



Screening of Rice Germplasm for Resistance to Rice Leaf Folder Under Natural Field Conditions

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ABSTRACT

Fifty rice germplasm were screened under natural field conditions during two years i.e *kharif* 2009-10 and 2010-11. In *kharif* 2009-10 the highest leaf infestation was in TN-1 (35.9 %), where as lowest leaf damage was observed in RP-2068-18-13-5 (9.8) with a mean damage of 20.3 percent. In *kharif* 2010-11, highest leaf folder incidence was noticed in NLR 33636-4 with 42.6 percent leaf damage and the lowest was observed in Jhitpiti followed by W-1263 and LF 333 with a leaf damage of 11.9, 12.4 and 12.8 percent, respectively. The cumulative mean incidence of two years indicated that the mean percent damage was 22.06 and the damage ranged from 11.4 to 37.39. the lowest leaf damage was recorded in Jhitpiti (11.4 %) and the highest damage was observed in NLR 145 (37.39 %) and T N-1 (37.16%).

Key words : Rice germplasm, Rice leaf folder, Screening

Rice (*Oryza sativa* L.) is one of the most significant cereals and is the staple food for more than 2 billion people. Almost 90 percent of the rice is grown and consumed in Asia. India is the second largest rice producing country in the world. In India, rice occupies about 44.6 million hectares with a production of 90 million tonnes (Ghule *et al.*, 2008) and it constitutes 52 percent of total food grain production.

One of the major yield limiting factors of paddy is the attack of insect pests that cause 20-30% losses every year (Salim *et al.*, 2001). Nearly 300 *spp* of insect pests are attacking the paddy crop at various stages and among them only 23 *spp* cause notable damage (Pasalu and Katti, 2006). The larvae fold the leaves and scrape the green tissues of the leaves from within and cause scorching and leaf drying. Each larva is capable of destroying several leaves by its feeding. Severe infestation of this pest may lead to 60 to 70% leaf damage (Kushwaha and Singh, 1984) and 50% reduction in yield.

The development and use of resistant varieties can be a better option to reduce the dependence on insecticides and also to obtain a sustainable rice production. The use of varietal resistance to control insect pests provides no additional cost and is also free from the problems connected with the environmental pollution. As all the existing commercial rice varieties are, unfortunately, susceptible to rice leaf folder attack,

it has become imperative to find out the resistance sources in rice germplasm, in order to evolve new rice varieties resistant to rice leaf folder (Rehman *et al.*, 2005).

MATERIAL AND METHODS

Fifty genotypes of paddy collected from different locations (Directorate of Rice Research, Rajendranagar, Agricultural Research Station, Nellore, Regional Agricultural Research station, Maruteru) were raised under natural field conditions at farmers fields, Nellore during *kharif* 2009-10 and 2010-11. The nurseries were sown on well prepared raised beds and about one month old seedlings were transplanted in the field with spacing of 20cmX15 cm @ 2 seedlings per hill. Two rows with 25 hills in each row were grown for each entry with two replications. No plant protection coverage was provided in the test material to create optimum conditions for pest multiplication. All the recommended agronomic practices were adopted during the experimentation. Incidence of leaf folder was recorded on 5 hills per test genotype selected at random. The total and affected leaves were counted on each test genotype and percent leaf damage was worked out. The observations were recorded at 25, 40 and 70 days after transplanta

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

Table 1. Leaf folder damage (%) in different genotypes of Rice (*Kharif* 2009- 10).

