

SOUTH FLORIDA MICROFUNGI: NEW RECORDS OF SAPROPHYTIC HYPHOMYCETES ON PLANT DEBRIS

GREGORIO DELGADO

Environmental Microbiology Laboratory (EMLab) 6301 NW 5th Way, Suite 2850,
Fort Lauderdale, FL 33309, email: e-mail: gdelgado@emlab.com

ABSTRACT: *Nine species of saprophytic hyphomycetes (anamorphic fungi), collected on plant debris from two different localities of southeast Florida, are recorded for the first time from the United States. They are: Anungitea fragilis, Beltraniella havanensis, Canalisporium caribense, Circinotrichum papakurae, Dictyosporium micronesicum, D. subramanianii, Dischloridium laeense, Gyrothrix verticillata and Piricauda cochinchinensis. Comments about their taxonomy, ecology and geographical distribution are included. Five infrequently reported species and twenty additional widespread taxa are also listed.*

Key Words: Lignicolous fungi, microfungi, palm fungi, taxonomy, systematics

THE ANAMORPHIC fungi are a group of microfungi that are disseminated by propagules formed from cells where mitosis has occurred, and include asexual states of mostly members of ascomycetes and basidiomycetes (Kirk et al., 2001). Traditionally, they have been separated into three form-classes known as agonomycetes, coelomycetes and hyphomycetes, the latter including mycelial forms that bear asexual propagules or conidia on separate hyphae or aggregations of hyphae (synnema or sporodochia) but not inside discrete conidiomata. They are able to exploit a wide range of nutrient sources, living as parasites on many living organisms or as decomposers of non-living, organic or inorganic substrates, contributing to the recycling and distribution of nutrients in nature (Rossman, 1997).

Despite the extensive human impact and rapid habitat loss of southeastern Florida natural ecosystems, the region still offers excellent conditions for the study of microfungi, specially those saprophytic hyphomycetes associated with dead plant debris. Compared with economically important plant pathogenic fungi, this ecological group has received little attention in the area, although previous studies showed a rich and noteworthy mycobiota (Dyko and Sutton, 1979; Fell and Hunter, 1979; Sutton, 1978; Wallace and Dickinson, 1978). During the course of short-term surveys of lignicolous and foliicolous microfungi carried out in natural localities of southeastern Florida, some interesting hyphomycetes were collected. The present paper is a small contribution to the knowledge of this group of fungi in Florida, and includes descriptions and comments of nine taxa not previously recorded in the United States, as well as other noteworthy and widely distributed species collected at the same localities.

MATERIALS AND METHODS—Dead branches, twigs, leaf litter, decaying bamboo culms and dead palm rachides and petioles were collected at Fairchild Tropical Botanic Garden, Miami Dade county, and different forest spots located in north Broward county. Samples were placed into plastic bags and returned to the laboratory for examination. They were cut in small pieces and incubated in plastic containers lined with moist filter paper, kept damp and exposed to ambient laboratory conditions (24–25°C and alternating fluorescent and daylight). Containers were regularly examined under a stereomicroscope to detect spore development. Permanent slides were prepared using lactophenol cotton-blue as mounting medium. All specimens were air-dried and sent for deposit to the Herbarium of the U.S. National Fungus Collections, USDA (BPI).

OBSERVATIONS AND DISCUSSION—All species are arranged alphabetically, and a description of the specimen collected is provided, followed by collection data such as habitat, locality, collector name, date and BPI herbarium specimen number.

Anungitea fragilis B. Sutton, *Mycol. Pap.* 132:10, 1973. Fig. 9.

= *Anungitea globosa* B. Sutton & Hodges, *Nova Hedwigia* 29:594, 1978.

Conidiophores erect, straight of slightly flexuous, brown, up to 66.8 µm, 2.5 µm wide. Conidiogenous cells polyblastic, integrated, swollen apically, terminal, denticulate. Conidia solitary or in very short, unbranched acropetal chains, cylindrical, pale brown, 1-septate, smooth, with truncated scars at each end, 9.2–15 × 1.67 µm.

Specimen examined: on dead leaves of unknown plant. Pompano Beach, Broward, Florida, G. Delgado, November, 2004 (BPI 877790D).

The genus *Anungitea* was introduced by Sutton (1973) with *A. fragilis* as the type species. The genus is characterized by possessing polyblastic, integrated, terminal conidiogenous cells with conspicuous denticulate loci and conidia forming acropetal, unbranched, fragmenting chains. The presence of cylindrical, 1-septate, smooth, pale olivaceous brown, identical primary and secondary conidia distinguish *A. fragilis* from the remaining species of the genus (Castaneda-Ruiz et al., 1997). Worldwide in distribution and mainly collected in temperate biomes (Heredia et al., 1995), this is the first record of its occurrence in continental United States, been previously known from Hawaii as *A. globosa* B. Sutton and Hodges (1978) on decaying leaves of *Eucalyptus* spp.

Beltraniella havanensis (Hol.-Jech.) Matsush., *Matsush. Mycol. Mem.* 5:5, 1987.

= *Pseudobeltrania havanensis* Hol.-Jech., *Ceská Mycol.* 41:34, 1987.

Colonies hairy, effused, brown. Setae absent. Conidiophores erect, straight of flexuous, simple, brown, septate, smooth, up to 355 µm length, 3.6–4.8 µm wide; basal cells radially lobed, dark brown. Conidiogenous cells polyblastic, integrated, terminal, denticulate, pale brown. Conidia rhombic or biconic, hyaline to pale olivaceous brown, with a hyaline, transverse band in the widest part and a prominent denticle at base, 13.4–20 × 8.3–11.7 µm.

Specimen examined: on dead leaves of *Clusia* sp. Pompano Beach, Broward, Florida, G. Delgado, November, 2004 (BPI 877791A).

