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VARIABILITY PARAMETERS AND CORRELATION COFFICIENT ANALYSIS FOR YIELD AND ITS COMPONENTS IN BARLEY (*HORDEUM VULGARE* L.)

Rajendra Kumar *et al.,*

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RAJENDRA KUMAR[1], RAVI KUMAR*[1], SUDHIR KUMAR[2], NEERAJ KUMAR[3] AND PRADEEP KUMAR[1]
[1]Department of Genetics and Plant Breeding,
Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut - 250 110, INDIA
[2]Department of Entomology, S. V. P. University of Agriculture and Technology, Meerut - 250 110, INDIA
[3]Department of Zoology, Vardhman College Bijnor - 246 701, INDIA
e-mail: ravik8401@gmail.com

ABSTRACT

Analysis of variance showed high significant variability among the genotypes for all characters *viz*., days to 50% flowering, days to maturity, plant height, number of tiller per plant, grain per spike, length of spike, duration of reproductive phase, 1000-grain weight, biological yield per plant, grain yield per plant and harvest index indicating wide spectrum of variation among the genotypes. High heritability estimates were recorded for days to 50% flowering, days to maturity, plant height, number of tillers per plant, length of spike, grain per spike, 1000-grain weight, biological yield per plant, grain yield per plant and harvest index. This indicates that lesser effect of environment on these traits. High heritability coupled with high genetic advance were observed for number of tillers per plant, length of spike, grain per spike, biological yield per plant and grain yield per plant. This indicates that influence of additive gene action on these characters and hence may prove useful for effective selection. Grain yield revealed significant positive correlation with harvest index, length of spike, 1000-grain weight, number of tillers per plant, grain per spike, biological yield per plant at genotypic and phenotypic level.

***Corresponding author**

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the first domesticated crop species in the world as evident from the archeological records. It has been considered as poor man's crop because of its input requirement and better adaptability to haresh environment, like drought, salinity, alkanity and marginal lands. The major utilization of barley as cattle feed and food, recent increase in industrial demand of barley as raw material result in its transformation as industrial crop. The barley products like Sattu and missi roti traditionally used in regular routine. Barley consumption reduces the plasma blood cholesterols content because of its high beta glucan content. Thus, it helps in prevention of high blood pressure and related heart problem. In modern times can serve as a very good nutritional as well as medicinal food, where the use of traditional food products decreased in fast food culture. In the future, no increment in area under barley is expected and all increase in production would have to be through production increase. The increasing costs of inputs and the escalation in the cost of barley production as also issue related to sustainability of productivity to meet out the increasing food demand for the rapidly growing population of India. The knowledge about the factors responsible for high yield is a difficult problem. Therefore, for attainment of high yield level, the breeder is required to simplify this complex situation through handling of yield components which have negative correlation with each other. For this rational approach it is essential to get information on the nature and magnitude of association between different yield components to resolve the quality, quantity and their mode of contribution to yield by Paroda and Joshi (1970), Bhatt (1973) and Lush (1949) referred the idea about heritability. He defined it as the measurement of the index of transmissibility of a character from parents to their offspring's; therefore, it is quite helpful to make an improvement in crop species through selections for various characters including quality attributes. The study of genetic advance is equally important as it measures the genetic gain based on selection in a particular character. Therefore, for any crop improvement programme through the selection, study of genetic variability, heritability together with genetic advance and correlation analysis is necessary. Similar types of work done by few researches *viz.,* Raikwar *et al.* (2003), Singh *et al.* (2006), Mishra *et al.*(2008), Sukhram *et al.* (2010), Khazaei *et al.* (2011), Khaiti (2012) and Kalpanden *et al.* (2015).

