On some dematiaceous lichenicolous hyphomycetes

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Abstract: HEUCHERT, B. & BRAUN, U. 2006. On some dematiaceous lichenicolous hyphomycetes. – Herzogia **19**: 11–21.

Two new lichenicolous hyphomycete species, namely *Cladosporium licheniphilum* on *Pertusaria alpina* in Russia (Altai), and *Ellisembia lichenicola* on *Pertusaria* spp. in Canada and Denmark and *Physconia distorta* in Denmark are described. Furthermore, the new combination *Corynespora laevistipitata*, based on *Taeniolella laevistipitata*, is introduced.

Zusammenfassung: HEUCHERT, B. & BRAUN, U. 2006. Über einige zu den Dematiaceen gehörende lichenicole Hyphomyzeten. – Herzogia **19**: 11–21.

Die neuen Hyphomyzetenarten *Cladosporium licheniphilum* auf *Pertusaria alpina* in Russland (Altai) und *Ellisembia lichenicola* auf *Pertusaria* spp. in Kanada und Dänemark und auf *Physconia distorta* in Dänemark werden beschrieben, und die neue Kombination *Corynespora laevistipitata*, basierend auf *Taeniolella laevistipitata*, wird eingeführt.

Key words: Lichens, anamorphs, Deuteromycotina, *Cladosporium*, *Corynespora*, *Ellisembia*.

Introduction

Lichens are appropriate substrates for a wide range of ascomycetes and ascomycetous anamorphs, including hyphomycetes. A survey of lichenicolous hyphomycetes, comprising keys, descriptions and illustrations, was published by HAWKSWORTH (1979), followed by a treatment of lichenicolous coelomycetes (HAWKSWORTH 1981). In 1983, HAWKSWORTH provided a key to 218 lichenicolous species known from Great Britain. Since that time, some larger compilations and contributions, e.g. CLAUZADE et al. (1989) and SANTESSON et al. (2004), as well as numerous smaller papers have been published. LAWREY & DIEDERICH (2003) offered a general discussion on and survey of all aspects of lichenicolous fungi, including biology, evolution, diversity, a systematic arrangement and a useful compilation of lichenicolous literature.

Recently a monographic revision of lichenicolous *Taeniolella* S.Hughes species has been initiated, comprising traditional light and scanning electron microscopic approaches as well as attempts to carry out molecular sequence analyses of lichenicolous and saprobic species of this genus. During the course of these studies, we came across some new hyphomycetous species, which in two cases belong in genera that have not yet been known to harbour any lichenicolous species.

Material and Methods

All collections have been examined and described, mounted in distilled water, by means of light microscopy (Olympus BX 50, Hamburg, Germany). The collections examined are deposited at the herbaria C, LE and MIN (abbreviations according to HOLMGREN et al. 1990).

Taxonomy

Cladosporium licheniphilum Heuchert & U.Braun **sp. nov.** [MycoBank 500716]

(Figs 1 and 5 A–F)

Differt a *C. gallicola* stromatibus nullis, conidiis 3.5–13 µm longis, 0–1-septatis.

Holotype: On apothecia of *Pertusaria alpina*, Russia, Altai, Zmeinogorsk Region, Belaya River near Mt. Stanovaya, 51°00'N/82°44'E, alt. 600 m, Taiga forest, 12 June 1999, E. A. Davydov (LE).

Colonies confined to apothecia of the host lichen, caespitose, reddish brown, somewhat shiny. Mycelium immersed; hyphae branched, sinuous, 5–8 µm wide, brown, septate, with constrictions, thick-walled, smooth, hyphal cells around the conidiophores swollen, subglobose to polygonal, about 12 µm diam. or 7–17 × 4–10 µm, thick-walled, dark brown, smooth. Stroma lacking. Conidiophores solitary or in small, loose tufts, arising from internal swollen hyphal cells, erect, straight to slightly curved, subcylindrical to slightly geniculate-sinuous, unbranched to usually 1–3 times branched, ramification usually terminal, divergent, branchlets short to moderately long, 10–55 × 4–6.5 µm, conidiophores (65–)90–190 × 5–8 µm, somewhat wider at the base and gradually narrowed towards the apex, 5–14-septate, usually not constricted at the septa, dark brown, paler towards the apex, thick-walled, but wall of the terminal conidiogenous cells thinner, smooth, often with a single or few distant enteroblastic-percurrent proliferations; conidiogenous cells integrated, terminal, occasionally intercalary, (7–)9–20 µm long, subcylindrical-conic to slightly geniculate-sinous, proliferation sympodial, with a single or usually numerous, up to 12, coronate conidiogenous loci, 1–2 µm diam. Conidia catenate, usually in branched acropetal chains, subglobose, limoniform to ellipsoid-subcylindrical, 0–1-septate, aseptate conidia 3.5–8 × 3–5 µm, septate conidia 7–13 × 5–7 µm, usually not constricted at the septa, pale brown or yellowish brown, wall thin to slightly thickened, smooth or almost so, ends more or less rounded or slightly attenuated, with a single basal and 1–4 terminal hila, coronate, 0.5–2 µm diam., occasionally with microcyclic conidiogenesis, true ramoconidia s. str. (with truncate base, but without coronate hilum) lacking or very rare.

