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Short Communication

Genetic analysis for grain yield and its components in barley (*Hordeum vulgare* L.)

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Abstract

Fifty two genotypes of barley were investigated for variability, character association and,path analysis for grain yield and its components. The data were recorded for days to 50% flowering, days to maturity, plant height, number of tillers per plant, spike length, grains per spike, 1000 grain weight, biological yield per plant, harvest index and grain yield per plant. Estimates of broad sense heritability were high for all traits except days to maturity, number of tillers per plant and, grain yield per plant. High heritability estimates coupled with moderate genetic advance as percentage of mean were recorded for biological yield per plant, grains per spike, plant height and days to 50% flowering. From path analysis recorded the highest positive direct effect of days to 50% flowering, biological yield per plant and lowest due to days to maturity on grain yield.

Keywords: Barley, Correlation, Path analysis, Heritability, Genetic advance

1. Introduction

Barley (Hordeum vulgare L.) is a self-pollinated crop with basic chromosome n =7 and belong to family *Poaceae.* Barley is considered as the fourth most important crop in the world after wheat, maize and rice Marwat *et al.* (2012). During the year 2012-13, the total harvested area of barley in India was 695 thousand hectares, with production 1743 thousand tones and productivity 25.1 q/ha. Madhya Pradesh has the immense potential; emerge as a front running state in production as well as grain trading. The area production and productivity of barley in states during 2012-13 was 84.9 thousand hectares, 144.9 tones, 17.1q/ha, respectively (Anonymous, 2012-13). It is apparent that information on morphological aspect of crop is also key feature to plan a resourceful breeding program. Construction of selection index that combines information on all the characters associated with dependent variable is the better way of exploiting genetic correlation and path coefficient with several traits having high heritability. Keeping in view the above perspective, the present research work was taken up to assess variability, heritability, correlation coefficients and, path coefficient to identify desirable characters for breeding programmes.

2. Materials and methods

Description of the study sites: Genetic analysis for component traits was carried out under All India Coordinated Research Project on Barley. The field experimentation was laid out on 22 November 2012 at JNKVV, College of Agriculture, Rewa, M.P.

The 52 genotypes were tested in randomized block design with three replications the parents were selected on the basis of different genetic and geographical origin. Data were organized by randomly selecting 10 competitive plants of each replication and genotypes for the all characters under study. Data collected on traits viz., days to 50% flowering, days to maturity, plant height (cm), number of tillers per plant, spike length (cm), grains per spike, 1000 grain weight (g), biological yield per plant (g), harvest index (%) and grain yield per plant (g) as yield component characters. The experimental data were subjected to statistical analysis as following standard statistical procedure described Panse and Sukhatme (1967) to assess component of variance and coefficient of variation. Correlation coefficient between different characters were calculated as per Miller *et al.* (1958), path coefficient analysis was done as suggested by Dewey and Lu (1959).

3. Results and discussion

Variability: The data pertaining to range, mean, GCV, PCV, heritability and genetic advance for 10 quantitative traits are presented in (Table 1.). Analysis of variance showed significant variation for all the traits studied indicating considerable amount of variation among the germplasm for each character. The estimates of phenotypic coefficient variation (PCV) were higher than genotypic coefficient variation (GCV) for all the traits under studied however, relatively low magnitude of difference was observed between GCV and PCV indicating less environmental influence. The highest estimate of PCV was observed for number of tillers per plant and lowest for days to maturity. Similar result was substantiated by Mishra *et al.* (2008).

Table 1. Estimation of mean, range and different genetic parameters for different characters in barley

S. N.	Character	Mean	Max.	Min.	PCV	GCV	$h^2_{(B)}$	GA	GA (%)
1	Days to 50% flowering	74.75	83.00	64.00	7.22	7.20	86	10.30	13.77
2	Days to maturity	121.11	124.00	119.00	0.96	0.93	45	1.54	1.27
3	Plant height (cm)	93.90	116.50	85.70	7.23	6.74	87	12.16	12.94
4	No. of tillers /plant	9.43	13.00	6.00	23.62	15.60	44	2.00	21.0
5	Spike length (cm)	8.25	9.40	7.10	8.45	6.88	66	0.95	11.5
6	Grains /spike	55.9	69.00	39.00	13.4	12.6	88	13.70	24.53
7	1000grain weight(g)	40.91	44.57	37.90	4.31	4.00	86	3.13	7.65
8	Biological yield/plant(g)	74.87	95.50	56.20	10.18	9.58	89	17.63	23.53
9	Harvest index (%)	38.93	45.70	30.37	8.47	6.86	66	4.02	10.34
10	Grain yield /plant	28.85	33.30	23.40	7.82	5.24	45	2.81	9.7

Wheat, PCV-Phenotypic coefficient of variation; GCV-Genotypic coefficient of variation; $h^2_{(B)}$ -Broad sense heritability; GA-Genetic advance; GA(%)-Genetic advance as percent of mean

Heritability: Heritability at highest were recorded for all the component traits except days to maturity, number of tiller per plant and grain yield per plant. These three traits were moderately heritable, similar finding reported by Akanksha *et al.* (2012), Om Vir and Sultan (2013), Kumar *et al.* (2013), and none was had the lowest values. Characters *viz.*, grains per spike,number of tiller per plant and biological yield per plant recorded high genetic advance as percent of mean.The estimates of heritability and genetic advance in combination are more important than heritability alone (Panse, 1967). High heritability coupled with high genetic advance as percentage of mean was recorded for grains per spike and biological yield per plant.Similar results were also reported by Mishra *et al.* (2008).which indicated the prevalence of additive gene action in the expression of this trait. Characters *viz.*, days to 50% flowering, plant height, spike length and harvest index recorded high heritability with moderate genetic advance as percentage of mean which indicated both additive to non- additive gene actions might be involved in controlling these traits.

