Stauriella gen. nov., proposed for a new lignicolous basidiomycetous anamorph from freshwater in Thailand

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The new genus *Stauriella* is erected for a freshwater basidiomycete collected on test blocks of *Dipterocarpus alatus* submerged in a stream in Khao Yai National Park, Thailand. Stauroconidia are produced on hyaline, septate hyphae with clamp connections. The species is known from only one stream at Khao Yai and its taxonomic position is discussed.

The diversity of aquatic basidiomycetes is low, as few have adapted for life in such a habitat (Goh & Hyde, 1996; Goh, 1997; Sivichai & al., 2000; Webster, 1994). Ten marine filamentous basidiomycetes, assigned to the genera *Calathella* D. A. Reid, *Digitatispora* Doguet, *Halocyphina* Kohlm., *Melanotaenium* de Bary, *Mycaureola* Maire & Chemin, *Nia* R. T. Moore & Meyers and *Physalacria* Peck, were described, most of them growing on wood (Hyde & al., 2000). Two genera (*Digitatispora, Mycaureola*) have tetraradiate basidiospores and appear to be well adapted to conditions in the marine environment. Marine basidiomycetous yeasts have also been described (Kurtzmann & Fell, 1998).

In freshwater habitats, a number of taxa with tetraradiate conidia are known, but their teleomorphs produce basidiospores that are better equipped for terrestrial dissemination (Webster & Descals, 1981) e.g. *Crucella subtilis* Marvanová & Suberkr. (teleomorph: *Camptobasidium hydrophilum* Marvanová & Suberkr.); and *Ingoldiella hamata* Shaw (*Sistotrema hamatum* Nawawi & Webster). *Limnoperdon incarnatum* Escobar is a freshwater basidiomycete described with no known anamorph (Escobar & al., 1976).

During our study of lignicolous freshwater fungi in Thailand, a slow growing basidiomycete producing stauroconidia was collected

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(Sivichai & al., 2000). It does not match any basidiomycetes known to us, and is described as a new species in a new genus.

Materials and methods

Sawn heart wood of *Dipterocarpus alatus* was cut into test blocks (15 × 2.5 × 2.5 cm) and submerged in a stream at road marker km 29.2 in Khao Yai National Park, Prachinburi Province, Thailand. They were recovered after nine months on the 14 May 1998 and incubated in the laboratory on moist damp tissue paper in closed plastic boxes in a glass fronted cabinet at 20° C under cool white fluorescent light (Sivichai & al., 2000).

All measurement reported for microscopic features were made from fresh material on wood in distilled water. Conidial statistics include: the arithmetic mean of the length, (±SD) and n for number of conidia measured.

Single-conidium isolations were made and grown on Corn Meal Agar (CMA). The conidia were spread over the agar surface with a flame-sterilised inoculation loop dipped in 0.05% (w/v) Triton X-100; plates were incubated at 20° C in a cabinet under cool, white fluorescent light and examined with a microscope each day for spore germination. Six of the germinated conidia were transferred to new plates and incubated in the same cabinet. Slides from cultures were made in water or in lactophenol. After study, dried specimens on wood were dried and deposited in the BIOTEC herbarium (SS557 in BBH).

Results

Two of the test blocks exposed for 9 months in the stream yielded small conidia on hyaline hyphae growing on the surface of the wood after one week of incubation in the laboratory. This new fungus was only found on *Dipterocarpus alatus* wood blocks at a single locality in a stream in Khao Yai National Park. May is the start of the rainy season at this locality. The fungus ceased sporulating after two weeks. No clamp connections were observed on the mycelium from natural substrata. Clamp connections, however, were produced in cultures on CMA and the conidia in culture matched those from the natural substratum. As this fungus is so small, with mycelium mostly immersed in the wood, it is easily overlooked when examining wood samples.

Taxonomy

Stauriella Sivichai & E.B.G. Jones, **gen. nov.**

Coloniae in cultura pura in ligno sparsae, ex hyphis hyalinis vel cremeis vel cinerascentibus, immersis, ramosis, septatis compositae. Cellulae conidiogenae simplices vel ramosae, hyalinae, septatae, apicaliter vel lateraliter orientes. Conidia hyalina, ex cellula basali et supra 4 vel 6 cellulis, 2–6 spinis praeditis.

