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Some additional species of *Astrosphaeriella*, with a key to the members of the genus

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Summary. – Six species are added to the genus *Astrosphaeriella* SYDOW & H. SYDOW (Dothideales, Melanommataceae): *A. africana* D. HAWKSW. sp. nov., *A. exorhiza* BOISE sp. nov., *A. minoensis* (HARA) D. HAWKSW. comb. nov. (syn. *Leptosphaeria minoensis* HARA), *A. striaspora* (E. MÜLLER) D. HAWKSW. & BOISE comb. nov. (syn. *Trematosphaeria striaspora* E. MÜLLER), *A. tornata* (BERK. & CURTIS) D. HAWKSW. & BOISE comb. nov. (syn. *Sphaeria tornata* BERK. & CURTIS, ?*Melanomma tornatum* SACC. & PAOLETTI) and *A. vesuvius* (BERK. & BROOME) D. HAWKSW. & BOISE comb. nov. (syn. *Sphaeria vesuvius* BERK. & BROOME, *S. agnocystis* BERK. & BROOME). *Trematosphaeria fusispora* RICK is treated as a synonym of *A. trochus* (PENZIG & SACC.) D. HAWKSW. Some additional collections seen are mentioned and a key is provided to the ten species accepted as members of the genus.

Introduction

The genus *Astrosphaeriella* SYDOW & H. SYDOW (Dothideales, Melanommataceae) was re-introduced by HAWKSWORTH (1981) for four species, characteristically occurring on the petioles of palms and bamboo culms in the tropics. The genus is most closely related to *Trematosphaeria* FÜCKEL from which it is distinguished by the relatively narrow and often also paler ascospores as well as the host ranges (BOISE, 1985).

In the course of studies on fungi referred to *Trematosphaeria*, some further species of *Astrosphaeriella* have been discovered. This contribution reports on these, but the opportunity is also taken to present additional observations on certain of the previously recognised species and to provide a revised key to the ten species accepted here as members of the genus.

Key to the known species of *Astrosphaeriella*

- 1. Ascospores smooth-walled 2
- Ascospores longitudinally striate 9

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- 2(1). Ascomata exposed from an early stage, ruptured cortical layers of the host usually persisting as reflexed teeth-like fragments around the base of the ascomata 3
 Ascomata covered by the cortical or epidermal layers of the host except at the ostiole, ruptured cortical layers not persisting as reflexed teeth-like fragments around the base of the ascomata 8
- 3(2). Ascospores 3–5 septate, brown when mature 4
 Ascospores 1(–3) septate, pale yellowish brown when mature, (35–)38–50(–55) × (5–)5.5–8 µm; on bamboos, Asia
 *A. stellata* (PAT.) SACC.
- 4(3). Ascospores mainly less than 70 µm in length 5
 Ascospores mainly exceeding 70 µm in length 7
- 5(4). Ascospores mainly exceeding 50 µm in length 6
 Ascospores (33–)36–45(–50) × (5.5–)7–8(–9) µm, 3-septate; on bamboos and palm petioles, Sri Lanka and the Philippines (?also Malacca)
 *A. vesuvius* (BERK. & BROOME) D. HAWKSW. & BOISE
- 6(5). Ascospores (44–)48–65(–72) × (5–)6–8(–9) µm, usually 5-septate; on bamboos and perhaps other stout grasses, Africa, Europe (introduced), South America and Asia
 6. *A. trochus* (PENZIG & SACC.) D. HAWKSW.
 Ascospores (40–)48–56(–58) × 8–9(–10) µm, usually 3-septate; probably on a palm petiole, Indonesia
 5. *A. tornata* (BERK. & CURTIS) D. HAWKSW. & BOISE
- 7(4). Ascospores (70–)72–80(–83) × (5–)6.5–7.5(–8.5) µm, 3-septate, pale brown when mature, the apices attenuated; on undetermined monocotyledon (?bamboo), Venezuela
 *A. venezuelensis* BARR & D. HAWKSW.
 Ascospores (68–)74–88 × 8–10 µm, (3–)5-septate, cinnamon brown, the apices not markedly attenuated; on *Iriartea*, Venezuela 2. *A. exorrhiza* BOISE
- 8(2). Ascospores (28–)32–40(–42) × (4.5–)5–7(–8) µm, 1-septate, mainly hyaline, on *Livistona*, Asia
 *A. aosimensis* HINO & KATUMOTO
 Ascospores 25–28 × 6–7 µm, 1–3 septate, mainly hyaline; on bamboo, Japan 3. *A. minoensis* (HARA) D. HAWKSW.

