

Atmospheric Pollen and Fungal Spores at Pune City

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Abstract

An aerobiological survey of Pune City was conducted from July 2000 to June 2001 at two different sites following the gravity slide technique. Forty two different types of bioparticles were observed in the air over Pune City. Among these, predominant airborne pollen belonged to family Poaceae, *Holoptelea integrifolia*, *Peltophorum pterocarpum*, *Ailanthus excelsa*, *Cocos nucifera*, *Casuarina equisetifolia* followed by pollen belonging to *Ricinus communis*, *Parthenium hysterophorus* and Amarnath Chenopod group. Among fungal spores, *Alternaria*, *Helminthosporium* and *Curvularia* were more dominant during August to November. *Fusarium* was most predominant from January to March than *Cladosporium*, *Curvularia*, *Helminthosporium* and other fungal spores.

Key words : Aerobiology, survey, pollen, fungal spores, gravity slide method

INTRODUCTION

The study of airborne pollen, fungal spores is pre-requisite for efficient diagnosis and treatment of allergic diseases. Aerobiological surveys were carried out in various parts of the country with a view to list out prevalent allergens. In western part of the country, the first aerobiological survey of Pune city was conducted by Kalra and Dumbrey¹ in the year 1957. They emphasized that airborne pollen and fungal spores are responsible, for inducing respiratory illness and the presence of these aeroallergens in a particular locality could be directly correlated with manifestations of allergic symptoms in local population. This investigation inspired the clinicians and scientists to identify local allergens in their respective area, as a

result aerobiological surveys were carried out in certain cities of western part of the country.²⁻¹²

In spite of advancement in the knowledge of aerobiology and its bearing on respiratory diseases, there has been no attempt to confirm and correlate the aeroallergens prevalent over the city of Pune as reported by Kalra and Dumbrey¹. The Pune city is the amongst fast growing cities in the western region, hence there has been enormous change in the vegetational cover and climatic conditions. The present study was therefore, carried out to identify airborne bioparticles in the atmosphere of Pune city; may be responsible for manifestation of allergic disorders in the local population.

MATERIAL AND METHODS

Frequent trips were made to different localities of Pune city to list plant species with their flowering period. Flowering specimens were collected of commonly growing plant species to identify airborne

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pollen grains, Durham's Gravity slide method was used in the study to trap airborne bioparticles. Safranin - stained glycerine jelly coated slides were exposed for twenty four hours at two different places. The first site was selected in the central part of the city near Ruby Medical Hall, while the other site was selected at Cardio-Thoracic Centre of Armed Forces Medical College - a newly developed suburban area. During the study, a total no. of 720 slides were exposed^{13,14} at two different sites for a period of 12 months (July 2000 to August 2001).

The exposed slides were transported to M/s Creative, Drug Industries, Navi Mumbai and mounted with 22X22 mm cover glass using melted safranin stained glycerine jelly. The mounted slides were then examined under a high power microscope. The identifications of the pollen / fungal spores was done mainly with the help of reference slides. Counting of the airborne bioparticles was done for the whole area (22mm X 22mm) under cover glass. The results were expressed as pollen/spores per sq. cm. area.

RESULTS AND DISCUSSION

Floristic variation is much marked due to human influence, by introducing new species and or denudation. The central Pune is now lacking herbaceous vegetation and is represented by roadside tree as *Samanea saman* (rain tree), *Peltophorum pterocarpum* (yellow gulmohar), *Erythrina indica* (coral tree), *Delonix regia* (gulmohar), *Polyalthia longifolia* (ashok tree), *Putranjiva roxburghii* (putrajivi), *Cassia siamea* (yellow cassia), *Mangifera indica* (mango tree), *Cocos nucifera* (coconut tree), *Azadirachta indica* (neem tree), *Tamarindus indica* (imli), *Eucalyptus globulus* (neelgiri tree), *Syzygium cumuni* (black plum tree), *Ailanthus excelsa* (heaven tree), *Holoptelea integrifolia* (Indian elm), *Morus alba* (mulberry tree), *Prosopis juliflora* (Australian acacia), *Casuarina equisetifolia* (sea oak), *Acacia auriculiformis* (show acacia), *Achras zapota* (cheeku), *Caryota urens* (fishtail palm), *Roystonea regia* (bottle palm), *Borassus flabellifer* (tad tree). Among entomophilous plants, tree species from family Leguminosae are characteristically widespread. Most of the tree species belonging to this family are insect pollinated as well as wind pollinated and categorized

