



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5

Issue: XII

Month of publication: December 2017

DOI:

www.ijraset.com

Call: ☎ 08813907089

E-mail ID: ijraset@gmail.com

Relationship between Phylloplane Mycroflora Aeromicroflora and Soil Microflora

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Abstract: Aeromicrobial studies of microbe population are for understanding the survival of microbes in the soil leaf surface and air. The objective of this study was to isolate and evaluate relationship between phylloplane micro flora aero micro flora and soil micro flora. Qualitatively studies on a total my co flora my co flora 30 fungi belonging to 11 genera with sterile form and pink yeast.

I. INTRODUCTION

The occurrence of a wide variety of microorganisms in the atmosphere have a direct correlation between surface colonizers and atmospheric spores as the spores from atmosphere settle down on the surface of the plants which play an important role in the leaf infection (or infection on aerial parts) and in the development of disease syndrome. In other words we can say that from open air, leaves remove some of the microbial burden normally carried out by wind as they remain in touch with the environment. Spores trapping by leaves is a natural phenomenon in nature. Spores and other propagules in the air reach the leaves by sedimentation under the influence of gravity, and by rain and splash droplets. Leaf surface commonly known as phylloplane provides a suitable habitat for the growth of antagonistic microorganisms which can compete with the pathogen for nutrients and inhibit pathogen multiplication by secreting antibiotics or toxins (Blakeman, 1982; Yadav et al., 2011). The phyllosphere of plants is a dynamic ecosystem inhabited by specific bacteria, yeasts and fungi. Their activity is related to various interactions between the biotic and abiotic factors of the environment (Behrendt et al., 1997, 1999). Interactions of microorganisms living on the surface of the plants aboveground parts are based on antibiosis, competition and parasitism (Chakraborty et al., 1994, Stromberg et al., 2000) which protect the plants from pathogenic microorganisms and improving their health.

Thus studies of aeromicroflora are necessary to understand the survival of fungi in air, phylloplane and soil. The present study was undertaken to assemble the following information.-

Periodicity of aeromicroflora over Stevia field

To evaluate the relationship between phylloplane microflora between aeromicroflora and soil microflora.

II. MATERIAL AND METHODS

Aeromicroflora of Stevia field was obtained by gravity petridish method (Durham 1946). Four petri dishes containing Martins Rose Bengal agar medium were exposed for 5-10 minutes at 4 feet height above the ground level at 8 a.m., 1 p.m. and 6 p.m. The plates were transferred to the laboratory and kept for incubation at $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$ for a period of 7 days and then the plates were examined for the development of fungal colonies. The number of fungal colonies appeared were counted. The numerical expression of the fungal population was obtained by

$$\text{Bacterial / fungal propagules / } 100\text{cm}^3 = \frac{\text{Total number of colonies in five plates}}{\text{Volume of Petri dish} \times 5} \times 100$$

Percentage of abundance and percentage of frequency of each species occurring on different plate was calculated as follows:-

$$\text{Percentage of abundance} = \frac{\text{No. of colonies of individual species in all the plates studied}}{\text{Total no. of colonies of all the species}} \times 100$$

$$\text{Percentage of frequency} = \frac{\text{No. of colonies of individual species in all the plates studies}}{\text{Total no. of observations}} \times 100$$

III. RESULTS AND DISCUSSION

A total of 40 fungal comprising zygomycetes ascomycetes and deuteromycetes including sterile forms were isolated during the course of investigation. Seasonal and diurnal fluctuation in the fungal content of air over *Stevia* field in year 2013 are given in table 1.6. the content of air at a particular sampling time varied between 6.2 and 35.6 propagules/100cm³. Minimum number of propagules was trapped on 06/03/13 at 6p.m. and maximum number on 20/06/13 at 1p.m. in the 2nd sampling the fungal content in the air i.e mean of all the twelve petri dishes exposed in a day was highest. The fluctuation in the aeromycoflora can be attributed to prevailing environmental condition. It is clear from the data that temperature, humidity and rainfall play a major role in quantification of aeromycoflora. The maximum number of fungal microflora spore was sampling in 2nd sampling on 26/06/13. Thirty six petri dishes containing Martin's Rose Bangal Agar Medium were exposed. A total of 639 colonies were trapped from the air of stevia field giving an average 10.75 colonies/plate. This is due to rain which provided humidity to the dry weather and helps in stimulating sporulation after the rain cease or diffusion of phylloplane mycoflora. The lowest mycoflora on 06/03/13 may be due to low temperature and absence of rain. Jogdand (1998) and Gadekar (2014) observed greatest concentration of fungi over others during rainfall while investigating aerospora on Jowar crop.

