NECTRIACEAE Tul. & C. Tul., Sel. Fung. Carpol. 3: 3. 1865

Type: *Nectria* (Fr.) Fr., *nom. cons.*

[= *Ophionectriaceae* Locq., Taxia Fungorum p. 29. 1974, nom. inval., Art. 41.1].
[= *Xenonectriellaceae* Locq., Taxia Fungorum p. 29. 1974, nom. inval., Art. 41.1].

In this work the family *Nectriaceae* is narrowly circumscribed to include only those hypocrealean species having uniloculate ascomata that are generally orange-red to purple, KOH+, yellow in lactic acid, and not immersed in a well-developed stroma. The *Nectriaceae* include 20 genera. Traditionally *Nectria* has been defined to include all hypocrealean species that have uniloculate, superficial ascomata and one-septate, non-apiculate ascospores not disarticulating at the septum. Most of the type species of genera now recognized in the *Nectriaceae* were placed in *Nectria sensu lato* at some time. Major genera within the *Nectriaceae* include *Calonectria* with *Cylindrocladium* anamorphs, *Gibberella* with *Fusarium* anamorphs, *Nectria sensu stricto* with *Tubercularia* anamorphs, and *Neonectria* with *Cylindrocarpon* anamorphs. *Haematonectria* is established to include species previously recognized in the complex of species referred to as *Nectria haematococca*, having anamorphs in *Fusarium* sect. *Martiella*. Although both have *Fusarium* anamorphs, *Gibberella* and *Haematonectria* represent separate clades within the *Nectriaceae* and are phylogenetically distinct from the core group of *Nectria*. The genus *Cosmospora* includes species having anamorphs placed in *Fusarium* sect. *Eupionnotes* as well as several other anamorph genera.

Although most members of the *Nectriaceae* have orange, red to purple, KOH+ ascomata, a few members having pallid ascomata are connected with the *Nectriaceae* based on other characteristics, particularly of the anamorph. The genus *Albonectria* includes species having white to pale yellow ascomata; however, the fast-growing *Fusarium* anamorphs indicate a relationship with the *Nectriaceae*. The type of *Pseudonectria*, *P. rousseliana*, has yellow to orange ascomata while the second species, *P. pachysandricola*, has orange to scarlet ascomata.

Key to the genera of the *Nectriaceae*

1. Ascomata dark brick red, bluish-purple to purple, macroscopically appearing black; anamorph, where known, fast-growing *Fusarium* **2**
1. Ascomata red, red-orange, or orange, rarely white to pale yellow, not dark blue or purple; anamorphs slow- or fast-growing *Fusarium* or other phialidic genera **5**

2. Ascospores muriform; on woody fruits of *Calamus* ..... **Pleogibberella**
2. Ascospores (0–)1–3-septate **3**

3. Ascomata dark brick-red; on dark stroma of *Phyllachora* on living leaves of bamboo ..... **Allonectella**
3. Ascomata bluish purple to purple; on plants **4**

4. Densely aggregated on an extensive stroma covering a gall-like formation; ascospores usually 1-septate; on *Serjania* (*Sapindaceae*) in Brazil ..... **Stalagmites**
4. Solitary or gregarious, non- or sparsely stromatic; ascospores usually 3-septate, rarely 0–1-septate; on monocotyledonous and dicotyledonous plants, generally in temperate regions ..... **Gibberella**

5. Ascomata white to pale yellow, or greyish yellow, KOH– **6**
5. Ascomata red, red-orange, or orange, KOH+ **7**

6. Ascomata warty, thick-walled, white to pale yellow; anamorph fast-growing *Fusarium* ..... **Albonectria**
6. Ascomata smooth- and thin-walled, yellow to orange or scarlet; anamorph *Volutella* ..... **Pseudonectria**

7. Ascomata with yellow or golden, spinulose, rarely smooth, hairs; ascospores striate; anamorphs *Actinostilbe*, sporodochial or synnematous, conidia usually 1-septate, yellow ..... **Lanatonectria**

7. Ascomata without yellow, spinulose hairs; ascospores striate, tuberculate or smooth; anamorphs other than above, conidia not yellow **8**

8. Ascomata immersed in thalli of lichens; ascospores transversely septate to muriform ..... **Xenonectriella**

8. Ascomata superficial, not immersed in lichen thalli; ascospores non- to multiseptate, or muriform **9**

9. Ascomata globose, small, less than 350 μm high, with a white to yellow, furfuraceous outer coating; ascospores ellipsoid, non-septate, hyaline, smooth; known on decaying leaves and fruits of *Clusia* sp.; anamorph *Gliocephalotrichum* ..... **Leuconectria**

9. Ascomata without a white to yellow, furfuraceous outer coating, or, if with furfuraceous outer coating, then ascomata ovoid or obpyriform, large, more than 350 μm high; ascospores non-septate to one- or multiseptate; anamorph not *Gliocephalotrichum* **10**

10. Ascomata ovoid-elongate, walls with warts to 100(–300) μm high; ascospores long, up to 250 μm, multiseptate, hyaline, finely striate; anamorph *Antipodium* or unknown ..... **Ophionectria**

10. Ascomata globose to pyriform, sometimes elongate; ascospores less than 100 μm long; anamorph not *Antipodium* **11**

11. Ascomata small, generally less than 300 μm diam; ascomatal wall smooth to slightly warted, usually less than 20 μm thick; ascospores smooth to tuberculate or coarsely striate, often yellow-brown, or if green, then smooth, rarely hyaline; fungicolous on other ascomycetes, corticolous or isolated from roots and soil **12**

11. Ascomata medium to large, generally more than 300 μm diam; ascomatal wall smooth to coarsely warted, more than 20 μm thick; ascospores smooth, striate-punctate or tuberculate, hyaline or yellow-brown; usually corticolous **17**

12. Ascomata smooth, non-stromatic or on an inconspicuous basal stroma, pyriform, collapsing laterally; ascomatal wall of thin-walled cells **13**

12. Ascomata slightly warted, non-stromatic, subglobose to globose, not collapsing; ascomatal wall of globose, thick-walled cells **14**

13. Ascospores non-septate, hyaline, smooth-walled; anamorph *Volutella*; on leaves and twigs of *Buxaceae* ..... **Pseudonectria**

13. Ascospores one- or multiseptate, yellow-brown and tuberculate, less frequently striate, or hyaline and smooth-walled; anamorphs *Acremonium*-like, *Chaetopsina*, *Cylindrocladiella*, *Fusarium* sect. *Eupionnotes*, *Stilbella*, *Volutella*; fungicolous on ascomycetes, rarely on Aphyllophorales; herbicolous or, less often, corticolous, or insecticolous .. **Cosmospora**

14. Ascospores non-septate, rarely one-septate, globose to ellipsoid, yellow to yellow-brown, ornamented; isolated from warm soil or as a plant pathogen; anamorphs, where known, *Acremonium*-like ..... **Neocosmospora**

14. Ascospores one-septate, rarely non-septate, ellipsoid to fusiform, not globose, yellow-brown with coarse striations or green, smooth; generally corticolous; anamorphs, where known, *Fusarium* or *Penicillifer*, not *Acremonium*-like **15**

15. Ascospores green, smooth; ascomata scattered, not obviously stromatic; anamorph, where known, *Penicillifer* ..... **Viridispora**

15. Ascospores yellow-brown, smooth, spinulose or striate; ascomata scattered or caespitose; anamorph, where known, *Fusarium*, or sporodochial with verticillate conidiophores . **16**

16. Ascospores coarsely striate; anamorph sporodochial with verticillate conidiophores .... **Rubrinectria**

16. Ascospores smooth to spinulose or faintly striate, rarely disarticulating; anamorph, where known, *Fusarium* ..... **Haematonectria**

17. Ascomata subglobose to globose, often becoming cupulate when dry, wall warted, rarely smooth, ascospores non-, 1- to multiseptate or muriform, in some species ascospores budding within the asci; usually corticolous, on dying or recently dead woody branches; rarely on tough monocotyledonous leaves (*N. miltina*); anamorphs sporodochial, pycnidial, or synnematous, conidiomata always some shade of red, *Tubercularia*..... **Nectria**

17. Ascomata globose to obpyriform, collapsing laterally or not collapsing, wall smooth when dry, sometimes shining, scaly or warted; ascospores 1- to multiseptate, never budding in the asci; on all kinds of organic material; anamorphs *Calostilbella*, *Cylindrocarpon*, *Cylindrocladium*, *Fusarium*, *Rhizostibella* **18**

18. Ascomata ovoid, very large, more than 800 µm high, apex often mammiform, orange, with white to straw, furfuraceous covering; ascospores hyaline or yellow-brown, 1-septate, coarsely striate; corticolous; anamorph *Calostilbella*, i.e. synnematous with 1-septate, yellow-brown conidia ..... **Calostilbe**

18. Ascomata globose to obpyriform, apex acute to constricted, then distinctly knobby; smooth and shining or scaly to coarsely warted; ascospores hyaline or yellow-brown, smooth, striate or tuberculate; corticolous; anamorphs not *Calostilbella* **19**

19. Ascomata globose to ovoid, with concolorous warts, solitary, often with blackened base; ascospores hyaline, smooth, ellipsoid to long fusiform, one- to multiseptate; corticolous or herbicolous; anamorph *Cylindrocladium*, i.e. with penicillate conidiophores with a sterile elongation and strictly cylindrical conidia ..... **Calonectria**

19. Ascomata globose to obpyriform or broadly pyriform, smooth and shining to scaly or warted; ascospores hyaline or yellow-brown, smooth, warted or striate; corticolous or herbicolous; anamorphs not *Cylindrocladium* **20**

20. Ascomata broadly obpyriform, smooth, slightly roughened to warted; ascospores hyaline, smooth, spinulose or striate; anamorph *Cylindrocarpon*, with or without microconidia .... **Neonectria**

20. Ascomata subglobose to obpyriform, smooth, scurfy or warted; cells at ascomatal surface non-descript or circular to angular, with > 1.5 µm thick walls and often much thicker; ascospores generally yellow-brown, smooth, warted, or striate; anamorphs *Fusarium* or *Rhizostilbella* **21**

21. Ascomata typically caespitose in groups or at the tips of rhizomorph-like strands, pyriform, papillate, smooth or covered with white scurf; ascospores yellow-brown, smooth or roughened; anamorphs synnematous *Fusarium* or *Rhizostibella* ..... **Corallomycetella**

21. Ascomata solitary to aggregated, subglobose to globose, non-papillate or with an indistinct acute apex, with concolorous warts; ascospores hyaline or yellow-brown, smooth, spinulose or faintly striate, rarely disarticulating; anamorphs, where known, *Fusarium* sect. *Martiella* ..... **Haematonectria**

THE GENERA OF THE *NECTRIACEAE*

ALBONECTRIA Rossman & Samuels, gen. nov.

Type: *Albonectria rigidiuscula* (Berk. & Broome) Rossman & Samuels (≡ *Nectria rigidiuscula* Berk. & Broome).

Ascomata superficialia, vulgo aggregata in stromate parce vel bene expresso, subglobosa vel globosa vel ellipsoidea, alba vel luteola, KOH–, parietes > 25 µm crassi, saepe verrucatae, cellulae parietis valde incrassatae. Asci 4–8-spori. Ascosporae ellipsoideae vel longe-ellipsoideae, 3- vel pluriseptatae, hyalinae vel fusco-luteae, laeves vel striatae.

Ascomata superficial, solitary to gregarious on a sparse to well-developed stroma. Ascomata subglobose, globose to ellipsoid, white to pale yellow, KOH–, walls relatively thick, more than 25 µm, often warty, walls unevenly thickened, particularly the outermost cell walls. Asci 4–8-spored. Ascospores ellipsoid to long-ellipsoid, 3- to multiseptate, hyaline to yellow-brown, smooth to striate. Anamorph, where known, *Fusarium decemcellulare* or related species of fast-growing *Fusarium*. Saprobic and pathogenic on dicotyledonous and monocotyledonous hosts, often fruiting on decaying woody substrata.

NOTES.— The genus *Albonectria* is established for those species that are distinguished by having white to pale yellow, strongly warted ascomata with the outermost cells having greatly thickened outer walls that appear capitate. In *A. rigidiuscula* and *A. albosuccinea* the ascomata are aggregated on well-developed, pseudoparenchymatous stromata. Although the stromata in *A. verrucosa* are not well-developed, the ascomatal wall and *Fusarium* anamorph are characteristic of this genus. The anamorphs known for *A. rigidiuscula* and *A. albosuccinea* are species of *Fusarium* that form a monophyletic group within this large anamorph genus (Guadet *et al.*, 1989; O'Donnell, 1993). *Albonectria* is unusual in the *Nectriaceae* in having pallid, KOH– ascomata; however, the anamorph of fast-growing *Fusarium* and biological relationship to *Gibberella* place this genus in the *Nectriaceae*. This hypothesis is corroborated by sequence analyses of 28S rDNA as reported both by Guadet *et al.* (1989), O'Donnell (1993), and Rehner & Samuels (1995).

Albonectria rigidiuscula (Berk. & Broome) Rossman & Samuels, *comb. nov.* — Plate 25, a–j.

≡ *Nectria rigidiuscula* Berk. & Broome, J. Linn. Soc., Bot. 14: 116. 1873.
≡ *Calonectria rigidiuscula* (Berk. & Broome) Sacc., Michelia 1: 313. 1878.
= *Calonectria lichenigena* Speg., Bol. Acad. Nac. Ci. 11: 530. 1889.
= *Calonectria eburnea* Rehm, Hedwigia 37: 196. 1898.
= *Calonectria sulcata* Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25: 29, 1899.
= *Calonectria meliae* Zimm., Centralbl. Bakteriol., Abth. 2, 7: 106. 1901.
= *Calonectria cremea* Zimm., Centralbl. Bakteriol., Abth. 2, 7: 140 1901.
= *Calonectria hibiscicola* Henn., Hedwigia 48: 105. 1908.
= *Scoleconectria tetraspora* Seaver, North Amer. Flora 3: 27. 1910.
≡ *Calonectria tetraspora* (Seaver) Sacc. & Trotter, Syll. Fung. 22: 487. 1913.
[= *Calonectria flavida* Massee, *in* Petch, Ann. Roy. Bot. Gard. (Peradeniya) 7: 117. 1920, nom. nud.].
[= *Calonectria squamulosa* Rehm, *in* Weese, Mitt. Bot. Lab. Techn. Hochsch. Wien 2: 53, nom. nud.].

Anamorph: *Fusarium decemcellulare* Brick, Jahresber. Vereinigung Angew. Bot. 6: 277. 1908.

Ascomata solitary to gregarious, in groups of up to 30, usually seated on a well-developed, pseudoparenchymatous stroma; stromata up to 400 µm high, of hyaline, angular cells, 5–10(–20) µm diam, with walls unthickened or up to 2 µm thick. Ascomata white to pale yellow, globose to subglobose, 220–320 µm high × 190–300 µm diam, slightly laterally pinched or not collapsing when dry, with small, pointed papilla, ascomatal surface with large, concolorous warts up to 50 µm high. Ascomatal wall 25–100 µm thick, of three regions: outer region including warts 10–80 µm thick, of angular to globose cells 10–18 µm diam, with walls up to 1.5 µm thick, outer region usually delimited from the middle region by one layer of large, globose cells 15–20 µm diam; middle region 12–15 µm thick, of elongate cells, 7–10 × 5–7 µm, with up to 1 µm thick walls, toward the base angular and larger, intergrading with the stroma; inner region 7–12 µm thick, of hyaline, thin-walled, elongate cells 14–20 × 4–7 µm. Asci narrowly clavate, 77–100 × 12–14 µm, simple, usually 4-spored, but 8-spored or variable in heterothallic strains, ascospores obliquely uniseriate to biseriate. Ascospores ellipsoid with broadly rounded ends, 24–35 × 7–10 µm, smaller in 8-spored asci, then 19–22 × 6–7 µm, 3-septate, hyaline, smooth or faintly striate at maturity.

ANAMORPH IN CULTURE: Producing a rose pigmentation on PSA. Macroconidiophores loosely branched with terminal phialides, 30–40 × 5–6 µm; macroconidia curved, cylindrical to broadly fusiform, with curved, pointed tip and foot-cell, 55–130 × 6–10 µm, 7–10-septate, hyaline, smooth. Microconidiophores develop as simple or sparsely bifurcated lateral branches; phialides more or less densely verticillate, 28–36 × 4–5 µm; microconidia formed in chains, oval with small, flattened,

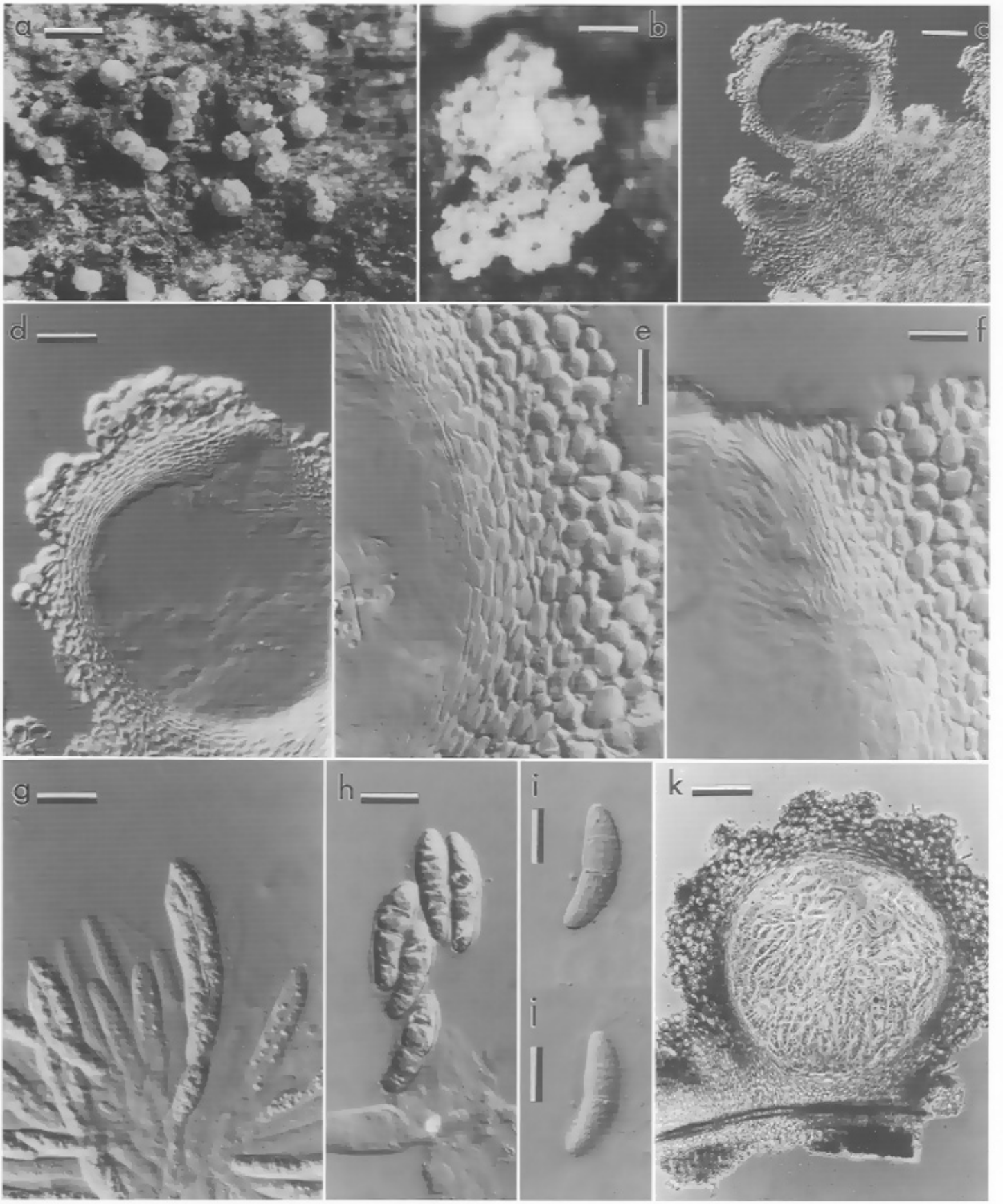


Plate 25. a–j. *Albonectria rigidiuscula*. a, b. Ascomata on natural substratum. c. Median section of ascomata on well-developed stroma. d. Median section of ascoma showing outer wall cells with capitate thickening. e. Section of ascomatal wall. f. Median section of ascomatal apex. g. Asci with developing ascospores. h. Ascus with mature ascospores. i. Ascospore in median focus. j. Ascospore in off-median focus to show fine ornamentation. **k.** *Allonectella guaranitica*, median section of ascoma. a, g. BPI 737674. b, e, f, h–j. BPI 745809A/B. c, d. BPI 553054. k. Holotype of *A. rubescens* – W. Scale bars: a = 500 μm; b = 250 μm; c = 100 μm; d = 50 μm; e–j = 25 μm; k = 75 μm.

basal papilla, 10–15 × 3–5 μm, non-septate, occasionally 1-septate, hyaline, smooth. Chlamydospores lacking. Anamorph description based on Booth (1971).

HABITAT.— Saprotrophic and pathogenic on dicotyledonous plants, known on hosts in the *Anacardiaceae, Annonaceae, Apocynaceae, Bignoniaceae, Bombacaceae, Euphorbiaceae, Fabaceae, Malvaceae, Meliaceae, Moraceae, Myrtaceae, Poaceae, Sterculiaceae, Tiliaceae, Ulmaceae* (Booth, 1971; Booth & Waterston, 1964; Gerlach & Nirenberg, 1982).

DISTRIBUTION.— Pantropical and subtropical (Booth, 1971).

HOLOTYPE.— SRI LANKA (Ceylon). On bark, No. 173c (K). The holotype specimen is in poor condition and was examined only macroscopically. The few remaining ascomata agree with the descriptions and illustrations written and drawn by authors who have examined it microscopically (Booth, 1971; Petch, 1920).

ILLUSTRATIONS.— Booth (1960, Figs. 4a–c, as *C. rigidiuscula*), Booth & Waterston (1964, Figs. a–c, as *C. rigidiuscula*), Rossman (1983, Fig. 30, Pl. 10a–d, as *N. rigidiuscula*), Samuels *et al.* (1990, Fig. 31, as *N. rigidiuscula*).

SPECIMENS ILLUSTRATED.— JAMAICA. St. Mary's Parish, between Buff Bay & Annotte Bay, on wood, 19 Jan 1971, A.Y. Rossman (BPI 553054). NEW ZEALAND. North Island, Gisborne District, Urewera National Park, track to Lake Ruapani, 31 May 1983, coll. G.J. Samuels *et al.*, cult. G.J.S. 83-175 (BPI 745098). PUERTO RICO. Luquillo Mountains, El Verde Research Area, on bark, May 1995, S.M. Huhndorf 1388, PR 2276, G.J. Samuels, cult. 95-50 (BPI 737674). Additional specimens examined listed in Rossman (1983) and Samuels *et al.* (1990), as *Nectria rigidiuscula*.

NOTES.— *Albonectria rigidiuscula* is a common tropical species that is often not directly associated with diseased trees; however, the anamorph, *Fusarium decemcellulare*, is found as a pathogen of various tropical crops, causing die-back and canker of branches associated with capsid injury, 'green-point' cushion gall of buds, and pod rot of cacao; panel decay of *Hevea* rubber, associated with *Phytophthora* spp.; stem canker of 'robusta' coffee associated with *Xyleborous morstatta*; stem rot of durian; and blight of rice plants, as listed by Booth & Waterston (1964). The cytology of *Albonectria rigidiuscula* (as *Calonectria rigidiuscula*) has been studied by Alexander & Carmichael (1973). The synonyms of *A. rigidiuscula* are discussed in Rossman (1979b; 1983, as *N. rigidiuscula*).

Albonectria albosuccinea (Pat.) Rossman & Samuels, *comb. nov.*

≡ *Calonectria albosuccinea* Pat., Bull. Soc. Mycol. France 8: 132. 1892.

≡ *Nectria albosuccinea* (Pat.) Rossman, Mycotaxon 8: 487. 1979.

= *Calonectria ecuadorica* Petrak, Sydowia 4: 463. 1950.

Anamorph: *Fusarium* sp.

Ascomata solitary or aggregated, each on a small, pseudoparenchymatous stroma 40–75 μm thick, stromata of hyaline, angular cells 7–18 μm diam with up to 2 μm thick walls. Ascomata globose to ovoid, 300–430 high × 300–410 μm diam, slightly laterally pinched or not collapsing when dry, white to pale yellow, with small, pointed papilla 40–65 μm high, ascomatal surface with large, concolorous warts up to 70 μm high, warts sometimes in longitudinal rows. Ascomatal wall 35–120 μm thick, of three intergrading regions: outer region including warts 10–80 μm thick, of angular to globose cells, cells variable in size, 10–30 μm diam, with up to 2 μm thick walls; walls of the outermost cells thickened up to 5 μm, outer region proliferating to form warts; middle region 20–25 μm thick, of elongate cells 12–20 × 4–5 μm with walls up to 1.5 μm thick; inner region 5–10 μm thick, of hyaline, thin-walled, elongate cells 7–12 × 4–7 μm. Asci narrowly clavate, 75–95 × 16–20 μm, simple, 8-spored, ascospores obliquely uniseriate. Ascospores fusiform, tapering to narrowly rounded ends, (31–)40–48 × (8.5–)10–12.5 μm, 3(–4)-septate, sometimes slightly constricted at each septum, hyaline, smooth or faintly striate.

ANAMORPH IN CULTURE: Conidiophores solitary to aggregated, cylindrical, 25-70 × 2.5–3.5 μm, straight, simple or multiply branched, hyaline, smooth, sparsely septate, bearing phialides at the apices. Conidiogenous cells phialidic, monoblastic, integrated, solitary, terminal 15–35 × 2.5–3.5 μm, cylindrical or expanding slightly toward the unflared apex, without conspicuous collarette. Macroconidia long-fusiform to clavate, tapering to curved, beaked ends, foot-cell distinctly beaked, (2–4–)5–6-septate: 2-septate, 32–40 × 5–6 μm; 4-septate, 46–62 × 5–6 μm; 5-septate, 52–80 × 5–6 μm; 6-septate, 68–80 × 5–6 μm. Microconidia ellipsoid to slightly clavate with truncate base, variable in size and shape, hyaline, smooth, 0–1-septate: 0-septate, 11–13 × 3.5–4 μm; 1-septate, 15–16 × 3.5–4 μm.

HABITAT.— On dead bark of dicotyledonous trees, often occurring on lenticels.

DISTRIBUTION.— Ecuador and Venezuela.

TYPE.— ECUADOR. Puente de Cimbo, "sur écorce pourrie, Août", Lagerheim (FH – Patouillard, holotype of *Calonectria albosuccinea*); Prov. Tungurahua, Hacienda San Antonio de Baños, "auf berindeten, am Boden liegenden, faulen Ästen," 10 Jan 1938, H. Sydow, Nr. 712b (W, holotype of *Calonectria ecuadorica*; ZT, isotype).

ADDITIONAL SPECIMENS EXAMINED.— VENEZUELA. Edo. Aragua, path between hotel and water source, Rancho Grande, Parque Nac. Henry Pittier, on wood, Dumont *et al.*, VE 1149, 3 July 1971, culture C.T. Rogerson 71-188, ATCC 44544 (NY); Edo. Monagas, vicinity of Cueva del Guácharo, Caripe, on bark, Dumont *et al.*, VE 5296, 18 July 1972 (NY); as above, Dumont *et al.*, VE 5349 (NY); as above, Dumont *et*

al., VE 5424 (NY); as above, Dumont *et al.*, VE 6060 (NY).
Illustrations.— Rossman (1983, Fig. 31, Pl. 9a, as *N. albosuccinea*).

Notes.— *Albonectria albosuccinea* has a *Fusarium* anamorph similar to *F. decemcellulare*; however, the anamorph of *A. albosuccinea* does not produce rose-red pigments in culture, the microconidia are not formed in chains, and the macroconidia are shorter and have fewer septa.

Albonectria verrucosa (Pat.) Rossman & Samuels, *comb. nov.*

≡ *Calonectria verrucosa* Pat., Bull. Soc. Mycol. France 11: 228. 1895.
≡ *Nectria astromata* Rossman, Mycotaxon 8: 550. 1979 [non *N. verrucosa* (Schwein.) Sacc., 1883].

Anamorph: *Fusarium* sp.

Ascomata solitary to densely gregarious, superficial on the substratum, without a stroma. Ascomata ovoid to obovoid, 350–400 μm high × 300–350 μm diam, slightly laterally pinched or not collapsing when dry, pale ochraceous, becoming ochraceous to cinnamon when dry, with large warts up to 50 μm high and paler than ascomata, area around the ostiole appearing darker due to lack of warts. Ascomatal wall 40–90 μm thick, of two intergrading regions: outer region 20–70 μm thick, of hyaline, angular cells 7–12 μm diam with walls up to 2 μm thick, walls of the outermost cells thickened up to 8 μm, outer region proliferating to form warts; inner region 15–20 μm thick, of hyaline, thin-walled, elongate cells, 10–15 × 5–7 μm, walls slightly thickened toward the outer region. Asci broadly clavate to fusiform, 100–180 × 17–23 μm, simple, 8-spored, ascospores pluriseriate. Ascospores long-fusiform, tapering to rounded ends, (40–)42–62 × 7–9 μm, 5–9(–13)-septate, each cell filled with small droplets, hyaline, smooth.

Anamorph in culture: Producing pale pink to salmon-colored pigmentation on PDA. Macroconidiophores arising directly from hyphae or more extensively, irregularly branched. Conidiogenous cells phialidic, monoblastic, integrated, solitary, terminal, cylindrical or expanding slightly toward the unflared apex, with slight periclinal thickening, 18–25 × 2.5–3.5 μm. Macroconidia long-fusiform to clavate, gently curved, uniform or more strongly curved at the apical end, basal cell pedicellate, thin-walled, hyaline, 3–5(–6)-septate: 3-septate, 24–39 × 2.5–4 μm; 4-septate, 31–45 × 3–4.5 μm; 5-septate, 39–48 × 3–4.5 μm; 6-septate, 38.5–50 × 4–5 μm. Microconidia oblong, sometimes with a poorly developed foot-cell, variable in size and shape, hyaline, smooth, 0–1-septate: 0-septate 7–10 × 1–2 μm; 1-septate 10–33 × 2–3 μm.

Habitat.— On dead culms of *Chusquea* sp. and other unidentified bamboo.
Distribution.— Brazil, Colombia, Ecuador and Venezuela.

Type.— ECUADOR. San Jorge, tiges mortes de *Chusquea*, leg. Lagerheim (FH – Patouillard, holotype).
Additional specimen examined and listed in Rossman (1983, as *N. astromata*): BRAZIL. Igapo, vic. "meeting of water", opposite Manaus City, on dead bamboo culm, 14 Dec. 1977, G.J. Samuels, BR 1022, culture G.J.S. 91-48, 91-49, det. A. Rossman (BPI 745920); on bamboo culm, Buck 20571A (BPI 1112822, NY); VENEZUELA. Territorio Federal Amazonas, Neblina Base Camp on Rio Baria, on bamboo, 17 Feb 1985, A. Rossman (BPI 550134).

Illustrations.— Rossman (1983, Fig. 29, Pl. 9 c, d).

Notes.— The warts on the ascomata of *Albonectria verrucosa* are often not as prominent as those of *A. rigidiuscula* and *A. albosuccinea*. A fast-growing *Fusarium* was produced by single ascospores of the Brazilian specimen.

Key to the species of *Albonectria*

1. On dead culms of bamboo; stroma lacking; ascomata seated directly on the substratum; ascospores narrowly fusiform, 42–62 × 7–9 μm, 5–9-septate ..... *A. verrucosa*
1. On dead wood and bark of dicotyledonous plants; ascomata on well-developed, pseudoparenchymatous stroma; ascospores 3-septate, ellipsoid or fusiform, generally less than 50 μm long 2

2. Ascospores ellipsoid, 24–35 × 7–10 μm; ascomata usually aggregated on a well-developed stroma; in tropical regions, common ..... *A. rigidiuscula*
2. Ascospores fusiform, 40–48 × 10–12.5 μm; ascomata solitary or aggregated on a scant, pseudoparenchymatous stroma that immediately subtends each ascoma; in tropical regions, rare ..... *A. albosuccinea*

ALLONECTELLA Petrak, Sydowia 4: 345. 1950.

Type: *A. rubescens* Petrak, recognized as *A. guaranitica* (Speg.) Rossman.

Ascomata scattered to aggregated in small groups on a well-developed stroma on host fungus, superficial, subglobose to globose, dark brick-red, KOH+, pigments dissolving in KOH. Asci clavate. Ascospores long ellipsoid, 3-septate, hyaline. Anamorph not known. On stroma of *Phyllachora* on living leaves.

NOTES.— The unispecific genus *Allonectella* was placed in the *Sphaeriales* by Petrak (1950b) near *Allonecte* Syd., a genus that was determined to be a loculoascomycete in the *Tubeufiaceae* (Barr, 1980; Rossman, 1979b, 1987). *Allonectella* is placed in the *Nectriaceae* because of the hypocrealean centrum characteristics and the dark-colored, fleshy ascomata. *Allonectella* appears superficially similar to *Gibberella* but is differentiated by characteristics of ascomatal pigmentation. In *Gibberella* the bluish purple ascomata become darker in KOH and red in lactic acid, while in *Allonectella* the ascomata are dark brick-red and the pigments dissolve in KOH. In addition, species of *Gibberella* are not known to occur on other fungi. No anamorph is known for *Allonectella*.

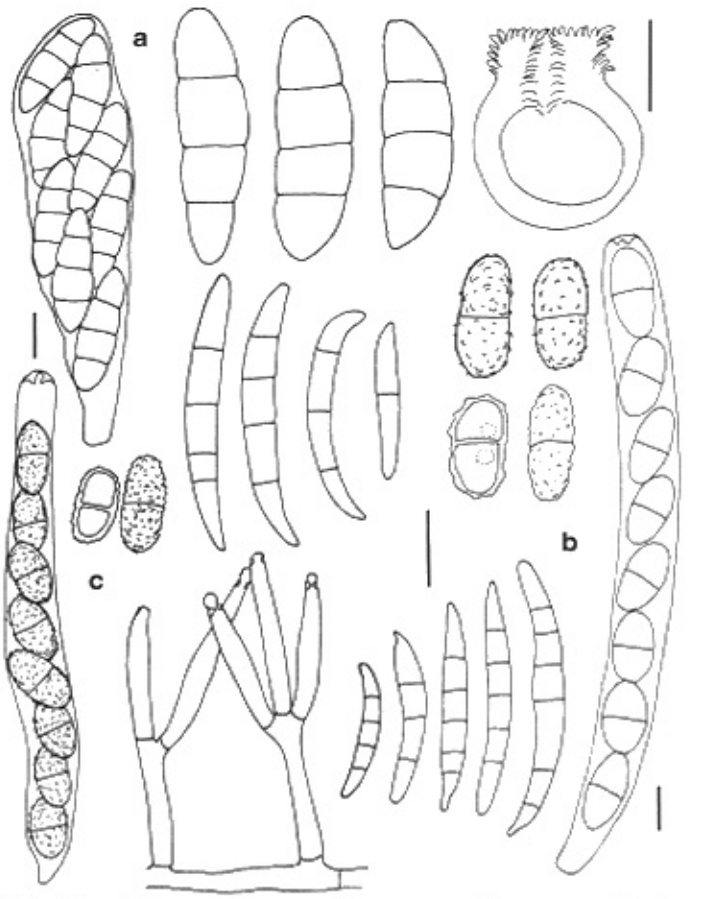


Plate 26. a. *Allonectella guaranitica*, ascus and ascospores. **b.** *Cosmospora dingleyae*, median section of ascoma, ascus, ascospores, macroconidia. **c.** *Cosmospora obscura*, ascus, ascospores, conidiophores and conidia. a. Holotype of *Calonectria guaranitica* – LPS. b. Holotype – PDD. c. Holotype – PDD. Scale bars: a = 10 µm, for asci in a and c; upper b = 100 µm, middle b = 10 µm for conidia and ascospores in a–c, lower b = 10 µm.

Allonectella guaranitica (Speg.) Rossman, Mycotaxon 8: 514. 1979. — Plate 25, k; Plate 26, a.

≡ *Calonectria guaranitica* Speg., Anales Soc. Ci. Argent. 19: 42.1885.
≡ *Broomella guaranitica* (Speg.) Roum., Rev. Mycol. (Toulouse) 9: 150. 1887.
= *Allonectella rubescens* Petrak, Sydowia 4: 345. 1950.

Anamorph: None known.

Ascomata scattered or aggregated in small groups along the margin of the host fungus, developing on a dark brick-red, pseudoparenchymatous stroma; stroma 20–40 µm thick, cells angular, 5–10 µm diam, thin-walled. Ascomata globose to subglobose, 330–400 µm high × 360–430 µm diam, sometimes laterally pinched when dry, dark brick-red, KOH+ dark vinaceous with pigments dissolving in KOH; papilla 80–100 µm diam, formed from short, erect hyphae around the ostiole pointing outward, ascomatal surface slightly rugose due to large, loose cells developing from the outer ascomatal wall. Ascomatal wall 35–75 µm thick, of two indistinct regions: outer region 25–60 µm thick, of globose to angular cells, 10–15 µm diam, with pigmented walls up to 2.5 µm thick; inner region 10–15 µm thick, of elongate, pigmented cells, 8–12 × 3–5 µm, walls up to 1.5 µm thick. Asci clavate, often slightly curved, 70–98 × (16–)23–33 µm, apex simple, 8-spored, ascospores biseriate or obliquely uniseriate. Ascospores ellipsoid with rounded ends, curved, 26–35 × 8–10 µm, 3-septate, often slightly constricted at each septum, hyaline, smooth.

HABITAT.— Along margins of dark stroma of *Phyllachora* sp. on living leaves of *Bambusa* sp. and *Chusquea serrulata*.

DISTRIBUTION.— Brazil, Ecuador.

TYPES.— BRAZIL. Peribebuy, Narango, near swamp in forest, on *Phyllachora* sp. on living leaves of *Bambusa* sp., May 1883, Balansa 3828 (LPS, holotype of *Calonectria guaranitica*; NY, isotype issued as Balansa, Champignons du Paraguay 247; BPI, NY, isotypes issued as Roumeguère, Fungi Selecti Exs. 4144, labeled *Broomella guaranitica* (BPI, NY). ECUADOR. Prov. Pichincha, Mindo, on stroma of *Phyllachora* sp. on living leaves of *Chusquea serrulata*, H. Sydow 229a, 24 Oct 1937 (W, holotype of *Allonectella rubescens*). A specimen at LPS labeled *C. guaranitica* Balansa 4757 no longer contains ascomata.

CALONECTRIA De Not., Comment. Soc. Crittogam. Ital. 2: 477. 1867.

Type: *C. daldiniana* De Not., a synonym of *C. pyrochroa* (Desm.) Sacc.

Ascomata superficial, solitary or gregarious, often on a small, basal pad of pseudoparenchymatous tissue, without a byssoid subiculum or well-developed stroma. Ascomata globose to ovoid, orange to scarlet or dark umber, rarely yellow, KOH+ dark red, yellow in lactic acid, ascomatal base darkened, scaly to warted. Ascomatal wall of two regions: outer region of thick-walled, globose to angular cells extended to form scales or warts; inner region of hyaline, thin-walled, elongate cells. Asci clavate to long-clavate, apex usually simple, asci often evanescent at maturity. Ascospores ellipsoid to long-fusiform, 1- to multiseptate. Anamorph, where known, *Cylindrocladium*. Saprobic and pathogenic on dicotyledonous and monocotyledonous plants, often fruiting on decaying leaves.

Notes.— This genus was established with one species that resembled *Nectria* but had three-septate ascospores. Saccardo (1883) interpreted *Calonectria* to include all *Nectria*-like species having ascospores with 2 or more septa. He transferred over one hundred species to *Calonectria* and divided the genus into sections based on the number of ascospore septa. The type specimen of *C. daldiniana* was redescribed by Rossman (1979a), who recircumscribed the genus *Calonectria* to include only those species having a characteristic ascomatal wall structure and a *Cylindrocladium* anamorph. Ascomata are usually firmly attached to the substratum and have a dark base at the point of attachment. *Calonectria* is morphologically similar to *Leuconectria* and '*Nectria*' *radicicola*, the teleomorph of *Cylindrocarpon destructans*, in both teleomorph and anamorph. *Calonectria* may be closely related to these taxa as suggested by the molecular work of Rehner & Samuels (1995).

Rossman (1979b) accounted for all species placed in *Calonectria* and monographed the five accepted species (Rossman, 1983). Since then two monographs have appeared following that generic concept both concerned primarily with the *Cylindrocladium* anamorphs. Peerally (1991) presented a synopsis of ten species of *Calonectria* and their *Cylindrocladium* anamorphs as well as six additional species of *Cylindrocladium*. Crous & Wingfield (1994) described and illustrated 16 species of *Calonectria* and their *Cylindrocladium* anamorphs as well as 7 additional species of *Cylindrocladium*. A number of important pathogens and new species continue to be described (Crous *et al.*, 1997; El Gholl *et al.*, 1997). *Calonectria ilicicola* Boedijn & Reitsma, often as the anamorph *Cylindrocladium parasiticum* Crous *et al.*, previously referred to as *C. crotalariae*, is the cause of *Cylindrocladium* black root, a serious pod and root necrosis disease of peanuts (*Arachis hypogaea* L.) in the United States (Kokalis-Burelle *et al.*, 1997).

Specimen illustrated.— VENEZUELA. El Limón, pr. Puerto La Cruz, on dead leaves of *Ficus radula*, 18 Jan 1928, H. Sydow, Fungi exotici exsiccati 837 (S – isotype of *Nectria venusta*): Plate 22, d (page 96).

Calonectria pyrochroa (Desm.) Sacc., Michelia 1: 308. 1878.

≡ *Nectria pyrochroa* Desm., Pl. Crypt. France Ed. 2(2), no. 372. 1856.
= *Calonectria daldiniana* De Not., Comment. Soc. Crittogam. Ital. 2: 477. 1867.
= *Ophionectria puiggarii* Speg., Bol. Acad. Nac. Ci. 11: 532. 1889.
= *Nectria abnormis* Henn., Hedwigia 36: 219. 1897.

Anamorph: *Cylindrocladium ilicicola* (Hawley) Boedijn & Reitsma, Reinwardtia 1: 57. 1950 [as '*ilicicolum*'].

≡ *Candelospora ilicicola* Hawley, *in* Rea & Hawley, Proc. Roy. Irish Acad. 31: 11. 1912.

Ascomata solitary, superficial, erumpent through and firmly adhering to the substratum, globose to ovoid, 300–410 × 320–380 µm, collapsing laterally or not at all when dry, red-orange to dark red, KOH+ rose to purple, often with a white to yellow cast due to scurfy outer wall, papilla indistinct to small, pointed, often darker. Ascomatal wall of two intergrading regions: outer region of *textura angularis*, becoming *textura globulosa* toward the outside, outer cells globose, large, 20–35 µm diam, walls pigmented, slightly thickened, up to 1.5 µm, outermost cells only loosely adhering to the ascoma, forming a thin scurf; rarely with long, straight, sparsely scattered, septate hairs 127–179 × 7–8 µm, occasionally branched, tapering gradually to an acuminate apex; inner region of hyaline, thin-walled, elongate cells. Asci broadly obovate to clavate, thin to evanescent at maturity, 64–90 × 17–25 µm, apex simple, sometimes with a short stalk on young asci, 8-spored, ascospores pluriseriate. Apical paraphyses present in young ascomata but disappearing at maturity. Ascospores narrowly fusiform with rounded ends, often curved or sigmoid, 40–70 × 4–7 µm, 1–3-septate, rarely 5- or 7-septate, hyaline, sometimes slightly constricted at each septum, smooth or becoming minutely roughened.

Anamorph: Sporulating branches erumpent, forming a black-rimmed spot, arising at the base of the ascomata or from the substratum surface or, in culture, from pigmented hyphae at the surface of the colony; branching monopodial or opposite, branches 5–6 µm wide, with a septum at the base of each branch.

HABITAT.— On leaves, shoots and stems of numerous dicotyledonous plants.
DISTRIBUTION.— Europe, North America, and South America.

