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STUDIES ON THE OCCURRENCE OF THE LIGHT TRAPPED ADULTS OF RICE YELLOW BORER, *TRYPORYZA INCERTULAS* (WALKER) (PYRALIDAE, LEPIDOPTERA) IN THE SALINE TRACTS OF WEST BENGAL

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INTRODUCTION

Light tarps are known to be an important tool in understanding the insect behaviour. In spite of controversy over its use for prediction of occurrence (Southwood, 1978), the phototropic insects of agricultural importance are monitored by daily collection of adults with the aid of various types of light-traps (Southwood, 1978 pp. 258). Emphasis is now being placed for obvious reasons in determining the periodical peaks of adult occurrence in crop fields to rationalise the time of surveillance, pesticide application or releasing of egg-parasitoids (Torii, 1964). The rice yellow borer, *Tryporyza incertulas* (Walker), is known to be an important stalk-borer pest in all rice-growing tracts of West Bengal. The species does not have any other alternative host plant. The information based on the monthly mean catches (Banerjee and Pramanik, 1964) and also, on the surveys of the damage indexed areas (Nath *et. al*, 1978) was so far in vogue for monitoring the pest in rice fields. But this deterministic approach ignored the life history of the insect, thus resulting in poor return of output.

Stochastic model of analyses of the catch data has been made in the present work to find out the number of broods and the time of peak occurrence of the moth in the saline rice growing areas of West Bengal, where the intensity of attack is high but the scope for a repeated sampling is limited. This region is also important, because it covers three major

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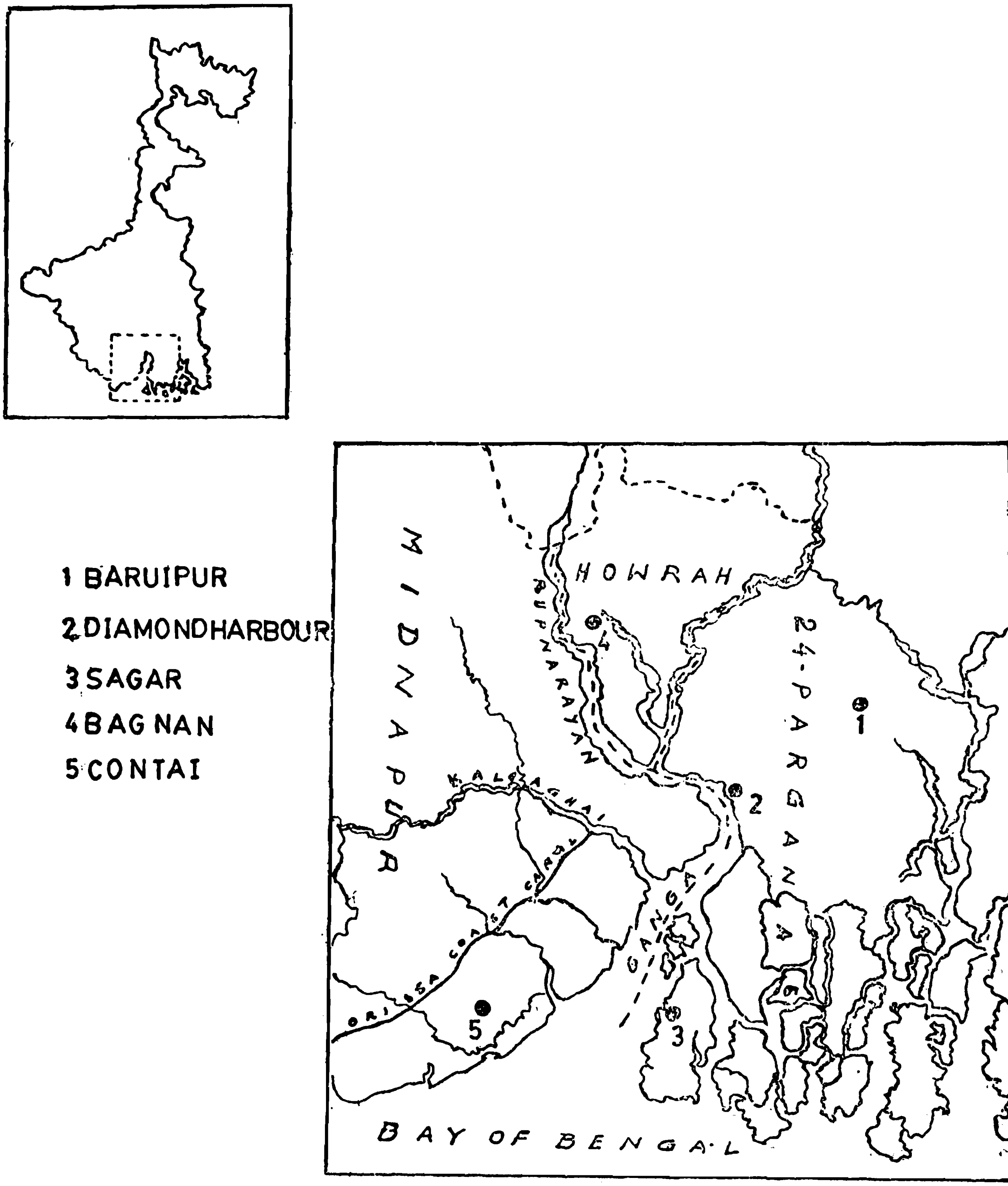

