



## FORSKNINGSRAPPORT FRÅN SVENSKA ARTPROJEKTET Projektperiod: 2007–2008

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FUNGI:

# Taxonomic revision of Swedish microfungi in Lasiosphaeriaceae and Sordariaceae (Sordariomycetes, Ascomycota)

Lasio-sphaeriaceae and Sordariaceae are two diverse families whose microfungi species play important roles as decomposers. Phylogenetic analyses have shown that members of Lasiosphaeriaceae are divided into two separate clades, while Sordariaceae forms a monophyletic group nested within one of the Lasiosphaeriaceae clades.

Genera in both families have mainly been circumscribed based on ascospore morphology. The ascospores consist of hyaline and/or dark brown cells that typically form an apical head and basal tail when two-celled, and commonly are surrounded by a gelatinous sheath or have appendages in various sizes and shapes (Fig. 1).

However, these characters have been shown to be homoplastic and unreliable criteria for interpreting relationships within Sordariales. Many genera are polyphyletic, and there are a large number of monophyletic groups without morphological synapomorphic features.

The aim of this project has been to study Swedish members of Lasiosphaeriaceae and Sordariaceae, and to clarify the systematics of this large group of cosmopolitan fungi by adding new molecular and morphological data in collaboration with international researchers.

The following molecular markers have been used: ITS-nLSU rDNA, mtSSU rDNA and  $\beta$ -tubulin. One part of the project focused on coprophilous genera of Lasiosphaeriaceae, while the second part focused on the genus *Cainiella*, a doubtful member of Sordariaceae.

This study includes the coprophilous genera *Anopodium*, *Apodospora*, *Arnium*, *Fimetariella*, and *ZygospERMella* (Lasio-sphaeriaceae), with focus on the largest genus *Arnium* (Fig. 1).

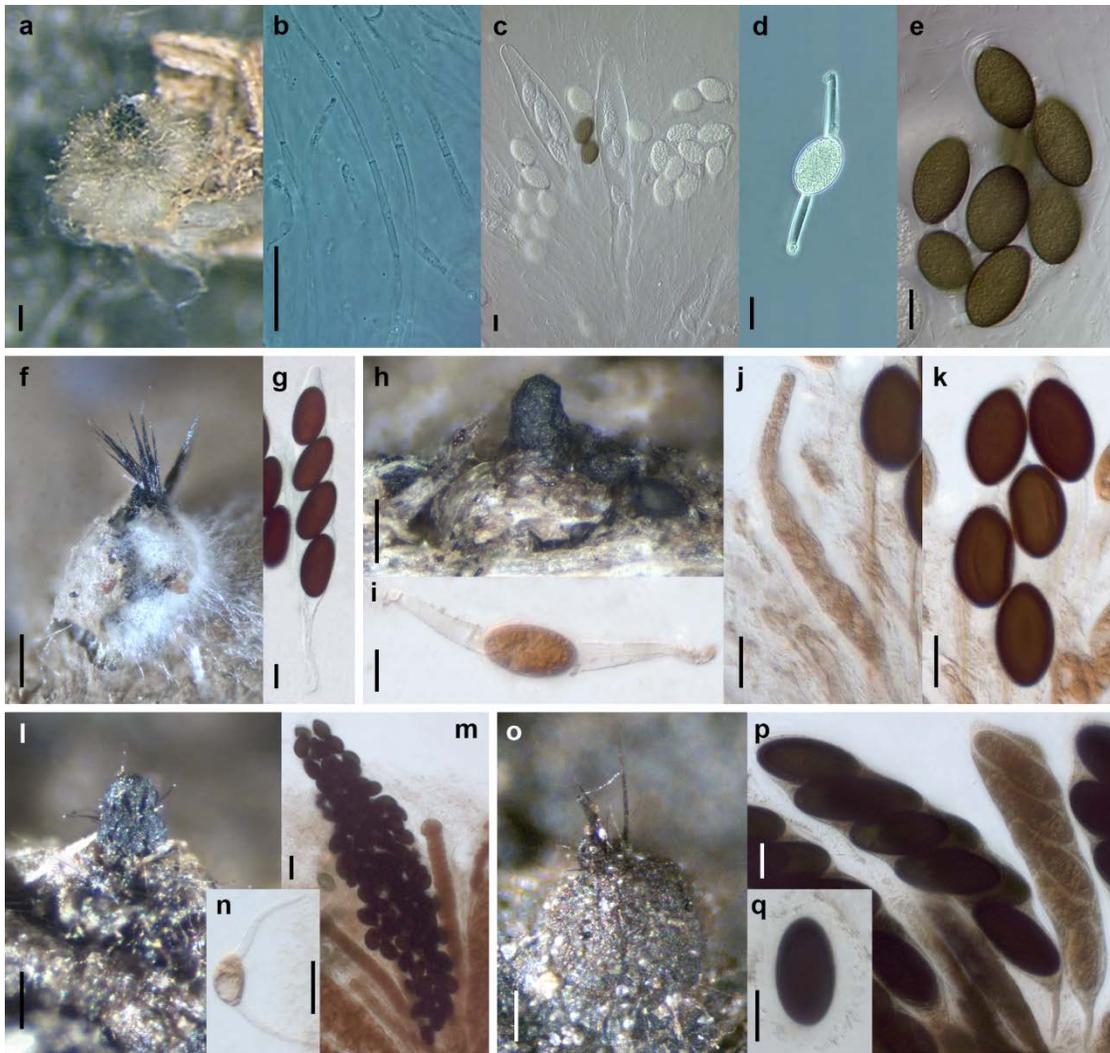
We investigated the monophyly of selected genera and contributed to a better resolution of the whole Sordariales phylogeny. The circumscription of genera as well as synapomorphic morphological characters were discussed.

