



The moss flora of Kirmir Valley (Güdül, Ankara/Turkey)

Sevgi Servet ARIÖZ¹, Recep KARA^{*1} Safiye Merve CAN, Tülay EZER¹

¹ Nigde University, Faculty of Science and Arts, Department of Biology, Nigde, Turkey

Abstract

In the study, the moss flora of Kirmir Valley (Güdül, Ankara) was investigated. At the result of identifications of 638 moss specimens, collected from the research area, 77 taxa belonging to 23 genera and 10 families were determined. Among them, 13 taxa are new for A2 grid-square according to Turkey grid system which was adopted by Henderson.

Key words: Moss, Flora, Kirmir Valley, Güdül, Ankara, Turkey

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Kirmir Vadisi'nin karayosunu florası (Güdül, Ankara/Türkiye)

Özet

Bu araştırmada Kirmir Vadisi'nin (Güdül, Ankara) karayosunu florası çalışılmıştır. Araştırma alanından toplanan 638 biryofit örneğinin teşhisi sonucunda 10 familyaya dahil 23 cins ve bunlara ait 77 karayosunu taksonu belirlenmiştir. Bunlar arasından 13 takson Henderson tarafından benimsenen Türkiye kareleme sistemine göre A2 karesi için yenidir.

Anahtar kelimeler: Karayosunu, Flora, Kirmir Vadisi, Güdül, Ankara, Türkiye

1. Introduction

The Kirmir Valley, within the boundaries of Güdül town where is 90 km North-west of was selected as the research area (Figure 1). As geographically this area is in Central Anatolia and in the Irano-Turanian phytogeographical region. In addition, the area is located in the A2 grid square according to the system adopted by Henderson (1961) (Figure 2). The study area is surrounded in the north by Yeşilöz district, in the southeast by Bent district and in the south by Güdül town. In this case, the research area is approximately 15 km long which probably represents the entire area in terms of vegetation. Kirmir Valley which is approximately 40 km length, economically, is a valuable area. The valley has a volcanic structure formed by agglomerate, andesitic, and basaltic rocks from the Galatean Volcanic province (Tarıkahya Elçi and Erik, 2005). The common soil types in the region are lime-free brown, brown, alluvial, colluvial, lime-free brown forest soils (Uzuntaş, 1992). Because of the absence of a meteorological station in Güdül we used meteorological data obtained from the neighbouring districts Beypazarı and Kızılcahamam to determine the climate in the region. In Beypazarı and Kızılcahamam the average annual temperature is 13°C and 9.9°C respectively. The average annual precipitation is 398.1 mm in Beypazarı and 577.4 mm in Kızılcahamam. A warm and humid climate is present in the area owing to its topography and precipitation regime. As requirement of this type of climate, winters are cold, summers are hot and little rainy, but stream flowing from valley bottom provides moist microclimate to its around. For this reason, depending on the area move away from the water and microclimate, in the valley can be distinguished aquatic, slope and rock vegetation (Akman, 1990; Tarıkahya Elçi and Erik, 2005).

Aquatic vegetation in the study area consists of mainly the following taxa: *Potamogeton nodosus* Poir., *Lemna minör* L., *Typha domingensis* Pers., *Phragmites australis* (Cav.) Trin. ex Steud., *Tamarix smyrnensis* Bunge, *Calamagrostis pseudophragmites* (Haller f.) Koeler., *Epilobium hirsutum* L., *Lythrum salicaria* L., *Ranunculus repens*

* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +903882254034; Fax.: +903882250180; E-mail: mail:recep кара77@gmail.com

