

Lichen records from Southeast and East Anatolian region (Turkey)

Seyhan Oran* and Şule Öztürk

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

ABSTRACT

In this study, 278 lichen specimens, collected from sixteen localities in Adıyaman, Ağrı, Batman, Diyarbakır, Gaziantep, Kars, Mardin and Şanlıurfa provinces, which located in Southeast and East Anatolian regions, were investigated. Onehundred and nine taxa were determined belonging to thirty six genera. Among the specimens that we are collected from the study region, 85 of them were reported previously. Our results indicated that 24 taxa are new to Southeast and East Anatolian region. *Rinodina rinodinoides* (Anzi) H. Mayrhofer & Scheid. is new record for Turkey.

Key Words: Lichen, Biodiversity, Turkey

INTRODUCTION

Despite, many studies on lichens in various regions in our country (John, 1996; John and Breuss, 2004; Özdemir Türk and Güner, 1998; Öztürk and Güvenç, 2003) the lichen diversity of Turkey has not completed for now. A forthcoming checklist of the lichens of Turkey at the present consist of approximately 1200 taxa (Breuss and John, 2004).

So far, there have been several publised studies on lichens from Southeast Anatolian region (Steiner, 1921; Szatala, 1927, 1941, 1960; Knoph, 1990; Nimis and John, 1998; John, 1996, 1999).

Previous lichen records from the East Anatolian region were published by Steiner (1899), Hertel (1970), Poelt and Obermayer (1990), Aslan and Öztürk (1994), Aslan and Öztürk (1998), Aslan (2000), Candan and Özdemir Türk (2000), John et al. (2000), Aslan et al. (2002), Yazıcı and Aslan (2003), and Candan (2006).

We believe that our present study will make significant contributions to the lichen diversity of Turkey, which is not sufficiently known yet.

Description of the study area

The study area located in the southeast and east of Turkey. The area of Southeast Anatolian region is 75.000 square kilometers, and East Anatolian region is 164.000 square kilometers.

Southeast Anatolian region usually consist of plains such as Şanlıurfa Harran and Gaziantep plateau. The highest summit of the Karacadağ is the Kollubaba top which has an altitude of 1957 m. Southeast Anatolian region is effected by Mediterranean and continental climate. Total annual precipitation of the province is 331 - 796 mm, and the average daily maximum temperature is aproximately 30°C, while the minimum temperature is 1.5 - 6 °C. Natural plant cover is steppe. Region is very poor in terms of forest area. *Quercus* sp. is common tree in that forest (www.turkcebilgi.com).

Average altitude is between 2000 - 2200 m at East Anatolian region. Ağrı Mountain (5165 m) is the highest mountain in Turkey. Summers tend to be hot and extremely dry. Winters are bitterly cold with frequent, heavy snowfall. Temperature decreases to - 40° C in winter. Natural plant cover is steppe. That's why summer rains steppe is meadow form in some region and high altitudes cover with forests. (<http://tr.wikipedia.org>)

Localities of the study area are;

1. Ağrı; Doğubeyazıt, Gürbulak border gate, 1650 m, 39° 25' 30" N 44° 22' 30" E, 26.07.2003
2. Kars; Center Ocaklı village, Ani Ruins, 1700 m, 40° 18' 30" N 43° 38' 30" E, 27.07.2003
3. Gaziantep; Nur Mountain, Ak yokuş geçidi, open rocky field, 1111 m, 37° 10' 42" N 36° 58' 45" E, 10.05.2004
4. Gaziantep; entrance of Yeşilce village, open rocky field, 980 m, 37° 10' 25" N 37° 12' 12" E, 10.05.2004
5. Gaziantep; Gaziantep-Yavuzeli road, 20. km, open rocky field, 838 m, 37° 13' 02" N 37° 29' 37" E, 10.05.2004
6. Gaziantep; Gaziantep-Nizip road, rocky area, 773 m, 37° 00' 39" N 37° 37' 47" E, 11.05.2004
7. Şanlıurfa; Birecik Dam (Zeugma), 753 m, 37° 03' 38" N 37° 52' 15" E, 11.05.2004

