

Rhizocarpon saurinum new to Asia, and other reports of *Rhizocarpon* species from Razavi Khorasan Province, Iran

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Abstract. Six species and one subspecies of *Rhizocarpon* are reported from the Razavi Khorasan province of north east Iran. *Rhizocarpon saurinum* is new to Asia, being previously reported only from western U.S.A. (Colorado and Utah), and *Rhizocarpon macrosporum* and *R. geographicum* subsp. *tinei* are new to Iran. The lichenicolous fungus *Endococcus macrosporus* is also reported for the first time from Iran.

Key words: Iran, lichenized fungi, new records, *Rhizocarpon*

Introduction

The lichen mycota of the three Khorasan provinces, although one of the richest in Iran, has attracted relatively little attention (Szatala 1940; Szatala 1957) until recently (Seaward *et al.* 2004; Moniry *et al.* 2005). The Razavi Khorasan province, with an area of c. 127 432 km² is located in the northeast of Iran at the border with Turkmenistan and Afghanistan (Fig. 1). Biogeographically the area belongs to the Holartic Kingdom, Irano-touranian region and Armenian-Iranian province (Thakhtajan 1986; Aghanabati 2004). The climate is moderately continental, with an annual average precipitation of 150 mm.

According to Seaward *et al.* (2008), eight species of *Rhizocarpon* Lam. ex DC. have been recorded from Iran, of which four were reported from Razavi Khorasan province. As a result of our observations six lichen species, one subspecies, and a lichenicolous fungus are reported here for the province. The lichenicolous fungus is new to Iran and among the lichens there is one species new to Asia (**), one species new to Iran (***) and also one species new to Razavi Khorasan (*). Included are brief descriptions of the species, their habitat and in two cases, their associated species in Razavi Khorasan province.

Material and methods

During 2007, 133 samples of *Rhizocarpon* were collected by the second author from 30 mountainous localities in the province, ranging from ca 900 to 2300 m (Fig. 1).

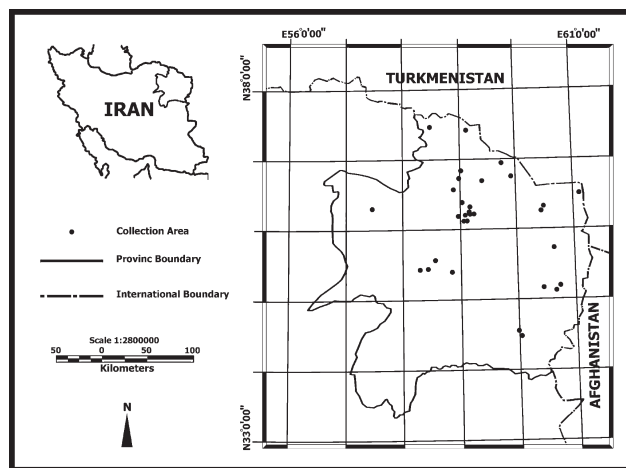


Fig. 1. Location of the Razavi Khorasan province (URL: <http://www.mpo.kh.ir>) with collection sites

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The authors examined the collection with light microscope and the usual test reagents (Orange *et al.* 2001). Full descriptions of the taxa can be found in Runemark (1956), Purvis *et al.* (1992), Bungartz & Fryday (2004) and Feuerer & Timdal (2004). Original material is deposited in the first author's lichen collection, duplicated in FUMH (Ferdowsi Univesity Mashhad Herbarium) with selected specimens in MSC and NBM.

Taxa reported

*****Endococcus macrosporus*** (Arnold) Nyl. (lichenicolous fungus)

Pseudothecia black, large, immersed; *ascomatal wall* apically dark brown, composed of tangentially flattened cells, below brown to reddish brown, upper part strongly dark brown. *Asci* 8-spored, thickened wall in about the upper third; *ascospores* pale brown, 1-septate, narrowly ellipsoid, 16.5–19.5 × 5.5–7 µm.

The only *Endocarpon* species with immersed perithecia occurring on *Rhizocarpon*. It is further distinguished by its large ascospores.

Specimen examined: IRAN: Mashhad-Dehbar, 1600 m, on *Rhizocarpon geographicum* subsp. *tinei*, 2007, # 2362.

