The bryophyte flora of Karınca Mountain (Pozantı-Adana)

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Abstract. In this study, the bryophyte flora of Karınca Mountain (Pozantı-Adana, South Turkey) was investigated. In different vegetation periods between 2019-2021, bryophyte specimens were collected from various habitats of the study area. As a result of the identification studies, 26 families, 65 genera and a total of 195 taxa (190 mosses, five liverworts) were determined. Twenty of them were new records for C13 grid-square. *Pottiaceae* (56 taxa), *Grimmiaceae* (27 taxa) and *Brachytheciaceae* (22 taxa) have been the richest families in the study area, while *Grimmia* (15 taxa), *Syntrichia* (15 taxa), *Ptychostomum* (13 taxa), and *Orthotrichum* (12 taxa) have been the most common genera. Also, *Grimmia pulvinata*, *Homalothecium philippeanum*, *Lewinskya rupestris, Syntrichia ruralis*, *S. virescens*, *Tortula inermis*, and *T. subulata* have been the most common species in the study area.

Key words: Adana, bryophyte flora, Karınca Mountain, liverworts, mosses, Turkey

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Introduction

Due to its geographical location connecting the continents of Asia and Europe, Turkey has different climatic conditions, geological, geomorphological and topographic diversity, and different aquatic ecosystems, such as seas, lakes and rivers. This determines its richness in terms of habitats, ecosystems and plant diversity. Furthermore, Turkey is located at the intersection of three phytogeographic regions (Euro-Siberian, Mediterranean and Irano-Turanian), which makes it the richest among its neighbors in Southwest Asia in terms of bryodiversity (Ezer & al. 2021). The group of bryophytes including approximately 15 000-25 000 species,

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is the second largest after *Magnoliophyta* (flowering plants amounting to 350,000 species) in the world. They can live almost anywhere in the world where there is water or moisture (Glime 2017). According to studies in recent years on the bryophyte flora in Turkey, the total number of bryophyte taxa in the country is about ±1059 (Erata & Batan 2020; Kürschner & Frey 2020; Unan & al. 2020; Uygur & al. 2020, Uygur & al. 2021; Erata & al. 2021; Keskin & al. 2021a; Kırmacı & al. 2021; Ursavaş & al. 2021, Abay & al. 2022, Alataş & al. 2022). With the new studies, that number is likely to increase. The present study has been aimed to shed light on the bryophyte flora of Karınca Mountain, so far not studied for bryophytes, as well as to make another contribution to the Turkish bryoflora.

Material and methods

Study area

Karınca Mountain is located in the north of Pozantı district, within the borders of Adana Province. The geographical location of the research area is at 37° 29' 44" N and 34° 52' 23" E, some eight km from Pozantı and 55 km from Niğde. The highest point of the study area lies at 2206 m, on an area of approximately 71 km² (Fig. 1).

The study area lies in the C13 grid-square, according to Henderson's Türkiye Bryophytes Grid-Square System (1961) (Fig. 2), and in the Mediterranean Phytogeographic Region.

The study area is characteristically high mountainous in terms of geomorphological structure. Due to its geological structure, geographical location and climatic characteristics, forest vegetation generally dominates in the area. Coniferous species are prevalent among the forest vegetation: *Pinus brutia* Ten. *brutia* f. *brutia*, *P. halepensis* Mill., *P. nigra* J.F. Arnold subsp. *pallasiana* (Lamb.) Holomboe, *Abies cilicica* subsp. *cilica*, *Cedrus libani* A.Rich. In addition to them, Juniper species are also found, such as *Juniperus drupacea* Labill., *J. excelsa* M. Bieb., *J. foetidissima* Willd., and *J. oxycedrus* L., as well as broad-leaved forest tree species, such as *Cercis siliquastrum* L., *Lonicera etrusca* Santi var. *etrusca*, *Paliurus spina-christi* P. Mill., *Pistacia palaestina* Boiss., *Platanus orientalis* L., *Quercus cerris* L., *Q. coccifera* L., *Q. infectoria* Oliv. subsp. *veneris* (A.Kern.) Meikle, *Q. libani* Oliv., *Q. pubescens* Willd. subsp. *pubescens*, *Rhamnus lib-*

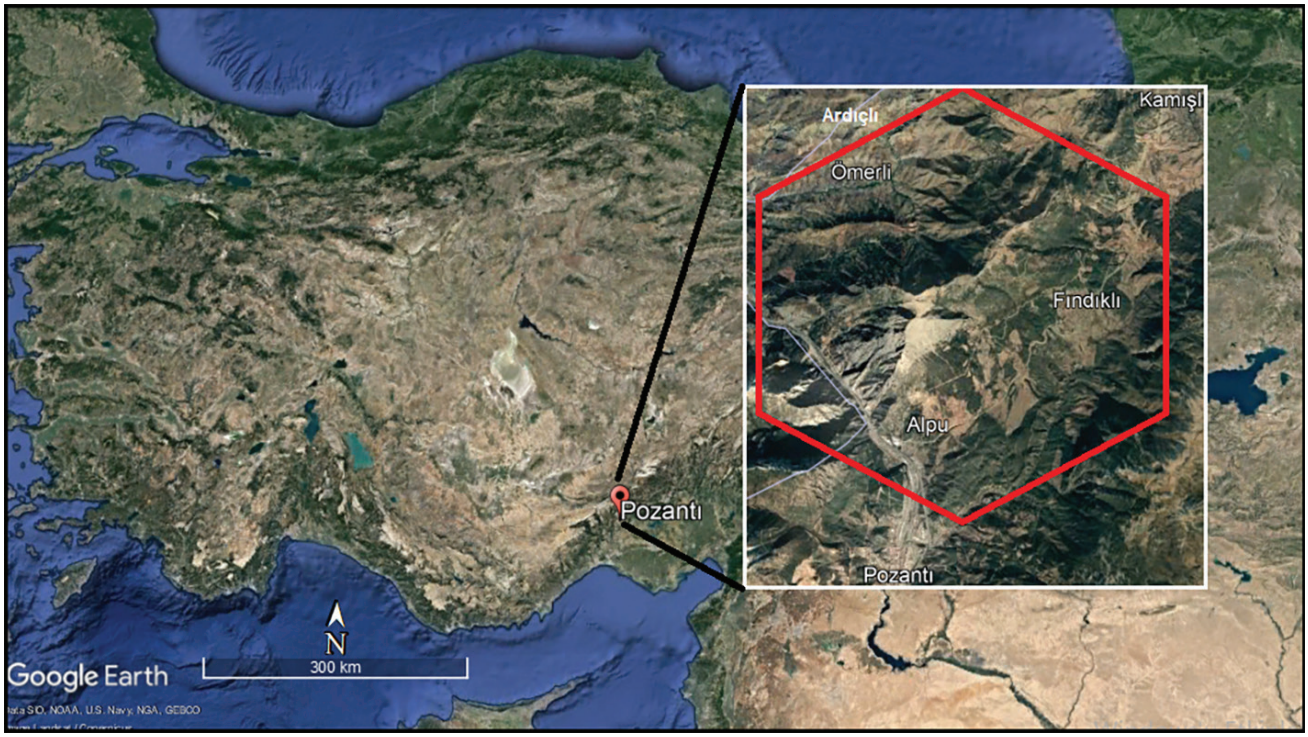


Fig. 1. The study area (adapted from Google Earth).

