
New species of *Chaetosphaeria*, *Melanopsammella* and *Tainosphaeria* gen. nov. from the Americas

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Fernández, F.A. and Huhndorf, S.M. (2005). New species of *Chaetosphaeria*, *Melanopsammella* and *Tainosphaeria* gen. nov. from the Americas. *Fungal Diversity* 18: 15-57.

Ten new species of *Chaetosphaeria*, and one new species of *Melanopsammella* are described from North temperate and tropical America. The new genus *Tainosphaeria* is also described and *Chaetosphaeria capitata* is reported from the Neotropics for the first time. Seven different, distinctive anamorphs are reported and connected to *Chaetosphaeria* teleomorphs. The morphological diversity in anamorphs of *Chaetosphaeria* and its phylogenetic significance is discussed.

Key words: anamorph, *Chaetosphaeriaceae*, *Lasiosphaeriaceae*, *Sordariales*, *Striatosphaeria*, systematics, *Trichosphaeriaceae*, *Zignoëlla*.

Introduction

Chaetosphaeria Tul. and Tul. and related genera are common saprobic pyrenomycetous ascomycetes which reproduce on extensively decomposed plant substrates and are worldwide in distribution. Ascomata are very small (*ca.* 100-300 µm in diam.), superficial, glabrous or setose, and are commonly found on decorticated and highly decayed wood, at or in close proximity to the ground. In the tropics, any highly decomposed, lignin-containing substrate (logs, branches, twigs, wood fragments, palm petioles) supports the fruiting of these fungi.

Chaetosphaeria had been placed in the *Lasiosphaeriaceae* (Barr, 1990), and it is currently in the *Chaetosphaeriaceae* (Réblová *et al.*, 1999) in the newly introduced *Chaetosphaeriales* (Huhndorf *et al.*, 2004). Morphological characters in teleomorphs of *Chaetosphaeria* are relatively few and generally simple, whereas corresponding anamorphs are, relatively speaking, distinctive and morphologically diverse. These circumstances have led to an emphasis on

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morphological characters of the anamorphs in order to distinguish species in the genus (Gams and Holubová-Jechová, 1976). This in turn has resulted in species with clearly distinctive anamorphs but hardly distinguishable teleomorphs. However anamorph data for many species are still unavailable. Only 24 out of more than 100 *Chaetosphaeria* species described have been connected to anamorphs, either by association on the substrate and/or by cultural studies.

European and South temperate species of *Chaetosphaeria* have been studied in detail (Booth, 1957, 1958; Gams and Holubová-Jechová, 1976) and recent papers have treated new species of *Chaetosphaeria* (Réblová, 1998; Hyde *et al.*, 1999; Réblová and Gams, 1999; Huhndorf *et al.*, 2001; Réblová, 2000). Survey work in the neotropics indicates that species of *Chaetosphaeria* are common components of the local mycota (Huhndorf, 1997). Additionally, a few species have been described from Southeast Asia (Hyde *et al.*, 1999). Our specimen collecting at various locations in the United States, Central and South America, and the Caribbean has yielded several new taxa with placement in *Chaetosphaeria* and related genera.

Melanopsammella Höhn. was synonymized under *Chaetosphaeria* (Gams and Holubová-Jechová, 1976) and was later reinstated (Réblová *et al.*, 1999). It is characterized by small superficial ascomata with one-septate ascospores that disarticulate into part-spores and *Chloridium* Link *sensu stricto* anamorphs (Réblová *et al.*, 1999). It currently includes three species: *M. chloroconia* (W. Gams & Hol.-Jech.) Réblová, M.E. Barr & Samuels, *M. inaequalis* (Grove) Höhn. and *M. vermicularioides* (Sacc. & Roum.) Réblová, M.E. Barr & Samuels. *Chaetosphaeria preussii* W. Gams & Hol.-Jech. was originally included in the genus (Réblová *et al.*, 1999) but it was later found to have closer phylogenetic affinities to *Chaetosphaeria innumera* Berk. & Broome ex Tul. & C. Tul. (Réblová and Winka, 2000). A collection from Puerto Rico, identified as a species of *Chaetosphaeria*, was found to have phylogenetic affinities outside *Chaetosphaeria* based on analyses of DNA sequence data (Fernández *et al.*, unpublished). Microscopic observations indicate that this species produces an anamorph in culture with morphological features that can be distinguished from those found in *Chaetosphaeria* anamorphs. This taxon is therefore described as a new genus in the *Chaetosphaeriaceae*. All the new taxa here described produce anamorphs that have not been either connected to and/or reported for those two genera. Teleomorph-anamorphs connections on the substrate have been confirmed by culture studies for some of these new species.

Materials and methods

Ascomatal contents from specimens were extracted and spread onto water agar plates. After 24 hours, germinating single and/or multiple ascospores were cut out from the medium and transferred to cornmeal agar (CMA) and/or malt-extract agar (MEA) in 6 cm diam. petri plates, and incubated for 30 days at room temp. Data on colony morphology and colony growth rate were recorded for up to three weeks. Colonies were also observed with a dissecting microscope for growth and presence of reproductive structures, particularly anamorphs. Microscopic observations of morphological structures were also made from squash mounts of ascomata. Ascomata were sectioned at 5 μm for light microscopy using the techniques of Huhndorf (1991) and images were captured using bright field (BF), phase contrast (PH) and differential interference microscopy (DIC). Images were captured and photographic plates were produced following the methods of Huhndorf and Fernández (1998). Abbreviations for collectors are SMH = S.M. Huhndorf and FF = F. Fernández. When no collector is listed, the collector's initials are given with the specimen number. All SMH collections are deposited in the Field Museum Mycology Herbarium (F). Latitude and longitude are given in degrees or calculated decimal equivalents. All specimens were collected from decorticated wood unless otherwise noted and dimensions given for the substrates are diameters.

Results

Chaetosphaeria capitata Sivan. & H.S. Chang, Mycological Research 99: 711-716 (1995) (Figs. 1-20)

Ascomata globose to broadly ovoid, dark brown, 100-260 μm in diam., 150-500 μm in height, separate, scattered to gregarious, superficial on the substratum, papillate, with scattered setae, brown, multiseptate, 45-119 \times 5-8.5 μm , apex capitate, globose to subglobose, 6-14 μm . Yellow pruina covering apices of setae and surface of ascomata. *Ascomatal wall* opaque in surface view in water, of *textura angularis* in lactophenol; 15-25 μm thick in longitudinal section. *Ascomatal apex* papillate, short. *Paraphyses* sparse, simple, septate, 2.9-3.7 μm wide. *Asci* cylindrico-clavate, short-stalked, 130-170 \times 10.5-16.5 μm , unitunicate, thin-walled, with a distinctive apical ring, with 8 ascospores irregularly arranged. *Ascospores* fusiform, with rounded end cells, 48-100 \times 3-5 μm , sub-hyaline to light brown, 7-10 septate. *Culture*: Seven-day-old colonies of SMH 3239 on CMA 2 mm diam., beige, mycelium dense, floccose, aerial mycelium abundant as tufts, border even, fringed,

Figs. 1-20. *Chaetosphaeria capitata*. **1-4.** Ascomata on substrate. **5.** Longitudinal section through ascoma. **6.** Ascus. **7.** Apex of ascomal seta. **8.** Developing seta attached to ascomal wall. **9.** Section through ascomal wall. **10.** Section through ascomal neck. **11.** Ascus apex. **12-15.** Ascospores. **16.** Asci. **17.** Conidiophore on CMA. **18, 19.** Conidia on CMA. **20.** Paraphyses. Figs. 1-4 by photomicrography; Figs. 5-20 by DIC. Figs. 1, 2, 5-12, 15, 17-19 from SMH 3239; Figs. 3, 4, 13, 14, 16, 20 from holotype IMI 361488. Bars: 1-4 = 200 μm ; 5 = 20 μm ; 6-10, 12-20 = 10 μm ; 11 = 5 μm .

reverse off-white. Seven-day-old colonies on MEA 4 mm diam., beige, mycelium dense, floccose, aerial mycelium abundant as tufts, border even, fringed, slimy, reverse off-white. Three-week-old colonies on CMA 4 mm diam., white, mycelium dense, appressed, moist, aerial mycelium sparse, border uneven, fringed, reverse white. Conidiophores produced throughout the colony. Three-week-old colonies on MEA 8-12 mm diam., varying from pale gray to black, mycelium dense, cottony-funiculose, moist, aerial mycelium abundant, some isolates developing dark concentric zones, border even, effuse, reverse white/pale brown/black. *Conidiophores* on CMA, mononematous, macronematous, brown, with few septa, 87-117 \times 8-12 μm at the base, 10-12 at the apex. Conidiogenous cell a phialide, obclavate, proliferating percurrently, 72-100 \times 10-19 (base) 5.2-8.3 (apex) μm . *Conidia* on CMA cylindrical to cylindrico-clavate, brown, 3 septate, 19-24 \times 10-13 μm .

Anamorph: *Exserticlava vasiformis* (Matsush.) S. Hughes.

Habitat: On decorticated wood

Known distribution: Costa Rica, Puerto Rico, Taiwan.

Material examined: COSTA RICA, Guanacaste Province, Liberia ACG, Sector Santa María, Estación Biológica, trail to el Bosque Encantado, 750 m, [10.7647, -85.3033], 26 June 1997, 5 cm branch, SMH3239. PUERTO RICO, Caribbean National Forest, Luquillo Mts., El Verde Research Area, 16-ha Grid, 350 to 425 m, [18.3167, -65.8167], 5 October 1995, on 1 cm branch, SMH1766.1. TAIWAN. Taichung: Puli, 18 January 1994, on undetermined rotting wood, H.S. Chang (IMI 361488, holotype).

***Chaetosphaeria chlorotunicata* F.A. Fernández & Huhndorf, sp. nov.**

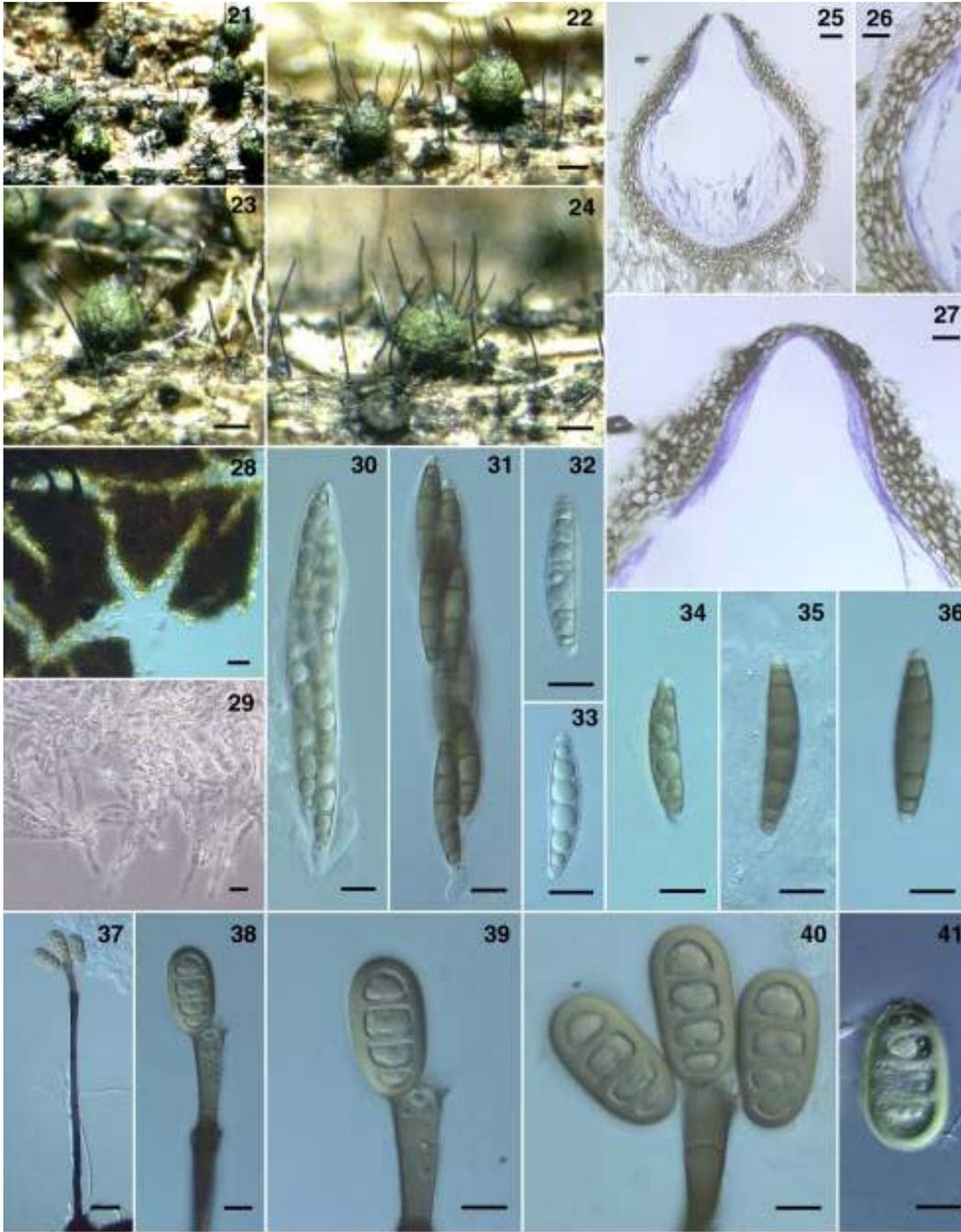
(Figs. 21-41)

Etymology: Refers to the outer coating of ascomata.

Ascomata ovoidea, tunica viride vel griseo-brunnea, 230-407 μm diam., 294-463 μm alta, separata, superficialia, setae sparsis ascomatis brunnea multiseptatae, 135-200 \times 5-7.5 μm ad base, 2.5-3 μm decrescens apicem acutatis. *Paries ascomatis* cum aspectu superficialis opacus, sectione longitudinali 13-20 μm crassus, cellulis pseudoparenchymatis, stratum superficialis 4-10 μm latus. Apicem ascomatis papillatis. *Paraphyses* simplices, septatae, hyalinae, 2-3 μm latae. *Asci* cylindrici, 97-127 \times 13-18 μm , octospori. *Ascospores* cylindricae vel fusiformes, 27-62 \times 6-9.5 μm , 7-septatae, interdum 9-septatae, avec cellulas medias brunneas et cellulas terminales hyalinas.

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Figs. 21-41. *Chaetosphaeria chlorotunicata*. **21-24.** Ascomata on substrate. **25.** Longitudinal section through ascoma. **26.** Section through ascomal wall. **27.** Section through ascomal neck. **28.** Pieces of the ascomal wall showing the outer coating. **29.** Paraphyses. **30.** Young ascus. **31.** Mature ascus. **32-36.** Ascospores. **37.** Conidiophore on CMA. **38, 39.** Conidium attached to a phialide. **40.** Conidia and a phialide. **41.** Conidium showing basal hilum (arrow). Figs. 21-24 by photomacrography; Figs. 25-28, 30-41 by DIC; Fig. 29 by PH. Figs. 21-24 from MO 1038; Figs. 25-27, 29 from SMH 3483; Figs. 28, 30, 31, 33, 35, 36 from SMH 3136, Fig. 32 from SMH 3507.1, Figs. 34, 37-41 from holotype SMH 1565. Bars: 21-24 = 200 μm ; 25, 28 = 20 μm ; 26, 27, 29-36, 38-41 = 10 μm ; 37 = 50 μm .

Ascomata ovoid, with greenish coating turning gray with age, 230-407 μm in diam., 294-463 μm in height, separate, superficial, papillate, with sparse, scattered setae, dark brown, multiseptate, 135-200 μm long, 5-7.5 μm at the base, tapering to 2.5-3 μm at the apex. *Ascomatal wall* opaque in surface view, inner wall pseudoparenchymatous, dark brown, 13-20 μm wide, outer coating 4-10 μm wide. *Ascomatal apex* papillate. *Paraphyses* sparse, simple, septate, 3.5-5 μm wide. *Asci* cylindrical, short-stalked, 97-127 \times 13-18 μm , unitunicate. *Ascospores* cylindrical-fusiform, mostly inequilateral, 27-62 \times 6-9.5 μm , mostly 7-septate, sometimes 9-septate, dark brown, terminal cells hyaline and short. *Culture*: One-week-old colonies on MEA 1 mm diam., white, mycelium dense appressed, aerial mycelium abundant, reverse white. No measurable growth on CMA. Two-week-old colonies on MEA 9 mm diam., white with a gray center, mycelium dense appressed, aerial mycelium sparse, border even, reverse white with dark gray center. Two-week-old colonies on CMA 4 mm diam., white, mycelium dense appressed, aerial mycelium sparse, border even, reverse white. *Conidiophores* mononematous, macronematous, dark brown, on the substrate 223-288 \times 6-9 μm for most of their length, widening to 11-13 μm at the apex; on CMA 235-382 μm long, up to 650 μm , 6-7.5 μm at the base, broadening to a single apical, funnel-shaped phialide, 10.5-12 μm wide. *Conidia* cylindrical, brown, thick-walled, distoseptate, 31-38 \times 16-19 μm on the substrate, 22-30 \times 10-15 μm on CMA, with a distinctive basal hilum, centric or slightly eccentric.

Anamorph: *Exserticlava* S. Hughes (Hughes, 1978)

Habitat: On decorticated wood and palm petioles

Known distribution: Costa Rica, Jamaica, Panama, Puerto Rico.

