



THE BRYOPHYTE FLORA IN CAMPUS CENTER OF ZONGULDAK KARAELMAS UNIVERSITY

Mevlüt ALATAŞ*¹, Muhammet ÖREN², Güray UYAR³

Department of Biology, Faculty of Sciences and Arts, Zonguldak Karaelmas University, 67100, Zonguldak-Turkey

ABSTRACT

In this study 53 taxa (51 mosses, 2 liverworts) were identified by the authors. These belong to 15 families and 36 genera of bryophytes. Among them two species (*Tortula truncata* (Hedw.) Mitt. and *Orthotrichum pumilum* Sw. ex anon) are new records for the A2 grid-square adopted by Henderson for Turkey.

Keywords: Bryophytes, Flora, Campus Center, Zonguldak Karaelmas University, Turkey

ZONGULDAK KARAELMAS ÜNİVERSİTESİ MERKEZ KAMPÜSÜ BRYOFİT FLORASI

ÖZET

Bu çalışmada bryofitlerin 15 familyası ve 36 cinsine ait 53 takson (51 karayosunu, 2 ciğerotu) tanımlanmıştır. Bu taksonlardan iki tür (*Tortula truncata* (Hedw.) Mitt. ve *Orthotrichum pumilum* Sw. ex anon) Türkiye için Henderson tarafından benimsenen kareleme sistemine göre A2 karesi için yeni kayıttır.

Anahtar Kelimeler: Bryofitler, Flora, Merkez Kampüsü, Zonguldak Karaelmas Üniversitesi, Türkiye

1. INTRODUCTION

Euro-Siberian phytogeographical region of Turkey is one of the bryologically better studied areas of Turkey. The earliest bryophyte records from the Euxinian section of the Euro-Siberian floristic region of Turkey were given by Henderson & Muirhead (1955). In the last decades, many studies from the Euxinian section of the Euro-Siberian floristic region of Turkey have been published by Uyar (2003a, 2003b), Uyar and Keçeli (2003), Keçeli (2004), Keçeli et al. (2004), Keçeli and Çetin (2005, 2006), Uyar and Çetin (2006), Keçeli and Çetin (2006) Uyar et al. (2007), Ören et al. (2010). Here we aim to make a further contribution to our knowledge of the bryophyte flora of Zonguldak province and the western part of Black Sea region of Turkey.

The surface area of the campus is 20 hectares. The north of the area was limited by Black Sea and other sides by main roads (Figure). The vegetation in the study area consists of mainly following taxa: *Abies nordmanniana* (Stev.) Spach subsp. *bornmüelleriana* (Matt.) Coode & Collen, *Platanus orientalis* L., *Laurus nobilis* L., *Robinia pseudoacacia* L., *Tilia tomentosa* Moench., *Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe., *P. sylvestris* L., *Cedrus libani* A. Richard, *Populus nigra* L., *Salix babylonica* L..

* Yazışma yapılacak yazar: mevlutalatas@hotmail.com

Makale metni 04.05.2011 tarihinde dergiye ulaştırılmış, 13.06.2011 tarihinde basım kararı alınmıştır.

2. MATERIAL AND METHODS

2.1. Study Area

Zonguldak province is situated between 41°00" - 41°35" N latitude and 31°18" - 32°19" E longitude within of the Euxinian section of the Euro-Siberian floristic region of Turkey. The climate of the province of Zonguldak is significantly changed from the coastal to the inland areas because of the mountains that run parallel to the coast. Depending on the climatic changes, different types of vegetation such as Oceanic, Sub-Mediterranean and Mediterranean was occurred from the north to the south of the area (Güvenç et al., 2009).

The study area is in the A2 grid-square according to Henderson & Prentice (1961) (Figure), Until now, no detailed study has yet been conducted on the bryophyte flora in Campus Center of Zonguldak Karaelmas University, which was chosen as the study area.

The mean annual rainfall in Zonguldak province in the coastal areas is 1231.9 mm and the mean annual temperature is 13.5°C. The maximum mean temperature (M) is 25.1°C in August and the minimum mean temperature (m) is 3.1°C in February. The seasonal precipitation regime during the year is winter, autumn, summer and spring (WASS). This is an ocean climate (Akman, 1999).

