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Nida Tabassum Khan *

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Research Article

Marine Fungi Causing Diseases in Marine Organisms

Iqra Mujeeb [1], Nida Tabassum Khan [2]*

[1]Department of Microbiology, Faculty of Life Sciences and Informatics, Balochistan University of Information Technology, Engineering and Management Sciences, Balochistan.

[2]Department of Biotechnology, Faculty of Life Sciences and Informatics, Balochistan University of Information Technology, Engineering and Management Sciences, Balochistan.

***Corresponding Author:** Nida Tabassum Khan, Department of Biotechnology, Faculty of Life Sciences and Informatics, Balochistan University of Information Technology, Engineering and Management Sciences, Takatu campus, Airport Road, Quetta.

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Abstract

Fungi are mainly terrestrial but can also be found in marine or estuarine habitats such as marine sediments, Arctic area, and sub-sea floor. These fungi are known as marine fungi. They are saprophytes and with the help of their symbiotic relationships, they help in recycling the nutrients. They also cause disease in plants, animals, and algae. Some cases are reported in Pakistan and Iran.

Key words: dengue fever; dengue protection; mosquito

Introduction

Fungus is a eukaryotic group of micro-organisms that digests its food through the process of absorption (Carris *et al.*, 2012). This heterotrophic group has its own kingdom with around 3.8 million species (Hawksworth *et al.*, 2017). From single celled yeast to multicellular moulds, fungi are ubiquitous micro-organism exhibit variety of size, colours, and shapes (Blackwell 2011; Desardin *et al.*, 2010; Lutzoni *et al.*, 2004). The most appropriate definition of marine fungi is offered by Kohlmeyer and Kohlmeyer in 1979, "Obligate marine fungi are those that grow and sporulate exclusively in marine or estuarine habitat."

Habitat

Fungi are mainly terrestrial but also aquatic (Brem *et al.*, 2008; Le Calvez *et al.*, 2009). The aquatic fungi that are found in ocean, sea etc. are called as marine fungi. They have been found in the marine sediments (Picard 2017), Arctic area (Rämä *et al.*, 2017) and sub-sea floor (Orsi *et al.*, 2013). 1255 specie has been claimed from marine realm (Jones *et al.*, 2019).

Ecological importance

Marine fungi are saprophytes and with the help of their symbiotic relationships, they help in recycling the nutrients (Gutiérrez *et al.*, 2011). From living organisms such as algae, guts of crustaceans, animals to sand, soil, mud and mangrove's decaying leaves, wood sediments, the marine fungi grow on variety of substrates (Kohlmeyer & Kohlmeyer, 1979; Hyde, 1996).

Role in marine ecosystem

They have important ecological role in marine ecosystem: degradation of wood and non-woody substrate (Blanchette *et al.*, 1990; Singh *et al.*, 1990; Holt and Jones, 1983; Hawksworth *et al.*, 1995), decomposition of animal's decay (Kohlmeyer & Kohlmeyer, 1979). They also form symbiotic relationship with other organism like algae (Kohlmeyer & Kohlmeyer, 1979; Fletcher, 1975; McCarthy, 1991) and plants (Mason, 1928; Rozema *et al.*, 1986; Boullard, 1958; Nicolson, 1960; Khan, 1974).

Pathogenic aspects of marine fungi

Despite the fact that fungi have its ecological importance as a decomposer they also involved in causing diseases in different organism i.e., parasitic relationship with aquatic plants, animals and algae (Muhsin, 1977).

Diseases in plants

There has been very little data reported regarding fungal diseases in plants.

Fungi spp.	Infected specie of plant	Disease	Reference
Cytospora rhizophorae	*Rhizophora spp.*	Prop roots	(Kohlmeyer & Kohlmeyer, 1979)
Phomopsis mangrovei	*Rhizophora apiculata*	Prop root	(Hyde, 1996)
Phytopthora spp.	*Avicennia marina*	Dieback	(Weste *et al.*, 1982; Pegg *et al.*, 1980)

Table 1: Fungal diseases in plants

Disease in algae

Some species of *Labyrinthulomycetes* cause infections in marine algae, are thought to be important pathogens (Mueglstein *et al.*, 1988) (Table 2). The members of oomycetes and chytrids were also observed to affect marine algae (Table 2).

