



Bryophyte flora of Akdağ (Pozantı–Adana/Turkey)

Recep KARA ¹, Ahmet SAVRAN ¹, Merve CAN GÖZCÜ ^{*2}

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

²Gazi University, Polatlı Faculty of Science and Arts, Biology Department, Ankara, Turkey

Abstract

In this study, bryophyte flora of Akdağ (Pozantı - Adana) was investigated. At the result of identifications of bryophyte specimens, collected from the research area, 70 taxa (4 liverworts and 66 mosses) belonging to 16 families and 37 genera were determined. Among them, *Distichium capillaceum* (Hedw.) Bruch & Schimp. is a new record for C13 grid-square according to Turkey grid system which was adopted by Henderson. In addition, the life forms and life strategies of the bryophytes in the area were determined and it was observed that the turf life form and colonists life strategy were dominant. The Bryophyte taxa of floristic list were determined xerophyte, sciophyte and subneutrophyte character.

Key words: Adana, Moss, Liverwort, Pozantı, Turkey

----- * -----

Akdağ (Pozantı – Adana / Türkiye) Briyofit Florası

Özet

Bu çalışmada Akdağ'ın (Pozantı - Adana) briyofit florası araştırılmıştır. Araştırma alanından toplanan briyofit örneklerinin teşhisi sonucunda 16 familyaya dahil 37 cins ve bunlara ait 70 takson (4 ciğerotu ve 66 karayosunu) belirlenmiştir. Bunlardan *Distichium capillaceum* (Hedw.) Bruch & Schimp. Henderson tarafından benimsenen Türkiye kareleme sistemine göre C13 karesi için yeni kayıttır. Ayrıca alandaki briyofitlerin hayat formları da belirlenmiş ve turf hayat formunun ve kolonist yaşam stratejisinin dominant olduğu gözlenmiştir. Ayrıca, floristik listedeki taksonların çoğunun kserofit (kurak), sciofit (gölge seven) ve subnötrofit (yarı nötral) karakterde olduğu belirlenmiştir.

Anahtar kelimeler: Adana, Karayosunu, Ciğerotu, Pozantı, Türkiye

1. Introduction

Turkey has many different vegetation types and rich plant diversity because of its geographical location. It has three phytogeographic regions; the Euro-Siberian, Irano-Turanian and the Mediterranean. These phytogeographical regions have given Turkey the richness of biodiversity.

Studies about bryophytes in Turkey have been rapidly increasing (Can et al., 2013; Ören and Keçeli, 2014; Özdemir and Batan, 2014; Kara et al., 2014; Alataş and Uyar, 2015). In spite of these studies, there is a need to more bryophytes studies in Turkey. Therefore, the aim of this study is to investigate bryophytes of Akdağ Mountain in Adana and to make a contribution to the bryophyte flora of Turkey.

1.1. Study Area

Akdağ, was selected as the research area, is located Pozantı District of Adana Province and between 37°23' N - 34°59' E. This area is situated in Mediterranean phytogeographical region and the C13 square of Turkey according to

* Corresponding author / Haberleşmeden sorumlu yazar: Tel.: +903126237394; Fax.: +903126228573; E-mail: mcgozcu@gmail.com

the grid system of Henderson (1961) (Figure 1). Gerdağ and Sarımsak Mountain is located in north of this area, Belemedik is in the south, Karaisalı is in the east and Tarsus-Ankara highway is in the west.

