

New lichen records of *Acarospora* and *Lecidea* species for Turkey and Asia

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Abstract: The three lichen species *Acarospora pseudofuscata*, *Acarospora rugulosa*, and *Lecidea erythrophaea* collected from the Bitlis, Muş and Giresun regions have been determined as new to Turkey. In addition, *Acarospora pseudofuscata* is also new to Asia. Descriptions are supplemented by notes on geographic distribution and chemistry and comparisons with morphologically similar taxa.

Zusammenfassung: Die drei Flechtenarten *Acarospora pseudofuscata*, *A. rugulosa* und *Lecidea erythrophaea* aus den Regionen Bitlis, Muş und Giresun wurden als neu für der Türkei ermittelt. Darüber hinaus ist *Acarospora pseudofuscata* auch für Asien neu. Die Beschreibungen werden mit Anmerkungen zur geographischen Verteilung und Chemie sowie mit Vergleichen morphologisch ähnlicher Taxa ergänzt.

Studies on lichens of Turkey have been intensive in recent years and yielded several new records and new species (YAZICI & APTROOT 2017; CANDAN 2017; KINALIOĞLU 2017; KINALIOĞLU & APTROOT 2017; YAZICI & ASLAN 2016a, b; KRISAI-GREILHUBER & al. 2017). However, there are many lichenologically unexplored parts in the country. Therefore, several field trips in the Muş and Bitlis regions resulted in three new records of crustose lichens for Turkey and Asia.

Although approximately 1650 lichen taxa have been noted from Turkey (YAZICI & APTROOT 2015), only seven have been reported from Muş Province (YAZICI & ASLAN 2016a, b; KRISAI-GREILHUBER & al. 2017; YAZICI & APTROOT 2017) and 34 taxa from Bitlis region (ÇOBANOĞLU 2005, ÇOBANOĞLU & YAVUZ 2007, VONDRÁK & al. 2012, YAZICI & APTROOT 2017, KRISAI-GREILHUBER & al. 2017). Forty taxa of *Acarospora* and 34 of *Lecidea* have thus far been reported from Turkey (JOHN & TÜRK 2017).

Materials and methods

Material: KENAN YAZICI collected lichen samples in April, May, July, and August during a 2015, 2016 and 2018 lichenological survey of the Bitlis, Muş and Giresun regions.

The descriptions are based on Turkish specimens and vouchers are stored in the Herbarium of the Biology Department, Karadeniz Technical University, Trabzon, Turkey (KTUB).

