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VARIETAL RESISTANCE AGAINST *SITOPHILUS ORYZAE* IN RICE

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ABSTRACT

Fifteen varieties/genotypes were screened against the rice weevil *Sitophilus oryzae* (L.) during 2018-19 at the Biological Control Laboratory and P.G. Research Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The varieties GR-7, GNR-7 and IR-28 were observed to show maximum resistance, as indicated by minimum seed damage, weight loss, more germination and less population build up while, the genotype GNR-4 was the most susceptible on the basis of seed damage, weight loss and population buildup.

Key words: *Sitophilus oryzae*, genotypes, varieties, screening, seed damage, weight loss, germination, population bulidup

Sitophilus oryzae (L.) is the most destructive pest of the stored cereals (Champ and Dyte, 1976). Rice weevil mainly attacks whole grains such as wheat, corn, barley and rice, with its host range now extended to split legumes (Deepthi and Manjunatha, 2015). The adults and grubs are internal feeders causing great loss both in quality and quantity. The prerequisite for developing resistant variety lies in identifying resistant sources by screening the available germplasm. This study screens some rice genotypes against *S. oryzae* in laboratory under storage condition.

MATERIALS AND METHODS

The experiment was carried out during 2018-19 at the Biological control Laboratory and P.G. Research Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. Seeds of 15 genotypes/ varieties namely NAUR-1, GNR-2,GNR-3, GNR-4, GNR-5, GNR-6, GNR-7, JAYA, GURJARI, GNR-13, GR-5,GR-7, GR-8,PURNA and IR-28 were collected from the Rice Research Station, Navsari Agricultural University, Navsari. Rice weevils were reared on seeds of the selected vaieties/genotypes, replicated thrice, in Completely Randomized Design. The healthy, sound, unaffected grains of each varieties/ genotype were dried in hot air oven for 6 hr at 42°C in order to eliminate the infestation, if any. The moisture content was 10.7±2%. Seeds of each variety/genotypes weighing 100 gm were kept in plastic container (7.5 x 7.0cm) separately for observations. Ten pairs of five days old adults were introduced in each and their top securely covered with muslin cloth. The observations were made up to 180 days, through periodical examinations at 30, 90 and 180 days after storage. The % loss of weight of seed and damaged seeds, % germination and population buildup were observed The data were subjected to statistical analysis, with data in % subjected to angular transformation, and those on population build up values subjected to square root transformation. Before recording the damaged ones, the seeds were thoroughly mixed and samples of 100 seeds were drawn for five times from each bottle, then damaged seeds in 100 seeds were counted for each sample.

Observations on % weight loss recorded by weight of infested and un-infested seeds and counting number of infested seeds. Weight loss was worked out using the following formula (Adams and Schulton, 1978).

$$\% \text{ weight loss} = \frac{(UND) - (DNU)}{U\,(ND + NU)} \times 100$$

Where, U - Weight of uninfested seeds (g); NU - Number of uninfested seeds; D - Weight of infested seeds (g); ND- Number of infested seeds. Seed germination was carried out employing rolled paper towel test (ISTA, 1996). The observation on population buildup was recorded by counting the total number of adult beetles emerged from each bottle.

RESULTS AND DISCUSSION

The data pertaining to % seed damage caused by *S. oryzae* in rice at 30 days after storage (Table 1) indicated

Table 1. Seed damage, weight loss, seed germination of rice varieties/ genotypes and population buildup of *S. oryzae*

