PHOTOPERIOD LINKED PATTERNS OF DAILY MATING BEHAVIOUR IN THE BUG *DYSDERCUS KOENIGII* F. (HEMIPTERA : PYRRHOCORIDAE)

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ABSTRACT

Daily mating activity pattern in *Dysdercus koenigii* does not exhibit diel rhythm. However, daily mating activity peaks towards the end of photophase. In the short day reared colony mating activity in the photophase is significantly higher than that of the scotophase.

INTRODUCTION

EARLIER studies[1] on the mating behaviour of the red cotton bug have provided details of the contribution of visual and olfactory stimuli towards the mating activity and further established that a short photoperiod (i.e. LD 4 : 20) causes significant reduction in the mating activity of the colony.

In the present work influence of naturally occurring day and night cycles (i.e. LD 12 : 12) and artificially induced short-day (i.e. LD 4 : 20) cycles on the daily pattern of mating responses of *D. koenigii* has been investigated by continuous observation of mating behaviour between 0 and 24 h.

MATERIALS AND METHODS

Colonies of *D. koenigii* were reared on soaked cotton seeds at 27 ± 1°C and 60–65% R.H. under selected photoperiods (viz. LD 12 : 12 and LD 4 : 20). Freshly moulted adults were collected hourly from the respective colonies, sexed and held under respective photoperiods on usual diet. A minimum of 24 batches (each consisting of at least 30 pairs) from each photoperiod were subjected to mating behaviour bioassay successively at the rate of one/two batches per 30 min. Mating behaviour was evaluated by observing parameters (a) mean per cent matings (i.e. per cent m.f.) over a period of time (pairs formed /30 min), and (b) mean pre-copulatory period (T) i.e. mean time taken for the formation of stable pair. The details of these parameters and actual procedure for mating behaviour bioassay have been described elswhere[2]. The mating behaviour bioassays were conducted round the clock for desired number of days. The observations of mating behaviour in the photophase were recorded at room temperature and ambient light conditions while that of scotophase were recorded inside a dark room under red light (1.5 lux intensity). The mean distance between the red-light source and the mating pairs was approximately 74.4 cm.

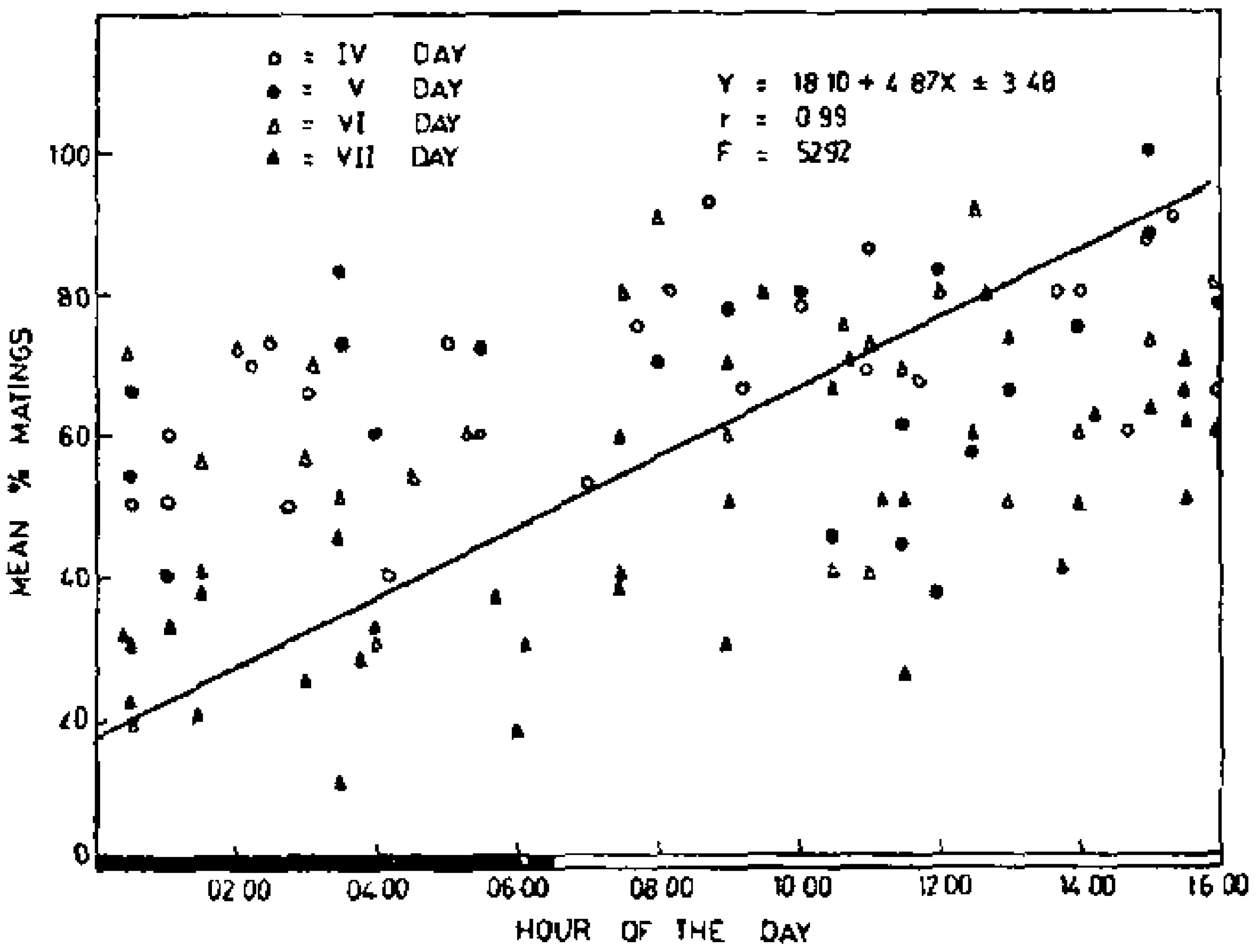
The regression curves were fitted by least square method and the correlation between the two parameters was estimated from the correlation coefficient (r) and F-test ratio[3].

