



## Identification of Diverse Genotypes of Fieldpea (*Pisum sativum* cv. *arvense*)

Sunaina Kumari Rosy and G Roopa Lavanya

Department of Genetics and Plant Breeding, Allahabad School of Agriculture  
Sam Higginbottom Institute of Agriculture, Technology and Sciences  
(Formerly Allahabad Agricultural Institute) Deemed-to-be-University Allahabad-211007,  
Uttar Pradesh, India

### ABSTRACT

Thirty genotypes of fieldpea were evaluated for ten qualitative characters to assess genetic variability and diversity. The genotypic and phenotypic coefficients of variation were higher for number of pods per plant, biological yield per plant, seed yield per plant and minimum for days to maturity. Heritability was higher for biological yield per plant, seed yield per plant, plant height, and number of pods per plant and lower for number of seeds per pod. The expected genetic advance as percent mean was recorded high for pods per plant followed biological yield per plant, moderate for plant height and 100 seed weight and observed low for number of seeds per pod. The genotypes studied were grouped into six clusters. Among six clusters, cluster II emerged as the largest with 11 genotypes followed by cluster III and IV with 7 genotypes each, cluster I with 3 genotypes and clusters V and VI were monogenotypic. The maximum inter-cluster distance ( $D^2$ ) was observed between clusters I and V followed by clusters I and VI, indicating wide divergence between these clusters. Therefore divergent genotypes may be selected from these clusters with better mean performance for different characters to be used as parents in hybridization programme. . Percent contribution to genetic diversity was found maximum for biological yield per plant and plant height. Hence due consideration should be given to these characters during selection.

**Key words :** Divergence, Fieldpea, Genetic advance, Heritability.

Pulses occupy a prominent place in our diet and the Indian agricultural economy, since they are major protein sources for the vegetarian masses of India. They maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in furthering sustainable agriculture. Fieldpea (*Pisum sativum* L. var. *arvense*) is amongst the popular legume crops of India. Currently, fieldpea occupies an area of 2.0-2.5 million hectares with an annual production of 17.65 million tonnes. The average productivity is 658 kg/ha (Anonymous, 2009). In spite of its importance, the area under this crop and its productivity remains low due to various biotic and abiotic stresses. Hence there is a need for efficient fieldpea breeding programme to address this lacuna. The genetic variability present in the base population for desired characters play a vital role in identification of divergent genotypes and development of new varieties. Hence the present study was conducted to identify desirable genotypes of fieldpea.

### MATERIAL AND METHODS

The experiment was conducted with 30 genotypes collected from Indian Institute of Vegetable Research, Varanasi at the Field Experimentation Centre, Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad in a randomized block design with three replications by adopting standard agronomic practices during *rabi*, 2007-2008. The plot size was 2 m<sup>2</sup> with the spacing of 30 cm between the rows and 15 cm between the plants. Observations were recorded on five randomly selected plants for each genotype for ten characters viz., plant height, number of primary branches per plant, number of clusters per plant, number of pods per plant, days of maturity, number of seeds per pod, pod length (cm), 100 seed weight (g), biological yield per plant (g), harvest index and seed yield per plant (g). Means were computed and data was analyzed for phenotypic and genotypic coefficient of variation as suggested by Burton

Table 1. Analysis of variance for 10 characters in 30 fieldpea genotypes.

S. No.	Characters	Mean sum square		
		Replication (df=2)	Treatment (df=29)	Error (df=58)
1	Plant height (cm)	6.41	616.95**	6.30
2	No. of primary branches	1.41	1.86**	0.77
3	No. of pods per plant	15.21	424.41**	3.61
4	Days to maturity	576.88	69.30**	1.10
5	No. of seeds per pod	7.60	1.55*	1.03
6	Pod length (cm)	2.64	1.84**	0.33
7	Biological yield per plant (g)	56.06	20.54**	11.32
8	Harvest index %	13.43	37.22**	3.66
9	100 seed weight (g)	17.03	37.04**	2.91
10	Seed yield per plant (g)	30.53	383.84**	4.40

\*and \*\* significance at 5% and 1%, respectively

Table 2. Estimates of mean and genetic parameters for different characters in fieldpea .