Summit of Akdağ is 2450 meters. Although the mountain is not very high, it hosts different vegetation type such as steppe, rock, water and forest vegetations. Steppe and shrub formations spread in the foothills of the mountain. There are forests in higher regions. Alpine meadows are observed starting from 1900 meters. Steppe vegetation in the study area consists of mainly the following taxa: *Fumana oligosperma* Boiss. & Kotschy, *Astragalus andrachneifolius* Fenzl, *Juniperus communis* L. var. *saxatilis* Pall., *Cotoneaster nummularia* Fisch. & C.A. Mey., *Rosa canina* L., *Daphne oleoides* Schreb. and *Atraphaxis grandiflora* Willd, especially in forest vegetation of this area; *Pinus nigra* Arn. subsp. *nigra* var. *karamanica* Rehder, *Pinus brutia* Ten., *Abies cilicica* (Ant. & Kotschy) Carr., *Cedrus libani* A. Rich., *Platanus orientalis* L., *Quercus cerris* L., *Acer monspessulanum* L. subsp. *microphyllum* (Boiss.) Bornm., *Cercis siliquastrum* L. L. are seen. Rocky vegetation in this field contain generally the species as follow *Ceterach officinarum* DC., *Thalictrum orientale* Boiss., *Dianthus crinitus* Sm., *Sedum album* L., *Onosma stenolobum* Hausskn. ex H.Riedl., *Senecio farfarifolius* Boiss. & Kotschy, and in aquatic vegetation of this area; *Caltha polypetalata* Hochst. ex Lorent, *Nasturtium officinale* R.Br., *Juncus conglomeratus* L., *Carex divisa* Hudson, *Bellis perennis* L. are observed. Topographically the area has steep slopes and deep pits. This aspect of the area allows diversification of vegetation.

There are many large and small rivers, Çalkit and Karaçayınkapuz, in the area. The area has Mediterranean climate with little rain and cold winter. According to Pozantı Meteorological Station, the average annual precipitation is 719.9 mm³ and the average annual temperature is 13.6°C. The coldest month is January with 2.2 °C, and the warmest is July with 25.4 °C.

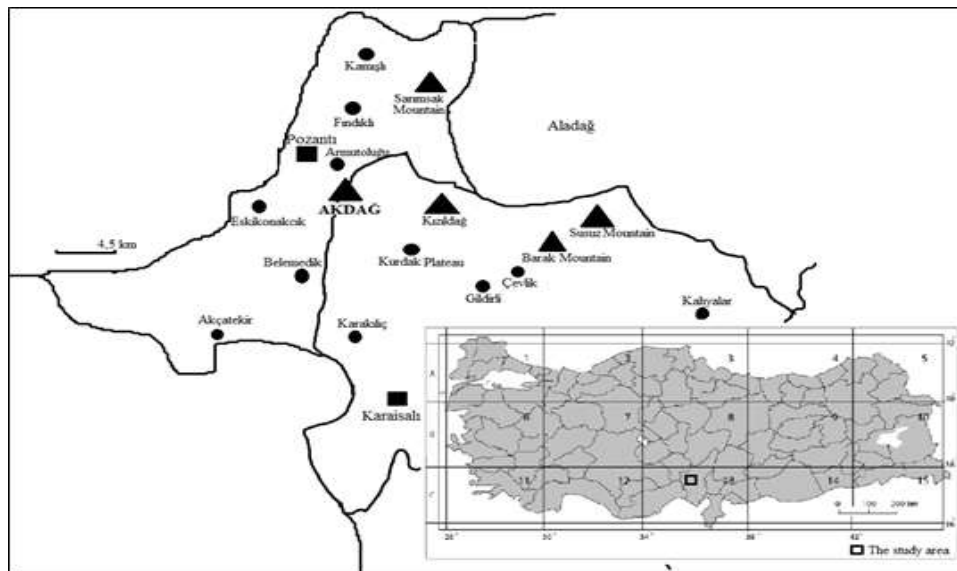


Figure 1. Map of the study area and grid system adopted by Henderson (1961)

2. Materials and methods

The study was carried out in the period from April to July 2009. Materials were collected from 11 localities (Table 1). All specimens were stored in the herbarium of the Niğde University. The specimens collected from Akdağ were identified by using relevant literature (Smith, 2004; Pedrotti, 2001, 2006; Casas et al., 2009; Bruges et al., 2007). The life forms of the taxa were determined according to (Hill et al., 2007), the life strategies of the taxa were according to Daring (1979) and Frey and Kürschner (1991), and the ecological preferences of the taxa such as humidity, light, and acidity were regulated in accordance with Dierßen (2001). Latest status of the taxa for Turkey has been assessed using the related literature (Uyar and Çetin, 2004; Kürschner and Erdağ, 2005; Özenoğlu Kiremit and Keçeli, 2009; Ros et al., 2013). Arrangement of taxa in the list follows the system which is proposed by Ros et al. (2007) and Hill et al. (2006). For each taxon, only one collector number (i.e., R.K. 1600) was given to avoid repetition in the floristic list.

