



## Research Article

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### STATISTICAL ANALYSIS OF AEROMYCOFLORA OF ACC JAMUL FACTORY AREA AND NON POLLUTED AREA IN JAMUL, BHILAI, DIST DURG, CHHATTISGARH, INDIA

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Received on: 02/03/16 Revised on: 26/04/16 Accepted on: 02/05/16

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DOI: 10.7897/2277-4343.073115

#### ABSTRACT

Fungi are an important microflora found in well diversified ecological conditions. In Chhattisgarh state, Jamul is situated in eastern region of Bilai. The floral and annual diversity of Jamul is a matter of Interest. Present paper deals with the fungal diversity in Jamul. For study of aeromycoflora, ten sterilized Petri plates containing PDA media were exposed 5 to 10 min. in both ACC and non polluted area of Jamul. These exposed Petri plates brought into the laboratory and incubated at  $28\pm 1^{\circ}\text{C}$  for incubation period. During the period of investigation, overall 68 fungal species (1371 fungal colonies) belonging to 30 genera of fungi were observed in ACC factory area and 77 fungal species (1687) fungal colonies) belonging to 34 genera of fungi were observed in non polluted environment of Jamul. Statistical analysis viz Test and Two Way ANOVA has been performed for statistical analysis

**Keywords:** Aeromycoflora, Statistical analysis and Anova test

#### INTRODUCTION

Aerobiology is a scientific and multi disciplinary approach focused on the transport of organisms and biologically significant materials. Aerobiology, not only deals with different kinds of organisms however additionally with their merchandise together with, spores and cells of bacteria, Actinomycetes, fungi and associated metabolites, pollen grains of upper plants, mites, insects, their fragments and fecal pellets, macromolecules discharged from the plants and animal cells etc. Impact of these on organisms includes infection, hypersensitivity reaction and toxicosis in man, animals and in plants. Lacey<sup>1</sup>, declared that 'Aerobiology is therefore a discipline in itself however, one that attracts and is used by the researchers in many fields. Every day, we are exposed to such airborne particles, like fungi, pollen, bacteria, and harmful particles, such as asbestos fibers and noxious chemicals. Air borne particles cause biodeterioration, allergy and disease in humans, animals and plants. Airborne conidium frames the major part of a range of airborne particles that may also include hyphae fragment, pollen grains and small particulate material (Bioaerosole). For the eco- management to achieve success it might be necessary to own a radical data concerning the sort and range of microorganisms within the atmosphere of an area which helps in formulating a correct eco-management strategy for the place.

Fungi are remarkable for their antiquity, diversity, ubiquitous distribution and longevity<sup>2</sup>. Therefore, a study on air borne fungi has been conducted in ACC cement factory Jamul Industrial town of Bilai which is one of the biggest industrial towns in the country and their statistical analysis has been done. Our study area is ACC Jamul factory area and non polluted area away from the factory, throughout the year both places are very crowded due to industry and village. During study we did comparative analysis of ACC Jamul factory area and non polluted area away from the factory.

#### MATERIALS AND METHODS

##### Sample collecting area

Jamul is situated in the eastern region of Durg District Chhattisgarh and situated in  $21.25^{\circ}\text{N}$  North latitude and  $81.4^{\circ}\text{E}$  East longitudes above 298.60 meter the sea levels. ACC (Associated Cement Companies) Jamul factory area is the main environment where air is very polluted from cement dust and soot. The climatic condition of Jamul city is divided by rainy seasons (July-October) winter (November-February) and summer season (March-June).

##### SURVEY OF AEROMYCOFLORA

For study of aeromycoflora, ten sterilized Petri plates containing PDA media were exposed 5 to 10 min. in ACC and non polluted area of Jamul. These exposed Petri plates brought into the laboratory and incubated at  $28\pm 1^{\circ}\text{C}$  for incubation period. At the end of incubation period fungal colonies were counted, isolated and identified with the help of available literature (Barnett 1969) Ellis (1988) and finally identified by the authentic authority. Targeted fungi were got identified by authentic centre TFR I (Tropical Forest Research Institute) Jabalpur. (M.P)

Potato dextrose agar media;  
Dextrose - 20 gm  
Potato - 250 gm  
Agar - 15 gm  
Distilled water - 1000 ml

##### Seasonal Variation

- Seasonal variation of the aeromycoflora over Jamul Cement factory area and non polluted area of Jamul.
- Monthly variation of the aeromycoflora over the Jamul factory area and non polluted area of Jamul.

