

**BIONECTRIACEAE** Samuels & Rossman, *fam. nov.*

Type: *Bionectria* Speg., Bol. Acad. Nac. Ci. 23: 563. 1919.

[= *Seliniaceae* Arx & E. Müll., Acta Bot. Neerl. 4: 121. 1955, nom. inval., Art. 36.1]

Ascomata perithecialia, raro cleistothecialia, candida, flava, aurantiaca, spadicea vel fusca, nec KOH nec acido lactico mutantia, centrum typi *Nectriae*.

Ascomata perithecial, rarely cleistothecial, white, yellow, orange to tan or brown, not changing color in KOH or lactic acid, centrum of *Nectria*-type.

The *Bionectriaceae* are characterized by having uniloculate perithecial, rarely cleistothecial, ascomata that are

pallid, ranging in color from white, yellow, orange to tan or brown, do not change color in KOH or lactic acid, and are generally superficial, lacking a stroma, or are immersed in the substratum. The *Bionectriaceae* include 26 genera. Five of the six cleistothecial hypocrealean genera, namely *Battarrina*, *Emericellopsis*, *Heleococcum*, *Mycoarachis*, and *Roumegueriella*, are placed in the *Bionectriaceae*. These cleistothecial genera lack the centrum characteristics that place them definitively in the *Hypocreales* but the ascomatal wall structure and anamorph suggest the *Bionectriaceae*. Except for *Battarrina* which is as yet unstudied, molecular studies have confirmed the affinities of these genera with the *Bionectriaceae* (Rehner & Samuels, 1994, 1995; Ogawa *et al.*, 1997; Spatafora & Blackwell, 1993).

**KEY TO THE GENERA OF THE *BIONECTRIACEAE***

1. Ascomata cleistothecial, globose, without an organized hymenium; asci generally globose, clavate in *Heleococcum* ..... 2
1. Ascomata perithecial, subglobose to pyriform, with organized hymenium; asci elongate ..... 6
- 2 (1). Ascomata dark olive-green to black or hyaline, but appearing brownish due to pale brown ascospores ..... 3
2. Ascomata hyaline to pale gray, bright yellow or reddish brown ..... 4
- 3 (2). Ascospores broadly ellipsoid, 1-septate, smooth-walled ..... **Mycoarachis**
3. Ascospores ellipsoid, non-septate, ornamented with elongate wings . **Emericellopsis**
- 4 (2). Ascospores ellipsoid, 1-septate, smooth to ornamented with wings; anamorph *Acremonium*-like or unknown ..... **Heleococcum**
4. Ascospores globose, non-septate, ornamented with sharp, pointed spines ..... 5
- 5 (4). Ascomata on sporocarps of *Tuber*; ascospores 4-6  $\mu\text{m}$  diam, with sparse echinulations; anamorph unknown ..... **Battarrina**
5. Ascomata on dung, compost, damp paper and various kinds of organic detritus; ascospores more than 6  $\mu\text{m}$  diam, densely echinulate; anamorph, where known, *Gliocladium*-like ..... **Roumegueriella**
- 6 (1). Ascomata immersed in the substratum or in a stroma that may itself be immersed in the substratum ..... 7
6. Ascomata superficial or immersed in a hyphal subiculum or thin stroma ..... 13
- 7 (6). Ascomata immersed in a stroma that may itself be immersed in the substratum; ascospores non- to one-septate; on dung, corticolous, or herbicolous, not lichenicolous or fungicolous ..... 8
7. Ascomata immersed in substratum, non-stromatic, usually solitary; ascospores non- to multiseptate or muriform; corticolous, herbicolous, fungicolous or lichenicolous, not on dung ..... 10

- 8 (7). Ascospores non-septate, more than 40  $\mu\text{m}$  long, hyaline, smooth, thick-walled; on dung ..... **Selinia**
8. Ascospores 1-septate, less than 20  $\mu\text{m}$  long; herbicolous or corticolous ..... 9
- 9 (8). Ascomata in a stroma immersed in bambusoid grasses or in living or dead wood; ascospores hyaline or yellow-brown, coarsely striate with age ..... **Valsonectria**
9. Ascomata immersed in a well-developed, tuberculate to very large stroma, over 5 cm diam, surrounding living stems of bamboo-like grass; ascospores hyaline, smooth to finely spinulose ..... **Mycocitrus**
- 10 (7). On algae or wood in marine habitats; ascomata without or each with a long neck 11
10. Terrestrial or in freshwater habitats; ascomata without a long neck ..... 12
- 11 (10). Ascomata each with a long neck, immersed in algae or wood in marine habitats; ascospores long-fusiform, non-septate, smooth-walled ..... **Halonectria**
11. Ascomata without neck or papilla, erumpent on woody substrata in marine habitats; ascospores ellipsoid, 1-septate, smooth-walled or longitudinally striate ... **Kallichroma**
- 12 (10). Ascomata immersed in herbaceous tissue, bark or wood, rarely fungicolous; anamorphs *Acremonium* or *Kutilakesa* ..... **Nectriella**
12. Ascomata immersed in thalli of terrestrial lichens, rarely on algae or fungi; anamorphs, where known, *Acremonium* ..... **Pronectria**
- 13 (6). Ascospores with long, attenuated ends; on lichens or algae ..... **Paranectria**
13. Ascospores with rounded ends; on lichens, algae or other substrata ..... 14
- 14 (13). Ascomata with straight, solitary hairs; ascospores 1- to multiseptate **Trichonectria**
14. Ascomata without hairs or, if present, hairs fasciculate or flexuous; ascospores generally 1-septate ..... 15
- 15 (14). Ascomata usually superficial on a thin subiculum; anamorph *Gliocladium*; on *Aphylliphorales* ..... **Sphaerostilbella** (*Hypocreaceae*)
15. Ascomata superficial on substratum or immersed in a stroma; if superficial on a thin to cottony subiculum, then not on *Aphylliphorales* ..... 16
- 16 (15). Ascomata immersed in a stroma or superficial with white to tan or green hyphae covering the ascomatal wall ..... 17
16. Ascomata superficial, seated directly on the substratum and without white to tan hyphae covering the ascomatal wall ..... 19
- 17 (16). Ascomata immersed, loosely united in a thin, pseudoparenchymatous stroma; ascomata less than 160  $\mu\text{m}$  diam, walls less than 10  $\mu\text{m}$  thick; ascospores narrowly cylindrical, smooth-walled ..... **Clibanites**
17. Ascomata immersed in an effused hyphal stroma or superficial with a covering of white to tan or green hyphae; ascomata more than 200  $\mu\text{m}$  diam, walls more than 20  $\mu\text{m}$  thick; ascospores ellipsoid to fusiform, smooth, striate, spinulose or tuberculate ..... 18
- 18 (17). Ascomata immersed in an effused hyphal stroma; ascospores generally striate, less often smooth or tuberculate; anamorphs *Acremonium*-like; usually on monocotyledonous plant debris ..... **Protocreopsis**
18. Ascomata immersed in an effused hyphal stroma or superficial with tan hyphae covering the ascomatal wall; ascospores spinulose or verrucose; anamorphs synnematos (*Stilbella*) or *Acremonium*-like; corticolous, sometimes on other ascomycetes ..... **Stilbocrea**

- 19 (16). Ascomata white to pale yellow, small, generally < 200  $\mu\text{m}$  diam, wall thick, smooth or covered with flexuous hairs; ascospores smooth or spinulose, rarely striate; anamorphs, where known, *Acremonium*-like, *Gliocladium*-like, or *Septofusidium*; fungicolous, on myxomycetes, pyrenomycetes and dematiaceous hyphomycetes, rarely on *Aphyllphorales*, or on liverworts and mosses ..... 20
19. Ascomata white to orange, sometimes with white warts, generally > 200  $\mu\text{m}$  diam, wall > 20  $\mu\text{m}$  thick, smooth to conspicuously warted, with or without hyphal to fasciculate hairs; ascospores smooth, spinulose or striate; corticolous, less often fungicolous or herbicolous ..... 22
- 20 (19). Ascomata on liverworts or mosses ..... **Bryonectria**
20. Ascomata on myxomycetes, pyrenomycetes or dematiaceous hyphomycetes, rarely on *Aphyllphorales* ..... 21
- 21 (20). Ascomata on *Asterina*, *Meliola*, *Schnifferula*, growing on superficial, black hyphae covering living leaves ..... **Dimerosporiella**
21. Ascomata on other fungi, including myxomycetes, not on *Meliola* or similar fungi on living leaves ..... **Nectriopsis**
- 22 (19). Ascomata globose to subglobose, occasionally doliiform, becoming cupulate upon drying; ascomatal wall of globose, thin-walled cells; ascospores often striate; anamorphs *Acremonium*-like ..... 23
22. Ascomata globose to subglobose or ovoidal, generally not cupulate upon drying; ascomatal wall of thick-walled cells; ascospores smooth, spinulose or striate; anamorphs *Acremonium*-like, *Clonostachys* or *Didymostilbe* ..... 24
- 23 (22). Ascomata of three regions, with orange oil droplets in the middle region of the wall ..... **Ochronectria**
23. Ascomata of two regions, without orange oil droplets ..... **Hydropisphaera**
- 24 (22). Ascomata with a flattened apex, often with solitary or fasciculate hairs forming an apical fringe; ascospores striate or spinulose; anamorphs *Acremonium*-like or unknown .... 25
24. Ascomata without distinct hairs, smooth to warted or with short, hyphal hairs; ascospores smooth, spinulose or rarely striate; anamorphs *Clonostachys* or *Didymostilbe* ..... 26
- 25 (24). Ascomata yellow-brown to dark brown, globose to subglobose, with solitary stiff or hyphal hairs, not forming a distinct fringe; ascospores striate or spinulose; anamorphs *Acremonium*; herbicolous or corticolous ..... **Lasionectria**
25. Ascomata white to pale yellow, globose to ovoidal, with a flattened apical disk, often with a fringe of fasciculate hairs; ascospores striate, rarely spinulose; herbicolous .... **Ijuhya**
- 26 (24). Ascomata white to pale yellow, with large concolorous warts; ascospores hyaline to golden brown, smooth or faintly striate; anamorph *Fusarium* ..... **Albonectria** (*Nectriaceae*)
26. Ascomata white, bright yellow, orange, tan to brown, smooth, scurfy or with large, white warts; ascospores hyaline, spinulose or striate; anamorph *Clonostachys* or *Didymostilbe* ..... 27
- 27 (26). Ascomata bright- to dark yellow, with walls over 50  $\mu\text{m}$  thick; ascospores broadly reniform to broadly fusiform, with rounded ends, more than 30  $\mu\text{m}$  long; anamorph synnematous, *Didymostilbe* ..... **Peethambara**
27. Ascomata white, yellow, tan, to brown, with walls less than 50  $\mu\text{m}$  thick; ascospores ellipsoid to fusiform, less than 30  $\mu\text{m}$  long; anamorph not synnematous, *Clonostachys* ..... **Bionectria**

## THE GENERA OF THE *BIONECTRIACEAE*

**BATTARRINA** (Sacc.) Clem., *in* Clem. & Shear, *Genera of Fungi* p. 279. 1931.

= *Hypocrea* subgenus *Battarrina* Sacc., *Syll. Fung.* 2: 533. 1883.

Type: *Battarrina inclusa* (Berk. & Broome) Clem. (= *Hypocrea inclusa* Berk. & Broome).

Ascomata immersed in host tissue, forming in discolored areas, non-ostiolate, hyaline to pale yellow, globose, about 250  $\mu\text{m}$  diam, walls thin, membranous. Asci evanescent, scattered, without an organized hymenium. Ascospores globose to angular, non-septate, hyaline, sparsely echinulate. Anamorph unknown. On fruiting bodies of *Tuber*.

NOTES.— *Battarrina* was established as a subgenus of *Hypocrea* for species with globose ascospores. Although three species, *H. inclusa*, *H. cervina* Berk. & M.A. Curtis, and *H. cerebriformis* Berk., were included in the subgenus, the taxon was raised to generic rank with only *B. inclusa* and remains a unispecific genus. Benny & Kimbrough (1980) included *Battarrina* in the *Hypocreales* based on the literature.

**Battarrina inclusa** (Berk. & Broome) Clem., *in* Clem. & Shear, *Genera of Fungi* p. 279. 1931.

= *Hypocrea inclusa* Berk. & Broome, *Ann. Mag. Nat. Hist.*, Ser. 3, 7: 461. 1861.

Ascomata about 250  $\mu\text{m}$  diam, cleistothecial, hyaline to pale yellow, membranous, thin-walled, wall structure of parallel hyphae up to 4  $\mu\text{m}$  diam. Asci cylindrical, 30–33  $\times$  5–6  $\mu\text{m}$ , clavate when young, evanescent at maturity, 8-spored, ascospores uniseriate. Ascospores globose to slightly angular, 4–6  $\mu\text{m}$  diam, hyaline, thin-walled with sparse, slender echinulations about 1  $\mu\text{m}$  tall.

HABITAT.— Parasitic in ascomata of *Tuber puberulum* Berk. & Broome.

DISTRIBUTION.— England.

HOLOTYPE.— ENGLAND. Bristol, Leigh Wood, Sept. 1859, C.E. Broome (K).

ADDITIONAL SPECIMENS EXAMINED.— ENGLAND. N. Bristol, Nov. 1869, C.E. Broome 2335 (K); Hanham near Bristol, Nov. 1871, C.E. Broome, Rabenhorst, *Fungi Europ.* 1610 (BPI, K, UPS).

ILLUSTRATIONS.— Berkeley & Broome (l.c., 1861, Fig. 23); Hawker (1955, Fig. 2); Petch (1938, Fig. 2).

NOTES.— The type specimen of *Battarrina inclusa* was

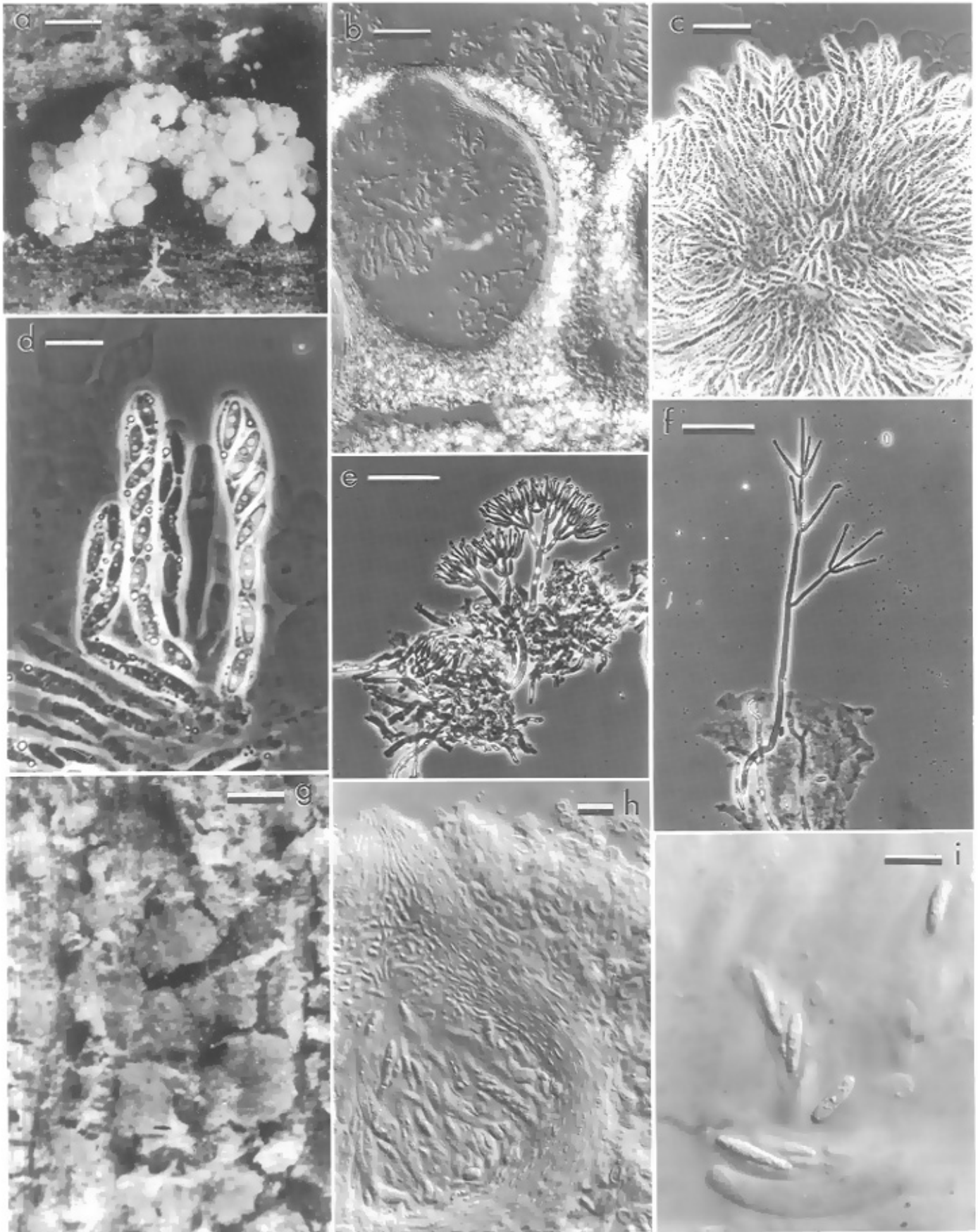
examined and found to be in poor condition apparently having been stored in liquid preservation and subsequently dried. The two sections of the host ascomata of *Tuber puberulum* contain indistinct ascomata of *B. inclusa*, appearing on the cut surface as glazed, pale-yellow areas. These areas are packed with asci and ascospores. The specimens of *Fungi Europaei* 1610 were also in poor condition. Petch (1938) included *B. inclusa* in his account of the British *Hypocreales*, based on the type description. Hawker (1955) discussed the species based on a fresh collection from Great Britain that was not located. Due to the poor condition of the type specimen and lack of additional specimens, many characteristics of *B. inclusa* remain obscure. The description given here includes details from Hawker (1955) and Petch (1938).

**BIONECTRIA** Speg., *Bol. Acad. Nac. Ci.* 23: 563. 1919.

Type: *B. tonduzii* Speg.

Ascomata solitary to gregarious, superficial to slightly immersed in an erumpent stroma, often occurring on other fungi. Ascomata white, yellow, pale orange, tan or brown. KOH–, wall smooth to warted or with scales, thin-walled hairs or flexuous setae, subglobose or globose to ovoid, when dried not collapsing or collapsing irregularly, ostiolate. Asci narrowly clavate to clavate. Ascospores 1-septate, rarely multiseptate, hyaline, smooth to spinulose or slightly warted. Anamorph *Clonostachys*. On leaves and decaying woody substrata.

NOTES.— At present *Bionectria* includes species formerly placed in the *Nectria ochroleuca*-group (Samuels, 1976a; Rossman, 1983; Schroers & Samuels, 1997), but it may also include species placed in the *N. ralfsii*-group (Samuels, 1976a), the *N. muscivora*-group (Rossman, 1983; Samuels, 1988), and species of *Nectria* having *Sesquicillium* anamorphs (Samuels, 1989a). Apart from having pallid perithecia, these species are similar in gross morphology and wall anatomy of the perithecium (Schroers & Samuels, 1997; Schroers *et al.*, 1999). Most species occur on woody substrata and are readily grown on agar. Anamorphs of species of *Bionectria* are useful in distinguishing species (Schroers *et al.*, 1999) and are classified primarily in *Clonostachys* (syn. *Dendrodochium*) or *Myrothecium*-like, the groups differing from each other by conidial color, viz. salmon in *Clonostachys*, and dark



**Plate 1.** a–f. *Bionectria ochroleuca* and anamorph, *Clonostachys rosea*. a. Ascomata. b. Median section of ascoma. c. Asci with ascospores and inflated cells of apical paraphyses. d. Asci with ascospores. e. Penicillate conidiophores of anamorph. f. Verticillate conidiophore of anamorph. g–i. *Clibanites paradoxa*. g. Stroma with ascomata. h. Median section of ascoma. i. Ascospores. a–d. BPI 749158. e–f. Anamorph grown from BPI 737784. g–i. Holotype of *Clibanites paradoxa* – H. Scale bars: a = 500  $\mu\text{m}$ ; b, e, f = 50  $\mu\text{m}$ ; c = 25  $\mu\text{m}$ ; d, h, i = 10  $\mu\text{m}$ ; g = 250  $\mu\text{m}$ .

green in *Myrothecium*-like anamorphs. *Bionectria ochroleuca*, particularly as its anamorph *Clonostachys rosea*, is one of the most commonly encountered soil fungi and is often cited in the biological control literature as a destructive mycoparasite (Schroers *et al.*, 1999).

***Bionectria tonduzii*** Speg., Bol. Acad. Nac. Ci. 23: 563. 1919 [as '*tonduzi*'].

≡ *Nectria tonduzii* (Speg.) Samuels, Mem. New York Bot. Garden 48: 22. 1988 [as '*tonduzi*'].

Mycelium tan, spreading. Ascomata seated in mycelium, solitary to caespitose in groups of up to 15, partially immersed in an erumpent, granular stroma, globose, 250–280 µm diam, non-papillate, wall warted, pale orange, KOH–, warts lighter, ascomata collapsing by lateral pinching. Surface of ascomatal wall of nearly circular cells in outline, 12–25 µm diam, walls slightly thickened, 2–4 µm. Ascomatal wall about 50 µm thick, of two regions: outer region about 25 µm thick, of cells circular to slightly elongate, 12–25 µm diam, forming warts up to 50 µm high; inner region about 25 µm thick, of cells flattened to fusiform, 10–15 × 2–3.5 µm. Ascomatal apex of narrow, about 1 µm wide hyphal elements arising from the inner ascomatal wall. Asci clavate, (62–)64–81(–85) × (11–)12.5 × 15 µm, apex broad, simple, 8-spored, ascospores entirely or partially biseriolate. Ascospores fusiform, (16–)19.5–24.5(–27) × (5–)5.5–6.5(–7) µm, 1-septate, hyaline, smooth to spinulose.

ANAMORPH.— None known.

HABITAT AND DISTRIBUTION.— Known only from the type collection.

HOLOTYPE.— COSTA RICA. San José: on leaves of *Byttneria carthagenensis*, possibly parasitizing ascomata of *Puiggarina costaricensis* Syd. (LPS).

ILLUSTRATIONS.— Samuels (1988, Figs. 5 a, b, as *N. 'tonduzi'*); Schroers & Samuels (1997, Fig. 6).

NOTES.— *Bionectria* was established for species that are like *Nectria* but occur on living plant parts. The type species of *Bionectria*, *B. tonduzii*, occurs on living leaves of *Byttneria carthagenensis* Jacq. (*Sterculiaceae*), possibly parasitizing ascomata of *Puiggarina costaricensis* Syd. Samuels (1988) redescribed and illustrated this species based on an examination of the type specimen. *Bionectria tonduzii* has never been cultured or linked to an anamorph.

The four species of *Bionectria* listed below in addition to the type were recently treated by Schroers & Samuels (1997) including color illustrations and references to recent descriptions.

***Bionectria apocyni*** (Peck) Schroers & Samuels, Z. Mykol. 63: 153. 1997.

≡ *Nectria apocyni* Peck, Bull. Buffalo Soc. Nat. Sci. 1: 71. 1873.

***Bionectria aureofulva*** (Cooke & Ellis) Schroers & Samuels, Z. Mykol. 63: 153. 1997.

≡ *Nectria aureofulva* Cooke & Ellis, Grevillea 7: 8. 1878.

***Bionectria byssicola*** (Berk. & Broome) Schroers & Samuels, Z. Mykol. 63: 152. 1997.

≡ *Nectria byssicola* Berk. & Broome, J. Linn. Soc. Bot. 14: 116. 1873.

***Bionectria ochroleuca*** (Schwein.) Schroers & Samuels, Z. Mykol. 63: 151. 1997. — Plate 1, a–f.

≡ *Sphaeria ochroleuca* Schwein., Trans. Amer. Philos. Soc., N.S. 4: 204. 1834.

≡ *Nectria ochroleuca* (Schwein.) Berk., Grevillea 4: 16. 1875.

Anamorph: *Clonostachys rosea* (Link : Fr.) Schroers *et al.*, Mycologia 91: 369. 1999.

A detailed account of *B. ochroleuca* and its *Clonostachys rosea* anamorph is given by Schroers *et al.* (1999).

SPECIMENS EXAMINED.— MEXICO. Veracruz: Laguna Verde, on dead leaves of *Yucca* sp., 2 Oct 1994, G. Bills, G.J.S. 94-122 (BPI 737784); PUERTO RICO. Caribbean National Forest: Luquillo Mts., Bisley Experimental Watershed, on dead bark of *Mangifera indica*, elev. 300 m, 21 Feb 1996, G.J. Samuels, H.J. Schroers (H.J.S. 82), D.J. Lodge, det. H.J. Schroers (BPI 749158).

KEY TO THE SPECIES OF *BIONECTRIA*

1. Ascospores more than 15  $\mu\text{m}$  long, warted ..... 2
1. Ascospores generally less than 15  $\mu\text{m}$  long, smooth, warted or spinulose ..... 3
2. On living leaves, possibly associated with stromatic fungi; ascomata with warts up to 50  $\mu\text{m}$  high; ascospores 19.5–24.5  $\times$  5.5–6.5  $\mu\text{m}$  ..... *B. tonduzii*
2. On decaying bark or wood; ascomata smooth; ascospores 16–33  $\times$  4.5–9.5  $\mu\text{m}$  ..... *B. apocyni*
3. Ascomata orange with conspicuous white warts; ascospores ellipsoid, (10–)11–14(–16)  $\times$  4–5(–6)  $\mu\text{m}$ , smooth or spinulose ..... *B. byssicola*
3. Ascomata orange to brown, smooth to slightly scaly or covered with a thin layer of hyphae ..... 4
4. Ascomata smooth; ascospores 8.5–15  $\times$  2.5–5  $\mu\text{m}$ , spinulose or warted ..... *B. aureofulva*
4. Ascomata slightly scaly or covered with a thin layer of hyphae; ascospores 7.5–14.5  $\times$  2.5–4.5  $\mu\text{m}$ , slightly spinulose ..... *B. ochroleuca*

**BRYONECTRIA** Döbbele, Nova Hedwigia 66: 334. 1998.

Type: *B. hylocomii* (Döbbele) Döbbele (= *Nectria hylocomii* Döbbele, Mitt. Bot. Staatssamml. München 14: 78. 1978).

Ascomata superficial, with hyphae penetrating the host cells, solitary or rarely aggregated, non-stromatic, globose to obpyriform, 80–200  $\mu\text{m}$  diam, hyaline to white, not changing color in KOH or lactic acid or rarely reacting. Smooth or with short setae. Ascomatal wall of thick-walled cells. Asci ellipsoid to cylindrical, with or without an apical ring. Ascospores ellipsoid, 1- or 2-septate, hyaline, often with a guttule in each cell. Anamorph unknown. Parasitic on liverworts and mosses.

NOTES.— *Bryonectria* was described to accommodate six species of hypocrealean fungi that occur on foliose liverworts and mosses.

**CLIBANITES** P. Karst., Bidrag Kännedom Finlands Natur Folk 19: 14. 1871.

= *Peziza* sect. *Clibanites* P. Karst., Monogr. Peziz. Fenn. p. 155. 1869. — Type: *C. paradoxa* (P. Karst.) P. Karst. (= *Peziza paradoxa* P. Karst.).

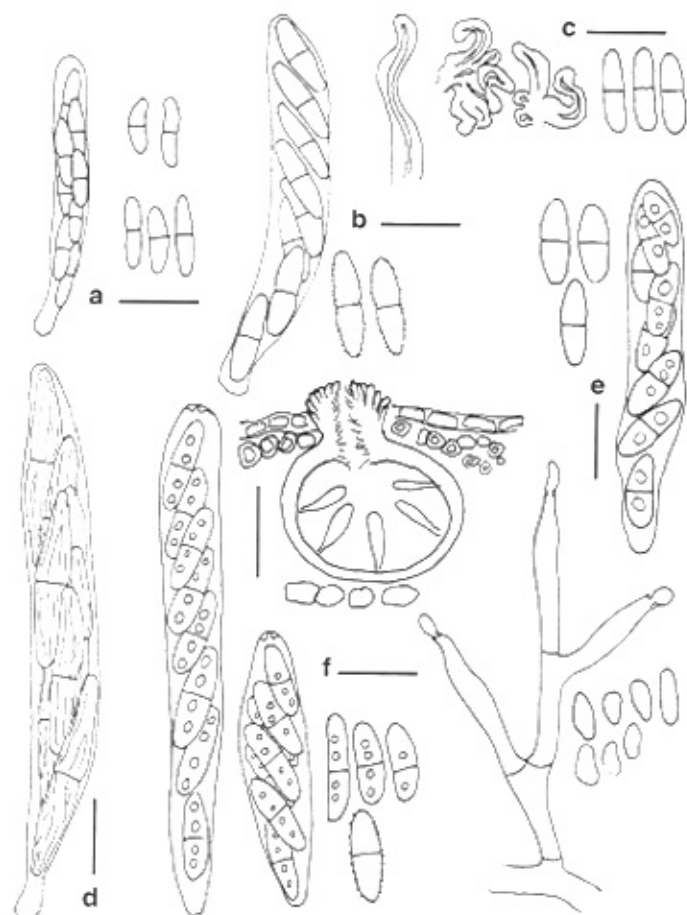
Stroma of intertwined hyphae in the middle and at the base, with highly compacted hyphae near the surface, ascomata immersed in a stroma, loosely united in groups up to ten. Ascomata globose, dark yellow, non-papillate, apex not differentiated, ostiolar canal periphysate, not collapsed upon drying. Ascomatal wall ca 10  $\mu\text{m}$  thick, of several layers of small, flattened cells. Asci subcylindrical, apex broad, blunt, with a ring, as-

cospores biserial. Ascospores narrowly cylindrical, equally 2-celled, not constricted, hyaline, smooth. Anamorph unknown. On well-rotted wood of *Quercus*. NOTES.— *Clibanites* is a unispecific genus originally described by Karsten as a discomycete. An examination of the type specimen reveals that, based on the small, thin-walled, pallid ascomata and non-disarticulating ascospores, *C. paradoxa* is similar to *Nectriopsis* in the *Bionectriaceae*. It differs from *Nectriopsis* in having relatively thick-walled ascomata loosely united in a common stroma and in the non-fungicolous habit.

**Clibanites paradoxa** P. Karst., Bidrag Kännedom Finlands Natur Folk 19: 14. 1871. — Plate 1, g–i, Plate 2, a.

= *Peziza paradoxa* P. Karst., Monogr. Peziz. Fenn. p. 155. 1869.

Stroma superficial on decorticated wood, evident as pallid scurf, dissected and squamose (possibly as an artifact of drying), entire stromal aggregate easy to remove; ascomata loosely united into groups of up to 10, immersed in a stroma, adjacent ascomata evident as slightly tuberculate, ostiolate areas, ascomata joined by a subiculum of smooth-walled, 2–3  $\mu\text{m}$  wide, branched, septate hyphae with few free ends, thin-walled, hyaline in transmitted light. Stroma 25–30  $\mu\text{m}$  thick, surface consisting of highly compacted, ca 3  $\mu\text{m}$  wide hyphae; internally hyphae more loosely disposed. Ostioles visible as viscid dots against the dull background of the ascomatal wall. Ascomata globose, ca 100–160  $\mu\text{m}$  diam, pale yellow, KOH–, non-papillate, not collapsed on drying, ostiolar canal periphysate. Ascomatal wall ca 10  $\mu\text{m}$  thick, of one region of small,



**Plate 2.** a. *Clibanites paradoxa*, asci and ascospores. b. *Hydriophora rufofusca*, ascus and ascospores. c. *Ijuhya aquifolii*, ascumata hairs and ascospores. d. *Ijuhya chilensis*, ascus. e. *Lasioneectria mantuana*, asci and ascospores. f. *Nectriella minuta*, median section of ascoma, asci, ascospores, conidiophores and conidia. a. Holotype - H. b. Holotype of *Nectriella rufofusca* - PAD. c. Lectotype of *Peziza aquifolii* - BPI 1113199. d. Holotype of *Lepidoneectria chilensis* - LPS. e. Holotype - PAD. f. Holotype - NY. Scale bars: a-f = 10  $\mu$ m, except upper figure in f = 100  $\mu$ m.

flattened cells. Asci subcylindrical, 25–30  $\times$  4–5  $\mu$ m, sessile, apex broad, blunt, with a ring, ascospores biserial. Ascospores narrowly cylindrical, 6–10  $\times$  1.5–2  $\mu$ m, equally 2-celled, not constricted, hyaline, smooth. **HABITAT AND DISTRIBUTION.**— Known only from the type specimen.

**HOLOTYPE.**— FINLAND. Runsala: 'prope oppid. supra lignum *Quercus vetustum*', 26 May 1861, P. Karsten No. 3365 (H).

**DIMEROSPORIELLA** Speg., *Revista Mus. La Plata* 15: 10. 1908.

Type: *D. paulistana* Speg.

= *Epinectria* Syd. & P. Syd., *Ann. Mycol.* 15: 215. 1917. — Type: *E. meliolae* Syd. & P. Syd.

Mycelium white, cottony, often bearing conidia, hyphae septate, branching. Ascumata scattered, superfi-

cial on white mycelium or directly on black mycelium of the host fungus, usually easily removed from substratum, subglobose, globose to obovoid, often collapsing by lateral pinching, 100–245(–270)  $\mu$ m diam, pale yellow, KOH–, non-papillate, smooth or with short, flexuous hairs up to 25  $\mu$ m long. Ascumatal wall thin, often about 10  $\mu$ m thick, with wall of non-descript, small cells, often forming a *textura epidermoidea*. Asci clavate, usually less than 70  $\mu$ m long, often with an apical ring, 8-spored. Ascospores ellipsoid, 1–3-septate, hyaline, smooth, spinulose or striate. Anamorph, where known, *Acremonium*-like. On black, thick-walled hyphae of *Asterina*, *Meliola*, *Schiffnerula* or related species on living leaves in tropical regions.

**NOTES.**— *Dimerosporiella* is herein recognized for species that have previously been placed in the *Nectria leucorrhodina*-group (Samuels, 1976a; Rossman, 1983) or treated within *Nectriopsis* (Samuels, 1988). Spegazzini placed *Dimerosporiella* near *Dimerosporium* in the *Englerulaceae* differentiated by the presence of an ostiole. Petrak & Sydow (1934) examined the rather sparse type specimen of *D. paulistana*, presented a detailed description, and concluded that this species belonged in *Nectria*. *Dimerosporiella paulistana* represents a species additional to those previously placed in the *N. leucorrhodina*-group and/or *Nectriopsis*. The unispecific genus *Epinectria* was established for a species considered to be close to *Hyalocrea* but having elongate, one-septate ascospores. Several parts of the type specimen of *E. meliolae* were examined and the fungus was determined to be a synonym of *Dimerosporiella pipericola*. Seven species are included in *Dimerosporiella* differentiated primarily by ascumatal wall surface features and characteristics of the ascospores.

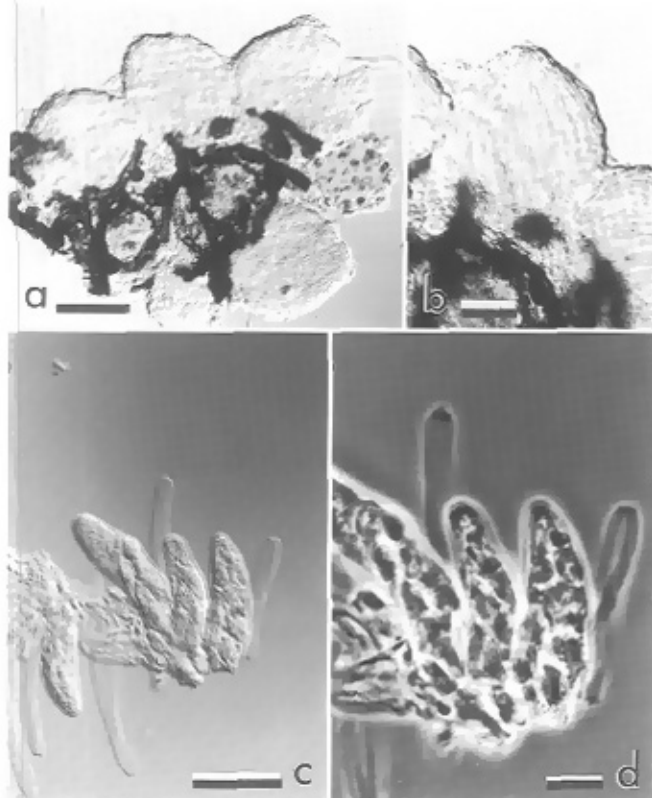
***Dimerosporiella paulistana*** Speg., *Revista Mus. La Plata* 15: 10. 1908. — Plate 3, a–d.

Ascumata superficial, on black mycelium of *Schiffnerula* and on the surrounding leaf tissue, obovoidal, minute, 117  $\mu$ m high  $\times$  80  $\mu$ m diam, pale yellow, ostiolate, thin-walled. Ascumatal wall ca 10  $\mu$ m thick, unpigmented, of *textura epidermoidea*. Asci clavate, apex thickened, with a ring, spent asci with open tops following ascospore discharge, ascospores biserial. Ascospores ellipsoid, 12–14  $\times$  4–4.5  $\mu$ m, 1-septate, hyaline, smooth.

**HABITAT.**— Known only from type specimen.

**HOLOTYPE.**— BRAZIL. São Paulo: Ipiranga Moça, on wilting leaves of *Buddleja* sp., Sep 1905, A. Uster, No. 143, det. C. Spegazzini, No. 402 (LPS).





**Plate 3. a–d.** *Dimerosporiella paulistana*. a–b. Translucent, thin-walled ascomata on black, thick-walled host hyphae. c, d. Asci with ascospores and overmature asci. a–d. Holotype – LPS. Scale bars: a = 50  $\mu$ m; b, c = 25  $\mu$ m; d = 10  $\mu$ m

#### ADDITIONAL SPECIES OF *DIMEROSPORIELLA*:

#### *Dimerosporiella cephalosporii* (Hansford) Rossman & Samuels, *comb. nov.*

= *Calonectria cephalosporii* Hansford, Mycol. Pap. 15: 117. 1946.

= *Nectriopsis cephalosporii* (Hansford) Samuels, Mem. New York Bot. Gard. 48: 38. 1988.

This species was described and illustrated in Gams (1971, anamorph only) and Samuels (1988).

#### *Dimerosporiella guarapiensis* (Speg.) Rossman & Samuels, *comb. nov.*

= *Calonectria guarapiensis* Speg., Anales Soc. Ci. Argent. 19: 41. 1885.

= *Nectria microleuca* Rossman, Mycotaxon 8: 515. 1979.

= *Nectriopsis guarapiensis* (Speg.) Samuels, Mem. New York Bot. Gard. 48: 42. 1988.

= *Nectria bakeri* Rehm, Ann. Mycol. 6: 319. 1908.

[= *Nectria perpusilla* Sacc., Ann. Mycol. 11: 515. 1913, non (Mont.) Mont. 1856].

This species was described and illustrated in Samuels (1976a, as *Nectria bakeri*, 1988).

#### *Dimerosporiella leucorrhodina* (Mont.) Rossman & Samuels, *comb. nov.* — Plate 4, a.

= *Peziza leucorrhodina* Mont., in Sagra, Hist. Phys. Cuba, Bot. Pl. Cell. p. 360. 1842.

= *Calonectria leucorrhodina* (Mont.) Speg., Anal. Soc. Ci. Argent. 19: 40. 1885.

= *Scutula leucorrhodina* (Mont.) Speg., Anal. Soc. Ci. Argent. 26: 58. 1888.

= *Belonidium leucorrhodinum* (Mont.) Sacc., Syll. Fung. 8: 501. 1889.

= *Trichobelonium leucorrhodina* (Mont.) Seaver, North Amer. Cup Fungi (Inoperculates), p. 161. 1951.

= *Nectriopsis leucorrhodina* (Mont.) Samuels, Mem. New York Bot. Gard. 48: 42. 1988.

= *Nectria byssiseda* Rehm, in Winter, Rabenhorstii Fungi Europ. Exs., Ed. Nova, Ser. 2, Cent. 22, no. 4152. 1898.

= *Calonectria tubaroënsis* Rehm, Hedwigia 37: 195. 1898.

= *Pseudomeliola collapsa* Earle, Bull. New York Bot. Gard. 3: 309. 1905.

= *Calonectria limpida* Syd. & P. Syd., Leafl. Philipp. Bot. 5: 1545. 1912.

= *Pseudomeliola pipericola* F. Stevens, Bot. Gaz. 65: 230. 1918.

= *Nectria puberula* Speg. var. *microspora* Bat. & Nascim., in Batista et al., Inst. Micol. Recife Publ. 33: 5. 1956.

= *Calonectria ukolayii* Thaug, Trans. Brit. Mycol. Soc. 67: 435. 1976.

This species was described and illustrated in Samuels (1976a, 1988).

**SPECIMEN ILLUSTRATED.**—UGANDA. Entebbe Rd., on *Meliola* on living leaves of *Trichilia buchamani*, Aug 1944, C.G. Hansford, as *Calonectria cephalosporii* (BPI 631957).

#### *Dimerosporiella oidioides* (Speg.) Rossman & Samuels, *comb. nov.*

= *Nectria oidioides* Speg., Bol. Acad. Nac. Ci. 11: 524. 1889.

= *Nectriopsis oidioides* (Speg.) Samuels, Mem. New York Bot. Gard. 48: 42. 1988.

This species was described and illustrated in Samuels (1976a, 1988).

#### *Dimerosporiella pipericola* (Henn.) Rossman & Samuels, *comb. nov.*

= *Nectria pipericola* Henn., Hedwigia 43: 244. 1904

= *Nectriopsis pipericola* (Henn.) Samuels, Mem. New York Bot. Gard. 48: 42. 1988.

= *Epinectria meliolae* Syd. & P. Syd., Ann. Mycol. 15: 215. 1917.

This species was described and illustrated in Samuels (1976a, 1988) and one synonym is added here.

**TYPE.**—PHILIPPINES: Luzon, prov. Sorsogon, parasitic on mycelium of *Meliola* on leaves of a grass, July–Aug 1915, M. Ramos (Bureau of Science 23722). (Specimen with a typed label at FH is herein designated the **lectotype** of *Epinectria meliolae*; isolectotype at FH; two isolectotypes at BPI).

KEY TO THE SPECIES OF *DIMEROSPORIELLA*

1. Ascospores generally less than 12  $\mu\text{m}$  long, smooth or finely spinulose ..... 2
1. Ascospores generally more than 12  $\mu\text{m}$  long, smooth or striate ..... 3
2. Ascospores 8–10.5  $\times$  2.5–3  $\mu\text{m}$ , smooth to finely spinulose; ascomata glabrous .....  
..... *D. guarapiensis*
2. Ascospores 9–11  $\times$  3–4  $\mu\text{m}$ , smooth; with modified, hair-like cells arising from around the  
ascomatal apex ..... *D. pipericola*
3. Ascospores (14–)17–22(–27)  $\times$  3–4  $\mu\text{m}$ , striate ..... *D. oidioides*
3. Ascospores smaller, smooth-walled, spinulose or striate ..... 4
4. Ascospores striate, (11–)12.5–16.5  $\times$  3–4  $\mu\text{m}$ ; ascomatal hairs lacking; anamorph not pre-  
sent ..... *D. leucorrhodina*
4. Ascospores smooth; ascomatal hairs present or lacking; ascomata often associated with an  
*Acremonium*-like anamorph having thick-walled conidiophores ..... 5
5. Ascospores (8.5–)11.5–15.5(–18)  $\times$  2.5–4  $\mu\text{m}$ ; ascus apex simple; with hyphal hairs arising  
from around the ascomatal apex ..... *D. cephalosporii*
5. Ascus apex with a small ring; ascomatal lacking hairs ..... 6
6. Ascospores (13.5–)14–16(–17)  $\times$  2–3.5(–4)  $\mu\text{m}$  ..... *D. sensitiva*
6. Ascospores 12–14  $\times$  4–4.5  $\mu\text{m}$  ..... *D. paulistana*

***Dimerosporiella sensitiva*** (Rehm) Rossman & Samuels, *comb. nov.*

≡ *Nectria sensitiva* Rehm, *Hedwigia* 39: 222. 1900.

≡ *Nectriopsis sensitiva* (Rehm) Samuels, *Mem. New York Bot. Gard.* 48: 40. 1988.

This species was described and illustrated in Samuels (1988).

