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RESEARCH ARTICLE

MARINE FUNGI FROM MANGROVE AND BEACH ECOSYSTEMS ALONG KERALA COAST, INDIA

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Abstract

A study dealing with the marine fungi associated with decaying woody samples was carried out from the beach and mangrove ecosystems along the northern Kerala coast. A total of twenty marine fungi comprising 13 ascomycetes and 7 mitosporic fungi were isolated. The mangrove ecosystem supported maximum fungal diversity than the beach ecosystem.*Periconiaprolifica* and *Hydeapygmea*, were common in both ecosystems.

Introduction:-

Marine fungi are an ecological rather than a taxonomic group comprising a predictable 1500species, excluding those that form lichens (Wijayawardene et al., 2022). It can be categorized into two groups, namely the obligate marine fungi which can grow and sporulate exclusively in marine and estuarine habitats and facultative marine fungi which originated from freshwater and terrestrial habitats but can grow and possibly sporulate in marine environments. They grow on a wide variety of substrates ranging from wood to sediments, muds, soil, sand, algae, tubes of mollusks, decaying leaves of mangroves, etc. Most fungi found in marine habitats are microscopic. The largest ascocarp occurs in *Amylocarpusencephaloides*, which do not exceed 3 mm (Kohlmeyer and Kohlmeyer, 1979).

Marine fungi also play an important part in biological aspects, agronomic, medical and bio-industry. Fungi can relate to the concentration of heavy metals in the estuarine area (Babich and Stotzky, 1983). Fungi from marine samples are also useful as microbial resources in the search for new bioactive compounds (Liberra and Lindequist, 1995; Blunt et al., 2008). Organisms that live in extreme environments tend to produce valuable secondary metabolites which are useful as antimicrobials and cancer. They produce lignin-degrading enzymes that can be used to decolourized effluent from pulp and paper mills, effluent from textile and dye making industries and molasses spent wash from alcohol distilleries (Pointing et al., 1998, Raghukumar et al., 1996). They also produce novel metabolites and biotechnological products.

The exploration of fungal distribution in marine environments lags behind that of freshwater and terrestrial ecosystems. Despite their significant role in marine ecosystems existing as decomposers of organic matter and parasites of living organisms, marine fungi remain poorly represented in research (Sarma, 2019). Their prevalence in marine environments, particularly on deceased organic matter, underscores their ecological importance, yet comprehensive evaluations of their distribution are still lacking. The paper intent to address the distribution and diversity of marine fungi on dead organic matter.

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Materials and Methods:-

Collection and treatment of wood samples:

Decaying woody samples were collected from mangrove ecosystem in Kuppam (12.0495558^0 N, 75.34523^{0}E)and Vellikkeel (11.9996°N, 75.3401°E) and the beach ecosystem in Thottada (11.83597^{0}N, 75.4546^{0}E) of North Kerala, India from June 2022 to March 2023. They were washed well, placed in sterile polythene bags and brought to the laboratory. Samples were observed under a stereomicroscope for fungal fructifications. Spores and sections are first mounted in seawater, so that any appendage present could dilate and their trace morphology could be studied. Permanent mounts were prepared by replacing the sea water with Lactophenol -cotton blue and sealing the cover glass with DPX. Later, the samples were incubated in polythene bags at room temperature. Periodical isolation of marine fungi from these samples was carried out for one year. Identifications of marine fungi were done using taxonomic keys by Kohlmeyer and Kohlmeyer, (1979), Kohlmeyer and Kohlmeyer (1991), Hyde et al., (2000) and Nambiar and Raveendran (2012). The marine fungi thus identified were tabulated and recorded (Table 1).

Presentation of data

Percent frequency of occurrence (FO) = Total number of isolates of a particular species divided by the total number of samples supporting marine fungi X100.

Based on the percentage frequency of occurrence, the marine fungi were classified as most frequent (>10%), frequent (7-10%), occasional (5-7%) and rare (<5%).

Results:-

A total of twenty marine fungi were isolated from the wood samples. These comprised 13 ascomycetes and 7 mitosporic fungi. From the mangrove ecosystem alone, fourteen fungi were obtained, indicating a diverse fungal community in this region while the beach area yielded five fungi. Out of the fourteen fungi obtained from the mangrove site, 10 were ascomycetes and the remaining 4 were mitosporic fungi. Similarly, in the case of five fungi isolated from the beach area, 1 was an ascomycete and 4 were mitosporic fungi. The number of marine fungi was higher in the mangrove ecosystem. Additionally, two fungi, namely *Periconiaprolifica* and *Hydeapygmea*, were common in both the mangrove and beach ecosystems.

The mangrove ecosystem exhibits a diverse range of marine fungi, with 8 species falling under the most frequent category, indicating their abundance and possibly important ecological roles. Additionally, 5 species were categorized as frequent, suggesting a consistent presence but to a lesser extent compared to the most frequent category. The presence of species in the occasional and rare categories highlights the variability and uniqueness of fungal distribution within mangrove habitats. In contrast to mangroves, the beach ecosystem shows a lower diversity of marine fungi, with only 3 species classified as most frequent. The presence of only one species in the frequent category suggests a less consistent occurrence compared to mangroves. Notably, no species were categorized as rare, indicating a different ecological dynamic compared to the mangrove ecosystem.

The study reveals that *Dactylosporahaliotrepha* and *Hydeapygmea* stand out as the most dominant species, with a significant number of isolates, totaling 20 from the mangrove ecosystem. This finding highlights the ecological prominence of these species within the mangrove habitat. Conversely, *Verruculinaenalia* and *Lignicolatropica* exhibit lower dominance suggesting a lesser prevalence within this ecosystem.

