



## Freshwater Fungi From Tapi District (Gujarat, India)–: Hyphomycetes

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## ABSTRACT

The article reports the occurrence of twelve Hyphomycetes species spread in eight genera viz, Anguillospora Ingold (1), Beltrania Penzig (1), Diplocladiella Arnaud (2), Flabellospora Alasoadura (3), Isthmotricladiella Matsushima (2), Lunulospora Ingold (1), Tetraploa Berkely and Broome (1) and Triscelophorus Ingold (1) from the foam samples collected from different streams in Tapi district of Gujarat state (India). All the taxa are being recorded for the first time from Gujarat state. The data provides information on the range of distribution of these fungi in India. Descriptions and illustrations are provided.

## KEYWORDS

Freshwater Hyphomycetes, Foam samples, Tapi River

## INTRODUCTION

Our knowledge on freshwater Hyphomycetes was mainly through the pioneering work of C.T. Ingold (1942) who termed them as "Aquatic Hyphomycetes". Later these fungi have also been described as "Freshwater Hyphomycetes" (Nilsson, 1964) and "Water-borne Hyphomycetes" (Webster and Descals, 1979). Webster and Descals (1981) termed these freshwater Hyphomycetes which bears tetraradiate or sigmoid conidia as "Ingoldian Hyphomycetes" in honour of Prof. C.T. Ingold. There are more than 500 named species of Hyphomycetes known from freshwater habitats all over the world. Most of them were recorded from temperate regions; information on tropical area is meagre. In India, the aquatic Hyphomycetes were studied by Bilgrami et al., (1991) and Jamaluddin et al., (2004). Report on freshwater Hyphomycetes from Gujarat state (India) was by only Ahire et al. (2009).

## MATERIALS AND METHODS

Approximately 10 ml of foam formed due to the fast flowing turbulent water at study area was collected in plastic bottles and kept for 24 hours to enable the foam to subside. It was fixed in FAA to yield 5 % foam solution at the collection spot or fixed in FAA taking 4 ml foam solution and 1 ml FAA. The samples were brought to the laboratory and examined under high power research microscope to detect the conidia.

## TAXONOMIC ACCOUNT

**Anguillospora longissima** (Wildeman) Ingold (Fig-1)

Trans. Br. Mycol. Soc., 25: 401 (1942).

**Conidia:** elongate, hyaline, 8-12-septate, sigmoid, with two curvatures in more than one plane, 210-250 x 4 µm, The Conidia of the present fungus often known to carry the remains of a separating cell as a basal frill.

**Habitat:** Conidia in foam samples, Purna river (near Songhad), 17 August.14; Leg., V.S. Patil

**Distribution in India:-** Maharashtra, Tamil Nadu, Uttarakhand, Karnataka, Kerala, Madhya Pradesh, Andhra Pradesh (Sridhar et al., 1992).

**Beltrania rhombica** Penzig. (Fig-2)

Nuovo G. Bot. Ital., 14: 72 (1882).

**Conidia:** biconic, Pale brown, with one (pseudo-) septum, smooth, 25-26 x 8-10µm with a hyaline, slender, pointed apical rostrum, 6-7 µm long and 1-2 µm wide.

**Habitat:** Conidia in foam samples, Gugalapani river, 16 August 14; Leg., V.S. Patil

**Distribution in India:-** Karnataka, Madhya Pradesh (Sridhar et al., 1992); Maharashtra: (Patil, 2000); Uttarakhand: (Arya and Sati, 2012).

**Diplocladiella longibrachiata** Nawawi & Kuthubutheen (Fig-3)

**In:** Santos-Flores & Betancourt-Lopez (1997) Aquatic and water-borne hyphomycetes (Deuteromycotina) in streams of Puerto Rico: Carribean J. Sci., Sp. Pub. No. 2, pp. 1-116.

**Conidia:** Y- or V- shaped, light brown, 8-celled, consisting of a 2-celled 30-37 µm long main axis and two divergent 25-38 x 10-12 µm, bilaterally symmetrical appendages, each with 2- oblique septa with two terminal 34-40 x 1.5-2 µm, hyaline non-septate projections. The basal cell of the axis is 8-10 x 3-4 µm.

**Habitat:** Conidia in foam samples, Kupermunda river, 18 August 14; Leg., V.S. Patil

**Distribution in India:-** Uttarakhand: (Belwal and Sati, 2007); Maharashtra: (Patil et al., 2012).

**Diplocladiella scalaroides** Arnaud (Fig-4)

Bull. trimest. Soc. Mycol. France, 69: 295 (1954).

