Research Article

STUDIES ON GENETIC VARIABILITY IN F₂ POPULATION OF CUCUMBER (*CUCUMIS SATIVUS* L.) FOR YIELD AND QUALITY ATTRIBUTES

M.R. BHOOMIKA[1*], N. ADIVAPPAR[1], D. THIPPESHA[1], S. GANGAPRASAD[2] AND SHARANABASAPPA[3]

[1]Department of Horticulture, College of Agriculture, University of Agricultural and Horticultural Sciences, Shivamogga, 577 204, India
[2]Department of Genetics and Plant Breeding, College of Agriculture, University of Agricultural and Horticultural Sciences, Shivamogga, 577 204, India
[3]Department of Agricultural Entomology, College of Agriculture, University of Agricultural and Horticultural Sciences, Shivamogga, 577 204, India
*Corresponding Author: Email - mrbhoomika2375@gmail.com

Abstract: The present investigation was conducted to known the nature and magnitude of genetic variability among the 150 F₂ segregating population along with their parents and standard check. The experiment was laid out at ZAHRS, Shivamogga, during *Kharif* 2019. The recorded data was statistically analyzed by using randomized block augmented design. The analysis of variance showed significant difference in the experimental material used for all the different characters under study. Results also revealed that the estimates of PCV were higher than the GCV for all traits. The highest PCV and GCV were recorded for trait *viz*., yield per vine, number of branches per vine, days to first male flower appearance, fruit diameter, number of nodes at which first male flower appear and rind thickness. The high heritability with high genetic advance as percent of mean was observed for the traits *viz*., number of seeds per fruit, days to first harvest, diameter of vine, days to first male flower appear, number of leaves per vine, fruit diameter, days to first female flower appear, fruit length, number of branches per vine, vine length and number of fruits per vine. Hence, genotypes are selected based on the phenotypic performance of these traits would be more rewarding for selection.

Keywords: *Cucumber, Segregating population, Yield, Variability*

Introduction

Cucumber is the most important vegetable crop of Cucurbitaceae family extensively grown in tropical and subtropical parts of India. It is grown for its tender fruits and it has both internal and external export value. The primary center of origin of cucumber is India.

It has wide range of variation for all the horticultural traits and this accumulated variability evitable for crop improvement programme. In the present study the variability observed in F₂ population is due to segregation and recombination of genes. This might be helpful for the breeder to get a desirable traits combination for improving the yield. Hence, the present study was conducted to know the extent of variability in segregating population and it can be estimated through the different genetic parameters *viz*., PCV, GCV, heritability and genetic advance as per cent of mean.

Material and Method

The present investigation was conducted with 150 F₂ population (Dharwad x Belgaum Local) of cucumber along with their parents (Dharwad and Belgaum Local) and standard check 'Chitra' during *Kharif* 2019. The experiment was carried out at Zonal Agriculture and Horticulture Research Station, Shivamogga.

The experimental design followed for data analysis was randomized block augmented design and the crop was raised with a spacing of 90 cm x 75 cm. For better growth and development of genotypes a good cultural practice was followed as per the package of practices of cucumber. The observations were recorded to know the variability for various growth, flowering, yield and quality parameters of cucumber. The observed variability can be estimated by the formula given by [1]. The heritability and the genetic advance were determined based on the formula by [2] and [3].

Results and Discussion

Analysis of variance revealed that, significant difference among 150 F₂ genotypes for each character indicating that sufficient variability existed in the population for the traits studied in the experiment [Table-1]. The mean performance of genotypes revealed a wide range of variability for all the traits except for a trait number of locules present in the fruit [Table-2]. The highest range of variation was observed for the traits *viz*., number of seeds per fruit (142.01-379.40), vine length (120.00-376.00 cm), days to last harvest (56.00-86.00), number of leaves per vine (34.00-99.00) and fruit length (7.24-19.74 cm). This indicates that range of variation was quite high for most of the characters in a population and suggesting that these traits are improved by individual plant selection. The obtained results are in accordance with [4] and [5].

