Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2018; 7(5): 1315-1318
Received: 15-07-2018
Accepted: 16-08-2018

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# Study of magnitude of genetic variability for yield and yield attributing traits among local cucumber genotypes

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**Abstract**
For finding some superior lines of local cucumber types available in Northern Karnataka, eleven local cucumber lines along with two Private sector varieties were evaluated at Main Agricultural Research Station, College of Agriculture, Dharwad. They were grown in a Randomized Block Design to study different parameters of variability like GCV and PCV, heritability, genetic advance etc. The genotypes exhibited significant differences for almost all the traits under study. The mean of sum squares were highly significant for all traits except node of first female flower bloom, indicating the presence of wide range of variability in the genotypes. The range of variation was high for characters like fruit weight, vine length, fruit length and days to first male and female flower bloom. The difference between PCV and GCV was negligible for all the characters except node of first female bloom representing that the characters (except node of first female bloom) are not much influenced by environment. High heritability and high expected genetic gain were observed for days to 1st male and female flower bloom, days to first fruit harvest, fruit yield per hectare, fruit length, fruit girth, fruit weight, vine length, no of branches per vine, internodal length, sex ratio indicating that these characters had additive gene effect and therefore are more reliable for effective selection.

**Keywords:** Heritability, cucumber, genetic advance, sex ratio, PCV, GCV

## Introduction
Cucumber (*Cucumis sativus* L.) is one of the most important and popular vegetables of the family Cucurbitaceae. India produces 1, 61,100 tonnes of cucumber and gherkins from an area of 25,200 ha. The productivity of cucumber in India is very low *i.e.* 15.6 tonnesha$^{-1}$ as compared to world average (31.7 tonnes ha$^{-1}$) (Anon., 2012) [2]. India, being a native place of cucumber, possesses wide range of genetic variability for qualitative and quantitative characters. Low fruiting ability and yield suppression due to its inherent fruiting habits are major factors limiting fruit yield in slicing and processing cucumbers. Especially in Northern Karnataka, lots of local type cucumbers (having very higher sex ratio of 20-30:1 and very late female flower emergence) are grown which are popular among the people as compared to other types of cucumbers. So there is an urgent need for improving these local cultivars through use of breeding program to boost the yield of this crop.

Among the cucurbits, cucumber is distinct where sex mechanism is unique and can be easily manipulated for production of $F_1$ hybrids. The favourable genetic system, low inbreeding depression, high heterosis percentage, large number of seeds per fruit (per pollination) and low seed rate requirement per unit area has distinct advantage in commercial exploitation of heterosis in this crop. Thus there is a good scope for improvement in yield and yield related traits of cucumber through genetic manipulation.

In the present study, steps were taken to study genetic variability among local cucumber genotypes. The genetic variability is the raw material of vegetable breeding in which selection acts to evolve superior genotypes. The wide genetic diversity that exists in the available genotypes provides ample scope for further improvement. For a successful crop improvement programme, information on the nature and magnitude of genetic variability, degree of transmission of the traits is of immense importance. The variability available in the population can be partitioned into heritable and non-heritable components *viz*., phenotypic and genotypic coefficients of variation, heritability and genetic advance on which selection can be effectively carried out. High heritability alone is not enough to make efficient selection in segregating generations, unless information is accompanied by substantial amount of genetic advance (Johnson *et al.,* 1955) [6].

## Materials and Methods

The experiment was conducted at Main Agricultural Research Station (MARS), Dharwad farm. The experimental materials consisted of eleven genotypes selected from vegetable block of Division of Horticulture, College of Agriculture, Dharwad. Thirteen genotypes *viz.* Belgaum Local (BGM), Hot Season (HS), Hyderabad (HYD), Pusa Sanyog, Priya, PCO-2, DWD-1, PCL-1, DWD-2, PCR-1, White Long, Indam Swadisht and Indam White Long were grown in the fields for evaluation of their performance under Dharwad conditions. They were grown during *Kharif* season of 2015-16 for their performance evaluation. The seeds were sown in a randomized complete block design (RCBD) with two replications. All recommended agronomic and intercultural practices were carried out thoroughly. During crop growth, the data for different characters such as days for first female flower, node number of first female flower, days to first fruit picking, number of total fruits per vine, total fruit yield per vine, fruit yield per hectare, average fruit weight, vine length, number of branches per vine, internodal length and sex ratio were recorded.

The data recorded for various characters were subjected to statistical analysis based on their sample means. The analysis of variance for each of the characters stated was done to find out varietals differences. The analysis was carried out separately for each trait following the procedure of randomized block design analysis.