TYPE SPECIMENS were examined as reported by Rossman (1979b, 1983).

ILLUSTRATIONS.— Crous & Wingfield (1994, Figs. 12 A–C); Rossman (1979a, Figs. 1–4; 1983, Figs. 25–26, 8C–D).

NOTES.— Crous & Wingfield (1994) present a review of the biology of this species.

CALOSTILBE Sacc. & Syd., Syll. Fung. 16: 591. 1902.

Type: *C. longiasca* (A. Möller) Sacc. & Syd. (≡ *Sphaerostilbe longiasca* A. Möller), recognized as *C. striispora* (Ellis & Everh.) Seaver.
= *Phaeonectria* (Sacc.) Sacc. & Trotter, Syll. Fung. 22: 485. 1913 (≡ *Nectria* subgenus *Phaeonectria* Sacc., Syll. Fung. 11: 359. 1895). — Type: *Nectria striispora* Ellis & Everh., recognized as *C. striispora*.

Anamorph: *Calostilbella*
Stromata well-developed, originating from a central point, pseudoparenchymatous below the ascomata, giving rise to synnemata, ascomata forming at the base and on rhizoids that arise from the stromata, growing under bark and breaking through at points. Ascomata superficial, densely aggregated, ovoid, not collapsing or collapsing laterally when dry, orange, KOH+ sienna, apical region with acute papilla. Ascomatal surface prosenchymatous, walls thickened. Ascomatal wall 40–70 µm thick, of two regions: outer region about 30 µm thick, of elongate interwoven cells perpendicular to the surface, 3–5 µm diam, with thickened walls and narrow lumina; inner region of flattened cells with thickened walls. Asci clavate, apex simple, base pointed to pedicellate, ascospores biseriate. Ascospores fusiform–ellipsoid, one-septate, slightly constricted or not, translucent yellow-brown, coarsely striate, striations appearing as longitudinal furrows. Anamorph *Calostilbella*. Sterile elements interspersed with phialides. Conidia ellipsoid, 1-septate, translucent yellow-brown. On decaying woody dicotyledonous and monocotyledonous substrata, often fruiting on newly killed wood.

NOTES.— *Calostilbe* was originally described for species that were like *Sphaerostilbe* but differed in having colored ascospores and an 'arthrosporioid conidial state' (Seaver, 1928). Samuels (1973a) reviewed the *Nectria*-like fungi having golden to brown ascospores. He did not consider ascospore color to be a distinctive generic character and placed all species of *Nectria*-like fungi in the genus *Nectria sensu lato*, rather than in genera segregated from *Nectria* on the basis of ascospore color alone. A number of *Nectria*-like genera have stilbellaceous anamorphs and these are distributed throughout the *Nectriaceae*. The only species included in the original description of the genus *Calostilbe* was *C. longiasca*, for which *Nectria striispora* provides the oldest epithet. *Calostilbe striispora* is an unusual and distinctive species occurring commonly in tropical regions in both its teleomorph and anamorph (Hewings & Crane, 1984). *Calostilbe* is recognized at the generic level because the type and only species is unique among hypocrealean fungi. The ascomatal wall of *C. striispora* is composed of thick-walled cells that form a *textura epidermoidea* in an upright palisade of interwoven cells visible below the white to pale yellow scurf. Although bearing some resemblance to *Neonectria* in the distinctive ascomatal wall structure of the '*Nectria*' *mammoidea*-group (Booth, 1959), *Calostilbe* is unlike *Neonectria* in the furfuraceous outer ascomatal layer, the large, striate, yellow-brown ascospores, and the distinctive synnematous anamorph.

Nectria subgenus *Phaeonectria* was established for one species of *Nectria* having yellow-brown ascospores, namely *N. striispora*. When the taxon was raised to generic rank by Saccardo & Trotter (1913), *P. olivacea* was added to the genus. In raising *Nectria* subgenus *Phaeonectria* to generic rank, reference was made to the original publication, although *Nectria striispora* was never formally transferred to *Phaeonectria*. We follow Samuels (1973a) who accepted the reference to the subgeneric description in the text of generic recognition as sufficient to consider *Nectria striispora* as type of the taxon, despite the fact that *N. striispora* was never formally transferred to *Phaeonectria*. Thus, *Phaeonectria* is a later synonym of the unispecific genus *Calostilbe*.

Calostilbe striispora (Ellis & Everh.) Seaver, Mycologia 20: 248. 1928. — Plate 27, a–d.

≡ *Nectria striispora* Ellis & Everh., *in* C.L. Smith, Bull. Iowa Univ. Lab. Nat. Hist. 2: 398. 1893.
≡ *Macbridella striispora* (Ellis & Everh.) Seaver, Mycologia 1: 196. 1909.
≡ *Letendraea striispora* (Ellis & Everh.) Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 125: 514. 1916.
= *Sphaerostilbe longiasca* A. Möller, Bot. Mitt. Tropen 9: 122. 1901.
≡ *Calostilbe longiasca* (A. Möller) Sacc. & P. Syd., Syll. Fung. 16: 591. 1902.
≡ *Letendraea longiasca* (A. Möller) Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 128: 742. 1919.
≡ *Nectria longiasca* (A. Möller) E. Müll., *in* Müller & von Arx, Beitr. Kryptogamenfl. Schweiz 11(2): 636. 1962.
= *Sphaerostilbe musarum* Ashby, Bull. Dept. Agric. (Kingston), N.S. 2: 118. 1914.

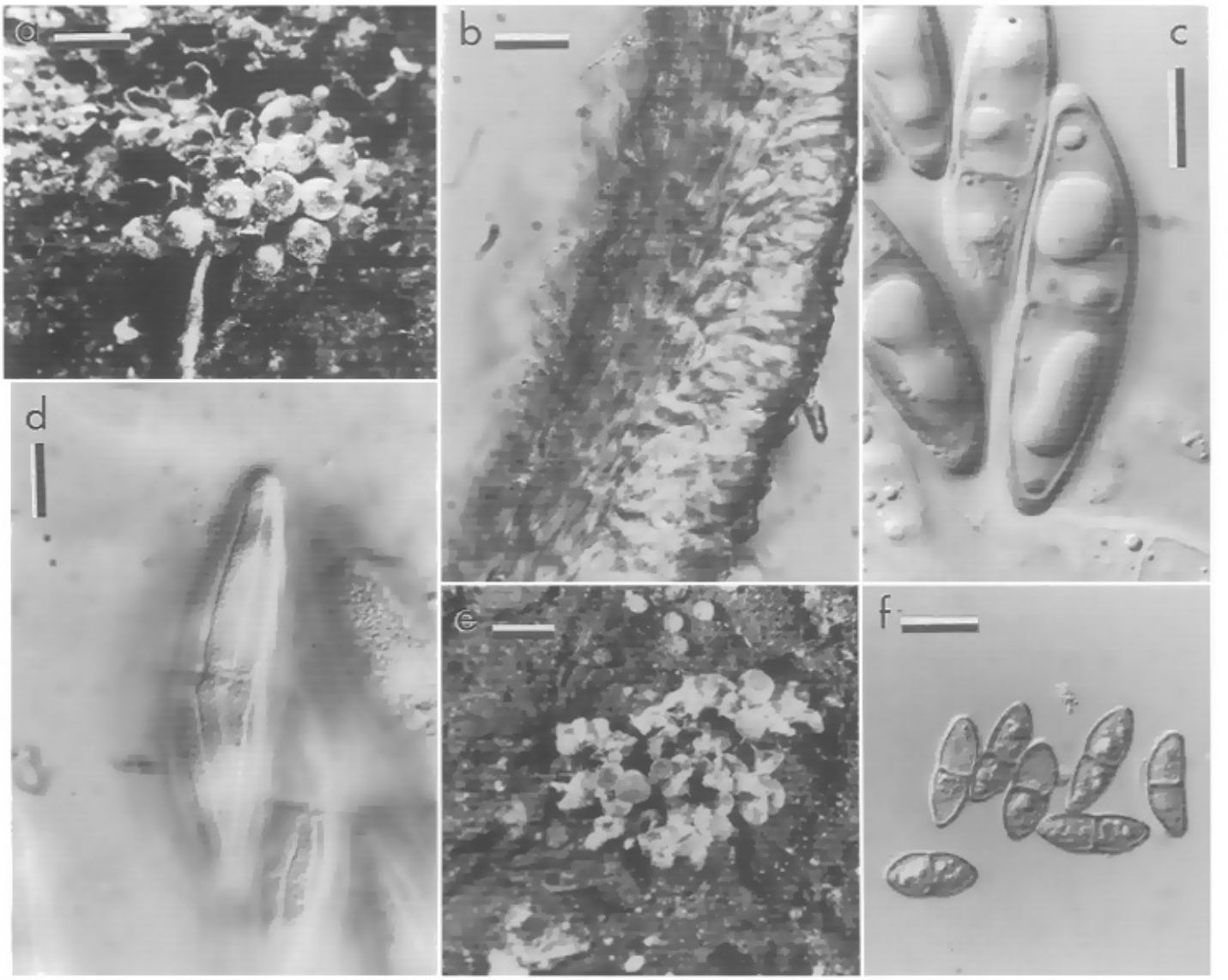


Plate 27. a–d. *Calostilbe striispora*. a. Ascomata on natural substratum. b. Median section of ascomatal wall. c. Ascospores in median focus. d. Ascospores in off-median focus to show wall ornamentation. **e–f.** *Corallomycetella jatrophae*. e. Ascomata on natural substratum. f. Ascospores. a, c, d. BPI 1107297, b. BPI 553210, isolectotype of *Nectria striispora*. e–f. BPI 1107268. Scale bars: a, e = 1 mm; b–d = 10 µm; f = 25 µm.

= *Calostilbe ledermannii* Syd., Engl. Bot. Jahrb. 57: 322. 1922.

Anamorph: *Calostilbella calostilbe* Höhn., Ber. Deutsch. Bot. Ges. 37: 160. 1919.

= *Xenostilbum sydowii* Petrak, Sydowia 13: 106. 1959.

Stromata erumpent through bark, at first appearing as yellow cushions, up to 6 µm wide × 2–5 µm high; stromata originating from a central point; in longitudinal section, cells prosenchymatous below, becoming pseudoparenchymatous immediately subtending the ascomata, cells 10–30 µm diam, walls about 1 µm thick. Synnemata arising from the stromata prior to ascoma formation, eventually ascomata displacing the synnemata. Rhizoids arising from the base of the stromata, growing under the bark, and breaking through at points; ascomata frequently forming on rhizomorphs. Ascomata ovoid, 800–1150(–1425) × 500–675 µm, superficial, densely aggregated in groups of 20–100 or more, wall orange, KOH+ sienna, appearing white to straw due to furfuraceous hyphal covering, with acute, papillate apex, scarlet, glabrous, not collapsing or collapsing laterally when dry. Ascomatal wall cells in surface view prosenchymatous, with about 2 µm thick walls. Ascomatal wall 40–70 µm thick, of two regions: outer region about 30 µm thick, of elongate interwoven cells perpendicular to the surface, 3–5 µm diam, with about 2 µm thick walls and narrow lumina; inner region about 15–20 µm thick, of flattened cells with about 2 µm thick walls. Hyphal covering of branched, septate, spinulose hyphae, 2–4 µm wide, thin-walled. Asci clavate, 210–360(–490) × 18–32 µm, 6–8-spored, ascospores

forming in the upper third of the asci, lower portion elongate, apex simple, base pointed to pedicellate, ascospores biseriate. Ascospores fusiform–ellipsoid, (27–)35–52(–55) × (8–)11–14 µm, one-septate, slightly constricted or not, translucent yellow-brown, coarsely striate, striations appearing as longitudinal furrows.
ANAMORPH: Synnemata arising throughout the stromata, conidia forming only on the longest synnemata. Hyphae of synnema surface parallel, branched, 2–3 µm wide, ends of the hyphae at the surface with small, 1 µm wide 'cork screws', giving the surface a granular-crystalline aspect. Phialides formed in a well-defined, hemispherical cluster; each phialide 22–34 µm long, with a swollen apex, 3.5–5 µm wide at the cylindrical base, then 2 µm wide, apex often slightly flared. Sterile elements interspersed with phialides, straight, smooth, 1.5–2 µm wide, thin-walled, septate. Conidia ellipsoid, 44–65 × 13–18 µm, 1-septate, translucent yellow-brown, wall 0.5–1 µm thick, hyaline ends with walls less than 0.5 µm thick, held in a solitary, brown drop of liquid at the apex.
HABITAT.— On rotting woody tissue of dicotyledonous plants and *Musa* sp. *Calostilbe striispora* is the cause of Bonnygate disease of banana (Wardlaw, 1961).
DISTRIBUTION.— Pantropical, known from Brazil, Colombia, Ecuador (Hewings & Crane, 1984), French Guiana, Jamaica, Nicaragua, New Guinea, Puerto Rico (Samuels, 1973a), Sierra Leone, Trinidad, Venezuela, and Congo (Steyaert, 1948).

TYPE.— NICARAGUA. Castillo Viejo, on bark, C.L. Smith, Feb–Mar 1893, Central American Fungi 6 (NY, lectotype of *N. striispora*; BPI, isolectotypes, three specimens, one bound, two unbound as BPI 553210 & BPI 553211). JAMAICA. Manacal, Causal, on wood, Ashby, Oct 1924 (NY, holotype of *Sphaerostilbe musarum*). BRAZIL. pr. Blumenau, auf morschem Holz, Santa Catarina, Roland Thaxter, No. 893 (FH – General Herbarium, holotype of *Sphaerostilbe longiasca*). NEW GUINEA. In dead wood with bark (Type of *Calostilbe ledermanii* – not seen).
ADDITIONAL SPECIMENS EXAMINED.— BRAZIL. San Domingo, Mato Grosso, K. D. Butler 7069, 30 June 1941 (BPI 553204); COLOMBIA. Near Tumaco, on latex (?) of *Hevea*, Skutch & Striker, E.C. Stakman 245, Dec 1940 (BPI 631902); Puerto Japon, Rio Peneya, Caqueta, Y. Doi, 25–28 July 1973, TNS–F 224809 = TNS–D 1580 (NY). FRENCH GUIANA. Route de Belizon, track to Montagne Tortue, 15 km from road N2, on bark of newly killed branch, 18 Feb 1988, A.Y. Rossman 3230C & C. Feuillet (BPI 1107297). SIERRA LEONE. Njala, Kori, on rotten trunk of *Albizia zygia*, coll. & det. F.C. Deighton, 4 Oct 1954, IMI 58125a (BPI 631903, NY). TRINIDAD. Verdant Vale, Arima, on *Erythrina velutina* Willd., R. Thaxter 1913, Reliquiae Farlowianae 632 (BPI – 2 specimens; FH). VENEZUELA. Amazonas, Neblina Base Camp on Rio Baria, 140 m, on bark, A. Rossman 2183, 19 Feb 1985 (BPI 553205); ibid., 23 Feb 1985, A. Rossman 2213 (BPI 553206).

ILLUSTRATIONS.— Booth & Holliday (1973b, Figs. A–D); Hewings & Crane (1984, Figs. 1 a–e, anamorph only); Morris (1963, Pl. 11); Samuels (1973a, Figs. 16–21); Samuels & Brayford (1994, Figs. 112–117, as *N. striispora*); Steyaert (1948, Figs. 6a–d).

NOTES.— This is a relatively common species on newly killed wood and bark in tropical regions.

CORALLOMYCETELLA Henn., Hedwigia 43: 245. 1904.

Type: *C. heinsenii* [as *heinesii*] (Henn.) Henn. (≡ *Corallomyces heinsenii* Henn., Bot. Jahrb. Syst. 23: 538. 1897), recognized as *Corallomycetella repens* (Berk. & M.A. Curtis) Rossman & Samuels.
[≡ *Corallomyces* Berk. & M.A. Curtis, J. Acad. Nat. Sci. Philadelphia, Ser. 2, 2: 289. 1853, non Fr. 1849. — Type: *C. elegans* Berk. & M.A. Curtis, recognized as *Corallomycetella repens* (Berk. & M.A. Curtis) Rossman & Samuels].

Ascomata solitary to gregarious, often associated with the synnematous anamorph, obpyriform, orange-red to red, KOH+ purple, slightly scurfy, smooth around the ostiole. Surface wall cells globose to angular, with 1–2 µm thick walls. Ascomatal wall of one region of angular cells. Asci clavate to cylindrical, ascospores uniseriate to apically biseriate. Ascospores ellipsoid, one-septate, hyaline, slightly roughened. Anamorph synnematous *Fusarium* or *Rhizostilbella*. On woody plants including monocotyledons, also isolated from soil.
NOTES.— Hennings established *Corallomycetella* for one species of *Corallomyces* having hyaline ascospores. The type specimen of *C. hinsenii* apparently no longer exists; however, the illustration of *C. heinsenii* in the protologue suggests that this is a taxonomic synonym of *C. repens*. In order to ensure that synonymy, *C. heinsenii* is neotypified with the type specimen of *Sphaerostilbe repens*. The name *Corallomyces elegans* was described in a genus that is a later homonym and thus, according to Article 55 of the ICBN (Greuter *et al.*, 1994), this name would have legitimacy only when it is placed in a legitimate genus. The genus *Corallomycetella* is recognized with two species.

Corallomycetella repens (Berk. & M.A. Curtis) Rossman & Samuels, *comb. nov.* — Plate 22 (page 96).

≡ *Sphaerostilbe repens* Berk. & M.A. Curtis, J. Linn. Soc., Bot. 14: 114. 1875.
[≡ *Corallomyces elegans* Berk. & M.A. Curtis, J. Acad. Nat. Sci. Philadelphia, Ser. 2, 2: 289. 1853, genus illeg., Art. 53].
[= *Corallomyces elegans* var. *camerunesis* Henn., Bot. Jahrb. Syst. 22: 76. 1895, genus illeg., Art. 53].
= *Corallomycetella heinsenii* Henn., Bot. Jahrb. Syst. 23: 538. 1897.
[= *Corallomyces mauritiicola* Henn., Hedwigia 43: 244. 1904, genus illeg., Art. 53].
≡ *Nectria mauritiicola* (Henn.) Seifert & Samuels, Stud. Mycol. 27: 161. 1985.
[= *Corallomyces berolinensis* Henn., Verh. Bot. Vereins Prov. Brandenburg 40: 153. 1898, genus illeg., Art. 53].

= *Nectria coccinea* (Pers. : Fr.) Fr. var. *platyspora* Rehm, Ann. Mycol. 7: 137. 1900.
≡ *Nectria platyspora* (Rehm) Weese, *in* Höhn. & Weese, Ann. Mycol. 8: 464. 1910.

Anamorph: *Rhizostilbella hibisci* (Pat.) Seifert, Stud. Mycol. 27: 162. 1985.

≡ *Stilbum hibisci* Pat., J. Bot., Paris 1891: 320. 1891.
= *Rhizostilbella rubra* van der Wolk, Mycol. Centralbl. 4: 237. 1914.
= *Stilbum incarnatum* Wakker, Ziekten van het Suikerriet op Java, Leiden, p. 197. 1898.
= *Stilbum incarnatum* var. *dioscoreae* Sacc., Boll. Orto Bot. Regia Univ. Napoli 6: 63. 1918.
= *Cephalosporium kashiense* R.Y. Roy & G.N. Singh, Curr. Sci. 37: 535. 1968.
≡ *Acremonium kashiense* (R.Y. Roy & G.N. Singh) W. Gams, *Cephalosporium*-artige Schimmelpilze (Hyphomycetes) p. 138. 1971.

Ascomata up to 10, caespitose, associated with rhizomorphs or synnemata, obpyriform, 300–650 μm high × 250–450 μm diam, orange-red to red, KOH+ dark red, yellow in lactic acid, papilla of vertically oriented, clavate hyphae, 20 × 7–10 μm. Ascomatal wall covered with globose or angular cells, smooth around the ostiole, cells with 1–2 μm thick walls; in section 50–70 μm thick, of a single region of angular cells, 7–35 μm diam, becoming narrow, compressed towards the centrum, with 1–2 μm thick walls, thinner towards the centrum. Asci cylindrical to clavate, 185–220 × 8–9 μm, 8-spored, ascospores uniseriate or apically biseriate. Ascospores ellipsoid, 14–21 × 5–9 μm, 1-septate, sometimes slightly constricted at the septum, hyaline to pale brown, with roughened walls up to 1 μm thick.
Anamorph: Synnemata scattered, gregarious, densely crowded or 2–5 caespitose, arising laterally or as terminal extensions of the rhizomorphs or directly from the substratum, cylindric-capitate, subulate-capitate, cylindrical, slender to robust, straight, curved or sinuous, unbranched or inequivalently once or twice branched, or repeatedly dichotomously branched, hirsute in young collections, becoming smooth with age, orange to red-brown, KOH+ bright red to dark red, yellow in lactic acid, 250–8000 μm high × 75–375(–1000) μm diam. Conidiophores unbranched, or once simple monochasial or monoverticillate; sterile hyphae intermixed with conidiophores, 100–200 μm long, 1.5–2 μm wide with abruptly rounded tips. Phialides cylindrical, terminal, lateral and terminal, or in terminal whorls of 3, 34–60 × (1.5–)2.5–3 μm, collarettes not flared, periclinal thickening conspicuous. Conidial mass white to yellow, becoming red-brown or black when dried, 250–450(–1500) μm diam. Conidia ellipsoid, ovoid, fusiform–ellipsoid, or oblong–ellipsoid, often with a truncate base, (9–)12–26 × (3.5–)5–9.5 μm. Rhizomorphs spreading over the surface of the substratum or underneath the bark, red-brown, becoming almost black with age, KOH+ dark red, 0.5–2 mm thick and 2–10 mm long. Description modified from Seifert (1985).
Habitat.— On woody plants including monocots such as *Musaceae* and *Arecaceae*. According to Seifert (1985), this species is mildly parasitic or saprobic on roots and bark of trees, probably plurivorous, and also isolated from soil.
Distribution.— Pantropical

Types.— SRI LANKA (Ceylon). Peradeniya, on decaying wood of *Artocarpus integrifolia*, August, Herb. Berkeley, no. 1005 (K, holotype of *Sphaerostilbe repens*, also **neotype** of *Corallomycetella heinsenii*, designated herein). SURINAM. Ex herb. Schweinitz in herb. Berkeley (K, holotype of *Corallomyces elegans*). GERMANY. Berlin-Dahlem, in the greenhouse, Dec 1893, P. Hennings (B, holotype of *Corallomyces berolinensis*).
Illustrations.— Booth & Holliday (1973a, Figs. A–D, as *S. repens*); Botton *et al.* (1979, Figs. 1–14, as *S. repens*); Goos (1962, Figs. 1–16); Hennings (1897, Figs. 2 a–e as *C. heinsenii*); Seifert (1985, Figs. 54–55, as *N. mauritiicola*).
Specimen illustrated.— JAMAICA. Cane River, 16 km from Kingston, on rotten bark, 11 Jan 1971, R.P. Korf *et al.*, A. Rossman A.Y.R. 412, Gary Samuels, G.S. 90J (CUP-MJ 822).

Notes.— An extensive search was made for the type specimen of *Corallomyces heinsenii* (Type data: East Africa, 'Derema, auf Baumrinden. Heinsen no. 51. 1896'). It is not at B (Hein, 1989, and *in lit.*), HBG, K, L, MA, or S. Thus, this name is neotypified with the type of the next available epithet for this species in the genus *Corallomycetella*, specifically that of *Sphaerostilbe repens*. Booth & Holliday (1973a, as *Sphaerostilbe repens*) reviewed the diseases caused by this fungus, namely 'violet root rot' of *Theobroma cacao*, root rot of *Carica papaya*, and 'stinking root disease' of many tropical woody plants, including *Camellia, Citrus, Coffea*, *Mangifera*, and *Persea americana*. This fungus is easily identified by its red rhizomorphs.

Corallomycetella jatrophae (A. Möller) Rossman & Samuels, *comb. nov.* — Plate 27, e–f.

[≡ *Corallomyces jatrophae* A. Möller, Bot. Mitt. Tropen 9: 295. 190. 1901, genus illeg., Art. 53].
≡ *Nectria jatrophae* (A. Möller) Wollenw., Z. Parasitenk. (Berlin) 3: 498. 1931.
[= *Corallomyces caricae* Henn., Hedwigia 43: 245. 1904, genus illeg., Art. 53].
= *Macbridella amazonensis* Bat., J.L. Bezerra & C.R. Almeida, An. XIV Congr. Nac. Soc. Bot. Brasil, 1963: 118. 1964.
≡ *Nectria amazonensis* (Bat., J.L. Bezerra & C.R. Almeida) Samuels, Canad. J. Bot. 51: 1278. 1973.

Anamorph: *Fusarium* sp.

Ascomata usually at the base of red synnemata, seated

Key to the species of *Corallomycetella*

1. Ascomata red with a furfuraceous, white to yellow coating below the papilla; ascospores 29–35 × 9–11 µm, pale brown, smooth ..... *C. jatrophae*
1. Ascomata orange-red to red, with a thin, concolorous scurf; ascospores 14–21 × 5–9 µm, hyaline to pale yellow, roughened ..... *C. repens*

on an erumpent stroma, in caespitose clusters of 2 to several, obpyriform, 350–700 × 460–500 µm, not collapsing when dry, red, KOH+ dark red, yellow in lactic acid, with white to yellow furfuraceous covering over the lower third of each perithecium that often wears off, with acute, red, smooth apex; papilla of cylindrical, septate hyphae with rounded apices, 2–3 µm wide, walls about 1 µm thick. Cells at the surface of *textura angularis*, 10–15 µm diam, with about 2 µm thick walls, producing yellow, thin-walled hyphae. Ascomatal wall 30–40 µm thick, not differentiated into regions, cells ellipsoid, 15–20 µm long, becoming progressively more flattened toward the interior, about 2 µm wide. Asci clavate, 90–110 × 13–18 µm, apex simple, 8-spored, ascospores biseriate. Ascospores ellipsoid to reniform, 29–35 × 9–11 µm, 1-septate, not constricted, hyaline, pale brown when discharged, smooth-walled.

Anamorph: Synnemata arising from ascomatal stromata, red, branched, fertile tips widely inflated at maturity, discoidal. Macroconidia developing on a disc, 40–100 × 8–10 µm, 3–7-septate.

Habitat.— On bark.

Distribution.— Brazil, Colombia, Costa Rica, French Guiana, Nicaragua, Panama (Samuels, 1973a; Samuels & Dumont, 1982), Venezuela.

Type.— BRAZIL. Amazonas, Manaus, on bark of unidentified plant, Batista, 20 Feb 1961 (URM 22, holotype of *M. amazonensis*); Rio Jurua, Cacoeira, on dead stems of *Carica* sp., May 1901, Ule 2822 (FH, isotype of *Corallomyces caricae*). PUERTO RICO, base of living tree, culture G.J.S. 96-18 = CBS 913.96.

Additional specimens examined.— FRENCH GUIANA. Route de Belizon, track to Montagne Tortue, 15 km from road N2, on bark of newly killed tree, 18 Feb 1988, A.Y. Rossman 3230b & C. Feuillet (BPI 1107295); ibid., A.Y. Rossman 3222 (BPI 1107291). NICARAGUA. Indian River, on bark of unidentified tree, 2 Mar 1896, C.L. Smith (NY). VENEZUELA. Amazonas: Cerro de la Neblina, valley at N base of Pico Phelps, cloud forest, on bark, Apr 1984, G.J. Samuels 1297 (BPI 1107268); Bolivar, along Rio Caroni near rapids just below Uriman, on bark, 11 Jan 1955, J.A. Steyermark & J.J. Wurdack, det. G.J. Samuels (BPI 552420).

Illustrations.— Möller (1901, Pl. 1, Figs. 21–28, 30; Pl. 2, Figs. 31, 32; Pl. 9, Fig. 5, as *Corallomyces jatrophae*); Samuels (1973a, Figs. 10–13, as *N. amazonensis*); Wollenweber (1930, No. 684, as *C. jatrophae*).

COSMOSPORA Rabenh., Fungi europaei no. 459. 1862

≡ *Nectria* subgenus *Cosmospora* (Rabenh.) Sacc., Syll. Fung. 2: 508. 1883.
Type: *C. coccinea* Rabenh.
= *Dialonectria* (Sacc.) Cooke, Grevillea 12: 109. 1884 (≡ *Nectria* subgenus *Dialonectria* Sacc., Syll. Fung. 2: 490. 1883). — Lectotype, designated by Clements & Shear (1931): *D. episphaeria* (Tode : Fr.) Cooke (≡ *Sphaeria episphaeria* Tode : Fr.), recognized as *Cosmospora episphaeria* (Tode : Fr.) Rossman & Samuels.
= *Chrysogluten* Briosi & Farneti, Atti Ist. Bot. Univ. Pavia, Ser. 2, 8: 117. 1904. — Lectotype, designated by Rogerson (1970): *C. biasolettianum* Briosi & Farneti, recognized as *Cosmospora biasolettiana* (Briosi & Farneti) Rossman & Samuels.
= *Stylonectria* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 124: 52. 1915. — Type: *S. applanata* Höhn., a synonym of *Cosmospora purtonii* (Grev.) Rossman & Samuels.

Ascomata solitary to densely gregarious, superficial, rarely immersed, non-stromatic or seated on a thin basal stroma, globose, obpyriform to broadly obpyriform, small to medium-sized, usually less than 300 µm diam, collapsing laterally or not collapsing when dry, orange to red or dark red, rarely pale yellow, usually KOH+ darker, rarely KOH–, smooth to slightly scaly, glabrous or with few to numerous hairs arising from cells of the ascomatal wall surface; papilla of parallel hyphal elements with rounded ends. Cells of the ascomatal wall surface lacking a definite shape, often with a meandering aspect with walls of variable thickness and narrow lumina, adjacent cells joined by fine pores. Ascomatal wall thin, less than 20 µm thick, often translucent, of a single region of interwined hyphae, rarely of two regions; cells lacking a definite shape or appearing ellipsoid. Asci cylindrical to narrowly clavate, apex simple or with a ring, sessile or short-stalked, 8-spored, ascospores generally uniseriate. Ascospores ellipsoid to ellipsoid–fusiform, rarely ovoid or cylindric, 1(–3)-septate, usually yellow-brown, also hyaline, usually spinulose to tuberculate, rarely striate or smooth. Anamorphs, where known, *Acremonium*-like, with colonies and microconidia similar to those of *Fusarium* sect. *Eupionnotes*, *Chaetopsina*, *Cylindrocladiella*, *Stilbella*, and *Volutella*. On other fungi and scale insects, less frequently on decaying woody substrata.

Notes.— ***Cosmospora*** and its type species were described on the label of Rabenhorst, Fungi europaei no.

459, which apparently is the earliest publication of these taxa. Saccardo (1883) recognized *Nectria* subgenus *Cosmospora* for species with verrucose ascospores including only *N. cosmariospora*, with *C. coccinea* Rabenh. as a synonym. Booth (1959), Rossman (1983), Samuels (1976a) and others have referred the species placed in *Cosmospora* as the *N. episphaeria*-group. Samuels *et al.* (1991) recognized this group at the subgeneric level as *Nectria* subgenus *Dialonectria* based on a combination of characteristics including ascomatal morphology and anamorph. Species additional to those in Samuels *et al.* (1991) are recognized here in *Cosmospora* including three species on scale insects. The species of slow-growing, fungicolous and insecticolous Fusaria that are anamorphs of *Cosmospora* have been shown to constitute a monophyletic group of related species within *Fusarium* (O'Donnell, 1993).

Saccardo (1883) established ***Dialonectria*** as a subgenus of *Nectria* including 51 species, without designating a type. Later Cooke (1884) raised the name to generic rank with 134 species, also without designating a type. Clements & Shear (1931) selected *D. episphaeria* as the lectotype of the genus *Dialonectria*. The name *Dialonectria episphaeria* is based on *Sphaeria episphaeria*, a species that has long been known as *Nectria episphaeria*. Booth (1959) designated a lectotype specimen for *Sphaeria episphaeria* and presented a modern description of *C. episphaeria* (as *Nectria episphaeria*) including the anamorph, *Fusarium aquaeductuum* Lagerh. var. *medium* Wollenw.

The genus ***Chrysogluten*** was described as a lichen in its own family, the *Chrysoglutenaceae*. Two species were included: *C. biasolettianum* and *C. cesatii*. Rogerson (1970) designated *C. biasolettianum* as the lectotype because the type specimen of this species was said to be mature. The type specimen of *Chrysogluten biasolettianum* was examined and determined to belong in the hypocrealean genus *Cosmospora*.

Stylonectria was described by von Höhnel as an anamorph genus with the type species, *S. applanata*, for which the teleomorph was considered to be *Nectria applanata*, a synonym of *Nectria purtonii* (Grev.) Berk. (Booth, 1959; Samuels *et al.*, 1991). Based on an examination of type material, Booth (1959) presented convincing evidence that the supposed pycnospores described by Fuckel (1871) and regarded by von Höhnel as conidia inside pycnidia are, in reality, ascospores that had been released from the asci within the ascomata, a common occurrence in hypocrealean fungi. The anamorph of *N. purtonii* has been shown by Booth (1959) and others to be *Fusarium aquaeductuum* (Radlk. & Rabenh.) Lagerh. var. *aquaeductuum* (Samuels *et al.* 1991). *Cosmospora purtonii* (as *Nectria purtonii* (Grev.) Berk.) has been placed in the *Nectria episphaeria*-group (Booth, 1959) and *Nectria* subgenus *Dialonectria* (Samuels *et al.* 1991).

Cosmospora coccinea Rabenh., Fungi europaei no. 459. 1862. — Plate 28, a.

= *Nectria cosmariospora* Ces. & De Not., Schema Classif. Sferiac. ital., Comment. Soc. Crittog. Ital. 1(4): 195. 1863.
≡ *Dialonectria cosmariospora* (Ces. & De Not.) Moravec, Česká Mykol. 8: 92. 1954.

Anamorph: *Verticillium olivaceum* W. Gams, *Cephalosporium*-artige Schimmelpilze p. 129. 1971.

Ascomata scattered, solitary, superficial, pyriform with a pointed apex, orange, smooth, 375–450 μm high × 280–300 μm diam. Ascomatal walls 20–30 μm thick. Asci cylindrical, 130–200 × 12–15 μm, tapering to a short base, 8-spored, ascospores uniseriate. Ascospores broadly ellipsoid, (13.5–)14.5–17(–18.5) × (8.5–)10–12.5(–14.5) μm, 1-septate, at first hyaline, becoming yellow-brown to reddish-brown, coarsely warted. Description modified from Gams (1971).

Habitat.— On hymenial surface of old polypore basidiomata, particularly *Inonotus* spp. on *Fagus* and *Alnus* (T. Læssøe and W. Gams, pers. comm.).

Distribution.— Europe.

Lectotype, designated herein: GERMANY. Near Laubach, on rotten wood [actually on rotting pores of a polypore], leg. Solms, Rabenhorst, Fungi europaei no. 459 (BPI).

Illustrations.— Gams (1971, Fig. 85); Munk (1957, Fig. 4); Samuels *et al.* (1991, Figs. 5–7); Schmid & Schmid (1990, Fig. 31), all as *Nectria cosmariospora*.

Specimen illustrated.— SWITZERLAND. Sächs, on old '*Polyporus*' *nodulosus*, Oct 1913, W. Krieger, Fungi saxonici 1858b as *Nectria cosmariospora* (BPI 551434).

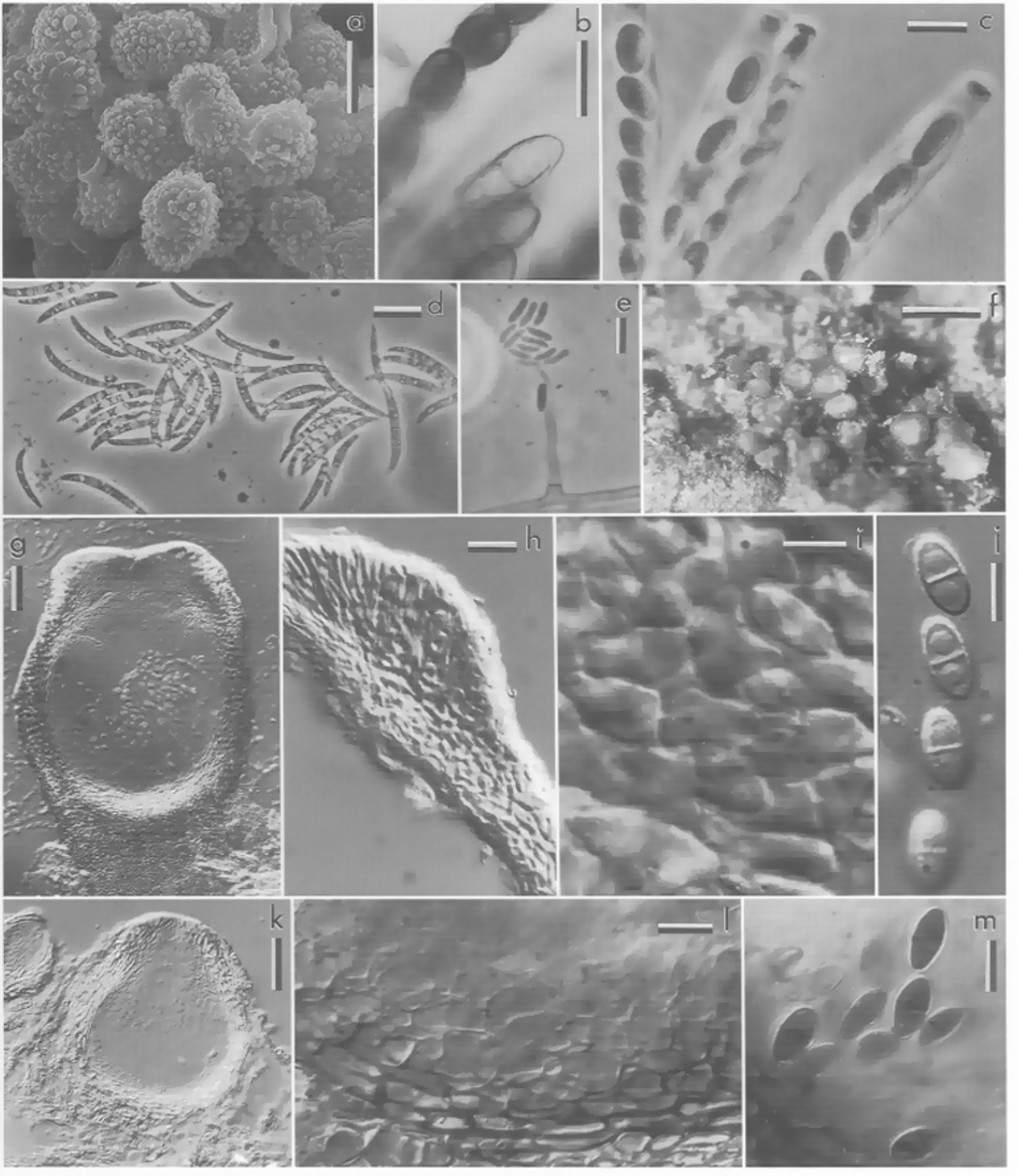
Notes.— This species has generally been referred to as *Nectria cosmariospora*; if combined in *Nectria*, it would become a later homonym of *N. coccinea* (Pers. : Fr.) Fr. An examination of the type specimen has con-

Plate 28. a. *Cosmospora coccinea*. SEM of ascospores. **b.** *Cosmospora dingleyae*. Ascal apex with ascospores. **c–e.** *Cosmospora obscura*. c. Asci with ascospores. d. Macroconidia of *Fusarium* anamorph. e. Microconidia of *Fusarium* anamorph. **f–j.** *Cosmospora pseudepisphaeria*. f. Ascomata on natural substratum. g. Median section of ascoma. h. Median section of ascomatal apex. i. Close-up of ascomatal wall cells showing pores between cells. j. Ascal apex with ascospores. **k–m.** *Cosmospora biasolettiana*. k. Median section of ascoma. l. Close-up of ascomatal wall. m. Ascospores stained in cotton blue. a. BPI 551434. b. Holotype – PDD 46011. c–e. Holotype – PDD 46349. f–j. Holotype of *Nectria pseudepisphaeria* – NY. k–m. Holotype of *Chrysogluten biasolettianum* – NY. Scale bars: a–c, e, l, m = 10 μm; d = 20 μm; f = 500 μm; g = 100 μm; h, k = 50 μm; i, j = 25 μm.

firmed *Cosmospora coccinea* to be synonymous with the published accounts of *N. cosmariospora*. Both Gams (1971, culture CBS 341.70) and Tayel & Hastie (1975) proved that *C. coccinea* is heterothallic.

ADDITIONAL SPECIES OF *COSMOSPORA*:

Most species of *Cosmospora* were included in Samuels *et al.* (1991) who provided a synopsis with illustrations



of the forty species of *Nectria* subgenus *Dialonectria*. All of these species are transferred herein to *Cosmospora*. Three new species and eight additional new combinations are recognized, three of which are insecticolous and have *Fusarium* anamorphs. The key included here is modified from Samuels *et al.* (1991).

Cosmospora aurantiicola (Berk. & Broome) Rossman & Samuels, *comb. nov.*

≡ *Nectria aurantiicola* Berk. & Broome, J. Linn. Soc. 14: 117. 1873.
≡ *Sphaerostilbe aurantiicola* (Berk. & Broome) Petch, Ann. Roy. Bot. Gard. (Peradeniya) 7: 199. 1920.
[≡ *Corallomyces aurantiicola* (Berk. & Broome) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 121: 353. 1912, gen. illeg., Art. 53].
= *Microcera aurantiicola* Petch, Trans. Brit. Mycol. Soc. 7: 158. 1921.

Anamorph: *Fusarium larvarum* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 369. 1869 [1870].

Habitat.— Associated with scale insects and adelgids.
Distribution.— Warm temperate and tropical regions, known from Australia, Canada (Quebec), Japan, Malawi, New Zealand, Sabah, Syria, Tanzania, United States (Alabama), West Indies and Zambia as the teleomorph, while the anamorph is reported from many additional countries.

Notes.— This species was described and illustrated by Booth (1971, 1981), as *Nectria aurantiicola*) and Gerlach & Nirenberg (1982, anamorph only).

Cosmospora biasolettiana (Briosi & Farneti) Rossman & Samuels, *comb. nov.* — Plate 28, k–m.

≡ *Chrysogluten biasolettianum* Briosi & Farneti, Atti Ist. Bot. Univ. Pavia II, 8: 117. 1904.

Anamorph: *Fusarium biasolettianum* Corda, Icon. Fung. 2: 3. 1838.

Ascomata solitary to gregarious, scattered, immersed in a translucent mass of hyphae forming a slimy, pale orange sheet over the substratum, outline of darker ascomata visible through stroma, hyphae of stroma agglutinated, forming a loose prosenchyma of thin-walled, hyaline cells, cells more or less oriented parallel to the ascomata around the sides and parallel to the substratum at the base of the ascomata; when dried, ascomata only partially immersed, when rehydrated ascomata completely immersed with only the short papilla emerging; ascomata solitary to gregarious, globose, 125–180 μm diam, laterally pinched when dry, pale yellow to pale buff, KOH–, papilla about 100 μm high × 30 μm diam. Ascomatal surface of large, thin-walled cells, 6–12 μm diam, forming a *textura angularis*. Ascomatal wall 15–25 μm thick, of elongate cells, 6–12 × 3–4.5 μm, forming a *textura prismatica*; around the apex cells becoming thick-walled, 1.5–2 μm thick. Asci narrowly clavate, 36–45 × 8–10 μm, simple, 8-spored, ascospores obliquely uniseriate. Ascospores ellipsoid with small guttules, 9–9.5 × 4–5 μm, 1-septate, hyaline, smooth.
Habitat.— In slime flux on tree trunks.
Distribution.— Italy, United States (New Hampshire).

Type.— ITALY. Istria, 'in truncis vivis *Vitis viniferae* veris tempore fletu madidis prope Cavam Carbonariam in agro ticinensi'. G. Briosi & R. Farneti, ex Herb. Briosi, received from Briosi 20 Mar 1903 (NY – slides of isotype ex FH; FH – specimen not located).
Additional specimen examined.— UNITED STATES. New Hampshire: Jackson, on slime exudate of *Betula*, June 1897 (NY ex FH).