Initially described within the genus *Pseudobeltrania* (Holubova-Jechova, 1987), this foliicolous hyphomycete has been widely collected in the island of Cuba, the type locality, always associated with dead, even submerged leaves of *Clusia* spp. (Delgado et al., 2003; Delgado and Mena-Portales, 2004a,b;

Matsushima, 1987). Only Heredia and Reyes (1999) recorded a specimen on dead leaves of *Quercus xalapensis* Humb. & Bonpl. from Mexico, with rough conidiophores and less wider conidia (5–7 μm). The Florida specimen is morphologically very similar to the original description but conidia are slightly wider than those of the type specimen (8–9.5 (–10 μm). The present collection is the second time this fungus is recorded outside the type locality, again on dead leaves of a *Clusia* species, showing a marked affinity for this substrate.

Canalisporium caribense (Hol.-Jech. & Mercado) Nawawi & Kuthub., *Mycotaxon* 34 (2):479, 1989. Figs. 1–3.

≡ *Berkleasium caribense* Hol.-Jech. & Mercado, *Ceská Mycol.* 38:99, 1984.

Sporodochia scattered, granular, black. Conidia broadly obclavate to obpyriform in face view, flattened, smooth, muriform, with a single vertical septa and 3–5 transverse septa, pale brown to brown, septa darkly pigmented, 9–11 cells per conidium, 21.6–31.2 μm \times 16.8–19.2 μm wide.

Specimens examined: on rachis and petiole of dead leaves of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Florida, *G. Delgado*, October 29, 2004 (BPI 877792B, 877807B, 877810B).

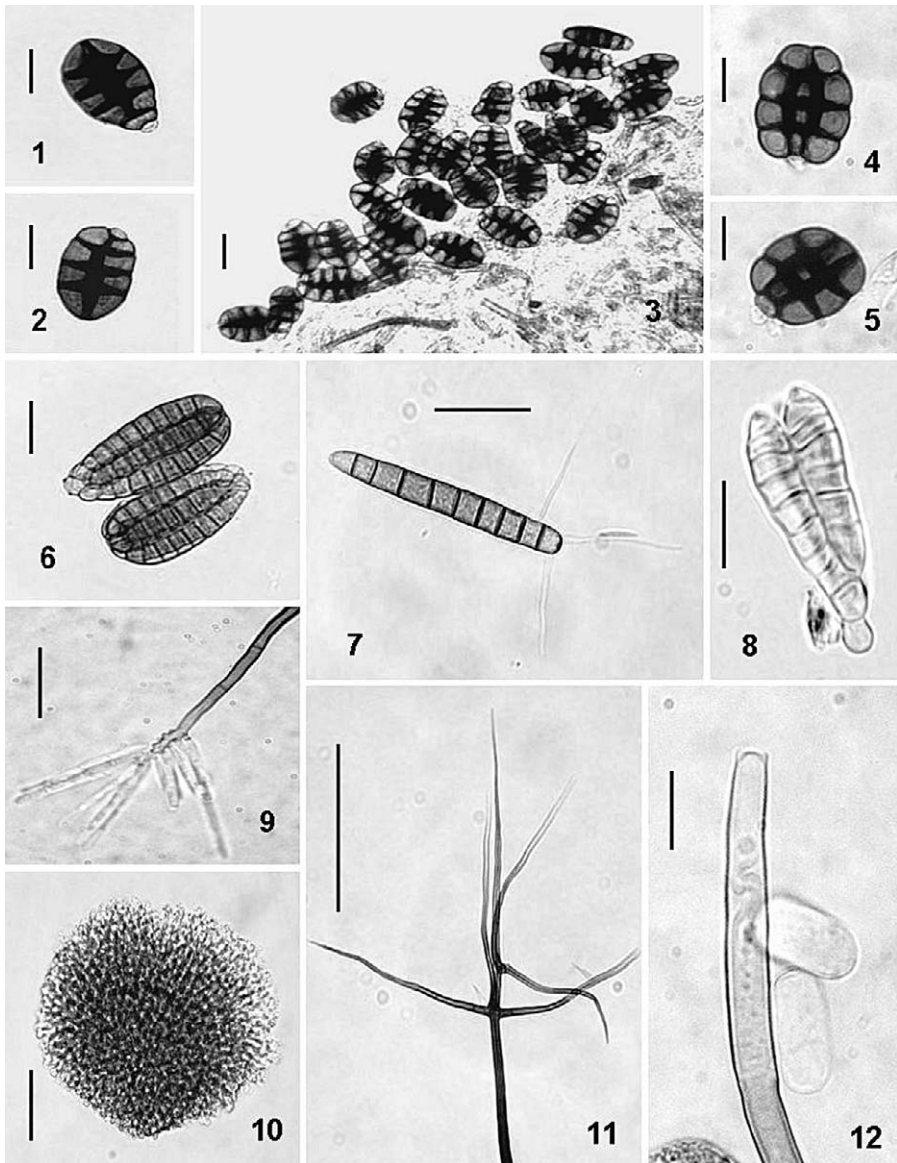
Holuvoba-Jechova and Mercado-Sierra (1984) originally described this fungus as *Berkleasium caribense* on rotten wood from Cuba. Later, Nawawi and Kuthubutheen (1989) erected the genus *Canalisporium* to accommodate this and two other lignicolous taxa having black, punctiform, non-stromatic sporodochia, and muriform, complanate, brown conidia with transverse and longitudinal rows of highly pigmented septa and remarkable pore-like canals connecting conidial lumina. *C. caribense* is easily distinguished by the presence of a single column of vertical septa and 3 to 6 equally spaced rows of transverse septa (Goh et al., 1998). According to the known distribution, this fungus appears to be widespread (McKenzie and Hyde, 1997), mainly in tropical areas, been previously recorded on rotten, submerged wood or decaying parts of palms and other monocotyledons from Brunei, Cuba, Hong Kong, India, Kenya, Malaysia, Mexico, Panama, Philippines, Taiwan, Thailand, Uganda and Vanuatu (Bussaban et al., 2001; Ferrer and Shearer, 2005; Goh et al., 1998; Heredia et al., 1997). Recently Czegzuga and co-workers (2006) found it growing on submerged birch nuts in a temperate water body in Poland.

