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RESEARCH ARTICLE

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE IN CUCUMBER (*Cucumis sativus* L.)

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ABSTRACT

Genetic variability, heritability and genetic advance were studied in eight parents and their 28 F_1s and 28 F_2s for ten characters, namely, days to first male flower, days to first female flower, node number of first male flower, node number of first female flower, fruit length, fruit diameter, fruit weight, number of fruits /vine, vine length and yield/ vine, in cucumber. The analysis of variance revealed the significant variability in the base material and the material generated subsequently involving all possible combinations in both F_1 and F_2 generations. The estimates of heritability for fruit weight yield/vine and fruit length and genetic advance in % of mean for fruit weight and yield/vine were recorded high in F_2 generation. The remaining characters were characterized moderate to low heritability as well as genetic advance in both generations. High estimates of heritability were due to greater contribution of additive genetic components, therefore, these traits could be improved by selection in segregating generations.

Key **W**ords : Genetic variability, heritability, genetic advance and Cucumber**.**

Cucumber (*Cucumis sativus* L) is an important member of the family cucurbitaceae. The crop is of Asian origin, the progenitor may be closely related to the wild *Cucumis sativus* var. *hardwickii*, which was first found in the Himalayan foothills of Nepal. Cucumber cultivation goes back to at least 3000 years in India and 2000 years in china (Robinson and Decker-Walters, 1997). Today cucumber is grown throughout the world in small gardens, large commercial farms and glass houses. The fruits are eaten as salad and pickle and are often consumed as cooked vegetables in various ways. It contains 0.6 g protein, 2.6 g carbohydrate, energy 12 cal, 18 mg Ca, 0.2 mg Fe, 0.02 mg thiamin, 0.02 mg riboflavin, 0.01 mg niacin, and 10 mg vitamin C per 100 g of edible portion (Rashid, 1999). Very few research works relating to variability of cucumber have been conducted in India. So, intensive research efforts are needed in several areas, particularly, selection of superior genotypes. There are a lot of variability's among the existing cucumber Germplasm of India. An understanding of the nature and magnitude of the variability among the genetic stocks of cucumber is of prime importance for the breeder. A good knowledge of genetic wealth might also help in identifying desirable cultivars for commercial production. Because of its nature of high cross pollination, hardly any genetically pure strain is available to the growers. Estimation of genetic diversity is considered as an important factor, which is also essential prerequisite for hybridization programme for developing high yielding variety. Heritability and genetic advance serve as useful tools for the breeders in determining the direction and magnitude of selection. Based on the information, the present study was undertaken to assess the variability for yield and yield attributes in cucumber.

MATERIALS AND METHODS

Eight genotypes of cucumber, namely, PCUC 15, EC 43342, PCUC 15-1, CHC 2, BIHAR 1, C 99-12, C-98-6 and C 99-

10 were used to make all possible crosses excluding reciprocals. The experiment material consisting 8 parents, 28 F_1s and 28 F_2s was sown in randomized block design with three replications at Department of Vegetable Science, C. S. Azad University of Agriculture and Technology, Kanpur during *Kharif*-2002. All the parents and F_1s were sown in a single row while F_2s were sown in two rows in each replication. The length of row was kept 6.0 m while row to row and plant to plant distance was maintained at 3.0 m and 5.0 m, respectively. All the recommended agronomic practices were adopted to ensure a good s crop. The data were recorded on five selected plants in each parents and F_1s as well as ten plants in F_2s for 10 characters *viz.*, days to first male flower, days to first female flower, node number of first male flower, node number of first female flower, fruit length (cm), fruit diameter (cm), fruit weight (g), number of fruit/vine, vine length (cm) and yield/vine (g). Heritability (in narrow sense) in F_1 generation and F_2 generation was calculated according to the methodology proposed by Crumpacker and Allard (1962) and Verhalen and Murrey (1969), respectively. The genetic advance was worked out by the formula proposed by Robinson *et al*. (1949).

RESULTS AND DISCUSSION

The analyses of variances (Table 1) for parents, F_1s, F_2s, parents vs F_1s and parents vs F_2s of ten characters are presented in Table 1. Highly significant variances among the parents and F_1s were recorded for all the characters indicating thereby highly significant variability in the base genetic material as well as population generated by subsequently.

Highly significant variances were noted among parents vs F_1s for all the characters except vine length, reflecting highly significant amount of heterotic response for these attributes. Parents vs F_2s were also revealed highly significant differences for all the characters. Which reflecting significant variability in the material generated subsequently involving all possible combinations in both F_1 and F_2 generations.

The mean values and range of variability among parents, F_1s and F_2s for ten characters are presented in Table 2. The mean performance of F_1s was higher than parents for fruit weight, number of fruits/vine and yield/vine.

The variances within the parents were found significant for all the characters but their magnitude varied from character to character. The variability among parents was fairly high for yield/vine followed by fruit weight, vine length, days to first female flower, fruit length, days to first male flower, node number of first female flower, number of fruits/vine, node number of first male flower and fruit diameter.

The variation in F_1 progenies was highest for yield/vine followed by fruit weight, vine length, days to first female flower, days to first male flower, fruit length, number of fruits /vine, node number of first female flower, node number of first male flower and fruit diameter.

Maximum variation was found in F_2 generation for yield/vine followed by fruit weight, vine length, days to first male flower, days to first female flower, fruit length, node number of first female flower, number of fruits /vine, node number of first male flower and fruit diameter.

