VIRIDISPORA Samuels & Rossman, *gen. nov.*

Type: *Viridispora penicilliferi* (Samuels) Samuels & Rossman.

Ascomata non stromatica, superficialia, solitaria, globosa vel pyriformia, rubra vel brunneola vel fusca vel atro-aurantiaca, KOH+ rubra vel neg., grosse verrucosa vel glabra. Asci clavati, apice simplici. Ascosporae typice virides, 1–2-cellulares.

Ascomata non-stromatic, superficial, solitary, globose to pyriform, red, orange-brown, tan, or brown, KOH+ red or –, coarsely warted or glabrous. Asci clavate, apex simple. Ascospores typically green, 1-septate, rarely non-septate, smooth. Anamorph, where known, *Penicillifer*. On decaying woody substrata, isolated from soil and plant roots.

Notes.— The genus *Viridispora* includes four species that are known primarily in culture, isolated from soil and roots or as endophytes of woody plants, although some species have also been found on woody substrata in nature. The genus is characterized by having *Penicillifer* anamorphs, ascomata in shades of red to dark red or orange-brown, and generally one-septate ascospores that are green in all but one species. Both green ascospores and *Penicillifer* anamorphs are rare in the ascomycetes and, in combination, are known for the two tropical species that occur on woody substrata in nature, namely *V. penicilliferi* and *V. alata*. *Viridispora fragariae* is known to parasitize roots and has also been isolated from soil, while *V. diparietispora* occurs on woody substrata and has also been isolated as an endophyte and from soil. *Viridispora alata*, *V. fragariae* and *V. penicilliferi* were originally included in *Nectria*, but they bear little similarity to the type of that genus. *Viridispora diparietispora* has previously been placed in genera of the *Hypocreales* that are characterized by having non-septate ascospores, specifically *Pseudonectria* (as *P. diparietispora*) and *Neocosmospora* (as *N. endophytica*). The molecular studies (28S rDNA sequences) of Rehner & Samuels (1995) suggest that *V. diparietospora* is sister to but distinct from a clade that includes *Albonectria*, *Gibberella*, *Haematonectria*, and *Neocosmospora*.

Viridispora penicilliferi (Samuels) Samuels & Rossman, *comb. nov.*

≡ *Nectria penicilliferi* Samuels, Mycologia 81: 349. 1989.

Anamorph: *Penicillifer macrosporus* Samuels, Mycologia 81: 349. 1989.

Ascomata superficial, non-stromatic, solitary to gregarious, globose, 220–240(–440) μm diam, non-papillate, with a flat ostiolar disc, not collapsing when dry, tan with a darker ostiolar area, KOH–, with concolorous warts up to 65 μm high, mainly forming around the ascomatal apex. Ascomatal surface of circular to angular cells, 7–20 μm diam, with 2.5–3 μm thick walls, cells of warts slightly larger. Ascomatal wall *ca* 65 μm thick, including the warts, of two regions: outer region up to 50 μm thick, of circular cells with 2-4 μm thick walls; inner region of hyaline cells with 1-1.5 μm thick walls. Asci clavate, 55–75 × 8–14 μm, apex simple; ascospores bi- to pluriseriate. Ascospores ellipsoid to subfusiform, (11.5–)13–17(–18) × 5–7 μm, 1-septate, pale green, smooth-walled.

Anamorph: Conidiophores arising directly from bark, unbranched or once branched, each branch bearing a single, terminal, appressed penicillus of phialides. Phialides cylindrical, 22–40 × 5–7 μm, collarette not flared, slightly thickened. Conidia cylindrical, mostly 33–47 × 4–5.5 μm, one-septate, papillate at one or both ends, held end-to-end in chains.

Habitat.— On bark of recently dead twigs and branches.
Distribution.— Costa Rica, French Guiana, Guyana, and Venezuela.

Holotype.— GUYANA. Cuyuni-Maxaruni region, on terminal branchlets of recently dead tree, 28 Feb 1987, Samuels 4952B, Pipoly & Gharbarran (NY). Cultures: CBS 423.88, ex-type, Guyana; CBS 446.96 = G.J.S. 96-20, Puerto Rico.
Additional specimens are listed in Samuels (1989).

Viridispora alata (Samuels) Samuels & Rossman, *comb. nov.*

≡ *Nectria alata* Samuels, Mycologia 81: 347. 1989.

Anamorph: *Penicillifer bipapillatus* Samuels, Mycologia 81: 347. 1989.

