

## LICHENS AND LICHENICOLOUS FUNGI FROM MUŞ PROVINCE IN TURKEY

K. YAZICI<sup>1</sup>, A. ASLAN<sup>2</sup>, D. KARAHAN<sup>1</sup>, A. APTROOT<sup>3</sup> and H. J. M. SIPMAN<sup>4</sup>

<sup>1</sup>Department of Biology, Faculty of Science, Karadeniz Technical University, 61080, Trabzon Turkey; E-mails: kenan65@gmail.com, kcagri\_1997@yahoo.com (corresponding author)

<sup>2</sup>Faculty of Pharmacy, Yüzüncü Yıl University, 65080 Campus, Van, Turkey;  
Kyrgyz-Turkish Manas University, Faculty of Arts and Science, Department of Biology  
Bishkek, Kyrgyzstan; E-mail: aliaslani@yahoo.com

<sup>3</sup>Laboratório de Botânica / Liquenologia, Instituto de Biociências  
Universidade Federal de Mato Grosso do Sul, Avenida Costa e Silva s/n, Bairro Universitário  
CEP 79070-900, Campo Grande, Mato Grosso do Sul, Brazil; E-mail: andreaproot@gmail.com

<sup>4</sup>Botanischer Garten und Botanisches Museum Berlin, Freie Universität Berlin  
Königin-Luise-Straße 6–8, D-14195 Berlin, Germany; E-mail: H.sipman@bgbm.org

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A contribution to the lichen flora of Turkey is presented. A total of 282 lichen taxa and 20 lichenicolous fungi, of which 4 are varieties, are determined from 87 different localities in Muş province (Turkey). *Lichenostigma gracile*, a lichenicolous fungus, is new to Turkey, and 274 lichen species and 20 lichenicolous fungi are new for Muş.

Key words: Ascomycota, biodiversity, lichen, Muş, Turkey

### INTRODUCTION

Studies on lichens and lichenicolous fungi of Turkey have been intensive in recent years but some parts are rather less investigated (John and Türk 2017). Still, we have some lichenologically poorly known areas waiting for investigations, and one of them, the Muş province, was never studied because of its harsh conditions: only eight lichenized fungi have thus far been reported from Muş region, and no lichenicolous fungi (Krisai-Greilhuber *et al.* 2017, Yazıcı and Aptroot 2017, Yazıcı *et al.* 2010a, b). Evidently, this region has remained largely unexplored.

Muş, a province located 38° 30'–39° 30' N latitude and 41° 06'–42° 47' E longitude in the east of Turkey, has the third largest plain in Eastern Anatolia and is surrounded by Ağrı, Batman, Bingöl, Bitlis, Diyarbakır and Erzurum provinces. It has a rarely found natural setting, being in the highest region of Turkey, nearby the Murat and Karasu rivers. Hidden between the mountains, this plain has a natural beauty, with lakes and greenery between high mountains. It is 8,196 km<sup>2</sup> in area (URL-1). The geographical area of the southern part of the Muş region, having many hills, valleys and slits, is the most rug-

ged part. 35% of the total area is mountains, 38% plateaus, which are situated on ridges amongst peaks of mountains, and 27% plains. The biggest river is Murat stream, which is a branch of the Fırat River and its length in Muş region is 206 km. Mt Akdoğan (2,878 m), which is an extension of Bingöl Mts, Şerafettin Mts (2,544 m), Bilican Mts, Bilicantepe (2,959 m), Haçres Mts and Big Kurtik (2,648 m) are the most important mountains and hills (URL-1). Plant cover in Muş region is predominantly formed by steppe and meadows (53%), *Quercus* forests and shrubberies (11%), and agricultural areas (33%). Woody vegetation occupying the central and southern part of Muş province is composed of mostly *Quercus* spp. and partly *Juglans* spp., while *Salix* and *Populus* spp. are present along rivers, lakes and streams (Baytop and Denizci 1963). High mountains and *Quercus* forests occur in some parts of the plateaus in the northern part of the region. Fruit trees, such as *Juglans*, *Prunus*, *Pyrus* and also *Quercus*, are predominantly seen in anthropogenic areas. Other parts of the study area are quite poor with regard to deciduous and coniferous trees. Collecting localities are well-lit, windswept, with gently sloping terrain containing calcareous and siliceous rocks. Muş region has a climate characterised by very cold and very snowy and long winters, and hot, dry and short summers, with temperatures ranging from  $-29^{\circ}\text{C}$  to  $41.6^{\circ}\text{C}$ . The annual average temperate is  $9.5^{\circ}\text{C}$ . The annual rainfall ranges between 350–1,000 mm and the average humidity is 60.3% (Akman 1999).

The present paper is a contribution to our knowledge of the lichen flora of Turkey and provides the first comprehensive checklist of lichens for Muş region.

## MATERIAL AND METHODS

Lichens and lichenicolous fungi were collected at 87 localities in Muş province between 28.06.2016 and 12.04.2018 (Fig. 1). Air dried samples were studied with a Nikon SMZ1500 stereomicroscope and a Nikon Eclipse 80i light microscope with standard identification methods for lichenized and lichenicolous fungi (Arup *et al.* 2013, Blanco *et al.* 2004, Brodo *et al.* 2001, Calatayud *et al.* 2002, Darmostuk 2016, Dobson 2005, Esslinger 1997, Etayo and Calatayud 1998, Galloway and Moberg 2005, Giralt 2001, Hawksworth 1983, Kocakaya *et al.* 2011, Marina *et al.* 2005, Navarro-Rosinés *et al.* 2009, Nordin *et al.* 2010, Smith *et al.* 2009). Specimens are deposited in the herbarium of the Biology Department, Faculty of Science, Karadeniz Technical University, Turkey (KTUB).

### *List of collecting localities*

- Loc. 1. Muş, south of the centre; coord.  $38^{\circ} 43' 29.89''$  N,  $41^{\circ} 28' 01.51''$  E, alt. 1,826 m a.s.l., date: 29.05.2015.
- Loc. 2. Muş, centre, Üçevler village; coord.  $38^{\circ} 38' 31.00''$  N,  $41^{\circ} 22' 40.56''$  E, alt. 1,788 m a.s.l., date: 29.05.2015.
- Loc. 3. Muş, centre, between Üçevler village and Muş: centre, main road; coord.  $38^{\circ} 40' 49.85''$  N,  $41^{\circ} 25' 30.87''$  E, alt. 2,585 m a.s.l., date: 29.05.2015.

- Loc. 4. Muş, centre, on the way to Üçevler village; coord. 38° 39' 09.91" N, 41° 23' 20.76" E, alt. 2,041 m a.s.l., date: 29.05.2015.
- Loc. 5. Muş, centre, the end of Kızılağaç main road; coord. 38° 47' 35.75" N, 41° 19' 44.25" E, alt. 1,319 m a.s.l., date: 30.05.2015.
- Loc. 6. Muş, centre, on the way to Kayalısu village; coord. 38° 43' 04.07" N, 41° 13' 47.60" E, alt. 1,824 m a.s.l., date: 30.05.2015.
- Loc. 7. Muş, centre, on the way to Cevzlidere village, roadside; coord. 38° 35' 25.33" N, 41° 20' 56.87" E, alt. 1,561 m a.s.l., date: 30.05.2015.
- Loc. 8. Muş, centre, exit of Cevzlidere village, Arıkonak village main road; coord. 38° 36' 57.16" N, 41° 19' 52.00" E, alt. 2,004 m a.s.l., date: 30.05.2015.
- Loc. 9. Muş, centre, towards Cevzlidere village; coord. 38° 38' 09.61" N, 41° 23' 04.42" E, alt. 1,788 m a.s.l., date: 30.05.2015.
- Loc. 10. Muş, centre, 200 m to Alaniçi village, main road; coord. 38° 39' 16.91" N, 41° 21' 11.78" E, alt. 1,719 m a.s.l., date: 29.05.2015.
- Loc. 11. Muş, centre, Ekindüzü village; coord. 38° 36' 36.28" N, 41° 24' 51.52" E, alt. 1,599 m a.s.l., date: 31.05.2015.
- Loc. 12. Muş, centre, south of Ağıllı village; coord. 38° 35' 51.54" N, 41° 26' 42.02" E, alt. 1,567 m a.s.l., date: 31.05.2015.
- Loc. 13. Muş, centre, between İlica and Muş main road; coord. 38° 38' 47.82" N, 41° 34' 09.57" E, alt. 1,873 m a.s.l., date: 31.05.2015.