****Rhizocarpon disporum*** (Nägeli ex Hepp) Müll. Arg.

Thallus crustose; flat to warty convex or almost globose areolate; on conspicuous black prothallus; surface gray to gray-brown. *Apothecia* lecideine, disc convex, black; *asci* 1-spored; *ascospores* dark olivaceous to brown muriform.

Distributed on siliceous rocks in the rather wet regions of the province, such as Binalud zone, as well as semi arid regions of the Torbate-jam (e.g., Bezd plain).

This species is characterized by the single-spored asci.

Specimens examined: IRAN: Mashhad-Zoshk, 1730 m, siliceous rock, 2007, # 2425a; Mashhad-Taraghdar, 1416 m, siliceous rock, 2007, # 2416; Kallat-gharehsoo, 1350 m, siliceous rock, 2007, # 2448; Torbatjam-Bezd, 1540 m, siliceous rock, 2007, # 2442; Neyshabour-Darroud, 1700 m, siliceous rock, 2007, # 2458.

Rhizocarpon geminatum Körb.

Thallus crustose; rounded, flat to convex gray areolate; on black prothallus that is visible among the areoles and sometimes at the margin of the thallus. *Apothecia* between or on thallus areoles; disc convex, black, epruinose. *Asci* 2-spored; *ascospores* dark olivaceous to brown, muriform.

Very similar to *Rh. disporum*, but with 2 spores/ascus.

Found in the rather wet and cold regions of the Binalud zone, Kallat-gharesoo and even in semiarid and cold regions of the province such as Torbate-jam. Apparently more frequent than *Rh. disporum*, having been found in the cold regions (high lands) whereas *Rh. disporum* was found only in semi-arid and wet regions.

Specimens examined: IRAN: Mashhad-Taraghdar, 1600 m, siliceous rock, 2007, # 2363; Mashhad-Taraghdar, 1620 m, siliceous rock, 2007, # 2364; Mashhad-Taraghdar, 1650 m, siliceous rock, 2007, # 2371; Mashhad-Kordineh, 1780 m, siliceous rock, 2007, # 2346; Mashhad-Dehbar, 1630 m, siliceous rock, 2007, # 2405; Mashhad-Dehbar, 1660 m, siliceous rock, 2007, # 2393; Mashhad-Dehbar, 1730 m, siliceous rock, 2007, # 2403; Mashhad-Dehbar, 1750 m, siliceous rock, 2007, # 2408, 2425; Neyshabour-Boujan, 1880 m, weakly calcareous rock, 2007, # 2462; Kallat-gharehsoo, 1340 m, siliceous rock, 2007, # 2449; Kallat-Gharehsoo, 1350 m, siliceous rock, 2007, # 2449; Torbatjam-Bezd, 1540 m, siliceous rock, 2007, # 2438 & 2439; Kallat-Zavein, 1500 m, siliceous rock, 2007, # 2452; Mashhad-Kang, 1600m, siliceous rock, 2007, # 2435.

Rhizocarpon geographicum (L.) DC.

Thallus crustose, with angular, flat to convex scattered areoles; on or among a conspicuous black prothallus that is also visible at the margin of the thallus; surface yellow-green or bright yellow. *Apothecia* between areoles; disc angular, black, epruinose. *Asci* clavate, 8-spored; *ascospores* dark olivaceous to brown, 20–36 µm long.

On siliceous and calcareous rocks, with wide distribution in the province.

This is a very variable species in gross morphology and a number of infra-specific taxa have been recognized, among which is the one recognized below.

Adjacent species and their frequency: *Acarospora bullata* Anzi (9), *Lecanora muralis* (Schreb.) Rabenh. (9), *Acarospora impressula* Th. Fr. (8), *Rhizocarpon geminatum* (8), *Candelariella vitellina* (Hoffm.) Müll. Arg. (6), *Candelariella aurella* (Hoffm.) Zahlbr. (3), *Xanthoria elegans* (Link) Th. Fr. (3), *Acarospora anatolica* H. Magn. (2), *Diplotomma epipolium* (Ach.) Arnold (1) and *Lecanora dispersa* (Pers.) Sommerf. (1).