Fungi spp.	Infected specie of algae	Disease	Reference
Labyrinthula sp.	(*Rhizoclonium* sp., *Zostera marina*, *Cladophora* sp.) and *cyanobacteria* (e.g. *Lyngbya* spp.)	Wasting disease	(Raghukumar, 1986; Raghukumar, 1987a, b; Muehlstein *et al.*,1988; Rheinheimer, 1992)
Chytridium polysiphonae	*Sphacelaria* sp.		(Raghukumar, 1986; Amon, 1984)
Pontisma lagenidiodes (oomycete)	*Chaetomorph media*	browing disease	(Raghukumar, 1987a)
Sirolpidium bryopsidis	*Cladophora* sp.		(Raghukumar, 1986)
Lagenisma coscinodici	Marine diatoms		(Schnepf and Diechgraber, 1978)

Table 2: Fungal diseases in algae

Disease in animals

Not only natural but cultured population of marine animals has been affected by the fungal diseases (Alderman and Polglase, 1986). Because of their high occurrences (Johnson, 1983; Polglase *et al.*, 1986; Noga, 1990), both populations are limited by the disease (Alderman and Polglase, 1986). Many species of fungi were reported but group of oomycetes are considered most important pathogens (e.g. *Aphanomyces*, *Haliphthoros*, *Lagenidium*, *Saprolegnia*, *Sirolpidium*) (Rand, 1996). Other important fungal pathogens of genus *Fusarium* are reported to be involved in the shell diseases of marine crustaceans (Lightner, 1988), other fungal infections in hermit crab (Smolowitz *et al.*, 1992) and lobsters (Stewart, 1984).

Cases reported in Pakistan

Species of *Aspergillus*, *Fusarium*, *Alternaria*, *Trichoderma*, *Helminthosporium* were also reported in fishes of river Ravi, Punjab, Pakistan (Zafar *et al.*, 2019).

Cases reported in Iraq

Mhaisen *et al.*, (2019) also reported *Ichthyophonous hoferi* in fishes of Basrah province, Iraq. Some fungal diseases are elaborated below (Leaño, 2001):

Major fungal disease of fishes

Ichthyophoniasis (Ichthyosporidiosis)

It is caused by *Ichthyophonus sp*. (*Ichthyosporidium sp.*). Many groups of fish like trouts, groupers, herrings, cods and flounders are affected by the infection.

Apparent signs

The apparent signs differ from specie to specie, while some infected fishes don't have any visual signs. Irregular swimming pattern and inflammation of abdomen are often observed among infected fishes. Internal body organs (liver, kidney and spleen) swell with up to 2mm diameter of whitish nodules. These nodules have not been reported in muscle tissues of infected fishes.

Outcomes of disease

Affected fishes become anaemic and slender due to loss of appetite.

Diagnosis

Microscopic examination of nodules formation will reveal the different stages of the pathogen.

Prevention and control

No treatment is available but avoiding contaminated food can prevent the infection.

Major fungal diseases of crustaceans

Aflatoxicosis (Red disease)

It is caused due to the production of toxin (aflatoxin) by *Aspergillus flavus* and other *Aspergillus* spp. It affects the shrimps spp. A*spergillus spp.* are the common contaminants of inappropriate stored or expired feeds.

Apparent signs

Shrimp's body and appendages become yellowish and gradually discharge reddish discoloration. These signs were observed among cultured juvenile pond-shrimps. The organism become sluggish and swims slowly near the pond dikes.

Outcomes of disease

Growth will be stopped.

Diagnosis

Infected shrimps will die in 30 seconds after the collection. There will be chemical tests to analyse suspected food of shrimps for aflatoxin.

Prevention and control

Prevent feed to be mouldy by standard storing procedure.

Conclusion

Because of the late realization of the importance of marine ecology, we discovered many great opportunities to make human life better. However, there is a long way to uncover many astonishing aspects of the ocean. The fungal diseases are not yet entirely divulged to the world due to the continued research. This progressive research will help us to fathom out the world of marine microbiology.

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