Karnataka J. Agric. Sci., 15 (4): (641-645):2002

Promising Resistant Sources for Charcoal Rot and Rust of Rabi Soughum

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(Received: November, 2001)

Abstract: The resistant sources developed by using pedigree method from the crosses between E 36-1 x M 35-1and E-36-1X GRS-1. The stabiliged material were screened in sick soil for chrcoal rot and rust. The genotypes DCCR-11, 15, 15-1 17, 18, 20, 24 and 25 were found resstant to charcoal rot for all the parameters studied. Whereas, DCCR-11, 15, 20, 25 and 18 were found promisng both for rust and charcoal rot. In the second cross DGCR-8, 9, 15, 16, 19-1, 27-3, were found promising both for charcoal rot and rust diseases.

Introduction

Charcoal rot of sorghum *Macrophomina phaseolina* (Tassi) Goid. has been a limiting factor in the cultivation of rabi sorghum. This disease apprears almost every year under receding moisture condition and becomes severe (Anahosur and Rao, 1979). The pathogen causes premature plant death before grain is physiologically mature curtailling grain yields. In India charcoal rot is a destructive disease in rabi sorghum regions of Karnataka, Maharastra, Andhra Pradesh and Gujarat. Many workers reported different management practices such as cultural, biological, chemical and host plant resistance (Avadhani and Ramesh, 1979, Indira *et al.*, 1984). The sorghum being a low cash value crop and to suit the needs of the sorghum growers identification and development of stable resistant sources is a cheapest alternative to manage the disease. Accordingly the work was carried out to develop resistant sources by crossing with locally adopted genotypes in sick soil.

Material and Methods

Two crosses viz., E 36-1x M35-1 and E 36-1x GRS-1 were developed by pedigree method. The F_1,s were planted in sick soil and advanced to F_2 generation. Large population of F_2's (500 plants) were planted during rabi 1992. The individual plants from selfed F_2's were selected for charcoal rot and rust resistance and further advanced by eliminating susceptible plants in sick soil to get stabilized material. Finally resistant stabilized progenies sources were identified by planting in 2 rows of 5 m length with two replications in Randomized block design at Main Research Station, Dharwad. The sowing was made in sick soil with 45 x15 cm spacing during second fortnight of October which is highly congenial for charcoal rot development in this place. At physiological maturity of the grain, the total number of plants and number of plants lodged were recorded and per cent lodging was calculated. The lodged plants were longitudinally split open to ensure that lodging was due to *Macrophomina phaseolina*. Other parameters like average number of nodes crossed and mean length of spread in cm by the pathogen was also

Table 1. Promising charcoal rot and rust resistant sources developed from E36-1x M351 at Dharwad

