

***Sphagnum molle* (Sphagnaceae, Bryophyta) in Turkey and SW Asia**

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Abstract – *Sphagnum molle* Sull. is recorded for the first time in Turkey and SW Asia, based on specimens collected in Fındıklı (Rize). The species, the area characteristics and the habitat are described and illustrated with photographs.

***Sphagnum molle* / Sphagnaceae / New record / Distribution / Ecology / Turkey**

Résumé – *Sphagnum molle* Sull. est cité pour la première fois en Turquie et dans le Sud-ouest Asie, à partir de spécimens récoltés dans le forêt de Fındıklı (Rize). L'espèce, les caractéristiques de l'aire et l'habitat sont décrits et illustrés.

***Sphagnum molle* / Sphagnaceae / Nouveau report / Distribution / Écologie / Turquie**

INTRODUCTION

Bryofloristic studies in Turkey are poorly known and underworked. Although in recent years many additions (Erdağ & Kırmacı, 2010; Lara *et al.*, 2010; Ören *et al.*, 2010; Erdağ & Kürschner, 2011; Ezer & Kara, 2011; Keçeli *et al.*, 2011; Kırmacı *et al.*, 2012; Ursavaş & Çetin, 2012; Kırmacı & Agcagil, 2012; Batan *et al.*, 2013; Kırmacı & Kürschner, 2013; Ros *et al.*, 2013; Uyar & Ören, 2013) showing the diversity of the bryophyte flora of Turkey have been made, the whole of bryophyte flora of Turkey is still unknown. NE Turkey where our specimens are collected is located in the square A4 according to Henderson's (1961) grid system (Fig. 1).

During our trips and studies on bryophytes of Fındıklı County in September 2012, we came across a group of conspicuous specimens belonging to the genus *Sphagnum* L. We considered that one of them could be a new record for Turkey. After contacting Jonathan Shaw we sent him the sample. He clarified that the specimen is *Sphagnum molle* Sull. Our investigations related to the subject confirmed that the specimen is a new record for Turkey and SW Asia. Therefore we discussed it in detail in this paper.

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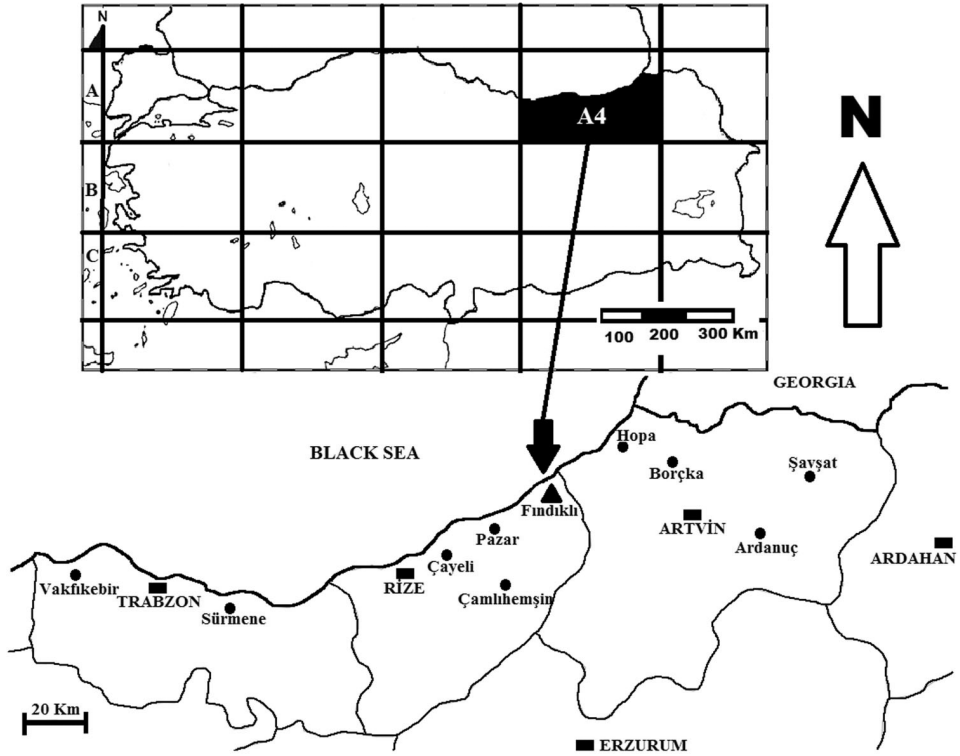


