

DIVERSITY OF AIRBORNE POLLEN GRAINS OVER RICE FIELD

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ABSTRACT: The diversity of airborne pollen grains was studied over Sonapur Rice Field, Kamrup district, Assam. The Burkard personal sampler was used to carry out the aeropalynological survey for the period of two consecutive years from March'08 to February'10. A total of 31 pollen types were reported during the study period. In the present study total number of spores recorded from March'08 to February'09 were 3658 pollen/m³ and from March'09 to February'10 were 4149.58 pollen/m³. The dominant pollen types recorded were, Poaceae, Amaranthaceae/ Chenopodiaceae, Asteraceae and *Mimosa pudica*. Some allergenically significant pollen types recorded were Amaranthaceae/ Chenopodiaceae, *Argemone mexicana* Linn., *Mangifera indica* Linn., Poaceae, *Terminalia cuneata* Roth. It was observed that entomophilous pollen ranked first in order of dominance.

Keywords: Pollen incidence, Rice Field, Environment, Kamrup.

INTRODUCTION

Plant produces huge amount of pollen which are dispersed in the air which is the source and sink of pollen flora. These stay afloat in air and even travel considerable distances with the slightest air movement. The air besides other requirements, has the inherent property to sustain the life on earth. The air is the basic amenity of man for respiration and breathing. With the advent of civilization, due to rapid industrialization, urbanization and population explosions various changes in the environment have taken place and the air is becoming polluted day by day.

Pollen grains, spores, algae, fungal filaments and other biocomponents are included in biopollutant. The pollen grains carry allergenic protein in the exine or intine for purpose of their own recognition reaction and germination. In order to identify the pollen grains that are responsible for allergenic disorders, continuous monitoring of airborne pollen is important with particular reference to their prevalence and dispersion. The concentration of airborne pollen grains varies not only from place to place but also within the same area due to climatic, vegetational, environmental and anthropogenic reasons. In order to identify the dominant pollen grains, aeropalynological surveys have been conducted in different parts of India. Mention may be made of contributions made by Arora and Jain (2001); Mandal *et. al.*, (2006); Das *et. al.*, (2009). From Kamrup district different workers have provided the information on the number and kinds of airborne pollen grains (Bora and Baruah, 1980; Sarma, 1984 and Devi *et. al.*, 2002). The present work undertaken over Sonapur Rice Field a rural area of Kamrup district.

MATERIALS AND METHODS

Air sampling

Air monitoring was done for qualitative and quantitative analysis of airspora over rice field with the help of Burkard personal sampler. The survey was carried out for two consecutive years i.e. from March'08 to February'10 at a regular interval of 10 days. The sampler was operated for 5 minutes. The conversion factor for the sampler is 20.

Calculation of conversion factor

Conversion factor for Burkard Personal Sampler was calculated as follows :

The suction rate of Burkard Personal Sampler is = 10 ltr. / min.

If the sampler is operated for 10min., air taken in = 0.1m^3

If 0.1m^3 has 1 pollen grain

1m^3 has $1/0.1$ pollen grain

For 10 min. = 10 pollen grains

For 5 min. = 20 pollen grains

The pollen count were expressed per m^3 of the air after multiplying the actual number of pollen grains with the conversion factor i.e. 20. Identification was done with the help of standard manuals for pollen identification (Nair, 1962 a, b, c; Nair *et. al.*, 1986; Tilak, 1989, 1998). Identification was confirmed with the help of reference slide of pollen collected directly from the plants.

RESULTS

Analysis of pollen grains

Qualitatively 28 pollen types were identified from the airspora with an incidence of 3658.24 pollen grains/ m^3 for the period March'08 to February'09 (Table-1). Of these Poaceae (18.77%) constituted the most dominant pollen type. Other numerically significant pollen types encountered were, *Amaranthaceae/ Chenopodiaceae* (9.33%), *Asteraceae* (7.55%), *Mimosa pudica* Linn. (6.11%), *Euphorbia hirta* Linn. (4.67%), *Cassia sophora* Linn. (4.35%), *Terminalia cuneata* Roth (4.32%), *Hibiscus rosa-sinensis* Linn. (3.68%), *Adiantum caudatum* Linn. (3.49%), *Solanum* sp. (3.21%), *Cucurbita maxima* Duch (3.20%), *Tectona grandis* Linn. f. (2.92%), *Malvaceae* (2.80%), *Anthocephalus chinensis* (Lamk.) A. Rich. ex Walp. (2.67%), *Tridax procumbens* Linn. (2.63%) and *Cassia occidentalis* Linn. (2.00%). Other pollen types contributing lesser number were, other pollen types contributing lesser number were, *Baugainvillea spectabilis* Willd (1.97%), *Polygonum* sp. (1.95%), *Rumex* sp. (1.91%), *Argemone mexicana* Linn. (1.84%), *Oryza sativa* Linn. (1.65%), *Allium* sp. (1.56%), *Bombax ceiba* Linn. (1.49%), *Pteris* sp. (1.30%), *Mangifera indica* Linn. (1.17%), *Carica papaya* Linn. (0.96%), *Brassica campestris* Linn. (0.95%), *Acacia auriculaeformis* A.Cunn. ex Benth. (0.72%) and Unidentified pollen grains were (0.82%).