Coefficient of variation
Phenotypic coefficient of variation

In the present investigation the results of phenotypic coefficient of variation was relatively high for the characters *viz*., yield per vine (39.14 %), number of branches per vine (35.64 %), days to first male flower appearance (33.11 %), fruit diameter (29.73 %), number of node at which first male flower appear (27.64 %), rind thickness (27.10 %), number of fruits per vine (25.55 %), fruit length (22.72 %) and vine length (21.52 %) [Table-3]. Hence, this PCV estimates recommend that higher levels of variability present in the population. It also suggested that genetic factors were predominantly responsible for expression of those attributes and selection could be made effectively on the basis of phenotypic performance. The moderate PCV estimates were observed for characters *viz*., internodal length (10.15 %), number of leaves per vine (11.44 %), diameter of vine (11.82 %), days to first female flower appearance (19.92 %), number of nodes at which first female

Studies on Genetic Variability in F$_2$ Population of Cucumber (*Cucumis sativus* L.) for Yield and Quality Attributes

Table-1 *Analysis of variance for quantitative traits of F$_2$ population (Dharwad × Belgaum Local) of cucumber*

Source of variation	DF	Vine length	Internodal length	No. of branches/vine	No. of leaves/vine	Diameter of vine (mm)	Days to first male flower appearance	Days to first female flower appearance	No. of node at which first male flower appear
							Mean sum of squares		
Blocks	9	17364.15**	1.81**	67.51**	214.38**	1.23**	73.26**	78.17**	0.65**
Entries (Varieties + checks)	150	2171.91**	0.69**	3.81**	79.923**	0.48**	11.14**	6.12**	0.46**
Varieties	149	2883.25**	0.77**	7.72**	79.63**	0.52**	15.20**	10.88**	0.36**
Checks	2	7564.38**	55.48**	3.63**	1290.53**	1.70**	9.03**	74.10**	8.40**
Varieties *vs* Check	1	40588.81**	2.15**	21.46**	2046.05**	5.78**	64.00**	1.36	19.65**
Error	18	326.06	0.13	0.55	1.49	0.005	0.21	0.32	0.14

*significant @ 5% level   ** significant @ 1% level

Source of variation	DF	No. of node at which first female flower appear	Days to first harvest	Days to last harvest	No. of seeds/fruit	No. of fruits/vine	Yield/vine (kg)	Fruit length (cm)	Fruit diameter (cm)	Rind thickness (mm)	Total soluble solids (˚Brix)	Total sugars (%)
								Mean sum of squares				
Blocks	9	1.67**	49.94**	144.98**	4523.44**	19.16**	2.41**	10.51**	15.20**	0.58**	0.32**	0.65**
Entries (Varieties + checks)	150	0.68**	26.52**	26.08**	1388.97**	5.58**	0.53**	18.40**	3.66**	0.25**	0.14**	0.23**
Varieties	149	0.60**	28.31**	32.45**	1658.36**	3.63**	0.64**	9.82**	4.27**	0.28**	0.16**	0.26**
Checks	2	112.23**	335.83**	1710.63**	10800.90**	110.63**	0.60**	236.44**	4.20**	0.15**	2.75**	2.20**
Varieties *vs* Check	1	25.59**	208.32**	380.25**	1855.77**	457.96**	4.77**	1383.41**	48.60**	2.07**	0.05**	2.70**
Error	18	0.12	0.2	0.22	10.25	0.74	0.02	0.42	0.08	0.0008	0.008	0.008

*significant @ 5% level   ** significant @ 1% level

Table-2 *Descriptive statistics for yield and quality attributes of F$_2$ population (Dharwad × Belgaum Local) of cucumber*