3. Results

As a result of the study, 66 moss taxa belonging to 12 families and 33 genera, 4 liverwort taxa belonging to 4 families and 4 genera have been found at Akdağ (Table 2). Among them, according to the grid square system of Henderson (1961), *Distichium capillaceum* is a new record for C13 square.

The dominant bryophyte family in the study area was *Pottiaceae* with 29 taxa. Up to 41% of the bryophyte species identified in this study were in this family (Figure 2). The most species rich genera recorded were *Didymodon* (7 taxa), *Grimmia* (5 taxa), *Syntrichia* (5 taxa), *Tortella* (5 taxa), *Bryum* (5 taxa) and *Tortula* (5 taxa). Other genera were represented with less taxa.

Table 1. Details of the study localities (LN: Locality number)

LN	Localities	GPS	Date	Alt (m)
1	Armutoluğu Plateau	37°26'3.99"N / 34°55'21.31"E	10.04.2010	1500
2	Armutoluğu Plateau road	37°26'2.37"N / 34°53'51.10"E	10.04.2010	800
3	Yelgirmez locality	37°25'27.38"N / 34°53'28.66"E	10.04.2010	850
4	Beypınarı locality	37°25'20.96"N / 34°57'56.31"E	10.04.2010	1500
5	Karaçay Creek	37°21'38.64"N / 34°54'57.02"E	10.04.2010	750
6	Merkezboztahta Village	37°22'58.41"N / 35°11'38.54"E	07.06.2010	300
7	Barakdağı Village	37°24'1.10"N / 35°11'36.42"E	07.06.2010	850
8	Çukur Village	37°21'27.68"N / 35°05'54.34"E	07.06.2010	350
9	Çukur Village road	37°22'7.78"N / 35°08'28.05"E	07.06.2010	300
10	Etekli Village	37°25'27.63"N / 35°13'52.64"E	08.06.2010	900
11	Nuhlu Village	37°18'60.00"N / 35°19'55.27"E	21.07.2010	350

Table 2. The bryofloristic list (*: new record for C13 grid square, LN: locality number, So: on soil, R: on rock, T: on tree, LF: life form, Mt: mat-thaloid, Fa: fan, Cu: cushion, Tf: turf, Ts: turf-scattered, Mr: mat-rough, Ms: mat-smooth, We: weft, LS: life strategy, c: colonists, p: perennials, ps: stress-tolerant perennials, l: long-lived shuttle, pc: competitive perennials, ce: ephemeral colonists, cp: pioneer colonists, s: short-lived shuttle, f: fugitives Ac: acidity, Hu: humidity, L: light, X: xerophyte, H: hydrophyte, M: mesophyte, S: sciophyte, P: photophyte, N: subneutrophyte, A: acidophyte, B: basiphyle RK.: collector number)

