Journal of Research in Biology

An International Scientific Research Journal

Original Research

Diversity of aquatic fungi in Hebbe water falls of Chikmagalore Taluk, Chikmagalore District, Karnataka

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ABSTRACT:

The aquatic fungi are commonly found in water bodies. The current study was carried out in Hebbe waterfalls of Chikmagalore district. The foam samples and decaying debris were collected from the water falls, and kept for incubation respectively. The decaying debris was screened using stereo binocular microscope and recorded the conidia. The contribution in the frequency of occurrence and abundance of aquatic fungi were also enumerated. A total of thirty three species were isolated belonging to thirteen genera were identified.

Keywords:
Aquatic fungi, decaying debris, waterfalls.

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Web Address:
http://jresearchbiology.com/documents/RA0255.pdf.

Article Citation:
Suresha HR, Raju GH, Krishnappa M, Enrique Descals and Syed abrar.
Diversity of aquatic fungi in Hebbe water falls of Chikmagalore Taluk, Chikmagalore District, Karnataka.
Journal of Research in Biology (2012) 2(5): 537-543

Dates:
Received: 07 Jun 2012 **Accepted:** 27 Jun 2012 **Published:** 28 Jul 2012

INTRODUCTION

Aquatic fungi play an important role in aquatic ecosystem. These fungi have the capacity to degrade aquatic dead plants and animals. Hebbe falls comes under the chikmagalure district. This stream falls down from a height of 168 meters in two stages to form Dodda Hebbe (Big Falls) and Chikka Hebbe (Small Falls) this falls is surrounded area contains many different kinds of trees, and medicinal plants water is running in this thick vegetation. Aquatic fungi rich diversity is reported in this area compared to other study sites decaying leaves using substrata. Aquatic hyphomycetes are decaying the leaves and animals as in an aquatic ecosystem. The selected study site contains rich fungal diversity in this location. This aquatic hyphomycetes are using leaf substrata, aquatic hyphomycetes were found to be colonizing among themselves. The organism produces an enzyme which can degrade it selves. These organisms can rapidly colonize the available substrata within a few days releasing prodigious number of conidia for further dispersal (Barlocher, 1992). This substratum is decomposed by physical, chemical, and biological factors. Lignocelluloses the major components of biomass are degraded by that enzyme itself. Natural disturbance, from seasonal changes rainfall and tree fall, to hurricane damage, cause population shifts and changes to communities of fungi (Lodge and Cantrell, 1995). The release of fungal propagules follows a similar dynamic, but after peaks earlier and declines more rapidly. Biomass estimates have generally been based on extracting and measuring ergosterol, a fungal specific indicator that does not allow differentiating between species (Gessner *et al.*, 2003). Fungal communities have generally have been characterized by counting and identifying conidia released in agitated water. This favours sporulating aquatic hypomycetes, widely considered to be dominant fungal group involved in leaf decomposition in streams (Barlocher 1992, Suberkropp 1997). Temperate woodland streams, in contrast to alpine streams, receive large amounts of litter during autumn leaf fall. Consequently, leaves from riparian plants have been recognized as an essential component of lotic organic matter dynamics and leaf breakdown considered to be a process in the metabolism of streams. The streambed of low order tropical streams is composed mainly by dead leaves and twig pieces originated from this type of forest. This substratum is decomposed by physical, chemical and biological factors, and can colonize by an aquatic hyphomycetes.

The estimated fungal diversity is usually linked with evolution patterns. The knowledge of general diversity of the native mycota is most important when considering that each fungal species as its own niche in the habitat. They can be found participating in the food webs as organic matter decomposers and contributors to nutrients cycling or symbionts with producers. The group of aquatic fungi produces conidia exclusively in the aquatic environment or in the terrestrial water among soil particles. The main habitats are streams, reservoirs, lakes, falls typically, substrates like leaves, twigs and of residues. Submerged macrophytes and eventually healthy roots. The conidia of aquatic hypomycetes may be found trapped in foam, dispersed in the water, floating on the surface or associated with decomposing organic matter (Ingold, 1975). Leaf breakdown in streams is caused by the joint action of physical factors, the activity of microorganisms, such as aquatic hypomyctes (Barlocher, 1992). Together with chemical reactions, the activities of these organisms result in changes in litter quality (eg. increases in N and P concentrations), and cause litter mass loss. A number of factors affect these processes, including pH of the stream water, concentration of nutrients, and temperature (Webster and Benfield, 1986, suberkropp, 1998). The role of aquatic hypomycetes as intermediaries between imported plant detritus (leaves, needles, wood) and