Material examined: COSTA RICA, Alajuela Province, Cantón Upala, Bijagua, Alto los Brenes, [10.73, -854], 6 June 1999, I. Lopez *IL473* (INB); Guanacaste Province, Cantón Cañas, Hacienda Montezuma, 715 m, [10.6708, -85644], 7 July 2000, on 2 cm branch, FAF with G.M. Mueller, B. Strack, J.P. Schmit, L. Umaña *SMH4258*; Area de Conservación Tempisque, Puntarenas Province, Nicoya peninsula, Reserva Absoluta Cabo Blanco, [9.59, -85.1], 13 August 2000, Cabuya station, Sueco trail, M. Oses *MO1038* (INB); Puntarenas Province, Area de Conservación Osa, Parque Nacional Corcovado, Sirena Station, Las Ollas trail, 10 m,

[8.4806, -83.5917], 16 July 2000, on wood fragment, FAF, with G.M. Mueller, B. Strack, J.P. Schmit, L. Umaña *SMH4276*. JAMAICA, Trelawny Parish, 1.5 miles beyond the village of Crown Lands, 610 m, [18.2608, -77.6517], 10 June 1999, on wood fragment, FAF *SMH4062*; Winsor Trail, 115 m, [18.3556, -77.6472], 12 June 1999, on wood fragment, FAF *SMH4076*. PANAMA, Barro Colorado Island National Monument, Thomas Barbour trail, 50 to 150 m, [9.1667, -79.8333], 18 September 1997, on 3 cm branch, SMH, FAF, *SMH3483*; on petiole, *SMH3487*; Snyder-Molino trail, 19 September 1997, on 1 cm branch, SMH, FAF, *SMH3507.1*. PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 25 September 1995, on log, S.M. Huhndorf *SMH1565* (F; **holotype designated here**); 25 September 1995, on 30 cm log, *SMH1580*; 29 January 1996, on 12 cm log, *SMH2094*; 20 January 1997, on palm petiole, SMH, FAF, *SMH3074*; 25 January 1997, on 5 cm branch, SMH, FAF, *SMH3136*.

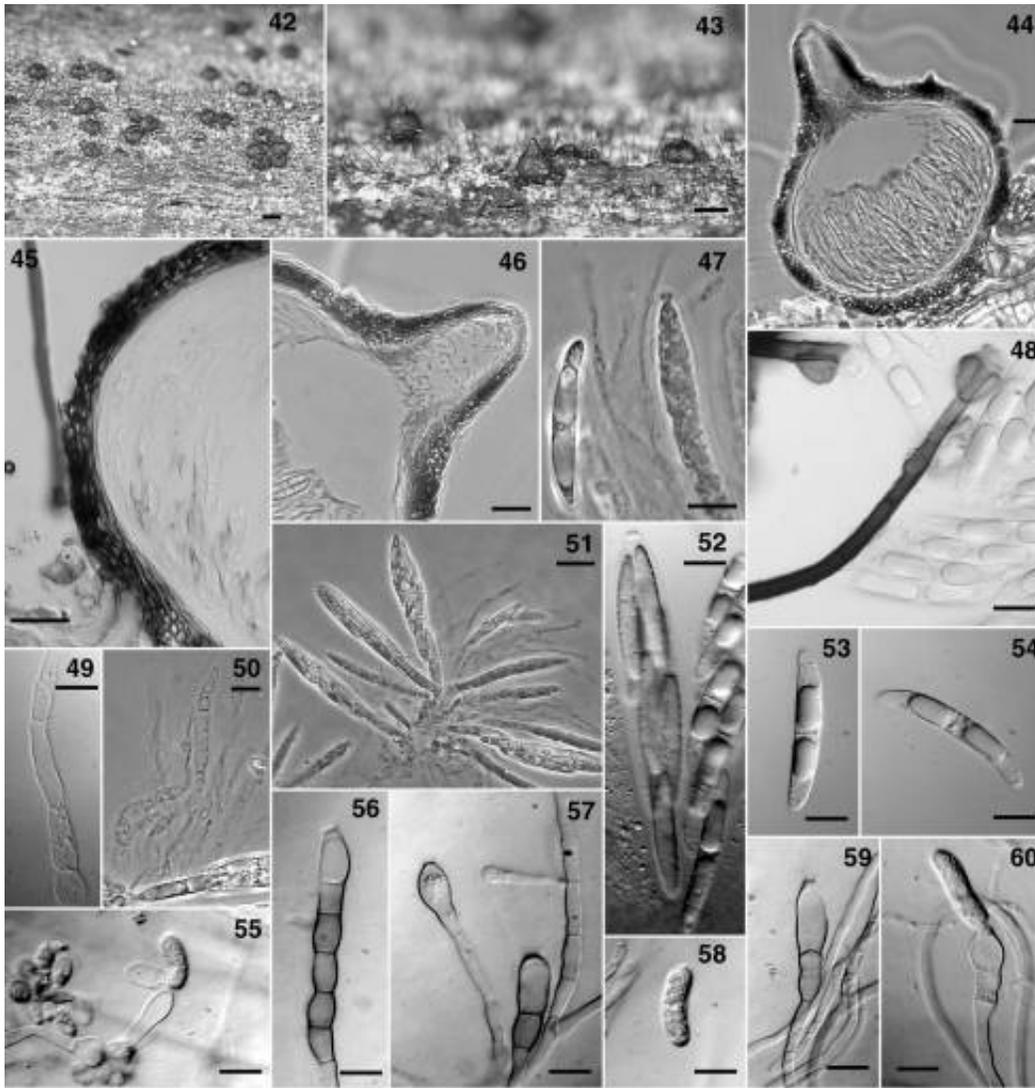
***Chaetosphaeria conirostris* F.A. Fernández & Huhndorf, sp. nov.**

(Figs. 42-60)

Etymology: Refers to the conical shape of the ostiolar beak

Ascomata obpyriformis, atrobrunnea, 208-230 μm lata, 240-270 μm alta, solitaria, superficialia, setae sparsis ascomatis brunnea multiseptatae 185-245 \times 6-7 μm , apicem capitatus, hyalino, 4.5-8.5 altus \times 7-11 μm latus, obtectus substantia hyalina aut ochracea. Setae adsunt super substrata. *Parietis ascomatis* cum aspectu superficialis opacus in aqua ut textura angularis in lactophenol, sectione longitudinali 12-15 μm crassus, cellulis pseudoparenchymatis. Collis ascomatis conicus, 63-71 \times 69-71 μm ad base, decrescens ad apicem 21.5-67.7 μm latus, papillatus, albidus, plectenchymatus. *Paraphyses* sparse, simplices, septatae, hyalinae, 4.2-4.7 (7.1) μm latae. *Asci* cylindrico-clavati, brevi pedicellati 95-120 \times 11-13 μm , unitunicatae, annuli apicales tenues, octospori, ascosporae dispositio irregulares. *Ascospores* cylindricae vel fusiformes, 35.5-48.5 \times 5.5-7.5 μm , hyalinae, plerumque uniseptatae, aut triseptatae, inequilaterales, rectae vel leviter curvatae.

Ascomata obpyriform, dark brown, 208-230 μm in diam., 240-270 μm in height, separate, superficial, with sparse setae, brown, multiseptate, 185-245 \times 6-7 μm , and a capitate apex, 4.5-8.5 \times 7-11 μm , covered with a hyaline to dark yellow droplet. Capitate setae are also present on the substrate. *Ascomatal wall* in surface view, opaque in water, textura angularis in lactophenol, 12-15 μm thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal beak*, conical, 63-71 \times 69-71 μm at the base, tapering to 21.5-67.7 μm , papilla off-white, plectenchymatous. *Paraphyses* sparse, unbranched, septate, 4.2-4.7 (7.1) μm wide. *Asci* cylindrico-clavate, short-stalked, 95-120 \times 11-13 μm , unitunicate, thin-walled, thin apical ring, with 8 ascospores irregularly arranged. *Ascospores* cylindrico-fusiform, hyaline, mostly one-septate, sometimes three-septate, 35.5-48.5 \times 5.5-7.5 μm , inequilateral, straight to slightly curved. *Culture*: Seven day old colonies on CMA 3 mm in diam., light brown, mycelium mostly immersed, superficial mycelium sparse, floccose, margin effuse, reverse white. Twenty-one day old colonies on CMA 16 mm in diam., brown, zonate and lighter colored at the edges, mycelium mostly immersed, superficial mycelium sparse, subhyaline, margin effuse,



Figs. 42-60. *Chaetosphaeria conirostris*. **42, 43.** Ascomata on substrate. **44.** Longitudinal section through ascoma. **45.** Section through ascomal wall. **46.** Section through ascomal neck. **47.** Ascus apex and ascospore. **48.** Ascomal seta. **49, 50.** Paraphyses. **51.** Asci. **52.** Ascus showing apical ring. **53, 54.** Ascospores. **55, 60.** Phialide and conidium on CMA. **56, 57, 59.** Phialides on CMA. **58.** Conidium on CMA. Figs. 42, 43 by photomicrography; Figs. 45, 46, 48, 49, 52-60 by DIC; Figs. 44, 46, 47, 50, 51 by PH. All figures from holotype SMH 2183. Bars: 42, 43 = 200 μm ; 44-46, 51 = 20 μm ; 47-50, 52-60 = 10 μm .

Figs. 61-81. *Chaetosphaeria lateriphiala* **61, 62.** Ascomata on substrate. **63.** Longitudinal section through ascoma. **64.** Young ascus. **65, 66.** Asci. **67.** Paraphyses. **68.** Section through ascomal wall. **69, 70, 72.** Ascospores. **71.** Ascospore from natural substrate showing microcycle conidiation. **73.** Conidiophore on substrate. **74, 75.** Lateral phialides on conidiophores from natural substrate. **76, 77.** Conidiophore and lateral arrangement of phialides, on CMA. **78, 79.** Conidia from natural substrate **80.** Degenerate phialides on CMA. **81.** Conidia on CMA. Figs. 61, 62 by photomacrography; Figs. 63-66, 68-81 by DIC; Fig. 67 by PH. Figs. 61, 62, 64, 65, 67, 70, 72 from SMH 3294; Figs. 63, 66, 68, 69, 76, 77, 80, 81 from SMH 2629.1; Figs. 71, 73-75, 78, 79 from SMH 3320. Bars: 61, 62 = 200 μm ; 63, 67, 76 = 20 μm ; 64-66, 68-72, 74-75, 77-81 = 10 μm ; 73 = 50 μm .

reverse off-white. *Conidiophores* absent or short, multiseptate, cylindrical, light brown. *Phialides* terminal, single, subhyaline to light brown, mostly clavate, 12.5-18 \times 2.3-5.8 μm at the base, 5-7.8 at the widest point; collarette absent or, when present, hyaline, obconical, very-thin walled, 1.6-3.3 \times 2.8-3.5 at the base, flaring to 3.8-5.5 at the apex. Proliferation of conidiogenous cells was not observed in culture. *Conidia* hyaline, oblong to reniform, one-celled, 19.5-21.5 \times 5.5-6.5 μm . A few conidia are limoniform, one-celled, 7-9 \times 4.5 μm .

Anamorph: It resembles *Craspedodydimum* Hol.-Jech. (Holubová-Jechová, 1972), observed only in culture.

Habitat: On decorticated wood.

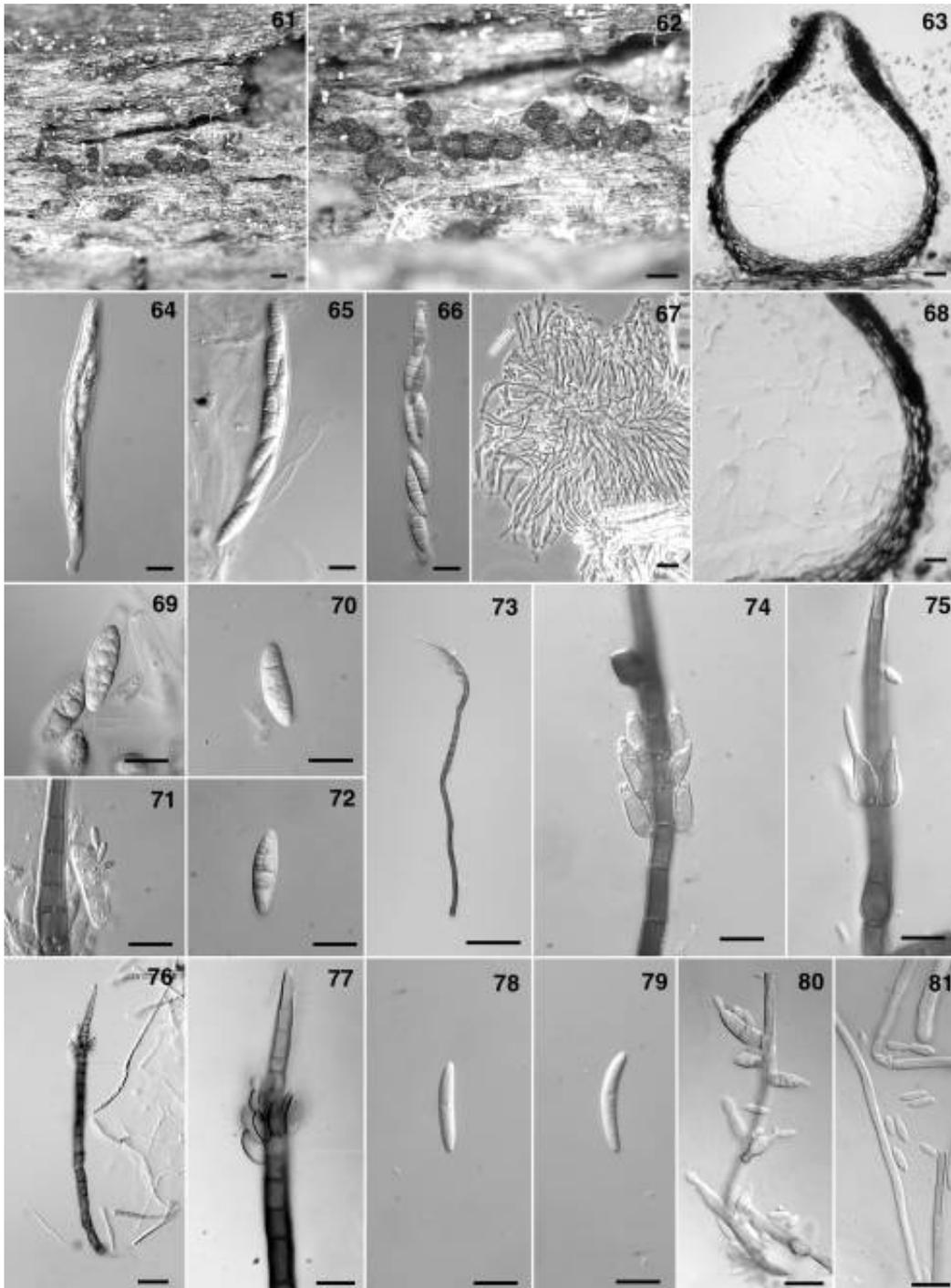
Known distribution: Costa Rica, Ecuador.

Material examined: COSTA RICA, Limón Province, Cantón Limón, Area de Conservación la Amistad Caribe, Reserva Biológica Hitoy Cerere, [9.67, -833], 28 April 2000, tepezcuintle trail, M. Umaña *MU1001* (INB); Puntarenas Province, Las Cruces Biological Station, San Vito, Rio Jaba trail, 1050 m, [8.7858, -82.9586], 5 May 1996, on 5 cm branch, SMH, FAF, *SMH2183* (F; **holotype designated here**); Area de Conservación la Amistad Pacífico, Cantón Coto Brus, fila Cedro, [8.92, -82.77], 5 June 2001, finca Cafrosa, E. Navarro *EN3295* (INB); [94, -82.96], 19 August 2001, Pittier station, E. Navarro *EN3716* (INB); Cantón Buenos Aires, Altamira research station, Los Arboles Gigantes trail, [94, -832], 29 June 2002, on wood fragment, *FAF1027*; trail to Valle del Silencio, [94, -82.99], 2 July 2002, on wood fragment, *FAF1061*. ECUADOR, Orellana Province, Yasuni National Park, Botanico trail, [-6713, -77.4005], 5 March 2001, on wood fragment, FAF, A.N. Miller, R. Briones, *SMH4332*; on 30 cm log, *SMH4338*.

***Chaetosphaeria lateriphiala* F.A. Fernández & Huhndorf, sp. nov.** (Figs. 61-81)

Etymology: Refers to the lateral arrangement of phialides on conidiophores.

Ascomata globosa vel obpyriformis, atrobrunnea, 200-248 μm lata, 234-307 μm alta, solitaria vel aggregata, superficialia vel leviter immersa, papillata. *Paries ascomatis* cum aspectu superficialis opacus in aqua et in lactophenol, sectione longitudinali 10-21 μm crassus, cellulis pseudoparenchymatis, extimus stratum 2-5 μm latus, ad 15 μm latus base collis. Collis ascomatis papillatis. *Paraphyses* simplices, hyalinae, 1.5-2.5 μm latae. *Asci* cylindrici, brevi



pedicellati, 95-113 × 10-12.5 µm, unitunicatae, annuli apicales 3.5-4 µm lati, 1.2-1.6 µm alti, octospori, ascosporae dispositio irregulares. *Ascospores* fusiformes, 18-24 × 4.5-6 µm, hyalinae, plerumque triseptatae, aut uniseptatae, interdum constrictae.