Notes.— Like many species of *Cosmospora*, *C. biasolettiana* is associated indirectly with other fungi on decaying substrata and it has a *Fusarium* anamorph. The basionym, *Chrysogluten biasolettianum* Briosi & Farneti as '(Corda) Briosi & Farneti', is the teleomorph of *Fusarium biasolettianum* and was originally based on that name. The type specimen of *C. biasolettianum* contains mature ascomata. The relationship between *C. biasolettianum* and *F. biasolettianum* has not been confirmed. According to Wollenweber & Reinking (1935) and Booth (1971), *Fusarium biasolettianum* may be a synonym of *F. merismoides* Corda. Briosi & Farneti (1904) mentioned that they found 'gonidia' in the slime, and that the species could be lichenized. Cooke & Hawksworth (1970) indicated that the family *Chrysoglutenaceae* was entirely or partially lichenized, probably based on Briosi & Farneti's description. Although algal cells were observed among other organisms in the mixture of material on the substratum, they were not consistently associated with the ascomata. *Cosmospora biasolettiana* seems most closely related to *C. rishbethii*, a species known only from England from the cut end of a log of *Pinus sylvestris*.

Cosmospora camelliae (Shipton) Rossman & Samuels, *comb. nov.*

≡ *Calonectria camelliae* Shipton, Trans. Brit. Mycol. Soc. 72: 163. 1979.

Anamorph: *Cylindrocladiella infestans* Boesewinkel, Canad. J. Bot. 60: 2290. 1982.

Habitat.— On wood and bark of *Pinus pinea* and on fruit of unknown rainforest tree.
Distribution.— Australia, New Zealand (anamorph).

Cosmospora chaetopsinae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria chaetopsinae* Samuels, Mycotaxon 22: 18. 1985.

Anamorph: *Chaetopsina* cf. *fulva* Rambelli, Atti Accad. Sci. Bologna 15: 5. 1956.
HABITAT.— On decaying leaves, possibly on dematiaceous hyphae.
DISTRIBUTION.— *Cosmospora chaetopsinae* is known only from New Zealand and Venezuela while *Chaetopsina fulva* is common and cosmopolitan.

Cosmospora chaetopsinae-catenulatae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria chaetopsinae-catenulatae* Samuels, Mycotaxon 22: 28. 1985.

Anamorph: *Chaetopsina catenulata* Samuels, Mycotaxon 22: 28. 1985.
HABITAT.— On bark and ascomycetous stromata.
DISTRIBUTION.— Ecuador, Indonesia, Jamaica, Venezuela. Culture: CBS 491.92.

Cosmospora chaetopsinae-penicillatae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria chaetopsinae-penicillatae* Samuels, Mycotaxon 22: 24. 1985.

Anamorph: *Chaetopsina penicillata* Samuels, Mycotaxon 22: 24. 1985.
HABITAT.— On bark and base of palm frond.
DISTRIBUTION.— Ecuador, Jamaica, and New Zealand.
NOTES.— In addition to Samuels *et al.* (1991), a complete description and illustrations were published in Samuels & Brayford (1994). Culture: CBS 608.92.

Cosmospora chaetopsinae-polyblastiae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria chaetopsinae-polyblastiae* Samuels, Mycotaxon 22: 21. 1985.

Anamorph: *Chaetopsina polyblastia* Samuels, Mycotaxon 22: 21. 1985.
HABITAT.— On bark and decaying palm debris.
DISTRIBUTION.— Tropical America, common.

Cosmospora chlorina (P. Crouan & H. Crouan) Lowen, *comb. nov.*

≡ *Nectria chlorina* P. Crouan & H. Crouan, Fl. Finistère, p. 37. 1867.
≡ *Nectriella chlorina* (P. Crouan & H. Crouan) Sacc., Michelia 1: 278. 1878.

Anamorph: unknown.
Ascomata superficial, scattered or in groups of 3, non-stromatic, obpyriform, 220 μm high × 190 μm diam, translucent red, KOH+ dark red, yellow in lactic acid; papilla conical. Surface covered with 1–2 μm wide hyphae. Asci cylindrical, 35–40 × 4–5 μm, apex truncate, containing a ring; ascospores uniseriate. Ascospores ellipsoid, 5.5–7 × 2.5–3 μm, 1-septate, hyaline, smooth to slightly striate.
HABITAT AND DISTRIBUTION.— Known only from the type.

TYPE.— FRANCE. Brittany: Finistère, at the base of a dead branch of *Angelica sylvestris*, 20 May 1857, labeled '*Nectria chlorina* olim, *Sphaeria citrina* Wallr., *N. chlorina* Fr. Summa'. Crouan & Crouan (CO, **lectotype**, designated herein; CO, isotype specimen – packet with picture labeled 'la thèque ne présente pas ... d'un fluide du lactique, gross. 40 fois').

NOTES.— Although the drawing on the packet and the original description of *Cosmospora chlorina* indicate that this species has bright yellow ascomata, the ascomata examined were translucent red but otherwise fit the original description. This species is distinguished by having ascospores smaller than any other species of *Cosmospora*; it is allied with the lineage of *Cosmospora* that includes corticolous or herbicolous species having hyaline ascospores (Samuels *et al.*, 1991).

Cosmospora consors (Ellis & Everh.) Rossman & Samuels, *comb. nov.*

≡ *Dialonectria consors* Ellis & Everh., J. Mycol. 4: 122. 1888.
≡ *Nectriella consors* (Ellis & Everh.) Saccardo, Syll. Fung. 9: 941. 1891.
≡ *Nectria consors* (Ellis & Everh.) Seaver, Mycologia 1: 61. 1909.
= *Nectria ignia* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 1475. 1909.

Anamorph: *Volutella minima* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 1543. 1909.
HABITAT.— On decaying herbaceous debris.
DISTRIBUTION.— Pantropical and subtropical, extending into the Smoky Mts. of North Carolina.
NOTES.— This species and its *Volutella* anamorph were described and illustrated by Samuels (1977). Culture: CBS 328.77.

Cosmospora digitalicola (P. Crouan & H. Crouan) Lowen, *comb. nov.*

≡ *Nectria digitalicola* P. Crouan & H. Crouan, Fl. Finistère, p. 37. 1867.
≡ *Nectriella digitalicola* (P. Crouan & H. Crouan) Sacc., Michelia 1: 278. 1878.

Anamorph: unknown.
Ascomata scattered or in groups up to 3, non-stromatic, superficial, obpyriform, 220 μm high × 190 μm diam,

red-orange, KOH+ red, pallid in lactic acid, collapsed vertically, smooth, papilla with rounded apex. Cells on ascomatal surface forming a *textua epidermoidea*. Ascomatal wall 8–12 µm thick. Asci clavate, 36–40 × 4–6.5 µm, apex simple, ascospores uniseriate with overlapping ends or irregularly biseriate. Ascospores cylindrical, 11–12 × 3–4 µm, 1-septate, slightly constricted, hyaline, smooth-walled.

Habitat and distribution.— Known only from the type locality.

Type.— FRANCE. Brittany: in marshy places, on stems of *Digitalis*, 12 Oct 1863, Crouan & Crouan (CO, holotype).

Notes.— Ascomata on the type collection of *Cosmospora digitalicola* are sparse. This species is allied with *C. consors* in the lineage of *Cosmospora* that includes corticolous or herbicolous species having hyaline ascospores (Samuels *et al.*, 1991).

Cosmospora diminuta (Berk.) Rossman & Samuels, *comb. nov.*

≡ *Nectria diploa* Berk. & M.A. Curtis var. *diminuta* Berk., Grevillea 4:46. 1875.
≡ *Nectria diminuta* (Berk.) Sacc., Syll. Fung. 2: 498. 1883.
= *Dialonectria gigaspora* Cooke & Massee, *in* Cooke, Grevillea 17: 42. 1888.
≡ *Nectriella gigaspora* (Cooke & Massee) Sacc., Syll. Fung. 9: 942. 1891.
≡ *Pseudonectria gigaspora* (Cooke & Massee) Petch, Ann. Roy. Bot. Gard. (Peradeniya) 7: 122. 1920.

Anamorph: unknown.
Ascomata on effete stromata of black pyrenomycetes, red, KOH+ dark red, bright yellow in lactic acid. Cells on the surface of the ascomata ellipsoid, 7 × 4 µm, thick-walled, surface obscured by 2.5–5 µm wide hyphae. Asci clavate, 40–50 × 10–12 µm; apex rounded to truncate, without apical ring, asci often deliquescing in the centrum, ascospores diagonally biseriate in the middle, ascospores uniseriate above and below. Ascospores ellipsoid–fusiform, (18–)25–39 × (6.5–)8.5–14 µm, at first 1-septate, ultimately 3-septate, hyaline, yellow-brown at maturity, finely to prominently striate.
Habitat.— On stromata of *Botryosphaeria* and *Valsa*.
Distribution.— Sri Lanka, United States (South Carolina).

Types.— SRI LANKA (Ceylon). Hakgalla, on *Botryosphaeria inflata*, Thwaites 542 (NY, isotype of *D. gigaspora*, filed as *Nectria gigaspora*); UNITED STATES. South Carolina, Society Hill, on some *Sphaeria* on alder, Car. Inf. No. 4029 (FH – Curtis Herbarium, isotype of *N. diploa* var. *diminuta*).

Illustrations.— Samuels *et al.* (1991, Fig. 17, as *Nectria diminuta*).

Notes.— Young ascospores of *Cosmospora diminuta* are 1-septate; however, additional septa often develop after the ascospores are released from the asci and are obscured by thick striations at maturity. A *Volutella*-like hyphomycete is present on the type collection of *D. gigaspora* that may be the anamorph of *C. diminuta* with characteristics as follows: Conidiogenous cells 5–11 × 3 µm, narrowing to 2 µm at the apex; apical wall thickened, but not flared; conidia ellipsoid, 4–5.5 × 3 µm, non-septate and smooth.

Cosmospora dingleyae Lowen, *sp. nov.* — Plate 26, b; Plate 28, b.
Anamorph: *Fusarium* sp.

Ascomata immersa, interdum erumpentia, sparsa, vel usque ad 20 aggregata, obpyriformia, 175–420 µm alta × 175–378 µm diam, rubro-aurantiaca, KOH+ parum fuscata, papilla truncata. Setae cingentes ostiolum, 14–24 × 5–8 µm, pariete usque ad 3 µm incrassata, apice rotundato. Asci cylindrici, 76–88 × 5–9 µm; apex annulo praeditus. Ascosporae ellipsoideae, 12–18 × 4–8 µm, 1-septatae, brunneolae, verrucosae.

Ascomata immersed, sometimes becoming erumpent, scattered or in groups of up to 20, obpyriform, 175–420 µm high × 175–378 µm diam, red-orange, KOH+ slightly darker red, pallid in lactic acid, slowly becoming yellow; papilla truncate, 60–120 µm high × 100–130 µm diam; collapsing vertically with the papilla retaining its shape. Setae surrounding the ostiole 14–24 × 5–8 µm, with walls up to 3 µm thick; apex rounded. Cells on ascomatal surface angular, 10–16 µm diam. Ascomatal wall 30–40 µm thick, of two regions: outer region 20–30 µm thick, of thick-walled, angular to rounded cells; inner region of thin-walled, elongate, rectangular cells. Asci cylindrical, 76–88 × 5–9 µm; apex truncate with a ring, ascospores uniseriate. Ascospores ellipsoid, 12–18 × 4–8 µm, 1-septate, occasionally slightly constricted, at first hyaline, becoming pale brown, verrucose.
Characteristics in culture.— Colonies grown at 20°C on PCA: aerial mycelium cottony, slightly zonate, at first orange, nearly transparent; reverse slighty darker orange; margin white, then pale brown with diffusing, pale brown pigment. Conidiophores arising directly from the agar surface and from the aerial mycelium; microconidiophores morphologically distinct from macroconidiophores. Microconidiophores arising from aerial mycelium, stipe *ca* 20 µm long, branching irregularly, each branch terminating in a single phialide; phialides cylindrical, *ca* 20 µm long, tapering from 1.5 µm at the base to 1 µm at the apex. Microconidia cylindrical, 4–7 × 1.5–2 µm. Macroconidiophores 70–255 µm long, 5–9 µm wide at the base, 3.5(–5) µm wide at the apex, hyaline, smooth; apex with visible periclinal thickening, not flared. Macroconidia falcate, 40–50 × 4–6 µm, 3–7-septate, smooth, hyaline; foot-cell indis-

tinct; held in a hyaline liquid droplet. Chlamydospores not observed.
HABITAT.— On bark.
DISTRIBUTION.— New Zealand.

TYPE.— NEW ZEALAND. Northland, Hokianga County, vic. Mangamuka Bridge, Omahuta State Forest, Omahuta Kauri Sanctuary, 10 May 1981, G.J. Samuels 81–106 & E. Horak (PDD 46011, holotype; IMI 297573, isotype culture and slides).
ADDITIONAL SPECIMEN EXAMINED.— NEW ZEALAND. Westland: Waiho, in bark of *Olearia avicenniifolia*, June 1950, J.M. Dingley 12/46 (part of PDD 10507).
ETYMOLOGY.— Named in honor of Joan M. Dingley, for her collection of this fungus and for her work with hypocrealean fungi.

NOTES.— The *Fusarium* anamorphs of *Cosmospora dingleyae* and *C. obscura* are characterized by slow-growing, slimy, orange cultures that produce little aerial mycelium, similar to *Fusarium merismoides* Corda and other *Fusarium* anamorphs of species of *Cosmospora*. Despite their immersed ascomata reminiscent of *Nectriella*, *C. dingleyae* and *C. obscura* are placed in *Cosmospora* on the basis of the verrucose, pale brown ascospores and *Fusarium* anamorphs. *Cosmospora dingleyae* is distinguished from *C. obscura* by the orange ascomata and setae encircling the ostiole and from other species of *Cosmospora* by the immersed, setose ascomata. *Cosmospora dingleyae* is similar to *C. pseudoflavoviridis* in having setae around the ostiole.

Cosmospora diploa (Berk. & M.A. Curtis) Rossman & Samuels, *comb. nov.*

≡ *Nectria diploa* Berk. & M.A. Curtis, J. Linn. Soc. (Bot.) 10: 378. 1869.
≡ *Creonectria diploa* (Berk. & M.A. Curtis) Seaver, Mycologia 1: 190. 1909.
≡ *Calonectria diploa* (Berk. & M.A. Curtis) Wollenw., Angew. Bot. 8: 193. 1926.
= *Nectria coccophila* Nomura, Rep. Imp. Agric. Exp. Stn. 18: 105. 1901.

Anamorph: *Fusarium coccidicola* Henn., Bot. Jahrb. Syst. 34: 57. 1904.

= *Fusarium juruanum* Henn., Hedwigia 43: 398. 1904.
= *Aschersonia henningsii* Koorders, Bot. Untersuch. Java p. 213. 1907.
≡ *Pseudomicrocera henningsii* (Koorders) Petch, Trans. Brit. Mycol. Soc. 7: 164. 1921.

HABITAT.— Associated with scale insects.
DISTRIBUTION.— Tropical regions.
NOTES.— This species was described and illustrated by Booth (1971, as *Calonectria diploa*) and Rossman (1983, as *Nectria diploa*). The anamorph synonymy follows Gerlach & Nirenberg (1982).

Cosmospora episphaeria (Tode : Fr.) Rossman & Samuels, *comb. nov.*

≡ *Sphaeria episphaeria* Tode : Fr., Tode, Fungi Mecklenb. Sel. 2: 21. 1791 : Fries, Syst. Mycol. 2: 454. 1823.
≡ *Nectria episphaeria* (Tode : Fr.) Fr., Summa Veg. Scand. p. 388. 1849.
≡ *Dialonectria episphaeria* (Tode : Fr.) Cooke, Grevillea 12: 110. 1884.

Anamorph: *Fusarium aquaeductuum* (Radlk. & Rabenh.) Lagerh. var. *medium* Wollenw., Z. Parasitenk. (Berlin) 3: 298. 1931.

HABITAT.— On stromatic ascomycetes on hardwoods.
DISTRIBUTION.— Cosmopolitan but more common in north temperate regions.

Cosmospora flammea (Tul. & C. Tul.) Rossman & Samuels, *comb. nov.*

≡ *Sphaerostilbe flammea* Tul. & C. Tul., Sel. Fung. Carpol. 3: 103. 1865.
≡ *Nectria flammea* (Tul. & C. Tul.) Dingley, Trans. Roy. Soc. New Zealand 79: 189. 1951.
= *Nectria laeticolor* Berk. & M.A. Curtis, J. Linn. Soc. (Bot.) 10: 377. 1868.
[≡ *Corallomyces laeticolor* (Berk. & M.A. Curtis) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 121: 363. 1912, genus illeg., Art. 53].
= *Nectria aglaothele* Berk. & M.A. Curtis, Grevillea 4: 45. 1875.
= *Nectria subcoccinea* Sacc. & Ellis, Michelia 2: 570. 1881.
= *Nectria passeriniana* Cooke, Grevillea 12: 81. 1884.
[= *Corallomyces brachysporus* Penz. & Sacc., Malphighia 15: 228. 1901, genus illeg., Art. 53].

Anamorph: *Fusarium coccophilum* (Desm.) Wollenw. & Reink., Die Fusarien p. 34. 1935.

HABITAT.— Associated with scale insects.
DISTRIBUTION.— Warm temperate and tropical regions.
NOTES.— This species was described and illustrated by Booth (1971, 1981, as *Nectria flammea*), Gerlach & Nirenberg (1982, anamorph only), and Samson *et al.* (1988, as *N. flammea*).

Cosmospora flavoviridis (Fuckel) Rossman & Samuels, *comb. nov.*

≡ *Sphaerostilbe flavoviridis* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 22. 1869 [1870].

Anamorph: *Fusarium melanochlorum* (Casp.) Sacc., Syll. Fung. 4: 725. 1886.
≡ *Fusisporium melanochlorum* Casp., Sitzungsber. Preuss. Akad. Wiss., Physik.-Math. Kl. p. 309. 1855.

HABITAT.— On stromatic ascomycetes on wood.
DISTRIBUTION.— Europe, England.

Cosmospora ganymede (Lowen & Minter) Rossman & Samuels, *comb. nov.*

≡ *Nectria ganymede* Lowen & Minter, Trans. Brit. Mycol. Soc. 88: 59. 1987.

Anamorph: *Fusarium* sp.

Habitat.— Ascomata of *Zeus olympius*.
Distribution.— Greece.

Cosmospora geastroides (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria geastroides* Samuels, Mycol. Pap. 164: 20. 1991.

Anamorph: *Acremonium*-like.
Habitat.— On bark, wood, petioles, possibly on mycelium and fructifications of ascomycetes.
Distribution.— Jamaica, Peru, ?New Zealand.

Cosmospora glabra (Rossman) Rossman & Samuels, *comb. nov.*

≡ *Nectria glabra* Rossman, Mycol. Pap. 150: 34. 1983.

Anamorph: *Fusarium* sp.

Habitat.— Fungicolous, herbicolous or corticolous.
Distribution.— Colombia, Ecuador, Jamaica, Venezuela.
Notes.— This species was described and illustrated by Rossman (1983) and Samuels & Brayford (1994).

Cosmospora joca (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria joca* Samuels, Mycol. Pap. 164: 21. 1991.

Anamorph: *Acremonium*-like.
Habitat.— On *Hypoxylon* sp.
Distribution.— Brazil.

Cosmospora jucundula (Sacc. & Speg.) Rossman & Samuels, *comb. nov.*

≡ *Nectriella jucundula* Sacc. & Speg., Michelia 1: 409. 1878.

Anamorph: None known.

Habitat.— On dead culms of *Arundo donax*.
Distribution.— Italy.
Notes.— This species was described in Rossman *et al.* (1993).

Cosmospora kurdica (Petrak) Rossman & Samuels, *comb. nov.*

≡ *Calonectria kurdica* Petrak, Sydowia 13: 95. 1959.
≡ *Nectria kurdica* (Petrak) Rossman, Mycol. Pap. 150: 35. 1983.

Anamorph: *Fusarium kurdicum* Petrak, Sydowia 13: 96. 1959.

= *Stagonopsis sclerotioides* Höhn., Ann. Naturhist. Hofmus. 20: 368. 1905.
≡ *Botryocrea sclerotioides* (Höhn.) Petrak, Sydowia 3: 141. 1949.
[≡ *Fusarium sclerotioides* (Höhn.) Samuels & Rossman, Mycol. Pap. 164: 23. 1991, non Sherb. 1915].

Habitat.— Corticolous.
Distribution.— Canary Islands, Iran.
Notes.— This species has a *Fusarium*-like anamorph that is produced in pycnidia as described in Rossman (1983) and Sutton (1980, anamorph only).

Cosmospora lasiodiplodiae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria lasiodiplodiae* Samuels, Mycol. Pap. 164: 24. 1991.

Anamorph: *Acremonium*-like.

Habitat.— On bark and on pycnidia of *Lasiodiplodia theobromae* and its teleomorph.
Distribution.— Brazil (Amazonas).

Cosmospora leptosphaeriae (Nießl) Rossman & Samuels, *comb. nov.*

≡ *Nectria leptosphaeriae* Nießl, Fungi Saxonici 165. 1886.
≡ *Hypomyces leptosphaeriae* (Nießl) Wollenw., Ann. Mycol. 15: 8. 1917.
≡ *Lasionectria leptosphaeriae* (Nießl) Petch, Trans. Brit. Mycol. Soc. 21: 268. 1938.
= *Nectria leptosphaeriae* var. *macrospora* Wollenw., Angew. Bot. 8: 187. 1926.

Anamorph: *Fusarium sphaeriae* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 370. 1869 [1870].

Habitat.— On *Leptosphaeria* on herbaceous stems.
Distribution.— England, Europe.

Cosmospora macrochaetopsinae (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria macrochaetopsinae* Samuels, *in* Samuels, Doi & Rogerson, Mem. New York Bot. Gard. 59: 40. 1990.

Anamorph: *Chaetopsina* sp.
Habitat.— Corticolous.
Distribution.— Indonesia (North Sulawesi), known only from the type.

Cosmospora magnusiana (Rehm) Rossman & Samuels, *comb. nov.*

≡ *Nectria magnusiana* Rehm, Michelia 1: 294. 1878.

Anamorph: *Fusarium epistromum* (Höhn.) C. Booth, The Genus *Fusarium* p. 66. 1971.

≡ *Dendrodochium epistromum* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 424. 1909.

HABITAT.— On *Diatrypella* spp. on *Betula* spp., *Fagus* spp., and *Quercus* spp.
DISTRIBUTION.— England, Europe.

Cosmospora meliopsicola (Henn.) Rossman & Samuels, *comb. nov.*

≡ *Nectria meliopsicola* Henn. in Engler, Pflanzenw. Ost-Afrikas. p. 32. 1895.

Anamorph: *Acremonium*-like.

HABITAT.— On wood, including *Meliopsis usambarensis*, possibly fungicolous.
DISTRIBUTION.— Eastern and southern Africa (Gabon, Zimbabwe).

Cosmospora metepisphaeria (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria metepisphaeria* Samuels, Mycol. Pap. 164: 29. 1991.

Anamorph: *Acremonium*-like.

HABITAT.— On immersed, black pyrenomycete.
DISTRIBUTION.— Venezuela (Coastal Cordillera), known only from the type.

Cosmospora nothepisphaeria (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria nothepisphaeria* Samuels, Mycol. Pap. 164: 30. 1991.

Anamorph: *Fusarium* cf. *ciliatum* Link, Species Plant. VI, 2: 105. 1825.

HABITAT.— On loculoascomycetes including *Leptosphaerulina* sp., *Leptosphaeria* sp., *Otthia* sp.
DISTRIBUTION.— New Zealand (North Island), known only from the type locality.

Cosmospora obscura Lowen, *sp. nov.* — Plate 26, c; Plate 28, c–e.
Anamorph: *Fusarium* cf. *merismoides* Corda, Icones Fungorum 2: 4. 1838.

Ascomata immersa vel erumpentia, distantia vel usque ad 20 aggregata ad caulis nodos, obpyriformia, 150–300 μm alta × 100–230 μm diam, luteola, KOH–; papilla conica, 80 μm alta × 60–80 μm diam; setis paucis, 20–60 × 4–10 μm, 0–1-septatis. Asci cylindrici vel leniter clavati, 60–110 × 5–8 μm, apex annulo praeditus. Ascosporae ellipsoideae vel ovoideae, 8–12 × 4–8 μm, 1-septate, brunneolae, verrucosae.

Ascomata immersed to erumpent with only the base immersed, separate or in groups of up to 20 at nodes of stem, obpyriform, 150–300 μm high × 100–230 μm diam, pale yellow, KOH–; papilla conical, 80 μm high × 60–80 μm diam; collapsing vertically; with sparse setae, 20–60 × 4–10 μm, 0–1-septate. Ascomatal surface cells angular, 5–10 μm diam. Ascomatal wall 12–20 μm thick, of two regions: outer region 16 μm thick, of thick-walled, angular cells; inner region 4 μm thick, of thin-walled, rectangular cells. Asci cylindrical to slightly clavate, 60–110 × 5–8 μm, apex truncate, with a ring; ascospores obliquely uniseriate. Ascospores ellipsoid to ovoid, 8–12 × 4–8 μm, 1-septate, at first hyaline, becoming pale brown, verrucose.
ANAMORPH IN CULTURE: Colonies on PSA lacking aerial mycelium, opaque, slimy, orange, with white radial furrows; margin white, scalloped; odor strong, sweet. Conidiophores arising as lateral branches directly from the agar surface, branching irregularly; each branch terminating in a single phialide; phialides cylindrical, 0–1-septate, hyaline, smooth, 13–30 × 2.5–3 μm; apex with a slight periclinal thickening, not flared. Microconidia lacking. Macroconidia falcate, arcuate, (0–1)–3(–6)-septate: 0-septate 16–26 × 2–3 μm; 1-septate 21–32 × 3–4 μm; 3-septate 34–48 × 3–5 μm; 4-septate 40–50 × 3–5 μm; 5–6-septate 43–54 × 3.5–5 μm; foot-cell indistinct. Chlamydospores not observed.
HABITAT.— On bark.
DISTRIBUTION.— French Guiana, New Zealand.
ETYMOLOGY.— Refers to the pallid ascomata that are difficult to see.

TYPE.— NEW ZEALAND. Gisborne, Urewera National Park, Lake Waikaremoana, vic. Motor camp, Ngamoko Track, on bark, 30 May 1983, G.J. Samuels 83-172, P.R. Johnston, T. Matsushima & A.Y. Rossman (PDD 46349, holotype; IMI 297574, isotype cultures and slides).
ADDITIONAL SPECIMENS EXAMINED.— FRENCH GUIANA. 15 km SW of Saül toward Mt. Galbao, 600-650 m, Jan 1986, G.J. Samuels 2858 & J. Boise (NY); vic. Saül, *ca* 7 km SW of Saül toward Mt. Galbao, 450–500 m, 3–16 Feb 1986, G.J. Samuels 2786 & J. Boise [*Haematonectria haematococca* also present] (NY). NEW ZEALAND. North Canterbury: Arthur's Pass National Park, Cockayne Nature Walk, on bark of *Pseudopanax crassifolia* [*Araliaceae*], 20 May 1983, G.J. Samuels 83-153, T. Matsushima, A.Y. Rossman (PDD 46333); Auckland: Waitemata City, Waitakere Ranges, Piha Road, Cowan Track, on bark of *Ripogonum scandens* (*Liliaceae*), 4 June 1983, A.Y. Rossman & G.J. Samuels 83-130 (IMI 297577, culture and slides; PDD 46312).

NOTES.— *Cosmospora obscura* was grown in culture from single ascospores and produced a slow-growing, slimy, orange culture with little aerial mycelium similar to *Fusarium merismoides* Corda. *Cosmospora obscura* is differentiated from the other immersed species, namely *C. dingleyae*, by the pale yellow ascomata with

sparse setae and from other species of *Cosmospora* by the immersed, inconspicuous, KOH– ascomata. *Cosmospora consors* and *Volutella* sp. are also present in the type collection of *Cosmospora obscura*.

Cosmospora papilionacearum (Seaver) Rossman & Samuels, *comb. nov.*

≡ *Nectria papilionacearum* Seaver, Mycologia 1: 62. 1909.

Anamorph: None known.

Habitat.— On *Parodiella* spp. on leaves of dicotyledonous plants.
Distribution.— Costa Rica, United States. (Mississippi, Missouri, Nebraska, South Carolina)

Cosmospora peponum (Berk. & M.A. Curtis) Rossman & Samuels, *comb. nov.*

≡ *Nectria peponum* Berk. & M.A. Curtis, *in* Berkeley, Grevillea 4: 16. 1875.
= *Nectria brassicae* Ellis & Sacc., *in* Saccardo, Michelia 2: 374. 1881.
≡ *Dialonectria brassicae* (Ellis & Sacc.) Cooke, Grevillea 12: 110. 1884.
= *Nectria peponum* Berk. & M.A. Curtis var. *aurelia* Berk., Grevillea 4: 16. 1874.
Anamorph: *Fusarium* (presumed).

Habitat.— Herbicolous
Distribution.— England, Panama (dubious), United States (Florida, Georgia, New Jersey, South Carolina, Virginia).

Cosmospora pseudepisphaeria (Samuels) Rossman & Samuels, *comb. nov.* — Plate 28, f–j.

≡ *Nectria pseudepisphaeria* Samuels, Mycol. Pap. 164: 34. 1991.
Anamorph: *Acremonium*-like.

Habitat.— On immersed pyrenomycete (*?Diatrypaceae*).
Distribution.— Venezuela (Mérida).

Cosmospora pseudoflavoviridis (Lowen & Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria pseudoflavoviridis* Lowen & Samuels, Mycol. Pap. 164: 36. 1991.

Anamorph: *Fusarium* cf. *melanochlorum* (Casp.) Sacc., Syll. Fung. 4: 725. 1886.
≡ *Fusisporium melanochlorum* Casp., Sitzungsber. Preuss. Akad. Wiss., Physik.-Math. Kl. p. 309. 1855.

Habitat.— Associated with other fungi, including *Nectria* cf. *discophora* and a pyrenomycete with black perithecia, on *Rhopalostylis sapida* and *Metrosideros robusta*.

Distribution.— New Zealand (North Island).

Cosmospora purtonii (Grev.) Rossman & Samuels, *comb. nov.*

≡ *Sphaeria purtonii* Grev., Scott. Crypt. Fl. 6, Synopsis: 23. 1828.
≡ *Nectria purtonii* (Grev.) Berk., Outl. Brit. Fungol. p. 394. 1860.
≡ *Cucurbitaria purtonii* (Grev.) O. Kuntze, Rev. Gen. Pl. 3(3): 461. 1898.
= *Nectria applanata* Fuckel, Jahrb. Nassauischen Vereins Naturk. 25–26: 310. 1871.
≡ *Dialonectria applanata* (Fuckel) Petch, Trans. Brit. Mycol. Soc. 25: 170. 1941.
= *Nectria microspora* Cooke & Ellis, Grevillea 5: 53. 1876.
= *Nectria moschata* Gluck, Hedwigia 34: 254. 1895.
= *Nectria episphaeria* (Tode : Fr.) Fr. var. *coronata* Wollenw., Z. Parasitenk. 3(3): 298. 1931.

Anamorph: *Fusarium aquaeductuum* (Radlk. & Rabenh.) Lagerh. var. *aquaeductuum*, Zentralbl. Bakteriol. Abt. 2, 9: 655. 1891.

≡ *Selenosporium aquaeductuum* Radlk. & Rabenh., Hedwigia 2: 73. 1873.

Habitat.— On other immersed pyrenomycetes including *Diatrype stigma*, and on bark of hardwoods and conifers.
Distribution.— North temperate regions.

Cosmospora rickii (Rehm) Rossman & Samuels, *comb. nov.*

≡ *Nectria rickii* Rehm, Hedwigia 44: 2. 1904.

Anamorph: None known.

Habitat.— On *Xylariaceae*.
Distribution.— Brazil, known only from the type.

Cosmospora rishbethii (C. Booth) Rossman & Samuels, *comb. nov.*

≡ *Nectria rishbethii* C. Booth, Mycol. Pap. 73: 92. 1959.

Anamorph: *Acremonium*-like.

Habitat.— On cut end of log of *Pinus sylvestris*.
Distribution.— England, known only from the type. Culture CBS 496.67.

Cosmospora rubrisetosa (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria rubrisetosa* Samuels, *in* Samuels, Doi, & Rogerson, Mem. New York Bot. Gard. 59: 42. 1990.
≡ *Dialonectria episphaeria* (Tode : Fr.) Fr. var. *verruculosa* Cooke, Grevillea 12: 84. 1884 [non *Nectria verruculosa* (Nießl) Penz. 1882].

Anamorph: None known.

HABITAT.— On black ascomycete on wood.
DISTRIBUTION.— Indonesia (Java), known only from the type.

Cosmospora sansevieriae (Bat., J.L. Bezerra & C.R. Almeida) Rossman & Samuels, *comb. nov.*

≡ *Macbridella sansevieriae* Bat., J.L. Bezerra & C.R. Almeida, An. XIV Congr. Nac. Soc. Bot. Brasil, Manaus 1963: 118. 1964.
≡ *Nectria sansevieriae* (Bat., J.L. Bezerra & C.R. Almeida) Samuels, Canad. J. Bot. 51: 1279. 1973.

Anamorph: None known.

HABITAT.— On decaying leaf of *Sansevieria* sp.
DISTRIBUTION.— Brazil, known only from the type.

Cosmospora stilbellae (Samuels & Seifert) Rossman & Samuels, *comb. nov.*

≡ *Nectria stilbellae* Samuels & Seifert, Sydowia 43: 250. 1991.

Anamorph: *Stilbella aciculosa* (Ellis & Everh.) Seifert, Stud. Mycol. 27: 44. 1985.

≡ *Stilbum aciculosum* Ellis. & Everh., J. Mycol. 1: 153. 1885.
≡ *Botryonipha aciculosa* (Ellis & Everh.) O. Kuntze, Rev. Gen. Pl. 2: 845. 1891.
= *Stilbum citrinellum* Cooke & Massee, Grevillea 16: 81. 1887.
= *Stilbum pallidulum* Penz. & Sacc., Malpighia 15: 250. 1901.
= *Stilbella bulbicola* Henn., Hedwigia 44: 176. 1905.
≡ *Stilbum bulbicola* (Henn.) M.A. Litv., Opredelitel' mikrosk. pochvenn. Gribov, p. 196. 1967.
= *Stilbella flavescens* Estey, Trans. Brit. Mycol. Soc. 68: 120. 1977.

HABITAT.— On bark of recently dead trees, possibly on mycelium and immersed fructifications of ascomycetes; the anamorph is known also from terrestrial, estuarine and marine soils, roots and fruits, and dung (Seifert, 1985).
DISTRIBUTION.— French Guiana; the anamorph is reported from both northern temperate and tropical regions (Seifert, 1985).

Cosmospora stilbosporae (Tul. & C. Tul.) Rossman & Samuels, *comb. nov.*
≡ *Nectria stilbosporae* Tul. & C. Tul., Sel. Fung. Carpol. 3: 66. 1865.

Anamorph: *Fusarium expansum* Schlecht., Flora Berol. 2: 139. 1824.

HABITAT.— On *Valsa* spp. including *V. sorbi*.
DISTRIBUTION.— Europe (France, Germany) and Canada (anamorph only, Gerlach & Nirenberg, 1982).

Cosmospora thujana (Sacc.) Lowen, *comb. nov.*

≡ *Nectriella thujana* Rehm ex Sacc., Michelia 1: 295. 1878.
[≡ *Nectriella thujana* Rehm, Ascomyceten no. 338. 1875, nomen nudum, Art. 32.1.]

Anamorph: unknown.
Mycelium white, sparse. Ascomata scattered or in groups of 4–5, superficial, easily removed from the substratum, obpyriform, 190–200 μm high × 140–150 μm diam, pale orange to pale red, KOH+ dark red, yellow in lactic acid, papilla conical, pallid, collapsing laterally. Cells on ascomatal surface angular, 10 μm diam, walls distinct. Asci clavate, 60–80 × 12 μm, without an apical ring; ascospores biseriate in the middle, uniseriate above and below, filling the ascus. Ascospores ellipsoid, 8–15 × 7–8 μm, 1-septate, often slightly constricted, hyaline, becoming pale brown, smooth to spinulose, with 1 large guttule per cell.

HABITAT.— In axils of dead, scale-like leaves of *Chamaecyparis*.
DISTRIBUTION.— United States (New Jersey), known only from the type.

TYPE.— UNITED STATES. New Jersey: Newfield, on dead foliage of *Cupressus thyoides* L. [≡ *Chamaecyparis thyoides* (L.) B.S.P.] (white cedar), Nov 1875, J.B. Ellis, with *Pithya cupressina* (S, holotype, handwritten packet; isotypes: NY as North American Fungi no. 160; K, 2 collections; S as Rehm, Ascomyceten no. 338, and Thümen, Mycoth. univers. no. 972).

NOTES.— Although Stevenson (1971) listed the type of *Cosmospora thujana* as Thümen, Mycotheca universalis no. 972, the packet in S has a handwritten packet, labeled 'original' suggesting that this was the specimen examined by Rehm. Rehm, Ascomyceten no. 338, Ellis, North American Fungi no. 160 and Thümen, Mycotheca universalis no. 972, are isotype collections. Rehm in Ascomyceten no. 338 did not validly publish this specific name; later Saccardo validated this taxon. Only a few ascomata remain in most of the specimens examined of *Cosmospora thujana*.

Cosmospora triqua (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria triqua* Samuels, Mycol. Pap. 164: 40. 1991.

Anamorph: *Acremonium*-like.
HABITAT.— On *Diatrypaceae* on bark.
DISTRIBUTION.— French Guiana, known only from the type.

Cosmospora tungurahuana (Petrak) Rossman & Samuels, *comb. nov.*

≡ *Nectria tungurahuana* Petrak, Sydowia 2: 345. 1948.

Anamorph: None known.

Habitat.— On *Parmulariaceae* (*Dothideales sensu* von Arx & Müller, 1975) on bamboo.
Distribution.— Ecuador, known only from the type.

Cosmospora vilior (Starbäck) Rossman & Samuels, *comb. nov.* — Plate 22, f (page 96).

≡ *Nectria vilior* Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25 (3, 1): 28. 1899.
= *Nectria stigme* Rehm, Hedwigia 44: 2. 1904.
= *Nectria episphaeria* var. *kretzschmariae* Henn., Bot. Jahrb. Syst. 14: 364. 1891.
≡ *Nectria kretzschmariae* (Henn.) Weese, Sitzungsber. Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl. Abt. 1, 125: 506. 1916.
= *Nectria ustulinae* Teng, Sinensia 4: 275. 1934.
= *Nectria viridescens* C. Booth, Mycol. Pap. 73: 89. 1959.

Anamorph: *Acremonium berkeleyanum* (P. Karst.) W. Gams, Netherlands J. Pl. Pathol. 88: 76. 1982.

≡ *Verticillium berkeleyanum* P. Karst, Meded. Soc. Fauna Fl. Fenn. 18: 64. 1891.
= *Acremonium butyri* (van Beyma) W. Gams, *Cephalosporium*-artige Schimmelpilze p. 126. 1971.
≡ *Tilachlidium butyri* van Beyma, Zentralbl. Bakteriol. Parasitenk., Abt. 2, 99: 388. 1938.

Habitat.— Fungicolous, most frequently on *Xylariaceae* but also on other pyrenomycetes (Europe) and on polypores (Europe, New Zealand).
Distribution.— Pantropical and subtropical, Europe, New Zealand.

Note.— *Verticillium berkeleyanum* was described as purported anamorph of *Hypomyces berkeleyanus* Plowr. & Cooke, but the teleomorph was misidentified by Karsten (see *Sphaerostilbella berkeleyana*).

Cosmospora viliuscula (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria viliuscula* Samuels, *in* Samuels, Doi, & Rogerson, Mem. New York Bot. Gard. 59: 44. 1990.

Anamorph: *Acremonium* cf. *berkeleyanum* (P. Karst.) W. Gams, Netherlands J. Pl. Pathol. 88: 76. 1982.

(= *Acremonium* cf. *butyri* (van Beyma) W. Gams, *Cephalosporium*-artige Schimmelpilze p. 126. 1971.
≡ *Tilachlidium butyri* van Beyma, Zentralbl. Bakteriol. Parasitenk., Abt. 2, 99: 388. 1938.)

Habitat.— On old stroma of *Ustulina* sp.
Distribution.— Indonesia, known only from the type.