Fig. 1 : Saline tracts of West Bengal and approximate location of the Light Traps.

districts (South 24-Parganas, Howrah and Midnapur) of West Bengal where rice is grown as the only major crop (vide Fig. 1).

MATERIALS and METHODS

The 'Chinsurah-type' light-trap (Banerjee and Basu, 1955) was set up in Government Agricultural Farms at Baruipur (Dist. South 24-Parganas), Diamond Harbour (Dist. South 24-Parganas), Sagar (Dist. South 24-Parganas), Bagnan (Dist. Howrah) and Contai (Dist. Midnapur). These farms are located in the saline tracts of West Bengal, where only one rice crop of local varieties is grown during monsoon. The traps were operated daily from dusk to dawn. The rice yellow borer moths were separated from the collection, their number was counted and recorded by daily workers, especially trained for this purpose. The data were also analysed stochastically. For this purpose, the total days (period) of moth emergence were divided, taking 5 days as unit. The 5-day unit, which was also the average duration of egg-stage under normal field conditions, was adopted after Ishikura (1950). The catches of each such unit were consolidated with unit period designated as the time point. The annual data of catches from all the foregone localities were grouped on the basis of their periodic rise and fall. The number of such groups was considered as corresponding to that of broods. For every brood, the time point started serially from 1 to any number actually observed therein. The time point was conveniently used to draw inferences on the number of median catch out of the temporally distributed cumulative counterpart representing the sigmoid curve in arithmetic scale and varying widely in shape and size at different localities. In the next phase of analyses, all the exercises were devoted to get linearity of the sigmoid curve along with the cumulation being changed to percentage-level which still showed a little amount of bulging. The figures in terms of cumulative percentage were, thus, transformed into probit after Fisher and Yates (1957). The time points were also transformed into $\log_{10}$ scale. The moving averages of log time point (independent variable, X) and the probit cumulative percentage catches (dependent variable, Y) were worked out by least square regression line with all the locations taken together for each brood. The peak time for the median adult emergence (Xm), and its confidence limit were estimated after Ishii (1956) and Torii (1964). Test for heterogeneity was made by χ^2_0 (Chi). The detailed procedure of data analysis for the first brood of the moth is as follows :-

The probit values of the cumulative percentage of moth catches at different localities against the respective time points are provided in table table below.

Time point (X)			Respective probit of the cumulative % (Y)				
Number	Dates	$\log_{10}$	Baruipur	Diamond Harbour	Sagar	Bagnan	Contai
1	2	3	4	5	6	7	8
1	(19.1-23.1)	0·00	—	2·49	2·25	0	2·74
2	(24.1-28·1)	0·30103	2·25	2·54	2·59	0	2·93
3	(29.1-2.2)	0·47712	2·42	2·63	2·88	0	3·02
4	(3.2-7.2)	0·60206	2·67	2·71	2·97	2·67	3·06
5	(8.2-12.2)	0·69897	2·95	2·71	3·35	3·29	3·41
6	(13.2-17.2)	0·77815	4·35	4·14	3·91	4·31	4·47
7	(18.2-22.2)	0·84510	5·03	4·97	4·98	5·12	5·32
8	(23.2-27.2)	0·90309	5·72	5·82	5·59	6·28	6·24
9	(28.2-4.3)	0·95424	6·56	6·40	5·77	6·88	6·79
10	(5·3-9.3)	1·0	6·64	6·43	5·84	6·94	6·84
11	(10·3-14·3)	1·04139	7·14	6·73	6·32	7·52	7·20

$\sum_{1}^{51} X = 37.2276$ $\qquad$ $\sum_{1}^{51} Y = 234{\cdot}78$

$\bar{X} = 0{\cdot}729953$ $\qquad$ $\bar{Y} = 4{\cdot}6035294$

$\sum X^2 = 4{\cdot}005581$ $\qquad$ $\sum Y^2 = 149{\cdot}71716$

$$\sum XY = 21{\cdot}32912$$

$$b = 5{\cdot}32485$$

$$Xm = \bar{X} + \frac{5 - \bar{Y}}{b} = {\cdot}8055138$$

Antilog ·8055138=6·39 time point

Corresponding actual time = February, 15

Goodness of fit

$$X_0^2\ (\text{Chi}) = \sum Y^2 - \frac{(\sum XY)^2}{\sum X^2} = 36{\cdot}143 < X^2_{(\text{Chi})}\ {\cdot}05 \text{ at } 50 \text{ df.}$$

Therefore, the heterogeneity is not significant and the regression is rectilinear.