A total of 23 families were recognized during the study period from March'08 to February'09. The identified families were, Poaceae (20.42%), Asteraceae (10.18%), *Amaranthaceae/ Chenopodiaceae* (9.33%), Mimosaceae (6.83%), Malvaceae (6.48%), Caesalpiniaceae (6.35%), Euphorbiaceae (4.67%), Combretaceae (4.32%), Polygonaceae (3.86%), Adiantaceae (3.49%), Solanaceae (3.21%), Cucurbitaceae (3.20%), Verbenaceae (2.92%), Rubiaceae (2.67%), Nyctaginaceae (1.97%), Papaveraceae (1.84%), Liliaceae (1.56%), Bombacaceae (1.49%), Pteridaceae (1.30%), Anacardiaceae (1.17%), Caricaceae (0.96%) and Brassicaceae (0.95%).

Maximum catch of pollen types were observed in the month of April (503.40 pollen grains/ m^3) and May (441.40 pollen grains/ m^3). The lowest number of pollen grains were recorded in January (126.40 pollen grains/ m^3) (Fig.-1).

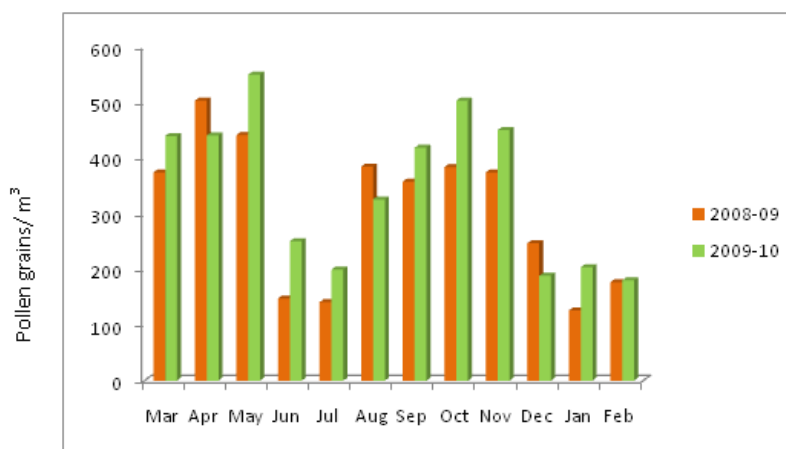


Fig.-1: Monthly variation in pollen grains for two consecutive years

The highest pollen diversity has been observed in February and March each with 19 pollen types. The least diversity has observed in June with 11 pollen types.

Seasonal periodicity has been observed during study period. Maximum concentration of pollen grains have been observed in summer season (1466.64 pollen grains/m³). Rainy season (1267.2 pollen grains/m³) showed second position which was followed by winter season (924.4 pollen grains/m³).

During the period of March'09 to February'10 showed a total of 4149.58 pollen grains/cum belonging to 28 pollen types (Table-2).

Poaceae (16.50%) pollen ranked the first which was followed by Asteraceae (7.94%). Other important pollen types recorded were Amaranthaceae/ Chenopodiaceae(6.56%), *Mimosa pudica* Linn.(5.97%), *Euphorbia hirta* Linn.(4.87%), *Terminalia cuneata* Roth(4.62%), *Adiantum caudatum* Linn.(4.19%), *Cassia sophera* Linn.(4.15%), Mimosaceae(3.98%), *Hibiscus rosa-sinensis* Linn.(3.94%), *Solanum* sp.(3.84%), *Bougainvillea spectabilis* Willd(3.76%), *Carica papaya* Linn.(2.95%), *Pteris* sp.(2.64%), *Anthocephalus chinensis* (Lamk.) A. Rich. ex Walp.(2.54%), *Argemone mexicana* Linn.(2.22%), *Gnaphalium polycaulon* Pers.(2.12%), *Tectona grandis* Linn. f.(2.08%), *Polygonum* sp.(1.96%), *Brassica campestris* Linn.(1.81%), *Rumex* sp.(1.80%), *Cucurbita maxima* Duch(1.67%), *Oryza sativa* Linn.(1.66%), *Allium* sp. (1.49%), *Tridax procumbens* Linn.(1.38%) and *Bombax ceiba* Linn.(1.10%).

