

## Fungi from palms. XXVII<sup>1</sup> *Capsulospora* gen. nov., with three new species

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*Capsulospora* gen. nov. is introduced to accommodate amphisphaeriaceous taxa on palms with unicellular, hyaline, ellipsoidal to ellipsoidal-fusiform ascospores, some with a germ slit at maturity, becoming brown with age and surrounded by a layered mucilaginous sheath; asci with a discoid, J+, subapical ring; and ascomata which are immersed under a clypeus. *Capsulospora frondicola* is designated the type species and two other new species are described. The taxa are illustrated with interference light micrographs and compared with other related genera.

Keywords: Amphisphaeriaceae, *Capsulospora*, Palmae.

Genera within the Xylariales with common representatives on palms include *Anthostomella* Sacc., *Apioclypea* K. D. Hyde, *Fasciatispora* K. D. Hyde, *Nipicola* K. D. Hyde and *Oxydothis* Syd. & P. Syd. (Hyde, 1992, 1994, 1995a, 1995b; Hyde & al., 1995). One group of fungi that I have frequently collected on rachides and stems of palms has unicellular ascospores with a layered mucilaginous sheath; they are hyaline, although a very small number of the ascospores within the ascomata become brown, some with a germ slit at maturity. The unitunicate asci are provided with a subapical, J+, discoid ring. This group of collections represents a new genus in the Xylariales. The ascomata are immersed under a clypeus and the new genus is probably best referred to the Amphisphaeriaceae. Few amphisphaeriaceous taxa have hyaline unicellular ascospores, and these are found in the genera *Ceriospora* Niessl., *Clypeophysalospora* Swart, *Iodosphaeria* Samuels, E. Müll. & O. Petrini, *Urosporella* G. Atk. and *Xylochora* Arx & E. Müll. Ascospore sheaths are only found in *Iodosphaeria*. In this genus, however, the ascomata are superficial and the peridium is composed of large pseudoparenchymatous cells (Samuels & al, 1987).

<sup>1</sup> XXVI in *Nova Hedwigia* 62.

## Taxonomy

### *Capsulospora* K. D. Hyde, gen. nov.

Ascomata sub clypeo immersa, ellipsoidea vel subglobosa, ostiolata, solitaria vel gregaria, paraphysaticum. Asci 8-spori, cylindracei vel cylindraceo-clavati, pedicellati, unitunicati, apparatu apicali iodo coerulescenti praediti. Ascosporae 1-3 seriatas, late fusiformes vel ellipsoideae-fusiformes, unicellulares, hyalinae, brunneae, tunica gelatinosae praeditae.

Typus generis: *Capsulospora frondicola* K. D. Hyde.

**Etymology.** – in reference to the mucilaginous capsule surrounding the ascospores.

**Ascomata** visible as slightly raised darkened discs or minute black dots on the host surface; in section ellipsoidal or subglobose, immersed, clypeate, ostiolate, solitary or gregarious. – **Peridium** hyaline or brown, comprising several layers of compressed fungal cells. – **Ascomata** surrounded by a small variable amount of stromatal tissue comprising host cells filled with thin-walled, brown, angular, fungal cells. – **Paraphyses** hypha-like, filamentous, irregular, composed of large basal ovoid cells, becoming narrower distally, septate and embedded in a gelatinous matrix. – **Asci** 8-spored, cylindrical or cylindro-clavate, pedicellate, thin-walled, unitunicate, apically rounded, with a discoid, J<sub>+</sub>, subapical ring. – **Ascospores** overlapping uniseriate, or 2-3 seriate, broad-fusiform or ellipsoidal-fusiform, one-celled, hyaline, rarely brown at maturity, some with a germ slit, surrounded by a layered mucilaginous sheath.

**Type species.** – *Capsulospora frondicola* K. D. Hyde.

The new genus *Capsulospora* has affinities with *Anthostomella* Sacc., because the ascomata are immersed under a clypeus, the asci contains a subapical J<sub>+</sub> ring and the ascospores are brown at maturity with a germ slit. However, in *Anthostomella* the ascospores are brown much earlier in their development and in most cases the asci are broadly cylindrical (Hyde, 1995b). The ascospores of *Anthostomella* are also unequally two-celled at the beginning of their formation according to Rappaz (1995). The asci in *Capsulospora* are either cylindro-clavate or narrowly cylindrical and are unlike those in *Anthostomella*. It is also rare to observe mature brown ascospores in the former genus. Most of the ascospores in any ascoma are usually hyaline and they are never unequally two-celled early in their

formation. I therefore prefer to introduce a new genus *Capsulospora*, to accommodate species with this set of features.

