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STUDY OF GENETIC VARIATION, HERITABILITY AND CORRELATION IN VEGETABLE PEA (*PISUM SATIVUM* L.)

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ABSTRACT
Twenty six genotypes of garden pea were evaluated for magnitude of Genetic variability, heritability, genetic advance and correlation for eleven yield contributing traits at V.R.C., GBPUAT, Pantnagar, Uttarakhand. The phenotypic coefficient of variation (PCV) was invariably higher than their corresponding genotypic coefficient of variation (GCV) for most of the characters. High genotypic coefficient of variation (GCV) as well as phenotypic coefficient of variation (PCV) was observed for plant height (25.94 and 25.58), pod yield per plant (25.28 and 25.32), number of pods per plant (21.89 and 24.22) and pod yield per hectare (20.34 & 20.62). High heritability with high genetic advance in percent of mean was observed for plant height (99, 53.36), total soluble solids (99, 53.36) and pod yield per plant (99, 51.99), which indicate that these traits were under additive gene control and selection for genotypic and phenotypic improvement for these traits would be effective. Correlation studies revealed that significant association of yield per hectare with pod yield per plant (0.84, 0.82), total soluble solids (0.72, 0.70), number of pods per plant (0.74, 0.62), and days to 50% flowering (0.67, 0.65) at genotypic and phenotypic level (GCV and PCV) respectively.

INTRODUCTION

Vegetable Pea (*Pisum sativum* var. *hortense* L.) is cultivated widely throughout the world. It is an important annual cool-season nutritious vegetable having pods as edible part. The pods are rich source of digestible protein, carbohydrates, vitamin A, vitamin C, phosphorus and calcium, has been employed. There is a very less work has employed regarding the crop improvement of vegetable pea. Critical analysis of the genetic variability is a prerequisite for initiating any crop improvement programme and for adoption of appropriate selection techniques (Dhanwani *et al*., 2013). The adequate information on extent of variability parameters may be helpful to improve the yield by selecting the yield component traits because yield is a complex trait, whose manifestation depends on the component traits (Mehandi *et al*., 2013). Generally, the estimates of heritability (h^2) of traits are environment specific (Shimelis and Shiringani, 2010). The higher the heritable variation, the greater will be the possibility of fixing the characters by selection methods. Therefore present investigation was carried out to assess the genetic variability and nature of association between yield and yield components in vegetable pea.

MATERIALS AND METHODS

The experimental material for the present investigation was comprised of 26 entries involving 21 new genotypes and 5 commercial checks were replicated in Randomized Block Design.The experiment was carried out at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, during *Rabi* season of 2012-13. The whole investigation was done under the scientific management practices. During study, observations for plant height, days to flower initiation, days to 50 per cent flowering, pod length, pod diameter, number of pods per plant, number of ovules per pod, pod yield per plant, pod yield per hectare, shelling percent and T.S.S. were recorded on five randomly selected plants from each treatment. The genotypic and phenotypic coefficients of variation were calculated as per the method was suggested by Comstock and Robinson (1952). Heritability in broad sense and expected genetic advance were calculated as per the formula given by Johnson *et al*. (1955) and Allard (1961) respectively. Data were subjected to statistical analysis for estimating correlation co-efficient among all possible combination at phenotypic and genotypic levels using formula of Al-Jibouri *et al*. (1958).

RESULTS AND DISCUSSION

In general, PCV values were higher than GCV values, which indicate the effect of environment on the expression of characters (Table 1). Characters showed considerable difference between PCV and GCV values, were number of pods per plant and number of ovules per pod (Table 1). It indicates more environment influenced variation rather than due to genotype, so these traits may be misleading in selection procedure in pea lines. Narrow differences observed between PCV and GCV values for plant height, days to 50% flowering, pod yield per plant, pod yield per hectare and total soluble solids, which revealed less environmental influence on the expression of these traits and these characters are rather stable.

Table 1: Genetic parameters for different characters in vegetable pea

S.No.	Characters	Range	General Mean	SEM	Coefficients of variance			Heritability h^2 (%)	Genetic Advance(GA)	GA as % of mean
					GCV	PCV	ECV			
1.	Plant height	41.65-114.91	63.31	0.54	25.94	25.98	1.48	99	33.78	53.36
2.	Days to flower initiation	31.33-50.67	39.98	1.02	12.46	13.22	4.43	88	9.67	2.19
3.	Days to 50% flowering	37.33-55.33	45.12	0.67	10.45	10.76	2.57	94	9.43	20.90
4.	Number of pods per plant	4.01-9.77	6.04	0.36	21.89	24.22	10.37	81	2.46	40.73
5.	Pod length	6.78-9.75	8.33	0.22	7.90	9.13	4.57	74	1.17	14.05
6.	Pod diameter	10.24-14.15	11.82	0.40	8.56	10.37	5.86	68	1.71	14.47
7.	Number of ovules per pod	4.19-6.93	5.92	0.28	10.36	13.21	8.19	65	0.99	16.72
8.	Pod yield per plant	16.270-48.11	29.87	0.24	25.28	25.32	1.42	99	15.53	51.99
9.	Pod yield per hectare	7.9-20.3	14.05	0.27	20.34	20.62	3.37	97	5.8	41.28
10.	Shelling per cent	37.65-61.27	52.61	0.62	11.92	12.09	2.04	97	12.73	24.20
11.	Total soluble solid	12.50-21.73	16.86	0.08	14.05	14.08	0.90	99	4.87	53.36

Table 2: Genotypic and phenotypic correlation coefficients (r_g,r_p) among eleven characters of vegetable pea

