixed *Fagus orientalis* forests consisting of *Carpinus betulus* L., *Fagus orientalis* Lipsky, *Pinus nigra* subsp. *nigra* var. *caramanica* (Loudon) Rehder, *Quercus cerris* L., *Q. frainetto* Ten, *Q. infectoria* Olivier, *Q. petraea* subsp *iberica* (Steven ex M. Bieb.) Krassiln., *Q. petraea* subsp. *petraea* (Mattuschka) Liebl., *Q. pubescens* Willd. and *Q. robur* L., which spread all over the mountain. The upper montane belt (1500-2000 m) consists of *Abies nordmanniana* subsp. *bornmuelleriana*, forming the forest line. Above 2100 m, swampy meadows and low sedge fens (communities of the Swertio ibericae-Nardion strictae Vural 1996 alliance), small bogs, springs, slow running rivulets and a few glacial lakes dominate that samples the acidophytic to subneutral plant communities of the Euxine territories. To name is a subalpine grassland with scattered *Juniperus communis* subsp. *nana* (J. & C. Presl) Nyman and *Vaccinium myrtillus* L. shrubland and the sparse alpine vegetation of the screes and rocks around the glacial lakes (e.g., Aynalıgöl, Buzlugöl, Karagöl, Kilimligöl) on the high summits of the Uludağ (Akdeniz and Yener, 2012; Kaynak et al., 2005; Özhatay and Çırpıcı, 1987; Zencirkıran, 2009).

2. Materials and methods

The study was carried out in June 2015, within a research project on Turkish *Sphagnum* species (TÜBITAK, TBAG, grant no. 113Z631 to M. Kırmacı). For species identification, Kürschner and Frey (2011) was consulted. The voucher species are kept in the herbarium of the Adnan Menderes University, Aydın (AYDN).

3. Results

Marchantiophyta

Aneura pinguis (L.) Dumort.

Oteller area, way to Çobankaya, 40°06'17.7"N, 29°08'20.5"E, 1770 m, swampy meadow along small rivulet (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-129).

Very variable in size and habit. When sterile sometimes confused with *Pellia* species. Narrow forms of *Pellia* can be distinguished by the more deeply emarginate apices (Paton 1999).

Cephaloziella divaricata (Sm.) Schiffn.

Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-135).

The most frequent species of the genus in Turkey.

Cephaloziella hampeana (Nees) Schiffn.

Sarıalan Yaylası, 40°07'57.8"N, 29°06'45.3"E, 1610 m, boggy low sedge fen, partly submerged (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6861a).

Fossombronia caespitiformis De Not.

Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-134); Oteller area, between Oteller and Volfram, 40°05'47.7"N, 29°09'39.04"E, 1980 m, glacial lake shore, on water-saturated sandy soil, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-209).

Without spores, impossible to identify. Differs from other species with violet rhizoids by flattened, truncate papillae and the absence of lamellae on the spores.

Gymnocolea inflata (Huds.) Dumort.

Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, in boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), submerged between *Sphagnum platyphyllum*, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-184).

A strongly calcifuge species of *Sphagnum* bogs and near rivulets and stream margins.

Jungermannia gracillima Sm.

Sarıalan Yaylası, 40°07'57.8"N, 29°06'45.3"E, 1610 m, boggy low sedge fen, partly submerged (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6861b).

Plagiochila porelloides (Nees) Lindenb.
Kirazlıyayla, 40°06'47.0"N, 29°05'25.9"E, on soil near stream in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-219).
Similar to *P. asplenioides* but smaller in all its parts and often with flagelliform branches. Small ecotypes of *P. asplenioides* sometimes are difficult to distinguish from *P. porelloides*.

Porella obtusata (Taylor) Trevis
Kirazlıyayla, 40°06'47.0"N, 29°05'25.9"E, on soil near stream in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 24 June 2015. A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6830).

Riccia gougetiana Durieu et Mont.
Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015. A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6824).

Riccia macrocarpa Lev.
Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015 A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6826); Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, on exposed soil in low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 24 June 2015. A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6870).

