

Letters to the Editor

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TOTAL SOLAR ECLIPSE OF 1995: OBSERVATIONS ON PLANTS' PHENOLOGICAL BEHAVIOUR AND BIRDS' ACTIVITY

1. Light influences many phases of plant growth and development through creation of photo-chemical reaction. Light duration, intensity, quality, nature of receipt and distribution within plant canopy have varying influences on morphology and many physiological aspects of wide variety of plants. Light is the most important environmental factor modifying stomatal movement. In some sensitive leguminous plants, leaf openness is correlated with the presence of light.

1.1. The total solar eclipse of 1995 resulted in an equivalent to a very short phase of night time condition during the day. Sudden change in radiation environment as influenced by total eclipse was expected to have some effect on plants' phenological behaviour and common birds' activity. The observations were taken at Principal Evapotranspiration Observatory of IMD, Canning, West Bengal. Intensive observations on sun, road side plant's phenological behaviour and bird's activity were carried out on the eclipse day. Objective of the present study was to judge the impact of total solar eclipse under anomalous micrometeorological and radiation environment.

2. The eclipse of 24 October, 1995 started in India at around 0723 hrs (IST) and ended at around 1019 hrs (IST) with the duration of total eclipse varying between 48 seconds in Rajasthan to 82 seconds in West Bengal. Thus, the observations on sun, plant's phenological behaviour and bird's activity were observed between 0715 to 1030 hrs (IST) on the eclipse day. The various parameters observed, types of instruments used, frequency of observations are mentioned under this heading.

2.1. Percentage of the sun closed (covered by the moon) was observed at 15 minutes interval between 0715 to 1030 hrs (IST) on 24 October 1995 with some special observations at 0732, 0848, 0850 and 1017 hrs (IST) (*i.e.* at the commencement, at total eclipse, at just after total eclipse and at the end, respectively, based on references collected through the then daily newspapers, scientific magazines). Special types of goggles made of mylar sheet was used for viewing sun. All the observations recorded are presented in Fig.1.

2.2. Some sensitive road side leguminous plants adjacent to the observatory were selected. The plants were Dad Manasa (local road side bushy plant with big sized leaves), Sirish (*Albizia lebbek*), Cassia weed (*Cassia tora*) in which leaf openness was correlated with the presence of light (and during night time, leaves remained closed). Percentage of open leaves was determined by simple eye estimation. The observations were taken at 15 minutes interval between 0715 to 1030 hrs (IST) on 24 October 1995 with special observation at 0850 hrs (IST) and are also presented in Fig. 1.

2.3. Activity of common birds (*viz.* crows, sparrows, parrots etc.) were observed by simple eye estimation on the eclipse day between 0715 to 1030 hrs (IST) with special observations at 0848 and 0850 hrs (IST). The observations recorded were, whether the birds were normal (N) in their behaviour, singing (S), flying (F), confused (C), making noise (MN), noise-less (NL), returning (R) to their nests or returned back (RB) in their nests. The observations recorded are presented in Table 1.

3. Total solar eclipse of 24 October, 1995 resulted in a sudden, significant but temporary change in agrometeorological parameters, the impact of which was studied on plants' phenological behaviour and birds' activity. The observational data are presented in either tabular forms or figures along with "cause and effect" relations.

3.1. The percentage of the sun covered by the moon's shadow on the eclipse day are presented in Fig. 1. The solar eclipse started at 0732 hrs (IST) and finished at 1017 hrs (IST). More than 80% of the sun covered was observed between around 0845 hrs (IST) to 0900 hrs (IST). The total eclipse was observed at around 0848 hrs (IST) and at 0850 hrs (IST) the percentage of the sun closed was 95%. The impact of both the partial and total eclipse phases are discussed in the next sub headings.

3.2. (a) The sensitive plants observed for leaf openness during the eclipse period were Dad Manasa, Sirish and Cassia (Fig.1) In case of Dad Manasa, 95% of the leaves openness was observed in the morning and even upto 0815 hrs (IST). Gradually, the percentage openness decreased. At the time of total eclipse (at 0848 hrs IST) 65% of the leaves were open and the minimum percentage of leaf openness (60%) was observed just after the total eclipse was over (at 0850 hrs IST). Afterwards, the percentage of leaf openness

