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“ATMOSPHERIC BIOPOLLUTION IN URBAN AND SUBURBAN AREA OF WESTERN MUMBAI “

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ABSTRACT :

Air samples were collected during were from July 2010 to June 2011 and examined for pollen grains Concurrently by using gravity slide and Petriplates exposure technique,. the distribution of local plants along railway lines and their flowering period were also assessed. The significant types includes *Alternanthera*, *Amaranthus*, *Azadirachta*, *Bougainvillea*, *Caesalpinia*, *Cleome*, *Cocos*, *Commelina*, *Cynodon*, *Ipomoea*, *Lawsonia*, *Nerium*, *Parthenium*, *Ricinus*, *Thespesia*, *Tridax*, *Quisqualis* etc. by using petriplates exposure were recorded. The significant fungal spore type types includes *Alternaria*, *Aspergillus*, *Basidiospores*, *Bispora*, *Candida*, *Chaetomium*, *Cladosporium*, *Curvularia*, *Didymosphaeria*, *Epicoccum*, *Fusarium*, *Helminthosporium*, *Hypoxyton*, *Mucor*, *Mamniolla*, *Trichonis*, *Penicillium*, *Pithomyces*, etc.

KEYWORDS : Aerobiology, pollen grains, fungal spores, gravity slide method, petriplate exposure.

INTRODUCTION:

Air is a heterogeneous assemblage of physical, chemical, as well as biological compounds. Due to its easy transportability, air causes great variation in environment pollutants, but scanty attention has been paid to understand systematically biotic environmental pollutants by scientific community.

Biotic pollutants in the air chiefly constitute pollen grains of higher plants and fungal spores along with minor matter as algal fragments, moss/fern spores, vegetable matter even bacteria and viruses.

These pollutants enter into the human physiological system through exposed sites such as skin, nose, mouth and eyes and accordingly cause allergic diseases like allergic rhinitis, lungs bronchial asthma, conjunction etc. such air pollutants in the atmosphere produced at localized concentration at the sources where they are produced.

Aerobiology is a scientific and multidisciplinary approach focused on the transport of microscopic organisms and biologically significant materials. It deals with the airborne particles of biological origin and their effect on living organisms. The term aerobiology came into existence since 1930 as a collective term for the studies of aiospora like air-borne fungal spores, pollen grains and other air-borne microorganisms. Tilak (1981), Alexander (1964), Ljungkvist (1977), Hyde and Williams (1945) mainly concentrated on air borne pollen and suggested the term Aeropalynology for such investigations. In India, aerobiology was initiated by the pioneering work of Cunningham in 1873. The results of his aerobiological investigations over the presidency jail of Calcutta were published as a classical book titled 'MICROSCOPIC EXAMINATION OF AIR.' He observed how rainfall brings about short-period changes in the atmospheric spore content and tried to establish relationship between the number and types of airborne particles and the prevalence of the so called 'zymotic' diseases. It revealed the

presence of large number of spores and vegetable cells and studied the airborne bioparticles, correlated his results with the disease prevalent in Calcutta. This appears to be the pioneering work on aerobiology in India.

Doshi and Kulkarni (1981) Ghai (1984), Subramanyam (1985) Iyer in 1987 Varghese (1988), Rawle in, Patil in 1997, Deodhar in 1999, Kunhiraman in 2000, Nair (2002), Kelkar (2002) while Potti (2006) studied vertical distribution of airspora at western suburbs of Mumbai, All these investigations jointly confirm the fact that the atmosphere of Mumbai is predominating in biopollutants like fungal spores, pollen grains, and large amount of dust particles. While Thousands of peoples staying along the railway lines expose to bioparticles. This has resulted in the deposition of large amount of organic matter on open areas which created pollution of bioparticles in air which are toxic and creating allergies to the people. Due to unhygienic condition, uncleanliness along Railway lines and occurrence of all toxic particles like pollen grains, fungal spores present in air are allergic. Along the railway lines, a large number of populations residing in slum areas are directly exposed to such allergenic biopollutants.

