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STATE OF ENVIRONMENT FROM MANGROVES OF TAMILNADU, INDIA

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Received on: 12-05-2017

Accepted on: 15-06-2017

Abstract:

Mangrove ecosystem is well known for the productivity. Fungi play an important role in the nutritive cycle and support the mangrove ecosystem. In the present investigation, an attempt has been made to isolate, characterize and identify some of the soil fungi from mangroves of Sathanur delta, Tamilnadu. They are categorized into common (10.75%), frequent (9.28 %), occasional (6.63 %) and rare (0.38 %). Among the 22 fungal species identified, *Fusarium solani* was recorded as common, *Penicillium chrysogenum*, *Penicillium citrinum*, *Penicillium red sclerotium* as frequent, *Aspergillus oryzae*, *Aspergillus flavus*, and *Aspergillus albus* as occasionally and the remaining species are rare. The identification of 22 soil fungal species from mangroves of sathanur delta is the first report from.

Key words: Fungi, Mangroove, Aspeergillus niger.

Introduction

Mangroves are coastal wetland forests established at the intertidal zones of estuaries, backwaters, deltas, creeks, lagoons, marshes and mudflats of tropical and subtropical latitudes. Mangrove forests are also referred to as mangrove swamps, tidal forests, tidal swamp forests or mangals [1] and considered a dynamic ecotone (or transition zone) between terrestrial and marine habitats.

Approximately 25 % of the world's coastline is dominated by mangroves distributed in 112 countries and territories encompassing an area of 181,000 sq km. worldwide. Mangrove forests are biodiversity "hotspots" for marine fungi [2]. These fungi play an important role in the nutritive cycle and support the mangrove ecosystem. They commonly occur as saprophytes on decomposing organic matter such as wood, stem, leaf etc and as symbionts of plants and animals and as parasites of plants in mangrove ecosystem. Fungi being ubiquitous organisms occur in all types of habitats and are the most adaptable organisms. The soil is one of the most important habitats for

microorganisms like bacteria, fungi, yeasts, nematodes, etc. [3]. Mangrove species diversity is well known for animals and plants, but poorly known for other organisms such as fungi. An account of diversity and ecology of fungi colonizing in litter of mangroves of east coast of India, Godavari and Krishna (Andhra Pradesh), Pichavaram (Tamil Nadu) and Andaman and Nicobar Islands) has been given by Sharma and Vittal [4]. A total 131 species belonging to 77 genera have been reported from four locations of Bay of Bengal region with majority belonging to Ascomycetes (102 species in 65 genera) followed by Anamorphic fungi (27 species in 20 genera) and only two Basidiomycetes. Of the 131 manglicolous fungi from Pichavaram of Tamil Nadu, Godavari and Krishna deltas of Andhra Pradesh and Andaman and Nicobar islands, only 22 species were found to be common to all the sites. There were however, 11 fungi found to be common to Godavari, Krishna and Pichavaram mangroves. Of the 17 fungi reported only from Andaman and Nicobar islands many are typical mangrove fungi reported from South East Asia. Interestingly some of them were reported from west coast of India also [4]. The mangrove fungi reported from west coast of India are somewhat different from the east coast. The informations on mangrove fungi occurring in Tamilnadu and West Bengal are largely unexplored. However, the recent studies conducted by Ramanathan et al. [5], Kumar and Ghose [6] on Sundarbans mangroves of West Bengal and Gupta et al. [7], mangroves of Tamilnadu coast have provided some information on mangrove fungi in these two important mangrove formations. Mangrove ecosystem in the Sathanur river delta occupies about 58.56 sq.km. Sathanur mangrove ecosystem is the second largest mangrove ecosystem of Tamilnadu next to Bhitarkanika which is in degraded state although some parts of this mangrove forest show very rich mangrove vegetation as seen in Bhitarkanika. About 34 true mangroves, 42 mangrove associates and 20 obligate mangroves are occupying in Sathanur delta [8]. Several studies in relation to flora and fungal diversity have been undertaken in this ecosystem [8]. However, no attempt has been made to assess the microbial diversity from this unique mangrove ecosystem. Hence, in the present study a preliminary attempt has been made to identify some of the soil fungi from this mangrove ecosystem.