2.2. Method

The bryophyte specimens were collected from 5 different localities in Campus Center of Zonguldak Karaelmas University in spring season of 2005 (Figure). The materials were scraped by knife or spatula from the habitats. After cleaning, the specimens were kept in plastic bags, each plastic bag has been labeled a providing the information about the habitat of the area, such as the location of the collection, the name of the predominating plant in the surrounding vegetation, the environments where the samples was originally found (soil, stone, root, trunk and branch of a tree, etc.).

The samples were identified by using relevant literatures (Watson, 1981; Paton, 1999; Smith, 1996; 2004; Nyholm, 1986; 1989; 1993; 1998; Hedenäs, 1992; Pedrotti, 2001, 2006; Casas et al., 2009; Schumacker and Váňa, 2005; Guerra et al., 2006; Brugués et al., 2007; Frey et al., 1995; Greven, 1995, 2003; Lewinsky 1993; Bednarek-Ochyra 1995; Bloom, 1996; Zander, 1993; Lawton, 1971; Noguchi and Iwatsuki, 1988; Noguchi et al., 1991; Sharp et al., 1994; Allen, 1994, 2002; Crum and Anderson, 1981). Latest status of the taxa for Turkey have been evaluated using the related literature (Uyar and Çetin, 2004; Kürschner and Erdağ, 2005; Özenoğlu Kiremit and Keçeli, 2009). Moreover the taxa new records for the A2 grid square were determined by reviewing the related literature (Ursavaş & Abay, 2009; Cangül & Ezer, 2010). All specimens are deposited in the personal herbarium of UYAR (Zonguldak).

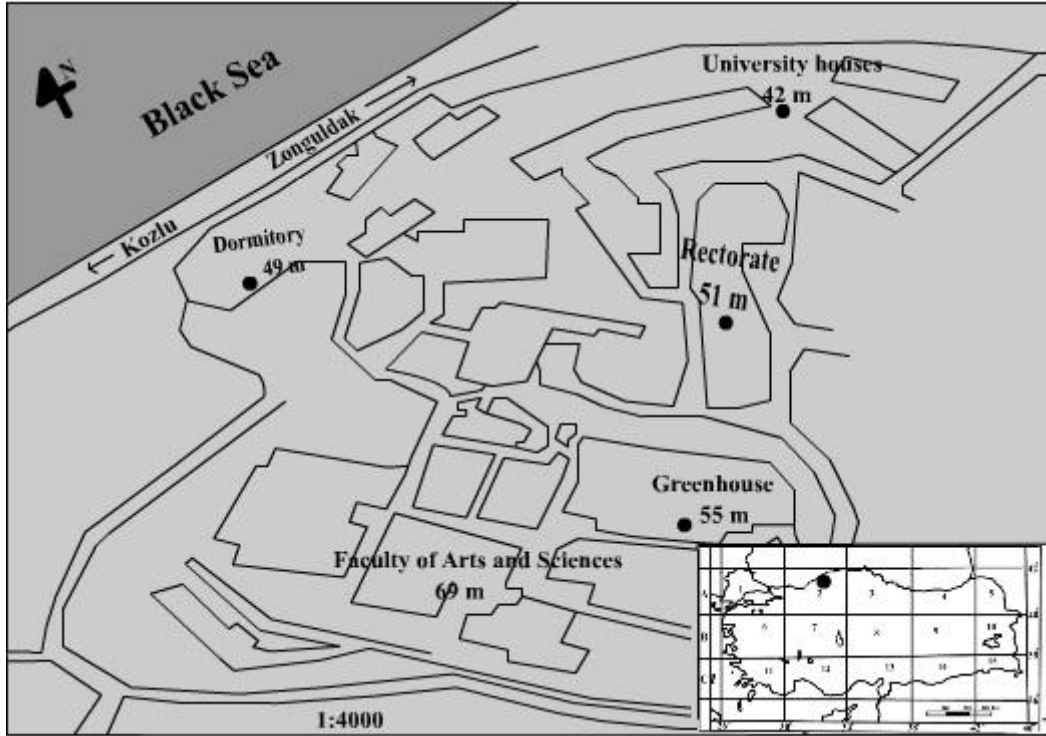


Figure. The map of study area and the grid system which is adopted by Henderson & Prentice for Turkey.