From the beach ecosystem, *Hydeapygmea* and *Periconiaprolifica* stand out as the most dominant species. Their occurrence emphasizes their ecological significance within this coastal habitat. Conversely, *Monodictispelagica* emerges as a rare species within the beach ecosystem,indicating a limited presence in the surveyed area.

The average number of isolates of marine fungi per sample from both sites was about 3.98. While calculating the total number of isolates, *Dactylosporahaliotrepha* had the highest number of isolates (33) whereas two fungi namely *Lignicolatropica* and *Verruculinaenalia* had the least number of isolates (2).

Discussion:-

The dominance of ascomycetes among the isolated fungi is consistent with previous studies indicating their prevalence in marine environments. The higher diversity of fungi in mangrove habitats suggests the influence of local environmental factors on fungal community composition. Mangrove ecosystems are known to harbor rich

fungal diversity due to the availability of woody substrates and unique environmental conditions. The presence of common fungal species in both mangrove and beach ecosystems suggests some level of fungal dispersal between these habitats. Species such as *Periconiaprolifica* and *Hydeapygmea* may exhibit ecological versatility, enabling them to thrive in different environmental conditions

Data on the frequency of occurrence of marine fungi from mangrove ecosystems were published by Sarma and Vittal (2001), Maria and Sridhar, (2003), Raveendran and Manimohan, (2007), Nambiar and Raveendran, (2009),Devadatha et al., (2021) from India and Alias et al., (2010), Leong et al., 1991, (Jones et al., 1998) etc from other parts of the world. The average number of fungi per sample is one of the major yardsticks to compare different habitats or substrates (Maria and Sridhar, 2002). In the present study, the average isolates of fungi per sample from both sites were 3.98.

Dactylosporahaliotrepha, *Periconiaprolifica* and *Hydeapygmea* were the dominant species obtained in the present study. A critical analysis of fungi recorded in the present study in the light of (Kohlmeyer and Kohlmeyer's, 1979) definition of marine fungi revealed that all the fungi encountered in the current study can be regarded as typically marine. The distribution of marine fungi is governed by a multitude of interacting factors and no single one can be identified to explain their occurrence and frequency of occurrence. However, some factors are more important than others. For example, availability of substratum, temperature, water salinity and geographical location are the key elements in the occurrence and distribution of marine fungi (Booth and Kenkel, 1986, Jones 2000). Since the incubation period and the duration of the study are in a short period, only a limited number of species were encountered during the study.

The study highlights distinct patterns of species dominance within the mangrove and beach ecosystems. While certain species like *Dactylosporahaliotrepha* and *Hydeapygmea* demonstrate significant prevalence in the mangrove habitat, others such as *Monodictispelagica* exhibit rarity within the beach environment. Understanding these dominance dynamics is crucial for elucidating ecosystem functioning and guiding conservation efforts.

The frequency of occurrence of marine fungi varies between mangrove and beach ecosystems, reflecting differences in environmental conditions and ecological interactions. While mangroves harbor a higher diversity and abundance of marine fungi, beaches exhibit a lower diversity but still maintain some level of fungal presence. Further research is necessary to understand the specific ecological roles of these fungi in both ecosystems and their responses to environmental changes

Conclusion:-

This study highlights the diversity of marine fungi associated with woody substrates in mangrove and beach ecosystems. Understanding the composition and distribution of these fungi is essential for assessing their ecological roles and potential biotechnological applications. Further studies are recommended to explore the ecological functions of isolated fungi and their potential for bioremediation, biocontrol, and bioprospecting in marine environments. Long-term monitoring of fungal communities in mangrove and beach ecosystems can provide valuable insights into ecosystem health and resilience. Additionally, efforts should be made to conserve these unique habitats to safeguard their fungal biodiversity.

Table 01:-The Frequency of Occurrence (FO) of marine fungi in mangrove and beach ecosystem.

Name Of Fungi	Mangrove Ecosystem		Beach Ecosystem	
	No. Of Isolates	FO	No. Of Isolates	FO
Ascomycetes				
*Aigialusmangrovei*Borse	9	15	-	-
Dactylosporahaliotrepha (Kohlm et Kohlm) Hafellner	33	55	-	-
Eutypabathurstensis Hyde et Rappaz.	6	10	-	-
*Haloroselliniaoceanica*Whalley et al.,	8	13	-	-
Halosarpheiaretorquens Shearer et. Crane	26	43	-	-

*Leptosphaeriaperuviana*Speg.	-	-	8	13
*Lignicolatropica*Kohlm.	2	3	-	-
Lineolatarhizophorae (Kohlm et Kohlm) Kohlm et Volk. Kohlm.	5	8	-	-
Marinosphaeramangrovei Hyde	15	25	-	-
Pleospora sp.	3	5	-	-
Quintaria sp.	4	6	-	-
Savoryellalignicola Jones et Eaton	14	23	-	-
Verruculinaenalia (Kohlm.) Kohlm. etVolkm. Kohlm.	2	3	-	-
Mitosporic Fungi				
Halenosporavaria (Anastasiou) Jones	-	-	5	8
Hydeapygmea(Kohlm)Pang et Pang.	27	45	10	16
Monodictyspelagica (Johnson) Jones	5	8	3	5
*Periconiaprolifica*Anastasiou	30	50	10	16
Trichocladiumlignicola Schmidt	4	6	-	-
Trichocladiumlinderi Crane et Shearer	5	8	-	-
Trichocladiumalopallonellum (Meyer et Moore) Kohlm. etKohlm.	5	8	-	-

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