SN	Character	F$_2$ Mean ± SEm	Mini.	Max.	Dharwad	Belgaum Local	Chitra
			Range		Mean of Parents		Mean of Standard check
1	Vine length (cm)	235.44 ± 4.38	120	376	281.22	245.90	300.08
2	Internodal length (cm)	8.22 ± 0.07	6.00	9.70	7.20	6.02	10.56
3	Number of branches per vine	7.34 ± 0.22	3.00	15.00	8.90	7.70	8.20
4	Number of leaves per vine	73.12 ± 0.72	34.00	99.00	87.70	69.10	89.70
5	Diameter of vine (mm)	5.72 ± 0.05	3.24	7.59	5.710	5.10	4.92
6	Days to first male flower appearance	11.03 ± 0.31	5.00.	19.00	12.60	13.60	11.70
7	Days to first female flower appearance	15.53 ± 0.26	11.00	23.00	15.70	17.80	12.40
8	Number of nodes at which first male flower appear	2.11 ± 0.04	1.00	4.00	2.80	2.20	4.00
9	Number of nodes at which first female flower appear	4.14 ± 0.06	2.00	6.00	3.70	2.80	9.00
10	Days to first harvest	32.25 ± 0.43	25.00	39.00	30.20	34.70	23.20
11	Days to last harvest	76.86 ± 0.46	56.00	86.00	83.40	80.20	65.70
12	Number of seeds per fruit	271.01 ± 3.32	142.01	379.4	349.10	290.90	147.20
13	Number of fruits per vine	7.08 ± 0.15	5.00	15.00	13.90	12.60	7.60
14	Fruit length (cm)	12.95 ± 0.255	7.24	19.74	14.78	23.09	23.31
15	Fruit diameter (cm)	6.51 ± 0.16	3.00	10.19	5.78	5.09	4.48
16	Rind thickness (mm)	0.57 ± 0.04	0.06	0.9	0.42	0.24	0.18
17	Number of locules	3.00 ± 0.00	3.00	3.00	3.00	3.00	3.00
18	Total soluble solids (˚B)	3.03 ± 0.03	0.34	3.62	2.54	2.84	3.57
19	Total sugars (%)	2.64 ± 0.04	0.27	3.44	2.31	2.80	3.50
20	Yield/vine (kg)	1.93 ± 0.065	0.931	7.276	2.64	2.18	2.27

Table-3 *Genetic variability for yield and quality attributes of F$_2$ population (Dharwad × Belgaum Local) of cucumber*

SN	Character	Mean	Vp	Vg	PCV (%)	GCV (%)	h^2 bs (%)	GA	GAM (%)
1	Vine length (cm)	235.44	2567.36	2241.29	21.52	20.10	87.30	91.12	38.70
2	Internodal length (cm)	8.22	0.69	0.56	10.15	9.14	81.07	1.33	16.96
3	Number of branches per vine	7.34	6.84	6.28	35.64	34.15	91.83	4.94	67.41
4	Number of leaves per vine	73.12	69.98	68.49	11.44	11.31	97.86	16.86	23.06
5	Diameter of vine (mm)	5.72	0.45	0.45	11.82	11.75	98.75	1.37	24.05
6	Days to first male flower appearance	11.03	13.34	13.13	33.11	32.84	98.36	7.4	67.10
7	Days to first female flower appearance	15.53	9.54	9.25	19.92	19.58	96.64	6.16	39.66
8	Number of nodes at which first male flower appear	2.11	0.34	0.2	27.64	21.19	58.77	0.7	33.46
9	Number of nodes at which first female flower appear	4.14	0.54	0.42	17.76	15.64	77.55	1.17	28.37
10	Days to first harvest	32.25	24.83	24.63	15.45	15.38	99.18	10.18	31.57
11	Days to last harvest	76.86	28.47	28.24	6.94	6.91	99.21	10.9	14.18
12	Number of seeds per fruit	271.01	1454.77	1444.51	14.07	14.02	99.29	78.01	28.78
13	Number of fruits per vine	7.08	3.27	2.53	25.55	22.46	77.30	2.88	40.69
14	Fruit length (cm)	12.95	8.66	8.24	22.72	22.15	95.09	5.76	44.51
15	Fruit diameter (cm)	6.51	3.75	3.67	29.73	29.40	97.79	3.9	59.90
16	Rind thickness (mm)	0.57	0.24	0.24	27.10	26.84	82.64	1.01	18.79
17	Number of locules	3	0	0	0	0	0	0	0
18	Total soluble solids (˚Brix)	3.03	0.142	0.134	12.45	12.06	93.86	0.73	24.08
19	Total sugars (%)	2.64	0.23	0.22	18.11	17.76	96.14	0.95	35.88
20	Yield/vine (kg)	1.93	0.57	0.54	39.14	38.19	95.20	1.48	76.77

flower appear (17.76 %), days to first harvest (15.45 %) and number of seeds per fruit (14.07 %) Thus, it indicates that the characters were least influenced by the environment. The character day to last harvest (6.94 %) recorded a low PCV level. Hence, it suggests that the probability of genetic improvement of these traits is low due to the greater influence of the environment in the expression of these traits.