L., *Rorippa sylvestre* (L.) Bessey, *Polygonum lapathifolium* L., *Rumex crispus* L., *Pulicaria dysenterica* (L.) Bernh., *Mentha longifolia* (L.) Hudson and *Polypogon monspeliensis* (L.) Desf. and especially in slope vegetation of this valley; *Paliurus spina-christi* Mill., *Pistacia atlantica* Desf., *Quercus pubescens* Willd., *Prunus spinosa* L., *Rosa canina* L., *Crataegus monogyna* subsp. *monogyna* J. Jacq., *Berberis crataegina* D.C., *Colutea cilicica* Boiss. & Bal., *Prunus cocomilia* Ten., *Amygdalus webbii* Spach., *Rubus caesius* L., *Rubus sanctus* Schreb, *Rosa hemisphaerica* Herrm., *Cotoneaster nummulariifolia* Fisch. & C.A.Mey., *Crataegus orientalis* Pall. ex M.Bieb. var. *orientalis*, *Sorbus aucuparia* L., *Pyrus elaeagnifolia* Pall. subsp. *kotschyana* (Boiss.) Browicz, *Lonicera etrusca* Santi var. *etrusca* and *Jasminum fruticans* L. are seen. Moreover rocky regions in this field contain generally the species as follow; *Arabis caucasica* Willd. subsp. *caucasica*, *Aubrieta pinardii* Boiss., *Minuartia juniperina* (L.) Maire & Petitm., *Umbilicus erectus* DC., *Parietaria judaica* L., *Sedum caespitosum* (Cav.) DC., *Sedum confertiflorum* Boiss., *Androsace maxima* L., *Asplenium adiantum-nigrum* L. and *Polystichum aculeatum* (L.) Roth.

The region's climate type, interesting topography and natural beauty which is suitable for tourism, attracted our attention. As a result of literature research, it was determined that many floristic study on vascular plants studied in the study area and around, but was not found in any research on mosses. Therefore, the aim of the present study is to compile a list of mosses of Kirmir Valley and to make a contribution to the moss flora of the Turkey.

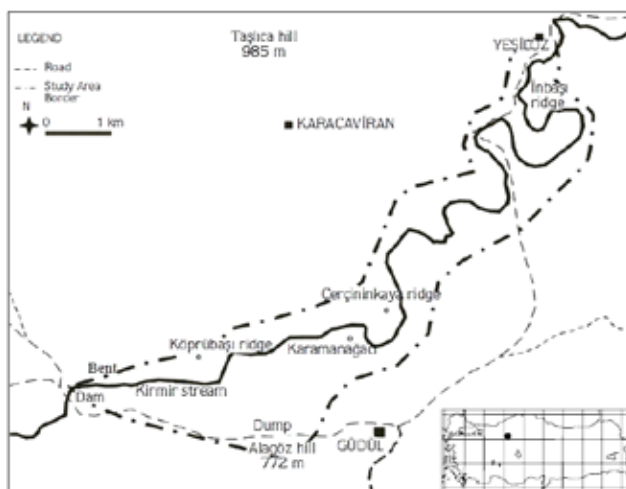


Figure 1. Geographical map of the study area (adaptation from Tarıkahya Elçi and Erik, 2005).

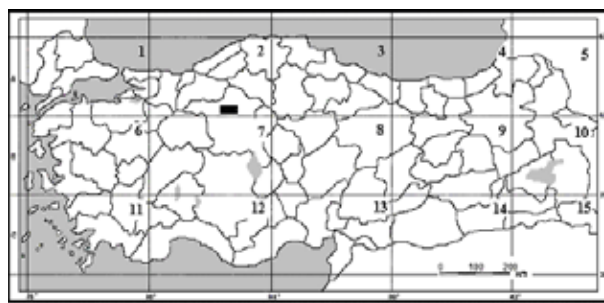


Figure 2. Geographic location of the study area in Turkey and grid system adopted by Henderson (1961)

2. Materials and methods

The bryophyte specimens were collected from 16 different localities in Kirmir Valley in different seasons of 2009 (Table 1). All specimens are deposited in the herbarium of the Niğde University and special collections of Ezer & Kara (Niğde). The specimens were identified by using relevant literatures (Smith, 2004; Pedrotti, 2001, 2006; Munoz, 1999; Zander, 1993; Heyn and Herrnstadt, 2004; Guerra and Cros, 2006, 2007). Arrangement of taxa in the list follows the system which is proposed by Hill et al. (2006). The state of the taxa for the study area and for Turkey was determined by reviewing the related literature (Uyar and Çetin, 2004; Kürschner and Erdağ, 2005). For each taxon, only one collector number (i.e., S.S.A. 75) was given to avoid repetition in the floristic list (Table 2).