as amphiphilous. The common shrub species which may be cultivated or wild are represented by *Ricinus communis*, *Lawsonia inermis*, *Bougainvillea glabra*, *Annona squamosa*, *Ipomoea fistulosa* and *Lantana camara*.

Herbaceous species are profusely distributed everywhere, except the areas of denudation due to human influence. Grass species are observed growing in open places, bare areas and vacant sites. *Cynodon dactylon* is common in lawns, parks and gardens. Wild and cultivated grasses are represented by *Setaria tomentosa*, *Dichanthium annulatum*, *Ischaemum indicum*, *Eragrostis pilosa* in the grassy fields of suburban areas. Cultivated grasses such as *Pennisetum typhoides*, *Sorghum vulgare*, *Oryza sativa*, and *Zea mays* are also present in suburban areas. Sedges are commonly growing on the banks of ponds and other water bodies and are represented by *Cyperus rotundus*, *C. iria* and *Typha angustata*. Among the weeds, *Xanthium strumarium*, *Amaranthus spinosus*, *Parthenium hysterophorus* are common on the vacant places and along the road side. *Amaranthus polygonoides*, *Chenopodium album* and *Chenopodium murale* are observed in cultivated fields.

A vegetational survey of Pune City and its surroundings revealed that about 10% plant species are suspected to be allergenically significant since they really satisfy Thommen's¹⁵ postulate. Field surveys conducted earlier to list allergenically significant plant species in other parts of the country also revealed that a small number of plant species contribute large quantity of pollen into environment hence are allergenically important. Aerobiological surveys conducted in the western region of the country^{1, 3, 4, 7, 9} have also revealed that pollen belonging to anemophilous plant species dominate the atmosphere. The presence of fair amount of grass pollen in the air is perhaps due to their anemophilous nature and wide distribution.

In present study, aeropalynological data collected during different months showed 4 pollen seasons (i) Mid Jan to April (ii) April to July (iii) Mid July to October and (iv) Mid October to January (Table 1). The first pollen season was loaded with tree pollen such as *Ailanthus excelsa*, *Holoptelea integrifolia*,

