

Lichenicolous fungi and lichens from Turkey with the description of new taxa

Javier ETAYO

<https://orcid.org/0000-0003-0392-0710>

Navarro Villoslada 16, 3^o dcha. 31003 Pamplona, Navarra, Spain

Correspondence: culesancio@gmail.com

Kenan YAZICI

<https://orcid.org/0000-0002-8750-9197>

Biology Department, Faculty of Science, Karadeniz Technical University,

61080, Trabzon, Turkey

Abstract. Several species of lichenicolous fungi from the region of Batman and Siirt provinces in Turkey are recorded here. A new species is described: *Rhymbocarpus circinariae* on *Circinaria* sp. A new combination, *Muellerella fuscoatrae* on *Lecidea fuscoatra*, is established alongside the selection of a neotype. Three species are reported for the first time in Turkey: *Lichenochora epidesertorum*, *Paralecia pratorum*, and *Sclerococcum homoclinellum*. In addition, *Paralecia pratorum* is also reported for the first time in Asia.

Keywords. Asia, *Muellerella*, *Rhymbocarpus*, taxonomy.

Resumen. Se indican tres especies de hongos liquenícolas de la región de las provincias de Batman y Siirt en Turquía. Se describe una nueva especie, *Rhymbocarpus circinariae* sobre *Circinaria* sp. Se establece una nueva combinación, *Muellerella fuscoatrae* sobre *Lecidea fuscoatra*, junto con la selección de un neotipo. Se reportan cuatro especies por primera vez en Turquía: *Lichenochora epidesertorum*, *Paralecia pratorum* y *Sclerococcum homoclinellum*. Además, *Paralecia pratorum* se reporta por primera vez en Asia.

Palabras clave. Asia, *Muellerella*, *Rhymbocarpus*, taxonomía.

How to cite this article: Etayo J., Yazıcı K. 2025. Lichenicolous fungi and lichens from Turkey with the description of new taxa. *Anales del Jardín Botánico de Madrid* 82: e157. <https://doi.org/10.3989/ajbm.666>

Title in Spanish: Hongos liquenícolas y líquenes de Turquía con la descripción de nuevos taxones.

Associate editor: Raquel Pino Bodas. Received: 10 April 2025; accepted: 31 May 2025; published online: 30 March 2026.

INTRODUCTION

In recent years, the knowledge of lichenicolous fungi in Turkey has increased considerably and many new taxa have been added. To date, 235 lichenicolous fungi have been found in the country (Halıcı & al. 2007a; Halıcı 2008a; Halıcı 2008b; Etayo & Yazıcı 2009; Halıcı & al. 2010; Halıcı & Candan 2011; Halıcı 2015; John & Türk 2017; Yazıcı & Aslan 2019; Güvenç & al. 2020; John & al. 2020; Yazıcı & al. 2021; Yazıcı & Aslan 2022; Yazıcı & al. 2022). However, it is estimated that there are many areas in Turkey that have to be explored, as well as numerous lichenicolous fungi that have not yet documented. During the project “Lichen flora of Batman and Siirt provinces”, some interesting lichenicolous taxa were recorded. Previously, only one lichenicolous fungus, *Rhizocarpon ochrolechiaae*, was known from Batman while *Muellerella erratica* has only been recorded from Siirt (John & Türk 2017; Güvenç & al. 2020; John & al. 2020; Yazıcı & al. 2010; Yazıcı & al. 2021).

The territory of the Batman province is covered with typical steppe vegetation. There are some scattered *Quercus* trees in the mountainous areas and the slopes of the valleys are typically covered with *Fraxinus* and *Salix* trees, amongst shrub and grassland communities. Understorey flora is generally very poor in these areas, while all the nearby mountains have many rocky habitats (Baytop & Denizci 1963). In general, the province of Batman has a Mediterranean climate. Summers are hot and dry, while winters are relatively warm and rainy. Precipitation takes the form of snow in the highlands and rain in the plains. The average annual temperature is 16°C and the annual main rainfall is 552 mm (Akman 1999).

The Siirt province has a continental climate. Summers are hot and dry and winters are cold and rainy. The north and east of the province are colder in winter and cooler in summer. The mean temperature during the summer months is approximately 30°C, with slightly lower values recorded in June (26.1°C), July (30.7°C), and August (30.4°C). During the winter months, the mean temperature remains above 4°C, ranging from 4.9°C in December to 4.4°C in February, with a slight decline to 2.8°C in January. The average annual rainfall is 757 mm and the average annual humidity is 51%, with higher humidity (around 70%) in January and December (Akman 1999).

There are limited *Quercus* forests in the parts of the Taurus Mountains east of Kahramanmaraş and in the plateaus and mountains extending northwards. Siirt Province is located in the eastern Anatolian deciduous forest belt and the south-eastern Anatolian steppe belt. These forests give way to a cover of shrubs and dwarf trees near the steppe belt in the south. In some areas, *Juniperus*, *Fraxinus* and *Platanus* are also found in *Quercus* communities. The south-western and western parts of the province are included in the steppe zone (Baytop & Denizci 1963). The objective of this study was to increase the knowledge of the biodiversity of lichenicolous fungi and lichens for the provinces of Batman and Siirt in Turkey.

MATERIAL AND METHODS

This study was based mainly on fresh material from Turkey collected by the second author, and deposited at KTUB as well as in the private herbarium of J. Etayo (Pamplona, Spain). Detailed information about each of the 26 localities visited in Turkey for field collecting is provided in Table 1.

Morphological and anatomical characters were examined using standard stereo microscope (Leica S9i) and compound microscopes (Nikon Eclipse 80i DIC). Sections were prepared manually using a razor blade. Sections and squash mounts were examined in distilled water, 10% KOH (K) or Congo Red. All photomicrographs showing anatomical characters were made using transmitted differential interference contrast (DIC) microscopy with a camera ProgRes CT1 and have been taken in water except where another reaction is recorded. Amyloid reactions of anatomical structures were tested using Lugol's solution (I), or with Lugol's solution preceded by a 10% KOH treatment (K/I). All measurements were made in distilled water and are presented as intervals with maximum and minimum sizes (if present) between brackets. In the case of ascospores, the number of measurements was also recorded at the end.

Table 1. List of the 26 localities visited in Turkey for field collecting and date of collection.

#	Locality	Coordinates	Elev. (m)	Date
1	Batman, Hasankeyf, exit of Saklı, E, streamside.	37°42'04.91"N 41°32'23.54"E	628	21 Jul. 2022
2	Batman, Hasankeyf, İncirli, SE, İncirli-Öğütlü crossroads.	37°42'53.58"N 41°34'37.02"E	631	21 Jul. 2022
3	Batman, Gercüş, Özler.	37°34'41.39"N 41°26'25.13"E	1063	17 Jun. 2021
4	Batman, Hasankeyf, 1 km to Soğucak, N.	37°41'34.56"N 41°36'30.08"E	819	21 Jul. 2022
5	Batman, Sason, Soğanlı, peak.	38°24'12.48"N 41°25'05.83"E	1480	3 Jun. 2021
6	Batman, Sason, Soğanlı road-Karşıyaka, towards Dağçatı.	38°25'06.75"N 41°24'47.25"E	1639	3 Jun. 2021
7	Siirt, center, Erüh road, 200 m to Botan bridge.	37°54'24.62"N 41°58'41.49"E	608	4 Aug. 2021
8	Siirt, Erüh, from Bağgöze to Kavaközü, around Kavaközü.	37°44'06.79"N 41°51'27.55"E	717	3 Aug. 2021
9	Batman, Gercüş, from Bağgözü to Ardıçlı köyü.	37°37'13.73"N 41°08'50.94"E	1044	19 Jun. 2021
10	Sason, 2 km to İncesu.	38°25'01.23"N 41°22'44.22"E	1479	3 Jun. 2021
11	Batman, Beşiri, Doğankavak.	37°57'31.15"N 41°12'35.20"E	908	7 Jul. 2021
12	Batman, Gercüş, 200 m to Yamanlar.	37°33'10.46"N 41°27'22.39"E	1131	17 Jun. 2021
13	Siirt, Erüh, from Bağgöze 2 km to the W, towards Kavaközü.	37°42'53.50"N 41°52'57.44"E	735	3 Aug. 2021
14	Siirt, center, 1 km to İnkapı, S.	37°59'25.11"N 41°53'34.87"E	854	9 Aug. 2022
15	Siirt, Erüh, Erüh road, towards Bayramlı.	37°50'36.55"N 42°06'36.76"E	967	4 Aug. 2021

Table 1. Cont'd.