* Corresponding author: seyhana@uludag.edu.tr

8. Şanlıurfa; entrance of Urfa, open rocky field, 698 m, 37° 08' 41" N 38° 45' 12" E, 11.05.2004
9. Şanlıurfa; Harran Ruins, 370 m, 36° 51' 56" N 39° 01' 54" E, 12.05.2004
10. Şanlıurfa; Viranşehir, before 38 km from Viranşehir, open rocky field, steppe, 695 m, 37° 13' 43" N 39° 15' 56" E, 12.05.2004
11. Mardin; Mardin-Midyat road, Yeşilli place, 946 m, 37° 20' 49" N 40° 49' 35" E, 13.05.2004
12. Batman; Hasankeyf-Batman road, around of Suçeken, 511 m, 37° 44' 19" N 41° 17' 31" E, 13.05.2004
13. Diyarbakır; Batman-Diyarbakır road, around of Murattaş village, rocky area, 602 m, 37° 48' 06" N 40° 22' 47" E, 13.05.2004
14. Şanlıurfa; Karacadağ, open rocky field, 1464 m, 37° 46' 30" N 39° 47' 10" E, 14.05.2004
15. Adıyaman; Nemrut Mountain, rocky slopes, 1415 m, 37° 57' 00" N 38° 45' 36" E, 14.05.2004
16. Adıyaman; Adıyaman-Maraş road, 25. km, open rocky field, vicinity of Atmalı, 730 m, 37° 42' 21" N 38° 00' 44" E, 15.05.2004

MATERIALS AND METHODS

The lichen samples which were collected from 16 localities in the year of 2003 and 2004 were identified with aid of literatures that include identification keys (Clauzade and Roux 1985, Giraldo 2001, Nash III et al. 2002; 2004; Purvis et al. 1994; Wirth 1995). Likewise, the nomenclature follows a rather modern concept, e.g. Blanco et al. (2004). Morphological and anatomical characters were determined using stereo (40 SZ Olympus) and light microscopes (Krüss). The specimens are kept in the herbarium of the Faculty of Arts and Sciences, Uludağ University (BULU).

RESULTS

The taxa are given in alphabetical order, followed by locality numbers and substrate. A herbarium number for specimens (BULU) were indicated in the parenthesis (10352-10631). The names of the authors are abbreviated according to Brummit and Powell (1992). An asteriks "*" indicates new records for Turkey and "#" indicates new records for Southeast and East Anatolian regions.

Acarospora cervina A.Massal

Loc: 3, 4, 5, 6, 8, 9, 11, 12, 15, on calcareous rock (10354, 10395, 10413, 10427, 10462, 10472, 10502, 10528, 10567)

Acarospora fuscata (Nyl.) Arnold

Loc: 13, on siliceous rock (10535)

Acarospora impressula Th.Fr.

Loc: 13, 14, on siliceous rock (10530, 10563)

Acarospora insolata H.Magn.

Loc: 14, on siliceous rock (10559)

Acarospora smaragdula (Wahlenb.) A.Massal.

Loc: 14, on siliceous rock (10610)

Acarospora veronensis A.Massal

Loc: 3, on fossil mussel shell (10356)

Aspicilia calcarea (L.) Mudd

Loc: 1, 3, 8, 16, on calcareous rock (10615, 10352, 10449, 10589)

Aspicilia cheresina var. *justii* (Servit) Clauzade & Cl.Roux

Loc: 8, on calcareous rock (10457)

Aspicilia cinerea (L.) Körb.

Loc: 13, 14, on siliceous rock (10536, 10543)

Aspicilia contorta (Hoffm.) Kremp. subsp. *contorta*

Loc: 16, on calcareous rock (10595)

Aspicilia contorta subsp. *hoffmanniana* S. Ekman & Fröberg

Loc: 2, 3, 6, 13, on calcareous rock (10623, 10598, 10431, 10609)

Aspicilia desertorum (Kremp.) Mereschk.

