CHAPTER SIX

ROOSTING BEHAVIOUR

1. Pariah kite Roost :

Roost R-I :

This was the largest and the only permanant Pariah kite roost in Kolhapur city. All together 39 observations were made on this roost in 17 months during the investigations from 4 November, 1986 till 31 March 1988. Table 4 gives the values of the important climatic factors on the days when the observations were made.

In the general roosting behaviour of Pariah kite, the birds arrive on roost at the time of Sunset. On the roost R-I, during the pre-breeding season the kites arrived 10-15 minutes after sunset. In breeding season the first kite arrived 5-6 minutes before sunset and the same pattern continued in the post breeding season.

The total arrival time (time between the first and the last kite arriving on the roost) at R-I ranged from a maximum of 40 minutes (22-3-88) to a minimum of 19 minutes (20, 28-7-87). The average arrival time was estimated to be 29 minutes (SD $\pm$ 7.8 min). The average mean arrival time was more (19 min.) in the post breeding season than the other two seasons i.e. breeding season (15 min.) and pre-breeding (13 min.),(Table 4).

In the early breeding season i.e. October to December which coincides with the winter, the days are shorter and the kites arrive at the roost before sunset (Fig.19). As the day length increases from January onwards after the winter solstice the kites started ariving little late and in four observations in the month of January 1987 and 1988 the kites arrived late and

Table 4 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-I.

Sr. No.	Date of Observation	Average Temp (°C)	Relative Humidity (%)	Hours of Sunshine (h)	Wind Speed (km/h)	Rainfall in (mm)	Cloud condition	Day length	Time of Sunset	Arival time of first kite	Arival time of last kite	Time range	Mean time	Total No.of Kite
1.	4.11.86	25.9	71	3.6	-	0.0	-	11.23	5.58	5.56	6.23	27	13.5	145
2.	18.11.86	25.5	40	10.0	-	0.0	-	11.12	5.54	5.52	6.25	33	16.5	136
3.	2.12.86	23.4	37	-	-	0.0	-	11.04	5.55	5.54	6.26	32	16.0	125
4.	18.12.86	23.0	43	9.7	3.3	0.0	-	11.01	5.59	5.50	6.26	36	18.0	103
5.	13.1.87	21.8	45	9.9	4.5	0.0	-	11.06	6.15	6.20	6.40	20	10.0	086
6.	27.1.87	24.9	25	-	-	0.0	-	11.14	6.23	6.27	6.50	23	11.5	076
7.	10.2.87	24.1	56	9.5	3.3	0.0	-	11.24	6.29	6.25	6.58	33	16.5	062
8.	24.2.87	26.5	27	10.1	4.0	0.0	1	11.36	6.34	6.32	7.06	34	17.0	058
9.	10.3.87	26.9	42	11.2	4.9	0.0	1	11.52	6.39	6.30	7.09	39	19.5	062
10.	24.3.87	28.9	12	8.5	6.0	0.0	1	12.03	6.41	6.36	7.11	35	17.5	062
11.	7.4.87	32.3	51	10.0	7.8	0.0	1	12.17	6.44	6.40	7.14	34	17.0	091
12.	21.4.87	32.1	46	11.1	6.2	0.0	1	12.28	6.48	6.46	7.22	36	18.0	098
13.	19.5.87	29.7	88	9.3	5.8	0.0	1	12.49	6.54	6.58	7.20	22	11.0	120
14.	26.5.87	28.9	52	10.2	8.2	6.3	1	12.53	6.57	6.54	7.21	27	13.5	140
15.	9.6.87	25.2	75	0.7	7.7	1.2	2	12.57	7.01	6.57	7.22	25	12.5	200
16.	17.6.87	24.0	77	4.8	9.1	0.0	1	12.59	7.03	7.06	7.30	24	12.0	245
17.	14.7.87	25.2	73	3.4	8.7	6.2	1	12.55	7.06	7.18	7.38	20	10.0	270
18.	28.7.87	24.4	77	7.7	6.2	3.3	1	12.52	7.05	7.15	7.34	19	9.5	270
19.	28.7.87	25.0	75	6.8	6.2	0.6	1	12.40	7.03	7.19	7.38	19	9.5	284
20.	4.8.87	26.6	75	-	7.0	0.0	1	12.43	7.00	7.13	7.38	25	12.5	340

Table 4 (Contd..)

21. 11.8.87	25.1	77	6.0	7.8	1.3	1	12.38	6.57	6.58	7.31	33	16.5	358
22. 25.8.87	23.5	90	1.2	9.1	29.3	2	12.31	6.52	6.40	7.05	25	12.5	360
23. 2.9.87	24.4	79	8.1	8.0	9.2	1	12.22	6.41	6.38	7.07	29	14.5	350
24. 11.9.87	25.7	80	8.8	8.4	0.0	0	12.14	6.38	6.40	7.11	31	15.5	337
25. 22.9.87	27.0	70	5.7	6.0	0.6	1	12.00	6.26	6.44	6.58	16	8.0	280
26. 23.9.87	25.2	63	6.9	5.2	0.0	1	12.00	6.26	6.00	6.55	55	27.5	280
27. 1.10.87	24.5	52	7.2	2.6	0.0	0	11.54	6.20	6.22	6.50	28	14.0	250
28. 30.10.87	21.3	44	10.8	4.2	0.0	0	11.27	6.00	5.50	6.28	38	19.0	104
29. 3.11.87	25.5	43	9.9	4.2	0.0	0	11.23	5.58	5.52	6.22	30	15.0	098
30. 17.11.87	25.9	86	4.8	2.4	19.6	2	11.14	5.54	5.50	6.24	34	17.0	096
31. 1.12.87	23.7	31	10.7	3.0	0.0	0	11.04	5.54	5.53	6.24	31	15.5	082
32. 22.12.87	17.2	49	10.7	2.6	0.0	0	11.00	6.00	5.50	6.26	36	18.0	090
33. 3.1.88	21.1	73	9.0	4.0	0.0	0	11.02	6.07	6.16	6.36	20	10.0	086
34. 15.1.88	23.3	33	9.5	2.6	0.0	0	11.06	6.15	6.20	6.40	20	10.0	070
35. 22.2.88	26.6	25	-	-	0.0	0	11.36	6.35	6.38	7.06	28	14.0	095
36. 26.2.88	24.8	27	4.8	9.8	0.0	0	11.39	6.36	6.34	7.06	32	16.0	115
37. 14.3.88	24.8	76	1.5	5.4	0.0	0	11.54	6.39	6.30	7.05	35	17.5	095
38. 22.3.88	24.2	24	11.0	5.8	0.0	0	12.00	6.40	6.35	7.15	40	20.0	086
39. 31.3.88	26.7	35	8.1	7.0	0.0	0	12.07	6.47	6.38	7.10	30	15.0	086

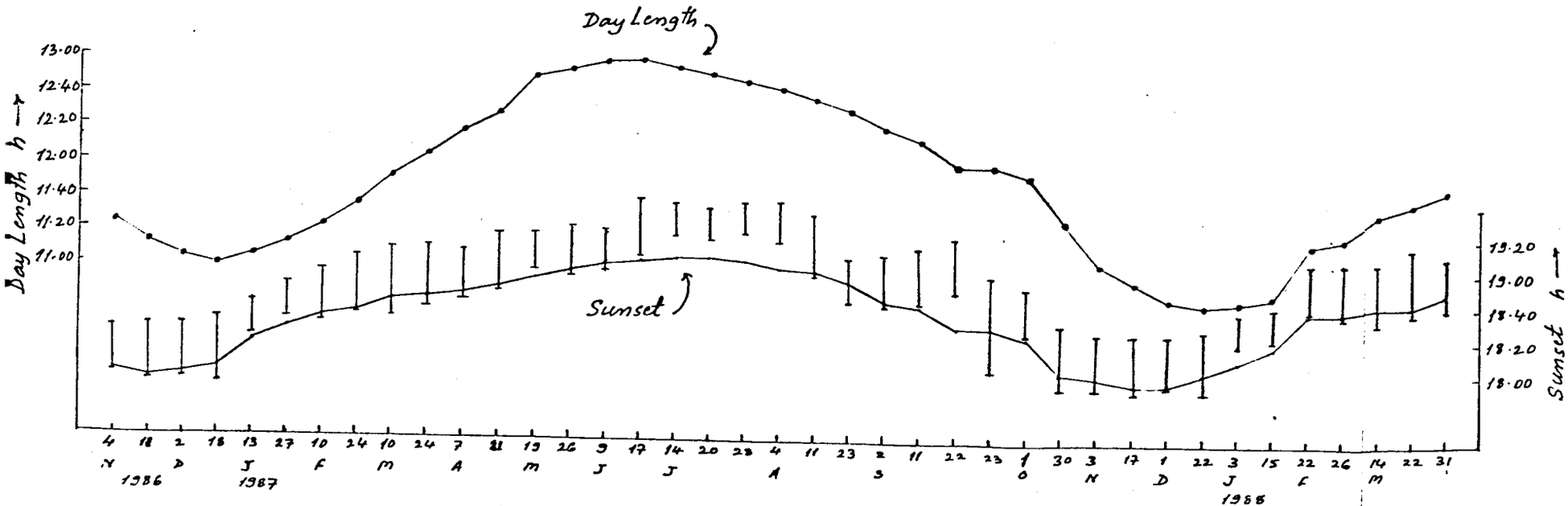

Fig: 19: Time of Sunset, Day Length and period of Assembly at robst R-I.

assembled in very short time recorded on the roost-I (20 min.) This uniform arrival pattern in January in two years was interesting. With the increase in day length after January till late May on most of the occassions kites arrive 2 - 9 minutes prior to sunset. The total time required for assembly during this season ranged from 20-40 minutes i.e. on 19-5-87 and 22-3-88 respectively.

As it could be noticed from Fig. 10 that there is direct correlation between the kite population in the city and monthly average precipitation. During the four monsoon months of June-September the first kite arrives after sunset and the duration of assembly is also less (Fig.19). The time range for the assembly was 19-33 minutes, the extremes were recorded on 27 and 28-7-87 and 11-8-87 respectively.

The interesting and unusual findings were observed on 23-9-1987 the day of partial solar eclipse. The kites behaved abnormally on this day which is attributed to the phenomenon of eclipse. The kites started arriving much earlier than normal for the season i.e. 26 minutes earlier before the sunset and it continued till 29 minutes after sunset. The total time of assembly was the longest i.e. 55 minutes, ever recorded at any roost in Kolhapur during the present observations. As compared to the observations made on the previous day i.e. 22-9-87, these results are still striking (Fig.19). Because all other climatic factors were uniform on both the days the peculiar roosting behaviour particularly time of arrival and assembly was solely due to the solar eclipse.

Table 5 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-II.

Sr. No.	Date of Observation	Average Temp(^{o}C)	Relative humidity (%)	Hours of Sunshine	Wind Speed	Cloud Condition	Day-length	Sun-set time	Arrival time of first kite	Arrival time of last kite	Time range	Mean time	Total No. of Kite
1.	19.11.86	25.4	42	10.4	-	0	11.12	5.54	6.00	6.16	16	8.0	30
2.	26.11.86	24.1	44	10.3	-	0	11.07	5.54	6.03	6.18	15	7.5	30
3.	12.12.86	24.9	41	-	-	0	11.04	5.57	6.03	6.21	19	9.5	24
4.	22.12.86	23.6	39	9.0	3.7	0	11.00	6.00	6.05	6.24	19	9.5	21
5.	14.1.87	23.5	45	7.9	4.0	1	11.05	6.15	6.18	6.32	14	7.0	20
6.	30.1.87	24.0	21	10.7	2.3	0	11.16	6.24	6.26	6.42	16	8.0	14
7.	4.2.87	23.6	21	4.2	3.7	0	11.19	6.26	6.28	6.44	16	8.0	13
8.	11.2.87	23.9	27	10.1	3.3	1	11.25	6.30	6.28	6.50	22	11.0	13
9.	16.10.87	23.7	43	9.4	3.5	2	11.41	6.09	6.00	6.35	35	17.0	65
10.	28.10.87	25.1	29	10.7	3.5	0	11.29	6.02	5.57	6.25	28	14.0	60
11.	4.11.87	26.3	55	2.2	5.2	2	11.23	5.58	6.05	6.20	15	7.5	18
12.	18.11.87	23.2	75	1.2	1.5	1	11.14	5.54	6.01	6.18	17	8.5	18

