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Assessment of hours for the peak activity of nocturnal rice insect pests through light trap

Rameshwar Singh Dhruv and Vijay Kumar Soni

Abstract

The study was conducted at the research farm of S.K. College of Agriculture & Research Station, Kawardha (Kabirdham) during *Kharif* 2018, aimed to assess the hours for the peak activity of nocturnal rice insect pests by recording hourly overnight catches through the light trap. The maximum hourly over night light trap catches for all the major rice insects were observed from sunset till midnight and also maximum activity recorded during the month of October and November.

Keywords: Light trap, rice, yellow stem borer, leaf folder, green leaf hopper, case worm, brown plant hopper, white backed plant hopper, insect pests

Introduction

Rice is an important cereal crop in the world serving as staple diet for millions of peoples. Rice stands second in the world after wheat in area and production. Almost 90% of rice is grown and consumed in Asia (Anonymous, 2015) ^[2]. In India, it is cultivated in an area of 431.94 lakh hectare with a production 110.15 million tones and productivity of 2550 Kg/ha. (Anonymous, 2017) ^[1]. The average losses of paddy production due to insect pests are 25-30% in India (Dhaliwal, 2010) ^[8] and about 40-100% in Chhattisgarh. losses were observed (Dhamdhare, 1990; Pathak and Dhaliwal, 1981 5,13) ^[9, 15] reported that over 100 insect pests species attack paddy crop at various stages of its growth in which 20 species cause economic damage. One of the most apparent behaviour of insects is flying to towards a light source at night known as phototaxis. It is traditional in Integrated Pest Management (IPM) to control of insect pest by exploiting there phototactic responses. Use of light trap was a common practice and indigenous technology during early decade of 20th century, mostly for the control of insect pests. The detailed effects of light trapping on agro ecosystem and biodiversity are unknown. In recent years, as non-chemical method for insect pest control, light trap have been widely used to control agricultural pests in developing countries such as India (Srivastava *et al.*, 1992) ^[18], China (Ma *et al.*, 2009) ^[11] and Brazil (Olivaeria *et al.*, 2008) ^[14] although much work have been conducted on use of light trap against insect pest of rice, but little information is available at Chhattisgarh. Large numbers of non- target species, especially beneficial insects that play a significant role in pest control, are also killed by light traps (Ma *et al.*, 2005, 2009) ^[11, 12]. So, by determining the times of the peak activity of nocturnal target insect pests it may be possible to manage the pest by operating the light traps. Therefore, present study aimed to assess the hours for the peak activity of nocturnal rice insect pests by recording hourly throughout the night the numbers of different rice insect species caught by light trap.

Materials and methods

Present study was conducted on rice insect pests catches in light trap at the research farm of S.K. College of Agriculture & Research Station, Kawardha (Kabirdham) during *Kharif* 2018 with the following trapping strategies, sampling and insect identification methods:

Light traps and trapping strategies

Light trap is a device effective for monitoring and mass trapping of various insects. It works on the principal of exploiting phototrophic responses by insect pests. Commercial light trap was used as they are widely used for pest control in India. The trap mainly consists of M.S.fabricated sheet, electric bulb, electric wire, funnel collecting box and power supply. It is made up of M.S. Sheet consisting of a funnel with 50 cm top diameter, four baffle plates made

of M. S. sheet mounted vertically on rim of funnel, placed in equidistant and projecting towards the centre of the funnel and a rain shade (M.S.) is fitted over the baffle plates. The insect collecting box is made from M. S. sheet with single box. Insects were attracted towards the artificial light and they attack the 200W ordinary (candy) bulb as well as baffle plates and drop down in the collection box through the funnel. In which a plastic bag is used for collecting insect pests. Trap was fitted with switch that manually controlled the switch status to "on" or "off" at any time during investigation. Light trap schedule to be "on" for 12 hrs from 18:00 to 06:00. The bottom of trap was positioned 1.8 meter above the ground to ensure that the light was visible to nocturnal insects.

Trapping, sampling and insect identification

The night trapping schedule was used to catch nocturnal insects at the research farm of S.K. College of Agriculture & Research Station, Kawardha (Kabirdham) during *Kharif* 2018. Sampling information including location, main crop, date, year and number of nights for which trap was operated are as follows:

The location, main crop, date, year and number of nights

Location	Main crop	Date and year	Number of nights
SKCARS, Kawardha (C.G.)	Paddy	02/07/2018 to 26/11/2018	22

On all the nights, in which, the traps were operated, sundown and sunrise was between 18:38 – 19:00 hrs and 05:05 – 06:05hrs, respectively. The insect collecting bag suspended below light trap was replaced by a new one every hour during the night and then frozen at -18°C in a refrigerator for 30 minute to kill the insects. Insect species and numbers were identified and counted in the Entomology laboratory of S.K. College of Agriculture & Research Station, Kawardha. A total of 22 nights × 12 samples/night = 264 samples were collected. The nightly catches of insects by light trap were identified and counted. The hourly light trap catches of insect pests at weekly interval were calculated for the assessment of hours for the peak activity of each insect pest species.

