Indian J. Genet., **62**(1): 69-70 (2002)

Short Communication

Character associations in *Secale cereale* L. introgressed bread wheats under irrigated and water stress conditions

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(Received: February 1998; Revised: September 2001; Accepted: November 2001)

Rye (*Secale cereale* L.) is known to perform better under various biotic and abiotic stresses including drought. Such desirable rye traits can be effectively introgressed into wheat (*Triticum aestivum* L em Thell.) via hexaploid triticale (X *Triticosecale* Wittmack) [1]. Twenty two advance generations (F_6/F_7), elite and wheat like derivatives of triticale × wheat crosses possessing some distinct phenotypic rye traits were selected from an on-going triticale × wheat hybridization programme for the present study (Table 1). To identify the nature of rye chromatin present in the derivatives, chromosome homology technique was followed which involves the hybridization of the derivatives with the known rye substitution lines and then inferring the alien chromatin

Table 1. The nature of rye chromation transfer, presence of disease resistance gene(s) alongwith presumptive alien traits in the derivatives

Line No.	Parentage	Rye chromatin	Presence of disease resistance gene		Presumptive rye trait(s)
			Pm8	*Lr26*	
RL1-2-1	CPAN1922/RL1	1RS-1BL	+	+	Long,tapering and laterally compressed grains
RL5-1-1	HB618/RL5	NS	+	-	Long spikes
RL5-1-2	"	NS	-	NS	Long and laterally compressed grains
RL22-1-1	HB618/RL22	NS	-	NS	More spikelets/spike, long spikes, very late, waxy, spreading, dark green leaves
RL22-1-2	"	6R(6D)	-	NS	Long spikes and waxy
RL22-1-3	"	Nil	-	NS	Laterally compressed and tapering grains
RL22-1-4	"	6R(6D)	-	NS	Long spikes and long grains
RL22-1-5	"	NS	-	NS	More spikelets/spike, very late, waxy, spreading and dark green leaves
RL22-2-1	RL22/CPAN1922	NS			Long and laterally compressed grains
RL24-2-1	CPAN1922/RL24	6R(6D)	-	NS	Long and laterally compressed grains
RL24-2-2	"	1RS-1BL	+	+	Late maturity, dark green leaves, tapering grains
RL103	TL1210/CPAN1922	1RS-1BL	+	+	Red grains
RL103-3	TL1217/CPAN1922	6R(6D)	+	-	Red grains
RL105-2	"	1RS-1BL	+	+	-
RL106	"	6R (6D)	+	+	-
RL107-2	"	6R(6D)	-	NS	Red and tapering grains
RL110-2	"	1R(1D)	+	+	Tapering grains
RL111	"	1RS-1BL	-	+	-
RL111-1	"	6R(6D)	-	NS	Late maturity,boat shaped leaves and waxy
RL118-1	"	6R(6D)	+	NS	-
Rl119-1	"	6R(6D)	+	-	Red grains
RL127-1	"	1RS-1BL	+	+	Purple stem, boat shaped leaves red long and tapering grains

+ : present, - : absent, NS : could not be studied

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through chromosome synapsis in the resulting F_1's. It is important to understand associations of different characters with grain yield to complement selection in this material. The derivatives were field grown in the irrigated and rainfed environments in RBD in a 3 × $0.92m^2$ plot with three replications. Three irrigations at different critical crop growth stages were given only to the irrigated environment. The drought intensity (D) calculated as per Fischer and Maurer [2] for grain yield was 0.32. Data were recorded on 5 competitive plants for 17 traits (Table 2). Phenotypic correlation coefficients were computed from the mean values.

Table 2. Significant (at 5%) phenotypic correlation coefficients among different characters under irrigated (I) and rainfed (R) environments

Pair	I	R	Pair	I	R
1,2	-	0.46	7,12	–0.40	-
1,3	-	0.48	8,13	-	0.48
1,4	0.50	-	9,10	0.56	0.52
1,6	0.82	0.76	9,15	–0.41	-
1,7	0.84	0.77	9,17	0.49	-
1,11	–0.41	-	10,11	–0.75	–0.47
2,4	0.50	0.59	10,12	–0.60	-
2,5	-	–0.45	10,13	-	–0.48
2,11	–0.45	-	11,12	0.87	0.83
2,12	–0.44	–0.46	11,13	0.46	0.48
5,8	-	0.47	11,14	-	0.47
5,10	–0.58	–0.48	11,15	0.45	0.39
5,11	0.65	0.59	12,13	0.40	0.51
5,12	0.62	0.61	12,14	-	0.42
5,13	-	0.63	12,15	0.46	0.43
5,14	-	0.39	13,14	0.71	0.65
6,7	0.97	0.98	13,17	0.40	-
6,11	–0.45	-	14,17	0.43	-
7,10	0.39	-	15,17	–0.47	-
7,11	–0.49	-			

1 = Grain yield/plant (g) 2 = Harvest index (%)
3 = 1000 grain wt.(g) 4 = Grains/spike
5 = Spikelet/spike 6 = Tillers/plant
7 = Spikes/plant 8 = Spike length (cm)
9 = Plant height (cm) 10 = Peduncle length (cm)
11 = Days to heading 12 = Days to maturity
13 = Leaf area (cm2) 14 = Leaf area index
15 = Specific leaf wt. (g/cm2) 16 = Leaf water retention (%)
17 = Early growth vigour

Grain yield was positively correlated with tillers and spikes/plant in both environments. Under irrigated conditions, grains/spike and heading duration had positive and negative associations, respectively with grain yield. Under water stress, grain yield exhibited positive correlations with harvest index, 1000-grain weight and productive tillers. In the irrigated as well as rainfed environments, grains/spike and maturity duration developed positive and negative correlations, respectively with the harvest index implying that lines with early maturity and more number of grains/ spike raised the harvest index. However, harvest index was negatively correlated with the heading duration and spikelet number in the irrigated and rainfed conditions, respectively. This is because under moisture stress development of more number of spikelets/spike might have induced spikelet sterility and/or shrivelled grain formation to lower the harvest index. The positive correlation between spikelets/spike and phenological traits in both the environments may be expected since so long as flowering and maturity continued, more spikelets will be produced. However, longer peduncles were negatively influencing the number of spikelets. Under rainfed environment alone, spikelets/spike exhibited a positive correlation with spike length, leaf area and leaf area index. In the irrigated conditions, number of spikes/plant was positively correlated with peduncle length but negatively with heading and maturity durations. This implies that early maturing derivatives would favour the formation of more effective tillers and therefore more grain yield. Taller plants were associated with long peduncles in both the environments, whereas short-staturedness was positively correlated with more specific leaf weight in the irrigated environment. Days to heading were positively correlated with the days to maturity and both these characters were positively correlated with the leaf area, leaf area index and specific leaf weight. This is understandable because in the late heading and maturing lines, allocation of the photosynthates is towards leaf expansion and/or thickening which might be at the expense of reproductive development. In the irrigated environment alone, early growth vigour was positively correlated with plant height, leaf area and leaf area index and inversely with specific leaf weight implying that early selection for seedling growth vigour might favour taller plants and those with expanded but thinner leaves in the later stages. Therefore, early growth vigour might not be predictive of higher grain yield or its components. In the present study, none of the physiological traits revealed any correlation with the grain yield.

References

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