Riccia papillosa Moris
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on stony, sun-exposed granite ground, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-136).
Easily recognized by long, straight or curved papillae scattered along thallus margins and upper part of thallus.

Riccia sorocarpa Bisch.
Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-133); Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, on exposed soil in low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-186); Oteller area, between Oteller and Volfram, 40°05'47.7"N, 29°09'39.04"E, 1980 m, glacial lake shore, on water-saturated sandy soil, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-207).
Distinguished in the field by the furrowed thallus into sharply acute grooves. Characteristic in thallus cross-section are hyaline, rounded and inflated epidermal cells which are soon collapsing and thick-walled subepidermal cells.
Riccia is richest genus among the Turkish liverwort flora with 25 taxa and widely distributed in Mediterranean basin with 40 taxa (Kiremit et al., 2016). Although many of them are more frequent in areas with Mediterranean type climate (Ros et al., 2007; Kürschner & Frey, 2011, Kiremit et al., 2014, Kiremit et al., 2016). Revision project on Turkish *Riccia* performed by Kiremit et al. (pers.com.) shown that, subalpine belt of the Uludağ is the richest area with 4 taxa in these latitudes.
Scapania compacta (Roth) Dumort.
Çobankaya area, 40°06'57.0"N, 29°08'34.7"E, 1760 m, seasonal melting pool, on muddy, water-saturated sandy soil, 23 June 2015 A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6803);

Scapania paludosa (Müll.Frib.) Müll.Frib.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on moist soil near riverside, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-141); Sarıalan Yaylası, 40°07'57.8"N, 29°06'45.3"E, 1610 m, boggy low sedge fen, partly submerged (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-169).
Leaf lobes unequally bilobed as in *S. undulata*, but dorsal leaf lobe long decurrent, reniform to cordate.

Scapania subalpina (Lindenb.) Dumort.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on moist soil near riverside, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-150).
Large, semi-aquatic forms sometimes are difficult to distinguish from *S. undulata*. But in *S. subalpina* the leaf lobes are subequally bilobed, the dorsal lobe is widely crossing the stem and the leaf gemmae are much larger (20-40 µm long vs. 13-20 µm in *S. undulata*).
In case of taxa number, *Scapania* is the second liverwort genus in Turkey and represented by 13 taxa with recent additions (Ezer et al., 2013; Kara et al., 2014). 5 of them were collected from the study area. *Scapania irrigua* (Nees) Nees and *S. undulata* (L.) Dumort. have already published by Çetin (1999). It is the richest liverwort genus in the bryophyte flora of Uludağ.

Bryophyta

Brachythecium mildeanum (Schimp.) Schimp.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on moist soil near riverside, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-149).
Similar to *B. rutabulum* and *B. rivulare*, but seta smooth, stem leaves with a long and fine acumen and leaf margins nearly entire.

Dicranum leioneuron Kindb.

Oteller area, way to Çobankaya, 40°06'17.7"N, 29°08'20.5"E, 1770 m, small *Sphagnum* bog, amongst *Sphagnum inundatum*, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-123, 15-127).
A rare species of raised and blanket bogs similar to *D. bonjeanii*. Differs from the latter by nearly entire leaf margins, a deeply channelled or almost tubular upper leaf part and flat, not undulate leaves.
Recorded by Uyar & Çetin (2004) for Turkey, however without any locality data.

Drepanocladus aduncus (Hedw.) Warnst. var. ***polycarpus*** (Blandow ex Voit) G.Roth
Sarıalan Yaylası, 40°07'57.8"N, 29°06'45.3"E, 1610 m, boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-177); Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-184).
A highly variable species complex, strongly subjected to environmental modifications (Smith 2004). Easily to be confused with *Warnstorfia fluitans* (Syn. *Drepanocladus fluitans*) listed in Henderson & Prentice (1969) for the Uludağ area. Leaves, however, entire and auricles (alar cells) not reaching costa.

Heterocladium heteropterum (Brid.) Schimp.
Kirazlıyayla, 40°06'47.0"N, 29°05'25.9"E, on soil near stream in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 24 June 2015. A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6894).

