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Epiphytic Algae on Mosses in the Altındere Valley National Park (Maçka-Trabzon/Turkey)

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Abstract: Species composition and abundance of epiphytic algae on mosses growing in the Altındere Valley National Park were investigated in March 2008. The epiphytic algae identified in these samples were 27 species in total, 15 of the Bacillariophyta, 7 of the Cyanophyta, 4 of the Chlorophyta and a single of the Euglenophyta species. The members of the Bacillariophyta were more frequently found among these epiphytic algae on mosses. *Netrium digitus* (Ehrenb.) Itzigs and Rothe var. *curtum* (Borge) Willi Krieg. was recorded for the first time in the desmids flora of Turkey. The epiphytic algal flora on mosses at the submerged habitat was the richest of the three habitats.

Key words: Bacillariophyta, Cyanophyta, Chlorophyta, Euglenophyta, Bryophytes

INTRODUCTION

The aim of this study was to investigate the Epiphytic Algae on Mosses as well as the endemic and rare Algae of Altındere Valley, situated in the Eastern Black Sea region of the Euro-Siberian floristic area. It is a part of Trabzon Province popular with tourists because this area is a national park and includes Sumela (Meryemana) Monastery, which is an important spiritual tourism site.

Although knowledge of moss flora has been accumulated, there are no published articles about epiphytic algal flora on mosses in Turkey. Whereas it is well known that mosses is often covered with epiphytic algae.

In the Altındere Valley National Park, the first study carried out by Palaba and Anşın (2006). It was reported forest flora in this study. Baydar and Özdemir (1996) described the moss flora of Altındere Valley National Park and Uzun and Terzioğlu (2008) studied vascular flora of forest vegetation. Kara and Şahin (2002) reported epipellic and epilithic algae of the Altındere River in the Altındere Valley.

MATERIALS AND METHODS

The Altındere Valley National Park is one of the most important national parks in Turkey, due to having the

most diverse flora comprising several vegetation types (forest, sub alpine and alpine) and the historical value of Sumela (Meryemana) monastery. Situated on a rock face 300 m above the deep valley, it is an important place for spiritual tourism and a favorite spot with tourist traveling along the Black Sea coast. The annual average rainfall is 754 mm and the average temperature is 9.8°C. The study area lies within the Eastern Black Sea Climatic Region according to the macroclimate types of Turkey. Additionally, the climate type of the study area is very humid (Cepel, 1995).

The moss samples used in this study were collected from the Altındere Valley National Park in Trabzon in 23 March 2008 (Fig. 1). The moss samples were collected from three different habitats. Nine moss samples from moist soil, five from on the wet rocks along the Altındere river and two from submerged were collected. A total of sixteen moss samples were used for this study (Table 1). In making a preparation, a moss sample was rewetted with distilled water for a few minutes. Algae were then scraped from the surface of a small piece (about 10 mm²) of moss with a needle under a binocular microscope.

The moss samples were incised by spatula from their habitats. After the samples were cleaned, they were preserved in plastic bags. Each plastic bag has a label providing the information about the habitat of the area. The moss species have been identified by many researchers (Watson, 1981; Frey *et al.*, 1995; Cortini-

Pedrotti, 2001; Herrnstadt and Heyn, 2004; Smith, 2004; Jimenez, 2006). Vouchers are deposited in the herbarium of Karadeniz Technical University, Faculty of Science and Arts, Department of Biology. The taxonomic identification of algae was carried out according to Krammer and Lange-Bertalot (1986, 1988, 1991a, b).

RESULTS

Twenty-seven species of epiphytic algae were recognized in the moss samples examined. These algae

were 15 species of the *Bacillariophyta*, 7 species of the *Cyanophyta*, 4 species of the *Chlorophyta* and a single of the *Euglenophyta* species (Table 2). Algae were predominantly observed among leaves and stems near the surface of moss turfs.