Notes: This is the first genuine lichenicolous species of the genus *Cladosporium* Link (HEUCHERT et al. 2005). The conidiophores are confined to apothecia of the living host lichen. *Cladosporium lichenicola* Linds. is an invalid, doubtful name, and *C. lichenum* Keissl. has been excluded and assigned to *Pseudocercospora* Speg. (HAWKSWORTH 1979, HEUCHERT et al. 2005). *C. licheniphilum* is easily distinguishable from most other species of *Cladosporium* by having conidiophores with numerous characteristic terminal branches. The fungicolous species *C. gallicola* B.Sutton, known from North America on galls and aecia of *Cronartium*, *Endocronartium* and *Pucciniastrum* species, is morphologically similar, but differs in forming well-developed stromata, 45–130 × 30–90 µm, and larger conidia, up to 29 × 8 µm, with up to 4 septa (HEUCHERT et al. 2005). Among saprobic *Cladosporium* spp., there is no morphologically comparable species, but some foliicolous taxa exhibit a similar ramification type of the conidiophores. *C. populicola* K.Schub. & U.Braun, a leaf-spotting species on *Populus tremula* in Germany, resembles *C. licheniphilum*, but differs in forming stromata, 15–45 µm diam., and narrower conidia, 3–5 µm wide (SCHUBERT 2005, SCHUBERT & BRAUN 2006). *C. syringicola* K.Schub. & U.Braun, on *Syringa* ×*chinensis* in Germany, is distinguished by having dimorphic

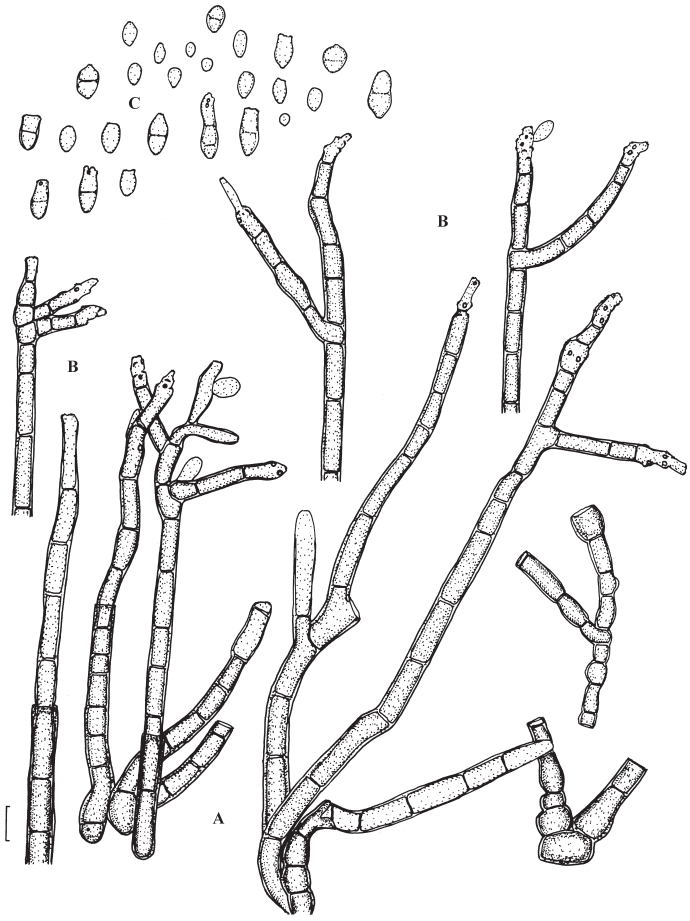

Fig. 1: *Cladosporium licheniphilum*, **A** – conidiophores, **B** – branched apices of conidiophores, **C** – conidia. Scale = 10 µm. B. Heuchert del.

conidiophores, i.e., short, paler, unbranched and long, pigmented, branched conidiophores, resembling those of *C. licheniphilum*, are formed (SCHUBERT 2005, SCHUBERT & BRAUN 2006). *C. ushuwaiensis* Speg., known from Argentina on *Berberis ilicifolia*, with a similar ramification type of the conidiophores, can be easily discriminated from *C. licheniphilum* by its very long and wide conidiophores, up to 310 × 15 µm, and integrated, intercalary conidiogenous cells (SCHUBERT 2005).

