ANALYSIS OF GENETIC PARAMETERS IN M_2 GENERATION OF FIELDPEA (*PISUM SATIVUM* L.)

G. Govardhan and G.M. Lal

Department of Genetics and Plant Breeding, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences. Allahabad-211007 Uttar Pradesh, India.

Abstract: The Present investigation was undertaken with an objective to assess the induced genetic variability in M_2 generation. The research programme was conducted during *rabi* 2008-09 at field Experimentation center, Department of Genetics and Plant Breeding, SHIATS, Allahabad. 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 RCBD for raising M_2 generation. Induced mutations delivered fairly good amount of genotypic coefficient of variation, phenotypic coefficient of variation, heritability and genetic advance with respect to plant height, number of pods per plant, 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.

Keywords: *Pisum sativum* L., Gamma rays, Induced variability, Genetic parameters, M_2 generation

INTRODUCTION

Fieldpea is an important pulse crop among pulses due to its 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. However our nation's pulse becomes weak due to stagnated pulse production. 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 assess the induced variability in yield attributes along with seed protein content in M_2 generation.

MATERIAL 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 data were recorded on different traits **(**plant height ,number of pods per plant, days to flowering, days to pod setting, days to maturity, grain yield per plant, test weight, 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. Heritability (H) estimate was worked out by the formula and Burton and Devane (1953).The genetic advance i.e. expected genetic gain was worked out

by using the formula suggested by Lush (1949) and Johnson *et al.,* (1955).

RESULT AND DISCUSSION

The success of breeding programme depends upon the thorough knowledge of genetic variability, heritability and genetic advance for improvement of desirable characters. Mutations affecting quantitative characters can be best inferred by estimates of range, mean, and other genetic parameters in the mutagen treated population. The experimental results revealed significant induced variability in different yield attributes. Selection on the significant characters like number of pods per plant, days to flowering, days to pod setting, harvest index may directly result in getting high yield since they are having high heritability, genetic advance. This indicates the scope for creating induced genetic variability and for selecting mutants having desirable traits.

The estimates of mean and range in the experiment was more for plant height (211.73-109.53), number of pods per plant (48.23-31.56), days to flowering (52.33-49.33), days to pod setting(73.66-69.33), days to maturity (129.66-125.33), grain yield per plant (34.73-28.16), test weight (25.20-22.00) harvest index(63.20-56.73) and seed protein content(11.93-11.49) was observed Table-1. Lal.M.Gaibrial (2006) was observed similar wide range for different yield attributes in M_2 generation. The analysis of variance Table-2 for different characters under consideration shown a quantum of genetic variability or mutability in five treatments of M_2 generation. The mean sum of squares due to treatments exhibited a significant difference for the traits under the study. Similar results in pea were also reported by Ghareeb (2006), and Khan and Irfan (1983) in Mungbean.

Table-1 Mean performances of six treatments of Gamma rays for different characters in Fieldpea cv-PUSA 212 (M_2 generation)

Treatment	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 (%)	Seed protein content (%)
Control	39.43	50.00	69.33	126.33	32.46	22.60	61.03	11.56
10kR	42.66	52.33	73.66	125.33	33.63	22.00	63.20	11.87
15kR	47.46	50.33	72.66	126.00	32.10	20.76	62.03	11.93
20kR	48.23	51.66	71.66	127.00	34.73	25.20	59.70	11.89
25kR	40.26	49.33	71.00	126.66	30.26	22.40	60.20	11.65
30kR	31.56	50.33	69.33	129.66	28.16	22.86	56.73	11.49
Grand mean	41.60	50.66	71.27	126.83	31.89	22.63	60.48	11.73
Maximum	48.23	52.33	73.66	129.66	34.73	25.20	63.20	11.93
Minimum	31.56	49.33	69.33	125.33	28.16	22.00	56.73	11.49
S.Em	0.843	0.379	0.696	0.459	0.338	1.895	0.588	0.159
S.Ed	1.193	0.537	0.984	0.649	0.478	2.680	0.832	0.225
CD (5%)	2.658	1.197	2.194	1.447	1.065	5.971	1.854	0.502
CD (1%)	3.780	1.701	3.118	2.056	1.514	8.492	2.636	0.713

Table-2 Analysis of variance for different characters in six gamma rays treatments rays for different characters in Fieldpea cv-PUSA 212 (M_2 generation)

