Plant Archives Vol. 15 No. 1, 2015 pp. 121-126 *ISSN 0972-5210*

SEASONAL INCIDENCE OF RICE LEAF FOLDER IN RELATION TO SRI AND CONVENTIONAL METHODS OF PLANTING AND ITS CORRELATION WITH WEATHER PARAMETERS

A. M. Kakde* and K. G. Patel

Department of Entomology, N. M. College of Agriculture, N.A.U., Navsari - 396 450 (Gujarat), India.

Abstract

The data on seasonal occurrence of rice leaf folder, *Cnaphalocrocis medinalis* Guenee revealed that the peak level reached during 4th week of September (39th SMW) when leaf damage due to leaf folder was 2.30% under conventional method and 2.66% under SRI method. The correlation results under conventional and SRI method indicated that the weather parameters had less impact on leaf folder damage.

Key words : Rice leaf folder, *Cnaphalocrocis medinalis* Guenee, conventional, SRI.

Introduction

Rice (*Oryza sativa* L.) is the world's second most important cereal crop and known with different names in India as Dangar (Gujarat), Bhatt (Maharashtra), Chawal (U.P., Bihar), Voldu (A.P.), Dhan (W.B.), Chaul (Punjab), Shali (J & K), Nellu (Tamil Nadu, Kerala). It is one of the oldest and second most intensively grown cereal crops next to wheat and ranks third in grain production. Rice is life and princess among the cereals, the staple food of 65% of the total population in India. It constitutes about 52% of the total food grain production and 55% of total cereal production. Rice is grown under diverse growing conditions such as irrigated, rainfed lowland, rainfed upland and flood prone ecosystems. India is the largest rice growing country, while China is the largest producer of rice in the world. Gujarat occupies about 2% of area among rice growing states. It is grown on 8.36 lakh ha area, which comprises nearly 90% of *Kharif* and 10% of Summer season rice with a total production of 17.90 lakh tonnes and the productivity of 2141 kg/ha (Anonymous, 2012). South Gujarat is an important rice growing tract of the state belonging to Dang, Valsad, Navsari and Surat districts of State. These districts occupy maximum rice growing area of the state, where the crop is mainly grown in *Kharif* as well as in summer season.

***Author for correspondence:** E-mail : amoljau@gmail.com

The incidence of leaf folder in Gujarat is more pronounced compared to other defoliating larvae. It has attained major pest status with the introduction of high yielding varieties and particularly in areas of high fertilizer use. It was recorded on paddy crop in the state for first time in 1964 (Patel *et al*., 1964) and a sudden outbreak took place for first time in Gujarat during September-October, 1971 (Upadhyay *et al*., 1975). For every unit increase in the leaf folder incidence at tillering, early earing and milky seed stage led to 2.81, 2.50 and 1.27% loss in yield during wet season, respectively (Pandya *et al*., 1994).

Materials and Methods

Study of seasonal incidence and effect of the weather parameters *viz*., maximum temperature, minimum temperature, relative humidity, sunshine hours, rainfall and rainy days on population of rice leaf folder under South Gujarat condition were carried out at Wheat Research Station Farm, Navsari Agricultural University, Bardoli during the *Kharif* seasons 2012 and 2013. The weekly meteorological data recorded at Wheat Research Station Farm, Navsari Agricultural University, Bardoli during the *Kharif* seasons 2012 and 2013. The simple correlation was worked out.

Method of observation : The following two methods were utilized for taking observations on seasonal incidence of brown plant hopper of paddy.

1. Conventional method (Transplanting)

2. SRI method (12 days old seedlings)

To know the incidence of rice leaf folder, *C. medinalis* on rice, the observations were recorded as per standard week from 15 days after transplanting till harvest. The observations were taken by counting the number of damaged leaves and total number of leaves from randomly selected five spots consisting of five hills in each spot.

Results and Discussion

Seasonal incidence and correlation of rice leaf folder in relation to SRI and Conventional methods of planting.

