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A new freshwater species of *Saccardoella* from Hong Kong and South Africa

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Abstract: *Saccardoella aquatica* sp. nov. occurring on wood submerged in streams in Hong Kong and South Africa is described and illustrated with differential interference micrographs. This species produces long, cylindrical asci and 3-septate ascospores surrounded by a mucilaginous sheath, and differs from other species in *Saccardoella* in having fusiform ascospores. A key and synopsis of *Saccardoella* species are provided.

Key Words: Ascomycetes, aquatic fungi, lignicolous fungi, systematics

During a survey of fungi found on submerged wood in streams in Hong Kong and South Africa, a new species belonging to *Saccardoella* was found. It is unique in producing fusiform, 3-septate, heavily guttulate ascospores surrounded by an inconspicuous sheath. It is here described as *S. aquatica* sp. nov. and illustrated with differential interference micrographs.

Saccardoella aquatica K. M. Tsui, K. D. Hyde, I. J. Hodgkiss & Goh, sp. nov. FIGS. 1–11

Ascomata 560–700 μm alta, nigra, 640–720 μm diam., erumpentia vel immersa, globosa vel subglobosa, papillata, ostiolata, coriacea, carbonacea, solitaria vel gregaria. Clypeata 10–6 μm crassa, ostiolum circum crassiora. Papilla conica, 125 μm alta, 150 μm in diam., periphysata. Peridium 20–30 μm crassum, ostiolum circum crassiora. Asci 185–230 \times 7–9 μm , (\bar{x} = 204.2 \times 7.9 μm , n = 30), 8-spore, longe cylindrici vel filiformis, unitunicati, pedicellati, apparato apicali praediti. Ascospores 26–34 \times 6–8 μm (\bar{x} = 29.2 \times 7 μm , n = 50), uniseriatae, late fusiformes, 3-septatae, ad septa constrictae, hyalinae, tunico gelatinoso praeditae.

Etymology. in reference to the freshwater habitat where this species was found.

HOLOTYPE. HONG KONG. New Territories, Tai Po, Lam Tsuen River, on submerged wood, 22 Jan. 1997, K. M. Tsui, KM56 (HKU(M) 5371).

