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THE EPIPHYTIC BRYOPHYTE FLORA AND VEGETATION OF BORABOY AND DESTEK FORESTS (AMASYA, TURKEY)

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Abstract

In this study, epiphytic bryophyte flora and vegetation were investigated of Boraboy and Destek forests in Amasya province (Turkey). A total of 22 bryophyte taxa (19 mosses, 3 liverworts) were recorded in the research site. As a result of the investigation of 32 sampling releves taken from the trunks by the Braun-Blanquet method, two epiphytic bryophyte associations (*Orthotrichetum pallentis*and *Orthotrichetum striati*) belonging to the *Ulotion crispae*alliance were detected. Among these syntaxa *Orthotrichetum pallentis*was recorded for the first time from Turkey. Furthermore, the life forms and life strategies spectrum in syntaxa were analyzed. Analysis result indicates a distinct correlation between life forms, strategies and ecological conditions of the area. Weft and cushion are dominant life forms, Perennial stayers with high sexual reproductive effort is dominant life strategy in the syntaxa. In addition, the ecological characteristics of bryophyte taxa were evaluated. According to these results the largest number of epiphytic bryophytes in the area are mesophytic, sciophyte and subneutrophyte.

Key words: Epiphytic communities, Life forms, Life strategies, *Orthotrichetum pallentis, Orthotrichetum striati*.

Introduction

Due to, the lack of protective epiderm, epiphytic bryophytes are susceptible against to the climatic conditions (Frahm *et al.*, 2003; Frego, 2007). Although most epiphytictaxa can cope with minor environmental changes, they can easily dry when exposed to drastic increases in isolation or fluctuationsin humidity (Barkman, 1958; Frahm *et al.*, 2003; Leon-Vargas *et al.*, 2006). Changes in the environment conditions (moisture, light etc.) consist of different microhabitats on different trees (Barkman, 1958). In these microhabitats, epiphytic bryophytes whose ecological needs are similar come together to form colonies (Schofield, 2001).

In the last decade, studies about epiphytic bryophyte communities in Turkey havebeen increasingly progressing (Alataş & Uyar, 2017; Ezer, 2017; Alataş *et al.*, 2015; 2016; Alataş & Batan, 2014; 2015; Kürschner *et al.*, 2012; Kara *et al.*, 2011; Düzenli *et al.*, 2009; Kürschner *et al.*, 2006; 2007). In bryososyological studies on epiphytic bryophytes vegetation, a total of 26 syntaxa till to date have been determined from Turkey. They are; *Orthotricho franzoniani, Antitrichietum breidlerianae* Walther 1969, *Scorpiurio sendtneri, Zygodontetum vulgaris* Walther 1975, *-cinclidotetosum mucronati* Kürchner 1998, *Brachythecio olympici Dicranoweisietum cirratae* Walther 1969, *Orthotrichetum lyellii* Lecointe 1975, *Orthotrichetum striati* (Gams, 1927) Marst. 1985, *Anomodonto-Leucodontetum sciuroidis, -palamocladietosum euchloronis* Kürschner & Düzenli 2009, *Anomodontetum attenuati* (Barkm. 1958) Pec. 1965, *Palamocladio euchloronis-Leucodontetum immersi* Kürschner, Kırmacı & Parolly 2012, *-neckeretosum crispae* Kürschner, Kırmacı & Parolly 2012, *Pseudoleskeello nervosae Leucodontetum immersi* Kürschner, Kırmacı & Parolly 2012, *Syntrichietum papillosae* Jaeggli 1934, *Pylaisietum polyanthae* Felf. 1941, *Dicrano scoparii - Hypnetum cupressiformis* Barkman 1958, *-sanionietosum uncinatae* Grgic 1983, *Plagiothecietum neglecti* Ricek 1968, *Pylaisietum polyanthae* Felf. 1941 *-lophocoleetosum heterophyllae* Kara, Ezer & Alataş 2015, *Leptodonto smithii-Leucodontetum sciuroidis* Priv. & Pug. 1997, *Cryphaeetum arborae* Barkman 1958, *-orthotrichetosum diaphani* Lecointe 1975, *Dicranetum taurici* Neu ex v. Hübschm, 1978, *Pterigynandretum filiformis* Hil. 1925, *Orthotricho straminei, Pterigynandretum filiformis* Gillet, 1986 and *Lewinskyetum affinis*Alataş & Uyar, 2017. Despite these studies, there are important gaps on the epiphytic bryophyte vegetation in Turkey (Kürschner *et al.*, 2007). Therefore, the aim of the present paper was to perform phytosociological investigations of the epiphytic bryophyte vegetation of Boraboy and Destek forests and to make contribution to the Turkish bryosociological studies. It is hoped that this study will be useful as a guide for future studies.

