

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).

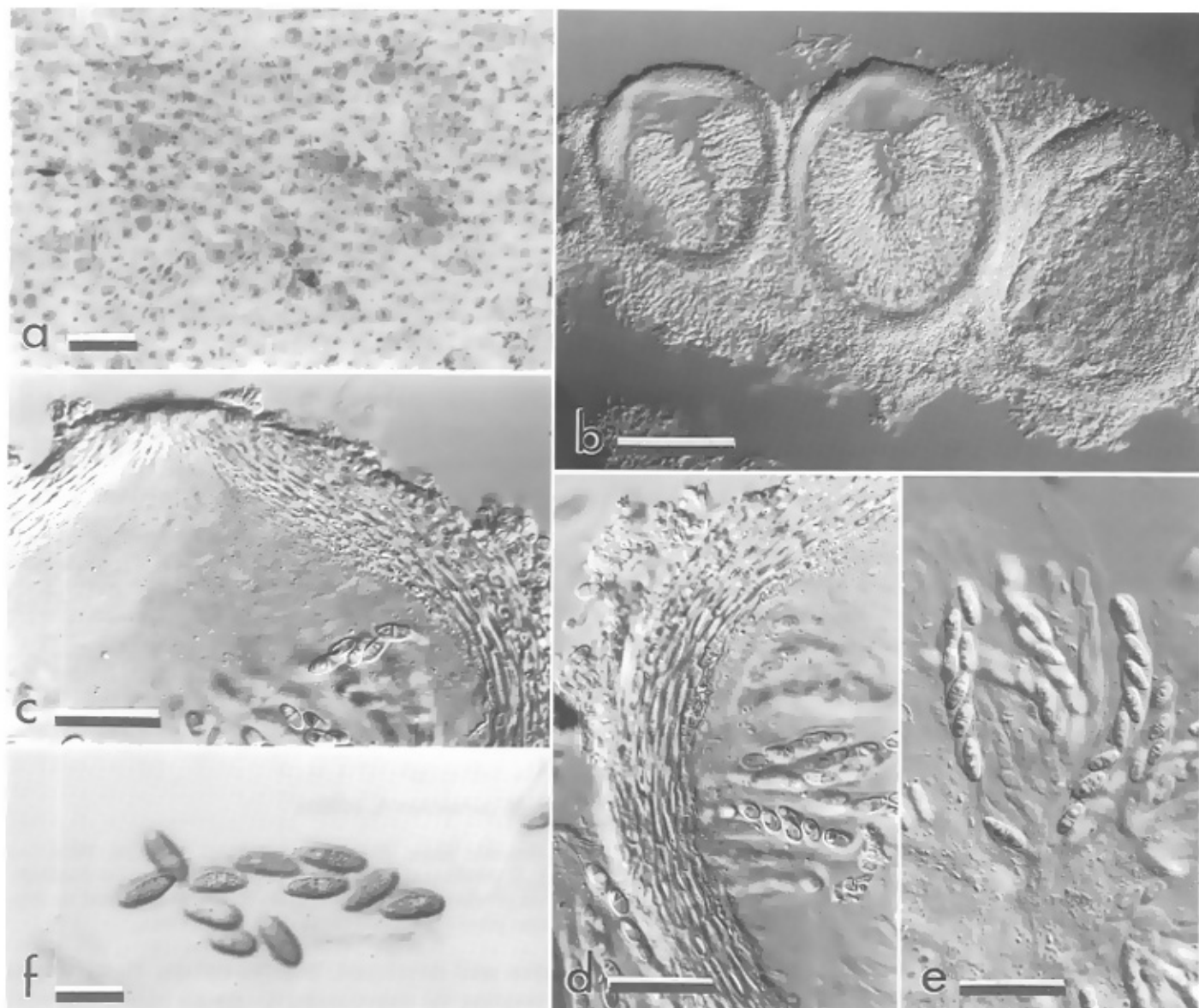
**MYCOCITRUS** A. Möller, *Bot. Mitt. Tropen* 9: 297. 1901.

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, ascal 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 biseriate 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 *Kutitakesa*. 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