AEROPALYNOLOGY OF JALPAIGURI TOWN

Phenology of airborne pollen grains

Phenology of each of the identified pollen grain (Table 8) is described below. Photography of some of the airborne pollen grains has been given in Plate IV and V :

(1) *Acacia auriculoformis*

The pollen of this species showed an extended period from March to October. The highest record was in May 1995-96 and in June 1996-97. Contribution to the two years aeropalynoflora was 98 (1.68) and 129 (2.18%) respectively (Table 8).

(2) *Acer* sp.

This pollen type was recorded from January to March with low percentage contribution of 0.24 in 1995-96 and 0.52 in 1996-97 (Table 8). This is migratory pollen, perhaps coming from Eastern Himalaya.

(3) *Albizia* sp.

This pollen type was recorded from January to July. The highest number occurred in May for both the years with a percentage contribution in between 1.85 – 2.09.

(4) *Alnus nepalensis*

This pollen type was recorded from October to March. The highest record was in October in 1995-96 and November in 1996-97. Contribution to the two years aeropalynoflora was 96 (1.64%) in 1995-96 and 101 (1.70%) in 1996-97. This is also a migratory pollen of Eastern Himalaya.

(5) *Areca catechu*

The pollen grains of *Areca catechu* occurred round the year and in 1995-96 with a total of 59 (1.01%) grains and in 1996-97 contributing 48 (0.81%) grains to the airspora. Maximum concentration was recorded in March 1995-96 and September 1996-97.

(6) *Artemisia* sp.

The pollen of this species recorded from October to April with a low percentage contribution of 0.82 in 1995-96 and 0.62% in 1996-97.

(7) Asteraceae

The Pollen of this family occurred round the year. It contributed 6.56% with a total of 383 pollen in 1995-96 and 7.25% with a total of 429 grains in 1996-97 with a peak period in between November to January for both the years.

(8) ***Azadirachta indica***

The pollen grain of this tree occurred from March to July for both the years, contributing a total of 64 and 41 grains respectively. The highest number of grains occurred with percentage contribution of 1.09 and 0.69 in the two years respectively.

(9) ***Betula alnoides***

Birch pollen appeared from first week of April from first week of March and continued until the end of July. It contributed 2.50% with a total of 146 grains in 1995-96 and 2.75% with a total of 163 grains in 1996-97.

(10) ***Bombax ceiba***

This pollen type was first encountered in the first week of March with maximum incidence in April (51 grains) in 1995-96 and 62 grains in March, 1996-97. Percentage concentration was 1.97 and 2.84 respectively.

(11) ***Callistemon lanceolatus***

The first bottle brush pollen grain was recorded on 2nd week of September extended upto February. In 1996-97 pollen grain was recorded up to May. Percentage contribution being 3.87% and 4.36% in 1995-96 and 1996-97 respectively.

(12) ***Cannabis sativa***

The pollen grains were recorded from March to September in 1995-96 and from March to November in 1996-97, showing highest frequency in May 1995-96 and March 1996-1997. Percentage contribution being 6.32 and 3.36 in 1995-96 and 1996-97 respectively.

(13) ***Carica papaya***

This pollen type was recorded from March to May with low percentage contribution of 0.30 for both the years.

(14) ***Cryptomeria japonica***

The Eastern Himalayan *Cryptomerica* pollen was first recorded in first week of February, subsequent occurrence extended until April in 1995-96 and May in 1996-97. It's percentage contribution was 0.34% in 1995-96 and 0.49% in 1996-97 with a total 20 and 29 grains respectively.

(15) ***Cassia* sp.**

In 1995-96, 4.45% pollen grains were distributed throughout the year varying in number in different months, the highest number was 52 in April and total pollen count was 260. In 1996-97 total count was 306 with a percentage contribution of 5.17. In the second year the grains recorded in all months with maximum incidence in September (52).

(16) *Casuarina equisetifolia*

It was first reported on first week of March though infrequent in the beginning but gradually increased in concentration with a peak of May. Frequency decreased from first week of June. It contributed 1.41% with a total of 83 and 1.03% with a total of 61 grains in 1995-96 and 1996-97 respectively.

(17) **Cheno-Amaranthaceae**

Pollen grains of goose foot family was recorded almost throughout the survey period with relatively high consistency from December to May. Percentage contribution was 4.23 (1995-96) and 4.73 (1996-97). The grains of these two families are clubbed together as morphological difference is little.

(18) *Cocos nucifera*

This pollen type was recorded in March and extended upto June. Maximum contribution was recorded in the month of May. In 1995-96 the percentage contribution was 2.55 and in the second year it was 2.53.

(19) **Cyperaceae**

The pollen grains of this family were first noted in October. Peak concentration was in October in both the year. For the remaining months occurrence was sporadic and no pollen grain was recorded in April (1995-96) and June (1996-97). Percentage contribution was 4.71 with a total 275 in the first year and 3.31 with a total 196 grains in the second year.

(20) *Eucalyptus globulosus*

Pollen grains of *Eucalyptus* were first trapped on October and extended upto March. In 1995-96, 131 grains were recorded with a concentration of 2.24%. In 1996-97, a total of 134, contributing 2.26% to the total aeropalynoflora, remained distributed in the same months.

(21) **Euphorbiaceae**

Pollen grain belonging in this family were first recorded in March and extended upto August. Total contribution to the aeropalynoflora in 1995-96 was 48 (0.82%) and 60 (1.01%) in 1996-97.

(22) *Ilex* **sp.**

The occurrence of migratory Eastern Himalayan *Ilex* was sporadic for the entire period from February to May. A total of 36 (0.61%) and 31 (0.52%) grains were recorded during the two years survey period.

(23) *Litsea glutinosa*

The pollen grain was encountered in April to June with a very low concentration.A total of 18 grains in 1995-96 and 16 grains in 1996-97 were recorded. In the first year the percentage was 0.30% and in the second year it was 0.27%.

(24) ***Mangifera indica***

This pollen type was recorded in March and extended upto May; with a low percentage contribution 0.54 in 1995-96 and 0.42 in 1996-97. Peak concentration was in April.

(25) ***Pinus* sp.**

The pine pollen was first recorded in 2nd week of January and in 1995-96 it was frequent until May with abundance in March. In 1996-97 it was extended upto June. The total grains reported were 144 in 1995-96 and 151 in 1996-97 with percentage contribution of 2.46 and 2.55 respectively. This is migratory pollen perhaps coming from Eastern Himalaya.

(26) ***Peltophorum pterocarpum***

This pollen type was first observed in September and then continued until March, with maximum values in December. It contributed a total of 129 (2.21%) and 98 (1.65%) to the total aeropalynoflora of 1995-96 and 1996-97 respectively.

(27) Polygonaceae

Pollen grains of this weed family appeared from March to July and October in 1995-96 while it was from March to June and October in 1996-97. Total pollen count was 96 (1.64%) in the first year and 86 (1.45%) in the second year. In both the years maximum number of pollen grains were recorded in April, the number being 31 and 26 respectively.

(28) ***Psidium guajava***

The occurrence of *Psidium guajava* pollen grains were sporadic with two peaks and appeared from April to May and August to September. In 1995-96, 54 (0.92%) grains and in 1996-97, 49 grains contributed 0.82% to the total aeropalynoflora. In both the year maximum values recorded in May.

(29) Poaceae

Grass pollen grains were first noted on September and in high concentration and recorded in all the months of the survey period. From December to March it was with low percentage. It occurred frequently from April to October. In the first year total pollen count was 1069 (18.32%) and in the second year 1095 (18.51%).

(30) Rutaceae

In 1995-96, 1.37% grains of this family remained distributed from November to March showing maximum incidence of 20 grains in December, and the total pollen catch was 80. In 1996-97 the grains remained distributed from October to March contributing 1.18% with a total count of 70 grains, with maximum values in December (18 grains).

(31) ***Quercus* sp.**

The occurrence of high altitude Oak pollen grains was noted from October. The values recorded were maximum in November. A total 162 (2.77%) and 156 (2.63%) grains were noted in aeropalynoflora of 1995-96 and 1996-97 respectively.

(32) Scrophulariaceae

Pollen grain of this family occurred sporadically from February to June, in very low concentration. Total pollen contribution was 19 (0.32%) and 12 (0.20%) in 1995-96 and 1996-97 respectively.

