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Effect of weather parameters on the seasonal incidence of rice leaf folder (*Cnaphalocrosis medinalis*, Gunee)

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Abstract
Study was undertaken to determine the effect of weather parameters on rice leaf folder during 2015-16 at Krishi Vigyan Kendra Jagatsinghpur, Odisha. The leaf folder infestation was monitored through light trap catches and the infestation percentage was observed during crop period and correlated with weather parameters. Results indicated that the peak activity of rice leaf folder was in the third week of September with 25.39 per cent leaf infestation. It was associated with 30.71 ^{0}C to 22.79 ^{O}C maximum and minimum temperatures and 92.00 and 45.00 per cent morning and evening relative humidity with the association of 65.8 mm rainfall. The correlation study revealed that the number of rice Leaffolder infestation were significantly correlated with maximum temperature (r= 0.465) and minimum temperature (r=0.381). Increasing temperature within upper threshold of the species promoted leaf folder growth. and showed negative and non significant correlation with average rainfall (r = - 0. 15), morning relative humidity (r = - 0.14) and evening relative humidity (r = - 0. 12).

Keywords: Weather parameters, correlation analysis, rice leaf folder

Introduction
Rice is one of the most important food crops not only in India but the world too. It is the staple food for more than sixty per cent of the world`s population and the total area under rice cultivation in India is 44.6 million hectares with a production of 90 million tonnes (Ghule *et al*., 2008) [1]. It constitutes 52 per cent of total food grain production and 55 per cent of total cereal production (Singh *et al*., 2006) [2]. Rice is grown in all the continents except Antarctica, occupying 158.8 million hectare in 111 countries in the world (Agricultural statistics at a glance, 2017). India ranks first in area with 43.39 million hectare of land under rice cultivation and second after China in production of rice with a production of 104.31 million tonnes that shares 19.51 per cent of world rice production with average productivity of 2404 kg/ha. Presently rice in Odisha is grown over an area of 4.03 million hectares, which accounts for 89 per cent of the area under cereals and contributes about 92 per cent of total cereal production in the state (Das, 2012).
The world population in expected to exceed 8 billion by 2025 with an increase of 2.50 billion in 25 years. Much of the increase will occur in developing countries/cities where urban population will be more than triple. Most of the analysts agree that given moderate income growth, food requirement in developing countries would nearly be double. The Nobel laureate Dr. Norman Barloug calculated that to meet projected food demands by 2025 the average yield of all cereals must be 80 per cent higher than the average yield in 1990 (The Hindu Survey of Indian Agriculture, 2000). Rice consuming population is increasing at alarming rate of 100 million per year. By 2020 AD the Asian rice requirement will exceed 760 million tonnes. As a matter of fact, Indian population will likely to exceed 1500 million marked by 2050 AD. Therefore, to meet the global challenges and feeding the world growing population, the productivity of rice must have to increase with sustainability.
The major reasons for low productivity of rice in India are the losses due to insect pest, diseases and weeds. Pest alone is responsible for 10-15 per cent yield loss in India (Krishnaiah *et al*., 2013). In case of rice, insect pests cause about 10 to 15 per cent reduction in yield as evidenced by multi-location experiments conducted under AICRIP for the last 40 years

(Krishnaiah *et al*., 2008). Rice leaffolder *Cnapholocrosis medinalis* (Guenee) which was a sporadic pest and minor pest, has now attained the status of major pest in India (Prakash *et al*., 2005) [3]

Insects are likely to be affected by the dynamics in weather parameters since they are poikilothermic and these effects can be direct, through the influence of climatic factors on the insect's physiology and behaviour. For developing any pest management strategies for specific agro-ecosystem information on abundance and distribution of pest in relation to weather parameters is a basic requirement (Patel e*t al*, 2006). The study of agricultural meteorology in relation to insects will be very useful to farmers in all areas,