Colonies on wood, sparsely developed, white to cream-white, becoming grey with age. – Mycelium partly immersed, composed of branched, septate, hyaline hyphae. – Conidiogenous cells flexuous or straight, simple or branched, hyaline, septate, arising terminally or laterally on the hyphae. – Conidia hyaline with a clamp connection, a basal cell bearing 4–6 cells and each cell giving rise 2–6 spines.

Etymology. – Staurós (Gr.)= star, in reference to the spore morphology

Typus generis.– *Stauriella aquatica* Sivichai & E. B. G. Jones

Stauriella aquatica Sivichai & E. B. G. Jones, **sp. nov.** – Figs. 1–10.

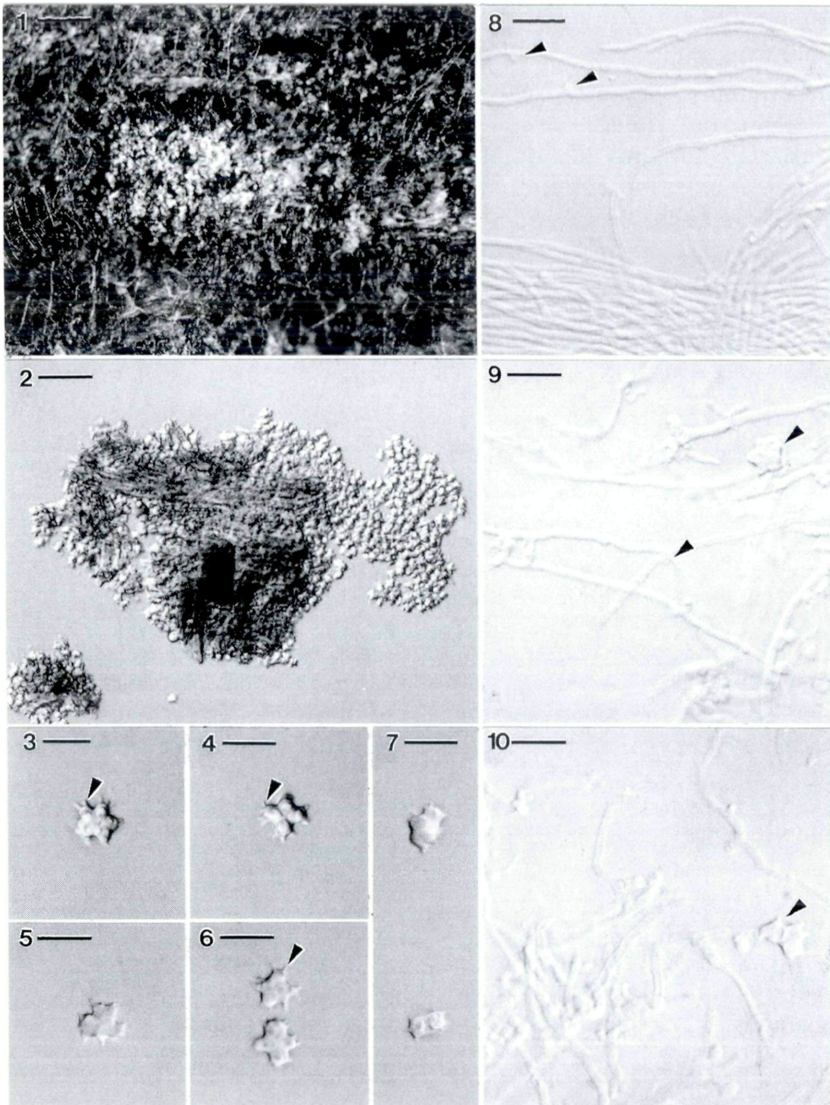
Coloniae in substrato sparse evolutae, hyphis hyalinis vel cinerascentibus, immersis, 1–2 µm latis, ramosis, septatis, laevibus, tenuitunicatis. Cellulae conidiogenae breves, 2 µm longae, simplices, hyalinae, septatae, terminales vel laterales. Conidia hyalina, 10–12.5 µm (11.2 $\pm$ 0.46, n = 60), ex cellula basali et 4 vel 6 cellulis, cum 2–6 spinis in omnibus cellulis.

