

Revisiones Generum Obscurorum Hyphomycetum: A revision of *Graphiothecium* Fuckel and *Stromatostysanus* von Höhnel*

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The anamorph genus *Graphiothecium* and the segregate genus *Stromatostysanus* are redescribed. The two genera are synnematosus, basistromatic hyphomycetes with enteroblastic conidiogenesis and small, aseptate conidia. In the present circumscription, *Graphiothecium* contains the type species, *G. fresenii*, *G. phyllogenum* and *G. ariae*. *Stromatostysanus* includes *St. pungens* [= *St. caprifoliorum*, type species] and *St. curvus*. The affinity of *Graphiothecium* and *Stromatostysanus* to teleomorphic states is unknown. A list of excluded species is included.

Keywords: *Graphiothecium*, *Stromatostysanus*, taxonomy.

Fuckel (1870) described the new genus *Graphiothecium*, with its type species, *G. fresenii*, a synnematosus hyphomycete saprophytic on dead *Viburnum* leaves. Saccardo (1886) adopted Fuckel's genus and added several species, including *G. parasiticum* (Desm.) Sacc. Lindau (1910) followed Saccardo's generic concept, but Höhnel (1919) excluded *G. parasiticum* from *Graphiothecium* and placed it in the new genus *Stromatostysanus* [type species: *St. caprifoliorum* (Desm.) Höhnel, syn.: *G. parasiticum* (Desm.) Sacc.]. This segregation was not recognized by most subsequent authors (e.g. Clements & Shear, 1931; Morris, 1963; Carmichael & al., 1980). Morris's (1963) description and illustration of *Graphiothecium* are not diagnostic. The depicted fungus ("G. *parasiticum*, drawn from herbarium material", but details on the material are absent) is neither the type species of the genus nor conspecific with *G. parasiticum*. Kendrick & Carmichael (1973) illustrated "*Graphiothecium fresenii*" but the source of their drawing (pl. 11c) is also unrecorded. The depicted monophialidic

* See Seifert, K. A. & M. A. Vincent (1992). *Sydowia* 44 (2): 307–320.

conidiogenous cells are characteristically constricted near the apex, differing from those of the true *G. fresenii*.

The structure of the conidiogenous cells and conidiogenesis in *Graphiothecium* s. l. are fairly uniform. The conidiogenous cells are terminal or lateral, sympodially proliferating and cicatrized. Each mature conidiogenous cell possesses two or more conspicuous conidial scars. These scars are about 0.5–1.25 µm wide. A minute central pore is surrounded by a conspicuous, narrow, somewhat darkened margin. The conidiogenesis is enteroblastic (polytretic or polyphialidic). The conidia are formed in chains. The function of the basal stroma is not quite clear. The conidiomata look like immature perithecia, but there is no evidence for an ostiole or a lumen. No central channel in the 'stipe' was observed.

Seifert & Okada (1990) surveyed morphological and anatomical variability of synnematosus conidiomata. Their terminology is applied in the present paper.

Following the system of Seifert & Okada (1990), *Graphiothecium* can be described as follows: synnemata determinate, with basistromatic stipes with a divergent capitulum, stipes composed of parallel hyphae, monomitic (= type f in Seifert & Okada, 1990, p. 31, fig. 1). *Stromatostysanus* is characterized by basistromatic, indeterminate synnemata with parallel, monomitic stipes and a loose fertile zone (= type l in Seifert & Okada, 1990, p. 31, fig. 1, but basistromatic). Because of these conspicuous differences in the morphology of the synnemata, the separation between *Graphiothecium* and *Stromatostysanus* is justified.

Key to species of *Graphiothecium* and *Stromatostysanus*

- 1 Basistromatic synnemata determinate, with loose to dense divergent capitulum *Graphiothecium*, 2
- 1* Basistromatic synnemata indeterminate, with loose fertile zone, spread over almost the entire stipe, without capitulum *Stromatostysanus*, 4
- 2 Stipes with dense, compact capitulae, enlarged, free hyphal ends with conidiogenous cells short, ca. 10–20 µm long, stromatic base large, ca. 90–180 µm diam., conidia 5–10 x 3–5 µm, smooth, pale olivaceous to yellowish brown, on dead leaves of *Amelanchier* and *Sorbus* 1.3 *Graphiothecium ariae*
- 2* Stipes with loose, divergent capitulae, not compact, free hyphal ends with conidiogenous cells long, ca. 10–60 µm long, stromatic base smaller, ca. 50–100 µm diam.3

