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Review Article

Interpreting the Pollen calendar of Pondicherry

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ABSTRACT

Pollen calendars are useful in the prevention and diagnosis of hay fever, respiratory allergies like rhino conjunctivitis and allergic asthma which cause wheezing, coughing, shortness of breathing and also skin rashes. It is a significant contribution to the occurrence of pollen load onto the atmosphere. The correlation between the onset of different airborne pollen seasons and the occurrence of a patient's symptom is not well known. Pollen grains causing an allergy are quite variable in different ecozones and also a particular place from season to season, year after year depending on changes in ecological and climatic conditions. A Pollen calendar helps to acquire the knowledge about the identification, verification and seasoning of the air borne pollen. It also gives the statistical data about the concentration and the pollen influx. So, this present review article is to elaborate the pollen calendar for Pondicherry for two years on (1989-1991) which provide a detail of the occurrence of air borne pollen. During this survey, the analysis and comparison of daily monthly and annual values showed that the types of pollen were captured by Cour's trap on impaction on a weekly basis. The results obtained over two years periods, the most abundant species are *Poaceae, Cyperaceae Urticaria, Parthenium* and *Syzygium*. The variation in pollen concentration showed the greatest intramural variations occurred during the period. Interpretation of the Pollen calendar of the area between the two years is shown.

Keywords: Aerobiology; Allergy; Atmosphere; Pollen calendar.

INTRODUCTION

No wonder that pollen is often referred to as the wonder dust of nature. From the days of the classical workers on pollination, like Koelreuter and Muller down to the present day, it has become increasingly clear that pollen grains play a vital role in the life of plants, animals and man. No seed, fruit or grain could be produced without the help of pollen. The recorded history of allergic diseases is almost old as the history of mankind. Asthma is known to ancient as well as the concept that one man's person (Faegri, 1989). Today more than 20-30 % global population is known to suffer from one or the allergenic like rhinitis, asthma, eczema and urticaria. (Singh, 2004).This allergic is mainly due to the atmospheric pollen, which is the most significant sensitizing aeroallergens. Some hypersensitive individuals are very sensitive to specific pollen which have been increased nowadays and particularly in urban areas (Amato, 2007). The atmospheric air borne pollen released is easily captured by artificial traps which can be identified microscopically. This identified pollen can be used to compile a pollen calendar.

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(Mandrioli, 1990). The particles present in the atmosphere mainly depends on the climatic condition, seasonal variations and meteorological data. (Amato, 1994). The effect of allergenic pollen in hypersensitive individuals can be easily diagnosed by using a pollen calendar. The importance of Pollen calendar is mainly for determining the composition and concentration. Although, pollen grains represent only a small proportion of the aerial bio particulate matter, they are responsible for the allergic responses in susceptible individuals; pollinosis, hence it is a health problem worldwide. Moreover, there is an escalating trend in allergic disorders and the dispersal of pollen grains frequently will impact the human health (Shivpuri, 1962). Therefore, it is imperative to evaluate the airborne pollen types of different ecozones as aerial pollen concentration is determined by diversity of local flora and weather conditions. Aeropalynological studies have thus been carried out in several geographical regions of the country to study the pollen spectrum (Agashe *et al.*, 1983). The role of the different pollen the allergens vary with environmental conditions, such as climatic factors, pollution and degree of exposure. Because of change in the climatic conditions, the study of variations in the diurnal and seasonal prevalence becomes very important (D'Amato *et al*., 2002). Knowledge about diurnal, seasonal and annual fluctuation in airborne pollen in any

The geographical area is essential for effective diagnosis and treatment of pollen allergy. Pollen grains are

well studied as allergens among all other aeroallergens and are the important source of pollinosis. It is estimated that 30–40 % of human population is sensitized to pollen. (Saha and Kalyansundaram, 1962) prepared a pollination calendar for the potentially allergic plants in Pondicherry. The present study was planned with an aim to study the atmospheric pollen load of Pondicherry by elaboration of a pollen calendar of dominant pollen types.This information will be beneficial in assessing the allergenic potential of the city and will be compared with other nearby stations. Moreover, the influence exerted by the meteorological factors on total pollen catch will also be established. The first record of atmospheric pollen and survey of the pollen calendar in Pondicherry was studied by (Anupama, 1990) and formulated for three years.

