



## Aquatic fungi from North Maharashtra-XI

Patil VR<sup>1\*</sup>, Patil SY<sup>2</sup> and Borse BD<sup>3</sup>

<sup>1</sup>S.V.S. Naik Arts, Comm. & Sci. College, Raver-425508, M.S., India.

<sup>2</sup>S.S.V.P. Sanstha's L.K. Dr. P.R. Ghogrey Science College, Dhule, M.S., India.

<sup>3</sup>N.S. Sanstha, Dhule's U.P. Arts & Science College, Dahivel, M.S., India.

**Received for publication:** September 11, 2014; **Accepted:** September 26, 2014.

**Abstract:** The present paper deals with six species of fungi encountered on submerged woody debris in freshwater habitats. Among them *Canalisporium pallidum* Goh *et al.*, and *Delortia palmicola* Pat. are new records for the fungi of India. *Canalisporium caribense* (Hol. Jech. & Mercado.) Nawawi and Kuthubudheen, *Dictyosporium digitatum* Chen *et al.*, *Sporoschisma saccadoi* Mason and Hughes, and *Sporoschisma uniseptatum* Bhat and Kendrick are being recorded for the first time from Maharashtra state. The data provides information on the distribution of these fungi in India, apart from their description and illustrations.

**Key Words:** Freshwater, Hyphomycetes, submerged wood

### Introduction

The "Submerged freshwater Hyphomycetes" is one of the ecological groups of freshwater mitosporic fungi, first addressed by Ingold (1975), represent a heterogeneous assemblage of fungi growing on submerged decaying plant materials. These fungi can be classified into two main types based on Park (1972), namely indwellers and immigrants. Species in several genera of freshwater mitosporic fungi like *Aquaphila*, *Camposporidium*, *Canalisporium* etc., can be classified as indwellers because they have been reported only from freshwater habitats. Whereas, species that belong to genera such as *Delortia*, *Dictyosporium*, *Sporochisma*, etc. can be classified as immigrants because they are reported from terrestrial as well as freshwater habitats. Goh and Tsui (2003) provide a key to some common genera of freshwater dematiaceous mitosporic fungi that have been reported from worldwide.

Recent biodiversity studies have revealed a number of undiscovered "Submerged freshwater Hyphomycetes" from different parts of the world (Su *et al.*, 2011; Yang *et al.*, 2012; Liu and Cai, 2013). The present paper deals with six species of fungi encountered on submerged woody debris in freshwater habitats. Among them *Canalisporium pallidum* Goh *et al.*, and *Delortia palmicola* Pat. are being recorded for the first time from India. *Canalisporium caribense* (Hol.Jech. & Mercado.) Nawawi and Kuthubudheen, *Dictyosporium digitatum* Chen

*et al.*, *Sporoschisma saccadoi* Mason and Hughes, and *Sporoschisma uniseptatum* Bhat and Kendrick are new addition to the fungi of Maharashtra state which are described and illustrated in the present paper.

### Materials and Methods

Samples of submerged woody debris were collected randomly during 2012-13 from different lentic and lotic habitats from North Maharashtra region. The samples were placed in plastic bags. On returning to the laboratory, samples were incubated in plastic boxes and kept moist by spraying with distilled water and periodically examined for presence of fungal growth. Permanent voucher slides of fungi were prepared according to the method "double cover glass" provided by Volkmann-Kohlmeyer and Kohlmeyer (1996). Identifications of isolated fungi were confirmed with the help of Nawawi & Kuthubudeen (1989), Goh, *et al.*, (1998), Goh and Hyde (1997), Chan *et al.*, (1991), Goh *et al.*, (1997), and Bhat and Kendrick (1993). Reports of fungi studied were confirmed with the help of Bilgrami *et al.*, (1991), Jamaluddin *et al.*, (2004) and relevant literature.

