Life-History Studies of Brazilian Ascomycetes 1.

Two new genera of the Sphaeriaceae having, respectively, *Sporoschisma*-like and *Codinaea* anamorphs

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Abstract: Two new monotypic genera of the Sphaeriaceae (Ascomycetes) are described from northern Brazil. *Porosphaeria sporoschismophora* sp. nov. has a *Sporoschisma*-like anamorph. Ascospores and conidia are phaeophragmosporous and have a pore at each end. *Striatosphaeria codinaeaphora* has furrowed, brown, bicellular ascospores and a *Codinaea* anamorph with bicellular conidia produced from non-proliferating phialides.

Introduction

This is the first of a series of papers describing Ascomycetes collected by the senior author in northern Brazil during November and December, 1977. The collections were made in the state of Amazonas, in the vicinity of Manaus, and the Federal Territory of Roraima, in forests and savannas along the road from Manaus through Boa Vista to the Venezuelan frontier and from Boa Vista to Bon Fim on the frontier with Guyana.

The expedition, lead by Dr. K. P. Dumont (The New York Botanical Garden) was supported by Projecto Flora Amazonica—The New York Botanical Garden (NSF INT-77-17704) and by a grant from the American Philosophical Society to the senior author. The Instituto Nacional de Pesquisas da Amazonia, Manaus, provided logistical support for field work. The Eidg. Technische Hochschule, Zürich, provided laboratory space and supplies for the subsequent studies. The work was carried out while the senior author was on study leave from the New Zealand Dept. of Scientific and Industrial Research, Plant Diseases Division.

Ascomycetes were collected and immediately divided into two portions. One portion was dried by heat in the field; the second portion was dried by air. The air-dried portions were carried to Zürich where ascospores were isolated with the aid of a micromanipulator during January and February, 1978. The medium used for isolation (Weak ME) was: malt extract (Oxoid), 10 g; yeast extract (Difco), 2 g; agar (Difco), 40 g; distilled water, 1000 ml. Isolated ascospores germinated

in the laboratory where the temperature varied from 18—23 C. Cultures were studied on the following media: Malt Extract (ME: malt extract, 20 g; agar (Difco), 20 g; tap water, 1000 ml), Potato Dextrose Agar (Difco, PDA), Oatmeal Agar (Difco, OA) and Potato Sucrose Agar (Booth 1971, PSA). Cultures are maintained by the senior author.

Descriptions of the Species [1])

1. *Porosphaeria* SAMUELS & E. MÜLLER, gen. nov.

Ascomata nigra, carbonacea, lignicola, superficialia, parte inferiori parvulo stromati insidenti, ostiolo periphysibus instructo. Asci unitunicati, hymenio formantes, parte apicali iodo non coerulescenti. Ascosporae phragmosporae, atrobrunneae, poro untrinque praeditae. Paraphyses ramosae, anastomosantes, hymenio affixae.

Status conidialis: *Sporoschisma* BERKELEY & BROOME.

Species typica: *Porosphaeria sporoschismophora* SAMUELS & E. MÜLLER.

Porosphaeria sporoschismophora SAMUELS & E. MÜLLER, sp. nov. Fig. 1—3.

Ascomata solitaria, nigra, superficialia, parte inferiori parvulo stromati insidenti, ovata, non papillata, 270—340 µm altitudine, 220—300 µm crassa. Asci unitunicati, anguste clavati, 85—120 × 8—10 µm, 4—8-spori, parte apicali iodo non coerulescenti. Ascosporae ellipticae, fusiformes, rectae, 16—24 × 4—6 µm, 3-septatae, atrobrunneae, utrinque poro praeditae. Paraphyses ramosae, hymenio affixae, reticulum formantes. In ligno putrido. Status conidialis: *Sporoschismae* similis.

Holotypus: DUMONT-BR 829, NY. Isotypus: INPA, ZT.

ANAMORPH: *Sporoschisma*-like.

