

## Two new species of *Synaptospora*

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*Synaptospora plumbea* and *S. setosa* are described and illustrated based on material from Europe and North America and are compared with *S. petrakii*. The genus *Synaptospora* is characterized by globose, superficial ascomata, cylindrical, stipitate asci and uniseriate, brown, one-celled ascospores that have the tendency to become fused together in groups of two to eight, becoming flattened along the area of contact. *Synaptospora setosa* differs from the other species by setose ascomata and *S. plumbea* differs by not having ascospores fused in groups. These two species also differ by having a basal stroma that forms distinctly delimited circular areas in the substrate surrounding the ascomata.

Keywords: Coniochaetaceae, *Collematospora*, *Roselliniopsis*, systematics, Trichosphaeriaceae

The temperate genus *Synaptospora* Cain was described for two species (Cain, 1957), *S. petrakii* Cain on decorticated wood and the lichen-inhabiting *S. tartaricola* (Nyl.) Cain that was subsequently transferred to *Roselliniopsis* Matzer and Hafellner (Matzer, 1993). *Synaptospora* is characterized within the Coniochaetaceae by globose, superficial ascomata, cylindrical, stipitate asci and uniseriate, brown, one-celled ascospores that have the tendency to become fused together in groups of two to eight, becoming flattened along the area of contact (Cain, 1957; Barr, 1990). Two new species were encountered in North America and Europe; these are described and illustrated and a key to all species is provided.

### Materials and methods

Ascomata were mounted first in water, then replaced with lactophenol containing azure A. Measurements were made of material in water. Ascomata were sectioned at 5 µm for light microscopy using the techniques of Huhndorf (1991) and images were captured using bright field (BF), phase contrast (PH) and differential interference

microscopy (DIC). Images were captured and photographic plates were produced following the methods of Huhndorf and Fernández (1998). These methods are discussed further in the electronic image management website at URL:

[http://www.fmnh.org./candr/botany/botany\\_sites/imagenage/intropage.htm](http://www.fmnh.org./candr/botany/botany_sites/imagenage/intropage.htm).

### Key to species

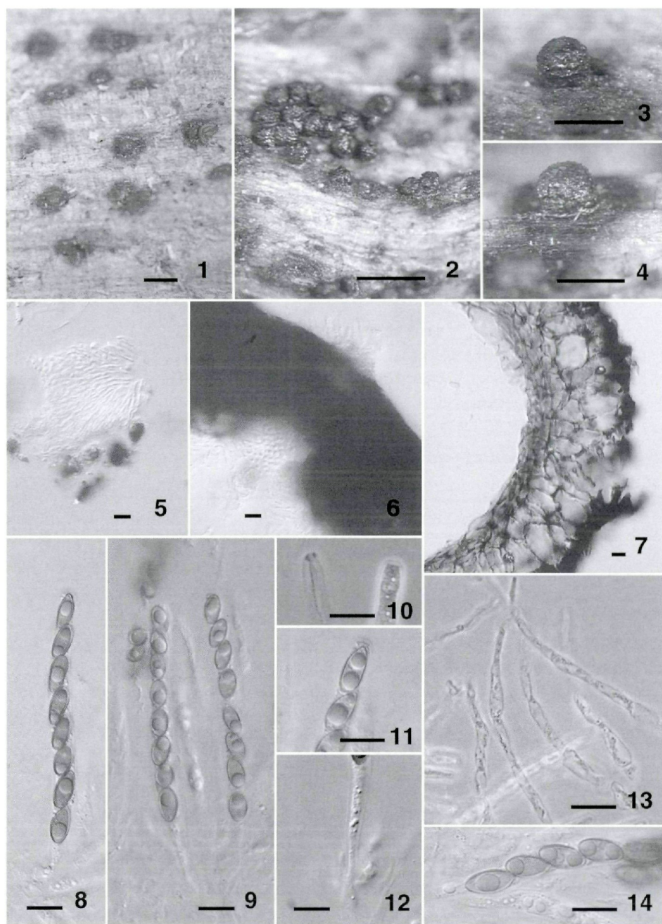
1. Ascospores usually becoming fused obliquely in groups of two to eight, becoming flattened in shape along the area of contact . . . 2
1. Ascospores not becoming fused in groups, ascomata globose, superficial, metallic gray color, with a circular basal stroma in the substrate . . . . . *S. plumbea*
2. Ascomata setose, with a circular basal stroma in the substrate, ascospores  $7.5-9 \times 5-6 \mu\text{m}$  . . . . . *S. setosa*
2. Ascomata coarsely roughened with elevated areas, lacking basal stroma, ascospores  $6-11 \times 5-6 \mu\text{m}$ . . . . . *S. petrakii*

