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Estimation of losses caused by rice leaf folder, *Cnaphalocrosis medinalis* Guen. (Lepidoptera: Pyralidae) on paddy crop at Jagdalpur (Chhattisgarh)

■ CHANDRA SHEKHAR NETAM* AND A. K. GUPTA

Department of Entomology, College of Agriculture, Indira Gandhi Agricultural University, RAIPUR (C.G.) INDIA

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***Corresponding author:**
Email : csnetam169@gmail.com

ABSTRACT :

Studies on estimation of losses caused by rice leaf folder on variety swarna presented regression analysis revealed a non significant negative relation between damaged flag leaves and grain yield in natural infestation ($r^2 = 0.186$) while, a significant negative relation observed in augmented condition ($r^2 = 0.739$).

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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. In Asia alone, more than 2 billion people obtain 60 to 70 per cent of their energy intake from rice and its derivatives. In world, rice has occupied an area of 157.7 M ha, with a total production of 650.2 M.T. In India, total rice crop area is 42.56 M ha, production is 95.98 M.T. and average productivity is 22.40 q ha^{-1} (Anonymous, 2011). Presently rice is cultivated in 112 countries covering continent and consumed by 2500 million people in the developing countries. 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. About 61 per cent area (20 lakh ha.) is under forest. Rice is foremost crop, grown in about 4.63 lakh ha. area, which covers 70 per cent 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 cultivation with no or a little use of fertilizers and plant protection measures (Anonymous, 2013). Among various factors responsible for low yield, losses due to insect-pests attack are of prime importance. Rice crop is attacked by more than hundred insect species, of which fifteen are of major economic importance. The extent of losses due to ravages of these insect pests varies greatly from area to area and season to season. 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 for. Presently leaf folder, *Cnaphalocrosis medinalis* Guen is an important pest in almost all the rice-growing countries of Asia. Adult male of *C.medinalis* (Gnen.) is uncus short and obtuse with two oblong-oval processes covered with transverse rows of short hairs. Tegumen is short fringed with long hairs, vaincculum with the saccus large and V shaped. Valvae short and ovate and costa with a broad sclerotized patch and fringed with long hairs in tuff and sclerotizations of the sacculus narrow. In female bursa elongated oval in shape. Dactus with the cephalic part broad and distal part narrow. Signum composed of a round orocess with scobination and ovipositor short, with broad swollen lobe. Newly hatched larva is dull white or light yellow with a brown head. Full grown larva is greenish yellow with a light brown head capsule and measures about 20 mm in length. The losses due to insect pests during vegetative phase (50%) contributes more to yield reduction than the reproductive (30%) or ripening phase (20%) as reported by Gupta and Raghuraman (2003). Among the insect pests damaging rice crop at different stages of crop growth, the leaf feeding insect pests are of major importance because of their ability to defoliate or to remove the chlorophyll content of the leaves, which results in considerable reduction in the yield. Rice leaf folder was earlier considered pest of minor importance but it has become major insect pest with the introduction of high yielding rice varieties in the recent past (Waldbauer and Mariciano, 1979). Incidence of leaf folder was recorded upto 22.40 per cent during *Kharif* season at Jagdalpur as reported by Bhatnagar (2004). Leaf folder causes damage to the crop during tillering and flag leaf initiation stages. Later is more concern to yield of crop. Attack on flag leaf leads to reduce the grain weight. In view of that to estimate the yield losses caused by leaf folder is necessary.

For the estimation of losses caused by rice leaf folder, *C. medinalis* (Guen.), Swarna variety of rice was planted on 2nd week of August during *Kharif* 2013-14 in the plot size of 500 m^2 with spacing of 20 cm from row to row and 15cm from plant to plant. Experimental area was divided into two equal sized plots (250 m^2 each plot) as natural infestation plot and augmentation plot. Each 250

Table 1: Effect of leaf folder damage on seed yield after panicle emergence in natural infestation plot

Hill	LFDL	No. of damaged flag leaves / hill	No. of larvae	No. of pupae	Grain yield / hill (g)
1	3.00	0.67	0.33	0.00	15.30
2	4.33	0.67	0.33	0.33	13.71
3	3.67	0.33	0.33	0.33	12.93
4	2.67	0.33	0.33	0.00	13.06
5	4.33	0.67	0.33	0.33	19.62
6	4.00	0.00	0.00	0.00	20.66
7	4.00	0.00	0.00	0.00	18.66
8	2.67	0.33	0.33	0.33	10.94
9	3.67	0.67	0.67	0.00	12.58
10	2.33	0.67	0.33	0.33	16.28
11	2.67	0.00	0.00	0.00	19.00
12	2.67	0.00	0.00	0.00	18.25
13	5.67	1.33	0.33	0.33	10.66
14	2.33	0.33	0.33	0.00	12.03
15	4.00	0.33	0.00	0.00	13.11
16	3.33	0.00	0.33	0.00	18.01
17	2.67	0.33	0.00	0.33	12.81
18	4.00	1.67	1.00	0.33	14.65
19	3.00	0.33	0.33	0.00	10.99
20	3.33	0.00	0.00	0.00	19.39
Mean	3.42	0.43	0.27	0.13	14.30

m^2 area was again divided into three equal sized plots and marked them as Range 1, Range 2 and Range 3.In each range of natural infestation plot, marked 20 hills at random and observations were recorded at 65 DAT and after panicle emergence. In each range of augmentation plot, marked 5area (on four sides and in the centre of the range) as given in the layout. At each marked area, covered 4 hills with a nylon net and augmented leaf folder adult as follows:

Range 1:

Cover each marked area of 4 hills with a nylon net and release 5 pairs of leaf folder adults. Allow them to lay eggs and remove the net for further development.

