Int.J.Curr.Microbiol.App.Sci (2016) *5*(3): 459-465

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 5 Number 3(2016) pp. 459-465**
Journal homepage: http://www.ijcmas.com

Original Research Article http://dx.doi.org/10.20546/ijcmas.2016.503.054

Effect of Meteorological Factor on Fluctuation of Aeromycoflora of *Barleria prionitis* L.

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Keywords

Barleria prionitis, Density, Aeromycoflora, Meteorological data.

Article Info

Accepted:
18 February 2016
Available Online:
10, March 2016

A B S T R A C T

During the present investigation 57 fungal species belong to 27 genera of fungi were isolated from the aeromycoflora of *Barleria prionitis* plants. The season and month wise densities of the aeromycoflora were also observed, maximum density of the aeromycoflora was observed in winter season and in the month of November. Minimum density was observed in summer season and in the month of May. The variations in meteorological factor Viz. Temperature, Relative humidity, Rainfall on dispersion of airspore where further discussed. The linear and non-parametric correlation between number of colonies and all meteorological factors were estimated and explored by means of Spearman's correlation analyses.

Introduction

Environmental abiotic factor consist of temperature, relative humidity, rainfall, while and biotic components have actinomycties, bacterial and fungal spore. Fungal spore are major part of air spore. Aerobiological studies are widely used to determine the fungal spectrum in the air. The fungal flora of air is not constant and is highly variable (Anderson 1985). It may originate from different resources in to the air to settle down for growth on suitable host. Fungal spores are an ever-present component of the atmosphere and are present in almost all seasons of the year (Burch and Levetin, 2002; Troutt and Levetin, 2001). Nevertheless, the meteorological conditions is cause of dispersion of spores and closely related to it variations (Sabariego et al., 2000). The environmental factors affect the daily and seasonal rhythms of airborne fungal and difficult to estimate that are known to importance of each factor (Kasprzyk 2006; Horner et al., 1995). The most effective and reliable application of the relationships between spore production and different environmental growth conditions, can be used for pesticides, or to improve diagnosis and treatment of respiratory allergic diseases (Rodríguez-Rajo et al., 2005). The current

studies carried out over *Barleria prionitis L.* (Family Acanthaceae), with lots of medical application (Swapna et al., 2011; Purohit and Vyas, 2004).

Materials and Methods

Barleria prionitis Linn. is a medicinal plant were cultivated in Botanical Garden of Govt. Science college Raipur. During present studies aeromycoflora of above plant was observed fortnightly with the help of gravity petriplate method (Diksha Khare and Tiwari, 2015). The collected spores are identified based on their characteristics such as shape, size and other morphological feature and literature can also be used for authentic identification. The densities were evaluated from following formulae,

$$\text{Density} = \frac{\text{Total No. of colonies of individual species}}{\text{Total No. of observation}}$$

Meteorological data [Temperature (Temp), Rainfall (RAF), Relative Humidity (RH)] obtain from the meteorological department of Indra Gandhi Krishi Vishwavidhyala, Raipur Chhattisgarh. The statistical analyses were carried out by SPSS version16.

Results and Discussion

During one year studies, 778 colonies (57 fungal species) were isolated from the aeromycoflora of *Barleria prionitis* in different month Table No. 1. Density represent the numerical strength of a species in the community.The number of individual of the species in any unity area is its density. Among 57 fungal species 3 species from Zygomycotina, 3 species from Ascomycotina and 51 species from Anamorphic fungi were recorded. From Table No.2 certain fungal species like *Aspergillus niger, A. flavus, A. versicolar, A. fumigatus, Alternaria alternata, Curvularia lunata, Cladosporum oxysporum, Fusarium oxysporum* were showed maximum density throughout the year. While some fungal species showed minimum density like *Rhizopus rhizopodiformis Cunninghamella blackesleeana, Thielavia boothi, Thielavia terricola, Aspergillus nidulens var. latus, Penicillium purpurogenum, Alternaria brassicola, A.humicola, Curvularia eragrostidis, C. ovoidea, C. pallescens, C. sengealensis, C. lunata var. aeria,*

Table.1 Showing Total Number of Colonies of Aeromycoflora of Different Month

S. No	*Month*	Total no of colony (TNC)
1	July	82
2	August	61
3	September	55
4	October	88
5	November	100
6	December	87
7	January	81
8	February	50
9	March	48
10	April	45
11	May	36
12	June	45
	Total	**778**

Table.2 Showing Densities of Different Fungi in Different Season and Month of Aeromycoflora

