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# Genetic Variability, Heritability and Genetic Advance in Brinjal (*Solanum melongena* L.)

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**Abstract**
A field investigation was carried out with 180 genotypes of brinjal to study the genetic variability, heritability and genetic advance of thirteen different characters. Highly significant differences were observed among all the genotypes and characters except days to last picking under study indicating the presence of sufficient amount of variability in all the characters. PCV estimates were higher than their corresponding GCV for all characters studied. GCV was found low for all the characters whereas, PCV was moderate for fruit yield per plant (15.69%) followed by number of fruits per plant (15.43%). High heritability was noticed for fruit length (86.62%), plant height (76.73%), plant spread – EW (72.99%), number of branches per plant (72.12%) and total soluble solid (63.38%). Expected genetic advance was observed to be low for all the characters. Therefore, studied characters may be included in assortment criterion for improvement in fruit yield per plant in brinjal.

**Keywords:** Genetic variability, Heritability, Genetic advance, Brinjal.

## Introduction
Brinjal, eggplant or aubergene (*Solanum melongena* L.), belongs to the family Solanaceae, is the native of India and is one of the most popular and widely grown crop of commercial and dietary significance in the world (Thompson and Kelly, 1957) [17]. It is widely accepted and grown crop of both tropic and sub-tropics of the world. The popularity of eggplant has increased rapidly from the middle of 19th century to the present time. Due to its sky-scraping production rate all over world, it is often referred to as a poor man's vegetable (Kumar *et al*., 2014) [9]. Hence, it is a good source of income to small and marginal farmers.

In spite of obvious importance in our daily life, little attention has been given to this crop in the past for the yield improvement. Use of traditional varieties and less variability affected by diseases and pest is the important constraint for low yield potentiality. Collection of germplasm and its genetic analysis can help to get a suitable genotype for higher yield or any other desirable character. To meet the demand of ever increasing population, there is need to enhance the productivity levels of brinjal crop. Therefore, it is essential to improve the yield potential of available genotypes through suitable breeding programme. It is one of very few self-pollinated crops where exploitation of hybrid vigour has been commercially successful because of high number of seeds obtained from a cross.

The success of any crop improvement programme largely depends upon the nature and magnitude of the genetic variability existing in breeding material with, which the plant breeder is working.

Variability is the basic requirement for any crop improvement programme. The total variability present in germplasm can be divided into heritable and non-heritable components through genetic parameters like phenotypic and genotypic coefficients of variation, heritability and genetic advance. The effectiveness of selection directly depends on the amount of heritability and genetic advance as per cent of mean for that character. Knowledge on genetic information obtained through the analysis of genetic variability and relatedness between or within species is pre-requisite towards effective utilization and conservation of plant genetic resources (Chaudhuri *et al*., 1976). Keeping in view the importance of these, the present research work has been formulated to study the genetic variability, heritability and genetic advance among different quantitative characters of brinjal.

## Materials and Methods

The present study was carried out at Vegetable Research Station, Junagadh Agricultural University, Junagadh. The material for the present study comprised 180 genotypes collected from Vegetable research station, Junagadh Agricultural University, Junagadh, and evaluated in Augmented Randomized Block Design (ARBD) with nine blocks during late *Kharif* 2017-18. Each block contain 20 genotypes with 3 checks. The seedlings were planted in a fashion accommodating 10 plants in each treatment at spacing of 90cm line to line and 60cm plant to plant. The package of practices and plant protection schedules were adopted as per recommendations for raising the crop successfully. Five randomly marked plants from each genotype were observed for recording various quantitative characters. Likewise, the randomly picked five fruits were used for recording the fruit characters for each genotype in each block. The mean of these five plants and fruits was used for statistical analysis. Analysis of variance was carried out as per methodology given by Panse and Sukhatme (1985) [15]. Genotypic and phenotypic coefficients of variation (GCV and PCV) were calculated by the formula given by Burton and De Vane (1953) [3], heritability in broad sense (h2) and Genetic advance and genetic gain were calculated as per the formula suggested by Lush (1940) [11] and Johnson *et al*. (1955) [8].