(33) Solanaceae

Pollen types included within the family remained distributed throughout the year except in January in 1995-96, with wide fluctuation in number for different months. The highest was in April 48 grains in the first year, 57 grains in the second year. The total pollen count were 259 (4.44%) and 386 (6.52%) in 1995-96 and 1996-97 respectively.

(34) *Syzygium* sp.

The occurrence of *Syzygium* pollen grains were sporadic and appeared from April to July and September to October. The total number of pollen grains recorded were 82 (1.40%) in the first year and 67 (1.12%) in the second year.

(35) *Terminalia* sp.

This pollen type was first encountered sporadically in the first week of April, with maximum concentration in June and July. Total pollen count was 152 (2.60%) and 1.50 (2.53%) in 1995-96 and 1996-97 respectively.

(36) *Trema orientalis*

The occurrence of *Trema orientalis* pollen grains appeared from March to June, with a maximum concentration in May. The total number of pollen grains recorded were 137 (2.34%) in 1995-96 and 132 (2.23%) in 1996-97.

(37) Verbenaceae

The pollen grains of this family occurred sporadically with a moderate percentage. Total contribution was 144 (2.46%) in the first year and 139 (2.35%) in the second year.

(38) *Xanthium strumarium*

This pollen type was first recorded in October and extended up February, with maximum values in December. Total pollen count was 67% (1.14%) in 1995-96 and 50 (0.84%) in 1996-97.

(39) *Zizyphus* sp.

This pollen type was present from September to December with a low concentration. The total pollen count were 77 (1.32%) and 68 (1.14%) in 1995-96 and 1996-97 respectively.

(40) *Indeterminate type*

The unidentified pollen grains were present round the year with low concentrations. A total of 119 grains (2.04%) in 1995-96 and 171 (2.89%) in 1996-97 were recorded.

Plate- IV
Legends of airborne pollen

1. *Acacia auriculoformis* (x 500)
2. *Azadirachta indica* (x 750)
3. *Cocos nucifera* (x 500)
4. *Bombax ceiba* (x 500)
5. *Scrophulariaceae* (x 500)
6. *Quercus sp.* (x 500)
7. Cheno-Amaranthaceae (x 750)
8. Cyperaceae (x 750)
9. *Cassia sp.*(x 750)
10. Euphorbiaceae *(Croton type)*(x 500)
11. *Eucalyptus sp.*(x 800)
12. Asteraceae (x 750)
13. *Cassia sp.* (x 750)
14. Polygonaceae (x 500)
15. Poaceae (x 500)
16. *Zizyphus sp.*(x 1000)
17. *Mangifera indica* (x 500)
18. *Trema orientalis* (x 1000)
19. *Casuarina equisetifolia* (x 1000)
20. Rutaceae (x 500)

Plate- V
Legends of airborne pollen

1. *Artemisia sp.*(x 1000)
2. Indeterminate (x 500)
3-4. Polygonaceae (x 500)
5-6. *Carica papaya* (x 1000)
7. Solanaceae (x 500)
8. *Psidiun guajava* (x 1000)
9. *Albizia sp.* (x 750)
10. *Terminalia sp.* (x 1000)
11. *Acer sp.* (x 500)
12. Polygonaceae (x 500)
13. *Pinus sp.* (x 500)
14. *Peltophorum sp.*(x 500)

Plate-IV

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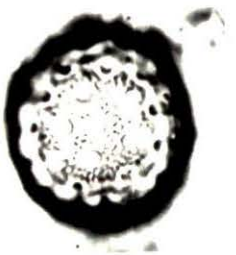

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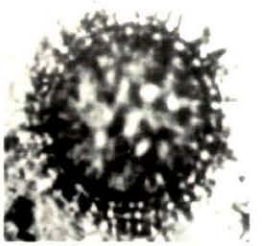

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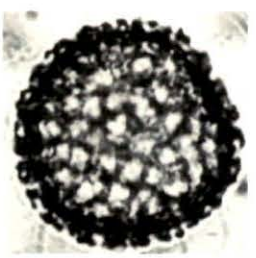

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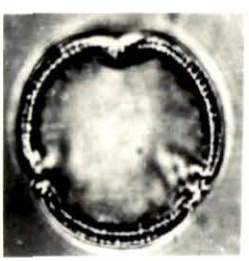

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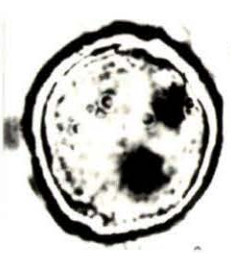

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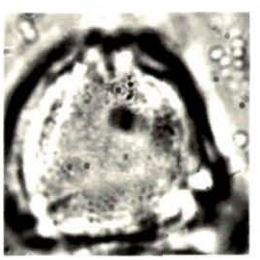

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Plate- V

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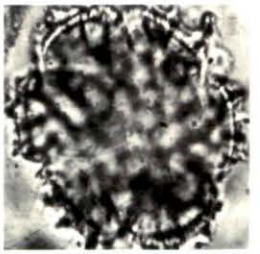

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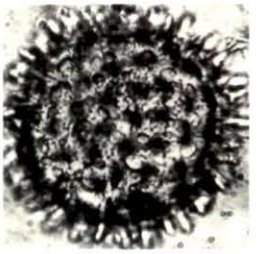

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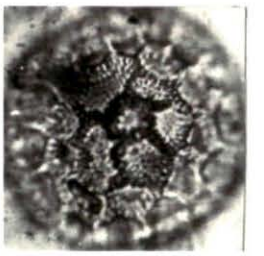

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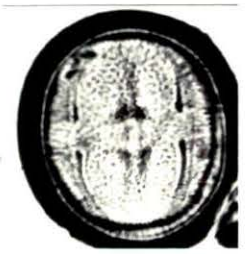

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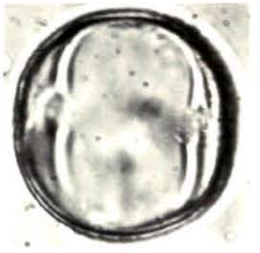

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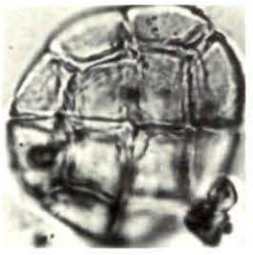

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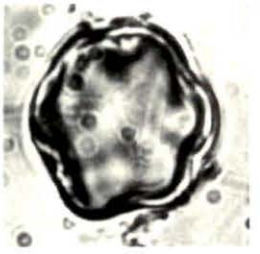

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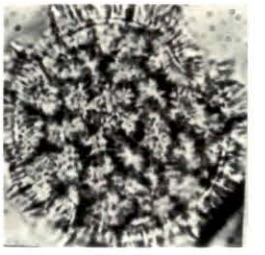

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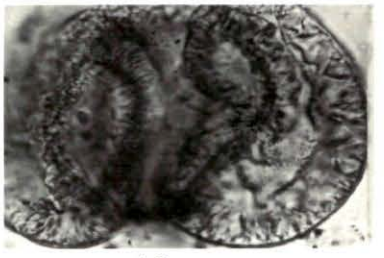

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TABLE 8 : POLLEN CALENDAR OF JALPAIGURI TOWN FOR THE YEAR 1995-1996 AND 1996-1997 BY USING GRAVITATIONAL SAMPLER