Families	Bryophytes Taxa	LN	Substrat			LF	LS	Ecology			RK
			So	R	T			Ac	Hu	L	
LIVERWORTS											
Aytoniaceae	<i>Reboulia hemisphaerica</i> (L.) Raddi	1,10	+			Mt	l	B	H	S	1582
Targioniaceae	<i>Targionia hypophylla</i> L.	6	+			Mt	l	N	H	S	1608
Lunulariaceae	<i>Lunularia cruciata</i> (L.) Lindb.	11	+			Mt	p	N	M	S	1628
Porellaceae	<i>Porella platyphylla</i> (L.) Pfeiff	1	+			Fa	ps	A	M	S	1583
MOSSES											
Encalyptaceae	<i>Encalypta vulgaris</i> Hedw.	1	+			Tuft	l	N	X	S	1584
Funariaceae	<i>Funaria hygrometrica</i> Hedw.	3, 8	+			Tuft	f	A	H	S	1609
	<i>Grimmia anodon</i> Bruch & Schimp.	1		+		Cu	ps	N	X	P	1586
	<i>Grimmia dissimulata</i> E.Maier	6		+		Cu	c	N	X	P	1610
	<i>Grimmia montana</i> Bruch & Schimp	4		+		Cu	c	A	X	P	1587
	<i>Grimmia ovalis</i> (Hedw.) Lindb.	2		+		Cu	c	A	X	P	1588
	<i>Grimmia pulvinata</i> (Hedw.) Sm.	2		+		Cu	c	A	X	P	1611
Grimmiaceae	<i>Schistidium apocarpum</i> (Hedw.) Bruch & Schimp.	1		+		Tuft	cp	A	H	S	1589
	<i>Schistidium confertum</i> (Funck) Bruch & Schimp	2		+		Cu	c	A	X	P	1590
	<i>Schistidium flaccidum</i> (De Not.) Ochyra	4	+			Cu	c	N	X	P	1591
Fissidentaceae	<i>Fissidens bryoides</i> Hedw.	5	+			Tf	c	A	H	S	1592
	<i>Fissidens viridulus</i> (Sw.) Wahlenb.	11	+			Tf	ce	N	H	S	1629
Ditrichaceae	<i>Ceratodon purpureus</i> (Hedw.) Brid	11	+			Tf	c	A	M	P	1630
	* <i>Distichium capillaceum</i> (Hedw.) Bruch & Schimp.	2		+		Tuft	cp	A	M	S	1593
Dicranaceae	<i>Dicranella varia</i> (Hedw.) Schimp.	7	+			Tf	ce	B	H	P	1612
	<i>Aloina aloides</i> (Koch ex Schultz) Kindb	11	+			Ts	c	N	X	P	1631
	<i>Barbula unguiculata</i> Hedw.	2	+			Tf	c	A	H	P	1594
	<i>Crossidium squamiferum</i> (Viv.) Jur.	11		+		Tf	c	B	X	P	1632
	<i>Didymodon acutus</i> (Brid.) K. Saito	8	+			Tf	c	B	M	P	1613
	<i>Didymodon fallax</i> (Hedw.) R. H. Zander	11	+			Tf	c	N	H	P	1633
	<i>Didymodon insulanus</i> (De Not.) M.O.Hill	2	+			Tf	c	N	H	S	1595
Pottiaceae	<i>Didymodon luridus</i> Hornsch. ex Spreng	9	+			Tf	c	B	X	P	1614
	<i>Didymodon rigidulus</i> Hedw.	9	+			Tuft	c	N	X	S	1615
	<i>Didymodon tophaceus</i> (Brid.) Lisa	7	+			Tf	c	B	H	P	1614
	<i>Didymodon vinealis</i> (Brid.) R. H. Zander	7	+			Tuft	c	N	X	P	1617
	<i>Gymnostomum calcareum</i> Nees & Hornsch	11		+		Tf	c	B	H	S	1634
	<i>Pleurochaete squarrosa</i> (Brid.) Lindb.	11	+			Tf	pc	B	X	P	1635
	<i>Syntrichia montana</i> Nees	1	+			Tuft	c	A	X	S	1568

