

## STUDIES ON AEROBIOLOGY OF GOPESHWAR-SPRING PERIODICITY OF AIR BORNE POLLEN GRAINS<sup>1</sup>

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### ABSTRACT

Periodicity of air borne pollen grains and miscellaneous objects were studied for ten days each during spring season, in two successive years. The slides were exposed in an open space four times a day at the interval of 6 hrs. i.e. 6 hrs, 12 hr, 18 hr, 24 hr. Only some types of pollen grains and miscellaneous objects caught in appreciable numbers could reflect the idea of periodicity and related factors. Pollen catch at night, especially in the dawn session was very low. Different periodicity patterns were observed i.e. *Coltis*, *Cupressus*—forenoon; *Carpinus*, *Fraxinus*, *Melia*, *Morus*, *Pinus*—afternoon; *Betula*—night and *Embllica*, *Engelhardtia*, *Rumex*, *Quercus*—double peak periodicity. *Carex*, *Juglans* and graminaceous pollen showed irregular patterns. Most of the miscellaneous objects showed afternoon pattern, with a few exceptions.

### INTRODUCTION

Pollen grains and miscellaneous objects are important constituents of the atmospheric biota. There are several studies conducted from various places denoting the air borne flora and their importance (*see* Gregory, 1978; Edmonds, 1979). These atmospheric microbes are never constant and vary from place to place, season to season and even hourly in the same place. Studies in relation to diurnal variation of pollen grains and miscellaneous objects have so far not received enough attention as compared to the fungal population in the air (Hirst 1953; Sreeramulu, 1959; Pady; *et al.*, 1962; Kramer *et al.*, 1963; Sreeramulu and Ramalingam, 1966; Bhati and Gaur, 1979). However, such studies are useful in understanding the discharge pattern, allergic and other allied aerobiological aspects. The pre-

sent communication pertains to the variations in the magnitude of atmospheric pollen and miscellaneous particles at different intervals of the day.

### MATERIALS AND METHODS

Studies were conducted at Gopeshwar, Chamoli district in Uttar Pradesh (India). Gopeshwar is a town situated at the base of North-West Himalaya, at an altitude of 1300 to 1500 m, on an intermediate hilly ridge and lies between 30° 25' N longitude and 79° 25' E latitude. Periodic observations were carried for ten days in the years 1980 and 1981, for the same season and period i.e. 25th March to 8th April. This period was selected for the study because it represented moderate climatic conditions and comparatively high quantities of pollen and miscellaneous elements in the air.

The gravity slide sampling method

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as recommended by the American Association of Allergy (Durham, 1946) was used and subsequent examination of slides were made as earlier studies of Gaur (1978) and Gaur and Bhati (1979). The apparatus was kept at an open exposed position on a roof of a private building, vicinity of which contains abundant sources of pollen and other vegetative objects. The slides were exposed at 6 hrly interval of the day and four periods 6 hr, 12 hr, 18 hr and 24 hr have been used to indicate different concentrations under various weather conditions. The slides were mounted by stained glycerine jelly and constant area (22 mm × 22 mm) under the cover glass was studied.

## RESULTS AND DISCUSSION

Both the years under investigation (25th March-8th April) represented almost similar types of the pollen grains and miscellaneous elements. Quantitatively pollen grains were more in number in the year 1980 as compared to the following year. *Melia*, *Carex*, Graminae, *Engelhardtia*, and pteridophytic spores were more in the year 1980 whereas, Chenopod-Amaranthaceae, *Emblica*, *Populus*, *Celtis*, *Cupressus* and Rosaceous pollen were caught in higher number in the year 1981.

Several types of pollen grains and miscellaneous objects represented in very low concentration and which could not ascertain their periodicity pattern are listed below.

Pollen grains	Miscellaneous
Cruciferae type	Algal Fragments
Compositae ( <i>Sonchus</i> ) type	Amoeboid cyst
<i>Sapium</i>	Insect eggs, leg, setae

Chenopod-  
Amaranthaceae

*Eucalyptus*

*Deutzia*

*Colebrookia*

*Daphiphyllum*

*Coriandrum*

Pteridophyte spores

Diatom cells

Lichen soredia

Elaters/pappus

Unidentified  
objects

Based on the individual concentration of these microbes following periodicity pattern were observed (Table I).

*Celtis* and *Cupressus* pollen grains were caught maximum during 6-12 hrs of the day representing forenoon discharge pattern, their occurrence at other period is also noticed, but represented decreasing trend as the time precedes.

