



Study of Seasonal Variation of Aeromycoflora of Railway Station, Janjgir-Naila, Janjgir, CG, India

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Abstract

The study of microorganisms such as bacteria, viruses, pollen grains, fungal spores, insects and molds, which are found in the air and passively transported by air, is called as Aerobiology. The present investigation was undertaken to study of seasonal variation of aeromycoflora of railway station, Janjgir-Naila, Janjgir (C.G.), India. The investigation was carried out from March 2014 to February 2015, by using the gravity petri plate method for the isolation of aeromycoflora with sterile PDA medium at monthly intervals. In this investigation period total 543 fungal colonies represented by 16 fungal types. Out of 543 fungal colonies, maximum numbers of fungal colonies (308) were isolated during winter season, moderate (148) during rainy season and minimum (87) during summer season. *Cladosporium cladosporioides* was most dominant aeromycoflora followed by *Aspergillus niger* and *Penicillium* species. *Aspergillus*, *Alternaria*, *Cladosporium*, *Curvularia*, *Penicillium*, *Rhizopus* sp. are the pathogenic and allergic in nature.

Keywords: Aeromycoflora, Fungal spore, Seasonal variation, Railway station.

Introduction

Airborne mycoflora disperse through the air and deposited on leaf surface, some on the ground and finally in the soil. They germinate and cause many diseases in host. The dehiscence of their sporangia or cleistothecia, perithecia or apothecia or fruiting bodies which spread their spores in air and that disperse through the air and fall on specific substratum where they haustoriate. Thus they continue complete their life cycle into the host and this way they cause many fungal diseases among various flora and fauna.

The airborne mycoflora present in air inhaled through living organism such as – animals, birds and human beings. They settle on their own specific host and where they germinate and produce toxins which are allergic in nature in human beings and they cause many incurable diseases in plants, animals and humans and also they play an important role for pollutant in air.

Fungal concentration was not homogenous throughout the year found in nature because their concentrations vary from season to season and meteorological factors such as – relative humidity, temperature and light intensity.

The present investigation was undertaken to study of seasonal variation of aeromycoflora of railway station, Janjgir-Naila, Janjgir (C.G.), India. This study will be providing important information regarding the composition and concentration of the airborne fungal spores.

Materials and Methods

Study site: Janjgir is a beautiful and historical town was founded by Maharaja Jajawalya Dev of Kulchury dynasty. This town was recognized as a district under the Chhattisgarh State of India on 25 May 1998. Geographically it is situated between the 82°3'E to 83°2' E latitude and 21°6'N to 22°4'N longitude direction. The total population of this district is about 16, 19,707 (as per census 2011).

The major crop of this district is Rice, Wheat etc. This district plays a major role for the rearing and weaving of Mulberry and Tassar silk which provide silk accessories for many textile industries. This town is also famous for its cultural heritage as having an ancient time built Vishnu Mandir which defines the golden past of this town as well as the artistic skill of Vaishnav community of this area.

Janjgir is connected with South Eastern Central Railway named as Janjgir-Naila Railway Station. It is located at 294.4 meters altitude above from the sea level. It is well connected to the rest of the country through the Indian Railway channels.

Sampling: The investigation was carried out for a period of 12 months from March 2014 to February 2015. Air sampling was carried out by using gravity petri plate method for the aeromycoflora isolation¹⁻³. Five sterilized petri plates containing PDA media were exposed for 5 to 10 minutes in the sampling site at monthly intervals⁴⁻⁷. The exposed petri plates were brought into lab and incubated at room temperature for the

incubation period after that fungal colonies were counted and identified with the help of microscopic slide and available published literature^{8,9,10}. The percentage frequency and percentage contribution of aeromycoflora was calculated by the following formula^{11,12}.

Percentage frequency =

$$\frac{\text{Number of observations in which a species appeared}}{\text{Total number of observations}} \times 100$$

Percentage contribution =

$$\frac{\text{Total number of colonies of individual species in all the plates}}{\text{Total number of colonies in all species}} \times 100$$

Results and Discussion

During investigation period of seasonal variation of aeromycoflora of railway station, Janjgir-Naila, Janjgir (C.G.) India, total 16 fungal species under 10 genus had been reported. In this investigation period total 543 fungal colonies represented by 16 fungal types. Out of 543 fungal colonies, maximum numbers of fungal colonies (308) were isolated during winter season, due to favourable temperature and relative humidity for aeromycoflora, moderate (148) during rainy season and minimum (87) during summer season, due to unfavourable temperature and relative humidity for aeromycoflora.

In the winter season, the maximum % contribution showed by *Cladosporium cladosporioides* (52.27%) followed by *Penicillium* sp. (10.06%), *Aspergillus niger* and *Mycelia sterilia* (White) (5.19%), *Fusarium oxysporum* (4.54%), *Aspergillus fumigatus* (3.89%), *Aspergillus flavus* (2.92%), *Aspergillus* sp. (2.92%), *Mycelia sterilia* (Brown) (2.92%), *Alternaria* sp. (2.59%), *Aspergillus sulphureus* (2.27%), *Curvularia lunata* (1.94%), *Rhizopus* sp. (1.29%), *Cladosporium* sp. and unidentified sp.-I (0.97%).