Material and Methods

Study area: The study site (Boraboy and Destek forests) is located in the Euxinian Zone of the Euro-Siberian phytogeographical region of Turkey(Zohary, 1973). The area is situated in the A3 square according to the grid system of Turkey adopted by Henderson (1961) (Fig. 1).

The climate type of study site is mainly semi-arid Mediterranean climate which have extremely cold winters, dry and warm to hot summers (Akman, 1990). Average annual precipitation in Amasya is 444.1 mm and average annual temperature is 13.5°C (Fig. 2).

Due to the study area take place in the transition zone between the Black Sea and the Central Anatolia regions, vegetation is under the influence of the temperate and humid Black Sea and arid territorial Central Anatolia climate (Özhatay *et al.*, 2005).

The main type of vegetation in study site is forest. Forest vegetation in the study site comprises a mixed forest of coniferous and deciduous. Dominating coniferous forest trees in study site are *Pinus brutia* Ten. and *P. sylvestris* L. They are dominant over 1300 meters. The mainly deciduous forests in study site consist of *Acer platanoides* L., *Carpinus betulus* L., *Fagus orientalis* Lipsky., *Pyrus communis* L., *Quercus cerris* L., *Q. pubescens* Willd. *F. orientalis*is dominant between 1100 and 1300 meters in the study site as pure and mixed forests.

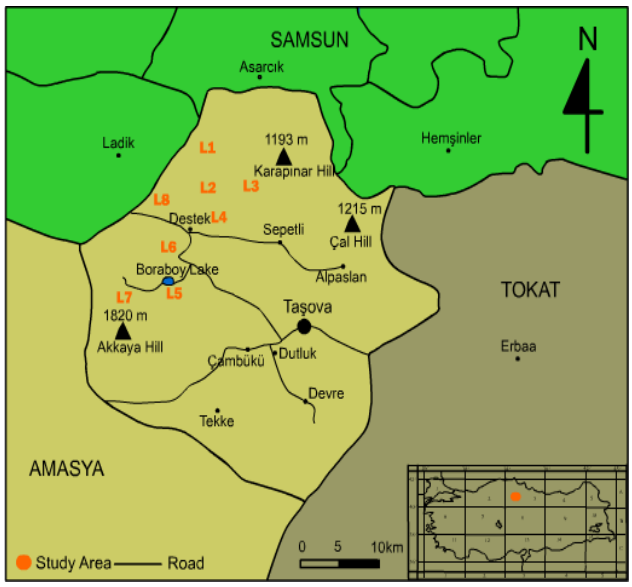

Fig. 1. Grid system of Turkey adopted by Henderson (1961) and the localities (L) of the study area.

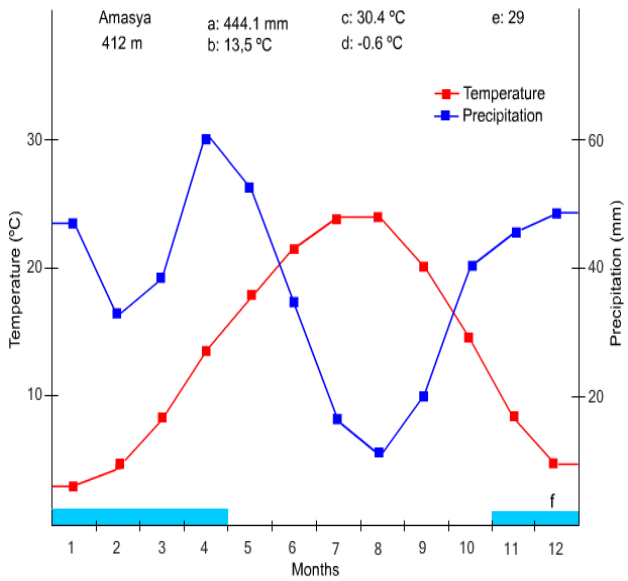

Fig. 2. The climatic diagram of Amasya.

Table 1. The list of localities.

Number of relevés	Number of localities	Altitude (m)	Phorophyte	Date	GPS Coordinates
1-10	1	1211	*F.o.*	18.05.2013	N 40°55'31.99" E 36°12'10.30"
11-13	2	1308	*P.s., F.o.*	19.05.2013	N 40°53'28.38" E 36°11'50.39"
14-17	3	1174	*P.c.*	19.05.2013	N 40°53'10.92" E 36°13'23.75"
18-22	4	945	*Q.c.*	20.07.2013	N 40°51'05.82" E 36°12'45.52"
23-28	5	1088	*C.b., A.p.P.s.*	20.07.2013	N 40°48'12.24" E 36°09'30.00"
29	6	1354	*P.s., F.o.*	04.10.2013	N 40°49'07.88" E 36°09'06.59"
30,31	7	1194	*F.o.*	04.10.2013	N 40°47'46.06" E 36°08'13.58"
32	8	1224	*P.b.*	04.10.2013	N 40°52'35.71" E 36°08'57.07"

(*F.o.: Fagus orientalis, P.c.: Pyrus communis, Q.c.: Quercus cerris, A.p.: Acer platanoides, P.b.: Pinus brutia, C.b.: Carpinus betulus, P.s.:Pinus sylvestris)*

Vegetation sampling and data sources: The research materials were composed of 32 sampling relevés and 193 bryophyte specimens were collected from the trunks of trees occurring in the different localities of the Boraboy-Destek forests with varying ecological characteristics (Table 1). For the relevés, trees with different diameters depending on floristic composition were selected. The relevés were performed from the base (0.2-0.5 m, 12 relevés) and trunk (0.5-1.6 m, 20 relevés).

