Torrentispora fibrosa gen. sp. nov. (Annulatascaceae) from freshwater habitats

INTRODUCTION

In a continuing study of freshwater fungi in the tropics (Hyde 1992, Ho, Hyde & Hodgkiss 1997, Goh, Hyde & Ho 1998, Wong, Hyde & Jones 1999a), an Annulatascaceae-like taxon was commonly collected which could not be accommodated in any existing genus of the Annulatascaceae (Wong, Hyde & Jones 1998, 1999a, Wong & Hyde 1999). It was similar to Annulatascus velatisporus, in having immersed beaked ascomata with dark walls, wide tapering paraphyses, long cylindrical asci with relatively massive refractive apical rings, and hyaline unicellular ascospores with a fibrillar sheath. Illustrations from light and scanning electron microscopy are provided. It is compared with species in the genus Annulatascus, from which it differs in ascoma peridium and ascospore sheath morphology, and with other aquatic ascomycetes possessing ascospores with a similar fibrillar sheath structure.

MATERIALS AND METHODS

Submerged wood collected from various streams in Hong Kong was returned to the laboratory, incubated in plastic boxes lined with damp tissue paper and examined periodically for the presence of ascomata. Squash mounts of ascomata were prepared in water and all measurements are from specimens mounted thus. Scanning electron micrographs were made according to Ho, Hyde and Hodgkiss (1999a).

TAXONOMY


Etym.: from the Latin *torrens* meaning torrent, in relation to the habitat.

Ascomata globose ad subglobosa, immersa ad superficialia, nigra, coriacea, papillata, ostiolata, paraphysata et solitaria. Collum longum et nigrum. Asci 8-spori, longe cylindrici, uniseriati, ovalis ad fusiformes, unicellularae, hyalinae, tunica fibrillae praeditae.


Ascomata globose or subglobose, immersed to superficial, black, coriaceous, papillate, ostiolate, paraphysate and solitary. Neck long and black. Peridium in section composed of an outer layer of dark-brown, angular cells, and an inner layer of hyaline, compressed cells; in surface view comprising black, thick-walled cylindrical cells, arranged in irregular rows. Paraphyses wide, septate and tapering distally. Asci 8-spored, long-cylindrical, uniseriate, pedicellate, with a relatively massive refractive apical ring. Ascospores uniseriate, oval to fusiform, occasionally flattened on one side, unicellular, hyaline, surrounded by a narrow fibrillar sheath (observed with SEM).


Etym.: from the Latin *fibrosa* meaning fibrillar, in relation to the appearance of the ascospore sheath.
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Figs 1–14. Torrentispora fibrosa. Interference contrast micrographs. Fig. 1. Immersed ascoma with a long, black neck. Fig. 2. Superficial ascoma. Fig. 3. Section of peridium comprising an outer layer of black, thick-walled, angular cells, and an inner hyaline compressed cells. Fig. 4. Surface view of peridium. Note the arrangement of the black, thick-walled, cylindrical cells. Fig. 5. Wide, hyaline and septate paraphyses and young asci. Figs 6–8. Long cylindrical ascii with uniseriate ascospores. Note the relatively massive refractive apical rings. Figs 9–10. Higher magnification of apical rings. Figs 11–14. Hyaline and non-septate ascospores. Note that the sheath is indistinct, except when India Ink is added (Figs 12–13). Bars: 1–2 = 100 µm; 3–8, 11–14 = 10 µm; 9–10 = 5 µm.

Ascomata 135–255 µm diam, globosa ad subglobosa, immersa ad superficialia, nigra, coriacea, papillata, ostiolata, paraphysata et solitaria. Collum longum et nigrum. Asci 154–254 × 6–9 µm, 8-spori, longe cylindrici, pedicellati, apparatu apicale 2.5 µm longi, 4.5 µm diam praediti. Ascospore 13.5–19.5 × 5–7 µm, uniseriatae, ovalis ad fusiformes, hyalinae, unicellulare, tunica fibrillae praeditae.


Ascomata 135–255 µm diam, globose to subglobose, immersed or superficial, black, coriaceous, papillate, ostiolate,
Bars residues (arrowed) on the polycarbonate membrane near to the ascospores. Fig. 16. Fibrillar material radiating from the ascospore wall. Bars = 1 µm.

Table 1. Comparison of some important characteristics in T. fibrosa and Annulatascus species.

