

***Endococcus variabilis*,
a new species on *Staurothele areolata***

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Abstract—*Endococcus variabilis* is described as a new species from the thallus of *Staurothele areolata* in Turkey and Austria. It differs from most other species of the genus in the 4–6(–8) spored asci and verrucose ascospores, from *E. zahlbrucknerellae* in ascomatal and ascospore size, and from all known species by the host selection.

Key words—lichenicolous fungi, *Dothideales*, *Ascomycota*

Introduction

The genus *Endococcus* comprises at least 37 species occurring on a wide range of crustose, foliose, and fruticose lichens. The species have been revised by Hawksworth (1979) and Triebel (1989, only lecideicolous species), but many others have been recognized since those works. Recent collections from Turkey and Austria of a species on *Staurothele areolata* differ significantly from previously described taxa and are described here as a new species.

Material and methods

The type specimen of the new species is deposited in ANES. It was examined by standard microscopic techniques, and drawings were made using a drawing tube. Sections were prepared by hand and examined in Congo red (1% solution in water, mixed 1:1 with 10% KOH), I (Lugol's iodine: I 0.5 g, KI 1.5 g, water

100 ml), 10% KOH, and water. Amyloid reactions were tested using Lugol's iodine solution (I) without and with pre-treatment by KOH (K/I). Ascus structures were examined and drawn in Congo red after pre-treatment with KOH. Ascospore measurements were made in water; extreme values are given in parentheses. Ascospore measurements are indicated as (minimum-) $\bar{x} - \sigma_x - \bar{x} + \sigma_x$ (-maximum), followed by the number of measurements (*n*); the length/breadth ratio of ascospore is indicated as l/b and given in the same way.

The species

Endococcus variabilis Halici, Kocourk. & Diederich, sp. nov.

FIGURES 1-2

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Fungus lichenicola in thallis lichenis Staurothele areolata vigens. Endococcus species insignis ascomatibus immersis vel semi-immersis, subsphaericis ad subpyriformibus, atris, 230–260 μm altis, 190–250 μm latis, pariete pallide brunneo sed apicaliter atrobrunneo, K+ viridulo, 20–25 μm crasso, apicaliter 40 μm crasso, hamathecio sine paraphysibus, periphysibus 30–36 μm longis, 3.5–5.5 μm latis, centro I+ dextrinoideo, K/I+ coeruleo, ascis clavatis ad subcylindricis, 4–6(–8)-sporis, 47–60 × 13.5–18.5 μm, parietate apicaliter incrassato, ascosporis auratobrunneis, 1-septatis, verruculosis, cum perisporo 0.5 μm crasso, (11.0–)13.0–16.0(–18) × (5.5–)6.5–7.5(–8.5) μm.

Typus: Turkey, Kayseri, Yahyalı, Aladağlar Milli Parkı, Karaboyunlar Mevkii, 37°52'N, 35°15'E, alt. 2795 m, on thallus of *Staurothele areolata* on exposed limestone rocks, 25 August 2006, M.G.Halici 0.2290 (ANES–holotypus).

Etymology: The epithet “*variabilis*” refers to the variable number of ascospores, usually 4 to 6, developing in the asci.

Description: Lichenicolous fungus growing on the areoles of the host thallus *Staurothele areolata*, suppressing host ascomatal production in infected areoles. **Ascomata** perithecioid, arising singly, sometimes aggregated in loose groups, immersed to erumpent, subglobose to obpyriform, upper part more or less applanate, with a broad ostiolar part up to 25 μm, black, somewhat shiny, 230–260 μm tall, 190–250 μm wide; wall mainly 25–35 μm thick, pseudoparenchymatous, formed of radially compressed polyhedral cells, dark brown near ostiole, basally to subapically subhyaline to pale brown, K+ greenish, c. (5–)7–9 cells thick, cells thin-walled, 6–10 × 2.5–4 μm in vertical section. **Hamathecium** of periphysoids, lining the ostiolar canal and spreading down to upper 1/5 of the ascoma, around the ostiolar part pale brown, beneath hyaline, simple or branched near the base, of 4–5 thin-walled cylindrical to broadly cylindrical cells 7–10(–15) × 3.5–5.5 μm diam, 30–36 μm long; central cavity formed of gelatinized tissue and the remains of discharged asci, hymenial gel hemiamyloid, I+ orange, K/I+ blue. **Asci** arising from the basal and side parts of the ascomatal cavity, lining a substantial part of the inner wall of ascomatal cavity, clavate to subcylindrical, sessile to shortly stalked, mostly without distinct

