International Journal of Advanced Research and Development
ISSN: 2455-4030
Impact Factor: RJIF 5.24
www.advancedjournal.com
Volume 2; Issue 5; September 2017; Page No. 469-473

Biodiversity of Freshwater Mitosporic fungi from Thane Dist., Maharashtra (India) - II

[*1] SA Gosavi, [2] BD Borse
[1] Sathaye (Parle) College, Vile-Parle (East), Mumbai, Maharashtra, India
[2] U.P. Arts & Science College, Dahiwel, Dhule, Maharashtra, India

Abstract
The present paper deals with eight species of freshwater Hyphomycetes: *Flabellospora acuminata, F. amphibia, F. multiradiata, F. verticillata, Flagellospora curvula, Isthmotricladia gombakiensis, I. laeensis* and *Jaculispora submersa* recorded for the first time from Thane district of Maharashtra, India. These taxa were encountered in foam sample from lotic habitats of Thane districts. The data provides information on the distribution of these fungi in Maharashtra, apart from their description and illustrations.

Keywords: biodiversity, mitosporic fungi, foam samples

1. Introduction
Among the freshwater mitosporic fungi, the Ingodian Hyphomycetes have received more attention from researchers in Mycology. Species in this group have been well investigated in temperate regions such as Canada, UK, France, Germany, Hungary, Italy, Pakistan, Switzerland and USA (Abdullah *et al*. 2005) [2]. Study in semi-tropical and tropical regions began about 20 years ago and about 280 species of freshwater Hyphomycetes have been recorded in this region (Goh and Hyde, 1996a) [15].
Knowledge of freshwater Hyphomycetes is phragmentary, but studies have been reported in various countries- Schoenlein-Crusius and Grandi (2003) compiled data of 90 species of freshwater Hyphomycetes for South America, including Argentina, Brazil, Chile, Ecuador, Peru and Venezuela. Malaysia, India (Bhat *et al*. 2009; Manoharachary, 2008) [5, 24]; Egypt (Abdel-Raheem, 2004) [1]; Pakistan (Arshad and Bareen-e-Firdaus, 2009) [4]; China (Hu *et al*. 2013; Zhao *et al*. 2007, 2012; Zhul *et al*. 2016) [16, 32, 33, 34].

2. Materials and Methods
Foam samples were collected from lotic habitats of Thane district at morning and evening times. Sample were placed in clean plastic bottles and kept for 24 hours to enable the foam to dissove. It was preserve by adding FAA. Then samples were returned to the laboratory and observed under research microscope for the presence of conidia of Hyphomycetes. The permanent slides were prepared as suggested by Volkmann-Kohlmeyer and Kohlmeyer (1996) [30]. Identification of freshwater Ingoldian fungi were confirmed with the help of monographic literature such as, Ingold (1975) [19], Carmichael *et al*. (1980) [12], Webster and Descals (1981) [31], Cai *et al*. (2003, 2006) [11, 10], Marvanova and Descals (2011) [25], Marvanová and Laichmanová (2014) [26]. Reports of fungi from India and Maharashtra were confirmed with the help of Kamat *et al*. (1971) [22], Bhide *et al*. (1987) [6], Mahabale (1987) [23], Bilgrami *et al*. (1981, 1991) [7, 8], Jamaluddin *et al*. (2004), Borse *et al*. (2017) [9] and other relevant literature.

3. Taxonomic account
1) *Flabellospora acuminata* Descals
Trans. Br. Mycol. Soc., 78- 411 (1982
Conidia are staurosporous, main body clavate, apex capitate, 4-6 µm diam, base pedunculate, 5-10 µm long, branches 4-7, budding out before relese, synchronous, 75-120 x 7-12 µm, one branch apical, the rest raditing slightly extrorsely, straight, fusiform (obclavate), apex greatly extended, cells 3-10, released as a strangulation at the base, dispersed singly or as interlocked pairs.

Material examined
Conidia in foam samples, Tansa dam on Tansa river (at Shahapur); S. A. Gosavi 1150 (PGDB); 29 Sept., 2013.

Distribution in India
Uttarakhand, Maharashtra, Madhya Predesh and Gujarat (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *F. acuminata* (Descals and Webster, 1982) [14]. Therefore, it is assigned to that species. It is being reported for the first time from the study area.

