



Original Research Article

Aquatic fungi from North Maharashtra-X. Stream spora

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Received for publication: September 02, 2014; **Accepted:** September 26, 2014.

Abstract: The present paper deals with conidia of nine species of fungi encountered in foam samples from freshwater habitats. Among them *Diplocradiella tricladioides* Nawawi, *Filospora aquatica* Nawawi, *Scutisporus brunneus* Ando and Tubaki, *Iyengaria asymmetrica* Kuthub. and Nawawi are being recorded for the first time from India and *Brachydesmiella caudata* Rao and de Hoog, *Flabellospora octacladia* Saikia and Sarbhoy, *Flagellospora curvula* Ingold, *Magdalaenaea monogramma* Arnaud and *Phalangispora bharathensis* Prasad and Bhat are new reports for fungi of Maharashtra. The data provides information on the distribution of these fungi in India, apart from description and illustrations.

Key Words: Aquatic fungi, Conidia, Foam, Hyphomycetes, Maharashtra

Introduction

The fungi from freshwater habitats include a spectacular array of Mitosporic fungi characterized by their magnificent spore types. These fungi were practically, untouched until the pioneer work of Ingold (1942), who recognized them as 'Aquatic Hyphomycetes' because they complete their life-cycle including the vegetative growth, reproduction, conidia formation, release, and dispersal on submerged substrates in well aerated freshwater. However, their occurrence in wet land as well as root endophytes of riparian and terrestrial plants including grasses, mosses, ferns, conifers and Angiosperms has also been reported (Park, 1974; Dix and Webster, 1974; Sati and Belwal, 2005).

Nikolcheva and Barlocher (2004) observed that the increase in fungal biomass and sporulation associated with leaf litter in streams is positively correlated with decomposition rates. This indicates that fungi have a significant role in the dynamics of the coarse particulate organic matter, while bacteria assume a greater role in the decomposition of fine particulate and dissolved organic matter. Moreover, fungal growth results in an increase in the content of organic nitrogen in leaf litter (Kaushik and Hynes, 1971), and thus, makes leaves more palatable and nutritious for invertebrates (Barlocher, 1985). Hence, fungi act as trophic intermediates of energy flow between the

fallen leaves and higher trophic levels (Barlocher, 1985, 1992; Suberkropp, 2001).

Hence, knowledge of the geographical distribution pattern of freshwater fungi is important since freshwater habitats are declining at an alarming rate due to human activities and climatic changes. Perturbation of aquatic habitats can lead to loss of species, which may further lead to alteration of ecological processes and ecosystem function.

The present paper deals with conidia of nine species of fungi encountered in foam samples from freshwater habitats. Among them *Diplocradiella tricladioides*, *Filospora aquatica*, *Scutisporus brunneus* and *Iyengaria asymmetrica* are being recorded for the first time from India and *Brachydesmiella caudata*, *Flabellospora octacladia*, *Flagellospora curvula*, *Magdalaenaea monogramma* and *Phalangispora bharathensis* are new reports for fungi of Maharashtra.

Materials and Methods

Foam constitutes a natural trap for the conidia of aquatic Hyphomycetes. Foam samples were collected at morning and evening time from study sites. Samples were placed in cleaned wide mouthed plastic bottles and kept for 24 hours to enable the foam to dissolve. It was prepared by adding FAA to yield 5% foam solution. Then samples were brought to laboratory and scanned

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under low or high power of a microscope using 15 x eyepiece for the presence of conidia of freshwater Mitosporic fungi. Permanent voucher slides of fungi were prepared according to the double cover glass method' described by Volkmann-Kohlmeyer and Kohlmeyer (1996). Reports of fungi studied were confirmed with the help of Bilgrami et al., (1991), Sridhar et al., (1992), Jamaluddin et al., (2004) and relevant literature.

Systematic account

1) *Brachydesmiella caudata* Rao and de Hoog

Studies in Mycology, **28**: 5 (1986).

Conidia: limoniform, with 2 thick, black septa; apical cell subhyaline, verrucose at the middle, acicular, 19-23 µm long, 3.8µm wide at the base; medium cell smooth and rather thick-walled, evenly dark reddish brown, ellipsoidal, 27-35 x 15.2-22.8µm, basal cell subhyaline to pale brown, verruculose, cylindrical, slightly constricted near the middle, 11-19 µm long and up to 3.8 µm wide, truncate at the base, scar with marked peripheral thickening and pigmentation.

Habitat: Conidia in foam samples; Sitakhai stream (Toranmal), 19 Sept., 2012; Leg., B.D. Borse

Distribution in India: Karnataka: On rotten branch (Rao and de Hoog, 1986); Maharashtra: Present studies.