Canalisporium pulchrum Nawawi & Kuthub., *Mycotaxon* 23:325, 1985. Figs. 4–5.

≡ *Berkleasium pulchrum* Hol.-Jech. & Mercado, *Ceská Mycol.* 38:101, 1984.

Specimens examined: on rachis of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877807E).

This is the second report of this species from North America, previously collected from the Great Smoky Mountains National Park (Ferrer and Shearer, 2005). The conidia of *C. pulchrum* are distinct in having 2 columns of vertical septa and 4 to 6 rows of transverse septa (Goh et al., 1998).



FIGS. 1-3. *Canalisporium caribense* (BPI 877792B). 1, 2. Conidia. Scale bar = 10 μ m. 3. Sporodochia. Scale bar = 15 μ m.

FIGS. 4-5. *Canalisporium pulchrum* (BPI 877807E). Conidia. Scale bar = 10 μ m.

FIG. 6. *Dictyosporium subramanianii* (BPI 877792E). Conidia. Scale bar = 10 μ m.

FIG. 7. *Camposporium antennatum* (BPI 877798C). Conidium. Scale bar = 20 μ m.

FIG. 8. *Dictyosporium micronesicum* (BPI 877807F). Conidium. Scale bar = 10 μ m.

FIG. 9. *Anungitea fragilis* (BPI 877790D). Conidiophore, conidiogenous cell and conidia. Scale bar = 10 μ m.

FIG. 10. *Candelabrum brocchiatum* (BPI 877792C). Conidial propagule. Scale bar = 50 μ m.

FIG. 11. *Gyrothrix verticillata* (BPI 877798B). Seta. Scale bar = 50 μ m.

FIG. 12. *Dischloridium laeense* (BPI 877794). Conidiogenous cell and conidia. Scale bar = 10 μ m.

Candelabrum brocchiatum Tubaki, *Trans. Mycol. Soc. Japan* 16:134, 1975. Fig. 10.

Specimens examined: on petiole of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792C, 877810C).

The genus *Candelabrum* Bowerw. currently includes six species of aero-aquatic fungi characterized by two main morphological characters such as a repeatedly dichotomously branched conidial body in combination with distinctly verrucose end lobes, although sometimes trichotomous branching is present in *C. brocchiatum* (Voglmayr, 1998). This fungus has been previously collected in North America on submerged wood from a freshwater cypress-tupelo swamp in Illinois (Shearer and Crane, 1986) and is recorded here for the first time from Florida. Our specimen was detected growing on rachides and petioles of the tropical palm *Drymophloeus pachycladus* (Burret) H.E. Moore, a terrestrial, non submerged substrate, but many other species of primarily aero-aquatic fungi frequently show this behavior (Voglmayr, 1998).

Circinotrichum papakurae S. Hughes & Piroz., *New Zeal. J. Bot.* 9:40, 1971. Fig. 21.

Colonies effuse, velvety, grayish brown. Setae erect, straight, septate, unbranched, brown, smooth, arising from a swollen, thick walled basal cell, up to 357.6 μm long, 2.5–3.3 μm wide, tapering to an acute, paler apex less than 1 μm wide. Conidiogenous cells polyblastic, discrete, obclavate to lageniform, subhyaline. Conidia fusiform, straight or slightly falcate, the free apex corniform, aseptate, hyaline, smooth, 11.6–18.3 \times 1.67 μm .

Specimen examined: on dead leaves of unknown plant. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877790B).

Among species of *Circinotrichum* Nees ex Pers. with straight, sterile setae, *C. papakurae* can be distinguished by the presence of acute, less robust setae and straight, corniform at the apex conidia lacking appendages (Kirk, 1981; Sutton, 1980). After comparison with previous collections of this fungus from New Zealand (Hughes and Pirozynski, 1971), Cuba (Mercado-Sierra and Mena-Portales, 1986) and Mexico (Heredia et al., 1997), the Florida specimen has the largest setae among them (up to 150 μm , 235 μm and 40 μm long respectively). Conidia are also slightly larger compared to the type specimen from New Zealand (11–17 μm long). This is the first report of *C. papakurae* in continental United States, been previously recorded from Hawaii (Farr et al., undated), and also associated with leaf litter and fallen leaves of different plants and palms from India, Ivory Coast, Sardinia and Singapore (Herb. IMI online, undated; Rambelli et al., 2004; Pasqualetti et al., 2005; Taylor and Hyde, 2003).

Dictyosporium micronesicum Matsush., *Matsush. Mycol. Mem.* 2:8, 1981. Fig. 8.

Colonies sporodochia-forming, brown. Conidia not complanate, ellipsoidal, light brown, 23.3–31.7 (–36.7) \times 10–12.5 μm , consisting of 3 closely appressed rows of 6–8 thick-walled cells, 2.5–3.3 \times 5–5.8 (–7.5) μm ; basal cell subconical, 5–6.6 \times 5–5.8 μm .

