

## Fungi from palms. XXXVI. Reflections on unitunicate ascomycetes with apiospores

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Ascomycetes with unitunicate asci and apiospores have been described in several genera, and in this paper those occurring on palms are brought together, keyed out, and discussed. Important taxa on palms treated in this paper are:

**Apiosporaceae** fam. nov.: **Apiospora**: *A. montagnei*, *A. sinensis* sp. nov.; **Appendicospora**.

**Clypeosphaeriaceae**: **Apioclypea**: *A. apiosporoides* comb. nov., *A. indica* comb. nov., *A. livistonae*, *A. nypicola* sp. nov., *A. phoenicicola* sp. nov.; **Brunneiapiospora**: *B. aequatoriensis* sp. nov., *B. australiensis* sp. nov., *B. daemonoropsis* sp. nov., *B. deightonella* comb. nov., *B. javensis* sp. nov., *B. jesseniae* sp. nov.

**Hyponectriaceae**: **Palmomyces** gen. nov.: *P. montaneus* sp. nov.; **Pseudomasaria**: *P. huwerae* sp. nov., *P. mauritiae* sp. nov., *P. megalospora* sp. nov.

**Xylariaceae**: **Anthostomella**: *A. frondicola* sp. nov., *A. oraniopsis* sp. nov., *A. phoenicis* comb. nov., *A. rattanicola* sp. nov.

The families Boliniaceae (*Apiocamarops*, *Endoxyla*), Phyllachoraceae (*Apiosphaeria*, *Stigmochora*), and Valsaceae are briefly discussed.

Type material of the type species of the following genera was examined (non-palmicolous species): Apiosporaceae: **Apiospora** (*A. montagnei*); Clypeosphaeriaceae: **Apiorhynchostoma** (*A. apiculatum*), **Clypeosphaeria** (*C. mamillana*), **Stereosphaeria** (*St. perfidiosa*, *St. americana* comb. nov.); Hyponectriaceae: **Pseudomasaria** (*P. chondrospora*); Phyllachoraceae: **Apiosphaeria** (*A. guaranitica*)

Keywords: apiospores, palm fungi, systematics.

In this paper fresh collections and herbarium material of apiosporous unitunicate ascomycetes from palms are described. Apiosporous is defined by Kohlmeyer & Kohlmeyer (1979) as “septate in the lower part” and in this paper it refers to ascospores that are bicellular, with cells of unequal size (ie. similar to bee-shaped). Of the ascomycetes with unitunicate asci and apiospores described from palms, only *Apiosphaeria indica* Bose (1975) has been illustrated in some detail. Other taxa (i.e. *Apiosporella coryphae* Rehm, 1913) are described only with short Latin descriptions that give little indication of the true identity of the fungi. Several apiosporous taxa occur on palms and in researching the taxonomic placement of these fungi it was necessary to examine type material of *Apiorhynchostoma*

Petr., *Apiosphaeria* Höhn., *Apiospora* Sacc., *Clypeosphaeria* Fuckel, *Pseudomassaria* Jacz. and *Stereosphaeria* Kirschst. Species from palms with hyaline apiospores are found in the genera *Apioclypea* K. D. Hyde, *Apiosphaeria*, *Apiospora*, *Appendicospora* K. D. Hyde, *Palmomyces* K. D. Hyde, J. Fröhlich & J. E. Taylor and *Pseudomassaria*, while species with brown apiospores with hyaline end cells are found in the genera *Anthostomella* Sacc. and *Brunneiapiospora* K. D. Hyde, J. Fröhlich & J. E. Taylor gen. nov.

In this paper descriptions and illustrations of some of these fungi are provided and one new family, the Apiosporaceae, two new genera, *Brunneiapiospora* and *Palmomyces*, and fifteen new species are described. The placement of these genera in various families is discussed. A key to the apiosporous genera illustrated in this paper and a key to species of *Apioclypea* and *Clypeosphaeria* are provided.

### Materials and methods

Type material was loaned from BRIP, IMI, K, LPS, PC, PAD, RO, UPS, and W. All other specimens examined are deposited in the herbarium of the Department of Ecology and Biodiversity (Mycology section), The University of Hong Kong (HKU(M)), with isotypes of Australian material deposited in BRIP. Measurements are made in water and Melzer's reagent was used for all iodine reactions.

### Taxonomy

#### Key to genera illustrated in this paper

- 1. Large cell of ascospores hyaline ..... 2
- 1. Large cell of ascospores brown ..... 7
  
- 2. Asci cylindrical to cylindric-clavate ..... 3
- 2. Asci clavate to saccate ..... 6
  
- 3. Ascromata immersed, aclypeate, with an eccentric ostiole, asci cylindric-clavate, ascospores longer than 30  $\mu\text{m}$  ..... 4
- 3. Ascromata immersed beneath a clypeus, ostiole central, asci cylindrical or cylindric-clavate ..... 5
  
- 4. Ascromata immersed with an eccentric ostiole, asci cylindric-clavate, ascospores longer than 30  $\mu\text{m}$  ..... *Palmomyces*
- 4. Ascromata immersed, ostiole central, asci cylindric-clavate, ascospores mostly less than 30  $\mu\text{m}$  ..... *Pseudomassaria*

- 5. Ascospores lacking a sheath, peridium cream coloured, comprising several layers of flattened cells, *Oswaldina* Rangel anamorph formed *in situ* with teleomorph ..... *Apiosphaeria*
- 5. Ascospores with sheath, peridium brown, comprising elongate angular cells, anamorph unknown, not forming alongside teleomorph ..... *Apioclypea*
- 6. Ascospores with a bifurcate appendage at one end, anamorph unknown, not forming in culture ..... *Appendicospora*
- 6. Ascospores lacking bifurcate appendages or surrounded by a sheath, *Arthrinium*-like anamorph forming in culture .. *Apiospora*
- 7. Ascospores usually with a germ slit ..... *Anthostomella*
- 7. Ascospores lacking a germ slit ..... 8
- 8. Ascospores always apiosporous ..... *Brunneiapiospora*
- 8. Ascospores not usually apiosporous ..... 9
- 9. Ascomata clypeate ..... *Clypeosphaeria*
- 9. Ascomata not clypeate ..... *Apiorhynchostoma*

### **Apiosporaceae**

**Apiosporaceae** K. D. Hyde, J. Fröhlich, J. E. Taylor & M. E. Barr, **fam. nov.**

Ascomata gregaria, areis elevatis, nigris, linearibus immersa, in sectione globosa, papillata, periphysata. Asci 8-spore, clavati, unitunicati, ad apicem rotundati, sine apparatus apicali. Ascosporeae 1-2-seriateae, apiosporae, hyalinae.

Ascomata immersed or semi-immersed, visible on the host surface as raised, blackened areas, gregarious; in vertical section globose, longitudinal axis vertical to the host surface, papillate, periphysate. – Peridium comprising elongate, isodiametric, mostly brown-walled cells. – Paraphyses hypha-like. – Asci 8-spored, clavate, thin-walled, apically rounded, lacking any apical apparatus. – Ascospores overlapping uniseriate or biseriate, hyaline, apiosporous and smooth-walled, possibly with appendages or sheaths.

Anamorph. – *Arthrinium* Kunze, *Cordella* Speg., *Pteroconium* Sacc.

Type genus. – *Apiospora* Sacc. (holotypus).

Nutrition. – Endotrophs, pathogens or saprotrophs on Arecaceae (palms), Poaceae (grasses and bamboo) and Cyperaceae (sedges).

Other included genera. – ?*Appendicospora* K. D. Hyde; anamorphic genera: *Dictyoarthrinium* S. J. Hughes, *Endocalyx* Berk. & Broome, *Scyphospora* Kantsch., *Spegazzinia* Sacc.

The taxonomic position of *Apiospora* has been debated for many years. The genus was placed originally in the Dothideales (bitunicate ascomycetes; Theissen & Sydow, 1915). Müller & Arx (1962) assigned *Apiospora* to the Amphisphaeriaceae, while Barr (1976) transferred it to the Hyponectriaceae. More recently, Barr (1990) following a suggestion of Samuels & al. (1981) organised *Apiospora* in the Lasiosphaeriaceae (Sordariales). This was accepted in the latest *Dictionary of the Fungi* (Hawksworth & al., 1995). Cannon, in Barr & Cannon (1994), was however, concerned with the placement of *Apiospora* in the Lasiosphaeriaceae.

This latest placement ignores the fact that most lasiosphaeriaceous taxon have anamorphs in *Chalara* (Corda) Rabenh., *Chloridium* Link, *Dictyochaeta* Speg. (= *Codinaea* Maire) and *Phialophora* Medlar (Barr, 1990). The anamorphs of *Apiospora*, however, are *Arthrinium*, *Cordella* and *Ptericonium*, where conidiophores are basauxic, with terminal and intercalary polyblastic conidiogenous cells, and the conidia are brown and unicellular, with a pallid germ slit or a longer pallid area in the conidial wall. The unusual anamorph and uniqueness of the teleomorph leads us to believe that a new family is required to accommodate *Apiospora*. It is not clear whether *Appendicospora* should be included in the family. Many of the characters of the teleomorph overlap with *Apiospora*, but no *Arthrinium* anamorph has been observed to form in culture (Yanna & al., 1997). The form-genera *Dictyoarthrinium*, *Endocalyx*, *Scyphospora* and *Spigazzinia* may also belong in the Apiosporaceae as they have basauxic conidiogenesis.

***Apiospora*** Sacc., Atti Soc. Veneto-Trentino Sci. Nat. Padova 4: 85. 1875.

= *Detonina* Kuntze, Revisio generum plantarum. 1891.

= *Hypopteris* Berk., Hook. J. Bot. 6: 227. 1854.

= *Rhabdostroma* Syd. & P. Syd., Ann. Mycol. 14: 362. 1916.

= *Scirrhella* Speg., An. Soc. Cient. Argent. 19: 91. 1885.

Recent accounts: Hudson & al. (1976); Samuels & al. (1981); Kirk (1991a); Müller (1992); Lambhate & al. (1993); Chen & al. (1994).

Ascomata immersed or semi-immersed, visible on the host surface as blackened areas, gregarious, often in linear rows; in vertical section globose, longitudinal axis vertical to the host surface, papillate, periphysate. – Peridium comprising elongate, angular,

brown-walled cells. – Paraphyses hypha-like. – Asci 8-spored, clavate, thin-walled, apically rounded, lacking any distinct apical apparatus. – Ascospores overlapping uniseriate or biseriate, hyaline, apiosporous and smooth-walled.

Anamorphs. – *Arthrimum* Kunze, *Cordella* Speg., *Pteroconium* Sacc.

Type species. – *Apiospora montagnei* Sacc.

Habitat. – Bamboo, grasses, palms, Cyperaceae.

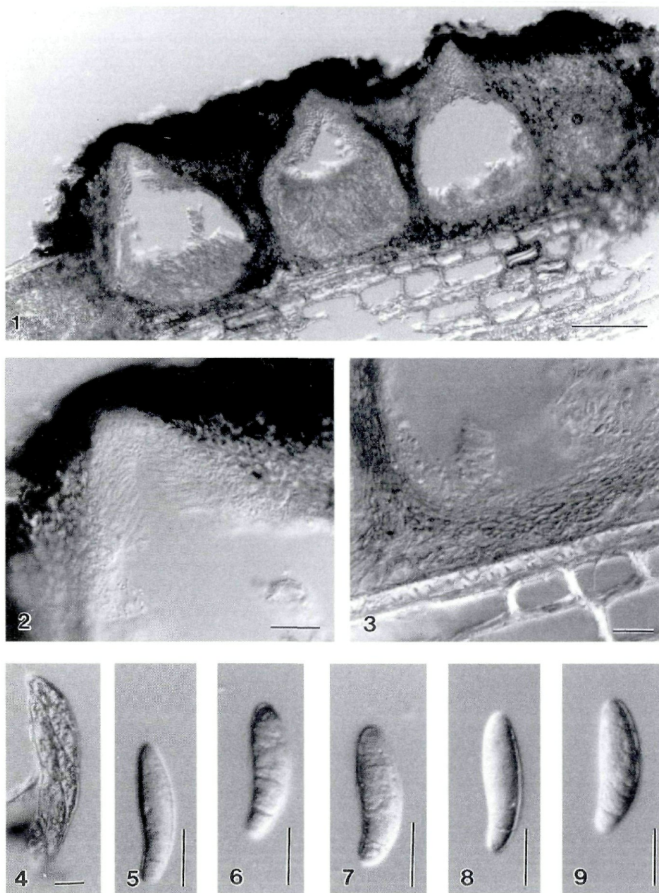
Distribution. – Worldwide.

*Apiospora* occurs on grasses and palms and throughout the world except in subarctic and arctic regions (Müller, 1992). The genus is very common on bamboo where the anamorph is readily distinguishable as dusty blackened regions on recently dead culms. Teleomorphs and anamorphs often develop simultaneously alongside each other. Parallel stripe-like stroma occur on the leaves or stems and contain one or two linear rows of ascomata, or the anamorph. *Apiospora* is readily distinguished from other apiosporous taxa as the asci are clavate and the anamorphs are *Arthrimum* (= *Cordella sensu* Samuels & al., 1981) species. Samuels & al. (1981) illustrated the ascus apex at the EM level, which appears to be a weakening of the wall rather than a well formed ring, and made reference to pores in the ascial base. *Apiospora* is a small genus of about 12 species (although there are more than 30 names), most of which are graminicolous or cypericolous (Samuels & al., 1981). Members of the genus have not been described from palms, but *Apiospora montagnei* or its anamorph have been recorded from *Areca* and *Elaeis* (Kirk, 1991a). One new species from a palm is described below.

***Apiospora montagnei*** Sacc., Atti Soc. Veneto-Trentino Sci. Nat. Padova 4: 85. 1875. – Figs. 1–9.

= *Sphaeria* *apiospora* Dur. & Mont., Flore d'Algérie 1: 482. 1846.

Ascomata immersed or semi-immersed, visible as raised, blackened areas on the host surface, with neck and upper surface visible through splits in the host tissue, gregarious, in linear rows; in section 16–200 µm diam, 200 µm high, globose, longitudinal axis vertical to the host surface (Figs. 1, 2). – Neck slightly raised, papillate, periphysate (Fig. 2). – Peridium up to 14 µm wide, comprising elongate, angular cells with brown walls. – Stroma between ascomata comprising hyaline, thick-walled cells, several ascomata covered by a stroma of smaller, globose cells with brown walls (Fig. 3). – Paraphyses up to 4 µm wide, hypha-like. – Asci 75–120 × 14–18 µm, 8-spored, clavate or cylindric-clavate, thin-



Figs. 1-9. *Apiospora montagnei* (from holotype). - 1. Section of ascomata covered with a pseudostroma. - 2. Ostiole. - 3. Peridium. - 4. Ascus. - 5-9. Ascospores. - Bars: 1, 2 = 100  $\mu$ m, 3-9 = 10  $\mu$ m.

walled, apically rounded and lacking any apical apparatus (Fig. 4). - Ascospores 23-28  $\times$  6-8  $\mu$ m, overlapping uniseriate or biseriata, hyaline and smooth-walled, apiosporous, basal cell 1/5 size of the larger apical cell (Figs. 5-9).

Anamorph. – *Arthrinium arundinis* (Corda) Dyko & B. Sutton.

Material examined. – Algeria: [not localised], in culm of *Arundo mauritanica* [date not given] Durieu (PC, holotype of *Sphaeria apiospora*).

For further synonyms and a description of the anamorph refer to Kirk (1991a).

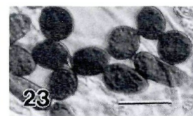
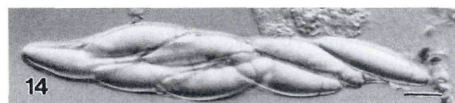
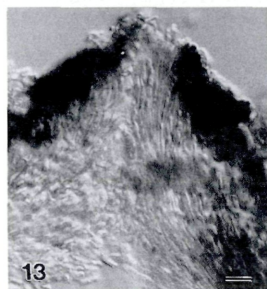
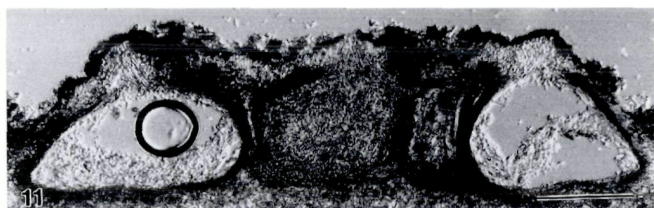
***Apiospora sinensis*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 10–23.

Ascomata immersa, 160–280  $\mu\text{m}$  diam, 170–208  $\mu\text{m}$  alta, subglobosa, papillata, periphysata, gregaria. Asci 84–116  $\times$  (13–)18–25  $\mu\text{m}$ , 8-sporei, clavati vel cylindracei-clavati. Ascosporae 26–34  $\times$  6–8.4  $\mu\text{m}$ , biseriatae, apiosporae, tunica gelatinosa praeditae. Status anamorphosis *Arthrinium* cf. *phaeospermum* (Corda) M. B. Ellis.

Etymology. – In reference to the collection of this taxon in China.

Ascomata immersed or semi-immersed, visible on the host surface as linear or irregular, raised, shiny, blackened areas, 400–1430  $\times$  371–486  $\mu\text{m}$  diam, 128–200  $\mu\text{m}$  high (mean = 836  $\times$  410  $\times$  165  $\mu\text{m}$ ), longitudinally splitting the covering host cells, with neck and upper surface visible, gregarious (Fig. 10); in section 160–280  $\mu\text{m}$  diam, 170–208  $\mu\text{m}$  high, subglobose with a flattened base, longitudinal axis vertical to the host surface (Figs. 11–13). – Neck slightly raised, papillate, periphysate (Figs. 11, 13). – Peridium 12–18  $\mu\text{m}$  wide (mean = 17.2  $\mu\text{m}$ , n = 10), comprising several layers of cells, with an outer layer of hyaline *textura angularis*, especially visible in the corners, a central layer of brown thin walled elongate and compressed *textura angularis*, 4–7 cells thick, becoming hyaline inwardly (Fig. 12). – Stroma covering several ascomata comprising dark brown, thick walled cells with large lumina (Fig. 11). – Paraphyses hypha-like. – Asci 84–116  $\times$  (13–)18–25  $\mu\text{m}$  (mean = 101  $\times$  21  $\mu\text{m}$ , n = 15), 8-spored, clavate or cylindric-clavate, thin-walled, slightly flattened apically, lacking any apical apparatus (Figs. 14–16). – Ascospores 26–34  $\times$  6–8.4  $\mu\text{m}$  (mean = 31  $\times$  7.6  $\mu\text{m}$ , n = 50), biseriate, hyaline, smooth-walled, apiosporous, straight or basal cell slightly bent, surrounded by an irregularly-shaped mucilaginous sheath 3–7  $\mu\text{m}$  wide, basal cell 1/4–1/5 the size of the larger apical cell (Figs. 17–21).