S. No.	Characters	Mean	GCV (%)	PCV (%)	h <sup>2</sup>	GA	GG
1	Plant height	72.22	19.75	20.06	97	28.95	40.08
2	No. of primary branches	3.09	19.54	34.44	32	0.71	22.84
3	No. of Pods per plant	28.84	41.06	41.58	97	24.09	83.51
4	Days to maturity	105.21	4.53	4.64	95	9.39	9.12
5	No. of Seeds per pod	4.40	9.50	24.90	15	0.33	7.47
6	Pod length	7.70	9.22	11.84	61	1.14	14.80
7	100 seed weight	16.03	21.04	23.57	80	6.20	38.65
8	Biological yield per plant	75.88	34.39	34.67	98	53.31	70.26
9	Harvest index	43.26	7.73	8.91	75	5.98	13.82
10	Seed yield per plant	32.88	34.20	34.79	97	22.77	69.26

(1952). Heritability (broad sense) and genetic advance was calculated from the formula suggested by Johnson *et al.* (1955). Genetic diversity was estimated by using D<sup>2</sup> statistics given by Mahalanobis (1936). The genotypes were grouped into different clusters following Tocher's method (Rao, 1952).

### RESULTS AND DISCUSSION

The analysis of variance indicated the presence of significant differences among the genotypes for all characters studied and existence of high percent of genetic variability, indicating greater

scope for selection (Table1). The genotypic coefficient of variation (GCV) was higher for number of pods per plant (41.06%), biological yield per plant (34.39%), seed yield per plant (34.20%) and minimum for days to maturity (4.53%). Sharma *et al.* (2003) also reported high genotypic coefficient of variation for seed yield followed by pods per plant. The phenotypic coefficient of variation (PCV) was found high for the number of pods per plant (41.58%), followed by seed yield per plant (34.79%), biological yield per plant (34.67%), number of primary branches per plant (34.44%) and lower for days to maturity (4.64%) (Table 2). Prasad and Suresh

Table 3. Distribution of 30 genotypes of fieldpea into different clusters.

Cluster number	Number of genotypes	Genotypes included
I	3	VRPMR-10, VRP-8, VRPMR-9
II	11	VRP-18, Pusa Pragati, Kashi Nandani, Kashauday, Arkel, VRP-250, Kashimukti, VRP-122, VRP-12, AP-1, VRP-324.
III	7	VRP-357, VRP-283, VRP-27, AP-3, VRP-21, VI-8, VL-3
IV	7	VRP-82, JP-583, PG-531, NADP-10, Kashi Samarth, Azad, VRP-44
V	1	VRP-95
VI	1	VRP-110

Table 4. Intra (diagonal) and inter-cluster average distance ( $D^2$ ) in fieldpea.

Cluster number	I	II	III	IV	V	VI
I	733.62	995.05	1910.26	3378.80	15870.88	15325.80
II		332.96	1400.94	1514.72	11426.28	10096.04
III			755.72	1634.79	9327.55	10436.68
IV				740.16	5860.65	5589.16
V					00.00	2859.68
VI						00.00

(2007) observed high PCV and GCV for seed yield per plant, number of pods per plant, number of clusters per plant and plant height.

The heritability was higher for the characters like biological yield per plant (98%), seed yield per plant (97%), plant height (97%), number of pods per plant (97%) and days to maturity (95%). Therefore, direct selection for these characters would be effective. The expected genetic advance as percent mean was recorded high for pods per plant (83.51) followed by biological yield per plant (70.26) while it was moderate for plant height (40.08) and 100 seed weight (38.68) and low for the characters like harvest index (13.82), days to maturity (9.12) and number of seeds per pod (7.47). High heritability coupled with high genetic advance was recorded for number of pods per plant whereas high heritability coupled with moderate genetic advance was recorded for plant height. Singh and Singh (2006) earlier reported high estimates of heritability for all characters except for days to flowering and pod length. Prasad and Suresh (2007) recorded high heritability for all characters studied except for pod length while high heritability coupled with high genetic advance was recorded for

plant height, number of pods per plant and seed weight.