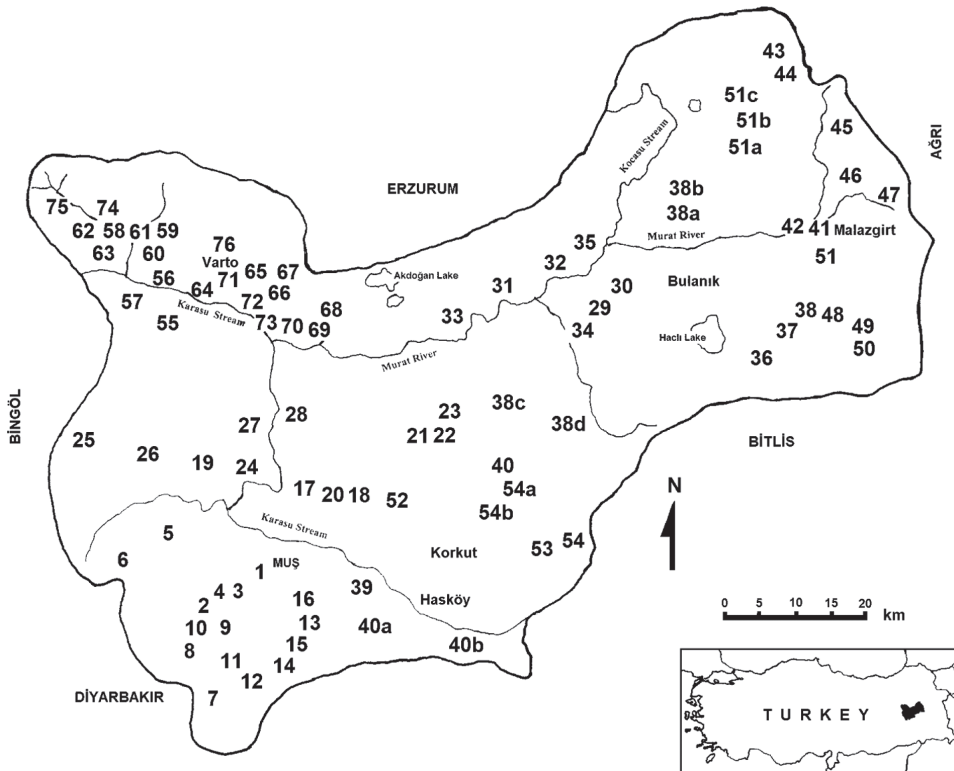


Fig. 1. Map of Turkey showing Muş province and the collecting numbers

- Loc. 14. Muş, centre, İlica roadside; coord. 38° 36' 04.15" N, 41° 29' 23.43" E, alt. 2,023 m a.s.l., date: 31.05.2015.
- Loc. 15. Muş, centre, İlica main road, roadside; coord. 38° 38' 06.16" N, 41° 32' 55.88" E, alt. 2,018 m a.s.l., date: 31.05.2015.
- Loc. 16. Muş, centre, İlica and Muş roadside; coord. 38° 40' 23.73" N, 41° 33' 54.81" E, alt. 1,421 m a.s.l., date: 31.05.2015.
- Loc. 17. Muş, centre, Boyuncuk village; coord. 38° 51' 02.97" N, 41° 35' 23.46" E, alt. 1,364 m a.s.l., date: 06.08.2015.
- Loc. 18. Muş, centre, Kırköy; coord. 38° 49' 58.07" N, 41° 39' 13.66" E, alt. 1,325 m a.s.l., date: 06.08.2015.
- Loc. 19. Muş, centre, Konukbekler, roadside; coord. 38° 53' 21.44" N, 41° 22' 53.15" E, alt. 1,311 m a.s.l., date: 05.08.2015.
- Loc. 20. Muş, centre, Ayranlı village; coord. 38° 50' 13.25" N, 41° 36' 28.47" E, alt. 1,302 m a.s.l., date: 06.08.2015.
- Loc. 21. Muş, merkez, Çiçekli village; coord. 38° 54' 58.53" N, 41° 41' 12.80" E, alt. 1,545 m a.s.l., date: 06.08.2015.
- Loc. 22. Muş, centre, between Çiçekli and Karameşe villages; coord. 38° 55' 09.70" N, 41° 42' 01.32" E, alt. 1,575 m a.s.l., date: 06.08.2015.
- Loc. 23. Muş, centre, towards Elçiler village; coord. 38° 55' 34.38" N, 41° 48' 22.04" E, alt. 1,872 m a.s.l., date: 06.08.2015.
- Loc. 24. Muş, centre, Bingöl throughout the road, 5 km to Muş centre, roadside towards Konukbekler village; coord. 38° 52' 28.26" N, 41° 28' 43.47" E, alt. 1,260 m a.s.l., date: 07.08.2015.
- Loc. 25. Muş, centre, Bingöl border, throughout the road, opposite of Karabey village; coord. 38° 56' 19.85" N, 41° 09' 22.51" E, alt. 1,569 m a.s.l., date: 07.08.2015.
- Loc. 26. Muş, towards Muş-Bingöl border, roadside; coord. 38° 55' 09.17" N, 41° 13' 03.45" E, alt. 1,361 m a.s.l., date: 07.08.2015.
- Loc. 27. Muş, Yeşilova; coord. 38° 55' 37" N, 41° 27' 54" E, alt. 1,334 m a.s.l., date: 10.04.2018.
- Loc. 28. Muş, Serinova; coord. 38° 55' 42" N, 41° 32' 21" E, alt. 1,270 m a.s.l., date: 10.04.2018.
- Loc. 29. Bulanık, 5 km to Arakonak, main road side; coord. 39° 04' 19.73" N, 42° 07' 35.35" E, alt. 1,594 m a.s.l., date: 01.06.2015, 30.06.2015.
- Loc. 30. Bulanık, 2 km to Arakonak, main road side; coord. 39° 05' 20.17" N, 42° 09' 08.13" E, alt. 1,547 m a.s.l., date: 01.06.2015.
- Loc. 31. Bulanık, side of Alparslan Dam, passing Doğantepe village; coord. 39° 07' 43.43" N, 41° 57' 28.69" E, alt. 1,629 m a.s.l., date: 23.07.2015.
- Loc. 32. Bulanık, side of Alparslan, passing Köprüyolu village; coord. 39° 07' 25.63" N, 41° 59' 45.12" E, alt. 1,658 m a.s.l., date: 23.07.2015.
- Loc. 33. Bulanık, side of Alparslan dam, Esenler village, roadside; coord. 39° 05' 56.70" N, 41° 52' 28.13" E, alt. 1,661 m a.s.l., date: 23.07.2015.
- Loc. 34. Bulanık, passing Gülçimen, main road; coord. 39° 02' 50.77" N, 42° 05' 32.40" E, alt. 1,531 m a.s.l., date: 23.07.2015.
- Loc. 35. Bulanık, exit of Karaağıl village; coord. 39° 08' 48.49" N, 42° 04' 59.70" E, alt. 1,522 m a.s.l., date: 24.07.2015.
- Loc. 36. Bulanık, Söğütlü; coord. 38° 58' 47" N, 42° 22' 19" E, alt. 1,784 m a.s.l., date: 31.07.2017.
- Loc. 37. Bulanık, Çaygeldi; coord. 39° 00' 29" N, 42° 26' 50" E, alt. 1,761 m a.s.l., date: 31.07.2017.
- Loc. 38. Bulanık, Elmakaya; coord. 39° 01' 41" N, 42° 29' 19" E, alt. 1,715 m a.s.l., date: 31.07.2017.

- Loc. 38a. Bulanık, Gündüzü; coord. 39° 12' 23" N, 42° 16' 03" E, alt. 1,482 m a.s.l., date: 11.04.2018.
- Loc. 38b. Bulanık, Şehittahir village; coord. 39° 13' 51" N, 42° 16' 42" E, alt. 1,500 m a.s.l., date: 11.04.2018.
- Loc. 38c. Bulanık, Çataklı village; coord. 38° 57' 12" N, 41° 54' 18" E, alt. 1,597 m a.s.l., date: 11.04.2018.
- Loc. 38d. Bulanık, Yokuşbaşı village; coord. 38° 54' 33" N, 42° 00' 23" E, alt. 1,635 m a.s.l., date: 11.04.2018.
- Loc. 39. Between Hasköy and Muş, 3 km to Hasköy, side of main road; coord. 38° 43' 07.57" N, 41° 36' 58.58" E, alt. 1,250 m a.s.l., date: 02.06.2015.
- Loc. 40. Hasköy, between Hasköy and Karakale main road; coord. 38° 49' 04.52" N, 41° 56' 17.85" E, alt. 1,511 m a.s.l., date: 02.06.2015.
- Loc. 40a. Hasköy, Elmabulak; coord. 38° 39' 03" N, 41° 39' 26" E, alt. 1,467 m a.s.l., date: 10.04.2018.
- Loc. 40b. Hasköy, Koçköy; coord. 38° 37' 48" N, 41° 50' 57" E, alt. 1,310 m a.s.l., date: 10.04.2018.
- Loc. 41. Malazgirt, centre; coord. 39° 09' 08.20" N, 42° 30' 41.43" E, alt. 1,485 m a.s.l., date: 02.06.2015.
- Loc. 42. Malazgirt, 5 km to Malazgirt, passing Okçuhan village; coord. 39° 08' 32.86" N, 42° 27' 30.06" E, alt. 1,505 m a.s.l., date: 02.06.2015.
- Loc. 43. Malazgirt, passing Bahçe village; coord. 39° 25' 02.76" N, 42° 27' 12.32" E, alt. 1,721 m a.s.l., date: 24.07.2015.
- Loc. 44. Malazgirt, passing Koçali village, roadside; coord. 39° 23' 23.08" N, 42° 29' 07.91" E, alt. 1,705 m a.s.l., date: 24.07.2015.
- Loc. 45. Malazgirt, Güleç village, roadside; coord. 39° 19' 56.10" N, 42° 33' 10.60" E, alt. 1,542 m a.s.l., date: 24.07.2015.
- Loc. 46. Malazgirt, Tatlıca village, roadside; coord. 39° 14' 50.24" N, 42° 32' 57.36" E, alt. 1,496 m a.s.l., date: 24.07.2015.
- Loc. 47. Malazgirt, Bostankaya village; coord. 39° 12' 05.09" N, 42° 39' 12.20" E, alt. 1,563 m a.s.l., date: 25.07.2015.
- Loc. 48. Malazgirt, Odaköy main road, separation of Elmakaya village; coord. 39° 03' 46.21" N, 42° 33' 20.91" E, alt. 1,642 m a.s.l., date: 25.07.2015.
- Loc. 49. Malazgirt, Adaksu village road, 3 km to Adaksu village, main road, separation of Kulcak village; coord. 38° 59' 18.50" N, 42° 35' 20.01" E, alt. 1,949 m a.s.l., date: 25.07.2015.
- Loc. 50. Malazgirt, 6 km to Adaksu village, roadside; coord. 39° 05' 56.70" N, 41° 52' 28.13" E, alt. 1,961 m a.s.l., date: 25.07.2015.
- Loc. 51. Malazgirt, 1 km to Adalar village; coord. 39° 06' 57.61" N, 42° 31' 46.02" E, alt. 1,589 m a.s.l., date: 25.07.2015.
- Loc. 51a. Malazgirt, Yukarıkıcık village; coord. 39° 17' 23" N, 42° 23' 29" E, alt. 1,918 m a.s.l., date: 09.04.2018.
- Loc. 51b. Malazgirt, Lala Mountain; coord. 39° 17' 30" N, 42° 24' 21" E, alt. 1,797 m a.s.l., date: 09.04.2018.
- Loc. 51c. Malazgirt, Kuruca village; coord. 39° 21' 27" N, 42° 22' 53" E, alt. 1,709 m a.s.l., date: 09.04.2018.
- Loc. 52. Korkut, Yedipınar passage, side of dam; coord. 38° 49' 37.08" N, 41° 43' 14.37" E, alt. 1,403 m a.s.l., date: 08.08.2015.
- Loc. 53. Korkut, Yünören village, 100 m to road separation; coord. 38° 42' 03.55" N, 41° 58' 53.73" E, alt. 1,640 m a.s.l., date: 08.08.2015.