Thus, the most frequent species (100%) was *Cladosporium cladosporioides* followed by *Alternaria* sp., *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus* sp., *Curvularia lunata*, *Fusarium oxysporum*, *Penicillium* sp., *Mycelia sterilia* (white and brown) (75%), *Aspergillus sulphureus*, *Rhizopus* sp. and Unidentified sp.-I (50%), *Cladosporium* sp. (25%).

In the rainy season, the maximum % contribution showed by *Cladosporium cladosporioides* (27.02) followed by *Aspergillus niger* (26.35%), *Penicillium* sp. (9.49%), *Aspergillus fumigatus*, *Curvularia lunata*, *Fusarium oxysporum* and *Mycelia sterilia* (white) (4.72%), *Aspergillus flavus* (4.05%), Unidentified sp.-II (3.37%), *Aspergillus sulphureus* and Unidentified sp.-I (2.70%), *Cladosporium* sp. and *Rhizopus* sp. (2.02%), *Aspergillus* sp. (1.35%).

Thus, the most frequent species (100%) were *Aspergillus niger* and *Cladosporium cladosporioides* followed by Unidentified sp.-I (75%), *Aspergillus flavus*, *Aspergillus fumigatus*, *Curvularia lunata*, *Fusarium oxysporum*, *Penicillium* sp., *Mycelia sterilia* (white) and *Rhizopus* sp. (50%), *Aspergillus sulphureus* and *Aspergillus* sp. (25%).

In the summer season, the maximum % contribution showed by *Aspergillus niger* (35.63%) followed by *Cladosporium cladosporioides* (18.39%), *Aspergillus sulphureus* (8.04%), *Curvularia lunata* (6.89%), *Cladosporium* sp., Unidentified sp.-I and II (5.74%), *Aspergillus flavus* (4.59%), *Penicillium* sp. and *Rhizopus* sp. (3.44%), *Mycelia sterilia* (2.29%).

Thus, the most frequent species (75%) were *Aspergillus niger* and *Cladosporium cladosporioides* followed by *Aspergillus sulphureus*, *Curvularia lunata*, *Rhizopus* sp. and Unidentified sp.-I (50%), *Aspergillus flavus*, *Cladosporium* sp., *Penicillium* sp., *Mycelia sterilia* and Unidentified sp.-II (25%).

During investigation period *Cladosporium cladosporioides* was most dominant fungal species followed by *Penicillium* sp., *Aspergillus niger*, *Mycelia sterilia* (white), *Fusarium oxysporum* in the winter season, while *Cladosporium cladosporioides* was the most dominant in the rainy season followed by *Aspergillus niger*, *Penicillium* sp. and *Aspergillus niger* was the most dominant fungal species in the summer season followed by *Cladosporium cladosporioides*, *Aspergillus sulphureus*, *Curvularia lunata*, the same type of result were also observed by many scientists¹³⁻²⁰.

Thus, *Cladosporium cladosporioides*, *Alternaria* sp., *Aspergillus flavus*, *Aspergillus fumigatus*, *Aspergillus niger*, *Aspergillus* sp., *Curvularia lunata*, *Fusarium oxysporum*, *Mycelia sterilia* (white and brown) and *Penicillium* sp. were most frequent mycoflora in the winter season. *Aspergillus niger* and *Cladosporium cladosporioides* were most frequent fungal species in the rainy and summer season, the same type of result were also obtained by many aerobiological scientists^{21, 22, 23}.

The huge number of passenger come on the railway station from different areas for the purpose of traveling are constantly being exposed to these spores of which a good number are known for their hypersensitive reactions leading to respiratory problems like bronchial responsiveness (asthma), hypersensitivity pneumonitis, allergic alveolitis such as bronchopulmonary aspergillosis, bronchoalveolar lavage or transbronchial lung problem²⁴⁻²⁶.

From the information of reference studies, it was found that *Aspergillus flavus*, *Aspergillus fumigatus*, *Cladosporium* sp., *Curvularia* sp. demonstrated greater than 60% positive reactions in skin prick tests in many experimental cases²⁷.

