**Scleroconidioma, a new genus of dematiaceous Hyphomycetes**

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**Abstract:** *Scleroconidioma sphagnicola* gen.nov. et sp.nov. (Hyphomycetes) is described from necrotic patches of *Sphagnumfuscum* (Schimp.) Klinggr. found in a bog in Alberta, Canada. In the leaves of the host and in culture the fungus forms minute dematiaceous stromata. Hyaline, bacilliform conidia are extruded in succession from papillate conidiogenous cells that develop on the stroma surface. Hyaline bacilliform conidia, as well as a more variable and pigmented conidial type, also arise from short conidiogenous cells or directly from vegetative hyphae in culture. Discrete tufts of white, setiform hyphae also form on agar media and constitute an additional distinctive feature of the new taxon.

**Key words:** taxonomy, mitosporic fungi, stromata, conidiogenesis, *Sphagnum*.

**Résumé:** Les auteurs décrivent le *Scleroconidioma sphagnicola* gen.nov et sp.nov. (Hyphomyctètes) à partir de plages nécrotiques sur le *Sphagnumfuscum* (Schimp.) Klinggr. trouvé en Alberta, au Canada. Dans les feuilles de l’hôte et en culture, le champignon forme de petits stromas démataiacés. Des conidies hyalines bacilliformes sont expulsées en succession par des cellules conidiogènes papillées qui se développent sur la surface du stroma. Les conidies hyalines bacilliformes, ainsi qu’un type de conidies pigmentées et plus variables, se forment également à partir de courtes cellules conidiogènes, ou directement sur le mycélium végétatif, en culture. Des touffes discrètes d’hyphes blanches et sétiformes se forment également sur milieu gélosé et constituent un caractère distinctif additionnel du nouveau taxon.

**Mots clés:** taxonomie, champignons mitosporiques, stromas, conidiogénèse, *Sphagnum*.

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**Introduction**

While examining apparently diseased leaves of the dominant hummock- and peat-forming moss, *Sphagnumfuscum* (Schimp.) Klinggr., in a southern boreal bog in Alberta, we found a peculiar fungus that developed minute dematiaceous stromata from vegetative hyphae growing on and in the leaf tissue. Although the vast majority of stromata collected in nature appeared to be in a dormant state and thus devoid of sporulation, those formed in culture developed papillate conidiogenous cells that extruded hyaline, bacilliform conidia in succession.

This fungus is superficially similar to *Phaeotheca* Sigler et al. or *Phaeosclera* Sigler et al. (Sigler et al. 1981; Tsuneda and Murakami 1985) in forming masses of sclerotic cells on their host plants. However, it differs markedly from these genera in conidiogenesis and other cultural characteristics. This fungus does not fit well with any previously described hyphomycete genera, as far as we are aware, and therefore we herein describe it as a new form-genus *Scleroconidioma* of the Hyphomycetes.

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**Materials and methods**

*Sphagnumfuscum* plants were collected from necrotic patches in a bog, 5 km east of Perryvyle, Alberta, Canada, from early May to late September in 1999. These necrotic patches occurred primarily on mid-hummock and at hummock-top locations. Stromata and hyphae occurring on the bryophyte leaves were examined under light and dissecting microscopes. To obtain pure cultures, stromata were removed from the leaves under a dissecting microscope and washed thoroughly with sterile distilled water. Stromata were then immersed in either 0.5% NaOCl or 70% ethanol for 0.5–1 min, rinsed with sterile distilled water, and air-dried for about 30 min on sterile filter paper in a biohazard hood. The air-dried stromata were crushed with forceps in a small amount of sterile distilled water and air-dried for about 1 h. Cultural and morphological characteristics were examined on CMAD because this medium readily induced conidium production and inhibited the formation of aerial hyphae and hyphal exudates, which concealed details of sporulation. For scanning electron microscopy, 5-mm agar discs were cut from 10- to 30-day-old cultures, washed in phosphate buffer (pH 7.0), and fixed in 2% glutaraldehyde in buffer for 2 h. After rinsing with buffer, these discs were immersed in 2% tannic acid – 2% guanidine hydrochloride solution for 4–5 h, rinsed thoroughly in distilled water, and postfixed overnight in 2% OsO 4 at 5°C. The fixed material was dehydrated in an ethanol series, taken to amylacetate, and critical
point dried in a Polaron E-3000 unit using carbon dioxide. The dried samples were coated with gold and examined with a Hitachi S-510 scanning electron microscope.

**Taxonomy**

*Scleroconidioma* Tsuneda, Currah & Thormann, gen.nov.


