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INHERITANCE OF GALL MIDGE RESISTANCE IN SOME RICE CROSSES

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ABSTRACT

Inheritance of resistance to rice gall midge was investigated in 14 F_1, 10 F_2, and 7 F_3 populations. The resistant parents used were Samridhi, Usha, Surekha, R 244-3012, and CR 95-181-2. Only one dominant gene was found to control resistance in each of the resistant parents. The resistant gene present in Surekha was confirmed to be different than that of Samridhi but was the same as that present in CR 95-181-2.

Key words : Rice, inheritance, gall midge, resistance.

Gall midge (*Orseolia oryzae*, Wood-Mason) is an important pest causing considerable losses in almost all south and South- east Asian countries [1-2], except Philippines. Since control of pest by chemicals has not been very successful [3], attention has been mainly focused on developing resistant varieties. Accordingly, several strains resistant to this pest have been released in India, Sri Lanka, Thailand and Philippines [4].

The occurrence of biotypes [5], however, render resistant varieties to be of limited geographic adaptability. This necessitates search of new genes as well as understanding genetic nature of resistance in different resistant parents.

MATERIALS AND METHODS

The experiment was conducted under field conditions during *kharif* season. The crosses were made during *kharif* seasons and part of the crossed seeds were raised during off season to advance the generation. The F_2 populations were grown during *kharif* season under protected conditions. From each cross, 50 to 200 random plants were selected to get F_3 progenies to be screened during the next *kharif* season.

In all 14 F_1, 10 F_2 and 7 F_3 populations were studied alongwith the parents for their reaction to gall midge. Four rows of purple leaf susceptible check line

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R 259-WR 37-2 were planted all around the test rows. The presence of single silver shoot per plant was taken as an index of susceptibility.

Individual plants in F_1 and F_2 populations were scored as resistant or susceptible, whereas, the F_3 progenies (coming from randomly selected F_2 plants) were classified as breeding true for either (1) resistance or (2) susceptibility and (3) segregating. The simple chisquare test was applied to fit the observed frequencies into the expected ratios and conclusions were drawn accordingly.

RESULTS

The level of natural infestation was quite satisfactory. This was evident from reactions of susceptible parents, showing cent percent infection. The resistant parents, on the other hand were completely free. The field screening, therefore was quite reliable.

All F_1 populations involving one resistant and one susceptible parent were resistant to gall midge (Table 2). This indicated presence of at least one dominant gene in each resistant parent. All F_2 populations segregated into 3 resistant : 1 susceptible ratio confirming that only one dominant gene was present in each of the resistant parents.

Table 1. Reaction of parental strains to gall midge

Cultivar	Parentage	Total plants	Resistant	Susce-ptible	Reaction
Samridhi	IR22/W 1263	24	24	0	R
Usha	IR22/W 1263	22	22	0	R
R-244-3012	Ob677/IR2071-586-1	20	20	0	R
Surekha	IR8/Siam 29	24	24	0	R
CR95-181-2	Leuang 152/IR8	30	30	0	R
Anupama	IR8/S10-16	45	0	45	S
Poorva	Saket-4/JR-2-331	40	0	40	S
IR-54	Nam sagui 19/IR2071-88/IR2061	48	0	48	S
IR-36	IR1561-228/IR24/0.Nivara/CR94-13	49	0	49	S
IR 1552	IR 160-25/Cross-2	40	0	40	S
Kranti	Cross 116/IR-8	80	0	80	S
Jaya	T(N)-1/T 141	46	0	46	S
R.11	Sel.From Dubraj	50	0	50	S
Bd 105	Sel. from Badshahbhog	40	0	40	S

Table 2. Reaction of F_1 and F_2 populations to gall midge

Cross	F_1 reaction	F_2 segregation				F_3 segregation				
		R	S	ratio	χ^2	R	seg	S	ratio	χ^2
Poorva × Samridhi	R	566	164	3:1	2.500	-	-	-	-	-
Samridhi × Poorva	R	239	61	3:1	3.481	-	-	-	-	-
Samridhi × Anupama	R	132	43	3:1	0.017	-	-	-	-	-
IR 36 × Samridhi	R	459	136	3:1	1.349	-	-	-	-	-
Usha × Bd 105	R	577	179	3:1	0.705	-	-	-	-	-
R244, 3012 × IR 54	R	241	69	3:1	1.240	-	-	-	-	-
Surekha × IR 54	R	223	67	3:1	0.695	-	-	-	-	-
IR 54 × Surekha	R	498	174	3:1	0.280	49	79	40	1:2:1	1.55
Kranti × Surekha	R	621	205	3:1	0.018	17	50	13	1:2:1	5.40
R 11 × Surekha	R	56	24	3:1	1.060	11	24	15	1:2:1	0.72
IR1552 × Surekha	R	-	-	-	-	45	94	61	1:2:1	3.35
Jaya × Surekha	R	-	-	-	-	18	49	33	1:2:1	4.59
Samridhi × Surekha	R	-	-	-	-	99	84	17	7:8:1	5.69
Surekha × CR95-181-2	R	-	-	-	-	50	0	0	-	-

No. of plants given for F_2 and progenies for F_3. R - resistant, S - susceptible, seg - segregating.

The F_3 populations were available for seven crosses. Progenies of all except two crosses (Table 2) segregated into proportion of 1 true breeding resistant : 2 segregating : 1 true breeding susceptible as expected for monogenic control of the trait.

The two hundred F_3 progenies of Samridhi × Surekha cross were classified in the ratio of 7 resistant : 8 segregating : 1 susceptible, suggesting involvement of two independent dominant genes. In the previous year this cross segregated into 15 R : 1 s ratio in F_2 generation [6]. All progenies of cross Surekha x GR95-181-2 bred true for resistance in conformity to F_2 behaviour of the cross giving no susceptible plants.

DISCUSSION

The results (Table 2) clearly indicate presence of only one dominant gene for resistance in all the cultivars. Of these Samridhi and Usha are derivatives of W 1263 and are likely to have same gene. The third resistant parent R244-3012 is a derivative of Ob677 which, in turn is derived from the cross IR8/Ptbl8/Eswarakora/IR8. Since "Ptb" source does not provide complete resistance at Raipur [7] it may be possible that R 244-3012 also has W 1263 gene for resistance.

The study, thus confirms the earlier reports on this subject [8-10]. The results of multigenic control of resistance as reported by earlier workers [11-13] could not

be verified. The gene present in Samridhi and Usha (derived from W 1263), has been designated as and the one present in Surekha as Gm2 [6]. The independence of resistance conferring gene present in Surekha is confirmed in the present study by behaviour of F_3 progenies observed in the cross Samridhi x Surekha. Their classification into 7:8:1 ratio 7 breeding true for resistance 8 segregating and 1 breeding true for susceptibility is indicative of two dominant genes segregating independently. This is what was exactly expected to happen in this cross since Samridhi and Surekha have already been shown to have one dominant gene each. The gene present in Surekha appears to be same as that present in CR 95- 181-2, since all progenies of this cross in F_3 generation bred true for resistance.

Their donor parents Siam 29 and Leaung 152, respectively, can be concluded to have same (or at least one common) gene for resistance.

No indication of cytoplasmic effects on gall midge resistance could be detected in two cross combinations which were available in reciprocal from (Table 2). Such effects were earlier reported by Prasad et al [10].

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