

## STUDIES ON GENETIC VARIABILITY IN CABBAGE (*Brassica oleracea*)

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Cabbage (*Brassica oleracea* var. capitata L) is mainly cultivated for its heads annually and for seeds production biennial in mid to high hills of Uttaranchal. It is good source of vitamins A and C Munger (1988). Keeping in view for seed production and pressing demand for a suitable varieties for seeds production, which can be achieved effectively by adopting proper breeding technique for which recognition of genotypes and quantitative assessment of the population for yield and its contributing characters is prerequisite. The nature of genetic variation for most of the yield attributes is considered in the crop and there is a need for the breeders to restructure his materials for increasing its productivity Bhagchandani et al. (1977) and Pearson (1934). Keeping in these view, the present investigation aimed to assess to estimate genetic variability, genetic advance so as to help in developing superior genotypes.

The studies was carried out during summer season of 1998, at the experimental form of Department of Vegetable science G. B. Pant University of Agriculture and Technology, Hill Campus Ranichauri, Tehri Garhwal, Uttaranchal. The climate of this site is humid temperate. 21 diverse genotypes of cabbage were sown in randomized block design with three replications. Suitable agronomic practices were adapted during crop period. The observations were recorded on four randomly selected plants on each plot on total number of branches per plant, plant height (cm), number of flowers per branches, length of inflorescence (cm), number of pods per branches, pod length (cm), peduncle length (cm) and number of seeds per pods. The analysis of variance was carried out as suggested by Gomez and Gomez (1976). The genotypic and phenotypic coefficients of variability were calculated as per method suggested by Burton and Devane (1953). Heritability in broad sense suggested by Allard (1960) and expected genetic advance as percent of mean were worked out by the method given by Johnson et al (1955). The correlations were worked out as per Aljibouri *et al.* (1958).

### RESULTS AND DISCUSSIONS

The analyses of variance for quantitative characters revealed that mean square were highly significant for all the characters indicating enough variability for all the characters (Table-1). Genotypic coefficient of variations showed that there is an ample scope for the improvement of this crop. The maximum variation was showed by number of pods per branch, followed by number of flowers per branch, total number of branches per plant and number of seeds per pod. Low variance was observed for plant height, length of inflorescence, pod length and peduncle length. The results for genotypic and phenotypic coefficient of variability are presented in table-2. The data indicated that phenotypic coefficients of variability were higher than the genotypic coefficient of variability for all the characters. High coefficient of variability recorded for two characters viz number of seeds per pod (25.21 and 32.13%) and number of pods per branches (19.51 and 29.00%). Moderate variability was recorded for number of flower per branch (18.21 and 27.02) and total number of branches per plant

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(13.16 and 26.13%). Low variability was recorded for plant height, length of inflorescence, pod length and peduncle length. Most of the characters under study got moderate Heritability. The highest Heritability was recorded for number of seeds per pod (61.56%) and number of pods per branches (45.42%). The characters pod length, total number of branches per plant. Plant height and length of inflorescence had low variability.

High genetic advance (as percent of mean) was recorded for number of seeds per pod, number of pods per branches and number of flowers per branches, while moderate to low genetic advance of 15.80, 13.48, 10.63, and 5.72 were recorded for pod length, total number of branches per plant, peduncle length, length of inflorescence and plant height respectively. The magnitudes of Heritability were quite high for number of seeds per pod, number of flowers per branches and number of pods per branch. High values of Heritability and genetic advance were found in number of seeds per pods and number of pods per branches, it is suggested that the major role of genetic constitutions in the expressions of the characters and such traits were considered to be dependable from breeding point of view. However for a breeding programme aimed at improving particular varieties through selection. The heritable can be estimated with greater degree of accuracy when heritability is studied along with genetic advance. A high heritability coupled with high genetic advance gives most effective criteria for selection (Johnson et al. 1955). Heritability along with genetic advance would be helpful in assessing the nature of gene action.

The moderate heritability along with low genetic advance was noticed for pod length, total number of branches per plant, indicating these characters to be controlled by non-additive genes and improvement through selection for these characters would be rather ineffective. The variability, GCV, heritability and expected genetic advance as percent of mean were observed for number of seeds per pod, number of pods per branches, number of flowers per branches, and pod length. Hence these traits could be used as selection criteria for development of more seeds producing plant type in cabbage.

In correlation studies the number of seeds per pods positively and significantly correlated with number of branches per plant, pod length and negatively correlated with number of flowers per branches and number of pods per branches. The number of pods per branches positively and significantly correlated with total number of branches per plant and number of flowers per branches.

Thus from the present investigation it may be concluded that the characters viz-number of seeds per pod, number of flowers per branches, number of pods per branches and total number of branches per plant will be effective to bring rapid improvement in increased the seed yield.