SL. NO	POLLEN TYPES	YEAR	TOTAL NUMBER PER 10 SQ.CM. TRAP SURFACE FROM 1ST OCTOBER 1995 TO 31ST SEPTEMBER 1997												TOTAL	%
			OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.		
1.	*Acacia auriculoformis*	1995-96	6	-	-	-	-	7	6	25	21	16	12	5	98	1.68
		1996-97	10	-	-	-	-	9	9	28	35	19	8	11	129	2.18
2.	*Acer* sp.	1995-96	-	-	-	6	4	4	-	-	-	-	-	-	14	0.24
		1996-97	-	-	-	11	12	8	-	-	-	-	-	-	31	0.52
3.	*Albizia* sp.	1995-96	-	-	-	11	25	21	14	27	10	-	-	-	108	1.85
		1996-97	-	-	-	17	28	16	22	30	7	4	-	-	124	2.09
4.	*Alnus* sp.	1995-96	35	30	12	6	10	3	-	-	-	-	-	-	96	1.64
		1996-97	28	32	17	12	5	7	-	-	-	-	-	-	101	1.70
5.	*Areca catechu*	1995-96	2	4	4	3	4	12	4	4	4	4	10	4	59	1.01
		1996-97	2	3	5	4	2	7	6	2	3	4	8	2	48	0.81
6.	*Artemisia* sp.	1995-96	6	4	4	6	8	14	6	-	-	-	-	-	48	0.82
		1996-97	8	6	3	3	4	8	5	-	-	-	-	-	37	0.62
7.	Asteraceae	1995-96	24	52	78	63	35	28	30	35	12	5	14	7	383	6.56
		1996-97	21	70	105	74	41	31	22	28	8	4	5	20	429	7.25
8.	*Azadirachta indica*	1995-96	-	-	-	-	-	7	6	21	18	12	-	-	64	1.09
		1996-97	-	-	-	-	-	5	4	12	15	5	-	-	41	0.69
9.	*Betula* sp.	1995-96	-	-	-	-	-	28	54	37	27	-	-	-	146	2.50
		1996-97	-	-	-	-	-	22	34	52	35	20	-	-	163	2.75
10.	*Bombax ceiba*	1995-96	-	-	-	-	-	30	51	24	10	-	-	-	115	1.97
		1996-97	-	-	-	-	-	62	55	42	9	-	-	-	168	2.84
11.	*Callistemon lanceolatus*	1995-96	35	72	47	30	18	-	-	-	-	-	-	24	226	3.87
		1996-97	41	32	54	37	35	16	3	9	-	-	-	31	258	4.36

Contd. ...

SL. NO	POLLEN TYPES	YEAR	TOTAL NUMBER PER 10 SQ.CM. TRAP SURFACE FROM 1ST OCTOBER 1995 TO 31ST SEPTEMBER 1997												TOTAL	%
			OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.		
12.	*Cannabis sativa*	1995-96	8	3	-	-	-	74	85	95	48	23	18	15	369	6.32
		1996-97	-	-	-	-	-	63	42	27	21	16	24	6	199	3.36
13.	*Carica papaya*	1995-96	-	-	-	-	-	4	9	5	-	-	-	-	18	0.30
		1996-97	-	-	-	-	-	3	12	3	-	-	-	-	18	0.30
14.	*Cassia* sp.	1995-96	41	14	6	12	14	24	52	18	21	9	14	35	260	4.45
		1996-97	38	25	11	17	21	26	38	35	16	5	22	52	306	5.17
15.	*Casuarina equisetiflia*	1995-96	-	-	-	-	-	12	25	28	18	-	-	-	83	1.41
		1996-97	-	-	-	-	-	9	24	16	7	5	-	-	61	1.03
16.	Cheno–Amaran-thaceae	1995-96	8	9	24	31	28	41	21	29	17	28	7	4	247	4.23
		1996-97	12	7	38	26	31	54	37	35	21	16	-	3	280	4.73
17.	*Cocos nucifera*	1995-96	-	-	-	-	-	21	45	67	16	-	-	-	149	2.55
		1996-97	-	-	-	-	-	16	54	74	6	-	-	-	150	2.53
18.	*Cryptomeria joponica*	1995-96	-	-	-	-	11	7	2	-	-	-	-	-	20	0.34
		1996-97	-	-	-	-	9	12	6	2	-	-	-	-	29	0.49
19.	Cyperaceae	1995-96	76	32	8	25	35	6	-	7	4	21	26	35	275	4.71
		1996-97	52	17	11	14	21	15	9	11	-	16	11	19	196	3.31
20.	*Eucalyptus globulosus*	1995-96	32	28	21	12	30	8	-	-	-	-	-	-	131	2.24
		1996-97	37	30	16	22	18	11	-	-	-	-	-	-	134	2.26
21.	Euphorbiaceae	1995-96	-	-	-	-	-	12	16	8	2	6	4	-	48	0.82
		1996-97	-	-	-	-	-	18	23	5	-	11	3	-	60	1.01
22.	*Ilex* sp.	1995-96	-	-	-	-	13	10	4	9	-	-	-	-	36	0.61
		1996-97	-	-	-	-	7	6	11	7	-	-	-	-	31	0.52
23.	*Litea glutinosa*	1995-96	-	-	-	-	-	-	12	6	-	-	-	-	18	0.30
		1996-97	-	-	-	-	-	-	9	4	3	-	-	-	16	0.27
		1996-97	4	17	32	24	9	-	-	-	-	-	-	12	98	1.65

Contd. ...

SL. NO	POLLEN TYPES	YEAR	TOTAL NUMBER PER 10 SQ.CM. TRAP SURFACE FROM 1ST OCTOBER 1995 TO 31ST SEPTEMBER 1997												TOTAL	%
			OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.		
24.	*Mangifera indica*	1995-96	-	-	-	-	-	7	21	4	-	-	-	-	32	0.54
		1996-97	-	-	-	-	-	6	11	8	-	-	-	-	25	0.42
25.	*Peltophorum pterocarpum*	1995-96	11	21	30	22	16	4	-	-	-	-	-	25	129	2.21
26.	*Pinus* sp.	1995-96	-	-	-	25	20	62	21	16	-	-	-	-	144	2.46
		1996-97	-	-	-	18	24	48	30	27	4	-	-	-	151	2.55
27.	Poaceae	1995-96	135	85	35	12	28	33	78	112	187	102	65	197	1069	18.32
		1996-97	104	96	94	9	17	48	95	157	169	110	48	148	1095	18.51
28.	Polygonaceae	1995-96	6	-	-	-	-	21	31	21	11	6	-	-	96	1.64
		1996-97	5	-	-	-	-	25	26	12	18	-	-	-	86	1.45
29.	*Psidium guajava*	1995-96	-	-	-	-	-	-	9	18	-	-	16	11	54	0.92
		1996-97	-	-	-	-	-	-	12	24	-	-	5	8	49	0.82
30.	Rutaceae	1995-96	-	10	20	16	18	16	-	-	-	-	-	-	80	1.37
		1996-97	4	14	18	9	14	11	-	-	-	-	-	-	70	1.18
31.	*Quercus* sp.	1995-96	38	64	32	28	-	-	-	-	-	-	-	-	162	2.77
		1996-97	27	58	46	17	8	-	-	-	-	-	-	-	156	2.63
32.	*Scrophulariaceae*	1995-96	-	-	-	-	3	4	3	7	2	-	-	-	19	0.32
		1996-97	-	-	-	-	1	6	2	-	3	-	-	-	12	0.20
33.	Solanaceae	1995-96	35	14	4	-	31	42	48	28	31	10	7	9	259	4.44
		1996-97	27	18	7	28	54	57	38	51	37	28	16	25	386	6.52
34.	*Syzygium* sp.	1995-96	11	-	-	-	-	-	11	14	21	4	-	21	82	1.40
		1996-97	8	-	-	-	-	-	6	21	14	-	-	18	67	1.12
35.	*Terminalia* sp.	1995-96	-	-	-	-	-	-	27	16	54	48	7	-	152	2.60
		1996-97	-	-	-	-	-	-	9	12	67	51	11	-	150	2.53
36.	*Trema orientalis*	1995-96	-	-	-	-	-	21	51	58	7	-	-	-	137	2.34
		1996-97	-	-	-	-	-	18	47	52	15	-	-	-	132	2.23

Contd. ...