Pollen type with a total catch of less than 1% were, *Mangifera indica* Linn. (0.90%) and *Basella* sp.(0.28%). Unidentified pollen grains were (1.01%) of total catch.

24 families were recognized during the study period. Different families contributed were, Poaceae(18.16%), Asteraceae (11.44%), Mimosaceae(9.95%), Amaranthaceae/ Chenopodiaceae(6.56%), Euphorbiaceae(4.87%), Combretaceae(4.62%), Adiantaceae(4.19%), Caesalpiniaceae(4.15%), Malvaceae(3.94%), Solanaceae(3.84%), Nyctaginaceae and Polygonaceae each with (3.76%), Caricaceae(2.95%), Pteridaceae(2.64%), Rubiaceae(2.54%), Papaveraceae(2.22%), Verbenaceae(2.08%), Brassicaceae(1.81%), Bombacaceae(1.10%), Cucurbitaceae(1.67%), Liliaceae(1.49%), Anacardiaceae(0.90%), and Basellaceae(0.28%).

Incidence of maximum catch of pollen grains was observed in May (550 pollen grains/cum) which was followed by October (503 pollen grains/m³). The least count was observed in February (180.20 pollen grains/m³).

Qualitatively high incidence of fungal spore types were recorded in the Month of February and March each with 18 pollen types while low incidence has been observed in December with 11 pollen types.

It is evident from the total count that seasonal variation have been observed. Summer season (1680.8 pollen grains/m³) contributed maximum concentration which was followed by rainy season (1446.78 pollen grains/m³). The least contribution was observed in winter season (1022.6 pollen grains/m³).

Entomophilous pollen grains were found dominated over anemophilous pollen and amphiphilous (Fig.-2).

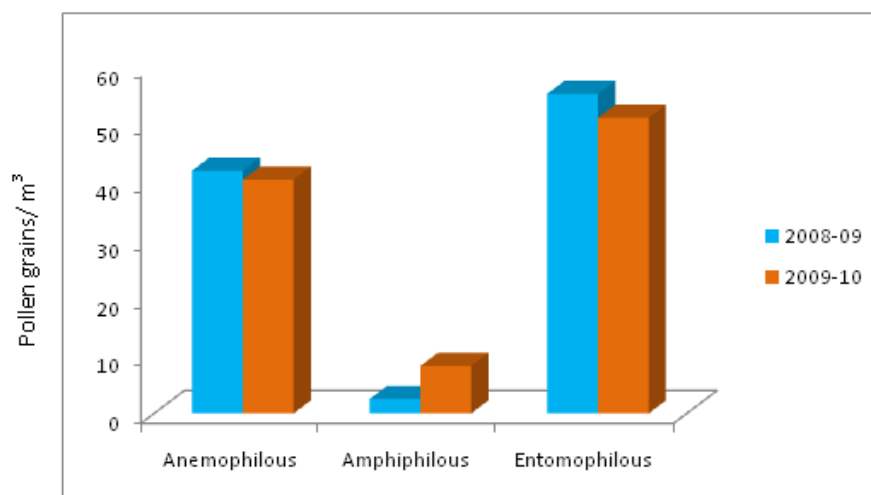


Fig.-2: Incidence of airborne pollen grains according to their mode of pollination for two consecutive years

DISCUSSION

In present study lesser number of pollen grains were recorded during first year of observation. A total of 28 pollen types were recorded. Out of which three pollen types viz. *Acacia auriculaeformis* A.Cunn. ex Benth, *Cassia occidentalis* Linn. and Malvaceae were not recorded in the second year of investigation. The maximum contributor belong to the family Poaceae. They accounted for 18.77% during first year. The predominance of grass pollen in the atmosphere has been reported by several workers in different parts of India (Chanda and Mandal, 1981; Vishnu and Khandelwal, 1973; Deshpandey and Chitaley, 1976).

