Progressive Research 9 (Conf. Spl.) : 1317-1326 (2014) *Society for Scientific Development in Agric. and Tech.*

STUDY ON RESPONSE OF SELECTED RICE HYBRIDS AND PARENTS TO GALL MIDGE RESISTANCE OVER LOCATIONS IN TELANGANA STATE

Ch. Damodar Raju, S. Sudheer Kumar, Ch. Surender Raju and A. Srijan

Rice Research Centre, Agriculture Research Institute, Rajendranagar, Hyderabad-30, Andhra Pradesh

ABSTRACT

The present investigation entitled "Study on response of selected rice hybrids and parents to gall midge resistance over locations in Telangana region of Andhra Pradesh" was undertaken to identify the reaction of selected rice hybrids and parents to gall midge, in Telangana region of Andhra Pradesh. Five CMS lines were crossed with 13 R lines and the resultant 65 hybrids along with the parents and six checks viz., KRH-2, DRRH-2, PA-6201 Jaya, IR- 64 and T(N)1 were evaluated for gall midge resistance, and stability of the hybrids at three locations viz., Kunaram (Karimnagar District), Warangal and Kampasagar (Nalgonda District) of Telangana region of Andhra Pradesh during Kharif, 2009.The reaction of genotypes towards the gallmidge at three locations is different, the incidence recorded was more at Warangal, followed by Kampasagar and Kunaram. This may be due to the different biotypes existing at three locations. The R lines used are taken from RARS, Jagtial, which may be resistant to gallmidge biotype 3, due to existence of different biotypes of gallmidge at Warangal as well as at Kampasagar, the incidence percentage varied, accordingly. However, some hybrids exhibited resistance reaction at all the three locations indicating the resistance of hybrids to different biotypes. Among the gallmidge resistant hybrids based on per se performance, the top five hybrids identified are, APMS 6 A x JGL 11111, APMS 6 A x JGL 8292, IR 58025 A x JGL 16284, IR 68897 A x JGL 16284 and APMS 6 A x JGL 13515. Out of five hybrids 4 are of medium duration and one is of short duration type. In the present investigation APMS 6 A x JGL 11111 is the most promising gallmidge resistant hybrid identified, followed by APMS 6 A x JGL 8292.

MATERIALS AND METHODS

Based on the successful maintainer/restorer reaction, 13 Lines from R.A.R.S Jagtial were selected and crossed with five(5)CMS lines, to develop 65 hybrids. The parents and hybrids developed is used as material to study on response hybrids and parents to gall midge resistance over locations. All necessary recommended packages of practices of ANGRAU were followed to raise a healthy crop. The data on gall midge damaged plants%, silver Shoots% is recorded as follows. Gall midge damaged plants (%) The incidence of silver shoots in randomly selected 15 plants was recorded and expressed in percentage on population basis.

Silver shoots (%) : Data recorded on the number of silver shoots and total tillers present in randomly selected 15 hills and expressed damaged tillers to total tillers in percentage.

Statistical analysis : Data on gallmidge damaged plants and silver shoots pertaining to 65 hybrids, 13 parents and 5 checks over three locations i.e. Kunaram, Warangal and Kampasagar were collected and transformed into angular values (00) and analyzed statistically for each environment. The mean values of damaged plants (%) and silver shoots (%) in 65 hybrids, 13 parents and 5 checks are presented in table 10 and their corresponding angular values are presented.

The data recorded on different traits were subjected to the following statistical analysis.

Analysis of variance : The adopted design was Randomized Complete Block Design (RCBD) replicated twice.

RESULTS AND DISCUSSION

The rice gall midge Orseolia oryzeae with different biotypes is a serious pest during the monsoon in India. Due to the biotype variations, each local breeding programme must be at aimed screening and selecting its own resistant cultures. Field screening by planting the test materials to coincide with high pest populations has been highly successful technique. The gall midge resistance can be easily transferred to the otherwise desirable varieties due to its simple inheritance. The gall midge resistant rice hybrids can be developed, by identifying suitable gall midge resistant parental lines. The experimental material comprising of 65 F1's, 18 parents (5 testers and 13 lines) and six checks (KRH-2, DRRH-2, PA 6201, JAYA, IR 64 and TN1) were evaluated at three locations of Kunaram, Warangal and Kampasagar.

Analysis of variance for gall midge resistance : Data on gallmidge damaged plants and silver shoots pertaining to 65 hybrids, 13 parents and 6 checks over three locations i.e. Kunaram, Warangal and Kampasagar were collected and transformed into angular values (00) and analyzed statistically for each environment. The mean data (Angular Values) collected on gallmidge damaged plants (%) and silver shoots (%) were analyzed and mean sum of squares are presented in table 3 and 4. The mean values and their corresponding angular values of damaged plants (%) and silver shoots (%) in 65 hybrids, 13 parents and 5 checks are presented in table 5 and 6. In the analysis of variance the genotypic differences were

Table 1. List of male sterile and successful restorer lines and checks used to study gall midge resistance, combining ability, heterosis and stability.

