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OCCURRENCE OF FUNGI ON MANGROVE PLANTS

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Abstract

Mangrove plants viz., *Rhizophora mucronata*, *Aegiceras corniculatum* and *Ceriops tagal* were collected from Sonmiyani, Korangi and Keti bunder. A total number of 18 species of fungi belonging to 11 genera were isolated from different parts of *Rhizophora mucronata*, 14 species and 7 genera from *Aegiceras corniculatum* and 13 species 9 genera from *Ceriops tagal* plants. Of the different plant parts, highest number of fungi were isolated from roots followed by stem and leaves. Greater number of fungi were observed from *R. mucronata* followed by *A. corniculatum* and *C. tagal*. Of the sites for the collection of mangrove, sample from Sonmiyani yielded highest number of fungal flora followed by Keti bunder and Korangi.

Introduction

Mangroves are widespread in tropical and sub tropical regions, growing in the saline intertidal zones of sheltered coast lines. Pakistan has a coastline of about 1,000 km. The Indus River delta extends over 250 km from Sir Creek at the Indian Border and Karachi in the west with about 250,000 ha of mangroves (Mirza *et al*., 1983). The Indus delta mangrove area occupies about 250,000 ha (Khan, 1966). *Avicennia marina* is the dominant species. The other species that comprises less than 5% are *Aegiceras corniculatum, Burguiera conjugate, Ceriops tagal, C. roxburghiana, Rhizophora mucronata, R. apiculata* and *Sonneratia caseolaris* (Saifullah, 1982). In Pakistan direct utilization of mangroves for fuel and fodder is restricted to only few types. The consumption of mangroves as fuel and fodder by local people exceeds the sustainable yield (Saifullah, 1997). The mangrove plant part is of various uses e.g., wood is used for construction, fish traps, house frames, piling and poles. Bark is used for tanning and dye. Leaves are the source of a black or chestnut dye (Burkill, 1966). It is reported that mangrove is a folk remedy for angina, diabetes, diarrhoea, dysentery, hematuria and haemorrhage (Duke & Wain, 1981). There is a trend to study mangroves as an ecosystem and as such all related living and non living components are being considered. Fungi make a very important part of the ecosystem along with other microbes of the biomass (Hyde, 1990, 1992; Harrison *et al.*, 1994; Jones *et al*., 1988), but unfortunately they have revealed very little information. Experiments were therefore carried out to study the occurrence of fungi on mangrove plants.

Materials and Methods

Mangrove plants viz., *Rhizophora mucronata*, *Aegiceras corniculatum* and *Ceriops tagal* were collected from different coastal areas of Sonmiyani, Korangi and Keti bunder. For isolation of fungi from different parts of mangrove plant like leaves, stem and roots untreated parts of mangrove plants after surface disinfection with 1% Ca $(OCl)_2$ for 10 minutes were placed on potato dextrose agar (PDA). Five pieces were placed on each Petri dish and the dishes were incubated for 5-7 days at 24 ± 1°C. The fungi growing on

plates were identified after reference to Ellis, (1971), Domsch *et al*., (1980), Nelson *et al*., (1983), Raper & Fennell, (1965). Data were analyzed and subjected to analysis of variance (ANOVA) following the procedure as given by Gomez & Gomez (1984).

Results and Discussion

A total number of 11 genera belonging to 18 species were observed from plant parts of *R. mucronata* out of which 9 genera, 16 species from leaves, 8 genera, 14 species from stem and 7 genera, 12 species from roots were observed from 3 samples collected from Sonmiyani, Korangi and Ketibunder. Of the fungi isolated *Absidia corymbifera* (Cohn) Sacc.& Trotter, *Alternaria alternata* (Fr.) Keissler, *A. citri* Ellis & Pierce apud Pierce, *Aspergillus candidus* Link ex Link, *A. flavus* Link ex Gray, *A. fumigatus* Fres, *A. niger* Van Tieghem, *A. parasiticus* Speare, *A. sulphureus* (Fres.) Thom & Church, *A. wentii* Wehmer, *Cladosporium cladosporioides* (Fres.) de Vries, *Drechslera australiensis* (Bugni.) Subram. & Jain ex M.B.Ellis, *Fusarium solani* (Mart.) Appel & Wollenw, *Mucor* sp., *Rhizopus stolonifer* (Ecicuh ex link) Lind, *Rhizoctionia solani* Kuhn, *Syncephalastrum* sp., *Trichoderma viride* Pers.ex Gray have been observed on *R. mucronata* (Table 1). Present work showed that 11 genera were observed from *R. mucronata* as compared to the report of Mehdi & Siddiqui (1999) where they isolated 21 from rhizoplane of *R. mucronata.* Among the more frequently isolated were *Absidia corymbifera, Aspergillus* spp., *A. alternata* and *D. australiensis.* Suryanarayanan *et al*., (1998) also reported same fungi from *R. mucronata* and *R. apiculata*. Of the three samples tested two sample were found to be infected with *R. solani* where 6% infection was observed in sterilized part of roots and 7% in sterilized stem whereas 2% in non sterilized stem. Infection of *F. solani* was recorded from 2 samples where 4% in surface sterilized and 3% infection in non sterilized stem whereas 6% in non sterilized and 3% in non sterilized roots (Table 1). The most dominant group of fungi belong to Deuteromycetes and only three representatives of Zygomycetes were observed. In *R. mucronata* 100 % sample were found to be infected with *A. flavus* and *A. niger*. Similar results were obtained by Mehdi & Saifullah (2000) who reported that *Aspergillus* was the most diverse genus. Manzoor *et al*., (2004) also observed same result on soil of coastal areas. Surface sterilization with 1% Ca $(OCl)_2$ significantly reduced the incidence of *A. flavus* and *A. niger*. Present result showed that surface sterilization of plant parts reduced the infection of *A. flavus* and *A. niger* and increased the incidence of pathogenic fungi viz., *A. alternata, C. cladosporioides, R. solani, M. phaseolina* and *T. viride* on *R. mucronata*. Such similar reports have been made by Tariq *et al*., (2006) on plant parts of *Avicennia marina*.

