

## **Two new species of Lichenostigma (Lichenotheliaceae, lichenicolous Fungi) from Iran**

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## Two new species of *Lichenostigma* (*Lichenotheliaceae*, lichenicolous fungi) from Iran

### Abstract

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Two species of *Lichenostigma*, both from Iran, are described as new to science: *L. iranicum*, growing on *Lobothallia praeradiosa*, is characterised by rounded to elongate ascomata, sparse hyphal strands, 6(–8)-spored asci and the almost complete absence of pigmentation in the lower ascomatal wall; *L. verrucosum*, growing on *Pleopsidium gobiense*, is distinguished by rounded to irregular ascomata with radiating superficial hyphae, verrucose brown ascospores and by the complete absence of pigmentation in the lower ascomatal wall.

Additional key words: *Ascomycota*, *Acarosporaceae*, *Aspiciliaceae*, biodiversity, taxonomy

### Introduction

In 1982 Hafellner introduced the genus *Lichenostigma* for the single species *L. maureri* from Austria, growing on *Usnea* spp. and *Pseudevernia furfuracea*. This species, which is now known from various fruticose lichens, is characterised by the following combination of features: rounded ascomata, fissitunicate asci, absence of hamathelial filaments but with more or less spherical cells filling the interascal spaces and 1-septate, brown ascospores with the upper cell broader than the lower one (Hafellner 1982). Later, two subgenera were recognised: *L.* subg. *Lichenostigma* with cushion-like ascomata not connected to dark superficial hyphal strands, and *L.* subg. *Lichenogramma* Nav.-Ros. & Hafellner with sack-shaped superficial ascomata connected to superficial stromatic or simple hyphal strands (Calatayud & al. 2002; Ihlen 2004).

### Material and methods

The study is based on specimens collected by the first author in 2004 and 2008 in Iran. The morphological and

anatomical observations were made using standard microscopic techniques. Microscopic measurements were made with an accuracy of up to 0.5 µm on hand-cut sections mounted in water. Measurements of ascospores are recorded in the descriptions as (minimum–)  $\bar{X}-\sigma_x - \bar{X}+\sigma_x$  (–maximum) followed by the number of measurements.

***Lichenostigma iranicum* Brackel & Valadbeigi, sp. nov.**  
Mycobank: 518508

Holotype: Iran, Gilan, c. 6 km on the road from Masouleh to Majalan village, siliceous rocks, on *Lobothallia praeradiosa*, c. 1600 m, 2004, *T. Valadbeigi* 9061 (TARI; isotype: herb. Valadbeigi).

Fungus lichenicola in thallo lichenis *Lobothallia praeradiosa* vigen. Filamenta superficialia rara, curta, fuscolivacea, aspera. Ascomata superficialia, rotunda vel elongata, dispersa, pulla, ad 100–110 µm crassa, cellulis subglobosis composita; filamenta interascalialia nulla. Parietis ascomatis in partem inferiorem hyalinus. Asci obovati, fissitunicati, 6(–8)-spori, 25–30 × 14 µm, iodo

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non reagentes. Ascospores 10–11.5×5.5–6 µm, uniseptatae, canae mox fuscae, tenue verruculosae.

**Description.** — *Vegetative hyphae* rare, superficial on the host thallus, short, single-stranded, unbranched, brownish olive, slightly constricted at the septa, hyphal cells 4–7 µm in diam., surface rugose. *Ascomata* superficial, scattered, not connected by vegetative hyphae, rounded to elongate, dark brown, shiny, 100–110 µm diam. and up to 70 µm high; *ascomatal wall* in section in the upper and lateral part distinctly brown, in the lower part (part connected to the host thallus) not continuous, hyaline or single cells pale brown; outermost cells brown, subglobose, 6–10 µm diam., on the outside covered by a granular brown pigment; internal cells subglobose to somewhat irregular, hyaline, 4–8×3–5 µm; centrum I+ yellow to pale orange, K/I–. *Asci* obovate, 25–30×14 µm, fissitunicate, 6(–8)-spored, apically thickened, I–. *Ascospores* ovoid to oblong-ovoid, grey to dark brown, finely verruculose, 1-septate, slightly constricted at the septum, lower cell narrower and shorter than upper cell, (10–)10.5–11(–11.5)×5.5–6 µm ( $n=30$ ), perispore I+ slightly blue.