S. No.	CMS lines	Characters	Source
1	IR-68897A	Short duration, Long slender grain	IRRI, Philippines (DRR)
2	APMS 8A	Medium duration, Medium slender grain	ANGRAU (RARS Maruteru)
3	CMS 16A	Medium duration, Medium slender grain	ANGRAU (RARS Maruteru)
4	APMS 6A	Medium duration, Medium slender grain	ANGRAU (RARS Maruteru)
5	IR-58025A	Medium duration, Long slender grain	IRRI, Philippines (DRR)
Restorer lines			
1.	JGL 11110-2	Medium duration , Medium slender grain	ANGRAU (R.A.R.S Jagtial)
2.	JGL 11110-1	Medium duration , Medium slender grain	ANGRAU (R.A.R.S Jagtial)
3.	JGL 17211	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
4.	JGL 16284	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
5.	JGL 13515	Medium duration , Medium slender grain	ANGRAU (R.A.R.S Jagtial)
6.	JGL 11160	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
7.	JGL 11118	Short duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
8.	JGL 11111	Short duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
9.	JGL 8605	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
10.	JGL 8292	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
11.	JGL 3855	Medium duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
12.	JGL 3844	Short duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
13.	JGL 1798	Short duration, Medium slender grain	ANGRAU (R.A.R.S Jagtial)
Checks			
1.	KRH-2	Short duration, Long slender grain	Directorate of Rice Research
2.	DRRH-2	Short duration , Medium slender grain	Directorate of Rice Research
3.	PA 6201	Short duration, Long slender grain	Private company (Pro-agro)
4.	JAYA	Medium duration, Medium slender grain	Directorate of Rice Research
5.	IR-64	Short duration, Long slender grain	Directorate of Rice Research
6.	TN1	Highly susceptible to gall midge	Directorate of Rice Research
	(Susceptible check for gall midge)		

highly significant at Kunaram, Warangal and Kampasagar as well as in pooled analysis indicating that the reaction of genotypes are different for gallmidge resistance at all the three locations. The differences over locations were also significant indicating that the gall midge incidence was different at three locations (Table 5 and 6).

Study of mean performance : The mean values of 2 characters recorded on parents, hybrids and checks over seasons, locations and their pool are presented character wise. Gallmidge infested plants (%): At Kunaram the damaged plants ranged from 0 to 58 % with a general mean of 0.53 % (Table 5) The mean damaged plants for testers varied from 0 (APMS 8A and CMS 16A) to 15.50 (APMS 6A), while in lines and hybrids the damage was not observed. The check PA 6201 recorded 43.5 %, while susceptible check TN1 recorded 58% plant damage.

At Warangal the damaged plants ranged from 0 to 81.67%, with a general mean of 9.30 % for genotypes. The mean damaged plants in testers ranged from 0 (APMS 8A and CMS 16A) to 22.33% (APMS 6A), while lines it was 0 (JGL 17211, JGL 11118, JGL 8605, JGL 8292 and JGL 3844) to 30.48 % (JGL 3855). The mean value of hybrid ranged from 0 to 34.96 (APMS 6A x JGL 11110-2). The check PA 6201 recorded 42.67 % damage while susceptible check TN1 recorded 81.67 % plant damage.

Genotypes at Kampasagar recorded a general mean of 5.20 % plant damage with a range from 0 to 75.33 %. The mean damaged plants for testers ranged from 0 (APMS 8A and CMS 16A) to 30.67 % (IR 68897A), while in lines, no damage was recorded. Among the hybrids the damage of plants ranged from 0 to 52.04% (APMS 6A X JGL 11110-2). The check (PA 6201) recorded 40 % damage, while susceptible check TN1 recorded 75.33 % plant damage.

Genotypes in pooled analysis recorded a general mean of 4.68 % plant damage with a range from 0 to 30.62 %. The mean damaged plants for testers ranged from 0 (APMS 8A and CMS 16A) to 21.83 % (IR 68897A), while in lines, it ranged from 0 to 10.16 % damage was recorded. Among the hybrids the damage of plants ranged from 0 to 30.62% (IR 58025A X JGL 11111). The

Table 3 : Analysis of variance for gall midge damaged plants and silver shoots in parents and hybrids.

		Kunaram		Warangal		Kampasagar	
Source of Variations	d.f	Damaged Plants % (ASIN)	Silver Shoots% (ASIN)	(Damaged Plants % (ASIN)	(Silver Shoots% (ASIN)	(Damaged Plants % (ASIN)	Silver Shoots% (ASIN)
Replicate	2	0	0.35**	161.64*	21.22**	1.97*	2.77**
Treatments	88	202.32**	11.69**	425.19**	26.44**	492.82**	29.08**
Error	176	0.04	0.04	35.6	1.98	0.44	0.13

Table 4. Analysis of variance for gall midge damaged plants (%) and gall midge silver shoots(%) in parents and hybrids (pooled)

Gall midge damaged Plants %						
Source of Variations	d.f	Sum of Squares	Mean Squares	F Ratio	Probability	
Replicate	2	87.43	43.72	0.91	0.4	
Locations	2	11267.61	5633.8	93.98	0	**
Interactions	4	239.78	59.95	1.25	0.29	
Overall Sum	8	11594.82	1449.35	30.28	0	**
Treatments	88	71244.77	809.6	16.92	0	**
Error	704	33693.95	47.86			
Gall midge Silver Shoots %						
Source of Variations	d.f	Sum of Squares	Mean Squares	F Ratio	Probability	
Replicate	2	14.04	7.02	2.64	0.07	
faautoLocations	2	495.15	247.58	28.59	0	**
Interactions	4	34.63	8.66	3.25	0.01	*
Overall Sum	8	543.83	67.98	25.52	0	**
Treatments	88	4418.01	50.2	18.85	0	**
Error	704	1875.03	2.66			

check (PA 6201) recorded 30.63 % damage, while susceptible check TN1 recorded 71.67 % plant damage.