Fig 1. Location of the investigated area (▲) in the square A4 of Turkey

MATERIALS AND METHODS

The field trips were carried out in September 2012 at the Black Sea region, northeast part of Turkey. *Sphagnum molle* was collected and photographed by the first author. Bryophytes associated with this species were also researched and identified in the study area. The mosses are kept in the private herbarium of the first author (Abay) and the liverworts in the second author's (Keçeli). Nomenclature follows Hill *et al.* (2006) and Ros *et al.* (2013) for mosses and Ros *et al.* (2007) for liverworts. The air dried samples of mosses were identified using standard taxonomic keys (Cortini Pedrotti, 2001; Smith, 2004; Brugués *et al.*, 2007) and so were the liverworts (Paton, 1999). The status of the moss species for Turkey was determined by reviewing the moss checklist of Turkey (Uyar & Çetin, 2004; Ros *et al.*, 2013), and bryophytes of Turkey (Kürschner & Erdağ, 2005). We consulted the literature (Dierßen, 2001) for ecological characterization of the new record taxa to compare the conditions of our new locality. The new record of *Sphagnum* species is described below.

HABITATS OF THE NEW LOCALITY

In general, main rock types in the region are granite and granodiorite with acidic character. Soil has also an acidic character and is non-calcareous due to the rain and main rock types of the region (Çevre Durum Raporu, 2006). The locality has a typical oceanic climate not seen in drought season (Akman, 1999). Meteorological data belonging to the region were taken from Pazar station (latitude 41°11', longitude 40°53', altitude 79 m) nearest to Fındıklı. The mean annual temperature is 13.3°C. The highest mean temperature is 21.7°C both in July and August, and also the lowest is 5.8°C in February. The highest temperature is 38.3°C in May and the lowest -7.0°C in January. Mean annual aboveground minimum temperature is 9.2°C. Total mean annual precipitation is 2036.0 mm. When we look at the winter months; February is the first with six days covered with snow following it January with four, March and December with two (Meteoroloji Genel Müdürlüğü, 2005). Based on this information, we can say that there is no permanent snow cover. The peaty grassland in the locality is under wet heathland and near small streamside. Broad-leaved woody taxa mainly consisting of alder, glossy buckthorn, and *Rhododendron* are seen. In the locality of *Sphagnum molle*, the main higher plants include *Alnus glutinosa* subsp. *barbata* (C.A. Mey) Yalt., *Frangula alnus* Mill., and *Rhododendron ponticum* L.