Quintero *et al.*, (2017) reported that increasing humidity induces sporulation and Levetin and Horner (2002) showed that rain drops facilitating the dispersion of these from vegetation. Diurnal cycle fungi showed afternoon tendency in all the samples except 1st sampling. Second peak was obtained at evening except in the 1st when it was obtained at afternoon. Morning and evening gave minimum count in all except 1st sampling. A total of thirty fungal forms (table -6.2) were trapped from the air during the period of investigation, the dominant species above 75% frequency of occurrence were *A.alternata*, *C. cladosporioides* and sterile white mycelia. Fungal species with 50-75% frequency of occurrence were *A.tenuissima*, *A.niger* and *P.citrum*. Highest occurrence of air mycoflora in month of June might be due to increase in temperature.

The periodicity and occurrence of various fungi in the air over many crop in relation to environmental condition were studied by Afzal *et al.*, 2004, Uddin, 2004, 2005, 2007; Ray *et al.*, 2011 Irga And torpy, 2015.

Table-6.1 Seasonal and diurnal variation in the density aeromycoflora per 100 cm³ over *S.rebaudiana* field

Sampling time	I 06/03/13	II 20/06/13	III 20/09/13
8 a.m.	15.1	25.4	13.63
1 a.m.	7.80	35.6	22.28
6 a.m.	6.20	26.4	14.94

Two-way analysis of table

Source of variation	Sum of square	DF	Mean of Square	F	P-value	F crit
Among means of treatment A	68.3929	1	68.3929	79.07607816	0.071291	161.4476
Among means of treatments B	153.5121	1	153.5121	177.491155*	0.047696	161.4476
Residual	0.8649	1	0.8649			

A=Diurnal cycle B= Time interval; DF= Degree of freedom, * Significant at 0.05 level

Table-1.2 Percentage abundance of aeromycoflora over *S.rebaudiana* field

S.N.	Name of microorganism						sampling no., date & sampling time					
I				II			III					
06/03/13				20/06/13			30/09/13					
		8 am	1 pm	6 pm	8 am	1 pm	6 pm	8am	1 pm	6 pm		
1.	Alternariaalternata						31	36.6	13.1	10.4	-	2.5
	5.3	15.4	28.2									
2.	Alernariatenuissima						-	-	-	-	-	5.4
	21.5	19.8	17.5									
3.	Aspergillusfumigatus						-	13.3	4.3	-	-	-
	-	-										

4.	A. niger	6.8	-	-	1.03	-	1.2	-
	1.2 -							
5.	Botrytis cinerea	-	-	-	-	1.50	-	-
	- -							
6.	Cladosporiumclodosporioides	37.9	13.3	17.3	-	17.6	7.2	25.9
	28.5 15.8							
7.	Curvularialunata	-	-	-	-	-	-	-
	3.5 -							
8.	Diplococciumspicatum	-	-	-	-	-	16.2	-
	- -							
9.	Dreschleratrigonis		-	-	-	-	-	-
	5.7 - -							
10.	Fudariumsporotrichioides	-	-	-	22.9	10.4	13.5	-
	- -							
11.	Geotrichumcandidum	-	-	-	39.2	45.3	29.3	-
	- -							
12.	Mucorhiemalis	-	-	-	-	1.48	-	5.3
	8.9 -							
13.	Penicilliumcitrinum		-	-	13.1	1.03	-	-
	- 7.1 9.2							
14.	P. cyclopium		-	-	8.6	-	-	-
	- - -							
15.	P. expansum		3.4	10	-	-	-	-
	- - -							
16.	P. Purpurogenum	3.4	-	17.3	-	-	-	-
	- -							
17.	P. notatum		-	-	-	-	-	-
	5.7 - -							
18.	P. oxalicum		-	-	-	-	-	-
	1.9 4.7 -							
19.	penicillium sp.	-	-	-	-	-	9.0	-
	- -							
20.	Rhizopusoryzae	-	-	-	-	-	-	3.8
	- -							
21.	Scopulariopsisbrevicaulis	-	-	-	-	5.2	-	-
	- -							
22.	Scytalidiumlignicola	6.8	-	-	-	-	-	
	- 8.8							
23.	Scytalidium sp.	-	-	-	-	-	-	-
	- 7.68							
24.	Sporobolomycesroseus	-	-	-	-	-	-	7.7
	5.9 2.3							
25.	Sporothrix sp.	-	-	-	-	-	-	1.9
	3.6 3.5							
26.	Syncephalastrumracemosum	-	-	-	10.3	13.3	8.1	-
	- -							
27.	Trichodermahamatum	-	-	-	10.4	5.0	7.8	-
	- -							
28.	Trichophyton sp.	-	-	-	-	-	-	-
	- 3.5							