**Conidia:** Y- or V-shaped, light-brown, 8-celled, consisting of a 2-celled, 30-40 µm long main axis and two divergent, 25-54 x 10-15µm, bilaterally symmetrical appendages, each with 2 oblique septa and with 2 terminal, 35-90 x 1.5-2-5 µm, hyaline, non-septate projections. The basal cell of the axis is 7-11 x 3-5 µm and lighter in colour.

**Habitat:** Conidia in foam samples, Kupermunda river, 18 August 14; Leg., V.S. Patil

**Distribution in India:-** Andhra Pradesh, Karnataka (Sridhar et al., 1992); Maharashtra: (Borse and Patil, 2007).

***Flabellospora acuminata*** Descals & Webster (Fig-5)

Trans. Br. Mycol. Soc., 78: 411 (1982).

**Conidia:** acrogenous, main body clavate, apex capitate, 4-6 µm diameter, base pendunculate, 5-10µm long, branches 4-7 synchronomous, 40-100 X 7-15 µm, one branch apical, the rest radiating, slightly retrorsely straight, fusiform, apex greatly extended, cells 3-10.

**Habitat:** Conidia in foam samples, Tapi river, 17 August14; Leg., V.S. Patil

**Distribution in India:-** Uttarakhand: (Belwal and Sati, 2007); Maharashtra: (Pawara et al., 2009).

***Flabellospora multiradiata*** Nawawi (Fig-6)

Trans. Br. Mycol. Soc., 66: 543 (1976).

**Conidia:** consist of a short obpyriform main axis, 9-13 µm long and 2-3 µm wide at the base, expanding above to form a globose structure 4-7 µm diameter. Arms are typically 9 to 20 in number, 90-40 µm long, 10-18 septate.

**Habitat:** Conidia in foam samples, Ambica river, 19 August 14 ; Leg., V.S. Patil

**Distribution in India:-** Karnataka, Kerala, Maharashtra (Sridhar et al., 1992).

***Flabellospora verticillata*** Alasoadura (Fig-7)

Nova Hedwigia, 15: 419 (1968).

**Conidia:** multi-radiate, consisting of a main axis and 5 to 10 radiating arms. Main axis 14-30 X 1.5-22 µm, septate, with terminal cell obclavate, each arm 8- 14 septate, 50- 90 X 4.5-5µm.

**Habitat:** Conidia in foam samples, Tapi river, 17 August14; Leg., V.S. Patil

**Distribution in India:-** Maharashtra, Uttarakhand, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh (Sridhar et al., 1992).

***Isthmotricladia gombakiensis*** Nawawi (Fig-8)

Trans. Br. Mycol. Soc., 64: 243 (1975).

**Conidia:** The mature conidia are 4 to 6-radiate consisting of a main axis, 20-27 µm long, 2-3 µm wide at the top, tapering to 1.5-2 µm at the base. The arms are fusiform, 74-102 µm long, 4-5.5 µm at the widest point, 9-15 septate, tapering gradually to 1-1.5 µm at the apex, and slightly constricted at the septa. The arms are connected to the axis by a narrow isthmus, 2-4.5 µm long, 1-1.5 µm wide.

**Habitat:** Conidia in foam samples, Doswada dam, 16 August14; Leg., V.S. Patil

**Distribution in India:-** Karnataka, Andhra Pradesh (Sridhar et al., 1992); Maharashtra: (Borse and Patil, 2006).

***Isthmotricladia laeensis*** Matsushima (Fig-9)

Bull. Nat. Sci. Mus. Tokyo, 14: 479 (1971)

**Conidia:** scopiform, hyaline with a narrow - clavate stalk. Stalk 14-20 µm in length, branches 3, with obconic bases, 35-52 µm long. Basal branching of the arm initial is arising from the stalk cell.

**Habitat:** Conidia in foam samples, Doswada dam, 16 August14; Leg., V.S. Patil

**Distribution in India:-** Karnataka: (Sridhar and Kaveriappa, 1982); Maharashtra: (Borse and Patil, 2007).

***Lunulospora curvula*** Ingold (Fig-10)

Trans. Br. Mycol. Soc., 25: 409 (1942).