**Habitat and distribution.** — *Lichenostigma iranicum* is so far known from one locality in Iran. It was found on *Lobothallia praeardiosa* (Nyl.) Hafellner (*Aspiciliaeae*) on horizontal and inclined faces of siliceous rock.

**Etymology.** — The new species is named after Iran, the native country of the first author and the country of the type locality. As the Greek word “stigma” and following the genus name is neuter, also the epithet has to get the neutral form.

**Observations.** — Growing on species of *Aspicilia*, five species of *Lichenostigma* are reported, *L. canariense* Etayo & Van den Boom, *L. elongatum* Nav.-Ros. & Hafellner, *L. radicans* Calat. & Barreno, *L. triseptatum* Halıcı & D. Hawksw. and *L. supertegentis* Ihlen & R. Sant., while the genus *Lobothallia* is reported as a host for *L. elongatum* (Navarro-Rosinés & Hafellner 1996; Calatayud & al. 2002; Calatayud & Barreno 2003; Ihlen 2004; Boom & Etayo 2006; Kukwa & Czarnota 2006; Halıcı & Hawksworth 2007; Kukwa & Jabłońska 2008).

The distinguishing features of *Lichenostigma* species growing on *Aspicilia* and *Lobothallia* are summarised in Table 1. The new species differs from all other species of *Lichenostigma* living on *Aspicilia* or *Lobothallia* in the almost complete lack of pigmentation in the lower ascomatal wall; only some single cells show a slight tinge of brown colour and darkened outer walls. The border between the ascoma and the host cells is not clearly distinguishable (Fig. 1D, 1E). Moreover, the aforementioned five species differ in the following characters:

*Lichenostigma elongatum* has larger ascospores (9–13 × 6–8.5 µm) with granular ornamentation, 8-spored

asci, distinct and ramifying dark superficial hyphae and always elongate ascomata. *L. canariense* has smaller ascospores (8.5–10.5×5–6 µm) and ascomata (25–80 µm) and no superficial mycelium. *L. radicans* has pale brown inner ascomatal cells and a penetrating, not superficial mycelium without ornamentation. *L. iranicum* is more similar to *L. triseptatum*, with subglobose to elongate-ellipsoid ascomata, intermediate between the subgenera *Lichenogramma* (elongate ascomata connected to simple or plurihyphal strands of vegetative hyphae, growing superficially on the host thallus and ascomata) and *Lichenostigma* (rounded ascomata without connection of superficial hyphal strands). However, *L. triseptata* has mostly 3-septate, larger ascospores and asci, and red-brown to black or dark reddish brown ascospores. *L. supertegentis* differs from *L. iranicum* in the larger ascospores (16–25×7–12 µm) and asci (40–50×25–35 µm) as well as in the absence of a superficial mycelium.

***Lichenostigma verrucosum* Brackel & Valadbeigi, sp. nov.**

Mycobank: 518509

Holotypus: Iran, Azarbayegan, Arasbaran protected area, top mountain to Mazgar, siliceous rocks, on *Pleopsidium gobiense*, 38°40'N, 47°00'E, c. 2200–2600 m, 1.2.2008, T. Valadbeigi 6525 (TARI; isotype: herb. Valadbeigi).

Fungus lichenicola in thallo lichenis *Pleopsidium gobiense* vigen. Filamenta superficialia, ramosa, fusca, aspera. Ascomata superficialia, rotunda, dispersa vel aggregata, ad 120–130 µm crassa, cellulis subglobosis composita; filamenta interascalialia nulla. Parietes ascomatis in partem inferiorem hyalinus. Asci saccati, fissitunicati, octospori, 3–45×25–33 µm, iodo non reagentes. Ascospores 12–14(–16)×(5.5–)6–7.5(–9) µm, uniseptatae, fuscae, verrucosae.

**Description.** — *Vegetative hyphae* radiating from the ascomata, superficial on the host thallus, sometimes penetrating into the thallus, near the ascomata plurihyphal, then single, branched, dark brown, slightly constricted at the septa, hyphal cells 5–10 µm in diam., suborbicular to irregular, surface rugose, later cracked. *Ascomata* superficial, loosely aggregated, not connected by vegetative hyphae, rounded to irregular, black, matt, 120–130 µm in diam. and 40–80 µm high; *ascomatal wall* in section in the upper and lateral part distinctly brown, in the lower part (part connected to the host thallus) not visible, hyaline; outermost cells brown, subglobose, 5–8 µm diam., covered by a granular brown pigment; internal cells subglobose to somewhat irregular, hyaline, 3–8 µm in diam; centrum I+ pale blue, K/I–. *Asci* saccate, 30–45×25–33 µm, fissitunicate, 8-spored, apically thickened, I–. *Ascospores* ovoid to oblong-ovoid, pale to dark brown, distinctly verrucose, 1-septate, constricted at the septum, easily splitting into two single cells, lower

Table 1. Main distinguishing features of *Lichenostigma* (*L.*) species growing on *Aspicilia* (*A.*) and *Lobothallia* (*Lo.*).

