

THE BRYOPHYTE FLORA OF ESKİŞEHİR PROVINCE (TURKEY)

БРИОФЛОРА ПРОВИНЦИИ ЭСКИШЕХИР (ТУРЦИЯ)

ERSİN YÜCEL¹ & TÜLAY EZER²

ЭРСИН ЮКЕЛ¹, ТУЛАЙ ЭЗЕР²

Abstract

In this study, the bryophyte flora of Eskişehir province (Turkey) were investigated. The field trips were conducted between 1986 and 1992. The 730 bryophyte specimens, collected from 53 different localities in Eskişehir province, were identified. As a result of the identification of the specimens, total 150 taxa (142 mosses, 8 liverworts) belonging to 29 families and 69 genera were determined. No hornworts were found in the study area. Among them, 68 are new records for B7 grid-square in the system adopted by Henderson for Turkey, 99 are new to Eskişehir province. The richest two families in the floristic list are Pottiaceae (36 taxa) and Brachytheciaceae (21 taxa). While the largest genus is *Ptychostomum* with 9 taxa, *Orthotrichum* and *Syntrichia* are represented by 8 taxa in the bryoflora of Eskişehir. *Homalothecium lutescens* and *Syntrichia ruralis* are the most common species in Eskişehir province.

Резюме

Представлены результаты изучения бриофлоры провинции Эскишехир в Турции. Полевые исследования проводились в 1986 – 1992 гг. Было собрано и определено 730 образцов из 53 местонахождений. Было выявлено 150 видов (142 вида мхов, 8 видов печеночников), которые относятся к 29 семействам и 69 родам. Антоцеротовые в районе исследования найдены не были. Из выявленных видов 68 являются новыми для квадрата В7 системы Хендерсона, которая принята для территории Турции, 99 видов – новые для провинции Эскишехир. Наиболее богаты видами семейства Pottiaceae (36 видов) и Brachytheciaceae (21 видов). Наиболее крупным по числу видов является род *Ptychostomum* (9 видов), *Orthotrichum* и *Syntrichia* представлены каждый 8 видами. *Homalothecium lutescens* и *Syntrichia ruralis* – наиболее часто встречающиеся в провинции Эскишехир виды мхов.

KEYWORDS: Mosses, liverworts, flora, Eskişehir, Turkey

INTRODUCTION

Turkey has a remarkable floral diversity including bryophytes due to its great variety of ecosystems, habitats, three different types of climate (Mediterranean, Continental, and Oceanic) and also the intersection of three biogeographical areas (Euro-Siberian, Mediterranean, and Irano-Turanian).

Bryophytes are one of the important members of the flora and play an important role in the ecosystem dynamics. However, yet poorly researched plant group in many regions of Turkey. Turkey has the richest bryodiversity among the South-west Asian countries with a total 966 bryophyte taxa (Batan *et al.*, 2016).

Although, in recent years, floristic studies on bryophytes have increased rapidly in many parts especially Black Sea, Aegean and Mediterranean Regions of Turkey (Ören *et al.*, 2015; Alataş & Batan, 2016; Ezer, 2016; 2017; Karakaş & Ezer, 2016; 2017; Kırmacı & Ağcagil, 2016; Özdemir & Batan, 2016; Batan *et al.*, 2016; Öze-

noğlu Kiremit *et al.*, 2016; Kırmacı & Kürschner, 2017, Alataş *et al.*, 2018; Uyar *et al.*, 2018), the bryophyte flora has not been completed in East, Southeast, and Central Anatolian Regions of Turkey yet.

The main objective of the present study is to contribute the bryophyte flora of the Eskişehir province, where a few studies on bryophytes were carried out (Yücel & Tokur, 1989; Yücel & Magill, 1997; Savaroğlu & Tokur, 2006), and also to the Turkish bryoflora.

MATERIALS AND METHODS

STUDY AREA

Eskişehir is located on the northwest of the Central Anatolia Region between 29-32° east longitude and 39-40° north latitude. Bolu is in the north of the province, Konya and Afyonkarahisar are in the south, Ankara is in the east, Kütahya and Bilecik are in the west. The province is situated within the Irano-Turanian phytogeographic region and in the B7 square in grid system of Turkey adopted by Henderson (1961) (Fig. 1).

¹ – Eskişehir Technical University, Faculty of Science, Biology Department, Eskişehir, Turkey, ebitki@gmail.com

² – Niğde Ömer Halisdemir University, Faculty of Science, Biology Department, 51100 Niğde, Turkey, tuezer@gmail.com; tezer@ohu.edu.tr