Table 2. continued

	<i>Syntrichia papillosum</i> (Copp.) Loeske	1	+	Tf	c	N	X	P	1569
	<i>Syntrichia princeps</i> (De Not.) Mitt.	5		Tf	c	A	M	S	1596
	<i>Syntrichia ruralis</i> (Hedw.) F.Weber & D.Mohr	5	+	Tf	c	N	X	P	1597
	<i>Syntrichia ruralis</i> (Hedw.) var. <i>ruraliformis</i> (Besch.) Delogne	4	+	Tf	c	A	X	P	1598
	<i>Timmiella barbuloidea</i> (Brid.) Mönk.	8	+	Tf	s	B	X	S	1618
	<i>Tortella flavovirens</i> (Bruch) Broth	11	+	Tuft	c	N	X	P	1636
	<i>Tortella humilis</i> (Hedw.) Jenn.	8	+	Tuft	c	A	X	S	1619
	<i>Tortella inclinata</i> (R. Hedw.) Limpr.	1		Tuft	c	B	X	P	1570
	<i>Tortella nitida</i> (Lindb.) Broth.	1	+	Cu	ps	N	X	P	1571
	<i>Tortella tortuosa</i> (Hedw.) Limpr	1	+	Tuft	ps	B	M	S	1572
	<i>Tortula marginata</i> (Bruch & Schimp.) Spruce	1	+	Tf	c	B	H	S	1573
	<i>Tortula inermis</i> (Brid.) Mont.	1	+	Tf	c	A	X	P	1574
	<i>Tortula muralis</i> Hedw.	8	+	Tf	c	N	M	S	1620
	<i>Tortula subulata</i> Hedw.	1	+	Tuft	c	N	M	S	1574
	<i>Trichostomum crispulum</i> Bruch	8	+	Tf	c	B	M	S	1621
	<i>Weissia controversa</i> Hedw.	8	+	Tf	c	A	X	P	1622
Orthotrichaceae	<i>Orthotrichum cupulatum</i> Hoffm. ex Brid.	1	+	Cu	c	N	H	S	1576
	<i>Orthotrichum diaphanum</i> Schrad. ex Brid.	8		Cu	c	N	X	P	1623
	<i>Orthotrichum rupestre</i> Schleich. ex Schwagr.	2	+	Cu	c	A	X	S	1599
Bryaceae	<i>Bryum argenteum</i> Hedw	8	+	Tf	c	N	M	P	1624
	<i>Bryum caespiticium</i> Hedw.	1	+	Tf	c	N	M	P	1577
	<i>Bryum capillare</i> Hedw.	1, 11	+	Tf	c	N	M	S	1578
	<i>Bryum dichotomum</i> Hedw.	11	+	Tf	c	N	X	P	1638
	<i>Bryum pallescens</i> Schleich. ex Schwäger	4	+	Tuft	c	A	H	P	1600
Amblystegiaceae	<i>Amblystegium serpens</i> (Hedw.) Schimp	11	+	Mr	p	A	H	S	1639
	<i>Cratoneuron filicinum</i> (Hedw.) Spruce	4	+	We	pc	B	H	P	1601
	<i>Hygroamblystegium tenax</i> (Hedw.) Jenn	8	+	Mr	p	N	H	S	1625
Pterigynandraceae	<i>Pterigynandrum filiforme</i> Hedw.	1		Ms	ps	N	M	S	1579
Brachytheciaceae	<i>Brachytheciastrum velutinum</i> (Hedw.) Ignatov & Huttunen	1	+	Mr	p	A	M	S	1580
	<i>Brachythecium glareosum</i> (Bruch ex Spruce) Schimp.	2	+	Mr	pc	N	M	S	1602
	<i>Homalothecium lutescens</i> (Hedw.) H.Rob.	2	+	We	p	N	M	P	1603
	<i>Homalothecium sericeum</i> (Hedw.) Schimp	4	+	Mr	p	B	X	S	1604
	<i>Kindbergia praelonga</i> (Hedw.) Ochrya	2		Mr	p	A	H	S	1605
	<i>Rhynchostegiella litorea</i> (De Not.) Limpr	7	+	Mr	ps	B	H	S	1626
	<i>Rhynchostegium confertum</i> (Dicks.) Schimp.	2	+	Mr	p	N	H	S	1606
	<i>Rhynchostegium megapolitanum</i> (Blandow ex F.Weber & D.Mohr) Schimp.	11	+	Mr	p	N	H	S	1640
	<i>Sciuro-hypnum populeum</i> (Hedw.) Ignatov & Huttunen	2		Mr	p	A	M	S	1607
	<i>Sciuro-hypnum starkei</i> (Brid.) Ignatov & Huttunen	1	+	Mr	ps	A	H	P	1581

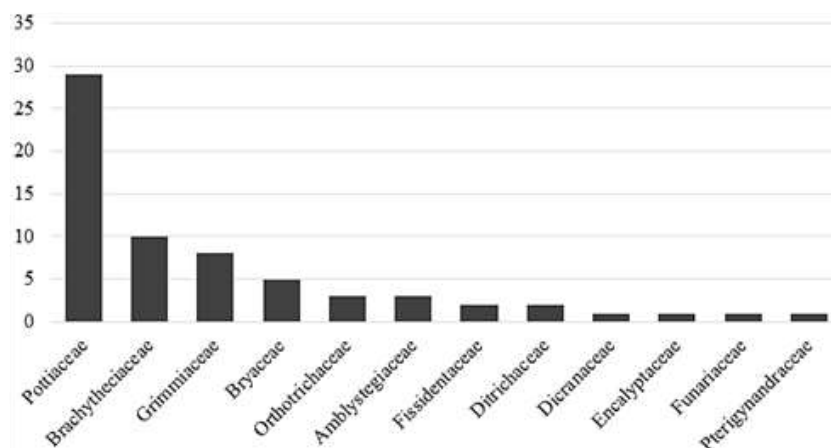


Figure 2. Proportions of families.