S.NO	Genotype	Damage at			Mean
		25 DAT	40 DAT	70 DAT	
1	NLR 40017	18.06	18.01	12.61	16.23
2	NLR 40054	10.62	22.85	16.25	16.57
3	NLR 40024	12.34	19.11	17.81	16.42
4	NLR 3010	7.00	17.96	18.36	14.44
5	NLR 3042	22.72	14.25	11.25	16.07
6	NLR 3041	15.64	20.11	20.51	18.75
7	NLR 40055	25.78	24.58	23.43	24.60
8	NLR 40057	16.11	17.78	15.68	16.52
9	NLR 40058	13.82	27.78	10.98	17.53
10	NLR 20104	11.9	21.24	14.94	16.03
11	NLR 20106	24.07	26.16	24.04	24.76
12	NLR 20127	32.81	35.37	36.87	35.02
13	NLR 20128	31.07	30.64	32.04	31.25
14	NLR 40065	13.97	25.24	18.64	19.28
15	NLR 40059	8.14	15.75	13.00	12.30
16	NLR 33636-4	39.69	24.77	27.77	30.74
17	NLR 33636-5	19.18	16.63	18.52	18.85
18	NLR 33671-1	32.2	30.83	27.93	30.32
19	NLR 33671-10	17.83	21.44	17.94	19.07
20	NLR 33671-6	24.68	25.45	10.85	20.33
21	NLR 33671-7	34.46	26.73	34.13	31.77
22	Kavya	33.31	20.52	16.42	23.42
23	ARC 6605	11.00	20.50	16.90	16.13
24	Phalguna	26.97	26.04	13.24	22.08
25	ARC- 5984	26.51	27.99	21.59	25.36
26	Dukong-1	16.25	24.51	17.71	19.49
27	RP-2333-156-8	17.13	19.36	20.96	19.15
28	Madhuri	17.04	24.35	30.55	23.98
29	BG-380-2	24.06	21.42	17.82	21.10
30	MR-1523	19.73	12.70	19.00	17.14
31	RP-2068-18-3-5	8.19	10.88	10.48	9.85
32	Abhaya	15.2	16.82	17.42	16.48
33	Jhitpiti	11.26	15.06	6.16	10.83
34	INRC-202	7.00	17.88	9.88	11.59
35	INRC-1997	16.16	16.13	10.13	14.14
36	INRC-3021	20.82	18.60	7.40	15.61
37	Aganni	26.35	22.66	10.86	19.96
38	Vasundhara	27.58	16.76	12.16	18.83
39	RP-4688-53-2-1255	33.27	27.8	30.80	30.62
40	W – 1263	15.66	15.81	11.41	14.29
41	LF 293	19.43	14.33	11.73	15.16
42	TN 1	35.94	35.10	36.90	35.98
43	LF 333	10.71	16.63	13.53	13.62
44	IR -36	29.64	32.11	30.51	30.75
45	NLR 145	33.30	26.39	38.49	32.73
46	SB-143	24.77	19.06	15.76	19.86
47	SB-319	13.88	19.12	12.52	15.17
48	SB-479	15.39	18.27	12.97	15.54
49	Suraksha	8.76	22.40	14.60	15.25
50	Sri satya	32.57	31.98	30.88	31.81
	Mean	20.55	21.78	18.64	20.30
	'F' test	*	*	*	
	SEm	0.699	0.74	0.82	
	CD (P=0.05%)	1.937	1.992	2.162	
	CV %	15.40	12.22	13.30	

* Significant at 5 % level

DAT – Days After Transplanting

Table 2. Leaf folder damage (%) in different genotypes of Rice (*Kharif* 2010-11).

S.NO	Genotype	Damage at			
		25 DAT	40 DAT	70 DAT	Mean
1	NLR 40017	30.65	23.04	10.91	21.53
2	NLR 40054	33.87	22.73	20.00	25.53
3	NLR 40024	35.61	20.75	13.82	23.39
4	NLR 3010	15.04	15.93	10.37	13.78
5	NLR 3042	43.33	17.82	16.22	25.79
6	NLR 3041	43.54	26.32	23.30	31.05
7	NLR 40055	24.16	12.21	24.82	20.40
8	NLR 40057	27.94	27.27	10.74	21.98
9	NLR 40058	30.77	25.77	12.84	23.13
10	NLR 20104	38.97	34.96	16.30	30.08
11	NLR 20106	39.25	23.42	14.29	25.65
12	NLR 20127	46.85	19.61	20.83	29.10
13	NLR 20128	55.43	25.48	21.11	34.01
14	NLR 40065	16.83	31.65	15.31	21.26
15	NLR 40059	20.82	12.76	14.81	16.13
16	NLR 33636-4	40.00	63.22	24.71	42.64
17	NLR 33636-5	42.99	44.58	23.61	37.06
18	NLR 33671-1	42.61	35.00	24.47	34.03
19	NLR 33671-10	35.05	19.30	18.10	24.15
20	NLR 33671-6	28.66	23.97	16.25	22.96
21	NLR 33671-7	35.97	61.76	27.71	41.81
22	Kavya	23.08	30.67	7.27	20.34
23	ARC 6605	12.02	26.32	10.53	16.29
24	Phalguna	17.39	4.27	23.88	15.18
25	ARC- 5984	11.69	38.89	19.53	23.37
26	Dukong-1	23.19	20.97	8.33	17.50
27	RP-2333-156-8	22.22	11.35	7.89	13.82
28	Madhuri	33.33	23.98	11.11	22.81
29	BG-380-2	30.15	24.14	14.29	22.86
30	MR-1523	27.97	25.58	8.93	20.83
31	RP-2068-18-3-5	14.21	19.46	8.89	14.19
32	Abhaya	20.35	17.36	14.29	17.33
33	Jhitpiti	14.72	11.82	9.40	11.98
34	INRC-202	18.30	15.65	10.20	14.72
35	INRC-1997	16.18	13.33	13.89	14.47
36	INRC-3021	15.94	11.51	12.31	13.25
37	Aganni	24.53	21.05	19.27	21.62
38	Vasundhara	24.21	47.31	10.78	27.43
39	RP-4688-53-2-1255	31.25	60.92	32.05	41.41
40	W – 1263	13.60	14.05	9.68	12.44
41	LF 293	18.02	18.22	4.60	13.61
42	TN 1	38.68	38.35	38.00	38.34
43	LF 333	17.13	14.11	7.35	12.86
44	IR -36	50.44	22.93	34.53	35.97
45	NLR 145	48.37	36.67	41.12	42.05
46	SB-143	45.54	24.42	17.24	29.07
47	SB-319	22.83	24.85	8.20	18.63
48	SB-479	32.85	22.46	13.16	22.82
49	Suraksha	41.94	27.27	13.04	27.42
50	Sri satya	34.33	34.81	27.13	32.09
	Mean	29.55	25.20	16.71	23.81
	'F' test	*	*	*	
	SEM	1.006	1.013	0.700	
	CD (P=0.05%)	2.787	2.808	1.939	
	CV %	17.8	16.4	15.4	