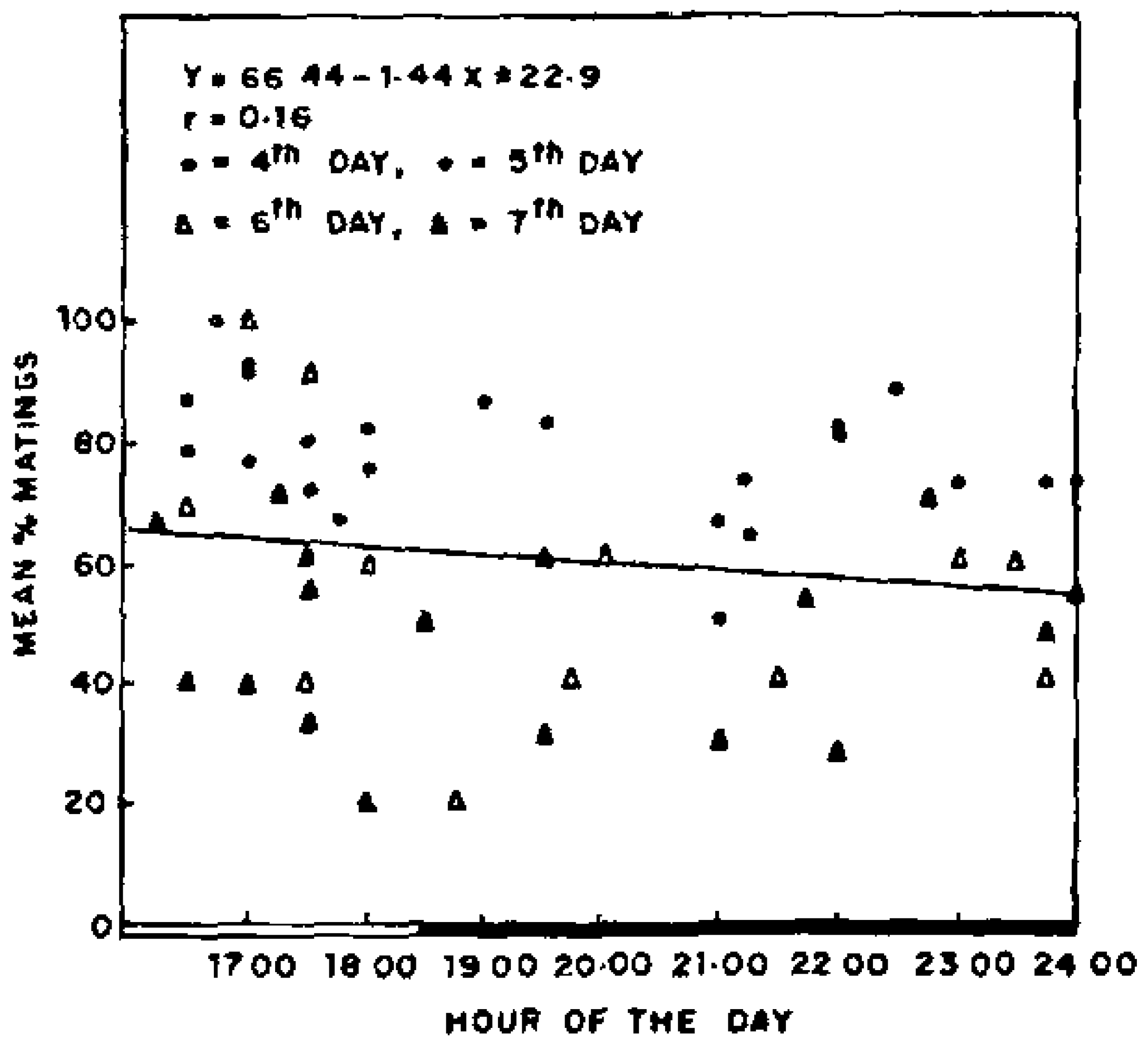
RESULTS AND DISCUSSION

As mating activity in *D. koenigii* colony (LD 12 : 12) rises to maximum levels between 4 and 7 days[1], adult batches of 4–7days age were chosen for the experiments. To investigate whether the daily mating activity (i.e. between 0 and 24 h) follows a particular rhythm during day and night cycles, regression of per cent matings on the hour of the day was studied. It was found that between 0 and 16 h a positive linear correlation (i.e. $Y = 18.10) + (4.87 \times \pm 3.48)$ existed between the mean per cent matings and the hour of the day (figure 1) which was extremely significant (where, $r = 0.99$ and $F_{1,108} = 5292$ significant at $P < 0.05$). However, the regression of per cent matings on the remainder hours of the day (i.e. between 16 and 24 h) showed (figure 2) a negative correlation (i.e. $Y = 66.44 - 1.44 \times \pm 22.9$) which was not significant statistically (where $r = 0.16$, $F_{1,55} = 1.7$, not significant at $P > 0.05$).

Thus, despite a wide range of age groups (i.e. between 4 and 7 days) daily mating activity of all the batches follows a common pattern: between 0 and 16 h mating activity increases steadily and reaches a peak (between 15 and 16 h) $2\frac{1}{2}$ h before the end of the photophase (figure 1). In the remaining hours (i.e. 16–24 h), it tends to decline (figure 2). Appearance of mating activity peak towards the end of the photophase is also reported in another hemipteran bug, *Oncopeltus fasciatus*[4]. As significant amount of mating activity is observed even during the night cycle, (figures 1 and 2) absence of 'diel rhythm' in the mating behaviour is apparent.

To investigate the effect of the short day on the daily mating activity pattern mentioned above, mating behaviour in the 4, 5 and 6-day-old-short





Figures 1 and 2. Correlation between the daily mating activity in *Dysdercus koenigii* colony (LD 12:12) and hour of the day. The line shows regression of per cent matings on the hour of the day. **1.** between 0 and 16 h; **2.** between 16 and 24 h.