Table-1
List of Aeromycoflora of railway station, Janjgir-Naila, Janjgir(C.G.), India in winter season

S.N.	Name of fungi	Winter season				Total colonies	% contribution	% frequency
		Nov	Dec	Jan	Feb			
	Zygomycotina							
1.	<i>Rhizopus</i> sp.	-	-	2	2	04	1.29	50
	Anamorphic fungi							
2.	<i>Alterneria</i> sp.	-	4	1	3	08	2.59	75
3.	<i>Aspergillus flavus</i>	-	2	4	3	09	2.92	75
4.	<i>Aspergillus fumigatus</i>	3	4	-	5	12	3.89	75
5.	<i>Aspergillus niger</i>	3	4	-	9	16	5.19	75
6.	<i>Aspergillus sulphureus</i>	3	4	-	-	07	2.27	50
7.	<i>Aspergillus</i> sp.	4	2	-	3	09	2.92	75
8.	<i>Cladosporium cladosporioides</i>	36	41	50	34	161	52.27	100
9.	<i>Cladosporium</i> sp.	-	-	-	3	03	0.97	25
10.	<i>Curvularia lunata</i>	-	2	1	3	06	1.94	75
11.	<i>Fusarium oxysporum</i>	6	4	-	4	14	4.54	75
12.	<i>Penicillium</i> sp.	4	21	-	6	31	10.06	75
	Mycelia sterilia							
13.	<i>Mycelia sterilia</i> (White)	7	6	-	3	16	5.19	75
14.	<i>Mycelia sterilia</i> (Brown)	3	2	-	4	09	2.92	75
	Unidentified fungi							
15.	Unidentified sp.- I	2	-	1	-	03	0.97	50
16.	Unidentified sp.- II	-	-	-	-	0	00	00
	Total					308		