A total of 7 genera and 14 species were isolated from *Aegiceras corniculatum* collected from Ketibunder. Of the fungi isolated *A. alternata, A. flavus, A. fumigatus, A. niger, A. parasiticus, A. sulphureus* and *F. solani* have been observed on all parts of *A. corniculatum* viz., leaves, stem and roots whereas pathogenic fungi viz., *F. solani* showed 6-13% infection in sterilized parts, 3-6% in non sterilized parts, *R. solani* showed 6% infection in surface sterilized roots and *M. phaseolina* 10% in sterilized roots (Table 1). Garg (1981) reported that all the Phycomycetous fungi belong to the order Mucorales. Ascomycetes were more in rhizoplane of *R. mucronata*. Basidiomycetes were not encountered at all in the present study. Fungi imperfecti were frequently isolated and formed the dominant mycoflora of rhizosphere and rhizoplane.

Table 1. Isolation of fungi from different parts of mangrove plants.

Name of Fungi	Sterilized						Non-sterilized					
	Leaves		Stem		Roots		Leaves		Stem		Roots	
	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD
	Rhizophora mucronata											
Absidia corymbifera	1	0.66± 0.00	2	3.22±2.58	2	3.33±2.53	2	8.33±10.60	2	8.88±9.43	2	22.2±4.70
Alternaria alternata	1	12± 0.00	2	6.11±8.25	0	0	1	13± 0.00	2	17.4±32.9	1	6.66±0.00
A. citri	1	24.4 ±0.00	0	0	1	2.22±0.00	0	0	0	0	0	0
Aspergillus candidus	1	2.22± 0.00	1	4.44±0.00	0	0	0	0	1	2.22± 0.00	0	0
A. flavus	3	24.4±6.941	3	18.8±12.6	2	35.8±23.5	3	47.4± 33.36	3	26.5±20.3	2	12.2±11.7
A. fumigatus	2	5.44± 6.83	2	3.77±3.30	2	1.11±0.00	1	4.66± 0.00	2	13.1 ±5.18	1	9.99±11.7
A. niger	2	39.2 39.35	3	31.9±23.5	2	40±14.14	3	83.3± 28.86	3	85.8± 21.6	2	55.5±9.43
A. parasiticus	1	3.33±0.00	1	2.22±0.00	2	16.6±25.9	2	16.66± 2.35	1	3.33± 0.00	2	7.77±0.00
A. sulphureus	3	9.22±7.85	3	5.11±4.28	3	19.9±12.0	3	10.6 ±13.86	1	1.11± 0.00	2	4.44±4.71
A. wentii	0	0	1	1 ±0.00	0	0	1	5.55± 0.00	0	0	0	0
Cladosporium cladosporioides	1	2.66± 0.00	1	3.33±0.00	0	0	1	5± 0.00	1	2.33± 0.00	0	0
Drechslera australiensis	2	8.88±4.70	0	0	1	0.66±0,00	2	4.11± 4.00	0	0	0	0
Fusarium solani	0	0	2	4.44±4.76	1	5.55±0.00	1	2.22±0.00	1	3.33±0.00	1	3.33±0.00
Mucor sp	1	0.66±0.00	0	0	0	0	1	1.33±0.00	0	0	0	0
Rhizopus stolonifer	1	8.66±0.00	1	5±0.00	0	0	2	8.88±4.70	2	13.5±5.19	0	0
Rhizoctonia solani	0	0	1	6.66±0.00	2	5.5±7.07	0	0	1	2.22±0.00	0	0
Syncephalastrum sp	0	0	0	0	1	4.4±0.00	0	0	0	0	1	5.55±0.00
Trichoderma viride	1	3±0.00	1	7.33±0.00	0	0	1	4.66±0.00	1	2±0.00	0	0

Table 1. (Cont'd.).