The epiphytic algal flora on mosses at the moist soil habitat was the poorest of the three habitats. Nine moss samples were examined at this habitat (Table 1). Bacillariophyta and Cyanophyta were represented by four species and *Hantzschia amphioxys* and *Lyngbya lagerheimii* were observed in most of the samples. *Eunotia praeurupta* became rather common in the moss sample of *Barbula convoluta*. Chlorophyta and Euglenophyta were represented by only a single species.

On the wet rocks habitats, the epiphytic algae on mosses were generally poor in quantity and number of species. Five moss samples were examined at this habitat (Table 1). Bacillariophyta was represented by 10 species while Cyanophyta was represented by 5 species. The members of the Chlorophyta and Euglenophyta were never observed in any samples at this habitat. *Diatoma mesodon* became rather common in the moss sample of *Plagiomnium rostratum*.

At the submerged habitat, on the contrary to the former two habitats, the epiphytic algae on mosses were rather abundant. Two moss samples were examined at this habitat (Table 1). A total of 18 species were recorded, of which 12 belong to Bacillariophyta, 3 to Chlorophyta and 3 to Cyanophyta. *Diatoma mesodon* became rather common in the moss samples of *Plagiomnium affine*. *Netrium digitus* (Ehrenberg) Itzigs and Rothe var. *curtum* (Borge) Willi Krieg. was recorded for the first time in the desmids flora of Turkey (L: 90, W: 40 µm) (Ohtani, 1986). This species was identified in the moss sample of *Plagiomnium affine*.

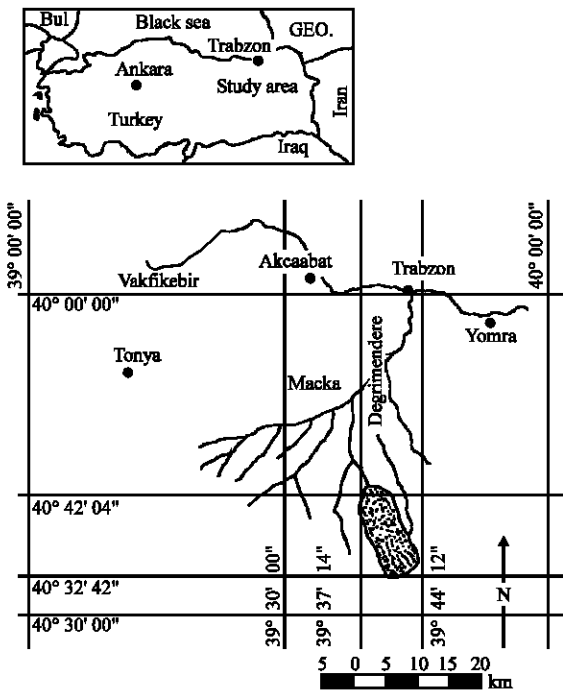


Fig. 1: The Study Area (Altındere Valley National Park-Trabzon)

Table 1: The moss samples studied

Moss species	Abbreviation	Habitats
<i>Atrichum undulatum</i> (Hedw.) P. Beauv	AU	Moist soil
<i>Barbula convoluta</i> Hedw.	BC	Moist soil
<i>Bazzania trilobata</i> (L.) S. Gray	BT	Wet rock
<i>Brachythecium rutabulum</i> (Hedw.) Schimp.	BR	Moist soil
<i>Bryoerhynchium recurvirostrum</i> (Hedw.) P. C. Chen	BrR	Moist soil
<i>Calliergonella cuspidata</i> (Hedw.) Loeske	CC	Moist soil
<i>Cirriophyllum crassinervium</i> (Taylor) Loeske	CiC	Moist soil
<i>Didymodon tophaceus</i> (Brid.) Lisa	DT	Wet rock
<i>Didymodon vinealis</i> (Brid.) R. H. Zander	DV	Wet rock
<i>Homolothecium lutesceus</i> (Hedw.) H. Rob.	HL	Moist soil
<i>Hypnum cupressiforme</i> Hedw.	HC	Moist soil
<i>Kindbergia praelonga</i> (Hedw.) Ochyra	KP	Wet rock
<i>Pseudoscleropodium purum</i> (Hedw.) M. M.	PP	Moist soil
<i>Plagiomnium affine</i> (Funck) T. J. Kop.	PA	Submerged
<i>P. rostratum</i> (Schrad.) T. J. Kop.	PR	Wet rock
<i>Platyhypnidium riparioides</i> (Hedw.) Dixon	PIR	Submerged