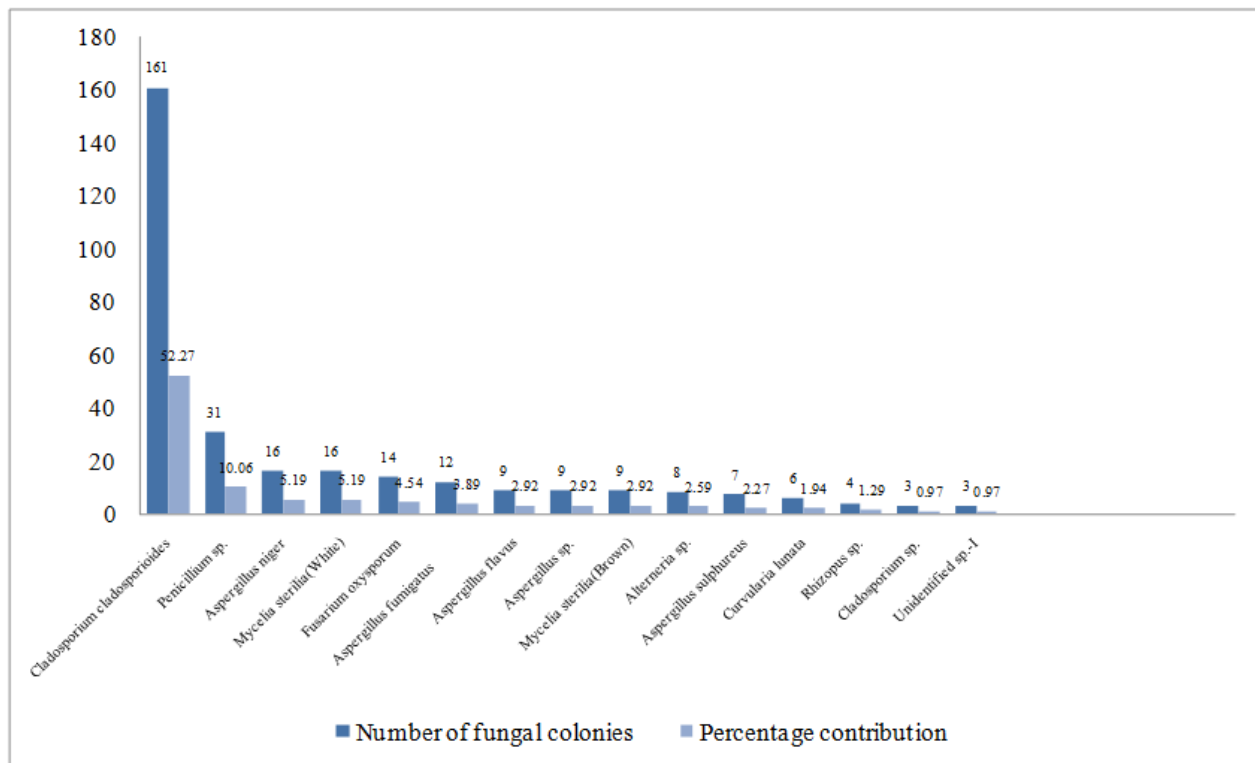


Figure-1
 Percentage Contribution of Fungal Species of Winter Season

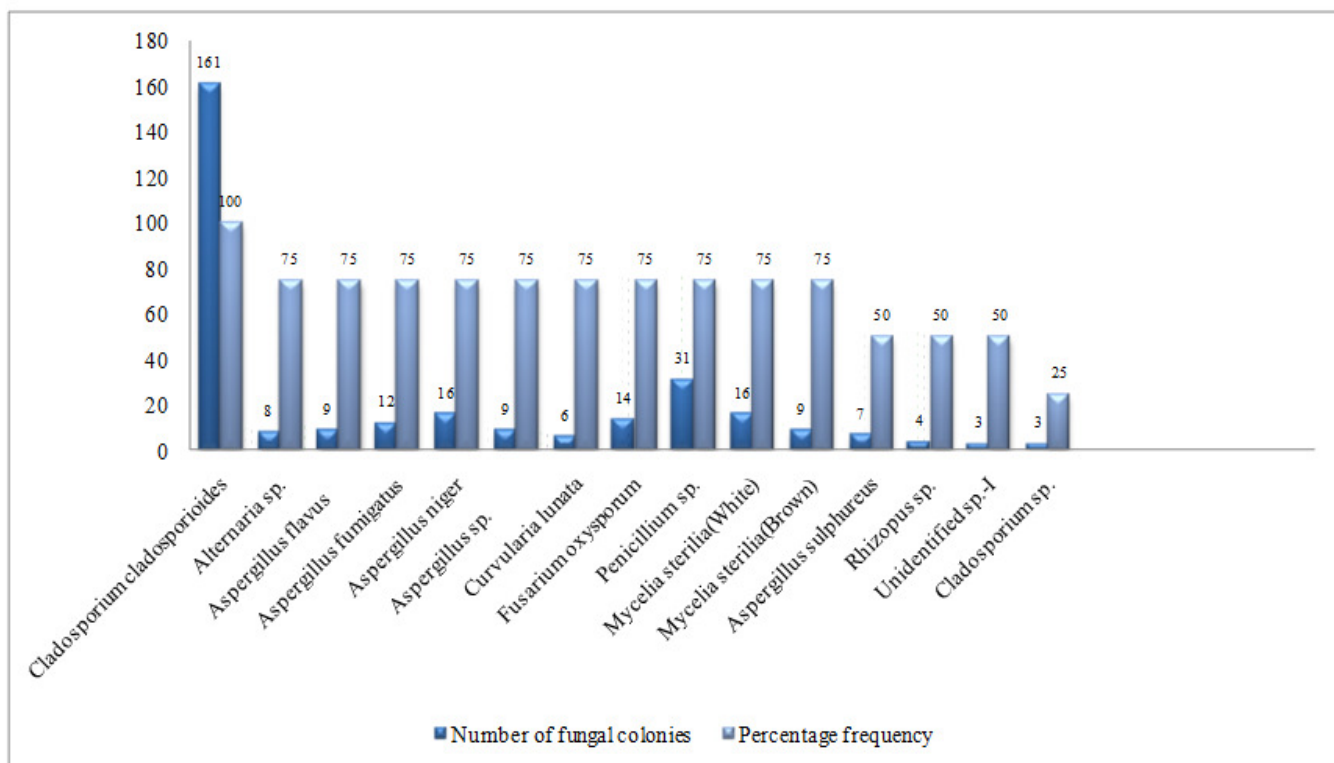


Figure-2
 Percentage Frequency of Fungal Species of Winter Season

Table-2
List of Aeromycoflora of railway station, Janjgir-Naila, Janjgir(C.G.), India in rainy season

S.N.	Name of fungi	Rainy season				Total colonies	% contribution	% frequency
		Jul	Aug	Sep	Oct			
	Zygomycotina							
1.	<i>Rhizopus</i> sp.	-	-	1	2	03	2.02	50
	Anamorphic fungi							
2.	<i>Alternaria</i> sp.	-	-	-	-	00	00	00
3.	<i>Aspergillus flavus</i>	-	-	2	4	06	4.05	50
4.	<i>Aspergillus fumigatus</i>	-	-	3	4	07	4.72	50
5.	<i>Aspergillus niger</i>	6	11	1	21	39	26.35	100
6.	<i>Aspergillus sulphureus</i>	-	-	4	-	04	2.70	25
7.	<i>Aspergillus</i> sp.	-	-	-	2	02	1.35	25
8.	<i>Cladosporium cladosporioides</i>	2	5	30	3	40	27.02	100
9.	<i>Cladosporium</i> sp.	-	-	2	1	03	2.02	50
10.	<i>Curvularia lunata</i>	-	-	3	4	07	4.72	50
11.	<i>Fusarium oxysporum</i>	-	-	4	3	07	4.72	50
12.	<i>Penicillium</i> sp.	-	-	9	5	14	9.49	50
	Mycelia sterilia							
13.	<i>Mycelia sterilia</i> (White)	-	-	3	4	07	4.72	50
14.	<i>Mycelia sterilia</i> (Brown)	-	-	-	-	00	00	00
	Unidentified fungi							
15.	Unidentified sp.- I	-	1	2	1	04	2.70	75
16.	Unidentified sp.- II	2	3	-	-	05	3.37	25
	Total					148		

