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HETEROSIS STUDIES FOR THE CHARACTERS ASSOCIATED WITH GRAIN MOLD RESISTANCE IN KHARIF SORGHUM

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Abstract

Heterosis studies in forty five hybrids revealed that out of forty five hybrids studied, ten hybrids were found to be desirable. These hybrids not only exhibited superior *per se* performance for germination percentage but also showed desirable significant heterosis for germination along with other component characters. These crosses also showed desirable and significant *sca* effects for germination percentage. Thus, these ten crosses appeared to be resistant to grain mold and need to be further exploited in grain mold resistance breeding programme.

Key words : Germination, grain mold, heterosis, *sca*, kharif sorghum.

Introduction

Knowledge of heterosis is necessary in selection of appropriate cross combinations showing superior performance than the parents involved. Since germination is the result of number of component traits associated with grain mold resistance, it may therefore, be desirable to consider the extent of heterosis for different traits along with the germination percentage. Grain mold is the serious problem of the sorghum grown in the *kharif* season. If the sorghum crop is caught in the rains between flowering to grain maturity stage, it is affected by grain mold and it affects the grain yield as well as the grain quality of kharif sorghum. The present investigation was undertaken to identify the potential cross combinations showing good per se performance along with high heterosis and desirable significant *sca* effects for the parameters associated with grain mold resistance in kharif sorghum.

Materials and Methods

The experimental material consisted of ten parents (SVD 9601, GM 9219, IS 14332, AKMS 14 B, IMS 9 B, MS 296 B, ICS 70 B, MS 27 B, IS 14384 and GMPR 65) and the forty five F_1 crosses developed by crossing these ten parents in half-diallel (excluding reciprocals) fashion. The experiment was conducted during *kharif* 2007-08 at the sorghum research unit, Dr. P.D.K.V., Akola (M.S.), India. The experiment was laid out in randomized block design with spacing of 45x15 cm. in three replications. Five spore inoculated plants were randomly selected from each entry in each replication for recording the observations and the observations were days to 50% flowering, grain yield(g), glume coverage (%), 100 seed weight (g), seed hardness (kg/cm^2), grain density (g/ml), water absorption capacity (g), electrical conductivity of grain leachates (ms/ppt), germination (%), fungal load of *Fusarium moniliforme* (%), fungal load of *Curvularia lunata* (%) and fungal load of other species (%). In case of F_2 progenies, all the observations as in F_1 crosses except fungal load of *Fusarium moniliforme* (%), fungal load of *Curvularia lunata* (%) and fungal load of other species (%) were recorded on the fifteen spore inoculated plants. The mid parent heterosis and heterobeltiosis were estimated as per cent increase or decrease of the mean of F_1 over its mid parent and better parent values respectively. Combining ability analysis was using method II, model I of Griffing (1956 b).

Results and Discussion

Denis and Girad (1977) reported loss in viability to be very important part of the grain mold syndrome and recommended the germination test as part of the standard evaluation for identification of grain mold resistance. Accordingly, in this study also the superior cross

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Table-1: Heterotic crosses for germination percentage (GP) along with heterosis and heterobeltiosis for the other associated parameters.

S. no.	Superior crosses for GP on the basis of mean performance	Mean GP of the crosses	Mid parent heterosis for GP	Hetero-beltiosis for GP	Significant heterosis for component characters		*Sca* effects of the crosses for GP
					Mid parent heterosis	**Heterobeltiosis**	
1	SVD 9601 x IS 14384	79.17**	10.63**	8.22**	Glume coverage, seed hardness, water absorption capacity, fungal load of *Fusarium moniliforme*, fungal load of other species.	Glume coverage, seed hardness, water absorption capacity, fungal load of *Fusarium moniliforme*, fungal load of other species	6.98**
2	GM 9219 x IS 14332	79.17**	8.97**	8.42**	Glume coverage, seed hardness, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	Glume coverage, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme* ,fungal load of other species	2.49*
3	IS 14384 x GMPR 65	77.52**	4.47*	3.00	Grain yield, glume coverage, seed hardness, grain density, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	Grain yield, seed hardness, grain yield, grain density, fungal load of *Fusarium moniliforme*, fungal load of other species	4.72**
4	SVD 9601 x GMPR 65	77.08**	6.14**	2.41	Glume coverage, seed hardness, 100 seed weight, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*	Glume coverage, seed hardness, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*	4.24**
5	GM 9219 x 9 B	77.08**	15.96**	6.64**	Glume coverage, seed hardness, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	Glume coverage, grain density, water absorption capacity, fungal load of *Fusarium moniliforme*	8.84**
6	9 B x GMPR 65	76.39**	12.40**	1.5	Grain yield, seed hardness, grain density, fungal load of *Fusarium moniliforme*, fungal load of *Curvularia lunata*, fungal load of other species	Grain density, fungal load of *Fusarium moniliforme*, fungal load of other species	8.60**
7	IS 14332 x 27 B	74.44**	8.53**	1.94	Glume coverage, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of *Curvularia lunata*, fungal load of other species	Glume coverage, water absorption capacity, fungal load of *Fusarium moniliforme*, fungal load of other species	5.46**
8	GM 9219 x 70 B	74.36**	11.61**	2.88	Grain yield, glume coverage, seed hardness, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	Grain yield, seed hardness, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	6.49**
9	IS 14332 x 70 B	74.21**	10.77**	1.64	Glume coverage, seed hardness, grain density, water absorption capacity, fungal load of other species	Glume coverage, fungal load of other species	4.46**
10	IS 14332 x 14 B	73.78**	8.19**	1.05	100 seed weight, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species	Water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme* ,fungal load of other species	3.97**