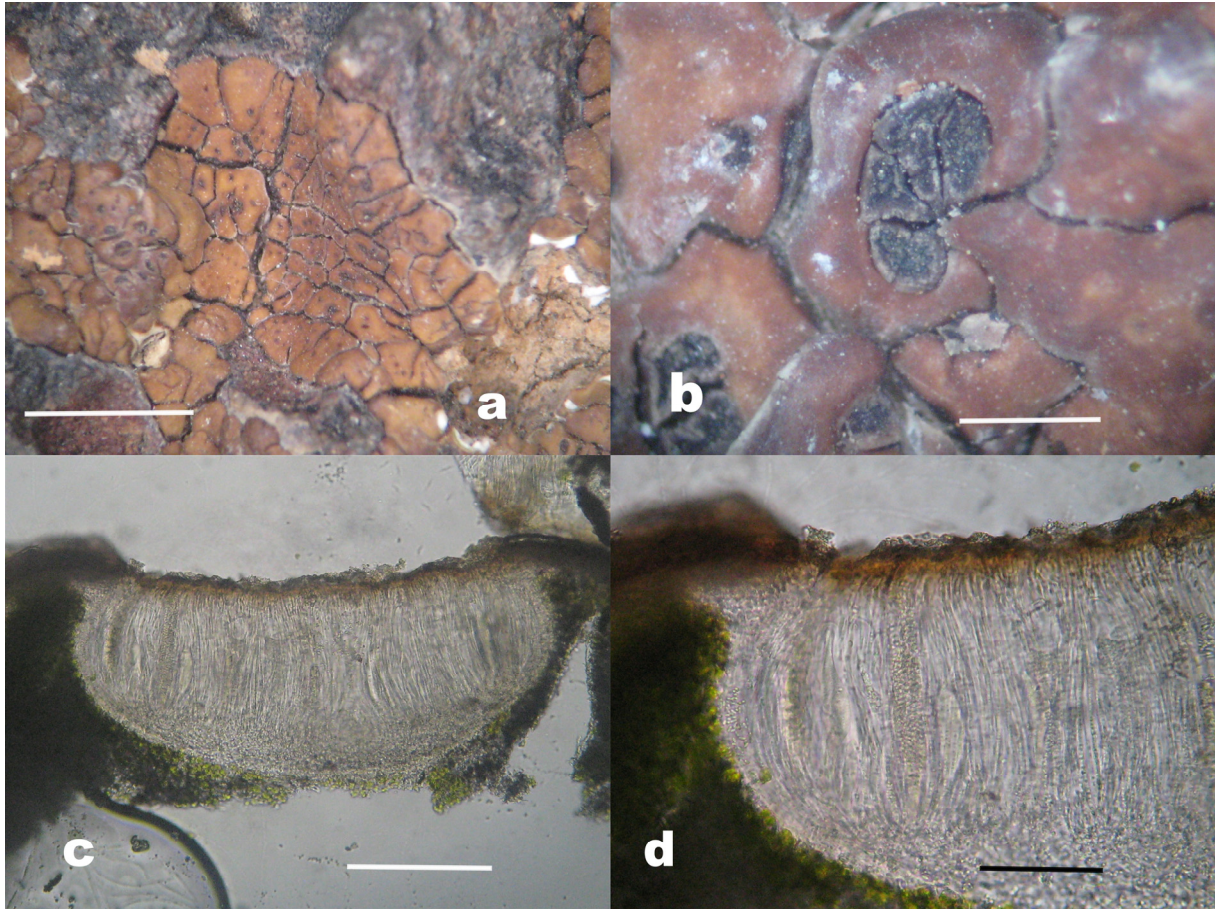


Fig. 1. *Acarospora pseudofuscata*. a Thallus with areoles. b Apothecia with margin. c Section through apothecium covered by algal layer with hymenium, epihymenium, hypothecium, ascus and ascospores. d Section of apothecium. Algal layer, hymenium, ascus and ascospores. Bars: a 0.5 cm, b 1 mm, c 125 μ m, d 50 μ m.

Samples were examined using a Zeiss Stemi 2000-c stereomicroscope and a Zeiss Axio Imager.A2 light microscope and digitally photographed with a Zeiss AxioCam ERc5s. They were identified by consulting the relevant keys (SIPMAN & RAUS 2002, SMITH & al. 2009, THOMSON 1997).

Study area: The Muş region (near Malazgirt) primarily encompasses vast areas of meadow, large plains, and steppe but no high mountains or canyons (BAYTOP & DENIZCI 1963). The sites are well-lit, windswept, treeless areas with gently sloping terrain containing streams, grass, and calcareous and siliceous rocks.

The other study areas in Bitlis region (Mutki: Çaygeçit) are mountainous with vast open areas, well-lit, large plains with calcareous and siliceous rocks with *Quercus*, *Populus* and *Salix* trees in some places. So crustose and foliose lichens are predominantly seen (BAYTOP & DENIZCI 1963).

The third site in Giresun (Görele) region has many forests of *Pinus*, *Picea*, *Fagus*, and *Alnus*. It has a mild constantly humid subtropical climate with no dry season. The summers are hot and muggy with thunderstorms. The annual average rainfall is 1420 mm and annual average temperature is 13.6 °C.