Monitoring air borne allergens

The main significance of pollen allergens like climatic conditions, seasonal fluctuations and the degree of exposure and geographical distribution are essential for effective diagnosis and treatment.

Because of change in the climatic conditions, observation on diurnal and seasonal prevalence becomes very important. Therefore a continuous monitoring of aerial pollen diversity is recommended. The small particles of pollen grains act as a carrier in which they are highly responsible for the allergens especially hay fever are located in the eyes, nose and nasopharynx.

Pollen grains having size of 15-40µm cannot enter into lower respiratory tract but it affects the nasopharyngeal membrane. (Hoehne, 1971 Wilson AF, 1973).

Content of pollen granules

When the pollen grains get ruptured, it releases some part of their content into the atmosphere. This is nothing but starch granules, ranges from 0.5 to 2–5 µm, which act as a carrier of specific pollen allergen.

Clinically important pollen allergens

Most of the allergens may vary from place to place. So the physicians should select those allergenic pollens based on their antigens, which is useful for the diagnosis and management.

Ailanthus excels, Casuarina equistifolia cannabis sativa,Parthenium and Ricinus communis.

Sampling principles

There are various methods available for monitoring pollen in the atmosphere. Although a great number of sampling devices are in use, all operate only a few basic principles like gravitational settling, impaction, suction, grab sampling and impinging. But most of the samplers have been constructed based on the principles of impaction.

Gravimetric Sampler

The sedimentation of pollen particles from the atmosphere is due to gravitational force and it falls down the earth when it reaches the terminal velocity.This can be achieved by means of sedimentation from still air, sedimentation from wind.

Impaction sampler

When the air borne particles are subjected to some obstacles in their way, they impact to the obstacle surface with some force and get deposited. Particles may impact on obstacles of any shape, but vertical cylinders are most commonly used as impaction samplers since they are horizontally symmetrical and their impaction efficiency can be calculated.

Where E= d/D

Suction samplers

The atmospheric air samplers can be sampled by means of suction through vacuum pump**.**

ANALYSIS OF AIR SAMPLES

Sampling site

An aeropolynological study was carried out in JIPMER Pondicherry using Cour's trap (K.Anupama 1992).The study of airborne pollen calendar by Cour's trap was studied on the weekly basis for two years. The efficiency of the method is testified by results obtained hundred and twenty-five pollen *taxa* were identified.

Pollen sampling

Pollen sampling was performed using a Cour's trap(area;400cm^2) made up of three layers of gauze coated with silicon oil gel, held in a plastic frame. The pollen grains carried in the volume of air passing through the trap during the period of exposure about a week are trapped by impaction on the surface of the filter. The trap is coupled to an anemometer which measures the volume of air passing through it.

Chemical analysis

Chemical treatment of gauze after exposure yields a residue containing airborne pollen. The method which has been modified by (Cambon 1981). The gauge treated with conc. sulphuric acid and then followed by acetolysis.

Volumetric analysis

The number of pollen grains present in the column of air passing through the trap was then estimated by a measured quantity of pure glycerin was added to the residue and mixed well. The number of pollen per cm^2 of the trap surface was calculated using the formula.

Number of pollen/ cm^2 of trap surface =P* Vt/Vs*1/a

Where, Vt –total volume of the residue; Vs – pollen count correspond to actual volume

Identification of pollen grains

Identification of Pollens was carried out using a light microscope at a magnification of 400X and the pollen was counted along vertical traverse on the slide. The number of lines studied is decided, approximately, by the number and type of pollen counted in the first line. The percentage and mean pollen concentration was counted longitudinally. Identification of pollen was given in Table 1.

Statistical analysis

The measurement of pollen concentration can be obtained by determining the concentration level of different pollen taxa. The weekly pollen counts converted into two quantitative estimates.