Anamorph. – *Arthrinium* cf. *phaeospermum* (Corda) M. B. Ellis. Forming an almost circular colony, 50  $\mu\text{m}$  diam, on PDA at 22 C within 30 days and producing conidia. – Colonies brownish grey, with powdery black speckles in the centre, raised and fluffy, with sparse aerial hyphae. – Conidiophores ca 7  $\times$  1.5–2  $\mu\text{m}$ , straight,





hyaline, smooth, septa not observed (Fig. 22). – Conidiophore mother cells lageniform, 6–7  $\mu\text{m}$  high, 3–5  $\mu\text{m}$  wide (Fig. 22). – Conidia 9–12  $\times$  6–8  $\mu\text{m}$ , mainly rounded in face view, mainly lenticular, brown, with an equatorial germ slit, smooth (Figs. 22, 23).

Material examined. – CHINA: south west HuBei Province, Xuanen, on dead petiole of *Trachycarpus fortunei*, 5 June 1995, J. E. Taylor JP5102 (HKU(M) 3963, holotype); *ibid.*, on dead leaf (HKU(M) 4114).

*Apiospora sinensis* is distinctive within the genus *Apiospora* in possessing ascospores surrounded by a wide, mucilaginous sheath. Ascospore size is considered an unreliable character for species identification due to the degree of overlap in ascospore length between species. Both Hudson & al. (1976) and Samuels & al. (1981), however, consider the anamorph to have undergone a greater degree of diversification and consider that the anamorph is important in the identification of the teleomorph. No members of the genus *Apiospora* has yet been recorded with an anamorph comparable to *Arthrimum phaeospermum* (Kirk, 1991b), which further justifies the description of a new species.

**Appendicospora** K. D. Hyde, Sydowia 47: 31. 1995.

Recent accounts: Hyde (1995); Yanna & al. (1997).

Type species. – *Appendicospora coryphae* (Rehm) K. D. Hyde

*Apiosporella coryphae* Rehm was described by Rehm (1913), but Saccardo (1926) synonymised it with *Apiospora coryphae* (Rehm) Sacc. Hyde (1995) considered it different from *Apiospora* and introduced *Appendicospora* to accommodate *Apiosporella coryphae*, since the latter generic name could not be used. In *Appendicospora* the ascospores are provided with a bifurcate mucilaginous appendage, while the asci are clavate and the ascomata form under a large stroma. A second species was described by Yanna & al. (1997).

## **Boliniaceae**

**Boliniaceae** J.E. Rick, Broteria, Ser. Bot. 25: 65. 1931.

For a description of family see Barr (1990).

The Boliniaceae included only *Camarops* P. Karst. [= *Bolinia* (Nitschke) Sacc.] until Barr (1990) added *Rhynchostoma* P. Karst.

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Figs. 10–23. *Apiospora sinensis* (from holotype). – 10. Appearance of fungus on host surface. – 11. Section of ascomata. – 12. Peridium. – 13. Ostiole. – 14–16. Asci. – 17–21. Ascospores. – 22, 23. *Arthrimum* anamorph, conidia and conidiophores. – Bars: 10 = 500  $\mu\text{m}$ , 11 = 100  $\mu\text{m}$ , 12–23 = 10  $\mu\text{m}$ .

and placed the family in the Xylariales. Following analysis of 18S rDNA sequences, Andersson & al. (1995) concluded that the Boli- niaceae were related to the Sordariales and suggested that *Apioca- marops* Samuels & J. D. Rogers, *Discoxyllaria* J. C. Lindq. & J. E. Wright, *Endoxyla* Fuckel, *Neohypodiscus* J. D. Rogers and *Pseudo- valsaria* Spooner were possibly related. *Rhynchostoma* was consid- ered to be probably unrelated. *Apiocamarops*, *Camarops* and *En- doxylla* were accepted in the Boliniaceae in the latest Dictionary of the Fungi (Hawksworth & al., 1995). *Apiocamarops* and *Endoxyla* are apiosporous and are discussed below.

**Apiocamarops** Samuels & J. D. Rogers, Mycotaxon 28: 54. 1987.

Recent accounts: Samuels & Rogers (1987); Rogers & Samuels (1988).

Type species. – *Apiocamarops alba* Samuels & J. D. Rogers.

In *Apiocamarops* the apiospores possess one larger brown cell with an apical germ pore and a smaller hyaline cell lacking a germ pore. The asci are cylindrical to somewhat clavate, with an indistinct apical apparatus which does not stain in Melzer's reagent. The genus could therefore be confused with some apiosporous taxa from palms, but *Apiocamarops* is distinct in possessing superficial caespitose as- comata united in a white to yellowish stroma. There are presently two species in the genus and the reader should refer to Samuels & Rogers (1987) and Rogers & Samuels (1988) for further information.

**Endoxyla** Fuckel, Jb. Nassau. Ver. Naturk. 25–26: 321. 1871.

Recent accounts: Untereiner (1993).

Type species. – *Endoxyla macrostoma* Fuckel.

*Endoxyla* has been monographed by Untereiner (1993) and the reader should refer to this paper for further information. *Clypeo- sphaeria*, *Endoxyla* and *Apiorhynchostoma* share a number of com- mon characteristics (Untereiner, 1993; Rogers & al., 1994). The dif- ferences between *Apiorhynchostoma*, *Clypeosphaeria* and *Endoxyla* are discussed under the former genera. Most *Endoxyla* species are only known from gymnosperms and need not be discussed further.

### **Clypeosphaeriaceae**

**Clypeosphaeriaceae** G. Winter, [as Clypeosphaerieae], Rabenh. Krypt.-Fl. edn 2 1(2): 554. 1886.

For a description of family see Barr (1990).

Type genus. – *Clypeosphaeria* Fuckel.

Barr (1989) revived the Clypeosphaeriaceae (type genus *Clypeosphaeria*), and added the genera *Apiorhynchostoma* Petr., *Melomastia* Nitschke, *Pseudovalsaria*, *Saccardoëlla* Speg., *Endoxyla* and *Urosporella* G. F. Atk. (Barr, 1990) and arranged it in the Xylariales. Later, Barr (1994) added *Jobellisia* M. E. Barr to the Clypeosphaeriaceae, and removed *Melomastia* and *Saccardoëlla* to the Pleurotremataceae. Hawksworth & al. (1995) accepted nine genera in the Clypeosphaeriaceae: *Apiorhynchostoma*, *Ceratostomella* Sacc., *Clypeosphaeria*, *Crassoascus* Checa, Barrasa & A. T. Martinez, *Duradens* Samuels & Rogerson, *Frondicola* K. D. Hyde, *Jobellisia*, *Melomastia* and *Pseudovalsaria*. The Clypeosphaeriaceae are therefore very unsettled and various authorities probably have quite different concepts of the family. It is also certainly very heterogenous as it stands, and extensive molecular work is required before we can acquire an understanding of the phylogeny of this group. Genera with apiospores include *Apiorhynchostoma*, *Clypeosphaeria*, *Apioclypea* K. D. Hyde and *Brunneiapiospora* K. D. Hyde, J. Fröhl. & J. E. Taylor, gen. nov.

***Apioclypea*** K. D. Hyde, Bot. J. Linn. Soc. 116: 316. 1994.

Recent accounts: Hyde (1994b).

Ascomata immersed under a poorly developed clypeus, globose or subglobose, mostly visible as minute ostiolar dots, or as faintly darkened regions, with a central ostiole, solitary or gregarious. – Peridium comprising several layers of brown-walled, elongate angular cells. – Paraphyses hypha-like, numerous, septate and embedded in a gelatinous matrix. – Asci 8-spored, cylindrical, pedicellate, apically round, with a J+, discoid, subapical ring, or J-, apical apparatus. – Ascospores overlapping uniseriate, hyaline, apiosporous, surrounded by a mucilaginous sheath, basal cell smaller.

Anamorph. – Unknown.

Type species. – *Apioclypea livistonae* K. D. Hyde.

Habitat. – Only known from palms.

Distribution. – Pantropical.

*Apioclypea* was described by Hyde (1994b) to accommodate unitunicate ascomycetes with hyaline apiospores, asci with a J- apical apparatus, amphisphaeriaceous (*sensu* Hyde, 1994a) paraphyses, and ascomata immersed under a clypeus. It was compared with *Pseudomassaria* Jacz., *Apiospora* and *Clypeosphaeria* and considered to differ in morphology. Both *Pseudomassaria* and *Apiospora* have clavate asci and ascospores lacking a mucilaginous sheath.

*Apiospora* species also have an *Arthrinium* or *Cordella* anamorph. *Clypeosphaeria* is more similar to *Apioclypea*, but the ascospores in *Clypeosphaeria* are brown. *Apioclypea* was originally a monotypic genus, but four additional species are described in this paper.

**Key to species of *Apioclypea***

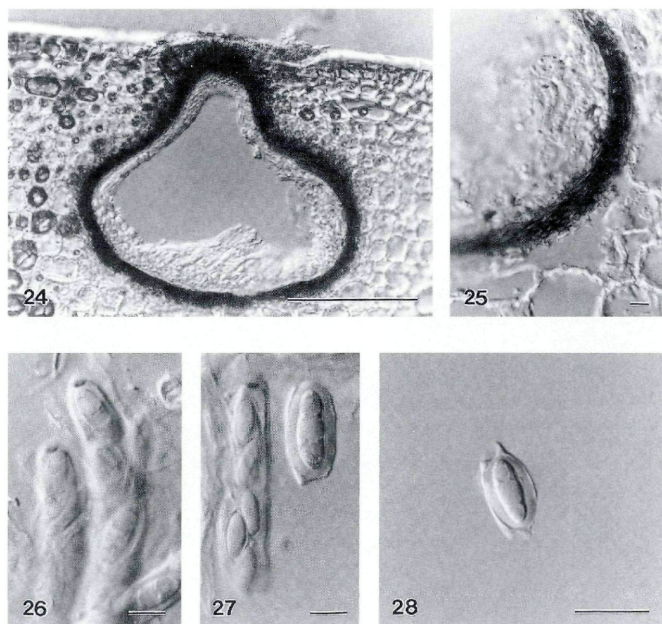
- 1. Apical apparatus of ascus amyloid (J+) ..... 2
- 1. Apical apparatus of ascus nonamyloid (J-) ..... 3
  
- 2. Ascospores 12–16 × 6–7.5 µm, small cell ca 1/6 the size of the larger cell ..... *A. apiosporioides*
- 2. Ascospores 16–20.5 × 5–7 µm, small cell ca 1/5 the size of the larger cell ..... *A. nypicola*
  
- 3. Ascospores 19.6–22.4 × 4.8–7.2 µm, small cell ca 1/8 the size of the larger cell ..... *A. livistonae*
- 3. Ascospores shorter than 18 µm, small cells less than 1/6 the size of the larger cell ..... 4
  
- 4. Ascospores 13–17.5 × 5–6.5 µm, small cell knob-like, ca 1/6 the size of the ellipsoidal larger cell ..... *A. phoenicicola*
- 4. Ascospores 12–16.5 × 4–5 µm, small cell ca 1/4 the size of the larger cell ..... *A. indica*

***Apioclypea apiosporioides*** (Petr.) K. D. Hyde, J. Fröhl. & J. E. Taylor, comb. nov. – Figs. 24–28.

≡ *Metasphaeria apiosporioides* Petr., Sydowia 7: 107. 1953.

Ascomata immersed, visible on the host surface as minute blackened ostiolar dots; in section 200–240 µm diam, 200–280 µm high, subglobose, clypeus poorly developed, with a central ostiole, solitary (Fig. 24). – Peridium up to 18 µm wide, comprising 5–6 layers of brown walled, elongate angular cells (Fig. 25). – Paraphyses up to 4 µm wide, hypha-like, numerous, septate and embedded in a gelatinous matrix. – Ascii 110–140 × 10–12 µm, 8-spored, cylindrical, pedicellate, apically rounded, with a J+, discoid, subapical ring, 4 µm diam, 1.5 µm high (Figs. 26, 27). – Ascospores 12–16 × 6–7.5 µm, overlapping uniseriate, hyaline, apiosporous, surrounded by a mucilaginous sheath, basal cell ca 1/6 the size of the larger cell (Figs. 27, 28).

Material examined. – U.S.A.: Florida, Kanto Park, *Sabal palmetto*, Dec. 1941, C. L. Shear (W, 10499, designate acquired 1973, no 05830, neotype of *Metasphaeria apiosporioides*); *ibid.* (W, 12141).



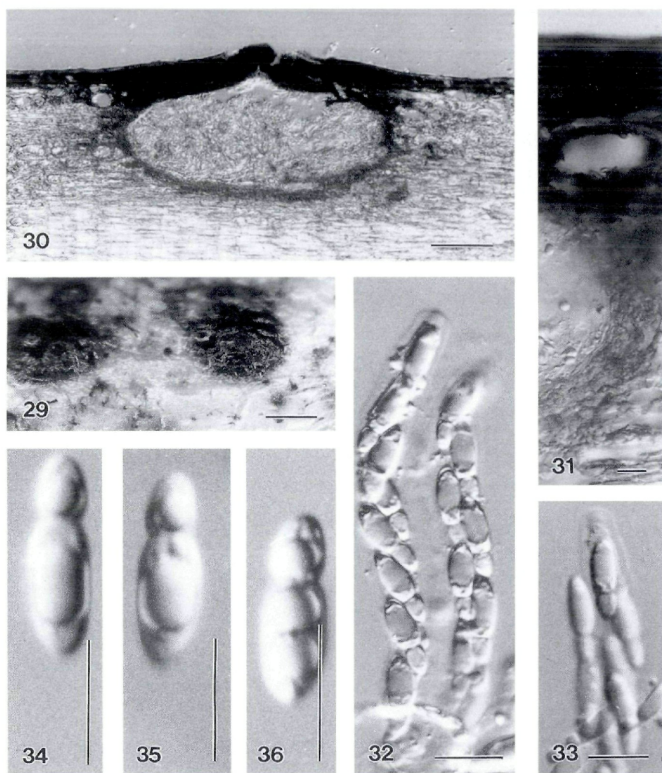
Figs. 24–28. *Apioclypea apiosporioides* (from neotype of *Metasphaeria apiosporioides*). – 24. Section of ascoma. – 25. Peridium. – 26–28. Asci, with J+ ring and ascospores. – Bars: 24 = 100  $\mu$ m, 25–28 = 10  $\mu$ m.

We have only been able to locate material of *Metasphaeria apiosporioides* in W. This material consists of two packages (12141 and 10499) of which 10499 is here designated neotype. The collection data differ slightly from those given by Petrak (1953). Although Petrak's specimen was recorded from Winter Park, 22 December 1941, nr 341, we are confident that this is the same species, as the ascospores are of a similar size ( $10\text{--}16 \times 4.5\text{--}6.5 \mu\text{m}$ ) and are reported as apiosporous. This is not a species of *Metasphaeria* but can readily be included in *Apioclypea* as it has hyaline ascospores.

***Apioclypea indica*** (S. K. Bose) K. D. Hyde, J. Fröhl. & J. E. Taylor, comb. nov. – Figs. 29–36.

≡ *Apiosphaeria indica* S. K. Bose, Indian Phytopathology 28: 575. 1975.

Recent accounts: Bose (1975).



Figs. 29–36. *Apioctypha indica* [from HKU(M) JF509]. – 29. Appearance on host surface. – 30. Section of ascoma. – 31. Peridium. – 32, 33. Asci. – 34–36. Ascospores. – Bars: 29 = 500  $\mu$ m, 30 = 100  $\mu$ m, 31–36 = 10  $\mu$ m.

Ascomata immersed, visible as slightly raised, black, ellipsoidal domes, 420–1700  $\mu$ m long, 308–560  $\mu$ m wide, with a central thin ring of paler tissue around a pore-like, periphysate ostiole (Fig. 29); in section 191–219  $\mu$ m high, 350–375  $\mu$ m diam, subglobose, clypeus poorly or well developed, mostly solitary (Fig. 30). – Peridium 17–22.5  $\mu$ m wide, comprising 8–10 layers of  $\pm$  globose cells (Fig. 31). – Paraphyses up to 4  $\mu$ m wide, hypha-like, numerous, septate. – Asci 56–89  $\times$  6–9  $\mu$ m, 8-spored, cylindrical, pedicellate, apically rounded, with a discoid, J+ subapical ring, 0.6–0.8  $\mu$ m high, 2.7–

3.5  $\mu\text{m}$  diam (Figs. 32, 33). – Ascospores (13.3–)14.35–17.5(–18)  $\times$  4.2–5.8  $\mu\text{m}$ , overlapping uniseriate or partially biseriate, hyaline, apiosporous, with a small inconspicuous mucilaginous sheath, basal cell ca 1/4 the size of the larger cell (Figs. 34–36).

Type. – INDIA: Almora, Kujgarh Valley, on dry leaves of *Phoenix humilis* Royle, Mar. 1959, B. S. Khatri (ZT, holotype, non vidimus).

Material examined. – BRUNEI: Temburong, Batu Apio Forest Reserve, Sungei Belalong, Kuala Belalong Field Studies Centre, Belalong Trail, East Ridge, on dead petiole of *Daemonorops ozycarpa*, Jan. 1995, J. Fröhlich (HKU(M) JF509). Near start of Ashton's Trail, on dead frond blade of *Licuala* sp., June 1995, J. Fröhlich (HKU(M) JF96). On small track leading to Ruth Levy's plot, on dead frond blade of *Licuala* sp., June 1995, J. Fröhlich (HKU(M) JF77). Ashton's Trail, in valley just South of Western Ridge, on dead frond blade of *Licuala* sp., Dec. 1994, J. Fröhlich (HKU(M) JF58). – HONG KONG: New Territories, Sek Kong, Tai Mo Shan Country Park, on dead petiole of *Calamus thysanolepis*, May 1993, J. Fröhlich & K. D. Hyde (HKU(M) JF19). *Ibid.*, (HKU(M) JF24). *Ibid.*, Mar. 1995, J. Fröhlich, B. Baker, T. Utteridge & Ng Sai Chit (HKU(M) JF514). Tai Po, Tai Po Kau Nature Reserve, on dead rachis of *Daemonorops margaritae*, June 1995, J. Fröhlich & J. E. Taylor (HKU(M) JF744). Sek Kong, Tai Lam Country Park, Kap Lung Forest Trail, on dead petiole of *D. margaritae*, July 1995, J. Fröhlich (HKU(M) JF779). Sheung Kwai Chung, Shing Mun Country Park, on dead petiole and rachis of *D. margaritae*, Aug. 1995, J. Fröhlich, D. Allan & J. R. Fellowes (HKU(M) JF 875). Hong Kong Island, Aberdeen, Aberdeen Country Park, on dead rattan sheath of *D. margaritae*, Aug. 1995, J. Fröhlich (HKU(M) JF889).