## Results and Discussion

The extent of variability present in eleven local cucumber lines along with two private sector varieties were measured in terms of range, phenotypic variance, phenotypic coefficient of variation (PCV), genotypic variance, genotypic coefficient variation (GCV), heritability (broad sense) and genetic advance (GA) (Tables 1 and 2). It was seen that, all the cucumber genotypes exhibited significant differences for almost all the traits studied. A wide range of variation was observed for different growth and yield related characters. The widest range was recorded for vine length (396.65-221.64) followed by fruit weight (236.3-159.35), fruit yield per hectare (49.99-90.54), days to first female bloom (33-48.75) and fruit length (7.07-22.05) indicating the presence of sufficient variability among the genotypes used in the present study. This will further help in selecting the best genotypes from existing collection. However, fruit yield per vine, node of first female bloom and intermodal length recorded low value which showed that there lies minimum variation and very less scope for selection from the present collection of cucumber genotypes. In cucumber similar findings were reported by Reshmi (2006) [14], Arunkumar *et al*. (2011) [3], Veena *et al*. (2012) [17], Jat *et al*. (2014) [5] and Rajawat and Collis (2017) [13].

As we know the expression of various characters are dependent on not only the genotypes but also on the growing environment, which is a very crucial factor in crop production. This is reflected by the findings that the PCV was always found to be higher than the corresponding GCV for all the characters. High values of PCV as well as GCV were recorded for characters like number of branches per vine, fruit length, fruit weight, downy mildew scoring, vine length and node of first male bloom. The high magnitude of GCV further revealed that the variation in expression of these characters are more influenced by the genotype than the environment, hence suggesting good scope for improvement of cucumber through selection of these characters. Similar findings were reported by Singh and Kumar (2002) [16] in bottle gourd, Kutty and Dharmatti (2004) [9] in bitter gourd and Afangideh and Uyoh (2007) [1], Jat *et al*. (2014) [5] and Rajawat and Collis (2017) [13] in cucumber.

The estimation of genetic coefficient of variation indicates the amount of genetic variation present for different desirable traits while the heritability gives an insight into the proportion of variation which is inherent. The heritability estimate gives an idea about the proportion of observed variability, which is attributed to genetic difference. Heritability in broad sense represents greater role about information of relative value of selection, but Johnson *et al*. (1955) [6] had shown that heritability and genetic advance should be jointly considered for reliable conclusion, otherwise it may not represent true inheritance properties. In the present study, all the traits expressed high heritability which ranged from 71.97% (Days to first male bloom) to 99.28% (Fruit weight). Characters like days to first fruit harvest, fruit weight, fruit length, fruit girth, internodal length and no. of branches per vine showed higher degree of heritability, suggesting the important role of genetic constitution in the expression of the character and such traits are considered to be important from breeders point of view as selecting the following generations based on these characters can help in increasing the efficiency of selection and thus help in achieving the goals of breeding programme quickly. In the present scenario, it is clear that these characters are less influenced by the environmental factors and are controlled by additive gene effect (Table 1). Similar high heritability values for the above traits was reported by Singh *et al*. (2012) [16] in bitter gourd, Kumar *et al*. (2013) [8] in Sponge gourd and Dhiman and Prakash (2005) [4], Kumar *et al*. (2008) [7], Jat *et al*. (2014) [5] and Rajawat and Collis (2017) [13] in cucumber,. Fruit yield per vine, downy mildew scoring, fruit yield per hectare and days to first female bloom recorded moderately heritable. Similar result was reported by Mishra *et al*. (2007) [10] in cucumber and Sharma and Sengupta (2013) [15] in bottle gourd. Out of 16 characters studied, in the present study high genetic advance over mean coupled with high heritability was observed in characters like vine length, fruit weight and fruit yield per hectare. As present findings thus correlated that the existing genoypic variability with respect to these traits is mainly due to additive type of genes (Panse 1957) [11], hence these characters are more reliable for effective selection in cucumber breeding. Higher heritability estimates were accompanied by lower genetic advance over the mean for vine length (m), days to first fruit harvest and sex ratio. This suggests that selection may not be useful for the improvement of this trait because of the narrow range of phenotypic variation among the genotypes in respect to this character. Similar findings were reported by Jat *et al*. (2014) [5] in cucumber. The maximum genetic gain in per cent was recorded for fruit length, number of branches per vine, weight of fruit, vine length, fruit girth and total yield per hectare.