- 9(1). Ascomata \pm superficial; ascospores $65-75 \times 7-8 \mu\text{m}$, 3-5(-6) septate; on dead grass (?*Valota*) stems, Venezuela
 4. *A. striaspora* (E. MÜLLER) D. HAWKSW. & BOISE
 Ascomata \pm immersed; ascospores $47-56 \times 6-8 \mu\text{m}$, 1(-3) septate, on dead grass (?*Phragmites*), Tanzania
 1. *A. africana* D. HAWKSW.

The Species

Descriptions and illustrations of species treated in the above key but which are not discussed in detail below may be found in HAWKSWORTH (1981).

1. *Astrosphaeriella africana* D. HAWKSW., sp. nov. – Figs. 1 A, 2 A

Ascomata perithecia, immersa, hemisphaerica, 0.6–0.7 mm lata et 0.4–0.6 mm alta, nigra; muris basilaribus discontinuis, 10–15 μm crassis. Hamathecium e paraphysoidea compositum, filamentosum, 1–1.5 μm crassum. Asci bitunicati, subcylindrici, circa $120 \times 15 \mu\text{m}$, 8-sporei. Ascosporae distichae inasco, fusiformes, stramineo-brunneae ad rubro-brunneae, 1(-3) septatae, striatae, $47-56 \times 6-8 \mu\text{m}$. Typus: Tanzania, Kigoma, Kalombe, in caulibus Gramineis (?*Phragmites australis*), 26 December 1963, K. A. PIROZYNSKI M104 (IMI 105924 – holotypus).

Ascomata arising singly, immersed, erumpent only at the ostiole, the epidermis scarcely raised, hemispherical, 0.6–0.7 mm wide and 0.4–0.6 mm tall, black; ostiole 100–120 μm diam; peridium poorly developed, sides of the ascomata mainly 10–20 μm thick, but extending to 60 μm thick around the ostiole, pseudoparenchymatous, textura angularis, cells subglobose to polyhedral, dark brown, thick-walled, mainly 4–8 μm diam, lumina tending to become occluded; cells in the angles of the ascomatal cavity arranged in palisade-like rows, elongate, olivaceous brown, mainly 8–15 \times 3–4 μm ; base discontinuous, when present to 10–15 μm and composed of olivaceous brown cells similar to those of the upper walls; epidermal cells sometimes becoming occluded and forming an integral part of the supporting tissues of the ascoma.

Hamathecium comprising paraphysoids (trabeculate pseudoparaphyses), persistent, branched and anastomosing, very sparsely septate, 1–1.5 μm thick. – Asci bitunicate, presumably fissitunicate, subcylindrical, about $120 \times 15 \mu\text{m}$, 8-spored. – Ascospores distichously arranged in the asci, fusiform, pale yellowish brown to reddish brown, 1(-3) septate, constricted at the median septum and often swollen immediately below it, striate, with ridges ca. 0.7 μm wide, $47-56 \times 6-8 \mu\text{m}$.