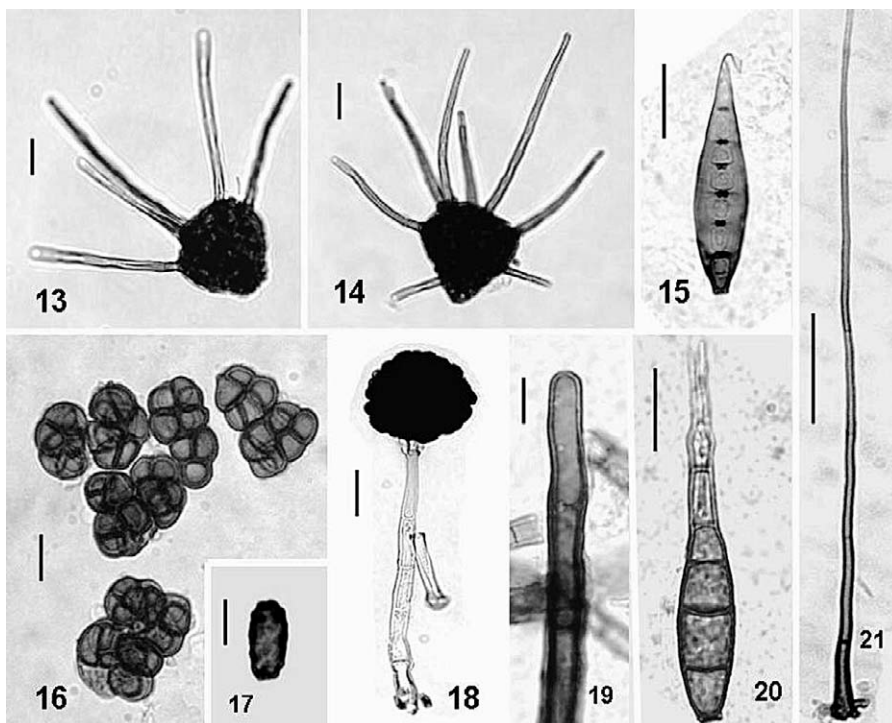


FIG. 13–14. *Piricauda cochiniensis* (BPI 877808A). Conidia. Scale bar = 10 μ m.

FIG. 15. *Ellisembia brachypus* (BPI 877793B). Conidium. Scale bar = 20 μ m.

FIG. 16. *Trimmatostroma betulinum* (BPI 877808D). Conidia. Scale bar = 10 μ m.

FIG. 17–18. *Stachybotrys dichroa* (BPI 877810H). 17. Conidium. Scale bar = 5 μ m. 18.

Conidiophore with conidial head. Scale bar = 20 μ m.

FIG. 19–20. *Helminthosporium foveolatum* (BPI 877805A). 19. Apex of a conidiophore. Scale

bar = 10 μ m. 20. Conidium. Scale bar = 20 μ m.

FIG. 21. *Circinotrichum papakurae* (BPI 877790B). Seta. Scale bar = 50 μ m.

Specimen examined: on rachis of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, G. Delgado, October 29, 2004 (BPI 877807F).

The genus *Dictyosporium* Corda is characterized by usually forming compact sporodochia or rarely effuse colonies, micronematous or absent conidiophores, discrete, doliiform or subspherical conidiogenous cells arising directly from the hyphae, and holoblastic, solitary, multiseptate, cheiroid conidia composed of multiple columns of cells, that rhexolytically secede from the conidiogenous cell (Goh et al., 1999). Arambarri and co-workers (2001) distinguish two different groups of conidia within *Dictyosporium* species: a group with cell rows arranged in one plane (complanate), and a second group with cells rows arranged in two or more planes (non complanate). Among the latter, *D. micronesicum* is distinct in having conidia usually comprising 3 rows of tightly appressed cells not embedded in a gelatinous matrix. Initially described on a decaying leaf of *Calophyllum inophyllum* L. from Micronesia

and *Cocos nucifera* L. from Guam (Matsushima, 1981), it has been recorded also on unidentified rotten leaves from Brazil and Cuba (Castaneda-Ruiz et al., 1997, 2003a) and on a rotten leaf of *Theobroma cacao* L. from Venezuela (Castaneda-Ruiz et al., 2003b). The Florida specimen has conidia slightly larger than those of the type specimen from Micronesia (20–30 µm long).

Dictyosporium subramanianii B. Sutton, *Proc. Indian Acad. Sci. (Plant. Sci.)* 94:239, 1985. Fig. 6.

= *Dictyosporium intermedium* Subram., *Hyphomycetes, an account of Indian species*:487, 1971.

Colonies sporodochia-forming, brown. Conidia not complanate, ellipsoidal, brown, paler toward the base, consisting of 5–7 rows of cells incurved at the apex, 36–43.2 × 14.4–18.3 µm; basal cell conical 4–6.6 µm.

Specimen examined: on rachis and petioles of dead leaves of *Bactris gasipaes* Kunth and *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792E, 877807C, 877808C, 877810D).

Originally described without Latin description as *Dictyosporium intermedium* Subram., this species was renamed later as *D. subramanianii* based on a specimen collected on wood of *Eucalyptus globulus* Labill. from India (Sutton, 1985). Among accepted species of the genus, *D. subramanianii* is morphologically similar to *D. heptasporum* (Garov.) Damon, the type species, but the latter has larger conidia (50–80 × 20–30 µm). Mainly known from tropical countries, it has been previously recorded in mainland China, Costa Rica, Cuba, India, Mexico, Peru, Thailand (Goh et al., 1999), Taiwan (Chen and Tzean, 1999) and now from the subtropical region of Florida, USA.

Dischloridium laeense (Matsush.) B. Sutton, *Kavaka* 4:47, 1976. Fig.12.

≡ *Chloridium laeense* Matsush., *Bull. Nat. Sci. Mus. Tokyo* 14(3):462, 1971.

Conidiophores mainly grouped in compact fascicles arising from an immerse stromata, sometimes solitary, straight or flexuous, dark brown, paler toward the apex, often proliferating percurrently, up to 575 µm long, 6.7–7.5 µm wide. Conidiogenous cells phialidic, integrated, terminal, hyaline to light brown, 61.8–70.1 (–90.1) × 5.8–8.3 µm, with inconspicuous collarettes. Conidia cylindrical or ellipsoidal, aseptate, hyaline, gutulate, slightly truncate at base, 16.7–20.8 × 8.3–10.8 µm.