<table>
<thead>
<tr>
<th></th>
<th>T. fibrosa</th>
<th>A. aquaticus</th>
<th>A. hongkongensis</th>
<th>A. bistrisporus</th>
<th>A. palmatensis</th>
<th>A. trisepatus</th>
<th>A. velatisporus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ascospore range (µm)</td>
<td>13.5–19.5 × 5–7</td>
<td>19–24 × 6–7</td>
<td>35–37.5 × 12.5–15</td>
<td>40–58 × 8–10</td>
<td>20–26 × 6–7</td>
<td>18–33 × 6–12</td>
<td>26–42 × 9–12</td>
</tr>
<tr>
<td>Verrucose wall ornamentation</td>
<td>Not seen</td>
<td>Sparse</td>
<td>Numerous</td>
<td>Numerous</td>
<td>Not resolved</td>
<td>Sparse</td>
<td>Numerous</td>
</tr>
<tr>
<td>Fine structure of sheath under SEM</td>
<td>Thick layer of exosporial fibrillar material without gel matrix</td>
<td>—</td>
<td>Thin network of exosporial fibrillar material, gel matrix dissolved</td>
<td>—</td>
<td>—</td>
<td>Gel matrix</td>
<td>Gel matrix</td>
</tr>
<tr>
<td>Fine structure of sheath under TEM</td>
<td>—</td>
<td>Exosporial fibrillar material embedded in a gel matrix</td>
<td>Exosporial fibrillar material embedded in a gel matrix</td>
<td>Sheath absent</td>
<td>—</td>
<td>Exosporial fibrillar material embedded in a gel matrix</td>
<td>Exosporial fibrillar material embedded in a gel matrix</td>
</tr>
<tr>
<td>Reference</td>
<td>This paper</td>
<td>Ho et al. (1999a)</td>
<td>Ho et al. (1999b)</td>
<td>Hyde (1995), Ho et al. (unpubl.)</td>
<td>Hyde, Goh &amp; Steinke (1998a)</td>
<td>Wong et al. (1999b)</td>
<td>Hyde (1992), Wong et al. (1999b)</td>
</tr>
</tbody>
</table>

— = Data not available.

solitary (Fig. 2). Neck long, black, periphysate (Fig. 1). Peridium to 21.5 µm wide, in vertical section composed of an outer layer of dark-brown, angular cells, heavily pigmented and amorphous at the periphery, and an inner layer of hyaline, compressed cells (Fig. 3); in surface view comprising black, thick-walled cylindrical cells, arranged in irregular rows (Fig. 4). Paraphyses to 5.5 µm wide, filamentous, numerous, septate, slightly constricted at the septa, and tapering distally (Fig. 5). Asci 154–254 × 6–9 µm (x = 184 × 8 µm, n = 25), 8-spored, long cylindrical, pedicellate, thin-walled, with a relatively massive refractive apical ring, ca 2.5 µm long and 4.5 µm wide (Figs 6–10). Ascospores 13.5–19.5 × 5–7 µm (x = 17 × 6 µm, n = 50), uniseriate, oval to fusiform, occasionally flattened on one side, hyaline, unicellular, thick-walled, surrounded by a narrow fibrillar sheath (visible in India Ink and with the SEM) (Figs 11–16).

Ecology: Saprobic on submerged wood in streams.
Distribution: Hong Kong.

Other material examined: Hong Kong: New Territories, Tai Po, Lam Tsuen River, on submerged decaying wood, 1 Oct. 1997, K. M. Tsui (HKU(M) 8093); ibid. (HKU(M) 8107); Tai Po Kau Forest Reserve, Tai Po Kau Forest Stream, on submerged decaying wood, 27 Jun. 1996, K. D. Hyde (HKU(M) 4534); ibid. (HKU(M) 4538); ibid. 21 Sep. 1996, W. H. Ho & K. M. Tsui (HKU(M) 4818); ibid. 20 Dec. 1996, W. H. Ho & S. Y. Ho (HKU(M) 5919); ibid. (HKU(M) 5932); ibid. 28 Jun. 1997, W. H. Ho (HKU(M) 6076); ibid. (HKU(M) 6084); ibid. (HKU(M) 6086); ibid. (HKU(M) 6089); ibid. (HKU(M) 6099); ibid. (HKU(M) 6101); ibid. (HKU(M) 6115); ibid. (HKU(M) 6118); ibid. 28 Sep. 1997, W. H. Ho (HKU(M) 6167); ibid. (HKU(M) 6178); Shing Mun Reservoir, on submerged wood, 14 Jan. 1998, K. M. Tsui (HKU(M) 8129); ibid. (HKU(M) 8197).
**SCANNING ELECTRON MICROSCOPY**

Mature ascospores of *Torrentispora fibrosa* are ellipsoidal and surrounded by a thin layer of fibrillar material (Fig. 15). It appears as a network of condensed fibrillar material which radiates outwards from the ascospore wall, mostly occurring on the surface of the ascospore adjacent to the polycarbonate membrane (Figs 15, 16). The fibrillar material probably aids in the attachment of ascospores to the substratum surface, in this case the polycarbonate membrane.

**DISCUSSION**

The ascospores of *T. fibrosa* are similar to those found in species of *Annulatascus* (Hyde 1992, Wong et al. 1999b). The major difference between species of *Annulatascus* and *T. fibrosa* is that the peridium in *Torrentispora* comprises black, thick-walled cylindrical cells, arranged in irregular rows in surface view, while in species of *Annulatascus* it is *textura epidermoides* (Hyde 1992). The ascospores in *T. fibrosa* are also relatively small (< 20 µm long) as compared to those in species of *Annulatascus* (> 20 µm long) (Table 1). The length to width ratio of asci in *T. fibrosa* is 25–28:1 while in *Annulatascus* species it is 13–19:1 (Table 1). The ascospores of *Annulatascus* species are surrounded by fibrillar exospoial sheath which is embedded in a gel matrix. This gel matrix may dissolve during the preparation procedures in SEM, as in *Annulatascus hongkongensis* (Hyde & Jones 1983, Jones et al. 1987). There does not appear to be any gel matrix associated with the fibrillar material of the ascospores of *T. fibrosa*.

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**REFERENCES**


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