Silver Shoots (%): The development of silver shoots due to gallmidge infestation in general was very high in susceptible check TN1, PA 6201 and in testers at all the three locations. Where as in lines and hybrids the silver shoots % is more at Warangal. Silver shoots ranged from 0 to 7.32% with general mean of 0.53% at Kunaram. Testers recorded a range 0 (APMS 8A and CMS 16A) to 1.96 (APMS 6A). The lines and hybrids were free from silver shoots. The check PA 6201 and TN1 recorded 5.50% and 7.32% silver shoots, respectively.

The silver shoots at Warangal ranged from 0 to 12.50% with a general mean of 1.37. In testers the range was from 0 (APMS 8A and CMS 16A) to 3.01 (APMS 6A). Of the thirteen lines five lines were free from silver shoots while in other eight cultures ranged from 1.31 (JGL 17211 and JGL 8605) to 3.75 (JGL 3844). Among the hybrids the range was 0 to 5.83 (IR 58025A x JGL 11111). The check PA 6201 and TN1 recorded 12.03(%) and 20.69(%) silver shoots respectively.

General mean of silver shoots at Kampasagar was 0.90% with a range from 0 to 9.87%. Testers recorded 0 (APMS 8A and CMS 16A) to 3.75% (IR 68897A). All the thirteen lines were resistant to gallmidge, while in hybrids it ranged from 0 to 6.38% (APMS 6A x JGL 11110-2). The check, PA 6201 recorded 5.05% followed by TN1 9.87(%) silver shoots.

General mean of silver shoots pooled analysis was 0.58% with a range from 0 to 3.81%. Testers recorded 0 (APMS 8A and CMS 16A) to 2.73% (APMS 6A). While in lines it ranged from 0 to 1.25 %, while in hybrids it ranged from 0 to 3.81% (IR 58025AX JGL 11111). The check, PA 6201 recorded 3.83% followed by TN1 9.91% silver shoots.

Stability

Gallmidge infested plants (%) : Among all genotypes tested, for the character gallmidge infested plants (%) 3 testers 5 lines and 35 hybrids had non- significant deviation from regression, (S2di) values i.e. the genotypes are satisfactorily within the range of minimum deviation from the regression, whose performance can be predicted. Among the lines and testers, IR 68897A (4.06), APMS 6A (4.06), JGL 16284 (4.06), JGL 11111(4.06), JGL 8292 (4.06), JGL 3855 (4.06) and JGL 1798 (4.06), recorded the less the unit of bi values, with gall midge resistance and thus possessed more than average stability and are adoptable to poor environments.

Among the hybrids, CMS 16A x JGL3844, APMS 6A x JGL8292, APMS 6A x JGL1798, IR58025A x

Table 5 : Gall midge damaged plant (%) in parents and hybrids over three locations.

Crosses	Damage Plant %	Damage Plant % (ASIN)	Damage Plant %	Damage Plant % (ASIN)	Damaged Plant %	Damage Plant % (ASIN)	Damage Plant %	Damage Plant % (ASIN)
Testers	**KNM**		**WGL**		**KSR**		**POOLED**	
IR 68897A	14.50	4.05	20.33	4.05	30.67	4.05	21.83	4.05
APMS 8A	0.00	23.18	0.00	28.19	0.00	30.44	0.00	27.27
CMS 16A	0.00	21.96	0.00	19.07	0.00	29.55	0.00	23.53
APMS 6A	15.50	4.05	22.33	4.05	25.67	4.05	21.17	4.05
IR 58025A	14.00	22.36	10.70	26.76	24.33	33.59	16.34	27.57
Mean	8.80	15.12	10.67	16.43	16.13	20.34	11.87	17.30
Lines							0.00	
JGL 11110-2	0.00	4.05	26.67	31.07	0.00	4.05	8.89	13.06
JGL 11110-1	0.00	4.05	21.33	27.49	0.00	4.05	7.11	11.87
JGL 17211	0.00	4.05	10.67	19.05	0.00	4.05	3.56	9.05
JGL 16284	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 13515	0.00	4.05	11.85	20.10	0.00	4.05	3.95	9.40
JGL 11160	0.00	4.05	23.70	29.11	0.00	4.05	7.90	12.41
JGL 11118	0.00	4.05	21.33	27.49	0.00	4.05	7.11	11.87
JGL 11111	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 8605	0.00	4.05	10.67	19.05	0.00	4.05	3.56	9.05
JGL 8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 3855	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 3844	0.00	4.05	30.48	33.50	0.00	4.05	10.16	13.87
JGL 1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
Mean	0.00	4.05	12.05	17.47	0.00	4.05	4.02	8.53
Parental Mean		7.13		17.18		8.58	6.20	10.96
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	7.62	14.44	0.00	4.05	2.54	7.52
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	5.93	12.84	11.41	19.73	5.78	12.21
IR 68897A	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
IR 68897A	0.00	4.05	5.93	12.84	0.00	4.05	1.98	6.98
IR 68897A	0.00	4.05	16.00	23.37	0.00	4.05	5.33	10.49
IR 68897A	0.00	4.05	16.00	23.37	0.00	4.05	5.33	10.49
IR 68897A	0.00	4.05	11.85	17.85	23.41	28.93	11.75	16.94
IR 68897A	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
IR 68897A	0.00	4.05	26.67	27.42	47.33	43.47	24.67	24.98
IR 68897A	0.00	4.05	10.67	19.05	0.00	4.05	3.56	9.05
APMS 8A	0.00	4.05	7.62	14.44	0.00	4.05	2.54	7.52
APMS 8A	0.00	4.05	10.67	19.05	0.00	4.05	3.56	9.05
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 8A	0.00	4.05	10.67	16.96	0.00	4.05	3.56	8.36
APMS 8A	0.00	4.05	10.67	16.96	0.00	4.05	3.56	8.36
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 8A	0.00	4.05	32.00	34.43	0.00	4.05	10.67	14.18
APMS 8A	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
APMS 8A	0.00	4.05	17.78	21.95	0.00	4.05	5.93	10.02
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 8A	0.00	4.05	16.00	23.37	0.00	4.05	5.33	10.49
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05