For bryosociological analysis the plant sociological method of Braun Blanquet (1964) was followed. The cover of each taxon was estimated according to the following values; + (<1%), 1 (1-10%), 2 (10.1-25%), 3 (25.1-50%), 4 (50.1-75%) and 5 (75.1-100%).

In addition, ecological (moisture, light etc.) and statistical (tree diameter, height, coverage etc.) data were recorded for each relevébased on the field observations.

Bryophyte specimens were identifed by consulting keys (Paton, 1999; Mazimpaka *et al.*, 2000; Cortini Pedrotti, 2001; Smith, 2004; Kürschner & Frey, 2011; Lara & Garilleti, 2014; Plášek *et al.*, 2015; Lara *et al.*, 2009; 2010; 2016). The nomenclature of the taxa in the floristic list is according to Söderström *et al.* (2016) for liverworts, and Ros *et al.* (2013) for mosses. The specimens were stored in special collection of the Alataş.

Marstaller (2006) was followed for syntaxonomic arrangement and synsystematic proposal was in accordance with the International Code of Phytosociological Nomenclature (ICPN, Weber *et al.*, 2000). The life forms of the species were determined according to Mägdefrau (1982), the life strategies of the species according to During (1979) and Frey and Kürschner (1991), and the habitat affinities of the taxa according to Draper *et al.* (2003). The ecological characteristics of the taxa such as humidity, light and acidity were regulated in accordance with Dierβen (2001).

Results and Discussion

Epiphytic flora: As a result of the study, twenty-two epiphytic bryophyte species were determined (19 mosses, 3 liverworts) (Table2). *Fagus orientalis* was the most species-rich tree in the study site, while the *Pinus brutia* was the poorest tree. *Leucodon sciuroides, Orthotrichum pallens, Lewinskya striata, Pterigynandrum filiforme, Frullania dilatata, Radula complanata* and *Porella platyphylla* were the mostly found taxa at the epiphytic habitats. Among them, *O. pallens* is the only species found on all trunk of tree species.

Table 2. Floristic list and ecological characteristics of taxa.

Families	Taxa	LN	H	L	A	Substrat (Tree species)						
						F.o.	P.s.	Q.c.	P.c.	A.p.	C.b.	P.b.
	Marchantiopsida											
Frullaniaceae	*Frullania dilatata* (L.) Dumort.	1,2,3,4,5,6	h	S	a	+	+	+	+		+	
Porellaceae	*Porella platyphylla* (L.) Pfeiff.	1,2,5,7	m	S	a	+				+	+	
Radulaceae	*Radula complanata* (L.) Dumort.	1,2,4,5,6,7	h	S	s	+		+		+	+	
	Bryopsida											
Grimmiaceae	*Grimmia pulvinata* (Hedw.) Sm.	3	x	P	a				+			
Dicranaceae	*Dicranum tauricum* Sapjegin.	2,6	m	S	a		+					
Pottiaceae	*Syntrichia princeps* (De Not.) Mitt.	3,4	m	S	a			+	+			
	Syntrichia ruralis (Hedw.) F. Weber & D.Mohr.	1,4,7	x	P	s	+		+				
	Syntrichia virescens (De Not.) Ochyra.	8	x	P	s							+
	Tortula subulata Hedw.	3	m	S	s				+			
Bryaceae	*Bryum moravicum* Podp.	3,4,5	m	S	s		+	+	+	+	+	
Orthotrichaceae	*Lewinskya affinis* (Schrad. ex Brid.) F. Lara, Garilleti & Goffinet	3,4,5	m	S	s			+	+		+	
	Pulvigera lyellii (Hook. & Taylor) Plášek, Sawicki & Ochyra.	7,8	m	P	s	+						+
	Orthotrichum pallens Bruch ex Brid.	1,2,3,4,5,6,8	h	S	s	+	+	+	+	+	+	+
	Lewinskya striata (Hedw.) F.Lara, Garilleti & Goffinet	1,3,4,5,7	m	P	b	+		+	+		+	
Brachytheciaceae	*Brachytheciastrum velutinum* (Hedw.) Ignatov & Huttunen.	5,6	m	S	s	+					+	
	Homalothecium philippeanum (Spruce) Schimp.	1,2,3,4,5	x	S	b	+		+	+	+		
	Homalothecium sericeum (Hedw.) Schimp.	1,4,5	x	P		+		+			+	
Hypnaceae	*Hypnum andoi* A.J.E. Sm.	1,2,4,5,8	m	S	a	+	+	+		+	+	+
	Pylaisia polyantha (Hedw.) Schimp.	6	h	S	a		+					
Pterigynandraceae	*Pterigynandrum filiforme* Hedw.	1,2,3,5,6,7	m	S	s	+	+		+		+	
Leucodontaceae	*Leucodon sciuroides* (Hedw.) Schwägr.	1,2,3,4,5,6,7	m	P	a	+		+	+	+	+	
Lembophyllaceae	*Isothecium alopecuroides* (Lam. ex Dubois) Isov.	1	m	S	s	+						

