



Assessment of rice leaf folder, *Cnaphalocrosis medinalis* (Guenee) damage on different rice accessions under field conditions

Kavikuilan K¹, R Kanagarajan²

¹ Research Scholar, Department of Agricultural Entomology, Annamalai University, Chidambaram, Tamil Nadu, India

² Associate Professor, Department of Agricultural Entomology, Annamalai University, Chidambaram, Tamil Nadu, India

Abstract

Field screening of 220 paddy accessions including 207 rice cultures, ten traditional varieties, two high yielding varieties along with a susceptible check (TN-1) was carried out against rice leaf folder, *Cnaphalocrosis medinalis* (Guenee) at Kodangudi village of Cuddalore district during Rabi 2021 under rainfed ecosystem. The leaf folder damage was recorded at 60 DAT and results varied between highly resistant (2.73%) and susceptible (0.45%). Out of 220 accessions, six accessions were ranked as highly resistance, one hundred and fifty five accessions are grouped as resistant (1- 10% leaf damage), fifty accessions were categorized as moderately resistant (11-20% leaf damage), eight accessions showed moderately susceptible character by recording between 21 – 35 per cent leaf damage. Only one variety was categorized as susceptible (36 – 50 % leaf damage). The susceptible check TN-1 recorded 44.36 per cent leaf damage.

Keywords: rice, accessions, traditional varieties, resistance, leaf folder, damage

Introduction

Rice (*Oryza sativa L.*) is a most important crop and worldwide it occupies second position among all the cereals it is grown in more than 100 countries, in an area of 165 million ha worldwide, with 759.6 million metric tons of production (FAO, 2018) [5]. India, the second-largest producer, cultivates rice in an area of 43.8 million ha, with a production of 118.91 million tons (Agricultural Statistics at a Glance, 2020). The rice production is affected by different types of biotic and abiotic factors, among which insect pests are most important biotic factor that affects the rice crop and cause huge yield losses. For every year, nearly 21 per cent of the rice yield was lost due to the attack of insect pests (Brookes and Barfoot, 2003). Most commonly paddy leaf folder *Cnaphalocrosis medinalis* is one of the most dangerous pest which causes around 11.18 per cent of yield losses in paddy crop in India (Shanmugam *et al.*, 2006) [10].

The leaf folder *Cnaphalocrosis medinalis* is distributed throughout South and South East Asia. Populations are often highest in fields that have received high rates of nitrogen fertilizer and at field edges near trees. The larva rolls the leaf by tying silk to the margins and feeds within the rolled leaves and removes the green layer. Heavily damaged fields turn brown and appear hopper burnt, the symptom commonly known as 'scorching symptom'. The leaf folder's attack not only makes the leaves to wither and dry but also additionally infected plants exhibit bacterial and fungal infections via affected wounds. Damage usually occurs during the reproductive stage of plant growth (Bashir *et al.*, 2004) [3]. The use of chemical insecticides is difficult to control the menace of pests during the rainy season in many part of rice cultivating areas. In recent days, the farmer's community is much aware about the hazardous insecticides and ill effects of chemicals, since then, they moved into alternate pest control strategies. In past several years, the researchers have made efforts to discover the resistant sources (Mishra *et al.*, 2002). The identification and use of resistant varieties for many of the crop plants are best alternate methods to minimize the insecticide usage and to achieve better yield in rice production. It's most effective, simple, easy, cheap and ideal method of combating pest problems. The Host plant resistance is one of the important tactics in integrated pest management and having eco-friendly benefits (Sarwar, 2012) [9].