#	Locality	Coordinates	Elev. (m)	Date
16	Batman, Gercüş, Seyrantepe	37°41'12.11"N 41°08'59.52"E	854	19 Jun. 2021
17	Siirt, Erüh, towards Bağgöze, from Dikboğaz-Bağgöze crossroads, Gönülaldı, N.	37°42'50.00"N 42°04'17.85"E	1254	3 Aug. 2021
18	Siirt, center, Erüh road, 1 km to Botan brigde.	37°54'24.62"N 41°58'41.49"E	608	4 Aug. 2021
19	Batman, Gercüş, Seyrantepe.	37°41'12.11"N 41°08'59.52"E	854	19 Jun. 2021
20	Batman, center, from Demirbilek 3 km to Suçeken.	37°44'47.18"N 41°16'31.76"E	642	20 Jul. 2022
21	Batman, center, Suçeken, E.	37°44'25.60"N 41°17'39.45"E	555	20 Jul. 2022
22	Siirt, center, Pınarca, NE.	37°59'06.41"N 41°51'42.56"E	586	9 Aug. 2022
23	Siirt, Erüh, towards Bağgöze, from Dikboğaz-Bağgöze crossroads 1 km to W, Gönülaldı, N.	37°42'50.00"N 42°04'17.85"E	1254	3 Aug. 2021
24	Siirt, Erüh, opposite of Demiremek, S.	37°43'00.85"N 42°06'48.32"E	1311	3 Aug. 2021
25	Siirt, center, 1 km to Beşyol, SE.	38°00'36.68"N 41°52'21.94"E	696	9 Aug. 2022
26	Batman, center, 200 m Hasankeyf, W.	37°44'10.82"N 41°24'06.10"E	657	20 Jul. 2022

RESULTS AND DISCUSSION

Below we include an account of the new records (20) of lichenicolous fungi and lichens from the Batman and Siirt provinces of Turkey including novelties, discussion, and localities according to Table 1.

1. *Acarospora* sp.

This species is clearly a parasite of *Aspicila*, inducing reduced, black, convex areolae on thallus and apothecia of the host. At the moment it is not possible to give it a name because there are twelve species, fundamentally described by H. Magnusson on this host or related substrate (Diederich & al. 2018) and they should be studied in deep.

Loc. 3b. on *Circinaria* sp. K. Yazıcı 3100 (hb. Yazıcı).

2. *Arthonia aspiciliae* Alstrup & E.S.Hansen subsp. *hertelii* Calat., Barreno & V.J.Rico

For a description of this species, see Calatayud & al. (2004). Recorded as *Aspicilia hertelii* in Turkey by several authors: Candan (2016) recorded it from Afyon and Denizli on *Circinaria fruticulosa*, *C. hoffmanniana* and *Circinaria* sp.; Hafellner & John, (2006), from Ağrı and Kayseri on *Aspicilia desertorum*; Kocakaya & al. (2009), from Konya, on *C. hoffmanniana*; Koç & al. (2017), from Isparta on *A. desertorum* and Yavuz & Türk (2016), from Eskişehir, on *C. fruticulosa* and *C. hoffmanniana*. Loc. 5c. on *Circinaria* sp., K. Yazıcı 3112 (hb. Yazıcı). Loc. 9c. on *Circinaria* sp., K. Yazıcı 3108 (hb. Yazıcı). Loc. 13d. on *Circinaria* sp., K. Yazıcı 3105 (hb. Yazıcı).

3. *Cercidospora caudata* Kernst.

The species has been reported by several authors on different species of Teloschistaceae in Turkey. According to Navarro-Rosinés & al. (2004), there is an important variability in the size and shape of the ascospores in this group. Previously, it has been reported on *Caloplaca* sp. (now split into several genera) by Candan (2016) from Afyon, on apothecia of *Rufoplaca arenaria*; Candan & Özdemir-Türk (2008) from Malatya, on *Xanthocarpia lactea*; Halıcı & Aksoy (2009) from Kayseri, on apothecia of *Variospora flavescens*; Halıcı & al. (2007b) from Niğde, on the thalli of *V. aurantia* and *Pyrenodesmia chalybaea* and the apothecia of *V. flavescens*; Kocakaya & al. (2014) from Konya, on the thallus of *P. chalybaea* and Yazıcı & Etayo (2014) from Iğdır, on *Pisutiella conversa*.

Loc. 9a. on thallus and apothecia of *Calogaya* gr. *saxicola*, K. Yazıcı 3110 (hb. Yazıcı). Loc. 9b. on *Kuettlingeria teicholyta*, K. Yazıcı 3194 (hb. Yazıcı).

Loc. 9c. on *Xalocoa ocellata*, K. Yazıcı 3111 (hb. Yazıcı).

4. *Cercidospora macrospora* (Uloth) Hafellner & Nav.-Ros.

It has been found in abundance on *Protoparmeliopsis muralis* and *P. klauskalbii*. On the latter host, several samples have an orange to brown wall instead of the typical green, but we also found green walls on some specimens. Regarding Calatayud & al. (2013), the spores are $20\text{--}25 \times 4\text{--}6$ but are slightly larger in our Turkey samples $(18\text{--})25\text{--}33 \times 5\text{--}7$ μm . This species is commonly found on *Protoparmeliopsis muralis* in some provinces of Turkey as follows, but has also been rarely recorded on other genera. Candan (2016) recorded from Denizli, on *P. muralis*; Candan & Özdemir-Türk (2008) from Elazığ, on *P. muralis*; Halıcı (2007) from Kayseri, on *P. muralis*; Halıcı & Aksoy (2009) from Adana, Kayseri and Niğde, on *P. muralis*, *Rhizoplaca melanophthalma* and *R. peltata*; Halıcı & al. (2006) from Nevşehir, on *R. melanophthalma*; Halıcı & al. (2007a) from Niğde, on *P. muralis*; Halıcı & al. (2009) from Eskişehir, on *P. muralis*; Kocakaya & al. (2009) from Konya, on *P. muralis*; Kocakaya et. al (2014) from Konya; Koç & al. (2017) from Isparta, on *P. bolcana*; Steiner (1905) from Kayseri, on *P. muralis*; Steiner (1899) from Ağrı, on *Lecanora heteromorpha*; Yavuz & Türk (2016) from Eskişehir, on *P. muralis*; Yazıcı & Aslan (2022, 2023) from Rize and Tunceli, on *P. muralis*; Yazıcı & Etayo (2015) from Burdur and Iğdır, on *P. muralis*; Yazıcı & al. (2010, 2011) from Ankara and Ardahan, on *P. muralis* and Yazıcı & al. (2020a, 2022) from Bingöl and Muş, on *P. muralis*.

Loc. 6. on *Protoparmeliopsis muralis*, K. Yazıcı 3142a, 3143b, 3145c, 3148d (hb. Yazıcı).

Loc. 13. on *P. muralis*, K. Yazıcı 3138a, 3119c (hb. Yazıcı); on *Protoparmeliopsis klauskalbii*, K. Yazıcı 3139b (hb. Yazıcı).

Loc. 14. on *P. klauskalbii*, K. Yazıcı 3144a, 3147b (hb. Yazıcı); on *P. muralis* K. Yazıcı 3117c (hb. Yazıcı).

Loc. 15. on *P. muralis* K. Yazıcı 3114a, 3116b, 3120c (hb. Yazıcı).

Loc. 16. on *P. muralis*, K. Yazıcı 3104d, 3101a, 3113c (hb. Yazıcı); on *P. klauskalbii*, K. Yazıcı 3102b (hb. Yazıcı).

Loc. 16. on *P. klauskalbii*, K. Yazıcı 3107b, 3140b (hb. Yazıcı); on *P. muralis*, K. Yazıcı 3103c, d, 3137b (hb. Yazıcı).

Loc. 17. on *Protoparmeliopsis* sp., K. Yazıcı 3109d, 3141c, 3146b, 3149a (hb. Yazıcı).

5. *Endococcus rugulosus* (Borrer ex Leight.) Nyl.

It has been frequently found on various species of *Aspicilia*. A feature of this taxon is that ascospores have a more densely pigmented zone around the septum. In Turkey, this species has been recorded from different provinces on *Acarospora*, *Aspicilia*, *Buellia*, *Circinaria* and *Rhizocarpon*. Candan (2016) recorded from Afyon, on *Aspiciliella intermutans*; Halıcı & al. (2007a, 2014) from Kayseri, on *Circinaria hoffmanniana*; Halıcı & al. (2007c) from Malatya, on *Aspicilia* sp.; Kocakaya & al. (2009) from Konya, on *C. hoffmanniana*; Kocakaya & al. (2014) from Konya, on *Acarospora fuscata*; Yavuz & Türk (2016) from Eskişehir, on *Rhizocarpon geographicum* and *R. lecanorinum*; Yazıcı & Etayo (2014) from Iğdır, on *Buellia sequax*; Yazıcı & Etayo (2015) from Burdur, on *Aspicilia cinerea*; Yazıcı & al. (2011) from Ardahan, on *Circinaria caesiocinerea*; Yazıcı & al. (2022) from Bingöl, on *A. cinerea*; Yazıcı & al. (2020b) from Bitlis, on *A. cinerea* and Yazıcı & Aslan (2023) from Trabzon, on *A. cinerea*.

