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# Variability studies in cucumber (*Cucumis sativus* L.)

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**ABSTRACT :** Twenty diverse genotypes of cucumber collected from Tamil Nadu and Kerala regions were evaluated for morphological characters like days to first female flowering, node number of first female flower, vine length, number of secondary branches, days to fruit harvest, fruit length, fruit girth, fruit diameter, average fruit weight, number of fruits per plant, 1000 seed weight and yield per plant to estimate the variability, heritability, genetic advance. In variability studies, yield per vine was obtained highest mean value CS 6 genotype. Maximum phenotypic and genotypic co-efficient of variation (PCV and GCV) was for yield per plant followed by average fruit weight, fruit diameter and number of fruits per plant. High heritability was observed for all the characters except node number of first female flower. Genetic gain was maximum for yield per plant followed by average fruit weight, fruit diameter, number of fruits per plant, number of secondary branches, fruit length, fruit girth and 1000 seed weight.

**KEY WORDS :** P C V, GCV. Cucumber, Heritability, Genetic advance

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Cucumber (*Cucumis sativus* L.) is one of the important summer vegetable crop of the family Cucurbitaceae, with a chromosome number 2n=14. It is chiefly grown for its edible tender fruits, preferred as salad ingredient, pickles and desert fruit and as a cooked vegetable. Cucumber has got cooling effect, so in the eastern countries, fruits are often used as cooling vegetable. It is ideal for people suffering from jaundice and allied diseases and also very much useful in preventing constipation. Seeds contain oil, which is helpful for brain development and body smoothness. Hence, it is being used in Ayurvedic preparations (Robinson and Decker-Walter, 1999). Besides this, the whole fruit is used in cosmetic and soap industries.

Cucumber is a highly cross pollinated crop and usually monoecious in nature preferring warm weather and bright light for its better growth and development. However, it can be grown in both summer and rainy season, but it can't tolerate cold injury (Rastogi, 1998). Being primary centre of origin, India has accumulated wide range of variability in this crop. In spite of large number of varieties available in India, only few are promising. This fact draws the attention of plant breeder for its improvement. Genetic variability plays an important role in selecting the best genotypes for making improvement in yield and yield attributing characters as well as to select the potential parent for hybridization programme. Heritability is an index for calculating the relative influence of environment on expression of genotypes, it becomes very difficult to judge how much of variability is heritable and how much is non-heritable. Therefore, the present investigation was carried out to study variability, heritability and genetic advance for twelve quantitative characters in cucumber.

## RESEARCH METHODS

The present study was carried out during 2009-2011 in the Department of Horticulture, Faculty of Agriculture,

Annamalai University, Annamalainagar. Twenty genotypes of cucumber were collected from different parts of Tamil Nadu and Kerala. The experiment was laid out in Randomised Block Design (RBD) with three replications. Pits of 60 cm diameter and 30 cm depth were taken at a spacing of 2 x 1.5 m. In each pit, four seeds were sown. All the recommended cultural and management practices were followed under irrigated condition. Five plants per replication in each accession were tagged for recording the biometrical observations like days to first female flower, node of the first female flower, vine length (cm), number of secondary branches, days to first harvest, fruit length (cm), fruit girth (cm), fruit diameter (cm), average fruit weight (g), fruits per plant, 1000 seed weight and yield per plant (g).

The estimation of mean, variances and standard error were worked out by adopting standard methods (Panse and Sukhatme, 1967). Phenotypic and genotypic co-efficient of variations were calculated by Burton (1952) and Comstock and Robinson (1952). Heritability in broad sense and genetic advance (GA) were estimated by adopting the formula suggested by Lush (1940) and Johnson *et al*. (1955), respectively.