SL. NO	POLLEN TYPES	YEAR	TOTAL NUMBER PER 10 SQ.CM. TRAP SURFACE FROM 1ST OCTOBER 1995 TO 31ST SEPTEMBER 1997												TOTAL	%
			OCT.	NOV.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.		
37.	Verbenaceae	1995-96	-	9	3	-	7	30	47	21	18	5	4	-	144	2.46
		1996-97	-	7	-	-	4	28	37	32	22	9	-	-	139	2.35
38.	*Xanthium strumarium*	1995-96	9	11	24	16	7	-	-	-	-	-	-	-	67	1.14
		1996-97	7	8	21	11	3	-	-	-	-	-	-	-	50	0.84
39.	*Zizyphus* sp.	1995-96	21	35	9	-	-	-	-	-	-	-	-	12	77	1.32
		1996-97	24	31	6	-	-	-	-	-	-	-	-	7	68	1.14
40.	INDETERMINATE	1995-96	2	7	21	28	17	13	19	6	4	2	-	-	119	2.04
		1996-97	1	11	19	34	13	37	22	18	7	4	2	3	171	2.89
	GRAND TOTAL	**1995-96**	**541**	**504**	**382**	**352**	**382**	**626**	**808**	**766**	**563**	**301**	**204**	**404**	**5833**	
		PERCENTAGE	**9.27**	**8.64**	**6.54**	**6.03**	**6.54**	**10.73**	**13.85**	**13.13**	**9.65**	**5.16**	**3.49**	**6.92**		
		1996-97	**460**	**482**	**503**	**387**	**381**	**708**	**760**	**836**	**542**	**327**	**163**	**365**	**5914**	
		PERCENTAGE	**7.77**	**8.15**	**8.50**	**6.54**	**6.44**	**11.97**	**12.85**	**14.13**	**9.16**	**5.52**	**2.76**	**6.17**		

Results :

Seasonal Variation

Five more or less well defined seasons, i.e., Autumn, winter, spring, summer and rainy season, were demarcated in Jalpaiguri District. The total number of pollen grains recorded in different months denote a relatively significant variance (Table 8 & 9). The changes in frequency of palynomorphs were probably related to the length of flowering period, pollen productivity and their extent of dispersal. The frequency of shrub and tree pollen grains dominated over the other groups (Table 10). The flowering period of majority of the trees began from the later part of winter and extended until early monsoon period. (Table 8)

By Gravitational Sampler :

More or less well defined seasonal variations were recorded. Total monthly catches were correlated with different seasons (Table 11). In 1995-96 highest frequency of pollen grains were recorded during winter amounting to 1620 with a percentage contribution of 27.78. This was followed by highest number in spring season, with a total contribution of 24.58% A total catch of 1329 (22.78%) was recorded in summer, preceeded by rainy season with 909 grains (15.58%). Autumn recorded lowest count, i.e. 541 grains (9.28%) in 1995-96.

During 1996-97 more or less same trend as 1995-96 was observed. Winter season recorded the highest number of grains amounting to 1753 with a percentage contribution of 29.64%, in the total aeropalynoflora. This was followed by spring, with a total of 1468 grains (24.82%) and summer with 1378 grains (23.30%), rainy season recorded 855 grains (14.46%) and autumn recorded lowest count with 460 grains (7.78%).

By Rotorod Sampler :

During two years' survey period 33 pollen types (including indeterminate type) were recorded from the rotorod trap. The seasonal periodicities were recorded for all the pollen types (Table 9) and the total pollen count changed throughout the year with peak period occurring in April and May.

Monthwise on an average, April and May recorded the highest incidence of total pollen, i.e. $736m^{-3}$ and $724m^{-3}$ respectively. This was followed in the degree of

prevalence by March and June (528m^{-3} each) November (376m^{-3}), October (368m^{-3}), January (344m^{-3}), etc. (Table 9).

Five more or less well defined seasons, i.e. Autumn, Winter, Spring, Summer and Rainy season were demarcated in Jalpaiguri District. The total number of pollen grains recorded in different months demonstrated a relatively significant variance (Table 12). The changes in the frequency of palynomorphs were probably related to the length of flowering period, pollen productivity and their extent of dispersal. The frequency of shrubs and tree pollen dominated over the other groups (Table 9). The flowering period of majority of the trees began from the latter part of winter and extended until early monsoon period.

When the total monthly catches were correlated with different seasons (Table 12), the highest frequency of pollen grains was recorded during the winter season, amounting to 1372m^{-3} with a percentage contribution of 27.07. This was immediately followed by spring season with a total of 1264 grains m^{-3} and percentage contribution of 24.94. A total catch of 1252m^{-3} (24.71%) was recorded in summer, preceeded by rainy season with 812 grains m^{-3} (16.02%). The autumn season recorded lowest count, i.e. 368 grains m^{-3} (7.26%).

The pollen types, i.e. the constituent members, had each a peak month (Fig 3). Accordingly, the dominant types were placed in different groups in relation to their respective high values and the corresponding season : -

Group I	Autumn	Asteraceae, Solanaceae, *Cassia*, Cyperaceae, *Eucalyptus*, *Xanthium*, *Callistemon*, *Peltophorum*, *Zizyphus*.
Group II	Winter	Asteraceae, *Areca catechu*, Cheno-Amaranthaceae, *Callistemon*, Cyperaceae, Rutaceae, *Samania saman*, *Zizyphus* sp., *Eucalyptus*, *Xanthium*.
Group III	Spring	*Bombax ceiba*, *Cannabis sativa*, *Cassia*, *Cocos nucifera*, *Cusuarina equisetifolia*, *Samania saman*, Cheno-Amaranthaceae, Polygonaceae, Solanaceae, Verbanaceae, Euphorbiaceae, *Mangifera india*, *Litsea* sp.
Group IV	Summer	*Acacia*, *Cannabis sativa*, *Cocos nucifera*, Poaceae, *Terminalia*, *Trema*, *Samania saman*, *Azadirachta indica*.
Group V	Rainy season	*Terminalia*, *Trema*, Cyperaceae, *Psidium*, *Areca catechu*.

The total assemblage of dominant pollen types recorded in these groups demonstrates the dominance of tree pollen grains.

TABLE 9 : MONTHLY CONCENTRATIONS (NO. PER M^3 AIR) OF DIFFERENT POLLEN GRAMS COLLECTED BY ROTOROD SAMPLING IN THE AIR OF JALPAIGURI TOWN FROM OCTOBER, 1996 TO SEPTEMBER 1997

Sl. No.	POLLEN TYPES	No. OF POLLEN PER M^2 AIR												TOTAL
		O	N	D	J	F	M	A	M	J	J	A	S	
1.	*Acacia auriculoformis*	16	-	-	-	-	16	24	48	56	32	32	8	232
2.	*Alnus* sp	16	32	8	16	-	8	-	-	-	-	-	-	80
3.	Apiaceae	8	16	16	-	8	16	24	-	-	-	-	-	88
4.	*Areca catechu*	8	8	4	8	32	24	16	12	8	16	24	12	172
5.	Asteraceae	32	48	48	64	32	24	24	32	8	16	16	8	352
6.	*Azadirhchta india*	-	-	-	-	-	16	8	24	24	16	-	-	88
7.	*Betula* sp					-		48	16	16	-	-	-	80
8.	*Bombax ceiba*	-	-	-	-	-	32	48	40	16	-	-	-	136
9.	*Callistemon lanceolatus*	32	32	24	24	16	-	-	-	-	-	-	-	128
10.	*Cannabis sativa*	8	-	-	-	-	64	80	72	48	32	32	16	352
11.	*Carica papaya*	-	-	-	-	-	-	8	-	-	-	-	-	8
12.	*Cassia* sp.	24	8	8	-	16	40	32	16	16	-	-	-	160
13.	*Casuarina equisetifolia*	-	-	-	-	-	-	32	32	16	-	-	-	80
14.	Cheno amaranthaceae	16	16	48	32	40	64	16	24	24	8	-	-	288
15.	*Cocos nucifera*	-	-	-	-	-	16	56	64	16	-	-	-	152
16.	Cyperaceae	48	16	-	16	32	-	8	-	-	32	32	24	208
17.	*Eucalyptus* sp.	24	24	16	32	16	-	-	-	-	-	-	-	112
18.	Euphorbiaceae	-	-	-	-	-	-	16	8	-	8	-	-	32
19.	*Mangifera indica*	-	-	-	-	-	-	32	8	-	-	-	-	40
20.	*Pinus* sp.	-	-	-	16	16	32	24	16	-	-	-	-	104
21.	Polygonaceae	-	-	-	-	-	-	24	16	-	8	-	-	8
22.	*Psidium guajava*	-	-	-	-	-	-	-	24	-	-	32	16	72
23.	Poaceae	80	64	56	32	16	56	80	96	128	96	80	88	872
24.	*Quarcus* sp	16	32	16	24	-	-	-	-	-	-	-	-	88
25.	Samania saman	-	-	-	16	32	16	16	32	-	-	-	-	112

Contd. ...

