

## *Cecidiomyces*, a new subantarctic lichenicolous hyphomycete genus

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**Abstract:** *Cecidiomyces santessonii* gen. & sp. nov., found on *Stereocaulon* species on the subantarctic Macquarie Island (Tasmania, Australia), is described, illustrated and compared with other morphologically similar genera and species. It is characterized by a lichenicolous habit, gall-formation, caespitose to sporodochial colonies, semi-macronematous, monoblastic, determinate conidiophores reduced to conidiogenous cells, solitary, 0–1-euseptate, pigmented conidia, and schizolytic conidial secession.

**Key words:** anamorphic fungus, gall formation, lichen-inhabiting, new taxa, *Stereocaulon*

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### Introduction

Species of *Stereocaulon* are hosts to a wide range of lichenicolous fungi, with 30 species of fungi belonging to 25 genera having been described on hosts of this genus (Zhurbenko 2010a, b; Kukwa *et al.* 2012; present publication); these include two genera, viz. *Cecidiomyces*, described below, and a probable new genus cited as “pyrenomycete 2” in Zhurbenko (2010a), as well as 19 species that are, as far as is known, confined to *Stereocaulon* spp.

The diversity of stereocaulicolous fungi in the Holarctic has recently been treated in detail (Zhurbenko 2010a), whereas extra-Holarctic regions are undoubtedly insufficiently explored in this respect. This assumption is supported by the fact that 16 out of 30 species known to occur on *Stereocaulon* spp. are reported only from the Holarctic, while just three species (*Abrothallus stereocaulorum* Etayo & Diederich, *Plectocarpon stereocau-*

*licola* Kukwa *et al.*, and the new *Cecidiomyces santessonii*) are known exclusively from extra-Holarctic areas (Etayo 2002, 2010; Hafellner & Mayrhofer 2007; Etayo & Sancho 2008; Zhurbenko 2010a; Kukwa *et al.* 2012; present publication).

During the course of an examination of the lichenicolous fungi deposited at UPS we found an undescribed gall-inducing hyphomycete on *Stereocaulon* spp., collected on the subantarctic Macquarie Island (54°30'S, 158°57'E). Attempts to assign this species to any known hyphomycete genus failed. Therefore, a new genus is described to accommodate this fungus.

### Material and Methods

The material was examined and photographed using a Zeiss Stemi 2000-CS microscope and Axio Imager A1, equipped with Nomarski differential interference contrast optics. Microscopic examination was carried out on material mounted in water, as well as 10% KOH (K). Conidial dimensions were rounded to the nearest 0.5 µm. The length, breadth and length/breadth ratio (l/b) of conidia are given as: (min.–){ $\bar{x}$ –SD}–{ $\bar{x}$ +SD}(–max.), where min. and max. are the extreme values,  $\bar{x}$  the arithmetic mean, and SD the corresponding standard deviation. The material examined is housed in the herbaria of the Museum of Evolution, University of Uppsala, Sweden (UPS) and of the V. L. Komarov Botanical Institute in St. Petersburg, Russia (LE).

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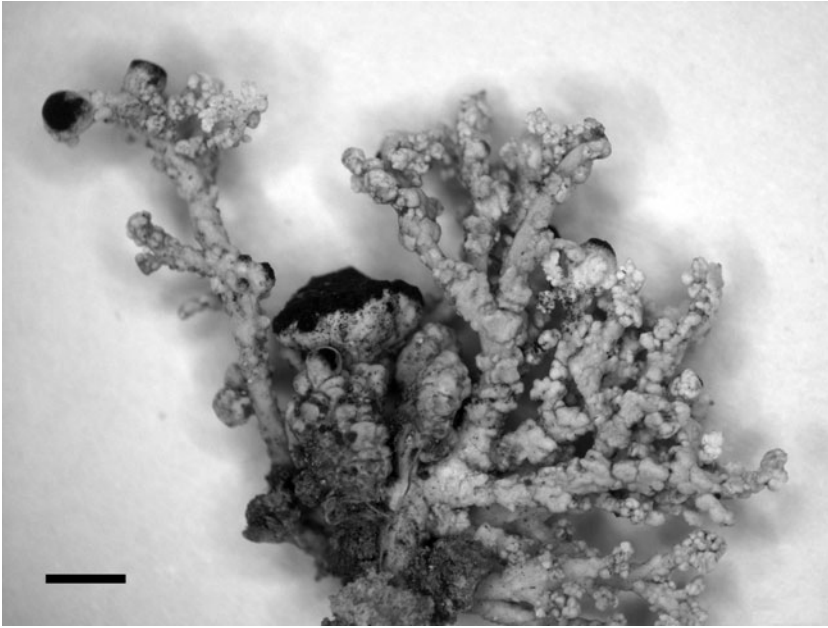