DESCRIPTION AND DISCUSSION

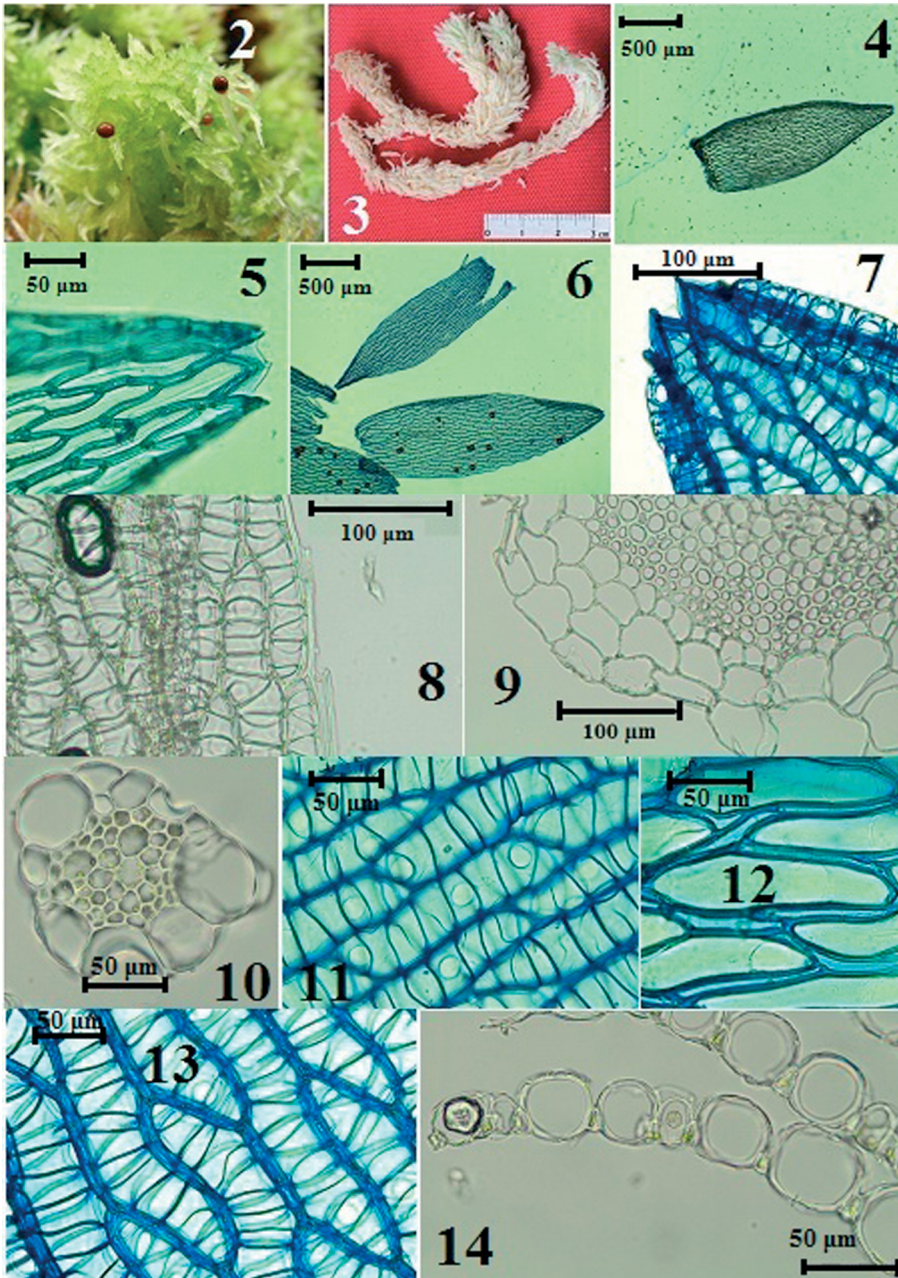
Sphagnum molle Sull. (section *Acutifolia*)

Figs 2-14

Synonyms: *Sphagnum labradorensis* Warnst., *Sphagnum molluscoides* Müll. Hal., *Sphagnum muelleri* Schimp., *Sphagnum tabulare* Sull.

Specimen examined: Turkey. Square A4, northeast part of Black Sea region, Rize, Fındıklı, road from Aslandere village to Gürcüdüzü plateau, 377 m above sea level, 41°13'31,9"N; 41°17'26,9"E, on wet rock, roadside, associated with *Sphagnum palustre* L., *Polytrichum commune* Hedw., *Campylopus pyriformis* (Schultz) Brid., *Dicranodontium denudatum* (Brid.) E. Britton, *Diplophyllum albicans* (L.) Dumort., *Pallavicinia lyellii* (Hook.) Carruth., and *Scapania* spp., 19 September 2012, G. Abay 1626 (Herb. Abay).