Table.1. Occurrence and distribution of aquatic fungi in Hebby falls

Sl no	Species Name	Number of study site	Number of species occurrence	Number of individual	Density	Frequency	Abundance		
1	*Alatospora accuminata*	8	1	2	0.25	0.13	2.00	0.75	1.15
2	*Alatospora pulchella*	8	4	5	0.63	0.50	1.25	1.89	4.60
3	*Anguillospora gigantea*	8	1	8	1.00	0.13	8.00	3.02	1.15
4	*Anguillospora crassa*	8	3	3	0.38	0.38	1.00	1.13	3.45
5	*Anguillospora longissima*	8	2	6	0.75	0.25	3.00	2.26	2.30
6	*Anguillospora pseudo longissima*	8	2	4	0.50	0.25	2.00	1.51	2.30
7	*Anoptodera indica*	8	1	3	0.38	0.13	3.00	1.13	1.15
8	*Anoptodera mangrovei*	8	2	6	0.75	0.25	3.00	2.26	2.30
9	*Centrospora acerina*	8	2	6	0.75	0.25	3.00	2.26	2.30
10	*Centrospora angulata*	8	2	10	1.25	0.25	5.00	3.77	2.30
11	*Centrospora filiformis*	8	4	11	1.38	0.50	2.75	4.15	4.60
12	*Clucidospora aquatica*	8	5	7	0.88	0.63	1.40	2.64	5.75
13	*Culicidospora gravida*	8	1	6	0.75	0.13	6.00	2.26	1.15
14	*Dactylella aquatica*	8	5	2	0.25	0.63	0.40	0.75	5.75
15	*Dactylella submersa*	8	3	8	1.00	0.38	2.67	3.02	3.45
16	*Lemonniera aquatica*	8	3	7	0.88	0.38	2.33	2.64	3.45
17	*Lemonniera pseudofloscula*	8	3	3	0.38	0.38	1.00	1.13	3.45
18	*Lemonniera terrestris*	8	2	5	0.63	0.25	2.50	1.89	2.30
19	*Lunulospors submersa*	8	2	14	1.75	0.25	7.00	5.28	2.30
20	*Lunulosporus aquatica*	8	3	8	1.00	0.38	2.67	3.02	3.45
21	*Lunulospora curvula*	8	3	20	2.50	0.38	6.67	7.55	3.45
22	*Tetracladium apiense*	8	1	10	1.25	0.13	10.00	3.77	1.15
23	*Tetracladium furcatum*	8	3	10	1.25	0.38	3.33	3.77	3.45
24	*Tetracladium marchalianum*	8	2	7	0.88	0.25	3.50	2.64	2.30
25	*Tetracladium maxilliforme*	8	1	8	1.00	0.13	8.00	3.02	1.15
26	*Tricladium angulatum*	8	4	9	1.13	0.50	2.25	3.40	4.60
27	*Tricladium attenuatum*	8	2	8	1.00	0.25	4.00	3.02	2.30
28	*Tricladium chietocladium*	8	3	12	1.50	0.38	4.00	4.53	3.45
29	*Tricladium curvisporum*	8	2	4	0.50	0.25	2.00	0.75	2.30
30	*Tricladium splendens*	8	1	10	1.25	0.13	10.00	2.64	1.15
31	*Triscelosphorus accuminatus*	8	4	12	1.50	0.50	3.00	4.53	4.60
32	*Triscelosphorus monosporus*	8	8	16	2.00	1.00	2.00	6.04	9.20
33	*Triscelosphorus patulum*	8	2	15	1.88	0.25	7.50	5.66	2.30