Key to the species of *Cosmospora*

1.	On scale insects and adelgids	2
1.	Not on scale insects	4
2 (1)	Ascospores 3–septate, 26–34 × 11–12.5 µm	*C. diploa*
2.	Ascospores 1-septate	3
3 (2).	Ascospores broadly fusiform, 12–15 × 5.5–6.5 µm	*C. aurantiicola*
3.	Ascospores ovoid to ellipsoid, 16–20 × 7.5–10 µm	*C. flammea*
4 (1)	Ascomata fully to partially immersed, pale yellow, KOH–; anamorph *Fusarium* cf. *merismoides*	*C. obscura*
4.	Ascomata superficial, orange, red to dark red, KOH+; anamorph not *Fusarium* cf. *merismoides*	5
5 (4).	Ascospores averaging < 10 µm long	6
5.	Ascospores averaging > 10 µm long	22
6 (5).	Ascospores averaging < 4 µm wide	7
6.	Ascospores averaging > 4 µm wide	15
7 (6)	Ascospores averaging < 7 µm long	8
7.	Ascospores averaging > 7 µm long	11
8 (7).	Ascospores averaging < 3.5 µm wide; perithecia with hairs or hyphae; on stromatic pyrenomycetes, wood, or herbicolous	9
8.	Ascospores averaging > 3.5 µm wide; perithecia glabrous; on *Xylariaceae*	10

9 (8). Perithecia with red, triangular, fasciculate hairs; ascospores (6–)6.5–8.5(10.5) × 2–3.5 μm, smooth to minutely spinulose; on stromatic pyrenomycetes, wood, or herbicolous ..... *C. geastroides*
9. Perithecia with hyphae; ascospores 5.5–7 × 2.5–3 μm, smooth to slightly striate; herbicolous ..... *C. chlorina*

10 (8). Ascospores (5.5–)6–7(–8) × 3.5–4(–5) μm; anamorph *Acremonium* cf. *butryi* with a white colony; Indonesia ..... *C. viliuscula*
10. Ascospores (5.5–)8–11(–13) × (3–)4–5.5(–6) μm; anamorph *Acremonium butyri* with a green colony, tropical and subtropical ..... *C. vilior*

11 (7). Fungicolous; ascospores averaging > 3.5 μm wide, spinulose, yellow brown 12
11. Corticolous or herbicolous; ascospores averaging < 3.5 μm wide, smooth, hyaline 13

12 (11). Ascospores (7–)9–11(–11.5) × (3.5–)4–4.5(–5) μm; ascomatal wall < 25 μm thick, of one region; anamorph *Fusarium aquaeductuum* var. *medium*, with microconidia ..... *C. episphaeria*
12. Ascospores 8–11 × 3.5–4.5 μm; ascomatal wall > 25 μm thick, of two regions; anamorph *Fusarium aquaeductuum* var. *aquaeductuum*, without microconidia ..... *C. purtonii*

13 (11). Ascospores (7–)8–9.5(–12.5) × 2–2.5(–3.5) μm; anamorph *Chaetopsina* cf. *fulva* .... *C. chaetopsinae*
13. Ascospores averaging > 2.5 μm wide; anamorph *Chaetopsina* or *Cylindrocladiella* . 14

14 (13). Anamorph *Chaetopsina*; ascospores 10–12 × 2.5–3.5 μm ..... *C.* cf. *chaetopsinae*
14. Anamorph *Cylindrocladiella*; ascospores 6.5–10.5 × 2.5–4 μm ..... *C. camelliae*

15 (6). Ascospores (5.5–)8–11(–13) × (3–)4–5.5(–6) μm, tuberculate, yellow-brown; on *Diatrypaceae* or *Xylariaceae*; tropical 16
15. Ascospores 7–12 × 3.5–5 μm, smooth, spinulose, or tuberculate, yellow-brown or hyaline; fungicolous, lignicolous, or corticolous; temperate or tropical 18

16 (15). On *Diatrypaceae*; ascospores (7–)8–9.5(–10.5) × (3.5–)4–4.5(–5) μm ..... *C. triqua*
16. On *Xylariaceae* 17

17 (16). Ascospores (5.5–)8–11(–13) × (3–)4–5.5(–6) μm; common ..... *C. vilior*
17. Ascospores (9.5–)9.5–11(–12) × 5.5–7(–7.5) μm; rare ..... *C. joca*

18 (15). Fungicolous; ascospores spinulose 19
18. Lignicolous or corticolous; ascospores spinulose to tuberculate 20

19 (18). Ascospores 7.5–9 × 4–5 μm; anamorph *Acremonium berkeleyanum* ..... *C. vilior* (temperate specimens)
19. Ascospores 7–11.5 × 3.5–4.5 μm; anamorph *Fusarium* ..... see 12

20 (18). Ascospores 8–9.5 × 4–5 μm, tuberculate; anamorph unknown; corticolous; Indonesia ..... *C. xanthostroma*
20. Ascospores smooth or spinulose; temperate 21

21 (20). Ascospores 8–12 × 3.5–5 μm, spinulose; anamorph *Acremonium*; lignicolous; England ..... *C. rishbethii*
21. Ascospores 9–9.5 × 4–5 μm, smooth; anamorph *Fusarium*; corticolous; Italy and United States (New Hampshire) ..... *C. biasolettiana*

22 (5). Ascospores averaging < 15 µm long 23
22. Ascospores averaging > 15 µm long 49

23 (22). Ascospores averaging < 4 µm wide, hyaline, smooth 24
23. Ascospores averaging > 4 µm wide, yellow-brown, spinulose, tuberculate, or striate; smooth and hyaline in one species 32

24 (23). Anamorph *Acremonium* or unknown; ascospores 8–14 × 3–4.5 µm 25
24. Anamorph *Chaetopsina*, *Stilbella*, or *Volutella*; ascospores 8–16 × 2.5–5 µm 28

25 (24). Lignicolous; ascospores 8–12 × 3.5–5 µm; anamorph *Acremonium*; England ..... *C. rishbethii*
25. Herbicolous (*Arundo*, *Sansevieria or Digitalis*); anamorph unknown 26

26 (25). On *Arundo donax* (*Poaceae*); ascospores 9.5–12 × 2.5–3 µm; Italy .... *C. jucundula*
26. On dicotyledonous plants 27

27 (26). On *Digitalis*; ascospores 11–12 × 3–4 µm; France ..... *C. digitalicola*
27. On *Sansevieria*; ascospores 11–14 × 3–4.5 µm; tropical America ... *C. sansevieriae*

28 (24). Anamorph *Stilbella* or *Volutella*; ascospores 9–13 × 2.5–4 µm 29
28. Anamorph *Chaetopsina*; ascospores 7.5–16 × 2.5–5 µm 30

29 (28). Anamorph *Stilbella*; ascospores (9–)10–11.5(–12.5) × 2.5–3(–3.5) µm *C. stilbellae*
29. Anamorph *Volutella*; ascospores (9–)10–11(–13) × (2.5–)3–4 µm ..... *C. consors*

30 (28). Conidia non- or 1-septate, (6.5–)10–19.5 × (1.5–)2–3.5(–4.5) µm; conidiogenous cells monoblastic; ascospores (10–)10.5–13(–15) × (3–)3.5–4.5(–5) µm ..... *C. chaetopsinae-catenulatae*
30. Conidia non-septate, smaller; conidiogenous cells monoblastic or polyblastic; ascospores 7.5–16 × 2.5–3.5 µm 31

31 (30). Conidia 3.5–4.5(–5) × 1.5–2 µm; conidiogenous cells monoblastic; ascospores (9–)10–12(–12.5) × 2.5–3.5(–3.5) µm ..... *C.* cf. *chaetopsinae*
31. Conidia (5.5–)7–9 × 2.5–3 µm; conidiogenous cells polyblastic or monoblastic; ascospores (7.5–)11–15(–16) × 3–3.5 µm ..... *C. chaetopsinae-polyblastiae*

32 (23). Ascospores averaging < 6 µm wide 33
32. Ascospores averaging > 6 µm wide 43

33 (32). Herbicolous, fructicolous, corticolous, or lignicolous, not fungicolous 34
33. Fungicolous 36

34 (33). Ascospores (8–)9.5–12.5(–13) × 4–4.5(–5) µm, hyaline; on herbaceous tissue; anamorph unknown ..... *C. peponum*
34. Ascospores 8–18 × 3.5–8 µm; pale brown to yellow brown; corticolous or lignicolous; anamorph *Acremonium*-like or *Fusarium* 35

35 (34). Ascospores 8–12 × 3.5–5 µm, hyaline to yellow-brown; lignicolous (*Pinus*); anamorph *Acremonium*-like ..... *C. rishbethii*
35. Ascospores 12–18 × 4–8 µm; pale brown; corticolous; anamorph *Fusarium* ..... *C. dingleyae*

36 (33). Ascospores striate, 10–15 × 4.5–6.5 µm; anamorph *Acremonium*-like; tropical America 37
36. Ascospores smooth to spinulose, verruculose or tuberculate, not striate; anamorph *Acremonium*-like, *Fusarium*, or unknown; tropical and temperate regions 38

37 (36). Ascospores 10–12(–12.5) × (4.5–)5–6(–6.5) µm; ascal apex with a conspicuous ring; with salmon colonies ..... *C. lasiodiplodiae*
37. Ascospores (10–)11–14(–15) × 5–5.5(–6) µm; ascal apex simple; with white colonies ..... *C. metepisphaeria*

38 (36). Ascospores tuberculate, 9.5–11(–12) × 5.5–7(–7.5) µm; anamorph *Acremonium*-like, with salmon colonies ..... *C. joca*
38. Ascospores smooth to spinulose or verruculose; anamorph *Acremonium*-like, *Fusarium*, or unknown 39

39 (38). Perithecia with hyphal hairs arising from the surface of the perithecial wall; ascospores 12–13 × 5–7 µm; anamorph unknown ..... *C. rubrisetosa*
39. Perithecia glabrous; ascospores 9.5–15 × 4.5–7 µm; anamorph *Acremonium*-like or *Fusarium* 40

40 (39). Ascospores (10–)11.5–14.5(–16) × (5–)5.5–7.5(–10) µm, smooth to slightly spinulose; anamorph *Acremonium*-like; on wood, possibly fungicolous; central and southern Africa ..... *C. meliopsicola*
40. Ascospores 9.5–15 × 4.5–7 µm, spinulose; on immersed ascomycetes; anamorph *Fusarium*; north temperate or New Zealand 41

41 (40). Perithecia scattered, perithecial apex acute to subacute; ascospores 10–16 × 5–8 µm; anamorph *Fusarium melanochlorum* with green cultures ..... *C. flavoviridis*
41. Perithecia caespitose, perithecial apex blunt to discoidal; ascospores 9.5–15 × 4.5–7 µm; anamorph *Fusarium* species with salmon-colored cultures 42

42 (41). Ascospores 10–15 × 4.5–6(–7) µm; on *Diatrypella* spp.; anamorph *Fusarium epistroma*; north temperate ..... *C. magnusiana*
42. Ascospores (9.5–)10–13(–14) × (5–)5–6.5(–7) µm; on loculoascomycetes; anamorph *Fusarium ciliatum*; New Zealand ..... *C. nothepisphaeria*

43 (32). Perithecia with a fringe of hyphal hairs around the perithecial apex; ascospores (12–)13–16.5(–17) × (5.5–)6–7.5(–8) µm; anamorph *Fusarium*; on non-valsaceous fungi ..... *C. pseudoflavoviridis*
43. Perithecia glabrous or with setae surrounding the ostiole; ascospores 8–18.5 × 4–8 µm 44

44 (43). Perithecia with setae surrounding ostiole; ascospores 12–18 × 4–8 µm; anamorph *Fusarium*; on bark; New Zealand ..... *C. dingleyae*
44. Perithecia glabrous; anamorph *Acremonium*-like, *Fusarium* or unknown; on *Xylariaceae* or wood; temperate or tropical regions 45

45 (44). Europe or United States (New Jersey) 46
45. Tropical America, central and southern Africa 47

46 (45). On *Valsa sorbi*; Europe; ascospores (13–)13.5–16.5(–18.5) × (5.5–)6–7(–7.5) µm; anamorph *Fusarium expansum* ..... *C. stilbosporae*
46. On dead, scale-like leaves of *Chamaecyparis* (possibly on immersed ascomycetes); United States (New Jersey); ascospores 8–15 × 7–8 µm; anamorph unknown .... *C. thujana*

47 (45). On *Xylariaceae*; ascospores (13.5)14.5–15.5(–16) × (5.5–)6.5–7.5(–8) µm; anamorph unknown; southern Brazil ..... *C. rickii*
47. On wood, possibly on immersed ascomycetes; ascospores 11–16 × 5–10 µm; anamorph *Acremonium*-like; tropical America, southern Africa 48

48 (47). Perithecia with an apical disc; ascospores 11–13(–14) × 6–7.5(–8) µm, smooth to spinulose; tropical America ..... *C. pseudepisphaeria*
48. Perithecial apex obtuse; ascospores (10–)11.5–14.5(–16) × (5–)5.5–7.5(–10) µm, smooth to spinulose; central and southern Africa ..... *C. meliopsicola*

49 (22). Ascospores averaging < 22 µm long 50
49. Ascospores averaging > 22 µm long 58

50 (49). Ascospores 3-septate, 17–22 × 5–7 µm; on bark; anamorph pycnidial *Fusarium* .... *C. kurdica*
50. Ascospores 1-septate; on fungi, wood, or palms; anamorph not pycnidial 51

51 (50). On *Polyporaceae*; ascospores (13.5–)14.5–17(–18.5) × (8.5–)10–12.5(–14.5) µm, conspicuously warted; anamorph *Verticillium* ..... *C. coccinea*
51. On ascomycetes, wood, or palms; ascospores 8–19(–28) × 5–9 µm, slightly tuberculate, or striate 52

52 (51). On *Rhytismataceae*; ascospores 8–23 × 6–8 µm; anamorph *Fusarium* *C. ganymede*
52. On loculoascomycetes, pyrenomycetes, wood or palm; ascospores 13–19(–28) × 5–9 µm 53

53 (52). On lignicolous or palmicolous ascomycetes 54
53. On herbicolous *Leptosphaeria* or *Parodiella* 57

54 (53). Perithecia with setae or a distinct fringe of hyphal hairs; anamorph *Fusarium* 55
54. Perithecia glabrous; anamorph *Acremonium*-like or unknown 56

55 (54). Perithecia with a distinct apical fringe of hyphal hairs; ascospores 13–16.5(–17) × (5.5–)6–7.5(–8) µm, striate ..... *C. pseudoflavoviridis*
55. Perithecia with setae surrounding the ostiole; ascospores 12–18 × 4–8 µm, verrucose ..... *C. dingleyae*

56 (54). On *Pseudovalsa berkeleyi*; ascospores (13–)16–19 × (7–)8–9 µm; anamorph *Acremonium*-like; north temperate ..... *C. wegeliniana*
56. On *Xylariaceae*; ascospores (13.5–)14.5–15.5(–16) × (5.5–)6.5–7.5(–8) µm; anamorph unknown; southern Brazil ..... *C. rickii*

57 (53). On *Leptosphaeria* on herbaceous stems; ascospores (14.5–)15–17.5(–26) × (5–)5.5–6.5(–7) µm; anamorph *Fusarium* ..... *C. leptosphaeriae*
57. On *Parodiella* on dicotyledonous leaves; ascospores 14–19(–28) × (5–)5.5–6.5(–8) µm; anamorph unknown ..... *C. papilionacearum*

58 (49). Ascospores 3-septate, striate or smooth 59
58. Ascospores 1-septate, striate, smooth, or spinulose 60

59 (58). Ascospores striate, yellow-brown, (18–)25–39 × (6.5–)8.5–14 µm; anamorph unknown ..... *C. diminuta*
59. Ascospores smooth, hyaline, 24–40 × 8–12 µm; anamorph *Fusarium* ..... *C. glabra*

60 (58). Ascospores striate 61
60. Ascospores smooth to spinulose 62

61 (60). Ascospores (18–)25–39 × (6.5–)8.5–14 µm, finely striate; anamorph unknown; fungicolous ..... *C. diminuta*
61. Ascospores (19–)25–42(–48) × 6–10(–11) µm, coarsely striate; anamorph *Chaetopsina*; corticolous or on palm fronds ..... *C. chaetopsinae-penicillatae*

62 (60). Corticolous, not conspicuously fungicolous; ascospores 36–41.5 × 6–7 µm, smooth; anamorph *Chaetopsina* ..... *C. macrochaetopsinae*
62. Fungicolous; ascospores smooth or spinulose; anamorph *Fusarium* 63

63 (62). On *Parmulariaceae* on bamboo; ascospores 28–37(–42) × 8–13.5(–16) µm, smooth; anamorph unknown ..... *C. tungurahuana*
63. Not on *Parmulariaceae* on bamboo; ascospores spinulose, < 28 µm long; anamorph *Fusarium* 64

64 (63). On *Rhytismataceae*; ascospores 8–23 × 6–8 µm ..... *C. ganymede*
64. On *Leptosphaeria*; ascospores (14.5–)15–17.5(–26) × (5–)5.5–6.5(–7) µm ..... *C. leptosphaeriae*

Cosmospora wegeliniana (Rehm) Rossman & Samuels, *comb. nov.*

≡ *Nectria episphaeria* (Tode : Fr.) Fr. var. *wegeliniana* Rehm, Hedwigia 30: 260. 1891.
≡ *Dialonectria wegeliniana* (Rehm) Petch, Trans. Brit. Mycol. Soc. 21: 266. 1983 [as '*wegeliana*'].

Anamorph: *Acremonium*-like.

Habitat.— On *Pseudovalsa berkeleyi*.
Distribution.— Europe (type), Neotropics, New Zealand.

Cosmospora xanthostroma (Penz. & Sacc.) Rossman & Samuels, *comb. nov.*

≡ *Nectria xanthostroma* Penz. & Sacc., Malpighia 11: 514. 1897.

Anamorph: None known.

Habitat.— On bark, possibly dematiaceous hyphae.
Distribution.— Indonesia

GIBBERELLA Sacc., Michelia 1: 43. 1877.

Type: *G. pulicaris* (Fr. : Fr.) Sacc. (≡ *Sphaeria pulicaris* Fr. : Fr.).
= *Lisea* (Sacc.) Sacc., Michelia 1: 43. 1877 (≡ *Botryosphaeria* subgenus *Lisea* Sacc., Michelia 1: 42. 1877). — Type: *L. nemorosa* (Sacc.) Sacc. (≡ *Botryosphaeria nemorosa* Sacc.), recognized as *Gibberella nemorosa* (Sacc.) Wollenw.).
= *Lisiella* (Cooke & Massee) Sacc., Syll. Fung. 9: 945. 1891 (≡ *Gibberella* subgenus *Lisiella* Cooke & Massee, *in* Cooke, Grevillea 16: 5. 1887). — Type: *L. passiflorae* (Cooke & Massee) Sacc., Syll. Fung. 9: 945. 1891, recognized as *Gibberella passiflorae* Cooke & Massee, *in* Cooke, Grevillea 16: 5. 1887.

Ascomata solitary or on a thin stroma erumpent through the epidermis, superficial, subglobose to globose, not collapsing, bluish purple, KOH+ dark purple, pigment dissolving in lactic acid, slightly rugose to tuberculate, without hairs or appendages. Ascomatal wall of two regions: outer region of thick-walled, pigmented cells forming a *textura angularis* to *textura globulosa*; inner region of elongate, hyaline, thin-walled cells, becoming thinner toward the centrum. Asci narrowly clavate, often with an apical ring. Ascospores (0–1–)3-septate, ellipsoid, hyaline. Anamorph, where known, *Fusarium*. Saprobic and pathogenic on woody and herbaceous substrata, isolated from soil.

Notes.— *Gibberella* was initially described in a footnote to *Botryosphaeria advena* Ces. & De Not., in which the genus *Botryosphaeria* is discussed as being heterogeneous and was divided into three genera, *Botryosphaeria*, *Giberella* (sic), and *Lisea*. In the original description, this generic name was spelled '*Giberella*'; however, the name is a diminutive of '*Gibbera*' and most authors have spelled it as '*Gibberella*' (Clements & Shear, 1931; Farr *et al.*, 1979b; Hawksworth *et al.*, 1995). The genus *Gibberella* was characterized by Saccardo (1877) as having fleshy, bluish purple ascomata and ovoid–fusoid, 3-septate, subhyaline ascospores. Both *Gibberella* and *Lisea* were placed in the *Hypocreaceae* at that time.

At the same time Saccardo (1877) raised *Botryosphaeria* subgenus *Lisea* to generic rank and considered *Lisea* to be similar to *Gibberella* except in having one-septate ascospores. *Botryosphaeria* subgenus *Lisea* initially included only one species, *B. nemorosa*,

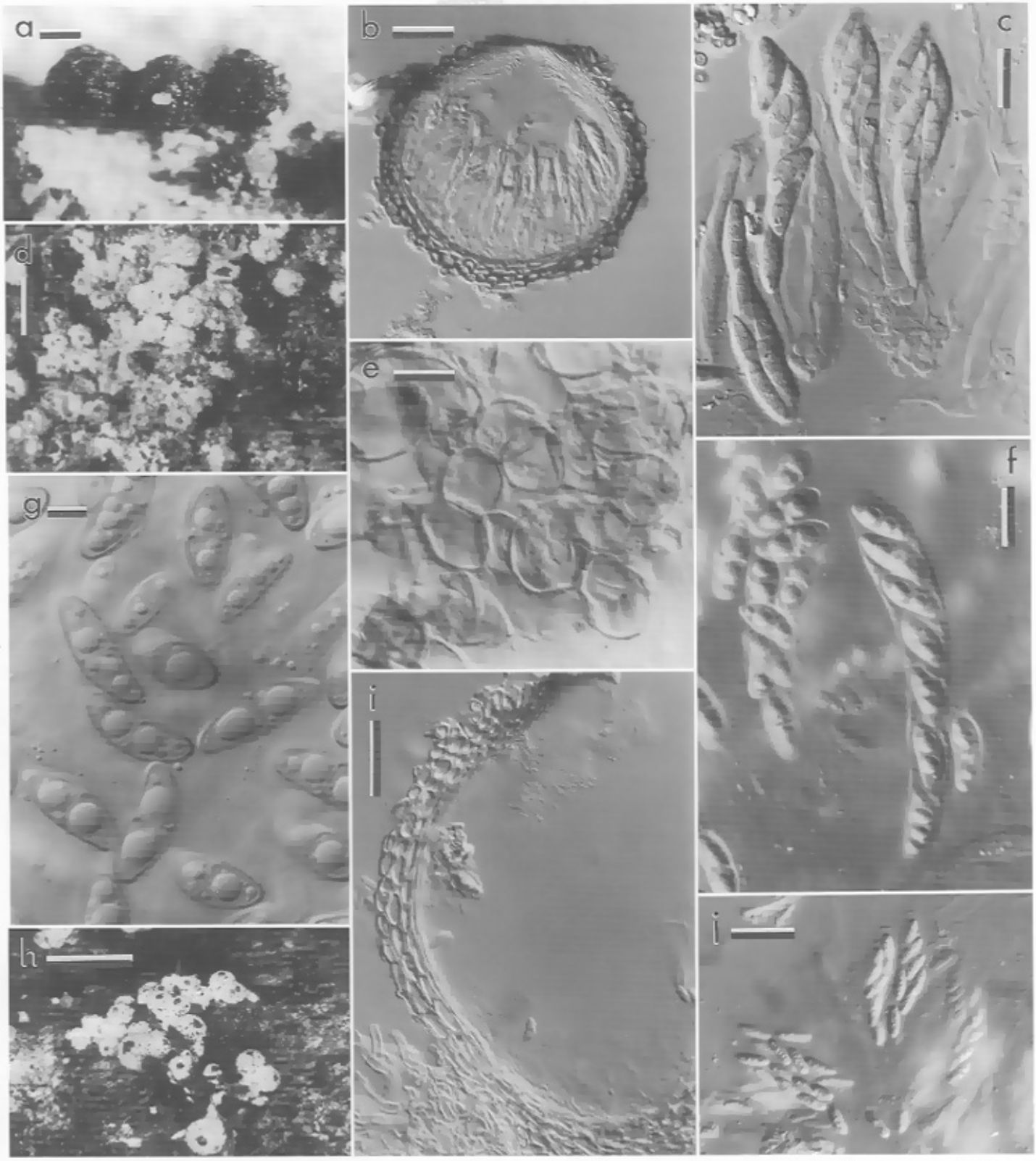


Plate 29. a–c. *Gibberella pulicaris*. a. Ascomata on natural substratum. b. Median section of ascoma. c. Asci with ascospores. **d.** *Haematonectria illudens*. Ascomata on natural substratum. **e–g.** *Haematonectria haematococca*. e. Ascomatal wall cells. f. Asci with ascospores. g. Ascospores. **h.** *Lanatonectria flavolanata*. Ascomata on natural substratum. **i–j.** *Lanatonectria flocculenta*. i. Median section of ascoma. j. Asci with ascospores. a–b. BPI 632303. c. BPI 632301. d. BPI 802461. e–g. BPI G.J.S. 92-140. h. G.J.S. 3584 – NY. i. BPI 552098; j. G.J.S. 1553 – NY. Scale bars: a = 100 μm; b, i = 50 μm; c, e, f, j = 25 μm; d, h = 1 mm; g = 10 μm.

which is therefore the type of the genus *Lisea* as *L. nemorosa* (Sacc.) Sacc. When raising *Lisea* to generic rank, he added a second species, *L. vitis* (Nießl) Sacc. Clements & Shear (1931) mistakenly designated *Lisea buxi* (Fuckel) Sacc. (≡ *Gibbera buxi* Fuckel) as the lectotype and Rogerson (1970) followed this designation. *Lisea buxi* was not included in the original *Botryosphaeria* subgenus *Lisea* nor in the genus *Lisea* as established by Saccardo (1877); it was added to the genus only in a later publication (Saccardo, 1878). Eriksson & Hawksworth (1987b) suggested that *Lisea* Sacc. 1877 was a later homonym of *Licea* Schrader 1797; however, these names, applying to unrelated organisms, are not based on the same root and are not homonyms.

Lisiella was established as a subgenus of *Gibberella* for species with aseptate ascospores. When Saccardo (1891) raised this taxon to generic rank, he included only the original species, *L. passiflorae*. A part of the type specimen of *L. passiflorae* was examined but it is in poor condition [NY, AUSTRALIA. Brisbane, on stems of *Passiflora edulis*, Bailey 535]. It appears to be an immature species of *Gibberella* having bluish purple, rugose ascomata of relatively thick-walled cells, and ascospores 12 × 6 μm, generally 3-septate, also 0–1-septate.

Gibberella teleomorphs are encountered much less frequently than the *Fusarium* anamorphs that have been more thoroughly studied, particularly those in the *Gibberella fujikuroi* species complex (Nirenberg & O'Donnell, 1998; Gams *et al.*, 1999b). Molecular studies suggest that the ubiquitous plant-pathogenic fungus, *F. oxysporum*, is allied with those species of *Fusarium* having *Gibberella* teleomorphs (Bruns *et al.*, 1991; O'Donnell *et al.*, 1998). About 50 names have been included in *Gibberella*; despite their economic importance, the genus *Gibberella* has never been monographed. Although not including some recently described species (Booth & Prior, 1984; Broadhurst & Johnston, 1994; Klaasen & Nelson, 1996; Klittich *et al.*, 1997), the most comprehensive reference remains Booth (1971) who included thirteen taxa of *Gibberella* and their related *Fusarium* anamorphs. Using both teleomorph and *Fusarium* anamorph characteristics, Samuels *et al.* (1998a) recently published a key to the species of *Gibberella* encountered in agricultural settings.

Gibberella pulicaris (Fr. : Fr.) Sacc., Michelia 1:43. 1877. — Plate 29, a–c.

≡ *Sphaeria pulicaris* Fr. : Fr., Syst. Mycol. 2: 417. 1823.

Anamorph: *Fusarium sambucinum* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 167. 1869 [1870], *nom. cons. prop.*

Stroma sparse, of densely interwoven hyphae arising from the base of the ascoma; mycelium sparse, bluish purple. Ascomata superficial, gregarious, on a minute, immersed, basal stroma, broadly pyriform, 220–265 μm diam, laterally pinched or not collapsing when dry, bluish purple, darker in KOH, becoming red in lactic acid, non-papillate, with warts to 50 μm high. Ascomatal surface of circular to angular cells, 7–10 μm diam, with 2–2.5 μm thick walls. Ascomatal wall 33–66 μm thick, inclusive of warts, of two regions: outer region, including warts, 15–44 μm thick, cells 7–10 μm diam, walls 2–2.5 μm thick; inner region of cells with more or less ellipsoid lumina, 15–18 × 4–5 μm, with 2 μm thick walls, cells increasingly more compacted and thin-walled toward the centrum. Apex of vertically elongate hyphal elements continuous with the inner region of the ascomatal wall, protruding through the outer region, and merging with the periphyses. Asci clavate, 75–100 × 15–20 μm, apex simple, 8-spored, ascospores biseriate to pluriseriate. Ascospores ellipsoid to cylindrical, (18–)21.5–27 (–29) × 5.5–7(–8) μm, 3(–6)-septate, not constricted at the septum, pale tan, smooth-walled.

Anamorph: Conidiophores abundant in the aerial mycelium, much-branched, 80–100 μm high fascicles, each branch terminating in one or two cylindrical phialides, 10.5–13.5 μm long × 2.5–3.5 μm wide, with visible periclinal thickening at the unflared tip. Conidia cylindrical, straight but with tip cell more or less hooked, with a well-developed, pedicellate foot-cell, (1–)3–5(–6)-septate: 1-septate: 16–20 × 2–3 μm; 2-septate: 16–21 × 3.5 μm; 3-septate: 20.5–31(–34) × (2–)3.5–4.5 μm; 4-septate: (26–)27.5–32(–33.5) × (3.5–)4–5(–5.5) μm; 5-septate: 29–35.5(–42.5) × (3.5–)4–4.5(–6) μm; 6-septate: 45 × 5.5 μm. Chlamydospores usually not abundant.

Habitat.— In soil, causing root and seedling rot of cereals and other crops, and storage rots in potatoes, also reported from hardwood trees causing cankers and collected on a palm trunk in Indonesia (Booth, 1971; Domsch *et al.*, 1980).

Distribution.— Worldwide but more common in temperate than tropical regions.

Type.— GERMANY. 'In rimis corticis *Sambuci*' (type not located).

Illustrations.— Booth (1971, Pl. 18A, Fig. 44); Domsch *et al.* (1980, Fig. 148); Ellis & Ellis (1985, Fig. 708); Ellis & Everhart (1892, Pl. 13, Figs. 1–6); Gerlach & Nirenberg (1982, Fig. 53, anamorph); Nirenberg (1995, Figs. 1–3, anamorph); Samuels *et al.* (1990, Fig. 2).

Specimens illustrated.— UNITED STATES. Massachusetts: Amherst, on *Zea mays*, 1904, G.E. Stone (BPI 632303). — New York, Farmington, on *Zea mays*, Aug 1889, E. Brown (BPI 632301).

Notes.— The type description of *Sphaeria pulicaris* includes reference to a substratum 'in rimis corticis *Sambuci*'. No type specimen exists at UPS; this species needs to be neotypified. The concept of the species *Gibberella pulicaris* is well established particularly as the teleomorph of *Fusarium sambucinum* (Booth, 1971, 1973; Nirenberg, 1995). A large body of literature is associated with this name because of its importance in the production of mycotoxins. Conservation of the anamorph name against the older and often confused *F. roseum* Link was proposed by Gams *et al.* (1997).

Gibberella nemorosa (Sacc.) Wollenw., Z. Parasitenk. (Berlin) 3: 489. 1931.

≡ *Botryosphaeria nemorosa* Sacc., Michelia 1: 42. 1877.
≡ *Lisea nemorosa* (Sacc.) Sacc., Michelia 1: 43. 1877.

Ascomata solitary to aggregated in groups of 2–5, on a sparse pseudoparenchymatous stroma, superficial, subglobose, 125–240 μm diam, becoming cupulate on drying, appearing black, microscopically dark purple, KOH+ black with purple pigments dissolving, fleshy, rugose. Ascomatal wall 12-18 μm thick, of one region of globose cells forming a *textura angularis*, cells 8–15 μm diam, walls slightly thickened to about 1.5 μm. Apical paraphyses visible as deliquescing strands. Asci narrowly clavate, 52–90 × 8–12 μm, apex simple. Ascospores ellipsoid, 12–16 × 4.5–7.5 μm, 1-septate, hyaline, smooth-walled.

Habitat.— On dead twigs and stems of *Clematis* and *Cytisus*.
Distribution.— Italy.

Type.— ITALY. Montello, on dead twigs of *Cytisus nigricans*, Oct. 1876 (PAD, holotype); Montello (Treviso), on dead stems of *Clematis vitalba*, Aug. 1902, P.A. Saccardo, D. Saccardo, Mycotheca italica no. 1305 (BPI, authentic, unbound).

Illustrations.— Wollenweber (1930, No. 821).

Note.— The holotype specimen at PAD of *Botryosphaeria nemorosa* has only a few remaining ascomata of a fungus resembling the original description. A later specimen identified as *Lisea nemorosa* by P.A. Saccardo was issued as Mycotheca Italica no. 1305. This specimen at BPI agrees with the original description; however, the specimen of that number at NY has larger, 3-septate ascospores of a species of *Gibberella* suggesting that Mycotheca Italica no. 1305 was a mixed collection and may have been the source of misunderstanding about this genus. Weese (1919), Petrak (1923) and later Müller & von Arx (1962) considered *Lisea* Sacc. to be a synonym of *Gibberella*. They noted that *Lisea nemorosa* occasionally has three-septate as well as one-septate ascospores but in all other respects is typical of the genus *Gibberella*. In the holotype specimen of *Lisea nemorosa*, only one-septate ascospores were observed; it is possible that these ascomata are immature.

HAEMATONECTRIA Samuels & Nirenberg, *gen. nov.*

Type: *Haematonectria haematococca* (Berk. & Broome) Samuels & Nirenberg.

Ascomata non stromatica, solitaria vel gregaria, superificialia, globosa vel pyriformia, flava vel rubra, KOH+ parum fuscata, grosse verrucata, verrucae sursum acutatae e cellulis angularibus, crassitunicatis constantes, 15–30 μm diam. Asci clavati, apice simplici. Ascosporae ellipsoideae, saepe utrinque leviter truncatae, fusco-luteae, striatae vel spinulosae.

Ascomata non-stromatic or with a basal stroma, solitary to gregarious, superficial, globose to pyriform, yellow to red, KOH+ slightly darkening, collapsing laterally when dry; coarsely warted, warts formed of angular cells, 15–30 μm diam, walls thickened; apex acute, of clavate hyphal elements. Asci clavate, apex simple, rarely with a ring, ascospores biseriate above, uniseriate below. Ascospores ellipsoid, often with ends slightly truncate, translucent yellow-brown, striate or spinulose. Anamorph *Fusarium* sect. *Martiella* or unknown. Saprobic and pathogenic on woody and herbaceous substrata.

Notes.— *Haematonectria* corresponds to the *Nectria haematococca*-group defined by Samuels (1976a) based on both teleomorph and anamorph characteristics. The *Fusarium* anamorphs of species of *Haematonectria* are common soil inhabitants, often causing root diseases of cultivated plants, unlike species of *Nectria sensu stricto* that occur as weak parasites of trees and shrubs and are not commonly isolated from soil. *Haematonectria haematococca* is not congeneric with *Nectria sensu stricto* as defined by Rossman (1989) either on morphological or molecular grounds. The results of the analysis of sequence data presented by both Guadet *et al.* (1989) and O'Donnell (1993) as well as differing mycotoxin profiles (Marasas *et al.*, 1984) indicate that *H. haematococca* is distinct from *Nectria sensu stricto*. Just as there is little similarity between species of *Haematonectria* and species of *Nectria sensu stricto*, there is little similarity between *Haematonectria* and other teleomorphs that have *Fusarium* anamorphs, viz. *Albonectria*, *Cosmospora*, and *Gibberella*. Based on rDNA sequences, Guadet *et al.* (1989) and O'Donnell (1993) have clearly demonstrated genetic differences between *Albonectria*, *Gibberella*, and *Haematonectria*. The accumulated data support the recognition of a separate genus for '*Nectria*' *haematococca* and its relatives.

Spatafora & Blackwell (1994) used 18S rDNA sequences to show that '*N.*' *haematococca* and *Neocosmospora vasinfecta*, the type of *Neocosmospora*, form a sister group to *Nectria cinnabarina*. O'Donnell (1996), who based his conclusion on the results of Spatafora & Blackwell (1994) as well as his own data, concluded that the correct genus for '*N.*' *haematococca* and members of *Fusarium* sect. *Martiella* is *Neocosmospora*, a genus characterized by orange-brown to red, rarely white, ascomata and non-septate, hyaline to yellow-brown, striate to tuberculate ascospores (see herein). The anamorph of *Neocosmospora vasinfecta* is *Acremonium*-like having unbranched conidiophores from which non-septate conidia are produced. This fungus is a common soil fungus in warmer regions. O'Donnell (1996) argued that *Neocosmospora vasinfecta* is a microconidial *Fusarium* that has lost its ability to produce macroconidia and septate ascospores. While there is no doubt about the close relationship between '*Nectria*' *haematococca* and *Neocosmospora vasinfecta*, there are numerous, conspicuous phenotypic differences that mitigate against combining '*Nectria*' *haematococca* and related species with *Neocosmospora*, including characters of both teleomorph and anamorph. In view of the fact that *N. haematococca* cannot be retained in *Nectria* and, given these differences from *Neocosmospora vasinfecta*, we propose the new genus *Haematonectria* for '*Nectria*' *haematococca* and its close relatives.

Haematonectria is a genus that may eventually accommodate many species, both sexual and asexual (O'Donnell, 1996; Hering, 1997). Within the morphological species regarded as *H. haematococca*, several intersterile groups are found in agricultural settings (Van Etten & Kistler, 1988), while Samuels (1976a) found intersterile groups in tropical forests. There are also self-fertile populations that are referable to *H. haematococca*. RAPD analysis has been used to characterize mating populations I and VI within *F. solani* f. sp. *cucurbitae* (Crowhurst *et al.*, 1991) and for many other isolates (Hering, 1997), yet there has been no effort to account for the teleomorph in morphological or anatomical terms. Among the many collections of *H. haematococca* collected in tropical forests, intersterile, heterothallic populations have been found, but it is not known whether they conform to any of the mating populations that have been defined from agricultural systems. There is ample genetic and phytopathological evidence for a multiplicity of species in the *H. haematococca/F. solani* complex. Within this complex, K. O'Donnell (pers. comm.) has found about fifty biological species, as defined by rDNA sequences. *Haematonectria haematocca* may exemplify a fungus that has been undergoing fairly rapid speciation in response to agricultural activities of humans. O'Donnell's molecularly defined groups will serve as a basis for the search for phenetic characters that may facilitate the recognition of the fusaria and their *Haematonectria* teleomorphs.

Species of *Haematonectria* occur on a variety of hosts both as pathogens and saprobes. While *H. haematococca* has a cosmopolitan distribution, its teleomorph is more common in the tropics, where it is found on woody and herbaceous substrata. The anamorph has been known as *Fusarium solani*, a soil fungus that is recorded on about 85 hosts in the United States (Farr *et al.*, 1989), although it is herein listed as *Fusarium* sp. (see below). At present only the three most common and best known species are placed in this genus, namely, *H. haematococca/Fusarium* sp., *H. ipomoeae/Fusarium striatum* and *H. illudens/F. illudens* (New Zealand) as well as two species having disarticulating ascospores.

Haematonectria haematococca (Berk. & Broome) Samuels & Nirenberg, *comb. nov.* — Plate 29, e–g.

≡ *Nectria haematococca* Berk. & Broome, J. Linn. Soc. Bot. 14: 116. 1873.
≡ *Cucurbitaria haematococca* (Berk. & Broome) O. Kuntze, Rev. Gen. Pl. 3(2): 461. 1898.
≡ *Hypomyces haematococcus* (Berk. & Broome) Wollenw., Angew. Bot. 8: 191. 1926.
= *Nectria episphaerioides* Penz. & Sacc., Malpighia 11: 511. 1897.
= *Nectria bogoriensis* C. Bernard, Bull. Dép. Agric. Indes Néerl. 11: 45. 1907.
= *Nectria calonectricola* Henn., Hedwigia 48: 105. 1909.
= *Nectria luteococcinea* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 299. 1909.
[= *Nectria confluens* Seaver, *in* Seaver & Chardón, Sci. Surv. Porto Rico & Virgin Islands 8: 44. 1926, non Petch, 1920].
= *Nectria cinnabarina* var. *jaraguensis* Höhn., Denkschr. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 83: 18. 1927.

Anamorph: *Fusarium* sp.

Ascomata solitary to densely gregarious, superficial, not obviously stromatic but difficult to remove from the substratum, globose to broadly pyriform, (225–) 275–325 μm diam, red, with red to yellowish warts, KOH+ dark red, yellow in lactic acid, non-papillate or with ascomatal apex acute, collapsing laterally or not at all, coarsely warted, warts 50–70 μm high. Cells at ascomatal surface and warts circular to angular in outline, (15–)20–25(–30) μm diam, walls 2–3(–4) μm thick. Ascomatal wall 65–95 μm thick, inclusive of warts, of two regions: outer region 50–80 μm thick including warts, of circular to angular cells, 10–30 μm diam with 2–2.5 μm thick walls; inner region 15–20 μm thick, of flattened, thin-walled cells. Asci broadly cylindric to, clavate, 60–90 × 10–17 μm, apex simple or with a ring, 8-spored, ascospores obliquely biseriate. Ascospores

ellipsoid, (9–)13–16(–18) × (4–)6–8(–9) µm, 1-septate, hyaline, becoming yellow-brown, finely striate.

Anamorph: Conidiophores typically sparse but sometimes abundant, tending to form in poorly developed sporodochia. Conidiophores 40–80 µm long, delicate, becoming verticillately branched, each branch terminating in 1–5 phialides. Phialides somewhat swollen in the middle, 10–24 µm long × 4 µm wide. Conidia subcylindrical, slightly curved with the tip cell slightly hooked, basal cell somewhat pedicellate, 5–7-septate, vacuolate. Macroconidia 1–9-septate, 15–80 × 4–7.5 µm; microconidia 0–1-septate, 6–24 × 2.5–5 µm, forming in abundance from long, little-branched, monophialidic conidiophores.

Habitat.— On bark.

Distribution.— Pantropical.

Type.— SRI LANKA (Ceylon). Central Prov., on bark, no. 1104, 1868 (K, lectotype, designated by Samuels, 1976a).

Illustrations.— Doi (1973b, Fig. 5, as *N. haematococca*); Penzig & Saccardo (1904, Pl. 29, Fig. 2, as *N. episphaerioides*); Samuels (1976a, Figs. 23A, 24, as *N. haematococca*); Samuels & Brayford (1994, Figs. 24–29, as *N. haematococca*); Samuels *et al.* (1990, Fig. 15, as *N. haematococca*); Wollenweber (1930: no. 830–832, as *Hypomyces haematococcus*).

Specimen illustrated.— FRANCE. Pyrénées Atlantiques: Ile de Sauveterres, on *Buxus sempervirens*, 29 Nov 1992, F. Candoussau 256 pp, G.J. Samuels 92-140, *H.* cf. *haematococca* (BPI).

Notes.— *Haematonectria haematococca* is more narrowly defined than in previous studies to include only tropical collections that occur on woody substrata, are heterothallic, and have relatively small ascospores. Although the anamorph has been known as *Fusarium solani* (Mart.) Sacc. (Booth, 1971) or *Fusarium eumartii* Carpenter (Gerlach & Nirenberg, 1982), it has most recently been found to be different from either of these species based on studies of their respective type specimens (H.I. Nirenberg, pers. comm.).

Haematonectria illudens (Berk.) Samuels & Nirenberg, *comb. nov.* — Plate 29, d.

≡ *Nectria illudens* Berk., *in* Hooker, Botany of the Antarctic Voyage. II. Flora of New Zealand 7: 203. 1855.

Anamorph: *Fusarium illudens* C. Booth, The Genus *Fusarium* p. 53. 1971.

Ascomata solitary to gregarious, non-stromatic or seated on an obscure basal stroma, superficial or with the base slightly immersed, globose and non-papillate to broadly obpyriform, with a short, acute papilla, (345–)400–600(–700) × (280)357–584(–700) µm diam, yellow-orange to red, dark red when dry, KOH+ dark red, coarsely warted, warts concolorous or lighter than the ascomatal wall. Cells at ascomatal surface circular to angular, 20–40 µm diam, with 1.5–2.5 µm thick walls. Ascomatal wall 50–160 µm thick, of two regions: outer region 30–140 µm thick including warts, cells of warts angular with lumina 10–20 µm diam, and 1.5–3.5 µm thick, pigmented walls, cells becoming progressively more ellipsoid toward the interior; inner region *ca* 15 µm thick, cells flattened, walls 1 µm thick, pigmented at the exterior, thinner, non-pigmented toward the centrum. Asci broadly cyindrical to clavate, (100–)120–160(–180) × 12–17 µm, apex simple, ascospores obliquely biseriate. Ascospores broadly ellipsoid to broadly fusiform, (17–)22–28(–33) × (10–)8.5–11.5(–15) µm, 1-septate, yellow-brown, finely striate.

Anamorph redescribed by Gerlach & Nirenberg (1982) and Samuels & Brayford (1994): Microconidia infrequent and few in number, ellipsoid, (5.5–)6–8.5(–9.5) × 2–2.5(–3.5) µm. Macroconidia mainly 3–5-septate, 34–63 × 6–7.5 µm. Heterothallic.

Habitat.— On bark of dicotyledonous trees.

Distribution.— New Zealand, anamorph reported from Africa (Booth, 1971).

Holotype.— NEW ZEALAND. North Island: Bay of Islands, on bark, J.D. Hooker (not examined).

Additional specimens examined listed in Samuels & Brayford (1994).

Illustrations.— Booth (1971, Fig. 9, as *Fusarium illudens*); Samuels & Brayford (1994, Figs. 36–42, as *N. illudens*).

Specimen illustrated.— NEW ZEALAND. Gisborne, Urewera National Park, Lake Waikaremoana, Ngamoko Track, on base of living *Beilschmiedia tawa*, G.J. Samuels 82-98 (BPI 802461, PDD 44267).

Haematonectria ipomoeae (Halst.) Samuels & Nirenberg, *comb. nov.*

≡ *Nectria ipomoeae* Halst., New Jersey Agric. Coll. Exp. Sta. Annual Rep. 12: 281. 1891.

≡ *Hypomyces ipomoeae* (Halst.) Wollenweber, Phytopathology 3: 34. 1913.

Anamorph: *Fusarium striatum* Sherb., Cornell Univ. Agric. Exp. Sta. Mem. 6: 255. 1915.

Ascomata solitary to gregarious, seated directly on host tissue, sometimes clustered around small cankers, non-stromatic, broadly pyriform with an acute apex, *ca* 300 µm diam, red-orange with lighter-colored warts. Asci 60–70 × 8–10 µm, apex simple. Ascospores broadly ellipsoid, (10.5–)11.5–13(–14) × (4–)4.5–5.5(–6) µm, 1-septate, finely striate.

Anamorph described by Nirenberg & Brielmaier-Liebetanz (1996): Macroconidia 5-septate, 49–64 × 4.8–5.9 µm; microconidia 0-septate, 9.8–14.5 × 4.5–5 µm.

Habitat.— Pathogenic on *Cucurbita ficifolia*, *Passiflora edulis*, *Solanum melongena*, and *S. tuberosum* (Nirenberg & Brielmaier-Liebetanz, 1996).

Distribution.— Europe, United States (New Jersey).

