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GENETIC VARIABILITY IN CUCUMBER (*Cucumis sativus* L.)

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Genetic variability, heritability and genetic advance of different yield contributing characters were studied in 31 collections of cucumber (*Cucumis sativus* L.). The study indicated the existance of considerable amount of genetic variability in respect to different characters contributing towards higher yield and quality in cucumber. It was identified that traits such as fruit weight, number of fruits per plant and node number of first female flower possessing high GCV, heritability and genetic advance could be used effectively in improving yield through selection.

Key words : Cucumber, genetic variability, heritability

Assessment of variability for yield and its components becomes absolutely essential before planning an appropriate breeding strategy for genetic improvement. Parameters such as genotypic and phenotypic variance as well as genotypic and phenotypic coefficient of variation are useful in detecting the amount of variability present in the germplasm. Heritability and genetic advance help in determining the influence of environment on the expression of genotype and the reliability of characters. Hence, present investigation was undertaken to quantify the available variability in cucumber (*Cucumis sativus* L.) based on fifteen important quantitative characters in order to identify desirable genotypes based on *per se* performance, and to select promising donors for various characters which may be used in a hybridisation programme to obtain useful recombinants and to create additional genetic variability.

MATERIALS AND METHODS

The present investigation was carried out at the research farm of Division of vegetable crops, IARI, New Delhi during the summer season of 1997. The experimental material consisted of 31 genotypes laid out in a randomised block design comprising three replications. Seeds were sown on sides of the channels in well prepared hills. Each treatment comprised 10 hills and two plants were allowed to grow per hill. The observations were recorded on five randomly selected plants per replication for each entry on fifteen quantitative traits viz., Days to first male and female flower anthesis, node number for first male and female flowers, days to first fruit harvest, total number of fruits per plant, maturity period, length, diameter and weight of fruit, fruit index, flesh thickness, vine length, total solube solids and yield per plant. The mean value obtained were used for determining phenotypic and genotypic coefficient of variation (Comstock and Robinson, 1952), Heritability (Allard, 1960) and expected genetic advance (Johnson *et al.*, 1955).

RESULTS AND DISCUSSION

The Anova for fifteen characters indicated that there is a considerable variation in respect to all the characters (Table 1). However, absolute variability in different characters cannot be the

criteria for deciding, as to which character is showing the highest degree of variability. This can most easily be done by computation of phenotypic, genotypic variances and coefficient of variations. Table 2 shows that maximum variation was exhibited by yield per plant followed by fruit weight and vine length, both at genotypic and phenotypic levels. The variance was very low for characters like flesh thickness, total soluble solids and node number for first male flower. Similar observations were reported by Mariappan and Pappiah (1990) in cucumber.

Table 1. Mean sum of squares (MSS) for different characters (ANOVA)

	Character	Source of variance		
		Replication	Treatment	Error
	df	2	30	60
1.	Days to first male flower anthesis	10.10	14.53**	0.69
2.	Node number for first male flower	0.49	0.50**	0.09
3.	Days to first female flower anthesis	0.70	41.20**	0.63
4.	Node number for first female flower	0.19	4.23**	0.08
5.	Maturity period	0.46	8.87**	0.24
6.	Days to first fruit harvest	4.04	36.14**	1.00
7.	Average fruit weight	438.37	9478.88**	289.65
8.	Number of fruits per plant	3.13	6.56**	0.18
9.	Fruit length	9.76	32.13*	4.65
10.	Fruit diameter	0.67	1.01**	0.37
11.	Fruit index	195.73	1080.10**	290.60
12.	Flesh thickness	0.01	0.11**	0.02
13.	Percentage total soluble solids	0.18	0.60**	0.19
14.	Vine length	465.43	3941.36**	352.52
15.	Yield per plant	143206.0	413206.53**	55139.00

**Significant at 1% level

In the present study (Table 2), GCV was less compared to that of PCV for all the characters indicating a considerable influence of the environment on their expression. The GCV which gives a picture of the extent of genetic variability in the population, ranged from 4.93 per cent (days to first male flower anthesis) to 44.46 per cent (yield per plant). The GCV values were considerably high for characters such as yield per plant, average fruit weight, number of fruits per plant and node number for first female flower. This is in confirmation with findings of Naga Prasuna and Rama Rao (1988). The above mentioned characters having higher range of variation have a better scope of improvement through selection. Characters such as days to first male flower anthesis, node number for first female flower, maturity period and days to first fruit harvest had nearly equal PCV and GCV values indicating least influence of the environment on their expression. In such a situation, selection can be effective on the basis of the phenotype alone with equal probability of success.