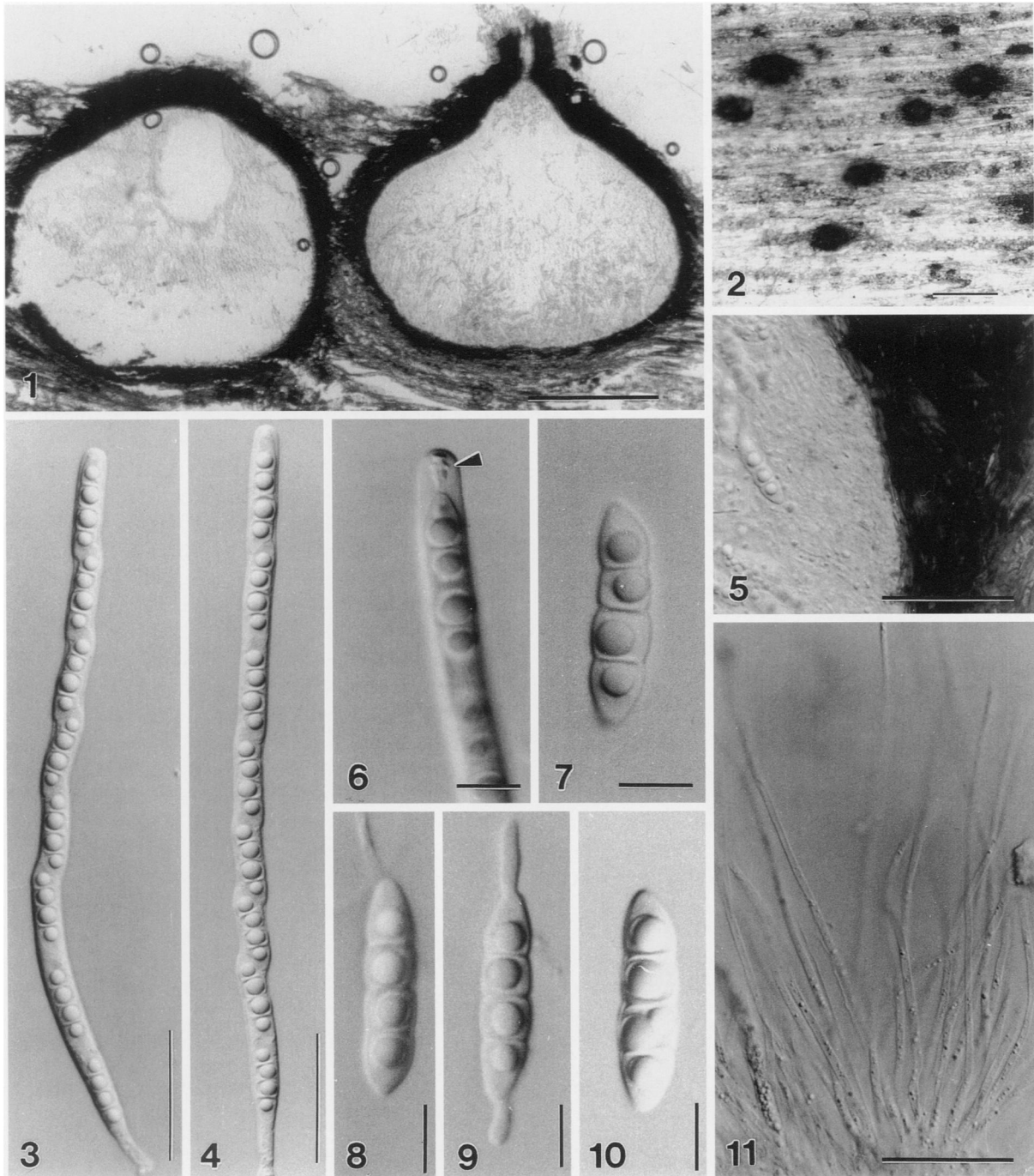
Colonies on potato dextrose agar superficial, cottony, white at the center, pale brown towards the margin; Reverse dark brown, growing in concentric rings, black in the center. No fruiting bodies or anamorphs formed in culture. Ascomata on natural substratum shiny, dark brown to black, 560–700 μm high, 640–720 μm diam, immersed or erumpent, globose or subglobose, papillate, ostiolate, coriaceous, carbonaceous, solitary to gregarious (FIGS. 1, 2). Clypeus extending outwards around the ascomata, 10–60 μm thick, thicker around the papilla, composed of dense, melanised cells in the host tissue (FIGS. 1, 5). Papilla blunt conical, up to 125 μm high, 150 μm diam, brown with periphyses (FIG. 1). Peridium 20–30 μm wide, wider around the ostiole, composed of two strata: an inner stratum of three to five layers composed of angular brown thin-walled cells forming a *textura angularis*, and an outer stratum composed of fungal hyphae interspersed with host cells forming a *textura intricata* (FIG. 5). Paraphyses numerous, 2–3 μm diam, filamentous and hypha-like (FIG. 11). Asci 185–230 \times 7–9 μm (\bar{x} = 204.2 \times 7.9 μm , n = 30), 8-spored, long-cylindrical or filiform, short-pedicellate, with an apical ring (FIGS. 3–4, 6). Ascospores 26–34 \times 6–8 μm (\bar{x} = 29.2 \times 7.0 μm , n = 50), overlapping uniseriate, fusiform, with acute ends, 3-septate, constricted at the septa, hyaline, surrounded by an inconspicuous mucilaginous sheath (FIGS. 7–10).

Habitat. Saprobic on submerged wood.

Known distribution. Hong Kong, South Africa.

