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Research article

CHARACTER ASSOCIATION STUDIES IN M_2 GENERATION OF FIELDPEA (*Pisum sativum* var. *arvense* L.)

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ABSTRACT: An experiment was carried out with an objective to study the association among characters of fieldpea in M_2 generation. The parent material, seeds of PUSA212 variety were irradiated with 10kR, 15kR, 20kR, 25kR and 30kR doses of gamma rays at NBRI, Lucknow. Next day after treatment, the seeds along with control were space planted for raising M_1 generation. Each M_1 plant was harvested separately. Desirable ten M_1 individual plant progenies from each treatment were bulked and laid in RBD for rising M_2 generation. Induced mutations delivered fairly good amount of genotypic correlation and phenotypic correlation. Grain yield per plant shown significant positive correlation with number of pods per plant, days to flowering, days to pod setting harvest index, seed protein content and negatively significant correlation with days to maturity as well as plant height at phenotypic level. Path coefficient analysis revealed that most of the characters under study exhibited positive direct effect on grain yield per plant at both genotypic and phenotypic level. However days to pod setting shown negative direct effect on grain yield per plant yield at both genotypic and phenotypic level. Thus pods per plant, harvest index determining grain yield indicating scope for improving fieldpea yield by selection. The mutants with small pods, tall and increased number of pods per plant were isolated in M_2 generation.

Key words: *pisum sativum* L., Gamma rays, Correlation, Path analysis, M_2 generation.

INTRODUCTION

Fieldpea is an important pulse crop with multiple uses, which is utilized in preparing several food products mostly dhal and snacks. Besides this some promising qualities of field pea are easy cook ability, high biological value and free from flatulence inducing substances. As a component of pulses, field pea supply major share for protein requirement of our country and per capita availability of pulses. But the area under pea production in India likely to be stagnating due to competition of irrigated wheat and other pulses with wider consumer use. A variety of factors like lack of genotypes with higher yield potential, use of landraces and native cultivars by farmers, agro climatic condition acting as a constraints in hampering the field pea area and production of our country. Ultimately it is too difficult meet the needs of human consumption. So, it is a challenge for breeder to increase the quantitative and qualitative traits of field pea, which are agronomically and economically desirable through genetic improvement. Conventional breeding methods exploit huge time to improve genetic variability which is already present in the population. In fact, the natural genetic variability in field pea has been exhausted due to natural and artificial selection. So, further broadening of genetic base of field pea can be made through mutagenesis. Mutation breeding is a supplementary breeding method which is rapid, potential and valuable tool to create genetic variability for various quantitative and qualitative characters in crop plants. Induced mutations are produced by the use of mutagenic agents like physical mutagens (x-rays, Gamma rays etc.) and chemical mutagens (alkalating agents, base analogues etc.) However gamma rays act on genetic material by ionization leading to more of chromosomal rather than point mutations and gamma rays are successfully used in plant breeding programmes because of its simple application, good penetration, reproducibility, high mutation frequency and less disposal problems. Genetic variability of desirable attributes is essential for any crop improvement programme and its creation and management are central to plant breeding. The investigation was carried to predict an appropriate plant type with desirable yield attributes along with seed protein content in M_2 generation.

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MATERIALS AND METHODS

The parent material used in the present mutation breeding experiment was PUSA-212 variety of fieldpea. Uniform, healthy and dry seeds of field pea variety PUSA - 212 were irradiated with different doses viz. 10, 15, 20 25,30 kilo Roentgen of gamma rays (source: cobalt 60) at NBRI, Lucknow. Next day, treated seeds of each dose and control were sown in two rows with 50x40cm. spacing during *rabi* 2007-08 for raising M_1 generation. For M_2 generation, ten M_1 plant progenies were selected which showed significant deviation in mean values of the control, particularly for yield. Seeds from each selected M_1 plant progenies were bulked and raised during r*abi* 2008-2009 in three replications for each treatment (Wani and Khan, 2006). The crop was raised 30cm x 15cm row to row and plant to plant respectively at field Experimentation center, Department of Genetics and Plant Breeding, SHIATS, Allahabad. Recommended package of practices were followed to raise healthy crop. The data were recorded on different traits in each replication *viz*., plant height(cm) ,number of pods per plant, days to flowering, days to pod setting, days to maturity, grain yield per plant(g), test weight(g), harvest index(%) and seed protein content(%) in M_2 generation. Seed protein content (%) is estimated by Lowry's (1951) method. The data was subjected to analysis of variance and used for estimation of extent of induced variability and genetic parameters. The correlation coefficients were estimated following method by Al-Jibouri *et al*., (1958) and direct and indirect effects were obtained according to the procedure given by Dewey and Lu (1959)

RESULTS AND DISCUSSION

The experimental results revealed significant induced variability in different yield attributes. The estimates of correlation coefficients between different traits of fieldpea are presented in Table 1. Grain yield exhibited positive significant correlation with plant height(0.62) ,number of pods per plant(0.76), days to flowering(0.77), days to pod setting(0.77), harvest index(0.86), seed protein content(1.40) and negatively significant correlation with days to maturity (-0.88) at genotypic level. However grain yield per plant shown significant positive correlation with number of pods per plant(0.76), days to flowering(0.62), days to pod setting(0.57), harvest index(0.71), seed protein content(0.46) and negatively significant correlation with days to maturity (-0.73) as well as plant height (-0.61)at phenotypic level. Singh and Singh (2005) earlier reported number seeds per pod, harvest index positively correlated with grain yield in fieldpea and Lal (2006) , recorded days to flowering positive significant correlation with grain yield in urdbean. So characters like number of pods per plant, days to flowering, days to pod setting, harvest index determining grain yield can serve as the most important selection indices during selection of desirable mutants.