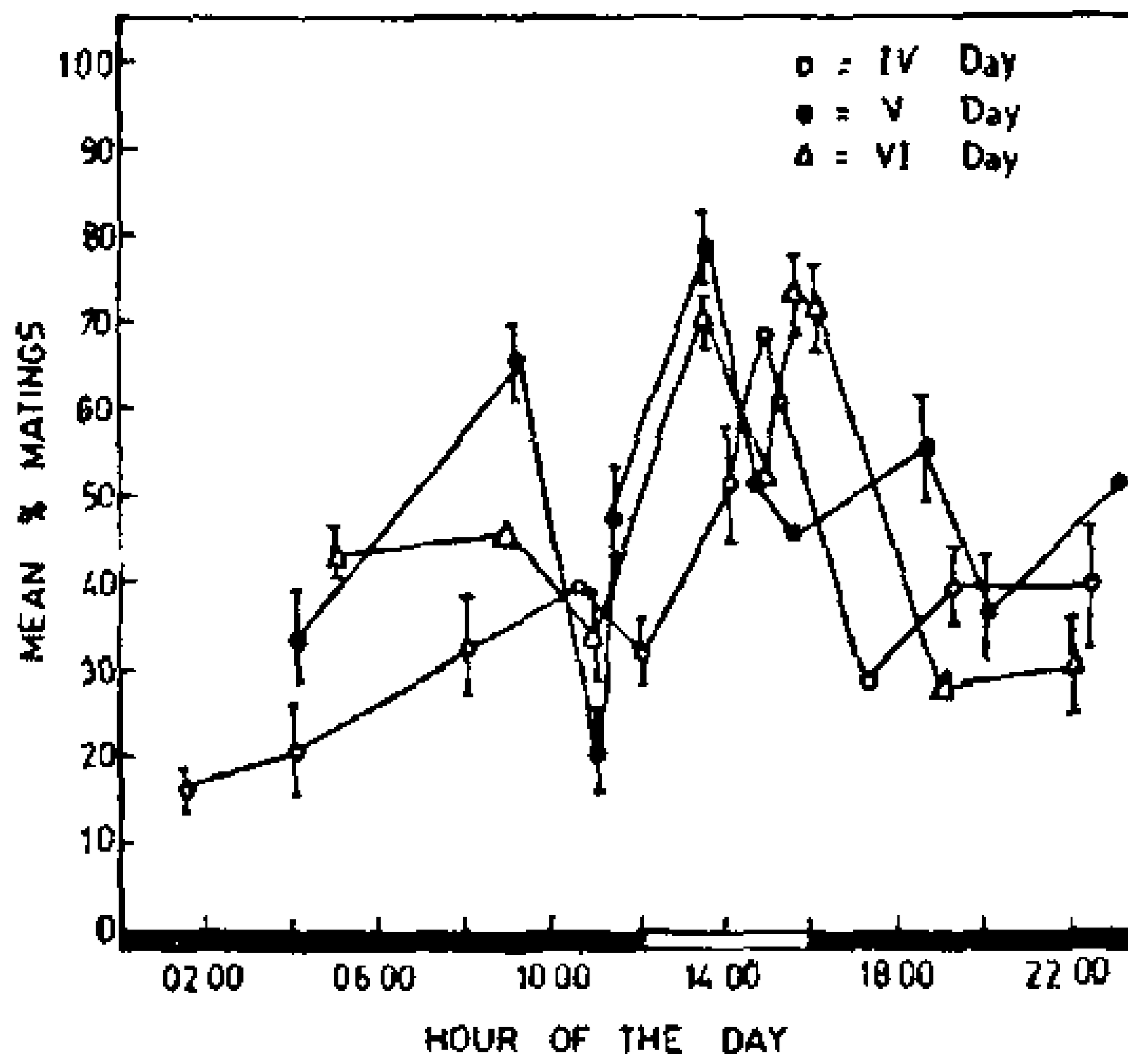


Figure 3. Daily mating activity pattern in short-day (i.e. LD 4:20) reared colony showing the correlation between per cent matings and the hour of the day (i.e. 0 and 24 h).

photoperiod (LD 4:20) reared *D. koenigii* colony was observed round the clock (i.e. between 0 and 24 h). It was found that mating activity in the short-day reared colony showed a distinct spurt during the photophase (i.e. between 12 and 16 h) which was flanked by abrupt fall at the beginning (i.e. 19 h) and end (i.e. 11 h) of the scotophase (figure 3).

Another parameter, mean precopulatory period (T) did not exhibit a common pattern in correlation with the hour of the day both in the normal (LD 12:12) and short day (LD 4:20) reared *D. koenigii* colonies.

Absence of diel rhythm in the mating activity of the bug was further confirmed by comparing the mean per cent matings observed in the photophase and scotophase of 4, 5 and 6-day-old batches reared under LD 12:12 photoperiod [table 1, LD 12:12, per cent m.f. (P) versus (S), A] statistical analyses showed that there was no significant difference between the total mean per cent matings observed in the photophase and scotophase of the above mentioned batches. The same was true in case of the mean precopulatory period values of the photophase and scotophase [table 1, LD 12:12, $T(p)$ versus (s), a] of these batches.