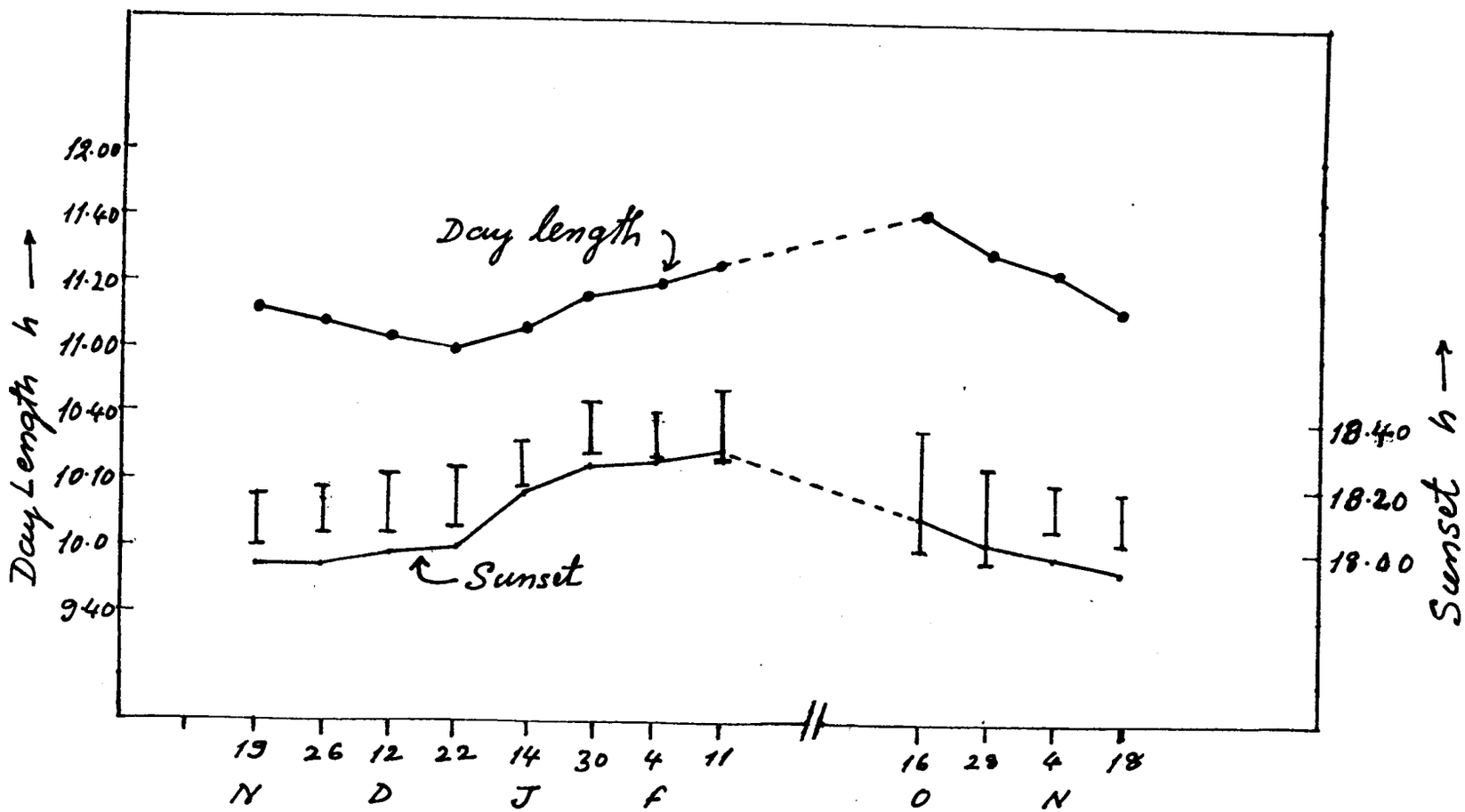

Fig 20: Time of Sunset, Day length and period of Assembly at P. kite roost R-II.

Roost R-II :

This was a temporary roost on which the kites were recorded in two spells in 12 readings, during the investigations (Fig.20). In the first phase (November 86 - February 87) the kites arrived at roost after the sunset and not before sunset as observed in the permanant roost R-I. In October 1987 the similar pattern was observed. There was some correlation with the sunset, day length and time of assembly. The average assembly time was 19 minutes (± 7.6 S.D.) and it ranged from a minimum of minutes on 14-1-87 to a maximum of 35 minutes on 16-10-87 (Table 5).

Roost R-III :

This was also a temporary roost as kites were absent during the period from late June till September 1987. Altogether 28 observations were made at this roost. During the breeding period i.e. October to January the kites arrived after the sunset in 1986 and 1987 (Fig.21). The average assembly time was 27 minutes (± 4.4 S.D.). The assembly time ranged from 16 to 34 minutes on 12-11-87 and 23-4-87 respectively. Apperantly there was no influence of the large number of kites occupying the roost on the time of arrival or assembly.

The mean time of arrival was maximum in the post breeding season i.e. 16 minutes, than in the breeding season (14 min.). The kites were absent on the roost during the pre breeding season (Table 6).

Median Time :

Median time of arrival (time at which 50 % of the total

Table 6 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-III.

Sr. No.	Date of Observation	Average Temp. °C	Relative Humidity (%)	Hours of Sunshine (h)	Wind Speed	Cloud condition	Day length	Time of Sunset	Time arrival of first kite	Time arrival of last kite	Time range	Mean time	Total No. of kite
1.	20.11.86	24.3	39	10.3	-	0	11.12	5.54	6.00	6.23	23	11.5	40
2.	27.11.86	23.9	41	10.5	-	0	11.06	5.54	6.00	6.26	26	13.0	38
3.	4.12.86	22.7	28	10.6	4.4	0	11.04	5.55	6.02	6.25	23	11.5	36
4.	20.12.86	22.5	37	10.8	2.8	0	11.00	6.00	6.05	6.33	28	14.0	32
5.	15.1.87	24.5	41	10.2	2.9	1	11.06	6.15	6.21	6.42	21	10.5	40
6.	31.1.87	25.2	31	10.5	3.4	0	11.16	6.24	6.29	6.52	23	11.5	36
7.	5.2.87	23.5	24	10.3	3.6	0	11.19	6.26	6.24	6.54	30	15.0	46
8.	12.2.87	24.7	25	10.4	4.2	0	11.26	6.30	6.27	6.59	32	16.0	52
9.	26.2.87	24.6	37	10.5	5.7	1	11.39	6.36	6.36	7.05	29	14.5	56
10.	11.3.87	26.9	42	10.7	6.5	0	11.55	6.40	6.40	7.12	32	16.0	58
11.	26.3.87	28.4	18	9.9	5.2	0	12.04	6.44	6.38	7.10	32	16.0	60
12.	9.4.87	29.2	39	9.6	5.4	0	12.24	6.45	6.45	7.17	32	16.0	54
13.	23.4.87	31.2	31	9.8	8.2	1	12.32	6.48	6.41	7.15	34	17.0	56
14.	14.5.87	28.6	36	6.5	5.9	1	12.45	6.52	6.48	7.17	29	14.5	60
15.	21.5.87	30.1	57	11.0	3.7	0	12.49	6.55	6.54	7.24	30	15.0	62
16.	28.5.87	29.1	37	8.6	7.4	0	12.55	6.57	6.57	7.26	29	14.5	64
17.	15.10.87	25.9	41	9.0	2.9	0	11.42	6.10	6.20	6.40	20	10.0	39
18.	29.10.87	25.3	38	11.1	2.8	0	11.29	6.02	6.16	6.40	24	11.0	52
19.	12.11.87	23.9	49	10.2	2.3	0	11.15	5.54	6.09	6.25	16	8.0	52

Table 6 : (Contd..)

20.	26.11.87	20.0	27	10.7	2.5	0	11.05	5.55	6.03	6.28	25	12.5	52
21.	3.12.87	23.9	32	10.4	2.7	0	11.04	5.55	6.01	6.27	26	13.0	42
22.	18.12.87	20.7	33	9.4	2.5	0	11.00	5.59	6.08	6.32	24	12.0	52
23.	1.1.88	21.1	47	9.4	3.6	0	11.01	6.07	6.13	6.38	25	12.5	38
24.	14.1.88	25.0	57	9.5	2.6	0	11.06	6.14	6.22	6.42	20	10.0	46
25.	25.2.88	25.8	27	10.1	4.5	0	11.38	6.35	6.35	7.05	30	15.0	60
26.	9.3.88	25.2	67	9.5	5.7	0	11.49	6.36	6.36	7.07	31	15.5	68
27.	16.3.88	27.2	32	7.8	4.0	0	11.55	6.39	6.37	7.06	29	14.5	70
28.	29.3.88	24.3	27	10.5	5.4	0	12.04	6.44	6.40	7.11	31	15.5	75

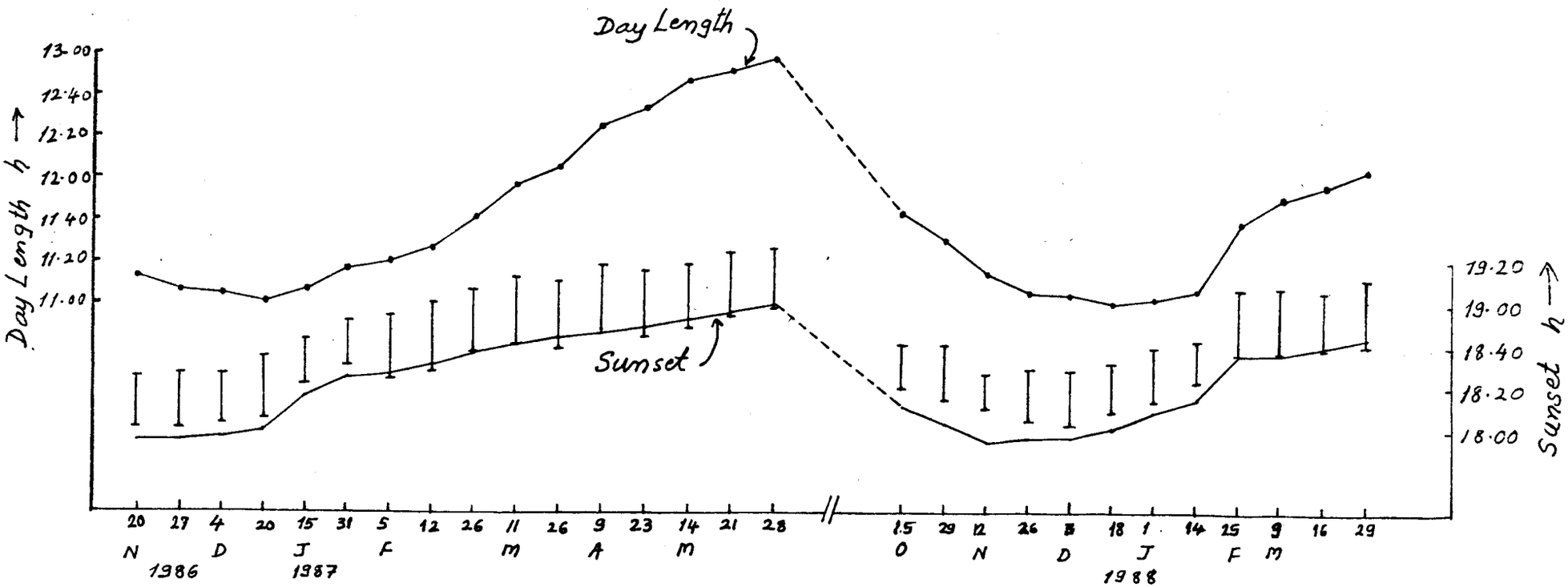

Fig : 21 : Time of Sunset, Day Length and period of Assembly at roost R-III

roosting population arrived) was studied only on this roost during the investigations as it consumed lot of time in detail observations. Together 13 observations were made to estimate the Median Time on the roost. Table 7 gives the median time of arrival of kites with reference to some important physical factors. The major finding in these studies was that in breeding season the Median time was calculated to be 12.5 minutes, where in post breeding season it was 17.5 minutes. This suggests that during the breeding season most of the kites arrive earlier on the roost as contrast to post breeding season by 5 minutes. The table 7 reveals that the kites arrived at the roost much after sunset than in the post breeding season (Fig. 22).

The Figures 22 also gives the variations in the time of arrival at 5 minutes interval in relation to the time of sunset on 13 days of the observations. In the breeding season the pattern of kite arrival was of "negetively skew" i.e. kite number rises slowly and reaches the maximum values and decreases rapidly i.e. on 20-11-86, 4-12-86, 15-1-87, 15-10-87, 12-11-87, 3-12-87 and 14-1-88. (Fig.22).

In the post breeding season it is of the nature of 'positive skew' i.e. the kites increased rapidly and reached the peak and the number decreased slowly on 26-2-87, 26-3-87, 9-4-87, 14-5-87, 25-2-88, 26-3-88. In other words birds arrive at the roost in an increasing tempo in the post breeding season and than declined abruptly (Fig.22).

Table 7 : Roosting schedule of Pariah kite at roost R-III in relation to the Median Time (50 % of the total population arrival calculated at five minute interval observations) with reference to some important physical factors.