**ECOLOGICAL STUDIES**

For ecological studies, at the end of the incubation period of the indoor and outdoor Aeromycoflora, percentage frequency and percentage contribution of fungal flora were calculated. These formulas were assessed by Jadhav and Tiwari<sup>3</sup> and Shrivastava *et al.*,<sup>4</sup>. Similar work were done by karkun and coworkers,<sup>5</sup>

$$\% \text{ Frequency} = \frac{\text{Number of observations (plates) in which a species appeared}}{\text{Total no. of Observations}} \times 10$$

$$\% \text{ Contribution} = \frac{\text{Total number of colonies of a species in all the observations taken together}}{\text{Total No. of colonies in all the species}} \times 100$$

**Meteorological Data**

The following meteorological data were recorded from ACC administrative office of the Jamul factory:

- Temperature
- Relative humidity and
- Rainfall

**FOR SOURCES MYCOFLORA ISOLATION**

Fungal spores, ubiquitous in nature are adapted to all kinds of environment. Fungi originate from different sources i.e. plants, water and soil and area become contaminated. They are transported through air current, from one place to another place. Plants, soil and water are the major sources of Aeromycoflora. In present study air samples were collected for isolation of mycoflora.

**Statistical analysis:** t Test and Two Way Anova has been performed for statistical analysis.

**RESULTS AND DISCUSSION**

**Mycobial Survey**

The present investigation deals with the ACC Jamul factory area and non polluted area of Jamul by using gravity petriplate (containing PDA medium) method from July 2013 to June 2014. During the period of investigation, overall 68 fungal species (1371 fungal colonies) belonging to 30 genera of fungi were observed in ACC factory area and 77 fungal species (1687) fungal colonies) belonging to 34 genera of fungi were observed in non polluted environment of Jamul.

**Table 1: Comparative study of fungal diversity of ACC Jamul factory and Non Polluted area**

	ACC Jamul factory area	Non Polluted area
<b>Total species</b>	68	77
<b>Rainy season</b>		
Zygomycotina	4 genera(6 species) (17 colonies)	4 genera (7 species) (25 colonies)
Basidiomycotina	-	-
Ascomycotina	1 genus (1 species) (5 colonies)	3 genera (3 species) (15 colonies)
Anamorphic fungi	9 genera (34 species) (234 colonies)	8 genera (37 species) (247 colonies)
Mycelia sterilia	1 genus (2species) (29 colonies)	1 genus (2species) (34 colonies)
<b>Winter season</b>		
Zygomycotina	4 genera (6 species) (26 colonies)	4 genera (6 species) (26 colonies)
Basidiomycotina	2 genera (2 species) (5 colonies)	2 genera(2 species) (5 colonies)
Ascomycotina	3 genera (3 species) (21 colonies)	8 genera (8 species) (101 colonies)
Anamorphic fungi	15 genera (47 species) (603colonies)	15 genera (47 species) (786 colonies)
Mycelia sterilia	1 genus (2 species) (16 colonies)	1 genus (2 species) (17 colonies)
<b>Summer season</b>		
Zygomycotina	2 genera (4 species) (16 colonies)	2 genera (4 species) (14 colonies)
Basidiomycotina	-	-
Ascomycotina	-	1 genus (1species) (6 colonies)
Anamorphic fungi	10 genera (33 species) (380 colonies)	10 genera (34 species) (390 colonies)
Mycelia sterilia	1 genus (2species) (19 colonies)	1 genus(2species) (21 colonies)

**Table 2: Comparative study of factors responsible for ACC Jamul factory area and Non Polluted area of Jamul**

	ACC Jamul factory area	Non Polluted area
<b>Rainy season</b>	<b>Average</b>	<b>Average</b>
Rainfall	8.8 mm	8.8mm
Temperature	31.71°C	31.62°C
Humidity	92%	93%
Organic matter	High	High
<b>Winter season</b>	<b>Average</b>	<b>Average</b>
Rainfall	3.3mm	3.3mm
Temperature	32.2°C	32.2°C
Humidity	86.72%	89.75%
Organic matter	High	High
<b>Summer season</b>	<b>Average</b>	<b>Average</b>
Rainfall	1mm	1mm
Temperature	40.3 °C	40.3°C
Humidity	40.65%	62.65%
Organic matter	Low	Low

**Statistical analysis**

Statistical analysis of all test was carried out using ANOVA and t Test. Analysis were carried out for data of ACC Jamul and Nonpolluted area of Jamul using t Test. Result obtained was not significant since there was not much difference between the fungal population of both area. This type of statistical analysis was done by Chakraborty<sup>6</sup>.