Aerobiological investigations were taken up along railway lines to find out the various pollen and spore constituents of the local air spora as well as the organic and inorganic impurities present there in. This information is useful while treating the air borne allergies. Present investigation was therefore, taken up to help the clinicians dealing with different aero-allergies.

Owing to their ubiquitous presence in nature, fungi as an allergen source is almost inevitable. Consequently, investigations of the environmental conditions of dwellings along the railway lines and the surrounding neighborhood must be an important part of allergy.

Mumbai the Financial capital of India is cosmopolitan city where all the people from India come, reside and prosper. Due to heavy increase in industrialization, people are continuously migrating in Mumbai, which result in over population. This resulted into increase in high cost of living so large populations have compelled to stay in slum areas along the railway line with highly unhygienic condition. This has resulted in deposition of large amount of organic matter on open areas, which created pollution of the bioparticles in air, which are toxic, and creating allergies to the people, who are traveling in local trains.

Along the railway track it has been observed that large amount of organic waste and slum area day by day increasing which is source of many air borne particulate matter which are being lifted in the air due to the currents of air developed by running trains, While traveling through specific route in Mumbai, peoples are complaining about respiratory disorders such as asthma, rhinitis, sinus problems, running nose, sneezing, cough, bronchial asthma, etching of skin and other skin problems, reddening of eyes etc. To find out the cause of such illness it has been proposed to investigate the ambient air to which passengers are exposed. Hence, it is proposed to undertake the aerobiological studies with the help of gravity slide method and petriplates exposur method and this work will help to understand the load of airborne hazardous bioparticulate matter and their sources along the railway lines.

Uncleanliness along railway line and occurrence of all toxic particles like pollen grains, fungal spores are present in air, which are allergic. The data obtained could be of great importance in the treatment of respiratory allergies in people who are regularly traveling in suburban trains.

The present investigation is expected to obtain some data about the qualitative and quantitative occurrence of pollen grains and fungal spores are aeroallergens in the atmosphere of Mumbai in terms of their role as environmental biopollutants. This study was undertaken to provide an index for the use of the allergologists and clinicians who are involved in the treatment of pollen/spore allergy.

The organic waste, sludge and garbage dumping in open areas has increased the growth of microbes which created pollution of bioparticles in air which are toxic and creating allergies to the people.

It was Shivpuri of V.P. Chest institute, Delhi who for the first time brought out the importance of aerobiological survey in the treatment of patients of pollinosis and allergenic rhinitis. Under his leadership series of contributions were made primarily pertaining to Delhi, Sandhu and Shivpuri (1964), Agrawal and Shivpuri (1974), Shivpuri and Agarwal (1969), Agrawal et al.(1980) these investigations encourage other workers of our country to prepare pollen calendar and to survey the airspora of different regions. Useful periodic reviews have been published on different aspects by Sreeramulu (1967), Tilak (1974), Tilak and Bhalke (1978), Chanda and

Mandal (1978), Mandal & Chanda (1981), etc.

Major contributors are Mehrotra and Claudius (1968), Nair et al. (1986), Nair and Kumar (1972), Subba Reddi (1970, 1974), Kamal and Verma (1977), Chitlay (1977), Pathak et al. (1978), Agashe and Vina (1980) and Chakraverty and Sinha (1985).

The other workers were Vishnumitre & Khandelwal (1973), Shenoi and Ramalingam (1975), Patil and Vyawahare (1981), Doshi and Kulkarni (1981), Kumar (1981), Sinha et al. (1980-1981), Nair P.K.K (1964, 1978, 1989), Vittal & Krishnamurthy (1981), Vittal and Ponnusamy (1979, 1982), Tilak (1982), Janakibai and Subba Reddi (1981), Singh (1982), Singh and Babu (1983), Gaur and Kala (1984), Vittal & Leela (1985), Bhagwan and Pande (1982), Chaubal and Kotmire (1982), Khillare (1989), Singh & Malik (1992), Athawale (1992) also carried out aerobiological investigation in India.