Ascomata globose to broadly obpyriform, dark brown, 200-248 µm wide, 234-307 µm high, glabrous, scattered to gregarious, superficial to slightly immersed in the substratum. *Ascomatal wall* opaque in surface view in water, also opaque in lactophenol, 10-21 µm thick in longitudinal section, composed of pseudoparenchymatic cells, with an opaque outermost layer, 2-5 µm wide, up to 15 µm thick at base of the neck. *Ascomatal apex*, papillate. *Paraphyses* simple, hyaline, 1.5-2.5 µm wide. *Asci* cylindrical, short-stalked, 95-113 × 10-12.5 µm, unitunicate, apical ring present, 3.5-4 µm wide, 1.2-1.6 µm deep, with 8 ascospores irregularly arranged. *Ascospores* fusiform to broadly fusiform, with rounded end cells, 18-24 × 4.5-6 µm, hyaline, often three-septate, sometimes one-septate, sometimes constricted. *Culture*: Isolates from SMH 2629-1 and SMH 3294 showed no observable growth on CMA or MEA after seven days. Three-week-old colonies on CMA 2 mm diam., dark brown, mycelium mostly immersed, aerial mycelium sparse, silky, border uneven, effuse, reverse dark brown. Three-week-old colonies on MEA 6 mm diam., dark gray-brown, aerial mycelium dense, light gray, border uneven, effuse, reverse dark brown. Three-week-old colonies of SMH 3294 on MEA 3 mm diam., dark reddish-dark brown, mycelium woolly, aerial mycelium sparse, border uneven, reverse reddish-dark brown. *Conidiophores* mononematous, macronematous, dark brown, becoming lighter in color towards the apex, distinctively multiseptate, 56-120 µm × 2.5-3 µm at base, tapering to a hyaline apical cell, 1-1.5 µm on MEA; on the substrate: 240-284 × 5-6.5 µm at base and tapering towards the apex, sometimes branched, branches 100-118 × 3.5-4.5 µm. Phialides ampulliform, light brown, on MEA: 8-10 × 3.5-5 µm at the widest point; on the substrate: 10-13.5 × 3.5-4.6 µm at the widest point, at single, one or more apical conidiogenous openings, 1.3-2 µm wide. Phialides are sessile, originating from the uppermost part of the conidiophore cell, typically arranged in whorls. In culture, the number of phialides in whorls diminishes with successive subculturing until only single phialides and extremely reduced conidiophores are produced directly on vegetative hyphae. *Conidia* one celled, fusiform, hyaline, 11-18 × 4-4.5 µm on MEA, 15-25 × 2.5-4 µm on the substrate.

Anamorph: It resembles *Zanclospora* S. Hughes & W.B. Kendr. (Hughes and Kendrick, 1965).

Habitat: On decorticated wood.

Known distribution: USA (Indiana, North Carolina, Wisconsin).

Material examined: USA, Indiana, Lawrence Co., Hoosier National Forest, Hickory Ridge trailhead, 26 July 1996, on 10 cm branch, SMH2629.1 (F; **holotype designated here**);

NORTH CAROLINA, Macon Co., Highlands Biological Station, Highlands, 20 July 1997, on wood fragment, FAF, *SMH 3294*; Jackson Co., Panthertown Valley, [35.1678, -83406], 22 July 1997, on wood fragment, FAF, *SMH 3320*; WISCONSIN, Green Co., New Glarus State Park, [42.71, -89.63], 13 September 1995, on 20 cm log, *SMH 1546*.

***Chaetosphaeria lignomollis* F.A. Fernández & Huhndorf, sp. nov.**

(Figs. 82-101)

Etymology: Refers to the soft wood on which it occurs.

Ascomata ovoidea vel globosa, atrobrunnea, 148-198 μm lata, 178-218 μm alta, solitaria, superficialia, setae sparsi vel pauci, brunnea, multiseptatae, 135-292 \times 3.5-6.5 μm , decrecens apicem tenuis. *Paries ascomatis* cum aspectu superficialis ut textura angularis, sectione longitudinali 10.5-17.5 μm crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis. *Paraphyses* simplices, septatae, hyalinae, 2-3 μm latae. *Asci* cylindrici, 92.5-118 \times 9.7-14 μm , octospori, cum ascosporae distichae. *Ascosporae* cylindricae vel fusiformes, 24-33 \times 4.7-6 μm , hyalinae, 7-septatae.

Ascomata broadly ovoid to obpyriform, dark brown, 148-198 μm in diam., 178-218 μm in height, separate, superficial on the substratum, with a few, scattered setae, brown, multiseptate, slender, 135-292 \times 3.5-6.5 μm , tapering to an attenuated apex. *Ascomatal wall* of textura angularis in surface view, 10.5-17.5 μm thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal apex* broad, papillate, short. *Paraphyses* unbranched, septate, hyaline, 2-3 μm wide. *Asci* cylindro-clavate, short-stalked, 92.5-118 \times 9.7-14 μm , unitunicate, thin-walled, with 8 biserially arranged ascospores, apical ring 2.8-3.1 μm wide, 1.2-1.5 μm deep. *Ascospores* cylindrical-fusiform, sometimes inequilateral, sometimes one end slightly curved, 24-33 \times 4.7-6 μm , hyaline to subhyaline, seven-septate, septa sometimes diagonal or at angles. *Culture*: No visible growth on CMA after seven days. Twenty-one day old colonies on CMA 2.5 mm in diam., light brown, mostly immersed, with knots of dark brown cells, reverse brown. *Conidiophores* produced singly on CMA, in fascicles of three or more on the substrate, unbranched, dark brown becoming light brown towards the apex, multiseptate, 69-84 \times 4-6.6 μm on CMA, 162-192 \times 4-5.9 μm on the substrate. Conidiogenous cell a phialide, on CMA: cylindrical, 23-47 \times 4.7-6 μm , with either a single apical collarette, obconical, 1.7-2 μm wide and 1.2-1.4 μm deep, on the substrate: a polyphialide with a single apical collarette and multiple lateral old conidiogenous loci that appear as refractive pegs. Proliferation mostly sympodial; percurrent proliferation was also observed. *Conidia* hyaline, cylindrical, broadly rounded at the apex, with a truncate base, 3-6 septa, straight or diagonal, unevenly spaced, 26-31 \times 7.3-8.6 μm on CMA, 21-28 \times 6-7.3 on the substrate.

Figs. 82-101. *Chaetosphaeria lignomollis*. **82, 83.** Ascomata on substrate. **84.** Longitudinal section through ascoma. **85.** Paraphyses. **86.** Section through ascomal wall. **87.** Section through ascomal neck. **88-90.** Asci. **91-93.** Ascospores. **94.** Conidiophore on CMA. **95.** Conidiophore showing sympodial proliferation of the conidiogenous cell on CMA. **96.** Conidiophore and conidia on CMA. **97.** Conidium on CMA. **98, 99.** Conidia from the natural substrate. **100, 101.** Conidiophore showing polyphialides, from the natural substrate. Figs. 82, 83 by photomicrography; Figs. 86-101 by DIC; Figs. 84, 85 by PH. Figs. 82-84, 86, 87, 90, 92 from SMH 1829; Figs. 85, 88, 89, 91, 93, 94-97 from holotype SMH 3015; Figs. 98, 101 from SMH 2888; Figs. 99, 100 from SMH 1642. Bars: 82, 83 = 200 μm ; 84 = 20 μm ; 85-101 = 10 μm .

Anamorph: It resembles *Kylindria* DiCosmo, S.M. Berch & W.B. Kendr. (DiCosmo *et al.*, 1983). Conidiophores and conidia are present on the substrate in collections SMH1642 and SMH2888.

Habitat: On decorticated wood.

Known distribution: Costa Rica, Puerto Rico.

Material examined: COSTA RICA, Guanacaste Province, Parque Nacional Guanacaste, Santa Cecilia, Sector Pitilla, 700 m, [10.9889, -85.4261], 23 June 1997, on 5 cm branch, SMH3209. PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 16 January 1997, on wood fragment, S.M. Huhndorf, F.A. Fernández, SMH3015 (F; **holotype designated here**); 29 September 1995, on 1 cm branch, SMH1642; 9 October 1995, on 30 cm log, SMH1829; 14 January 1996, on 25 cm log, SMH1883; 12 January 1997, on 7.5 cm root, SMH, FAF, SMH2888.

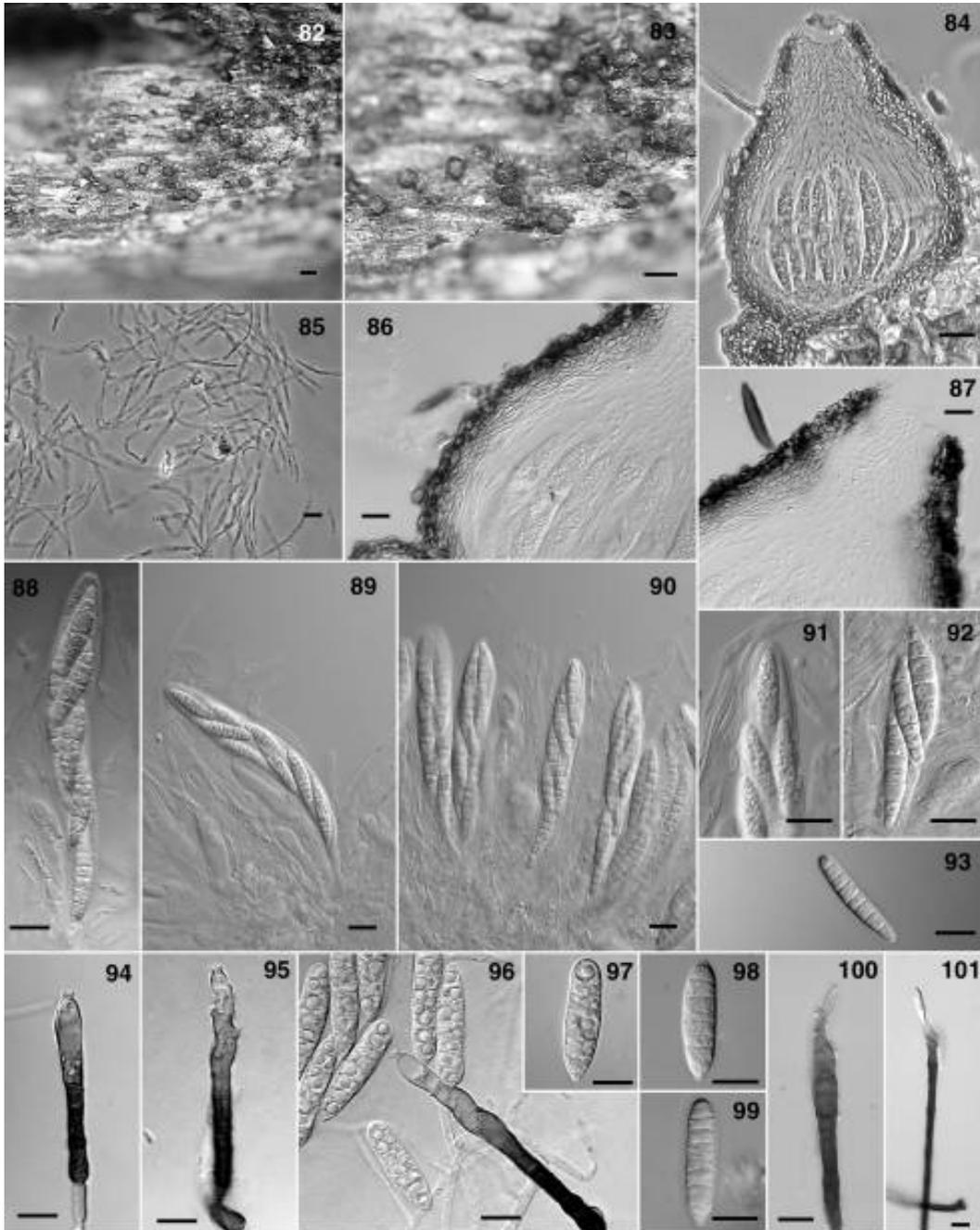
Chaetosphaeria longiseta F.A. Fernández & Huhndorf, **sp. nov.** (Figs. 102-131)

Etymology: Refers to the long setae borne on the ascomata.

Ascomata globosa vel ovoidea, atrobrunnea, 139-158 μm lata, 148-178 μm alta, solitaria, superficialia, papillata; setae sparsi vel pauci, brunnea, multiseptatae, 147-166 \times 5.5-7 μm ad base, 3-4.5 μm decrescens apicem acutatis. *Paries ascomatis* cum aspectu superficialis ut textura epidermoidea in aqua et in lactophenol, sectione longitudinali 9-15 μm crassus, cellulis pseudoparenchymatis, tunica extima tenuissime pallida. Apicem ascomatis papillatis, brevis. *Paraphyses* simplices, septatae, hyalinae, 2.5-3.5 μm latae. *Asci* unitunicati, cylindrico-clavati, brevi pedicellati, 59-80 \times 7-12 μm , octospori. *Ascospores* hyalinae, fusiformes vel ellipsoideae, non-septatae vel uniseptatae, 10-17 \times 4-5.6 μm .

Ascomata subglobose to broadly ovoid, dark brown, 139-158 μm in diam., 148-178 μm in height, separate, superficial, papillate; setae sparse, scattered, brown, multiseptate, slender, 147-166 \times 5.5-7 μm at the base, 3-4.5 μm for most of its length, tapering to an acute apex. *Ascomatal wall* of textura epidermoidea in surface view in water, and in lactophenol, 9-15 μm thick in longitudinal section, composed of pseudoparenchymatic cells, with a thin, light-colored outer coating. *Ascomatal apex* papillate, acute, short. *Paraphyses* sparse, unbranched, hyaline, septate, 2.5-3.5 μm wide. *Asci* cylindro-clavate, short-stalked, 59-80 \times 7-12 μm , unitunicate, thin-walled, broad apical cap, with 8 ascospores irregularly arranged. *Ascospores* hyaline, broadly fusiform to

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Figs. 102-131. *Chaetosphaeria longiseta*. **102-105.** Ascomata on substrate. **106.** Longitudinal section through ascoma. **107.** Section through ascomal neck. **108.** Section through ascomal wall. **109.** Surface view of ascomal wall. **110.** Section through ascomal wall showing seta. **111, 112.** Asci. **113.** Ascus showing apical ring. **114.** Ascus. **115.** Paraphysis. **116-118.** Ascospores. **119-122.** Conidiophores with phialides and percurrent proliferations on CMA. **123.** Setae associated with conidiophore on the substrate. **124.** Conidiophores (polyphialides) from the substrate. **125.** Conidiophore showing percurrent proliferations and clusters of microconidia on CMA. **126.** Cluster of microconidia on CMA. **127-129.** Conidia from natural substrate. **130.** Microconidia on CMA. **131.** Aberrant conidium after repeated culturing on CMA. Figs. 102-105 by photomacrography; Figs. 107-111, 114, 116-131 by DIC; Figs. 106, 112, 113, 115 by PH. Figs. 102, 103 from SMH 2316; Figs. 104-108, 110-113, 115, 118-124, 127-129 from holotype SMH 3048; Figs. 109, 116, 125, 126, 130 from SMH 3854; Figs. 114, 117, 131 from SMH 1725. Bars: 102-105 = 200 μm ; 106-122, 124-131 = 10 μm ; 123 = 50 μm .