(LN: Locality Number, F.o.: *Fagus orientalis*, P.c.: *Pyrus communis*, Q.c.: *Quercus cerris*, A.p.: *Acer platanoides*, P.b.: *Pinus brutia*, C.b.: *Carpinus betulus*, P.s.:*Pinus sylvestris* and certain ecological characteristics, H: humidity (m: mesophyte, h: hygrophyte, x: xerophyte), L: lighting (S: sciophyte, P: photophyte), A: acidity (a: acidophyte, s: subneutrophyte, b: basiphyte)

Dominated families of the study site are Orthotrichaceae (4 taxa), Pottiaceae (4 taxa), Brachytheciaceae (3 taxa), and Hypnaceae (2 taxa). The other 9 families have one taxon (Table 2). The Orthotrichaceae members were wide-spread on upper parts of the trunk, while Hypnaceae and Brachytheciaceae members were distributed in the more humid lower part of the trunk.

According to the humidity preference of taxa, mesophytes (59%) are dominant in the study site. These are followed by xerophytes (23%), and hygrophytes (18%). According to the light request of taxa; sciophytes (68%) are dominant in the study site (Fig. 3). The high rate of mesophytes and sciophytes found in study site is meaningful because of acrocarpic Orthotrichaceae, Pottiaceae and then pleurocarpic Brachytheciaceae and Hypnaceae members. These values indicate that the investigated area has semi-arid habitats as well as humid and shady habitats as the study area occurs in the transition zone between the Black Sea and the Central Anatolia regions. Considering acidity preference of taxa, subneutrophytes (50%) are dominant. These are followed by acidophytes (36%) and basiphytes (14%) in the study site (Fig. 3).

Epiphytic vegetation: As a result of the examination of the phytosociological 32 sampling relevés, two epiphytic bryophyte associations belonging to the Orthotrichetalia order of the Frullanio dilatatae-Leucodontetea sciuroidis class are determined. These are: 1. *Orthotrichetum pallentis* Ochsn. 1928, 2. *Orthotrichetum striati* (Gams 1927) Marst. 1985 the association *Orthotrichetum pallentis* is reported for the first time from Turkey.

Orthotrichetum pallentis Ochsn. 1928 (Table 3): *Orthotrichetum pallentis* was first defined by Ochsner in 1928 (Marstaller, 2006) and later on it was reported in Germany, Romania and Russia recpectively (Hübschmann, 1986; Marstaller, 2006; Goia & Schumacker , 2003; Baisheva, 2000).

The association is recorded within the total of 11 relevés taken from the tree trunks and more humid lower base in this study. It grows frequently on *Fagus orientalis* and then *Pinus sylvestris* and *Pinus brutia* in all localities of the study site (Fig. 4). The association mainly occurs on the northern aspects of the tree trunks epiphytically.

The species number per sampling relevé varies in the association from 4 to 8 (the average number of taxa are 5) and cover ranges from 60% to 96%.

The characteristic species of the association is acrocarpous *Orthotrichum pallens*, xerophytic or mesophytic species in open woodlands and semi-neutral environmentswith the highest constancy (100%).

Co-dominant species are highly constant peurocarpus *Hypnum andoi* and *Pterigynandrum filiforme*. At the same time, they are the alliance characteristics. Especially *Leucodon sciuroides*, *Radula complanata* and *Frullania dilatata* are the class characteristics, the other co-dominant species with highest cover values within the association.

The number of acrocarpous and pleurocarpous moss species are equall within the association. Therefore, the epiphytic community is wide-spread on sunny tree trunk and more humid lower base in the study site.

