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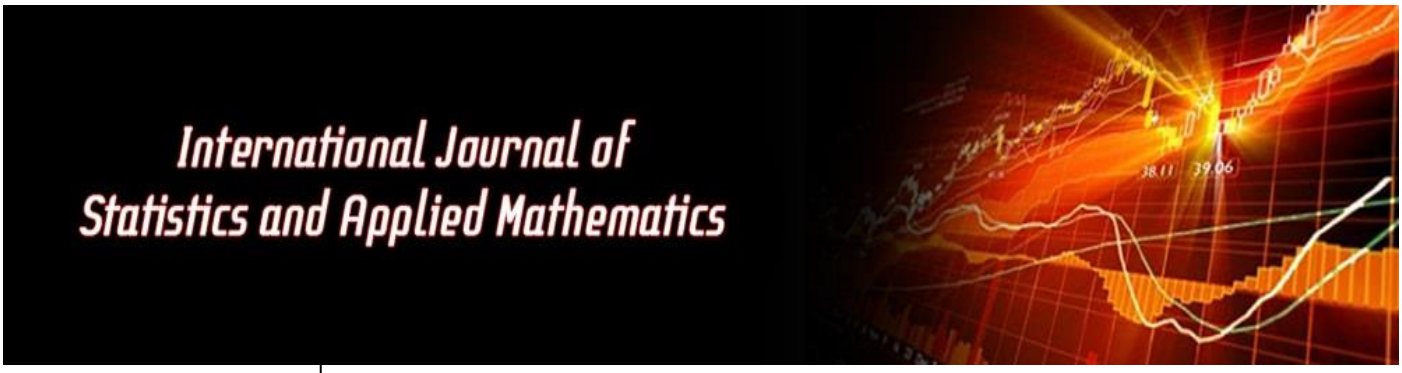

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S Srinivasa Raju
SMS, Department of Horticulture, KVK, Rastakuntabai ANGRAU, Lam, Guntur, Andhra Pradesh, India

K Uma Jyothi
Dean of PG Studies Dr. YSRHU, VR Gudem, Andhra Pradesh, India

M Paratpara Rao
Associate Professor, Department of Olericulture, Dr. YSRHU, VR Gudem, Andhra Pradesh, India

K Usha Kumari
Associate Professor, Department of Olericulture, Dr. YSRHU, VR Gudem, Andhra Pradesh, India

B Bala Krishna
Associate Dean, KL University, Andhra Pradesh, India

N Emmanuel
Professor, Department of Entomology, Dr. YSRHU, VR Gudem, Andhra Pradesh, India

S Narasimha Rao
Associate Professor, Department of Pathology, Dr. YSRHU, VR Gudem, Andhra Pradesh, India

G Amrutha Veena
SMS, Department of Plant Protection, ANGRAU, Guntur, Andhra Pradesh, India

Corresponding author
S Srinivasa Raju
SMS, Department of Horticulture, KVK, Rastakuntabai ANGRAU, Lam, Guntur, Andhra Pradesh, India

Genetic parameters for different characters of the brinjal (*Solanum melongena* L.) in F_4, F_5 and F_6 generation of the cross (Babajipet-1 × EC-169084)

S Srinivasa Raju, K Uma Jyothi, M Paratpara Rao, K Usha Kumari, B Bala Krishna, N Emmanuel, S Narasimha Rao and G Amrutha Veena

