

THREE NEW LICHENICOLOUS FUNGI RECORDS FOR TURKEY AND ASIA

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(Received 8 August, 2018; Accepted 9 January, 2019)

Three lichenicolous fungi, *Abrothallus peyritschii*, *Lichenochora verrucicola* and *Sclerococcum montagnei*, collected from Burdur and Bitlis provinces, are reported as new to Turkey, the latter species is also new to Asia. Short descriptions, including geographical distributions, hosts and comparisons with similar taxa are provided.

Key words: Ascomycota, biodiversity, Bitlis, Burdur, lichenicolous fungi, Turkey

INTRODUCTION

Lichenicolous fungi, growing as obligate parasites or saprotrophs on lichens, include a large group of about 1,800 taxa (Lawrey and Diederich 2018). They mainly belong to the Ascomycota (about 95%), and the rest to the Basidiomycota (Lawrey and Diederich 2003).

Within our projects “Lichen flora of Muş and Bitlis Provinces” and “Lichen and bryophyte flora of Burdur province” we found some interesting lichenicolous fungi. No lichenicolous fungi had been reported previously from Bitlis province but from Burdur (Kocakaya *et al.* 2016). Although studies on lichenicolous fungi flora of Turkey have been increasing in the last five years, there are still many unexplored parts of Turkey (Yazici and Etayo 2014, Yazici *et al.* 2011). Approximately 146 taxa of lichenicolous fungi are known from other regions of Turkey (John and Türk 2017).

This number is still low when compared with other European countries or regions, e.g. Czech Republic (226 species including lichenicolous lichens, Kocourková 2009), Fennoscandia (430 species, Santesson *et al.* 2004), Germany (449 species, Brackel 2015a), Italy (525 species, Brackel 2015b). Great Britain and Ireland (403 species including lichenicolous lichens, Hawksworth 2003), Poland (216 species, Czyżewska and Kukwa 2009) or Ukraine (220 species, Darmostuk and Khodosovtsev 2017). Thus extensive explorations are urgently needed for more regions of Turkey.

According to the latest circumscriptions of the genera *Abrothallus* is composed of approx. 40 taxa (Suija 2006, Suija *et al.* 2015, Brackel 2015a, b), *Licheno-*

chora 41 taxa (Lawrey and Diederich 2018), while *Sclerococcum* 13 sporodochial anamorphic taxa (Lawrey and Diederich 2018). Five taxa of *Abrothallus*, one taxon of *Sclerococcum* and two taxa of *Lichenochora* have been reported so far from Turkey (John and Türk 2017).

The present contribution resulted records from fieldworks in the region of Bitlis (eastern Turkey) and Burdur (western Turkey). The study area (Bitlis) has a climate characterised by very cold and snowy winters, and short, hot and dry summers, with mean annual temperature is 9.7 °C and, with a temperature range from -21.3 °C to 37 °C, a mean annual rainfall of 822.9 mm, and mean annual humidity of 61% (Akman 1999). On the other hand, in Burdur the climate is characterised by cold, snowy winters and very hot, long and dry summers. The temperatures range from -16 °C to 39 °C, while the mean annual temperature is 15 °C. The mean annual rainfall is 468 mm with an average humidity of 51.2% (Akman 1999).

MATERIALS AND METHODS

The present study is based on specimens from the Bitlis and Burdur regions collected in 29.06.2012, 17.07.2016 and 06.08.2016. Microscopical examination of hand-made sections was performed in water (incl. all measurements), 10% KOH, and lactophenol cotton blue. Air dried samples were observed and studied with a Nikon Zeiss Stemi 2000-c stereomicroscope and a Zeiss Axio Imager.A2 light microscope. Macrophotographs and microphotographs were taken with the digital camera Zeiss AxioCam ERc5s. The nomenclature of genera and species concept were followed according to Diederich (2015), Etayo and Calatayud (1998), Lindsay (1857), Nash *et al.* (2001), Navarro-Rosinés *et al.* (1998), and Suija (2006). Specimens are deposited in the herbarium of the Biology Department, Faculty of Science, Karadeniz Technical University, Trabzon, Turkey (KTUB). The descriptions are based on Turkish specimens.