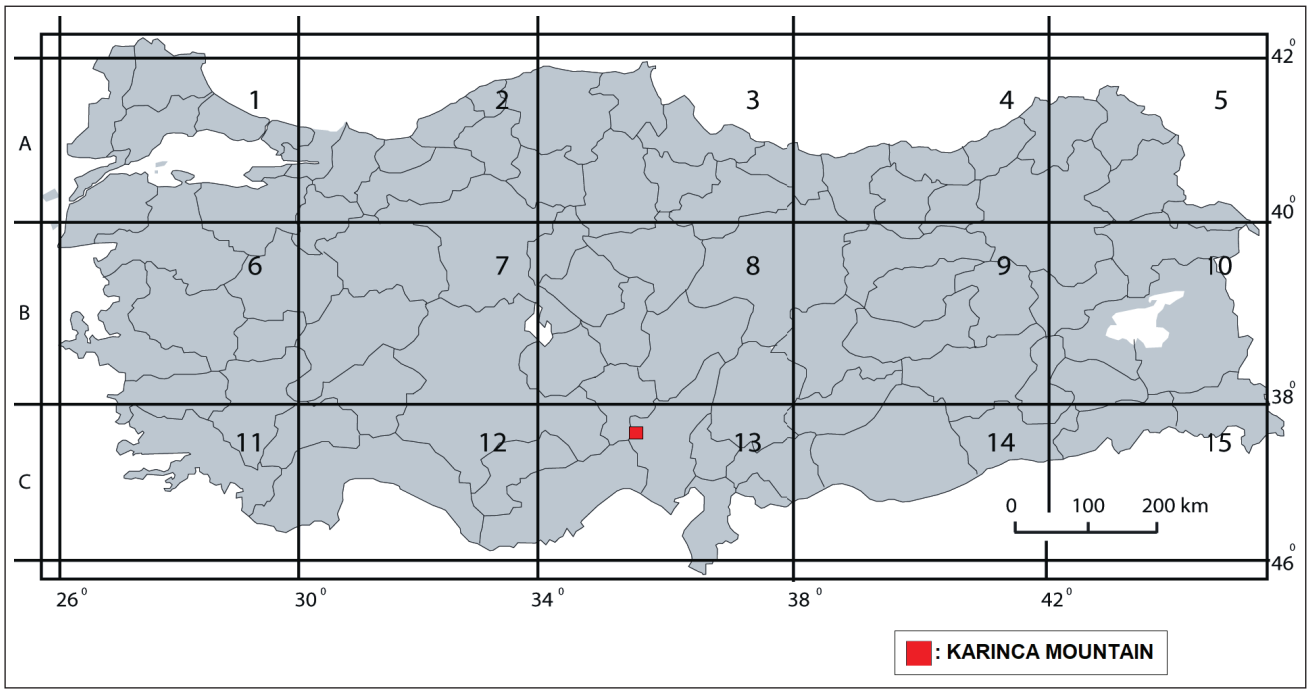


Fig. 2. Henderson's grid system in Turkey (1961) and location of the study area.

anotica Boiss., *Rhus coriaria* L., *Styrax officinalis* L., and *Ulmus glabra* Huds. (Keskin & al. 2021b) (Fig. 3a). While forest vegetation in the area reaches an altitude of 1700-1800 m, steppe vegetation occurs in the alpine areas and above the timberline, exceeding 1800 m (Fig. 3d). There have been also some herbaceous taxa between 1700-1800 m above the timberline of the study area: *Achillea cappadocica* Hausskn. & Bornm., *A. arabica* Kotschy, *Anchusa leptophylla* Roem. & Schult., *Alyssum simplex* Rudolph, *Aubrieta canascens* (Boiss.) Bornm., *Centaurea cheirolopha* (Fenzl) Wagenitz., *Colchicum szovitsii* Fisch. & C.A.Mey subsp. *szovitsii*, *Crocus cancellatus* Herb. subsp. *cancellatus*, *Erysimum crassipes* Fisch. & C.A.Mey., *Gladiolus atroviolaceus* Boiss., *Lamium garganicum* L. subsp. *striatum* (Sm.) Hayek var. *striatum*, *Lathyrus cilicicus* Hayek & Siehe, *Iris stenophylla* Hausskn. ex Baker subsp. *stenophylla*, *Muscari tenuiflorum* Tausch, *Ornithogalum armeniacum* Baker., *Poa bulbosa* L., *Trifolium caudatum* Boiss., *Triticum aestivum* L. The dominant shrub forms are *Ampelopsis orientalis* (Lam.) Planch, *Acantholimon libanoticum* Boiss., *Astragalus christianus* L. subsp. *christianus*, *Paliurus spina-christi* P. Mill., *Rosa canina* L. Rock; as well as some aquatic vegetation types (Keskin & al. 2021b) (Fig. 3b, 3c).

Climate information for the study area was taken from the data of the Meteorological Station of the Pozantı district of Adana Province (https://www.mgm.gov.tr/site). The annual average temperature was 13.24 °C. The highest average temperature was 24.9 °C in July, and the lowest average temperature was 1.9 °C in January. Average annual precipitation amounted to 650.25 mm. According to the data of Pozantı Meteorological Station, the study area had Mediterranean climate with scanty precipitation and cold winters (Akman 2011).

The research area includeed brown forest soils, less calcareous brown forest soils and alluvial soils, which have been dominant in the Mediterranean region (Dizdar 2003). Geologically, neritic limestones, culms, terrestrial detritus, carbonates (partly volcanic), ophiolitic melanges, marbles, and partly schists have been found in the study area (http://www.mta.gov.tr/).

Data source

Bryophyte specimens for the present study were collected from various habitats and substrates at 35 localities of the study area, in different vegetation periods between March 2019 and December 2021 (Table 1). Localities of bryophyte specimens are given in Fig. 4.

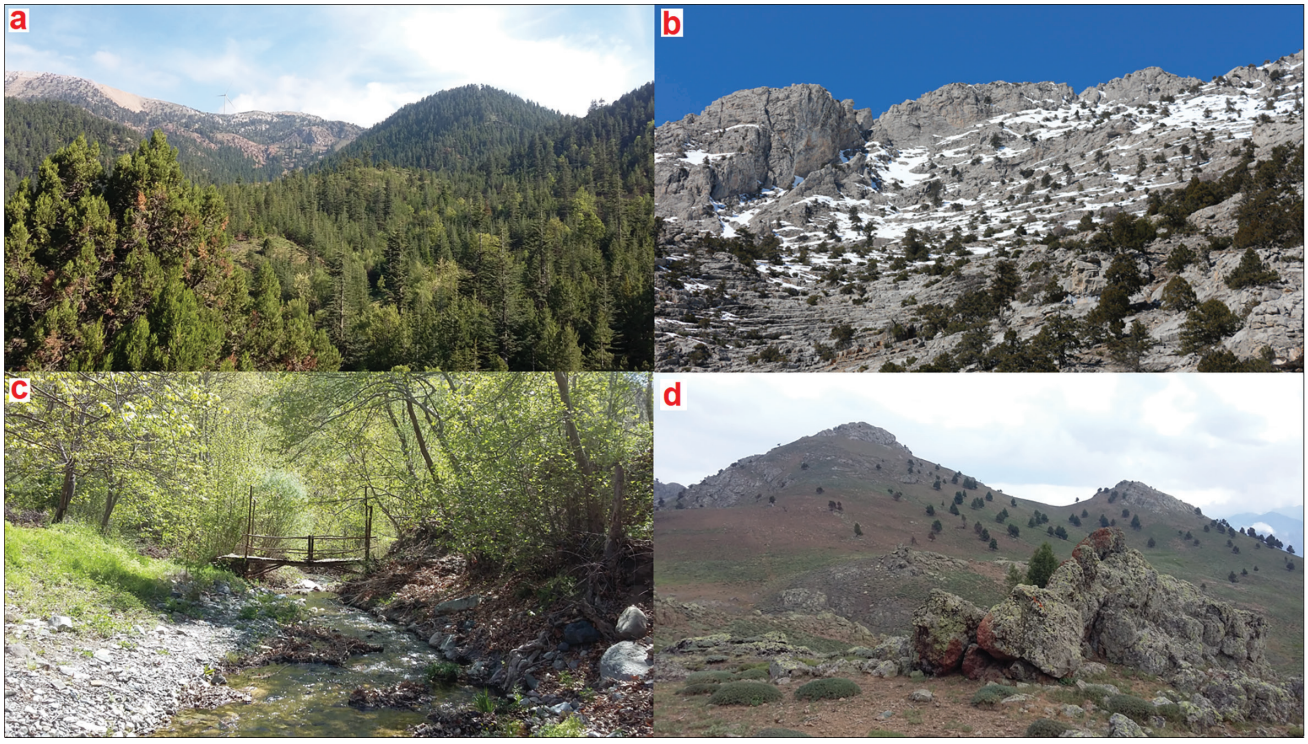


Fig. 3. Vegetation types of Karınca Mountain (a. mixed forest vegetation, b. rock vegetation, c. aquatic vegetation, d. steppe vegetation).