Approximate confidence limit

$$95\%\text{CL of } X_m = X_m \pm \frac{t{\cdot}05 \text{ at } (n-2) \text{ df}}{b}\sqrt{\frac{1}{n} + \frac{(Xm-\bar{X})^2}{\sum X^2}}$$

$= {\cdot}8055138 \pm {\cdot}0550442$ ($= 6{\cdot}43 \pm 1{\cdot}13$ time point in Antilog)
Corresponding actual time = February 15 ± 6.

RESULTS and DISCUSSION

Light-traps are widely used in the field of entomological work, as the regular catch of the phototropic insects-is more or less ensured. Difficulties arise in so far as their use for

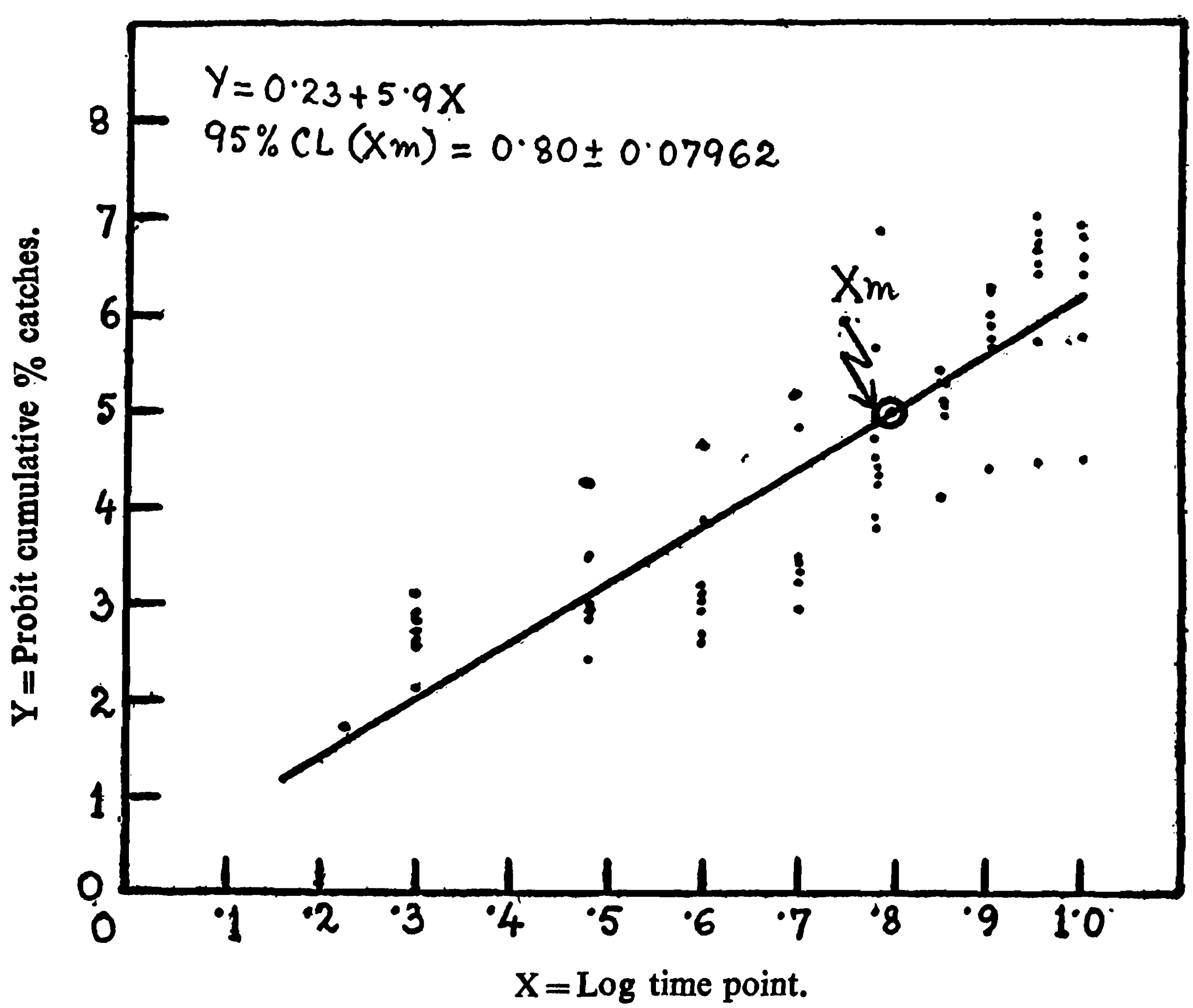

Fig. 2 : Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of winter hibernating first brood (February, 15±6 days).