Table 1. Incidence of airborne pollen at Pune from July 2000-June 2001

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total cm ²
<i>Poaceae</i>	65	164	201	100	77	-	21	21	14	18	6	13	700
<i>Cocos nucifera</i>	11	44	20	91	185	26	14	18	3	55	16	3	486
<i>Holoptelea</i>	-	-	-	-	-	100	180	53	35	-	-	-	368
<i>Intergrifolia</i>	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Peltophorum pterocarpum</i>	-	-	8	3	5	2	2	1	2	247	71	-	341
<i>Casuarina equisetifolia</i>	-	111	94	18	26	20	4	2	14	5	5	-	299
<i>Ailanthus excelsa</i>	-	-	-	-	-	-	92	170	20	-	-	-	282
<i>Ricinus communis</i>	11	38	34	70	65	24	2	1	2	4	2	3	256
<i>Parthenium hysterophorus</i>	38	29	33	11	15	10	14	21	10	7	-	-	188
<i>Putranjiva roxburghii</i>	-	-	-	-	-	-	-	4	58	63	-	-	125
<i>Myrtaceae</i>	70	4	2	2	2	2	-	-	-	-	-	-	82
<i>Morus alba</i>	-	-	-	-	-	44	2	2	-	-	-	-	48
<i>Xanthium strumarium</i>	-	-	-	31	11	-	-	-	-	-	-	-	42
<i>Cassia spp</i>	3	5	3	2	4	-	1	3	2	2	2	9	36
<i>Arecaceae</i>	-	21	2	2	4	2	2	1	-	-	-	-	34
<i>Cyperaceae</i>	-	-	29	-	-	-	-	-	-	-	-	-	29
<i>Asteraceae</i>	1	1	2	4	2	2	4	2	2	-	-	2	22
<i>Tamarindus indica</i>	1	-	-	-	-	-	-	-	-	-	10	11	22
<i>Eucalyptus spp</i>	-	-	-	9	-	-	1	4	2	5	-	-	21
<i>Carica papaya</i>	6	-	-	-	9	-	1	-	-	-	-	-	16
<i>Samanea saman</i>	3	-	-	-	-	-	-	-	-	5	2	4	14
<i>Brassica spp</i>	-	-	-	-	-	-	3	4	-	-	-	-	7
<i>Acacia spp</i>	-	-	-	-	-	-	-	-	-	-	2	4	6
<i>Delonix regia</i>	1	-	-	-	-	-	-	-	-	-	2	1	4
<i>Azadirachta indica</i>	-	-	-	-	-	-	-	-	-	1	3	-	4
<i>Typha angustata</i>	-	-	4	-	-	-	-	-	-	-	-	-	4
<i>Prosopis juliflora</i>	-	-	-	3	-	-	-	-	-	-	-	-	3
<i>Salmalia malabarica</i>	-	-	-	-	-	-	-	-	-	-	3	-	3
<i>Pithecellobium dulce</i>	-	-	-	-	-	-	2	1	-	-	-	-	3
Unidentified pollen	1	2	2	1	2	4	2	2	1	2	1	2	22

Cocos nucifera, *Peltophorum pterocarpum* and *Putranjiva roxburghii*. The second season was represented by less airborne pollen counts. Among the tree pollens, *Cocos nucifera* and *Peltophorum pterocarpum* showed good incidence during the month of May. Sporadic occurrence of other pollen types such as grasses, weeds were also recorded. The third season was dominated by grass and weed pollen. Among the weed pollen *Amaranthus* and *Parthenium* showed good incidence. Among the tree pollen, *Casuarina equisetifolia* and *Cocos nucifera* showed good incidence followed by sporadic incidence of *Peltophorum pterocarpum* and pollen belonging to family Myrtaceae. The fourth pollen season was loaded with grass, tree and weed pollens. It is interesting to note that airborne pollen belonging to *Cocos nucifera* showed its occurrence throughout the year having its peak during the months of April and October-November. Similarly, *Peltophorum pterocarpum* pollen showed peak during April-May and sporadic occurrence during September-October. *Casuarina equisetifolia* was also represented twice in the year with its peak during August - October and moderate prevalence during the month of March. Grass pollen were trapped throughout the year in good quantity with their peak during August - November. Weed pollens which showed occurrence throughout the year belonged to *Amaranthus* - *Chenopodium* group and *Parthenium hysterophorus*. Other palynomorphs, which showed their presence in the air over Pune City belonged to *Xanthium strumarium*, *Prosopis juliflora*, *Azadirachta indica*, *Eucalyptus* sp, *Cassia* sp, *Ricinus communis*, *Pithocellobium dulce*, *Brassica*, *Carica papaya*, *Samanea saman*, *Tamarindus indica*, *Delonix regia*, *Morus alba* and *Typha angustata*. Certain palynomorphs belonging to family Myrtaceae, Asteraceae and Umbelliferae could not be identified even upto generic level due to their indistinguishable morphological characters. Apart from these, there were some pollen grains trapped on the slides whose identity could not be established even upto family level due to ill-defined structure, such pollen grains were categorized as "Unidentified".

The Military Hospital (Site No 2) located about 15 kilometers away from site no 1 showed higher incidence of grass pollen in comparison to site no 1 located in the middle of the city. However, no

considerable difference was observed in the incidence of tree and weed pollens, though the deposition was marked by the plant growing near the vicinity.

