

Short communication

Pollen production in some plant taxa with a supposed role in allergy in Eastern India

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Abstract

This paper deals with the production of pollen grains per anther per flower of 15 probably allergenic pollen producing angiospermic plant taxa growing in Eastern India. The selected plant taxa includes *Ailanthus excelsa*, *Alstonia scholaris*, *Argemone mexicana*, *Azadirachta indica*, *Cassia alata*, *C. siamea*, *Dalbergia sissoo*, *Holarrhena pubescens*, *Lagerstroemia speciosa*, *Madhuca indica*, *Milletia pinnata*, *Mimusops elengi*, *Morus alba*, *M. indica* and *Murraya paniculata*. Among the investigated taxa, *A. excelsa* produces the highest number of pollen grains (1635180) followed by *C. siamea* (1589245) and *A. mexicana* (463800). The production of pollen grains is lowest in *H. pubescens* (2500), followed by *A. scholaris* (5175), *A. indica* (6220) and *M. paniculata* (11200). © 1998 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Pollen production; Allergenic plants; Pollination mechanism; India

1. Introduction

The production of pollen grains and their dispersal in the air are important aspects of aerobiological studies. Pollen production by anemophilous plants has been studied by Subba Reddi and Reddi (1986). In flowering plants, pollen productivity is referred to as the number of pollen grains produced per anther of the flower. The total pollen production of a particular plant depends on the number of anthers per flower and the number of flowers per plant. This has a great significance in aerobiological work dealing with allergy problems. According to the postulates of Thommen (Coca et al., 1931) allergenic pollen in the atmosphere is instrumental for

the onset of allergic symptoms if found in great abundance in the air. The dispersal in the air is controlled by several factors such as morphology of the flowers, flowering season, anemophily and entomophily. It has been proved that the plants with high pollen production are more capable of inducing allergy problems. Investigations were carried out on the pollen production of 15 selected plants which probably play a significant role in pollen allergy problems in Eastern India.

2. Materials and methods

The pollen production study was carried out following the method of Nair and Rastogi (1963) and Mandal and Chanda (1981). The plant species selected for the present investigation were collected from different parts of Eastern India. Unopened flowers were collected in

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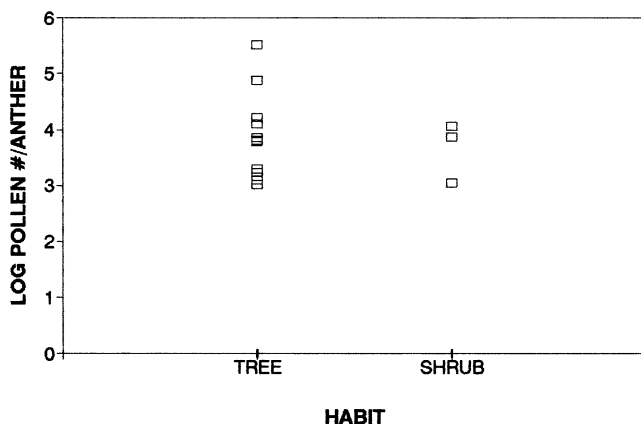


Fig. 1. Pollen production in 15 probably allergenic trees and shrubs.

the morning hours, i.e. between 8.00–9.00 a.m. from which one anther was crushed and dispersed uniformly in 50 drops of 50% glycerine. One drop of the mixture was put on a slide and covered with a 18×18 mm cover glass. The number of pollen grains in this area was counted with an average of five drops for each plant species. This average was multiplied by 50 to get the number produced per anther. The pollen count was made for ten anthers randomly collected from the different flowers of the selected plants. The morphology and pollen grain size were studied.

3. Results and discussion

Pollen production in terms of number per anther and per flower varied widely in the selected plant taxa studied (Figs. 1–3). The highest pollen production was observed in *Ailanthus excelsa* (1635180 pollen per flower), an allergenic tree being extensively planted under afforestation programmes, useful as a wind break, firewood and building material. This is followed in decreasing order, respectively, by *Cassia siamea* (537096 pollen per flower), *Argemone mexicana* (463800 pollen per flower), *Madhuca indica* (301800 pollen per flower), *Holarrhena pubescens* (231424 pollen per flower), *Mimusops elengi* (132000 pollen per flower) etc. Except *Mimusops elengi* all have been reported to be allergenic plants (Tables 1–3). Although *C. siamea*, *H. pubescens* and *M. elengi* are entomophilous, these plants follow the postulates of Thommen (1931). As a matter of fact, a 2-year aerobiological survey (1992–1994) carried out in Burdwan district of West Bengal, India, showed the presence of the pollen of these plants in the total air flora (Table 3). The postulates of Thommen indicate that the pollen of allergenic plants should be present in great abundance in the air. Another important criteria for a plant to be allergenic according to Thommen is that the pollen of these plants should be wind dispersed. The behaviour of *C. siamea* and *H. pubescens* proved allergenic, is however, in contrast