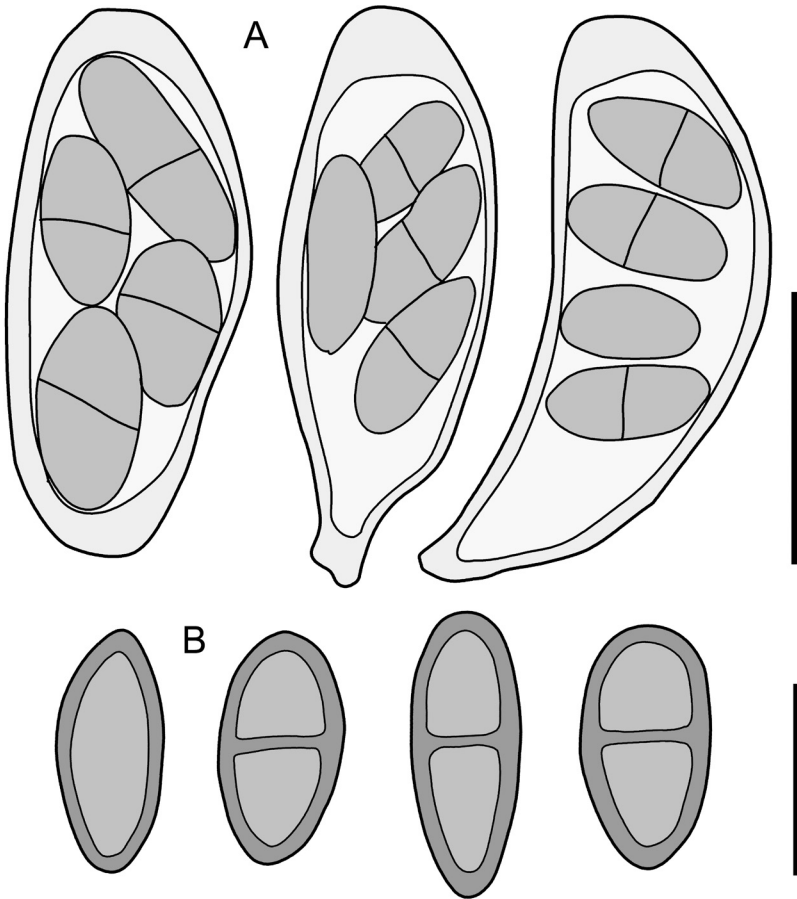


Fig. 1. *Endococcus variabilis* (holotype). A, asci in Congo red after pre-treatment with KOH. B, ascospores. Scales A = 20 μ m, B = 10 μ m.

internal apical beak, 4–6(–8)-spored, 47–60 \times 13.5–18.5 μ m, fissitunicate, K/I+ blue. **Ascospores** uniseriate or distichously arranged in the asci, ellipsoid to slightly fusiform, golden brown, simple when young, becoming 1-septate when mature, not or slightly constricted at the septum, some with one or two big oil droplets, golden brown, pigment somewhat concentrated at the slightly thickened apices and septum, the outermost layer faintly verruculose, 0.5–1 μ m thick, the septum of the same thickness (0.5–1 μ m), the gelatinous, thin, perispore 0.5 μ m thick, (11.0–)13.0–16.0(–18) \times (5.5–)6.5–7.5(–8.5) μ m ($n=40$), length/breadth ratio (1.6–)1.8–2.4(–2.1) μ m. **Conidiomata** not observed.

Additional specimen examined: Austria, Steiermark, Ostalpen, Niedere Tauren, Schladminger Tauern, WSW of Schladming, eastern overhangs of mountain range between Gasselhöhe and Rippetegg, path to Mittersee, MTB 8647/2, alt. 1820 m, on mineral rich calcareous mica schist, on thallus of *Staurothele areolata*, 26 August 2001, J. Kocourková (PRM 895949).