## RESEARCH FINDINGS AND DISCUSSION

The extent of variability present in twenty germplasm of cucumber was measured in terms of range, mean, phenotypic co-efficient of variation and genotypic co-efficient of variation. The analysis of variance estimated for different characters showed highly significant mean sum of squares estimated for all the characters under study (Table 1). The range of different characters (Table 2) observed for vine length, node number of first female flower, days to first female flower, days to fruit harvest, fruit length, fruit girth, fruit diameter, average fruit weight, number of fruits per plant, 1000 seed weight and yield per plant indicating maximum variability present in these traits which showed greater scope for selection among the existing genotype other than secondary branches as it showed smallest range. The genotype CS-9 recorded the highest mean value of vine length. The lowest days required for first fruit harvest was observed in the genotype CS 11. The genotype CS 6 recorded the highest number of secondary branches, average fruit weight, yield per plant, number

**Table 1 : General analysis of variance for various characters of cucumber genotypes**

| Source | df | Mean sum of squares (MSS) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Days to first female flower | Node number of I$^{st}$ female flower | Vine length (cm) | Number of secondary branches | Days to I$^{st}$ fruit harvest | Fruit length (cm) | Fruit girth (cm) | Fruit diameter (cm) | Average fruit weight (kg) | Number of fruits per plant | 1000 seed weight (g) | Yield per plant (kg) |
| Replication | 2 | 1.09 | 1.91 | 10.32 | 0.50 | 7.14 | 5.05 | 1.32 | 0.01 | 0.03 | 3.22 | 0.08 | 1.06 |
| Genotype | 19 | 10.73** | 4.26** | 2655.52** | 1.38** | 49.13** | 108.74** | 92.45** | 25.32** | 0.20** | 25.73** | 20.58** | 26.99** |
| Error | 38 | 1.30 | 1.08 | 4.04 | 0.09 | 2.01 | 0.43 | 0.80 | 0.02 | 0.01 | 2.54 | 0.05 | 1.14 |

** indicate significane of value at P=0.01

**Table 2 : Magnitude of variability for various characters in cucumber genotypes**

| Characters | Mean range | Genotypes | Phenotypic variance (PV) | Genotypic variance (GV) | Phenotypic co-efficient of variation PCV (%) | Genotypic co-efficient of variation GCV (%) |
|---|---|---|---|---|---|---|
| Days to first female flower | 33.25-39.25 | CS6, CS16 | 4.44 | 3.14 | 5.94 | 4.99 |
| Node number of first female flower | 7.25-11.25 | CS16, CS6 | 2.14 | 1.06 | 16.28 | 11.47 |
| Vine length (cm) | 196.67-249.15 | CS9, CS16 | 887.87 | 883.83 | 12.03 | 12.01 |
| Number of secondary branches | 1.98-4.38 | CS6, CS8 | 0.52 | 0.43 | 22.33 | 20.30 |
| Days to first harvest | 51.10-64.10 | CS3, CS9 | 17.72 | 15.71 | 7.32 | 6.89 |
| Fruit length (cm) | 25.47-45.53 | CS3, CS9 | 36.54 | 36.10 | 16.53 | 16.43 |
| Fruit girth (cm) | 30.67-49.73 | CS10, CS9 | 31.35 | 30.55 | 13.56 | 13.39 |
| Fruit diameter (cm) | 6.26-15.38 | CS10, CS7 | 8.45 | 8.43 | 26.87 | 26.85 |
| Average fruit weight (kg) | 0.48-1.46 | CS6 | 0.07 | 0.06 | 29.79 | 27.94 |
| Number of fruits per plant | 6.20-15.80 | CS6 | 10.27 | 7.73 | 29.04 | 25.19 |
| 1000 seed weight (g) | 15.58-25.30 | CS10 | 6.89 | 6.84 | 12.21 | 12.17 |
| Yield per plant (kg) | 5.69-16.20 | CS6 | 9.76 | 8.62 | 33.82 | 31.78 |

of fruits per plant and also earliness observed in same genotype. The highest fruit girth, fruit diameter and 1000 seed weight was observed in CS 10.

Knowledge on the extent and nature of genetic variability is more important rather than observed variation alone. The characters vine length, fruit length, fruit girth had expressed the higher values of genotypic variation and phenotypic variation. However, the co-efficient of variation estimation appear to be better index when the characters with different units of measurements are to be compared as it indicates the relation among the variability present in the germplasm. In the present study, the magnitude of phenotypic co-efficient of variation (PCV) was greater than the corresponding genotypic co-efficient of variation (GCV) for all the characters indicating the interaction of the genotypes with the environment and its influence on the expression of these characters (Choudhary *et al.*, 1985). Higher values of phenotypic co-efficient of variation were observed for number of secondary branches, fruit diameter, average fruit weight, number of fruits per plant and yield per plant. Rastogi and Aryadeep (1990); Nagaprasuna and Rao (1988) and Saikia *et al*. (1995) and Afangideh and Oyoh (2007) in cucumber had also observed higher PCV values for single fruit weight, number of fruits per vine and yield per vine. The characters like node number of first female flower, vine length, fruit length, fruit girth and 1000 seed weight exhibited moderate values of PCV. The characters like days to first female flower and days to fruit harvest exhibited low values of PCV.