2.2.1. Collected Localities of Bryophyte Samples in the Study Area

1. ZKU Campus Center, in the vicinity of University houses, 42 m, N 41° 27'20.9" - E 31° 45' 82.1", 13.04.2005.
2. ZKU Campus Center, neighboring of Rectorate, 51 m, N 41° 27' 07.1" - E 31° 45'74.4", 13.04.2005.
3. ZKU Campus Center, environment of Dormitories, 49 m, N 41° 27' 10.8"- E 31° 45' 65.7", 14.04.05.
4. ZKU Campus Center, near of Greenhouse, 55 m, N 41° 27' 02.9"- E 31° 45' 81.4", 14.04.05.
5. ZKU Campus Center, around of Sciences and Arts Faculty, 69 m, N 41° 27' 92.7" - E 31° 45' 71.4", 14.04.05.

3. RESULTS AND DISCUSSION

3.1. List of the Bryophyte Taxa

The list of species was arranged according to the system described by Ros et al. (2007) and Hill et al. (2006). For each taxon, only one collector number (i.e., ÖREN 174) was given to avoid repetition in the floristic list. In addition, the list was followed by number of localities, substrate and collector number. Author names are abbreviated according to Brummitt and Powell (1992).

The list comprises 36 genera, 53 taxa of bryophytes. New records for the A2 grid- square adopted by Henderson for Turkey are marked with an asterisk (Table 1).

Table 1. The Bryofloristic list

Families	Bryophyta Taxa	Station No	Substratum			Collector No.
			Rock	Soil	Wood	
Lunulariaceae	<i>Lunularia cruciata</i> (L.) Dumort.	5	+			ALATAŞ144

	ex Lindb.			
Aneuraceae	<i>Aneura pinguis</i> (L.) Dumort	3		ALATAŞ145
Polytrichaceae	<i>Atrichum undulatum</i> (Hedw.) P. Beauv.	5		ÖREN 174
Funariaceae	<i>Funaria hygrometrica</i> Hedw.	2		ÖREN 158
Grimmiaceae	<i>Grimmia pulvinata</i> (Hedw.) Sm.	4, 5	+	ÖREN 133
	<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp.	5	+	ÖREN 140
Fissidentaceae	<i>Fissidens dubius</i> P. Beauv.	1	+	ÖREN 136
	<i>Fissidens taxifolius</i> Hedw.	1		ÖREN 163
	<i>Fissidens viridulus</i> (Sw.) Wahlenb.	2, 4		ÖREN 149
Dicranaceae	<i>Dicranella varia</i> (Hedw.) Schimp.	1		ÖREN 156
Pottiaceae	<i>Barbula convoluta</i> Hedw.	1, 2		ÖREN 159
	<i>Barbula unguiculata</i> Hedw.	4	+	ÖREN 142
	<i>Didymodon luridus</i> Hornsch.	1, 5	+	ÖREN 155
	<i>Didymodon sinuosus</i> (Mitt.) Delogne.	2	+	ÖREN 150
	<i>Didymodon tophaceus</i> (Brid.) Lisa.	4	+	ÖREN 177
	<i>Eucladium verticillatum</i> (With.) Brunch & Schimp.	5	+	ÖREN 129
	<i>Gymnostomum calcareum</i> Nees & Hornsch.	4, 5	+	ÖREN 169
	<i>Pleurochaete squarrosa</i> (Brid.) Lindb.	2		ÖREN 157
	<i>Syntrichia calcicola</i> J. J. Amann.	2		ÖREN 141
	<i>Tortella nitida</i> (Lindb.) Broth.	1	+	ÖREN 137
	<i>Tortula muralis</i> Hedw.	1, 5	+	ÖREN 135
	* <i>Tortula truncata</i> (Hedw.) Mitt.	5	+	ÖREN 138
Bryaceae	<i>Bryum argenteum</i> Hedw.	5	+	ÖREN 140
	<i>Bryum caespiticium</i> Hedw.	4	+	ÖREN 139
	<i>Bryum capillare</i> Hedw.	1, 3, 5	+	ÖREN 147
	<i>Bryum pseudotriquetrum</i> (Hedw.) P.Gaertn. et al.	2		ÖREN 175
	<i>Bryum pallescens</i> Schleich. ex Schwägr.	5	+	ÖREN 166
Mniaceae	<i>Plagiomnium ellipticum</i> (Brid.) T. J. Kop.	2		ÖREN 160
	<i>Plagiomnium undulatum</i> (Hedw.) T. J. Kop.	1		ÖREN 162
	<i>Pohlia wahlenbergii</i> (F.Weber & D.Mohr) A. L. Andrews var. <i>calcareum</i> (Warnst.) E. F. Warb.	5	+	ÖREN 128
Orthotrichaceae	<i>Orthotrichum affine</i> Schrad. ex Brid.	4		ÖREN 125
	<i>Orthotrichum cupulatum</i> Hoffm. ex Brid.	5	+	ÖREN 171
	<i>Orthotrichum diaphanum</i> Schrad. ex Brid.	4		ÖREN 126
	* <i>Orthotrichum pumilum</i> Sw. ex anon.	4		ÖREN 127
Amblystegiaceae	<i>Amblystegium serpens</i> (Hedw.)	5	+	ÖREN 148