FIG. 1. *Cecidiomyces santessonii* (UPS F 552775), habitus. Scale = 1 mm.

### The New Genus and Species

#### ***Cecidiomyces* U. Braun & Zhurb. gen. nov.**

Mycobank No.: MB 800818

Hyphomycetes. Lichenicolous. Inducing the formation of gall-like swellings on lichen thalli. Mycelium immersed, branched, septate, pigmented. Conidiophores aseptate, reduced to conidiogenous cells, short, little differentiated, semi-macronematous, arising from internal hyphae, erumpent, erect, pigmented, caespitose to sporodochial on the gall surface, holoblastic, monoblastic, determinate, conidiogenous loci terminal, truncate to subtruncate, without any special differentiation. Conidia ('aleuriosporae') solitary, subglobose, broadly ellipsoid-ovoid to obovoid or obpyriform, apex broadly rounded, 0–1-euseptate, pigmented, base rounded, truncate to obconically truncate, hila without any special differentiation, conidial secession schizolytic.

Type species: *Cecidiomyces santessonii* U. Braun & Zhurb.

*Etymology.* Derived from 'cecidium' (kekis, kekidos, Greek origin, gall) and '-myces' (mýkes, Greek origin, fungus).

#### ***Cecidiomyces santessonii* U. Braun & Zhurb. sp. nov.**

Mycobank No.: MB 800819

Lichenicolous gall-inducing hyphomycete forming caespitose to sporodochial colonies on thalli of *Stereocaulon* species. Conidiophores semi-macronematous, monoblastic, determinate, reduced to conidiogenous cells. Conidia solitary, 0–1-euseptate, pigmented,  $(12.5\text{--}15.5\text{--}20.0(-24) \times (9.5)10.5\text{--}13.5(-15.0) \mu\text{m}$ . Conidial secession schizolytic.

Type: Australia, Tasmania, Macquarie Island, E shore of Prion Lake,  $54^{\circ}36'S$ ,  $158^{\circ}55'E$ , alt. 150 m, on pseudopodetia of *Stereocaulon argus* growing on rock, 1964, R. Filson 6217 (UPS F-552770—holotype; LE 260898—isotype).

(Figs 1 & 2)

Lichenicolous fungus, inducing the formation of hemispherical, cushion-like to subglobose or somewhat irregularly shaped, basally constricted, often composite gall-like swellings up to 2.5 cm diam., covered by blackish colonies (sometimes with a whitish film

