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AIRBORNE POLLEN--FLORA IN AN OUTDOOR SITE IN GWALIOR (MP)

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ABSTRACT

An aeropalynological survey was conducted for two years, between September 2012 to August 2014 by using "**Burkard Portable Spore Trap Sampler" at** Kampoo, an outdoor site at Gwalior (MP). Total 33 pollen types were identified. The pollen grains belonged to angiospernic families. Dicotyledonous taxa contributed maximum number of pollen grains as compared to monocotyledons. Observations indicate that pollen of Poaceae was maximum followed by Asteraceae, Mimosaceae and *Cassia* type. On the basis of mode of pollination amphiphilous type of pollen were maximum followed by entomophily and anemophily. Total as well as individual pollen types and their number displayed distinct seasonal periodicity in their incidence.

Keywords: Aeropalynology, seasonal incidence, pollination, airborne pollen grains, outdoor site, Gwalior.

INTRODUCTION

Air is one of the basic needs required for the sustenance of life on earth. The air is becoming polluted day by day due to various human activities such as mode of transportation, industries, biotic exploitation and rapid growth of population particularly in urban areas. Among the viable and non-viable particulates of the atmosphere, biological pollution is caused by the pollutants like pollen grains, spores, algal, fungal filaments and other biocomponents. During the year 1920-1930, extensive investigations were undertaken to understand the microbial Components of the atmosphere. Study of atmospheric pollen grains form an essential part of aerobiological survey. The concentration of airborne pollen grains varies not only from place to place but also within the same area due to climatic, vegetational, environmental and anthropogenic reasons. In order to identify the dominant pollen allergens, aerobiological surveys have been conducted in different parts of India and the World.

Aerobiological studies are important because airborne pollen are chief causative agent of the respiratory allergy. Allergy and asthma is a common health problem in the world as well as Gwalior in particular. Continuous sampling of airborne particles during all weathers is necessary for combating various allergic ailments (Mandal, 2006, 2008).

The incidence of these allergies are usually observed during the pollination of wind pollinating plant species. Flower blooming and pollination are linked to the climatic factors (Spikshma, 1995., Njokuocha, 2006, and Prabhudesai, 2009). Atmospheric temperature is probably the most important environment variable for pollen release (Singh, 1988, and Ahlawat, 2010). Various types of air biocomponents have been reported from Pune (Tripathi; 2009), Gwalior (Jain, 1981, 1999, Gupta, 2010, Mishra, 1988 and Datta, 1993), Pune (Tripathi; 2009) and other places.

Aerobiological survey made in different parts of India revealed that composition and concentration of air pollen flora changes according to climate, vegetational and geographical factors (Spikshma, 1995., Njokuocha, 2006, and Prabhudesai, 2009). Atmospheric temperature is probably the most important environment variable for

pollen release (Singh, 1988, and Ahlawat, 2010). Various types of air biocomponents have been reported from Gwalior (Jain, 1981, 1999, Gupta, 2010, Mishra, 1988 and Datta, 1993), Pune (Tripathi; 2009) and other places. Regular sampling of airborne pollen at and around Gwalior was initiated by Jain and Datta (1992).

MATERIALS AND METHODS

Monitoring of air borne pollen flora was done with the help of **"Burkard portable spore trap sampler**" for two consecutive years at weekly intervals i.e. from 1.9.2012 to 31.8.2014. The standard zone of the slide was mounted by glycerin jelly and covered with a rectangular cover slip (22mmX50mm). Slides were then examined for identification of airborne pollen types.

Sampling was done at human height for 10 minutes. Pollen identification was made with the help of reference slides and authentic literature. Beside this, Pollen atlases available on internet and published literature were also consulted, Erdtman, (1952), Walker, (1976). Reference slides were prepared by Acetolysis method (Erdtman, 1960).

The pollen count was expressed in number of pollen per cubic metre of air samples. The conversion factor of Burkard spore trap sampler is 10. For Burkard sampler the conversion formula is —

$$\frac{\text{Total number pollen in one exposure}}{\text{Total volume of air sampled}} \times 100$$

$$\% \text{ Contribution} = \frac{\text{Total count of a pollen type over one month/one year/two years}}{\text{Total pollen count over one month/one year/two years}} \times 100$$

Fig. 1. "Burkard portable spore trap sampler"

RESULTS

A Total of 33 pollen types were recorded during the study period. Species of Poaceae contributed its pollen throughout the year with a maximum count in Nowemver and February (130/ M3) and minimum in July (3o/M3) followed by August (40/M3). The observations (Table 1) indicate that there were four periods, when pollen were abundant in the air. Maximum pollen counts was observed in April followed by 890/M3 in March, 800/M3 in May and 780/M3 in January Least pollen count was observed in July (130/M3) followed by August (140/M3).