*Apiosphaeria indica* was found causing slightly raised, black, round, oval or linear spots on the leaves of *Phoenix humilis* Royle, a date palm occurring at an altitude of 2000 metres in Almora, India (Bose, 1975). ZT will not release material of this species as it is in delicate condition and we have been unable to examine the type. The collections from Brunei and Hong Kong are identical (in most respects) to the description of Bose (1975) and are therefore considered to be conspecific. We are, however, unable to confirm the absence of a gelatinous matrix surrounding the paraphyses, the lack of an ascial apical apparatus, and the lack of an ascospore sheath in the type material. The species is better accommodated in *Apioclypea* than in *Apiosphaeria*.

***Apioclypea livistonae*** K. D. Hyde, Bot. J. Linn. Soc. 116: 317. 1994.

Ascomata immersed, visible as minute blackened ostiolar dots; in section 185–260  $\mu\text{m}$  diam, 156–235  $\mu\text{m}$  high, globose or sub-globose, clypeus poorly developed, with a central ostiole, solitary or gregarious. – Peridium 16–20  $\mu\text{m}$  wide, comprising several layers of brown-walled elongate cells. – Paraphyses up to 4  $\mu\text{m}$  wide, hypha-like, numerous, septate and embedded in a gelatinous matrix.

– Ascii 110–140 × 11–16 µm, 8-spored, cylindrical, pedicellate, apically rounded, with a faint, J-, ring-like canal leading to the tip, 2.4 µm diam, 4 µm high. – Ascospores 19.6–22.4 × 4.8–7.2 µm, overlapping uniseriate, hyaline, apiosporous, surrounded by a mucilaginous sheath, basal cell ca 1/8 the size of the larger cell.

Material examined. – PAPUA NEW GUINEA: Western Province, Bensbach, on rachis of *Livistona* sp., May 1992, K. D. Hyde 1365a (BRIP 22262, holotype).

*Apioclypea livistonae* is the type of the genus.

***Apioclypea nypicola*** K. D. Hyde, J. Fröhl. & J.E. Taylor, sp. nov. – Figs. 37–44.

Ascomata 130–180 µm alta, 220–455 µm diam, immersa, subglobosa, membranacea, brunnea, breviter papillata, periphysata, solitaria vel gregaria, paraphysata. Ascii 100–150 × 9–12 µm (in media parte 124.3 × 10.5 µm, n = 20), octospori, cylindrici, unitunicati, leptodermi, breve pedunculati, apparatus J+, subapicale praediti. Ascospores 16–20.5 × 5–7 µm (in media parte 17.7 × 5.85 µm, n = 20), bicellulares, apiosporae, hyalinae, tunica gelatinosa praeditae.

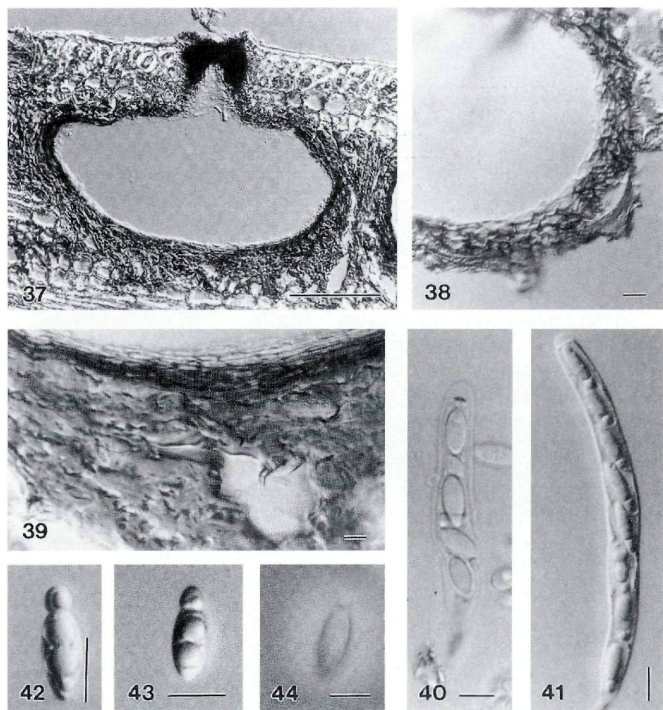
Etymology. – In reference to the taxon occurring on *Nypa fruticans*.

Ascomata immersed, visible on host surface as raised blister-like areas, with minute blackened ostiolar dots; in section 220–455 µm diam, 130–180 µm high, subglobose, immersed, clypeus poorly developed, solitary or gregarious, ostiole central (Fig. 37). An orange ooze of ascospores may occur around the ostiole. – Peridium ca 20 µm wide, comprising several layers of brown-walled elongate cells (Figs. 38, 39). – Paraphyses up to 4 µm wide, hypha-like, septate, numerous, embedded in a gelatinous matrix. – Ascii 100–150 × 9–12 µm (mean = 124.3 × 10.5 µm, n = 20), 8-spored, cylindrical, pedicellate, apically rounded, with a discoid, J+, subapical ring, 0.8–1 µm high, 3.2–4 µm diam (Figs. 40, 41). – Ascospores 16–20.5 × 5–7 µm (mean = 17.7 × 5.85 µm, n = 20), overlapping uniseriate, hyaline, apiosporous, surrounded by a mucilaginous sheath, basal cell ca 1/5 the size of the larger cell (Figs. 42–44).

Material examined. – MALAYSIA: Kuala Selangor, on intertidal rachis of *Nypa fruticans*, Oct. 1991, K. D. Hyde (HKU(M) 1629, holotype).

Ascospores of *Apioclypea nypicola* have an indistinct mucilaginous sheath that can be seen only when mounted in India Ink. The species is inconspicuous, visible as minute ostiolar dots on the host



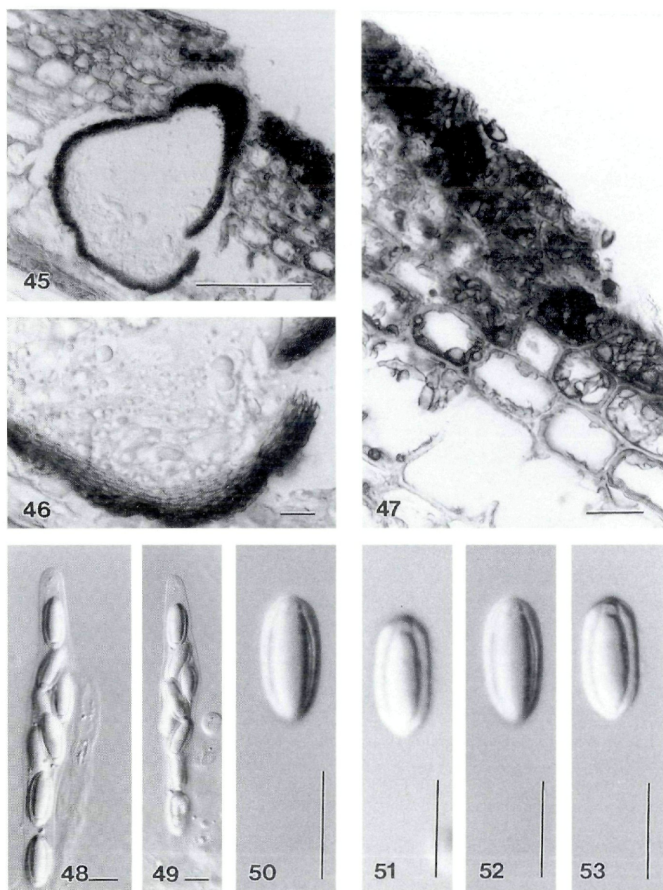


Figs. 37-44. *Apioclypea nypicola* (from holotype). - 37. Section of ascoma. - 38, 39. Peridium. - 40, 41. Asci with J+ ring (in 40). - 42-44. Ascospores. - Bars: 37 = 100  $\mu$ m, 38-44 = 10  $\mu$ m.

surface, and can easily be overlooked. The ascospores in this species are distinct as they are highly constricted at the septum, and the ascus subapical ring stains blue in Melzer's reagent. It differs from *A. indica* in ascospore shape and in its intertidal habitat.

***Apioclypea phoenicicola*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov.  
- Figs. 45-53.

Ascomata 130-170  $\mu$ m diam, 180-250  $\mu$ m alta, immersa, globosa vel subglobosa, clypeata, ostiolata, solitaria vel gregaria. Asci 100-135  $\times$  13-20  $\mu$ m, 8-sporei, cylindracei-clavati, pedicellati, unitunicati, ad apicem rotundati, apparatus apicali



Figs. 45–53. *Apioclypea phoenicicola* (from holotype). – 45. Section of ascoma. – 46. Peridium. – 47. Pseudostroma. – 48, 49. Asci. – 50–53. – Bars: 45 = 100  $\mu\text{m}$ , 46–53 = 10  $\mu\text{m}$ .

J+ praediti. Ascosporae 13–17.5  $\times$  5–6.5  $\mu\text{m}$ , 1–2 seriatae, apiosporae, hyalinae, bicellulares: cellula apicalis maior et ellipsoidea, cellula basilaris minor et umbonata.

**Etymology.** – In reference to the fungus occurring on the host *Phoenix*.

Ascomata immersed, visible on the host surface as minute blackened regions with a central ostiole; in section 130–170  $\mu\text{m}$  diam, 180–250  $\mu\text{m}$  high, globose or subglobose, clypeate, ostiolate, solitary or gregarious (Figs. 45, 47). – Peridium up to 15  $\mu\text{m}$  wide, comprising several layers of brown-walled elongate cells, outer cells angular in shape (Fig. 48). – Paraphyses up to 4  $\mu\text{m}$  wide, hyphal-like, septate, numerous, embedded in a gelatinous matrix. – Ascii 100–135  $\times$  13–20  $\mu\text{m}$ , 8-spored, cylindric-clavate, pedicellate, apically rounded, with a J- subapical ring (Figs. 48, 49). – Ascospores 13–17.5  $\times$  5–6.5  $\mu\text{m}$ , 1–2 seriate, hyaline, apiosporous, surrounded by a mucilaginous sheath, basal cell knob-like, ca 1/5 the size of the ellipsoidal larger apical cell (Figs. 50–53).

Material examined. – HONG KONG: Pokfulam Country Park, on dead frond of *Phoenix* sp., 1 May 1993, K. D. Hyde (HKU(M)1665, holotype).

***Apiorhynchostoma*** Petr., Ann. Mycol. 21: 185. 1923.

Recent accounts: Rogers & al. (1994).

Type species. – *Apiorhynchostoma curreyi* (Rabenh.) E. Müll.

*Apiorhynchostoma* includes the type *A. curreyi*, *A. tumulatum* (Cooke) Sivan., and *A. altipetum* (Peck) F. Rappaz (Rogers & al., 1994; Rappaz, 1995). This genus has had an unsettled past and is included in the Clypeosphaeriaceae (with a “?”) in the latest edition of the Dictionary of the Fungi (Hawksworth & al., 1995). *Apiorhynchostoma curreyi* is similar to species of both *Clypeosphaeria* and *Endoxyla*, and all genera are included in the Clypeosphaeriaceae (Barr, 1990). *Endoxyla* is placed in the Boliniaceae in Hawksworth & al. (1995). In a review of *Endoxyla*, Untereiner (1993) discussed the differences between *Clypeosphaeria* and *Endoxyla* and these will be discussed under *Clypeosphaeria*. Untereiner (1993) and Rogers & al. (1994), however, considered that *Apiorhynchostoma curreyi* had its closest affinities with *Endoxyla*. Dennis (1981) also compared *Endoxyla operculata* (Fr.: Fr.) Sacc. with *Apiorhynchostoma curreyi*. Considering that both genera have many characters in common and that both occur on gymnospermous substrates, their placement in separate families and genera requires confirmation.

Barr (pers. comm.) considers that one of the major differences between *Apiorhynchostoma* and *Endoxyla* is the position of the ascomata. In *Apiorhynchostoma* ascomata occur just beneath the clypeus and the apex is papillate, while in *Endoxyla* ascomata are deep in the wood with a short or long ostiole to the surface. In *Apiorhynchostoma* the asci are also cylindrical, while in *Endoxyla* they are cylindric-clavate, with a long stipe. Barr (pers. comm.) also consid-

ered the ascospore shapes to differ. In the light of these differences the taxonomic placement of these species is maintained.

***Apiorhynchostoma curreyi*** (Rabenh.) E. Müll., Beitr. Kryptogamenfl. Schweiz 11 (2): 707. 1962. – Figs. 54–63.

For synonyms see Müller & Arx (1962).

Ascomata immersed, ca 280  $\mu\text{m}$  diam, 240  $\mu\text{m}$  high, subglobose to globose, ostiolate, papillate, solitary (Fig. 54). – Peridium up to 25  $\mu\text{m}$  wide, comprising several layers of angular, brown-walled cells, hyaline and thinner inwardly (Fig. 55). – Paraphyses up to 3  $\mu\text{m}$  wide, hypha-like, numerous, septate, embedded in a gelatinous matrix. – Asci 150–170  $\times$  8–11  $\mu\text{m}$ , 8-spored, cylindrical, pedicellate, apically rounded, with a subapical, J- ring, seen by invagination of the plasmalemma (Figs. 56, 57). – Ascospores 20–27.5  $\times$  7.5–10  $\mu\text{m}$ , overlapping uniseriate, ellipsoidal, apiosporous, one septum near the base, separating a hyaline to light-brown basal cell, ca 1/8 the size of the larger cell, the other septum ca 1/3 from the other end of the spore, dividing the larger brown cell, with a germ pore at the end of the larger brown cell (Figs. 58–63).

Material examined. – UK: Weybridge station, S.W. Railway, on fence, 1856 & 1857, Rabenh. Fungi Europ. 250 (K, lectotype designated here).

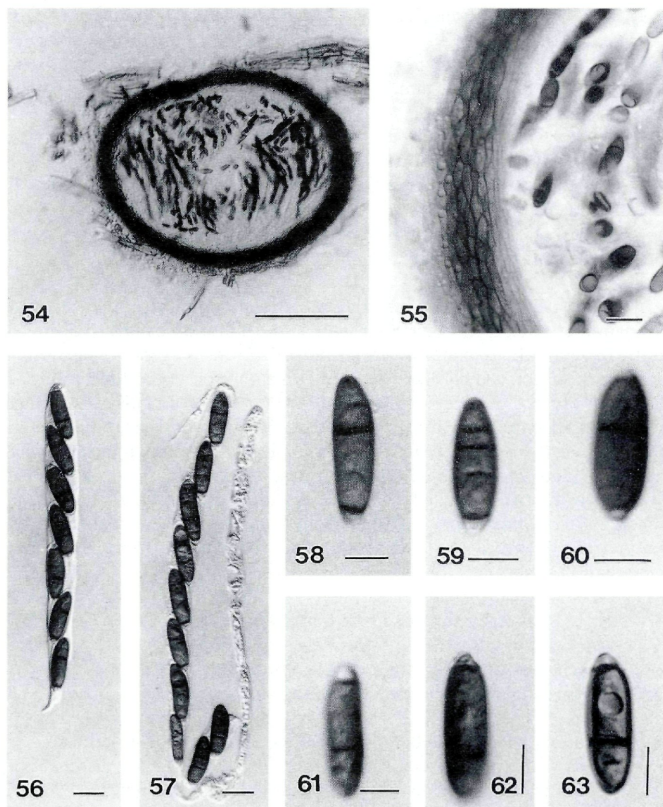
***Apiotypa*** Petr., Ann. Mycol. 23: 104. 1925.

Type species. – *Apiotypa philippensis* Petr.

*Apiotypa philippensis* was described from the Philippines and may be a good genus to accommodate apiosporous taxa on palms. In the protologue, ascomata of *Apiotypa* are reported to be immersed under a clypeus, and have long cylindrical asci with a J+ ring. Unfortunately, despite a lengthy search we have been unable to locate the type or any other collections of this species. Although the description may agree with the above characters, the genus name cannot be used with certainty as type material is lacking. We therefore introduce a new genus *Brunneiapiospora*.

***Brunneiapiospora*** K. D. Hyde, J. Fröhl. & J. E. Taylor, gen. nov.

Ascomata sub clypeo immersa, subglobosa, periphysata, papillata vel ostiolata, paraphysata. Asci 8-sporei, cylindrici, pedicellati, unitunicati, apparatus apicali J+ vel J- praediti. Ascosporeae uniseriatae, apiosporae. Cellulae hyalinae vel pallide brunneae, cellulae apicales brunneae, basales tunica gelatinosa praeditae vel sine tunica.



Figs. 54–63. *Apiorhynchostoma apiculatum* (from holotype). – 54. Section of ascoma. – 55. Peridium. – 56, 57. Asci. – 58–63. Ascospores. – Bars: 54 = 100  $\mu$ m, 55–63 = 10  $\mu$ m.

Typus generis. – *Brunneiapiospora javensis* K. D. Hyde, J. Frohl. & J. E. Taylor.

Ascomata immersed beneath a darkened clypeus, subglobose, with central periphysate papilla or ostiole. – Peridium composed of several layers of compressed, brown walled cells. – Paraphyses hypha-like, septate, numerous, tapering distally, in some species in a gelatinous matrix. – Asci 8-spored, cylindrical, pedicellate, thin-

walled, apically rounded, with a J+, or J- discoid subapical ring and faint canal leading to the apex. – Ascospores uniseriate or overlapping uniseriate, apiosporous, usually surrounded by a mucilaginous sheath, basal cell smaller, hyaline to light brown, apical cell brown.

Anamorph. – Unknown.

Type species. – *Brunneiapiospora javensis* K. D. Hyde, J. Fröhl. & J. E. Taylor.

Habitat. – Only known from palms.

Distribution. – Pantropical.

*Brunneiapiospora* is introduced to accommodate species with apiospores, with a larger brown cell and a smaller basal, hyaline to light brown cell. Ascomata are immersed under a clypeus, paraphyses are numerous, irregular in shape, and may be embedded in a gelatinous matrix. Asci are cylindrical with a J+ or J- subapical ring, with a faint canal leading to the apex. We have deliberately chosen *B. javensis* to represent the genus as it has a distinct hyaline basal cell. We have also included species in the genus with ascospores with smaller light brown basal cells (i.e. *B. daemonoropis*, *B. aequatoriensis*). *Brunneiapiospora* differs from *Anthostomella* species which have broadly cylindrical asci and ascospores usually provided with a germ slit.