Corynespora laevistipitata (M.S.Cole & D.Hawksw.) Heuchert & U.Braun **comb. nov.** [MycoBank 500717] (Figs 2 and 5 G–J)

Basionym: *Taeniolella laevistipitata* M.S.Cole & D.Hawksw., Mycotaxon 77: 334, 2001.

Material examined: On *Pertusaria ophthalmiza*, on *Acer rubrum*, USA, Minnesota, St. Louis Co., Voyageurs National Park, N side of small bay S of Mukooda lake, Sand point Lake area, 15 July 1997, C. M. Wetmore 40239B (MIN – holotype of *T. laevistipitata*).

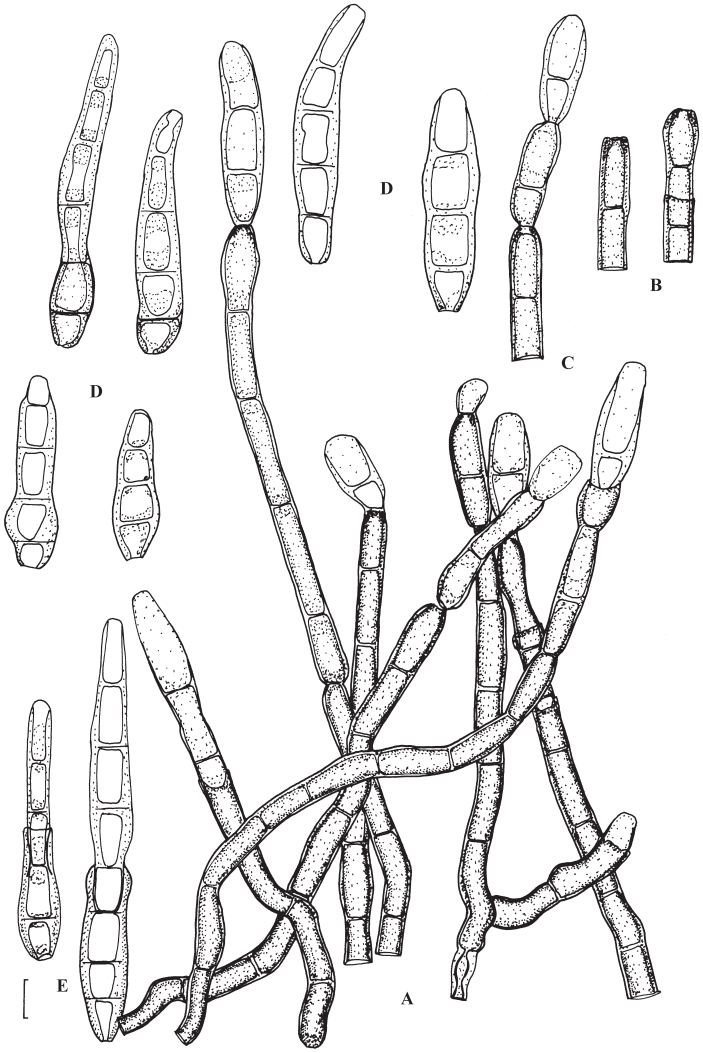

Fig. 2: *Corynespora laevistipitata*, **A** – conidiophores, **B** – terminal conidiogenous cells, **C** – conidiogenous cells with short conidial chain, **D** – conidia, **E** – proliferating conidia. Scale = 10 µm. B. Heuchert del.

Colonies discrete on isolated areas of the thallus, dark brown to blackish, caespitose. Mycelium internal; hyphae branched, septate, thin-walled, yellowish to pale brown, smooth, occasionally with a few superficial hyphae, 1.5–3 µm wide. Stroma lacking. Conidiophores solitary to loosely aggregated in small tufts, arising from internal hyphae, erumpent, erect, straight to curved or slightly sinuous, unbranched or occasionally branched at the base, cylindrical, 63–228 × 5–10 µm, (1–)4–10-septate, usually not constricted at the septa, except for the conidiogenous cells, medium to dark brown, paler towards the apex, wall somewhat thickened, 1–2 µm wide, smooth to somewhat rough-walled or granulate, occasionally with enteroblastic-percurrent proliferations which are not produced in connection with conidiogenesis, leaving coarse, distant annellations; conidiogenous cells integrated, terminal, 13–40

µm long, monotretic, non-determinate, proliferation percurrent, monopodial, with conspicuous annellations or conidiogenous cells somewhat inflated, subcylindrical to doliiform, constricted at the septa, conidiogenous locus 2–3 µm diam., unthickened, with a conspicuous central pore, 1–1.5 µm diam., wall around the pore unchanged to somewhat darkened. Conidia solitary or occasionally in short chains, broadly ellipsoid-ovoid, doliiform to obclavate, 20–70 × 8–13(–15) µm, 1–4-distoseptate, usually not constricted at the septa, pale brown, often distinctly paler at the apex, wall thick, 1–3 µm, smooth or almost so, lumen of the cells conspicuously diminished, apex rounded, base truncate, hilum 2–5 µm wide, with a distinct pore; microcyclic conidiogenesis observed, shed conidia able to proliferate and form secondary conidia.