*Carpinus*, *Fraxinus*, *Populus*, *Melia*, *Morus*, *Pinus* represented afternoon pattern, being observed in maximum concentration at 12-18 hrs. Except for *Populus*, the concentration of pollen grains of these plants was shared with night pattern i.e. 18-24 hr. *Populus* pollen represented next maximal pattern at 6-12 hr. *Betula* represented maximum in quantity at night (18-24 hr.) and shared its high concentration with C and A periods. None of the pollen represented characteristic A(0-6 hr) pattern, however, graminaceous pollen were appreciably high in this period, sharing with B and C pattern. Several of the pollen types represented double peaks i.e. concentration at two periods of the day such as *Quercus*, *Engelhardtia* (C D), *Rumex*; *Emblica* (B C), *Juglans*, *Carex* pollen showed irregular pattern in their pollen periodicity.

Among the miscellaneous objects hyphal fragments, tracheary elements, burnt dried plant parts, stellate hairs, epidermal peelings were in abundance in C period (12-18 hr). Other tricho-



TABLE I

A 1—6 hr	B 6—12 hr	C 12—18 hr	D 18—24 hr
	<i>Celtis</i> <i>Cupressus</i>	<i>Carpinus</i> <i>Fraxinus</i> <i>Populus</i> <i>Melia</i> <i>Morus</i> <i>Pinus</i>	<i>Betula</i>
Grasses ?	Grasses ?  <i>Rumex</i> <i>Emblica</i>	Grasses ?  <i>Quercus</i> <i>Rumex</i> <i>Emblica</i> <i>Engelhardtia</i>	<i>Quercus</i>   <i>Engelhardtia</i>
		Hyphal fragments Trachary elements Stellate hairs Epidermal peelings	

mes, bristles of insects scales, some unidentified gelatinous balls showed irregular pattern in the air.

There are several factors i.e. source and production of these elements, mechanism of dehiscence, rain, humidity, temperature, wind velocity and sunshine which determine the periodicity of the atmospheric microbes in a particular period of the day. Under the present period of investigation; source of the abundantly occurring pollen were found to be in the adjacent localities, a few of them i.e. *Betula*, *Engelhardtia*, *Carpinus*, *Fraxinus*, *Emblica*, *Carex* were comparatively far distant (10-25 kms) in the forest localities.

*Pinus*, grasses, *Populus*, *Quercus*, *Celtis*, *Juglans*, *Cupressus* were quite near to the trapping site and represented good amount of pollen grains. Production of some pollens were comparatively low, i.e. *Coriandrum*, *Melia*, *Populus* and their occurrence in the air is due to their close vicinity to the exposure site. *Dap-*

*hnyphyllum*, *Deutzia* though produce huge number of pollen grains, but far situated from the local site had represented only a few number of grains in the air. *Rumex* being abundant and close to the trapping site represented highest number of the grains for both the years.

In *Celtis* and *Cupressus*, high pollen output associated with their proximity to the trapping site and early pollen discharge resulted forenoon pattern. Their pollen grains require moderate temperature and relative humidity. Variation in the pattern were observed due to rain and increased humidity (see Fig. I).

As the sunshine and temperature increases till 2 p.m., pollen of *Fraxinus*, *Carpinus*, *Populus*, *Melia*, *Morus*, *Pinus* tend to discharge more pollen grains therefore, caught in maximum number in afternoon period (C). Some of the long distant pollens i.e. *Fraxinus*, *Carpinus*, might take some time for their longer travel in the air from all the sur-