#### Key to species of *Brunneiapiospora*

1. Ascospores surrounded by a distinct mucilaginous sheath ..... 2
1. Ascospores lacking a distinct mucilaginous sheath ..... 3
2. Ascospores 12–14.4 × 4.8–6 µm, basal cell hyaline, ca 1/4 the size of the brown apical cell ..... *B. javensis*
2. Ascospores 13.3–17 × 5.5–5.8 µm, basal cell pale brown, ca 1/5 size of the light brown apical cell ..... *B. australiensis*
3. Ascospores fusoid with acute ends ..... *B. jesseniae*
3. Ascospores ellipsoidal or ellipsoidal-fusiform with rounded ends ..... 4
4. Ascospores 22–32 × 7.5–10 µm ..... *B. deightoniella*
4. Ascospores less than 20 µm long ..... 5
5. Ascospores 12.5–17.5 × 4.5–6.25 µm ..... *B. aequatoriensis*
5. Ascospores 10.5–14.4 × 4.5–5 µm ..... *B. daemonoropis*

***Brunneiapiospora aequatorensis*** K. D. Hyde, J. Fröhl. & J. E. Taylor,  
sp. nov. – Figs. 64–74.

Ascomata sub clypeo immersa, 400–525 µm diam, 150–250 µm alta, lenticularia, ostiolata, paraphysata. Asci 135–175 × 5–6.5 µm, 8-spori, longe cylindrici, pedicellati, apparatu apicali, J+, 2.5 µm diam, 1 µm alto praediti. Ascosporae 12.5–17.5 × 4.5–6.25 µm, uniseriatae, apiosporae, brunneae, tunica gelatinosa praeditae.

**Etymology.** – In reference to Ecuador, where the fungus was collected.

Ascomata visible on host surface as blackened discs, with a central ostiolar dot; individual discs clearly visible, but always clustered (Figs. 64, 65); in vertical section 400–525 µm diam, 150–250 µm high, lenticular, immersed beneath a clypeus (Figs. 66, 67). – Clypeus large, erumpent, comprising host epidermal cells and blackened fungal cells (Figs. 66, 67). – Peridium comprising a few layers a brown-walled compressed cells, fusing with host tissue outwardly (Fig. 66). – Paraphyses up to 2.5 µm wide, hypha-like, septate, numerous, embedded in a gelatinous matrix. – Asci 135–175 × 5–6.5 µm, 8-spored, long cylindrical, pedicellate, apically rounded, with a J+, discoid subapical ring, 2.5 µm diam, 1 µm high (Figs. 68, 69). – Ascospores 12.5–17.5 × 4.5–6.25 µm, uniseriate, brown, apiosporous, surrounded by a spreading mucilaginous sheath, basal cell ca  $\frac{1}{3}$  the size of larger apical cell (Figs. 70–74).

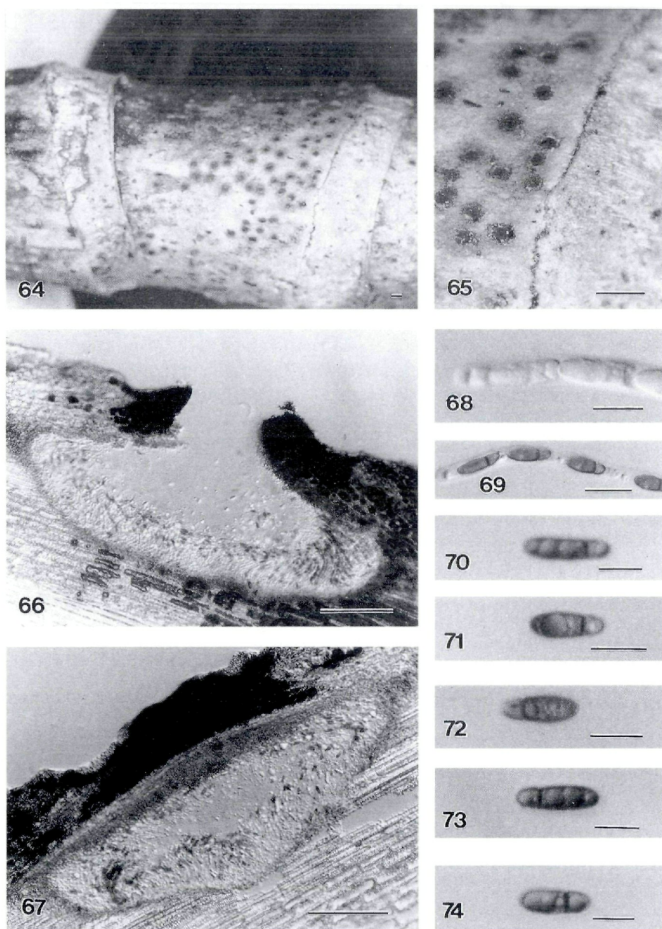
**Material examined.** – ECUADOR: Oriente, Reserva de Producción Faunística Cuyabeno, Rio Cuyabeno, forest near Laguna Grande, Terra firme, on dead trunk of *Geonoma* sp., Aug. 1993, K. D. Hyde E35 (HKU(M) 2656, holotype; syntype at QCA).

***Brunneiapiospora australiensis*** K. D. Hyde, J. Fröhl. & J. E. Taylor,  
sp. nov. – Figs. 75–83.

Ascomata sub clypeo immersa, 148–160 µm diam, 198–233 µm alta, subglobosa. Asci 67.5–97.5(–106) × 7.5–10.5(–12) µm, cylindricei-clavati, apparatu apicali, J+, 2.4–2.8 µm diam, 0.3–0.6 µm alto praediti. Ascosporae 13.3–17(–18.6) × 5.5–5.8(–6.2) µm, apiosporae, pallide brunneae, tunica gelatinosa praeditae.

**Etymology.** – In reference to the country in which the fungus was collected.

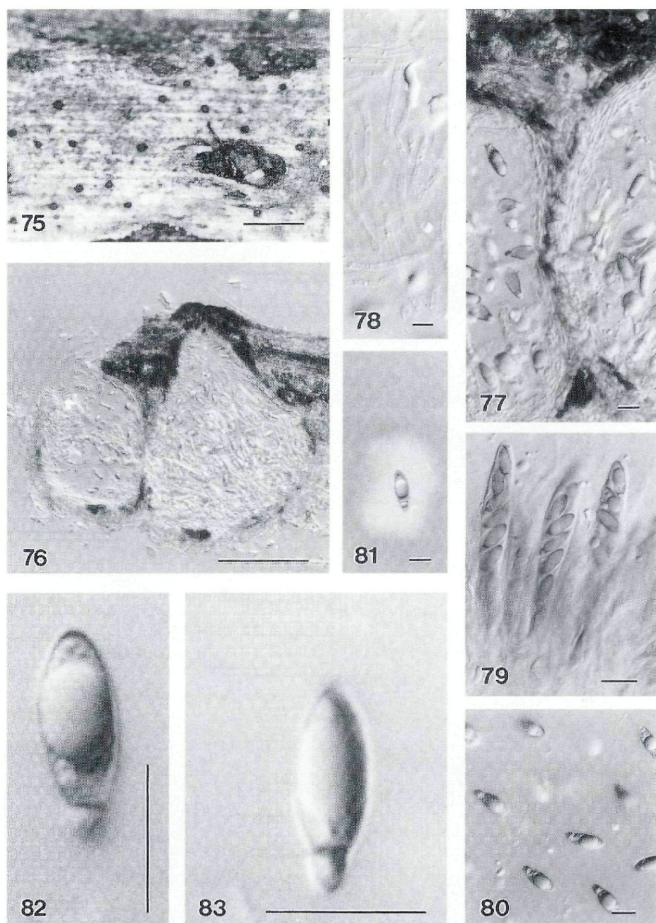
Ascomata visible on the host surface as blackened dots (Fig. 75); in section 148–160 µm diam, 198–233 µm high, subglobose, immersed beneath a clypeus (Fig. 76). – Clypeus large, erumpent, comprising host epidermal cells and blackened fungal cells (Fig. 76). – Peridium comprising several layers of compressed cells (Fig. 77). – Paraphyses up to 2–4 µm wide, hypha-like, septate, numerous, embedded in a gelatinous matrix (Fig. 78). – Asci 67.5–97.5



Figs. 64–74. *Brunneiapiospora aequatoriensis* (from holotype). – 64, 65. Appearance on host surface. – 66, 67. Sections of ascomata with clypeus. – 68, 69. Asci with J+ ring. – 70–74. Ascospores. – Bars: 64, 65 = 1 mm, 66, 67 = 100  $\mu$ m, 68–74 = 10  $\mu$ m.

(–106)  $\times$  7.5–10.5(–12)  $\mu$ m, 8-spored, cylindric-clavate, short pedicellate, apically rounded, with a J+, discoid subapical ring, 2.4–2.8  $\mu$ m diam, 0.3–0.6  $\mu$ m high (Fig. 79). – Ascospores 13.3–17(–18.6)  $\times$  5.5–





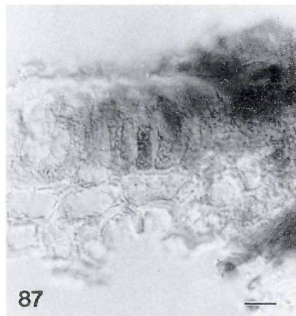
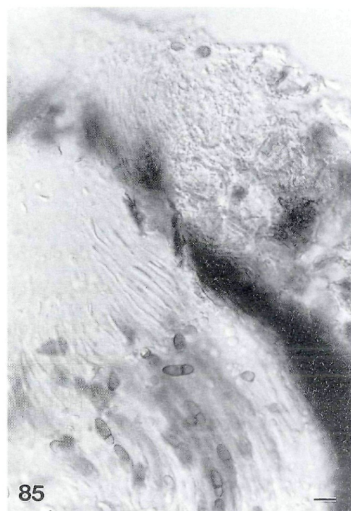
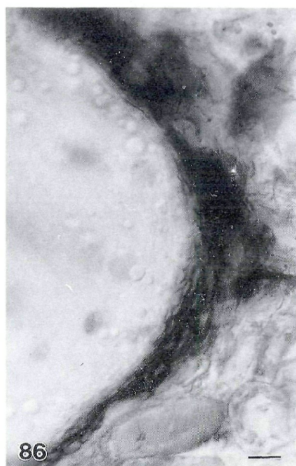
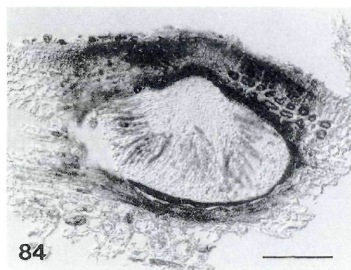
Figs. 75–83. *Brunneiapiospora australiensis* (from holotype). – 75. Appearance on host surface. – 76. Section of ascogonium with clypeus. – 77. Peridium. – 78. Paraphyses. – 79. Asci with J+ ring. – 80–83. Ascospores. Note the wide sheath (in 81). – Bars: 75 = 1 mm, 76 = 100 µm, 77–83 = 10 µm.

5.8(–6.2) µm, overlapping uniseriate to biseriata, pale brown, apiosporous, surrounded by a wide mucilaginous sheath, basal cell ca 1/5 the size of larger apical cell (Figs. 80–83).

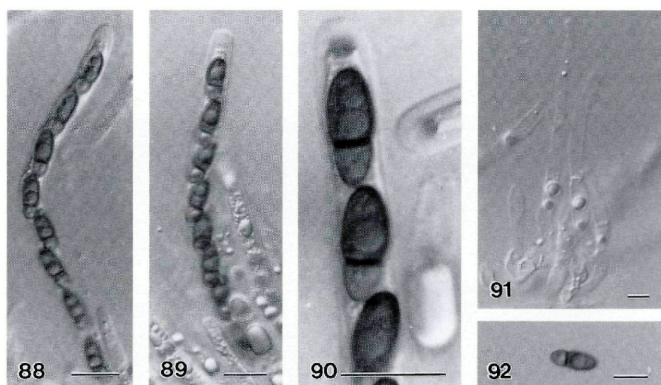
Material examined. – AUSTRALIA: north Queensland, Tolga, Tolga Scrub, on dead flagella base of *Calamus australis*, Apr. 1995, J. Fröhlich (HKU(M) JF629, holotype; syntype at BRIP).

***Brunneiapiospora daemonoropis*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 84–100.

Ascomata sub clypeo immersa, ca 320  $\mu\text{m}$  diam, 280  $\mu\text{m}$  alta, subglobosa, ostiolata, periphysata, paraphysata. Asci 100–130  $\times$  5–7  $\mu\text{m}$ , 8-spори, cylindrici, pedi-



Figs. 84–87. *Brunneiapiospora daemonoropis* (from holotype). – 84. Section of ascoma with clypeus. – 85, 86. Peridium. – 87. Clypeus. – Bars: 84 = 100  $\mu\text{m}$ , 85–87 = 10  $\mu\text{m}$ .

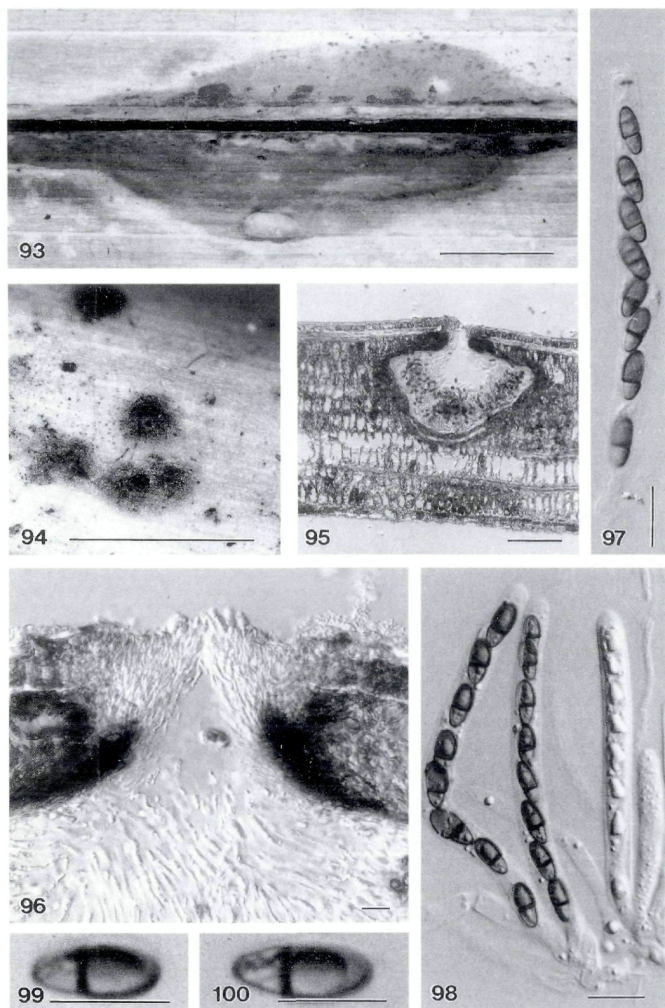


Figs. 88–92. *Brunneiapiospora daemonoropis* (from holotype). – 88–90. Asci with J+ ring. – 91. Paraphyses. – 92. Ascospore. – Bars = 10  $\mu$ m.

cellati, apparatu apicali, J+, 2.4  $\mu$ m diam, 1.6  $\mu$ m alto praediti. Ascosporae 10.5–14.4  $\times$  4.5–5  $\mu$ m, ellipsoideae, apiosporae; cellula apicalis brunnea, 6.4–9.6  $\mu$ m longa; cellula basalis hyalina vel pallide brunnea, 3.2–4.8  $\mu$ m longa, sine tunica gelatinosa.

**Etymology.** – In reference to the host on which the fungus was collected.

Ascomata immersed, visible on the host surface as slightly raised, darkened regions (Fig. 93, 94); in vertical section ca 300–332  $\mu$ m diam, 208–280  $\mu$ m high, subglobose, clypeate, with a central vertical periphysate ostiole (Figs. 84, 85, 95, 96). – Clypeus up to 200  $\mu$ m diam, forming a disc around the lighter-coloured ostiole, comprising host cells filled with brown angular fungal cells (Figs. 84, 85, 87, 95, 96). – Peridium up to 30  $\mu$ m wide, comprising several layers of brown compressed cells (Fig. 86). – Paraphyses up to 6  $\mu$ m wide at the base, hypha-like, numerous, septate, unbranched, tapering abruptly distally (Fig. 91, 96, 98). – Asci 100–130  $\times$  5–7  $\mu$ m, 8-spored, cylindrical, thin-walled, pedicellate, apically rounded, with a J+, wedge-shaped subapical ring, 2.4–3.5  $\mu$ m diam, 1–2  $\mu$ m high (Figs. 88–90, 97, 98). – Ascospores 10.5–14.4  $\times$  4.5–5.8  $\mu$ m, uniseriate or overlapping uniseriate, ellipsoidal, apiosporous, smooth-walled, lacking a sheath or appendages, apical cell brown, 6.4–9.6  $\mu$ m long, basal cell hyaline to light-brown, 3.2–4.8  $\mu$ m long (Figs. 90, 92, 99, 100).



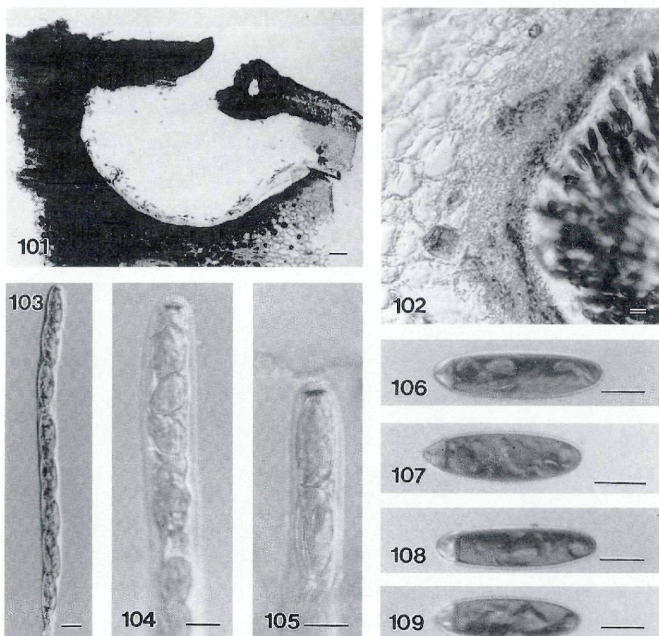
Figs. 93–100. *Brunneiapiospora daemonoropis* (from HKU(M) JF 155). – 93. Leaf spot. – 94. Appearance on host surface. – 95, 96. Section of ascus with papilla and clypeus. – 97, 98. Asci with J+ ring and paraphyses. – 99, 100. Ascospores. – Bars: 93, 94 = 1 mm, 95 = 100  $\mu$ m, 96–100 = 10  $\mu$ m.

**Material examined.** – BRUNEI: Kampong Long Mayan, on rachis of *Daemonorops* sp. in freshwater swamp (submerged after rainstorm), Nov. 1992, K. D. Hyde BKM2 (HKU(M) 1974, holotype). – Ecuador: Oriente, Reserva de Producción Faunística Cuyabeno, Rio Cuyabeno, forest near Laguna Grande, Canangucho, Path A, on leaf spot on living frond blade of *Mauritia flexuosa*, Aug. 1993, J. Fröhlich & J. Chapman (HKU(M) JF155).

This species differs from *B. aequatoriensis* which has narrower ascospores. The collection of *B. daemonoropsis* from Ecuador were associated with leaf spots, 20–45  $\mu\text{m}$  long, 7–16  $\mu\text{m}$  wide, which were various shades of brown and visible on both surfaces of the leaf. It may not be a pathogen, as the type collection from Brunei occurred on a dead rachis of *Daemonorops* sp.