Discussion

Following Triebel (1989), *Endococcus* specimens with ascospores similar in size to our new species belong to *E. rugulosus* Nyl. 1855. However, this author used a very broad species concept, including under that name material from a wide variety of hosts belonging to at least seven genera. Recent studies (Brand, unpubl.; Sérusiaux et al. 1999, Kocourková 2000) suggest that *Endococcus* species are generally host-specific, and the name *E. rugulosus* should probably be restricted to specimens growing on *Verrucaria*. As the host of the new species, *Staurothele areolata*, is closely related to *Verrucaria*, both *Endococcus* species were carefully compared. Moreover, recently two additional *Endococcus* species were described from related host genera. *Endococcus incrassatus* Etayo & Breuss (Etayo & Breuss 2001) from *Placidiopsis cinerascens* and *E. karlstadtensis* Kocourk. & Brackel (Brackel & Kocourková 2006) from *Endocarpon pusillum*.

Apart from the different hosts, the new *Endococcus variabilis* differs from *E. rugulosus*, *E. incrassatus* and *E. karlstadtensis* in having 4–6(–8)-spored asci (versus constantly 8-spored), and substantially larger ascomata, mainly 230–260 × 190–250 µm, versus 90–220 µm diam in *E. rugulosus* and 100–120 µm in *E. incrassatus*. The ascospores of *E. variabilis* are (11.0–)13.0–16.0(–18) × (5.5–)6.5–7.5(–8.5) µm, distinctly verruculose and thick walled (wall c. 1 µm), larger than in *E. karlstadtensis* (8.5–)9.5–11.6(–12.7) × (4.9–)5.9–6.9(–7.5) µm, in which ascospores are pale brown for a long time and verruculose only when fully mature. The material on *Verrucaria* called *E. rugulosus* by Sérusiaux et al. (1999) has dark brown, also small and verruculose ascospores, 10–12(–12.5) × 5.5–7.5 µm that are thin walled (wall c. 0.5 µm); the material of *E. rugulosus* used for comparison in this study has also small ascospores, (8.5–)9.5–13.0(–15.5) × (5.0–)6.0–7.0(–8.0) µm. However, none of these authors studied the type specimen of *E. rugulosus*, and thus it is not entirely certain if they were dealing with the genuine *E. rugulosus*, or with a similar, undescribed species. Triebel (1989) gave the ascospores of *E. rugulosus* s. l. as smooth and (12–)13–16(–16.5) × (5.5–)6–7.5(–8) µm. In the holotype they are smooth and 12–15 × 6–9 µm (D. L. Hawksworth, pers. comm.).

With our current knowledge, *E. zahlbrucknerellae* (Henssen) D.Hawksw. 1979 is the only other known *Endococcus* species with 4-spored asci. That species differs in having much smaller ascomata (up to 100 µm diam), smaller ascospores (10.5–13.5 × 5.5–6 µm, fide Hawksworth 1979; 12–15 × 5–6 µm, fide