**Table 3: t-Test**

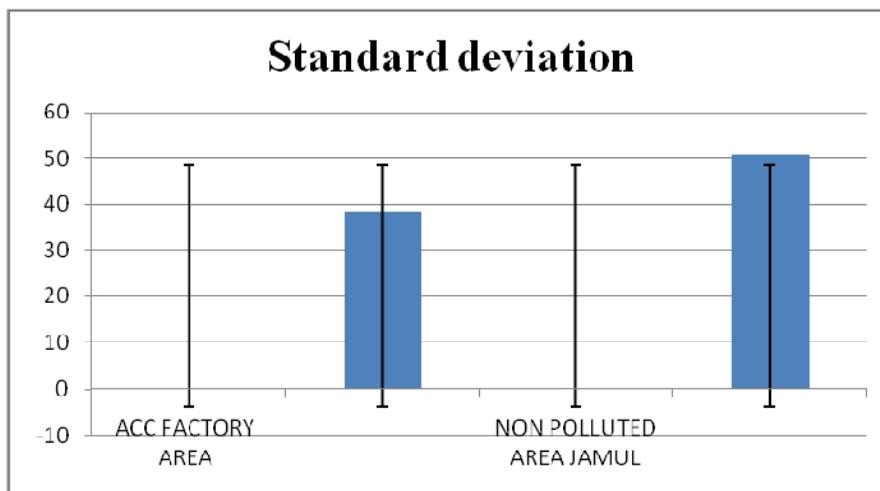
t-Test: Two-Sample Assuming Unequal Variances		
		Variable 2
Mean	20.16176471	21.90909091
Variance	1470.794337	2582.110048
Observations	68	77
Hypothesized Mean Difference	0	
Df	140	
t Stat	-0.235260581	
P(T<=t) one-tail	0.40717513	
t Critical one-tail	1.655810511	
P(T<=t) two-tail	0.814350261	
t Critical two-tail	1.977053689	

**Table 4: Statistical difference between ACC and Non polluted area**

S.No	ACC Factory Area		Non polluted area Jamul	
1	Mean	20.16176471	Mean	21.90909091
2	Standard Error	4.650734188	Standard Error	5.790845942
3	Median	8	Median	8
4	Mode	2	Mode	8
5	Standard Deviation	38.35093659	Standard Deviation	50.81446691
6	Sample Variance	1470.794337	Sample Variance	2582.110048
7	Kurtosis	23.78647828	Kurtosis	44.22213984
8	Skewness	4.607937429	Skewness	6.261931497
9	Range	248	Range	403
10	Minimum	1	Minimum	1
11	Maximum	249	Maximum	404
12	Sum	1371	Sum	1687
13	Count	68	Count	77

**Table 5: Standard deviation of samples**

ACC Factory Area	Non Polluted Area Jamul
Standard Deviation 38.35093659	Standard Deviation 50.81446691



**Figure 1: Standard Deviation of ACC factory and nonpolluted area Jamul**

**Table 6: Standard error of samples**

ACC Factory Area	Non Polluted Area Jamul
Standard Error 4.650734188	Standard Error 5.790845942

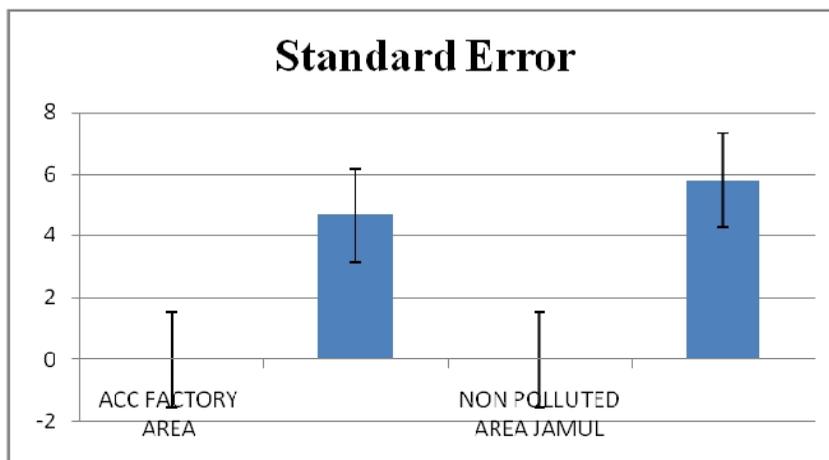


Figure 2: Standard Error of ACC factory and Nonpolluted area of Jamul

**ANOVA TEST**

Analysis of variance (ANOVA) was analysed for seasonal variation (Fungal colonies, fungal genera and fungal species of both the area with ANOVA at  $P \leq 0.05$  level (Significance Level) All test were conducted in 5 plates. The result obtained was significant it shows that there is effect of seasonal variation in both the areas. This type of statistical analysis was done by Mandloi<sup>7</sup>, Uddin<sup>8</sup> aeromycoflora in jute fields Pavan and Manjunath<sup>9</sup> in indoor and outdoor air quality of Poultry farm of Bangalore. Inamdar<sup>10</sup> studied antifungal activity of Hinguliya Manikyarasa in *Candida albicans* by its various concentration.