- Loc. 54. Korkut, Yolgözler village; coord. 38° 42' 44.19" N, 42° 02' 27.51" E, alt. 1,651 m a.s.l., date: 08.08.2015.
- Loc. 54a. Korkut, 2 km to Karakale, main road; coord. 38° 48' 42.33" N, 41° 55' 51.87" E, alt. 1,510 m a.s.l., date: 01.06.2015.
- Loc. 54b. Korkut, 5 km to Karakale, main road; coord. 38° 47' 26.22" N, 41° 54' 51.78" E, alt. 1,450 m a.s.l., date: 01.06.2015.
- Loc. 55. Varto, Karameşe; coord. 39° 07' 36" N, 41° 22' 08" E, alt. 1,674 m a.s.l., date: 12.08.2017.
- Loc. 56. Varto, Kalecik; coord. 39° 08' 11" N, 41° 20' 28" E, alt. 1,615 m a.s.l., date: 12.08.2017.
- Loc. 57. Varto, Buzlugöze; coord. 39° 08' 05" N, 41° 18' 26" E, alt. 1,770 m a.s.l., date: 13.08.2017.
- Loc. 58. Varto, Küçüktepe; coord. 39° 15' 12" N, 41° 16' 09" E, alt. 1,579 m a.s.l., date: 13.08.2017.
- Loc. 59. Varto, Armutkaşı; coord. 39° 14' 00" N, 41° 20' 43" E, alt. 1,716 m a.s.l., date: 13.08.2017.
- Loc. 60. Varto, Yılanlı; coord. 39° 13' 06" N, 41° 18' 35" E, alt. 1,646 m a.s.l., date: 14.08.2017.
- Loc. 61. Varto, Güzelkent; coord. 39° 14' 25" N, 41° 17' 56" E, alt. 1,546 m a.s.l., date: 14.08.2017.
- Loc. 62. Varto, Teknedüzü; coord. 39° 15' 42" N, 41° 13' 47" E, alt. 1,646 m a.s.l., date: 14.08.2017.
- Loc. 63. Varto, Yeşildal; coord. 39° 15' 00" N, 41° 14' 31" E, alt. 1,632 m a.s.l., date: 14.08.2017.
- Loc. 64. Varto, Aşağı Alagöz; coord. 39° 08' 35" N, 41° 25' 32" E, alt. 1,421 m a.s.l., date: 27.08.2017.
- Loc. 65. Varto, Yedikavak; coord. 39° 07' 51" N, 41° 29' 22" E, alt. 1,521 m a.s.l., date: 27.08.2017.
- Loc. 66. Varto, Özenç; coord. 39° 06' 52" N, 41° 30' 11" E, alt. 1,457 m a.s.l., date: 27.08.2017.
- Loc. 67. Varto, Baltaş; coord. 39° 07' 36" N, 41° 31' 23" E, alt. 1,806 m a.s.l., date: 28.08.2017.
- Loc. 68. Varto, Yeşilpınar; coord. 39° 05' 32" N, 41° 37' 52" E, alt. 1,719 m a.s.l., date: 28.08.2017.
- Loc. 69. Varto, Kayalıkale; coord. 39° 04' 70" N, 41° 35' 52" E, alt. 1,475 m a.s.l., date: 29.08.2017.
- Loc. 70. Varto, Kuşluk; coord. 39° 05' 38" N, 41° 34' 52" E, alt. 1,626 m a.s.l., date: 29.08.2017.
- Loc. 71. 3 km to Varto, main road; coord. 39° 08' 42.80" N, 41° 26' 08.61" E, alt. 1,520 m a.s.l., date: 30.06.2015.
- Loc. 72. 12 km to Varto, main road; coord. 39° 06' 35.94" N, 41° 29' 12.13" E, alt. 1,375 m a.s.l., date: 30.06.2015.
- Loc. 73. 15 km to Varto, main road, passing Tepeköy; coord. 39° 06' 08.90" N, 41° 30' 15.08" E, alt. 1,310 m a.s.l., date: 30.06.2015.
- Loc. 74. Varto, passing 1 km Çalidere, main road; coord. 39° 16' 25.67" N, 41° 14' 18.58" E, alt. 1,710 m a.s.l., date: 01.07.2015.
- Loc. 75. Varto, passing Onpınar; coord. 39° 16' 34.45" N, 41° 10' 28.99" E, alt. 1,765 m a.s.l., date: 30.06.2015.
- Loc. 76. Varto, Ağaçalı village, main road; coord. 39° 11' 52.43" N, 41° 24' 50.43" E, alt. 1,600 m a.s.l., date: 30.06.2015.

## RESULTS AND DISCUSSION

A total of 282 lichen taxa and 20 lichenicolous fungi, of which 4 are varieties, are identified from 87 different localities in Muş province (Turkey). *Lichenostigma gracile*, a lichenicolous fungus, is new to Turkey. 274 lichen taxa and all lichenicolous fungi (20 species) are for the first time reported from Muş province except for eight species (*Aspicilia asiatica*, *A. glomerulans*, *Lobothallia chadefaudiana*, *Merismatium deminutum*, *Opegrapha parasitica*, *Porpidia zeoroides*, *Protoparmelia atriseda*, and *Rhizocarpon furfurosum*) (Krisai-Greilhuber *et al.* 2017, Yazıcı and Aptroot 2017, Yazıcı and Aslan 2016a, b).

The taxa are listed alphabetically. An asterisk (\*) indicates new records for Turkey, "+" is for lichenicolous fungus, while a lichenicolous lichen is marked by "#".

