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Pollen Production Studies in Some Trees Growing at Bhopal, M.P.

Smriti Chitnis[1*] and Uday Chitnis[2]

[1*,2]Department of Botany,
Govt. Holkar [Autonomous] Science College, Indore- India

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Abstract- Bhopal is a beautiful city which is famous for its planning and greenery. The city represents a fine assortment of forest trees, avenue trees, fruit trees and trees planted during plantation programmes. These trees flower and produce pollen grains to multiply the species. Pollen grains produced by some of these trees may trigger on allergenic reactions in sensitive people. Pollen production in 11 such trees of allergenic significance was studied. The production per flower and per cent liberation of pollen grains from the flower was calculated. Maximum production per flower was reported in *Eucalyptus globulus* and minimum number was obtained in *Azadirachta indica.* Percentage liberation of pollen grains ranges from 94% to 100%. Production was reported to be higher in anemophilous species than in entomophilous species.

Keywords- Pollen Production, Allergy , Trees, Bhopal

INTRODUCTION

Palynology is the science devoted to the study of pollen grains and spores. Pollen grains are small entities representing the male gametophytic phase of an angiospermic plant. They contain two male gametes enclosed in a double layered wall. They are transported through the agencies of insects, air, water, birds, and animals and even through the combinations of two agencies. Pollen grains are produced in anthers of the plants. They are destined to reach stigma but most of the pollen grains do not reach their destination and become part of the surrounding environment. Production of the pollen grain within an anther and its liberation in the atmosphere are the two aspects closely related to the floral biology of the plants. Pollen grains which are released in air or which becomes air-borne during their dispersion may cause allergenic reactions in sensitive people. Bhopal is the capital city of Madhya Pradesh. Approximately, 10% of its population is suffering from major allergic diseases like allergenic rhinitis, urticaria, asthma, conjunctivitis etc. It is, therefore, necessary to identify the plants which may have allergenic potential and to study their other floral aspects.

REVIEW OF LITERATURE

Pollen production studies are relatively few in India. Mandal and Chanda (1977) studied the pollen production in *Antirrhinum majus*. Pollen production in allergenic grasses around Lucknow was determined by Agnihotri and Singh (1975). Subba Reddi (1976) proposed a new method for computing th pollen productivity. Jankibai and Subba Reddi (1980) reported the qualitative and quantitative estimation of aerial pollen grains of some plants at Vishakhapattanam with reference to pollen productivity. These studies were also carried out at the far-east region of the country. Singh and Choudhary(1981) determined the pollen productivity of a few allergenic plants at Shillong. Mondal *et al.* (1998) studied pollen production in eastern India. Pollen production studies of allergenically significant trees, shrubs and herbs in relation to their aerial incidence ware made by Singh (1984).

Pollen production in crop plants has also been reported by some workers. Nair and Rastogi (1963), Nair and Sharma (1970), Nair and Kapoor (1974), Vaish(1973), Sreerangaswamy and Raman(1974) and Trivedi and Verma(1975) are a few to name. Bhowmik and Datta (2013) studied pollen production in some hydrophytes and marsh plants in relation to ecology.

IMPORTANCE OF THE STUDY

Bhopal is a beautifully planned city with lush green vegetation. The vegetation of Bhopal is an assortment of the remnants of the natural vegetation on the one hand and several new species introduced in the city on the other. Therefore, the atmosphere of Bhopal is always loaded with a great variety of pollen grains. The aerial incidence of pollen grains depends on their production and liberation in the atmosphere. Such studies have not been reported from this region. Present study will provide an idea about the production and liberation of pollen grains in allergenically significant trees growing in the city.

OBJECTIVES

Present study was undertaken to determine the pollen productivity in a few allergenically significant trees growing at Bhopal. The per cent liberation of pollen grains from the anther was also computed to get a comprehensive picture.

MATERIAL AND METHODS

Selection of Plants:-
Trees with known allergenic potential were selected. The selected species were-
Azadirachta indica, Cassia siamea, Delonix regia, Melia azedarach, Peltophorum pterocarpum, Prosopis spicigera, Ailanthus excela, Cassia fistula, Eucalyptus globulus, Holoptelea integrifolia, Putranjiva roxburghii.