Hygrohypnum luridum (Hedw.) Jenn.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on granite rock in river, partly submerged, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-154).

Lescuraea saxicola (Schimp.) Molendo
Oteller area, way to Çobankaya, 40°06'17.7"N, 29°08'20.5"E, 1770 m, on granite rock, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-108).

Leskea polycarpa Hedw.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on granite rock in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-145).

Orthotrichum lyellii Hook. & Taylor
Uludağ road, 15km to oteller area, $40^0$08'07,4"N, $29^0$01'53,1"E, 975 m ,on *Quercus* sp. trunk. mixed forest of *Quercus* spp., *Carpinus betulus* and *Castanea sativa*, 23 June 2015. A.Erdağ, H.Kürschner & M.Kırmacı (MKIR 6802; 15-103).

Orthotrichum rupestre Schleich. ex Schwägr. var. ***sturmii*** (Hoppe & Hornsch.) Boulay
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on granite rock in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-159).
O. rupestre is a highly variable species with a number of varieties, many of them continuous and integrating, appearing only habitat forms. Variety *sturmii* is characterized by a bistratose leaf lamina (cf. Kürschner and Frey 2011). The taxonomic status of the taxon, however remains unsolved at present.

Plagiomnium elatum (Bruch & Schimp.) T.J.Koponen
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on moist soil near riverside, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-143).

Plagiomnium ellipticum (Brid.) T.J.Koponen
Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-184).

Pohlia nutans (Hedw.) Lindb.
Between Çobankaya area and Bakacak, 40°07'07.34"N, 29°09'34.43"E, 1890 m, swampy meadows (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-163).
Characteristic of acidic peaty soil and easily recognized by long setae and the dark green colour.

Racomitrium lanuginosum (Hedw.) Brid.
Oteller area, way to Çobankaya, 40°06'17.7"N, 29°08'20.5"E, 1770 m, on stony, sun-exposed granite ground, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-114); Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on stony, sun-exposed granite ground, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-138); Oteller area, between Oteller and Volfram, 40°05'47.7"N, 29°09'39.04"E, 1980 m, on stony, sun-exposed ground in subalpine meadow with *Juniperus communis* subsp. *nana* scrub, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-208).

Schistidium rivulare (Brid.) Podp.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on granite rock in river, partly submerged, 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-152).
Similar to *S. platyphyllum*, perichaetial leaves, however overtopping capsules.

Sphagnum auriculatum Schimp.

Sarıalan Yaylası, 40°07'57.8"N, 29°06'45.3"E, 1610 m, boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), 23 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-168, 15-176 conf. A.Hölzer); Oteller area, between Oteller and Volfram, 40°05'32.4"N, 29°09'03.3"E, 1980 m, in boggy low sedge fen (communities of the Swertio ibericae-Nardion strictae alliance), submerged, 24 June 2015 A.Erdağ, M.Kırmacı & H.Kürschner (15-193, 15-198, 15-202).

S. auriculatum (Sect. *Subsecunda* Lindb.) belongs to a complex of very similar species, not easily to distinguish and treated taxonomically different within the European floras by various authors (cf. Smith 2004, Frey et al. 2006, Hölzer 2010). Especially submerged forms and aquatic ecotypes are difficult to separate. Here we followed the concept of Hölzer (2010) who distinguished five species in the *S. subsecundum* agg.:
S. auriculatum Schimp. [Syn. *S. denticulatum* Brid., *S. obesum* (Wils.) Warnst., *S. subsecundum* var. *rufescens* (Hornsch.) Hueb.]
S. contortum Schultz [Syn. *S. subsecundum* var. *contortum* (Schultz) Hueb.)]
S. inundatum Russow [Syn. *S. subsecundum* subsp. *inundatum* (Russow) A.Eddy, *S. auriculatum* var. *inundatum* (Russow) M.O.Hill)]
S. platyphyllum (Lindb. ex Braithw.) Sull. ex Warnst.]
S. subsecundum Nees.