* Significant at 5 % level

Table 3. Pooled mean percent leaf folder damage in different genotypes of Rice during *Kharif* 2009-10 and 2010-11

S.NO	Genotype	Mean percent damage	Damage Rating	Status
1	NLR 40017	18.88	3	Moderately Resistant
2	NLR 40054	21.05	3	Moderately Resistant
3	NLR 40024	19.91	3	Moderately Resistant
4	NLR 3010	14.11	1	Resistant
5	NLR 3042	20.93	3	Moderately Resistant
6	NLR 3041	24.90	3	Moderately Resistant
7	NLR 40055	22.50	3	Moderately Resistant
8	NLR 40057	19.25	3	Moderately Resistant
9	NLR 40058	20.33	3	Moderately Resistant
10	NLR 20104	23.05	3	Moderately Resistant
11	NLR 20106	25.21	3	Moderately Resistant
12	NLR 20127	32.06	5	Moderately susceptible
13	NLR 20128	32.63	5	Moderately susceptible
14	NLR 40065	20.27	3	Moderately Resistant
15	NLR 40059	14.29	1	Resistant
16	NLR 33636-4	36.69	5	Moderately susceptible
17	NLR 33636-5	27.96	3	Moderately Resistant
18	NLR 33671-1	32.17	5	Moderately susceptible
19	NLR 33671-10	21.61	3	Moderately Resistant
20	NLR 33671-6	21.64	3	Moderately Resistant
21	NLR 33671-7	36.79	5	Moderately susceptible
22	Kavya	21.88	3	Moderately Resistant
23	ARC 6605	16.21	3	Moderately Resistant
24	Phalguna	18.63	3	Moderately Resistant
25	ARC- 5984	24.37	3	Moderately Resistant
26	Dukong-1	18.49	3	Moderately Resistant
27	RP-2333-156-8	16.49	3	Moderately Resistant
28	Madhuri	23.39	3	Moderately Resistant
29	BG-380-2	21.98	3	Moderately Resistant
30	MR-1523	18.99	3	Moderately Resistant
31	RP-2068-18-3-5	12.02	1	Resistant
32	Abhaya	16.91	3	Moderately Resistant
33	Jhitpiti	11.40	1	Resistant
34	INRC-202	13.15	1	Resistant
35	INRC-1997	14.30	1	Resistant
36	INRC-3021	14.43	1	Resistant
37	Aganni	20.79	3	Moderately Resistant
38	Vasundhara	23.13	3	Moderately Resistant
39	RP-4688-53-2-1255	36.02	5	Moderately susceptible
40	INRC-3021	13.37	1	Resistant
41	LF 293	14.39	1	Resistant
42	TN 1	37.16	5	Moderately susceptible
43	LF 333	13.24	1	Resistant
44	IR -36	33.36	5	Moderately susceptible
45	NLR 145	37.39	5	Moderately susceptible
46	SB-143	24.47	3	Moderately Resistant
47	SB-319	16.90	3	Moderately Resistant
48	SB-479	19.18	3	Moderately Resistant
49	Suraksha	21.34	3	Moderately Resistant
50	Sri satya	31.95	5	Moderately susceptible

IRRI Standard Evaluation System.