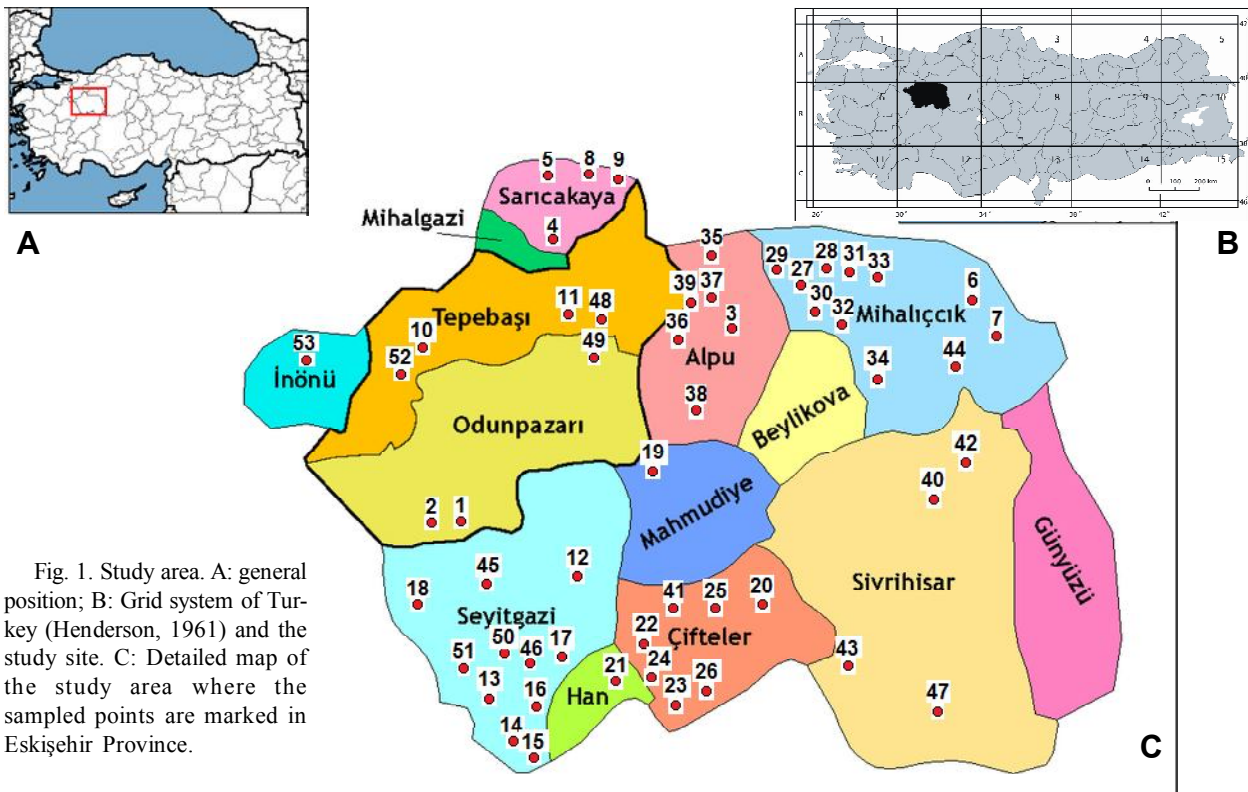


Fig. 1. Study area. A: general position; B: Grid system of Turkey (Henderson, 1961) and the study site. C: Detailed map of the study area where the sampled points are marked in Eskişehir Province.

Due to its geographical conditions, elevations, topography and distance to the sea, Eskişehir province has typical continental climate characteristics such as semi-arid and extremely cold climate with a severe frost period in winter. The mean annual maximum temperature is 29.3 °C in August, with mean minimum temperature is -3.4 °C in February. The mean precipitation per year is 366 mm, the highest precipitations occur in December and the lowest in August (Akman, 1999).

The Central Anatolian steppe, the North Anatolian and the Western Anatolian forests form the vegetation cover of Eskişehir Province. The forest vegetation in the study area have been mainly formed by *Pinus brutia* Ten., *P. nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe, *P. sylvestris* L. and *Quercus cerris* L. var. *cerris* (Savaroğlu & Tokur, 2006). On the southern slopes of the Sündiken Mountains, after 1000 meters oak shrubs and then dwarf oaks are seen. *P. nigra* subsp. *pallasiana* and *P. sylvestris* are dominant after 1300 meters. Steppe vegetation is generally seen in the southern parts of the Eskişehir province and characterized by *Acantholimon puberulum* Boiss. & Balansa, *Genista aucheri* Boiss., *Astragalus condensatus* Ledeb., *Asphodeline taurica* Endl., *Allium cappadocicum* Boiss., *Elymus hispidus* (Opiz) Melderis subsp. *hispidus* and *Serratula lasiocephala* Bornm (Arslan *et al.*, 2014).

Geologically, the oldest rocks in Eskişehir Province are Paleozoic granitic rocks and amphibolite schist, glaucophane schist, quartzite and marble rocks (Sönmez, 2015).

SAMPLING AND STUDY MATERIALS

Materials of the present study, were collected from different localities and habitats in Eskişehir Province in

different vegetation periods in the years 1986, 1988 and 1992 (Table 1). Detailed map to the study area where the sampled points are marked in Eskişehir province was given in Fig. 2.

The bryophyte specimens were identified using relevant literature (Zander, 1993; Greven, 1995; 2003; Muñoz, 1999; Paton, 1999; Cortini Pedrotti, 2001; 2006; Heyn & Herrnstadt, 2004; Smith, 2004; Guerra *et al.*, 2006; 2007). Voucher specimens are deposited in the special collections of Ersin Yücel.

The latest taxonomic and distributional status of bryophyte taxa in regional scale for Turkey was determined by reviewing the recent literatures (Yücel & Tokur, 1989; Yücel & Magill, 1997; Uyar & Çetin 2004; Kürschner & Erdağ, 2005; Savaroğlu & Tokur, 2006; Özenoğlu Kiremit & Keçeli, 2009; Kürschner & Frey, 2011; Ros *et al.*, 2013). Arrangement of the nomenclature in the floristic list follows Ros *et al.* (2013) and Söderström *et al.* (2016). For each taxon, only one collector number (i.e., EY.682b) was given to avoid repetition in the floristic list. The new records for only the Eskişehir Province are indicated with (*), new records for both B7 and Eskişehir are indicated with (+) in the floristic list presented in Table 2.