Loc: 14, on siliceous rock (10542)

Aspicilia farinosa (Flörke) Motyka

- Loc: 5, 16, on calcareous rock (10417, 10596)
Aspicilia intermutans (Nyl.) Arnold
- Loc: 14, on siliceous rock (10564)
Buellia leptocline (Flot.) A.Massal.
- Loc: 14, on siliceous rock (10557)
Caloplaca atroflava (Turner) Mong.
- Loc: 3, on siliceous rock (10378)
Caloplaca aurantia (Pers.) Steiner
- Loc: 5, 10, on calcareous rock (10410, 10489)
Caloplaca biatorina (A.Massal.) J.Steiner
- Loc: 2, on calcareous rock (10621)
Caloplaca cerina (Ehrh. ex Hedw.) Th.Fr. var. *cerina*
- Loc: 3, *Quercus coccifera* (10387)
Caloplaca chalybaea (Fr.) Müll.Arg.
- Loc: 3, 5, 15, on calcareous rock (10359, 10409, 10565)
Caloplaca citrina (Hoffm.) Th.Fr.
- Loc: 2, on calcareous rock (10631)
Caloplaca crenularia (With.) J.R.Laundon
- Loc: 3, on siliceous rock (10370)
Caloplaca crenulatella (Nyl.) H.Olivier
- Loc: 2, on artificial substrate (10628); 6, 11, 15, on calcareous rock (10445, 10510, 10570); 14, on siliceous rock (10548)
Caloplaca decipiens (Arnold) Blomb. & Forssell
- Loc: 2, 12, on calcareous rock (10617, 10524)
Caloplaca demissa (Flot.) Zahlbr.
- Loc: 2, 7, 8, 12, on calcareous rock (10625, 10448, 10471, 10525)
Caloplaca dolomiticola (Hue) Zahlbr.
- Loc: 6, 8, 9, 10, 11, 12, 15, 16, on calcareous rock (10432, 10463, 10481, 10490, 10505, 10522, 10569, 10591)
Caloplaca erythrocarpa (Pers.) Zwackh.
- Loc: 12, on calcareous rock (10526)
Caloplaca flavorubescens (Huds.) J.R.Laundon
- Loc: 3, *Quercus coccifera* (10386)
Caloplaca holocarpa (Ehrh. ex Ach.) Wade
- Loc: 3, 14, on siliceous rock (10376, 10553); 2, 12, on calcareous rock (10626, 10519)
Caloplaca lactea (A.Massal.) Zahlbr.
- Loc: 3, 4, 5, 6, 8, 9, 16, on calcareous rock (10375, 10396, 10419, 10444, 10467, 10480, 10583)
Caloplaca polycarpa (A. Massal.) Zahlbr.
- Loc: 5 on *Verrucaria* sp. (10600)
Caloplaca saxicola (Hoffm.) Nordin
- Loc: 11, 15, on calcareous rock (10512, 10568)
Caloplaca teicholyta (Ach.) J.Steiner
- Loc: 9, on calcareous rock (10482)
Caloplaca variabilis (Pers.) Müll.Arg.
- Loc: 3, 4, 5, 6, 8, 9, 10, 11, 12, 15, 16, on calcareous rock (10374, 10392, 10422, 10425, 10456, 10484, 10492, 10506, 10521, 10574, 10584)
Caloplaca xantholyta (Nyl.) Jatta
- Loc: 6 on log (10442); 9, 10, on calcareous rock (10487, 10497); 16, on moss (10579)
Candelariella aurella (Hoffm.) Zahlbr.
- Loc: 6, on siliceous rocks including limestone (10334); 2, 3, 4, 7, 8, 10, 11, 12, on calcareous rock (10620, 10357, 10394, 10447, 10450, 10498, 10503, 10520)
Candelariella coralliza (Nyl.) H.Magn.
- Loc: 13, on siliceous rock (10532)
Candelariella vitellina (Hoffm.) Müll.Arg.
- Loc: 14, on siliceous rock (10549)
Candelariella xanthostigma (Pers. ex Ach.) Lettau