Table 1. Details of the study localities

Locality number	Localities	Latitude-Longitude (UTM)	Date	Altitude (m)
1	Edge of the creek	N40° 15' 18.14" E32° 15' 50.20"	23.03.2009	758
2	Caves location	N40° 14' 51.00" E32° 17' 07.02"	23.03.2009	691
3	Yeşilöz	N40° 15' 18.04" E32° 15' 50.20"	23.03.2009	759
4	Yeşilöz Çavlan	N40° 15' 18.14" E32° 15' 50.20"	23.03.2009	759
5	Kırkırca location	N40° 15' 26.74" E32° 15' 53.02"	23.03.2009	759
6	Edge of Kirmir Stream	N40° 15' 26.74" E32° 15' 53.02"	23.03.2009	750
7	Kızıldaş location	N40° 15' 18.04" E32° 15' 50.20"	23.03.2009	706
8	Waterfall rocks	N40° 15' 17.66" E32° 16' 00.55"	08.04.2009	704
9	Güdül-İnönü	N40° 12' 56.64" E32° 15' 19.32"	17.05.2009	690
10	Güdül- İmamlar	N40° 13' 12.63" E32° 14' 06.63"	15.06.2009	693
11	Between Güdül- Yeşilöz	N40° 13' 07.44" E32° 14' 38.76"	15.06.2009	719
12	Güdül Bridge	N40° 14' 11.09" E32° 15' 44.04"	14.10.2009	760
13	Yeşilöz- İnbaşı back	N40° 15' 17.00" E32° 15' 56.20"	24.11.2009	765
14	Bent around	N40° 12' 58.00" E33° 12' 44.00"	24.11.2009	690
15	Güdül- Karaçamur	N40° 12' 39.66" E32° 14' 49.47"	24.11.2009	780
16	Yeşilöz- İnbaşı	N40° 15' 17.00" E32° 15' 56.02"	24.11.2009	765

Table 2. The floristic list. *: new record for A2 grid-square, LN: locality number, S: on soil, R: on rock, sR: on soil overlying of rocks, T: on tree, W: on wall, CN: Collector number of Sevgi Servet Ariöz.

Families	Mosses Taxa	LN	Substratum					CN		
			S	R	sR	T	W			
BRYOPSIDA										
Encalyptaceae Schimp.	<i>Encalypta vulgaris</i> Hedw.	9, 10, 13		+	+			66b		
Funariaceae Schwägr.	<i>Funaria hygrometrica</i> Hedw.	1, 2		+				5		
Grimmiaceae Arn	<i>Grimmia anodon</i> Bruch & Schimp.	12		+	+			271		
	<i>Grimmia decipiens</i> (Schultz) Lindb.	12		+				236b		
	<i>Grimmia dissimulata</i> E.Maier	9, 11		+	+			65		
	<i>Grimmia donniana</i> Sm.	12				+		247		
	* <i>Grimmia lisa</i> De Not.	3, 9		+	+			74		
	<i>Grimmia longirostris</i> Hook.	12					+	291		
	* <i>Grimmia nutans</i> Bruch.	9, 12, 14, 15		+	+		+	101		
	<i>Grimmia ovalis</i> (Hedw.) Lindb.	2, 3, 8, 9, 10, 11, 12, 14, 15 16			+	+		+	38	
	<i>Grimmia pulvinata</i> (Hedw.) Sm.	2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 14, 15, 16		+	+	+		+	+	11
	* <i>Grimmia tergestina</i> Tomm. ex Bruch & Schimp.	2, 3, 8, 9, 12, 15			+	+		+	4a	
	<i>Grimmia trichophylla</i> Grev.	3, 9, 11, 12, 16, 15			+	+			68	
	<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp.	2, 9, 10, 12, 15, 16			+	+		+	33b	
	<i>Schistidium confertum</i> (Funck) Bruch & Schimp.	12, 15			+	+		+	259	
	* <i>Schistidium elegantulum</i> H.H.Blom.	3					+		10b	
	Pottiaceae Schimp	<i>Eucladium verticillatum</i> (With.)Bruch & Schimp.	9, 10, 11		+	+			145	
<i>Hymenostylium recurvirostrum</i> (Hedw.) Dixon		10				+		162		
<i>Pleurochaete squarrosa</i> (Brid.) Lindb.		9				+		92a		
<i>Tortella flavovirens</i> (Bruch) Broth.		9				+		669		
<i>Trichostomum brachydontium</i> Bruch		11				+		200a		
<i>Trichostomum crispulum</i> Bruch		9			+			90b		
* <i>Weissia wimmeriana</i> (Sendtn.) Bruch & Schimp.		9				+		91c		
* <i>Crossidium squamiferum</i> (Viv.) Jur.var. <i>pottioideum</i> (De Not.) Mönk.		12						+	264a	
<i>Didymodon acutus</i> (Brid.) K.Saito		8, 9, 10, 11, 12, 16			+	+			160	
* <i>Didymodon australasiae</i> (Hook.& Grev.) R.H.Zander		9, 16			+	+			362	
<i>Didymodon fallax</i> (Hedw.) R.H.Zander		9, 10, 11, 12, 16			+	+		+	75	
<i>Didymodon luridus</i> Hornsch.		3			+				62	
<i>Didymodon nicholsonii</i> Culm.		3, 9			+	+			95	
<i>Didymodon rigidulus</i> Hedw.		2, 9, 11, 12, 14, 16			+	+		+	317	
<i>Didymodon spadiceus</i> (Mitt.)Limpr.		9, 11			+	+			150a	
* <i>Didymodon umbrosus</i> (Müll.Hal.) R.H.Zander	11				+			203b		
<i>Didymodon vinealis</i> (Brid.) R.H.Zander	2, 3, 8, 9, 10, 11, 16			+	+			49		