Result and discussion

Yellow Stem Borer (YSB)

The YSB (male + female) catches was observed during July to November of *Kharif* 2018. YSB collected from light trap revealed that the population occurred throughout the rice season from July to November. The collected population of YSB ranges from 0 to 6 (Table No.1). Maximum population of YSB (3.44) was collected at 20 hrs followed by 2.36 at 21 hrs and minimum population (0.13) recorded were at 04 hrs. However, no catches were recorded after 05 hrs. throughout the cropping season from light trap. The highest numbers of Coleoptera were caught between 20:00 and 22:00hrs. and most of Lepidoptera between 02:00 and 4:00 hrs. (Gang and Chun- Sen, 2012) [10]. Chakraberty and Nanda (2011) [5] recorded the maximum population of Yellow Stem Borer (148 females + 153 males) during fourth week of September. Similarly Bhutto *et al.*, (2015) [4] observed that the activity of adult yellow rice stem borer started from July to last week of November and maximum catches started during 2nd week of August to 1st week of October.

Leaf folder (LF)

The leaf folder population was not found in light trap from July to first week of August; it may be due to the early stage

of rice crop grown around the light trap. The leaf folder was collected hourly over night from 18:00 to 06:00 hrs and the maximum mean trap catches was recorded at 21 hrs (1.95) and minimum was at 05 hrs (0.137). The mean light trap collections of leaf folder ranges from 0 to 19 insects throughout the crop season (Table No.2). The month of August is identified as the peak activity period for this pest as observed in light trap. Sharma *et al.* (2013) [16] revealed that major activity period of paddy leaf folder was confined between August to December. Chhavi *et al.* (2016) reported that adults of leaf folder started appearing during 3rd week of July and peak activity was recorded in 4th week of August. The maximum mean trap catches of leaf folder was 43 adults/week.

Case worm (CW)

The hourly over night light trap catches of rice case worm was started from 1st week of September and remained continue up to last week of November during *Kharif* 2018 (Table No.3). This pest was not found in July and August, may be due to early age of rice crop grown around the light trap. The maximum catches of case worm were recorded at 20 hrs with the mean population of 0.68 followed by 22 hrs with 0.63 and minimum was observed at 05 hrs with 0.04. No case worm adult was trapped in light trap at 04 hrs, throughout the crop season; it may be due to unstagnant water and not intermittent rainfall in rice crop. Similar findings were reported by Shukla *et al.*, (2008) [17] that the peak activity of case worm was observed during September and October.

Green leaf hopper (GLH)

Green leaf hopper population collected in light trap was very low from July to IIIrd week of September. Although this species fly to the light during all night, light traps did not catch it in consideration number in the month of September to October. October onwards, the number of catches in light trap was more and gradually increasing the catches of Green leaf hopper (GLH) up to the end of November (Table No. 4). In early first three to four hours (18 to 22 hrs) the mean collection frequency of GLH was more and gradually the catches was decreased because of the insect species start their flight in early hours of night and highly photo attractive towards light source. Similar findings were reported by Anonymous (2010) [3], Chakraberty and Nanda (2011) [5] that the population of GLH (*Nephotettix virescens*) were maximum during the second week of November at Raipur.

Brown planthopper (BPH) and white backed planthopper (WBPH)

The activity of BPH and WBPH were started in later phase of rice crop. The frequency of collection in light trap was nil from July to September (Table No.5). Further, the catches were increased from October and reached peak in the November month. After sunset the mean light trap catches were started with its peak at 20 hrs (70.68) and further population decreasing. Data revealed that the frequency of catches of BPH and WBPH in light trap the mean catches ranges from 9.6 to 70.68 BPH and WBPH throughout the crop season. Mukherjee and Khan; (2017) [13] reported that at seedling, maximum tillering and panicle initiation stage the highest abundance of leaf hopper was recorded with 94.25, 122.5 and 65.25, respectively.

Gundhi Bug (GB)

The hourly over night light trap catches of gundhi bug revealed that the activity began from last week of October

when rice crop reach at milking stage. The mean catches were maximum in the second week of November (31) (Table No.6). The mean overnight catches in light trap was range from 0 to 38. The maximum mean light trap collection of gundhi bug (1.72) was recorded just after sunset at 18 hrs and further, the frequency of catches were decreased up to 02 hrs. In the dawn period 03 hrs afterwards no catches of gundhi bug was found in light trap. The study revealed that gundhi bug follows a special daily rhythm that usually corresponds to the time of flying to light. Anonymous (2010)^[3] reported that the highest activity of gundhi bug was observed during IInd week of October.