**TYPUS GENERIS:** *Scleroconidioma sphagnicola* Tsuneda, Currah & Thormann

**ETYMOLOGY:** Sclerotic cells converted to a conidiovia.

Mitosporic dematiaceous fungus. Stromata minute and irregularly lobed, of thick-walled fungal cells, resembling sclerotia and giving rise to papillate conidiogenous cells at the surface. Conidia bacilliform, hyaline, single-celled and extruded in a series through a pore at the apex of the papilla.

*Scleroconidioma sphagnicola* Tsuneda, Currah & Thormann, sp.nov.

Hyphae septatae, dematiaceae, 3–5 μm latae, in foliis vel intra folia Sphagni fusci hospitalis; in culturis novis morphologia hypharum similis, sed in culturis maioribus uvae cristaedae ad 300 μm vel longiores hypharum setosarum splendide-albarum adsunt. Stromata minuta, prepinque ad brevibus conidiogenes vel directe ex hyphis vegetativis. Thormann, sp.nov.

Scleroconidioma sphagnicola Tsuneda, Currah & Thormann, gen.nov.

**HOLOTYPE:** UAMH 9731, dried plants of *Sphagnum fuscum* bearing stromata, collected 5 km east of Perryvale, Alberta, Canada, Sept. 20, 1999, A. Tsuneda. A culture and dried colonies prepared from the type specimen are also preserved in UAMH.

**ETYMOLOGY:** Occurring on *Sphagnum*.

On leaves of *Sphagnum fuscum*: hyphae light to dark brown, mostly 3–5 μm wide, septate, branched, often penetrating into host tissues; sclerotic cells developing by division of terminal or intercalary hyphal cells, darkly pigmented, thick walled; stromata forming by the aggregation of adjacent masses of sclerotic cells, black, irregular in shape, measuring up to 200 μm or longer in diameter (Fig. 1, arrows). Conidiogenous cells, found rarely on stromata from host, squat ampulliform, mostly 4.5–6 μm wide at the broadest portion, papillate. Conidia hyaline, one-celled, bacilliform, mostly 1 x 3–4.5 μm.

On CMAD, colonies dark brown to greenish brown with a narrow white margin, smooth when young, becoming somewhat flocculose with age, containing 49–51 mm diameter in 10 days at 20°C in the dark. Hyphae, mostly submerged in young cultures, light to dark brown, smooth or sometimes rough surfaced, septate, 2.5–6 μm wide (Figs. 2–4); aerial hyphae abundant in older cultures, erect, septate, branched, up to 300 μm or longer, at the base light brown, straight or sometimes moniliform, 2.5–3 μm wide, becoming hyaline, tapered, 1–2.5 μm wide at the tip, arising from sclerotic cells (Fig. 5, arrows) or more commonly from submerged hyphae in a small clusters, forming shiny white tufts (Fig. 6). Masses of sclerotic cells abundant in young colonies (Fig. 2), light brown when actively dividing (Fig. 3, arrows), but soon becoming dark brown to black. Stromata, consisting of many sclerotic cells, black, subglobose (Fig. 4), mostly 30–80 μm diameter, often aggregating to form large and lobate clumps (Fig. 7). Conidiogenous cells either newly developing from or by conversion of pre-existing surface cell layer of the stromata, squat ampulliform, mostly 4.5–7 μm wide at the broadest portion, papillate, having a single conidiogenous locus below papilla inside the cell; conidia bacilliform, hyaline, one-celled, 0.9–1 x 3–5.5(7.5) μm, extruded in succession from a central pore in the papilla (Figs. 7–9). Conidia also arising from hyphae, either hyaline or variously pigmented; hyaline conidia indistinguishable from those produced on conidiomata in shape and size, developing biastically from more or less rod-shaped conidiogenous cells, mostly 1–3 x 1–5 μm (Fig. 10), often appearing annellate (Fig. 11, arrowhead); pigmented conidia variable in shape, size, and degree of pigmentation, commonly fusiform, clavate or spathulate, 1–3 x 6.5–9 μm, one-celled or occasionally two or more celled, arising singly and directly from hyphal cells or sympodially from peg-shaped conidiogenous cells (Fig. 11, arrow).

**Discussion**

A wide variety of fungi ranging from myxomycetes to basidiomycetes have been reported to be associated with mosses, including *Sphagnum* spp. (Racovitza 1959; Coker 1966; Bowen 1968; Döbbeler 1978, 1986; Redhead 1981; Berch and Fortin 1983; Nakase and Suzuki 1985; Bandoni and Marvanová 1989; Horak and Miller 1992). Felix (1988) reviewed the literature and provided an extensive list of bryophilous fungi. Although a variety of different dematiaceous taxa are listed, no fungus resembling *S. sphagnicola* is found.