Maximum occurrence of pollen type were recorded in the month of April and May during the first year of observation.

The observations during second year indicate the occurrence of 28 pollen types with higher number of pollen catch than the first year. Out of which 3 were recorded only during second year viz. *Basella* sp., *Gnaphalium polycaulon* Pers., Mimosaceae pollen types. During the second year of investigations maximum number of pollen types were recorded in May which was followed by October.

The significant variation in the atmospheric concentration of pollen is influenced by many factors like climatic factors, frequency, density and abundance of plants and their flowering behaviour at a given locality (Singh *et. al.*, 1988; Rajo *et. al.*, 2003).

In present study entomophilous pollen accounted maximum which may be due to abundance of entomophilous plant in the locality. Boral and Bhattacharya (1999), recorded maximum number of entomophilous pollen in Berhampore town..

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Table - 1. Showing the contribution of airborne pollen grains (no./m³) and %age of occurrence to monthly total using Burkard Personal Sampler from (Mar'08-Feb'09)

Sl. No.	Name of pollen types	March'08		April		May		June		July		August		September		October		November		December		January'09		February		Total	
		No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%	No./m ³	%
1	<i>Acacia auriculaeformis</i> A.Cunn. ex Benth.	6.60	1.76															6.60	1.76	2.40	0.97	6.60	5.22	4.20	2.37	26.40	0.72
2	<i>Adiantum caudatum</i> Linn.									13.40	9.49	11.20	2.91	9.60	2.68	33.40	8.70	26.60	7.11	33.40	13.52					127.60	3.49
3	<i>Allium</i> sp																	30.60	8.18	26.60	10.77					57.20	1.56
4	<i>Argemone mexicana</i> Linn.	6.60	1.76	28.60	5.68	13.40	3.04	9.00	6.10															9.60	5.42	67.20	1.84
5	Amaranthaceae/ Chenopodiaceae	40.00	10.69	25.00	4.97	42.80	9.70	33.00	22.36			24.60	6.40	49.60	13.86	39.40	10.27	28.60	7.65	35.40	14.33	8.60	6.80	14.20	8.02	341.20	9.33
6	<i>Anthocephalus chinensis</i> (Lamk.) A.Rich. ex Walp.	13.40	3.58	33.40	6.63	13.40	3.04	6.60	4.47	6.60	4.67									4.20	1.70	13.40	10.60	6.60	3.73	97.60	2.67
7	Asteraceae	44.64	11.93	40.80	8.10	39.00	8.84	15.40	10.43	5.20	3.68	21.40	5.57	38.80	10.84	15.80	4.12	15.20	4.06	20.40	8.26	11.40	9.02	8.20	4.63	276.24	7.55
8	<i>Bougainvillea spectabilis</i> Willd.	4.80	1.28	9.80	1.95	25.20	5.71											6.60	1.76	16.20	6.56	2.60	2.06	6.80	3.84	72.00	1.97
9	<i>Bombax ceiba</i> Linn.	6.60	1.76	39.20	7.79																			8.60	4.86	54.40	1.49