*Capsulospora* also has some affinities (e.g. clypeus, cylindrical asci, J+ ring, unicellular ascospores) with *Clypeosphaeria*, which is placed in the Clypeosphaeriaceae by Barr (1989), although I am unconvinced that *Clypeosphaeria* differs significantly from other genera in the Amphisphaeriaceae to warrant its own family. Unfortunately, the Amphisphaeriaceae presently embraces a rather heterogeneous group of genera, many of which seem distantly related to *Amphisphaeria* Ces. & De Not. (e.g. *Ceriospora*, *Iodosphaeria*), but which are clumped together on the basis of a J+ subapical ring and immersed ascomata. I therefore prefer to include *Capsulospora* in the Amphisphaeriaceae at this time. The results of molecular studies presently in progress may help us to clarify better its taxonomic position.

### Key to *Capsulospora* species (Tab. 1)

1. Ascospores less than 4.5  $\mu\text{m}$  wide ..... 2
1. Ascospores mostly wider than 4.5  $\mu\text{m}$  ..... 3
2. Ascospores surrounded by a sheath which is compact at the poles, spores uniseriate ..... 1. *C. brunneispora*
2. Ascospores surrounded by a clearly visible bilayered sheath, spores biseriate ..... 2. *C. calamicola*
3. Ascospores with a germ slit and rarely brown at maturity, asci cylindro-clavate ..... 3. *C. frondicola*
3. Ascospores without a germ slit and brown at maturity, asci cylindrical ..... 1. *C. brunneispora*

#### 1. *Capsulospora brunneispora* K. D. Hyde, sp. nov. – Figs. 1–15.

Ascomata 280–350  $\mu\text{m}$  diam, 210–280  $\mu\text{m}$  alta, sub clypeo immersa, subglobosa, ostiolata, solitaria vel gregaria, paraphysata. Asci 130–175  $\times$  6–7  $\mu\text{m}$ , 8-spori, cylindranei, pedicellati, unitunicati, apparatus apicali iodo coerulescenti, 2.5–3  $\mu\text{m}$   $\times$  0.5  $\mu\text{m}$  praediti. Ascosporae 12.5–15(–19)  $\times$  3–4(–6)  $\mu\text{m}$ , uniseriatae, fusiformes, unicellulares, hyalinae, brunneae, tunica gelatinosae praeditae.

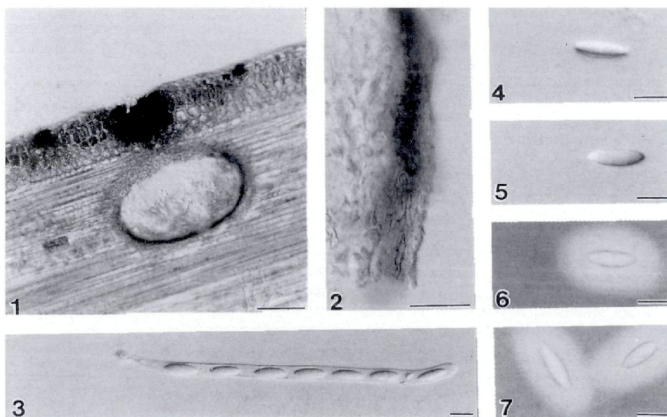
**Etymology.** – In reference to the browning of the spores with age.

**Holotypus.** – BRUNEI DARUSALAM: Temburong, Kuala Belalong, Field Studies Centre, on rachis of *Daemonorops* sp., Jul. 1993, K. D. Hyde (B24) 1724, BRIP 22756.