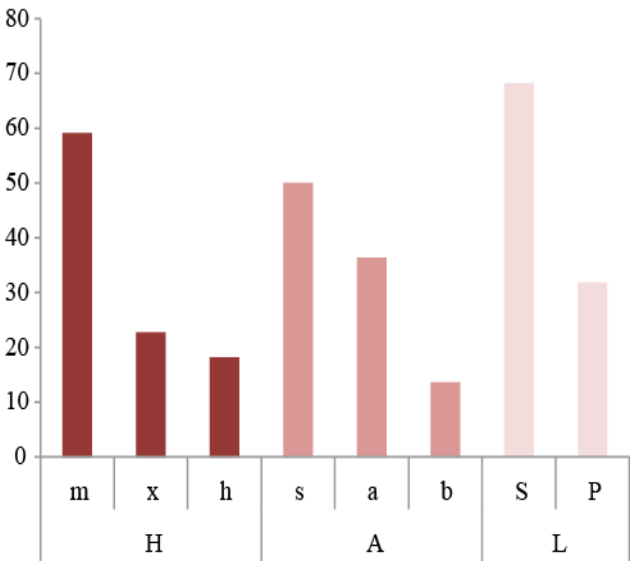

Fig. 3. Humidity (H), acidity (A) and the light (L) preferences of the taxa.

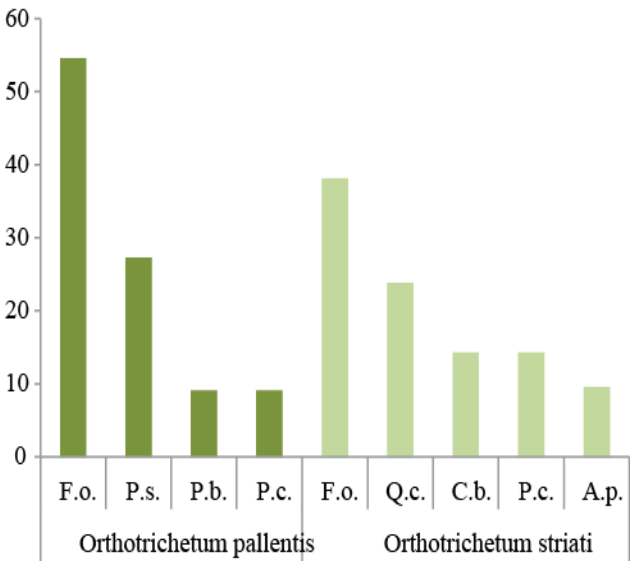

Fig. 4. The tree preferences of the syntaxa.

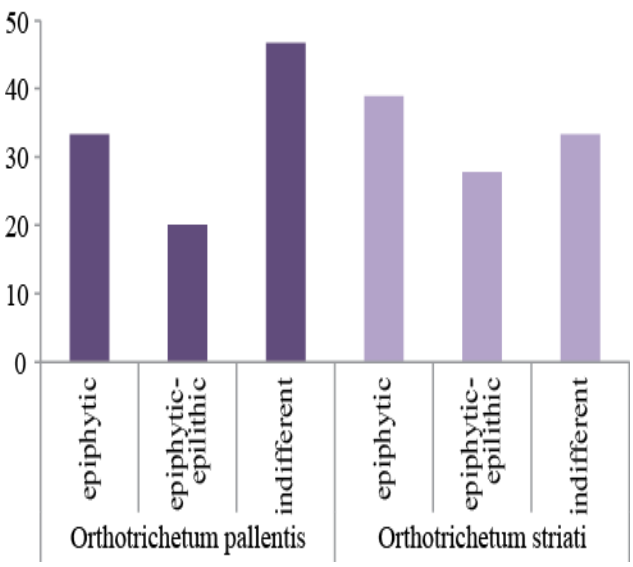

Fig. 5. The habitat affinities spectrum of the taxa in the syntaxa.

The habitat affinity of the taxa within the association; indifferent taxa are 47%, epiphytic taxa are 33%, epiphytic-epilitic taxa are 20% (Fig. 5).

Syntaxonomically, the association can be classified within the the *Ulotion crispae* alliance of the Orthotrichetalia order. Higher-ranked characteristic species; *Frullania dilatata, Leucodon sciuroides, Radula complanata, Pterigynandrum filiforme, Hypnum andoi* and *Pulvigera lyellii* support the classification within the epiphytic class Frullanio dilatatae-Leucodontetea sciuroidis, which are wide-spread at the northern hemisphere, phytosociologically (Table 3) Marstaller (2006).

In addition, the association in the study site matches in Romania (Goia & Schumacker, 2003) and Germany (Marstaller, 2006; Hübschmann, 1986) in terms of alliance, ordo and class characteristics.

***Orthotrichetum striati* (Gams, 1927) Marst, 1985 (Table 4):** The *Orthotrihetum striati* was first defined by Jaeggli (1934) in Italy as a Leucodon-Orthotrichum, then it was reported by Barkman (1958) as a *Orthotrichetum speciosi* from the Netherlands. Marstaller (1985) emphasized that this association reported by Barkman as a synonym of the *Orthotrihetum striati*. The association grows on shade and moist areas (Marstaller, 2006). It spreads semi-humid mountain belt in Scandinavia, Central Europe, France, Central Mediterranean, Italy and the Balkans. Also, the association was reported by Frey and Kürschner (1995) in Israel and Jordan on *Quercus coccifera* trees an then it was recorded for the first time by Kürschner *et al*. (2006) from *Quercus vulcanica* forests in Turkey.