predictive purpose is concerned, particularly when the analyses of the catch data are made in deterministic model. Thus, Banerjee and Pramanik (1964) presented the data of three years' catches from the Rice Research Station, Chinsurah, with mention of monthly mean catch per night and got only two peaks of occurrence of the rice yellow borer in a year, coinciding with the period of crop maturity during autumn/winter and that of rice growing during summer. Several workers (Banerjee and Pramanik, 1964 ; Nath *et. al.*, 1979 ; Banerjee and Mondal, 1983 ; Banerjee *et. al.*,

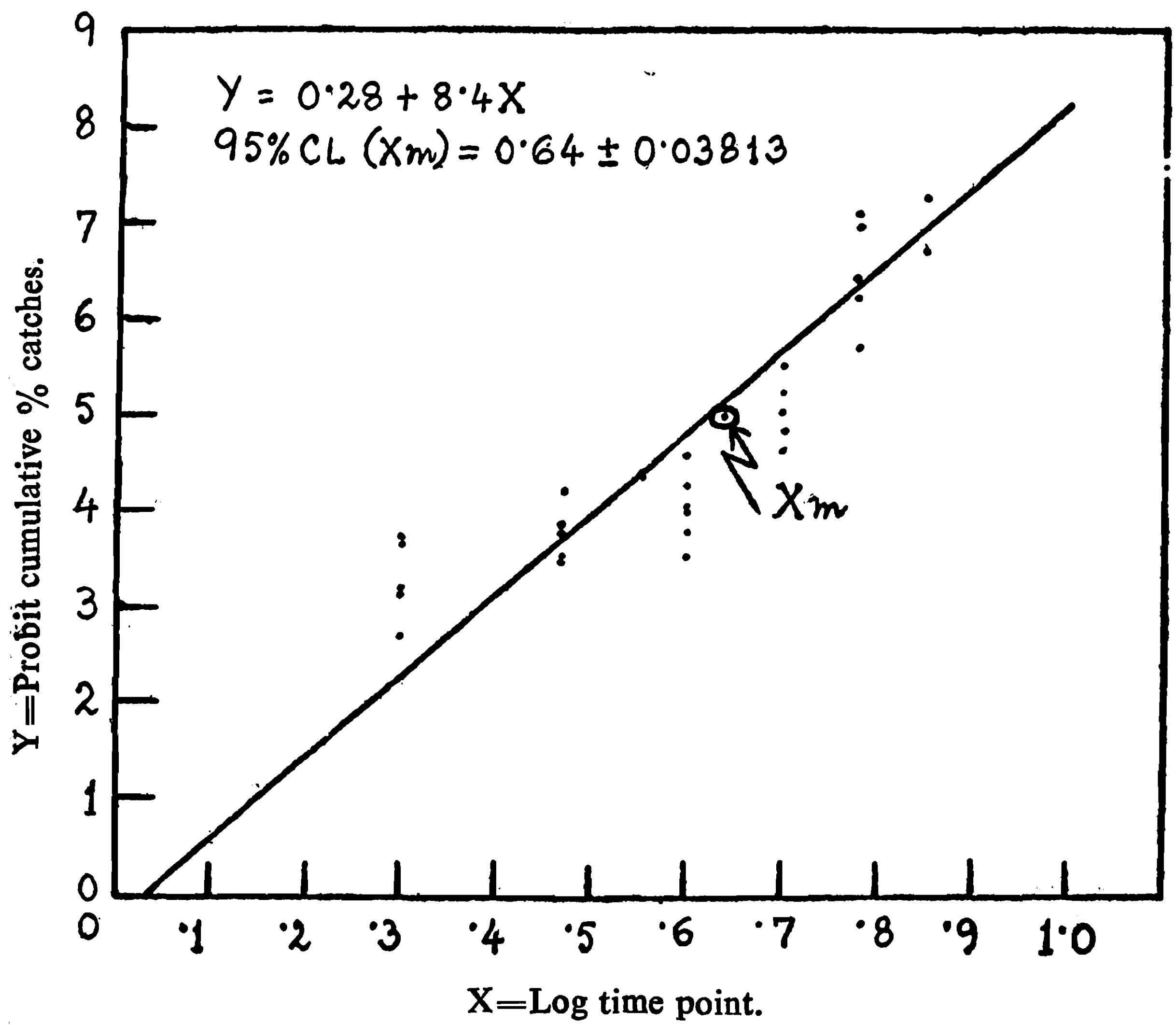

Fig. 3 : Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of second brood (April, 5±6 days).

