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RESEARCH ARTICLE

DIVERSITY OF AQUATIC FUNGI IN LOTIC WATER BODIES OF SRINGERI TALUK, CHIKMAGALUR DISTRICT, KARNATAKA

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ABSTRACT

The aquatic fungi are commonly found in water bodies' especially rich biodiversity in lotic water bodies. The selected study sites of water samples and decaying debris were collected in the same study area and kept for screening and incubation respectively. The conidia developing on decaying debris were screened using microscope. The collected water samples revealed aquatic fungi. In this contribution of occurrence and abundance of aquatic fungi were enumerated. A total of 30 species belongs to fifteen genera were identified.

INTRODUCTION

The aquatic hyphomycetes are a relatively small group of water inhabiting fungi, some of these fungi complete their entire life cycle including growth, sporulation, spore liberation and dispersal below the surface of water, but some are amphibious and may have telomorphs substrata exposed to air. Very little was known about these fungi until ingold published his now famous paper on aquatic Hyphomycetes of decaying alder leaves. Aquatic hyphomycetes play an important role in biogeochemical cycles, being the main decomposer fungi of plant detritus in water bodies of Sringeri taluk. The stream bed of low order tropical streams is composed mainly by dead leaves and twigs, activities during the preliminary stages of leaf litter decaying when they assimilate leaf material to form mycelia and conidia. The buildup of conidial concentration coincides with the leaf decomposition in temperate regions (Iqbal and Webster, 1973). The leaves and branches originated from forest, fresh water fungi are abundantly found in decaying submerged plant materials in fresh water streams, rivers throughout world. Most aquatic hyphomycetes from of teteradiate, branched or filiform conidia which are adapted for dispersal in flowing water (Webster&Descals1981). Aquatic hypomycetes have been recorded from alpine streams in northern Sweden(Nelsson1964) and a number of species are known to be active in low temperature (Suberkropp 1984,Sridhar and Barlocher 1993) However ,some conidia may be produced outside the stream and then introduced from terrestrial leaf litter(Bandoni 1981,Sridhar and Barlocher1993) It is believed that species composition of conidia in water is generally in agreement with aquatic hyphomycetes communities developing on submerged substances in a particular stream (Balocher1982).

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These fungi exhibits 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 conidia of aquatic hypomycetes are trapped in foam, dispersed in the water, floating on the surface or associated with decomposing organic matter (Ingold, 1975). Aquatic hypomycetes are recognized as important intermediated of energy flow from allochthonous plant material to higher tropihic levels in freshwater lotic ecosystems (Barlocher & Kendrick 1981, Suberkropp1992).

Decomposing potential and nutritional requirements of the aquatic hyphomycetes have reinforced recognition of their importance for the recycling of mineral content in aquatic ecosystem. These organisms can rapidly colonize the available substrata within a few days releasing number of conidia for further dispersal (Barlocher 1992). 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, evaluate work was carried to colonization of aquatic fungi on the specific composition of leaf debris and sporulation. Their diversity has been correlated with temperature, water chemistry and quality of riparian vegetation (Baerlocher, 1987; Gonczol, 1987). Hypomycetes are group of aquatic community which degrades leaves and twigs shed in to water (Kaushik & Hynes, 1971). Fungal community has been characterized by counting identifying conidia released in agitated water. This favours sporulating aquatic hyphomycetes widely considered to be the dominant fungal group involved in leaf decomposition in streams (Barlocher 1992, Suberkropp1992).

The present study is based on a survey of two streams each with a distinctly different vegetation contributing a characteristic, though scanty substratum in summer when conidia of aquatic fungi occur in low numbers. In rainy session aquatic fungi numerous occurs in aquatic habitats of substrate spora and stream spora have been compared using percent similarity to correlate the species composition and structure of these communities with sholla vegetation. 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

Sringeri taluk comes under district of chikmagalur the south Western parts of Karnataka state in India, situated at 13° 25′ 12″ N latitude and 75° 15′ 0″ E longitude, the altitude of is 20975h. The temperature varies from 15° 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 on to 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.

Flabellospora verticillata alasodura

Conidia:

In this Nigerian species the stalk of the conidium is longer than in fabellospora crassa and there are about seven arms instead of four arms.