TELEOMORPH: Mycelium not apparent. Ascomata perithecioid, solitary, with the base slightly immersed and seated on a small, basal stroma; scattered over the surface of wood, black, hard, ovate, non-papillate, 270—340 µm high × 220—300 µm wide, wall rough but shining, collapsing by lateral pinching when dry, not changing color and no soluble pigment in 3% KOH or 100% lactic acid. Ascomatal wall 40—50 µm wide. Longitudinal section: Outer region ca. 25 µm wide; cells elliptic, 6—7 × 2—2.5 µm, slightly thick-walled hyaline or light brown; cells at the surface disintegrating. Middle region ca. 25 µm wide, cells elongate or elliptic, 7—10 × 3—4 µm, thickwalled, darkly pigmented. Inner region ca. 10 µm wide, cells elliptic, 6—8 × 3—4 µm, thin-walled, hyaline. Ostiolar region comprised of elongate, hyphal-like elements ca. 25 µm long, septate, ends rounded, 2—4 µm diam; ostiolar canal periphysate.

Asci unitunicate, narrowly clavate, 85—120 × 8—10 µm, 4—8-spored; apices rounded, with an inamyloid ring-like structure pierced by a pore; bases pedicellate to pointed; ascospores biseriate above, uniseriate below; the lower 10—45 µm of each ascus lacking spores; forming in a hymenium over the lower ¼ of the ascomatal wall.

[1]) The Latin descriptions were prepared by Dr. O. PETRINI, ETH, Zürich.

Ascospores elliptic-fusiform with rounded ends, 16—24×4—6 µm, 3-septate with a pore in the middle of each septum and one in each end of each spore while still in asci; not constricted at the septa or slightly constricted; dark brown, septa darker, while still in asci;

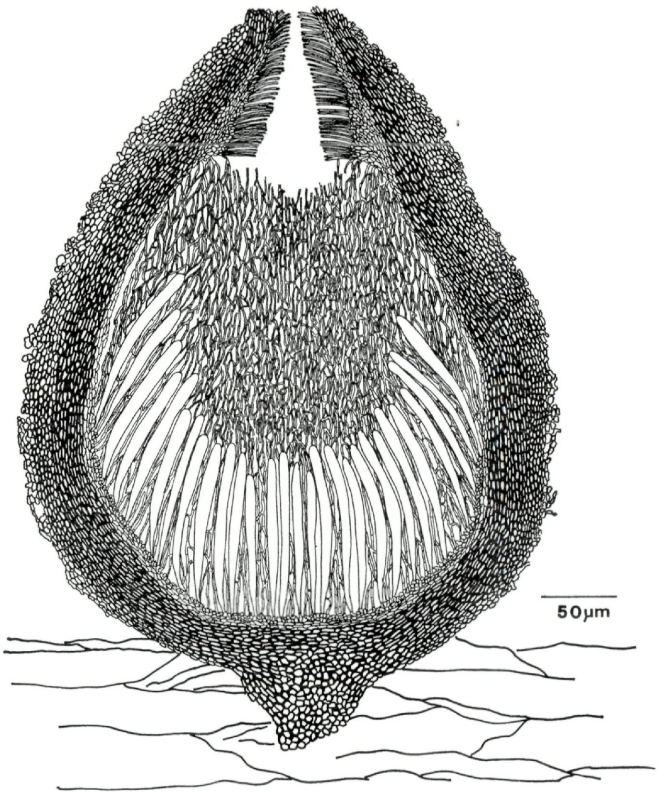

Fig. 1. *Porosphaeria sporoschismophora* (Dumont-BR 829): longitudinal section of ascoma

smooth; producing a single germ-tube at one or both ends; germ-tubes unbranched, 10—20 µm long within 12 hrs. Interascal filaments ca. 3 µm wide, hyaline, branching and anastomosing, attached to the hymenium and to the top of the ascomatal wall.

