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New and rare lignicolous hyphomycetes from Zhejiang Province, China*

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Abstract: *Sporidesmiopsis zhejiangensis* sp. nov. and *Spadicoides americana* were found on submerged wood from streams in Zhejiang Province, China. *Sporidesmiopsis zhejiangensis* is characterized by obclavate to fusiform, 5-6-distoseptate, versicolorous, verruculose conidia with an apical mucilaginous sheath. *Spadicoides americana* is a new record to China. These taxa are described and illustrated, and morphological differences between these species and their similar species were summarized.

Key words: Freshwater fungi, *Sporidesmiopsis zhejiangensis*, *Spadicoides americana*, Taxonomy
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INTRODUCTION

Ascomycetes and their anamorphs occur on submerged wood in freshwater and serve to breakdown and recycle the components of wood (Vijaykrishna and Hyde, 2006; Vijaykrishna *et al*., 2006). In addition, several species of freshwater fungi have been found to produce a variety of enzymes (Yuen *et al*., 1999; Bucher *et al*., 2004; Simonis *et al*., 2008) and have anti-fungal activities (Ho *et al*., 2003). A number of studies on the diversity of freshwater fungi were conducted in temperate regions (Hyde and Goh, 1999; Raja and Shearer, 2006; Shearer *et al*., 2007), but recently there have been more studies in tropical and subtropical regions (Ho *et al*., 2001; Cai *et al*., 2003; Vijaykrishna and Hyde, 2006), including peat swamps (Pinnoi *et al*., 2006; Pinruan *et al*., 2007). In China, freshwater fungi have received less attention as compared to endophytic fungi and saprobic fungi in terrestrial environment (Liu *et al*., 2006; Wei and Dai, 2006; Cai and Hyde, 2007; Hu *et al*., 2007; Wei *et al*., 2007). In 2004, 121 species of freshwater ascomycetes and anamorphic fungi were reported in China (Luo *et al*., 2004a). Recent studies on freshwater fungi in Yunnan Province revealed numerous novel taxa and records for China (Cai *et al*., 2002; Luo *et al*., 2004b; Cai *et al*., 2006). However, freshwater fungi in this large geographical region are still undersampled.

With the need to establish freshwater fungi diversity and distribution data in China, we have conducted a survey of freshwater fungi on submerged woody material in Zhejiang Province. During our collection, two interesting freshwater hyphomycetes were found. *Sporidesmiopsis zhejiangensis* is proposed as a new species. In addition, the rare fungus *Spadicoides americana* Wang was recorded from China for the first time. Both taxa are, therefore, described and illustrated in this article.

MATERIALS AND METHODS

Samples were processed and examined following the methods described by Jiang *et al*.(2008). The specimens are deposited in Herbarium Mycologicum

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of Zhejiang University (HMZ), China. All microscopic measurements were conducted at their widest point from materials mounted in water. The range between minimum and maximum values for measurements is given.

RESULTS AND DISCUSSION

Sporidesmiopsis zhejiangensis **Wongsawas, H.K. Wang, K.D. Hyde & F.C. Lin, sp. nov. (Fig.1)**

Coloniae effusae, atrobrunnae vel nigrae, pilosae. Mycelium immersis vel superficialis, ex hyphis ramosis, septatis, verruculosis, 1.5~4 µm latis, brunnae compositum. Conidiophora mononematica, discreta, erecta vel flexuosa, atrobrunna usque nigra, verruculosa, crassitunucata, usque ad 460 µm longa, basi inflata usque ad 30 µm lata, apice 6~8 µm lata, usque ad 15-septata, in dimidio superiore infra septa ramose; crassitunucati, 1-septati, verruculosi, atrobrunnei, (17~25) µm×(6~8) µm. Cellulae conidiogenae integratae, apicales in axe principali et ramis, anguste doliiformae, post secessionem conidiorum apice truncatae, (10.5~16) µm×(6.5~8) µm. Conidia solitaria, obclavata vel fusiformia, leniter curvata, basi truncata, apice rotundata et muco globosa, 5-6-distoseptata, versicoloria, cellulis in medio atrobrunnneis, cellulis in extremis pallidioribus, verruculosa, (46~65) µm×(10.5~18) µm, basi 2~3 µm lata, apice 3~4 µm lata.