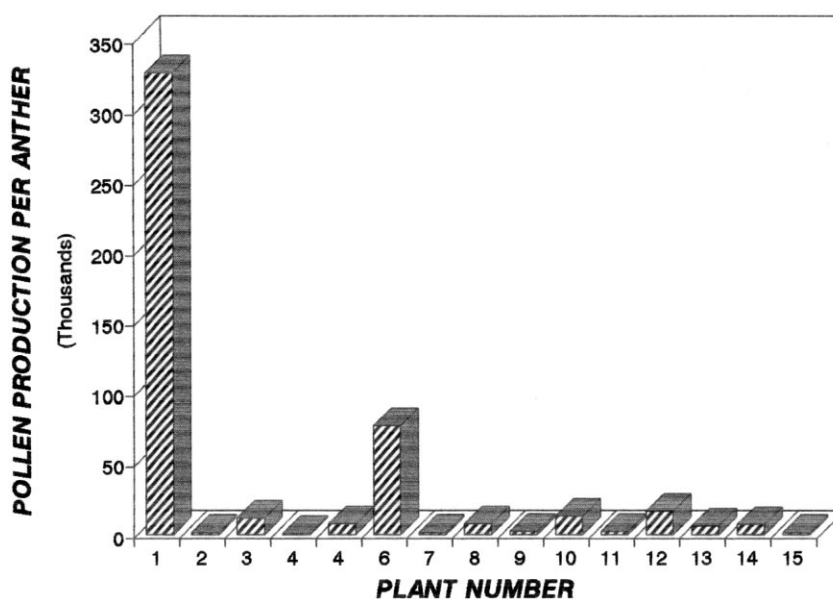


Fig. 2. Pollen production per anther in 15 probably allergenic plant taxa. (1) *A. excelsa*; (2) *A. scholaris*; (3) *A. mexicana*; (4) *A. indica*; (5) *C. alata*; (6) *C. siamea*; (7) *D. sissoo*; (8) *H. pubescens*; (9) *L. speciosa*; (10) *M. indica*; (11) *M. pinnata*; (12) *M. elengi*; (13) *M. alba*; (14) *M. indica*; and (15) *M. paniculata*.

Table 1
Selected plant taxa and their pollen character

Sl. no.	Name	Family	Pollination mechanisms	Habit	Aperture	Pollen character and shape	Size in μm
1	<i>A. excelsa</i> Roxb.	Simaroubaceae	E	Tree	3-Colporate	Oblate-spheroidal	$\pm 25 \times 29$
2	<i>A. scholaris</i> R. Br.	Apocynaceae	E	Tree	3-Colporate	Elliptical	$\pm 28 \times 19$
3	<i>A. mexicana</i> L.	Papaveraceae	A/E	Shrub	3-Colpate	Suboblate	$\pm 48 \times 25$
4	<i>A. indica</i> A. Juss.	Meliaceae	E	Tree	3-Colporate	Elliptical	$\pm 28 \times 17.5$
5	<i>C. alata</i> L.	Caesalpinhiaceae	E	Shrub	3-Colporate	Prolate spheroidal	$\pm 44 \times 19$
6	<i>C. siamea</i> Lamk.	Caesalpinhiaceae	E	Tree	3-Colporate	Sub-prolate	$\pm 46.8 \times 36.4$
7	<i>D. sissoo</i> Roxb.	Fabaceae	A/E	Tree	3-Colporate	Sub-prolate	$\pm 28 \times 24$
8	<i>H. pubescens</i> (Buch. Ham) Wall. ex. G. Don	Apocynaceae	E	Tree	2-3-Porate	Spheroidal	$\pm 39 \times 22.5$
9	<i>L. speciosa</i> (L. ex. Murray) Pers.	Lythraceae	E	Tree	3-Colporate	Elliptic	$\pm 35 \times 24$
10	<i>M. indica</i> Lam.	Sapotaceae	A/E	Tree	4-5-Colporate	Sub-prolate	$\pm 56.5 \times 29$
11	<i>M. pinnata</i> (L.) Panigr.	Fabaceae	A/E	Tree	3-Colporate	Oblate spheroidal	$\pm 31.5 \times 18.5$
12	<i>M. elengi</i> L.	Sapotaceae	A/E	Tree	4-5-Colporate	Sub-prolate	$\pm 37 \times 33.0$
13	<i>M. alba</i> Poir	Moraceae	A/E	Tree	3-Porate	Sub-prolate	$\pm 56.5 \times 35$
14	<i>M. indica</i> L.	Moraceae	A/E	Tree	2-3-Porate	Spheroidal	$\pm 16.7 \times 10$
15	<i>M. paniculata</i> (L.) Jack	Rutaceae	A/E	Shrub	5-Colporate	Spheroidal	$\pm 31 \times 19.5$

A/E, amphiphilous; E, entomophilous.