- Loc: 4, on calcareous rock (10402)
Clauzadea monticola (Ach.) Hafellner & Bellem.
- Loc: 3, on calcareous rock (10353)
Collema crispum (L.) Weber ex F.H.Wigg.
- Loc: 4, 8, on calcareous soil (10404, 10470); 11, 16, on calcareous rock (10516, 10587)
Collema cristatum (L.) Weber ex F.H.Wigg.
- Loc: 6, 11, 16, on calcareous rock (10602, 10607, 10611); 10, on calcareous soil (10606)
Collema polycarpon Hoffm.
- Loc: 11, 15, on calcareous rock (10515, 10577)
Collema undulatum Laurer ex Flot.
- Loc: 3, on calcareous rock (10381)
Collema tenax (Sw.) Ach.
- Loc: 8, 12, on calcareous soil (10469, 10529)
Diploschistes gypsaceus (Ach.) Zahlbr.
- Loc: 9, on calcareous rock (10603)
Diploschistes ocellatus (Vill.) Norman
- Loc: 4, 5, 8, 9, 10, 16, on calcareous rock (10397, 10416, 10466, 10473, 10491, 10581)
Diplotomma epipolium (Ach.) Arnold
- Loc: 2, 6, 8, 10, 11, on calcareous rock (10624, 10438, 10465, 10488, 10504)
Endocarpon pusillum Hedw.
- Loc: 9, on calcareous rock (10486)
Fulgensia fulgens (Sw.) Elenkin
- Loc: 8, on calcareous soil (10452)
Lecania inundata (Hepp ex Körb.) M. Mayrhofer
- Loc: 2, on artificial substrate (10627)
Lecanora albescens (Hoffm.) Branth & Rostr.
- Loc: 9, 10, on calcareous rock (10604, 10605)
Lecanora chlarotera Nyl.
- Loc: 3, *Quercus coccifera* (10385)
Lecanora crenulata (Dicks.) Hook.
- Loc: 2, 11, on calcareous rock (10622, 10511)
Lecanora dispersa (Pers.) Röhl.
- Loc: 15, on calcareous rock (10572)
Lecanora frustulosa (Dicks.) Ach.
- Loc: 14, on siliceous rock (10540)
Lecanora hagenii (Ach.) Ach.
- Loc: 3, *Quercus coccifera* (10390) 3, 10, on calcareous rock (10367, 10499)
Lecanora rupicola (L.) Zahlbr. subsp. *rupicola*
- Loc: 14, on siliceous rock (10561)
Lecidea atrobrunnea (Ramond) Schaer.
- Loc: 14, on siliceous rock (10555)
Lecidea fuscoatra (L.) Ach.
- Loc: 3, 6, on siliceous rocks including limestone (10369, 10424); 14, on siliceous rock (10556)
Lecidella carpathica Körb.
- Loc: 14, on siliceous rock (10560)
Lecidella elaeochroma (Ach.) M.Choisy
- Loc: 3, *Quercus coccifera* (10383)
Lecidella patavina (A.Massal.) Knoph & Leuckert
- Loc: 3, on calcareous rock (10379)
Lecidella stigmatea (Ach.) Hertel & Leuckert
- Loc: 3, on calcareous rock (10364); 14, on siliceous rock (10541)
Lepraria incana (L.) Ach.
- Loc: 3, on moss (10391)
Leptogium corniculatum (Hoffm.) Minks
- Loc: 10, on calcareous soil (10500)
Leptogium lichenoides (L.) Zahlbr.