Materials and Methods

Sampling sites of the present study mainly comprises of mangrove forest soil (Site 1), Sathanur river flat (Site 2) Soil nutrient content analysis of site 1 and site 2 revealed that, the pH of the soil samples varied from 5.52-6.70, salinity varies from 0.5-1.04 N and Organic Carbon 0.65-0.80 (%). The N, P, K (Kg/ hect.) varies from 215-285, 9.32-23.0, and 470.42-496.00 respectively. The fungi were isolated from soil samples collected from two different locations of Sathanur delta mangrove forest. The fungal isolates were isolated using different medium viz., Mycological broth

agar, Potato dextrose agar, Czepeck dox agar, Malt extract agar. One ml soil suspensions (10⁻⁴) were inoculated separately in three different petriplates containing above medium separately. Then the plates were incubated at 30°C for 7 days. The colony forming units (cfu.) of the fungal isolates were counted. All of the experiments were repeated three times; mean and standard error of cfu were calculated. Further pure cultures of the fungal isolates were maintained and identified microscopically with the help of phase contrast microscope (100 X). The fungal isolates were stained with cotton blue dye for photomicrographs. Morphology and septation of ascospores/ basidiospores/ conidia were used for their identification. In some cases, asci and sterile elements of the ascocarps such as paraphyses and pseudoparaphyses of the fruit bodies were used as characters for identification. The fungi were identified with standard manuals of Marine Mycology, the Higher Fungi [9]. Percentage frequency was calculated as follows:

No. of soil samples in which a particular fungus occurred

% frequency = -----

Total No of soils examined

Results and Discussion

The mangrove soil of Sathanur delta is generally clayey, rich in nitrogen, phosphorus, calcium and potassium content. Soil nutrients viz. N, P, K (kg/ha) and total C (%) contents were generally more in the rainy season did not follow any common trend with respect to their season as well as site. Similarly soil pH and salinity (mS/cm) did not show very high variation during the study period.

In the present investigation totally 22 species of fungi belonged to 14 genera were identified from two soil samples collected from mangroves of Sathanur delta Tamilnadu, India and were presented in Table 1. Among the total isolates, 13 genera were belonged to Ascomycetes, 1 species/ 1 genus was belonged to Actinobacteria. Among the two study sites, Site 1 (Mangrove soil) harbors comparatively large number of fungal population than Site 2 (River flat soil). The fungi *Alternaria alternata* exhibits the highest population (x 10⁴ cfu/ g. soil) 23.00, followed by *Aspergillus oryzae* (22.00) and *Phoma* spp. (22.00) (Table 1). *Fusarium solani* was the dominant fungi found in both the study sites (Table 1).

Fusarium oxysporum, *Verticillium* spp., *Penicillium citrinum*, *Penicillium red sclerotium* and *Trichoderma viride* was not found in the mangrove soil samples but they were frequently found in the soil samples collected from river flat (Table 1). Similarly the river flat soil is mainly dominated by (% gm. soil) *Trichoderma viride* (22.83), followed by *Trichoderma Virnse* (8.37 %), *Fusarium solani* (5.93), *Penicillium red sclerotium* (4.47), *Streptomyces albus* (3.80)

G. Sandhyarani*et al. /International Journal of Pharmacy & Technology and *Graphium spp.* (3.65) respectively. Among the 22 fungal species identified, *Fusarium solani* was recorded as common (10.75 %), *Penicillium chrysogenum*, *Penicillium citrinum*, *Penicillium red sclerotium* as frequent (9.28 %), *Aspergillus oryzae*, *Aspergillus niser*, *Aspergillus flavus*, and *Aspergillus albus* as occasionally (6.63 %) and the remaining species are rare (Table 1). The above soil fungi have been recorded for the first time from mangroves of Sathanur delta, Tamilnadu, India.

Ascomycotina were the most prevalent group of fungi. The abundance of this group of fungi on marine and mangrove substrates has been reported by Hyde and Jones [10] and this might be due to their spores show adaptation to the marine ecosystem by way of production of appendages, which provide buoyancy in water, entrapment and adherence to the substrates, as reported in mangrove wood driftwood and animal substrates [11-13].

Besides the above, Ascomycetes also possess enzyme producing ability and hence they could potentially colonize the lignocellulosic woody substrates. It is observed that the majority of the marine fungi encountered during the current study belonged to

o Ascomycota. The reports of several workers support the same observation [14, 4]. Moreover, the frequency of occurrence and relative abundance of marine fungi from various mangrove forests of world shows variation. This could be attributed to the difference in the species diversity of mangrove ecosystem, age and preference of host substrate, ecological factors etc. In the present study area, the backwater is supporting maximum mangrove coverage area than estuary which in turn supporting the present result of maximum marine mangrove fungi from mangrove environment.