AIM OF STUDY

1. Detailed floristic survey along western suburban railway lines to determine the pollination periods of the recorded plant species.
2. To determine bio-particulate matter such as pollen grains, fungal spores in different seasons at the different stations of Mumbai suburban trains and along the railway tracks of western region to determine the incidence and concentration of the pollen grains and fungal spores.
3. Enlisting the offending air borne micro-allergens and evaluation of occurrence of toxic aerobiocomponents along railwaylines environment.
4. Suggesting control / preventive measures in order to reduce the emission of biopollutants from different sources.
5. To determine diurnal and seasonal variation in load of fungal spores and pollen grains at the experimental site with relation to metrological data.
6. Preparation of a key to the fungal spores prevalent in the air.
7. To conduct the health survey of regular passengers of potent routes such as Churchgate to Virar, Churchgate to Borivali, Andheri to Virar, Borivali to Virar, Bandra to Virar and Churchgate to Bhyander .
8. To identify fungal spores which could not be identified up to their generic species level on slide by the method of culture plate method.
9. The present investigation is expected to obtain some data about the qualitative and quantitative occurrence of pollen grains and fungal spores are aeroallergens in the atmosphere of Mumbai in terms of their role as environmental biopollutants. This study was undertaken to provide an index for the use of the allergologists and clinicians who are involved in the treatment of pollen /spore allergy.

MUMBAI HAS BEEN FOCUSED IN TERMS OF THE FOLLOWING:

1. Large city with industrial as well as biological pollution.
2. No significant work has been done from railway line area.
3. The city has a number of parks, public and private gardens, grass lands, where wild, exotic cultivated and indigenous plants grow in large number, roads being well studded with a number of avenue trees besides having agricultural rice fields and salt land at the outskirts of the city.

MATERIALS AND METHODS:

Sampling of air-spores were carried out for a continuous period of two calendar year i.e., from July 2010 to June 2011. by to study the routes of the western suburban railway and the nine main stations were selected as sampling sites for better monitoring.

Gravity slide sampling: Glycerin jelly coated microslides were exposed eight day in a month, continuously for the period of two years. The exposures were made on different stations of western railway.

Petri-plate culture method: Petriplates containing potato-dextrose agar medium with streptomycin for culturable fungi were exposed for 5 minutes at all the sampling sites ie. from Churchgate to Virar (a to i) for the period of two years (from July 2010 to June 2011). The fungal colonies thus developed on petriplates were

identified and quantified after 5-7 days of exposure. Records on the daily data of rainfall, relative humidity, temperature and wind velocity during the period of investigation were collected and recorded periodically from the newspapers published by Metrological department Govt. of India, located at Santacruz and also from websites.