1983) integrated the insect catch with some of the weather variables and crop stages, which may elucidate the insect behaviour but can not predict temporal occurrence of the moth having functional relationship with the crop. Present data of light-trapped catches have also been given in deterministic model and showed the variation in size of the catches in different localities with but only two peaks, corresponding to the time of Banerjee and Pramanik (1964). The intermediate peaks, caused by the completion of life-cycle of the borer are, however, not revealed in such representation. Besides, the latter peaks are

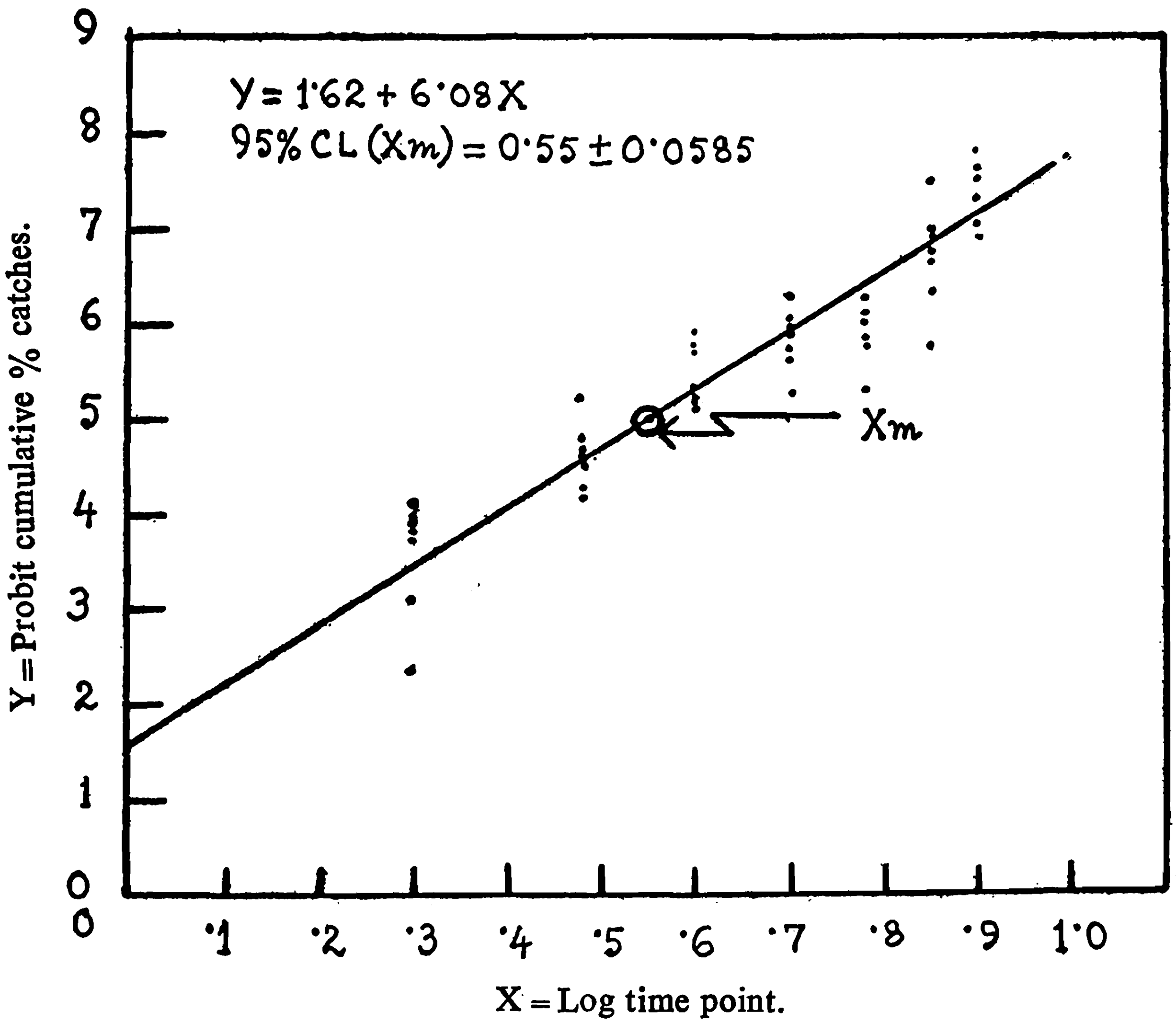

Fig. 4 : Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of third brood (May, 19±6 days).

subduced for their low intensity but have definite role in causing dead-hearts in the vegetative phase of the monsoon crop.

