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Influence of ambient weather on population fluctuation of rice insect pests through light trap catches

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Abstract
Studies were undertaken at S.K. College of Agriculture and Research Station, Kawardha, during kharif 2017-2018 to assess the influence of ambient weather on population fluctuation of rice insect pests *viz*., stem borer, leaf folder, green leafhopper, plant hopper and gundhi bug through light trap catches. The light trap catches of rice insect pests were recorded at weekly interval during 27th Standard Meteorological Week (SMW) to 48th Standard Meteorological Week (SMW) and the data were correlated with the weather parameters which, indicates that IInd week of October to last week of November is the period of maximum activity of major insect pests of rice. Yellow stem borer and case worm showed significant negative correlation with minimum temperature with r value -0.487, -0.500, respectively, however, leaf folder showed significant positive correlation with RH-II with r value 0.421 at 5% level of significance. Green leafhopper, planthopper (BPH +WBPH) and gundhi bug were showed significant positive correlation with sunshine hours with r value 0.525, 0.522, 0.484, respectively, at 5% level of significance.

Keywords: Rice, Yellow stem borer, Leaf folder, Green leaf hopper, Gundhi bug

1. Introduction
In India, rice (*Oryza sativa*) is the staple food crop and source of calories for 65 per cent of the population and the most favoured ecology of the rice plant is tropical and humid climate with a temperature range of 15-35^0 C and RH of 85-100 per cent which is best suited for the survival and multiplication of many insects pests. The rice cultivated area is 431.94 lakh hectare with annual production of 110.15 million tones and productivity of 2550 Kg/ha.It is grown under diverse ecological conditions like upland, lowland, irrigated, deep water *etc*. Chhattisgarh is known as "Rice Bowl" of India. In Chhattisgarh, rice cultivated area is 4052.60 thousand hectare with a total production and productivity of 8.79 million tones and 2212 Kg/ha, respectively (Anonymous, 2017b) [3]. It is attacked by more than 100 species of insects and 20 of these are major pests causing 30 per cent yield loss (Pathak and Dhaliwal, 1981; Atwal and Dhaliwal, 2005) [8, 4]. 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 occurrence of insect pests in paddy is influenced by various factors including weather components, cultivation methods and rice varieties. Among these weather component temperature and humidity are the most important factors. A feasible solution to insect pest problems is through proper understanding of interrelationship of pest incidence and meteorological parameters, which trigger their outbreak under favourable conditions. According to Ramasubramaniun *et al.*, (2006) [9] rainfall and relative humidity played a significant role in the population build up of yellow stem borer and rice gundhi bug apart from these no other meteorological variables were found to be significant. Some researchers also correlated the incidence of insect pest with weather derived indices e.g. in mango by Sahoo *et al.* (2016) [10] and Samui *et al.* (2004) [11]. Therefore keeping this in mind, present study aimed to observe the influence of ambient weather on population fluctuation of rice insect pests through light trap catches.

2. Materials and Methods
2.1 Geographical Situation
Kawardha (Kabirdham) is situated in Chhattisgarh plain region and lies between 21.32 to 21.35º North latitude and 80.48 to 81.28º East longitude with an altitude of 353 meters above

from the mean sea level.

2.2 Weather condition during crop growth period

During the crop growth period range of prevailing weather parameters were 29.5 to 34.4 ºC for maximum temperature and 14 to 25 ºC for minimum temperature, the rainfall ranged from 0.00 to 79 mm, the average RH-I was 71 to 92 and RH-II was 66 to 92% and sunshine hours were observed 3.4 to10.4 hours per day.

2.3 Experimental details

Present study was carried out at the research farm of S.K. College of Agriculture & Research Station, Kawardha (Kabirdham), Chhattisgarh during *kharif* 2018. The populations of hourly overnight collections of major rice insect pests through light trap were recorded at weekly interval during the rice crop season. Daily weather data was collected from Agro-meteorological observatory of S. K. College of Agriculture & Research Station, Kawardha (Kabirdham), Chhattisgarh. The experimental field was free from insecticide sprays. Weekly average data of weather parameters and hourly catches of insect pests were calculated from the daily data. The pest succession of major insect pests of rice was correlated with the weather parameters like Maximum temperature, Minimum temperature, rainfall, relative humidity (I & II) and sunshine hours, for the instantaneous impact of light trap catches studied on the fluctuation of insect population.

3. Results and Discussion

The observation of hourly overnight catches through light trap of important insect pests of rice were recorded during 27th Standard Meteorological Week (SMW) to 48th Standard Meteorological Week (SMW) and the data were correlated with the weather parameters (Table 1 & 2 and Fig. 1).