The climate of the Muş and Bitlis regions are characterized by very cold snowy winters and short hot dry short summers, with temperatures ranging from (–21)–29 to (37–)41.6 °C, annual rainfall ranges from 350–1000 mm and the average humidity is 60.3 % (AKMAN 1999).

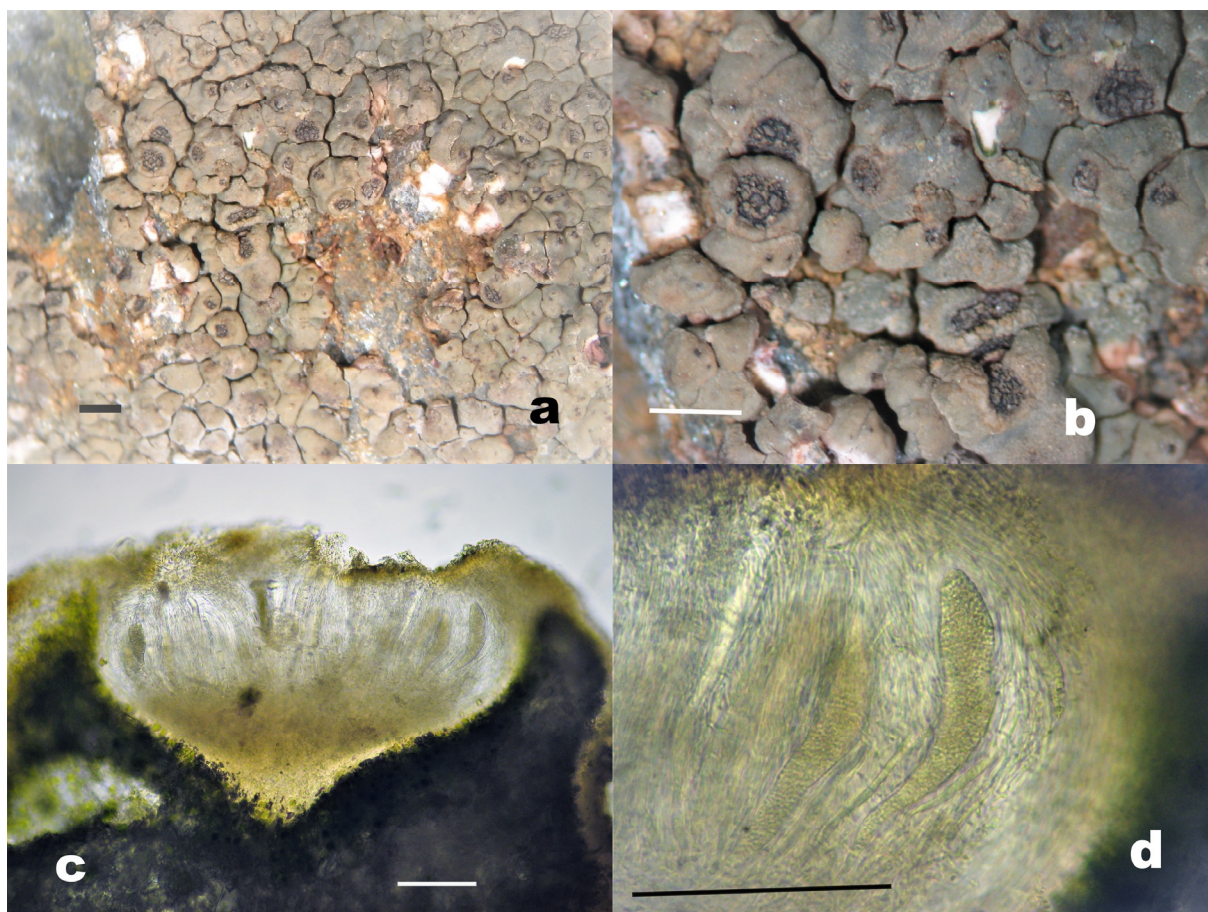


Fig. 2. *Acarospora rugulosa*. a Thallus with areoles. b Thallus with areoles and apothecia. c Cross-section of apothecium; hymenium, epihymenium, hypothecium. d Section of apothecium; hymenium, ascus and ascospores. Bars: a, b, 1 mm, c, d 100 μ m.