Habitat: Conidia in leaf sample

Anguillospora longissima

Table.1. Occurrence and distribution of aquatic fungi in sringeri

Species Name	no t st	no t oc	no of in	den	fre	abu	rd	rf
Tricelosporus monosporus	8	4	8	1.00	0.50	2.00	3.11	4.40
Tricelosporus acuminatus	8	2	6	0.75	0.25	3.00	2.33	2.20
Tricelosporuse elegans	8	2	10	1.25	0.25	5.00	3.89	3.30
Tricelosporus setigerum	8	3	1	0.13	0.38	0.33	0.39	3.30
Lemoneria aquatica	8	1	6	0.75	0.13	6.00	2.33	1.10
Tetracladium maxilliformis	8	4	8	1.00	0.13	8.00	3.11	1.10
Lemoneria filiformis	8	3	7	0.88	0.13	7.00	2.72	1.10
Clavatospora longibrachiata	8	2	7	0.88	0.25	3.50	2.72	2.20
Clavatospora tentacula	8	4	9	1.13	0.50	2.25	3.50	4.40
Flagillospora pencillioides	8	2	4	0.50	0.25	2.00	1.56	2.20
Flagillospora curvula	8	8	20	2.50	1.00	2.50	7.78	8.79
Flagillospora stricta	8	6	22	2.75	0.75	3.67	8.56	6.59
Clavatospora longibrachiata	8	3	4	0.50	0.38	1.33	1.56	3.30
Lunulospora curvula	8	5	18	2.25	0.63	3.60	7.00	5.49
Anguilospora crassa	8	3	9	1.13	0.38	3.00	3.50	3.30
Anguilospora longissima	8	4	10	1.25	0.50	2.50	3.89	4.40
Anguilospora gigantea	8	2	11	1.38	0.25	5.50	4.28	2.20
Anguilospora psuidolongissima	8	2	8	1.00	0.25	4.00	3.11	2.20
Centrospora acerina	8	3	5	0.63	0.38	1.67	1.946	3.297
Centrospora filiformis	8	4	7	0.88	0.50	1.75	2.724	4.396
Volucrispora graminata	8	4	4	0.50	0.50	1.00	1.556	4.396
Tricladium eccentricum	8	3	11	1.38	0.38	3.67	4.280	3.297
Lemoneria cornuta	8	2	7	0.88	0.25	3.50	2.724	2.198
Tetrachetum elegans	8	5	11	1.38	0.63	2.20	4.280	5.495
Flabellospora crass	8	3	6	0.75	0.38	2.00	2.335	3.297
Tetracladium patulum	8	2	10	1.25	0.25	5.00	3.891	2.198
Clucidospora aquatica	8	1	10	1.25	0.13	10.00	3.891	1.099
Diplocladiella scalaroides	8	1	6	0.75	0.38	2.00	2.335	3.297
Clucidospora filiformis	8	2	5	0.63	0.25	2.50	1.946	2.198
Clucidospora angulata	8	4	7	0.88	0.50	1.75	2.724	4.396
			257	32.13	11.38			