Table 2
Pollen production in selected plant taxa

Sl. no.	Name of the plants	Flowering period	No. of anthers	Length of the anther (mm)	Average no. of pollen per anther	Average no. of pollen per flower	Log pollen per anther
1	<i>A. excelsa</i>	Jan–Mar	5	1–1.2	32 7036	163 5180	5.514
2	<i>A. scholaris</i>	Aug–Feb	5	1.5–2.2	1035	5175	3.015
3	<i>A. mexicana</i>	Jan–May	40	2–2.5	11 595	46 3800	4.064
4	<i>A. indica</i>	Apr–July	10	1.2–1.5	622	6220	3.793
5	<i>C. alata</i>	June–Nov	3	0.6–7.2	7348	22 044	3.866
6	<i>C. siamea</i>	Oct–Jan	7	5–5.5	76 728	537 096	4.885
7	<i>D. sissoo</i>	Feb–Apr	9	1–1.5	1275	11 475	3.105
8	<i>H. pubescens</i>	Mar–June	5	0.5–1.2	7232	231 424	3.859
9	<i>L. speciosa</i>	July–Oct	45	3.2–4.2	1715	77 175	3.234
10	<i>M. indica</i>	Dec–Mar	24	2.6–3.3	12 575	301 800	4.099
11	<i>M. pinnata</i>	June–Dec	10	1.7–2.1	1975	19 750	3.296
12	<i>M. elengi</i>	May–Aug	8	6.5–6.8	16 500	132 000	4.217
13	<i>M. alba</i>	Jan–Mar	4	2.5–3.7	6231	24 924	3.795
14	<i>M. indica</i>	Feb–May	4	2.2–2.5	6375	25 500	3.804
15	<i>M. paniculata</i>	Apr–Sep	10	2.5–3.2	1120	11 200	3.049

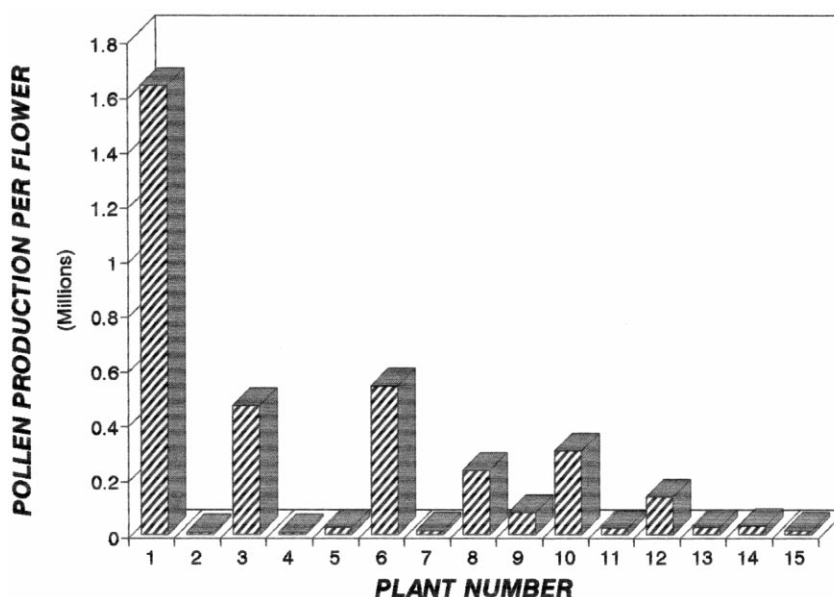


Fig. 3. Pollen production per flower in 15 probably allergenic plant taxa. (1) *A. excelsa*; (2) *A. scholaris*; (3) *A. mexicana*; (4) *A. indica*; (5) *C. alata*; (6) *C. siamea*; (7) *D. sissoo*; (8) *H. pubescens*; (9) *L. speciosa*; (10) *M. indica*; (11) *M. pinnata*; (12) *M. elengi*; (13) *M. alba*; (14) *M. indica*; and (15) *M. paniculata*.