Based on Mahalanobis's  $D^2$  analysis, all 30 genotypes were grouped into six clusters (Table 3). The cluster II was the largest which comprised 11 genotypes, followed by cluster III and cluster IV with 7 genotypes each, cluster I with 3 genotypes, while cluster V and VI was monogenotypic. The pattern of distribution of genotypes from different geographical regions into six clusters was at random, indicating that geographical diversity and genetic diversity were not related (Bhattacharya and Ganguly, 1998). The maximum intra-cluster distance ( $D^2$ ) was recorded for cluster III (755.72) followed by cluster IV (740.16) and cluster I (733.62), whereas cluster V and cluster VI had zero intra cluster distance because they are represented by single genotype. The maximum inter-cluster distance was observed between cluster I and V (15870.88) followed by cluster I and VI (15325.80), cluster II and V (11426.28) and cluster II and VI (10096.04) whereas minimum inter-cluster distance was observed between cluster V and VI (00.00). The cluster I included genotypes with high mean value for days

Table 5. Clusters mean performance for 10 morphological characters in fieldpea .

S.no	Cluster no. Characters	I	II	III	IV	V	VI
1	Plant height (cm)	66.11	61.90	89.38	71.47	94.66	66.66
2	Primary branches per plant	2.77	2.57	3.46	3.51	4.00	2.66
3	Pods per plant	23.22	22.12	33.97	33.61	62.66	20.00
4	Days to maturity	107.77	102.63	107.04	105.90	106.66	106.66
5	Seeds per pod	4.44	4.27	4.97	4.52	5.33	3.33
6	Pod length (cm)	8.56	7.54	7.38	7.92	7.66	7.46
7	Biological yield	44.86	65.59	67.42	91.27	153.30	156.10
8	Harvest index (%)	39.57	43.19	44.90	43.04	36.83	44.60
9	100 seed weight (gm)	16.11	17.12	14.33	15.33	13.66	16.33
10	Seed yield per plant (gm)	17.97	28.33	30.31	40.36	56.43	69.63

Table 6. Percent contribution of 10 characters to genetic diversity in fieldpea.

S. No	Characters	Number of times appeared in 1 <sup>st</sup> rank	Percent contribution of characters
1	Plant height	105	24.14
2	No. of primary branches per plant	0	0.00
3	No. of pods per plant	85	19.54
4	Days to maturity	75	17.24
5	Seeds per pod	5	1.15
6	Pod length	1	0.23
7	100 seed weight	26	5.98
8	Biological yield per plant	128	29.43
9	Harvest index	8	1.84
10	Seed yield per plant	2	0.49

to maturity, plant height, biological yield per plant and harvest index and the cluster V recorded highest mean value for biological yield per plant, days to maturity, plant height and pods per plant (Lal *et al.*, 2001).

Two characters namely the biological yield per plant (29.43%) and plant height (24.14%) contributed maximum to the genetic diversity and the characters number of pods per plant (19.54%) and days to maturity (17.24%) contributed moderately to genetic diversity (Table 5). From the above results it was noted that considerable amount of variation was present among the thirty genotypes of fieldpea, which is essential for any breeding programme. The biological yield per plant, plant

height and number of pods per plant were the major contributing characters for genetic divergence and hence should be given top priority during selection. The genotypes present in cluster I (VRPMR-10, VRP-8 and VRPMR-9) and V (VRP -95) can be effectively utilized as parents for obtaining desirable and useful segregants in future fieldpea breeding programmes.

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