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Genetic variability studies in cucumber (*Cucumis sativus* L.) genotypes under hill zone of Karnataka

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Abstract

Thirty diverse genotypes of cucumber collected from different indigenous sources were planted in randomized complete block design and were assessed to know the nature and magnitude of variability for different horticultural traits. The analysis of variance indicated significantly higher amount of variability among the genotypes for all the characters studied. High magnitude of GCV and PCV (>20 per cent) were observed for node at first female flower appear, total number of fruits per vine, fruit length, flesh thickness, average fruit weight, fruit yield per vine, fruit yield per hectare, chlorophyll content and rind thickness. High heritability coupled with high genetic advance as per cent over mean was recorded for the characters viz., field emergence, vine length, number of nodes per vine, node at first male flower appear, days to first male flowering, node at first female flower appear, days to first female flowering, total number of fruits per vine, fruit diameter, fruit length, flesh thickness, average fruit weight, yield per vine, yield per hectare, chlorophyll content and rind thickness. The study indicated that the characters with high GCV, PCV, heritability and genetic advance can be considered for direct selection for improvement in cucumber genotypes.

Keywords: cucumber, variability, genotypic, phenotypic, heritability

Introduction

Cucumber (*Cucumis sativus* L.) is one of the most important cucurbitaceous vegetable crop grown extensively in tropical and sub-tropical parts of the country. It can be grown round the year both in open and in protected structures which becomes an off-season crop for the markets of plains, fetching remunerative returns to the growers. The scope of improvement of any crop depends upon the magnitude of genetic variability present in the available germplasm. Greater the variability in the available germplasm better would be the chances of selecting superior genotypes. Genetic improvement can be brought about by manipulating the genetic makeup of the plant for desirable characters or to get rid of the undesirable genes which retard or inhibit certain pathways. The cucumber varieties released by public sector are old, poor yielder and vulnerable to insect-pest and diseases. So, there is a need to study the variability in cucumber, so that specific genotypes may be identified and promoted for commercial cultivation. In the present study, the information were obtained regarding nature and extent of variability, heritability, genetic advance and genetic gain to have guidelines for selection of desirable traits.

Material and Methods

The present research study was carried out at Department of Vegetable science, College of Horticulture, Mudigere during 2017-18. The material used for research work consists of thirty cultivars of cucumber which were procured from COH Bangalore, KRCCCH Arabhavi and UAHS Shivmogga (Table 1). The experiment was laid out by adopting Randomized Complete Block Design (RCBD) comprising of thirty treatments and two replications. All the cultural practices followed as per the package of practices. Observations on growth, flowering and yield parameters were recorded and subjected to statistical analysis.

Result and Discussion

Analysis of variance

The analysis of variance indicated significantly higher amount of variability among the genotypes for all the characters studied viz., field emergence, vine length, number of branches

per vine, number of nodes per vine, inter nodal length, node at first male flower appear, node at first female flower appear, days to first male flowering, days to first female flowering, days to 50 per cent flowering, days to first harvest of the fruit, days to last harvest of the fruit, total number of fruits per vine, fruit diameter, fruit length, flesh thickness, average fruit weight, per cent marketable fruits per vine, per cent

unmarketable fruits per vine, fruit yield per vine, fruit yield per hectare, chlorophyll content and rind thickness (Table 2). Overall high variability existed for the characters studied and considerable improvement could be achieved in most of the characters by selection. These are in agreement with the findings of [1, 2, 3, 4, 5].

Table 1: List of cucumber genotypes used in study

Sl. No	Genotypes	Sl. No	Genotypes
1	Arbhavi Local -1	16	Honnavar Local
2	Haveri Local	17	IIHR-285
3	Arbhavi Local-2	18	IIHR-341
4	Arbhavi Local-3	19	JMG-1
5	Poinsette	20	Phule Shubhangi
6	Arbhavi Local-4	21	Pebkernal
7	Arbhavi Local-5	22	Kerala-2
8	Banglore Local	23	NCU-1207
9	Davangere Local	24	Pondecherry -1
10	White Long	25	Pusa Uday
11	Dharwad Local	26	Sirsi Local-1
12	EMU-102-402	27	Sirsi Local-2
13	Green Salad	28	TUPE
14	Hasan Local	29	US-640
15	Himangi	30	US-646

Table 2: Analysis of variance for different horticultural traits in cucumber genotypes