***Brunneiapiospora deightoniella* (Petr.) K. D. Hyde, J. Fröhl. & J. E. Taylor, comb. nov.** – Figs. 101–109.

≡ *Entosordaria deightoniella* Petr., Sydowia 6: 310. 1952.



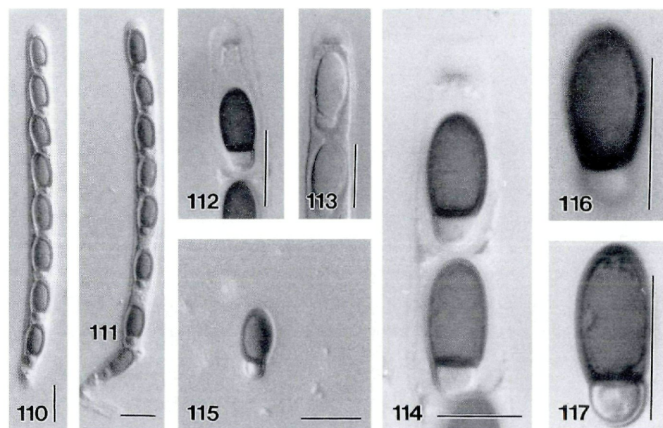
Figs. 101–109. *Brunneiapiospora deightoniella* (from holotype). – 101. Section of ascoma with clypeus. – 102. Peridium. – 103–105. Asci with J+ ring. – 106–109. – Bars: 101 = 100  $\mu\text{m}$ , 102–109 = 10  $\mu\text{m}$ .

Ascomata visible on the host surface as blackened, raised, shiny regions, which may be solitary or clustered; in vertical section ca 1.5  $\mu\text{m}$  diam, 1  $\mu\text{m}$  high, subglobose to ellipsoidal, clypeate, with a central ostiolar canal (Fig. 101). – Peridium 30–50  $\mu\text{m}$  thick, comprising small, hyaline to brown, irregularly globose cells, fusing above with the clypeus and at the sides with the host tissue (Fig. 102). – Paraphyses up to 2  $\mu\text{m}$  wide, hypha-like, septate and embedded in a gelatinous matrix. – Asci 8-spored, cylindrical, pedicellate, apically rounded, with a J+, discoid subapical ring, 3–4  $\mu\text{m}$  diam, 1  $\mu\text{m}$  high (Figs. 103–105). – Ascospores 22–32  $\times$  7.5–10  $\mu\text{m}$ , uniseriate, apiosporous, smooth-walled, apical cell large and brown, basal cell small (3–5  $\mu\text{m}$ ) and hyaline or very pale brown (Figs. 106–109).

Material examined. – SIERRA LEONE: on dead stem? of *Elaeis guineensis*, 19 July 1947, F. C. Deighton (IMI 3749, holotype); 16 Nov. 1950, F. C. Deighton (IMI 46540). – TANGANYIKA: Kigoma, Kakombe, on *Elaeis guineensis*, 19 Dec. 1963, K. Pirozynski (IMI 105779).

***Brunneiapiospora javensis*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 110–117.

Ascomata sub clypeo immersa, ca 330  $\mu\text{m}$  diam, 250  $\mu\text{m}$  alta, subglobosa, papillata, periphysata, paraphysata. Asci 90–115  $\times$  7–8.5  $\mu\text{m}$ , 8-sporei, cylindrici, breviter pedicellati, apparatu apicali, J+, 2.4–3.2 diam, 0.8  $\mu\text{m}$  alto praediti. Ascospores



Figs. 110–117. *Brunneiapiospora javensis* (from holotype). – 110–114. Asci with J+ ring. – 115–117. Ascospores. – Bars = 10  $\mu\text{m}$ .

porae 12–14.4 × 4.8–6 µm, uniseriatae, apiosporae. Cellula basalis hyalina, 2.4–3.2 µm longa; cellula apicalis brunnea, 8.8–12 µm longa, tunica gelatinosa praedita.

**Etymology.** – In reference to the location Java, in which the fungus was collected.

**Ascomata** immersed, visible on the host surface as slightly raised and darkened areas up to 780 µm diam; in vertical section ca 330 µm diam, 250 µm high, subglobose, clypeate, brown, with central barely protruding periphysate papilla. – **Clypeus** as a disc around the ostiole, 80–100 µm diam, comprising upper epidermal host cells filled with brown fungal hyphae. – **Stroma** an area of variable stromatal development, comprising large host cells and brown fungal hyphae at the sides of the ascomata. – **Peridium** 16–22 µm thick, composed of several layers of compressed cells, with pale brown walls, fusing and indistinguishable from the stroma at the sides, and comprising compressed host cells at the base. – **Paraphyses** 3–4 µm wide, hypha-like, septate, numerous, longer than asci, tapering distally. – **Asci** 90–115 × 7–8.5 µm, 8-spored, cylindrical, short pedicellate, thin-walled, apically rounded, with a J+, discoid subapical ring, 2.4–3.2 diam, 0.8 µm high, and faint canal leading to the apex (Figs. 110–114). – **Ascospores** 12–14.4 × 4.8–6 µm, uniseriate, apiosporous, surrounded by a mucilaginous sheath, basal cell smaller, 2.4–3.2 µm long, hyaline, cap-like; apical cell 8.8–12 µm long, brown, ellipsoidal (Figs. 115–117).

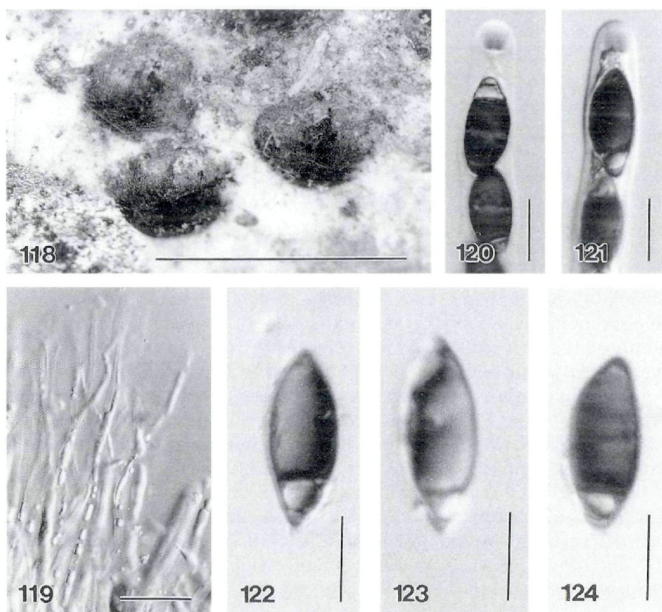
**Material examined.** – INDONESIA: Java, Cibodas, on rachis of *Calamus* sp., Apr. 1992, K. D. Hyde (HKU(M)1121b, holotype).

***Brunneiapiospora jesseniae*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 118–124.

**Ascomata** sub clypeo immersa, lenticularia. Asci 125–180 × 8–10.5 µm, apparatus apicali, 3–4 µm diam, 2.5–3 µm alto praediti. Ascosporae 22.5–27.5(–30) × 7–8 (–9) µm, uniseriatae, apiosporae, brunneae.

**Etymology.** – In reference to the host on which this fungus was collected.

**Ascomata** immersed, visible on the host surface as blackened discs, with a central ostiolar dot; clustered (Fig. 118); in section lenticular, clypeate. – **Clypeus** large, erumpent, comprising host epidermal cells and blackened fungal cells. – **Paraphyses** up to 2.5 µm wide, hypha-like, septate, numerous, embedded in a gelatinous matrix (Fig. 119). – **Asci** 125–180 × 8–10.5 µm, 8-spored, long cylindrical, pedicellate, apically rounded, with a J+, discoid subapical ring,



Figs. 118–124. *Brunneiapiospora jesseniae* (from holotype). – 118. Appearance on host surface. – 119. Paraphyses. – 120, 121. Asci with J+ ring. – 122–124. Ascospores. – Bars: 118 = 1 mm, 119–124 = 10  $\mu$ m.

3–4  $\mu$ m diam, 2.5–3  $\mu$ m high (Figs. 120, 121). – Ascospores 22.5–27.5(–30)  $\times$  7–8(–9)  $\mu$ m, uniseriate, fusoid with acute ends, brown, apiosporous, surrounded by remnants of mucilage, basal cell ca 1/5 the size of the larger apical cell (Figs. 122–124).

**Material examined.** – ECUADOR: Oriente, Reserva de Producción Faunística Cuyabeno, Rio Cuyabeno, forest near Laguna Grande, Terra firme, on dead petiole of *Jessenia bataua*, Aug. 1993, J. Fröhlich (HKU(M) JF160, holotype; isotype at QCA).

This species is distinct from other *Brunneiapiospora* species as it has fusoid apiospores with acute ends (Figs. 122–124).

***Clypeosphaeria*** Fuckel, Jahrb. Nassau. Ver. Nat. 23–24: 117. 1870.

For synonyms see Barr (1989).

Recent accounts: Barr (1989).

Type species. – *Clypeosphaeria mamillana* (Fr.) Lamb.



*Clypeosphaeria* was discussed by Barr (1989) and included three species; the type species *C. mamillana* (Fr.) Lamb., *C. perfidiosa* (De Not.) Barr and *C. americana* Barr & Samuels. All species have ascomata immersed under a clypeus, whereas the asci and ascospores differ. In *C. mamillana* and *C. americana* the asci are provided with a wedge-shaped, J+, subapical ring, while in *C. perfidiosa* the ring is J- and not clearly visible. The brown ascospores also differ. In *C. mamillana* they are variable, either one-celled, or with a septum near one end (Figs. 131–153), and with a small germ pore or slit at the end. The ascospores of *C. perfidiosa* possess a small hyaline apical cell and a radiating basal germ slit (Figs. 144–147). In *C. americana* the ascospores possess a smaller hyaline to light brown cell and an inconspicuous rounded or X- to Y-shaped germ pore (Barr, 1989). The germ pore may be in the end opposite the smaller cell or in septum at base of large cell. *Clypeosphaeria* is treated here as monotypic, with *C. perfidiosa* and *C. americana* transferred to *Stereosphaeria*.

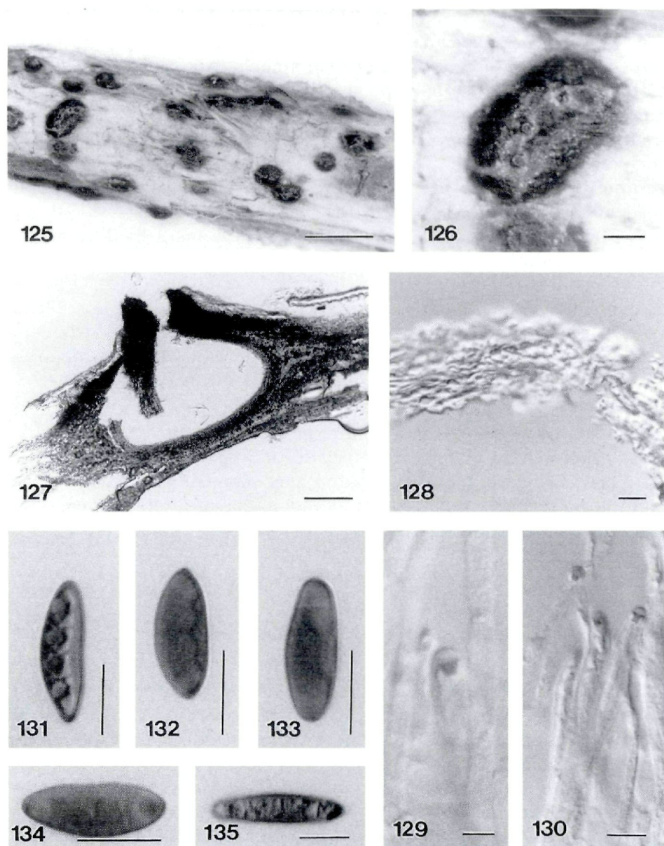
In many respects *Clypeosphaeria* is similar to *Endoxyla* and these genera share many characteristics (Untereiner, 1993; Rogers & al., 1994). They are, however, treated here separately as in *Endoxyla* there is no clypeus, the asci are cylindrical-clavate with a long stipe and lack a J+ ring, and the hosts are primarily gymnosperms.

***Clypeosphaeria mamillana*** (Fr.) Lamb., Mém. Soc. Roy. Sci. Liège, ser 2. 14: 128. 1887. – Figs. 125–135.

= *Sphaeria mamillana* Fr., Syst. Mycol. 2: 487. 1823.

Ascomata immersed, visible as dark, mammiform, shiny, black, raised regions on the host surface, solitary, with a central erumpent papilla (Figs. 125, 126); in section subglobose or ovoid, 320–400 µm diam, 240–320 µm high, clypeate (Fig. 127). – Clypeus up to 560 µm diam, a black disc around the ostiole comprising subepidermal host cells filled with brown fungal hyphae. – Peridium up to 30 µm wide, comprising pale, thick-walled cells, fusing with and indistinguishable from the host tissue (Fig. 128). – Paraphyses up to 5 µm diam, hypha-like, septate, numerous and embedded in a gelatinous matrix (Fig. 129). – Asci (not possible to measure), 8-spored, cylindrical, pedicellate, apically rounded, with a J+, wedge-shaped subapical ring, 2 µm diam, 4 µm high (Figs. 129, 130). – Ascospores 17–24 × 5–7 µm, overlapping uniseriate, ellipsoidal, brown, unicellular, some with 3–5 pseudosepta, or rarely apiosporous, smooth-walled, lacking a germ slit (Figs. 131–135).

Material examined. – Lund, Skåne, Suecia (UPS).



Figs. 125–135. *Clypeosphaeria mamillana* (from UPS). – 125, 126. Appearance on host surface. – 127. Section of ascoma with clypeus. – 128. Peridium. – 129, 130. Paraphyses and asci with J+ ring. – 131–135. Ascospores. Note the apiospore in 135. – Bars: 125 = 1 mm, 126, 127 = 100  $\mu$ m, 128–135 = 10  $\mu$ m.

*Clypeosphaeria* is treated here as monotypic and represented by *C. mamillana*. Ascospores are ellipsoidal, brown, some with up to 5-pseudosepta and lack any mucilaginous sheath. Barr (1989) reported some immature ascospores to have a single septum near the base, but this is rare. The paraphyses are typically amphisphaeriaceous (*sensu*

Hyde, 1994a), while the asci are long cylindrical, with a J+, subapical ring. We do not consider *Entosordaria* and *Clypeosphaeria* to be congeneric (see discussion under *Stereosphaeria*). There are presently no species of *Clypeosphaeria* known from palms.

***Stereosphaeria*** Kirschst., Ann. Mycol. 37: 96. 1939.

= *Entosordaria* Höhn., Höhn., Akad. Wiss. Wien. Math. nat. Klasse, Abt 1, 129: 31. 1920, non Speg. 1910.

= *Anthostomella* subg. *Entosordaria* Sacc., Syll. Fung. 1: 286. 1882.

Recent accounts: Eriksson (1966); Eriksson & Hawksworth (1986a); Barr (1989).

Anamorph. – Unknown.

Type species. – *Stereosphaeria perfidiosa* (De Not.) O. Erikss.

Habitat. – Bark and woody plants.

Distribution. – Northern temperate.

*Entosordaria* was used as a subgenus of *Anthostomella* (Saccardo, 1882; Höhnel, 1920) and its history has been reviewed by Eriksson (1966), Eriksson & Hawksworth (1986a) and Barr (1989). *Entosordaria* was considered to differ from *Anthostomella* and to be a separate genus (Eriksson & Hawksworth, 1986a). In introducing the Clypeosphaeriaceae, Barr (1989) treated the type of *Entosordaria* Höhn., *E. perfidiosa* (De Not.) Höhn., and found that many of the characters found in *Clypeosphaeria mamillana* (Fr.) Lamb. were similar to those in *E. perfidiosa*. Barr (1989) combined *Entosordaria* with *Clypeosphaeria* and renamed *Entosordaria perfidiosa* as *Clypeosphaeria perfidiosa* (De Not.) Barr.

We consider the two genera *Entosordaria* and *Clypeosphaeria* to differ. The ascumata of species of *Entosordaria* are superficial with a complex peridium, while those of *Clypeosphaeria* are immersed with a relatively simple peridium. The ascal apical apparatus in *Clypeosphaeria mamillana* is composed of a "large, refractive pulvillus surmounting a shallow or occasionally wide annulus" (Barr, 1990), reacting in iodine, but this is not the case in *E. perfidiosa*. Furthermore, ascospores of species of *Entosordaria* possess a distinct basal radiating germ slit and an apical hyaline cell. In *Clypeosphaeria mamillana* there is a germ pore or slit in the end of some ascospores, and there is sometimes a hyaline cell in immature ascospores. The name *Entosordaria*, however, cannot be used, as it was first applied at the generic level by Spegazzini in 1910 for unrelated fungi. *Stereosphaeria* is considered the most acceptable name (Eriksson & Hawksworth, 1986a).

***Stereosphaeria americana*** (M.E. Barr & Samuels) K. D. Hyde,  
J. Fröhl. & J. E. Taylor, comb. nov.

≡ *Clypeosphaeria americana* M.E. Barr & Samuels, Syst. Ascomycet. 8: 7. 1989.

Recent accounts: Barr (1989).

In *S. americana* the ascus apical ring is J+ and the ascospores are 18–22 × 7–9 μm, apiosporous, with a large brown cell and a small hyaline to light brown smaller cell. There is an inconspicuous rounded or X- to Y-shaped germ pore in end opposite the smaller cell or in the septum at base of larger cell (Barr, 1989).

***Stereosphaeria perfidiosa*** (De Not.) O. Erikss. Syst. Ascomycet. 5:  
158. 1986. – Figs. 136–147.

≡ *Sordaria perfidiosa* De Not., Comm. Soc. Critt. Ital. 2: 481. 1867.

≡ *Anthostomella perfidiosa* Sacc., Syll. Fung. 1: 386. 1882.

≡ *Entosordaria perfidiosa* (De Not.) Höhn., Akad. Wiss. Wien. Math. nat. Klasse,  
Abt 1, 129: 167. 1920.

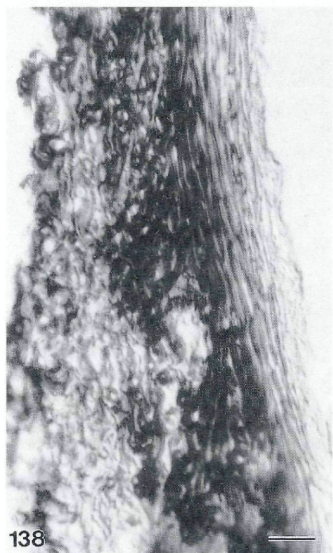
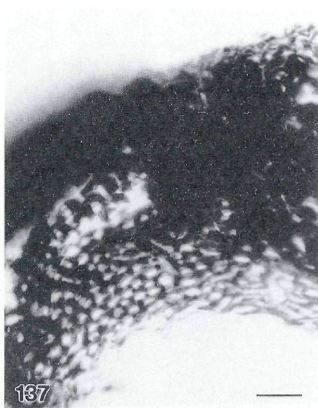
≡ *Clypeosphaeria perfidiosa* (De Not.) M.E. Barr, Syst. Ascomycet. 8: 5. 1989.