Table 5. cont.....

Crosses			Damage Plant %	Damage Plant % (ASIN)	Damage Plant %	Damage Plant % (ASIN)	Damage d Plant %	Damage Plant % (ASIN)	Damage Plant %	Damage Plant % (ASIN)
			KNM		WGL		KSR		POOLED	
CMS 16A	X	JGL11110-2	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL11110-1	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
CMS 16A	X	JGL17211	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL16284	0.00	4.05	21.33	24.21	0.00	4.05	7.11	10.77
CMS 16A	X	JGL13515	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
CMS 16A	X	JGL11160	0.00	4.05	16.00	23.37	0.00	4.05	5.33	10.49
CMS 16A	X	JGL11118	0.00	4.05	5.93	12.84	0.00	4.05	1.98	6.98
CMS 16A	X	JGL11111	0.00	4.05	10.67	16.96	0.00	4.05	3.56	8.36
CMS 16A	X	JGL8605	0.00	4.05	5.93	12.84	0.00	4.05	1.98	6.98
CMS 16A	X	JGL8292	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
CMS 16A	X	JGL3855	0.00	4.05	5.33	12.22	0.00	4.05	1.78	6.78
CMS 16A	X	JGL3844	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL11110-2	0.00	4.05	34.96	35.16	52.04	46.19	29.00	28.47
APMS 6A	X	JGL11110-1	0.00	4.05	17.19	24.20	20.81	27.11	12.67	18.45
APMS 6A	X	JGL17211	0.00	4.05	17.19	24.20	19.41	26.11	12.20	18.12
APMS 6A	X	JGL16284	0.00	4.05	10.67	16.96	20.67	27.04	10.44	16.02
APMS 6A	X	JGL13515	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL11160	0.00	4.05	11.26	19.59	10.74	19.12	7.33	14.26
APMS 6A	X	JGL11118	0.00	4.05	5.93	12.84	10.74	19.12	5.56	12.00
APMS 6A	X	JGL11111	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL8605	0.00	4.05	10.67	19.05	10.00	18.43	6.89	13.85
APMS 6A	X	JGL8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL3855	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL3844	0.00	4.05	21.33	27.49	20.00	26.57	13.78	19.37
APMS 6A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11110-2	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11110-1	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL17211	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL16284	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL13515	0.00	4.05	21.33	27.49	20.00	26.57	13.78	19.37
IR 58025A	X	JGL11160	0.00	4.05	10.67	19.05	10.00	18.43	6.89	13.85
IR 58025A	X	JGL11118	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11111	0.00	4.05	47.41	43.49	44.44	41.78	30.62	29.78
IR 58025A	X	JGL8605	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL3855	0.00	4.05	32.00	34.43	30.00	33.21	20.67	23.90
IR 58025A	X	JGL3844	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
Crosses mean			0.00	4.05	8.64	13.87	5.40	9.61	4.68	9.18
Grand mean			0.53	4.72	9.30	14.59	5.20	9.38	5.01	9.56
KRH - 2			10.00	29.33	10.67	4.05	10.00	29.11	10.22	20.83
DRRH - 2			23.00	18.43	35.56	19.05	33.33	18.43	30.63	18.64
PA 6201			43.50	28.66	42.67	36.57	40.00	35.24	42.06	33.49
JAYA			22.22	41.26	23.70	40.77	22.22	39.23	22.72	40.42
IR - 64			24.00	28.11	0.00	29.11	23.67	28.11	15.89	28.44
TN1			58.00	49.60	81.67	64.71	75.33	60.26	71.67	58.19
Mean			2.52	6.60	10.85	15.79	7.15	11.12	6.84	11.17
S.E.				0.12		3.44		0.38		2.31
C.V.				3.09		37.80		5.95		61.95
C.D. 5%				0.33		9.61		1.07		6.40

*Values in italics are angular transformed values.