Sl. No.	POLLEN TYPES	No. OF POLLEN PER M³ AIR												TOTAL
		O	N	D	J	F	M	A	M	J	J	A	S	
26.	Scrophulariaceae	-	-	-	-	8	16	-	8	-	-	-	-	32
27.	Solanaceae	24	16	16	24	48	48	24	48	32	24	32	16	352
28.	*Syzygium* sp.	-	-	-	-	-	-	-	24	16	-	-	-	40
29.	*Terminalia* sp.	-	-	-	-	-	-	16	24	48	24	16	-	128
30.	*Trema orientalis*	-	-	-	-	-	16	48	24	16	-	-	-	104
31.	*Xanthium strumarium*	-	16	32	8	8	-	-	-	-	-	-	-	64
32.	*Zizyphus* sp.	16	32	16	-	-	-	-	-	-	-	-	-	64
33.	Indeterminate	-	16	16	32	8	24	32	16	8	8	-	8	168
	TOTAL :	368	376	324	344	328	528	736	724	528	320	296	196	5068

Yearly variation of Airborne Pollen Grains.

The components of airborne pollen were identical in both the years, i.e. 1995-96 and 1996-97 (Table 8).

Total aeropalynoflora :

A total of 40 types of pollen grains were recorded by gravitational sampler and 33 types by Rotorod sampler in different months during the survey period. Their percentage contribution have been given in Table 8. Highest concentration was recorded in April (1995-1996) and May (1996-1997). In the first year percentage contribution was 13.85% and in the second year it was 14.13%. A total of 33 pollen types were recorded by rotorod sampler. The highest concentration ($736m^{-3}$) of pollen have been observed in April which was followed by May ($724m^{-3}$) (Table 9).

Frequency of Incidence :

The correlation of yearly frequency of the main morphotypes between 1995-1996 and 1996-1997 showed marginal variations (Fig.3) *Cannabis sativa* displayed maximum difference (369 in 1995-1996 & 199 in 1996-1997) considering the total catches followed by Solanaceae (259 in 1995-96 & 386 in 1996-1997). Further look at the calendar (Fig.3) of dominant types reflect their relative incidence in each month during both the years.

Peak Month of Incidence :

The value of peak monthly incidence of major pollen grains, and their monthly total number per 10 cm^2 of the trapping surface during the same months of 1995-1996 and 1996-1997 have been provided in Table 8. The data incidate that the peak months of incidence were not same for all types in both the years. Moreover, the total number recorded for each individual type represented no significant differences in the investigated period.

Percentage contribution of different groups and of major individual types :

The percentage contribution of different pollen types to the total aeropalynoflora showed marginal differences.

The percentage contribution of the major pollen grains to the total aeropalynoflora in the two years survey are shown in Table 8.

TABLE 10 : MONTHLY TOTAL CONTRIBUTION OF GRASSES, HERBS AND WEEDS, SHRUBS AND TREES AND INDETERMINATE INDETERMINATE TYPES DURING THE PERIOD 1995 – 1996 AND 1996 – 1997 BY GRAVITATIONAL SAMPLER.

AEROPALYNOFLORA	YEAR	TOTAL NO. PER 10 CM^2 OF TRAP SURFACE												TOTAL
		OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	
Grasses (Poaceae)	1995-96	135	85	35	12	28	33	78	112	187	102	65	197	1069
	1996-97	104	96	94	9	17	48	95	157	169	110	48	148	1095
Herbs & Weeds	1995-96	164	125	142	141	147	242	240	230	127	99	101	70	1828
	1996-97	132	126	185	156	155	277	204	169	108	91	59	73	1735
Shrubs & Trees	1995-96	240	287	184	171	190	338	471	418	245	98	38	137	2817
	1996-97	223	249	205	188	196	346	439	492	258	122	54	141	2913
Indeterminate types	1995-96	2	7	21	28	17	13	19	6	4	2	-	-	119
	1996-97	1	11	19	34	13	37	22	18	7	4	2	3	171

TABLE 11 : SEASONAL VARIATION OF THE TOTAL AEROPALYNOFLORA TRAPPED BY GRAVITATIONAL SAMPLER AND THEIR CORRESPONDING PERCENTAGE CONTRIBUTION DURING THE PERIOD 1995-1996 AND 1996-1997

SEASON (MONTH)	1995 – 1996		1996 – 1997	
	TOTAL NO. OF POLLEN GRAINS	PERCENTAGE CONTRIBUTION	TOTAL NO. OF POLLEN GRAINS	PERCENTAGE CONTRIBUTION
AUTUMN (October)	541	9.28	460	7.78
WINTER (November to February)	1620	27.78	1753	29.64
SPRING (March to April)	1434	24.58	1468	24.82
SUMMER (May to June)	1329	22.78	1378	23.30
RAINY SEASON (July to September)	909	15.58	855	14.46
TOTAL	5833	100.00	5914	100.00

Table 12 : Seasonal Variation of the total aeropalynoflora trapped by Rotorod Sampler during 1995-1997.

Season (Month)	Total No. of Pollen grains in m^{-3} of air	Percentage Contribution
Autumn (October)	368	7.26
Winter (November – February)	1372	27.07
Spring (March – April)	1264	24.94
Summer (May – June)	1252	24.71
Rainy (July – September)	812	16.02
Total :	**5068**	**100.00**

In results of gravitational sampler Poaceae showed highest dominance (18.32 – 18.51%) followed by Asteraceae (6.56 – 7.25%), *Cannabis sativa* (3.36 – 6.32%), *Solanaceae* (4.44 – 6.52%), *Cassia* sp. (4.45 – 5.17%), Cheno-Amararanthaceae (4.23 – 4.73%) and so on.

Discussions :

The most important aspect to conduct an Aerobiological investigation is the selection of an appropriate Sampler. The sampling techniques in case of gravitational sampler mainly work on the principles of gravity and impaction. But in the case of volumetric sampler, it is suction. Currently the most commonly used sampler is a volumetric sampler, e.g. Hirst Sampler (Hirst 1952) and Burkard 7-day automatic volumetric sampler (Burkard Manufacturing Co. U.K.) and Astir personal volumetric Sampler (Astir India Co. Ltd.). This Sampler helps in recording the periodicity and volumetric composition of airborne pollen. In the present investigation Gravity Slide Sampler and Rotorod Samplers were used to study the seasonal periodicities of airborne pollen grains of the study area.

All the 40 pollen types trapped by gravity sampler were encountered during the entire survey period. Some pollen grains belonging to the family Poaceae, Asteraceae, Cyperaceae, Solanaceae, Amaranthaceae, Chenopodiaceae, Euphorbiaceae, Rutaceae, Polygonaceae, Scrophulariaceae, Verbenaceae could not be distinguished morphologically at generic or specific levels. The grass pollen grains have been included in the family Poaceae. The pantoporate type of pollen grains have been included within Cheno-Amaranthaceae. Some pollen grains were identified upto generic or species level by comparing with reference slides. The pollen grains of *Areca catechu, Azadirachta indica, Bombax ceiba, Callistemon lanceolatus, Xanthium strumarium, Cannabis sativa, Carica papaya, Casuarina equisetifolia, Cocos nucifera, Mangifera indica* etc. were identified upto specific level as their pollen grains have distinct features and respective plant species were recorded in the ecofloristic survey.

The frequency of pollen grains in the air generally depends on the distribution, density of local vegetation, rate of pollen production and pollination mechanism. Pollen grains are generally found during respective pollination periods. The meteorological factors have also a great influence on the incidence of pollen grains, particularly during the heavy monsoon rains. Moreover, the intensity of air currents

and changes in weather condition affect the qualitative and quantitative count of pollen (Hirst, 1953; Gregory 1961; Sreeramulu and Seshavataram 1962).

Wind pollinated plants produce a large number of smooth walled pollen grains which are often inconspicuous, colourless and lacking nector. Such pollen grains are mostly found in the air and are potentially more allergenic than the insect pollinated or entomophilous plants. But in the present investigations a number of entomphilous grains were found, some of which have been proved to be allergenic, viz. *Bassia latifolia, Carica papaya, Azadirachta indica, Bambax ceiba, Peltophorum pterocarpum, Eucalyptus globulosus, Cassia* sp. etc.