## List of taxa

- Acarospora cervina* (Ach.) A. Massal. – Locs 3, 12–13, 16, 19, 23, 25, 29–31, 34–36, 38a–d, 39–40a, 41, 43–51a, 51c–54b, 58, 60, 62–65, 70–71, 74–76: on calcareous rock.
- A. fuscata* (Schr.) Arnold – Locs 1, 13, 16, 21–22, 29–35, 41–42, 44–47, 49–50, 53, 64–65, 68–70, 74–75: on siliceous rock.
- #*A. hospitans* (H. Magn.) Clauzade et Cl. Roux – Locs 4–6, 10, 12–13, 16, 29, 31–33, 35, 41, 45–47, 49–50, 52–54, 71, 73: on *Aspicilia cinerea*.
- A. impressula* Th. Fr. – Locs 5, 13, 16, 29–30, 44, 46, 49: on siliceous rock.
- A. insolata* H. Magn. – Loc. 32: on siliceous rock.
- A. macrospora* (Hepp) A. Massal. ex Bagl. – Loc. 29: on siliceous rock.
- A. peliscypha* (Wahlenb.) Th. Fr. – Loc. 47: on siliceous rock.
- A. scabra* (Pers.) Th. Fr. – Locs 3, 11, 30, 34: on siliceous rock.
- A. strigata* (Nyl.) Jatta – Locs 34, 41, 43–44: on calcareous rock.
- A. umbilicata* Bagl. – Loc. 31: on siliceous rock.
- A. veronensis* A. Massal. – Locs 1, 4–5, 8–13, 29–30, 32–33, 35, 39, 41, 44–50, 52–54a, 56, 64, 71, 73, 76: on siliceous rock.
- A. versicolor* Bagl. et Carestia – Loc. 12: on siliceous rock.
- Agonimia tristicula* (Nyl.) Zahlbr. – Loc. 11: on mosses.
- +*Arthonia epiphyscia* Nyl. – Loc. 42: on *Physcia dubia* thallus.
- +*A. hertelii* (Calat., Barreno et V. J. Rico) Hafellner et Volk. John – Loc. 52: on *Circinaria calcarea*.
- A. lapidicola* (Taylor) Branth et Rostr. – Locs 5, 8–9, 13, 16, 31–32, 44, 49–50: on calcareous rock.
- +*A. varians* (Davies) Nyl. – Locs 5–6, 8, 10, 12, 22, 52: on *Lecanora rupicola*.
- Aspicilia asiatica* (H. Magn.) Oxner – Loc. 3: on calcareous rock.
- A. cinerea* (L.) Körb. – Locs 1, 3–7, 9–13, 15–16, 19, 21–22, 29–35, 38a–b, 39, 40b, 41–42, 44–51a, 51c–56, 59, 63, 68–73, 75–76: on siliceous rock.
- A. desertorum* (Kremp.) Mereschk. – Locs 1, 4–13, 15–16, 21–22, 29–30, 32, 35, 39, 40a, 41–42, 44, 46–47, 49–50, 52–54, 57, 66–67, 73: on siliceous rock.
- A. glomerulans* (Poelt) Poelt – Locs 34–35, 44–45, 74: on calcareous rock.
- A. intermutans* (Nyl.) Arnold – Locs 21, 33: on siliceous rock.

- A. laevata* (Ach.) Arnold – Loc. 13: on siliceous rock.  
*A. polychroma* Anzi – Loc. 76: on calcareous rock.  
*Athallia holocarpa* (Hoffm.) Arup, Frödén et Søchting – Locs 3–4, 9, 11–12, 16, 30, 43–44, 46, 52–53, 73: on calcareous rock.  
*Bacidia rubella* (Hoffm.) A. Massal. – Loc. 7: on *Quercus* sp.  
*Bagliettoa baldensis* (A. Massal.) Vězda – Locs 40a, 74: on calcareous rock.  
*B. calciseda* (DC.) Gueidan et Cl. Roux – Loc. 73: on calcareous rock.  
*B. parmigera* (J. Steiner) Gams – Loc. 49: on calcareous rock.  
*Bellemerea cupreoatra* (Nyl.) Clauzade et Cl. Roux – Locs 5, 8, 12, 30, 33, 35, 41, 45, 49–50, 52–54, 71–74, 76: on siliceous rock.  
*Blastenia crenularia* (With.) Arup, Søchting et Frödén – Locs 4–5, 33, 40a: on siliceous rock.  
*B. ferruginea* (Huds.) A. Massal. – Loc. 11: on *Quercus* sp.  
*Blennothallia crispa* (Huds.) Otálora, P. M. Jørg et Wedin – Loc. 22: on calcareous rock.  
*Bryobilimbia hypnorum* (Lib.) Fryday, Printzen et S. Ekman – Loc. 72: on mosses.  
*B. sanguineoatra* (Wulfen) Fryday, Printzen et S. Ekman – Loc. 30: on mosses.  
*Buellia aethalea* (Ach.) Th. Fr. – Loc. 29: on siliceous rock.  
*B. badia* (Fr.) A. Massal. – Locs 21–22, 29–30, 44, 47, 49–50, 71: on siliceous rock.  
*B. ocellata* (Flörke ex Flot.) Körb. – Loc. 22: on siliceous rock.  
*Calogaya biatorina* (A. Massal.) Arup, Frödén et Søchting – Loc. 39: on calcareous rock.  
*C. decipiens* (Arnold) Arup, Frödén et Søchting – Locs 39, 43–44, 50, 52, 54a: on calcareous rock.  
*C. lobulata* (Flörke) Arup, Frödén et Søchting – Locs 2, 6, 17, 20–21: on *Salix* sp., Locs 9, 15–16: on *Juglans* sp., Loc. 11: on *Quercus* sp., Loc. 41: on *Populus* sp.  
*C. saxicola* (Hoffm.) Vondrák – Locs 1, 16, 22, 29, 32–35, 39, 41, 43–47, 52, 71–72: on calcareous rock.  
*C. schistidii* (Anzi) Arup, Frödén et Søchting – Loc. 35: on mosses.  
*Caloplaca albolutescens* (Nyl.) H. Olivier – Locs 22, 33: on calcareous rock.  
*C. aractina* (Fr.) Häyrén – Loc. 39: on siliceous rock.  
*C. areolata* (Zahlbr.) Clauzade – Loc. 5: on siliceous rock.  
*C. atroflava* (Turner) Mong. – Locs 6–7, 12–13, 38c–d, 40a, 48, 53, 54a, 66, 70, 72: on calcareous rock.  
*C. ceracea* J. R. Laundon – Locs 16, 22, 29, 31–32, 45–47, 53: on calcareous rock.  
*C. cerina* (Ehrh. ex Hedw.) Th. Fr. var. *cerina* – Locs 4, 29–30, 36, 44–45, 47, 49–50, 56, 59, 61, 63: on mosses, Locs 5, 7, 11: on *Quercus* sp., Loc. 9: on *Quercus* sp. and *Juglans* sp., Loc. 13: on *Juglans* sp., Locs 14–15, 22: on *Salix* sp.  
*C. chlorina* (Flot.) Sandst. – Locs 5–6, 9, 12, 41: on siliceous rock.  
#*C. epithallina* Lyngé – Loc. 45: on *Aspicilia cinerea*.  
#*C. grimmiae* (Nyl.) H. Olivier – Locs 32, 41, 45–47, 49, 50: on *Candelariella vitellina*.  
*C. inconnexa* (Nyl.) Zahlbr. – Loc. 43: on siliceous rock.  
*C. pellodella* (Nyl.) Hasse – Loc. 31: on siliceous rock.  
*C. soralifera* Vondrák et Hrouzek – Locs 20, 54: on calcareous rock.  
*C. stillicidiorum* (Vahl.) Lyngé – Loc. 32: on mosses.  
*C. teicholyta* (Ach.) J. Steiner – Loc. 22: on calcareous rock.  
*C. xerica* Poelt et Vězda – Loc. 49: on siliceous rock.  
*Candelariella aurella* (Hoffm.) Zahlbr. – Locs 1, 2, 5–6, 13: on *Salix* sp., Locs 7, 9, 11: on *Quercus* sp., Locs 14–16: on *Juglans* sp., Locs 29–30, 34–35, 39–44, 46–50, 52–53, 54a, 72–73: on *Populus* sp.  
*C. coralliza* (Nyl.) H. Magn. – Loc. 72: on siliceous rock.  
*C. kuusamoensis* Räsänen – Locs 5, 11: on mosses.