In the present study, *Orthotrihetum striati*, an epiphytic community, was determined between 1066 and1194 meters of the study site within the total of 21 relevés taken from the tree trunks and lower base. The association mostly spreads on *Quercus cerris, Carpinus betulus* and *Fagus orientalis* growing on semi-arid and humid slopes in the study site (Fig. 4).

The character species of the community with the highest constancy is the xerophyte and mesophyte *Lewinskya striata*. It is wide-spread within the high mountain communities especially on *Quercus cerris* and *Q. pubescens* trees in Anatolia.

The co-dominants are facultative epiphytes *Pterigynandrum filiforme* and *Hypnum andoi*, typical epiphytes *Leucodon sciuroides, Radula complanata, Frullania dilatata* and obligate epiphytic *Orthotrichum pallens* and *Lewinskya affinis.*

A total of 18 taxa (3 liverworts, 15 mosses) were found within the *Orthotrichetum striati.* The species number per sampling relevé varied from 4 to 8 and the cover ranges from 65% to 90%.

The acrocarpous are dominant with 9 taxa within the epiphytic community. The xerophytic and drought-tolerant characteristics taxa of the community are found on sunny and semi-arid habitats and generally at the lower base and upper part of the trees in the study site.

The habitat affinity of the taxa within the association; epiphytic taxa are 39%, epiphytic-epilitics, facultative epiphytes, are 28% (Fig. 5).

Leucodon sciuroides, Radula complanata, Frullania dilatata, Lewinskya affinis, Orthotrichum pallens, Pulvigera lyellii, Pterigynandrum filiforme and *Hypnum andoi*have or show characteristic of higher phytosociological units. For this reason, the typical subassociation is evaluated within the *Ulotion crispae* aliiance of the Orthotrichetalia order and the Frullanio dilatatae-Leucodontetea sciuroidis class as Kürschner *et al*. (2006).

Life forms and life strategies: In this study, epiphytic communities of the Borabay and Destek forests seven life forms and life strategies belonging to taxa were determined (Tables 5 and 6, Figs. 6 and 7). Additionally, the main characters of the species within the epiphytic communities such as, life form, life strategy, spore dimension, sexual and asexual reproduction, life interval and diffusion strategies are presented in Table6.

Life forms (Fig. 6): In generally, cushion (Cu) and short turf (sT) forming acrocarpous mosses grow under xerophytic, sun-exposed conditions, whereas mat, weft, tail and fan forming pleurocarpous mosses and liverworts grow under the more humid, shady and hygrophytic conditions (Kürschner, 2004; Düzenli *et al.,* 2009, Kürschner *et al.,* 2012).

The dominant life forms in the *Orthotrichetum pallentis* are weft (We) with 27% and cushion (Cu) with 20 % due to pleurocarpous moss *Hypnum andoi*, the characteristic species of alliance, with the high cover and the character species acrocarpous moss is*Orthotrichum pallens* with the highest constancy. The other life forms such as, mat, fan and tail have lower percentage in the association.

Dominating life forms in the *Orthotrichetum striati* are cushion (33%) due to the highest constancy of the obligate epiphytic acrocarpous character species *Lewinskya striata*. The life form weft takes the second place (22%) within the community.

As a result of the life form analysis, *Orthotrichetum striati* is wide-spread in arid and sun-exposed slope in the study site as a xerophytic community, whereas *Orthotrichum pallentis* is more common in humid to mesic habitats as a mesophytic community.

Life strategies (Fig. 7): According to the analysis of the life strategies within the studied epiphytic communities; three main categories of life strategies; colonists, perennial shuttle species and perennial stayers were determined. These categories were further divided into sub-categories accordding to their reproduction strategies (Table 5). Perennial stayers with high sexual reproductive effort (Ag) are clearly dominant in the both communities due to the high constancy and cover of *Orthotrichum pallens, Lewinskya affinis* and *Hypnum andoi*. By contrast, colonists with high sexual and asexual reproductive effort (Bv,g), perennial shuttle species with high sexual reproductive effort (Pg) and pauciennial colonists (Ba) have relatively low proportion in the both communities. In general, the colonists are acrocarpous mosses of pioneer stages in the successional gardient (Kürschner *et al.,* 2012). Therefore, it can be said that the epiphytic communities in this study nearly reached to climax in successional stages due to low proportion of colonists and high proportion of perennial stayers with high sexual reproductive effort.

Table 3. *Orthotrichetum pallentis* Ochsn. 1928.