Loc. 18. on *Aspicilia* sp., K. Yazıcı 3130b (hb. Yazıcı).

Loc. 20. on *Aspicilia cinerea*, K. Yazıcı 3153a, 3155b (hb. Yazıcı).

Loc. 25. on *A. cinerea*, K. Yazıcı 3150c, 3154b, 3156a (hb. Yazıcı).

6. *Lichenochora epidesertorum* Nav.-Ros.

This species was recorded growing on *Gyalolechia desertorum* and *G. poeltii* (Etayo & Navarro-Rosinés 2008) from Spain, then, it is new to Turkey and Asia where it has been found growing on *Gyalolechia* cf. *bracteata*.

Loc. 8. on *Gyalolechia* cf. *bracteata*, K. Yazıcı 3125b (hb. Yazıcı).

7. *Lichenochora verrucicola* (Wedd.) Nik.Hoffm. & Hafellner

This species is characterized by its simple, ellisoidal to subcylindrical spores (Hoffman & Hafellner 2000). A discrepancy with the protologue was found. The spores were described as always hyaline, $(18\text{--})19.8\text{--}31.8(38) \times (6\text{--})6.3\text{--}11(12)$ μm and asci $75\text{--}95 \times 15\text{--}20$ μm , while our specimen has spores soon light brownish or pinkish, $22\text{--}25 \times 6\text{--}9$ μm , and asci $72\text{--}75 \times 17\text{--}18$ μm . It has been recorded on *Aspicilia cinerea*, *Circinaria calcarea* and *C. contorta* from Europe and North America (Etayo & Navarro-Rosinés 2008). More recently this taxon was reported from Bitlis (Turkey) on *Aspicilia cinerea* (Yazıcı & Aslan 2019). This is the second record for Turkey.

Loc. 21. on *Aspicilia cinerea*, K. Yazıcı 3128b (hb. Yazıcı).

8. *Lichenostigma* sp.

Vegetative hyphae superficial, forming black strands on the surface of the host, simple or with some lateral branches more or less perpendicular to the main strands (subgenus *Lichenogramma*). Apparently, no hyphae penetrating the host thallus. The strands do not usually form dense groups, but sometimes they are condensed in some black coloured zones. The main strands are sinuous, 100–500 µm long and 10–35 µm wide, formed by a paraplectenchymatic, stromatic tissue with externally rounded to angulose cells of 5–8 µm diameter, with rugulose surface and brown colour, internally sub- to hyaline. Mature branches with macroconidia. Macroconidia also have a granulose ornamentation and are first subglobose, $7-9 \times 7$ µm, then they form a transverse basal septum, then $10-11 \times 8-9$ µm, then the upper cell is divided by a transverse septum or, commonly, by a diagonal one, of $12-13 \times 9-10$ µm, finally they can be submuriform, $13-16 \times 9-10$ µm. No asci or spores have been observed, so it seems to be a normally sterile species. This is a conspicuous species that the second author has collected several times in Turkey, but has not yet been described, growing sterile on *Protoparmeliopsis muralis* and *P. klauskalbii*.

Loc. 12. on *Protoparmeliopsis klauskalbii*, K. Yazıcı 3157d, 3160a, 3161c (hb. Yazıcı). Loc. 14. on *P. klauskalbii*, K. Yazıcı 3158a, 3164b (hb. Yazıcı); on *Protoparmeliopsis muralis*, K. Yazıcı 3165c (hb. Yazıcı).

Loc. 17. on *Protoparmeliopsis* sp., K. Yazıcı 3168a, 3169b, 3171c, 3173d (hb. Yazıcı).

9. *Lichenostigma triseptatum* Halici & D.Hawksw.

See description in Halici & Hawksworth (2007). We found this species on *Circinaria* spp. and on *Aspicilia polychroma*. The sample on *Circinaria* rarely is showing triseptate spores. It has been found by some authors in several provinces in Turkey: Candan & Özdemir-Türk (2008) from Malatya, on *Aspiciliella intermutans*; Halici & Aksoy (2009) from Kayseri, on *Aspicilia cinerea*; Halici & Hawksworth (2007) from Kayseri, on *Circinaria caesiocinerea*; Kocakaya & al. (2009) from Konya, on *Circinaria hoffmanniana*; Yazıcı & Etayo (2014) from Iğdır, on *C. caesiocinerea*; Yazıcı & al. (2010) from Ankara, on *C. caesiocinerea*, and Yazıcı & al. (2022) from Bingöl, on *Aspicilia* sp.

Loc. 2. on *Aspicilia polychroma*, K. Yazıcı 3118d, 3151a (hb. Yazıcı); on *Aspicilia* sp., K. Yazıcı 3152b (hb. Yazıcı); on *A. polychroma*, K. Yazıcı 3159c (hb. Yazıcı). Loc. 11. on *Circinaria* sp.; K. Yazıcı 3123b (hb. Yazıcı).

10. *Lichenothelia rugosa* (G.Thor) Ertz & Diederich

This is the first record of the species on *Xalocoa ocellata* (recently excluded from *Diploschistes* by Kraichak & al. 2013). In Turkey it has been previously recorded on *Diploschistes* species: Halici (2008c) on *D. scruposus*; Yavuz and Türk (2016) from Eskişehir, on *D. scruposus*; Yazıcı & al. (2011) from Ardahan, on *Diploschistes* sp.; Yazıcı & Etayo (2014) from Iğdır, on *D. muscorum*.

Loc. 9c. on *Xalocoa ocellata*, K. Yazıcı 3131 (hb. Yazıcı).

11. *Llimoniella muralicola* Halici

This species was described in Halici (2008a) from Denizli (Turkey) on *Protoparmeliopsis muralis* and recorded by Yazıcı & al. (2020b) from Bitlis, on the same host. According to Diederich & al. (2018), *L. muralicola* should be classified under *Unguiculariopsis* s.l. However, *L. muralicola* lacks the characteristic hooked excipular hairs of *Unguiculariopsis*. Additionally, orange excipular pigments, like those found in *L. muralicola*, are also present in the *Llimoniella phaeophyscia* group (Diederich & al. 2010). Based on our observations, *L. muralicola* is an authentic *Llimoniella* species.

Loc. 26. on *Protoparmeliopsis muralis*, K. Yazıcı 3106b (hb. Yazıcı)

12. *Monerolechia badia* (Fr.) Kalb

This species is common and widespread in Turkey. In its first stages of development it is a parasite on saxicolous lichens (Diederich & al. 2018) and then forms an independent lichen. In Turkey it was known mainly on the thallus of *Xanthoparmelia* spp., but also on other lichens such as *Aspicilia*, *Lecanora*, and directly on siliceous rocks. It has been recorded by: Candan (2016) from Afyon, on *Xanthoparmelia* spp.; Candan & Özdemir Türk (2008) from Elazığ, on *Xanthoparmelia pulla*, *X. tinctina* and *X. delisei*; from Adıyaman, on *X. tinctina* and from Malatya, on *Aspiciliella intermutans*, *X. tinctina*, *X. conspersa* and *X. loxodes*; Çiçek & Özdemir Türk (1998) from Sakarya, on siliceous rock; Halici & Duman (2007) from Karabük, on *Aspiciliella intermutans* and *X. pulla*; Halici & Aksoy (2006) from Niğde, host not

given; John & al. (2000) from Gümüşhane, host not given; John & Breuss (2004) from Rize, on siliceous rock; John & Breuss (2004) from Trabzon, on siliceous rock; John (1999) from İzmir, on *X. pulla*; Kocakaya & al. (2009) from Konya, on *Lecanora rupicola*; Nimis & John (1998) from Çanakkale, on siliceous rock; Oran & al. (2007), on siliceous rock; Öztürk (1990) from Bursa, on siliceous rock; Singer & al. (2014) from Eskişehir, on *X. pulla* and *X. stenophylla*; Türk & al. (2003) from Yozgat, on siliceous rock; Türk & al. (2009) from Ankara, on *X. glabrans*; Yavuz & Çobanoğlu (2007) from Denizli, on calcareous rock; Yazıcı & al. (2011) from Ardahan, on siliceous rock; Yazıcı & al. (2010) from Ankara, on *X. glabrans* and *X. pulla*; Yazıcı & al. (2013) from Iğdır, on *X. pulla* and *X. tinctina*; Yazıcı & al. (2015) from Burdur, on siliceous rock; Yazıcı & al. (2020a) from Muş, on siliceous rock; Yazıcı & al. (2020b) from Bitlis, on *X. tinctina*; Yazıcı & Aslan (2022, 2023) from Tunceli, on siliceous rock; Yazıcı & al. (2022) from Bingöl, on siliceous rock; Yazıcı & al. (2010) from Uşak and Marmara Island, on siliceous rock and *X. pulla*; Yılmaz & al. (2015) from Manisa, on *Aspicilia* sp., *Pertusaria chiodectonoides*, *Squamarina cartilaginea*, *X. loxodes*, *X. pulla* and *X. stenophylla*.
Loc. 6. on *Squamarina cartilaginea*, K. Yazıcı 3132e (hb. Yazıcı)

13. *Muellerella erratica* (A.Massal.) Hafellner & V.John

This species has often been found in Turkey on a variety of species such as *Acarospora*, *Aspicilia*, *Caloplaca*, *Circinaria*, *Lecidea*, *Lecidella*, *Lecanora*, *Pertusaria*, *Protoblastenia*, *Pyrenodesmia*, *Tephromela* and *Verrucaria*.