Table 2. (continued)

	<i>Syntrichia calcicola</i> J.J.Amann	3, 8, 9, 11, 12, 14, 16	+	+	+	97
	<i>Syntrichia montana</i> Nees	2, 3, 8, 11, 14, 16	+	+		19
	<i>Syntrichia papillosissima</i> (Copp.) Loeske	3, 6	+		+	35a
	<i>Syntrichia princeps</i> (De Not.) Mitt.	2, 3, 6, 8, 11, 12, 15, 16	+	+	+	199
	<i>Syntrichia ruralis</i> (Hedw.) F.Weber & D.Mohr	2, 3, 6, 7, 10, 11, 12, 16	+	+	+	25
	<i>Syntrichia virescens</i> (De Not.) Ochyra	2, 9, 12, 15, 16	+	+		374
	* <i>Tortula atrovirens</i> (Sm.) Lindb.	9		+		144a
	<i>Tortula inermis</i> (Brid.) Mont.	11, 12		+	+	250
	<i>Tortula marginata</i> (Bruch & Schimp.) Spruce	11		+		192a
	<i>Tortula muralis</i> L. ex Hedw. var. <i>muralis</i> Spec.	12, 14	+	+	+	267
	<i>Tortula muralis</i> L. ex Hedw. var. <i>aestiva</i> Brid. ex Hedw.	5, 12		+	+	9a
	<i>Tortula subulata</i> Hedw.	3, 9	+	+	+	53d
	<i>Tortula truncata</i> (Hedw.) Mitt.	6			+	225c
Orthotrichaceae Arn.	<i>Orthotrichum anomalum</i> Hedw.	2, 3, 8, 9, 11, 15	+	+		20
	<i>Orthotrichum cupulatum</i> Hoffm. ex Brid.	15	+			425a
	<i>Orthotrichum diaphanum</i> Schrad. ex Brid.	3, 5, 9, 15	+		+	2
	<i>Orthotrichum pallens</i> Bruch ex Brid.	9			+	141
	<i>Orthotrichum tenellum</i> Bruch ex Brid.	9			+	140b
	<i>Orthotrichum laevigatum</i> J.E.Zetterst.	5			+	14b
	<i>Orthotrichum rupestre</i> Schleich. ex Schwagr. var. <i>rupestre</i>	2, 3, 5, 6, 8, 10, 11, 15, 16	+	+		27
	* <i>Orthotrichum rupestre</i> Schleich. ex Schwagr. var. <i>franzonianum</i> (De Not.) Venturi	6			+	224a
	<i>Orthotrichum affine</i> Schrad. ex Brid.	4, 5	+		+	3a
	<i>Orthotrichum striatum</i> Hedw.	6, 9, 16		+	+	319
	<i>Orthotrichum speciosum</i> Nees	6			+	224c
Bartramiaceae Schwagr	* <i>Anacolia webbii</i> (Mont.) Schimp.	11		+		200d
	<i>Philonotis marchia</i> (Hedw.) Brid.	9		+		108
	* <i>Philonotis caespitosa</i> Jur.	9	+			155b
	<i>Philonotis fontana</i> Hedw.	9		+		67
	<i>Philonotis tomentella</i> Molendo	9	+	+		73
Bryaceae Schwagr.	<i>Bryum argenteum</i> Hedw. var. <i>argenteum</i>	3, 9, 12	+			242
	<i>Bryum argenteum</i> Hedw. var. <i>lanatum</i> (P.Beauv.) Hampe	6, 11, 12, 14	+	+	+	267
	<i>Bryum canariense</i> Brid.	10, 12	+	+	+	164a
	<i>Bryum capillare</i> Hedw.	2, 3, 8, 9, 10, 11, 16	+	+	+	18
	<i>Bryum dichotomum</i> Hedw.	3, 6	+			7a
	* <i>Bryum ruderale</i> Crundw. & Nyholm	11		+		203a
Brachytheciaceae Schimp.	<i>Rhynchostegiella tenella</i> (Dicks.) Limpr.	6			+	224d
	<i>Brachythecium albicans</i> (Hedw.) Schimp.	3, 9, 10, 11, 14, 16	+	+		313