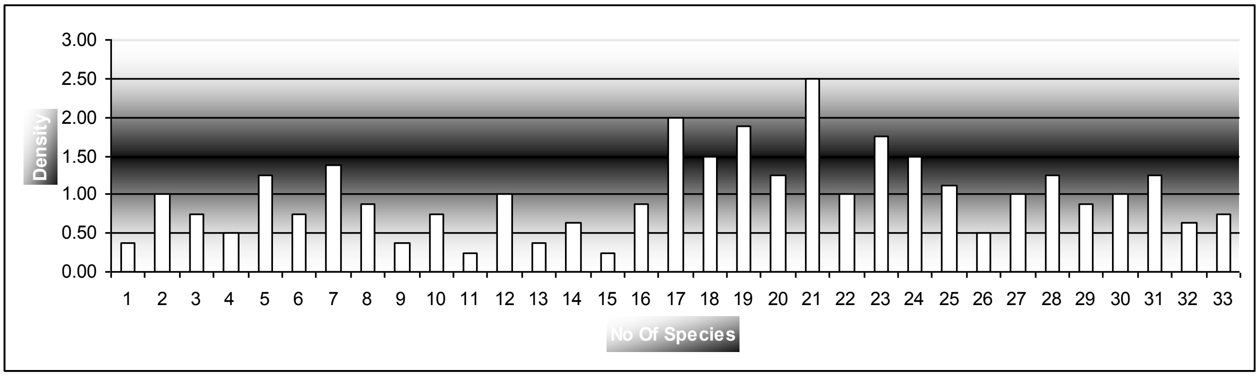


Fig-1 Graphical representation of the Density against no of species

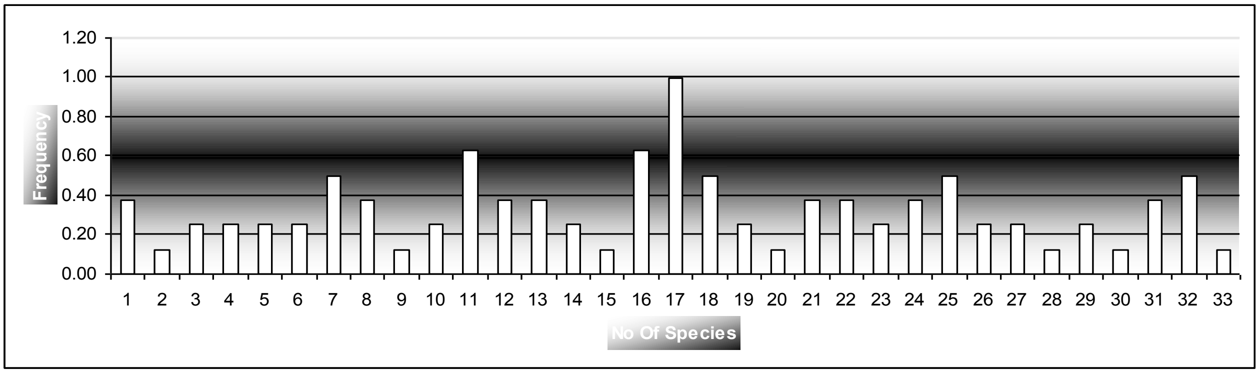


Fig-2 Graphical representation of the Frequency against no of species

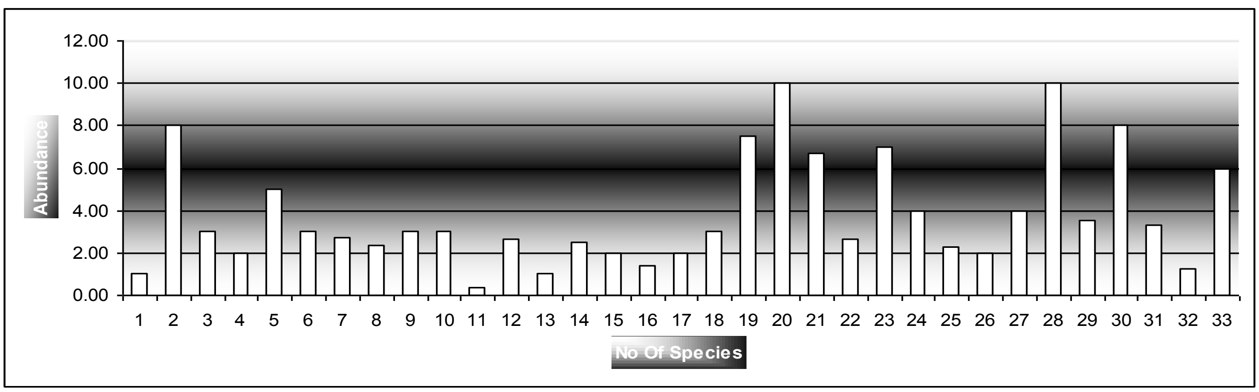


Fig-3 Graphical representation of the Abundance against no of species

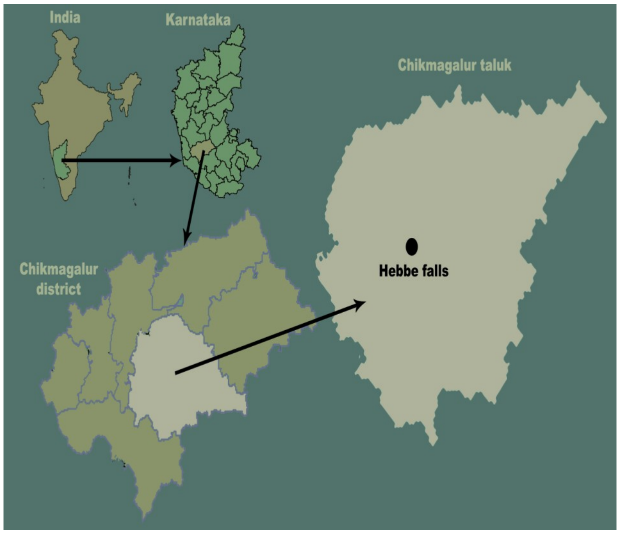
higher tropic levels has been well documented (Barlocher, 1992; Suberkropp, 1997). In the first and thus far only published study of annual production of these fungi, it fell within the same range as that of bacteria and invertebrates, two other major heterotropic groups of organisms in wood land streams (suberkropp, 1997). Because of their strong dependence on deciduous leaves in many temperate streams, biomass, growth, and reproduction of aquatic hypomycetes are strongly seasonal and generally peak a few weeks after the autumnal leaf fall (Barlocher, 1992; Suberkrpopp, 1997).

The physical factors like light, temperature and pH are the important environmental factors in aquatic ecosystem. These environmental factors are very essential for productivity of aquatic biotic and abiotic components. In the present study, work was carried out on the colonization of aquatic fungi on the specific composition of leaf debris and sporulation.

Study area

Chikmagalur taluk comes under district of

Chikmagalur the south Western parts of Karnataka state in India. The hebbe falls situated 13° 22' and 13° 47' N latitude to 75° 29' and 75° 46' E longitude. The altitude of hebbe falls is 20975h. The temperature varies from 15°C to 25°C and the annual rain fall is 1904 mm. The heavy rain fall has resulted in many water tanks, streams and reservoirs. A lot of foam is developed in all the seasons.



METHODOLOGY

Foam analysis:

The foam was scooped with the help of spoon and transferred into a jam jar or similar receptacle. Equal parts of FAA (Formal-acetic-alcohol) was added and fixed. The germined conidia were examined under microscope.

Leaf packs baiting experiment:

The leaves were collected and cut in to small pieces and were kept in nylon mesh. The same set was kept in a direction of moving water and observed after fifteen days. Later aquatic hyphomycetes were isolated.

