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RESEARCH ARTICLE

Association of seed mycoflora infection in assessment of new source of resistance against grain mould of sorghum

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ABSTRACT

The frequency of association of different seed borne infections of sorghum hybrids and their parents was assessed during *Kharif* 2011 at MARS, UAS, Dharwad. The study examined the frequency of the two most common grain mould fungi, *Fusarium* and *Curvularia*. The germination percentage varied from 13.45 per cent (296 B) to 80.21 per cent (B 58586). The newly developed hybrid DNB 4 x GMRP 950-285 had higher germination percentage of 78.59 and lower *Fusarium* infection per cent of 11.45 which was on par with highly grain mold resistant check B 58586 (80.21per cent germination and 9.78 per cent seed infection with *Fusarium*). The association of *Fusarium* infection in crosses was higher when compared to *Curvularia* infection. There were highly significant negative correlations between germination and *Fusarium* species (r = -0.84). Germination was reduced upto 25-30 per cent in sorghum genotypes due to infection of grain mould species. Thus, the study identified a new hybrid with lesser frequency of *Fusarium* and *Curvularia* causing grain mould in Karnataka.

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INTRODUCTION

Grain mould, caused by a complex of pathogenic and saprophytic fungi species like *Curvularia*, *Fusarium*, *Alternaia*, *Phoma soghina* and *Helminthosporium* and is a highly destructive disease of *Kharif* sorghum around the globe which take heavy toll every year. Most of these fungi are unspecialized or facultative parasites, and the predominant species vary depending on location, year and the environment. Among the fungi involved in the mould complex, species of *Fusarium, Curvularia* and *Alternaria* are more abundant than others (Girish *et al.,* 2004). The annual economic loss in Asia and Africa as a result of grain mould is more than US$130 million (Chandrashekar *et al.,* 2000).

Grain mould reduces grain quality through deterioration of endosperm and reduced embryo viability. Grain infected with mould is also more likely to be contaminated with mycotoxins, and these metabolites can present hazards to consumers (Williams and Rao, 1981). All of these factors result in reduced grain quality and yield and hence a reduced market value of the crop. Planting photosensitive cultivars that mature during periods of dry weather or resistant cultivars can minimize these yield losses. Though there is significant research finding on genotypic reaction to grain mould in general, there is a little information available on the frequency of mould fungi on seed and their effect on germination in sorghum cultivars under climate change regimes. Kotgire (2009) found that the fungi *viz*., *F. moniliforme* (38.75%), *Fusarium* sp. (21.50%), *Penicillium* sp. (4.00%), *Aspergillus niger* (3.00%) and *Macrophomina phaseolina* (2.50%) associated in pinkish discolored grains of sorghum. Increased grain mould severity and reduced seed germination in sorghum seed inoculation with *Fusarium thapsinum*, *C. lunata* and a mixture of the two fungi in all sorghum cultivars tested were reported by Prom *et al*. (2003). Narnaware *et al*. (2006) reported that *Fusarium* and *Curvularia* are the two most important fungal genera causing grain discoloration and reduction in viability of seed. Castor (1981) and Garud *et al*. (2000) also

reported a negative correlation between seed germination rates and *Fusarium* sp. Keeping these points in view, the present study was aimed to identify the association of the frequency of *Fusarium* and *Curvularia* species on seed mycoflora and effect on seed germination for 32 hybrids and respective parents and checks of *Kharif* sorghum under changing climatic conditions in recent years. The results of these studies are discussed in this paper.

MATERIALS AND METHODS

Experimental location :

The experiment was conducted at All India Co-ordinated Sorghum Improvement Project, University of Agricultural Sciences, Dharwad during *Kharif* 2011.Seeds harvested from *Kharif* 2011 were examined to assess the effect of *Fusarium* and *Curvularia* species of mould fungi on germination of genotypes and their frequencies on seeds.