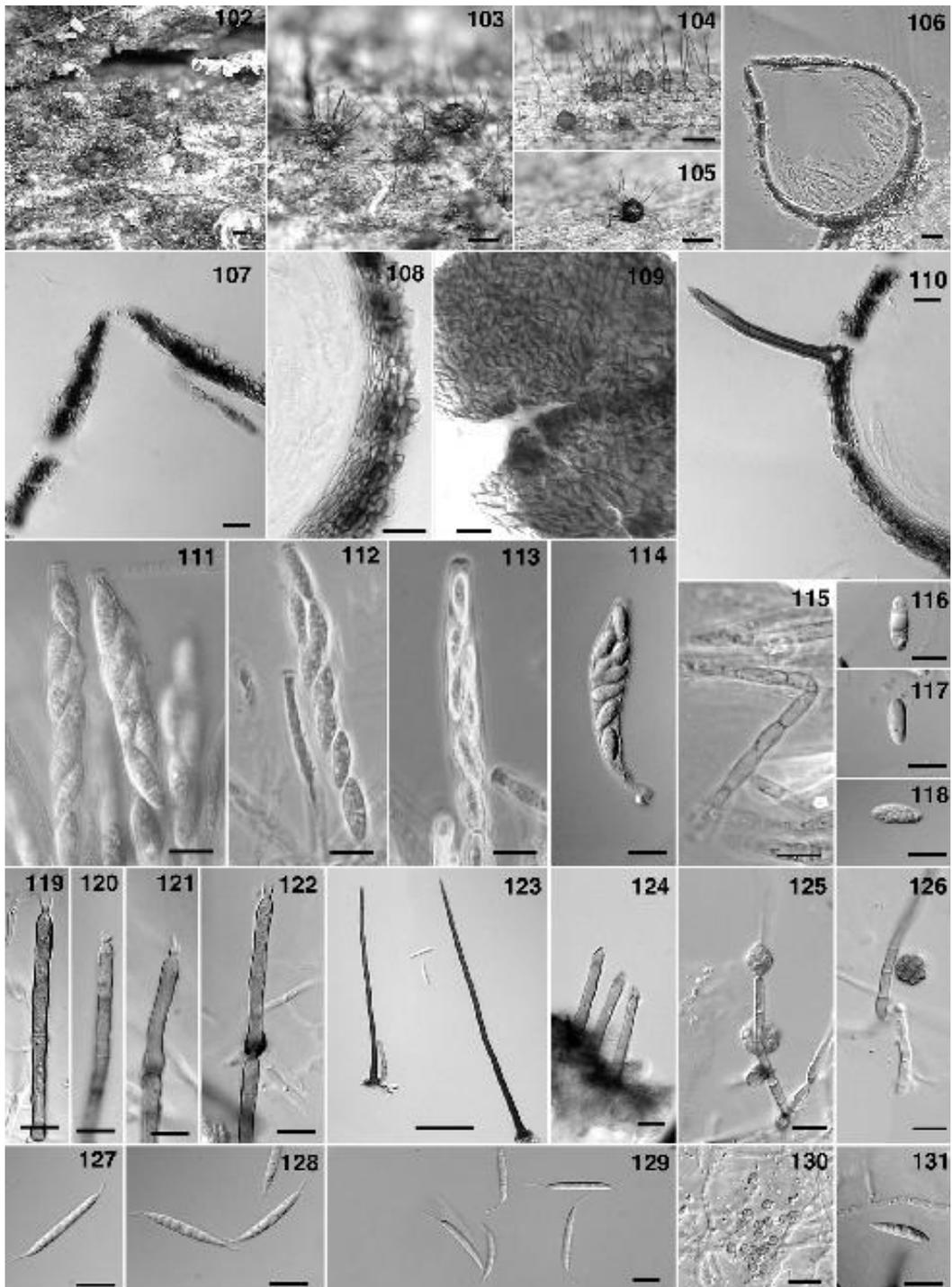
ellipsoid, rounded ends, nonseptate, rarely one-septate, $10-17 \times 4-5.6 \mu\text{m}$. *Culture*: Colony on CMA 7 mm in diam. after seven days. Twenty-one day old colonies on CMA 20 mm in diam., white, mostly immersed, reverse white or light brown, surface mycelium floccose, margins effuse, conidiophores produced abundantly. *Conidiophores* single, brown, multiseptate, $142-155 \times 3.5-5.1 \mu\text{m}$ on CMA, $28-104 \times 3-4.8 \mu\text{m}$ on the substrate. Conidiogenous cells cylindrical, $30-36 \times 2.8-4 \mu\text{m}$ on CMA, with a single, tubular, apical collarette, $1.4-2.5 \times 2.4-3 \mu\text{m}$, proliferating percurrently, or phialides with multiple, conidiogenous loci, resulting from sympodial proliferation, often ending in an apical collarette, $25-37.5 \times 3.5-4.6 \mu\text{m}$, exclusively found on the substrate. Setae associated with conidiophores, multiseptate, brown, tapering to an acute apex, $184-251 \times 7-9.2 \mu\text{m}$ at the base, sometimes two most apical cells dark brown. *Conidia* of two morphologically distinct types produced from the same phialides on CMA: one celled, ellipsoid, hyaline to light-brown, $3.3-4.2 \times 2.3-2.8 \mu\text{m}$; and one-celled, hyaline, narrowly fusiform, $20.3-24.5 \times 2.7-3.2 \mu\text{m}$, with a single setula at each end, $2.3-3.8 \times 1 \mu\text{m}$. The small conidia are produced in tight, mucilagenous clusters and remain attached after the conidiogenous cell proliferates, appearing as a series of intercalary masses on the conidiophore. On the substrate, conidia hyaline, fusiform, $21.3-24.8 \times 2.4-2.9 \mu\text{m}$, with a single setula at each end, $5-8.3 \times 1 \mu\text{m}$.

Anamorph: It resembles *Dictyochoeta* Speg. (Spegazzini, 1923).

Habitat: On decorticated wood of twigs and branches.

Known distribution: Costa Rica, Ecuador, Puerto Rico, USA (South Carolina).

Material examined: COSTA RICA, Puntarenas Province, Area de Conservación la Amistad Pacifico, Cantón Coto Brus, Zona Protectora Tablas, fila Cedro, [8.91, -82.77], 27 June 2002, on wood fragment, F.A. Fernández *FAF1016*; ECUADOR, Orellana Province,



Figs. 132-156. *Chaetosphaeria luquillensis*. **132-134.** Ascomata on substrate. **135.** Longitudinal section through ascoma. **136.** Section through ascomal neck. **137.** Section through ascomal wall. **138, 139.** Paraphyses. **140-142.** Asci. **143-146.** Ascospores. **147.** Conidiophores and setae from natural substrate. **148.** Polyphialide from natural substrate. **149.** Phialide and a developing conidium on CMA. **150.** Conidia from natural substrate. **151.** Developing phialide on CMA. **152.** Phialide and developing conidium on CMA. **153.** Conidium on CMA. **154, 155.** Proliferating phialide on CMA. **156.** Conidium on CMA. Figs. 132-134 by photomicrography; Figs. 135-137, 140-156 by DIC; Figs. 138, 139 by PH. All figures from holotype SMH 2973. Bars: 132-134 = 200 μm ; 135, 147 = 20 μm ; 136-146, 148-156 = 10 μm .

Yasuni National Park, Botanico trail, [-.6713, -77.4005], 5 March 2001, on 1.5 cm branch, FAF, A.N. Miller, R. Briones, *SMH4335*; Bariso trail, 7 March 2001, on branch, FAF, A.N. Miller, R. Briones, *SMH4380*. PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 18 January 1997, on 1 cm branch, S.M. Huhndorf, F.A. Fernández, *SMH3048* (F; **holotype designated here**); 4 October 1995, on 40 cm log, *SMH1725*. USA, South Carolina, Oconee Co., Sumter National Forest, Walhalla State Fish Hatchery, left trail through pine area to East Fork Trail, [34.9836, -83739], 31 July 1998, on 10 cm branch, FAF, *SMH3854*.

***Chaetosphaeria luquillensis* F.A. Fernández & Huhndorf, sp. nov.**

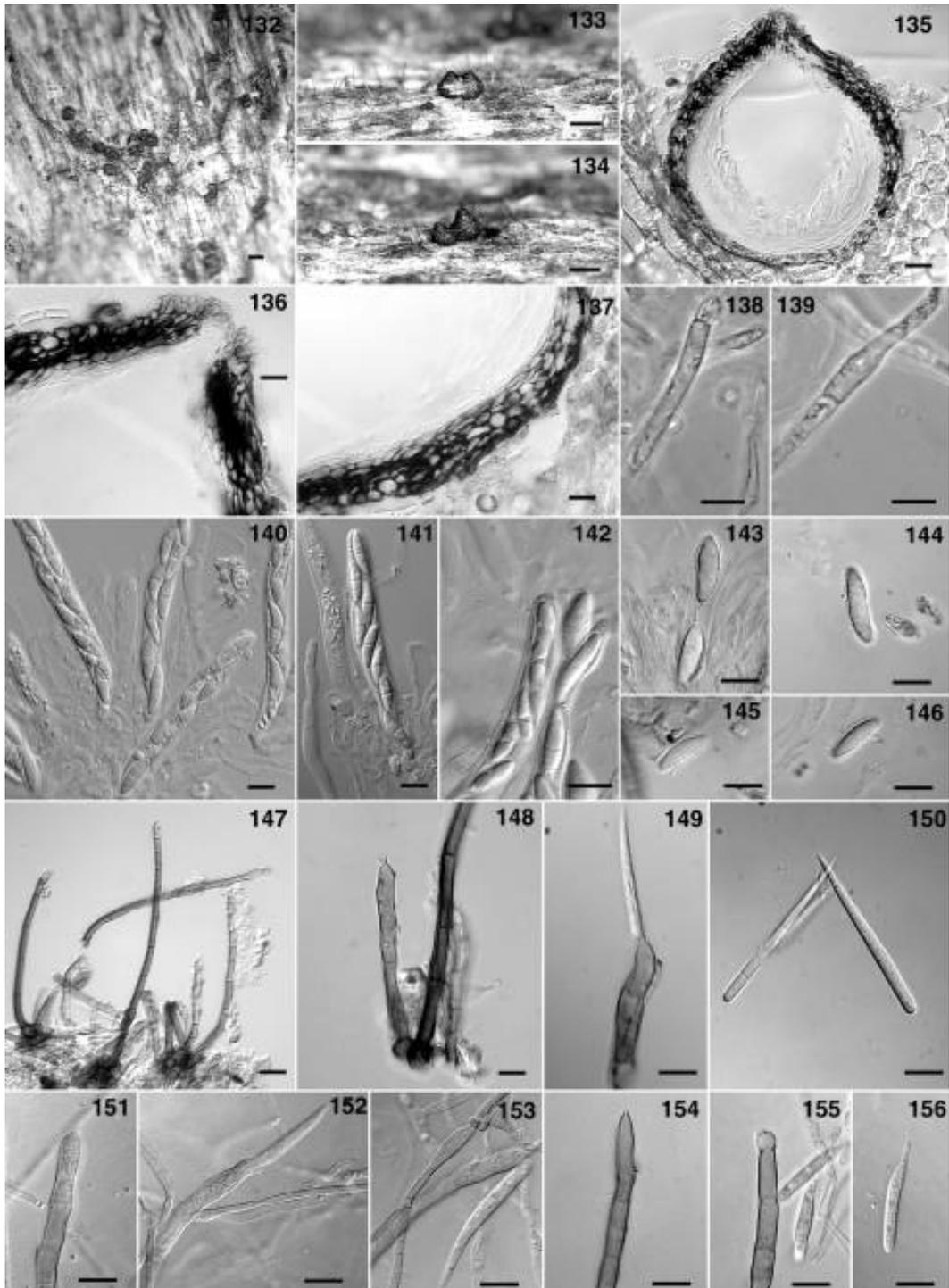
(Figs. 132-156)

Etymology: Refers to Luquillo, name of collection locality in Puerto Rico.

Ascomata ovoidea, atrobrunnea, 168-224 μm lata, 186-198 μm alta, solitaria, superficialia vel leviter immersa, papillata, setae sparsi vel pauci, atrobrunnea, multiseptatae, apicem tenuissimae. *Paries ascomatis* cum aspectu superficialis opacus in aqua et textura epidermoidea in lactophenol, sectione longitudinali 12-20 μm crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis, acutatus, breve. *Paraphyses* simplices, hyalinae, septatae. *Asci* unitunicati, cylindrico-clavati, brevi pedicellati, 79-90 \times 9-12 μm , annulo apicali tenuis, octospori. *Ascospores* hyalinae, fusiformes, 15-19 \times 4-5.5 μm , inaequalis, 1-septatae, interdum 2-3-septatae, tunica gelatinosa praeditae.

Ascomata broadly ovoid, dark brown, 168-224 μm in diam., 186-198 μm in height, separate, superficial to partly immersed, papillate, with sparse, scattered setae, light brown, multiseptate, slender, tapering to an acute apex. *Ascomatal wall* in surface view, opaque in water, textura epidermoidea in lactophenol, 12-20 μm thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal apex* papillate, acute, short. *Paraphyses* sparse, simple, septate. *Asci* unitunicate, cylindro-clavate, short-stalked, 79-90 \times 9-12 μm , firm-walled, thin apical cap, with 8 ascospores irregularly arranged. *Ascospores* hyaline, fusiform, 15-19 \times 4-5.5 μm , sometimes inequilateral, sometimes ends curved opposite directions, mostly one-septate, sometimes two or three-septate, covered with a gelatinous sheath. *Culture:* Colony on CMA 8 mm in diam. after seven days. Twenty-one day old colonies

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on CMA 16 mm in diam., light brown, mostly immersed, reverse light brown, surface mycelial growth dense, margins feathery. *Conidiophores* single, light brown, cylindrical, mostly multiseptate, $49.5-90 \times 4-5.1 \mu\text{m}$ on CMA, $28-104 \times 3-4.8 \mu\text{m}$ on the substrate. Conidiogenous cell a phialide, cylindrical, most often proliferating sympodially to produce multiple lateral conidiogenous loci, sometimes proliferating percurrently, $12-40 \times 4-4.5 \mu\text{m}$ on CMA, $29-41 \times 4.5-6.3 \mu\text{m}$ on the substrate. Setae singly on the substrate, multiseptate, light brown, $124-190 \times 5-6.5 \mu\text{m}$, tapering to a rounded apex, $3-4.7 \mu\text{m}$ wide. *Conidia* obclavate, mostly bent and rounded at apex on CMA, straight and acute at apex on the substrate, hyaline, $29-43 \times 3.4-3.9 \mu\text{m}$ on CMA, $40-49 \times 2.7-3 \mu\text{m}$ on the substrate.

Anamorph: Dematiaceous phialidic.

Habitat: On decorticated wood of dead trunks.

Known distribution: Puerto Rico.

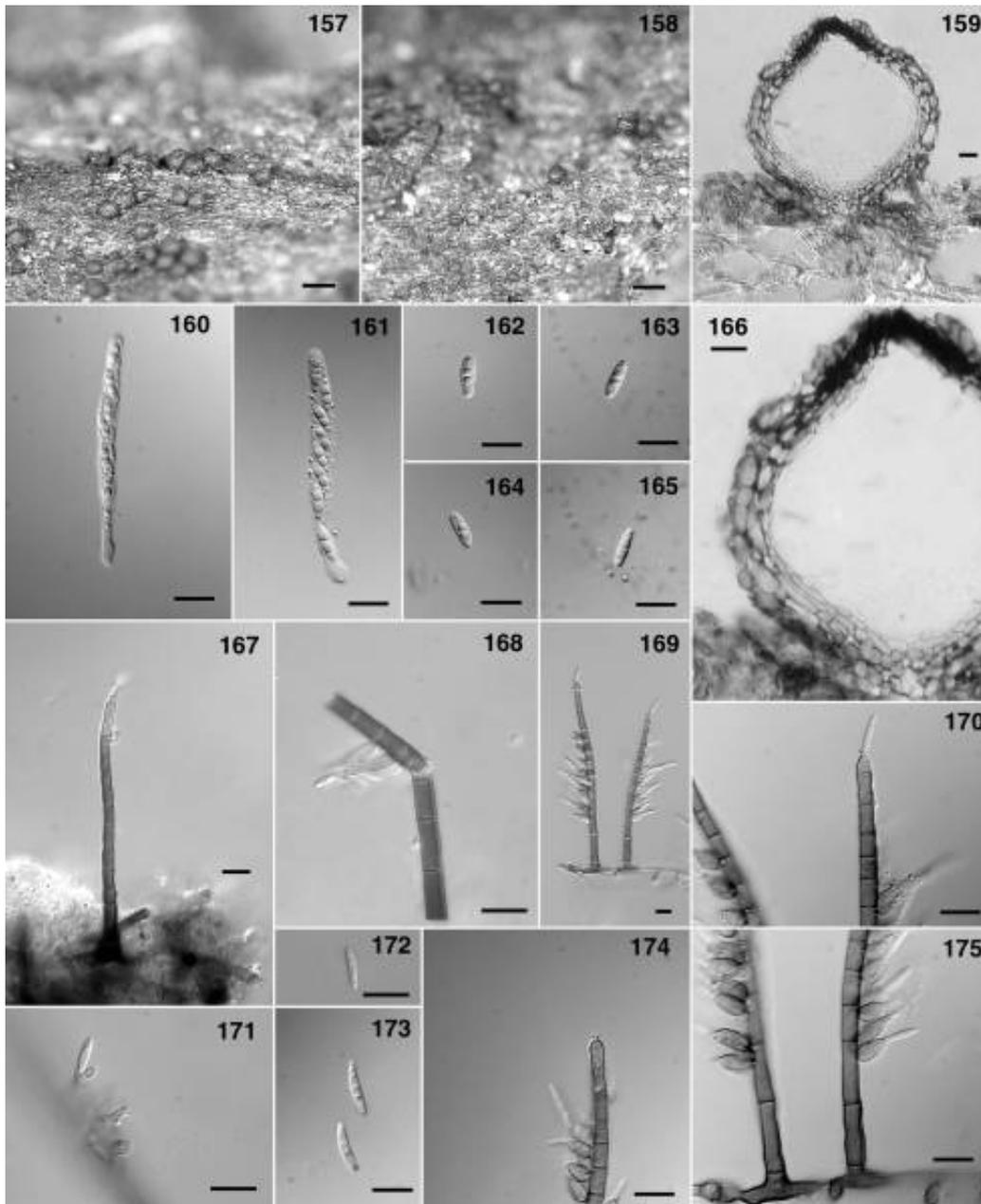
Material examined: PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 15 January 1997, on 30 cm log, S.M. Huhndorf, F.A. Fernández SMH2973 (F; **holotype designated here**).

***Chaetosphaeria minuta* F.A. Fernández & Huhndorf, sp. nov.** (Figs. 157-175)

Etymology: Refers to the small size of ascomata.

Ascomata globosa vel subglobosa, atrobrunnea, $106-119 \mu\text{m}$ lata, $100-109 \mu\text{m}$ alta, solitaria vel aggregata, superficialia, propria papillata. *Paries ascomatis* cum aspectu superficialis opacus in aqua et textura angularis in lactophenol, sectione longitudinali $11.5-15.5 \mu\text{m}$ crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis, opacus. *Paraphyses* simplices, septatae, hyalinae, $1.9-2.5 \mu\text{m}$ latae, tenuis apicem. *Asci* cylindrico-clavati, brevi pedicellati, $105-150 \times 8.5-15 \mu\text{m}$, unitunicati, octospori. *Ascospores* hyalinae, fusiformes vel ellipsoideae, $9.5-10.5 \times 2.5-3.5 \mu\text{m}$, uniseptatae.