## Results and Discussion

The analysis of variance (Table 1.) revealed that the mean squares due to genotypes were significant for all the characters except days to last picking which indicating the presence of sufficient amount of genetic variability among genotypes for fruit yield per plant and other yield contributing traits. These findings are in accordance with the findings of Sharma and Swaroop (2000) [16] for most of the characters. Hence, it can be noted that systematic crossing among selected genotypes in brinjal generates good amount of variability in subsequent generations.

The mean, range, coefficient of range, heritability and genetic advance are presented in Table 2. In the present study among all the characters studied, the genotypic coefficient of variation was low in magnitude for almost all the traits studied, while phenotypic coefficient of variation was observed moderate in magnitude for fruit yield per plant followed by number of fruits per plant. This indicated the presence of wide variation for these characters under study to allow selection for individual traits. Moderate phenotypic coefficient of variation for fruit yield per plant was reported by Naliyadhra *et al*. (2007) [13], Golani *et al*. (2015) and Nilakh *et al*. (2017) [14], while moderate PCV for number of fruits per plant was reported by Nilakh *et al*. (2017) [14], which support our findings.

The estimate of heritability is more advantageous when expressed in terms of genetic advance. Johnson *et al*. (1955) [8] suggested that without genetic advance the estimate of heritability will not be practical value and emphasized the concurrent use of genetic advance along with heritability and stated that heritability and genetic advance are two complementary concepts. Based on this consideration, high heritability was observed for fruit length, plant height, plant spread (EW), number of branches per plant and total soluble solid. This indicates that good correspondence between genotypic and phenotypic values and there by low environmental effect on the expression of characters. These results are in close conformity with the findings of Naliyadhara *et al*. (2007) [7]. While, moderate estimates of heritability was found for days to 50% flowering, fruit weight, fruit girth, days to first picking and plant spread (NS). These findings were corroborated with the findings of Ansari *et al*. (2011) [1] for days to 50% flowering and fruit girth. On the other hand, low heritability was found in the number of fruits per plant, fruit yield per plant and days to last picking. Low heritability for these traits suggested that environmental effects constituted major portion of total phenotypic variation and hence direct selection for these characters would be less effective. This view was supported by Sharma and Swaroop (2000) [16] for number of fruits per plant and fruit yield per plant.

Burton (1952) [3] suggested that genotypic coefficient of variation along with heritability estimates would provide a better idea of the amount of advance expected by phenotypic selection as heritability estimates very often subjected to genotype x environment interaction. Heritability estimates in conjunction with genetic gains are more effective and reliable in predicting the improvement through selection (Johnson *et al*., 1955) [8]. In the present study, all the traits *viz*., plant height, plant spread (EW), fruit weight, days to 50% flowering, plant spread (NS), days to first picking, fruit length, fruit girth, number of branches per plant, total soluble solid, number of fruits per plant, days to last picking and fruit yield per plant expressed low genetic advance. Similar findings were reported by Sharma and Swaroop (2000) [16], Kushwah and Bandhyopadhya (2005) [10].

**Table 1:** Analysis of variance showing mean squares for 13 characters in 180 genotypes of brinjal

| Source of variation | d.f. | Days to 50% flowering | Plant Height (cm) | Plant Spread – EW (cm) | Plant Spread - NS (cm) | Days to First Picking | Days to Last Picking | Number of branches per plant | Fruit length (cm) | Fruit girth (cm) | Fruit weight (g) | No. of fruits per plant | Total soluble solids ($^0$Brix) | Fruit yield per plant (kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Block (B) (Eliminating Check+Var.)** | 8 | 426.01** | 799.98** | 360.57** | 190.31** | 106.76** | 57.40** | 4.07** | 45.23** | 10.94** | 477.82** | 7.39 | 22.43** | 0.21* |
| **Entries (E) (including block)** | 182 | 92.71** | 199.33** | 186.82** | 156.20** | 25.49** | 18.31 | 0.63** | 9.78** | 10.24** | 159.14** | 10.21* | 0.89** | 0.17* |
| **Check (C)** | 2 | 813.37** | 1120.16** | 229.84** | 53.97 | 16.33* | 12.70 | 0.80** | 11.92** | 157.86** | 745.94** | 35.95** | 0.10 | 0.37* |
| **Varieties (V)** | 179 | 103.02** | 182.91** | 183.19** | 125.64** | 27.37** | 20.53 | 0.72** | 9.17** | 6.52** | 145.29** | 9.09* | 1.74** | 0.17* |
| **Check vs. Varieties** | 1 | -3194.38 | 1296.44** | 750.53** | 5831.69** | -292.91* | -367.14 | -16.30 | 113.19** | 380.91** | 1464.53** | 157.87** | -150.33 | 0.71** |
| **Error (E)** | 16 | 10.16 | 5.96 | 7.23 | 20.15 | 4.08 | 12.70 | 0.03 | 0.15 | 0.17 | 15.24 | 3.77 | 0.11 | 0.08 |