Among previously established hyphomycete genera, *Phaeotheca* and *Phaeosclera* are superficially similar to *S. sphagnicola* in forming masses of black sclerotic cells on host plants but differ in that the former genus produces endo-conidia in sclerotic mother cells, and the latter is devoid of sporulation (Sigler et al. 1981; Tsuneda and Murakami 1985). *Sarcinomyces crustaceus* Lindner forms clusters of sclerotic cells in culture, but this fungus produces conidia singly by budding and lacks true hyphae (Sigler et al. 1981).

Colonial appearance of *S. sphagnicola* on CMA and MEA was similar to that on CMAD, which is described above. However, colonies were black and more or less carbonaceous on PDA because of the enhanced production of aggregating sclerotic cells, aerial hyphae, and hyphal exudates. Among these media, CMAD was the most suitable for the observation of cultural characteristics because of suppressed formation of aerial hyphae and hyphal exudates as well as ready production of actively sporulating stromata, which is the most important delimiting characteristic of *S. sphagnicola* (Figs. 7 and 8). Bacilliform conidia form successively from a single conidiogenous locus inside the conidiogenous cell,
Figs. 1–6. Development of stromata and hyphal tufts. Fig. 1. Black, irregularly shaped stromata (arrows) formed at the apex of a *Sphagnum fuscum* leaf. Scale bar = 200 µm. Figs. 2–6. On corn meal agar with dextrose (CMAD). Fig. 2. Dividing hyphal cells. Scale bar = 20 µm. Fig. 3. Masses of sclerotic cells. Actively dividing cells at the surface are thin walled and light brown (arrows), whereas sclerotic cells inside are highly pigmented. Scale bar = 10 µm. Fig. 4. Stromata. Those shown in this figure are mostly aerial ones (arrows), but many develop also within the agar (arrowheads). Scale bar = 100 µm. Fig. 5. Hyaline aerial hyphae (arrows) arising from sclerotic cells. Scale bar = 10 µm. Fig. 6. Hyphal tufts consisting of branched, hyaline, aerial hyphae most of which have arisen from submerged pigmented hyphae. Scale bar = 100 µm.

Figs. 7–11. Conidial development on corn meal agar with dextrose. Fig. 7. Scanning electron micrograph of actively sporulating stromata covered with a conidiogenous cell layer. Adjacent stromata often aggregate. Fig. 8. Enlarged view of a part of Fig. 7, showing emerging conidia (arrows) from ostiole-like openings of conidiogenous cells. Fig. 9. Bacilliform conidia detached from a stroma. Nomarsky interference (NI), oil immersion. Scale bar = 10 µm. Fig. 10. Conidiogenous cells developed from a vegetative hypha. Conidia are nearly identical in shape with those shown in Fig. 9. NI, oil immersion. Scale bar = 10 µm. Fig. 11. Sympodial conidia (arrow) and an annellide-like conidiogenous cell (arrowhead) occurring on the same hypha. NI, oil immersion. Scale bar = 10 µm.
but it is yet uncertain whether the conidiogenesis is phialidic or annellidic.

Conidia developing from vegetative hyphae were pleomorphic and observed only in culture. They varied in shape and degree of pigmentation, but form two groups: (i) hyaline, one-celled, bacilliform conidia (Fig. 10) similar to those formed from stromata; and (ii) variously pigmented, one- or more-celled conidia, larger than those of group i and irregular in shape. The exact mode of conidiogenesis in group i is uncertain, although it may be annellidic (Fig. 11, arrowhead). In group ii, conidia arise either singly or sympodially (Fig. 11, arrow) from a vegetative hypha. Transmission electron microscopy of this fungus is in progress to elucidate the details of conidiogenesis.

In nature, stromata of *S. sphagnicola* were found only on apparently diseased leaves of *S. fuscum* and conidiogenous cells were absent on the majority of stromata. Our subsequent inoculation tests and ultrastructural investigation revealed that *S. sphagnicola* is, in fact, the causal agent of a necrotic disease of the moss and that most of the component cells of stromata contain large lipid bodies (A. Tsuneda, M.N. Thorlman, and R.S. Currah, unpublished data). It appears that stromata of this fungus remain dormant during the majority of the growing season and survive until environmental conditions become favorable for conidium production and dispersal.

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**References**