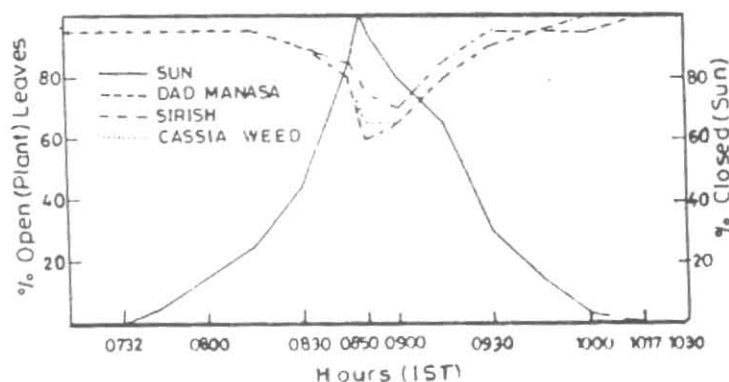


Fig.1. Observation on sun and plants' phenological behaviour on the eclipse day

TABLE 1
Birds' activity on the solar eclipse day

Item	Hours (IST) of observations															
	0715	0732	0745	0800	0815	0830	0845	0848	0850	0900	0915	0930	0945	1000	1017	1030
Birds' activity*	N	N	N	N	N	MN	R	RB	RB	C	F	N	N	N	N	N
	S	S	S	S	S	C	C	C	MN	MN	MN	S	S	S	S	S
	F	F	F	F	F		MN	NL	C		C	F	F	F	F	F

* N -Normal, S-Singing, F-Flying, C-Confused, MN-Making noise, R- Returning to their nests, RB-Returned back to their nests, NL- Noise-less.

increased slowly and after 1000 hrs (IST), the plant leaves were fully open.

(b) In case of Sirish tree, 95% of the leaves were open from morning till 0815 hrs (IST) and beyond that gradually leaves were slightly to partially closed. At the time of total eclipse, leaves openness was 80% and just after total eclipse it was 75% at 0850 hrs (IST) and 70% at 0900 hrs (IST). Afterwards, leaves openness increased slowly and after 0945 hrs (IST) the tree leaves were fully open.

(c) In case of *Cassia* weed, 95% openness of the leaves were observed upto 0815 hrs (IST). Gradually, leaves openness reduced. At the time of total eclipse 70% leaves openness was observed, while between 0850 to 0900 hrs (IST), the openness was the minimum (65%). Afterwards leaves openness increased slowly and after 1000 hrs (IST), the weed leaves were fully open.

(d) In case of the sensitive plants, stomatal opening is correlated with the presence of light when other conditions for opening are favourable. Under sudden change in radiation environment as well as in temperature as influenced by total eclipse, the plants responded more slowly than the air its temperature was for a time higher or lower, which was due to abundance of water within plant tissues and their high

specific heat (Weaver and Clements 1980). Thus, the plants lag in the change in proportion to its mass and surface.

3.3. The activity of common birds were observed on 24 October 1995 during the eclipse period (Table 1). They were normal in their behaviour, singing and flying as usual, in the morning till 0815 hrs (IST). At 0830 hrs (IST), the birds were making noise as if they were confused. At 0845 hrs (IST), the birds were returning to their nests, confused and making noise. At the time of total eclipse, the birds were confused, returned back to their nests and became noise-less, momentarily. Just after total eclipse (at 0850 hrs IST), the birds started making noise, confused and returned back to their nests. At 0900 hrs (IST), the birds were still confused and making noise. At 0915 hrs (IST), the birds were flying though they were making noise as if they were confused. From 0930 hrs (IST) they were normal, started singing and flying.

4. The present study of observations on plants' phenological behaviour and birds' activity as influenced by the total solar eclipse of October, 1995, revealed the following conclusions:

- (i) The solar eclipse started at 0732 hrs (IST) and finished at 1017 hrs (IST) with the total eclipse observed at around 0848 hrs (IST).

(ii) The minimum percentage of leaf openness observed at 0850 hrs (IST) for Dad Manasa (60 % of the leaves were open), at 0900 hrs (IST) for Sirish tree (70 % of the leaves were open) and between 0850 to 0900 hrs (IST) for *Cassia* weed (65% to the leaves were open).

(iii) After 0830 hrs (IST) on the eclipse day the common birds were confused, till 0900 hrs (IST). At 0845 hrs (IST), the birds were returning to their nests, confused and were making noise. During the total eclipse phase, the birds were confused, returned back to their nests and became noiseless, momentarily. After 0900 hrs (IST) the birds activity was normal.

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A. KASHYAPI
S.K. SHAHA

Meteorological Office, Pune-411005, India
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