Sr. No.	Date of Observation	Average Temp.(°C)	Relative humidity (%)	Hours of sunshine (h)	Wind speed (km/h)	Cloud condition	Day length	Sunset time	Median time	Time between Median & sunset time	Total No.of kite
1.	20.11.86	24.3	39	10.3	-	0	11.12	5.54	12.2	18	40
2.	4.12.86	22.7	28	10.6	4.4	0	11.04	5.55	15.0	22	36
3.	15.1.87	24.5	41	10.2	2.9	1	11.05	6.15	12.0	18	40
4.	26.2.87	24.6	37	10.5	5.7	1	11.39	6.36	15.6	16	56
5.	26.3.87	28.4	18	9.9	5.2	0	12.04	6.44	19.4	13	60
6.	9.4.87	29.2	39	9.6	5.4	0	12.24	6.45	15.0	15	54
7.	14.5.87	28.6	36	6.5	5.9	1	12.45	6.52	18.4	14	60
8.	15.10.87	25.9	41	9.0	2.9	0	11.42	6.10	7.8	18	39
9.	12.11.87	23.9	49	10.2	2.3	0	11.15	5.54	8.3	23	52
10.	3.12.87	22.9	32	10.4	2.7	0	11.04	5.55	15.8	22	42
11.	14.1.88	25.0	57	9.5	2.6	0	11.06	6.14	11.7	20	46
12.	25.2.88	25.8	27	10.1	4.5	0	11.38	6.35	14.0	14	60
13.	16.3.88	27.2	32	7.8	4.0	0	11.55	6.39	19.2	12	70

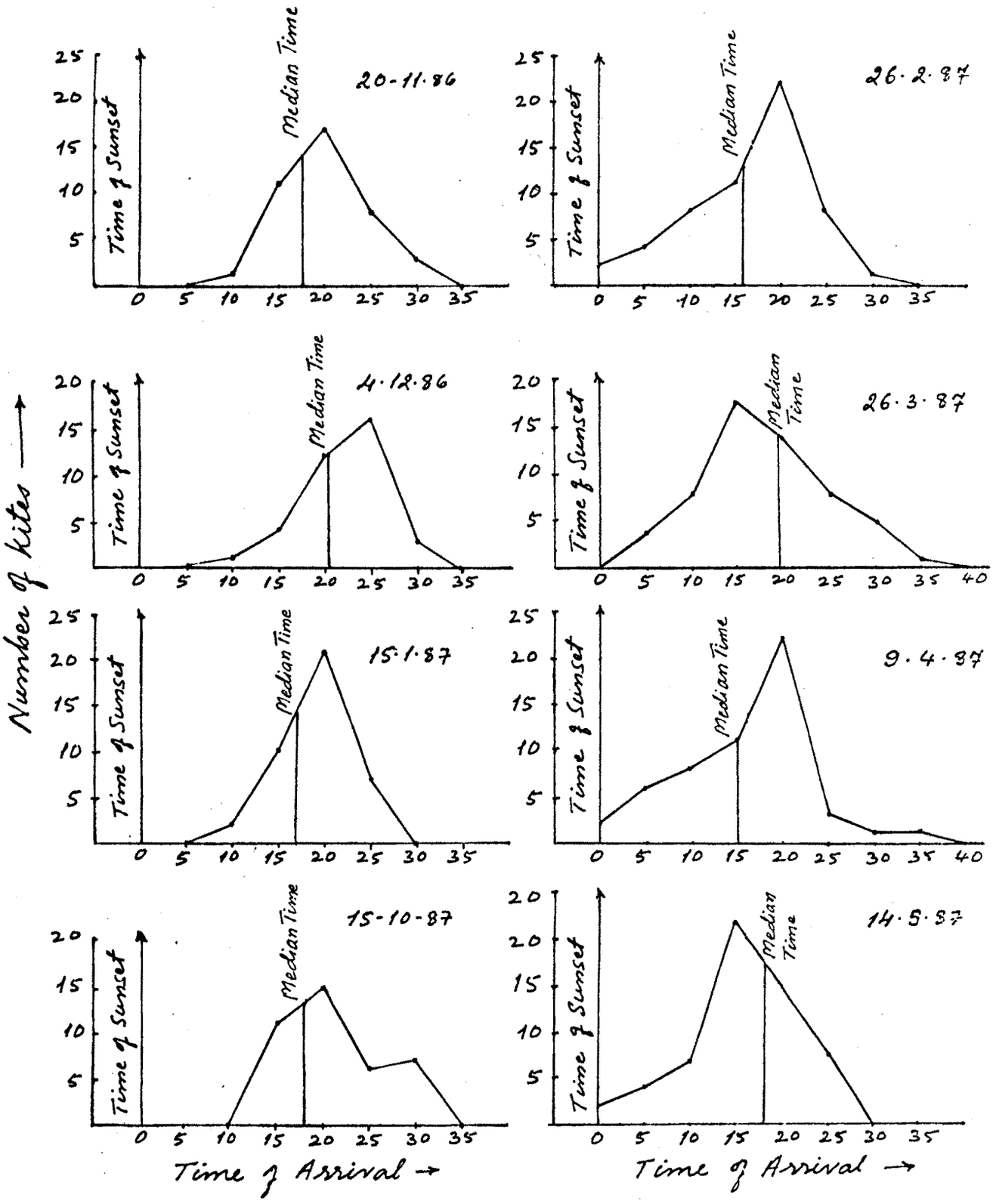

Fig 22: Variations in the time of arrival, at 5 minutes interval, at Roost R-III in Relation to the time of Sunset during November 1986 – March 1988.

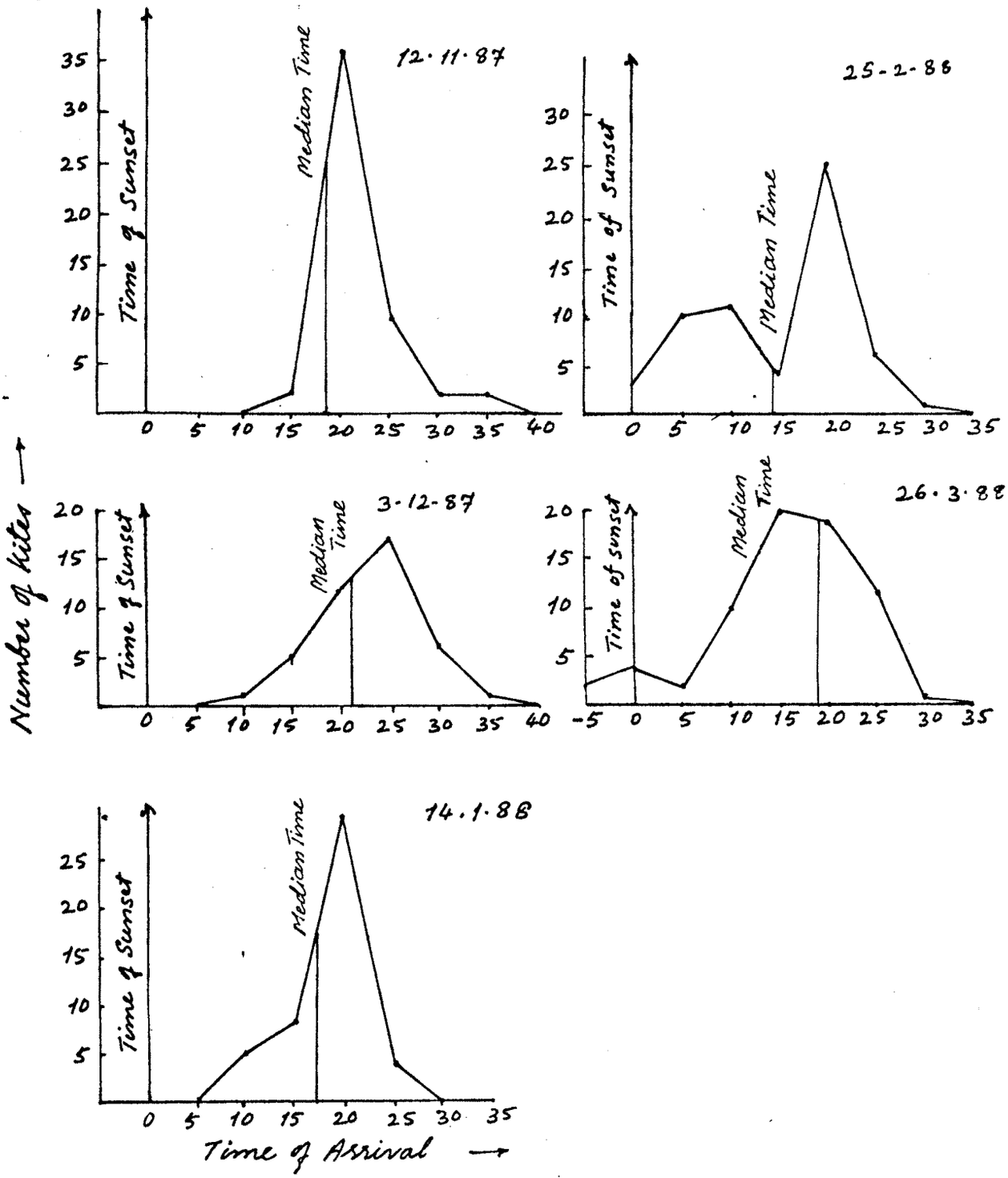

Fig 22: Continued.

Roost R-IV :

This was a temporary roost with a moderate population of kites (n=20). The birds were recorded on 12 occassions on the roost in two spells i.e. during March-May 1987 and December-March 1988. The roost had kites during post breeding season in 1987 and breeding and early post breeding season in 1988. There was a uniform pattern of the arrival of kites in post breeding month of March in both the years (Fig.23), where the kites arrived 5.7 minutes before sunset. In other months the arrival was late as well as the duration of assembly was short. In the post breeding season the mean arrival time was more i.e. 15 minutes as compared to the value in breeding season i.e. 13 minutes (Table 8). The average arrival time on the roost was 25 minutes (± 6.6 S.D) and it ranged from a minimum of 14 minutes (1-12-87) to a maximum of 38 minutes (25-3-88). ~~In the post breeding season~~

Roost R-V :

This roost being a temporary one was occupied for 14 months during the study period where 15 observations made on the roost. The kites were almost absent during the pre-breeding season or monsoon months, only 4 kites were observed on the roost in July and August. Table 9 gives the values of important climatic factors on the days of observations at roost R-V. The period of assembly of kites ranged from 15 minutes (17-1-88) to 35 minutes (24-4-87), the average arrival time recorded the roost was 26 minutes. The values of roosting in the breeding season in the years 1987 and 1988 are almost uniform (Fig. 24).

Table 8 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-IV.

Sr. No.	Date of Observation	Average Temp.(°C)	Relative humidity (%)	Hours of Sunshine (h)	Wind speed (km/h)	Cloud Condition	Day length	Sunset time	Arrival time of first kite	Arrival time of last kite	Time range	Mean time	Total No. of kite
1.	17.3.87	24.7	35	-	7.4	0	11.56	6.40	6.33	7.02	29	14.5	12
2.	25.3.87	28.7	25	10.3	7.0	1	12.04	6.41	6.32	7.00	28	14.0	18
3.	1.4.87	29.5	47	10.0	5.2	0	12.13	6.43	6.49	7.10	21	10.5	12
4.	15.4.87	31.3	47	11.1	5.5	1	12.24	6.46	6.51	7.20	29	14.5	11
5.	13.5.87	29.8	72	8.0	5.6	1	12.43	6.52	6.50	7.16	26	13.0	12.
6.	20.5.87	30.1	39	8.9	6.9	1	12.49	6.54	6.50	7.10	20	10.0	12
7.	2.12.87	23.5	33	10.2	3.1	0	11.05	5.55	6.10	6.24	14	7.0	20
8.	16.12.87	22.0	43	10.2	2.1	0	11.00	5.58	6.04	6.20	16	8.0	20
9.	2.1.88	21.1	43	9.0	2.6	0	11.02	6.08	6.14	6.36	22	11.0	16
10.	16.1.88	24.0	36	10.5	3.9	0	11.06	6.15	6.16	6.40	24	12.0	16
11.	23.2.88	25.7	38	10.4	7.3	0	11.24	6.35	6.30	7.00	30	15.0	23
12.	25.3.88	24.0	32	9.5	7.6	0	11.59	6.41	6.30	7.08	38	19.0	20