A. Conventional method (Transplanting):

i. I year (*kharif* 2012)

The data presented in table 1 and graphically depicted in fig. 1 revealed that 0.57% damaged leaves of rice leaf folder, *C. medinalis* was initiated from third week of August (34th SMW) and reached to its peak level of 2.04% damaged leaves during fourth week of September (39th SMW). Then after, per cent damaged leaves (0.68) was gradually declined and reached to a zero level at the maturity of crop (43rd SMW) during *Kharif* 2012 in conventional method of planting.

The correlation co-efficient study during *Kharif* 2012 (table 2) indicated that maximum temperature (r = 0.133), relative humidity (r = 0.176) rainfall (r = 0.256) and bright sunshine hrs (r = 0.225) had non-significant positive relationship with *C. medinalis* infestation under conventional method of planting. While, minimum temperature (r = -0.341) had negative association with the infestation of *C. medinalis*.

ii. II year (*kharif* 2013)

The infestation of leaf folder in second year trial was recorded from third week of August (34th SMW) with 0.82% leaf damage in field, which showed increasing incidence and reach its peak during fourth week of September (39th SMW) with 2.56% leaf damage. The infestation of leaf folder showed decline an population after 39th SWM and attained zero level at harvest (table 1 and fig. 1). The incidence of the leaf folder was slightly higher during second year trial, which may be due to seasonal difference of both years.

Based on correlation co-efficient of second year study (table 2), it is found that maximum temperature (r = 0.230), rainfall (r = 0.309) and bright sunshine hrs (r = 0.389) had non-significant positive relationship with *C. medinalis* incidence. Minimum temperature (r= -0.059) and relative humidity (r = -0.248) had negative association with the infestation of leaf folder.

iii. Pooled

The data on seasonal occurrence of leaf folder, *C. medinalis* (table 1 and fig. 1) revealed that the pest first appeared on 3rd week of August (34th SMW) with 0.77% leaf damage, continued till 3rd week of October (42nd SMW), when crop was almost nearer to maturity stage. The activity of the pest gradually increased and reached to peak level during 4th week of September (39th SMW) when leaf damage due to leaf folder was 2.30% in conventional method of planting.

The pooled results of correlation co-efficient (table 2) indicated that maximum temperature (r= 0.216), relative humidity (r = 0.002), rainfall (r = 0.386) and sunshine hrs (r = 0.330) had non-significant positive correlation with leaf damage of leaf folder under conventional method of planting, while minimum temperature (r = -0.254) had non-significant negative correlation with leaf folder population damage.

Earlier, Ram (1986) observed the population of *C. medinalis* peaked in October and Kushwaha (1988) reported that infestation of *C. medinalis* peaked during second week of September when crop was at the booting to panicle emergence stage. Velusamy and Subramaniam (1974) recorded *C. medinalis* occurrence throughout the year in Tami Nadu and reaching peak numbers during October-November and April. According to Kaul and Singh (1999), peak activity of *C. medinalis* larvae occurred during second week of September at Kangra valley.

The leaf folder infestation at grain filling stage was more detrimental, which was in accordance with the findings made by Saikia and Parameswaran (1999) as well as Mishra *et al*. (2001), who observed maximum leaf folder damage during maximum tillering stage of the crop. While, Patnaik (2001) pointed out increased infestation of leaf folder in rice that during the last week of September and first week of October and Kumar *et al*. (2003) recorded the peak activity of leaf folder in the first fortnight of August during the *Kharif* season. Alvi *et al*. (2003) also reported the activity of *C. medinalis* from second week of August to second week of October with peak activity during second fortnight of September in Pakistan. These results of above authors are more or less similar may be due to change in location research trial, but confirms the similar trend of the seasonal occurrence.