Remarks: The descriptions and measurements of conidia are completely agreed with that of *Brachydesmiella caudata* Rao and de Hoog (1986). Therefore, it is assigned to that species. It is being recorded for the first time from Maharashtra.

2) *Diplocladiella tricladioides* Nawawi

Mycotaxon, **24**: 217 (1985).

Conidia: obpyramidal, fuscous to dark grey, with sides of equal length, 20-23 µm, 8-celled; the main body consisting of 4 thick-walled cells, with a small truncate basal cell and 3 apical cells of the same size, each ending in a long, thin, hyaline, non-septate appendage, 38- 48 µm x 1-5 µm. The apical cells are bell-shaped and their walls are thickened half-way.

Habitat: Conidia in foam samples; Aner River (Tal.-Shirpur), 23 Sept., 2012; Leg., S.M. Pawara

Distribution in India: Maharashtra: Present studies.

Remarks: The descriptions and measurements of conidia are completely

agreed with that of *Diplocladiella tricladioides* Nawawi (1985). Therefore, it is assigned to that species. It is being reported for the first time from India.

3) *Filospora aquatica* Nawawi

Trans. Br. Mycol. Soc., **67**: 173 (1976).

Conidia: hyaline, filiform, straight or mostly curved, 6-12 septate, 178-245µm long, 4-5 µm at their broadest point and taper at the obtuse apex. Each cell of the conidium contains 2 or more guttules. Newly detached conidia have a truncate base but this eventually becomes cone-or teat-shaped.

Habitat: Conidia in foam shaped; Tapi River, Bhusawal, 2 Sept., 2012; Leg., R.S. Patil

Distribution in India: Maharashtra: Present studies.

Remarks: The descriptions and measurements of conidia are completely agreed with that of *Filospora aquatica* Nawawi (1976). Therefore, it is assigned to that species. It is being recorded for the first time from India.

4) *Flabellospora octacladia* Saikia and Sarbhoy

Indian Phytopathology, **33**: 459-461 (1980).

Conidia: stalked which terminates in a head or primordium. Primordium spherical, hyaline, 4.5-7.5 µm in diam. and is formed first in the process of formation of the conidia from which eight elegant arms arise equidistantly around it. Arms, 2-3 of which are often shorter than the rest, hyaline, 3-5 septate, measuring 18-54 µm long, 6-9 (-10.5) µm broad at the middle across, tapering to 2.1-2.8 µm at the apex.

Habitat: Conidia in foam samples; Amalibari stream (Tal. Akrani, Dist.-Nadurbar), 20 August, 2012; Leg., B.D. Borse

Distribution in India: Assam: on Plant litter (Saikia & Sarbhoy, 1980); Maharashtra: Present studies

Remarks: Saikia and Sarbhoy (1980) described this species from terrestrial habitats from Assam. The descriptions and measurements of conidia are completely agreed with that of *Flabellospora octacladia* Saikia & Sarbhoy (1980). Therefore, it is assigned to that species. It is being recorded for the first time from freshwater habitats in Maharashtra.

5) *Flagellospora curvula* Ingold

Trans. Br. Mycol. Soc., **25**: 404 (1942).

Conidia: curved or sigmoid, hyaline, unicellular, 100-150µm long, 2µm broad in

middle region tapering to 1.5µm towards its ends.

Habitat: Conidia in from samples; Girna River, (Tal. Kalwan, Dist. Nashik), 26 August, 2012; Leg. B.D. Borse

Distribution in India: Karnataka: On submerged leaves and conidia in foam samples (Sridhar and Kaveriappa, 1984b); Kerala: On submerged leaves, conidia in foam and in water samples (Sridhar and Kaveriappa, 1985a); Madhya Pradesh: On submerged leaves, twigs and conidia in foam samples (as *F. curvula* var. *minuta*, Agarwal et al., 1992); Maharashtra: Present studies.

Remarks: The present species is common on submerged leaves and conidia are found in foam samples. The descriptions and measurements of conidia are completely agreed with that of *Flagellospora curvula* Ingold (1942). Therefore, it is assigned to that species. It is being recorded for the first time from Maharashtra.

6) *Iyengaria asymmetrica* Kuthubutheen and Nawawi

Can. J. Bot., **70**: 102 (1992).