This fungus has reduced ascomata similar to those seen in *A. minoensis* (see below), but the ascospores are strikingly striate recalling those of *A. striaspora*. However, in addition to the differ-

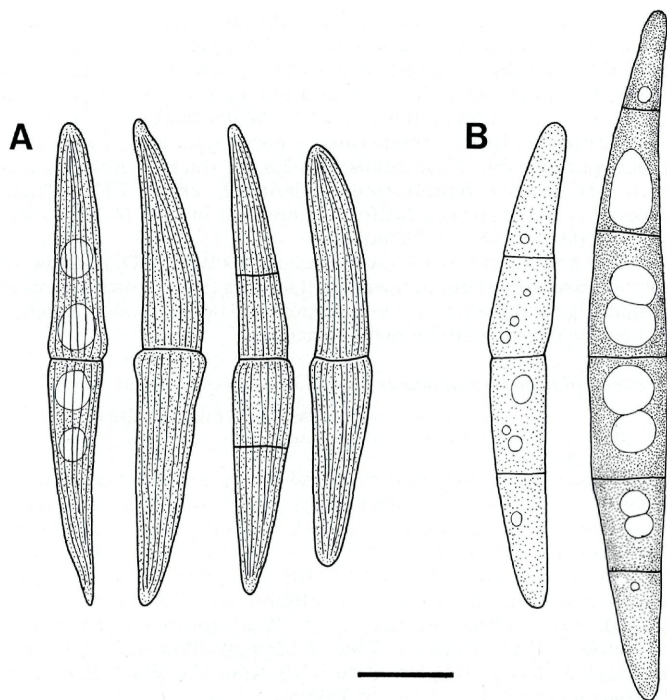


Fig. 1: Ascospores: A. *Astrosphaeriella africana* (IMI 105924 – holotype). – B. A. *exorrhiza* (NY – isotype; young ascospore on the left). Scale = 10 μ m.

ences in ascomatal structure, *A. africana* differs from *A. striaspora*, to which species this collection was referred by PIROZYNSKI, in having much shorter ascospores which are also generally 1-septate and only rarely 3-septate.

2. *Astrosphaeriella exorrhiza* BOISE, sp. nov. – Fig. 1 B

Ascomata perithecia, erumpescentia, conica, 1–1.5 mm diam, brunnea ad nigra, apice nitidula, minutissime papillatis; muris lateralibus carbonaceis, 60–80 μ m latis, muris basilaribus tenuibus. Hamathecium e paraphysoidea compositum, filamentosum, 1.5–2.5 μ m latis. Asci bitunicati, cylindrici, circa 230 \times 12 μ m. Ascospores fusiformes, cinnamomeae, (3–)5 septatae, laeves, (68–)74–88 \times 8–10 μ m. Typus: Venezuela, Cerro de la Neblina, valley north of the base of Pico Phelps, cloud forest between 1250–2000 m, 0°49' N 66°0' W, in radicibus extraterraneis suffulto (*Iriarte* sp.), 13 April 1984, G. J. SAMUELS 1266 (VEN – holotypus; NY – isotypus).

Ascomata erumpent, finally almost superficial, conical, 1–1.5 mm diam, cortical layers of the host persisting as reflexed teeth-like flanges arranged in a stellate pattern, dark brown to black, the apices smooth, shiny and minutely papillate; peridium well-developed, sides carbonaceous, 60–80 μm thick, base thin.

Hamathecium comprising paraphysoids (trabeculate pseudoparaphyses), filamentous, 1.5–2.5 μm thick. – Asci bitunicate, presumably fissitunicate, cylindrical, about $230 \times 12 \mu\text{m}$, 8spored. – Ascospores fusiform, cinnamon brown, (3–)5 septate, smooth, (68–)74–88 \times 8–10 μm .

This new species recalls *A. venezuelensis* BARR & D. HAWKSW. in the long ascospores but in the present species they become 5-septate at maturity and the tips of the ascospores do not show any tendency to become strongly attenuated or unciate.

3. *Astrosphaeriella minoensis* (HARA) D. HAWKSW., comb. nov.

Bas.: *Leptosphaeria minoensis* HARA, Bot. Mag. (Tokyo) 27: 250 (1913).

Syn.: *Asterotheca minoensis* (HARA) HARA, Trans. mycol. Soc. Japan 1 (5): 6 (1957).