Species records

Acarospora pseudofuscata SIPMAN in SIPMAN & RAUS, Willdenowia 32(2): 358(2002). (Fig. 1)

Thallus: crustose, polymorph, light brown to dark brown, firmly attached the substratum, to 1.5 cm wide, areolate, areoles polymorph, sometimes glossy, 1–1.5 μ m wide, to 0.4 mm thick, contiguous sometimes white pruinose in the centre, slightly concave or not, marginal areoles longer, sometimes rounded and darker brown, and $\pm$ narrow, 2–2.5 μ m long, 1 mm wide, not overlapping (Fig. 1a); cortex 3–5 mm; algal cell 7.5 μ m, and algal layer 40 μ m (Fig. 1a); medulla loose.

Ascomata: mostly single per areole (1–1.5 mm long), sometimes 2–3, to 800 μ m wide, darker from thallus, emarginate, immersed, depressed, slightly rounded disc at first and angular, $\pm$ smooth and $\pm$ dark brown and with margin later (Fig. 1b).

Hymenium: up to 130 μ m, colourless, **hypothecium** 35 μ m, colourless (Fig. 1c), **paraphyses** up to 2.5 μ m wide, with septa; ascomata densely covered by algal layer; **epihymenium** light brown, yellow-brown or brown; **ascus** 85–95 μ m long, 12 μ m wide, **ascospores** 4 $\times$ 2 μ m and numerous (hundreds of) (Fig. 1d). Thallus C+ red.

A detailed description is provided by SIPMAN & RAUS (2002).

Specimen examined: Turkey, Bitlis: Mutki, Çaygeçit, 38° 24' 33.62" N, 41° 50' 26.04" E, 1275 m s. m., on siliceous rock, 18. August 2016, K. YAZICI (KTUB-2461). Associated species *Immersaria athrocarpa*, *Aspicilia desertorum*, *Candelariella vitellina* and *Myriolecis dispersa*.

Notes: *Acarospora pseudofuscata* grows on rather steep slopes of siliceous, exposed boulders between 50 and 400 m s.m. (SIPMAN & RAUS 2002). It was also recorded to grow in 1275 m s. m. It was previously known from Greece, and Italy, and is new to Turkey and Asia.

Acarospora pseudofuscata looks like *A. fuscata*, but the latter has a wavy thallus with C + red reaction (apparently) in small patches. *Acarospora pseudofuscata* may be further confused with *A. scotica*, which has, however, areoles with consistent black margins (ROUX 1981).

***Acarospora rugulosa* KÖRB. Parerga lichenol. (Breslau) 1: 59 (1859). (Fig. 2)**

Thallus crustose, to 5–6 cm in diam., light grey, grey-beige or light brown, ±circular or elliptical, 1–1.2 mm thick, thinner towards lobe ends, thicker in the middle, areolate (Fig. 2a); areoles up to 1.8 mm in diam., convex with convex, rounded or angular lobes; lobes, convex, 0.4–1 mm, pressed (especially ends), contiguous or separate, sometimes white pruinose especially on lobe ends.

Apothecia to 0.7 mm in diam., 1–3 per areola, margin prominent; disk 0.5–0.65 mm in diam. (Fig. 2b); medulla white, hymenium 120–146 µm thick, ±light brown or ±beige; hypothecium 73–86 µm thick, ±brown, light-brown or ±yellow-brown; epithecium light brown or brown (Fig. 2c); ascus clavate, (100–)110–135(–145) × 19.5–6(–5) µm; ascospores numerous, widely ellipsoid, 2.5 × 3 µm, paraphyses capitate, with brown tips, 7.32 µm (Fig. 2d). Thallus C+ red.