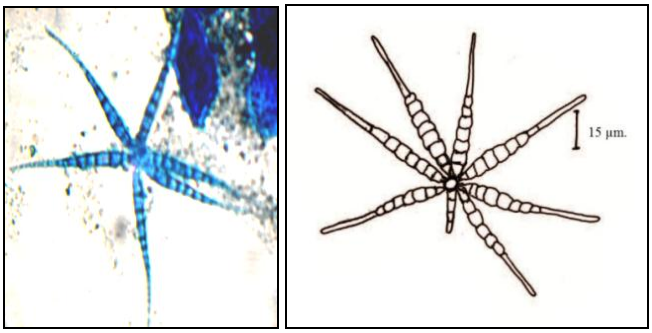

Fig 1

2) *Flabellospora amphibia* (Price & Talbot) Descals
In- Descals and Webster, *Trans. Br. Mycol. Soc*., 78- 414 (1982) [14];

Conidia are staurosporous, septa often indistinct, main body sinous, delicate, obconical, apex capitate to obconical, 5-7.5 µm diam, base pedunculate, 6-14 µm long, cells 1-2, branches (4)-5-(6) budding out before relese, one branch apical, the rest radiating antrorsely, straight or slightly curved, irregularly fusiform, 70-100 x 6-8 µm, multicellular, hyline, vacuolated.

Material examined
Conidia in foam samples, Surya river (at Maswan); S. A. Gosavi 1151 (PGDB); 29 Sept., 2013.

Distribution in India
Maharashtra- In foam samples (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions of conidia are agreed with that of *F. amphibia* (In- Descals and Webster, 1980) [13]. Hence, it is assigned to that species. It is being reported for the first time from Thane district.

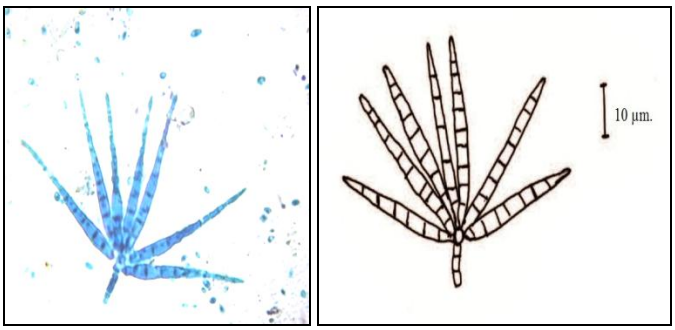

Fig 2

3) *Flabellospora multiradiata* Nawawi
Trans. Br. Mycol. Soc., **66-** 543 (1976a) [29].
Conidia are hyaline, multi-radiate, main axis 9-13 µm long x 2-3 µm at the base, expanding above to form a globose structure 4-6.5 µm diam., from around this, which is usually demarcated from the narrow stalk by a septum, 12-25 µm long, slender, fusiform arms arise, each arm is markedly constricted at its point of origin and thereafter broadens to 1.5-2 µm at the widest point and finally tapers to 1.5-2 µm at the apex which is acute to accumulate and lacks septation in the parts 12-20 µm from the tip, the arms are 90-140 µm long, 10-18-septate and slightly constricted at the septa especially along the basal half, at maturity the cells become vacuolated and impart a pearly appearance to the whole conidia, conidia in foam samples usually have a blob of mucilaginous material at the tip of each arm.

Material examined
Conidia in foam samples, Ulhas river (at Badlapur); S. A. Gosavi 1152 (PGDB); 21 July 2013.

Distribution in India
Karnataka, Kerala, Maharashtra, Madhya Pradesh and Gujarat (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *F. multiradiata* (Nawawi, 1976a) [29]. Therefore, it is assigned to that species. It is being collected for the first time from Thane district.

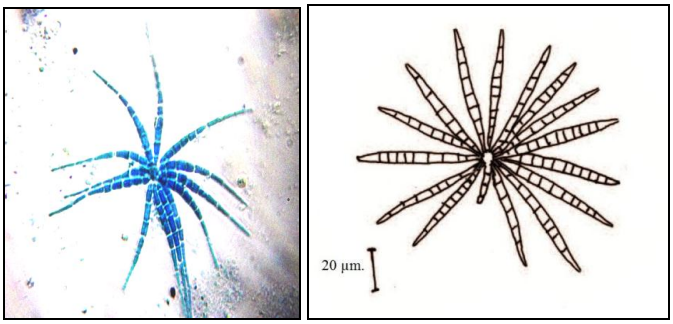

Fig 3

4) *Flabellospora verticillata* Alasoadura
Nova Hedwigia, **15-** 419 (1968b) [3].
Conidia are consist of a main axis 15-35 µm long, 2-3 µm wide with a terminal spherical or sub-spherical portion 2-3.5 µm across; and a variable number of arms, each 75-125 µm long, about 1.5 µm at the attachment constriction, 4-6 µm at the widest part and tapering to about 2 µm at the tip. The arms arise from the dome-shaped apex but also from round the side of the apical cell. In a few detached conidia, the arms were restricted to the anterior part of the sub-spherical tip of the main axis.