- Loc: 3, on calcareous soil (10368); 4, on calcareous rock with moss (10406); 6, on log (10436)
Lobothallia radiosa (Hoffm.) Hafellner
- Loc: 2, 3, 4, 6, 9, 12, on calcareous rock (10619, 10365, 10398, 10430, 10474, 10527); 13, on siliceous rocks including limestone (10534); 14, on siliceous rock (10547)
Physcia adscendens (Th.Fr.) H.Olivier
- Loc: 3, *Quercus coccifera* (10384)
Physcia aipolia (Ehrh. ex Humb.) Fűrnr.
- Loc: 3, *Quercus coccifera* (10389)
Physcia caesia (Hoffm.) Fűrnr.
- Loc: 14, on siliceous rock (10544)
Physcia dimidiata (Arnold) Nyl.
- Loc: 6, on log with moss (10441); 9, on calcareous rock (10477)
Physcia dubia (Hoffm.) Lettau
- Loc: 14, on siliceous rock (10554)
Physconia enteroxantha (Nyl.) Poelt
- Loc: 14, on siliceous rock with moss (10545)
Placidium rufescens (Ach.) A.Massal.
- Loc: 3, 8, 16, on calcareous soil (10382, 10464, 10597); 4, 11, on calcareous rock (10407, 10501)
Placocarpus schaereri (Fr.) Breuss
- Loc: 3, 4, 6, on calcareous rock (10358, 10393, 10440)
Placynthium nigrum (Huds.) Gray
- Loc: 3, 4, 16, on calcareous rock (10373, 10399, 10593)
Protoparmeliopsis muralis (Schreb.) M.Choisy
- Loc: 2, 3, 4, 5, 6, 8, 9, 12, 15, 16, on calcareous rock (10616, 10361, 10400, 10414, 10433, 10458, 10479, 10518, 10566, 10590); 13, 14, on siliceous rock (10531, 10546)
Psora decipiens (Hedw.) Hoffm.
- Loc: 4, 8, 16, on calcareous soil (10405, 10451, 10582); 3, 9, on calcareous rock (10360, 10478)
Psora testacea Hoffm.
- Loc: 16, on calcareous rock (10580)
Rhizocarpon geographicum (L.) DC.
- Loc: 3, 14, on siliceous rock (10371, 10537)
Rhizoplaca melanophyalma (DC.) Leuckert
- Loc: 14, on siliceous rock (10539)
Rhizoplaca peltata (Ramond) Leuckert & Poelt
- Loc: 14, on siliceous rock (10538)
Rimularia insularis (Nyl.) Rambold & Hertel
- Loc: 14, on siliceous rock (10562)
Rinodina bischoffii (Hepp) A.Massal.
- Loc: 3, 5, 6, 10, 11, 12, 16, on calcareous rock (10380, 10420, 10426, 10493, 10507, 10517, 10585)
Rinodina dubyana (Hepp) J.Steiner
- Loc: 3, 5, on calcareous rock (10366, 10412)
Rinodina immersa (Körb.) Arnold
- Loc: 8, 11, on calcareous rock (10455, 10513)
Rinodina luridata (Körb.) H. Mayrhofer, Scheid. & Sheard
- Loc: 5, on calcareous rock (10612)
* *Rinodina rinodinoides* (Anzi) H. Mayrhofer & Scheid.
- Loc: 5, 6, on calcareous rock (10599, 10601)
Rinodina sophodes (Ach.) A.Massal.
- Loc: 3, *Quercus coccifera* (10388)
Sarcogyne privigna var. *calcicola* H.Magn.
- Loc: 3, 8, 16, on calcareous rock (10362, 10468, 10586)
Sarcogyne regularis Körb.
- Loc: 5, 6, 8, 10, on calcareous rock (10614, 10435, 10454, 10494)
Squamarina cartilaginea (With.) P.James
- Loc: 3, 5, 9, on calcareous rock (10355, 10415, 10475); 6, on calcareous soil with moss (10437); 4, 8, on calcareous soil (10403, 10453); 16, on moss (10578)

- Staurothele frustulenta* Vain.
Loc: 2, on calcareous rock (10618)
Staurothele hymenogonia (Nyl.) Th.Fr.
Loc: 3, 5, 11, 15, 16, on calcareous rock (10363, 10423, 10509, 10576, 10588)
Staurothele rugulosa (A. Massal.) Arnold
Loc: 5, on calcareous rock (10418)
Toninia candida (Weber) Th.Fr.
Loc: 4, 6, on calcareous rock with moss (10408, 10443)
Toninia sedifolia (Scop.) Timdal
Loc: 3, 4, on calcareous rock (10377, 10401); 6, 9, 10, on calcareous soil (10446, 10476, 10496)
Verrucaria calciseda DC.
Loc: 5, on calcareous rock (10421)
Verrucaria fuscella (Turner) Winch
Loc: 15, 16, parasitic on *V. nigrescens* (10575, 10594)
Verrucaria lecideoides (A. Massal.) Trevis.
Loc: 12, on calcareous rock (10608)
Verrucaria macrostoma Dufour ex DC.
Loc: 8, 9, on calcareous rock (10460, 10483)
Verrucaria muralis Ach.
Loc: 9, 11, 15, on calcareous rock (10485, 10514, 10573)
Verrucaria nigrescens Pers.
Loc: 2, on artificial substrate (10629); 3, 5, 6, 8, 10, 11, 15, 16, on calcareous rock (10372, 10613, 10429, 10459, 10495, 10508, 10571, 10592)
Verrucaria subfuscella Nyl.
Loc: 6, on siliceous rocks including limestone (10439); 8, 12, on calcareous rock (10461, 10523)
Xanthoparmelia pulla (Ach.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Loc: 5, 6, 14, on siliceous rock (10411, 10428, 10558)
Xanthoparmelia tinctina (Maheu & A. Gillet) Hale
Loc: 13, on siliceous rock (10533)
Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch
Loc: 14, on siliceous rock (10551)
Xanthoria elegans (Link) Th.Fr.
Loc: 2, on calcareous rock (10630), 14, on siliceous rock (10550)