***Synaptospora plumbea*** S. Huhndorf, F. A. Fernández & F. Candous-sau, sp. nov. – Figs. 1–14.

Ascomata numerosa, globosa,  $300-350 \mu\text{m}$  diametro, non papillata, pagina ascomatis aspera, stromate circulari, basali. Parietis ascomatis superficialis textura angularis-prismatica, in sectione longitudinali  $66-83 \mu\text{m}$  crassus, distriatus. Ascii cylindrici,  $80-95 \times 6-7.5 \mu\text{m}$ , stipitati, pars sporifera  $65-75 \mu\text{m}$ , octospori, uniseriati. Ascosporae ellipsoideae,  $8-11 \times 4.5-5.5 \mu\text{m}$ , brunneae, non septatae, sine vagina vel appendicibus, non connataescenter aggregatae.

Holotype. – U.S.A. ILLINOIS: Ogle Co., White Pines Forest State Park, 28 Sep. 1996, on 1 m log, S. M. Huhndorf 2708, with F. Fernández (F).

Ascomata globose, non-papillate, not collapsing when dried;  $300-350 \mu\text{m}$  diameter; numerous, gregarious or separate; superficial; surface roughened, appearing shining black to metallic gray; stroma basal, forming distinctly delimited circular area in the substrate surrounding 1 to several ascomata. – Ascomal wall of *textura angularis-prismatica* in surface view, composed of cells radiating outward from multiple loci of darker cells; in longitudinal section 2-layered, inner layer  $12-18 \mu\text{m}$  thick, composed of 4–6 layers of pale brown, elongate to flattened, pseudoparenchymatic cells, outer layer  $55-65 \mu\text{m}$  thick, composed of 4–6 layers of pale brown, polygonal to globose, pseudoparenchymatic cells, with an external, melanized crust. – Ascomatal apex ostiolate, with periphyses. – Paraphyses  $4-6 \mu\text{m}$  wide; septate, some cells swollen; abundant; persistent; without gelatinous coating. – Ascii cylindrical;  $80-95 \times 6-7.5 \mu\text{m}$ ; stipitate, spore bearing part  $65-75 \mu\text{m}$ ; numerous; basal and lateral, lining the peripheral wall of the centrum; unitunicate; apex blunt,



Figs. 1-14. *Synaptospora plumbea*. - 1-4. Ascomata on substrate. - 5. Periphyses. - 6. Ostiole. - 7. Longitudinal section through ascomatal wall. - 8, 9. Asci. - 10, 11. Ascus apices. - 12. Ascus base. - 13. Paraphyses. - 14. Ascospores. - Figs. 1-4 = macroscopic view; 5-9, 11, 12, 14 = DIC; 10, 13 = PH. - Scale bars: 1, 2 = 1 mm; 3, 4 = 0.5 mm; 5-14 = 10  $\mu$ m. - Figs. 1, 4-6, 9, 12 from FC 447; 2, 3, 7, 8, 10, 11, 13, 14 from SMH 2708.

with small ring; with 8, uniseriate ascospores. – Ascospores ellipsoid;  $8-11 \times 4.5-5.5 \mu\text{m}$ ; brown; wall smooth; 1-celled; without sheath or appendages; not becoming fused in groups.