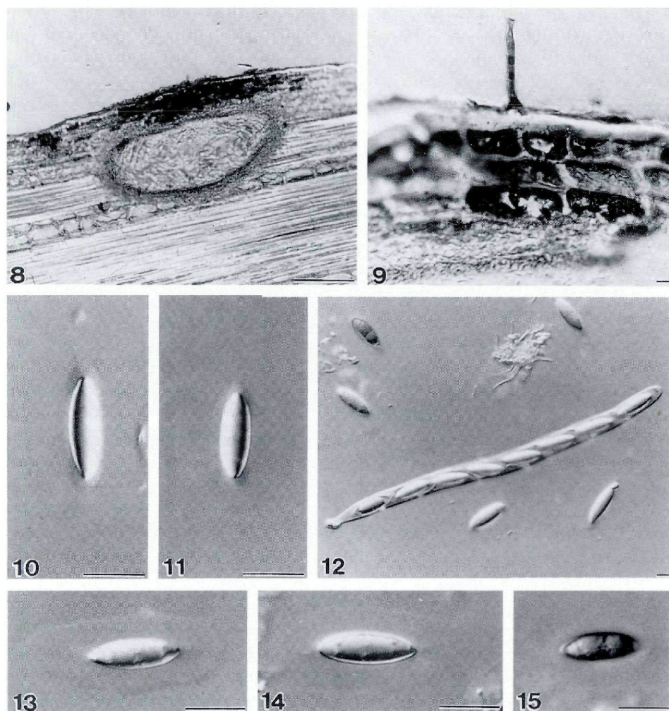
Tab. 1. – Synopsis of *Capsulospora* species.

	<i>C. brunneispora</i>	<i>C. calamicola</i>	<i>C. frondicola</i>
Ascomata	280–350 µm diam, 210–280 µm high	250–330 µm diam, 65–94 µm high	180–250 µm diam, 100–140 µm high
Asci	130–175 x 6–7 µm Cylindrical	80–110 x 10–16 µm Cylindrical to cylindro- clavate	86–104 x 12–14 µm Cylindro-clavate
Ascal ring size	2.5–3 x 0.5 µm	2.4–3 x 0.9–1.2 µm	2–2.5 x 1–1.5 µm
Ascospores	12.5–15 (–19) x 3–4 (–6) µm, fusiform	12–15.5 x 3.2–4.5 µm broad-fusiform	14–20 x 4.5–6 µm ellipsoidal-fusiform
Host(s)	<i>Calamus</i> , <i>Daemonorops</i> , <i>Eugissonia</i> , <i>Geonoma</i> , <i>Licuala</i> , <i>Oncosperma</i>	<i>Calamus</i>	<i>Licuala</i> , <i>Pinanga</i> , <i>Daemonorops</i>

Ascomata developing beneath slightly raised circular blackened areas, on the host surface, with a central raised erumpent papilla, or visible only as minute ostiolar dots surrounded by a whitish halo, scattered; in vertical section 280–350 µm diam, 210–280 µm high, subglobose, immersed beneath a clypeus, with a central ostiolar canal (Figs. 1, 8). – Clypeus up to 550 µm diam, comprising



Figs. 1–7. – *Capsulospora brunneispora* (holotype). – 1. Section of ascoma. – 2. Peridium. – 3. Cylindrical ascus. – 4–7. Ascospores. Note the sheath in India Ink (6, 7). – Bars: 1 = 100 µm, 2–7 = 10 µm.



Figs. 8–15. – *Capsulospora brunneispora* (BRIP 22718). – 8. Section of ascoma. Note the clypeus. – 9. Clypeus. – 10–15. Ascus and ascospores. Note the ascospore sheath (10–14) and ascospore which has become brown (12, 15). – Bars: 8 = 100  $\mu$ m, 9–15 = 10  $\mu$ m.

host cells filled with black fungal hyphae (Fig. 9). – Peridium 10–12 mm wide, comprising several layers of compressed angular cells with light brown walls (Fig. 2). – Ascii and paraphyses forming from the lower sides and base of the ascoma (Fig. 1). – Paraphyses up to 5  $\mu$ m diam, hypha-like, filamentous, irregular, septate, hyaline and embedded in a gelatinous matrix. – Ascii 130–175  $\times$  6–7  $\mu$ m, 8-spored, long cylindrical, pedicellate, thin-walled, unitunicate, apically rounded with a J+, discoid, subapical ring, 2.5–3  $\mu$ m diam, 0.5  $\mu$ m high (Figs. 3, 12). – Ascospores 12.5–15(–19)  $\times$  3–4(–6)  $\mu$ m, uniseriate, fusiform, unicellular, hyaline when immature, mature



specimens becoming brown (germ slit not observed), surrounded by a mucilaginous sheath which is compact at the ends (Figs. 4–7, 10–15).

