

## Additions to Lichen Flora of Zonguldak Province

Şaban Güvenç\*, Şule Öztürk, Seyhan Oran

Uludağ University, Faculty of Arts and Sciences, Department of Biology, 16059 Görükle, Bursa, Turkey

### ABSTRACT

78 lichen taxa are reported from 18 localities in the coastal and inland part of Zonguldak province. Twenty four species are new for the lichen flora of Zonguldak province. *Rinodina oxydata* (A.Massal.) A.Massal. and *Xanthomendoza fallax* (Hepp) Søchting are new record both Zonguldak and the western part of Black Sea region of Turkey.

**Key Words:** Lichens, biodiversity, Zonguldak, Turkey.

### INTRODUCTION

Euro-Siberian phytogeographical region of Turkey is one of the lichenologically better studied areas of Turkey. The earliest lichen records from the Euxinian section of the Euro-Siberian floristic region of Turkey were given by Czecczott (1939), Motyka (1936) and Szatala (1927). In the last decades, many studies from the Euxinian section of the Euro-Siberian floristic region of Turkey have been published by Breuss and John (2004), Çiçek and Özdemir Türk (1998), Çobanoğlu and Akdemir (2004), Güvenç et al. (2006), John (2000), Özdemir Türk (1997), Öztürk and Güvenç (2003), Yıldız and John (2002) and Yıldız et al. (2002). Historically, the first studies about the lichen species from the eastern part of the Black Sea region of Turkey were published by Hertel (1989) and Steiner (1909). In the last decades, numerous studies on the lichen biodiversity of the eastern part of the Black Sea region of Turkey were published (Aslan 2000; Aslan et al. 2002a, b, 2005; Cansaran Duman and Yurdakulol 2007; Gönülol et al. 1995; John 1999, 2002; John et al. 2000; John and Breuss 2004; Kınalıoğlu 2005; Yazıcı 1995a, b, c, 1996, 1999; Yazıcı and Aslan 2002a, b, 2003; Yazıcı et al. 2005). The lichens of Zonguldak province are so far completely unknown. Until now, approximately thirty taxa are known from Zonguldak situated in western Black Sea region (Breuss and John 2004; Gülşah 2005; Szatala 1960, Yazıcı and Aslan 2006). The records of 222 lichen taxa were given in a detailed study on lichens from Zonguldak province (Yazıcı et al. 2007). Here we aim to make a further contribution to our knowledge of the lichen flora of Zonguldak province and the western part of Black Sea region of Turkey.

### Description of the Study Area

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

The mean annual rainfall in Zonguldak province in the coastal areas is 1231.9 mm and the mean annual temperature is 13.5°C. The maximum mean temperature (M) is 25.1°C in August and the minimum mean temperature (m) is 3.1°C in February. The seasonal precipitation regime during the year is winter, autumn, summer and spring (WASS). This is a ocean climate (Akman 1990). The forest vegetation in the coastal area of Zonguldak province consists of mainly following taxa: *Abies nordmanniana* (Stev.) Spach subsp. *bornmüelleriana* (Matt.) Coode & Collen, *Carpinus betulus* L., *Castanea sativa* Miller., *Fagus orientalis* Lipsky and *Rhododendron ponticum* L. (Akman 1995). The climate of Gökçebeğ and Devrek district in the inland area of Zonguldak province is Mediterranean type. The mean annual rainfall at Devrek and Gökçebeğ districts are 785.4 mm and 853.9 mm, respectively. The seasonal precipitation regime during the year both Devrek and Gökçebeğ are winter, autumn, spring and summer (WASS). The forest vegetation of the inland areas of Zonguldak province consists of mainly following taxa: *Abies nordmanniana* (Stev.) Spach subsp. *bornmüelleriana* (Matt.) Coode & Collen, *Pinus nigra* Arn. subsp. *pallasiana* (Lamb.) Holmboe, *P. sylvestris* L., *Quercus petraea* (Mattuschka) Liebl. subsp. *iberica*. (Steven ex Bieb.) Krassiln, and *Q. macranthera* Fisch. & C.A. Mey. ex Hohen. subsp. *sypirensis* (C.Koch) Menitsky (Akman 1995).