Similarly, Kharat (2006) found leaf folder incidence started increasing from 32nd standard week and declining from 42nd standard week. The incidence was found

highest in 41st standard week, while Patel (2006) reported leaf folder incidence from 36th standard week and its peak level (3.20%) during 43rd standard week, which declined gradually and reached to a zero level at the maturity of crop. Sankpal (2011) showed that the higher incidence of *C. medinalis* was observed from 3rd week of September to 3rd week of October. Similarly, Boopathi (2012) showed that leaf folder was initiated on last week of August and reach peak population during third week of September, which decline in preceding weeks as well as Gole (2012) also confirmed the initiation of leaf folder incidence from second week of August (32nd SMW). These reports are more or less similar and strongly support the present finding.

Correlation studies carried out at Rajendranagar by Kumar *et al*. (2003) revealed a significantly negative association with morning relative humidity. The relationship with rainfall and rainy days was negative, while it was positive with temperature and sunshine hrs but non-significant. Patel (2006) exhibited significant positive correlation with maximum temperature and sunshine hrs, while non-significant negative correlation was observed with minimum temperature and morning relative humidity. These earlier reports support the present findings.

In contrast to this, Kaul and Singh (1999) reported that there was a significant positive correlation between *C. medinalis* infestation with rainfall and frequency of rainy days at Kangra valley as well as Bhatnagar and Saxena (1999) from Jagdalpur reported that *C. medinalis* showed a significantly negative correlation with minimum temperature, evening relative humidity and rainfall and a positive correlation with sunshine hrs and maximum temperature. The results of Manisegaram and Letchoumanane (2001) showed that a unit increase in the minimum temperature caused an increase in the population of rice leaf folder adults, while there was negative correlation between leaf folder population and relative humidity.

While other earlier reports, Kharat (2006) revealed leaf folder incidence exhibited non-significant positive correlation with maximum temp., minimum temp, average humidity and sunshine hrs. The correlation between leaf folder and rainfall and evening humidity were negatively non-significant. This might be due to difference in environmental conditions and locations. Sankpal (2011) found variance in results, wherein he indicated that the maximum temperature and bright sunshine hrs had significant positive relationship with *C. medinalis* population. Minimum temperature, relative humidity and rainfall had negative association with the population of *C. medinalis*. These variations in the results might be due to alteration in ecological conditions.

B. SRI method

i. I year (*Kharif* 2012)

The results of first year seasonal incidence of leaf folder under SRI method of planting presented in table 1 and graphically depicted in fig. 1 showed that per cent damaged leaves of 0.59 of rice leaf folder initiated from 3rd week of August (34th SMW) and reached to its peak damage of 2.34% during 4th week of September (39th SMW). Thereafter, per cent damaged leaves (0.62) was gradually declined and reached to a zero level at the maturity of crop (43rd SMW).

The correlation co-efficient for relationship between infestation of rice leaf folder and weather parameters under SRI method during *kharif* 2012 are presented in table 2. The results revealed that larval population of rice leaf folder had non-significant positive correlation with maximum temperature (r = 0.151), relative humidity (r = 0.181), rainfall (r = 0.229) and sunshine hrs (r = 0.234) as well as non-significant negative correlation with minimum temperature (r = -0.342).

ii. II year (*Kharif* 2013)

The data on incidence of per cent damaged leaves of rice leaf folder during *Kharif* 2013 was also started from 34th SMW (0.80%) and reached to its peak damage during 39th SMW (2.66%), which showed further gradual decline in per cent damaged leaves (2.35) and reached to zero level at 43rd SMW (table 1 and fig. 1). The damage intensity of the leaf folder was slightly higher during *kharif* 2013 as compared to *kharif* 2012.

The correlation co-efficient during *Kharif* 2013 (table 2) showed that maximum temperature (r = 0.181), rainfall (r = 0.249) and bright sunshine hrs (r = 0.338) had non-significant positive relationship with *C. medinalis* incidence in rice. However, minimum temperature (r = -0.047) and relative humidity (r = -0.254) had negative association with the infestation of *C. medinalis*.

iii. Pooled

The pooled data on seasonal incidence of leaf folder, *C. medinalis* in SRI method presented in table 1 and graphically depicted in fig. 1 revealed that 0.70% damaged leaves of rice leaf folder was initiated from 3rd week of August (34th SMW), which increased further and reached to its peak damage of 2.66% during 4th week of September (39th SMW). Then after, percentage of damaged leaves (2.35) was gradually declined and reached to zero level at the maturity of crop (43rd SMW).