Name of Fungi	Sterilized						Non-sterilized					
	Leaves		Stem		Roots		Leaves		Stem		Roots	
	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD
	Aegiceras corniculatam											
Absidia corymbifera	0	0	0	0	1	10±0.00	0	0	1	6.66±0.00	1	16.6±0.00
Alternaria alternata	3	30±26.45	21	23.33±21.21	3	6.66±25.16	3	43.33±11.54	1	6.66±0.00	2	33.33±28.28
A. citri	2	20±28.28	0	0	1	10±0.00	0	0	0	0	1	6.66±0.00
Aspergillus candidus	0	0	0	0	0	0	0	0	0	0	1	6.66±0.00
A. flavus	2	20±14.14	3	33.33±15.27	3	20±10	1	10±0.00	3	20±10	3	50±10
A. fumigatus	1	6.66±0.00	1	3.33±0.00	1	6.66±0.00	0	0	2	10±7.07	0	0
A. niger	3	66.66±28.86	3	73.33±15.27	3	50±20	3	80±10	3	90±10	3	93.3±11.54
A. parasiticus	1	3.33±0.00	3	16.66±5.77	3	16.6±11.54	3	16.66±5.77	1	16.66±0.00	3	56.66±25.16
A. sulphureus	1	6.66±0.00	2	10±7.07	2	10±7.07	2	16.66±7.07	3	13.33±5.77	3	16.6±11.54
A. wentii	0	0	0	0	0	0	1	6.66±0.00	0	0	0	0
F.solani	2	16.66±7.07	2	10±7.07	1	6.66±0.00	1	3.33±0.00	2	10±0.07	1	6.66±0.00
Macrophomina phaseolina	0	0	0	0	1	10±0.00	0	0	0	0	0	0
Rhizopus stolonifer	1	6.66±0.00	0	0	0	0	1	16.66±0.00	0	0	0	0
Rhizoctonia solani	0	0	0	0	1	6.66±0.00	0	0	0	0	0	0

Table 1. (Cont'd.).

Name of Fungi	Sterilized						Non-sterilized					
	Leaves		Stem		Roots		Leaves		Stem		Roots	
	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD	NSI	1% ± SD
	Ceriops tagal											
Absidia corymbifera	1	2.22±0.00	1	2.22±0.00	0	0	2	11.10±0.00	1	20±0.00	1	5.55±0.00
Alternaria alternata	0	0	2	8.88±4.709	1	1.11±0.00	1	1.11±0.00	1	2.22±0.00	0	0
Aspergillus flavus	2	11.11±9.42	2	9.99±2.35	2	6.66±4.71	2	17.77±0.00	2	7.77±11.78	2	15.5±18.85
A. fumigatus	1	3.33±0.00	1	7.77±0.00	1	2.22±0.00	0	0	1	30±0.00	1	4.33±0.00
A. niger	2	27.77±11.78	2	34.44± 25.92	2	30± 7.07	2	50±35.35	2	57.7±4.71	2	59.99±9.42
A. parasiticus	1	12.22±0.00	1	2.22±0.00	1	2.22± 0.00	1	13.33±0.00	0	0	1	3.33±0.00
A. sulphureus	2	4.44±0.00	1	2.22± 0.00	1	1.11±0.00	2	7.77±2.35	1	1.11±0.00	1	22.2±0.00
Drechslera australiensis	1	2.22± 0.00	0	0	1	13.3±0.00	0	0	0	0	0	0
Fusarium solani	2	8.88± 14.14	2	8.88± 4.70	1	4.44±0.00	1	5.55±0.00	1	2.22±0.00	1	3.33±0.00
Monilia sp.	0	0	1	5.55±0.00	0	0	0	0	1	5.55±0.00	0	0
Mucor sp.	0	0	0	0	0	0	1	6.66±0.00	0	0	0	0
Nigrospora oryzae	1	3.33± 0.00	0	0	1	3.33± 0.00	0	0	0	0	0	0
Rhizoctonia solani	0	0	0	0	1	2.22±0.00	0	0	0	0	1	3.33±0.00

NSI = Number of samples infected
SD = ± standard deviation
1% = Percentage of infected seeds

A total number of 9 genera and 13 species were observed from leaves, stem and roots of *Ceriops tagal*. Of the fungi isolated *A. corymbifera, A. alternata, A. flavus, A. fumigatus, A. niger, A. parasiticus, A. sulphureus* and *F. solani* was isolated from all parts of *C. tagal* plant viz., leaves, stem and roots collected from Korangi and Ketibunder. Infection % of *R. solani* was recorded from one sample, 20% in surface sterilized and 3% in non sterilized root. *D. australiensis* showed 2 % infection in sterilized leaves and 13 % in sterilized roots. *F. solani* was obtained in all parts of plant in both sterilized (4-8%) and non sterilized parts (2-5%) (Table 1). Highest number of fungi were obtained in leaves followed by roots and stem. Mehdi & Saifullah (1992) reported maximum number of species on leaves. Present work showed that 13 species were observed from *C. tagal* whereas Sultana (2002) reported 5 species isolated from leaf litter sample of *C. tagal.* Of the plating method used for isolation of fungi from different parts, roots yielded highest number of fungi as compared to leaves and stem. There is therefore need to study the mycoflora of mangrove species on a large scale from other areas of Pakistan and also keep the coastal areas clean.

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