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Research Article

SEASONAL INCIDENCE OF RICE LEAF FOLDER (CNAPHALOCROSIS MEDINALIS GUENEE) AND ITS CORRELATION WITH ENVIRONMENTAL FACTORS ON RAINFED RICE CROP IN MANIPUR

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A B S T R A C T

An experiment on rainfed rice was carried out for two consecutive years during 2010 and 2011 at Farmer's Field, Patsoi-IV, Imphal West, Manipur, to study the impact of weather factors on rice leaf folder. Based on pooled mean data for two years, seasonal occurrence of *C. medinalis, Kharif* rice revealed that pest infestation initiated on mid of August (14-20 days after transplanting) with 3.26 per cent and continued till third week of October (77-83 days after transplanting) with 2.43 per cent. The maximum leaf damage incidence was observed during third week of September (49-55 days after transplanting) with 4.93 per cent and gradually decreased till the maturity of the crop. However, correlation coefficient study for *C. medinalis* was non-significant but positively correlated with mean temperature whereas mean relative humidity and mean rainfall were proved to be positive and significantly correlated ($P \leq 0.05$).

INTRODUCTION

Rice (*Oryza sativa* Linn.) is the major staple food of Manipur, India and other parts of the world. It is cultivated under different growing conditions viz. irrigated, rainfed and flood prone ecosystems. Inspite of being the world largest rice cultivation country in terms of area, the production is quite low. The two major factors responsible for the low yield of the crop are mainly due to insect pest infestation and adverse agro-climatic conditions. Rice is highly sensitive and potential host plant for several insect species (Prasad *et.al.,* 2004), more than 100 insect species are prone to attacked the crop of which 20 insect species can caused economic damage (Arora and Dhaliwal, 1996).

In Manipur, about 30 insect species were recorded infesting rice, of which Asian gall fly, yellow stem borer, leaf folder, rice case worm, rice whorl maggot, small grass hopper, green leaf hopper, gundhi bug, rice swarming caterpillar and army worm are of the major importance (Thokchom *et.al* 2016).

The rice leaf folder *C. medinalis* was once considered as minor insect pest but now its status assumed as major insect pest from the last two decades (Nanda *et.al.* 2000). Severe infestation by this pest may lead to 60-70.0% leaf damage (Kushwaha and Singh, 1986). In Asia, the estimated yield loss in rice due to insect pest is 31.5% (Cramer, 1967) whereas in India, it is 31.5-86.0% (Gunathilagaraj and Kumar, 1997).

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Changes in the environmental conditions, cultural practices, cropping patterns, application of chemical fertilizers, pesticides are the major reasons for rice leaf folder infestation. Under favourable conditions rice leaf folder affects the crop adversely resulting in severe yield losses (Anuj *et.al.*1999).

Though insect pests are cold-blooded organisms, temperature of their bodies is approximately similar to that of the surrounding environmental conditions. A small change in abiotic factors could affect the rate of chemical reaction in their body drastically. Insect physiology is directly affected by abiotic factors and indirectly by the quality of the host plant (Ramya, 2012). Different weather parameters play a role in growth of pest as well as diseases.

Therefore, studies on environmental effect on pest incidence helps in understanding population dynamics and to plan the suitable control measures in time.

MATERIAL AND METHOD

A field trial was conducted for two consecutive years during *Kharif* season of 2010 and 2011 at the Farmer's Field, Patsoi-IV, Imphal West which is located at 24°79' N latitude and 93°86' E longitude with an elevation of 779 meter above msl, to study the seasonal incidence and effect of the weather parameters on rice leaf folder, *C. medinalis* under Manipur agro-climatic condition. All the recommended agronomic practices for *Kharif* rice cultivation were adopted for growing the experimental crop. The rice variety, "Leimaphou (KD-2-6-3)" was grown over an area of 1000 m^2. One month old seedlings were transplanted with a spacing of 20cm x15 cm.

Insecticide was not applied during the cropping season. For recording incidence of rice leaf folder, total number of tillers and the number of leaf damage (LD) were counted in 20 randomly selected hills from the experimental field at weekly interval starting from 14-20 days after transplanting (DAT) till maximum tillering stage 77-83 DAT and converted into per cent leaf damage.

The percentage of the infestation was determined by using the formula.

$$\text{Infestation \%} = \frac{\text{Number of damaged leaves /20 hills}}{\text{Total number of tillers/20 hills}} \text{ X } 100$$

The weekly meteorological data recorded at ICAR, NEH Region, Sub Station, Lemphalpat during the *Kharif,* 2010 and 2011 were pooled standard week-wise and subjected to correlation and regression studies with weather parameters *viz.,* maximum temperature, minimum temperature, relative humidity and rainfall.