Sl. No.	Source of variation/ characters	Replication	Treatments (Genotypes)	Error	S.Em ±	CD @ 5%
	Degrees of freedom	1	29	29		
Growth parameters						
1	Field emergence (days)	1.35	5.00**	0.42	0.46	1.32
2	Vine length (m) at 90 DAS	0.32**	0.10**	0.02	0.10	0.28
3	Number of branches at 90 DAS	0.11	0.76**	0.11	0.24	0.69
4	Number of nodes per vine at 90 DAS	5.95	16.16**	75.12	1.14	3.29
5	Inter nodal length (cm) at 90 DAS	1.16	1.98**	0.81	0.63	1.84
Flowering and yield parameters						
6	Node at first male flower appearance	0.06	0.59**	0.03	0.13	0.37
7	Days to first male flowering	0.99	32.91**	1.68	0.92	2.65
8	Node at first female flower appearance	0.12	3.32**	0.09	0.21	0.61
9	Days to first female flowering	7.15	33.40**	4.09	1.43	4.13
10	Days to 50 per cent flowering	4.60	31.03**	3.64	1.35	3.90
11	Days to first harvest of the fruit	15.04	58.85**	9.66	2.20	6.36
12	Days to last harvest of the fruit	14.05	137.34**	21.78	3.30	9.55
13	Total number of fruits per vine	0.28	9.91**	0.17	0.29	0.84
14	Fruit diameter (cm)	0.01	1.08**	0.06	0.17	0.48
15	Fruit length (cm)	0.77	29.70**	0.84	0.65	1.87
16	Flesh thickness (mm)	2.72	43.12**	1.20	0.77	2.24
17	Average fruit weight (g)	0.17	7462.96**	701.43	18.73	54.17
18	Per cent marketable fruits per vine	20.09	50.06**	14.65	2.71	7.83
19	Per cent unmarketable fruits per vine	20.09	50.06**	14.65	2.71	7.83
20	Fruit yield per vine (kg)	0.01	1.03**	0.05	0.15	0.45
21	Yield per hectare (t)	1.14	82.39**	4.12	1.44	4.15
Quality parameters						
22	Chlorophyll content (mg/g)	0.00	0.37**	0.01	0.06	0.18
23	Rind thickness (mm)	0.03	4.39**	0.14	0.26	0.75

** Significant at 1% DAS- Days after sowing

Genotypic and phenotypic co-efficient of variation

The analysis of variance by itself is not enough and conclusive to explain all the inherent genotypic variance in the genotypes. One of the way by which the variability present in these characters was assessed through a simple approach of examining phenotypic coefficient of variation, genotypic coefficient of variation and the heritability of a character as it enables the plant breeder to decide the extent of selection pressure to be applied under a particular environment, which separates out the environmental influence

from the total variability.

High magnitude of GCV and PCV (>20 per cent) were observed for node at first female flower appear, total number of fruits per vine, fruit length, flesh thickness, average fruit weight, fruit yield per vine, fruit yield per hectare, chlorophyll content and rind thickness (Tables 3 & 4). This reveals that the existence of some variability in the population for these characters. Therefore, selection for above traits can be beneficial for improvement. These findings are in accordance with the [6, 7 8].

Table 3: Estimate of genetic parameters for growth and flowering parameters in cucumber genotypes

Sl. No	Characters	Mean \pm S.Em	Range	GV	PV	GCV (%)	PCV (%)	h ² (%)	GA	GAM (%)
1	Field emergence (days)	9.58 \pm 0.46	7.00-12.00	2.29	17.18	15.79	17.18	84.50	2.86	29.92
2	Vine length (m) at 90 DAS	1.51 \pm 0.10	1.22-2.22	0.04	0.06	13.47	16.26	68.60	0.34	23.00
3	Number of branches at 90 DAS	5.73 \pm 0.24	4.41-6.81	0.32	0.44	9.89	11.52	73.70	1.00	17.50
4	Number of nodes per vine at 90 DAS	16.10 \pm 1.14	10.85-21.34	6.79	9.38	16.17	19.01	72.40	4.56	28.35
5	Inter nodal length (cm) at 90 DAS	9.51 \pm 0.63	7.80-13.30	0.59	1.39	8.04	12.39	42.10	1.02	10.75
6	Node at first male flower appearance	3.02 \pm 0.13	2.15-4.25	0.28	0.31	17.48	18.49	89.40	1.02	34.06
7	Days to first male flowering	25.70 \pm 0.92	20.66-34.12	15.61	17.30	15.37	16.18	90.30	7.73	30.09
8	Node at first female flower appearance	5.64 \pm 0.21	3.51-8.59	1.62	1.70	22.55	23.16	94.80	2.54	45.23
9	Days to first female flowering	33.79 \pm 1.43	26.13-44.84	14.66	18.74	11.33	12.81	78.20	6.97	20.63
10	Days to 50 per cent flowering	35.73 \pm 1.39	30.68-45.35	13.69	17.33	10.35	11.65	79.00	6.77	18.96