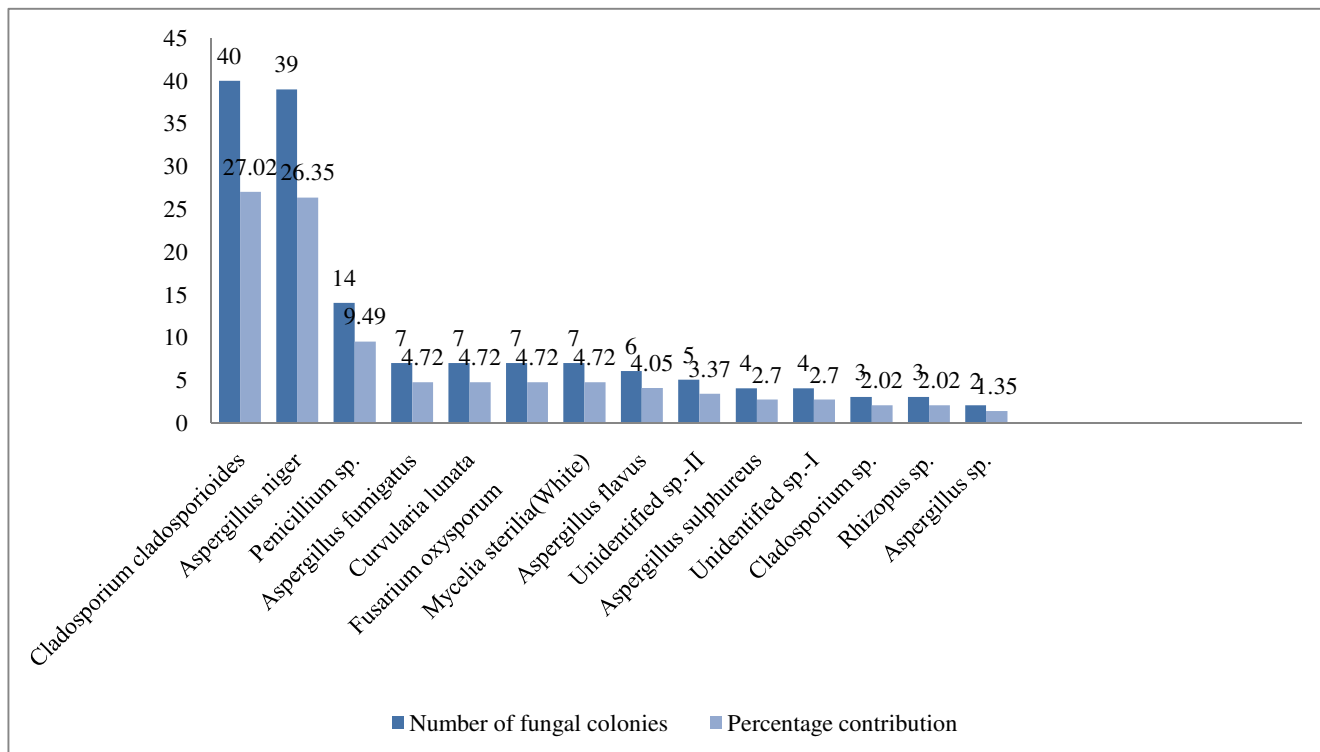


Figure-3
 Percentage Contribution of Fungal Species of Rainy Season

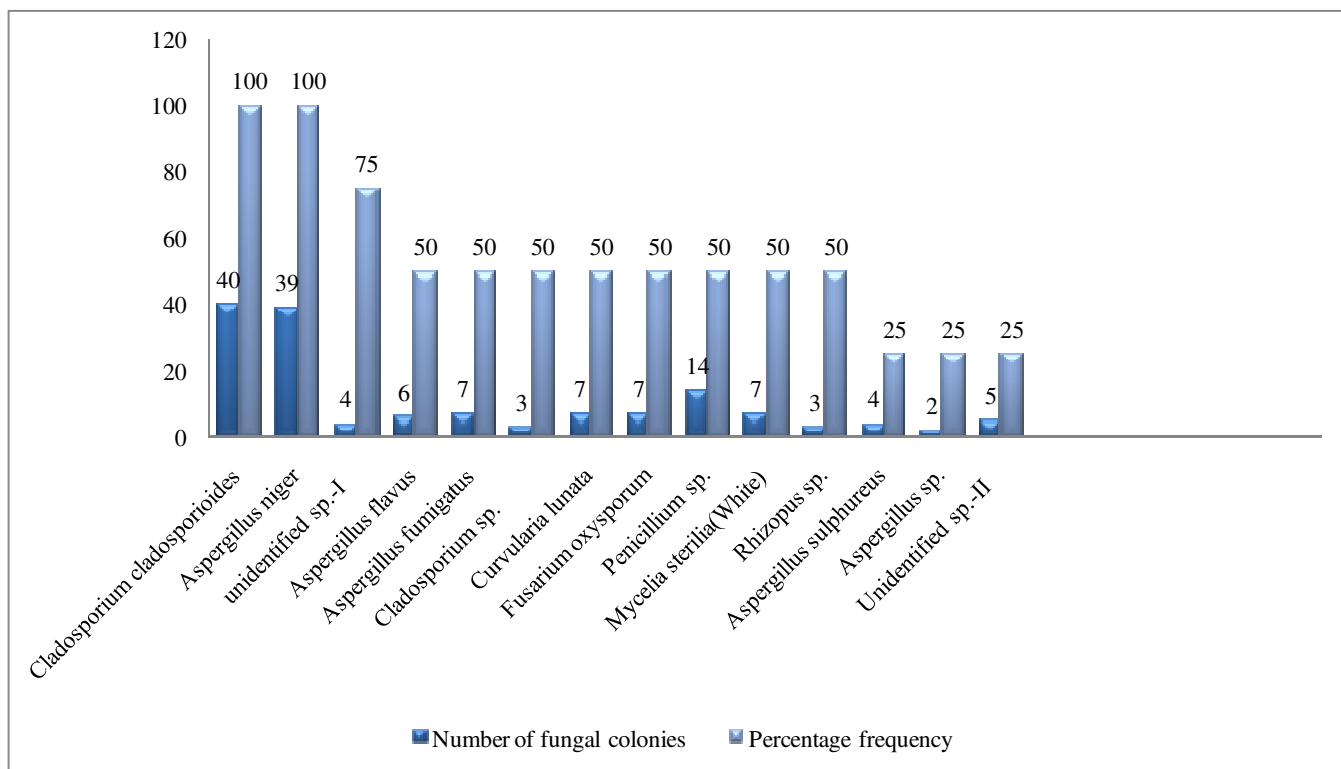


Figure-4
 Percentage Frequency of Fungal Species of Rainy Season

Table-3
List of Aeromycoflora of railway station, Janjgir-Naila, Janjgir(C.G.), India in summer season

S.N.	Name of fungi	Summer season				Total colonies	% contribution	% frequency
		Mar	Apr	May	Jun			
	Zygomycotina							
1.	<i>Rhizopus</i> sp.	2	1	-	-	03	3.44	50
	Anamorphic fungi							
2.	<i>Alterneria</i> sp.	-	-	-	-	00	00	00
3.	<i>Aspergillus flavus</i>	-	4	-	-	04	4.59	25
4.	<i>Aspergillus fumigatus</i>	-	-	-	-	00	00	00
5.	<i>Aspergillus niger</i>	7	7	17	-	31	35.63	75
6.	<i>Aspergillus sulphureus</i>	3	4	-	-	07	8.04	50
7.	<i>Aspergillus</i> sp.	-	-	-	-	00	00	00
8.	<i>Cladosporium cladosporioides</i>	10	3	3	-	16	18.39	75
9.	<i>Cladosporium</i> sp.	-	5	-	-	05	5.74	25
10.	<i>Curvularia lunata</i>	3	-	3	-	06	6.89	50
11.	<i>Fusarium oxysporum</i>	-	-	-	-	00	00	00
12.	<i>Penicillium</i> sp.	3	-	-	-	03	3.44	25
	Mycelia sterilia							
13.	<i>Mycelia sterilia</i> (White)	2	-	-	-	02	2.29	25
14.	<i>Mycelia sterilia</i> (Brown)	-	-	-	-	00	00	00
	Unidentified fungi							
15.	Unidentified sp.- I	-	3	2	-	05	5.74	50
16.	Unidentified sp.- II	-	-	-	5	05	5.74	25
	Total					87		