Other material examined. Hong Kong. New Territories, Tai Po, Lam Tsuen River, on submerged wood, 22 Jan. 1997, K. M. Tsui, KM56 (HKU(M) 5372); South Africa, Durban, Palmet River, on submerged wood, Nov. 1994, K. D. Hyde and T. S. Steinke, KM56 (HKU(M) 2202).

Saccardoella aquatica bears some resemblance to *S. marinospora* K. D. Hyde and *S. macrasca* (Sacc.) M. E. Barr which also produce 3-septate ascospores (Hyde, 1992; Barr, 1994). *Saccardoella macrasca* has consistently smaller asci and ascospores, and is unique in having more fusiform, distoseptate as-



FIGS. 1–11. Interference micrographs of *Saccardoella aquatica* (from holotype) 1. Section of the ascomata. 2. Appearance of ascomata on submerged wood. 3, 4. Asci. 5. Section of the peridium. 6. Close-up of the ascus apex. Note the subapical apparatus (arrowed). 7–10. Ascospores. 11. Paraphyses. Scale bars: 1 = 300 μm , 2 = 400 μm , 3–4 = 40 μm , 5 = 50 μm , 6–10 = 10 μm , 11 = 40 μm .

cospores which taper towards their apices and lack a mucilaginous sheath (Barr, 1994). Asci and ascospores of *S. aquatica* and *S. marinospora* are of similar dimensions but differ in a number of respects. *S. aquatica* has fusiform, 3-septate asco-

spores, whereas in *S. marinospora* the ascospores are broadly ellipsoidal. Furthermore, ascospores in *S. aquatica* are constricted at the septa, while constrictions are absent in *S. marinospora*. The ascomata in *S. aquatica* are also smaller (560–700 μm

TABLE I. A synopsis of the known species of *Saccardoella*. (Barr, 1994; Berlese, 1894; Hsieh et al., 1997; Hyde, 1992; Mathiasson, 1993; Riedl, 1967; Spegazzini, 1879)

Species	Ascomata	Asci	Ascospore sizes
<i>S. aquatica</i> K. M. Tsui et al.	640–720 µm diam, 560–700 µm high	185–230 × 7–9 µm (\bar{x} = 204.2 × 7.9 µm, n = 30)	26–34 × 6–8 µm (\bar{x} = 29.2 × 7.0 µm, n = 50), 3-septate, with mucilaginous sheath
<i>S. ingradae</i> Riedl	650–800 µm diam	250 × 8–10 µm	70–100 × 9 µm, 25–28-septate, with polar appendages
<i>S. kanderana</i> Math.	540–900 µm diam	260–348 × 10.4–14 µm (\bar{x} = 312.7 × 11.8 µm, n = 41)	35–60.5 × 7.3–10.5 µm (\bar{x} = 50.2 × 8.7, n = 160), 11–18-septate
<i>S. macrasca</i> (Sacc.) M. E. Barr	485–660 µm diam	100–150 × 6–9 µm	16–36 × 4–5.5 µm, 3-septate
<i>S. mangrovei</i> K. D. Hyde	390–845 µm diam, 38–585 µm high	154–216 × 8.5–14 µm	26–33 × 6–8 µm, 7–9-septate, with mucilaginous sheath
<i>S. marinospora</i> K. D. Hyde	650–960 µm diam, 780–1040 µm high	190–240 × 10–12 µm	25–31 × 7.5–10 µm, 3-septate, with mucilaginous sheath
<i>S. miscanthi</i> W. H. Hsieh, C. Y. Chen & Sivan.	340–390 µm diam, 468–546 µm high	185–250 × 4–6 µm	38–50 × 3.5–4.5 µm, 9–15-septate, with mucilaginous sheath, one cell in the middle sometimes swollen
<i>S. montellica</i> Speg.	500–750 µm diam	400–450 × 14–15 µm	100–115 × 12 µm, 20–30-septate, with polar appendages
<i>S. rhizophorae</i> K. D. Hyde	364 µm diam, 325–455 µm high	135–160 × 8–10 µm	19–26 × 6–8 µm, 4–6-septate, with mucilaginous sheath
<i>S. separans</i> M. E. Barr	500–600 µm diam	300–400 × 10–12 µm	65–85 × 9–10 µm, 18–23-septate, with cap-like appendages, at maturity it disarticulates into individual cells to form endospores
<i>S. transylvanica</i> (Rehm) Berl.	1000 µm diam	260–300 × 12 µm	45–50 × 8–9 µm, 7–19-septate, without any appendages or mucilaginous sheath