Based on a combination of morphological and molecular data, *Echria* stat. nov. is recognized at the genus level for the former *Arnium* section and two new combinations are proposed: *E. gigantospora* and *E. macrotheca*.

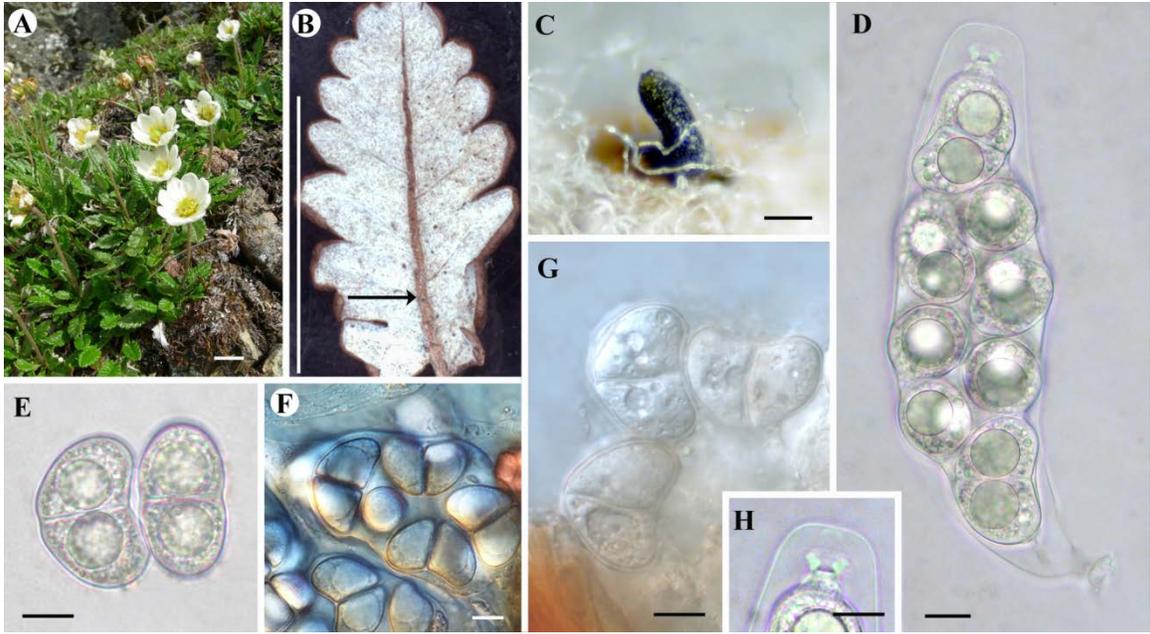
*Cainiella* is an ascomycete genus associated with arctic alpine plants. The cold-dominated environment of arctic alpine heaths harbors a number of interesting microfungi, of which many are associated with a particular host plant. One species often found on *Dryas octopetala* is the type species of *Cainiella*, *C. johansonii* (Fig. 2). The second member of the genus to date is *C. borealis* (Fig. 3). It occurs on old branches of *Cassiope tetragona*.

The genus *Cainiella* has previously had an uncertain taxonomic position within the family Sordariaceae, in the order Sordariales. Our molecular data show that *Cainiella* instead belongs to the family Sydowiellaceae, and the order Diaporthales. The study also includes new sequences of other Sydowiellaceae species, and contributes to a better understanding of the phylogenetic relationship within that family.