= *Stereosphaeria phloeophila* Kirschst., Ann. Mycol. 37: 96. 1939.

For other synonyms see Barr (1989).

Ascomata superficial, 520–780 μm diam, 390–520 μm high, subglobose to mammiform, base somewhat applanate, black, carbonaceous, ostiolate, short papillate, solitary or clustered (Fig. 136). – Neck dark brown, comprising angular thick-walled brown cells, without periphyses. – Upper and lateral peridium up to 60 μm wide, inwardly comprising 7–10 layers of compressed cells with light brown walls, outwardly brown, comprising *textura intricata*, interspersed with a few host cells. – Lower lateral and basal peridium up to 20 μm wide, comprising 8–10 layers of compressed cells with light brown walls (Figs. 137–139). – Paraphyses 2–4 μm diam, hypha-like, branching, septate, and embedded in a gelatinous matrix (Fig. 140). – Asci 170–200 × 12–14 μm, 8-spored, cylindrical, short pedicellate, apically rounded, with a faint, J-, apical ring (Figs. 141–143). – Ascospores 20–27 × 8–14 μm, uniseriate, ovoid to broadly ellipsoidal, brown, 2-celled, with a small hyaline cell that is somewhat flattened and provided with a small mucilaginous cap-like appendage, the larger cell acute at its base with radiating germ-pores (Figs. 144–147).

Material examined. – ITALY: Riva, on bark of *Acer pseudoplatanus*, 22 Apr. 1858, Carestia (PAD, lectotype designated here; RO, syntype).



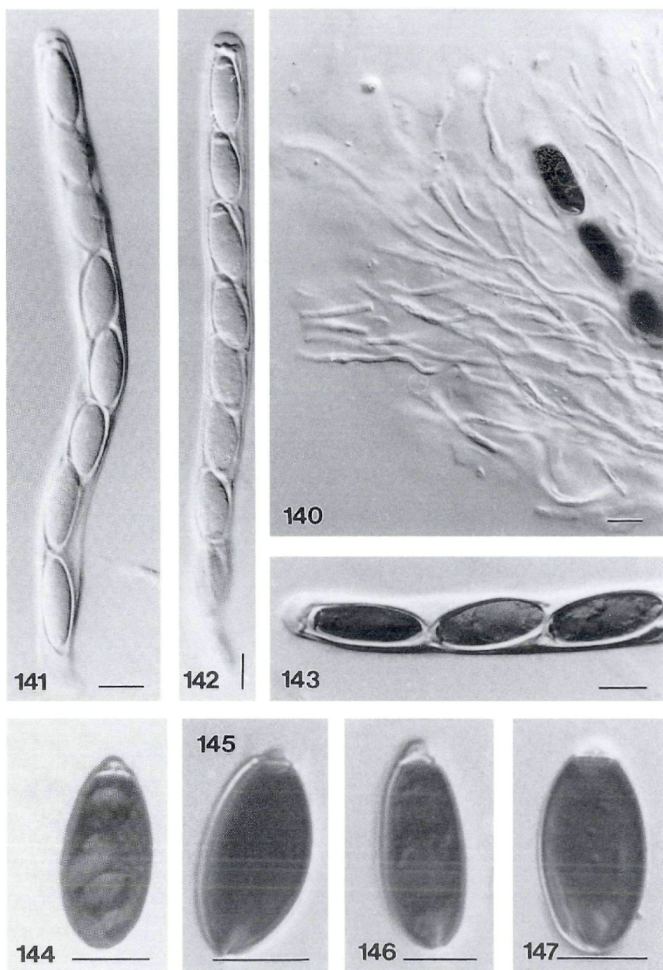
Figs. 136–139. *Stereosphaeria perfidiosa* (from PAD). – 136. – Section of ascoma. – 137–139. Peridium. – Bars: 136 = 100  $\mu$ m, 137–139 = 10  $\mu$ m.

### ***Hyponectriaceae***

**Hyponectriaceae** Petr., Ann. Mycol. 21: 305. 1923.

For description and details of anamorph and habit see Barr (1990).

Type species. – *Hyponectria buxi* (DC.) Sacc.



Figs. 140–147. *Stereosphaeria perfidiosa* (from PAD). – 140. Paraphyses. – 141–143. Asci. – 144–147. Ascospores. Note the germ slits at the base. – Bars = 10  $\mu\text{m}$ .

Eriksson & Hawksworth (1986b) placed the Hyponectriaceae in the Amphisphaeriales together with the Amphisphaeriaceae, Cai-

niaceae and Clypeosphaeriaceae. Eriksson & Hawksworth (1987) and Hawksworth & al. (1995) later removed these latter families to the Xylariaceae and placed the Hyponectriaceae in the *Ascomycota incertae sedis* pending further studies. Recent accounts of the Hyponectriaceae were given by Barr (1990, 1994), although the family is not well circumscribed and probably presently includes several unrelated genera.

Genera in the Hyponectriaceae with apiospores include *Apioclypea*, *Apiothyrium* and *Pseudomassaria* (Hawksworth & al., 1995). *Apioclypea* is considered here to belong in the Clypeosphaeriaceae, while a new hyponectriaceous genus, *Palmomyces*, is introduced here.

***Apiothyrium*** Petr., Sydowia 1: 1. 1947.

This poorly known monotypic genus is represented by *A. arcticum* Petr., a species with ascomata that lie horizontally between the cuticle and epidermis of the host and a laterally placed ostiole. The asci lack a J+ apical ring and the ascospores are hyaline, two-celled and apiosporous (Wehmeyer, 1975).

***Palmomyces*** K. D. Hyde, J. Fröhl. & J. E. Taylor, gen. nov.

Ascomata subglobosa, immersa, solitaria, ostiolata, periphysata, paraphysata. Asci 8-spori, cylindricei-clavati, unitunicati, pedicellati, apparatu apicali praediti. Ascosporae biseriatae, hyalinae, obclavatae, 1-septatae, apiosporae.

Typus generis. – *Palmomyces montaneus* K. D. Hyde, J. Fröhl. & J. E. Taylor.

Etymology. – In reference to the palm loving habit of this genus.

Associated with palm leaf spots. – Ascomata immersed, subglobose, solitary, with a eccentric periphysate ostiole. – Peridium comprising several layers of angular, brown-walled cells. – Paraphyses hypha-like, numerous, septate, hyaline, tapering distally. – Asci 8-spored, cylindric-clavate, pedicellate, apically rounded, with a J-, subapical ring. – Ascospores biseriatae, hyaline, obclavate, 1-septate, apiosporous.

Anamorph. – Unknown.

Type species. – *Palmomyces montaneus* K. D. Hyde, J. Fröhl. & J. E. Taylor.

Habitat. – Associated with leaf spots on palms.

Distribution. – Australia, known only from the type collection.

***Palmomyces montaneus*** K. D. Hyde, J. Fröhl. & J.E. Taylor, sp. nov. – Figs. 148–160.

Maculae ellipsoideae vel subcirculares, 13–18 × 7–10 µm, epiphylligenae, brunneae. Ascumata 160–250 µm diam, 65–220 µm alta, subglobose, immersa, solitaria. Asci 137–165 × 17.5–24 µm, 8-sporei, cylindracei-clavati, pedicellati, apparatus subapicali praediti. Ascosporeae 31–40 × 8.5–11.5 µm, biseriatae, hyalinae, obclavatae, 1-septatae, apiosporae, tunica gelatinosa praeditae.

**Etymology.** – From the Latin *montaneus*, pertaining to a mountain.

Leaf spots ellipsoidal or subcircular, 13–18 × 7–10 µm, epiphyllous, brown, with a small white necrotic centre, darker at the edges, with an orange halo of variable thickness (Fig. 148). – Ascumata immersed, 160–250 µm diam, 65–220 µm high, subglobose, solitary, with an eccentric periphysate ostiole (Figs. 149, 150). – Peridium 10–40 µm thick, comprising 5–7 layers of angular brown-walled cells (Fig. 151). – Paraphyses 2–4 µm diam, hypha-like, numerous, septate, hyaline, tapering distally (Fig. 152). – Asci 137–165 × 17.5–24 µm, 8-spored, cylindric-clavate, pedicellate, apically rounded, with a J-, subapical ring (Figs. 152–155). – Ascospores 31–40 × 8.5–11.5 µm, biseriatae, hyaline, obclavate, 1-septate, apiosporous, surrounded by a narrow irregular mucilaginous sheath, basal cell ca 1/5 the size of the larger cell (Figs. 156–160).

**Material examined.** – AUSTRALIA: north Queensland, Julaten, Mount Lewis, on living leaf of *Oraniopsis appendiculata*, July 1992, J. Fröhlich & C. Pearce (HKU(M)1485, holotype; isotype at BRIP).

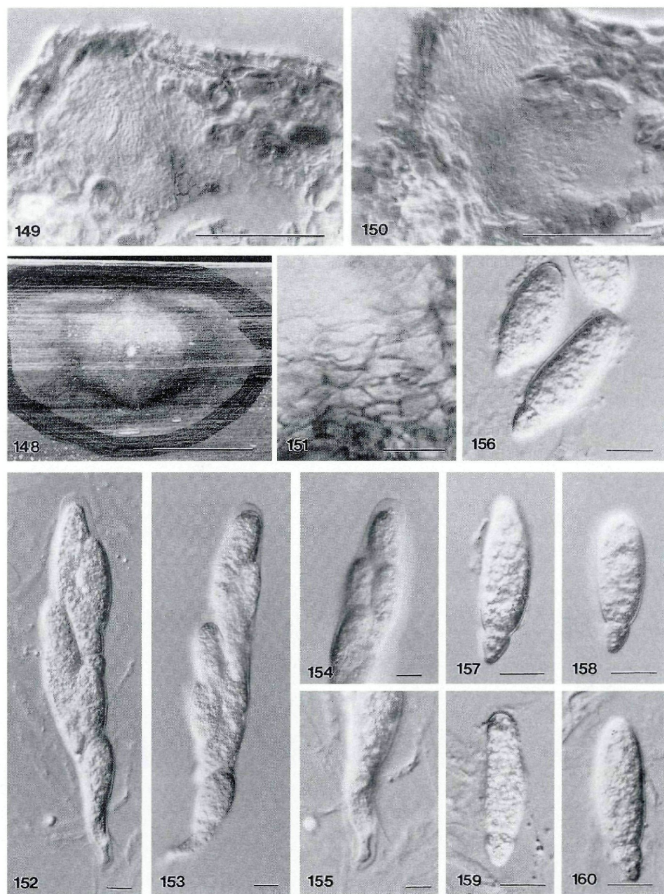
There are several differences between *Palmomyces* and *Pseudomassaria*. Although both have immersed ascumata, the ostiole is central and the peridium comprises flattened cells with dark brown walls in *Pseudomassaria*, while in *Palmomyces* the ostiole is eccentric and the peridium comprises pale brown angular cells. The asci also differ, being clavate-saccate with a distinct subapical ring in *Pseudomassaria* and cylindric-clavate, lacking a ring, in *Palmomyces*.

***Pseudomassaria*** Jacz., Bull. Herb. Boiss. 2: 663. 1894.

For synonyms and other details see Barr (1964).

Ascumata immersed, subglobose, solitary, with a central periphysate papilla. – Peridium comprising several layers of flattened cells with brown walls. – Paraphyses hypha-like, numerous, septate, embedded in a gelatinous matrix. – Asci 8-spored, clavate, short pedicellate, thickened at the apex, ring J- or J+. – Ascospores





Figs. 148–160. *Palmomyces montaneus* (from holotype). – 148. Leaf spot. – 149, 150. Sections of ascoma with eccentric neck. – 151. Peridium. – 152. Paraphyses and asci. – 153–155. Asci. 156–160. Ascospores. Bars: 148 = 1 mm, 149, 150 = 100  $\mu$ m, 151–160 = 10  $\mu$ m.

pores overlapping uniseriate, hyaline to pale yellowish, obclavate, broadly ellipsoidal or obovate, smooth-walled apically rounded, tapering towards the base, 1-septate in the lower third.

Anamorph. – Unknown.

Type species. – *Pseudomassaria chondrospora* (Ces.) Jacz.

Habitat. – Mostly on leaves.

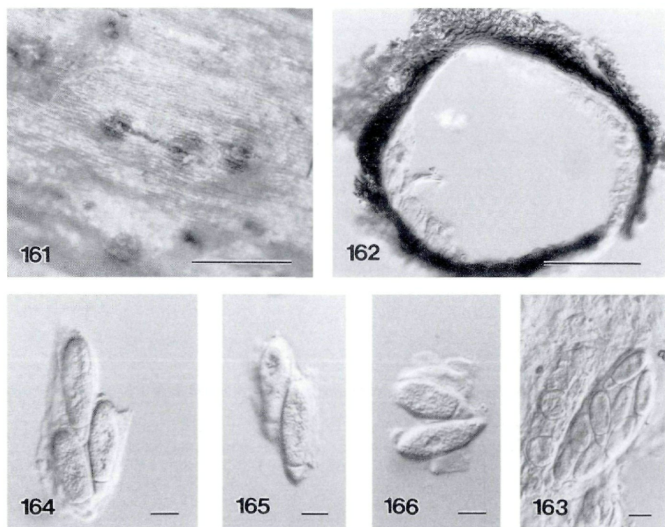
Distribution. – Cosmopolitan.

*Pseudomassaria* contains about 15 species (Barr, 1964) that differ from species of *Apioclypea* which possess ascomata which are usually immersed under a distinct clypeus. Paraphyses in *Apioclypea* are numerous, and the asci are long cylindrical in comparison to clavate in species of *Pseudomassaria*. Three species of *Pseudomassaria* from palms are described below.

***Pseudomassaria chondrospora*** (Ces.) Jacz., Bull. Herb. Boiss. 2: 663. 1894. – Figs. 161–166.

For synonyms see Barr (1964).

Ascomata immersed, visible as raised, slightly darkened areas on the host surface, solitary; in section 210–300  $\mu\text{m}$  diam, 150–300  $\mu\text{m}$  high, subglobose, with a central erumpent periphysate papilla



Figs. 161–166. *Pseudomassaria chondrospora* (from lectotype). – 161. Appearance on host surface. – 162. Section of ascoma. – 163. Asci. – 164–166. Ascospores. – Bars: 161 = 500  $\mu\text{m}$ , 162 = 100  $\mu\text{m}$ , 163–166 = 10  $\mu\text{m}$ .

(Figs. 161, 162). – *Peridium* 14–22  $\mu\text{m}$  wide, comprising several layers of flattened brown-walled cells (Fig. 162). – *Paraphyses* hypha-like, numerous, septate, embedded in a gelatinous matrix. – *Asci* 60–120  $\times$  16–31  $\mu\text{m}$ , 8-spored, clavate-saccate, short pedicellate, apically thickened, lacking a J+ ring (Fig. 163). – *Ascospores* 25–35  $\times$  10–12.5  $\mu\text{m}$ , overlapping uniseriate, hyaline to pale yellowish, obclavate, broadly ellipsoidal, or obovate, apically rounded, tapered towards the base, apiosporous, smooth-walled, basal cell ca 1/4 the size of the larger cell (Figs. 164–166).

**Material examined.** – GERMANY: Neckendorfer Thal, prope Islebiam, on twigs of *Tilia platyphylla*, May 1875, J. Kunze, Rabenh. Fungi Europ. 2038 (RO, lectotype designated here).

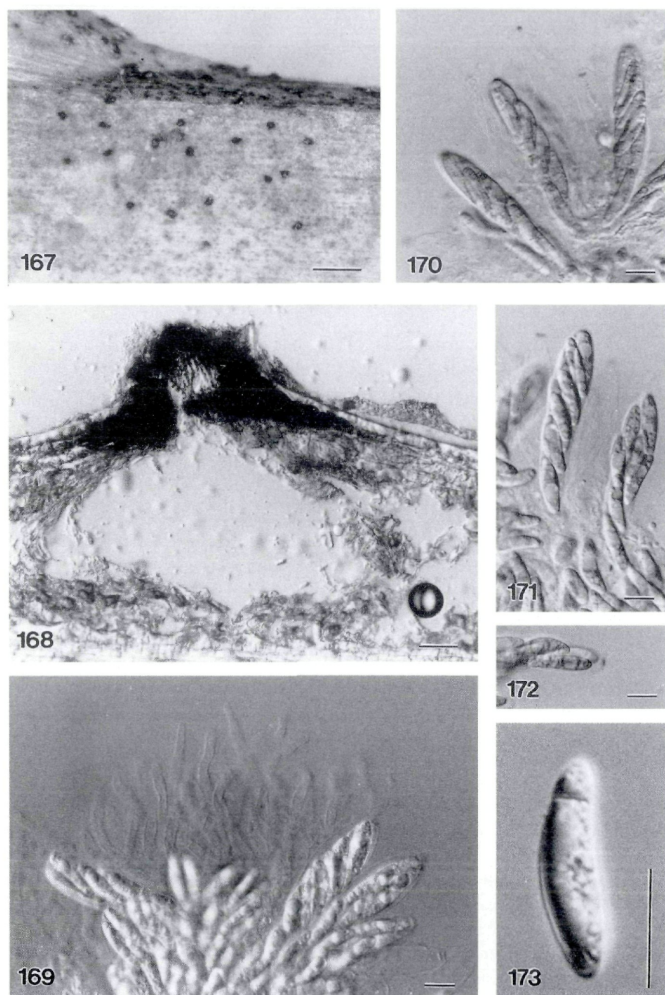
***Pseudomassaria huwerae*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov.  
– Figs. 167–173.

*Ascomata* sub clypeo immersa, 200–232  $\mu\text{m}$  diam, 140–210  $\mu\text{m}$  alta, subglobose, solitaria, periphysata, papillata. *Asci* 52–70(–100)  $\times$  11–13.5(–17.6)  $\mu\text{m}$ , 8-spore, clavati, pedicellati, apparatus apicali, J+, 3.4–4  $\mu\text{m}$  diam, 0.8–1.3  $\mu\text{m}$  alto praediti. *Ascosporeae* 21.5–28  $\times$  4.7–5.75  $\mu\text{m}$ , biseriatae, hyalinae, ellipsoideae, naviculares, apiosporae.