Out of the 33 pollen types trapped by rotorod sampler Poaceae and *Areca catechu*, were found all round the year with varying frequencies but with maximums concentration during April-June. *Bombax ceiba, Syzigium, Terminalia, Cocos nucifera, Mangifera indica,Casuarina equisetifolia* have the peak period from March to May. Other pollen types like *Eucalyptus*, *Cassia, Azadirachta, Xanthium* sp. were found frequently in the air with moderate concentration. Cyperaceae pollen were more prevalent during the months of July to October. *Cocos* pollen counts were relatively high in April-May and were seasonal. Pollen grains of *Mangifera indica, Bombax ceiba, Psidium guajava,* were also seasonal but in low concentration. Some pollen types, e.g. *Xanthium*, showed distinct seasonality confined to 4 months of the year. From August to October, apart from Poaceae, the main pollen contributor to the aeroapalynoflora was Cyperaceae, *Trema, Acacia, Areca, Psidium, Zizyphus,* whereas during January-March pollen grains of *Albizzia,* Solanaceae, Cheno-Amaranthaceae were the dominating constituents.

Thus in both the years, April-May are the months of maximum pollen incidence and in August it was minimum. With regard to the concentration pertaining to climatic season 76.72% of the pollen catch was obtained in the dry period (November – June) while remaining 23.28% in the wet period (July – October).

The extent of variation in the monthly incidence of certain pollen types has been shown in Table 8. However, the general running up of the seasons remained nearly the same in both years except for summer and winter seasons. There was a marginal increase in the total pollen count from first (5833) to second year (5914). The incidence of all the pollen types in both the years differed to some extent (Table 11).

In the two years' survey it was found that Poaceae was the major contributor to the aeropalynoflora and rice crop probably was the major source of this pollen type.

The predominance of grass pollen in rural and cultivated areas was also reported from Britain (Hyde, 1952), from Bhimavarans of Andhra Pradesh, India (Atluri *et. al* 1988), and from a farm in West Bengal, India (Chakraborty *et. al.* 1998a). As poaceae is a strongly stenopalynous family, it is suggested that a study of grass pollen of such areas and their daily time of pollen release will help the pollen allergy patients regarding specific identification of the allergen. There are plantations of the taxa like *Eucalyptus* sp., *Acacia auriculiformis, Mangifera indica, Psidium gurajava* etc., as a result the pollen grains of these plants are found to be present. Some pollen grains were found throughout the year and some found quite frequent with one or two peak periods. From the several pollen surveys at different parts of India (Vishnu – Mittrre and Khandelwal 1973, Deshpande and Chitaley 1976, Mandal & Chanda 1981, Atluri & Subba Reddi 1982, Singh and Babu 1982, Bhat and Rajasab 1985, Chakraborty *et. al.* 1998a & b), two peak periods of total pollen were observed. The first peak during August to November was found due to the growth and flowering of several grass species in response to the monsoon rains and the February – May peak was observed due to the flowering of tree species during that time. In this survey two main peak periods were found.

Poaceae contributed much to the first peak along with Cyperaceae and it also contributed dominantly in the second peak along with *Acacia, Cassia, Cannabis, Casuarina, Mangifera,* etc. The peaks in Poaceae coincided with the flowering period of rice crop. In the two year pollen survey variation in the total pollen count as well as individual pollen types were also noted.

It was observed that the frequency of incidence of pollen is high in low relative humidity, modest temperature and minimum rainfall. Here the same condition prevailed. Pollen dispersal is facilitated by the dry weather with low relative humidity, because the pollen particles become light and dry and can be disseminated in the air with less constraint (Gupta *et.al* 1994). Wind velocity also plays a role in pollen release. Generally, wind velocity higher than 1km./hr. results in higher concentration of airborne pollen grains (Edmonds, 1979).

The occurrence of pollen grains of *Acer* sp., *Alnus* sp., *Betula* sp., *Cryptomeria japonica, Ilex* sp., *Pinus* sp. and *Quercus* sp. were interesting in the sense that these plants do not occur in the district flora, but are restricted to the hills of Eastern Himalayas and Bhutan Ranges, thus justifying their presence probably due to long distance transport.