**Etymology.** – Lead-colored, referring to the metallic ascomatal color.

**Habitat.** – On bark and decorticated wood.

**Anamorph.** – None known.

**Known distribution.** – France, U.S.A. (Illinois).

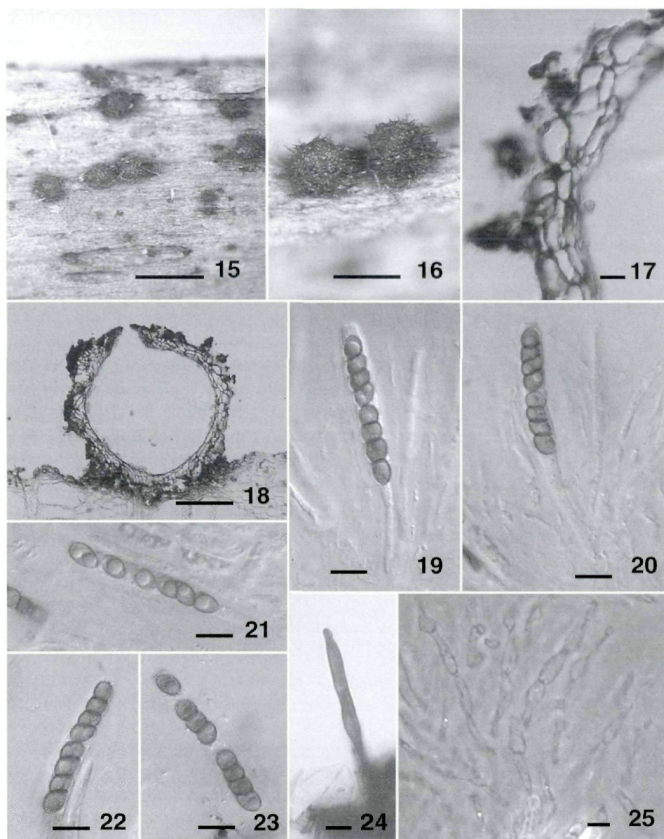
**Other material examined.** – FRANCE. Pyrénées Atlantiques (64): Forêt Domaniale d'Oloron, 22 Oct. 1995, on *Quercus* bark, F. Candoussau 397; Parking Forêt Oloron, 23 Jun. 1996, on *Quercus* bark on the ground, F. Candoussau 444; 20 Oct. 1996, on *Quercus*, F. Candoussau 447; Bois Bastard de Pau, 30 Jun. 1996, on rotten *Betula* wood, F. Candoussau 445 (F). U.S.A. ILLINOIS: Ogle Co., White Pines Forest State Park, 28 Sep. 1996, on 30 cm log, S. M. Huhndorf 2693, with F. Fernández (F).

***Synaptospora setosa*** S. Huhndorf, F. A. Fernández & F. Candoussau, sp. nov. – Figs. 15-25.

Ascomata numerosa, globosa, 300–350  $\mu\text{m}$  diametro, non papillata, pagina ascomatis setosa, stromate circulari, basali. Parietis ascomatis superficialis textura angularis, in sectione longitudinali 40–60  $\mu\text{m}$  crassus, unistriatus. Asci cylindrici,  $65-75 \times 7.5-8.5 \mu\text{m}$ , stipitati, pars sporifera 40–50  $\mu\text{m}$ , octospori, uniseriati. Ascosporae ellipsoidae,  $7.5-9 \times 5-6 \mu\text{m}$ , brunneae, non septatae, sine vagina vel appendicibus, connataescenter ternae vel quinque aggregatae, oblique compressae.

**Holotype.** – FRANCE. Pyrénées Atlantiques (64): Forêt Domaniale d'Oloron, 15 Aug. 1997, on *Quercus rubra* on the ground, F. Candoussau 508 (F).

Ascomata globose, non-papillate, not collapsing when dried; 300–350  $\mu\text{m}$  diameter; numerous, gregarious or separate; superficial; surface setose, dark brown appearing black; setae short, pointy, brown, thick-walled, septate; stroma basal, forming distinctly delimited circular area in the substrate surrounding 1 to several ascomata. – Ascomal wall of *textura angularis* in surface view; in longitudinal section 1-layered, 40–60  $\mu\text{m}$  thick, irregular with thickened patches, composed of 5–10 layers of pale brown, polygonal to globose, pseudoparenchymatic cells, with an external, melanized crust. – Ascomatal apex ostiolate, with periphyses. – Paraphyses 3–7  $\mu\text{m}$  wide; septate, some cells swollen; abundant; persistent; without gelatinous coating. – Asci cylindrical;  $65-75 \times 7.5-8.5 \mu\text{m}$ ; stipitate, spore bearing part 40–50  $\mu\text{m}$ ; numerous; basal and lateral, lining the peripheral wall of the centrum; unitunicate; apex truncate, blunt, with indistinct ring; with 8, uniseriate ascospores. –



Figs. 15–25. *Synaptospora setosa*. – 15, 16. Ascomata on substrate. – 17. Longitudinal section through ascomatal wall. – 18. Longitudinal section through ascoma. – 19, 20. Ascus. – 21–23. Ascospores. – 24. Ascomal seta. – 25. Paraphyses. – Figs. 15, 16 = macroscopic view; 17, 19–24 = DIC; 18 = BF; 25 = PH. – Scale bars: 15 = 1 mm; 16 = 0.5 mm; 17, 19–25 = 10  $\mu$ m; 18 = 100  $\mu$ m. – Figs. 15, 16, 19–25 from FC 508; 17, 18 from SMH 2692.