The air of this site was predominated by the pollen of various taxa e.g. Poaceae, Asteraceae, Convolvulaceae, Papaveraceae, Caesalpinaceae, Anacardiaceae, Liliaceae, Lythraceae, Mimosaceae, Malvaceae, Amaranth-chenopodiaceae, Moringaceae, and Myrtaceae. Aerobiological studies at Gwalior have shown presence of different types of biocomponents in the atmosphere. Different types of bioparticles present in the air mainly happen to be directly concerned with the occurrence of flora and fauna of the particular locality.

Table 1. Incidence of Pollen types at the site NO/M^3 (01.09.2012 to 3.08.2013)

S. No.	Pollen type	2006										2007														Total	
		Sept.06		Oct.06		Nov.06		Dec.06		Jan.07		Feb.07		Mar.07		Apr.07		May.07		Jun.07		Jul.07		Aug.07		No.	%
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
1	*Ailanthus excelsa*	-	-	-	-	-	-	-	-	-	-	40	5.7	80	19	-	-	-	-	-	-	-	-	-	-	120	1.97
2	*Amaranth-chenopodiad*	50	15.1	40	10	40	6.4	-	-	-	-	-	-	90	21.4	50	13.5	-	-	30	18.7	30	14.2	-	-	330	5.42
3	*Asparagus racemosus*	80	24.2	-	-	-	-	30	3.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	110	1.8
4	*Asteraceae*	-	-	200	50	170	27.4	50	5.2	270	20.3	40	5.7	-	-	-	-	-	-	-	-	40	19	30	18.7	800	13.15
5	*Azadirachta indica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	90	24.3	340	80.9	-	-	-	-	-	-	430	7.07
6	*Bauhinia sp.*	-	-	-	-	170	27.4	80	8.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250	4.11
7	*Brassica compestris*	-	-	-	-	-	-	-	-	-	-	40	5.7	-	-	-	-	-	-	-	-	-	-	-	-	40	0.65
8	*Cassia sp.*	-	-	-	-	40	6.4	280	29.1	160	12	-	-	-	-	-	-	40	9.5	50	31.2	30	14.2	-	-	600	9.86
9	*Casuarina equisetifolia*	-	-	-	-	-		-	-	-	-	40	5.7	-	-	-	-	-	-	-	-	-	-	-	-	40	0.65
10	*Clerodendron inermae*	-	-	-	-	-	-	-	-	-	-	40	5.7	-	-	-	-	-	-	-	-	-	-	-	-	40	0.65
11	*Delonix regia*	-	-	-	-	-	-	-	-	-	-	50	7.1	-	-	40	10.8	-	-	-	-	-	-	-	-	90	1.48
12	*Holoptelia sp.*	-	-	-	-	-	-	-	-	-	-	20	2.8	90	21.4	50	13.5	-	-	-	-	-	-	-	-	160	2.63
13	*Lagerstroemia indica*	-	-	-	-	-	-	-	-	90	6.71	180	25.7	-	-	-	-	-	-	-	-	-	-	-	-	270	2.44
14	*Malvaceae*	40	12.1	-	-	80	12.8	160	16.6	170	12.7	-	-	-	-	-	-	-	-	-	-	20	9.5	30	18.7	500	8.22
15	*Mimosaceae*	-	-	80	20	80	12.8	280	29.1	360	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	13.15
16	*Morus alba*	-	-	-	-	-	-	-	-	40	3	50	7.1	30	7.1	-	-	-	-	-	-	-	-	-	-	120	1.97
17	*Poaceae*	120	36.3	40	10	40	0.4	40	4.1	80	6	90	12.8	80	19	140	37.8	40	9.5	80	50	8	38	80	50	910	14.96
18	*Polyalthia longefolia*	-	-	-	-	-	-	20	2	70	5.2	50	7.1	10	2.3	-	-	-	-	-	-	-	-	-	-	150	2.46
19	*Tamarindus indica*	-	-	-	-	-	-	-	-	20	1.5	20	2.8	40	9.5	-	-	-	-	-	-	-	-	-	-	80	1.31
20	*Zizyphus sp.*	-	-	-	-	-	-	20	2	30	2.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	0.82
Unidentified		40	12.1	40	10	-	-	-	-	40	3	40	5.7	-	-	-	-	-	-	-	-	10	4.7	20	12.5	190	3.12
Grand Total		**330**		**400**		**620**		**960**		**1330**		**700**		**420**		**370**		**420**		**160**		**210**		**160**		**6080**	
%		**5.42**		**6.57**		**10.19**		**15.78**		**21.87**		**11.51**		**6.9**		**6.08**		**6.9**		**2.63**		**3.45**		**2.63**			