RESULTS AND DISCUSSION

As a result of the identification of bryophyte samples, a total of 150 taxa belonging to 29 families and 69 genera were determined. Among them, the mosses are represented by 142 taxa and the liverworts are represented by 8 taxa in the study area. While 68 taxa are new to B7 grid-square, 99 taxa are new to Eskişehir Province. Moreover, *Entosthodon hungaricus* and *Encalypta affi-*

Table 1. Collecting localities shown in Fig. 1,

NN	Altitude	GPS Coordinates	Location	Date	Habitat
1	816	39°44'N-30°26'E	Eskişehir-Orman Fidanlığı 1	17.02.1986	Afforestation area
2	845	39°44'N-30°26'E	Eskişehir-Orman Fidanlığı 2	17.02.1986	Afforestation area
3	761	39°46'N-31°00'E	Eskişehir-Alpu, Çayırbaşı road	12.03.1986	Slope
4	310	40°02'N-33°37'E	Eskişehir-Sarıcakaya, Küplü village	13.03.1986	Roadside
5	275	40°01'N-30°36'E	Eskişehir-Sarıcakaya, Şoförler çeşmesi	13.03.1986	Forest
6	831	39°56'N-31°41'E	Eskişehir-Sekiören 1	13.03.1986	Forest
7	845	39°56'N-31°42'E	Eskişehir-Sekiören 2	13.03.1986	Forest
8	195	40°01'N-30°31'E	Eskişehir-Sarıcakaya, Karaoğlan village	18.03.1986	Riverside
9	865	39°58'N-30°30'E	Eskişehir-Sarıcakaya, Atalan village	18.03.1986	Creek bed
10	830	39°48'N-30°23'E	Eskişehir-Yukarı Söğütünü	02.04.1986	Plain
11	783	39°50'N-30°34'E	Eskişehir-Tepebaşı, Mutalip village	02.04.1986	Plain
12	1000	39°27'N-30°41'E	Eskişehir-Seyitgazi	03.04.1986	Plain
13	1140	39°10'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village	03.04.1986	Forest
14	1020	39°11'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village, Karacaören pond	03.04.1986	Plain
15	1070-1146	39°10'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village	03.04.1986	Forest
16	1168	39°10'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village, Seyircik place	03.04.1986	Slope
17	1115	39°11'N-30°35'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village, Tokmaklı creek	03.04.1986	Plain
18	1118	39°10'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village	03.04.1986	Plain
19	910	39°36'N-30°49'E	Eskişehir-Odunpazarı, Yahnikapan village	05.04.1986	Swamp
20	866	39°22'N-31°04'E	Eskişehir-Çifteler, Sakarya başı	15.04.1986	Swamp
21	1200	39°09'N-30°53'E	Eskişehir-Çifteler, Han town-Başara village road	15.04.1986	Steppe
22	910	39°17'N-30°58'E	Eskişehir-Çifteler, Ilıcabaşı village	15.04.1986	Plain
23	973	39°12'N-30°58'E	Eskişehir-Çifteler, Çatmapınar village	15.04.1986	Plain
24	1120	39°09'N-30°55'E	Eskişehir-Çifteler, Başara-Kadıkuyusu village road	15.04.1986	Forest
25	1100	39°42'N-31°24'E	Eskişehir-Mihalıççık- Çifteler road	15.04.1986	Forest
26	985	39°15'N-31°01'E	Eskişehir-Çifteler, Kadıkuyusu village	15.04.1986	Plain
27	1500	39°58'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests	18.04.1986	Forest
28	1430	39°59'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests, Taşlıburun place	18.04.1986	Forest
29	1150	39°58'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests, Karakütük place	18.04.1986	Forest
30	1500	39°57'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests, Kuzugölcük, Değirmendere place	18.04.1986	Forest
31	1650	39°55'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests, Asarlıktepe place	18.04.1986	Forest
32	1500	39°57'N-31°09'E	Eskişehir-Mihalıççık, Çatacık Forests, Aydo place	19.04.1986	Forest
33	1620	39°57'N-31°13'E	Eskişehir-Mihalıççık, Çatacık Forests, Yalınkırın place	19.04.1986	Forest
34	1400	39°52'N-31°29'E	Eskişehir-Mihalıççık, Aydulum place	19.04.1986	Plain
35	1110	40°00'N-30°59'E	Eskişehir-Alpu, Gökçekaya road	23.04.1986	Forest
36	940	39°46'N-31°00'E	Eskişehir-Alpu	23.04.1986	Plain
37	1200	39°57'N-30°57'E	Eskişehir-Alpu, Başören forest store	23.04.1986	Forest
38	900	39°42'N-30°56'E	Eskişehir-Alpu, Güneli village, Karpuzpınarı place	23.04.1986	Wetland
39	1000	39°54'N-30°58'E	Eskişehir-Alpu, Söğütcük village	23.04.1986	Forest
40	830	39°33'N-30°56'E	Eskişehir-Sivrihisar, Hamidiye village	05.05.1986	Steppe
41	800	39°22'N-31°04'E	Eskişehir-Çifteler	05.05.1986	Wetland
42	950	39°27'N-31°32'E	Eskişehir-Sivrihisar	05.05.1986	Steppe
43	850	39°19'N-31°20'E	Eskişehir-Sivrihisar, Aktaş village, Sakarya River side	05.05.1986	Wetland
44	982	39°48'N-31°39'E	Eskişehir-Mihalıççık, Üçbaşı village, Kocagöz creek, Ağdacık place	26.05.1986	Valley
45	950	39°26'N-30°40'E	Eskişehir-Seyitgazi	27.05.1986	Plain
46	1400	39°15'N-30°41'E	Eskişehir-Seyitgazi, Şükranlı-Çukurca village	27.05.1986	Forest
47	800	39°17'N-31°35'E	Eskişehir-Sivrihisar, Ertuğrul village, Balıkdanı place	08.04.1988	Plain
48	810	39°47'N-30°30'E	Eskişehir, Anadolu University, Yunus Emre Campus	28.09.1992	Plain
49	815	39°44'N-30°26'E	Eskişehir Forest Nursery	30.09.1992	Afforestation area
50	1000	39°16'N-30°31'E	Eskişehir-Seyitgazi, Kırka	03.04.1986	Plain
51	1145	39°10'N-30°33'E	Eskişehir-Seyitgazi, Kırka, Büyükyayla village	03.04.1986	Forest
52	830	39°49'N-30°24'E	Eskişehir-Yukarı Söğütünü village	02.04.1986	Plain
53	1070	39°48'N-30°07'E	Eskişehir-İnönü	20.01.1988	Slope

Table 2. Floristic list. *: new records for the Eskişehir Province, +: new records for both B7 and Eskişehir, r: rock, s: soil, t: tree, rs: the soil covering the rock, C.N.: Collector number).

