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VARIABILITY IN PEA GERMPLASM FOR SOME AGROMORPHOLOGICAL TRAITS

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A study was carried out on genetic variation of 69 accessions of pea germplasm of exotic and indigenous origin, for ten agro-morphological traits. Genotypic coefficient of variation revealed high to moderate variability for all the characters studied, except for days to 50% flowering and days to maturity, which showed low variability. Seed yield per plant, plant height, number of primary branches per plant and seed weight expressed high heritability (broad sense) coupled with high genetic advance; number of clusters per plant, number of pods per plant, pod length and number of seeds per pod showed moderate to high values whereas days to 50% flowering and days to maturity had low estimates. The wide genetic variability observed in the accessions for yield and yield related traits could be useful for breeding superior genotypes. EC-6620, EC-8257, IC-240775, IC- 240779 and IC-209107 were identified as superior accessions for utilization.

Key words : Pea, germplasm, coefficient of variation, heritability, genetic advance

Pea (*Pisum sativum* L.) is known to have been domesticated and cultivated as a winter annual crop in the Mediterranean basin. Adaptation to relatively cool conditions has enabled its spread to areas beyond initial domestication. In India, this crop has a long history of cultivation, as *rabi* vegetable/pulse crop grown throughout the country. Success in varietal adaptation/improvement has been attained in the past from direct introductions, such as, the varieties Bonneville, Arkel and Lincolon, as vegetable types, or through introduction/breeding and selection, such as, the dual purpose variety Pusa Harbhajan or the seed type Rachna, among others. The National Bureau of Plant Genetic Resources presently holds over 1,050 accessions in its active collection and 1,488 accessions in the long term repository of National Gene Bank. The materials are shared with wide category of users, breeders, geneticists, scientists of other disciplines from various organisations, on request for their immediate and sustained use.

Nevertheless, further improvement for yield and other traits depends upon the amount of variability present in the breeding materials for the required traits. Germplasm provides the most valuable reservoir of variability,

on which direct selection can be made for evolving superior genotypes or it may be utilized as parent/donor in hybridization programmes. The present study attempts to find out initial variability parameters for some agro-morphological traits in respect of pea germplasm augmented from different eco-geographic sources within the country and from abroad.

MATERIALS AND METHODS

The experimental material for this study comprised 69 germplasm accessions (Table 1), including 34 indigenous collections from Rajasthan (18), Uttar Pradesh (12), Madhya Pradesh (3) and Bihar (1). The 35 exotic collections were introduced from USA (26), France (4), U.K. (4) and Holland (1). The experiment was laid at the NBPGR Experimental Station, Issapur, New Delhi, during *Rabi*, 1996, in a randomized block design, in paired row blocks replicated thrice. Four checks were used, viz. Rachna, DMR-11, Bonneville and Harbhajan.

Table 1. List of Indian and Exotic germplasm of pea

Sl. No.	Place of Collection/Country of Introduction	Accession numbers
1.	Bihar, India	IC 240779
2.	Madhya Pradesh, India	IC 240778, IC 209136, IC 209137
3.	Uttar Pradesh, India	IC 209117, IC 209119, IC 209120, IC 209122, IC 209127, IC 209131, IC 209132 IC 219020, IC 219026, IC 240777, IC 240780, IC 240781
4.	Rajasthan, India	IC 209092, IC 209093, IC 209095, IC 209096, IC 209102, IC 209103, IC 209107, IC 209108, IC 209109, IC 209110, IC 209111, IC 209112, IC 209113, IC 219005, IC 240773, IC 240774 IC 240775, IC 240776
5.	USA	EC 8257, EC 8495, EC 8762, EC 8763, EC 341765, EC 341766, EC 341771, EC 341787, EC 341793, EC 341986, EC 341988, EC 341998, EC 342007, EC 381953, EC 381854, EC 381855, EC 381856, EC 381857, EC 381858, EC 381859, EC 381860, EC 381861, EC 381862, EC 381864, EC 381865, EC 381866
6.	UK	EC 6620, EC 385244, EC 385245, EC 385246
7.	France	EC 269322, EC 269538, EC 269540, EC 269581
8.	Netherlands	EC 9123

Observations were recorded on five randomly selected plants in each replication, for 10 characters, viz days to 50 per cent flowering, days to maturity, plant height, number of primary branches per plant, number of

clusters per plant, number of pods per plant, pod length, number of seeds per pod, 100-seed weight and seed yield per plant. Genetic variability parameters were estimated, based on mean values, as per Singh and Choudhary (1979).