S.No	NAME OF FUNGI	RAINY SEASON					WINTER SEASON					SUMMER SEASON					
		July	Aug	Sep	Oct	Total	Nov	Dec	Jan	Feb	Total	Mar	April	May	June	Total	Grand Total
	ZYGOMYCOTINA																
1	*Cunninghamella blakesleeana*	0.10	-	-	-	0.025	-	-	-	-	-	-	-	-	-	-	0.008
2	*Rhizopus rhizopodiformis*	-	-	-	-	-	-	-	0.10		0.025			0.1	-	0.025	0.016
3	*Syncephalastrum racemosum*	0.10		0.30		0.10	0.10	-	-	-	0.25	0.3	-	0.2	-	0.125	0.08
	ASCOMYCOTINA	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-
1	*Chaetomium globosum*	-	-	-	-	-	-	-	-	0.40	0.10	0.30	-		-	0.075	0.058
2	*Thielavia boothi*	-	-	-	-	-	-	-	-	-	-	-	-	0.10		0.025	0.008
3	*Thielavia terricola*	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.10	0.025	0.016
	ANAMORPHIC FUNGI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1	*Alternaria alternate*	0.70	0.50	0.30	0.80	0.575	0.10	0.20	0.50	0.30	0.275	0.20		0.10	0.30	0.15	0.333
2	*Alternaria brassicola*	-	-	-	-	-	-	0.30	0.20	0.20	0.175	-	-	-	-	-	0.058
3	*Alternaria chlamydospora*	-	-	0.50	-	0.125	-	0.40	0.20	0.10	0.175	-	-	-	-	-	0.10
4	*Alternaria citri*	0.60	0.30	0.30	0.40	0.40	0.10	0.20	-	-	0.075	-	-	-	-	-	0.158
5	*Alternaria humicola*	-	-	-	-	-	-	-	-	-	-	-	-	0.10	-	0.025	0.008
6	*Alternaria radicina*	0.50	0.20	-	-	0.175	-	-	0.3	-	0.075	-	-	-	-	-	0.08
7	*Aspergillus nidulans var. latus*	-	-	-	-	-	-	-	-	-			0.1	0.10		0.05	0.016
8	*Aspergillus nidulans var. acristatus*	-	-	-	-	-	-	-	-	0.10	0.025	0.10	0.2	0.10		0.1	0.041
9	*Aspergillus awamori*	-	-	-	0.60	0.15	0.40				0.10			0.20	0.10	0.075	0.108
10	*Aspergillus flavus*	0.60	0.50	0.20	0.40	.425	0.30	0.50	0.60	0.40	0.45	0.50	0.7	0.80	0.60	0.65	0.508
11	*Aspergillus fumigates*	0.40	0.20	-	-	0.15	0.60	0.40		0.20	0.30	1.10	0.9	0.70	0.70	0.85	0.433
12	*Aspergillus nidulans*	-	-	-	-	-	0.50	0.30	-	-	0.20		0.3	0.20		0.125	0.108
13	*Aspergillus niger*	0.50	1.00	0.40	0.60	0.625	0.50	0.30	0.20	0.20	0.30	0.50	0.3	0.20	0.40	0.35	0.425
14	*Aspergillus ochraceus*	-	-	-	0.65	0.15	0.70	-	-	-	0.175	-	-	-	-	-	0.108
15	*Aspergillus niveus*	0.30	-	-	-	.075	-	-	-	-	-	-	-	0.20	0.40	0.15	0.075
16	*Aspergillus terreus*	0.40	0.60	-	-	0.25	0.40	-	0.30	-	0.175	-	-	-	-	-	0.141
17	*Aspergillus versicolor*	1.10	0.80	0.10		0.5	0.50	0.30	0.30	0.20	0.325			0.10	0.20	0.075	0.30
18	*Cladosporium cladosporioides*	-	-	-	0.60	0.15	0.60	0.5	0.6	0.50	0.55	-	-	-	-	-	0.233
19	*Cladosporium oxysporum*	0.50	-	-	0.50	0.125	0.50	0.4	0.4	0.30	0.4	0.80	0.70	-	-	0.375	0.341
20	*Cladosporium sphaerospermum*	0.30	0.20	0.60	-	0.275	0.50	0.5	0.6	0.40	0.5	-	-	-	-	-	0.258