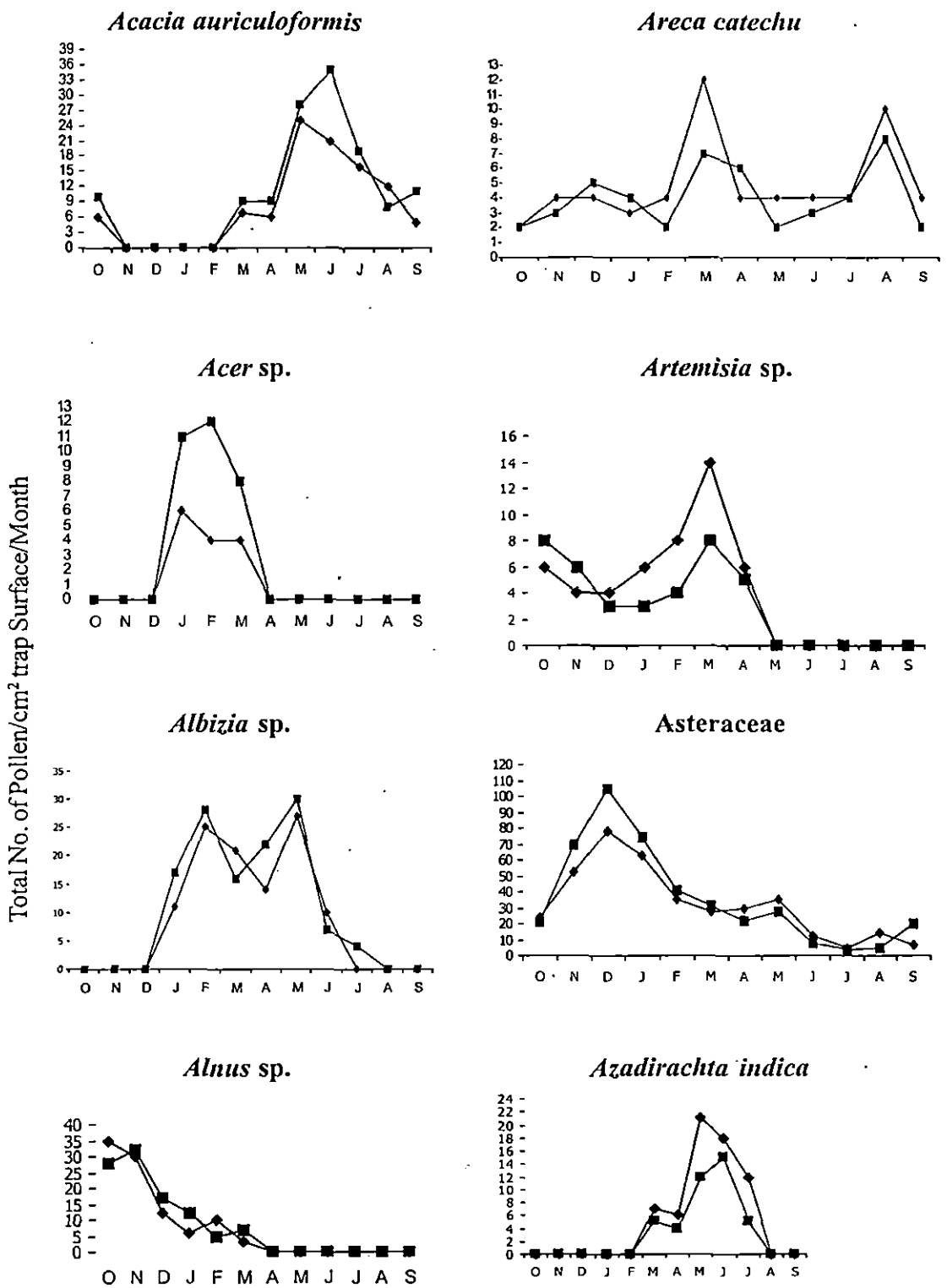
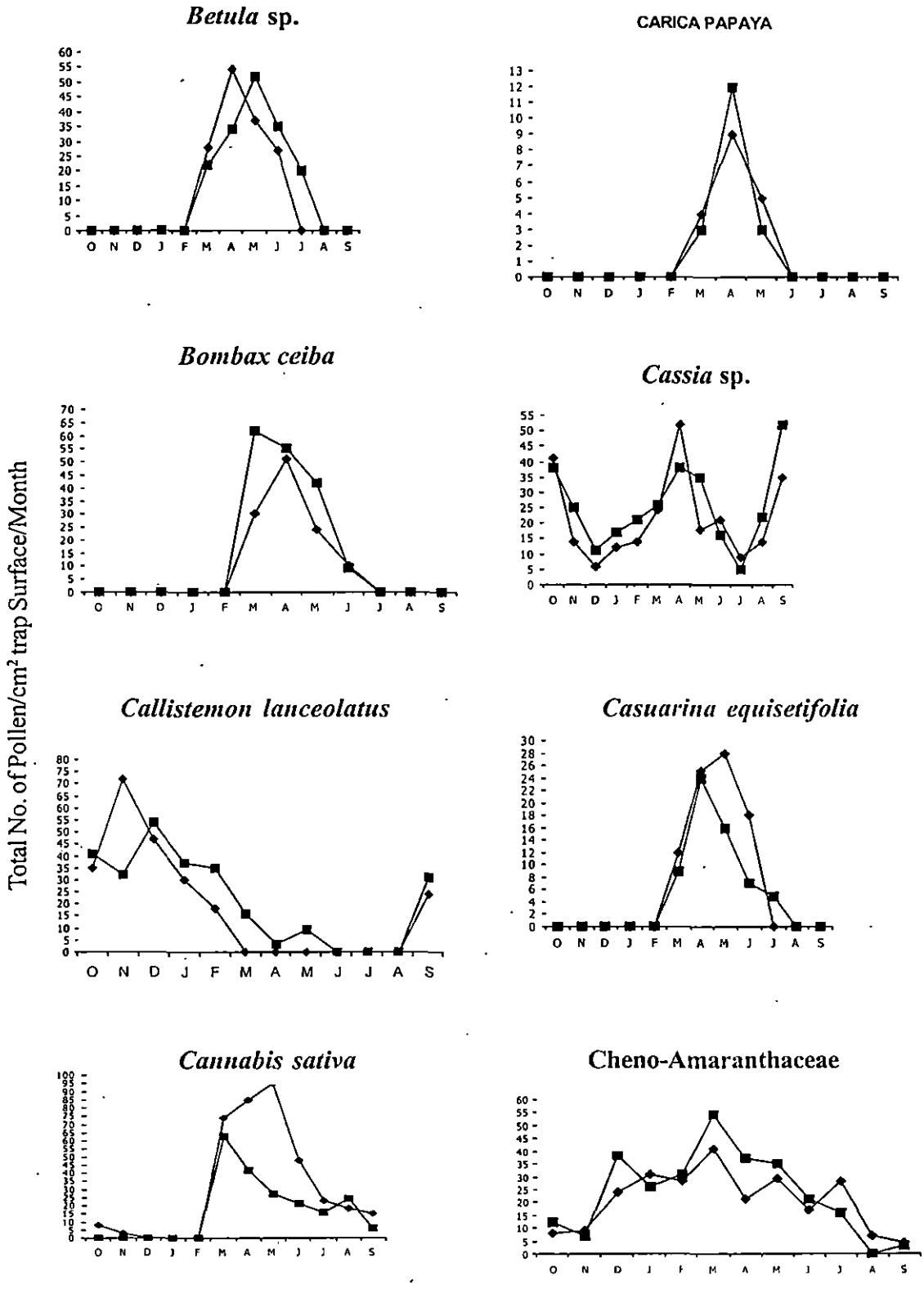
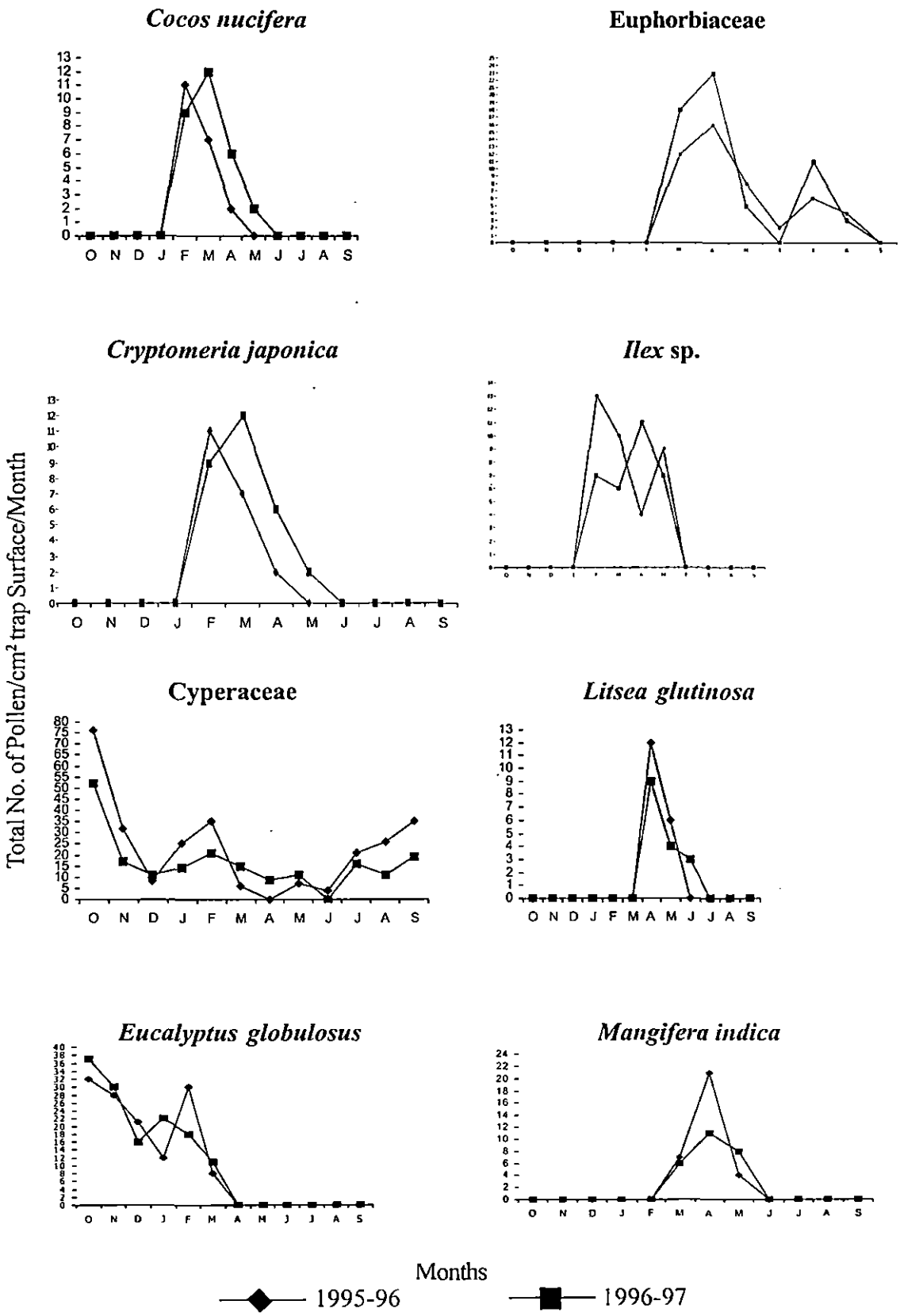
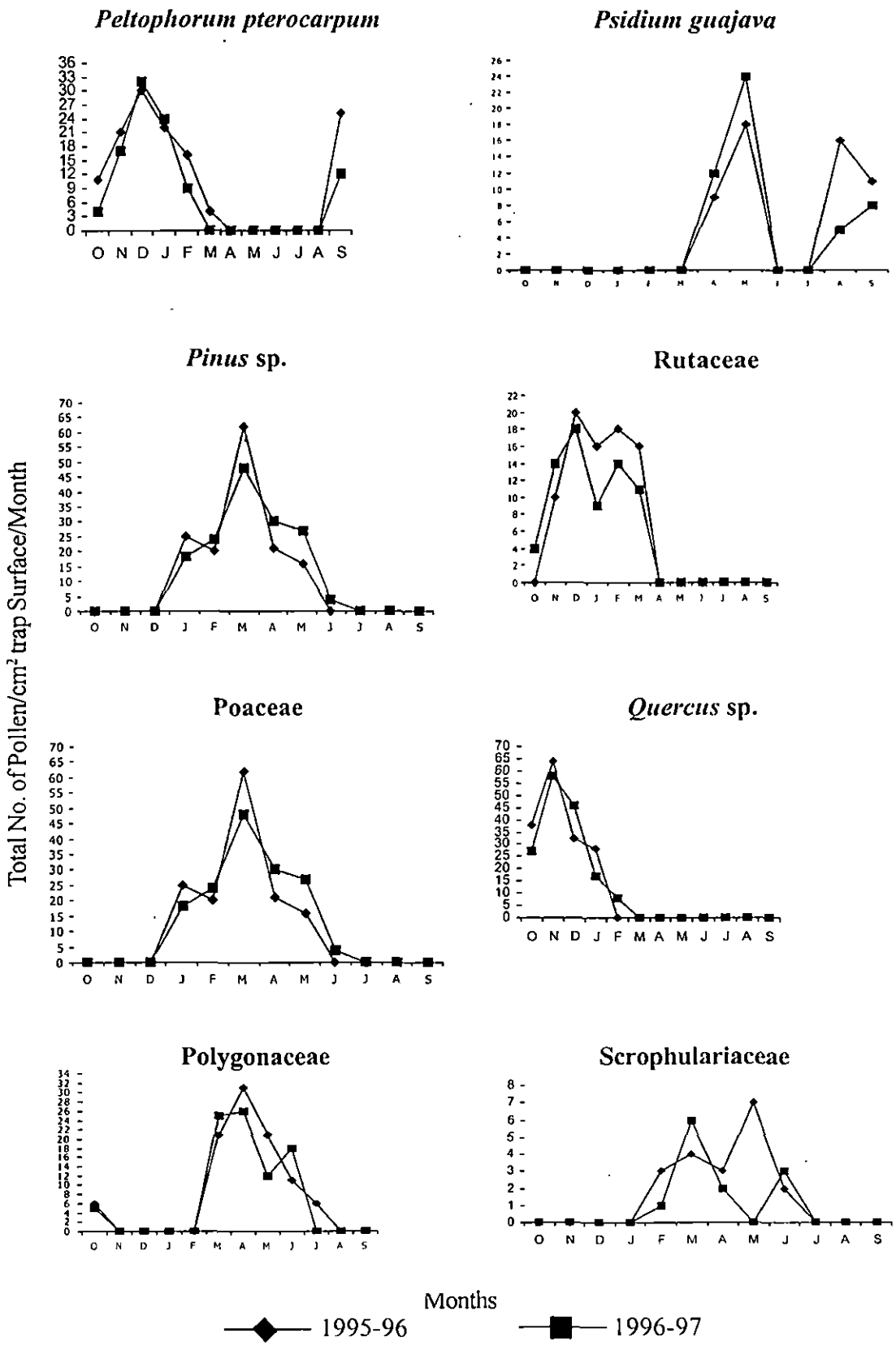
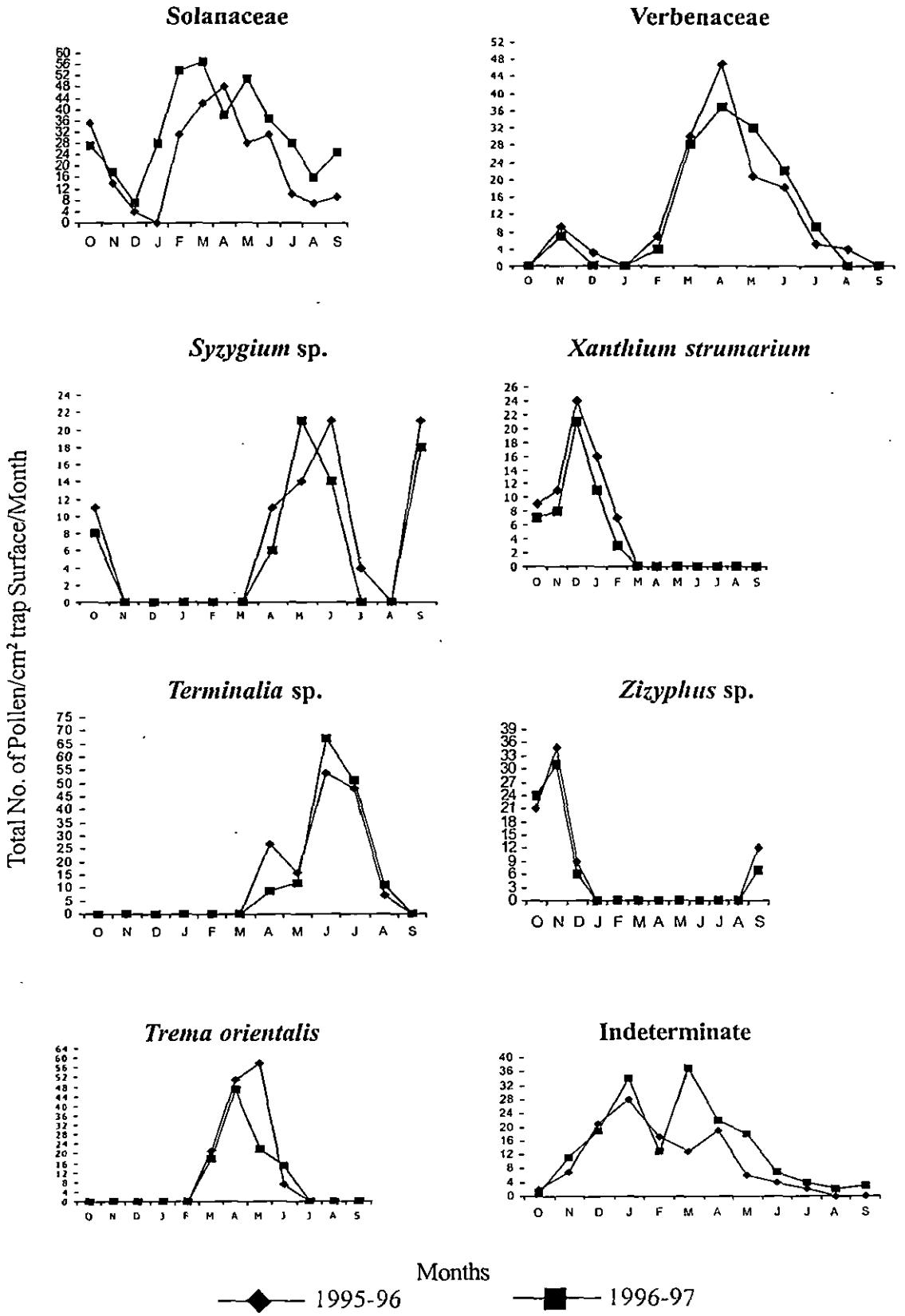