1. Pollen influx- measured by number of pollen per unit area (cm^2) of the trap surface
2. Pollen concentration- measured by number of pollen per unit volume (m^3) of air

Interpretation of Pollen calendar in Pondicherry

The results obtained during the month of may 1989-1991 shows that the shift in the wind pattern has not caused any drastic change in the composition of the airborne pollen assemblages. In terms of the relative pollen percentage, *Poaceae* were dominant throughout except for 6 weeks in February-March from May to August, the three most dominant taxa were *Poaceae, Acalypha* and *Syzygium*. From August to November, the prominence of *Acallypha* started decreasing gradually. There was a significant increase in the dominance of *Casuarina* from mid-september.up to the end of October and *Combretaceae* from early September. *Caryot* increased in mid-August between mid-February and mid-may, the domianance of *poaceae* had become reduced for about for about six weeks, till the middle of March on the other hand, Causuarina remained highly dominant up to early April shown in Table 2.

The dominance of Eucalyptus increased in February-March and that of *Lannea, Peltophorum, Cocos and Borassus* in April – May. By mid-May *Syzygium* also started flowering although it was not very prominent in this period. Compared to the previous year the duration of the maximum flowering period and the total influx was higher for *Poaceae, cyperaceae and Acalypha.* The period of maximum influx of *Syzygium* was delayed by a month and the data's are given in Fig 2 and 3.In terms of the relative pollen percentages *poaceae* were dominant although out except por 6 weeks in Feb –march. The entire most dominant taxa were *Poaceace, Aacalypha & Syzygium*. There was significant increase in the dominance of *cassuarina*. Eucalyptus was increased in Feb-march and that of *Lannea, Peltophorum, Cocos and Borassus* in April-May. The net increase in the influx of the herbaceous taxa from the end of the Febrauary was higher in the second year. Among the herbaceous taxa, *Paocea* and *Cyperaceaee* after a short decline in the influx of the herbaceous taxa from the end of February started increase and became dominant in March.

Compared to the previous year the period of maximum for the trees remained more or less the same although there were some differences.

i. The maximum influx, as well as its duration, was higher in the second year for *Eucalyptus* and in the first year for *Peltophorum*.
ii. The maximum influx was slightly lower for *Borassus, Cassia, Trema and Adenanthera, Lannea* in the second year.
iii. There was an increase in pollen influx for *Syzygium*. On the whole during this period; the relative influx of the herbaceous taxa was higher than that in the first year.

In terms of relative percentage, *Poaceae* was the dominant taxon throughout the year 1989 and *Casuarina* becomes significantly higher for a week in October-November and *Azadiracta* and *Trema* was most dominant on January and February. The absolute values and the relative weekly percentage of the interdural taxa are represented graphically in Fig 3and 4.

Applications of pollen calendar

The main goal of an aero biologist is to establish a pollen calendar, which will be useful in diagnosing allergenic symptoms. Considerable concentrations of specific pollen are tested among the patients which include skin prick test and evaluation of serum IgE levels in the patients. It is evident from the work known earlier that the magnitude as well as quality of the annual pollen load in the atmosphere, vary significantly. Therefore it is crucial that an aerobiological survey of an area is conducted continuously over the year (Agashe, 1993).

Medicine (Pollen as allergen (comtois, 1995))

Pollen grains released into the atmosphere by plants, attack the respiratory system of the people living in the town causing first sensitization which leads to allergic manifestations such as rinitis, cough, breathlessness, wheezing, bronchitis, bronchial asthma. Bronchial allergic reaction is caused by pollen grains which penetrate deep into the respiratory tracts (Michel *et al*., 1977). Distribution of plants allergenic significant, and types of potential allergens have been given (Saha & Kalyanasundaram, 1962).

Agronomy

One of the important requirements is the ability to predict the yield of crops with the help of pollen calendar it is reliable and early prediction. Based on aeropalynological over ten years using Cour's trap airborne pollen concentrations of *vitis vinfera* used successfully to predict the yield of grapes and wine production for the Montpellier region. This was based on the conclusion that annual variations of crops yield are