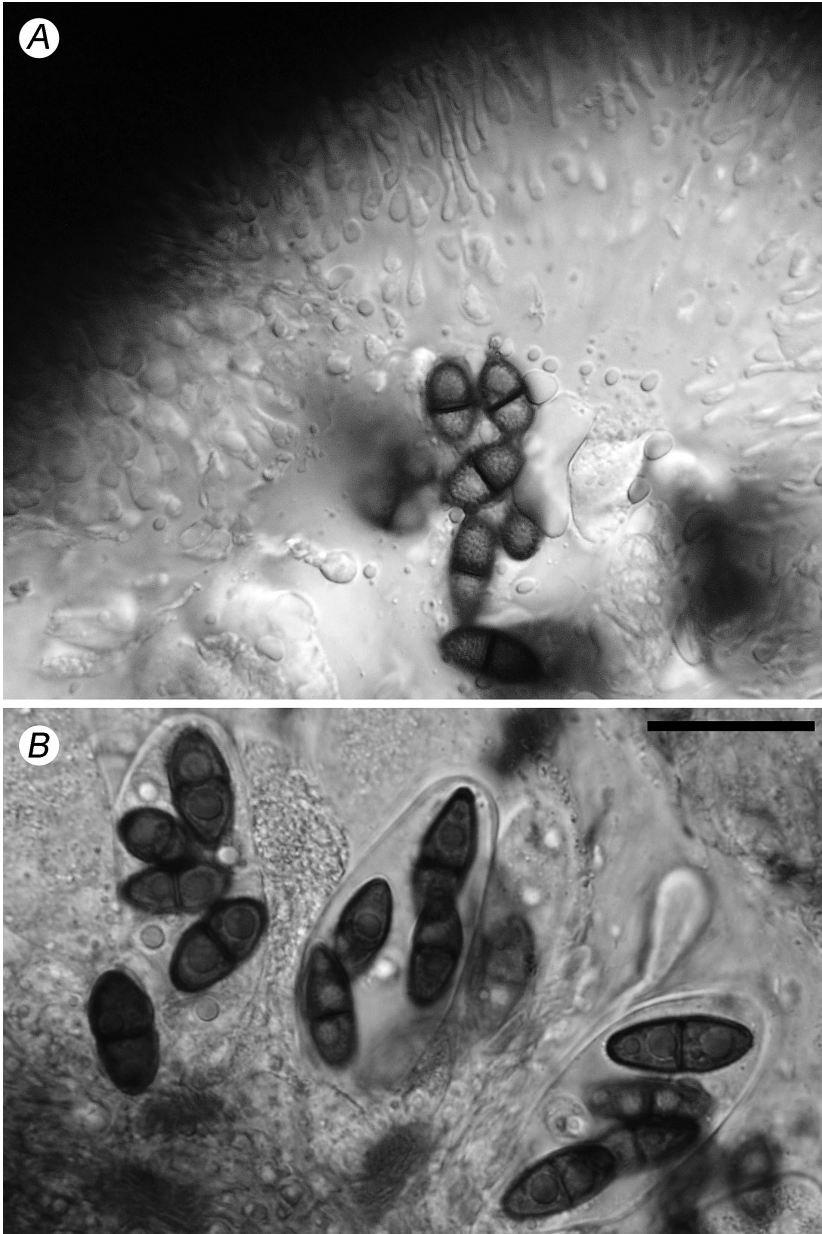


Fig. 2. *Endococcus variabilis*. A, section through a perithecium showing verruculose ascospores from one ascus and periphysoids (*J. Kocourková*, PRM 895949). B, 4-spored asci (holotype). Scale = 20 μ m.

Henssen 1977), and the induction of distinct galls on a different host lichen, *Zahlbrucknerella calcarea*.

Hafellner (2002) reported the discovery of a specimen from the Canary Islands on *Acarospora* with 4-spored asci that he provisionally included in *Endococcus stigma*, a species with soleiform and apically often strongly attenuated ascospores.

Endococcus rugulosus specimens examined (All on *Verrucaria nigrescens*): CZECH REPUBLIC: Central Bohemia, Praha, between Velká Chuchle and Slivenec, 290 m, MTB 5952, Homolka calcareous rocks, 4 January 1994, *J. Horáková* (PRM 889662). - Praha, Nová Ves, 290 m, MTB 5952, Hemrovy skály diabasic rocks, 15 April 1999, *J. Kocourková* (PRM 758701). - Praha, near Nová Ves settlement in Prokopské valley, MTB 5952, 310 m, Bílé skály calcareous rocks, 24 September 1999, *J. Kocourková* (PRM 758700). - Praha, Prokopské údolí valley, 280 m, MTB 5952, calcareous rocks above old swimming pool Holyňské koupaliště, 10 April 1988, *J. Horáková* (PRM 758688).

SLOVAKIA: Carpathians, Spišské Podhradie, Sivá Brada hill, on calcareous sinter, 500 m, 21 May 1958, *A. Vězda* (PRM 515663; Vězda, Lich. Bohemosl. exs. no. 235, sub *Caloplaca lactea*).

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