HAWKSWORTH (1981) described and illustrated this taxon on the basis of an authentic specimen (Japan, Prov. Mino, Kawaue-mura, on *Phyllostachys bambusoides*, 30 June 1912, K. HARA, TNS F-209745) collected the year after the holotype, which had not been located. In the course of a visit to TNS in September 1981, D. L. H. re-discovered the holotype in a different part of the herbarium (Japan, Prov. Mino, Kawaue, on *Phyllostachys bambusoides*, 11 October 1911, K. HARA, TNS F-226309); this collection was amongst material transferred to TNS from the Plant Pathology Herbarium of the University of Tokyo.

Comparison of the 1911 and 1912 collections leaves no doubt as to their conspecificity; the description and illustrations published by HAWKSWORTH (1981) cover both adequately and so are not repeated here. However, studies of microtome sections of the 1911 collection demonstrated that in juvenile ascomata a distinct peridium developed below the clypeus involving host cells, and the palisade-like rows of cells in the angles of the ascomata were often well-developed and persistent. In addition the ascospores were regularly 3-septate, occasionally 5-septate, and essentially hyaline, only rare spores becoming yellowish brown to brown; the range of size of the spores seen can now also be extended to $24\text{--}32 \times 4\text{--}7 \mu\text{m}$.

HAWKSWORTH (1981) hesitated from considering this taxon as an *Astrosphaeriella* in which the true ascomatal wall had been drastically reduced mainly because of the shape and colour of the ascospores. The discovery of some longer and narrower ascospores in the 1911 collection, and an appreciation of the rarity of brown spores

(perhaps largely degenerating ones), remove the principle causes for doubt and the appropriate combination is therefore made above.

Astrosphaeriella minoensis is most similar to *A. aosimensis*, from which it differs in the reduced true ascomata wall, well-developed clypeus, and the shorter ascospores which are (1-)3(-5) septate and not only 1-septate. *A. aosimensis* is only known from *Livistona* leaf stalks (Palmae) and is not reported from any bamboos.

4. *Astrosphaeriella striaspora* (E. MÜLLER) D. HAWKSW. & BOISE, comb. nov.

Bas.: *Trematosphaeria striaspora* E. MÜLLER, in MÜLLER & DENNIS, Kew Bull. 19: 384 (1965).

The holotype of this species (Venezuela, roadside in the Guatopo forest between Ocumare del Tuy and Altigracia de Orituco, Edo Miranda, on dead grass [*Valota insularis*], 25 June 1958, R. W. G. DENNIS 1306, K) is now in a rather poor condition but the excellent illustrations of this species provided by MÜLLER & DENNIS (1965: 376 fig. 12) leave no doubt that the fungus should be referred to *Astrosphaeriella*. This species is of especial interest in the genus in having longitudinally striate ascospores, only otherwise seen in *A. africana* (see above), although in *A. striaspora* these cannot always easily be observed.

5. *Astrosphaeriella tornata* (BERK. & CURTIS) D. HAWKSW. & BOISE, comb. nov. — Figs. 2 B, 3 A

Bas.: *Sphaeria tornata* BERK. & CURTIS, J. Acad. nat. Sci. Philadelphia, ser. 2, 2: 277 (1853).

Syn.: *Trematosphaeria tornata* (BERK. & CURTIS) COOKE, Grevillea 16: 91 (1888).

Ascomata arising singly, immersed only at the base, erumpent through the cortical layers of the host which persist as reflexed teeth-like flanges around the base of the ascomata, mammiform to conical, 1-1.6 mm wide and about 1 mm tall, purplish brown except around the ostiole; ostiole black, 75-100 µm diam; peridium well-developed, sides carbonaceous, to about 70 µm thick, composed of pseudoparenchymatous cells, textura angularis, individual cells thick-walled, mainly 5-8 µm diam; cells in the angles of the ascomatal cavity elongated, palisade-like, mainly 6-12 × 3-4.5 µm; base continuous, 15-25 µm thick, composed of cells similar to those of the peridium in ± vertically orientated rows.