Abstract
The present investigation entitled "Genetic studies in advanced generations for yield and yield contributing traits in brinjal (*Solanum melongena* L.)" was conducted at College of Horticulture, Venkataramannagudem, Andhra Pradesh during *Kharif*-2020, *Rabi*-2020 and *Kharif*-2021. The F_4, F_5 and F_6 generations of the cross (Babajipet-1 x EC-169084) were evaluated with the objective of selecting superior genotypes through pedigree method of selection for economically important traits and to assess the various genetic parameters for the brinjal crop improvement. The data from advanced generations were collected and statistically analyzed to compute mean, range, phenotypic and genotypic coefficients of variance, heritability, expected genetic advance, genetic advance as per cent mean, genetic gain.
The pedigree of the cross T_1 (Babajipet-1 x EC-169084) recorded the genetic gain from F_4 to F_5 and F_5 to F_6 generation; for yield per plant (45.88 and 8.60), plant height (4.22 and 0.17), plant spread N-S (22.83 and 3.06), plant spread E-W (17.49 and 5.66), number of primary branches (2.77 and 3.77), number of flowers per inflorescence (5.72 and 8.28), number of fruits per inflorescence (8.98 and 6.45), days to final harvest (2.62 and 0.67), fruit length (17.84 and 5.16), number of fruits per plant (13.37 and 6.80), fruit volume (6.44 and 7.17), number of fruits per plant (21.31 and 12.73), average fruit weight (16.53 and 3.24) and fruit firmness (20.16 and 10.27) respectively. Two top performing plants were selected in F_6 generation and selfed for further preliminary yield trials.

Keywords: Genetic studies, Mean, Range, PCV, GCV, heritability, genetic advance and genetic gain

Introduction
Brinjal (*Solanum melongena* L.) is a solanaceous vegetable with chromosome number 2n=2x=24. It is a perennial vegetable but commercially grown as annual crop. Because of it's highest production potential and availability to consumers, it is often referred as poor man's vegetable. It is essentially tropical and sub-tropical crop grown extensively in India, Bangladesh, Pakistan, China, Japan and Philippines.
In India, egg plant occupies an area of 7.36 lakh hectares with an annual production of 127.77 lakh tonnes and the productivity stands at 17.36 tonnes per hectare. In Andhra Pradesh, it is grown over an area of 0.69 lakh hectares with annual production of 12.40 lakh tonnes and productivity of 17.97 tonnes per hectare (NHB, 2019-20). In initial days of crop improvement mass selection was practiced by the breeders and resulting varieties were non-uniform in terms of many traits. Consumer demand for uniform, good quality produce is increasing day by day and obviously the farmer should produce market demanded produce and at the same time the cultivated genotypes should be high yielding and resistant to biotic and abiotic stresses.
For achieving uniformity, pure line selection, hybridization followed by pedigree/bulk selection and heterosis breeding (F_1 hybrids) are the best methods. But in often cross-pollinated crops like brinjal, pure lines are mostly preferred by the farmers because of ease of seed production. Hybridization followed by selection is widely followed method for developing high yielding genotypes in solanaceous vegetables. After hybridization, selling is done to get the variability. Recombination and segregation leads to release of genetic variability in segregating populations.

Estimation of nature and magnitude of variability, heritability of yield contributing and other traits is immense importance. The available variability can be portioned into heritable and non-heritable components. If greater the available genetic variability more is the chance for getting better genotypes by direct selection (Vavilov, 1951) [26].

Heritability can be measured by the genetic relationship between the parent and offspring. Greater the heritable variation, the possibility of fixing the characters by selection methods is higher. Genetic advance is helpful to devise the effect of selection. Heritability, and genetic advance studies are of immense use to identify whether the observed variation for a particular character is due to genotype or environment. Hybridization followed by selection in the segregation generations (pedigree/ bulk method of breeding) is one of the widely used breeding methods to develop varieties in self-pollinated as well as often cross-pollinated vegetable crops including brinjal. There are fair chances of isolation of transgressive segregants also in this procedure (Briggs and Allard, 1953 and Singh, 2002) [3, 23]. Many high yielding varieties in brinjal *viz*., Pusa purple long, Pusa purple cluster, Pusakranti, Pusabhairav, PusaShymala, Pusa Anmol, Arka shirish, Arka sheel, Arka keshav, Arka Nidhi, Arka Neelkanth, Arka Kusumkar*etc.*, have been developed through hybridization followed by pedigree selection.

Materials and Methods

In order to develop superior recombinant genotypes in brinjal, hybridization programme was initiated with the cross Babajipet-1 × EC-169084 at College of Horticulture, Venkataramannagudem, during *Kharif*, 2016 and selection was exercised in F_2, F_3 generations during *Kharif*, 2019 and *Rabi*, 2019 respectively. The fifteen top performing plants selected from F_3 generation were selfed to get F_4 generation for the present study.