Table 7: Two way ANOVA for Grand Total Number of Fungal Colonies of ACC Jamul and Non polluted area Jamul

Season	ACC	Non Polluted
Rainy	285	321
Winter	671	935
Summer	415	431

Table 8: Two Factor without replication

Anova: Two-Factor Without Replication						
SUMMARY	Count	Sum	Average	Variance		
Rainy	2	92	46	18		
winter	2	125	62.5	12.5		
summer	2	80	40	2		
ACC	3	142	47.33333	124.3333		
Non polluted	3	155	51.66667	149.3333		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	543	2	271.5	125.3077	0.007917	19
Columns	28.16667	1	28.16667	13	0.069051	18.51282
Error	4.333333	2	2.166667			
Total	575.5	5				

Table 9: Two way ANOVA for Grand total number of fungal species of ACC Jamul and Non Polluted area of Jamul

Season	ACC	Non Polluted
Rainy	43	49
Winter	60	65
Summer	39	41

Table 10: Two way ANOVA for Grand total number of fungal genera of ACC Jamul area and Non polluted area

Season	Acc	Non
Rainy	15	16
Winter	25	30
Summer	13	14

Table 11: ANOVA method

ANOVA: Two-Factor Without Replication						
SUMMARY	Count	Sum	Average	Variance		
rainy	2	31	15.5	0.5		
winter	2	55	27.5	12.5		
summer	2	27	13.5	0.5		
ACC	3	53	17.66667	41.33333		
Non polluted	3	60	20	76		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	229.3333	2	114.6667	43	0.022727	19
Columns	8.166667	1	8.166667	3.0625	0.222222	18.51282
Error	5.333333	2	2.666667			
Total	242.8333	5				

## CONCLUSION

Fungal spores are common in our atmosphere and it is found in the factory area throughout the year. Fungi require certain environmental conditions and a suitable host for their growth and reproduction. Microorganisms can enter from outside area of factory through air and contaminate the atmosphere. Employees and visitors are also the sources of dust as they play role of dust carrier, breathing, cough and sneezing causes a dispersion of the microflora which can be present in human throat, pharynx and even lungs. Cement dust is also one of the major cause of respiratory disorders. Different types of fungal spores were found in the air of factory area during investigation period. Spore and vegetative cell concentration does not decrease in the environment but regularly multiplies and increase. Soil, water and plants are the three main sources of aeromycoflora present in our environment. Vegetative cells and fungal spores present in the atmosphere emerge from soil, human activities like transportation, visiting, farming aerosols leads to the formation of fine droplets librated in the atmosphere. The soil is single unit which get associated with other particles by the action of wind. The present study serves a preliminary information on different groups of fungi that are present in the factory atmosphere .The regular monitoring of fungal spores may provide better knowledge of specific groups of fungi causing various types of health disorder which are human pathogenic. Therefore, it is very important to check and do regular air monitoring of aeromycoflora of factory area

Control of microorganisms in the ACC Jamul can be done by maintaining humidity and temperature in environment. The gases used for fumigation can also be used to control the growth of fungal species. In factory area cleanliness should be maintained by avoiding the accumulation of organic substances. The chemicals may be used for checking the multiplication of aeromycoflora .The windows and different ventilators ought to be sieved so as to minimize entry of microorganisms .ACC Factory area is a place where number of human being come everyday. The air of ACC factory area consist microorganisms which are harmful for human being. Therefore it is necessary to survey the aeromycoflora of ACC Factory area.

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## Cite this article as:

Seema Verma and Arunima Karkun. Statistical analysis of Aeromycoflora of ACC Jamul factory area and non polluted area in Jamul, Bhilai, Dist Durg, Chhattisgarh, India. *Int. J. Res. Ayurveda Pharm.* May - Jun 2016;7(3):70-74 <http://dx.doi.org/10.7897/2277-4343.073115>

Source of support: Nil, Conflict of interest: None Declared

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