\* Corresponding author: [saban@uludag.edu.tr](mailto:saban@uludag.edu.tr)

## MATERIALS AND METHODS

Lichen specimens were collected from 18 localities in Zonguldak province between 31 July, 2001 and 23 August, 2002 (Fig. 1). All specimens were identified with flora books (Clauzade and Roux 1985; Nash et al. 2004; Purvis et al. 1994; Wirth 1995), monographs (Giralt 2001; Mayrhofer 1988) and paper (Blanco et al. 2004a, b). Specimens are deposited in the Herbarium of the Faculty of Art and Sciences, Uludag University, Bursa (BULU). Air dried specimens were examined with a stereomicroscope (Olympus SZ 40) and a high power microscope (Olympus CH-2) for external morphology and anatomical observations. Sections of the ascomata were examined and stained with Lugol's iodine.

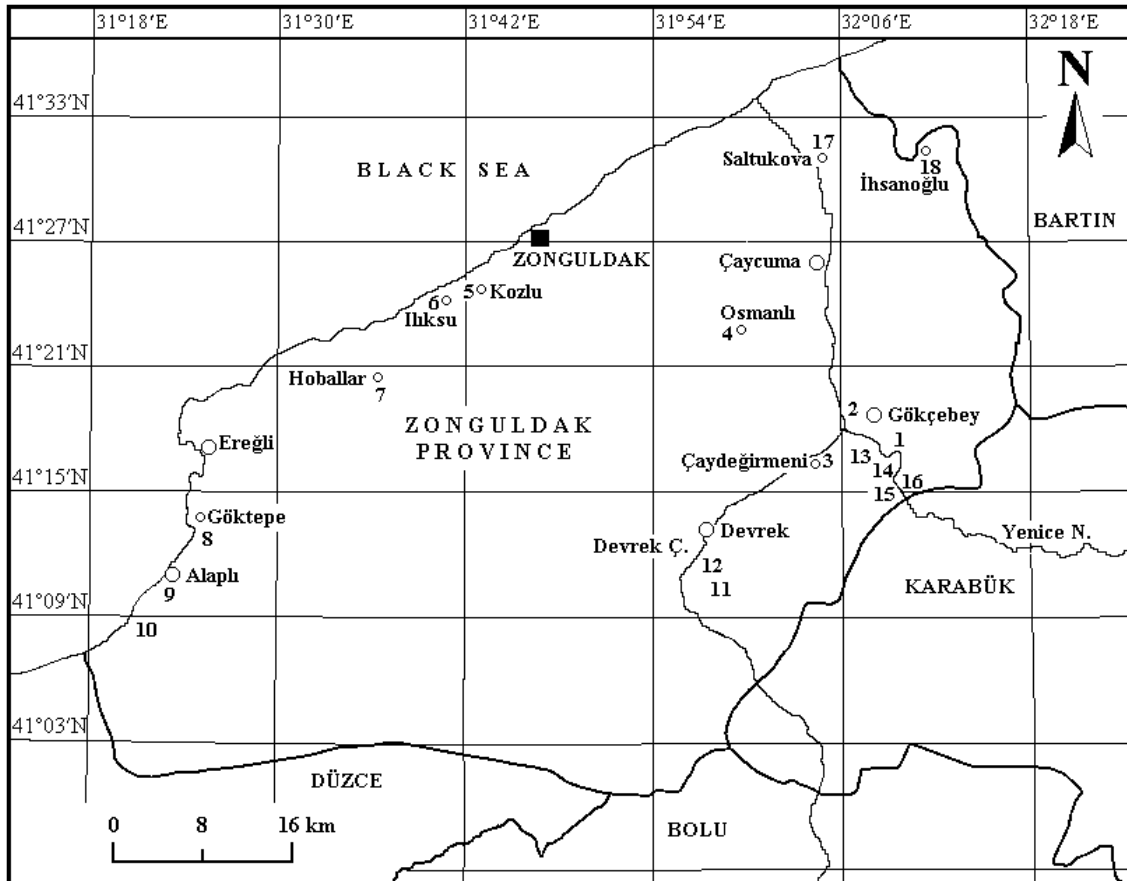


Figure 1. The localities in the study area

### Collected localities of lichens samples.

1. Zonguldak: Karabük – Zonguldak road; 4 km to Gökçeşey, edge of stream, 41°17'16" N-32°09'22" E, alt. 75 m, 31 July, 2001.
2. Zonguldak: Karabük – Zonguldak road; exit of Gökçeşey, 41°18'28" N-32°07'09" E, alt. 50 m, 31 July, 2001.
3. Zonguldak: Karabük - Zonguldak road; 6 km after from Devrek road junction, in the vicinity of Çaydeğirmeni village, 41°16'30" N-32°04'13" E, alt. 65 m, 31 July, 2001.
4. Zonguldak: Karabük – Zonguldak road, 20 km to Zonguldak, road junction of Osmanlı village, rocky hillside, 41°23'07" N-31°56'28" E, alt. 260 m, 31 July, 2001.
5. Zonguldak: Zonguldak – Ereğli road; 5 km after from Kozlu village, 41°25'29" N-31°43'31" E, alt. 80 m, 31 July, 2001.
6. Zonguldak: Zonguldak – Ereğli road; in the vicinity of İlksu, 41°24'12" N-31°40'53" E, alt. 25 m, 31 July, 2001.