Data analysis

Collected data of leaf damage per cent were transformed (square root transformation) prior to ANOVA using Microsoft Office Excel 2007. Pearson correlation coefficient (r) was used to determine the relationship between leaf damage per cent and the weather factors.

RESULT AND DISCUSSION

The insect population dynamics are directly influence by abiotic factors through modulation of developmental rates, survival, fecundity, voltinism and dispersal (Karuppaiah and Sujayanad, 2012). During present investigation, the record of leaf folder infestation indicated that abiotic factors *viz*. rainfall, temperature and relative humidity plays a key role in regulating the leaf folder incidence on rice plants.

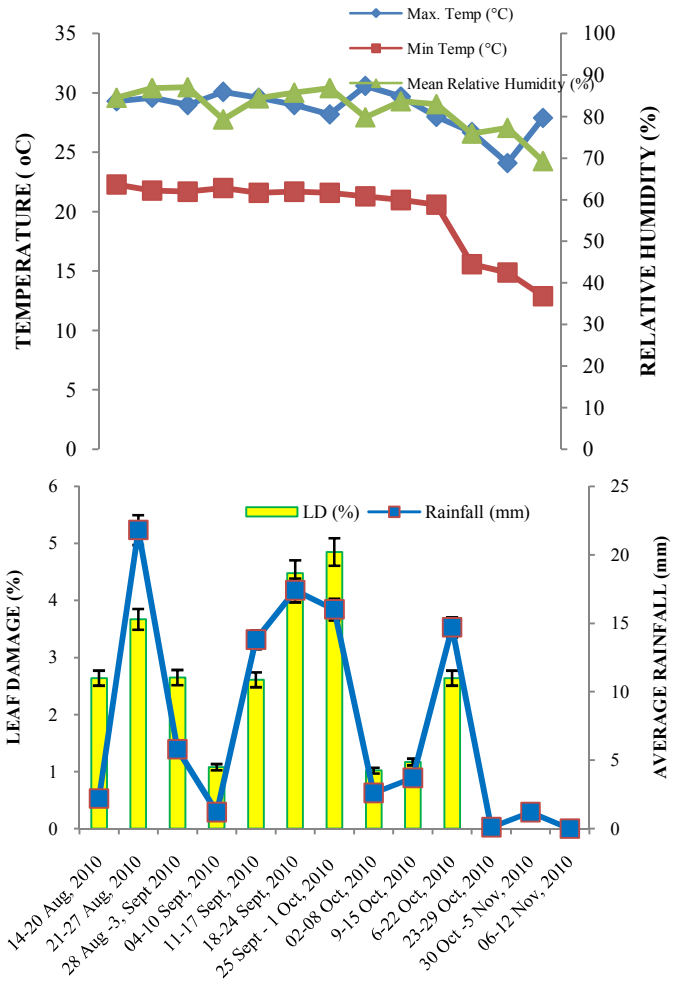


Fig 1 Graphical representation of the effect of abiotic factors on *C. medinalis,* rice *var.* "Leimaphou (KD-2-6-3)" during *Kharif* , 2010

Table 1 Correlation of rice leaf folder incidence with weather parameters during *Kharif season* 2010 and 2011

Year		Weather parameter						
		Temperature (°C)			Relative Humidity (%)			Rainfall (mm)
		Max.	Min.	Mean	Morning	Evening	Mean	
2010	(r)	-0.701*	0.195 NS	-0.444 NS	0.865**	0.773**	0.822**	0.805**
	'F'	7.74	0.32	1.96	23.70	11.88	16.72	14.74
	't'	-2.78	0.56	-1.40	4.87	3.45	4.09	3.84
2011	(r)	-0.465 NS	0.634*	0.109 NS	0.455 NS	0.717*	0.696*	0.822**
	'F'	2.21	5.38	0.10	2.09	8.46	7.51	16.62
	't'	-1.49	2.32	0.31	1.45	2.91	2.74	4.08
Pooled mean (2010-11)	(r)	-0.261 NS	0.649*	0.271 NS	0.572 NS	0.747*	0.735*	0.677*
	'F'	0.59	5.81	0.63	3.89	10.08	9.41	6.75
	't'	-0.76	2.41	0.80	1.46	3.18	3.07	2.60

Note: * = Significant at 0.05 % ; NS = Non significant ; DAT = Days after transplanting; LD = Leaf Damage, + = Mean of 20 hills; ++ = Sources: Experimental Agromet Advisory Service. ICAR , Research Complex for NEH Region, Manipur

The infestation of leaf folder during *Kharif*, 2010 was recorded from mid August i.e. 14 - 20 DAT with 2.64 per cent leaf damage in the field, which showed increasing incidence and reached its peak during 56 -62 DAT i.e last week of September with 4.85 per cent leaf damage. The infestation of leaf folder showed declining trend in population on 62 DAT and attained the lowest leaf damage per cent of 2.64 at reproductive stage.

