Eco. Env. & Cons. 28 (November Suppl. Issue) : 2022; pp. (S58-S61)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2022.v28i07s.010

Fungal Spore Diversity over Garbage Depot of Pimpri Chinchwad, Pune, M.S., India

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(Received 23 February, 2022; Accepted 12 April, 2022)

ABSTRACT

Aerobiology deals with the airborne particles of biological origin and their effect on living organisms. The atmosphere of the big city including Pimpri Chinchwad is dominated by biopollutants such as grain pollen, fungal grains and piles of dust particles. These days garbage disposal is a major problem in various cities. Many nearby villages are experiencing serious health problems due to elevated levels of aerobiopollutants. Air monitoring within garbage depot has been very rare. Therefore, it was felt that if a continuous survey of aerobiocomponents is conducted, it may be helpful in solving or suggesting a suitable solution. The present study deals with the assessment of aeromicrobiota over the garbage depot of Moshi, Pune for a year (Jan 2019 to Dec 2019). The study aimed to monitor the concentration of various biocomponents in the atmosphere over garbage depot. While scanning the prepared slides of the garbage depot for a year, fungal spores, pollen, hyphal fragments, insect parts, etc. were observed. However, during the present investigation, more emphasis has been given to the fungal components of airspora. The outcome of the present study would ultimately help allergy clinicians in the treatment of allergies and to the Municipal Corporation for designing the dumping site for garbage and developing better garbage disposal mechanisms ultimately bringing comfort to the population of the adjoining area.

Key words : *Allergy, Garbage Depot, Fungal Diversity, Biocomponents, Airspora.*

Introduction

Aerobiology deals with the airborne particles of biological origin and their effect on living organisms. Jacobs (1951) reported that aerobiology involves the dispersal of a number of insects, fungal spores, bacteria, viruses, pollen etc. and in fact all forms of life that are virtually borne aloft and transported partially or wholly by air currents. He also emphasised the importance of aerobiological surveys in connection to meteorological conditions.

The atmosphere of the big city including Pimpri Chinchwad is dominated by biopollutants such as grain pollen, fungal grains and piles of dust particles. These days garbage disposal is a major problem in various cities. Many nearby villages are experiencing serious health problems due to elevated levels of aerobiopollutants. The lives and productivity of plants, animals, and humans are all threatened by airborne infections and the resulting diseases in the areas where garbage depots are located.

The Moshi Garbage Depot is a site 12 km from Pimpri Chinchwad. Daily huge garbage dumps in the area by Pimpri Chinchwad Municipal Corporation (PCMC). There is growing pressure from locals on Pimpri Chinchwad Municipal Corporation officials to suspend the project and relocate the garbage depot. The fact is that there is no scientific method

available with the Municipal Council and the local people to assess the microbial flora in the air and its effects on human health. The Several fungal spores play a significant role in inducing illnesses in humans, which is a growing issue of human health hazards.

A regular monitoring network has to be established to predict changes in the environment of study area induced by bio pollutants and meteorological factors. Air monitoring within garbage depot has been very rare. Therefore, it was felt that if a continuous survey of aerobic components is conducted, it may be helpful in solving or suggesting the suitable solution. No systematic studies on fungal spore concentration and its effect on normal everyday activities and human population living around the garbage disposal plant have been reported. However, such information is needed to assess the importance of fungal spore concentrations and to understand the quality and quantity of the fungal spores over garbage depot. The present study deals with the assessment of aeromicrobiota over garbage depot of Moshi, Pune for a year (Jan 2019 to Dec 2019). The study aimed to monitor concentration of various fungal biocomponents in the atmosphere over garbage depot. An attempt was made to correlate the fungal spores in the air with existing meterological conditions during the period of investigation.

Material and Methods

The present extramural aerobiological investigations were carried out over the Garbage Depot at Moshi, Pune from 1st January 2019 to 31st December 2019. It includes the qualitative and quantitative analysis of airspora for a year over Garbage depot using Tilak air sampler.

Composition and Identificationof the Catches

Visual identifications under the microscope and comparisons with reference slides were used to identify the spores captured.