Incubation studies:

During investigation, water samples were collected from the study sites (from lentic and lotic water bodies) of Chikmagalur district and the water samples were also collected in forest and agriculture fields. The water samples were collected in small plastic bottles and sterile polythene bags, which were used to collect debris. The fungi were isolated by plating technique. The substratum of plant leaves and wood pieces were also kept for incubation. The aquatic fungi were monocultures and were further studied for their colony characters. The diversity studies include chytrids in lotic ecosystem and lentic ecosystems, which revealed zoospores and mitosporic fungi. The incubation study showed five aquatic fungi. These fungi were further mass multiplied by the help of baiting technique and were stored in sterile polythene bags.

Isolation of Spores by using England finder.

Most Ingoldian fungi were isolated by this technique as it offers several important advantages over the spore suspension technique. The spores were identified under compound microscope with great accuracy that relatively small spores down to 5mm in spam or less can also be isolated.

The slide finder is a standard sized microscopic slide bearing a photographically reduced grid pattern each compartment being identified with letter and /or number coordinates arranged sequentially along the horizontal and vertical axes. A piece of agar medium from the foam plates. This foam plates were placed on the finder, the spores relocated individually under the compound microscope, the coordinates directly underneath each spore were noted and the spores relocated under the dissecting microscope for lifting.

Isolation of suspended spores

Hair technique

This technique was used to capture the single spore isolation using hair under the dissection microscope. The incubated plates were placed under the dissection microscope then spore along with leaf bits. The conidial expression was observed, after confirming the conidia with the help of mounted hair, single conidia were transferred to malt extract plats. The plates were incubation at 18°C for one week.