Conidia: Y-shaped with one arm of the Y slightly longer, basal cell broadly obconical, subhyaline to pale brown, 5.5-10 µm long, 5-6.5 µm in the widest part, surmounted by a conspicuously darkened and thick-walled, sub-basal cell 7-10 µm long, 6-9 µm wide, from which two septate arms 18-32 µm long arise. The longer arm of the Y is directed vertically upwards along the same axis as that of the basal and sub-basal cells. More arms then proliferate consecutively from the sub-basal cell giving the conidium an asymmetrical appearance. All arms are usually septate, pale brown to brown toward the base becoming subhyaline to hyaline and attenuated toward the tips. The overall length of the conidia along the vertical axis is 29-44 µm and all conidia are provided with a basal frill derived from the apices of the conidiogenous cells.

Habitat: Conidia in foam samples; Panzara River, Pimpalner (Dist. Dhule), 15 August, 2013; Leg. B.D. Borse

Distribution: Maharashtra: Present studies.

Remarks: The present fungus is rare in occurrence. The descriptions and measurements of conidia are completely agreed with that of *Iyengaria asymmetrica* Kuthubutheen and Nawawi (1992). Therefore, it is assigned to that species. It is being recorded for the first time from India.

7) *Magdalaenaea monogramma* G. Arnaud *Bull. Trimestr. Soc. France*, **68**: 209 (1952).

Conidia: typically multiradiate consisting of a main axis, 36-42 µm long and 2-3 µm wide, giving rise to a pair of opposite primary branches / arms, measuring 31.5-38.5 µm long, 2-3 µm wide near the base. Each of primary branches produces secondary lateral branch / arm again in the same manner to produce star shaped conidium with 4-5 arms. Arms are septate or without non septate.

Habitat: Conidia in foam samples; Kan River, Dahivel (Dist. Dhule), 9 August, 2013; Leg. B.D. Borse

Distribution in India: Uttarakhand: On submerged leaves and conidia in foam samples (Sati et al., 2002a); Maharashtra: Present studies.

Remarks: The present fungus is rare in occurrence. The descriptions and measurements of conidia are completely agreed with that of *Magdalaenaea monogramma* G. Arnaud (1952) as provided by Sati et al., (2002). Therefore, it is assigned to that species. It is being recorded for the first time from Maharashtra.

8) *Phalangispora bharathensis* Keshav Prasad and Bhat

Mycotaxon, **83**: 405 (2002).

Conidia: hyaline, smooth, aseptate, in 2-3-branched chains of 75-85 µm long, 2.5-4 µm wide, connected by narrow isthmi, uniseriate below, bi- to triseriate above, with branches arising from the third and forth cells of the main axis, of two types: apical and basal cells conical to obclavate, 7-9 x 2.5-3.5 µm; intermediate cells cylindrical with truncate ends, 8-10 x 2.5-4 µm; in mass initially whitish, latter becoming pale brown.

Habitat: Conidia in foam samples; Panzara River, Pimpalner (Dist. Dhule), 15 August, 2013; Leg. B.D. Borse

Distribution in India: Goa: On leaf litter in terrestrial habitats (Keshva Prasad and Bhat (2002)); Maharashtra: Present studies.

Remarks: Keshva Prasad and Bhat (2002) described the present species from leaf litter in terrestrial habitats. Conidia of this species are common in occurrence in foam samples in freshwater habitats. The descriptions and measurements of conidia are completely agreed with that of *Phalangispora bharathensis* Keshav Prasad and Bhat (2002). Therefore, it is assigned to that species. It is being recorded for the first time from Maharashtra.

9) *Scutisporus brunneus* Ando and Tubaki
Trans. Mycol. Soc. Japan, **26**: 151-160 (1985).

Conidia: dictyosporous, euseptate, subhyaline to pale brown, butterfly shaped, appendiculate, consisting of a cuneiform basal cell with truncate point of attachment and a main body of four cells each bearing a filiform appendage, basal cell 2-5 x 1-2 µm, main body 9-15 x 8-12 µm, appendages non-septate and up to 25 µm long.

Habitat: Conidia in foam samples; Aner River (Shirpur, Dist. Dhule), 25 August, 2013; Leg., C.M. Pawara

Distribution in India: Maharashtra: Present studies

Remarks: The present fungus is rare in occurrence. The descriptions and measurements of conidia are completely agreed with that of *Scutisporus brunneus* Ando and Tubaki (1985). Therefore, it is assigned to that species. It is being recorded for the first time from India.

Acknowledgments

Authors are thankful to Principal of S.V.S. Naik Arts, Comm. & Sci. college, Raver-525508; Principal, S.P.D.M. college, Shirpur, Dist. Dhule; Principal, Kisan college, Parola, Dist. Jalgaon; Principal of S. S. V. P. Sanstha's L. K. Dr. P. R. Ghogrey Science College, Dhule, and Chairman, Navodaya Shaikhanic Sanshtas, 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.

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Source of support: Nil

Conflict of interest: None Declared