References of this species in Turkey appears in: Candan & Özdemir Türk (2008) from Malatya, on *Lobothallia cheresina* and *Circinaria hispida*; Candan (2016) from Afyon, on *Acarospora cervina*, *Circinaria contorta* and *Verrucaria* sp.; Candan (2016) from Denizli, on *Circinaria calcarea* and *Pyrenodesmia variabilis*; Halıcı & al. (2005) from Kayseri, host not given; Hafellner & John (2006) from İzmir, on *C. calcarea*; from Sivas, on *Protoblastenia incrustans* and from Van, on *C. calcarea*; Kocakaya & al. (2014) from Konya, on thalli of *Circinaria hoffmanniana* and *Caloplaca transcaspica*; Yavuz & Türk (2016) from Eskişehir, on *A. cervina*, *C. hispida*, *Lecidea promiscens* and *Lecidella stigmathea*; Yazıcı & Aslan (2022) from Tunceli, on *Lecidella* sp.; Yazıcı & Aslan (2023) from Giresun, on *Acarospora* sp.; Yazıcı & Etayo (2014) from Iğdır, on *Acarospora* sp., *Lecanora* sp., *Lecidea* sp.; Yazıcı & Etayo (2015) from Burdur, on *Aspicilia* sp., *C. calcarea*, *Lecidella stigmathea*; Yazıcı & al. (2008) from Nevşehir, on *Tephromela atra*; Yazıcı & al. (2010) from Siirt, on *C. calcarea*; from Uşak, on *Pertusaria* sp. and Marmara Island, on *C. calcarea* and from Ankara, on *C. calcarea* and *Pertusaria* sp.; Yazıcı & al. (2011) from Ardahan, on *Circinaria caesiocinerea*; Yazıcı & al. (2020b) from Bitlis, on *Lecidea tessellata*; Yazıcı & al. (2020b) from Muş, on *C. caesiocinerea*; Yazıcı & al. (2022) from Bingöl, on *Lecidella* sp.

Loc. 5. on *Circinaria* sp., K. Yazıcı 3122b (hb. Yazıcı).

Loc. 7. on *Lecidea* sp., K. Yazıcı 3179c (hb. Yazıcı).

Loc. 10. on *Aspicilia* sp., K. Yazıcı 3167a, 3166b, 3170c (hb. Yazıcı);

Loc. 11. on *Circinaria* sp., K. Yazıcı 3175c, 3180a (hb. Yazıcı).

Loc. 18. on *Aspicilia* sp., K. Yazıcı 3185a (hb. Yazıcı).

Loc. 19. on *Aspicilia* sp. K. Yazıcı 3195a, 3124b (hb. Yazıcı).

Loc. 21. on *Aspicilia cinerea* K. Yazıcı 3162c, 3163a, 3176a (hb. Yazıcı).

Loc. 22. on *A. cinerea*, K. Yazıcı 3172c, 3178a, 3181b (hb. Yazıcı).

Loc. 23. on *Aspicilia* sp, K. Yazıcı 3129a (hb. Yazıcı).

Loc. 24. on *A. cinerea*, K. Yazıcı 3174c, 3183b, 3184a (hb. Yazıcı).

Loc. 25. on *A. cinerea*, K. Yazıcı 3177b, 3182a (hb. Yazıcı).

14. *Muellerella fuscoatrae* (Steiner) Etayo & Yazıcı, **comb. nov.**

MycoBank: MB 859636. Fig. 1.

≡ *Tichothecium fuscoatrae* Steiner, Sitzungsber. Kaiserl. Akad. Wiss., Nath.-Naturwiss. Cl., Abt. 1, 102: 161 (1893).
≡ *Tichothecium pygmaeum* var. *fuscoatrae* (Steiner) Vouaux, Bull. Soc. Mycol. France 29: 64 (1913). Type: Griechenland, Pentelikon (on *Lecidea fuscoatra*), 1892, Dr. Fritz Kerner von Marilaun (? Herb. Steiner: type lost: KL-, W-, WU-). **Neotype chosen here:** Turkey, Batman, center, 200 m Hasankeyf town, west part of the town, 37°44'10.82"N 41°24'06.10"E, 657 m, 20 Jul. 2022, on *L. fuscoatra* growing on acid rock, K. Yazıcı 3133 (KTUB).

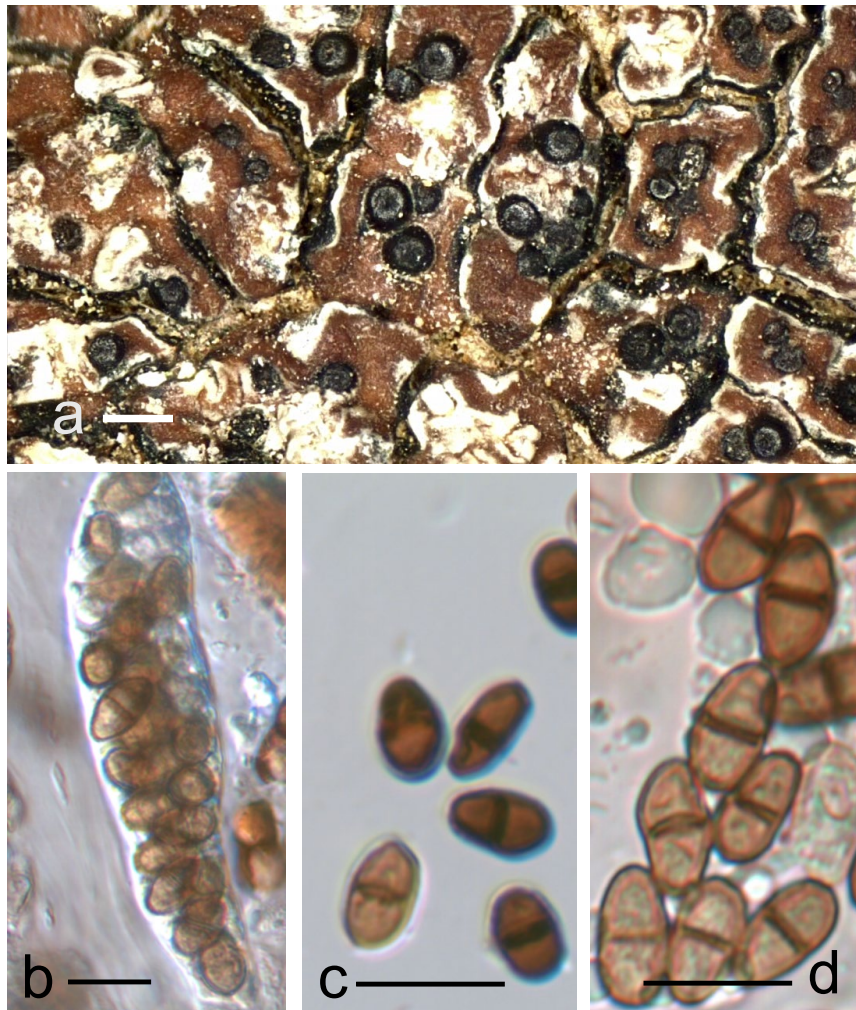


Fig. 1. *Muellerella fuscoatrae*: **a**, perithecia on the host thallus of *Lecidea fuscoatra* (KTUB 3133); **b**, ascus, in water (KTUB 3133); **c**, ascospores of *M. pygmaea* growing on *L. fuscoatra* from Navarre (Spain), in water (hb. Etayo 30767); **d**, ascospores of *M. fuscoatrae*, in water (KTUB 3133) [scale bars: a = 250 μ m; b, c & d = 10 μ m].

Description.—Ascomata perithecia, abundant, black, rough, subglobose, slightly applanate at the apex, (125–)150–250(–300) μ m in diam., immersed with only apical part exposed, arising singly; ostiolar depression distinct. Exciple 20–25 μ m thick laterally, thicker above to 80 μ m in upper part, in cross section composed of tangentially elongated cells, the outer dark brown walls and the inner colourless; in surface view dark brown, of textura angularis, composed of cells 5–8 μ m diam. Hymenial gel I+ red, K/I+ blue. Hamathecium of Internal periphyses lining the ostiolar canal, 40–60 $\times$ 1.5–2 μ m. Interascal hyphae absent at maturity. Asci bitunicate, clavate, wall markedly thickened at the apex, without a distinct apical apparatus, (60–)68–82(–) $\times$ 19–23(–25) μ m ($n = 10$), apparently only 16–24-spored, I+ red, K/I+ blue. Ascospores pale brown (young) to dark brown, smooth-walled, ellipsoidal to broadly ellipsoidal, $\pm$ rounded at the ends, (8.5–)9–11.5(–12.5) $\times$ (5–)5.5–6(–6.5) μ m ($n = 60$), l/w = (1.4–)1.7–2.0(–2.2), 1-septate when mature not constricted at the septa.