Table 2. (continued)

	<i>Brachythecium salebrosum</i> (Hoffm.ex F.Weber & D.Mohr) Schimp.		2, 3		+	+			37
	<i>Homalothecium lutescens</i> (Hedw.) H.Rob.		6, 9, 14, 16		+	+	+	+	352
	<i>Homalothecium philippeanum</i> (Spruce) Schimp.		3, 9,		+	+			47b
	<i>Homalothecium sericeum</i> (Hedw.) Schimp.		2, 3, 5, 6, 7, 8, 9, 10, 11, 14, 15, 16		+	+	+	+	1
Hypnaceae Schimp	<i>Hypnum cupressiforme cupressiforme</i>	Hedw. var.	2, 3, 9, 14, 16		+	+			46
	<i>Hypnum cupressiforme lacunosum</i> Brid.	Hedw. var.	9				+		72c
	<i>Hypnum cupressiforme resupinatum</i> (Taylor) Schimp.	Hedw. var.	9, 11, 12, 16		+	+	+		262
Leucodontaceae Schimp	<i>Leucodon sciuroides</i> (Hedw.) Schwagr.		2, 3, 16		+	+			23

3. Results and discussion

As a result of the study, samples of 638 mosses were diagnosed and 77 moss taxa belonging to 23 genera and 10 families were determined. 13 moss taxa were reported for the first time from A2 (Ursavaş and Abay, 2009a; Alataş et al., 2011). The number of taxa identified in the study area, is less than according to other studies carried out in A2 grid-square (Çetin and Yurdakulol, 1985, 1988; Uyar and Çetin, 2001, 2006; Çetin et al., 2002; Uyar, 2003; Abay and Çetin, 2003; Uyar et al., 2007; Ursavaş and Abay, 2009b; Cangül and Ezer, 2010). The reason for this situation, the study area is not located the northern part of A2 square prevailing more humid climate, is located in the south-eastern corner prevailing the continental climate.

The dominant family in the study area is Pottiaceae (30 species). Other families with the most number of taxa are, respectively, Grimmiaceae (14 species) and Orthotrichaceae (11 species) which generally consist of xerophytic species. The most species-rich genera recorded were *Orthotrichum* (11), *Grimmia* (11), *Didymodon* (9) and *Tortula* (7). By the number of collected all samples in the study area,, the most common taxa is *Grimmia pulvinata*. According to the number of collected moss specimens, the second common species of this area is *Homalothecium sericeum*.

Generally, when it is tried to establish a relationship between mosses and climate, it cannot misleading to use rates acrocarpous and pleurocarpous in the areas which is under impact of a single macro-climate. A single macro-climate prevails in this area, acrocarpous constitute 87.2% and pleurocarpous constitute 12.8% of total area, are support to previous sentence. This is proper rate for acrocarpous mosses in the area because of their advantages under extreme conditions such as less humidity and drought.