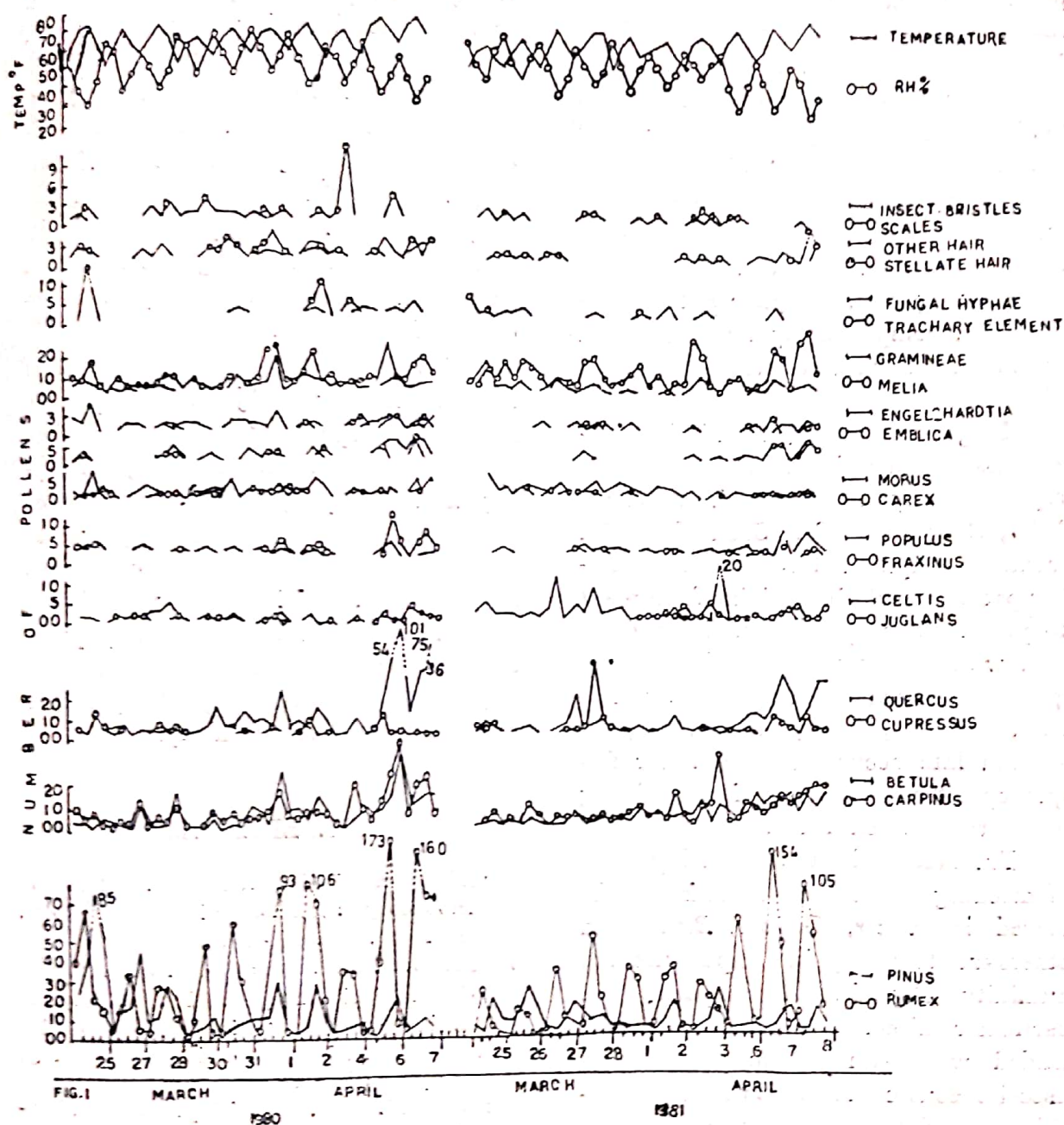


Fig. 1. Diurnal fluctuations in different types of pollen grains during the period 25th March-8th April 1920 and 1921. Missing dates represented low-nil pollen catch due to rains.

rounding sites and consequently resulted higher accumulation in afternoon session.

*Betula* pollen distinctly represented night pattern (D), due to their far distant situations or plants are localized in humid and cold conditions, pollen dispersal probably initiated after longer

period of sunshine and temperature, and ultimately transported with evening wind (see Fig. I).

Several of the pollen grains representing double peak pattern, associated with the daily fluctuations of weather conditions, or their discharge continues for a longer period. *Rumex* pollens re-



presenting double peak, indicated close relation with temperature conditions. During the period of low temperature, their occurrence was predominant at "C" period and higher temperature of the day represented "B" pattern, a shift from C to B pattern. Graminaceous pollen though represented well in forenoon session, however, in the present investigation, irregular pattern was observed, comparatively found in good number in dawn and afternoon period also.

In general, rain resulted in immediate loss of microbes in the air as also reported by earlier workers (Gaur, 1978; Gregory, 1973). Soon after rain, duration required for normal dehiscing pattern would be variable from plant to plant. Some plants i.e. *Rumex* followed with *Cupressus* started liberation of grains in normal frequency shortly after rain, however, *Pinus*, *Betula*, *Carpinus* showed late occurrence and lower frequency after rain. (Fig. I, the missing dates represented rain).

Fluctuation in the normal pattern of discharge have been remarkably observed in *Rumex*, Grasses, *Betula* and others due to change in temperature and humidity (Fig. I). Wind speed in a particular direction and its variations loaded with atmospheric pollens and miscellaneous contents also resulted modification of the normal periodicity of the contents. The present investigation site Gopeshwar experienced high wind velocity and thunderstorms, particularly at the afternoon session, which may extend till early night. Therefore, quantitatively afternoon session represented highest population including some distant pollen types.

The periodicity of a particular type of grain receives its maxima at a very specific period of flowering. Some of

the grains representing decreasing trend due to late flowering stage i.e. *Pinus*, *Celtis*, *Cupressus*; other showed normal trend i.e. *Rumex*, *Carpinus*, *Juglans*, *Populus* (mid phase of flowering) and increasing trend in *Quercus*, *Emblica*, *Betula*, *Engelhardtia* (early phase of flowering). These flowering phases were observed in the field during the tenure of study and indicated their respective occurrence in the air.

The mode of liberation of most of the miscellaneous objects are passive and more dependent on the weather factors associated with the stage of drying and decaying. Their occurrence at afternoon period is mainly due to high wind velocity and drier conditions in the air. Miscellaneous objects showed considerable decrease in population after rain and represented increasing trend with the high temperature and lower relative humidity.

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