- C. reflexa* (Nyl.) Lettau – Loc. 7: on *Quercus* sp.
- C. vitellina* (Ehrh.) Müll. Arg. – Locs 1, 3–13, 16–17, 20–22, 25–26, 29–36, 38a–b, 39–50, 52–54a, 71, 73, 76: on siliceous rock.
- C. xanthostigma* (Pers. ex Ach.) Lettau – Loc. 11: on *Quercus* sp.
- +*Carbonea vitellinaria* (Nyl.) Hertel – Locs 5, 10–12, 29–33, 42, 46–47, 49–50, 76: on *Candelariella vitellina*.
- C. vorticosa* (Flörke) Hertel – Locs 12–13, 31, 44–47, 50: on *Lecidea* sp.
- +*Cercidospora macrospora* (Uloth) Hafellner et Nav.-Ros. – Loc. 12: on *Protoparmeliopsis muralis*.
- +*C. melanophthalmae* Nav.-Ros., Calat. et Hafellner – Loc. 35: on *Rhizoplaca melanophthalma*.
- Chrysothrix chlorina* (Ach.) J. R. Laundon – Loc. 43: on siliceous rock.
- Circinaria caesiocinerea* (Nyl. ex Malbr.) A. Nordin, Savić et Tibell – Locs 1, 3–6, 8–16, 22, 24, 29–31, 33–35, 38c, 39, 41, 44–50, 53, 72–73, 76: on siliceous rock.
- C. calcarea* (L.) A. Nordin Savić et Tibell – Locs 8, 24, 39, 46, 50, 63: on calcareous rock.
- C. contorta* (Hoffm.) A. Nordin, Savić et Tibell – Locs 7, 9, 16, 22, 30, 35, 44, 46–47, 50, 53–54, 68, 72, 75: on calcareous rock.
- C. fruticulosa* (Eversm.) Sohrabi – Loc. 73: on soil.
- C. hoffmanniana* (S. Ekman et Fröberg ex R. Sant.) A. Nordin – Locs 7, 9: on calcareous rock.
- Cladonia coniocraea* (Flörke) Spreng. – Loc. 35: on *Quercus* sp.
- C. pyxidata* Hoffm. – Locs 18, 23: on soil.
- C. rangiformis* Hoffm. – Loc. 11: on soil.
- Collema furfuraceum* (Schaer.) Du Rietz – Loc. 21: *Populus* sp.
- C. subflaccidum* Degel. – Locs 9, 59, 73: on siliceous rock.
- C. tenax* (Sw.) Ach. – Locs 8, 13, 34, 39, 42–45: on soil, Locs 47, 70, 72–75: on calcareous rock.
- Dermatocarpon intestiniforme* (Körb.) Hasse – Loc. 11: on calcareous rock.
- D. minutum* (L.) W. Mann – Locs 5–6, 11–13, 38a, 44, 46, 50, 53–54a, 64, 70, 72–73: on calcareous rock.
- Dimelaena oreina* (Ach.) Norman – Locs 4, 12, 29, 31–32, 34–35, 38b–c, 39, 44–46, 49–50, 71: on siliceous rock.
- Diploschistes caesioplumbeus* (Nyl.) Vain. – Loc. 26: on siliceous rock.
- D. gypsaceus* (Ach.) Zahlbr. – Loc. 44: on calcareous rock.
- D. muscorum* (Scop.) R. Sant. – Locs 12, 49, 72: on soil.
- D. scruposus* (Schreb.) Norman – Locs 12–13, 21, 31, 42, 44, 47, 50, 73: on siliceous rock.
- Diplotomma alboatrum* (Hoffm.) Flot. – Locs 12–13, 22, 39, 43–44, 52, 68: on calcareous rock.
- D. epipolium* (Ach.) Arnold – Locs 16, 44: on calcareous rock.
- D. venustum* (Körb.) Körb. – Locs 8, 44, 47: on calcareous rock.
- Endocarpon adscendens* (Anzi) Müll. Arg. – Locs 4, 33, 41, 47: on soil.
- +*Endococcus macrosporus* (Hepp ex Arnold) Nyl. – Loc. 35: on *Rhizocarpon geographicum*.
- +*Endohyalina insularis* (Arnold) Giralt, van den Boom et Elix – Loc. 29: on *Lecanora rupicola*.
- Gallowayella fulva* (Hoffm.) S. Y. Kondr., Fedorenko, S. Stenroos, Kärnefelt, Elix, Hur et A. Thell – Locs 2, 13, 22, 53, 17: on *Salix* sp., Locs 9, 14–16: on *Juglans* sp., Locs 6–7, 23, 27–28, 38b, 40b, 51a–b, 56, 58, 60, 62, 65: on *Quercus* sp.
- Gyalolechia flavorubescens* (Huds.) Søchting, Frödén et Arup – Locs 7, 9, 13, 16: on *Juglans* sp.
- G. flavovirescens* (Wulfen) Søchting, Frödén et Arup – Locs 43, 53: on calcareous rock.
- G. fulgens* (Sw.) Søchting, Frödén et Arup – Loc. 60: on soil.
- G. fulgida* (Nyl.) Søchting, Frödén et Arup – Loc. 51b: on mosses.
- #*Heteropladidium fusculum* (Nyl.) Gueidan et Cl. Roux – Loc. 39: on *Lecanora rupicola*.

- Immersaria athroocarpa* (Ach.) Rambold et Pietschm. – Locs 1, 4–5, 10–13, 15–16, 21–22, 29–35, 40a–42, 44–47, 49–50, 52–54, 54b, 64, 68, 70–74, 76: on siliceous rock.  
+*Intralichen lichenicola* (M. S. Christ. et D. Hawksw.) D. Hawksw. et M. S. Cole – Loc. 13: on *Candelariella vitellina*.
- Ionaspis lacustris* (With.) Lutzoni – Locs 4–5, 8–9, 50: on siliceous rock.
- Lathagrium auriforme* (With.) Otálora, P. M. Jørg. et Wedin – Loc. 54b: on mosses.
- L. cristatum* (L.) Otálora, P. M. Jørg. et Wedin – Locs 8, 44, 70: on calcareous rock.
- L. fuscovirens* (With.) Otálora, P. M. Jørg. et Wedin – Locs 8, 72: on calcareous rock.
- Lecania inundata* (Hepp ex Körb.) M. Mayrhofer – Loc. 43: on calcareous rock.
- L. turicensis* (Hepp) Müll. Arg. – Loc. 54: on calcareous rock.
- Lecanora argentata* (Ach.) Malme – Loc. 36: on *Quercus* sp.
- L. argopholis* (Ach.) Ach. – Locs 12–13, 16, 21–22, 29–32, 34–35, 38a, 41–42, 44–47, 49–50, 53–54, 73, 76: on siliceous rock.
- L. bicincta* Ramond var. *bicincta* – Locs 29, 31, 33, 35, 44–47, 49–50, 53: on siliceous rock.
- L. carpinea* (L.) Vain. – Locs 7, 9: on *Quercus* sp.
- L. cenisia* Ach. – Locs 13, 22, 39, 49–50, 69–71, 76: on siliceous rock.
- L. chlarotera* Nyl. – Loc. 21: on *Pyrus* sp.
- L. frustulosa* (Dicks.) Ach. – Locs 22, 34–35, 42, 45, 54: on siliceous rock.
- L. gangaleoides* Nyl. – Locs 13, 16, 22, 35: on siliceous rock.
- #*L. gisleriana* Müll. Arg. – Loc. 39: on *Lecanora* sp.
- L. intricata* (Ach.) Ach. – Locs 12–13, 21–22, 29–33, 35, 38a, 38c, 41, 44–45, 47–50, 53–54, 72–73: on siliceous rock.
- L. intumescens* (Rebent.) Rabenh. – Loc. 15: on *Quercus* sp.
- L. pannonica* Szatala – Loc. 72: on siliceous rock.
- L. polytropa* (Ehrh.) Rabenh. – Locs 1, 5–7, 9, 11–13, 35, 42, 49–50, 53, 66, 71, 74, 76: on siliceous rock.
- L. rupicola* (L.) Zahlbr. – Locs 3–6, 10, 12–13, 21–22, 29–35, 39–42, 44–47, 49–50, 53–54, 68, 70–71, 73–74, 76: on siliceous rock.
- L. rupicola* var. *efflorens* Leukert et Poelt – Locs 13, 16, 29–30, 47: on siliceous rock.
- L. subcarnea* (Lilj.) Ach. var. *subcarnea* – Loc. 52: on siliceous rock.
- L. sulphurea* (Hoffm.) Ach. – Locs 5, 22, 49–50: on siliceous rock.
- L. swartzii* (Ach.) Ach. – Locs 13, 21–22, 31, 33, 35, 46, 50, 53, 76: on siliceous rock.
- Lecidea atrobrunnea* (DC.) Schaer. – Locs 4–5, 13, 16, 21–22, 25, 31–33, 35, 38c, 41, 45–46, 53, 54b, 73: on siliceous rock.
- L. auriculata* Th. Fr. – Locs 4–5, 9, 13, 22, 26, 47: on siliceous rock.
- L. fuscoatra* (L.) Ach. – Locs 1, 3–5, 10, 13, 16, 22–23, 25–26, 29–31, 33–35, 38b–c, 40b–42, 45–47, 49–50, 52–54a, 63–64, 69–71, 73, 75–76: on siliceous rock.
- L. grisella* Flörke ex Sommerf. – Loc. 54: on siliceous rock.
- L. lapicida* (Ach.) Ach. – Loc. 46: on siliceous rock.
- L. plana* (J. Lahm) Nyl. – Locs 3, 5, 9, 16, 22, 32–33, 42, 45–46, 50, 52, 54: on siliceous rock.
- L. promiscua* Nyl. – Locs 9, 22, 31–33, 44, 46–47: on siliceous rock.
- L. sarcogynoides* Körb. – Locs 1, 3–5, 7–10, 12–16, 21, 25, 29–30, 40a, 44, 46, 54–54a, 58, 70–71, 74: on siliceous rock.
- L. tessellata* Flörke – Locs 13, 16, 52: on siliceous rock.
- Lecidella carpathica* Körb. – Locs 1, 4–13, 16, 19, 21–22, 24–26, 29–34, 38c, 40a, 41–42, 44–50, 52–54a, 55, 57, 63–64, 66, 70–73, 76, 74: on siliceous rock.
- L. elaeochroma* (Ach.) M. Choisy – Loc. 14: on *Pyrus* sp., Locs 36, 38: on *Prunus* sp.
- L. patavina* (A. Massal.) Knoph et Leuckert – Loc. 5: on siliceous rock.