S.N.	NAME OF FUNGI	July	Aug	Sep	Oct	Total	Nov	Dec	Jan	Feb	Total	Mar	April	May	June	Total	Grand Total
21	*Colletotrichum dematium*	-	-	0.30	-	0.075	-	-	0.5	-	0.125	-	-	-	-	-	0.066
22	*Corynespora cassiicola*	0.30	0.20	0.30	0.20	0.25	0.20	-	-	-	0.05	-	-	-	-	-	0.1
23	*Curvularia borreriae*	-	-	-	0.10	0.025	0.50	-	-	-	0.125	-	-	-	-	-	0.05
24	*Curvularia clavata*	0.20	0.50	0.80		0.375	0.60	0.5	0.4	0.30	0.45	0.30	0.10	-	0.20	0.15	0.325
25	*Curvularia eragrostidis*	-	-	-	-	-	-	-	-	-	-	0.10	0.20	-	-	0.075	0.025
26	*Curvularia lunata var. aeria*	-	-	-	0.70	0.175	-	-	-	-	-	-	-	-	-		0.058
27	*Curvularia lunata*	0.30	0.50	0.30		0.275	0.30	0.70	0.03	0.50	0.45	0.20	0.20	0.10	0.20	0.175	0.3
28	*Curvularia ovoidea*	-	-	-	-	-	-	0.20	0.10	-	0.075	-	-	-	-	-	0.025
29	*Curvularia pallescens*	-	-	-	-	-	0.20	-	-	-	0.05	-	-	-	-	-	0.166
30	*Curvularia senegalensis*	-	-	-	-	-	-	0.20	-	-	0.05	-	-	-	-	-	0.016
31	*Diplococcium sp*	0.20			0.30	0.125	0.40	0.70	0.30		0.35	-	-	-	-	-	0.158
32	*Drechslera autstraliensis*	-	-	-	-	-	-	-	-	-	-	-	-	0.10	0.20	0.075	0.025
33	*Drechslera hawaiiensis*	-	-	-	0.20	0.05	0.40	0.30	-	-	0.175	-	-	-	-	-	0.09
34	*Epicoccum purpurascens*	-	-	0.20	0.10	0.075	0.30	0.20	-	0.30	0.125	-	-	-	-	-	0.066
35	*Fusarium moniliforme*	-	-	-	0.20	0.05	0.30	0.30	0.20	-	0.2	-	-	-	-	-	0.083
36	*Fusarium oxysporum*	0.30	0.50	0.40	0.60	0.45	0.30	0.30	0.30		0.225	0.20	0.20	0.10		0.125	0.266
37	*Glioclodium viride*	-	-	0.20	-	0.05	-	-	-	-	-	-	-	-	-	-	0.016
38	*Macrophomina sp.*	-	-	-	0.50	0.125	0.10	0.20	-	-	0.075	-	-	-	-	-	0.066
39	*Monodictys fluctuate*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.30	0.075	0.025
40	*Nigrospora oryzae*	0.20	-	-	0.30	0.125	0.30	0.20	0.50	0.30	0.325				0.30	0.075	0.175
41	*Nigrospora sphaerica*	0.10	-	-	-	0.025	-	-	-	-	-	-	-	-	0.40	0.10	0.014
42	*Paecilomyces varioti*	-	-	0.10	0.20	0.075	-	-	-	-	-	-	-	-	-	-	0.025
43	*Penicillium purpurogenum*	-	-	-	0.10	0.025	-	-	-	-	-	-	-	-	-	-	0.008
44	*Penicillium notatum*	0.30	-	-	-	0.075	-	-	0.60	0.30	0.225	-	-	-	-	-	0.1
45	*Penicillium rugulosum*	-	-	-	-	-	-	-	-	0.10	0.025	0.20	0.30	-	-	0.125	0.05
46	*Periconia sp.*	-	-	-	-	-	-	-	-	-	-	-	-	0.10	-	0.025	0.008
47	*Pestalotiopsis glandicola*	-	-	-	-	-	-	0.20	-	-	0.05	-	-	-	-	-	0.016
48	*Pithomyces graminicola*	-	-	-	-	-	0.20	-	-	-	0.05	-	-	-	-	-	0.016
49	*Trichoderma sp.*	-	-	-	-	-	0.20	0.30	0.20	-	0.175	-	-	-	-	-	0.058
50	*Uloclaodium alternariae*	-	-	0.20	0.50	0.175	-	0.20	-	-	0.05	-	-	-	-	-	0.075
51	Mycelia sterila black	0.20	0.10	-	0.30	0.15	-	0.10	0.10	0.20	0.1	-	0.20	-	0.10	0.075	0.108