Species	Host	Spores Size [ $\mu\text{m}$ ]	Colour	Ornamentation	Asci Cells	Size [ $\mu\text{m}$ ]	Spores / ascus	Ascospores Wall colour	Ascomata Size [diam. x h in $\mu\text{m}$ ]	Shape	Mycelium Strands	Colour and ornamentation	Basal ascoma wall
<i>L. iranicum</i>	<i>Lo. praeradiosa</i>	(10–)11(–11.5) x (5.5–)6	grey to dark brown	verruculose	2	25–30 x 14	6–8	brown	100–110 x 70	rounded to elongate	rare, superficial, simple, in single rows	in brown, rough	–
<i>L. canariense</i>	<i>A. calcarea</i>	8.5–10.5 x 5–6	hyaline to brown	smooth	2	22 x 16	4–8	brown	25–80	ellipsoid to subglobose	immersed, rare, simple or ramified	–	+
<i>L. elongatum</i>	<i>A. spp. + Lo. radiosa</i>	(9–)10–13 x 6–8.5	hyaline to brown	finely granular	2	20–25 x 15–18	8	dark brown granularly pigmented	50–200 x 30–60	elongated	partly superficial, partly penetrating, simple or ramified, stromatic	brown?	+
<i>L. radicans</i>	<i>A. spp.</i>	(9–)10–13(–14) x 5–7(–7.5)	soon brown	verruculose	2	18–22 x 13–15	8	dark brown	90–170 x 45–70	rounded	penetrating downwards, not superficial, rootlike	pale brown, smooth	±
<i>L. triseptatum</i>	<i>A. spp.</i>	(12–)13–16.5 x 6.5–10	subhyaline to dark red-brown to almost black	slightly ver- ruculose	(2–)4 (–6)	32.5–44 x 16–22	8	brown to dark red- dish brown	100–200	subglobose to elongate ellip- soid or irregular	absent or poorly devel- oped, simple	dark brown to black	+
<i>L. supertergentis</i>	<i>A. super- tegens</i>	16–21.5(–25) x (7–)8–11(–12)	brown	slightly ver- ruculose	2	40–50 x 25–35	4–8	dark brown	300–1000 x 25–110	elongated, branched, radiating	absent	–	+