Colonies on substrate, superficial, sparsely developed, white to cream-white, becoming grey with age (Fig. 1). Mycelium partly immersed in the wood, hyphae 1 to 2 µm wide, branched, septate, hyaline, thin-walled and smooth. – Conidiogenous cells short up to 2 µm long, simple, occasionally branched, hyaline, septate, arising terminally or laterally on the hyphae (Figs. 9–10). – Conidia hyaline 10–12.5 µm (11.2 $\pm$ 0.46, n = 60), comprising 4–6 cells, each with 2–6 spines (Figs. 3–7).

Conidia germinating on CMA within 24–48 hours at 20° C and in light, producing a single germ tube. – Colonies on agar diffuse, with no aerial mycelium, slow growing (less than 2 mm within 30 days). – Hyphae hyaline, with clamp connections (Fig. 9), narrow, 1–3 µm wide, septate, thin-walled, smooth, branched or unbranched, little aerial mycelium, mainly immersed in the agar and sporulating within 40 days.

Etymology. – *aquatica* : in reference to the freshwater habitat of the species.

Holotypus. – THAILAND: Prachinburi Province, Khao Yai National Park, stream at road marker km 29.2, on submerged for 9 months test blocks of *Dipterocarpus alatus*, 14 May 1998, S. Sivichai, (SS557 in BBH).



Figs. 1–10. *Stauriella aquatica*. –1. White to pale cream colony superficial on the test block. – 2. Squash mount of conidia. Figs. 3–6. Hyaline conidia from test blocks; each conidium composed of 4 cells (Fig. 4–6) to 5 (Figs. 3), and each cell with 2–6 spines (arrowed). – 7. Side view of conidia. – 8. Hyphae on CMA with clamp connections (arrowed). – 9–10. Clamp connection and conidial (arrowed) development on CMA. – Bars: Fig. 1 = 200 µm; Fig. 2 = 50 µm; Figs. 3–10 = 10 µm.

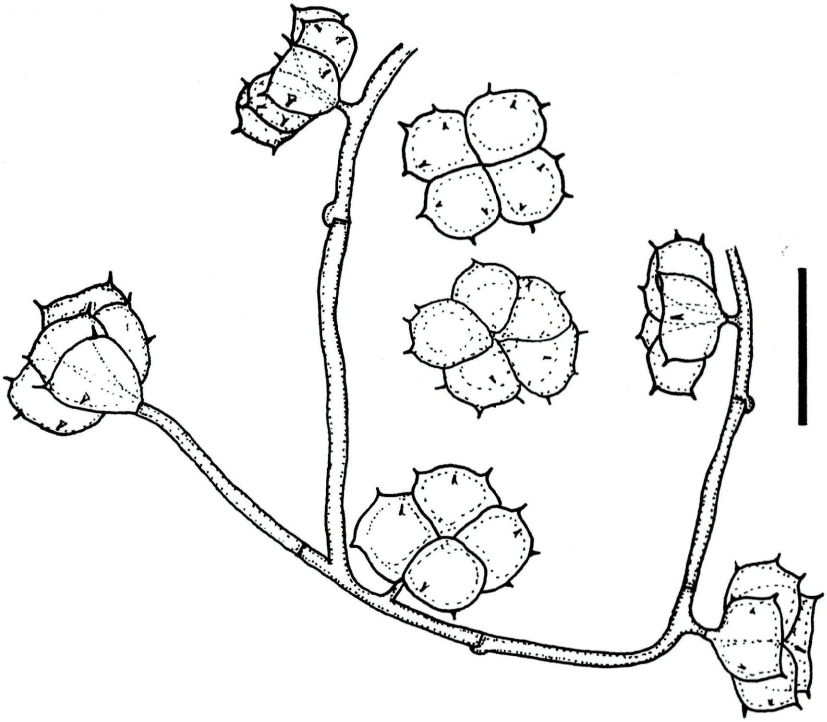


Fig. 11. – Line drawings of conidia arising from a conidiogenous cell on hyphae with clamp connections. – Bar 10 µm.