Selection of Samples:-
Flower material for productivity studies was collected from the early phase of flowering as early flowers are more vigorous, produce more pollen grains and are less affected by insect activities.

Mode of Sampling:-
Flower buds were collected from different sites and brought to the laboratory. Out of these 100 healthy buds were selected. Each flower bud was opened and the anthers were taken out. Care was taken to select all sizes of buds.

Counting of pollen grains/anther:-
Number of anthers per flower was counted. If the number of anthers was variable, then the number was determined by taking the average number of anthers in 10 flowers. Each anther was crushed in 1ml (=25 drops) of 50% glycerine solution. One drop was pipetted out from this solution and was put on a microscopic slide. The drop was covered with a cover slip and then observed under a light microscope under low magnification (10x X 10x). During microscopic observation, Number of pollen grains under one microscopic field was noted. Five such readings were made for each of 3 such drops from the same suspension. The average number of pollen grains/ microscopic field was multiplied with a conversion factor *i.e.*134.5 to get the number of pollen grains per drop.

$$Conversion\ factor = \frac{Area\ of\ coverslip}{Area\ of\ a\ microscopic\ field}$$

% liberation of pollen grains:-
The flowering material in which most of the anthers had undergone dehiscence was selected. 100 such anthers were selected for counting of percentage of liberation in the same manner as described earlier. Dehisced anthers were mounted on a slide and were examined carefully for residual pollen grain, if any, under a stereoscopic binocular dissecting microscope. An average of 100 such readings was taken as the number of the pollen grain / anther not liberated. The percentage of the pollen grains liberated was calculated by following formula-

$$\%\ liberation = \frac{No.of\ pollen\ grains\ per\ anther - No.of\ pollen\ grains\ unliberated}{No.of\ pollen\ grains\ per\ anther}$$

Analysis of Data:-
The mean value of the number of pollen grains produced by an anther was calculated by the formula-

$$m = \sum \frac{fv}{n}$$

Where m= mean; f= frequency;
v= mean value for frequency class; n= number of samples (i.e. 100)

Standard deviation around the mean was calculated by the formula-

$$\sigma = \sqrt{\ } f d^2/n$$

Where σ = standard deviation, f= frequency;
d = deviation; n= number of samples (i.e. 100)

RESULTS AND DISCUSSION

Out of the 11 tree species selected for the study 4 showed entomophilous mode of pollination, 3 showed anemophilous mode of pollination while 4 of them were pollinated by both the agencies (amphiphily). Data obtained from the studies is being presented in the given table-

Table-1 Pollen production and per cent liberation in some allergenically significant trees growing at Bhopal, M.P.

s. no.	Name of Tree	Family	Mode of Pollination	No. of anthers/ flower	No. of pollen grains /anther	No. of pollen grains /flower	% liberation
1	*Azadirachta*	Meliaceae	En	10	1032±116	10320	96.9

	indica						
2	*Cassia siamia*	Caesalpinioideae	Am	10	1760±620	17600	97.57
3	*Delonix regia*	Caesalpinioideae	En	10	4614±972	46140	93.94
4	*Melia azedarach*	Meliaceae	En	10	2560±1618	25600	97.99
5	*Peltophorum pterocarpum*	Caesalpinioideae	En	10	6200±1952	62000	94.25
6	*Prosopis spicigera*	Mimosoideae	Am	10	3050±1016	30500	98.00
7	*Ailanthus excela*	Simaroubaceae	An	10	13920±5487	139200	100.00
8	*Cassia fistula*	Caesalpinioideae	Am	10	17050±3493	170500	97.89
9	*Eucalyptus globulus*	Myrtaceae	Am	154*	29750±17173	4581500	95.00
10	*Holoptelea integrifolia*	Urticaceae	An	10	28700±5564	287000	100.00
11	*Putranjiva roxburghii*	Euphorbiaceae	An	3-5	35120±750	105360-175600	100.00

An=Anemophily En= Entomophily Am= Amphiphily

- *= Average of 10 flowers.

In general, anemophilous plants showed higher pollen production. *Eucalyptus globulus* although considered as amphiphilous by few authors (Singh, 1982), produces as many as 29750 pollen grains per anther. Highest number of pollen production has been recorded for this species. Lowest number of pollen grains was reported in *Azadirachta indica,* which is an entomophilous plant.