Table 1 : Seasonal incidence of rice leaf folder in Conventional and SRI Method during *Kharif* 2012 and 2013.

Month	Std. Meteoro. Weeks	% leaf damage by leaf folder					
		Conventional Method			SRI Method		
		Kharif 2012	*Kharif* 2013	Pooled	*Kharif* 2012	*Kharif* 2013	Pooled
July	28	0.00	0.00	0.00	0.00	0.00	0.00
	29	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00
Aug.	32	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00
	34	0.57	0.82	0.70	0.59	0.80	0.70
	35	0.99	1.05	1.02	1.03	1.23	1.13
Sept.	36	1.53	1.64	1.59	1.60	1.72	1.66
	37	1.70	1.90	1.80	1.87	1.90	1.89
	38	2.08	2.44	2.26	2.16	2.72	2.44
	39	2.04	2.56	2.30	2.46	2.86	2.66
Oct.	40	1.93	2.22	2.08	2.34	2.36	2.35
	41	1.39	1.86	1.63	1.59	1.42	1.51
	42	0.68	0.80	0.74	0.62	0.58	0.60
	43	0.00	0.00	0.00	0.00	0.00	0.00

Table 2 : Correlation of rice leaf folder incidence with weather parameters in conventional and SRI method during *Kharif* 2012 and 2013.

Method & year	Max. temp. (^{0}C)	Min. temp. (^{0}C)	Relative humidity (%)	Rainfall (mm)	Bright sunshine hrs.
Conventional method (% leaf damage)					
I year (*Kharif* 2012)	0.133	-0.341	0.176	0.256	0.225
II year(*Kharif* 2013)	0.230	-0.059	-0.248	0.309	0.389
Pooled	0.216	-0.254	0.002	0.386	0.330
SRI method (% leaf damage)					
I year (*Kharif* 2012)	0.151	-0.342	0.181	0.229	0.234
II year(*Kharif* 2013)	0.181	-0.047	-0.254	0.249	0.338
Pooled	0.176	-0.232	0.020	0.373	0.290

* Significant at 5% level (r = 0.482) and ** at 1% level (r = 0.606).

The difference in leaf damage under different planting methods showed that the higher damage of leaf folder, *C. medinalis* was observed in SRI method than conventional method (transplanting) of planting indicating less efficiency of SRI method to reduce the leaf folder infestation.

In earlier reports of Anonymous (2010), standard transplanting (STP) proved most effective planting method against *C. medinalis* in South India, while SRI was found less effective for controlling the insect pests. Similar type of trend was also observed in this study. Likewise, Gole (2012) recorded the lowest per cent leaf damage due to leaf folder in Standard Transplanting Method (STP) (2.39%) as compared to SRI (3.69%) and found significantly superior than rest of the treatments. Thus, the observations in case of STP are in accordance with this present report.

The pooled data on correlation co-efficient with weather parameters under SRI method of planting (table 2) revealed that maximum temperature (r = 0.176),