Most of the fungal spores have been recognized upto generic level. For confirmation of identification, reference slides of parasitic and saprophytic forms were prepared from adjoining area where sampling was carried out. Various types of biocomponents were trapped on the sampler's exposed cellophane tape during the investigation. In the present study the main importance was given on the study of fungal spore types trapped as a component of airspora and their identification with percentage contribution to the total airspora.

Results and Discussion

Composition and Components of airspora over Garbage Depot

While scanning the prepared slides of Garbage Depot for a year, fungal spores, pollen, hyphal fragments, insect parts, etc. were observed. However, during the present investigation, more emphasis has been given on the fungal components of the airspora.

During the period of air sampling over the Garbage Depot for a period of 1 year, in all 24 fungal spore types were recorded. The fungal spores have been identified up to generic level as listed in Table 1.

Table 1 fungal spore types.

Table 1. Fungal Spore Types.

Ascomycotina	*Chaetomium* Kunz ex. Fr.
	Cucurbitaria Gray. Ex Grev.
	Didymosphaeria Fuck.
	Hypoxylon Bull ex Fr.
	Leptosphaeria Ces & de Not.
	Melanospora Corda.
	Pleospora Rabh.
	Pringsheimia Schultz.
Basidiomycotina	Basidiospores.
	Smut spores
Deuteromycotina	*Alternaria* Nees.
	Bispora Corda.
	Cercospora Fr.
	Cladosporium Link.
	Curvularia Boed
	Diplodia Fr.
	Fusarium Link.
	Helminthosporium Link.
	Nigrospora Zimm.
	Pithomyces Berk and Br.
	Tetraploa Berk and Br.
	Torula (Pers.) Link.
Zygomycotina	*Mucor* Micheli ex Fr.
	Rhizopus Ehrenberg.

Leptosphaeria, Pleospora, Pringshemia, Alternaria, Cladosporium, Curvularia, Nigrospora, Helminthosporium, Tetraploa found maximum during monsoon season. Their abundance were found to be influenced by the occurrence and amount of rainfall.

During the study the maximum spore concentration appeared in the period from June to October months of year 2019. Minimum number occurred in the months from March to May of year 2019. Seasonal changes were observed in different spore categories throughout the year. Out of the 24 fungal spore types, 12 belong to Deuteromycotina, 08 to Ascomycotina, 02 to Zygomycotina, and 02 to Basidiomycotina. Group Deuteromycotina was found dominant with 50.00% contribution. It was followed by Ascomycotina (33.34%), Zygomycotina (14.06%) and Basidiomycotina (2.60%) contribution.

Table 2 presents weather variables and monthly rational average percentage contribution of airspora. The highest airspora reported in July and September. In May, minimum percentage contribution of airspora was observed.

Month wise highest percentage contribution of Zygomycotina, Ascomycotina and Deuteromycotina was observed in July. Group Basidiomycotina showed its supremacy in November. Utmost percentage contribution of another group was also recorded in October. The pathogenic spore type smut was observed maximum in the month of June to October. Other Pathogenic spore types like *Alternaria, Helminthosporium, Curvularia, Cercospora, Nigrospora* and *Fusarium* showed their presence throughout the investigation period with maximum event in August. Similar findings were recorded by Bharti (1998). This spore type was also reported to be allergenic. Spore types like *Tetraploa*were observed with low percentage contribution in April.

Cladosporium, Alternaria, Nigrospora, Curvularia, Periconia and *Helminthosporium* were the largest contributors to the airspora in each month of the study.

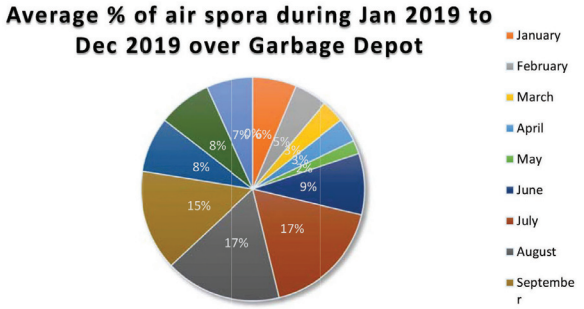

Fig. 1. Average % of air spora during Jan 2019 to Dec 2019 over Garbage Depot.