- 3 Stipes about 100–450 μm long, conidia small, ca. 4–10 x 1.5–3 μm , hyaline to pale greenish, brownish, smooth, on dead *Fragaria* leaves 1.2 *Graphiothecium phyllogenum*
- 3* Stipes shorter, about 50–100 μm long, conidia larger, ca. 8–18 (–25) x 2.5–5 μm , hyaline, almost smooth to verruculose, on dead *Viburnum* leaves 1.1 *Graphiothecium fresenii*
- 4 Stipes straight or only slightly curved, gradually attenuated towards the apex, apex subacute, more or less pointed, on dead *Lonicera* leaves 2.1 *Stromatostysanus pungens*
- 4* Stipes almost straight to usually curved, sinuous to almost spirally twisted, not or only slightly attenuated towards the apex, apex obtuse, rounded, on dead *Ribes* leaves
..... 2.2 *Stromatostysanus curvus*

Taxonomic part

1. *Graphiothecium* Fuckel, Jahrb. Nass. Ver. Naturk. 23–24: 366. 1870. emend. U. Braun
= *Fresenia* Fuckel, Fungi Rhen. Exs., Suppl., Fasc. I, No. 1537, Hostrichiae ad Rhenanum. 1865. A later homonym of *Fresenia* DC., 1836, Compositae.

Type: *Graphiothecium fresenii* Fuckel, l. c.

Saprophytic, synnematos Hyphomycetes. – Synnemata determinate, basistromatic, with loose to dense, divergent capitulae, stromatic base broadly conic to subglobose, partly immersed in the substrate, dark brown to blackish, composed of *textura angularis*, stipes composed of parallel, brown, septate hyphae, monomitic. – Conidiogenous cells apical, integrated, pale, sympodially proliferating, cicatrized, enteroblastic (polytretic or polyphialidic), each conidiogenous locus with a minute central pore surrounded by a conspicuous, narrow, somewhat darkened margin. – Conidia catenate, aseptate, hyaline to faintly coloured, smooth to verruculose. Teleomorphs unknown.

- 1.1. *Graphiothecium fresenii* Fuckel, Jahrb. Nass. Ver. Naturk. 23–24: 366. 1870. – Fig. 1.
= *Fresenia penicillata* Fuckel, Fungi Rhen. 1537 (1865), nom. illegit. Art. 64.

Synnemata on old, rotten leaves of *Viburnum lantana*, scattered or loosely grouped, basal stromata broadly conic to subglobose, partly immersed in the substrate, ca. 50–100 μm diam., dark brown to blackish. – Stipes at first fairly loose, later compact, dense, ca. 50–100 μm long, 10–25 μm wide, hyphae parallel, brown,

septate, smooth, apically splaying out. – Loose, divergent, free hyphal ends with conidiogenous cells ca. $10\text{--}30 \times 1.5\text{--}3.5 \mu\text{m}$, paler, subhyaline to pale brown. – Conidia ellipsoid, ovoid, fusiform, $8\text{--}18\text{--}(25) \times 2.5\text{--}5 \mu\text{m}$, hyaline, almost smooth to verruculose.

Material examined. – GERMANY: Budenheim, on *Viburnum lantana*, Fuckel, Fungi Rhen. 1537 (Lectotype, here designated, HAL). The original material of *G. fresenii* was distributed by Fuckel in "Fungi Rhenani". Hence, the proposed lectotypification is necessary). On *Viburnum lantana*, herb. Winter, no. 56, sub *Stysanus sphaeriaeformis* Auersw. (B).

1.2. *Graphiothecium phyllogenum* (Desm.) Sacc., Syll. Fung. 4: 628. 1886. – Fig. 2.

= *Graphium phyllogenum* Desm., Ann. Sci. Nat., bot., 3 sér., 16: 297. 1851.

Synnemata on old, rotten leaves of *Fragaria* spp., scattered to loosely grouped, basal stromata subglobose, partly immersed, ca. $50\text{--}100 \mu\text{m}$ diam., dark brown to blackish. – Stipes dense, compact, ca. $100\text{--}450 \times 25\text{--}40 \mu\text{m}$, hyphae parallel, brown, septate, smooth, apically splaying out, loose, divergent. – Free hyphal ends with conidiogenous cells paler, up to $60 \mu\text{m}$ long, $2\text{--}5 \mu\text{m}$ wide. – Conidia ellipsoid, ovoid, $4\text{--}10 \times 1.5\text{--}3 \mu\text{m}$, smooth, hyaline to pale greenish or brownish.