Ascomata superficial, non-stromatic, solitary, globose to ovoidal, 175–400 μm diam, with a minute, flat ostiolar disc, not collapsed when dry, red to red-orange to orange, with a red ostiolar area, KOH–, coarsely warted, warts large, conical, up to 150 μm high. Ascomatal surface cells circular, 10–15 μm diam, having 1.5–2 μm thick walls. Ascomatal wall 60-150 μm thick, including the warts, of two regions: outer region 30-120 μm thick, cells angular to circular, 15-20 μm diam, with 2 μm thick walls; inner region 20-30 μm thick, of thin-walled, elongate cells. Asci clavate, (65–)73–93 (–105) × (8–)12–20 μm, apex simple, ascospores biseriate. Ascospores ellipsoid to subfusiform, (16–)19–22 (–23.5) × 7–9 μm, 1-septate, pale green, smooth-walled.

Anamorph: Conidiophores as for *V. penicilliferi*. Conidia cylindrical to slightly falcate, (18–)27–38(–58) × 5–7 μm, non- or 1-septate, papillate at each end, held in chains, hyaline, smooth-walled.

Habitat.— On bark.
Distribution.— American tropics.

CULTURES.— CBS 420.88, ex-type, Venezuela; CBS 421.88 = G.J.S. 87-37, CBS 422.88 = G.J.S. 87-48A, Guyana; CBS 452.96 = G.J.S. 96-34, Puerto Rico.
ILLUSTRATIONS.— Samuels (1989b, Figs. 1–7).

Viridispora diparietispora (J.H. Miller, Giddens & A.A. Foster) Samuels & Rossman, *comb. nov.*

≡ *Pseudonectria diparietispora* J.H. Miller, Giddens & A.A. Foster, Mycologia 49: 793. 1957 (1958, as '*diparietospora*').
≡ *Neocosmospora diparietispora* (J.H. Miller, Giddens & A.A. Foster) Rossman, Samuels & Lowen, Mycologia 85: 699. 1993.
= *Neocosmospora arxii* Udagawa, Horie & P. Cannon, Sydowia 41: 353. 1989.
= *Neocosmospora endophytica* Polishook, Bills & Rossman, Mycologia 83: 798. 1991.

Anamorph: *Penicillifer furcatus* Polishook, Bills & Rossman, Mycologia 83: 798. 1991.

Ascomata globose, ovoidal or pyriform, 270–350 μm high × (160–)240–270 μm diam, yellow-orange, orange to red-orange, KOH+ dark red, yellow in lactic acid, glabrous. Ascomatal surface cells angular, 10–20 μm diam, with *ca* 2 μm thick walls. Ascomatal wall 20–30 μm thick, of two regions: outer region of thick-walled, angular cells, 7.5–20 × 6.5–17.5 μm; inner region of thin-walled, elongate cells. Asci clavate, 60–85 × 12–25 μm, apex simple, ascospores biseriate. Ascospores ellipsoid to broadly ovoidal, (16–)21–25 × 12–15 μm, non-septate, smooth-walled, green when formed on V8 Juice agar and yellow on oatmeal agar.
ANAMORPH: Conidiophores 150–280 μm long, branched once or twice, each branch bearing a single, terminal penicillus of appressed phialides. Phialides cylindrical, 16–25 × 4–5 μm. Conidia cylindrical to slightly naviculate, 17–23 × 4–5 μm, one-septate, hyaline, smooth-walled, papillate at the base, held end-to-end in chains.
HABITAT.— Isolated from forest soil and from *Crataegus, Chamaecyparis*, and *Hudsonia*; also isolated from the interior of a basidiome of *Fomes fomentarius*.
DISTRIBUTION.— Japan and eastern United States.

TYPES.— UNITED STATES. Georgia: Davisboro, isolated by A.A. Foster from soil in forest nursery, 30 cm deep, 14 Sep. 1955, det. by J.H. Miller 2067 (NY, neotype of *P. diparietispora*, designated by Rossman et al., 1993; ex-neotype culture ATCC 13214 ≡ CBS 376.59); New York: Kings Co., Bedford Stuyvesant, on galls of *Crataegus crus-galli*, Rogerson 80-76 (NY – holotype of *N. endophytica*; BPI – isotype); JAPAN. Omotoama, Hahajima Island, Ogawawara-mura, Tokyo-to, isolated from forest soil, 3 Dec 1977, Y. Horie (IMI – ex-type culture of *N. arxii* ≡ CBS 447.93).
ILLUSTRATIONS.— Miller *et al.* (1957, Figs. 15–19; as *P. diparietospora*); Polishook *et al.* (1991, Figs. 1–12; as *N. endophytica*); Rossman *et al.* (1993, Fig. 28, as *N. diparietospora*), Udagawa *et al.* (1989, Figs. 2, 5, 6, 13, as *N. arxii*).