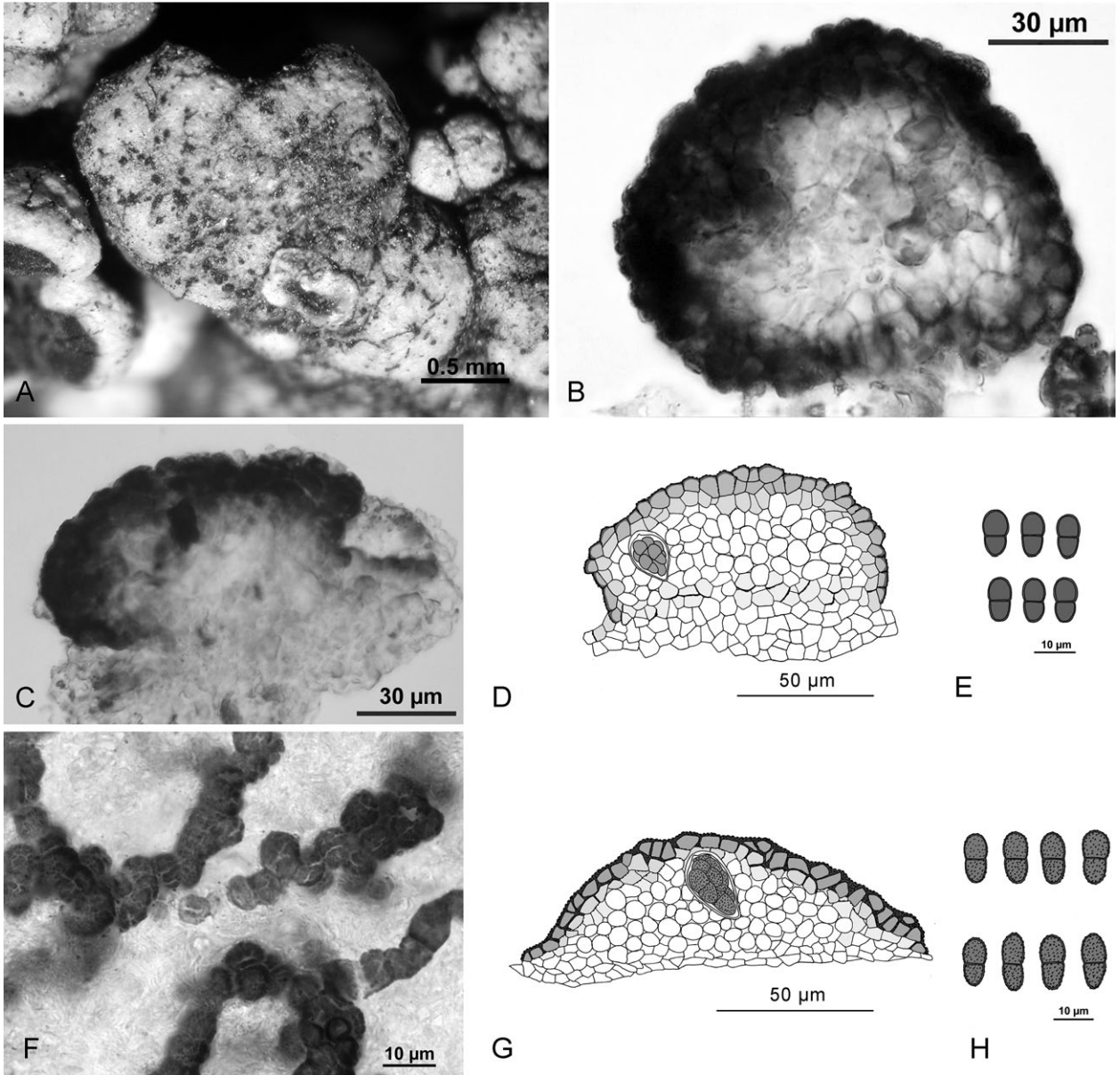


Fig. 1. A, C–D: *Lichenostigma iranicum*: on *Lobothallia praeradiosa*, habitus (A); ascoma without basal wall (C) and section through an ascoma (D); ascospores (E). – B: *L. elongatum*: ascoma with basal wall. – F–H: *L. verrucosum*: vegetative hyphal strands (F); section through an ascoma (G); ascospores (H). – A, C, F = photographs from the type collections; B = photograph from a specimen from Italy, Sicily, Prov. Palermo, on *Aspicilia calcarea* agg. (herb. IVL 3943); D, E, G, H = drawn from the type collections.

cell narrower and shorter than upper cell, 12–14(–16) × (5.5–)6–7.5(–9.5) µm ( $n=32$ ), perispore hyaline, 1–1.5 µm, I+ slightly blue.

**Habitat and distribution.** — *Lichenostigma verrucosum* so far is known only from the type locality in Iran. It was found on *Pleopsidium gobiense* (H. Magn.) Hafellner (*Acarosporaceae*), on siliceous rock.

**Observations.** — Until now no species of *Lichenostigma* was known on hosts of the genus *Pleopsidium*. On *Acarospora*, which belongs to the same family as *Pleopsidium* (*Acarosporaceae*), four species of the genus have

been described: *L. subradians* Hafellner & al. on yellow and rarely on brown species of *Acarospora*, *L. gracile* Calatayud & al. on *A. fuscata*, *L. anatolicum* Halıcı & Kocakaya on an unidentified species of *Acarospora* and *L. svandae* Vondrák & Soun on *A. cervina*. The first three have clearly smaller ascospores (9–10 × 5–6 µm, 9–12 × 5–6 µm, and 9.2–11.8 × 5.5–7 µm, respectively) than the new species. *L. svandae* is similar to the new species in several features, but distinguished by root-like coloured hyphae penetrating the host thallus below the ascomata and an I– centrum. From all mentioned species *L. verrucosum* is distinguished by the easily splitting spores.

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