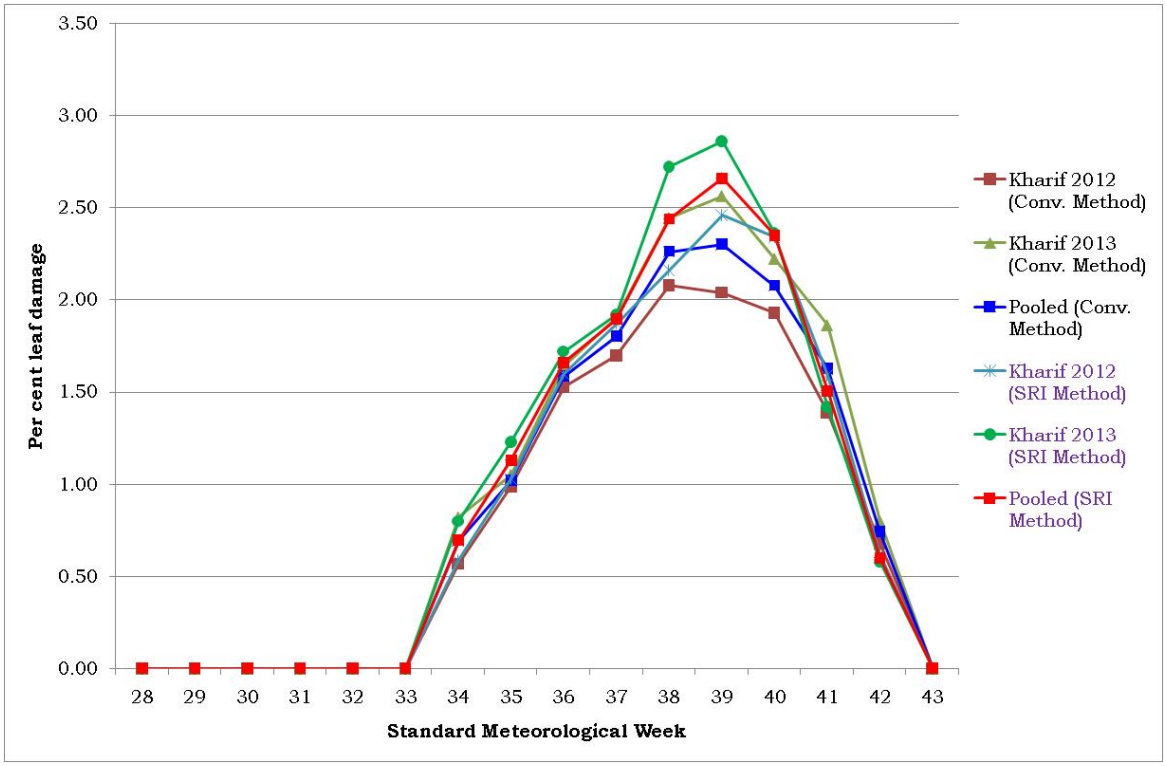

Fig. 1 : Seasonal incidence of rice leaf folder in Conventional and SRI method.

relative humidity (r = 0.020), rainfall (r = 0.373) and sunshine hrs (r = 0.290) had non-significant positive relationship with leaf damage of leaf folder under SRI method of rice planting. While, minimum temperature (r = -0.232) had non-significant negative correlation with leaf folder population damage under SRI method.

These results under conventional and SRI method of planting indicated that the weather parameters had less impact on leaf folder damage as well as no difference found among both type of planting, which justified that the damage was mainly concealed leaf folder activity with plant phenology.

Conclusion

A. Conventional method (Transplanting)

The data on seasonal occurrence of leaf folder, *C. medinalis* revealed that the pest first appeared on 3rd week of August (34th SMW) with 0.77% leaf damage, continued till 3rd week of October (42nd SMW), when crop was almost nearer to maturity stage. The activity of the pest gradually increased and reached to peak level during 4th week of September (39th SMW), when leaf damage due to leaf folder was 2.30%.

B. SRI method

The seasonal incidence of leaf folder in SRI method revealed that 0.70% damaged leaves of rice leaf folder was initiated from 3rd week of August (34th SMW), which increased further and reached to its peak damage of 2.66% during 4th week of September (39th SMW) and reached to a zero level at the maturity of crop (43rd SMW).

The difference in leaf damage under planting method showed that the damage of leaf folder in SRI method was observed higher than conventional method (transplanting) of planting indicating less efficiency of SRI method to reduce the leaf folder infestation.

The correlation results under conventional and SRI method indicated that the weather parameters had less impact on leaf folder damage, which predicted that the damage was mainly concealed leaf folder activity with plant phenology.

References

Alvi, S. M., M. A. Ali, C. Sanaullah and I. Shaheen (2003). Population trends and chemical control of rice leaf folder. *International Journal Agricultural Bio*., **5(4)** : 615-617.