MATERIALS AND METHODS

The experimental material consisted of thirty genetically divers genotypes of barley (*Hordeum vulgare* L.) The present investigation was conducted during the rabi season of 2011-12 at the crop research center, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.). The experiment was laid out in Randomized Block Design with three replications. The entries were sown by hand dibbling method in a single row plot of 5 m long with row to row distance 23 cm and plant to plant distance 10 cm, respectively. The recommended cultural practices

were carried out to raise good crop. The pre and post harvest observations were recorded on five plants selected at random from each genotype in each replication for eleven characters. Mean of the data from the sampled plants of each plot in respect of different characters were used for various statistical analysis. Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated by the method suggested by Johnson *et al.* (1955). Correlation coefficients were calculated for all the character combinations at genotypic and phenotypic levels as per the formula given by (Searle, 1961), heritability (Allard, 1960), genetic advance (Allard, 1960), was done in the present study.

RESULTS AND DISCUSSION

In the present study, thirty genotypes of barley have been screened for grain yield and its component characters. Screening of the material study under present investigation exhibited (Table 1) sufficient variability for all the eleven characters, indicating wide spectrum of variation among the genotypes. Raikwar *et al.* (2003), Yadav *et al.* (2004), Singh *et al.* (2006), Mishra *et al.* (2008), Sukhram *et al.* (2010), Khazaei *et al.* (2011) and Kalpande *et al.* (2015) also reported similar result which supported the present finding.

High heritability (>60%) in broad sense was high for days to 50% flowering, days to maturity, plant height, number of tillers per plant, length of spike, number of grain per spike, 1000-grain weight, biological yield per plant, grain yield per plant and harvest index. The high heritability denotes high proportion of genetic effects in the determination of these characters and can be adopted for improving grain yield. These finding was in accordance with by Bouzerzour *et al.* (1995), Sajeda *et al.* (1997), Lalic *et al.* (2005), Fox *et al.* (2007), *Sirohi et al.* (2012) and Kalpande *et al.* (2015).

In the present study high heritability coupled with high genetic advance were observed for number of tillers per plant, length of spike, number of grain per spike, biological yield per plant and grain yield per plant. This indicates that influence of additive gene action on these characters and hence may prove useful for effective selection. High heritability coupled with high genetic advance for some of these characters have also been reported earlier by Al-Yassin *et al.* (2005), Fox *et al.* (2006), Singh *et al.* (2008), Kakani and Sharma (2010), Sirohi *et al.* (2012) and Kalpande *et al.* (2015). Estimates phenotypic coefficient of variance (PCV) and genotypic coefficient of variance (GCV) were high (>25%) (Table 2) for biological yield per plant, grain yield per plant, number of grain per spike, harvest index and number of tillers per plant, moderates (10-25%) for length of spike, 1000-grain weight and days to maturity and low (<10%) for duration of reproductive phase and plant height. This suggested that the parents chosen on the basis of these characters may be utilized in the crossing programme for obtaining good transgressive segments. These findings are similar in agreement with earlier reported by Bhattym *et al.* (1996), Sajeda *et al.* (1997), Rybinski *et al.* (2007) and Kalpande *et al.*(2015).

High (>20%) estimates of genetic advance expressed as percent of mean have been observed for number of tillers per plant, length of spike, number of grain per spike, biological yield per plant and grain yield per plant. This indicates good response for selection based on *per se* performance for these characters. On the basis of the value of phenotypic and genotypic correlation coefficient (Table 3) depicted for all the eleven traits, grain yield per plant was significantly associated with number of tillers per plant, length of spike, number of grain per spike, biological yield per plant, harvest index and 1000-grain weight two traits *viz.*, harvest index and length of spike are more important since these have highest correlation coefficient values. This suggests that grain yield can be increased whenever there is an increase in characters that showed positive and significant association with grain yield. Hence, these characters can be considered as criteria for selection for higher yield as these are mutually and directly associated with

Table 1: Analysis of variance (ANOVA) for eleven characters of barley (*Hordeum vulgare L.*)

Source of variations	d.f	Days to 50% flowering	Days to maturity	No. of tillers per plant	Plant height (cm)	Duration of reproductive phase	Length of spike (cm)	No. of grains per spike	Biological yield per plant (g)	Harvest index	Grain yield per plant(g)	1000 Grain weight(g)
Replication	2	3.377	0.544	0.069	1.368	2.133	0.002	2.809	0.039	0.039	0.000	0.053
Treatment	29	14.499**	34.389**	4.063**	44.938**	9.129**	7.061**	23.450**	8.251**	8.580**	7.440**	45.772**
Error	58	2.492	1.234	0.107	0.711	2.491	0.008	3.001	0.263	1.088	0.031	0.406