Conclusion

During the entire *Kharif* season, the maximum hourly over night light trap catches for all the major rice insects were observed from sunset till midnight and also maximum activity recorded during the month of October and November. At this time the weather was favourable for their growth and development and the nature of insects are intensive photoactive from sunset to early hours of midnight and close on sunrise. The findings of this study revealed that the period of maximum activity of these rice insect pests were observed during October and November month in light trap.

Table 1: Observation of hourly overnight catches of yellow stem borer through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06		
02/07/2018	2	0	1	4	0	0	0	0	0	0	0	0	7	53
09/07/2018	2	0	2	2	4	1	0	0	0	0	0	0	11	
16/07/2018	2	1	4	1	0	0	0	0	0	0	0	0	8	
23/07/2018	1	4	3	5	2	0	0	0	0	0	0	0	15	
30/07/2018	4	1	6	1	0	0	0	0	0	0	0	0	12	
06/08/2018	3	2	7	4	0	0	0	0	0	0	0	0	16	78
13/08/2018	1	3	7	5	3	2	0	1	0	0	0	0	22	
20/08/2018	1	0	2	3	4	2	6	1	4	0	0	0	23	
27/08/2018	2	1	6	5	2	1	0	0	0	0	0	0	17	
03/09/2018	0	1	3	1	3	1	2	4	1	2	0	0	18	42
10/09/2018	1	3	1	0	0	1	0	0	0	0	0	0	6	
17/09/2018	0	2	0	0	1	3	3	3	0	2	2	0	16	
24/09/2018	0	0	0	0	0	0	2	0	0	0	0	0	2	
01/10/2018	0	1	0	0	0	1	0	0	1	0	1	0	4	26
08/10/2018	1	2	1	1	1	2	0	1	1	0	0	0	10	
15/10/2018	1	2	1	1	0	1	2	0	1	0	0	0	9	
22/10/2018	0	0	0	0	1	0	0	0	0	0	0	0	1	
29/10/2018	0	0	1	1	0	0	0	0	0	0	0	0	2	
05/11/2018	3	4	2	6	0	1	0	0	0	1	0	0	17	98
12/11/2018	2	8	7	2	1	1	0	0	0	0	0	0	21	
19/11/2018	4	6	9	4	1	1	0	0	0	0	0	0	25	
26/11/2018	3	8	13	6	3	1	1	0	0	0	0	0	35	
Total	33	49	76	52	26	19	16	10	8	5	3	0	297	
Mean	1.50	2.23	3.45	2.36	1.18	0.86	0.73	0.45	0.36	0.23	0.14	0.00	13.50	

Table 2: Observation of hourly overnight catches of Leaf folder through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06		
02/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
16/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
23/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
30/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
06/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	129
13/08/2018	0	0	3	2	1	0	0	0	0	0	0	0	6	
20/08/2018	0	0	7	5	3	1	0	0	0	0	0	0	16	
27/08/2018	0	9	11	13	19	8	7	18	6	9	7	0	107	
03/09/2018	0	0	2	1	2	4	0	0	0	2	1	0	12	60
10/09/2018	3	2	7	11	6	3	0	0	2	0	0	0	34	
17/09/2018	1	1	0	0	0	2	3	2	1	1	2	1	14	
24/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
01/10/2018	1	0	0	0	0	0	1	0	0	2	1	0	5	92
08/10/2018	1	3	3	2	0	4	3	3	7	2	0	0	28	
15/10/2018	6	1	2	2	0	2	1	3	4	5	5	2	33	
22/10/2018	0	0	0	0	0	0	0	0	1	0	3	0	4	
29/10/2018	0	0	2	1	1	0	3	2	6	4	3	0	22	
05/11/2018	0	0	1	2	0	0	0	3	0	0	0	0	6	30
12/11/2018	0	4	0	3	0	2	1	1	0	2	0	0	13	
19/11/2018	0	0	1	0	1	0	1	2	2	0	1	0	8	
26/11/2018	0	0	2	1	0	0	0	0	0	0	0	0	3	
Total	12	20	41	43	33	26	20	34	29	27	23	3	311	
Mean	0.55	0.91	1.86	1.95	1.50	1.18	0.91	1.55	1.32	1.23	1.05	0.14	14.14	