Evaluation of F_4 generation

During *Kharif*, 2020-21, 15 progenies of Babajipeta-1 × EC-169084 were raised with a spacing of 75 cm × 75 cm in a Randomized Block Design with three replications. Each progeny in each replication had 10 individual plants and a total of 30 plants over three replications per progeny were accommodated to exercise selection and nine top performing plants were selected and selfed to get F_5 generation for the present study.

Evaluation of F_5 generation

During *Rabi*, 2020-21, nine progenies of Babajipeta-1 × EC-169084 were raised with a spacing of 75 cm × 75 cm in a Randomized Block Design with three replications. Each progeny in each replication had 10 individual plants and a total of 30 plants over three replications per progeny were accommodated to exercise selection and three top performing plants were selected and selfed to get F_6 generation for the present study.

Evaluation of F_6 generation

During *kharif*, 2021-22, three progenies of Babajipeta-1 × EC-169084 were raised with a spacing of 75 cm × 75 cm in a Randomized Block Design with three replications. Each progeny in each replication had 10 individual plants and a total of 30 plants over three replications per progeny were accommodated to exercise selection and two top performing plants were selected and selfed to get F_7 seed.

Results and Discussion

Observations were taken for all the individual plants separately and the data was statistically analyzed to compute mean, range, phenotypic and genotypic coefficients of variance, heritability, expected genetic advance, genetic advance as per cent mean, genetic gain in F_4, F_5 and F_6 generation for the cross Babajipet-1 x EC-169084 was presented as follows.

Plant height (cm)

The range for plant height varied from 80.60 to 107.92 with a mean of 94.22. The estimates of PCV and GCV were low (7.14 and 3.24) respectively in F_4 generation, whereas, in F_5 generation it varied from 91.43 to 100.80 with a mean of 98.20 and the PCV and GCV were low (7.40 and 6.71) respectively. In F_6 plant height varied from 96.87 to 100.16 with a mean of 98.37. The estimates of PCV and GCV were low (2.02 and 1.02) respectively in F_6 generation. The per cent genetic gain for this trait was 4.22 from F_4 to F_5 generation and 0.17 from F_5 to F_6 generation. The results are in conformity with Neelambika *et al*. (2020) [12].

Low, high and low heritability (20.60, 82.30 and 25.50) coupled with low, moderate and low genetic advance as per cent of mean (3.03, 12.55 and 1.06) were observed in F_4, F_5 and F_6 generations for plant height. The per cent genetic gain for this trait was 4.22 from F_4 to F_5 generation and 0.17 from F_5 to F_6 generation. Genetic advance for this trait was 2.98 per cent in F_4, while genetic advance in F_5 was 11.82 per cent and it was 1.04 per cent in F_6 generation. These results are in consonance with findings of Surabhi *et al*. (2020) [25].

The PCV was higher than the respective GCV, denoting environment influencing the expression of the trait to some degree or other in F_4, F_5 and F_6 generations. However, the values of F_6 generation were less than those in F_4 andF_5 generation indicating decrease in variability due to selection. The expected genetic advance as per cent of mean was less in F_6 when compared to that of F_4 andF_5 generation which may be due to reduction in variance. Low, high and low heritability (20.60, 82.30 and 25.50) coupled with low, moderate and low genetic advance as per cent of mean (3.03, 1.55 and 1.06) were observed in F_4, F_5 and F_6 generations for plant height. Heritability values may vary from generation to generation for the same population and also affected by varying magnitude of genotypic x environmental interaction. There is no consistent tendency of increase or decrease in heritability from F_4 to F_6 generation (Raval *et al*., 2017) [20]. The results are in conformity with Neelambika *et al*. (2020) [12] Surabhi *et al*. (2020) [25].