RESULTS AND DISCUSSION

Abrothallus peyritschii (Stein) Kotte,
Centralbl. Bakt. Parasitkde, Abt. II 24: 76 (1909)
(Figs 1a–c)

Ascomata apothecia, with golden pruina, superficial, immersed when young, 180–200(–300) µm in diam., K/I reaction of sterile hyphae negative; disc black, flattened or ±globose (Fig. 1a); epihymenium dark green or light brown; hymenium hyaline or ±light brown, ±light green towards hypothecium, 75–90 µm (Figs 1b, 1c); hypothecium dark brown to red brown, 65–90 µm high in water; asci 8-spored, clavate or ellipsoid, 55–65 × 17–14 µm; ascospores

2-celled, light blue-green, greenish brown or \pm brown in water, \pm verruculose, upper cell \pm broader, $12.25\text{--}14.7 \times 4.5\text{--}4.9 \mu\text{m}$ (Figs 1c–d); pycnidia \pm immersed, outer wall K \pm green, I–; conidia hyaline, ellipsoid to obpyriform, $5.0\text{--}5.5 \times 3.5\text{--}4.0 \mu\text{m}$. A detailed description is provided by Kotte (1909).

Abrothallus peyritschii grows on the thallus and soredia of *Vulpicida* species and infection is \pm evident on these specimens.

Specimen examined: Turkey, Burdur province, between İbecik and Altınyayla villages, on main roadside, $36^\circ 58' 07.19'' \text{N}$, $29^\circ 26' 17.70'' \text{E}$, 1348 m, on *Vulpicida pinastri*, leg.: Yazici, K., 29.06.2012 (KTUB-2450), det. Yazici, K.

Distribution: *Abrothallus peyritschii* is previously known throughout Europe (Austria, Belarus, Czech Republic, England, Estonia, Finland, France, Germany, Italy, Norway, Poland, Russia, Spain, Sweden, Switzerland); Asia (Russia: Altai-Sayan, China, India, Kyrgyzstan), Greenland, New Zealand and North America (Golubkov 2011, Obermayer 2004, Roux 2012, Sedelnikova 2013, Suija 2006, Wirth *et al.* 2011). This species is new to Turkey.

Lichenochora verrucicola (Wedd.)

Nik. Hoffm. et Hafellner,
Bibl. Lichenol. 77: 55 (2000)
(Figs 2a–d)

Mycelium mostly inconspicuous and developing in one or several irregular galls containing perithecia and pycnidia on the thallus of *Aspicilia cinerea* (Fig. 2a). Perithecia black, \pm semi-immersed or immersed in the galls, $180\text{--}250 \mu\text{m}$ diam., $250\text{--}350 \mu\text{m}$

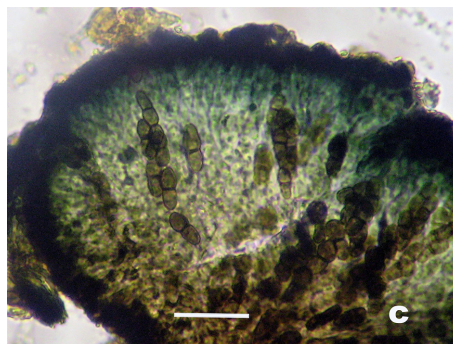
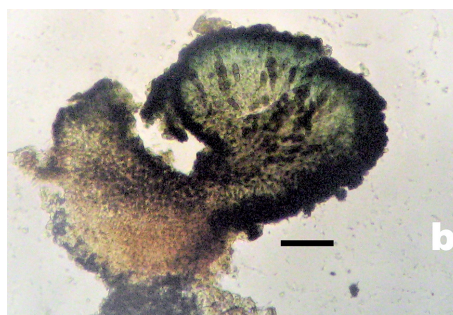
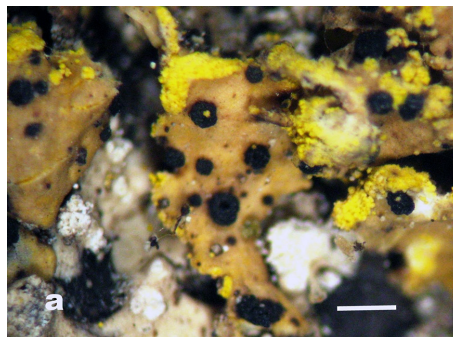