Especially *S. inundatum* and S. *subsecundum*, both widely distributed in nearly all swampy and boggy grounds in the Uludağ area (cf. Henderson and Prentice 1969, Çetin 1999b) often are treated only as subspecies or varieties (Eddy 1977, Hill 1975) and confused with *S. auriculatum*. Distinguishing characters of the latter is a single layered stem cortex, the often cornute, horn-like twisted and tumid branches and branches arising in clusters of only 3 to 4 (rarely 5) and stem leaves which are broadest above the middle (Hölzer 2010). Confusion between the three species, however, may arise in depauperate or swollen, submerged plants as typical for many of the swampy sites and flushes of the Uludağ plateaus.
Recorded only once from Turkey by Handel-Mazzetti (1909, as *S. obesum*) from the Giresun province [Bei Ezeli, Tschemlikschi Deressi (Çemlikçi Deresı), 900 m, an überronnenen, kupferinfiltrierten, vulkanischen Tufffelsen, Juli 1907 Frh. H. v. Handel-Mazzetti Nr. 802] (cf. Kırmacı and Kürschner 2013). Most recently, it was collected from the western Black Sea coast near Şile (Istanbul: Şile, 41°08'N; 29°35'E, swampy and boggy ground in oak forest, Febr. 2015, M. Kırmacı).

Syntrichia princeps (De Not.) Mitt.
Between Çobankaya area and Softaboğan Şelalesı, 40°07'20.2"N, 29°08'46.3"E, 1700 m, on granite rock in *Abies nordmanniana* subsp. *bornmuelleriana* forest, 23 June 2015, H.Kürschner, M.Kırmacı & A.Erdağ (ERD 15-10).

Acknowledgements

The study was supported by a grant of TÜBITAK (TBAG 113Z631) to M. K. for the investigation of Turkish Sphagna. We are grateful to A. Hölzer (Jockgrim/Karlsruhe), who confirmed the record of *Sphagnum auriculatum* from Uludağ.

References

Akdeniz, N.S., Yener, D.Y. 2012. Bursa, Uludag and Fir. Kastamonu Univ., Journal zof Forestry Faculty. Special Issue. 256-258.
Bornmüller, J. 1931. Zur Bryophyten-Flora Kleinasiens. Magyar Botanikai Lapok. 30. 1-21.
Eddy, A. 1977. *Sphagnum subsecundum* agg. in Britain. Journal of Bryology. 9. 309-319.
Ezer, T., Kara, R., Alataş, M. 2013. *Scapania gracilis* Lindb. (*Hepaticae, Scapaniaceae*), new to bryophyte flora of Turkey. Folia Cryptog. Estonica. 50: 117-119.
Frey, W., Frahm, J.-P., Fischer, E., Lobin, W. 2006. The liverworts, mosses and ferns of Europe. Ed.: T.L. Blockeel. – Harley Books, Colchester, Essex.
Handel-Mazzetti, H.v. 1909. Musci. In: Handel-Mazzetti, H.v.: Ergebnisse einer botanischen Reise in das Pontische Randgebirge im Sandschak Trapezunt, unternommen im Jahre 1907, S. 124-132. Annalen des Naturhistorischen Museums in Wien. 23. 6-212.
Henderson, D.M. 1959. Contributions to the bryophyte flora of Turkey: V. Summary of present knowledge. Notes Royal Botanic Garden Edinburgh. 23. 279-301.
Henderson, D.M., Prentice, H.T. 1969. Contributions to the bryophyte flora of Turkey: VIII. Notes Royal Botanic Garden Edinburgh. 29. 235-262.
Hill, M.O. 1975. *Sphagnum subsecundum* Nees and *S. auriculatum* Schimp. in Britain. Journal of Bryologie. 8. 435-441.
Hölzer, A. 2010. Die Torfmoose Südwestdeutschlands und der Nachbargebiete. Weissdorn Verlag Jena.
Kara, R., Ezer, T., Can Gözcü, M., Bozdoğan, Ş.G. 2014. Bryophyte flora of Erciyes Mountain in Turkey, with 6 bryophyte records from the country. Turk. J. Bot. 38: 763-781.