CHARACTERISTICS IN CULTURE: Colonies on Weak ME, in 2 weeks, 7.5—10 cm diam; aerial mycelium lacking, surface mycelium flat, white; colony transparent, nearly invisible; eventually becoming dark green to black and velvety from the abundant conidiophores. Conidiophores arising directly from surface of agar, solitary, erect, straight, cylindrical; dark brown basally, lighter above, 70—110 μm long, 4—7 μm wide basally, 2—5-septate, arising from a hypha

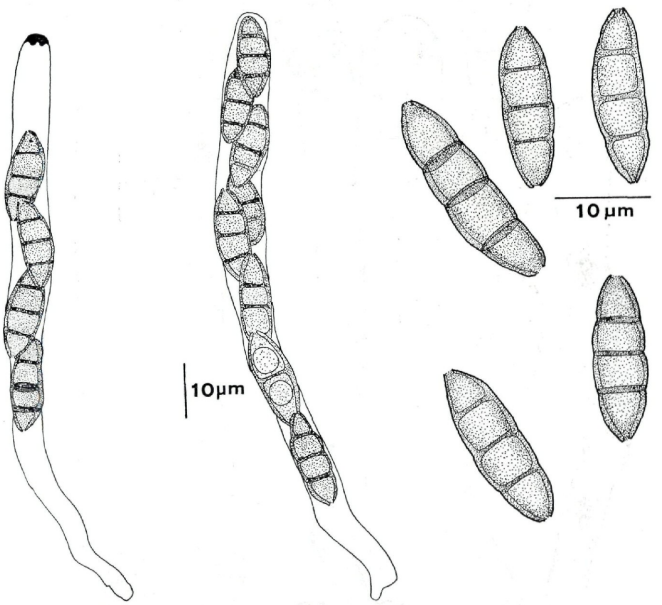

Fig. 2. *Porosphaeria sporoschismophora* (Dumont-BR 829): asci and ascospores (mounted in 100% lactic acid; ascus at left as seen in phase contrast microscopy)

4—6 μm wide, covered with minute pits, terminating in single phialide, a light-refractive "button" present on the tips of unopened phialides. Phialides constituting the upper 40—45 μm of each conidiophore, composed of a cylindrical venter, 20—30×4—5 μm, and an obconical collarette 15—20 μm long and 8.5—10 μm wide at the apex; wall of apex of unopened phialides much thinner that the rest of the phialide wall. Conidia in chains of 5—6, obovate to cylindrical with a flat base and a rounded apex, 3-septate, basal cell lighter brown than the upper three cells, with a pore in the middle of each septum and a pore at

each end of each conidium, not constricted at septa, 18—22 µm long, ca. 10 µm wide at the widest point, 6.5—8 µm wide at the base; produced within the venter, frequently the ruptured end of the phialide remaining attached to the first conidium.

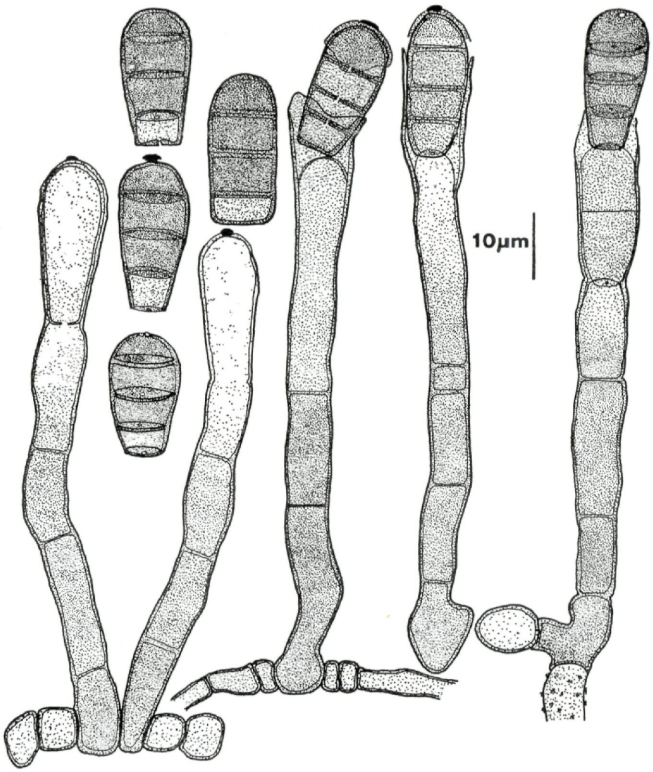

Fig. 3. *Porosphaeria sporoschismophora* (Dumont-BR 829): anamorph from culture

HABITAT: On decorticated, well rotted, dicotyledonous wood.