Colonies effuse, dark brown to black, hairy. Mycelium partly immersed and partly superficial, composed of branched, septate, verruculose, 1.5~4 µm wide, brown hyphae. Conidiophores mononematous, differentiated, erect, straight or flexuous, dark brown to black, verruculose, thick-walled, up to 460 µm tall, up to 30 µm wide at the swollen base, 6~8 µm wide at the apex, up to 15-septate; branched below septa in the upper half, without or rarely percurrent proliferations, thick-walled, 1-septate, verruculose, dark brown, (17~25) µm×(6~8) µm. Conidiogenous cells integrated, apical on main stipe and branching, narrowly doliiform, truncate at the apex after conidium secession, (10.5~16) µm×(6.5~8) µm. Conidia solitary, obclavate to fusiform, slightly curved, base truncate, apex rounded with a globose mucilaginous sheath, 5-6(7)-distoseptate, with dark brown central cells and paler polar cells, verruculose, (46~65) µm×(10.5~18) µm (average 57 µm×15 µm, *n*=30), 2~3 µm wide at base, 3~4 µm wide at apex.

Holotype: Submerged wood, Songyang County, Lishui City, Zhejiang Province, China; Oct. 24, 2007, No. HMZFW 00001.
Mycobank No.: MB 512233.
Teleomorph: Unknown.
Etymology: *zhejiangensis*, in reference to the province where the type was found.
Habitat: Saprobic on wood submerged in stream.
Distribution: China.

The genus *Sporidesmiopsis* Subram. and Bhat was established by Subramanian and Bhat (1987) and *S. malabarica* Subram. and Bhat is the type species. The genus is segregated from *Sporidesmium* Link ex Fries by the characteristics of the conidiophores

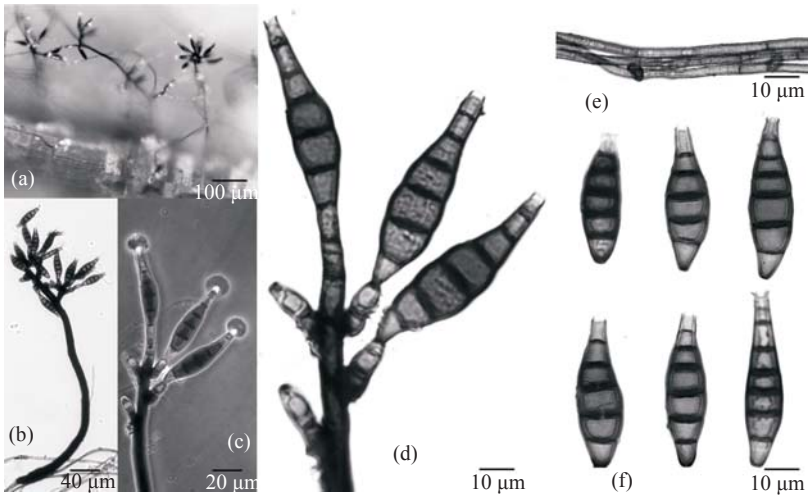

Fig.1 Light micrographs of *Sporidesmiopsis zhejiangensis*

(a) A portion of the colonies on submerged wood; (b) Conidiophore with conidia; (c) Conidia showing a globose mucilaginous sheath at the apex. Note under phrase contrast microscopy in (c); (d) Upper portion of conidiophore showing production of conidia. Note the verruculose conidia; (e) Verruculose hyphae; (f) Distoseptate conidia

which are mononematous with apical branches, and conidiogenous cells occur on both the stipe and branches. Bhat and Kendrick (1993) later published the second species, *S. goanensis* Bhat & Kendrick, and combined *S. malabarica* with *Brachysporiella dennisii* Crane and Dumont (Crane and Dumont, 1978; Mercado-Sierra, 1984) as *S. dennisii* (Crane and Dumont) Bhat, Kendrick and Nag Raj.

Sporidesmiopsis zhejiangensis accords well with the generic concept of *Sporidesmiopsis* in having macronematous conidiophores with branches at the apex and conidiogenous cells arising on both stipe and branches. This species most resembles *S. goanensis* in having distoseptate and similar shaped conidia. The conidia of *S. goanensis*, however, differ in the absent of apical mucilaginous sheaths, and have smooth walls and all cells have similar coloration. Moreover, *S. zhejiangensis* is distinguished in having rough-walled hyphae and conidiophores; the conidia have more septa (5~6 vs 3~5) and are larger [(46~65) μm×(10.5~18) μm vs (20~40) μm×(5~10) μm] (Bhat and Kendrick, 1993; Wu and Zhuang, 2005).