HOLOTYPE.— UNITED STATES. New Jersey, Mickelton, on *Solanum melongena*, 8 July 1891, B.D. Halsted (BPI 552416).

ILLUSTRATIONS.— Nirenberg & Brielmaier-Liebetanz (1996, Figs. 1–10, as *Nectria ipomoeae*), Wollenweber (1916: no. 56; 1930: no. 823, 825, as *Hypomyces ipomoeae*, 1025, as *F. javanicum*).

NOTES.— The description given above is based solely on the holotype collection. Nirenberg & Brielmaier-Liebetanz (1996) described pathogenicity of *Haematonectria ipomoeae* to *Passiflora edulis* and discussed the use of the name *Fusarium striatum* for the anamorph. The species is self-fertile.

Haematonectria monilifera (Berk. & Broome) Samuels & Rossman, *comb. nov.*

≡ *Nectria monilifera* Berk. & Broome, J. Linn. Soc. Bot. 14: 114. 1873.
≡ *Neoskofitzia monilifera* (Berk. & Broome) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl. 121, Abt. 1: 367. 1912.
≡ *Nectriella monilifera* (Berk. & Broome) Sacc., Michelia 1: 279. 1878.

Anamorph: None known.

Ascomata solitary to gregarious, superficial, often immersed at the base, with a conspicuously shining ostiolar area, globose to ovoid, 320–520 μm high × 300–450 μm diam, orange to red, becoming darker red in KOH, warted. Ascomatal wall 40–50 μm thick, of two regions: outer region 15–35 μm thick, of thick-walled, pigmented cells. Asci narrowly clavate to cylindrical, 52–140 × 3.5–4.5 μm, ascospores uniseriate. Ascospores ellipsoid to cylindrical, 5.5–7.5 × 3–4 μm, 1-septate, disarticulating early into part-ascospores, part-ascospores subglobose, 3–3.5 μm diam, hyaline, becoming yellow-brown, smooth to spinulose.
HABITAT.— On 'laterite' soil.
DISTRIBUTION.— Indonesia (Java, specimen at FH, not examined), Sri Lanka.

HOLOTYPE.— SRI LANKA (Ceylon). Peradeniya, on soil, 1870, Berkeley 1105 (K).

ILLUSTRATION.— Weese (1924, Tab. 8, Figs. 7–12, as *Neoskofitzia 'molinifera'*].

NOTES.— Although Petch (1920) suggested that *Haematonectria monilifera* (as *Neoskofitzia monilifera*) is a synonym of *H. termitum* (as *N. termitum*), the two species differ in thickness of the ascomatal wall, ascal size, ascospore ornamentation and habitat. Weese (1924) provided excellent illustrations of both species including sections of the ascomatal wall.

Haematonectria termitum (Höhn.) Samuels & Rossman, *comb. nov.*

≡ *Neoskofitzia termitum* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 117: 998. 1908.

Anamorph: None known.

Ascomata superficial, caespitose in groups of up to 12, densely gregarious, effused over the substratum, ovoid, 170–270 μm diam (Weese, 1924), non-papillate, red, becoming darker in KOH, yellow in lactic acid, slightly warted, not collapsing. Ascomatal wall 50–60 μm thick, of two regions: outer region continuous with the stroma, of ellipsoid, elongate cells, 15–50 μm diam, with about 3.5 μm thick walls. Ascomatal apex of a palisade of clavate hyphal elements that arise from the wall below and merge with periphyses. Asci clavate, 35–52 × 4–8 μm, disintegrating early, apex simple. Ascospores 1-septate, disarticulating into sixteen part-ascospores, part-ascospores broadly ellipsoid, 3–4(–4.5) × 3–3.5 μm, translucent yellow-brown, becoming densely spinulose.

HABITAT.— On old termite nest.
DISTRIBUTION.— Indonesia (Java).

TYPE.— INDONESIA. Java: Buitenzorg, in a termite nest, 1907, Höhnel (BPI 630983, lectotype, designated herein); same data except 1908, Rehm: Ascomycetes no. 1818 (BPI 630984, paratype, specimen overmature).

ILLUSTRATION.— Weese (1924, Tab. 8, Figs. 1–6, as *Neoskofitzia termitum*).

NOTES.— Petrak erred in noting *'n. gen. et spec.'* on the BPI packet of von Höhnel's type specimen of *Haematonectria termitum*.

LANATONECTRIA Samuels & Rossman, *gen. nov.*

Type: *Lanatonectria flocculenta* (Henn. & E. Nyman) Samuels & Rossman (≡ *Nectriella flocculenta* Henn. & E. Nyman).

Stroma pseudoparenchymatosum. Ascomata superficialia, subglobosa vel late obpyriformia, rubra, KOH+ phaeorubra, non papillata vel papilla minuta praedita; pilis hyphalibus hyalinis vel luteis, levibus vel spinulosis, uncinatis vel rectis, septatis, tenuitunicatis obtecta, interdum tomentosa; paries ascomatis extus e cellulis conspicue angularibus, 10–15 μm diam, compositus. Asci clavati vel fusiformes, apice simplici vel annulo praediti. Ascosporae ellipsoideae vel fusiformes, ad medium 1-septatae, hyalinae vel raro ochroleucae, striatae.

Stroma continuous with the ascomatal base, pseudoparenchymatous or of highly compacted, somewhat thick-walled hyphae. Ascomata superficial on a minute basal stroma, on an erumpent, previously conidial stroma, or at the base of a synnema, subglobose to broadly obpyriform, not collapsing when dry; red, KOH+ dark red, yellow in lactic acid, non-papillate or with a minute

papilla, with hyaline to yellow hyphal hairs, hairs smooth or spinulose, hooked or straight, septate, thin-walled, arising from the surface of the ascomatal wall and from around the ascomatal base, sometimes forming a tomentum on the ascomatal surface. Ascomatal wall with outer region of conspicuously angular cells, 10–15 µm diam, with 1.5–2 µm thick walls. Asci clavate to fusiform, apex simple or with a ring, ascospores biseriate. Ascospores ellipsoid to fusiform, medially 1-septate, hyaline or rarely pale yellow-brown, striate. Anamorph, where known, *Actinostilbe*. On decaying woody and herbaceous substrata, also on stromatic fungi.

Notes.— *Lanatonectria* is most easily recognized through the spinulose, golden, often hooked hairs that form on the ascomata, striate ascospores, and distinctive anamorphs. Four species are included, all of which occur on small twigs and bark of living or recently dead trees and fruits in tropical or subtropical areas. *Lanatonectria flocculenta* is the most common, while *L. mammiformis* is known only from northern South America. This genus was previously referred to as the *Nectria flavolanata*-group (Samuels *et al.*, 1990; Samuels & Seifert, 1987).

Lanatonectria flocculenta (Henn. & E. Nyman) Samuels & Rossman, *comb. nov.* — Plate 29, i–j.

≡ *Nectriella flocculenta* Henn. & E. Nyman, *in* Warburg, Monsunia 1: 160. 1899.
= *Nectria flocculenta* (Henn. & E. Nyman) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 121: 360. 1912.
= *Nectria tjibodensis* Penz. & Sacc. var. *crebrior* Sacc., Syll. Fung. 14: 636. 1899.
= *Nectria bainii* Massee var. *hypoleuca* Sacc., Nuovo Giorn. Bot. Ital. II, 23: 205. 1916.
= *Nectria luteopilosa* Zimm., Centralbl. Bakteriol., Abth. 2, 8: 182. 1902.
= *Nectria vanillae* Zimm., Centralbl. Bakteriol., Abth. 2, 8: 473. 1902.

Anamorph: ***Actinostilbe macalpinei*** (Agnihothrudu & Barua) Seifert & Samuels, *comb. nov.*

≡ *Kutilakesopsis macalpinei* Agnihothrudu & Barua, J. Indian Bot. Soc. 36: 309. 1957, as '*macalpineae*'.

Ascomata solitary to gregarious in groups of 2 to 15, forming aggregates 1–2 mm diam, superficial on an erumpent, previously conidial stroma, globose to subglobose, (125–)224–314 µm high × (125–)215–293 (–310) µm diam, non-papillate or with a minute papilla; hairs arising from ascomatal surface, straight or conspicuously hooked, (25–)40–70 µm long × 4–7(–10) µm wide, septate, unbranched, with apex somewhat enlarged, wall slightly thickened, golden, prominently spinulose. Surface cells circular to angular, (7–)10–15(–20) µm, walls 1–1.5 µm thick. Ascomatal wall 30–35 µm thick, of two regions: outer region *ca* 20 µm thick, of angular cells with lumina 10–15 × *ca* 10 µm, walls 1.5–2 µm thick; inner region *ca* 10 µm thick, of fusiform cells with lumina 15–20 µm × 3–5 µm and 1.5–2 µm thick walls, walls becoming thinner toward the centrum. Ascomatal apex continuous with the ascomatal wall below, ostiolar opening of vertically elongate hyphal elements, continuous with the inner region of the ascomatal wall, protruding through the outer region, increasingly narrower, merging with periphyses. Asci narrowly clavate to fusiform, (32–)42–63 (–75) × (6.5–)7.5–10(–12) µm, apex with ring, 8-spored, ascospores obliquely uniseriate. Ascospores ellipsoid to narrowly fusiform, 10–13(–17) × (2.5–)3– 4.5(–6) µm, 1-septate, not constricted at the septum, hyaline to very pale brown, striate.

Anamorph: Long, flexuous, golden, unbranched, densely spinulose, hyphal setae arising from the periphery of a tuberculate sporodochium and from conidiophores within the stroma. Phialides cylindrical, 25–50 µm long × 2–3 µm wide. Conidia cylindrical, (6–)7.5–11(–14) × 2.5–3.5(–4.5) µm, medially 1-septate, forming a yellow, hemispherical mass.

Habitat.— On recently dead twigs of trees, also on pyrenomycetous stromata and herbaceous debris including pods of *Theobroma cacao*.
Distribution.— Pantropical.

Type.— The holotype specimen of *Nectriella flocculenta* originally housed at B (INDONESIA. Java. Bogor, on dead stems, Aug 1898, *Nyman*), no longer exists (Hein, 1989). However, this specimen was examined and illustrated by Wollenweber (1930), thus his illustration, namely Tab. 744 at BPI, is herein regarded as the 'neo-iconotype'.
Additional specimens examined are listed in Samuels & Brayford (1994) and Samuels *et al.* (1990).

Illustrations.— Doi (1977, Figs. 1, 2, as *Nectria flavolanata*), Samuels & Brayford (1994, Figs. 16–20, as *N. flavolanata*), Samuels & Seifert (1987, Fig. 3.23, as anamorph of *N. flavolanata*), Samuels *et al.* (1990; Figs. 19 D–F; as *N. flocculenta*), Wollenweber (1930, Tabs. 744, 745, both as *N. flavolanata;* Tab. 746, drawn from the type of *N. vanillae*; Tab. 747, drawn from the type of *Nectriella flocculenta*), Zimmermann (1902, Figs. 1–4, as *Nectria vanillae*).

Specimens illustrated.— JAMAICA. Cane river, 16 km from Kingston, on bark, 12 Jan 1970, A. Rossman 399 (BPI 552098). VENEZUELA. Amazonas: Cerro de la Neblina, base camp, on decaying fruit of *Guarea ?glabra*, 23 Apr 1984, G.J. Samuels 1553, cult. G.J.S. 84-372 (NY).

Notes.— *Lanatonectria flocculenta is* one of the most common of the hypocrealean fungi in tropical regions. It is frequently found on small twigs of shrubs and is conspicuous because of the hooked, spinulose, yellow, hairs and yellow conidial masses. Species-level taxonomy of *L. flocculenta* was discussed in detail by

Samuels *et al.* (1990). The species had previously been referred to as *N. flavolanata* Berk. & Broome (Doi, 1977; Nag Raj & Govindu, 1969).

ADDITIONAL SPECIES OF *LANATONECTRIA:*

Lanatonectria flavolanata (Berk. & Broome) Samuels & Rossman, *comb. nov.* — Plate 29, h.

≡ *Nectria flavolanata* Berk. & Broome, J. Linn. Soc., Bot. 14: 114. 1873.
= *Nectria radians* Penz. & Sacc., Malpighia 11: 510. 1897.
= *Nectria tjibodensis* Penz. & Sacc., Malpighia 11: 512. 1897.
= *Chilonectria javanica* Penz. & Sacc., Malpighia 11: 508. 1897.
= *Calonectria sulphurella* Starbäck, Bih. Kongl. Svensk Vetensk.-Akad. Handl. 25: 30. 1899.
= *Sphaerostilbe ochracea* Pat., *in* Duss, Énum. Champ. Guadeloupe p. 79. 1903.

Anamorph: *Actinostilbe* sp.
Ascomata associated with the base of synnemata or separate, caespitose in groups of 5–20, superficial on an erumpent stroma, with long, unbranched, septate, flexuous, spinulose, golden hairs arising from around the ascomatal base, subglobose to broadly pyriform, 340–500 μm high × 310–430 μm diam, not collapsing when dry; red, KOH+ dark red; papillate or non-papillate; ascomatal wall, exclusive of the apex, furfuraceous, with white to orange-buff tomentum, individual hyphae 50–60 μm long × 5–6 μm wide at the somewhat enlarged, clavate apex, straight and flexuous or hooked, septate, spinulose, yellow. Ascomatal surface cells angular, 10–15 μm diam, with 2–3 μm thick walls. Ascomatal wall 30–40 μm thick, of two regions: outer region, *ca* 20 μm thick, cells with circular lumina 5–7 μm diam, with 2–4 μm thick pigmented walls; inner region 10–15 μm thick, cells fusiform, flattened, compressed with *ca* 2.5 μm thick, unpigmented walls. Ascomatal apex formed at the exterior of diverging chains of more or less elongate cells; towards the interior consisting of narrow hyphal elements merging with periphyses. Asci clavate, 50–65(–110) × 6–9(–11) μm, apex with ring, 8-spored, ascospores biseriate. Ascospores ellipsoid to fusiform, 13.5–18(–21) × 4–6(–7.5) μm, 1-septate, not constricted at the septum, hyaline, striate.
ANAMORPH: Synnemata 825–2000 μm high × (25–)50–375 μm wide in the stalk, white, red-orange with age, tomentose, cylindrical to subulate with a globose capitulum. Conidia oblong ellipsoid, to obovoid, 10–17 (–22) × 4–7 μm, 1-septate, in a white, yellow or orange-yellow slimy mass.

HABITAT.— On bark.
DISTRIBUTION.— Pantropical.

HOLOTYPE.— SRI LANKA [Ceylon]. Thwaites 239b (K).
SPECIMEN EXAMINED.— FRENCH GUIANA. Saül, Mt. Boef Mort, on recently killed wood, 8 Feb 1986, G.J. Samuels 3584, cult. G.J.S. 86-171 (NY).

ILLUSTRATIONS.— Penzig & Saccardo (1904, Pl. 30, Fig. 4, as *N. tjibodensis*); Samuels & Brayford (1994, Figs. 6–9, 12–15, as *N. flavolanata*); Seifert (1990, Fig. 1A, anamorph only).
NOTE.— The *Actinostilbe* anamorph of *Lanatonectria flavolanata* was fully described by Seifert (1990).

Lanatonectria mammiformis (Chardón) Samuels & Rossman, *comb. nov.* — Plate 22, g (see page 96).

≡ *Sphaerostilbe mammiformis* Chardón, *in* Seaver & Chardón, Sci. Surv. Porto Rico & Virgin Islands 8: 46. 1926.
≡ *Nectria mammiformis* (Chardón) Samuels, *in* Samuels & Dumont, Caldasia 13: 393. 1982.
Anamorph: ***Actinostilbe mammiformis*** (Cif.) Seifert & Samuels, *comb. nov.*

≡ *Stromatographium mammiforme* Cif., Sydowia 8: 264. 1954.

Ascomata solitary or in caespitose groups of 10 or more, superficial on a minute basal stroma, broadly obpyriform, 300–700 μm diam, with a minute papilla; apex of narrow hyphal elements continuous with middle wall region and periphyses; hairs arising from the ascomatal surface densely disposed and forming a white to off-white tomentum; terminal parts of individual hyphae of tomentum narrowly clavate, spinulose, to 50 μm long, 7.5 μm wide apically, straight or slightly hooked, unbranched. Ascomatal surface cells angular, 10–20 μm diam, walls *ca* 2 μm thick. Ascomatal wall 40–50 μm thick laterally, of three intergrading regions: outer region to 25 μm thick, of circular to angular cells, 7–25 μm diam, with pigmented, 2–2.5 μm thick walls; middle region *ca* 15 μm thick, of cells with elongate lumina, *ca* 25 × 3 μm, with pigmented, *ca* 3 μm thick walls; inner region *ca* 10 μm thick, of flattened, compressed cells with hyaline, thin walls. Asci clavate, (60–)75–100(–115) × 10–18 μm, 8-spored. Ascospores fusiform, (17–)24–30(–34) × (5–)7–9(–10) μm, hyaline, coarsely striate.
ANAMORPH: Synnemata to 2 mm long, off-white to white, bearing a single, terminal, globose head of clear yellow liquid. Hyphae at the surface of the synnema narrowly clavate, 4–6 μm wide, conspicuously spinulose, thin-walled, septate, branched. Phialides cylindrical, 35–50 μm long, 3.5–4.5 μm wide. Conidia oblong, (14–)25–35(–40) × (6–)10–14(–16) μm, medially 1-septate, hyaline in transmitted light, smooth-walled.

HABITAT.— On recently killed wood, found once also on stem of *Philodendron* sp.
DISTRIBUTION.— Tropical America.

Key to the species of *Lanatonectria*

1. Ascomatal hairs smooth-walled; anamorph not known ..... *L. raripila*
1. Ascomatal hairs spinulose; anamorph *Actinostilbe* 2

2. Ascospores (17–)24–30(–34) × (5–)7–9(–10) μm ..... *L. mammiformis*
2. Ascospores less than 20 μm long 3

3. Ascospores 10–13(–17) × (2.5–)3–4.5(–6) μm; anamorph sporodochial ..... *L. flocculenta*
3. Ascospores 13.5–18(–21) × 4–6(–7.5) μm; anamorph synnematous ..... *L. flavolanata*

Type.— PUERTO RICO. Maricao, forest reserve, on dead wood, 11 Nov 1921, C.E. Chardón, Cornell University Explorations of Porto Rico no. 1270 (BPI 631164, holotype). Additional specimens examined are listed in Samuels & Brayford (1994) and Samuels & Dumont (1982).

Illustrations.— Samuels & Brayford (1994, Figs. 32–34, 55–61, as *N. mammiformis*).
Specimen illustrated.— PUERTO RICO. Bosque Estatal de Guajataca, along Vereda Nueva, on branch, 22 Jan 1996, S.M. Huhndorf 2002 (F).

Notes.— *Lanatonectria mammiformis* is characterized by its large ascospores and conidia and by the lanose covering on the ascomata that leaves the ostiolar area free. Two species of *Lanatonectria*, *L. flavolanata* and *L. mammiformis*, are known to have synnematous anamorphs. Of these, the conidia and ascospores of *L. mammiformis* are larger than those of *L. flavolanata*. *Stilbella ecuadorensis* Morgan-Jones & McKemy (Morgan-Jones *et al.*, 1991) is a probable synonym of *Actinostilbe mammiformis*.

Lanatonectria raripila (Penz. & Sacc.) Samuels & Rossman, *comb. nov.*

= *Nectria raripila* Penz. & Sacc., Malpighia 15: 228. 1901.

Anamorph: None known.
Ascomata scattered, solitary to gregarious in small groups, superficial on a minute basal stroma, pyriform, 220–280 μm high × 220–250 μm diam, apex acute, not collapsing when dry, red to yellow, with scattered hairs; hairs flexuous, cylindrical, 80–100 μm long × 10–15 μm wide, septate, unbranched, end obtuse, walls *ca* 2 μm thick, smooth. Ascomatal surface cells and warts angular, 15–20 μm diam, with *ca* 1 μm thick walls. Ascomatal wall *ca* 20 μm thick, of two regions: outer region, *ca* 10 μm thick, of large, angular cells; inner region *ca* 10 μm thick, of flattened, compressed cells. Asci clavate, 60–87 × 13–17 μm, apex simple, 8-spored, ascospores biseriate. Ascospores fusiform, (24–)27.5–32(–33) × (6–)6.5–8 μm, 1-septate, not constricted at the septum, hyaline, coarsely striate.
Habitat.— On decaying stems of *Elettaria (Zingiberaceae)*.

Distribution.— Indonesia (Java), known only from the type collection.

Type.— INDONESIA. Java, [Tjibodas, on *Elettaria* sp., 1898, M. Fleischer] 923 (PAD, holotype).

Illustrations.— Penzig & Saccardo (1904, Pl. 32, Fig. 2); Samuels & Brayford (1994 Figs. 83, 84); Samuels *et al.* (1990 Fig. 19g), all as *N. raripila*.

Notes.— *Lanatonectria raripila* is distinguished by its large ascospores. The hairs are unusual in the genus in being smooth-walled, not spinulose.

LEUCONECTRIA Rossman, Samuels & Lowen, Mycologia 85: 868. 1993.

Type: *L. clusiae* (Samuels & Rogerson) Rossman, Samuels & Lowen (≡ *Pseudonectria clusiae* Samuels & Rogerson).

Ascomata superficial, solitary, with a thin, hyphal stroma, globose to subglobose, scarlet, KOH+ purple, with a white to pale yellow, furfuraceous outer coating on the ascomatal wall; ascomatal wall about 25 μm thick, of two regions: outer region of angular to circular, thick-walled cells; inner region of ellipsoid to elongate, thick-walled cells, that become thinner toward the centrum. Asci narrowly clavate, apex with a ring. Ascospores non-septate, hyaline, smooth-walled. Anamorph *Gliocephalotrichum*. On decaying leaves and woody fruits of *Clusia*, also isolated from soil.

Notes.— The genus *Leuconectria* was established for one species having both a distinctive teleomorph and anamorph. Molecular analysis of 28S rDNA sequence data (Rehner & Samuels, 1995) support the hypothesis that *Leuconectria* is similar to but not congeneric with *Calonectria*.

Leuconectria clusiae (Samuels & Rogerson) Rossman, Samuels & Lowen, Mycologia 85: 686. 1993.

≡ *Pseudonectria clusiae* Samuels & Rogerson, Mem. New York Bot. Gard. 64: 173. 1990.

Anamorph: *Gliocephalotrichum bulbilium* J. J. Ellis &

Hesseltine, Bull. Torrey Bot. Club 89: 22. 1962.

Ascomata solitary, superficial on a sparse hyphal stroma, globose to subglobose, 180–260 μm diam, not collapsed when dry, wall red-orange, scarlet when dry, becoming slightly darker in KOH, yellow in lactic acid, appearing white to pale yellow due to an amorphous substance coating the ascomatal wall; amorphous substance dissolving in KOH, but not in water; ascomatal wall slightly rugose; ostiolar region without amorphous substance, thus appearing scarlet, non-papillate. Ascomatal surface cells angular to circular, 10–20 μm diam, with pigmented, about 1 μm thick walls, fine pores joining the cells, evident as small depressions in face view. Ascomatal wall about 20–25 μm thick, of two regions: outer region of angular cells, 8–12 μm diam, with 1.5 μm thick walls; inner region about 10 μm thick, of elongate cells, with 1.5 μm thick walls. Asci narrowly clavate, 50–70 × 7–10 μm, apex with a minute ring, 8–spored; ascospores biseriate toward the apex. Ascospores ellipsoid, (8–)9–11(–12.5) × (2.5–)3–4 (–4.5) μm, non-septate, hyaline, smooth-walled.

Anamorph: In culture vegetative hyphae flexuous, 3–6 μm wide, thin-walled, becoming orange toward the colony center. Microsclerotia irregularly globose, 42–63 μm diam, of inflated cells with orange, thin walls, each cell filled with guttules. Conidiophores formed abundantly within 5 days, scattered, solitary, arising directly from the agar surface, 120–540 μm high, stipe 10–15 μm wide, thin-walled, pale orange, often once or twice branched; primary branches developing from inflated apex, 13–16 μm wide, slightly clavate, 18–23 μm long × 4.5–7 μm wide at the base, 7.5–10 μm wide at the apex, bearing secondary branches similar to the primary branches, or conidiogenous cells. Three to six sterile, determinant 'arms' developing from below the base of the secondary branches, arms 160–220 μm long, extending well beyond the penicillus. Conidiogenous cells phialidic, narrowly clavate to cylindrical, constricted at the apex, 6–9 × 2–3 μm. Conidia ellipsoid with ends broadly rounded to cylindrical, variable in size and shape, 3.5–10 × 2.5–3.5 μm, hyaline, non-septate, smooth-walled, forming a droplet at the apex.

Habitat.— On the undersurface of decaying leathery leaves and fruits of *Clusia*. Anamorph isolated from diverse substrata including soil and wood.

Distribution.— Teleomorph known from Guyana and Puerto Rico. Anamorph only reported from the Central African Republic, India, Indonesia, Japan, Peru, Thailand, United States (Hawaii, Louisiana, West Virginia, Wisconsin).

Types.— GUYANA. Cuyuni-Mazaruni Region: VII: Mazaruni Subregion, VII–2, foothills immediately S of Mt. Ayangana, *ca* 1 km W of Pong River, 05°28′ N, 60°04′ W, elev. 550–650 m, on decaying leaves of *Clusia* sp., 26 Feb 1987, Samuels 4854 *et al.* (NY, holotype of *Pseudonectria clusiae*). UNITED STATES. Louisiana, Tunica Hills, isolated from a soil sample collected under moss, L.J. Wickerham, isol. C.W. Hesseltine, 24 Aug. 1960, ex-type culture of *G. bulbilium*, ATCC 22228 (≡ NRRL 2899 ≡ QM 9007), (BPI 414619, lectotype of *Gliocephalotrichum bulbilium*, designated by Rossman *et al.*, 1993, NY).
Additional specimens examined listed in Rossman *et al.* (1993).

Illustrations.— Ellis (1971, Fig. 398, anamorph); Ellis & Hesseltine (1962, Figs. 1–19, anamorph); Rossman *et al.* (1993, Figs. 1–6); Samuels & Rogerson (1990, Figs. 36–40, as *P. clusiae*); Tubaki & Fujita (1980, Figs. 1–6, 16C, 21–22, anamorph); Wiley & Simmons (1971, Figs. 1–5, anamorph).

NECTRIA (Fr.) Fr., Summa Veg. Scand. 2: 387. 1849, *nom. cons.*

≡ *Hypocrea* Fr. sect. *Nectria* Fr., Syst. Orb. Veg. p. 105. 1825.
Lectotype, designated by Clements & Shear (1931): *N. cinnabarina* (Tode : Fr.) Fr. (≡ *Sphaeria cinnabarina* Tode : Fr.).
= *Ephedrosphaera* Dumort., Commentat. bot. p. 90. 1822. — Lectotype, designated by Cannon & Hawksworth (1983): *Sphaeria decolorans* Pers., a synonym of *Nectria cinnabarina* (Tode : Fr.) Fr.
= *Sphaerostilbe* Tul. & C. Tul., Sel. Fung. Carpol. 1: 130. 1861. — Lectotype, designated by Seaver (1909b): *S. aurantiaca* Tul. & C. Tul., recognized as *Nectria aurantiaca* (Tul. & C. Tul.) Jacz.
= *Pleonectria* Sacc., Mycotheca Ven. no. 688. 1876. — Type: *P. lamyi* (Desm.) Sacc. (≡ *Sphaeria lamyi* Desm.), recognized as *Nectria lamyi* (Desm.) De Not.
= *Chilonectria* Sacc., Michelia 1: 279. 1878. — Lectotype, designated by Clements & Shear (1931): *C. cucurbitula* (Tode : Fr.) Sacc. (= *Sphaeria cucurbitula* Tode : Fr.), recognized as *Nectria cucurbitula* (Tode : Fr.) Fr.
= *Megalonectria* Speg., Anales Soc. Ci. Argent. 12: 211. 1881. — Type: *M. pseudotrichia* (Berk. & M.A. Curtis) Speg., recognized as *Nectria pseudotrichia* Berk. & M.A. Curtis.
= *Aponectria* (Sacc.) Sacc., Syll. Fung. 2: 516. 1883 (≡ *Nectria* subgenus *Aponectria* Sacc., Michelia 1: 296. 1878). — Type: *A. inaurata* (Berk. & Broome) Sacc. (≡ *Nectria inaurata* Berk. & Broome), a synonym of *Nectria aquifolii* (Fr.) Berk.
= *Stilbonectria* P. Karst., Hedwigia 28: 194. 1889. — Type: *S. lateritia* P. Karst., recognized as *Nectria lateritia* (P. Karst.) Rossman.
= *Allantonectria* Earle, *in* E.L. Greene, Plantae Bakerianae 2: 11. 1901. — Type: *A. yuccae* Earle, a synonym of *Nectria miltina* (Mont.) Mont.
= *Creonectria* Seaver, Mycologia 1: 183. 1909. — Type: *C. purpurea* (L.) Seaver (≡ *Tremella purpurea* L. 1753), a synonym of *Nectria cinnabarina* (Tode : Fr.) Fr.
= *Scoleconectria* Seaver, Mycologia 1: 197. 1909. — Type: *S. scolecospora* (Brefeld & Tavel) Seaver (≡ *Ophionectria scolecospora* Brefeld & Tavel 1891), a synonym of *Nectria cucurbitula* (Tode : Fr.) Fr.

Stroma well-developed, pseudoparenchymatous. Ascomata superficial, generally aggregated on a stroma. Ascomata subglobose, globose to ellipsoid, collapsing

cupulate, red to dark red, KOH+ purple, ostiolate, with relatively thick walls, more than 25 µm, often with warted outer region of thick-walled cells. Asci 8-spored. Ascospores broadly ellipsoid to long-fusiform, non-, 1- to multiseptate or muriform, hyaline to yellow-brown, smooth to striate. Anamorph *Tubercularia* and related pycnidial and synnematal species. On decaying woody dicotyledonous substrata, also on decaying leaves of *Agavaceae*.

Notes.— *Nectria* was first recognized as *Hypocrea* sect. *Nectria* Fr. and raised to generic rank by Fries (1849) who included eighteen species in the genus *Nectria*, none of which was designated as type. Although Seaver (1909a) cited *N. peziza* as the type, this lectotypification is not considered legitimate because he was following the first-species rule of the American Code of Botanical Nomenclature, a code that was never officially recognized. The first legitimate typification of the genus *Nectria* was made by Clements & Shear (1931), who designated *N. cinnabarina* as lectotype. Cannon & Hawksworth (1983) proposed the conservation of *Nectria* (Fr.) Fr. with *N. cinnabarina* as the type over *Ephedrosphaera* Dumort. 1822 and *Hydropisphaera* Dumort. 1822. The conservation of this name was approved as listed in Greuter *et al.* (1994).

The concept of the genus *Nectria* had become extremely broad, including all hypocrealean fungi with uniloculate ascomata not immersed in either the stroma or substratum. At least 800 names have been proposed in *Nectria sensu lato* with the number of accepted species estimated at 200 (Booth, 1959; Rossman, 1996). No monographic account exists of *Nectria sensu lato*. Seaver (1909a) included 23 species of *Nectria* in North America and Booth (1959) provided a valuable account of the British species. Following Weese (1919), Booth (1959) arranged the British species into groups based primarily on characters of the ascomatal wall, anamorph, and host. The groups defined by Booth were expanded by Samuels & Rossman (1979), who correlated more fully the anamorph characteristics and ascomatal wall structure. Most of these groups are herein recognized at the generic level within the *Bionectriaceae* and *Nectriaceae*.

Species in *Nectria sensu stricto* were listed and discussed with a key to 28 species in a synopsis of the *Nectria cinnabarina*-group by Rossman (1989). One additional species, *N. miltina* (Mont.) Weese, is described and illustrated below. Although previously included in *Nectria sensu stricto*, *Nectria patavina* and *N. chrysogramma* are herein excluded from *Nectria* as discussed under the excluded genera *Thyronectria* and *Thyronectrioidea*.

Nectria cinnabarina (Tode : Fr.) Fr., Summa Veg. Scand. 2: 388. 1849. — Plate 22, h (page 96); Plate 30, a–b.

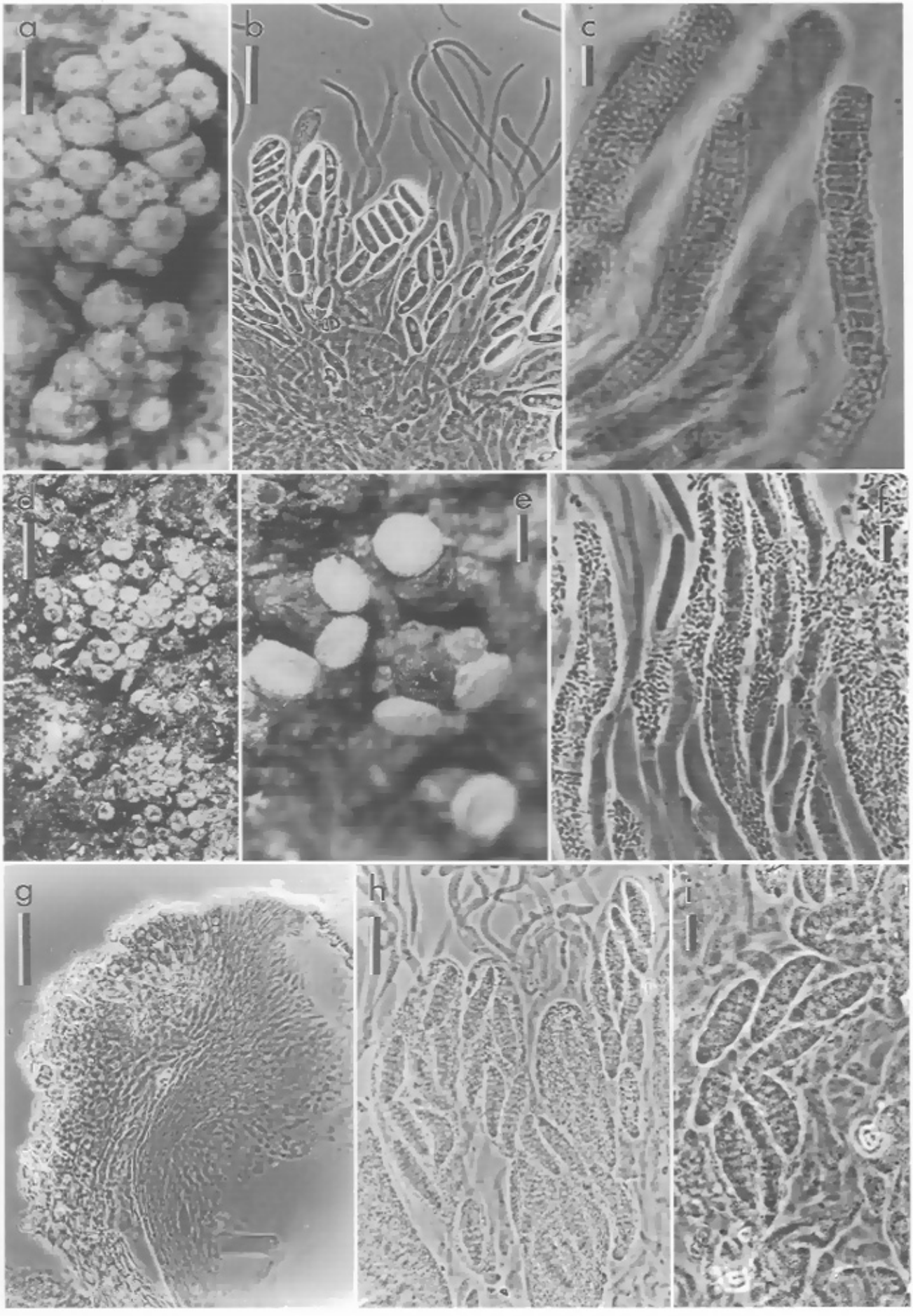
≡ *Sphaeria cinnabarina* Tode : Fr., Tode, Fungi mecklenb. sel. 2: 9. 1791 : Fries, Syst. Mycol. 2: 412. 1823.
≡ *Cucurbitaria cinnabarina* (Tode : Fr.) Grev., Scot. Crypt. Fl. 3: 135. 1825.

= *Tremella purpurea* L., Sp. Pl. 2: 1158. 1753.
≡ *Nectria purpurea* (L.) G.W. Wilson & Seaver, J. Mycol. 13: 51. 1907.
≡ *Creonectria purpurea* (L.) Seaver, Mycologia 1: 184. 1909.
= *Sphaeria tremelloides* Weigel, Obs. Bot. p. 46. 1772.
= *Sphaeria decolorans* Pers. : Fr., Persoon, Syn. Meth. Fung., p. 49. 1801 : Fries, Syst. Mycol. 2: 412. 1823.
= *Sphaeria celastri* Schwein. : Fr., *in* Fries, Elenchus Fungorum 2: 81. 1827.
= *Sphaeria dematiosa* Schwein., Trans. Amer. Philos. Soc. II, 4: 205. 1832.
= *Nectria russellii* Berk. & M.A. Curtis, *in* Berkeley, Grevillea 4: 45. 1875.
= *Nectria offuscata* Berk. & M.A. Curtis, *in* Berkeley, Grevillea 4: 45. 1875.
= *Nectria nigrescens* Cooke, Grevillea 7: 50. 1878.
= *Nectria sambuci* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1890: 246. 1891.
= *Nectria meliae* Earle, Bull. Torrey Bot. Club 25: 364. 1898.
= *Nectria fuscopurpurea* Wakef., Kew Bull., p. 232. 1918.

Anamorph: *Tubercularia vulgaris* Tode : Fr., Tode, Fungi mecklenb. sel. 1: 18. 1790 : Fries, Syst. Mycol. 3: 464. 1832.

≡ *Knyaria vulgaris* (Tode : Fr.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia discoidea* Pers., Obs. Mycol. 1: 79. 1796.
= *Tubercularia confluens* Pers., Syn. Meth. Fung., p. 113. 1801.
≡ *Knyaria confluens* (Pers.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia granulata* Pers. : Fr., Persoon, Syn. Meth. Fung. 113. 1801 : Fries, Syst. Mycol 3: 465. 1832.
= *Tubercularia sarmentorum* Fr., Obs. Mycol 1: 208. 1815.
≡ *Knyaria sarmentorum* (Fr.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia minor* Link, *in* Linn. Sp. Pl. 2: 100. 1825.
≡ *Knyaria minor* (Link) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia mutabilis* Nees, *in* Link, Linn. Sp. Pl. 2: 101. 1825.

Plate 30. a–b. *Nectria cinnabarina*. a. Ascomata on stroma. b. Asci with ascospores and remnants of apical paraphyses in phase contrast. **c.** *Nectria balsamea*, asci with ascospores producing ascoconidia. **d.** *Nectria guarapiensis*, ascomata on natural substratum. **e–f.** *Nectria cucurbitula*. e. Ascomata and pycnidia on natural substratum. f. Asci with ascospores producing ascoconidia. **g–i.** *Nectria lamyi*. g. Median section of ascoma. h. Asci with immature ascospores and remnants of apical paraphyses. i. Asci with ascospores. a–b. Neotype Fries, Sclerom. Succ. 184 – UPS. c. Seaver 321a – NY. d. Holotype – LPS. e–f. BPI 632633. g–i. Isolectotype – BPI. Scale bars: a = 500 µm; b, h = 25 µm; c, f, i = 10 µm; d = 1 mm; e = 250 µm; g = 50 µm.


a
b
c
d
e
f
g
h
i

≡ *Knyaria mutabilis* (Nees) O. Kuntze, Rev. Gen. Pl. 2: 846. 1891.
= *Tubercularia celastri* Schwein., Proc. Amer. Philos. Soc. 4: 301. 1831.
≡ *Knyaria celastri* (Schwein.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia radicalis* Schwein., Proc. Am. Philos. Soc. 4: 301. 1831.
≡ *Knyaria radicalis* (Schwein.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia subpedicellata* Schwein., Proc. Am. Philos. Soc. 4: 301. 1831.
≡ *Knyaria subpedicellata* (Schwein.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia calycanthi* Schwein., Proc. Am. Philos. Soc. 4: 302. 1831.
≡ *Knyaria calycanthi* (Schwein.) O. Kuntze, Rev. Gen. Pl. 2: 856 1891.
= *Tubercularia subdiaphana* Schwein., Proc. Amer. Philos. Soc. 4: 302 1831.
≡ *Knyaria subdiaphana* (Schwein.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia aesculi* Opiz, *in* Corda, Icones Fung 1: 4. 1837.
≡ *Knyaria aesculi* (Opiz) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia hysterina* Corda, Icones Fung. 1: 4. 1837.
≡ *Knyaria hysterina* (Corda) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia sambuci* Corda, Icones Fung. 1: 4. 1837.
≡ *Knyaria sambuci* (Corda) O. Kuntze, Rev. Gen. Pl. 2: 856 1891.
= *Tubercularia vaginata* Corda, Icones Fung. 1: 4. 1837.
≡ *Knyaria vaginata* (Corda) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
[= *Tubercularia gyrosa* Opiz, Seznam Rostl. Květ. České p. 149. 1852, nom. nud.].
≡ *Knyaria gyrosa* (Opiz) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
[= *Tubercularia laburni* Opiz, Seznam Rostl. Květ. České p. 149 1852, nom. nud.].
≡ *Knyaria laburni* (Opiz) O. Kuntze Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia filicis* Lasch, *in* Klotzsch. Herb. mycol. no. 1818. 1854.
≡ *Knyaria filicis* (Lasch) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia berberidis* Thüm., Mycoth. univ. no. 696. 1877.
≡ *Knyaria berberidis* (Thüm) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891
= *Tubercularia evonymi* Roum., Fungi gall. exs. no. 55. 1879.
≡ *Knyaria evonymi* (Roum.) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia brassicae* Libert, Herb. crypt. Ard. no. 1019.
≡ *Knyaria brassicae* (Libert) O. Kuntze, Rev. Gen. Pl. 2: 856. 1891.
= *Tubercularia ailanthi* Cooke, Grevillea 12:26. 1883.
= *Tubercularia aquifolii* Cooke & Massee, Grevillea 12: 45. 1887.
= *Tubercularia conorum* Cooke & Massee, Grevillea 16: 49. 1887.
= *Tubercularia coryli* Paol., Atti Accad. Scient. Veneto-trent.-istriana 11: 59. 1887.
= *Tubercularia rhamni* Paol., Atti Accad. Scient. Veneto-trent.-istriana 11: 59. 1887.
[= *Tubercularia calycanthi* Passer., Atti Reale Accad. Lincei, Rendiconti Cl. Sci. Fis. Ser. 4, 7: 51. 1891, non Schwein. 1831].
= *Tubercularia hamata* Ellis & Everhart, Proc. Acad. Nat. Sci. Philadelphia 1894: 386.
= *Tubercularia miniata* Earle, *in* E.L. Greene, Plantae Bakerianae 2: 29. 1901.
= *Tubercularia pteleae* Oudem., Ned. Kruidk. Arch., Ser. 3, 2: 925. 1903.

Stroma up to 5 mm diam, formed primarily of *textura angularis* to *textura prismatica* with cells oriented more or less vertically; cells 10–30 × 5–15 μm, with 1–3 μm thick walls; surface of stroma a palisade of closely packed hyphae with terminal cells 3.5–11 × 2–3.5 μm; basal part of the stroma sometimes a *textura intricata* of 2–5 μm wide hyphae. Ascomata solitary or caespitose up to 15 on an erumpent stroma, sometimes clustered around the sporodochia, globose to slightly pomiform, 250–400 μm diam, red-brown, KOH+ dark red, darker around the ostiole, non-papillate, usually with a conspicuously warted wall, though sometimes smooth-walled. Ascomatal surface covered with globose to ellipsoid cells, 10–25 μm diam with 1–2 μm thick walls. Ascomatal wall 50–100 μm thick, of two regions: outer region 40–80 μm thick, of globose to angular cells, 8–20 μm diam with 1–2 μm thick walls; inner region 10–20 μm thick, of compressed, rectangular cells, 6–20 × 1–4 μm, with thin to slightly thickened walls. Asci cylindrical to slightly clavate, 60–90 × 7–11(–14) μm, apex simple, 8-spored, ascospores uniseriate or partly biseriate. Ascospores ellipsoid, usually slightly curved, (14–)16–23 × 4–6 μm, 1(–3)-septate, hyaline to pale yellow, smooth-walled.