Kaynak G, Daşkın R., Yılmaz, O. 2005. Bursa Bitkileri. T.C. Uludağ Üniversitesi Kent Tarihi ve Araştırmaları Merkezi. Yayın No. 2, Bursa.

Kırmacı, M., Kürschner, H. 2013. The genus *Sphagnum* L. in Turkey – with *S. contortum, S. fallax, S. magellanicum* and *S. rubellum* new to Turkey and Southwest Asia. Nova Hedwigia. 96. 383-397.

Kürschner, H., Frey W. 2011. Liverworts, mosses and hornworts of Southwest Asia (*Marchantiophyta, Bryophyta, Anthocerotophyta*). Nova Hedwigia. Beiheft. 139: 1-240.

Kürschner, H., Frey, W. 2011. Liverworts, mosses and hornworts of Southwest Asia. (*Marchantiophyta, Bryophyta, Anthocerotophyta*). Nova Hedwigia. Beiheft. 139: 1-240.

Kürschner, H., Frey, W. 2011. The Liverworts, Mosses and Hornworts of Southwest Asia (Marchantiophyta, Bryophyta, Anthocerotophyta) - Afghanistan, Bahrain, Iraq, Iran, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Sinai Peninsula, Syria, Turkey, United Arab Emirates, and Yemen (incl. Socotra Island). Beihefte Nova Hedwigia. 139. 1-240.

Özenoğlu Kiremit, H., Özçelik, A.D., Ören, M., Uyar, G. 2014. A note on *Riccia canaliculata* (*Ricciaceae, Hepaticopsida*) in Turkey. Biodicon. 7/1: 32-34

Özhatay, N., Çırpıcı, A. 1987. Guide to excursion (Uludağ-Bursa). 1-3. Istanbul.

Öztürk, Ş., Güvenç, Ş. 2010. The distribution of epiphytic lichens on Uludag fir (*Abies nordmanniana* (Steven) Spach subsp. *bornmuelleriana* (Mattf.) Coode & Cullen) forests along an altitudinal gradient (Mt. Uludağ, Bursa, Turkey). Ekoloji. 19. 131-138.

Paton, J.A. 1999. The liverwort flora of the British Isles. Harley Books, Colchester, Essex.

Ros, R.M., Mazimpaka, V., Abou-Salama, U., Aleffi, M., Blockeel, T.L., Brugues, M., Cano, M.J., Cros,R.M., Dia, M.G., Dirkse, G., Draper, I., El-Saadawi, W., Erdag, A., Ganeva, A., Gonzales-Mancebo, J.M., Herrnstadt, I., Khalil, K., Kurschner, H., Lafranco, E., Losada-Lima, A., Refai, M.S., Rodríguez-Nuñez, S., Sabovljevic, M., Sergio, C., Shabbara, H.M., Sim-Sim, M., Söderström L. 2007. Hepatics and Anthocerotes of the Mediterranean, an annotated checklist. Cryptogamie, Bryologie. 28 (4): 351-437.

Schiffner, V. 1901. Einige Materialien zur Moosflora des Orients. – Österreichische Botanische Zeitschrift. 51. 156-161.

Smith, A.J.E. 2004. The moss flora of Britain and Ireland, 2nd ed. – Cambridge University Press, Cambridge.

Uyar, G., Çetin, B. 2004. A new check-list of mosses of Turkey. Journal of Bryology. 26. 203-220.

Walther, K. 1967. Beiträge zur Moosflora Westanatoliens I. Mitteilungen aus dem Staatsinstitut für Allgemeine Botanik in Hamburg. 12. 129-186.

Zencirkıran, M. 2009. Determination of native woody landscape plants in Bursa and Uludağ. African Journal of Biotechnology. 8: 5737-5746.

Çetin, B. 1999a. The liverworts (Hepaticae) of Uludağ National Park (Bursa). Turkish Journal of Botany. 23. 277-280.

Çetin, B. 1999b. The moss flora of the Uludağ National Park (Bursa/Turkey). Turkish Journal of Botany. 23. 187-193.

(Received for publication 26 May 2016; The date of publication 15 December 2016)