When the analysis are made in stochastic model, taking 5 days' catch as unit, the periodical rise and fall of catches are revealed and six broods a year are evident (Figs. 2-7). As the raw catch data are based on removal of moths in every night and considerable overlapping of generations are very common under the weather conditions of West Bengal, such graphical representation of the data nonetheless fails to show the definite peaks of the successive broods—an information urgently needed by the plant protection workers. The Fig. 4, however, shows that the intensity of the brood during dry season is very low when there is scarcity of food and shelter in these saline tracts, with only single harvest a year. On the contrary, there is a many fold increase of successive broods during monsoon, which

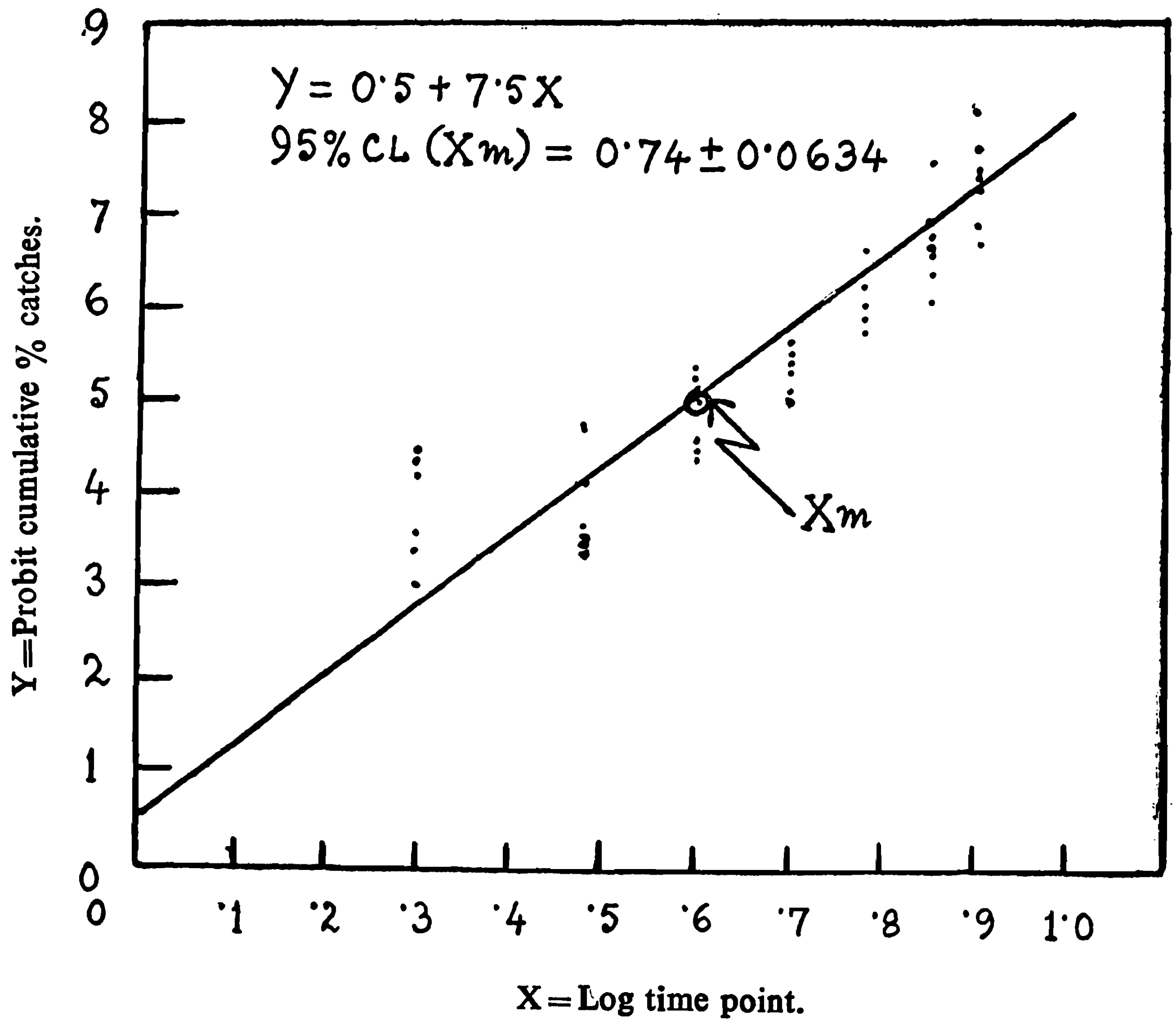

Fig. 5 : Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of fourth brood (July, 7±6 days).

is a cropping season in these areas. Wide variations are observed in the size of catches between the farms near and away from the coast, which may be due to the effect of noon-humidity (Nath *et. al.* 1979).