Aerobiological study by Kalra and Dumbrey¹ at Poona was aimed to identify pollens and fungal spores prevalent in the atmosphere of Armed Forces Medical College campus and the Military Hospital. Over a period of 50 years Pune city underwent many changes in relation to vegetational cover due to rapid industrial growth around the city. Hence, it was felt essential to carry out aerobiological survey to record new aeroallergens. Similar to Kalra and Dumbrey 1957¹ predominance of pollen belonging to *Holoptelea integrifolia* was observed in the present study, among tree pollens. However, we observed that these pollen types (trees) were present in the air in good quantity from Mid December to March against Mid January to March reported earlier. The shifting in pollination period may be attributed to change in climatic conditions over the years. Similar finding are also reported by Burge¹⁶ and many other workers in India^{3,7,8,10,17}.

Here it is interesting to record predominance of other tree pollens in the city of Pune which were not reported earlier. These pollen types belonged to *Cocos nucifera*, *Casuarina equisetifolia* and *Ailanthus excelsa*. Existence of these aeroallergens may be due to introduction of new tree species. *Parthenium hysterophorus* a highly allergenic weed contributed pollen grains throughout the year, was not reported in the earlier study¹. Another predominant pollen in our study is *Peltophorum pterocarpum* which could not be recorded in previous survey. The presence of high number of airborne pollen of this species may be due to extensive cultivation in recent years.

In addition to airborne pollen, considerable number of fungal spores were trapped at both the sites (Table 2). It is interesting to note that comparatively higher concentration of fungal spores were recorded at site No 2. *Alternaria* was most dominant airborne spore type recorded throughout the year with its peak during September-November. It was followed by *Helminthosporium* and *Curvularia* which showed sporadic incidence throughout the year. *Fusarium* and *Cladosporium* were recorded from August to March. Conidia belonging to *Pithomyces*, *Diplodia*,

Table 2. Incidence of airborne fungi and other bioparticles at Pune (July 2000-June 2001)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total cm ²
<i>Alternaria</i>	5	6	40	45	56	28	28	14	-	10	5	5	242
<i>Cucurbitaria</i>	38	29	33	11	15	10	4	3	1	-	-	-	144
<i>Helminthosporium</i>	-	13	20	16	17	8	3	1	2	3	-	-	83
<i>Fusarium</i>	-	32	2	-	4	-	10	10	3	-	-	-	61
<i>Cladosporium</i>	-	-	15	10	4	-	1	3	2	-	-	-	35
<i>Tetraploa</i>	-	2	2	3	-	-	4	4	3	2	-	-	20
<i>Ascospores</i>	-	-	-	-	8	-	4	2	1	-	-	-	15
<i>Cercospora</i>	-	-	-	-	4	4	1	1	-	-	-	-	10
<i>Pithomyces</i>	-	6	-	2	-	-	1	-	-	-	-	-	9
<i>Diplodia</i>	-	2	2	2	-	-	-	-	-	-	-	-	6
Unidentified fungal spores	2	20	20	10	15	2	4	6	10	2	4	2	97

Cercospora and *Ascospores* were also recorded during this period.

Certain fungal spores could not be identified due to their hyaline nature and ill-defined morphological features. The concentration of such spores was more on the slide exposed at site No. 2. They may belong to *Aspergillii* and *Penicillium* group. Along with pollen and spores, other airborne particles such as fragments of fungal hyphae, insect parts, plant parts and mites were also trapped at both the sites. Similar finding were also reported by earlier workers at Pune^{1,5}.

In conclusion the presence of new airborne pollen such as *Ailanthus excelsa*, *Casuarina equisetifolia*, *Cocos nucifera*, *Peltophorum pterocarpum*, *Parthenium hysterophorus*, *Putranjiva roxburghii*, etc may bear significant role in the diagnosis and treatment of local allergic population. The airborne pollen types present in the atmosphere over Pune city are not the same (2000-2001) as reported by Kalra and Dumbrey in the year 1957. Therefore, such studies are necessary from time to time to have better understanding about the atmospheric allergen load in a particular area.

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