Specimen examined: on dead stems of *Carludovica drudei* Mast. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877794).

This phialidic hyphomycete was initially described as *Chloridium laeense* on a rotten leaf of a broadleaf tree in Papua-New Guinea (Matsushima, 1971). Bhat and Sutton (1985) extensively discussed the taxonomy of this fungus, the type species of the genus *Dischloridium* B. Sutton. This is a common hyphomycete in tropical and subtropical areas, been previously collected growing on a wide variety of plants as lignicolous or foliicolous (Mercado-Sierra et al., 1997; Heredia et al., 2004), and is recorded here for the first time from the USA. The presence of an immerse stromata, on which fasciculate conidiophores develop, was detected in our collection. However, Kirk (1986) as

well as Cooper (2005) mentioned that this characteristic often appears to be absent, and the conidiophores of the England and New Zealand collections were solitary, non fasciculate, arising directly from the immerse mycelium.

Gyrothrix verticillata Piroz., *Mycol. Pap.* 84:23, 1962. Fig. 11.

Setae erect, straight, light brown to brown, septate, smooth, sparingly branched, up to 177 μm long, 3.3–4.2 μm at base, tapering to 0.5 μm width; branches verticillate, in whorls of 3 to 4, horizontal, straight, slender. Conidiogenous cells flask-shaped, hyaline, 6.7–8 \times 3.3–5 μm . Conidia cylindrical to fusiform, straight or somewhat curved, corniform at the free apex, obtuse at base, aseptate, hyaline, smooth, 11.7–15 \times 1.7 μm .

Specimen examined: on dead leaves of unidentified plant. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877798B).

The presence of typically branched, smooth, slender and never circinate or spirally coiled setae, with straight branches in 1 or 2 whorls of 3 or 4 arising at right angles to the vertical axis, distinguish *G. verticillata* from other *Gyrothrix* species (Pirozynski, 1962). Simple, unbranched setae with nodose swellings were detected in the Florida specimen, a feature mentioned in Pirozynski's original description. Kirk (1981) speculated about the possibility to unite *Circinotrichum britannicum* P. M. Kirk and *G. verticillata*, on the basis of the variability in branching of both taxa. However, setae in *Circinotrichum* are never branched and nodose swellings in *G. verticillata* indicate where branches arise in young, not completely developed setae. This is the first report of this fungus in North America, initially described on dead stems of *Urtica dioica* L. in England and fallen leaves of *Khaya anthotheca* (Welw.) C. DC. from Sierra Leone (Pirozynski, 1962). A search of computerized specimens deposited in IMI and BPI show further records in Argentina, Australia, China, India, Ireland and Spain (Farr et al., undated; HerbIMI on-line, undated).

Helminthosporium foveolatum Pat., *J. Bot.* 5:32, 1891. Figs.19–20.

≡ *Corynespora foveolata* (Pat.) S. Hughes, *Can. J. Bot.* 36:757, 1958.

Specimen examined: on dead stems of *Bambusa multiplex* (Lour.) Rausch. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877805A).

Morgan-Jones and Sinclair (1978) first recorded this fungus in North America as *Corynespora foveolata* (Pat.) S. Hughes, growing on culms of *Bambusa* sp. from Alabama. They described the conidiogenous cells as monotretic and terminal, even their drawing picture showed only a terminal pore at the apex of the conidiophore. However, the Florida collection is distinctively polytretic as in *Helminthosporium* Link ex Fries, with terminal and lateral pores on the apical and subapical conidiogenous cells. Hughes (1978), after closer examination of a specimen collected on dead stems of *Phyllostachys* sp. in New Zealand, also found that the terminal cell of the conidiophores had 5 to 8 scattered pores in the lateral wall and reverted his previous combination in *Corynespora* (Hughes, 1958) to the original name of Patouillard in *Helminthosporium*, reversal kept here for our specimen.

Piricauda cochinchensis (Subram.) M.B. Ellis, *More Dematiaceous Hyphomycetes*, Kew:367, 1976. Figs.13–14.

≡ *Petrakia cochiniensis* Subram., *Sydowia* 1:15, 1957.

Conidia obconical, pyriform, obpyriform or variable in shape, muriform, golden brown to dark brown, truncate and verruculose at base, $33.4\text{--}57.6 \times 21.6\text{--}45.6 \mu\text{m}$, with 3–8 septate, smooth, brown appendages arising from all over the conidial surface, $24\text{--}112.8 \times 2.4\text{--}6 \mu\text{m}$.

Specimen examined: on petioles of dead leaves of *Bactris gasipaes* Kunth. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, G. Delgado, October 29, 2004 (BPI 877808A).

Piricauda cochiniensis is easily recognizable by the presence of mostly obconic to pyriform, dark brown conidia with several long appendages, and is considered common on palms from tropical areas (Mercado-Sierra et al., 2005). The Florida specimen is smaller in conidial size and has a less number of appendages compared with the description provided by Ellis (1976) for a specimen collected on dead spathes of *Cocos nucifera* L. from India (30–70 μm length and up to 15 appendages). The present collection was found growing on dead petioles of *Bactris gasipaes* Kunth., the peach palm, confirming that the host range of this fungus seems to be restricted to this group of monocotyledons (Taylor and Hyde, 2003).

Stachybotrys dichroa Grove, *J. Bot. Lond.* 24:201, 1886. Figs.17–18.

Specimen examined: on petiole of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, G. Delgado, October 29, 2004 (BPI 877810H).

Among species of *Stachybotrys* Corda with hyaline conidiophores, *S. dichroa* can be distinguished by the presence of ellipsoidal to cylindrical, olivaceous brown to black, verruculose conidia, often obliquely attenuated at the base and gathered in a black, slimy and shiny head around the apex of smooth phialides (Ellis, 1971; Hughes, 1978). To my knowledge, only a specimen deposited in IMI without further collection data (IMI Number=55300) (HERB IMI on-line, undated) shows that this species occurs in the United States. The present collection is thereby the second report of its occurrence in USA.