Materials and Methods

The research work was carried out in field conditions at Kodangudi village (11°40'71.99"N Latitude; 79°15'59.11"E Longitude; +4.6m MSL) of Cuddalore district, Tamilnadu, India. Two hundred and twenty rice accessions were collected from Department of Entomology, Faculty of Agriculture, Annamalai University. All the test accessions were sown during Rabi season of 2021 in raised nursery bed and were transplanted at 21 days after sowing (DAS). Each genotype was planted in three rows of two meter length with an inter and intra row spacing of 20 × 10 cm. Planting was carried out in such a manner to harbor maximum leaf folder infestation. After every five accessions, one line of susceptible check (TN1) was planted. Five plants were randomly selected

and number of damaged leaves and total number of leaves in each accession were counted. All the recommended crop management practices except that plant protection measures (Pesticides) were followed. Based on the severity of the leaf folder incidence, the leaf damage score was applied. The per cent damaged leaves per hill were recorded and calculated as follows:-

$$\text{Per cent leaf damage} = \frac{\text{Number of damaged leaves}}{\text{Total number of leaves}} \times 100$$

Based on the damage rating and scale, the status of rice accessions were determined by following IRRI's Standard Evaluation System (SES) for rice (IRRI, 1998) ^[7] (Table 1). As the natural climate can play a major role in pest infestation, meteorological data has been recorded for the entire crop duration and the monthly average data presented (Table 2).

Table 1: SES for damage rating and scale of rice accessions for resistance against Rice leaf folder on per cent damage basis.

Scale	Per cent leaf damage (%)	Varietal Reaction/ Rating
0	0	Highly Resistant/Immune (HR)
1	1-10	Resistant (R)
3	11-20	Moderately Resistant (MR)
5	21-35	Moderately Susceptible (MS)
7	36-50	Susceptible (S)
9	51-100	Highly susceptible (HS)

(IRRI, 1998) ^[7]

Table 2: Monthly average meteorological data for three months (90 days) of the crop duration

Temperature (°C)			Rain fall (mm)	Wind speed (kmph)			Average (%)		UV index	Sunny Conditions		Visibility (km)
Maximum	Minimum	Average		Maximum	Average	Average gust	Cloud	Humidity		Hours	Days	
January – 2021												
28	22	26	168.5 (20 days)	16.9	13.1	19.7	81	48	7	279	10	9.3
February – 2021												
31	21	27	8.1 (4 days)	19.5	12.7	18.1	68	15	7	317	24	9.9
March – 2021												
35	23	31	0.9 (3 days)	20.8	11.2	15	63	10	9	367	28	9.9

Results and Discussion

Leaf damage recorded at 60 DAT, varied between highly resistant/immune (0%) and susceptible (44.36%). Out of 220 accessions, only six accessions (2.73%) were proved to be highly resistant by recording 0 (Zero) per cent leaf damage. One hundred and fifty five accessions (70.45%) are recorded as resistant accessions scored grade 1 (1-10% leaf damage), they shown only minimum amount of leaf damages. Fifty accessions (22.72%) were observed as moderately resistant category by registering grade 3 (11-20% leaf damage), eight accessions (3.63%) were identified as moderately susceptible accessions by accounting grade 5 (21-35% leaf damage), only one variety (0.45%) was observed as susceptible accession by scoring grade 7 (36-50% leaf damage). The percentage of rice accession under various resistant categories were also illustrated (Fig. 1).

Table 3: Assessment of paddy leaf folder damage by *Cnaphalocrosis medinalis* (Guenee) on different rice accessions under field conditions at 60 DAT.

S.No.	Accessions	Leaf folder damage (%)	Score	Status
1.	BA-1	5.40	1	R
2.	BA-2	10.00	1	R
3.	BA-3	7.96	1	R
4.	BA-4	8.62	1	R
5.	BA-5	16.81	3	MR
6.	BA-6	12.09	3	MR
7.	BA-8	16.81	3	MR
8.	BA-12	12.00	3	MR
9.	BA-14	11.38	3	MR
10.	BA-17	3.73	1	R