- L. stigmata* (Ach.) Hertel et Leuckert – Locs 1, 4–5, 7–9, 11, 13, 16, 24, 30, 49–50, 52–54a, 70, 72–75: on calcareous rock.
- Lempholemma polyanthes* (Bernh.) Malme – Loc. 44: on calcareous rock.
- Lepraria incana* (L.) Ach. – Locs 13, 25, 54b, 57: on siliceous rock.
- L. lobificans* Nyl. – Locs 13, 50: on mosses.
- L. membranacea* (Dicks.) Vain – Locs 11, 13, 67: on mosses.
- L. nivalis* J. R. Laundon – Locs 4, 12, 29, 49, 54b–55: on mosses.
- L. vouauxii* (Hue) R. C. Harris – Loc. 54b: on mosses.
- Leptoplaca xantholyta* (Nyl.) Nyl. – Locs 11, 34: on calcareous rock.
- Leptogium cyanescens* (Rabenh.) Körb. – Loc. 59: on mosses.
- L. teretiusculum* (Flörke ex Wallr.) Arnold – Loc. 8: on *Quercus* sp., Loc. 9: on *Juglans* sp.
- +*Lichenostigma anatolicum* Halıcı et Kocakaya – Loc. 72: on *Bellemerea cupreoa*tra.
- +*L. dimelaenae* Calat. et Hafellner – Loc. 34: on *Dimelaena oreina*.
- +*L. elongatum* Nav.-Ros. et Hafellner – Loc. 52: on *Aspicilia cinerea*.
- \*+*L. gracile* Calat., Nav.-Ros. et Hafellner – Loc. 52: on *Aspicilia cinerea*. – Black vegetative hyphae superficial, firmly or loosely adpressed on surface of the host (Fig. 2a), ± orbicular. In early infections slender and abundantly main hyphal strands, about 120–250 µm long, are radial, arising from a central point; on the other hand, large ones have clearer radiate figure towards the margin of infection. Each strand usually arises from a main axis with dense lateral and mostly long ramifications. Branching single or partially ramified, lateral ramifications occur on willing towards the border of the early infections (Fig. 2b). Previously known from Spain from *Acarospora fuscata* (Calatayud *et al.* 2002).
- +*L. rouxii* Nav.-Ros., Calat. et Hafellner – Loc. 54: on *Squamarina cartilaginea*.
- Lichinella stipatula* Nyl. – Loc. 43: on siliceous rock.
- Lobothallia alphoplaca* (Wahlenb.) Hafellner – Locs 44–45, 47: on siliceous rock.
- L. chadefaudiana* (Cl. Roux) A. Nordin, Cl. Roux et Sohrabi – Loc. 10: on calcareous rock.
- L. cheresina* (Müll. Arg.) A. Nordin, Cl. Roux et Sohrabi – Locs 33, 49, 54a: on calcareous rock.
- L. praeradiosa* (Nyl.) Hafellner – Locs 2, 13, 30, 41, 44, 47, 49–50, 54, 54b: on siliceous rock.
- L. radiosa* (Hoffm.) Hafellner – Locs 5–9, 11–13, 15–16, 22, 29–32, 35, 39–40, 41–42, 44–45, 49–50, 53, 71–73: on calcareous rock.
- L. recedens* (Taylor) A. Nordin, Savić et Tibell – Locs 16, 44, 50, 72: on siliceous rock.
- Megaspora verrucosa* (Ach.) Hafellner et V. Wirth – Locs 4, 45: on mosses, Loc. 54b: on soil.

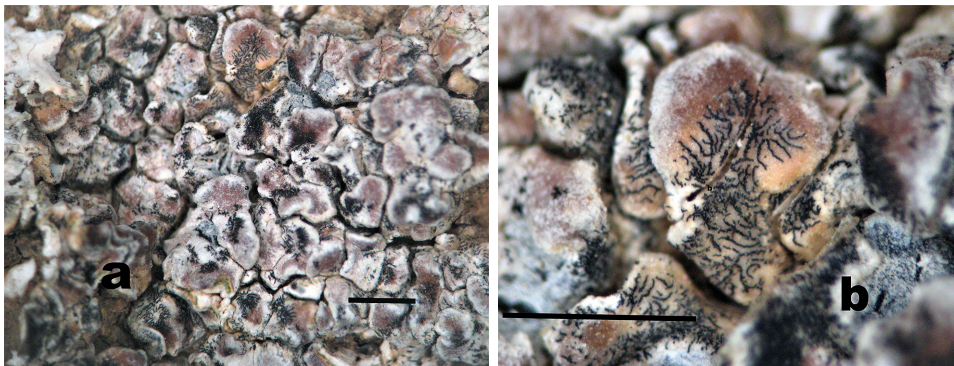


Fig. 2. *Lichenostigma gracile*: a = habit, b = habit and hyphal strands. Scales: 1 mm

- Melanelia stygia* (L.) Essl. – Loc. 45: on siliceous rock.  
*Melanelixia subaurifera* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. et Lumbsch  
 – Loc. 60: on *Pyrus* sp., Loc. 62: on *Prunus* sp.  
*Melanohalea infumata* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. et Lumbsch  
 – Locs 3, 11, 13, 16, 29–32, 34–35, 41, 44–47, 49, 50, 52, 54b, 72–73: on siliceous rock,  
 Loc. 53: on *Salix* sp.  
*Merismatium deminutum* (Arnold) Cl. Roux et Nav.-Ros. – Loc. 74: on calcareous rock.  
*Miriquidica deusta* (Stenh.) Hertel et Rambold – Locs 4, 12, 35, 49: on siliceous rock.  
*Montanelia sorediata* (Ach.) Divakar, A. Crespo, Wedin et Essl. – Loc. 12: on siliceous rock.  
*Myriolecis albescens* (Hoffm.) Šliwa, Zhao Xin et Lumbsch – Locs 4, 35, 43–44, 49, 52, 54, 54b:  
 on calcareous rock.  
*M. crenulata* (Ach.) Šliwa, Zhao Xin et Lumbsch – Locs 12, 21, 30, 39, 40a, 43–45, 52, 54: on  
 calcareous rock.  
*M. dispersa* (Pers.) Šliwa, Zhao Xin et Lumbsch – Locs 1–2: on *Salix* sp., Locs 3–6, 8, 11–13,  
 15–16, 21–23, 25, 29–30, 32, 34–35, 38a, 39–40a, 41, 44–45, 47–51, 52–54, 60, 67, 72–73:  
 on calcareous rock.  
*M. hagenii* (Ach.) Šliwa, Zhao Xin et Lumbsch – Locs 2, 5–6, 16, 21–22, 29–30, 32, 35, 44–46,  
 49, 50, 53–54, 71, 73: on *Salix* sp., Loc. 11: on *Quercus* sp. and *Pyrus* sp., Loc. 41: on  
*Populus* sp., Locs 9, 12–13: on *Juglans* sp.  
*M. semipallida* (H. Magn.) Šliwa, Zhao Xin et Lumbsch – Locs 17, 41, 50, 52: on calcareous rock.  
*Myriospora glaucocarpa* (Ach.) Hepp – Locs 31, 33–35, 41–42, 44–45, 53, 76: on calcareous rock.  
+*Muellerella erratica* (A. Massal.) Hafellner et Volk. John – Loc. 7: on *Lecidea* sp., Loc. 72: on  
*Circinaria caesiocinerea*.  
+*M. lichenicola* (Sommerf. ex Fr.) D. Hawksw. – Loc. 35: on *Circinaria caesiocinerea*.  
+*M. pygmaea* (Körb.) D. Hawksw. – Loc. 52: on *Aspicilia cinerea*.  
*Normandina pulchella* (Borrer) Nyl. – Loc. 5: on mosses on rock.  
*Ochrolechia subviridis* (Høeg) Erichsen – Locs 8, 33, 52: on siliceous rock.  
#*Opegrapha parasitica* (A. Massal.) H. Olivier – Loc. 29: on *Circinaria* cf. *calcareo*.  
*Oxneria fallax* (Arnold) S. Y. Kondr. et Kärnefelt – Locs 2, 6, 25, 28, 37, 40a, 55, 69: on *Salix*  
 sp., Locs 24, 75: on *Quercus* sp., Locs 14–15, 18, 22, 36, 38, 61, 63: on *Populus* sp.  
*Parmelina tiliacea* (Hoffm.) Hale – Locs 29, 41–42, 44–45, 49–50, 54b, 60, 62: on mosses.  
*Parvoplaca tirolensis* (Zahlbr.) Arup, Søchting et Frödén – Locs 4–5: on mosses.  
*Peltigera canina* (L.) Willd. – Locs 13, 16, 23, 38c, 53, 74: on mosses.  
*P. malacea* (Ach.) Funck – Loc. 72: on mosses.  
*P. ponojensis* Gyeln. – Loc. 4: on mosses.  
*P. praetextata* (Flörke ex Sommerf.) Zopf – Locs 4, 11, 74 on mosses.  
*P. rufescens* (Weiss) Humb. – Locs 4, 11, 13, 41, 47, 50, 72–73: on mosses, Loc. 12: on soil.  
*Peltula euploca* (Ach.) Poelt ex Pišút – Loc. 72: on siliceous rock.  
*Pertusaria excludens* Nyl. – Locs 16, 52, 54a: on siliceous rock.  
*P. flavicans* Lamy – Locs 12, 23: on siliceous rock.  
+*Phacographa glaucomaria* (Nyl.) Hafellner – Loc. 6: on *Lecanora rupicola*.  
*Phaeophyscia cernohorskyi* (Nádv.) Essl. – Locs 12, 43, 72–73: on mosses, Locs 39, 44: on sili-  
 ceous rock.  
*P. ciliata* (Hoffm.) Moberg – Loc. 64: on *Pyrus* sp.  
*P. endococcina* (Körb.) Moberg – Locs 11–12, 42, 63, 73: on calcareous rock.  
*P. nigricans* (Flörke) Moberg – Loc. 54a: on calcareous rock.