RESULTS AND DISCUSSION

Mean, range, mean sum of squares and standard errors of mean values for all the ten characters are presented in Table 2. The mean sum of squares were highly significant for all characters, indicating the presence of wide

Table 2. Mean, range, mean sum of squares (MSS) and standard error of mean

Sr. No.	Characters	Mean squares		Range			Mean ± SEM
		Treatment	Error				
	(df)	72	144				
1.	Seed yield/ plant(g)	173.57**	3.82	2.92 (IC 240781)	-	37.39 (EC 6620)	7.55 ± 1.59
2.	No. of primary branches/plant	18.87**	1.45	2.0 (IC240774)	-	13.70 (IC 240781)	6.09 ± 0.98
3.	No. of pods/ plant	2013.03**	364.33	19.30 (EC-381862)	-	122.00 (IC-209026)	63.21 ± 15.58
4.	No. of clusters/plant	1623.27**	192.81	17.00 (EC-385242)	-	106.00 (EC 8257)	54.18 ± 11.33
5.	Pod length (cm)	3.66**	0.17	4.40 (IC 240781)	-	10.60 (EC 342007)	5.97 ± 0.34
6.	No. of seeds/pod	4.37**	0.81	2.60 (IC 240775)	-	7.80 (IC 209102)	5.38 ± 0.73
7.	100-seed weight (g)	58.91**	0.01	4.35 (IC-240781)	-	26.50 (IC 209122)	17.52 ± 0.09
8.	Plant height (cm)	3171.58**	171.98	40.00 (EC 341793)	-	158.00 (IC 209122)	84.42 ± 10.70
9.	Days to 50% flowering	119.48**	16.37	77.00 (EC 381861)	-	109.00 (IC 240779)	98.65 ± 3.30
10.	Days to maturity	51.40**	0.63	137.0 (EC-381862)	-	156.00 (EC-8763)	150.38 ±0.65

**Significant at 1% level

variability in the germplasm studied. Grain yield per plant showed a wide range (2.92-37.39 g); the minimum and maximum yield were recorded in accessions IC 240781 and EC 6620, respectively. Number of primary branches per plant ranged from 20 (IC 240774) to 13.70 (IC 240781), with a mean of 6.09. Pods per plant and number of clusters per plant also registered considerable variability which ranged from 19.3 (EC 381862) to 122.0 (IC 219026) and 17.0 (EC 385242) to 106.0 (EC 8257), respectively. Maximum pod length (10.6 cm) was recorded in EC 342007 and minimum (4.4 cm) in EC 8257 and IC 240781. The present set of germplasm possessed an average of 5.38 seeds per pod, which ranged from 2.6 (IC 240775) to 7.8 (IC 209102). IC 209122 exhibited maximum 100 seed weight (26.50 g) whereas a minimum 100-seed weight was exhibited by IC 240781 (4.35 g). Plant height varied from 40 to 158 cm, EC 341793 registering the lowest and IC 209122 the maximum values. However, narrow range was observed for days to 50% flowering (77-109 days) and maturity (137-156 days). Genotypes EC 381861 and EC 381862 were observed to be early types for flowering and maturity, respectively. EC 6620, EC 8257, IC 240779 and IC 209106 were observed to be the most notable accessions for seed yield per plant, 100-seed weight and plant height.