**EMERICELLOPSIS** J.F.H. Beyma, *Antonie van Leeuwenhoek Ned. Tijdschr. Hyg.* 6: 263. 1940.

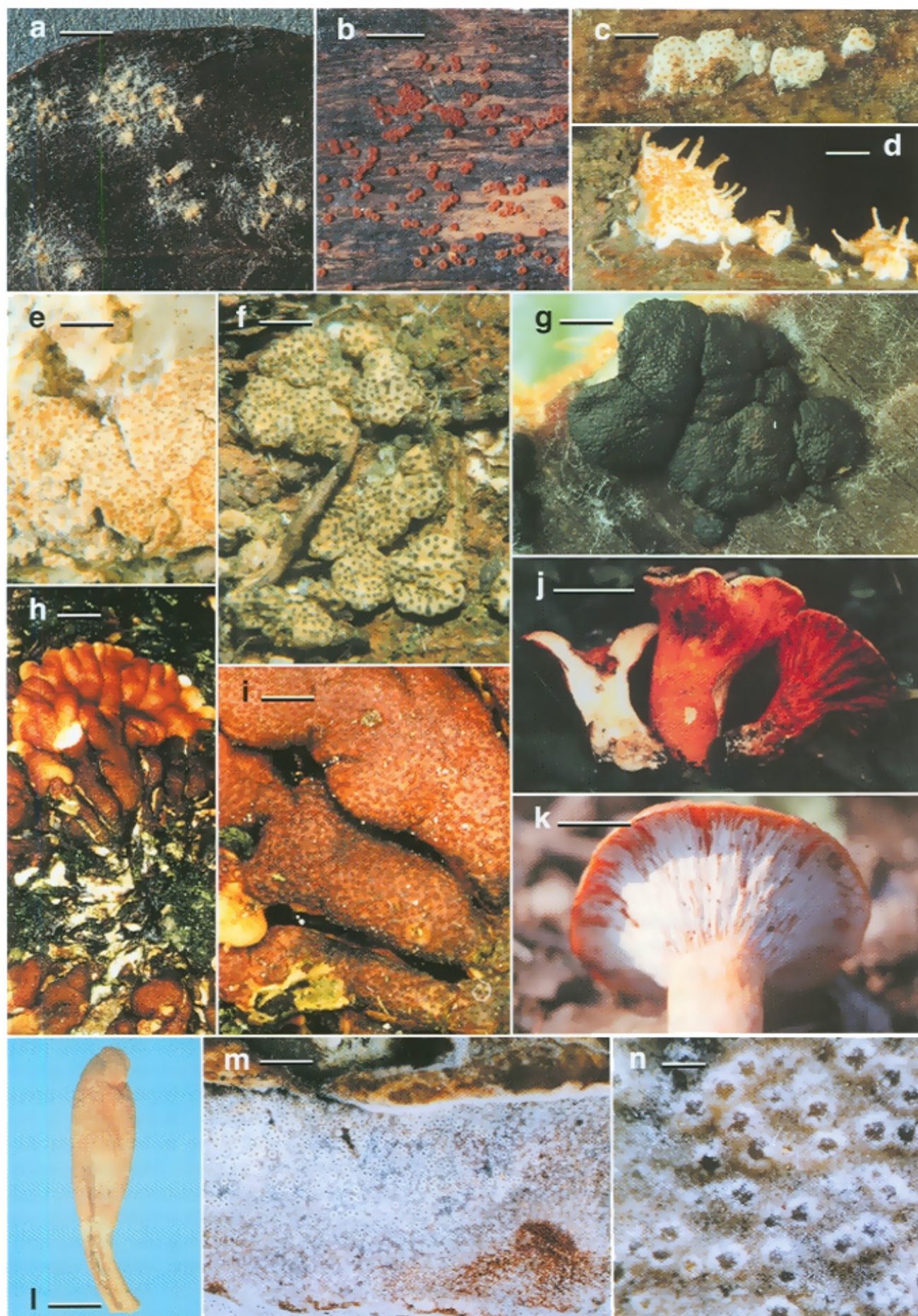
Type: *E. terricola* J.F.H. Beyma.

Ascomata globose, hyaline but appearing brown due to the ascospores, wall of hyaline, flattened cells, non-ostiolate. Asci globose, hyaline, 8-spored. Ascospores ellipsoid, pale brown, initially smooth, wide, gelatinous layer collapsing to form 3–6 longitudinal wings at ma-

turity' (Domsch *et al.*, 1980, vol. 1, p. 272). Anamorph *Acremonium*. Isolated from soil and numerous organic substrata.

NOTES.—*Emericellopsis* was described as a member of the *Eurotiaceae* and assumed to bear a relationship with the teleomorph of *Emericella nidulans* based on the distinctively ornamented ascospores. Recent molecular studies have confirmed accounts that place this genus in the *Hypocreales*. Based on both 18S and 28S sequence data, *Emericellopsis* grouped within the *Hypocreales* (Glenn *et al.*, 1996; Ogawa *et al.*, 1997), allied with *Mycocarachis* in a subclade of the *Bionectriaceae* along with several anamorph genera. A nomenclatural account of the genus *Emericellopsis* with descriptions of six accepted species is provided by Gams (1971); since then three more species have been published.

**Plate 4.** a. *Dimerosporiella leucorrhodina*. b. *Ochronectria calami*. c. *Protocreopsis fusigera*. d. *Stilbocrea macrostoma*. e. *Arachnocrea stipitata*. f. *Hypocrea aureoviridis* f. *macrospora*. g. *Hypocrea pseudokoningii*. h–i. *Hypocreopsis lichenoides*. j. *Hypomyces lactiflorum*. k. *Hypomyces lateritius*. l. *Podostroma alutaceum*. m–n. *Protocrea farinosa*. a. BPI 631957. b. Holotype of *Calonectria oödes* – K. c. EC 682. d. BPI 744508; e. Fuckel 2358, BPI. f. G.J.S. 96-189, BPI 744424. g. PDD 23871. h, i. Photograph by J.-F. Magni, A8907. j. BPI slide 2030, photograph by K.H. McKnight. k. Photograph by S. Stein, Wayne, Maine, 1963. l. Holotype of *Podostroma leucopus* – H. m. n. Photograph by J.-F. Magni, specimen A94131. Scale bars: a = 2 mm, b = 2.7 mm, c = 1.8 mm, d = 1.6 mm, e = 3 mm, f = 5 mm, g = 2.5 mm, h = 4 mm, i = 1 mm, j = 50  $\mu\text{m}$ , k = 25 mm, l = 4 mm, m = 2.5 mm, n = 500  $\mu\text{m}$ .



**Emericellopsis terricola** J.F.H. Beyma, Antonie van Leeuwenhoek Ned. Tijdschr. Hyg. 6: 263. 1940.  
ANAMORPH: *Acremonium*.

Ascomata 30–125(–300)  $\mu\text{m}$  diam, non-ostiolate, wall 6–15  $\mu\text{m}$  thick. Asci 14–16  $\mu\text{m}$  long. Ascospores ellipsoid, pale brown, 4.5–6.5  $\times$  2.5–4  $\mu\text{m}$ , surrounded by 4–6 longitudinal, subhyaline wings, finely spinulose. Anamorph *Acremonium*, with phialides 30–45  $\mu\text{m}$  long, tapering from 1.5–2.5  $\mu\text{m}$  at the base to 1–1.5  $\mu\text{m}$  at the apex. Conidia narrowly ellipsoid, 5.5–8.5  $\times$  2–2.5  $\mu\text{m}$ , about the same length as but narrower than the ascospores, hyaline. Description modified from Domsch *et al.* (1980).

HABITAT.— Isolated from forest- and cultivated soils, fresh and estuarine water, sputum, slime fluxes, bean and potato rhizosphere, mycorrhizae, bee provisions, and air.

DISTRIBUTION.— Worldwide.

EX-TYPE CULTURE.— NETHERLANDS. Isolated from soil, F.H. van Beyma, CBS 120.40, not examined.  
ILLUSTRATIONS.— Domsch *et al.* (1980, Fig. 113); Gams (1971, Fig. 9 d, e).

**HALONECTRIA** E.B.G. Jones, Trans. Brit. Mycol. Soc. 48: 287. 1965.

Type: *H. milfordensis* E.B.G. Jones.

Ascomata partly or totally immersed in the substratum, solitary or gregarious, ascomata orange, globose, each with an elongate neck emerging from the substratum, fleshy. Asci clavate, deliquescing at maturity, 8-spored. Ascospores fusiform, non-septate, thin-walled, hyaline, smooth. Anamorph unknown. On intertidal wood.

NOTES.— Jones (1965) described this unispecific genus as being similar to *Nectria* but differentiated by the immersed perithecia with long necks. Kohlmeyer & Kohlmeyer (1968, 1979) provided a description and illustrations of *H. milfordensis* noting its occurrence on intertidal wood from northern regions of both the Atlantic and Pacific Oceans. They considered the genus to be a member of the *Hypocreaceae* similar to *Trailia* stating, however, that '*Halonectria* has many characters in common with members of the family *Halosphaeriaceae* von Arx & E. Müll.', from which it was excluded due to the lack of appendaged ascospores. In a recent classification of filamentous marine ascomycetes, Kohlmeyer (1986) retained *Halonectria* as one of the four marine hypocrealean genera. The immersed ascomata with long necks and the elongate, aseptate ascospores of *H. milfordensis* are unlike most

hypocrealean fungi. However, the wall surface anatomy and negative reaction in KOH indicate that it could be hypocrealean and, at present, is best included in the *Bionectriaceae*.

**Halonectria milfordensis** E.B.G. Jones, Trans. Brit. Mycol. Soc. 48: 287. 1965.

Ascomata immersed, solitary, scattered, orange, becoming dark orange with age, KOH–, yellow in lactic acid, globose to subglobose, 130–250  $\mu\text{m}$  tall  $\times$  105–180  $\mu\text{m}$  diam, each with an elongate, orange neck 108–252  $\mu\text{m}$   $\times$  30–54  $\mu\text{m}$ ; in immature ascomata, necks filled with elongate, hyaline, thin-walled cells. Cells of wall surface forming a *textura angularis*, thin-walled. Asci clavate, deliquescing at maturity, 21.5–28.5  $\times$  4–6.5  $\mu\text{m}$ , 8-spored. Ascospores fusiform, slightly curved, 16.5–29  $\times$  2–3.5  $\mu\text{m}$ , non-septate, hyaline, smooth-walled. Associated anamorph with pycnidia partly immersed or superficial, solitary or gregarious, reddish brown, obpyriform or cylindrical, coriaceous, 140–170  $\times$  45–55  $\mu\text{m}$ ; conidia filiform, non-septate, hyaline.

HABITAT.— On intertidal wood.

DISTRIBUTION.— Temperate regions of the Atlantic and Pacific Oceans.

HOLOTYPE.— GREAT BRITAIN. South Wales: Pembrokeshire, Dale Fort Field Centre, on blocks of Scots pine, 19 Apr 1961, E.B.G. Jones (IMI 86722). This specimen consists of thin slices of wood without bark. A few ascomata lying near the surface were examined but the specimen is in poor condition.

ILLUSTRATIONS.— Jones (1965, Fig. 1), Kohlmeyer & Kohlmeyer (1968, Figs. 1–8).

NOTES.— This description is based primarily on the original publication and Kohlmeyer & Kohlmeyer (1979).

**HELEOCOCCUM** C.A. Jørg., Bot. Tidsskr. 37: 417. 1922.

Type: *H. aurantiacum* C.A. Jørg.

Ascomata superficial, white, pale pink, pale orange, pale brown to greyish or bright yellow. KOH–, globose, surface of loosely interwoven hyphae, wall pseudoparenchymatous, non-ostiolate, disintegrating at maturity. Asci subglobose, globose to broadly clavate or cylindrical, irregularly arranged. Ascospores ovoid to ellipsoid, 1-septate, slightly constricted or not, hyaline to pale yellow, smooth, slightly roughened, irregularly striate, or having irregular wing-like ridges, with or without an irregular gelatinous sheath. Anamorph, where known, *Acremonium*- or *Trichothecium*-like. Isolated from soil or water submerged in seawater.

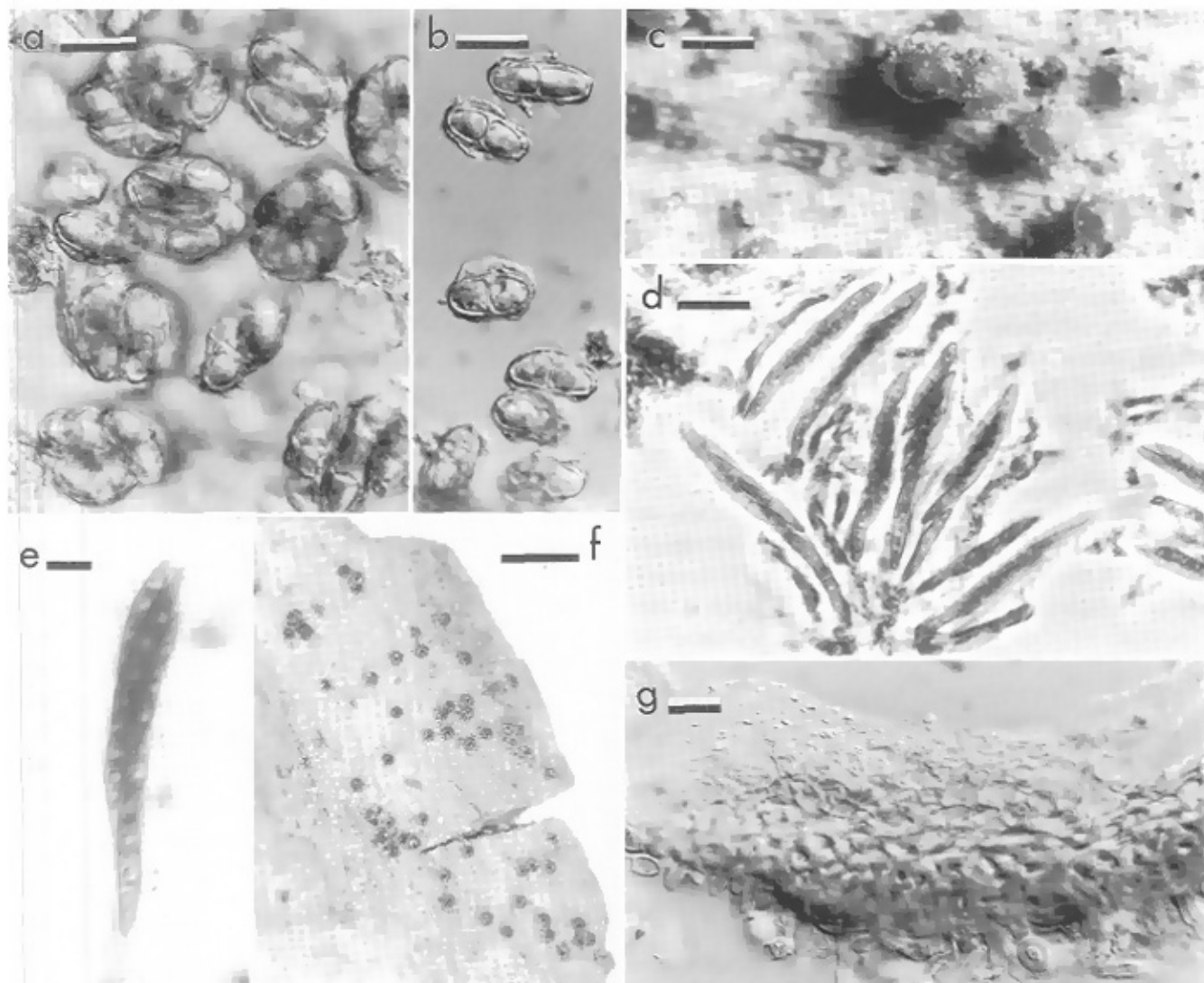
NOTES.— *Heleococcum* is a cleistothecial fungus that has been placed in the *Eurotiales* as well as the *Hypocreales*. Although characteristics of *Heleococcum* such as the cleistothecial ascomata, lack of a nectrioid centrum, and deliquescent asci are not typical, the fleshy, bright-colored ascomata, one-septate, hyaline ascospores, and *Acremonium*- or *Trichothecium*-like anamorphs suggest that *Heleococcum* does belong in the *Hypocreales*. Tubaki (1967) presented a thorough review of the genus, speculating on the relationship of *Heleococcum* with the *Eurotiales* or *Hypocreales* and suggested that the genus represents a link between these two orders. Using 28S rDNA sequence data, Rehner & Samuels (1995) demonstrated that *Heleococcum japonense* is hypocrealean and grouped with *Roumegueriella rufula*, another cleistothecial member of the *Bionectriaceae*.

***Heleococcum aurantiacum*** C.A. Jørg., Bot. Tidsskr. 37: 417, 1922. — Plate 5, a–b.

Ascomata solitary, scattered, superficial, pale orange, KOH-, globose, 210–275  $\mu\text{m}$  diam, non-ostiolate, ascumatal wall pseudoparenchymatous, breaking down to release the asci. Asci subglobose to globose, 37.5–45  $\times$  30  $\mu\text{m}$ , irregularly arranged, 8-spored. Ascospores ellipsoid, 23.5–27  $\times$  9–10.5  $\mu\text{m}$ , 1-septate, hyaline to pale yellow, walls 1.5  $\mu\text{m}$  thick, smooth with irregular gelatinous sheath on outer wall, loosening in KOH.

HABITAT.— On moist soil associated with algae or mushroom compost.

DISTRIBUTION.— England and Denmark.



**Plate 5.** a–b. *Heleococcum aurantiacum*. a. Asci with ascospores. b. Ascospores. c–e. *Ijuhya chilensis*. c. Ascomata. d–e. Asci with striate ascospores. f, g. *Lasionectria mantuana*. f. Ascomata on natural substratum. g. Median section of ascumatal wall. a, b. Holotype – C. c–e. Holotype of *Lepidonectria chilensis* – LPS. f, g. Holotype – PAD. Scale bars: a, b = 20  $\mu\text{m}$ ; c = 250  $\mu\text{m}$ ; d = 25  $\mu\text{m}$ ; e = 10  $\mu\text{m}$ ; f = 1 mm; g = 100  $\mu\text{m}$ .

KEY TO THE SPECIES OF *HELEOCOCCUM*modified from Udagawa *et al.* (1995)

1. Ascospores 22.5–25.5 × 9–10.5 μm, pale yellow, not constricted at the septum, with an irregular gelatinous sheath; anamorph unknown; on moist soil; known from England and Denmark ..... *H. aurantiacum*
1. Ascospores less than 22 μm long, hyaline; anamorph *Acremonium*-like or *Trichothecium*-like; isolated from soil or wood immersed in sea water; known from Indonesia, Japan, or the Philippines ..... 2
2. Ascospores 18–21 × 10–13 μm, smooth or slightly roughened; anamorph *Trichothecium*-like; isolated from wood immersed in sea water; known from Japan ..... *H. japonense* Tubaki
2. Ascospores less than 18 μm long; anamorph *Acremonium*-like; isolated from soil; known from Indonesia or the Philippines ..... 3
3. Ascospores 10–11 × 5–6 μm, slightly verrucose to striate, surrounded by a sheath; known from the Philippines ..... *H. inapertum* Udagawa *et al.*
3. Ascospores 6–8 × 3–3.5 μm, slightly verrucose, with 2–3 longitudinal, wing-like ridges; known from Indonesia ..... *H. alatosporum* Udagawa *et al.*

HOLOTYPE.— DENMARK. Botanical Garden of the University of Copenhagen, in the moor, on moist soil, Autumn 1921, L. Kolderup Rosenvinge (C; NY, slides of holotype). Culture CBS 201.35

ILLUSTRATIONS.— Dennis (1978, Pl. 44J); Jørgensen (1922, Figs. 1–2); Tubaki (1967, Pl. 2E–F).

NOTES.— The holotype specimen and slides of *Heleococcum aurantiacum* were examined, on which the few remaining ascomata were broken, apparently disintegrating, revealing globose asci and loose ascospores in the centrum. The above description is based on this fragmentary type specimen, the original description, and the description and illustrations based on the type specimen by Tubaki (1967).

A second species, *Heleococcum japonense*, was described by Tubaki (1967) that occurs on submerged wood in a marine habitat and produces a *Trichothecium*-like anamorph (culture CBS 397.67). Two additional species of *Heleococcum* both having *Acremonium*-like anamorphs have been described recently by Udagawa *et al.* (1995) who included a key to the four species of *Heleococcum*.

**HYDROSPHAERA** Dumort., *Comment. bot.* p. 90, 1822.

Type: *H. peziza* (Tode : Fr.) Dumort. (= *Sphaeria peziza* Tode : Fr.).

= *Nectria* subgenus *Hyphonectria* Sacc., *Syll. Fung.* 2: 501, 1883.

= *Hyphonectria* (Sacc.) Petch, *J. Bot.* 75: 220, 1937. — Lectotype, designated by Samuels (1976a): *Nectria peziza* (Tode : Fr.) Fr. (= *Sphaeria peziza* Tode : Fr.), recognized as *Hydropsphaera peziza* (Tode : Fr.) Dumort.

= *Neuronectria* Munk, *Dansk Bot. Ark.* 17 (1): 56, 1957. — Type: *N. peziza* (Tode : Fr.) Munk (= *Sphaeria peziza* Tode : Fr.), recognized as *H. peziza*.

= *Neohenningsia* Koord., *Verh. Kon. Ned. Akad. Wetensch. Afd. Natuurk., Sect. 2*, 13: 164, 1907. — Type: *N. stellatula* Koord. (= *Nectria stellatula* (Koord.) Höhn., a synonym of *H. rufofusca*).

= *Perrotiella* Naumov, *Bull. Soc. Oural. Amis Sci. Nat.* p. 26, 1916. — Type: *P. uralensis* Naumov, a synonym of *H. peziza*.

Ascomata superficial, non-stromatic, pale yellow, orange or umber, KOH –, globose to subglobose or doliform, usually collapsed and deeply cupulate, smooth or with fasciculate hairs. Ascomatal wall generally over 25 μm thick, of two regions: outer region of thin-walled, globose cells. Asci clavate. Ascospores ellipsoid, 1- to multiseptate, hyaline, generally finely to coarsely striate, rarely smooth or spinulose. Anamorph, where known, *Acremonium*-like. On dead herbaceous or woody monocotyledonous or dicotyledonous substrata.

NOTES.— Within the *Nectria*-like fungi of the *Hypocreales*, *Hydropsphaera* is unique in ascomatal wall structure in which the wall is relatively thick, generally over 25 μm, and up to 100 μm thick in *H. pachyderma*, and is composed of large, thin-walled, globose cells often over 15 μm diam. This ascomatal wall structure results in a characteristic deeply cupulate collapse of the ascumata upon drying (Booth, 1959; Rossman, 1983; Samuels, 1976b). The ascospores of *Hydropsphaera* are one- to multiseptate, often finely to coarsely striate although also spinulose or smooth. The anamorphs have been placed in *Acremonium* or, if the conidia are septate, in *Cephalosporiopsis*, always having simple conidiophores and relatively long, tapering, phialidic conidiogenous cells. Species of *Hydropsphaera* often occur as saprobes on decaying monocotyledonous plants and ferns, although there are many exceptions in-

cluding *H. boothii* (on *Oenanthe* (*Apiaceae*), England), *H. erubescens* (various dicotyledonous herbaceous substrata in temperate regions), *H. gigantea* (on *Conium* and other herbaceous stems, Argentina and Ecuador), *H. haematites* (on unidentified woody plant, Africa), *H. peziza* (on decaying wood, polypores, bark, soil, and other organic substrata, cosmopolitan) and *H. pachyderma* (on bark of unidentified twig, Colombia). In his molecular study of *Fusarium* and related fungi, O'Donnell (1993) included *H. peziza* (as *N. peziza*) and found that this species grouped most closely with other pallid *Nectria*-like species now placed in the *Bionectriaceae*.

At the time the generic name *Hydropisphaera* was proposed, almost all pyrenomycetes were included in the one family *Sphaeriaceae* and the name had been ignored until recently. In proposing *Nectria* for conservation against *Hydropisphaera* and *Ephedrosphaera* Dumort., Cannon & Hawksworth (1983) unearthed *Hydropisphaera* as the oldest name available for the *Nectria peziza*-group when recognized at the generic level.

Saccardo (1883) established *Nectria* subgenus *Hyphonectria* Sacc. in which he included nine species. When Petch (1937) raised the subgenus to generic rank, he made reference to Saccardo's subgeneric taxon and included four additional species (*Hyphonectria violacea*, *H. berkeleyana*, *H. aureonitens*, and *H. solani*). Neither Saccardo (1883) nor Petch (1937) designated a type species. Samuels (1976a) discussed the problem of typification of *Nectria* subgenus *Hyphonectria* and the genus *Hyphonectria* and lectotypified this taxon with *Nectria peziza* as one of the original nine species included in *Nectria* subgenus *Hyphonectria* by Saccardo (1883). Samuels (1976a) considered the reference by Petch to the nine species originally included in *Nectria* subgenus *Hyphonectria* to constitute inclusion in *Hyphonectria* at the generic rank even though Petch did not specifically transfer any of the species to the genus.

*Neohenningsia* was initially placed in the *Aspergillaceae*, *Eurotiaceae*, despite the presence of an ostiole. Although Koorders (1907) suggested a relationship with *Charonectria* Sacc. and *Baculospora* Zúkal in the *Hypocreales*, he differentiated his genus from these in stating that *Neohenningsia* had superficial ascumata with fasciculate appendages, thin-walled asci, and septate ascospores. Von Höhnelt (1909a) placed the type species of *Neohenningsia* in *Nectria*. Samuels (1976b) reviewed the history of *Neohenningsia* and unsuccessfully sought the type specimen of *N. stellulata* at BO and FH; it does also not exist at B. Based on the original description, *Neohenningsia stellulata* is herein neotypified and this species is regarded as a synonym of *H. rufofusca*.

*Perrotiella* was described as a discomycete in the

*Pezizaceae*. Nannfeldt (1932) examined authentic material of the type species and confirmed that *P. uralensis* is a synonym of *Nectria peziza*, thus *Perrotiella* is a synonym of *Hydropisphaera*.

*Neuronectria* was described for species of *Nectria* having striate ascospores. This character is not unique to any particular group of nectrioid fungi as evidenced by Samuels (1988). He included thirty species of *Nectria* having pallid ascumata and hyaline, striate ascospores in seven different groups of *Nectria sensu lato*, and Rossman (1989) documented three of the 28 species in the *Nectria sensu stricto* having striate ascospores. Many genera of nectrioid fungi include species having striate ascospores.

***Hydropisphaera peziza* (Tode : Fr.) Dumort., Comment. bot. p. 90. 1822.**

≡ *Sphaeria peziza* Tode : Fr., Tode, Fungi Mecklenb. Sel., Fasc. 2: 46. 1791 : Fries, Syst. Mycol. 2: 452. 1823.

≡ *Nectria peziza* (Tode : Fr.) Fr., Summa Veg. Scand. p. 388. 1849.

≡ *Dialonectria peziza* (Tode : Fr.) Cooke, Grevillea 12: 110. 1884.

≡ *Cucurbitaria peziza* (Tode : Fr.) O. Kuntze, Rev. Gen. Pl. 3: 461. 1898.

≡ *Neuronectria peziza* (Tode : Fr.) Munk, Dansk Bot. Ark. 17 (1): 58. 1957.

= *Nectria fimicola* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 179. 1869 [1870].

≡ *Byssonectria fimicola* (Fuckel) Cooke, Grevillea 12: 109. 1884.

≡ *Cucurbitaria fimicola* (Tode : Fr.) O. Kuntze, Rev. Gen. Pl. 3: 461. 1898.

= *Nectria pezicula* Speg., Michelia 1: 232. 1878.

≡ *Byssonectria pezicula* (Speg.) Cooke, Grevillea 12: 109. 1884.

= *Nectria epigaea* Cooke, Grevillea 8: 10. 1879.

≡ *Byssonectria epigaea* (Cooke) Cooke, Grevillea 12: 109. 1884.

= *Nectria rimicola* Cooke, Grevillea 11: 108. 1883.

≡ *Cucurbitaria rimicola* (Cooke) O. Kuntze, Rev. Gen. Pl. 3: 461. 1898.

= *Nectria umbellulariae* Plowr. & Harkn., Bull. Calif. Acad. Sci. 1: 26. 1884.

≡ *Cucurbitaria umbellulariae* (Plowr. & Harkn.) O. Kuntze, Rev. Gen. Pl. 3: 462. 1898.

= *Nectria perforata* Ellis & Holw., in Arthur, Geol. Nat. His. Surv. Minnesota Bull. 3: 33. 1887.

≡ *Cucurbitaria perforata* (Ellis & Holw.) O. Kuntze, Rev. Gen. Pl. 3: 461. 1898.

= *Nectria consanguinea* Rehm, Hedwigia 26: 92. 1887.

= *Nectria importata* Rehm, Hedwigia 27: 171. 1888.

≡ *Cucurbitaria importata* (Rehm) O. Kuntze, Rev. Gen. Pl. 3: 461. 1898.

= *Nectria henningsii* Rehm, Hedwigia 28: 352. 1889.

= *Nectria betulina* Rehm, Ann. Mycol. 3: 519. 1905 [1906].

= *Nectria sphagnicola* Kirschst., Verh. Ver. Prov. Brandenburg 48: 59. 1906.

= *Nectria fallax* Rick, Ann. Mycol. 4: 309. 1906.

= *Perrotiella uralensis* Naumov, Bull. Soc. Oural. Amis Sci. Nat. p. 26. 1916.

ANAMORPH: *Acremonium* sp.

Mycelium not visible or white, surrounding the ascomatal base, subtending hyphae unbranched, thin-walled, ca 4  $\mu\text{m}$  wide. Ascomata superficial or basally immersed, solitary to gregarious, subglobose, globose to urniform or almost discoidal, becoming cupulate when dry, 370–420  $\mu\text{m}$  high  $\times$  (250–)370–430(–550) across the flat tops, yellow to orange, smooth or slightly furfuraceous, papilla lacking or short and acute, of cylindrical, septate, unbranched hyphae with rounded tips, ca 3  $\mu\text{m}$  wide; periphyses 20–30  $\mu\text{m}$  long. Ascomatal wall 30–50(–70)  $\mu\text{m}$  thick, of two regions: outer region 15–30(–50)  $\mu\text{m}$  thick, cells broadly ellipsoid to globose, 10–15  $\mu\text{m}$  diam, thin-walled; inner region ca 15  $\mu\text{m}$  thick, cells flattened and compacted; cells in surface view spherical, 15–25  $\mu\text{m}$  diam, thin-walled. If present, hairs short, orange, consisting of septate, unbranched, thin-walled hyphae, occasionally forming triangular fascicles. Asci clavate, (49–)60–75(–100)  $\times$  (5–)8–10(–14)  $\mu\text{m}$ , apices flat, 8-spored, ascospores biserial above, uniserial below. Ascospores broadly ellipsoid, (9–)11–14(–17)  $\times$  (3–)5–7  $\mu\text{m}$ , equally 2-celled, not constricted or slightly constricted at the septum, hyaline, conspicuously longitudinally striate.

HABITAT.— On well-rotted wood, bark, dung, decaying cloth, and basidiocarps of polypores.

DISTRIBUTION.— Cosmopolitan, especially common in temperate regions.

LECTOTYPE, designated here.— SWEDEN. On rotten wood, Sclerom. Suec. 24 no. 235. 1822 (BPI, in Sbarbaro collections in bound centuries 1–3). The specimens of Tode were destroyed, thus none of the specimens of *S. peziza* examined by Tode are still in existence. Fries (1823) mentioned several specimens following the description of *S. peziza*, including Sclerom. Suec. 24 no. 235. Booth (1959) stated that the specimen of this number at K was in poor condition. The specimen at BPI is in excellent condition.

ILLUSTRATIONS.— Booth (1959, Fig. 32, as *Nectria peziza*); Dennis (1978, Pl. 32C, as *N. peziza*); Dingley (1951b, Fig. 1, as *N. peziza*); Ellis & Ellis (1985, Fig. 135); Hanlin (1963a, Figs. 1–47, as *Neuronectria peziza*); Malençon (1979, Fig. 1A, as *Nectria peziza*); Samuels, (1976b, Figs. 16A, 17A–E, as *N. peziza*).

NOTES.— Hanlin (1963a) studied the centrum development of *H. peziza* as *Neuronectria peziza*. Gams (1971) and Samuels (1976b) described the anamorph in culture.

SEVENTEEN ADDITIONAL SPECIES are included in *Hydropisphaera* as follows:

**Hydropisphaera arenula** (Berk. & Broome) Rossman & Samuels, *comb. nov.*

$\equiv$  *Sphaeria arenula* Berk. & Broome, Ann. Mag. Nat. Hist., Ser. 2, 9: 320. 1852.

$\equiv$  *Nectria arenula* (Berk. & Broome) Berk., Out. Brit. Fung. p. 394. 1860.

$\equiv$  *Dialonectria arenula* (Berk. & Broome) Cooke, Grevillea 12: 110. 1884.

$\equiv$  *Cucurbitaria arenula* (Berk. & Broome) O. Kuntze, Rev. Gen. Pl. 3: 460. 1898.

$\equiv$  *Calonectria transiens* Rehm, Hedwigia 39: 225. 1900.

This species was described and illustrated in Booth (1959), Samuels (1978), and Schmid & Schmid (1991), each as *Nectria arenula*.

**Hydropisphaera arenuloides** (Samuels) Rossman & Samuels, *comb. nov.*

$\equiv$  *Nectria arenuloides* Samuels, New Zealand J. Bot. 14: 254. 1976.

This species was described and illustrated in Samuels (1976b).

**Hydropisphaera boothii** (D. Hawksw.) Rossman & Samuels, *comb. nov.*

$\equiv$  *Nectria boothii* D. Hawksw., Trans. Brit. Mycol. Soc. 74: 572. 1980.

This species was described and illustrated in Hawksworth & Minter (1980) as *N. boothii*.

**Hydropisphaera cyatheae** (Dingley) Rossman & Samuels, *comb. nov.*

$\equiv$  *Nectria cyatheae* Dingley, Trans. Roy. Soc. New Zealand 83: 652. 1956 (as '*cyathea*').

This species was described and illustrated in Dingley (1956) and Samuels (1976b) as *N. cyatheae*. Culture CBS 575.76.

**Hydropisphaera dolichospora** (Penz. & Sacc.) Rossman & Samuels, *comb. nov.*

$\equiv$  *Nectria dolichospora* Penz. & Sacc., Malpighia 11: 513. 1897.

This species was described and illustrated in Samuels (1976a) and Samuels *et al.* (1990) as *N. dolichospora*.

**Hydropisphaera erubescens** (Desm.) Rossman & Samuels, *comb. nov.*

$\equiv$  *Sphaeria erubescens* Desm., Ann. Sci. Nat., Bot., Sér. 3, 6: 72. 1846.

$\equiv$  *Calonectria erubescens* (Desm.) Sacc., Michelia 1: 309. 1878.



≡ *Amphinectria erubescens* (Desm.) Sacc. ex Speg., Bol. Acad. Ci. (Cordoba) 26: 347. 1927.  
 = *Calonectria umbelliferarum* Seaver, Mem. New York Bot. Gard. 6: 507. 1916.  
 = *Calonectria venezuelensis* Syd. & P. Syd., Ann. Mycol. 33: 88. 1935.  
 = *Calonectria crescentiae* Seaver & Waterston, Mycologia 32: 404. 1940.

This species was described and illustrated in Rossman (1983) and Samuels (1978), as *N. erubescens*. Cultures CBS 333.76–335.76.

**Hydropisphaera gigantea** (Speg.) Rossman & Samuels, *comb. nov.*

≡ *Lasionectria gigantea* Speg., Anal. Mus. Nac. Buenos Aires 3, 1: 77. 1902.  
 ≡ *Nectria gigantea* (Speg.) Sacc. & D. Sacc., Syll. Fung. 17: 792. 1905.

This species was described in Samuels (1976a) as *N. gigantea*, based on the type specimen from Argentina.

A specimen additional to the type has been collected, examined, and is reported here: ECUADOR, Prov. Zamora: ca 21 km from Zamora, on the Zamora-Yanzoza Road, elev. ca 1,000 m, on herbaceous stem, 31 July 1975, K.P. Dumont (Dumont-EC 1779), S.E. Carpenter & P. Buritica (NY).

**Hydropisphaera haematites** (Syd. & P. Syd.) Rossman & Samuels, *comb. nov.*

≡ *Nectria haematites* Syd. & P. Syd., in Mildbraed, Wiss. Ergebn. Deutsch. Zent. Afrika Exped. 2, Bot. prior to 99. 1914.

This species was described and illustrated in Samuels (1976a) as *N. haematites*.

**Hydropisphaera hypoxantha** (Penz. & Sacc.) Rossman & Samuels, *comb. nov.*

≡ *Nectria hypoxantha* Penz. & Sacc., Malpighia 11: 513. 1897.

This species was described and illustrated in Samuels *et al.* (1990) as *N. hypoxantha*.

**Hydropisphaera leucotricha** (Penz. & Sacc.) Rossman & Samuels, *comb. nov.*

≡ *Nectria leucotricha* Penz. & Sacc., Malpighia 11: 512. 1897.

This species was described and illustrated in Samuels *et al.* (1990) as *N. leucotricha*.

**Hydropisphaera macrarenula** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria macrarenula* Samuels, Mem. New York Bot. Gard. 59: 83. 1990.

This species was described and illustrated in Samuels *et al.* (1990) as *N. macrarenula*.

**Hydropisphaera multiloculata** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria multiloculata* Samuels, New Zealand J. Bot. 16: 78. 1978.

This species was described and illustrated in Rossman (1983) and Samuels (1978) as *N. multiloculata*. Cultures CBS 339.77–341.77.

**Hydropisphaera multiseptata** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria multiseptata* Samuels, New Zealand J. Bot. 16: 77. 1978.

This species was described and illustrated in Rossman (1983) and Samuels (1978) as *N. multiseptata*. Cultures CBS 336.77–338.77.

**Hydropisphaera nymaniana** (Henn.) Rossman & Samuels, *comb. nov.*

≡ *Nectria nymaniana* Henn., Monsunia 1: 161. 1899.

This species was described and illustrated in Samuels (1976a) and Samuels *et al.* (1990) as *N. nymaniana*.

**Hydropisphaera pachyderma** (Rossman) Rossman & Samuels, *comb. nov.*

≡ *Nectria pachyderma* Rossman, Mycol. Pap. 150: 75. 1983.

This species was described and illustrated in Rossman (1983) as *N. pachyderma*.

**Hydropisphaera rufofusca** (Penz. & Sacc.) Rossman *et al.*, Mycologia 85: 702. 1993. — Plate 2, b.

≡ *Nectriella rufofusca* Penz. & Sacc., Malpighia 11: 507. 1897. — Holotype: INDONESIA, Java: Tjibodas, in caulibus emortuis *Elettariae*, 6 Feb 1897, No. 436 p.p. (PAD).

= *Neohenningsia stellatula* Koord., Verh. Kon. Ned. Akad. Wetensch., Afd. Natuurk., Tweede Reeks, Sect. 2, 13: 164. 1907. **Neotype** here selected: BRAZIL, Parà: in foliis *Monsterae* sp., Dec. 1907, Baker, (FH, also holotype of *N. brasiliensis*).

≡ *Nectria stellatula* (Koord.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 819. 1909.  
 = *Neohenningsia brasiliensis* Henn., Hedwigia 48: 102. 1909 (1908).

≡ *Nectria brasiliensis* (Henn.) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 1186. 1909.

≡ *Pseudonectria brasiliensis* (Henn.) Weese, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturw. Kl. Abt. 1, 125: 518. 1916.

This species was described and illustrated in Samuels *et al.* (1990) as *Nectria brasiliensis*.

**Hydropisphaera suffulta** (Berk. & M.A. Curtis) Rossman & Samuels, *comb. nov.*

= *Nectria suffulta* Berk. & M.A. Curtis, J. Linn. Soc., Bot. 10: 378, 1868.

= *Nectria musae* Pat., J. Bot. (Morot) 11: 369, 1897.

= *Nectria pezizelloides*, Rehm, Hedwigia 37: 192, 1898.

= *Nectria calamicola* Henn. & E. Nyman, in Warburg, Mon-  
sunia 1: 161, 1900 [1899].

= *Nectria ornata* Masee & E.S. Salmon, Ann. Bot. (London)  
16: 75, 1902.

= *Nectria setosa* Ferd. & Winge, Bot. Tidsskr. 29: 11, 1908.

= *Neohenningsia confluens* Petch, Ann. Roy. Bot. Gard. (Per-  
adeniya) 7: 114, 1920.

This species was described and illustrated in Samuels  
(1976a) and Samuels *et al.* (1990) as *N. suffulta*. Cul-  
ture CBS 122.87.

### KEY TO THE SPECIES OF *HYDROPISPHAERA*

- |         |   |                         |
|---------|---|-------------------------|
| 1.      | Ascospores 3- or more-septate; ascomata without hairs .....   | 2                       |
| 1.      | Ascospores 1-septate; ascomata with or without hairs .....  | 5                       |
| 2 (1).  | Ascospores 3-septate, smooth-walled to faintly striate .....  | 3                       |
| 2.      | Ascospores more than 3-septate, smooth to faintly or coarsely striate .....   | 4                       |
| 3 (2).  | Ascospores 18–26 × 4–5 μm, fusiform; ascomata orange to brown, glabrous to slight-<br>ly scurfy .....   | <i>H. erubescens</i>    |
| 3.      | Ascospores 65–92 × 6–8 μm, very long fusiform; ascomata orange to dark umber or<br>brown-vinaceous, glabrous .....                              | <i>H. pachyderma</i>    |
| 4 (2).  | Ascospores 50–70 × 6–7 μm, 15–20-septate, striate; ascomata orange to brown, smooth<br>.....  | <i>H. multiloculata</i> |
| 4.      | Ascospores 28–38 × 4–6 μm, 5–7(–10)-septate, faintly striate; ascomata yellow to or-<br>ange, smooth to slightly scaly .....                    | <i>H. multiseptata</i>  |
| 5 (1).  | Ascomata without hairs, smooth, slightly scaly or warty .....   | 6                       |
| 5.      | Ascomata with solitary, flexuous or fasciculate hairs .....   | 11                      |
| 6 (5).  | Ascospores more than 23 μm long .....   | 7                       |
| 6.      | Ascospores less than 23 μm long .....   | 8                       |
| 7 (6).  | Ascomata yellow-orange to orange-red, with a flattened apex; ascospores 23–27 ×<br>5–6 μm, striate .....  | <i>H. nymaniana</i>     |
| 7.      | Ascomata orange, with a broadly rounded apex; ascospores 23–30 × 5.5–7.5 μm, striate<br>.....   | <i>H. macrarenula</i>   |
| 8 (6).  | Ascospores 11–14 × 5–6 μm, striate or coarsely striate .....  | 9                       |
| 8.      | Ascospores averaging more than 14 μm long and less than 5 μm wide; smooth or<br>striate .....   | 10                      |
| 9 (8).  | Ascospores striate; ascomata yellow to orange, often with yellow subtending hyphae,<br>entirely superficial.....                                | <i>H. peziza</i>        |
| 9.      | Ascospores coarsely striate; ascomata orange to reddish-orange, surrounded by erect,<br>yellow hyphae, basally immersed in the substratum ..... | <i>H. hypoxantha</i>    |
| 10 (8). | Ascospores 14–16 × 3.5–4 μm, ellipsoid-fusiform to fusiform, smooth or striate; as-<br>comata orange, becoming brown .....                      | <i>H. arenula</i>       |
| 10.     | Ascospores 19–22 × 4–4.5 μm, fusiform, striate; ascomata white, becoming orange<br>.....  | <i>H. arenuloides</i>   |

- 11 (5). Ascospores averaging more than 25  $\mu\text{m}$  long ..... 12  
 11. Ascospores averaging less than 25  $\mu\text{m}$  long ..... 14
- 12 (11). Ascomata dark red with red hairs; ascospores 27–30  $\times$  7–8  $\mu\text{m}$ , spinulose to spinulose-striate ..... *H. haematites*  
 12. Ascomata dark orange to brown with concolorous hairs; ascospores smooth-walled 13
- 13 (12). Ascospores 48–55  $\times$  6–7  $\mu\text{m}$ ; ascomata dark orange with orange hairs *H. gigantea*  
 13. Ascospores 25–38  $\times$  5–7  $\mu\text{m}$ ; ascomata brown with brown hairs ... *H. dolichospora*
- 14 (11). Ascomata with white or orange, fasciculate hairs; ascospores averaging more than 17  $\mu\text{m}$  long ..... 15  
 14. Ascomata with white, fasciculate hairs; ascospores averaging less than 17  $\mu\text{m}$  long ..... 16
- 15 (14). Ascomata yellow to orange or nearly brown with white hairs; ascospores 16–22  $\times$  4–5  $\mu\text{m}$ , striate or spinulose ..... *H. leucotricha*  
 15. Ascomata orange with orange hairs; ascospores 17–23  $\times$  5–7  $\mu\text{m}$ , striate *H. cyatheae*
- 16 (14). Ascospores striate, 12–17  $\times$  4–5  $\mu\text{m}$ ; ascomata pale yellow to yellow .... *H. suffulta*  
 16. Ascospores smooth or spinulose, not striate; ascomata orange to dark orange ..... 17
- 17 (16). Ascospores 12.5–17.5  $\times$  3.5–4  $\mu\text{m}$ , spinulose; warm temperate and tropical .....  
 ..... *H. rufofusca*  
 17. Ascospores 12–15  $\times$  4–5  $\mu\text{m}$ , smooth; known only from England ..... *H. boothii*

**IJUHYA** Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25: 30. 1899.

Type: *I. vitrea* Starbäck, a synonym of *I. peristomialis*.