**Known hosts.** – *Calamus*, *Daemonorops*, *Eugissonia*, *Geonoma*, *Licuala*, *Oncosperma*.

**Known distribution.** – Brunei Darussalam, Ecuador, Malaysia.

**Other material examined.** – BRUNEI DARUSALAM: Temburong, Kuala Belalong, Field Studies Centre, on rachis of *Oncosperma horridum*, Jul. 1993, K. D. Hyde (B39) 1739, BRIP 22754. Nov. 1992, K. D. Hyde BP8b, BRIP 22761. – Bandar Seri Begawan, Jalan Akar, rainforest, on rachides of *Calamus* sp., 16 Nov. 1992, K. D. Hyde (B1) 1844, BRIP 22659. – ECUADOR: Cuyabeno, in rainforest on stem of *Geonoma* sp., Aug. 1993, K. D. Hyde E76, BRIP 22719. – MALAYSIA: Negiri Sembilan, Pasoh Forest Reserve, on rachis of *Licuala* sp., Nov. 1992, K. D. Hyde ML 28, BRIP 22660. On *Daemonorops* sp., Nov. 1992, K. D. Hyde (ML 38) 1636, BRIP 22755. On rachis of *Eugissonia* sp., Nov. 1992, K. D. Hyde ML13, BRIP 22718.

In specimen ML13 ascospores were 14–19  $\times$  4.5–6  $\mu$ m, but it was otherwise identical and is therefore considered conspecific with *C. brunneispora*.

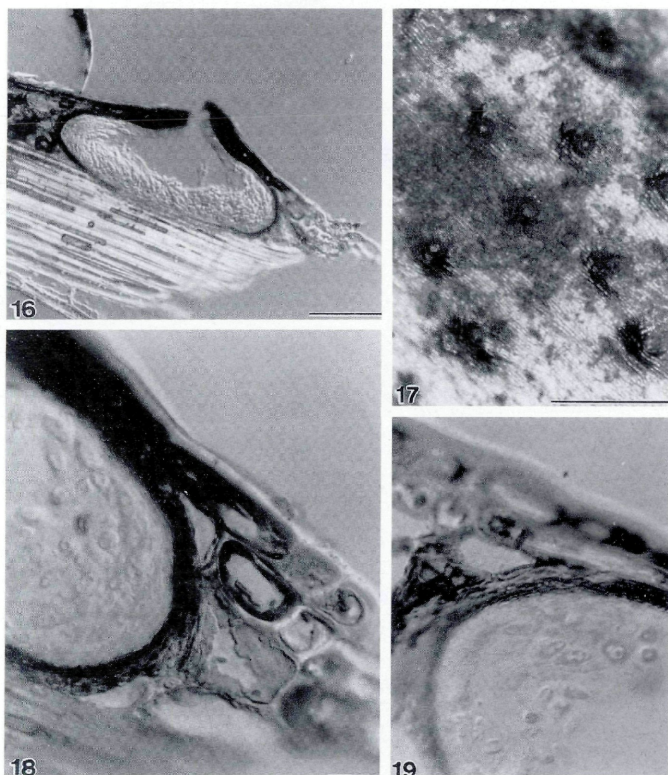
## 2. *Capsulospora calamicola* K. D. Hyde, sp. nov. – Figs. 16–28.

Ascomata 250–330  $\mu$ m diam, 65–94  $\mu$ m alta, sub clypeo immersa, lenticularia vel cylindracea, ostiolata, solitaria vel gregaria, paraphysata. Asci 80–110  $\times$  10–16  $\mu$ m, 8-spori, cylindraceo-clavati, pedicellati, unitunicati, apparatus apicali iodo coerulescenti, 2.4–3  $\mu$ m  $\times$  0.9–1.2  $\mu$ m praediti. Ascosporae 12–15.5  $\mu$ m  $\times$  3.2–4.5  $\mu$ m, 1–2-seriatae, late fusiformes, unicellulares, hyalinae, tunica gelatinosa praeditae.

**E t y m o l o g y.** – In reference to the host.

**H o l o t y p u s.** – INDONESIA: Java, Cibodas National Park, on dead rachis of *Calamus* sp., Mar. 1992, K. D. Hyde 1134a, BRIP 22712.