Notes: A re-examination of type material of *Taeniolella laevistipitata* revealed that this species is characterised by having monotretic conidiogenous cells, with a conspicuous central pore, 1–1.5 µm diam., and distoseptate conidia. Based on the combination of percurrently proliferating, monotretic conidiogenous cells and distoseptate conidia, this species has to be excluded from *Taeniolella* and re-allocated to *Corynespora* Güssow. In previous wider circumscriptions of *Corynespora*, species with eu- and distoseptate conidia, formed singly as well as in chains, have been included (ELLIS 1971, 1976; MERCADO et al. 1997). *Corynesporopsis* P.M.Kirk (KIRK 1981) was introduced for *Corynespora* species with catenate, euseptate conidia, and the segregate genus *Hemicorynespora* M.B.Ellis (ELLIS 1972) has amero- to didymosporous conidia. *Solicorynespora* R.F.Castañeda & W.B.Kendr. (CASTAÑEDA & KENDRICK 1990) was proposed for former *Corynespora* species with euseptate conidia. A key to the species concerned was published by CASTAÑEDA et al. (2004). The monotypic genus *Briansuttonia* R.F.Castañeda, Minter & Saikawa (CASTAÑEDA et al. 2004) was described for a corynespora-like species with muriform, distoseptate conidia. Whether the strong splitting of the *Corynespora* complex is justified and tenable in future is unclear and somewhat doubtful, but this problem can only be solved on the base of comprehensive molecular sequence analyses, which have not yet been accomplished.

In any case, *Taeniolella laevistipitata* pertains in *Corynespora* in the traditional wide sense as well as the current narrower sense, and represents the first lichenicolous species of this genus. The mycelium is immersed in the thallus of a living lichen, giving rise to erumpent conidiophores. *Corynespora* encompasses approximately 70 species, which are foliicolous or saprobic on litter and wood. Beside the obvious ecological peculiarities, *C. laevistipitata* is unlike most other species of *Corynespora*. It belongs to a group of species having ellipsoid-ovoid to obclavate, non-rostrate conidia with only few distosepta. Many species of this genus strongly resemble the foliicolous as well as saprobic *C. cassiicola* (Berk. & M.A.Curtis) C.T.Wei (ELLIS 1971), the type species, or are barely distinguishable, e.g., *C. heterospora* J.M.Yen, *C. erianthemi* J.M.Yen & Lim, *C. hemigraphidis* J.M.Yen & Lim, *C. ruelliae* J.M.Yen & Lim (YEN 1980), *C. ligustri* Y.L.Guo, *C. merremiae* Y.L.Guo, *C. millettiae* Y.L.Guo and *C. viticis* Y.L.Guo (Guo 1984), and they deviate from *C. laevistipitata* by their much longer and wider, pluridistoseptate conidia. Most species of *Corynespora* s. lat. with similar conidia have been excluded due to conidial catenation or euseptation, e.g. *C. aterrima* (Berk. & M.A.Curtis) M.B.Ellis, now belonging in *Solicorynespora*. *C. vismiae* M.B.Ellis and *C. trichiliae* M.B.Ellis possess conidia with few septa, but they are distinctly rostrate. The conidia in *C. pruni* (Berk. & M.A.Curtis) M.B.Ellis are also alike, but much wider, 10–16 µm (ELLIS 1971).

In the original description of *Taeniolella laevistipitata*, long, wide conidiophores, (93–)120–170(–192) × 8–11(–11.5) µm, were described, well corresponding to our own observations. However, the conidia were characterised as follows: '(0–)1–2(–3)-septate units break, 1–2-septate conidia 17.5–24 × 7–8 µm'. The type of septation and the wall thickness were not