Anamorph: Sporodochia scattered, gregarious, or 2–3 caespitose, usually erumpent, sessile or stipitate, pustular, discoid or cylindrical–capitate, 375–1000 μm high × 250–2500 μm diam, stipe, when visible, pink-brown to red-brown, KOH+ dark red, 350–550 μm diam. Conidiophores with one or two basal verticillate branches, then developing acropleurogenously for 3–6 levels, straight, curved, or strongly coiled. Phialides intercalary or terminal; intercalary phialides with a cylindrical body 10–20(–30) μm long, 1.5–2.5 μm wide, and a subterminal lateral conidiogenous extension 1–6 × 1.5–2.5 μm, terminal phialides cylindrical, tapered slightly at the apex, 16–21 μm long, 1.5–2.5 μm wide, terminal cells sometimes sterile; collarettes not flared, periclinal thickening usually obvious. Conidial mass convex, usually bright pink or orange, sometimes brown, red, or even black, usually opaque, 250–2500 μm diam. Conidia oblong-ellipsoid to cylindrical, sometimes with slightly conical base, straight or slightly curved, 5–10(–12) × 1.5–3 μm. Description modified from Seifert (1985).

Habitat.— On newly killed and weakened woody substrata.

DISTRIBUTION.— Widespread in north temperate regions, also known from southern temperate regions.

TYPE.— SWEDEN. Fries, Scleromyceti Sueciae no. 184 (UPS, as *Sphaeria cinnabarina*, **neotype** designated herein). This number was issued as both *S. decolorans* and *S. cinnabarina*; these names have long been considered synonyms. None of the Tode specimens exist, thus the name *S. cinnabarina* could be typified by Tabula IX, Fig. 68, a–d in Tode (1791), however, for a sanctioned name anything associated with the sanctioning protologue can be regarded as type (Art. 7.8); this specimen was mentioned in the protologue and therefore should be regarded as the type.
SPECIMEN ILLUSTRATED.— FRANCE. Forêt Domaniale d'Oloron (64), on *Rosa*, 19 Sep 1993, Françoise Candoussau, J.-F. Magni A9827.

ILLUSTRATIONS.— Breitenbach & Kränzlin (1981, Fig. 324); Dennis (1978, Pl. 31F); Ellis & Ellis (1985, Fig. 324); Müller & von Arx (1962, Fig. 249); Sinclair *et al.* (1987, Pls. 99–100); Tulasne & Tulasne (1865, Tab. XIII), among others.

NOTES.— *Nectria cinnabarina* is known to be plant-pathogenic causing coral spot of fruit trees and shrubs and a canker disease of honey locust (Bedker *et al.*, 1982; Sinclair *et al.*, 1987).

GENERIC SYNONYMS OF *Nectria*:

Allantonectria was implicitly placed in the *Hypocreales* by Earle (in Greene, 1901) when he described the 'ascomata as in *Nectria*' but he differentiated this genus from *Nectria* by allantoid ascospores. The type species, *Allantonectria miltina*, is similar to *Nectria cinnabarina* (Tode : Fr.) Fr. in ascomatal anatomy and anamorph. *Allantonectria miltina* is recognized as *Nectria miltina* (Mont.) Mont., thus the genus is regarded as a synonym of *Nectria*. See the list of species in *Nectria sensu stricto* for a description of *Nectria miltina*.

Aponectria was described as a subgenus of *Nectria* for species having appendaged ascospores. Only one species, *Nectria inaurata*, was included. Based on an examination of the holotype specimen and authentic material, *Aponectria inaurata* is considered a synonym of *N. aquifolii* as suggested by Booth (1959). The structures interpreted as appendages by Saccardo are the phialides formed at the apex of the ascospores inside the asci. These structures eventually produce numerous ascoconidia. *Nectria aquifolii* was placed in the *Nectria cinnabarina*-group (Booth, 1959; Rossman, 1989), thus *Aponectria* is a synonym of *Nectria sensu stricto*.

HOLOTYPE of *N. inaurata*: ENGLAND. Shooter's Hill, near Bath, on dead twigs of holly, F. Currey Esq. (K).
ADDITIONAL SPECIMEN EXAMINED.— ENGLAND. Shrewsbury, W. Phillips, M.C. Cooke, Fungi Britannici, Ser. II, 476, issued 1876 (BPI).

Chilonectria was established by Saccardo (1878) for species of *Nectria* having polysporous asci. He included four species, as follows: *C. cucurbitula* (Tode : Fr.) Sacc. as '(Currey) Sacc.', *C. myriospora* (P. Crouan & H. Crouan) Sacc., *C. rosellinii* (Carest.) Sacc., and *C. sulphurella* (De Not.) Sacc. None of these was designated as type until Clements & Shear (1931) lectotypified the genus with *C. cucurbitula* (≡ *Nectria cucurbitula* (Tode : Fr.) Fr. ≡ *Sphaeria cucurbitula* Tode : Fr.). *Nectria cucurbitula* is a member of the genus *Nectria sensu stricto* (Rossman, 1989, 1993), thus *Chilonectria* is a synonym of *Nectria sensu stricto*.

The name *Nectria cucurbitula* has been a source of confusion because of its use in three different senses as clarified by Booth (1959). The oldest, legitimate name is *Nectria cucurbitula* (Tode : Fr.) Fr., based on *Sphaeria cucurbitula* Tode : Fr., a fungus occurring only on conifers and containing elongate, multiseptate, primary ascospores. This species was described, illustrated and discussed as *Scoleconectria cucurbitula* (Tode : Fr.) C. Booth by Booth (1959), Glawe & Jacobs (1988), and Rossman (1977). Saccardo (1878) erroneously attributed the name *Sphaeria curcubitula* to Currey rather than Tode, referring to a fungus described later in publications by Currey (1858) and Berkeley (1875). In these publications the epithet is attributed to Tode and/or Fr., not Currey. The description and illustration in Currey (1858) is of a fungus with relatively short '0.0004 inch long', one-septate ascospores that produce ascoconidia; the host is not mentioned. In Berkeley (1875) only the 'spermatia' or ascoconidia are described and the hosts mentioned are woody, dicotyledonous substrata, not conifers. The species referred to by Currey (1858) and Berkeley (1875) and thus, indirectly, by Saccardo (1878), is the long-spored species, *N. cucurbitula* (Tode : Fr.) Fr., despite the fact that these authors may have been looking at a different fungus. The fungus actually described in Berkeley (1875) and Currey (1858) is probably *N. coryli* Fuckel according to Booth (1959). Fuckel (1870) used the name *N. cucurbitula* for yet another fungus which was named *N. fuckeliana* C. Booth (1959), probably belonging to *Neonectria*. *Chilonectria cucurbitula* (Tode : Fr.) Sacc. is referred to as *Nectria cucurbitula* (Tode : Fr.) Fr.

Creonectria was proposed for *Nectria*-like species that occur on a well-developed stroma. The type species of *Creonectria*, based on *Tremella purpurea*, is a pre-Friesian name that is superseded by *Sphaeria cinnabarina* Tode : Fr. of which it is a synonym (Seaver, 1909a). The latter name is the type species of *Nectria*, of which *Creonectria* is a synonym.

Ephedrosphaera was lectotypified with *Sphaeria decolorans* Pers.: Fr. by Cannon & Hawksworth (1983). *Sphaeria decolorans* is a synonym of *Nectria cinnabarina*. Although *Ephedrosphaera* is an earlier name for *Nectria*, Cannon & Hawksworth (1983) proposed the conservation of *Nectria* over *Ephedro-*

sphaera, and this was approved as listed in Greuter *et al.* (1988, 1994).

Megalonectria was proposed by Spegazzini for species that resemble *Pleonectria* in ascomata, asci and ascospores but have ascomata associated with a synnematous anamorph. Only one species, *M. pseudotrichia* (≡ *Nectria pseudotrichia*), was included in the original description of the genus. This is placed in *Nectria sensu stricto* as *N. pseudotrichia*, thus *Megalonectria* is a synonym of *Nectria sensu stricto* (Rossman, 1989).

Pleonectria was described for *Nectria*-like fungi having muriform, primary ascospores that produce numerous, small ascoconidia in the asci. Seeler (1940) regarded *Pleonectria* as a synonym of *Thyronectria* and transferred many *Pleonectria* names to that genus. The type species of *Pleonectria* is recognized as *Nectria lamyi*, placed in the *Nectria cinnabarina*-group (Booth, 1959), now regarded as *Nectria sensu stricto* (Rossman, 1989); thus *Pleonectria* is a synonym of *Nectria*. All species previously named in *Pleonectria* have been redisposed, primarily in *Nectria sensu stricto* or as listed in the excluded genera.

Scoleconectria was established for *Nectria*-like fungi that are similar to *Ophionectria* in having long, multiseptate ascospores but, like *Creonectria*, produce fruiting-bodies on a well-developed stroma. The type specimen of *S. scolecospora* was examined and determined to be a synonym of *N. cucurbitula* (Booth, 1959; Rossman, 1983). *Nectria cucurbitula* was placed in the *N. cinnabarina*-group by Booth (1959) and Rossman (1983). Rossman (1989) restricted the genus *Nectria* to members of the *Nectria cinnabarina*-group, thus *Scoleconectria* is a synonym of *Nectria sensu stricto*.

Sphaerostilbe was established by Tulasne & Tulasne (1861) for five species each having '*Stilbe*', i.e. synnematous anamorphs and 'pyrenomycetous asci'. Seaver (1909b) listed *Stilbum aurantiacum* Babington as the type species. According to Seifert (1985), the Tulasnes (1861) explicitly stated that this species was intended to serve for the teleomorph of *Stilbum aurantiacum*, thus Seaver's lectotypification with *Sphaerostilbe aurantiaca* has been accepted by succeeding authors (Rogerson, 1970). Seifert (1985) designated a lectotype specimen for *Sphaerostilbe aurantiaca* from among the Tulasne specimens at PC. Based on Seifert's (1985) detailed account of both the teleomorph and anamorph, *Tubercularia aurantiaca* (Babington) Seifert, the conclusions of Booth (1959), and an examination of additional specimens, *Nectria aurantiaca* is considered to belong in the *Nectria cinnabarina*-group; thus *Sphaerostilbe* is considered a synonym of *Nectria sensu stricto*.

Stilbonectria was erected by Karsten (1889) for species that are similar to *Calonectria*, considered at the time to include *Nectria*-like species having phragmospores, but with ascomata developing at the base of '*Stilbum*'-like synnemata. Based on an examination of the type specimen, Rossman (1983) described and illustrated *Stilbonectria lateritia* and placed it in *Nectria*, as distinct from *N. pseudotrichia* in the *Nectria cinnabarina*-group; thus *Stilbonectria* is a synonym of *Nectria sensu stricto*.

Additional species of *Nectria*:

Nectria antarctica (Speg.) Rossman, Mem. New York Bot. Gard. 49: 257. 1989.

≡ *Pleonectria antarctica* Speg., Bol. Acad. Nac. Ci. 11: 236. 1887.
≡ *Thyronectria antarctica* (Speg.) Seeler, J. Arnold Arbor. 21: 437. 1940.
= *Pleonectria vagans* Speg., Bol. Acad. Nac. Ci. 11: 236. 1887.

Anamorph: *Tubercularia* sp.

Nectria antarctica is similar to *N. pseudotrichia* but distinguished by the strictly horizontal transverse septa of the ascospores and the sporodochial anamorph. *Nectria antarctica* was described and illustrated by Seeler (1940) as *Thyronectria antarctica*. Previously known only from Argentina and Chile; a recently collected specimen from Washington represents a new record for North America.

Specimen examined.— UNITED STATES. Washington: Seattle, Washington Memorial Park, on standing dead stem of *Berberis aquifolium*, 29 July 1998, Walter Jaklitsch W.J. 1180, isol. Amy Y. Rossman 2767 (BPI 746217).

Nectria aquifolii (Fr.) Berk., Outl Brit. Fungol., p. 393. 1860.

≡ *Sphaeria aquifolii* Fr., Elench. Fung. 2: 82. 1828.
= *Nectria inaurata* Berk. & Broome, Ann. Mag. Nat. Hist., Ser. 2, 8: 467. 1854.
≡ *Aponectria inaurata* (Berk. & Broome) Sacc., Michelia 1: 296. 1878.
= *Nectria aquifolii* (Fr.) Berk. var. *appendiculata* Feltgen, Vorstud. Pilzfl. Luxemb. 3: 305. 1903.

Anamorph: *Tubercularia*-like, known only in culture. This species was described and illustrated by Booth (1959).

Nectria aurantiaca (Tul. & C. Tul.) Jacz., Opredelitel' Gribov, T. 1, p. 215. 1913.

≡ *Sphaerostilbe aurantiaca* Tul. & C. Tul., Select. Fung. Carpol. 1: 131. 1861.

Anamorph: *Tubercularia aurantiaca* (Babington) Seifert, Stud. Mycol. 27: 106. 1985.

≡ *Stilbum aurantiacum* Babington, *in* Berkeley & Broome, Ann. Mag. Nat. Hist, Ser. 1, 6: 432. 1841.
≡ *Botryonipha aurantiaca* (Babington) O. Kuntze, Rev. Gen. Pl. 2: 845. 1891.
≡ *Stilbella aurantiaca* (Babington) Lindau, Rabenhorst's Kryptog.-Fl. 1, Pilze 9: 298. 1910.
= *Ditiola tubercularioides* Lib., Herb. Cryptog. Arden. No. 470.
≡ *Cilicipodium tubercularioides* (Lib.) Sacc., Fungi italici autogr. delin. T. 755. 1881.
= *Dendrostilbella moravica* Petrak, Ann. Mycol. 22: 65. 1924.

This species was described and illustrated by Booth (1959), Samuels & Brayford (1994), and Seifert (1985).

Nectria aurigera Berk. & Rav., Grevillea 4: 46. 1875.

≡ *Calonectria aurigera* (Berk. & Rav.) Sacc., Michelia 1: 308. 1878.

Anamorph: None known.
This species was described and illustrated by Rossman (1983).

Nectria australiensis Seifert, Stud. Mycol. 27: 109. 1985.
Anamorph: *Tubercularia australiensis* Seifert, Stud. Mycol. 27: 109. 1985.
This species was described and illustrated by Seifert (1985).

Nectria austroamericana (Speg.) Rossman, Mem. New York Bot. Gard. 29: 257. 1989.

≡ *Pleonectria austroamericana* Speg., Anales Soc. Ci. Argent. 10: 22. 1880.
≡ *Thyronectria austroamericana* (Speg.) Seeler, J. Arnold Arbor. 21: 405. 1940.
= *Chilonectria crinigera* Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 1890: 246. 1891.
= *Pleonectria denigrata* G. Winter, Bull. Torrey Bot. Club 10: 49. 1883.
≡ *Thyronectria denigrata* (G. Winter) Seaver, Mycologia 1: 204. 1909.
= *Pleonectria guaranitica* Speg., Anales Soc. Ci. Argent. 19: 44.1885.
= *Pleonectria nigropapillata* Starbäck, Ark. Bot. 2: 13. 1904.
= *Nectria sphaerospora* Ellis & Everh., *in* Bessey & Weber, Nebraska State Board Agric. Annual Rep. 1889: 53. 1890.
≡ *Thyronectria sphaerospora* (Ellis & Everh.) Seaver, Mycologia 1: 206. 1909.

Anamorph: *Gyrostroma austroamericanum* Seeler, J. Arnold Arbor. 21: 447. 1940.

This species is the cause of honey-locust canker and has been described and illustrated in Bedker & Wingfield (1983) and Seeler (1940), both as *Thyronectria austroamericana*.

Nectria balsamea Cooke & Peck, *in* Cooke, Grevillea 12: 81. 1884. — Plate 30, c.

≡ *Calonectria balsamea* (Cooke & Peck) Sacc., Syll. Fung. 9: 986. 1891.
≡ *Thyronectria balsamea* (Cooke & Peck) Seeler, J. Arnold Arbor. 21: 442. 1940.
≡ *Scoleconectria balsamea* (Cooke & Peck) Seaver, Mycologia 1: 200. 1909.
≡ *Pleonectria balsamea* (Cooke & Peck) Vassilyeva, Plantae non Vasc., Fungi et Bryopsidae, Orientis Extremi Rossica, Fungi, Pyrenomycetidae et Loculoascomycetidae 4: 167. 1998.
= *Pleonectria pinicola* Kirschst., Abh. Bot. Ver. Prov. Brandenburg 48: 59. 1906.
= *Ophionectria cylindrospora* (Sollm.) Berl. & Voglino var. *tetraspora* Weese, Centralbl. Bakteriol., Abt. 2, 42: 598. 1914.
= *Pleonectria calonectrioides* Wollenw., Z. Parasitenk. (Berlin) 3: 493. 1931.

Anamorph: *Zythiostroma* sp.

This species was described and illustrated by Booth (1959), Rossman (1985), and Seeler (1940) as *Thyronectria balsamea*.

Specimen illustrated.— CANADA. Newfoundland: Waghome, on fir, 13 Nov 1897, F.J. Seaver 321a (NY).

Nectria berolinensis (Sacc.) Cooke, Grevillea 12: 107. 1884.

≡ *Pleonectria berolinensis* Sacc., Michelia 1: 123. 1878.
≡ *Thyronectria berolinensis* (Sacc.) Seaver, Mycologia 1: 205. 1909.
= *Nectria ribis* Nießl, Verh. Naturf. Vereins Brünn 2: 114. 1865.
= *Nectria fenestrata* Berk. &. M.A. Curtis, *in* Cooke, Grevillea 12: 81. 1884.
≡ *Pleonectria fenestrata* (Berk. & M.A. Curtis) Berl. & Voglino, Syll. Fung. Addit. 1–4: 216. 1886.

Anamorph: *Tubercularia berolinensis* (Wollenw.) Rossman, Mem. New York Bot. Gard. 49: 258. 1989.

≡ *Dendrodochium berolinense* Wollenw., Z. Parasitenk. (Berlin) 3: 492. 1931.

This species was described and illustrated by Booth (1959) and Seeler (1940), both as *Thyronectria berolinensis*, and Ellis & Everhart (1892) as *Pleonectria berolinensis*.

Nectria canadensis Ellis & Everh., Bull. Torrey Bot. Club 11: 74. 1884.

≡ *Calonectria canadensis* (Ellis & Everh.) Berl. & Voglino, Syll. Fung. Addit. 1–4: 212. 1886.
≡ *Scoleconectria canadensis* (Ellis & Everh.) Seaver, Mycologia 1: 199. 1909.

Anamorph: *Tubercularia grayana* (Sacc. & Ellis) Seifert, Stud. Mycol. 27: 112. 1985.

≡ *Cilicipodium grayanum* Sacc. & Ellis, Michelia 2: 581. 1882.
= *Dendrostilbella ulmi* Dearness, Mycologia 16: 175. 1924.

This species was described and illustrated by Ellis & Everhart (1892, as *Calonectria canadensis*), Rossman (1983) and Seifert (1985).

Nectria chlorinella Cooke, Grevillea 11: 108. 1883.

≡ *Calonectria chlorinella* (Cooke) Sacc., Syll. Fung. 2: 543. 1883.
≡ *Thyronectria chlorinella* (Cooke) Seeler, J. Arnold Arbor. 21: 444. 1940.

Anamorph: None known.

This species was described and illustrated by Seeler (1940) as *Thyronectria chlorinella*.

Nectria coryli Fuckel, Fung. Rhen. Exs., suppl. 1, no. 1582. 1865.

≡ *Chilonectria coryli* (Fuckel) Ellis & Everh., N. Amer. Pyrenomyc. p. 117. 1892.
≡ *Creonectria coryli* (Fuckel) Seaver, Mycologia 1: 186. 1909.
= *Coelosphaeria acervata* P. Karst., Meddeland. Soc. Fauna Fl. Fenn. 4: 41. 1879.
= *Nectria coryli* f. *salicis* Rehm, Ascomyceten Exsicc. No. 680. 1882.

Anamorph: *Tubercularia*-like, known only in culture.

This species was described and illustrated by Booth (1959) and Breitenbach & Kränzlin (1981).

Nectria cucurbitula (Tode : Fr.) Fr., Summa Veg. Scand. 2: 388. 1849. — Plate 30, e–f.

≡ *Sphaeria cucurbitula* Tode : Fr., Tode, Fungi mecklenb. sel. 2: 38. 1791 : Fries, Syst. Mycol. 2: 415. 1823.
≡ *Scoleconectria cucurbitula* (Tode : Fr.) C. Booth, Mycol. Pap. 73: 15. 1959.
= *Nectria cylindrospora* Sollm., Bot. Zeitung (Berlin) 22: 265. 1864.
≡ *Ophionectria cylindrospora* (Sollm.) Berl. & Voglino, Syll. Fung. Addit. 1–4: 217. 1886.
= *Ophionectria scolecospora* Bref. & Tav., *in* Brefeld, Unters. Gesamtgeb. Mykol. 10: 178. 1891.
≡ *Scoleconectria scolecospora* (Bref. & Tav.) Seaver, Mycologia 1: 198. 1909.

Anamorph: *Zythiostroma pinastri* (P. Karst.) Höhn. ex Weese, Mitt. Bot. Lab. Techn. Hochsch. Wien 8: 90. 1931.

≡ *Zythia pinastri* P. Karst., Rev. Mycol. (Toulouse) 7: 106. 1885.

Nectria cucurbitula has been confused with *N. balsamea*, a species similar to *N. cucurbitula* but having elongate, muriform, primary ascospores that also become obscured by the production of ascoconidia within the asci (Rossman, 1983). Within the ascus the ascospores sporulate phialidically to produce ascoconidia, also referred to as secondary ascospores, which often obscure the primary ascospores, as described, illustrated and discussed by Glawe & Jacobs (1988). *Nectria cucurbitula* was also described and illustrated by Booth (1959) and Rossman (1983), both as *Scoleconectria cucurbitula*.

Specimens illustrated.— UNITED STATES. New York: North Creek, on *Abies balsamea*, 15 Aug 1919, C.L. Shear, det. F. Petrak as *Ophionectria scolecospora* (BPI 632633).

Nectria guarapiensis Speg., Anales Soc. Ci. Argent. 19: 37. 1885. — Plate 30, d.

Anamorph: None known.

Known only from the type collection in Brazil, this species was recently described and illustrated by Samuels & Brayford (1994).

Nectria lamyi (Desm.) De Not., Sfer. Ital., 1: 13. 1863. — Plate 30, g–i.

≡ *Sphaeria lamyi* Desm., Pl. Crypt. France, no. 839. 1836.
≡ *Pleonectria lamyi* (Desm.) Sacc., Mycotheca Ven. no. 688. 1876.
≡ *Thyronectria lamyi* (Desm.) Seeler, J. Arnold Arbor. 21: 449. 1940.

Anamorph: pycnidial *Tubercularia* (*Zythiostroma*).

Ascomata and pycnidia forming together in caespitose aggregates, with 3–5 ascomata in a group, on a discrete pseudoparenchymatous stroma, subcortical, becoming erumpent; reddish-brown, ostiolar area nearly black, not changing color in KOH, but becoming uniformly yellow in lactic acid. Ascomata globose to subglobose, non-papillate, rough or slightly furfuraceous, 300–600 μm diam, not collapsing when dry or becoming slightly cupulate, wall around the apex to 100 μm thick, thinner elsewhere, of globose to oblong cells, cells around the ascomatal apex appearing to have thicker walls than elsewhere, exterior cells 10–15 μm diam, with visibly thickened, pigmented walls; cells toward the interior forming a pseudoparenchyma. Asci cylindrical, increasing in size as ascospores mature, 100–145 × 25–45 μm, apex simple. Ascospores fusiform, 22–33 × 7–11 μm, muriform, with *ca* 5 transverse septa and one longitudinal septum, budding to produce hyaline, thin-walled, bacillar ascoconidia, 3–4.5 × 1–1.5 μm, that fill the asci.

Anamorph: Pycnidia globose, smooth, 350–450 μm diam, wall 30–40 μm thick, of angular cells 5–7 μm diam, outermost cells reddish-brown; innermost cells hyaline; inner wall of the pycnidium convoluted, lined with short-branched conidiophores that terminate in narrow, subulate phialides 7–9 μm long, 1–1.5 μm wide at the base. Conidia similar to the ascoconidia, bacillar to slightly curved, 3–4.5 × 1–1.5 μm, hyaline. Description modified from Booth (1959).

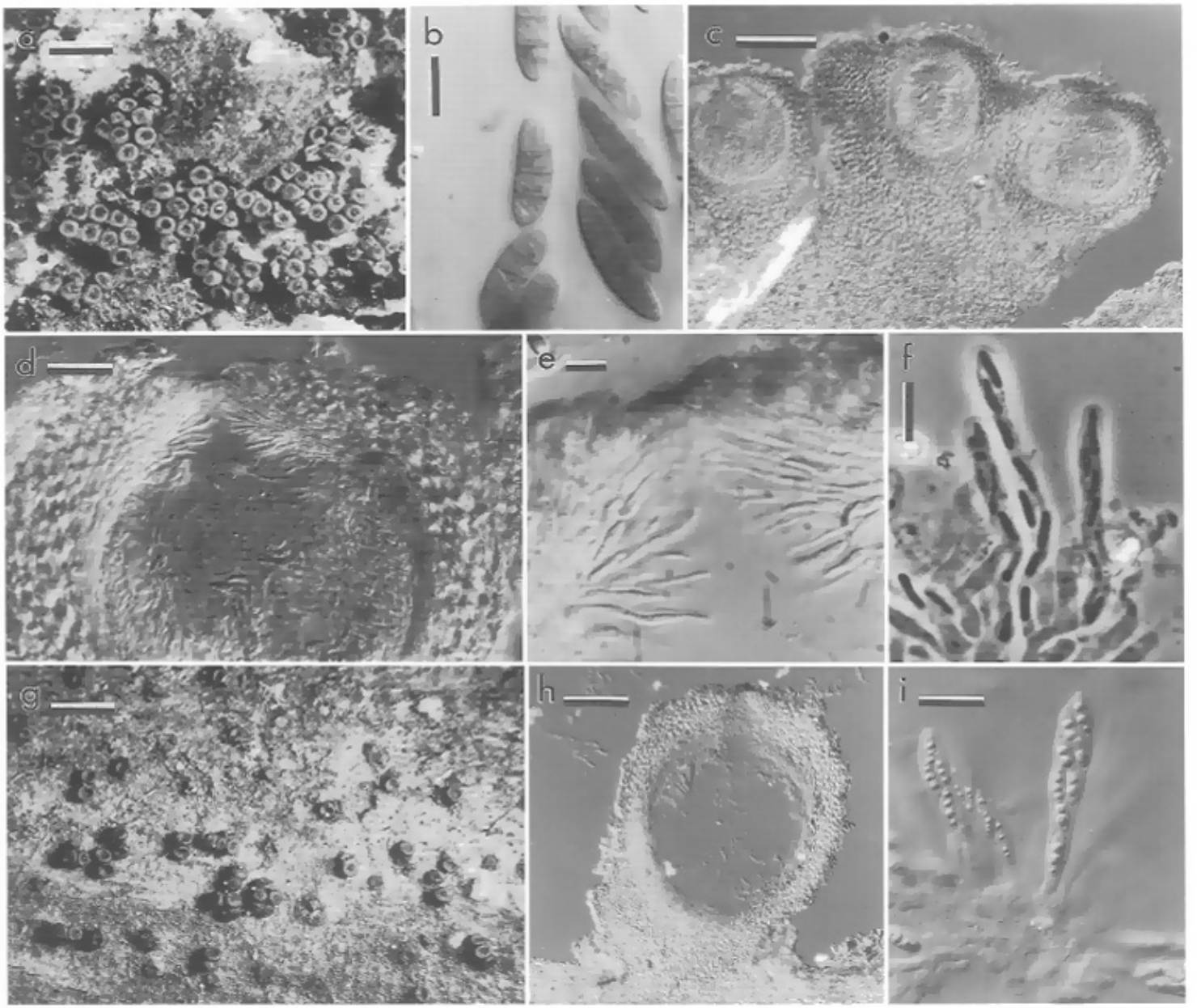


Plate 31. a–b. *Nectria lateritia*. a. Ascomata aggregated on stroma. b. Ascospores stained in cotton blue. **c–f.** *Nectria miltina*. c. Median section of well-developed stroma and ascomata. d. Median section of ascoma. e. Ascomatal apex. f. Asci with ascospores in phase contrast. **g–i.** *Nectria pseudocinnabarina*. g. Ascomata aggregated on stroma. h. Median section of ascoma. i. Asci with ascospores. a. BPI 552479. b. G.J.S. 1843. c–e. BPI 630105, holotype of *Allantonectria yuccae*. f. BPI 630124. g. BPI 552864, isotype. h, i. BPI 802837. Scale bars: a, g = 1 mm; b, e, f = 10 µm; c, h = 100 µm; d, i = 25 µm.

HABITAT.— On dead branches of *Berberis* and unidentified plants.

DISTRIBUTION.— Canada (Ontario), France, Germany, Hungary, Italy, Russia, Sweden (Seeler, 1940).

LECTOTYPE, designated by Seeler (1940): FRANCE. Limoges, on dead branches of *Berberis* sp., Lamy, Desmazières, Pl. Crypt. France no. 839 (FH – not examined; BPI – isolectotype).

SPECIMEN EXAMINED.— AUSTRIA. Kärnten, St. Margareten im Rosental, on dead twigs of *Berberis vulgaris*, 26 Oct 1998, W. Jaklitsch 1264 (BPI).

ILLUSTRATIONS.— Booth (1959, Fig. 5, as *T. lamyi*); Schmid & Schmid (1990, Fig. 33); Seeler (1940, Pl. 2, Figs. 1A–F, as *T. lamyi*).

Nectria lateritia (P. Karst.) Rossman, Mycol. Pap. 150: 22. 1983. — Plate 31, a–b.

≡ *Stilbonectria lateritia* P. Karst., Hedwigia 28: 194. 1889.
= *Calonectria erythrina* Syd. & P. Syd., Ann. Mycol. 10: 81. 1912.
≡ *Nectria erythrina* (Syd. & P. Syd.) Rossman, Mycotaxon 8: 508. 1979.

Anamorph: *Tubercularia* cf. *lateritia* (Berk.) Seifert, Stud. Mycol. 27: 119. 1985.

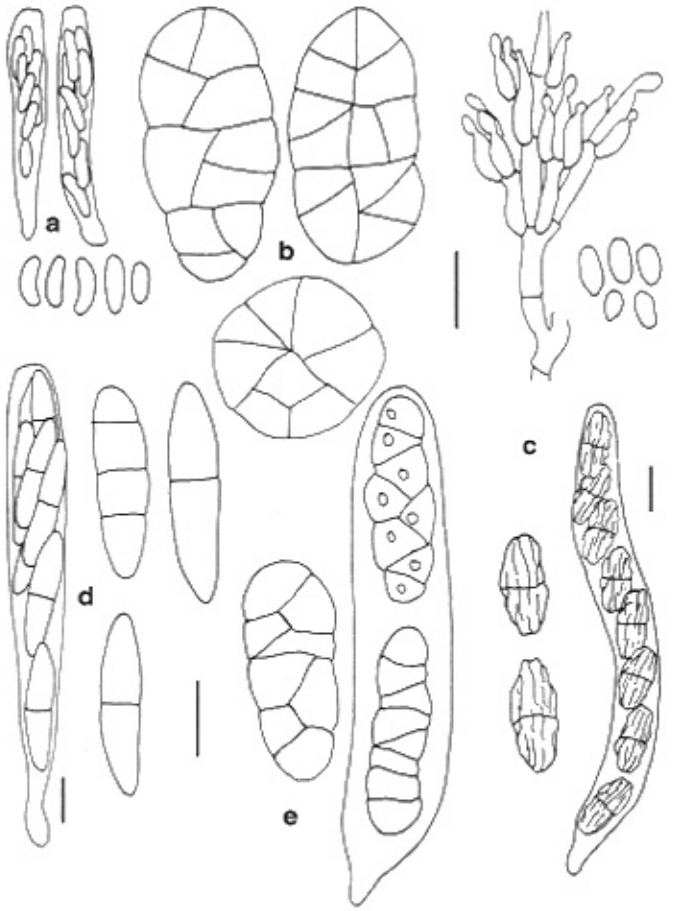


Plate 32. a. *Nectria miltina*, asci and ascospores. **b.** *Pleogibberella calami*, ascospores, one in cross-section. **c.** *Rubrinectria olivacea*, ascus, ascospores, conidiophores and conidia. **d.** *Stalagmites tumefaciens*, ascus and ascospores. **e.** *Xenonectriella lutescens*, ascus and ascospore. a. Holotype of *Allantonectria yuccae* – BPI 630106. b. Holotype – NY. c. BPI 1107210. d. Lectotype – S. e. Lectotype – BPI. Scale bars: a = b, c–e, all = 10 µm.

≡ *Stilbum lateritium* Berk., J. Bot., London 2: 642. 1843.

According to Seifert (1985), the stilbellaceous anamorph of *N. lateritia* (as *Stilbonectria lateritia*) is indistinguishable from the *Tuberculariа* anamorph of *Nectria pseudotrichia*. The multiseptate ascospores of *N. lateritia* readily separate this species from the muriform ascospores of *N. pseudotrichia* as described and illustrated by Rossman (1983) and Samuels & Brayford (1994). Both species are common in tropical America.

Specimens illustrated.— CHINA. Yen-hsien, Hainan, on bark, 16 Jun 1934, S.Q. Deng 3429, S.C. Teng 3959, as *Calonectria polythalama* (BPI 552479). VENEZUELA. Amazonas: Neblina base camp, on bark of recently dead tree, G.J. Samuels 1843, culture G.J.S. 84-423 (NY).

Nectria lonicerae (Seeler) Rossman, Mem. New York Bot. Gard. 49: 260. 1989.

≡ *Thyronectria lonicerae* Seeler, J. Arnold Arbor. 21: 450. 1940.

Anamorph: None known.

This species was described and illustrated by Seeler (1940) as *Thyronectria lonicerae*.

Nectria miltina (Mont.) Mont., Syll. gen. sp. crypt. p. 225. 1856. — Plate 31, c–f; Plate 32, a.

≡ *Sphaeria miltina* Mont., *in* Durieu, Expl. sci. Algérie, Bot. I, 1: 477. 1848 [1849].

≡ *Allantonectria miltina* (Mont.) Weese, *in* Höhn. & Weese, Ann. Mycol. 8: 464. 1910.

≡ *Nectriella miltina* (Mont.) Sacc., Michelia 1: 278. 1878.

= *Allantonectria yuccae* Earle, *in* E.L. Greene, Plantae Bakerianae 2: 11. 1901.

= *Nectriella bacillispora* Traverso & Spessa, Bol. Soc. Broteriana 25: 172. 1910.

Anamorph: *Tuberculariа* sp.

Stromata erumpent, 400–800 µm diam × *ca* 210 µm tall, brick-red to orange, KOH+ blood-red, pseudoparenchymatous, cells forming a *textura angularis*, with pigmented, thick-walled cells, 9–14 × 7–10.5 µm, with about 1.5 µm thick wall, integrating with the outer ascomatal wall. Ascomata superficial on well-developed stromata, aggregated in groups of up to 25, subglobose to globose, 175–195 µm high × 185–200 µm diam, becoming slightly cupulate upon drying, sometimes with only a depressed apical region, bay to scarlet, apical region slightly darker, KOH+ blood-red, surface finely scurfy, concolorous, slightly rugose when dry. Ascomatal surface cells forming a *textura angularis*, 8–12 µm diam, with pigmented *ca* 1.5 µm thick walls. Ascomatal wall 25–35 µm thick, of two distinct regions: outer region 20–25 µm thick, integrating with the stroma, cells forming a *textura angularis*, walls pigmented, about 1.5 µm thick; inner region 5–10 µm thick, of elongate, thin-walled, hyaline cells, forming a *textura prismatica*. Asci narrowly clavate, 28–36 × 3.6–4.8 µm, with apical ring about 2 µm diam, 8-spored, ascospores biseriate above, uniseriate below. Ascospores allantoid to short-cylindrical with rounded corners, straight to slightly curved, (4.5–)5.5–7 × 1.5–2 µm, non-septate, hyaline, smooth.

Anamorph in culture: colony bright orange, slimy, with *Acremonium*-like phialides, conidia ellipsoid, 3–5 × 1–3 µm, hyaline (Lowen, 1991).

Habitat.— On living and dead leaves of members of the *Agavaceae* including *Agave americana*, *Agave* sp., *Dasylirion* sp., *Furcraea gigantea*, *Nolina* sp., *Yucca baccata*, *Y. brevifolia*, *Y. glauca*, *Y. harrimaniae*, *Y. schidigera*, and *Yucca* sp.

Distribution.— Algeria, Austria (Lowen, 1991), France, Greece, Italy, Mexico, Panama, United States: Arizona, California, Colorado, Nebraska, and Utah (Lowen, 1991).

Types.— ALGERIA. On *Agave americana*, Bommes 1847

(FH ex Herb. Paris, **lectotype** of *Sphaeria miltina*, designated herein, based on Lowen, 1991). PORTUGAL. Coimbra, Horto botanico Conimbricensi, on leaves of *Furcraea gigantea* (*Agavaceae*), Nov 1906, A. Möller (PAD, holotype of *Nectriella bacillispora*). UNITED STATES. Colorado, Hermosa, on *Yucca*, C. F. Baker s. n., Mar 1899, det. F.S. Earle (BPI 630106, holotype of *A. yuccae*); Colorado, Hermosa, on dead, withered leaves of *Yucca*, C.F. Baker 12, Apr 1899, det. F.S. Earle (BPI, NY, topotype specimens).

ADDITIONAL SPECIMENS EXAMINED.— FRANCE. Golfe Juan, Château Robert, on dead leaves of *Agave americana*, Dec 1894, L. Rolland, Roumeguère 6860 (BPI). GREECE. Corfu, on leaves of *Agave americana*, Rechinger, Apr 1912, Rehm: Ascomycetes 1962b, as *Nectriella miltina* (BPI, FH). ITALY. Naples, on rotting leaves of *Agave americana*, Cesati (FH); South Tyrol, Arco-Merano, on living leaves of *Agave americana*, Diettrich-Kalkhoff, Dr. Wolff, 1911, Rehm: Ascomycetes 1962 (BPI, FH). MEXICO, intercepted at Nogales 77179, on *Agave* sp., D.E. Noel & F.A. Allen, det. A.J. Watson, 26 Nov 1957 (BPI). PANAMA. Prov. Chiriqui, Llanos del Vacan, 1250–1300 m alt., on *Yucca* sp., G.W. Martin 2815c, 14 July 1935 (BPI, as *A. yuccae*). UNITED STATES. Arizona, Santa Rita Mountains, O.F. Cook, 22 Oct 1914, det. A.J. Watson (BPI, as *A. yuccae*); California, San Diego Co., Camp Kearney, on *Yucca* sp., O.A. Plunkett, Apr 1935, det. O.A. Plunkett (BPI, as *A. yuccae*); Colorado, Denver, on *Yucca glauca*, C.L. Shear, 11 Oct 1913, det. F. Petrak (BPI); Denver, on dead leaves of *Yucca glauca*, E. Bethel, 28 Mar 1910, E. Bartholomew, Fungi Columbiani 3204 (BPI); Leyden, on *Yucca glauca*, E. Bethel, 5 Feb 1910 (BPI, as *A. yuccae*); Mesa Verde, 2400 m alt., on *Yucca harrimaniae*, F.E. and E.S. Clements, 6 July 1907, Cryptogamae Formationum Coloradensium 460 (BPI, as *A. yuccae*); Nebraska, Valentine, on *Yucca* sp., C.L. Shear, 23 Feb 1898, det. F. Petrak (BPI); New Mexico, Lincoln Co., Valley of Fires, on dead leaves of *Nolina* sp., A. Ramaley 9316, 23 May 1993 (BPI); Texas, Pecos Co., on dead leaves of *Dasylirion* sp., A. Ramaley 9308, 22 May 1993 (BPI).

NOTES.— *Nectria miltina* is distinguished from other species of *Nectria sensu stricto* by the non-septate ascospores and occurrence on monocotyledonous plant material rather than rotting wood of deciduous trees. The stromata of *N. miltina* develop from the woody fibers within the leaves of *Agave* and *Yucca*. Although the *Tuberculariа* anamorph of *N. miltina* produces sporodochia in nature, in culture this species forms only *Acremonium*-like phialides. This is similar to the situation in *Nectria cinnabarina* and other species of *Nectria sensu stricto* (Rossman, 1989; Seifert, 1985).

Nectria missouriensis Ellis & Everh., J. Mycol. 4: 57. 1888.

≡ *Pleonectria missouriensis* (Ellis & Everh.) Sacc., Syll. Fung. 9: 990. 1891.

≡ *Paranectria missouriensis* (Ellis & Everh.) Rabenhorst, *in* Winter, Fungi europaei no. 3748. 1891.

≡ *Thyronectria missouriensis* (Ellis & Everh.) Seaver, Mycologia 1: 205. 1909.

Anamorph: *Gyrostroma missouriense* Seeler, J. Arnold Arbor. 21: 441. 1940.

This species was described and illustrated by Seeler (1940) as *Thyronectria missouriensis*.

Nectria neorehmiana Rossman, Mycol. Pap. 150: 23. 1983.

Anamorph: None known.

This species was described and illustrated by Rossman (1983).

Nectria novaezelandiae (Dingley) Rossman, Mycol. Pap. 150: 24. 1983 (as '*novaezealandica*').

≡ *Calonectria novae-zelandiae* Dingley, Trans. & Proc. Roy. Soc. New Zealand 79: 404. 1952.

Anamorph: None known.

This species was described and illustrated by Rossman (1983).

Nectria pseudocinnabarina Rossman, Mem. New York Bot. Gard. 49: 260. 1989. — Plate 31, g–i.

Anamorph: *Tuberculariа* cf. *lateritia* (Berk.) Seifert, Stud. Mycol. 27: 119. 1985.

This species was described and illustrated by Rossman (1989) and Samuels & Brayford (1994).

SPECIMEN ILLUSTRATED.— VENEZUELA. Territorio Federal Amazona, San Carlos de Rio Negro, along road to airport, on wood, 24 Jan 1985, A. Rossman 2351 (BPI 552864 isotype); Edo. Aragua, Henry Pittier National Park, 1200–1300 m, on dead bark of tree, 3 Dec 1990, G.J. Samuels 7855, cult. 90-223, B. Hein, & S.M. Huhndorf (BPI 802837).

Nectria pseudotrichia Berk. & M.A. Curtis, J. Acad. Nat. Sci. Philadelphia 2, 2: 289. 1853.

≡ *Sphaerostilbe pseudotrichia* (Berk. & M.A. Curtis) Berk. & Broome, J. Linn. Soc. 14: 114. 1875.

≡ *Calonectria pseudotrichia* (Berk. & M.A. Curtis) Sacc., Michelia 1: 208. 1878.

≡ *Megalonectria pseudotrichia* (Berk. & M.A. Curtis) Speg., An. Soc. Cient. Argent. 2: 216. 1881.

≡ *Pleonectria pseudotrichia* (Berk. & M.A. Curtis) Wollenw., Angew. Bot. 8: 195. 1921.

≡ *Thyronectria pseudotrichia* (Berk. & M.A. Curtis) Seeler, J. Arnold Arbor. 21: 438. 1940.

= *Nectria polythalama* Berk., Hooker's Flora Novae-Zelandiae 2: 203. 1855.

= *Sphaerostilbe cinnabarina* Tul. & C. Tul., Sel. Fung. Carpol. 1: 129 (footnote). 1861.

= *Sphaerostilbe lateritia* Berk. & M.A. Curtis, J. Linn. Soc., Bot. 10: 377. 1869.

= *Sphaerostilbe incerta* Ces., Atti Accad. Sci. Fis. Mat., Napoli 8: 14. 1879.

= *Sphaerostilbe nigrescens* Kalchbr. & Cooke, Grevillea 9: 15. 1880.

≡ *Megalonectria nigrescens* (Kalchbr. & Cooke) Sacc., Syll. Fung. 2: 561. 1883.