With the help of GCV alone, it is not possible to determine the amount of variation that is heritable. Heritable variation can be found out with greater degree of accuracy when heritability in conjunction with genetic advance is studied (Dudley and Moll, 1969). Hence, both heritability and genetic advance were determined to get a clear picture of the scope of improvement in various characters through selection. The heritability estimates ranged from 36.20 per cent for fruit diameter to 95.54 per cent for days to first female flower anthesis (Table 3) very high heritability values were observed for days to first female flower anthesis, node number for first female flower, maturity period, number of fruits per plant, days to first fruit harvest and fruit weight indicating less influence of environment in these traits. The heritability estimate of yield

Table 2. Genotypic, phenotypic and environmental variances and coefficient of variation for 15 characters

	Characters	Vg	Vp	Vc	GCV %	PCV %
1.	Days to first male flower anthesis	4.61	5.30	0.69	4.93	5.29
2.	Node number for first male flower	0.14	0.23	0.09	13.90	17.82
3.	Days to first female flower anthesis	13.52	14.15	0.63	7.56	7.73
4.	Node number for first female flower	1.38	1.46	0.08	26.33	27.09
5.	Maturity period	2.87	3.11	0.24	17.09	17.79
6.	Days to first fruit harvest	11.71	12.71	1.00	5.86	6.10
7.	Average fruit weight	3063.08	3352.72	289.65	32.58	34.08
8.	Number of fruits per plant	2.12	2.30	0.18	31.51	32.82
9.	Fruit length	9.16	13.81	4.65	21.46	26.35
10.	Fruit diameter	0.21	0.58	0.37	10.07	16.73
11.	Fruit index	263.16	553.76	290.60	24.58	35.65
12.	Flesh thickness	0.03	0.05	0.02	16.49	21.29
13.	Percentage total soluble solids	0.13	0.32	0.19	8.58	13.46
14.	Vine length	1196.27	1548.8	352.52	23.70	26.97
15.	Yield per plant	119335.84	174494.84	55139.00	44.46	53.74

Table 3. Heritability and genetic advance for different characters

Character	Broad sense heritability (%)	Expected genetic advance	
		5% intensity of selection	As percentage of mean
Days to first male flower anthesis	86.98	4.12	9.46
Node number for first male flower	60.86	0.60	22.28
Days to first female flower anthesis	95.54	7.40	15.22
Node number for first female flower	94.52	2.35	52.63
Maturity period	92.28	3.35	0.34
Days to first fruit harvest	92.13	6.76	11.59
Average fruit weight	91.36	108.97	64.14
Number of fruits per plant	92.17	2.88	62.47
Fruit length	66.32	5.07	36.00
Fruit diameter	36.20	0.56	12.30
Fruit index	47.52	23.03	34.91
Flesh thickness	60.00	0.27	25.70
Percentage total soluble solids	40.62	0.47	11.19
Vine length	77.23	62.61	42.90
Yield per plant	68.40	588.59	75.72

was of moderate level suggesting that the environmental effects constitute a major portion of the total phenotypic variation and hence, direct selection for yield will be less effective.

Expected genetic advance and its estimate as percentage of mean for various characters (Table 3) revealed that yield per plant, fruit weight, number of fruits per plant and node number for first female flower exhibited the highest genetic advance. Though characters such as days to first male flower and female flower anthesis, maturity period, days to first fruit harvest had high heritability values, their GCV was comparatively less, resulting in less genetic advance. Total soluble solids and fruit diameter possessed low heritbaility values along with low GCV resulting in low genetic advance. This confirms to findings of Burton (1952), that GCV together with heritability estimates would give a better picture of genetic advance to be expected from selection. It is clear from Table 3 that the traits like fruit weight, number of fruits per plant and node number for first female flower possessing high GCV, heritability and genetic advance could be effectively

used in selection, as it has been suggested that characters with high heritability coupled with high genetic advance would respond to selection better than those with high heritability and low genetic advance (Johnson *et al.*, 1955).

The high variability and heritability along with high genetic advance expressed by the above mentioned traits indicate that the genotypes could be evaluated in multilocation trials and selected as donors for these characters or used as parents in hybridisation programme.

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