7. Zonguldak: Zonguldak – Ereğli road; in the vicinity of Hoballar, 41°20'34" N-31°37'52" E, alt. 420 m, 31 July, 2001.
8. Zonguldak: Ereğli – Alaplı road; in the vicinity of Göktepe, 41°13'24" N-31°24'14" E, alt. 5 m, 01 August, 2001.
9. Zonguldak: Alaplı – Akçakoca road; exit of Alaplı, 41°10'10" N-31°22'02" E, alt. 20 m, 01 August, 2001.
10. Zonguldak: Ereğli – Akçakoca road; 20 km to Akçakoca, in the vicinity of Kocaman stream, 41°07'57" N-31°20'04" E, alt. 30 m, 01 August, 2001.
11. Zonguldak: Devrek; Yedigöller road, 41°12'15" N-31°57'12" E, alt. 100 m, 22 August, 2002.
12. Zonguldak: Devrek; Yedigöller road, 41°11'32" N-31°56'40" E, alt. 170 m, 22 August, 2002.
13. Zonguldak: From Devrek to Gökçebey, in the vicinity of Çukur village, 41°17'25" N-32°05'51" E, alt. 70 m, 23 August, 2002.
14. Zonguldak: Zonguldak – Karabük road; 26 km to Yenice, 41°17'22" N-32°08'12" E, alt. 100 m, 23 August, 2002.
15. Zonguldak: Zonguldak – Karabük road, 23 km to Yenice, steam side, 41°15'36" N-32°09'26" E, alt. 90 m, 23 August, 2002.
16. Zonguldak: Zonguldak – Karabük road; Yenice, in the vicinity of Kayadibi, 41°13'05" N-32°13'16" E, alt. 140 m, 23 August, 2002.
17. Zonguldak: Çaycuma; in the vicinity of Saltukova, 41°31'39" N-32°06'25" E, alt. 70 m, 23 August, 2002.
18. Zonguldak: Çaycuma; in the vicinity of İhsanoğlu village, 41°31'25" N-32°11'36" E, alt. 150 m, 23 August, 2002.

## RESULTS

The taxa are listed in alphabetical order, followed by number of localities, substrate and herbarium number. Author names are abbreviated according to Brummitt and Powell (1992). Before the name of the species, new record for the western Black Sea region of Turkey is pointed with (+) and new record for Zonguldak province is pointed with (\*).