S. No	Varieties /genotypes	% seed damage*			Pooled	% weight loss*			Pooled	% seed germination*			Pooled	Population build up**			Pooled
		30 DAS	90 DAS	180 DAS	Data	30 DAS	90 DAS	180 DAS	Data	30 DAS	90 DAS	180 DAS	Data	30 DAS	90 DAS	180 DAS	Data
1.	NAUR-1	12.27 (4.52)	19.34 (10.98)	30.29 (25.47)	20.63 (13.66)	8.82 (2.35)	17.51 (9.06)	28.58 (22.90)	18.30 (11.44)	53.91 (65.33)	45.17 (50.33)	39.40 (40.33)	46.16 (52.00)	3.78 (14.33)	5.51 (30.33)	9.66 (93.33)	6.32 (46.00)
2.	GNR-2	12.35 (4.58)	23.96 (16.52)	38.61 (38.97)	24.97 (20.02)	11.19 (3.77)	21.09 (12.97)	33.35 (30.25)	21.88 (15.66)	51.53 (30.33)	38.82 (39.33)	31.27 (27.00)	40.54 (42.55)	3.91 (15.33)	12.16 (148.00)	22.28 (496.33)	12.79 (219.89)
3.	GNR-3	11.85 (4.22)	16.20 (7.79)	27.17 (20.87)	18.41 (10.96)	5.81 (1.03)	15.33 (7.00)	25.70 (18.83)	15.62 (8.95)	54.32 (66.00)	46.32 (52.33)	41.15 (43.33)	47.26 (53.89)	3.11 (9.67)	4.97 (24.67)	8.46 (71.67)	5.51 (35.33)
4.	GNR-4	13.39 (5.37)	41.34 (43.65)	66.77 (84.46)	40.49 (44.49)	14.50 (6.28)	31.77 (27.75)	42.44 (45.57)	29.57 (26.53)	46.70 (53.00)	30.19 (25.33)	16.40 (8.00)	31.10 (28.78)	4.28 (18.33)	18.66 (348.33)	24.25 (588.00)	15.73 (318.22)
5.	GNR-5	11.87 (4.23)	16.48 (8.07)	27.45 (21.27)	18.60 (11.19)	7.36 (1.64)	15.51 (7.17)	26.16 (19.45)	16.34 (9.42)	54.31 (66.00)	46.13 (52.00)	40.38 (42.00)	46.94 (53.33)	3.11 (9.67)	5.19 (27.00)	8.60 (74.00)	5.63 (36.89)
6.	GNR-6	12.19 (4.47)	18.16 (9.73)	29.82 (24.75)	20.06 (12.98)	7.92 (1.90)	16.82 (8.38)	26.29 (19.64)	17.01 (9.97)	54.11 (65.67)	45.94 (51.67)	39.99 (41.33)	46.68 (52.89)	3.51 (12.33)	5.41 (29.33)	8.62 (74.33)	5.85 (38.67)
7.	GNR-7	11.61 (4.05)	14.23 (6.05)	23.35 (15.72)	16.39 (8.61)	4.67 (0.66)	14.17 (6.01)	23.51 (15.92)	14.12 (7.53)	54.72 (66.67)	47.08 (53.67)	41.92 (44.67)	47.91 (55.00)	2.31 (5.33)	4.90 (24.00)	7.94 (63.00)	5.05 (30.78)
8.	JAYA	13.18 (5.20)	30.51 (25.80)	56.18 (69.05)	33.29 (33.35)	14.45 (6.23)	30.38 (25.59)	35.58 (33.87)	26.80 (21.90)	49.01 (57.00)	35.04 (33.00)	27.94 (22.00)	37.33 (37.33)	4.16 (17.33)	14.33 (205.33)	22.49 (505.67)	13.66 (242.78)
9.	GURJARI	11.75 (4.15)	16.31 (7.89)	26.79 (20.33)	18.28 (10.79)	4.90 (0.73)	14.22 (6.05)	25.35 (18.35)	14.82 (8.38)	54.51 (66.33)	46.51 (52.67)	41.15 (43.33)	47.39 (54.11)	2.58 (6.67)	4.96 (24.67)	7.96 (63.33)	5.17 (31.56)
10.	GAR-13	12.28 (4.53)	20.09 (11.81)	31.06 (26.64)	21.14 (14.33)	9.02 (2.46)	18.37 (9.95)	28.64 (22.99)	18.68 (11.80)	53.91 (65.33)	45.00 (50.00)	39.02 (39.67)	45.97 (51.67)	3.78 (14.33)	5.69 (32.33)	9.68 (93.67)	6.38 (46.78)
11.	GR-5	12.28 (4.53)	22.54 (14.70)	31.41 (27.16)	22.07 (15.46)	9.34 (2.64)	18.63 (10.22)	29.19 (23.81)	19.06 (12.22)	53.51 (64.67)	43.64 (47.67)	35.45 (33.67)	44.20 (48.67)	3.83 (14.67)	5.91 (35.00)	9.71 (94.33)	6.48 (48.00)
12.	GR-7	10.89 (3.57)	12.55 (4.73)	21.52 (13.48)	14.98 (7.26)	3.97 (0.48)	12.29 (4.54)	20.65 (12.46)	12.01 (5.83)	54.92 (67.00)	47.27 (54.00)	43.07 (46.67)	48.42 (55.89)	2.16 (4.67)	4.79 (23.00)	7.39 (54.67)	4.78 (27.44)
13.	GR-8	12.29 (4.53)	19.14 (10.76)	30.27 (25.43)	20.57 (13.57)	8.31 (2.09)	17.43 (8.98)	28.36 (22.58)	18.03 (11.22)	54.11 (65.67)	45.75 (51.33)	39.60 (40.67)	46.49 (52.56)	3.65 (13.33)	5.50 (30.33)	8.79 (77.33)	5.98 (40.33)
14.	PURNA	12.19 (4.47)	18.09 (9.66)	28.73 (23.12)	19.67 (12.42)	7.49 (1.72)	15.99 (7.60)	26.24 (19.56)	16.57 (9.63)	54.11 (65.68)	46.13 (52.00)	40.18 (41.67)	46.81 (53.11)	3.36 (11.33)	5.35 (28.67)	8.58 (73.67)	5.77 (37.89)
15.	IR-28	11.69 (4.11)	16.02 (7.62)	23.63 (16.09)	17.12 (9.27)	4.29 (0.56)	14.22 (6.05)	23.66 (16.12)	14.06 (7.58)	54.71 (66.67)	46.51 (52.67)	41.73 (44.33)	47.65 (54.56)	2.45 (6.00)	4.90 (24.00)	7.98 (63.67)	5.11 (31.22)
S.Em.±	T	0.14	0.32	0.39	3.48	0.15	0.37	0.24	0.95	0.67	0.61	0.69	1.40	0.05	0.06	0.08	1.67
	Y*T	-	-	-	0.30	-	-	-	0.27	-	-	-	0.66	-	-	-	0.06
CD at 5%	T	0.41	0.91	1.12	NS	0.44	1.08	0.69	2.74	1.93	1.75	1.99	4.06	0.15	0.16	0.23	4.84
	Y*T	-	-	-	0.87	-	-	-	0.78	-	-	-	1.85	-	-	-	0.18
CV %		2.05	2.70	2.04	2.39	3.25	3.55	1.48	2.58	2.17	2.41	3.21	2.54	2.64	1.34	1.18	1.48