Assessment of seed mycoflora associated with grain mould infections :

Seeds of 47 hybrids and their parents, which have varying degrees of reaction to grain mould were evaluated for identification of associated seed mycoflora by following the rolled paper towel method (Sanap *et al.*, 2008). One hundred grains from each genotype were evaluated for germination in two replications. Seeds were surface sterilized by dipping in 0.1 per cent sodium hypochloride solution for two minute followed by three washings with sterilized water and placed on moist germination paper. Second sheet of germination paper covered the seeds followed by moistening it carefully. Both sheets were rolled along with wax coated paper and were incubated in seed germinator (28 ± 1^{0}C). After seven days, germinated seeds from each of the treatments and also the infection by *Curvularia* and *Fusarium* were counted based on colour and texture of colony. Generally, *Curvularia* sp. appears as shiny velvety black fluffy growth and *Fusarium* sp. produces pinkish white mycelium on seeds (Thakur *et al.*, 2006).

RESULTS AND DISCUSSION

The pertinent data on germination percentage, per cent of *Fusarium* and *Curvularia* infection in parents, hybrids and checks are detailed in Table 1.

Influence of seed mycoflora on germination percentage in various hybrids and their parents :

Seeds harvested from *Kharif* 2011 were examined to assess the effect of *Fusarium* species and *Curvularia lunata* mould fungi on germination of genotypes and their frequencies on seeds. The germination percentage in different genotypes was significant. The germination percentage varied from 13.45 per cent (B296) to 80.21 per cent (B 58586).

Among thirty two cross combinations and their parents four hybrids *viz.*, DNB 4 x GMRP 950-285 (78.59%), SPV 570 x GMRP 16 (76.49%), SPV 570 x GMRP 97 (75.86%) and DNB 4 x GMRP 108 (75.28%) and five parents *viz.,* GMRP 950-285 (79.51%) GMRP 13 (77.12%), DSV 6 (76.49%), GMRP 216 (76.49%) showed significantly higher germination percentage over resistant check IS 14332 (71.17%). The hybrid DNB 4 x GMRP 950-285 showed higher germination percentage of 78.59 whereas it was at par with B 58586. DNB 4 x GMRP 261 recorded lower germination percentage of 25.85 with 31.32 per cent of *Fusarium* and 24.74 per cent of *Curvularia* infection on seeds. Susceptible check 296 B exhibited lowest germination percentage of 13.45 with 38.96 per cent of *Fusarium* and 29.01 per cent of *Curvularia* infection on seeds. Significantly higher negative correlation (-0.84) between germination and *Fusarium* infection were observed. However, there was also negative correlation (-0.32) observed between germination and *Curvularia* infection (Table 2). It indicated that germination drastically affected by mould fungi. However, *Fusarium* infection was predominately involved in reduction of seed germination. Garud *et al.* (2000) and Naraware *et al.* (2006) also reported that these two mould causing fungi reduced germination percentage of seeds.

Association of seed mycoflora and their frequencies in different hybrids and their parents :

Infection by *Fusarium* and *Curvularia* species on the grains were statistically significant. The per cent of *Fusarium* infection ranged between 9.98 per cent (B 58586) and 38.96 (296 B). The highest percentage of *Fusarium* infection was recorded in DNB 1 x GMRP 950-285 (33.22%) followed by 31.37 per cent in case of SPV 570 x GMRP 950-285. Lowest per cent of infection was observed in DNB 4 x GMRP 950-285(11.45%), which was significantly lower than resistant check IS 14332 (19.36%). Among the parents *Fusarium* infection ranged between 15.31 per cent (GMRP 216) and 33.22 per cent (SPV 570).

Among the cross combinations, per cent of *Curvularia* infection varied from 12.24 per cent (DSV 6 x GMRP 16) to 27.99 per cent (DNB 4 x GMRP 216). In case of parents, minimum and maximum value were recorded in DNB 4 (14.77%) and GMRP 13(25.85%), respectively. The cross DSV 6 x GMRP 16 showed significantly lower per cent infection of *Curvularia* species than the both highly resistant (B 58586) and resistant (IS 14332) checks. This infection was lower than both parents also. The range of infection in hybrids was higher than parents. The study revealed that association of *Fusarium* infection was higher than *Curvularia* infection in Karnataka. These results of *Fusarium* and *Curvularia* infection were also reported by

