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GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN DIVERSE GENOTYPES OF BARLEY (HORDEUM VULGARE L.)

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ABSTRACT
Genetic diversity is a primary prerequisite for improvement in genetic makeup of plant through breeding. So an experiment was conducted to investigate the genetic diversity among fourteen genotypes of Barley (*Hordeum vulgare* L.). The mean data estimated were subjected to analysis of variance, correlation coefficient and path analysis to identify promising genotypes for ten quantitative traits, during *rabi* 2011-12 and 2012-13. High GCV and PCV were observed for number of effective tillers per plant (29.86, 28.97), peduncle length (30.96, 30.67) and grain yield per plant (21.82, 20.72). The character association study revealed significant positive association of grain yield per plant with 1000 grain weight ($r_p = 0.83$), peduncle length ($r_p = 0.51$), number of effective tillers per plant ($r_p = 0.46$) and plant height ($r_p = 0.18$). Hence by exercising selection for these characters, it may be possible to isolate superior, high yielding genotypes. Path coefficient analysis revealed high positive direct effect of 1000 grain weight followed (0.72) by number of effective tillers per plant (0.62), number of grains per ear (0.41), and plant height (0.25).

INTRODUCTION

Barley (*Hordeum vulgare* L.) is the oldest crop in the world. It ranks fourth in both quantity produced and in area of cultivation of cereal crops in the world. The annual world harvest of barley in the late century was approximately 140 million tonnes from about 55 million ha. It is very versatile in every way and has well adapted through its evolution. In fact, it is the most adaptable cereals. Barley is a major source of food for large number of people in the cooler and semiarid areas of the world where other cereals are poorly adapted.

Being an important crop, the barley has been neglected in our country due to priority on wheat, rice and other cash crops. As a result the harvested area, production and productivity are falling down year by year. Average productivity in India is 19.3 q/ha as compared to 24.7 q/ha of worlds average. Although it requires less fertilizer and irrigation and its price stands in market equal to wheat. Till date availability of desirable genotypes with better yielding is not completely satisfactory. Hence effort is being made to develop the desirable genotype which also can be adopted in various range of environmental stress; it is the ultimate goal of plant breeders (Sabaghpour *et al.* 2003). This crop originated in the 'Fertile Crescent', most likely from geographic areas within Israel, with the Himalayas as a diversification region of domesticated barley (Azhaguval and Komatsuda 2007).

Grain yield, being a complex entity is subjected to environmental fluctuation and is largely dependent on interrelation of various components. The understanding of genetic correlation usually helps in finding out the phenotypic character which are closely associated with seed yield. Wright, (1921) suggested path analysis which provides a clear understanding of the direct and indirect effect of various components attributing to the expression of seed yield. A successful selection depends upon the information on the genetic variability and association of morpho-agronomic traits with grain yield (Binod *et al.* 2013). Desirable attributes along with higher yield from two or more genotypes could be brought together through hybridization and ultimately a new line, reflecting desirable attribute of the parents are developed (Potla *et al.,* 2013). Therefore, in view of these fact fourteen barley variety evaluated in this study, with an objective of the screening genetic variability present in the genotypes for yield and its contributing characters.

MATERIALS AND METHODS

The experimental materials consisted of fourteen genotypes of Barley, obtained from the All India Co-ordinate Barley Improvement Project. The present investigation was conducted during the *rabi* season of 2011-12 and 2012-13 at the Agriculture Research Farm of Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment was laid out in Randomized Block Design with four replications. Each entry was sown with a six row of 1.5 m length with row to row spacing of 30 cm and plant to plant spacing of 10 cm. 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 ten 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 Burton (1952). The estimates of PCV and GCV were classified as low, moderate and high according to Sivasubramanian and Madhavamenon (1973). Correlation coefficients were calculated for all the character combinations at genotypic and phenotypic levels as per the formula given by Miller *et al* (1958). Path coefficient analysis was under taken in parents for designing new plant type with the knowledge of direct and indirect influence of yield contributing characters on yield. Wright (1921) proposed the original technique; analysis was carried out by modified method devised by Dewey and Lu. (1959). Path coefficients were rated based on the scales given by (Lenka and Mishra 1973).