*Figures in parentheses original values and those outside arcsine transformed values. DAS- Days after storage, Y-Time period; T-Treatment; **Figures in parentheses original values and outside square root transformed values.

that rice genotype GR-7 recorded significantly minimum seed damage of 3.57% followed by GNR-7 (4.05%), IR-28 (4.11%) and Gurjari (4.15%). At 90 days after storage, again GR-7 recorded significantly minimum damage of 4.73 % followed by GNR-7 (6.05%), IR-28 (7.62%), GNR-3 (7.79%), Gurjari (7.89%) and GNR-5 (8.07%). At 180 days after storage same trend was observed. The mean % seed damage data indicated that the genotype GNR- 4 recorded significantly more seed damage (44.49%) followed by Jaya (33.35%) while, GR-7 was recorded least % seed damage (7.26%) among all genotypes followed by GNR-7 (8.61%) and IR-28 (9.27%).

At 30 days after storage, GR-7 revealed significantly minimum weight loss of 0.48 % and it was remained at par with IR-28 (0.56 %). At 90 days after storage, GR-7 again revealed significantly minimum weight loss. This was similarly the case at 180 days after storage. The mean % weight loss indicated that the significantly maximum % weight loss was observed in variety GNR-4 (26.53%) and it was followed by Jaya (21.90%), while minimum % weight loss was recorded in GR-7 (5.83%) followed by GNR-7 (7.53%) and IR-28 (7.58%).

At 30 days after storage significantly maximum germination was found in GR-7 (67.00%) and it was at par with all varieties/ genotypes except GNR-2, Jaya and GNR-4. At 90 days after storage, GR-7 maintained significantly maximum germination, and at 180 days after storage, a same trend was observed. \The data on mean % germination in different rice genotypes indicated that among different genotypes GR-7 (55.89%) recorded more germination and it was followed by GNR 7 (55.00%) and IR 28 (54.26%). while, significantly minimum germination was observed in the varieties GNR-4 (28.78%) followed by Jaya (37.33%).

Significantly more adults emerged in GNR-4 (18.33) and it was at par with Jaya (17.33) while, less number of adults were observed in GR-7 (4.67) followed by GNR-7 (5.33), IR-28 (6.00) and Gurjari (6.67) at 30 days after storage when ten pairs of weevils were released at the beginning of storage. At 90 DAS significant higher number of adults were emerged in GNR-4 (348.33) followed by Jaya (205.33) and GNR-2 (148.00) while, less number of adults were observed in GR-7 (23.00) and was remained at par with all the varieties/genotypes except GNR-3, GNR-7, Gurjari and IR-28. Significantly higher number of adults were emerged in GNR-4 (588.00) followed by Jaya (505.67) and it was at par with GNR-2 (496.33) while, less number of adults were observed in GR-7 (54.67) and it was followed by GNR-7 (63.00), Gurjari (63.33) and IR-28 (63.67) at 180 days after storage. The mean data of population buildup indicated that significantly more population in GNR-4 (318.22 adults) followed by Jaya (242.78 adults), GNR-2 (219.89 adults) while, the lowest population was in GR-7 (27.44 adults) followed by GNR 7 (30.78%) and IR 28 (31.22%).

Thus, GR-7, GNR-7 and IR-28 showed high degree of resistance to *S. oryzae* with minimum % of seed damage, lower weight loss, higher germination percentage and lower population build up. While, varieties GNR-4, Jaya and GNR-2 found to be susceptible. So, these varieties are not suitable in long time storage. Earlier, Rashid et al. (2009), Khan and Halder (2012), Khaliq et al. (2013), Choudhary and Chakraborty (2014) and Bamisile et al. (2014) studied the relative susceptibility of rice varieties and recorded % seed damage and weight loss in difference genotypes/varieties.

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