Specimens examined: IRAN: Mashhad-Dehbar, 1610 m, siliceous rock, 2007, # 2415, 2416, 2417, 2418, 2419; Mashhad-Dehbar, 1630 m, siliceous rock, 2007, # 2385; Mashhad-Dehbar, 1650 m, siliceous rock, 2007, # 2394, 2395; Mashhad-Dehbar, 1680 m, siliceous rock, 2007, # 2397; Mashhad-Dehbar, 1700 m, siliceous rock, 2007, # 2401, 2402 & 2403; Mashhad-Dehbar, 1750 m, siliceous rock, 2007, # 2407, 2408 & 2409; Mashhad-Taraghdar, 1600 m, siliceous rock, 2007, # 2360; Mashhad-Taraghdar, 1610 m, siliceous rock, 2007, # 2361; Mashhad-Taraghdar, 1620 m, siliceous rock, June 2007, # 2365, 2411; Mashhad-Taraghdar, 1630 m, siliceous rock, 2007, # 2369, 2370, 2373, 2378, 2379 & 2380; Mashhad-Taraghdar, 1650 m, siliceous rock, 2007, # 2362; Mashhad-Kordineh, 1750 m, siliceous rock, 2007, # 2351; Mashhad-Kordineh, 1800 m, siliceous rock, 2007, # 2347, 2353; Khaf-Arzaneh, 1340 m, siliceous rock, 2007, # 2454; Mashhad-Zoshk, 1730 m, siliceous rock, 2007, # 2421, 2422 & 2424; id., Khaf-Arzaneh, 1400 m, siliceous rock, August 2007, # 2453; id., Torbatjam-Bezd, 1540 m, siliceous rock, 2007, # 2437, 2438, 2439 & 2440; Salehabad-Baghkeshmir, 1500

m, siliceous rock, 2007, # 2444; Neyshabour-Boujan, 1750 m, siliceous-calcareous rock, 2007, # 2463; Neyshabour-Boujan, 1880 m, siliceous rock, 2007, # 2464; Mashhad-Kang, 1600 m, siliceous rock, 2007, # 2426; Mashhad-Kang, 1770 m, siliceous rock, 2007, # 2430; Mashhad-Kang, 1850 m, siliceous rock, 2007, # 2431; Neyshabour-Darroud, 1670 m, siliceous rock, 2007, # 2459; Kallat-gharehsoo, 1340 m, siliceous rock, 2007, # 2445 & 2446; Kallat-Zavein, 1500 m, siliceous rock, 2007, # 2452; Kashmar-Kahriz, 1560 m, siliceous rock, 2007, # 2470.

*****Rhizocarpon geographicum* subsp. *tinei* (Tornab.) Clauzade & Cl. Roux**

This subspecies has bright yellow, often convex, contiguous areoles and relatively large ascospores (24–40 × 12–22 µm) with many septa.

Specimens examined: IRAN: Mashhad-Dehbar, 1600 m, siliceous rock, 2007, # 2362; *ibid.*, 1630 m, siliceous rock, 2007, # 2387.

*****Rhizocarpon macrosporum* Räsänen**

Thallus crustose; angular, flat to convex yellow-green areolate, on black prothallus that is visible at the margin of the thallus. *Asci* 8-spored; *ascospores* dark olivaceous to brown, 32–60 µm long.

On siliceous-calcareous rocks from the highlands around Mashhad.

This species is separated from *Rh. geographicum* by its larger ascospores.

Specimen examined: IRAN: Mashhad-Zoshk, 1850 m, siliceous rock, 2007, # 2425b.

******Rhizocarpon saurinum* (W.A. Weber) Bungartz** Fig. 2

Thallus crustose, yellow-green to green, verrucose to areolate; medulla I–. *Apothecia* immersed, disc rounded, black, epruinose. *Asci* clavate, 8-spored; *ascospores* dark olivaceous to brown, ellipsoid, one-septate to submuriform.

Characterized by its submuriform ascospores and I–medulla.

This species has been found in only three localities in the southeast of the Binalud highlands, which have a rather wet and cold climate.