Plant spread N-S (cm)

The variation for this character ranged from 49.40 to 75.43 with an average of 63.77. The PCV (15.51) and GCV (9.11) were moderate and low respectively in F_4 generation, whereas in F_5 generation plant spread varied from 76.13 to 85.20 with a mean of 78.33 and the PCV and GCV were low (5.07 and 3.23) respectively. The range for plant spread varied from 73.43 to 81.46 with a mean of 80.73. The per cent genetic gain for this trait was 22.83 from F_4 to F_5 generation and 3.06 from F_5 to F_6 generation. The estimates of PCV and GCV were low (5.18 and 4.76) respectively in F_6 generation indicating the presence of narrow variability for this trait in the present study. The results are similar with findings of Surabhi *et al*. (2020) [25].

Moderate, moderate and high heritability (34.50, 40.50 and 84.70) coupled with moderate, low and low genetic advance

as per cent of mean (11.02, 4.23 and 9.03) were observed in F_4, F_5 and F_6 generation for plant spread. Genetic advance for this trait was 7.03 per cent in F_4, while genetic advance in F_5 was 3.42 per cent and it was 7.07 per cent in F_6 generation. Heritability values may vary from generation to generation for the same population and also affected by varying magnitude of genotypic x environmental interaction (Raval *et al*., 2017) [20]. The per cent genetic gain for this trait was 4.22 from F_4 to F_5 generation and 0.17 from F_5 to F_6 generation. The results are in line with Surabhi *et al*. (2020) [25].

Plant spread E-W (cm)

The trait plant spread E-W ranged from 51.16 to 78.50 with a mean of 67.40. The PCV (15.86) and GCV (3.20) were moderate and low respectively in F_4 generation, while in F_5 generation it varied from 74.86 to 85.33 with a mean of 79.19 and the PCV and GCV were low (6.12 and 3.63) respectively. The range for plant spread E-W varied from 80.20 to 88.53 with a mean of 83.68. The per cent genetic gain for this trait was 17.49 from F_4 to F_5 generation and 5.66 from F_5 to F_6 generation. The estimates of PCV and GCV were low (4.84 and 4.75) respectively in F_6 generation indicating the presence of narrow variability for this trait in the present study. Comparable results are noticed by Surabhi *et al*. (2020) [25].

Low, moderate and high heritability (4.10, 35.20 and 96.20) coupled with low, low and low genetic advance as per cent of mean (1.32, 4.44 and 9.60) were observed in F_4, F_5 and F_6 generation for plant spread. Genetic advance for this trait was 0.89 per cent in F_4, while genetic advance in F_5 was 3.51 per cent and it was 8.03 per cent in F_6 generation. The per cent genetic gain for this trait was 17.49 from F_4 to F_5 generation and 5.66 from F_5 to F_6 generation. These results are in conformity with the findings of Surabhi *et al*. (2020) [25].

Number of primary branches

The variation for this character ranged from 5.60 to 8.06 with an average of 7.22. The PCV (11.26) and GCV (5.93) were moderate and low respectively in F_4 generation. These results are in conformity with the findings of Shilpa *et al.* (2018) [22], whereas in F_5 generation, number of primary branches were varied from 5.93 to 8.23 with a mean of 7.42 and the PCV and GCV were moderate and low (10.75 and 9.70) respectively. The number of primary branches varied from 7.26 to 8.06 with a mean of 7.70 in F_6 generation. The estimates of PCV and GCV were low and low (4.48 and 4.22) respectively in F_6 generation. The per cent genetic gain for this trait was 2.77 from F_4 to F_5 generation and 3.77 from F_5 to F_6 generation. These results are in conformity with the findings of Shilpa *et al.* (2018) [22].

Low, high and high heritability (27.80, 81.30 and 88.60) coupled with low, moderate and low genetic advance as per cent of mean (6.44, 18.02 and 8.19) were observed in F_4, F_5 and F_6 generation for number of primary branches. Genetic advance for this trait was 0.46 per cent in F_4, while genetic advance in F_5 was 1.30 per cent and it was 0.63 per cent in F_6 generation. The per cent genetic gain for this character was 2.77 from F_4 to F_5 generation and 3.77 from F_5 to F_6 generation. These results are in conformity Muktilata *et al.* (2018) [11] and Shilpa *et al.* (2018) [22].

