Kalchbrenneriella cyanescens and *Rhizocarpon ochrolechiae* – two new lichenicolous fungi records for Turkey and Asia

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Received: November 15, 2021 ▷ Accepted: December 02, 2021

Abstract. Records of two lichenicolous fungi, namely, *Kalchbrenneriella cyanescens* and *Rhizocarpon ochrolechiae*, collected from Trabzon and Batman provinces, are reported as new to Turkey and Asia. Short descriptions, including geographic distribution, and comparison with similar taxa are provided.

Key words: *Ascomycetes,* lichenicolous fungi, new records, Turkey

Introduction

Approximately 150 lichenicolous fungi are known from Turkey. In recent years, knowledge of lichenicolous fungi in Turkey has significantly increased and substantial new lichen records of already known species and new lichen species have been added to Turkish lichenicolous census diversity (John & Türk 2017; John & al. 2020).

However, more extensive surveys of unexplored regions of Turkey are still needed, especially in the eastern and southeastern Anatolia (e.g. Tunceli, Bingöl, Batman, Hakkari, Siirt, Şırnak, and Mardin). Under the project *Lichen flora of Batman and Siirt provinces*, some interesting lichen taxa have been recorded. No lichenicolous fungi have been reported earlier from the Batman province, only nine taxa from Trabzon (John & Türk 2017; John & al. 2020).

Genus *Kalchbrenneriella* has been found for the first time in Turkey, while 36 taxa are known from the *Rhizocarpon,* many of them lichenized (John & Türk 2017; John & al. 2020)

In the present paper, the authors report two newly recorded lichenicolous fungi for Turkey.

Material and methods

Collecting sites

Kenan Yazıcı has collected lichen samples on 8th April 2018 and 12th July 2021, during a lichenological survey of the Batman and Trabzon regions.

The territory of the Batman province is covered with steppes. Only steppe plants are found there. There are *Quercus* L. trees, albeit few, in the mountainous regions. The slopes of the valleys are covered by *Fraxinus* Tourn. ex L., *Salix* L. and the grasslands include also bushes and weeds. Forest understory flora is very poor in these areas, while all nearby mountains have many rock habitats (Baytop & Denizci 1963). In general, Mediterranean climate is charac-

teristic for the Batman province. Summers are hot and dry, and winters are relatively warm and rainy. Precipitation is in the form of snow in the highlands and as rain in the plains. The annual average temperature is 16 °C and the precipitation is 552 mm (Akman 1999).

Mt Sis (Trabzon: Şalpazarı district) is a highland, mainly covered by deciduous and conifereous trees, but it also has alpine and subalpine zones with rocks and grasslands (Baytop and Denizci 1963). Forest tree species are predominantly *Alnus glutinosa* (L.) Gaertn., *Buxus sempervirens* L., *Castanea sativa* Mill., *Carpinus betulus* L, *Fagus orientalis* Lipsky, *Picea orientalis* (L.) Peterm., and *Pinus sylvestris* L. The flora is very species-rich and abundant, although some parts of the mountain are covered with rocks. The region has oceanic climate characterized by warm winters, cool summers and rain all seasons. Temperatures range from –7.4 °C to 38.2 °C, and the mean annual rainfall ranges from 730 to 1680 mm, with average humidity of 80% (Akman 1999).

Collecting, storage and processing of samples

Manually prepared sections were examined microscopically in water (including all taken measurements). Air-dried samples were observed and studied with 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 lichens were identified by consulting relevent keys (Diederich 2002; Smith & al. 2009). Specimens have been stored in the lichen collection of the Biology Department, Faculty of Science, Karadeniz Technical University, Trabzon, Turkey (KTUB). The descriptions are based on Turkish specimens.

Recorded species

Kalchbrenneriella cyanescens (Kalchbr.) Diederich & M.S. Christ. (Plate 1, Fig. 1a-f)

Lichenicolous fungus, infecting *Usnea* sp., almost pruinose, forming a dense and mat-like whitish tomentum in dense conidiophores. Mycelia hyaline, branched, penetrating into host cortex and also medulla; conidiophores erect, straight, superficial, mostly branched, 3-5 celled, 13–20 µm long, 2.5–4.0 µm thick; conidiogeneous monoblastic, terminal, hyaline, ±ellipsoid; conidiophores acrogenous, arising in acropetal chains, lacking a truncated base, subcylindric to ellipsoid, one-celled, occasionally two-celled, 5-6.25 µm long and 4.4-4.5 µm thick.