Table 1. Locality details (L.N.: Locality number, H.T.: Habitat type, m: meters).

L.N.	Localities - GPS coordinates - date	H.T.	Altitude (m)
1	**Adana: Pozantı,** Alpu, Karınca Mountain south, road to the Radar Site - 37°29'25"N / 34°53'6.05"E - 04.03.2020, 10.11.2021	Slope	1500
2	**Adana: Pozantı,** Alpu, Karınca Mountain south, road to the Radar Site - 37°29'7.06"N / 34°52'19.73"E - 14.06.2020, 24.08.2021	Maquis	1650
3	**Adana: Pozantı,** Karınca Mountain south, mountain road between Alpu and Fındıklı - 37°30'25.79"N / 34°55'18.38"E - 14.06.2020, 15.06.2020	Forest	1450
4	**Adana: Pozantı,** Fındıklı, Karınca Mountain southeast, fire tower road - 37°30'30.80"N / 34°55'3.08"E - 05.07.2019, 22.10.2021	Forest	1500
5	**Adana: Pozantı,** Ömerli, Karınca Mountain north, fire tower, Güzelolukçeşmesi surroundings - 37°30'42.36"N / 34°53'48.21"E - 18.08.2020	Forest	2000
6	**Adana: Pozantı,** Kamışlı, Karınca Mountain northeast, Asar Plateau, Aksuyungözü surroundings, Asar bridge - 37°32'11.44"N / 34°55'48.47"E - 15.06.2020, 29.12.2020, 05.04.2021, 25.08.2021	Forest	1350
7	**Adana: Pozantı,** Kamışlı, Karınca Mountain northeast, Asar Plateau, Çataloluk Mosque Gürlevik-dere surroundings - 37°32'33.04"N / 34°55'7.56"E - 15.06.2020, 28.12.2020, 09.03.2021, 22.10.2021	Forest	1350
8	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Çetendere surroundings - 37°31'45.13"N / 34°52'3.45"E - 19.08.2019, 09.03.2021, 22.10.2021	Forest	1180 - 1350
9	**Adana: Pozantı,** Ömerli, Karınca Mountai north, Karabeydere surroundings - 37°32'6.70"N-/ 34°52'18.53"E - 15.06.2020, 27.04.2021, 10.11.2021	Forest	1250 - 1400
10	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Gedik surroundings - 37°32'13.01"N / 34°53'16.40"E - 19.08.2019, 06.04.2021, 21.10.2021	Maquis	1400
11	**Adana: Pozantı,** Ömerli, Karınca Mountain northeast, Evciyes surroundings - 37°32'16.54"N / 34°53'0.40"E - 19.08.2019, 29.12.2020, 05.04.2021, 22.10.2021	Stream side	1350 - 1400

L.N.	Localities - GPS coordinates - date	H.T.	Altitude (m)
12	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Meydandere surroundings - 37°30’55.98”N / 34°53’11.75”E - 27.10.2019, 15.06.2020, 05.04.2021	Forest	1600
13	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Salamın Plateau, Salamındere surroundings - 37°31’45”N / 34°52’3.90”E - 05.07.2019, 27.10.2019, 27.04.2021	Forest	1450 - 1550
14	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Karlığındere surroundings - 37°30’48.90”N / 34°53’10.62”E - 26.10.2020, 26.05.2021, 24.08.2021	Forest	1500
15	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Beşçatal surroundings, pool and surroundings - 37°31’14.14”N / 4°52’24.68”E - 29.12.2020, 18.05.2021	Forest	1350
16	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Domuzluk Deresi, Çatak surroundings - 37°31’34”N / 34°52›13”E - 26.10.2020, 19.08.2020, 19.05.2021	Forest	1350
17	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Kurtderesi surroundings - 37°30’53.55”N / 34°52’55.32”E - 27.10.2020, 09.03.2021, 05.07.2021	Forest	1330 - 1500
18	**Adana: Pozantı,** Ömerli, Karınca Mountain northwest, Çakılpınar surroundings - 37°30’50.8”N / 34°51’38.63”E - 28.12.2020, 08.03.2021, 06.07.2021, 22.10.2021	Forest	1300 - 1400
19	**Adana: Pozantı,** Ömerli, Karınca Mountain northeast, Karanlığındere surroundings - 37°31’50”N / 34°53›39.5”E - 27.10.2020, 28.12.2020, 09.03.2021	Maquis	1450 - 1585
20	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Çamlısenir surroundings - 37°31’4.08”N-34°52’8.33”E - 28.12.2020, 25.05.2021	Forest	1480
21	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Meydan Plateau, Çağşakaltı surrounding s- 37°30’38.40”N / 34°52’47.69”E - 29.12.2020	Forest	1560
22	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Aşağıbağderesi surroundings - 37°31’35.72”N / 34°50’51.64”E - 05.04.2021	Stream side	1150
23	**Adana: Pozantı,** Karınca Mountain east, Kamışlı north - 37°32’54.95”N / 34°56’16.46”E - 09.03.2021	Forest	1350
24	**Adana: Pozantı,** Karınca Mountain, southeast, Fındıklı north - 37°30’17.91”N / 34°55’15.34”E - 28.12.2020, 24.08.2021	Forest	1250
25	**Adana: Pozantı,** Alpu, Karınca Mountain south - 37°28’31.69”N / 34°52’41.49”E - 28.12.2020	Forest	1250
26	**Adana: Pozantı,** Karınca Mountain, south, Pharmacists Site login - 37°29’21.53”N / 34°54’16.06”E, 29.12.2020, 25.05.2021	Forest	1350
27	**Adana: Pozantı**, Karınca Mountain south, Fındıklı, Sandıklı surroundings - 37°30’23.99”N / 34°54’19.03”E - 29.12.2020, 06.07.2021, 10.11.2021	Forest	1450
28	**Adana: Pozantı,** Fındıklı, Karınca Mountain south, Tavşanlıktepe surroundings - 37°29’35.58”N / 34°54’45.67”E - 08.03.2021	Forest	1210
29	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Karakütük surroundings - 37°30’56.62”N / 34°52’25.25”E - 08.03.2021	Forest	1315
30	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Sarıpınar stream surroundings - 37°32’5.65”N / 34°52’6.62”E - 19.08.2020, 28.12.2020, 09.03.2021	Stream side	1250 - 1350
31	**Adana: Pozantı,** Karınca Mountain northwest, Kırkgeçit stream - 37°30’37.98”N / 34°49’25.17”E - 08.03.2021	Road side	1000
32	**Adana: Pozantı,** Ardıçlı, Karınca Mountain north, Kelle Meydanı - 37°33’54.59”N / 34°50’46.21”E - 26.05.2021	Maquis	1575
33	**Adana: Pozantı,** Ömerli, Karınca Mountain north, Sarınıntaşı surroundings - 37°31’22.53”N / 34°52’59.25”E - 29.12.2020, 25.08.2021	Road side	1600
34	**Adana: Pozantı,** Kamışlı, Karınca Mountain north, Asar Plateau, Cemetery - 37°32’24.11”N / 34°54’20.89”E - 09.03.2021	Road side	1350
35	**Adana: Pozantı,** Kamışlı, peak Karınca - 37°30’17.99”N / 34°52’48.58”E - 10.11.2021, 28.06.2021, 24.08.2021	Maquis	1900