HOLOTYPE: Brazil: Territorio de Roraima, Boca da Mata, ca. 219 km N of Boa Vista, on the Boa Vista-Sta. Elena, Venezuela Rd; on unidentified, decorticated wood; Dumont, Hosford, Samuels,

BUCK, ARAUJO, SOUZA, BERNARDI; 1 Dec 1977 (DUMONT-BR 829, NY; ISOTYPES: INPA, ZT).

NOTES: *Porosphaeria* is a member of the Sphaeriaceae (sensu MÜLLER & von ARX 1973) because of its unitunicate asci which have a simple, inamyloid, ring-like structure in the apex. It differs from all other genera of the family in having terminal germ-pores in its ascospores. The relationships of *Porosphaeria* are not clear. The sterile filaments are unique within the Sphaeriaceae because of their branched and netlike aspect. The *Sporoschisma* anamorph is suggestive of the anamorphs found for *Chaetosphaeria* TULASNE but the only known telemorphs of *Sporoschisma* are species of *Melanochaeta* E. MÜLLER, HARR & SULMONT. Asci of the type species of *Melanochaeta*, *M. hemispila* (BERKELEY & BROOME) E. MÜLLER, HARR & SULMONT, have a complicated, inamyloid apical apparatus which led the authors to place the genus in the Diaporthales, Melogrammaceae. The ascospores of the known species of *Melanochaeta* are phragmosporous and brown with the end cells being lighter brown; no germ-pores are present.

It is not possible to refer the conidial state of *Porosphaeria* unequivocally to *Sporoschisma* BERKELEY & BROOME. Terminal pores are not reported in conidia of the four known species of the genus and are apparently unique within the hyphomycetes. Furthermore, in delimitations of the genus proposed by HUGHES (1977) and NAG RAJ and KENDRICK (1975), conidiophores and capitate hyphae arise from a small, black basal stroma. Even though the *Sporoschisma* state was abundant on the type specimen of *P. sporoschismophora*, neither capitate hyphae nor stromata were seen. The conidiophores were much longer, up to 200 μm, than those produced in culture and conidia were opaque black with the end cells lighter and translucent.

Because of its conidial pores, on might be tempted to create a new genus for this anamorph. The overall form of the conidia and conidiogenous apparatus is well accounted for in the form-genus *Sporoschisma*. Placing this or any anamorph in a form-genus is a statement of similarity in morphology and does not necessarily imply biological relatedness.

2. *Striatosphaeria* SAMUELS & E. MÜLLER, gen. nov.

Ascomata nigra, solitaria, corticola, superficialia, parte inferiori parvulo stromati insidenti, ovata vel obpyriformia, ostiolo periphysibus instructo. Asci unitunicati, hymenio basilari affixi, cylindracei, parte apicali iodo non coerulescenti. Ascosporae uniseptatae, brunneae, striis longitudinalibus atrobrunneis elevatis ac pallide brunneis planis alternantibus. Paraphyses cylindaceae, septatae, ex hymenio nascentes.