**Etymology.** – In recognition of Ruth Huwer, for the help she provided in German to English translations.

*Ascomata* immersed, visible as slightly raised, darkened dots, 137.5–225  $\mu\text{m}$  long, 105–180  $\mu\text{m}$  wide, forming within groups surrounded by a pale area of host tissue with a thin black border (Fig. 167); in section 200–232  $\mu\text{m}$  diam, 140–210  $\mu\text{m}$  high, subglobose, clypeate, with a central erumpent periphysate papilla (Fig. 168). – *Peridium* 3.8–5  $\mu\text{m}$  wide, comprising several layers of flattened pale brown walled cells (Fig. 168). – *Paraphyses* ca 3.6–5.6  $\mu\text{m}$  wide, hypha-like, septate, tapering to rounded tips (Fig. 169). – *Asci* 52–70(–100)  $\times$  11–13.5(–17.6)  $\mu\text{m}$  (mean = 63.2  $\times$  12.5  $\mu\text{m}$ , n = 25), 8-spored, clavate, pedicellate, apically rounded, with a J+, discoid apical ring, 3.4–4  $\mu\text{m}$  diam, 0.8–1.3  $\mu\text{m}$  high (Figs. 169–172). – *Ascospores* 21.5–28  $\times$  4.7–5.75  $\mu\text{m}$  (mean = 25  $\times$  5  $\mu\text{m}$ , n = 40), biseriata, hyaline, ellipsoidal, fusiform-ellipsoidal or navicular, smooth-walled, straight or slightly curved, apiosporous, often with an apical mucilage pad, larger cell 16.2–23  $\mu\text{m}$  long, basal cell 3.1–5.2(–7.6)  $\mu\text{m}$  long, ca 1/5 the size of the larger cell (Fig. 173).

**Material examined.** – AUSTRALIA: north Queensland, Palmerston, Palmerston National Park, on dead rachis of *Calamus australis*, Mar. 1994, J. Fröhlich, (HKU(M) JF322A, holotype; isotype at BRIP). Near Topaz, Bellenden Ker National Park, Mt. Bartle Frere walking track, on dead petiole of *C. australis*, Apr.



Figs. 167–173. *Pseudomassaria huwerae* (from holotype). – 167. Appearance on host surface. – 168. Section of ascoma with clypeus. – 169. Paraphyses and asci. – 170–172. Asci with J+ ring. – 173. Ascospore. – Bars: 167 = 500  $\mu\text{m}$ , 168 = 20  $\mu\text{m}$ , 169–173 = 10  $\mu\text{m}$ .

1995, J. Fröhlich (HKU(M) JF702). – HONG KONG: Hong Kong Island, Pok Fu Lam, Pok Fu Lam Country Park, Victoria Peak, on dead petiole of *Livistona chinensis*, July 1994, J. Fröhlich (HKU(M) JF416).

This species is similar to *P. occidentalis* M. E. Barr (1964), but differs as the ascospores are longer and hyaline rather than greenish to yellowish hyaline.

***Pseudomassaria mauritiae*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 174–180.

Ascomata sub clypeo immersa, 359–432  $\mu\text{m}$  diam, 205–283  $\mu\text{m}$  alta, subglobosa, gregaria, periphysata, papillata. Asci 103–135  $\times$  15–25  $\mu\text{m}$ , 8-spori, clavati, pedicellati, apparatus apicali J+, (3.8–)4.5–5  $\mu\text{m}$  diam, 1.25–1.5  $\mu\text{m}$  alto praediti. Ascospores 31–40.5  $\times$  8–12.5  $\mu\text{m}$ , biseriatae, hyalinae, fusiformes-ellipsoideae vel naviculares, apiosporae.

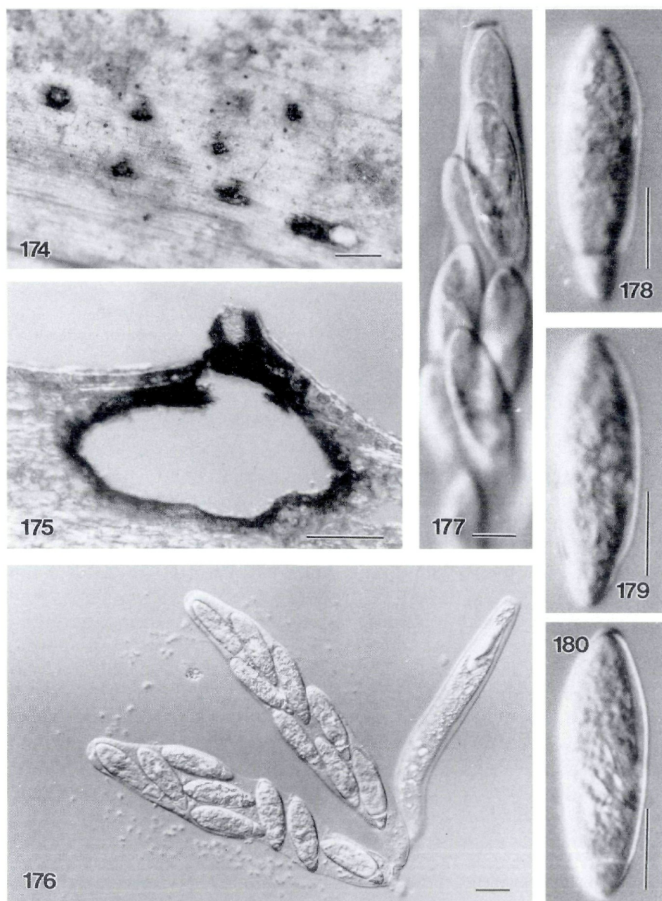
**Etymology.** – In reference to the occurrence of this fungus on *Mauritia*.

Ascomata immersed, visible as raised, dome-shaped areas, 175–250  $\mu\text{m}$  diam, forming within groups surrounded by a pale area of host tissue with a thin black border (Fig. 174); in section 359–432  $\mu\text{m}$  diam, 205–283  $\mu\text{m}$  high, subglobose, clypeate, with a central erumpent periphysate papilla (Fig. 175). – Peridium 2.4–6.4  $\mu\text{m}$  wide, comprising 3–5 layers of flattened dark brown walled cells. – Paraphyses 3.8–5.5  $\mu\text{m}$  wide, hypha-like, septate, not tapering. – Asci 103–135  $\times$  15–25  $\mu\text{m}$  (mean = 119.2  $\times$  20.3  $\mu\text{m}$ , n = 25), 8-spored, clavate, pedicellate, apically rounded, with a J+, discoid subapical ring, (3.8–)4.5–5  $\mu\text{m}$  diam, 1.25–1.5  $\mu\text{m}$  high (Figs. 176, 177). – Ascospores 31–40.5  $\times$  8–12.5  $\mu\text{m}$  (mean = 36.1  $\times$  9.8  $\mu\text{m}$ , n = 50), biseriatae, hyaline, fusiform-ellipsoidal or navicular, smooth-walled, straight or slightly curved, apiosporous, some spores with remnants of mucilage, larger cell 27.5–35  $\mu\text{m}$  long, basal cell 3.8–6.3  $\mu\text{m}$  long, ca 1/5–1/6 the size of the larger cell (Figs. 178–180).

Material examined. – ECUADOR: Oriente, Reserva de Producción Faunística Cuyabeno, Rio Cuyabeno, forest near Laguna Grande, Canangucho, Path A, on dead petiole of *Mauritia flexuosa*, Aug. 1993, J. Fröhlich & J.A.I. Chapman (HKU(M) JF139, holotype; isotype at QCA). *Ibid.*, (HKU(M) JF154).

***Pseudomassaria megalospora*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 181–190.

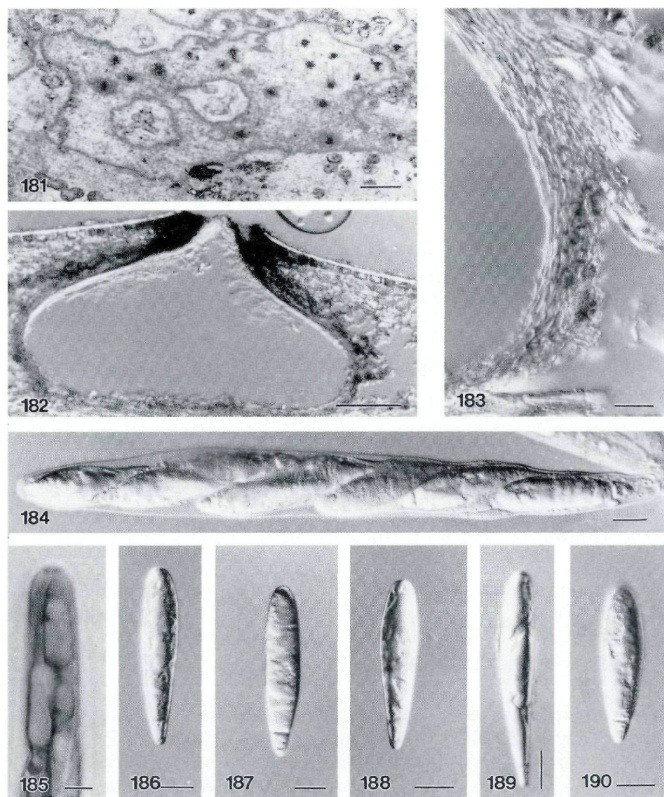
Ascomata sub clypeo immersa, 516–548  $\mu\text{m}$  diam, 306–342  $\mu\text{m}$  alta, subglobosa, gregaria, periphysata, papillata. Asci 152.5–202.5  $\times$  16–25  $\mu\text{m}$ , 8-spori, clavati, pedicellati, apparatus subapicali, J+, 4–5  $\mu\text{m}$  diam, 1.25–1.5  $\mu\text{m}$  alto praediti.



Figs. 174–180. *Pseudomassaria mauritiae* (from holotype). – 174. Appearance on host surface. – 175. Section of ascoma with clypeus. – 176, 177. Asci with J+ ring. – 178–180. Ascospores. – Bars: 174 = 500  $\mu\text{m}$ , 175 = 100  $\mu\text{m}$ , 176–180 = 10  $\mu\text{m}$ .

Ascospores (41.5–)45.5–63.5(–67.5)  $\times$  9–12  $\mu\text{m}$ , biseriatae, hyalinae, naviculares, apiosporae.

**Etymology.** – In reference to the large ascospores found in this species.



Figs. 181–190. *Pseudomassaria megalospora* (from holotype). – 181. Appearance on host surface. – 182. Section of ascoma with clypeus. – 183. Peridium. – 184, 185. Asci with J+ ring. – 186–190. Ascospores. – Bars: 181 = 1 mm, 182 = 100  $\mu$ m, 183–190 = 10  $\mu$ m.

Ascomata immersed, visible as pale, dome-shaped areas, 750–1125  $\mu$ m long, 475–825  $\mu$ m diam, forming within groups surrounded by a pale area of host tissue with a thin black border (Fig. 181); in section 516–548  $\mu$ m diam, 306–342  $\mu$ m high, subglobose, clypeate, with a central erumpent periphysate papilla (Fig. 182). – Peridium 8–25.5  $\mu$ m, comprising a thin, inner layer of thin-walled compressed, hyaline cells, and an outer region of pale to dark brown angular cells

(Fig. 183). – Paraphyses ca 5  $\mu\text{m}$  wide, hypha-like, septate, hyaline, tapering slightly. – Asci 152.5–202.5  $\times$  16–25  $\mu\text{m}$  (mean = 173.2  $\times$  19.7  $\mu\text{m}$ , n = 25), 8-spored, clavate, pedicellate, apically rounded, with a discoid, J+ subapical ring, 4–5  $\mu\text{m}$  diam, 1.25–1.5  $\mu\text{m}$  high (Figs. 184, 185). – Ascospores (41.5–)45.5–63.5(–67.5)  $\times$  9–12  $\mu\text{m}$  (mean = 50.8  $\times$  10.3  $\mu\text{m}$ , n = 50), biseriata, hyaline, navicular, smooth-walled, straight, apiosporous, larger cell 40–57.5  $\mu\text{m}$  long, basal cell (4–)4.5–9.5  $\mu\text{m}$  long, ca 1/7–1/8 the size of the larger cell (Figs. 186–190).

Material examined. – ECUADOR: Oriente, Reserva de Producción Faunística Cuyabeno, Rio Cuyabeno, forest near Laguna Grande, Canangucho, Path A, on dead petiole of *Mauritia flexuosa*, Aug. 1993, J. A. I. Chapman (HKU(M) JF147, holotype; isotype at QCA).

This species has longer ascospores than *A. mauritiae*, but is otherwise very similar.

### **Phyllachoraceae**

The Phyllachoraceae are a well circumscribed family of ascomycetes (Barr, 1990; Cannon, 1991) and will not be discussed further here. Apiosporous genera include *Apiosphaeria* and *Stigmochora*.

***Apiosphaeria*** Höhn., Sitz. K. Ak. Wiss. Wien, math.-nat. Kl., I. Abt., 118: 1218. 1909.

For synonyms see Müller & Arx (1962).

Ascomata subglobose to ellipsoidal, developing on upper surface of leaves, visible as black, shiny clypei, ostiolate. – Peridium hyaline, comprising several layers of flattened cells. – Paraphyses hypha-like, hyaline, septate. – Asci 8-spored, clavate, apically rounded with an apical apparatus. – Ascospores overlapping uniseriate or biseriata, apiosporous, hyaline, without mucilage or appendages. – Conidiomata between ascomata, roughly spherical or irregularly ellipsoidal, wall indistinguishable, immersed beneath a small clypeus. – Conidiogenous cells cylindrical, proliferating percurrently, hyaline, pycnidial (*sensu* Sutton 1980). – Conidia filiform, curved, hyaline, aseptate, smooth walled.

Anamorph. – *Oswaldina* Rangel.

Type species. – *Apiosphaeria guaranitica* (Speg.) Höhn.

Habitat. – On leaves.

Distribution. – South America.



*Apiosphaeria* is included in the Phyllachoraceae (Barr, 1990; Hawksworth & al., 1995). The ascomata develop on leaves and are immersed under a clypeus, the peridium is wide and hyaline, the asci are cylindrical with an apical apparatus, and the ascospores are hyaline. The anamorph *Oswaldina* is also characteristic of the Phyllachoraceae. *Apiosphaeria indica* is not typical of this genus and is transferred to *Apioclypea* in this paper.

***Apiosphaeria guaranitica*** (Speg.) Höhn., Sitz. K. Ak. Wiss. Wien. math-nat. Kl., 118: 1218. 1909. – Figs. 191–198.

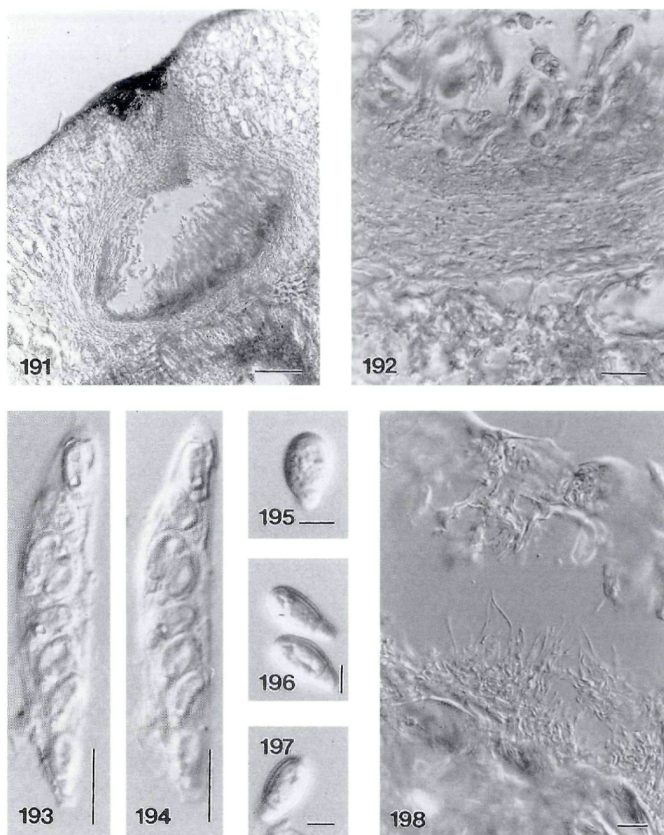
For synonyms see Dianese & al. (1994).

Ascomata immersed on upper surface of leaves, visible as numerous raised blackened shiny areas, 90–250  $\mu\text{m}$  diam, within a slightly raised orange-brown region, slightly darker than surrounding leaf tissue; in vertical section 520–910  $\mu\text{m}$  diam, 450–520  $\mu\text{m}$  high, in leaf mesophyll tissue, subglobose to ellipsoidal, ostiolate, clypeate, ostiole ca 200  $\mu\text{m}$  high, 120  $\mu\text{m}$  diam, central, periphysate (Fig. 191). – Clypeus ca 30  $\mu\text{m}$  thick, up to 250  $\mu\text{m}$  diam, comprising host cells and brown intracellular hyphae (Fig. 191). – Peridium up to 20  $\mu\text{m}$  wide, cream-coloured, membranous, comprising several layers of flattened cells, highly compressed at the base and fusing with the host tissue outwardly (Fig. 192). – Paraphyses hypha-like, hyaline, septate. – Asci 64–80  $\times$  12–14  $\mu\text{m}$ , 8-spored, clavate, apically rounded with a clear, hyaline, J-, subapical region, indicative of an apical ring (Figs. 193, 194). – Ascospores 12–14  $\times$  6–8  $\mu\text{m}$ , overlapping uniseriate or biseriate, apiosporous, hyaline, without mucilage or appendages, basal cell ca 1/4 the size of the larger cell (Figs. 195–197).

Conidiomata growing in leaf mesophyll in areas between ascomata, roughly spherical or irregularly ellipsoidal, 140–240  $\mu\text{m}$  high, 90–220  $\mu\text{m}$  diam, immersed beneath a small clypeus, peridium indistinguishable from the host surface. – Clypeus comprising host tissue and brown fungal hyphae (Fig. 198). – Ostiole epigenous, indistinct. – Conidiogenous cells cylindrical, proliferating percurrently, hyaline. – Conidia 16–23  $\times$  1–1.5  $\mu\text{m}$ , almost filiform, widest towards the base, tapering towards both ends, curved, hyaline, aseptate, smooth-walled (Fig. 198).

Material examined. – PARAGUAY: on living leaves of *Tabebuia* (as *Tecoma* sp.), (LPS, holotype of *Munkiella guaranitica* Speg.).

*Apiosphaeria* is a small genus with about 5 species. No species are presently known from palms.



Figs. 191–198. *Apiosphaeria guaranítica* (from holotype of *Munkiella guaranítica*). – 191. Section of ascus with clypeus. – 192. Peridium. – 193, 194. Asci with apical ring. – 195–197. Ascospores. – 198. *Oswaldina* anamorph with conidiophores and conidia. – Bars: 191 = 100  $\mu\text{m}$ , 192–198 = 10  $\mu\text{m}$ .

***Stigmochora*** Theiss. & Syd., Ann. Mycol. 12: 272. 1914.

Type species. – *Stigmochora controversa* (Starb.) Theiss. & H. Sydow.

*Stigmochora* belongs in the Phyllachoraceae and causes tar spots on leaves. No species have been recorded from palms. For a description of *Stigmochora controversa* refer to Cannon (1992).