= *Peristomialis* (W. Phillips) Boud., Hist. Classif. Discom. Europe p. 116. 1907.

= *Mollisia* subgenus *Peristomialis* W. Phillips, Man. Brit. Discom. p. 201. 1887.

= *Cyathicula* subgenus *Peristomialis* (W. Phillips) Sacc., Syll. Fung. 8: 306. 1889. — Type: *P. berkeleyi* Boud., a nomenclatural synonym of *I. peristomialis*.

= *Lepidonectria* Speg., Revista Fac. Agron. Univ. Nac. La Plata 6: 97. 1910. — Type: *L. chilensis* Speg., recognized as *I. chilensis*.

Ascomata solitary or in small groups, superficial, non-stromatic, white to pale yellow, KOH–, globose to subglobose, usually with a discoidal apex; disk formed of intertwined hyphae that often develop into triangular fasciculate hairs forming an apical crown, rarely apex discoidal without hairs or with short, sinuous hairs. Ascumatal wall usually less than 20  $\mu\text{m}$  thick, of one region of thick-walled, relatively small cells, often forming *textura epidermoidea* in surface view. Asci clavate, 8-spored. Ascospores clavate or fusiform to long fusiform, one- to multiseptate or muriform, hyaline, smooth to striate. Anamorph, where known, *Acremonium*-like. On decaying herbaceous debris or wood, also on black stroma, hyphae, and ascomata of pyrenomycetous fungi.

NOTES.— *Ijuhya* was originally placed in the *Gymnoascaceae*; later it was considered a member of the *Sphaeriaceae* (Müller & von Arx, 1973) as well as the *Hypocreaceae* (Rogerson, 1970). Samuels (1976b) examined the type specimen and determined *Ijuhya vitrea* to be a synonym of *Nectria peristomialis*.

Phillips (1887) described *Mollisia* subgenus *Peristomialis* for one species having triangular hairs on the ascumata and fusiform, multiseptate ascospores. *Mollisia peristomialis* was the only species included in the subgenus, thus, when raised to generic rank, the taxon is automatically typified by that species. When raising the subgenus to generic rank, Boudier (1907) proposed a new epithet for the type species in order to avoid a tautonym. He included six species in *Peristomialis*. Samuels (1976b) examined the type specimen and regarded the type species as *Nectria peristomialis*, thus he considered *Peristomialis* to be a synonym of *Nectria*. Although listed as a synonym of *Peristomialis* by Samuels (1976b), *Ijuhya* has priority over *Peristomialis*.

Spegazzini (1910) described one species in the genus *Lepidonectria*. Based on the presence of 'squamules' on the ascumata of *L. chilensis*, Spegazzini may have intended his species to be in *Nectria* subgenus *Lepidonectria* Sacc.; however, no reference is made to that taxon. Spegazzini was the first to use the name *Lepidonectria* at the generic level which constitutes the valid publica-

tion of a new genus with *L. chilensis* as the implicit type species. None of the species in *Nectria* subgenus *Lepidonectria* were ever placed in the genus *Lepidonectria*. The type specimen of *Lepidonectria chilensis* was examined and the species is herein placed in *Ijuhya*.

Samuels (1988) recognized *Ijuhya* (as *Peristomialis*) as a genus distinct from other pallid members of *Nectria*-like fungi, differentiated primarily by the fasciculate hairs around the ascumatal apex. In addition to the fasciculate hairs, the ascumatal wall anatomy is distinct, composed of thick-walled, relatively small cells. Within *Ijuhya*, ten species are recognized, distinguished primarily on characteristics of the ascospores that vary from one-septate to multiseptate or muriform and are generally coarsely striate, although some species have smooth or spinulose ascospores.

***Ijuhya peristomialis* (Berk. & Broome) Rossman & Samuels, *comb. nov.***

≡ *Peziza peristomialis* Berk. & Broome, Ann. Mag. Nat. Hist., Ser. 3, 18: 126. 1866.

≡ *Mollisia peristomialis* (Berk. & Broome) W. Phillips, Man. Brit. Discom. p. 201. 1887.

≡ *Cyathicula peristomialis* (Berk. & Broome) Sacc., Syll. Fung. 8: 308. 1889.

≡ *Actiniopsis peristomialis* (Berk. & Broome) Petch, Trans. Brit. Mycol. Soc. 21: 282. 1938.

≡ *Nectria peristomialis* (Berk. & Broome) Samuels, New Zealand J. Bot. 14: 251. 1976.

≡ *Peristomialis berkeleyi* Boud., Hist. Classif. Discom. Europe p. 116. 1907.

≡ *Helotium ciliatum* P. Crouan & H. Crouan, Fl. Finistère p. 47. 1867.

≡ *Cyathicula ciliata* (P. Crouan & H. Crouan) Sacc., Syll. Fung. 8: 306. 1889.

≡ *Peristomialis ciliata* (P. Crouan & H. Crouan) Boud., Hist. Classif. Discom. Europe p. 116. 1907.

≡ *Ijuhya vitrea* Starbäck, Bih. Kongl. Svenska Vetensk.-Akad. Handl. 25: 30. 1899.

≡ *Ijuhya vitrea* Starbäck var. *javanica* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 121: 380. 1912.

≡ *Nectria tympaniformis* Petrak, Sydowia 4: 514. 1950.

Anamorph: *Acremonium* sp.

Ascomata solitary or in small groups, superficial, without a stroma or on a sparse, hyphal subiculum. Ascomata hyaline to pale yellow, translucent, becoming darker and opaque when dry, KOH-, globose to subglobose with flattened apex, apex often slightly sunken; ascomata not collapsing when dry, 230–375  $\mu\text{m}$  high  $\times$  260–350  $\mu\text{m}$  diam, without papilla; each ascoma with an apical disk 150–200  $\mu\text{m}$  diam with a ring of long, fasciculate, hyaline hairs; fascicles of hairs 145–300  $\times$  30–90  $\mu\text{m}$ , tapering to a narrowly rounded tip, agglutinated hyphae hyaline, septate, 2.5–4  $\mu\text{m}$  wide with a 0.5–1  $\mu\text{m}$  thick wall. Ascumatal wall 35–60  $\mu\text{m}$  thick, of three regions: outer region 10–20

$\mu\text{m}$  thick, of loose, prosenchymatous hyphae 3–4  $\mu\text{m}$  wide, with up to 1  $\mu\text{m}$  thick walls; middle region 15–25  $\mu\text{m}$  thick, of elongate cells, 7–12  $\times$  5–7  $\mu\text{m}$ , with hyaline, up to 1  $\mu\text{m}$  thick walls, thicker in the corners, middle region up to 75  $\mu\text{m}$  thick in the upper part, expanding into a flattened apical disk; inner region 10–15  $\mu\text{m}$  thick, of hyaline, thin-walled, elongate cells. Asci 50–100  $\times$  12–15  $\mu\text{m}$ , clavate, simple, 8-spored, ascospores irregularly biseriate to pluriseriate. Ascospores fusiform with rounded ends, often curved, (24–)30–60(–110)  $\times$  4–7(–8)  $\mu\text{m}$ , (1–)5–7(–11)-septate, hyaline, coarsely striate, 3–4 striae per half spore.

ANAMORPH.— Conidiophores arising from the colony surface, solitary, erect, straight, unbranched, cylindrical, tapering toward the apex, septate at the base, occasionally with one or two additional septa, smooth, 20–50  $\mu\text{m}$   $\times$  2–3.5  $\mu\text{m}$  at the base. Conidiogenous cells monophialidic, terminal cell of erect conidiophore, cylindrical, 22–33  $\times$  1.5–1.8  $\mu\text{m}$  at the unflared apex. Conidia ellipsoid to cylindrical with rounded ends, 5–8  $\times$  1.7–2.5  $\mu\text{m}$ , aseptate, hyaline, smooth, held in a solitary, hyaline drop of liquid.

HABITAT.— On monocotyledonous and dicotyledonous wood and herbaceous debris.

DISTRIBUTION.— Brazil, Colombia, England, France, India, Java, New Zealand, Panama and Venezuela (Rossman, 1983; Samuels, 1976b).

YPES.— ENGLAND. Penzance, on *Ilex* sp., no. 248 (K, holotype of *P. peristomialis*); BRAZIL. Rio Grande do Sul, on culms of bamboo, 7 Apr 1893, Malme 340 (S, holotype of *Ijuhya vitrea*); INDONESIA. Java, Tjibodas, on bamboo, 1907–8, Höhnel 5792 (FH, holotype of *I. vitrea* var. *javanica*). Culture: CBS 569.76.

ILLUSTRATIONS.— Dennis (1978, Pl. 31K, as *A. peristomialis*); Rossman (1983, Fig. 40, Pl. 13A–B, as *N. peristomialis*); Samuels (1976b, Fig. 9, as *N. peristomialis*).

NOTES.— Samuels (1976b) and Rossman (1983) provided descriptions of *I. peristomialis* (as *N. peristomialis*) and its *Acremonium* anamorph.

***Ijuhya chilensis* (Speg.) Rossman & Samuels, *comb. nov.* — Plate 2, d, Plate 5, c–e.**

≡ *Lepidonectria chilensis* Speg., Revista Fac. Agron. Univ. Nac. La Plata 6: 97. 1910.

Ascomata gregarious, superficial, without visible basal mycelium, difficult to remove from the substratum. Ascomata globose, 275  $\mu\text{m}$  diam, non-papillate, dull orange, KOH-, not collapsed, with a fringe of thick-walled, fasciculate hairs around the apex, hairs up to 100  $\mu\text{m}$  long. Ascumatal surface of tightly intertwined hyphae, wall of several regions of intertwined, thick-

walled hyphae. Asci clavate to fusiform, 65–96 × 9–11.2 μm, widest in the middle, apex simple, 6–8-spored, ascospores pluriseriate. Ascospores narrowly fusiform, (19–)21–28 × 3.5–4.5 μm, 1-septate, slightly or not constricted at septum, hyaline, coarsely striate with striations extending over the length of the spore, few in number.

**HABITAT AND DISTRIBUTION.**— Known only from the type specimen.

**HOLOTYPE.**— CHILE. *Valdivia*, on decaying shoots of *Lobelia lupa*, Jan 1909. C. Spegazzini (LPS-1696).

**NOTES.**— Based on Spegazzini's illustrations and the type specimen, *Lepidonectria chilensis* belongs in *Ijuhya* and is similar to *Ijuhya paraparilis* except that ascomata of *I. paraparilis* have a flattened apical disk and occur on black mycelium on bamboo. The ascomata of *I. chilensis* are associated with an effete, black fungus.

EIGHT ADDITIONAL SPECIES are included in *Ijuhya* as follows:

***Ijuhya aquifolii*** (Cooke & Ellis) Rossman & Samuels, *comb. nov.* — Plate 2, c.

≡ *Peziza aquifolii* Cooke & Ellis, *Grevillea* 6: 91. 1878 (as '*aquifoliae*'). — Lectotype, designated in Rossman *et al.* (1993); UNITED STATES. New Jersey: Newfield, on dead leaves of *Ilex*, associated with dematiaceous hyphae, 21 May 1877, J.B. Ellis 2559 (BPI 1113199).

≡ *Pseudonectria aquifolii* (Cooke & Ellis) Dennis, *Personia* 3: 35. 1964.

≡ *Peristomialis aquifolii* (Cooke & Ellis) Rossman *et al.*, *Mycologia* 85: 696. 1993 (as '*aquifoliae*').

This species was described and illustrated in Rossman *et al.* (1993) as *N. aquifolii*.

***Ijuhya bambusina*** (Syd. & P. Syd.) Rossman & Samuels, *comb. nov.*

≡ *Pseudonectria bambusina* Syd. & P. Syd., *Ann. Mycol.* 15: 214. 1917.

≡ *Peristomialis bambusina* (Syd. & P. Syd.) Rossman *et al.*, *Mycologia* 85: 699. 1993.

This species was described and illustrated in Rossman *et al.* (1993) as *N. corynespora*.

***Ijuhya corynespora*** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria corynespora* Samuels, *New Zealand J. Bot.* 16: 78. 1978.

≡ *Peristomialis corynespora* (Samuels) Samuels, *Mem. New York Bot. Gard.* 48: 18. 1988.

This species was described and illustrated in Samuels (1978) as *N. bambusina*.

***Ijuhya dentifera*** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Nectria dentifera* Samuels, *New Zealand J. Bot.* 14: 253. 1976.

≡ *Peristomialis dentifera* (Samuels) Samuels, *Mem. New York Bot. Gard.* 48: 18. 1988.

This species was described and illustrated in Samuels (1976b) as *N. dentifera*. Culture CBS 574.76.

***Ijuhya dictyospora*** (Rossman) Rossman & Samuels, *comb. nov.*

≡ *Nectria dictyospora* Rossman, *Mycol. Pap.* 150: 69. 1983.

≡ *Peristomialis dictyospora* (Rossman) Samuels, *Mem. New York Bot. Gard.* 48: 20. 1988.

This species was described and illustrated in Rossman (1983) as *N. dictyospora* and Samuels (1988) as *P. dictyospora*.

***Ijuhya leucocarpa*** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Peristomialis leucocarpa* Samuels, *Mem. New York Bot. Gard.* 48: 16. 1988.

This species was described and illustrated in Samuels (1988) as *P. leucocarpa*.

***Ijuhya paraparilis*** (Samuels) Rossman & Samuels, *comb. nov.*

≡ *Peristomialis paraparilis* Samuels, *Mem. New York Bot. Gard.* 48: 16. 1988.

This species was described and illustrated in Samuels (1988) as *P. paraparilis*.

***Ijuhya parilis*** (Syd.) Rossman & Samuels, *comb. nov.*

≡ *Nectria parilis* Syd., *Ann. Mycol.* 28: 121. 1930.

≡ *Peristomialis parilis* (Syd.) Samuels, *Mem. New York Bot. Gard.* 48: 15. 1988.

This species was described and illustrated in Samuels (1988) as *P. parilis*.

KEY TO THE SPECIES OF *IJUHYA*

1. Ascospores 5- or more-septate or muriform ..... 2  
 1. Ascospores 1-3-septate ..... 4
- 2 (1). Ascospores muriform, with 7-13 transverse septa and one, irregular, longitudinal septum, 48-97 × 10-16 μm, smooth ..... *I. dictyospora*  
 2. Ascospores only transversely septate, generally less than 45 μm long, coarsely striate 3
- 3 (2). Ascospores 5-7-septate, rarely 1-3- or up to 11-septate, (24-)30-60(-110) × 4-7(-8) μm, fusiform ..... *I. peristomialis*  
 3. Ascospores 5-9(-13)-septate, 27-42 × 3-4.5 μm, narrowly fusiform . *I. corynespora*
- 4 (1). Ascospores fusiform, more than 10 μm long ..... 5  
 4. Ascospores oblong to ellipsoid or narrowly ellipsoid, less than 10 μm long ..... 8
- 5 (4). Ascospores 14.5-20 × (2.5-)3-5(-5.5) μm, spinulose ..... *I. parilis*  
 5. Ascospores more than 20 μm, coarsely striate ..... 6
- 6 (5). Ascomata with a flattened apical disk; ascospores (19.5-)21.5-24.5(-25.5) × 4-5 μm ..... *I. paraparilis*  
 6. Ascomata with an apical fringe of fasciculate hairs ..... 7
- 7 (6). Ascospores (1-)5-7(-11)-septate, (24-)30-60(-110) × 4-7(-8) μm long; ascomata white to pale yellow ..... *I. peristomialis* (see under 3)  
 7. Ascospores 1-septate, 21-28 × 3.5-4.5 μm; ascomata dull orange ..... *I. chilensis*
- 8 (4). Ascospores finely striate, 7.5-9 × 2.5-3 μm; ascomata umber, with an acute apex, finely scurfy due to free ends of hyphae ..... *I. bambusina*  
 8. Ascospores smooth or finely spinulose; ascomata white, yellow to orange or sienna, with an apical disk and/or fasciculate hairs or hyphae ..... 9
- 9 (8). Ascomata white, 150 μm diam or less; ascospores ellipsoid to oblong, (7.5-)8.5-10(-11) × 2-2.5(-3) μm, smooth-walled ..... *I. leucocarpa*  
 9. Ascomata yellow, orange or sienna, more than 150 μm diam; ascospores smooth or finely spinulose ..... 10
- 10 (9). Ascomata sienna, with short, sinuous hairs extending from the wall; ascospores oblong to narrowly ellipsoid, 7-9 × 2-2.5 μm, smooth-walled ..... *I. aquifolii*  
 10. Ascomata yellow to orange, with fasciculate hairs; ascospores ellipsoid, 6-8 × 3-4 μm, finely spinulose ..... *I. dentifera*

**KALLICHROMA** Kohlm. & Volkm.-Kohlm., Mycol. Res. 97: 759. 1993.

Type: *K. tethys* (Kohlm. & E. Kohlm.) Kohlm. & Volkm.-Kohlm. (≡ *Hydronectria tethys* Kohlm & E. Kohlm.).

Ascomata depressed subglobose to ellipsoid, at first immersed, erumpent, ostiolate, periphyses surrounded by a gelatinous matrix, non-papillate, indistinctly clypeate, fleshy-leathery, yellow-orange, gregarious or frequently confluent; clypeoid tissue extending from peridium around the ostiole and often connecting with adjacent ascomata. Ascomatal wall of three regions: outer region of

polygonal cells with large lumina; middle region of thick-walled cells with small lumina; inner region of elongate, flattened, thick-walled cells, forming a *textura angularis*. Apical paraphyses present, septate, simple, apically attached, merging with the periphyses. Asci subcylindrical to clavate, thin-walled at maturity except for the narrow, thick-walled persistent apex, without apical apparatus, maturing successively on the ascogenous tissue at the bottom of the centrum, 8-spored, ascospores biseriate. Ascospores ellipsoid, equally 1-septate, hyaline, longitudinally striate by thin ribs or smooth, with or without an early dissolving mucilaginous sheath. Anamorph un

known. On driftwood, mangrove roots, and submerged wood and branches in marine habitats. Description modified from Kohlmeyer & Volkmann-Kohlmeyer (1993).

NOTES.— Kohlmeyer & Volkmann-Kohlmeyer (1993) established this genus for two taxa previously described in *Hydronectria*. They provided a thorough account of the genus including the type, *K. tethys*, and one additional species, *K. glabrum* (Kohlm.) Kohlm. & Volkm.-Kohlm. (= *Hydronectria tethys* var. *glabra* Kohlm.). *Kallichroma tethys* occurs in warm temperate and tropical regions of the Atlantic, Indian and Pacific Oceans, while *K. glabrum* has been less commonly collected, known only from the Indian Ocean and the Pacific Ocean on the east coast of Australia.

**LASIONECTRIA** (Sacc.) Cooke, *Grevillea* 12: 111. 1884.

= *Nectria* subgenus *Lasionectria* Sacc., *Syll. Fung.* 2: 505. 1883.

Lectotype, designated by Clements & Shear (1931): *L. mantuana* (Sacc.) Cooke (= *Nectria mantuana* Sacc.).

Ascomata non-stromatic, superficial, orange to dark red-orange or dark brown, slightly darker in KOH but not KOH+, subglobose to globose, collapsed slightly cupulate when dry or not, often with fasciculate and/or solitary hairs. Ascomatal wall generally more than 20  $\mu\text{m}$  thick, of two regions: outer region of thick-walled, pigmented cells; inner region of elongate, thin-walled, hyaline cells. Asci clavate. Ascospores broadly ellipsoid, 1-septate, hyaline, generally smooth-walled. Anamorph, where known, *Acremonium*. On dead woody and herbaceous substrata including basidiocarps.

NOTES.— Saccardo (1883) established *Nectria* subgenus *Lasionectria* for nine species of *Nectria* having hairs on the ascomata. Cooke (1884) listed nineteen species in *Lasionectria* including many of the original nine species; he divided the genus into two subgenera based on ascospore septation. The presence of hairs on the ascomata is not a characteristic that reflects relatedness, thus most species previously placed in *Lasionectria* are excluded from the genus. Clements & Shear (1931) considered *Dasyphthora* Clem., *Epinectria* Syd. & P. Syd., and *Neohenningsia* Koord. to be later synonyms of *Lasionectria*. Based on an examination of their type specimens, none of these genera are synonyms of *Lasionectria* and they are discussed elsewhere. The type specimen of *Lasionectria mantuana* was examined. This species is similar to species previously placed in the *Nectria sylvana*-group (Samuels, 1976b) for which *Lasionectria* provides a generic name. The genus *Lasionectria* is distinct among genera in the *Bionectriaceae* in that the ascomatal wall is composed

of thick-walled cells each with a small lumen. Three species are included in *Lasionectria* as described below.

**Lasionectria mantuana** (Sacc.) Cooke, *Grevillea* 12: 111. 1884. — Plate 2, e; Plate 5, f, g.

= *Nectria mantuana* Sacc., *Michelia* 1: 52. 1877.

Ascomata superficial with bases slightly immersed on decorticated wood fibers, solitary or in groups of 2–3; ascomata subglobose, collapsed cupulate when dry, 150  $\mu\text{m}$  high  $\times$  250  $\mu\text{m}$  diam, dark red-orange, becoming slightly darker in KOH but not blood-red or purple, without papilla. Ascomatal wall appearing roughened due to both short, fasciculate and solitary hairs. Ascomatal wall 18–35  $\mu\text{m}$  thick, of two regions: outer region 12–15  $\mu\text{m}$  thick, of thick-walled cells forming a *textura angularis*, walls pigmented in the upper portion of the ascomata, hyaline towards the base, about 1.5  $\mu\text{m}$  thick, each with a small lumen; inner region 8–21  $\mu\text{m}$  thick, cells elongate, forming a thin-walled *textura angularis* to *textura prismatica*. Short, solitary hairs extending from the outer region, hairs 12–18  $\mu\text{m}$  long  $\times$  3–3.5  $\mu\text{m}$  wide, 0–1-septate, slightly flexuous to wavy, hyaline, tapering slightly from the base to the broadly rounded apex. Around the apex beset with sparse, fasciculate hairs, 30–36  $\mu\text{m}$  long  $\times$  15–22  $\mu\text{m}$  wide at the base, individual hyphae 3–4.5  $\mu\text{m}$  wide with rounded apices. Asci clavate, 42  $\times$  6  $\mu\text{m}$ , apex simple, 8-spored, ascospores uniseriate. Ascospores broadly ellipsoid, 8.5–9.5  $\times$  3–3.5  $\mu\text{m}$ , 1-septate, slightly constricted, hyaline, smooth (although one striate spore was seen).

HABITAT AND DISTRIBUTION.— Known only from the type specimen.

HOLOTYPE.— ITALY. Mantova, Migliaretto, on decorticated poplar wood, Feb 1873. A. Magnaguti-Rondinini (PAD).

ILLUSTRATIONS.— Weese (1916, Figs. 4 A–C).

**Lasionectria sylvana** (Mouton) Rossman & Samuels, *comb. nov.*

= *Nectria sylvana* Mouton, *Bull. Soc. Roy. Bot. Belgique* 39: 49. 1900.

= *Calonectria fimbriata* Seaver & Waterston, *Mycologia* 32: 404. 1940.

Anamorph: *Acremonium* sp.

Ascomata superficial on sparse subtending hyphae, hyphae septate, branched, smooth, ca 3  $\mu\text{m}$  diam, walls ca 1  $\mu\text{m}$  thick. Ascomata urniform, ca 150  $\mu\text{m}$  high  $\times$  (185–)210–250  $\mu\text{m}$  across the flat top, superficial, solitary or in groups of 2–4, orange, becoming slightly collobent, when dry; papilla lacking or very short and acute; ostiolate, apex flattened, of cylindrical, septate, unbranched hyphae, tips of the hyphae rounded, ca 2  $\mu\text{m}$  wide. Ascomatal wall 15–25  $\mu\text{m}$  thick, cells in lon-

itudinal section indistinct, walls *ca* 1  $\mu\text{m}$  thick; outer wall cells producing ascomatal hairs. Hairs orange, up to 100  $\mu\text{m}$  long, *ca* 3  $\mu\text{m}$  wide, walls *ca* 1  $\mu\text{m}$  thick, septate, unbranched, straight, smooth, solitary or bound in fascicles and forming triangular projections. Asci clavate to fusiform, 55–75  $\times$  6–9  $\mu\text{m}$ , apex simple, 8-spored, ascospores biserial. Ascospores fusiform-ellipsoid, (9–)11–15(–17)  $\times$  (2.5–)3–4(–5)  $\mu\text{m}$ , equally 2-celled, not constricted or slightly constricted at the septum, hyaline, smooth-walled.

ANAMORPH.— Conidiophores arising from the agar surface and aerial hyphae, monophialidic, unbranched or rarely verticillately branched, straight or undulate below the tip, smooth, (40–)45–55(–78)  $\times$  (2–)2.5–3(–4)  $\mu\text{m}$  wide at the base. Phialides terminal, (17–)37–50(–54)  $\mu\text{m}$  long, 1–2  $\mu\text{m}$  wide at the unflared tip. Conidia ellipsoid to nearly cylindrical, rarely elongating, (3–)5–7(–11)  $\times$  (1.5–)2–3  $\mu\text{m}$ , unicellular, without a visible basal abscission scar, hyaline, arising in basipetal succession, held in a solitary, hyaline drop of liquid.

HABITAT.— On decaying herbaceous stems.

DISTRIBUTION.— Belgium, Bermuda, Germany, New Zealand, and United States (New York).

TYPES.— BELGIUM. Near Liège, on stems of *Angelica sylvestris*, no. 21 (BR, holotype of *N. sylvana*); BERMUDA. On dead stems of *Foeniculum vulgare* (NY, holotype of *Calonectria fimbriata*).

ADDITIONAL SPECIMENS EXAMINED.— GERMANY. Kirmitschthal: near Schandow, on stems of *Calamagrostis arundinacea*, 6 June 1898. Krieger, Fungi Saxonici no. 1421, as *Nectria graminicola* Berk. & Broome (NY). UNITED STATES. New York: Fort Hunter, Erie Canal State Park, Yankee Hill Lock, on *Equisetum arvense*, 29 July 1972, Haines 2191 (NY). — NEW ZEALAND. Westland Prov., ex rachis of *Cyathea smithii*, G.J.S. 74–75 = CBS 566.76.

ILLUSTRATIONS.— Samuels (1976a, Fig. 14; 1976b, Fig. 18, both as *N. sylvana*); Seaver & Waterston (1940, Fig. 3 lower, as *C. fimbriata*).

NOTES.— The *Acremonium* anamorph known in culture (CBS 566.76) is present on the type specimen and on the Haines collection. *Neohenningsia stellulata* Koord. and *N. brasiliensis* Henn., previously regarded as synonyms of *L. sylvana* (as *N. sylvana*) by Samuels (1976 a, b), are here considered synonyms of *Hydropisphaera rufofusca*.

***Lasionectria vulpina*** (Cooke) Rossman & Samuels, *comb. nov.*

= *Nectria vulpina* (Cooke) Ellis, North Amer. Fungi no. 774, 1882.

= *Peziza vulpina* Cooke, Hedwigia 14: 82, 1875.

= *Dialonectria vulpina* (Cooke) Cooke, Grevillea 12: 83, 1884.

= *Nectriella vulpina* (Cooke) Sacc., Syll. Fung. 9: 941, 1891.

= *Nectria incrustans* Weese, Z. Gärungsphysiol. 1: 144, 1912.

Anamorph: *Acremonium* sp.

Mycelium white, flat, scanty, hyphae septate, branched, 3–4  $\mu\text{m}$  wide, thin-walled. Ascomata urniform, (155–)190–220(–230)  $\mu\text{m}$  high  $\times$  (200–)240–270(–375)  $\mu\text{m}$  across the flattened apices, solitary or in groups of a few, orange, becoming slightly cupulate when dry; papilla lacking or very short; ostiolar area formed by cylindrical, septate unbranched hyphae with rounded tips, *ca* 2  $\mu\text{m}$  wide; periphyses 15–20  $\mu\text{m}$  long. Ascomatal wall when dry shining, 15–25(–40)  $\mu\text{m}$  thick; cells ellipsoid, 5–7  $\times$  3–4  $\mu\text{m}$ , with *ca* 1  $\mu\text{m}$  thick walls, cells becoming progressively more flattened toward the interior. Hairs orange, 10–50  $\mu\text{m}$  long, 3–5  $\mu\text{m}$  wide, with *ca* 1  $\mu\text{m}$  thick walls, septate, unbranched, straight, solitary, or in triangular fascicles. Asci broadly cylindrical to clavate, 37–58  $\times$  6–8(–10)  $\mu\text{m}$ , 8-spored; with an apical ring, ascospores obliquely uniseriate, becoming irregularly arranged. Ascospores fusiform-ellipsoid, (7–)8–11(–13)  $\times$  3–4  $\mu\text{m}$ , equally 2-celled, slightly constricted at the septum, hyaline, striate.

ANAMORPH.— Conidiophores arising from surface of the agar and the aerial mycelium; monophialidic, unbranched, aseptate, straight, smooth, 49–57  $\mu\text{m}$  long, 2.5–3  $\mu\text{m}$  wide at the base. Conidiogenous cells phialidic, 44–52  $\mu\text{m}$  long, 1–1.5  $\mu\text{m}$  wide at the unflared apex. Conidia ellipsoid to cylindrical, 5–7  $\times$  1.5–2  $\mu\text{m}$ , unicellular, hyaline, lacking a visible basal abscission scar, arising in basipetal succession, held in a solitary pink to salmon or hyaline drop of liquid.

HABITAT.— On decorticated, deciduous wood and on basidiocarps of *Stereum subpileatum*.

#### KEY TO THE SPECIES OF *LASIONECTRIA*

1. Ascospores (9–)11–15(–17)  $\times$  (2.5–)3–4(–5)  $\mu\text{m}$ , averaging more than 12  $\mu\text{m}$  long, striate; ascomatal hairs 70–200  $\mu\text{m}$  long ..... *L. sylvana*
1. Ascospores less than 12  $\mu\text{m}$  long, striate or smooth; ascomatal hairs less than 70  $\mu\text{m}$  long ..... 2
2. Ascospores striate, 8–11  $\times$  3–4  $\mu\text{m}$ ; ascomatal hairs 10–50  $\mu\text{m}$  long ..... *L. vulpina*
2. Ascospores smooth, 8.5–9.5  $\times$  3–3.5  $\mu\text{m}$ ; ascomatal hairs 12–36  $\mu\text{m}$  long ... *L. mantuana*



DISTRIBUTION.— Common in temperate regions.

TYPES.— UNITED STATES. New Jersey: Newfield, on fallen apple wood, 6 Dec 1874 (NY, lectotype of *P. vulpina*, designated in Samuels, 1976a). GERMANY. Mark Brandenburg: Triglitz in der Prignitz, on *Alnus glutinosa*, 6 Oct 1908, Jaap, Höhnel 5519 (FH-Höhnel), lectotype of *Nectria incrustans*, designated in Samuels, 1976a); same location, on *Betula*, 1 Oct 1909, Jaap, Höhnel 5519 (FH, paratype of *N. incrustans*). Culture: CBS 565.76.

ILLUSTRATIONS.— Samuels (1976a, Figs. 9f, 15; 1976b, Figs. 6, 29, both as *N. vulpina*).

**MYCOARACHIS** Malloch & Cain, *Canad. J. Bot.* 48: 1820. 1970.

Type: *M. inversa* Malloch & Cain.

Ascomata subglobose to globose, dark olive-green to black, non-ostiolate. Asci subglobose to globose, irregularly disposed, 8-spored. Ascospores one-septate, hyaline, smooth-walled. Conidia borne in clusters at the tips of simple phialides, one-celled, hyaline, smooth. Anamorph *Acremonium*. Isolated from herbivore dung.

NOTES.— The unispecific genus *Mycoarachis* was described in the cleistothecial family *Pseudeurotiaceae* and distinguished by dark olive-green to black ascomata, hyaline, one-septate ascospores, and an *Acremonium* anamorph. Later Benny & Kimbrough (1980) suggested that the fungus belonged in the *Hypocreales* because of the two-celled ascospores and *Acremonium*-like anamorph. Rehner & Samuels (1994, 1995) included the type culture in their molecular study and confirmed that *M. inversa* is a cleistothecial member of the *Hypocreales* related to *Bionectria*. Ogawa *et al.* (1997) reported the affinity of another cleistothecial genus, *Emericellopsis*, with *Mycoarachis* in a subclade of the *Bionectriaceae*.

**Mycoarachis inversa** Malloch & Cain, *Canad. J. Bot.* 48: 1822. 1970.

Anamorph: *Acremonium* sp.

Mycelium hyaline, hyphae septate, branched, 1–3  $\mu\text{m}$  wide, occasionally developing very thick walls near the septa and swelling up to 7  $\mu\text{m}$  wide. Ascomatal initials at first simple coils with filaments about 1–3  $\mu\text{m}$  wide, later becoming compact and contorted as a result of abundant proliferation. Ascomata subglobose to globose, 50–200  $\mu\text{m}$  diam, metallic in reflected light when dry, dark green to black, non-ostiolate; ascomatal wall 11–30  $\mu\text{m}$  thick, consisting of a pale outer region and a darker inner region; outer region of hyaline to pale brown cells, 3–22  $\mu\text{m}$  diam; inner region of dark brown, flattened, cells, 4–20  $\times$  2–10.5  $\mu\text{m}$ . Asci subglobose to globose, 5.5–11  $\mu\text{m}$  diam, evanescent, 8-

spored. Ascospores cylindrical to broadly ellipsoid, 5–5.5  $\times$  3–3.5  $\mu\text{m}$ , with a constricted, single median septum dividing the spore into two equal globose cells, hyaline, smooth.

ANAMORPH.— Conidiophores arising from submerged mycelium, simple or sparingly branched, septate, tapering from the base to the apex, ending in a phialide, 14–35  $\times$  2–3.5  $\mu\text{m}$ . Conidia ellipsoid, fusoid, ovoid, cylindrical or allantoid, 3–10  $\times$  1.5–3.5  $\mu\text{m}$ , non-septate, hyaline, smooth-walled, borne in moist clusters at the tip of the conidiophores. Description modified from Malloch & Cain (1970).

HABITAT.— Isolated from cow-, elephant- and unidentified herbivore dung.

DISTRIBUTION.— Tanzania, Uganda, and United States (Nebraska), as reported by Malloch & Cain (1970).

HOLOTYPE.— UGANDA. Mweya Lodge: Queen Elizabeth National Park, isolated from elephant dung, 27 July 1966, Cain, Griffin & Krug (TRTC 66.2166f, not examined). Culture CBS 517.70.

ILLUSTRATIONS.— Malloch & Cain (1970, Figs. 20–25).

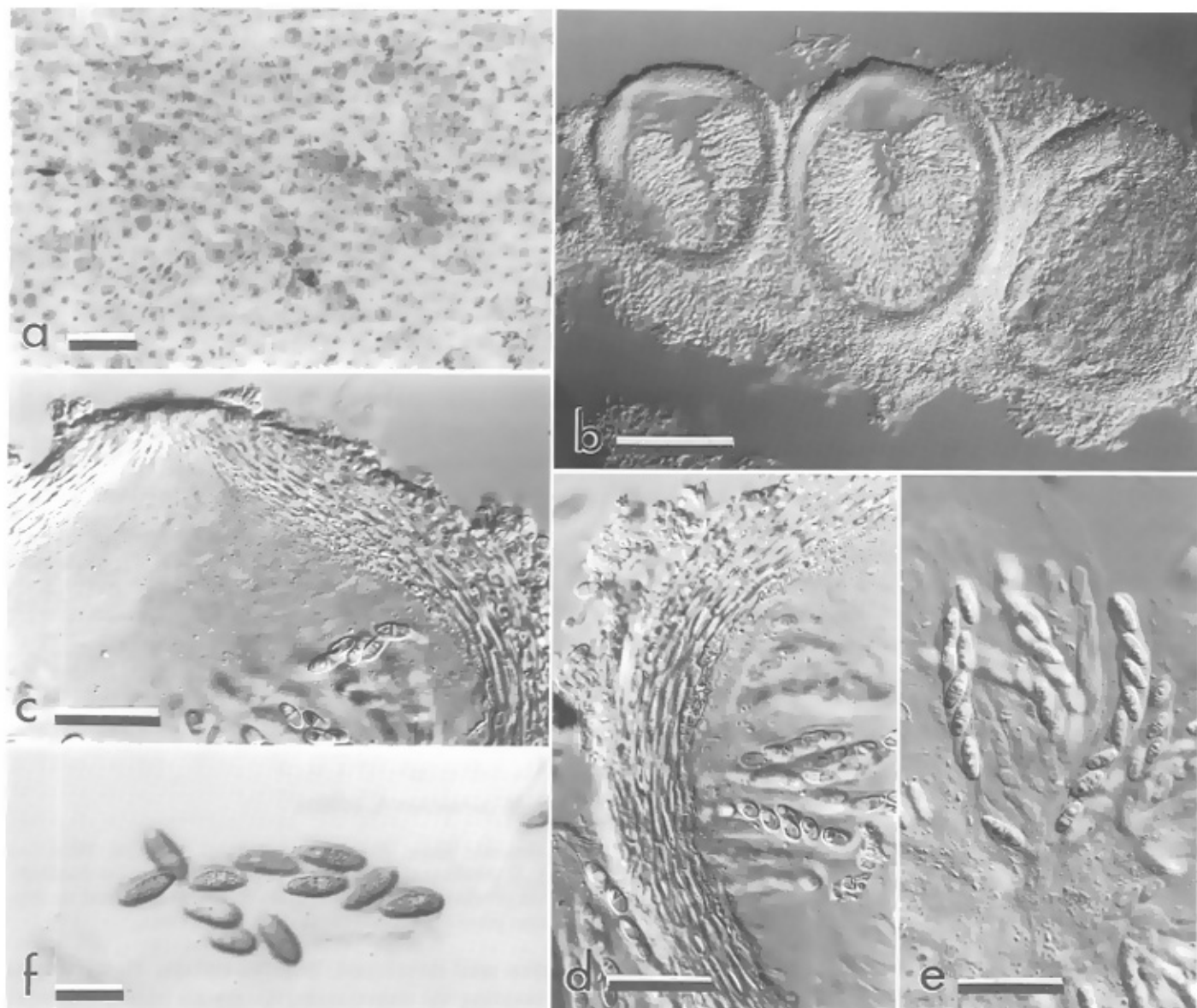
**MYCOCITRUS** A. Möller, *Bot. Mitt. TROPEN* 9: 297. 1901.

Type: *M. aurantium* A. Möller.

= *Shiraiella* Hara, *Bot. Mag. (Tokyo)* 28: 274. 1914. — Type: *S. phyllostachydis* (Syd. & P. Syd.) Hara (= *Ustilago noidea phyllostachydis* Syd. & P. Syd.), recognized as *Mycocitrus phyllostachydis* (Syd. & P. Syd.) Doi.

Stroma well-developed, buff to rufous, clasping and surrounding the substratum. Ascomata immersed, with apices barely visible, densely gregarious, forming a single layer. Asci cylindrical, ascus apex simple. Ascospores ellipsoid, 1-septate, hyaline, spinulose. Anamorph *Acremonium*. On living stems of bamboo.

NOTES.— *Mycocitrus* is characterized by ascomata partially to fully immersed in the upper region of large, fleshy stromata that clasp and surround bamboo stems. Möller (1901) illustrated an *Acremonium*-like anamorph. Although the type specimen of *M. aurantium* probably no longer exists, an excellent illustration serves to characterize this species. The unispecific genus *Shiraiella* was established for *Ustilago noidea phyllostachydis*. Doi (1967a) was unable to locate the type specimen of *U. phyllostachydis* at B suggesting that it was destroyed. He designated a non-type specimen examined by Hara (TNS 209286) as the neotype and transferred *U. phyllostachydis* to *Mycocitrus*. *Mycocitrus* is recognized with these two species.



**Plate 6. a–f.** *Mycocytrus aurantium*. a. Surface view of stroma with ostioles of immersed ascomata. b. Median section of ascomata and stroma. c. Median section of ascomatal apex. d. Median section showing ascomatal wall. e. Asci with ascospores and remnants of apical paraphyses. f. Asci with ascospores. a, c–f. BPI Lloyd 37616. b. Rick 117 – BPI. Scale bars: a = 500  $\mu\text{m}$ ; b = 100  $\mu\text{m}$ ; c–e = 25  $\mu\text{m}$ ; f = 10  $\mu\text{m}$ .

***Mycocytrus aurantium*** A. Möller, Bot. Mitt. Tropen 9: 297. 1901. — Plate 6, a–f.

Anamorph: *Acremonium*-like.

Stroma very large, 7–10 cm diam, globose, surface buff to rufous, clasping and surrounding the substratum, internal tissue hyphal, white. Ascomata partially to fully immersed at surface, apices barely visible, densely gregarious, formed in a single layer, yellow to orange, KOH–; ascomatal apex not sharply differentiated, ostiolar opening formed of narrowly clavate cells, continuous with periphyses. Ascomatal wall ca 20  $\mu\text{m}$  thick, forming a single region of cells of intertwined, hyaline, thick-walled hyphae, cell lumina ellipsoid to fusiform, 2.5–10  $\mu\text{m}$  long  $\times$  2–2.5  $\mu\text{m}$  wide, with outer cells be-

coming conspicuously hyphal. Asci 45–60  $\times$  4.5–8.5  $\mu\text{m}$ , ascial apex simple, eight-spored, irregularly biseri-ate. Ascospores ellipsoid, (6–)7.5–10(–11)  $\times$  3.5–4.5  $\mu\text{m}$ , 1-septate, hyaline, spinulose.

**HABITAT.**— On living stems of bamboo.

**DISTRIBUTION.**— Brazil.

**TYPES.**— BRAZIL. Blumenau: on living stems of bamboo, A. Möller (iconotype: Möller, 1901, Tafel II, Figs. 38a–f, Tafel IV, Fig. 45); São Leopoldo: on living *Arundinaria*, 1905, Rick, Fungi austro-americi 117 (BPI, in bound set, **epitype** designated herein; BPI 631727, FH-General, FH-Höhnel, FH-Patouillard, isoeotypes).

**ADDITIONAL SPECIMEN EXAMINED.**— BRAZIL. Rio Grande Do Sul: P. Pio Buck, 14317, Lloyd 37616 (BPI 744967).

**ILLUSTRATION.**— Müller & von Arx (1962, Fig. 257).

KEY TO THE SPECIES OF *MYCOCITRUS*

1. Stromata very large, 7–10 cm diam, globose, smooth; ascospores (6–)7.5–10(–11) × 3.5–4.5 μm, spinulose; on *Arundinaria* in Brazil ..... *M. aurantium*
1. Stromata 5–9 mm long × 4–5 mm diam, elongate, tuberculate; ascospores 6.5–9 × 3.5–5.5 μm, hyaline, smooth to slightly roughened; on *Phyllostachys* in Japan . *M. phyllostachydis*

NOTES.— The type specimen of *Mycocitrus aurantium*, deposited either at B or HBG, was apparently destroyed. The detailed illustration accompanying the type description is considered the iconotype, with the Rick exsiccata herein designated as the epitype. In these and other specimens, the ascomata develop only at the surface of a very large stroma. In the illustrations by Möller (1901) and Müller & von Arx (1962), the perithecia are shown to be immersed at the surface and below it in several layers. However, in all the specimens examined, the ascomata were found to be irregularly arranged but developing only at the surface of the stroma. If the extensive stroma were sectioned obliquely, the ascomata might appear to be distributed as shown in these illustrations.

***Mycocitrus phyllostachydis*** (Syd. & P. Syd.) Doi, Bull Natl. Sci. Mus. 10: 31. 1967.

≡ *Ustilaginoidea phyllostachydis* Syd. & P. Syd., Mem. Herb. Boiss. 4: 5. 1900.

≡ *Hypocreopsis phyllostachydis* (Syd. & P. Syd.) Miyake & Hara, Bot. Mag. (Tokyo) 24: 333. 1910.

≡ *Shiraiella phyllostachydis* (Syd. & P. Syd.) Hara, Bot. Mag. (Tokyo) 28: 402. 1914.

Anamorph: *Acremonium*-like.

Doi (1967a) provided a good description and illustrations of *M. phyllostachydis* including the anamorph.