Characters		Plant height	Days to flower initiation	Days to 50% flowering	Number of pods per plant	Pod length	Pod diameter	Number of ovules per pod	Pod yield per plant	Pod yield per hectare	Shelling per cent	Total soluble solid
Plant height	r_g	1	0.63**	0.70**	-0.87	-0.31	0.11	-0.37	-0.40	-0.15	0.12	-0.42
	r_p	1	0.60**	0.68**	-0.79	-0.27	0.75**	-0.29	-0.40	-0.15	-0.13	-0.42
Days to flower initiation	r_g		1	0.97**	0.88**	-0.75	0.15	0.13	0.15	0.28	0.13	-0.44
	r_p		1	0.90**	0.92**	-0.94	0.13	-0.41	0.13	-0.26	0.13	-0.41
Days to 50% flowering	r_g			1	0.36*	-0.15	0.13	-0.61	0.17	0.67**	0.14	-0.49
	r_p			1	0.33*	-0.11	0.85**	0.47*	0.17	0.65**	0.13	-0.47
Number of pods	r_g				1	-0.26	0.36*	-0.24	0.21	0.74**	0.23	-0.17
per plant	r_p				1	-0.19	0.33*	-0.49	0.19	0.62**	0.21	-0.16
Pod length	r_g					1	-0.15	0.40*	-0.12	-0.61	0.12	0.42*
	r_p					1	-0.85	0.30*	-0.10	-0.39	0.11	0.37*
Pod diameter	r_g						1	-0.30	0.48*	0.21	-0.32	0.28
	r_p						1	-0.10	0.40*	0.18	-0.96	0.23
Number of ovules	r_g							1	0.17	0.36*	-0.35	-0.19
per pod	r_p							1	0.14	0.29	-0.30	-0.15
Pod yield per plant	r_g								1	0.84**	0.57**	0.67**
	r_p								1	0.82**	0.54**	0.66**
Pod yield per hectare	r_g									1	-0.35	0.72**
	r_p									1	-0.35	0.70**
Shelling per cent	r_g										1	-0.21
	r_p										1	-0.21
Total soluble solid	r_g											1
	r_p											1

*,**: significant at 5% and 1 % level of significance respectively

Therefore, selection based on these parameters may be comparatively more effective. These results are supported by the study of Sharma and Bora (2013), recorded the estimates of GCV were highest for green pod yield per plant (33.35), followed by plant height (26.82) and number of green pods per plant (21.02), respectively. Similar findings were noticed by Tiwari and Lavanya (2012) during variability analysis among characters in field pea crosses in F4 generation.

Most of the traits showed considerable high heritability in broad sense (>80%) except pod length (74%) pod diameter (68%) and number of ovules per pod (65%) (Table 1). In field pea similar results with high broad sense heritability was recorded by Rathi and Dhaka (2007), for 100 seed weight, plant height, days to flowering, days to maturity and pod length but observed low heritability for number of pods per plant and seed yield per plant. They were of the view that characters having high heritability considered as less affected by environment, whereas selection could not be done on the basis of broad sense heritability only, because this depends upon additive, dominant and epistatic variances. The highest value of genetic advance as percent of mean was observed for plant height (53.36), total soluble solids (53.36) and pod yield per plant (51.99). The higher broad sense heritability coupled with moderate genetic advance as percent of mean observed for pod yield per hectare (41.28) and number of pods per plant (40.73) suggested that these characters might be under the control of both additive and non-additive gene action and mass or pureline selection would be effective to a limited extent. High heritability accompanied with low genetic advance as percent of mean recorded for days to flower initiation (2.19), days to 50% flowering (20.90) and shelling percent (24.20) which shows involvement of non-additive gene action and the high heritability is being exhibited due to favourable influence of the environment rather than genotypes. On the

other hand high heritability accompanied with high genetic advance as percent of mean observed in plant height (53.36), total soluble solids (53.36) and pod yield per plant (51.99) indicates more influence of genotypes and less variation due to environment facilitate the breeders to go for effective selection. Similarly Tiwari and Lavanya (2012) found high heritability for days to 50% flowering and days to maturity and high excepted genetic advance as per cent of mean for seed yield per plant. Rathi and Dhaka (2007) and Tyagi *et al*., (2012) were also recorded similar observations in their study.

Correlation revealed the association of different traits among themselves, to find the traits suitable for breeding programme. The study showed that for most character pairs, genotypic and phenotypic associations were in the same direction and phenotypic estimates were little bit higher than the genotypic ones, indicating an inherited association between the characters (Table 2). This observation is supported by the study of correlation in vegetable pea done by Tyagi *et al*., (2012). The correlation coefficient of variation revealed that there is a positive and significant genotypic and phenotypic relationship between yield and days to 50% flowering (0.67, 0.65), number of pods per plant (0.74, 0.62), pod yield per plant (0.84, 0.82) and total soluble solids (0.72, 0.70). Therefore it is suggested that increment in these characters would improve the yield of the crop however reduction in days to flowering is desirable for getting early maturity. The correlation analysis done by Kalloo *et al*., (2005) also revealed same association of green pod yield with number of pods per plant, first flowering node and days to flowering. Number of pods per plant also showed significant correlation with days to flower initiation, days to 50 per cent flowering and pod diameter and total soluble solids content was positively correlated with pod yield per plant and pod length. Rai *et al*. (2006) also noticed similar kind of correlation in their experiment. Positive association was also found in number of pods per plant with pod diameter and shelling percent supported by Ali and Ceyhan (2006).

On the basis of heritability and genetic advance relation it could be concluded that characters like number of pods per plant and pod yield per hectare should be considered in selection programme. However characters which were associated with pod yield directly like days to 50% flowering, number of pods per plant, pod yield per plant and total soluble solids and indirectly like diameter of pod and shelling percent could be used as selection tools for production improvement of the genotypes.

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