

## A new species and new records of the lichen genus *Pyrenula* from Iran

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**Abstract:** The lichen *Pyrenula minutissima* is described as new to science from the Hyrcanian forests in northern Iran. In addition, three further, essentially tropical, *Pyrenula* species are reported for the first time from Iran. An identification key is provided for all eight *Pyrenula* species now known from Iran.

**Key words:** Caspian, Gilan, Golestan, Hyrcanian, new species, *Pyrenulaceae*, taxonomy

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### Introduction

The genus *Pyrenula* is a group of crustose lichens typically growing on smooth, shaded bark. The genus is characterized by closed, carbonized perithecioid ascomata, a hamathecium of paraphyses and brown, thick-walled ascospores. Almost all species are lichenized with *Trentepohlia* and occur on living bark. In its current circumscription (Harris 1989) it comprises c. 170 species worldwide (Aptroot 1991, 2009, 2012) and is most speciose in the tropics with, for example, 42 species in Australia (Aptroot 2009) and 55 species known from the small country of Costa Rica alone (Aptroot *et al.* 2008); however, only 10 species (see e.g. Smith *et al.* 2009) are known in the whole of Europe (with an additional one on the Azores). The recently revised checklist of lichenized, lichenicolous and allied fungi for Iran (Seaward *et al.* 2008) includes 632 species. Valadbeigi *et al.* (2010), Haji Moniri & Sipman (2009) and Valadbeigi & Sipman (2010) together add another 116 species to Iran. Among these are four *Pyrenula* species: *P. chlorospila* Arnold, *P. laevigata*

(Pers.) Arnold, *P. nitida* (Weigel) Ach. and *P. subelliptica* (Tuck.) R. C. Harris.

Iran is one of the world's most mountainous countries, largely covered by the Iranian Plateau. Extended lowlands exist only along the coasts of the Caspian Sea and in Khuzeestan. During recent collecting trips by the second and third authors, several *Pyrenula* species were found. The second author collected in six different provinces in areas with a wide range of ecological characteristics. The third author collected mainly in the Golestan Province close to the Caspian Sea, where a species new to science was collected as well as the three newly recorded species which are reported below. This brings the total number of *Pyrenula* species known from Iran up to eight. The present paper describes the new species, which was already mentioned and keyed out in Aptroot (2012), and provides a key to the Iranian species of *Pyrenula*, based on material from that country.

The primary forests of the Golestan Province, belonging to the type known as the Hyrcanian forest, proved to be unexpectedly rich in *Pyrenula* species for such a temperate (hardly subtropical) region. Golestan is part of the Mazandaran region situated in the north of Iran. It has a temperate climate, being cool and humid and known as moderate Caspian climate, which supports a lush vegetation. These special conditions are caused by the presence of the Alborz mountain range,

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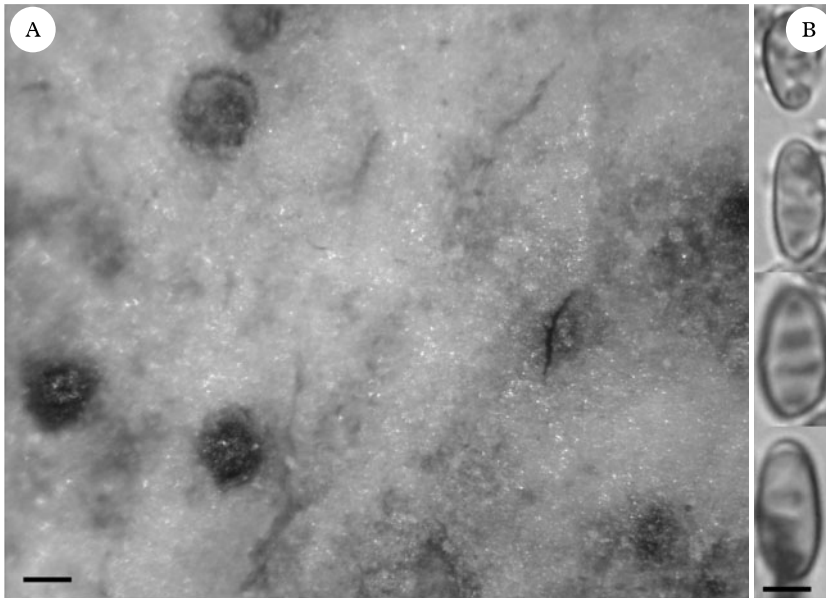


FIG. 1. *Pyrenula minutissima* (holotype). A, thallus with ascomata; B, ascospores. Scales: A = 0.1 mm; B = 3  $\mu$ m.

the orientation of the mountains, the elevation of the area and the proximity to the sea.

### Materials and Methods

The study is based mainly on material collected by the second author in 2004–2009 and by the third author in 2007. Most specimens are deposited in B, with some duplicates in ABL, IRAN and TARI. The morphology of all specimens was studied using an Olympus SZX7 stereomicroscope and an Olympus BX50 compound microscope with differential interference contrast optics and photomicrographs taken using an attached Nikon Coolpix 995 digital camera. Chemistry was investigated in short-wave UV.

### The New Species

#### *Pyrenula minutissima* Aptroot, Valadbeigi & Sipman sp. nov.

Mycobank No: MB563998

*Pyrenula* ascomatis minutissimis ascosporis minutis, ad 7–9  $\mu$ m longis.

Typus: Iran, Golestan, Gorgan district, 11 km SW of Gorgan, Shast Kola forest, alt. 350 m, on *Carpinus* in degenerated *Carpinus*-dominated forest, 30 October 2007,

H. J. M. Sipman, M. Sohrabi, U. Sochting & R. Zare 55304a (B—holotypus; IRAN—isotypus).

(Fig. 1)

*Thallus* corticolous, olive yellowish brown, smooth, without pseudocyphellae or crystals, with trentepohlioid algae.