Material examined. – FRANCE: on *Fragaria vesca*, Roum., Fungi gall. exs. 1781 (B). GERMANY: on *F. virginiana*, Thüm., Myc. univ. 585 (B, HAL). On *Fragaria* sp., Thuringia, Arnstadt, 1867, Fleischhack (B).

1.3. *Graphiothecium ariae* (DC.) U. Braun comb. nov. – Fig. 3.

Bas.: *Sphaeria ariae* DC., Fl. Fr. 6: 131. 1815.

= *Stysanus sphaeriaeformis* Auerswald, in Gonnerm. & Rabenh., Myc. eur., Heft 5–6 (Dresden), p. 28. 1869. A later homonym of *St. sphaeriaeformis* Fuckel, 1863, see below.

= *Graphiothecium parasiticum* auct. p.p.

Synnemata on old, rotten leaves of *Amelanchier* and *Sorbus* spp., scattered to loosely grouped, basal stromata subglobose, partly immersed, ca. $90\text{--}180 \mu\text{m}$ diam., dark brown to almost black. – Stipes dense, compact, ca. $350\text{--}800 \mu\text{m}$ long, $15\text{--}55 \mu\text{m}$ wide, hyphae parallel, brown, septate, paler above, apically enlarged, with a dense, compact capitulum. – Free hyphal ends with conidiogenous cells fairly short, ca. $(5\text{--})10\text{--}20\text{--}(25) \times 1.5\text{--}3 \mu\text{m}$, pale. – Conidia ellipsoid, ovoid to somewhat asymmetric, ca. $5\text{--}10 \times 3\text{--}5 \mu\text{m}$, smooth, subhyaline to pale olivaceous or yellowish brown.

Material examined. – FRANCE: as *Sphaeria ariae* DC., on *Sorbus aria*, May, f.f. 3683, herb. de Candolle 324 (Lectotype, here designated, G). There are three original samples of *S. ariae* in herb. de Candolle. Therefore, the present lecto-

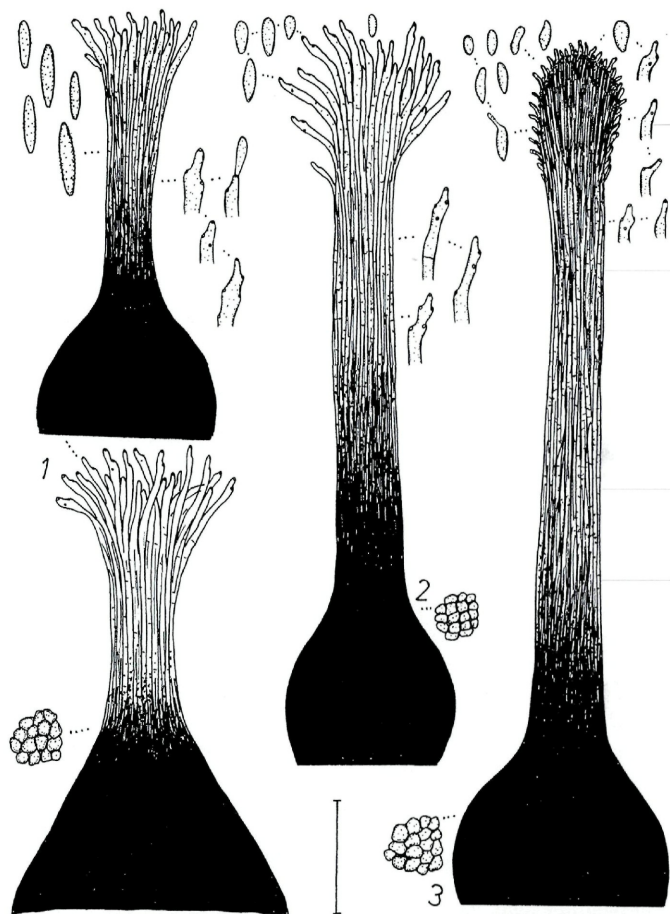


Fig. 1-3. - Synnemata, conidiogenous cells, conidia, and surface cells of stroma (textura angularis). - 1. *Graphiothecium fresenii* (based on type material). - 2. *G. phyllogenum* (based on Roum., Fungi sel. exs. 1781). - 3. *G. ariae* (based on type material).
Bar = 50 μ m (for synnemata).

typification is proposed). – ITALY: as *Stysanus sphaeriaeformis* Auerswald, on *Amelanchier vulgaris*, Tirol, Beutte, 16–6–1869, Auerswald (Lectotype, here designated, B. Auerswald cited several collections in the original description of *S. sphaeriaeformis*. Hence, the proposed lectotypification is necessary). – GERMANY: On *Sorbus aria*: Fuckel, Fungi Rhen. 877 (HAL); Rabenh., Fungi eur. 1354 (B, HAL); Thuringia, Arnstadt, VI. 1864, Auerswald (B). – SWITZERLAND: Neuchâtel, on *Sorbus aria*, IV. 1871, Morthier (B).