Fig. 1. *Abrothallus peyritschii* – a = ascomata on thallus of *Vulpicida pinastri* (scale: $500 \mu\text{m}$); b = section through an ascoma with ascospores, epihymenium, hymenium and hypothecium, in water (scale: $20 \mu\text{m}$); c = section of ascoma with ascus and ascospores, epihymenium, hymenium and hypothecium, in water (scale: $20 \mu\text{m}$)

tall, with \pm dark brown wall; hymenium hyaline, with small or large droplets (Figs 2b–c); paraphyses branched-anastomose; asci unitunicate, clavate, 4–8-spored, $80\text{--}90 \times 16\text{--}20 \mu\text{m}$; ascospores simple, \pm ellipsoid or mostly oblong, hyaline, $18.50\text{--}26.5 \times 6.5\text{--}8.35 \mu\text{m}$ (Fig. 2d). Pycnidia present; conidia filiform, $20 \times 2 \mu\text{m}$. A detailed description is provided by Hoffmann and Hafellner (2000) and Nash *et al.* (2001).

Lichenochora verrucicola mainly occurs on the thallus of *Aspicilia cinerea*, *Circinaria contorta* and other aspicilioid species (Nash *et al.* 2001, Navarro-Rosinés *et al.* 1998) with an evident pathogenic effect on the host.

Specimen examined: Turkey, Bitlis province, Adilcevaz district, south of Sodalı Lake, near Karşiyaka village, $38^{\circ} 49' 26.29''$ N, $42^{\circ} 57' 16.60''$ E, 1712 m, on *Aspicilia cinerea*, leg. Yazici, K., 17.07.2016 (KTUB-2455), det. Yazici, K. and Etayo, J.

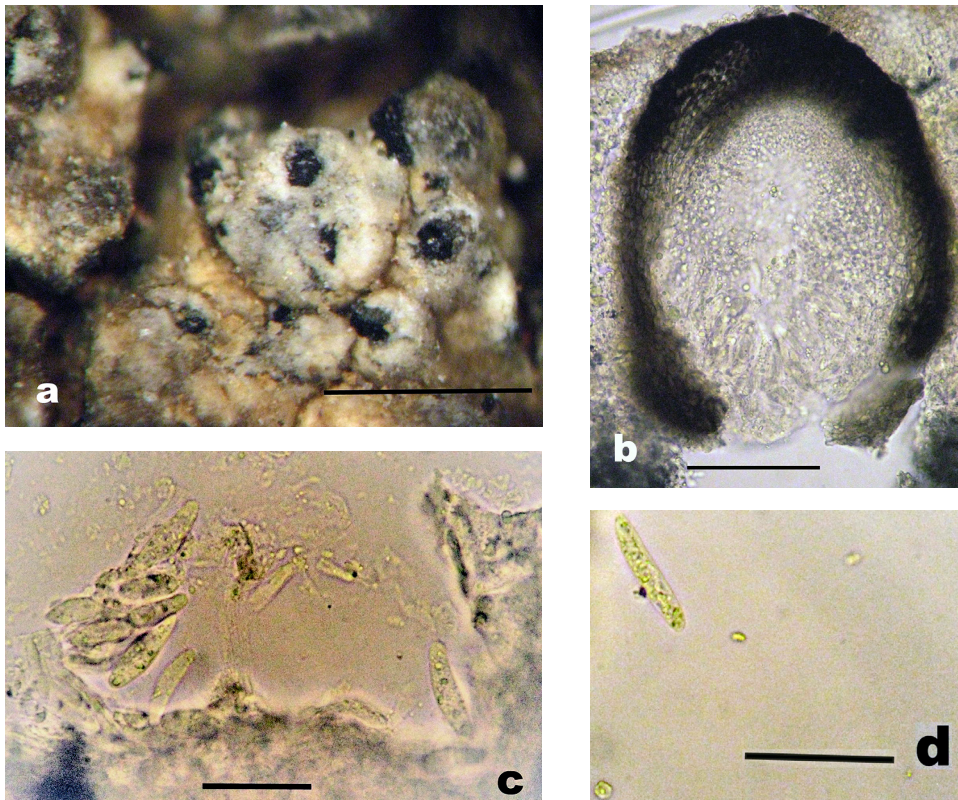


Fig. 2. *Lichenochora verrucicola* – a = ascomata on thallus of *Aspicilia cinerea* (scale: 1 mm); b = section through the perithecium with large droplets, ascus and ascospores, in water (scale: 50 μm); c = section of perithecium with ascus, ascospores, in water (scale: 30 μm); d = ascospore, in water (scale: 30 μm)

Distribution: This species is previously known from Europe (France, Spain, the Netherlands), India and North America (Joshi *et al.* 2016, Knudsen 2006, Sparrius *et al.* 2002). It is new to Turkey.