Trimmatostroma betulinum (Corda) S. Hughes, *Can. J. Bot.* 31:628, 1953. Fig. 16.

≡ *Coniothecium betulinum* Corda, *Icones Fungorum* 1:32, 1837.

Specimen examined: on petioles of dead leaves of *Bactris gasipaes* Kunth. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, G. Delgado, October 29, 2004 (BPI 877808D).

The Florida specimen is clearly conspecific with *T. betulinum* in having a large stromatic, sporodochial conidiomata and extremely variable in shape, smooth or verruculose, pale to mid brown, irregularly septate conidia developed in poorly defined basipetal chains (Ellis, 1971). This species has been collected several times in Europe and associated with *Betula* sps. in Canada (Bogomolova and Minter, 2003; Sutton, 1973), suggesting that this fungus commonly occurs at temperate latitudes. However, only IMI records a specimen associated with *Populus tremuloides* Michx. from the United States (IMI Number=166290) (HERB IMI on-line, undated).

ADDITIONAL WIDELY DISTRIBUTED SPECIES COLLECTED FROM SOUTHEAST FLORIDA:

Beltrania rhombica Penz., *Nuov. Giorn. Bot. Ital.* 14:73, 1882.

Specimen examined: on dead leaves of unknown plant. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877790A).

Beltraniella portoricenis (F. Stevens) Piroz. & Patil, *Can. J. Bot.* 48:575, 1970.

Specimen examined: on dead leaves of *Clusia* sp. and unknown plant. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877790C, 877791B).

Brachysporiella gayana Bat., *Bol. Sec. Agric. Ind. Com. Est. Pernambuco* 19:109, 1952.

Specimens examined: on petiole of dead leaves of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792A, 877810G).

Camposporium antennatum Harkn., *Bull. Calif. Acad. Sci.* 1:37, 1884. Fig. 7.

Specimen examined: on petiole of dead leaves of *Drymophloeus pachycladus* (Burret) H. E. Moore, and dead wood. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792G, 877810F, 877809D); on dead leaves of unidentified plant, bract fragment of dead inflorescence and sheath fragment of dead leaf of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877798C, 877793C, 877801C).

Dendryphiella vinosa (Berk. & M. A. Curtis) Reis., *Bull. Trimest. Soc. Mcol. Fr.* 84:28, 1968.

Specimen examined: on petioles of dead leaves of *Bactris gasipaes* Kunth. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877809D).

Diplocladiella scalaroides G. Arnaud ex M.B. Ellis, *More Dematiaceous Hyphomycetes*:229, 1976.

Specimens examined: on petiole of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792F).

Ellisemia brachypus (Ellis & Everh.) Subram., *Proc. Indian Nat. Sci. Acad.* B 58:183, 1992. Fig. 15.

Specimen examined: on bract fragment of dead inflorescence and sheath fragment of dead leaf of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877793B, 877801B).

Endocalyx melanoxanthus (Berk. & Br.) Petch, *Ann. Bot.* 22: 390, 1908.

Specimen examined: on peduncle of dead inflorescence of *Wodyetia bifurcata* Irvine and rachis of dead leaf of *Roystonea borinquena* O. F. Cook. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877796, 877795A).

Gyrothrix circinata (Berk. & M. A. Curtis) S. Hughes, *Can. J. Bot.* 36:771, 1958.

Specimen examined: on spathe of dead inflorescence of *Wodyetia bifurcata* Irvine and dead stems of *Philodendron* sp. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877800, 877799); on rachis of dead leaf of unknown palm, on dead leaves of unidentified plant and on bract fragment of dead inflorescence of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877797, 877798A, 877801A).

Helicoma muelleri Corda, *Icones Fungorum* 1:15, 1837.

Specimens examined: on dead rotten trunk Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877802, 877803A).

Helicosporium griseum Berk. & M. A. Curtis, *Grevillea* 3:51, 1874.

Specimens examined: on petiole of dead leaves of *Drymophloeus pachycladus* (Burret) H. E. Moore, and unknown palm. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877792D, 877807D, 877810E, 877804A).

Phaeoisaria clematidis (Fuckel) S. Hughes, *Can. J. Bot.* 36:795, 1958.

Specimens examined: on rachis of dead leaf of *Drymophloeus pachycladus* (Burret) H. E. Moore. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877807A).

Pithomyces maydicus (Sacc.) M. B. Ellis, *Mycol. Pap.* 76:15, 1960.

Specimen examined: on dead wood. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877809C).

Pithomyces sacchari (Speg.) M. B. Ellis, *Mycol. Pap.* 76:17, 1960.

Specimen examined: on dead leaves of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877811D).

Spegazzinia deightonii (S. Hughes) Subram., *J. Indian Bot. Soc.* 35:78, 1956.

Specimen examined: on rachis and petiole of dead leaf of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877806B).

Spegazzinia tessarthra (Berk. & M. A. Curtis) Sacc., *Syll. Fung.* 4:758, 1886.

Specimen examined: on petioles of dead leaves of *Drymophloeus pachycladus* (Burret) H. E. Moore and dead wood. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877810A, 877809A); on dead leaves of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877811A).

Tetraploa aristata Berk. & Br., *Ann. Mag. Nat. Hist.* 2,5:459, 1850.

Specimen examined: on petioles of dead leaves of *Bactris gasipaes* Kunth. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877808E); on dead leaves of *Sabal* sp. and fragment of dead trunk. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877811C).

Torula herbarum (Pers.) Link f. *quaternella* Sacc., *Ann. Mycol.* 11:556, 1913.

