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A PRELIMINARY STUDY OF AIR BORNE POLLEN GRAINS IN KARACHI

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Abstract

During May-November, 1978, atmospheric pollen grains of the families Gramineae, Cyperaceae, Chenopodiaceae, Boraginaceae, Tamaricaceae, Scrophulariaceae, Fabaceae, Solanaceae, Primulaceae, Capparidaceae, Convolvulaceae, Cupressaceae, Euphorbiaceae and Aristolochiaceae were trapped from Karachi area. The highest pollen frequency was recorded in the last week of June with grass pollen grains dominating in over-all pollen counts. Pollen frequency was higher at a height of 15 meters than 1.2 meters.

Introduction

Aeropalynology is important in the field of forestry, agriculture, paleobotany and human allergy. Pollen grains are the main cause of certain forms of human allergy like hay fever, asthma, utricaria rarely eczema (Stanley & Linskens, 1974).

Wyman (1876) was the first to have established that asthma was caused by the pollen grains of ragweed. Dunbar (1903) demonstrated that pollen grains of grasses were also responsible for asthma. Atmospheric pollen grains have been surveyed in various places for instance in London by Gregory & Stedman (1953), in India by Shivpuri (1964), in New York by Stanley & Linskens (1974), in Iran by Amin & Bokhari (1976), but no data is available on the atmospheric pollen grains for Karachi. This work was, therefore, undertaken to determine the time, frequency and duration of various atmospheric pollen grains in Karachi. Pollen data was also correlated with temperature, humidity, wind velocity, sun shine and rainfall.

Materials and Methods

The study was conducted at Karachi University Campus from May 14, 1978 to November 30, 1978. Atomospheric pollen grains were trapped by using an adhesive tape on an ordinary microscope slide. These slides were exposed for 24 hours by gravity slide method (Durham, 1942), at two different places, at 1.2m at the ground level and the other 15m high at the top of the building of the department of Botany. Horizonatal slide stands were not used because of less pollen deposition on them.

Table 1. Atmospheric pollen grains/cm^2 during the period of 14th May to 30th November 1978 at a height of [illegible]

Dates	No. of weeks	Pollens/cm^2	Gr	Cy	Ch	Bor	Pr	Sc	Ar	Fa	Cap	Eup	Tam	Con	Sol	
May 14-21	1	213	152	10	4	20	17	10								
22-31	2	1656	1544	20	8	35	30	19								
June 1-7	3	456	374	28	15	39										
8-14	4	396	296	64	16	18		1					1			
15-21	5	1323	1263	32	15	9	1	2								
22-30	6	1824	1738	48	20	10		8								
July 1-7	7	49	40	6	1			1		1						
8-14	8	8	8													
15-21	9	1397	1375	22												
22-31	10	173	170													
Aug. 1-7	11	99	96	3												
8-14	12	630	561	50	18		1									
15-21	13	127	113	14												
22-31	14	105	105											1		2
Sept. 1-7	15	100	90	8	1					1						
8-14	16	116	72	40		2			2							
15-21	17	150	141	3			5				1					
22-30	18	110	90	10	5	5										
Oct. 1-7	19	64	58		3	3										
8-14	20	32	30		1	1										
15-21	21	7	5	1				1								
22-31	22	26	26													
Nov. 1-7	23	81	51	29	1											
8-14	24	53	52													
15-21	25	8	5			1	2								1	
22-30	26	6								6						

Abbreviations:
Gr=Gramineae Cy=Cyperaceae Bor=Boraginaceae
Pr=Primulaceae [illegible]c=Scrophulariaceae Ar=Aristolochiaceae
Fa=Fabaceae Cap=Capparidaceae Eup=Euphorbiaceae
Tam=Tamaricaceae Con=Convovulaceae Sol=Solanaceae
Cup=Cupressaceae

Cover slips, 22 mm^2, were placed on the slides and pollen grains counted under the microscope. Atmospheric pollen grains under the portion of the cover slip including that of tape was dipped in a beaker containing few ml of glacial acetic acid and left over night. The cover slips and the tape were washed carefully with the help of fine needle and forceps and the material centrifuged at 5000 rpm for half an hour. The liquid was decanted and recentrifuged for half an hour with 50% glycerine at the same speed and mounted in glycerine jelly. Pollen grains were identified with the help of freshly prepared reference slides and relevant literature of Erdtman (1952), Hyde & Adam (1958), Faegeri & Iverson (1975).

Results

1. *Frequency of occurrence:* Pollen grains belonging to the families Gramineae, Cyperaceae, Chenopodiaceae, Boraginaceae, Primulaceae, Fabaceae, Solanaceae, Euphorbiaceae, Tamaricaceae, Capparidaceae, Scrophulariaceae, Convolvulaceae, Cupressaceae and Aristolochiaceae were recorded during 14th May to 30th November 1978 at a height of 1.2 meters (Table 1). At a height of 15 meters pollen grains of Gramineae Cyperaceae, Chenopodiaceae, Primulaceae and Boraginaceae were trapped (Table 2).