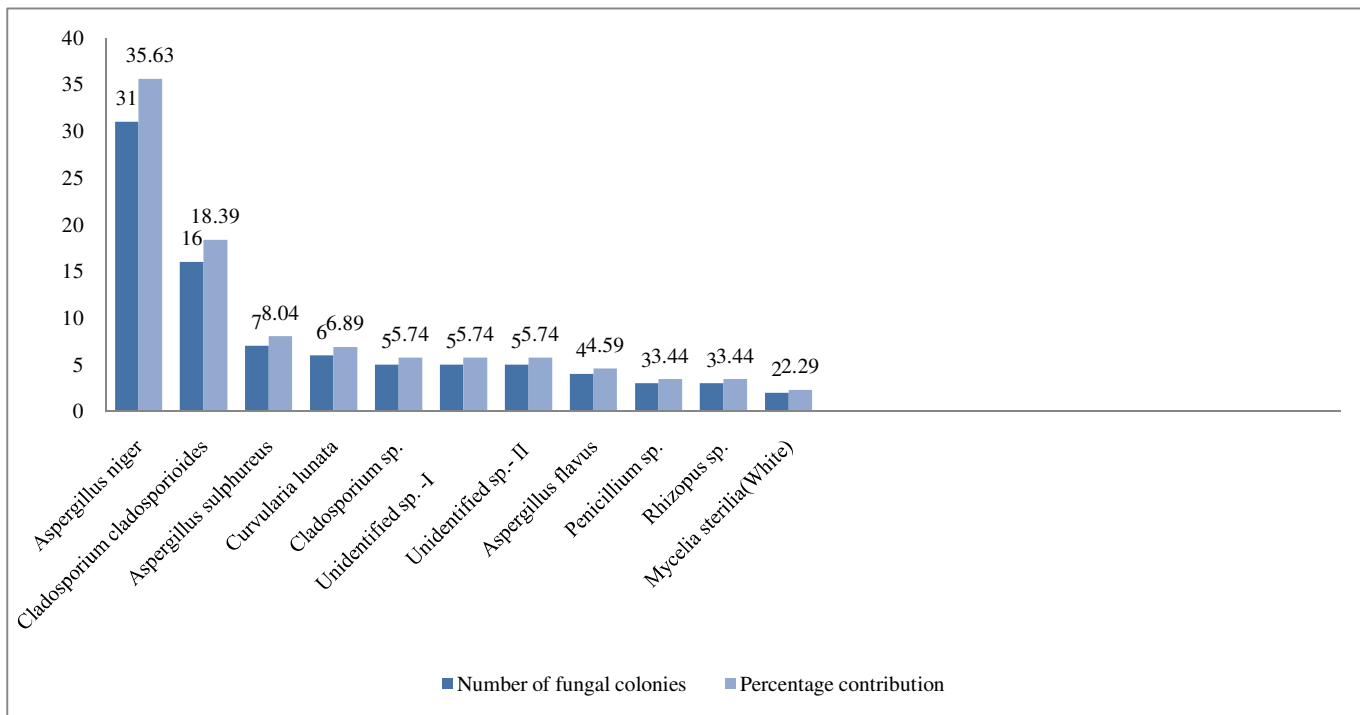


Figure-5
 Percentage Contribution of Fungal Species of Summer Season

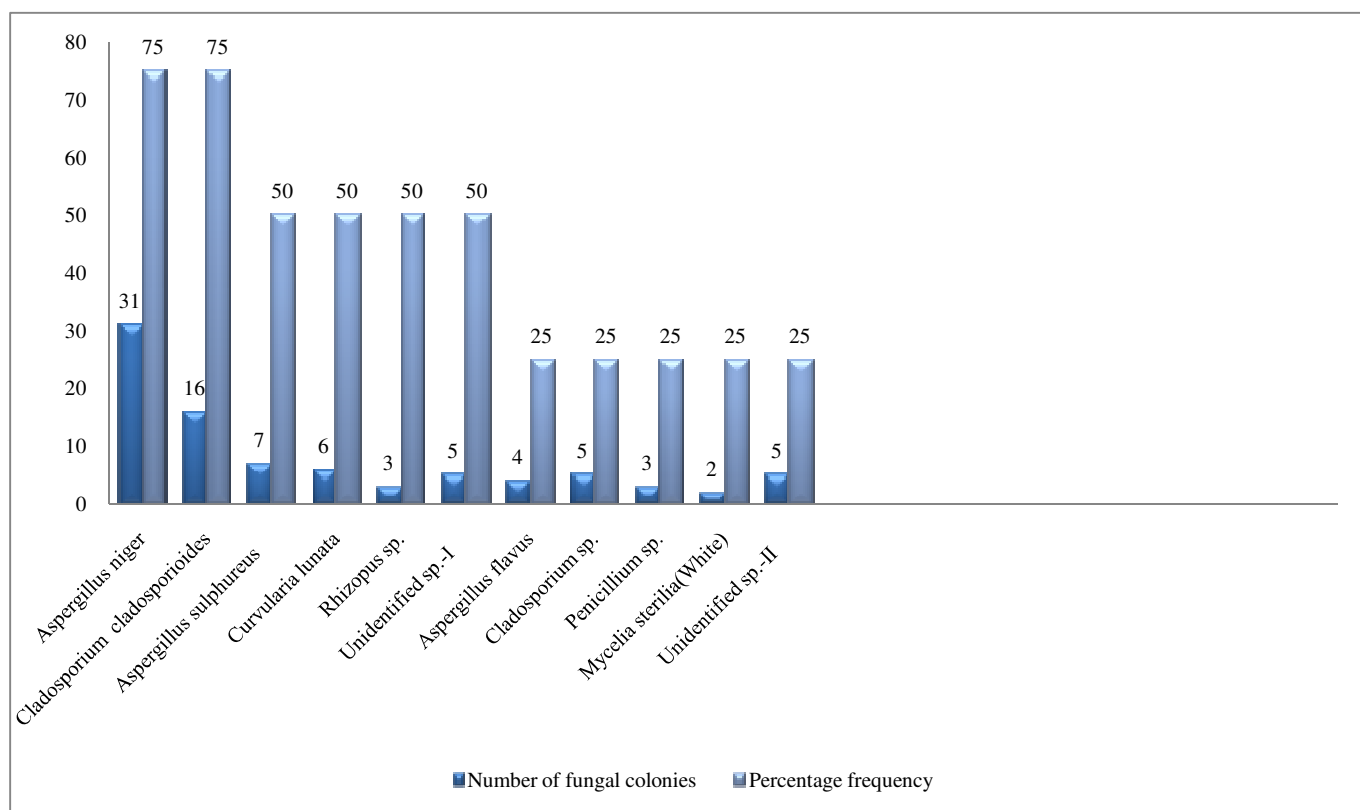
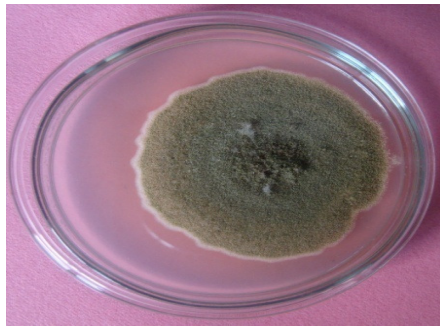
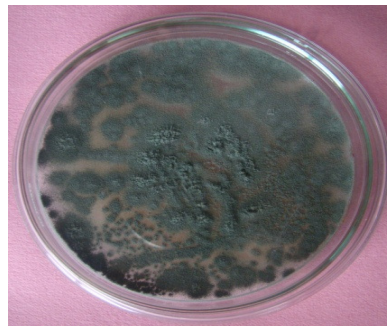