Material examined
Conidia in foam samples, Vaitarna river (at Khodala); S. A. Gosavi 1153 (PGDB); 20 Aug., 2012.

Distribution in India
Maharashtra, Uttarakhand, Karnataka, Kerala, Tamil Nadu, Andhra Predesh, Madhya Pradesh and Gujarat (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with

that of *F. verticillata* (Alasoadura, 1968b) [3]. Hence, it is assigned to that species. It is being reported for the first time from the study area.

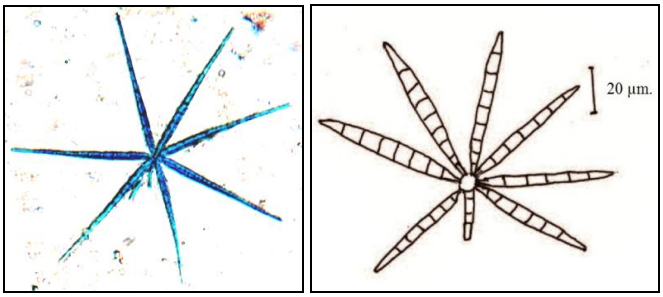

Fig 4

5) *Flagellospora curvula* Ingold
Trans. Br. Mycol. Soc., **25-** 404 (1942) [18].
Conidia are curved or sigmoid, hyaline, unicellular, 100-150 µm long, 2 µm broad in middle region tapering to 1.5 µm towards its ends.

Material examined
On submerged leaves and conidia in foam samples, Bhatsa river (at Atgaon); S. A. Gosavi 1154 (PGDB); 29 Sept., 2013.

Distribution in India
Karnataka, Kerala, Madhya Pradesh (as *F. curvula* var. *minuta*,) and Maharashtra (Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *F. curvla* Ingold (1942) [18]. Therefore, it is assigned to that species. It is being reported for the first time from Thane district.

Fig 5

6) *Isthmotricladia gombakiensis* Nawawi
Trans. Br. Mycol. Soc., **64-** 243 (1975).
Conidia are 4-6-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, 74-100 µm long, 4-6 µm at the widest point, 10-15-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, and 1-1.5 µm wide.

Material examined
Conidia in foam samples, Vaitarna river (at Wada); S. A. Gosavi 1155 (PGDB); 28 July 2013.

Distribution in India
Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh and Gujarat (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *I. gombakiensis* (Nawawi, 1975a) [28]. Hence, it is assigned to that species. It is being reported for the first time from the Thane district.

Fig 6

7) *Isthmotricladia laeensis* Matsush.
Bull. Nat. Sci. Mus. Tokyo, **14-** 479 (1971a) [27].
Conidia are tetra-radiate consisting of a main axis 15-19 µm long, 1.8-2 µm wide at the top, tapering at the base, 0-1-septate. The arms are cylindrical, 40-52 x 2.4-3.2 µm, 3-septate. The arms are connected to the axis by a narrow isthmus. (Main axis- 14-20 x 1.5-2 µm, 0-1-septate. *Arms* are three to four, 35-50 x 2-3 µm, 3-4-septate.

Material examined
Conidia in foam samples, Tansa river (at Vajreshwari); S. A. Gosavi 1156 (PGDB); 22 Sept., 2013.

Distribution in India
Karnataka, Maharashtra and Gujarat (Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *I. laeensis* (Marsushima, 1971a) [27]. Therefore, it is assigned to that species. It is being reported for the first time from the Thane district.