** Significant at 5% and * Significant at 1% level

Table 2: Estimates of variability parameters for eleven characters in barley (*Hordeum vulgare L.*)

Characters	Heritability (%)	Genetic advance	GA (% of mean)	GCV (%)	PCV (%)
Days to 50% flowering	61.600	3.235	3.952	2.444	3.113
Days to maturity	89.900	6.495	3.331	11.705	11.797
No. of tiller per plant	89.900	16.495	28.331	25.705	25.797
Plant height (cm)	95.300	7.725	9.071	4.508	4.616
Duration of reproductive phase	47.000	2.101	5.131	8.631	8.294
Length of spike (cm)	99.600	3.153	30.456	14.809	14.835
No. of grains per spike	69.400	14.481	22.932	27.534	29.041
Biological yield per plant (g)	91.000	13.206	28.555	34.353	34.563
Harvest index (%)	91.000	3.206	8.555	26.353	26.563
Grain yield/plant (g)	98.700	13.216	23.920	31.686	31.760
1000 Grain weight (g)	69.600	2.717	7.965	14.633	15.551

Table 3: Estimates of correlation coefficient for genotypic (G) and phenotypic (P) levels among different characters in barley (*Hordeum vulgare L.*)

Characters		Days to 50% flowering	Days to maturity	No. of tillers per plant	Plant Height (cm)	Duration of reproductive phase	Length of spike (cm)	No. of grains per	Biological yield spike (g)	Harvest index (%) per plant	1000 Grain weight (g)	Grain yield per plant (g)
Days to 50%	G	**1.000**	0.15	-0.046	0.378**	-0.01	0.105	-0.101	-0.157	0.177	0.177	0.102
flowering	P	**1.000**	0.097	-0.006	0.314**	-0.002	0.08	-0.071	-0.119	0.136	0.151	0.197
Days to maturity	G		**1.000**	0.051	0.176	0.152	0.066	-0.108	0.354**	0.21	0.437**	0.139
	P		**1.000**	0.047	0.171	0.129	0.052	-0.026	0.363**	0.222	0.286**	0.076
No. of tillers per plant	G			**1.000**	0.095	-0.231	-0.165	-0.103	0.129	0.005	0.226	0.520**
	P			**1.000**	0.1	-0.097	-0.156	-0.208	0.115	0.023	0.102	0.334**
Plant Height (cm)	G				**1.000**	-0.196	-0.17	0.361**	0.126	0.02	0.137	0.081
	P				**1.000**	-0.142	-0.161	0.392**	0.023	-0.075	-0.083	0.056
Duration of reproductive phase	G					**1.000**	-0.009	-0.092	0.227	-0.051	0.003	0.066
	P					**1.000**	-0.007	-0.164	0.208	-0.08	0.197	0.08
Length of spike(cm)	G						**1.000**	0.783**	-0.148	0.468**	0.274	0.372**
	P						**1.000**	0.648**	-0.15	0.460**	0.234	0.420**
No. of grains per spike	G							**1.000**	-0.085	0.360**	0.098	0.320**
	P							**1.000**	-0.055	0.329**	-0.005	0.281**
Biological yield per plant (g)	G								**1.000**	-0.036	-0.107	0.350**
	P								**1.000**	-0.045	-0.095	0.328**
Harvest index (%)	G									**1.000**	0.553**	0.929**
	P									**1.000**	0.397**	0.916**
1000 Grain weight (g)	G										**1.000**	0.494**
	P										**1.000**	0.373**
Grain yield per plant (g)	G											**1.000**
	P											**1.000**

** Significant at 5% and * Significant at 1% level

grain yield. Similar type of association was reported by Singh *et al*. (2014), Kalpande *et al*. (2015) and Deepak *et al*. (2015).

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