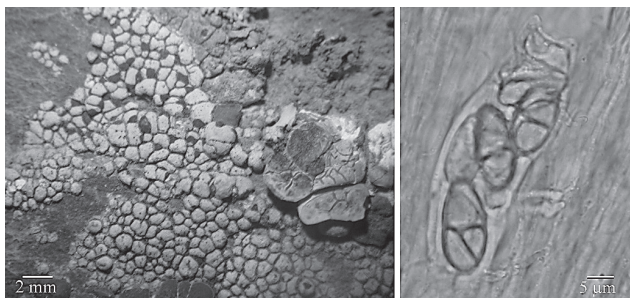


Fig. 2. Thallus and ascospores of *Rhizocarpon saurinum* (W.A. Weber) Bungartz. Bars = 2 mm and 5 µm, respectively

Specimens examined: IRAN: Mashhad-Kordineh, 1716 m, siliceous rock, 2007, # 2352; Mashhad-Kordineh, 1800 m, siliceous rock, 2007, # 2342; Mashhad-Dehbar, 1600 m, siliceous rock, 2007, # 2420; Mashhad-Taraghdar, 1620 m, siliceous rock, 2007, # 2354, 2376; Mashhad-Kang, 1500 m, siliceous rock, 2007, # 2432; Mashhad-Kang, 1850 m, siliceous rock, 2007, # 2433, 2434.

***Rhizocarpon viridiatrum* (Wulfen) Körb.**

Thallus crustose; convex areolate; lichenicolous, on *Aspicilia cinerea* (L.) Körb. and *Pertusaria* spp.; surface matt, bright green, conspicuous. *Apothecia* relatively large, on or between the areoles; disc black, convex, rounded, epruinose. *Asci* clavate, 8-spored; *ascospores* dark olivaceous to brown, ellipsoid, septate.

Lichenicolous on crustose lichens (usually *Aspicilia* spp.), on siliceous-calcareous usually shaded rocks. Distributed in semiarid regions of the province.

Adjacent species and their frequency: *Aspicilia candida* (Anzi) Hue (6), *Xanthoria elegans* (6), *Aspicilia calcarea* (L.) Mudd (4), *Caloplaca variabilis* (Pers.) Müll. Arg. (4), *Aspicilia desertorum* (Kremp.) Mereschk. (2), *Dimelaena oreina* (Ach.) Norman (2) and *Fulgensia subbracteata* (Nyl.) Poelt (1).

Specimens examined: IRAN: Mashhad-Dehbar, 1630 m, siliceous rock, 2007, # 2372; Mashhad-Dehbar, 1650 m, siliceous rock, 6 2007, # 2375, 2377, 2383 & 2389; Mashhad-Dehbar, 1680 m, siliceous rock, 6 2007, # 2391, 2392; Mashhad-Dehbar, 1710 m, siliceous rock, 6 2007, # 2406, 2413 & 2414. Mashhad-Taraghdar, 1620 m, siliceous rock, 2007, # 2355, 2354, 2355, 2356, 2357, 2358 & 2359; Mashhad-Kordineh, 1763 m, siliceous rock, 6 2007, # 2345; Mashhad-Kordineh, 1800 m, siliceous rock, 6 2007, # 2348; Mashhad-Kordineh, 1870 m, siliceous rock, 2007, # 2350; Mashhad-Zoshk, 1730 m, siliceous rock, 2007, # 2422; Khaf-Arzaneh, 1070 m, siliceous rock, 2007, # 2457; Mashhad-Kang, 1750 m, siliceous rock, 6 2007, # 2427 & 2428; Mashhad-Kang, 1850 m, siliceous rock, 6 2007, # 2429; Torbatjam-Bezad, 1540 m, siliceous rock, 6 2007, # 2436; Torbatjam-Bezad, 1650 m, siliceous rock, 2007, # 2442; Torbatjam-Palangawar, 1650 m, siliceous rock, 6 2007, # 2443 & 2445; Kashmar-Chelpoo, 1820 m, siliceous-calcareous rock, 2007, # 2467, 2468 & 2469; Kashmar-Kariz, 1560 m, siliceous rock, 2007, # 2470, 2471 & 2472; Daregaz-Dorbadam, 2306 m, calcareous-siliceous rock, 2007, # 2465; Kallat-ghalenow, 1510 m, siliceous rock, 2007, # 2450; Mashhad-Kang, 1600 m, siliceous rock, 2007, # 2429; Neyshabour-Darroud, 1700 m, siliceous rock, 2007, # 2460, 2461; Daregaz-Chehelmir, 960 m, siliceous rock, 2007, # 2466; Torbateydarieh-Roodmajan, 1700 m, siliceous rock, 6 2007, # 2475; Chenaran-Radkan-Baroo, 1000 m, siliceous rock, 2007, # 2474; Chenaran-Akhlamad, 950 m, siliceous rock, 2007, # 2476; Sabzevar-Shareh, 1600 m, siliceous rock, 2007, # 2477.

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