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COMPATRATIVE STUDY OF CHLOROPHYLL AND SUGAR CONTENTS IN RESISTANT AND SUSCEPTIBLE CULTIVARS OF SORGHUM TO CHARCOAL ROT

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ABSTRACT

Chemical components like total chlorophyll, chlorophyll 'a' Chlorophyll 'b' reducing sugar, non reducing sugar and total sugar in relation to charcoal rot disease across three seasons were estimated and compared in each of the two proven resistant and susceptible sorghum cultivars. It was observed that the lower concentrations of total chlorophyll, chlorophyll 'b' and higher concentration of chlorophyll 'a', reducing sugar, non reducing sugar and total sugars were associated with resistance reaction to charcoal rot whereas the reverse trend was observed in the susceptible cultivars. The relative magnitude of concentrations of chlorophyll 'a', chlorophyll 'b' and total chlorophyll were higher during summer, whereas reducing sugar, non reducing sugar and total sugars were higher in Kharif for all the cultivars. It is further projected that the higher concentrations of chlorophyll

'a', reducing sugar, non reducing sugar and total sugars may be utilised as possible indices to screen sorghum genotypes against charcoal rot disease.

KEY WORDS : Charcoal rot

The Charcoal rot of sorghum caused by **Machrophomina phassolina** (Tassi) Goid, has become a serious pathogen and it is a common soil borne fungus known by its imperfect state (Domsch et al, 1980), which occurs in ecologically diverse areas of sorghum production in the tropics, subtropics and temperate regions (Mughogho and Pande 1984). Evolving disease resistant varieties involved a thorough understanding of the mechanism of resistance which can be physical, chemical, morphological or nutritional. In the present investigation each of the two proven resistant and susceptible genotypes were taken and their respective chemical components like total chlorophyll, chlorophyll 'a', chlorophyll 'b', reducing sugar, non reducing sugar, and total sugars were estimated across the season, simultaneously their association with charcoal rot resistance was studied.

MATERIAL AND METHODS

Experiment was carried out on four sorghum genotypes viz. IS 121, IS 3443, CSH-6 and CSH-5 of these, first two resistant (3.0 and 1.0 rating respectively) and latter two susceptible (8.0 and 9.0 rating respectively) to charcoal rot, (AICSIP, Annual Progress Report 1979-80 and ICRISAT Progess Report 1978) replicated 5 times were sown in randomized block design at College Farm, Agricultural College, Rajendranagar for three seasons. Each entry was sown in five row plot with a inter row distance of 45 cm. and intra row distance of 15 cm. Recommended cultural practices were adopted so as to raise a healthy rainfed crop during Kharif and irrigated crop under rabi and summer. Different chemical components like chlorophyll 'a' chlorophyll 'b' and total chlorophyll were estimated after panicle emergence following Arnon 1949 formulae by taking the 3rd leaf from the top in 25 randomly selected plants of all the cultivars in each of the replication. Similarly plant samples were also collected and estimations were made separately from roots, stems and leaves for reducing sugar and total sugars by Anthrone reagent method as suggested by Morris, 1948 and for non reducing sugars by Khatti and Chenulu, 1969.

RESULTS AND DISCUSSION

Estimated mean values of total chlorophyll, chlorophyll 'a', and chlorophyll 'b' across the seasons in four cultivars are presented in Table-1, which indicates that the mean values of chlorophyl 'a' were higher along with lower mean values for both chlorophyll 'b' and total chlorophyll in resistant genotypes. Whereas the reverse trend was observed in susceptible cultivars. The magnitude of mean values for all these three components were higher during summer when compared to other seasons. The highest mean value of chlorophyll 'a' was recorded by IS 3443

TABLE 1. Distributing pattern of chlorophyll 'a', chlorophyll 'b' and total chlorophyll (mg/g) of leaves of sorghum cultivars across the seasons in relation to charcoal rot

Seasons	Cultivars	Chlorophyll 'a' content mg/g.	Chlorophyll 'b' content mg/g.	Total chlorophyll content(mg/g) of leaves
Kharif	IS 121 (R)	1.104	0.858	1.961
	IS 3443 (R)	1.067	0.829	1.897
	CSH 6 (S)	1.027	0.899	1.926
	CSH 5 (S)	1.081	0.946	2.026
Rabi	IS 121 (R)	1.159	0.901	2.060
	IS 3443 (R)	1.175	0.913	2.088
	CSH 6 (S)	1.085	0.949	2.034
	CSH 5(S)	1.132	0.991	2.129
Summar	IS 121 (R)	1.206	0.937	2.146
	IS 3443 (R)	1.216	0.945	2.160
	CSH 6 (S)	1.145	1.002	2.147
	CSH 5 (S)	1.209	1.058	2.267