Hamathecium and intact asci not seen. — Ascospores broadly fusiform, reddish brown but the end cells sometimes paler, 3(-5) septate, slightly constricted at the septa, smooth-walled with a

thin (ca. 1 μm thick) gelatinous sheath, (40–)50–55(–58) \times 8–9(–10) μm .

The holotype material of this species ("*S. stellulata*, Schwein. Surinam Herb. Schwein.", K) is very limited and only small ascomata remain intact. Although no paraphysoids or intact asci were seen, on the basis of all other features this species can be referred to *Astrosphaeriella* with confidence. *A. tornata* was most probably growing on a dead palm petiole and is known to us only from the holotype.

A. tornata is most similar to *A. vesuvius*, which occurs on palm petioles in Sri Lanka, and may even prove to be conspecific with that species when more information is available on its range of variation. On the evidence currently available, however, *A. tornata* is separated here on the basis of the longer ascospores which only occasionally become 5-septate. *A. trochus*, which occurs on bamboos rather than palms, has longer and relatively narrow ascospores which are almost invariably 5-septate.

6. *Astrosphaeriella trochus* (PENZIG & SACC.) D. HAWKSW., Bot. J. Linn. Soc. 82: 46 (1981)

Syn.: *Trematosphaeria fusispora* RICK, Broteria, ser. trim. 2: 178 (1933).

For further synonyms, description and illustrations, see HAWKSWORTH (1981).

This species, which occurs on old stems of various bamboos, was seen by HAWKSWORTH (1981) from Chile, Colombia, Ecuador, Japan, Java and Uganda. It can now also be reported from Europe for the first time on the basis of a collection made recently in England (Cornwall, nr. Fowey, Caerhays Castle, on old indet. bamboo stems, 13 May 1982, C. BOOTH, IMI 273957). This material is typical of the species, with ascospores to 72 μm long; it was presumably introduced into the British Isles together with plants of the host.

Trematosphaeria fusispora RICK is added to the synonymy of this species here on the basis of two collections (Brazil, Sao, Leopoldo, Rio Grande do Sul, "in *Bambusa*", 5 September 1929, H. BRAUN, FH; loc. cit., 1930, J. RICK, FH). RICK (1935) did not cite any specimen in the original diagnosis of this species, simply stating "In *Arundinaria*". The 1929 collection cited above is selected as the lectotype for his name here in order to fix the application of this epithet.

A. trochus has not previously been reported from Brazil but was to have been expected in view of its known distribution in South America.

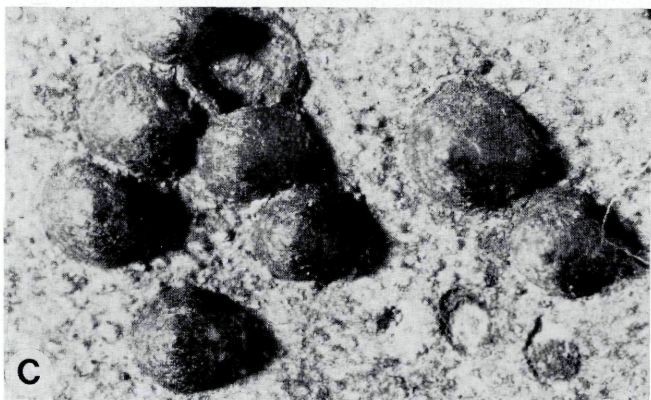
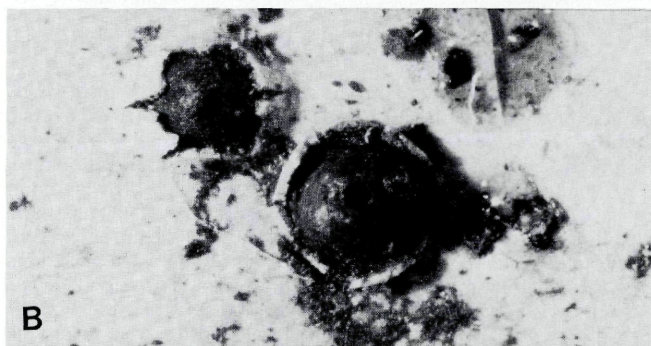
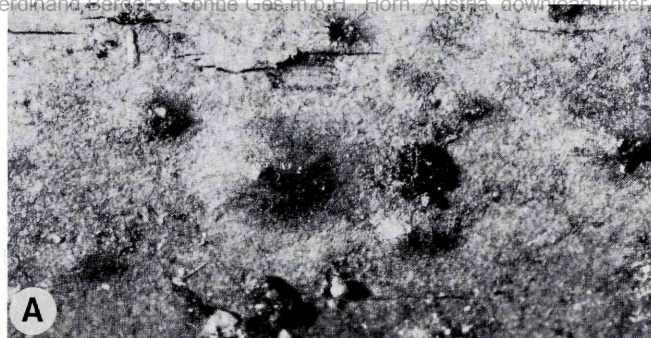