*, ** Significant at 5 % and 1% levels, respectively

**Table 2:** Mean, range, coefficient of range, phenotypic and genotypic coefficients of variation, heritability (Broad Sense), genetic advance and genetic advance expressed as percentage of mean for 13 characters in 180 genotypes of brinjal

| Characters | Mean | Range | Coefficient of range (%) | Genotypic Coefficient of Variation (%) | Phenotypic Coefficient of Variation (%) | Heritability in broad sense (%) | GA | GA as % of mean |
|---|---|---|---|---|---|---|---|---|
| Days to 50% flowering | 61.85 | 43.00 – 87.00 | 33.85 | 5.19 | 7.32 | 50.38 | 4.70 | 7.59 |
| Plant height (cm) | 61.39 | 27.20 – 92.30 | 54.48 | 7.22 | 8.25 | 76.73 | 8.00 | 13.03 |
| Plant spread (EW) | 78.90 | 35.44 – 122.98 | 55.26 | 5.60 | 6.56 | 72.99 | 7.78 | 9.86 |
| Plant spread (NS) | 78.12 | 38.78 – 98.68 | 43.58 | 4.38 | 7.23 | 36.78 | 4.28 | 5.47 |
| Days to first picking | 151.90 | 147.00 – 168.00 | 6.67 | 1.06 | 1.70 | 38.78 | 2.06 | 1.36 |
| Days to last picking | 199.72 | 182.00 – 203.00 | 5.45 | 0.47 | 1.84 | 6.41 | 0.49 | 0.24 |
| No. of branches per plant | 3.92 | 2.20 – 5.80 | 45.00 | 7.06 | 8.32 | 72.12 | 0.48 | 12.36 |
| Fruit length (cm) | 10.82 | 5.19 – 25.35 | 66.01 | 9.25 | 9.94 | 86.62 | 1.92 | 17.73 |
| Fruit girth (cm) | 15.72 | 8.83 – 21.93 | 42.59 | 5.06 | 7.70 | 43.12 | 1.08 | 6.84 |
| Fruit weight (g) | 143.35 | 110.60 – 201.00 | 29.01 | 2.65 | 3.80 | 48.67 | 5.46 | 3.81 |
| Number of fruits per plant | 13.53 | 6.17 – 24.39 | 59.62 | 5.69 | 15.43 | 13.58 | 0.58 | 4.32 |
| Total soluble solids ($^0$ Brix) | 6.95 | 4.08 – 10.44 | 43.80 | 6.14 | 7.71 | 63.38 | 0.70 | 10.06 |
| Fruit yield per plant (kg) | 1.92 | 1.15 – 3.60 | 51.58 | 5.26 | 15.69 | 11.24 | 0.07 | 3.63 |

## Conclusion

The study revealed that the phenotypic coefficient of variation estimates were higher than their corresponding genotypic coefficient of variation for all characters studied due to the environmental condition. High heritability was noticed for fruit length, plant height, plant spread - EW, number of branches per plant and total soluble solid with low genetic advance which indicated the both of additive and non-additive gene action, hence may be improved through selection at later generation. Therefore, studied characters may be included in assortment criterion for improvement in fruit yield per plant in brinjal.

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