Days to 50% flowering

The number of days to 50% flowering ranged from 41.66 to 49.33 days with a mean of 45.51 and the estimates of PCV and GCV were low (7.24 and 3.14) in F_4 generation, whereas in F_5 generation, days to 50% flowering was varied from 38.66 to 46.33 days with a mean of 43.48 and the PCV and GCV were low (7.28 and 3.01) respectively. The days to 50% flowering varied from 40.33 to 44.66 days with a mean of 42.66. The estimates of PCV and GCV were low (5.71 and 4.15) respectively in F_6 generation. The per cent genetic gain for this trait was -4.46 from F_4 to F_5 generation and -1.88 from F_5 to F_6 generation. These findings agree with the findings of Prabhu *et al*. (2009) [17], Muktilata *et al.* (2018) [11], Balas *et al.* (2019) [1], Jyothi *et al.* (2019) [12], Surabhi *et al*. (2020) [25], Balasubramaniyam *et al*. (2021) [2].

Low, low and moderate heritability (18.80, 17.10 and 52.80) coupled with low, low and low genetic advance as per cent of mean (2.80, 2.56 and 6.21) were observed in F_4, F_5 and F_6 generation for days to 50% flowering. Genetic advance for this trait was 1.22 per cent in F_4, while genetic advance in F_5 was 1.16 per cent and it was 2.65 per cent in F_6 generation. The per cent genetic gain for this character was - 4.46 from F_4 to F_5 generation and -1.88 from F_5 to F_6 generation. The results are in line with Prabhu *et al*. (2009) [17 and Neelambika *et al*. (2020) [12].

Number of flowers per inflorescence

The mean variation ranged from 1.90 to 4.56 with a mean value of 2.97 and the estimated PCV (34.43) and GCV (8.77) were high and low in F_4 generation. The results are in line with Mehboob *et al*. (2017) [9] in F_4 population, whereas in F_5 generation, number of flowers per inflorescence was varied from 2.43 to 3.53 with a mean of 3.14 and the PCV and GCV were moderate (15.11 and 12.03) respectively. The results are in line with the number of flowers per inflorescence varied from 3.16 to 5.46 days with a mean of 3.40. The estimates of PCV and GCV were high (32.67 and 32.45) respectively in F_6 generation. These results are in conformity with the findings of Ravali *et al.* (2017) [20] and Balasubramaniyam *et al*. (2021) [2]. The per cent genetic gain for this trait was 5.72 from F_4 to F_5 generation and 8.28 from F_5 to F_6 generation.

Low, high and high heritability (6.50, 63.40 and 98.70) coupled with low, moderate and high genetic advance as per cent of mean (4.60, 19.72 and 66.40) were observed in F_4, F_5 and F_6 generation for number of flowers per inflorescence. Genetic advance for this trait was 0.14 per cent in F_4, while genetic advance in F_5 was 0.58 per cent and it was 2.92 per cent in F_6 generation. Low and low heritability and GAM in F_4 generation. These results are in conformity with the findings of Neha *et al*, (2016) [13]. The per cent genetic gain for this trait was 5.72 from F_4 to F_5 generation and 8.28 from F_5 to F_6 generation.

Number of fruits per inflorescence

The range of variation observed for this trait was 1.93 to 3.76 with a mean of 2.56. The PCV (27.23) and GCV (6.67) were recorded for this trait in F_4 generation, whereas in F_5 generation, number of fruits per inflorescencevaried from 2.10 to 3.36 with a mean of 2.79 and the PCV and GCV were high (23.09 and 21.88) respectively. The number of fruits per inflorescence varied from 2.30 to 3.53 with a mean of 2.97. The estimates of PCV and GCV were moderate (17.98 and 16.93) respectively in F_6 generation. These are in testament to the work of Priyanka *et al.* (2018) [18], Shilpa *et al.* (2018) [22], Balas *et al.* (2019) [1], Jyothi *et al.* (2019) [12], Surabhi *et al.* (2020) [25].