Status conidialis: *Codinaea* MAIRE

Species typica: *Striatosphaeria codinaeaphora* SAMUELS & E. MÜLLER

Striatosphaeria codinaeaphora SAMUELS & E. MÜLLER sp. nov. Fig. 4—6

Ascomata nigra, solitaria, corticola, superficialia, parte inferiori parvulo stromati insidenti, ovata bis obpyriformia, ostiolo periphysibus instructo, apice acuto, 330—430 µm alta, 280—330 µm crassa. Asci unitunicati, hymenio basilari affixi, cylindracei, parte apicali iodo non coerulescenti, 4—8-spori, 140—160×25—35 µm. Ascosporae uniseptatae, brunneae, ellipsoideae, striis longitudinalibus atrobrunneis elevatis ac pallide brunneis planis alternantibus, 19—23×7—9 µm. Paraphyses cylindraceae, septatae, ex hymenio nascentes, ca. 200 µm longae et 3—5 µm crassae. Ad lignum putridum. Status conidialis: *Codinaea* sp.

Holotypus: DUMONT-BR 785, NY. Isotypus: INPA, ZT.

ANAMORPH.: *Codinaea* sp.

TELEOMORPH: Mycelium not apparent. Ascomata perithecioid, solitary or in caespitose clusters of from 5—30, superficial on cortex; bases slightly immersed and seated on a small, basal stroma; black, hard, ovate to slightly obpyriform, with an acute apex, 330—430 µm high×280—330 µm wide; wall slightly verrucose, shining; not collapsing when dry, not changing color and no soluble pigment in 3% KOH or 100% lactic acid. Ascomatal wall 45—70 µm wide. Longitudinal section: Cells elliptic, 4—8×3—4 µm thick-walled and very darkly pigmented. Cells of the inner 10—15 µm fusiform, 13—16 µm long×3.5—4.5 µm wide, thinwalled, hyaline. Ostiolar region of structure similar to that of the subtending ascomatal wall, cells heavily pigmented; ostiolar canal periphysate.

Asci unitunicate, cylindrical, (130—) 140—160 (170)×25—35 (—40) µm, 4—8-spored; apices rounded, with an inamyloid ring-like structure pierced by a pore, bases pedicellate; ascospores uniseriate, the lower 25—35 µm of each ascus lacking ascospores; forming a hymenium over the lower ⅓ of the ascomatal wall. Ascospores elliptic with rounded ends, (17—) 19—23 (—26)×(6—) 7—9 (—10) µm, 1-septate; septum median, with a central pore, spore not constricted at the septum; brown, septum darker while still in asci; with longitudinally arranged, darker brown, broad ridges alternating with lighter brown, flat furrows, ridges and furrows running the entire length of each ascospore; producing a single, unbranched germ-tube, ca. 20 µm long, from one or both ends of the ascospore within 12 hrs; germ-tubes easily broken off. Interascal filaments ca. 200 µm long by 3—5 µm wide, hyaline, unbranched, septate, attached to the ascogenous system and free above, more numerous in areas of young asci.

CHARACTERISTICS IN CULTURE: Colonies on Weak ME and PDA, in 1 week, ca. 1 cm diam; aerial hyphae sparse, white, cottony, surface and immersed hypae dark green to black. Conidiophores arising from surface of agar and from aerial hyphae, solitary, erect, cylindrical, dark brown to black basally, lighter at the tip; (15—) 35—70 (—240) µm long, 4—5 µm wide at the base, 0—3-sep-