	SE ±	CD at 0.01	SE ±	CD at 0.01	SE ±	CD at 0.01
Between two cultivars means	0.0036	0.008	0.0027	0.006	0.0061	0.013
Between two seasons means	0.0030	0.006	0.0024	0.005	0.0056	0.011
Between two seasons for the same cultivar	0.0060	0.012	0.0049	0.010	0.041	0.023
Between two cultivars means for the same of different seasons	0.0061	0.013	0.0048	0.010	0.0107	0.022

a resistant cultivar and chlorophyll 'b' was and total chlorophyll by CSH-5 at susceptible hybrid.

Distribution pattern of mean values of reducing sugar, non reducing sugar and total sugars in four sorghum cultivars across the seasons are presented in table 2. From the table it was very clear that all these three types of sugars were in higher concentration in resistant cultivars than susceptible cultivars. The relative magnitude of these three types of sugars were very high especially in Kharif when seasons compared. The analysis of sugars of different parts of sorghum cultivars reveal that stems contain the highest concentrations of reducing sugar, non reducing sugar and total sugars followed by the roots. Highest concentrations of reducing sugar, non reducing sugars and total sugar were recorded during Kharif by IS 121 a resistant variety whereas the lowest values for these parameters were measured during summer by CSH-6 an susceptible hybrid. The relatively lowered

TABLE 2 : Distribution pattern of Reducing sugars, Non reducing sugars and Total sugars (mg/g dry weight as expressed in glucose equivalents) in resistant and susceptible sorghum cultivars to Charcoal rot.

Season	Cultivars	Sugars (mg/g) in different plant parts								
		Leaf			Steam			Root		
		R.S	N.R.S	T.S	R.S	N.R.S	T.S	R.S	N.R.S	T.S
Kharif	IS 121 (R)	60.75	136.386	207.40	84.00	200.274	299.35	70.71	149.438	231.60
	IS 3443 (R)	55.20	119.028	183.15	75.65	183.314	273.25	66.61	138.606	215.65
	CSH 6 (S)	40.37	87.308	134.25	58.15	132.712	200.85	51.90	108.622	168.70
	CSH 5 (S)	44.30	94.304	145.70	65.41	142.654	218.80	57.01	121.822	188.05
Rabi	IS 121 (R)	51.90	86.954	145.40	69.90	145.686	226.55	64.95	115.180	188.80
	IS 3443 (R)	47.20	78.110	131.19	64.85	132.152	206.95	60.65	105.648	174.25
	CSH 6 (S)	35.25	58.994	98.75	50.16	95.224	152.55	46.90	81.356	134.28
	CSH 5 (S)	39.75	62.75	106.75	53.60	104.72	165.30	51.31	87.732	145.65
Summer	S 121 (R)	61.40	107.178	176.35	74.75	169.304	256.80	67.70	129.918	207.40
	IS 3443 (R)	56.40	98.902	162.75	69.60	153.260	234.40	62.90	117.922	189.70
	CSH 6 (S)	38.15	74.630	118.40	51.80	104.810	164.50	45.25	79.434	130.65
	CSH 5 (S)	43.20	78.534	127.63	57.15	117.630	183.45	52.60	90.952	150.40

R: Resistant ; R.S: Reducing sugars ; S: Susceptible ; NRS: Non Reducing Sugars ; T.S: Total Sugars.

concentrations of sugars during rabi and summer could be a favourable point for wider prevalence of charcoal rot in these seasons.

Similar reports of higher concentrations of reducing sugars and total sugars were also reported in resistant varieties of sorghum by Patil et al 1981, Patil et al 1984, Anahosur K.H and S.T. Naik 1985 and 1986.

To sum up, this investigation brings out the potentiality of the chlorophyll 'a' content and reducing sugar, non reducing sugar and total sugar content of sorghum genotypes as possible indices to screen sorghum genotypes for their reaction to charcoal rot.

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