2. *Stromatostysanus* Höhnel, Ber. deutsch. Bot. Ges. 37: 153. 1919.

Type: *Stromatostysanus caprifoliorum* (Desm.) Höhnel, l. c. [= *St. pungens* (Wallr.) U. Braun].

Saprophytic, synnematos Hyphomycetes. – Synnemata indeterminate, basistromatic, base subglobose, partly immersed, dark brown to blackish, composed of textura angularis, with a loose, fertile zone, spread over almost the entire stipe. – Stipes composed of parallel hyphae, brown, septate, smooth, monomitic. – Conidiogenous cells lateral, integrated, pale, sympodially proliferating, cicatrized, enteroblastic (polytretic or polyphialidic), each conidiogenous locus with a minute central pore surrounded by a conspicuous, narrow, somewhat darkened margin. – Conidia catenate, aseptate, subhyaline to faintly coloured, almost smooth to verruculose. Teleomorph unknown.

2.1. *Stromatostysanus pungens* (Wallroth) U. Braun comb. nov. – Fig. 4.

Bas.: *Sphaeria pungens* Wallr., Fl. Crypt. Germ. (Nürnberg) II: 803. 1833.
 Type: "ad folia *Lonicerae xylostei putrida*", herb. Wallroth (STR), not seen!
 = *Sphaeria caprifoliorum* Desm., Ann. Sci. Nat., bot., 2 sér., 13: 188. 1840.
 ≡ *Stromatostysanus caprifoliorum* (Desm.) Höhnel, Ber. deutsch. Bot. Ges. 37: 153. 1919.
 = *Stysanus parasiticus* Desm., Ann. Sci. Nat., bot., 3 sér., 10: 344. 1848.
 ≡ *Graphiothecium parasiticum* (Desm.) Sacc., Syll. Fung. 4: 624. 1886.
 = *Stysanus sphaeriaeformis* Fuckel, Fungi Rhen. Exs., Fasc. II, No. 173, Hostrichiae ad Rhenanum. 1863 (with description!).

Synnemata on old, rotten leaves of *Lonicera*, scattered to loosely grouped, basal stromata subglobose, partly immersed, ca. (75–) 90–170 (–190) μm diam., dark brown to blackish. – Stipes about 400–1000 μm long, ca. 20–60 μm wide below, gradually attenuated towards the apex, straight to slightly curved, composed of parallel hyphae, monomitic, brown, septate, smooth, paler in the upper part, apex more or less pointed, fertile zone scattered over the stipe. – Conidiogenous cells integrated, terminal and lateral, short, ca. 5–20 x 2–4 μm , subhyaline. – Conidia ellipsoid, ovoid, fusiform, ca. 4–10 x 1.5–4 μm , hyaline to faintly greenish, almost smooth to verruculose.