Nath and Sen (1978), Nath and Banerjee (1984) suggested the application of the probit analysis of the light-trapped catch data for the occurrence prediction of the phototropic insects of field crops in the tropical countries. Practice of such an analysis is in vogue in Japan (Torii, 1964). On the basis of such analysis, Nath *et. al.* (1978), Nath and Sen (1979) got six annual peaks of occurrence of the rice yellow borer from the studies of ten years' light-trapped catch data and two years' insect rearing data at the Rice Rescarah Station, Chinsurah. Same probit analysis is made in the present study and the

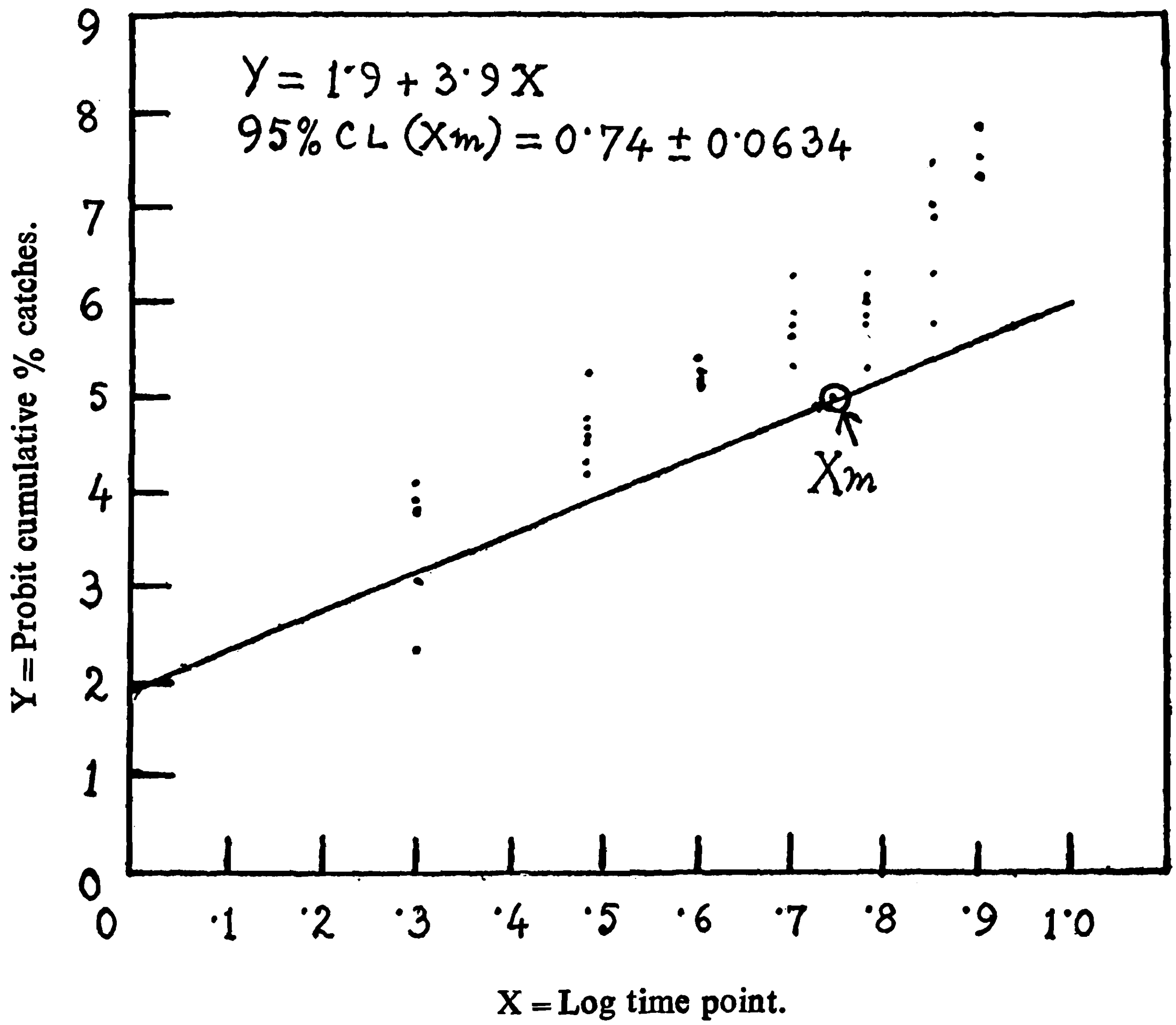

Fig. 6 : Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of fifth brood (August, 27±6 days).

results are given. The knowledge on the definite peaks of occurrence of the moth during different stages of crop growth will help in timing the operation of pest surveillance, chemical control or releasing of egg-parasitoids for effective regulation in the fields. Though the rice agro-ecological conditions of Chinsurah (Gangetic alluvial tract) and those of the saline tracts are different, the temporal distribution of moths is more or less same, thus signifying the greater importance of the seasonality of the life-cycles of the insect rather than the edapic factors for occurrence prediction in warm humid regions. It is also interesting to note that in spite of pooling the data from widely separated localities, there is no heterogeneity [χ^2_0, (Chi) not significant], suggesting thereby linear response of the probit cumulative percentage catches to the time for all the broods.