Ascomata developing beneath slightly raised, globose, blackened areas up to 400  $\mu$ m diam, solitary or coalescing in groups of up to 5, each with a central raised erumpent papilla (Fig. 17); in vertical section 250–330 diam, 65–94  $\mu$ m high, lenticular or cylindrical, immersed beneath a clypeus, with a central erumpent ostiole (Fig. 16). – Clypeus up to 400  $\mu$ m diam, comprising epidermal cells filled with black fungal hyphae (Fig. 18). – Stromatal development variable in the wedge-shaped areas at the periphery of the ascoma (Fig. 18). – Peridium up to 10  $\mu$ m wide, composed of several layers of compressed cells with dark brown walls, fusing above with the clypeus (Figs. 18, 19). Basal walls thin, cells less compressed, and fusing with the host tissue below



Figs. 16-19. - *Capsulospora calamicola* (holotype). - 16. Section of ascus. Note the clypeus. - 17. Appearance of ascomata on host surface with erumpent papilla. - 18. Clypeal tissue. - 19. Peridium. - Bars: 17 = 1  $\mu$ m, 16 = 100  $\mu$ m, 18, 19 = 10  $\mu$ m.

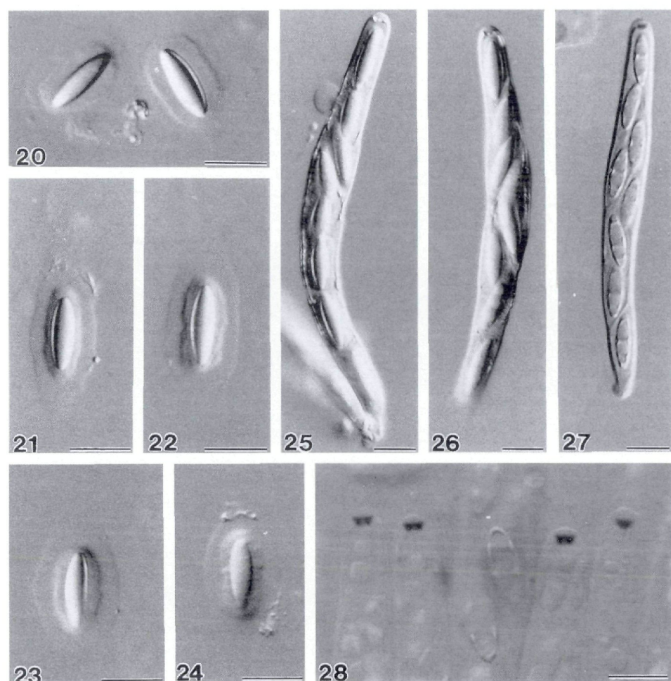
(Fig. 16). - Ascii and paraphyses forming from the base and lower sides of the ascomata (Fig. 16). - Paraphyses up to 4  $\mu$ m diam, hypha-like, filamentous, irregular, septate, hyaline and embedded in a gelatinous matrix. - Ascii 80-110 x 10-16  $\mu$ m, 8-spored, cylindro-clavate, short pedicellate, thin-walled, unitunicate, apically rounded with a discoid, J+, subapical ring, 2.4-3  $\mu$ m diam, 0.9-1.2  $\mu$ m high (Figs. 25-27). - Ascospores 12-15.5  $\mu$ m x 3.2-4.5  $\mu$ m, 1-2-seriate,

broadly fusiform, hyaline, unicellular, lacking a germ slit and surrounded by a hyaline two-layered mucilaginous sheath (Figs. 20–24).

Known host. – *Calamus*.

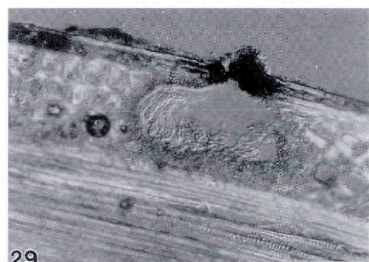
Known distribution. – Indonesia (Java).

Other material examined. – INDONESIA: Java, Cibodas National Park, on dead rachis of *Calamus* sp., Mar. 1992, K. D. Hyde 1125a, BRIP 22713.



Figs. 20–28. – *Capsulospora calamicola* (holotype). – 20–24. Ascospores. Note the bilayered mucilaginous sheath. – 25–28. Cylindro-clavate asci with J+ subapical ring (27, 28). – Bars: 20–28 = 10  $\mu$ m.