10	<i>Brassica campestris</i> Linn.	23.80	6.36																			2.40	1.90	8.60	4.86	34.80	0.95
11	<i>Carica papaya</i> Linn.											17.20	4.47	8.40	2.35	9.60	2.50									35.20	0.96
12	<i>Cassia occidentalis</i> Linn.													13.40	3.75	33.40	8.70	10.60	2.83	2.40	0.97	6.60	5.22	6.60	3.73	73.00	2.00
13	<i>Cassia sophora</i> Linn.									26.60	18.84	24.60	6.40	33.40	9.33	33.40	8.70	17.80	4.76	15.20	6.15	4.60	3.64	3.60	2.03	159.20	4.35
14	<i>Cucurbita maxima</i> Duch					33.00	7.48	7.80	5.28	13.40	9.49	53.40	13.89	9.60	2.68											117.20	3.20
15	<i>Euphorbia hirta</i> Linn.	7.20	1.92	6.80	1.35	13.80	3.13	13.40	9.08	13.40	9.49	8.20	2.13	23.60	6.60	33.40	8.70	25.00	6.68	13.40	5.43	10.40	8.23	2.40	1.36	171.00	4.67
16	<i>Hibiscus rosa-sinensis</i> Linn.	6.60	1.76	8.60	1.71	20.80	4.71	9.00	6.10	9.00	6.37	20.00	5.20	6.60	1.84	13.40	3.49	13.40	3.58	15.20	6.15	7.80	6.17	4.20	2.37	134.60	3.68
17	Malvaceae	13.40	3.58	55.80	11.08	26.60	6.03																	6.60	3.73	102.40	2.80
18	<i>Mangifera indica</i> Linn.	26.60	7.11																					16.20	9.15	42.80	1.17
19	<i>Mimosa pudica</i> Linn.			73.40	14.58			7.40	5.01	4.80	3.40	48.60	12.64	25.80	7.21	30.20	7.87	33.40	8.93							223.60	6.11
20	<i>Oryza sativa</i> Linn.	20.60	5.50	15.20	3.02	21.60	4.89							2.80	0.78											60.20	1.65
21	Poaceae	79.20	21.16	65.00	12.91	89.60	20.30	27.80	18.83	25.60	18.13	39.20	10.20	93.40	26.10	108.60	28.30	90.80	24.28	39.20	15.87	18.80	14.87	9.40	5.31	686.60	18.77
22	<i>Polygonum</i> sp.	5.00	1.34													6.60	1.72	19.60	5.24	9.60	3.89	17.20	13.61	13.40	7.57	71.40	1.95
23	<i>Pteris</i> sp.															9.60	2.50	24.60	6.58	9.80	3.97	3.60	2.85			47.60	1.30
24	<i>Rumex</i> sp.	14.80	3.95	28.40	5.64	7.60	1.72															2.60	2.06	16.60	9.38	70.00	1.91
25	<i>Solanum</i> sp.	18.20	4.86	16.40	3.26	9.60	2.17	11.60	7.86	3.20	2.27	33.40	8.69	7.60	2.12	8.60	2.24	5.40	1.44	3.60	1.46					117.60	3.21
26	<i>Tectona grandis</i> Linn. f.	5.80	1.55	25.60	5.09	33.40	7.57	6.60	4.47	13.40	9.49											3.60	2.85	18.40	10.40	106.80	2.92
27	<i>Terminalia cuneata</i> Roth	26.20	7.00	26.80	5.32	33.40	7.57					26.20	6.82	26.60	7.43							6.20	4.91	12.80	7.23	158.20	4.32
28	<i>Tridax procumbens</i> Linn.							6.60	4.67	53.40	13.89	8.60	2.40	8.40	2.19	19.20	5.13									96.20	2.63
29	Unidentified pollen grains	4.20	1.12	4.60	0.91	18.20	4.12					3.00	0.78													30.00	0.82
	Total	374.24	100.00	503.40	100.00	441.40	100.00	147.60	100.00	141.20	100.00	384.40	100.00	357.80	100.00	383.80	100.00	374.00	100.00	247.00	100.00	126.40	100.00	177.00	100.00	3658.24	100.00