**Table 1:** Variability, heritability, genetic advance and genetic gain of different characters in cucumber genotypes

| Sl. No. | Characters | Mean sum of squares | | | Minimum | Maximum | Mean | CV | GCV (%) | PCV (%) | $h^2$ bs (%) | GA | GAM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Replication | Genotype | Error | | | | | | | | | |
| | | 2 | 13 | 12 | | | | | | | | | |
| 1 | Days to first male bloom | 6.01 | 14.38** | 2.34 | 30.25 | 40.5 | 34.25 | 4.47 | 7.16 | 8.44 | 71.97 | 4.29 | 12.52 |
| 2 | Days to first female bloom | 0.09 | 41.56** | 8.59 | 33 | 48.75 | 43.25 | 6.78 | 9.39 | 11.58 | 65.73 | 6.78 | 15.68 |
| 3 | Node of first male bloom | 0.01 | 1.04** | 0.27 | 2.75 | 5.25 | 3.63 | 14.35 | 17.08 | 22.31 | 14.35 | 0.98 | 26.94 |
| 4 | Node of first female bloom | 0.25 | 0.8 | 0.73 | 3 | 5 | 3.84 | 22.15 | 5.16 | 22.74 | 5.15 | 0.09 | 2.41 |
| 5 | Days to first fruit harvest | 3.47 | 28.87** | 0.54 | 42.5 | 55.5 | 49.7 | 1.47 | 7.57 | 7.72 | 96.35 | 7.61 | 15.32 |
| 6 | No of fruits per vine | 0.7 | 1.77** | 0.96 | 7.34 | 11.03 | 9.56 | 10.24 | 6.65 | 12.21 | 29.69 | 0.71 | 7.47 |
| 7 | Fruit yield per vine | 0.02 | 0.08* | 0.02 | 0.9 | 1.63 | 1.18 | 13.05 | 14.14 | 19.24 | 53.98 | 0.25 | 21.4 |
| 8 | Fruit yield per hectare | 118.72 | 295.34** | 69.19 | 49.99 | 90.54 | 67.69 | 12.29 | 15.71 | 19.94 | 62.04 | 17.25 | 25.49 |
| 9 | Fruit length | 0.61 | 47.08** | 0.98 | 7.07 | 22.05 | 15.14 | 6.54 | 31.71 | 32.38 | 95.92 | 9.69 | 63.98 |
| 10 | Fruit girth | 0.61 | 5.65** | 0.26 | 10.26 | 15.93 | 12.64 | 4.05 | 12.98 | 13.59 | 91.12 | 3.23 | 25.52 |
| 11 | Fruit weight | 0.01 | 4267.56** | 15.39 | 103.2 | 236.3 | 159.35 | 2.46 | 28.94 | 29.04 | 99.28 | 94.64 | 59.39 |
| 12 | Vine length | 3014.31 | 6723.67** | 826.18 | 164.05 | 396.65 | 221.64 | 12.97 | 24.5 | 27.72 | 78.11 | 98.87 | 44.61 |
| 13 | No of branches per vine | 4.62 | 27.16** | 2.36 | 4.25 | 16 | 11.06 | 13.88 | 31.83 | 34.73 | 84.03 | 6.65 | 60.12 |
| 14 | Internodal length | 0.18 | 0.81** | 0.05 | 7.02 | 9.25 | 8.41 | 2.74 | 7.34 | 7.83 | 87.73 | 1.19 | 14.16 |
| 15 | Sex ratio | 0 | 81.8** | 1.08 | 16.34 | 22.43 | 20.21 | 5.15 | 8.38 | 9.83 | 72.58 | 2.97 | 14.7 |
| 16 | Downly mildew scoring | 9.85 | 5.35* | 1.35 | 2 | 8 | 5.38 | 21.55 | 26.26 | 33.97 | 59.77 | 2.25 | 41.83 |