Low, high and high heritability (6.00, 89.70 and 88.70) coupled with low, high and high genetic advance as per cent of mean (3.36, 42.70 and 32.85) were observed in F_4, F_5 and F_6 generation for number of fruits per inflorescence. Genetic

advance for this trait was 0.09 per cent in F_4, while genetic advance in F_5 was 1.09 per cent and it was 0.97 per cent in F_6 generation. The per cent genetic gain for this trait was 8.98 from F_4 to F_5 generation and 6.45 from F_5 to F_6 generation. High heritability along with high genetic advance as per cent of mean was recorded for this trait in F_5 and F_6 generation, which indicates the role of additive gene action in the inheritance of this trait. Hence, direct phenotypic selection may be useful with respect to this trait. These results are in conformity with the findings of Jyothi *et al.* (2019) [12], Balasubramaniyam *et al*. (2021) [2].

Days to first harvest

Days to first harvest ranged from 53.33 days to 61.00 days with a mean of 58.03 days and the PCV (6.24) and GCV (3.27) were recorded low for this trait in F_4 generation, whereas in F_5 generation, days to first harvest ranged from 49.00 days to 57.33 days with mean of 53.55 days and the PCV and GCV were low (5.50 and 3.72) respectively. In F_6 the days to first harvest ranged from 51.00 days to 55.66 days with a mean of 52.41. The estimates of PCV and GCV were low (4.39 and 4.04) respectively. These results are in conformity with the findings of Ravali *et al.* (2017) [20], Balas *et al.* (2019) [1].

Low, moderate and high heritability (27.40, 45.80 and 84.80) coupled with low, low and low genetic advance as per cent of mean (3.52, 5.19 and 7.67) were observed in F_4, F_5 and F_6 generation for days to first harvest. Genetic advance for this trait was 1.88 per cent in F_4, while genetic advance in F_5 was 3.01 per cent and it was 4.02 per cent in F_6 generation. The per cent genetic gain for this trait was -7.72 from F_4 to F_5 generation and -2.12 from F_5 to F_6 generation. Comparable results are reported by Ravali *et al.* (2017) [20], Balasubramaniyam *et al*. (2021) [2].

Days to final harvest

Days to final harvest ranged from 150.00 days to 174.33 days with a mean of 163.33 days and the PCV (4.63) and GCV (3.75) were recorded low for this trait in F_4 generation, whereas in F_5 generation, days to final harvest ranged from 150.66 days to 175.33 days with mean of 167.62 days and the PCV and GCV were low (6.49 and 6.00) respectively. In F_6 generation the days to final harvest ranged from 167.00 days to 171.00 days with a mean of 168.75. The estimates of PCV and GCV were low (1.42 and 1.10) respectively.

High, high and high heritability (65.70, 85.30 and 60.90) coupled with low, moderate and low genetic advance as per cent of mean (6.27, 11.42 and 1.78) were observed in F_4, F_5 and F_6 generation for days to final harvest. Genetic advance for this trait was 10.52 per cent in F_4, while genetic advance in F_5 was 18.66 per cent and it was 3.00 per cent in F_6 generation. The per cent genetic gain for this trait was 2.62 from F_4 to F_5 generation and 0.67 from F_5 to F_6 generation. The results are in line with the findings of Madhavi *et al.* (2015), Ravali *et al.* (2017) [20] and Balas *et al.* (2019) [1].

Fruit length (cm)

The value for fruit length ranged from 6.21 to 8.44 with a mean of 7.23 and moderate PCV (14.68) and low GCV (2.71) were recorded for this trait in F_4 generation, whereas in F_5 generation, it ranged from 7.38 to 9.96 with a mean of 8.52 and the estimates of PCV and GCV were moderate (10.92 and 10.47) respectively. The results are in line with Shilpa *et al.* (2018) [22]. The fruit length ranged from 8.65 to 9.51 with a mean of 8.96 in F_6 generation and the PCV and GCV were recorded low (4.27 and 4.16) respectively for this trait under study. Similar results are observed by Prabhu *et al.* (2009) [17] and Neelambika *et al*, (2020) [12].

