

SEASONAL INCIDENCE OF RICE LEAF FOLDER *CNAPHALOCROSIS MEDINALIS* (GUEN.) IN AGRO CLIMATIC CONDITION OF AT BASTER PLATEAU ZONE

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ABSTRACT

A field experiment was conducted during kharif season of 2013 at Jagdalpur (Chhattisgarh) to study the seasonal incidence of rice leaf folder in Bastar Plateau Zone. The results revealed that infestation of rice leaf folder (15.2% seasonal mean) was observed throughout the cropping period with maximum infestation of 25.3 % during third week of September. The correlation of leaf folder with their natural enemies revealed that significantly positive correlation existed between leaf folder and spiders and leaf folder and mirid bugs with (*r*) values of 0.663 and 0.890, respectively. The peak activity of rice leaf folder was associated with 30.6 °C and 21.7 °C maximum and minimum temperatures and 90.5 and 45.4 % morning and evening relative humidities with the association of 57.9 mm rainfall. Correlation studies revealed a significant positive correlation between leaf infestation and maximum temperature with correlation coefficient (*r*) value of 0.537, whereas, significant negative correlation between leaf infestation and evening relative humidity observed with the correlation coefficient (*r*) value of -0.523. The regression equation for maximum temperature [$Y = 2.149x - 47.42$; $R^2 = 0.288$] and evening relative humidity [$y = -0.491 + 42.14$; $R^2 = 0.273$].

Key words: Incidence, rice leaf folder, Bastar

INTRUCTION

Rice (*Oryza sativa* L.) is the most important and extensively cultivated food crop, which provides half of the daily food for one of every three persons on earth. Chhattisgarh state is popularly known as “rice bowl of India” because maximum area is covered under rice during kharif and contribute major share in national rice production. Chhattisgarh state came into existence in 2001 and having three major agro-climatic zone like Chhattisgarh plain (16 district), Bastar plateau (6 district) Northern hills (5 district). The total geographic area of Baster is 32.63 lakh ha out of which only 6.55 lakh ha. is net sown area. Rice is foremost crop, grown in about 4.63 lakh ha. area, which covers 70% of net sown area. In Bastar region, Gall midge, Leaf folder and Brown plant hopper are the most distractive pests of rice area. Farmers adopt traditional methods of ultivation with no or a little use of fertilizers and plant protection measures. Among various factors responsible for low yield, losses due to insect-pests attack are of prime importance. Among these insect-pests, leaf folder is noticed as regular insect-pest at Baster plateau zone. Leaf folder is a complex of species. Eight species of leaf folder have been recorded so far. In Chhattisgarh, severe damage due to this pest has been reported by Srivastava (1989). The population of rice leaf folder fluctuated in different periods during the seasons. The maximum number of larvae was observed during 4th week of August and 1st week of September (Ankit

kumar *et al.* 2013). Chakraborty (2011) reported that leaf folder infestation was started at about 33 SMW attaining maximum peak of abundance at about 39 SMW with regular generations during single crop season. Hence, study on seasonal incidence of leaf folder is essential as this provide information on the status of leaf folder and their natural enemy fauna and also help in identifying the vulnerable stage of the crop. This information helps in developing an efficient management model for the leaf folder attacking various growth stages of the crop. Therefore, present study was undertaken.

MATERIALS AND METHODS

The experiment was conducted at Research Farm of College of Agriculture and Research Station, IGKV, Kumhrawand, Jagdalpur, (C.G.) during karif season, 2013. Jagdalpur comes under Bastar plateau zone. It is located at 21°16' North latitude and 81°36' East longitude with an altitude of 289.56 m above mean sea level. Jagdalpur comes under sub humid region. It has a seasonal rainfall of 1600 mm. Nearly, 85 % of the annual rainfall is received from 1st week of June to 3rd week of November. Climate of Jagdalpur is more suitable for growth and development of rice leaf folder. Swarna variety of rice was transplanted on 2nd week of August during kharif season in the plot size of 500 m². Planting was done at a distance of 15 cm from row to row and 15 cm from plant to plant. The crop was grown by adopted standard agronomical practices. Weekly observations

on leaf folder infestation with their natural enemies 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 natural enemies was also counted. Leaf folder and natural enemies population was subjected to simple correlation, where, leaf folder infestation was as dependent factor and weather parameters, such as, temperature and humidity as independent factors. Where 'r' was found significant, linear regression equation $y = a \pm bx$ was worked out. Here, y = Dependent factor, a = Constant, b = Regression coefficient, x = Independent factor. Leaf folder damage was worked out by using following formula:

Leaf folder damage (%) =

$$\frac{\text{Total number of leaves/hill}}{\text{Number of damage leaves/hill}} \times 100$$

RESULTS AND DISCUSSION

The results revealed that occurrence of leaf

folder commenced from 34 standard meteorological week (SMW). Observation of leaf folder incidence was recorded on randomly selected ten plants at weekly interval. Besides this insect pest, associated natural enemies were also recorded during the cropping period. During the course of study, leaf folder was noticed causing damage at various growth stage of the crop. Predatory population of Spider (*Lynx sp.*), Mirid bug (*Cyrtorhinus lividipennis*) Damselfly (*Enallagma cyathigerum*) and a parasitic wasp (*Cotesia glomerata*) were observed preying on larvae of leaf folder.

Leaf folder *Cnaphalocrosis medinalis* (Guen.)

First incidence of leaf folder was recorded at tillering stage of the crop in the third week of August with 7.4 % leaf infestation. The level of infestation was gradually increased up to 21.8% leaf infestation recorded in first week of September. Two peak periods were recorded during third week of September and third week of October where leaf infestation reached maximum with 25.3 and 22.4%, respectively. Thereafter, the activity of leaf folder decreased gradually up to last week of November with a seasonal mean of 15.16 % (Table1).

Table 1: Seasonal incidence of leaf folder of rice on variety Swarna

Date of observation	SMW	Total Leaf	Damage Leaf	% Damage Leaf
22-08-13	34	14.7	1.1	7.4
29-08-13	35	15.8	1.7	10.7
05-09-13	36	17.4	3.8	21.8
12-09-13	37	19.0	3.2	16.8
19-09-13	38	38.2	9.7	25.3
26-09-13	39	31.9	5.2	16.3
03-10-13	40	41.4	7.6	18.3
10-10-13	41	44.7	9.6	21.4
17-10-13	42	54.4	12.2	22.4
24-10-13	43	54.1	8.0	14.7
31-10-13	44	51.3	5.9	11.5
07-11-13	45	39.5	3.1	7.8
14-11-13	46	57.9	9.0	15.5
21-11-13	47	35.2	3.7	10.5
28-11-13	48	35.0	2.2	6.2
Seasonal Mean of % Damage Leaf				15.16

Leaf folder was noticed as major leaf feeder insect active throughout the cropping season especially at tillering and panicle initiation stage during third week of September and October. Patnaik (2001) also recorded the peak incidence of leaf folder occurred in the month of September and October in Kendujhar, Orissa which is in confirmity with the present finding. Present investigation was also in accordance with the findings of Balasubramani *et al.* (2000), who reported significantly higher leaf folder

incidence during the month of September in Tamilnadu. Kumar *et al.* (2003) indicated that the peak activity of leaf folder occurred in the first fortnight of October while, in present investigation, second peak activity was noticed during third fortnight of October. Kumar *et al.* (1996) revealed that minimum level of infestation was recorded during the month of July and reached maximum during the month of September with 33.2 per cent leaf infestation. The present investigation also revealed

maximum leaf infestation during September with 25.3 % infestation. Patel *et al* (2001) reported that leaf folder infestation initiated from 36 SMW during Kharif season and reached its peak level during 43 SMW while, in present findings, infestation started from 34 SMW and reached its peak infestation during 38 SMW followed by 42 SMW. Present findings were contradictory with those of Chakraborty (2011) who reported that leaf folder infestation was initiated during 33 SMW and peak abundance during 39 SMW in Navsari (Gujarat).

Natural enemy fauna on leaf folder of rice

The predatory fauna on leaf folder are given in Table 2.

Spider: Species of spider (*Lynx sp.*) was recorded as major bio agent. They made their first appearance on the crop in the last week of August with 0.10 spider/plant. They were observed feeding on the larval and adult stages of leaf folder. Their activity continued till last week of October. Maximum population of 0.90 spider/ plant was observed during second week of October.