Taxa	Locality number	Substrates				C.N.
		r	s	t	rs	
Liverworts						
+ <i>Cephaloziella baumgartneri</i> Schiffn.	31			+		EY.682b
+ <i>C. divaricata</i> (Sm.) Schiffn.	32			+		EY.693d
+ <i>C. rubella</i> (Nees) Warnst.	27,31				+	EY.685b
+ <i>C. stellulifera</i> (Taylor ex Carrington et Pearson) Croz.	40			+		EY.809a
+ <i>Chiloscyphus polyanthos</i> (L.) Corda	27,31				+	EY.684b
+ <i>Pellia epiphylla</i> (L.) Corda.	27			+		EY.675b
<i>Porella platyphylla</i> (L.) Pfeiff.	13,39,40				+	EY.817a
* <i>Radula complanata</i> (L.) Dumort.	15				+	EY.572a
Mosses						
* <i>Amblystegium serpens</i> (Hedw.) Schimp.	10,13,27,34,48			+		EY.521
+ <i>Anoetangium handelii</i> Schiffn.	10			+		EY.518c
<i>Antitrichia curtipendula</i> (Hedw.) Brid.	13,39,40				+	EY.765b
<i>Aulacomnium androgynum</i> (Hedw.) Schwägr.	30,31			+		EY.685c
+ <i>Barbula convoluta</i> var. <i>sardoa</i> Schimp.	8			+		EY.513a
* <i>B. unguiculata</i> Hedw.	7,28,40			+		EY.819c
<i>Brachytheciastrum velutinum</i> (Hedw.) Ignatov & Huttunen	10,15,27,30,34,39,40,42				+	EY.707d
* <i>Brachythecium albicans</i> (Hedw.) Schimp.	22,34,39,40,44,51,52			+		EY.732
+ <i>B. glareosum</i> (Bruch ex Spruce) Schimp.	4,10,13,14,15,17,21,27,29,32,39				+	EY.560c
* <i>B. rivulare</i> Schimp.	10,34,39			+		EY.700b
+ <i>B. rutabulum</i> (Hedw.) Schimp	27,28,34			+		EY.704a
+ <i>Bryoerythrophyllum recurvirostrum</i> (Hedw.) P.C.Chen	31			+		EY.683a
* <i>Bryum argenteum</i> Hedw.	15,26,39,44			+		EY.841b
+ <i>B. dichotomum</i> Hedw.	8,26,42,43,47			+		EY.847a
+ <i>B. gemmiparum</i> De Not.	46				+	EY.844f
* <i>B. radiculosum</i> Brid.	49			+		EY.853a
+ <i>Campyliadelphus chrysophyllus</i> (Brid.) R.S. Chopra	27			+		EY.677b
* <i>Ceratodon purpureus</i> (Hedw.) Brid.	13,15,27,29,30,31,32,39,40,42,44		+	+	+	EY.665
* <i>Cirriphyllum crassinervium</i> (Taylor) Loeske & M. Fleisch.	34			+		EY.711b
<i>Cratoneuron filicinum</i> (Hedw.) Spruce	10,27,39			+	+	EY.727
+ <i>Dicranella heteromalla</i> (Hedw.) Schimp.	28				+	EY.660a
+ <i>D. subulata</i> (Hedw.) Schimp.	27			+		EY.631b
<i>Dicranoweisia cirrata</i> (Hedw.) Lindb.	13,28,30				+	EY.670a
+ <i>Dicranum majus</i> Sm.	27,31,39,40			+	+	EY.638
<i>D. scoparium</i> Hedw.	27,30,31,39,40				+	EY.808
<i>D. tauricum</i> Sapiegin	28,30,31,32,34,48				+	EY.650
+ <i>D. viride</i> (Sull. & Lesq.) Lindb.	30				+	EY.644a
<i>Didymodon acutus</i> (Brid.) K.Saito	8,41			+		EY.512b
* <i>D. cordatus</i> Jur.	37			+		EY.716b
+ <i>D. fallax</i> (Hedw.) R.H.Zander	11,39			+		EY.527a
+ <i>D. insulanus</i> (De Not.) M.O.Hill	12,27			+	+	EY.617c
+ <i>D. rigidulus</i> Hedw.	11,14,15,18,27,44			+		EY.564b
* <i>D. vinealis</i> (Brid.) R.H.Zander	17,20,24,30,31,34,37,39,41,44			+	+	EY.705a
* <i>Ditrichum flexicaule</i> (Schwägr.) Hampe	11,48			+		EY.849a
<i>Drepanocladus aduncus</i> (Hedw.) Warnst.	10			+		EY.516a
+ <i>D. lycopodioides</i> (Brid.) Warnst.	10,39			+		EY.735
<i>Encalypta affinis</i> R. Hedw.	44			+		EY.848
<i>E. rhaptocarpa</i> Schwägr.	44			+		EY.835
+ <i>E. spathulata</i> Müll.Hal.	4			+		EY.506
<i>E. vulgaris</i> Hedw.	21,25,37,40,42,44			+	+	EY.579
<i>Entodon concinnus</i> (De Not.) Paris	27,30			+		EY.674
+ <i>E. schleicheri</i> (Schimp.) Demet	48			+		EY.849e
<i>Entosthodon hungaricus</i> (Boros) Loeske	31			+		EY.683b
+ <i>E. muhlenbergii</i> (Turner) Fife	10			+		EY.523
+ <i>Epipterygium tozerii</i> (Grev.) Lindb.	27			+		EY.610
+ <i>Eucladium verticillatum</i> (With.) Bruch & Schimp.	4,47			+	+	EY.507a
+ <i>Eurhynchiastrum pulchellum</i> (Hedw.) Ignatov & Huttunen	30,33			+		EY.696b
+ <i>Eurhynchium angustirete</i> (Broth.) T.J.Kop.	30			+		EY.647c