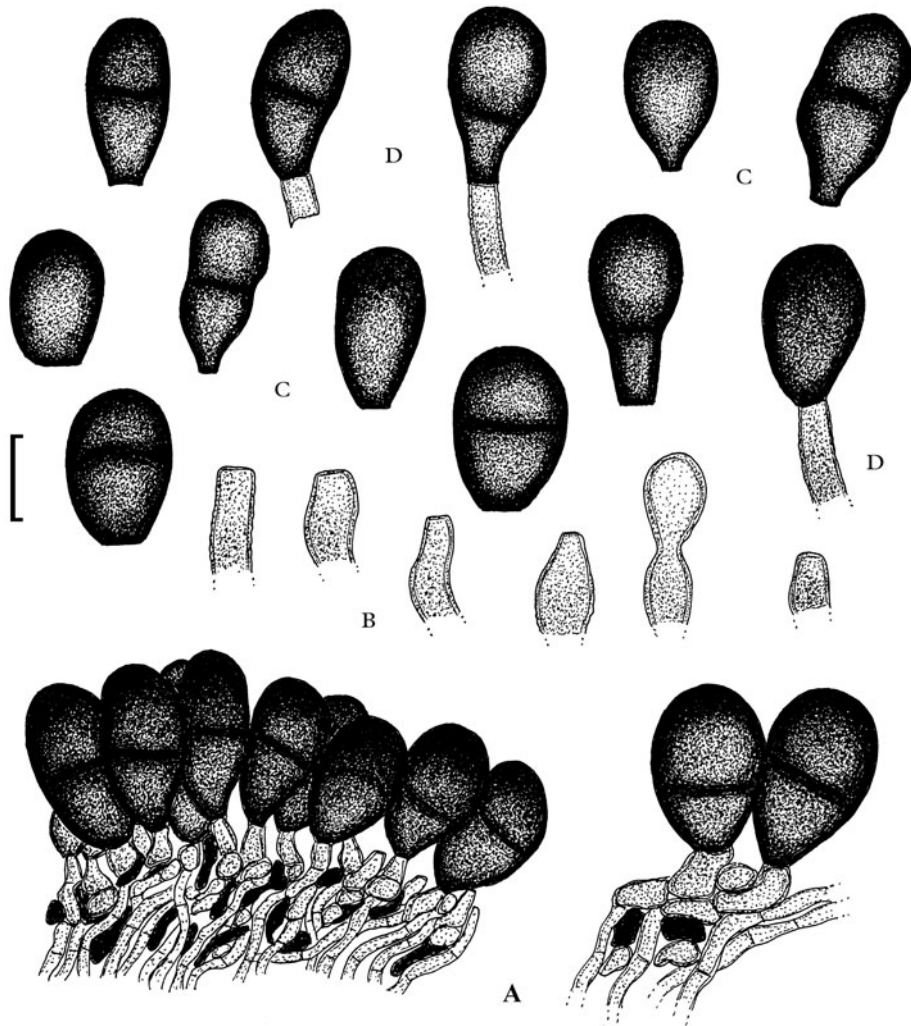


FIG. 2. *Cecidiomyces santessonii* (holotype). A, portions of colonies; B, conidiophores reduced to conidiogenous cells; C, conidia; D, conidia on conidiogenous cells. Scale = 10  $\mu$ m.

probably representing remnants of the host tissues) on pseudopodetia of *Stereocaulon* species. *Mycelium* composed of internal hyphae, almost straight to strongly sinuous, branched, septate, at first subhyaline, later brown, thin-walled, smooth to somewhat rough, 1–4  $\mu$ m wide, loose to dense, forming brown to dark brown stromatic hyphal aggregations. *Fructification* (colonies) superficial, blackish, loosely to densely caespitose to sporodochial.

*Conidiophores* aseptate (i.e. reduced to conidiogenous cells), arising from internal hyphae or stromatic hyphal aggregations, erumpent, erect, short, 4–15  $\times$  3–7  $\mu$ m, straight to slightly curved-sinuous, unbranched, subcylindrical to somewhat ampulliform or irregular, pale to medium brown, wall slightly thickened, almost smooth to verruculose-rugose, monoblastic, determinate (i.e. with a single, non-proliferating terminal conidiogenous locus), truncate to subtruncate, 2–5  $\mu$ m