29.	Sterile Brown mycelia	1.7	6.6	4.3	-	-	-	-
30.	Sterile white mycelia	8.6	20.0	20.6	3.1	-	-	15.3
	2.4 3.5							

Table 6.3 Percentage contribution & percentage frequency of aeromycoflora over *S. rebaudiana* field

S.N.	Name of microorganisms	% contribution	% frequency
1.	<i>Alternaria alternata</i>	12.52	88.89
2.	<i>Alternaria tenuissima</i>	6.89	44.45
3.	<i>Aspergillus fumigatus</i>	0.79	22.22
4.	<i>A. niger</i>	1.26	44.45
5.	<i>Botrytis cinerea</i>	0.32	11.11
6.	<i>Cladosporium cladosporioides</i>	16.90	88.89
7.	<i>Curvularia lunata</i>	0.47	11.11
8.	<i>Diplococcium spicatum</i>	1.41	11.11
9.	<i>Dreschleria trigonis</i>	0.47	11.11
10.	<i>Fusarium sporotrichioides</i>	7.98	33.33
11.	<i>Geotrichum candidum</i>	20.50	33.33
12.	<i>Mucor hiemalis</i>	2.04	33.33
13.	<i>Penicillium citrinum</i>	2.35	44.44
14.	<i>P. cyclopium</i>	0.31	11.11
15.	<i>P. expansum</i>	0.78	22.22
16.	<i>P. Purpurogenum</i>	0.94	22.22
17.	<i>P. notatum</i>	0.47	11.11
18.	<i>P. oxalicum</i>	0.78	22.22
19.	<i>penicillium sp.</i>	1.57	11.11
20.	<i>Rhizopus oryzae</i>	0.31	11.11
21.	<i>Scopulariopsis brevicaulis</i>	1.09	11.11
22.	<i>Scytalidium lignicola</i>	1.25	22.22
23.	<i>Scytalidium sp.</i>	0.47	11.11
24.	<i>Sporobolomyces roseus</i>	1.57	33.33
25.	<i>Sporothrix sp.</i>	0.94	33.33
26.	<i>Syncephalastrum racemosum</i>	5.79	33.33
27.	<i>Trichoderma hamatum</i>	4.07	33.33
28.	<i>Trichophyton sp.</i>	0.31	11.11
29.	Sterile Brown mycelia	0.63	33.33
30.	Sterile white mycelia	4.85	77.78

Table 6.4 Value of colony forming units (cfu/g) for fungi in soil at 10^{-3} dilution

Sampling no. and date		
I	II	III
06/03/13	20/06/13	30/09/13
0.54	1.3	0.733

Table 6.5 Percentage occurrence of fungal species in soil (10^{-3} dilution) obtained by soil dilution plating technique