= *Pleonectria megalospora* Speg., An. Soc. Cient. Argent. 12: 216. 1881.

= *Megalonectria caespitosa* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 538. 1889.

≡ *Pleonectria caespitosa* (Speg.) Wollenw., Angew. Bot. 8: 195. 1926.

= *Megalonectria verrucosa* A. Möller, Phycom. u. Ascom. Bras. p. 298 1901.

= *Megalonectria polytrichia* (Schwein.) Speg. var *australiensis* Henn., Hedwigia 42: 79. 1903.
= *Megalonectria madagascariensis* Henn., *in* Voeltzkow, Reise in Ostafrika 3: 29. 1908.
= *Megalonectria yerbae* Speg., An. Mus. Nac. Hist. Nat. Buenos Aires 17: 129. 1908.
= *Pleonectria riograndensis* Theissen, Broteria, Ser. Bot. 9: 143. 1910.
= *Pleonectria heveana* Sacc., Boll. Orto Bot., Napoli 24: 13. 1918.

Anamorph: *Tubercularia lateritia* (Berk.) Seifert, Stud. Mycol. 27: 119. 1985.

≡ *Stilbum lateritium* Berk., J. Bot., London 2: 642. 1843.
≡ *Botryonipha lateritia* (Berk.) O. Kuntze, Rev. Gen. Pl. 2: 845. 1891.
≡ *Stilbella lateritia* (Berk.) Bres., Ann. Mycol. 9: 276. 1911.
= *Stilbum caespitosum* Welw. & Curr., Trans. Linn. Soc. Lond. 26: 291. 1867.
≡ *Ciliciopodium caespitosum* (Welw. & Curr.) Sacc., Syll. Fung. 4: 577. 1886.
= *Stilbum inconspicuum* Curr., Trans. Linn. Soc. Lond., Ser. 2 (Bot.) 1: 129. 1874.
≡ *Stilbum kurzianum* Cooke, Grevillea 16: 71. 1888 (unnecessary name change for *S. inconspicuum*).
= *Crinula aurantiocinnabarina* Speg., An. Soc. Cient. Argent. 9: 167. 1880.
≡ *Stilbum aurantiocinnabarinum* (Speg.) Speg., An. Soc. Cient. Argent. 13: 30. 1882.
≡ *Calocera aurantiocinnabarina* (Speg.) Sacc., Syll. Fung. 6: 734. 1888.
≡ *Botryonipha aurantiocinnabarina* (Speg.) O. Kuntze, Rev. Gen. Pl. 2: 845. 1891.
= *Sphaerostilbe rosea* Kalchbr., Grevillea 9: 26. 1880.
≡ *Stilbella rosea* (Kalchbr.) Weese, Sitzungsber. Kaiserl. Akad. Wiss. 128: 44. 1919.
= *Stilbum kalchbrenneri* Sacc., Syll. Fung. 4: 570. 1886.
= *Stilbum aurantiocinnabarinum* var. *fuscipes* Speg., An. Soc. Cient. Argent. 13: 30. 1882.
[= *Stilbum physaroides* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 615. 1889, non Kalchbr. 1882.]
≡ *Stilbum spegazzinianum* Sacc., Syll. Fung. 10: 682. 1892.
= *Stilbum fuscocinnabarinum* Speg., Bol. Acad. Nac. Cienc. Córdoba 11: 616. 1889.
= *Stilbum javanicum* Henn., Hedwigia 32: 227. 1893.
= *Stilbum proliferum* Marchal, Bull. Soc. Belge Microsc. 20: 267. 1894.
= *Stilbum camerunense* Henn., Bot. Jahrb. Syst. 22: 81. 1895.
[= *Stilbum nanum* Massee, Kew Bull. 1898: 112, non (Ehrenb.) Sprengel 1827.]
= *Stilbum fructigenum* Penz. & Sacc., Malpighia 15: 250. 1901.
= *Stilbella rubescens* Sydow, Bull. Herb. Boisser 1901: 85. 1901.
≡ *Stilbum rubescens* (Sydow) Sacc., Syll. Fung. 16: 1082. 1901.
= *Stilbella heveae* Zimm., *in* Henn., Hedwigia 41: 148. 1902.
≡ *Stilbum heveae* (Zimm.) Sacc. & D. Sacc., Syll. Fung. 18: 631. 1906.
= *Stilbella theae* Ch. Bernard, Bull. Dép. Agric. Indes Néerl. 11:25. 1907.
≡ *Stilbum theae* (Ch. Bernard) Sacc. & Trotter, Syll. Fung. 22: 1437. 1913.
= *Ciliciopodium costaricense* Speg., Bol. Acad. Nac. Cienc. Córdoba 23: 591. 1919.
[= *Ciliciopodium caespitosum* Speg., An. Mus. Nac. Hist. Nat. Buenos Aires 31: 442. 1922, non (Welw. & Curr.) Sacc., 1886.]
= *Stilbum minutulum* Penz. & Sacc., Malpighia 15: 250. 1902.
= *Polycephalum subaurantiacum* Peck, Bull. New York St. Mus. 167: 46. 1912.
= *Dendrostilbella bonarii* E.F. Morris, Mycopath. Mycol. appl. 28: 100. 1966.

This species was described and illustrated by Seeler (1940, as *Thyronectria pseudotrichia*), Samuels *et al.* (1990) and Seifert (1985); the latter examined the type specimen and provided a detailed account of *N. pseudotrichia* and its anamorph, *Tubercularia lateritia*, and listed the numerous synonyms. Subramanian & Bhat (1984) published a developmental study of this species as *T. pseudotrichia*. In tropical and subtropical regions *Nectria pseudotrichia* is one of the most conspicuous and common nectrioid fungi occurring on recently killed dicotyledonous wood.
Specimen examined.— BRAZIL. São Leopoldo, on bark, S.J. Rick (FH – holotype of *Pleonectria riograndensis*).

Nectria pulcherrima Berk. & Broome, J. Linn. Soc., Bot. 14: 166. 1873.

≡ *Calonectria pulcherrima* (Berk. & Broome) Sacc., Michelia 1: 315. 1878.

Anamorph: None known.
This species was described in Rossman (1989).

Nectria pyrrhochlora Auersw., *in* Rabenh., Hedwigia 8: 88. 1869.

≡ *Calonectria pyrrhochlora* (Auersw.) Sacc., Michelia 1: 251. 1878.
≡ *Thyronectria pyrrhochlora* (Auersw.) Sacc., Michelia 1: 325. 1878.
≡ *Pleonectria pyrrhochlora* (Auersw.) G. Winter, Rabenh. Krypt.-Fl. Ed. 2, 1(2), II. Abt.: Ascomyc.: Gymnoasceen p. 108. 1884.

Anamorph: None known.
This species was described and illustrated in Seeler (1940) as *Thyronectria pyrrhochlora*.

Nectria rehmiana (Kirschst.) Rossman, Mycol. Pap. 150: 24. 1983.

≡ *Calonectria rehmiana* Kirschst., Verh. Bot. Vereins Prov. Brandenberg 48: 59. 1906 (1907).

Anamorph: None known.
This species was described and illustrated by Rossman (1983).

Nectria sinopica (Fr. : Fr.) Fr., Summa Veg. Scand. 2: 388. 1849.

≡ *Sphaeria sinopica* Fr. : Fr., Elench. Fung. 2: 81. 1828.
Anamorph: *Zythiostroma mougeotii* (Fr. : Fr.) Höhn., Mitt. Bot. Tech. Hochsch. Wien 8: 88. 1931.

≡ *Sphaeria mougeotii* Fr. : Fr., Elench. Fung. 2: 100. 1828.

KEY TO THE SPECIES OF *NECTRIA*

1. Ascospores allantoid, non-septate; on members of the *Agavaceae* ..... *N. miltina*
1. Ascospores ellipsoid to long-fusiform, 1- to multiseptate or muriform; on woody substrata 2

2 (1). Ascospores budding within the asci 3
2. Ascospores not budding within the asci, sometimes budding immediately upon release from the asci 8
3 (2). Ascospores 1-septate 4
3. Ascospores multiseptate or muriform 5

4 (3). Ascomata covered with yellow-green scurf; ascospores 9–12 × 3–5 µm; on decaying branches of *Ilex*; Europe ..... *N. aquifolii*
4. Ascomata without scurf; ascospores 11–13 × 3–3.5 µm; on decaying wood of *Corylus* and *Salix*; Europe ..... *N. coryli*

5 (3). Ascospores long-fusiform, multiseptate, 30–77 × 2–4 µm; erumpent through needle scars of conifers; in Europe and North America ..... *N. cucurbitula*
5. Ascospores ellipsoid to long-ellipsoid, muriform; on conifers or on dicotyledonous wood 6

6 (5). Ascomata covered with bright yellow scurf; ascospores disarticulating into single cells, 4.5–8.5 µm diam ..... *N. chlorinella*
6. Ascomata red-orange to dark red or black, without yellow scurf; ascospores not disarticulating 7

7 (6). Ascospores 17–26 × 5–6 µm; erumpent through needle scars of conifers ..... *N. balsamea*
7. Ascospores 22–33 × 7–11 µm; on dead wood of *Berberis* ..... *N. lamyi*

8 (2). Ascospores 1-septate, rarely 3-septate 9
8. Ascospores multiseptate or muriform 14

9 (8). Ascomata covered with bright yellow-green scurf; ascospores 9–12 × 4–6 µm; on recently killed roots of *Hedera helix*; Europe ..... *N. sinopica*
9. Ascomata with concolorous scurf; ascospores generally longer than 12 µm 10

10 (9). Ascospores slightly echinulate, 13–15 × 5–6.5 µm; on unidentified bark; known from Australia ..... *N. australiensis*
10. Ascospores smooth or striate 11

11 (10). Ascospores 8.5–13.5 × 4–5 µm, ellipsoid with rounded ends, smooth, eventually finely striate; on decaying bark of diverse woody plants; known from northern South America ..... *N. pseudocinnabarina*
11. Ascospores more than 15 µm long, smooth or slightly striate with age 12

12 (11). Ascospores 22–24 × 9 µm, narrowly ellipsoid with slightly apiculate ends, coarsely striate; on decaying bark of unidentified tree; known from Sri Lanka ..... *N. pulcherrima*
12. Ascospores smooth to faintly striate, ends rounded; known from temperate regions 13

13 (12). Ascospores smooth, 16–23 × 4–6 µm; on diverse woody substrata; common throughout temperate regions ..... *N. cinnabarina*

13. Ascospores smooth to faintly striate with age, 17–26 × 7–9 µm; on corticated branches of *Ulmaceae*; northern and central Europe ..... *N. aurantiaca*

14 (8). Ascospores transversely multiseptate 15
14. Ascospores muriform 20

15 (14). Ascospores 7-septate, ellipsoid with broadly rounded ends, 18–26 × 5–6.5 µm; on diverse woody substrata; eastern North Amercia ..... *N. aurigera*
15. Ascospores 3-septate, ellipsoid to fusiform 16

16 (15). Ascospores striate, 14–20 × 4–6 µm; on unknown woody substrata; tropical ..... *N. lateritia*
16. Ascospores smooth, usually longer than 20 µm 17

17 (16). Ascospores ellipsoid with rounded ends, less than 24 µm long 18
17. Ascospores fusiform, more than 24 µm long 19

18 (17). Ascospores 16–26 × 5.5–7.5 µm, producing ascoconidia outside the asci; eastern Canada and the northeastern United States ..... *N. canadensis*
18. Ascospores 20–24 × 7–10 µm, not producing ascoconidia; known from New Zealand ..... *N. novaezealandiae*

19 (17). Ascospores 24–30 × 6–7 µm; on *Cornus*; known from Germany ..... *N. rehmiana*
19. Ascospores 33–38 × 7–8 µm; on unidentified woody substratum; known from Ecuador ..... *N. neorehmiana*

20 (14). Ascomata with bright yellow, yellow-green or olive-green scurf 21
20. Ascomata with concolorous scurf 23

21 (20). Ascospores broadly ellipsoid, 15–20 × 7.5–10.5 µm; on *Acer*; Europe ..... *N. pyrrhochlora*
21. Ascospores ellipsoid to narrowly ellipsoid, more than 20 µm long; on *Carya*, *Rhus*, or *Xanthoxylum*; North America 22

22 (21). Ascospores ellipsoid, 16.5–27 × 6–8 µm; on *Rhus* and *Xanthoxylum* . *N. xanthoxyli*
22. Ascospores narrowly ellipsoid, 21–49 × 8–15 µm; on *Carya* ..... *N. missouriensis*

23 (20). Ascospores more than 20 µm long 24
23. Ascospores less than 20 µm long 25

24 (23). Ascospores 26–41.5 × 9–12.5 µm; anamorph sporodochial; on *Berberis*; temperate regions of North and South America ..... *N. antarctica*
24. Ascospores 17–31(–40) × 6–15 µm; anamorph synnematous; on diverse woody substrata; common in tropical regions ..... *N. pseudotrichia*

25 (23). Ascospores 10–15.5 × 5–9 µm; on leguminous trees, *Acacia* and *Gleditsia*; North America ..... *N. austroamericana*
25. Ascospores generally longer than 15 µm; on *Ribes, Lonicera* and *Symphoricarpos*; Europe and North America 26

26 (25). Ascospores 15–21 × 6.5–8 µm; on *Ribes*; Europe and North America ..... *N. berolinensis*
26. Ascospores 18–23 × 6–8 µm; on *Caprifoliaceae*, *Lonicera* and *Symphoricarpos*; North America ..... *N. lonicerae*

≡ *Zythia mougeotii* (Fr. : Fr.) Jacz., Nouv. Mém. Soc. Imp. Naturalistes, Moscou. 15: 367. 1898.
≡ *Sphaeronamella mougeotii* (Fr. : Fr.) Sacc., Syll. Fung. 3: 617. 1884.
= *Sphaeronaema hederae* Fuckel, Fung. Rhen. Exs. 8: 775. 1863.

This species was described and illustrated by Booth (1959).

Nectria xanthoxyli (Peck) Rossman, Mem. New York Bot. Gard. 49: 264. 1989.

≡ *Valsa xanthoxyli* Peck, Annual Rep. New York State Mus. 31: 49. 1879.
≡ *Pseudovalsa xanthoxyli* (Peck) Sacc., Syll. Fung. 2: 137. 1883.
≡ *Fenestella xanthoxyli* (Peck) Sacc., Syll. Fung. 2: 332. 1883.
≡ *Thyronectria xanthoxyli* (Peck) Ellis & Everh., North Amer. Pyrenomyc. p. 92. 1892.
= *Valsonectria virens* Harkn., *in* Ellis & Everh., North Amer. Fungi 2, No. 1549. 1886.
≡ *Thyronectria virens* (Harkn.) Harkn., *in* Ellis & Everh., North Amer. Pyrenomyc. p. 92. 1892.

Anamorph: None known.
This species was described and illustrated by Seeler (1940) as *Thyronectria xanthoxyli*.

NEOCOSMOSPORA E.F. Sm., U.S.D.A. Div. Veg. Pathol. Bull. 17: 45. 1899.

Type: *N. vasinfecta* E.F. Sm.

Ascomata solitary to sparsely aggregated, superficial, stroma lacking, orange-brown to red, rarely hyaline, KOH+ darker, globose to pyriform, ostiolate, not collapsing on drying, surface smooth to slightly roughened. Ascomatal wall of two regions, outer region pigmented. Asci narrowly clavate to cylindrical, apex generally simple, 8-spored, ascospores uniseriate. Ascospores globose to ellipsoid, yellow to yellow-brown or reddish brown, thick-walled, non-, rarely one-, septate, variously ornamented with longitudinal or transverse striations or with bumps, ridges, flanges or

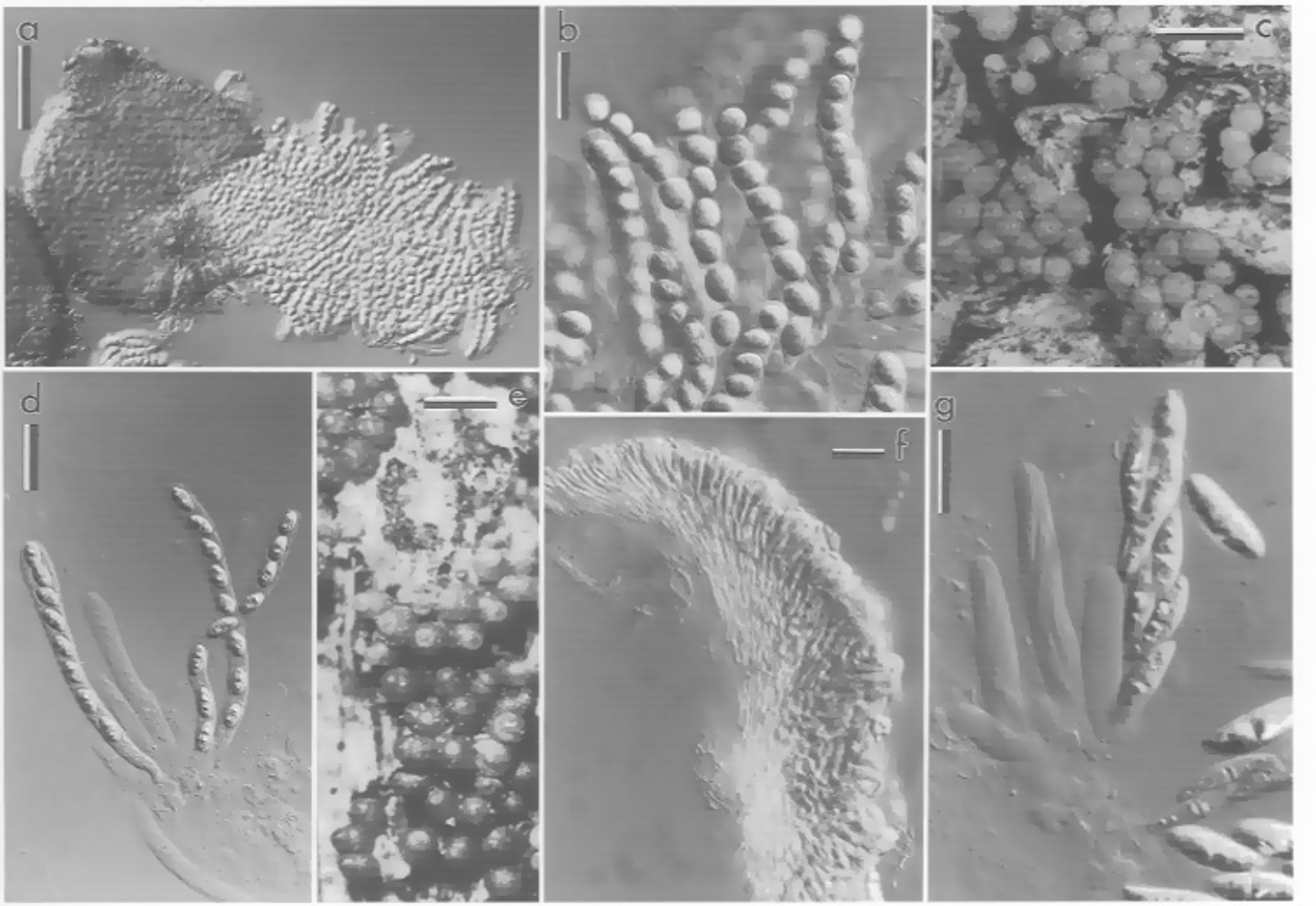


Plate 33. a, b. *Neocosmospora vasinfecta*. a. Whole ascoma broken with asci and ascospores. b. Asci with ascospores. **c, d.** *Neonectria coccinea*. c. Ascomata on natural substratum. d. Asci with ascospores. **e, g.** *Nectria jungneri*. e. Ascomata on natural substratum. g. Asci with ascospores. **f.** *Neonectria ramulariae*, median section of ascoma. a–b. BPI 630324, neotype of *N. vasinfecta* var. *nivea*. c, d. BPI 551493. e. BPI 745420. f. Holotype – B. g. BPI 1107212. Scale bars: a, c = 100 µm; b, d = 25 µm; e = 500 µm; f = 10 µm; g = 50 µm.

spines. Chlamydospores generally present. Most species homothallic. Anamorph, where known, *Acremonium*-like. On herbaceous substrata, isolated from soil.

Notes.— Within the *Nectriaceae*, *Neocosmospora* most closely resembles *Cosmospora* in having relatively thin-walled, red, KOH+ ascomata and yellow-brown, often ornamented ascospores, and *Acremonium*-like anamorphs. Unlike *Cosmospora*, *Neocosmospora* species are not fungicolous. Using sequences of 18S and 28S rDNA, Rehner & Samuels (1995) and Spatafora & Blackwell (1993) demonstrated that *Neocosmospora* is closely related to *Haematonectria haematococca* and suggested that the *Acremonium*-like anamorph of *Neocosmospora vasinfecta* is comparable to the microconidial form of a *Fusarium* (O'Donnell, 1996). Most of the *Acremonium*-like anamorphs of species of *Neocosmospora* are morphologically simple and have remained unnamed. *Neocosmospora* as defined herein excludes species having green ascospores and *Penicillifer* anamorphs, which are removed to *Viridispora*. Cannon & Hawksworth (1984) monographed *Neocosmospora* with descriptions and illustrations of five species, to which Udagawa *et al.* (1989) added two species. Species of *Neocomospora* are commonly isolated from soil and *N. vasinfecta* is known to be plant pathogenic.

Neocosmospora vasinfecta E.F. Sm., U.S.D.A. Div. Veg. Pathol. Bull. 17: 45. 1899. — Plate 33, a–b.

[= *Nectriella tracheiphila* E.F. Sm., Proc. Amer. Assoc. Advancem. Sci. 1895: 190. 1895, nom. inval. (Arts. 32, 34) (as *'trocheiphila'*)].
= *Neocosmospora vasinfecta* var. *tracheiphila* E.F. Sm., U.S.D.A. Div. Veg. Pathol. Bull. 17: 45. 1899.
= *Neocosmospora vasinfecta* var. *nivea* E.F. Sm., U.S.D.A. Div. Veg. Pathol. Bull. 17: 45. 1899.
= *Pseudonectria ornata* Bat. & Maia, Anais Soc. Biol. Pernamb. 13: 74. 1955.
= *Neocosmospora vasinfecta* var. *major* Rama Rao, Mycopath. Mycol. Appl. 21: 218. 1963.
[= *Neocosmospora ornamentata* Barbosa, García de Orto 13: 17. 1965, nom. inval. (Art. 37)].

Anamorph: *Acremonium*-like.

Mycelium white to pale buff, floccose, hyphae 1–4(–5) µm wide, septate, tending to aggregate in strands, anastomosing. Ascomata globose, (200–)300–500 µm high × (170–)280–480 µm diam, orange-brown to red, KOH+ dark red, glabrous with an inconspicuous hyphal web at the base, ostiolate, neck (20–)30–70(–100) µm long, 40–100(–150) µm diam. Ascomatal wall of two regions: outer region pigmented, of thick-walled *textura angularis* with cells 8–20 µm diam; inner region hyaline, of *textura angularis*. Periphyses of vertically oriented rows of hyaline thin-walled cells, evanescent at an early stage. Asci cylindrical, 80–95(–105) × 10.5–15(–16) µm, apex simple, 8- (rarely 6–7)-spored, ascospores uniseriate. Ascospores globose to ellipsoid, (9–)10–15.5(–18) × (7–)7.5–12(–13.5) µm, non-septate, hyaline to pale yellow, buff to salmon pink in mass, rugose.
Anamorph: Conidiogenous cells elongate-cylindrical (20–)30–100(–150) µm long, 1–2 µm diam, hyaline, usually arising directly from the vegetative mycelium. Conidia cylindrical to oblong-ellipsoid, sometimes allantoid, 5–13 × (1.5–)2–3.5 µm, non-septate, hyaline, aggregating in a gummy mass at the apex of the conidiogenous cell. Chlamydospores often present, hyaline to pale yellow, globose to obovoid, terminal or intercalary, smooth, 5–10 × 4–8 µm. Description modified from Cannon & Hawksworth (1984).

Habitat.— Isolated from soil, also from nematodes, pathogenic on crop plants causing root- and fruit-rots and seedling damping-off of *Cucurbitaceae*, *Fabaceae* (soybean stem rot), *Malvaceae*, *Piperaceae*, and others, and diseases in nurseries (Domsch *et al.*, 1980).

Distribution.— Warm temperate and tropical regions.

Types.— UNITED STATES. South Carolina: Cameron, on *Gossypium herbaceum*, Oct. 1902, W.A. Orton (BPI 630336, neotype designated by Cannon & Hawksworth, 1984); ibid., Monetta, on *Citrullus vulgaris*, 10 Oct 1904, W.W. Gilbert (BPI 630324 neotype of *N. vasinfecta* var. *nivea*, designated by Cannon & Hawksworth, 1984). BRAZIL. Pernambuco, Recife, on living leaves, 22 Sep. 1955, A. Chaves Batista, Fungos do Brasil no. 2960 (NY, isotype of *Pseudonectria ornata*).

Illustrations.— Cannon & Hawksworth (1984, Figs. 1–5, 7–10); Carris & Glawe (1989, Figs. 322–328, Fig. 422); Domsch *et al.*, 1980, Fig. 215); Rossman *et al.* (1993, Fig. 29); Smith (1899, Pl. 1–3, 5).

Notes.— *Neocosmospora vasinfecta* was originally described as the cause of a wilt disease of cotton, watermelon, and cowpea. This fungus has since been associated with a variety of vascular plants and isolated from soil and soil environments e.g. infecting nematodes and as a saprobe on roots.

Additional taxa of *Neocosmospora*:
Neocosmospora boninensis Udagawa, Horie & P. Cannon, Sydowia 41: 350. 1989.
Anamorph: *Acremonium*-like.
Habitat.— Isolated from forest soil.
Distribution.— Japan, known only from the type (extype CBS 446.93).

Neocosmospora indica Wadhwani, Indian Bot. Reporter 2 (1983): 158. 1984.
Anamorph: *Acremonium*-like.

HABITAT.— Isolated from soil.
DISTRIBUTION.— India, known from two isolations.

Neocosmospora parva Mahoney, Mycologia 68: 1111. 1976.
Anamorph: *Acremonium*-like.
HABITAT.— Isolated from soil.
DISTRIBUTION.— Educador: Galápagos Islands, known only from the type (ex-type CBS 466.70).

Neocosmospora spinulosa Pfenning, Sydowia 47: 66. 1995.
Anamorph: *Acremonium*-like.
HABITAT.— Isolated from soil under *Theobroma cacao*.
DISTRIBUTION.— Brazil, known only from the type.

Neocosmospora tenuicristata S. Ueda & Udagawa, Mycotaxon 14: 387. 1983.
Anamorph: *Acremonium tenuicristatum* S. Ueda & Udagawa, Mycotaxon 14: 387. 1983.
HABITAT.— Isolated from marine sludge.
DISTRIBUTION.— Japan, known only from the type.

Neocosmospora vasinfecta var. **africana** (Arx) P. Cannon & D. Hawksw., Trans. Brit. Mycol. Soc. 82: 676. 1984.

≡ *Neocosmospora africana* Arx, Antonie van Leeuwenhoek Ned. Tijdschr. Hyg. 21: 161. 1955.

Anamorph: *Acremonium*-like.
HABITAT.— Isolated from soil.
DISTRIBUTION.— Warm temperate and tropical regions.

NEONECTRIA Wollenw., Ann. Mycol. 15: 52. 1917.

Type: *Neonectria ramulariae* Wollenw. (≡ *Nectria ramulariae* (Wollenw.) E. Müll.).

= *Chitinonectria* Morelet, Bull. Soc. Sci. Nat. Archéol. Toulon Var 178: 6. 1969. — Type: *C. coccinea* (Pers. : Fr.) Morelet (≡ *Sphaeria coccinea* Pers. : Fr.), herein recognized as *Neonectria coccinea*.

Ascomata superficial on a minute basal stroma or on an erumpent, previously conidial stroma, or at the base of a synnema; subglobose to broadly obpyriform, collapsing laterally or not collapsing when dry, non-papillate or with a minute papilla, red, KOH+ dark red, yellow in lactic acid, smooth, varnished to scurfy. Ascomatal wall 50 or more µm thick, of two or three regions: outer region of conspicuously angular cells, 10–15 µm diam, with 1.5–2 µm thick walls; middle region, if present, of thick-walled cells oriented perpendicular to the centrum; inner region of thin-walled, hyaline, elongate cells. Asci fusiform to clavate, sessile, apex simple or

KEY TO THE SPECIES OF *NEOCOSMOSPORA*

The following key to the species is modified from Udagawa *et al.* (1989) with the addition of one recently described species, *N. spinulosa*.

1. Ascospores with conspicuous spines, reddish-brown in mass, translucent through the hyaline ascomatal wall ..... *N. spinulosa*
1. Ascospores variously ornamented with longitudinal or transverse striae or with bumps, ridges, flanges or reticulations, yellowish-brown in mass 2

2. Ascospores with transversely striate flanges or ridges 3
2. Ascospores with longitudinal ridges, reticulations or rugose to cerebriform ornamentation 4

3. Ascospores 7.5–12 × 5–6.5 µm, with 6–10 transverse, hyaline flanges ..... *N. striata*
3. Ascospores 13.5–17 × 10–11.5 µm, with many inconspicuous transverse ridges ..... *N. tenuicristata*

4. Ascospores 8.5–10.5 × 4.5–6 µm, verruculose ..... *N. parva*
4. Ascospores more than 10 µm long, reticulate or conspicuously rugose to cerebriform ... 5

5. Ascospores ellipsoid, 12.5–16 × 9–10 µm, reticulate, although reticulations partially obscured by an epispore layer ..... *N. indica*
5. Ascospores globose to slightly ellipsoid, 9–15.5 × 7.5–12 µm, conspicuously rugose to cerebriform 6

6. Ascospores conspicuously rugose ..... *N. vasinfecta* var. *vasinfecta*
6. Ascospores with cerebriform ornamentation ..... *N. vasinfecta* var. *africana*

with a refractive ring, ascospores biseriate. Ascospores ellipsoid to fusiform, medially 1-septate, smooth, hyaline. Anamorph, where known, *Cylindrocarpon*. On woody substrata.

Notes.— *Neonectria* was described as being similar to *Mycosphaerella* and *Calonectria* as well as close to *Nectria* and *Hypomyces*; it was differentiated by the anamorph that was placed at first in *Ramularia*, and later in *Cylindrocarpon*. The type specimen of *Neonectria ramulariae* contains a few immature ascomata along with its anamorph, *Cylindrocarpon magnusianum*. In the protologue Wollenweber (1917) refers to his Fusaria autographice delineata no. 67 that includes drawings of the teleomorph from the ex-type culture. Because only immature ascomata remain on the type specimen, this illustration is herein regarded as the iconotype. Based on this illustration and the immature ascomata on the type specimen, *Neonectria* is an available generic name for species related to *N. ramulariae*. The unispecific genus *Chitinonectria* was established for species of *Nectria* having a chitinoid ring in the ascal apex. Because the presence of a chitinoid ring in the ascal apex is a relatively common feature among members of the *Hypocreales*, this genus has not been accepted as a segregate of *Nectria*.

At present, nectrioid species having *Cylindrocarpon* anamorphs are placed in five groups that are differentiated as follows: (1) Species having few to numerous ascomata clustered on wood, ascomatal walls thinner than 50 μm, of relatively thick-walled, small cells, and ascospores that are generally smooth, have been placed in the '*Nectria*' *coccinea/galligena*-group (Booth, 1959). At present only species of this group are formally recognized as *Neonectria*. (2) Species having a distinctive '*Nectria*' *mammoidea*-type ascomatal wall structure as defined initially by Booth (1959) and later by Samuels & Brayford (1993), spinulose ascospores, and a non-microconidial anamorph constitute the '*Nectria*' *mammoidea*-group. (3) Species having an ascomatal wall thicker than 50 μm, of large, thick-walled cells and striate ascospores are placed in the '*Nectria*' *rugulosa*-group (Samuels & Brayford, 1994). (4) Species in the '*Nectria*' *radicicola*-group have warted, usually solitary, ascomata with walls of large, thick-walled cells, and smooth ascospores (Samuels & Brayford, 1990). (5) Species having ascomata with a flattened or knobby apex, ascomatal walls of thick-walled cells, and tuberculate ascospores are placed in the '*Nectria*' *veuillotiana*-group (Brayford & Samuels, 1993). It has not yet been determined what are the limits of these groups nor whether they should be included in *Neonectria* or as separate genera. For these reasons, only a few species are recognized in *Neonectria* at present.

Neonectria ramulariae Wollenw., Ann. Mycol. 15: 52. 1917. — Plate 33, f.

≡ *Nectria ramulariae* (Wollenw.) E. Müll., Beitr. Kryptogamenfl. Schweiz 11(2): 634. 1962.

Anamorph: *Cylindrocarpon magnusianum* (Sacc.) Wollenw., Fusaria autogr. del., ed. 2, no. 463. 1926.

≡ *Septocylindrium magnusianum* Sacc., Michelia 1: 130. 1878.

≡ *Ramularia magnusiana* (Sacc.) Lindau, *in* Rabenh., Kryptogamenfl. 1/8: 483. 1906.

Ascomata solitary or caespitose, up to fifteen developing from a central point, without a subtending stroma, with sparse white hyphae between the ascomata; ascomata superficial, obpyriform, 200–300 μm high × 210 μm diam, with a broadly rounded apex, collapsing laterally when dry, red-orange, KOH+; papilla integrated, indistinct, smooth. Ascomatal wall 40–45 μm thick, of two regions: outer region about 25–35 μm thick, of thick-walled cells that are irregularly elongate perpendicular to the ascomatal wall, cells often becoming thin-walled toward the apex, forming a *textura epidermoidea* and meandering, in the upper regions of the ascomata, cells more regularly oriented outward and slightly clavate, thus appearing circular in surface view. Asci narrowly clavate, 8-spored. Ascospores ellipsoid, (11–)12–15(–20) × 3–4 (–4.5) μm, 1-septate, when germinating 1–3-septate, hyaline, smooth.

Anamorph: Conidia cylindrical, 19–27 × 3–5 μm, straight, slightly wider and obliquely rounded at the distal end, 1–3-septate, hyaline.

Type.— GERMANY. Rhineland, Nordrhein-Westfalen, near Vohwinkel, on living *Rubus fruticosa* branches, Wollenweber, winter of 1915–1916, producing *Cylindrocarpon magnusianum* in culture (B – holotype; *Fusaria autographice delineata* no. 67, iconotype).

Notes.— Domsch *et al.* (1980) followed Wollenweber (1928) in recognizing *Neonectria ramulariae* (as *Nectria ramulariae*) to be the teleomorph of *Cylindrocarpon magnusianum* and stated that the ascomata were only known from Wollenweber's type specimen. No asci or ascospores were seen on the type specimen and are described here from the protologue. *Neonectria ramulariae* needs to be more fully characterized based on living cultures.

Additional species of *Neonectria*:

Neonectria coccinea (Pers. : Fr.) Rossman & Samuels, *comb. nov.* — Plate 22, i (page 26); Plate 33, c–d.

≡ *Sphaeria coccinea* Pers. : Fr., Persoon, Icon. & Descr. Fung. 2: 47. 1800 : Fries, Syst. Mycol. 2: 412. 1823.

≡ *Nectria coccinea* (Pers. : Fr.) Fr., Summa Veg. Scand. 2: 388. 1849.

= *Sphaerostilbe caespitosa* Fuckel, Jahrb. Nassauischen Vereins Naturk. 27–28: 33. 1873.
≡ *Neonectria caespitosa* (Fuckel) Wollenw., Angew. Bot. 8: 192. 1926.

Anamorph: *Cylindrocarpon candidum* (Link) Wollenw., Fus. Autogr. Del., ed. 2, no. 655. 1926.

≡ *Fusidium candidum* Link, Observationes I, Mag. Ges. Naturf. Freunde Berlin 3: 6. 1809.

= *Fusidium fractum* Sacc. & Cav., N. Giorn. Bot. ital. 7: 308. 1900.
≡ *Cylindrocarpon fractum* (Sacc. & Cav.) Wollenw., Fus. Autogr. Del., ed. 1, no. 655. 1924.

Booth (1966) stated that *Neonectria caespitosa* is a synonym of *Nectria coccinea*, based on an examination of type material (K, isotype, Fuckel, Fungi rhenani 2533). Seifert (1985) examined the holotype of *S. caespitosa* at G and isotypes at BR and K and confirmed Booth's evaluation. *Nectria coccinea* was lectotypified by Booth (1959) with a Persoon specimen.

Specimen illustrated.— UNITED STATES. Maine: Washington Co., near Princeton, on *Fagus*, Dec 1934, E. Brower, V. Mentzer (BPI 551493).

Neonectria galligena (Bres.) Rossman & Samuels, *comb. nov.*

≡ *Nectria galligena* Bres., *in* Strasser, Verh. K.K. Zool.-Bot. Ges. Wien 51: 413. 1901.

Anamorph: *Cylindrocarpon heteronema* (Berk. & Broome) Wollenw., Z. Parasitenk. (Berlin) 1: 149. 1928.

≡ *Fusarium heteronema* Berk. & Broome, Ann. Mag. Nat. Hist. Ser. 3, 15: 1051. 1865.
= *Fusarium mali* Allesch., Ber. Bot. Ver. Landshut 12: 130. 1892.
≡ *Cylindrocarpon mali* (Allesch.) Wollenw., Z. Parasitenk. (Berlin) 1: 150. 1928.

This species was described and illustrated by Booth (1959) and Booth (1966), in which *Cylindrocarpon heteronema* is cited as the correct name for the anamorph.

Specimens illustrated:
'*Nectria*' *jungneri* in *N. mammoidea*-group. FRENCH GUIANA. Saül, Saut Mais, 17 km E from Saül, on bark of newly fallen log, 2 Nov 1986, A.Y. Rossman 2957, C. Feuillet & L. Skog (BPI 1107212). PUERTO RICO. Luquillo Mountains, Bisley Watershed, on branch of *Manilkara* sp., 8 May 1995, S.M. Huhndorf 1397, D.J. Lodge PR 2280, & G.J. Samuels (BPI 745420): Plate 33, e, g.

OPHIONECTRIA Sacc., Michelia 1: 323. 1878.

Lectotype, designated by Seaver (1909a): *O. trichospora* (Berk. & Broome) Sacc. (≡ *Nectria trichospora* Berk. & Broome).

Ascomata solitary to aggregated in small groups, hyphal stroma sometimes present, superficial, short ovoid to elongate–ovoid, red-orange to scarlet, KOH+ bay, not collapsing when dry, surface warted; warts of loose, globose, thick-walled, pigmented cells. Asci clavate, apex simple. Ascospores long-fusiform, multiseptate, hyaline, with faint longitudinal striations or smooth. Anamorph, where known, *Antipodium*. On decaying woody substrata.
Notes.— Saccardo proposed the genus *Ophionectria* with three species of *Nectria*-like fungi having very long, septate ascospores. Rossman (1977) circumscribed the genus based on the ascomatal wall structure, the long fusiform ascospores, and the unusual anamorph and retained only the type species. One other species has been added to the genus since then, namely *O. magniverrucosa* Rossman (1983).

Ophionectria trichospora (Berk. & Broome) Sacc., Michelia 1: 323. 1878. — Plate 22, j, k (page 96); Plate 34, a–c.

≡ *Nectria trichospora* Berk. & Broome, J. Linn. Soc., Bot. 14: 115. 1873.
≡ *Tubeufia trichospora* (Berk. & Broome) Petch, Ann. Roy. Bot. Gard. Peradeniya 5: 285. 1912.
= *Calonectria cinnabarina* Henn., Hedwigia 36: 220. 1897.
≡ *Ophionectria cinnabarina* (Henn.) Henn., Hedwigia 41: 7. 1902.
= *Calonectria ornata* A.L. Smith, J. Linn. Soc. Bot. 35: 18. 1901.
= *Calonectria theobromae* Pat., in Duss, Énum. Champ. Guadeloupe p. 81. 1903.
= *Ophionectria portoricensis* Chardón, Mycologia 13: 285. 1921.
[= *Ophionectria anomala* Petch, Trans. Brit. Mycol. Soc. 27: 143. 1944, non Racib. 1907].

Anamorph: *Antipodium spectabile* Piroz., Canad. J. Bot. 52: 1144. 1974.

Ascomata gregarious to scattered, superficial, sometimes seated on a white to bright-yellow subiculum of thick-walled, minutely warted, septate, 5–7.5 µm wide hyphae, each cell swollen at one end. Ascomata ovoid to cylindrical, often truncate at the apex, 400–600 µm high × 250–350 diam, red-orange to scarlet, KOH+ dark red, sometimes collapsing laterally when dried; covered with conspicuous, concolorous warts, 25–100 µm high, of loosely compacted, irregularly globose cells, 10–25 µm diam, with thickened, pigmented walls; ascomata often naked toward the apex; ostiole, 45–50 µm diam. Ascomatal wall of two regions: outer region 15–90 µm thick, of large, irregularly globose cells 10–25 µm diam, with thickened, pigmented walls forming a *textura globulosa*; inner region

7–10 µm thick, of hyaline, thin-walled, elongate cells. Asci clavate, 180–260 × 25–30 µm, apex simple, 8-spored, ascospores parallel, often twisted around each other. Ascospores long-fusiform, often somewhat bent, vermiform, 180–250 × 6–10 µm, 13–24-septate, the proximal end slightly inflated and bluntly rounded, the distal end tapering and narrowly rounded; walls thickened, hyaline, with faint longitudinal striations.

Anamorph: Mycelium sparse, superficial or submerged, with aerial conidiophores, white to yellow-orange, hyphae 5-7.5 µm wide, with small warts, becoming pigmented and thickened with age, often swollen at the septa. Conidia fusiform with beaked apex, 120–140 × 26–28 µm, 3–5-septate, beak 3–11 µm long, basal cell truncate, hyaline, smooth-walled.

Habitat.— On bark, dead wood and other plant debris, often among mosses and saprobic fungi.

Distribution.— Pantropical.

Illustrations.— Doi (1977, Fig. 5-6); Rossman (1977, Figs. 1–5; 1983, Fig. 19, Pls. 6F, 7 A–E); Pirozynski (1974, Fig. 1, anamorph only); Samuels *et al.* (1990, Fig. 32A); Subramanian & Bhat (1978a, Figs. 1–59).

Specimens illustrated.— COSTA RICA. Above El Silencio, near Tileran, on bark of newly killed log, 14 Sep 1964, G. Carroll 664 (BPI 1107322). GUYANA. Mazaruni region, no. VII, Mazaruni subregion, No. VII-2, foothills immediately S of Mt. Ayanganna, *ca* 1 km W of Pong Creek, elev. 550-600 m, 05°28′ N, 60°04′ W, swamp and montane forest dominated by *Inga*, *Dicymbe* and *Swartzia*, on recently dead tree, 26 Feb 1987, G.J. Samuels, G.J.S. 4829a, J.J. Pipoly, G. Gharbarran (NY). JAMAICA. Hanover Parish, Dolphin Head near Askenish, on decorticated wood, 22 Jan 1971, R.P. Korf *et al.*, culture derived from single ascospores produced anamorph, ex type culture ATCC 28509 (DAOM 139482 – holotype of *Antipodium spectabile*).

Notes.— Subramanian & Bhat (1978a) studied ascal development and conidial ontogeny of *O. trichospora* and presented detailed descriptions and illustrations.