Table 2. Weather variables and % contribution of airspora in different months during Jan 2019 to Dec 2019 over Garbage Depot

Sr. No.	Month	Average % of air spora	Average Temperature (°C)	Average Rainfall in mm	Relative Humidity (%)	Wind Velocity km/hr.
1	January	6.32	25.83	00	36.66	08
2	February	4.75	29.89	00	26	9.14
3	March	3.37	33.88	00	17.7	11.93
4	April	3.43	37.1	0.5	15..56	13.06
5	May	1.96	36.58	5.38	21.09	15.96
6	June	8.89	30.8	30.56	53.5	18.33
7	July	17.48	25.35	256.1	80.32	20.45
8	August	16.8	25.35	134.2	77.09	24.25
9	September	14.55	25.16	60.65	78.3	17.77
10	October	08	26.12	3.88	71.96	9.96
11	November	7.7	28.03	1.20	51.26	9.03
12	December	6.74	26.45	00	46.61	9.7

Table 3. The total airspora and % contribution of each group in Garbage Depot during Jan 2019 to Dec 2019

Sr. No	Spore Group	Total airspora /m^3	Percentage contribution
1	Zygomycotina	3524502	14.06
2	Ascomycotina	8349331	33.34
3	Basidiomycotina	651313	2.60
4	Deuteromycotina	12525354	50.00
	Total	**25050500**	**100**

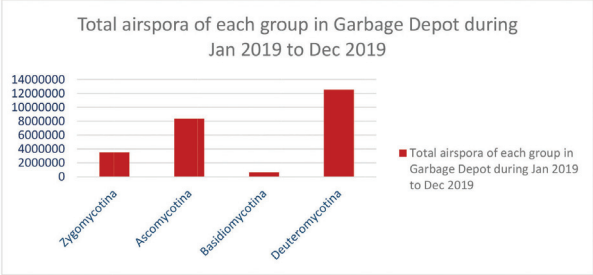

Fig. 2. Total airspora of each group in Garbage Depot during Jan 2019 to Dec 2019

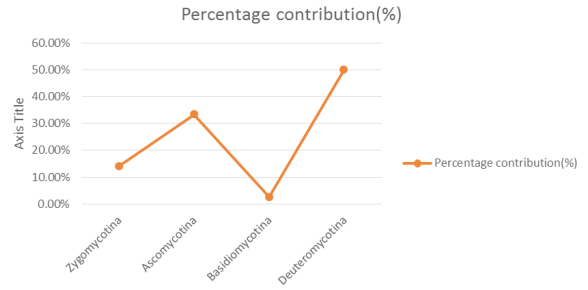

Fig. 3. Percentage contribution (%) each group in Garbage Depot during Jan 2019 to Dec 2019.

Table 3 shows the total airspora and percentages contribution of each class over Garbage Depot from January to December 2019. It shows the dominance of group Deuteromycotina followed by Ascomycotina and Zygomycotina.

Conclusion

The present research work was concernedwith aeromycological sampling over garbage depot of Moshi. Air monitoring at Garbage depot has provided meaningful information of practical utility. A close relation between the source and release of allergic aerobiocomponents and its impact on the adjoining population may be clearly estimated. The air monitoring studies over garbage depot would serve as an important contribution to understand the airspora over garbage disposalplant. The outcome of present study would ultimately help allergy clinicians in treatment of allergy and to the Municipal Corporation for designing the dumping site for garbage and to develop better garbage disposal mechanism ultimately bringing comfort to the population of adjoining area.

Acknowledgement

The authors acknowledge with profound gratitude, the facilities provided by Principal, Prof. Ramkrishna More College, Akurdi, and Principal, AnnasahebAwate Arts, Commerce and Hutatma Babu Genu Science College Manchar for the completion of the present study. The authors are also thankful to the UGC for providing financial assistance for the research work.

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