*Ascomata* numerous, black, globose to applanate, quite dispersed, not much projecting above the thallus surface, c. 0.1–0.2 mm diam. Ostiole central, minute. *Hamathecium* not interspersed, without crystals, IKI+ reddish. *Asci* disintegrating relatively early in the development. *Ascospores* 8 per ascus, 7–9  $\times$  3.5–4.5  $\mu$ m, fusiform, grey, 3-septate, not ornamented, surrounded by a thin gel layer, lumina angular, equally shaped, terminal lumina separated from the exospore by an endospore layer.

*Chemistry.* No secondary substances detected with TLC; UV–.

*Remarks.* This species is one of the smallest known in the genus, both in ascospore size and in ascoma size. In general appearance, it resembles a pycnidial morph of an *Opegrapha* rather than a *Pyrenula* because of the

tiny, quite dispersed black dots on an olive thallus. It seems closest to the recently described Australian *Pyrenula xanthominuta* Aptroot (Aptroot 2007, 2009), which differs by the pseudocyphellate thallus containing crystal pockets and lichexanthone.

### *Pyrenula aspistea* (Ach.) Ach.

*Syn. Meth. Lich.* 123 (1814); type: Guinea (H–ACH, syntypes, n.v.).

*Selected specimens examined. Iran: Golestan:* Gorgan district, 11 km SW of Gorgan, Shast Kola forest, alt. 350 m, on *Carpinus* in degenerated *Carpinus*-dominated forest, 2007, *H. J. M. Sipman, M. Sohrabi, U. Söchting & R. Zare* 55301a & 55302 (B, IRAN); Gorgan district, 14 km SW of Gorgan, Baran Kuh forest, alt. 500–700 m, on *Fagus orientalis* in primary deciduous forest in valley along stream, 2007, *H. J. M. Sipman, M. Sohrabi, U. Söchting & R. Zare* 55316 (B, IRAN). *Gilan:* 65 km on the road from Khalkhal to Asalem, alt. 150 m, 2007, *T. Valadbeigi* 5848 (ABL, TARI).

### *Pyrenula nitidula* (Bres.) R. C. Harris

In A. Aptroot, P. Diederich, E. Sérusiaux & H. J. M. Sipman, *Bibliotheca Lichenologica* 64: 165 (1997); type: Puerto Rico (n.v.).

*Specimen examined. Iran: Golestan:* Gorgan district, 11 km SW of Gorgan, Shast Kola forest, alt. 350 m, on *Carpinus* in degenerated *Carpinus*-dominated forest, 2007, *H. J. M. Sipman, M. Sohrabi, U. Söchting & R. Zare* 55302a (B, IRAN).

### *Pyrenula santensis* (Nyl.) Müll. Arg.

*Flora* 65: 400 (1882); type: USA, South Carolina, Santee Canal, *H. W. Ravenel* (H–Nyl, holotype, n.v.).

**Note.** This species has recently been synonymized with *Pyrenula balia* (Krempelh.) R.C. Harris (Aptroot 2012).

*Selected specimens examined. Iran: Golestan:* Gorgan district, 14 km SW of Gorgan, Baran Kuh forest, alt. 500–700 m, on *Fagus orientalis* in primary deciduous forest in valley along stream, 2007, *H. J. M. Sipman, M. Sohrabi, U. Söchting & R. Zare* 55315, 55325 & 55327 (B, IRAN).

## Key to the species of *Pyrenula* in Iran

- 1 Ascospores 30–36 µm long, with unequal lumina; middle lumina elongated; hamathecium at least partly interspersed with hyaline oil globules. . . . . ***P. subelliptica***
- Ascospores < 30 µm long, with equally shaped lumina; hamathecium not interspersed. . . . . 2
- 2(1) Ascomata in majority 0.1–0.4 mm diam. . . . . 3
- Ascomata in majority 0.4–1.2 mm diam. . . . . 6
- 3(2) Ascospores 23–30 µm long, with equally shaped lumina; hamathecium not interspersed . . . . . ***P. chlorospila***
- Ascospores 7–21 µm long . . . . . 4
- 4(3) Ascospores 17–21 µm long, with unequal lumina; terminal lumina closely appressed to the outer ascospore wall . . . . . ***P. nitidula***
- Ascospores 7–16 µm long, with equally shaped lumina; terminal lumina separated from the exospore by an endospore layer . . . . . 5
- 5(4) Ascospores 11–16 µm long; ascomata c. 0.2–0.4 mm diam. . . . . ***P. aspistea***
- Ascospores 7–9 µm long; ascomata c. 0.1–0.2 mm diam. . . . . ***P. minutissima***
- 6(2) Hamathecium with orange-red crystals, KOH+ purple-red soluble pigment; ascospores 20–27 µm long . . . . . ***P. nitida***
- Hamathecium without coloured crystals, KOH– . . . . . 7
- 7(6) Ascospores 14–16 µm long; thallus generally olive-green. . . . . ***P. santensis***
- Ascospores (15–)17–22 µm long; thallus whitish grey . . . . . ***P. laevigata***

### Discussion

The first indication of a tropical pyrenocarpous element in the lichen flora of Iran was the report of *Lithothelium obtectum* (Müll. Arg.) Aptroot (identified by the first author, and reported by Valadbeigi & Sipman 2010), known to be pantropical and common only in India (Aptroot 1991). It was also found in Iran along the Caspian coast in the zone of the Hyrcanian forests. All of the present additions to the *Pyrenula* flora of Iran are distinctly tropical, while the species already reported are generally thought of as Atlantic European, with the surprising exception of the representative of a North American element, *viz.* *Pyrenula subelliptica* (Harris 1989).

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