Detailed descriptions are provided by THOMSON (1997).

Specimen examined: Turkey, Muş: Malazgirt, 3 km to Adaksu village, roadside, 38° 59' 18.50" N, 42° 35' 20.01" E, 1949 m s. m., on siliceous rock, 29. July 2015, K. YAZICI (KTUB-2463).

Notes: *Acarospora rugulosa* occurs mainly on acid rocks usually with iron. Associated species are *A. cervina* and *A. peliscypha*. It was previously known from Europe (Scandinavia and the Alps) and Greenland and is new to Turkey.

Acarospora rugulosa looks like *A. peliscypha*, but it differs from Turkish samples of *A. peliscypha* by a ±pale underside and a thicker hymenium.

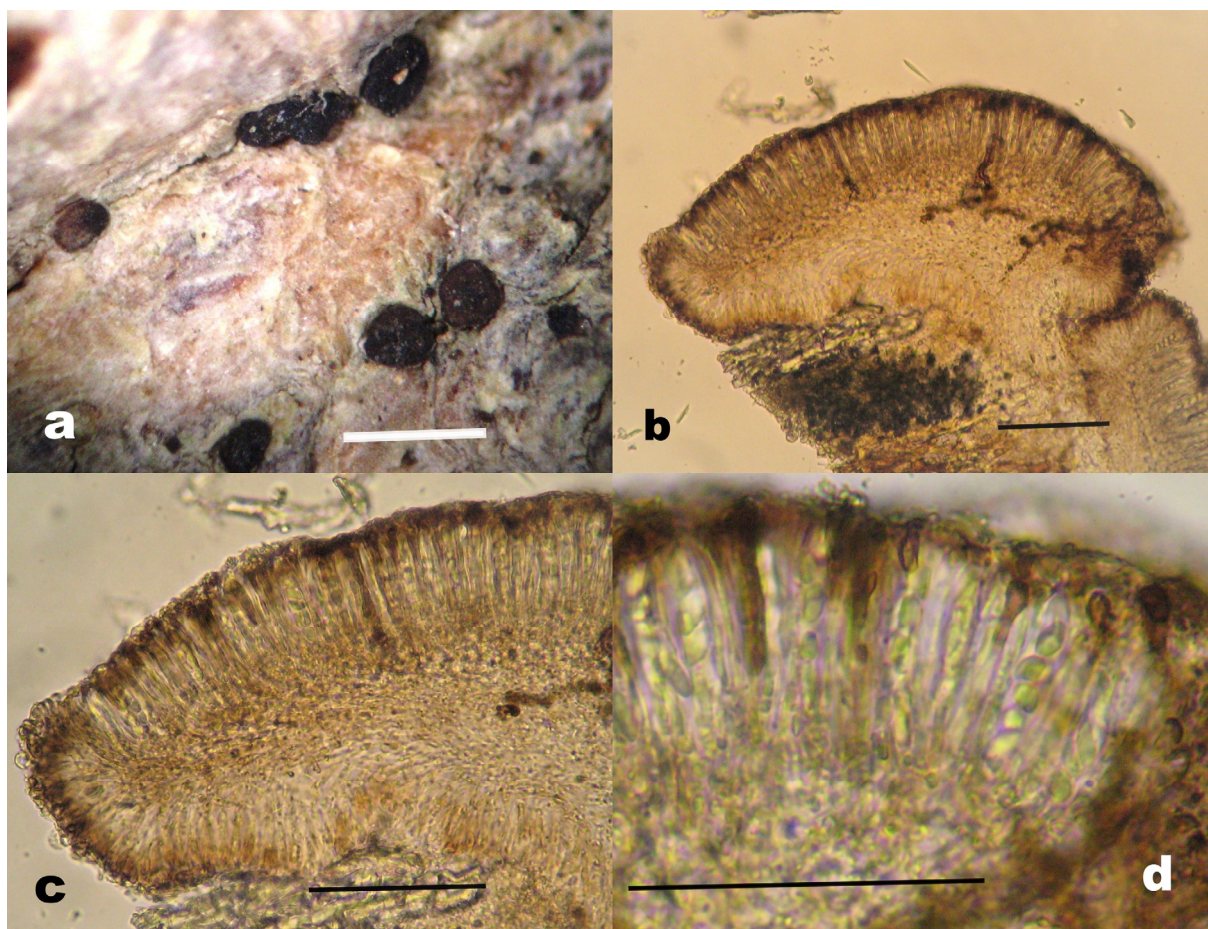
***Lecidea erythrophaea* FLÖRKE ex SOMMERF., Suppl. Fl. Lapp. (Oslo): 163 (1826). (Fig. 3)**