These moss species is seen to prefer to on rock (37%), on soil (7%), on tree (5%), on wall (4%) and on soil overlying of rocks (47%). According to this order, it is seen that bryophytes growing on the rock and soil overlying of rocks, was dominated with a large percentage. This is a result of the availability of the work area. Only a small portion of the area is covered by trees. The rest of the area consists of rock areas such as slope under the anthropogenic influence, valley bottom and canyon wall.

Research field of vascular vegetation separated as aquatic vegetation, slope vegetation and rock vegetation. Thus, specific taxa to these places were written easily. It was attempted for mosses to make such a distinction, however, for mosses could be made only generalization. This is due to, adaptation of mosses is higher than vascular plants and they are drought tolerant.

The following species were found in the moist hygrophytic habitats at the edge of the creek (on tree, soil and rock); *Eucladium verticillatum*, *Funaria hygrometrica*, *Anacolia webbii*, *Philonotis marchia*, *Philonotis caespitosa*, *Philonotis fontana*, *Philonotis tomentella*, *Orthotrichum diaphanum*, *Bryum argenteum* var. *argenteum*, *Brachythecium salebrosum*, *Brachythecium albicans*, *Hypnum cupressiforme* var. *resupinatum*.

The following species were found away from the creek, but, under the vascular plant communities in the semi-humid mesophytic habitats (on tree, soil and rock); *Grimmia ovalis*, *Pleurochaete squarrosa*, *Didymodon australasiae*, *Tortula marginata*, *Tortula muralis* *Tortula subulata*, *Orthotrichum anomalum*, *Orthotrichum speciosum*, *Bryum canariense*, *Rhynchostegiella tenella*, *Homalothecium lutescens*, *Hypnum cupressiforme* var. *cupressiforme*.

The following species, were found in arid xerophytic habitats exposed to direct sunlight, and far away from the creek (on tree, soil and rock); *Encalypta vulgaris*, *Grimmia pulvinata*, *Grimmia tergestina*, *Schistidium apocarpum*, *Trichostomum crispulum*, *Didymodon vinealis*, *Syntrichia calcicola*, *Syntrichia montana*, *Syntrichia papillosissima*, *Syntrichia princeps*, *Syntrichia ruralis* var. *ruralis*, *Tortula truncata*, *Orthotrichum rupestre* var. *rupestre*, *Homalothecium sericeum*, *Leucodon sciuroides*.

The following taxa are new record for A2 square; *Grimmia lisae*, *Grimmia nutans*, *Grimmia tergestina*, *Schistidium elegantulum*, *Weissia wimmeriana*, *Crossidium squamiferum* var. *pottioideum*, *Didymodon australasiae*,

Didymodon umbrosus, *Tortula atrovirens*, *Orthotrichum rupestre* var. *franzonianum*, *Anacolia webbia*, *Philonotis caespitosa*, *Bryum ruderae*.

Moss flora of Kirmir Valley which is anthropogenic pressure at the bottom and has a unique microclimate, investigated in this study. This study, carried in a local area will contribute both moss flora of Turkey and A2 square.