Comments.—The taxonomic concept of the saxicolous species belonging to the genus *Muellerella* Hepp ex Müll.Arg. was established by Triebel (1989) on the basis of spore size, number of spores in asci and host genera. Those who try to assign their specimens to the *M. pygmaea* group are aware of the difficulties. The second author has been collecting lichenicolous fungi in Turkey for several years, including a remarkable *Muellerella* species with large spores. The fungus was consistently found on *Lecidea fuscoatra* and appears to be a good match for *Tichothecium fuscoatrae*, which Triebel

(1989), due to the unavailability of the original type for study, tentatively synonymised with *M. pygmaea* var. *pygmaea* (Körb.) D.Hawksw. whose type originating from Poland grew on *Lecidea lapicida*.

Vouaux (1913) accepted this taxon as a variety of *Tichothecium pygmaeum*, as var. *fuscoatrae* (Steiner) Vouaux. According to Vouaux it differs from the type in having smaller perithecia (less than 150 µm in diameter), a smaller number of ascospores in the ascus (24) and larger spores ($9\text{--}11 \times 4.8\text{--}6.6$ µm). According to a diagram (p. 163 in Triebel 1989) showing the spore size of *M. pygmaea* on lecideicolous fungi, the spores of this species are $7.5\text{--}10.2 \times 3.6\text{--}5$ µm, smaller than the specimens from Turkey, which have spores measuring $8.5\text{--}12.5 \times 5\text{--}6.5$ µm, which is much larger than the normal size for the *M. pygmaea* group. However, apparently Triebel (1989) extended the range of spore size to $(7.5\text{--})8\text{--}10\text{--}(13) \times (3.5\text{--})4\text{--}5\text{--}(6)$ µm, perhaps to include the largest size of some specimens such as those on *L. fuscoatra*. We have studied specimens of *M. pygmaea* from northern Navarre (N. Spain) growing on *Lecidea fuscoatra* and they fit well the spore size of about $7\text{--}8 \times 4\text{--}4.5$ µm (15) reported by Triebel (1989) for this species. As a possible explanation for this fact, we hypothesize two possibilities: first, that the oriental (Greece, Turkey) specimens of *Muellerella* growing on the host *L. fuscoatra* are different from those in occidental Europe and therefore not conspecific, and second, that the oriental specimens named “*Lecidea fuscoatra*” are in fact another related species, different from *L. fuscoatra* s. str. As a result, a new combination based on the Turkish specimens (as neotypes) is proposed. Recently, Zhurbenko (2025) recorded three species, including a new, *M. sibirica* Zhurb., with large spores, measuring $12\text{--}15.5 \times 5\text{--}7$ µm. However, all of these species have spores (0–)1(–3)-septate. In the specimens of *M. fuscoatrae* examined, no three-septate spore was found. *M. vesicularia* (Linds.) D.Hawksw., a species that grows on *Thalloidima sedifolium* (the type host), was also reported by Halıcı & al. (2007a) as growing on *Lecidea fuscoatra* in Turkey, but it could possibly belong to *M. fuscoatrae*.

Other Turkish specimens examined belonging to *Muellerella fuscoatrae*: Turkey: Burdur province, between Burdur-Bucak road, enter to Beşkonak, $37^{\circ}25'46.94''\text{N}$ $30^{\circ}40'14.53''\text{E}$, 806 m, 25 Jun. 2012, on *Lecidea fuscoatra*, K. Yazıcı 2811(hb. Yazıcı) (Yazıcı & Etayo 2015). Turkey: Tunceli province, Çemişgezek, 2 km to Çemişgezek, $39^{\circ}02'18''\text{N}$ $38^{\circ}55'29''\text{E}$, 1109 m, 04 Jul. 2018, on *L. fuscoatra*, K. Yazıcı 2820 (hb. Yazıcı) (Yazıcı & Aslan 2022). Turkey: Bingöl province, Adaklı, 3 km from Adaklı, Çatma village, main road roadside, $39^{\circ}14'29.22''\text{N}$ $40^{\circ}33'10.12''\text{E}$, 1580 m, 28 Aug. 2018, on *L. fuscoatra*, K. Yazıcı 2823 (hb. Yazıcı) (Yazıcı & al. 2022).

Specimens examined for comparison.—*Muellerella pygmaea* on *Lecidea fuscoatra*, Spain, Navarra, valle del Baztán, Legate from Lecároz, $43^{\circ}10'26''\text{N}$ $1^{\circ}34'03''\text{W}$, 850 m, on siliceous rock, J. Etayo 30767 (hb. Etayo).

15. *Paralecia pratorum* Brackel, Greiner, Peršoh & Rambold

This is an endothallic lichenicolous fungus related to the genus *Squamarina*. It was recently described in Liu & al. (2015) as growing on *Protoparmeliopsis muralis*. The apothecia have a dark brown to black disk and simple spores. It was previously known to occur in Italy (type), Montenegro (Hafellner & Mayrhofer 2020) and Sweden (Svensson & al. 2017). This is the first record of this species in Asia.

Loc. 12. on *Protoparmeliopsis muralis* K. Yazıcı 3188b (hb. Yazıcı); on *Protoparmeliopsis klauskalbii*, K. Yazıcı 3190d (hb. Yazıcı). Loc. 14. on *P. klauskalbii*, K. Yazıcı 3187b, 3189a (hb. Yazıcı); on *P. muralis*, K. Yazıcı 3191c (hb. Yazıcı).

16. *Rhymbocarpus circinariae* Etayo & Yazıcı, **sp. nov.**

MycoBank: MB 859635. Fig. 2.

Type: Turkey, Batman province, Gercüş, Özler village, on *Circinaria hoffmanniana* on calcareous rock, $37^{\circ}34'41.39''\text{N}$ $41^{\circ}26'25.13''\text{E}$, 1063 m, 17 Jun. 2021, K. Yazıcı 3134 (holotype: KTUB).

Diagnosis.—It is similar to *R. fuscoatrae*, which lives on a different host (*Lecidea fuscoatra*), and differs from it in having smaller ascomata (up to 260 µm in diameter), a blackish green to green epihymenium, K+ brownish instead of an olivaceous green K–, a green-black lateral exciple, K+ brownish instead of black-brown, K+ reddish-brown and a dark brown basal exciple (K+ violaceous in the lower part). Furthermore, spores are slightly different $(7\text{--})8\text{--}10\text{--}(13) \times 3.5\text{--}4.5\text{--}(5)$ µm instead of $9\text{--}12\text{--}(13) \times 3\text{--}4\text{--}(4.5)$ µm in *R. fuscoatrae*.

Description.—Ascomata aggregated in small groups, firstly immersed and completely closed by the exciple, then erumpent and open, black, 160–260 µm diam., margin 40–70 µm thick, and with deep, irregular fissures, crenulate in

older ascomata, hairs not visible. Exciple green-black to brown-green; K+ brownish in the upper part and violet-brown in the lower part, N+ olivaceous green, basally paraplectenchymatous of isodiametric cells, not extending into a stipe, with thick-walled cells 7–10 μm wide; lateral exciple in the upper part of more elongated, narrow, thick-walled, radiate hyphae, not protruding as hairs. Hymenium hyaline, 60–70 μm tall, with abundant paraphyses, easy to separate even in water, simple to more rarely branched, septate, hyaline, 2–3 μm thick, apically not broadened and glued by a gel connecting the paraphyses. Epithymenium blackish green to green, K+ greyish brown to olivaceous. Asci unitunicate, subcylindrical, 42–60 $\times$ 5–6(–8) μm (n = 10), wall only slightly thickened apically, KI-, 8-spored. Ascospores hyaline, ellipsoid to irregular, non-septate, straight to slightly curved, biguttulate, (7–)8–10(–13) $\times$ 3.5–4.5(–5) μm (n = 35). Conidiomata not seen.