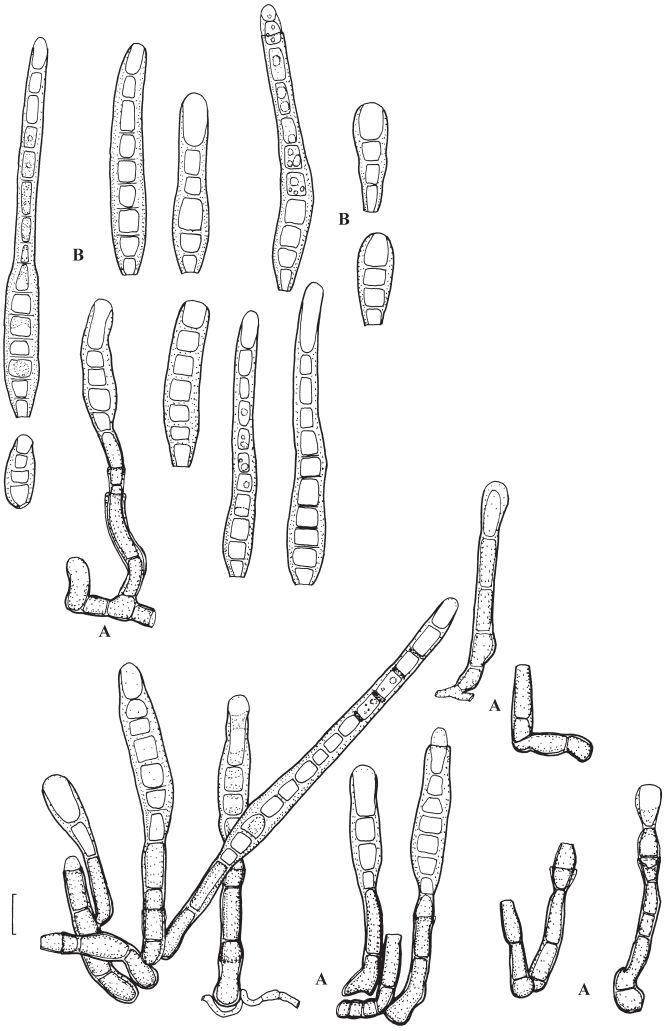

Fig. 3: *Ellisembia lichenicola* (from type material), **A** – conidiophores, partly with attached conidia, **B** – conidia. Scale = 10 µm. B. Heuchert del.

described, but the original illustration (COLE & HAWKSWORTH 2001: 335, Fig. 10) suggests thick walls and distoseptation.

Ellisembia lichenicola Heuchert & U.Braun **sp. nov.** [MycoBank 500718] (Figs 3, 4 and 6)

Differt a *E. coronata* et *E. ploversovensi* conidiophoris 5–8 µm latis, conidiophoris et cellulis conidiogenis percurrente proliferantibus.

Holotype: On *Physconia distorta* (associated with sclerotia of *Athelia arachnoidea*), on a trunk of an old poplar, Denmark, Lolland, Majbälle, NO of Saksköbing, along the road in the wood Faergemark, near Guldborg, 19 July 1984, M. S. Christiansen (C, 4383).

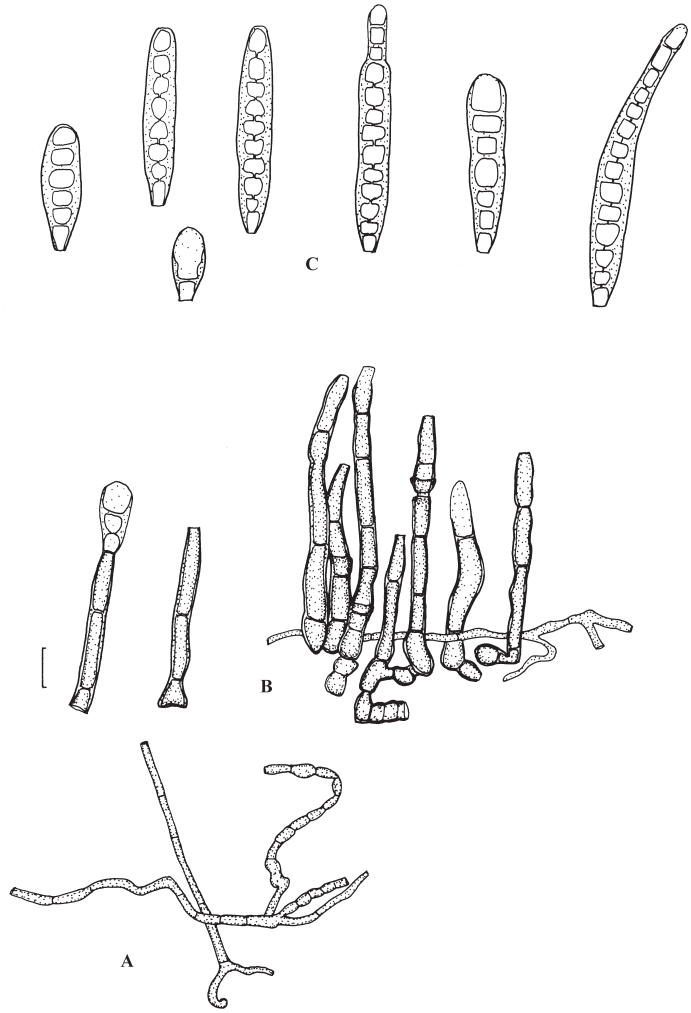

Fig. 4: *Ellisembia lichenicola* (from MIN 7038), **A** – superficial hyphae, **B** – conidiophores, **C** – conidia. Scale = 10 µm. B. Heuchert del.