Number of pollen grains produced by a flower also depends upon the number of anthers in a flower as well. Flowers of *Eucalyptus globulus* have around 150 anthers per flower and the total number of pollen grains per flower reaches as high as 45, 81,500. *Putranjiva roxburghii* , however, produces only3-5 stamens and the number of pollen grains per flower reaches up to 1,75,000.

Per cent liberation of pollen grains was reported to be cent per cent in anemophilous species. While in amphiphilous and entomophilous plants only 93.94 to 97.99% pollen were liberated in the atmosphere. Anemophilous pollen grains are non-sticky and light in weight, so they tend to disperse completely. But, pollen grains which are carried away by insects are sticky and heavier. They also show a tendency to adhere to each other and to the insect parts. Their stickiness may be a possible reason for their retention inside the anthers.

Eucalyptus globulus is planted at many places. So, we can find the deviation in their number. Such a deviation may be attributed to difference in edaphic and other ecological factors as pollution, nutrition etc. Pollen production is also affected by other factors as, infestations, infections etc. The insect infested buds collected during the survey showed less number of pollen grains as compared to the healthy ones.

When the data was compared with production studies conducted by other workers, it was observed that the production of pollen grains was found to be variable in different studies. It is rather difficult to explain the cause of these variations. Subjective variation and the experimental procedure cannot be the only cause for such differences. Several edaphic and meteorological factors may affect this production.

CONCLUSION

Pollen grains produced by a flower not only take part in reproduction but also interact with nature in many ways. Their production depends upon a number of factors. During this study main thrust was put on the allergenically significant plants growing at Bhopal. The data reveals that theanemophilous plants produce pollen grains in higher number as compared to the entomophilous plants.

Bibliography

[1]. Agnihotri, M.S. and B.P. Singh (1975): Pollen production and allergenic significance of some grasses around Lucknow. *J.Palynol*. XI: 1& 2 : 151-154.

[2]. Bhowmik,S. and B. Datta,(2013): "Pollen Production in Relation to Ecological Class of Some Hydrophytes and Marsh Plants," *American Journal of Plant Sciences*, 4(2): 324-332

[3]. Janakibai, A, and C.Subba Reddi (1976): Pollen productivity and pollen incidence in *Cyperus rotundus* Linn. . *Botanique.* 7: 107.

[4]. Mandal,S. And S. Chanda (1977): Pollen production in *Antirhhinum majus* L. *XI Ann. Conf. Ind. Coll. Allergy and Appl. Immunol.* Mukteshwar.

[5]. Mondal,A.K.; S. Mondal and S.Mandal (1998):Pollen production in some plant taxa with a supposed role in allergy in Eastern India. *Aerobiologia* 14(4): 397-403

[6]. Nair,P.K.K. and S.K.Kapoor (1974): Pollen production in some vegetable crops. *Geobios.* (Jodhpur) :1:71-73.

[7]. Nair,P.K.K. and K. Rastogi (1963): Pollen production in some allergenic plants. *Curr.Sci. 32*:566-567.

[8]. Nair,P.K.K. and R.K.Sharma (1970) :A study of pollen production in Brassica. *Palynol. Bull.*6(2)62-66.

[9]. Singh,A.B. (1984): Pollen production in common allergenic plants of Delhi and their atmospheric prevalence. *Sci and Cult.* 50:65.67.

[10]. Singh,N.I. and D.Choudhary(1981): Pollen production in some allergenic plantsof Shillong.*J Palynol.*17(2):87-89.

[11]. Sreerangaswamy,S.R. andV.S. Raman (1974): Pollen production in diploids and autotetraploids of rice(*Oryza sativa* L.) *Pollen et spores.* 15:189-194.

[12]. Subba Reddi, C. (1976): A study of potentially allergic pollen producing plants of Vishakhapattanam. *J Palynol.*10:155-157.

[13]. Trivedi, B.S.and H.Verma (1975): A study of pollen production and stainability in *Cassia tora* L. And *Arachis hypogea* L. *J. Palynol*. 11(1-2):139-142.

[14]. Vaish,S.S.(1973): Pollen production in *Lablab niger*. *Medic. J. Palynol.* 9(1):83-86.