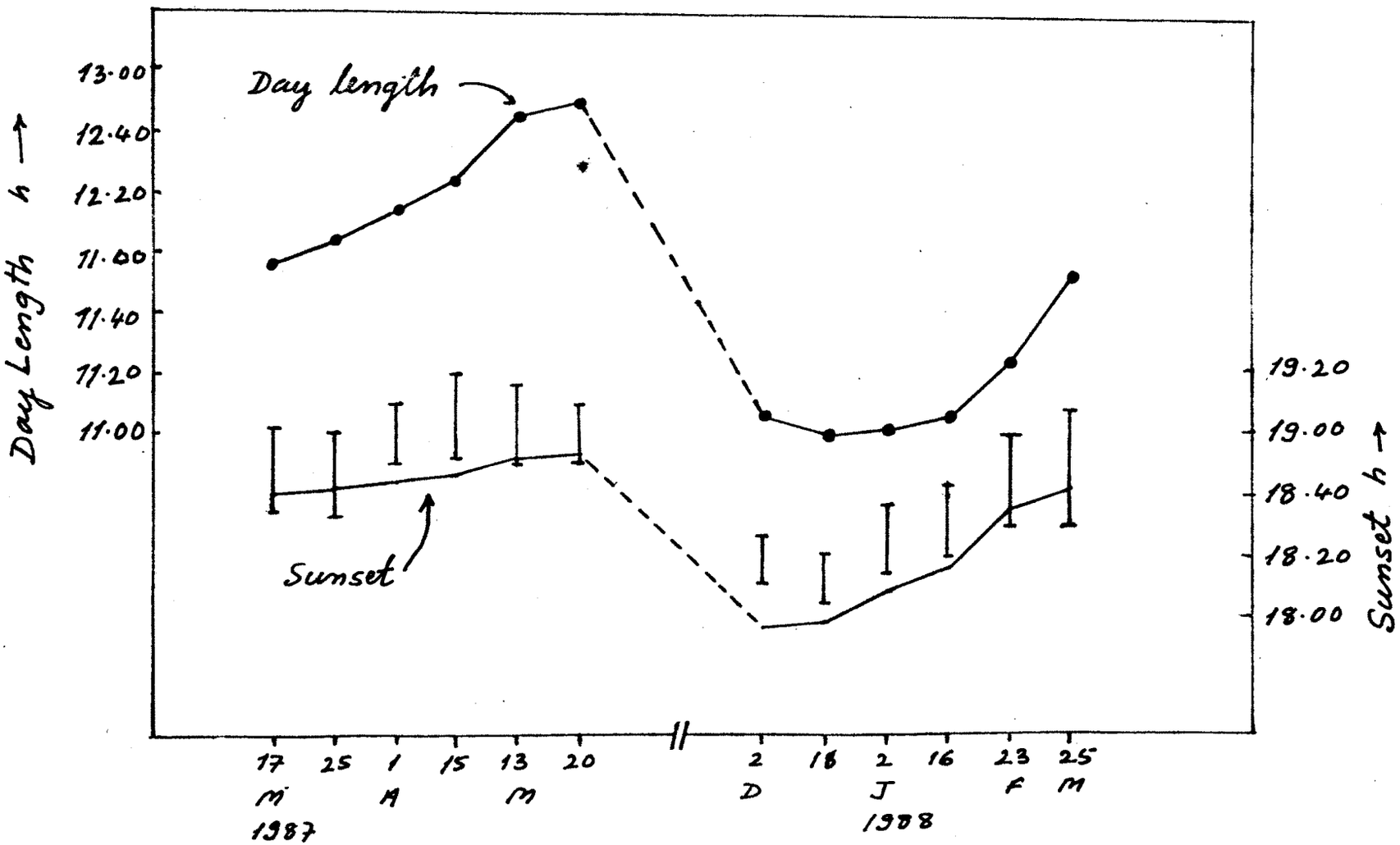

Fig 23: Time of Sunset, Day Length and period of Assembly at roost A-IV.

Table 9 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-V.

Sr. No.	Date of Observation	Average Temp.(°C)	Relative humidity (%)	Hours of Sunshine (h)	Wind speed (km/h)	Cloud Condition	Day-length	Sunset time	Arrival time of first kite	Arrival time of last kite	Time range	Mean time	Total No of kite
1.	26.12.86	22.4	38	10.0	3.3	0	11.00	6.03	6.00	6.26	26	13.0	15
2.	20.1.87	24.5	39	9.1	3.6	0	11.05	6.15	6.10	6.32	22	11.0	12
3.	17.2.87	23.2	39	10.5	5.1	0	11.31	6.33	6.30	6.58	28	14.0	12
4.	4.3.87	27.6	31	9.0	5.6	0	11.40	6.36	6.30	7.00	30	15.0	24
5.	12.3.87	23.7	23	-	-	0	11.52	6.40	6.35	7.06	31	15.5	24
6.	8.4.87	29.1	35	-	-	0	12.20	6.45	6.40	7.10	30	15.0	20
7.	24.4.87	30.2	56	10.2	6.5	0	12.32	6.48	6.40	7.15	35	17.5	20
8.	27.5.87	28.9	37	8.6	7.4	0	12.53	6.57	6.54	7.14	20	10.0	22
9.	23.6.87	27.7	59	7.0	8.9	1	13.00	7.05	6.55	7.18	23	11.5	09
10.	15.9.87	26.8	63	9.3	7.0	0	12.07	6.32	6.32	6.50	18	9.0	12
11.	19.12.87	22.4	44	9.5	-	0	11.00	5.58	5.54	6.20	26	13.0	16
12.	17.1.88	23.6	34	10.4	3.4	0	11.06	6.15	6.14	6.29	15	7.5	10
13.	20.2.88	25.7	39	8.5	6.0	0	11.36	6.35	6.30	7.00	30	15.0	14
14.	17.3.88	27.0	29	9.0	5.5	0	11.56	6.40	6.35	7.05	30	15.0	22
15.	27.3.88	22.7	25	10.2	7.2	0	12.04	6.42	6.35	7.07	32	16.0	22

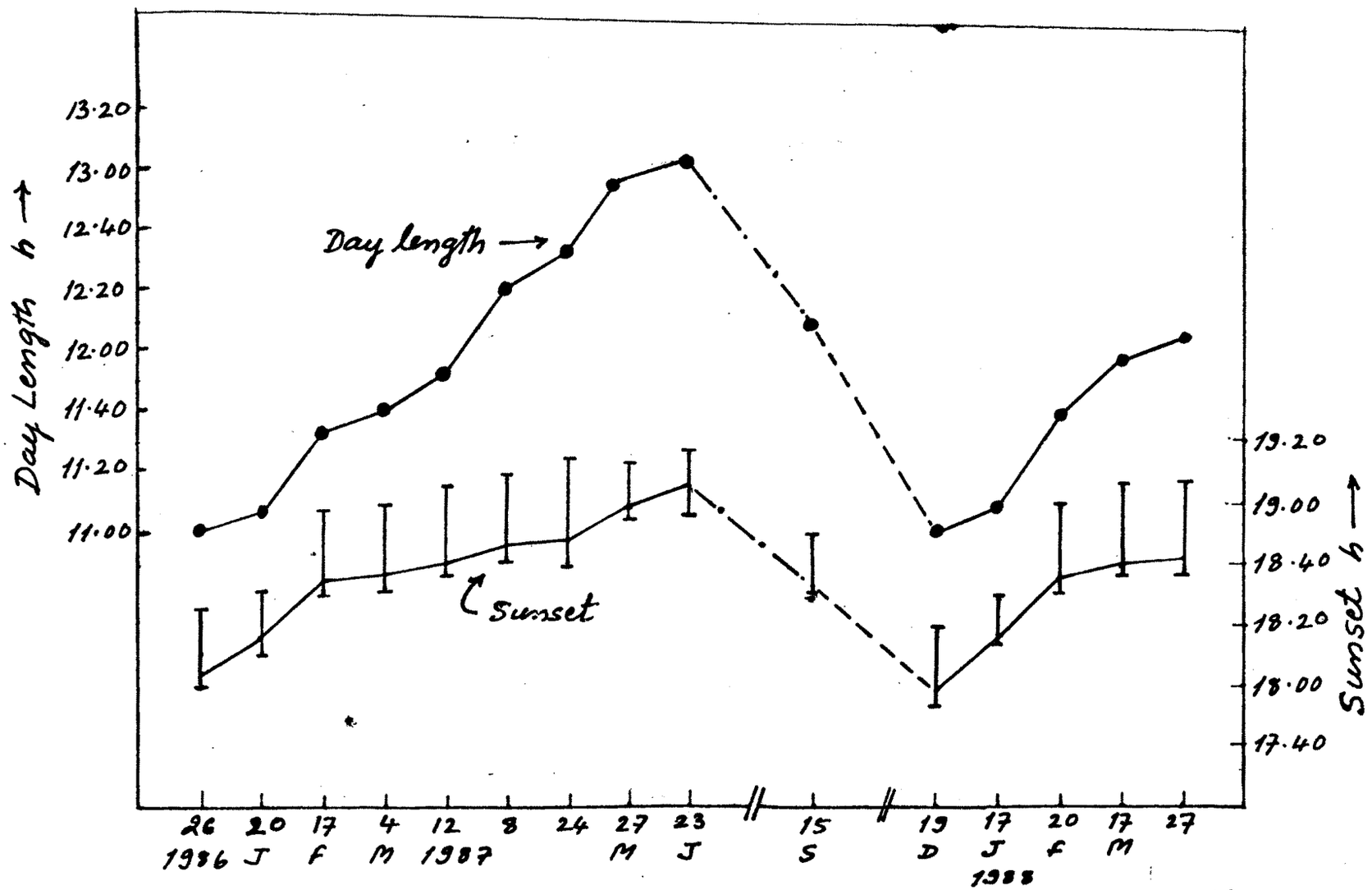

Fig 24: Time of Sunset, Day Length and period of Assembly at roost R-V.

In all the observations the striking features was the early arrival of kites before sunset and longer assembly time. There was not much difference in the mean time of arrival (12 min. minimum and 13 min. maximum) in the breeding season and post breeding season. This roost appeared to be the major temporary roost as this was the only temporary roost to have kite population during the monsoon months July-September in 1987.

Roost R-VII :

Out of the last four temporary roost i.e. R-VI, R-VII, R-VIII and R-IX only the roost R-VII was studied as a representative of the short duration roosts. Roosts R-VI, R-VII and R-VIII were seen only for three months. The roosts had a monthly average population of 12-15, R-VII 30-35 and R-VIII - 30-45 during the three months of observation. Five observations were made at R-VII in the breeding season where there was no much difference in the assembly values of maximum and minimum, which were around 21 minutes (Table 10, fig. 25).

Table 10 : Roosting schedule of Pariah kite in relation to some climatic factors at roost R-VII.

Sr. No.	Date of Observation	Average Temp.	Relative humidity	Hours of Sunshine	Wind speed	Cloud condition	Day-length	Sunset time	Arrival time of first kite	Arrival time of last kite	Time range	Mean time	Total No. of kite
1.	28.11.87	24.0	42	10.5	-	0	11.04	5.54	6.00	6.21	21	10.5	37
2.	4.12.87	19.3	39	10.4	2.5	0	11.03	5.55	6.04	6.25	21	10.5	32
3.	28.12.87	17.7	48	7.5	4.5	0	11.01	6.05	6.10	6.30	20	10.0	36
4.	7.1.88	19.2	43	-	-	0	11.00	6.07	6.15	6.35	20	10.0	32
5.	18.1.88	23.6	34	10.4	9.4	0	11.06	6.15	6.22	6.42	20	10.0	28

R-VII

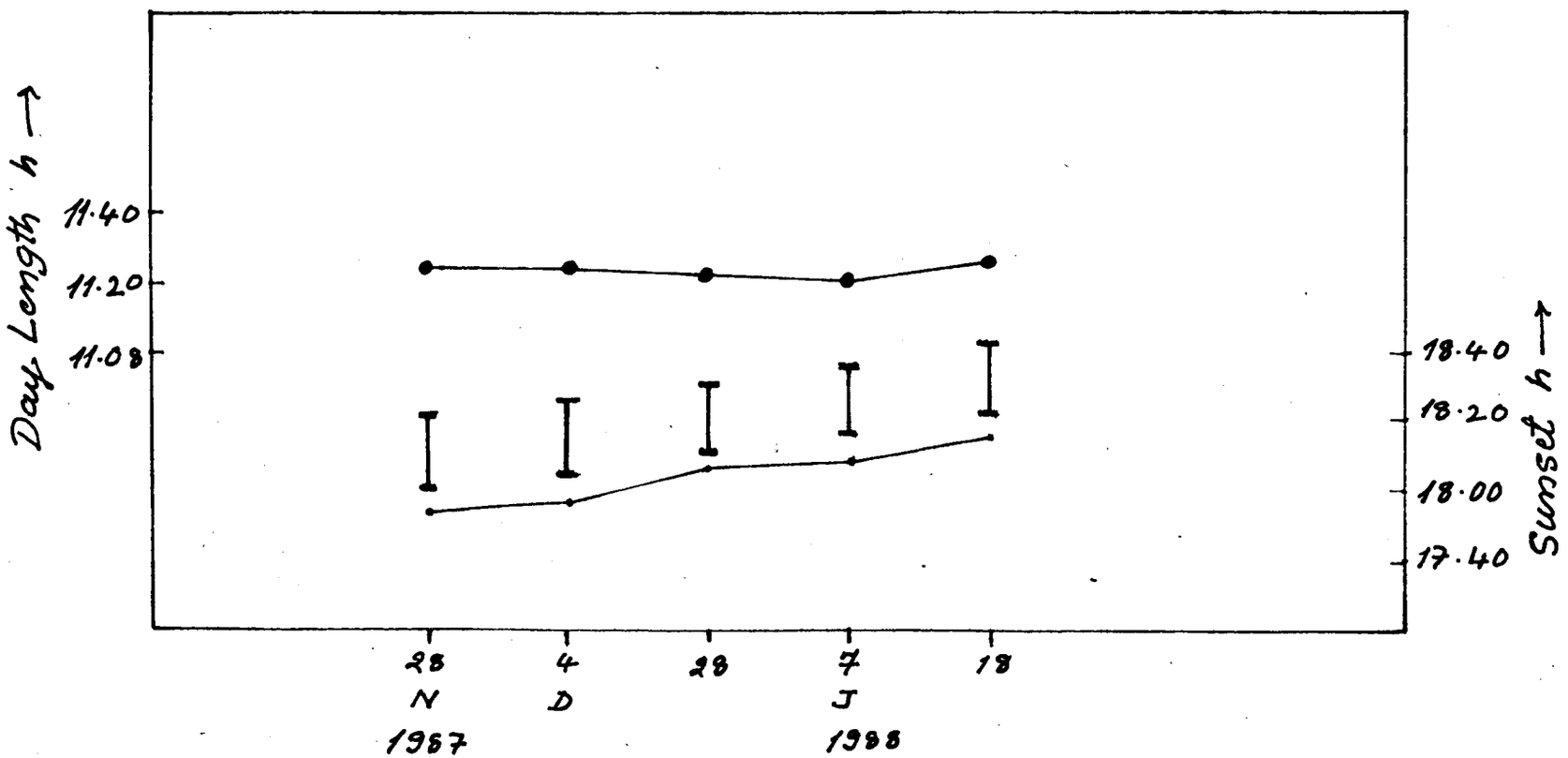

Fig 25: Time of Sunset, Day Length and period of Assembly at roost R-VII.