broad, without any special differentiation. *Conidia* formed singly, subglobose, broadly ellipsoid-ovoid to obovoid or obpyriform, apex broadly rounded, base rounded, truncate to obconically truncate, (12.5–)15.5–20.0(–24.0) × (9.5–)10.5–13.5(–15.0) μm, l/b = (1.1–)1.3–1.7(–2.0) ( $n = 62$ , in water or K), 0–1-septate, septum median or somewhat in the upper or lower half, wall 0.75–2.00 μm thick, smooth or almost so to somewhat rough or irregularly rugose, pigmented, young conidia pale brown, older conidia medium to dark brown, sometimes very dark so that the septum is barely visible, pigmentation uniform or paler below and darker towards the apex, sometimes the upper cell very dark and the lower one much paler, staining umber in K, occasionally with a single or several circular lateral perforations, 0.5–1.5 μm diam., rather inconspicuous in water, but easily visible in K, basal hilum rounded to mostly truncate or almost so, broadly truncate to attenuated, sometimes narrower and peg-like, 3–7 μm wide, wall of the hilum without any special differentiation, conidial secession schizolytic.

*Etymology.* Dedicated to Rolf Santesson, an outstanding expert in lichenicolous fungi, who selected specimens of the fungus for further studies.

*Distribution and hosts.* Known from two localities in the subantarctic tundra biome of Macquarie Island. The species grows on healthy-looking saxicolous *Stereocaulon* species, inducing gall-like swellings on their pseudopodia.

*Additional specimen examined.* **Australia:** Tasmania: Macquarie Island, Mount Waite, 54°39'S, 158°52'E, alt. 375 m, on pseudopodia of *Stereocaulon corticatulum* growing on rock, 1964, R. Filson 5956 (UPS F-552775—paratype).

## Discussion

A key to lichenicolous hyphomycete genera has recently been published by Diederich in Seifert *et al.* (2011). Attempts to identify the present lichenicolous fungus from the Subantarctic, based on this key, did not lead to any appropriate genus. Due to the simple, little differentiated conidiophores, reduced

to monoblastic, determinate conidiogenous cells, giving rise to solitary conidia, this fungus belongs to the Aleuriosporae/Monoblastosporae in the sense of Kiffer & Morelet (1999). The conidiogenous cells are undoubtedly determinate, i.e. no trace of proliferation has been observed, neither percurrent nor sympodial. The conidial secession is certainly schizolytic. In a few conidia, remnants of conidiogenous cells have been observed which were, however, the result of mechanical treatment during the preparation. In naturally shed conidia such remnants have not been seen. Among other hyphomycete genera hitherto not known to have lichenicolous species, there are only a few with comparable characters. *Bactrodesmium* Cooke is characterized by having similar conidiophores and conidiogenesis. Its conidia are formed singly, are often unequally pigmented with paler basal cells, and species of this genus may form sporodochial colonies (Ellis 1971, 1976; Kiffer & Morelet 1999; Seifert *et al.* 2011), but the conidia are usually phragmosporous with three or more septa, often with dark bands at the septa and, above all, the conidial secession is rhexolytic. *Pithomyces* Berk. & Broome and *Trichocladium* Harz are other similar genera (Ellis 1971, 1976; Kiffer & Morelet 1999; Seifert *et al.* 2011). However, species of these genera are non-sporodochial hyphomycetes with effuse mycelium and pleurogenous or integrated conidiogenous cells and often only with peg-like lateral conidiogenous denticles. Most species of *Pithomyces* are phragmo- to dictyosporous, although a few 0–1-septate species have been assigned to this genus, for example *P. cupaniae* (Syd.) M. B. Ellis and *P. africanus* M. B. Ellis (Ellis 1971). *Pithomyces* is easily distinguishable from *Cecidiomyces* by its rhexolytic conidial secession with conspicuous remnants of conidiogenous cells at the base of the conidia. *Trichocladium* species are didymo- to scolecosporous (Ellis 1971, 1976) and the conidia may also be unequally pigmented and similar in shape and size. In addition to differences in the structure of the colonies, the conidial secession in *Trichocladium* is also rhexolytic (Seifert *et al.* 2011), although less conspicuous than in *Pitho-*