- Arthonia dispersa* (Schrad.) Nyl. 2, 3, *Populus* sp. (5505, 5508).  
*Arthonia radiata* (Pers.) Ach. 3, *Juglans* sp. (5514).  
*Aspicilia caesiocinerea* (Nyl. ex Malbr.) Arnold 1, 14, siliceous rock (5496, 5916).  
*Aspicilia contorta* (Hoffm.) Kremp. subsp. *contorta* 4, calcareous rock (5517).  
\* *Bacidia naegelii* (Hepp) Zahlbr. 17, *Populus* sp. (5952); 18, *Fraxinus* sp. (5957).  
\* *Buellia aethalea* (Ach.) Th.Fr. 1, siliceous rock (5498).  
*Caloplaca arenaria* (Pers.) Müll.Arg. 1, siliceous rock (5497).  
*Caloplaca cerina* var. *cerina* (Ehrh. ex Hedw.) Th.Fr. 8, *Prunus* sp. (5536).  
\* *Caloplaca cerinella* (Nyl.) Flagey 17, *Populus* sp. (5951).  
*Caloplaca citrina* (Hoffm.) Th.Fr. 18, mortar (5958).  
*Caloplaca holocarpa* (Hoffm.) A.E.Wade 5, calcareous rock (5520).  
\* *Caloplaca lactea* (A.Massal.) Zahlbr. 5, calcareous rock (5521).  
*Candellariella vitellina* (Hoffm.) Müll. Arg. 2, *Populus* sp. (5503).  
\* *Catillaria nigroclavata* (Nyl.) Schuler 2, *Populus* sp. (5504).  
*Chrysothrix candelaris* (L.) J.R.Laundon 10, *Castanea sativa* (5561).  
*Collema subflaccidum* Degel. 10, *Tilia* sp. (5549).  
*Diploschistes scruposus* (Schreb.) Norman 1, siliceous rock (5493).  
\* *Diplotomma chlorophaeum* (Hepp ex Leight.) Szatala 9, siliceous rock (5540).  
\* *Eopyrenula leucoplaca* (Wallr.) R.C.Harris 15, *Platanus* sp. (5921).  
*Evernia prunastri* (L.) Ach. 13, *Prunus* sp. (5914); 16, *Fraxinus* sp., garden fence (5935, 5936).  
*Flavoparmelia caperata* (L.) Hale 1, siliceous rock (5490); 11, *Quercus* sp. (5815); 13, *Prunus* sp. (5912).  
*Graphis scripta* (L.) Ach. 10, *Ulmus* sp. (5551); 15, *Fagus* sp. (5920).  
\* *Hyperphyscia adglutinata* (Flörke) H.Mayrhofer & Poelt 8, *Prunus* sp., *Platanus* sp. (5533, 5534).  
*Hypogymnia tubulosa* (Schaer.) Hav. 16, *Fagus* sp. (5940).  
*Lecania crytella* (Ach.) Th.Fr. 3, *Acacia* sp., *Juglans* sp. (5513, 5515).  
\* *Lecania fuscella* (Schaer.) Körb. 3, *Acacia* sp. (5511); 6, *Morus* sp. (5526).

