J. Phytol. Res. 9 (1): 29–33, 1996

SEASONAL DYNAMICS OF MICROFUNGAL POPULATION IN COASTAL SAND DUNES OF ORISSA

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A total of 102 species belonging to 46 genera of fungi were isolated from a coastal sandy belt of Orissa for a period of two years, 1989 to 1991. The dominant species were *Trichoderma viride*, *Penicillium verruculosum*, *Aspergillus flavus*, *A. niger*, *Pencillium citrinum*. The number of fungal colonies was maximum in September and minimum in May which tended to decrease with increase in depth. The population showed significant +ve correlation with soil moisture, total organic carbon and soil respiration while -ve with soil temperature. Bacteria were studied quantitatively and it was maximum in July and minimum in January.

Keywords: Coastal sandy belt; Fungi.

Introduction

Microfungi and bacteria are involved in organic matter decomposition and energy recycling in soil ecosystems. The Quantitative and qualitative composition of soil microflora depend largely upon the characteristics of soil and relative composition of its organic and inorganic constitents. Fungal population from diverse vegetational sites has earlier been studied and it has been concluded that soil microfungi show ecological and geoclimatic specificity with response to environmental parameters[1]. No works on this aspect has yet been done in coastal soils of Orissa. Therefore, the present work was undertaken to find out the occurrence, distribution, dominance and variation of soil fungi and bacteria and the factors influencing their ecophysiology in the noted belt having uniculture plantation of *Casuarina*.

Materials and Methods

The site of the study was Ganjam District of Orissa, 19 15' N latitude and 84 50' E Longitude having 60 Km of sea coast along the Bay of Bengal at a height of 6 - 8 m above MSL (Fig.1) cashew plantations at this site covers more than 150 hectares extending 4-5 km along the sea coast with a width of 250-450 m and a shelter belt plantation of casuarina having 10-15 rows covering 10-20 m along the coast.

The unproductive uplands, coastal sand dunes and sandy beds have been extensively covered by *Casuarina* for soil conservation.

The climate of the region is monsoonic with coastal characteristics. The temperature ranges from 13 to 47°C. The annual rainfall is nearly 130 cm.

Random sampling was done monthly. Soil samples were collected from 0-3cm and 8-15 cm depth in sterilized test tubes and temporarily stored in an ice chest. The fungi were isolated by dilution plate[2] and soil plate[3] method using Potato Dextrose Agar medium. 10^2 dilution was used for fungi and 10^3 for bacteria. Becterial plate count was made after 48 hr while fungi were studied after 3-7 days of incubation. Soil temperature at different depths was recorded using a soil thermometer, moisture by oven dry method and pH by a glass electrode pH meter. Total organic carbon was determined by Walkeley and Black rapid titration method and total nitrogen by micro-Kjeldahl method. Soil metabolism was estimated by alkali absorption method[4].