The proportion of acrocarpous mosses, especially xerophytic Pottiaceae family members in the Mediterranean regions is higher than Black Sea region. In this study, acrocarpous mosses constituted 71% of the total moss flora (Figure 3).

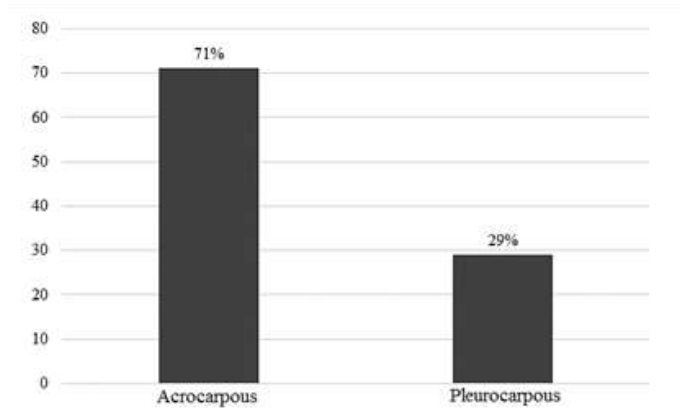


Figure 3. Proportions of Acrocarpous / Pleurocarpous

In this study was determined that 5 taxa are epiphytic, 40 taxa epigeic and 25 taxa epilitic (Figure 4). According to this order, it is seen that bryophytes growing on the rocks and soil, was dominated with a large percentage. This is a result of the destruction of forests by humans.

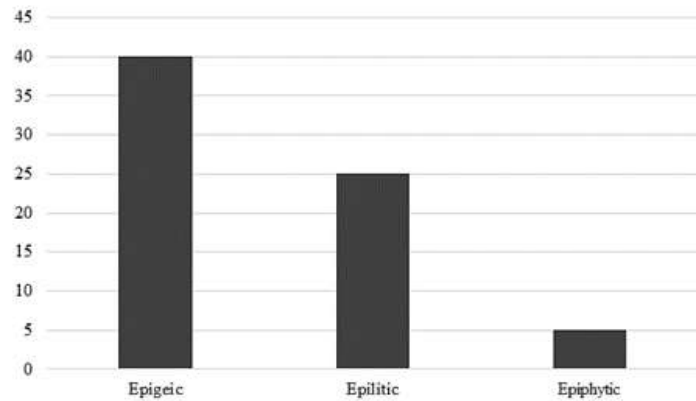


Figure 4. Substrate preferences of bryophytes

According to field observations and literature reviews, 9 life strategies were recorded: colonists (59%), perennials (15%), stress-tolerant perennials (10%), long-lived shuttle (4%), competitive perennials (4%), ephemeral colonists (3%), pioneer colonists (3%), short-lived shuttle (1%) and fugitives (1%) (Figure 5). According to these proportions, the colonist life strategy, which are characterised by the xeropottioid life syndrome (Kürschner, 2004), is dominant with a remarkable incidence. In the study, 9 life forms were recorded: turf (39%), tuft (19%), cushion (16%), mat-rough (16%), mat-thalloid (4%), weft (3%), fan (1%), mat-smooth (1%) and turf-scattered (1%) (Figure 6). There is a strong relationship between the ecological factors of habitat, life strategies and life forms in bryophytes. While acrocarpous mosses showing cushions or turf life forms grow xerophytic and photophytic habitats, pleurocarpous mosses showing mat, weft or fan life forms grow mesophytic, hydrophytic and sciophytic habitats (Kürschner et al., 1998). In this study was found that turf life form was dominant because of the area under the influence of Mediterranean climate with low rainfall.

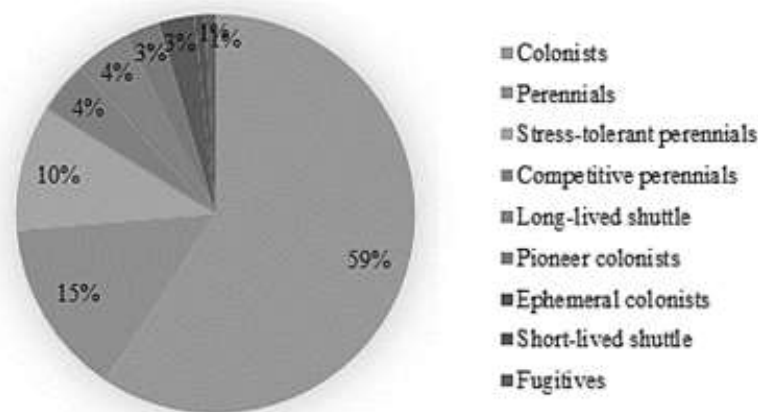


Figure 5. Life strategies spectrum of bryophytes.