S.N.	Name of microorganisms	Sampling no. and sampling date		
		I	II	III

			06/03/13	20/06/13	30/09/13
1.	Aspergillusflavus	18.72	11.52	-	
2.	A. fumigatus	37.83	10.64	-	
3.	A niger	2.54	7.98	-	
4.	A terreus	1.5	6.65	-	
5.	Aspergillus sp.	-	2.66	-	
6.	Cladosporiumcladosporioides	3.75	7.8		5.15
7.	Curvularialunata	-	-	9.27	
8.	Emericellandidulans	-	2.66	-	
9.	Fusariumsporotrichioides	-	6.65	3.09	
10.	Geotrichumcandidum	-	-	3.03	
11.	Gliocladium sp.	-	-	5.15	
12.	Histoplasma sp.	-	-	26.78	
13.	Microsporum sp.	-	-	7.21	
14.	Mucorhiemalis	-	2.66	-	
15.	Penicilliumcitrinum	-	7.68	-	
16.	P. cyclopium	29.32	7.98	-	
17.	P. oxalicum	-	-		4.12
18.	P. purpurogenum	6.76	-	-	
19.	Rhizomusorvzae	-	18.62	-	
20.	Scytalidiumlignicola	-	-	8.24	
21.	Sporobolomycesroseus	-	-	11.33	
22.	Stachybotryschartarum	-	-	2.06	
23.	Trichodermahamatum	-	-	9.27	
24.	Sterile White mycelia	-	1.83	5.15	

Table 6.6 Percentage contribution and percentage frequency of soil fungi is S.rebaudiana field

S.N.	Name of microorganisms	%contribution	%frequency
1.	Aspergillusflavus	11.79	66.67
2.	A. fumigatus	19.19	66.67
3.	A niger	3.37	66.67
4.	A terreus	2.36	66.67
5.	Aspergillus sp.	0.67	33.33
6.	Cladosporiumcladosporioides	5.39	100
7.	Curvularialunata	3.03	33.33
8.	Emericellandidulans	0.67	33.33
9.	Fusariumsporotrichioides	2.69	66.67
10.	Geotrichumcandidum	1.01	33.33
11.	Gliocladium sp.	1.68	33.33
12.	Histoplasma sp.	8.76	33.33
13.	Microsporum sp.	2.36	33.33
14.	Mucorhiemalis	0.67	33.33
15.	Penicilliumcitrinum	2.02	33.33
16.	P. cyclopium	15.15	66.67
17.	P. oxalicum	1.35	33.33
18.	P. purpurogenum	3.03	33.33
19.	Rhizomusorvzae	2.69	33.33
20.	Scytalidiumlignicola	2.69	33.33
21.	Sporobolomycesroseus	3.70	33.33

22.	Stachybotryschartarum	0.67	33.33
23.	Trichodermahamatum	3.03	33.33
24.	Sterile White mycelia	2.02	66.67

Table 6.7 Percentage abundance of phylloplanemycoflora of *S. rebaudiana* obtained by dilution plate method

S.N.		Name of microorganism		Sampling no., sampling date and agr of plant									
				(Day)									
		I				II				III			
		06/03/13				20/06/13				30/09/13			
		56				162				264			
		Y		M		Y		M		Y		M	
1.	Alternariatenuissima	-	-	-	-	10.85	5.75						
2.	Aspergillusflavus	10.12	-	-	-	15.6	12.08						
3.	A. fumigatus		-	25.91	-	25.47	-	-					
4.	A. ochraceus		-	-	-	-	-	19.71					
5.	Aspergillus sp.	-	-	-	5.7	-	-						
6.	Cladosporiumcladosporioides	9.78	25.80	9.5	-	12.54	-						
7.	Emericellandidulans		-	-	14.75	-	-	-					
8.	Mucorhiemalis	-	5	-	5.58	21.3	23.39						
9.	Penicilliumcyclopium	23.39	9.36	24.65	34.90	-	-						
10.	P. expansum		30.26	-	-	-	-	-					
11.	P. notatum		-	-	-	-	12.5	2.08					
12.	P.purpurogenum	14.67	17.55	25.54	14.2	-	-						
13.	Pericomiella sp.	9.78	5.85	12.25	-	-	-						
14.	Scytalidiumlignicola	2.05	3.51	-	-	-	8.85						
15.	Scytalidium sp.	-	-	14.75	10.49	-	-						
16.	Sporobolomycesroseus	-	-	-	13.32	20	16.4						
17.	Stachybtryschartarum	-	-	-	-	-	5.7						
18.	Trichodermahamatum	-	-	-	-	-	5.75						
19.	Seterile White mycelia	-	7.02	-	-	7.5	-						

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