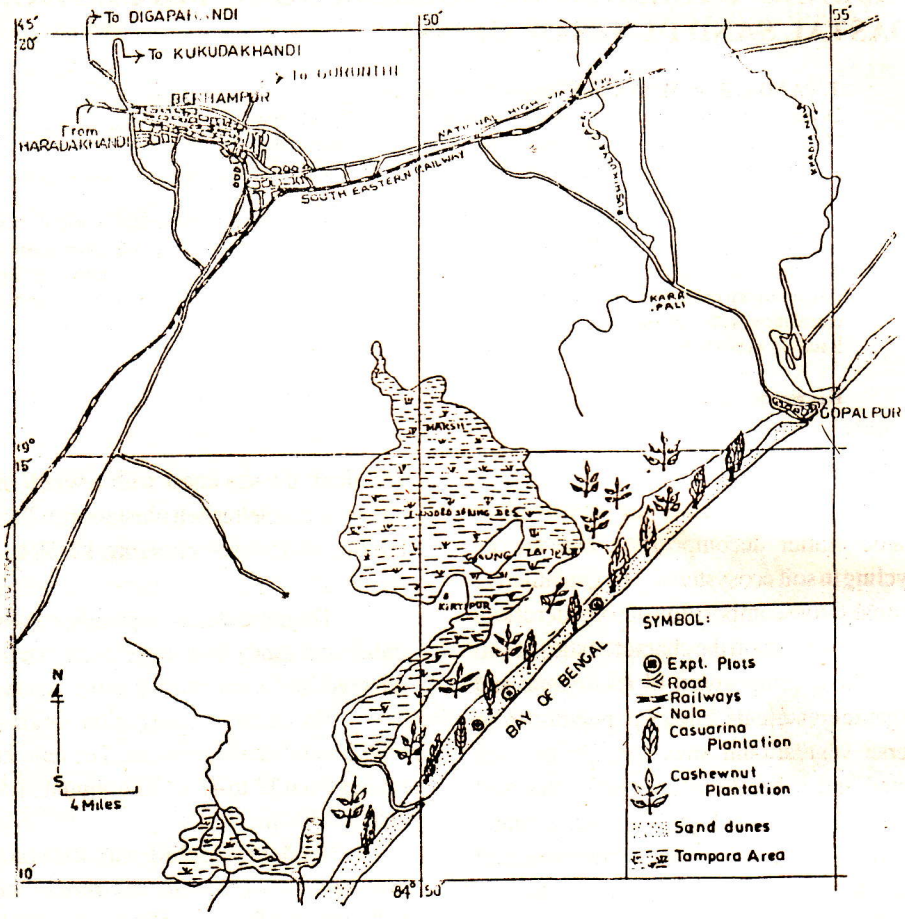

Fig. 1 Map of Study Site

Results and Discussion

The temperature of the surface layer was higher than the subsurface layer (Table 1). Maximum temperature was recorded in the month of May and minimum in January. The moisture was higher in subsurface layer than the surface. The soil samples of both the layer were alkaline. Surface soil possessed more organic carbon and total nitrogen than the subsurface soil.

The surface soil possessed more fungal and bacterial population than the subsurface one. Fungal population attains its maxima in September and minimum in May in both the layers. Bacterial population was maximum in July in surface layer an in October in subsurface layer. It was minimum in January in both the layers. The fungal population of both the layers has +ve correlation with soil mositure (Surface soil r = + 0.587 P< 0.05 and Subsurface soil r=+0.642 P<0.05), Organic carbon (Surface soil r=+ 0.876 P< 0.05 and Subsurface soil r = + 0.737P < 0.05) and -ve correlation with temperature (Surface soil r = -0.798 P<0.05 and Subsurface soil r = ! 0.583P

Table 1. Soil characteristics and total population of fungi and bacteria g^{-1} dry soil. (Average of two years)

Month	Soil	temp-erature (°C)	Moisture content %	Total Organic Carbon %	Total Nitrogen %	pH	Fungal × (10^2) Popul - ation	Bacterial × (10^3) Population
Dec.	S2	26.0	0.38	0.38	0.0112	7.41	44.4	32.4
	S3	24.8	0.53	0.25	0.0098	7.5	40.8	42.1
Jan.	S2	25.5	0.35	0.38	0.0102	7.15	45.1	27.3
	S3	25.0	0.69	0.22	0.0095	7.59	46.4	30.6
Feb.	S2	27.0	0.34	0.36	0.0137	7.06	48.7	36.9
	S3	26.0	0.62	0.22	0.011	7.43	43.5	33.4
Mar.	S2	31.8	0.28	0.25	0.0156	6.92	43.8	33.7
	S3	30.1	0.56	0.18	0.0113	7.24	34.7	36.2
Apr.	S2	35.5	0.21	0.23	0.0152	6.98	33.2	40.5
	S3	32.8	0.51	0.15	0.0103	7.39	26.7	31.8
May	S2	38.8	0.16	0.18	0.015	6.9	21.8	43.8
	S3	34.7	0.39	0.15	0.0103	7.23	17.1	37.9
June	S2	33.0	0.59	0.29	0.0156	7.08	34.4	46.9
	S3	32.5	0.36	0.26	0.0118	7.29	37.9	44.6
July	S2	30.5	0.9	0.34	0.0184	7.01	45.8	50.7
	S3	29.7	2.3	0.27	0.0123	7.17	47.07	41.3
Aug.	S2	30.0	1.29	0.39	0.0159	7.08	47.5	45.4
	S3	29.0	3.09	0.3	0.0108	7.26	48.1	39.8
Sept.	S2	29.5	1.21	0.39	0.0137	6.93	53.2	52.3
	S3	28.4	3.02	0.33	0.011	7.17	51.9	43.9
Oct.	S2	28.5	0.61	0.33	0.0143	7.1	42.4	47.3
	S3	27.5	1.52	0.3	0.0098	7.4	33.7	52.5
Nov.	S2	27.5	0.48	0.35	0.0121	7.4	41.8	37.5
	S3	26.5	0.87	0.23	0.0094	7.77	29.9	44.3

S2 = Surface soil; S3 = subsurface soil.