with the earlier postulate as they show relatively high pollen production despite being entomophilous. At the same time *Alstonia scholaris*, even if producing an extremely low amount of pollen results to be allergenic. It is also possible that the pollen of *A. scholaris* is capable of inducing allergic reactions even when present in low concentrations. Very little work has been done however to determine the concentration thresholds of pollen in the atmosphere at which susceptible people begin to experience allergic rhinitis due to the pollen of a particular plant. Emberlin et al. (1990) have also reported that less pollen is needed to induce a reaction at the end of the season as exposure to the allergen will further sensitize a sufferer. Another reason for the low production of entomophilous pollen of *A. scholaris* (5175 pollen per flower) and *Azadirachta indica* (6220 pollen per flower) could be due to their entomophilous nature and less elaborate flower display features due to which pollen dispersal in these plants are relatively limited, leading to intense inbreeding within the colonies (Ganeshaiah and Uma Shaanker, 1991). Other plants showing moderate pollen production include *Dalbergia sissoo* (11475 pollen per flower), *Lagerstroemia speciosa* (77175 pollen per flower), *Milletia pinnata* (19750 pollen per flower), *Morus alba* (24924 pollen per flower), *M. indica* (25500 pol-

len per flower) and *Murraya paniculata* (11200 pollen per flower).

4. Conclusion

This study will help in giving some idea to the aerobiologists and medical practitioners working on pollen allergy, on the amount of pollen produced by the plants surveyed and its assumed concentration in the atmosphere during the flowering season. This study also helps us to conclude that entomophilous plants with low pollen production like *A. scholaris* are also capable of inducing allergic reactions in human beings. At the same time pollen of amphiphilous plants like *M. elengi*, inspite of their high pollen production, may play a supposed role in allergy. Finally the pollen production in trees was found to be higher than in shrubs (Fig. 1).

Acknowledgements

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Table 3
References for allergenicity of the pollen of investigated taxa

Sl. no.	Name of the plants	Collected during the year	Frequency (%)	References
1	<i>A. excelsa</i>	1992–1993	2.96	Acharya (1980), Mandal and Rahaman (1988), Tilak (1989), Dasgupta and Mandal (1990)
		1993–1994	2.90	
2	<i>A. scholaris</i>	1992–1993	0.62	Banik and Chanda (1992)
		1993–1994	0.71	
3	<i>A. indica</i>	1992–1993	1.11	Acharya (1980), Shivpuri (1980), Mandal and Rahaman (1988), Mandal et al. (1988), Tilak (1989), Dasgupta and Mandal (1990), Jain et al. (1992), Mari Bhat and Rajasab (1992)
		1993–1994	1.02	
4	<i>A. mexicana</i>	1992–1993	1.59	Singh and Shivpuri (1971), Chanda and Sarkar (1972), Tripathi et al. (1977), Acharya (1980), Mandal and Rahaman (1988), Tilak (1989), Dasgupta and Mandal (1990), Banik and Chanda (1992), Jain et al. (1992), Singh and Devi (1992)
		1993–1994	1.32	
5	<i>C. alata</i>	1992–1993	0.65	Tripathi et al. (1977), Singh and Devi (1992)
		1993–1994	1.57	
6	<i>C. siamea</i>	1992–1993	0.65	Tripathi et al. (1977), Acharya (1980), Shivpuri (1980), Tilak (1989), Singh and Devi (1992)
		1993–1994	1.57	
7	<i>D. sissoo</i>	1992–1993	0.24	Tilak (1989)
		1993–1994	0.38	
8	<i>H. pubescens</i>	1992–1993	0.24	Mondal (1993)
		1993–1994	0.36	
9	<i>L. speciosa</i>	1992–1993	3.02	Mandal et al. (1988), Banik and Chanda (1992), Singh and Devi (1992)
		1993–1994	2.12	
10	<i>M. indica</i>	1992–1993	0.17	Mandal et al. (1993)
		1993–1994	0.56	
11	<i>M. pinnata</i>	1992–1993	0.31	Mari Bhat and Rajasab (1992)
		1993–1994	0.86	
12	<i>M. elengi</i>	1992–1993	1.26	Tilak (1989), Atluri et al. (1992), Banik and Chanda (1992), Mari Bhat and Rajasab (1992)
		1993–1994	1.31	
13	<i>M. alba</i>	1992–1993	2.57	Shivpuri (1980), Mandal et al. (1988), Tilak (1989), Malik et al. (1991), Singh and Devi (1992)
		1993–1994	2.41	
14	<i>M. indica</i>	1992–1993	2.57	Mandal and Rahaman (1988), Mandal et al. (1988), Malik et al. (1991)
		1993–1994	2.41	
15	<i>M. paniculata</i>	1992–1993	2.14	Singhal and Kaur (1989), Mondal (1993)
		1993–1994	1.74	

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