### Systematic account

**1) *Canalisporium caribense*** (Hol.Jech. & Mer.) Nawawi & Kuthubudeen  
*Mycotaxon*, **34**: 477 (1989).

*Sporodochia*: scattered, punctiform, pulvinate, granular, black, shining, up to 200 diam. *Mycelium*: mostly immersed in the

### \*Corresponding Author:

**Dr.V.R.Patil,**  
S.V.S. Naik Arts,  
Comm. & Sci. College,  
Raver-425508, M.S., India.

substratum, composed of irregularly branched, septate, smooth, subhyaline to pale brown to brown hyphae 1.5-2.5  $\mu\text{m}$  wide. *Stromata*: none or rudimentary consisting of irregularly branched, short, intertwined hyphae. *Conidiophores*: semi-macronematous to macronematous, mononematous, fasciculate, erect to ascending, unbranched to sparsely branched, hyaline to subhyaline, smooth up to 20  $\mu\text{m}$  long x 2-3.5  $\mu\text{m}$  wide. *Conidiogenous cells*: integrated, terminal, determinate, cylindrical, or swollen. *Conidial secession*: schizolytic. *Conidia*: acrogenous, solitary, flattened, one-cell thick, smooth, thick-walled, broadly ellipsoidal to obovoid in surface view, fusiform to obclavate in lateral view, muriform, with a single, slightly curved longitudinal septum and 3-6 straight transverse septa, slightly constricted at the septa, evenly brown to reddish dark brown, 28-41  $\mu\text{m}$  long x 21-28  $\mu\text{m}$  wide x 10-14  $\mu\text{m}$  thick. Basal cell is subhyaline to pale brown, cuneiform, with thin-wall, 5-5.5  $\mu\text{m}$  long, 3-3.5  $\mu\text{m}$  wide. Septa are becoming progressively darker with conidial maturity. The left and right cell lumen are connected by narrow canals, each surrounded by a marked ring of pigmentation, visible in surface view as a circular disc 2-2.5  $\mu\text{m}$  diam, barrel-shaped in side view. Canals are also present in the transverse septa, but only on one side of the conidium adjacent to the curved side of the longitudinal septum.

**Habitat:** On submerged wood; Panzara River (Latipada water reservoir, Pimpalner, Dist. Dhule), 15 August, 2012; Leg., B.D. Borse

**Distribution in India:** Karnataka: On submerged wood (Sridhar et al., 2010); Maharashtra: Present work.

**Remarks:** The present fungus is rare in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Canalisporium caribense* (Hol.Jech. & Mer.) Nawawi & Kuthubdeen (1989). Therefore, it is assigned to that species. It is an addition to the fungi of Maharashtra state.

**2) *Canalisporium pallidum*** Goh, Ho & Hyde *Can. J. Bot.*, **76**: 148 (1998).

*Sporodochia*: scattered, punctiform, granular, dark grey, up to 200  $\mu\text{m}$  diam. *Mycelium*: mostly immersed in the substratum, composed of branched, septate, subhyaline, 1.5-2.5  $\mu\text{m}$  wide, smooth hyphae. *Conidiophores*: macronematous or semi-macronematous, mononematous, fasciculate, simple or sparsely branched, smooth, hyaline

or subhyaline, up to 25  $\mu\text{m}$  long x 2-3  $\mu\text{m}$  wide. *Conidiogenous cells*: integrated, terminal, determinate, cylindrical and slightly vesiculate. *Conidial secession*: schizolytic. *Conidia*: 25-39  $\mu\text{m}$  long x 16-20  $\mu\text{m}$  wide x 8-10  $\mu\text{m}$  thick, acrogenous, solitary, one-cell thick and flattened, smooth, more or less ellipsoidal or obovoid in surface view, slightly curved, cylindrical or broadly clavate in lateral view, pale olivaceous or very pale olivaceous brown, muriform, mostly with a slightly curved column of vertical septa and 4-5 rows of transverse septa, occasionally one or two of the central rows of cells may have additional 1-2 vertical septa, septa unpigmented, thin and canals visible, basal cell cuneiform, 2.5-3.5  $\mu\text{m}$  wide, thin-walled. Canals are also present in the transverse septa, only those on the concave side of the conidium, those on the convex side are not perforated.