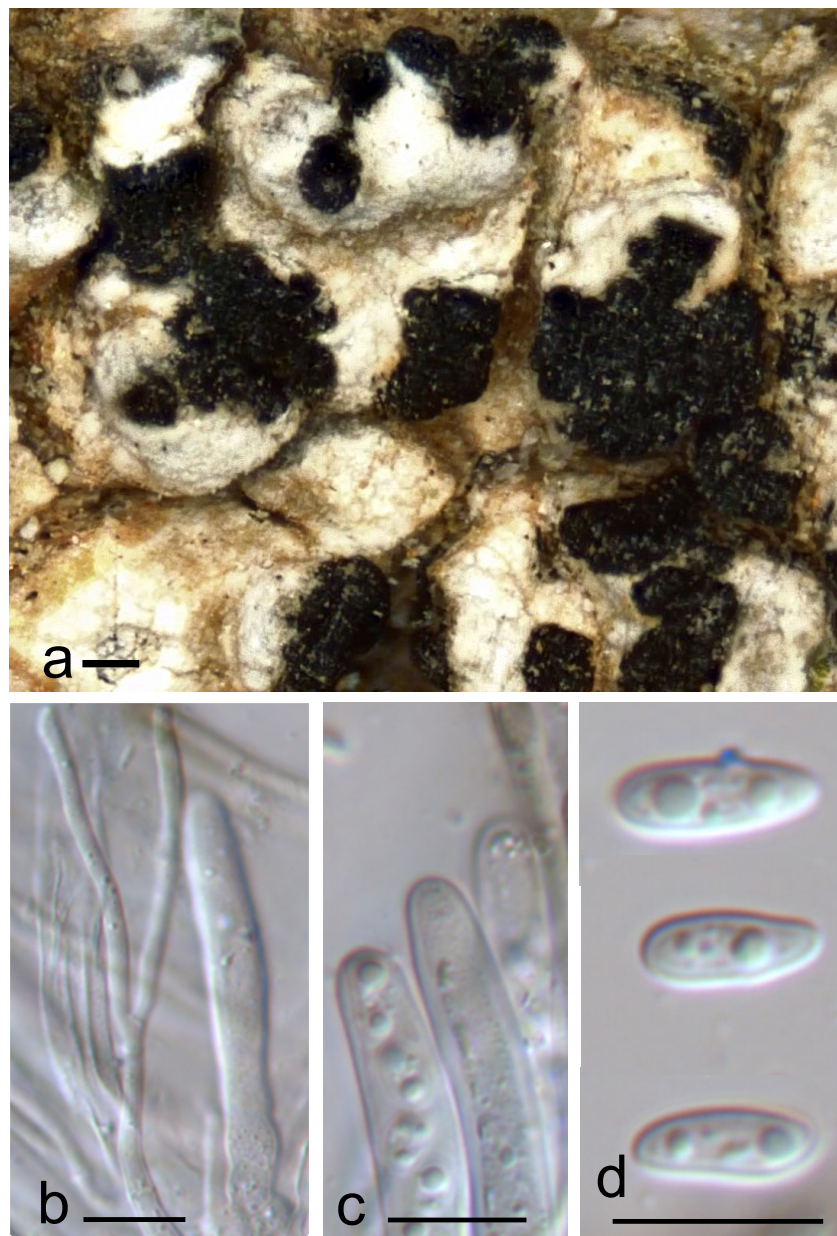


Fig. 2. *Rhymbocarpus circinariae* (holotype KTUB 3134): **a**, apothecia on the *Circinaria* thallus; **b**, **c**, asci and paraphyses, in water; **d**, ascospores, in water [scale bars: a = 100 μm ; b, c & d = 10 μm]

Distribution and habitat.—The new species is known only from the type collection growing on a calcicolous *Circinaria hoffmanniana*.

Comments.—Pigments and exciple structure with narrow, elongated, radiating hyphae in the lateral exciple are typical for *Rhymbocarpus*, as noted in description and figure 1A by Diederich & Etayo (2000). The genus is very host specific. The most similar species of this genus is *R. fuscoatrae* (Hafellner) Diederich & Etayo (Hafellner 1996), but this species lives on *Lecidea fuscoatra* thallus and differs in ascomata up to 350 µm diam., epihymenium olivaceous green K⁻, lateral exciple black-brown (K⁺ reddish-brown). Furthermore, asci are clavate instead of subcylindrical, shorter and broader, 40–50 × 8–12 µm and spores a bit larger [9–12(–13) × 3–4(–4.5) µm] in *R. fuscoatrae*.

Specimen examined for comparison.—*R. fuscoatrae*, Azores, Terceira, Lagoinha de Serreta, way from the park to Lagoinha, c. 600 m, 38°44'53"N 27°19'55"W, on *L. fuscoatra* on volcanic boulder, 24 Jul. 2017, J. Etayo 30902 & E. Ros (hb. Etayo).

17. *Rosellinula haplospora* (Th.Fr. & Almqu.) R.Sant

The species was found in some provinces in Turkey by some authors: Candan & Özdemir-Türk (2008), host not given; Candan (2016) from Afyon, on *Aspiciliella intermutans*; Halıcı & Aksoy (2009) from Adana, on *A. intermutans*; Halıcı & Candan (2007) from Malatya, on *A. intermutans*; Yazıcı & al. (2011) from Ardahan, on *A. intermutans*.

Loc. 21. on *Aspiciliella intermutans*, K. Yazıcı 3126c (hb. Yazıcı).

18. *Sclerococcum homoclinellum* (Nyl.) Ertz & Diederich

References of this species in Turkey (as *Dactylospora homoclinella*) appears in: Candan (2016) from Afyon province, on *Circinaria hoffmanniana*, *C. calcarea*, *Lecanora rupicola* and *Tephromela atra*; Halıcı & al. (2007b), Halıcı (2008c) from Zonguldak province, on *C. hoffmanniana*; Kocakaya & al. 2009 from Konya province, on *C. hoffmanniana* and Yazıcı & al. (2020b) from Bitlis province, on *Aspicilia cinerea*.

Loc. 1. on *Circinaria* sp. K. Yazıcı 3135a, 3136b (hb. Yazıcı).

19. *Stigmidium tabacinae* (Arnold) Triebel

Hafellner and John (2006) reported *S. tabacinae* from Turkey, considering *S. glebarum* (Arnold) Hafellner to be a synonym of this species. For now, this species concept is maintains, although other authors, including Brackel (2014) and Westberg & al. (2021), still consider them to be two distinct species.

Loc. 8. on *Thalloidima sedifolium*, K. Yazıcı 3192d, 3193c (hb. Yazıcı).

20. *Zwackhiomyces calcariae* (Flagey) Hafellner & Nik.Hoffm.

This species was described from Algeria on *Circinaria calcarea*, with ascomata 170–270 µm diam., asci 8-spored, 70–100 × 15–21 µm and ascospores 15–20 × 6–7 µm (Hoffmann & Hafellner 2000).

Our specimen description is as follows: perithecia one to several per areola of *Aspicilia*, semi-immersed, black, 100–200 µm diam. Ascomata wall dark brown composed of large cells 7–12 µm diam., containing a dark brown pigment. Paraphysoids abundant, branched, 2–3 µm thick, not capitate. Asci clavate, 4–8-spored, with a thick apex, KI-, 70–80 × 16–17 µm. Ascospores hyaline, 1-septate, smooth, containing many small oil droplets, 1-septate, with larger upper cell, 19–22 × 6.5–7.5 µm (n=10).

Several species of the genus *Zwackhiomyces* have been recorded on *Aspicilia* s.l., *Z. lithoiceae* (de Lesd.) Hafellner & V.John (Grube & Hafellner 1990, Hafellner & John 2006) was recorded in Turkey on *Lobothallia radiosa* by Halıcı (2008a). However, the presence of this species on *Aspicilia* s.l. needs to be approved as its type-host is a member of *Verrucaria nigrescens* aggr. *Z. aspiciliae* Halıcı & Candan (Halıcı & Candan 2009) was described as growing on *Circinaria hoffmanniana*. It has ascomata 200–270 µm diam., asci (6–)8-spored, 70–75(–90) × (9–)11–15 µm and ascospores smooth and with a gelatinous sheath, (18–)20–25(–28) × (5–)6–8(–9) µm. In their description Halıcı & Candan did not refer to Hoffmann & Hafellner (2000) where *Z. calcariae* was described. As both species are very similar and are growing

on the same host genus, we believe they could be synonyms and we refer to the first name *Z. calcariae*. Candan & Halıcı (2008) however, recorded *Z. calcariae* on *Circinaria hoffmanniana* from Uşak province of Turkey. Loc. 3. on *Circinaria* sp. K. Yazıcı 3127c (hb. Yazıcı).

ACKNOWLEDGEMENTS

The second author acknowledges financial support from TÜBİTAK (Project No. 219Z014). Thanks are given to Dr André Aptroot for identifying some hosts, and to Dr W. von Brackel, Dr R. Pino-Bodas and Dr M. Zhurbenko for improving previous versions of the paper.