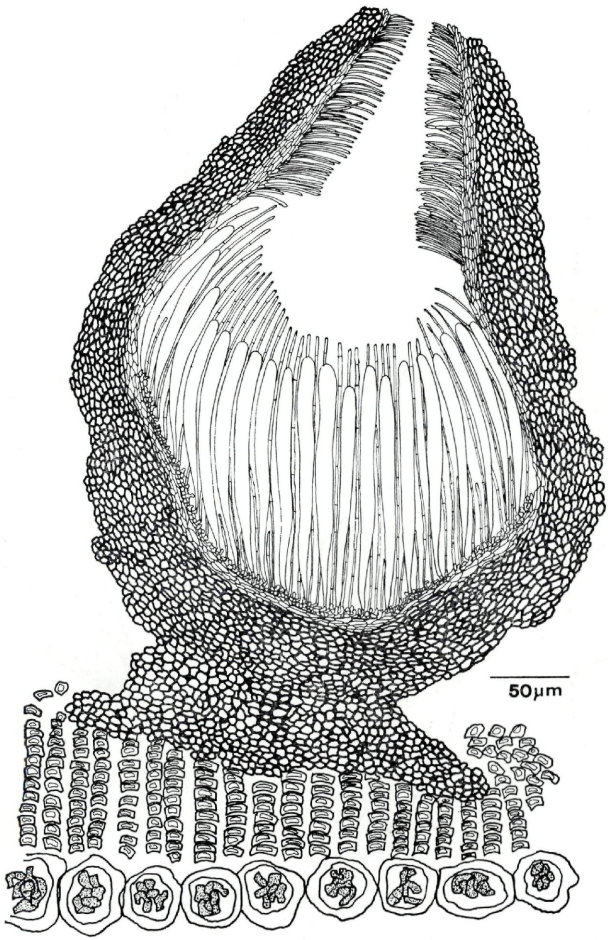

Fig. 4. *Striatosphaeria codinaeaphora* (Dumont-BR 785): longitudinal section of ascoma

tate, arising from a hypha 2—3.5 μm wide, smooth, terminating in a single phialide; not apparently proliferating. Phialides constituting the upper 20—40 (—90) μm of each conidiophore, cylindrical to subcylindrical, abruptly narrowed just below the collarette to a width of 1.5—2 μm; collarette flared, 2.5—4.5 μm wide. Conidia held in a single, slimy fascicle at the tip of each phialide; reniform to botuliform;

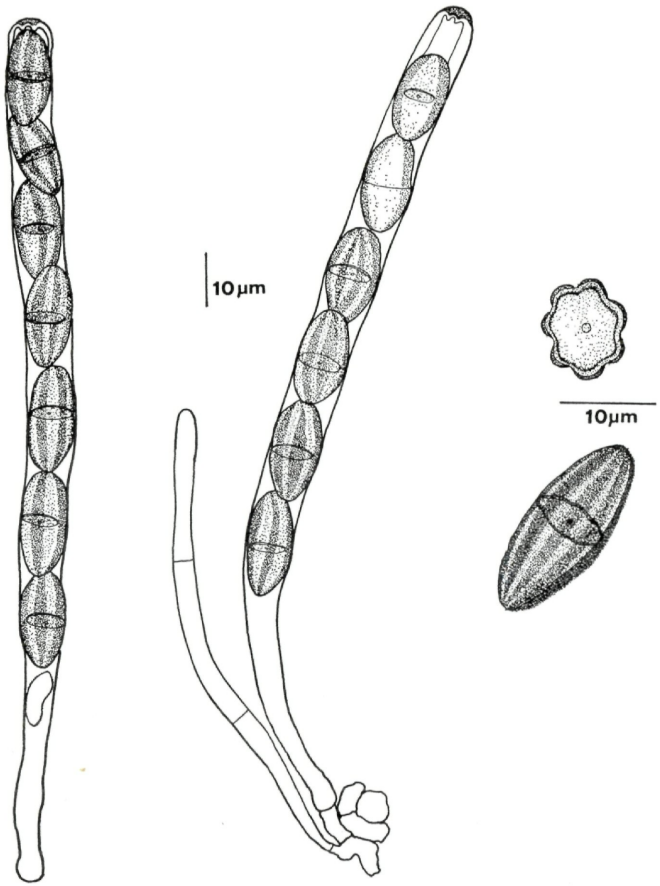

Fig. 5. *Striatosphaeria codinaeaphora* (Dumont-BR 756): asci and ascospores (mounted in 100% lactic acid; as seen in phase contrast microscopy)

1-septate, septum median, not constricted at the septum; lacking apical cilia, light brown, 15—20× 4.5—6 µm, produced asymmetrically at the tip of each phialide. Sterile hairs not seen.

HABITAT: On cortex of dead, angiospermous trees.