Table 1: Angular values for seed germination, *Fusarium* and *Curvularia* infection percentages in sorghum

Genotypes	Seed germination %	Infection %	
		Fusarium	*Curvularia*
DSV 6 x GMRP 16	71.62	21.97	12.24
DSV 6 x GMRP 950-285	62.42	17.96	21.13
DSV 6 x GMRP 261	72.60	17.44	17.96
DSV 6 x GMRP 81	70.22	19.36	15.31
DSV 6 x GMRP 108	71.13	20.26	14.77
DSV 6 x GMRP 97	62.42	17.96	19.83
DSV 6 x GMRP 13	65.69	22.39	14.19
DSV 6 x GMRP 216	65.69	24.35	26.22
SPV 570 x GMRP 16	76.49	16.44	21.98
SPV 570 x GMRP 950-285	50.21	31.32	15.89
SPV 570 x GMRP 261	62.76	25.85	16.95
SPV 570 x GMRP 81	62.76	25.12	26.58
SPV 570 x GMRP 108	68.51	26.20	24.36
SPV 570 x GMRP 97	75.86	12.86	21.13
SPV 570 x GMRP 13	61.04	25.49	23.98
SPV 570 x GMRP 216	63.12	25.49	21.97
DNB 1 x GMRP 16	57.77	25.11	26.22
DNB 1 x GMRP 950-285	42.15	33.22	15.35
DNB 1 x GMRP 261	49.92	31.32	21.56
DNB 1 x GMRP 81	72.60	25.49	13.56
DNB 1 x GMRP 108	70.25	21.13	23.19
DNB 1 x GMRP 97	71.13	21.97	17.44
DNB 1 x GMRP 13	67.25	26.93	17.96
DNB 1 x GMRP 216	61.04	22.39	18.42
DNB 4 x GMRP 16	74.15	19.36	20.71
DNB 4 x GMRP 950-285	78.59	11.45	21.56
DNB 4 x GMRP 261	25.85	31.32	24.74
DNB 4 x GMRP 81	68.51	16.95	19.83
DNB 4 x GMRP 108	75.28	14.77	20.26
DNB 4 x GMRP 97	64.58	25.85	15.89
DNB 4 x GMRP 13	56.21	22.80	16.44
DNB 4 x GMRP 216	44.74	25.11	27.99
SPV 570	38.37	33.22	22.39
DNB 1	61.04	25.85	18.44
DNB 4	62.76	23.98	14.77
GMRP 16	72.09	18.42	17.44
GMRP 950-285	79.51	18.42	24.74
GMRP 261	67.35	22.39	25.11
GMRP 81	76.49	17.47	19.38
GMRP 108	67.65	22.79	15.89
GMRP 97	70.22	16.95	25.11
GMRP 13	77.12	17.44	25.85
GMRP 216	76.49	15.31	16.41
DSV 6(Resistant)	76.49	15.89	15.31
296 B (Susceptible check)	13.45	38.96	29.01
IS 14332 (Resistant check)	71.17	19.36	20.71
B 58586 (Highly resistant check)	80.21	9.98	15.31
S.E.±	1.03	0.73	0.62
C.D. (0.01)	3.92	2.77	2.37

Table 2: Correlation between the infection of mold fungi and germination percentage in sorghum

Source of variations	Mean sum of squares		
	Fusarium %	*Curvularia%*	Germination %
Fusarium %	1	0.181	-0.845**
Curvularia%		1	-0.320*
Germination %			1

* and ** Indicate significance of values at P=0.05 and 0.01, respectively

Garud *et al.* (2000) and Sanap *et al.* (2008).

Conclusion :

Out of 32 hybrids and their parents tested for association of seed mycoflora infections, the cross DNB 4 x GMRP 950-285 showed significantly higher seed germination and minimum seed mycoflora which can be further used in identification of durable resistance source against grain mould in Karnataka. The study also assessed association of *Fusarium* infection in greater frequency compared to *Curvularia* in sorghum ecosystem in Karnataka.

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