Table 2. Incidence of Pollen types at the site NO/M^3 (1.09.2013 to 30.08.2014)

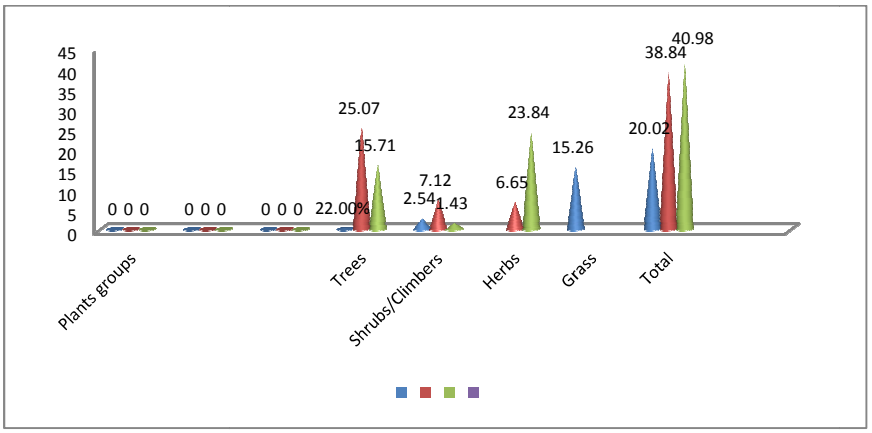
S. No.	Pollen type	2007								2008														Total	
		Sept.07		Oct.07		Nov.07		Dec.07		Jan.08		Feb.08		Mar.08		Apr.08		May.08		Jun.08		Jul.08		Aug.08			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
1	*Ailanthus excelsa*	-	-	-	-	-	-	-	-	-	-	60	10	160	17.9	40	3.6	-	-	-	-	-	-	-	-	260	4.04
2	*Amaranth-chenopodiad*	30	10.7	80	15.6	30	7.5	70	12.5	60	7.6	-	-	40	4.4	50	4.5	30	3.6	-	-	-	-	-	-	390	6.06
3	*Argemone mexicana*	-	-	-	-	-	-	-	-	-	-	-	-	30	3.3	70	6.4	40	5	-	-	-	-	-	-	140	2.17
4	*Asteraceae*	40	14.2	90	17.6	30	7.5	50	8.9	120	15.3	50	8.4	100	11	250	22.9	150	18.7	30	11.5	20	15.3	40	28.5	970	15
5	*Azadirachta indica*	20	7.1	-	-	-	-	-	-	-	-	-	-	80	8.8	50	4.5	70	8.7	-	-	-	-	-	-	220	3.42
6	*Bauhinia sp.*	50	17.8	40	7.8	-	-	-	-	50	6.4	60	10	-	-	-	-	-	-	-	-	-	-	-	-	200	3.11
7	*Callistemon lanceolatus*	-	-	-	-	-	-	-	-	-	-	-	-	50	5.6	40	3.6	30	3.6	-	-	-	-	-	-	120	1.86
8	*Calotropis sp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	2.4	-	-	-	-	-	-	20	0.31
9	*Cassia sp.*	-	-	60	11.7	50	12.5	80	14.2	-	-	-	-	40	4.4	60	5.4	170	21.2	30	11.5	-	-	-	-	490	7.62
10	*Casuarina equisetifolia*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	2.7	20	2.4	-	-	-	-	-	-	50	0.77
11	*Clerodendron inermae*	-	-	-	-	-	-	-	-	20	2.5	-	-	-	-	-	-	-	-	30	11.5	20	15.3	-	-	70	1.08
12	*Convolvulus sp.*	30	10.7	50	9.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	14.2	100	1.55
13	*Croton sp.*	-	-	-	-	-	-	-	-	30	3.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	0.46
14	*Dalbergia sp.*	-	-	-	-	-	-	-	-	-	-	-	-	40	4.4	10	0.9	-	-	-	-	-	-	-	-	50	0.77
15	*Delonix regia*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	2.7	10	1.2	-	-	-	-	-	-	40	0.62
16	*Eucalyptus sp.*	-	-	-	-	-	-	-	-	50	6.4	30	5	-	-	-	-	-	-	-	-	-	-	-	-	80	1.24
17	*Holoptelia sp.*	-	-	-	-	-	-	-	-	-	-	-	-	40	4.4	20	1.8	-	-	-	-	-	-	-	-	60	0.93
18	*Lagerstroemia indica*	-	-	-	-	-	-	-	-	130	16.6	90	15	30	3.3	-	-	-	-	-	-	-	-	-	-	250	3.88
19	*Lantana camara*	-	-	20	3.9	10	2.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	0.46
20	*Lawsonia inermis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	2.7	40	5	10	3.8	10	7.6	-	-	90	1.39