The estimates of heritability in narrow sense (Table 3) were not found high for any character in F_1 generation. Moderate heritability was observed for fruit length, days to first female flower, yield/vine, fruit weight, node number of first male flower and node number of first female flower. Low heritability was recorded for fruit diameter, number of fruits /vine, vine length and days to first male flower.

Table 1: Analysis of variance for parents, F_1s, F_2s, Parents vs F_1s and Parents vs F_2s of 10 characters in 8x 8 parent diallel cross of cucumber. (*Kharif*-2002)

Source of variation	d. f.	Days to first male flower	Days to first female flower	Node no. of first male flower	Node no. of first female flower	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	No. of fruits /vine	Vine length (cm)	**Yield/ vine (g)**
Replication	2	2.45	2.33	0.04	1.03	0.77	0.43	91.76	0.20	145.63	9280.89
Treatment	63	57.36**	58.09**	1.83**	7.42**	18.58**	1.03**	9830.99**	5.74**	1254.84**	544060.31**
Parents	7	7.50**	44.44**	0.97**	3.30**	20.49**	0.60**	6855.51**	1.39**	241.69**	416362.84**
F_1s	27	57.22**	66.69**	1.87**	5.95**	23.24**	1.28**	16953.42**	6.60**	1308.60**	752834.32**
Parents vs F_1s	1	267.57**	180.99**	4.06**	11.90**	37.85**	3.63**	400.02**	7.21**	99.63	438646.88**
F_2s	27	55.05**	50.44**	1.94**	10.02**	7.18**	0.50**	1226.34**	2.91**	1194.39**	945909.27**
Parents vs F_2s	1	524.29**	142.07**	0.58*	3.63*	167.11**	11.24**	37425.61**	14.45**	4847.44**	1606115.60**
Error	126	1.88	2.90	0.16	0.78	0.68	0.17	39.74	0.31	48.01	4873.20

*Significant at 5% level; ** significant at 1% level.

Table 2: Mean and range of 10 characters in parents, F_1s and F_2s, of 8x8 parent diallel cross analysis of cucumber. (*Kharif*-2002)

Characters	Mean			Range					
				Parent		F_1		F_2	
	Parent	F_1	F_2	Min.	Max.	Min.	Max.	Min.	Max.
Days to first male flower	40.14	36.35	34.84	38.33	42.60	28.67	46.23	27.87	46.40
Days to first female flower	47.81	44.65	45.00	42.20	52.27	36.27	52.67	36.83	53.33
Node no. of first male flower	5.57	5.10	5.39	4.77	6.25	3.23	6.0	3.67	6.53
Node no. of first female flower	9.14	8.34	8.69	7.27	10.47	5.93	11.27	6.00	13.20
Fruit length (cm)	16.50	15.08	13.76	13.25	21.11	10.64	23.07	11.33	20.05
Fruit diameter (cm)	4.05	3.61	3.28	3.43	4.43	2.74	5.40	2.60	3.87
Fruit weight (g)	157.34	152.51	112.36	99.63	228.77	81.33	411.10	56.27	157.80
No. of fruits /vine	6.85	7.77	5.97	6.13	8.23	4.60	10.13	3.93	8.27
Vine length (cm)	133.33	131.27	117.49	121.80	150.87	87.07	156.60	83.48	155.07
Yield/ vine (g)	1092.76	1246.05	799.43	6643.37	1820.53	595.27	2815.13	332.07	1249.80

Table 3: Grand mean, h^2, GA and GA in % over mean for 10 characters in 8x 8 parent diallel cross of cucumber. (Kharif-2002)

Characters	$\bar{X}$		h^2 (in narrow sense)		GA		GA in % over mean	
	F_1	F_2	F_1	F_2	F_1	F_2	F_1	F_2
Days to first male flower	36.25	34.84	2.72	2.20	0.18	0.20	0.48	0.56
Days to first female flower	44.65	45.00	16.96	18.82	1.95	1.61	4.37	3.59
Node no. of first male flower	5.09	5.39	10.99	11.74	0.16	0.19	3.20	3.49
Node no. of first female flower	8.34	8.69	10.15	7.49	0.30	0.25	3.63	2.99
Fruit length (cm)	15.08	13.76	20.63	42.56	1.20	1.95	7.96	14.19
Fruit diameter (cm)	3.61	3.28	8.13	13.08	0.11	0.15	3.10	4.65
Fruit weight (g)	152.51	112.36	11.28	63.52	15.75	43.85	10.33	39.03
No. of fruits /vine	7.47	5.97	4.42	8.39	0.12	0.17	1.54	2.87
Vine length (cm)	131.27	117.49	4.24	4.24	1.59	1.61	1.21	1.37
Yield/ vine (g)	1246.05	799.43	15.60	61.56	153.40	271.54	12.31	33.97

Contrary to F_1 high heritability estimates were recorded for fruit weight, yield/vine and fruit length in F_2 generation. Moderate heritability was observed for days to first female flower, fruit diameter and node number of first male flower. Low heritability estimates were also recorded for number of fruits /vine, node number of first female flower, vine length and days to first male flower.

Estimates of genetic advance in % of mean (Table 3) was observed moderate for yield/vine and fruit weight and low for all other traits in F_1 generation. In F_2 generation, high genetic advance in % of mean was reported for fruit weight and yield/vine and remaining characters were categorized as low genetic advance except fruit length. Zhao *et al*. (1991) and Prasad and Singh (1992) have also reported similar findings in cucumber.

Conclusion

High estimates of heritability were due to greater contribution of additive genetic component in F_2 generation. Therefore, these traits could be improved by selection in segregating generations.

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