Plants are moderate-sized, soft, lax and rather dense when wet, on damp area, mostly forming pure stands, with velvety surface, and tussocks, green, whitish-green and sometimes pink coloring (Fig. 2). Stems stiffly when dry, branched, pale throughout, shoot branches pointing upwards (Fig. 3), capitula usually pale green and not stellate when viewed from above, stem leaves widest at mid-leaf, ovate to ovate-lingulate, up to 2.0 × 0.8 mm (Fig. 4), apex truncate, broad and toothed (Fig. 5); branch leaves narrowly ovate and widest at about mid-leaf, not abruptly narrowed towards the apex, relatively large, 2.3 × 0.7 mm (Fig. 6), apex truncate-dentate (Fig. 7), denticulate at margin in upper half, bordered by linear cells (Fig. 8); stem cortex 3-layered of inflated hyaline cells, cortical cells of stem without pores, 0.6 mm in diameter (Fig. 9); branch cortex 1-layered and 0.1mm in diameter, retort cells in groups and varying in size, usually a few times larger than other cortical cells (Fig. 10); cells with pores in lower side regions of branch leaf, dorsal side, 15 μm, (Fig. 11), hyaline cells large,



Figs 2-14. *Sphagnum molle*. 2. In habit. 3. Dry plants. 4. Stem leaf. 5. Stem leaf apex. 6. Branch leaves. 7. Branch leaf apex. 8. Branch leaf margin. 9. Cross section of stem. 10. Cross section of branch. 11. Lower cells with pores of branch leaf, dorsal side. 12. Lower cells of stem leaf. 13. Branch leaf cells, ventral side. 14. Cross sections of branch leaves [Some microscopic photographs (Figs 4, 5, 6, 7, 11, 12, and 13) were taken on the preparations stained with methylene blue water solution]. All from G. Abay 1626.

210 × 18 μm, without fibrils in lower part of the stem leaf, septa only (Fig. 12); ventral pores absent in branch leaf cells (Fig. 13), chlorocysts in section triangular and branch leaf margin with a resorption furrow, ends of cross-sections C-shaped (Fig. 14).

Microscopically, the denticulate-margined branch leaves of *S. molle* (Fig. 8) with a marginal resorption furrow (Fig. 14) distinguish this taxon from the related species belonging to the section *Acutifolia* (Nyholm, 1969; Smith, 2004). The very similar looking *S. angermanicum* Melin branch leaves in the same section are without a resorption furrow. There exist also some hemi-isophyllous forms of the section *Acutifolia*, especially *S. capillifolium*, sometimes its leaves distinctly narrowed above, but without a resorption furrow (Daniels & Eddy, 1990). The Turkish materials differ from the American (Crum & Anderson, 1981), Fennoscandian (Nyholm, 1969) and British (Smith, 2004) ones by narrower branch leaves (Fig 6). Finally, the number of the septa in our materials is only one whereas in European examples it is numerous (Daniels & Eddy, 1990).

The genus *Sphagnum* had fifteen species in Turkey until 2005 (Kürschner & Erdağ, 2005). Payne *et al.* (2007) added *S. fuscum* (Schimp.) H. Klinggr. from Trabzon province and one other species *S. centrale* C.E.O. Jensen was recorded in NE Turkey (Abay *et al.*, 2009). Additionally, several new discoveries (*S. contortum* K.F. Schultz, *S. fallax* (H. Klinggr.) H. Klinggr., *S. magellanicum* Brid. and *S. rubellum* Wilson) were reported from eastern Black Sea Mts (Kirmaci & Kürschner, 2013). To date, based on the aforementioned literatures, 21 species of *Sphagnum* have been recognized in Turkey. According to the checklist of mosses of SE Europe including European part of Turkey (Sabovljević *et al.*, 2008; Ros *et al.*, 2013), *Sphagnum molle* was only known from Macedonia, Romania, and Serbia. But, the distribution data of Sphagnophyta of Europe and Macaronesia was updated by Séneca & Söderström (2009) and they excluded Romania from their distribution table referring to Dihoru (2004). These countries (Macedonia and Serbia) are the nearest localities to the *S. molle* in Turkey. In the checklist of mosses of the former USSR (Ignatov & Afonina, 1992) and East Europe and North Asia (Ignatov *et al.*, 2006), the species is known from the European part of the former USSR (Estonia, Latvia, Lithuania, Belarus, and Ukraine). Also, this species is known from a few localities in Russian Karelia (Isoviita, 1970; Maksimov, 1995) and Kaliningrad region (Maksimov & Napreenko, 2001), and other North Russia regions which are Murmansk, Archangelsk, Komi, and Vologda (Séneca & Söderström, 2009). Based on our finding, this paper contributes a remarkable range extension of *S. molle* towards the Asian part of Turkey (Fig. 15). Turkish *Sphagnum* species belonging to section *Acutifolia* (*Sphagnum girgensohnii* Russow, *S. warnstorffii* Russow, and *S. capillifolium* (Ehrh.) Hedw.) in Turkey are all from A4 square according to Henderson's (1961) grid system and were recorded before 1961 (Hazer, 2010). The bryophyte flora of Southwest Asia containing the current knowledge available on this subject (Kürschner & Frey, 2011) does not include this species. Therefore, the present study informs that *S. molle* is reported for the first time in Turkey (Uyar & Çetin, 2004, Kürschner & Erdağ, 2005). This species is also newly recorded for the SW Asia (Kürschner & Frey, 2011).