Colonies on parts of the thallus (in the type attacked by *Athelia arachnoidea*), scattered, caespitose, in small tufts, blackish brown, shiny. Mycelium immersed, branched, sinuous, septate, 1–3 µm wide, around conidiophores wider, 5–8 µm, pale to dark brown, smooth, wall thickened, but swollen cells thin-walled. Stroma lacking. Conidiophores arising from swollen internal hyphal cells, erect, solitary or in small tufts of 2–7 conidiophores, straight to somewhat curved, subcylindrical, unbranched, occasionally branched at the base, 20–60(–95) × 5–8 µm, 1–4-septate, occasionally constricted at the septa, above all at the base of the conidiogenous cells, pigmented, thick-walled, 1–2 µm, smooth to irregularly rough-walled, with enteroblastic-percurrent proliferations which are not formed in connection with conidiogenesis; conidiogenous cells integrated, terminal, 10–25 µm long, cylin-

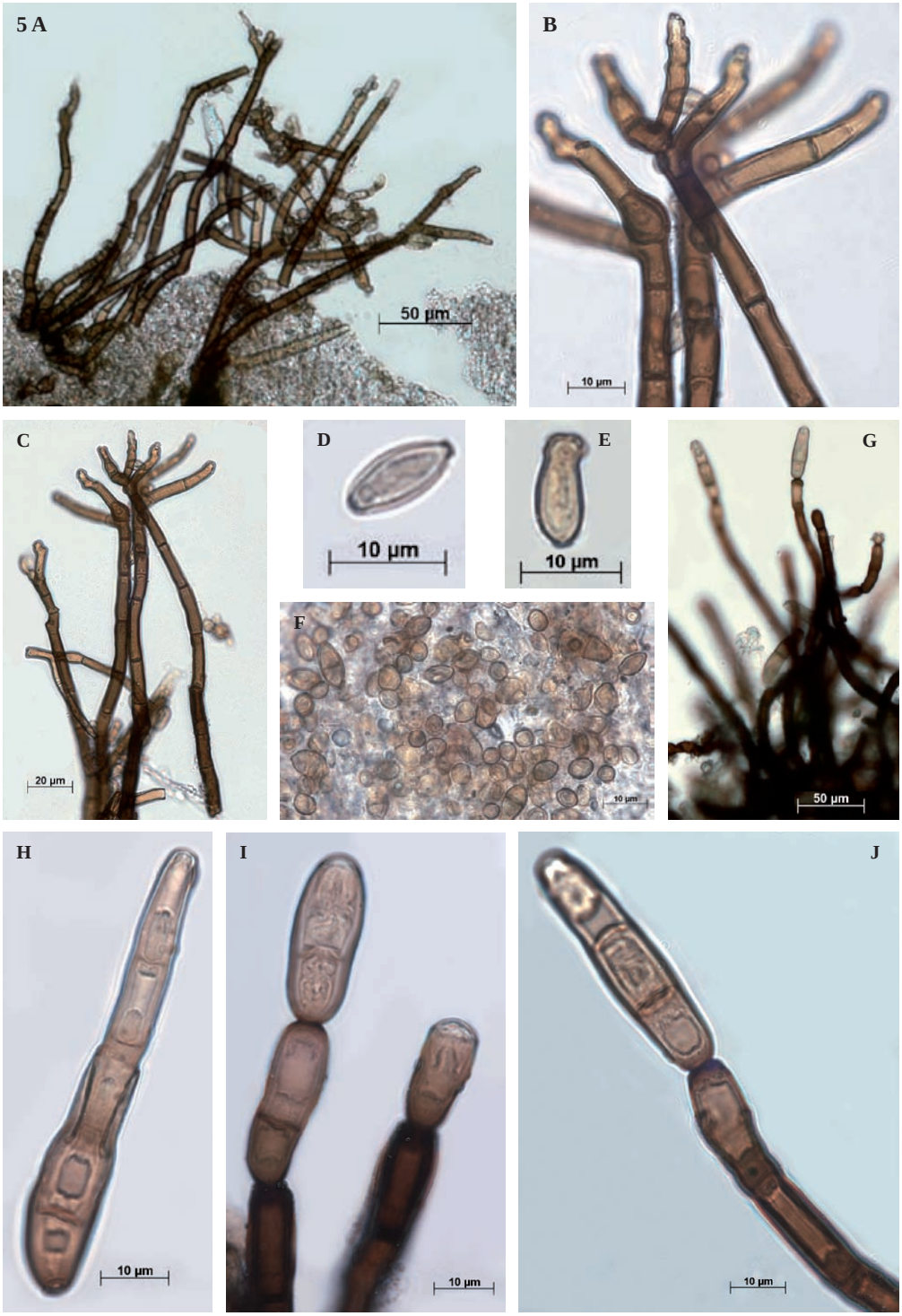

Fig. 5: Legend on the next page.