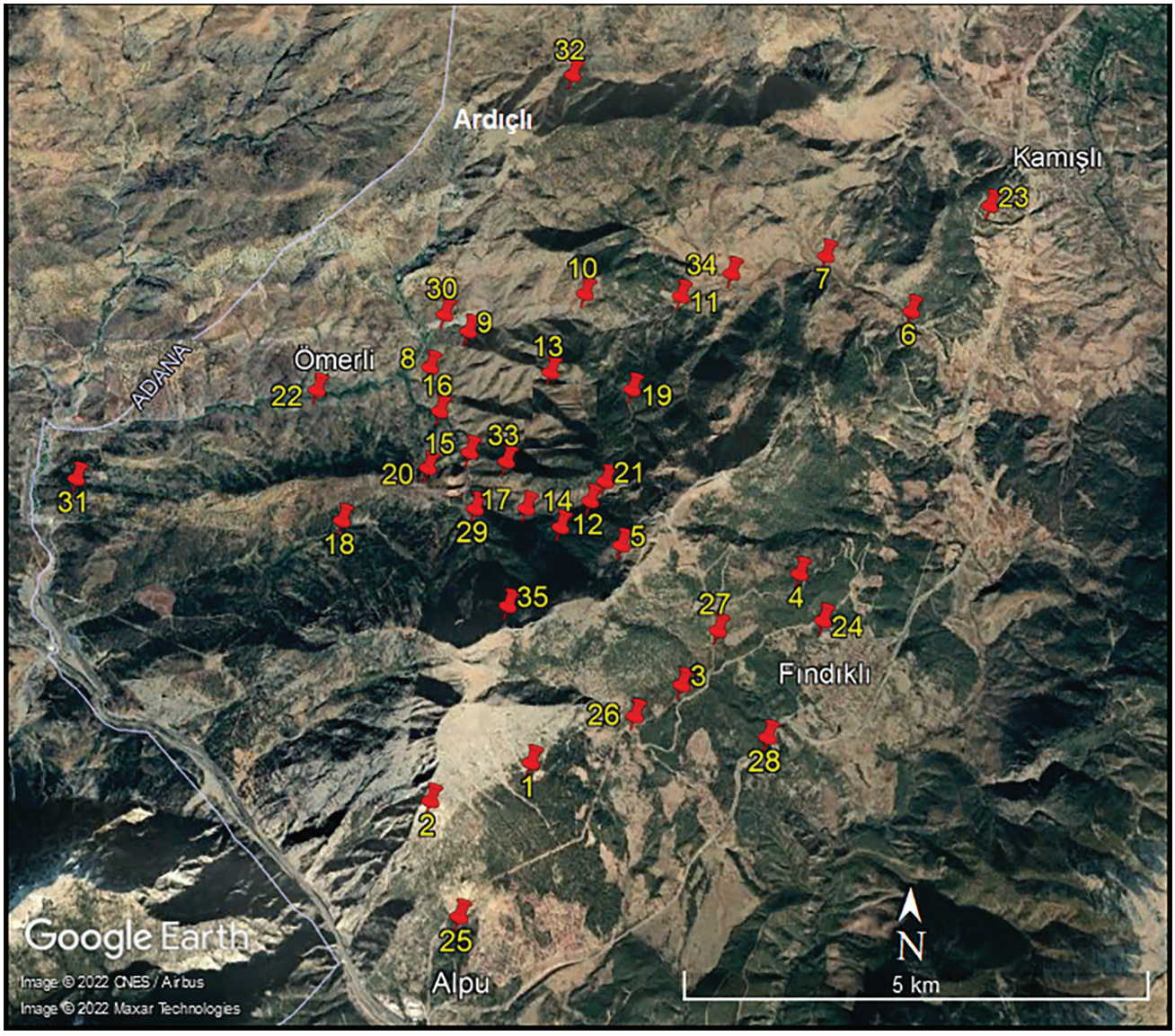


Fig. 4. Map of localities where bryophyte specimens were collected (adapted from Google Earth).

Bryophyte specimens were identified using various floras, revisions and monograph studies (Frey & Kürschner 1991; Lewinsky 1993; Zander 1993; Sharp & al. 1994; Frey & al. 1995; Bloom 1996; Paton 1999; Muñoz & Pando 2000; Erdağ & Kürschner 2002; Smith 2004; Cortini Pedrotti 2001, 2006; Ignatova & Muñoz 2004; Guerra & al. 2006; Brugués & al. 2007; Allen 1994, 2004, 2010, 2018; Lara & al. 2009; Erdağ & Kürschner 2009a, 2009b; Lara & al. 2010; Erdağ & Kürschner 2011; Orgaz & al. 2011, 2012, 2013; Plášek & al. 2015; Lara & al. 2016; Fedosov & al. 2017; Özenoğlu & al. 2019; Kürschner & Frey 2020). The taxonomic status and nomenclature in the floristic list followed Hodgetts & al. (2020). For each taxon, locality and substrate, families and ecological characteristics were presented. The status of new records for C13 grid-square and Turkey was determined on the basis of relevant literature (Kürschner & Erdağ 2005; Özenoğlu & Keçeli 2009; Ros, & al. 2013; Erdağ & Kürschner 2017a, 2017b; Kürschner & Frey 2020). Voucher specimens were deposited in the herbarium of Biology Department, Faculty of Science, Niğde Ömer Halisdemir University, Turkey.

Results

As a result of identification of the bryophyte specimens collected from different habitats in Karınca Mountain, a total of 195 taxa (186 species and nine varieties) were determined, belonging to 26 families and 65 genera. *Marchantiophyta* was represented by five species belonging to four families and four genera, and *Bryophyta* was represented by 190 taxa (125 acrocarpous and 65 pleurocarpous), 181 species and nine varieties, belonging to 22 families and 61 genera. Distribution of the taxa and families is given in Table 2.

Table 2. Floristic list (Legend - L.N: locality number, S: substrate, H: humidity, L: light, r: rock, s: soil, rs: soil covering rock, dw: decayed wood, Ac: *Abies cilicica*, Co: *Carpinus orientalis*, Po: *Platanus orientalis*, Qc: *Quercus cerris*, Qi: *Quercus infectoria*, Ql: *Quercus libani*, Qp: *Quercus pubescens*, Je: *Juniperus exelsa*, Jd: *Juniperus drupacea*, Pn: *Pinus nigra* subsp. *pallasiana*, Sa: *Salix alba*, h: hygrophytic, m: mesophytic, x: xerophytic, p: photophytic, sc: sciophytic, ▲: new records for the C13 grid-square)