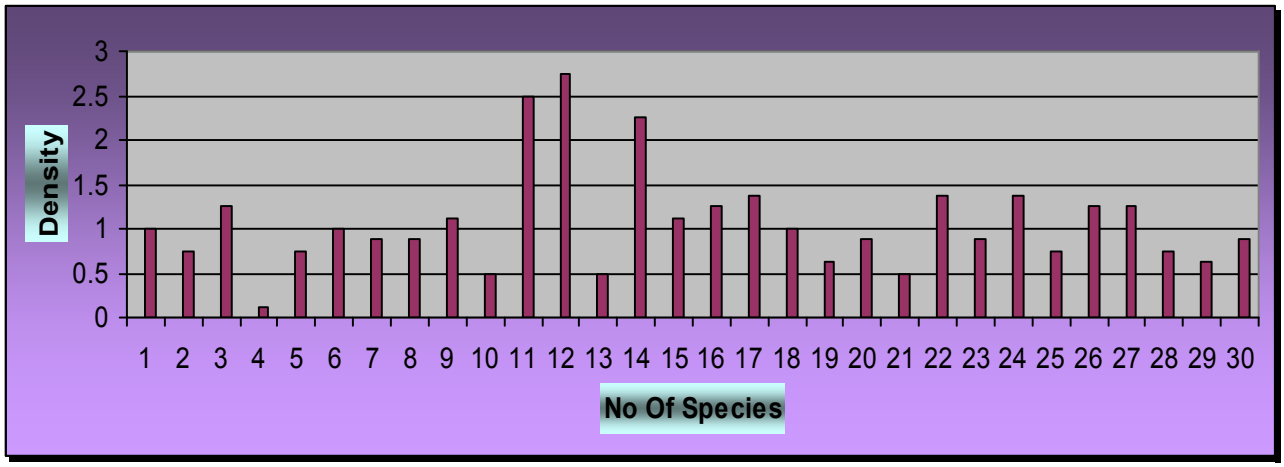

Table.2. Graphical representation of Density

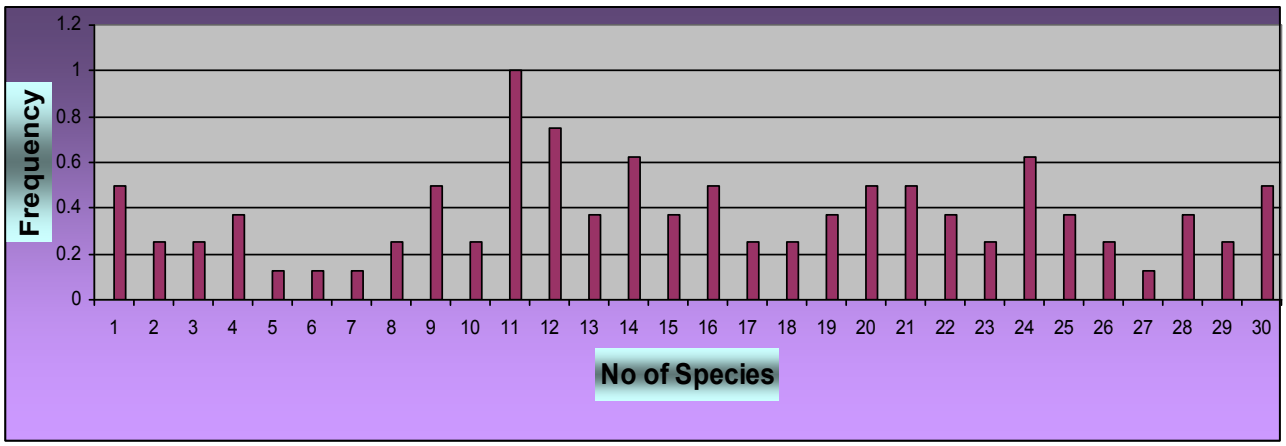

Table 2. Graphical representation of Frequency

Conidia: Conidia acute or sigmoid 150-250 x 5-6 mm 7-13 septate, basal extension growing through a frill(remnants of separating cell)which is usually difficult to observe.

Habitat: Foam as well as leaf sample

Lunulospora curvula

Conidia:

Detachment scar lateral, dorsal (or basal extension integrated), conidia aseptate, lunate or sigmoid.

Habitat: This organism is found in leaf samples**.**

Tricelophorus monosporus:

Conidia: The conidia are the type of species which I found on only a few occasions in Britain but which is abundant in tropical countries. It occurs I Europe, Asia, Africa, Australia and North and South America. Development of conidiam is very characteristic with the four arms arising I succession. The projecting knob of the main axis makes the conidium easy of recognition in foam samples.

Habitat: Conidia found in leaf sample

Diplocladiella species

This is a terrestrial fungus occurring in many parts of the world. It is included have as its conidia are common in foam samples. The conidia are brown triangular, thick walled with the two corner cells drown in to narrow appendage. The corner cells or apical cells and the basal cells are lighter in colour. Conidia do not germinate readily.

Habitat: Conidia are found in foam samples

Lemnorea aquatic

The conidia rare species are found some regions of Western Ghats the have three arms arranged in equal in length and they contain septet. This species are commonly found rainy seasons.

Habitat: Conidia are found in foam samples

Tetrachaetum elegans

This fungus has been found several times particularly from the highlands, both as conidia in foam as well as in decaying leaves.The large slinder tetra radiate conidia consist of a bent main axis with two diverging arms more or less equal length and uniform width,septa are not clearly visible.

Habitat: Conidia are found in foam samples

Varicospoium graminata

Conidia of this fungus were only observed from the highlands pure cultures studies have confirmed the identity of this fungus. Conidia vary in their degree of branching. Basically each consists of a main axis with two or three straight lateral arms any of which may branch again.

Habitat: Conidia are found in foam samples

RESULTS AND DISCUSSION

In the present study were accounts 30 species (Table-1) of aquatic fungi belonging to fifteen genera were isolated from the foam samples of study sites. Environmental factors which influence the diversity of aquatic hyphomycetes. *Flagillospora curvula* are the common in all the study sites (Fig-1) shows clearly graphical representation. *Lemoniera aquatic and Diplocladiella scalaroides* are very rare species in this study area. 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. The effect of whole stream substrate manipulations aquatic hyphomycetes has not been previously studied. However, it is known that 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. In the present study accounts 30 species (Table-1) of aquatic fungi belonging to ten genera were isolated from the foam samples of study sites. In Sringeri taluk maximum numbers of aquatic fungi were recorded out of eight study sites*, Lemoniera aquatic and Diplocladiella scalaroides* are very rare species recorded only in one study site, where as *Flagillospora curvula sp*. was recorded in eight study sites (Fig-1) shows clearly in graphical repregentaion.. These results indicate that some species of aquatic hyphomycetes can tolerate adverse environmental conditions as also stressed by baerlocher (1987). In the present study accounts thirty (Table-1) of aquatic fungi belonging to fifteen ten genera were isolated from the foam samples of study sites. Density, frequency and abundance against no of species were recorded in eight study sites. Shannon and shimson test will be applied, the past software is used, version is 2004, (Fig-1), (fig-2) and (fig-3) shows clearly in graphical representation. These results indicate that some species of aquatic hyphomycetes can tolerate adverse environmental conditions as also stressed by baerlocher (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.

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