Two species of mycoparasitic fungi

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Abstract. – *Mycogone calospora* (KARST.) v. HÖHNEL is redescribed in pure culture. *Dipodascus armillariae* sp. nov. is found to be the teleomorph of *Geotrichum decipiens* (TUL.) comb. nov. (= *G. armillariae* v. ARX).

Introduction

Coccosporella was erected by KARSTEN (1893) for a single species and distinguished from *Coccospora* WALLR. (a genus of sterile mycelia, but *C. rosea* KARST. = *Mycogone rosea* LINK, fide HUGHES, 1958) by verrucose conidia without mention of *Mycogone* LINK. Von HÖHNEL (1924) recognized the affinity of KARSTEN's taxon with the latter genus and made the transfer. After examining KARSTEN's type specimen, HUGHES (1958) confirmed this conclusion. The species has passed unnoticed in recent literature on mycoparasitic fungi (for example: ARNOLD, 1976). TUBAKI (1955) probably had this fungus when describing "*Mycogone rosea* LINK" isolated from a *Ramaria* species. A recent finding of *M. calospora* in Austria made the following description possible.

A. *Mycogone calospora* (KARST.) v. HÖHNEL – Figs. 1, 2.

Coccosporella calospora KARST. – Acta Soc. Fauna Flora fenn. 9: 11. 1893 = *Mycogone calospora* (KARST.) v. HÖHNEL, Zentbl. Bakt. Partasit. Kde, Abt. 2, 90: 12. 1923.

Description. – Colonies on 2% MEA growing very rapidly, reaching 7–8 cm diam in 5 days at 20 or 24° C, white fluffy, forming mainly the *Sibirina* synanamorph: Conidiophores erect, repeatedly verticillate, bearing dense verticils of phialides, on each of which 1–3 phialoconidia are formed. – Phialides subulate, 38–56 µm long, 3–6 µm wide at the base, tapering to 1.2–2.0 µm at the tip. – Phialoconidia arranged in radiating heads, obpyriform to clavate, hyaline, smooth-walled, measuring 7–13×3–6 µm. After 7 days the aleurioconidial form of sporulation begins to dominate, giving the colony a powdery, pale ochraceous-salmon aspect. Aleurioconidia typically two-celled and usually supported by one or a few lateral hyphal cells; top cell globose, finely and densely warted, thick-walled (2.5–3.0 µm), 25–40(–52) µm diam., basal cell much narrower, barrel-shaped, smooth or finely warted,

thin-walled, 8–24×7–14 μm; both cells appearing hyaline in unstained microscopic mounts. Temperature optimum for growth 20–24° C, no growth occurring at 27° C.

Material examined. – Holotype specimen of *Coccosporella calospora*, "ad *Clavariam fennicam*, Tavastia australis, Tammela, Mustiala, 4. IX. 1892". Herb. Petter Adolf KARSTEN, No. 2368 (H).

Living material, CBS 504.82, collected on unrecognizably putrid *Ramaria* sp., above Mariatal, Brandenbergtal, Tyrol, Austria, W. GAMS and J. THIEN, 10 Sept. 1982.

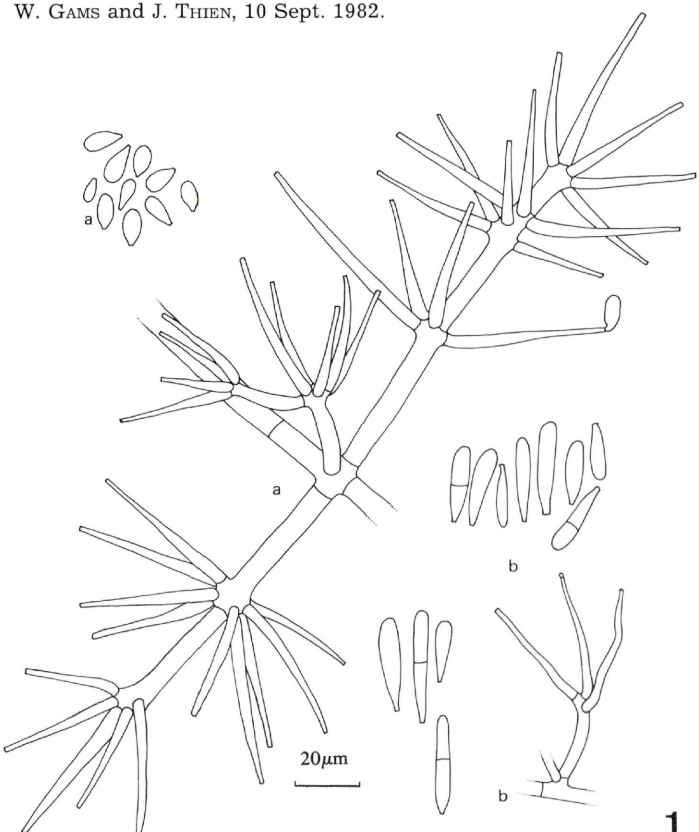


Fig. 1. *Mycogone calospora: Sibirina* synanamorph: a. developed in culture. – b. conidia and phialides from the natural substrate

Discussion. – On the natural substrate the fungus causes a dark grey discoloration with a white overgrowth, accompanied by strong decomposition of the host. The microscopic morphology on the host and in pure culture is similar except for the frequent septation and greater length of the phialoconidia on the host (13–35×3–6 μm, Fig. 1 b).