DISCUSSION

In this study, a total of 278 lichen specimens were collected from 16 localities and 109 taxa belonging to 36 genera were determined. From these taxa 24 of them are new records for the study area.

According to the literatures, *Rinodina rinodinoides* is the new record for Turkey. *Acarospora insolata*, *Buellia leptocline*, *Endocarpon pusillum* and *Rinodina luridata* are the lichen species recorded for the second time from Turkey.

Diploschistes gypsaceus was recorded from Van previously by Szatala (1941). This species was also found in our study at one locality from Şanlıurfa.

According to the literatures, parasitic species *Caloplaca polycarpa* and *Verrucaria fuscella* are found on *Verrucaria* spp. (Wirth, 1995).

The first lichen records from study area were given by Steiner (1899). He recorded 13 lichen specimens from this region. Then, other lichenologists also published several articles on the lichen diversity of this region in different years.

The richest genera are *Caloplaca* (20), *Aspicilia* (8), *Lecanora* (6), *Verrucaria* (6), *Acarospora* (5) and *Physcia* (5). Among all taxa, 82 taxa are saxicolous, 7 taxa are epiphytic, 4 are terricolous, 1 is muscicolous, and 2 taxa are parasitic on the other lichen. Other 13 taxa are observed on two or more substrate.

With respect to substrate of saxicolous specimens, which determined at study area, except localities of 3 (Gaziantep), 13 (Diyarbakır) and 14 (Şanlıurfa-Karacadağ), calcareous rocks are common.

Common Mediterranean specimens on calcareous rocks such as *Aspicilia calcarea*, *A. cheresina* var. *justii*, *A. farinosa*, *Caloplaca aurantia*, *C. dolomiticola*, *C. variabilis*, *Candelariella aurella*, *Collema*

crispum, *C. undulatum*, *Diploschistes ocellatus*, *Lobothallia radiosa*, *Placocarpus schaereri* and *Verrucaria calciseda* were observed at the study area (John, 1996).

Karacadağ differs from other localities with siliceous rock composition. At this locality such as *Acarospora impressula*, *A. insolata*, *Aspicilia cinerea*, *A. intermutans*, *Buellia leptocline*, *Candelariella vitellina*, *Lecanora frustulosa*, *L. rupicola* subsp. *rupicola*, *Lecidea atrobrunnea*, *Lecidea fuscoatra*, *Lecidella carpathica*, *Rhizocarpon geographicum*, *Rhizoplaca melanophyalma*, *R. peltata*, *Rimularia insularis*, *Xanthoparmelia pulla*, *X. verruculifera* and *Xanthoria elegans* were determined, which prefer exposed sunny siliceous rock at region at high altitudes of mountain (Purvis, 1992; Wirth, 1995).

The species known as "Manna Lichen" which usually grows in steppes, *Aspicilia desertorum* was also found on siliceous rock in open area. It was previously reported that this species found on siliceous rock in open areas, which supports our results on the manna lichen.

Southeast Anatolian region is rather poor in terms of woodland area. Therefore epiphytic lichen species are quite few at the study area.

According to geological literatures, a large part of Anatolia was covered with Tethys Ocean million years ago. The sea disappeared owing to the land arise in area of Tethys Ocean by geological events and a lot of mount lines had occurred. In this study, *Acarospora veronensis* found on fossil mussel shell from Mount Nur in Gaziantep. This provides an evidence for the presence of the sea in this region in the past (Clauzade and Roux, 1985).

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