References

- Abay, G., Çetin, B. 2003. The moss flora (Musci) of Ilgaz Mountain National Park. *Turk J Bot.* 27: 321–332.
- Akman, Y. 1990. İklim ve biyoiklim. Palme Yayın Dağıtım, Mühendislik serisi: 103. Ankara.
- Alataş, M., Ören, M., Uyar, G. 2011. The bryophyte flora in Campus Center of Zonguldak Karaelmas University. *Bartın Orman Fakültesi Dergisi.* 13: 51-56.
- Cangül, C., Ezer, T. 2010. The bryophyte flora of Kaplandede Mountain (Düzce, Turkey). *Folia Cryptogamica Estonica.* 47: 3–12.
- Çetin, B., Yurdakulol, E. 1988. Yedi Göller Milli Parkı'nın karayosunu (Musci) florası. *Doğa.* 12: 128-146.
- Çetin, B., Yurdakulol, E. 1985. Gerede-Aktaş (Bolu) Ormanlarının karayosunları florası. *Doğa Bilim Dergisi.* 9: 29-39.
- Guerra, J., Cros, M. 2006. *Flora Briofítica Ibérica, Volumen III.* Sociedad Española de Briología. Murcia.
- Çetin, B., Unç, E., Uyar, G. 2002. The Moss Flora of Ankara - Kızılcahamam -Çamkoru and Çamlıdere Districts. *Turk J Bot.* 26: 91-101.
- Guerra J., Cros M. 2007. *Flora Briofítica Ibérica, Volumen I.* Sociedad Española de Briología. Murcia.
- Henderson, D. M. 1961. Contributions to the bryophyte flora of Turkey V: summary of present knowledge. *Notes from Royal Botanic Garden.* 23: 279–301.
- Heyn, C. C., Herrnstadt, I. 2004. The bryophyte flora of Israel and Adjacent Regions. The Israel Academy of Sciences and Humanities. Jerusalem. Israel.
- Hill, M. O., Bell, N., Bruggeman-Nannenga, M. A., Brugués, M., Cano, M., Enroth, J. J., Flatberg, K. I., Frahm, J. P., Gallego, M. T., Garilleti, R., Guerra, J., Hedenäs, L., Holyoak, D. T., Hyvönen, J., Ignatov, M., Lara, S. F., Mazimpaka, V., Muñoz, J., Söderström, L. 2006. Bryological monograph an annotated checklist of the mosses of Europe and Macaronesia. *J Bryol.* 28: 198–267.
- Kürschner, H., Erdağ, A. 2005. Bryophytes of Turkey: an annotated reference list of the species with synonyms from the recent literature and an annotated list of Turkish. *Turk J Bot.* 29: 95–154.
- Munoz, J. 1999. A revision of *Grimmia* (Musci, Grimmiaceae) in the Americas. 1: Latin America. *Ann Missouri Bot Gard.* 86: 118–191.
- Pedrotti, C. C. 2001. *Flora dei Muschi d'Italia, Sphagnopsida, Andreaopsida, Bryopsida (I parte).* Antonia Delfino Editore. Roma.
- Pedrotti, C. C. 2006. *Flora dei Muschi d'Italia, Bryopsida (II parte).* Antonia Delfino Editore. Roma.
- Smith, A. J. E. 2004. *The Moss Flora of Britain and Ireland, (Second Edition).* Cambridge Univ Press. Cambridge.
- Tarıkahya Elçi, B., Erik, S. 2005. Flora of Kirmir Valley (Güdül, Ankara), *Turk J Bot.* 29: 435-461.
- Ursavaş, S., Abay, G. 2009a. Türkiye'nin A2 karesinin karayosunları (Musci) kontrol listesi. *Bartın Orman Fakültesi Dergisi.* 16/11: 33-43.
- Ursavaş, S., Abay, G. 2009b. Contributions to the bryoflora of Ilgaz Mountains, Yenice Forests, Turkey. *Biological Diversity and Conservation.* 2/3: 112-121
- Uyar, G., Çetin, B. 2004. A new check-list of the mosses of Turkey. *Journal of Bryology.* 26: 203-220.
- Uyar, G., Alataş, M., Ören, M., Keçeli, T. 2007. The bryophyte flora of Yenice Forests Karabük, Turkey. *International Journal of Botany.* 3/2: 129-146.
- Uyar, G. 2003. The moss flora of Düzce - Akçakoca Mountains. *OT Sistematik Botanik Dergisi.* 10: 77-95.
- Uyar, G., Çetin, B. 2001. The moss flora of Ankara- Kızılcahamam Soğuksu National Park. *Turk J Bot.* 25: 261-273.
- Uyar, G., Çetin, B. 2006. Contribution to the moss flora of Turkey: Western Black Sea region (Bolu, Kastamonu, Karabük, Bartın, Zonguldak). *International Journal of Botany.* 2: 229-241.
- Uzuntaş, Z. 1992. Ankara İli Arazi Varlığı. TC Tarım ve Köyişleri Bakanlığı Köy Hizmetleri Genel Müdürlüğü Yayınları. İl Rapor no: 06. Ankara.
- Zander, R. H. 1993. Genera of the Pottiaceae: Mosses of Harsh Environments. *Bulletin of the Buffalo Society of Naturel Sciences.* 32: 1-378.

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