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Short Communication

Genetics of quantitative characters in six-rowed Barley over environments

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The experimental material consisted of parents, F_1 and F_2 generations of a 10 × 10 half diallel set. The material was laid out in RBD with 3 replications in three environments namely, early, normal and late sowings referred to as E_1, E_2 and E_3 respectively. The ten parents included were BG 105, BG 25, BH 28, BL 2, DL 100, DL 165, DL 88, K 125, RD 103 and RD 728. Each plot consisted of a single 4m row in parental and F_1 generations, and 4 rows of 4m each in F_2 generation with a row to row spacing of 30 cm and plant to plant spacing of 10 cm. Ten competitive random plants in parents and F_1s and 25 plants in each of F_2 progenies, were selected for recording observations on nine characters under each environment. The mean of each plot was used for statistical analysis. The genetical analysis for each character was conducted following Hayman [1].

Pooled ANOVA over the environments revealed highly significant differences amongst progenies for all the traits studied. So was true of progenies × environmental interactions. However, the environment mean squares were non- significant for harvest index in both the generations. Significant deviation of 'b' from zero and the non-significant departure of regression coefficient from unity for maturity, plant height and number of grains per ear in both the generations indicated that the assumptions of diallel analysis were fulfilled for these traits.

The additive component (D) (Table 1) was highly significant for all the characters in both the generations. The two measures of dominance H_1 and H_2 were found to be highly significant for all the traits in both the generations. These results indicated that nonadditive components for almost all the characters in both the generations, were higher than the additive components as per the earlier findings also [2-4].

The estimates of 'F' value were found to be positive and highly significant for ear length, number of grains per ear and harvest index in both the generations; plant height in F_1 and tiller number, 1000 grain weight and grain yield in F_2, suggesting a higher proportion of dominant alleles controlling these characters. However, positive but non-significant 'F' for the remaining traits in both the generations, gave some indication of the excess of dominant alleles in the parental lines. Different characters showed variable trends in both the generations for h^2, the net dominance effect. It was observed to be highly significant and positive for days to heading, plant height, ear length, number of grains per ear and grain yield in F_1 and in F_2 for harvest index, 1000 grain weight, number of grains per ear, ear length and plant height.

The proportion $(H_1/D)^{1/2}$ was found to be near unity for days to maturity, plant height and ear length in F_1, indicating complete dominance while for rest of the characters in F_1 and for all traits in F_2, the value was above one, suggesting either over dominance or epistasis in the expression of characters. The ratio $H_2/4H_1$ was lower than 0.25 for all the characters in both F_1 and F_2 generations, indicating asymmetrical distribution of genes with positive and negative effects. In view of above findings, biparental mating and/or diallel selective mating would hold promise for genetic improvement of six rowed barley.

References

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Table 1. Estimates of genetic components of variation for yield and its components over three environments