***Spadicoides americana* C.J.K. Wang, Mem. New York Bot. Gard. 28:222, 1976 (Fig.2)**

Colonies effuse, hairy, dark brown to black. Mycelium partly immersed, partly superficial on woody substratum, composed of pale to dark brown, septate, 1.5~4 μm wide, slightly branched hyphae. Conidiophores macronematous, mononematous, unbranched, solitary or in small groups, erect, straight or slightly flexuous, brown to dark brown, paler towards the apex, up to 416 μm long, up to 22 septate, rounded apex, 3~5 μm wide, 4~7 μm wide near the base. Conidiogenous cells polytretic (up to 10 pores (loci) in single conidiogenous cell), integrated, terminal and intercalary. Conidia solitary, cylindrical, rounded at both ends, with a small hilum at the base, with thick and dark band at the septa, predominately 2-septate, concolored, brown to dark brown, thick-walled, smooth, (10.5~14.5) μm×(4~6.5) μm (average 12.5 μm×5 μm, *n*=30).

Material examined: Submerged Wood, Stream at Nine Creeks, Hangzhou City, Zhejiang Province, China; Apr. 20, 2008, No. HMZFW 00002.

Teleomorph: Unknown.

Habitat: Lignicolous, saprobic on wood and submerged wood.

Distribution: USA, Hungary and China.

The genus *Spadicoides* S. Hughes with the type species *S. bina* (Corda) S. Hughes is characterized by polytretic, terminal or intercalary conidiogenous cells with several conidiogenous pores (Hughes, 1958). It has similar conidial ontogeny to the related genus *Diplococcium* Grove. However, *Spadicoides* produces solitary conidia on unbranched or branched conidiophores, whereas *Diplococcium* conidia are formed in short or long chains (Sinclair *et al*., 1985).

Morphological characteristics of the present fungus agree well with the description of *S. americana* (Wang, 1976; Holubova-Jechova, 1982; Goh and Hyde, 1996). *Spadicoides americana* has been previously reported from the North America (USA) (Wang, 1976) and Europe (Hungary) (Holubova-Jechova, 1982). This rare species has not been found in China (Teng, 1996; Zhuang, 2001; 2005) and our discovery has increased its distribution to include Asia.

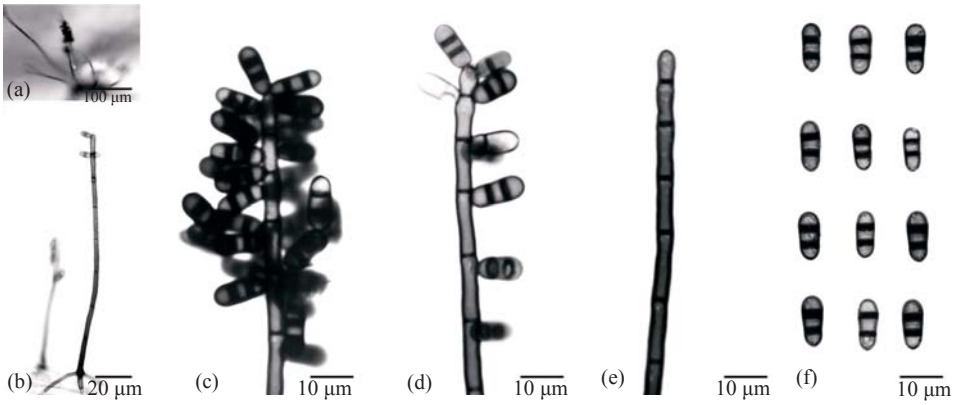

Fig.2 Light micrographs of *Spadicoides americana*

(a) A portion of the colonies on submerged wood; (b) A whole conidiophore; (c)~(d) Conidiophores with conidia; (e) A portion of conidiophore showing rounded apex. Note the conidiogenous pores (loci); (f) Conidia

CONCLUSION

Two lignicolous hyphomycetes were described in the present survey of freshwater fungi on submerged woody material in Zhejiang Province, China. Among them, *Sporidesmiopsis zhejiangensis* is new to science and *Spadicoides americana* is the new record to China.

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