Fig. 2: Ascomata: A. *Astrosphaeriella africana* (IMI 105924 - holotype), $\times 20$. - B. *A. tornata* (K-holotype), $\times 25$. - C. *A. vesuvius* (K-holotype), $\times 13$.

7. *Astrosphaeriella vesuvius* (BERK. & BROOME) D. HAWKSW. & BOISE, comb. nov. — Figs. 2 C, 3 B–C

Bas.: *Sphaeria vesuvius* BERK. & BROOME, J. Linn. Soc., Bot. 14: 127 (1875).

Syn.: *Trematosphaeria vesuvius* (BERK. & BROOME) SACC., Syll. Fung. 2: 119 (1883).

Melanomma vesuvius (BERK. & BROOME) BERL., Icones Fung. 1: 36 (1891).

Sphaeria agnocystis BERK. & BROOME, J. Linn. Soc., Bot. 14: 128 (1875).

Amphisphaeria agnocystis (BERK. & BROOME) SACC., Syll. Fung. 1: 722 (1882).

Trematosphaeria agnocystis (BERK. & BROOME) COOKE, Grevillea 16: 92 (1888).

?*Melanomma tornatum* SACC. & PAOLETTI, Atti R. Ist. Venet., ser. 6, 6: 408 (1888).

?*Trematosphaeria maquilingiana* REHM, Leaflet. Philipp. Bot. 8: 2952 (1916).

Trematosphaeria maquilingiana var. *schizostachi* REHM, Leaflet. Philipp. Bot. 8: 2952 (1916).

Ascomata usually arising in small groups, sometimes singly, immersed only at the base, erumpent through the cortical layers of the host which sometimes persist as reflexed teeth-like flanges around the base of the ascomata, mammiform to steeply conical, 0.75–1.8 mm wide and to 0.8–1.2 mm tall, purplish brown to dark brown except around the ostiole; ostiole black, ca. 50 μ m diam; peridium well-developed, sides carbonaceous, 70–90 μ m thick, composed of pseudoparenchymatous cells, textura angularis, individual cells thick-walled, mainly 4–5 μ m diam, becoming occluded; cells in the angles of the ascomatal cavity elongated, palisade-like, variable in length, 3–4 μ m wide; base poorly developed, uneven, sometimes discontinuous, 20–30 μ m thick, similar in structure to the peridium sides.

Hamathecium consisting of paraphysoids (trabeculate pseudoparaphyses), persistent, branched and anastomosing, remotely septate, 1–1.5 μ m thick. — Asci bitunicate, presumably fissitunicate, subcylindrical, 130–145 \times 10–12 μ m, 8-spored. — Ascospores distichously arranged in the asci, broadly fusiform, reddish brown, concolourous, consistently 3-septate when mature, slightly constricted at the septa, smooth-walled, lacking any gelatinous sheath, (33–)36–45(–50) \times (5.5–)7–8(–9) μ m.