**Habitat:** On submerged wood; Kan River (Dahivel, Dist. Dhule), 26 January, 2013; Leg., B.D. Borse

**Distribution in India:** Maharashtra: Present work

**Remarks:** The present fungus is rare in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Canalisporium pallidum* Goh, Ho & Hyde (1998). Therefore, it is assigned to that species. It is an addition to the fungi of India.

**3) *Delortia palmicola*** Pat.

*Bull. De la Soc. Mycol. De France*, **4**: 7-46 (1888).

*Conidiomata*: sporodochial, tuberculiform, gelatinous and milky white when fresh, up to 1 cm diam. becoming much smaller, amber-coloured, hard and inconspicuous when dried, composed of hyaline, septate, branched hyphae embedded in a gelatinous matrix. *Conidiophores*: arise laterally as alternate or opposite branches of the vegetative hyphae near the surface of the sporodochium, multiseptate, hyaline thin-walled, determinate to indeterminate, 1.5-3  $\mu\text{m}$  wide, up to 100  $\mu\text{m}$  long, bearing terminal or lateral conidiogenous cells. *Conidiogenous cells*: intergrated, terminal or lateral, slightly inflated, clavate to ampulliform, 8-13 x 4-5  $\mu\text{m}$ , each producing a single conidium. *Conidia*: holoblastic, acrogenous, thin-walled, hyaline, surrounded by hyaline gelatinous sheath, (2-) 3 (-4) septate, 8-12  $\mu\text{m}$  wide, tightly coiled, U- or horseshoe-shaped, 15-22  $\mu\text{m}$  diam., the distal end rounded and the

proximal end somewhat towards a wide flat, thin-walled, basal scar ca. 1.5 µm diam.

**Habitat:** On submerged decaying parts of palms; Girna River (Kalwan, Dist Nashik), 13 May, 2013; Leg., B.D. Borse

**Distribution in India: Maharashtra:** On submerged wood (BDB, Unpublished).

**Remarks:** The present fungus is occasional in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Delortia palmicola* Pat. as provided by Goh and Hyde (1997). Therefore, it is assigned to that species. It is being reported for the first time from India.

**4) *Dictyosporium digitatum*** J.L. Chen, C.H. Hwang & Tzean

*Mycol. Res.*, **95**: 1146 (1991).

**Colonies:** on natural substratum consisting of effuse, septae, branched grayish blue to dark blue mycelium and abundant sporodochia.

**Sporodochia:** scattered or confluent, superficial or immersed in crevices, globose, subglobose, ellipsoidal, fusiform or irregularly shaped. **Conidiophores:** micronematous, simple or branched, smooth, hyaline or brown, often constricted at the septa. **Conidiogenous cells:** integrated, subglobose, doliiform, cuneiform, thin-walled, smooth, hyaline or brown, 4.2-10 µm long, 3.3-7.5 µm wide. **Conidia:** solitary, dry, holoblastic, chieroid, grayish orange to reddish golden or reddish brown, arm with (4)7-13(14) septa, septa usually constricted, cells 3-8.8 µm wide, terminal cell distinctly thin-walled, hyaline, digitate, straight or flexuous, incurved or even curved, total number of conidial cells (54) 57-88 (94).

**Habitat:** On submerged decaying wood; Yashawant lake (Toranmal, Dist. Nandurbar) 12 June, 2012; Leg., S.Y. Patil

**Distribution in India:** Karnataka: On submerged wood (Sudheep and Sridhar, 2011); Maharashtra: Present work

**Remarks:** The present fungus is occasional in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Dictyosporium digitatum* Chen et al., (1991). Therefore, it is assigned to that species. It is being reported for the first time from Maharashtra state.

**5) *Sporoschisma saccadoi*** E.W. Mason & S. Hughes

*Mycolo. Pap.*, **31**: 20 (1949).

= *Sphaeria hemipsila* Berk. & Br., *Fungi of Cylon*, Thwaites, Nr. 1098 (1875).