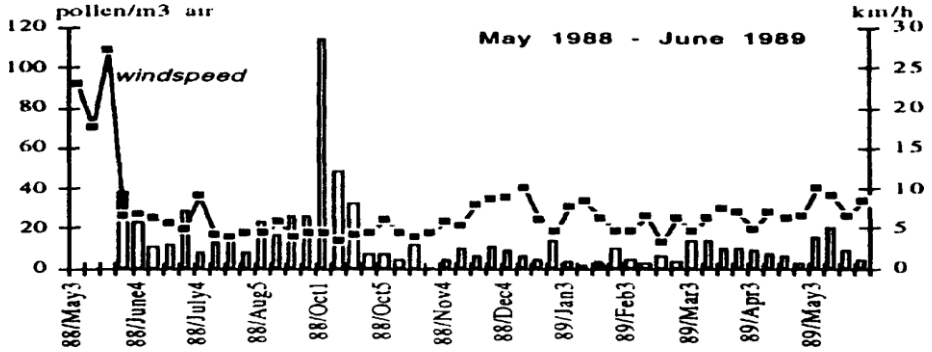

Figure 1: Variations in the total weekly pollen influx

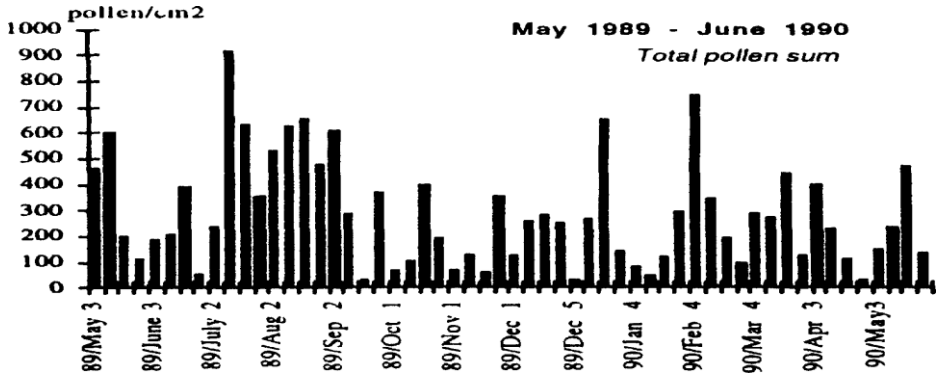

Figure 2: Pollen concentration and fluctuations in weekly average wind speeds

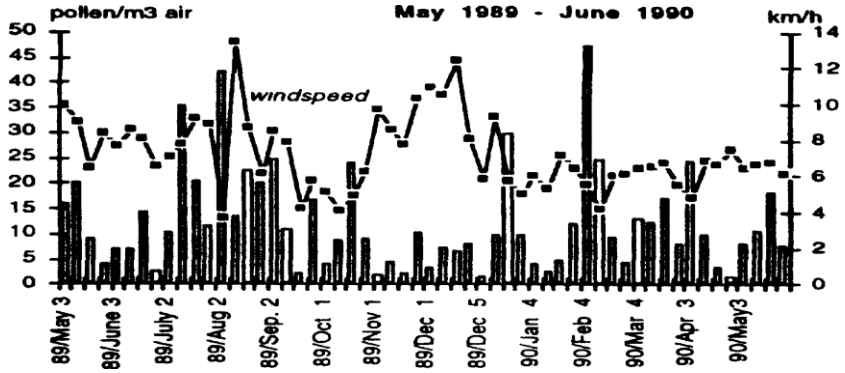

Figure 3: Pollen concentration and fluctuations in weekly average wind speeds

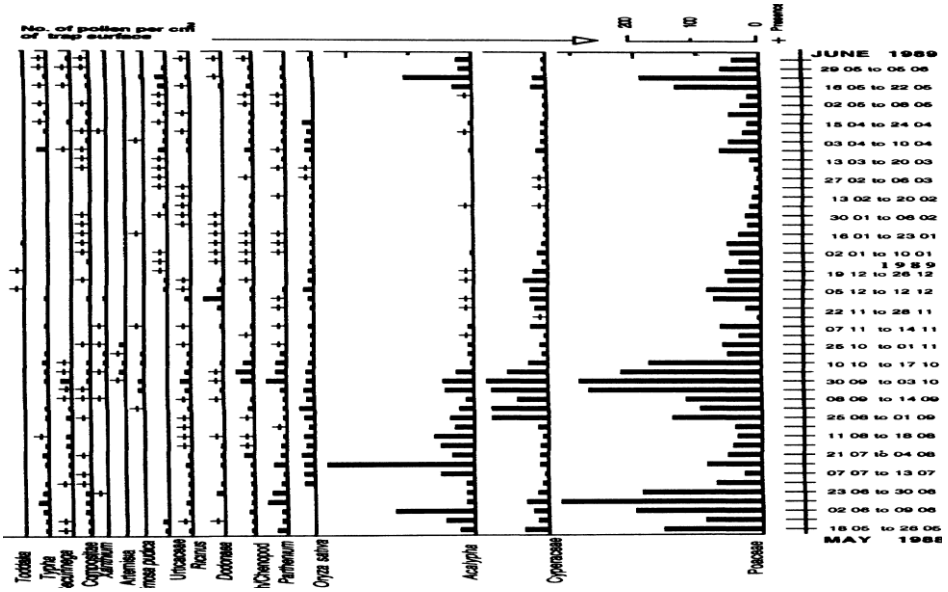

Figure 4: Pollen Calendar for Pondicherry

Table 1: List of potential allergenic taxa

Sl.No	Potential allergenic taxa	Maximum pollen release period
1.	Acalypha	May-August
2.	Acacia spp	May -July
3.	Amaranthaceae	August-November
4.	Artemisia sp	October –November
5.	Azadirachta	March-April
6.	Borassus	April-August
7.	Cassia spp	March –July
8.	Casuarina	September – October
9.	Cocos	April –August
10.	Cyperaceae	August –October, December - March
11.	Dodoneae	November –December
12.	Eualyptus	February –April
13.	Lannea	May – June
14.	Parthenium type	July –October
15.	Peltophorum	March – May
16.	Phoenix	January –February
17.	Poaceae	April –January
18.	Prosopis	March –April
19.	Ricinus	August –October
20.	Sapotaceae	March –May
21.	Syzygium	June – August
22.	Trema	March –May
23.	Typha	June –October
24.	Urticacaeae	April –June
25.	Xanthium type	September –October

Table 2: potential allergenic *taxa* and pollen influx

Potential aller-genic Taxa	Year-I IMay1988- June 1989		Year-II May 1989-June 1990	
	Percentage of pollen grains	Maximum pollen influx	Percentage of pollen grains	Maximum pollen influx
Poaceae	47	319	76	499
Acalypha	44	233	31	189
Cyperaceae	28	97	24	85
Syzygium	14	113	37	305
Lannea	7	44	11	64
Cassia	4	32	5	23
Cocos	5	44	1	28
Combretaceae	6	46	-	-
Casuarina	15	85	-	-
Peltophorum	-	-	3	15