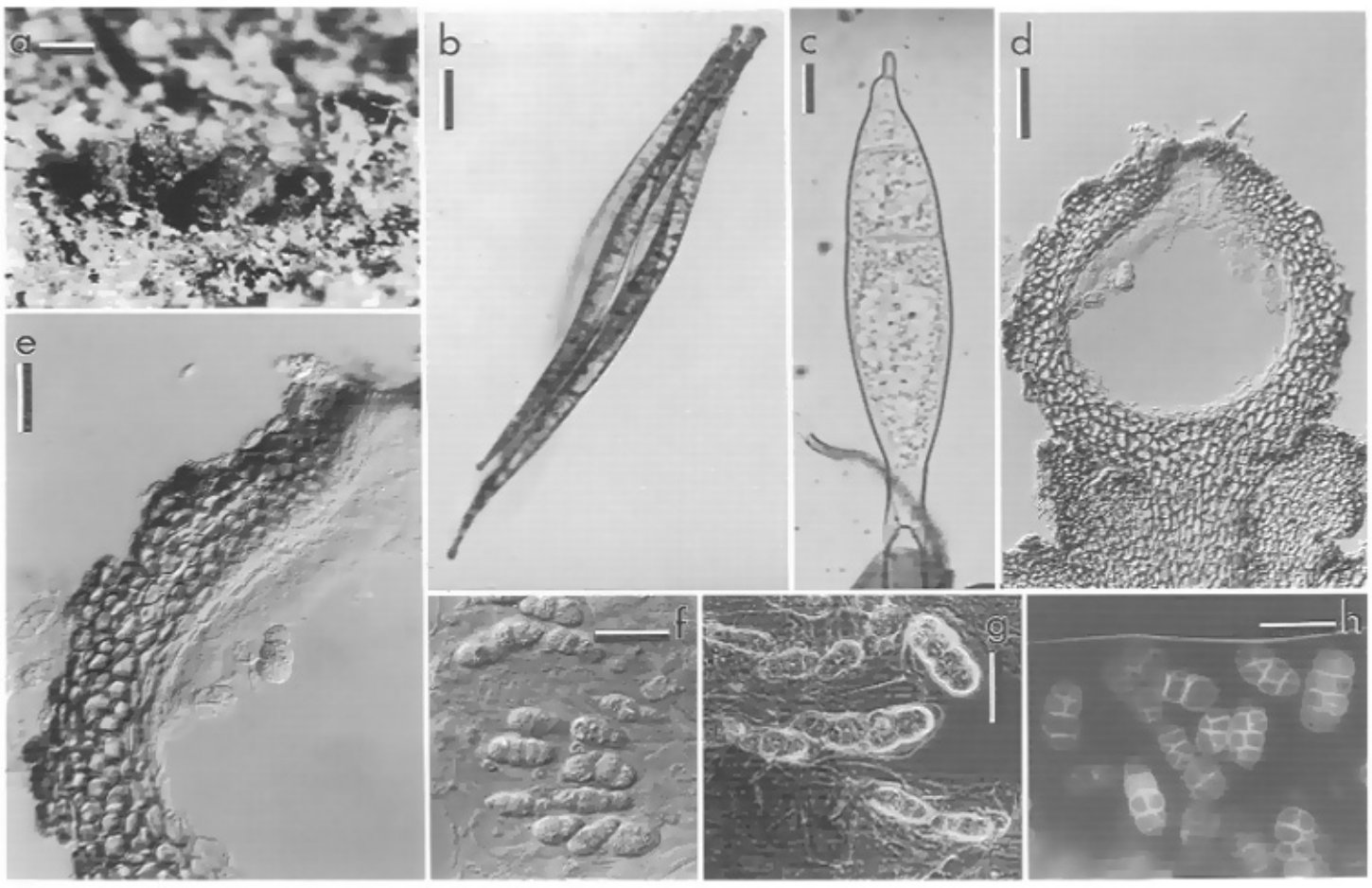


Plate 34. a–c. *Ophionectria trichospora* and its anamorph, *Antipodium spectabile*. a. Ascomata on natural substratum. b. Asci with ascospores. c. Conidium developing on conidiogenous cell. **d–h.** *Pleogibberella calami*. d. Median section of ascoma. e. Close-up of median section of ascomatal wall. f. Asci with ascospores and remnants of apical paraphyses. g. Asci with ascospores and remnants of apical paraphyses in phase contrast. h. Ascospores in fluorescence microscopy. a. BPI 1107322. b. Holotype – IMI. c. Holotype of *Antipodium spectabile*. d–h. Holotype – NY. Scale bars: a = 250 µm; b = 20 µm; c = 10 µm; d = 100 µm; e = 50 µm; f–h = 25 µm.

KEY TO THE SPECIES OF *OPHIONECTRIA*

1. Ascospores 3–5(–7)-septate, 58–105 × 6–7 μm; ascomata having very large, conical warts, up to 300 μm high; anamorph unknown; on thin bark of unidentified, dead twig; known only from Ecuador ..... *O. magniverrucosa*
1. Ascospores 13–24-septate, 180–250 × 6–10 μm; ascomata having tuberculate warts, up to 100 μm high; anamorph *Antipodium spectabile*; on bark of decaying woody substrata; pantropical ..... *O. trichospora*

PLEOGIBBERELLA Sacc., *in* Berl. & Voglino, Syll. Fung. Addit. 1–4: 217. 1886.

Type: *P. calami* (Cooke) Berl. & Voglino (≡ *Gibberella calami* Cooke).

Stroma well-developed, pseudoparenchymatous, dark purple, becoming black when dry. Ascomata superficial, aggregated on the stroma, globose to pyriform, dark purple, KOH+ black, surface scurfy. Asci clavate, 2–3-spored. Ascospores muriform, hyaline, smooth-walled. Anamorph not known. On fruits of *Calamus*.

NOTES.— Although similar in the dark ascomata, *Pleogibberella* is differentiated from *Gibberella* by large, muriform ascospores, a well-developed stroma, and occurrence on palm fruits. Despite the dark purple pigmentation, the stroma and ascomatal wall structure are reminiscent of members of *Nectria sensu stricto*, a group that includes several species having muriform ascospores. After soaking in lactic acid, the ascomatal wall cells of *P. calami* lose their dark purple pigments and become red-orange.

Pleogibberella calami (Cooke) Berl. & Voglino, Syll. Fung. Addit. 1–4: 217. 1886 (as '*calamia*'). — Plate 32, b; Plate 34, d–h.

≡ *Gibberella calami* Cooke, Grevillea 13: 8. 1884.

Stroma well-developed, spreading, completely surrounding the individual fruits on the rachis, up to 1 mm thick, dark purple, appearing black when dry, pseudoparenchymatous, of thick-walled, pigmented cells, 7–22 μm thick, forming a *textura angularis*, stroma intergrading with outer wall of ascomata. Ascomata superficial, aggregated on the stroma, globose to pyriform, 360–420 μm high × 318–360 μm diam, collapsing laterally or not at all, dark purple, appearing dark brown when dry, KOH+ black, surface slightly cracked, scurfy, or scaly, apical region often flattened, shiny, smooth. Ascomatal wall 60–72 μm thick, of two regions: outer region 42–60 μm thick, of thick-walled, pigmented cells, 10–16 μm diam, forming a *textura angularis*, outermost cells slightly darkened with encrusted dark pigments; inner region about 12 μm thick, of thin-walled, hyaline, elongate cells, 7–10 × 3–5 μm. Cells around the ostiole elongate, parallel toward the apex, becoming thin-walled, slightly inflated toward the apex, forming a distinct, flattened area. Asci clavate, thin-walled, soon dissolving, generally 2-spored, occasionally 3-spored. Ascospores broadly ellipsoid, 22–41.5 × 13.5–23 μm, tending to develop a median septum first, then one or two additional septa, ultimately becoming dictyosporous with 2–3 major transverse, 1–2 partially transverse septa, 1 irregular longitudinal septum, and 1–2 diagonal septa in the apical cells, with one or more guttules in each cell, hyaline, becoming yellow with age, smooth-walled.

HABITAT AND DISTRIBUTION.— Known only from the type specimen.

HOLOTYPE.— INDIA. Andhra Pradesh: Vizagapatam, on the fruits of *Calamus fasciculatus* (*Arecaceae*) (NY).

NOTES.— No anamorph was observed on the type and only known specimen of *Pseudogibberella calami*.

PSEUDONECTRIA Seaver, Mycologia 1: 48. 1909.

as nom. nov. for *Nectriella* Sacc. 1877, non Nitschke 1870.

Type: *P. rousseliana* (Mont.) Wollenw. 1931 (≡ *Nectria rousseliana* Mont.).

[≡ *Nectriella* Sacc., Michelia 1: 51. 1877, non Nitschke, 1870].

[≡ *Notarisiella* Sacc., *in* Clem. & Shear, Gen. Fungi p. 280. 1931 ≡ *Nectriella* Sacc. subgenus *Notarisiella* Sacc., Syll. Fung. 2: 452. 1883 ≡ *Lasionectria* (Sacc.) Cooke subgenus *Notarisiella* Cooke, Grevillea 12: 111. 1884]. — Type: *Notarisiella rousseliana* (Mont.) Clem. & Shear (≡ *Nectria rousseliana* Mont.), recognized as *Pseudonectria rousseliana* (Mont.) Wollenw.

Ascomata superficial, solitary, with an inconspicuous basal stroma, globose to pyriform, often with a pointed apex, pale yellow, yellow to scarlet, rarely orange or greyish yellow-green, KOH– or KOH+ slightly darker, yellow in lactic acid; ascomatal wall smooth, with or without sparse to numerous hyaline to orange setae or hairs; ascomatal surface of cells with irregularly thickened walls and joined by pores; ascomatal wall less than 20 μm thick, of one region. Asci narrowly clavate. Ascospores non-septate. Anamorph *Volutella*. On decaying leaves and twigs of *Buxaceae* (*Buxus* and *Pachysandra*).

Notes.— The genus *Pseudonectria* was established as a new name for the genus *Nectriella* Sacc. 1877, a later homonym of *Nectriella* Nitschke 1870. Initially *Pseudonectria* was defined to include *Nectria*-like species with non-septate ascospores, a concept that persisted until Lowen (1991) reexamined many of the type specimens of described species and redisposed of those previously placed in *Pseudonectria* and *Nectriella* Sacc. Rossman *et al.* (1993) further restricted the genus to three species that are similar in ascomatal morphology and occurring on *Buxaceae*. One of these species, *P. coronata* (Juel) Lowen, having a *Sesquicillium* anamorph, has recently been shown to belong to the *Bionectriaceae* (H.-J. Schroers, in lit.).

Pseudonectria is similar to species of *Cosmospora* in the ascomatal wall structure that is relatively thin, often less than 15 μm thick, of one region, with cells at the ascomatal surface having a meandering aspect with irregularly thickened walls as illustrated in Rossman *et al.* (1993) and Samuels *et al.* (1991). Like *Pseudonectria*, species of *Cosmospora* generally have orange to red, KOH+ ascomata that become yellow in lactic acid.

The genus *Notarisiella* is based on *Lasionectria* subgenus *Notarisiella*, a taxon that Cooke (1884) recognized for *Nectria*-like species having hairs or setae on the ascomata and non-septate ascospores, namely *L. rousseliana* Mont., *L. villosula* Speg., *L. carnea* Desm., and *L. nigroviridis* Crouan. Clements & Shear (1931) selected *L. rousseliana* as the type; thus *Notarisiella* is a nomenclatural synonym of *Pseudonectria*.

Pseudonectria rousseliana (Mont.) Wollenw., Z. Parasitenk. (Berlin) 3: 488. 1931. — Plate 22, 1 (page 96).

≡ *Nectria rousseliana* Mont., *in* Castagne, Cat. Pl. Marseille Suppl. p. 44. 1851.
≡ *Stigmatea rousseliana* (Mont.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 97. 1870.
[≡ *Nectriella rousseliana* (Mont.) Sacc., Michelia 1: 51. 1877].
≡ *Notarisiella rousseliana* (Mont.) Sacc., *in* Clem. & Shear, Gen. Fungi p. 280. 1931.
= *Nectria rousseliana* Mont. var. *viridis* Berk. & Broome, Ann. Mag. Nat. Hist., Ser. 3, 3: 21. 1859.

Anamorph: *Volutella buxi* (DC. : Fr.) Berk., Outl. Brit. Fungol. p. 340. 1860.

≡ *Tubercularia buxi* DC. : Fr., De Candolle, Fl. gall. 6: 100. 1815 : Fries, Syst. Mycol. 3: 447. 1832.
≡ *Chaetostroma buxi* (DC. : Fr.) Corda, Icon. Fung. 2: 30. 1838.
≡ *Chaetodochium buxi* (DC. : Fr.) Höhn., Mitt. Bot. Inst. Tech. Hochschule Wien 9: 44. 1932.
= *Psilonia rosea* Fr., Sclerom. Sueciae 6, no. 220. 1821, fide Bezerra (1963).

Ascomata solitary to gregarious, superficial, with inconspicuous stroma at the base, globose with a small, pointed apex, 190–204 μm high × 168–175 μm diam, collapsing laterally, pale yellow to yellow or greyish yellow-green, KOH–, with long, hyaline setae scattered over the ascomatal surface, setae occasionally lacking on overmature ascomata. Ascomatal wall thin, 7–12 μm thick, of a single region of intertwined hyphae, with 1.5 μm thick walls. Setae arising from individual outer wall cells, lanceolate, (25–)56–160 μm long × 5.5–7(–9.5) μm at the base, tapering toward the rounded apex, walls at the base 1.5 μm thick, becoming thin-walled at the apex, with finely granular incrustations on the surface, with thin-walled septa every 12–35 μm, setae rarely branching, producing red droplets at the apex when moist. Asci narrowly clavate, 43–52 × 7.5–11 μm, slightly truncate at the apex, ascospores irregularly biseriate. Ascospores narrowly ellipsoid with ends slightly truncate, 11–15(–17.5) × 3–4.5(–5) μm, non-septate, often with one, rarely two small droplets in each end, hyaline, smooth-walled.

Anamorph: Sporodochia developing on the undersurface of recently killed leaves, evenly scattered, solitary to aggregated, non-stromatic, easily detached from the substratum, variable in size, 50–240 μm diam, with red-tipped, hyaline setae developing from base and sides, setae 80–180 × 3–5.5 μm, conidial mass salmon, sometimes conidial masses of adjacent sporodochia coalescing. Conidiophores solitary, borne on weakly fasciculate, aerial hyphae at the margin, coalescing to form slimy masses of conidia toward the center, monophialidic, slender, tapering to the apex, 19–43 μm long, tapering from 2.5–3.5 μm at the base to 1.5–2 μm at the apex, septate only at the base, rarely two developing at the same point at an acute angle, thus appearing weakly verticillate. Conidia ellipsoid to short-fusiform, variable in size and shape, 3–8.5 × 2–4.5 μm, non-septate, hyaline, smooth-walled.

Habitat.— On the undersurface of dead leaves including recently killed leaves still attached to a twig, and dead twigs of *Buxus sempervirens*, often associated

Key to the species of *Pseudonectria*

1. Ascomata pale yellow to yellow, rarely orange or greyish yellow-green, with long, scattered hairs, up to 160 μm long; ascospores 11–15(–17.5) × 3–4.5(–5) μm; on *Buxus* ..... *P. rousseliana*
1. Ascomata scarlet, with short, protruding hairs interspersed with sparse, long setae, up to 135 μm long; ascospores 9.5–13 × 3–4 μm; on *Pachysandra* ..... *P. pachysandricola*

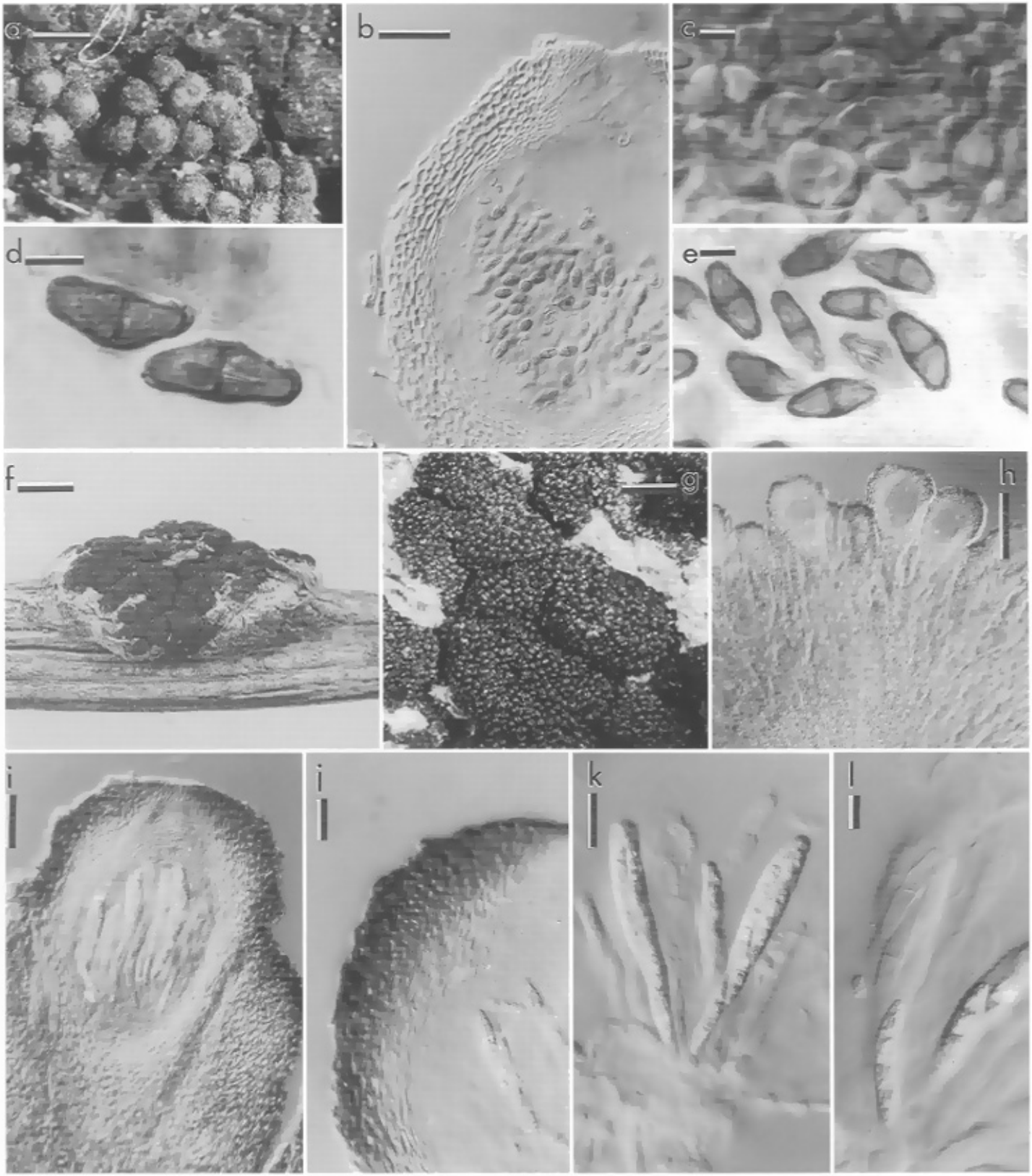


Plate 35. a–e. *Rubrinectria olivacea*. a. Ascomata on natural substratum. b. Median section of ascoma. c. Close-up of ascomatal wall showing pores between cells. d, e. Ascospores in asci. **f–l.** *Stalagmites tumefaciens*. f, g. Ascomata on natural substratum. h, i. Median sections of ascomata and stroma. j. Close-up of median section of ascomatal wall. k, l. Asci with ascospores. a, d, e. BPI 801936. b. BPI 1107216. c. BPI 631932. f, g. Isolectotype – LPS. h. Lectotype – S. Scale bars: a = 500 μm; b, i = 50 μm; c–e, l = 10 μm; f = 4 mm; g = 1 mm; h = 200 μm; j, k = 25 μm.

with *Hyponectria buxi* (Desm.) Sacc., '*Pseudonectria*' *coronata* or its anamorph, *Sesquicillium buxi* (Link : Fr.) W. Gams.

Distribution.— Europe and North America.

Type.— FRANCE. Ad folia *Buxi sempervirentis*, Meloduno, primus Roussel (PC, lectotype).
Additional specimens examined are listed in Rossman *et al.* (1993).
Specimen illustrated.— FRANCE. Sauveterre de Bearn Isle (64), on leaves of *Buxus*, 12 June 1994,. J.-F. Magni, A9491.

Illustrations.— Bezerra (1963, Figs. 1–3); Candoussau & Magni (1995, Fig. 4a); Dennis (1978, Pl. 35M); Juel (1925, Fig. a, Pl. I.1); Petch (1938, Fig. 4); Rossman *et al.* (1993, Figs. 7–12).

Notes.— *Pseudonectria rousseliana* and its anamorph *Volutella buxi* (DC.) Berk. are known as the cause of a disease of *Buxus* (Bezzera, 1963; Samuels, 1977; Sinclair *et al.*, 1987). The ascomata of *P. rousseliana* are variable in color ranging from pale yellow to yellow-green. In one collection the ascomata on one leaf varied in color from straw to greyish yellow-green, thus, the variety *viridis* distinguished by greenish ascomata is considered a synonym of the type variety.

The anamorph bears similarity to *Volutella minima*, the anamorph of *Cosmospora consors* (Samuels, 1977; Samuels *et al.*, 1991, as *Nectria consors*) as discussed in Rossman *et al.* (1993), but it has much more diffuse sporodochia, giving the culture a slimy aspect. *Pseudonectria rousseliana* and its more commonly encountered anamorph are reported wherever *Buxus sempervirens* is grown, primarily in Europe and North America (Petch, 1938). Unlike most species of *Cosmospora*, *P. rousseliana* occurs on living to recently killed plant tissue.

The second accepted species in *Pseudonectria*, *P. pachysandricola* Dodge, and its anamorph, *Volutella pachysandricola* Dodge, was described and illustrated in Rossman *et al.* (1993) and Sinclair *et al.* (1987).

RUBRINECTRIA Rossman & Samuels, *gen. nov.*

Type: *R. olivacea* (Seaver) Rossman & Samuels (≡ *Macbridella olivacea* Seaver, Mycologia 2: 178. 1910).

Stroma pseudoparenchymatosum. Ascomata aggregata, superficialia, aurantiaca vel rubra, verrucis concoloribus vel viridibus obtecta. Paries ascomatis 20–30 μm crassus, e duabus partibus: pars externa *textura angulari*, cellulae usque ad 1 μm crassitunicatae et pigmentatae; pars interna *textura prismatica*, elongata, cellulae tenuitunicatae. Asci cylindrici. Ascosporae 1-septatae, aureo-brunneae, grosse striatae. Anamorphosis *Dendrodochii* similis, sed conidiis catenatis.

Stromata erumpent, pseudoparenchymatous. Ascomata aggregated, superficial, orange to red with concolorous to greenish warts. Ascomatal wall 20–30 μm thick, of two regions: outer region of *textura angularis*, cells with up to 1 μm thick, pigmented walls, intergrading with the stroma; inner region of *textura prismatica*, with elongate, thin-walled cells. Asci cylindrical. Ascospores broadly ellipsoid to fusiform, one-septate, golden-brown, with coarse striations. Anamorph similar to *Dendrodochium* but bearing conidia in chains. On decaying woody substrata, often fruiting on newly killed wood.

Notes.— The unispecific genus *Rubrinectria* is described for an unusual *Nectria*-like species having ascomata often with a green-tinged, warted wall, golden-brown, coarsely striate ascospores, and a peculiar sporodochial anamorph bearing conidia in chains.

Rubrinectria olivacea (Seaver) Rossman & Samuels, *comb. nov.* — Plate 32, c; Plate 35, a–e.

≡ *Macbridella olivacea* Seaver, Mycologia 2: 178. 1910.
≡ *Phaeonectria olivacea* (Seaver) Sacc. & Trotter, Syll. Fung. 22: 485. 1913.
≡ *Nectria olivacea* (Seaver) Samuels, Canad. J. Bot. 51: 1277. 1973.
= *Macbridella cinnabarina* Seaver, *in* Seaver & Chardón, Sci. Surv. Porto Rico and Virgin Isl. 8: 43. 1926.

Anamorph: cf. *Dendrodochium* sp., but conidia in chains.

Mycelium subcortical, forming stromata at points. Stromata erumpent through bark, gregarious, buff-colored, at first conidial, later producing ascomata, cells of stroma pseudoparenchymatous, about 10 μm in greatest dimension, walls about 1 μm thick. Ascomata aggregated in groups of 5 to 10 to densely gregarious, superficial, globose to broadly ovate or broadly pyriform, (280–)340–450 μm high × 280–375 μm diam, collapsing laterally when dry or not, with a short, rounded papilla, orange to red with orange, rarely green, scales, KOH+ dark red. Papilla obtuse, 80–100 μm diam at the apex, cells at the surface of the papilla ellipsoid, 7–10 × 3–4 μm, thin-walled. Ascomatal surface cells forming a *textura angularis*, circular to ellipsoid, 10–15 μm diam, walls 1–1.5 μm thick. Ascomatal wall 30–60 μm thick, of two regions: outer region 20–30 μm thick, of ellipsoid cells, about 10 μm diam, becoming flattened toward the interior, with 1–2 μm thick walls, merging with the stroma below, forming scales at the surface; inner region of elongate, hyaline, thin-walled cells. Asci cylindrical, 75–105 × (6–)7–13 μm, apex simple or with a small, refractive ring, 8-spored, ascospores uniseriate to irregularly biseriate. Ascospores broadly ellipsoid to fusiform, 10–17 × 5–8 μm, one-septate, slightly constricted at the septum, very pale brown to golden-brown, coarsely striate.
Anamorph: Sporodochia erumpent, about 1–2 mm diam × 0.5 mm high, buff-colored, in culture pale orange.

Conidiophores macronematous, mononematous, arising from vegetative hyphae, 40.5–67.5 × 3.5–4 μm, once or twice branched, each branch bearing 1–4 penicillately arranged phialides, or phialides arising directly from the hyphae. Phialides cylindrical, (9–)11–18 × 2.5–3.5 μm, narrowing toward the apex, apex thickened, slightly flared or not. Conidia broadly ellipsoid to oblong with slightly protuberant, flat, with or without recognizable basal abscission scar, 4.5–7(–10) × 2–4 μm, non-septate, hyaline, held in dry, white chains. Ascomata developing in culture after two months (Seaver, 1910b).

HABITAT.— On dead bark, wood, or palm stems.

DISTRIBUTION.— Probably pantropical, known from Central and South America (Colombia, French Guiana, Mexico, Panama, Puerto Rico, Peru), China, the Philippines (Samuels & Brayford, 1994), and Thailand.

TYPES.— MEXICO. Motzorongo, near Córdoba, in moist forest, on stem of unidentified palm, 15 Jan. 1910, Murrill & Murrill 911 (NY, holotype of *Macbridella olivacea*). PUERTO RICO. on dead wood, 24 Jan–5 Apr 1923, Seaver & Chardón 525 (NY, lectotype of *Macbriella cinnabarina*, designated by Samuels, 1973a).

SPECIMENS EXAMINED.— CHINA. Ting-an, Hainan, on bark of dead tree, 6 Sep 1934, S.Q. Deng 4366, S.C. Teng 5897 (BPI 631932). FRENCH GUIANA. Saül, Saut Mais, 17 km E of Saül, on bark of newly fallen log, 2 Nov 1986, A.Y. Rossman 2955, C. Feuillet & L. Skog (BPI 1107216, culture CBS 101604). PHILIPPINES. Luzon: Mt. Maquiling, on bark, Feb 1912, P.W. Graff, Lloyd 11408 (BPI 801936). THAILAND. Saraburi Province, Khao Yai National Park, Wang Jumpee trail to Lamp Tha Kong Creek, on bark of recently killed tree, 31 Jul 1997, G.J. Samuels 97-163 ≡ CBS 101605, P. Chaverri. & K. Poldmaa (BPI 745636).
Additional specimens examined listed in Samuels & Brayford (1994, as *Nectria olivacea*).

ILLUSTRATIONS.— Samuels (1973a, Figs. 5–9, 26–27, as *N. olivacea*); Samuels & Brayford (1994, Figs. 35, 62–72, as *N. olivacea*); Seaver (1910b, Figs. 6–13, as *M. olivacea*).

STALAGMITES Theiss. & Syd., Ann. Mycol. 12: 189. 1914.

Type: *S. tumefaciens* (Syd. & P. Syd.) Theiss. & Syd. (≡ *Dothidea tumefaciens* Syd. & P. Syd.).

Causing galls on host branches, oval to globose, up to 3 cm diam. Stroma spreading over the gall surface. Ascomata caespitose in groups of 100 or more, densely aggregated, superficial, globose to broadly ovoid, not collapsed or slightly laterally pinched when dry, black, violet in transmitted light, KOH+ dark purple, purple pigments dissolving in KOH, red in lactic acid, ostiolate, surface smooth, shiny. Ascomatal wall *ca* 75 μm thick, outer regions continuous with the stroma, *ca* 25 μm thick, walls pigmented; inner region up to 40 μm thick, cells hyaline. Asci clavate, apex simple, ascospores bi- to pluriseriate. Ascospores narrowly ellipsoid, usually 1(–3)-septate, occasionally multiseptate with age, slightly constricted, hyaline, smooth-walled. Anamorph not known. On branches of *Serjania*.

NOTES.— *Stalagmites* was established for what was considered an unusual member of the *Dothideales* having a well-developed, dark purple stroma with immersed ascomata, lacking paraphyses, and having dark, non-septate ascospores. Based on an examination of several parts of the type specimen, *Stalagmites* is recognized as a genus in the *Nectriaceae*. It bears similarity to *Gibberella* that has a dark-purple ascomatal wall and three-septate ascospores, and *Pleogibberella* that has a dark-purple ascomatal wall and muriform ascospores.

Stalagmites tumefaciens (Syd. & P. Syd.) Theiss. & Syd., Ann. Mycol. 12: 189. 1914. — Plate 32, d; Plate 35, f–l.

≡ *Dothidea tumefaciens* Syd. & P. Syd., Ann. Mycol. 5: 360. 1907.

Galls apparently caused by the fungus, oval to globose, up to 3 cm diam, stroma spreading over the gall surface, up to 10 mm thick; in section of thin-walled, angular cells forming a *textura angularis*. Ascomata densely aggregated in groups of 100 or more, superficial, globose to broadly ovoid, not collapsed or slightly laterally pinched when dry, 240–400 × 210–275 μm, black, violet in transmitted light, KOH+ dark purple, purple pigments dissolving in KOH, red in lactic acid, fleshy, ostiolate; surface smooth, shiny. Ascomatal wall *ca* 75 μm thick, outer region continuous with the stroma, *ca* 25 μm thick, walls pigmented, 1.5–3 μm thick, cells irregular in outline, up to 10 μm diam; inner region up to 40 μm thick, cells hyaline, progressively thinner-walled, *ca* 10 × 4.5 μm. Asci clavate, 75–110 × (9–)11–17 μm, sessile, apex simple, ascospores bi- to pluriseriate. Ascospores narrowly ellipsoid, 23–34 × 5.5–7.5 μm, usually 1(–3)-septate, slightly constricted, occasionally multiseptate with age, hyaline, smooth-walled.

ANAMORPH: Pale orange substance, possibly a *Fusarium*, associated with the ascomata but lacking conidia.

HABITAT AND DISTRIBUTION.— Known only from the type specimen.

TYPES.— BRAZIL. São Paulo, Campinas, on branches of *Serjania* (*Sapindaceae*), Nov. 1897, F. Noack, no. 811 (S, **lectotype** of *Dothidea tumefaciens*, designated herein; FH, isolectotype; LPS, W, ex Petrak Pilzherbarium 04285, isolectotypes).

NOTES.— The lectotype specimen consists of 1 cm diam piece of vine-like wood with a woody gall covered with dispersed clumps of densely aggregated, dark ascomata.

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*

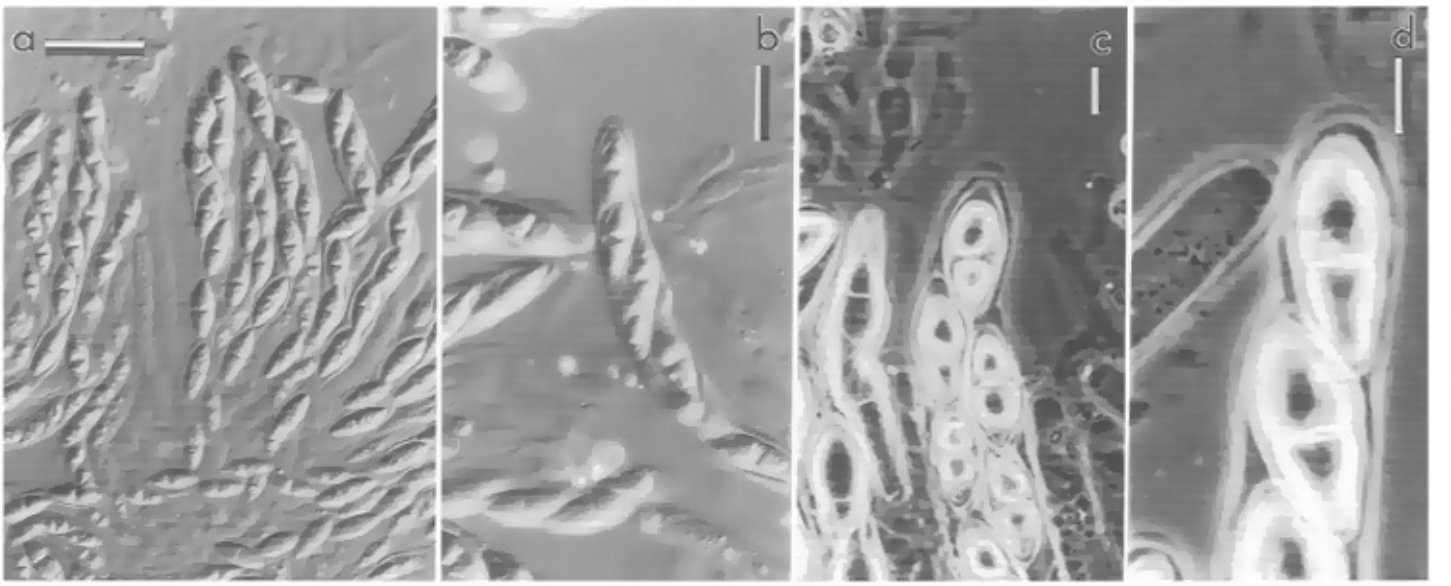


Plate 36. a–d. *Xenonectriella lutescens*. a. Asci with ascospores and remnants of apical paraphyses. b. Asci with ascospores. c. Asci with ascospores in phase contrast microscopy. d. Close-up of ascal apex in phase contrast microscopy. a–d. GZU 47–11-78. Scale bars: a = 50 μm; b = 25 μm; c, d = 10 μm.

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

a *textura prismatica* of elongate cells, 7–10 × 3.5 µm, cells becoming more elongate near the apex to form a broad papilla, cells parallel, oriented toward the apex; inner region 5–7 µm thick, of thin-walled, elongate cells forming a *textura prismatica*. Sterile hyphae among the asci, tending to be much branched, highly irregular in form, constricted at the septa. Asci cylindrical, 135–180 × 12–19.5 µm, with simple apex, 2-spored, ascospores uniseriate. Ascospores fusiform to naviculate, 23–32 × 7.5–11 µm, muriform with 4–6 often oblique transverse septa, and 0–4 obliquely longitudinal septa, the basal cell may be conspicuously attenuated, ends subacute or papillate, often covered with an up to 3 µm thick sheath, hyaline, becoming yellow, smooth, slightly verrucose with age.

HABITAT.— On the thallus of the lichen *Solorina*.
DISTRIBUTION.— Germany.

TYPE.— GERMANY. Bavaria, Kreuzberg near Vilseck, Oberpfalz, parasitic on the thallus of *Solorina saccata*, F. Arnold, Sep 1882, Rehm Ascomyceten 681 (BPI, **lectotype** of *Nectria lutescens*, designated herein; FH, isolectotype). The type collection was distributed both as Arnold, Lichenes exs. no. 963 and Rehm, Ascomycetes no. 681.
ADDITIONAL SPECIMEN EXAMINED.— GERMANY. Allgäuer Alpen, Schwaben: Iseler über Oberjoch bei Hindelang, Nordhang, Gipfelgrat, auf *Solorina*, J. Poelt, 10 Sep 1978 (GZU 47–11–78).

ILLUSTRATIONS.— Weese (1919, Figs. 1–4).

Xenonectriella leptaleae (J. Steiner) Rossman & Lowen, *comb. nov.*

≡ *Parcidia leptaleae* J. Steiner, *in* Fritsch, Denkschr. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 68: 238. 1900.
≡ *Nectria leptaleae* (J. Steiner) R. Sant., Publ. Herb. Univ. Uppsala 13: 11. 1984.
≡ *Pronectria leptaleae* (J. Steiner) Lowen, Mycotaxon 39: 462. 1990.
= *Pronectria angulospora* Etayo, Nova Hedwiga 67: 502. 1998.

Anamorph: None known.

Ascomata immersed in apothecia and thallus of lichens, in groups of six to 10, pale orange to red, upper third red, KOH+ pale brown to black, yellow in lactic acid, obpyriform, 130–240 high × 150–325 µm diam; papilla truncate, 40–130 µm wide, nonsetose. Ascomatal wall 20 µm thick, of two regions: outer region 10 µm thick, of cells 6 × 1 µm; inner region 10 µm thick, of thin-walled, elongate cells, orange oily drops emerging from crushed ascomata. Asci clavate, 60–100 × 8–11.5 µm; apex simple; 3–8-spored; ascospores obliquely uni- to biseriate. Ascospores subglobose to ellipsoid, 8–12 × 6.5–8 µm, 1-septate, at first hyaline, then pale golden-brown, prominently tuberculate with age.

HABITAT.— On thallus and apothecia of various species of *Physciaceae*, including *Heterodermia* (Etayo, 1998), *Physcia* and *Physconia* (Santesson, 1984).
DISTRIBUTION.— Europe (Austria, France, Sweden, Turkey) and United States (Oklahoma).

HOLOTYPE.— TURKEY. Belgrade woods: Umgebung von Konstantinopel, on the apothecial disc of *Physcia leptaleae*, 1896/97, J. Nemetz 2957 (WU).
SELECTED SPECIMENS EXAMINED.— AUSTRIA. Steiermark: Hochschwab-Gruppe, an der Straße von *Thörl* zum Gasthof Bodenbauer, kurz vor dem Moarhaus *ca* 2.5 km NW von Innerzwain, *ca* 840 m, am Straßenrand, on *Physcia stellaris*, on *Tilia*, 21 June 1985, J. Hafellner 13266 (GZU); Steiermark: Eisenerzer Alpen, Gößgraben NW von Trofaiach, an Alleebäumen *ca* 2 km taleinwärts von Oberdorf, *ca* 800 m, on *Physcia stellaris* on *Quercus rubra* (cult.), 1 Apr 1984, J. Hafellner 11148 (GZU); Steiermark: Gesäuse-Gebiet, Johnsbach, *ca* 0.5 km E des Gasthofs Kölbl, *ca* 875 m, Grundfeld 8453/4, on *Physcia aipolia*, on *Fraxinus exelsior*, 20 May 1988, J. Hafellner 20289 & E. Schreiner (GZU). SWEDEN. Jämtland: Brunflo par., Torvalla, on *Physcia stellaris*, on twigs of *Salix caprea*, 18 Aug 1948, R. Santesson 48502 (S; IMI 292399); UNITED STATES. Oklahoma: Cherokee County, along Terapin Creek, *ca* 6 mi N of St. Rd. 82, on St. Rd. 100, on *Physcia caesia*, 23 Apr 1988, R.C. Harris 21337 (NY).

KEY TO THE SPECIES OF *XENONECTRIELLA*

1. Ascospores fusiform to naviculate, initially transversely multiseptate, becoming muriform, 23–32 × 7.5–11 µm; immersed in the thallus of *Solorina* ..... *X. lutescens*
1. Ascospores subglobose to ellipsoid or cylindrical, 1-septate; immersed in apothecia and thallus of lichens other than *Solorina* 2

2. Ascospores ellipsoid, (18–)25–31 × 7–9(–10) µm; immersed in thalli of *Peltigera* ..... *X. ornamentata*
2. Ascospores subglobose to ellipsoid or cylindrical, less than 18 µm long 3

3. Ascospores subglobose to ellipsoid, 8–12 × 6.5–8 µm; immersed in apothecia and thalli of *Physciaceae* ..... *X. leptaleae*
3. Ascospores ellipsoid to cylindrical, (10–)12.5–16 × (7–)8–10 µm; immersed in thalli of *Sticta* ..... *X. streimannii*

Notes.— Based on the description of *Pronectria angulospora*, this recently described species is regarded as a synonym of *Xenonectriella leptaleae* having distinctive KOH+ ascomata, relatively small, tuberculate ascospores, and a lichen host in the *Physciaceae*.

Xenonectriella ornamentata (D. Hawksw.) Rossman, *comb. nov.*

≡ *Nectriella ornamentata* D. Hawksw., Nova Hedwigia 35: 756. 1982 [1983].
≡ *Pronectria ornamentata* (D. Hawksw.) Lowen, Mycotaxon 39: 462. 1990.

Anamorph: None known.

Lichen thallus appearing dead where infected, upper cortex discolored, whitish. Ascomata immersed, scattered or in groups of up to 50, obpyriform, 290–360 high × 290–320 μm diam, dark red, sometimes black when dry, KOH+ very dark red, yellow in lactic acid, papilla truncate, 60–85 μm high × 100–120 μm diam, ostiolate, non-setose. Ascomatal wall 10 μm thick, of one region of thick-walled angular to circular cells. Asci clavate, 70–100 × 7–13 μm; usually containing 4 mature ascospores and 4 hyaline, deteriorated ascospores; apex truncate, simple; ascospores uniseriate. Ascospores ellipsoid, (18–)25–31 × 7–9(–10) μm, 1-septate, slightly constricted, at first hyaline, then pale brown, tuberculate, tubercules 1–1.5 μm × 1–2 μm.

Habitat.— On thallus of *Peltigera*.
Distribution.— Europe (Andorra *fide* Martínez & Hafellner, 1998, Luxembourg, Switzerland, Sweden), Greenland, Iceland.

Holotype.— ICELAND. Jokuldalur, in thallus of *Peltigera*, 26 June 1970, P.B. Topham (IMI 247733).
Selected specimens examined.— LUXEMBOURG. Gutland: Between Dudelange and Kayl, Haardt, on *Peltigera* among mosses or vegetable debris, 24 Feb 1989, P. Diederich 9009 & C. Roux (LG). SWITZERLAND. Valais: Aletschwald between Grossem Aletschgletscher and Riederalp oberhalb Mörel, elev. 1840 m, on *Peltigera*, 20 Sep 1973, P. Döbbeler 560 (GZU). SWEDEN. Jämtland: Åre s:n, Handö, elev. *ca* 550 m, on *Peltigera lepidophora*, 4 Aug 1948, R. Santesson 48.182 (herb. R. Sant., UPS).

Notes.— This species is placed in *Xenonectriella* based on the dark red, KOH+, lichenicolous ascomata and pale brown, tuberculate ascospores as described by Hawksworth (1982b).

Xenonectriella streimannii (Kondratyuk, Coppins & D.J. Galloway) Rossman, *comb. nov.*

≡ *Pronectria streimannii* Kondratyuk, Coppins & D.J. Galloway, Muelleriana 9: 93. 1996.

Ascomata immersed in the thallus, developing in the middle layer and damaged upper cortex, single or aggregated, obpyriform, 300–350 μm high × 270–300(–350) μm diam, pale pink, rose, orange to slightly orange-brown, or red-violet, KOH reaction unknown, papillae 100–130 μm high × 80 μm diam. Ascomatal wall prosenchymatous, outer region of cells, 6.5–10.5(–12) × 2–8 (–9) μm, with red-brown, thickened walls; inner region of elongate, thin-walled cells, less intensely pigmented to hyaline. Asci 80–100 × 10–12 μm, 8-spored, ascospores uniseriate. Ascospores ellipsoid with rounded apices when young, becoming cylindrical, (10–)12.5–16 × (7–)8–10 μm, 1-septate, olivaceous-brown, verruculose, warts 1–2 μm diam. Description based on Kondratyuk (1996).

Habitat.— On thallus of the lichen *Sticta cyphellulata*.
Distribution.— Australia, known only from the type.

Holotype (not examined): AUSTRALIA. Queensland: Barron State Forest, Herberton Range, 11 km SSW of Atherton, 7° 22′ S, 145°36′ E, 1050 m, rain forest, logged in the past, on *Sticta cyphellulata* on treelet stem, 2 Mar. 1983, H. Streimann 27294 (CBG 830 4195).

Notes.— Despite the unknown color reaction of the ascomata in KOH and lactic acid, this hypocrealean species belongs in *Xenonectriella* based on the occurrence on lichen thalli, ascomatal color, and warted, thick-walled, brown ascospores.