11.	BA-18	9.24	1	R
12.	BA-20	5.60	1	R
13.	BA-23	11.57	3	MR
14.	BA-24	5.83	1	R
15.	BA-25	2.38	1	R
16.	BA-26	2.89	1	R
17.	BA-30	0.00	0	HR
18.	BA-31	9.83	1	R
19.	BA-32	8.73	1	R
20.	BA-33	5.44	1	R
21.	BA-35	10.68	3	MR
22.	BA-36	5.30	1	R
23.	BA-37	8.80	1	R
24.	BA-39	6.99	1	R
25.	BA-40	3.33	5	MS
26.	BA-44	2.32	1	R
27.	BA-46	8.27	1	R
28.	BA-47	4.58	1	R
29.	BA-52	3.57	1	R
30.	BA-53	5.50	1	R
31.	BA-54	14.38	3	MR
32.	BA-56	5.92	1	R
33.	BA-65	3.44	1	R
34.	BA-68	4.44	1	R
35.	BA-76	18.65	3	MR
36.	BA-78	13.68	3	MR
37.	BA-80	16.17	3	MR
38.	BA-81	13.86	3	MR
39.	BA-82	4.19	1	R
40.	BA-83	5.55	1	R
41.	BA-86	11.11	3	MR
42.	BA-87	10.79	3	MR
43.	BA-90	5.55	1	R
44.	BA-91	18.70	3	MR
45.	BA-92	3.81	1	R
46.	BA-93	3.70	1	R
47.	BA-94	5.83	1	R
48.	BA-95	3.57	1	R
49.	BA-96	2.91	1	R
50.	BA-98	4.09	1	R
51.	BA-101	5.05	1	R
52.	BA-103	1.42	1	R
53.	BA-104	5.34	1	R
54.	BA-105	18.57	3	MR
55.	BA-106	5.14	1	R
56.	BA-107	7.14	1	R
57.	BA-109	9.02	1	R
58.	BA-110	3.52	1	R
59.	BA-111	3.64	1	R
60.	BA-112	6.52	1	R
61.	BA-113	7.14	1	R
62.	BA-114	3.57	1	R
63.	BA-115	6.61	1	R
64.	BA-116	9.85	1	R
65.	BA-117	6.10	1	R
66.	BA-118	11.45	3	MR
67.	BA-119	15.09	3	MR
68.	BA-120	10.86	3	MR
69.	BA-121	6.61	1	R
70.	BA-122	5.60	1	R
71.	BA-123	2.34	1	R

72.	BA-124	6.66	1	R
73.	BA-125	2.87	1	R
74.	BA-126	17.85	3	MR
75.	BA-127	22.22	5	MS
76.	BA-128	11.36	3	MR
77.	BA-129	17.42	3	MR
78.	BA-130	11.19	3	MR
79.	BA-131	12.32	3	MR
80.	BA-132	14.49	3	MR
81.	BA-133	25.19	5	MS
82.	BA-134	20.61	5	MS
83.	BA-135	12.78	3	MR
84.	BA-136	10.37	3	MR
85.	BA-137	7.19	1	R
86.	BA-139	7.63	1	R
87.	BA-140	6.94	1	R
88.	BA-141	2.12	1	R
89.	BA-143	10.14	3	MR
90.	BA-145	16.29	3	MR
91.	BA-146	4.37	1	R
92.	BA-147	4.44	1	R
93.	BA-148	8.95	1	R
94.	BA-149	24.81	5	MS
95.	BA-150	4.72	1	R
96.	BA-151	7.69	1	R
97.	BA-152	5.00	1	R
98.	BA-153	8.06	1	R
99.	BA-154	10.56	3	MR
100.	BA-155	11.90	3	MR
101.	BA-156	20.74	5	MS
102.	BA-157	3.33	1	R
103.	BA-158	8.20	1	R
104.	BA-159	10.85	3	MR
105.	BA-160	5.14	1	R
106.	BA-161	5.07	1	R
107.	BA-162	2.17	1	R
108.	BA-163	13.33	3	MR
109.	BA-164	2.34	1	R
110.	BA-165	3.31	1	R
111.	BA-166	8.16	1	R
112.	BA-168	0.68	1	R
113.	BA-169	1.37	1	R
114.	BA-170	5.55	1	R
115.	BA-171	3.97	1	R
116.	BA-172	7.04	1	R
117.	BA-173	2.81	1	R
118.	BA-174	4.10	1	R
119.	BA-175	7.14	1	R
120.	BA-176	2.83	1	R
121.	BA-178	0.71	1	R
122.	BA-179	2.02	1	R
123.	BA-180	13.38	3	MR
124.	BA-182	3.57	1	R
125.	BA-183	7.24	1	R
126.	BA-184	5.97	1	R
127.	BA-185	9.09	1	R
128.	BA-186	7.63	1	R
129.	BA-187	8.88	1	R
130.	BA-188	7.63	1	R
131.	BA-189	31.25	5	MS
132.	BA-190	1.38	1	R