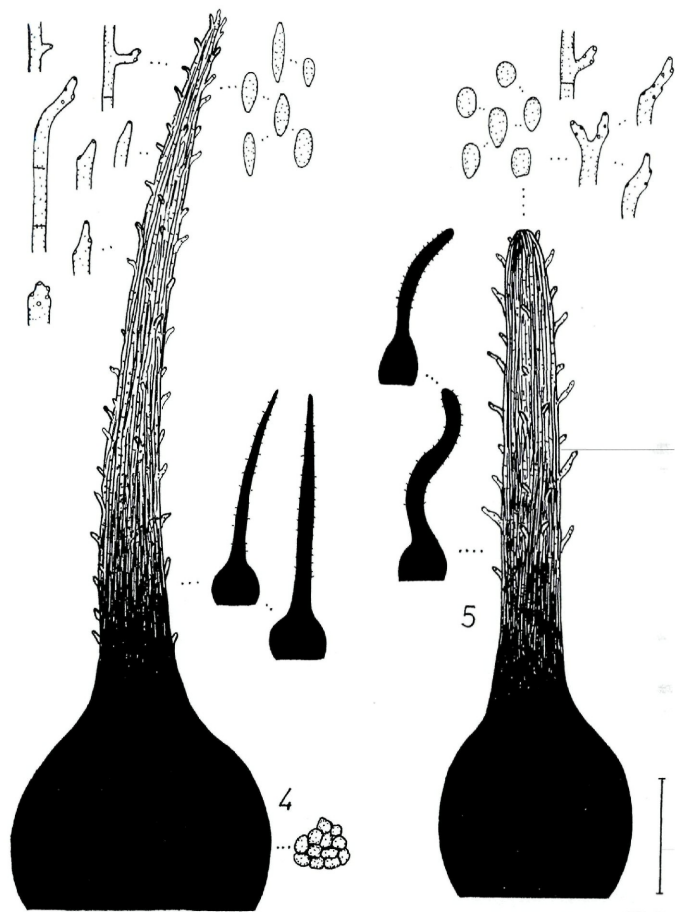


Fig. 4-5. - Synnemata, conidiogenous cells, conidia, and surface cells of stroma (*textura angularis*). - 4. *Stomatostysanus pungens* (based on Fuckel, Fungi Rhen. 173). - 5. *S. curvus* (based on material from Thuringia, 1869, Auerswald, ex herb. B).
Bar = 50 μ m (for synnemata).

Material examined. – FRANCE: *Sphaeria caprifoliorum* Desm., on *Lonicera caprifolium*, Pl. Crypt. Fr., ed. 1, 1299 (Lectotype, here designated, PC). *Stysanus parasiticus* Desm., on *Lonicera caprifolium*, Pl. Crypt. Fr., ed. 1, 1704 (Lectotype, here designated, PC). – GERMANY: *Stysanus sphaeriaeformis* Fuckel, on *Lonicera xylosteum* (sub “*Euonymus*”), Fuckel, Fungi Rhen. 173 (Lectotype, here designated, HAL). The original material of *S. caprifoliorum*, *S. parasiticus* and *S. sphaeriaeformis* is widespread in the cited exsiccatae. Therefore, I propose the above mentioned lectotypifications. – POLAND: on *Lonicera tatarica*, Tamsel, 10. 5. 1909, Syd., Myc. germ. 949 (B). – FRANCE(?): on *Lonicera xylosteum*, without exact data (B). – GERMANY: Ziegenberg, III. 1871, on *Lonicera xylosteum*, ex herb. Nitschke (B); ca. Hostrichiae, on *Lonicera xylosteum*, Fuckel, Fungi Rhen. 865 (HAL). – SWITZERLAND: Corcelles, near Neuchâtel, on *Lonicera xylosteum*, IV. 1871, Morthier (B); Switzerland, Beckhaus, on *Lonicera xylosteum*, IX. 1880, Morthier (B).

Graphiothecium parasiticum (Desm.) Sacc. sensu Saccardo (1886) and Lindau (1910) is heterogeneous and comprises various species belonging to either *Graphiothecium* or *Stromatostysanus*.

2.2. *Stromatostysanus curvus* (Wallroth) U. Braun comb. nov. – Fig. 5.

Bas.: *Sphaeria curva* Wallr., Fl. Crypt. Germ. (Nürnberg) III: 803. 1833. Typus: on *Ribes alpinum*, Germany, Thuringia, herb. Wallroth (STR), not seen!

Synnemata on old, rotten leaves of *Ribes alpinum*, scattered to loosely grouped, basal stromata subglobose, partly immersed, ca. 50–100 µm diam., dark brown to almost black. – Stipes about 200–600 x 25–50 µm, straight to usually curved, sinuous to almost spirally twisted, composed of parallel, brown, septate, smooth hyphae, paler above, only slightly narrowed towards the apex, apex obtuse, rounded, fertile zone loosely scattered over the stipe. – Conidiogenous cells integrated, terminal and lateral, short, pale, ca. 5–20 x 1.5–3.5 µm. – Conidia catenate, subglobose, ellipsoid, ovoid, ca. 4–8 x 3–4 µm, subhyaline, almost smooth to verruculose.

Material examined. – GERMANY: on *Ribes alpinum*, Thuringia, Arnstadt, 21–5–1869, Auerswald (B).

Excluded species

Graphiothecium fragariastris (Schw.) Sacc., Syll. Fung. 4: 624. 1886
= *Coremium fragariastris* Schw., Proc. Am. Phil. Soc. Phila. 4: 282. 1831.