Kalchbrenneriella cyanescens occurs mainly on *Usnea* spp., including *Usnea hirta*, *Usnea florida* and *Usnea flammea*. It is previously known from Europe (Denmark, England, Hungary, Ireland, Italy, Scotland), Canada and Papua New Guinea. (Diederich 2002). A new species to Turkey and Asia.

Specimen examined: Turkey, Trabzon: Şalpazarı, Mt Sis, Kalpakkaya, at roadside, 40°51'33"N and 39°09'04"E, 1866 m, on *Usnea* sp., 08.04.2018, leg. Kenan Yazıcı (KTUB–2476), det. K. Yazıcı and A. Aslan.

Remarks: *Kalchbrenneriella cyanescens* has similar conidiophores to *Refractohilum* spp. and *Hawksworthiana peltigericola,* developing over the gall-like swellings on their hosts, but its conidia are different from these taxa (Braun 1988; Hawksworth 1977)

Comments: A modern description of this species is offered by Diederich (2002).

Rhizocarpon ochrolechiae (Poelt & Nimis) Hafellner, (Plate 2, Fig. 2a-d)

Lichenicolous fungus, growing on the thallus of *Ochrolechia* cf. *pallescens*. Ascomata apothecia-like, flat to convex, 0.4-0.6 mm in diameter, irregularly rounded, black, 150-500 µm in diameter and 200-250 µm high; exciple 60-65 µm thick, hyaline with brown-purple granules; epithecium a thick gel surrounding the apex of paraphysoids, purple brown-black; hymenium hyaline, but with many dots of brown purpura; hypothecium dark brown, 70-100 µm high, K-; paraphysoids branched anastomosed, with apices swollen,; asci 4-8-spored, clavate to subglobose, semi-fissitunicate, with *Rhizocarpon*-type. Ascospores widely ellipsoid, submuriform to muriform, blue-black to brown, subsequently rather grey then black, without warts, with several visible cells, straight to seldom curved, 21-29 × 11-14 µm.

Rhizocarpon ochrolechiae has been recorded growing mainly on saxicolous *Ochrolechia* spp., but in this study, was found on corticolouıs *Ochrolechia* cf. *Pallescens,* on xeric supralittoral seashores. Previously, it has been known from Scotland, Wales (Radnor), England, Italy, North America (Hawksworth & al. 2010), Macaronesia, Sardinia, England (Zhurbenko 2017). A new species to Turkey and Asia.