Table 3: Observation of hourly overnight catches of Caseworm through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06		
02/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
16/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
23/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
30/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
06/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
20/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
27/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
03/09/2018	1	2	1	0	2	1	1	3	1	0	0	0	12	24
10/09/2018	0	1	0	0	0	0	0	0	0	0	0	0	1	
17/09/2018	0	1	2	0	3	0	1	3	1	0	0	0	11	
24/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
01/10/2018	0	0	0	0	0	0	0	1	0	0	0	0	1	29
08/10/2018	0	0	5	3	4	5	1	2	2	1	0	1	24	
15/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
22/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
29/10/2018	0	0	0	0	2	0	1	0	0	1	0	0	4	
05/11/2018	0	0	0	1	0	0	2	0	0	0	0	0	3	32
12/11/2018	0	0	2	0	1	0	3	0	0	0	0	0	6	
19/11/2018	2	1	4	1	0	0	1	0	0	0	0	0	9	
26/11/2018	0	4	1	3	2	3	1	0	0	0	0	0	14	
Total	3	9	15	8	14	9	11	9	4	2	0	1	85	
Mean	0.14	0.41	0.68	0.36	0.64	0.41	0.50	0.41	0.18	0.09	0.00	0.05	3.86	

Table 4: Observation of hourly overnight catches of Green leaf hopper through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06		
02/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
16/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
23/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
30/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
06/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	6
13/08/2018	0	1	0	1	0	0	0	0	0	0	0	0	2	
20/08/2018	1	0	0	2	0	0	0	0	0	0	1	0	4	
27/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
03/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	20
10/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	
17/09/2018	1	0	0	1	0	0	0	0	0	0	0	0	2	
24/09/2018	0	5	0	0	2	0	3	0	3	0	2	3	18	
01/10/2018	0	2	0	2	1	3	0	1	2	3	0	1	15	481
08/10/2018	3	2	3	1	0	0	0	3	0	2	3	1	18	
15/10/2018	11	8	5	9	6	3	4	6	4	3	0	3	62	
22/10/2018	37	44	41	17	14	5	0	0	0	1	0	0	159	
29/10/2018	75	41	13	9	7	11	15	17	10	13	7	9	227	
05/11/2018	88	69	76	82	40	33	28	17	22	15	10	7	487	2101
12/11/2018	93	89	112	72	49	31	17	11	16	9	5	3	507	
19/11/2018	86	93	123	94	54	36	24	17	7	6	3	2	545	
26/11/2018	46	93	146	105	66	39	21	17	12	9	5	3	562	
Total	441	447	519	395	239	161	112	89	76	61	36	32	2608	
Mean	20.05	20.32	23.59	17.95	10.86	7.32	5.09	4.05	3.45	2.77	1.64	1.45	118.55	

Table 5: Observation of hourly overnight catches of Brown planthopper/White backed planthopper through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total	
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06			
02/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1532
01/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
08/10/2018	8	4	10	13	0	2	11	8	13	0	11	3	83		
15/10/2018	35	13	11	29	22	19	10	13	35	18	7	3	215		
22/10/2018	33	27	34	25	28	0	56	0	0	7	9	17	236		
29/10/2018	217	166	115	63	37	28	11	64	43	89	58	107	998		
05/11/2018	219	256	291	188	142	117	93	54	42	33	17	9	1461	6241	
12/11/2018	158	264	313	209	284	35	24	52	32	22	46	57	1496		
19/11/2018	287	291	398	283	68	56	29	52	44	46	27	20	1601		
26/11/2018	269	302	383	256	107	89	54	64	51	46	37	25	1683		
Total	1226	1323	1555	1066	688	346	288	307	260	261	212	241	7773		
Mean	55.73	60.14	70.68	48.45	31.27	15.73	13.09	13.95	11.82	11.86	9.64	10.95	353.32		

Table 6: Observation of hourly overnight catches of Gundhi bug through light trap at weekly interval

Date/hours	Time of night (hrs)												Total	Month total	
	18 - 19	19 - 20	20 - 21	21 - 22	22 - 23	23 - 24	00 - 01	01 - 02	02 - 03	03 - 04	04 - 05	05 - 06			
02/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30/07/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
27/08/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24/09/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
01/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
08/10/2018	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15/10/2018	0	0	0	1	1	0	1	0	0	0	0	0	0	3	
22/10/2018	0	1	0	0	0	0	0	0	0	0	0	0	0	1	96
29/10/2018	8	3	2	1	0	0	0	1	1	0	0	0	0	16	
05/11/2018	10	7	3	5	1	2	0	0	1	0	0	0	0	29	
12/11/2018	7	9	5	6	2	2	0	0	0	0	0	0	0	31	
19/11/2018	5	2	0	0	2	0	1	0	1	0	0	0	0	11	96
26/11/2018	8	6	6	1	0	3	0	0	1	0	0	0	0	25	
Total	38	28	16	14	6	7	2	1	4	0	0	0	0	116	
Mean	1.73	1.27	0.73	0.64	0.27	0.32	0.09	0.05	0.18	0.00	0.00	0.00	0.00	5.27	

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