**Conidia:** Aleuriospore unicellular, sigmoid or crescent-shaped, 70-90 µm long, 4-5 µm broad in its middle region, tapering to 1.5 µm at its ends, with a row of conspicuous vacuoles, attached at a point along its convex surface to the stalk cell. Aleuriospore liberated by the breakdown of the stalk cell. Liberated spore with an inconspicuous hilum where it was originally attached to the stalk cell.

**Habitat:** Conidia in foam sample, Tapi river, 17 August14 ; Leg., V.S. Patil

**Distribution in India:-** Tamil Nadu, Uttarakhand, Karnataka, Kerala, Andhra Pradesh, Madhya Pradesh (Sridhar et al., 1992).

***Tetraploa aristata*** Berk. & Br., (Fig-11)

Ann. Mag. Nat. Hist., 2, 5: 459 (1850)

**Conidia:** mostly with 4 cells to each column, 25-40 x 14-30 µm, with septate appendages 12-80 µm long, 5-8 µm thick at the base, 2-4 µm at the apex. Sometimes a second type of conidium is formed with 2 cells to each column, 8-18 x 7-12 µm, with appendages 90-320 µm long, 3-6 µm thick at the base and 1-2 µm at the apex.

**Habitat:** Conidia in foam samples, Kupermunda river, 18 August 14; Leg., V.S. Patil

**Distribution in India:-** Andhra Pradesh, Karnataka (Sridhar et al., 1992); Maharashtra: (Patil, 2003); Madhya Pradesh: (Upadhyaya et al., 2012); Tamil Nadu: (Udaiyan and Manian, 1991).

***Triscelophorus monosporus*** Ingold (Fig-12)

Trans. Br. Mycol. Soc., 26: 148 (1943).

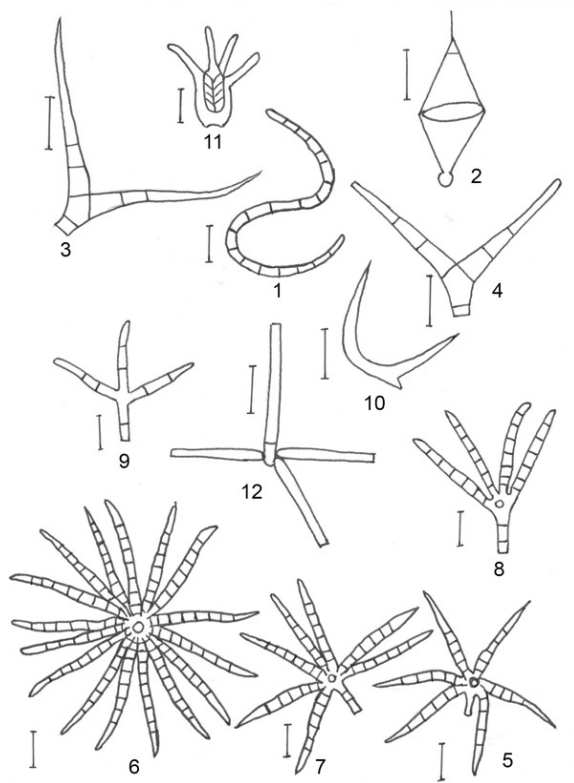
**Conidia:** tetraradiate, hyaline, with a main axis and 3 lateral branches. Main axis is with a septum just above the point of origin, 40-60 µm long, 4-5 µm wide above the base and tapering to 1-5 µm at the apex. Lateral branches arising in a whorl below the septum on the main axis, 30-40 µm long, constricted at the point of attachment.

**Habitat:** Conidia in foam sample, Tapi river, 17 August14; Leg., V.S. Patil

**Distribution in India:-** Uttarakhand, Maharashtra, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Madhya Pradesh (Sridhar et al., 1992).

**DISCUSSION**

Fungi are an important component of biodiversity. In aquatic environment the planktonic taxa is an integral part of food chain. They play an important role in freshwater food webs as organic matter decomposers and contributors to nutrient cycling, as symbionts with plants. Aquatic fungi are important for industrial and pharmaceutical use.

