

Monitoring of yellow stem borer, *Scirpophaga incertulas* (Walker) using pheromone trap and light trap along with determination of field incidence in *kharif* rice

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ABSTRACT

The insect, *Scirpophaga incertulas* commonly known as yellow stem borer (YSB) of rice is distributed widely, covering almost all the Asian countries. YSB usually occupied more than 90 per cent of the borer populations in the rice crop from seedling to maturity stage of the crop. Their infestation caused "dead heart" at the tillering stage and "white ear head" at reproductive stage resulting a yield loss of about 10-60 per cent. Pest surveillance is the most important and integral part of IPM programme which involves direct measurement of pest development in terms of either population or damage at regular intervals. Light trap and pheromone trap are the convenient tools to monitor adult moth population of YSB in rice. The present investigation was undertaken at RRS, Chinsurah to monitor the population fluctuation of YSB using light trap and pheromone trap in *kharif* rice during 2010 and 2011. The experimental result revealed that the YSB population reaches its peak during November 3-4th week and maximum dead heart incidence was recorded between 3rd and 4th week of September whereas, the peak white heads was noticed between 1st and 2nd week of November.

Keywords : Dead heart, light trap, monitoring, pheromone trap, yellow stem borer, white ear head

West Bengal ranks second in area (5,386,000 ha) and first in production (14,771,0000 tons) of rice in India (Chatterjee *et al.*, 2015). About 78 per cent of total area under rice in the state is concentrated under high and medium productivity groups, which accounts for nearly 84 per cent of total production of rice in the state. A critical analysis of the gap between the potential and actual rice yields across the nation would reveal that several factors act as yield constraints. Among these factors, insect-pests contribute substantially to yield loss in rice production and productivity (Chatterjee *et al.*, 2016). Yellow stem borer is the dominant and is considered as prime devastator responsible for major economic loss in rice occurring throughout the country causing the yield loss of about 10-60 percent (Chatterjee and Mondal, 2014). Pest surveillance is the most important and integral part of IPM programme in rice. Population dynamics is not only an important tool to monitor the insect-pests but also to find out the peak and lean period of population of insect-pests. It involves direct measurement of pest development in terms of either population or damage at regular intervals. Indiscriminate use of pesticide can be avoided easily, if we have good awareness regarding pest population (Singha and Chatterjee, 2009). Light trap and pheromone trap are the important tools to monitor adult moth population of YSB in the field condition very easily and accurately. Sex pheromone (chemically synthesized female sex pheromone) had been found promising for monitoring and management of YSB.

The actual peak period of insect-pests population can be calculated through monitoring of the pest and it will

help to judge the actual time for initiation of management practice against the pest. Therefore, the experiment was conducted to find out the peak period of population of yellow stem borer in *kharif* rice along with their field incidence which will help in future to fix the right time of insecticidal application for the management of YSB.

MATERIALS AND METHODS

The experiment was conducted at Rice Research Station, Chinsurah, Hooghly during *kharif* 2010 – 2011 to monitor the population fluctuation of yellow stem borer (YSB) using pheromone trap (PMT) and light trap (LT), to find out the correlation between mean moth population of YSB and level of field infestation in rice cv. Swarna (MTU 7029). In the field, the pheromone traps (funnel traps) with scirpolure were installed 200 m away from the source of light. Three traps were placed in a triangular fashion with 40 m apart from each other in a 50 x 50 m quadrat. Pheromone traps were placed at 30 cm above the crop canopy. Each trap contained one lure tube which was impregnated with a mixture of (Z)-11 hexadecenal + (Z)-9 hexadecenal in 3:1 ratio. Both traps and the lure (Scirpolure) were supplied by Pest Control India (Private) Limited, Bangalore. The scirpo-lure was changed at every 15 days interval after first installation which was done after 15 days of transplanting of rice. The trap catch was recorded at weekly interval. The daily collection of YSB male moths through Chinsurah type light trap, installed at Rice Research Station, Chinsurah was counted and the weekly mean population of trapped YSB male moth was

Table 1 : Yellow stem borer population along with their incidence level during *kharij* 2010 and 2011