**NECTRIELLA** Nitschke, in Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 175. 1869 [1870].

Lectotype, designated by Seaver (1909a): *N. fuckelii* Nitschke. Ascomata immersed to partially erumpent, scattered or in groups, non-stromatic, obpyriform, less often subglobose, 100–500 μm diam, white, pale yellow, pale red or pale brown, not changing color in KOH or lactic acid or rarely reacting weakly, ostiolate, collapsing vertically by lateral pinching or not collapsing. Ascomatal wall 10–30(–40) μm thick, often of two intergrading regions: outer region of thick-walled, angular to rounded cells; inner region of thin-walled, elongate cells. Ascomatal apex of parallel rows of vertically elongate cells, continuous with the inner wall region; cells increasingly narrow, merging with paraphyses at the interior, somewhat expanded or clavate at the exterior. Gelatinized remains of apical paraphyses sometimes seen. Asci clavate, apex usually with a ring, 8-spored,

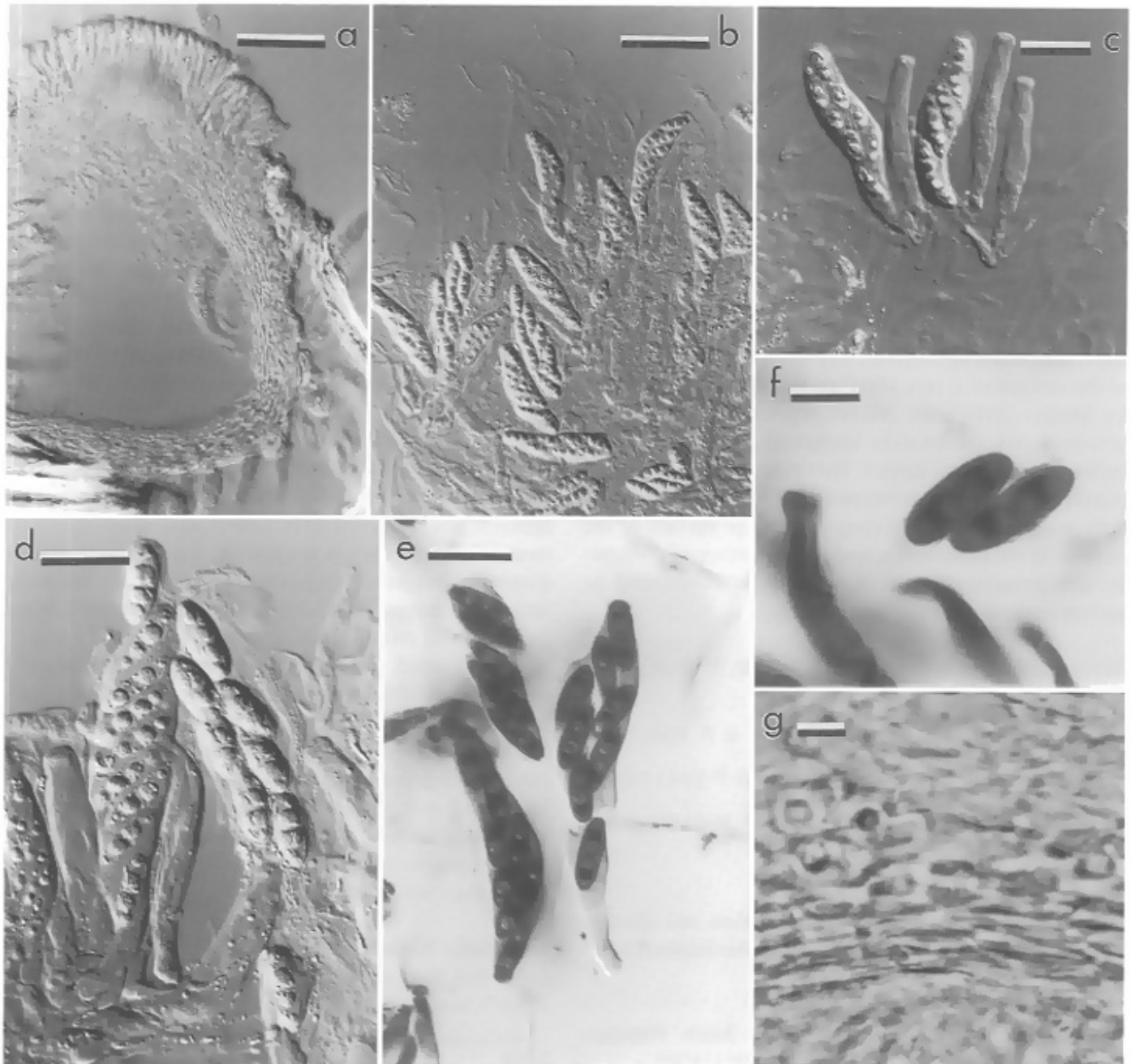
ascospores usually biseriolate in the middle, uniseriate above and below, occasionally entirely uniseriate. Ascospores navicular, ellipsoid or fusiform, 1-septate, rarely non-septate, hyaline, smooth, faintly spinulose, verrucose or longitudinally striate. Anamorph, where known, *Acremonium*-like or *Kutilakesa*. On dead woody and herbaceous substrata.

NOTES.— *Nectriella* was established for species of *Nectria* that are immersed in the substratum. Lowen (1991) circumscribed the genus based on a study of the type species; she provided descriptions and illustrations of over twenty species in *Nectriella*. *Nectriella* is distinguished from other hypocrealean genera by the non-stromatic, immersed, KOH–, ascomata with walls often composed of two regions. Species of *Nectriella* generally have small, pale yellow, inconspicuous ascomata and occur on dead wood, herbaceous debris, rarely on fungi or as plant parasites, as in *N. pironii* (Alfieri & Samuels, 1979). It is expected that many species have yet to be discovered. Because species of *Nectriella* are immersed in the substratum, they tend to lose characteristics of the ascomata that might be useful in placing them taxonomically, thus species now classified in *Nectriella* may not be closely related.

***Nectriella fuckelii*** Nitschke, in Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24: 175. 1869 [1870]. — Plate 7, a–f.

≡ *Calonectria fuckelii* (Nitschke) Sacc., Michelia 1: 310. 1878.

Ascomata solitary or in groups of up to 10, immersed to partially erumpent with emergent papilla, difficult to remove from substratum, globose to obpyriform, 220–400 μm high × 200–410 μm diam, at first pale pink, then pale yellow, KOH–; papilla rounded to flattened, 88–168 μm high × 150–200 μm diam, of loosely joined hyphal elements, ca 3.5–4.5 μm wide, with rounded ends that extend to same height, scattered, very thick-walled, unbranched elements arising from and extending beyond the margin of the ascomata. Setae clavate, 24–64 μm long × 4–5 μm wide, tapering to 3 μm at the base, sparingly septate, hyaline, brittle, with round apex and 1.5–2 μm thick walls. Ascomatal wall 21–28 μm thick, of two regions: outer region 14–18 μm thick of thick-walled, rounded cells, 3–7 × 2–8 μm, with 2 μm thick walls, fusing and terminating



**Plate 7.** a–f. *Nectriella fuckelii*. a. Median section of ascoma. b. Asci with deliquescent apical paraphyses. c, d. Asci with ascospores. e. Asci with ascospores stained in cotton blue. f. Ascospores stained in cotton blue. g. *Nectriella utahensis*. Median section of ascomatal wall. a–f. Isolectotype – BPI. g. Holotype – NY. Scale bars: a, b = 50  $\mu\text{m}$ ; c = 25  $\mu\text{m}$ ; d, e = 20  $\mu\text{m}$ ; f, g = 10  $\mu\text{m}$ .

at the upper side of the papilla; inner region 8–10  $\mu\text{m}$  thick, of elongate cells 3.5–10.5  $\times$  1–5  $\mu\text{m}$ . Apical paraphyses visible among mature asci, narrowly filamentous. Asci clavate, 68–95  $\times$  12–19  $\mu\text{m}$ , constricted at the base, apex rounded to truncate, with a ring; ascospores biseriolate. Ascospores narrowly ellipsoid, (12–)16–19  $\times$  (5.5–)6–7(–8)  $\mu\text{m}$ , 1-septate, at first hyaline, then slightly yellow, spinulose due to collapse of the narrow sheath.

**HABITAT AND DISTRIBUTION.**— Known only from the type collection.

**TYPES.**— GERMANY. Hessen (formerly Nassau): Rheingau, on dead but still hard wood of *Populus nigra*, spring, Fuckel, Herb. Boissier No. 915 as *Calonectria fuckelii* (FH, lectotype, designated by Rossman, 1979b; B, BPI, FH – Höhnle, S, isolectotypes).

TWENTY-ONE ADDITIONAL SPECIES are included in *Nectriella* based on Lowen (1991), three of which are described here as new species.

***Nectriella alpina*** (G. Winter) Weese, Ann. Mycol. 12: 148. 1914.

≡ *Nectria alpina* G. Winter, Hedwigia 19: 175. 1880.

ANAMORPH.— None known.

Ascomata immersed, becoming erumpent, scattered or in groups of 5–6, obpyriform, 220–260  $\mu\text{m}$  high  $\times$  195–250  $\mu\text{m}$  diam, at first orange-yellow, then yellow with brownish ostiole. KOH–; papilla truncate, 50  $\mu\text{m}$  high  $\times$  100–150  $\mu\text{m}$  diam, apex of clavate, diverging, thin-walled hyphae, 10–17.5  $\times$  3–5  $\mu\text{m}$ , 0–2 septate, ends free. Cells on surface consisting of intertwined hyphae. Ascum wall 10–12  $\mu\text{m}$  thick, of two regions: outer region of intertwined hyphae with ellipsoid cells 5–9  $\times$  1.5–3.5  $\mu\text{m}$ ; inner region of parallel hyphae, 0.5–1.5  $\mu\text{m}$  wide. Asci clavate, 60–89  $\times$  9–12.5  $\mu\text{m}$ ; apex rounded, with an inconspicuous apical ring, ascospores biserial. Ascospores ellipsoid, (12.5–) 13–17.5(–19)  $\times$  3.5–5(–7)  $\mu\text{m}$ , 1-septate, sometimes slightly constricted, with upper cell often wider than lower cell, hyaline, spinulose.

HABITAT.— On basal leaves and stems of *Arabis* and *Saxifraga*.

DISTRIBUTION.— Austria, Switzerland.

LECTOTYPE, designated herein: SWITZERLAND. Grisons: Rhaetia, Albula near Hospiz, in wilted and dry leaves of *Arabis pumila* (*Brassicaceae*) associated with *Pleospora pyrenaica* Niessl, May 1880, G. Winter (NY).

ADDITIONAL SPECIMEN EXAMINED.— AUSTRIA. Steiermark: Eisenerzer Alpen, Reiting W von Trofaiach, NE-Abhang des Grieskogels, ca 2050 m, Caricetum firmae, on *Saxifraga paniculata*, 9 July 1984, J. Hafellner & A. Nogrsek (GZU 140–88).

NOTES.— The species was recollected and redescribed by Nogrsek (1990).

*Nectriella balansiae* R.H. Arnold, Mycologia 59: 248. 1967.

ANAMORPH: None known.

Ascomata immersed in stromata and occasionally in empty ascomata of *Balansia*, obpyriform, 110–128  $\mu\text{m}$  high  $\times$  70–120  $\mu\text{m}$  diam, nearly white, KOH–; papilla 30–66  $\mu\text{m}$  high  $\times$  16–30  $\mu\text{m}$  diam. Ascum wall 12  $\mu\text{m}$  thick, of one region of elongate cells 6  $\times$  2  $\mu\text{m}$ , with 1  $\mu\text{m}$  thick walls; periphyses prominent. Asci clavate, 31.5–40  $\times$  5.5  $\mu\text{m}$ ; apex truncate, with a ring; ascospores biserial. Ascospores irregularly ellipsoid-fusiform, 9.5–10.5  $\times$  2.5–3  $\mu\text{m}$ , typically 1-septate, one cell often narrower, hyaline, smooth, two prominent guttules per cell.

HABITAT.— Fungicolous, on stromata of *Balansia*.

DISTRIBUTION.— Known only from the type collection.

LECTOTYPE, designated herein.— CENTRAL AFRICAN REPUBLIC ('French Congo'). Kouti Region [near Ndéle], journey II, immersed in the stromata of *Balansia volkensii* on high herbs [grass], 15 Nov 1891, J. Dybowski, Patouillard Herb. 597 (FH, as *Hyalodothis clavis*).

NOTES.— *Nectriopsis epichloë* (Speg.) Samuels also occurs on *Balansia* and produces similarly sized and shaped asci and ascospores, but differs from *Nectriella balansiae* by yellow, superficial ascomata and ascospores that lack prominent guttules.

*Nectriella bloxamii* (Berk. & Broome) Fuckel, Jahrb. Nassauischen Vereins Naturk. 29–30: 21. 1876–1877 [1877].

$\equiv$  *Nectria bloxamii* Berk. & Broome, Ann. Mag. Nat. Hist., Ser. 2, 13: 467. 1854.

$\equiv$  *Nectria umbelliferarum* P. Crouan & H. Crouan, Fl. Finistère, p. 37. 1867.

$\equiv$  *Nectria heraclei* P. Crouan & H. Crouan, Fl. Finistère p. 38. 1867.

$\equiv$  *Nectria fuscidula* Rehm, Hedwigia 21: 199. 1882.

$\equiv$  *Nectria dacrymycelloides* Rehm, Hedwigia 42: 175. 1903.

[ $\equiv$  *Nectriella dacrymycelloides* (Rehm) Höhn. & Weese, Ann. Mycol. 8: 465. 1910, *comb. inval.*, Art. 33.1].

Ascomata immersed, becoming erumpent, scattered or in groups of up to 8, subglobose, 250–300  $\mu\text{m}$  diam, pale at first, orange-brown, then tan. KOH–; collapsed vertically, nonsetose. Cells on surface of ascomata angular, ca 10  $\mu\text{m}$  diam. Ascum wall 20  $\mu\text{m}$  wide, of two regions: outer region 12  $\mu\text{m}$  thick, of thick-walled, angular to rounded cells, 10  $\mu\text{m}$  diam; inner region 8  $\mu\text{m}$  thick, of thin-walled, elongate cells. Asci clavate, 40–70  $\times$  8–9(–12)  $\mu\text{m}$ ; apex truncate, with a ring; ascospores biserial. Ascospores ellipsoid, 16–24  $\times$  3–5  $\mu\text{m}$ , 1-septate, often slightly constricted, hyaline, pale orange in mass when fresh, smooth to slightly roughened, often many guttules per cell.

ANAMORPH.— None known.

HABITAT.— On dead stems of herbaceous dicotyledonous plants.

DISTRIBUTION.— Europe, New Zealand.

TYPE SPECIMENS.— UNITED KINGDOM. England: Leicestershire, Twycross, on Jerusalem artichoke (*Helianthus tuberosus* L., *Asteraceae*), 16 Nov 1855, Rev. A. Bloxam 781 (holotype of *N. bloxamii* K; isotypes: IMI 52290, slides; K, 3 collections; K, BM, PC, all as *Sphaeria* (*Nectria*) *bloxamii*); FRANCE. Brittany: Finistère, on dead stems of *Oenanthe crocata*, 20 June 1864, Crouan & Crouan (lectotype of *Nectria umbelliferarum*, designated herein, CO); on dead stems of *Urtica*, 18 June 1864, Crouan & Crouan (paratype of *Nectria umbelliferarum*, CO); on stem of *Umbelliferae* (*Apiaceae*), 30 Jan 1862, Crouan & Crouan (paratype of *Nectria umbelliferarum*, CO); on stems of *Heracleum sphondylium*, 27 Mar 1863, Crouan & Crouan (holotype of *Nectria heraclei*, CO).

NOTES.— *Nectriella bloxamii* can be confused with *N. luteola* in macroscopic appearance but is distinguished by longer ascospores, differences in substrata (herbaceous stems versus leaf veins and petioles) and the color of the ascomata. *Nectriella dacrymycella* has orange, translucent ascomata that usually remain under the epidermis of the substratum and have a more thickened

apex due to the globose, thick-walled cells of the outer region of the ascumatal wall.

***Nectriella crouanii*** Lowen, *nom. nov.*

≡ *Nectria aurea* P. Crouan & H. Crouan, Fl. Finistère, p. 37, 1867 [non *Nectriella aurea* Sacc. & Speg. 1878].

Ascomata immersed, often becoming erumpent, scattered, subglobose, 100–200 µm diam, yellow; ascumatal apex red, becoming darker in KOH, papilla truncate. Ascumatal wall 21–23 µm thick, of two regions at the apex and sides, one at the base: outer region 9–13 µm thick; walls indistinct; inner region 10–12 µm thick, of thin-walled, elongate cells. Asci clavate, 44 × 4–5 µm; apex truncate, with a ring; ascospores biseri-ate. Ascospores ellipsoid to fusiform, 12 × 3 µm, 1-septate, not constricted, hyaline, smooth-walled, with two guttules per cell.

ANAMORPH.— None known.

HABITAT.— *Rubus* and 'moulin'.

DISTRIBUTION.— France, known only from the two Crouan collections.

HOLOTYPE.— FRANCE, Brittany: Tenfeld, on small branches of *Rubus*, 26 Feb 1863, Crouan & Crouan (CO).

ADDITIONAL SPECIMEN EXAMINED.— FRANCE, Brittany: Vallon, on white 'moulin', 8 March 1866, Crouan & Crouan (CO).

NOTES.— *Nectriella crouanii* and *N. exigua* are distinguished from other species of *Nectriella* by the ascumatal walls that have two regions at the apex and sides and by asci that average less than 45 µm long. *Nectriella crouanii* differs from *N. exigua* by the substratum and the ascumata that are red at the apex and yellowish on the sides and base.

***Nectriella curtisii*** (Berk.) Lowen, *comb. nov.*

≡ *Nectria curtisii* Berk., Grevillea 4: 46, 1875.  
= *Nectria lacustris* Kirschst., Ann. Mycol. 34: 186, 1936.  
≡ *Nectriella lacustris* (Kirschst.) Magnes & Hafellner, Biblioth. Mycol. 139: 105, 1991.

NOTES.— Magnes & Hafellner (1991) provided a recent description and illustrations of this species as *N. lacustris*.

***Nectriella dacrymycella*** (Nyl.) Rehm, *Ascomyceten* no. 232, 1874.

≡ *Sphaeria dacrymycella* Nyl., Flora 46: 332, 1863.

Ascomata immersed, scattered or in groups of up to 20, subglobose, 140–200 µm high × 180–230 µm diam, bright orange, remaining covered by host epidermis, KOH–. Cells on the surface of the ascumata angular, 6–10 µm diam. Ascumatal wall 10 µm thick, up to 20

µm at the apex as expanded outer region of rounded, thick-walled cells; inner region of elongate cells; ostiolar region of thick-walled, angular to rounded cells, outer cells merging with the substratum. Asci clavate, 50–75 × 9–10 µm, apex truncate, with a ring; ascospores biseri-ate. Ascospores fusiform–ellipsoid, 13–20 × 4–5.5 µm, 1-septate, sometimes slightly constricted, curved, at first hyaline, then pale brown, smooth to slightly roughened, sometimes with 2 guttules per cell.

ANAMORPH.— None known.

HABITAT.— On herbaceous stems.

DISTRIBUTION.— Europe.

HOLOTYPE.— FINLAND, Tavastia australis, Lempäälä, on stems of *Urtica*, 9 Sep 1860, P.A. Karsten (H 2236; isotypes, IMI 52313, slide; H 2237).

ADDITIONAL SPECIMENS EXAMINED.— CZECH REPUBLIC, Moravia: Mähr. Weißkirchen, on *Urtica dioica*, Oct 1926, F. Petrak (C; as *Nectria dacrymycella*). FRANCE, Brittany: on dead stems of *Urtica*, 22 Oct 1869, Crouan & Crouan (CO; as *Nectria dacrymycella*). UNITED KINGDOM, England: Bucks, on stems of *Iris pseudacorus* (IMI 96574); Isle of Lygha, E. Bay at Tabet, on *Iris pseudacorus*, 12 May 1981, R.W.G. Dennis (K; as *Nectria arenula*); Norfolk: King's Lynn, on stem of *Urtica dioica*, 26 June 1979, A. Moore (K; as *Nectria arenula*); Norfolk: Norwich, on stems of *Iris pseudacorus* (IMI 70195); Wales: Monmouthshire: Gwernesey, on stems of *Iris pseudacorus*, (IMI 49092); Powys, Forden, on nettle stems, 27 Sep 1934, Vize 37 (K).

ILLUSTRATION.— Ellis & Ellis (1985, Fig. 1541).

NOTES.— *Nectriella dacrymycella* and *Charonectria sceptri* both have ascumata that look like orange blisters under the epidermis of herbaceous stems. *Nectriella dacrymycella* usually has smaller, non-papillate ascumata with a narrower lateral wall, shorter asci and, unlike *C. sceptri*, does not have true paraphyses. Ascumata of *N. dacrymycella* are found on *Iris pseudacorus* and *Urtica dioica*, whereas those of *C. sceptri* are known on species of *Aconitum*, *Pedicularis sceptrum-carolinum*, and other dead herbaceous plants. *Nectriella dacrymycella* has ascospores that overlap in size and shape with those of *Nectriella bloxamii* and *N. luteola*, but it is distinguished from the latter two species by ascumata that have a wider wall at the ascumatal apex and the bright orange pigment. *Nectriella dacrymycella* is illustrated and briefly described by Ellis and Ellis (1985).

***Nectriella dakotensis*** (Seaver) Lowen, *comb. nov.*

≡ *Hyponectria dakotensis* Seaver, Mycologia 1: 20, 1909.  
= *Nectriella muelleri* Samuels, Rogerson, Rossman & J.D. Sm., Canad. J. Bot. 62: 1899, 1984.

This species was described and illustrated by Samuels *et al.* (1984) as *N. muelleri*, including the *Acremonium*-like anamorph.

**Nectriella exigua** Dennis, *Revista Biol. (Lisbon)* 12: 22. 1983.

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

**Nectriella funicola** (Berk. & Broome) Petch, *Naturalist* 970: 281. 1937.

≡ *Sphaeria funicola* Berk. & Broome, *Ann. Mag. Nat. Hist.*, Ser. 2, 7: 188. 1851.

= *Nectria charticola* Fuckel, *Fungi rhenani* no. 990. 1864.

≡ *Nectriella charticola* (Fuckel) Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 176. 1869 [1870].

= *Nectria fibricola* Plowr., in *Sacc.*, *Michelia* 2: 152. 1880.

This species was described and illustrated by Booth (1959) and Ellis & Ellis (1985).

**Nectriella galii** (Plowr. & Harkn.) Lowen, *comb. nov.*

≡ *Nectria galii* Plowr. & Harkn., *Bull. Calif. Acad. Sci.* 1: 26. 1884.

Ascomata immersed, raising the epidermis of the stem, scattered, subglobose, 160  $\mu\text{m}$  high  $\times$  220–240  $\mu\text{m}$  diam, pale pink, KOH–; collapsing vertically, setae flexuous, septate, to 200  $\mu\text{m}$  long. Ascumatal wall 10  $\mu\text{m}$  thick, of two regions: outer region 8  $\mu\text{m}$  thick, of thick-walled, angular to rounded cells; inner region 2  $\mu\text{m}$  thick, of thin-walled, elongate cells. Asci cylindrical, 40–60  $\times$  4–8  $\mu\text{m}$ , apex truncate, simple, thin-walled, deliquescing early; ascospores overlapping, uniseriate. Ascospores ellipsoid, 10–12  $\times$  4–6  $\mu\text{m}$ , 1-septate, hyaline, smooth to slightly roughened, one guttule per cell, ascospores occurring in great numbers, filling the centrum.

ANAMORPH.— None known.

HABITAT.— On stems of *Galium*.

DISTRIBUTION.— Known only from the type collection.

HOLOTYPE.— UNITED STATES. California: on *Galium trifolium* (*Rubiaceae*), H.W. Harkness 3070 (K).

NOTES.— *Nectriella galii* has ascomata with an enlarged apical region typical of the genus *Nectriella*. *Nectriella galii* is similar to *N. bloxamii* and *N. luteola*, two other species that have subglobose ascomata. The ascomata of *N. galii* could be mistaken for pycnidia because the fragile asci rupture easily in a squash mount liberating great numbers of ascospores into the centrum.

**Nectriella guttulata** Lowen, *Mem. New York Bot. Gard.* 49: 244. 1989.

This species is described and illustrated by Lowen (1989).

**Nectriella halonata** Lowen, *nom. nov.*

≡ *Charonectria umbelliferarum* Höhn., *Hedwigia* 42: 187. 1903 [non *Nectriella umbelliferarum* P. Crouan & H. Crouan 1867].

Ascomata immersed, scattered or in groups of 20 or more, obpyriform, 300–400  $\mu\text{m}$  high  $\times$  180–420  $\mu\text{m}$  diam, pale yellow, KOH–, papilla truncate, 60–170  $\mu\text{m}$  high  $\times$  80–140  $\mu\text{m}$  diam, collapsing vertically with the papilla retaining its shape; setae forming a circle around the ostiole, clavate, 10–80  $\times$  2–5  $\mu\text{m}$ , widening to 6  $\mu\text{m}$  at the apex, wall 1  $\mu\text{m}$  thick, apex rounded, thin-walled, base sometimes uneven, 0–2-septate, hyaline. Ascumatal wall 14–16  $\mu\text{m}$  wide, of one region of thin-walled, elongate cells. Asci clavate, 40–80  $\times$  6–10  $\mu\text{m}$ ; apex thickened, with a ring; ascospores biseriolate. Ascospores ellipsoid-fusiform, often slightly curved, (10–)15–20(–22)  $\times$  4–5.5  $\mu\text{m}$ , 1-septate, at first hyaline, then brownish yellow, distinctly verrucose when mature, with 1–2 guttules per cell.

ANAMORPH.— None known.

ETYMOLOGY.— *Halonata*, referring to the halo of setae on the papilla.

HABITAT.— In herbaceous stems of dicotyledonous plants.

DISTRIBUTION.— Known from temperate regions, Europe, and U.S.A. (Colorado).

HOLOTYPE.— AUSTRIA. Tirol: Ötztal, Tumpener See, on dry stems of umbellifer, 8/99, 27 Aug 1902, Höhnel (FH, FH – Höhnel, slide).

ADDITIONAL SPECIMENS EXAMINED.— FRANCE. Côte-d'Or: Morvan plateau, edge of pond of Ste. Isabelle, on *Angelica sylvestris*, Aug 1891, F. Fautrey, Roumeguère Fungi Sel. Exs. 6049 (K, NY, as *Nectria umbelliferarum*). GERMANY. Bavaria: Hochvogel, Bärgeunde-Alpe, (Allgäuer Hochalpen), on dry stems of umbellifer, ca 1300 m, 1909, Rehm, *Ascomyceten* 1867 (FH, K, NY as *Charonectria umbelliferarum*); Bavaria: München, Kiesgrube near Fürstenried, on dry stems of umbellifer, Oct 1902, Rehm, *Ascomyceten* no. 1466 (IMI 104344; K; as *Calonectria bloxamii*). SWEDEN. Uppland: Dalby par., roadside ca 125 m W of Jerusalem, on *Carlina vulgaris* (*Asteraceae*), overwintered stems and leaves, 28 June 1988, K. & L. Holm 4941a (NY). UNITED KINGDOM. England: Suffolk: Dunwich Forest, on *Angelica sylvestris*, 21 Sep 1979, M.B. & P. Ellis (IMI 241564); Yorkshire: Pickering marshes, on *Urtica dioica*, 21 June 1956, W.G. Bramley (K; as *Lasionectria*). UNITED STATES. Colorado: location unknown, in herbaceous stems, 1910, Seaver & Bethel (NY; as *Nectriella fuckelii*).

NOTES.— *Nectriella halonata* is similar to *N. dakotensis* in having ascomata ornamented with setae encircling the ostioles and collapsing vertically with the papillae retaining their shapes. *Nectriella halonata* has larger asci and ascospores than *N. dakotensis*. Although no ascomata remain in the holotype collection, there is a slide in the Höhnel herbarium that serves as the type.

The description herein is based primarily on Rehm, *Ascomyceten* 1867.

**Nectriella jucunda** (Durieu & Mont.) Sacc., *Michelia* 1: 278. 1878.

≡ *Sphaeria jucunda* Durieu & Mont., in Durieu, *Explor. sci. Algérie, Bot.* 1: 478. 1849.

≡ *Nectria jucunda* (Durieu & Mont.) Mont., *Syll. Gen. Sp. Crypt.*, p. 225. 1856.

≡ *Hyponectria jucunda* (Durieu & Mont.) Weese, in Höhnel & Weese, *Ann. Mycol.* 8: 466. 1910.

= *Nectriella cacti* Ellis & Everh., *J. Mycol.* 8: 66. 1902.

≡ *Hyponectria cacti* (Ellis & Everh.) Seaver, *Mycologia* 1: 20. 1909.

Ascomata immersed, scattered or in groups of up to 20, nonstromatic, subglobose, 360 µm high × 250–300 µm diam, pale red or orange to yellow, KOH–, apex truncate, ostiolar area sometimes darker. Surface cells of the ascomata epidermoid to angular, 5–10 µm in the longest dimension. Asci clavate, 42–70 × 3–4 µm, apex truncate, simple; ascospores irregularly uniseriate to biseriate in the middle, uniseriate above and below, filling the upper two thirds of the ascus. Ascospores cylindrical to allantoid, ca 5.5 × 1.5 µm, unicellular, hyaline, smooth-walled.

ANAMORPH.— *Leptodermella opuntiae* Dodge (circumstantial).

HABITAT.— In stems of *Opuntia*.

DISTRIBUTION.— Algeria, U.S.A. (Alabama), Spain.

TYPES.— ALGERIA. Hill over Bab-Azoun, in stems of *Opuntia*, 22 Feb 1840, M.C. Durieu de Maisonneuve (lectotype, designated herein of *Sphaeria jucunda*, PC, filed as *Hypocrea jucunda*, two isotypes at PC filed as *Sphaeria jucunda*). UNITED STATES. Alabama: Tuskegee, on *Opuntia ficus-indica*, Carver 584 (holotype of *Nectriella cacti* NY).

ADDITIONAL SPECIMEN EXAMINED.— SPAIN. Los Retacos, Almeria, on *Opuntia*, June 1997, J. Checa, det. A. Rossman (BPI 744973).

NOTES.— Pink pycnidia of *Leptodermella opuntiae* were present on the type of *Nectriella cacti* but the anamorph association with *N. jucunda* is not proven.

**Nectriella luteola** (Desm.) Weese, *Ann. Mycol.* 12: 131. 1914.

≡ *Sphaeria luteola* Desm., *Pl. Crypt France*, Ed. 1, Sér. 1, Fasc. 42: 2078. 1850.

≡ *Calonectria luteola* (Desm.) Sacc., *Michelia* 1: 315. 1878.

≡ *Charonectria luteola* (Desm.) Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1*, 115: 1193. 1906.

Ascomata immersed–erumpent, scattered, on veins or petioles of leaves, subglobose, 300 µm diam, orange-

brown, translucent, KOH–, collapsing vertically. Ascumatal wall 20–30 µm thick, of two regions: outer region 10–15 µm thick, of thick-walled, angular to rounded cells, 6 µm diam; inner region of thin-walled, elongate cells. Asci clavate, 44–60 × 8–12 µm; apex truncate, with a ring; ascospores biseriate. Ascospores naviculate–ellipsoid, 11–16 × 3–5(–6) µm, 1-septate, often slightly constricted, slightly roughened, several small guttules per cell.

ANAMORPH.— None known.

HABITAT.— In leaf veins and petioles of deciduous trees.

DISTRIBUTION.— Europe.

LECTOTYPE, DESIGNATED HEREIN.— FRANCE. In leaves and petioles of *Populus* and *Fraxinus*, summer, no collector, Pl. Crypt. France 2078 (PC; isolectotypes, BPI; FH – Höhnel; H; K; NY).

ADDITIONAL SPECIMENS EXAMINED.— LUXEMBOURG. On petiole of *Fraxinus*, Apr 1902, J. Feltgen (FH–A2899; as *Charonectria luteola*). SWITZERLAND. Valais: Aletschwaldreservat, Reidialz, on fallen leaves of *Alnus viridis*, 9 Sep 1970, R.W. Dennis (K; as *Nectria arenula*;). UNITED KINGDOM. England: Devon, Slapton Ley Nature Reserve, on stem of *Rubus*, 10 Oct 1979, M.C. Clark (IMI 24778; K).

NOTES.— *Nectriella luteola* is similar to *N. bloxamii*, separated by host and ascumatal color.

**Nectriella minuta** Lowen, *sp. nov.* — Plate 2, f.

Ascomata obpyriformia, 160–200 × 130–175 µm, immersa, gregaria; apex luteus; setae nullae; parietes 14–20 µm crassi, bistratosi. Asci clavati, 40–70 × 6–8 µm, annulo praediti. Ascospores biseriatae, ellipsoideae, 10–12 × 2–3 µm, 1-, demum 3-septatae, hyalinae, laeves, guttulateae. Anamorphosis: *Acremonium* sp.

Ascomata immersed with only the papilla emerging, or appearing superficial if epidermis erodes, then seated on the mycelium in dense groups. Ascomata obpyriform, smooth, 160–200 µm high × 130–175 µm diam, nearly white, KOH–, apex yellow, papilla truncate to acute, 40–50 µm diam, smooth, collapsing by lateral pinching. Ascumatal wall 14(–20) µm thick, of two regions: outer region of thick-walled, angular to rounded cells, ca 4 × 4 µm diam; inner region of thin-walled cells. Asci clavate, 40–70 × 6–8(–14) µm; with an apical ring, ascospores biseriate. Ascospores narrowly ellipsoid, one end occasionally tapered, (9–)10–12(–14) × 2–3(–4) µm, 1-septate, becoming 3-septate, slightly constricted, hyaline, smooth to spinulose.

CHARACTERISTICS IN CULTURE.— Conidiophores arising from aerial hyphae and from agar surface, solitary; terminating in a single phialide; phialides (10–)15–38 × 1.5–3 µm at the base, narrowing to 1–1.5 µm at the apex. Conidia oblong to ellipsoid, 3–5(–12) × 1–1.5(–2) µm, unicellular, smooth, hyaline; basal ab-



scission scar protuberant and flattened on ellipsoid conidia, not seen on oblong conidia; conidia held in hyaline liquid.

**HABITAT AND DISTRIBUTION.**— Known only from the type collection.

**TYPE.**— VENEZUELA. Edo. Mérida, La Montaña, El Teleférico above Mérida, on dead culms of bamboo, 30 July 1971, K.P. Dumont VE 3435 & G.J. Samuels, culture C.T.R. 71-347 (NY, holotype).

**ETYMOLOGY.**— Referring to the small, inconspicuous ascomata.

**NOTES.**— *Nectriella minuta* is distinguished from other species of *Nectriella* by the tropical distribution, occurrence on bamboo, nearly white ascomata, and *Acremonium*-like anamorph. The species was grown in culture from single ascospores.

***Nectriella paludosa*** Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 176. 1869 [1870].

[= *Nectria paludosa* (Fuckel) Sacc., *Michelia* 1: 289. 1898, non *Nectria paludosa* H. Crouan & P. Crouan 1876].

[= *Nectriella diaphana* Fuckel & Nitschke, in Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 176. 1869 [1870], name invalid, Art. 34.1, not accepted by author]

Ascomata often remaining immersed, sometimes erumpent, scattered or in groups of up to 5, often only the papilla showing through the epidermis, obpyriform, 190–290  $\mu\text{m}$  high  $\times$  230–430  $\mu\text{m}$  diam, at first pale pink, then yellow, KOH–, with truncate papilla, collapsing vertically or not collapsing. Setae on papilla, clavate, 8  $\times$  2  $\mu\text{m}$ , 2-septate, sparse. Ascomatal wall 20–24  $\mu\text{m}$  thick, of two regions: outer region of thick-walled, angular to rounded cells, surface cells ca 8  $\mu\text{m}$  diam; inner region of thin-walled, rectangular cells. Asci clavate, 68–85  $\times$  7.5–10  $\mu\text{m}$ , apex truncate, with a ring; ascospores biserial. Ascospores ellipsoid, (12–)14–23  $\times$  4–5  $\mu\text{m}$ , 1-septate, often slightly constricted, hyaline, pale pink in mass, echinulate, with 2 guttules per cell.

**ANAMORPH.**— None known.

**HABITAT.**— In stems of *Typha* and *Iris*.

**DISTRIBUTION.**— Europe, United States.

**Plate 8. a.** *Nectriella rubricapitula*, median section of ascoma and ascus. **b.** *Nectriella utahensis*, median section of ascoma, ascus, ascospores, and conidiophore. **c.** *Pronectria robergei*, ascomatal wall cells, ascus apex, and ascospores. **d.** *Pronectria echinulata*, ascomatal wall cells, ascus, and ascospores. **e.** *Pronectria pertusariicola*, median section of ascoma, asci and ascospores. a. Isotype – NY. b. Holotype – NY. c. Lectotype of *Cryptodiscus lichenicola* – BPI. d. Holotype – IMI. e. Holotype – UPS. Scale bars: a. for ascoma = 50  $\mu\text{m}$ , for ascus = 10  $\mu\text{m}$ , upper b, upper e = 100  $\mu\text{m}$ ; lower b, c, d, and lower e = 10  $\mu\text{m}$ .

**HOLOTYPE.**— GERMANY. Hessen: Near Budenheim, on rotting leaves of *Typha angustifolia*, floating in swamp water, spring, Fuckel & Nitschke, *Fungi rhenani* 2048, Fasc. 6. 1867 (G; isotypes, Herb. Barb. Boiss., as *N. diaphana* FH, IMI, K).

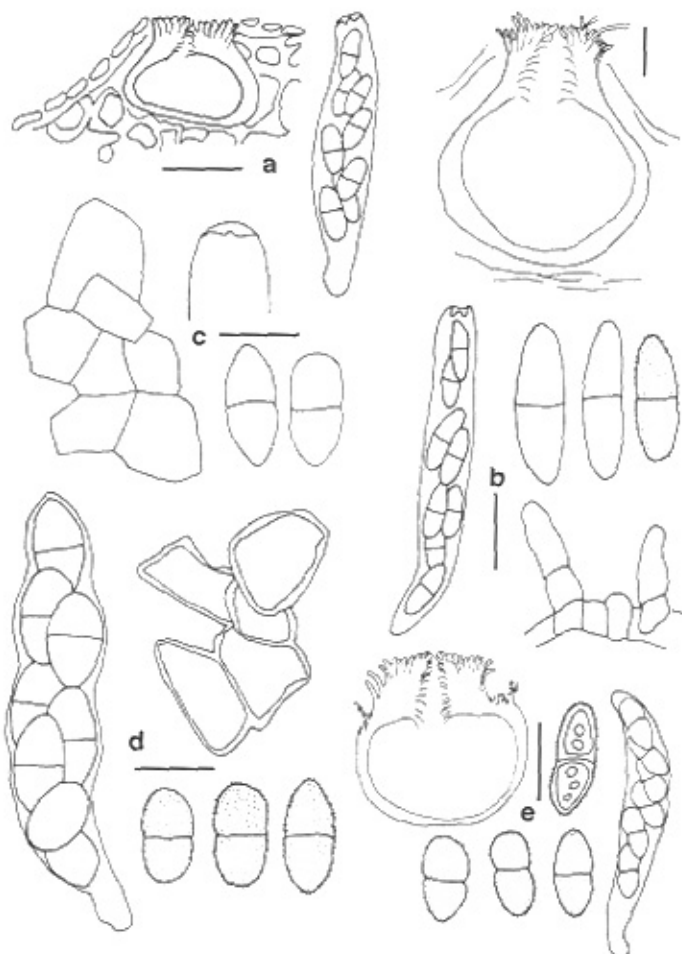
**ADDITIONAL SPECIMENS EXAMINED.**— CZECH REPUBLIC. Moravia: Mähr.-Weißkirchen, Thein, on *Typha latifolia*, Sep 1927, F. Petrak (C, IMI); Lipnik, Thrin, on *T. latifolia* (IMI 9446). GERMANY. On *Iris pseudacorus*, Aug 1904, Krieger, *Fungi Sax.* 1769 (FH, K); on *T. latifolia*, Petrak 456 (K); Petrak 2488 (K); (IMI 202253; as *N. dacrymycella*). UNITED KINGDOM. England: West Sussex, Loder Valley Nature Reserve, on *T. latifolia*, 26 Oct 1986, R. Lowen 232 (IMI 348647). UNITED STATES. Maine: Sagadahoc County, Merrymeeting Bay, ca 6 mi N of Woolwich, highway 128, across road from R.P.T. Coffin Wild flower Sanctuary, 44°01' N, 69°48' W, on damp, dead stems of *T. latifolia*, 19 Sep 1987, C.T. Rogerson & R. Lowen 356–87 (NY).

**NOTES.**— The papilla of *Nectriella paludosa* sometimes appears dark due to the presence of algae on the surface of the substratum. In the cultures produced from single ascospores no anamorph formed. Ascomata developed from single ascospores, thus the species is homothallic.

***Nectriella pironii*** Alfieri & Samuels, *Mycologia* 71: 1181. 1979 [1980].

**ANAMORPH:** *Kutilakesa pironii* Alfieri, *Mycotaxon* 10: 217. 1979.

This species was described and illustrated by Alfieri & Samuels (1979).



**Nectriella rubricapitula** Lowen, *sp. nov.* — Plate 8, a.

Ascomata obpyriformia, 80 × 100 µm, immersa, solitaria vel gregaria; apex ruber; setae nullae; parietes 14 µm crassi, e strato unico compositi. Asci clavati, 35–45 × 4.5–5.5 µm, annulo praediti. Ascospores biseriatae, ellipsoideae, 6–7.5 × 2 µm, 1-septatae, hyalinae, laeves, guttulate. Anamorphosis ignota.

Ascomata obpyriform, 80 µm high × 100 µm diam, immersed, scattered or in groups of up to 10, strongly adherent to the substratum, red at ascomatal apex, immersed part of the wall pale yellow, KOH–; papilla truncate, 50 µm diam, smooth. Ascomatal wall 14 µm thick, of one region, thick-walled, elongate. Asci clavate, (29–)35–45 × 4.5–5.5(–6.5) µm; apex truncate, with a ring, ascospores biseriate. Ascospores ellipsoid, 6–7.5 × 2 µm, 1-septate, often slightly constricted, hyaline, smooth, inconspicuously guttulate. Anamorph unknown. HABITAT AND DISTRIBUTION.— Known only from the type collection.

HOLOTYPE.— BRAZIL. Amazonas: Plateau of Serra Araca, N side of N Mountain, 1250 m, 00° 57' N, 63° 21' W, cloud forest, on twig, 17–22 Feb 1984, G.J. Samuels 481a, G.T. Prance & J. Pipoly (INPA; NY, isotype).

ETYMOLOGY.— Referring to the red apex of the ascomata.

NOTES.— *Nectriella rubricapitula* is distinguished from other species of *Nectriella* by the adherence of the ascomata to the woody substratum and the red ascomatal apex.

**Nectriella sambuci** (Höhn.) Weese, *Ann. Mycol.* 12: 150, 1914.

≡ *Charonectria sambuci* Höhn., *Hedwigia* 42: 187, 1903.

Ascomata immersed, sometimes erumpent, scattered or in groups of up to 30, some contiguous, obpyriform, 100–300 µm high × 220 µm diam, at first reddish yellow, then yellow, KOH–; papilla truncate, 60–140 µm high × 120–160 µm diam; sometimes collapsing vertically, setae clavate, 40 × 4 µm (not seen in type). Cells on surface of ascomata angular, 5–10 µm diam. Ascomatal wall 20–30 µm thick, of two regions: outer region of rectangular to ellipsoid cells, 6–10 × 2–3 µm, with 2 µm thick walls; cells of the inner region having 1 µm thick walls. Asci clavate when young, mature asci in type not seen, 50–68 × 6–8 µm, apex truncate, with a ring, deliquescing at maturity; ascospores biseriate. Ascospores ellipsoid, 14–16 × 3–4(–6) µm, typically 1-septate, occasionally 3-septate, often slightly constricted, many curved, at first hyaline, then slightly brown, smooth, often several guttules per cell.

ANAMORPH.— None known.

HABITAT.— On stems of woody plants.

DISTRIBUTION.— Europe.

HOLOTYPE.— YUGOSLAVIA. Herzegovina, Jablanica, on thin, dry stems of *Sambucus nigra*, Apr 1903, Höhnel (FH). ADDITIONAL SPECIMENS EXAMINED.— UNITED KINGDOM. England: N. Yorkshire, Levisham, Hagg Wood Marsh NR, BW. C-73-4, on *Filipendula ulmaria* [Rosaceae], 1 July 1973, collector unknown (IMI 177564).

NOTES.— *Nectriella sambuci* has papillate ascomata with scattered hairs and a wall with two regions. Like the related species, *N. fuckelii* and *N. paludosa*, the ascomata have scattered secretory setae and do not usually collapse when dry.