Table 1: Observation of hourly overnight catches of rice insect pests and weather parameters during *Kharif*-2018

SMW	DATE	YSB	LF	CW	GLH	BPH/WBPH	GB	Temperature (ºC)		Rainfall (mm)	RH (%)		Sunshine (hours)
								Max.	Min.		I	II	
27	02/07/2018	7	0	0	0	0	0	30.3	23	0	92	66	5.7
28	09/07/2018	11	0	0	0	0	0	32	25	0	77	85	4.2
29	16/07/2018	8	0	0	0	0	0	34	24	25.8	92	78	0
30	23/07/2018	15	0	0	0	0	0	30.1	20	79	91	86	0
31	30/07/2018	12	0	0	0	0	0	31	23	0	92	78	3.4
32	06/08/2018	16	0	0	0	0	0	31	23	0	92	84	6
33	13/08/2018	22	6	0	2	0	0	31	25	0	78	67	0
34	20/08/2018	23	16	0	4	0	0	34	24	4.3	90	81	3
35	27/08/2018	17	107	0	0	0	0	29.5	23	10.2	88	91	0
36	03/09/2018	18	12	12	0	0	0	32	22.2	0	92	88	0
37	10/09/2018	6	34	1	0	0	0	33	24	0	92	85	4.6
38	17/09/2018	16	14	11	2	0	0	33	18	0	84	77	9.1
39	24/09/2018	2	0	0	18	0	0	34	24	0	71	72	10.1
40	01/10/2018	4	5	1	15	0	0	34.4	24	0	78	85	10.3
41	08/10/2018	10	28	24	18	83	0	35	22	0	83	92	9.7
42	15/10/2018	9	33	0	62	215	3	34	25	0	76	77	9.4
43	22/10/2018	1	4	0	159	236	1	33.5	23	0	77	77	9.5
44	29/10/2018	2	22	4	227	998	16	33	16	0	71	72	10.4
45	05/11/2018	17	6	3	487	1461	29	35	20	0	73	74	10.2
46	12/11/2018	21	13	6	507	1496	31	33	15	0	76	71	9.3
47	19/11/2018	25	8	9	545	1601	11	33.1	15	0	88	77	9.1
48	26/11/2018	35	3	14	562	1683	25	32	14	0	78	78	9.8

* YSB = Yellow Stem Borer, LF = Leaf folder, CW = Case worm, GLH = Green Leaf Hopper, BPH/WBPH = Brown Planthopper/White Backed Planthopper, GB = Gundhi Bug

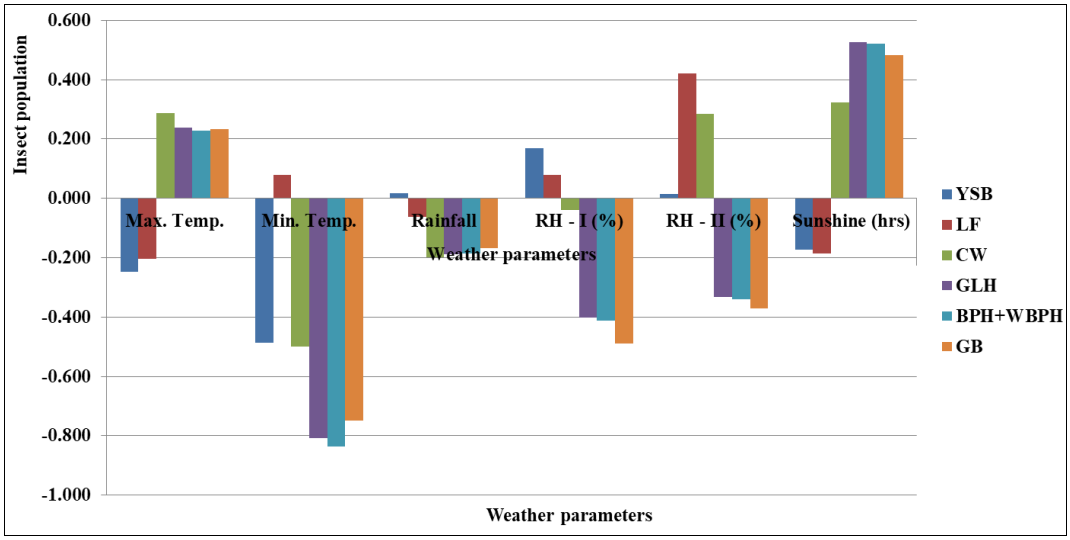

Fig 1: Correlation coefficient (r) between insect population and weather parameters.

Table 2: Correlation coefficient (r) between insect population and weather parameters.