Characters	Replication	Treatments	Error
d.f.	**(2)**	**(5)**	**(10)**
Plant height	40.350	4440.133*	12.590
Number of pods per plant	3.84	112.0178*	2.136
Days to flowering	1.50	3.732*	0.433
Days to pod setting	3.388	9.255*	1.455
Days to maturity	0.166	6.766*	0.633
Grain yield per plant	1.1705	16.7992*	0.3432
Test weight	1.1505	6.349*	1.197
harvest Index	0.3072	14.8942*	1.0392
Seed protein content (%)	0.0363	0.1069	0.0762

* Indicates significant at 5% level of significance

Table-3 Estimation of components of variance and genetic parameters for different characters in six gamma ray treatments of field pea Cv PUSA-212 (M_2 generation)

Characters	GCV (%)	PCV (%)	Heritability (bs) (%)	GA (%)
Plant height	28.29	28.41	99.2	78.80
Number of pods per plant	14.54	14.96	94.48	12.11
Days to flowering	2.069	2.443	71.73	1.82
Days to pod setting	2.26	2.82	64.11	2.65
Days to Maturity	1.12	1.290	76.35	2.57
Grain yield/ plant	7.34	7.57	94.11	4.68
Test weight	7.58	12.87	58.92	2.07
Harvest Index	3.55	3.93	81.63	3.99

Genetic parameters of different traits under study was represented in table- 3.Highest phenotypic coefficient of variation (PCV) and Genotypic coefficient of variation (GCV) for the plant height (28.41, 28.21) was observed. Thus it suggests substantial amount of variation was present in the experimental material. Phenotypic coefficient of variation was higher than genotype coefficient of variation for all the characters where as other characters exhibited moderate to low estimates of PCV Coefficient of variation was observed for character number of Pods per plant (14.54, 14.96) followed by Test weight (12.87,5.8) , Grain Yield per plant (7.34, 7.57) . These finding are in agreement with the Mazik Tokei and Furedi (1991), Mehandjiev *et.al.,* (2006) in Fieldpea,

Heritability was highest for the character number of Pods per plant (94.48), followed by grain yield per plant (94.11), and remaining characters exhibited less than 80 percent. Genetic advance for different traits revealed that it varied from. days to flowering(1.82) to Plant height(78.80) and for number of pods/plant is (12.11). The higher values of heritability and genetic advance were earlier reported by Ghareeb (2006), Amitava and Singh (2005) in fieldpea

REFERENCES

Burton, G.W. and Devane (1953), Estimating heritability, GCV and PCV in tall fescue from replicated clonal material. *Agronomy Journal*, **45(3)**: 171-181.

Ghareeb El, I.M. (2006), Gamma rays mutagen influence in development pea agronomic and biochemical characters. *Annals of Agricultural Science, Moshtohor*, **44 (2):**637-652.

Johnson, H.W., Robinson, H.F. and Comstock, R.E. (1955). Genotypic and phenotypic phenotypic correlation in Soybean and their implication in selection. *Agronomy Journal*, **74**: 47-83.

Lal, M. Gaibriyal. (2006). Effect of Induced Mutagenesis on yield, yield attributing traits and protein content in Blackgram (*Vigna mungo L.*), Ph.D Thesis, AAI-DU, Allahabad.

Lush, J.L. (1949) Heritability of quantitative traits in farm animals *Proc. 8th International Congress of Genetics Heridities, 35*: 356-375.

Lowry,O.H., Ropsebrough,N.J., Farr,A.L. and Randall, R.J. (1951). "Protein measurement with the Folin phenol reagent. *Journal of Biological Chemistry*, **193**(1): 265–275.

Mazik-TokeI, K. and Furedi, J. (1991). Studies on quantitative characters of pea varieties affected by Acute and Recurrent gamma irradiation. *Acta Agronomica Hungarica*, **40(1)** 129-139.

Mehandjiev, A., Noveva, S., Kosturkova, G (1999). Induced mutations and their application in genetic improvement of pea. *Pisum Genetics*, **31**:24-26.

Wani ,M.R., Khan, S. (2006). Estimates of genetetic variability in mutated population and scope of selection for yield attributes in *vigna radiata* (L.) Wilczek. *Egyptian Journal of Biology*, **8**:1-6