Taxa	Locality number	Substrates				C.N.
		r	s	t	rs	
<i>E. striatum</i> (Hedw.) Schimp.	34,44			+		EY.705b
+ <i>Exsertotheca crispa</i> (Hedw.) S.Olsson, Enroth & D.Quandt	39,40			+		EY.764a
<i>Funaria hygrometrica</i> Hedw.	4,9,14,15,19,27,41,43,49				+	EY.654
* <i>Grimmia anodon</i> Bruch & Schimp.	44,47			+		EY.836
+ <i>G. elatior</i> Bruch ex Bals.-Criv. & De Not.	33			+		EY.698a
* <i>G. laevigata</i> (Brid.) Brid.	12,33,45,53			+		EY.840b
* <i>G. orbicularis</i> Bruch ex Wilson	15,22,27,39,46			+		EY.622b
<i>G. ovalis</i> (Hedw.) Lindb.	13,17,21,32,39,40,42,46,53			+		EY.770
<i>G. pulvinata</i> (Hedw.) Sm.	1,12,15,20,21,22,27,39,40,44,47			+		EY.734
<i>G. trichophylla</i> Grev.	21,34			+	+	EY.581b
+ <i>Gymnostomum calcareum</i> Nees & Hornsch	4,41,47				+	EY.823b
+ <i>G. viridulum</i> Brid.	8,15				+	EY.513c
+ <i>Gyroweisia tenuis</i> (Hedw.) Schimp.	8				+	EY.569c
* <i>Hedwigia ciliata</i> (Hedw.) P.Beauv.	41			+		EY.821
+ <i>H. stellata</i> Hedenäs	32,39,40,48			+		EY.778
* <i>Homalothecium aureum</i> (Spruce) H.Rob.	11,13,28			+	+	EY.642b
* <i>H. lutescens</i> (Hedw.) H.Rob.	11,13,17,21,24,27,30,34,37,39,46,48,51			+	+	EY.718
* <i>H. philippeanum</i> (Spruce) Schimp.	11,13,16,21,24,27,28,33,38,39,40,51			+	+	EY.641
<i>H. sericeum</i> (Hedw.) Schimp.	2,11,13,15,24,27,34,35,39,44,46,53			+	+	EY.594
+ <i>Hygroamblystegium varium</i> (Hedw.) Mönk. var. <i>varium</i>	10				+	EY.520a
<i>H. varium</i> var. <i>humile</i> (P.Beauv.) Vanderp. & Hedenäs	10,39				+	EY.751
+ <i>Hymenoloma crispulum</i> (Hedw.) Ochyra	30			+		EY.644b
+ <i>Hypnum bambergieri</i> Schimp.	13,15				+	EY.568
<i>H. cupressiforme</i> Hedw. var. <i>cupressiforme</i>	8,21,27,28,31,34,39,40,48			+	+	EY.706a
<i>H. cupressiforme</i> Hedw. var. <i>lacunosum</i> Brid.	13,39,48,50				+	EY.854
<i>H. imponens</i> Hedw.	30,31,46,48			+	+	EY.676c
<i>Isoetecium alopecuroides</i> (Lam. ex Dubois) Isov.	30				+	EY.668c
+ <i>Leptobarbula berica</i> (De Not.) Schimp.	8				+	EY.513d
+ <i>Lescuraea patens</i> Lindb.	30			+		EY.619a
+ <i>L. plicata</i> (Schleich. ex F. Weber & D. Mohr) Broth.	39			+		EY.722
<i>Leucodon sciuroides</i> (Hedw.) Schwägr.	27,46,51				+	EY.844c
+ <i>Microbryum starckeanum</i> (Hedw.) R.H.Zander	19				+	EY.573c
+ <i>Nogopterium gracile</i> (Hedw.) Crosby & W.R.Buck	13,27,39,40			+	+	EY.738a
<i>Orthotrichum affine</i> Schrad. ex Brid.	29,39				+	EY.730
* <i>O. anomalum</i> Hedw.	39			+		EY.739
+ <i>O. bistratosum</i> (Schiffn.)	44			+		EY.837b
<i>O. cupulatum</i> Brid.	27,40,53			+	+	EY.620
<i>O. diaphanum</i> Brid.	37,52				+	EY.714b
<i>O. lyellii</i> Hook. & Taylor	29,34,36,37,39,40				+	EY.715
<i>O. rupestre</i> Schleich. ex Schwägr.	13,15,16,21,27,39,40,41,51			+	+	EY.580b
<i>O. speciosum</i> Nees	13,27				+	EY.546c
<i>Oxyrrhynchium hians</i> (Hedw.) Loeske	40				+	EY.815b
* <i>O. speciosum</i> (Brid.) Warnst.	34				+	EY.711d
<i>Palustriella commutata</i> (Hedw.) Ochyra	27,48					EY.852a
* <i>P. falcata</i> (Brid.) Hedenäs	20				+	EY.577a
+ <i>Philonotis caespitosa</i> Jur.	15,28				+	EY.659
<i>P. seriata</i> Mitt.	30,34				+	EY.637c
+ <i>P. tomentella</i> Molendo	34				+	EY.704b
+ <i>Physcomitrium pyriforme</i> (Hedw.) Bruch & Schimp.	3				+	EY.503
+ <i>Plasteurhynchium meridionale</i> (Schimp.) M.Fleisch.	28				+	EY.662b
+ <i>P. striatulum</i> (Spruce) M.Fleisch.	34				+	EY.701b
+ <i>Platygyrium repens</i> (Brid.) Schimp.	40				+	EY.815a
* <i>Pohlia cruda</i> (Hedw.) Lindb.	27				+	EY.685a
+ <i>P. drummondii</i> (Müll.Hal.) A.L.Andrews	8				+	EY.512e
+ <i>P. elongata</i> Hedw.	27				+	EY.626c
<i>Polytrichum juniperinum</i> Hedw.	27				+	EY.656
* <i>P. piliferum</i> Hedw.	12,14,50				+	EY.533
<i>P. strictum</i> Menzies ex Brid.	27,28,30,31,33				+	EY.680
+ <i>Pterigynandrum filiforme</i> Hedw.	27,30,31,32,34,39,40			+	+	EY.814