Number of relevés	**2**	**4**	**6**	**9**	**10**	**11**	**12**	**15**	**28**	**29**	**32**
Altitude (m)	1176	1176	1176	1176	1176	1308	1308	1175	1066	1354	974
Size of relevés (dm^2)	12	30	16	18	24	6	9	6	2	6	12
Phorophyte	F.o.	F.o.	F.o.	F.o.	F.o.	P.s.	P.s.	P.c.	P.s.	F.o.	P.b.
Diameter of Trunks (m)	1,3	1,4	1,7	2,1	1,6	1,6	1,4	1,4	1,1	1,2	1,6
Exposition	N	N	N	N	N	N	N	N	N	N	N
Position of relevés	N	N	N	N	N	N	N	NE	NE	NE	N
Covering (%)	91	90	90	96	85	60	65	60	65	90	80
Canopy (%)	100	100	100	100	100	90	90	80	100	90	80
Base (B) / Trunk (T)	T	T	T	T	T	T	T	B	B	B	B
Number of species	6	7	7	8	5	4	4	4	4	6	4
Characteristic species											
Orthotrichum pallens	2	2	3	2	2	1	2	1	1	3	2
Characteristic species of the *Ulotion crispae* alliance											
Hypnum andoi	3	.	2	2	2	4	4	.	4	.	4
Pterigynandrum filiforme	2	2	1	3	2	2	3	.	3	2	.
Pulvigera lyellii	.	.	.	.	.	.	.	.	.	.	3
Characteristic species of the *Orthotrichetalia* order and *Frullanio dilatatae-Leucodontetea sciuroidis* class											
Leucodon sciuroides	4	4	3	4	3	.	.	.	.	4	.
Radula complanata	.	2	2	2	.	.	.	.	.	3	.
Frullania dilatata	2	3	3	.	.	3	2	2	.	3	.
Others											
Homalothecium sericeum	.	.	.	1	.	.	.	.	.	.	.
Isothecium alopecuroides	.	1	.	.	.	.	.	.	.	.	.
Porella platyphylla	1	2	3	3	4	.	.	.	.	.	.
Syntrichia ruralis	.	.	.	1	.	.	.	.	.	.	.
Brachytheciastrum velutinum	.	.	.	.	.	.	.	.	.	2	
Syntrichia princeps	.	.	.	.	.	.	.	3	.	.	.
Syntrichia virescens	.	.	.	.	.	.	.		.	.	1
Bryum moravicum	.	.	.	.	.	.	.	4	1	.	.

Table 4.*Orthotrichetum striati* (Gams, 1927) Marstaller 1985.

Number of relevés	**1**	**7**	**14**	**8**	**26**	**18**	**19**	**16**	**20**	**13**	**22**	**23**	**21**	**24**	**3**	**25**	**17**	**30**	**5**	**31**	**27**
Altitude (m)	1176	1176	1175	1176	1066	1175	1175	1175	1175	1308	1175	1066	1175	1066	1176	1066	1175	781	1176	781	1066
Size of relevés (dm^2)	8	12	12	35	4	4	3	4,5	3	15	9	6	6	9	20	12	4	20	30	20	6
Phorophyte	F.o.	F.o.	P.c.	F.o.	A.p.	Q.c.	Q.c.	P.c.	Q.c.	F.o.	Q.c.	C.b.	Q.c.	C.b.	F.o.	C.b.	P.c.	F.o.	F.o.	F.o.	A.p.
Diameter of Trunks (m)	0,8	1,8	1,6	1,8	0,6	0,7	0,6	1,1	0,5	1,5	0,9	0,8	0,8	1,0	1,5	1,3	1,0	1,4	1,6	1,5	0,9
Exposition	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Position of relevés	N	N	NE	N	NE	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	NE
Covering (%)	88	95	80	90	80	70	75	60	80	85	75	75	75	83	85	80	65	80	85	70	85
Canopy (%)	100	100	80	100	100	80	80	80	80	90	80	100	80	100	100	100	80	90	100	90	100
Base (B) / Trunk (T)	B	T	T	B	B	B	B	B	B	T	B	B	B	B	B	T	B	T	T	T	T
Number of species	5	7	6	6	7	5	6	5	5	7	4	6	6	8	5	8	4	4	7	5	6
Characteristic species																					
Lewinskya striata	1	1	2	2	1	3	3	1	2	1	3	2	2	1	1	2	2	3	1	2	1
Characteristic species of the *Ulotion crispae* alliance																					
Hypnum andoi	.	.	.	3	3	.	.	.	.	.	4	.	.	3	.	2	.	.	.	.	.
Pterigynandrum filiforme	.	2	2	2	.	.	.	.	.	1	.	4	.	4	2	3	.	2	2	.	.
Pulvigera lyellii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.
Orthotrichum pallens	2	2	.	.	1	.	1	2	.	1	.	.	.	.	2	1	2	.	2	.	2
Characteristic species of the *Orthotrichetalia* order and *Frullanio dilatatae-Leucodontetea sciuroidis* class																					
Leucodon sciuroides	4	4	4	3	4	2	4	.	4	4	3	4	4	.	.	3	.	4	3	4	4
Radula complanata	2	2	.	.	2	.	.	.	.	2	2	1	.	1	.	1	.	.	1	1	2
Lewinskya affinis	.	.	2	.	.	.	.	.	3	.	.	.	3	3	.	.	.	.	.	.	.
Frullania dilatata	3	.	.	.	.	.	2	.	2	2	.	.	1	1	3	2	.	.	3	.	.
Others																					
Homalothecium sericeum	.	.	.	.	.	4	1	.	.	.	.	.	.	2	.	.	.	.	.	.	.
Homalothecium philippeanum	.	2	.	2	1	.	.	4	.	2	.	.	2	.	4	.	4	.	2	.	3
Porella platyphylla	.	3	.	3	2	.	.	.	.	3	.	3	.	.	2	.	.	.	2	2	3
Syntrichia ruralis	.	1	.	.	.	1	.	.	1	.	.	.	1	.	.	.	.	.	.	5	.
Brachytheciastrum velutinum	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.
Syntrichia princeps	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bryum moravicum	.	.	1	.	1	1	.	1	.	.	.	.	.	1	.	1	2	.	.	.	1
Grimmia pulvinata	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Tortula subulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.