- P. orbicularis* (Neck.) Moberg – Locs 2, 6, 14–18, 20, 22–23, 38d, 51, 51b, 53, 55, 63–64: on *Salix* sp., Locs 7, 11, 61, 69: on *Quercus* sp., Locs 62, 65: on *Juglans* sp., Loc. 9: on *Quercus* sp. and *Juglans* sp., Loc. 13: on *Salix* sp. and *Juglans* sp.
- Phaeorrhiza nimbose* (Fr.) H. Mayrhofer et Poelt – Loc. 11: on soil.
- Physcia adscendens* H. Olivier – Loc. 24: on *Salix* sp., Loc. 53: on *Quercus* sp. and *Salix* sp., Locs 57, 63: on *Pyrus* sp.
- P. aipolia* (Ehrh. ex Humb.) Fűrnr. – Locs 2, 9, 19, 37, 51b, 56, 60: on *Salix* sp., Loc. 7: on *Juglans* sp., Locs 14–15, 18, 75: on *Quercus* sp., Locs 24, 27, 38b–c, 42, 55, 58: on *Populus* sp., Loc. 66: on *Pyrus* sp.
- P. biziana* (A. Massal.) Zahlbr. – Loc. 11: on *Quercus* sp., Locs 13, 16: on *Juglans* sp., Locs 29–31, 33–35, 37, 42: on calcareous rock, Locs 6, 44–45, 49, 53, 71: on *Salix* sp.
- P. caesia* (Hoffm.) Hampe ex Fűrnr. – Locs 4, 11–13, 16, 38b, 44, 47, 50: on mosses, Locs 53, 76: on calcareous rock.
- P. dimidiata* (Arnold) Nyl. – Locs 3, 21: on *Salix* sp., Loc. 22: on *Quercus* sp., Locs 44, 47: on mosses.
- P. dubia* (Hoffm.) Lettau – Locs 4–6: on siliceous rock, Locs 7–9, 11–13, 15–16, 22, 26, 29–35, 39, 41–42, 44–47, 49–50, 52–54, 71–73, 76: on mosses.
- P. stellaris* (L.) Nyl. – Locs 4, 61: on *Quercus* sp., Locs 9, 11, 28: on *Pyrus* sp., Locs 16, 58: on *Juglans* sp.
- P. tenella* (Scop.) DC. – Loc. 53: on *Salix* sp.
- Physconia detersa* (Nyl.) Poelt – Locs 22, 33: on mosses.
- P. distorta* (With.) J. R. Laundon – Locs 2, 6, 13–17, 20, 27, 38, 38d, 58, 66, 75: on *Salix* sp., Locs 7, 9, 11, 25, 28, 57: on *Quercus* sp., Locs 37, 61: on *Pyrus* sp., Loc. 53: on *Salix* sp. and *Pyrus* sp.
- P. enteroxantha* (Nyl.) Poelt – Loc. 29: on mosses.
- P. muscigena* (Ach.) Poelt – Locs 41, 73: on mosses.
- P. perisidiosa* (Erichsen) Moberg – Locs 29, 44, 72: on mosses.
- Placocarpus schaeereri* (Fr.) Breuss – Locs 38a, 48: on calcareous rock.
- Placopyrenium bucekii* (Nádv. et Servít) Breuss – Loc. 47: on siliceous rock.
- P. fuscillum* (Turner) Gueidan et Cl. Roux – Locs 22, 32, 34–35, 44–45, 50, 52–53: on calcareous rock.
- P. iranicum* Breuss – Locs 16, 41, 45, 47, 50: on siliceous rock.
- P. trachyticum* (Hazsl.) Breuss – Locs 1, 13, 16, 39, 44, 54: on siliceous rock.
- Placynthium nigrum* (Huds.) Gray – Loc. 48: on calcareous rock.
- Pleurosticta acetabulum* (Neck.) Elix et Lumbsch – Loc. 11: on *Quercus* sp.
- Polysporina simplex* (Taylor) Vězda – Locs 5, 39, 43: on siliceous rock.
- Porpidia zeoroides* (Anzi) Knoph et Hertel – Loc. 10: on calcareous rock.
- Protoblastenia incrustans* (DC.) J. Steiner – Loc. 12: on calcareous rock.
- Protoparmelia atriseda* (Fr.) R. Sant. et V. Wirth – Locs 29, 47: on siliceous rock.
- Protoparmeliopsis bolcana* (Pollini) Lumbsch – Locs 13, 16, 29, 33–34, 42, 47, 68, 71: on siliceous rock.
- P. garovaglii* (Körb.) Arup, Zhao Xin et Lumbsch – Locs 13, 16, 21–22, 29–32, 34–35, 41, 44–47, 49, 50, 52, 54, 71: on siliceous rock.
- P. laatokkensis* (Räsänen) Moberg et R. Sant. – Locs 10, 12, 35, 45, 50, 53–54: on siliceous rock.
- P. macrocyclos* (H. Magn.) Moberg et R. Sant. – Locs 46–47, 72: on siliceous rock.
- P. muralis* (Schreb.) M. Choisy – Locs 4–17, 20–22, 29–35, 38a, 38c–51a, 51c–61, 63–66, 68–76: on calcareous rock.

- P. peltata* (Ramond) Arup, Zhao Xin et Lumbsch – Locs 3, 10, 29, 34, 41–42, 45, 47–49, 54, 73: on siliceous rock.
- Psilolechia leprosa* Coppins et Purvis – Loc. 50: on calcareous rock.
- Psora decipiens* (Hedw.) Hoffm. – Loc. 38c: on soil.
- P. globifera* (Ach.) A. Massal. – Loc. 12: on soil.
- P. vallesiaca* (Schaer.) Timdal – Loc. 12: on calcareous rock and soil.
- Psorotichia schaeereri* (A. Massal.) Arnold – Loc. 34: on calcareous rock.
- Pyrenodesmia variabilis* (Pers.) A. Massal. – Locs 5–6, 8, 12, 22, 31–33, 37–38, 39–40, 41, 43–44, 52–53: on calcareous rock.
- Ramalina capitata* (Ach.) Nyl. – Locs 29, 35, 44–45, 49–50: on siliceous rock.
- Rhizocarpon disporum* (Nägeli ex Hepp) Müll. Arg. – Locs 21, 44–47: on siliceous rock.
- #*R. epispilum* (Nyl.) Zahlbr. – Loc. 30: on *Pertusaria* sp.
- R. furfurosum* H. Magn. et Poelt ex Poelt – Locs 29, 47: on siliceous rock.
- R. geminatum* Körb. – Locs 25, 38c, 64, 68: on siliceous rock.
- R. geographicum* (L.) DC. – Locs 3–7, 9–13, 16, 21–26, 29–35, 38a, 38c 40b–42, 44–47, 49–51, 53–55, 57, 59, 62, 64, 68, 70–76: on siliceous rock.
- R. hochstetteri* (Körb.) Vain. – Loc. 14: on siliceous rock.
- R. lecanorinum* Anders – Loc. 72: on siliceous rock.
- Rhizoplaca chrysoleuca* (Sm.) Zopf – Locs 3, 13, 29, 31, 33–35, 44–48, 50, 64, 70, 74–75: on siliceous rock.
- R. melanophthalma* (DC.) Leuckert et Poelt – Locs 10, 13, 16, 21–22, 26, 29, 31–35, 42, 44–50, 54, 64, 68–75: on siliceous rock.
- R. subdiscrepans* (Nyl.) R. Sant. – Loc. 29: on siliceous rock.
- Rinodina bischoffii* (Hepp) A. Massal. – Locs 29, 34, 37, 40, 43–44, 52: on calcareous rock.
- R. immersa* (Körb.) J. Steiner – Locs 43–44, 71: on calcareous rock.
- R. lecanorina* (A. Massal.) A. Massal. – Locs 11–13, 16, 22, 29, 39, 40, 47, 53, 73: on calcareous rock.
- R. milvina* (Wahlenb.) Th. Fr. – Locs 4–5, 11–13, 15–16, 21–22, 29–35, 39, 44–47, 49–50, 53, 71–72: on siliceous rock.
- R. occulta* (Körb.) Sheard – Loc. 21: on siliceous rock.
- R. pyrina* (Ach.) Arnold – Locs 21–22, 52: on *Populus* sp., Locs 41, 53: on *Salix* sp.
- Romjularia lurida* (Ach.) Timdal – Locs 12, 25, 36, 40b, 47, 54a, 56, 74: on soil.
- Rufoplaca arenaria* (Pers.) Arup, Søchting et Frödén – Locs 4–5, 7, 9, 11–13, 15–16, 22, 29–30, 32–35, 42, 44, 46–47, 49–50, 52–53, 71, 76: on siliceous rock.
- Rusavskia elegans* (Link) S. Y. Kondr. et Kärnefelt – Locs 1, 3, 5, 13, 16, 21–22, 29–30, 32, 34–35, 39, 41–50, 52–54, 71–73: on calcareous rock.
- Sagedia mastrucata* (Wahlenb.) A. Nordin, Savić et Tibell – Loc. 34: on siliceous rock.
- Sarcogyne clavus* (DC.) Kremp. – Locs 3, 5, 29–30, 43–44: on siliceous rock.
- S. privigna* (Ach.) A. Massal. – Locs 5, 10, 12: on siliceous rock.
- S. regularis* Körb. – Locs 3–5, 10, 13, 16, 45, 62: on calcareous rock.
- Scytinium gelatinosum* (Wirth.) Otálora, P. M. Jørg. et Wedin – Loc. 54: on mosses.
- S. lichenoides* (L.) Otálora, P. M. Jørg. et Wedin – Locs 12, 47, 70, 74–75: on mosses.
- S. palmatum* (Huds.) Gray – Loc. 3: on mosses.
- S. plicatile* (Ach.) Otálora, P. M. Jørg. et Wedin – Loc. 8: on calcareous rock.
- S. schraderi* (Bernh.) Otálora, P. M. Jørg. et Wedin – Loc. 25: on mosses.
- S. subtile* (Schrad.) Otálora, P. M. Jørg. et Wedin – Loc. 33: on *Quercus* sp.
- Solenopsis candicans* (Dicks.) J. Steiner – Loc. 44: on calcareous rock.
- Squamarina cartilaginea* (With.) P. James – Loc. 54: on soil.
- Staurothele areolata* (Ach.) Lettau – Locs 45, 52–53, 64, 70: on siliceous rock.