Anonymous (2010). Rice pest scenario under sri and normal system of cultivation. (Fide : http://www.ricecongress.com/pdflink/3888. pdf.)

Anonymous (2012). Directorate of Economics and Statistics, Department of Agri. And Cooperation, Ministry of Agri., Govt. of India. All India area, production and yield of rice.

Bhatnagar, A. and R. R. Saxena (1999). Environmental correlates of population build up of rice insect pests through light trap catches. *Oryza*, **36(3)** : 241-245.

Boopathi, T. (2012). Influence of weather factors on the population dynamics of chewing pests of lowland paddy in Mizoram. *Indian Journal of Entomology*, **72(4)** : 329-335.

Gole, C. A. (2012). Influence of planting method on major insect pest of rice and their management under middle Gujarat condition. *M. Sc. (Agri.) thesis* submitted to Anand Agricultural University, Anand (Gujarat).

Kaul, B. K. and R. Singh (1999). Seasonal abundance of rice leaf folder in Kangra valley of Himachal Pradesh, India. *Oryza*, **36(1)** : 96-97.

Kharat, S. R. (2006). Influence of nutrients on incidence of insect pest complex of paddy and their management. *M. Sc. (Agri.) thesis* submitted to Navsari Agricultural University, Navsari (Gujarat).

Kumar, A. D. V. S. L. P. A., T. R. Sudhakar and D. R. Reddy (2003). Influence of meteorological parameters on the incidence of leaf folder and whorl maggot in rice ecosystem of Andhra Pradesh. *Journal of Agrometeorology*, **5(1)** : 84-85.

Manisegaran, S. and S. Letchoumanane (2001). Influence of weather factors on the population of rice leaf folder in the coastal region of Karaikal. *Madras Journalof Agricultural Research*, **88(7/9)** : 502 - 503.

Mishra, B. K., B. Senapati, P. R. Mishra and S. M. A. Mandal (2001). Antixenosis of some rice varieties to rice leaf folders. *Annals of Plant Protection Sciences*, **9** : 179-183.

Pandya, H. V., A. H. Shah and M. S. Purohit (1994). Estimation of losses due to rice leaf folder, *Cnaphalocrosis medinalis*. *GAU Research Journal*, **20(1)** : 171-172.

Patel, H. K., R. C. Patel and V. C. Patel (1964). Record of some insect pests of different crops, ornamental crops, weeds and stored products in Gujarat state. *Indian Journal of Entomology*, **26(3)** : 364-367.

Patel, H. N. (2006). Seasonal incidence, varietal screening and botanical control of rice leaf folders, *Cnaphalocrocis medinalis* Guenee and *Pelopidas mathias* Fabricious in South Gujarat. *M. Sc. (Agri.) thesis* submitted to Navsari Agricultural University, Navsari (Gujarat).

Patnaik, H. P. (2001). Forecast of rice leaf flolder, *Cnaphalocrocis medinalis* Guenee incidence. *Insect Environment*, **7(1)** : 36.

Ram, P. (1986). White backed plant hopper (WBPH) and leaf folder (LF) in Haryana. *International Rice Research Newsletter*, **11(3)** : 23.

Saikia, P. and S. Parameswaran (1999). Assessment of yield losses at different growth stages of rice due to rice leaf folder. *Annals of Plant Protection Sciences*, **7** : 135-138.

Sankpal, N. D. (2011). Seasonal occurrence and management of major insect pests of paddy (*Oryza sativa* L.) under middle Gujarat conditions. *M. Sc. (Agri.) thesis* submitted to Anand Agricultural University, Anand (Gujarat).

Upadhyay, V. R., N. D. Desai and A. H. Shah (1975). Extent of damage and varietal susceptibility of rice leaf folder, *Cnaphalocrocis medinalis* (Guenee) in Gujarat. *Pesticides*, **5(9)** : 27-28.

Velusamy, V. R. and T. R. Subramaniam (1974). Bionomics of the leaf roller, *Cnaphalocrocis medinalis* (Guenee). *Indian Journal of Ent*omology, **36(3)** : 185-189.