Materials and Methods

A field experiment was conducted during 2015-2016 at Krishi Vigyan Kendra Jagatsinghpur state of Odisha which is situated lies between 860 3' E to 860 45' East longitude and between $19^0$58' to $20^0$23' North latitude. The soil type of experimental plot was loam with slightly acidic in nature and having irrigation and drainage facilities. Swarna (MTU-7029) variety of rice sown on 2nd week of July and transplanted on 2nd week of August during kharif, and the plot size of 500 m2. Transplantation was done with 30 days old seedlings with Line planting. Two to three seedlings were planted per hill. All the recommended agronomic practices were adopted during the experimentation without any plant protection measure. Planting was done at a distance of 15 cm. from row to row and 20 cm. from plant to plant. Weekly observations on leaf folder infestation with their moths were observed on ten randomly selected plants during the cropping season i.e. from August to November. The leaf folder infestation was recorded weekly from ten plants selected randomly by the counting of total number of leaf and the number of leaf infested by leaf folder side by side population of leaf folder moth was also counted. Leaf folder infestation was subjected to simple correlation, where, leaf folder infestation was as dependent factor and weather parameters, such as, temperature and humidity as independent factors. Trapping and counting of insect pests was done by using a Chinsurah type light trap fitted with 200-watt electric bulb. The insects were collected and counted in the next morning. Rice leaf folder populations were recorded daily during the rice growing season from August to November in the years from 2015 to 2016 along with daily observations of meteorological variables, viz., temperature (maximum and minimum),rainfall and relative humidity (morning and evening). To predict the impact of weather parameters, correlation studies were used to know about the dynamics of rice leaf folder relation to time and meteorological variables. linear regression equation y = a ± by was worked out.

Leaf folder damage was estimated by using following formula

$$\text{Leaf folder per cent damage} = \frac{\text{Number of damaged leaves per hill}}{\text{Total number of leaves on the hill}} \text{ X } 100$$

Statistical analysis

Influence of weather parameters viz., mean temperature (ºC), morning relative humidity (%) and total rainfall (mm), were correlated with the catches of leaf folder moths population collected through light trap.

Results and Discussion

Effect of various weather parameters on incidence of rice leaf folder was observed on variety Swarna (MTU-7029) during kharif 2015-16. During the period of observation, weekly fluctuation of maximum and minimum temperatures ranged from 34.84 ^{0}C to 30.21 ^{O}C and 24.56 ^{O}C to 22.29 ^{O}C, respectively. Similarly morning and evening relative humidity ranged from 92.0 to 80.0 per cent and 78.0 to 45.0 per cent, respectively. Rainfall varied from 0.35 to 65.8 mm during whole cropping season. Leaf folder infestation was first observed on the crop in the last week of August with 7.48 per cent leaf infestation, which was associated with 30.21 ^{O}C and 23.12 ^{O}C maximum and minimum temperatures and 88.0 and 54.00 per cent morning and evening relative humidity with the seasonal rainfall of 36.5 mm. The insect gradually increased its density and exhibited peak activity in the third week of September with 25.45 per cent leaf infestation. It was associated with 30.71 ^{O}C and 22.79 ^{O}C maximum and minimum temperatures and 92.00 and 45.00 per cent morning and evening relative humidity with the association of 65.8 mm rainfall. The second peak activity was exhibited during third week of October with 22.38 per cent leaf damage which was associated with 34.48 ^{O}C and 24.56 ^{O}C maximum and minimum temperatures, 80.00 and 76.00 per cent morning and evening relative humidity and 2.86 mm rainfall.

The correlation studies made between rice leaf folder and weather parameters are presented in the Table 2. There was a significant positive correlation between leaf infestation and maximum temperature with correlation coefficient (r) value of 0.465, whereas significant negative correlation existed between leaf infestation and evening relative humidity with the correlation coefficient (r) value of -0.123.

Regression equation for maximum temperature was

$$y = a+-bx$$

y= Dependent variable/ per cent leaf infestation
a = Constant
b = Regression coefficient
x = Independent variable/ maximum temperature
y = 2.139x- 47.32

The result shows that the number of rice Leaf folder larvae were significantly correlated with maximum temperature (r= 0.465) and minimum temperature (r=0.381). Increasing temperature within upper threshold of the species promoted leaf folder growth and showed negative and non-significant correlation with average rainfall (r = - 0. 15), morning relative humidity (r = - 0.14) and evening relative humidity (r = - 0. 12) (Table 2). It is evident from the present investigation maximum temperature varied from 30.21 to 34.48 ^{O}C and minimum temperature from 22.2 to 24.56 ^{O}C and morning relative humidity around 92.0 per cent and evening relative humidity from 45 per cent with less rainfall were found congenial for pest multiplication on the crop

Almost similar findings were reported by Ankit *et al*. (2013) [5] at Haryana. They observed a significant positive correlation between maximum temperature and leaf infestation and negative correlation between rainfall and leaf infestation. Present findings are in agreement with those of Mukherjee e*t al*. (2008) [4] who found significant negative correlation with evening relative humidity and rainfall at Sambalpur. Khan *et al*. (2004) on the other hand, observed a significant relationship between maximum temperature and per cent leaf infestation.