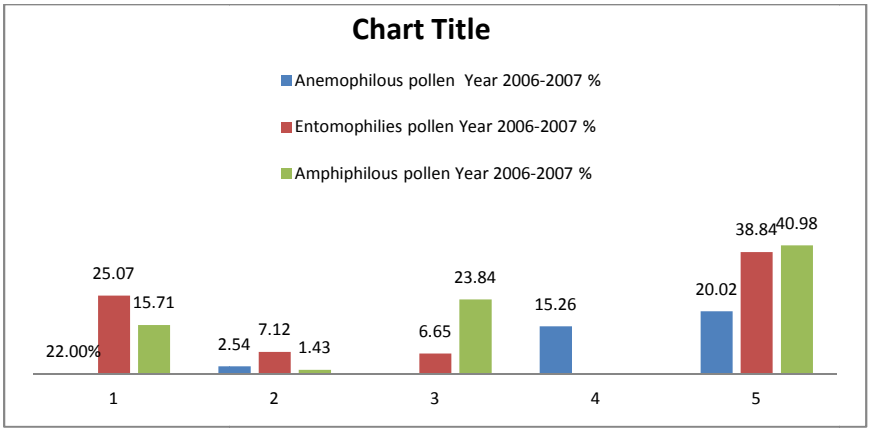
21	*Liliaceae*	-	-	-	-	30	7.5	-	-	-	-	20	3.3	-	-	-	-	-	-	-	-	-	-	-	-	50	0.77
22	*Malvaceae*	20	7.1	-	-	20	5	40	7.1	-	-	-	-	-	-	30	2.7	50	6.2	40	15.3	20	15.3	30	21.4	250	3.88
23	*Mangifera indica*	-	-	-	-	-	-	-	-	-	-	-	-	70	7.7	120	11	-	-	-	-	-	-	-	-	190	2.95
24	*Mimosaceae*	-	-	70	13.7	90	22.5	170	30.3	-	-	-	-	-	-	-	-	90	11.2	-	-	-	-	-	-	420	6.53
25	*Moringa oleifera*	-	-	-	-	-	-	70	12.5	20	2.5	-	-	-	-	30	2.7	-	-	-	-	-	-	-	-	120	1.86
26	*Morus alba*	-	-	-	-	-	-	-	-	120	15.3	70	11.7	30	3.3	-	-	-	-	-	-	-	-	-	-	220	3.42
27	*Peltophorum pterocarpum*	-	-	-	-	-	-	-	-	-	-	-	-	30	3.3	20	1.8	10	1.2	-	-	-	-	-	-	68	0.93
28	*Poaceae*	90	32.1	80	15.6	130	32.5	80	14.2	110	14.1	130	22	60	6.6	80	7.3	70	8.7	60	23	30	23	40	28.5	960	14.93
29	*Polyalthia longifolia*	-	-	-	-	10	2.5	-	-	-	-	-	-	40	4.4	30	2.7	-	-	-	-	-	-	-	-	80	1.24
30	*Quisqualis indica*	-	-	-	-	-	-	-	-	30	3.8	10	1.6	-	-	-	-	-	-	-	-	-	-	-	-	40	0.62
31	*Ricinus communis*	-	-	-	-	-	-	-	-	20	2.5	50	8.4	30	3.3	60	5.3	-	-	-	-	-	-	-	-	160	2.48
32	*Tamarindus indica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	11.5	20	15.3	-	-	50	0.77
33	*Zizyphus sp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30	2.7	-	-	-	-	-	-	-	-	30	0.46
Unidentified		-	-	20	3.9	-	-	-	-	20	2.5	20	3.3	20	2.2	10	0.9	-	-	30	11.5	10	7.6	10	7.1	140	2.17
Grand Total		**280**		**510**		**400**		**560**		**780**		**590**		**890**		**1090**		**800**		**260**		**130**		**140**		**6430**	
%		**4.35**		**7.93**		**6.22**		**8.7**		**12.13**		**9.17**		**13.84**		**16.95**		**12.44**		**4.04**		**2.02**		**2.17**			

The contribution of various pollen types on the mode of pollination (Table 3 and Fig.) indicates that the amphiphilous types contributed more (40.98%) than entomophilous (38.84%) and anemophilous (20.02%). Among trees entomophilous type exhibited higher concentration (25.07%) than amphiphilous and anemophilous respectively (15.71 and 2.22%). In case of grass only anemophilous type was recorded.