**Nectriella silenes-acaulis** Nogrsek, *Biblioth. Mycol.* 133: 69, 1990.

This species was described and illustrated by Nogrsek (1990).

**Nectriella utahensis** Lowen & Rogerson, *sp. nov.* — Plate 7, g; Plate 9, b.

Ascomata obpyriformia, 238–500 × 255–400 µm, immersa, solitaria vel gregaria, luteo-aurantiaca; setae cylindricae, 7–30 × 3.5–5 µm, parum septatae; parietes 18–35 µm crassi, bistratosi. Asci clavati, 40–60 × 5.5–12 µm, annulo praediti. Ascospores biseriatae, ellipsoideo-fusiformes, 14–20 × 4–6.5 µm, 1-septatae, hyalinae, demum leviter coloratae, spinulosae, guttulis compluribus. Anamorphosis ignota.

Ascomata obpyriform, 238–500 µm high × 255–400 µm diam, immersed to erumpent, scattered or in groups up to 10, yellow-orange, KOH–; papilla truncate, 62–100 µm high × 123–176 µm diam; collapsing by lateral or vertical pinching of ascomatal base. Setae around the ostiole, 7–30 × 3.5–5 µm, tapering to the rounded apex, septate, walls slightly thickened. Ascomatal wall 18–35 µm thick, of two regions: outer region 7–18 µm thick, of ellipsoid cells, 3.5–7 × 1.5–4.5 µm; inner region 11–18 µm thick, of thin-walled cells 7–15 × 0.5–2 µm. Asci clavate, 40–60 × 5.5–12 µm, apex truncate, with a ring, ring often pushed to one side in mature asci, ascospores biseriate. Ascospores ellipsoid-fusiform, 14–20 × 4–6.5 µm, 1-septate, pale orange in mass, spinulose when mature, with several orange guttules per cell. Anamorph unknown.

HABITAT.— On dead leaves of *Swertia radiata* (Gentianaceae) and possibly larkspur.

DISTRIBUTION.— United States (Colorado, Utah).

HOLOTYPE.— UNITED STATES. Utah: Weber County: north of N. Ogden Divide, Wasatch Crest trail, on decaying leaves of *Swertia radiata*, 19 Aug 1987, C.T. Rogerson (NY).

ADDITIONAL SPECIMEN EXAMINED.— UNITED STATES. Colorado: Mesa County, Grand Mesa Nat. Forest, S.E. of Mesa Lake, on stems of larkspur?, 14 July 1930, R.W. Davidson 646 (BPI, as *Nectriella pedicularis*).

ETYMOLOGY.— Named for the location of the type collection, a favorite locale of the collector.

**Nectriella verrucosa** Urries, An. Jard. Bot. Madrid 1: 67. 1941.

Ascomata immersed, scattered or in groups of up to 20, obpyriform, 313–387  $\mu\text{m}$  high  $\times$  176–317  $\mu\text{m}$  diam, at first reddish, then yellow, KOH–; papilla truncate, 282–310  $\mu\text{m}$  high  $\times$  132–308  $\mu\text{m}$  diam, setae broken, the largest ones 66  $\times$  5  $\mu\text{m}$ , base tapered to 2  $\mu\text{m}$ , hyaline, septate, with *ca* 1  $\mu\text{m}$  thick wall. Ascromatal wall 20–35  $\mu\text{m}$  thick, of two regions: outer region 12–26  $\mu\text{m}$  thick, of thick-walled cells; inner region 7–9  $\mu\text{m}$  thick, of thin-walled, parallel, densely packed cells. Asci clavate, (70–)80–135  $\times$  10–20  $\mu\text{m}$ ; apex angular; simple; ascospores biseriate in the middle; base clavate, lower quarter occasionally empty. Ascospores narrowly

ellipsoid, one side often curved, the other side straight, (20.5–)22–28(–30)  $\times$  (5–)6–8(–9)  $\mu\text{m}$ , 1-septate, septum inconspicuous in mature ascospores, hyaline, verrucose at maturity, often many guttules per cell, tending to disappear at maturity.

HABITAT.— On rotting paper.

DISTRIBUTION.— Known only from the type collection.

HOLOTYPE.— SPAIN. Near Madrid, on rotting paper, 14 Jan 1940, Urries (MA).

NOTES.— *Nectriella verrucosa* is related to *N. funicola* but distinguished by the larger, more ornamented ascospores, more elongate, thin ascromatal wall cells and an angular apex of the ascus. The two taxa are represented by only a few collections.

#### KEY TO THE SPECIES OF *NECTRIELLA*

1. In empty ascomata of *Balansia*; ascospores ellipsoid-fusiform, 9.5–10.5  $\times$  2.5–3  $\mu\text{m}$ , smooth-walled ..... *N. balansiae*
1. On living or decorticated, rotting wood or twigs, decaying herbaceous stems, leaves or petioles, or rotting rope or paper ..... 2
- 2 (1). Ascospores generally less than 10  $\mu\text{m}$  long, non- to 1-septate, smooth-walled ..... 3
2. Ascospores generally more than 10  $\mu\text{m}$  long, 1-septate, smooth or ornamented .... 6
- 3 (2). Ascospores non-septate, cylindrical to allantoid, 5–6  $\times$  1.5  $\mu\text{m}$ , hyaline; ascomata pale yellow to orange; on *Opuntia* ..... *N. jucunda*
3. Ascospores 1-septate, ellipsoid or naviculate to ellipsoid-fusiform ..... 4
- 4 (3). Ascomata yellow with red apical region; ascospores ellipsoid, 6–7.5  $\times$  2  $\mu\text{m}$ ; on woody twigs ..... *N. rubricapitula*
4. Ascomata concolorous, pale pink, yellow, orange to yellow-brown; ascospores ellipsoid or naviculate to ellipsoid-fusiform; on herbaceous substrata ..... 5
- 5 (4). Ascomata pale pink, non-setose; ascospores ellipsoid, 8–10  $\times$  2–3  $\mu\text{m}$ , on decaying leaves of *Ammophila* ..... *N. exigua*
5. Ascomata yellow to orange or yellow-brown, with clavate setae up to 60  $\mu\text{m}$  long surrounding the ostiole; ascospores naviculate to ellipsoid-fusiform, 7–10  $\times$  2–3  $\mu\text{m}$ ; on dead herbaceous dicotyledonous stems ..... *N. dakotensis*
- 6 (2). Ascomata with long, straight setae, or flexuous hyphae or hairs, often in a circle around the ostiole, globose to obpyriform, generally papillate ..... 7
6. Ascomata lacking setae, hyphae or hairs in the ostiolar region, subglobose to globose, often with a flattened apex ..... 18
- 7 (6). Associated with galls and cankers on living stems and leaves of woody plants; ascomata pale yellow to yellow, with clavate, thick-walled hairs up to 20  $\mu\text{m}$  long surrounding the ostiole; ascospores ellipsoid-fusiform, 12.5–26  $\times$  2.5–4.5  $\mu\text{m}$ , finely striate; anamorph *Kutilakesa* ..... *N. pironii*
7. On non-living, herbaceous or woody substrata or on rotting paper or rope; anamorph, where known, *Acremonium*-like ..... 8

- 8 (7). On decorticated wood of *Populus*; ascospores narrowly ellipsoid,  $16\text{--}19 \times 4\text{--}7 \mu\text{m}$ , spinulose ..... *N. fuckelii*
8. On rotting herbaceous leaves and stems, paper or rope ..... 9
- 9 (8). On rotting paper and rope ..... 10
9. On herbaceous stems, leaves or petioles ..... 11
- 10 (9). Ascospores ellipsoid,  $16\text{--}24 \times 4\text{--}8 \mu\text{m}$ , spinulose to verrucose; on rotting paper and rope, known throughout Europe ..... *N. funicola*
10. Ascospores narrowly ellipsoid,  $(20\text{--})22\text{--}28(\text{--}30) \times 5\text{--}9 \mu\text{m}$ , verrucose; on rotting paper; known only from Spain ..... *N. verrucosa*
- 11 (9). On decaying leaves including petioles ..... 12
11. On herbaceous stems ..... 13
- 12 (11). On decaying leaves of *Swertia* in western United States; ascomata yellow-orange with cylindrical, straight setae; ascospores ellipsoid-fusiform,  $14\text{--}17.5 \times 4\text{--}6.5 \mu\text{m}$ , spinulose ..... *N. utahensis*
12. On petioles of *Gunnera* in Chile; ascomata bright orange with cylindrical, recurved setae; ascospores ellipsoid-fusiform,  $17\text{--}20 \times 3.5\text{--}5.5 \mu\text{m}$ , minutely spinulose ..... *N. guttulata*
- 13 (11). On *Iris* and *Typha*; ascospores ellipsoid,  $14\text{--}23 \times 4\text{--}5 \mu\text{m}$ , spinulose ... *N. paludosa*
13. On dicotyledonous herbaceous stems; ascospores smooth, spinulose, verrucose or finely striate ..... 14
- 14 (13). On *Silene*; ascospores finely striate, ellipsoid-fusiform,  $12.5\text{--}16 \times 2.5\text{--}4.5 \mu\text{m}$  ..... *N. silenae-acaulis*
14. On herbaceous stems other than *Silene*; ascospores smooth or verrucose ..... 15
- 15 (14). Ascomata subglobose, pale pink; ascospores  $10\text{--}12 \times 4\text{--}6 \mu\text{m}$ , ellipsoid, smooth to slightly roughened; on *Galium* ..... *N. galii*
15. Ascomata obpyriform, yellow; ascospores more than  $12 \mu\text{m}$  long ..... 16
- 16 (15). Ascospores ellipsoid,  $14\text{--}16 \times 3\text{--}4 \mu\text{m}$ , smooth-walled ..... *N. sambuci*
16. Ascospores ellipsoid or ellipsoid-fusiform, spinulose or verrucose ..... 17
- 17 (16). Ascospores ellipsoid,  $13\text{--}18 \times 3.5\text{--}5 \mu\text{m}$ , spinulose; on *Arabis* or *Saxifraga* ..... *N. alpina*
17. Ascospores ellipsoid-fusiform,  $15\text{--}20 \times 4\text{--}5.5 \mu\text{m}$ , verrucose; on *Apiaceae*, *Asteraceae* or unknown herbaceous stems ..... *N. halonata*
- 18 (6). Ascomata yellow with a red apical region, subglobose to globose; ascospores ellipsoid to fusiform,  $12 \times 3 \mu\text{m}$ , smooth-walled; on *Rubus* ..... *N. crouanii*
18. Ascomata concolorous ..... 19
- 19 (18). On decaying monocotyledonous plant parts, either on *Typha* and *Poaceae*; ascomata pale yellow ..... 20
19. On decaying woody twigs, leaves, petioles or herbaceous stems of dicotyledonous plants; ascomata bright orange to orange-brown or tan 0 ..... 21
- 20 (19). On dead leaves of *Typha* or grasses; ascomata subglobose; ascospores ellipsoid,  $15\text{--}25 \times 4\text{--}5.5 \mu\text{m}$ , spinulose ..... *N. curtisii*

20. On bamboo; ascomata obpyriform; ascospores narrowly ellipsoid, (9–)10–12(–14) × 2–3(–4) μm, smooth to spinulose ..... *N. minuta*
- 21 (19). Ascospores 11–16 × 3–5(–6) μm, ellipsoid–naviculate, spinulose; ascomata orange-brown; on decaying leaves including petioles of deciduous trees and stems of *Rubus* ..... *N. luteola*
21. Ascospores averaging longer than 16 μm, ellipsoid to ellipsoid–fusiform, smooth to spinulose; ascomata bright orange to orange-brown or tan; on various herbaceous stems ..... 22
- 22 (21). Ascomata orange-brown to tan; ascospores ellipsoid, 16–24 × 3–5 μm; on herbaceous stems especially of *Apiaceae* and *Asteraceae* ..... *N. bloxamii*
22. Ascomata bright orange; ascospores ellipsoid–fusiform, 13–20 × 4–5.5 μm; on herbaceous stems, known from *Iris* and *Urtica* ..... *N. dacrymycella*

**NECTRIOPSIS** Maire, Ann. Mycol. 9: 323. 1911, nom. cons. prop.

Lectotype, designated by Weese (1913): *N. violacea* (Fr.) Maire (= *Sphaeria violacea* Fr.).

= *Dasyphthora* Clem., Gen. Fungi p. 45. 1909, nom. rej. prop. — Type: *D. lasioderma* (Ellis) Clem. (= *Nectria lasioderma* Ellis), recognized as *Nectriopsis lasioderma* (Ellis) Samuels.

= *Peloronectriella* Doi, Bull. Natl. Sci. Mus. Tokyo 11: 179. 1968. — Type: *P. sasae* Doi, recognized as *Nectriopsis sasae* (Doi) Rossman & Samuels.

Ascomata superficial or immersed in substratum, generally not conspicuously stromatic, generally less than 200 μm diam, nearly white to pale yellow or orange, rarely violet or purple, KOH–. Ascomatal wall less than 20 μm thick, usually of a single region of small, thin-walled, non-descript cells; wall cells at surface forming a *textura epidermoidea*. Anamorph, where known, *Acremonium*, *Gliocladium*-like, or *Verticillium*-like. On free-living fungi, lichens, and myxomycetes, less frequently on herbaceous substrata.

NOTES.— *Nectriopsis* was established with four species of hypocrealean fungi having ascomata in a byssoid stroma and considered intermediate between *Nectria* and *Hypomyces*. Samuels (1988) presented a thorough account of the genus including 43 species each of which was described and illustrated. In the present work, the species that occur on *Meliola* have been removed to the genus *Dimerosporiella*. Thus, 39 species, including two additional species described below, are recognized in *Nectriopsis*. Clements (1909) placed *Dasyphthora* in the *Hypocreaceae* with only one species, *D. lasioderma*, that was included in *Nectriopsis* (Samuels, 1988). Although *Dasyphthora* provides an earlier name, *Nectriopsis* has been proposed for conservation (Rossman & Samuels, 1998). The unispecific genus *Peloronectriella* was described for a species on bamboo having an elon-

gate, tuberculate stroma with *Nectria*-like ascomata and 1-septate ascospores. The type specimen of *Peloronectriella sasae* was examined and found to be a *Nectriopsis* growing on the surface of overmature stromata of *Shiraia bambusicola* Henn. Thus *Peloronectriella sasae* belongs in the genus *Nectriopsis* and *Peloronectriella* is a synonym of *Nectriopsis*.

**Nectriopsis violacea** (Fr.) Maire, Ann. Mycol. 9: 323. 1911.

= *Sphaeria violacea* Fr., Summa Veg. Scand. 2(2): 441. 1823.

= *Nectria violacea* (Fr.) Fr., Summa Veg. Scand. 2: 388. 1849.

= *Hypomyces violaceus* (Fr.) Tul., Ann. Sci. Nat. Bot. ser. 4, 13: 14. 1860.

= *Peckiella violacea* (Fr.) Sacc., Syll. Fung. 9: 945. 1899.

= *Hypolyssus violaceus* (Fr.) O. Kuntze, Revis. Gen. Plant. 3 (2): 488. 1898.

= *Byssonectria violacea* (Fr.) Seaver, Mycologia 2: 65. 1910.

= *Hyphonectria violacea* (Fr.) Petch, J. Bot. 75: 222. 1937.

ANAMORPH.— *Acremonium fungicola* (Sacc.) Samuels, Mycologia 65: 404. 1973

= *Diplosporium album* var. *fungicola* Sacc., Syll. Fung. 4: 178. 1886.

Mycelium white, becoming violet immediately surrounding each perithecium, dense, covering the surface of the host aethalia. Ascomata immersed in mycelium, becoming collabent when dry, broadly pyriform, (116–)240–275(–390) μm high × (150–)240–260(–310) μm diam, or globose, (170–)240–260(–340) μm diam, violet to purple; surface cells thin-walled, angular, 7–10 μm diam; papilla acute, of thick-walled, septate, unbranched hyphae; hyphae extending outwardly as hairs, 10–50 μm long, 5 μm wide at the rounded apices, forming a fringe around the papilla; periphyses ca 15 μm long, 2 μm wide at the base, rounded apices

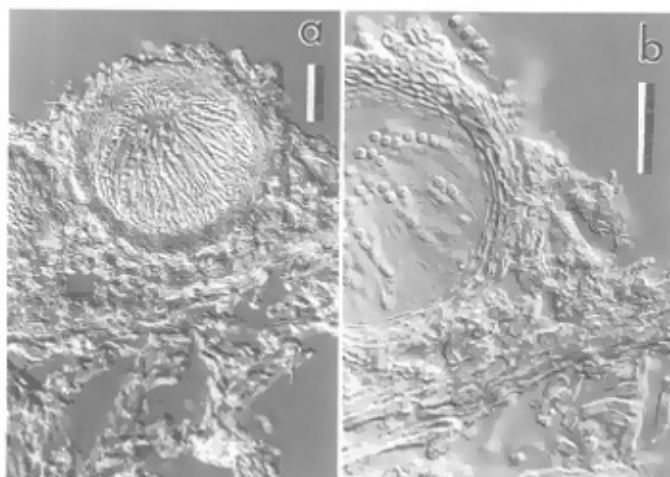


Plate 9. a-b. *Nectriopsis queletii*. a. Median section of ascoma on natural substratum. b. Close-up of ascomatal wall. a-b. Holotype - H. Scale bars = 25  $\mu\text{m}$ .

1  $\mu\text{m}$  wide. Ascomatal walls 15–20  $\mu\text{m}$  thick. Asci cylindrical, (40–)50–60(–75)  $\times$  3–5  $\mu\text{m}$ , 8-spored, sessile, with an apical ring, ascospores obliquely uniseriate with overlapping ends. Ascospores cylindrical, (5–)7–8  $\times$  2.5–3  $\mu\text{m}$ , equally 2-celled, not constricted, hyaline, spinulose.

ANAMORPH.— Conidiophores arising from both surface and aerial mycelium, white, unbranched phialides or 2–3 phialides arising from tip of one axis. Phialides aseptate or uniseptate, smooth, 30–50  $\mu\text{m}$  long, from 2  $\mu\text{m}$  at the base tapering to 1  $\mu\text{m}$  at the tip. Conidia unicellular, smooth-walled, hyaline, ellipsoid, 6–9.5(–17)  $\times$  2–3  $\mu\text{m}$ , in solitary, slimy, hyaline heads at apices of phialides.

HABITAT.— On the myxomycete *Fuligo septica* (L.) Wiggers.

DISTRIBUTION.— Known throughout temperate North America and Europe.

HOLOTYPE.— GERMANY, Bernstadt, on *Fuligo violacea*, 1817 (UPS; herb. E. Fries, as *Sphaeria violacea*).

ILLUSTRATIONS.— Müller & von Arx (1962, Fig. 250); Munk (1957, Fig. 8, as *Nectria violacea*); Plowright (1882, Pl. 157, Fig. 2 a–e, as *N. violacea*); Samuels (1973b, Figs 1, 2, 7–11, as *N. violacea*); Schmid & Schmid (1990; Fig. 32).

NOTES.— Samuels (1971) studied the ontogeny of ascomatal development in *Nectriopsis violacea* and *N. candidans* (Plowr.) Maire, a similar myxomyceticolous species, and demonstrated that both had a *Nectria*-type of centrum development.

***Nectriopsis sasae*** (Doi) Rossman & Samuels, *comb. nov.*

≡ *Peloronectriella sasae* Doi, Bull. Natl. Sci. Mus. Tokyo 11: 179, 1968.

Ascomata basally to almost totally immersed in a stroma covering overmature stromata of the *Shiraia* host; *Nectriopsis* stroma readily differentiated from that of *Shiraia*, evident when sectioned; stroma of *Nectriopsis* 100–500  $\mu\text{m}$  thick, prosenchymatous to pseudo-parenchymatous, with hyphal hairs on the surface, in section often of two regions: lower region 0–270  $\mu\text{m}$  thick, of thin-walled cells 2–6  $\mu\text{m}$  diam, forming a prosenchyma; upper region 150–380  $\mu\text{m}$  thick, of thin-walled cells forming a *textura prismatica*, cells 8–14  $\mu\text{m} \times$  2.5  $\mu\text{m}$ . Hairs on stromatal surface and upper portions of ascomata, 12–40  $\times$  3–6  $\mu\text{m}$ , thin-walled, septate, flexuous, apex rounded. Ascomata globose to broadly pyriform, 200–250  $\mu\text{m}$  high  $\times$  175–200  $\mu\text{m}$  diam, collapsing when dry or not, ochraceous to umber, becoming pale ochraceous when dry, KOH–, ascomatal wall of one 20–25  $\mu\text{m}$  thick region, cells thin-walled, 6–10  $\times$  3–4  $\mu\text{m}$ , forming a *textura prismatica*, toward the apex becoming *textura angularis*, cells 4–6  $\mu\text{m}$  diam, with walls slightly thickened up to 1.5  $\mu\text{m}$ . Ostiole lined with periphyses. Apical paraphyses seen in immature ascomata, of thin-walled, inflated cells. Asci cylindrical with truncate apex, 77–87  $\times$  5.5–6  $\mu\text{m}$ , apical ring barely visible, ascospores uniseriate. Ascospores ellipsoid, 8.5–10  $\times$  3–4.5  $\mu\text{m}$ , 1-septate, hyaline, spinulose.

HABITAT.— Parasitic on stromata of *Shiraia bambusicola*.

DISTRIBUTION.— Japan, known only from the type specimen.

HOLOTYPE.— JAPAN, Iwate Pref.: Mt. Hayachine, Ohazama-cho, 18 July 1967, Y. Doi, D-304 (TNS-F-199660). Culture CBS 333.69.

ILLUSTRATION.— Doi (1968, l.c.), as *Peloronectriella sasae*.

NOTES.— All ascomata on the type specimen were slightly immature, thus ascospores were measured inside the ascus. *Nectriopsis sasae* is placed among the mostly fungicolous species of *Nectriopsis* and appears to be similar to those species of *Nectriopsis* that occur on large clavicipitaceous stromata on grasses, namely *N. epichloë* and *N. macroepichloë*. The anamorph described for *N. sasae* is similar to the *Acremonium*-like anamorphs known for other species of *Nectriopsis*.

One species is described below in addition to those included above and in Samuels (1988).

***Nectriopsis queletii*** (P. Karst.) Samuels, *comb. nov.* — Plate 9, a–b.

≡ *Hyponectria queletii* P. Karst., Hedwigia 21: 34, 1882.  
≡ *Nectriella queletii* (P. Karst.) P. Karst., Acta Soc. Fauna Fl. Fenn. 2: 15, 1885.

ANAMORPH: *Acremonium* sp.

Ascomata superficial, effused stroma of *Nectriopsis* intermixed with host hyphae, densely gregarious to caespitose with a sparse basal fringe, subglobose, 60–78 × 75–82 µm, yellow to orange, KOH–, becoming cupulate, smooth, apex not differentiated. Cells at surface angular to *textura epidermoidea*. Ascomatal wall 7–10 µm thick, of a single region of compressed cells, cells 3–7 µm diam, walls slightly thickened. Asci cylindrical, 53–75 × 6.5–9.1 µm, apex simple, sessile, 8-spored. Ascospores oblong to subglobose, 3–4.5 × 2–3 µm, 1-septate, hyaline, smooth.

ANAMORPH.— Conidiophores 23–36 × 2.5–4.5 µm at the base, apex not thickened, not flared, smooth-walled. No conidia seen on the type.

HABITAT.— On hymenium of *Phlebia albida*.

DISTRIBUTION.— Finland and Sweden.

HOLOTYPE.— FINLAND. Near Mustiala, in hymenium of *Stereum subcostatum* P. Karst. [host identified as *Phlebia albida*], on fallen stems of *Betula* in shady places, 10 Oct 1881, ex Herb. Karsten 1367b (H).

ILLUSTRATION.— Eriksson *et al.* (1981, Fig. 553, as *Nectriella queletii*).

NOTES.— The small, pallid, superficial ascomata and mycoparasitic habit place this species in *Nectriopsis* as defined by Samuels (1988), unlike the immersed ascomata on decaying herbaceous or lignicolous substrata characteristic of *Nectriella*. *Nectriopsis queletii* is similar to *N. oropensoides* in having very small ascospores and occurring on basidiomycetes in temperate regions; however, the ascospores of *N. queletii* are among the smallest in *Nectriopsis*, even smaller than those of *N. oropensoides*. Eriksson *et al.* (1981) noted that *N. queletii* occurs in both Finland and Sweden.

For a comprehensive account and a key to the remaining species of *Nectriopsis*, see Samuels (1988).

#### OCHRONECTRIA Rossman & Samuels, *gen. nov.*

Type: *Ochronectria calami* (Henn. & E. Nyman) Rossman & Samuels (= *Nectria calami* Henn. & E. Nyman).

Ascomata superficialia, vulgo aggregata super stromate bene effecto, subglobosa vel globosa vel ellipsoidea, alba vel luteola. KOH–, parietes > 45 µm crassi, cellulae strati exterioris hyalinae, globosae; cellulae strati medii guttulis aurantiis oleaginis interspersae. Asci 4–8-sporei. Ascosporeae fusiformes, pluriseptatae, hyalinae, laevigatae vel striatae.

Ascomata superficial, solitary to gregarious on a thin subiculum. Ascomata subglobose to globose, cupulate when dry, pale yellow to yellow-orange, KOH–, ascomatal surface smooth to slightly roughened, walls more than 45 µm thick, of three regions: outermost region of

hyaline, thin-walled, globose cells; middle region of angular to globose, thin-walled cells, with abundant, orange, oily droplets between the cells; inner region of hyaline, thin-walled, elongate cells. Asci narrowly clavate, 4–8-spored. Ascospores fusiform, multiseptate, hyaline, smooth to faintly striate. Anamorph *Acremonium*-like. On dead woody, often monocotyledonous, also dicotyledonous substrata.

NOTES.— This unispecific genus is similar to *Hydropisphaera* recognized for members of the *Nectria peziza*-group in which the relatively thick ascomatal wall is composed of large, thin-walled, inflated cells resulting in a cupulate collapse when dry. The characteristic wall structure consists of three regions with orange oil droplets in the middle region. Recent unpublished molecular studies of the *Bionectriaceae* suggest that the type species, *O. calami*, is distinct from species of *Hydropisphaera*. *Ochronectria calami* is relatively common in tropical regions.

***Ochronectria calami*** (Henn. & E. Nyman) Rossman & Samuels, *comb. nov.* — Plate 4, b (see page 25).

= *Calonectria calami* Henn. & E. Nyman, *in* Warburg, *Monsunia* 1: 163, 1899.

= *Nectria calami* (Henn. & E. Nyman) Rossman, *Myxotaxon* 8: 494, 1979.

= *Calonectria blumenaviae* Henn., *Hedwigia* 41: 6, 1902.

= *Calonectria oödes* Petch, *Ann. Roy. Bot. Gard. (Peradeniya)* 7: 135, 1920.

= *Calonectria ignota* Chardón, *Scientific Survey of Porto Rico and Virgin Islands* 8: 41, 1926.

= *Calonectria kampalensis* Hansford, *Proc. Linn. Soc. Lond.* 153: 34, 1941.

Anamorph: *Acremonium*-like.

Ascomata solitary to gregarious, superficial on a thin subiculum of hyaline, thin-walled, 2–3 µm wide hyphae. Ascomata pale yellow to orange, becoming darker when dry, KOH–, globose to subglobose, cupulate when dry, 185–240 µm high × 175–260 µm diam, with small, pointed papilla 10–20 µm high, ascomatal surface smooth to slightly roughened. Ascomatal wall 45–60 µm thick, of three regions: outer region of one layer of hyaline, globose, thin-walled cells, 7.5–10 µm diam; middle region 15–30 µm thick, widest near ascomatal apex, of angular to globose, thin-walled cells, 3–10 µm diam, with abundant, orange oily droplets formed between the cells; inner region 10–25 µm thick, thickest near the apex, of hyaline, thin-walled, elongate, 5–10 µm long cells. Asci unitunicate, 47–63 × 8–12 µm, narrowly clavate, without specialized apical discharge mechanism, 8-spored, ascospores obliquely uniseriate. Ascospores 24–38 × 4–5.5 µm, fusiform, sometimes curved or sigmoid, with narrowly rounded

ends, (3–5–)7–9-septate, hyaline, smooth or faintly striate.

ANAMORPH.— Conidiophores solitary, cylindrical, 35–100  $\mu\text{m}$  long, 3.5–4  $\mu\text{m}$  wide at the base, straight to slightly sinuous, thin-walled, smooth, developing from aerial fascicles or from the agar surface. Conidiogenous cells monophialidic, integrated, solitary, terminal, cylindrical, 30–80  $\times$  3–3.5  $\mu\text{m}$  wide at the base, tapering slightly, becoming 2–2.5  $\mu\text{m}$  wide at the apex, apex with flaring collarette up to 2  $\mu\text{m}$  long. Conidia broadly cylindrical, straight, (0–)1–3–(5–7)-septate, 0-septate 8–13  $\times$  3.5–4  $\mu\text{m}$ , 1-septate 8–13  $\times$  3.5–4  $\mu\text{m}$ , 2-septate 11–13  $\times$  4–4.5  $\mu\text{m}$ , 3-septate 15–26  $\times$  4–5.5  $\mu\text{m}$ , 5-septate 22–25  $\times$  5–6  $\mu\text{m}$ , 7-septate, 21–36  $\times$  5–6  $\mu\text{m}$ , hyaline, smooth. Hyphae hyaline, smooth, 2.5–4  $\mu\text{m}$  wide, chlamydospores lacking. Ascospores forming on PDA and V-8 after four weeks.

HABITAT.— On monocotyledonous wood and woody parts such as palm fruits, leaves and leaf sheaves, rarely also on tree ferns and dicotyledonous wood known from *Calamus*, *Cocos*, *Heliconia*, *Hoya*, *Musa*, *Pipturus* and *Sabal*.

DISTRIBUTION.— Pantropical, known from Bermuda, Brazil, French Guiana, Guadeloupe, Indonesia, Jamaica, Java, Panama, Peru, Puerto Rico, Sri Lanka, Uganda, United States (Hawaii), Venezuela (Rossman, 1983; Samuels *et al.*, 1990).

TYPE.— JAVA, Hort. Bogor, on leaf sheaths of *Calamus* sp., E. Nyman, 4 Mar 1898, FH-general, lectotype, designated by Rossman, 1979b, isolectotypes FH – Höhnel, GZU. Cultures: CBS 125.87, 445.96, 454.96. Additional specimens examined listed in Rossman (1983) and Samuels *et al.* (1990).

ILLUSTRATIONS.— Rossman (1983, Fig. 33, Pl. 11 C–F, as *N. calami*); Samuels *et al.* (1990, Fig. 23 D–F, as *N. calami*).

SPECIMEN ILLUSTRATED.— SRI LANKA (Ceylon). Peradeniya, on a decaying stem, Jun 1919, Petch 6009 (K – holotype of *Calonectria oödes*).

**PARANECTRIA** Sacc., *Michelia* 1: 317. 1878.

Type: *P. affinis* (Grev.) Sacc. (= *Sphaeria affinis* Grev.) = *Ciliomyces* Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1*, 115: 673. 1906. — Type: C.

*oropensis* (Ces.) Höhn. (= *Nectria oropensis* Ces.), recognized as *Paranectria oropensis* (Ces.) D. Hawksw. & Piroz.

Ascospores solitary, superficial on a white, thin, byssoid stroma or stroma lacking. Ascospores hyaline to pale orange or pale pink when fresh, KOH–, broadly pyriform to globose or subglobose, collapsing laterally or not at all when dry, smooth, scurfy or with short, septate hairs, wall relatively thin, less than 30 nm thick, of two regions. Asci cylindrical, 8-spored. Ascospores fusiform to ellipsoid with long, attenuated ends, multiseptate to muriform, hyaline, smooth. Anamorph unknown. On decaying lichens.

NOTES.— The genus *Paranectria* was established for species with *Nectria*-like ascospores and long-attenuated, 3-septate ascospores. Within the *Hypocreales*, *Paranectria* is distinguished by the lichenicolous habit, white to pale yellow, often orange when fresh, KOH–, relatively thin-walled ascospores, and multiseptate to muriform ascospores with thin, attenuated ends. *Paranectria* belongs to the nectrioid *Hypocreales* affiliated with *Ijuhya* and *Trichonectria* based on similarities in ascospore morphology and habitat. The type species, *P. affinis*, has been well-characterized (Rossman, 1983) and two additional species are included in *Paranectria*. Hawksworth & Pirozynski (1977) clarified the nomenclature of the generic names, *Paranectria* and *Paranectriella*. *Ciliomyces* was introduced by Von Höhnel for a *Nectria*-like species having muriform ascospores with attenuated ends. The type and only species, *Ciliomyces oropensis*, is found to be congeneric with *Paranectria* (Hawksworth & Pirozynski, 1977; Rossman, 1983).

**Paranectria affinis** (Grev.) Sacc., *Michelia* 1: 317. 1878.

= *Sphaeria affinis* Grev., *Scott. Crypt. Flor.* 4: 186. 1826.  
= *Nectria affinis* (Grev.) Cooke, *Grevillea* 8: 9. 1879.

ANAMORPH: Unknown.

#### KEY TO THE SPECIES OF *PARANECTRIA*

1. Ascospores transversely 3-septate, narrowly ellipsoid to fusiform, 24–34  $\times$  6–8  $\mu\text{m}$ ; on *Ephebe* spp. .... *P. affinis*
1. Ascospores muriform, ellipsoid to broadly ellipsoid ..... 2
2. Ascospores ellipsoid, 28–36  $\times$  9–11  $\mu\text{m}$ ; asci 8-spored; on various squamulose lichens .... *P. oropensis*
2. Ascospores broadly ellipsoid, 30–46  $\times$  13–18  $\mu\text{m}$ ; asci 2- or 4-spored; on *Peltigera rufescens* ..... *P. superba*



Ascomata solitary, superficial, loosely attached to the substratum by a sparse, white subiculum of hyphae, 5–6  $\mu\text{m}$  wide. Ascomata white to pale yellow, KOH–, globose, cupulate when dry, ca 235  $\mu\text{m}$  high  $\times$  215  $\mu\text{m}$  diam, with a small, pointed papilla, ascomatal surface smooth, slightly roughened, or with loose strands of hyphae. Ascomatal wall 25–30  $\mu\text{m}$  thick, of two intergrading regions: outer region 20–25  $\mu\text{m}$  thick, of angular to elongate cells, 8–13  $\times$  4–6  $\mu\text{m}$ , with up to 1  $\mu\text{m}$  thick walls; inner region ca 5  $\mu\text{m}$  thick, of hyaline, thin-walled, elongate cells. Asci clavate, 45–70  $\times$  15–18  $\mu\text{m}$ , simple, 8-spored, pluriseriate. Ascospores narrowly ellipsoid to fusiform, 24–34 (excluding ends)  $\times$  6–8  $\mu\text{m}$ , with long, thin, attenuated ends, 8–15  $\mu\text{m}$  long  $\times$  0.8  $\mu\text{m}$  wide; ascospores 3-septate, hyaline, smooth-walled.

HABITAT.— On thalli of lichens, *Ephebe lanata* and *E. pubescens*.

DISTRIBUTION.— Great Britain and France.

HOLOTYPE.— GREAT BRITAIN. Scotland: Appin, Carmichael (K. not examined; PC, possible isotype).

SPECIMEN EXAMINED.— FRANCE. Fontainebleau, on *Ephebe pubescens*, 1893, De Notaris (RO).

ILLUSTRATIONS.— Dennis (1978, Pl. 31H); Greville (1826, Figs. 1 a–d, as *Sphaeria affinis*); Petch (1938, Fig. 21); Rossman (1983, Pl. 13E, Fig. 45).

**Paranectria oropensis** (Ces.) D. Hawksw. & Piroz., *Canad. J. Bot.* 55: 2555. 1977.

≡ *Sphaeria oropensis* Ces., in Rabenh., *Bot. Zeitung* 15: 406. 1857.

≡ *Ciliomyces oropensis* (Ces.) Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. I*, 115: 673. 1906.

= *Nectria lichenicola* P. Crouan & H. Crouan, *Fl. Finistère*, p. 256. 1867.

≡ *Pleonectria lichenicola* (P. Crouan & H. Crouan) Sacc., *Michelia* 1: 325. 1879.

= *Pleonectria appendiculata* Vouaux, *Bull. Trimestriel Soc. Mycol. France* 28: 193. 1912.

This species is described and illustrated in Samuels (1976a, as *Ciliomyces oropensis*) and Hawksworth (1982a). It is known from Austria, France, Ireland, Italy and Scotland on the lichens *Cladonia* sp., *Lecidea enteroleuca*, *Parmeliella atlantica*, and an undetermined leprose thallus.

**Paranectria superba** D. Hawksw., *Notes Roy. Bot. Gard. Edinburgh* 40: 390. 1982.

Hawksworth (1982a) described and illustrated this species that is known only from the type collection on thallus of *Peltigera rufescens* in Great Britain.

**PEETHAMBARA** Subram. & D.J. Bhat, *Rev. Mycol. (Paris)* 42: 49. 1978.

Type: *P. sundara* Subram. & D.J. Bhat.

Ascomata scattered, solitary to aggregated in small groups; superficial, on a thin, pseudoparenchymatous stroma. Ascomata bright- or dark yellow, globose to subglobose with a flattened apex, ostiolate. Ascomatal wall very thick, over 50  $\mu\text{m}$ , of two regions: the outer region of very thick-walled, angular cells. Asci cylindrical, clavate, to broadly clavate, simple. Ascospores broadly reniform, 1- to 3-septate, hyaline. Anamorph synnematous, *Didymostilbe*. On dead woody substrata.

NOTES.— The genus *Peethambara* was established for the teleomorph of *Putagraivam sundaram*, now *Didymostilbe sundara*. The type specimen of *Peethambara sundara* is apparently lost. The description included here is based on the original publication. *Peethambara* was described as having a *Nectria*-type centrum with a distinct ascomatal wall of two regions, one of which consists of extremely thick-walled, sclerenchyma-like cells. Seifert (1985) examined the type and additional specimens of the anamorph from Indonesia and Sierra Leone on woody hosts. Despite the lack of a type specimen, *Peethambara* is included in the *Hypocreales* based on the ascomatal wall characteristics and distinctive anamorph. *Peethambara* resembles members of *Bionectria* in having large, pale yellow to yellow, thick-walled ascomata, large, ascospores, and a synnematous anamorph. Preliminary molecular data suggest that *Peethambara* belongs in the *Bionectriaceae* allied with several anamorph genera having synnema and green, often multiseptate conidia (Rossman *et al.*, 1998).

*Peethambara spirostriata* and *P. sundara* are similar in their thick-walled ascomata, broadly fusiform ascospores, and synnematous anamorphs producing multiseptate, greenish conidia. In addition, molecular data also suggest a close relationship between these species and the anamorph species, *Albosynnema elegans* E.F. Morris (Rossman *et al.*, unpubl.).

**Peethambara sundara** Subram. & D.J. Bhat, *Rev. Mycol. (Paris)* 42: 49. 1978.

ANAMORPH: *Didymostilbe sundara* (Subram. & D.J. Bhat) Seifert, *Stud. Mycol.* 27: 140. 1985.

≡ *Putagraivam sundarum* Subram. & D.J. Bhat, *Proc. Indian Acad. Sci., Sect. B*, 87: 103. 1978.

Ascomata scattered, solitary to aggregated in small groups; superficial, with thin, pseudoparenchymatous stroma, stroma 148–162  $\times$  33  $\mu\text{m}$ , of golden-yellow hyphae. Ascomata golden-yellow, globose to subglo-

bose with a flattened apex, 380–440 × 360–420 µm, smooth, ostiolate. Ascromatal wall 60–70 µm thick, of two regions: outer region 38–46 µm thick, of very thick-walled, angular cells, 7–16.5 × 5–6.5 µm; inner region 16–23 µm thick, of thin-walled, elongate cells. Periphyses cellular, cylindrical, 15–20 × 1.5–2.2 µm, ends rounded. Apical paraphyses evident in young ascromata, visible as remnants in mature ascromata. Asci cylindrical, clavate to broadly clavate, 81–105 × 21–28 µm, simple, 4–8-spored, ascospores uniseriate above to biseriate below. Ascospores broadly reniform with rounded ends, 31–42 × 14.5–21 µm, 1-septate, hyaline, smooth.

**HABITAT AND DISTRIBUTION.**— Known only from the type collection.

**HOLOTYPE.**— INDIA, Karnataka State: South Kanara district, near Irde, at Darbhe, on dead twigs of *Macaranga indica* Wight, 22 Dec 1976, D.J. Bhat (MUBL 2358 – apparently lost; ex-type culture CBS 646.77). Culture CBS 521.96.

**ILLUSTRATIONS.**— Seifert (1985, Fig. 47; 1990, Fig. 5F, anamorph); Subramanian & Bhat (1978b, Figs. 1–22, anamorph; 1978c, Figs. 1–2, Pl. 1).

***Peethambara spirostriata*** (Rossman) Rossman, *comb. nov.*

≡ *Nectria spirostriata* Rossman, Mycol. Pap. 150: 61, 1983.

**ANAMORPH:** *Didymostilbe echinofibrosa* (E.F. Morris) Rossman, *comb. nov.*

≡ *Virgatospora echinofibrosa* E.F. Morris, Mycologia 59: 538, 1967.

Ascromata superficial, solitary or in groups of up to five, without stroma, yellow to dark yellow, becoming darker when dry, KOH–, globose to subglobose, irregularly cupulate or not collapsing when dry, 305–470 µm high × 360–575 µm diam, without papilla, smooth. Ascromatal wall 50–70 µm thick, of two regions: outer region 25–35 µm thick, of angular to globose cells 10–18 µm diam, with hyaline up to 1.5 µm thick walls; inner region 25–35 µm thick, of small angular to slightly elongate cells, 7.5–12 × 5–7.5 µm, with 2–3 µm thick walls, the cells with only a small lumen; empty shell of ascromatal wall remaining when overmature. Asci clavate, 87–100 × 17–23 µm, simple, number of ascospores in

each ascus variable, often only 4–6, ascospores irregularly biseriate. Ascospores broadly fusiform with narrowly rounded ends, curved, 38–55 × 10–13 µm, 3–(4–5)-septate, with large guttules in each cell, hyaline, spirally striate, with 10–12 striae per half spore.

**ANAMORPH.**— Synnemata scattered, solitary, 400–1500 µm tall × 40–70 µm wide at the apex, broadening to 150 µm at the base, stalk dark olivaceous-grey, paler toward the base, cells of stalk with dark walls, elongate, 12–25 × 2–3 µm, head of synnemata globose, 125–200 µm diam, with conidia in a slimy, olivaceous-black mass. Conidiophores unbranched along most of their length, branching penicillately toward their apices. Conidiogenous cells phialidic, determinate, cylindrical to clavate, 10–30 × 3–4 µm. Conidia broadly fusiform with papillate, truncate ends, straight or curved, 3-septate, 38–45 × 10–15 µm, olivaceous-grey, coarsely striate.

**HABITAT.**— On decaying woody substrata.

**DISTRIBUTION.**— Tropical, known primarily from the Neotropics, also Gabon and Malaysia.

**TYPES.**— PANAMA: Prov. Panama, vicinity of Altos de Pacora, 26–31 km N of Pan American Hwy, on old road to Mandinga, elev. ca 700–730 m, on trunk of *Cecropia* sp., associated with *Virgatospora echinofibrosa*, K. P. Dumont *et al.*, 30 June 1975, PA 1553 (holotype of *Nectria spirostriata* NY); Barro Colorado Island, Pierson Trail, on dead twigs, 3 Aug 1964, E.F. Morris & J.W. Strain 780, (lectotype of *Virgatospora echinofibrosa*, designated by Rossman, 1983; BPI 449174, isolectotype ILLS).

Additional specimens examined are cited in Rossman (1983).

**ILLUSTRATIONS.**— Ellis & Ellis (1971, Fig. 401, anamorph only); Rossman (1983, Fig. 32, Pl. 11 A, B).

**PRONECTRIA** Clem., in Clem. & Shear, Gen. Fungi p. 282, 1931.

Type: *P. lichenicola* (Ces.) Clem. (≡ *Cryptodiscus lichenicola* Ces. ≡ *Nectria lichenicola* (Ces.) Sacc.), a synonym of *Pronectria robergei* (Mont. & Desm.) Lowen.