RESULTS AND DISCUSSION

The analysis of variances for genetic advance showed highly significant difference among the genotypes for all the ten characters studied, including appreciable amount of variability between the genotypes. Considering the magnitude of phenotypic and genotypic coefficient of variation it was revealed that, peduncle length, number of effective tillers per plant, grain yield per plant and number of grains per ear had relatively larger amount of genetic variability. Singh *et al*. (2008), Sharma and Maloo (1994), Jalata *et al*. (2011) also reported similar result which supported the present finding.

Heritability in broad sense was high for number of grains per ear, plant height, peduncle length, 1000-grains weight and days to 75% heading. These finding was in accordance with Therrien (2006), Jalata *et al*. (2011). In the present study, high heritability coupled with high genetic advance was estimated for plant height and number of grain per ear. A character exhibiting high heritability may not necessary give high genetic advance. Genetic advance as percentage of mean was higher for peduncle length and number of effective tillers per plant; similar finding was also observed by Singh *et al*. (2008).

On the basis of the value of phenotypic correlation coefficient (Table 1) depicted for all the 10 traits, grain yield per plant was significantly associated with peduncle length, number of effective tillers per plant and 1000-grain weight in present study. 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 grain yield. Similar type of association was reported by Pal *et al*. (2010), Ram Kishor *et al*. (2000). The effect of plant height, spike length with awn, numbers of grains per ear, number of effective tillers per plant and 1000 grain weight on grain yield per plant were observed as direct and positive (Table 2). These result were consonance with that of Najeeb and Wani (2004) and Mittal *et al*. (2009) for 1000 grain weight and plant height upon grain yield. Thus, an overall observation suggested that the selection of an ideal plant may be based on plant height, number of effective tillers per plant and 1000 grain weight.

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Table 1: Estimates of phenotypic correlation coefficient between yield and its related characters of 14 genotypes of barley

Traits	Days to 75% heading	Days to maturity	Peduncle length	Plant height	Spike length with awn	Spike length without awn	No. of grains/ear	No. of effective tillers/plant	1000-grain weight	Grain yield/plant
Days to 75% heading	1.00	0.77**	-0.44**	0.35**	0.09	0.07	0.29*	-0.005	-0.55**	-0.55**
Days to maturity		1.00	-0.44**	0.40**	0.16	0.13	0.30*	-0.03	-0.36**	-0.36**
Peduncle length			1.00	0.35**	-0.12	0.17	-0.52**	0.37**	0.56**	0.51**
Plant height				1.00	0.30*	0.20	-0.22	0.12	0.26*	0.18
Spike length with awn					1.00	0.69**	0.13	-0.04	-0.11	0.01
Spike length without awn						1.00	0.09	0.15	-0.17	0.004
No. of grains per ear							1.00	-0.80**	-0.60**	-0.60**
No. of effective tillers per plant								1.00	0.29*	0.46**
1000-grain weight									1.00	0.83**

*Significant at 5% level of significance, **Significant at 1% level of significance

Table 2: Estimates of direct and indirect effects between yield and its related characters of 14 genotypes of barley

Traits	Days to 75% heading	Days to maturity	Peduncle length	Plant height	Spike length with awn	Spike length without awn	No. of grains/ear	No. of effective tillers/plant	1000-grain weight
Days to 75% heading	**-0.35**	-0.27	0.15	-0.12	-0.03	-0.02	-0.10	0.002	0.19
Days to maturity	-0.10	**-0.13**	0.06	-0.05	-0.02	-0.02	-0.04	0.004	0.05
Peduncle length	0.08	0.08	**-0.18**	-0.06	0.02	-0.03	0.10	-0.07	-0.10
Plant height	0.08	0.10	0.09	**0.25**	0.07	0.05	-0.05	0.03	0.06
Spike length with awn	0.002	0.003	-0.002	0.01	**0.02**	0.01	0.003	-0.001	-0.002
Spike length without awn	-0.0004	-0.001	-0.001	-0.001	-0.004	**-0.01**	-0.001	-0.001	0.001
No. of grains per ear	0.12	0.12	-0.22	-0.09	0.05	0.04	**0.41**	-0.33	-0.25
No. of effective tillers per plant	-0.003	-0.02	0.23	0.07	-0.03	0.09	-0.50	**0.62**	0.18
1000-grain weight	-0.38	-0.25	0.39	0.18	-0.08	-0.12	-0.42	0.20	**0.70**

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