Range 2:

Cover each marked area of 4 hills with a nylon net and release 10 pairs of leaf folder adults. Allow them to lay eggs and remove the net for further development.

Range3:

Cover each marked area of 4 hills with a nylon net and release 15 pairs of leaf folder adults. Allow them to lay eggs and remove the net for further development.

Following observations were recorded in each marked hills in both natural infestation plot and augmentation plot are given below:

– Total number of leaves / hill.
– Total number of leaf folder damage leaves / hill
– Total number of larvae/ pupae present per hill
– Total number of damaged flag leaves/ hill
– Leaf area damage by leaf folder/ hill
– Grain yield/ hill

This study was formulated with the main objective of generating data on the losses caused by leaf folder at different stages of the crop. Varying levels of leaf folder damage was created by augmenting through the release of adults at different crop growth stages to know the impact on grain yield. Leaf folder adults were augmented in the marked area planted with Swarna variety. Experimental plots were divided into three ranges *i.e.* R_1, R_2 and R_3. In each range of natural infestation plot, observations were recorded on randomly selected 20 hills. In natural infestation plot damaged leaves varied from 2.33 to 5.67 with the mean damaged leaves of 3.42 while, 0.00 to 1.67 damaged flag leaves were recorded with the mean damaged flag leaf of 0.43. Grain yield ranged from 10.66 to 20.66 g/ hill with the mean grain yield/ hill of 14.3 g. In each range of augmentation plot, marked 5 area (on four sides and in the centre of the range). Observations were recorded on 4 hills covered by nylon net in each marked area of each range (Table

Table 2: Effect of leaf folder damage on seed yield after panicle emergence in augmentation plot

Range	Marked area	LFDL/ 4 hills	No. of flag leaves damaged / 4 hills	No. of larvae/ 4 hills	No. of pupae	Grain yield (g)/ 4 hills
1	1	10	5	1	0	30.67
	2	8	6	2	1	23.23
	3	11	4	1	0	34.26
	4	9	3	2	1	39.63
	5	12	4	1	1	35.71
2	1	11	6	2	1	21.21
	2	15	4	2	1	28.02
	3	9	7	1	0	20.21
	4	13	4	1	1	35.03
	5	12	5	2	1	23.58
3	1	15	5	2	1	37.25
	2	12	4	1	0	38.96
	3	13	4	1	1	36.56
	4	9	4	2	1	37.23
	5	10	6	1	1	22.52
Mean / 4 hill		11.27	4.73	1.47	0.73	30.94
Mean/ hill		2.82	1.18	0.37	0.18	7.73

Table 3 : Effect of damage flag leaf on grain yield

Damage area of flag leaf/ hill (cm^2)	Yield/ hill (g)
3.08	7.67
4.23	5.81
3.54	8.57
4.32	9.91
5.25	8.93
8.12	5.30
4.01	7.01
7.47	5.05
4.81	8.76
4.31	5.90
1.33	9.31
2.16	9.74
1.46	9.14
2.24	9.31
4.49	5.63
Correlation co-efficient	-0.683

2). In augmented plot, leaf folder population was augmented by releasing adults at 60 DAT. Leaf folder damage ranged from 8 to 15 per 4 hill with mean damaged leaves per hill of 2.82. The average number of flag leaves damaged per 4 hill varied between 3 to 7 with the mean damaged flag leaves/ hill of 1.18. Grain yield ranged from 20.21 to 39.63 g per 4 hill with the mean grain yield of 7.73 g per hill recorded. Regression analysis worked out between damage flag leaves and yield parameters revealed a non-significant negative relation between damage flag leaves and grain yield in natural infestation (R^2 = 0.186) whereas in augmented plot, these existed, a significant negative correlation between damage flag leaves and grain yield with '$R^{2'}$ value (-) 0.739. To study the effect of damage area of flag leaf on grain yield, data was analysed that the damage area of flag leaf/ hill ranged from 1.33 to 8.12 cm^2 and grain yield/ hill varied from 5.05 to 9.91 g. (Table 3). From the table it was clear that as the damage area increases in flag leaf, seed yield decreases. On the basis of correlation studies, a significant negative correlation (r = -0.683) between damage area of flag leaf and seed yield (regression equation being y = -0.748x + 9.842) recorded. The b value (regression co-efficient) indicated that with the increase of 1 cm^2 damage area in flag leaf there was 0.748 per cent reduction in seed yield.

In the present investigation, a significant negative correlation between damage flag leaf and seed yield was recorded. Similar observation were recorded by Pandya *et al.* (1994) who reported significant negative correlation between yield of rice and incidence of leaf folder during summer and wet season. Anonymous (2012) reported that highly significant negative correlation between leaf folder damage leaf and seed yield recorded at 50 DAT in Pattambi centre of AICRIP-Rice. Similarly, in present investigation a significant negative relationship between damage leaf and seed yield was observed in augmented plot.

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