Ascromata immersed in the host thallus, scattered or in groups, non-stromatic, subglobose to obpyriform, 100–500 µm diam, pale yellow to orange or red, rarely yellow, KOH– or rarely reacting. Setae rarely present. Cells on the ascromatal surface usually angular. Ascromatal wall 10–40 µm thick, generally of one region, also of two, rarely three, regions. Ascromatal apex of rows

#### KEY TO THE SPECIES OF *PEETHAMBARA*

1. Ascospores 1-septate, broadly reniform with rounded ends, 31–42 × 14.5–21 µm, smooth ..... *P. sundara*
1. Ascospores 3–(4–5)-septate, broadly fusiform with narrowly rounded ends, curved, 38–55 × 10–13 µm, spirally striate ..... *P. spirostriata*

of parallel, vertically elongate cells, continuous with the inner region of the ascumatal wall. Asci clavate, usually less than 200  $\mu\text{m}$  long or 15  $\mu\text{m}$  wide, apex truncate, usually with a ring, 2–8-spored, ascospores biserial in the middle, uniseriate above and below, or rarely uniseriate. Ascospores fusiform, ovoid or ellipsoid, typically not over 25  $\mu\text{m}$  long and 8  $\mu\text{m}$  wide, 1-septate, hyaline, smooth-walled, verruculose or spinulose. Anamorph, where known, *Acremonium*. On lichenized fungi and algae.

NOTES.— Clements (in Clements & Shear, 1931) described and differentiated the genus *Pronectria* based on the lichenicolous habit, keying it out among hypocrealean fungi having one-septate, hyaline ascospores and non-stromatic, superficial ascumata. Although *Pronectria* was considered a synonym of *Nectriella* by Rogerson (1970), Lowen (1991) differentiated *Pronectria* from other hypocrealean genera by immersed ascumata, occurrence on lichens and algae, and a combination of morphological characters, i.e. ascumatal wall thin, often of one region, presence of ascumatal cells intermingled with those of the host, pale yellow to orange or dark red ascumata, generally KOH– except in *P. fissuriprodiens*, *P. septemseptata*, and *P. subimperspicua*. Another hypocrealean genus that includes lichenicolous species is *Xenonectriella* in the *Nectriaceae*. This genus has KOH+ ascumata with thickened wall cells, generally cylindrical asci, and verruculose to tuberculate ascospores that become yellowish brown with age. The species of *Pronectria* with KOH+ ascumata may belong in *Xenonectriella*; however, careful observation of ascumatal anatomy is needed to make this determination. Although *Pronectria* and *Nectriella* are similar in having KOH–, thin-walled ascumata immersed in the substratum, *Nectriella* differs in occurring on decaying herbaceous or woody plant material and having an ascumatal wall of two regions. Anamorphs of species of *Pronectria* have been placed in *Acremonium*, *Diplosporium*, and *Illosporium*. Lowen (1991) provided an account of the genus *Pronectria* with a key to the accepted species including two new species published here.

***Pronectria robergei*** (Mont. & Desm.) Lowen, Mycotaxon 39: 462, 1990. — Plate 8, c.

≡ *Nectria robergei* Mont. & Desm., Pl. Crypt. France, Ed. 3, Fasc. 8: 374, 1856.

≡ *Nectriella robergei* (Mont. & Desm.) Weese, in Höhn. & Weese, Ann. Mycol. 8: 467, 1910.

= *Cryptodiscus lichenicola* Ces., in Rabenh. Herb. Mycol. ed. 2, fasc. 6: 523, 1857.

≡ *Nectria lichenicola* (Ces.) Sacc., Michelia 1: 289, 1878.

≡ *Calonectria lichenicola* (Ces.) Rehm, Ascom. Lojk. p. 44, 1882.

≡ *Nectriella lichenicola* (Ces.) Fuckel, in Höhn. & Weese, Ann. Mycol. 8: 466, 1910.

≡ *Pronectria lichenicola* (Ces.) Clem., in Clem. & Shear, Gen. Fungi p. 282, 1931.

= *Nectriella carnea* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–23: 176, 1869 [1870].

= *Nectria peltigerae* W. Phillips & Plowr., Grevillea 4: 123, 1876.

Ascumata immersed, scattered or in groups of up to 20, closely adherent and raising the epidermis of the lichen or visible through star-like cracks in the epidermis, obpyriform, 240–340  $\mu\text{m}$  high  $\times$  250–320  $\mu\text{m}$  wide, pale red to orange, yellow when dry, KOH–; papilla truncate, 60–130  $\mu\text{m}$  diam; ostiolar area sometimes depressed and hyaline. Ascumatal wall ca 35  $\mu\text{m}$  thick, of two regions: outer region ca 17  $\mu\text{m}$  thick, of thick-walled, globose to ellipsoid cells, 3.5  $\mu\text{m}$  diam or 5  $\times$  3.5  $\mu\text{m}$ ; inner region ca 18  $\mu\text{m}$  thick, of thin-walled, elongated cells 3.5–10.5  $\times$  2–3  $\mu\text{m}$ ; periphyses directed downward into the centrum. Asci clavate, 40–70  $\times$  8–9(–14)  $\mu\text{m}$ ; apex with a ring, 8-spored, ascospores biserial. Ascospores ovoid to ellipsoid, 8–16  $\times$  (3–)4–8  $\mu\text{m}$ , 1-septate, sometimes slightly constricted, hyaline, smooth to slightly roughened.

HABITAT.— On *Peltigera canina* and other species of *Peltigera*, often damaging the thallus of the lichen, discoloring areas delimited by a dark line from the inner layers, leaving smooth craters where ascumata have fallen out.

DISTRIBUTION.— Chile, Europe (Belgium, Finland, France, Germany, Italy, Luxembourg, Romania, Scotland, Spain – *vide* Martínez & Hafellner, 1998, Sweden), United States (Montana, New Hampshire, New York).

TYPE.— FRANCE. Normandy: Lebisey Park, on thallus of *Peltigera canina*, on old elm, Apr 1843, Roberge, Pl. Crypt. France, ed. 3, fasc. 8: 374, 1856 (PC, lectotype of *Nectria robergei*, designated herein; FH, H, IMI, K, PC, isolectotypes). ITALY. Piedmont: Oct.–Nov. 1856, Rabenhorst, Herb. Mycol. ed. 2, fasc. 6: 523, 1857 (BPI, lectotype of *Cryptodiscus lichenicola*, designated herein; IMI, K, S isolectotypes). GERMANY. Freienweinstein: Kiefernwald (pine wood), in thallus of *Peltigera canina*, spring, Kalchbrenner, Fungi Rhenani Exsiccati 1835 (G, holotype of *Nectriella carnea*, FH – Höhnel, IMI, K, S, isotypes). UNITED KINGDOM. Norfolk: Castle Rising [as 'Lynn'], Nov 1875, collector unknown (E, FH – Höhnel, isotypes of *Nectria peltigerae*).

Many additional specimens examined as cited in Lowen (1991).

ILLUSTRATIONS.— Müller & von Arx (1962, Fig. 247, as *Nectriella robergei*).

ADDITIONAL SPECIES OF *PRONECTRIA*:

***Pronectria anisospora*** (Lowen) Lowen, Mycotaxon 39: 461, 1990.

≡ *Nectriella anisospora* Lowen, Mem. New York Bot. Gard 49: 248, 1989.

This species was described and illustrated in Lowen (1989).

***Pronectria casaesii*** Etayo, *Nova Hedwigia* 67: 504. 1998.

Recently described and illustrated from Spain by Etayo (1998), this is one of two species in *Pronectria* having more than one-septate ascospores.

***Pronectria dealbans*** (Müll. Arg.) Etayo & Breuss, *Cryptogamie, Bryol. Lichénol.* 17: 220. 1996.

= *Sphaerella dealbans* Müll. Arg., *Flora* 55: 507. 1872.

This species was described and illustrated in Etayo & Breuss (1996).

***Pronectria echinulata*** Lowen, *sp. nov.* — Plate 9, d.

Ascomata obpyriformia, 120–140 × 100–130 µm, immersa, gregaria, aurantiaco-brunnea. Setae nullae. Parietes 8–12 µm crassi, unistratosi. Asci clavati, 52 × 2 µm; annulo deficientes. Ascospores biseriatae, ellipsoideae vel ovoideae 12–14 × 5.5–8 µm, 1-septatae, hyalinae, echinulatae. Anamorphosis ignota.

Ascomata immersed in discolored, raised host thallus, in groups of up to 20, obpyriform, 120–140(–250) µm high × 100–130(–160) µm diam, orange-brown, becoming darker in KOH, not changing color in lactic acid; papilla truncate, non-setose. Surface cells angular, 5–9.5 × 8.5–12 µm. Ascomatal wall 8–12 µm thick, of one region of thin-walled angular cells, ca 7 × 5 µm. Asci clavate, 52 × 12 µm; simple, ascospores biseriatae. Ascospores ellipsoid-ovoid, (11–)12–14(–18) × 5.5–8(–10) µm, 1-septate, sometimes slightly constricted, thin-walled, hyaline, spinulose. Anamorph unknown.

HABITAT.— On *Physcia*.

DISTRIBUTION.— Austria, Ireland, Spain (Etayo, 1998), U.S.A. (Idaho).

HOLOTYPE.— IRELAND. Gortnaskehy (H10), on *Physcia aipolia* on *Salix*. 30 Aug 1985. M.R.D. Seaward (IMI 105139).

ADDITIONAL SPECIMENS EXAMINED.— AUSTRIA: Steiermark: Hochschwab-Gruppe, Seetal W of Seewiesen, ca 10 km NE of Aflenz, 930 m, on *Physcia ascendens*, on *Fraxinus*, 19 Jan 1985, J. Hafellner 12580 & A. Ochsenhofer (Herb. J. Hafellner); UNITED STATES. Idaho: Lochsu River near Howell, on *Physcia* on stick, 29 June 1989, Katia Rodrigues (NY).

ETYMOLOGY.— Referring to the echinulate ascospores.

NOTES.— *Pronectria echinulata* is distinguished from other species of *Pronectria* by its thin lateral ascomatal wall of brownish cells, spinulose ascospores with fragile walls that fracture easily with pressure, and ascomata aggregated in a raised, discolored area of the lichen thallus.

***Pronectria erythrinella*** (Nyl.) Lowen, *Mycotaxon* 39: 461. 1990.

= *Sphaeria erythrinella* Nyl., *Not. Sällsk. Fauna Fl. Fenn. Förh.* 4: 125. 1859.

= *Nectria erythrinella* (Nyl.) Tul. & C. Tul., *Sel. Fung. Carpol.* 3: 95. 1865.

= *Charonectria erythrinella* Jaap, *Verh. Bot. Vereins Prov. Brandenburg* 52: 133. 1910.

= *Nectriella erythrinella* (Nyl.) Höhn. & Weese, *Ann. Mycol.* 8: 466. 1910.

= *Nectriella kalchbrenneri* Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 177. 1869 [1870].

ANAMORPH: *Illosporium* sp.

Ascomata immersed, scattered or in groups of up to six, obpyriform, 280–320 µm high × 240–340 µm diam, at first red to orange, fading to yellow, KOH–; papilla truncate occasionally with hyphal ends free at edges, averaging 80 µm high × 160 µm diam, non-setose. Cells on surface angular to irregularly rectangular, mostly 10 × 5 µm. Ascomatal wall 20 µm thick, of one region, of thin-walled rectangular cells 5–12 × 2.5–3.5 µm, widening to two regions in upper quarter; outer cells thick-walled, subglobose. Asci clavate, 72–90 × 10–14 µm; apex truncate, with a ring; ascospores biseriatae. Ascospores ellipsoid-fusiform, (17–)18–20(–30) × (4–)5.5–6(–8) µm, 1-septate, septa often jagged, at first hyaline to pale yellow, then pale orange, verruculose, guttules often present in immature ascospores.

ANAMORPH.— Sporodochia erumpent, scattered or in groups on the lichen thallus, sometimes contiguous with ascomata, ca 250 µm diam, reddish orange. Conidia germinating from groups of cells, not from single cells.

HABITAT.— On thalli of *Peltigera* spp.

DISTRIBUTION.— In cool temperate regions.

TYPE SPECIMENS.— FINLAND. Nylandia: Helsinki (Helsingfors), Grid 27°E, on *Peltigera* sp., Nov 1858, W. Nylander (holotype of *N. erythrinella*, H; isotype, IMI 211135, slide, as *Sphaeria erythrinella*). CZECH REPUBLIC. Near Spis-Olaszi, in *Peltigera canina*, parasitic and ultimately destructive, June 1860, after heavy rain, Kalchbrenner, Rabenh. Fungi Eur. no. 73b (isotype of *N. kalchbrenneri*, NY, filed as *Illosporium carneum*).

SELECTED SPECIMENS EXAMINED.— CANADA. Alberta: SW of Calgary, Eau Claire camp ground, 1400 m (4600'), on *Peltigera rufescens* [= *P. leptophora*], on rock outcrops, lower subalpine region, 19 July 1981, R. Rosentreter 2198 (IMI 269698, *Illosporium* sp. also present). FINLAND. Pp: li: lin aseman ratapihan N-pää sillanpieli en ratavallin W-rinne, grid 27°E, on *Peltigera didactyla*, 21 July 1964, J. Suominen (H, as *Nectriella robergei*, *Illosporium* sp. present); Myllyperä, on *Peltigera*, äng, May 1866, Karsten, Fungi Fenn. 475 (K, as *S. erythrinella*). RUSSIA. Bologoye: prov. Nangorva, 29 Aug. 10 Sep 1897, W. Tranzschel (Š). SWEDEN. location unknown, 16 Aug 1974, R. Santesson (UPS, as *N. robergei*); UNITED STATES. Idaho: Lemhi County, Gilmore Summit,

Lemhi-Birch creek valley T13N, R27E, 2500 m, 20 June 1987, R. Rosentreter 4243, culture as R. Lowen 359a-87 (NY, Herb. Rosentreter); New Hampshire: Coos County, Shelburne, Sep 1891, W.G. Farlow 406 (FH, S, *Illosporium* sp. present).

NOTES.— The ascomatal papilla of *Pronectria erythrinella* is barely visible through cracks in the thallus of the host, or it can become emergent surrounded by host tissue. The ascomatal apex is composed of parallel hyphae. Although similar to *P. robergei*, ascomata of *P. erythrinella* are brighter in color than those of *P. robergei* at first, but in the herbarium, where the colors usually fade, these species cannot be distinguished macroscopically. *Pronectria robergei* has smaller ascospores, shorter asci, and ascomatal walls of two regions unlike *P. erythrinella*. *Pronectria robergei* is usually found on *Peltigera* cf. *canina* whereas *P. erythrinella* often occurs on *Peltigera didactyla*.

***Pronectria fissuriprodiens*** Etayo, in Etayo & Diederich, Bull. Soc. Nat. Luxemb. 97: 110. 1996.

This species was described and illustrated in Etayo & Diederich (1996).

***Pronectria laminariae*** (O.E. Erikss.) Lowen, Mycotaxon 39: 461. 1990.

= *Nectriella laminariae* O.E. Erikss., Svensk Bot. Tidskr. 58: 233. 1964.

This species was described and illustrated in Eriksson (1964).

***Pronectria oligospora*** Lowen & Rogerson, Mycotaxon 53: 88. 1995.

This species was described and illustrated in Lowen (1995).

***Pronectria oligospora* var. *octospora*** Etayo, Nova Hedwigia 67: 505. 1998.

This species was described by Etayo (l.c.).

***Pronectria pertusariicola*** Lowen, sp. nov. — Plate 8, e.

Ascomata obpyriformia vel subglobosa, 220–300 × 150–270 μm, immersa, gregaria, aurantiaca. Setae nullae. Parietes

17–20 μm crassi, bistratosi. Asci clavati, 60–80 × 7–9 μm; annulo indistincto. Ascospores biseriatae, ovoideae, 9–12 × 4.5–5 μm, 1-septatae, hyalinae, echinulatae, guttulateae. Anamorphosis ignota.

Ascomata immersed in the host thallus, in groups of 20 to 100, obpyriform to subglobose, 220–300 high × 150–270 μm diam, orange to yellow, KOH–; papilla truncate, 40 μm high × 100–200 μm diam, non-setose. Ascromatal wall 17–20 μm thick, of two regions: outer region 9–13 μm thick, of thick-walled, angular to rounded cells, 2–3.5 × 1–1.5 μm; inner region 7–8 μm thick, of thin-walled, elongate cells, 2–8.5 × 0.5 μm. Asci clavate, 60–80 × 7–8(–12) μm; apex truncate and simple; ascospores irregularly uniseriate to biseriate. Ascospores ovoid, (9–)15–20 × 4.5–5(–6) μm, 1-septate, slightly constricted; hyaline, spinulose, spines sometimes arranged in rows as striations. Anamorph unknown.

HABITAT.— On thallus of *Pertusaria* sp.

DISTRIBUTION.— France, Spain (Etayo, 1998), Sweden.

HOLOTYPE.— SWEDEN, Skåne: Brunnby par., Krapperup, by a road, on *Pertusaria pertusa* on *Ulmus*, 19 July 1947, R. Santesson (UPS).

ADDITIONAL SPECIMENS EXAMINED.— FRANCE, Brittany: Finistère, Coatadon, on *Pertusaria pertusa* (as *P. communis*), 18

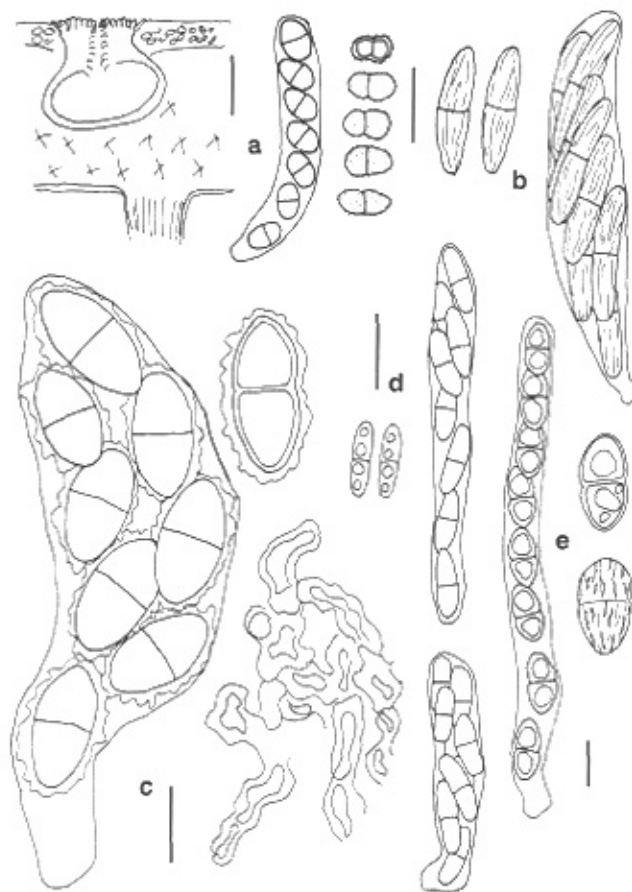


Plate 10. a. *Pronectria subimperspicua*, median section of ascoma, ascus and ascospores. b. *Protocreopsis javanica*, ascus and ascospores. c. *Stilbocrea impressa*, hairs on ascromatal wall, ascus, and ascospore. d. *Valsonectria boldoae*, asci and ascospores. e. *Valsonectria pulchella*, ascus and ascospores. a. Holotype – LPS. b. Holotype of *P. palmicola* – TNS. c. G.J.S. 84-256 – NY. d. Holotype – LPS. e. Holotype – LPS. Scale bars: left a = 100 μm; right a, b–e = 10 μm.

June 1870, Crouan & Crouan (CO, filed under *Nectria*); same locality, [on *Pertusaria* sp.] on bark of elm, 18 Oct 1868, Crouan & Crouan (CO).

ETYMOLOGY.— The specific epithet is based on the host lichen, *Pertusaria*.

NOTES.— The collections of *Pronectria pertusariicola* from Sweden and France differ somewhat in ascospore size. The collection from Sweden is chosen as the holotype because it is in better condition and is more readily available for study than the collections from the Crouan herbarium. *Pronectria pertusariicola* and *P. robergei* are morphologically similar, but *P. pertusariicola* differs in host and ascomatal wall anatomy, having asci with an apical ring, and ascospores that are more conspicuously ornamented than those of *P. robergei*.

***Pronectria santessonii*** (Lowen & D. Hawksw.) Lowen, Mycotaxon 39: 462. 1990.

≡ *Nectriella santessonii* Lowen & D. Hawksw., Lichenologist 18: 322. 1986.

This species was described and illustrated in Lowen & Hawksworth (1986).

***Pronectria septemseptata*** Etayo, Nova Hedwigia 67: 507. 1998.

Recently described and illustrated from Spain by Etayo (1998), this species is unique in having generally 7-septate ascospores.

***Pronectria subimperspicua*** (Speg.) Lowen, Mycotaxon 39: 462. 1990. — Plate 10, a.

≡ *Nectria subimperspicua* Speg., Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 290. 1899.

Ascomata immersed, scattered or in groups of up to 30, obpyriform, 120–240 high × 120–240 µm diam, pale orange, outer wall region KOH+ red, changing to yellow in lactic acid; papilla conical to truncate, 60 µm diam, slightly paler than lateral and basal walls. Ascomatal wall 10 µm thick, of two regions: outer region 5 µm wide of thick-walled, round to oval cells; inner region 5 µm wide, of thick-walled, elongate cells. Centrum contents pale orange; orange oily drops emerging from crushed ascomata. Asci clavate, 40–50 × 6.5–7.5 µm, apex rounded, simple; asci in fascicles; ascospores diagonally uniseriate, filling the ascus. Ascospores subglobose, 6.5–8 × 5–6 µm, 1-septate, slightly constricted, at first hyaline, then pale orange, verruculose.

HABITAT.— On thallus of *Punctelia*.

DISTRIBUTION.— Known only from type.

HOLOTYPE.— ARGENTINA. Buenos Aires: La Plata, in park, on the wilting thallus of *Punctelia constantimontium* [as *Ricasolia casarettoana*], 1 Apr 1890, Spegazzini 1618 (LPS).

NOTES.— *Pronectria subimperspicua* differs from other species of *Pronectria* in the KOH reaction of the outer ascomatal wall. *Pronectria paucispora* is also found on *Punctelia*, but has subglobose ascomata and longer, narrower ascospores than those of *P. subimperspicua*.

***Pronectria tenacis*** (Vouaux) Lowen, Mycotaxon 39: 462. 1990.

≡ *Pharcidia mamillula* (Anzi) Vouaux f. *tenacis* Vouaux, in Bouly de Lesdain, Rech. Lich. Dunkerque p. 273. 1910.

Ascomata immersed in host thallus and apothecia, scattered or in groups of up to six, obpyriform, 240 µm high × 200 µm diam, orange, KOH–, papilla conical to truncate, purplish red. Ascomatal wall 17–22 µm thick, of one region of thin-walled rounded to angular cells 3 µm diam, cells becoming longer and thinner toward the centrum. Centrum contents pale orange; orange oily drops emerging from crushed ascomata. Asci clavate, 50–70 × 8–14 µm, with an apical ring; ascospores biserial. Ascospores ellipsoid–ovoid, 10–16 × 5–6 µm, 1-septate, at first hyaline, then pale orange, verruculose. ANAMORPH.— None known.

HABITAT.— In thallus of *Collema tenax* on dunes.

DISTRIBUTION.— United Kingdom and France.

NEOTYPE DESIGNATED HEREIN.— UNITED KINGDOM. England: North Devon: Braunton Barrows NNR, on *Collema tenax* on dunes, 16 Apr 1988, D.L. Hawksworth 5314 (IMI 327003).

NOTES.— The type specimen at the Vouaux herbarium was destroyed, thus this taxon is neotypified with a specimen that agrees with the protologue. The sand dune habitat is similar to that described as the original locality. *Pronectria tenacis* is distinguished from other species of *Pronectria* by the host lichen and the ascomata with purplish red papillae.

***Pronectria tenuispora*** (D. Hawksw.) Lowen, Mycotaxon 39: 462. 1990.

≡ *Nectriella tenuispora* D. Hawksw., Notes Roy. Bot. Gard. Edinburgh 36: 187. 1978.

This species was described and illustrated in Hawksworth (1978).

***Pronectria terrestris*** Lowen & Diederich, Mycologia 82: 790. 1990.

This species was described and illustrated in Lowen & Diederich (1990).

***Pronectria tinctoria*** (Fuckel) Lowen, Mycotaxon 39: 462. 1990.

≡ *Cryptodiscus tinctus* Fuckel, *Fungi rhenani* exs., Fasc. 4: 1836. 1867.

≡ *Calonectria tincta* (Fuckel) Rehm, *Ann. Mycol.* 8: 302. 1910.

≡ *Nectriella tincta* (Fuckel) R. Sant., in Eriksson, *Svensk Bot. Tidskr.* 58: 235. 1964.

[≡ *Nectriella coccinea* Fuckel, *Jahrb. Nassauischen Vereins Naturk.* 23–24: 177. 1869 [1870], non *N. coccinea* (Pers.: Fr.) Fr. 1849].

≡ *Nectria fuckelii* Sacc., *Michelia* 1: 289. 1878.

[≡ *Calonectria fuckelii* (Sacc.) Rehm, *Tranzschel & Serebriani-kow, Mycotheca Rossica* Fasc. 2: 68. 1910, non *C. fuckelii* (Nitschke) Sacc., *Michelia* 1: 310. 1878].

= *Calonectria fuckelii* (Sacc.) Rehm f. *everniae* Rehm, in Motouschek, *Centralbl. Bakteri-ol.*, Abth. 2, 42: 105. 1915.

Ascomata immersed in ectal excipulum and thallus, scattered or in groups of up to 15, obpyriform, 170–220 µm high × 170–230 µm diam, at first pale red, then pale yellow, KOH–, papilla conical, 75–80 µm high × 100–120 µm diam. Ascomatal wall 10–16 µm thick, of one region of thin-walled cells. Asci clavate, 60–80 × 9–11 µm, apex rounded, simple; ascospores biseri-ate. Ascospores fusiform, 17–22 × 4–5.5 µm, 1-septate, cells unequal, one cell wider than the other, hyaline, verruculose, with one to many guttules per cell.

ANAMORPH.— None known.

HABITAT.— On thallus and ectal excipulum of *Anaptychia ciliaris*.

DISTRIBUTION.— Europe.

TYPE SPECIMENS.— SWITZERLAND. Neuchâtel: near Neuchâtel, in Jura, on thallus and apothecia of *Anaptychia ciliaris* [as *Hagenium ciliarum*], Spring 1870, P. Morthier, *Fungi rhenani* exs. 1836 (holotype of *C. tinctus* G; isotypes,

Herb. Barb. Boiss. FH – Höhnel, G; IMI, K). RUSSIA. Prov. Kursk: Schebekino, in thallus of '*Evernia prunastri*', 15 July 1908, Serebriani-kow, in *Tranzschel & Serebriani-kow, Mycoth. Ross.* Fasc. 2, 68 (isotypes, BPI, FH, K, S, all as *Calonectria fuckelii* f. *everniae*).

ADDITIONAL SPECIMENS EXAMINED.— FINLAND. Tavastia australis: Tammela, Mustiala, 13 Oct 1888, P.A. Karsten 2740 (H: as *Nectria fuckelii*); *ibid.*, on *Physcia stellaris*, 4 Oct 1888, P.A. Karsten 2739 (H: as *Nectria fuckelii*); *ibid.*, Oct 1888, P.A. Karsten 2738 (H: as *Nectria fuckelii*). USSR. Prov. Kursk: Schebekino, in thallus, Aug 1908, Serebriani-kow, Rehm *Ascom.*, Fasc. 46: 1897 (FH – Höhnel, K, S, all as *Calonectria tincta*).

NOTES.— *Pronectria tincta* is distinguished from other species of *Pronectria* by the host and the unequal, fusiform ascospores.

***Pronectria verrucariae*** (Vouaux) Lowen, *Mycotaxon* 39: 462. 1990.

≡ *Nectria verrucariae* Vouaux, *Bull. Trimestrial Soc. Mycol. France* 28: 186. 1912.

Ascomata immersed in ascomata of the lichen, visible as black or sometimes orange spots due to the barely visible papilla, scattered or in groups of up to 6, ascomata falling out leaving orange, circular craters, obpyriform, 180–320 µm high × 150–280 µm diam, pale orange, KOH–, papilla truncate, 60 µm wide. Ascomatal wall 16–20 µm thick, of one region, of thin-walled, elongate cells. Asci clavate, 44–70 × 8–12 µm, with 2–4 ascospores, apex with a ring; ascospores uniseriate. Ascospores ovoid to ellipsoid–fusiform, one end often pointed, other end rounded, 16–21 × 5–7 µm.

#### KEY TO THE SPECIES OF *PRONECTRIA*

1. Ascospores 3- or more septate ..... 2
1. Ascospores 1-septate ..... 3
- 2 (1) Ascospores 3-septate, elongate ellipsoid, 15.5–21 × 5–6 µm ..... *P. casaresii*
2. Ascospores (3–5–)7-septate, fusiform, 41–63 × 4.5–6 µm ..... *P. septemseptata*
- 3 (1) Ascomata becoming darker in KOH and yellow in lactic acid; ascospores uniseriate . 4
3. Ascomata not changing color in KOH or lactic acid; ascospores biseri-ate ..... 5
- 4 (3). Ascospores 6.5–8 × 5–6 µm, pale orange, verruculose; ascomata immersed in thallus of *Punctelia constantimontium* ..... *P. subimperspicua*
4. Ascospores 6.5–10 × 3–5 µm, hyaline, smooth-walled; ascomata immersed in thallus of *Lobaria* ..... *P. fissuriprodiens*
- 5 (3). Ascomata having a red ostiolar area ..... 6
5. Ascomata concolorous ..... 8
- 6 (5). Algicolous, in stipe of *Laminaria* sp.; ascomata white with red ostiolar area; ascospores 13–20 × 7–9 µm, pale brown, verruculose ..... *P. laminariae*
6. Lichenicolous, in thallus or apothecia of lichenized fungi; ascomata orange with red os-tiolar area ..... 7

- 7 (6). Ascospores ellipsoid-ovoid,  $10-16 \times 5-6 \mu\text{m}$ , pale orange, verruculose; in thallus and apothecia of *Collema* ..... *P. tenacis*
7. Ascospores fusiform,  $22-28(-33) \times 3.5-5 \mu\text{m}$ , hyaline, smooth; in thallus of *Peltigera* ..... *P. tenuispora*
- 8 (5). Ascospores smooth-walled; ascomata subglobose ..... 9
8. Ascospores usually ornamented; ascomata obpyriform ..... 12
- 9 (8). Ascomata immersed in the thallus of *Hypogymnia physodes*; ascomata yellow to bright orange with white hairs around the ostiole; ascospores  $12-17 \times 4-6 \mu\text{m}$ , pale orange ..... *P. anisospora*
9. Ascomata immersed in the thallus of other lichens; ascomata pale pink, yellow, red or dark red, without hairs; ascospores hyaline ..... 10
- 10 (9). Ascomata dark red; ascospores ellipsoid,  $14-20(-22) \times (2.5-)4-6 \mu\text{m}$ ; on *Punctelia*, known from France and the eastern United States ..... *P. oligospora*
10. Ascomata pale pink to yellow or orange ..... 11
- 11 (10). Ascomata pale pink to yellow; ascospores ellipsoid to ovoid,  $12-17 \times 5.5-7 \mu\text{m}$ ; on *Thrombium*, known only from Luxembourg ..... *P. terrestris*
11. Ascomata orange; ascospores ellipsoid to subcylindric,  $(13-)16-21(-24) \times 5-7.5 \mu\text{m}$ ; on *Endocarpon*; known from Spain ..... *P. dealbens*
- 12 (8). Ascomata orange-brown, immersed in the thallus of *Physcia aipolia*; ascospores ellipsoid-ovoid,  $12-14(-18) \times 5.5-8(-10) \mu\text{m}$ , hyaline, echinulate ..... *P. echinulata*
12. Ascomata pale yellow, immersed in thalli of other lichens; ascospores ellipsoid to fusiform ..... 13
- 13 (12). Ascomata in *Peltigera* spp. .... 14
13. Ascomata in other lichens ..... 15
- 14 (13). Ascospores  $(17-)18-20(-30) \times (4-)5.5-6(-8) \mu\text{m}$ , hyaline, becoming pale orange, verruculose ..... *P. erythrinella*
14. Ascospores  $8-16 \times (3-)4-8 \mu\text{m}$ , hyaline, smooth to spinulose ..... *P. robergii*
- 15 (13). Ascospores ovoid,  $9-12 \times 4.5-5 \mu\text{m}$ , echinulate; in *Pertusaria* ..... *P. pertusariicola*
15. Ascospores ellipsoid or fusiform, more than  $12 \mu\text{m}$  long; in other lichens ..... 16
- 16 (15). Ascospores ellipsoid,  $12-18 \times 4.5-8 \mu\text{m}$ , hyaline, slightly echinulate; ascomata dark red; in *Anaptychia*; known from Europe ..... *P. santessonii*
16. Ascospores ellipsoid or fusiform, averaging more than  $17 \mu\text{m}$  long, hyaline to pale orange, smooth to slightly roughened, slightly echinulate or verruculose; ascomata pale yellow to pale or bright orange ..... 17
- 17 (16). In ascomata of *Verrucaria*; ascospores  $16-21 \times 5-7 \mu\text{m}$ , ellipsoid to fusiform, rarely ovoid, hyaline to pale orange, smooth to slightly roughened ..... *P. verrucariae*
17. In other lichens; ascospores verruculose ..... 18
- 18 (17). In thallus and apothecia of *Xanthoria*; ascospores  $17-24 \times 4-5 \mu\text{m}$ , ellipsoid, of equal cells, hyaline to pale orange; known from the United Kingdom and Luxembourg ..... *P. xanthoriae*
18. In thalline exciple of *Anaptychia ciliaris*; ascospores  $17-22 \times 4-5.5 \mu\text{m}$ , fusiform, one cell wider than the other, hyaline ..... *P. tincta*



1-septate, often slightly constricted, at first hyaline, then pale orange, smooth to slightly roughened, with 1 to several guttules per cell.

ANAMORPH.— None known.

HABITAT.— In thallus and perithecia of *Verrucaria*.

DISTRIBUTION.— France, United States (New York).

HOLOTYPE.— FRANCE. Nord: Dunkirk, on dunes near the lighthouse, in thallus of *Verrucaria integra* on calcareous rocks, 20 May 1904, B. de Lesdain (Herb. Vouaux; isotype, FH - Höhnelt).

ADDITIONAL SPECIMEN EXAMINED.— UNITED STATES. New York: Niagara County, Goat Island, near shore, north slope on retaining wall, in ascomata of *Verrucaria muralis* associated with *Caloplaca feracissima*, 1 Nov 1989, R.C. Harris 22856A (NY).

NOTES.— *Pronectria verrucariae* is distinguished from other species of *Pronectria* by the ascomata immersed in ascomata and thallus of the *Verrucaria* host.

***Pronectria xanthoriae*** Lowen & Diederich, *Mycologia* 82: 788. 1990.

This species was described and illustrated in Lowen & Diederich (1990).

**PROTOCREOPSIS** Doi, Bull. Natl. Sci. Mus., Tokyo, B. 2: 129. 1976.

Type: *P. musicola* Doi, a synonym of *P. fusigera* (Berk. & Broome) Doi.

[= *Cryptothecium* Penz. & Sacc., *Malpighia* 1: 388. 1897,

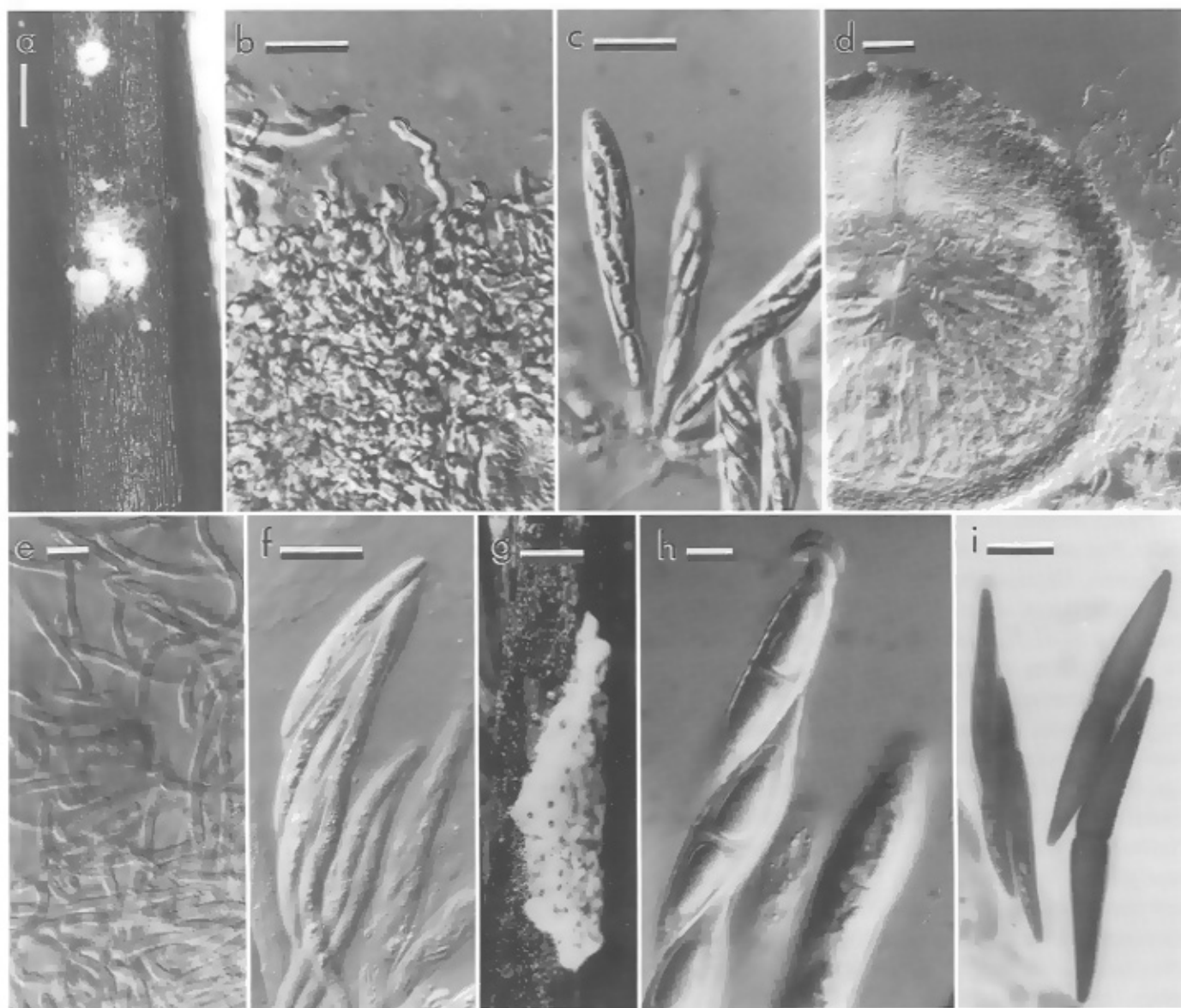


Plate 11. a-c. *Protocreopsis pertusa*. a. Ascomata on natural substratum. b. Ascomatal surface with hairs. c. Asci with ascospores. d-f. *Protocreopsis javanica*. d. Median section of ascoma. e. Hairs on ascomatal surface. f. Asci with ascospores. g-i. *P. fusigera*. g. Ascomata on natural substratum. h. Ascus apex and ascospores. i. Ascospores stained in cotton blue. a-c. G.J.S. 1288 - NY. d-f. Holotype of *P. palmicola* - TNS-F-192958. g-i. BPI 745424. h. TNS-F-226974, holotype of *P. musicola*. i. TNS-F-192691, holotype of *P. zingibericola*. Scale bars: a, g = 1 mm; b, c = 100  $\mu$ m; d, i = 25  $\mu$ m; e, h = 10  $\mu$ m; f = 50  $\mu$ m.

non Hübner 1851]. — Type: *C. javanicum* Penz. & Sacc. (= *Calonectria javanica* Höhn.), recognized as *Protocreopsis javanica* (Höhn.) Rossman & Samuels.]

Ascomata superficial on substrata, densely gregarious, less commonly solitary, surrounded by white to tan hyphae arising from ascomatal wall with few to many free ends visible, thus appearing *Hypocrea*-like, often extensive; ascomata hyaline to orange, KOH-; cells at ascomatal surface completely obscured by investing hyphae; ascomatal wall > 20 µm thick, comprising a single region of small, brick-like cells. Asci clavate to fusiform, apex simple or with an obscure ring; ascospores bi- to pluriseriate. Ascospores ellipsoid to fusiform, 1-septate, hyaline, typically striate, also smooth, punctate-striate, or tuberculate. Anamorph, where known, *Acremonium*-like. On dead monocotyledonous substrata.

NOTES.— Doi (1976) established *Protocreopsis* for *Nectria*-like species having ascomata surrounded by a hyphal stroma. He included the type species, *P. musicola*, added two more species, *P. zingibericola* and *P. palmicola* (Doi, 1977), and later (Doi, 1978 a, b) revised the genus, adding several species and providing a key to all of them. The homonymous genus *Cryptothecium* Penz. & Sacc. was originally placed in the *Perisporieae* of the *Eurotiaceae*, although Rogerson (1970) included this genus in the *Hypocreales*. The type specimen of *C. javanicum* from PAD was examined, and, as suggested by the illustrations in Penzig & Saccardo (1897), this species was found to be an earlier name for *Protocreopsis palmicola* Doi.

*Protocreopsis* is most easily recognized by the ascomata that are completely enclosed in long, white to tan or green, flexuous hyphae. Species of *Protocreopsis* generally occur on monocotyledonous leaves, often on palms or *Musaceae*, that are decaying but still attached to living plants in tropical areas. Morphologically they are characterized by pallid ascomata surrounded by a hyphal stroma and striate ascospores. Species of *Protocreopsis* may be confused with those of *Stilbocrea*, a genus similar in having ascomata surrounded by an effused hyphal stroma or confluent hyphae or hairs. In *Stilbocrea* ascospores are generally spinulose, anamorphs are synnematosus or pycnidial, and the species are corticolous, occasionally fungicolous, while in *Protocreopsis* ascospores are usually striate, although they may be smooth or tuberculate, anamorphs are *Acremonium*, and the species are herbicolous on monocots. Characteristics of the type species of *Protocreopsis* agree with those of species that have been placed in the *Nectria subfalcata*-group as defined by Samuels (1976 a, b). Although two species included by Samuels (1976

a, b) in the *Nectria subfalcata*-group are now placed in *Lasionectria*, most members of that group are among the nine species of *Protocreopsis*.

**Protocreopsis fusigera** (Berk. & Broome) Doi, Bull. Natl. Sci. Mus., Tokyo, B. 4: 119, 1978. — Plate 4, c (see page 25); Plate 11, g-i.

= *Hypocrea fusigera* Berk. & Broome, J. Linn. Soc. 14: 112, 1873.

= *Nectria subfalcata* Henn., Hedwigia 41: 4, 1902.

= *Hypocrea bromeliicola* Bat., Nascim. & Cif., Sydowia Beih. 1: 332, 1957.

= *Nectria bromeliicola* (Bat., Nascim. & Cif.) Samuels, Mem. New York Bot. Gard. 26: 32, 1976.

= *Protocreopsis bromeliicola* (Bat., Nascim. & Cif.) Doi, Bull. Natl. Sci. Mus., Tokyo, Ser. B. 4: 118, 1978.

= *Nectria heliconiae* E. Müll. & Dennis, Kew Bull. 19: 383, 1965.

= *Protocreopsis musicola* Doi, Bull. Natl. Sci. Mus., Tokyo, B. 2: 129, 1976.

= *Protocreopsis zingibericola* Doi, Kew Bull. 31: 552, 1976 [1977].

ANAMORPH.— *Acremonium*-like.

Mycelium spreading slightly from the ascomata, at first white and cottony, becoming roseous to buff, densely compacted, enveloping one to several ascomata in *Hypocrea*-like aggregates; hyphae surrounding the ascomata indefinite in length, flexuous, smooth, septate, branched, with many free ends, ca 5 µm wide, with 1–2 µm thick walls. Ascomata globose, 430–720 µm diam, orange. Asci 125–185 × 12–21 µm, apex simple. Ascospores narrowly fusiform, 50–76 × 6.5–9 µm, without a sheath, smooth to finely striate.

ANAMORPH.— Conidiophores in culture unbranched, septate, monophialidic, 150–210 µm long, 4.5–6.5 µm wide at the base. Conidia fusiform to ellipsoid, 40–55 × 11–13 µm, basal abscission scar not recognizable, unicellular, hyaline, smooth, wall visibly thickened especially at the ends, held in a drop of hyaline liquid at the tip of each phialide.

HABITAT.— On decaying debris of monocotyledonous plants, especially *Heliconia* and *Musa*.

DISTRIBUTION.— American tropics, Indonesia (North Sulawesi), western Pacific region; probably pantropical.