Table.3 Showing Meteorological Data

S.No	Month	Temperature		Relative Humidity	Rainfall [mm]
		Maximum	Minimum		
1	July	31.80	24.3	69.50	026.00
2	August	29.10	24.4	60.00	031.00
3	September	32.20	24.4	48.50	011.60
4	October	30.80	19.3	39.00	004.20
5	November	30.20	13.8	35.00	008.90
6	December	28.10	10.9	62.00	252.20
7	January	26.80	11.9	83.50	379.80
8	February	28.90	12.3	86.00	156.60
9	March	36.60	17.7	80.00	136.40
10	April	39.90	23.4	71.50	020.20
11	May	41.10	27.9	60.50	000.00
12	June	36.00	25.9	61.00	000.00

Table.4 Showing Spearman's Correlation

Correlations

			Total no colony	RH	Temp	Rainfall
Spearman's rho	Total no colony	Correlation Coefficient	1.000			
		Sig. (2-tailed)	.			
		N	12			
	RH	Correlation Coefficient	-.680*	1.000		
		Sig. (2-tailed)	.015	.		
		N	12	12		
	Temp	Correlation Coefficient	-.382	-.140	1.000	
		Sig. (2-tailed)	.221	.665	.	
		N	12	12	12	
	Rainfall	Correlation Coefficient	.247	-.676*	.669*	1.000
		Sig. (2-tailed)	.438	.016	.017	.
		N	12	12	12	12

. Correlation is significant at the 0.05 level (2-tailed).

Drechslera australiensis, Paecilomyces varioti, Periconia sp. Pestalotiopsis glandicola, Pithomyces graminicola, Glioclodium viride, Tircoderma sp. and Monodicyts fluctuate.

On the contrary some fungal species were showed moderate density, like *Chaetomium globosum, Aspergillus niveus, A. terrus, A. ochraceus, A. nidulans, Aspergillus nidulans var. sacristatus, Penicillium rugulosum, P. notatum, A. radicina, A. citri, A. chlamydospora, Curvularia borreriae, Drechslera hawaiiensis, Collectotrichum dematium, Cladosporium cladosporioids, Cladosporium sphaerosperum, Nigrospora sphaerica, Fusarium moniliform, Epicoccum purpurasecns, Uloclodium alteranariae, Corynespora cassicola, Microphomina sp. a*nd *Diplococcium*. In Rainy season maximum density shown by *Alternaria alternate, A.citri. Aspergillus niger*.In winter season maximumdensity shown by *Aspergillus flavus, Cladosprum cladosporids. C. sphaerospermum, Curvularia clavata, Diplococcium.* In Summere the maxium *density show by Aspergillus fumigates, Asp.flavus, Cladoserium oxysporum*.

The meteorological data was present in the Table No.3 Maximum number of fungal population was recorded during winter season due to favorable temperature (28.46^{o}C). Moderate number of fungal species during rainy season due to temperature slightly favorable (32.86^{o}C). Minimum number of fungal population in summer season was due to unfavorable temperature (38.47^{o}C) Figure No.1.

The influences of Temp, RH and RAF on total numbers of colony (TNC) were analyses statistically through linear correlation and were shown in equation1, 2, 3. The regression with temperature is quite good about 0.709, while with rainfall is about 0.254 that shows that temperature effect more on the spore of related fungi while effect of rainfall is low as due heavy rainfall flashed out the spore. The effects of time of sampling on the data were also effect as in rainy time than it effect on TNC. The moderate relation of RH on TNC was 0.427.Althrough some author also state the significance of the correlation with humidity on the number of spore (Oliveira 2009).

TNC = 42.70536(±3.32138) -0.15548(±0.04884) Temp, R = 0.70946, N=12 {1}

TNC = 84.2084 (±14.83363) -0.32648 (±0.21813) RH, R = 0.42781, N=12 {2}

TNC = -8.521 (±118.99382) + 1.45135 (±1.74981) RAF, R = 0.25371, N=12 {3}

The non parametric correlation among total number of colony and all meteorological factor were shown as Spearman's correlation in Table No.4. From table the total number of colony showing positive correlation with rainfall, while negative with temperature and RH.

In conclusion, the analysis of data indicates that concentration of airborne fungi over *Barleria prionitis* environment is very high and quite variable depending on the climatic conditions. The seasonal climate had positive variations of the influence on occurrence of aeromycoflora. Winter and rainy months registered maximum density of fungal spores due to favorable growth and sporulating conditions for fungi and availability of suitable.

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How to cite this article:

Diksha Khar and Tiwari, K.L. 2016. Effect of Meteorological Factor on Fluctuation of Aeromycoflora of *Barleria prionitis* L. *Int.J.Curr.Microbiol.App.Sci.* 5(3): 459-465.
doi: http://dx.doi.org/10.20546/ijcmas.2016.503.054