Sl.No	Genotypes	Rust		Mean lodging % due to CR		Mean no. of nodes Crossed		Mean length of spread (cm)	
		2000	2001	2000	2001	2000	2001	2000	2001
1	DCCR-1	2	2	24.81 (5.05)	15.87 (23.45)**	2.17 (1.77)	1.65 (1.63)*	29.05	13.70
2	DCCR-1-1	2	2	20.30 (4.55)	7.74 (16.13)	1.87 (1.69)	0.77 (1.33)	25.16	10.03
3	DCCR-2	2	2	25.63 (5.15)	5.74 (13.86)	1.70 (1.63)	0.27 (1.16)	27.10	8.87
4	DCCR-3	2	2	7.41 (2.89)	3.65 (10.90)	1.10 (1.38)	0.00 (1.00)	17.40	3.85
5	DCCR-5	2	2	25.44 (4.95)	5.71 (13.80)	2.00 (1.73)	0.25 (1.11)	19.37	5.66
6	DCCR-8	2	3	7.82 (2.93)	4.75 (12.57)	0.00 (1.00)	0.00 (1.00)	7.17	4.00
7	DCCR-11	2	2	5.13 (2.47)	2.60 (9.23)	0.10 (1.04)	0.00 (1.00)	9.50	5.05
8	DCCR-12	2	2	10.55 (3.39)	4.68 (12.50)	1.25 (1.50)	0.00 (1.00)	28.25	5.80
9	DCCR-12-1	2	2	9.14 (3.16)	8.59 (17.05)	1.95 (1.70)	0.27 (1.13)	34.17	8.31
10	DCCR-13	2	2	16.11 (4.12)	5.62 (13.73)	1.87 (1.66)	0.45 (1.20)	27.62	4.89
11	DCCR-14	2	3	8.26 (2.59)	3.19 (10.30)	0.80 (1.34)	0.45 (1.20)	17.30	10.82
12	DCCR-15	2	2	0.00 (1.00)	2.93 (9.77)	0.20 (1.09)	0.65 (1.28)	9.70	9.00
13	DCCR-15-1	2	2	6.15 (2.67)	3.16 (10.27)	0.95 (1.38)	0.00 (1.00)	19.52	4.90
14	DCCR-16	2	3	6.38 (2.70)	4.75 (12.64)	2.02 (1.73)	0.50 (1.22)	31.45	11.66
15	DCCR-17	2	3	2.94 (1.81)	6.03 (14.24)	0.62 (1.25)	0.00 (1.00)	18.37	5.62
16	DCCR-18	2	2	7.72 (2.82)	2.82 (9.62)	0.00 (1.00)	0.27 (1.13)	7.66	6.94
17	DCCR-19	3	2	6.77 (2.78)	6.59 (14.67)	1.80 (1.67)	0.85 (1.36)	26.00	10.70
18	DCCR-20	2	2	4.00 (2.40)	3.56 (10.75)	0.40 (1.18)	0.15 (1.07)	13.40	7.02
19	DCCR-22-1	3	3	6.47 (2.64)	4.75 (12.64)	0.37 (2.16)	0.00 (1.00)	11.02	5.55
20	DCCR-24	3	2	5.63 (2.53)	2.72 (9.41)	0.20 (1.09)	0.00 (1.00)	10.80	2.95
21	DCCR-25	2	2	3.52 (2.00)	3.63 (10.91)	0.12 (1.05)	0.00 (1.00)	5.75	4.02
22	E36-1 (R)	2	3	7.72 (2.82)	5.78 (16.42)	0.00 (1.00)	0.00 (1.00)	7.80	3.82
23	CSV 8R (S)	3	3	43.17 (6.64)	49.76 (44.88)	3.06 (2.01)	2.39 (1.84)	45.85	40.55
	SEm±			0.55	0.76	0.12	0.02	5.67	0.86
	CD at 5%			1.60	2.22	0.36	0.06	16.46	2.52

*$\sqrt{x+}$ values ** Angular transformations

CR= Charcoal rot

recorded. The entries were also graded for rust reaction using 1-5 scale as followed in All India Coordinated Sorghum Improvement Project.

The data were transformed by using angular and square root transformation and analysed for further interpretations.

Results and Discussion

Susceptible check CSV8R showed more lodging indicating that the disease incidence was quite high. Statistically significant differences were obtained among sorghum genotypes for lodging due to charcoal rot and for other parameters. The results from the cross between E-36-1x M35-1(Table1) revealed that the genotypes DCCR 15(0.00 and 2.93) DCCR-17(2.94 and 6.03) DCCR 20 (4.00 and 3.56),DCCR 25 (3.52 and 3.63) DCCR 11 (5.13 and 2.60), DCCR 24 (5.63 and 2.72) DCCR 15-1 (6.15 and 3.6) and DCCR18 (7.72 and 2.82) were found highly promising in both the years for lodging and other parametes to chrcoal rot.

It is wise to select the genotypes promising for rust and charcoal rot in zone -8 of Karnataka. The majority of the genotypes were found resistant to rust. In addition to resistance character the genotype DCCR-18 also maintained stay green character till physiological maturity.