TYPES.— SRI LANKA (Ceylon). Peradeniya, on leaves of monocotyledonous plant, Nov 1867, No. 44 (K, holotype of *H. fusigera*); NEW BRITAIN ISLAND. Rabaul, on decayed stems and leaves of a species of *Zingiberaceae*, 1 Jan 1970, Y. Doi D.685, TNS-F-192961; holotype of *P. zingibericola*; same locality and substratum, 2 Jan 1970, Y. Doi D.708 (TNS-F-192959, paratype of *P. zingibericola*). PERU. Tingo María, about 700 m elev., on well-decayed leaf of *Musa*, 27 Jan 1976, Y. Doi D.2276 (TNS-F-226974, holotype of *P. musicola*).

Additional specimens examined are listed in Samuels (1976a) and Samuels *et al.* (1990).

ILLUSTRATIONS.— Batista & Ciferri (1957, Figs. 11, 12, as *H. bromeliicola*); Doi (1976, Fig. 7, as *P. musicola*); Doi (1978a, Fig. 4 as *P. bromeliicola*, Fig. 5); Müller & Dennis (1965, Fig. 4, as *N. heliconiae*); Samuels (1976a, Figs. 9S, 10, as *N. subfalcatata*); Samuels *et al.* (1990, Fig. 27G, 28, as *N. subfalcatata*).

SPECIMENS ILLUSTRATED.— PUERTO RICO. Luquillo Mts., Bislely Watershed 3, trail to stream, on *Heliconia* sp. at base of plant, 10 May 1995, S.M. Huhndorf 1379, D.J. Lodge 2273 (BPI 745424). ECUADOR. Prov. Pichincha, ca 19 km from Santo Domingo, on the new road from Santo Domingo to Quito, on herbaceous stem, elev. ca 860 m, 19 July 1975, K.P. Dumont-EC 682. S.E. Carpenter and P. Buriticà (NY, as *Nectria subfalcatata*).

NOTES.— The holotype of *Protocreopsis zingibericola* Doi is clearly *P. fusigera*, although the specimen consists of a few fragments of a leaf of *Zingiberaceae*. The ascomata appear immature, no asci were seen, but a few, very large conidia typical of *P. fusigera* are present.

**Protocreopsis albofimbriata** (Penz. & Sacc.) Doi, Bull. Natl. Sci. Mus., Tokyo, B. 4: 117. 1978.

≡ *Nectria albofimbriata* Penz. & Sacc., Malpighia 11: 513. 1897.

ANAMORPH: None known.

Mycelium tan, completely covering the aggregated ascomata; ascomata 250–350 µm diam, hyphae arising from ascomatal wall, sinuous, septate, infrequently branched, with many free ends visible, 3–4 µm wide, with ca 1 µm thick walls. Asci (40–)55–75(–80) × (9–)10–11(–12) µm, apex simple, 8-spored. Ascospores ellipsoid, 15.5–21 × 4–6 µm, equally 2-celled, not constricted at the septum, with many, low, ridge-like striations.

HABITAT AND DISTRIBUTION.— Known only from the type locality.

LECTOTYPE, designated here.— INDONESIA. Java: Tjibodas, on dead stems of (?)*Elettaria* sp., 6 Feb 1897. [? Penzig] 436a (PAD); same data, 6 Feb 1897. [? Penzig] 430 (PAD, syntype); same data, date unknown, [? Penzig] 172 (PAD, syntype).

ILLUSTRATIONS.— Doi (1978a, Fig. 3); Penzig & Saccardo (1904, Pl. 31, Fig. 1, as *N. albofimbriata*); Samuels *et al.* (1990, Fig. 27 A, B, as *N. albofimbriata*).

NOTES.— *Protocreopsis albofimbriata* differs from *P. pertusa* in having larger ascospores with more pronounced, ridge-like striations. For discussion of this species, see Samuels *et al.* (1990).

**Protocreopsis foliicola** (Berk. & M.A. Curtis) Samuels & Rossman, *comb. nov.*

≡ *Nectria foliicola* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 378. 1869.

ANAMORPH: None known.

Mycelium completely enveloping groups of ascomata, hyphae straight, to 80 µm long and free ends visible, ca 3 µm wide, walls ca 0.5 µm thick, tan. Ascomata 225–275 µm diam, brown. Asci 60–80 × 10–12 µm, apex simple. Ascospores fusiform, straight or slightly curved or sigmoid, 21–27 × 4–5 µm, lacking a sheath, striate. Conidiophores not forming in culture. Ascomata forming in cultures derived from single ascospores.

HABITAT.— On leaves of *Chusquea*, *Heliconia*, *Musa*, *Puya* and on peduncles of fruits of unidentified tree.

DISTRIBUTION.— Tropical America.

TYPE.— CUBA. On leaves of *Musa*, date not known, Wright 752 (K, holotype; FH, isotype). Additional specimens examined are listed in Samuels (1976a).

ILLUSTRATIONS.— Samuels (1976a, Figs. 9D, 13, as *N. foliicola*).

NOTES.— *Protocreopsis foliicola* is characterized by brown ascomata that are clothed in tan hyphal hairs. Despite isolation from several specimens, this species has never produced conidia in culture nor has an anamorph been observed associated with the teleomorph in nature.

**Protocreopsis freycinetiae** (Samuels) Samuels & Rossman, *comb. nov.*

≡ *Nectria freycinetiae* Samuels, New Zealand J. Bot. 14: 243. 1976 [as '*freycinetii*'].

Anamorph: *Acremonium*-like.

Mycelium white, completely enveloping groups of ascomata, hyphae straight, 2–3 µm wide, with 0.5–1 µm thick walls, smooth, many free ends visible. Ascomata 260–370 µm diam, orange. Asci 100–110 × 11–17 µm, apex simple. Ascospores fusiform, straight or slightly curved, 26–32 × 6–7 µm, lacking a sheath, striate. Conidiophores in culture unbranched, 4–6-septate, monophialidic, 60–90 µm long, ca 3 µm wide at the base, spinulose on phialides. Conidia ellipsoid, 6–10 × 2–4 µm, unicellular.

HABITAT AND DISTRIBUTION.— Known only from type specimen.

HOLOTYPE.— NEW ZEALAND. Auckland, Thames County, Coromandel Forest Park, Kauaeranga Valley, vic. Thames, on leaves of *Freycinetia banksii* [= *F. baueriana* subsp. *banksii*], 27 Aug 1974, G. J. Samuels 74–115 (PDD 32577). Culture CBS 573.76.

NOTES.— This species is similar to *P. foliicola*, but the investing hyphae in the latter species are tan.

**Protocreopsis javanica** (Höhn.) Rossman & Samuels, *comb. nov.* — Plate 10 b; Plate 11, d–f.

[= *Cryptothecium javanicum* Penz. & Sacc., *Malpighia* 1: 388, 1897, genus illeg.]

= *Calonectria javanica* Höhn., *Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1*, 118: 1180, 1909. = *Protocreopsis palmicola* Doi, *Kew Bull.* 31: 551, 1976.

ANAMORPH: None known.

Mycelium completely enveloping groups of ascomata, hyphae straight, roughened, 6–7  $\mu\text{m}$  wide, white to tan, loosely interwoven. Ascomata 300–400  $\mu\text{m}$  diam, pale yellow. Asci 55–70  $\times$  8–12  $\mu\text{m}$ , apex with a ring. Ascospores ellipsoid to fusiform or slightly sigmoid, 15–18  $\times$  4–5  $\mu\text{m}$ , lacking a sheath, striate, with many striae visible in one plane.

HABITAT.— On decaying palm leaves.

DISTRIBUTION.— Gabon, Indonesia, New Guinea, and Thailand.

TYPES.— INDONESIA. Java: Tjibodas, in foliis putrescentibus, 4 Mar 1897 (PAD, holotype of *Cryptothecium javanicum*). NEW GUINEA. Lae: near Markham Bridge, on rachides of decayed palm leaves, 20 Jan 1970, Doi D.786 (TNS-F-192958, holotype of *P. palmicola*; PNG, isotype, not examined).

SPECIMENS EXAMINED.— GABON. Libreville: La Mondah, on dead palm parts, 8 Dec 1979, G. Gilles (BPI 745899); THAILAND. Nakorn Nayok Province: Khao Yai National Park, Phakrajai, on bamboo, 6 Aug 1997, G.J. Samuels (BPI 745855); same data (BPI 745867); same data, on palm (BPI 745858).

ILLUSTRATION.— Doi (1976, Fig. 1 A–G).

NOTES.— *Protocreopsis javanica* resembles *P. foliicola* in the tan to brown coloration of the ascomata; however, ascospores of *P. javanica* are shorter than those of *P. foliicola* and the hyphae that envelop the ascomata of *P. foliicola* are smooth-walled. *Protocreopsis javanica* is the only member of the genus that has warted hyphae.

**Protocreopsis pertusa** (Pat.) Samuels & Rossman, *comb. nov.* — Plate 11, a–c.

= *Nectria pertusa* Pat., in Patouillard & Lagerheim, *Bull. Soc. Mycol. France* 11: 227, 1895.

= *Nectria scitula* Bres., *Hedwigia* 35: 299, 1896.

= *Protocreopsis scitula* (Bres.) Doi, *Bull. Natl. Sci. Mus., Tokyo, B*, 4: 116, 1978.

= *Nectria aemulans* Rehm, *Ann. Mycol.* 7: 539, 1909.

ANAMORPH.— *Acremonium*-like.

Mycelium white but tan over individual ascomata, completely covering the ascomata; hyphae sinuous, smooth-walled, 2–2.5  $\mu\text{m}$  wide, with many short, free and hair-like ends around the ostiolar opening, walls visibly thickened, hyaline. Ascomata globose, 150–190  $\mu\text{m}$  diam, orange. Asci 70–80  $\times$  9–12  $\mu\text{m}$ , apex simple. Ascospores ellipsoid, 13–17  $\times$  4–5  $\mu\text{m}$ , 3 or fewer striations visible in one plane of view. Conidiophores in culture unbranched, 0–1-septate, monophialidic, 20–30  $\mu\text{m}$  long, 2–3  $\mu\text{m}$  wide at the base; tip of phialide not flared. Conidia ellipsoid, 4–7  $\times$  1.5–2  $\mu\text{m}$ , unicellular.

HABITAT.— On leaves of *Musa*, *Heliconia*, and palms, culms of bamboo, and rachides of tree ferns; on bark.

DISTRIBUTION.— Probably pantropical and subtropical.

TYPE.— ECUADOR. San George, on culms of *Chusquea* sp., July 1892, Lagerheim (FH, holotype of *N. pertusa*); BRAZIL. S. Catharina: Blumenau, on palm? leaf, date and collector not known, n. 9b, (lectotype of *N. scitula*, designated herein: S-herb Bresadola; isolectotype S-herb. Sydow).

ADDITIONAL SPECIMENS EXAMINED.— VENEZUELA. Amazonas. Cerro de la Neblina, elev. 1350 m, on dead fern rachis, 13 April 1984, G.J. Samuels 1288 (NY, VEN, filed as *Nectria pertusa*), and as listed in Samuels (1976 a, b, as *N. pertusa*) and Samuels *et al.* (1990, as *N. pertusa*). Culture CBS 568.76.

ILLUSTRATIONS.— Doi (1978a, Fig. 2, as *P. scitula*); Samuels (1976b, Fig. 2, as *N. pertusa*); Samuels *et al.* (1990, Figs. 27 C–F, as *N. cf. pertusa*).

NOTES.— This is a common species in the American tropics. In a collection from Indonesia, Samuels *et al.* (1990) reported smaller ascospores than is usual for this species.

**Protocreopsis pertusoides** (Samuels) Samuels & Rossman, *comb. nov.*

= *Nectria pertusoides* Samuels, *New Zealand J. Bot.* 14: 241, 1976.

ANAMORPH.— *Acremonium*-like.

Mycelium white, spreading over the substratum, completely enveloping groups of ascomata, hyphae straight to slightly sinuous, smooth-walled, 2–3  $\mu\text{m}$  wide, with 1–2  $\mu\text{m}$  thick, hyaline walls. Ascomata 220–375  $\mu\text{m}$  high  $\times$  220–280  $\mu\text{m}$  diam, orange. Asci 55–70  $\times$  5.5–9  $\mu\text{m}$ , apex with an indistinct ring. Ascospores allantoid, ellipsoid to fusiform, 9–12  $\times$  3–5  $\mu\text{m}$ , lacking a sheath, striate or punctate-striate. Conidiophores in culture un-

**Plate 12. a–g.** *Protocreopsis viridis*. a. Median section of ascomata on natural substratum. b. Close-up of ascomatal wall. c. Close-up of ascomatal apex. d. Ascomatal hairs. e. Asci with ascospores including remnants of apical paraphyses in centrum. f–g. Asci with ascospores, g. stained in cotton blue to show median striations on ascospore wall. a–g. Holotype – BPI 745254. Scale bars: a = 100  $\mu\text{m}$ ; b, c, f, g = 20  $\mu\text{m}$ ; d = 50  $\mu\text{m}$ ; e = 25  $\mu\text{m}$ .

branched, 0–1-septate, monophialidic, smooth, 30–70  $\mu\text{m}$  long, 2–3  $\mu\text{m}$  wide at the base; tip of phialide not flared. Conidia ellipsoid to oblong, 6–7  $\times$  2–2.5  $\mu\text{m}$ , unicellular.

HABITAT.— On decaying herbaceous tissue, less frequently on bark.

DISTRIBUTION.— New Zealand.

HOLOTYPE.— NEW ZEALAND: Taranaki, Mt. Egmont Natl. Park, Stratford Mountain House, on dead leaves of *Cordyline indivisa*, G. J. Samuels 73-213 & C. S. Samuels (PDD 32032).

Additional specimens examined are listed in Samuels (1976b).

ILLUSTRATIONS.— Samuels (1976b; Figs. 3, 14, 26, as *N. pertusoides*).

NOTES.— This species differs from *P. pertusa* in having smaller ascospores in which the striations are incomplete throughout the length, thus appearing punctate. Striations on ascospores of *P. pertusa* are always few in

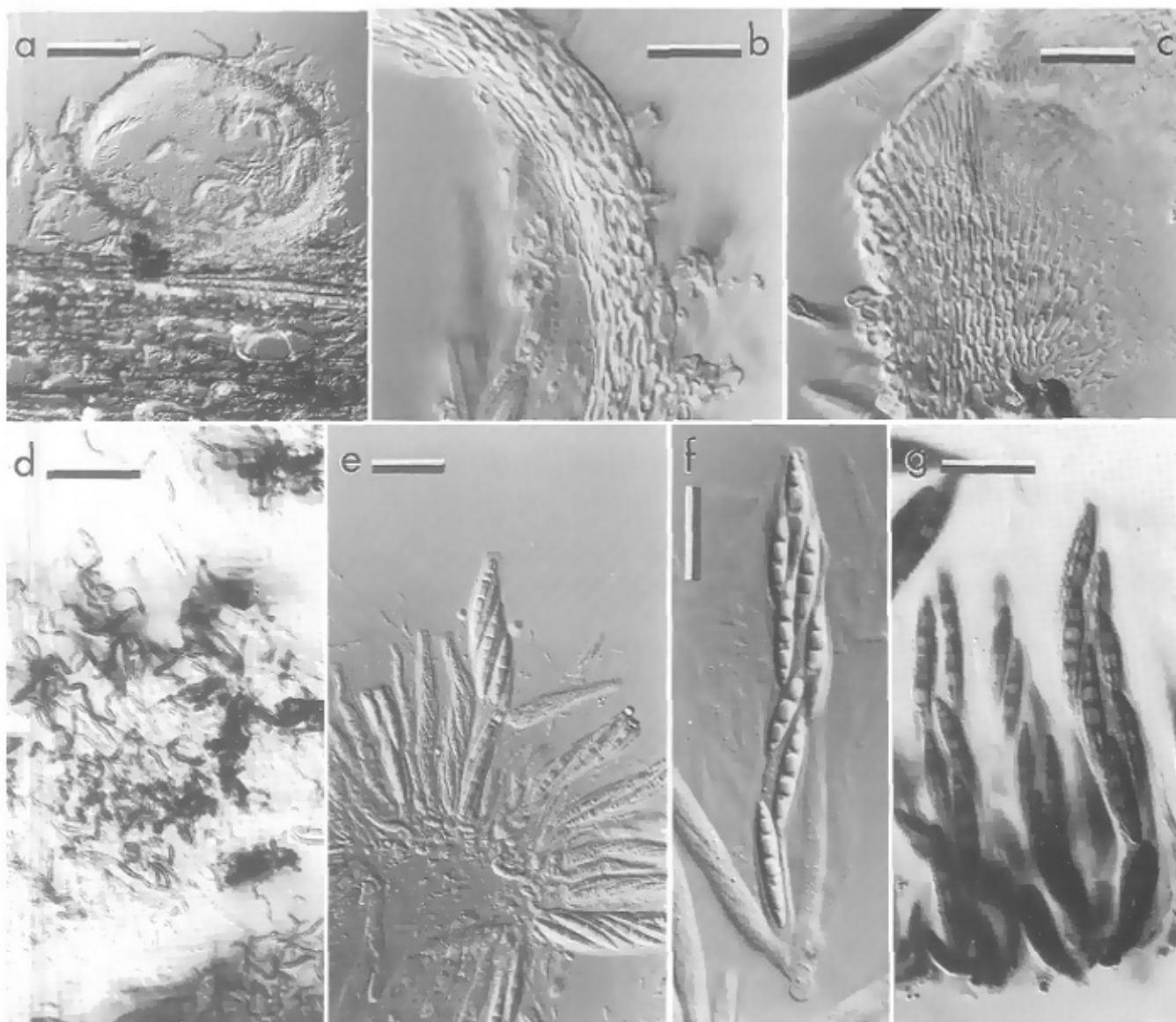
number and extend over the entire length of the ascospore.

**Protocreopsis phormiicola** (Samuels) Samuels & Rossman, *comb. nov.*

$\equiv$  *Nectria phormiicola* Samuels, New Zealand J. Bot. 14: 244, 1976.

ANAMORPH.— *Acremonium*-like.

Mycelium white, spreading over the substratum, completely covering individual ascomata; hyphae slightly sinuous, 2–3  $\mu\text{m}$  wide, walls 0.5–1  $\mu\text{m}$  thick, hyaline. Ascomata 150–220  $\mu\text{m}$  diam, yellow. Asci 60–70  $\times$  9–10  $\mu\text{m}$ , apex with an inconspicuous ring. Ascospores ellipsoid to fusiform-ellipsoid, 10–14  $\times$  3–4  $\mu\text{m}$ , surrounded by a sheath while still in the asci, tuberculate at maturity. Conidiophores in culture unbranched, 0–1-septate, monophialidic, smooth or spinulose, 33–45  $\mu\text{m}$



long, 2–3  $\mu\text{m}$  wide at the base; tip of phialide not flared. Conidia ellipsoid, 5–7  $\times$  2–3  $\mu\text{m}$ , unicellular.

**HABITAT AND DISTRIBUTION.**— Known only from the type locality.

**HOLOTYPE.**— NEW ZEALAND. Auckland: Waitemata County, Waitakere Ranges, vic. Piha, Marowhara Loop Track, on dead leaves of *Phormium tenax*, 17 Dec. 1974, J. M. Dingley *et al.* (PDD 32684; Samuels culture 74-133 = CBS 567.76 = ATCC 34049).

**ILLUSTRATIONS.**— Samuels (1976b, Figs. 5, 16, 28, as *N. phormiicola*).

**NOTES.**— This species is unusual in the genus in having tuberculate ascospores that are surrounded by a gelatinous sheath while still in the asci.

**Protocreopsis viridis** Samuels, *sp. nov.* — Plate 12, a–g.

Perithecia solitaria vel pauca aggregata, hyphis viridibus, spinulosis vestita. Ascospores (24–)26–29(–30)  $\times$  3.5–5.5  $\mu\text{m}$ , anguste fusiformes, striatae, bicellulares.

**ANAMORPH.** None known.

Ascomata scattered and solitary or caespitose in groups of a few, non-stromatic, superficial, easily removed from the substratum, clothed in green hyphae, looking

like masses of *Trichoderma* conidia, hyphae becoming brown in KOH, again green when followed by lactic acid. Ascomata subglobose, 250–300  $\mu\text{m}$  high, 250–275  $\mu\text{m}$  diam, non-papillate. Investing hyphae arising from ascomatal surface, strongly contorted, septate, branched, with few free ends visible, strongly spinulose, 2.5–3  $\mu\text{m}$  wide, walls not thickened. Ascomatal wall ca 15  $\mu\text{m}$  thick, of a single region of intertwined hyphae that appear cellular with individual cells ellipsoid, ca 5  $\mu\text{m}$  long with walls ca 1.5  $\mu\text{m}$  thick. Ascomatal apex a continuation of the wall below, the hyphae around the ostiolar opening forming a palisade of ca 3  $\mu\text{m}$  wide cells with walls 1–1.5  $\mu\text{m}$  thick. Asci narrowly clavate, 85–120(–180)  $\times$  (9–)11–13(–15)  $\mu\text{m}$ , apex with an indistinct ring; ascospores pluriseriate. Ascospores narrowly fusiform, (24–)26–29(–30)  $\times$  3.5–5.5  $\mu\text{m}$ , equally 1-septate, striate, striations ridge-like, few in number, staining in cotton blue/lactic acid.

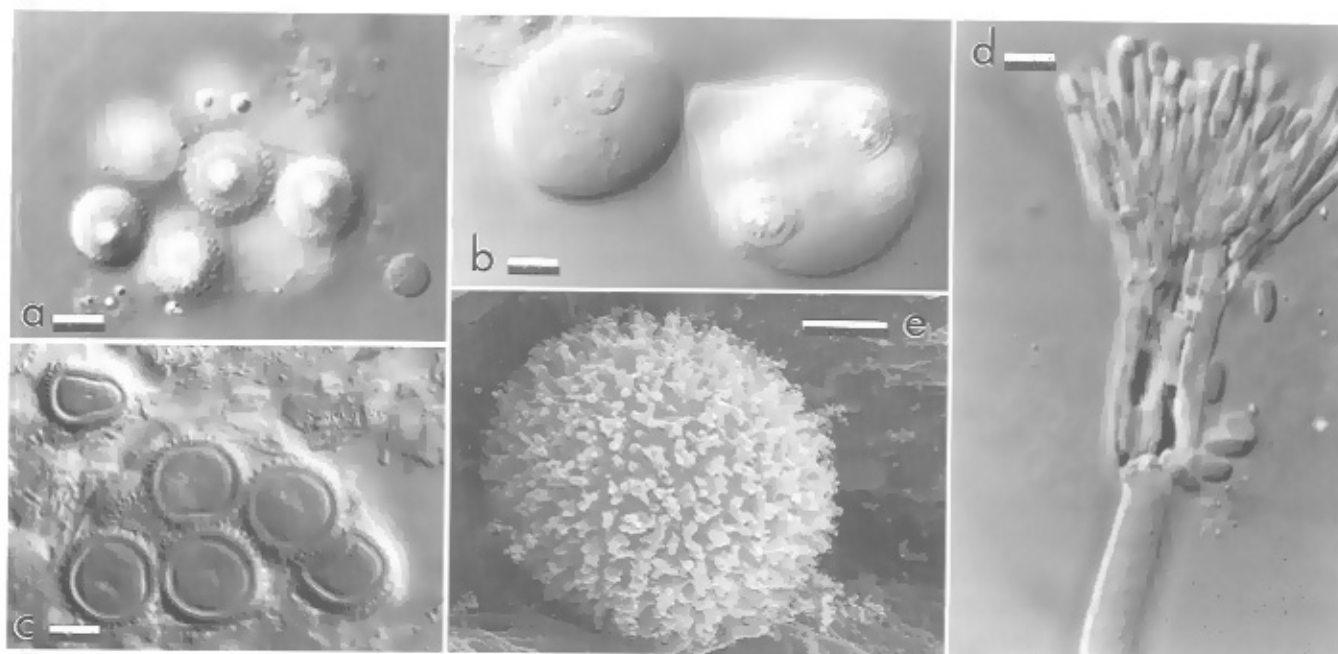
**HABITAT.**— On decaying palm leaf.

**DISTRIBUTION.**— Puerto Rico, known only from the type collection.

**HOLOTYPE.**— PUERTO RICO. Cordillera Central, Charioi Azul, off Rte. 184, elev. 550 m, on decaying palm leaf (*Praestoea monticola*), 25 Feb 1996, G. J. Samuels, D. J. Lodge & H. J. Schroers 8104 (BPI 745254).

#### KEY TO THE SPECIES OF *PROTOCREOPSIS*

- |  |                         |
|--|-------------------------|
| 1. Ascospores more than 20 $\mu\text{m}$ long .....  | 2                       |
| 1. Ascospores less than 20 $\mu\text{m}$ long .....  | 5                       |
| 2. Ascospores 50–76 $\times$ 6.5–9 $\mu\text{m}$ .....   | <i>P. fusigera</i>      |
| 2. Ascospores less than 30 $\mu\text{m}$ long .....  | 3                       |
| 3. Enveloping hyphae green; ascospores (24–)26–29(–30) $\times$ 3.5–5.5 $\mu\text{m}$ .....                                  | <i>P. viridis</i>       |
| 3. Enveloping hyphae white to tan .....  | 4                       |
| 4. Enveloping hyphae tan; ascospores 26–32 $\times$ 6–7 $\mu\text{m}$ .....  | <i>P. foliicola</i>     |
| 4. Enveloping hyphae white; ascospores 21–27 $\times$ 4–5 $\mu\text{m}$ .....  | <i>P. freycinetiae</i>  |
| 5. Ascospores tuberculate .....  | <i>P. phormiicola</i>   |
| 5. Ascospores striate or punctate-striate .....  | 6                       |
| 6. Ascospores 9–12 $\times$ 3–5 $\mu\text{m}$ , striations broken, punctate-striate, many visible in one plane of view ..... | <i>P. pertusoides</i>   |
| 6. Ascospores more than 12 $\mu\text{m}$ long, striations unbroken for the length of the spore .....                         | 7                       |
| 7. Only few (up to 3) striations visible in one plane of view .....  | <i>P. pertusa</i>       |
| 7. Many striations visible in one plane of view .....  | 8                       |
| 8. Hyphae enveloping ascomata roughened, white to tan .....  | <i>P. javanica</i>      |
| 8. Hyphae enveloping ascomata smooth, white .....  | <i>P. albofimbriata</i> |



**Plate 13. a–e.** *Roumegueriella rufula* and anamorph, *Gliocladium* sp. a. Ascus with ascospores. b. Immature asci with ascospores. c. Ascus with ascospores in median focus to show wall ornamentation. d. Conidiophore with conidiogenous cells and developing conidia. e. SEM of ascospore. a–c. CBS 346.85. Scale bars: a–d = 10  $\mu$ m; e = 5  $\mu$ m.

**NOTES.**— An attempt to isolate ascospores from the fresh specimen failed. No anamorph was associated with the ascomata on the host. This species is distinguished in *Protocreopsis* by the green hyphae that enclose the ascomata.

**ROUMEGUERIELLA** Speg., in Roumeguère & Spegazzini, *Rev. Mycol. (Toulouse)* 2: 18. 1880.

Type: *R. muricospora* Speg., a synonym of *R. rufula* (Berk. & Broome) Malloch & Cain.

= *Lilliputia* Boud. & Pat., *Bull. Soc. Mycol. France* 16: 144. 1900. — Type: *L. gaillardii* Boud. & Pat., a synonym of *R. rufula* (Berk. & Broome) Malloch & Cain.

= *Lysipenicillium* Bref., *Unters. Gesamtgeb. Mykol.* 14: 210. 1908. — Type: *L. insigne* Bref., a synonym of *R. rufula* (Berk. & Broome) Malloch & Cain.

Ascomata globose, soft, non-ostiolate, disintegrating at maturity, yellow to reddish-brown, of pseudoparenchymatous tissue; asci saccate, evanescent; ascospores globose, hyaline, ornamented. Anamorph *Gliocladium*-like. On dung and well-rotten debris.

**NOTES.**— Spegazzini's generic description of *Roumegueriella* stated that the genus stands questionably between 'Sphaeropsideos et Hyphomycetes'; he apparently did not see asci in the type specimen and considered this to be an asexual fungus. However, Hughes (1951) and later Malloch & Cain (1972) reviewed the history of this genus noting that it is a cleistothecial ascomycete. Within the *Hypocreales*, *Roumegueriella* is one of six cleistothecial genera; it is most

closely allied with another cleistothecial genus, *Heleococcum*, both of which were confirmed as members of the *Hypocreales* using molecular data (Rehner & Samuels, 1995). *Roumegueriella* includes two species.

The unispecific genus *Lilliputia* was originally described as a member of the *Tuberaceae* because of its cleistothecial ascomata. Malloch & Cain (1972) were the first to recognize that *L. gaillardii* is a synonym of *Roumegueriella rufula*.

Brefeld based his name *Lysipenicillium* upon *Penicillium insigne* without citing author and publication, simply stating: 'Eine Form von *Penicillium* ist als *P. insigne* fälschlich bezeichnet'. Although two later homonyms of this binomial exist, Brefeld was probably referring to *P. insigne* (G. Winter) Schröter based on *Eurotium insigne* G. Winter as listed below. Brefeld gave a clear description and illustration of *Roumegueriella rufula* including ascomata. The interpretation of *Lysipenicillium* as a possible synonym of *Gliocladium* as suggested by Raper & Thom (1949) is therefore not correct. All epithets described for this fungus in *Gliocladium* include the teleomorph and are therefore regarded as synonyms of *R. rufula*, while the anamorph strictly speaking has not been named.

***Roumegueriella rufula*** (Berk. & Broome) Malloch & Cain, *Canad. J. Bot.* 50: 64. 1972. — Plate 13, a–e.

= *Chaetomium rufulum* Berk. & Broome, *Ann. Mag. Nat. Hist.*, Ser. 4, 11: 348. 1873.

= *Lilliputia rufula* (Berk. & Broome) S. Hughes, *Mycol. Pap.* 42: 2. 1951.

= *Eurotium insigne* G. Winter, in Rabenh., Fungi Europaei no. 1732, 1874

= *Lysipenicillium insigne* Bref., Unters. Gesamtgeb. Mykol. 14: 210, 1908.

= *Lilliputia insignis* (G. Winter) Dennis & Wakefield, Trans. Brit. Mycol. Soc. 29: 145, 1946.

= *Roumegueriella muricospora* Speg., in Roumeguère & Spegazzini, Rev. Mycol. (Toulouse) 2: 18, 1880.

= *Cephalotheca francisci* D. Sacc., Malpighia 12: 206, 1898.

= *Lilliputia gaillardii* Boud. & Pat., Bull. Soc. Mycol. France 14: 144, 1900.

= *Mycogala macrospora* Jaap, Verh. Bot. Ver. Brandenb. 52: 19, 1910.

= *Gliocladium prolificum* Bainier, Bull. Trimestriel Soc. Mycol. France 26: 385, 1910.

= *Gliocladium borysseviczii* Pidopl., Mikrobiol. Zhurn. 12(2): 36, 1950 (also Gribnaya Fl. grub. Kormov: 197, 1953).

Anamorph: *Gliocladium*-like.

Ascomata superficial, without a stroma, solitary or in groups of 2–3, irregularly globose, 450–640 µm diam, dark yellow to reddish brown, non-ostiolate; ascomatal wall thin, of indistinct cells, becoming brittle and breaking down at maturity to expose the ascospores. Interthecial elements lacking. Asci irregularly saccate, 46–66 × 24–35 µm, evanescent at maturity. Ascospores globose, 16–23 µm diam, hyaline, smooth when young, becoming densely echinulate.

HABITAT.— On various kinds of detritus including goose dung, damp paper, mushroom compost, nematodes, decaying seaweed, and rotting grass clippings.

DISTRIBUTION.— Belgium, England, France, Germany, India, Ireland, Japan (Udagawa *et al.*, 1994), Mexico, Taiwan (Yaguchi *et al.*, 1997), United States (California, Maine).

TYPES.— GERMANY. 'Auf Gänsemist in meinem Pilz-Cultur-Kasten. Halle a/S. im Juli 1873', Rabenhorst, Fungi Europaei no. 1732 (BPI, isotype of *Eurotium insigne*, none with good ascomata); Schleswig-Holstein: Reinbek bei Bergedorf, 'auf abgeschnittenem, faulendem Gras, 25 X. 1908, leg. Otto Jaap,' Jaap, Fungi Selecti Exs. no. 3961 (BPI, isotype of *Mycogala macrospora*). BELGIUM. Malmedy, 'in foliis et ramentis dejectis putrescentibus prope Malmedyanum et recentissime, aut. 1879, proxime Toloxam lectis' (isotype of *Roumegueriella muricospora*, not seen). FRANCE. Angers, 'dans la tannée ancienne d'une serre à Palmiers, inter frustulis caldario Andegavensi, Aprili 1900,' Revisio Reliquiae Libertianae (FH – Patouillard 4575, holotype of *Lilliputia gaillardii*).

ADDITIONAL SPECIMENS EXAMINED.— IRELAND. Rathmines Co., Dublin, on [herbivore] dung, 23 May 1935, S.W. Webb (BPI, as *Mycogala macrospora*). SWITZERLAND. Isolated from female *Globodera rostochiensis* buried in soil (CBS 346.85).

ILLUSTRATIONS.— Bainier (1910, Pl. 21, anamorph only); Brefeld (1912, Taf. VII, Figs. 1–7, as *Lysipenicillium insigne*); Hughes (1951, Fig. 12, as *Lilliputia rufula*; Pl. I, Fig.

5–9, as *Chaetomium rufulum*, *Cephalotheca francisci*, *Eurotium insigne*, *Gliocladium prolificum*, and *Lilliputia gaillardii*); Rabenhorst (1874, as *E. insigne*); Udagawa *et al.* (1994, Fig. G).

NOTES.— Hughes (1951) and Malloch & Cain (1972) accounted for the various synonyms of *Roumegueriella rufula*. Hughes (1951) illustrated the variability in ascospore size and presented a detailed account of the specimens of the fungus known up to that time. The anamorph was described in detail by Bainier (1910) as *Gliocladium prolificum*.

A second species was described in *Roumegueriella* as *R. pulchella* Udagawa *et al.* (1994). Although similar to *R. rufula*, *R. pulchella* is differentiated by the small, ellipsoid ascospores, 6.5–8 × 4–5 µm, and the lack of an anamorph.

SELINIA P. Karst., Meddeland. Soc. Fauna Fl. Fenn. 1: 57, 1876

[= *Hypocreopsis* G. Winter, Hedwigia 14: 26, 1875, non P. Karst. 1873]. — Type: *S. pulchra* (G. Winter) P. Karst. = *Hypocreopsis pulchra* G. Winter.

= *Winteria* Sacc., Michelia 1: 281, 1878. Type: *Winteria pulchra* '(G. Winter)' Sacc., a nomenclatural synonym of *S. pulchra* (G. Winter) P. Karst.

= *Seliniana* O. Kuntze, Revis. Gen. Pl. 2: 869, 1891. — Type: *Seliniana pulchra* '(G. Winter)' O. Kuntze, a nomenclatural synonym of *S. pulchra* P. Karst.

Ascomata immersed in stromata, up to five immersed in each stroma, stromata of two parts, external part reddish-brown, of non-descript, small, heavily pigmented cells, internal tissue of *textura epidermoidea*, thin-walled. Ascomata becoming crumpled, ostiolate, with a white, granular opening. Asci clavate, 8-spored. Ascospores ellipsoid, unicellular, hyaline, thick-walled, smooth. Anamorph phialidic. On dung.

NOTES.— *Selinia* was described as a new name for *Hypocreopsis* G. Winter 1875, a later homonym of *Hypocreopsis* P. Karst. 1873. Winter considered his new genus to be similar to *Hypocrea* but differentiated by the few ascomata in each stroma, the distinct form of the asci and ascospores, and the presence of numerous paraphyses. Although paraphyses are described, they were not seen in the specimens examined of *S. pulchra*. Despite the soft-textured, light to bright-colored ascomata, several characteristics of the genus *Selinia* are unusual for members of the *Hypocreales*, specifically the thick-walled ascospores with nerve-like markings

Plate 14. a–f. *Selinia pulchra*. a. Ascomata on natural substratum. b. Median section of ascomata. c. Section of stroma surrounding ascomata. d. Close-up of ascomatal apex. e. Asci with ascospores. f. Asci with ascospores in fluorescence microscopy. a–f. F 48-978 – FLAS. Scale bars: a, b = 500 µm; c, e, f = 50 µm; d = 100 µm.



on the inner wall and gelatinous epispore and occurrence on dung. In addition to *Selinia pulchra*, three other species are accepted in the genus as discussed by Khan & Krug (1989).

***Selinia pulchra*** (G. Winter) P. Karst., Meddeland. Soc. Fauna Fl. Fenn. 1: 57. 1876. — Plate 14, a–f.

[= *Hypocreopsis pulchra* G. Winter, Hedwigia 14: 26. 1875, non *Hypocreopsis* P. Karst. 1873].

= *Winteria pulchra* (G. Winter) Sacc., Michelia 1: 281. 1878.

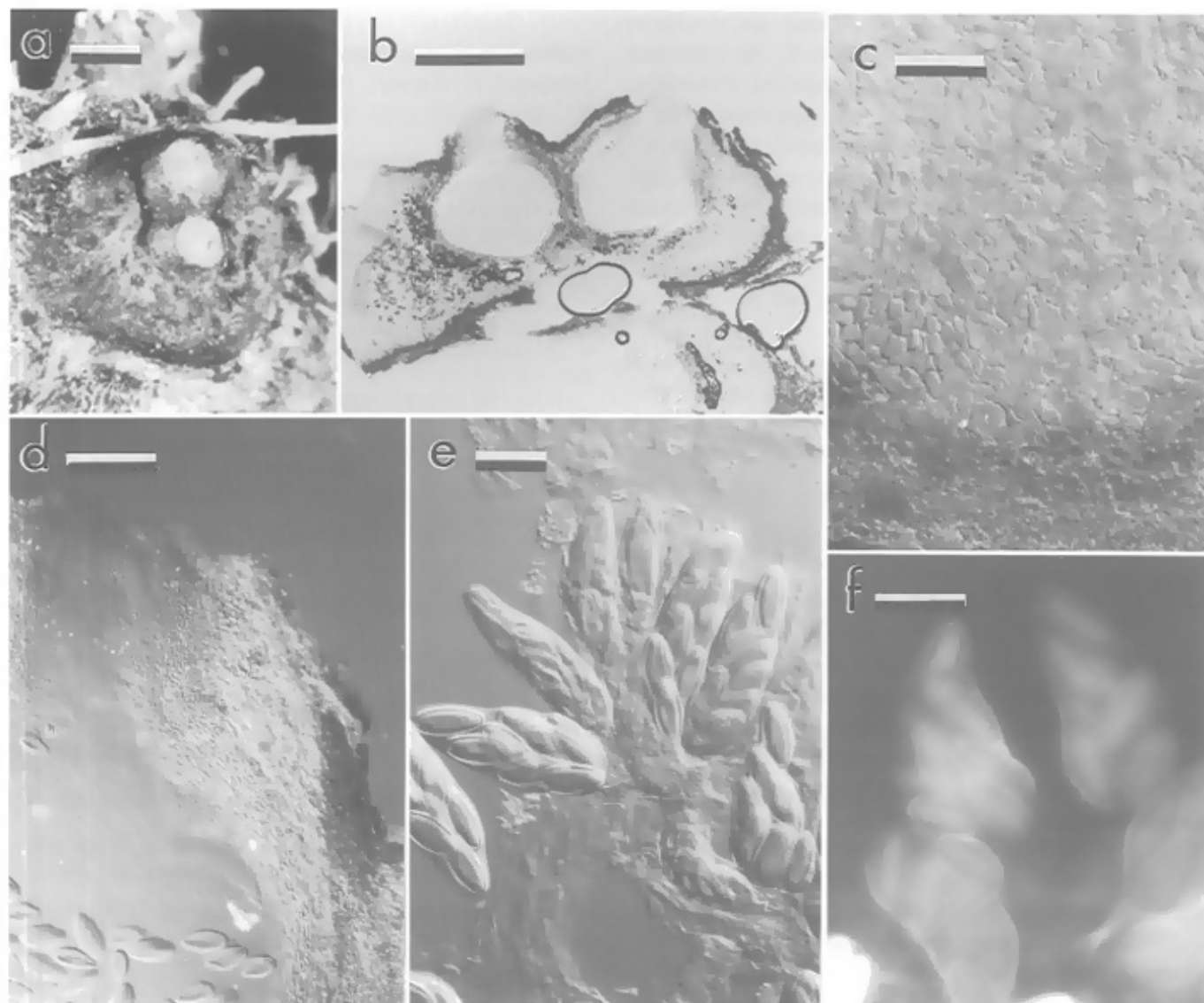
= *Seliniana pulchra* (G. Winter) O. Kuntze, Revis. Gen. Pl. 2: 869. 1891.

Stroma evident as small, less than 1 mm diam, amorphous, tar-like, blackened areas scattered on the substratum, consisting of two parts, external part rufous, ca 50  $\mu\text{m}$  thick, of non-descript, small, heavily pigmented cells, several cell-layers thick; internal tissue *textura epidermoidea*, cells 7–10  $\mu\text{m}$  diam, thin-walled, compact; ascomatal wall ca 40  $\mu\text{m}$  thick, of about 10

layers of fusiform to rectangular cells, 15–20  $\mu\text{m}$  long  $\times$  4–7  $\mu\text{m}$  diam, walls 1.5–2.5  $\mu\text{m}$  thick, hyaline; merging at the exterior with the surrounding stroma. Ascomata immersed in stroma, evident as a white, granular margin around the ostiolar opening, up to five ascomata in each stroma, apex protruding, venter remaining immersed in the stroma; papilla of vertically elongate cells, becoming progressively narrower toward the ostiolar canal, periphyses arising from and merging with elements of the papilla. Paraphyses not seen among the mature asci. Asci clavate, apex simple, 8-spored. Ascospores ellipsoid, 45–56(–60)  $\times$  20–24  $\mu\text{m}$ , hyaline, smooth.

**HABITAT.**— On dung of herbivores including cow, deer, hare, horse, opossum, and sheep.

**DISTRIBUTION.**— Argentina (Ranalli & Mercuri, 1995), Canada (Ontario); Chile (Udagawa, 1980), Denmark (Læssøe, 1995), Germany, Netherlands (von Arx & Müller, 1955; Larsen, 1971), Japan (Udagawa, 1980), New Zealand (Bell, 1975, 1983), United States (Florida, Maine).



KEY TO THE SPECIES OF *SELINIA*

1. Ascospores more than 45  $\mu\text{m}$  long ..... 2  
 1. Ascospores less than 45  $\mu\text{m}$  long ..... 3
2. Ascospores 45–50  $\times$  20–25  $\mu\text{m}$  ..... *S. intermedia*  
 2. Ascospores 48–64  $\times$  20–26  $\mu\text{m}$  ..... *S. pulchra*
3. Ascospores 25–30  $\times$  12–13  $\mu\text{m}$  ..... *S. antarctica*  
 3. Ascospores (26–)32–39(–41)  $\times$  (12–)14–18(–22)  $\mu\text{m}$  ..... *S. africana*

TYPE.— ENGLAND: Shrewsbury, on sheep dung, W. Phillips, G. Winter, issued as C.B. Plowright, Sphaeriacei Britannici 100 (B – authentic specimen of *Hypocreopsis pulchra*).

SPECIMEN EXAMINED.— UNITED STATES: Florida, off Mill-hopper Road, 10 mi. NW of Gainesville, on cow dung in pasture, 7 May 1970, J.W. Kimbrough (FLAS-F 48-978).

ILLUSTRATIONS.— von Arx & Müller (1955, Figs. 1, 2); Bell (1983, Fig. 35), Dennis (1978, Pl. 31D); Læssøe (1995, p. 52–53); Udagawa (1980, Figs. 8, 21).

NOTES.— According to the original description, the type specimen of *Selinia pulchra* was found 'auf trockenem Schafkoth am Galgenberg bei Halle a. S.' No specimen agreeing with these data has been located. Plowright, Sphaeriacei Britannici no. 100 was apparently examined by Winter and is considered authentic material. Although unusual in having large, thick-walled, non-septate ascospores, developmental studies by Mercuri (pers. comm.) revealed the presence of apical paraphyses characteristic of hypocrealean fungi. Ranalli & Mercuri (1995) report an anamorph and were able to produce fertile ascomata in culture.

Three additional species are included in *Selinia*, *S. africana* Khan & Krug, *S. antarctica* Speg., and *S. intermedia* Speg., as reviewed by Khan & Krug (1989). *Selinia intermedia* may be a synonym of *S. pulchra*.

**STILBOCREA** [*'Stilbocera'*] Pat., Bull. Soc. Mycol. France 16: 186. 1900.

Type: *S. dussii* Pat., a synonym of *S. macrostoma* (Berk. & M.A. Curtis) Höhn.