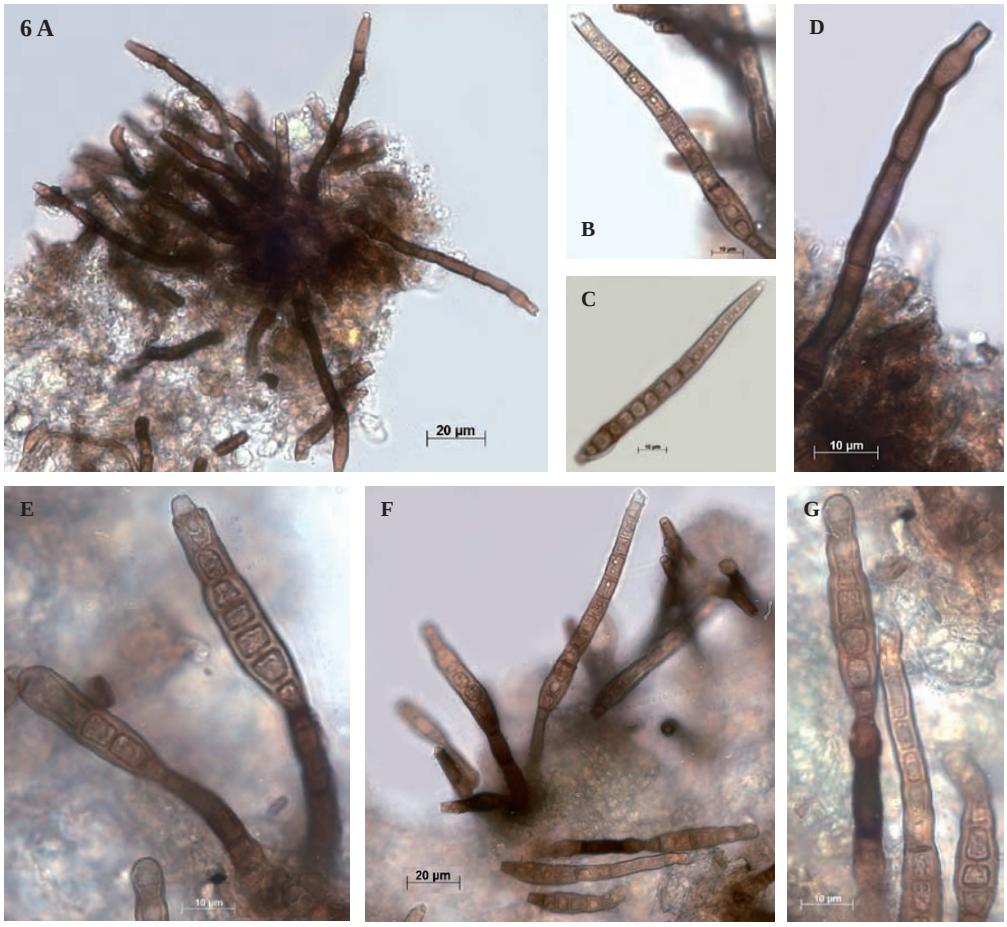

Fig. 5 (page 18): Micrographs of *Cladosporium licheniphilum* (A–F): **A** – colonies, **B** and **C** – branched conidiophores, **D–F** – conidia. *Corynespora laevistipitata* (G–J): **G** – colonies, **H** – microcyclic conidiogenesis, **I** – conidia in simple chain, **J** – conidiophore with attached conidium.

Fig. 6: Micrographs of *Ellisembia lichenicola* (A–G): **A** – colonies, **B** and **C** – conidium, **D** – conidiophores, **E** and **G** – conidiophores with attached conidia, **F** – conidiophores with attached conidia, conidia.

drical to doliiform, monoblastic, proliferation percurrent, monopodial, with conspicuous annellations as well as somewhat swollen conidiogenous cells, constricted at the septa, conidiogenous locus truncate, 3–4.5 µm wide, unthickened, not darkened. Conidia solitary, obclavate-subcylindrical, straight to somewhat curved, (19–)25–107 × 8–10 µm, (1–)2–12-distoseptate, not constricted at the septa, brown, near the apex usually distinctly paler, wall 1–2 µm thick, but thinner at the apex, smooth, apex rounded, base truncate, 3.5–4.5 µm wide, unthickened, not darkened.