Table 2: Seasonal incidence of leaf folder and associated predators on rice variety Swarna

Date of Observation	SMW	Mean Population per Plant			
		Leaf folder	Spider	Mirid bug	Damselfly
22-08-13	34	0.10	0.10	0.00	0.10
29-08-13	35	0.20	0.10	0.10	0.10
05-09-13	36	0.40	0.10	0.30	0.10
12-09-13	37	0.30	0.10	0.10	0.20
19-09-13	38	0.50	0.40	0.30	0.00
26-09-13	39	0.20	0.10	0.10	0.10
03-10-13	40	0.30	0.00	0.10	0.10
10-10-13	41	0.50	0.90	0.40	0.00
17-10-13	42	0.40	0.10	0.30	0.20
24-10-13	43	0.10	0.00	0.10	0.00
31-10-13	44	0.20	0.16	0.00	0.00
07-11-13	45	0.10	0.00	0.10	0.00
14-11-13	46	0.30	0.00	0.20	0.10
21-11-13	47	0.10	0.00	0.00	0.00
28-11-13	48	0.20	0.00	0.10	0.10
Seasonal mean		0.26	0.14	0.14	0.07
Correlation coefficient(r)		Leaf folder	0.663*	0.890*	0.173

* Significant at 5% level

Mirid bug: Besides the spider, mirid bug (*Cyrtorhinus lividipennis*) was observed feeding on every larval stage of leaf folder. Bug was active from last week of August to second week of November. Peak activity of mirid bug was recorded during second week of October with 0.40 bug/ plant. Besides the above predators damselfly (*Enallagma*

cyathigerum) was also observed from last week of August with two peaks of their population recorded during second week of September and third week of October. A parasitic wasp (*Cotesia glomerata*) was noticed parasitizing the larval stage of leaf folder also. In the present investigation, three predators were observed preying upon leaf folder of rice. Spider was observed as a major bio-agent against leaf folder followed by mirid bug and damselfly. Besides these predators, *Cotesia sp.* was observed as larval parasitoid. Ankit Kumar *et al.* (2013) reported *Cotesia sp.* as dominating larval parasitoid. A spider (*Lycosa sp.*) also predated upon larvae of pest, whereas, in the present studies spider (*Lynx sp.*) was recorded as major bio-agent against the pest.

Correlation studies

To observe the effect of predator population on the activity of leaf folder, the population of leaf folder was correlated with the population of spider and mirid bug. It revealed that leaf folder was significantly positively influenced with spider and mirid bug population with correlation coefficient (r) of 0.663 and 0.890, respectively. From the correlation it is clear that as the population of leaf folder increases population of spider and mired bud are also increases. However, non significant positive relationship existed between leaf folder and damselfly.

Effect of ambient weather parameters on seasonal incidence of rice leaf folder

Table 3 indicated seasonal incidence of leaf folder and effect of various weather parameters. During the period of observation, weekly fluctuation of maximum and minimum temperatures ranged from 26.1 to 30.6 °C and 12.1 to 23.1 °C, respectively. Similarly morning and evening relative humidity ranged from 88.4 to 94. 1% and 45.4 to 73.2 %, respectively. Vapour pressure (morning and evening) varied from 12.4 to 21.9 % and 12.5 to 20.2 %, respectively. Rainfall varied from 3.8 to 76.5 mm during whole cropping season. Leaf folder infestation was first observed on the crop in the last week of August with 7.4 % leaf infestation, which was associated with 30.1 °C and 23.1 °C maximum and minimum temperatures and 89.0 and 53.7 % morning and evening relative humidity with the seasonal rainfall of 36.4 mm. The insect gradually increased its density and exhibited peak activity in the third week of September with 25.3 % leaf infestation. It was associated with 30.6 °C and 21.7 °C maximum and minimum temperatures and 90.5 and 45.4 % morning and evening relative humidity with the association of 57.9 mm rainfall. The second peak activity was

Table 3: Effect of weather parameters on the seasonal fluctuation of leaf folder on rice variety Swarna