Micropipette technique

This technique was suitable to capture floating spores in incubated plates. The incubated plates were placed under the dissection microscope and the spore /conidia were observed. The selected spores were sucked using micropipette and same was directly transfer to the malt extracts plate. The plates were kept for incubation at 18°C for week.

Sedimentation Experiment

This experiment is a standard technique used in zooplanktons by limnologists. Its main handicap is that the sedimented samples have to be observed with an inverted microscope where resolution is not the best. But this could possibly be solved if sedimentation is carried out in a burette and the bottom potion collected and observed. The Spore suspension collected from a burette could be placed on a disc of cellophane attached by its margins onto a peteriplate and air dried in front of a fan or heater. The spores adhered to the cellophane could then be mounted under cover slips placed directly in it and observed under microscope and the cellophane disc could be lifted from the petridish and pieces of it cut up and mounted on slides.

RESULTS AND DISCUSSION

During the current study, conidia belonging to thirty three species were encountered in hebbe falls, aquatic fungi belonging to thirteen genera. The table-1 shows total thirty three species were recorded in the study site. *Tricelosporas monosporus*, are the common to in all the study site. To describe fungal communities in streams, biologists have identified sporulating structures on substrata (collecting a random, or introduced and studied after variable periods of stream) or characterized numbers and types of aquatic hypomycetes. The second approach is more direct, and relies on a well-defined stage in the fungal life cycle. One potential drawback is that some conidia may have been washed in form the terrestrial surroundings or even dripped in to the stream from the phylloplane of the riparian trees (Barlocher, 1992). The aquatic fungi play important role in degradation of organic complex to simpler form. The species of hyphomycetes occurs abundantly in submerged leaves. The study proved that different aquatic hyphomycetes species vary in their susceptible to soluble substance present in plant materials. In this study area contains rich vegetation of different types tree species is commonly found in this study area. The tree species produces variety of dead leaves and are collected in aquatic ecosystem. The rain fall is very high in compare to other taluks rain fall create aquatic ecosystems. The diversity of aquatic fungi rich in this study area compares the other study sites. Producers, such as plants and algae, acquire nutrients from inorganic sources that are supplied primarily by decomposers where as decomposers, mostly fungi and bacteria acquire carbon from organic sources that are supplied primarily by producers. This producer–decomposer co-dependency is important in governing ecosystem processes which implies that the impacts of declining biodiversity on ecosystem functioning should be strongly influenced by this process. Present study show, by simultaneously manipulating producer (green algal) and decomposer (heterotrophic bacterial) diversity in freshwater microcosms that algal biomass production varies considerably among microcosms. In the present study accounts thirty three species (Table-1) of aquatic fungi belonging to thirteen genera were isolated from the study site. In Hebbe falls maximum numbers of aquatic fungi were recorded out of eight study sites the domnent species is *Tricelosporas monosporus,* and *Alatospora accuminata* and *Dactylella aquatica are* very rare in species recorded out of two study sites. Density, frequency and abundance against number of species, which can be shown (Fig-1), (fig-2) and (fig-3) clearly in graphical representation. Shannon and shimson test will be applied, the past software is used, and version is 2004. These results indicate that some species of aquatic hyphomycetes can tolerate adverse environmental conditions as also stressed by (Barlocher, 1987).

CONCLUSION

The role of aquatic fungi found to be more important in the degradation of organic complex to simpler form. The hyphomycetes occur commonly and abundantly in submerged leaves. The study proved that different aquatic hyphomycetes species vary in their susceptible to soluble substance present in plant materials. We explored the significance of fungal diversity on aquatic ecosystem processes by testing whether microfungal in different tropical leaf species increases the rate of decomposition. This plant leaves revealed aquatic fungal diversity will changes according to particular species. The physical factors like light, temperature and pH are the important environmental factors in aquatic ecosystem. These environmental factors are very essential for productivity of aquatic biotic and abiotic components. In the present study, work was carried out on the colonization of aquatic fungi on the specific composition of leaf debris and sporulation. The associated aquatic hypomycetes in plant leaves are very useful in self purification of the aquatic ecosystem.

ACKNOWLEDGEMENT

I am very thankful to department of Applied Botany Kuvempu University for providing the laboratory facilities.

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