*, ** = Significant at 5% and 1% levels, respectively

combinations having good *per se* performance as well as high heterosis for germination percentage along with some of the component traits associated with grain mold resistance have been identified (table 1).

From the data of heterosis and heterobeltiosis for germination percentage, it was observed that hybrids with high magnitude of heterosis or heterobeltiosis have not necessarily showed better *per se* performance or vice versa. Hence, selection of superior crosses should necessarily be based not only on the magnitude of heterosis, but also on actual performance of hybrids for germination percentage, so that appropriate selections can be made without errors.

It was observed form table 1 that the cross SVD 9601 × IS 14384 exhibited high *per se* performance for germination percentage (79.17%) along with significant positive mid parent heterosis (10.63**) and heterobeltiosis (8.22**). Besides germination percentage, this cross also exhibited desirable significant mid parent heterosis and heterobeltiosis for five other traits associated with grain mold resistance *viz.,* glume coverage, seed hardness, water absorption capacity, fungal load of *Fusarium moniliforme*, fungal load of other species. Also this cross has shown positive significant sca effects for germination percentage (6.98**).

Another cross GM 9219 × IS 14332 exhibited high *per se* performance for germination percentage (79.17%) along with significant positive mid parent heterosis (8.97**) and heterobeltiosis (8.42**). Besides germination percentage, this cross also exhibited desirable significant mid parent heterosis for seven other traits associated with grain mold resistance *viz.,* glume coverage, seed hardness, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species and heterobeltiosis for six other traits associated with grain mold resistance *viz*., glume coverage, grain density, water absorption capacity, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species. Also this cross has shown positive significant *sca* effects for germination percentage (2.49*).

Cross is 14384 × GMPR 65 exhibited high *per se* performance for germination percentage (77.52%) along with significant positive mid parent heterosis (4.47**) and non significant heterobeltiosis (3.0). Besides germination percentage, this cross also exhibited desirable significant mid parent heterosis for seven other traits associated with grain mold resistance *viz*., grain yield, glume coverage, seed hardness, grain density, electrical conductivity, fungal load of *Fusarium moniliforme*, fungal load of other species and heterobeltiosis for six other traits associated with grain mold resistance *viz*., grain yield, seed hardness, grain yield, grain density, fungal load of *Fusarium moniliforme*, fungal load of other species. Also this cross has shown positive significant *sca* effects for germination percentage (4.72**).

The remaining seven crosses in table 1 also exhibited good *per se* performance for germination percentage along with desirable significant mid parent heterosis and heterobeltiosis for some of the component traits associated with grain mold resistance. Besides this all these crosses showed positive and significant *sca* effects for germination percentage. Ghorade (1995) and Agarkar (2000) also reported positive heterosis for germination percentage indicating increase in the germination percentage. Wadikar and Jagtap (2010) reported highest *sca* for germination percentage among all the characters studied.

On the basis of their better *per se* performance for germination percentage along with good amount of desirable heterosis and significant *sca* effects for germination percentage, ten crosses *viz.,* SVD 9601 × IS 14384, GM 9219 × IS 14332, IS 14384 × GMPR 65, SVD 9601 × GMPR 65, GM 9219 × 9 B, 9 B × GMPR 65, IS 14332 × 27 B, GM 9219 × 70 B, IS 14332 × 70 B and IS 14332 × 14 B need to be exploited in further generations for isolating the mold resistant lines.

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