Table 2: The algal species on mosses in the Altindere Valley National Park

Species	Mosses ⁽¹⁾
Bacillariophyta	
<i>Melosira varians</i> Agardh	HL, KP, PIR
<i>Cocconeis placentula</i> var. <i>euglypta</i> (Ehrenberg) Grunow	BT, PIR
<i>Cymbella affinis</i> Kützing	PIR
<i>C. minnta</i> Hilse	BC, DV, KP
<i>Diatoma mesodon</i> (Ehrenberg) Kützing	DT, KP, PA, PR
<i>D. moniliformis</i> Kützing	PIR
<i>D. vulgaris</i> Bory	BT, KP, PIR
<i>Diploneis elliptica</i> (Kützing) Cleve	PIR
<i>Eunotia praerupta</i> Ehrenberg	BC
<i>Fragilaria arcus</i> (Ehrenberg) Cleve var. <i>arcus</i>	BT
<i>F. ulna</i> (Nitzsch) Lange-Bertalot var. <i>ulna</i>	PIR
<i>Hantzschia amphioxys</i> (Ehrenberg) Grunow in Cleve and Grunow	BC, CC, CiC, DT, HC, KP, PA
<i>Nitzschia gracilis</i> Hantzsch	PA
<i>N. sigmoidea</i>	BR, BT, PIR
<i>Navicula graciloides</i> Mayer	PIR
<i>Pinnularia borealis</i> Ehrenberg	BC, BrR, DV
Cyanophyta	
<i>Anabaena</i> sp.	DT, PP
<i>Lyugbya lagerheimii</i> (Möbius emend. Gomont) Gomont	BR, CC, CiC, DV,
<i>L.</i> sp.	KP
<i>Nostoc</i> sp.	DT
<i>Oscillatoria amoena</i> (Kützing) Gomont	PA
<i>O. formosa</i> (Bory) Gomont	PA, PIR, PR,
<i>O. limosa</i> (C. Agardh) Gomont	PA
Chlorophyta	
<i>Chlorella</i> sp.	AU
<i>Closterium pseudoinnula</i> Borge	PIR
<i>Netrium digitus</i> (Ehrenberg) Itzigs and Rothe var. <i>curtum</i> (Borge) Willi Krieg.	PA
<i>Stichococcus scopulimus</i> Hazen	PA
Euglenophyta	
<i>Trachelomonas volvocina</i> Ehrenberg	BC, CiC

¹Abbreviation same as Table 1

DISCUSSION

Among the three habitats, submerged was the most favorable habitat for the epiphytic algae. The epiphytic algal flora on mosses turned out to be poorer than submerged algal flora in the Altindere Valley National Park. The same situation was observed in the Antarctic. At the submerged habitat, the members of the Bacillariophyta are rich in comparison with those of moist soil and wet rocks habitats. The same situation was observed in the Antarctic (Ohtani, 1986).

The scarcity of the Cyanophyta shown in the present study is remarkable. Whereas, Ohtani (1986) reported that the members of the Cyanophyta predominated in all the samples as in the earlier studies on the algal flora of the Antarctic region. Especially, the members of the Nostoc were more common on mosses in the Antarctic (Ohtani, 1986). Because, the species of Nostoc could colonize favorably in such nutrient-deficient habitats by the ability to fix atmospheric nitrogen and these algae might play an importance role in providing moss vegetation with nitrogen source. In the present study, the *Nostoc* genera

was represented by unidentified one species. The proportion of the *Oscillatoria* members was much less than that of the submerged habitat.

Ohtani (1986) reported two species of *Desmids* in the Syowa Station in Antarctic. In the present study, the same result was observed. Lenzenweger (1996) reported that *Netrium digitus* var. *curtum* was associated with Sphagnum. In the present study, it was confirmed that the availability of water supply for the moss habitat seemed to largely influence the growth of the epiphytic algae as well.

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