Plate 1

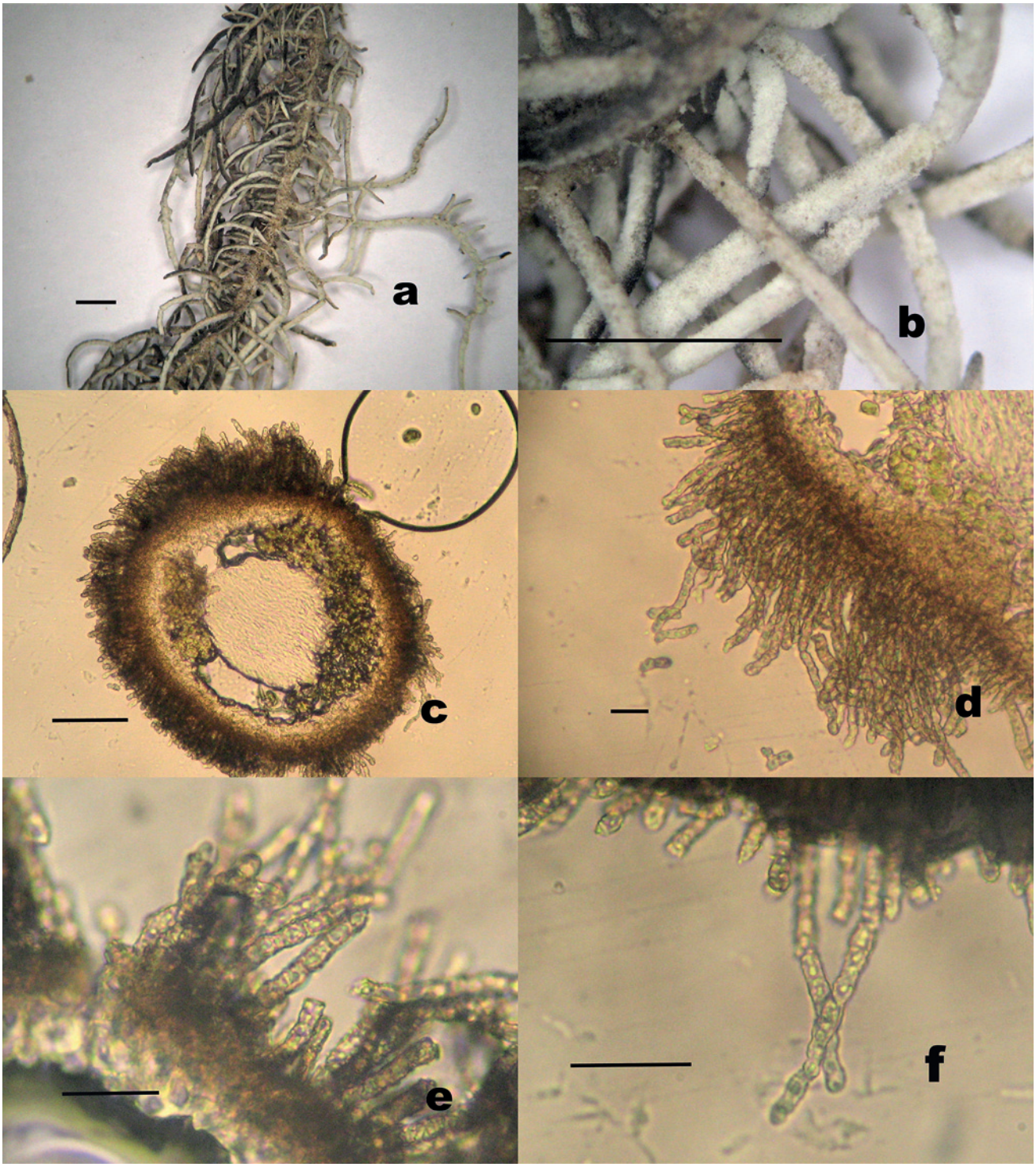

Fig. 1a-f. *Kalchbrenneriella cyanescens*: **a, b**. infected thallus of *Usnea* sp., **c**. cross-section of thallus of *Usnea* sp. with conidiophores and conidia of *Kalchbrenneriella cyanescens*. **d, e, f.** conidiophores and conidia. Scale: a, b: mm, c: 50 μm, d, e: 20 μm, f: 25 μm