**Table 2:** Mean performance of genotypes for different characters studied in local cucumber genotypes

| Sl. No. | Genotypes | Days to first male bloom | Days to first female bloom | Node of first male bloom | Node of first female bloom | Days to first fruit harvest | No of fruits per vine | Fruit yield per vine | Fruit yield per hectare | Fruit length | Fruit girth | Fruit weight | Vine length | No of branches per vine | Internodal length | Sex ratio | Downy mildew scoring |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Belgaum Local | 32.25 | 35.5 | 3.5 | 3.33 | 52.5 | 9.43 | 1.16 | 64.43 | 15.26 | 10.82 | 103.2 | 183.55 | 11 | 7.94 | 22.12 | 6.5 |
| 2 | Hot Season | 36 | 44.65 | 5.25 | 4.15 | 52.8 | 9.23 | 1.09 | 60.82 | 11.26 | 14.25 | 179.15 | 215.95 | 8.25 | 9.08 | 17.13 | 3 |
| 3 | Hyderabad | 31.5 | 46.5 | 4.9 | 3.55 | 55.5 | 10.51 | 1.33 | 73.83 | 21.15 | 10.91 | 173.17 | 193.1 | 14.5 | 8.47 | 20.71 | 5 |
| 4 | Pusa Sanyog | 35 | 44.65 | 3.3 | 4 | 50.25 | 9.27 | 1.03 | 57.21 | 20.31 | 11.94 | 198.7 | 210.18 | 16 | 8.35 | 21.91 | 5.5 |
| 5 | Priya | 30.25 | 43.9 | 2.815 | 4.75 | 47.25 | 9.63 | 1.00 | 55.83 | 18.29 | 10.26 | 165.8 | 230.05 | 12 | 8.37 | 19.77 | 6 |
| 6 | PCO-2 | 35.75 | 44 | 3.665 | 3.15 | 51.75 | 11.02 | 0.95 | 52.76 | 8.92 | 14.11 | 124.92 | 252.11 | 11.83 | 8.35 | 20.17 | 7 |
| 7 | DWD-1 | 36.25 | 46.15 | 2.83 | 4.4 | 48.5 | 9.25 | 1.1 | 61.19 | 7.065 | 12.64 | 122.08 | 171.9 | 9.5 | 7.48 | 20.5 | 4 |
| 8 | PCL-1 | 34.5 | 48.75 | 2.75 | 3 | 50.75 | 10.67 | 1.27 | 70.54 | 14.28 | | 236.17 | 164.05 | 13.75 | 8.48 | 20.81 | 6 |
| 9 | DWD-2 | 35 | 46.15 | 3.65 | 4.15 | 46.8 | 10.1 | 1.35 | 74.99 | 17.81 | 14.82 | 236.3 | 208.4 | 6.4 | 9.17 | 19.36 | 2 |
| 10 | PCR-1 | 40.5 | 46.5 | 4.465 | 3.1 | 51.8 | 9.38 | 1.24 | 68.87 | 9.555 | 12.34 | 104.2 | 228.09 | 13.5 | 8.61 | 21.92 | 6.5 |
| 11 | White Long | 31.5 | 40 | 3.5 | 3.65 | 52.15 | 7.34 | 0.9 | 49.99 | 16.79 | 12.11 | 122.67 | 222.30 | 15.5 | 8.71 | 19.58 | 8 |
| 12 | Indam Swadisht | 33.25 | 42.5 | 3.415 | 3.75 | 42.5 | 8.71 | 1.63 | 90.54 | 22.05 | 12.45 | 179.1 | 396.65 | 7.33 | 9.25 | 22.43 | 5 |
| 13 | Indam White Long | 33.5 | 33 | 3.5 | 5 | 43.5 | 9.66 | 1.295 | 71.93 | 14.06 | 11.79 | 126.1 | 205 | 4.25 | 7.02 | 16.33 | 5.5 |
| | Mean | 34.25 | 43.25 | 3.63 | 3.84 | 49.7 | 9.56 | 1.18 | 67.69 | 15.14 | 12.64 | 159.35 | 221.64 | 11.06 | 8.41 | 20.21 | 5.38 |
| | CV | 4.47 | 6.78 | 14.34 | 22.15 | 1.47 | 10.24 | 13.05 | 12.29 | 6.54 | 4.05 | 2.46 | 12.97 | 13.88 | 2.74 | 5.15 | 21.55 |
| | CD (5%) | 3.34 | 2.69 | 1.12 | 1.86 | 1.6 | 2.13 | 0.34 | 17.84 | 2.16 | 1.12 | 8.55 | 62.63 | 3.34 | 0.5 | 2.27 | 2.53 |
| | CD (1%) | 4.68 | 4.16 | 1.55 | 2.6 | 2.24 | 2.99 | 0.47 | 24.76 | 3.03 | 1.56 | 11.98 | 87.8 | 4.69 | 0.7 | 3.18 | 3.54 |
| | Range | 10.25 | 15.75 | 2.5 | 2 | 13 | 3.69 | 0.73 | 40.55 | 14.99 | 5.67 | 133.1 | 232.6 | 11.75 | 2.23 | 6.1 | 6 |

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