Table 6 : Gall midge Silver Shoots (%) in parents and hybrids over three locations.

Parent/Cross	Silver Shoots %	Silver Shoots % (ASIN)	Silver Shoots %	Silver Shoots % (ASIN)	Silver Shoots %	Silver Shoots % (ASIN)	Silver Shoots %	Silver Shoots % (ASIN)
TESTERS	**KNM**		**WGL**		**KSR**		**POOLED**	
IR 58025A	1.77	7.78	1.47	8.95	3.04	11.15	2.09	9.30
IR 68897A	1.82	4.05	2.42	4.05	3.75	4.05	2.66	4.05
APMS 6A	1.96	4.05	3.01	4.05	3.22	4.05	2.73	4.05
APMS 8A	0.00	8.06	0.00	10.01	0.00	10.29	0.00	9.45
CMS 16A	0.00	7.59	0.00	7.02	0.00	10.07	0.00	8.23
Mean	1.11	6.31	1.38	6.82	2.00	7.92	1.50	7.02
Lines							0.00	
JGL 11110-2	0.00	4.05	3.28	10.39	0.00	4.05	1.09	6.17
JGL 11110-1	0.00	4.05	2.62	9.26	0.00	4.05	0.87	5.79
JGL 17211	0.00	4.05	1.31	6.61	0.00	4.05	0.44	4.91
JGL 16284	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 13515	0.00	4.05	1.46	6.86	0.00	4.05	0.49	4.99
JGL 11160	0.00	4.05	2.91	9.84	0.00	4.05	0.97	5.98
JGL 11118	0.00	4.05	2.62	9.26	0.00	4.05	0.87	5.79
JGL 11111	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 8605	0.00	4.05	1.31	6.61	0.00	4.05	0.44	4.91
JGL 8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 3855	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
JGL 3844	0.00	4.05	3.75	11.16	0.00	4.05	1.25	6.42
JGL 1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
Mean	0.00	4.05	1.48	6.94	0.00	4.05	0.49	5.02
Parental Mean		4.68		6.91		5.13	0.77	5.57
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	0.99	6.02	0.00	4.05	0.33	4.71
IR 68897A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 68897A	0.00	4.05	0.77	5.43	1.46	6.95	0.74	5.48
IR 68897A	0.00	4.05	0.62	4.96	0.00	4.05	0.21	4.36
IR 68897A	0.00	4.05	0.77	5.43	0.00	4.05	0.26	4.51
IR 68897A	0.00	4.05	2.01	8.01	0.00	4.05	0.67	5.37
IR 68897A	0.00	4.05	2.01	8.01	0.00	4.05	0.67	5.37
IR 68897A	0.00	4.05	1.37	6.81	2.92	9.85	1.43	6.90
IR 68897A	0.00	4.05	0.69	5.24	0.00	4.05	0.23	4.45
IR 68897A	0.00	4.05	3.47	10.14	5.83	13.94	3.10	9.38
IR 68897A	0.00	4.05	1.31	6.61	0.00	4.05	0.44	4.91
APMS 8A	0.00	4.05	0.99	6.02	0.00	4.05	0.33	4.71
APMS 8A	0.00	4.05	1.31	6.61	0.00	4.05	0.44	4.91
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 8A	0.00	4.05	1.39	6.88	0.00	4.05	0.46	5.00
APMS 8A	0.00	4.05	1.23	6.54	0.00	4.05	0.41	4.88
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 8A	0.00	4.05	3.94	11.41	0.00	4.05	1.31	6.51
APMS 8A	0.00	4.05	0.62	4.96	0.00	4.05	0.21	4.36
APMS 8A	0.00	4.05	2.06	8.08	0.00	4.05	0.69	5.40
APMS 8A	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05

Table 6. Cont.....