133.	BA-191	6.49	1	R
134.	BA-192	0.71	1	R
135.	BA-193	0.00	0	HR
136.	BA-194	5.10	1	R
137.	BA-196	1.43	1	R
138.	BA-197	3.07	1	R
139.	BA-198	1.51	1	R
140.	BA-199	0.71	1	R
141.	BA-200	1.49	1	R
142.	BA-201	6.29	1	R
143.	BA-202	6.15	1	R
144.	BA-203	3.00	1	R
145.	BA-204	1.50	1	R
146.	BA-205	0.00	0	HR
147.	BA-206	7.69	1	R
148.	BA-207	0.00	0	HR
149.	BA-208	11.11	3	MR
150.	BA-209	3.84	1	R
151.	BA-210	0.00	0	HR
152.	BA-211	14.28	3	MR
153.	BA-212	2.94	1	R
154.	BA-213	1.40	1	R
155.	BA-214	18.75	3	MR
156.	BA-215	6.10	1	R
157.	BA-216	5.07	1	R
158.	BA-217	5.75	1	R
159.	BA-218	4.96	1	R
160.	BA-219	2.25	1	R
161.	BA-221	12.40	3	MR
162.	BA-223	5.92	1	R
163.	BA-225	7.57	1	R
164.	BA-227	4.61	1	R
165.	BA-228	6.61	1	R
166.	BA-230	10.60	3	MR
167.	BA-231	15.10	3	MR
168.	BA-234	5.42	1	R
169.	BA -235	0.00	0	HR
170.	BA-238	14.28	3	MR
171.	BA-240	14.61	3	MR
172.	BA-242	13.33	3	MR
173.	BA-243	9.70	1	R
174.	BA-245	13.49	3	MR
175.	BA-247	9.37	1	R
176.	BA-249	7.04	1	R
177.	BA-250	13.33	3	MR
178.	BA-251	4.44	1	R
179.	BA-252	4.96	1	R
180.	BA-253	5.71	1	R
181.	BA-254	26.76	5	MS
182.	BA-257	1.00	1	R
183.	BA-258	6.66	1	R
184.	BA-260	13.04	3	MR
185.	BA-262	3.05	1	R
186.	BA-264	6.66	1	R
187.	BA-266	8.08	1	R
188.	BA-267	12.16	3	MR
189.	BA-269	7.24	1	R
190.	BA-270	6.66	1	R
191.	BA-271	6.80	1	R
192.	BA-274	1.36	1	R
193.	BA-275	7.63	1	R

194.	BA-276	5.07	1	R
195.	BA-277	2.81	1	R
196.	BA-278	6.97	1	R
197.	BA-282	4.31	1	R
198.	BA-283	3.93	1	R
199.	BA-284	10.86	3	MR
200.	BA-285	6.52	1	R
201.	BA-287	5.42	1	R
202.	BA-288	7.35	1	R
203.	BA-293	11.62	3	MR
204.	BA-294	2.83	1	R
205.	BA-295	2.29	1	R
206.	BA-296	3.67	1	R
207.	BA-298	5.22	1	R
208.	Kala	15.90	3	MR
209.	Norungan	6.81	1	R
210.	Nootripathu	3.70	1	R
211.	Kuliyadichan	1.40	1	R
212.	Poongkar	3.67	1	R
213.	Kuruvai Kalanchiyam	2.87	1	R
214.	Kattanur	5.07	1	R
215.	Sivappu chitraikar	3.73	1	R
216.	Vellai chithiraikar	2.85	1	R
217.	Mattaikar	4.58	1	R
218.	Sigappi	8.63	1	R
219.	AUI-GSR	6.66	1	R
220.	TN-1	44.36	7	S

DAT- Days After Transplanting, HR- Highly Resistant, R-Resistant, MR- Moderately Resistant, MS-Moderately Susceptible, S-Susceptible