Insects	Weather parameters					
	Max. Temp. (ºC)	Min. Temp. (ºC)	Rainfall (mm)	RH – I (%)	RH – II (%)	Sunshine (hrs)
YSB	-0.248	-0.487*	0.017	0.168	0.015	-0.173
LF	-0.203	0.078	-0.061	0.079	0.421*	-0.186
CW	0.287	-0.500*	-0.198	-0.040	0.285	0.323
GLH	0.238	-0.807**	-0.189	-0.401	-0.333	0.525**
BPH+WBPH	0.227	-0.836**	-0.185	-0.413*	-0.339	0.522**
GB	0.232	-0.750**	-0.168	-0.489*	-0.370	0.484*

*****Significant at 5% level of significance
******Significant at 1% level of significance
YSB = Yellow stem borer, LF = Leaf folder, CW = Case worm, GLH = Green leafhopper, BPH +WBPH = Brown planthopper and white backed planthopper, GB = Gundhi bug.

3.1 Yellow Stem Borer (YSB)
The YSB population remained active throughout the crop season. Maximum population of adult catches of YSB was observed during 48th SMW. Data revealed that significant negative correlation between YSB and minimum temperature with r value -0.487 at 5% level of significance. There was no statistically significant relationship could be established between YSB population and maximum temperature, rainfall, relative humidity-I, relative humidity-II and sunshine hours. Chakraberty and Nanda (2011) [5] also reported that YSB has significantly negative correlation with minimum temperature. However, Jhansi Laxmi *et al*., (2018) [6] showed significant positive correlation with minimum and avg. temp., rainfall and wind velocity with YSB.

3.2 Leaf folder (LF)
The initial population of leaf folder adult catches was very low during 33 SMW, then its population gradual increase up to 35 SMW and fluctuates up to 48th SMW. No population of LF was observed during 27-32 and 39th SMW, because of early age of rice crop grown around the light trap. Data revealed that significant positive correlation between leaf folder population and RH-II with r value 0.421 at 5% level of significance. There was no significant correlation was observed between population of LF and maximum temp., minimum temp., rainfall, RH-1 and sunshine hours. Present findings are in accordance with the findings of Ahmad *et al.*, (2010) [1] who reported that only mean RH (r = 0.793) and minimum temperature (r = 0.513) had a significant positive effect on light trap catches of leaf folder adults.

3.3 Case worm (CW)
The CW adult catches in light trap was started from 36th SMW and remained continues up to 38th SMW and in 39th, 42nd and 43rd SMW no catches were found in light trap. The catches of CW again starts from 44th to 48th SMW. The highest population of CW was observed during 41st SMW during first week of October. Present investigation revealed that there is a significant negative correlation between peak population of CW and minimum temperature at 5% level of significance.

3.4 Green Leafhopper (GLH)
In the initial stage of rice crop, the adult population of GLH was not found because crop grown around the light trap apparatus and started from 38th SMW and remained continue up to 48th SMW. The peak population of GLH was observed during 48th SMW and the second peak was observed during 47th SMW. From present study it is observed that there is a significant negative correlation between peak population of GLH and minimum temperature with r value (-0.807) and significant positive correlation with sunshine hour at 5% level of significance with r value (0.525). Similar findings were reported by Shamim *et al.* (2009) [12] in which, a significant positive correlation between peak population of GLH and bright sunshine hours had established, while minimum temperature, rainfall and relative humidity showed non-significant effect on the population build up of GLH.

3.5 Plant hoppers
The planthoppers (BPH + WBPH) adult catches in light trap were started from 41st SMW and remained continued up to 48th SMW. The correlation between planthopper population and bright sunshine hours showed significant positive correlation at 5% level of significance with r value 0.522 while, negative correlation showed minimum temperature at 1% level of significance and RH-I at 5% level of significance with r value of - 0.836 and -0.413, respectively. Similar findings were reported by Shamim *et al.* (2009) [12] that, the correlation between WBPH peak population and bright sunshine hours showed positive significant correlation.

3.6 Gundhi bug (GB)
The largest peak population of GB was observed during 46th SMW followed by 45th and 48th SMW. Data revealed that there is a significant positive correlation between gundhi bug population with bright sunshine hours at 5% level of significance with r value of 0.484, while, RH-I showed significant negative correlation with r value of -0.489 on the build up of gundhi bug population in light trap at 5% level. Minimum temperature showed significant negative correlation between GB population and weather parameter at 1% level of significance with r value of - 0.750. Similar findings were reported by Jhansi Lakshmi *et al.* (2018) [6] that the gundhi bug was significantly and negatively correlation with minimum temperature and wind velocity. It may be stated that there is a significant positive correlation between GB population collection in light trap with sunshine and significant negative correlation between the GB population and minimum temperature.

4. Conclusion
Weekly light trap catches of different rice insect pests indicates that IInd week of October to last week of November is the period of maximum activity of major insect pests of rice. Yellow stem borer and case worm showed significant negative correlation with minimum temperature with r value -0.487, -0.500, respectively, however, leaf folder showed significant positive correlation with RH-II with r value 0.421 at 5% level of significance. Green leafhopper, planthopper (BPH +WBPH) and gundhi bug were showed significant positive correlation with sunshine hours with r value 0.525,

0.522, 0.484, respectively, at 5% level of significance.

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