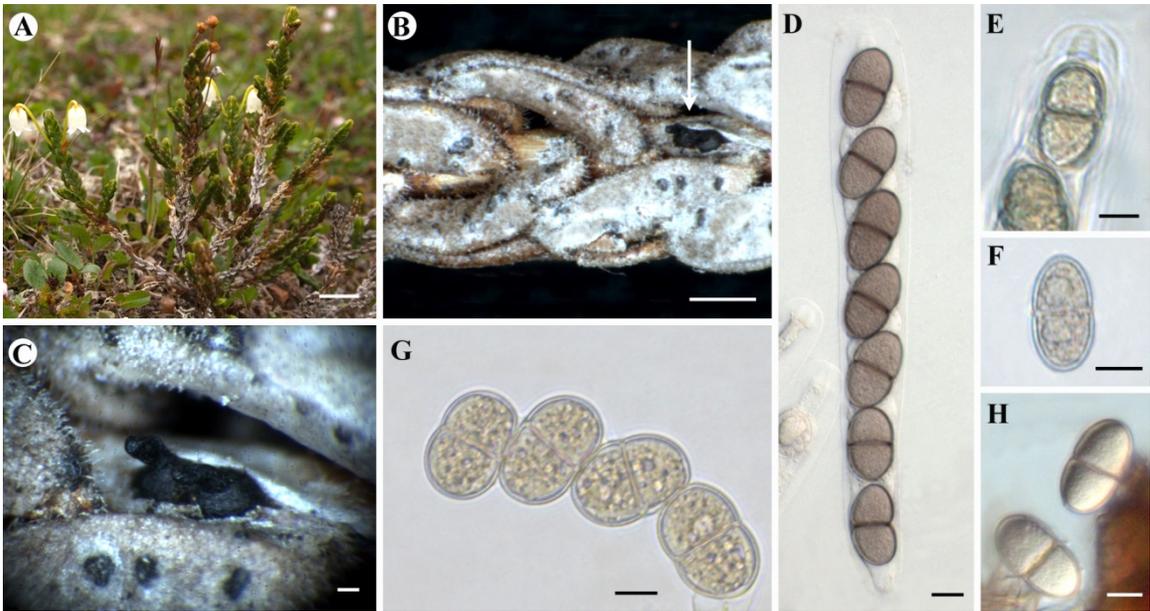
Morphological studies of the two species also added new knowledge, which both confirm and reject previous doubtful observations.



**Fig. 1.** *Arnium olerum*, **a** ascoma, **b** paraphyses, **c** asci, **d** immature hyaline ascospore with gelatinous appendages, **e** ascospores. (Coll. SMH3253 3, F). *A. arizonense*, **f** ascoma, **g** ascus with ascospores. (f Coll. F66864, S, g Coll. TRTC38138, TRTC). *A. mendax*, **h** ascoma, **i** immature ascospore with gelatinous appendages, **j** ascus, **k** ascospores, (h Coll. F66872, S, i-k Coll. TRTC156621, TRTC). *A. leporinum*, **l** ascoma, **m** asci and ascospores, **n** immature ascospore with gelatinous appendages. (l Coll. F-007,119, UPS, m-n Coll. TRTC156605, TRTC). *Echria macrotheca*, **o** ascoma, **p** asci, **q** ascospore with gelatinous sheath. (o Coll. F-644,828, UPS, p-q Coll. TRTC54023, TRTC). Scale bars: a, f, h, l, o=200  $\mu$ m, b-e, g,i-k, m-n, p-q=20  $\mu$ m



**Fig. 2** *Cainiella johansonii*. **A.** The host plant *Dryas octopetala*. **B.** Perithecium on underside of decaying *Dryas* leaf. **C.** White *Dryas* hairs surround the long, protruding neck of an immersed perithecium. **D.** Ascus. **E–G.** Ascospores. **H.** Ascus top. C–E, H. Coll. Kruys 732, UPS. F. Coll. A. Chlebicki F 56257, KRAM. B, G. coll. Kruys 733, UPS. Bars: A, B 5 1 cm, C 5 100 mm, D–H 5 10 mm.



**Fig. 3.** *Cainiella borealis*. **A.** The host plant *Cassiope tetragona*. **B.** Perithecia on old decaying branches of *C. tetragona*. **C.** Ascomata of *C. borealis* often occur in pairs. **D.** Ascus with brown ascospores. **E.** Ascus top. **F–H.** Ascospores. **B–H.** Coll. Kruys 734, UPS. Bars: A 5 1 cm, B 5 1 mm, C 5 100 mm, **D–H** 5 10 mm

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**PUBLICATIONS:**

Kruys Å, Huhndorf SM, Miller AN. 2015. Coprophilous contributions to the phylogeny of Lasiosphaeriaceae and allied taxa within Sordariales (Ascomycota, Fungi). *Fungal Diversity* 70: 101-113. DOI: 10.1007/s13225-014-0296-3

Kruys Å, Castlebury LA. 2012. Molecular phylogeny of Sydowiellaceae-resolving the position of *Cainiella*. *Mycologia* 104: 419-426. DOI: 10.3852/11-163.

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