REFERENCES

- Akman Y. 1999. *Climate and bioclimate (The methods of bioclimate and climate types of Türkiye)*. 1st ed. Kariyer Matbaacılık Ltd., Şti. Ankara. 350 p.
- Baytop A. & Denizci R. 1963. Türkiye'nin flora ve vejetasyonuna genel bir bakış. *Ege Üniversitesi Basımevi. Ege Üniversitesi Fen Fakültesi Monografileri* 1: 1–43, İzmir.
- Brackel W. von. 2014. Kommentierter Katalog der flechtenbewohnenden Pilze Bayerns. *Bibliotheca Lichenologica* 109: 1–476.
- Calatayud V., Barreno E. & Rico V.J. 2004. Two lichenicolous species of *Arthonia* on vagrant *Aspicilia* species. *Bibliotheca Lichenologica* 88: 67–78.
- Calatayud V., Navarro-Rosinés P. & Hafellner J. 2013. Contributions to a revision of *Cercidospora* (Dothideales), 2: Species on *Lecanora* s. l., *Rhizoplaca* and *Squamarina*. *Mycosphere* 4: 539–557.
- Candan M. 2016. Lichens and Lichenicolous fungi of Akdag Natural Park (Afyon-Denizli) in Turkey. *Biological Diversity and Conservation* 9: 198–203.
- Candan M., Halıcı M.G. 2008. Seven new records of lichenicolous fungi from Turkey. *Mycotaxon*. 104: 241–246.
- Candan M., Özdemir Türk A. 2008. Lichens of Malatya, Elazığ and Adıyaman provinces (Turkey). *Mycotaxon* 105: 19–22.
- Çiçek A., Özdemir Türk A. 1998. Lichen Flora of Sakarya province. (Turkey). *Turkish Journal of Botany* 22: 99–119.
- Diederich P. & Etayo J. 2000. A synopsis of the genera *Skyttea*, *Llimoniella* and *Rhymbocarpus* (lichenicolous Ascomycota, Leotiales). *Lichenologist* 32: 423–485.
- Diederich P., Ertz D. & Etayo J. 2010. An enlarged concept of *Llimoniella* (lichenicolous Helotiales), with a revised key to the species and notes on related genera. *Lichenologist* 42: 253–269.
- Diederich P., Lawrey J.D. & Ertz D. 2018. The 2018 classification and checklist of lichenicolous fungi, with 2000 non-lichenized, obligately lichenicolous taxa. *The Bryologist* 121: 340–425.
- Etayo J. & Navarro-Rosines P. 2008. Una combinación y tres especies nuevas de *Lichenochora* (Phyllachorales, ascomicetes liquenícolas), y notas adicionales para el género. *Revista Catalana de Micología* 30: 27–44.
- Etayo J. & Yazıcı K. 2009. *Microsphaeropsis caloplacae* sp. nov. on *Caloplaca persica* in Turkey. *Mycotaxon* 107: 297–302.
- Grube M. & Hafellner J. 1990. Studien an flechtenbewohnenden Pilzen der Sammelgattung *Didymella* (Ascomycetes, Dothideales). *Nova Hedwigia* 51: 283–360.
- Güvenç Ş., John V. & Türk A. 2020. Phytogeographical analysis of the lichens and lichenicolous fungi of Turkey. *Borziana* 1: 87–108.
- Hafellner J. 1996. Bemerkenswerte Funde von Flechten und lichenicolen Pilzen auf makaronesischen Inseln V. Über einige Neufunde und zwei neue Arten. *Herzogia* 12: 133–145.
- Hafellner J. & John V. 2006. Über funde lichenicoler nichtlichenisierter Pilze in der Türkei, mit einer Synopsis der bisher im Land nachgewiesenen Taxa. *Herzogia* 19: 155–176.
- Hafellner J. & Mayrhofer H. 2020. Noteworthy records of lichenicolous fungi from various countries on the Balkan Peninsula. II. *Herzogia* 33: 494–511.
- Halıcı M.G. 2007. Sarımsaklı barajı (Kayseri) likenleri. *Türk Liken Topluluğu Bülteni* 4: 3–5.
- Halıcı M.G. 2008a. *Llimoniella muralicola* sp. nov. (Ascomycota, Helotiaceae) on *Protoparmeliopsis muralis* from western Turkey. *Mycotaxon*. 105: 203–206.
- Halıcı M.G. 2008b. *Arthonia hawksworthii* sp. nov. (Ascomycota, Arthoniaceae) on *Dimelaena oreina* from Turkey. *Mycotaxon* 105: 89–93.
- Halıcı, M.G. 2008c. A key to the lichenicolous Ascomycota (including mitosporic fungi) of Turkey. *Mycotaxon* 104: 253–286.
- Halıcı M.G. 2015. New records of crustose Teloschistaceae and lichenicolous fungi from Turkey. *Mycotaxon* 130: 769–773.
- Halıcı M.G. & Aksoy A. 2006. Niğde ilinden yeni liken kayıtları. *Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi* 22: 20–25.
- Halıcı M.G. & Aksoy A. 2009. Lichenised and lichenicolous fungi of Aladağlar National Park (Niğde, Kayseri and Adana provinces) in Turkey. *Turkish Journal of Botany* 33: 169–189.
- Halıcı M.G. & Candan M. 2007. Notes on some lichenicolous fungi from Turkey. *Turkish Journal of Botany* 31: 353–356.
- Halıcı M.G. & Candan M. 2009. New lichenicolous fungi from Turkey. *Nova Hedwigia* 88: 483–490.