The critical observations made from the cross E36-1 x GRS-1 (Table 2) revealed that the genotypes DGCR-11(0.00 and 2.03), DCCR 24 (0.00 and 2.09) DGCR-6 (0.00 and 2.69), DGCR-5 (0.00 and 2.70) DGCR-12 (0.00 and 2.74), DGCR-10 (0.00 and 3.85) DGCR-27 (4.41 and 1.74 and DGCR 20 (0.00 and 5.00) and DGCR 21 (0. 00 5.16) recorded < 5% lodging and found consistantly resistant in both years, followed by DGCR-8,DGCR-9,DGCR-15,DGCR-16,DGCR19-1,DGCR-27-2 and DGCR-27-3 recorded<10% lodging and found consistantly resistant in both the years for all the parameters studied. Most of the genotypes showed resistant to rust. Above this the genotypes DGCR-6, DGCR-9, DGCR-10, DGCR-21,DGCR-24 and DGCR-27-3 having resistant blood both for rust and charcoal rot.

In addition to resistance the genotypes DGCR-12 ,DGCR-20 and DGCR-24 were also maintained stay green character till physiological maturity of the grains. Two years of study also indicated that there was slight variation in some of the parameters studied, this may be due to variation in inoculum density in soil is one of the factors responsible for the highly variable incidence of charcoal rot in the field (Papavizas and Klag,1975). So, while selecting for chrcoal rot resistance consistent year wise results were considered but not based on average of two years. Several reports have been made on host plant resistance viz,. M 35-1x CSV8R,M35-1 x E 36-1 and CSV8R x E36-1(Sahib *et al.*,1990). The erlier investigation revealed that among all the parameters evaluated lodging parameter has strong and positive correlation with loss in seeds weight of sorghum (Anahosur *et al.*, 1987). However, the entries reported as resistant else where were not included in the present study and due importance was given to locally adopted material to develop resistant lines for rust and charcoal rot and can be successfully utilized in the resistant breeding programme for rust and charcoal rot of sorghum.

Table 2. Promising charcoal rot and rust resistant sources developed from E36-1x GRS-1 at Dharwad

Sl.No	Genotype	Rust		Mean lodging % due to CR		Mean no. of nodes Crossed		Mean length of spread (cm)	
		2000	2001	2000	2001	2000	2001	2000	2001
1	DGCR-1	3	3	0.00 (1.00)	3.96 (15.90)**	0.00 (1.00)	0.00 (100)*	7.20	4.20
2	DGCR-3	2	3	4.56 (2.35)	5.81 (13.94)	1.15 (1.46)	0.35 (1.16)	24.65	8.06
3	DGCR-3-1	2	3	6.94 (2.82)	21.60 (27.65)	1.30 (1.51)	0.45 (1.20)	25.60	10.70
4	DGCR-3-3	2	2	12.03 (3.49)	5.39 (13.39)	0.87 (1.36)	0.05 (1.28)	22.00	4.15
5	DGCR-5	2	3	0.00 (1.00)	2.70 (8.53)	0.22 (1.10)	0.11 (1.05)	8.40	5.85
6	DGCR -6	2	2	0.00 (1.00)	2.69 (8.53)	0.50 (1.21)	0.00 (1.00)	11.10	3.87
7	DGCR-7	3	2	14.16 (3.81)	5.0 (12.92)	0.45 (1.20)	0.00 (1.00)	15.30	4.39
8	DGCR-8	3	2	8.00 (2.99)	5.05 (12.98)	0.30 (1.13)	0.00 (1.00)	17.25	5.20
9	DGCR-9	2	2	5.39 (2.52)	9.39 (17.80)	0.90 (1.37)	0.00 (1.00)	16.60	4.16
10	DGCR-10	2	2	0.00 (1.00)	3.85 (11.30)	0.54 (1.23)	0.15 (1.07)	10.12	4.90
11	DGCR-11	3	3	0.00 (1.00)	2.03 (7.85)	0.10 (1.04)	0.00 (1.00)	6.77	3.16
12	DGCR-12	3	3	0.00 (1.00)	2.74 (9.43)	0.00 (1.00)	0.00 (1.00)	7.30	4.29
13	DGCR-14	3	3	0.00 (1.00)	11.37 (19.61)	0.40 (1.17)	0.68 (1.29)	13.60	13.90
14	DGCR-15	4	3	8.33 (3.05)	4.13 (11.73)	0.50 (1.20)	0.10 (1.04)	16.00	6.38
15	DGCR-16	3	2	6.51 (2.73)	7.28 (15.64)	0.65 (1.28)	0.25 (1.11)	16.40	12.85
16	DGCR-17	2	2	8.80 (2.93)	14.69 (22.54)	0.70 (1.27)	1.00 (1.41)	16.56	14.93
17	DGCR-18	3	2	14.58 (3.93)	13.50 (21.53)	1.00 (1.41)	1.16 (1.47)	18.80	19.18
18	DGCR-19	2	2	21.07 (4.67)	14.21 (22.12)	1.90 (1.70)	0.58 (1.25)	15.20	15.85
19	DGCR-19-1	3	3	6.79 (2.77)	7.97 (16.29)	0.20 (1.09)	0.00 (1.00)	13.20	3.90