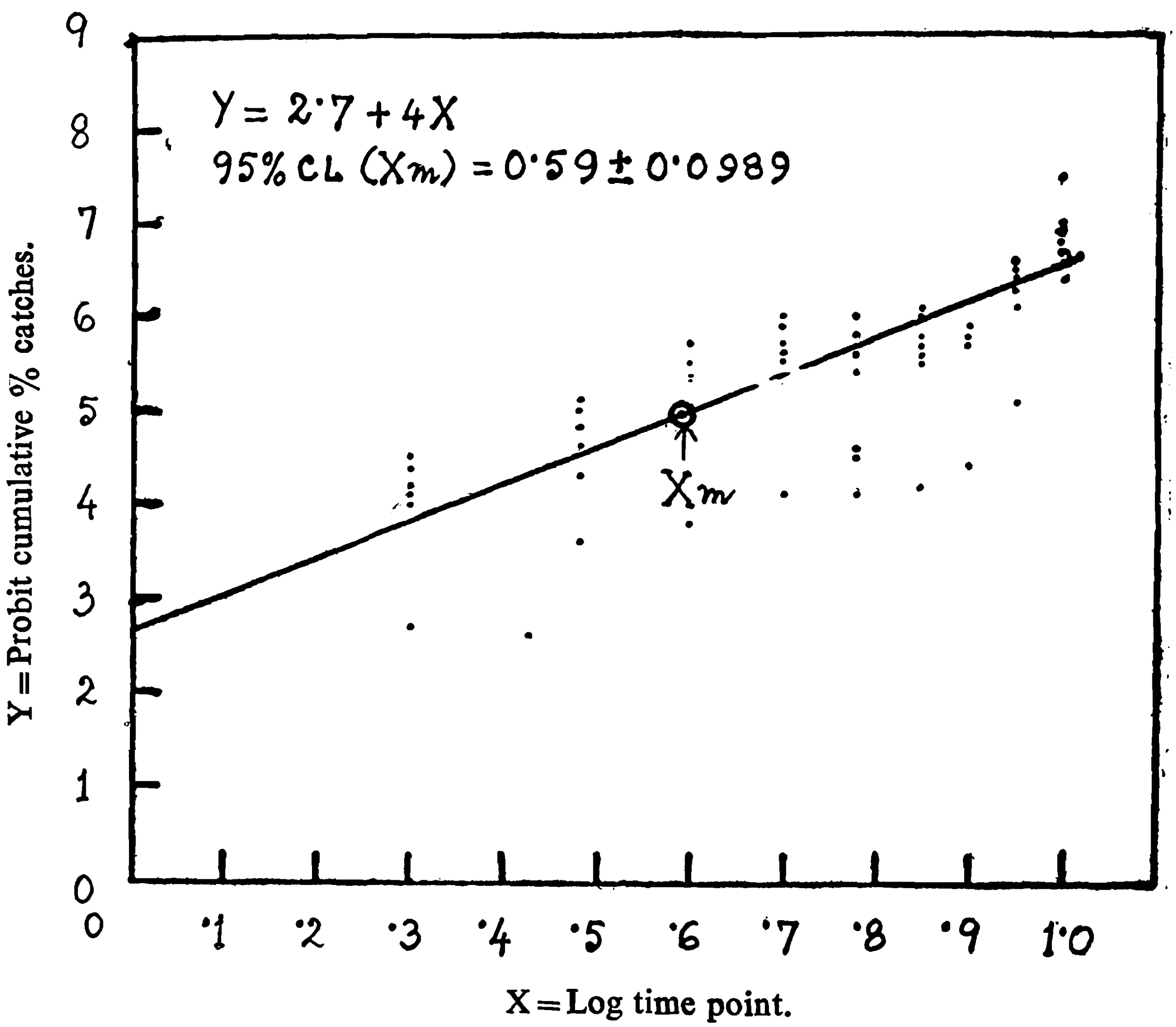

Fig. 7: Scatter diagram, regression equation and the peak emergence (Xm) of trapped moths of sixth brood (October, 16±6 days).

SUMMARY

Light-trapped catches of adults of the rice yellow borer, *Tryporyza incertulas* (Walker) have been studied for a year from 5 different agricultural farms of the saline tracts of West Bengal. These farms are Baruipur, Diamond Harbour and Sagar of South

24-Parganas, Bagnan of Howrah and Contai of Midnapur districts. The traps have been operated daily from dusk to dawn. The data have been analysed by stochastically considering time point as 5 days-unit. The step-wise analysis of the data for the first brood, as an example, has been furnished in details for occurrence prediction. The result has confirmed the occurrence of six active annual broods of the borer having different intensities. The intensity of the broods during dry season is very low due to the scarcity of food and shelter in these saline tracts, having only one rice crop in a year. On the contrary, there is a many-fold increase in numbers of successive broods of the moth during monsoon, the typical cropping season in these areas. The temporal distribution of the moth is more or less same as at Chinsurah (Gangetic alluvial tract) as at other areas (saline tracts) monitored and there is no heterogeneity among the pooled data of widely separated localities (X_0^2, not significant), thus suggesting the linear response of the probit cumulative percentage catches to the time point for all the broods.

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