The results of high PCV estimates were in accordance with the Das, *et al.,* (2003) [6], Kanwar and Rana (2006) [7] and Khan, *et al.,* (2015) [8]. The evaluated PCV for the traits days to first female flower appearance and days to first harvest were high in the present study and confirm with the results obtained by Bhave, *et al.,* (2003) [9] and Kumari, *et al.,* (2017).

Genotypic coefficient of variation

The high estimates of GCV for the traits *viz.*, yield per vine (38.19 %), number of branches per vine (34.15 %), days to first male flower appearance (32.84 %), fruit diameter (29.40 %), number of nodes at which first male flower appear, rind thickness, number of fruits per vine, fruit length and vine length [Table-3]. This indicates higher magnitude of variability present in the population for selection. The experiment results are in agreement with the evidences of Veena, *et al.,* (2012) [10], Rajawath and Collis (2017) [11] and Shet, *et al.,* (2018) [12].

Heritability

The relative magnitude of genotypic and phenotypic variability was computed by estimating heritability which is contributed through environmental factors. Heritability and genetic advance are important selection parameters. The high magnitude of heritability indicates that the role of environmental effects is less on expression of characters and selection is made based on the phenotypic performance. A low value of heritability of a character reveals that trait is majorly influenced by environmental effects and selection of trait may be difficult due to masking effects of the environment on the genotypic effects.

In the present investigation, the high heritability estimates were observed for all the traits except for a trait number of nodes at which first male flower appear (58.77 %) [Table-3]. Often, the heritability estimates mislead sometimes due to additive components and more genetic variance transferred from generation to next generation. So, heritability along with genetic advance as per cent of mean is reliable for selecting the traits. The high magnitude of heritability accompanied with high genetic advance as per cent of mean were observed in F_2 population of (Dharwad × Belgaum Local) cucumber for the characters study *viz.*, number of seeds per fruit, days to first harvesting, diameter of vine, days to first male flower appear, number of leaves per vine, fruit diameter, days to first female flower appear, fruit length, number of branches per vine, vine length, fruit diameter, number of fruits per vine and node at which first female flower appear. This indicates that high heritability accompanied with high genetic advance is more rewarding. Selection of a trait is effective and gives a more precise in predicting the genetic gain under selection. The obtained results are in agreement with the evidences of Pradhan, *et al*., (2018) [13], Alekar, *et al*., (2019) [14], Deepa, *et al*., (2018) [15], and Pushpalatha, *et al*., (2016) [16].

Conclusion

In the present study, the observed mean performance was high with wider range of variation and showed a significant difference for all the traits except for number of locules present in the fruit. The experiment also revealed that high PCV estimates recorded for the traits *viz.*, yield per vine, number of branches per vine, days to first male flower appearance, fruit diameter, number of nodes at which first male flower appear, rind thickness, number of fruits per vine, fruit length and vine length. The high heritability coupled with high genetic advance as per cent of mean were recorded for the traits *viz.*, number of seeds per fruit, days to first harvesting, days to first male flower appear, days to first female flower appear, node at which first female flower appear, number of leaves per vine, fruit length, fruit diameter, number of branches per vine, vine length and number of fruits per vine.

Application of research: It is found that there is a good source of variability in the segregating population of cucumber and which helps in identification of promising lines for yield and quality attributes.

Research Category: Horticulture

Abbreviations:
ZAHRS:- Zonal Agricultural and Horticultural Research Station
UAHS :- University of Agricultural and Horticultural Sciences
PCV :- Phenotypic coefficient of variation
GCV :- Genotypic coefficient of variation

**Principal Investigator or Chairperson of research: Dr N. Adivappar
University: University of Agricultural and Horticultural Sciences, Shivamogga, 577 204, India
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Cultivar / Variety / Breed name: Cucumber (*Cucumis sativus* L.)

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