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2. Mean Time and Climatic Factors :

The mean time of arrival of P. kite and its correlation with average temperature, relative humidity, hours of Sunshine, wind speed, day length and sunset time were compared for the six roosts studied. Table 11 gives the correlation factors, number of observations and one tailed significance for all the six roosts and the six climatic parameters.

There was well correlation established between some of the climatic factors and monthly average number of Pariah kite in Kolhapur city (Table 3). However the correlation between the eight climatic factors and mean time of arrival at different roosts could not be established as there was much erratic relationships observed. This is mainly because of the complex nature of roosting behaviour of kites, specific location and characteristics of the roosts, inter changing of kite populations from one roost to another and changing local climatic variables.

It was revealed by Table 3 that there is no correlation between the average temperature values and the monthly kite populations. Similarly there was no correlation between mean time of arrival of kites and average temperature values at any roost except at R-III where moderate correlation (r=.44, P=0.07) was noticed.

Roost R-I showed negative correlation with relative humidity (r=-0.40, P=0.005). But in case of rest of the roosts no correlation could be established. In case of hours of Sunshine again R-I and R-VII showed marginal correlation i.e.

Table 11 : Correlation between Mean Time of arrival of Kites at different roosts and important climatic factors.

Sr. No.	Climatic factor	R-I	R-II	R-III	R-IV	R-V	R-VII
1.	Average temperature	r = 0.0688	0.0169	0.4481	0.1874	0.1309	0.3402
		n = 37	12	28	12	15	5
		p = 0.3429	0.4747	0.0720	0.0972	0.3210	0.2876
2.	Relative humidity	r = -0.4093	-0.0827	-0.2834	-0.1098	-0.3046	-0.1237
		n = 37	12	28	12	15	5
		p = 0.0059	0.4922	0.6720	0.1278	0.1349	0.4215
3.	Hours of sunshine	r = 0.4214	0.2299	0.0717	-0.0572	0.1481	0.5902
		n = 33	11	28	11	13	4
		p = 0.0073	0.1929	0.3585	0.4740	0.3146	0.2049
4.	Wind-speed	r = -0.1991	0.0121	0.7214	0.7509	0.1592	-0.7237
		n = 32	9	26	12	12	3
		p = 0.1373	0.4277	0.0000	0.0022	0.3106	0.2424
5.	Day-length	r = -0.2868	0.0051	0.5445	0.2323	0.4844	0.0417
		n = 37	12	28	12	15	5
		p = 0.0426	0.5611	0.0014	0.1565	0.0124	0.4735
6.	Sunset time	r = 0.1885	0.2727	0.6766	0.6727	-0.0123	-0.9922
		n = 37	12	28	12	15	5
		p = 0.1320	0.3324	0.0000	0.0012	0.4826	0.0004

r=0.42, P=0.007 and r=0.59, P=.20, other four roosts failed to show any significance. In case of wind speed with the correlation of mean time of arrival contrast values were obtained. Roosts R-III and R-IV showed well and positive correlations of r=0.72, P=0.00 and r=0.75, P.0.00, respectively. In contrast to this at R-VII the correlation was negative and significant i.e.(r=-0.72, P=0.24). Apparantly high wind speed and more time spent by kites in high sky for manouvre had some correlation as noticed at the roosts R-III and R-IV.

Also in case of correlation between day length and the mean time of arrival of kite at various roosts there was no uniform pattern. Roost- R-I recorded negative but insignificant correlation and R-II and R-IV had no correlation. Only at roosts R-III and R-V there was positive and moderate correlations i.e. r=0.54, P=0.00 and r=0.48, P=0.01 respectively. The correlation with sunset values had well and positive correlation at roost R-III and R-IV both (r=0.67, P=0.00). Roost R-VIII expressed a significant but negative correlation (r=-0.99, P=0.00) with sunset time.

From the above observations it is revealed that R-III had maximum positive correlations, i.e. four out of the six climatic factors, as compared to other roosts. Roost R-IV had two well positive correlations whereas R-II and R-V failed to establish any correlation. In case of the permanant roost R-I except in hours of sunshine there was no correlation. The well correlations observed, in three parameters, at R-VII could not be considered seriously as they were based on comparatively less number of samples. Therefore the decision taken to study the

median time at R-III was found to be correct.

When the six climatic factors were correlated with Median Time at the roost R-III, very good results were obtained. Table 12 shows the correlation between Median time and the six parameters of average temperature, relative humidity, hours of sunshine, wind speed, day length and sunset time studied in 13 observations.

Average temperature was though moderatly, positively correlated (r=0.45, P=0.05). Other parameters positively and well correlated with the median time were wind speed (r=0.69, P=0.00), day length (r=0.53, P=0.02) and moderatly correlated sunset time i.e. (r=0.47, P=0.05). Relative humidity was though significant it was negatively correlated (r=-0.68, P=0.00). Similarly hours of sunshine had negative relationship (r=-0.35, P=0.11) but it was not significantly correlated.

In other wards the median time of arrival of kites at the roost R-III increased slightly with the increase in the average temperatures in the study area. However there was increase correlation with the change in relative humidity, viz. the median time increase with decrease in humidity and vice versa. Hours of Sunshine could not establish any correlation with the median time of arrival as there was no apparant relation. With the stronger wind velocity at the roost site the median time of arrival also increased proportionately as in the afternoons the thermals had maximum impact on kite flight which could drift them away resulting in the arrival time at the roost.

Table 12 : Correleation between Median Time and Six parameters of roost R-III

Sr. No.	Climatic factors	Correlation (r)	Sample size (n)	One-tailed significance (p)
1.	Average Temperature	0.4554	13	0.0589
2.	Relative Humidity	-0.6807	13	0.0052
3.	Hours of Sunshine	-0.3567	13	0.1158
4.	Wind Speed	0.6960	12	0.0060
5.	Day-length	0.5386	13	0.0288
6.	Sunset time	0.4702	13	0.0525

The length of day also contributes substantially in the time of arrival on the roost. With increase in day length the median time also increases, particularly in the post breeding season when the days are long and median time maximum. Since usually day length and sunset time are directly correlated there was a direct and positive relation between the sun set and the median time of arrival of kites at R-III

3. Pre-Roosting Display :

After spending the day time in search of food and other activities in a wide area the kites start returning to the communal roost in the evening, normally about 30 to 45 minutes before sunset. The kites arrive from all directions and gather above the roost in flocks to manoeuvre in the sky for some time before settleing down. Some times, the kites which had already roosted suddenly took off from the roost without making any noise and took a complete round over the roost, flew in circular fashion for some time and then again settle down on the roosting trees.

The permanant roost R-I exhibited specific behaviour of kites during the monsoon months which was different than the one observed during the rest of the period. The size of the gathering of the birds being large in this season flocks contained around 40 birds or more. The assemblage of these birds moved to the north side of the roost, perhaps to counter the south west wind, before forming one or two large groups. The large flocks in tight formations manoeuvred above the roost for five to ten minutes before sunset and then suddenly

settled down at the roost.

In contrast to this in other seasons the bird gathering was in much loose formations even on the permanant roost R-I.

Second major difference observed was in the pre-roosting display in the late monsoon months. The intensity of these displays was accute in August and in early September. The displaying flocks comprising of 50 - 300 birds was not uncommon. The flocks ascended high in the sky by taking large circles for some time and than descending slowly over the roost before ascending again to repeat the performance (Plate 8). This activity continued for number of times and at the end just after sunset all the kites settle down slowly at the roost.

Though aerial displays were also observed at the roost R-II and R-IV for many months they differed in nature and magnitude from the one observed at R-I. At roost R-III majority of the birds observed were either solitary or in pairs on many occassions but more paired birds were recorded during November and December. The aerial displays were much away from the roost site R-III but in case of R-V they were seen very close during all observations (Plate 9.a.). Even 10 - 15 minutes after sunset in September aerial displays were seen at roost R-V. When some of the birds were settled down on R-V while others flew to R-III or other roost.

There was a feeding site located near the roosts R-VI, R-VII and R-VIII. The kites were seen havouring on the feeding ground during daytime but not on the nearby roost. When the birds took of from the feeding site either they

Plate 8 : Large pre-roosting assemblage of Pariah kites exhibiting communal display at hight.

Plate 9 : a) Pre-roosting display at roost R-V after Sunset.

Plate 9 : b) Pre-roosting assemblages at Subhashnagar near roost R-VI.

Plate 10 : Whitebacked Vulture Gyps bengalensis roost near Ramanandnagar.

directly settled at the roost or went beyond to other roosts.

On many occassions the kites were observed sitting on ground around Rajaram tank at times in company with Scavanger Vultures. In the afternoon hours kites were seen drinking water at Rajaram tank and in ponds near Subhashnagar. Another interesting feature observed in the pre-roosting behaviour in kites was they collected on nearby trees or grounds in large groups as pre-roosting gatherings and than moved to different roosts for night stay. Such preroosting sites were located near Shivaji University, slaughter house, open lands, Sadar-bazar on a nearby tree etc (Plate 9 b). Just prior to the sunset the birds go to predetermined roosts. It was not clear from the gatherings whether the kites decide at this stage about which roost to occupy that night. Because there were continuous fluctuations in the number of kites even on the neighbouring roosts during the investigations.

4. Roosting in Whitebacked Vulture, Gyps bengalensis :

Whitebacked Vulture having very few natural enemies and being hardy birds have little need for an elaborate shelter. However, for roosting purpose they require large trees with strong branches, Ficus trees such as peepal (Ficus religiosa) and banyan (Ficus bengalensis) are particularly sought after. But even old neem (Azadirachta indica), tamrind (Tamarindus indicus) and shisham (Dalbergia sissoo) and other trees with strong branches are often used. As for roosting they may even spend the night on roof tops and broken walls if food supply is assured near by (Grubh, 1974).

In the present study only one roosting site of whitebacked Vulture was discovered in the study area. The roost was located in Ramanand Nagar, a suburban in South eastern side of Kolhapur city. In this less crowded area the roost consisted of 11 trees belonging to two species Bhoker, Cordia myxa (7) and Ain, Terminalia arjuna. (Plate 10) All the trees were on a side of a stream in agricultural field and close to carcass dump their favourite feeding site.

Vultures are not known to roost regularly because of dispersal of food in their vast territories. Table 13 shows the weekly fluctuations and monthly average number of Vultures recorded at the roost for 15 months i.e. January 1987 to March 1988. According to Ali (1941) the breeding period in white-backed vultures is from October to March. During the investigations an interesting pattern was observed in the weekly observations that on some occassions the vultures were absent on the roost. It was thought that they drifted to other neighbouring locality in search food. In January the average number was low (n=36) which gradually increased to reach the highest value (n=114) recorded during the study in July 1987. There was sudden and interesting drop in the population of Vultures in August when the lowest value (n=2) was recorded. This may be attributed to the temporary shifting of roost site to a temporary roost. Again in September-October there was significant roost population at the roost (Fig. 26). There was sudden fall in the population from November to March i.e. breeding season of the Vultures. The Vultures were seen at the feeding site throughout the day and at dusk went directly to

Table 13 : Monthly average number of White-backed vulture, Gyps bengalensis at Ramanandnagar roost from January 1987 to March 1988.