The aleurioconidia of *M. calospora* are different from those of all other known species of *Mycogone* in that the basal cell is more distinct from the terminal cell and does not form one ovoid structure with it. The basal cells are usually collapsed in dried material. The illustration of *M. rosea* presented by TUBAKI (1954) shows similar basal cells. In *M. rosea* LINK the opposite is true, the hemispherical basal cell being broadly attached to the terminal cell. This species has so far not been reported from *Ramaria*.

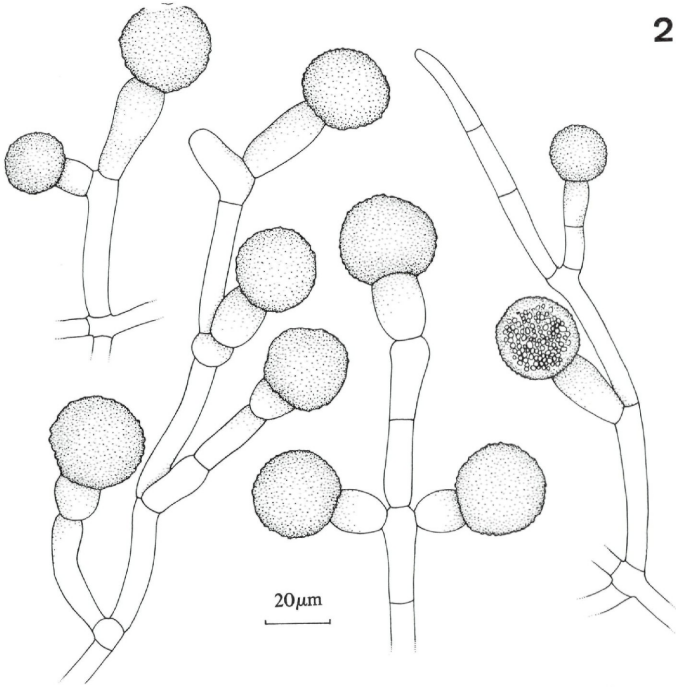
The phialidic synanamorph of this and other species of *Mycogone* can be classified in *Sibirina* G. ARNOLD, although the definition of this genus must then be extended to include nonseptate conidia. In other named species of *Sibirina* no distinct synanamorph is known. A connection with a *Hypomyces* teleomorph as with *Mycogone cervina* DITM. (ROGERSON & SIMMS, 1971) is very likely.

Sibirina merges with *Cladobotryum* LINK: FR. via species such as *C. apiculatum* (TUBAKI) W. GAMS & HOOZEMANS. The genus is distinct from *Verticillium* by the rapid, fluffy growth, larger structures throughout and limited numbers of conidia produced on each phialide.

B. *Dipodascus armillariae* sp. nov., the teleomorph of *Geotrichum decipiens* (TUL.) comb. nov. – Fig. 3

Since the description of the ascigerous *Endomyces decipiens* REESS on *Armillaria mellea* (REESS, 1870; de BARY, 1884), its anamorph connection has been debated. TULASNE & TULASNE (1865) described *Hypomyces decipiens* as a purely anamorphic fungus with arthroconidia and chlamydospores. BREFELD & LINDAU (1891) described the same anamorph and suggested it was probably connected with *E. decipiens,* but with regard to the chlamydospores they stated: „von denen es, ebenso wie von den Oidien, fraglich blieb, ob sie überhaupt dem *Endomyces decipiens* angehörten".

Subsequently this connection has generally been taken as established. REDHEAD & MALLOCH (1977) redefined the genus *Endomyces,* redescribed and neotypified the teleomorphic *E. decipiens* from herbarium material and recognized the commonly found *Geotrichum* sp. as a distinct fungus. VON ARX (1972) after numerous unsuccessful attempts to find the teleomorph, concluded that *E. decipiens* was an anamorphic fungus. In 1977 he examined fresh ascal material from Switzerland and recognized that it was different from the common



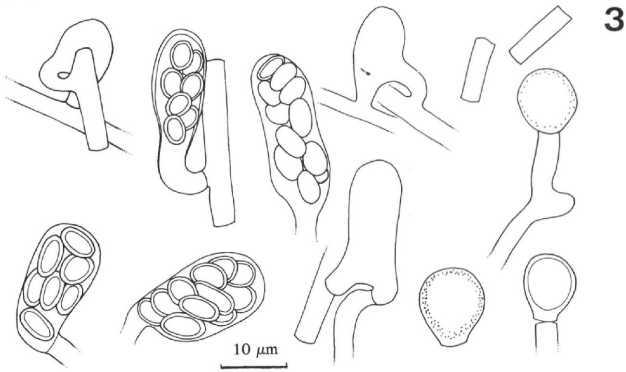


Fig. 2. *Mycogone calospora:* Formation of aleurioconidia, from the natural substrate. – Fig. 3. *Dipodascus armillariae:* Development of asci and mature asci, chlamydospores and two arthroconida