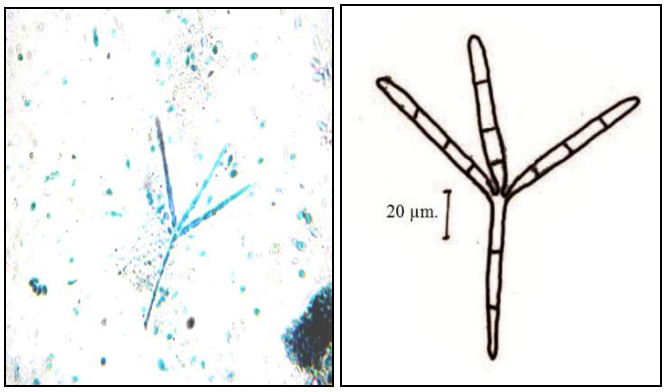

Fig 7

8) *Jaculispora submersa* H.J. Hudson & Ingold
Trans. Br. Mycol. Soc., 43- 475 (1960) [17].
Conidiua are hyaline, unicellular, main axis straight, 35-55 µm long with truncate base, 3-3.5 µm wide at the base increasing to 5-7 µm wide at the distance of about 25-35 µm from the base, apex ending in a fine point, making the conidia appear dart-shaped except for three lateral appendages. *Appendages* are three, hair-like, equally spaced around the circumference, arise at a level just beyond half way between the base and apex, 10-24 µm long and 0.5-1 µm wide.

Material examined
Conidia in foam samples, Surya river (at Safale); S. A. Gosavi 1157 (PGDB); 29 Oct., 2013.

Distribution in India
Andhra Pradesh, Uttarakhand, Karnataka and Maharashtra (Source: Borse *et al*. 2017) [9].

Remarks
The descriptions and measurements of conidia are agreed with that of *J. submersa* (Hudson and Ingold, 1960) [17]. Hence, it is assigned to that species. It is being reported for the first time from Maharashtra.

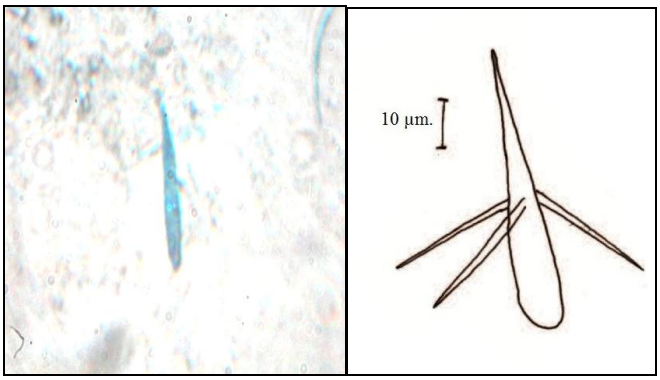

Fig 7

4. Acknowledgement
Authors are thankful to the management of N.S. Sanstha Dhule, Maharashtra; Principal of Sathaye College, Vile Parle (East), Mumbai and Dr. Mrs. Kavita Rage for providing necessary laboratory facilities.

5. References
1. Abdel-Raheem AM. Study of the effect of different techniques on diversity of freshwater Hyphomycetes in the River Nile (Upper Egypt). *Mycopath*. 2004; 157:59-72.
2. Abdullah SK, Gene J, Guarro J. A synopsis of the aero-aquatic genus *Pseudaegerita* and description of two new species. Mycol. Res. 2005; 109:490-594.
3. Alasoadura SO. *Flabellospora verticillata*, a new species of aquatic Hyphomycetes from Nigeria. *Nova Hedwigia*. 1968b; 15:419-421.
4. Arshad M, Bareen-e-Firdaus. Ecological studies of aquatic Hyphomycetes in a canal and its connecting irrigation channels. Bio. Di. Con. 2009; 3:99-106.
5. Bhat DJ, Pratibha J, Gawas P, Sarita KY, Swapnaja D. Diversity of microfungi in the forest of Western Ghats in Goa and surrounding regions. In- *Plant*, fungal biodiversity and bioprospeting, (eds. Krishnan, S. & Bhat, D.J.), Broadway Book Centre Publishers and Distributors, Pangim, Goa. 2009; 117-133.
6. Bhide VP, Pande, Alka, Sathe AV, Rao VG, Patwardhan PG. Fungi of Maharashtra, (Sup-I), Agharkar Res. Institute (MACS) Publication, Pune, Maharashtra. 1987, 1-146.
7. Bilgrami KS, Jamaluddin S, Rizwi MA. Fungi of India. Part-II. Today and Tomorrows Print and Pub., New Delhi. 1981, 1-268.
8. Bilgrami KS, Jamaludeen S, Rizwi MA. Fungi of India, Today and Tomorrow's Printers and Publishers, New Delhi. 1991, 798.
9. Borse BD, Borse KN, Patil SY, Pawara CM, Nemade LC, Patil VR. Freshwater Higher Fungi of India, Lulu publishers, USA and Laxmi Pub., Solapur, India. 2017, 1-636.
10. Cai L, Hyde KD, Tsui CKM. Genera of freshwater fungi, Fungal Diversity Press, Hong Kong, China. 2006, 1-261.
11. Cai L, Zhang KQ, Hyde KD. Freshwater Ascomycetes. In- Freshwater Mycology. Fungal Diversity Press, Hong Kong, China. 2003, 275-324.
12. Carmichael JW, Kendrick WB, Conners IL, Sinler L. Genera of Hyphomycetes, University of Alberta Press, Alberta, Canada. 1980, 1-386.
13. Descals E, Webster J. Taxonomic studies on aquatic Hyphomycetes-II. The *Dendrospora* aggregate. Trans. Br. Mycol. Soc. 1980; 74:135-158.
14. Descals E, Webster J. Taxonomic studies on aquatic Hyphomycetes-III. Some new species and new combinations. Trans. Br. Mycol. Soc. 1982; 78:405-437.
15. Goh TK, Hyde KD. Biodiversity of freshwater fungi. J. Industria Microbiol. 1996a; 17:328-345.
16. Hu, Dian-Ming, Liu, Fang, Lei. Biodiversity of aquatic fungi in China. Mycology. 2013; 4:1-20.
17. Hudson HJ, Ingold CT. Aquatic Hyphomycetes from Jamaica. Trans. Br. Mycol. Soc. 1960; 43:469-478.
18. Ingold CT. Aquatic Hyphomycetes of decaying alder leaves. Trans. Br. Mycol. Soc. 1942; 25:339-417.
19. Ingold CT. An illustrated guide to aquatic and water-borne Hyphomycetes, Biological Association Scientific Publication. 1975; 30:97.
20. Jamaludeen S, Goswami MG, Ojha BM. Fungi of India