Specimen examined: on rachis of dead leaf of *Roystonea borinquena* O. F. Cook, unknown palm and dead wood. Fairchild Tropical Botanic Garden, Coral Gables, Miami Dade, Florida, *G. Delgado*, October 29, 2004 (BPI 877795B, 877804B, 877809B); on dead leaves of *Sabal* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877811B).

Zygosporium masonii S. Hughes, *Mycol. Pap.* 44: 15, 1951.

Specimen examined: on dead leaves of *Tillandsia* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877812A).

Zygosporium oscheoides Mont., *Ann. Sci. Nat. ser. 2*, 77:121, 1842.

Specimen examined: on dead leaves of *Tillandsia* sp. Pompano Beach, Broward, Florida, *G. Delgado*, November, 2004 (BPI 877812B).

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LITERATURE CITED

- ARAMBARRI, A. M., M. N. CABELLO, AND M. C. CAZAU. 2001. *Dictyosporium triramosum*, a new hyphomycete from Argentina. *Mycotaxon* 78:185–189.
- BHAT, D. J. AND B. C. SUTTON. 1985. Some 'phialidic' hyphomycetes from Ethiopia. *Trans. Br. Mycol. Soc.* 84:723–730.
- BOGOMOLOVA, E. V. AND D. W. MINTER. 2003. *Trimmatostroma betulinum*. IMI Description of Fungi and Bacteria No. 1560, 1–2.
- BUSSABAN, B., S. LUMYONG, P. LUMYONG, E. H. C. MCKENZIE, AND K. D. HYDE. 2001. A synopsis of the genus *Berkleasium* with two new species and new records of *Canalisporium caribense* from Zingiberaceae in Thailand. *Fungal Div.* 8:73–85.
- CASTANEDA-RUIZ, R. F., J. GUARRO, AND J. CANO. 1997. Notes on conidial fungi XII. New or interesting hyphomycetes from Cuba. *Mycotaxon* 63:169–181.
- , ———, S. VELAZQUEZ-NOA, AND J. GENE. 2003a. A new species of *Minimelanolocus* and some hyphomycete records from rain forests in Brazil. *Mycotaxon* 85:231–239.
- , T. ITURRIAGA, D. W. MINTER, M. SAIKAWA, G. VIDAL, AND S. VELAZQUEZ-NOA. 2003b. Microfungi from Venezuela. A new species of *Brachydesmiella*, a new combination, and new records. *Mycotaxon* 85:211–229.
- CHEN, J. L. AND S. S. TZEAN. 1999. Three species of *Dictyosporium* from Taiwan. *Fungal Sci.* 14(3,4):105–109.
- COOPER, J. A. 2005. New Zealand hyphomycete fungi: additional records, new species, and notes on interesting collections. *New Zeal. J. Bot.* 43:323–349.
- CZECZUGA, B., E. MUSZYNSKA, A. GODLEWSKA, B. MAZALSKA, M. KOZLOWSKA, AND A. ZUBRZYCKA. 2006. Aquatic fungi and fungus-like organisms growing on drifting in water nuts of seven birch species. *Mycol. Balc.* 3:47–54.

- DELGADO, G. AND J. MENA-PORTALES. 2004a. Hifomicetes aero-acuáticos e ingoldianos de la Reserva de la Biosfera Sierra del Rosario (Cuba). *Bol. Soc. Micol. Madrid* 28:105–113.
- AND ———. 2004b. Hifomicetos (Hongos Anamórficos) de la Reserva Ecológica “Alturas de Banao” (Cuba). *Bol. Soc. Micol. Madrid* 28:115–124.
- , ———, AND A. MERCADO-SIERRA. 2003. Nuevos registros de Hifomicetos (Hongos Anamórficos) en las Alturas de Trinidad (Cuba). *Bol. Soc. Micol. Madrid* 27:253–257.
- DYKO, B. J. AND B. C. SUTTON. 1979. New and interesting dematiaceous Hyphomycetes from Florida. *Mycotaxon* 8:123–132.
- ELLIS, M. B. 1971. Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, UK.
- . 1976. More Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, UK.
- FARR, D. F., A. Y. ROSSMAN, M. E. PALM, AND E. B. MCCRAY. undated. Fungal Databases, Systematic Botany & Mycology Laboratory, ARS, USDA. (<http://nt.ars-grin.gov/fungalatabases/>). (Last accessed February, 2007).
- FELL, J. W. AND I. L. HUNTER. 1979. Fungi associated with the decomposition of the black rush, *Juncus roemerianus*, in South Florida. *Mycologia* 71:320–342.
- FERRER, A. AND C. A. SHEARER. 2005. New records and a new species of *Canalisporium* from aquatic habitats in Panama. *Mycotaxon* 93:179–188.
- GOH, T., K. D. HYDE, W. H. HO, AND YANNA. 1999. A revision of the genus *Dictyosporium*, with descriptions of three new species. *Fungal Div.* 2:65–100.
- , W. H. HO, K. D. HYDE, S. R. WHITTON, AND T. E. UMALI. 1998. New records and species of *Canalisporium* (Hyphomycetes), with a revision of the genus. *Can. J. Bot.* 76:142–152.
- HERB IMI on-line. undated. CABI Bioscience Databases (<http://194.203.77.76/herbIMI/>). (Last accessed February 2007).
- HEREDIA, G., A. MERCADO-SIERRA, AND J. MENA-PORTALES. 1995. Conidial fungi from leaf litter in a mesophilic cloud forest of Veracruz, Mexico. *Mycotaxon* 55:473–490.
- , J. MENA-PORTALES, AND A. MERCADO-SIERRA. 1997. Hyphomycetes saprobios tropicales. Nuevos registros de Dematiáceos para México. *Rev. Mex. Micol.* 13:41–51.
- AND M. REYES. 1999. Hongos conidiales de bosque mesófilo: algunas especies foliícolas y de la hojarasca desconocidas para México. *Rev. Mex. Micol.* 15:79–88.
- , ———, AND R. M. ARIAS. 2004. Adiciones al conocimiento de la diversidad de los hongos conidiales del bosque mesófilo de montaña del estado de Veracruz. *Acta Bot. Mex.* 66:1–22.
- HOLUBOVÁ-JECHOVÁ, V. 1987. Studies on Hyphomycetes from Cuba V. Six new species of dematiaceous Hyphomycetes from Havana Province. *Česká Mykol.* 41:29–36.
- AND A. MERCADO-SIERRA. 1984. Studies on Hyphomycetes from Cuba II. Hyphomycetes from the Isla de la Juventud. *Česká Mykol.* 38:96–120.
- HUGHES, S. J. 1958. Revisions hyphomycetum aliquot cum appendice de nominibus rejiciendis. *Can. J. Bot.* 36:727–836.
- . 1978. New Zealand Fungi 25. Miscellaneous species. *New Zeal. J. Bot.* 16:311–370.
- AND K. A. PIROZYNSKI. 1971. New Zealand Fungi 15. *Beltraniella*, *Circinotrichum* and *Gyrothrix* (Syn. *Peglionia*). *New Zeal. J. Bot.* 9:39–45.
- KIRK, P. M. 1981. New or interesting microfungi III. A preliminary account of microfungi colonizing *Laurus nobilis* leaf litter. *Trans. Br. Mycol. Soc.* 77:457–473.
- . 1986. New or interesting microfungi XV. Miscellaneous Hyphomycetes from the British Isles. *Trans. Brit. Mycol. Soc.* 86:409–428.
- , P. F. CANNON, J. C. DAVID, AND J. A. STALPERS. 2001. *Ainsworth & Bisby's Dictionary of the Fungi*. CAB International, Wallingford, UK.
- MATSUSHIMA, T. 1971. Microfungi of the Solomon Islands and Papua-New Guinea. Published by the author, Kobe, Japan.
- . 1981. *Matsushima Mycological Memories 2*. Published by the author, Kobe, Japan.
- . 1987. *Matsushima Mycological Memories 5*. Published by the author, Kobe, Japan.