Thallus crustose, very superficial, thin, yellowish white, some areas yellowish-green, esorediate. Medulla I–, very thin, sometimes ±absent (Fig. 3a).

Apothecia sessile, constricted at base, 150–490 µm wide, one or in two groups, scattered, or slightly crowded, disk flat, sometimes convex, dark brown or red brown, circular or slightly ellipsoid; (Fig. 3b); true excipulum excluded, or sometimes slightly red brown or concolorous with disk; epihymenium light brown, ±dark or ±red brown, partly hyaline, K–, N–.

Hymenium (40–)45–78.5(–85) µm thick, light brown, colourless or hyaline; hypothecium light brown or yellow brown, (35–)40–80(–95) µm thick, paraphyses simple or ±branched, sometimes septate, top cell 2.5–3 µm (Fig. 3c).

Asci 8-spored, clavate, *Bacidia*-type, $(5-)7.35-12.5 \times 36-50(-55) \mu\text{m}$; **ascospores** hyaline, simple, $\pm$ ellipsoid or $\pm$ fusiform, $1.9-2.95(-4.25) \times (3-)6.2-7.95(-10.98) \mu\text{m}$ (Fig. 3d). Spot tests negative.



Figs. 3. *Lecidea erythrophaea*. *a* Thallus with apothecia. *b* Section of apothecium. *c* Section of apothecium; ascus and ascospores. *d* Section of apothecium; paraphyses, ascus, ascospores. Bars: *a* 1 mm, *b–d* 100 μm .

A detailed description of *Lecidea erythrophaea* is provided by SMITH & al. (2009).

Specimen examined: Turkey, Muş: Center, 1 km to Cevizliere, $38^{\circ} 35' 25.33''$ N, $41^{\circ} 20' 56.87''$ E, 1561 m s. m., on *Quercus*, 30. May 2015, K. YAZICI (KTUB–2464). Giresun: Sıdağı, Çağmanlı, $40^{\circ} 53' 58''$ N, $39^{\circ} 08' 12''$ E, 1684 m s. m., on *Fagus orientalis*, 8. April 2018, K. YAZICI (KTUB–2465).

Notes: *Lecidea erythrophaea* is mainly boreal-montane, probably circumpolar, growing mainly on shrubs and smooth bark of deciduous trees, e.g. *Fraxinus*, *Corylus*, *Populus*, *Quercus*, *Ribes*, *Rhus*, in sheltered woodlands, especially of conifers. An associated species is *Lecanora argentata*. It was previously reported from throughout Europe (Austria, Croatia, Czech Republic, Denmark, England, Estonia, Finland, France, Germany, Iceland, Italy, Latvia, Montenegro, Norway, Poland, Romania, Scotland, Spain, Sweden), Greenland, North America, South Africa, and Taiwan and is new to Turkey.

Lecidea erythrophaea is similar to *L. exigua* but has larger and not pruinose apothecia and a *Lecidea*-type ascus. The similar species *L. nylanderi*, differs by marginate apothecia and globose spores. *Lecidea hypopta*, mostly confused with *L. erythrophaea*, differs by young apothecia with raised excipulum.

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