Damage rating %	Scale	Status
0	0	Highly Resistant
1 – 15	1	Resistant
16 – 30	3	Moderately Resistant
31 – 50	5	Moderately susceptible
51 – 75	7	Susceptible
>75	9	Highly Susceptible

Based on the damage rating and scale the status of rice genotypes was determined by the following IRRI'S Standard Evaluation System (SES) for rice.

RESULT AND DISCUSSION

Under natural field conditions, data on percent leaf damage was assessed in fifty genotypes of rice from 25 DAT to 70 DAT during *kharif* 2009-10 and the cumulative data was presented in the table 1.

Leaf folder damage at 25 DAT indicated the highest leaf damage was observed in the genotype NLR 33636-4 (39.69%) followed by TN -1(35.49 %), where as the lowest incidence was in NLR -3010 and INRC- 202 (7%) which was on par with NLR-40059 (8.14%), RP-2068-18-3-5 (8.19%) and suraksha (8.76%). At 40 DAT the mean percent damage was 21.78 percent with the highest leaf damage was in NLR- 20127 (35.37%), which was on par with TN-1(35.1%) and the lowest leaf damage was noticed in RP-2068-18-3-5(10.88%) and at 70 DAT the average percent leaf damage was recorded as 18.64 percent. The maximum damage was noticed in NLR -145(38.4%) where as minimum percent of leaf damage was observed in Jhitpiti (6.16%) followed by INRC 3021 (7.4%). The cumulative mean percent damage ranged from 9.85 to 35.98 percent, and the highest leaf infestation was in TN-1(35.98%), where as lowest damage was on RP-2068-18-3-5 (9.85) with a mean leaf damage of 20.30 percent.

During *kharif* 2010-11 the incidence of leaf folder damage was recorded from 25 DAT to 70 DAT and was presented in the table 2.

The mean percent leaf damage due to leaf folder at 25 DAT was 29.5percent, and the damage ranged between 12.02 to 55.43 percent. The highest percent leaf damage was noticed in NLR – 20128 (55.43%). The lowest incidence was in the genotype

ARC 6605(12.02%). Leaf folder damage at 40 DAT in the screened genotypes indicated that the average leaf damage per plant was 25.20. The highest leaf damage was observed in NLR 33636-4 (63.28%), followed by NLR 33671- (61.76%). The lowest leaf damage was observed in RP-2333-156-8 (11.35%). The genotypes Jhitpiti (11.82%) and INRC-3021 were on par with each other. Leaf folder damage at 70 DAT ranged from 4.6 percent to 41.12 percent with the mean damage of 16.71 percent. The genotype NLR-145 recorded highest leaf folder incidence (41.12%), where as the genotype LF -293 had the lowest leaf damage (4.6%). The cumulative mean data from 25 DAT to 70 DAT during *kharif* 2010-11 revealed that the highest leaf folder incidence was noticed in NLR 33636-4 with 42.64 percent leaf damage, which is on par with NLR-145 (42.05%). The lowest leaf folder damage was observed in Jhitpiti (11.98%). The genotypes W-1263 and LF-333 were on par with each other with an average leaf damage of 12.44 and 12.86 percent respectively. The cumulative mean percent damage of fifty genotypes was 23.8 percent.

Pooled mean incidence of leaf damage of two years i.e *kharif* 2009-10 and 2010-11

The leaf damage in the year 2009-10 and 2010-11 in fifty genotypes during different growth stages (25, 40 and 70 DAT) were pooled (Table 3). The cumulative mean percent damage was 22.06 and the damage ranged from 11.4 to 37.39%. The lowest damage was recorded in Jhitpiti (11.4%) and highest damage was observed in NLR-145 (37.39%) and TN-1(37.16%). Based on overall reaction of leaf folder in two years in different (50) entries, the genotypes were categorized in to various groups according to Standard Evaluation System for Rice given by IRRI, Phillipines. Out of 50 genotypes of rice, ten resistant (19%) thirty moderately resistant (62%) and 10 moderately susceptible (19%) were found.

These findings are in corrobation with Xu *et al.* (2010), who reported that among different lines screened for rice leaf folder, TN- 1 was most susceptible line among all with DLS of 9. It was also in accordance with Rathika, 2008 where TN-1 was the most susceptible genotype among twenty genotypes screened.

The present results are also in conformity with the finding of AICRP on Rice results. It was documented in DRR progress report (2009-10 and 2010-11) that the rice genotypes W-1263, LF 293, LF 333, INRC 3021 were resistant to rice leaf folder.

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