Based on correlation co-efficient of first year study, it was recorded that the maximum temperature (r= -0.701) had significant but negative correlationship while mean temperature (r = -0.444) had showed non significant but negative correlation.

On the other hand, morning relative humidity (r= 0.865), evening relative humidity (r= 0.773), mean relative humidity (r= 0.822) and rainfall (r = 0.805) had significant positive relationship while minimum temperature (r= 0.195) had non-significant but positive relationship with *C. medinalis* incidence.

During *Kharif,* 2011 the incidence of leaf folder were also initiated during mid August i.e 14- 20 DAT with 3.87 per cent leaf damage and reached to the peak at mid September i.e. 49-55 DAT with 5.37 per cent leaf damage followed by declining

trend and ended on third week of October with 2.22 per cent leaf damage.

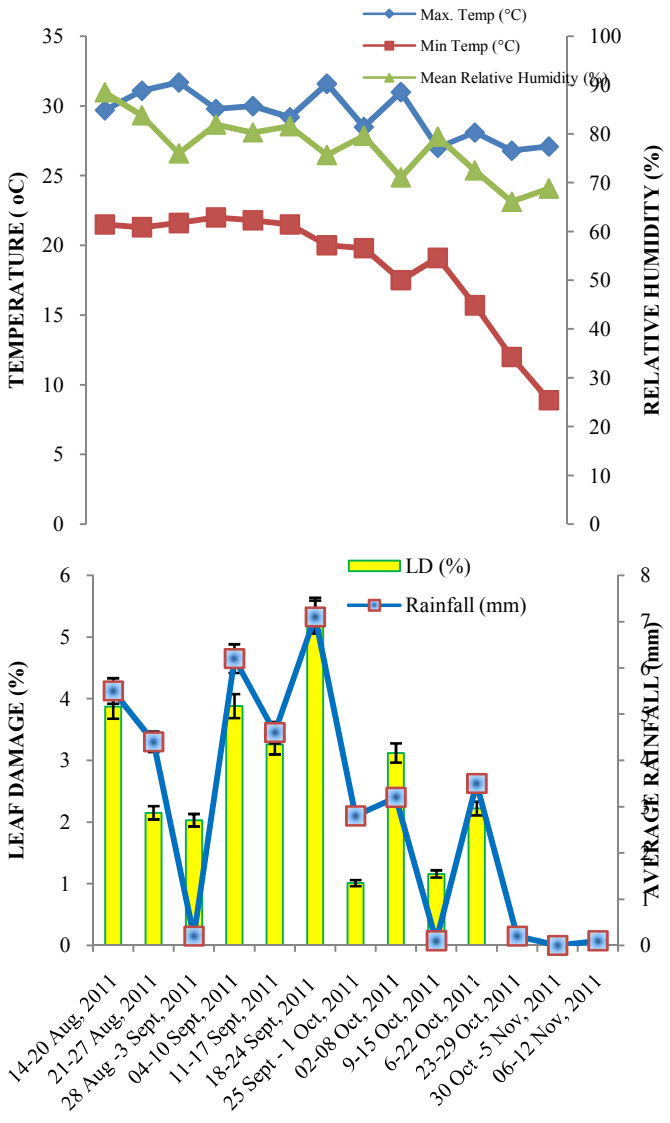
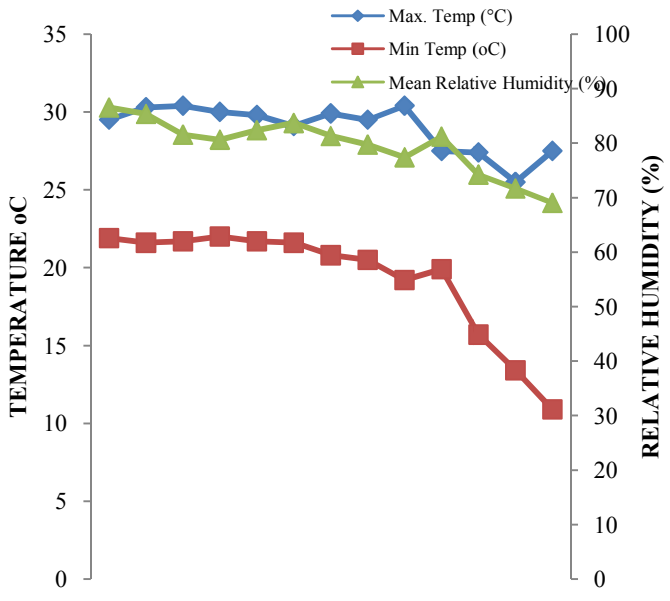