Remarks: *Lichenochora verrucicola* is similar to *L. thorii* as both species have simple ascospores but those in *L. verrucicola* are larger and finally becoming brown (Zhurbenko 2008).

Sclerococcum montagnei Hafellner,
Herzogia 12: 139 (1996)
(Figs 3a–d)

Lichenicolous fungus with convex, rough surfaced, dark brown to black sporodochia of 350–450 μm in diam. (Fig. 3a); conidiophores with brown cells mainly aggregated and \pm distinguishable among hyaline mycelia in K (Fig. 3b); conidia mainly 2-celled, rarely 1-celled brown (dark brown in K), \pm irregularly and \pm uneven thick wall, \pm constricted at the septa with thicker wall, $8.0\text{--}10.5 \times 4.9\text{--}7.3$ μm , ellipsoid, \pm straight or somewhat curved, ends rounded or slightly pointed (Fig. 3c). A detailed description is provided by Hafellner (1996) and Nash *et al.* (2001).

Sclerococcum montagnei mainly occurs on the thallus areoles of *Lecanora rupicola* group (Coppins 1997, Etayo and Calatayud 1998, Hafellner 1996, Hawksworth *et al.* 2010, Nash *et al.* 2001), and grows mostly on the margin of areoles of *L. rupicola*.

Specimen examined: Turkey, Bitlis province, Güroymak district, near Günkırı village, $38^{\circ} 34' 30.06''$ N, $41^{\circ} 58' 33.94''$ E,

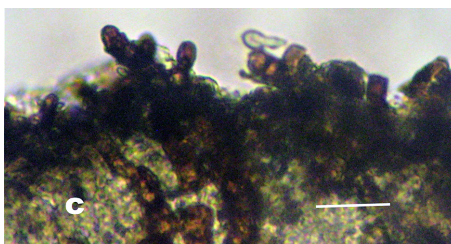
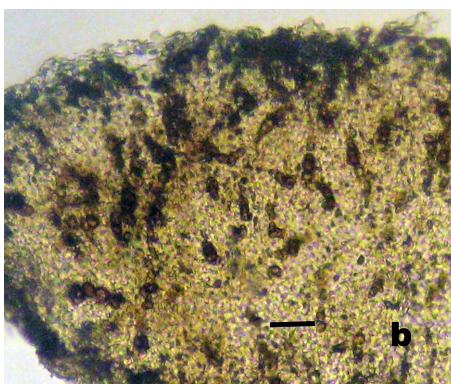
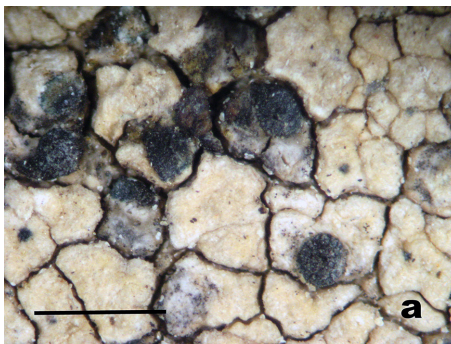


Fig. 3. *Sclerococcum montagnei* – a = sporodochia on thallus of *Lecanora rupicola* (scale: 1 mm); b = hyaline mycelia and 1- and 2-celled conidia, in water (scale: 20 μm); c = hyaline mycelia, 1- and 2-celled conidia, in K (scale: 20 μm)

1511 m, on *Lecanora rupicola*, leg. Yazici, K., 06.08.2016 (KTUB-2453), det. Yazici, K., Aslan, A. and Etayo, J.

Distribution: Previously known from Europe (England, France, Germany, Ireland, Italy, the Netherlands, Scotland, Spain, Wales), Canary Islands and North America (Aptroot *et al.* 2004, Brackel 2008, Coppins 1997, Etayo and Calatayud 1998, Hafellner 1996, Hawksworth *et al.* 2010, Hutten *et al.* 2013, Wirth *et al.* 2011). This species is new to Turkey and Asia

Remarks: *Sclerococcum montagnei* resembles *S. sphaerale* but walls of conidia in *S. montagnei* are with fissures, irregular and uneven (Etayo and Calatayud 1998, Yazici and Etayo 2014).

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Acknowledgements – We are grateful to Dr Javier Etayo for revisions and helpful comments on an earlier draft of this manuscript and also his comments about the identification of the species. This study was supported by TUBITAK (projects 111T857 and 114Z892).

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