Additional material examined: Parasitic on *Pertusaria pertusa* auct. (associated with *Lichenoconium erodens*), Denmark (Zealand), Rye, between Roskilde and Holbæk, on *Acer pseudoplatanus* in the wood "Ryegaard Dyrehave", (Coll.no. 66.558,a), 16 Aug. 1966, M. Skytte Christiansen (C, 4327). On *Pertusaria* sp., on *Acer saccharum*, Canada, Quebec, Quebec Co., Stoneham, Mont Wright Parc de Conservation Muncipale, 7 Aug. 1997, M. S. Cole & I. M. Brodo 7038 (MIN), p.p. (type of *Taeniolella caespitosa* M.S.Cole & D.Hawksw.).

Notes: In the type material of *Taeniolella caespitosa* some caespituli well coinciding with those of *Ellisembia lichenicola* have been found. The conidiophores, formed in loose tufts, are 40–73 × 4–5(–6) µm, (1–)2–4(–5)-septate, and the conidia are formed singly, obclavate, 33–77 × 8–10 µm, 5–13-distoseptate, with hila 2–4 µm wide.

The present new species fits well into the concept of *Ellisembia* Subram. (SUBRAMANIAN 1992), which was introduced to accommodate sporidesmium-like hyphomycetes with distoseptate conidia. *Ellisembia* currently comprises approximately 38 species. Species of *Ellisembia* are usually saprobic on litter of woody plants and dead culms of grasses and bamboos (WU & ZHUANG 2005). However, *E. asterinum* (Cooke) Shoemaker & Hambleton (SHOEMAKER & HAMBLETON 2001) has been found to inhabit other fungi (*Sphaeropsis* or *Macrophoma*). *E. lichenicola* is the first lichenicolous species of this genus, growing on a living lichen. This species is characterised by its percurrently proliferating conidiogenous cells, either unswollen, with conspicuous annellations, or somewhat swollen, doliiform, and obclavate-subcylindrical conidia with obtuse apex. *E. coronata* (Fuckel) Subram., a widespread wood-inhabiting species (ELLIS 1976, WU & ZHUANG 1995), and *E. plovercovensis* Goh & K.D.Hyde (GOH & HYDE 1999), described from Hong Kong on submerged wood, possess similar conidia, but the conidiophores are much narrower, 3.5–7 µm, and non-proliferating. Other species of *Ellisembia* differ from *E. lichenicola* by either much longer and/or wider conidia, up to 375 × 10–20 µm (*E. adscendens* (Berk.) Subram., *E. bambusina* (N.D.Sharma) McKenzie, *E. crassispora* (M.B.Ellis) Subram., *E. ellipsoidea* W.P.Wu, *E. folliculata* (Corda) Subram., *E. leonensis* (M.B.Ellis) McKenzie, *E. opacum* (Cooke & Harkn.) Subram., *E. palauensis* McKenzie, *E. uvariicola* (M.B.Ellis) Subram., *E. vaga* (Nees & T.Nees) Subram.), much narrower conidia, 3–7 µm wide (*E. britannica* (B.Sutton) W.P.Wu, *E. turcomanica* (Hol.-Jech.) W.P.Wu), conidia with terminal mucilaginous sheath (*E. antillana* (Castañeda & W.B.Kendr.) McKenzie, *E. bambusae* (M.B.Ellis) Subram., *E. calyptrata* (Cabello, Cazau & Aramb.) W.P.Wu, *E. globulosa* W.P.Wu, *E. guangdongensis* W.P.Wu, *E. minigelatinosa* (Matsush.) W.P.Wu, *E. mucicola* W.P.Wu, *E. paravaginata* McKenzie, *E. repentioriunda* Goh & K.D.Hyde, *E. suttonii* W.P.Wu, *E. vaginata* McKenzie) or distinctly rostrate conidia (*E. bambusicola* (M.B.Ellis) J.Mena & Delg.-Rodr., *E. brachypus* (Ellis & Everh.) Subram., *E. camelliae-japonicae* (Subram.) W.P.Wu, *E. carrii* (Morgan-Jones) W.P.Wu, *E. flagelliformis* (Matsush.) W.P.Wu, *E. filia* W.P.Wu, *E. leptospora* (Sacc. & Roum.) W.P.Wu, *E. longispora* (Cabello, Cazau & Aramb.) W.P.Wu) [ELLIS 1971, 1976; GOH & HYDE 1999; MCKENZIE 1999; WU & ZHUANG 2005].

Acknowledgements

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