	Schimp.				
Brachytheciaceae	<i>Brachythecium mildeanum</i> (Schimp.) Schimp.	2, 4	+	+	ÖREN 132
	<i>Brachythecium rivulare</i> Schimp.	4	+		ÖREN 224
	<i>Eurhynchiastrum pulchellum</i> (Hedw.) Ignatov & Huttunen.	4		+	ÖREN 165
	<i>Eurhynchium striatum</i> (Hedw.) Schimp.	1, 5	+		ÖREN 134
	<i>Kindbergia praelonga</i> (Hedw.) Ochyra.	1, 5	+	+	ÖREN 131
	<i>Oxyrrhynchium pumilum</i> (Wilson) Loeske.	1		+	ÖREN 161
	<i>Oxyrrhynchium speciosum</i> (Brid.) Warnst.	1		+	ÖREN 170
	<i>Platyhypnidium riparioides</i> (Hedw.) Dixon.	5	+		ÖREN 130
	<i>Pseudoscleropodium purum</i> (Hedw.) M.Fleisch.	1	+		ÖREN 144
	<i>Rhynchostegiella tenella</i> (Dicks.) Limpr.	1, 4	+		ÖREN 167
	<i>Rhynchostegium confertum</i> (Dicks.) Schimp.	1	+		ÖREN 164
	<i>Rhynchostegium megapolitanum</i> (Blandow ex F.Weber & D.Mohr)	1, 2	+	+	ÖREN 168
	<i>Sciuro-hypnum plumosum</i> (Hedw.) Ignatov & Huttunen, nom. cons.	3	+		ÖREN 176
	<i>Scleropodium touretii</i> (Brid.) L.F.Koch.	2, 5		+	ÖREN 154
	<i>Scorpiurium circinatum</i> (Bruch) M.Fleisch. & Loeske.	1	+		ÖREN 153
Hypnaceae	<i>Hypnum cupressiforme</i> Hedw.	5	+		ÖREN 151
	<i>Calliargonella cuspidata</i> (Hedw.) Loeske.	5		+	ÖREN 145
Hylocomiaceae	<i>Ctenidium molluscum</i> (Hedw.) Mitt.	1	+		UYAR 862

The family list was shown in Table 2. The first 6 families compose 78 % of the total taxa in the study area and the other 9 families constitute 22 %.

Table 2. The Distributions of the Taxa According to the Families

Family	Number of taxa	Percentage of taxa according to the total number of taxa
Brachytheciaceae	15	28
Pottiaceae	12	22
Bryaceae	5	9
Orthotrichaceae	4	7
Fissidentaceae	3	6
Mniaceae	3	6
Grimmiaceae	2	4
Hypnaceae	2	4

Amblystegiaceae	1	1
Polytrichaceae	1	1
Dicranaceae	1	1
Funariaceae	1	1
Hylocomiaceae	1	1
Lunulariaceae	1	1
Aneuraceae	1	1

As a result of our efforts to determine the ecological habitat of bryophytes, the following moss species were found to be abundant on open areas, around manmade habitats such as concrete, stone and wall: *Tortula muralis*, *T. truncata*, *T. nitida*, *Bryum argenteum*, *B. caespiticium*, *B. capillare*, *B. pallescens*, *Grimmia pulvinata*, *Schistidium apocarpum*. Moreover, the following taxa were seen especially on soil near aforementioned places: *Syntrichia calcicola*, *Funaria hygrometrica*, *Pleurochaete squarrosa*, *Bryum pseudotriquetrum*. These plants are extraordinarily resilient, having to endure massive fluctuations in temperature and moisture in their chosen habitat.