(1989-2001), Scientific Publishers (India), Jodhpur. 2004, 1-308.
21. Jones EBG, Alias SA, Nawawi A. New fungi described from Malaysia. In- Malasian fungal diversity (eds. Jones E.B.G.*et al*.), Univ. of Malaya and Ministry of Natural Resources Malayasia, Kuala Lumpur. 2007, 377-419.
22. Kamat MN, Patwardhan PG, Rao VG, Sathe AV. Fungi of Maharashtra, Bulletin No.-I, M. P. Agril. Uni. Pub., Rahuri (M.S.). 1971, 124.
23. Mahabale TS. Botany and Flora of Maharashtra, Gazetteer of India, M. S. Gazetteers, Govt. of M. S. 1987, 169-222.
24. Manoharachary C. Biodiversity, taxonomy, conservation, ecology and utilization of freshwater aqatic fungi from India. Indian Phytopath. 2008; 61:421-436.
25. Marvanova L, Descals E. Genera of aquatic Hyphomycetes. In- The Genera of Hyphomycetes (eds. Seifert, K. A., Gams, K. W., Morgan-Jones, G. & Kendrick, B.), CAB Biodiversity Ser. 9, Utrecht, The Netherlands. 2011, 874-885.
26. Marvanová L, Laichmanová M. *Camylospora leptosoma* sp. nov., and charactristics of *Camylospora* spp. Based on morphology and on ITS sequences. *Mycosphere*. 2014; 5:245-261.
27. Matsushima T. Microfungi of the Solomon Islands and Papua-New Guinea. Published by author, Kobe. 1971a, 78.
28. Nawawi A. Another Hyphomycete with branched conidia. Trans. Br. Mycol. Soc. 1975a; 64:243-246.
29. Nawawi A. Another new Flabellospora. Trans. Br. Mycol. Soc. 1976a; 66:543-547.
30. Volkmann-Kohlmeyer B, Kohlmeyer J. How to prepare truly permanent microscopic slides. Mycologist. 1996; 10:107-108.
31. Webster J, Descals E. Morphology, distribution, and ecology of conidial fungi in freshwater habitats. In- Biology of conidial fungi, (eds. Cole, G.C. & Kendrick, B.), Academic Press, London. 1981, 295-355.
32. Zhao G, Liu X, Wu W. Helicosporous Hyphomycetes from China. Fungal Diversity. 2007; 26:313-524.
33. Zhao G, Yu P, Liu X. *Cancellidium* and *Canalisporium* (Hyphomycetes) from China. Nova Hadwigia. 2012; 96:221-236.
34. Zhu1 D, Luo ZL, Baht DJ, Mckenzie EC, Bahkali AH, Zhou D *et al*. *Helminthosporium velutinum* and *H. aquaticum sp.* nov. from aquatic habitats in Yunnan Province, China. Phytotaxa. 2016; 253**:**179-190.