Crosses			Silver Shoots %	Silver Shoots % (ASIN)	Silver Shoots %)	Silver Shoots % (ASIN)	Silver Shoots %	Silver Shoots % (ASIN)	Silver Shoots % (ASIN)	Silver Shoots % (ASIN)
			KNM		WGL		KSR		POOLED	
CMS 16A	X	JGL11110-2	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL11110-1	0.00	4.05	0.69	5.24	0.00	4.05	0.23	4.45
CMS 16A	X	JGL17211	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL16284	0.00	4.05	2.78	9.15	0.00	4.05	0.93	5.75
CMS 16A	X	JGL13515	0.00	4.05	0.62	4.96	0.00	4.05	0.21	4.36
CMS 16A	X	JGL11160	0.00	4.05	2.01	8.01	0.00	4.05	0.67	5.37
CMS 16A	X	JGL11118	0.00	4.05	0.77	5.43	0.00	4.05	0.26	4.51
CMS 16A	X	JGL11111	0.00	4.05	1.23	6.54	0.00	4.05	0.41	4.88
CMS 16A	X	JGL8605	0.00	4.05	0.69	5.16	0.00	4.05	0.23	4.42
CMS 16A	X	JGL8292	0.00	4.05	0.62	4.96	0.00	4.05	0.21	4.36
CMS 16A	X	JGL3855	0.00	4.05	0.62	4.96	0.00	4.05	0.21	4.36
CMS 16A	X	JGL3844	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
CMS 16A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL11110-2	0.00	4.05	4.48	11.56	6.38	14.57	3.62	10.06
APMS 6A	X	JGL11110-1	0.00	4.05	2.16	8.31	2.55	9.19	1.57	7.18
APMS 6A	X	JGL17211	0.00	4.05	2.07	8.25	2.53	9.15	1.53	7.15
APMS 6A	X	JGL16284	0.00	4.05	1.23	6.54	2.59	9.26	1.28	6.62
APMS 6A	X	JGL13515	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL11160	0.00	4.05	1.39	6.77	1.34	6.70	0.91	5.84
APMS 6A	X	JGL11118	0.00	4.05	0.77	5.43	1.34	6.70	0.70	5.40
APMS 6A	X	JGL11111	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL8605	0.00	4.05	1.31	6.61	1.26	6.45	0.86	5.71
APMS 6A	X	JGL8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL3855	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
APMS 6A	X	JGL3844	0.00	4.05	2.62	9.26	2.53	9.14	1.72	7.49
APMS 6A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11110-2	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11110-1	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL17211	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL16284	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL13515	0.00	4.05	2.62	9.26	2.53	9.14	1.72	7.49
IR 58025A	X	JGL11160	0.00	4.05	1.31	6.61	1.26	6.45	0.86	5.71
IR 58025A	X	JGL11118	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL11111	0.00	4.05	5.83	13.94	5.61	13.67	3.81	10.56
IR 58025A	X	JGL8605	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL8292	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL3855	0.00	4.05	3.94	11.41	3.79	11.23	2.57	8.90
IR 58025A	X	JGL3844	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
IR 58025A	X	JGL1798	0.00	4.05	0.00	4.05	0.00	4.05	0.00	4.05
Crosses mean			0.00	4.05	1.07	6.05	0.68	5.31	0.58	5.14
Grand mean			0.07	4.19	1.15	6.24	0.65	5.27	0.62	5.23
KRH - 2			1.26	10.00	1.31	4.05	1.26	10.02	1.28	8.03
DRRH - 2			2.91	6.46	4.37	6.61	4.21	6.45	3.83	6.51
PA 6201			5.50	9.83	5.25	12.03	5.05	11.86	5.27	11.24
JAYA			2.81	13.55	2.91	13.19	2.81	12.95	2.84	13.23
IR - 64			3.03	9.66	0.00	9.84	3.03	9.68	2.02	9.73
TN1			7.32	15.67	12.52	20.69	9.87	18.30	9.91	18.22
Mean			0.32	4.64	1.37	6.56	0.90	5.69	0.86	5.63
S.E.				0.12		0.81		0.21		0.54
C.V.				4.48		21.43		6.36		28.97
C.D. 5%				0.33		2.27		0.58		1.51

*Values in italics are angular transformed values

Table-7 : Mean performance and stability parameters for Gall midge damaged Plant %(ASIN) and Silver Shoots % (ASIN) in rice.