The following species were found on the top and bottom of a stone wall with a water leak: *Lunularia cruciata*, *Amblystegium serpens*, *Pohlia wahlenbergii* var. *calcareae*, *Eucladium verticillatum*, *Platyhypnidium riparioides*, *Scorpiurium circinatum*, *Pseudoscleropodium purum*, .

All *Orthotrichum* species except *O. cupulatum* in the area were seen on trunks of *Platanus orientalis* L.

The following taxa are abundant below the layer of *Laurus nobilis* L. community which grows on wet soil: *Ctenidium molluscum*, *Didymodon luridus*, *Rhynchostegium confertum*, *R. tenella*, *Fissidens taxifolius*, *F. viridulus*, *Oxyrrhynchium speciosum*, *O. pumilum*, *Kindbergia praelonga*, *Barbula convoluta*, *Plagiomnium undulatum*, *Dicranella varia*, *Brachythecium mildeanum*.

In addition, *Fissidens dubius*, *Didymodon tophaceus*, *D. sinuosus*, *Sciuro-hypnum plumosum*, *Orthotrichum cupulatum*, *Gymnostomum calcareum*, *Hypnum cupressiforme*, *Eurhynchium striatulum* *Barbula unguiculata*, *Brachythecium rivulare*, were found on rock and stone and *Aneura pinguis*, *Rhynchostegium megapolitanum*, *Calliergonella cuspidata*, *Scleropodium touretti*, *Plagiomnium ellipticum*, *Eurhynchiastrum pulchellum*, *Atrichum undulatum* on wet soil under the mixed forest which contains *Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe., *P. sylvestris* L., *Cedrus libani* A. Richard, *Populus nigra* L.

Hypnum cupressiforme, *Brachythecium mildeanum*, *Eurhynchium striatulum*, *Grimmia pulvinata* and *Tortula muralis* are the most common species found in the study area.

The percentage of pleurocarpous mosses, especially meso-hygrophytic *Brachytheciaceae* is the most species-rich pleurocarpous family in the study area as well as in other areas in the Black Sea region of Turkey (Uyar et al., 2007; Uyar, 2003; Uyar & Çetin, 2006; Cangül & Ezer, 2010). The second richest family *Pottiaceae* includes acrocarpous mosses (Table 2).

All liverwort and moss species of the study area have been cited for many European countries. They were evaluated for threat status in Europe and classified as not threatened (NT).

REFERENCES

- Akman, Y. 1999. İklim ve Biyoiklim 350, Kariyer Matbacılık. Ankara.
- Allen, B. 1994. Moss Flora of Central America, Part 1: Sphagnaceae-Calymperaceae Volume 49. 242, The Missouri Botanical Garden.
- Allen, B. 2002. Moss Flora of Central America, Part 2: Encalyptaceae-Orthotrichaceae Volume 90. 699, The Missouri Botanical Garden.
- Bednarek-Ochyra, H. 1995. The genus *Racomitrium* (Musci, Grimmiaceae) in Poland: taxonomy, ecology and phytogeography, *Fragmenta Floristica et Geobotanica Series Polonica*. 2, 3-307.