Families	Taxa	L. N.	S.	H.	L.
	MARCHANTIOPHYTA				
Porellaceae	*Porella cordaeana* (Huebener) Moore	17	r	h	sc
	P. platyphylla (L.) Pfeiff.	17, 35	r	m	sc
Pelliaceae	*Pellia epiphylla* (L.) Corda	11, 18	s, dw	m	sc
Aytoniaceae	*Reboulia hemisphaerica* (L.) Raddi	1, 2, 22	r, s	h	p
Targioniaceae	*Targionia hypophylla* L.	1	s	m	p
	BRYOPHYTA				
Timmiaceae	*Timmia bavarica* Hessl.	35	r	m	sc
Encalyptaceae	*Encalypta alpina* Sm., Engl.	11	r	x	p
	E. ciliata Hedw.	6	r	h	sc
	E. streptocarpa Hedw.	24	s	m	sc
	E. vulgaris Hedw.	2, 7, 12, 16, 17, 19, 20, 33	r, s, Pn	m	p
Funariaceae	*Entosthodon muhlenbergii* (Turner) Fife	2, 9, 17, 22	r	x	p
	Funaria hygrometrica Hedw.	3, 15, 22	r, s	m	sc
Hymenolomataceae	▲ *Hymenoloma crispulum* (Hedw.) Ochyra	16, 17	r	h	sc
Flexitrichaceae	▲ *Flexitrichum flexicaule* (Schwägr.) Ignatov & Fedosov	13	r	x	p
Dicranellaceae	▲ *Dicranella staphylina* H.Whitehouse	11	r	x	sc
	D. heteromalla (Hedw.) Schimp.	18	r	h	sc
	D. varia (Hedw.) Schimp.	1, 2, 6	r, s	h	p
Fissidentaceae	*Fissidens exilis*	1	s	x	sc
	F. taxifolius Hedw.	17	r, s	h	sc
Rhabdoweisiaceae	*Dicranoweisia cirrata* (Hedw.) Lindb.	17	Pn	m	sc
Ditrichaceae	*Ceratodon conicus* (Hampe) Lindb.	6, 9, 11, 34	r, s, Sa	m	p
	C. purpureus (Hedw.) Brid.	9	r	m	p
Pottiaceae	*Anoectangium aestivum* (Hedw.) Mitt.	8	r	x	sc
	Barbula unguiculata Hedw.	6, 7, 8, 9, 10, 12, 17, 18, 19, 22, 33	r, s, dw	m	sc
	Crossidium squamiferum (Viv.) Jur. var. *squamiferum*	2, 7, 9, 10	r	x	p
	C. squamiferum (Viv.) Jur. var. *pottioideum* (De Not.) Mönk.	2	s	x	p
	Didymodon acutus (Brid.) K. Saito	1, 4, 7, 10, 11, 13, 18, 20, 22	r, s, rs	m	p
	D. cordatus Jur.	6, 10, 18	r, rs, Co	m	p
	D. fallax (Hedw.) R.H. Zander	13	r	h	sc
	D. insulanus (De Not.) M.O. Hill	9, 17	r	m	sc
	D. luridus Hornsch.	6, 8, 10, 18, 19	r	m	p
	D. nicholsonii Culm.	2, 10, 12	r	m	sc
	D. rigidulus Hedw.	6, 7, 12, 22, 29, 30	r, s, Je	m	sc
	D. tophaceus (Brid.) Lisa	2, 8, 9, 10, 18, 22, 30	r	x	p
	D. vinealis (Brid.) R.H. Zander	1, 5, 6, 7, 9,11, 15, 17, 19, 22, 33	r, s	m	sc

Families	Taxa	L. N.	S.	H.	L.
	Eucladium verticillatum (With.) Bruch & Schimp.	21	r, s	h	sc
	Gymnostomum aeruginosum Sm.	31	e	m	sc
	G. calcareum Nees & Hornsch.	8, 18	r	m	sc
	G. viridulum Brid.	2	r	x	p
	Gyroweisia tenuis (Hedw.) Schimp.	18	r	h	sc
	Microbryum davallianum (Sm.) R.H.Zander	4	r	x	p
	Pterygoneurum ovatum (Hedw.) Dixon	2, 22	r, s	x	p
	Streblotrichum convolutum (Hedw.) P.Beauv.	1, 2	r, s	m	sc
	Syntrichia calcicola J.J. Amann	6, 7	r	h	sc
	S. caninervis Mitt. var. *caninervis*	1, 5, 6, 7, 8, 13, 19, 29, 33	r, s, rs, Je	x	p
	▲ *S. caninervis* var. *gypsophila* (J.J. Amann ex G. Roth) Ochyra	13, 18	r, Qp	h	p
	▲ *S. caninervis* Mitt. var. *pseudodesertorum* (Vondr.) M.T. Gallego	13	Qp	h	p
	S. echinata (Schiffn.) Herrnst. & Ben-Sasson	6, 10, 13	r, s, Sa, Co	h	sc
	S. handelii (Schiffn.) S. Agnew & Vondr.	6, 7, 15	r, s	m	p
	S. laevipila Brid.	6, 11, 17, 19, 22	r, dw, Jd	m	sc
	S. montana Nees	6	s	h	sc
	S. norvegica F.Weber	6, 17, 32	r, s, Ac	x	p
	S. papillosissima (Copp.) Loeske	3, 6, 9, 17, 22, 26, 32	r, s	x	p
	S. princeps (De Not.) Mitt.	1, 4, 7, 9, 11, 13, 15, 17, 18, 19, 2,	r, s, rs, Qp, Co, Jd, Pn	m	sc
	S. ruraliformis (Besch.) Mans.	4, 7, 9, 11, 13, 17, 31	r, s	m	sc
	S. ruralis (Hedw.) F. Weber & D. Mohr	1, 5, 6, 7, 9, 11, 12, 15, 16, 17, 18, 19, 26, 27, 31	r, s, rs, Qp, Sa, Pn, Po, Co	m	p
	S. subpapillosissima (Bizot & R.B. Pierrot ex W. Kramer) M.T. Gallego & I. Guerra	9, 10, 15	r	h	sc
	S. virescens (De Not.) Ochyra	1, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 17, 18, 20, 22, 27, 35	r, s, rs, dw, Je, Pn, Qp	x	p
	Tortella densa (Hedw.) Limpr.	4, 21	r	x	sc
	T. nitida (Lindb.) Broth.	17	s	h	sc
	T. squarrosa (Brid.) Limpr.	15, 18	r, s	m	p
	T. tortuosa (Hedw.) Limpr.	1, 2, 5, 13, 17, 19, 27, 33, 35	r, s, Co	m	sc
	Tortula acaulon (Herrnst. & Heyn) R.H. Zander var. *acaulon*	6, 9	r, s	x	p
	T. acaulon var. *pilifera* (Hedw.) R.H. Zander	17	s	h	sc
	T. atrovirens (Sm.) Lindb.	3, 4, 7	r	x	p
	T. brevissima Schiffn.	9, 22, 34	r	x	p
	▲ *T. canescens* Mont.	7	r	x	p
	T. hoppeana (Schultz) Ochyra	32	s	x	p
	T. inermis (Brid.) Mont.	1, 2, 4, 5, 6, 7, 9, 11, 13, 15, 18, 19, 20, 22, 27, 33, 34	r, s, dw, Co, Pn	x	p
	T. marginata (Bruch & Schimp.) Spruce	6, 17	r, s	h	sc
	T. mucronifolia Schwägr.	5, 11, 19	r, rs	x	p
	T. muralis L. ex Hedw.	1, 2, 6, 8	r, s	m	sc
	T. subulata Hedw.	1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 18, 19, 20, 22, 30, 34, 35	r, s, dw, Qp, Co	x	p
	▲ *T. vahliana* (Schultz) Mont.	11	Sa	h	p
	Trichostomum brachydontium Bruch.	1	s	x	sc
	T. crispulum Bruch.	10	r	h	sc
	Weissia condensa (Voit) Lindb.	1, 2, 3, 13, 27	r, s, Pn	x	p
	W. controversa Hedw.	2, 14, 22	r	x	p