Taxa	Locality number	Substrates		C.N.
		r	s	
* <i>Pterygoneurum ovatum</i> (Hedw.) Dixon	26,40,42,43,44	+		EY.830
+ <i>Ptychostomum archangelicum</i> (Bruch & Schimp.) J.R.Spence	10,19,21,27,37,39,40	+		EY.575
<i>P. boreale</i> (F.Weber & D.Mohr) Ochyra & Bednarek-Ochyra	11,33,36,39,40	+		EY.713b
<i>P. capillare</i> (Hedw.) Holyoak & N.Pedersen	4,13,14,15,17,18,27,30,34,39,40	+	+	EY.805
+ <i>P. donianum</i> (Grev.) Holyoak & N.Pedersen	27	+		EY.635c
<i>P. imbricatulum</i> (Müll.Hal.) Holyoak & N.Pedersen	10,29,34,39,40	+	+	EY.761
* <i>P. moravicum</i> (Podp.) Ros & Mazimpaka	4,13,15,30,39,40		+	EY.670c
* <i>P. pseudotriquetrum</i> (Hedw.) J.R.Spence & H.P.Ramsay				
var. <i>pseudotriquetrum</i>	11,17,27,30,39	+	+	EY.621
+ var. <i>bimum</i> (Schreb.) Holyoak & N.Pedersen	27	+		EY.632b
+ <i>P. torquescens</i> (Bruch & Schimp.) Ros & Mazimpaka	6,27,37,51	+	+	EY.855c
+ <i>Rhynchostegiella litorea</i> (De Not.) Limpr.	6,7,10,21,42	+		EY.510
+ <i>R. tenella</i> (Dicks.) Limpr.	17	+		EY.563b
<i>Rhynchostegium riparioides</i> (Hedw.) Cardot	44	+		EY.832c
<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp.	1,27,34,38,40	+		EY.720c
<i>Sciuro-hypnum plumosum</i> (Hedw.) Ignatov & Huttunen	27,34	+		EY.678a
+ <i>Syntrichia caninervis</i> Mitt. var. <i>gypsophila</i> (J.J.Amann ex G.Roth) Ochyra	44		+	EY.837a
<i>S. laevipila</i> Brid.	36		+	EY.713a
* <i>S. montana</i> Nees	39		+	EY.733a
+ <i>S. norvegica</i> F.Weber	10	+		EY.517b
<i>S. princeps</i> (De Not.) Mitt	22,25,39,41,48,53	+	+	EY.740
<i>S. ruralis</i> (Hedw.) F.Weber & D.Mohr var. <i>ruralis</i>	5,11,13,15,17,21,22,23,24,27, 28,34,38,39,40,42,44,46,48,51	+	+	EY.589
var. <i>ruraliformis</i> (Besch.) Delogne	13,23,24,28,33	+	+	EY.655b
+ <i>S. virescens</i> (De Not.) Ochyra	4,13,21,24,27,37,39,40,44,48,51	+	+	EY.804
+ <i>Tortella squarrosa</i> (Brid.) Limpr.	8,37	+		EY.719a
<i>T. tortuosa</i> (Hedw.) Limpr.	21	+	+	EY.587b
+ <i>Tortula brevissima</i> Schiffn.	40,48	+		EY.818a
* <i>T. inermis</i> (Brid.) Mont.	22,23,26,39,42	+	+	EY.593b
* <i>T. lindbergii</i> Broth.	22	+		EY.585a
+ <i>T. marginata</i> (Bruch & Schimp.) Spruce	14,17,18,27,29,30,39	+	+	EY.624
<i>T. muralis</i> Hedw.	8,20,21,34,41,44,45,47	+	+	EY.512c
<i>T. subulata</i> Hedw.	5,6,14,15,19,21,22,23,25,26,27,39,40	+	+	EY.558
+ <i>Trichostomum crispulum</i> Bruch	2	+		EY.502b
+ <i>Weissia brachycarpa</i> (Nees & Hornsch.) Jur.	33	+		EY.697c
* <i>W. controversa</i> Hedw.	37	+		EY.717b
+ <i>Zygodon viridissimus</i> (Dicks.) Brid.	52		+	EY.857b

nis were recorded as new for Turkey from the study area (Yücel & Ezer, 2017; 2018).

Pottiaceae is the most species-rich with 36 taxa in 15 genera in the study area. Pottiaceae which contains many desiccation-tolerant members is the most dominant acrocarpous moss family in the bryoflora of Turkey. Pottiaceae are characteristic of variable or harsh environments. Its members have been strongly adapted to the long arid season and dry summer climate (Zander, 1993; Kırmacı & Erdağ, 2014). Therefore, this result is not surprising in the study area. Central Anatolian steppes, including the study area, evolved under continental climate, which is extremely cold in winter and dry and hot during summer (Kürschner & Parolly, 2012). The second richest family is Brachytheciaceae with 21 taxa. The Brachytheciaceae is one of the largest families of pleurocarpous mosses. Members of the family have a wide ecological tolerance and are spreading from arid to humid habitats in a wide range. While the forest floor with more humid

habitats provide suitable shelters for hygrophytic Brachytheciaceae members, steppes in the xeric slopes and plains are inhabited by xerophytic members in the study area.