Ascospores ellipsoid; 7.5–9  $\times$  5–6  $\mu$ m; brown; wall smooth; 1-celled; without sheath or appendages; usually becoming fused obliquely in groups of three to five, becoming flattened in shape along the area of contact.

**Etymology.** – Setose, referring to the ascomatal surface.

**Habitat.** – On decorticated wood.

**Anamorph.** – None known.

**Known distribution.** – France, U.S.A. (Illinois).

**Other material examined.** – U.S.A. Illinois, Ogle Co., White Pines Forest State Park, 28 Sep 1996, on wood, S. M. Huhndorf 2692, with F. Fernández (F).

### Discussion

All species of *Synaptospora* have ascomata that are superficial on the substrate. *Synaptospora plumbea* and *S. setosa* are similar to each other in having a basal stroma surrounding each individual ascoma. This appears prominently on the substrate as a circular dark area approximately as large as the diameter of the ascoma (Figs. 1–4, 15). This feature was not described for *S. petrakii* but could be present and might have been overlooked because according to Cain (1957) the substrate had a blackened surface. The type specimen of *S. petrakii* was not seen and must be examined to determine if this feature is present. Both *S. plumbea* and *S. setosa* have ascomata with firm walls that have a dark outer wall layer (Figs. 7, 17); *S. petrakii* was described as being carbonaceous (Cain, 1957). In *S. petrakii* the outer surface is given as coarsely roughened with elevated areas, as is the case in *S. setosa*. However, *S. setosa* differs from the other species in having setae and *S. plumbea* differs in its shiny gray lustre.

The asci of *S. plumbea* have a narrow apical ring (Fig. 10) as do the asci of *S. petrakii* (Cain, 1957). In *S. setosa* the ascus apex is truncate but a ring is not distinct. The paraphyses in *Synaptospora* are relatively wide and septate with occasional cells somewhat swollen (Figs. 13, 25).

*Synaptospora plumbea* differs from the other two species in ascospore morphology and arrangement. In this species the ascospores remain ellipsoid and separate whereas in the other species the ascospores become fused obliquely in groups of two to five and become flattened along the area of contact (Figs. 19–23). However in some asci in *S. plumbea*, the ascospores show a slight tendency to segregate into groups, in this case four and four (Fig. 9). *Roselliniopsis tartaricola* (Nyl.) Matzer also shows this feature (Cain, 1957) as does *Collematospora venezuelensis* Jeng and Cain (Jeng & Cain, 1976). The dung-inhabiting *C. venezuelensis* differs from *S. setosa* and *S. petrakii* in its fused ascospores forming a dextrinoid, membrane-like structure. The ascomata of *C. venezuelensis* have setae and the wall in longitudinal section is firm (given as “membranaceous to semi-

coriaceus" in Jeng & Cain, 1976) and shows a similar arrangement of the cells in a dark outer wall layer as in *S. plumbea* and *S. setosa*.

All attempts to obtain *S. plumbea* and *S. setosa* in culture were unsuccessful as were attempts to include it in molecular analyses using DNA extraction from intact ascomata. Jeng & Cain (1976) arranged the genus in the Trichosphaeriaceae but Eriksson & Hawksworth (1991) removed it to "unitunicate ascomycetes, *inc. sed.*" and later accepted it in the Coniochaetaceae (Eriksson & Hawksworth, 1993). Preliminary molecular data from the large subunit nuclear ribosomal DNA gene (25S) (Huhndorf, Fernández, Miller and Lutzoni, unpublished), place members of the Coniochaetaceae (*Coniochaeta* sp. and *Coniochaetidium* sp.) in the same clade with strong bootstrap support but the higher-level relationship of this clade remains unclear. No members of the Trichosphaeriaceae have been included in these molecular analyses yet. Based on morphology, the Trichosphaeriaceae and the Coniochaetaceae are both being examined as possible placements for *Synaptospora* and *Collematospora* Jeng & Cain, but at this time judgement is reserved.

### Acknowledgments

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