Genetic components	Generations	Days to heading			Plant height			Tiller number			Ear length		
		E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
D	F_1	18.7** ± 4.9	21.5** ± 3.3	7.5** ± 1.8	267.3** ± 13.9	227.6** ± 32.6	140.8** ± 23.4	10.2 ± 10.1	16.8** ± 5.3	3.2** ± 0.8	2.2** ±0.2	3.4** ± 0.3	1.8** ± 0.2
	F_1	19.1** ± 3.4	21.4** ± 5.5	7.5** ± 3.4	267.0** ± 15.3	226.6** ± 37.6	140.0** ± 9.2	10.55** ± 1.7	16.9** ± 2.5	3.3** ± 2.3	3.4** ± 0.2	2.2** ± 0.1	1.8** ± 0.3
H_1	F_1	46.9** ± 10.5	38.9** ± 7.1	20.7** ± 3.9	215.1** ± 29.6	359.6** ± 69.4	225.7** ± 49.7	77.5** r ± 21.5	58.3** ± 11.2	15.2** ± 1.9	2.9**± 0.5	3.4 ± 0.6	2.9** ± 0.3
	F_2	144.2** ± 28.8	294.3** ± 46.8	182.4** ± 292.	662.8** ± 130.7	1231.1 ± 319.9	642.2** ± 78.1	92.8** ± 14.9	109.3** ± 21.6	70.2** ± 20.0	11.04** ± 1.9	4.92** ± 1.2	8.1** ± 2.1
H_2	F_1	31.0** ± 9	27.2** ± 6.0	17.9** ± 3.3	103.8** ± 25.1	253.6** ± 59.0	199.9** ± 42.2	68.1** ± 18.3	43.2** ± 9.5	13.4** ± 1.6	1.8** ± 0.3	2.3** ± 0.5	2.1** ± 0.3
	F_2	104.7** ± 24.4	160.5** ± 39.7	100.4** ± 24.7	442.8** ± 111.1	963.3** ± 271.8	530.3** ± 66.4	72.5** ± 12.6	64.9** ± 18.3	52.13** ± 17.0	6.2** ± 1.0	2.95** ± 0.9	6.0** ± 1.8
F	F_1	1.16** ± 1.5	12.1 ± 7.6	4.4 ± 4.2	287.5** ± 32.1	214.7** ± 75.2	25.7 ± 53.9	11.8 ± 23.5	19.4 ± 12.1	0.98 ± 2.1	2.81** ± 0.5	3.2** ± 0.6	1.8** ± 0.4
	F_2	6.6 ± 15.6	80.7** ± 25.3	12.7 ± 15.8	358.6** ± 70.8	165.0 ± 173.3	38.9 ± 42.3	21.4* ± 8.0	50.1** ± 11.7	2.3 ± 10.8	6.4** ± 1.0	2.43** ± 0.6	2.8* ± 1.2
E	F_1	1.2 ± 1.5	0.6 ± 1.0	0.4 ± 0.5	2.1 ± 4.2	2.2 ± 0.8	1.0 ± 7.0	0.9 ± 3.0	0.7 ± 1.8	0.4 ± 1.3	0.1 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
	F_2	0.8 ± 1.0	0.7 ± 1.6	0.4 ± 1.0	2.4 ± 4.5	3.1 ± 11.3	1.8 ± 2.7	0.6 ± 0.5	0.6 ± 0.7	0.4 ± 0.7	0.0 ± 0.0	7.2** ± 0.0	0.0 ± 0.0
h^2	F_1	20.8** ± 6.0	53.4** ± 4.0	17.4** ± 2.2	54.9** ± 16.9	13.2 ± 39.4	215.5** ± 28.3	12.7 ± 12.2	0.3 ± 6.3	0.9 ± 11.1	3.5** ± 0.3	5.3** ± 0.3	3.6** ± 0.2
	F_2	0.0 ± 4.0	4.6 ± 6.6	1.2 ± 4.4	18.5 ± 18.6	122.0* ± 45.4	107.4** ± 11.1	0.8 ± 2.1	10.0** ± 3.0	0.2 ± 2.8	0.8** ± 0.2	1.1** ± 0.2	0.12 ± 0.3
$(H_1/D)^{1/2}$	F_1	1.5	1.3	1.6	0.8	1.3	1.3	2.7	1.8	2.1	1.1	1.0	1.3
	F_2	2.7	3.7	4.9	1.6	2.3	2.1	2.9	2.5	4.5	1.0	1.5	2.0
$H_2/4H_1$	F_1	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	F_2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1