= *Lasiosphaeria hemipsila* (Berk. & Br.) Sacc., *Syl. Fung.*, **2**: 198 (1883).

= *Chaetosphaeria hemipsila* (Berk. & Br.) Petch, *Am. R. Bot. Gard., Peradenijia*, **6**: 336 (1917).

= *Chaetosphaeria coelestina* Hohn., *Akad. Der Wissens. In Wein*, **118**: 275-452 (1909).

**Colonies:** effuse, velutinous, composed of mixed tufts of conidiophores and strile capitate hyphae. **Mycelium:** immersed, composed of pale to dark brown hyphae 2.5-4 µm wide. **Capitate setae:** pale brown, becoming paler towards the apex, straight or slightly flexuous, 1-3-septate, 150-200 µm long and 5-6.5 µm wide below the terminal swelling which is 10-12 µm wide and subhyaline, arising from a bulbous stroma 45-60 µm diam. **Conidiophores:** solitary or rarely in groups of 2-3, also arising from stroma, often with one or two capitate hyphae, 250-270 µm long, 9-13 µm wide below and 17-21 µm wide above, venter up to 22 µm wide, dark brown, paler at the torn apex. **Conidia:** formed enteroblastically inside the tubular collarette of the conidiogenous cell and emerging in a 'false chain', doliiform, (-32)42-48 x (10-) 12.5-15 µm, 5-septate, often constricted at the septa, the four inner cells dark brown and the two end cells much paler, shorter and somewhat truncate, giving the appearance of constriction between successive conidia of a chain. Two central cells are 6.5-8 µm long, penultimate cells 6.5-9 µm long. Thus the four inner cells are of almost equal length, but penultimate ones are often slightly longer than the two central ones.

**Habitat:** On submerged wood; Tapi river (Bhusawal, Dist. Jalgaon); 15 August, 2013; Leg., V.R. Patil

**Distribution in India:** Karnataka: On submerged wood (Sridhar et al., 2010).

**Remarks:** The present fungus is occasional in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Sporoschisma saccadoi* Mason & Hughes as given by Goh et al., (1997). Therefore, it is assigned to that species. It is an addition to the fungi of Maharashtra state.

**6) *Sporoschisma uniseptatum*** Bhat & W.B. Kendrick

*Mycotaxon*, **49**: 71 (1993).

**Colonies:** effuse, black, velvety. **Capitate setae:** arising from the same stromat, erect,

flexuous, medium brown, smooth, up to 175 µm tall, 8-10 µm wide, up to 12.5 µm wide at the flared apex, 3-6-septate, regenerating precurrently 2-3 times. *Conidiophores*: mononematous, differentiated, erect, straight or flexuous, 140-205 µm tall, 10-12.5 µm wide, 1-2-septate, unbranched, thick-walled, dark brown, arising from dark brown stromata up to 65 µm across. *Conidiogenous cells*: phialids, up to 160 µm long, terminal, integrated, thick-walled, dark brown, consisting of a slightly swollen ventre up to 22 µm wide and a tubular collarette 70-80 x 12-16.5 µm. *Conidia*: basic-phialidic, cylindrical, truncate at both ends, 1-septate, very rarely 2-septate, thick-walled, verruculose, pale brown, 27-32 x 11-12.5 µm, often in slimy false chains of 10-15 conidia.

**Habitat:** On decaying twigs; Yashawant lake (Toranmal, Dist. Nandurbar) 12 June, 2012; Leg., B.D. Borse

**Distribution in India:** Karnataka: On submerged wood (Sudheep and Sridhar, 2011); Maharashtra: Present work

**Remarks:** The present fungus is occasional in occurrence. The descriptions and measurements of conidia and conidiophores are completely agreed with that of *Sporoschisma uniseptatum* Bhat & Kendrick (1993). Therefore, it is assigned to that species. It is being recorded for the first time from Maharashtra state.