Period of monitoring	PMT		LT		Adult sqm ⁻¹		Egg mass sqm ⁻¹		DH%		WE%	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Aug.,1 st wk	1.00	1.67	1.00	2.86	0.00	0.00	0.00	0.00	0.00	0.00	-	-
Aug.,2 nd wk	1.67	1.67	0.57	2.29	0.07	0.07	0.00	0.00	0.00	0.00	-	-
Aug.,3 rd wk	1.33	2.33	0.71	3.00	0.13	0.20	0.07	0.13	0.00	1.24	-	-
Aug.,4 th wk	0.67	2.67	1.57	3.29	0.13	0.20	0.07	0.20	2.45	4.86	-	-
Sept.,1 st wk	2.00	2.67	4.00	2.57	0.26	0.33	0.07	0.20	3.13	5.90	-	-
Sept.,2 nd wk	5.33	1.67	5.43	2.57	0.33	0.33	0.13	0.20	3.57	7.60	-	-
Sept.,3 rd wk	7.33	4.00	4.29	14.14	0.73	0.47	0.20	0.33	5.15	9.05	-	-
Sept.,4 th wk	7.00	13.00	4.29	22.57	0.47	0.53	0.53	0.67	5.07	11.45	-	-
Oct.,1 st wk	5.00	15.00	3.71	9.00	0.53	1.00	0.33	0.53	5.32	10.57	-	-
Oct.,2 nd wk	3.67	5.67	3.43	12.00	0.40	0.33	0.20	0.40	-	-	3.87	6.21
Oct.,3 rd wk	5.67	7.00	4.57	17.29	0.47	0.33	0.33	0.47	-	-	6.58	10.63
Oct.,4 th wk	8.33	11.00	6.57	22.29	0.40	0.33	0.20	0.20	-	-	8.93	15.62
Nov.,1 st wk	8.00	21.33	9.43	35.14	0.33	0.40	0.20	0.27	-	-	8.51	18.84
Nov.,2 nd wk	8.00	26.67	10.18	51.00	0.27	0.47	0.07	0.20	-	-	5.52	13.53
Nov.,3 rd wk	8.33	23.00	10.15	48.43	0.20	0.27	0.13	0.20	-	-	5.41	16.67
Nov.,4 th wk	4.67	8.33	8.43	15.00	0.20	0.13	0.00	0.27	-	-	3.36	7.39
Dec.,1 st wk	2.33	2.33	4.86	9.29	0.13	0.07	0.13	0.13	-	-	3.47	5.89

Table 2. Correlation between population of YSB and level of field incidence during *kharij* 2010 and 2011

Incidence	Pheromone trap		Light trap		Adultsqm ⁻¹		Egg masssqm ⁻¹	
	2010	2011	2010	2011	2010	2011	2010	2011
DH%	0.840**	0.740*	0.862**	0.734*	0.908**	0.843**	0.784*	0.920**
WE%	0.758*	0.790*	0.238	0.755*	0.563	0.613	0.519	-0.214

** Significant at p<0.01* Significant at p< 0.05

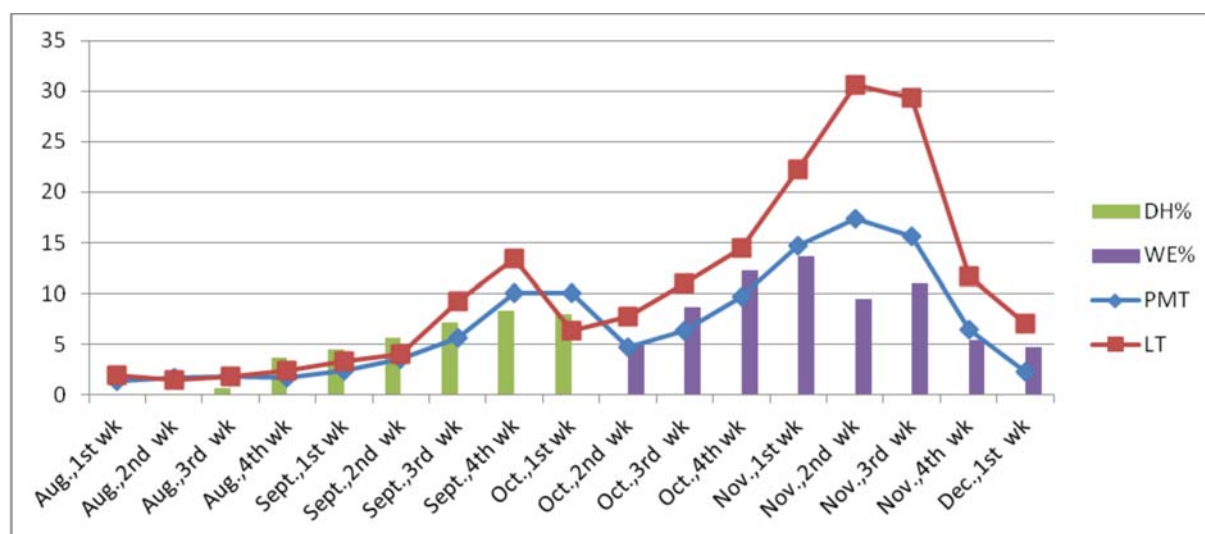


Fig. 1. Yellow stem borer population along with their incidence during *kharif* 2010-11

calculated. The YSB adult sqm^{-1} and egg mass sqm^{-1} in rice field were also recorded once in a fixed day of the week. The level of insect-pest infestation was determined by counting dead heart (DH) and white ear head (WE), once in a fixed day of the week. The correlation coefficient was calculated between YSB population along with their incidence.