Table 1: Influence of abiotic factors on the seasonal incidence of rice leaf folder *Cnaphalocrocis medinalis* Gunee. on rice during Kharif -2015 and 2016

Standard week	SMW	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	Leaf folder Infestation (%)	No of Adult moths captured/week/trap
		Maximum	Minimum	Morning	Evening			
09-Aug-15	32	31.55	25.65	70.4	68.15	9.2	0.42	4
Aug,16-22	33	31.75	26	83	84.2	141.95	2.245	7.5
Aug,23-29	34	33.55	25.95	82.95	78.2	41.95	5.65	12.5
Aug,30-Sep,05	35	32.3	26.45	83.6	81.9	61.05	6.175	7
Sep,06-12	36	31.15	25.3	81	79.55	27.25	13.33	7.5
Sep,13-19	37	32.3	26.4	81	78.25	27.65	12.475	18.5
Sep,20-26	38	33.7	27.2	83	77.6	58.3	21.375	7
Sep,27-Oct,03	39	32.65	26.6	82.45	79.55	30.45	22.05	0.5
Oct,04-10	40	32.45	26.35	82.9	80.7	15.7	23.595	4.5
Oct,11-17	41	32.55	25.5	82.5	79.15	42.05	20.31	2.5
Oct,18-24	42	32.4	24.8	82.55	77.95	60.3	19.205	6.5
Oct,25-31	43	32	23.05	80.3	77.85	65.8	17.605	2
Nov,01-07	44	30.05	23.55	87.35	82.5	98.05	14.315	4.5
Nov,08-14	45	29.35	21.2	81.7	75.45	21.35	12.775	1.5
Nov,15-21	46	29.55	20.5	82.15	74	3.95	10.775	1
Nov,22-28	47	29.2	17.85	83.25	77	31.6	2.31	0

*Mean data of 2015 and 2016 kharif season
SW = Standard week

Table 2: Correlation coefficient between rice leaf folder infestation % with different weather parameters during kharif 2015 & 2016

Variable	Correlation co-efficient (r)
X1- Maximum temperature (^{0}C)	0.094
X2-Minimum temperature (^{0}C)	-0.768
X3-Morning relative humidity (%)	0.348
X4- Evening relative humidity (%)	-0.721
X5- Rain fall (mm)	-0.605

	Max. Temp.	Min. Temp	Morning RH (%)	Evening RH (%)	Rainfall (mm)	Leaf folder Infestation (%)
Max. Temp.	1					
Min. Temp	0.482	1.000				
Morning RH (%)	-0.452	-0.307	1.000			
Evening RH (%)	-0.217	0.612	0.195	1.000		
Rainfall (mm)	-0.445	0.460	0.136	0.682	1.000	
Leaf folder Infestation (%)	0.091	-0.769	-0.348	-0.724	-0.648	1.000

*Significance at 5% level

Table 4: Correlation between rice leaf folders captured moth with environmental factors during *kharif* – 2015 and 2016

Parameters	Max. Temp.	Min. Temp	Morning RH (%)	Evening RH (%)	Rainfall (mm)	No of Adult Moth captured/Week
Max. Temp.	1					
Min. Temp	0.862	1.000				
Morning RH (%)	-0.052	-0.107	1.000			
Evening RH (%)	0.217	0.292	0.795	1.000		
Rainfall (mm)	0.145	0.206	0.436	0.682	1.000	
No of Adult Moth captured/Week	0.486	0.543	0.020	0.209	0.142	1

*Significance at 5 % level

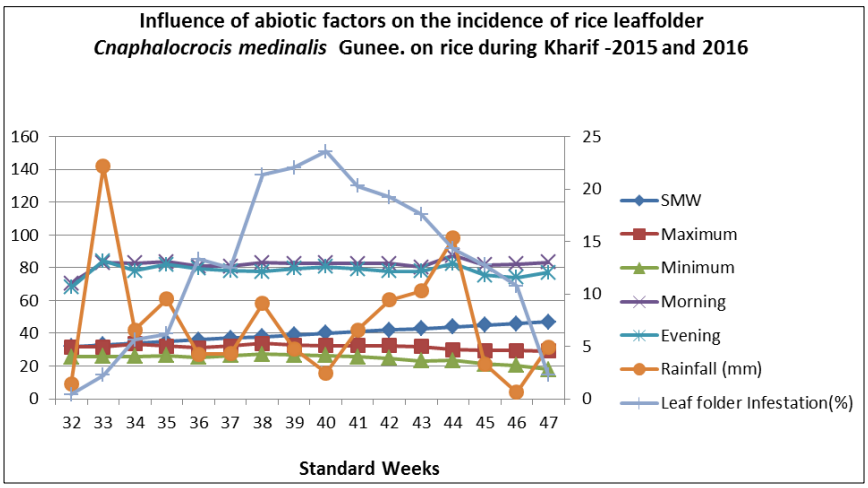

Fig 1.