Ascomata globose to sub-globose, dark brown, $106-119 \mu\text{m}$ in diam., $100-109 \mu\text{m}$ in height, solitary to densely gregarious, superficial on a thin subiculum, distinctly papillate. *Ascomatal wall* in surface view, opaque in water, textura angularis in lactophenol, $11.5-15.5 \mu\text{m}$ thick, composed of pseudoparenchymatic cells. *Ascomatal apex* papillate, opaque. *Paraphyses* unbranched, septate, $1.9-2.5 \mu\text{m}$ wide, tapering. *Asci* cylindro-clavate, short-stalked, $105-150 \times 8.5-15 \mu\text{m}$, unitunicate, thin-walled, apical ring not observed, with 8 ascospores irregularly arranged. *Ascospores* hyaline, fusiform to narrow-ellipsoid, $9.5-10.5 \times 2.5-3.5 \mu\text{m}$, one-septate. *Culture*: Seven-day-old colonies on CMA 6 mm diam., light to dark gray, mycelium appressed, mostly immersed, aerial mycelium sparse, abundant conidiophores throughout, developing concentric zones, border even, fringed, reverse gray. Seven-day-old colonies on MEA 10 mm diam., off-white, appressed, aerial mycelium sparse, border even, fringed, reverse off-white. Three-week-old colonies on CMA 12 mm diam., pale gray-brown, mycelium mostly immersed, aerial mycelium



Figs. 157-175. *Chaetosphaeria minuta*. **157, 158.** Ascomata on substrate. **159.** Longitudinal section through ascoma. **160, 161.** Asci. **162-165.** Ascospores. **166.** Section through ascomal wall. **167.** Conidiophore from natural substrate. **168.** Lateral phialide with conidium, from natural substrate. **169.** Conidiophores on CMA. **170.** Conidiophore apex showing terminal phialide with conidium, from CMA. **171.** Apex of conidiogenous cell showing multiple collarettes, from natural substrate. **172.** Conidium from natural substrate. **173.** Conidia on CMA. **174.** Apex of conidiophore showing terminal phialide, on CMA. **175.** Bases of conidiophores showing lateral phialides on CMA. Figs. 157, 158 by photomicrography; Figs. 159-175 by DIC. All figures from holotype SMH 3396. Bars: 157, 158 = 200 μm ; 159-175 = 10 μm .

sparse, developing concentric zones, border fringed, reverse light brown agar. Conidiophores and conidia produced abundantly throughout the colony. Three-week-old colonies on MEA 18 mm diam., white, mycelium mostly immersed, appressed, border uneven, effuse, lobed, reverse white. Conidiophores produced in center, on the old agar block. *Conidiophores* single, unbranched, multiseptate, brown, on CMA: 100-149 × 5-6.5 μm at the base, tapering to an apical phialide, 2.7-3.5 μm, several unilateral phialides produced along the midsection; on the substrate 90-120 × 4.8-5.2 μm at the base, narrowing to 2.7-3.4 μm in width. Conidiogenous cells are phialides, ovoid, brown, produced along the conidiophore midsection, on CMA 10.3-11.5 μm at the widest point, collarettes small, funnel-shaped, 1.6-3 μm wide at the apex, 1-1.3 μm deep; on the substrate 13-14 μm wide, with several collarettes in a sympodial arrangement, or sometimes with percurrent proliferations. *Conidia* narrow fusiform, hyaline, one-celled, 12-14.3 × 2.2-2.7 μm on CMA, 7.5-9.6 × 1.5-2 μm on the substrate.

Anamorph: It resembles *Chaetopsis* Grev.

Habitat: On decorticated wood of branches on the ground.

Known distribution: Panama.

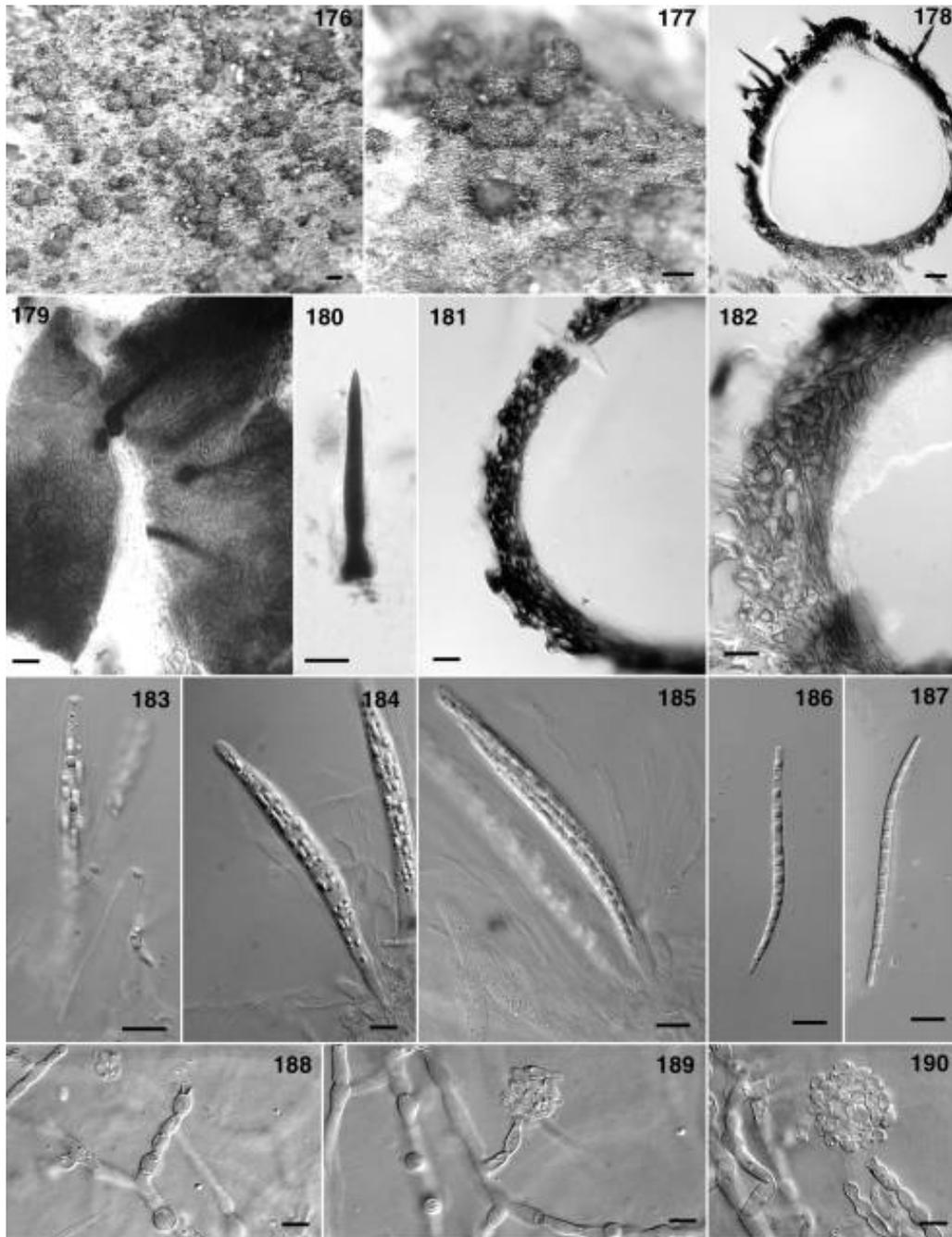
Material examined: PANAMA, Barro Colorado Island National Monument, Fausto trail, 50 to 150 m, [9.1667, -79.8333], 15 September 1997, on 4 cm branch, S.M. Huhndorf, F.A. Fernández SMH3396 (F; **holotype designated here**).

***Chaetosphaeria spinosa* F.A. Fernández & Huhndorf, sp. nov.** (Figs. 176-190)

Etymology: Refers to the spiny appearance of ascomata.

Ascomata globosa vel ovoidea, atrobrunnea, 215-245 μm diametro, 238-260 μm alta, solitaria, superficialia, abundans setae brunnea, 45-67 × 3.5-6.5 μm. *Paries ascomatis* cum aspectu superficialis textura epidermoidea in aqua et in lactophenol, sectione longitudinali 10.5-14 μm crassus. *Paraphyses* simplices, septatae, hyalinae, 2.6-3.6 μm latae. *Asci* cylindrico-clavati, brevi pedicellati, 118-119 × 8.5-10 μm, unitunicati, octospori. *Ascospores* hyalinae, filiformes, 68-76 × 2-3 μm, multiseptatae.

Ascomata globose to ovoid, dark brown, 215-245 μm in diam., 238-260 μm in height, separate, superficial on the substratum, setae abundant, rigid, dark brown, opaque, 45-67 × 3.5-6.5 μm, wider at the base, tapering toward apex. *Ascomatal wall* of textura epidermoidea in surface view in water, and in lactophenol, 10.5-14 μm thick in longitudinal section. *Paraphyses* unbranched, hyaline, septate, 2.6-3.6 μm wide. *Asci* cylindrical-clavate, short-stalked, 110-142 × 10.5-12.5 μm, unitunicate, thin-walled, with 8 ascospores, apical ring distinctive, 2-3 μm wide, 1-2 μm high. *Ascospores* filiform, sometimes slightly bent, 68-76 × 2-3 μm, hyaline, nonseptate, with numerous guttules. *Culture*: No measurable growth either on CMA or MEA after seven days. Three-week-old colonies on CMA 6 mm diam., white, mycelium mostly immersed, aerial mycelium sparse, appressed, border even, reverse white Three-week-old



Figs. 176-190. *Chaetosphaeria spinosa*. **176, 177.** Ascomata on substrate. **178.** Longitudinal section through ascoma. **179.** Surface view of the ascomal wall. **180.** Ascomal seta. **181, 182.** Longitudinal sections through ascomal walls. **183.** Ascus apex showing apical ring. **184, 185.** Asci. **186, 187.** Ascospores. **188.** Phialide with a cluster of conidia on CMA. **189.** Phialide on CMA. **190.** Conidia on CMA. Figs. 176, 177 by photomacrography; Figs. 178-190 by DIC. All figures from holotype SMH 2754. Bars: 176, 177 = 200 μm ; 178-190 = 10 μm .

colonies on MEA 10 mm diam., white, aerial mycelium densely funiculose in center, appressed elsewhere, border even, reverse white. *Conidiophores* semi-macronematous on CMA. Conidiogenous cell a phialide, ampulliform, hyaline, $10-15 \times 4.5-6 \mu\text{m}$, with a funnel-shaped collarettes, $2.3-3.3 \mu\text{m}$ deep, $4-4.5 \mu\text{m}$ at opening. *Conidia* one-celled, ellipsoid to globose, hyaline, $6.5-8.5 \times 3-4.5 \mu\text{m}$, in clusters at tips of phialides.

Anamorph: Phialidic.

Habitat: On decorticated wood (birch).

Known distribution: USA (North Carolina, Texas)

Material examined: USA, North Carolina, Macon Co., Whiteside Mountain, Highlands, 1000 m, [35192, -83.2736], 7 October 1996, on inside surface of peeling birch bark, S.M. Huhndorf, F.A. Fernández, with Q.X. Wu, J.C. Wei, G.M. Mueller, SMH2754 (F; **holotype designated here**); TEXAS, Hardin Co., Texas Nature Conservancy Roy Larson Sandyland Sanctuary, ca. 10 mi N of Beaumont, 10 June 2000, on 20 cm birch log, A.N. Miller, SMH4232.

***Chaetosphaeria sylvatica* F.A. Fernández & Huhndorf, sp. nov.** (Figs. 191-206)

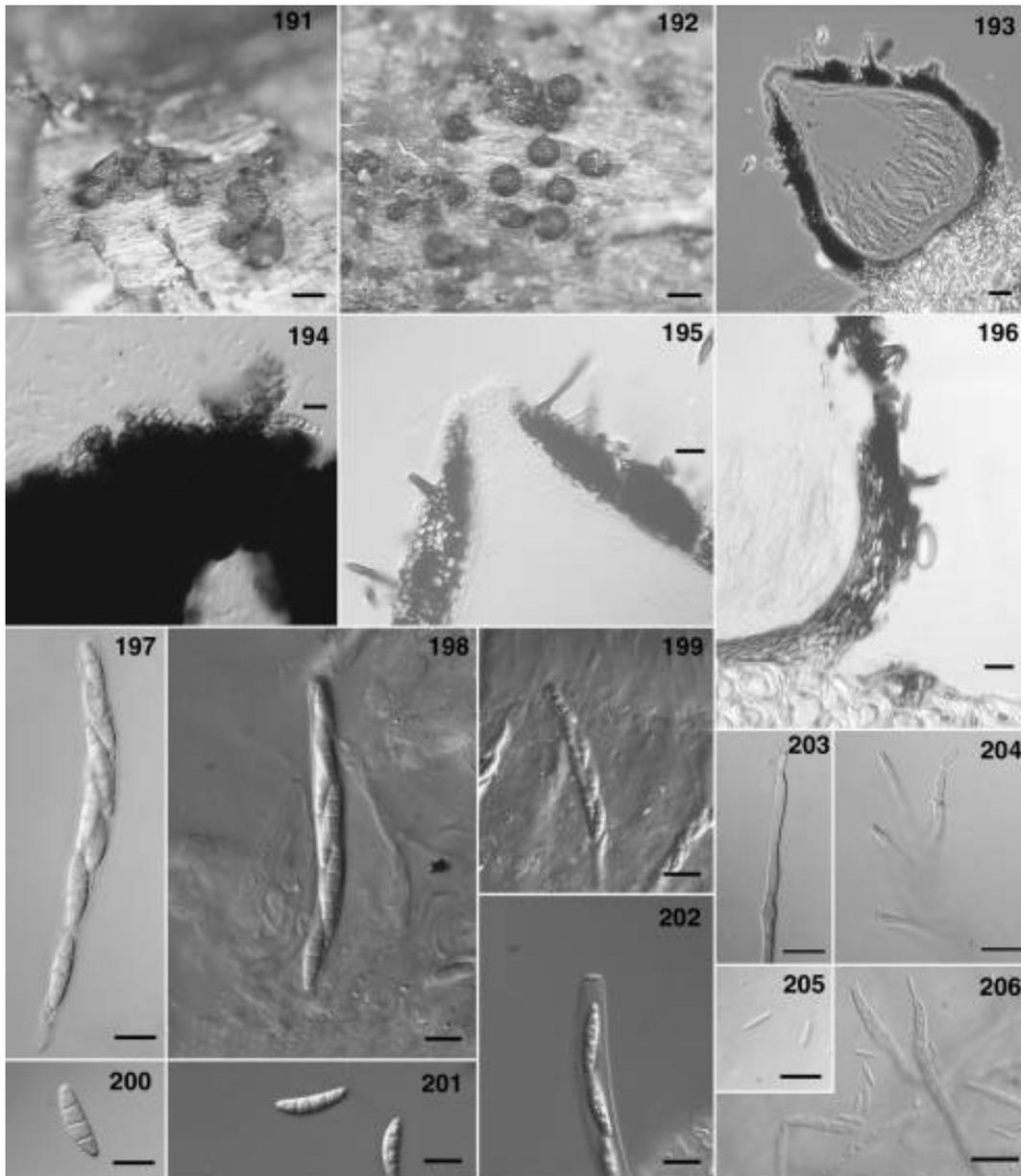
Etymology: Refers to its common occurrence in tropical forests.

Ascomata ovoidea vel obpyriformis, atrobrunnea, $264-302 \mu\text{m}$ lata, $269-292 \mu\text{m}$ alta, solitaria, superficialia, aggregata, papillata, sparsim setosa. *Paries ascomatis* cum aspectu superficialis opacus in aqua et in lactophenol, sectione longitudinali $15.5-18.5 \mu\text{m}$ crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis, cum collis, ad $33 \mu\text{m}$ altis, ad $60 \mu\text{m}$ basis latis. *Paraphyses* simplices, septatae, hyalinae, in matrix gelatineus. *Asci* cylindrici, brevi pedicellati, $95-115 \times 8.7-10.7 \mu\text{m}$, unitunicati, tenuis paries, tennuis annulus apicalis, octospori. *Ascospores* fusiformes, hyalinae, $13-20 \times 4-5.5 \mu\text{m}$, 3-septatae.

Ascomata broadly ovoid to obpyriform, dark brown, $264-302 \mu\text{m}$ in diam., $269-292 \mu\text{m}$ in height, separate, superficial, solitary to gregarious, sometimes sparsely setose. *Ascomatal wall* in surface view opaque in water and in lactophenol, $15.5-18.5 \mu\text{m}$ thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal apex* papillate, beaked, up to $33 \mu\text{m}$ in length, $60 \mu\text{m}$ at the base. *Paraphyses* sparse, simple, septate, hyaline, embedded in a gel matrix. *Asci* cylindrical, short-stalked, $95-115 \times 8.7-10.7 \mu\text{m}$, unitunicate, thin-walled, shallow apical cap, with 8 ascospores irregularly arranged. *Ascospores* fusiform, hyaline, $13-20 \times 4-5.5 \mu\text{m}$, three-septate. *Culture*: Colony on CMA 7 mm in diam. after seven days. Twenty-one day old colonies on CMA 31 mm in diam., grayish black, mostly immersed, reverse black, surface mycelial growth sparse, grayish, margins effuse. *Conidiophores* semi-macronematous, black. Conidiogenous cell a phialide, cylindrical to narrowly lageniform, terminal, $13-18 \times 1.4-2$ (base) $2.3-3$ (venter) $1.2-1.5$ (apex) μm , collarettes inconspicuous or absent. *Conidia* cylindrical to clavate, hyaline, $5-8 \times 1.2-1.5 \mu\text{m}$ on CMA.