Families	Taxa	L. N.	S.	H.	L.
Grimmiaceae	*Grimmia anodon* Bruch & Schimp.	2, 3, 7, 9, 10, 11, 12, 18, 27, 31	r, s, Pn, Qp	x	p
	G. decipiens (Schultz) Lindb.	5, 22	r	x	p
	G. dissimulata E.Maier	9, 18	r	x	p
	G. donniana Sm.	7, 10, 17	rs, Je, Po	h	sc
	G. elatior Bruch ex Bals.-Criv. & De Not.	9	r	x	p
	▲*G. elongata* Kaulf.	9	r	h	sc
	▲*G. funalis* (Schwägr.) Bruch & Schimp.	31	r	m	sc
	G. leavigata (Brid.) Brid.	2, 3, 4, 7, 9, 10, 11, 16, 17, 18, 19	r, s	x	
	G. lisae De Not.	6, 8, 9, 11, 15 17, 18, 22, 26	r, s, Sa, Ac	m	sc
	G. longirostris Hook.	10, 18	r, Sa, Qp	h	sc
	G. montana Bruch & Schimp.	9	s	x	p
	▲*G. muehlenbeckii* Schimp.	18	s	h	sc
	G. ovalis (Hedw.) Lindb.	1, 7, 11, 15, 17, 19	r, s	m	p
	G. pulvinata (Hedw.) Sm.	1, 2, 3, 5, 6, 7, 10, 11, 15, 17, 19, 27, 31	r, s, rs, Pn, Jd, Ac, Qc	m	sc
	G. reflexidens Müller Hal.	7, 10, 12, 13, 17,18, 19	r, s, Je	x	p
	Schistidium apocarpum (Hedw.) Bruch & Schimp.	1, 3, 8, 11, 15, 17, 22, 30, 31, 33	r, s, rs	h	sc
	S. atrofuscum (Schimp.) Limpr.	2, 7, 12, 15, 33	r	x	p
	S. brunnescens Limpr.	10	r	h	sc
	S. confertum (Funck) Bruch & Schimp.	1, 4, 9, 11	r, s	x	p
	S. crassipilum H.H.Blom	6, 9, 18, 31	r, s, Qc	x	p
	S. flaccidum (De Not.) Ochyra	7, 9, 12, 15	r, s	m	p
	S. helveticum (Schkuhr) Deguchi	7	r	x	p
	S. papillosum Culm.	33	r	x	p
	S. platyphyllum (Mitt.) H.Perss.	1, 6, 18, 19	r, s	h	sc
	▲*S. poeltii* H.H.Blom	17	r	h	sc
	▲*S. pruinosum* (Wilson ex Schimp.)	14, 16	r	m	sc
	S. rivulare (Bridel) Podpera	6, 7, 8, 9, 21	r	m	sc
Bartramiaceae	*Philonotis calcarea* (Bruch & Schimp.) Schimp.	8	r	x	p
	P. fontana (Hedw.) Brid	11	s	x	sc
	▲*P. tomentella* Molendo	11, 32	r, s	x	p
Bryaceae	*Bryoerythrophyllum recurvirostrum* (Hedw.) P.C.Chen	17, 27, 30	r, s, dw	h	sc
	B. rubrum (Jur. ex Geh.) P.C.Chen	17, 33	r, dw	h	sc
	Bryum argenteum Hedw.	2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 18, 30, 35	r, s, Sa	x	p
	B. dichotomum Hedw.	2, 5, 10, 17, 22, 29, 35	r	x	p
	B. gemmiferum R. Wilczek & Demaret, Bull.	9	r	m	sc
	B. gemmiparum De Not.	22, 30	r	m	sc
	Imbribryum alpinum (Huds. ex With.) N.Pedersen	10, 12, 22, 32	r, s	x	p
	Ptychostomum capillare (Hedw.) Holyoak & N.Pedersen	2, 4, 5, 6, 9, 11, 12, 15, 17, 18, 20, 22, 27, 30, 33	r, s, rs, dw, Qp, Qc	m	p
	P. compactum Hornsch.	2, 5, 7, 8, 9, 10, 11, 16, 17, 18, 22, 26, 32, 35	r, s, rs, dw	x	p
	P. donianum (Grev.) Holyoak & N.Pedersen	6, 9, 11, 12, 15, 16, 17, 18, 21	r, s, rs, Qp	m	sc
	▲ *P. elegans* (Nees) D.Bell & Holyoak	32	s	x	p
	P. kunzei (Hornsch.) J.R. Spence	7, 8	r, s	x	p
	P. knowltonii (Barnes) J.R.Spence	5, 6, 13	r	x	p

Families	Taxa	L. N.	S.	H.	L.
	P. imbricatulum (Müll. Hal.) Holyoak & N. Pedersen	1, 2, 5, 6, 7, 9, 11, 17, 19, 22, 26, 31, 34	r, s, rs	m	p
	P. inclinatum (Sw. ex Brid.) J.R.Spence	6, 9, 11, 12, 15, 17 19, 22, 32, 34, 35	r, s, rs	m	sc
	P. moravicum (Podp.) Ros & Mazimpaka	4, 6, 7, 8, 12, 14, 17, 18, 19, 22, 35	r, s, dw, Je, Ql, Qc, Pn,	x	p
	P. pallens (Sw. ex anon.) J.R.Spence	22	r	x	p
	P. pallescens (Schleich. ex Schwägr.) J.R.Spence	5, 7, 9, 12, 22, 32	r, s, Qp	x	p
	P. pseudotriquetrum (Hedw.) J.R. Spence & H.P. Ramsay	7, 10, 11, 15, 17, 32	r, rs, Qc	m	sc
	P. torquescens (Bruch & Schimp.) Ros & Mazimpaka	1, 2, 3, 9, 13, 14, 17, 18, 19, 22, 27, 32, 33	r, s, Qp, Qc	x	p
	Pohlia melanodon (Brid.) A.J.Shaw	8, 11, 12, 18, 22	r, s	x	p
	P. cruda (Hedw.) Lindb.	18	r	h	sc
Mniaceae	*P. elongata* Hedw.	18	r	h	sc
	▲ *P. wahlenbergii* (F.Weber & D.Mohr) A.L.Andrews	18	r	x	p
	Epipterygium tozeri (Grev.) Lindb.	11, 18	r	m	sc
	Lewinskya affinis (Schrad. ex Brid.) F.Lara, Garilleti & Goffinet	6, 7, 11, 17	r, s dw, Sa	x	p
	L. laevigata (J.E.Zetterst.) F.Lara, Garilleti & Goffinet	19	r	m	p
	L. rupestris (Schleich. ex Schwägr.) F.Lara, Garilleti & Goffinet	9, 11, 12, 13, 16, 17, 18, 19, 21, 32	r, s, dw, Qp, Qc, Ac, Co	h	sc
	L. speciosa (Nees) F.Lara, Garilleti & Goffinet	3, 17, 19, 20	dw, Qp, Jd, Pn	x	p
	L. striata (Hedw.) F.Lara, Garilleti & Goffinet	7	r	m	p
	▲ *Nyholmiella obtusifolia* (Brid.) Holmen & Warncke	11	dw	m	sc
	Orthotrichum alpestre Bruch & Schimp.	6, 7, 8, 9, 17	r, dw, Je	x	p
	O. anomalum Hedw.	1, 7, 8, 9, 12, 15, 18, 22, 31	r, s, Qp, Sa	x	sc
	O. bistratosum (Schiffn.) Guerra	7, 12, 16, 18	r, s, Qp	x	p
Orthotrichaceae	*O. cupulatum* Brid.	1, 2, 5, 6, 7, 8, 10, 11, 12, 15, 17, 18, 19, 22, 27	r, s, dw, Qp, Sa, Qc,	x	p
	O. diaphanum Brid.	4, 11, 15	r, Pn, Jd, Co, Pn	x	p
	O. pallens Bruch ex Brid.	5, 10, 17	Sa, Ac, Qc	h	sc
	O. patens Bruch ex Brid.	8, 13, 17	Qp, Ac, Je	h	p
	O. pumilum Sw. ex Anon.	6, 19	Co, Jd	h	sc
	O. scanicum Grönvall	14	Ac	m	sc
	O. stramineum Hornsch. ex Brid.	16	dw	m	sc
	O. tenellum Bruch ex Brid.	1, 3, 4, 5, 11, 12, 14, 15, 17	dw, Pn, Co, Jd, Ac, Je, Qc, Sa	x	sc
	O. urnigerum Myrin	7, 19	r	h	sc
	Pulvigera lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra	18	Po	x	sc
	Zygodon rupestris Schimp. ex Lorentz	11	Sa, Po	x	p
Pterigynandraceae	*Pterigynandrum filiforme* Hedw.	17, 27, 35	dw, Pn	m	sc
	Cratoneuron filicinum (Hedw.) Spruce	5, 6, 7, 8, 9, 11, 17, 21, 22, 30	r, s	m	sc
Amblystegiaceae	*Palustriella commutata* (Hedw.) Ochyra	8, 11, 21	r	x	sc
	P. decipiens (De Not.) Ochyra	7, 9, 21, 33	r, rs	h	sc
	P. falcata (Brid.) Hedenäs	15, 21	r	h	sc
	Amblystegium serpens (Hedw.) Schimp.	11, 31	s, Sa	m	sc