GV- Genotypic Variance

PV- Phenotypic Variance

GAM- Genetic Advance as per cent of Mean

GCV- Genotypic coefficient of Variation

PCV- Phenotypic coefficient of Variation

h² - Broad sense heritability

GA- Genetic Advance

Table 4: Estimate of genetic parameters for yield and quality parameters in cucumber genotypes

Sl. No	Characters	Mean \pm S.Em	Range	GV	PV	GCV (%)	PCV (%)	h ² (%)	GA	GAM (%)
1	Days to first harvest of the fruit	43.79 \pm 2.20	36.48-57.32	24.60	34.25	11.32	13.36	71.8	8.65	19.77
2	Days to last harvest of the fruit	92.01 \pm 3.30	83.38-112.34	57.78	79.56	8.26	9.69	72.6	13.34	14.50
3	Total number of fruits per vine	7.58 \pm 0.29	4.04-13.90	4.87	5.04	29.12	29.62	96.7	4.47	58.99
4	Fruit diameter (cm)	4.51 \pm 0.168	3.21-6.18	0.51	0.57	15.85	16.69	90.2	1.40	31.01
5	Fruit length (cm)	18.12 \pm 0.646	12.27-24.59	14.43	15.21	20.97	21.56	94.5	7.60	41.99
6	Flesh thickness (mm)	20.39 \pm 0.77	11.99-29.66	20.96	22.15	22.52	23.15	94.6	9.17	45.12
7	Average fruit weight (g)	180.87 \pm 18.73	95.89-341.70	3380.80	4082.26	32.14	35.32	82.8	109.00	60.26
8	Per cent of marketable fruits/vine	75.79 \pm 2.71	64.72-85.43	17.71	32.35	5.55	7.50	54.7	6.41	8.46
9	Per cent of unmarketable fruits/vine	24.21 \pm 2.71	14.57-32.29	17.71	32.35	17.37	23.49	54.7	6.41	26.48
10	Fruit yield per vine (kg)	1.42 \pm 0.15	0.55-2.55	0.49	0.53	49.37	51.71	91.2	1.37	97.12
11	Fruit yield per hectare (t)	12.9 \pm 0.00	4.89-24.00	39.14	43.26	48.68	51.18	90.5	12.25	95.38
12	Chlorophyll (mg/g)	1.22 \pm 0.06	0.600-2.12	0.18	0.19	34.74	35.48	95.9	0.85	70.08
13	Rind thickness (mm)	7.21 \pm 0.27	4.40-9.70	2.10	2.26	20.11	20.82	93.3	2.88	40.03

GV- Genotypic Variance

PV- Phenotypic Variance

GAM- Genetic Advance as per cent of Mean

GCV- Genotypic coefficient of Variation

PCV- Phenotypic coefficient of Variation

h² - Broad sense heritability

GA- Genetic Advance

Heritability and genetic advance as per cent of mean

Estimate of heritability was recorded high for the characters viz., field emergence (84.5%), vine length (68.6%), number of branches (73.7%), number nodes per vine (72.4%), node at which first male flower appear (89.4%), days to first male flower appear (90.3%), node at which first female flower appear (94.8%), days to first female flower appear (78.2%), days to 50 per cent flowering (79.0%), days to first harvest of the fruit (71.8%), days to last harvest of the fruit (72.6%), total number of fruits per vine (96.7%), fruit diameter (90.2%), fruit length (94.5%), flesh thickness (94.5%), average fruit weight (82.8%), fruit yield per vine (91.2%), yield per hectare (90.5%), chlorophyll content (95.9%) and rind thickness (93.3%). Moderate heritability was observed for inter nodal length, per cent marketable fruits per vine and per cent unmarketable fruits vine. Low magnitude of heritability was not observed for any of the character in the present study (Tables 3 & 4).

High heritability coupled with high genetic advance as per cent over mean was recorded for the characters viz., field emergence, vine length, number of nodes per vine, node at first male flower appear, days to first male flowering, node at first female flower appear, days to first female flowering, total number of fruits per vine, fruit diameter, fruit length, flesh thickness, average fruit weight, yield per vine, yield per hectare, chlorophyll content and rind thickness. Moderate heritability with moderate genetic advance over mean was observed for inter nodal length (Tables 3 & 4).

The above finding indicates that the characters with high and moderate heritability and genetic advance can be considered for direct selection for improvement. In agreement to the results of [9, 10].

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