## Valsaceae

The Valsaceae *sensu* Hawksworth & al. (1995) includes those genera arranged in the Gnomoniaceae by Barr (1990). For treatments of these families see Barr (1978, 1990). There are many genera with apiospores [e.g. *Anisogramma* Theiss. & Syd., *Apiognomonina* Höhn., *Apioplagiostoma* M. E. Barr, *Apioporthella* Petr., *Hypospilina* (Sacc.) Traverso, *Lambro* Racib., *Mamiania* Höhn., *Phylloporthe* Syd., *Stegophora* Syd. & P. Syd.]. No members of apiosporous Valsaceae have been described from palms.

## Xylariaceae

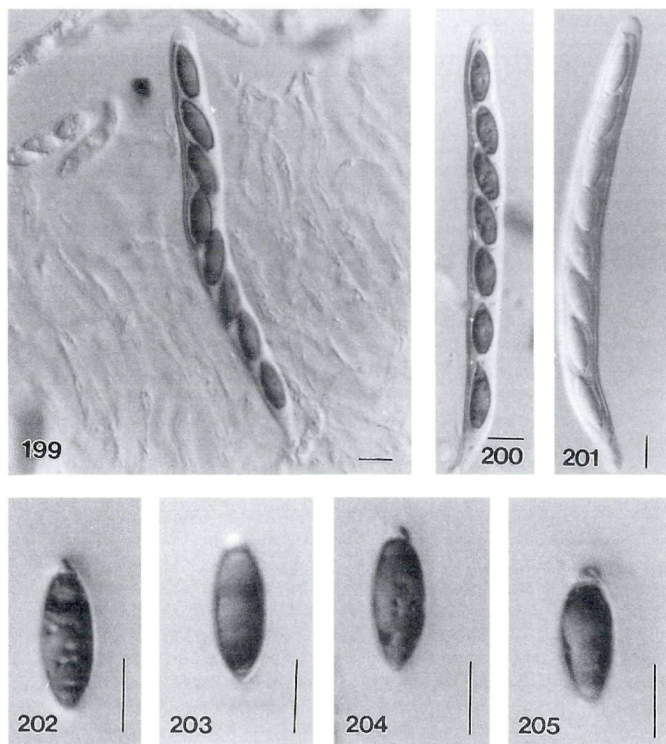
The Xylariaceae are a well circumscribed family (Barr, 1990; Læssøe, 1995) and need not be further discussed here. Several taxa with ascospores with a small hyaline "cell" were identified during this study and are placed in *Anthostomella*. The small hyaline "cell" is considered to be an important character of immature ascospores in the genus (Rappaz, 1995). However, we have examined numerous *Anthostomella* species and this character is not consistent. *Anthostomella* (*sensu* Francis, 1975; Rappaz, 1995; Hyde, 1996) is certainly heterogeneous and is in need of taxonomic review involving molecular studies.

***Anthostomella*** Sacc., Atti Accad. Sci. Veneto-Trentino-Istria 4: 84. 1975.

For recent accounts see Rappaz (1995) and Hyde (1996). In her review of *Anthostomella*, Francis (1975) included nineteen species with 'apiospores', but in all cases the hyaline cell is very small and termed a 'dwarf cell'. The dwarf cell is relatively small in comparison to the larger cell, it is often knob-like and/or cellular, and the ascospores are mostly asymmetrical, provided with a germ slit, and rarely have a wide spreading sheath. The asci in *Anthostomella* are also mostly broadly cylindrical and the subapical ring is wedge-shaped. Only a small number of *Anthostomella* species are likely to be confused with other apiosporous genera. *Anthostomella* species on palms are dealt with by Hyde (1996) who includes a single species, *A. belalongensis* K. D. Hyde, with a dwarf cell. Three new species with small hyaline basal "cells" are introduced.

***Anthostomella frondicola*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 199–205.

Ascomata sub clypeo immersa. Asci 125–150 × 10–12.5 µm, apparatus subapicali, J+, 4 µm diam, 3 µm alto, praediti. Ascospores 15–20 × 6–7.5 µm, apiosporae, tunica gelatinosa praeditae.



Figs. 199–205. *Anthostomella frondicola* (from holotype). – 199. Paraphyses and ascus. – 200, 201. Asci with apical ring. – 202–205. Ascospores with mucilaginous sheath. – Bars = 10  $\mu\text{m}$ .

**Etymology.** – In reference to the occurrence of the taxon on palm fronds.

Ascomata immersed, visible on the host surface as raised blister-like regions with minute blackened ostiolar dots; in vertical section 200–360  $\mu\text{m}$  diam, 200  $\mu\text{m}$  high, irregularly subglobose, minutely clypeate, papillate. – Peridium up to 30  $\mu\text{m}$  wide, comprising several layers of angular cells with light-brown walls. – Paraphyses up to 5  $\mu\text{m}$  wide, hypha-like, numerous, septate and embedded in a gelatinous matrix (Fig. 199). – Asci 125–150  $\times$  10–12.5  $\mu\text{m}$ , 8-spored, cylindrical, pedicellate, apically rounded, with a J+, wedge-

shaped subapical ring, 4  $\mu\text{m}$  diam, 3  $\mu\text{m}$  high (Figs. 200, 201). – Ascospores 15–20  $\times$  6–7.5  $\mu\text{m}$ , overlapping uniseriate, apiosporous, constricted between the cells and surrounded by a mucilaginous sheath, basal hyaline “dwarf” cell 1.5–2  $\mu\text{m}$  long, larger apical cell brown (Figs. 202–205).

Material examined. – AUSTRALIA: north Queensland, Bamaga, on unidentified palm, 12 Mar. 1991, K. D. Hyde 535 (HKU(M) 535 holotype; isotype at BRIP).

The “dwarf” cell in this species is larger than in *A. rattanicola* and the ascospores are also wider. It is most similar in shape to *A. licualicola* K. D. Hyde, but differs as this species lacks a small basal “dwarf cell” and has mucilaginous sheath which is drawn out at the ends to form caps (Hyde, 1996).

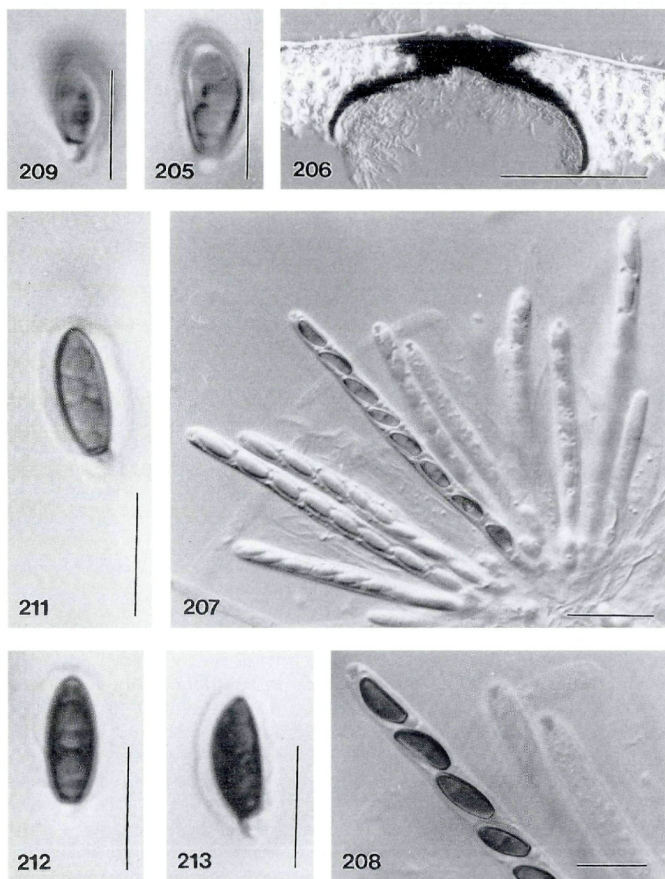
***Anthostomella oraniopsis*** K. D. Hyde, J. Fröhl. & J. E. Taylor, sp. nov. – Figs. 206–213.

Ascomata sub clypeo immersa. Asci 95–120  $\times$  5.6–8  $\mu\text{m}$ , apparatus subapicali, J+, 1.6  $\mu\text{m}$  diam, 2–2.4  $\mu\text{m}$  alto praediti. Ascosporae 19.2–24  $\times$  3.6–4.6  $\mu\text{m}$ , apiosporae, tunica gelatinosa praeditae.

**Etymology.** – In reference to the occurrence of the taxon on *Oraniopsis*.

Ascomata immersed, visible as blackened, unraised areas, up to 260  $\mu\text{m}$  diam, solitary or clustered, with a central barely protruding papilla; in vertical section globose to subglobose, up to 260  $\mu\text{m}$  diam, 130–185  $\mu\text{m}$  high, clypeate, ostiole periphysate (Fig. 206). – Clypeus up to 160  $\mu\text{m}$  diam, comprising host cells and fungal hyphae. – Peridium 8–20  $\mu\text{m}$  wide, comprising several layers of elongate brown walled cells. – Paraphyses up to 5  $\mu\text{m}$  at the base, hypha-like, tapering and septate (Fig. 207). – Asci 95–120  $\times$  5.6–8  $\mu\text{m}$ , 8-spored, cylindrical, thin-walled, apically rounded, with a J+, wedge-shaped subapical ring, 1.6  $\mu\text{m}$  diam, 2–2.4  $\mu\text{m}$  high (Figs. 207, 208). – Ascospores 19.2–24  $\times$  3.6–4.6  $\mu\text{m}$ , overlapping uniseriate, apiosporous, surrounded by a thin mucilaginous sheath which is irregular in outline; larger apical cell 16–20.8  $\mu\text{m}$  long, inequilateral, ellipsoidal, brown, with a germ slit along the entire length; basal cell 3.2–4  $\mu\text{m}$  long, hyaline (Figs. 209–213).

Material examined. – AUSTRALIA: north Queensland, Mt Lewis, on dead frond of *Oraniopsis appendiculata*, in rainforest litter, Aug. 1992, K. D. Hyde (HKU(M) 1553, holotype; isotype at BRIP); on dead frond of *Archontophoenix alexandrae*, Aug. 1992, K. D. Hyde (HKU(M) 1525).



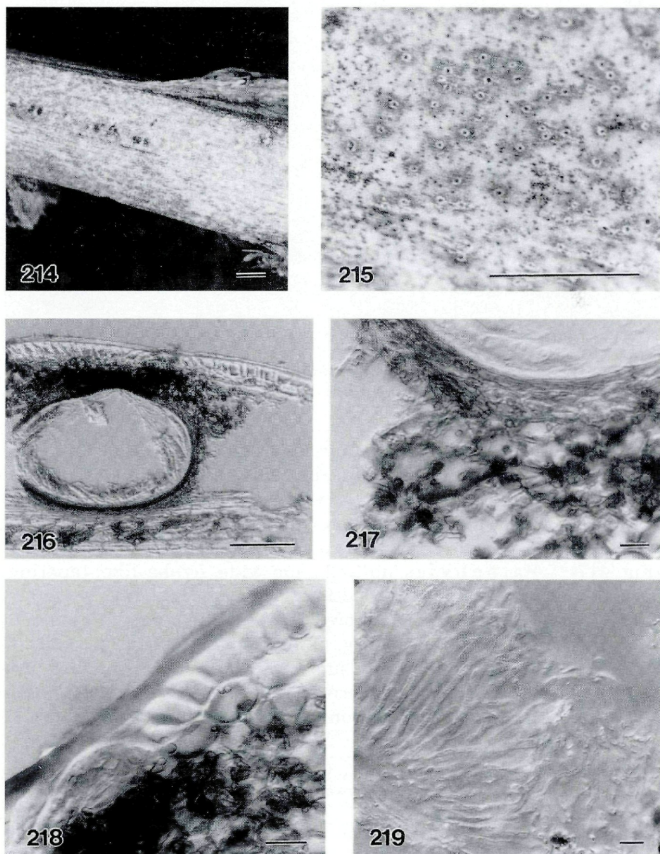
Figs. 206–213. *Anthostomella oraniopsis* (from holotype). – 206. Section of ascoma with clypeus. – 207, 208. Paraphyses and asci with apical ring. – 209–213. Ascospores with mucilaginous sheath. – Bars: 206 = 100  $\mu$ m, 207–213 = 10  $\mu$ m.

*Anthostomella oraniopsis* has ascospores with a distinct basal hyaline “cell” surrounded by a mucilaginous sheath. It is most similar to *A. frondicola*, but has inequilateral ascospores.

*Anthostomella phoenicis* (Dhaware) K. D. Hyde, J. Fröhl. & J. E. Taylor, comb. nov. – Figs. 214–227.

= *Entosordaria phoenicis* Dhaware, Botanique Nagpur 10: 19. 1979.

Ascomata immersed, visible on the host surface as minute blackened ostiolar dots, surrounded by white rings and a faintly



Figs. 214–219. *Anthostomella phoenicis* (from holotype). – 214, 215. Appearance on host surface. – 216. Section of ascoma with clypeus. – 217. Peridium. – 218. Section of clypeus. – 219. Paraphyses. – Bars: 214, 215 = 1 mm, 216 = 100  $\mu$ m, 217–219 = 10  $\mu$ m.



Figs. 220–227. *Anthostomella phoenicis* (from holotype). – 220–223. Asci with J+ apical ring. – 224–227. Ascospores with mucilaginous sheath. – Bars = 10  $\mu$ m.

blackened disc (Figs. 214, 215); in vertical section up to 280  $\mu$ m diam, 200  $\mu$ m high, subglobose, ostiolate, clypeate, with variable stromatal development (Figs. 216, 218). – Clypeus comprising brown fungal hyphae. – Peridium up to 20  $\mu$ m wide, composed of ca 6 layers of elongate brown-walled cells, *textura intricata* at the outside (Fig. 217). – Paraphyses up to 2.5  $\mu$ m wide, hypha-like, tapering, septate, numerous and embedded in a gelatinous matrix (Fig. 219). – Asci 100–110  $\times$  8–10  $\mu$ m, 8-spored, cylindrical, apically rounded, with a J-, discoid subapical ring, 5  $\mu$ m diam, 2  $\mu$ m high (Figs. 220–223). – Ascospores 13–16  $\times$  6  $\mu$ m, uniseriate or overlapping uniseriate, ovoid, apiosporous, surrounded by a thin mucilaginous sheath, hyaline basal cell 2  $\mu$ m long (Figs. 224–227).

Material examined. – INDIA: Osmanabad, Udgir, on rachis of *Phoenix sylvestris* Roxb., 6 Oct 1974, A.S. Dhaware AMH 4228 (IMI, holotype designated here).

This species also has a distinct small hyaline basal “cell”, but has smaller ascospores than other species. Signs of germ slit were evident, but since it is rehydrated dried material this may be an artifact.

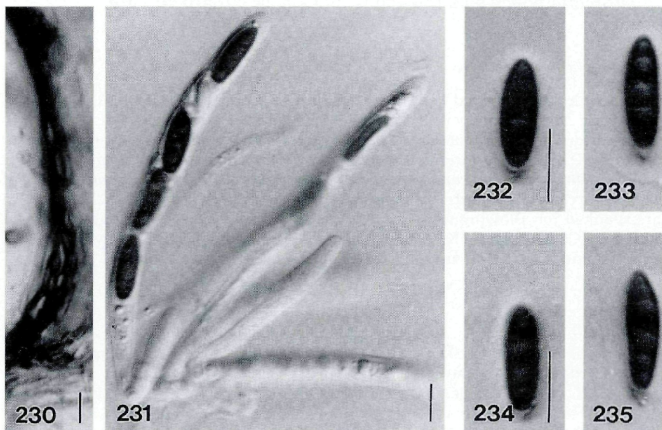
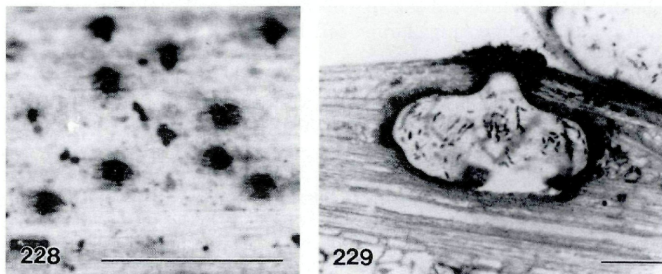


***Anthostomella rattanica*** K. D. Hyde, J. Fröhl. & J.E. Taylor, sp. nov. – Figs. 228–235.

Ascomata sub clypeo immersa, subglobosa. Asci 112–125 × 7.5–10 µm, apparatus subapicali, J-, 2.5 µm diam, 0.8 µm alti praediti. Ascospores 15–17.5 × 4.5–5.5 µm, apiosporae, tunica gelatinosa praeditae.

**Etymology.** – In reference to the occurrence on this taxon on rattan.

Ascomata immersed, visible on the host surface as raised, blackened, conical regions, with a central blackened, barely erum-



Figs. 228–235. *Anthostomella rattanica* (from holotype). – 228. Appearance on host surface. – 229. Section of ascoma with clypeus. – 230. Peridium. – 231. Asci with apical ring. – 232–235. Ascospores. – Bars: 228 = 1 mm, 229 = 100 µm, 230–235 = 10 µm.

pent ostiolar dot, solitary or gregarious (Fig. 228); in vertical section 300  $\mu\text{m}$  diam, 200  $\mu\text{m}$  high, subglobose, clypeate (Fig. 229). – Clypeus a small disc around the neck comprising host cells and intracellular fungal hyphae. – Peridium up to 14  $\mu\text{m}$  wide, comprising a few layers of brown-walled angular cells, fusing with host tissue outwardly (Fig. 230). – Paraphyses up to 2.5  $\mu\text{m}$  wide, hypha-like, septate, numerous, embedded in a gelatinous matrix. – Asci 112–125  $\times$  7.5–10  $\mu\text{m}$ , 8-spored, cylindrical, pedicellate, apically rounded, with a J-, discoid subapical ring, 2.5  $\mu\text{m}$  diam, 0.8  $\mu\text{m}$  high (Fig. 231). – Ascospores 15–17.5  $\times$  4.5–5.5  $\mu\text{m}$ , overlapping uniseriate, apiosporous, ascospore wall verruculose, surrounded by a mucilaginous sheath, basal cell ca 1/8 the size of the larger cell, light-brown, conical, often disappearing; larger cell brown, with a spiral germ slit (Figs. 232–235).

Material examined. – BRUNEI: Kampong Belalong, rachis of *Daemonorops* sp. July 1993, K. D. Hyde B89 (HKU(M) 1789, holotype).

The small cell in this species is very small and almost reminiscent of the 'apical' cell in *Anthostomella tomicoides* (Francis, 1975). The ascospores are most similar in shape to those of *A. hemileuca* Speg., but differ as it has a different type of mucilaginous sheath and shorter ascospores (Hyde, 1996). This taxon is unusual amongst *Anthostomella* species as the ascus lacks a J+ subapical ring.

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