Other material examined. – THAILAND: Prachin Buri Province, Khao Yai National Park, stream at road marker km 29.2, dried material consisting of excised portion of test blocks (*Dipterocarpus alatus*) submerged for 9 months, 14 May 1998, S. Sivichai, (SS564 in BBH).

Discussion

Basidiomycete anamorphs are less well documented than their ascomycete counterparts, because they are generally less conspicuous and frequently overlooked (Kendrick & Watling, 1979). A number of basidiomycete conidia resemble *S. aquatica*: *Asterophora lycoperdoides* (Bull.) Ditm. : Fr. (anamorph of *Nyctalis asterophora* Fr.) with terminal or intercalary chlamydospores; *Glomopsis corni* Peck (no known teleomorph) with stauroconidia aggregated on a hyphal tip. *Nyctalis asterophora* chlamydospores are dark, thick-walled resting spores produced on the pileipellis and stipe and frequently replace the gills (Watling, 1979). These are features not shared by *S. aquatica*. In *Glomopsis corni*, the conidia have appendages, which Kendrick & Watling (1979) presume to be homologous with clamp-connections. In this species the conidial head is a fused structure and dispersed as a simple unit, while in *S. aquatica* the conidium is a single entity born on a hypha.

We cannot currently assign *Stauriella* to any order of the Basidiomycota as it has not been possible to sequence the DNA of this interesting species as the culture has died-out.

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References

Escobar, G. U., D. E. McCabe & C. W. Harpel. (1976). *Limnoperdon*, a floating gasteromycete isolated from marshes. – Mycologia 87: 874–880.

Goh, T. K. (1997). Tropical Freshwater Hyphomycetes. – In: Hyde, K. D. (ed.) Biodiversity of Tropical Microfungi, Hong Kong University Press: Hong Kong, pp.189–227.

—— & K. D. Hyde. (1996). Biodiversity of aquatic fungi. – Journal of Industrial Microbiology 17: 328–345.

Hyde, K. D., V. V. Sarma, & E. B. G. Jones (2000). Morphology and taxonomy of higher marine fungi. – In: Hyde, K. D. & S. B. Pointing (eds.) Marine Mycology: A Practical Approach, Fungal Diversity Research Series 1, Fungal Diversity Press, Hong Kong, pp. 172–204.

Kendrick, B. & R. Watling (1979). Mitospores in Basidiomycetes. – In: Kendrick, B. (ed.) The Whole Fungus. National Museum of Natural Sciences, Ottawa, Canada, Vol. 2, pp. 473–546.

Kurtzman, C. P. & J. W. Fell (1998). The yeasts: A Taxonomic study. – Fourth Edition, Netherlands Elsevier Science B. V. Press.

Sivichai, S. E. B. G. Jones & N. L. Hywel-Jones (2000). Fungal colonisation of wood in a freshwater stream at Khao Yai National Park, Thailand. – Fung. Divers. 5: 71–88.

Watling, R. (1979). The morphology, variation and ecological significance of anamorphs in the Agaricales. – In: Kendrick, B. (ed.) The Whole Fungus. National Museum of Natural Sciences, Ottawa, Canada, Vol. 2, pp. 453–472.

Webster, J. (1994). Anamorph-teleomorph relationships. – In: Bärlocher, F. (ed.) The Ecology of Aquatic Hyphomycetes. Springer-Verlag, Berlin, Heidelberg, pp. 99–117.

—— & E. Descals (1981). Morphology, distribution and ecology of conidial fungi in freshwater habitats. In: Cole, G. T. & B. Kendrick (eds.) Biology of Conidial Fungi, vol. 1. Academic Press, New York, pp. 295–355.

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