Ptychostomum is the largest genus with 9 taxa. Members of the genus are common and abundant in mesophytic habitats alongside creeks and rivers in the study area. *Orthotrichum* and *Syntrichia* are represented by 8 taxa in the bryoflora of Eskişehir. The genus *Orthotrichum* which has xerophytic taxa is a widespread moss group on the World except in deserts and wet tropical forests (Goffinet *et al.*, 2007). Members of the genus usually grow epiphytically on trees, and some grow on rocks. *Orthotrichum* members were found on trees and on rocks under the forest canopy in the study area.

Syntrichia has xerophytic taxa and is specifically common on soil in forest and steppe communities in the study area. In addition, *Syntrichia ruralis* and, *Homalothecium lutescens* are the most common species in Eskişehir Province.

As a result, bryoflora of Eskişehir Province reflects condition of the typical continental climate, which is extremely cold in winter and dry and hot during summer and features of typical Central Anatolian steppes.

LITERATURE CITED

- AKMAN, Y. 1999. Climate and bioclimate. – *Kariyer Matbaacılık, Ankara*, 346 pp.
- ALATAŞ, M. & N. BATAN. 2016. The Moss Flora of Arapgir (Malatya/Turkey) District. – *Biological Diversity and Conservation* 9(2): 102–107.
- ALATAŞ, M., N. BATAN & T. EZER. 2018. The Life Forms, Life Strategies and Ecological Characteristics of Epiphytic Bryophytes in Kamillet Valley (Artvin-Türkiye) and Surroundings. – *Anatolian Bryology* 4(1): 8–16.
- ARSLAN, M., N. ERDOĞAN, M.Ü. BİNGÖL & N. ÇELİK. 2014. Bozan Çevresi (Eskişehir) Bozuk Orman ve Bozkır Vegetasyonu. II. Ulusal Akdeniz Orman ve Çevre Sempozyumu. “Akdeniz ormanlarının geleceği: Sürdürülebilir toplum ve çevre” 22-24 Ekim 2014. Isparta. 69–76.
- BATAN, N., Ö. ÖZEN, M. ALATAŞ & T. ÖZDEMİR. 2016. *Hygrohypnum ochraceum* (Bryophyta), new to Turkey and Southwest Asia. – *Phytologia Balcanica* 22(3): 331–333.
- CORTINI-PEDROTTI, C. 2001. Flora dei muschi d’Italia, Sphagnopsida, Andreaopsida, Bryopsida, (I parte). – *Roma: Antonia Delfi no Editore medicina-scienze*, 817pp
- CORTINI-PEDROTTI, C. 2006. Flora dei muschi d’Italia, Bryopsida, (II parte). – *Roma: Antonia Delfi no Editore medicina-scienze*, 1234 pp.
- EZER, T. 2016. *Fissidens gymnanthus* (Bryophyta, Fissidentaceae), a new moss record from Turkey and Southwest Asia. – *Phytologia Balcanica* 22(1): 3–5.
- EZER, T. 2017. Contributions to the bryophyte flora of Turkey. – *Acta Biologica Turcica* 30(4): 128–133.
- GOFFINET, B., W.R. BUCK & M.A. WALL. 2007. *Orthotrichum freyanum* (Orthotrichaceae, Bryophyta), a new epiphytic species from Chile. – *Nova Hedwigia* 131: 1–11.
- GREVEN, H.C. 1995. *Grimmia* Hedw. (Grimmiaceae, Musci) in Europe. – *Backhuys Publishers, Leiden, The Netherlands*, 159 pp.
- GREVEN, H.C. 2003. *Grimmiaceae* of the World. – *Leiden: Backhuys Publishers*, 247 pp.
- GUERRA, J., M.J. CANO & R.M. CROS. 2006. Flora Briofítica Ibérica, Vol. 3. – *Murcia: Universidad de Murcia Sociedad Española de Briología*, 183 pp.
- GUERRA, J. & M. CROS. 2007. Flora Briofítica Ibérica, Vol. 1. – *Murcia: Universidad de Murcia Sociedad Española de Briología*, 305 pp.
- HENDERSON, D.M. 1961. Contributions to the bryophyte flora of Turkey V: summary of present knowledge. – *Notes Roy Bot Gard Edinburgh*, 23: 279–301.
- HEYN, C.C. & I. HERRNSTADT. 2004. The bryophyte flora of Israel and adjacent regions. – *Jerusalem, The Israel Academy of Sciences and Humanities*, 719 pp.
- KARAKAŞ, M. & T. EZER. 2016. Two new moss records in the family Grimmiaceae from Turkey, Southwest Asia. – *Telopea* 19: 65–72.
- KARAKAŞ, M. & T. EZER. 2016. The bryophyte flora of Göllüdağ Volcano (Niğde/Turkey). – *Phytologia Balcanica* 23(3): 355–360.
- KIRMACI, M. & A. ERDAĞ. 2014. *Acaulon fontiquerianum* (Pottiaceae), a new species to the bryophyte flora of Turkey and Sw Asia. – *Polish Botanical Journal* 59(2): 229–233.
- KIRMACI, M. & E. AĞCAGİL. 2016. New national and regional bryophyte records, 49. 21. *Orthotrichum philberti* Venturi. – *Journal of Bryology* 38(4): 335.
- KIRMACI, M. & H. KÜRSCHNER. 2017. New national and regional bryophyte records, 50. 28. *Sphagnum tenellum* (Brid.) Brid. – *Journal of Bryology* 39(1): 109.