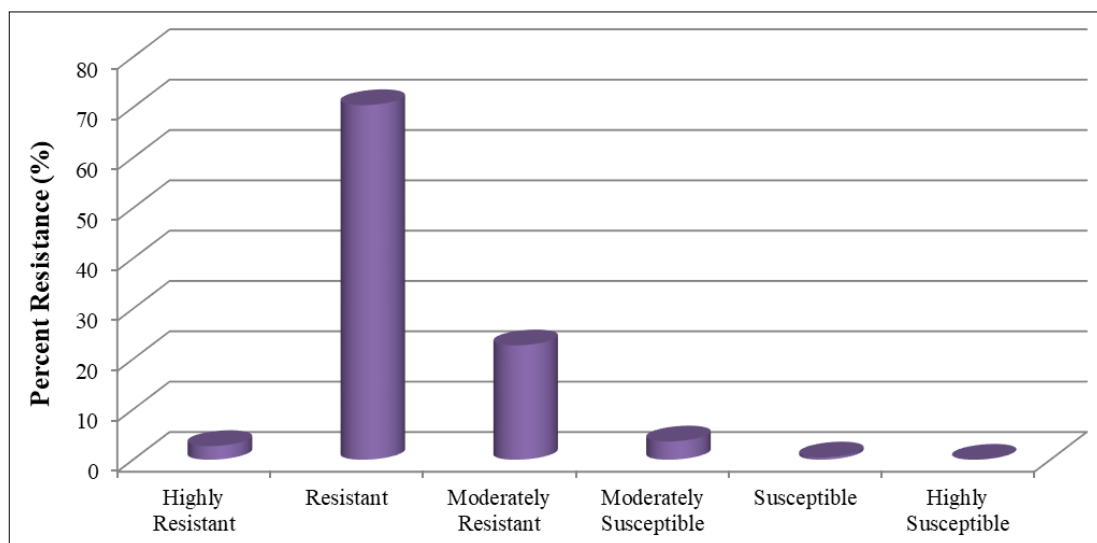


Fig 1: Percent resistance of rice accession categories

Among all the accessions, very less per cent of accessions fall under the category of resistance. Similarly, the present study was correlated with the Greenhouse screening of 17,914 accessions of rice, *Oryza sativa* L., out of which 35 accessions were reported as resistant and 80 of them are shown moderately resistant reactions to *Cnaphalocrocis medinalis* Guenee as reported by Heinrics *et al.*, (1985), was similar to the earlier reports of Ahmed *et al.* (2006) ^[2], who reported that out of 50 cultivars tested, eighteen of them were moderately resistant. According to the findings of Chatterjee *et al.*, (2021) ^[4], 78 rice varieties were screened against *Scirpophaga incertulas* (yellow stem borer) and *Cnaphalocrocis medinalis* (rice leaf folder) of rice and eight were reported as resistant against both *Scirpophaga incertulas* and *Cnaphalocrocis medinalis*. Sridharan *et al.*, (2001) ^[11] tested promising rice varieties and hybrids for resistance against rice leaf folder where in the results indicated that ASD 19, ADT 38, ADT 39 and Improved White Ponni were recorded as resistant and CO 40 and CO 45 are susceptible varieties. A demonstration was conducted by Mandal *et al.*, (1997) ^[8] and evaluated 19 rice varieties under upland condition for resistance against the leaf folder, in which OR-83-23 variety proved as promising one while, varieties OR-377-85-6 and OR-924-2-5 proved as susceptible against *Cnaphalocrocis medinalis*.

Conclusion

For the development of resistant varieties, identification and evaluation of rice leaf folder is a fundamental work. Among all the accessions tested, 6 of them are reported as highly resistance against rice leaf folder *Cnaphalocrosis medinalis*. The traditional rice varieties like Kala, Norungan, Nootripathu, Kuliyaadichan, Poongkar, Kuruvai Kalanchiyam, Kattanur, Sivappu chitraikar, Vellai chithiraikar, Mattaikar and the recently released rice varieties from Annamalai University Sigappi and AU1-GSR are found resistant against rice leaf folder. These resistance lines may be used as parents in breeding for resistance against Leaf folder in rice.

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