Year	Month	Weekly fluctuation in population				Average No.
		1st Week	2nd Week	3rd Week	4th Week	
1987	Jan.	40	--	38	--	36
	Feb.	40	--	42	--	41
	Mar.	--	50	--	--	50
	April	58	--	--	--	58
	May	--	--	--	80	80
	June	90	--	94	--	92
	July	--	110	--	118	114
	Aug.	--	02	--	02	02
	Sept.	--	88	--	--	88
	Oct.	90	102	--	--	96
	Nov.	--	50	--	--	50
	Dec.	--	50	--	--	50
1988	Jan.	38	--	38	--	38
	Feb.	40	--	41	--	40
	Mar.	--	--	42	--	42

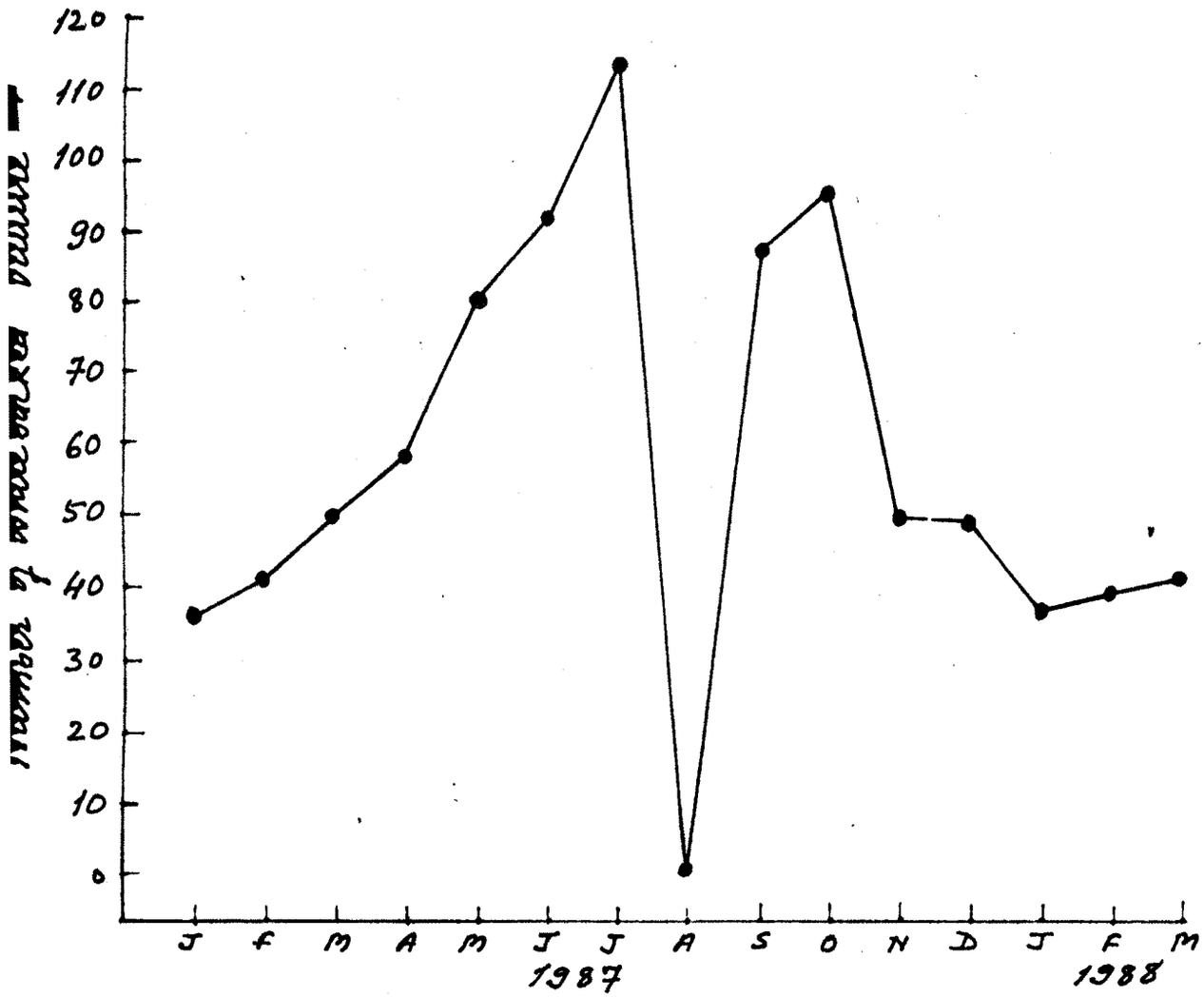

Fig 26: Monthly fluctuations in the average values of Whitebacked Vulture at Ramanand Nagar in Kolhapur (1987-1988).

their roosting site with-out pre roosting displays.

The Scavanger Vultures were seen at the feeding sites occassionally. However their roosts could not be located. During premonsoon and post monsoon season as many 24 birds were observed at a time the feeding ground behind the Boys Hostels in Shivaji University Campus.

5. Vulture Roost and Climatic Factors :

The correlation between monthly average number of Vulture and important eight climatic factors was studied during the 14 months investigations from January 1987 to March 1988 (Table 14).

Minimum temperature had positive and well correlation with the changing values in vulture population (r=0.78, P=0.00). Figure 27 gives the graphical presentation in a scatterplot. However, maximum and average recorded values of temperature had no correlation with the average number of Vulture population figures 28 and 31 respectively.

There was excellent correlation established between the percentage of relative humidity and the average number of Vulture population (r=0.85, P=0.00)(Fig.29). During the pre-monsoon and monsoon months larger number of vultures are recorded.

Hours of Sunshine had a well negative correlation with vulture population (Fig.33). As the Hours of Sunshine increases there is significant decrease in the vulture populations. The correlation was (r=-0.83, P=0.00). Wind speed also had significant correlation (r=0.54, P=0.02) but since there is no

Table 14 : Correlation between monthly average number of White-backed vulture, Gyps bengalensis and climatic factors.

Sr. No.	Climatic factors	Correlation (r)	Sample size (n)	One-tailed significance (p)
1.	Maximum temperature	-0.2813	14	0.1650
2.	Minimum temperature	0.7847	14	0.0004
3.	Average temperature	0.3428	14	0.1157
4.	Relative humidity	0.8581	14	0.0000
5.	Hours of sunshine	-0.8319	14	0.0001
6.	Wind speed	0.5461	14	0.0217
7.	Radiation	-0.1595	12	0.3197
8.	Rainfall	0.8463	14	0.0001

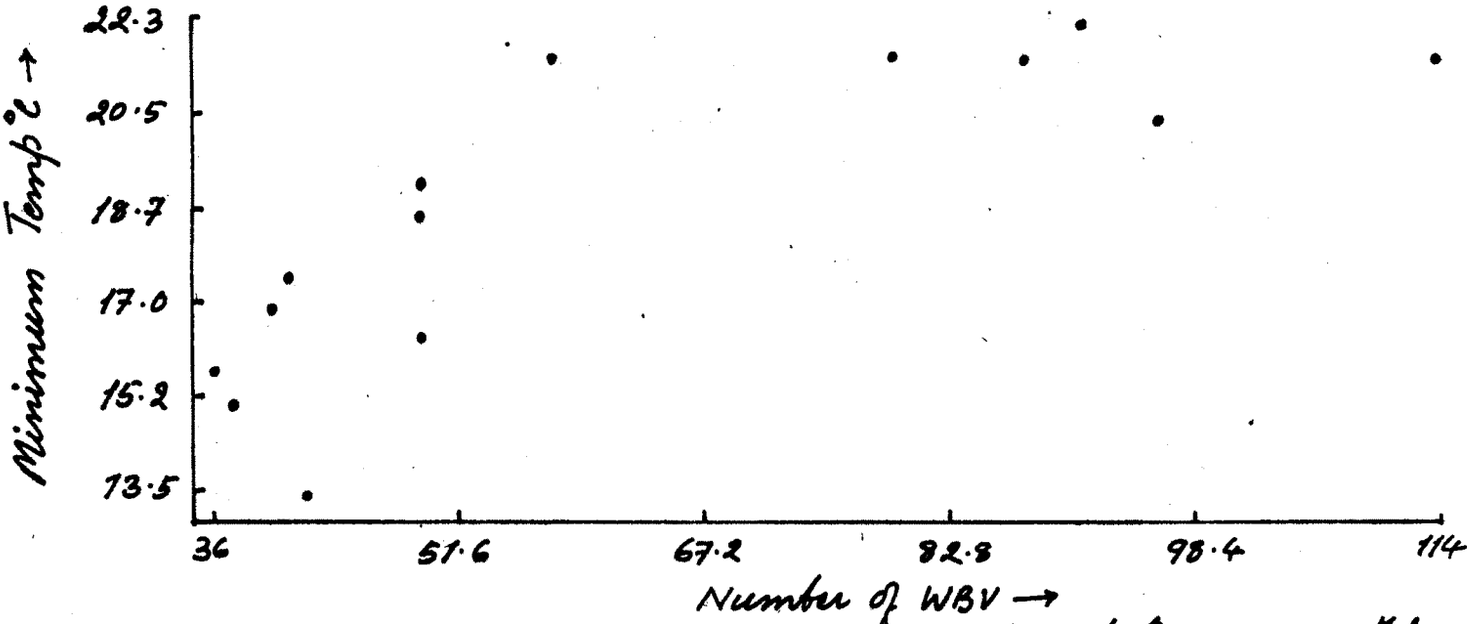

Fig 27: Scatterplot showing correlation between monthly average number of White backed Vulture and minimum temperature.

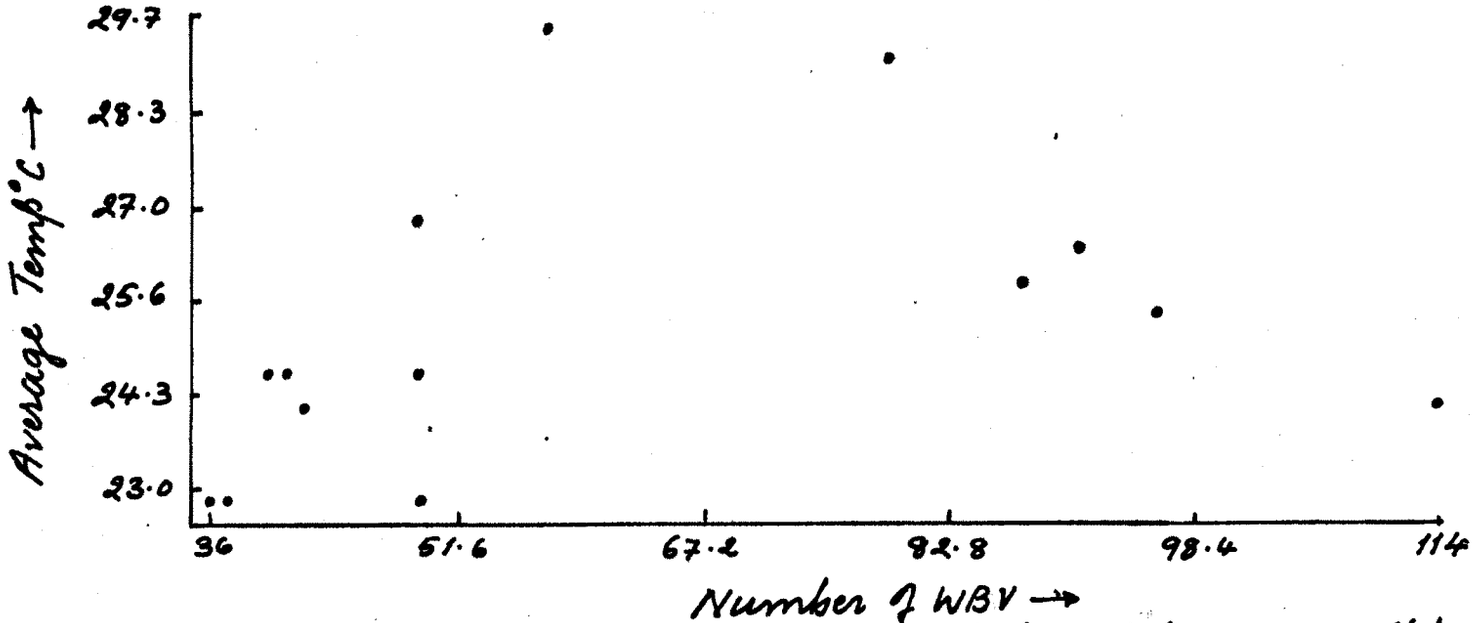

Fig 28: Scatterplot showing correlation between monthly average number of White backed Vulture and average temperature.

constant wind with strong velocity in the study area there was not much of a releavance to the parameter (Fig.30). The relation of Vulture population fluctuations with radiation was not established the factor was a mere ($r=-0.15$, $P=0.31$)(Fig.32). As in the ease of relative humidity there was a very strong positive correlation between Rainfall values and Vulture population fluctuations ($r=0.8463$, $P=0.00$). This can be seen from the scatterplot Fig.34 as wel as the conventional graph Fig.26. Except the irratic drop in the population in August 87 ($n=2$) which suggests that they occupied some other roost in the region which was not located.

The Figure 35 gives excellent positive correlation between the monthly average number of Pariah kite and white-backed Vultures in the study area during investigations. The fluctuation pattern is almost uniform and well correlated to each other.

6. Mixed Roost :

Some species have communal roosts which rarely include members of another species, but others frequently form mixed species roosts. The co-roosting species of mixed roost are ecologically similar or commonly feed together in mixed flocks or in the same habitat (Ward & Zahavi, 1972).

There are Indian bird species which occupy mixed roost but these dissimilar species feed neighter together nor in familiar situations. Gadgil (1972) observed communal roosts of House Crow, Jungle Crow, Common Myna, Rose ringed Parakeet and Cattle Egret on a single Peepal tree in well wooded area.