- Lecanora argentata* (Ach.) Malme 12, *Juglans* sp. (5835); 16, *Acer* sp. (5926).  
*Lecanora carpinea* (L.) Vain. 18, *Fraxinus* sp. (5954).  
*Lecanora chlarotera* Nyl. 10, *Ulmus* sp. (5555).  
*Lecanora dispersa* (Pers.) Röhl. 4, 9, calcareous rock (5516, 5547).  
\* *Lecanora hagenii* (Ach.) Ach. 6, *Morus* sp. (5524).  
\* *Lecanora pulicaris* (Pers.) Ach. 10, *Prunus* sp. (5559); 16, *Fagus* sp., garden fence (5942, 5943)  
\* *Lecanora saligna* (Schrad.) Zahlbr. 16, garden fence (5949).  
*Lecanora strobilina* (Spreng.) Kieff. 10, *Prunus* sp. (5560).  
\* *Lecanora subintricata* (Nyl.) Th.Fr. 10, *Ulmus* sp. (5557); 16, *Fagus* sp. (5944).  
\* *Lecanora symmicta* (Ach.) Ach. 8, *Platanus* sp. (5539).  
*Lecidella carpathica* Körb. 1, 16, siliceous rock (5494, 5946).  
*Lecidella elaeochroma* (Ach.) M.Choisy 2, *Populus* sp., *Salix* sp. (5501, 5502); 3, *Populus* sp., *Acacia* sp. (5509, 5510); 6, *Morus* sp. (5523); 7, *Quercus* sp. (5529); 8, 13, *Prunus* sp. (5535, 5913); 10, *Ulmus* sp., *Prunus* sp. (5553, 5558); 12, *Juglans* sp., *Platanus* sp. (5833, 5832); 16, *Acer* sp., *Fraxinus* sp. (5931, 5932); 17, *Populus* sp. (5950); 18, *Fraxinus* sp. (5953).  
*Lepraria eburnea* J.R.Laundon 10, *Castanea sativa* (5562).  
*Lepraria incana* (L.) Ach 11, *Quercus* sp. (5829).  
\* *Lepraria lobificans* Nyl. 11, *Quercus* sp. (5830).  
*Lobaria pulmonaria* (L.) Hoffm. 11, *Quercus* sp. (5817); 16, *Acer* sp. (5924).  
*Lobaria scrobiculata* (Scop.) P.Gaertn. 11, *Quercus* sp. (5818).  
*Melanelixia fuliginosa* (Duby) O.Blanco et al. subsp. *glabratula* (Lamy) J.R. Laundon 16, *Acer* sp. (5927).  
*Melanelixia subaurifera* (Nyl.) O.Blanco et al. 16, *Fagus* sp. (5941).  
*Nephroma laevigatum* Ach. 11, *Quercus* sp. (5828).  
*Nephroma tangeriense* (Maheu & A. Gillet) Zahlbr. 10, *Tilia* sp. (5548).  
*Opegrapha atra* Pers. 8, *Platanus* sp. (5538); 10, *Ulmus* sp. (5556).  
*Parmelia sulcata* Taylor 1, siliceous rock with moss (5491); 7, 11, *Quercus* sp. (5528, 5820); 16, garden fence (5939)  
\* *Parmotrema chinense* (Osbeck) Hale & Ahti 11, *Quercus* sp. (5816).  
\* *Peltigera collina* (Ach.) Röhl. 11, *Quercus* sp. (5827).  
*Pertusaria amara* (Ach.) Nyl. 11, *Quercus* sp. (5821).  
*Pertusaria leioplaca* DC. 10, *Ulmus* sp. (5552).  
*Phaeophyscia ciliata* (Hoffm.) Moberg 13, *Populus* sp. (5915).  
*Phaeophyscia orbicularis* (Neck.) Moberg 13, *Populus* sp. (5910).  
*Phlyctis argena* (Spreng.) Flot. 10, *Ulmus* sp. (5550); 15, *Platanus* sp. (5922); 16, *Acer* sp. (5923).  
*Physcia adscendens* (Th. Fr.) H.Olivier 2, 13, *Populus* sp. (5500, 5909); 3, *Acacia* sp. (5512); 6, *Morus* sp. (5522); 7, *Quercus* sp. (5527); 8, *Platanus* sp. (5537); 9, calcareous rock (5541); 14, siliceous rock (5918); 16, *Fraxinus* sp. (5934); 18, *Fraxinus* sp., mortar (5955, 5956)  
*Physcia aipolia* (Ehrh. ex Humb.) Fürnr. 11, *Quercus* sp. (5826).  
*Physcia semipinnata* (J.F.Gmel.) Moberg 16, *Fraxinus* sp. (5933).  
*Physconia distorta* (With.) J.R.Laundon 11, *Quercus* sp. (5824).  
\* *Physconia perisidiosa* (Erichsen) Moberg 1, *Quercus* sp. (5825).  
*Protoparmeliopsis muralis* (Schreb.) M.Choisy 1, 11, 14, 16, siliceous rock (5492, 5831, 5917, 5945).  
\* *Pyrenula macrospora* (Degel.) Coppins & P. James 3, *Salix* sp. (5506).  
*Ramalina farinacea* (L.) Ach. 11, *Quercus* sp. (5823); 16, *Fraxinus* sp. (5948).  
*Ramalina fastigiata* (Pers.) Ach. 11, *Quercus* sp. (5822); 16, *Fraxinus* sp., garden fence (5937, 5938).  
*Ramalina pollinaria* (Westr.) Ach. 16, *Acer* sp. (5925).  
\* *Rhizocarpon petraeum* (Wulfen) A.Massal. 9, siliceous rock with limestone (5544).  
*Rhizocarpon umbilicatum* (Ramond) Flagey 9, siliceous rock with limestone (5545).  
\* *Rinodina exigua* (Ach.) Gray 10, *Ulmus* sp. (5554).  
\* *Rinodina interpolata* (Stirt.) Sheard 9, siliceous rock with limestone (5543).  
\* *Rinodina oxydata* (A.Massal.) A.Massal. 14, siliceous rock (5919).  
\* *Rinodinella controversa* (A.Massal.) H. Mayrhofer & Poelt 4, calcareous rock (5518).  
*Sarcogyne regularis* Körb. 5, 9, calcareous rock (5519, 5542); 11, mortar (5959).  
*Verrucaria nigrescens* Pers. 9, calcareous rock (5546).  
\* *Xanthomendoza fallax* (Hepp) Søchting 8, *Platanus* sp. (5532).  
*Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale 16, siliceous rock (5947).