Table - 2. Showing the contribution of airborne pollen grains (no./ m³) and %age of occurrence to monthly total using Burkard Personal Sampler from (Mar'09-Feb'10)

Sl. No.	Name of pollen types	March'08		April		May		June		July		August		September		October		November		December		January'09		February		Total	
		No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%	No./ m ³	%
1	<i>Adiantum caudatum</i> Linn.									26.60	13.33	39.40	12.10	53.40	12.76	6.60	1.31	48.20	10.71							174.20	4.31
2	<i>Allium</i> sp																	53.40	11.86	8.60	4.56					62.00	1.53
3	<i>Argemone mexicana</i> Linn.	13.60	3.09	18.80	4.27	26.60	4.84	11.60	4.63													13.40	6.58	8.40	4.66	92.40	2.28
4	Amaranthaceae/ Chenopodiaceae	53.60	12.19	43.00	9.76	22.80	4.15	19.00	7.58	15.80	7.92	15.80	4.85	28.80	6.88	19.60	3.90	26.80	5.95	23.40	12.41			3.60	2.00	272.20	6.73
5	<i>Anthocephalus chinensis</i> (Lamk.) A.Rich.ex Walp.	6.60	1.50	26.60	6.04	28.60	5.20	13.40	5.35	6.60	3.31									13.40	7.10	6.80	3.34	4.20	2.33	106.20	2.63
6	Asteraceae	64.60	14.70	40.80	9.26	27.00	4.91	17.60	7.02	12.40	6.21	41.40	12.71	29.80	7.12	59.40	11.81	18.80	4.18			15.00	7.37	2.80	1.55	329.60	8.15
7	<i>Basella</i> sp	5.20	1.18																					6.60	3.66	11.80	0.29
8	<i>Bauhinivillea spectabilis</i> Willd.	22.80	5.19	49.80	11.30	52.20	9.49											19.20	4.26	3.60	1.91	2.40	1.18	6.20	3.44	156.20	3.86
9	<i>Bombax ceiba</i> Linn.	3.80	0.86	33.80	7.67																			8.20	4.55	45.80	1.13
10	<i>Brassica campestris</i> Linn.	58.20	13.24																			6.60	3.24	10.60	5.88	75.40	1.86
11	<i>Carica papaya</i> Linn.											22.80	7.00	53.40	12.76	46.60	9.26									122.80	3.04
12	<i>Cassia sophera</i> Linn.							8.20	4.11	26.40	8.11	9.40	2.25	33.40	6.64	39.60	8.80	27.60	14.63	12.40	6.09	15.60	8.66			172.60	4.27
13	<i>Cucurbita maxima</i> Duch					11.20	2.04	8.20	3.27	5.20	2.61	27.80	8.54	16.80	4.01											69.20	1.71
14	<i>Euphorbia hirta</i> Linn.	6.60	1.50	8.60	1.95	19.20	3.49	2.40	0.96	9.80	4.91	6.60	2.03	33.40	7.98	35.20	7.00	31.40	6.97	15.20	8.06	11.20	5.50	22.40	12.43	202.00	5.00
15	<i>Gnaphalium polycaulon</i> Pers.	4.20	0.96	33.40	7.58	17.20	3.13															26.60	13.06	6.60	3.66	88.00	2.18
16	<i>Hibiscus rosa-sinensis</i> Linn.	6.60	1.50	6.80	1.54	21.80	3.96	10.80	4.31	4.20	2.10	13.40	4.12	8.98	2.15	22.40	4.45	20.00	4.44	13.40	7.10	18.60	9.14	16.60	9.21	163.58	4.05
17	<i>Mangifera indica</i> Linn.	33.80	7.69																					3.60	2.00	37.00	0.92
18	<i>Mimosa pudica</i> Linn.					58.40	10.62	34.60	13.81	8.40	4.21	29.80	9.15	38.40	9.17	43.00	8.55	35.20	7.82							247.80	6.13
19	Mimosaceae					73.40	13.35	46.60	18.60	33.40	16.73	11.80	3.62													165.20	4.09
20	<i>Oryza sativa</i> Linn.	18.40	4.19			37.60	6.84							12.80	3.06											68.80	1.70
21	Poaceae	73.80	16.79	50.40	11.44	76.80	13.96	58.60	23.38	36.40	18.24	41.00	12.59	66.60	15.91	127.60	25.37	69.00	15.33	39.20	20.78	29.80	14.64	15.60	8.66	684.80	16.93
22	<i>Polygonum</i> sp.	9.00	2.05													33.40	6.64	13.60	3.02	9.20	4.88	2.40	1.18	13.60	7.55	81.20	2.01
23	<i>Pteris</i> sp.															49.80	9.90	24.80	5.51	18.80	9.97	16.20	7.96			109.60	2.71
24	<i>Rumex</i> sp.	9.40	2.14	24.80	5.63	16.60	3.02															9.80	4.81	14.20	7.88	74.80	1.85
25	<i>Solanum</i> sp.	28.60	6.51	34.40	7.81	16.80	3.05	17.00	6.78	15.20	7.62							19.60	4.35	16.20	8.59	6.60	3.24	4.80	2.66	159.20	3.94
26	<i>Tectona grandis</i> Linn. f.	18.40	4.19	9.60	2.18	13.40	2.44	6.60	2.63	8.40	4.21											13.40	6.58	16.60	9.21	86.40	2.14
27	<i>Terminalia cuneata</i> Roth			53.40	12.12	26.60	4.84	4.20	1.68	2.40	1.20	39.40	12.10	53.40	12.76							12.40	6.09			191.80	4.74
28	<i>Tridax procumbens</i> Linn.									6.60	3.31	6.60	2.03	13.40	3.20	16.80	3.34	13.80	3.07							57.20	1.41
29	Unidentified pollen grains	2.40	0.55	6.40	1.45	3.80	0.69					3.40	1.04			9.20	1.83	16.80	3.73							42.00	1.04
	Total	439.60	100.00	440.60	100.00	550.00	100.00	250.60	100.00	199.60	100.00	325.60	100.00	418.58	100.00	503.00	100.00	450.20	100.00	188.60	100.00	203.60	100.00	180.20	100.00	4043.98	100.00