- McKENZIE, E. H. C. AND K. D. HYDE. 1997. Microfungi on Pandanaceae. Pp. 157–177. *In*: K. D. HYDE (ed.), Biodiversity of Tropical Microfungi. Hong Kong University Press, Hong Kong, PRC.
- MERCADO-SIERRA, A., J. GUARRO, AND G. HEREDIA. 2005. The hyphomycete genus *Piricauda*, with the description of a new species. *Mycol. Res.* 109:723–728.
- AND J. MENA-PORTALES. 1986. Hifomicetes de Topes de Collantes, Cuba I. Especies holoblasticas. *Acta Bot. Hung.* 32:189–205.
- , V. HOLUBOVA-JECHOVA, AND J. MENA-PORTALES. 1997. Hifomicetes demaciaceos de Cuba. Enteroblasticos. Museo Regionale di Scienze Naturali, Torino, Italy.
- MORGAN-JONES, G. AND R. C. SINCLAIR. 1978. Fungi of Alabama VII. Dematiaceous hyphomycetes. *J. Alab. Acad. Sci.* 49:1–15.
- NAWAWI, A. AND A. J. KUTHUBUTHEEN. 1989. *Canalisporium*, a new genus of lignicolous Hyphomycetes from Malaysia. *Mycotaxon* 34:475–487.
- PASQUALETTI, M., A. RAMBELLI, B. MULAS, AND S. TEMPESTA. 2005. Identification key and description of Mediterranean maquis litter microfungi. *Bocconea* 18:5–176.
- PIROZYNSKI, K. A. 1962. *Circinotricum* and *Gyrothrix*. *Mycol. Pap.* 84:1–28.
- RAMBELLI, A., B. MULAS, AND M. PASQUALETTI. 2004. Comparative studies on microfungi in tropical ecosystems in Ivory Coast forest litter: behavior on different substrata. *Mycol. Res.* 108:325–336.
- ROSSMAN, A. Y. 1997. Biodiversity of tropical microfungi: an overview. Pp. 1–10. *In*: K. D. HYDE (ed.), Biodiversity of Tropical Microfungi. Hong Kong University Press, Hong Kong, PRC.
- SHEARER, C. A. AND J. L. CRANE. 1986. Illinois Fungi XII. Fungi and myxomycetes from wood and leaves submerged in Southern Illinois swamps. *Mycotaxon* 25:527–538.
- SUTTON, B. C. 1973. Hyphomycetes from Manitoba and Saskatchewan, Canada. *Mycol. Pap.* 132:1–143.
- . 1978. New and interesting hyphomycetes from Tampa, Florida. *Mycologia* 70:784–801.
- . 1980. Microfungi from Australian leaf litter. *Proc. R. Soc. Qd* 91:11–19.
- . 1985. Notes on some deuteromycete genera with cheiroid or digitate brown conidia. *Proc. Indian Acad. Sci., Plant Sci.* 94:229–244.
- AND C. S. HODGES. 1978. *Eucalyptus* microfungi. *Chaetendophragmiopsis* gen. nov. and other hyphomycetes. *Nova Hedwigia* 29:593–607.
- TAYLOR, J. E. AND K. D. HYDE. 2003. Microfungi of Tropical and Temperate palms. Fungal Diversity Press, Hong Kong, PRC.
- VOGLMAYR, H. 1998. *Candelabrum desmidiaceum* and *Candelabrum clathrosphaeroides* spp. nov., additions and key to *Candelabrum*. *Mycol. Res.* 103:410–414.
- WALLACE, B. AND C. H. DICKINSON. 1978. Peat microfungi in three habitats in the Florida Everglades. *Mycologia* 70:1151–1163.

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