NOTE.— Using 28S rDNA sequence data, both Rehner & Samuels (1995) and Suh *et al.* (1998) obtained results that grouped closely the type strains of *V. diparietispora* (as *N.* '*diparietospora*') and *N. endophytica* outside the *Gibberella-Haematonectria-Neocosmospora* clade.

Viridispora fragariae (Ts. Watan.) Samuels & Rossman, *comb. nov.*

≡ *Nectria fragariae* Ts. Watan., Trans. Mycol. Soc. Japan 31: 229. 1990.

Anamorph: *Penicillifer fragariae* Ts. Watan., Trans. Mycol. Soc. Japan 31: 230. 1990.

Ascomata immersed in root tissue, 210–300 μm high × 160–250 μm diam, yellowish brown, KOH reaction not known, glabrous. Ascomatal surface cells angular, 11–26 μm diam. Asci clavate, 55–80 × 14–20 μm, apex simple, ascospores bi- to pluri-seriate. Ascospores ellipsoid to broadly fusiform, 21–25 × *ca* 10 μm, 1-septate, yellow-brown, smooth-walled.
ANAMORPH: Conidiophores 120–540 μm long, stipes unbranched or once branched, each branch bearing a single, terminal cluster of appressed phialides. Phialides cylindrical, 20–25 × 3.5–5 μm. Conidia ellipsoid to cylindrical, 14–18 × 4.5–5.5 μm, one-septate, apiculate at one end, held end to end in chains. Description modified from Watanabe (1990).
HABITAT.— On roots of *Fragaria chiloënsis* var. *ananassa*.
DISTRIBUTION.— Japan.

KEY TO THE SPECIES OF *VIRIDISPORA*

1. Ascospores non-septate, ellipsoid to broadly ovoid, (16–)21–25 × 12–15 μm, green ..... *V. diparietispora*
1. Ascospores one-septate, less than 12 μm wide 2

2. Ascomata glabrous; ascospores yellow-brown, 21–25 × *ca* 10 μm ..... *V. fragariae*
2. Ascomata warted; ascospores green, less than 10 μm wide 3

3. Ascospores (16–)19–22(–23.5) × 7–9 μm ..... *V. alata*
3. Ascospores (11.5–)13–17(–18) × 5–7 μm ..... *V. penicilliferi*