Season II: Mid October to Mid March				
Poaceae	57	178	58	117
Cyperaceae	11	37	74	33
Dodonaea	28	97	17	37
Casuarinas	14	113	12	64
Phoenix	7	44	12	55
Season III: Mid March to Mid May				
Eucalyptus	3	17	13	58
Lannea	8	35	7	11
Azadiracta	5	30	17	74
Casuarinas	69	289	-	-
Borassus	-	29	7	32
Cocos	9	25	4	17
Syzygium	13	16	10	46

essentially determined by the pollination intensity. (cour & van campon, 1980) Short- term prediction of rice production using pollen counts. The pollen calendar for Imphal in northeast India shows that in August there is a maximum in the airborne concentration of pollen grains of *Oryza sativa*. Which flower in the region between June to October (Sing & Devi, 1992).

CONCLUSION

During the last two decades, much work has been down in the field of aeropalynology and ecology of Pondicherry to establish a pollen calendar. The pollen was captured with Cour's trap on a weekly basis for two years. The results afforded the identification of 125 taxa of different types of pollen grains. With the data obtained a first attempt of pollen in the atmosphere from herbaceous taxa at both levels was highest during April, May & August. The results obtained over the two-year periods reveal the most abundant pollen species are herbaceous taxa, *Poacae, Cyperaceae, Eucalyptus and Azadiracta indica*. Thus in order counted per cubic meter of air contrast with maximum pollen influx and the percentage of pollen grains. Despite this the highest value is usually recorded in April- May. The atmospheric conditions coinciding with the weeks with highest counts are relative air humidity, mean temperature, precipitation of rainfall.

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