- KÜRSCHNER, H. & A. ERDAĞ. 2005. Bryophytes of Turkey: An annotated reference list of the species with synonyms from the recent literature and an annotated list of Turkish bryological literature. – *Turkish Journal of Botany* 29: 95–154.
- KÜRSCHNER, H. & W. FREY. 2011. Liverworts, mosses and hornworts of Southwest Asia (Marchantiophyta, Bryophyta, Anthocerotophyta). – *Nova Hedwigia* 139: 1–240.
- KÜRSCHNER, H. & G. PAROLLY. 2012. The Central Anatolian steppe. – *In: Marinus M.J.A. and Van Staalduinen, M.A. (Eds.), Eurasian Steppes. Ecological Problems and Livelihoods in a Changing World. Springer, Netherlands*, pp. 149–171.
- MUÑOZ, J. 1999. A revision of *Grimmia* (Musci, Grimmiaceae) in the Americas, 1: Latin America. – *Annales Missouri Botanical Garden* 86: 118–191.
- ÖREN M., B. SARI & S. URSAVAŞ. 2015. *Syntrichia minor* (Pottiaceae) and *Cephalozia integerrima* (Cephalozellaceae) new to bryophyte flora of Turkey. – *Archives of Biological Sciences* 67(2): 367–372.
- ÖZDEMİR, T. & N. BATAN. 2016. New national and regional bryophyte records, 47. 18. *Frullania teneriffae* (F. Weber) Nees. – *Journal of Bryology* 38(2): 157.
- ÖZENOĞLU KİREMİT, H. & T. KEÇELİ. 2009. An annotated checklist of the Hepaticae and Anthocerotae of Turkey. – *Cryptogamie Bryologie* 30(3): 343–356.
- ÖZENOĞLU-KİREMİT, H., M. KIRMACI & F. KİREMİT. 2016. New findings of *Riccia* species (Marchantiophyta) in Turkey and Southwest Asia. – *Cryptogamie Bryologie* 37(1): 19–25.
- PATON, J.A. 1999. The liverwort flora of the British Isles. – *ISBN: 0-946589-60-7, Harley Books, Colchester*, 626 pp.
- ROS, R.M., M. MAZIMPAKA, U. ABOU-SALAMA, M. ALEFFI, T.L. BLOCKEEL, M. BRUGUÉS, R.M. CROS, M.G. DIA, G. DIRKSE, I. DRAPER, W. EL-SAADAWI, A. ERDAĞ, A. GANEVA, R.M.A. GABRIEL, J.M. GONZÁLES-MANCEBO, C. GRANGER, I. HERRNSTADT, V. HUGONNOT, K. KHALIL, H. KÜRSCHNER, A. LOSADA-LIMA, L. LUÍS, S.D. MIFSUD, M. PRIVITERA, M. PUGLISI, M. SABOVLEVIĆ, C. SÉRGIO, H.M. SHABBARA, M. SIM-SIM, A. SOTIAUX, A. TACCHI, A. VANDERPOORTEN & O. WERNER. 2013. Mosses of the Mediterranean, Annotated Checklist. – *Cryptogamie Bryologie* 34: 99–283.
- SAVAROĞLU, F. & S. TOKUR. 2006. The Moss Flora (Musci) of the Sındiken Mountains. – *Turkish Journal of Botany* 30: 137–148.
- SMITH, A.J.E. 2004. The moss flora of Britain and Ireland. Second Edition. – *ISBN: 0-521-81640-8, Cambridge Univ. Press*, 1012 pp.
- SÖDERSTRÖM, L., A. HAGBORG, M. VON KONRAT, S. BARTHOLOMEW-BEGAN, D. BELL, L. BRISCOE, E. BROWN, D.C. CARGILL, D.P. COSTA, B.J. CRANDALL-STOTLER, E.D. COOPER, G. DAUPHIN, J.J. ENGEL, K. FELDBERG, D. GLENNY, S.R. GRADSTEIN, X. HE, J. HEINRICH, J. HENTSCHEL, A.L. ILKIUBORGES, T. KATAGIRI, N.A. KONSTANTINOVA, J. LARRAÍN, D.G. LONG, M. NEBEL, T. PÓCS, F. FELISA PUCHE, E. REINERDREHWALD, M.A.M. RENNER, A. SASS-GYARMATI, A. SCHÄFER-VERWIMP, J.G.S. MORAGUES, R.E. STOTLER, P. SUKKHARAK, B.M. THIERS, J. URIBE, J. VÁÑA, J.C. VILLARREAL, M. WIGGINTON, L. ZHANG & R.L. ZHU. 2016. World Checklist of Hornworts and Liverworts. – *PhytoKeys* 59: 1–821.
- SÖNMEZ, E. 2015. Odunpazarı ve Tepebaşı İlçelerinin (Eskişehir) Liken Çeşitliliği. – *Yüksek Lisans Tezi, Anadolu Üniversitesi, Fen Bilimleri Enstitüsü, Eskişehir (in Turkish)*.
- UYAR, G. & B. ÇETİN. 2004. A new check-list of the mosses of Turkey. – *Journal of Bryology* 26: 203–220.
- UYAR, G., M. ÖREN, T. EZER & M.C. GÖZCÜ. 2018. The Genus *Pseudophemerum* and *Schistidium confusum* newly reported from Turkey and Southwestern Asia. – *Cryptogamie Bryologie* 39(1): 55–60.
- YÜCEL, E. & R.E. MAGILL. 1997. Eskişehir Bölgesi Karayosunları (Musci) üzerine Bir Araştırma. – *Anadolu Üniversitesi, Fen Fakültesi Dergisi* 3: 43–50.

- YÜCEL, E. & S. TOKUR. 1989. Eskişehir Yöresi Bazı Bryidae Alt Sınıfı Türleri Üzerinde Floristik Çalışmalar I. – *Anadolu Üniversitesi, Fen Edebiyat Dergisi* **2**: 9–16.
- YÜCEL, E. & T. EZER. 2017. New national and regional bryophyte records, 53. 14. *Entosthodon hungaricus* (Boros) Loeske. – *Journal of Bryology* **39**(4): 373–374.
- YÜCEL, E. & T. EZER. 2018. New national and regional bryophyte records, 56. 14. *Encalypta affinis* R.Hedw. – *Journal of Bryology* **40**(3): 7.
- ZANDER, R.H. 1993. Genera of The Pottiaceae: Mosses of Harsh Environments. – *Bulletin of the Buffalo Society of Natural Sciences Vol. 32*.