RESULTS AND DISCUSSION

The results revealed that during *kharif*, 2010 the maximum YSB male was trapped in pheromone trap between October 4th week–November 3rd week (8.00–8.33) and the results almost followed the light trap catch (Table 1). The maximum per cent dead heart was discernible during September 3rd week (5.15%) to October 1st week (5.32%). Whereas, the highest white ear head was observed during November 2nd week (10.18%) followed by next week (10.15%). Through the field observations of YSB adult sqm^{-1} and egg mass sqm^{-1} during the season, it was found that the observation of this experiment didn't across the economic threshold level. Perusal of table 2 revealed that YSB population in nature was positively correlated with dead heart incidence. It has been found that the YSB male population by pheromone trap ($r=0.840^{**}$) and by light trap ($r=0.862^{**}$), YSB adult sqm^{-1} ($r=0.908^{**}$) and egg mass sqm^{-1} ($r=0.784^*$) has significant effect on dead heart incidence. All the YSB population parameters were positively correlated with white ear head incidence. Pheromone trap catch showed positive significant correlation with white ear head incidence ($r=0.758^*$) but failed to show any significant effect by light trap ($r=0.238$), adult sqm^{-1} ($r=0.563$) and egg mass sqm^{-1} ($r=0.519$).

In *kharif* 2011, the maximum male YSB moth catch by PM trap was recorded, during November 1st-3rd week which followed the light trap YSB male moth catch. The maximum YSB adult moth sqm^{-1} was found during October 1st week (1.00). The maximum dead heart incidence was found during September 4th week (11.45%) followed by October 1st week (10.57%) and the highest white ear head incidence was recorded during 1st week of November (18.84%) followed by November 3rd week (16.67%). All the YSB population played a positive role on incidence of dead heart as this was evident from the significant positive correlation with the YSB male population by pheromone trap ($r=0.740^*$) and by light trap ($r=0.734^*$), YSB adult sqm^{-1} ($r=0.843^{**}$) and egg mass sqm^{-1} ($r=0.920^{**}$). Among the YSB population factors, pheromone trap ($r=0.790^*$) and by light trap ($r=0.755^*$) population played a significant positive role on the incidence of white heads during the crop growing season but adult sqm^{-1} ($r=0.613$) failed to show any significant effect. The egg mass sqm^{-1} ($r=-0.214$) showed a negative effect, which was probably happened because the YSB adult dislike to lay eggs on matured crop. Therefore, it can be inferred that YSB population in nature played an important role in dead heart as well as white ear head incidence. The observations made in the present study are in agreement with the findings of Patel and Desai (2004) who observed that the correlations between moth catches from pheromones, light and pheromone+light traps with per cent infestation were significant.

In the present findings, the maximum number of YSB male moth were caught through pheromone trap during 4th week of October and 3rd week of November (*kharif*, 2010) and 2nd week of November (*kharif*, 2011). The

observations made in the present study partly corroborates to the observation of Varma *et al.* (2000) who recorded the peak periods of YSB during July, August, September in *kharif*. They also reported that from the temporal relationship between peak periods of pheromone trap catches and field infestation, the peak dead heart and white ear infestation occurred during 2 and 3 weeks after the peak or sudden increase in moth captures, respectively which trend has also been noticed in this present findings.

Finally this can be concluded from this experiment that the YSB population reaches its peak twice *i.e.* during September 4th week (responsible for dead heart) and November 1st week (responsible for white ear head) in *kharif* rice (Fig. 1). The maximum dead heart incidence was recorded during 3-4th week of September whereas, the peak white heads was noticed during 1-2nd week of November. YSB population in nature played an important role in dead heart as well as white ear head incidence. Therefore, this experiment will help for adoption of management practices against YSB. The farmers should go for insecticidal application against YSB during two weeks before the two peak period of population of YSB *i.e.* during September 2nd week (for dead heart management) and October 4th week (for white ear head management).

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