high, 640–720 µm diam) when compared to *S. marinospora* (780–1040 µm high, 650–960 µm diam). The ascus wall of *S. aquatica* is wide and similar to that found in other species of *Saccardoella*.

The genus *Saccardoella* is saprotrophic and widely distributed geographically, with species recorded from Austria, Australia, Brunei, Canada, Hong Kong, Norway, South Africa, Switzerland, Thailand, and USA, and species occur in terrestrial, aquatic and marine habitats. A mucilaginous sheath surrounding ascospores is found only in species reported from freshwater and marine habitats, i.e., *S. aquatica*, *S. mangrovei* K. D. Hyde, *S. marinospora*, and *S. rhizophorae* K. D. Hyde. The mucilaginous sheath may aid in the dispersal of ascospores and their attachment to substrates. The presence of lipid globules in the ascospores may facilitate ascospore flotation.

The genus *Saccardoella* has been revised by Barr (1994) who produced a key to North American species. A key to all published species and a synopsis of characters is given (TABLE I), however *S. berberidis* Eliasson, *S. canadensis* Ellis & Everh. and *S. dehliana* are not included. Mathiasson (1993) concluded that the first two species are inseparable from *S. transylvanica* (Rehm) Berl. We agree with Heish et al. (1997) that *S. dehliana* does not belong in this genus. In the description and illustration provided by Malhotra and Mukerji (1978), asci are typically loculoascomycetous.

KEY TO *SACCARDOELLA* SPECIES

1. Ascospores without a sheath or polar appendages . . . 2
1. Ascospores with a mucilaginous sheath or polar appendages 4
 2. Ascospores 3-septate, fusiform in shape, and tapering at the apices *S. macrasca*
 2. Ascospores with more than 3 septa 3
3. Ascospores 35–60.5 × 7.3–10.5 µm, distinctly constricted at the central septum *S. kanderana*
3. Ascospores 45–50 × 8–9 µm, not constricted at the central septum *S. transylvanica*
 4. Ascospores with polar appendages 5
 4. Ascospores with a mucilaginous sheath 7
5. Ascospores with long terminal appendages 6
5. Ascospores 65–85 × 9–10 µm, with 18–23 septa, constricted at the septum and having caplike appendages. At maturity, ascospores disarticulate into individual cells to form endospores *S. separans*
 6. Ascospores 70–100 × 9 µm, 25–28 septate *S. ingradae*
 6. Ascospores 100–115 × 12 µm, 20–30 septate *S. montellica*
7. Ascospores with more than 9 septa, 38–50 × 3.5–4.5 µm, with a swollen cells in the middle *S. miscanthi*
7. Ascospores with less than 10 septa 8
 8. Ascospores 26–33 × 6–8 µm, 7–9 septate *S. mangrovei*

8. Ascospores with fewer than 7 septa 9
9. Ascospores $19\text{--}26 \times 6\text{--}8 \mu\text{m}$, 4–6 septate
 *S. rhizophorae*
9. Ascospore 3-septate 10
10. Ascospores $25\text{--}31 \times 7.5\text{--}10 \mu\text{m}$, broadly ellipsoidal,
 not constricted at a septa *S. marinospora*
10. Ascospores $26\text{--}34 \times 6\text{--}8 \mu\text{m}$, fusiform, constricted
 at septa *S. aquatica*

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