Environment & Ecology 29 (1) : 133—135, 2011
 ISSN 0970-0420

Character Association and Component Analysis in Garden Pea (*Pisum sativum* L. *hortense*)

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Abstract

An experiment was conducted to study character association among different quantitative characters and their direct and indirect effects on seed yield in garden pea crosses. Analysis of variance showed significant differences among all crosses for all characters, indicating that there is ample scope for selection of promising crosses from present gene pool for yield improvement in garden pea. Plant height, pods per plant and primary branches per plant showed positive and significant correlation with seed yield at genotypic and phenotypic levels, suggesting, their potential use as selection indices for improvement of garden pea genotypes for higher yield. Further, plant height and pods per plant exhibited high positive direct effect on seed yield.

Key words : Garden pea, Character association, Direct effect, Indirect effect.

Pea is among the four important cultivated legumes next to soybean, groundnut and bean. The pean occupies an area of 2.0 to 2.5 million hectare with an annual production of 17.65 million tones (1). In India, productivity of this crop remained stagnant and area is shrinking due to competition from irrigated wheat and more remunerative pulses. Therefore, there is an urgent requirement to increase the pea production to cater the needs of growing population. But the economic yield or seed yield in majority of crops is a complex entity whose manifestation results from multiplicative interactions of several yield components and environmental factors. Therefore, selections made on the basis of phenotypic expression alone are likely to be misleading. It is therefore, essential, to have the knowledge of interrelationships existing among the yield component characters. Correlation coefficient provides a measure of association between the characters and reveals the character that might be useful as an index for selection. The present experiment was undertaken to study character association among different yield contributing characters and with seed yield in garden pea.

Methods

The experiment was carried out during *rabi* 2007-08 at Field Experimentation Centre, Departmentation Centre, Department of Genetics and Plant Breeding. The experimental material for the present study comprised 34 entries (16 parents, 17 crosses and a check), planted in randomized block design with three replications in two row plot of 4 m length. Recommended agronomic practices were followed to grow a healthy crop. Observations were recorded on 10 randomly selected plants for eight characters viz., days to 50% flowering, days to maturity, plant height (cm), no. of primary branches per plant, pod length, no. of pods per plant, 100-seed weight (g) and pod yield per plant (g). The genotypic and phenotypic correlation coefficients were estimated following Al-Jibouri et al. (2) and the measures of direct and indirect effects were obtained according to the procedure given by Dewey and Lu (3).

Results and Discussion

A clear understanding of genetic variability for different characters is a pre-requisite for plant breeder before going for selection of appropriate genotype. Analysis of variance showed significant differences among all entries, indicating the presence of adequate genetic variability among them for eight characters (Table 1).

Table 1. Analysis of variance for eight characters in garden pea. * and ** significant at 0.05 and 0.01 level if significance, respectively.

	Characters	Mean sum of squares		
		Replication	Treatment	Error
	Degrees of freedom	2	33	66
1	Days to 50% flowering	15.186	145.389**	5.842
2	Plant height (cm)	39.625	1530.109**	71.835
3	No. of primary branches/plant	0.186	0.950**	0.166
4	No. of pods/plant	77.686	513.962**	22.403
5	Pod length (cm)	0.672	0.681**	0.255
6	Days to maturity	0.618	60.682**	5.274
7	100-seed weight (g)	0.122	28.774**	0.055
8	Pod yield/plant (g)	63.229	656.499**	49.822

Information regarding the nature and extent of association of morphological characters would be helpful in developing a suitable plant type, in addition to yield improvement of, a complex character for which direct selection is not effective (Tables 2 and 3). Thus, it is important to explore the possibility of increasing grain yield by indirect selection of some component traits. Any unfavorable association between the desirable characters may lead to limited genetic advance. To study the inter-relationship of contributing characters and with seed yield, genotypic and phenotypic correlation coefficients were computed from the estimates of variances and co variances for all possible combinations of the characters studied. The characters plant height (0.89**, 0.77**), pods per plant (0.72**, 0.74**) and primary branches per plant (0.42**, 0.28**) recorded positive and significant correlation with seed yield at genotypic and phenotypic levels, respectively. The results of correlation coefficient revealed that genotypic correlations were higher in magnitude than phenotypic correlation coefficients, indicating that the traits are positively governed by additive gene action and are useful in genetic improvement of garden pea. Further, increase in plant height may help indirectly by increasing the leaf number which indicates the source of photosynthetic activity resulting in increased grain weight. The results are quite expected in case of pods per plant and primary branches because they are directly related with pod yield per plant. Thus selection for higher yield on the basis of above characters would be reliable Kumar et al. (4) reported significant correlation of seed yield with plant height, pod length, number of pods / plant and straw yield/ plant. But pod length exhibited with pod yield/plant at both genotypic and phenotypic levels. Patel et al. (5) also reported that yield/plant was positively as-

Table 2. Genotypic and phenotypic correlation coefficients for yield and yield contributing characters in garden pea crosses. * and ** significant at 0.05 and 0.01 level if significance, respectively.