Table 2. Special group distribution by presence in samples of coastal soil.

Depth in cm	Surface (0-3 cm)				Subsurface (8-15 cms)			
Name of the groups	Number of genera	% of total	Number of Spp.	% of total	Number of genera	%of total	Number of Spp.	% of total
Zygomycotina	5	13.9	7	9.0	3	7.9	5	5.9
Ascomycotina	2	5.6	2	2.6	3	7.9	4	4.7
Deuteromycotina	29	80.5	69	88.4	32	84.2	76	89.4
Monililes	24	82.8	64	92.8	21	65.6	65	35.6
Sphaeropsidales	3	10.4	3	4.2	7	21.8	7	9.2
Melanconiales	1	3.4	1	1.5	2	6.3	2	2.6
Mycelia sterilia	1	3.4	1	1.5	2	6.3	2	2.6
Total	36	100.0	78	100.0	38	100.0	85	100.0

< 0.05). The pH and total nitrogen proved insignificant.

Of total 1778 colonies, the surface soil contributed 903 colonies belonging to 36 genera and 78 spp while subsurface soil produced 875 colonies belonging to 38 genera and 85 Spp. Deuteromycotina shared between 80 to 90 % followed by Zygomycotina and Ascomycotina in both the layers (Table 2). The fungi that contributed more than 2.0% towards the total occurrence are enlisted with their ranks (Table 3). *Aspergillus* Spp. were dominant followed by *Penicillium* and *Trichoderma.* The CO_2 evolved /m^2 /hr was maximum in August and minimum in May. Similar fluctuation in fungal population was observed which had +ve correlation with the soil respiration Cr = + 0.701 P<0.05).

Behera and Mukerji[5] have pointed out that the change in fungal population correspond to the soil moisture. Marginal variations in pH at sites fail to influence fungal population as it has a triffle role[6]. Highest number of fungi and bacteria coincides with higher percentage of organic carbon and nitrogen as reported earlier[5]. The seasonal variation seems to influence the density of individual fungus and population as a whole. The rainy season carried higher population followed by winter and summer. Higher moisture content and temperature of sand corresponding to the rains and summer, might be the reason for such fluctuations.

Members of aspergilli and penicillia were dominant flora in both the soil layers as earlier reported[7]. The order Deuteromycotina <Ascomycotina <Zygomycotina of occurrence might be due to ability of the fungi for survival of adversity and adjustment with the environment.

Similar to the present observation, the soil CO_2 evolution was reported to be influenced by soil temperature and the moisture[8,9] and possessed +ve correlation with microbial population.[10]

Table 3. Percentage contribution (above 2.0%) of some dominant fungi with their relative ranks.

S. No.	Fungus Spp.	Surface Soil			Subsurface soil		
		Number of colonies	% contri-bution	Rank	Number of colonies	% contri-bution	Rank
1.	*Trichoderma viride*	65	7.2	1	96	10.97	1
2.	*Penicillium verruculosum*	63	6.98	2	85	9.71	2
3.	*Aspergillus flavus*	62	6.86	3	19	2.17	14
4.	*A. niger*	55	6.09	4	72	8.22	3
5.	*Penicillum citrinum*	52	5.76	5	22	2.51	11
6.	*Fusarium Sp.*	47	5.2	6	39	4.46	7
7.	*Aspergillus terreus*	34	3.77	7	69	7.89	4
8.	*Cladosporium cladosporiodes*	32	3.54	8	-	-	-
9.	*Aspergillus fumigatus*	30	3.32	9	45	5.14	6
10.	*A. awamori*	29	3.21	10	58	6.62	5
11.	*Cladosporium oxysporum*	26	2.88	11	-	-	-
12.	*Curvularia lunata*	23	2.55	12	28	3.2	8
13.	*Penicillium rubrum*	22	2.43	13	22	2.51	12
14.	*Drechslera australiensis*	21	2.32	14	-	-	-
15.	*Absidia butteri*	20	2.21	15	21	2.4	13
16.	*Rhizopus nigricans*	20	2.21	16	26	2.97	9
17.	*Aspergillus candidus*	19	2.1	17	-	-	-
18.	*Penicillium minioleuteum*	-	-	-	23	2.63	10

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