Anamorph: It resembles *Phaeostalagmus* W. Gams.

Habitat: On decorticated wood.



Figs. 191-206. *Chaetosphaeria sylvatica*. **191, 192.** Ascomata on substrate. **193.** Longitudinal section through ascoma. **194.** Surface view of the ascomal wall in lactophenol. **195.** Section through ascomal neck. **196.** Section through ascomal wall. **197, 198.** Asci. **199.** Paraphyses. **200, 201.** Ascospores. **202.** Ascus apex showing apical ring. **203-206.** Conidiophores and conidia from CMA. Figs. 191, 192 by photomacrography; Figs. 194-206 by DIC; Fig. 193 by PH. Figs. 191, 193, 195, 196 from SMH 1319; Figs. 192, 194, 197, 200, 203-206 from holotype SMH 2893; Figs. 199, 201, 202 from SMH 1909; Fig. 198 from SMH 4081. Bars: 191, 192 = 200 μ m; 193 = 20 μ m; 194-206 = 10 μ m.

Known distribution: Jamaica, Puerto Rico.

Material examined: JAMAICA, Trelawney Parish, Winsor Trail, 115 m, [18.3556, -77.6472], 13 June 1999, on wood fragment, FAF, with T. Armstrong, T. Barroni, S. Cantrell, T. Commock, K.H. Larssen & L. Ryvardeen, *SMH4081*. PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 12 January 1997, on 30 cm log, S.M. Huhndorf, F.A. Fernández, *SMH2893* (F; **holotype designated here**); 27 April 1995, on wood fragment, *SMH1173*; 4 May 1995, on 1 cm twig, *SMH1319*; 16 January 1996, on 4 cm branch, *SMH1909*; Caribbean National Forest, El Yunque Road, La Coca trail, Luquillo Mts., [18.283, -65.800], 10 June 1998, on wood fragment, FAF, A.N. Miller, *SMH3799*.

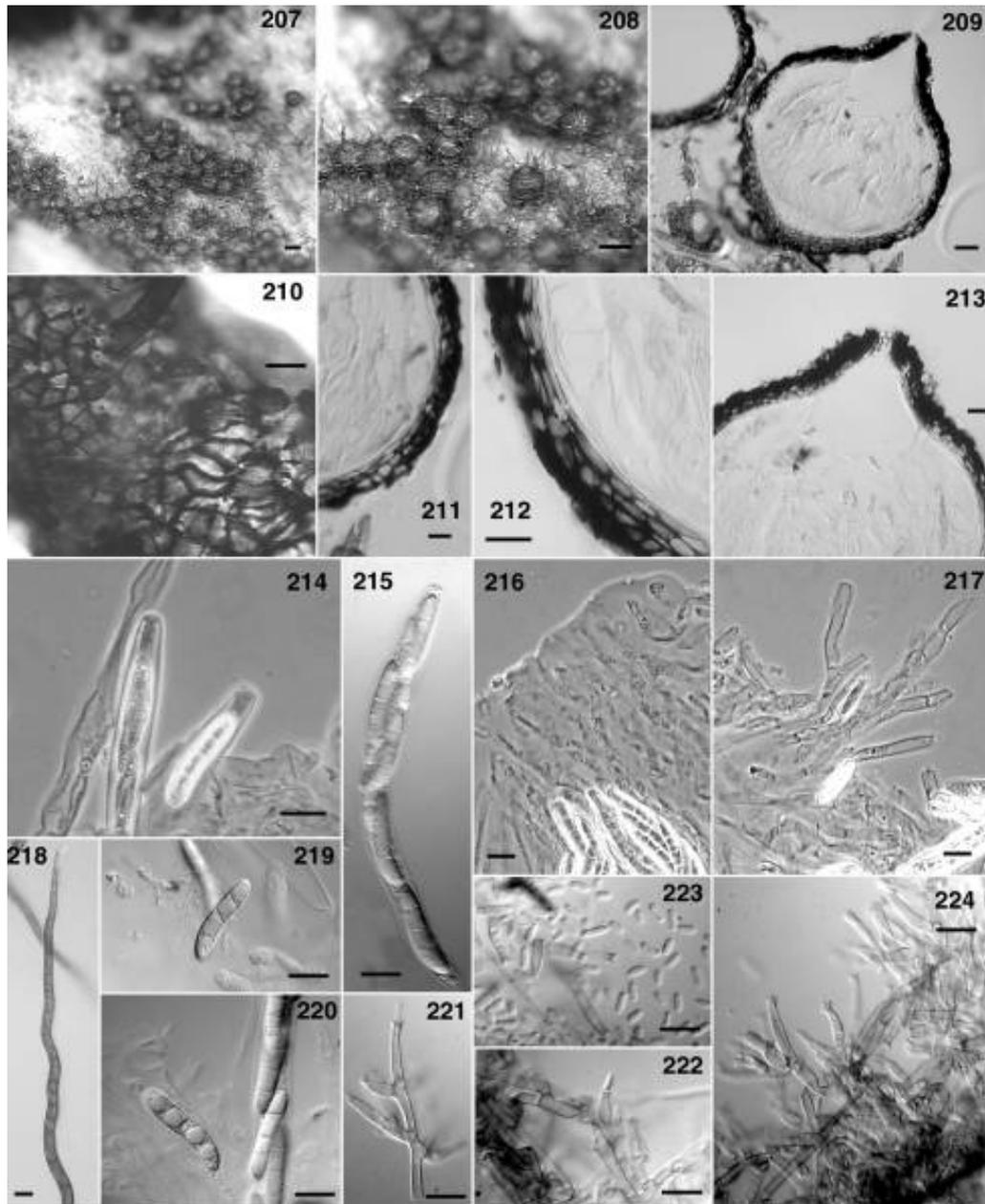
***Chaetosphaeria tropicalis* F.A. Fernández & Huhndorf, sp. nov.** (Figs. 207-224)

Etymology: Refers to its common occurrence in the tropics.

Ascomata globosa vel subglobosa, atrobrunnea fulgens cinerascens, 194-271 μm lata, 236-295 μm alta, superficialia, papillata, dense aggregata, asperum, abundans setae brunnea multiseptatae sinuosa apicem obtusum ab basi ascomatis. *Paries ascomatis* cum aspectu superficialis ut textura angularis in aqua et in lactophenol, sectione longitudinali 11-14 μm crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis, breve. *Paraphyses* simplices, septatae, hyalinae, 3.6-4.9 μm latae. *Asci* cylindrico-clavati, brevi pedicellati, 100-138 \times 10-12.5 μm , unitunicati, tennuis annulus apicalis, octospori. *Ascospores* fusiformes, hyalinae, 19-26 \times 3.2-6.3 μm , 3-septatae, curvatura minima distinguibilis.

Ascomata globose to subglobose, dark brown with a gray luster, 194-271 μm in diam., 236-295 μm in height, superficial, papillate, with a roughened surface, often in dense clusters, with abundant, brown multiseptate, sinuous, tubular or tapering setae, apically rounded, arising from the base of ascomata, abundant on the substrate and forming a subiculum. *Ascomatal wall* of textura angularis in surface view in water and in lactophenol, 11-14 μm thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal apex* papillate, short. *Paraphyses* sparse, simple, septate, 3.6-4.9 μm wide. *Asci* cylindrico-clavate, short-stalked, 100-138 \times 10-12.5 μm , unitunicate, thin-walled, thin apical refractive ring, with 8 ascospores biserially arranged. *Ascospores* fusiform, hyaline, sometimes very pale brown, three-septate, 19-26 \times 3.2-6.3 μm , with a slight distinctive curve. *Culture:* Colony on CMA 6 mm in diam. after seven days. Twenty-one day old colonies on CMA 16 mm in diam., greenish black, mostly immersed, reverse greenish black, surface mycelial light gray, cottony, margins effuse. *Conidiophores* semi-macronematous, dark brown. Phialides on CMA cylindrical to narrowly ampulliform, in terminal or lateral whorls, 7.8-17 \times 1.9-2.5 μm at the base or up to 3.8 μm at midsection, tapering to 1.4-1.7 μm just below the collarette, collarettes small, cylindrical to funnel-shaped, 1-1.7 μm deep, 1.8-2.9 μm at opening. *Conidia* narrow oblong, hyaline, 5-8 \times 1.2-1.5 μm on CMA. The cluster arrangement of the phialides disappears with repeated subculturing and is replaced by production of single, lateral phialides.

Anamorph: It resembles *Phaeostalagmus*.



Figs. 207-224. *Chaetosphaeria tropicalis*. **207, 208.** Ascomata on substrate. **209.** Longitudinal section through ascoma. **210.** Surface view of the ascomal wall. **211, 212.** Sections through ascomal walls. **213.** Section through ascomal neck. **214.** Ascus apex. **215.** Ascus. **216, 217.** Paraphyses. **218.** Ascomal seta. **219, 220.** Ascospores. **221, 223, 224.** Conidiophores with phialides on CMA. **222.** Conidia on CMA. Figs. 207, 208 by photomacrography; Figs. 209-213, 215, 218-224 by DIC; Figs. 214, 216, 217 by PH. Figs. 207, 208 from SMH 1312; Figs. 209, 211-213 from SMH 2833; Figs. 210, 214-217, 219, 220 from holotype SMH 1267; Figs. 221-224 from SMH 2250; Fig. 218 from SMH 3040. Bars: 207, 208 = 200 μm ; 209 = 20 μm ; 210-224 = 10 μm .

Habitat: On decorticated wood and bark of twigs and branches.

Known distribution: Costa Rica, Jamaica, Puerto Rico, Thailand, Venezuela

Material examined: COSTA RICA, Puntarenas Province, Parque Internacional La Amistad Pacifico, Los Alturas Biological Station, trail to Cerro Echandi, 1st 500 m, 1580 m, [8.9500, -82.8333], 6 May 1996, on 2.5 cm branch, SMH, FAF, *SMH2224* (F); on 60 cm log, *SMH2242* (F); on wood, *SMH2250* (F); on 50 cm log, *SMH2258* (F). JAMAICA, Trelawney Parish, Winsor Trail, 115 m, [18.3556, -77.6472], 13 June 1999, on wood fragment, FAF, with T. Armstrong, T. Barroni, S. Cantrell, T. Commock, K.H. Larssen & L. Ryvardeen, *SMH4080*; Portland Parish, Ecelesdown, John Crow Mts., [18433, -76.3108], 16 June 1999, on wood fragment, FAF, *SMH4101.1*. PUERTO RICO, Caribbean National Forest, El Verde Research Area, 16-ha Grid, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 1 May 1995, on 4 cm branch, S.M. Huhndorf *SMH1267* (F; **holotype designated here**); 25 April 1995, on log, SMH, D.J. Lodge, *SMH1148*; 27 April 1995, on wood, *SMH1182*; 28 April 1995, on 25 cm log, *SMH1202*; 4 May 1995, on 4 cm branch, buried under litter, *SMH1312*; 10 June 1995, on 15 cm log, *SMH1457*; 26 September 1995, on 38 cm log, *SMH1590*; 2 October 1995, on log, *SMH1692*; 3 October 1995, on 20 cm log, *SMH1711*; 10 October 1995, on 30 cm log, *SMH1859*; 16 January 1996, on 25 cm log, *SMH1926*; 18 January 1996, on 15 cm log, *SMH1944*; 26 January 1996, on 38 cm branch, *SMH2071*; 12 January 1997, on 3.75 cm branch, SMH, FAF, *SMH2896*; 14 January 1997, on wood fragment, SMH, FAF, *SMH2932*; 14 January 1997, on 30 cm trunk, SMH, FAF, *SMH2945*; 18 January 1997, on 3 cm branch, SMH, FAF, *SMH3040*; Caribbean National Forest, El Yunque Road, El Toro trail, Luquillo Mts., 5 June 1998, on wood fragment, FAF, A.N. Miller, *SMH3772*; near Rio Sabana, NW of junction of Rte 983 & 991, Luquillo Mts., 70 m, [18.3500, -65.725], 17 January 1996, on log, SMH with, D.J. Lodge, D. Pfister, M. Harrington, *SMH1940*. THAILAND, Khao Suk National Park, 19 November 1996, on branch fragment, *SMH2833*. VENEZUELA, Edo. Aragua, Parque Nacional Rancho Grande, Estacion Biológica Henry Pittier, Periquito Peak, 1100 m, [10.3489, -67.6856], 30 August 1999, on bark, FAF, *SMH4154*.

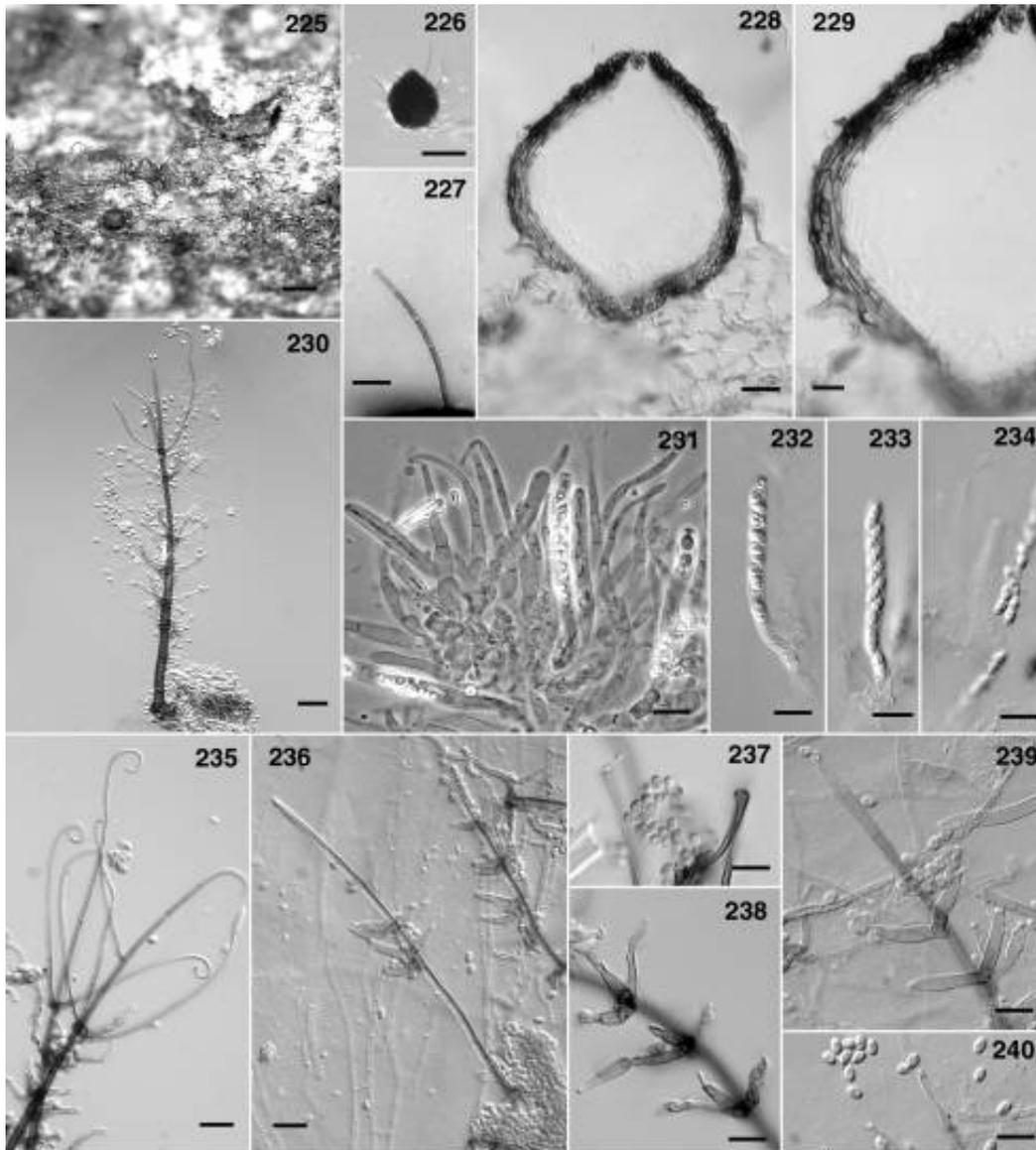
Melanopsammella gonytrichii F.A. Fernández & Huhndorf, **sp. nov.**

(Figs. 225-240)

Etymology: Refers to genus name given to anamorph.

Ascomata ovoidea vel subglobosa, atrobrunnea, 108-120 μm lata, 127-138 μm alta, solitaria, superficialia, papillata, setae sparsi vel pauci, brunnea, multiseptatae, apicem tenuissimae. *Paries ascomatis* cum aspectu superficialis ut textura angularis, sectione longitudinali 8.5-12 μm crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis, opacus. *Paraphyses* simplices, septatae, hyalinae, 4.2-5.9 μm latae, tenuis apicem 1.5-2 μm . *Asci* cylindrico-clavati, brevi pedicellati, 48-57 \times 4.5-5 μm , unitunicati, octospori. *Ascospores* ellipsoideae, hyalinae, 6.5-9 \times 2.8-3.2 μm , uniseptatae, secedens ad septum.