*myces. Stanjehughesia* Subram. (Subramanian 1992) is another comparable genus which was segregated from *Sporidesmium* Link: Fr. based on an absence of conidiophores, that was introduced for former species of the latter genus having conidiophores reduced to conidiogenous cells (McKenzie 1995; Réblová 1999; Wu & Zhuang 2005; Marincowitz *et al.* 2008; Seifert *et al.* 2011). However, *Cecidiomyces* and *Stanjehughesia* are only comparable due to their short conidiophores being reduced to conidiogenous cells. All other characters are quite distinct. *Stanjehughesia* comprises saprobic species occurring on bark, wood, twigs, leaf litter and similar substrata with usually effuse conidiophores, and its conidia are always pluriseptate and more or less scolecosporous. The allocation of the new species to this genus would lead to an inappropriate artificial widening of its circumscription. The position of *Stanjehughesia* is equivocal. Réblová (1999) did not recognize this genus and reduced it to synonymy with *Sporidesmium*. Other authors have accepted *Stanjehughesia* and added new species (McKenzie 1995; Wu & Zhuang 2005; Marincowitz *et al.* 2008). Seifert *et al.* (2011) tentatively treated it as a separate genus, keyed out in a special key to genera of the *Sporidesmium* complex. However, several species assigned to *Stanjehughesia* are intermediate between this genus and *Sporidesmium* s. str. in structure of the conidiophores. McKenzie (1995) proposed the combination *Stanjehughesia decorosa* (R. F. Castañeda & W. B. Kendr.) McKenzie ( $\equiv$  *Sporidesmium decorosa* R. F. Castañeda & W. B. Kendr.) for a species with 0–1-septate, sometimes percurrent conidiophores, and Wu & Zhuang (2005) described *S. fasciculata* J. Mena *et al.*, characterized by having 0–2-septate and relatively long ( $30\text{--}65 \times 5\text{--}7 \mu\text{m}$ ) conidiophores, and *S. larvata* (Cooke & Ellis) Subram. with 0–2-septate and very short conidiophores. These intermediate species support Réblová's taxonomic concept.

Due to its lichenicolous habit, induction of gall-like swellings on the host thallus, caespitose to sporodochial colonies, semi-macronematous but distinct monoblastic, determinate, aseptate conidiophores (reduced

to conidiogenous cells), solitary, 0–1-euseptate conidia, and schizolytic conidial secession, the present subantarctic fungus is assigned to a new hyphomycete genus.

Gall induction, as in *Cecidiomyces santessonii*, is a common phenomenon in lichenicolous fungi and known in about 80 species (5%) of this ecological fungal group (Grube & de los Ríos 2001). Three other species growing on *Stereocaulon*, viz. *Plectocarpon stereocaulicola*, *Polycoccum tryphelioides* (Th. Fr.) R. Sant., and *Rhymbocarpus stereocaulorum* (Alstrup & D. Hawksw.) Etayo & Diederich (Zhurbenko 2010a; Kukwa *et al.* 2012), which are all ascoma-forming ascomycetes quite distinct from the new species, also form galls. Other lichenicolous hyphomycetes causing galls, viz. *Hawksworthiana peltigericola* (D. Hawksw.) U. Braun, *Galloea cladoniicola* Alstrup & Søchting (possibly not a genuine gall-inducer), *Refractohilum galligenum* D. Hawksw., *R. peltigeriae* (Keissl.) D. Hawksw., *Taeniolella atricerebrina* Hafellner, and *T. rolffii* Diederich & Zhurb. (Hawksworth 1977, 1980; Braun 1995; Diederich & Zhurbenko 1997; Hafellner 2007; Alstrup & Søchting 2009), are also quite distinct and not comparable with the new species.

*Cecidiomyces santessonii* might easily be added to the worldwide key of fungi growing on *Stereocaulon* (Zhurbenko 2010a) as a counterpart of *Taeniolella christiansenii* Alstrup & D. Hawksw., the only other hyphomycete known from this host genus.

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