- Blom, H. H. 1996. A Revision of the Schistidium apocarpum Complex in Norway and Sweden Band 49. 333, Bryophytorum Bibliotheca.
- Brugués, M., Cros, R. M. and Guerra, J. 2007. Flora Briofítica Ibérica Volume I. 183, Uniersidad de Murcia Sociedad Espanola de Briyologia. Murcia.
- Brummit, R. K., Powell, C. E. 1992. Authors of plant names 732, Royal Botanic Gardens. Kew.
- Cangül, C., Ezer, T. 2010. The Bryophyte Flora of Kaplandede Mountain (Düzce, Turkey), Folia Cryptog. Estonica. 47, 3-12.
- Casas, C., Brugués, M., Cros, M. R., Sérgio, C. and Infante, M. 2009. Handbook of Liverworts and Hornworts of The Iberian Peninsula and The Balearic Islands 177, Institut D'estudis Catalans. Spain.
- Cortini Pedrotti, C. 2001. Flora dei muschi d'Italia, Sphagnopsida, Andreaopsida, Bryopsida (I parte) 1-817, Antonio Delfino Editore Medicina-Scienze.
- Cortini Pedrotti, C. 2006. Flora dei muschi d'Italia, Bryopsida (II parte) 827-1235, Antonio Delfino Editore Medicina-Scienze.
- Crum, H. A., Anderson, L. E. 1981. Mosses of Eastern North America, Vol. 1-2. 1328, Columbia University Press. New York.
- Frey, W., Frahm, J. P., Fischer, E. und Lobin, W. 1995. Kleine Kryptogamenflora, Band 4, Die Moos – und Farnpflanzen Europas 426, Gustav Fischer Verlag. Stuttgart.
- Greven, H. C. 1995. Grimmiia Hedw. (Grimmiaceae, Musci) in Europe 160, Backhuys Publishers. Leiden.
- Greven, H. C. 2003. Grimmiias of The World 247, Backhuys Publishers. Leiden.
- Guerra, J., Cano, M. J. and Cros, R. M. 2006. Flora Briofítica Ibérica Volume 3. 305, Uniersidad de Murcia Sociedad Espanola de Briyologia. Murcia.
- Güvenç, Ş., Öztürk, Ş., Oran, S. 2009. Additions to Lichen Flora of Zonguldak Province, J. Biol. Environ. 3(7), 1-6.
- Hedenäs, L. 1992. Flora of Maderian Pleurocarpous Mosses (Isobryales, Hypnobryales, Hookeriales) Band 44. 165, Bryophytorum Bibliotheca.
- Henderson, D. M. 1961. Contribution to the Bryophyte Flora of Turkey: IV., Notes from Royal Botanic Garden Edinburgh. 23, 263-278.
- Hill, M. O., Bell, N., Bruggeman-Nannenga, M. A., Brugués, M., Cano, M. J., Enroth, J., Flatberg, K. I., Frahm, J. P., Gallego, M. T., Garilleti, R., Guerra, J., Hedenäs, L., Holyoak, D. T., Hyvönen, J., Ignatov, M. S., Lara, F., Mazimpaka, V., Muñoz, J. and Söderström, L. 2006. An annotated checklist of the mosses of Europe and Macaronesia, Journal of Bryology. 28, 198–267.
- Keçeli, T. 2004. New national and regional bryophyte records, 9: *Pedinophyllum interruptum*, Turkey, Journal of Bryology. 26, 63–64.
- Keçeli, T., Çetin, B. and Uyar, G. 2004. New national and regional bryophyte records, 9, 6. *Riccardia latifrons* (Lindb.) Lindb. (Aneuraceae, Hepaticae), a new record to the liverwort flora of Southwest Asia and Turkey, Journal of Bryology. 26, 63-66.
- Keçeli, T., Çetin, B. 2005. *Ptilidium pulcherrimum* (Ptilidiaceae, Hepaticae) new to south-west Asia, Cryptogamie Bryologie. 26, 313-317.
- Keçeli, T., Çetin, B. 2006. A Contribution to the Liverwort Flora of Western Black Sea Region, Northern Turkey, and a new record (*Cephaloziella dentata*, Cephaloziellaceae) to Southwest Asia, Cryptogamie Bryologie. 27 (4), 459-470.
- Keçeli, T., Çetin, B. 2006. A Contribution to the Liverwort Flora of Western Black Sea Region, Northern Turkey, and a new record (*Cephaloziella dentata*, Cephaloziellaceae) to Southwest Asia, Cryptogamie Bryologie. 27 (4), 459-470.
- 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 Bryological Literature, Turk. J. Bot. 29, 95-154.
- Lawton, E. 1971. Moss Flora of Pasific Northwest 760, Journal of Hattori Botanical Garden Laboratory.
- Lewinsky, J. 1993. A synopsis of the genus *Orthotrichum* Hedw. (Musci, Orthotrichaceae), Bryobrothera. 2, 1-59.
- Noguchi, A., Iwatsuki, Z. 1988. Illustrated Moss Flora of Japan, Part 2. 249, The Hattori Botanical Laboratory.
- Noguchi, A., Iwatsuki, Z. and Yamaguchi, T. 1991. Illustrated Moss Flora of Japan, Part 4. 269, The Hattori Botanical Laboratory.
- Nyholm, E. 1986. Illustrated Flora of Nordic Mosses, Fasc. 1. Fissidentaceae – Seligeriaceae 1-72, The Nordic Bryological Society. Lund.