The highest frequency of pollen grains was recorded in the last week of June at a height of 15 meters (Table 2) whereas the lowest frequency was observed in the last week of November at a height of 1.2 meters (Table 1). The frequency of pollen grains of the family Graminaeae was maximum followed by Cyperaceae, Chenopodiaceae, Boraginaceae, Primulaceae, Scrophulariaceae, Aristolochiaceae, Boraginaceae, Primulaceae, Scrophulariaceae, Aristolochiaceae, Fabaceae, Capparidaceae, Euphorbiaceae, Tamaricaceae, Convolvulaceae, Solanaceae and Cupressaceae.

2. *Time of occurrence:* Atmospheric pollens of various families showed different frequencies at different time period (Table 3). Three definite groups of plant families were recognized on the basis of time of occurrence of pollen grains. Group I includes Gramineae and Cyperaceae whose pollens were recorded throughout the year. Group II includes Chenopodiaceae, Boraginaceae, Primulaceae, Scrophulariaceae and Fabaceae- the pollens of which were recorded intermittently. Group III has Convolvulaceae, Aristolochiaceae, Solanaceae, Euphorbiaceae, Tamaricaceae, Capparidaceae and Cupressaceae – the pollens of which were trapped only once.

3. *Climatic factors.*

a) *Temperature:* The highest temperature (34.3°C) was recorded in the third week of October and the lowest (26.6°C) in the last week of November (Table 4).

Table 2. Atmospheric pollen grains/cm^2 during the period of 14th May to 30th November 1978 at a height of 15 meters

Dates	No. of weeks	Pollens /cm^2	Number of pollen grains/cm^2				
			Gr.	Cyp.	Chen.	Bor.	Pr.
May 14-21	1	341	274	–	19	29	19
May 22-31	2	5175	4182	640	240	110	3
June 1-7	3	1530	1064	273	100	74	19
June 8-14	4	1018	781	157	65	15	–
June15-21	5	1073	760	218	92	3	–
June 22-30	6	9504	9206	232	60	6	–
July 1-7	7	1713	1408	295	10	–	
July 8-14	8	54	53	1	–	–	–
July 15-21	9	1375	1292	80	–	3	–
July 22-31	10	2742	1970	759	–	13	–
Aug. 1-7	11	463	409	54	–	–	–
Aug. 8-14	12	2004	1980	24	–	–	–
Aug. 15-21	13	436	436	–	–	–	–
Aug. 22-31	14	327	219	70	19	–	19
Sept. 1-7	15	885	883	1	1	–	–
Sept. 8-14	16	499	496	1	–	2	–
Sept. 15-21	17	1323	1236	80	7	–	–
Sept. 22-30	18	548	461	40	42	5	–
Oct. 1-7	19	821	723	68	30	–	–
Oct. 8-14	20	243	232	9	2	–	–
Oct.15-21	21	17	12	4	1	–	–
Oct. 22-31	22	105	105	–	–	–	–
Nov. 1-7	23	46	46	–	–	–	–
Nov. 8-14	24	19	19	–	–	–	–
Nov. 15-21	25	174	1	92	–	81	–
Nov. 22-30	26	17	1	16	–	–	–

Abbreviations: Gr=Gramineae Cy=Cyperaceae Ch=Chenopodiaceae
Bor=Boraginaceae Pr=Primulaceae

b) *Humidity:* Highest humidity (85.8%) was recorded in the second week of July and the lowest (20.6%) in the last week of November.

c) *Wind velocity:* The highest wind velocity (19.7 km/hr.) was recorded in the

Table 3. Duration of different atmospheric pollen grains

Group	Name of Taxon	Time of Occurrence
I	Gramineae	May – November
	Cynodon dactylon	–do–
	Cenchrus setigerus	–do–
	Chrysopogon aucheri	–do–
	Dicanthium annulatum	–do–
	Zea mays	–do–
	Cyperaceae	–do–
II	Chenopodiaceae	May
		July (1st week)
		Aug. (2nd week)
		Sept. (1st & last week)
		Oct. (1st & 2nd week)
		Nov. (1st & 3rd week)
	Boraginaceae	May
		June
		Sept. (2nd & last week)
		Oct. (2nd week)
		Nov. (last week)
	Primulaceae	May
		June (3rd week)
		Aug. (2nd week)
	Scrophulariaceae	May
		June
		July (1st week)
		Sept. (3rd week)
		Oct. (3rd week)
	Fabaceae	Sept. (1st week)
		Nov. (last week)
III	Aristolochiaceae	Sept. (2nd week)
	Solanaceae	Nov. (2nd week)
	Euphorbiaceae	July (1st week)
	Tamaricaceae	June (2nd week)
	Capparidaceae	Sept. (3rd week)
	Cupressaceae	July (last week)

Table 4. Frequency of pollen grains at two different heights and environmental factors.