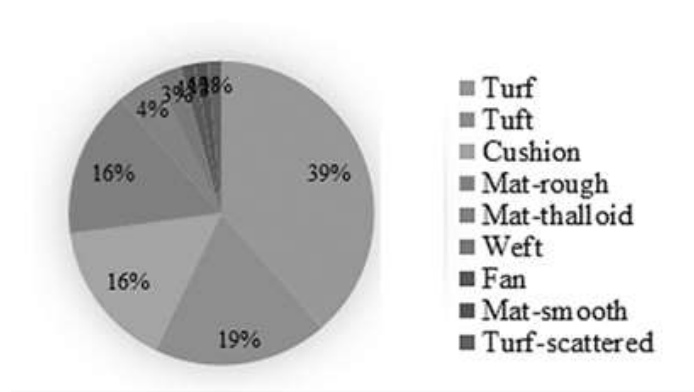


Figure 6. Distribution of life forms of bryophytes

The bryophyte specimens were also evaluated ecological features such as moisture condition, light requirement and the pH of the substrate according to field observations and literature reviews. As a result of this analysis, it was found that xerophyte, sciophyte and subneutrophyte taxa were dominant in the area (Figure 7). These results are compatible with climatic features of the area where located in the Mediterranean region.

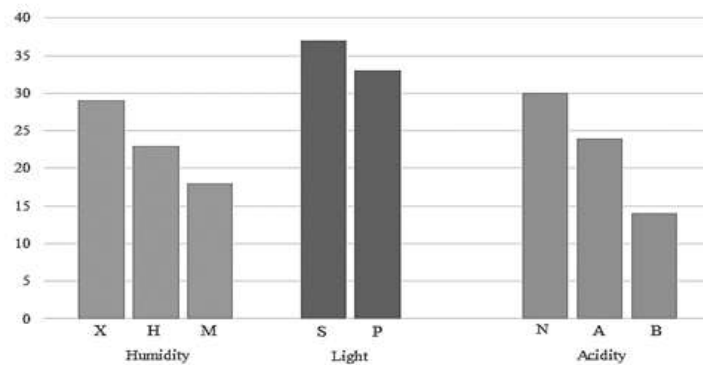


Figure 7. Ecological preferences of the taxa (X: xerophyte, H: hydrophyte, M: mesophyte, S: sciophyte, P: photophyte, N: subneutrophyte, A: acidophyte, B: basiphYTE)

Acknowledgements

The authors are indebted to the Scientific and Technological Research Council of Turkey (TUBİTAK) for the financial support (Project Code: 109T055).

References

- Alataş, M., Uyar, G. 2015. The Bryophyte flora of Abant Mountains (Bolu/Turkey). *Biological Diversity and Conservation*. 8/1: 35-43.
- Brugues, M., Cros, R.M., Guerra, J. 2007. *Flora Briofítica Ibérica*, Vol. 1. Sociedad Española de Briología, Murcia.
- Can, S.M., Kara, R., Ezer, T. 2013. Bryophyte flora of the Melendiz Mountain in Turkey. *Turkish Journal of Botany*. 37: 575-588.
- Casas, C., Brugues, M., Cros, R.M., Sergio, C., Infante, M. 2009. *Handbook of Liverworts and Hornworts of the Iberian Peninsula and the Balearic Islands*. Institut d'Estudis Catalans, Barcelona.
- Dierßen, K. 2001. *Distribution, ecological amplitude and phytosociological characterization of European bryophytes*. Bryophytorum Bibliotheca, Stuttgart.
- During, H.J. 1979. *Life Strategies of Bryophytes: A Preliminary Review*, *Lindbergia*. 5: 2-18.
- Frey, W., Kürschner, H. 1991. *Conspectus Bryophytorum Orientalum et Arabicorum*. An annotated catalogue of the bryophytes of Southwest Asia. Bryophytorum Bibliotheca, Stuttgart.
- Henderson, D.M. 1961. *Contributions to the bryophyte flora of Turkey V: summary of present knowledge*. *Notes from Royal Botanic Garden*. 23: 279-301.
- Hill, M.O., Bell, N., Bruggeman-Nannenga, M.A., Brugues, M., Cano, M., Enroth, J.J., Flatberg, K.I., Frahm, J.P., Gallego, M.T., Garilleti, R., Guerra, J., Hedenas, L., Holyoak, D.T., Hyvonen, J., Ignatov, M., Lara, S.F., Mazimpaka, V., Munoz, J., Soderstrom, L. 2006. *Bryological monograph an annotated checklist of the mosses of Europe and Macaronesia*. *Journal of Bryology*. 28: 198-267.