Sphagnum molle extends to sub-tropics in North America has generally amphiatlantic distribution and is most close to Atlantic coastal areas (Heikkilä & Lindholm, 1988; Daniels & Eddy, 1990; Hill & Preston, 1998; Smith, 2004) as seen in Fig. 15. According to Dierßen (2001); the habitat features of the species are highly acidic, humidity is moderately hygrophytic, light availability is highly-considerably photophytic, human impact is ahemerobous (absent) – mesoheme-

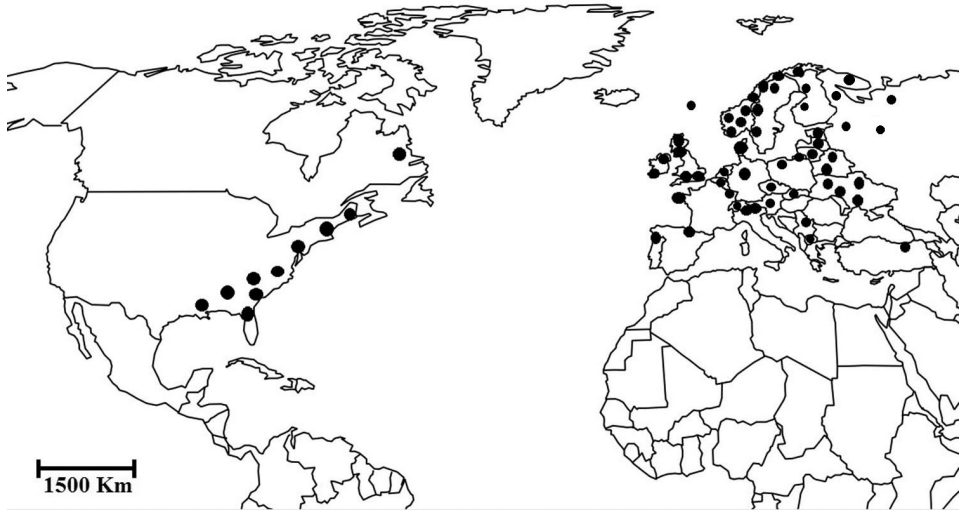


Fig. 15. World distribution of *Sphagnum molle* (●) according to previously published papers and present study.

robous (moderate). This species generally grows in low and tight cushions, on sandy or peaty soil in wet heathland and damp peaty grassland, occasionally in shadow blanket bogs; life strategy category of the specimen is long-lived shuttle. The habitat features of *S. molle* are almost the same in the Turkish locality. *Sphagnum molle*'s most frequent associates are *Sphagnum compactum* Lam. et DC., *S. tenellum* (Brid.) Pers. ex Brid. and *S. subnitens* Russow et Warnst. (Daniels & Eddy, 1990). In addition to other species, however, only *S. palustre* was seen as an associate of *S. molle* in our study area.

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