Table: 1 Estimates of genotypic correlation and phenotypic correlation for different component characters interse and with seed yield of fieldpea in M_2 generation.

Character		Days to pod setting	Plant height (cm)	Number of pods per plant	Days to maturity	Test weight (g)	Harvest index (%)	Seed protein content (%)	Grain yield per plant
Days to flowering	rg	0.72*	0.08	0.36	-0.31	0.36	0.38	1.20*	0.77*
	rp	0.51*	0.07	0.41	-0.26	-0.26	0.32	0.33	0.62*
Days to pod setting	rg		-0.38	0.77*	-0.75*	-0.21	0.80*	1.55*	0.76*
	rp		-0.32	0.58*	-0.60*	-0.33	0.66*	0.65*	0.57*
Plant height (cm)	rg			-0.74*	0.90*	0.13	-0.76*	-0.94*	0.62*
	rp			-0.71*	0.76*	0.12	-0.68*	-0.30	-0.61*
Number of pods per plant	rg				-0.75*	0.07	0.65*	1.77*	0.76*
	rp				-0.62*	0.06	0.60*	0.54*	0.71*
Days to maturity	rg					0.36	-1.05*	-1.01*	-0.88*
	rp					0.29	-0.85*	-0.54*	-0.73*
Test weight	rg						-0.55*	0.17	0.15
	rp						-0.33	-0.18	0.03
Harvest index (%)	rg							1.45*	0.86
	rp							0.30	0.71*
Seed protein content (%)	rg								1.40*
	rp								0.46**

*,** indicates significance at 5% and 1% levels respectively rg and rp genotypic correlation and phenotypic correlation

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Table: 2 Direct (diagonal) and indirect effects of yield components on grain yield of fieldpea in M2 generation.

Character		Days to flowering	Days to pod setting	Plant height (cm)	Number of pods per plant	Days to maturity	Test weight	Harvest index (%)	Seed protein content (%)	Grain yield per plant
Days to flowering	G	**1.76**	1.27	0.14	0.64	-0.54	0.64	0.66	2.12	0.77
	P	**0.71**	0.36	0.05	0.29	-0.18	0.14	0.23	0.24	0.62
Days to pod setting	G	-2.06	**-2.84**	1.09	-2.2	2.15	0.6	-2.29	-4.43	0.76
	P	-0.03	**-0.07**	0.02	0.29	0.04	0.02	-0.05	-0.05	0.57
Plant height (cm)	G	-0.04	0.21	**-0.54**	0.41	-0.49	-0.07	0.42	0.52	-0.62
	P	-0.05	0.24	**-0.74**	0.53	-0.57	-0.09	0.51	0.23	-0.61
Number of pods per plant	G	0.25	0.54	-0.52	**0.70**	-0.53	0.05	0.46	1.24	0.76
	P	-0.1	-0.14	0.17	**0.24**	0.15	-0.01	-0.14	-0.13	0.71
Days to maturity	G	-0.57	-1.4	1.66	-1.39	**1.85**	0.66	-1.94	-1.95	0.88
	P	-0.01	-0.04	0.05	-0.04	**0.07**	0.02	-0.06	-0.04	-0.73
Test weight	G	-0.2	0.12	-0.07	-0.04	-0.2	**-0.57**	0.31	-0.1	0.15
	P	0.01	-0.01	0.007	0.004	0.01	**0.05**	-0.01	-0.01	0.03
Harvest index (%)	G	0.88	1.87	-1.78	1.52	-2.44	-1.29	**2.32**	3.37	0.86
	P	0.06	0.13	-0.14	0.12	-0.17	-0.06	**0.20**	0.06	0.71
Seed protein content (%)	G	0.76	0.99	-0.6	1.12	-0.66	0.11	0.92	**0.63**	1.4
	P	0.05	0.11	-0.05	0.09	0.09	-0.03	0.05	**0.16**	0.46

Path coefficient analysis was carried out using correlation coefficients. The perusal of table2 revealed that most of the characters under study exhibited positive direct effect on grain yield per plant. Number of pods per plant (0.70 and 0.24), days to flowering (1.76 and 0.71), days to maturity (1.85 and 0.07), harvest index (2.32 and 0.20) and seed protein content (0.63 and 0.16) recorded high positive direct effect on grain yield at both genotypic and phenotypic level. However days to pod setting (-2.84 and -0.07), test weight (-0.57 and -0.05) shown negative direct effect on grain yield per plant yield at both genotypic and phenotypic level but plant height (-0.54 and 0.70) shown negative direct effect at genotypic level and viceversa. Similar findings reported by chaudary and Sharma (2003) and singh and singh (2005).Thus selection for number of pods per plant, days to flowering, days to maturity, harvest index and seed protein content give good response in fieldpea improvement.

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