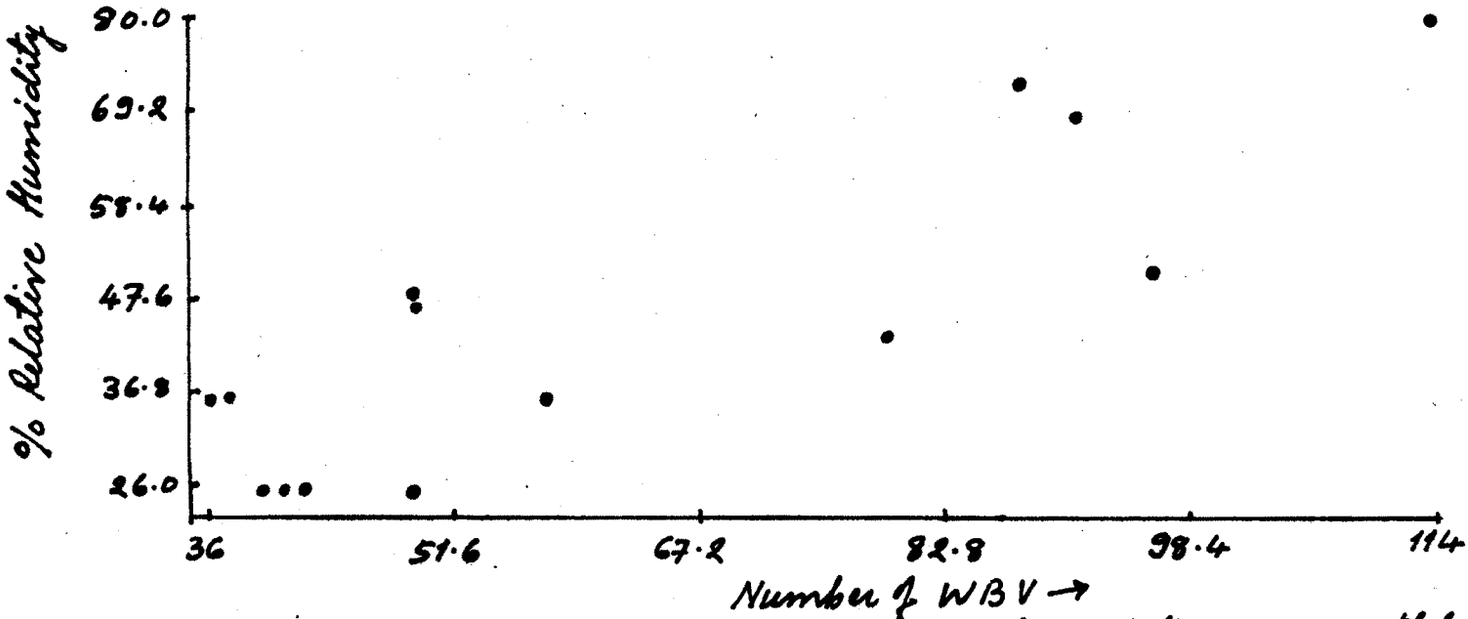

Fig 29: Scatterplot showing correlation between monthly average number of White backed Vulture and Relative Humidity.

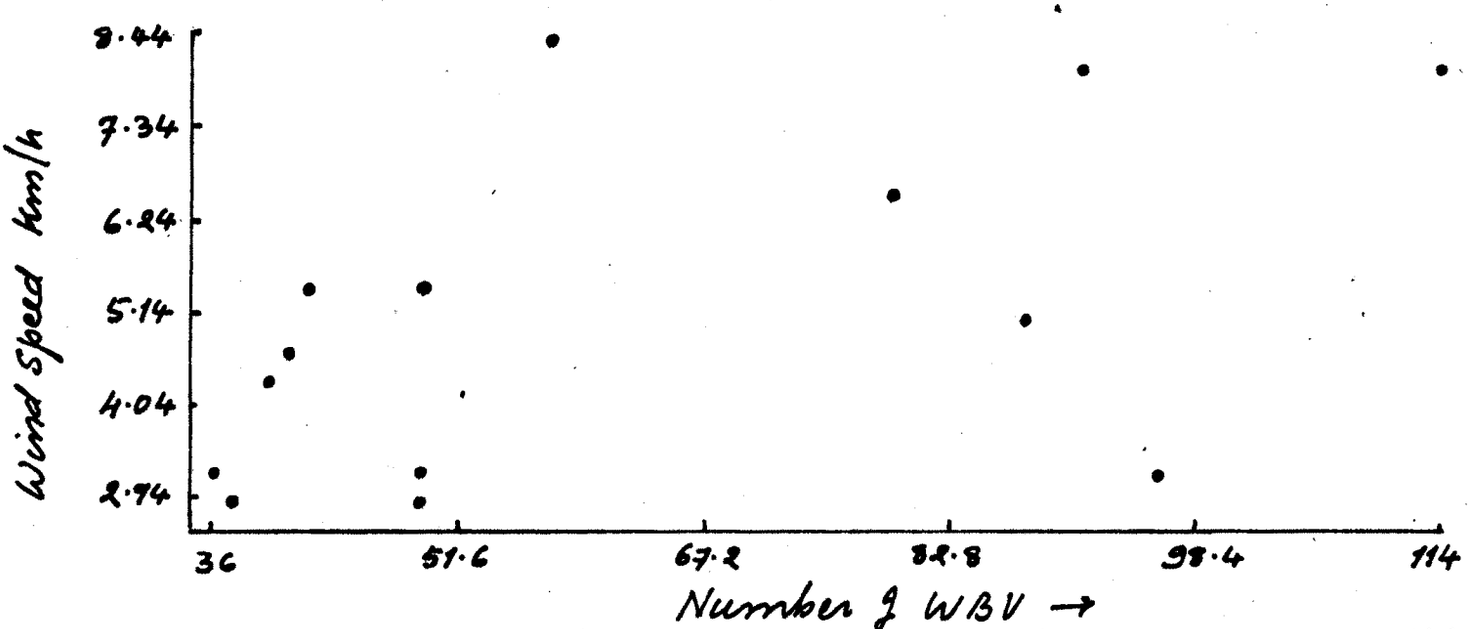

fig 30: Scatterplot showing correlation between monthly average number of White backed Vultures and Wind Speed.

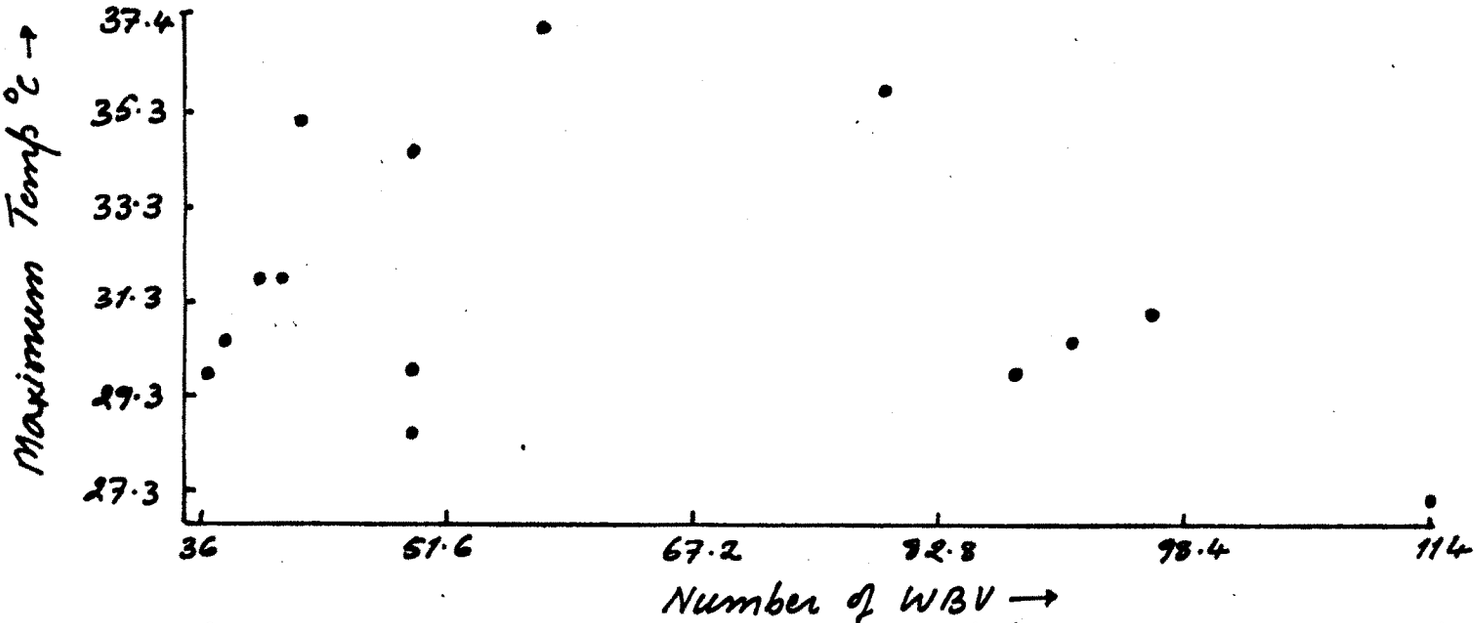

Fig 31: Scatterplot showing correlation between monthly average number of White backed Vulture and maximum temperature.

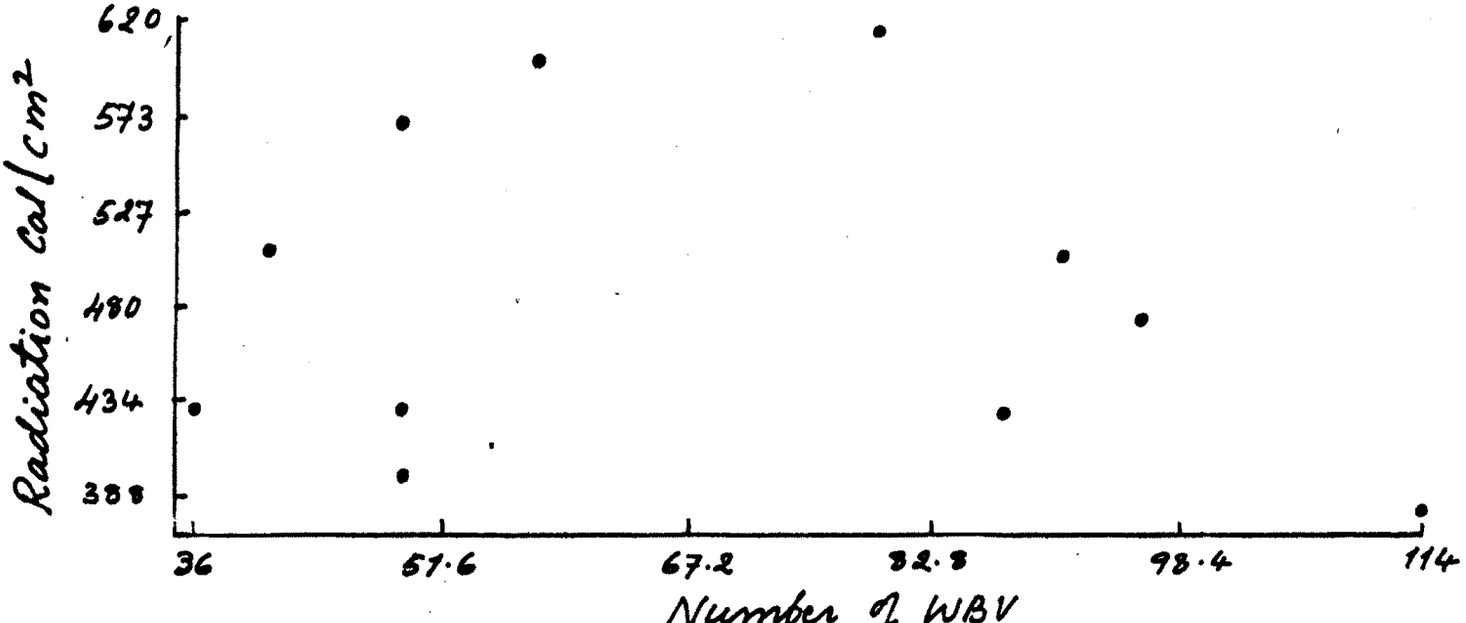

Fig 32: Scatterplot showing correlation between monthly average number of White backed Vulture and Radiation.