However, the interaction of the marine fungi with the mangrove ecosystem and supply of essential nutrients to the mangrove detritivores is not clearly known. Mangrove fungi constitute the second largest ecological group of the marine fungi [15]. From Indian context about 48 fungal species were found in decomposing *Rhizophora* debris in Pichavaram, South India [16].

The dominant phylloplane fungi were *Alternaria alternata*, *Rhizopus nigricans*, *Aspergillus* and *Penicillium sp.* Seven species of fungi that exist on mangrove leaf surface of Sundarbans of West Bengal has been reported by Pal and Purkayastha [17].

Ten fungal species isolated from the mangrove leaves of Pichavaram are *Aspergillus flavus*, *A. ochraceus*, *Alternaria alternata*, *A. tenuissima*, *Rhizopus nigricans*, *Penicillium funiculosum*, *P. pansum*, *Humicola fuscoatra*, *Mucor racemosus* and *Fusarium oxysporum*. Among the 10 fungal species *Alternaria alternata* and *Rhizopus nigricans*

are abundant in all the mangrove leaves [18].

In the present study, the identification of 22 different fungal species from Soil samples of Sathanur delta, Tamilnadu also supports the previous researchers who have identified the same fungal species from different mangrove habitats of India. The fungal identification from different Indian mangrove is mainly from decaying leaf litter, submerged wood, decomposing mangrove plants, nematophores etc. However, a very little has been known about soil fungi from mangroves. So in the present study the identification of 22 fungal species from mangrove soil of Sathanur delta is the first report from this ecosystem.

Table 1. Diversity of soil fungal species from mangrove soils of Sathanur delta.

| S.N. | Fungi Isolated | Site 1 | | Site-2 | |
|------|----------------------------------|------------|--------------|------------|--------------|
| | | CFU | %/Gms soil | CFU | %/Gms soil |
| 01 | <i>Acremonium roseum</i> | 15 | 1.44 | 24 | 3.65 |
| 02 | <i>Alternaria alternate</i> | 23 | 2.21 | -- | -- |
| 03 | <i>Aspergillus albus</i> | 04 | 0.38 | -- | -- |
| 04 | <i>Aspergillus flavus</i> | 20 | 1.92 | -- | -- |
| 05 | <i>Aspergillus niser</i> | 23 | 2.21 | -- | -- |
| 06 | <i>Aspergillus oryzae</i> | 22 | 2.12 | 09 | 1.36 |
| 07 | <i>Cladosporium oxysporum</i> | 10 | 0.96 | -- | -- |
| 08 | <i>Epicoccumpurpura scence</i> | 10 | 0.96 | -- | -- |
| 09 | <i>Fusarium oxysporum</i> | -- | -- | 13 | 1.97 |
| 10 | <i>Fusarium pallidoroseum</i> | 02 | 0.19 | -- | -- |
| 11 | <i>Fusarium solani</i> | 50 | 4.82 | 39 | 5.93 |
| 12 | <i>Graphium spp.</i> | 08 | 0.77 | 24 | 3.65 |
| 13 | <i>Geotrichum candium</i> | 04 | 0.38 | -- | -- |
| 14 | <i>Verticillium spp.</i> | -- | -- | 16 | 2.43 |
| 15 | <i>Paecilomyces variotii</i> | 08 | 0.77 | -- | -- |
| 16 | <i>Penicillium chrysogenum</i> | 20 | 1.92 | -- | -- |
| 17 | <i>Penicillium citrinum</i> | -- | -- | 19 | 2.89 |
| 18 | <i>Penicilliumred sclerotium</i> | -- | -- | 36 | 4.47 |
| 19 | <i>Phoma spp.</i> | 22 | 2.12 | 27 | 4.19 |
| 20 | <i>Streptomyces albus</i> | 21 | 2.02 | 25 | 3.80 |
| 21 | <i>Trichoderma Virnse</i> | 10 | 0.96 | 55 | 8.37 |
| 22 | <i>Trichoderma viride</i> | -- | -- | 150 | 22.83 |
| | Total 272 | 272 | 26.15 | 437 | 65.54 |

Conclusion

Hence it could be concluded that the mangrove is a unique habitat where there are diverse niches for fungi. The reports on marine mangrove fungi from different Indian mangroves were mainly from decaying woods, submerged plants, decaying plant materials, pneumatophores. However, a very little information is available regarding the diversity of soil fungi in mangroves. In the present study the identification of 22 fungal species from mangrove soils of Sathanur delta, revealed that the soil is also a potential substrate for harboring a large number of fungi. An extensive study is required for exploitation of soil fungi from different mangroves.

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