- Halıcı M.G. & Candan M. 2011. *Arthonia anatolica* sp. nov. (Arthoniaceae) on *Aspicilia contorta* subsp. *hoffmanniana*, a new lichenicolous species from Turkey. *Mycotaxon* 116: 335–339.
- Halıcı M.G. & Duman D.C. 2007. Lichenized and lichenicolous fungi of Yaylacık (Bolu) and Yenice (Karabük) research forests in Turkey. *Mycologia Balcanica* 4: 97–103.
- Halıcı M.G. & Hawksworth D.L. 2007. Two new species of lichenicolous fungi from Turkey. *Lichenologist* 39: 439–443.
- Halıcı M.G., John V. & Aksoy A. 2005. Lichens of Erciyes Mountain (Kayseri, Turkey). *Flora Mediterranea* 15: 567–680.
- Halıcı M.G., Karabulut Ş.N., Oran S., Uğur E., Singer E.T. & Akpınar Ü. 2006. Temenni tepesi'nden (ürgüp, nevşehir) bazı liken kayıtları. *Türk liken topluluğu bülteni*. 3: 2–3.
- Halıcı M.G., Hawksworth D.L. & Aksoy A. 2007a. New and interesting lichenicolous fungi records from Turkey. *Nova Hedwigia* 85: 393–401.
- Halıcı M.G., Hawksworth D.L. & Aksoy A. 2007b. Contributions to the lichenized and lichenicolous fungal biota of Turkey. *Mycotaxon* 102: 403–414.
- Halıcı M.G., Özdemir Türk A. & Candan M. 2007c. New records of pyrenocarpus lichenicolous fungi from Turkey. *Mycotaxon* 99: 201–206.
- Halıcı M.G., Candan M. & Özdemir Türk A. 2009. Notes on some lichenicolous fungi species from Turkey. II. *Turkish Journal of Botany* 33: 389–392.
- Halıcı M.G., Akata I. & Kocakaya M. 2010. New records of lichenicolous and lichenized fungi from Turkey. *Mycotaxon* 114: 311–314.
- Halıcı M.G., Kocakaya M. & Kiriş Z. 2014. Lichenized and lichenicolous fungi of Bakırdağ (Kayseri, Adana). *Acta botanica Hungarica* 56: 319–332.
- Hoffmann N. & Hafellner J. 2000. Eine Revision der lichenicolen Arten der Sammelgattungen *Guignardia* und *Physalospora*. *Bibliotheca Lichenologica* 77: 1–190.
- John V. 1999. Lichenes Anatolici Exsiccati. Fasc. 1–3 (1–75). *Arnoldia* 16: 1–41.
- John V. & Breuss O. 2004. Flechten der östlichen Schwarzmeer-Region in der Türkei (BLAM- Exkursion-1997). *Herzogia* 17: 137–155.
- John V. & Türk A. 2017. Türkiye Likenleri Listesi. [A Checklist of the Lichens of Turkey] – *Nezahat Gökyiğit Botanik Bahçesi. İstanbul, Yayın xv* (in Turkish).
- John V., Seaward M.R.D. & Beatty J.W. 2000. A neglected lichen collection from Turkey. Berkhamsted school expedition 1971. *Turkish Journal of Botany* 24: 239–248.
- John V., Güvenç Ş. & Türk A. 2020. Additions to the checklist and bibliography of the lichens and lichenicolous fungi of Turkey. *Archive for Lichenology* 19: 1–32.
- Kocakaya M., Halıcı M.G. & Aksoy A. 2009. Lichens and lichenicolous fungi of Kızıldağ (Derebucak, Konya). *Turkish Journal of Botany* 33: 105–112.
- Kocakaya M., Halıcı M.G. & Aksoy A. 2014. Lichenised and lichenicolous fungi of Gevne valley (Konya, Antalya). *Turkish Journal of Botany* 38: 358–369.
- Koç Ş.N., Ataşlar E., Türk A. & Tufan-Çetin Ö. 2017. Lichens of Barla Mountain in Isparta, Turkey: Diversity study and ecological assessment of the aerea. *Plant Biosystems* 151: 985–995.
- Kraichak E., Parnmen S., Lücking R. & Lumbsch H.T. 2013. *Gintarasia* and *Xalocoa*, two new genera to accommodate temperate to subtropical species in the predominantly tropical Graphidaceae (Ostropales, Ascomycota). *Australian Systematic Botany* 26: 466–474.
- Liu J., Hyde K., Jones E., Gareth B., Ariyawansa H., Bhat D., Boonmee S., Maharachchikumbura S.N., McKenzie E.C., Phookamsak R., Phukhamsakda C., Shenoy B., Abdel-Wahab M., Buyck B., Chen J., Chethana K., Thilini W., Singtripop C., Dai D., Dai Y., Da-ranagama D., Dissanayake A., Doilom M., D'souza M., Fan X., Goonasekara I., Hirayama K., Hongsanan S., Jayasiri S., Jayawardena R., Karunarathna S., Li W., Mapook A., Norphanphoun C., Pang K., Perera R., Persoh D., Pinruan U., Senanayake I., Somrithipol S., Suetrong S., Tanaka K., Thambugala K., Tian Q., Tibpromma S., Udayanga D., Wijayawardene N., Wanasinghe D., Wisitrassameewong K., Zeng X., Abdel-Aziz F., Adamcik S., Bahkali A., Boonyuen N., Bulgakov T., Callac P., Chomnunti P., Greiner K., Hashimoto A., Hofstetter V., Kang J., Lewis D., Li X., Liu X., Liu Z., Matsumura M., Mortimer P., Rambold G., Randrianjohany E., Sato G., Sri-Indrasutdhi V., Tian C., Verbeken A., Brackel W. von, Wang Y., Wen T., Xu J., Yan J., Zhao R. & Camporesi E. 2015. Fungal diversity notes 1–110: taxonomic and phylogenetic contributions to fungal species. *Fungal Diversity* 1–197.
- Navarro-Rosinés P., Calatayud V. & Hafellner J. 2004. *Cercidospora*. In Nash III T.H., Ryan B.D., Diederich P., Gries C. & Bungartz F. (eds.): *Lichen Flora of the Greater Sonoran Desert Region, Vol. 2*: 635–639, Lichens Unlimited, Arizona State University, Tempe, Arizona.
- Nimis P.L. & John V. 1998. A contribution to the lichen flora of mediterranean Turkey. *Cryptogamie, Bryologie and Lichenologie* 16: 99–103.
- Öztürk Ş. 1990. Türkiye için yeni liken kayıtları. Doğa. *Turkish Journal of Botany* 14: 87–96.
- Oran S., Uğur A. & Öztürk S. 2007. Some lichen records from *Quercus vulcanica* forests around yukarı Gökdere (Isparta, Turkey). *Journal of Biological and Environmental Sciences* 1: 121–126.
- Singer E.T., Özdemir Türk A. & Candan M. 2014. Additional records to the lichenized and lichenicolous fungi diversity of Bozdağ (Eskişehir, Turkey). *Biological diversity and conservation* 7: 79–87.
- Steiner J. 1899. Flechten aus Armenien und dem Kaukasus. *Österreichische Botanische Zeitschrift* 49: 248–254.
- Steiner J. 1905. Lichenes. Ergebnisse einer naturwissensch. Reise zum Erschias-Dagh (Kleinasien) von Dr. Arnold Penten und Dr. Emerich Zederbauer im Jahre 1902. *Annalen des Naturhistorischen Museums in Wien* 20: 369–384.
- Svensson M., Ekman S., Klepsland J.T., Nordin A., Thor G., von Hirschheydt G., Jonsson F., Knutsson T., Lif M., Spribille T. & Westberg M. 2017. Taxonomic novelties and new records of Fennoscandian crustose lichens. *MycoKeys* 25: 51–86.

- Triebel D. 1989. Lecideicole Ascomyceten. Eine Revision der obligat lichenicolen Ascomyceten auf lecideoiden Flechten. *Bibliotheca Lichenologica* 35: 1–278.
- Türk A., John V. & Candan M. 2003. Kapadokya bölgesi likenleri Tübitak proje no: TGAG-1966 (101T109). *Ekim* 2003: 1–86, *Eskişehir, Türkiye*. [A report of Tübitak Project in Turkey]
- Türk A., Öztürk Ş., Çobanoğlu G., Candan M., Güvenç Ş. & Oran S. 2009. TLT araştırma gezisinden bazı liken kayıtları. Ankara Beynam ormanı. *Türk liken topluluğu bülteni* 7: 12–17.
- Vouaux L. 1913. Synopsis des champignons parasites de lichens. *Bulletin de la Société mycologique de France* 29: 33–128.
- Westberg M., Moberg R., Myrdal M., Nordin A. & Ekman S. 2021. *Santesson's Checklist of Fennoscandian Lichen-Forming and Lichenicolous Fungi*. Uppsala, University: Museum of Evolution.
- Yavuz M. & Çobanoğlu G. 2007. Lichen flora of Pamukkale (Hierapolis) Turkey. *Pakistan Journal of Biological Sciences* 10: 2998–3001
- Yavuz Y. & Türk A. 2016. Sündiken Dağları'nın saksikol, terrikol, muskikol liken ve likenikol mantar çeşitliliği. *Anadolu Üniversitesi Bilim ve Teknoloji Dergisi C. Yaşam Bilimleri ve Biyoteknoloji* 6: 1–13.
- Yazıcı K. & Aslan A. 2019. Three new lichenicolous fungi records for Turkey and Asia. *Acta Botanica Hungarica* 61: 205–212.
- Yazıcı K. & Aslan A. 2022. Lichens and lichenicolous fungi from Tunceli province in Turkey. *Phytologia Balcanica* 28: 161–185.
- Yazıcı K. & Aslan A. 2023. Additional records of lichens and lichenicolous fungi from the Giresun, Trabzon and Rize provinces, Turkey. *Phytologia Balcanica*. 29: 15–34.
- Yazıcı K. & Etayo J. 2014. Lichenicolous fungi in Iğdır province, Turkey. *Acta Botanica Brasilica* 28: 1–7.
- Yazıcı K. & Etayo J. 2015. Lichenicolous fungi of Burdur province in Turkey *Mycotaxon* 130 (1–9): 1214.
- Yazıcı K., Aslan A., Etayo J. & Giordani P. 2008. Lichens from Antalya, Çankiri, Konya and Nevşehir Provinces (Turkey). *Pakistan Journal of Biological Sciences* 11: 2201–2208.
- Yazıcı K., Aptroot A., Aslan A., Etayo J. & Karagöz Y. 2010. Lichenized and lichenicolous fungi from nine different areas in Turkey. *Mycotaxon* 111: 113–116.
- Yazıcı K., Etayo J. & Aslan A. 2011. A note about lichenicolous fungi from Ardahan (Turkey). *Cryptogamie Mycologie* 32: 429–437.
- Yazıcı K., Aptroot A. & Aslan A. 2013. The lichen biota of Iğdır province (Turkey). *Mycotaxon* 123: 492.
- Yazıcı K., Aptroot A., Aslan A., Sipman H. & Piercey-Normore M.D. 2015. The lichen biota of Burdur province (Turkey). *Mycotaxon* 130: 926.
- Yazıcı K., Aslan A., Karahan D., Aptroot A. & Sipman H. 2020a. Lichens and lichenicolous fungi from Muş province in Turkey. *Acta Botanica Hungarica* 62: 435–452.
- Yazıcı K., Aslan A., Aptroot A., Etayo J., Karahan D. & Sipman H. 2020b. Lichens and lichenicolous fungi from Bitlis province in Turkey. *Lindbergia* 43: 1–12.
- Yazıcı K., Etayo J. & Aslan A. 2021. *Kalchbrenneriella cyanescens* and *Rhizocarpon ochrolechia* – two new lichenicolous fungi records for Turkey and Asia. *Phytologia Balcanica* 27: 155–159.
- Yazıcı K., Aslan A. & Etayo J. 2022. Lichens and lichenicolous fungi from the Bingöl Province in Turkey. *Phytologia Balcanica* 28: 11–38.
- Yılmaz Y., Özdemir Türk A., Candan M. & Yavuz Y. 2015. Diversity of Lichenized and Lichenicolous Fungi in Kula Volcanic area (Uşak-Manisa/ Turkey). *Biological Diversity and Conservation* 8: 51–58.
- Zhurbenko, M.P. 2025. A new species of *Muellerella* from the Russian Arctic, with a key to the lichenicolous species of the genus. *Opuscula Philolichenum* 24: 1–7.