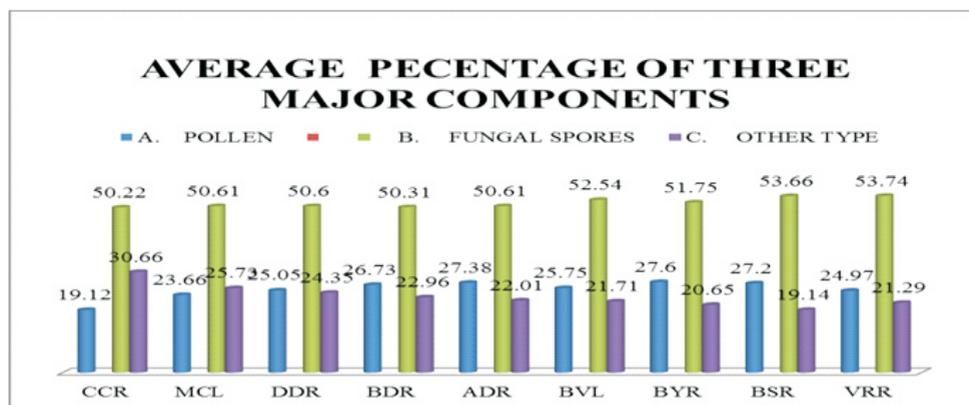
RESULTS AND DISCUSSION

The present study the on the sampling of air spora revealed the predominance of fungal spores over the pollen types at all the sites. An aerobiological survey carried out for the period of two year along railway lines of Western region of Mumbai had shown that pollen grains *Alternanthera*, *Amaranthus*, *Azadirachta*, *Bougainvillea*, *Caesalpinia*, *Cleome*, *Cocos*, *Commelina*, *Cynodon*, *Ipomoea*, *Lawsonia*, *Nerium*, *Parthenium*, *Ricinus*, *Thespesia*, *Tridax*, *Quisqualis* etc. were observed.

Three major components to total aerospora at the different sites from gravity slide sampling

Components	Sampling Sites								
	A. Ccr	B. Mcl	C. Ddr	D. Bdr	E. Adr	F. Bvl	G. Byr	H. Bsr	I. Vrr
Pollens Grains	19.12	23.66	25.05	26.73	27.38	25.75	27.6	27.2	24.97
Fungal Spores	50.22	50.61	50.60	50.31	50.61	52.54	51.75	53.66	53.74
Other Types	30.66	25.73	24.35	22.96	22.01	21.71	20.65	19.14	21.29

Graph showing the comparison of Average percentage of three major components



Fungal spores dominated airspora of all the sites. fungi were recorded from this study includes *Alternaria*, *Aspergillus*, *Cladosporium*, *Bispora*, *Curvularia*, *Helminthosporium*, *Hypoxyylon*, *Nigrospora*, *Periconia*, *Penicillium*, *Rhizopus*, *Torula*, *Triconis*, Rust and Smut spores,

Plant parts like trichomes, epidermal hairs, fibers etc. trapped in the atmosphere frequently during winter and summer months, during post-monsoon month’s insect parts, protozoan cysts, etc. made their presence felt in the trapping. Studies over different sites have contributed in understanding the components of air spora; it was also observed that fungal spores and pollen grains showed a marked correlation with the weather condition and flowering period.

The results of the present study showed similarity to other studies carried out in the city of Mumbai, both intramural and extramural, by previous workers like Prasad(1973), Doshi and Kulkarni (1981), D’Silva and Freitas (1981), Ghai (1984), Iyer (1987), Rawle (1989), Naronha (1993), Sasikumar and Suhasini Sasikumar (2000), Yeragi (1988), Nair (2002) and Potti (2006). Mumbai and its Western suburbs have a hot and humid climate. The humid weather and wet substrate after the rains, favours fungal growth. This is a reason for the higher rate of fungus spores in the month of July and August. Heavy rains washes away the airspora but it also promotes the growth and sporulation in fungi. (Karmer *et al.*1960).

Pollen grains when inhaled are responsible for widespread allergy of upper respiratory tract. Diseases

caused by pollen grains are defined as a special case of hypersensitivity responded by a kind of protein which under favorable condition gets discharged from the pollen grains. It varies in toxicity when it enters in human respiratory tract.

The Aerobiological survey along railway line of western suburban area of Mumbai showed a number of similarities and few disparities compared to the other places. The present study is a survey of airborne fungal spores, pollen and airborne fungal spores, pollen grains, airborne biotic material like hyphal fragments, trichomes, insect parts, and other miscellaneous particles like fibers, scales etc. at the nine selected sites and also along railway lines of western region of Mumbai. The data presented here may serve the useful purpose of identifying the source, season, percentage contribution of aeroallergens in these regions. The salient feature of this investigation, highlighting the major findings, conclusions drawn and recommendations are listed below:

1. The present extramural aerobiological studies along western region of Mumbai of significance, as there has been no previous similar survey on aerobiology in relation to allergens carried out in these localities.
2. The sites have dense population and with many multi-storied buildings, slum areas, dumping grounds, marshy places along railway lines due to which it had become essential to analyses of air-spores rather than the customary "above the ground level" survey.
3. There was not much difference in the composition of the air-spores at all the site.
4. It revealed the predominance of fungal spores over the pollen types at all the sites; which clearly indicates the lack of vegetation these localities.
5. The air-spores components mainly consisted of pollen grains, fungal spores and "Other types."
6. However, there was a drastic decrease in the incidence of pollen grains towards the city area (Churchgate end) pollens of *Palmae*, *Poaceae*, *Verbinaceae* and *Amaranthaceae* are found towards Virar site (opposite end) and that of but *Parthenium*, *Alternanthera* which are known to be allergenic, were found in sufficient numbers at all the sites.
7. The fungal spores also showed a fluctuating trend of incidence towards the Churchgate end than at the Virar end. However, when compared to the pollen, this fluctuating trend of incidence of fungal spores was marginal.
8. There are several known allergenic fungal spore types as also those biodeteriorating fungi like *Alternaria*, *Aspergillus*, *Cladosporium*, *Curvularia*, *Helminthosporium*, *Hypoxyton*, rust and smut spores, etc. present in sufficient numbers at all sites. Thus, it is pertinent to take precautionary measures against their incidence.
9. Among the "other types" recorded at all the three heights were dried plant parts viz. trichomes, epidermal peelings, fibers, heterocyst, insects parts etc. which were frequency in the atmosphere during the winter and summer months. During the post-monsoon month's mites, insect parts including scales, larvae etc. made their presence felt in the trappings.
10. There was a higher incidence of air-spores showing a peak during the windy months. It is deduced that the velocity and direction of wind play an important role in carrying the air-borne pollen, fungal spores as also other microbiocomponents to greater heights.
11. An interesting observation made was the presence of fragmented algal forms like *Anabaena*, *Chlorococcum*, *Nostoc*, and *Oscillatoria* also accounting for the "other types" of air-spores. Their presence could be corroborated to the water collected in pools and ditches due to large number of building construction activities going on in these localities.

CONCLUSION:

Pollen grains recorded in the study and observed that the incidence of weed pollens like *Parthenium* and grass pollen was most common in the atmosphere. On being analyzed, during study the samplings have shown fungal spores dominating the airspores at the sites over pollen grains and other micro bioparticulate. Among the fungal spores there are substantial species belonging to the biodeteriorating category.

A significant observation made was the frequent presence of miscellaneous type like fibers, human particles like hairs, dust particles, hyphal fragments, epidermal hairs, protozoan cysts epidermal hairs, insect parts, which occupied the third position among the total airborne micro-bio particulate. And as this study has recorded several, fungal spore types and pollen grains, which are known to be allergenic.

The data thus obtained could be of immense help to the medical practitioner while treating their patients suffering from allergic diseases like asthma, allergic rhinitis and other form of allergies, also plant growers, traders and exporters of fruits, herbs, and flowers and even meteorologists. Also it helps the administrative authorities in various cities to take necessary steps to control the pollution level due to various factors such as air, water, industrial, and vehicle and like other sources.

For a vast city like Mumbai, which is thickly inhabited, it is necessary to undertake extensive aerobiological survey to trap and enlist the offending bio-allergens in different seasons of various locations.

SUGGESTIONS:

For minimizing, the allergic pollen grains the precautions are to be taken.

- All the allergenically significant trees need to be deleted from the list of recommended tree plantation in 'Gazette of India'.
- The existing allergenically significant trees need to be replaced with non-allergenic trees in a phased manner.
- On medical ground, railway administrators should remove the allergy causing plants, grasses along the railway line. People should take care during flowering period of allergy causing plant.

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