Parent/Cross			Gall midge damaged Plant %(ASIN)					Silver Shoots % (ASIN)				
			μ Mean	βι		σ²di			βi		σ²di	
Testers												
IR 58025A			27.57	50.64		0.47	**	9.30	4.68		0.70	**
IR 68897A			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
APMS 6A			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
APMS 8A			27.27	11.13		0.54		9.45	0.63		1.05	
CMS 16A			23.53	49.97		-0.33	**	8.23	4.91		-0.21	**
Lines												
JGL 11110-2			13.06	113.46		2.96	**	6.17	7.73		3.18	**
JGL 11110-1			11.87	84.33		2.56	**	5.79	5.13		2.61	**
JGL 17211			9.05	32.05		1.64	**	4.91	1.04		1.28	*
JGL 16284			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
JGL 13515			9.40	37.34		1.76	**	4.99	1.30		1.41	*
JGL 11160			12.41	97.01		2.74	**	5.98	6.40		2.90	**
JGL 11118			11.87	84.33		2.56	**	5.79	5.13		2.61	**
JGL 11111			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
JGL 8605			9.05	32.05		1.64	**	4.91	1.04		1.28	*
JGL 8292			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
JGL 3855			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
JGL 3844			13.87	135.60		3.22	**	6.42	9.80		3.57	**
JGL 1798			4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
Crosses			4.06	-4.17		0.00		4.06	-0.27		0.00	
IR 68897A	X	JGL11110-2	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 68897A	X	JGL11110-1	7.52	13.22	*	1.14		4.71	0.50	*	0.99	
IR 68897A	X	JGL17211	4.06	-4.17		0.00	*	4.06	-0.27		0.00	
IR 68897A	X	JGL16284	12.21	81.79	*	0.94		5.48	2.78	*	0.79	
IR 68897A	X	JGL13515	6.78	6.58		0.89	**	4.36	-0.10		0.45	**
IR 68897A	X	JGL11160	6.98	8.27		0.96		4.51	0.11		0.69	
IR 68897A	X	JGL11118	10.49	55.95		2.11		5.37	2.85		1.99	
IR 68897A	X	JGL11111	10.49	55.95		2.11	**	5.37	2.85		1.99	**
IR 68897A	X	JGL8605	16.94	213.91		1.48	**	6.90	11.93		1.57	**
IR 68897A	X	JGL8292	6.78	6.58		0.89	**	4.45	0.02		0.60	**
IR 68897A	X	JGL3855	24.98	515.50		2.51		9.38	28.26		3.38	
IR 68897A	X	JGL3844	9.05	32.05		1.64	**	4.91	1.04		1.28	**
IR 68897A	X	JGL1798	7.52	13.22		1.14	**	4.71	0.50		0.99	*
APMS 8A	X	JGL11110-2	9.05	32.05		1.64	*	4.91	1.04		1.28	
APMS 8A	X	JGL11110-1	4.06	-4.17		0.00	**	4.06	-0.27		0.00	*
APMS 8A	X	JGL17211	8.36	22.68	*	1.41		5.00	1.33	*	1.42	
APMS 8A	X	JGL16284	8.36	22.68		1.41	*	4.88	0.96		1.25	*
APMS 8A	X	JGL13515	4.06	-4.17		0.00	*	4.06	-0.27		0.00	*
APMS 8A	X	JGL11160	14.18	144.54	*	3.32		6.51	10.51	*	3.69	
APMS 8A	X	JGL11118	6.78	6.58		0.89	**	4.36	-0.10		0.45	**
haAPMS 8A	X	JGL11111	10.02	47.47		1.96		5.40	2.96		2.02	
APMS 8A	X	JGL8605	4.06	-4.17		0.00	**	4.06	-0.27		0.00	**
APMS 8A	X	JGL8292	10.49	55.95	*	2.11		5.37	2.85	*	1.99	
APMS 8A	X	JGL3855	4.06	-4.17		0.00	**	4.06	-0.27		0.00	**
APMS 8A	X	JGL3844	27.57	50.64	*	0.47		9.30	4.68	*	0.70	

Table 8 : Cont.....

Crosses			Gall midge damaged Plant %(ASIN)					Silver Shoots % (ASIN)				
			μ Mean	βi		σ²di		μ Mean	βi		σ²di	
APMS 8A	X	JGL1798	4.06	-4.17		0.00	**	5.54	3.68		2.23	**
CMS 16A	X	JGL11110-2	6.78	6.58	*	0.89		4.06	-0.27	*	0.00	
CMS 16A	X	JGL11110-1	4.06	-4.17		0.00		4.45	0.02		0.60	
CMS 16A	X	JGL17211	10.77	61.28	*	2.21		4.06	-0.27	*	0.00	
CMS 16A	X	JGL16284	6.78	6.58		0.89	**	5.75	4.90		2.56	**
CMS 16A	X	JGL13515	10.49	55.95		2.11		4.36	-0.10		0.45	
CMS 16A	X	JGL11160	6.98	8.27		0.96	**	5.37	2.85		1.99	**
CMS 16A	X	JGL11118	8.36	22.68		1.41		4.51	0.11		0.69	
CMS 16A	X	GL11111	6.98	8.27		0.96	*	4.88	0.96		1.25	*
CMS 16A	X	JGL8605	6.78	6.58		0.89		4.42	-0.02		0.55	
CMS 16A	X	JGL8292	6.78	6.58		0.89		4.36	-0.10		0.45	
CMS 16A	X	JGL3855	4.06	-4.17		0.00		4.36	-0.10		0.45	
CMS 16A	X	JGL3844	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
CMS 16A	X	JGL1798	28.47	475.99	*	3.35		4.06	-0.27	*	0.00	
APMS 6A	X	GL11110-2	18.45	111.05		2.18	**	10.06	26.97		4.11	**
APMS 6A	X	JGL11110-1	18.12	94.15		2.18	**	7.18	4.95		2.31	**
APMS 6A	X	JGL17211	16.02	180.33		1.39	**	7.15	4.93		2.27	**
APMS 6A	X	JGL16284	4.06	-4.17		0.00	**	6.62	9.58		1.42	**
APMS 6A	X	JGL13515	14.26	32.58	*	1.68		4.06	-0.27	*	0.00	
APMS 6A	X	JGL11160	12.00	72.79		0.94	**	5.84	0.63		1.45	
APMS 6A	X	JGL11118	4.06	-4.17		0.00	**	5.40	2.11		0.78	**
APMS 6A	X	JGL11111	13.85	28.58	*	1.62		4.06	-0.27	*	0.00	
APMS 6A	X	JGL8605	4.06	-4.17		0.00	**	5.71	0.40		1.36	
APMS 6A	X	JGL8292	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
APMS 6A	X	JGL3855	19.37	76.31	*	2.54		4.06	-0.27	*	0.00	
APMS 6A	X	JGL3844	4.06	-4.17		0.00	**	7.49	3.07		2.78	**
APMS 6A	X	JGL1798	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL11110-2	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL11110-1	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL17211	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL16284	19.37	76.31	*	2.54		4.06	-0.27	*	0.00	
IR 58025A	X	JGL13515	13.85	28.58		1.62	**	7.49	3.07		2.78	**
IR 58025A	X	JGL11160	4.06	-4.17		0.00	**	5.71	0.40		1.36	
IR 58025A	X	JGL11118	29.78	220.07	*	4.27		4.06	-0.27	*	0.00	
IR 58025A	X	JGL11111	4.06	-4.17		0.00	**	10.56	11.48		5.28	**
IR 58025A	X	JGL8605	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL8292	23.90	130.63	*	3.29		4.06	-0.27	*	0.00	
IR 58025A	X	JGL3855	4.06	-4.17		0.00	**	8.90	6.30		3.93	**
IR 58025A	X	JGL3844	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
IR 58025A	X	JGL1798	4.06	-4.17	*	0.00		4.06	-0.27	*	0.00	
KRH - 2			18.64	-4.11	*	0.07		6.51	-0.26	*	0.07	
DRRH - 2			33.49	0.67		0.86		11.24	0.18		1.17	
PA 6201			40.42	-2.03		-0.05		13.23	-0.16		-0.20	
JAYA			28.44	-4.01	*	0.11		9.73	-0.26	*	0.09	
IR - 64			20.83	95.10		-2.77	**	8.03	6.87		-2.99	**
TN1			58.19	2.77		1.64		18.22	-0.26	*	2.60	
Population Mean				11.17					5.63			
SE of ±				1.05					1.17			