Date of Observation	SMW	Leaf folder infestation (%)	Temperature (°C)		Rainfall (mms)	Relative Humidity (%)		Vapour Pressure		Wind Velocity (kmph)	Evaporation (mms)	Sunshine hours
			Maximum	Minimum		I	II	I	II			
22/08/2013	34	7.4	30.1	23.1	36.4	89.0	53.7	21.7	18.4	3.2	2.6	4.5
29/08/2013	35	10.7	27.6	21.9	33.3	89.5	61.2	21.3	18.9	9.0	2.0	2.8
05/09/2013	36	21.8	29.1	22.1	20.1	88.4	51.2	21.3	17.9	4.1	3.7	3.7
12/09/2013	37	16.8	30.2	21.7	26.6	91.7	55.0	21.9	19.2	3.1	4.1	3.3
19/09/2013	38	25.3	30.6	21.7	57.9	90.5	45.4	21.7	17.4	1.7	4.6	7.3
26/09/2013	39	16.3	29.1	21.9	11.3	91.0	55.0	21.5	18.5	3.5	5.5	3.1
03/10/2013	40	18.3	30.4	21.3	38.0	89.7	49.5	21.3	17.6	2.7	4.1	5.4
10/10/2013	41	21.4	29.8	21.1	53.8	89.8	54.8	21.2	19.0	3.8	2.1	3.7
17/10/2013	42	22.4	29.6	21.2	20.2	90.4	50.7	21.3	17.8	4.7	2.1	3.5
24/10/2013	43	14.7	30.0	19.6	30.0	92.7	50.2	20.3	17.8	1.4	3.0	7.1
31/10/2013	44	11.5	26.1	20.5	76.5	94.1	73.2	20.8	20.2	5.4	1.6	1.4
07/11/2013	45	7.8	28.7	19.0	0.0	91.0	58.7	19.6	19.2	3.1	2.2	5.1
14/11/2013	46	15.5	30.6	21.0	0.0	89.5	54.2	21.1	17.5	2.7	2.1	4.3
21/11/2013	47	10.5	26.2	12.1	0.0	89.8	55.8	12.4	12.5	2.2	2.0	6.7
28/11/2013	48	6.2	27.9	16.2	3.8	89.8	54.1	16.0	17.3	4.3	2.2	4.1
Correlation Coefficient (r)	Leaf folder Infestation		0.537*	0.426	0.332	-0.093	-0.523*	0.479	0.049	-0.216	0.482	0.126

* Significant at 5% level

exhibited during third week of October with 22.4 % leaf damage which was associated with 29.6 °C and 21.2 °C maximum and minimum temperatures, 90.4 and 50.7 % morning and evening relative humidity and 20.2 mm rainfall. There was a significant positive correlation ($r= 0.537$) between leaf infestation and maximum temperature (regression equation being $y = 2.149x - 47.42$), whereas, significant negative correlation ($r= -0.523$) existed between leaf infestation and evening relative humidity (regression equation being $y = -0.491x + 42.14$). The maximum temperature varied from 29 to 30 °C and minimum from 20 to 21 °C. The morning relative humidity was around 90 % and evening relative humidity from 44 to 45 % with less rainfall which was found congenial for pest multiplication on the crop. Almost similar findings were reported by Ankit kumar *et al.* (2013) at Haryana. They observed a significant positive correlation between maximum temperature and leaf infestation and negative correlation between rainfall and leaf infestation. In the present study, leaf infestation was significant positively correlated with maximum temperature with r values of 0.537 and

significant negatively correlated with evening relative humidity with r values of -0.523. Present findings are in agreement with those of Mukherjee *et al.* (2008) who found significant negative correlation with evening relative humidity and rainfall at Sambalpur. Khan *et al.* (2004) on the other hand, observed a significant negative relationship between maximum temperature and per cent leaf infestation. In the present studies, leaf folder made its first infestation on the crop in the last week of August with peak activity in the third week of September, whereas, Patel *et al.* (2001) reported the first leaf infestation of the pest in the first week of September with peak activity in the last week of October.

On the basis of present investigation, it was concluded that peak activity of rice leaf folder was observed in the third week of September. Leaf infestation had significant positive correlation with maximum temperature and significant negative with evening relative humidity. The correlation of leaf folder with their natural enemies concluded that significantly positive correlation existed between leaf folder and spiders and leaf folder and mirid bugs.

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