The type material of both *Sphaeria agnocystis* ("649. Ceylon", K-holotype, 2 isotypes) and *S. vesuvius* ("212. G. H. K. T. [THWAITES] Ceylon", "Nov. 1867", K-holotype, 4 isotypes) occur on what is almost certainly dead palm petioles. The ascomata in *S. vesuvius* are more steeply conical than in the collections of *S. agnocystis* but in all other details agree so closely that they are regarded as conspecific here.

Astrosphaeriella vesuvius differs from *A. stellata* in the consistently reddish brown rather than pale yellowish-brown ascospores

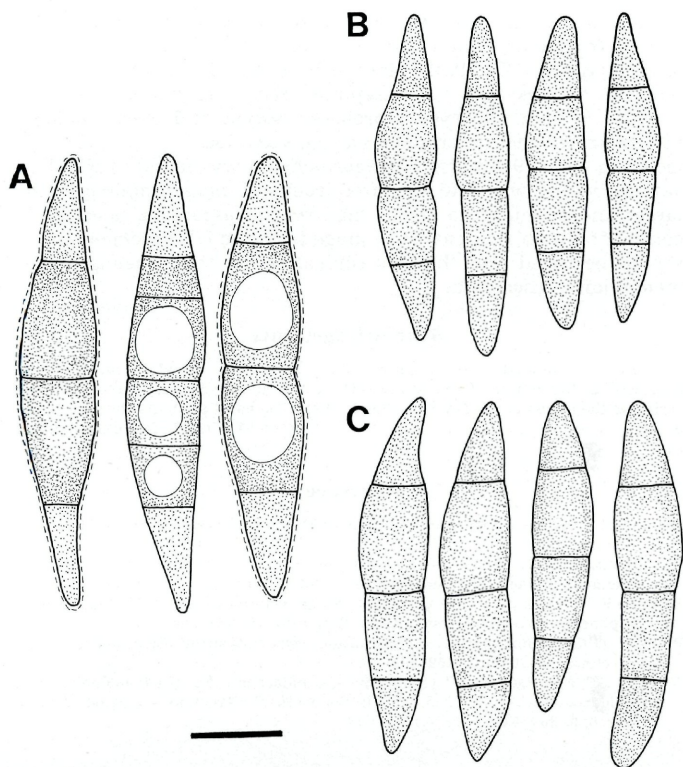


Fig. 3: Ascospores: A. *Astrosphaeriella tornata* (K-holotype). – B–C. *A. vesuvius* (B, K-holotype of *Sphaeria agnocystis*; C, K-holotype of *Ss. vesuvius*). Scale = 10 μ m.

which are also exclusively 3-septate when mature in *A. vesuvius* and generally 1-septate (very exceptionally 3-septate) in *A. stellata*, a species so far only certainly known from bamboos. The separation of *A. vesuvius* from *A. tornata* is discussed under the latter species above.

We have not studied material of *Melanomma tornatum*, described from dead stems, probably bamboos, collected in Malacca, but from the ascospore measurements given (40–45 \times 6 μ m) and illustrations provided by SACCARDO & PAOLETTI (1888: tab. 6 fig. 4 a–e) this fungus might well also prove to belong here.

Authentic material of *Trematosphaeria maquiliana*, described from a dead palm (*Calamum* sp.) collected by C. F. BAKER on Mt. Maquiling in The Philippines in June 1914, has not been located but this species also had 3-septate ascospores which measured $35-40 \times 6-7 \mu\text{m}$. However, a probable isotype of *T. maquiliana* var. *schizostachyi*, described from the same locality, and also collected in June 1914 but on *Schizostachyum* was found in NY. This variety, which was said to differ from var. *maquiliana* in the larger and mammiform rather than conical ascomata, is certainly conspecific with *A. vesuvius* to judge from the NY specimen, but it should be noted that this has conical rather than "hemiglobosomammilaria" ascomata.

Acknowledgements

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