(Scale = 20  $\mu$ m)(Scale = 20  $\mu$ m)

*Anguillospora longissima* (Wildeman) Ingold.  
*Beltrania rhombica* Penzig.  
*Diplocladiella longibrachiata* Nawawi & Kuthubutheen  
*Diplocladiella scalaroides* Arnaud.  
*Flabellospora acuminata* Descals & Webster  
*Flabellospora multiradiata* Nawawi.  
*Flabellospora verticillata* Alasoadura.  
*Isthmotricladia gombakiensis* Nawawi.  
*Isthmotricladia laeensis* Matsushima.  
*Lunulospora curvula* Ingold.  
*Tetraploa aristata* Berk. & Br.  
*Triscelophorus monosporus* Ingold

#### ACKNOWLEDGMENTS

The authors 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. V.S.P is grateful to Prin. Dr. D.A. Patil and Mrs. Dr. Sandhya S. Patil (Head, P.G. Dept. of Botany), S.S.V.P. Sanstha's L.K. Dr. P. R. Ghogrey Science College, Dhule, Maharashtra for providing laboratory facilities.

#### REFERENCES

- Ahire, P.K., Borse, B.D. & Patil, S.Y. (2009) Aquatic fungi from Dang District of Gujarat - I. In: Biodiversity, Sustainable Development and Human Welfare, (Eds. Nandan et al.), Pub. SSVPS's, Sci. College, Dhule, (M.S.), pp. 278-283. | Arya, P. & Sati, S.C. (2012) Estimation of conidial concentration of freshwater Hyphomycetes in two streams flowing at different of Kumaun Himalaya. *J. Ecol. & Nat. Environ.*, 4: 29-32. | Belwal, M. & Sati, S.C. (2007) Ingodian fungi: New additions to Indian aquatic mycoflora. *J. Mycol. Pl. Pathol.*, 37: 11-14. | Bilgrami, K.S., Jamaludeen, S. & Rizwi, M.A. (1991) "Fungi of India", Today and Tomorrow's Printers and Publishers, New Delhi, pp. 798. | Borse B.D. & Patil R.S. (2007) Aquatic fungi from North Maharashtra-I. | *Bioinfolet*, 4: 101-104. | Borse B.D. & Patil S.Y. (2006) Aquatic fungi from North Maharashtra-IV. *J. Adv. Sci. & Tech.*, 9: 91-95. | Jamaluddin, S., Goswami, M. G. & Ojha, B. M. (2004) Fungi of India (1989-2001), Scientific Publishers (India) Jodhpur, pp. 308. | Ingold, C.T. (1942) Aquatic Hyphomycetes of decaying alder leaves. *Trans. Br. Mycol. Soc.*, 25: 339-417. | Nilsson, S. (1964) Freshwater Hyphomycetes: Taxonomy, morphology and ecology. *Symb. Bot. Ups.*, 18: 1-130. | Patil, N.N. (2000) Occurrence of aquatic conidial fungi on *Mecycylon umbelatum* Burm. In: *Plant Resource Development*, Pub. Dept. of Botany, Dr. B.A.M. University, Aurangabad, M.S., India. pp. 83-85. | Patil, S.Y., Wagh, D.D. & Borse B.D. (2012) Hyphomycetes from north Maharashtra. *Current Botany*, 3: 23-25. | Pawara, C.M., Patil, S.Y., Ahire, P.K. & Borse, B.D. (2009) Aquatic fungi from North Maharashtra - V. In: *Biodiversity, Sustainable Development and Human Welfare*, (Eds. Nandan et al.), Pub. SSVPS's, Sci. College, Dhule, (M.S.), pp. 411-415. | Sridhar, K.R. & Kaveriappa, K.M. (1982) Aquatic fungi of the Western Ghat forest in Karnataka. *Indian Phytopath.*, 35: 293-296. | Sridhar, K.R., Chandrashekar, K.R. & Kaveriappa, K.M. (1992) Research on the Indian Subcontinent. In: *The Ecology of Aquatic Hyphomycetes* (ed. Balocher, F.), Spinger\_Verlag, Berlin, pp. 182-211. | Udaiyan, K. & Manian, S. (1991) Fungi colonizing wood in the Cooling tower water system at the Madras fertilizer company, Madras, India. *Intern. Biodeteri. Bull.*, 27: 351-371. | Webster, J. & Descals, E. (1979) The teleomorphs of water-borne Hyphomycetes from fresh water. In: *The Whole Fungus* (ed. Kendrick, W.B.), National Museum of Natural Sciences, Ottawa, Canada, pp. 419-451. | Webster, J. & Descals, E. (1981) Morphology, distribution, and ecology of conidial fungi in freshwater habitats. In: *Biology of conidial fungi* (eds. Cole, G.C. and Kendrick, B.), Academic Press, London, pp. 295-355. |