Families	Taxa	L. N.	S.	H.	L.
	Campyliadelphus chrysophyllus (Brid.) R.S.Chopra	1, 4, 6, 19	r, s, Jd	x	sc
	Campylium bambergeri (Schimp.) Hedenäs, Schlesak & D. Quandt	17	Pn	m	sc
	▲*Drepanocladus aduncus* (Hedw.) Warnst.	11	s	x	p
	Hygroamblystegium fluviatile (Hedw.) Loeske	7, 11	r, s	h	sc
	H. humile (P.Beauv.) Vanderp., Goffinet & Hedenäs	11	s	x	sc
	H. tenax (Hedw.) Jenn.	9, 11, 22	r, s	x	sc
	H. varium (Hedw.) Mönk.	17, 35	dw, Qc	h	sc
Brachytheciaceae	*Plasteurhynchium striatulum* (Spruce) M.Fleisch.	6	r	m	sc
	Rhynchostegium confertum (Dicks.) Schimp.	11	s	m	sc
	R. riparioides (Hedw.) Cardot	8, 9, 11, 30, 32	r, s	x	sc
	▲*Brachytheciastrum collinum* (Schleich. ex Müll. Hal.) Ignatov & Huttunen	8	r	x	sc
	B. velutinum (Hedw.) Schimp.	1, 5, 6, 9, 11, 12, 14, 16, 17, 18, 19,	r, rs, s, dw, Co, Pn, Sa, Qp, Ac	x	sc
	Brachythecium albicans (Hedw.) Schimp.	5, 6, 11, 12	r, s, dw, Qp	x	sc
	B. capillaceum (F. Weber & D. Mohr) Giacom.	1, 4, 6, 11, 12, 18, 19	r, s, Qp, Qc	x	p
	B. glareosum (Bruch ex Spruce) Schimp.	3, 8, 11, 12, 20	r, s, dw, Qc, Je	x	sc
	B. mildeanum (Schimp.) Schimp.	5, 6, 9, 12, 17, 18, 19, 20, 22, 34, 35	r, s, Qc, Qi, Pn	m	sc
	B. rivulare Schimp.	7, 11	r, Sa, Qc	m	p
	B. rutabulum (Hedw.) Schimp.	6, 7, 11, 12, 22	r, s	x	p
	B. salebrosum (Hoffm. ex F. Weber & D. Mohr) Schimp.	7, 15, 19	r, s, rs	h	sc
	Eurhynchiastrum pulchellum (Hedw.) Ignatov & Huttunen	12	s	x	sc
	Homalothecium aureum (Spruce) H.Rob.	4	r	x	sc
	H. lutescens (Hedw.) H. Rob.	4, 5, 6, 8, 11, 13, 14, 15, 17, 18, 19, 20, 27, 35	r, dw, Qc, Ql, Pn, Qp	m	sc
	H. philippeanum (Spruce) Schimp.	5, 7, 9, 11, 12, 13, 14, 15, 17, 20, 32, 33, 35	r, s, rs, Qp, Pn	x	p
	H. sericeum (Hedw.) Schimp.	5, 7, 11, 13, 16, 17, 18, 19, 20, 33	r, s, dw, Co, Qp, Qc	h	sc
	Kindbergia praelonga (Hedw.) Ochyra	6, 11	r, s	m	p
	Sciuro-hypnum plumosum (Hedw.) Ignatov & Huttunen	17	Pn	h	sc
	S. populeum (Hedw.) Ignatov	31	s	m	p
	Scleropodium cespitans (Wilson ex Müll. Hal.) L.F. Koch	32	s	x	p
	S. touretii (Brid.) L. F. Koch	1	s	x	sc
Hypnaceae	▲*Hypnum andoi* A.J.E. Sm.	17	r	h	sc
	H. cupressiforme var. *cupressiforme* Hedw.	11	r, Sa	x	p
	H. cupressiforme Hedw. var. *lacunosum* Brid.	17	r	h	sc
Pylaisiaceae	*Calliergonella cuspidata* (Hedw.) Loeske	6, 11	r, rs, Pn	x	sc
Leucodontaceae	*Leucodon sciuroides* (Hedw.) Schwägr.	13, 16, 18	r, s, Qc	h	sc
	Nogopterium gracile (Hedw.) Crosby & W.R. Buck	12, 19	r, s	h	p
Neckeraceae	*Leptodon smithii* (Hedw.) F. Weber & D. Mohr	24	s	m	sc

Discussion

Pottiaceae with 56 taxa, *Grimmiaceae* with 27 taxa, and *Brachytheciaceae* with 22 taxa have been the most species-rich families in the overall bryoflora of Karınca Mountain. These families constituted 54% of the all families. Acrocarpous *Pottiaceae* have proved to be the most species-rich family in the study area and in Turkey (Erdağ & Kürschner 2017a). Distribution of the number of taxa identified in the study area according to the families and percentage rates is given in Fig. 5.

Pottiaceae, the acrocarpous family, contains many desiccation-tolerant members that can adapt to several ecosystems, and is the dominant family in the Mediterranean macrobioclimate (Ros & al. 2013). Therefore, members of this family have been common and abundant in the study area. The fact that members of the acrocarpous *Grimmiaceae* with xerophytic character have been more widespread in the study area is due to the dominance of xeric habitats in the forest clearings and on calcareous rocks in the southern parts of the area. Pleurocarpous *Brachytheciaceae* members usually grew on soil, calcareous rocks, decaying wood, and bark. The humid habitats formed by the streams, especially in the northern parts of the area, provided a suitable living environment for the mesophytic *Brachytheciaceae* members. Other species-rich families in the study area have been *Orthotrichaceae*, and *Bryaceae*. Forest floors and humid rocky habitats in the study area have been inhabited by the mesophytic members of *Bryaceae* (20 taxa). The acrocarpous *Orthotrichaceae* family, with a xerophytic character and mostly epiphytic members, has been represented by a total of 20 taxa on tree trunks and rocks, in both the southern and northern parts of Karınca Mountain.

Fig. 5. Distribution of taxa according to their families and percentage.