On the other hand, comparison of the mean per cent matings (in 4, 5 and 6-day-old batches) observed in the photophase and scotophase of short day reared colony (i.e. LD 4:20) showed that the total mean percent matings observed in the photophase were significantly higher than those of the scotophase [table 1, LD 4:20, per cent m.f.:(P) versus (S), B]. However, the total mean precopulatory period values obtained for the photophase and scotophase of these batches [table 1, LD 4:20, T:(p) versus (s), b] did not differ significantly.

Slama[5] pointed out that reduced mating activity, observed in the short day reared hemipteran colony is a characteristic of adult diapause. Such a characteristic reduction in the mating activity was observed in the hemipteran bugs such as *Pyrrhocoris a.*[6] and *Oncopeltus f.*[7] when the photophase was reduced by 6 and 4 h respectively. On the other hand, studies on *D. koenigii* showed that the reduction of the photophase by 4 h (i.e. from LD 12:12 to LD 8:16) did not induce reduction in mating activity, but further reduction of photophase by 8 h (i.e. from LD 12:12 to LD 4:20) induced reduction in the mating activity[1]. Based on the above reports it appears that *D. koenigii* is less photosensitive than *Oncopeltus* and *Pyrrhocoris*. On the other hand, increased mating activity in the photophase of the diapausing (LD 4:20) *D.koenigii*. Colony [table 1, LD 4:20, per cent m.f. ;

Table 1 *Comparison of mating responses observed in photophase and scotophase of LD 12:12 and LD 4:20 reared Dysdercus koenigii colonies (temp. 27 ± 1°C; 60–65% R.H.)*

Day	Photo-period	Mean mating responses (/30 min/day:1–8 days)					
		% m.f.			T (min)		
		Photophase (P)	Scotophase (S)	Significance of difference	Photophase (p)	Scotophase (s)	Significance of difference
4	LD 12:12	76.91 ± 2.5	62.79 ± 3.28	(NS)[A]	3.92 ± 0.46	4.36 ± 0.55	(NS)[a]
5	LD 12:12	71.7 ± 3.5	70.66 ± 3.47		4.05 ± 0.47	3.11 ± 0.38	
6	LD 12:12	64.39 ± 3.88	45.93 ± 4.78		4.36 ± 0.64	5.97 ± 0.94	
4	LD 4:20	56.2 ± 5.44	31.9 ± 2.79	(S)[B]	7.97 ± 1.55	7.08 ±3.28	(NS)[b]
5	LD 4:20	59.5 ± 6 99	44.5 ± 4.14		5.72 ± 2.96	8.36 ± 3.7	
6	LD 4:20	68.2 ± 2.95	45.4 ± 4.64		4.1 ± 1.41	8.05 ± 1.6	

A = difference NS between (P) and (S) of LD 12:12, $t = 1.38$, $(P > 0.01)$, $\partial f = 4$; a = difference NS between (p) and (s) of LD 12:12, $t = 0.58$, $(P > 0.01)$, $\partial f = 4$; B = difference S between (P) and (S) of LD 4:20, $t = 4.54$, $(P < 0.01)$, $\partial f = 4$; b = difference NS between (p) and (s) of LD 4:20, $t = 1.61$, $(P > 0.01)$, $\partial f = 4$; NS, Not significant, S, Significant.

(*P*) versus (*S*),*B*] may account for increase in its photosensitivity.

3 September 1987

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NEWS

SWAMINATHAN—THE FIRST LAUREATE OF GENERAL FOODS WORLD FOOD PRIZE

The First General Foods World Food Prize was presented to Dr M. S. Swaminathan, F.R.S., Director General, International Rice Research Institute, Manila, Philippines, at the Smithsonian Institution in Washington, D.C. on 6th October 1987.

James L. Ferguson, Chairman of the Executive Committee of General Foods Corporation presented the prize, which consisted a $200,000 cash award and a commemoration sculpture.

The prize was conceived by Norman E. Borlaug, 1970 Nobel Peace Prize laureate, to recognize, encourage and reward outstanding individual achievement in improving and increasing the world food supply. Another purpose of the prize is to attract talented, creative and dedicated young people to careers in the complex and changing systems of food and agriculture. It is financed by the General Foods Fund, Inc., a Foundation funded by General Foods.

Dr Swaminathan announced that he would use the cash award to foster farmer-scientist partnerships to develop an integrated approach to biological and social engineering applied to technological development and diffusion under small-farm conditions. (*The IRRI Reporter*, 4/87, p. 1, published by the International Rice Research Institute, P.O. Box 933, Manila, Philippines.)