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Study on variability, heritability and genetic advance with respect to yield and yield contributing characters in field pea (*Pisum sativum* L.)

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Abstract

The present investigation entitled “Estimate of variability, heritability and genetic advance with respect to yield and yield contributing characters in field pea (*Pisum sativum* L.)” for 10 characters. The experiment comprising of 23 genotypes of pea were grown in a Randomized Block Design (RBD), with three replications at Research Farm, Department of Genetics & Plant Breeding, Post Graduate College, Ghazipur, during *rabi* season of 2017-2018, plant to plant and row to row distance was kept 10 cm and 45 cm, respectively. The estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) and environmental coefficient of variation (ECV) showed a wide range. It indicates that considerable amount of variability was present in the material. The high estimates of genotypic coefficient of variation (GCV) were observed for plant height, biological yield per plant, number of pods per plant, seed yield per plant, number and 100-seed weight. Moderate estimates of GCV were observed for days to 50% flowering, pod length and number of seed per pod. Whereas, low GCV were observed for harvest index and days to maturity. The high estimates of phenotypic coefficient of variation (PCV) were observed for seed yield per pod, number of pods per plant, biological yield per plant, harvest index, plant height. Moderate estimates of PCV for 100-seed weight, pod length and number of seed per pod. Whereas low PCV were observed for days to 50% flowering and days to maturity. The estimates of heritability in broad sense were high for plant height, days to maturity, days to 50% flowering, 100-seed weight, biological yield per plant. Moderate estimates of heritability were observed for number of pods per plant, number of seed per pod and pod length. High estimates of genetic advance were observed for plant height, biological yield per plant, days to 50% flowering and number of pods per plant. Moderate estimates of genetic advance were observed for 100 seed weight, days to maturity and seed yield per plant. Whereas low genetic advance were observed for pod length, number of seed per pod and harvest index.

Keywords: Genetic variability, heritability and genetic advance

Introduction

Field pea (*Pisum sativum* L.) is one of the oldest cultivated crops and was grown in farming villages of the China at least as early as 8000 B.C.; but origin of field pea is near the Mediterranean. This plant is a common forage legume in the semiarid regions of the Anatolia and Mediterranean area (rain fall 350-550mm). It performs best on fertile, well- drained soils with high moisture holding capacity. Optimum growth is obtained on loams, silt loam, or well texture soils with a pH 6.0-7.5. Pulses have been given the status of "wonder crop", as pulses are relatively high in protein content, which makes the diet more balanced in its nutritive value, and their ability to develop a symbiotic relationship in their root nodules with the nitrogen fixing bacteria of rhizobium species to enhance the soil fertility. Field pea (*Pisum sativum* L.) is a temperate crop, grown in higher altitudes in tropical areas with temperature ranging between 7-30 °C.

Pulses are the basic ingredient in the diets of a vast majority of the Indian population, as they provide a perfect mix of vegetarian protein component of high biological value when supplemented with cereals. Pulses are also an excellent feed and fodder for livestock. Endowed with the unique ability of biological nitrogen fixation, carbon sequestration, soil amelioration, low water requirement and capacity to withstand harsh climate, pulses have remained an integral component of sustainable crop production system since time immemorial, especially in the dry areas.

Field pea (*Pisum sativum* L.) is the most important legume crops of India, belongs to leguminosae family, largely confined to cooler temperate zone between the tropic of cancer and mediterranean region. Peas are a rich source of protein having essential amino acids particularly lysine. This considered the cheapest source of protein in diet. Field pea (*Pisum sativum* L.) is a self-pollinated rabi pulse crop which is grown for food, feed and vegetables. There are two types of peas grown in India viz. grain type and Vegetable type. It is annual crop belongs to family leguminosae. Field pea is used for seed, hay, pasture, silage, and green manure. Plant is rich in high quality protein. It is rich in phosphorus and calcium; and also a good source of vitamins, especially vitamins A and D. These qualities make field pea one of the best feeds for animals and almost indispensable for efficient, economical livestock feeding. Keeping this in view, an attempt was made in the present investigation to assess the magnitude of variability, heritability and genetic advance for different characters in pea. The crop is grown coefficients of variation were estimated by given by Burton (1952) ^[4] and Johnson *et al.*, (1955) ^[6] and heritability in broad sense was estimated as per formula given by Allard (1960) ^[3]. The expected genetic advance was calculated by using formula as suggested by Allard (1960) ^[3] and Robinson *et al.*, (1955) ^[6].

Materials and Methods

The experimental materials were grown in a Randomized Block Design with three replications at Research Farm, Department of Genetics & Plant Breeding, Post Graduate College, Ghazipur during rabi season of 2017-2018. Plant to plant and row to row distance was kept 10 cm. and 50 cm. respectively. All the recommended agronomical practices were adopted to ensure good performance of crop. Materials for the present investigation comprised of 23 genotypes of pea (*Pisum sativum* L.) collect from N.D. University of Agriculture & Technology, Kumarganj, Ayodhya-224229.

Results and Discussion

The present investigation entitled "Estimate of variability, heritability and genetic advance with respect to yield and yield contributing characters in field pea (*Pisum sativum* L.)" for all traits. The experiment comprising of 23 genotypes of pea were grown in a Randomized Block Design. Analysis of variance showed the mean squares due to treatments were highly significant at 1% level of significance for all the 10 characters indicating the variation among the characters.

Therefore, the data were subjected for further analysis Table 1.