Table 5. Life form and life strategy rates of the taxa in the syntaxa.

Syntaxa			**Orthotrichetum pallentis**	**Orthotrichetum striati**	**Shortening**
			%	**%**	
Life Form	Weft		27	22	We
	Cushion		20	33	Cu
	Mat		13	11	Ma
	Tail		13	11	Ta
	Short turf		13	11	sT
	Tall turf		7	6	tT
	Fan		7	6	Fa
Life Strategies	Colonists	Pauciennial colonists	7	11	Ba
		Colonists with high sexual and asexual reproductive effort	7	6	Bv,g
	Perennial shuttle species	Perennial shuttle species with high sexual reproductive effort	7	11	Pg
		Perennial shuttle species with high asexual reproductive effort	13	11	Pv
	Perennial stayers	Perennial stayers with high sexual reproductive effort	33	33	Ag
		Perennial stayers with high asexual reproductive effort	13	11	Av
		Perennial stayers with high sexual and asexual reproductive effort	20	17	Ap

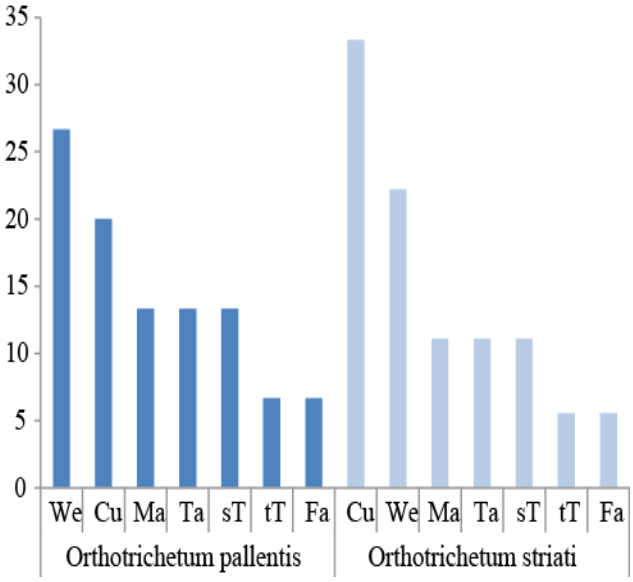

Fig. 6. Life forms spectrum of the taxa in the syntaxa.

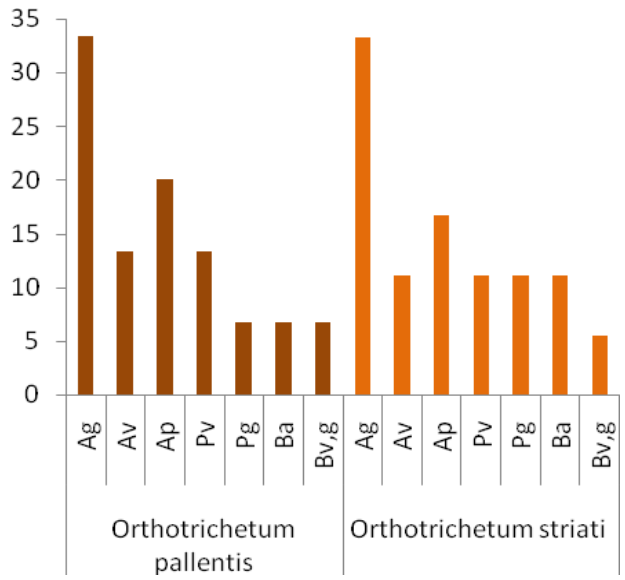

Fig. 7. Life strategies spectrum of the taxa in the syntaxa.

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