Seed yield per plant had highest coefficient of variation, both at the phenotypic and genotypic levels and the magnitude was considerably higher than the corresponding values at environment level (Table 3). Coefficient of variation was also high in 100- seed weight at phenotypic and genotypic level, with a negligible environmental value. Sizable coefficient of variation at

Table 3. Estimates of genetic parameters for some agro-morphological traits in pea germplasm

S.No.	Characters	Coefficient of variation			Heritability in broad sense (%)	Genetic advance as % of mean
		Phenotypic	Genotypic	Environmental		
1	Seed yield/plant	102.88	99.57	25.86	93.68	198.54
2	No. of primary branches/plant	44.19	39.54	19.74	80.05	72.87
3	No. of pods/plant	47.83	37.09	30.19	60.13	59.24
4	No. of clusters/plant	47.78	40.30	25.63	71.21	70.06
5	Pod length	20.20	18.94	7.01	87.95	36.59
6	No. of seeds/pod	26.27	20.26	16.75	59.48	32.19
7	100-seed weight	25.29	25.28	0.65	99.93	52.17
8	Plant height	40.55	37.46	15.53	85.32	71.27
9	Days to 50% flowering	7.22	5.94	4.10	67.73	10.07
10	Days to maturity	2.79	2.74	0.53	96.43	5.53

genotypic (18-40%) and phenotypic (20-48%) level was observed for number of clusters per plant, number of primary branches per plant, plant height, number of pods per plant, number of seeds per plant and pod length. However, pods per plant recorded high values for environmental component which calls for more systematic evaluation by the users of this germplasm set intending to manipulate the trait expression. In the present case, selection based on number of pods per plant may not be rewarding as compared with involving seed yield per plant and/or 100-seed weight.

Heritability estimates were high (> 80%) for 100-seed weight, days to maturity, seed yield per plant, pod length, plant height and number of branches per plant and moderate (50-80%) for number of clusters per plant, days to 50% flowering, number of pods per plant and number of seeds per pod. Reports of high heritability for yield and yield components in pea have also been reported (Singh, 1995, Kumaran *et. al.*, 1995 and Vikas *et al.*, 1996). The high heritability was associated with high genetic advance as per cent of mean (> 50%) for seed yield per plant, plant height, number of primary branches per plant and 100 seeds weight, in conformity with the earlier similar observations of Solanki *et al.* (1988) and Dev *et al.* (1995).

Table 4. Donors for various morpho-agronomic characters in pea germplasm

Characters	Accessions					
	EC 6620	EC 8257	IC 240779	IC 209107	IC 240775	IC 209026
Seed yield/plant(g)	37.39	34.49	32.08	30.00	31.82	28.96
100-seed weight(g)	22.10	18.91	22.83	23.20	24.99	13.83
Plant height (cm)	115.00	125.00	124.33	77.67	68.00	158.00
No. of primary branches/plant	9.67	9.00	7.67	5.67	5.33	11.0
No. of clusters/ plant	47.67	106.30	63.67	67.67	51.00	99.33
No. of pods/plant	48.00	104.00	70.67	85.67	69.33	121.67
Pod length(cm)	5.52	4.40	6.27	6.73	5.20	5.50
No. of seeds/pod	5.67	5.00	5.00	5.33	3.00	3.33
Days to 50% flowering	105.00	120.00	109.30	100.33	96.67	103.33
Days to maturity	155.00	151.00	154.00	152.00	149.00	149.00

The parallelism between the magnitude of heritability and degree of genetic gain has been due to the fact that additive genes play a predominant role. Presence of high and moderate heritability for days to maturity and days

to 50% flowering with low genetic gain suggested that high heritability did not necessarily lead to increased genetic gain unless sufficient genetic variability existed in the germplasm. Sardana ad Sasikumar (1989) also reported high variability but low genetic gain for days to 50% flowering.

Occurrence of sufficient genetic variability for yield *per se* and its contributing traits, in the present set of germplasm can be exploited for pea improvement and also for characterization of traits during selection or validation. Seed yield per plant, plant height and 100-seed weight were observed to be most reliable selection parameters. EC 6620, IC 240779, EC 8257, IC 209107, IC 240775 and IC 209026 were recorded as superior lines, along with some others (Table 4) for yield *per se* and its component traits, which can be used in further breeding programmes.

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