The status of *G. fragariastris* (Schw.) Sacc. is unclear. Type material is not preserved in PH or K (Seifert & Samson 1985).

Graphiothecium maculicolum Karsten, Hedwigia 28: 192. 1889.

Karsten (1889) described *Graphiothecium maculicolum* from dead leaves, possibly of *Magnolia* sp.

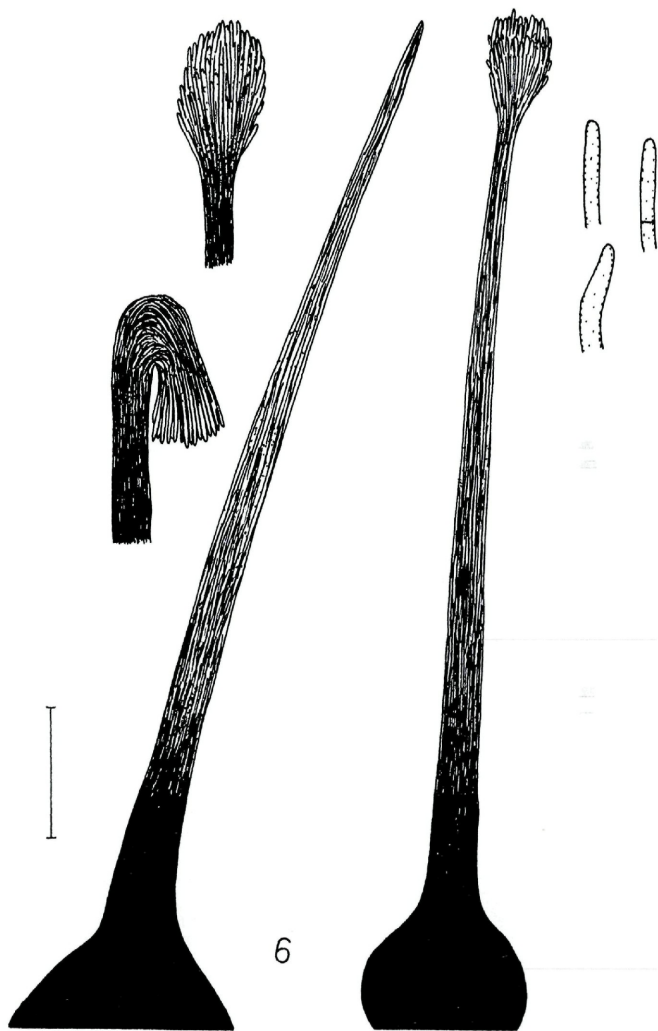


Fig. 6. - *Graphiothecium maculicolum*, synnemata, apical parts, sterile hyphal ends (based on type material). Bar = 50 μ m (for synnemata).

This insufficiently known species is characterized as follows: synnemata erect, stromatic base 50–100 µm diam., blackish, stalk straight to slightly curved, 500–960 µm long, 15–40 µm wide in the lower half, narrowed towards the apex, composed of parallel hyphae, dark brown below, paler above, apex often somewhat enlarged, compact to loose, straight to strongly recurved, synnemata sterile, conidiogenous cells and conidia not developed (Fig. 6).

The conidiomata resemble those of *Graphiothecium* species, but the true affinity of this species is unclear because of the lack of conidiogenous cells and conidia.

Material examined. – BRAZIL: on dead leaves (? *Magnolia*), Minas Lafayette, 1885, Wainio (Holotype, H).

Graphiothecium pusillum (Fres.) Sacc., Syll. Fung. 4: 625. 1886

≡ *Isariopsis pusilla* Fres., Beitr. Mykol. p. 87. 1863.

≡ *Stysanus pusillus* (Fres.) Fuckel, Jahrb. Nass. Ver. Naturk. 23–24: 101. 1869.

This species is phytoparasitic and a synonym of *Phacellium albo-rosellum* (Desm.) U. Braun (Braun, 1990).

Graphiothecium vinosum Davis, Trans. Wisconsin Acad. Sci. 18: 90. 1915.

This species must be reduced to synonymy with *Phaeoramularia coalescens* (Davis) U. Braun & C. T. Rogerson (1993) (= *Cercospora coalescens* Davis, *Ramularia coalescens* (Davis) Piroz.). The identity of these species was also mentioned by Pirozynski (1974).

Material examined. – USA: on *Ribes americanum*, Madison, Wisc., 7–8–1912, Davis, and overwintered material, 24. 5. 1913. (Holotype, WIS).

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