Dates	No. of weeks	Pollens /cm^2 15 m. height	Pollens /cm^2 1.2 m height	Temp. °C	Humidity %	Wind velo-city km/hr	Sunshine cal sq. ft^{-1} day^{-1}	Rain-fall mm
1	2	3	4	5	6	7	8	9
May 14-21	1	341	213	32.1	59.5	13.3	11.8	00
22-31	2	5176	1656	31.1	66.5	13.3	8.7	00
June 1- 7	3	1530	456	32.3	64.6	10.0	8.3	00
8-14	4	1018	396	33.9	59.4	8.9	6.1	00
15-21	5	1073	1323	33.4	57.6	6.3	8.4	00
22-30	6	9504	1824	32.2	62.2	11.3	6.6	00
July 1- 7	7	1713	49	31.7	67.0	14.7	3.7	0.1
8-14	8	54	8	29.7	85.8	7.8	4.2	1.2
15-21	9	1375	1397	28.9	80.3	17.5	0.3	4.0
22-31	10	2742	173	30.2	73.2	8.2	3.5	1.2
Aug. 1- 7	11	463	99	29.3	70.2	11.2	2.7	00
8-12	12	2004	630	29.0	63.7	12.0	2.3	00
15-21	13	436	127	28.2	75.9	19.7	3.4	0.8
22-31	14	327	105	30.5	71.6	8.5	6	00
Sept. 1- 7	15	885	100	29.3	64.9	19.7	6.7	00
8-14	16	499	116	29-4	65.0	17.4	6.8	00
15-21	17	1323	150	30.0	64.7	17.5	7.7	00
22-30	18	548	110	28.7	56.8	8.2	7.2	00
Oct. 1- 7	19	821	64	30.3	63.2	7.0	8.5	00
8-14	20	243	32	32.3	27.2	5.4	10.9	00
15-21	21	17	7	33.0	32.6	5.5	9.9	00
22-31	22	105	26	34.3	25.9	4.0	9.6	00
Nov. 1- 7	23	46	81	32.3	32.7	6.0	9.1	00
8-14	24	19	53	29.2	32.5	8.7	6.4	00
15.21	25	174	8	32.0	46.0	5.7	8.9	00
22-30	26	17	6	26.6	20.6	5.8	9.4	00
		=31659	=8209					

third week of August and the lowest wind velocity (4 km/hr) was recorded in last week of October (Table 4).

d) *Sun-shine:* The highest value of sunshine (11.8 cal. sq. ft^{-1} day^{-1}) was recorded in the third week of May and the lowest value (.3 cal. sq. ft^{-1} day^{-1}) was recorded in the third week of July (Table 4).

e) *Rain fall:* First rain fall was recorded in the first week of July and it continued till August (Table 4).

4. *Effect of Height:*

Highest frequency of pollen grains recorded at a height of 15 meters was 31609/cm^2, while at a height of 1.2 meters the highest pollen frequency recorded was 8209/cm^2 (Fig. 1).

Discussion

Pollens of all the 14 families were recorded at a height of 1.2 meters while at 15 meters, pollens of only 5 families could be trapped (Table 1 & 2). The pollen frequency remained higher at 15 meters (Fig. 1). Blackley (1873) also concluded that there seemed to be a zone of atmosphere commencing some distance above the earth which contained much larger number of pollens and spores than were found in the lower portion. However in the present study, exception to the above generalization was observed on 4 occasions i.e. third week of June and July, first two weeks of November (Table 2) when the frequency of pollen grains at 1.2 meters respectively were 1323, 1397, 81 and 53 pollen grains/cm^2 as compared to 1073, 1375, 46 and 18 pollen grains/cm^2 at 15 meters.

Temperature and humidity are reported to affect pollen frequency (Shivpuri, 1964) since temperature and humidity directly influence and regulate the pollen discharge in the flower (Frankel & Galun, 1977). In the present study also (Fig. 1) pollen frequency was higher in the weeks with high temperature and low humidity.

Wind helps the distribution of pollen grains over a wide area and also causes greater dispersal of pollens from the anthers (Hyde & William, 1945; Shivpuri, 1964; Scott, 1970). Increases in the pollen frequency was related to high wind velocity except in the third and last week of May when the pollen frequency was higher at low wind velocity (Table 4). Similarly sunshine, another climatic variable, enhances the ripening and discharge of pollens (Adam, 1952; Shivpuri 1964). In the current study also a direct correlation in sunshine and atmospheric pollen frequency was observed (Fig. 1). Precipitation also affects the pollen dispersal since after preseasonal rains the grasses and weeds grow luxuriantly producing large crop of pollens. If rainfall occurs during the pollination season the pollen contents of the air diminish because of precipitation of pollens present in the upper air (Shivpuri, 1964) as observed in the present study (Table 4).