### Acknowledgments

Authors are thankful to the Principal of S.V.S. Naik Arts, Comm. and Sci. college, Raver-425508; the Principal of S.S.V.P. Sanstha's L.K. Dr. P.R. Ghogrey Science College, Dhule, and Chairman, N.S. Sanshta, Dhule's U.P. Arts and Science college, Dahivel, Dist. Dhule, Maharashtra for providing laboratory and library facilities. We are thankful to Dr. Angel Aguirre-Sanchez and authorities of Smithsonian Tropical Research Institute, Washington, DC, USA for sending pdf files of rare research articles on aquatic fungi.

### References

- Bhat DJ, & Kendrick B, (1993) Twenty-five new conidial fungi from the Western Ghats and the Andaman Islands (India), *Mycotaxon*, 49: 19-90.
- Bilgrami KS, Jamaludeen S & Rizwi MA, (1991) "Fungi of India", Today and Tomorrow's Printers and Publishers, New Delhi, pp, 798.
- Chen JL, Hwang CH & Tzean SS (1991) *Dictyosporium digitatum*, a new Hyphomycete from Taiwan, *Mycol, Res*, 95: 1145-1149.
- Goh TK & Hyde KD (1997) *Delortia palmicola* and two new species from wood submerged in a freshwater streams in Australia, *Mycol, Res*, 101: 42-40.
- Goh TK, & Tsui CKM (2003), Key to common dematiaceous Hyphomycetes from freshwater, In: Freshwater Mycology (Eds, Tsui, C,K,M, & Hyde, K,D,), Fungal Diversity Press, Hong Kong, pp, 325-343.
- Goh TK, Ho WH, Hyde KD & Umali TE, (1997) New records and species of *Sporoschisma* and *Sporoschismopsis* from submerged wood in the tropics, *Mycol, Res*, 101: 1295-1307.
- Goh TK, Ho WH, Hyde KD, Whitton SR & Umali TE (1998) New records and species of *Canalisporium* (Hyphomycetes), with a revision of the genus, *Can, J, Bot*, 76: 142-152.
- Ingold CT (1975) *An illustrated guide to Aquatic and Water-borne Hyphomycetes (Fungi Imperfect) with notes on their Biology*, Freshwater Biological Association Scientific Publications, No, 30, pp, 1-96.
- Jamaludeen S, Goswami MG & Ojha BM, (2004) "Fungi of India (1989-2001)", Scientific Publishers (India), Jodhpur, pp, 308.
- Liu F & Cai L, (2013), A novel species of *Gliocladiopsis* from freshwater habitat in China, *Cryptogamie Mycologie*, 34: 233-241.
- Park D, (1972) On the ecology of heterotrophic Micro-organisms in freshwater, *Trans, Br, Mycol, Soc*, 58: 291-299,
- Sridhar KR, Karamchand KS & Hyde KD, (2010) Wood-inhabiting filamentous fungi in high-altitude streams of the Western Ghats by damp incubation and bubble chamber incubation, *Mycoscience*, 51: 104-115.

13. Su H, Hao Y, Liu S, Li Y, Cao Y, Chen M, Su X, & Yang X, (2011), *Dactylella qiluensis*, a new species of aquatic hyphomycete from China, *Cryptogamie Mycologie*, 32: 177-183.
14. Yang GZ, Lu KP, Yang Y, Ma LB, Qiao M, Zhang KQ & Yu ZF (2012), *Sympodioplanus yunnanensis*, a new aquatic species from submerged decaying leaves, *Mycotaxon*, 120: 287-290.
15. Sudheep NM & Sridhar KR (2011) Diversity of lignicolous and Ingoldian fungi on woody litter from the River Kali (Western Ghats, India), *Mycology*, 2: 98-108.
16. Volkmann-Kohlmeyer B, & Kohlmeyer J, (1996), How to prepare truly permanent microscopic slides, *Mycologist*, 10: 107-108.
17. Yang GZ, Lu KP, Yang Y, Ma LB, Qiao M, Zhang KQ & Yu ZF (2012), *Sympodioplanus yunnanensis*, a new aquatic species from submerged decaying leaves, *Mycotaxon*, 120: 287-290.

**Source of support:** Nil

**Conflict of interest:** None Declared