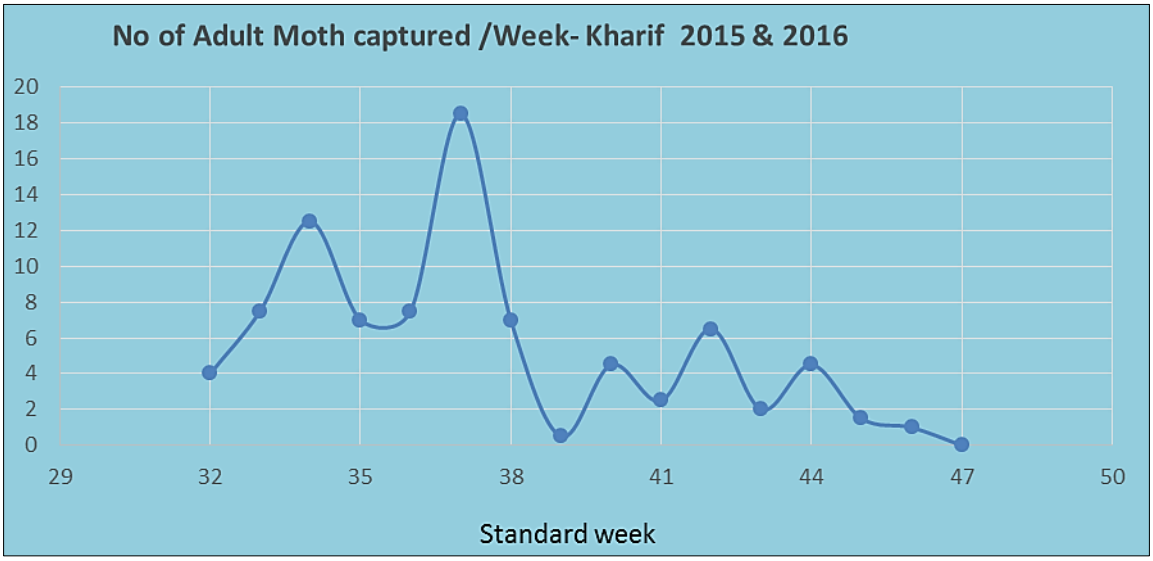

Fig. 2: Light Trap Catches of Rice leaf folder Moths

Conclusion

Different weather parameters such as temperature, rainfall and humidity greatly influence the population dynamics of leaf folder population under changing climatic scenario in various crop ecosystems and for developing leaf folder management programme for specific agro ecosystem information on abundance and distribution of leaf folder in relation to weather parameters is a fundamental requirement, hence the prediction and forecasting correlation studies described in paper this research may be used to predict the dynamics of the leaf folder population while taking management decisions. These considerations may also help to reduce the loss caused by these leaf folder in rice.

References

1. Ghule SD, Patel KG, Pandya HV. Seasonal incidence of Rice earhead bug (*Leptocorisa acuta* Thun.) of paddy in south Gujarat. Insect Environment. 2008; 14(1):7-8.
2. Singh RB, Singh RA, Dwivedi JL, Chaudhary RK. Reaction of different rice varieties/cultivars against leaf folder, *Cnaphalocrocis medinalis* Guen. and stem borer, *Scirpophaga incertulas* Walker. under irrigated conditions. Journal of Plant Protection and Environment. 2006; 3(2):14-16.
3. Prakash A, Rao J, Rath PC. Advances in rice entomology. Advances in Indian Entomology Productivity &Health, Published by Uttar Pradesh zoological society, Muzaffarnagar, UP, 2005, 51-70p.
4. Mukherjee SK, Samalo AP, Mishra PR, Dash AN. Effect of environmental factors on the incidence of rice leaf-folders in costal Orissa conditions. Pest Management and Economic Zoology. 2008; 16(1):43-50.
5. Ankit Kumar, Banvir Singh, Maan Singh, Jaglan MS. Population dynamics of rice leaf folder *Cnaphalocrocis medinalis* (Guenee) under agro climatic conditions of Haryana. Research in Plant Biology. 2013; 3(4):40-45.
6. Patel HN, Kadu RV, Landge SA. Study on effect of different botanicals against rice leaf folders (Cnaphalocrocis medinalis Guen. and Pelopidas mathias Fb.). International Journal of Plant Protection. 2011; 4(1):148-152.