Genetic components	Generations	Number of grains/ear			1000 grain weight			Harvest index			Grain yield		
		E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3	E_1	E_2	E_3
D	F_1	34.9** ± 7.7	69.1** ± 15.1	43.5** ± 11.02	41.4** ± 5.0	50.1** ± 9.6	16.7** ± 2.6	89.0** ± 17.5	97.6** ± 21.0	45.9** ± 7.7	94.8** ± 31.3	97.6** ± 21.0	45.9* ± 7.7
	F_2	35.4** ± 3.6	68.4** ± 8.5	436.8** ± 6.6	41.9** ± 3.2	501.3** ± 3.8	16.7** ± 5.0	88.25** ± 18.9	90.2** ± 14.6	125.0** ± 20.3	85.1** ± 19.3	970.7** ± 15.0	460.1** ± 9.2
H_1	F_1	149.1** ± 16.3	187.4** ± 32.3	130.9** ± 23.4	49.1** ± 10.7	84.1** ± 20.4	33.4** ± 5.5	274.2** ± 37.5	297.5** ± 44.8	72.9** ± 16.5	516.0** ± 66.7	297.5** ± 44.8	72.9** ± 16.5
	F_2	338.2** ± 31.0	371.8** ± 72.8	305.7** ± 56.4	156.7** ± 27.3	179.1** ± 32.7	198.3** ± 43.3	1111** ± 161.6	,559.7** ± 119.8	1097** ± 173.3	877.1** ± 164.8	587.2** ± 128.3	256.5** ± 79.1
H_2	F_1	222.7** ± 26.4	229.3** ± 61.9	254.5** ± 47.9	88.6** ± 23.1	107.7** ± 27.8	158.2** ± 36.7	820.2** ± 137.3	503.3** ± 101.8	797.5** ± 147.3	635.7** ± 140.1	408.6** ± 109.0	236.5** ± 67.2
	F_2	97.2** ± 13.9	138.8** ± 27.5	111.8** ± 19.9	33.6** ± 9.1	58.5** ± 17.3	23.2** ± 4.7	202.0** ± 31.7	211.4** ± 36.0	64.8** ± 14.1	418.6** ± 56.7	211.4** ± 36.0	64.8** ± 14.0
F	F_1	61.7** ± 17.7	96.4* ± 35.0	23.1 ± 25.4	35.2** ± 11.6	7.8 ± 22.1	0.9 ± 6.0	128.6** ± 40.5	38.7 ± 48.5	0.0 ± 17.9	119.0 ± 72.3	38.7 ± 48.5	0.0** ± 17.9
	F_2	97.8** ± 16.8	152.9** ± 39.4	70.2* ± 30.5	97.8** ± 14.7	80.2** ± 17.7	0.6 ± 23.4	293.9** ± 87.5	91 ± 64.9	286.9** ± 93.9	257.0** ± 89.3	202.4** ± 69.5	29.7 ± 42.8
E	F_1	1.6 ± 2.3	1.6 ± 4.5	2.0 ± 3.3	1.3 ± 1.5	1.1 ± 2.8	0.6 ± 0.8	1.8 ± 5.3	0.9 ± 6.3	0.8 ± 2.3	2.4 ± 9.5	0.9 ± 6.3	0.8 ± 2.3
	F_2	1.4 ± 1.1	2.4 ± 2.6	1.8 ± 1.9	0.7 ± 0.9	1.0 ± 1.1	0.6 ± 1.5	2.5 ± 5.7	2.1 ± 4.2	1.8 ± 6.1	2.2 ± 5.8	1.5 ± 4.5	0.8 ± 2.8
h^2	F_1	239.9** ± 9.2	34.6 ± 18.3	216.8** ± 13.3	27.5** ± 6.1	0.2 ± 11.6	0.1 ± 33.2	3.1 ± 21.2	6.6 ± 25.5	5.3 ± 9.4	893.4** ± 37.9	6.6 ± 25.5	5.3 ± 9.4
	F_2	239.9** ± 9.2	34.6 ± 18.3	216.9** ± 13.3	27.5** ± 6.1	0.2** ± 11.6	0.1 ± 3.2	3.0 ± 21.2	6.6 ± 25.6	5.3 ± 9.4	893.4** ± 37.9	6.6 ± 25.5	5.3 ± 9.4
$(H_1/D)^{1/2}$	F_1	2.1	1.6	1.7	1.0	1.2	1.4	1.7	1.7	1.2	2.4	1.7	1.3
	F_2	3.1	2.3	2.6	1.9	1.9	3.4	3.5	2.4	2.9	3.2	2.5	2.4
$H_2/4H_1$	F_1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	F_2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.8

* Significant at p = 0.05 and ** significant at p = 0.01