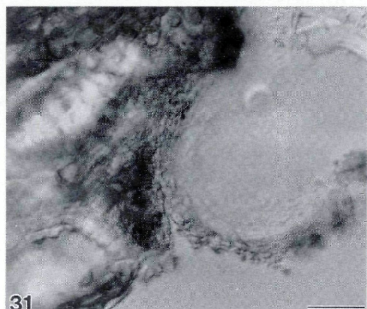




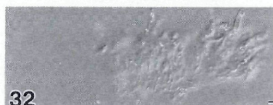
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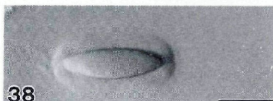
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Figs. 29–38. – *Capsulospora frondicola* (holotype). – 29. Section of ascoma. Note the clypeus. – 30. Neck and clypeus. – 31. Peridium. – 32. Paraphyses. – 33–34. Asci with J+ subapical ring. – 35–39 Ascospores with mucilaginous sheath. – Bars: 29 = 100  $\mu$ m, 30–38 = 10  $\mu$ m.

### 3. *Capsulospora frondicola* K. D. Hyde, sp. nov. – Figs. 29–38.

Ascomata 180–250  $\mu\text{m}$  diam, 100–140  $\mu\text{m}$  alta, sub clypeo immersa, ellipsoidea vel subglobosa, ostiolata, solitaria vel gregaria, paraphysata. Asci 86–104  $\times$  12–14  $\mu\text{m}$ , 8-spori, cylindraceo-clavati, pedicellati, unitunicati, apparatu apicali iodo coerulescenti 2–2.5  $\mu\text{m}$   $\times$  1–1.5  $\mu\text{m}$  praediti. Ascosporae 14–20  $\times$  4.5–6  $\mu\text{m}$ , 2–3 seriatæ, ellipsoideae-fusiformes, unicellulares, hyalinae, brunneae, tunica gelatinosa praeditae.

**E t y m o l o g y .** – From *frondicola* meaning dwelling on leaves.

**H o l o t y p u s .** – MALAYSIA: Pasoh Forest Reserve, on rachis of *Daemonorops* sp., Nov. 1992, K. D. Hyde (ML40) 1638, BRIP 22714.

**A s c o m a t a** visible as minute black dots on the host surface, immersed; in section 180–250  $\mu\text{m}$  diam, 100–140  $\mu\text{m}$  high, ellipsoidal or subglobose, clypeate, ostiolate, solitary or gregarious (Fig. 29). – **Clypeus** small, 160  $\mu\text{m}$  diam, centre black, outwardly brown, comprising host cells blackened by fungal hyphae (Fig. 29). – **Peridium** up to 14  $\mu\text{m}$  wide, hyaline, comprising several layers of compressed fungal cells, outwardly granular and fusing with the host tissue (Fig. 31). – **Papilla** short, occasionally protruding slightly above the host surface, surrounded by the blackened clypeus, periphyses not seen (Fig. 30). – **A s c o m a t a** surrounded by a small variable amount of stomatal tissue comprising host cells filled with thin-walled, brown, angular, fungal cells (Fig. 31). – **P a r a p h y s e s** up to 8  $\mu\text{m}$  wide, hypha-like, filamentous, composed of large basal ovoid cells, becoming narrower distally, septate and embedded in a gelatinous matrix (Fig. 32). – **A s c i** 86–104  $\times$  12–14  $\mu\text{m}$ , 8-spored, cylindro-clavate, pedicellate, thin-walled, unitunicate, apically rounded, with a discoid, J+, subapical ring, 2–2.5  $\mu\text{m}$  diam, 1–1.5  $\mu\text{m}$  high (Figs. 33, 34). – **A s c o s p o r e s** 14–20  $\times$  4.5–6  $\mu\text{m}$ , 2–3 seriate, ellipsoidal-fusiform, one-celled, hyaline, surrounded by a layered mucilaginous sheath which is narrower at the ends, rarely with a single brown mature spore with a full length germ slit in an ascus (Figs. 35–38).

**K n o w n h o s t s .** – *Daemonorops*, *Licuala*, *Pinanga*.

**K n o w n d i s t r i b u t i o n .** – Brunei Darussalam, Indonesia (Irian Jaya), Malaysia.

**O t h e r m a t e r i a l e x a m i n e d .** – BRUNEI DARUSSALAM: Temburong, Kuala Belalong, Field Studies Centre, on rachis of *Licuala* sp., June 1993, K. D. Hyde (B19) 1718, BRIP 22715. – MALAYSIA: Pasoh Forest Reserve, on rachis of *Pinanga* sp., Nov. 1992, K. D. Hyde (ML 20) 1953, BRIP 22716. – INDONESIA:

Irian Jaya, Manokwari, in freshwater swamp, on petiole of undetermined palm, Mar. 1992, K. D. Hyde & N. Raga, KDH 1216c, BRIP 22717.

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