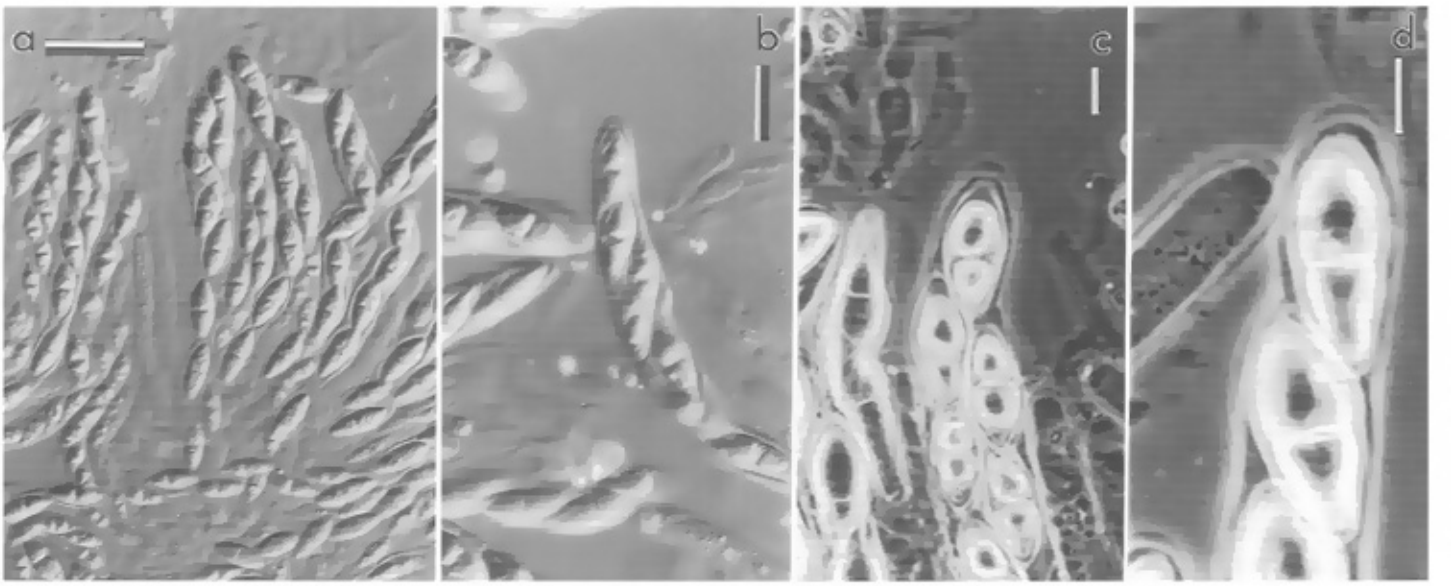

Plate 36. a–d. *Xenonectriella lutescens*. a. Asci with ascospores and remnants of apical paraphyses. b. Asci with ascospores. c. Asci with ascospores in phase contrast microscopy. d. Close-up of ascal apex in phase contrast microscopy. a–d. GZU 47–11-78. Scale bars: a = 50 μm; b = 25 μm; c, d = 10 μm.

Type.— JAPAN. Shizuoka, cultured from roots of *Fragaria chiloënsis* var. *ananassa*, 10 June 1973, T. Watanabe, T.W. 73-178 (FFPRI, holotype, not examined).
Illustrations.— Watanabe (1990, Figs. 3, 4).

Notes.— Although the conidia are described as fusiform, they appear to be ellipsoid to cylindrical in the illustration.

XENONECTRIELLA Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 128: 749. 1919.

Type: *X. lutescens* (Arnold) Weese (≡ *Nectria lutescens* Arnold).

Ascomata partially to completely immersed in the lichen thallus, stroma lacking. Ascomata globose with broad papilla, scarlet, KOH+ dark red, wall smooth. Ascomatal wall about 25 μm thick, of two regions: outer region 10–20 μm thick, of pigmented cells; inner region 5–7 μm thick, of thin-walled, elongate cells. Asci cylindrical, apex simple, 2-, 4-, or 8-spored, ascospores uniseriate. Ascospores ellipsoid to fusiform or naviculate, one-septate above the middle, transversely multiseptate, or muriform, hyaline when young, becoming golden-brown or olivaceous, smooth-walled when young, becoming slightly verrucose or tuberculate. Anamorph not known. On apothecia and thalli of lichens.
Notes.— Weese (1919) described *Xenonectriella* as a genus similar to *Nectriella* Nitschke but distinguished by the large, brown, warted, multiseptate ascospores in *Xenonectriella*. The type species, *X. lutescens*, has been transferred to a number of different genera defined primarily on ascospore characteristics. Based on an examination of two portions of the type collection, *X. lutescens* appears to be related to species of *Cosmospora* in the *Nectriaceae*. Both genera have red, relatively thin-walled ascomata, golden-brown, ornamented ascospores, and a fungicolous habit. *Xenonectriella* is distinct in the irregularly shaped, one-septate, transversely multiseptate or muriform ascospores in ascomata that are partially immersed in the apothecia or the thallus of various lichens. Because of these characteristics, *Xenonectriella* with four species is included in the *Nectriaceae*.

Xenonectriella lutescens (Arnold) Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 128: 749. 1919. — Plate 32, e; Plate 36, a–d.

≡ *Nectria lutescens* Arnold, Hedwigia 22: 54. 1883.
≡ *Pleonectria lutescens* (Arnold) Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 128: 746. 1919.
≡ *Passerinula lutescens* (Arnold) E. Müll. & Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 625. 1962.
≡ *Letendraea lutescens* (Arnold) Petrak, Ann. Mycol. 32: 359. 1934.

Ascomata partially to completely immersed in the substratum, visible as orangish spots, upper one-third of the ascomata, especially the papilla, extending above the surface, stroma lacking. Ascomata globose with a broad papilla, 310 μm high × 250 μm diam; papilla 125 μm high × 150 μm diam, scarlet, bay when dry, KOH+ dark red, smooth-walled. Ascomatal wall about 25 μm thick, of two regions: outer region 10–20 μm thick, of pigmented cells with about 1.5 μm thick walls, forming