- Hill, M.O., Preston, C.D., Bosanquet, S.S., Roy, D.B. 2007. *Bryoatt: Attributes of British and Irish Mosses, Liverworts and Hornworts With Information on Native Status, Size, Life Form, Life History, Geography and Habitat*. The Saxon Print Group, Norwich.
- Kara, R., Ezer, T., Can Gözcü, M., Gül Bozdoğan, Ş. 2014. Bryophyte flora of Erciyes Mountain in Turkey, with 6 bryophyte records from the country. *Turkish Journal of Botany*. 38: 763-781.
- Kürschner, H. 2004. Life strategies and adaptations in bryophytes from the Near and Middle East. *Turkish Journal of Botany*. 28: 73-84.
- 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. *Turkish Journal of Botany*. 29: 95–154.
- Kürschner, H., Tonguç, Ö., Yayıntaş, A. 1998. Life Strategies in Epiphytic Bryophyte Communities of the Southwest Anatolian Liquidambar orientalis forest. *Nova Hedwigia* 66: 435-450.
- Ören, M., Keçeli, A. 2014. The moss flora Ihlara Valley (Aksaray/Turkey). *Biological diversity and conservation*. 7: 88-93.
- Özdemir, T., Batan, N. 2014. New and noteworthy moss records for Turkey and Southwest Asia. *Telopea*. 17: 35-42.
- Özenoğlu Kiremit, H., Keçeli, T. 2009. An annotated check-list of the Hepaticae and Anthocerotae of Turkey, *Cryptogamie, Bryologie*. 30: 343-356.
- 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.
- Ros, P.R.M., Mazimpaka, V., Abou-Salama, U., Aleffi, M., Blockeel, T.L., Bruges, M., Cano, M.J., Cros, R.M., Dia, M.G., Dirkse, G.M., El Saadawi, W., Erdağ, A., Ganeva, A., Gonzalez-Mancebo, J.M., Herrnstadt, I., Khalil, K., Kürschner, H., Lanfranco, E., Losada-Lima, A., Refai, M.S., Rodriguez-Nunez, S., Sabovljević, M., Sergio, C., Shabbar, H., Sim-Sim, M., Soderstrom, L. 2007. Hepatics and Anthocerotae of the Mediterranean, an annotated checklist, *Cryptogamie, Bryologie*, 28: 351–437.
- Ros, R.M., Mazimpaka, V., Abou-Salama, U., Aleffi, M., Blockeel, T.L., Brugués, M., Cros, R.M., Dia, M.G., Dirkse, G.M., Draper, I., El-Saadawi, W., Erdağ, A., Ganeva, A., Gabriel, R., González-Mancebo, J.M., Granger, C., Herrnstadt, I., Hugonnot, V., Khalil, K., Kürschner, H., Losada-Lima, A., Luis, L., Mifsud, S., Privitera, M., Puglisi, M., Sabovljevic, M., Sérgio, C., Shabbara, H.M., Sim-Sim, M., Sotiaux, A., Tacchi, R., Vanderpoorten, A., Werner, O. 2013. Mosses of the Mediterranean, an annotated checklist. *Cryptogamie, Bryologie*, 34: 99-283.
- Smith, A.J.E. 2004. *The Moss Flora of Britain and Ireland, (Second Edition)*. Cambridge Univ Press, Cambridge.
- Uyar, G., Çetin, B. 2004. A new check-list of the mosses of Turkey, *Journal of Bryology*, 26: 203-220.

(Received for publication 26 June 2015; The date of publication 15 December 2015)