	Characters	*r*	Plant height	Primary branches/ plant	No. of pods/ plant	Pod length	Days to maturity	100-seed weight	Pod yield/ plant
1	Days to 50%	r_g	– 0.04	– 0.07	– 0.19	0.41**	0.55**	– 0.31**	0.01
	flowering	r_p	– 0.03	– 0.02	– 0.16	0.25	0.49**	– 0.29**	0.01
2	Plant height	r_g		0.42**	0.73**	– 0.51**	0.20	0.11	0.89**
		r_p		0.33	0.66**	– 0.20	0.16	0.10	0.77**
3	No. of primary	r_g			0.50**	– 0.29**	– 0.39**	0.28	0.42**
	branches	r_p			0.38**	– 0.20	– 0.23	0.23	0.28**
4	No. of pods	r_g				– 0.70**	0.01	0.25	0.72**
	plant^{-1}	r_p				– 0.37**	– 0.04	0.23	0.74
5	Pod length	r_g					0.16	– 0.40**	– 0.48**
		r_p					0.10	– 0.24	– 0.23**
6	Days to maturity	r_g						– 0.31**	0.21
		r_p						– 0.27	0.24
7	100-seed weight	r_g							0.15
		r_p							0.13

Table 3. Direct (diagonal) and indirect effects of yield contributing characters on seed yield in garden pea crosses at genotypic and phenotypic level.

	Characters	Level	Days to 50% flowering	Plant height	Primary branches/ plant	No. of pods/ plant	Pod length	Days to maturity	100 seed weight	Pod yield/ plant
1	Days to 50% flowering	G	0.064	–0.003	– 0.005	– 0.012	0.027	0.352	– 0.020	0.010
		P	0.079	0.002	– 0.001	– 0.013	0.020	0.039	– 0.023	0.003
2	Plant height	G	– 0.031	0.763	0.323	0.560	– 0.389	0.159	0.082	0.889
		P	– 0.0158	0.483	0.158	0.317	– 0.101	0.078	0.031	0.768
3	Primary branches	G	– 0.002	0.013	0.030	0.015	– 0.009	–0.012	0.008	0.417
		P	0.001	–0.015	– 0.047	– 0.017	0.009	0.011	– 0.010	0.276
4	No. of pods/ plant	G	– 0.026	0.102	0.070	0.139	– 0.097	– 0.001	0.035	0.715
		P	– 0.073	0.298	0.170	0.454	– 0.167	– 0.016	0.103	0.740
5	Pod length	G	0.000	–0.000	– 0.000	– 0.000	0.000	0.000	– 0.000	–0.484
		P	0.003	–0.003	– 0.003	– 0.005	0.014	0.001	– 0.003	–0.228
6	Days to maturity	G	0.021	0.008	0.015	– 0.000	0.006	0.039	0.012	0.204
		P	0.014	0.005	– 0.007	– 0.001	0.003	0.028	– 0.008	0.135
7	100 seed weight	G	– 0.017	0.006	0.015	0.013	– 0.021	–0.016	0.053	0.146
		P	– 0.007	0.002	0.005	0.005	– 0.005	0.006	0.022	0.132

sociated with number of pods/plant, number of primary branches, plant height, pod length and number of seeds/pod.

Number of pods/plant recorded with plant height (0.73**, 0.66**) and primary branches/plant (0.50**, 0.38**) at both genotypic and phenotypic levels while pod length exhibited significant negative correlation with plant height (–0.51**), primary branches / plant (–0.29**) and pods per plant (–0.70**) at genotypic level. Days to maturity recorded significant positive correlation (0.55**, 0.49**) and 100 seed weight showed significant negative correlation (–0.31**, –0.29**) with days to 50% flowering at both genotypic and phenotypic levels.

All characters recorded positive direct effect on pod yield / plant but the characters, plant height (0.763, 0.483) and pods per plant (0.139, 0.454) exhibited maximum direct positive effect on seed yield at both genotypic and phenotypic levels, respectively. Sharma and Kalia (6) revealed that it was mainly the direct effect of which contributed to its association with pod yield/plant. High direct effect of can serve as reliable variable for selection (7). Patel et al. (5) also reported the greatest direct effect of number of pods / plant on yield. From the above results, it could be inferred that pods per plant, plant height and pod length primarily contribute to seed yield and can be used as selection criteria for yield improvement in garden pea.

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