- Nyholm, E. 1989. Illustrated Flora of Nordic Mosses, Fasc. 2. Pottiaceae – Splachnaceae – Schistostegaceae 75-141, The Nordic Bryological Society. Lund.
- Nyholm, E. 1993. Illustrated Flora of Nordic Mosses, Fasc. 3. Bryaceae – Rhodobryaceae – Mniaceae – Cinclidiaceae – Plagiomniaceae 145-244, The Nordic Bryological Society. Lund.
- Nyholm, E. 1998. Illustrated Flora of Nordic Mosses, Fasc. 4. Aulacomniaceae – Meesiaceae – Catocopiaceae – Bartramiaceae – Timmiaceae – Encalyptaceae – Grimmiaceae – Ptychomitriaceae – Hedwigiaceae – Orthotrichaceae 145-244, The Nordic Bryological Society. Lund.
- Ören, M., Uyar, G. and Keçeli, T. 2010. *Anomodon longifolius* (Anomodontaceae, Bryopsida) new to the bryophyte flora of Turkey, Turk J Bot. 34, 141-145.
- Özenoğlu Kiremit, H., Keçeli, T. 2009. An Annotated Check-list of the Hepaticae and Anthocerotae of Turkey, Cryptogamie Bryologie. 30(3), 343-356.
- Paton, J. 1999. The Liverworts Flora of the British Isles 626, Harley Books. England.
- Ros, R.M., Mazimpaka, V., Abou-Salama, U., Aleffi, M., Blockeel, T.L., Brugués, M., Cano, M.J., Cros, R.M., Dia, M.G., Dirkse, G.M., El Saadawi, W., Erdağ, A., Ganeva, A., González-Mancebo, J.M., Herrstadt, I., Khalil, K., Kürschner, H., Lanfranco, E., Losada-Lima, A., Refai, M.S., Rodríguez-Nuñez, S., Sabovljević, M., Sérgio, C., Shabbara, H., Sim-Sim, M., Söderström, L., Hepatics and Anthocerotae of the Mediterranean, an annotated checklist, Cryptogamie Bryologie, 2007, 28 (4): 351-437.
- Schumacker, R., Váňa, J. 2005. Identification Keys to The Liverworts and Hornworts of Europe and Macaronesia (Distribution and Status), Second Edition 210, SORUS Publishing & Printing House. Poznań, Poland.
- Sharp, A. J., Crum, H. and Eckel, P. M. 1994. The Moss Flora of Mexico, Part 1-2 Volume 69. 1113, Memories of The New York Botanical Garden.
- Smith, A. J. E. 1996. The Liverworts of Britain and Ireland 384, Cambridge University Press. London.
- Smith, A. J. E. 2004. The Moss Flora of Britain and Ireland 1012, Cambridge University Press. London.
- Ursavaş, S., Abay, G. 2009. Türkiye'nin A2 Karesinin Karayosunları (Musci) Kontrol Listesi1, Bartın Orman Fakültesi Dergisi. 16, 33-43.
- Uyar, G. 2003a. Two New Varieties of *Ctenidium molluscum* (Hedw.) Mitt. (Hypnaceae, Musci) for The Moss Flora of Turkey, Turk J Bot. 27, 227-229.
- Uyar, G. 2003b. The Moss Flora of Akçakoca Mountains (Düzce), Ot Sistematik Botanik Dergisi. 10(1), 77-95.
- Uyar, G., Keçeli, T. 2003. A Note on *Ditrichum pusillum* (Hedw.) Hampe, (Ditrichaceae, Musci), in Turkey, Turk J Bot. 28, 443-447.
- Uyar, G., Çetin, B. 2004. A new check-list of the mosses of the Turkey, Journal of Bryology. 26, 203-220.
- Uyar, G., Çetin, B. 2006. Contribution to the Moss Flora of Turkey: Western Black Sea Region (Bolu, Katamonu, Karabük, Bartın and Zonguldak), International Journal of Botany. 2 (3), 229-241.
- Uyar, G., Alataş, M., Ören M. and Keçeli, T. 2007. The Bryophyte Flora of Yenice Forests (Karabük, Turkey), International Journal of Botany. 3(2), 129-146.
- Watson, E. 1981. British Mosses and Liverworts 519, Cambridge University Press. London.
- Zander, R. H. 1993. Genera of The Pottiaceae: Mosses of Harsh Enviroments Vol. 32. 378, Bulletin of the Buffalo Society of Naturel Sciences.