Ascomata immersed in a hyphal stroma that forms a continuous or discontinuous layer. Ascomata globose to ellipsoid or ovoid, pale yellow to orange, becoming red-brown or dark olive-green with age. KOH–, walls relatively thick, more than 25  $\mu\text{m}$ . Asci narrowly clavate to cylindrical, 8-spored. Ascospores ellipsoid to ellipsoid-fusiform, 1-septate, hyaline, verrucose, echinulate or conspicuously spinulose. Anamorph *Acremonium*-like or *Stilbella*. On dead woody dicotyledonous and monocotyledonous substrata as well as decaying ascomycetous stromata.

NOTES.— Patouillard described the genus *Stilbocrea* as being like *Hypocrea* but having a *Stilbum* anamorph and he included one species. Seifert (1985) studied the type specimens of *Stilbocrea dussii* and found *Nectria macrostoma* to be an earlier name. The genus *Stilbocrea* includes two additional species, namely *S. gracilipes*, with an even more darkly pigmented synnematal base than the dark green one of *S. macrostoma*, and *S. impressa*, with an *Acremonium*-like anamorph.

***Stilbocrea macrostoma*** (Berk. & M.A. Curtis) Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 118: 1185. 1909. — Plate 4, d (see page 25).

≡ *Nectria macrostoma* Berk. & M.A. Curtis, J. Linn. Soc., Bot. 10: 378. 1868.

≡ *Hypocreopsis macrostoma* (Berk. & M.A. Curtis) E. Müll., Beitr. Kryptogamenfl. Schweiz 11(2): 650. 1962.

= *Hypocrea corticioides* Berk. & Broome, J. Linn. Soc. Bot. 14: 111. 1873.

≡ *Clintoniella corticioides* (Berk. & Broome) Petch, Ann. Roy. Bot. Gard. (Peradeniya) 8: 134. 1920.

= *Sphaerostilbe variabilis* Berk. & Broome, J. Linn. Soc., Bot. 14: 115. 1875.

≡ *Nectria grisea* Dingley, Trans. Roy. Soc. New Zealand 79: 180. 1951.

= *Sphaerostilbe hypocreoides* Kalchbr. & Cooke, Grevillea 9: 26. 1880.

≡ *Stilbocrea hypocreoides* (Kalchbr. & Cooke) Seaver, Mycologia 2: 62. 1910.

= *Hypocrea carteri* Berk. & Broome, Grevillea 12: 79. 1883.

≡ *Hypocreopsis carteri* (Berk. & Broome) Sacc., Syll. Fung. 9: 981. 1891.

= *Stilbocrea dussii* Pat., Bull. Soc. Mycol. France 16: 186. 1900.

= *Sphaerostilbe henningsii* Ferd. & Winge, Bot. Tidsskr. 29: 12. 1908.

[≡ *Sphaerostilbe hypocreoides* Hennings, Hedwigia 41: 4. 1902. non Kalchbr. & Cooke 1880].

= *Sphaerostilbe intermedia* Ferd. & Winge, Bot. Tidsskr. 29: 12. 1908.

≡ *Stilbocrea intermedia* (Ferd. & Winge) Seaver, Mycologia 2: 63. 1910.

= *Sphaerostilbe placenta* Theissen, Ann. Mycol. 9: 55. 1911.

= *Stilbocrea jenkiana* [sic] Viégas, Bragantia 4: 97. 1944.

Anamorph: *Stilbella aleuriata* (Berk. & M.A. Curtis)

Seifert, Stud. Mycol. 27: 54. 1985.

- = *Stilbum aleuriatum* Berk. & M.A. Curtis, *Grevillea* 3: 63. 1874.  
 = *Botryonipha aleuriata* (Berk. & M.A. Curtis) O. Kuntze, *Rev. Gen. Pl.* 2: 845. 1891.  
 = *Stilbum cinnabarinum* Mont., *Ann. Si. Nat., Bot. Sér.* 2: 8: 360. 1837 (nom. rej.).  
 = *Botryonipha cinnabarina* (Mont.) O. Kuntze, *Rev. Gen. Pl.* 2: 845. 1891.  
 = *Stilbella cinnabarina* (Mont.) Wollenw., *Angew. Bot.* 8: 195. 1926.  
 = *Stilbum connatum* Kalchbr. & Cooke, *Grevillea* 9: 22. 1880.  
 = *Botryonipha connata* (Kalchbr. & Cooke) O. Kuntze, *Rev. Gen. Pl.* 2: 845. 1891.  
 = *Isaria aggregata* Cooke & Masee, *Grevillea* 19: 48. 1890.  
 = *Stilbum corallinum* Cooke & Masee, *Grevillea* 19: 91. 1891.  
 = *Stilbum subiculosum* Pat., *Bull. Trimestriel Soc. Mycol. France* 20: 138. 1904.  
 = *Stilbum intermedium* Sacc. & Trott., *Syll. Fung.* 22: 477. 1913, as anamorph of *Sphaerostilbe intermedia* Ferd. & Winge.  
 = *Stilbum vanderystii* Sacc. & Trott., *Syll. Fung.* 22: 477. 1913, as anamorph of *Sphaerostilbe henningsii* Ferd. & Winge.

Stromata convex, round, ellipsoid or irregular in outline, at first white, becoming orange or pink and finally grey, smooth, punctate or pubescent, 1–15 mm long, 1–10 mm diam, 375–1250  $\mu\text{m}$  thick, of *textura intricata*, hyphae 3–5  $\mu\text{m}$  wide. Ascumata up to several hundred embedded in a single layer in the stroma, visible as a papilla protruding through the surface of the stroma, orange when young, becoming red-brown to dark olive-green with age, globose to subglobose, KOH–, 250–375  $\mu\text{m}$  high  $\times$  200–300  $\mu\text{m}$  diam, collapsing cupulate or laterally; papilla about 70–90  $\mu\text{m}$  diam, of a palisade of vertically oriented, parallel hyphae, 2.5–3  $\mu\text{m}$  wide; periphyses 1–1.5  $\mu\text{m}$  wide. Ascumatal wall of a single, 10–30  $\mu\text{m}$  thick region of compressed, ellipsoid to fusiform, hyaline cells, 5–17  $\times$  2–3  $\mu\text{m}$ , with walls slightly thickened, becoming less thickened towards the centrum; wall surrounded by *textura intricata*, hyphae 2.5–3  $\mu\text{m}$  wide. Asci cylindrical, 70–110  $\times$  5–11  $\mu\text{m}$ , with an apical ring, 8-spored, ascospores uniseriate. Ascospores ellipsoid to slightly fusiform, (8.5–)10–14  $\times$  4–6  $\mu\text{m}$ , 1-septate, not constricted or slightly constricted at the septum, hyaline, verruculose to verrucose.

ANAMORPH.— Synnemata of two types, called A-synnemata and B-synnemata by Seifert (1985). A-synnemata solitary, gregarious, crowded or caespitose, arising from the teleomorph stroma, cylindrical-capitate, subulate-capitate, sometime clavate, slender to robust, curved, nodding or straight, unbranched or sometimes with a single branch, in some specimens with up to 10 inequivalent branches near the apex, smooth to granulate, stipe at first white, becoming orange or orange-pink, 250–2000  $\mu\text{m}$  tall  $\times$  50–225(–375)  $\mu\text{m}$  wide. B-synnemata solitary, gregarious to 3–4 caespitose,

emerging from a stroma at the periphery or several mm away from the stroma, subulate-capitate, cylindrical-capitate, or clavate, stipe grey, black or grey-brown, shiny, sometimes granulate toward the apex, 1–2 mm tall, 50–200  $\mu\text{m}$  wide. Conidiophores branching once, monovercillate, stipe 1.5–2  $\mu\text{m}$  wide. Phialides cylindrical, subulate, straight or curved, lateral and terminal or in terminal whorls of 3–4, 10–25  $\mu\text{m}$  long  $\times$  1–1.5  $\mu\text{m}$  wide, periclinal thickening sometimes obvious. Conidial mass hemispherical, globose or ellipsoid, orange, pink-orange, yellow-orange or red-brown, 75–350(–550)  $\mu\text{m}$  diam. Conidia oblong-ellipsoid, cylindrical or obovate, 3–6(–13)  $\times$  1–2(–2.5)  $\mu\text{m}$ . Descriptions modified from Seifert (1985).

HABITAT.— On bark and decaying wood of dicotyledonous plants, often on other ascomycetes.

DISTRIBUTION.— Pantropical and subtropical, occasionally temperate.

TYPES.— CUBA. On bark, date unknown, Wright 517 (K, holotype of *N. macrostoma*); SRI LANKA (Ceylon). South of the Island, on bark, July 1868, Herb. Berkeley No. 645 (K, holotype of *H. corticioides*); INDIA. Bombay, on bark, H.J. Carter, Herb. Berkeley, No. 8318 (K, holotype of *H. carteri*). Additional specimens examined from Indonesia are listed in Samuels *et al.* (1990). Culture CBS 542.95.

ILLUSTRATIONS.— Müller & von Arx (1962, Fig. 256, as *Hypocreopsis macrostoma*), Seifert (1985, Figs. 12–13, as *N. macrostoma*), Samuels *et al.* (1990, Fig. 29, as *N. macrostoma*).

SPECIMEN ILLUSTRATED.— UNITED STATES. Mississippi: Wilkinson Co., Clark Creek Natural Area, vicinity of pond, on twigs of dicotyledonous tree, 18 Aug 1996, G.J. Samuels, G.J.S. 96-175 = CBS 101601, M. Blackwell (BPI 744508).

NOTES.— Seifert (1985) presented a complete account of *Nectria macrostoma* and its anamorph, *Stilbella aleuriata*, with documentation of their numerous synonyms.

***Stilbocrea gracilipes*** (Tul. & C. Tul.) Samuels & Seifert, *comb. nov.*

= *Sphaerostilbe gracilipes* Tul. & C. Tul., *Sel. Fung. Carpol.* 1: 131. 1861.

= *Nectria gracilipes* (Tul. & C. Tul.) Wollenw., *Angew. Bot.* 8: 198. 1926.

= *Nectria dealbata* Berk. & Broome, *J. Linn. Soc., Bot.* 14: 117. 1873.

= *Nectria hypocreoides* Berk. & Cooke, *Grevillea* 12: 81. 1884.

= *Sphaerostilbe tetraspora* Pat. & Gaill., *Bull. Soc. Mycol. France* 4: 115. 1888.

= *Sphaerostilbe cinerascens* Hennings, *Ann. Jard. Bot. Buitenzorg, Sér.* 11, 8: 63. 1909.

[= *Sphaerostilbe ochracea* Syd., *Ann. Mus. Roy. Congo Belg.*, ser. 5, 3: 15. 1909, non Pat. 1903].

= *Sphaerostilbe vanderystii* Hennings, *in* Beeli, *Bull. Jard. Bot. Nat. Belg.* 8: 77. 1922.

= *Allantonectria creonectrioides* Chardón, J. Dept. Agric. Porto Rico 14: 241. 1930.

ANAMORPH: *Stilbella clavulata* (Mont.) Seifert, Stud. Mycol. 27: 85. 1985.

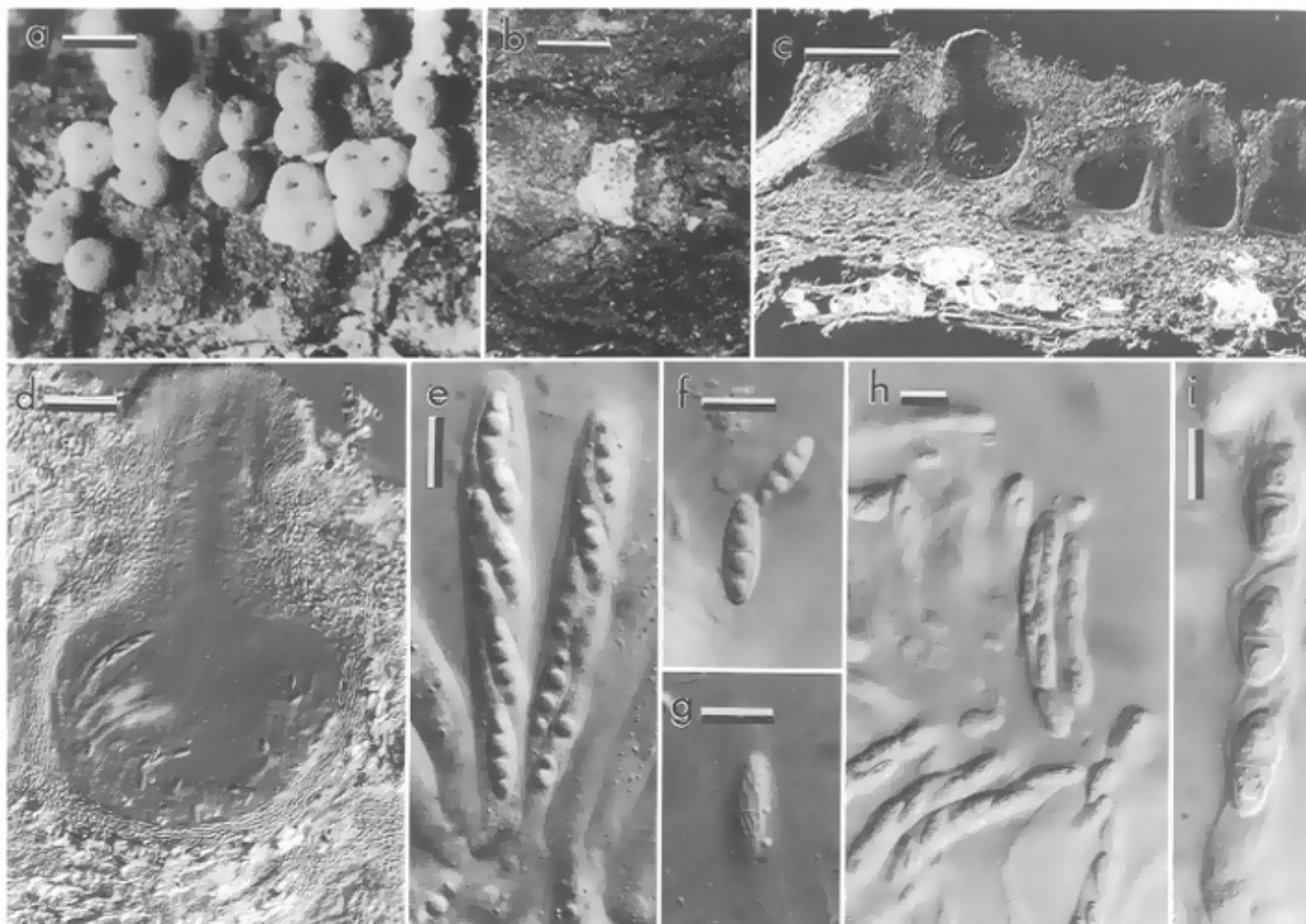
= *Stilbum clavulatum* Mont., Ann. Sci. Nat. Bot., Sér. 2, 18: 248. 1842.

Additional synonyms listed in Seifert (1985).

Stroma white, grey or brown, erumpent, composed of *textura intricata* of hyaline hyphae, 3–9  $\mu\text{m}$  wide, with smooth, to 0.5  $\mu\text{m}$  thick walls. Ascumata 10–30(–50) caespitose, rarely solitary, seated on or slightly immersed in the stroma, globose to ellipsoid, 200–375  $\mu\text{m}$  diam, sometimes collapsed cupulate, pale yellow, orange or pink when young, becoming brown with age, finally black, with an orange to black spot around the ostiole, KOH–, smooth-walled to granulose; papilla about 60–100  $\mu\text{m}$  diam, of vertically oriented parallel, 1–2  $\mu\text{m}$  wide hyphae, with slightly thickened walls; periphyses 1  $\mu\text{m}$  wide. Ascumatal wall in surface view of

monilioid hyphae, 4–8  $\mu\text{m}$  wide, which ultimately fragment into globose to ellipsoid cells, 5–10  $\mu\text{m}$  diam, accumulating black pigment; in section 25–50  $\mu\text{m}$  thick, of two regions: outer region of *textura intricata* to *textura angularis*, 15–35  $\mu\text{m}$  thick, cells hyaline, 3–6  $\times$  3–8  $\mu\text{m}$ , becoming incrustated with black pigment with age, walls up to 0.5  $\mu\text{m}$  thick; inner region of *textura prismatica*, 10–20  $\mu\text{m}$  thick, of thin-walled, hyaline cells, 5–12  $\times$  3  $\mu\text{m}$ . Asci cylindrical, 60–90  $\times$  5–7  $\mu\text{m}$ , apex simple, 8-spored, ascospores uniseriate. Ascospores ellipsoid, often flattened on one side, 9.5–15(–17)  $\times$  3.5–6  $\mu\text{m}$ , 1-septate, not or slightly constricted at the septum, hyaline, spinulose.

ANAMORPH.—Synnemata scattered, gregarious, crowded, 2–10 caespitose, erumpent through the bark, emerging from a white basal subiculum or ascumatal stroma, cylindrical-capitate, subulate-capitate to spatulate, straight, nodding or sinuous, usually slender, unbranched, or in some collections dichotomously to highly branched, stipe black, grey, or grey-brown,



**Plate 15.** a. *Stilbocrea impressa*. Ascumata on natural substratum. b–g. *Valsonectria simpsonii*. b. Ascumata in stroma partially immersed in substratum. c. Median section of ascumata. d. Close-up of median section of ascumata. e. Asci with ascospores. f. Ascospores. g. Ascospore focussed out of median plane to show surface ornamentation. h. *Valsonectria boldoae*, asci with ascospores. i. *Valsonectria pulchella*, close-up of ascus with ascospores. a. BPI 745018. b–g. BPI 802564. h. LPS holotype. i. LPS holotype. Scale bars: a = 500  $\mu\text{m}$ ; b = 1 mm; c = 100  $\mu\text{m}$ ; d = 50  $\mu\text{m}$ ; e–i = 10  $\mu\text{m}$ .

smooth to hirsute at the base, upper parts granulose, grey to white, 500–4000  $\mu\text{m}$  tall  $\times$  50–250  $\mu\text{m}$  wide in the middle, up to 450  $\mu\text{m}$  wide at the base. Conidiophore branching once or twice monochasial. Phialides subulate or cylindrical, straight or curved, lateral, lateral and terminal, or in terminal whorls of 3(–6), 10–25  $\mu\text{m}$  long  $\times$  1–5–3  $\mu\text{m}$  wide at the base, sometimes proliferating percurrently to form a new phialide, 1–1.5  $\mu\text{m}$  wide at the conidiogenous aperture, collarettes sometimes slightly flared, periclinal thickening usually obvious. Conidial mass orange or green, at times yellow, red, or brown, hemispherical to globose, ovoid or ellipsoid, 60–625  $\mu\text{m}$  diam. Conidia ellipsoid, oblong–ellipsoid or ovoid, straight or slightly curved, 4–7(–8)  $\times$  2–3(–3.5)  $\mu\text{m}$ , walls slightly thickened. Description modified from Seifert (1985).

**HABITAT.**— On dead wood and bark of dicotyledonous plants and palms.

**DISTRIBUTION.**— Pantropical and warm temperate regions; anamorph common in temperate North America.

**TYPES.**— Holotype of *Sphaerostilbe gracilipes* at PC, fide Seifert (1985), not examined for this study. COLOMBIA, Dept. Valle de Cauca: Hacienda El Hatico between Cerrito and Palmira, on dead bark, 23 May 1929, C. E. Chardón & J. A. B. Nolla, 735 (CUP, holotype of *Allantonectria creonectrioides*). Cultures: CBS 657.83, 658.83, 523.85, 531.85, 532.85.

Additional specimens examined from Indonesia are listed in Samuels *et al.* (1990).

**ILLUSTRATIONS.**— Tulasne & Tulasne (1865, Pl. XIV, Figs. 14–19, as *Sphaerostilbe gracilipes*); Samuels *et al.* (1990, Fig. 30, as *N. gracilipes*), Seifert (1985, Figs. 26, 27, as *N. gracilipes*).

***Stilbocrea impressa*** (Mont.) Samuels, *comb. nov.* — Plate 10, c, e; Plate 15a.

≡ *Hypocrea impressa* Mont., Ann. Sci. Nat. Bot., Sér. 4, 3: 143, 1855.

≡ *Clintoniella impressa* (Mont.) Sacc. & P. Syd., Syll. Fung. 16: 588, 1902.

**ANAMORPH:** *Acremonium*-like.

Stroma 1–2 mm diam, about 350  $\mu\text{m}$  high, erumpent through the bark at a single point, then spreading out, discrete, scattered, each with a single upper layer of 2–30 ascospores; stromal surface white to dull buff, slightly furfuraceous, hyphae highly branched, 3.5  $\mu\text{m}$  wide, with many free ends, basal stroma of loose hyphae, occasionally associated with a black, pycnidial fungus. Ascospores globose, 280–500  $\mu\text{m}$  diam, brown, KOH–; ascospore wall 20–30  $\mu\text{m}$  thick, of three regions: outer region ca 10  $\mu\text{m}$  thick, of tightly compacted pseudoparenchyma, cells ca 5  $\mu\text{m}$  diam, walls slightly thickened; middle region 15–20  $\mu\text{m}$  thick, of loosely joined hyphae with cells 10–15  $\times$  2–3  $\mu\text{m}$ ; inner region ca 7  $\mu\text{m}$  thick, of compacted, fusoid cells, 5–7  $\times$  ca 1  $\mu\text{m}$ . Periphyses 20–30  $\mu\text{m}$  long, tapering from ca 1  $\mu\text{m}$  in the lower part to the apex, stout toward outer regions. Asci clavate, 65–141  $\times$  16–25  $\mu\text{m}$ , apex simple, 8-spored, ascospores biserial or irregular. Ascospores ellipsoid to ellipsoid–fusiform, ends slightly pointed, 15–22  $\times$  7–10  $\mu\text{m}$ , equally 1-septate, hyaline, with a sheath that at maturity appears prominently spinulose.

**ANAMORPH.**— Buff-colored sporodochia formed on PDA after eight weeks. Sporodochia scattered, hemispherical, 1–2 mm diam, 45–55  $\mu\text{m}$  thick, basal tissue of tightly compacted hyphae. Conidiophores arising as lateral branches from basal hyphae forming abundantly in sporodochia or from surface of agar, densely packed into a compact palisade, loosely and more or less verticillately branched, macronematous, mononematous, 25–37  $\mu\text{m}$  long  $\times$  2–3  $\mu\text{m}$  at the base to 1–1.5  $\mu\text{m}$  at the apex, straight, smooth, aseptate or 1-septate, not conspicuously thickened or flared at the apex, proliferating percurrently to form a second full-length phialide, conidia held in hyaline to buff drops of liquid. Phialides straight, smooth, tapering gradually and uniformly from 2–3  $\mu\text{m}$  at the base to ca 1  $\mu\text{m}$  at the apex, apex with periclinal thickening, not flared, many phialides proliferating percurrently to form a second phialide. Conidia oblong, straight or slightly curved, with apical end often broader than the basal end, 3.5–7.5  $\times$  1.5–3  $\mu\text{m}$ , unicellular, hyaline, smooth, lacking an obvious basal abscission scar.

### KEY TO THE SPECIES OF *STILBOCREA*

1. Ascospores 15–22  $\times$  7–10  $\mu\text{m}$ , ellipsoid to ellipsoid–fusiform, ends slightly apiculate; anamorph known only in culture, *Acremonium*-like ..... *S. impressa*
1. Ascospores generally less than 15  $\mu\text{m}$  long, ellipsoid to fusiform, not apiculate; anamorph synnematous, often present in nature ..... 2
2. Ascospores orange to red-brown or dark olive-green; ascospores (8.5–)10–14  $\times$  4–6  $\mu\text{m}$ , verrucose to verruculose ..... *S. macrostoma*
2. Ascospores pale yellow, orange or pink to dark brown with age; ascospores 9.5–15(–17)  $\times$  3.5–6  $\mu\text{m}$ , spinulose ..... *S. gracilipes*

HABITAT.— On small, dead twigs with bark still present.  
DISTRIBUTION.— Northern South America (Brazil, French Guiana, and Guyana)

HOLOTYPE.— FRENCH GUIANA. On bark, Leprieur, Crypt. Guyan. 517 (PC).

ADDITIONAL SPECIMENS EXAMINED.— BRAZIL. Amazonas, 0.3 km S of central portion of Serra Araca and 8 km E of Rio Javari, ca 1 h walk SE from camp, on twigs with bark, elev. 60 m, 00°49' N, 63°19' W, 6 Mar 1984, G.J. Samuels 84-256 (NY). FRENCH GUIANA. Remire, 15 km from Cayenne, trail to Vidal old farm, 52°18' W, 4°52' N, on dead twigs, 12 Feb. 1988, A. Rossman 3198, cult. G.J. Samuels 88-8 = CBS 101600 (BPI, CAY); St. Laurent, near Mana, along road to Jahoury, white sand forest, 53°51' W, 5°34' N, on dead wood, 18 Nov 1986, A. Rossman 4020, cult. G.J. Samuels 86-570 (BPI 745018, CAY).

NOTES.— Doi (1975a) described and illustrated a *Hypocrea* as *H. impressa* but, based on a comparison of his description with the type specimen of *H. impressa*, Doi's specimen is of *Hypocrea*, not *Stilbocrea*.

**TRICHONECTRIA** Kirschst., Verh. Bot. Vereins Prov. Brandenburg 47: 60, 1906 [1907].

Type: *T. aculeata* Kirschst., a synonym of *Trichonectria hirta* (Bloxam) Petch.

Ascomata solitary, superficial, without stroma; globose to subglobose, white, yellow, pale orange to pale reddish-brown, occasionally pink when fresh. KOH–, not collapsing when dry, wall less than 40  $\mu\text{m}$  thick, of small, non-descript cells; with thick-walled, straight, solitary hairs, or glassy, hyaline appendages in *T. hyalocristata*, arising from the surface of the ascomatal wall. Asci clavate, broadly clavate or broadly cylindrical. Ascospores ellipsoid, fusiform, broadly to long fusiform or cylindrical, 1- to multiseptate, hyaline, smooth-walled. Anamorph, where known, *Acremonium*-like. On decaying algae, mosses, lichenized and non-lichenized fungi.

NOTES.— *Trichonectria* was described as being similar to *Calonectria* and *Ophionectria*, differentiated by the delicate, prosenchymatous ascomata covered with stiff hairs. The type specimen of the type species, *T. aculeata*, was apparently destroyed and Hawksworth (1978) neotypified that name with the type of *T. hirta*, thus assuring the synonymy of these two species. *Trichonectria* is characterized by a pallid, thin-walled ascomata having hyaline, thick-walled hairs and are often associated with lichens, bryophytes, and fungi.

Döbbeler (1978) described one additional species in *Trichonectria*, *T. pellucida*, from living leaves of a liverwort in Brazil, Samuels (1988) added four species, three of which are fungicolous, and Scheuer (1988, 1989) described a species having glassy, flattened, hyaline appendages around the ostiolar region that occurs on overwintered leaves of *Carex*. At present, seven

species are included in *Trichonectria*. Species of *Trichonectria* show affinities to species of *Nectriopsis* and *Paranectria* in having small, pallid, thin-walled ascomata and occurring primarily on algae, bryophytes, lichens or other fungi.

**Trichonectria hirta** (Bloxam) Petch, Naturalist (Hull) 1937: 282, 1937.

= *Nectria hirta* Bloxam, in Currey, Trans. Linn. Soc. London 24: 158, 1884.

= *Calonectria hirta* (Bloxam) Sacc., Michelia 1: 307, 1878.

= *Lasionectria hirta* (Bloxam) Cooke, Grevillea 12: 112, 1884.

= *Calonectria vermisporea* Masee & Crossland, Naturalist (Hull) 1904: 4, 1904.

= *Dialonectria vermisporea* (Masee & Crossland) Masee & Crossland, Fungus Flora Yorkshire p. 214, 1905.

= *Trichonectria aculeata* Kirschst., Verh. Bot. Vereins Prov. Brandenburg 47: 60, 1906 [1907].

= *Calonectria aculeata* (Kirschst.) Weese, Centralbl. Bakteriologie, Abth. 2, 42: 595, 1914.

= *Trichonectria rosella* Höhn., Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Kl., Abt. 1, 127: 624, 1918.

Ascomata solitary or sparsely aggregated, superficial on the substratum, without a stroma or with a sparse hyphal subiculum radiating from the base of the ascomata, hyphae hyaline, thin-walled, 1.5–2  $\mu\text{m}$  wide. Ascomata globose to subglobose, 230–300  $\mu\text{m}$  high  $\times$  240–300  $\mu\text{m}$  diam, laterally pinched or not collapsing when dry, white to pale yellow or pale saffron, KOH–, without papilla, with numerous, long, straight, solitary hairs projecting from the upper part of the ascomata, hairs 43–100  $\mu\text{m}$  long  $\times$  10–12  $\mu\text{m}$  wide at the base, with 1.5–3  $\mu\text{m}$  thick walls, unthickened toward the apex. Ascomatal wall 25–40  $\mu\text{m}$  thick, of two regions: outer region 20–35  $\mu\text{m}$  thick, of hyaline, thin-walled, elongate cells, 6–12  $\times$  3–4  $\mu\text{m}$ ; inner region 3–7  $\mu\text{m}$  thick of hyaline, thin-walled, elongate cells. Asci broadly cylindrical, 60–100  $\times$  11–15  $\mu\text{m}$ , apex simple, 8-spored, ascospores pluriseriate. Ascospores long fusiform to cylindrical, vermiform or sigmoid, 45–85  $\times$  5–8  $\mu\text{m}$ , 11–21-septate, forming cuboid to subcuboid cells, hyaline, smooth.

HABITAT.— On very rotten, decorticated wood, often associated with granular lichen thalli.

DISTRIBUTION.— Austria, Belgium, Denmark (T. Læsøe, pers. comm.), England, and Germany.

HOLOTYPE.— England, Twycross, Leicestershire, on decaying rails, associated with *Lecidiea uliginosa* (K).

Additional specimens examined as cited in Rossman (1983).

ILLUSTRATIONS.— Dennis (1978, Pl. 31G); Döbbeler (1978, Fig. 21, as *T. rosella*); Hawksworth (1978, Fig. 7); Petch (1938, Fig. 26); Rossman (1983, Fig. 46).

KEY TO THE SPECIES OF *TRICHONECTRIA*

1. Ascomata with glassy, flattened, hyaline appendages around the ostiolar region; ascospores fusiform,  $9.5\text{--}12.5 \times 2\text{--}2.5 \mu\text{m}$ ; on overwintered leaves of *Carex*; Austria and Great Britain ..... *T. hyalocristata*
1. Ascomata with straight hairs, not on overwintered leaves of *Carex* ..... 2
2. Ascospores more than  $25 \mu\text{m}$  long ..... 3
2. Ascospores less than  $25 \mu\text{m}$  long ..... 4
3. Ascospores long fusiform to cylindrical, with broadly rounded ends,  $45\text{--}85 \times 5\text{--}8 \mu\text{m}$ , on old wood associated with granular lichen thalli; Europe ..... *T. hirta*
3. Ascospores broadly fusiform, tapering to the narrowly rounded ends,  $70\text{--}94 \times 12.5\text{--}16 \mu\text{m}$ ; on liverworts; Brazil ..... *T. pellucida*
4. On leaves of *Erythroxylum*; ascomatal hairs  $25\text{--}35 \mu\text{m}$  long; ascospores fusiform ( $12.5\text{--}13.5\text{--}16.5(-17) \times (2.5\text{--}3\text{--}3.5(-4) \mu\text{m}$ ; Brazil ..... *T. erythroxylifolii*
4. Fungicolous, on pyrenomycetes or inoperculate discomycetes ..... 5
5. On hymenium of inoperculate discomycetes; hairs  $30\text{--}60 \mu\text{m}$  long; ascospores narrowly ellipsoid to fusiform,  $(10\text{--})11.5\text{--}13.5(-14.5) \times 2\text{--}3 \mu\text{m}$ ; Venezuela ..... *T. albidopilosa*
5. On pyrenomycetes; hairs generally longer than  $60 \mu\text{m}$  ..... 6
6. Hairs  $75\text{--}150 \mu\text{m}$  long; ascospores fusiform,  $(12\text{--})14.5\text{--}18.5(-24.5) \times (2.5\text{--})3\text{--}4 \mu\text{m}$ ; on stromata of *Diatrype stigma*; North America ..... *T. rectipila*
6. Hairs  $50\text{--}80 \mu\text{m}$  long; ascospores fusiform to ellipsoid,  $(13\text{--})13.5\text{--}16(-18) \times (3\text{--})3.5\text{--}4.5(-5) \mu\text{m}$ ; on a sphaeriaceous pyrenomycete; New Zealand ..... *T. horrida*

ADDITIONAL SPECIES OF *TRICHONECTRIA*:

***Trichonectria albidopilosa*** (Rogerson & Samuels) Samuels, Mem. New York Bot. Gard. 48: 11. 1988.  
This species was described and illustrated in Rogerson & Samuels (1985, as *Nectria albidopilosa*).

***Trichonectria erythroxylifolii*** Samuels, Mem. New York Bot. Gard. 48: 11. 1988.  
This species was described and illustrated in Samuels (1988).

***Trichonectria horrida*** Samuels, Mem. New York Bot. Gard. 48: 11. 1988.  
This species was described and illustrated in Samuels (1988).

***Trichonectria hyalocristata*** Scheuer, Mycol Res. 93: 117. 1989.  
This species was described and illustrated in Scheuer (1988, 1989).

***Trichonectria pellucida*** Döbbeler, Mitt. Bot. Staatssamml. München 14: 119. 1978.  
This species was described from living leaves of a liverwort in Brazil by Döbbeler (1978).

***Trichonectria rectipila*** Samuels, Rogerson & M.E. Barr, Mem. New York Bot. Gard. 48: 11. 1988.  
This species was described and illustrated in Samuels (1988) and is known from the eastern United States,

**VALSONECTRIA** Speg., Anales Soc. Ci. Argent. 12: 211. 1881.

Type: *V. pulchella* Speg.

= *Endocreas* Samuels & Rogerson, Stud. Mycol. 31: 145. 1989. — Type: *E. lasiacidis* Samuels & Rogerson, recognized as *V. lasiacidis* (Samuels & Rogerson) Samuels & Rossman.

Stroma immersed in the substratum, becoming partially erumpent, pale yellow, pseudoparenchymatous. Ascospores immersed in the stroma, globose to subglobose, yellow, KOH-, ostiolate. Asci clavate to cylindrical. Ascospores narrowly ellipsoid, ellipsoid to fusiform, equally 1-septate, hyaline or yellow-brown, smooth or coarsely striate. Anamorph, where known, *Acremonium*-like. On living and dead woody substrata and bamboo-like grasses.

NOTES.— Spegazzini (1881) established *Valsonectria* for a species having *Nectria*-like ascomata immersed in

a valsoid stroma and lightly pigmented, one-septate ascospores. Petrak & Sydow (1936) examined the type specimen of *V. pulchella*, provided a detailed description, and concluded that the genus belonged in the *Hypocreales*. Müller & von Arx (1962) examined the type specimen and presented a description with illustrations that show the ascomata immersed at different depths in the stroma, although, based on our examination of the type specimen, the ascomata form a single layer in the substratum.

*Endocreas* Samuels & Rogerson was described as a hypocrealean genus similar to *Nectriella* (Samuels & Rogerson, 1989). In a recent publication Seifert & Samuels (1997) recognized the synonymy of *Endocreas* with *Valsonectria* and transferred the type species of *Endocreas* to *Valsonectria*. *Valsonectria* is distinguished from other genera in the *Bionectriaceae* by ascomata immersed in a well-developed stroma that is itself immersed in the substratum, and hyaline to yellow-brown, smooth or coarsely striate ascospores. At present, four species are included in *Valsonectria*.

***Valsonectria pulchella*** Speg., *Anales Soc. Ci. Argent.* 12: 211. 1881. — Plate 10, e.

Stromata evident as ellipsoid, brightly colored, slightly raised bumps on bark, about 1 mm long, forming a single layer in the substratum, hyphae loosely disposed, 2–3 µm wide, hyaline, thin-walled, branched, septate. Ascomata immersed in stromal periphery, globose, yellow, non-papillate, ostiolate. Asci cylindrical, 88.5–97.5 × 7.5 µm, apex simple, 8-spored, ascospores uniseriate. Ascospores ellipsoid to fusiform, 11–14 × 6–7 µm, equally 2-celled, yellow-brown, with wall up to 1 µm thick, coarsely striate, numerous, short, the striations resulting from accretion to the spore surface. ANAMORPH associated with mature ascomata, forming on the stromal surface. Phialides narrowly cylindrical, 7–15 × 1.5–2 µm, widest at the base, collarete not flared, periclinal thickening not visible. Conidia unicellular, hyaline, without a recognizable basal abscission scar, slightly curved.

HABITAT AND DISTRIBUTION.— Known only from the type specimen.

HOLOTYPE.— ARGENTINA. Flores: Buenos Aires, on decaying branches of *Melia azedarach*, Apr 1881, C. Spegazzini (LPS 1217).

NOTES.— The holotype specimen consists of a few, small woody twigs and most material is immature.

***Valsonectria lasiacidis*** (Samuels & Rogerson) Samuels & Rossman, *Mycologia* 89: 515. 1997.

≡ *Endocreas lasiacidis* Samuels & Rogerson, *Stud. Mycol.* 31: 145. 1989.

Stromata immersed, becoming partially erumpent and rupturing the epidermis, linear parallel to the long axis of the host culm, pale yellow, KOH–, pseudoparenchymatous, cells 6–10 µm diam, with ca 1 µm thick walls, arranged in files perpendicular to the surface of the host; each stroma enclosing several ascomata; stromal tissue lacking below ascomata, ascomata seated directly on host tissue; hyphae invading epidermal cells of host. Ascomata globose, 145–155 µm high × (132–)165–185 µm diam, non-papillate or with a short papilla, remaining immersed within the stroma, pale yellow, KOH–. Ascomatal wall 10–15 µm thick, of a single region of small, ellipsoid to flattened cells. Ascomatal apex formed of hyphal elements 1 µm or less wide, merging with the periphyses at the interior and with surrounding stromal cells at the exterior. Sterile filaments persisting or not among mature asci, 3–4 µm wide, constricted at the refractive septa. Asci clavate, (48–)53–66 × (8–)9–12(–13.5) µm, with simple apex; 8-spored, ascospores completely filling each ascus or up to 20 µm of the ascus base empty. Ascospores narrowly ellipsoid to fusiform, (13.5–)15–17.5(–20) × 2.5–3.5(–4.5) µm, equally 1-septate, not constricted at the septum, hyaline, smooth, becoming coarsely striate with age.

HABITAT.— On dead culms of *Lasiacis ligulata* (*Poaceae*).

DISTRIBUTION.— French Guiana.

TYPES.— FRENCH GUIANA. Saül, elev. 200 m, Feb 1986, G.J. Samuels 3785 (NY, holotype); Upper Marouini River, ca 3 h walk W of river, ca 1 km E of Roche Koutou, 02°55' N, 54°03' W, elev. 15–350 m, 18 Aug 1987, G.J. Samuels 5866 (NY, paratype). Culture CBS 179.88.

NOTES.— Although unique in many characteristics, the sparsely developed stroma, pallid, discrete ascomata, shape, septation, and striation of the ascospores, and the occurrence on dead herbaceous material suggest affinities with the genus *Bionectria*.

***Valsonectria boldoae*** Speg., *Revista Fac. Agron. Univ. Nac. La Plata*, Ser. 2, 6: 98. 1910. — Plate 10, d.

Ascomata immersed, caespitose in groups of up to 10 but not obviously stromatic, globose, about 375–400 µm diam, orange, KOH–, smooth, non-papillate, with a viscid ostiolar opening. Ascomatal wall 25–30 µm thick, of a single region of intertwined hyphal cells. Ascomatal surface of *textura epidermoidea*. Asci cylindrical, 28–40 × 6–7.5 µm, apex simple, 8-spored, as-



cospores biseriate. Ascospores narrowly ellipsoid to oblong,  $8\text{--}11 \times 2\text{--}3 \mu\text{m}$ , equally 1-septate, straight or slightly curved, hyaline, smooth-walled.

**HABITAT AND DISTRIBUTION.**— Known only from the type specimen.

**HOLOTYPE.**— CHILE. Talchano, on *Boldoa fragrans*, Jan 1909, C. Spegazzini (LPS 1754).

**NOTES.**— A large packet contains two smaller packets each with a handwritten label. One has a drawing of two perithecia, an ascus with allantoid ascospores, and some unicellular, allantoid ascospores, and is labelled '*Nectriovalsa boldoaea* Speg. (n.sp.) cum *Mattirolia (Diatrype) vitellina* (Montagne) Speg.' This specimen is regarded as the holotype. The second packet has a drawing of allantoid spores and is labelled '*Diatrype [enteracantha]* Berk. vii. p. 47.' No hypocreacean fungus was found in that packet.

***Valsonectria simpsonii*** Samuels & Seifert, *Mycologia* 89: 512. 1997. — Plate 15, b–g.

Stromata inconspicuous to 1 mm diam, white, subcortical, erumpent, ostiolar openings appearing as pale orange dots, stromata of hyphae  $5\text{--}6 \mu\text{m}$  wide, thick-walled, densely compacted especially at the surface, stroma lacking below the ascomata. Ascomata immersed in groups of 30–50, ca  $275 \mu\text{m}$  high  $\times$   $190 \mu\text{m}$  diam. Ascomatal wall ca  $15 \mu\text{m}$  thick, of a single region of ellipsoidal cells with  $1.5 \mu\text{m}$  thick walls. Asci cylindrical to narrowly clavate,  $50\text{--}73 \times 6\text{--}9 \mu\text{m}$ , apex thickened, 8-spored. Ascospores ellipsoidal to fusiform,  $(9.5\text{--})10.5\text{--}13\text{--}(14) \times 3.5\text{--}4.5 \mu\text{m}$ , equally 2-

celled with two guttules in each cell, becoming slightly constricted at the septum, yellow-brown, coarsely striate while in the asci.

**ANAMORPH.**— Synnemata in nature  $150\text{--}625 \mu\text{m}$  tall,  $30\text{--}160 \mu\text{m}$  wide, sometimes almost sessile, gregarious or caespitose, more or less cylindrical or clavate, unbranched, or often with several median to apical branches, white to straw-colored, with brownish bands. Conidiophore branching monoverticillate, occasionally with a basal dichotomous branch; metulae, when present,  $15\text{--}25 \times 1.2\text{--}2 \mu\text{m}$ ; phialides  $15\text{--}37 \times 0.5\text{--}1.5 \mu\text{m}$ , hyaline, cylindrical to slightly subulate, often curved, sinuous and uneven in outline, in whorls of 2–4, sometimes regenerating percurrently to produce a new conidiogenous aperture, conidiogenous aperture  $0.5\text{--}1 \mu\text{m}$  wide, periclinal thickening obvious with phase contrast, collarete inconspicuous, cylindrical, about  $1 \mu\text{m}$  long. Conidial mass slimy, in nature, sparse, pale salmon-colored, up to  $500 \mu\text{m}$  diam. Conidia ellipsoidal or ovate,  $3.5\text{--}6 \times 1.5\text{--}2.5 \mu\text{m}$ , sometimes slightly truncate at the base.

**HABITAT.**— On living branch of *Elaeagnus pungens* Thunb.

**DISTRIBUTION.**— France (Pyrénées Atlantiques), known only from the type locality.

**HOLOTYPE.**— FRANCE. Pyrénées Atlantiques: Île de Sauveterre, on *Elaeagnus pungens*, 31 Oct 1992, F. Candoussau 252 (BPI 802564; ex-type culture G.J.S. 93-9 = CBS 101602, also DAOM).

**NOTES.**— *Valsonectria simpsonii* can be distinguished from the other three species in the genus on the basis of the host, ascospore characters, and the white, smooth synnematus anamorph with branching monoverticillate conidiophores.

#### KEY TO THE SPECIES OF *VALSONECTRIA*

1. On bamboo-like grass; ascospores  $15\text{--}17.5 \times 2.5\text{--}3.5 \mu\text{m}$ , narrowly ellipsoid to fusiform, hyaline, coarsely striate; French Guiana ..... *V. lasiacidis*
1. On living or dead wood; ascospores less than  $15 \mu\text{m}$  long, hyaline or yellow-brown, smooth or coarsely striate ..... 2
2. Ascospores  $11\text{--}14 \times 6\text{--}7 \mu\text{m}$ , ellipsoid to fusiform, yellow-brown, coarsely striate; on dead wood; Argentina ..... *V. pulchella*
2. Ascospores less than  $6 \mu\text{m}$  wide ..... 3
3. On dead bark of *Boldoa*; ascospores  $8\text{--}11 \times 2\text{--}3 \mu\text{m}$ , narrowly ellipsoid to oblong, hyaline, smooth-walled; Chile ..... *V. boldoae*
3. On living branch of *Elaeagnus pungens*; ascospores  $10.5\text{--}13 \times 3.5\text{--}4.5 \mu\text{m}$ , ellipsoid to fusiform, yellow-brown, coarsely striate; southern France ..... *V. simpsonii*