- S. caesia* (Arnold) Arnold – Loc. 67: on calcareous rock.  
*S. fissa* (Taylor) Zwackh – Locs 63, 67: on siliceous rock.  
*Tephromela atra* (Huds.) Hafellner – Locs 71–72: on siliceous rock.  
*T. grumosa* (Pers.) Hafellner et Cl. Roux – Locs 4, 49–50, 71: on siliceous rock.  
*Thelenella muscorum* (Th. Fr.) Vain. – Loc. 29: on mosses.  
*Thyrea confusa* Henssen – Locs 43–44, 72: on calcareous rock.  
*Toninia candida* (Weber) Th. Fr. – Locs 8, 54a, 74: on calcareous rock.  
*T. diffracta* (A. Massal.) Zahlbr. – Loc. 72: on mosses.  
*T. opuntioides* (Vill.) Timdal – Loc. 12: on soil.  
*T. sedifolia* (Scop.) Timdal – Locs 8, 19, 23–25, 38a–b, 40b, 54a–b, 56, 62, 74–75: on soil.  
*T. squalida* (Ach.) A. Massal. – Locs 45, 54: on soil.  
*Umbilicaria crustulosa* (Ach.) Lamy – Loc. 3: on siliceous rock.  
*U. proboscidea* (L.) Schrad. – Loc. 29: on siliceous rock.  
*U. vellea* (L.) Ach. – Loc. 52: on siliceous rock.  
*Vahliella leucophaea* (Vahl.) P. M. Jørg – Loc. 33: on siliceous rock.  
*Variospora dolomiticola* (Hue) Arup, Søchting et Frödén – Loc. 43: on calcareous rock.  
*Verrucaria muralis* Ach. – Locs 44, 52: on calcareous rock.  
*V. nigrescens* Pers. – Locs 5, 7–9, 12, 29–30, 37–38, 39–40a, 43–44, 48, 52, 63: on calcareous rock.  
*V. ochrostoma* Borrer ex Leight. – Loc. 41: on calcareous rock.  
*V. polysticta* Borrer – Loc. 73: on calcareous rock.  
*V. sphaerospora* Anzi – Locs 34, 48, 53: on calcareous rock.  
*V. viridula* (Schrad.) Ach. – Loc. 72: on calcareous rock.  
*Verrucula latericola* (Erichsen) Nav.-Ros. et Cl. Roux – Locs 54, 73: on calcareous rock.  
*Verruculopsis lecideoides* (A. Massal.) Gueidan et Cl. Roux – Locs 52, 72: on calcareous rock.  
*Xalocoa ocellata* (Vill.) E. Kraichak, R. Lücking et T. Lumbsch – Loc. 50: on calcareous rock.  
*Xanthocarpia crenulatella* (Nyl.) Frödén, Arup et Søchting – Locs 4–9, 17, 20, 22, 41, 43–45, 50, 73: on calcareous rock.  
*X. lactea* (A. Massal) A. Massal. – Locs 4–5, 7, 11–13, 21, 30, 53, 73. on calcareous rock.  
*X. marmorata* (Bagl.) Frödén, Arup et Søchting – Locs 43–44: on calcareous rock.  
*Xanthoparmelia conspersa* (Ehrh. ex Ach.) Hale – Loc. 64, 75: on siliceous rock.  
*X. delisei* (Duby) O. Blanco, A. Crespo, Elix, D. Hawksw. et Lumbsch – Loc. 72: on siliceous rock.  
*X. pulla* (Ach.) O. Blanco, A. Crespo, Elix, D. Hawksw. et Lumbsch – Locs 29–31, 33–35, 41, 44–47, 50, 54, 72–73. 75: on siliceous rock.  
*X. stenophylla* (Ach.) Ahti et D. Hawksw. – Loc. 47: on siliceous rock.  
*X. tinctina* (Maheu et A. Gillet) Hale – Locs 44–47: on siliceous rock.  
*X. verruculifera* (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. et Lumbsch – Locs 12, 21–22, 29, 31–35, 41, 44–47, 49, 50, 53–54, 71–73: on siliceous rock.  
*Xanthoria aureola* (Ach.) Erichsen – Locs 30, 47: on calcareous rock.  
*X. parietina* (L.) Beltr. – Loc. 6: on *Salix* sp., Loc. 11: on *Quercus* sp., Loc. 38: on *Pyrus* sp.  
+*Zwackhiomyces turcicus* Kocakaya, Halıcı et Aksoy – Loc. 13: on *Physcia dubia*.

In this study a total of 302 lichen and lichenicolous fungi, of which 221 are crustose, 49 foliose, 4 fruticose, 8 leprose and 20 lichenicolous fungi, were identified in Muş province. On the other hand, seven of them, namely *Acarospora hospitans*, *Caloplaca epithallina*, *C. grimmiae*, *Heteroplacidium fuscum*, *Lecanora gisleriana*, *Opegrapha parasitica* and *Rhizocarpon epispilum*, were reported growing on other lichens (as lichenicolous lichen).

*Acarospora insolata*, *A. peliscypha*, *Aspicilia glomerulans*, *Lempholemma polyanthes*, *Lichenostigma anatolicum*, *Ochrolechia subviridis*, *Placopyrenium iranicum*, *Protoparmeliopsis macrocyclos*, *Rhizocarpon hochstetteri*, and *Zwackhiomyces turcicus* were rarely reported from Turkey (Breuss and John 2004, Çobanoğlu and Akdemir 2000, John and Breuss 2004, John and Türk 2017, Verseghe 1982, Yazıcı and Aslan 2016a, Yazıcı and Aptroot 2017, Yazıcı *et al.* 2015) and *Aspicilia glomerulans*, *Lichenostigma anatolicum*, *O. subviridis*, *Placopyrenium iranicum*, *R. hochstetteri* and *Z. turcicus* were reported for the second time in Turkey (Halıcı *et al.* 2009, John and Türk 2017, Kocakaya *et al.* 2011, Oran and Öztürk 2010, Yazıcı and Aslan 2016a). In total, *Calogaya lobulata*, *C. cerina*, *Candelariella aurella*, *Gallowayella fulva*, *Myriolecis dispersa*, *M. hagenii*, *Phaeophyscia orbicularis*, *Physcia adscendens*, *P. biziana*, *P. dimidiata*, *P. dubia* and *Physconia distorta* are among the most tolerant members in terms of choice of substrata.

The most common genera are *Lecanora* (18 taxa), *Caloplaca* (15 taxa), *Acarospora* (12 taxa), *Lecidea* (9 taxa), *Physcia* (8 taxa), *Aspicilia* and *Rhizocarpon* (7 taxa) in a total of 101 genera (excluding lichenicolous fungi), they are the most common genera in the study area, respectively.

In sense of phorophytes, *Quercus* was the most hospitable tree to lichens with 25 species, followed by *Salix*, *Juglans*, *Pyrus*, *Populus* and *Prunus* with 15, 11, 9, 7 and 2, respectively. The most diverse localities in terms of lichen are 12, 13, 16, 22, 29, 35, 44, 45, 47, 49, 50, 53, 73. Localities nos 5, 7, 8, 9, 12, 29, 30, 37, 38, 39, 40, 40a, 43, 44, 52, 48, 63, 73, 74 are situated near a lime pit, where *Verrucaria baldensis*, *V. calciseda* and *V. nigrescens* are found, which are regarded as indicator species of calcareous substrate (Fig. 1).

Lichen biodiversity of Muş province was poorer because of the weak forest area, few rocky areas, soil without mosses in most areas, meadows and grasslands covering a larger area in some areas, hard climate, and dry summer season. Epiphytic lichens, growing mostly on some deciduous trees such as *Quercus*, *Populus*, *Salix*, were also defined to be less frequent than we expected. Most of the lichen species are saxicolous and they preferred to grow mostly on rocks.

20 lichenicolous fungi were found to grow on 12 different lichens and they preferred to grow on mostly crustose and saxicolous lichens. *Carbonea vitellinaria*, growing on *Candelariella vitellina*, was found to be the most common lichenicolous fungus in the area.

\*

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