In the present work the number of pollen grains were found highest in June. The pollens of Gramineae, Cyperaceae, Chenopodiaceae, Fabaceae are responsible for causing allergies (Blackley, 1879; Duchaine, 1959). Shivpuri (1964) found that with

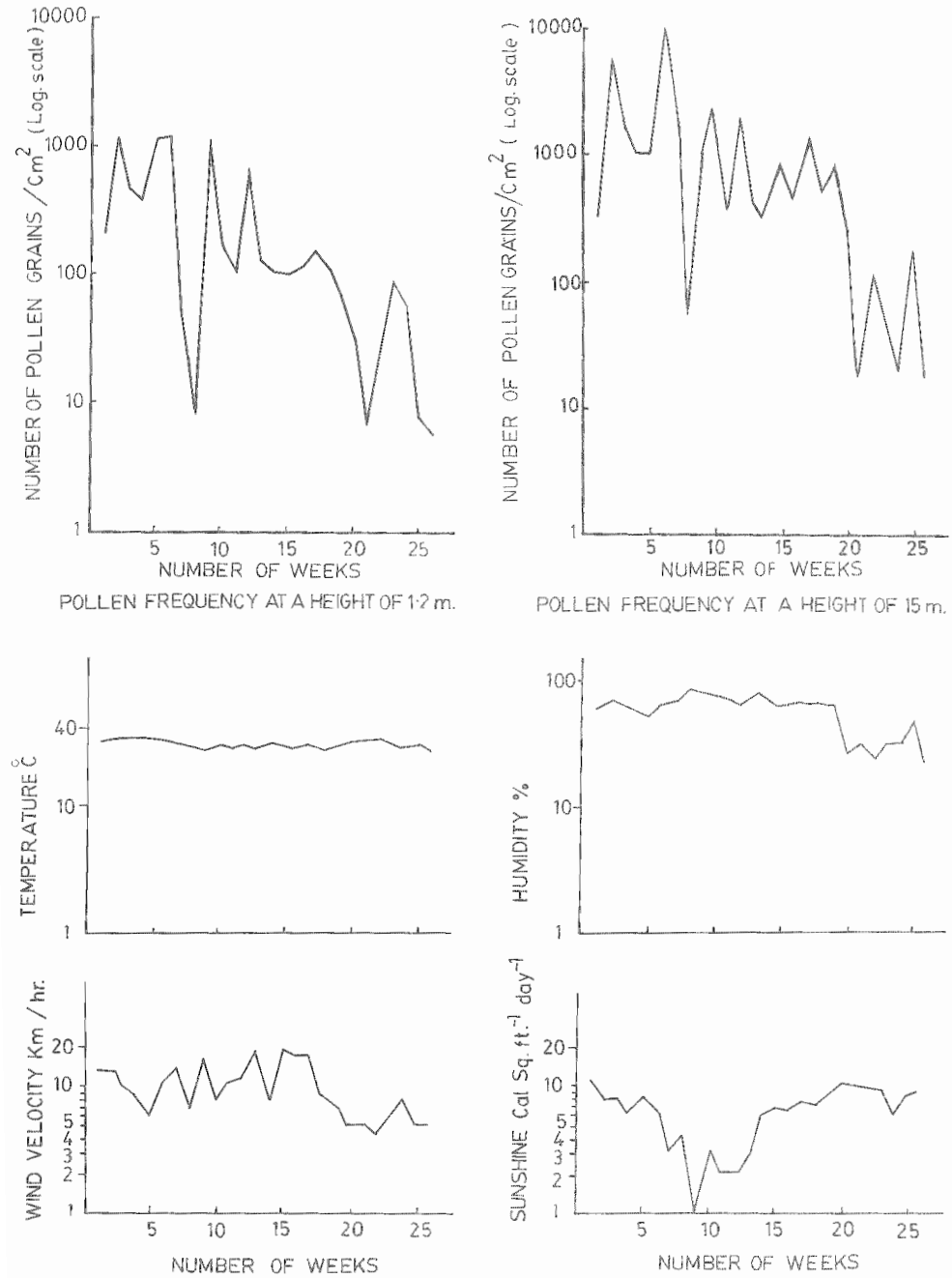

Fig. 1. Changes in concentration of pollen at a height of 1.2 and 15 meters in relations to weather (temperature, R.H., wind velocity and sunshine).

the increase of atmospheric pollen frequency the number of patients suffering with seasonal asthma and seasonal rhinitis also increased. No data however, is available about such patients in Karachi area which needs a careful study.

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