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Table-1 Mean Performance difference genotypes of cabbage

Genotypes	Total no. of branches/plant	Plant height	No. of flowers/branches	Length of inflorescence	No. of pods/branches	Pod length	Peduncle length	No. of Seeds/pod
Pusa Mukta	24.33	139.33	55.00	37.23	42.00	8.50	2.06	13.66
AC-204	19.00	100.00	30.33	29.33	20.66	9.66	2.80	25.66
Pride of India	16.33	116.66	41.66	34.00	34.33	11.23	2.33	17.33
India Market	22.00	145.00	61.66	42.00	36.00	7.56	1.83	19.66
ARU- Glory	27.34	145.66	65.00	37.00	42.66	7.96	1.83	14.66
POI (Ranichauri)	28.00	108.33	85.66	49.33	61.66	6.50	2.50	14.00
Pusa Drum Head	23.00	138.33	63.33	45.00	46.00	7.20	1.66	16.33
September	16.00	113.23	62.00	33.33	49.00	7.80	1.75	12.00
Express Pucha	24.00	126.66	57.66	34.66	49.00	8.50	2.00	15.00
G1	18.66	121.33	42.00	23.00	37.00	7.00	1.66	11.00
G2	25.00	124.33	54.33	44.00	57.00	11.16	1.96	29.00
AC-204	29.00	113.33	72.00	32.00	51.33	8.16	1.60	20.00
AC-208	30.33	110.66	49.00	38.00	40.46	9.16	1.40	20.00
Express Mail	20.33	123.33	49.00	40.00	33.66	8.83	2.36	25.00
Verma Pride	22.00	122.33	49.00	33.66	41.66	9.16	1.66	22.00
Ganesh	23.66	136.66	48.00	44.00	29.00	7.16	1.93	21.00
PI (Pucha)	33.33	118.00	52.66	41.33	30.00	7.30	1.50	27.00
Express	26.66	133.60	54.00	40.00	40.33	7.50	1.70	28.66
Pride of Asia	22.00	110.00	50.00	37.00	41.00	9.00	1.66	17.66
Express Suttons	27.00	138.66	57.66	32.00	50.00	8.00	1.76	20.66
Express Durga Seeds	25.00	115.00	71.33	30.66	47.66	8.13	1.60	26.00
Range	16.00-33.33	100-145.66	30.33-85.66	23.00-49.33	20.66-61.86	6.50-11.23	1.40-2.80	11.0-28.66

Table-2. Variability studies in Cabbage.

Characters	G. Mean	Range	Coefficient of variation		Heritability	GA	GA as % of mean
			GCV	PCV			
Total number of branches/ Plant	24.03+-3.13*	16.00-33.33	13.16	26.13	25.34	3.28	13.48
Plant height (cm)	123.55+-10.21	100-145.66	6.60	15.74	17.61	7.07	5.72
No. of flowers/branches	55.93+-6.44	30.33-85.66	18.21	27.02	45.42	14.14	25.28
Length of inflorescence (cm)	37.06+-4.46	23.00-49.33	10.46	24.17	19.38	3.57	9.63
No. of pods/branch	41.96+-5.19	20.66-61.86	19.51	29.00	45.26	11.35	27.04
Pod length (cm)	8.35+-0.72	6.50-11.23	12.16	19.36	39.89	1.32	15.80
Peduncle length (cm)	1.886+- . 26	1.40-2.80	12.18	27.62	19.46	0.20	10.63
No. of seeds/pod	19.82+-2.28	11.00-28.66	25.21	32.13	61.65	8.07	40.71

\* SEM



Table-3. Estimates of genotypic and phenotypic correlation coefficients among various characters of cabbage

Characters		Total number of branches/Plant	Plant height (cm)	No. of flowers/branches	Length of inflorescence (cm)	No. of pods/branch	Pod length (cm)	Peduncle length (cm)	No. of seeds/pod
Total number of branches/Plant	G	1	0.137	0.729**	0.921**	0.535**	-0.510**	-0.799**	0.502**
Plant height (cm)	P	1	0.089	0.255	0.121	0.102	-0.160	-0.259	0.186
No. of flowers/branches	G		1	0.305	0.746**	-0.036	-0.458*	-0.514**	-0.154
Length of inflorescence (cm)	P		1	0.062	0.092	0.056	-0.196	-0.113	-0.088
No. of pods/branch	G			1	0.481*	0.895**	-0.739	-0.455*	-0.332*
Pod length (cm)	P			1	0.341*	0.664**	-0.288	-0.054	-0.113
Peduncle length (cm)	G				1	0.270	-0.253	0.055	0.253
No. of seeds/pod	P				1	0.201	-0.140	0.127	0.119
	G					1	-0.070	0.321	-0.346*
	P						1	-0.123	-0.141
	G							0.353*	0.378*
	P							0.247	0.249
	G							1	0.072
	P							1	-0.055
	G								1
	P								1

\* \*\*, Significant at 5% and 1% respectively.