Ascomata broadly ovoid to globose, dark brown, 108-120 μm in diam., 127-138 μm in height, separate, papillate, with a few, scattered setae, brown, multiseptate, slender, tapering to an attenuated apex. *Ascomatal wall* of textura angularis in surface view, 8.5-12 μm thick in longitudinal section, composed of pseudoparenchymatic cells. *Ascomatal apex* papillate, opaque. *Paraphyses* unbranched, septate, hyaline, 4.2-5.9 μm at the base, tapering to 1.5-2 μm at the apex. *Asci* cylindrical-clavate, short-stalked, 48-57 \times 4.5-5 μm , unitunicate,



Figs. 225-240. *Melanopsammella gonytrichii*. **225.** Ascoma on substrate. **226.** Ascoma mounted in water. **227.** Seta on the ascoma. **228.** Longitudinal section through ascoma. **229.** Section through ascomal wall. **230.** Conidiophore from natural substrate. **231.** Paraphyses. **232, 233.** Asci. **234.** Ascospores. **235.** Conidiophore apex showing coiled terminal setae, from natural substrate. **236.** Conidiophores showing lateral and terminal phialides, from CMA. **237.** Conidia from natural substrate. **238.** Lateral phialides, from natural substrate **239.** Lateral and terminal phialides, from CMA. **240.** Conidia from CMA. Fig. 225 by photomacrography; Figs. 226-230, 232-240 by DIC; Fig. 231 by PH. All figures from holotype SMH 3785. Bars: 225 = 200 μm ; 226 = 100 μm ; 227, 228, 230, 235, 236 = 20 μm ; 229, 231-234, 237-240 = 10 μm .

thin-walled, with 8 ascospores arranged uniseriately. *Ascospores* ellipsoid, hyaline, $6.5-9 \times 2.8-3.2 \mu\text{m}$, 1-septate, easily disarticulating into part-spores. *Culture*: One-week-old colonies on CMA 26 mm diam., two-week-old colonies 45 mm diam., white, mycelium mostly superficial, aerial mycelium abundant, floccose, border even, reverse white. Conidiophores and conidia produced sparsely throughout the colony. One-week-old colonies on MEA 25 mm diam., two-week-old colonies 50 mm diam., light and dark grayish green, mycelium superficial, aerial mycelium abundant, floccose, border even, reverse dark green with a white border. Conidiophores and conidia produced abundantly in concentric rings. *Conidiophores*, single, unbranched, dark brown becoming light brown towards the apex, multiseptate, $69-84 \times 4-6.6 \mu\text{m}$ on CMA, with 5-8 whorls of phialides in midsection, a single phialide at the apex; conidiophores on the substrate $221-265 \times 5.5-7.5 \mu\text{m}$ at the base, tapering to a terminal phialide, $1.2-2.3 \mu\text{m}$ setiform branches subterminal or terminal, tapering to a coiled apex, light-brown becoming hyaline towards the apex, 1 to 4 on a whorl, 1 or 2 whorls per conidiophore. Conidiogenous cell a phialide, cylindrical to lageniform, producing conidia from multiple conidiogenous loci, phialides borne on collar hyphae around the conidiophore, percurrent proliferation observed on the substrate. *Conidia* ellipsoid, light green, $3.8-4.5 \times 1.9-2.6 \mu\text{m}$ on CMA, $2.9-3.4 \times 1.8-2.4$ on the substrate.

Anamorph: It resembles *Gonytrichum* Nees & T. Nees.

Habitat: On decorticated wood.

Known distribution: Puerto Rico.

Material examined: PUERTO RICO, Caribbean National Forest, El Verde Research Area, Luquillo Mts., 350 to 425 m, [18.3167, -65.8167], 9 June 1998, on 4 cm branch, comm. J. McKemy, FAF, A.N. Miller, SMH3785 (F; **holotype designated here**).

***Tainosphaeria* F.A. Fernández & Huhndorf, gen. nov.**

Etymology: ‘Taino’ — referring to the Taino indians, pre-hispanic inhabitants of Puerto Rico and the Caribbean, + ‘sphaeria’ — meaning sphere.

Ascomata subglobosa vel ovoidea, atrobrunnea. *Paraphyses* simplices, septatae, hyalinae. *Asci* unitunicati, cylindrici, stipitati, annulo apicali adsum. *Ascospores* fusiformes, hyalinae.

Typus generis: *Tainosphaeria crassiparies* F.A. Fernández & Huhndorf

Ascomata subglobose to ovoid. *Paraphyses* simple, septate, hyaline. *Asci* unitunicate, cylindrical, stipitate, with an apical ring. *Ascospores* hyaline, septate.

***Tainosphaeria crassiparies* F.A. Fernández & Huhndorf, sp. nov.**

(Figs. 241-262)

Etymology: ‘Crassi’ refers to the relatively thick ascomal wall.

Ascomata subglobosa vel ovoidea, atrobrunnea, 198-248 μm lata, 208-297 μm alta, cum exterior aspero, solitaria, superficialia, aggregata, papillata. *Paries ascomatis* cum aspectu

superficialis opacus in aqua et textura angularis in lactophenol, sectione longitudinali 22-33 μm crassus, cellulis pseudoparenchymatis. Apicem ascomatis papillatis. *Paraphyses* simplices, septatae, hyalinae. *Asci* cylindrici, brevi pedicellati, 92.5-112.5 \times 7-10 μm , unitunicati, tenuis paries, tennuis annulus apicalis, octospori. *Ascospores* fusiformes, hyalinae, 22-33 \times 2.5-4 μm , 3-septatae, 4- et 5-septatae raro.

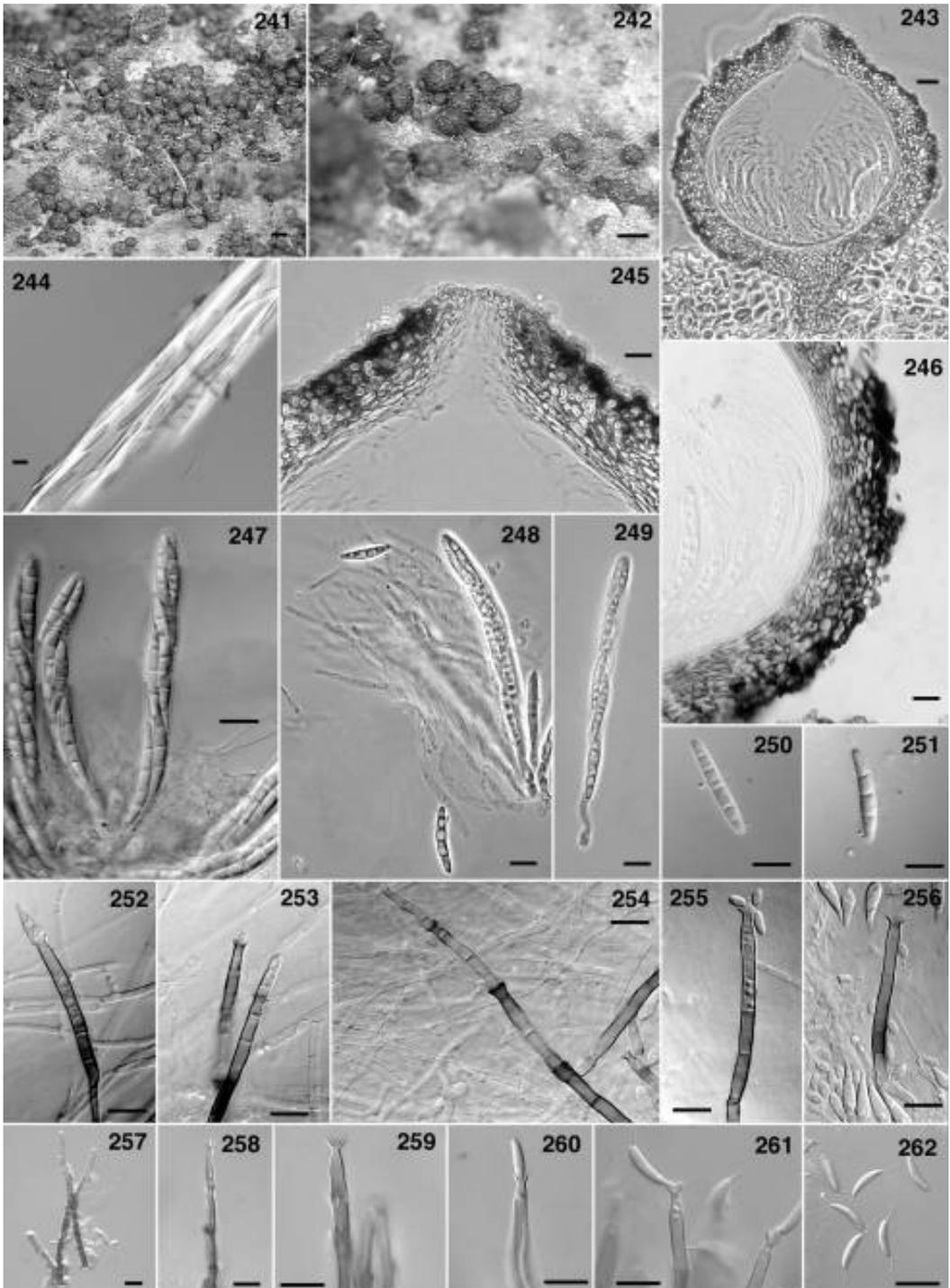
Ascomata subglobose to broadly ovoid, dark brown, 198-248 μm in diam., 208-297 μm in height, roughened surface, separate to gregarious, superficial on the substratum, distinctly papillate. *Ascomatal wall* in surface view, opaque in water, of textura angularis in lactophenol, 22-33 μm thick in longitudinal section. *Ascomatal apex* broad, papillate, short. *Paraphyses* unbranched, septate, hyaline, tapering, 2.2-3 μm wide. *Asci* cylindro-clavate, short-stalked, 92.5-112.5 \times 7-10 μm , unitunicate, thin-walled, apical ring very small, with 8 ascospores biserially arranged. *Ascospores* narrow-fusiform, with rounded ends, often inequilateral, 22-33 \times 2.5-4 μm , hyaline, mostly three-septate, rarely 4- or 5-septate. *Culture*: Colony on CMA 25 mm in diam. after seven days. Twenty-one day old colonies on CMA 45 mm in diam., subhyaline, mycelium mostly superficial, moist, appressed, margin effuse, reverse white, conidiophores produced throughout the colony. *Conidiophores* single, multiseptate, unbranched, brown becoming light brown towards the apex or viceversa, 43-100 \times 3-3.7 μm at the base, tapering to 1.8-2.7 μm . *Phialides* cylindrical, light brown, 14-27 \times 2.5-3.6 μm , collarette generally present, funnel-shaped, 1.5-2 μm deep, 2-2.7 at the base, widening to 3.8-4.5 μm at apex. Conidiogenous cell proliferating repeatedly in a percurrent manner. *Conidia* in culture ranging from one celled, ellipsoid, hyaline, 3.5-4 \times 2-2.5 μm , to one-celled, clavate, hyaline, rounded at the apex, acute at the base, sometimes with a short basal vertical slit, 12-14.6 \times 3-3.6 μm , produced from the same phialides. On the substrate, conidiophores are mononematous, macronematous, brown, 87-121 \times 2.7-4.5 μm at the base, tapering to a terminal, single phialide, often showing percurrent proliferations. *Phialides* cylindrical, light brown, 27-35 \times 2.5-3.5 at the base, narrowing to 1.2-1.5 μm just below the collarette. Collarettes light brown, funnel shaped, 3-3.9 μm at the opening, 2-2.5 μm deep. *Conidia* falcate, inequilateral, hyaline, basal end truncate, apical end rounded, 10.5-14.8 \times 2-3 μm , a single setula at both ends, 4-8.5 μm long.

Anamorph: It resembles *Codinaea* Maire (Maire, 1937).

Habitat: On *Hymenia* pod and on erumpent stromata of overmature ascomycetes.

Known distribution: Puerto Rico.

Material examined: PUERTO RICO, Sabana, near Rio Sabana, NW of junction of Rte. 983 & 991, hill above chicken farm, 70 m, 18° 21' N, 65° 43' 30'' W, [18.35, -65.725], 17 January 1996, on *Hymenaea* seed pod, S.M. Huhndorf, with D.J. Lodge, D. Pfister, M. Harrington, SMH1934 (F; **holotype designated here**).



Figs. 241-262. *Tainosphaeria crassiparies* **241, 242.** Ascomata on substrate. **243.** Longitudinal section through ascoma. **244.** Cellulose degradation. **245.** Section through ascomal neck. **246.** Section through ascomal wall. **247, 249.** Asci. **248.** Ascus and paraphyses. **250, 251.** Ascospores. **252.** Conidiophore with developing conidium on CMA. **253, 254.** Conidiophores showing percurrent proliferations, on CMA. **255.** Conidiophore and microconidia formed from multiple loci on conidiogenous cell, on CMA. **256.** Conidiophore and macroconidia, on CMA. **257.** Conidiophores on natural substrate. **258.** Conidiophore showing percurrent proliferation from natural substrate. **259.** apical phialide. **260.** Phialide with a developing conidium. **261.** Phialide with developed conidium. **262.** Conidia from natural substrate. Figs. 241, 242 by photomacrography; Figs. 246, 247, 250-262 by DIC; Figs. 243-245, 248, 249 by PH. All figures from holotype SMH 1934. Bars: 241, 242 = 200 μm ; 243 = 20 μm ; 244-262 = 10 μm .

Key to *Chaetosphaeria* species in the Americas

1. Ascospores 1-celled, 1- or 3 septate 2
1. Ascospores 3-septate to multiseptate, hyaline or pigmented 15
2. Conidiophores with discrete lateral phialides 3
2. Conidiophores with a discrete apical phialide or conidiophores with integrated polyphialides 6
3. Ascospores 1-septate, hyaline, ascomata small (approx 120 μm diam), phialides unilaterally arranged, tropical *C. minuta*
3. Ascospores 3-septate, temperate or tropical 4
4. Ascospores 3-septate, lateral phialides in whorls, temperate *C. lateriphiala*
4. Ascospores 3-septate, lateral phialides verticillately arranged 5
5. Ascomata sparsely setose, ascospores fusiform, conidia narrow fusiform, hyaline, tropical *C. sylvatica*
5. Ascomata with basal setae, ascospores distinctively curved, conidia narrow -ellipsoid to oblong, hyaline, tropical *C. tropicalis*
6. Conidiophores with a discrete apical phialides 7
6. Conidiophores with integrated polyphialides 11
7. Ascospores 1- or 3-septate, long tapering at both ends, conidia one-celled, ellipsoid, brown, south temperate *C. fennica* (P. Karst.) Réblová & W. Gams
7. Ascospores 1- or 3-septate, cylindrical to fusiform, temperate or tropical 8
8. Ascoma beak prominent, setae capitate, ascospores 1- or 3-septate, conidia hyaline, cylindrical to reniform, tropical *C. conirostris*
8. Ascoma beak absent or very short 9
9. Ascomata glabrous, ascospores 1-septate, phialide with a deep cylindrical collarette, conidia clavate, hyaline, tropical *C. chalaroides* Hol.-Jech.
9. Ascomata setose 10

10. Ascospores 3-septate, phialide with a distinctive collarete, conidia cuneiform, brown, tropical *C. cubensis* Hol.-Jech.
10. Ascospores 1- or 3-septate, phialide cylindrical, conidia ellipsoid to oblong, hyaline, temperate *C. atrobarba* (Cooke & Ellis) Sacc.
11. Ascomata glabrous..... 12
11. Ascomata setose and/or, with/among conidiophores 13
12. Ascospores mostly 1-septate, conidia obclavate, hyaline, 29-49 × 2.7-3.9 μm, septate, tropical..... *C. luquillensis*
12. Ascospores 3-septate, conidia cylindrical to narrow-ellipsoid, hyaline, 3.5-4.5 × 1.3-1.7 μm, temperate *C. innumera*
13. Ascomata with long setae, ascospores one-celled or 1-septate, temperate and tropical *C. longiseta*
13. Ascospores 1- or 3-septate 14
14. Conidia narrow-ellipsoid to fusiform, one celled or 1-septate, 4-12.5 × 2-2.7 μm, hyaline, temperate *C. hebetiseta*
14. Conidia fusiform to falcate, one-celled, 10-20 × 2-2.9 μm, hyaline, temperate *C. callimorpha* (Mont.) Sacc.
15. Ascospores filiform to narrow-cylindrical, hyaline 16
15. Ascospores cylindrical to fusiform, hyaline or pigmented 18
16. Ascomata setose, wall of textura epidermoidea, ascospores filiform, one-celled, temperate *C. spinosa*
16. Ascomata glabrous or setose, outermost wall layer of large globose cells 17
17. Ascomata glabrous, ascospores narrow-cylindrical, 5-7 septate, tropical *C. lapaziana* (Carroll & Munk) F.A. Fernández & Huhndorf **comb. nov.** [= *Lasiochaeria lapaziana* Carroll & Munk, Mycologia 56: 90. 1964. Basionym.]
17. Ascomata setose, ascospores almost filiform, 5-9 septate, tropical and temperate..... *C. raciborskii* (Penz. & Sacc.) F.A. Fernández & Huhndorf
18. Anamorph conspicuous when present 19
18. Putative anamorph inconspicuous, ascomata robust, asci long-stalked, ascospores broadly fusiform to cylindrical, 6-7 septate, hyaline, tropical *C. cylindrospora* F.A. Fernández, Huhndorf, J.E. Taylor & K.D. Hyde
19. Ascospores 3-septate to multiseptate, conidia hyaline or hyaline becoming versicolorous 20
19. Ascospores multiseptate, conidia uniformly pigmented 21
20. Ascospores cylindrical-fusiform, 7-septate, hyaline, conidiophore with integrated polyphialide, conidia cylindrical, multiseptate, hyaline, tropical *C. lignomollis*
20. Ascospores fusiform, 3-5 septate, hyaline, conidiophore with a single apical phialide, conidia broadly allantoid to oblong, base truncate, 3-septate, turning versicolorous, temperate *C. decastyla* (Cooke) Réblová & W. Gams

21. Ascomata with colored outer coating or colored crystals on the surface, conidia brown, with distinct basal hylum..... 22
21. Ascomata glabrous or covered with conidiophores, ascospores cylindrical-fusiform, 7-septate, versicolorous, conidia on the natural substrate cylindrical, dark brown, multiseptate, apical cell hyaline, truncate base, temperate
C. caesariata (Cooke & Peck) F.A. Fernández & Huhndorf, **comb. nov.** [= *Sphaeria caesariata* Cooke & Peck in Peck, Ann. Rep. New York State Mus. Nat. Hist. 29: 60 (for 1875) 1878. Basionym. Note. The authority for the basionym of *C. caesariata* has been incorrectly cited as Clinton & Peck in previous publications (Shoemaker and White, 1985; Réblová, 1999).]
22. Ascomata with scattered setae, apices capitate and covered with yellow crystalline material, ascospores fusiform, 7-10 septate, yellow light brown, tropical.....*C. capitata*
22. Ascomata with a greenish coating, fading with age, scattered setae, ascospores cylindrical-fusiform, mostly 7-9 septate, versicolorous, tropical*C. chlorotunicata*

Discussion

Neotropical and temperate species of *Chaetosphaeria* here described present some unique and sometimes rather unusual morphological characters. *Chaetosphaeria capitata*, for example, possesses setae on the ascomata that are covered with a distinctive yellow pruina at their apices. This crystalline material was found on both the type material and additional collections made in Costa Rica and Puerto Rico. Setae were particularly emphasized and compared to those in *C. cupulifera* (Berk. & Broome) Sacc. and *C. novae-zelandiae* S. Hughes & Shoemaker (Sivanesan and Chang, 1995). Ascomata in *C. capitata* are relatively small and comparable in size to other species of *Chaetosphaeria*. The uniform pigmentation and the cylindrical to narrowly fusiform shape of its ascospores were used as criteria to place this species in the genus (Sivanesan and Chang, 1995). Two hyphomycetes (*Exserticlava vasiformis* and *Sporidesmium* sp.) were reported on the type of *C. capitata* although a link among them was considered unlikely (Sivanesan and Chang, 1995). In our study, the connection between *C. capitata* and *E. vasiformis* has been established by culturing of ascospores *in vitro*.