The estimates of GCV, PCV and ECV showed wide range, the GCV, PCV and ECV respectively varied from 1.54, 1.77 and 0.89 for days to maturity to 34.99, plant height 74.48 and 72.29 for seed yield per plant. The wide range of GCV, PCV and ECV indicates the presence of considerable amount of variability among all the characters.

The other characters showed high estimates of GCV in order of their magnitude were Plant height, biological yield per plant and number of pods per plant. Consequently GCV estimates were moderate for seed yield per plant and days to 50% flowering for 100-seed weight. The estimates of GCV were low for seeds per pod, harvest index and days to maturity.

The estimates of PCV were also high for the characters like seed yield per plant, number of pods per plant, biological yield, harvest index and plant height. Consequently PCV estimates were moderate for 100-seed weight, pod length and number of seeds per pod. Low PCV estimates were days to 50% flowering and days to maturity.

The estimates of ECV were also high for the characters like seed yield per plant, number of pods per plant, harvest index, biological yield. The estimates of ECV were low for days to 50% flowering and days to maturity. High genetic variability in pea were reported for the character plant height, number of pods per plant, number of seeds per pod, seed yield per plant, biological yield. 100 seed weight and harvest index (Achal *et al.*, 1992; Tyagi, 1990; Vikash, 1992; Singh, 1995) ^[1, 9, 10] and number of pods per plant (Solanki *et al.*, 1988) ^[8]. Similarly the low genetic variability was reported for 100 seed weight (Vikas, 1992) ^[10], number of pods per plant (Singh *et al.*, 1978) ^[7] and number of seed per pod (Vikas, 1992) ^[10].

The estimates of heritability in broad sense were high in order of their magnitude for characters plant height, days to maturity, days to 50% flowering, 100-seed weight and biological yield per plant. The estimates of heritability were moderate for harvest index, seed yield per plant, number of seeds per pods (Table 2) estimates of genetic advance were high for the characters plant height, biological yield, days to 50% flowering, number of pods per plant, 100 seed weight. Moderate value of genetic advance was recorded for harvest index and low value of genetic advance were observed for number of seeds per pod, pod length, days to maturity and 100 seed weight.

Table 1: Analysis of variance for ten characters in pea (*Pisum sativum* L.)

Source of variation	Mean squares (Characters)										
	D. F.	Days to 50% flowering	Days to maturity	Plant height (cm)	Pod length (cm)	No. of pods/plant	No. of seeds/pod	100 seed weight (g)	Biological yield/plant (g)	Seed yield/plant(g)	Harvest Index (%)
Replication	2	21.89	1.21	386.27	0.84	120.46	0.41	2.05	330.79	188.31	251.37
Treatment	22	60.25**	12.26**	2062.72**	0.68*	183.89**	0.40 *	27.81**	587.74 **	60.65**	139.71**
Error	44	8.23	1.23	81.56	0.40	82.17	0.22	4.07	198.88	51.21	138.12

* Significant at 5% level of significance

** Significant at 1% level of significance

Table 2: Estimates of range, mean, genotypic and phenotypic coefficients of variation, heritability, genetic advance and genetic advance as percentage of mean for 10 quantitative characters in pea.

Characters	Range	Grand mean	Coefficients of variation (CV)			Heritability (h ²)	Genetic advance	GA (% of mean)
			GCV	PCV	ECV			
Days to 50% flowering	59.60-76.44	70.82	6.32	7.5	4.05	0.7083	7.75	10.94
Days to maturity	121.08-128.60	124.82	1.54	1.77	0.89	0.7495	3.42	27.39

Plant height(cm)	44.84-99.85	73.43	34.99	37.1	12.29	0.8901	49.94	68.01
Pod length(cm)	4.24 -6.34	5.47	5.6	12.87	11.59	0.1896	0.27	49.36
Number of pods per plant	7.26-34.14	19.08	3.54	56.46	47.49	0.2926	6.49	34.01
Number of seeds per pod	4.72-5.93	5.27	4.72	10.03	8.85	0.2219	0.24	4.55
100-seed weight(g)	7.43-20.67	16.69	16.85	20.74	12.08	0.6605	4.71	28.22
Biological yield /plant (g)	10.86-59.36	34.37	33.121	52.74	41.03	0.3946	14.73	42.86
Seed yield per plant(g)	2.59-18.97	9.89	17.92	74.48	72.29	0.0579	0.88	8.99
Harvest index (%)	14.46-38.02	26.27	2.77	44.83	44.74	0.0038	0.09	0.34

Summery and conclusion

The present investigation entitled “Estimate of variability, heritability and genetic advance with respect to yield and yield contributing characters in field pea (*Pisum sativum* L.)” for 10 characters. The experiment comprising of 23 genotypes of pea were grown in a Randomized Block Design (RBD), with three replications at Research Farm, Department of Genetics & Plant Breeding, Post Graduate College, Ghazipur, during *rabi* season of 2017-2018, plant to plant and row to row distance was kept 10 cm and 45 cm, respectively. The estimates of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) and environmental coefficient of variation (ECV) showed a wide range. The high estimates of genotypic coefficient of variation (GCV) were observed for plant height, biological yield per plant, number of pods per plant, seed yield per plant, number, 100 seed weight. The high estimates of phenotypic coefficient of variation (PCV) were observed for seed yield per pod, number of pods per plant, biological yield per plant, harvest index, plant height. The estimates of heritability in broad sense were high for plant height, days to maturity, days to 50% flowering, 100-seed weight, biological yield per plant. High estimates of genetic advance were observed for plant height, biological yield per plant, days to 50% flowering and number of pods per plant.

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