Correlation and path analysis: Knowledge on association will help in selection of characters during breeding programme.Phenotypic and genotypic correlation coefficients are presented in (Table 2.). Significant positive correlation of biological yield per plant, 1000 grain weight, spike length, number of tillers per plant and days to 50%flowering were found with grain yield per plant. Similar results were substantiated by Shahinnia, *et al.* (2005). These were because of the good grain filling, high-biomass above ground surface, high spike length, early maturing leads to higher yield. Number of tiller per plant exhibited a significant positive correlation with spike length and grains per spike. Similarly, a significant positive correlation of spike length with 1000 grain weight and biological yield per plant were observed and also significant association between 1000 grain weight and biological yield was observed similar findings were reported by Najeeb and Wani(2004), Drikvand *et al.* (2011), Shahinnia *et al.* (2005) and Pal *et al.* (2010). Grain yield was taken as dependent variable; biological yield per plant had highest positive direct effect on grain yield per plant (Table 3.) and also, biological yield per plant had highest positive indirect effect on grain yield per plant *via* 1000 grain weight, days to 50 % flowering, and spike length. Similar results were confirmed by report of Dadashi *et al.* (2010), Carpc and Celk (2012). Therefore preference given to these traits in selection programme will help to isolate superior lines with genetic potentiality for higher yield.

Table 2. Phenotypic and genotypic correlation matrix

Character		Days to flowering	Days to maturity	Plant height (cm)	No. of tillers / Plant	Spike length (cm)	Grains /spike	1000 Grain weight (g)	Biological yield/ Plant(g)	Harvest index (%)	Grain yield / plant(g)
Days to flowering	P	1.000	0.424**	0.183*	-0.080	0.461**	-0.095	0.565**	0.285**	-0.095	0.262**
	G	1.000	0.728	0.205	-0.103	0.599	-0.099	0.657	0.323	-0.143	0.402
Days to maturity	P		1.000	0.049	-0.096	0.248**	-0.046	0.264**	0.145	-0.092	0.105
	G		1.000	0.144	-0.234	0.386	-0.097	0.408	0.22	-0.084	0.294
Plant height (cm)	P			1.000	-0.083	0.190*	0.009	0.085	0.163*	-0.255**	-0.051
	G			1.000	-0.134	0.287	0.008	0.104	0.204	-0.356	-0.169
No. of tillers / plant	P				1.000	0.162*	0.163*	0.111	0.098	0.101	0.236**
	G				1.000	0.322	0.243	0.092	0.147	0.330	0.580
Spike length (cm)	P					1.000	0.031	0.577**	0.256**	0.060	0.307**
	G					1.000	0.048	0.738	0.329	0.039	0.665
Grains /spike	P						1.000	0.140	0.043	0.059	0.093
	G							0.151	0.085	0.086	0.183
1000 Grain weight (g)	P							1.000	0.217**	-0.014	0.338**
	G							1.000	0.314	-0.007	0.493
Biological yield/ Plant(g)	P								1.000	-0.613	0.440**
	G								1.000	-0.823	0.733
Harvest index (%)	P									1.000	0.006
	G									1.000	0.147
Grain yield/ plant(g)	P										
	G										

****,*:** *Significant at p = 0.05 and p = 0.01*

Table 3. Phenotypic path analysis coefficient

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of tillers / plant	Spike length (cm)	Grains /spike	1000 Grain weight (g)	Biological yield/ plant(g)	Harvest index (%)	Grain yield / Plant(g)
Days to 50% flowering	0.0751	0.0319	0.0138	-0.0060	0.0346	-0.0072	0.0424	0.0215	-0.0072	0.2627
Days to maturity	-0.0007	-0.0017	-0.0001	0.0002	-0.0004	0.0001	-0.0005	-0.0002	0.0002	0.1057
Plant height (cm)	-0.0147	-0.0039	-0.0802	0.0067	-0.0152	-0.0008	-0.0068	-0.0131	0.0205	-0.0518
No. of tillers /plant	-0.0098	-0.0117	-0.0101	0.1217	0.0197	0.0199	0.0136	0.120	0.0124	0.2360
Spike length(cm)	0.0136	0.0073	0.0056	0.0048	0.0294	0.0009	0.0170	0.0016	0.0018	0.3073
Grains / spike	-0.0018	-0.0009	0.0002	0.0030	0.0006	0.0185	0.0026	0.0008	0.0011	0.0936
1000 grain weight (g)	0.0649	0.0304	0.0098	0.0128	0.0663	0.0161	0.1149	0.0312	-0.0017	0.3386
Biological yield/ plant(g)	0.1688	0.0859	0.0965	0.0259	0.1516	0.0259	0.1604	0.5905	-0.362	0.4407
Harvest index (%)	-0.0327	-0.0315	-0.0873	0.0202	0.0207	0.202	-0.0049	-0.2905	0.3413	0.0060
Grain yield/ plant(g)	0.2627	0.1507	-0.0518	0.0936	0.3073	0.4407	0.3386	0.4407	0.0060	
Partial R^2	0.0197	-0.0002	0.0042	0.0090	0.0389	0.0287	0.0017	0.2602	0.0020	Partial R^2

R=Residual

Experimental result concludes that significant genetic variability was observed for grain yield and its components. Characters *viz.,* biological yield per plant, 1000 grain weight and spike length (cm), were identified as major yield contributing characters.

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