Chaetosphaeria chlorotunicata bears similarities to *C. capitata* in the pigmented, multiseptate ascospores and the *Exserticlava* anamorph. *Chaetosphaeria chlorotunicata* also bears similarities in ascospore morphology with *Chaetosphaeria hiugensis* I. Hino (Hino, 1938) except that, in the latter, a subiculum is present and the greenish-gray outer coating in the ascomata is missing.

Chaetosphaeria conirostris also exhibits distinctive morphological features such as a conical ascomal beak and capitate setae bearing yellow-brown droplets. Its cultural anamorph is reminiscent of morphologies

described in *Craspedodidymum* (Holubová-Jechová, 1972), *Dischloridium* B. Sutton (Sutton, 1977), *Hyalocylindrophora* J.L. Crane & Dumont (Crane and Dumont, 1978) and *Monilochaetes* Halst. ex Harter (Rong and Gams, 2000). The shape and size of phialides and conidia in *C. conirostris* are somewhat similar to *Craspedodidymum hyalosporum* Bhat & W.B. Kendr. reported from India (Bhat and Kendrick, 1993) and to the pantropical taxon known as *Dischloridium laeense* (Matsush.) B. Sutton (Sutton, 1977). Unfortunately, the anamorph of *C. conirostris* was not found on the natural substrate and comparisons to its manifestation in culture were not possible.

Chaetosphaeria lateriphiala bears similarities to *C. innumera*, type species of the genus. Ascum dimensions of the two species overlap and are not significantly different although those in *C. lateriphiala* produce slightly taller ascumata with more robust apices. Also, ascospore size and morphology in the two species is almost identical. Nevertheless, *C. lateriphiala* can be distinguished by its morphologically distinctive *Zanclospora* anamorph (Hughes and Kendrick, 1965), which it shares with its putative south temperate sister species, *C. brevispora* Shoemaker (Hughes and Kendrick, 1968). Phialides and conidia in *C. lateriphiala* closely resemble *Z. novae-zelandiae* S. Hughes & W.B. Kendr., except for the excrescences at the apices of conidiophores in the latter (Hughes and Kendrick, 1965).

Chaetosphaeria minuta possesses some of the smallest ascumata in the genus and an anamorph exhibiting a wide range of morphological variation. In culture, it produced conidiophores with a single apical integrated phialide, and lateral phialides with a single collarette, versus lateral, slender polyphialides on the natural substrate. The range of morphological variation and conidiogenesis observed spans across the typical morphologies of *Chaetopsis* (Hughes, 1951), *Cryptophialoidea* Kuthub. & Nawawi (Kuthubutheen and Nawawi, 1987), *Dictyochaetopsis* Aramb. & Cabello (Arambarri and Cabello, 1990) and *Kionochaeta* P.M. Kirk & B. Sutton (Kirk and Sutton, 1986). The unilateral arrangement of phialides on conidiophores observed in culture fits the fundamental character circumscribing the anamorphic genus *Cryptophialoidea*. Many of the diverse anamorph characters of *C. minuta* resemble *Chaetopsis cubensis* R.F. Castañeda, which presumably bears affinities to *Dictyochaeta* (Holubová-Jechová, 1990, Mercado *et al.*, 1997). The lateral arrangement of phialides and the sympodial proliferations of the conidiophores on the substrate are also reminiscent of *Dictyochaetopsis brasiliensis* Caldach, Géné, Stchigel & Guarro (Caldach *et al.*, 2002).

Chaetosphaeria lignomollis possesses ascumata with relatively thin ascumatal walls and long, delicate ascumatal setae, which are reminiscent of *C. pulchriseta* S. Hughes, W.B. Kendr. & Shoemaker (Hughes and Kendrick,

1968) and *C. longiseta*. Nevertheless, ascospores in *C. lignomollis* are cylindrico-fusiform and multiseptate, reminiscent of those found in *C. cupulifera*, *C. capitata* and *C. decastyla*. The conidiogenous cells of *C. lignomollis* can proliferate either percurrently (in culture) or sympodially (on the natural substrate). The overall morphology of its conidiophore is macronematous, dark brown, with an apical, integrated, tapering phialide, resembling those of the anamorphic genus *Kylindria* (DiCosmo *et al.*, 1983). The cylindrical shape and the tapered, truncate base in conidia of *C. lignomollis* are strikingly similar to those of *Kylindria triseptata* (Matsush.) DiCosmo, S.M. Berch & W.B. Kendr. Also, its multiseptate conidia resemble those of *K. pluriseptata* R.F. Castañeda (Mercado *et al.*, 1997) except for the eccentric conidium base. The genus *Cylindrotrichum* also contains species with close morphological similarities to the anamorph of *C. lignomollis*. However, the morphological circumscription of this anamorphic genus has been mired by differing taxonomic opinions (DiCosmo *et al.*, 1983; Réblová and Gams, 1999; Réblová, 2000) and is viewed as polyphyletic at the order level (Réblová and Winka, 2000). The morphological variation in the anamorph of *C. lignomollis* challenges its placement into a clearly ‘artificial’ circumscription, similar to the situation observed in *C. minuta*.

Chaetosphaeria longiseta has several morphological similarities with *C. dingleyae* S. Hughes, W.B. Kendr. & Shoemaker (Hughes and Kendrick, 1968), *C. montana* (Réblová, 1998) and *C. pulchriseta* (Hughes and Kendrick, 1968). All of these species produce ascomata with walls of textura epidermoidea in surface view, mostly ellipsoid one celled and/or one-septate ascospores, and *Dictyochaeta* anamorphs. *Chaetosphaeria callimorpha* also produces a *Dictyochaeta* anamorph but the ascomal wall is of textura angularis and the ascospores are mostly 3-septate and fusiform. Conidia of *C. longiseta* present an wide array of conidium morphologies. For example, conidia produced on CMA resemble size and overall morphology of those in *Dictyochaeta pluriguttulata* Kuthub. & Nawawi (Kuthubutheen and Nawawi, 1991); the ones from the substrate resemble those of *D. vittata* Kuthub. & Nawawi. Morphologies in these two anamorphic taxa have been closely compared to the anamorph morphology of *C. pulchriseta* and these anamorphic entities represent varying degrees of a same morphological continuum (Kuthubutheen and Nawawi, 1991).

Chaetosphaeria luquillensis can be compared to the tropical species *C. arecacensis* K.D. Hyde, Goh, Joanne E. Taylor & J. Fröhl. (Hyde *et al.*, 1999) in having ascospores surrounded by a gelatinous sheath. It can also be compared to *C. callimorpha* in morphologies of ascospores and conidiophores. However, conidia in both species differ considerably. The obclavate shape and

three-septate conidia in *C. luquillensis* are unique and have not been previously associated with any species of *Chaetosphaeria*. Conidium shape resembles that of *Phialogeniculata guadalcanalensis* Matsush. (Matsushima, 1971) and *Chloridium obclaviforme* J. Mena & Mercado (Mercado *et al.*, 1997). Close morphological similarities of these two taxa have been previously suggested (Mercado *et al.*, 1997).

Chaetosphaeria sylvatica and *C. tropicalis* share very similar anamorphs reminiscent of the genus *Phaeostalagmus* (Gams and Holubová-Jechová, 1976) and characterized by phialides arranged in verticillate-like clusters and flared collarettes. A connection of *Phaeostalagmus* to *Chaetosphaeria* was previously suggested (Samuels, 1985). Ascospores of *Chaetosphaeria tropicalis* are uniquely bent which distinguishes it from all other species. On the other hand, *C. sylvatica* closely resembles *C. innumera* and *C. lateriphiala*, except for its anamorph and its neotropical distribution. *Chaetosphaeria tropicalis* is also found in Thailand and it possibly has a pantropical distribution.

Morphology indicates that *C. spinosa* is closely related to *Chaetosphaeria raciborskii*, a taxon formerly placed in *Lasiosphaeria* Ces. & De Not. *sensu lato* (Miller and Huhndorf, 2004). These two species belong in a monophyletic *sensu lato* circumscription of the genus *Chaetosphaeria* (Fernández *et al.*, unpublished).

Species of *Melanopsammella* are easily distinguished by their small, one-septate ascospores that disarticulate into part-spores. Teleomorphs are almost identical and separation of species is only possible by noting differences in the anamorph. *Melanopsammella gonytrichii* closely compares to *M. inaequalis* and *M. chloroconia*. Its anamorph most closely resembles *Gonytrichum macrocladum* (Sacc.) S. Hughes (Hughes, 1951) except for the setae with coiled ends and the light green-colored conidia. In *M. vermicularioides*, the anamorph presents a much simpler morphology than in most species of *Gonytrichum* although conidium ontogeny and conidiogenous cell proliferation are essentially the same. Such production of conidia from multiple loci and percurrent proliferation of the conidiogenous cell was considered a special mode of phialidic development (Gams and Holubová-Jechová, 1976). Species of *Gonytrichum* are commonly found in decomposing wood and isolated from soil worldwide (Mercado *et al.*, 1997). In the Neotropics, *Gonytrichum* has been reported from Cuba (Holubová-Jechová and Mercado, 1984) and Jamaica (Ellis, 1971). *Gonytrichum macrocladum* is cosmopolitan in distribution (Ellis, 1971). This is the first report of a tropical species of *Melanopsammella* with a *Gonytrichum* anamorph.

The genus *Tainosphaeria* bears a few morphological similarities with some *Chaetosphaeria* species. For example, ascospore size and shape are almost identical to those of *C. abietis* (Höhn.) W. Gams & Hol.-Jech. and *C. fusiformis* W. Gams & Hol.-Jech. However, both of these *Chaetosphaeria* species are temperate, each produce its own distinctive anamorph and *C. abietis* is restricted to coniferous wood (Gams and Holubová-Jechová, 1976; Réblová and Gams, 1999). Most importantly, *Tainosphaeria* bears morphological similarities and close phylogenetic affinities with the genus *Zignoëlla* Sacc. (Fernández *et al.*, unpublished).

The anamorph of *Tainosphaeria* resembles, in some respects, at least two anamorphic taxa. It resembles *Chloridium matsushimae* W. Gams & Hol.-Jech. in the percurrent proliferations of the conidiogenous cell and the setulose conidia. It also resembles *Codinaea aristata* Maire in the terminal integrated conidiogenous cell, the conspicuous collarete and the terminally setulate conidia. The anamorph of *Tainosphaeria* also resembles those of *Striatosphaeria* Samuels & E. Müll. and *Zignoëlla*, two other genera in the *Chaetosphaeriaceae*. In *Striatosphaeria*, the apically integrated conidiogenous cell proliferates percurrently and conidia possess terminal setulae (F.A. Fernández, pers. observ.) although conidia lack setulae when produced in culture (Samuels and Müller, 1978). In *Zignoëlla*, specifically in *Z. ovoidea* (Fr.) Constantinescu, K. Holm & L. Holm, setulate conidia are commonly produced. Nevertheless, conidiogenous cells are laterally attached to the conidiophore and usually have recurved tips (Hughes and Kendrick, 1963).

Previous analyses of sequence data of the nuclear large-subunit ribosomal DNA revealed that species groupings within *Chaetosphaeria* are concordant with groupings based on morphological characters of their anamorphs (Fernández *et al.*, 1998). Moreover, the morphological and molecular systematics of mainly temperate species of *Chaetosphaeria* were evaluated and some general morphological patterns indicative of phylogenetic relationships were discerned (Réblová, 2000; Réblová and Winka, 2000). However, the discovery of new *Chaetosphaeria* species with distinctive and/or novel anamorphs adds to the morphological complexities of the genus. It also reveals the particular difficulties in inferring phylogenetic relationships within the genus, especially when viewed through the existing circumscriptions of anamorphic genera. Phylogenetic analyses of nuclear ribosomal and β -tubulin sequences indicate that the new species of *Chaetosphaeria* described here form a strongly supported monophyletic group which includes *C. innumera* (Fernández *et al.*, unpublished).

Distribution and biogeography

Collections and abundance of some of these *Chaetosphaeria* species suggest notable distribution patterns. For example, *C. longiseta* presents a southeastern North America-Greater Antilles geographic distribution. Similar distribution patterns have been reported for some of the species of basidiomycete fungi (Baroni *et al.*, 1997). Molecular evidence also indicates that at least two collections (North American and a Puerto Rican) share spliceosomal introns with very high sequence similarity (Bhattacharya *et al.*, 2000).

Species such as *C. conirostris* have so far only been found in Costa Rica and Ecuador, suggesting a northern South America-Central America distribution pattern. Species such as *C. tropicalis*, appear to be abundant and widely distributed, with possibly a pantropical distribution. Species such as *C. luquillensis*, *C. minuta* and *C. spinosa* are apparently rare and further collecting is needed to discern their possible distribution patterns. The same applies to the showy *C. capitata* which presents a disparate distribution pattern, from Taiwan to Costa Rica and Puerto Rico, probably stemming from its rarity.

Several other species of *Chaetosphaeria* have been reported from the tropics such as *C. arecacensis*, *C. hongkongensis* K.D. Hyde, Goh, Joanne E. Taylor & J. Fröhl. and *C. saltuensis* K.D. Hyde, Goh, Joanne E. Taylor & J. Fröhl. from Southeast Asia (Hyde *et al.*, 1999); *C. cubensis* from Cuba (Holubová-Jechová, 1984) and the pantropical species *C. cylindrospora* (Huhndorf *et al.*, 2001). The occurrence and diversity of species of *Chaetosphaeria* has only recently started to be documented in the tropics (Huhndorf, 1997). The genus and its anamorphs are also known from freshwater habitats (Cai *et al.*, 2003; Fryar *et al.*, 2004). Our survey work seems to indicate higher diversity of the genus in the tropics than in the temperate areas as previously suggested (Réblová *et al.*, 1999). The availability, abundance and rapid turn-over of plant substrates in tropical habitats probably translate in high species richness in *Chaetosphaeria* and related genera. Further studies, including extensive and intensive collecting in tropical areas, are necessary to assess and confirm these possibilities.

Acknowledgements

This project was supported by a National Science Foundation PEET (Partnerships for Enhancing Expertise in Taxonomy) Grant (DEB-9521926) and Biotic Surveys and Inventories Grant (DEB-0072684) to the Field Museum of Natural History and in part by the National Research Council Resident Research Associate Post-Doctoral Program in cooperation with the USDA Forest Service, Madison, Wisconsin. Fieldwork in Ecuador was supported by a

National Geographic Society grant (No. 6914-00) to F.A. Fernández. We are grateful to Drs. D.J. Lodge, J. Thompson and J. Zimmerman for assistance in Puerto Rico, Dr. Julieta Carranza (Universidad de Costa Rica), Milagro Mata and Loengrin Umaña (INBio) in Costa Rica, Oris Acevedo at BCI in Panama, Tracy Commock at the Institute of Jamaica in Jamaica, R. Briones (PUCE) and David Suarez (QCNE) in Ecuador.

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(Received 10 June 2004; accepted 1 November 2004)