Table 3. Pollen contribution by plants on the basis of mode of pollination at study site (Kampoo) during the study period (2007-2008)

Plants groups	Anemophilous pollen Year 2006-2007 %	Entomophilies pollen Year 2006-2007 %	Amphiphilous pollen Year 2006-2007 %
Trees	22.00%	25.07	15.71
Shrubs/Climbers	2.54	7.12	1.43
Herbs		6.65	23.84
Grass	15.26		
Total	20.02	38.84	40.98





DISCUSSION

Observations indicate that the air of Gwalior comprises a good amount of pollen types representing various taxa. Poaceae, Asteraceae, Mimosaceae*, Cassia sp.,* Malvaceae and Amaranth - Chenopodiad were found to be dominant taxa because all these plants are abundantly growing at this site. A large number of *Holoptelia* and *Tamarindus* trees are growing in the vicinity of hospital, college and school, situated at this site.Pollen types belonging to the Species of *Argemone*, *Callistemone*, *Calotropis*, *Croton*, *Dalbergia*, *Eucalyptus*, *Mangifera, Moringa*, *Quisqualis*, *Ricinus* and others were recorded during this year observation.

Pollen of *Croton*, *Convolvulus*, *Quisqualis*, *Zizyphus*, *Millingtonia* and *Parkinsonia sp*. were represented only for one to two months. The short duration of flowering and entomophilous mode of pollination of many such taxa could be the factors for this condition.

The contribution of Mimosaceae was maximum (Table 1) during Autumn season followed by winter. This is because many representatives of these taxa remain in flowering stage for a longer period.

During rainy season the occurrence of pollen was very low. These seasons exhibited maximum presence of tree and shrubs pollen. This is because of flowering of these taxa during summer season. During rainy season the pollen types mainly belong to herbaceous taxa with less presence in the air. Rain fall and high-humidity become the main obstacles in way of dispersal.

The significant variation of the atmospheric concertration of pollen is influenced not only by the climatic factors but its essentially a function of the frequency, density and abundance of plants and their flowering behaviour at a given locality (Singh, 1988 and Rajo-Rodroguez, 2003). Concentration of airborne pollen grains showed day to day seasonal as well as yearly variations. The variations may be caused by several reasons, but most commonly related to intencity of flowering and pollen productivity which in turn is dependent on the meteorological parameters (Sharma et al. 2004, 2008).

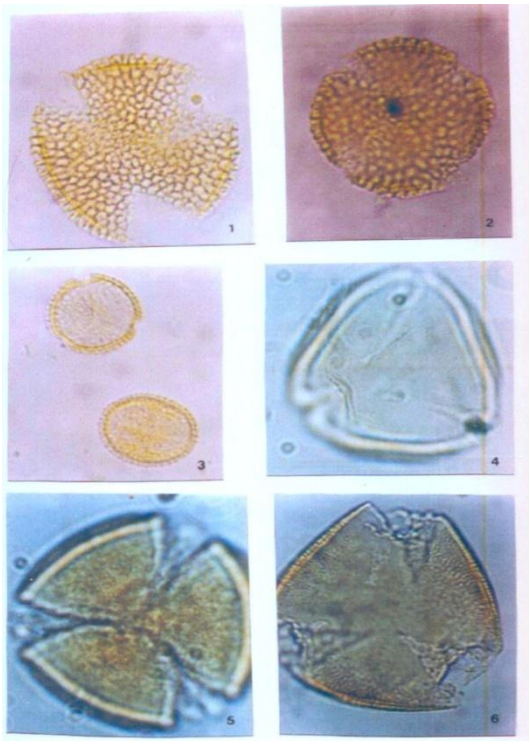


Fig. 2. Some identified airborne Pollen grains
1-Jasmium sambac 2--Jasmium sambac 3-Citrus sp. 4-Cassia fistula 5-Argemone Mexicana 6-Bauhinia variegata.

Conclusions:

The result of this study has highlighted the presence of multiple allergic plants within the investigated region. Angiosperms are the most effective source of airborne pollen in Gwalior district. The local

vegetation has direct impact on concentration and composition of atmospheric pollen flora. Pollen data should be included in air quality information. Reports on pollen grains prevalence and abundance may be helpful in treatment patients suffering from pollen allergy.

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