Geotrichum which he then named *Geotrichum armillariae*. Like other congeneric species with hat-shaped ascospores, *E. decipiens* has fusoid to ellipsoid blastoconidia formed in a dendroid manner and should not be confused with *Geotrichum armillariae* (REDHEAD & MALLOCH, 1977; VON ARX, 1977). The teleomorph of *G. armillariae* has remained unknown until recently, when material of a *Dipodascus* species was found in connection with the *Geotrichum* arthroconidia in Belgium.

Dipodascus armillariae sp. nov.

Anamorph: *Geotrichum decipiens* (TUL.) W. GAMS, comb. nov.
Hypomyces decipiens TUL., Sel. Fung. Carpol. 3: 61. 1865.
Synonym: *Geotrichum armillariae* v. ARX, Antonie van Leeuwenhoek 43: 339. 1977.

Asci tantum in *Armillaria* hospite inventi, e copulatione arthroconidiorum vel hypharum vegetativarum oriundi, late saccati, fere tenuitunicati, 6–12 ascosporas continentes, pedicellis exclusis 20–28×8–12 μm. Ascosporae ellipsoideae, hyalinae, crassitunicatae, leves, 4.5–7×3–4.5 μm. Anamorphosis *Geotrichum decipiens* (TUL.) W. GAMS.

Holotypus in Herb. CBS 1719, lectus in *Armillariella ?bulbosa*. Fond d'Auffe, in Belgio, 3 Oct. 1982.

Description. – Asci present on the natural substrate only, formed after copulation of short outgrowths from two arthroconidia or an arthroconidium and a hyphal cell or two cells of separate hyphae (so far not found between adjacent hyphal cells). Asci broadly saccate, rather thin-walled, without apical differentiation, containing irregular numbers of ascospores (mostly 6–12), without the pedicels measuring about 20–28×8–12 μm. – Ascospores ellipsoidal, hyaline, thick-walled, 4.5–7×3–4.5 μm.

Anamorph *Geotrichum decipiens*, as described under *Endomyces decipiens* by VON ARX (1972) and under *G. armillariae* by VON ARX (1977). To these descriptions may be added that the chlamydospores usually appear smooth-walled under lower magnification, but are clothed with amorphous material and may become roughened or even warted in older cultures.

Material examined. Ascosporic material: Herb. CBS 1719 (holotypus) and 1726, Fond d'Auffe near Vencimont, 4 Oct. 1982; Herb. CBS 3348, on *Armillariella* sp., Schovenhorst near Putten, Netherlands, 13 Oct. 1983. All collected by W. GAMS on *Armillariella ?bulbosa* (BARLA) ROMAGN. in the Belgian Ardennes. – Living cultures: CBS 623.82, derived from CBS 1732, CBS 624.82, derived from CBS 1726, CBS 458.83, derived from CBS 1719; CBS 598.83, derived from CBS 3348. All mass-conidial isolates taken from strongly affected fruit-bodies at places where asci were present.

Discussion. – The connection of *Dipodascus armillariae* with the *Geotrichum* anamorph corroborates VON ARX's (1977) conclusion that species of *Dipodascus* should have *Geotrichum* anamorphs. The genus is distinct from *Endomyces* by thick-walled and sometimes ornamented but not hat-shaped ascospores. *Endomyces decipiens* has not yet found in the Netherlands, possibly because of a preference toward warmer climates.

A unique submiscroscopic feature of *Dipodascus* and *Geotrichum* is the numerous irregularly scattered plasmodesmata perforating the hyphal septa which have also been observed in the present species (KREGER-VAN RIJ & VEENHUIS, 1972).

As *Hypomyces decipiens* TUL. was originally described as an anamorphic fungus in a teleomorphic genus, the epithet *decipiens* TUL. is available for the anamorph, and antedates *armillariae* V. ARX by 112 years. The description of *Endomyces decipiens* REESS, though apparently intended as a combination with TULASNE's epithet, fulfills the requirements set by ICBN for a new species and must be cited without the authorship of TULASNE.

This study is not yet satisfactory because asci have not been obtained in pure culture. A whole range of culture media and incubation temperatures were tested with the above-mentioned mass-conidial isolates. In addition the three cultures were grown together with each other in streak cultures and suspensions. The cultures were also inoculated singly and in combination on *Armillariella* fruit-bodies which had been sterilized by either autoclaving or propylene oxide. Failure to obtain asci in pure culture may be due either to the requirement for a living host, specific actions of different *Armillariella* hosts, as the original one probably represented *Armillariella bulbosa* (in the above experiments another taxon was used), or influences of contaminating yeasts present on the natural substrate.

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