1	2	3	4	5	6	7	8	9	10
20	DGCR-20	2	3	0.00	5.00	0.60	0.11	20.00	7.70
				(1.00)	(12.98)	(1.25)	(1.05)		
21	DGCR-21	2	2	0.00	5.16	0.67	0.16	23.90	9.87
				(1.00)	(13.06)	(1.29)	(1.08)		
22	DGCR-22	2	3	10.16	7.67	1.10	0.30	25.50	11.40
				(3.22)	(16.04)	(1.44)	(1.14)		
23	DGCR-24	2	2	0.00	2.09	0.25	0.35	16.87	7.38
				(1.00)	(7.94)	(1.25)	(1.16)		
24	DGCR-27	3	3	4.41	1.74	0.00	0.12	12.30	4.00
				(2.31)	(7.41)	(1.00)	(1.05)		
25	DGCR-27-2	2	3	5.42	7.00	0.70	0.14	20.90	5.89
				(2.50)	(15.33)	(1.29)	(1.06)		
26	DGCR-27-3	2	2	7.94	4.60	0.30	0.00	13.40	7.27
				(2.96)	(12.45)	(1.13)	(1.00)		
27	E-36-1	2	3	8.30	7.01	0.00	0.00	9.20	8.50
				(3.04)	(15.34)	(1.00)	(1.00)		
28	CSV 8R (S)	3	3	42.75	50.62	2.88	2.49	44.37	39.18
				(6.60)	(45.37)	(1.96)	(1,87)		
	SEm.±			0.40	1.18	0.10	0.02	3.84	0.21
	CD at 5%			1.17	3.41	0.29	0.06	11.14	0.60

*$\sqrt{x+1}$values ** Angular transformations CR= Charcoal rot

References

ANAHOSUR, K.H. AND M.V.H.,RAO, 1979, A note on the epidemic of charcoal rot of sorghum in the Regional Research Station. Dharwad. *Sorghum Newsletter*, **20**:22.

ANAHOSUR,K.H.,NAIK, S.T. AND NADAF, S.K., 1987, Correlation and path coefficient analysis of sorghum. *Indian Phytopathology*, **40** (4): 478-481.

AVADHANI, K.K. AND RAMESH,K.V.,1979, Charcoal rot incidence in some released and pre released varieties and hybrids. *Sorghum Newsletter*,**21**:37-38.

INDIRA,S.,RANA, B.S. AND RAO, N.G.P,, 1984, Resistance to charcoal rot and its relationship with other characters in sorghum. *Indian Phytopathology*, **37** (2):337-339.

PAPAVIZAS, G.C. AND KLAG, N.G.,1975, Isolation and quantitative determination of *Macrophomina phaseoline* from soil. *Phytopthology*,**65**:182-187.

SAHIB,K.H.,REDDY, B.B. AND ALI,S.M. 1990, Genetics of charcoal rot resistance in rabi sorghum. *Indian Journal of Genetics and Plant Breeding* ,**50** (3): 263-267.