Figure-6
 Percentage Frequency of Fungal Species of Summer Season



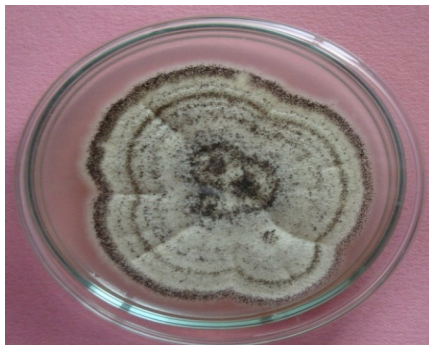
Aspergillus flavus



Aspergillus fumigatus



Aspergillus niger



Aspergillus sp.



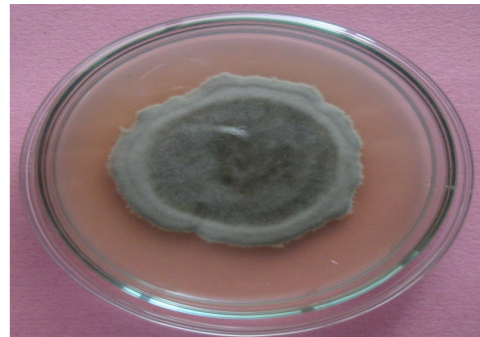
Cladosporium cladosporioides



Penicillium sp.



Fusarium oxysporum

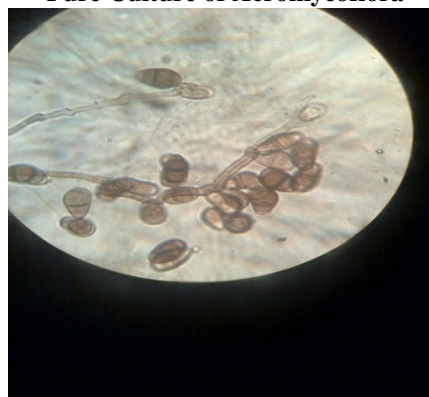


Curvularia lunata

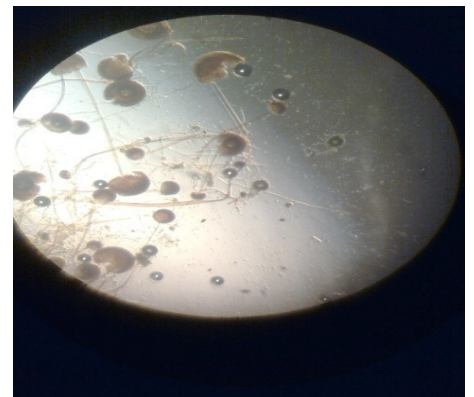
Figure-7
Pure Culture of Aeromycoflora



Aspergillus sulphureus



Curvularia lunata



Rhizopus sp.

Figure-8
Microscopic Photographs

Conclusion

The present study suggested that the railway station of Janjgir-Naila, owing to its high contaminations which harbors the various species of aeromycoflora. So the negligence of proper cleaning and maintenance of this site became a good source of the deteriorative and detri-mental effect of the mould which may cause a potential health hazard. Certain corrective measures, strict maintenance or precautions which can reduce their frequency of occurrence include use of vacuum cleaner to remove dust and more frequent cleaning and preventive processes. It is of significance that our findings may be of use with regard to the diagnosis and prophylaxis of allergic and other human diseases resulting from airborne mycoflora.

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