\* *Xanthoparmelia somloënsis* (Gyeln.) Hale 1, siliceous rock (5495).

*Xanthoria parietina* (L.) Th. Fr. 2, *Populus* sp. (5499); 8, *Prunus* sp., *Cydonia* sp. (5530, 5531); 16, *Acer* sp., *Fraxinus* sp., garden fence (5928, 5929, 5930).

## DISCUSSION

In this study, a total of 44 genera and 78 species are reported from 18 localities in the costal and inland part of Zonguldak province. Twenty four species are new for the lichen flora of Zonguldak province. *Rinodina oxydata* (A.Massal.) A.Massal. and *Xanthomendoza fallax* (Hepp) Søchting are new record both Zonguldak and the western part of Black Sea region of Turkey.

The genera with the highest number of species were *Lecanora* (10) and *Caloplaca* (6), all of them except for *Caloplaca arenaria* with a cosmopolitan range. Of total 78 lichen taxa, 53 were epiphytic and 25 were saxicolous. Total 78 lichen taxa consists of 45 crustose, 28 foliose, 1 fruticose and 4 leprose.

The most common foliose species in study area were *Flavoparmelia caperata*, *Physcia adscendens* and *Parmelia sulcata* while most common crustose species were *Lecidella elaeochroma*, *Phlyctis argena*, *Protoparmeliopsis muralis* and *Sarcogyne regularis*.

The localities contain the highest number of species were 16 (20 species), 11 (17 species) and 10 (14 species). These localities were in dense forest area consist of *Castanea sativa*, *Tilia* sp. and *Ulmus* sp. in the vicinity of Kocaman stream, in dense *Fagus orientalis* forest area in the vicinity of Kayadibi village of Yenice and in open oak stands in the vicinity of Devrek. Oceanic and Suboceanic species shown to distribution in humid forest from boreal to Mediterranean mountain belts (Wirth, 1995) were found in above mentioned localities. These Oceanic and Suboceanic species were *Catillaria nigroclavata*, *Lobaria pulmonaria*, *L. scrobiculata*, *Nephroma tangeriense*, *Parmotrema chinense*, *Pyrenula macrospora* and *Peltigera collina*.

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