Plate 2

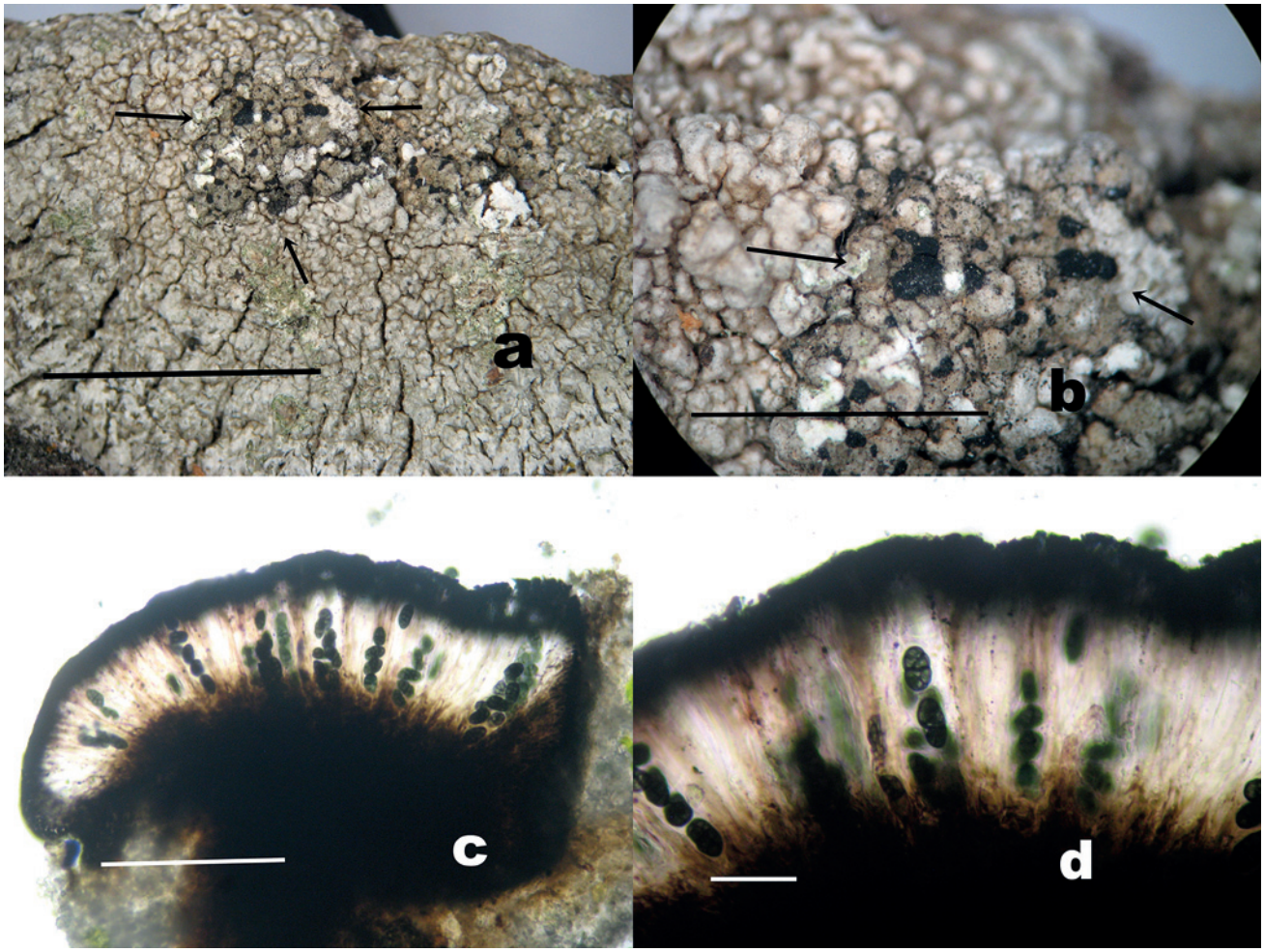

Fig. 2a-d. *Rhizocarpon ochrolechiae* **a, b**. habitus, apothecia on the thallus of *Ochrolechia* cf. *pallesces*. **c.** section through an ascomata with epihymenium, hymenium, hypothecium and ascospores. **d.** purple brown-black epithecium, dark brown hipothecium, grey-black submuriform ascospores. Scale: a. 1cm, b: 5mm, c: 100 µm, d: 50 µm

Specimen examined: Turkey, Batman: Gercüş, between Tepecik and Gökçe villages, at roadside, 37°35'37.50"N and 41°08'08.01"E, 993 m, on corticolous *Ochrolechia* cf. *pallescens*, 12.06.2021, leg. Kenan Yazıcı (KTUB–2477). det. K. Yazıcı and J. Etayo

Remarks: *Rhizocarpon ochrolechiae* resembles in appearance *Rhizocarpon lusitanicum* var. *ochrolechiae* and *Rhizocarpon vorax*, but in the short description of the first species the authors mention the epihymenium as purple brown, and K+ intense purple in *R. vorax*, (Poelt & Hafellner 1982). It is growing on *Pertusaria* sp. but has been also seen on *Ochrolechia parella* (Lawrey & Diederich 2017). Similarly to *R. ochrolechiae*, this species also has a purple brown epihymenium but a brown epipsamma, K+ olivaceous and with a bit larger spores, 28-33×18.5-21 µm.

Comments: A diagnosis of this species under the name *R. lusitanicum* (Nyl.) Arnold var. *ochrolechiae* Poelt & Nimis was published in Nimis & Poelt (1987) and a more detailed description was provided by Kalb & Hafellner (1992).

Acknowledgements. This study was supported financially by TUBITAK (Project 219Z014).

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