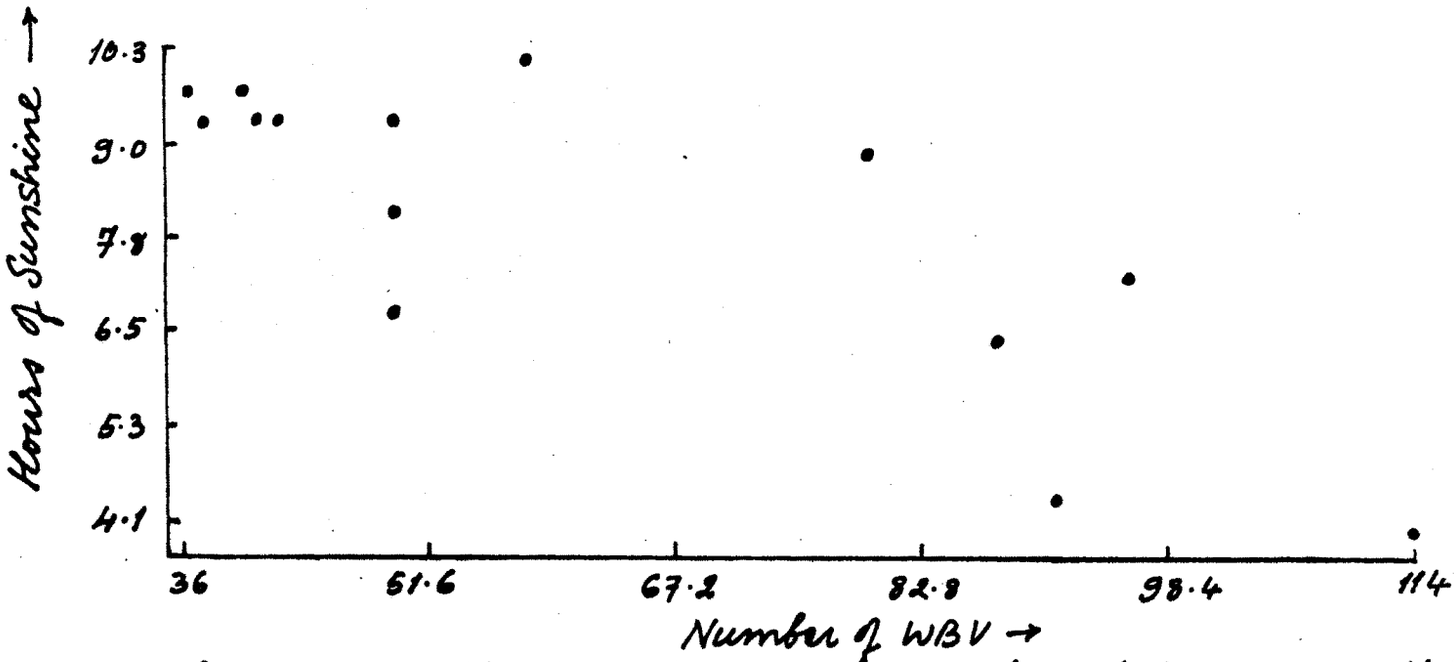

Fig 33: Scatterplot showing correlation between monthly average number of White backed Vulture and Hours of Sunshine.

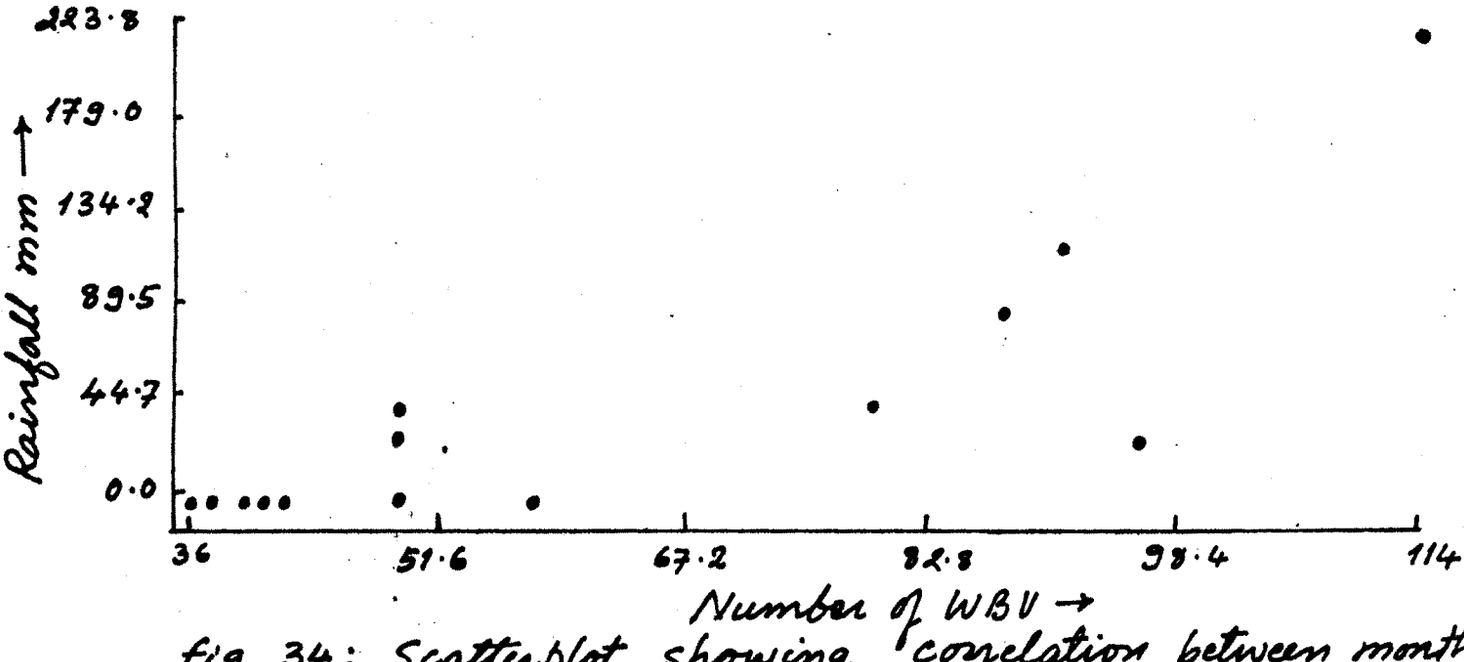

Fig 34: Scatterplot showing correlation between monthly average number of Whitebacked Vulture and Rainfall.

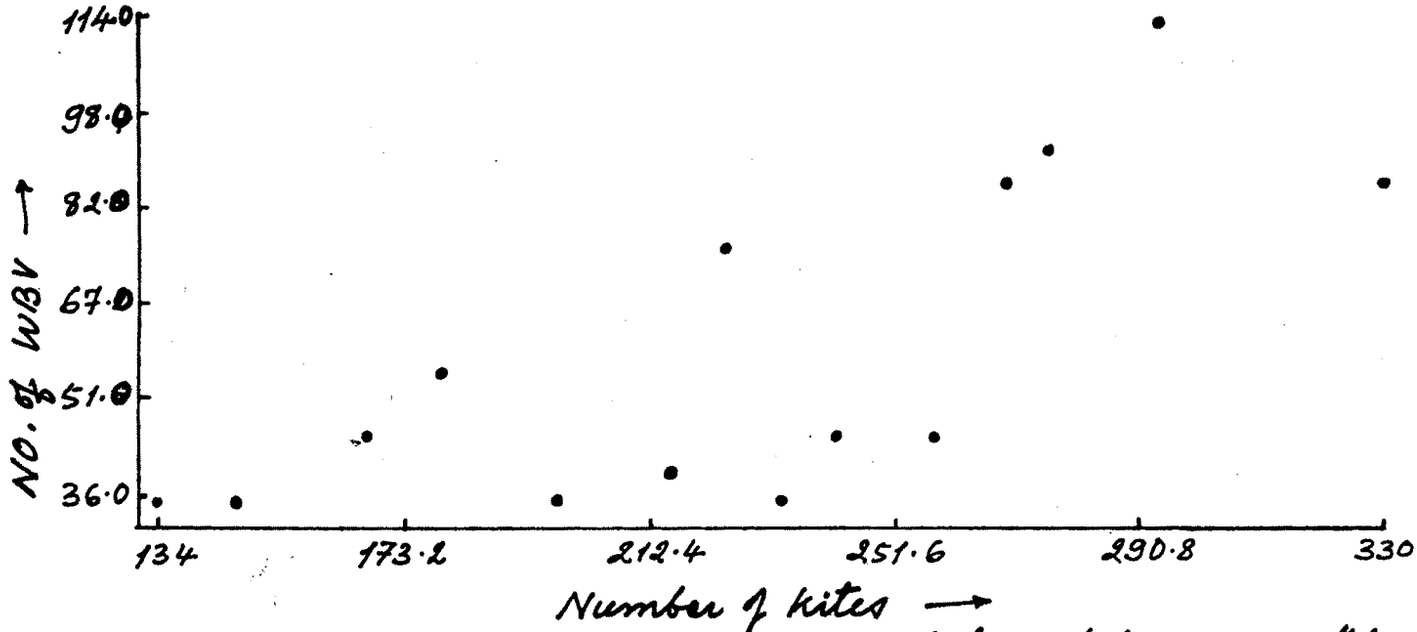

Fig 35: Scatterplot showing correlation between monthly average number of Pariah kite and monthly average number of White backed Vulture.

During the study period it was observed that at a few roosting sites Pariah kite invariably formed mixed communal roost in company with House Crow Corvus splendens, Jungle Crow Corvus macrorhynchos, Indian Myna Acridotheres tristis and House Sparrow Passer domesticus. A total of nine Pariah kite roosts which were studied in Kolhapur city, two roosts, R-I and R-III were found to be mixed roosts. Both the roosts were large and first was a permanant kite roost and second a temporary roost. Pariah kites were roosting together with House Crow, Jungle crow, Indian Myna and House Sparrow.

The Common Myna usually roosts communaly. It may utilize a variety of safe situations for its communal roost. in trees like, palm Phoenix canariensis and Pinus radiata (Counsilman, 1975). In India babul (Acacia arabica), Sisu (Dalbergia sisso), mango (Manifera indica) and Ficus sp. are common roosting sites for Mayna (Sengupta, 1976).

At roost R-I mayna used 2 to 4 palm trees Phoenix sylvensis, 4 to 6 eucalyptus trees, Eucalyptus cambldulensis and 1 raintree Samanea saman. Roost R-III used a peepal tree, Ficus religosa. The use of buildings as roosting sites has been reported in New Zealand (Wilson, 1973) and in Australia (Hindwood, 1948).

In the evenings mayna arrive in party after party, in pairs from all directions and settle for the night to the accompaniment of a great deal of cocophony. Half an hour before sunset they display in the trees close to the roost and after sunset within 10 to 15 minutes directly go to roost.

At R-I, mynas were seen roosting with house crows and

Jungle crows on eucalyptus and rain trees. Pariah kites were not observed in these roosts, though these trees were close to the kite roost trees. Also only mynas were seen in palm trees and not crows. On R-III the only roosting tree was used by mynas and crows during the absence of Pariah kite populations. At no time kite and myna were seen roosting together.

Myna use some roosts during late spring and summer only and some roosts throughout the year. The temporary roosts are formed just before reproduction.(Counsilman, 1975). Roost R-I was a permanant and R-III was a temporary roost even for myna like P.kite. At R-I myna population showed decreasing trend from August to October and increasing from November upto March. An average of 208 mynas were reported on the roost during the study period (Table 15). The number fluctuated from 100 (30-10-87) to a maximum of 375 (22-3-88). At R-III the average population was little smaller (n=119) and it ranged from a minimum of 40 on 30-9-87 and a maximum of 160 on 5-8-87 (Table 16).

Table 15 gives the monthly fluctuations of hours at R-I from August 87 to March 88. The average number of crows during the period was 487. The maximum values of crow population (n=1231) were recorded in August 87. The lowest value (n=96) was recorded in December 87. The crow number increased from January onwards.

At R-III the crow population decreased from July onwards as kites were absent during July, August, and September 87. The lowest value (n=12) was recorded on 12-11-87. The lowest monthly average was in the month of March (n=20).

Table 15 : Monthly fluctuations of crows (House crow, Corvus splendens, and Jungle crow, Corvus macrorhynchos) and Common myna Acridotheres tristis population at the mixed roost R-I.

Sr. No.	Date of Observation	Crows		Myna	
		Total No.	Average No.	Total No.	Average No.
1.	8.8.87	1231	1115.5	183	181.5
2.	30.8.87	1000		180	
3.	2.9.87	1000	740.0	170	174.0
4.	15.9.87	0480		178	
5.	30.10.87	0300	300.0	100	100.0
6.	17.11.87	0180	180.0	138	138.0
7.	1.12.87	0096	198.0	-	228.0
8.	22.12.87	0300		228	
9.	6.1.88	0400	415.0	220	230.0
10.	15.1.88	0430		240	
11.	26.2.88	0400	400.0	-	-
12.	14.3.88	0550	553.0	280	327.0
13.	22.3.88	0556		375	

Table 16 : Monthly fluctuations of Crows (House crow, Corvus splendens and Jungle crow, Corvus macrorhynchos and Common Myna, Acridotheres tristis, population at the mixed roost R-III.

Sr. No.	Date of Observation	Crow		Myna	
		Total No.	Average No.	Total No.	Average No.
1.	19.7.87	137	140	094	124
2.	29.7.87	143		154	
3.	5.8.87	160	130	160	155
4.	26.8.87	100		150	
5.	23.9.87	104	104	120	080
6.	30.9.87	-		040	
7.	8.10.87	100	95	00	00
8.	29.10.87	090		00	
9.	12.11.87	012	16	00	00
10.	26.11.87	020		00	
11.	3.12.87	089	67	00	00
12.	18.12.87	045		00	
13.	1.1.88	086	62	00	00
14.	14.1.88	056		00	
15.	25.2.88	020	20	00	00
16.	16.3.88	020		00	
17.	29.3.88	020	20	00	00

The kite's roosts at times were occupied by the early arriving crows. The crows which arrive prior to sunset in the roosting area spend some time on nearby buildings, trees, on ground etc. before occupying the roost after sunset. The crows which come after sunset directly go to the roost.

The house sparrow, Passer domesticus also roost along with P.kite on roost R-I. They used lower and unused branches of Eucalyptus tree where kites perched. Trees like Ashoka, Polyathia longifolia were also used by sparrows.