Fig. 3 : Seasonal variation of pollen types recorded in the air of Jalpaiguri by Gravitational Sampler


Betula sp.
CARICA PAPAYA
Bombax ceiba
Cassia sp.
Callistemon lanceolatus
Casuarina equisetifolia
Cannabis sativa
Cheno-Amaranthaceae
Total No. of Pollen/cm² trap Surface/Month
O N D J F M A M J J A S
Months
1995-96
1996-97


Cocos nucifera
Euphorbiaceae
Cryptomeria japonica
Ilex sp.
Cyperaceae
Litsea glutinosa
Eucalyptus globulosus
Mangifera indica
O N D J F M A M J J A S
Total No. of Pollen/cm² trap Surface/Month
Months
1995-96
1996-97


Peltophorum pterocarpum
Psidium guajava
Pinus sp.
Rutaceae
Poaceae
Quercus sp.
Polygonaceae
Scrophulariaceae
Total No. of Pollen/cm² trap Surface/Month
O N D J F M A M J J A S
Months
1995-96
1996-97


Solanaceae
Verbenaceae
Syzygium sp.
Xanthium strumarium
Terminalia sp.
Zizyphus sp.
Trema orientalis
Indeterminate
Total No. of Pollen/cm² trap Surface/Month
O N D J F M A M J J A S
Months
1995-96
1996-97