* Significant at 5% level; ** Significant at 1% level

JGL11110-2, IR 58025A x GL11110-1, IR 58025A x JGL8605, IR 58025A x JGL3844, IR58025A x JGL17211, and IR 58025A x JGL1798 recorded the unit of bi value, and thus possessed average stability and are adoptable to all environments possessing the gall midge resistance. While the hybrids IR 68897A x JGL11110-2, CMS 16A x JGL11110-1, CMS 16A x JGL3855 recorded the less the unit of bi value with gall midge resistance and are adoptable to poor environments.

Silver shoots (%) : Among all genotypes tested, for the character, silver shoots (%), 3 testers, 5 lines and 40 hybrids had non- significant deviation from regression (S^2di) values i.e. the genotypes are satisfactorily within the range of the minimum deviation from the regression whose performance can be predicted (Table 7).

Among the lines and testers for the character silver shoots (%), APMS 6A, IR 68897A, JGL 3855, JGL 13515, JGL 11118, JGL 11160, JGL 3844 recorded the less than the unit of bi value and thus possessed more than average stability and are adaptable to poor environments with gall midge resistance.

In the stability analysis hybrid IR 68897A x JGL11110-2 recorded unit of bi value and thus possessed average stability and are adoptable to all environments, where as hybrids IR68897A x JGL17211, CMS 16A x JGL11110-2,CMS 16A x JGL17211,CMS 16AxJGL3844, CMSA x JGL1798, APMS6A x JGL13515, APMS 6A x JGL11111, APMS 6A x JGL8292, APMS 6A x JGL3855, APMS 6A x JGL1798,IR 58025A x JGL11110-2, IR58025A x JGL11110-1, IR58025A x JGL16284, IR58025A x JGL17211, 1, IR58025A x JGL11118, IR58025A x JGL8605,IR 58025A x JGL8292,IR 58025A x JGL3844, IR 58025A x JGL1798 recorded the less than unit of bi value, and thus possessed more than average stability and more adoptable to poor environments along with gall midge resistance, while all other hybrids are unstable for this character (Table 7).

The reaction of genotypes towards the gallmidge at three locations is different; the incidence recorded was more at Warangal, followed by Kampasagar and Kunaram. This may be due to the different biotypes existing at three locations. The R lines used are taken from RARS, Jagtial, which may be resistant to gallmidge biotype 3, Hence the hybrids developed with these R lines also shown resistance reaction at RARS, Jagtial, Hence the damaged plants and silver shoots (%) was less at RARS, Jagtial, where as it is high at RARS, Warangal which may be due to existence of different biotypes of gallmidge at Warangal as well as at Kampasagar, due to which the incidence percentage varied, accordingly. However, some hybrids exhibited resistance reaction at all the three locations indicating the resistance of hybrids to different biotypes.

Similar results were obtained for gallmidge resistance by Srinivas *et al*. (1994) who studied and reported that gallmidge biotype 3 exists at Jagtial and the biotype pattern at Warangal was different and a change in the pattern of gallmidge reaction was indicated. Pasalu *et al.* (1998) studied the current rice gallmidge biotypes in India and reported the changing biotypes. Bentur et al. (1998) reported that the gallmidge is a pest of rice that has been successfully managed through breeding and cultivation of resistant varieties. Laxmi *et al*. (2006) studied a new biotype of Asian rice gallmidge from the Warangal population. Jian Xian Bin *et al.* (2006) studied the restoring ability of rice varieties and resistance evaluation of F_1 generation. Bentur *et al.* (2008) studied the monitoring of virulence of Asian rice gallmidge population in India. Naikebawane *et al.* (2008) reported JGL 384 as a donor for gallmidge resistance.

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