Fig 2 Graphical representation of the effect of abiotic factors on *C. medinalis,* rice *var.* "Leimaphou (KD-2-6-3)" during *Kharif* , 2011



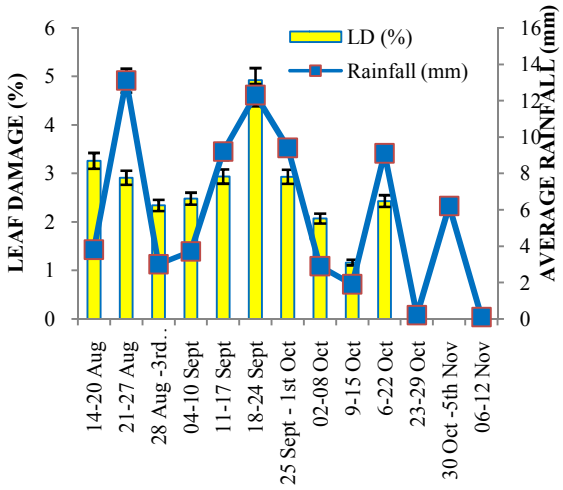


Fig 3 Graphical representation of the effect of abiotic factors on *C. medinalis* rice *var.* "Leimaphou (KD-2-6-3)" during *Kharif* , 2010-11

The correlation co-efficient of second year study i.e. during *Kharif,* 2011 season revealed that maximum temperature (r = -0.465), mean temperature (r = 0.109) and morning relative humidity (r = 0.455) had non significant relationship whereas minimum temperature (r = 0.634), evening relative humidity (r = 0.717), mean relative humidity (r = 0.696) and rain fall (r = 0.822) showed positively significant correlationship.

Climate can substantially influence the development and distribution of insects. Analysis of two years pooled mean data (2010 and 2011) observations with regard to seasonal incidence of *C. medinalis* revealed that the activity of leaf folder was initiated first during 14-20 DAT (mid August) with 3.26 per cent leaf damage and continued till 77- 83 DAT, when crop attained almost maturity stage. The activity of the pest gradually increased and attained the peak level during mid September (49- 55 DAT) where leaf damage due to leaf folder was 4.93 per cent and gradually decreased to 1.17 per cent and 2.43 per cent during 70-76 DAT and 77- 83 DAT, respectively. These results are in agreement with the findings of Sankpal (2011). Similarly, Boopathi (2012) also confirmed the initiation of rice leaf folder incidence from last week of August and reach peak population during third week of September, which declined in preceding weeks. Gole (2012) also exhibited the initiation of leaf folder incidence from second week of August. These findings are more or less similar and strongly support the present investigation.

However, correlation co-efficient study for leaf folder indicates that the minimum temperature (r=0.649), evening relative humidity (r =0.747), mean relative humidity (r=0.735) and total rainfall (r=0.677) proves significantly positive correlation whereas mean temperature (r= 0.271) and morning relative humidity (r= 0.572) proves non-significant. While maximum temperature (r= -0.261) shows non-significant but negative correlation. These results may be due to the increasing temperature of the environment in the study area.

In support of the present finding Kaul and Singh (1999), reveals that there was a significant and positive correlation between leaf folder infestations with rainfall at Kangra valley. Xu Ruique *et.al.* (1999), also supports the results in which the generations of leaf folder were positively correlated with the number of rainy days and amount of rainfall while relative humidity was significant but positively correlated with the

per cent incidence. But the mean temperature shows insignificant but negatively correlated. Similarly, Manisegaram and Letchoumanane (2001) also reveals that unit increase in the maximum temperature caused an increase in the population of rice leaf folder who reported negative correlation between relative humidity and the leaf folder.

CONCLUSION

The seasonal incidence data reveals that *C. medinalis* first initiated on mid of August (14-21 DAT) and continued till third week of October (77-83 DAT) in both the study periods. The activity of the pest gradually increases and gained its peaks at mid September (49-55DAT). Further, this infestation turns down and observed up to third week of October (77- 83 DAT).

The correlation results exhibited that the temperature had less impact on pest incidence whereas relative humidity and rainfall had resulted positive and significant interaction.

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