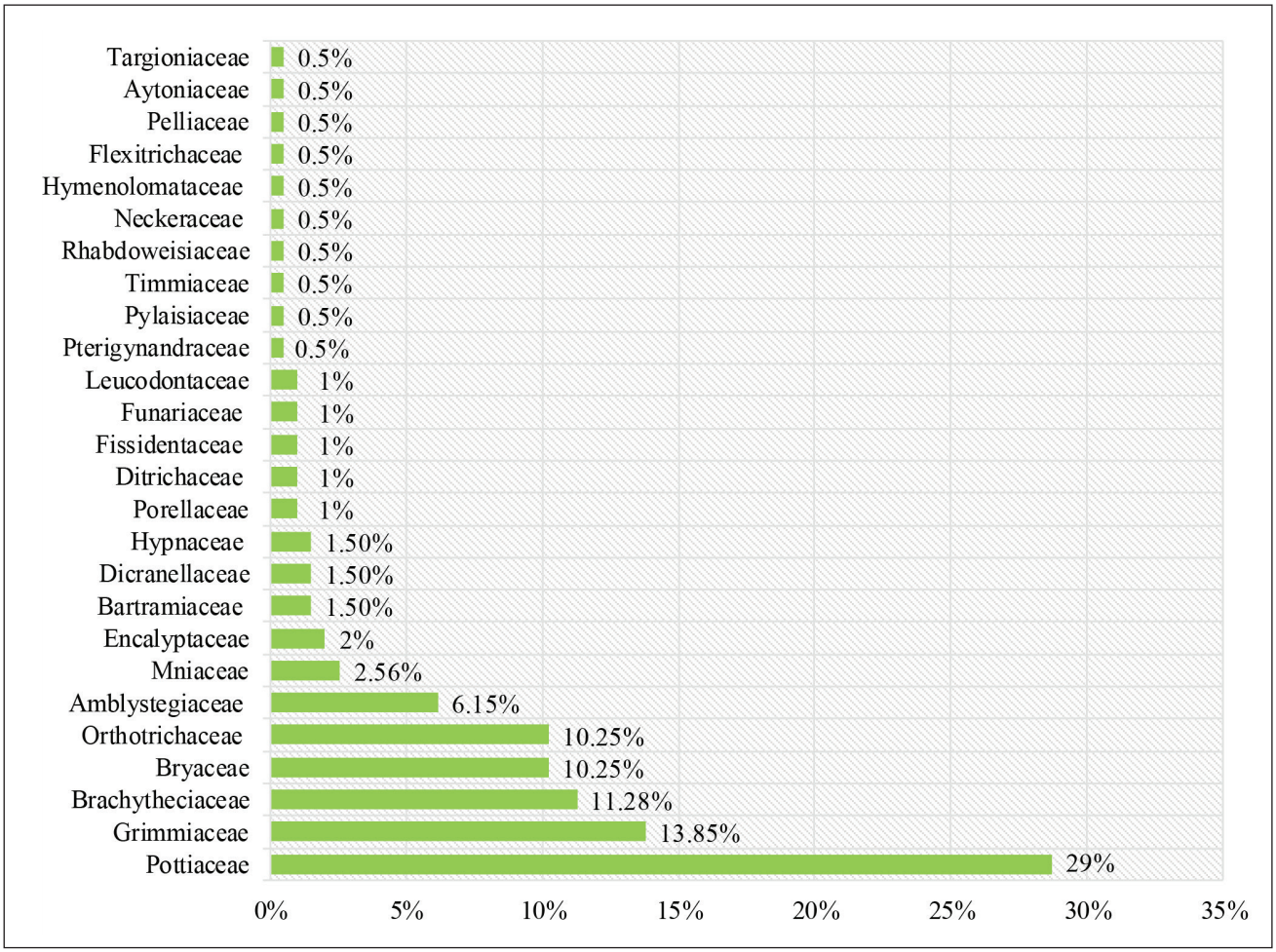
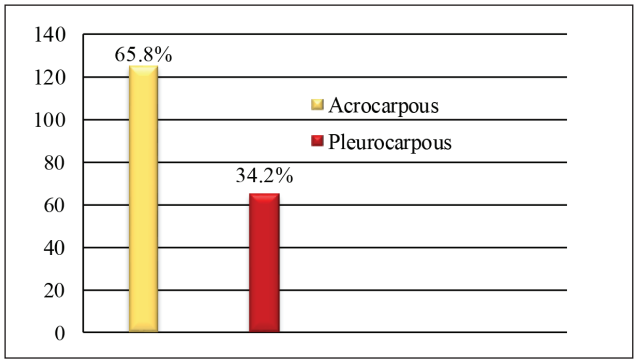


Fig. 6. Distribution of acrocarpous and pleurocarpous taxa in the study area.



Dominance of acrocarpous mosses in the study area has been due to the presence of xeric habitats receiving direct sunlight, especially in forest clearings in the southern parts of the mountain. Pleurocarpous moss members, on the other hand, have been distributed mostly on humid rocks, humid tree trunks and humid soils under the forest canopy in the northern parts of the area (Fig. 6).

In terms of the number of genera, the three richest families were *Pottiaceae* with 15 genera, *Brachytheciaceae* with nine genera, and *Amblystegiaceae* with seven genera. *Syntrichia* and *Grimmia* with 15 taxa, *Ptychostomum* with 13 taxa and *Tortula*, *Schistidium* and *Orthotrichum* with 12 taxa were the richest genera. The ratio of taxa in those genera was 40.5% (Table 2). Richness of those genera in the number of taxa was due to the fact that the area was located in the transition zone between the Mediterranean and Irano-Turanian Phytogeographic Regions. Furthermore, in terms of frequency, the most common species in the study area have been *Grimmia pulvinata*, *Homalothecium philippeanum*, *Lewinskya rupestris*, *Syntrichia ruralis*, *S. virescens*, *Tortula inermis*, and *T. subulata*. Those species were acrocarpous in character and showed that xeric steppe and rock vegetation dominated the area.

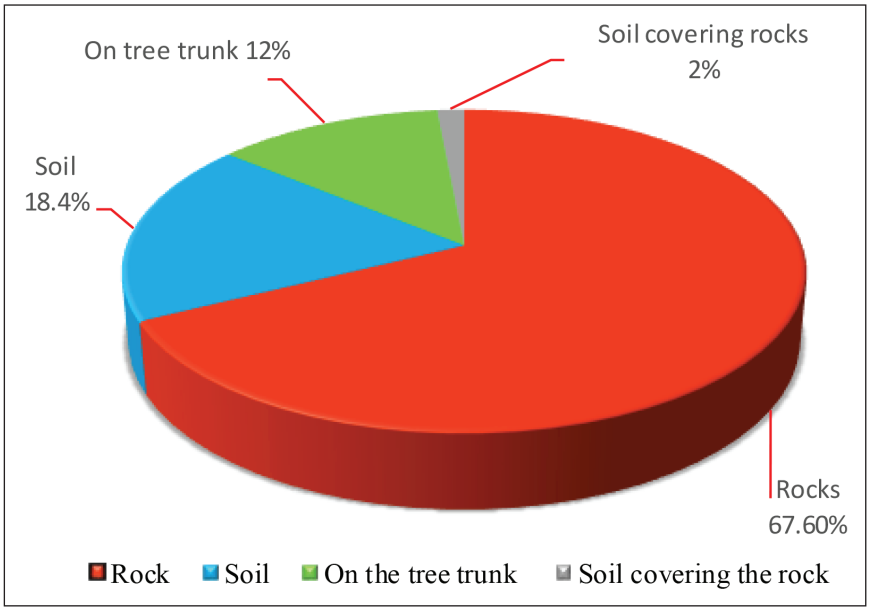
Twenty taxa have been new to C13 square, according to Henderson's grid-square system (1961). Among them, *Schistidium poelti* was recorded in the study area as new for Turkey and Southwest Asia (Keskin & al. 2021a). *S. poeltii*, a saxicolous moss species, has been collected on rock surface in the alpine zone of Karınca Mountain. That species was reported from the western part of the Scandinavian mountain range (Norway and Sweden). It was rare outside Scandinavia (Canada and Greenland) (Blom, 1996). Therefore, the record of *S. poeltii* from Anatolia stands as an important extension of its range southwards.

With respect to substrate preferences of the taxa from the study area, the most common substarte was rock, followed by soil, tree trunks (epiphytic), and soil covering rocks (Fig. 7).

The fact that most taxa identified in the study area preferred rock surfaces could be explained by the existence of rocky and open habitats in the arid periods of the typical Mediterranean climate in the study area.

Preferred tree species by the epiphytic taxa were mostly *Quercus pubescens* (24 taxa) and *Pinus nigra* (21 taxa). In addition to those two porophyte species, *Salix alba* (17 taxa), *Carpinus orientalis* (13 taxa), *Juniperus exelsa* (10 taxa), *Abies cilicica* (8 taxa), *J. drupacea* (7 taxa), *Cedrus libani* (6 taxa), and *Platanus orientalis* (4 taxa) were also preferred by the epiphytic taxa.

Fig. 7. Distribution of taxa according to their substrate preferences.



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