Highest values of GCV were observed for fruit diameter, average fruit weight, number of fruits per plant and yield per plant. This result is in consonance with the findings of Sriramamurthy (2000) in cucumber, Rahman *et al.* (2002) in snake gourd and Rakhi and Rajamony (2005) in culinary melon. The characters like number of secondary branches, vine length, fruit length, fruit girth exhibited moderate values of GCV. The characters like days to first female flower, days to fruit harvest exhibited low values of GCV indicating the least scope for improvement through selection. It is further understand that the suitable plant type could be selected where there is minimum difference between PCV and GCV.

The GCV does not offer full scope to estimate the variation that is heritable and therefore, estimation of heritability becomes necessary. The magnitude of heritability was quite higher for all the characters except node number of first female flower. The character showed heritability present in the order as fruit diameter, vine length, 1000 seed weight, fruit length, fruit girth, days to fruit harvest, yield per plant and average fruit weight. These results are in conformity with the findings of Joshi (1981), Rastogi and Aryadeep (1990) and Kumar *et al*. (2008) for yield per plant, fruit weight and number of fruits per plant in cucumber, Neeraja *et al*. (2005) in ridge gourd observed the high heritability for yield per plant and fruit weight.

Heritability estimates alone provide no indication of the amount of genetic progress that could result from the selection of the best genotypes. This happens only when the high heritability coupled with greater genetic advance rather than heritability values for selection best individual. These results revealed the genetic gain ranged from 8.66 (days to first female flower) to 61.52 per cent (yield per plant) (Table 3). The higher GCV and heritability associated with greater genetic gain was

**Table 3 : Estimation of heritability and genetic advance for various characters in cucumber genotypes**

| Sr. No. | Characters | Heritability $h^2$ (%) | Genetic advance | Genetic advance as per cent of mean |
|---|---|---|---|---|
| 1. | Days to first female flower | 70.72 | 6.12 | 8.66 |
| 2. | Node number of first female flower | 49.63 | 8.26 | 16.64 |
| 3. | Vine length (cm) | 99.55 | 24.57 | 24.68 |
| 4. | Number of secondary branches | 82.60 | 31.39 | 38.00 |
| 5. | Days to first harvest | 88.64 | 11.85 | 13.37 |
| 6. | Fruit length (cm) | 98.80 | 33.25 | 33.65 |
| 7. | Fruit girth (cm) | 97.46 | 26.53 | 27.22 |
| 8. | Fruit diameter (cm) | 99.83 | 55.17 | 55.26 |
| 9. | Average fruit weight (kg) | 88.00 | 47.52 | 54.00 |
| 10. | Number of fruits per plant | 75.28 | 33.91 | 45.04 |
| 11. | 1000 seed weight (g) | 99.33 | 24.81 | 24.98 |
| 12. | Yield per plant (kg) | 88.31 | 54.33 | 61.52 |

observed for yield per plant, fruit diameter, average fruit weight and number of fruits per plant indicated these characters had additive gene effects and, therefore, they are more reliable for effective selection. Mariappan and Pappaiah (1990) also reported high heritability coupled with genetic gain for these characters in cucumber. Lal and Singh (1997) and Dahiya *et al*. (2001) in round melon also reported that high heritability coupled with genetic gain for number of female flowers per plant, yield per plant, number of fruits per plant and flesh thickness. Days to first female flower, days to first fruit harvest, vine length, fruit length, fruit girth, 1000 seed weight exhibited high heritability but genetic gain was low in magnitude indicating the non-additive gene action governing these characters. Hence, heterosis breeding would be worthwhile. Considering the diverse nature of the material, it is concluded that the genotypes under investigation had the greater quantity of heritable variation particularly for fruit weight, number of fruits per plant and yield per plant and there is possibility for improvement of these traits by selection.

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