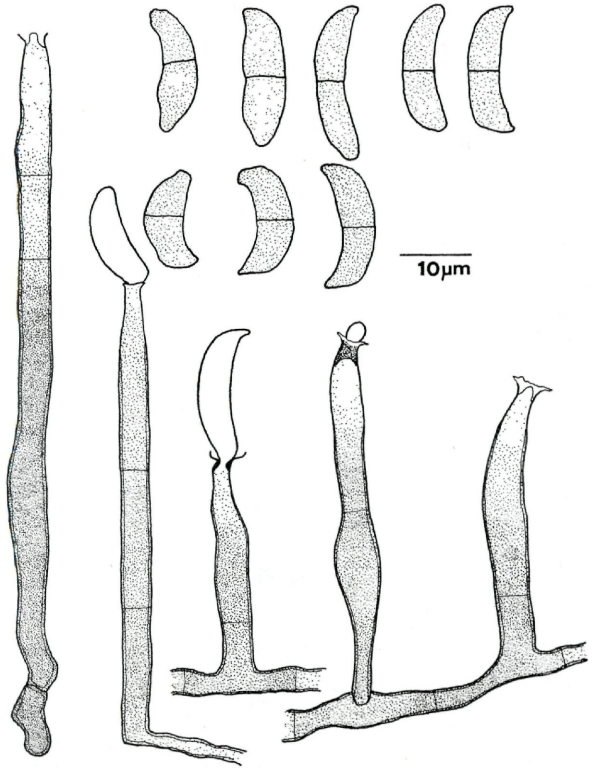

Fig. 6. *Striatosphaeria codinaeaphora* (Dumont-BR 785): anamorph from culture

HOLOTYPE: Brazil: Territorio de Roraima, Boca da Mata, ca. 219 km N of Boa Vista, on the Boa Vista-Sta. Elena, Venezuela Rd; on cortex of unidentified, dead tree; DUMONT, HOSFORD, SAMUELS, BUCK, ARAUJO, SOUZA, BERNARDI; 1 Dec 1977 (DUMONT-BR 785, NY; ISOTYPES: INPA, ZT).

ADDITIONAL COLLECTION EXAMINED: Brazil: Territorio de Roraima, 204 km N of Boa Vista on the Boa Vista-Sta. Elena, Venezuela Rd; on bark of unidentified, dead tree; DUMONT, HOSFORD, SAMUELS, BUCK, ARAUJO, SOUZA, BERNARDI; 29 Nov 1977 (DUMONT-BR 756, INPA, NY, ZT).

NOTES. *Striatosphaeria* is closely related to *Chaetosphaeria*, from which it differs in having brown, longitudinally furrowed ascospores. Four species of *Chaetosphaeria* are known to produce *Codinaea* anamorphs (HUGHES & KENDRICK 1968). None of the currently accepted species of *Chaetosphaeria* have brown ascospores. *Chaetosphaeria phaeostroma* (DURIEU & MONTAGNE) FUCKEL and *C. fusca* FUCKEL both have brown ascospores and were placed in the genus *Chaetosphaerella* E. MÜLLER & C. BOOTH (1972). Conidial states of *Chaetosphaerella* are species of *Oedemium* LINK ex FRIES, a genus distinct from *Codinaea* in having holoblastic conidiogenesis.

The longitudinally furrowed ascospores of *S. codinaeaphora* are a distinctive feature of the species. It cannot be unreservedly said that the lighter areas on the spores are not actually slits in the wall or that they do not culminate in terminal openings.

The *Codinaea* state of *S. codinaeaphora*, as it is seen in culture, has not yet been named. On the substrate, an old rotting log, a variety of stiff, erect, brown hairs were found but were not associated with ascomata or conidiophores. None of the hairs resembled those described for several species of *Codinaea* by HUGHES and KENDRICK (1968), and hairs did not form in culture. Conidiophores of the *Codinaea* were not found on either of the above cited specimens. This anamorph differs from the usual case in *Codinaea* (HUGHES & KENDRICK 1968) in that the phialides are non-proliferating.

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