Low, high and high heritability (3.40, 91.90 and 95.00) coupled with low, high and low genetic advance as per cent of mean (1.03, 20.67 and 8.36) were observed in F_4, F_5 and F_6 generation for fruit length. Genetic advance for this trait was 1.03 per cent in F_4, while genetic advance in F_5 was 20.67 per cent and it was 8.36 per cent in F_6 generation. The per cent genetic gain for this trait was 17.84 from F_4 to F_5 generation and 5.16 from F_5 to F_6 generation. Low heritability for fruit length in F_4 generaion may be due to the use of average performance of each line for the analysis of interplant variability as reported by Neelambika *et al*, (2020) [12] in F_4 generation. The high heritability coupled with high and low genetic advance as percent of mean was observed in F_5 and F_6 generation. The results are in line with Prabhu *et al.* (2009) [17], Surabhi *et al.* (2020) [25], Balasubramaniyam *et al.* (2021) [2].

Fruit girth (cm)

The value for fruit girth ranged from 9.49 to 15.94 with a mean of 12.71 and moderate PCV (15.69) and low GCV (1.94) were recorded for this trait in F_4 generation, whereas in F_5 generation, it ranged from 12.63 to 17.81 with a mean of 14.41 and the estimates of PCV and GCV were moderate (16.76 and 16.47) respectively. The fruit girth ranged from 13.18 to 17.29 with a mean of 15.39 in F_6 generation and the PCV and GCV were recorded moderate (11.39 and 11.09) respectively for this trait under study. These results agree with earlier workers Prabhu *et al.* (2009) [17], Ramesh *et al.* (2013) [19], Balas *et al.* (2019) [1].

Low, high and high heritability (1.50, 96.50 and 94.70) coupled with low, high and high genetic advance as per cent of mean (0.49, 33.33 and 22.24) were observed in F_4, F_5 and F_6 generation for fruit girth. Genetic advance for this trait was 0.49 per cent in F_4, while genetic advance in F_5 was 33.33 per cent and it was 22.24 per cent in F_6 generation. Low heritability in F_4 generation may be due to the use of average performance of each lines for the analysis of interplant variability as reported by Prabhu *et al.* (2009) [17] and Neelambika *et al.* (2020) [12]. The per cent genetic gain for this trait was 13.37 from F_4 to F_5 generation and 6.80 from F_5 to F_6 generation. These are in testament to the work of Prabhu *et al.* (2009) [17], Balas *et al.* (2019) [1] and Surabhi *et al.* (2020) [25].

Fruit length to girth ratio

The trait fruit length to girth ratio ranged from 0.40 to 1.22 with a mean of 0.70. The estimates of PCV (47.97) and GCV (45.03) were high for fruit length to girth ratio in F_4 generation. The results are similar with findings of Reshmika *et al.* (2015) [21], Neha *et al.* (2016) [13] and Jyothi *et al.* (2019) [12], whereas in F_5 generation, it was ranged from 0.55 to 0.78 with a mean of 0.68 and the estimates of PCV and GCV were moderate (13.07 and 12.17) respectively. The fruit length to girth ratio ranged from 0.51 to 0.65 with a mean of 0.58 in F_6 generation and the PCV and GCV were recorded moderate (11.61 and 11.13) respectively for this trait under study.

High, high and high heritability (88.10, 86.70 and 91.90) coupled with high, low and low genetic advance as per cent of mean (89.08, 23.35 and 21.98) were observed in F_4, F_5 and F_6 generation for fruit length to girth ratio. Genetic advance for this trait was 0.61 per cent in F_4, while genetic advance in F_5 was 0.15 per cent and it was 0.12 per cent in F_6 generation.

The per cent genetic gain for this trait was -2.85 from F_4 to F_5 generation and -14.70 from F_5 to F_6 generation. Comparable results are reported by Reshmika *et al.* (2015) [21], Neha *et al.* (2016) [13] and Jyothi *et al.* (2019) [12].

Fruit volume (cm^3)

The variation for fruit volume ranged from 290.00 to 350.00 with a mean of 316.29. The PCV (10.96) and GCV (4.20) were moderate and low indicating the presence of narrow variability for this trait in F_4 generation, whereas in F_5 generation, it ranged from 296.66 to 366.66 with a mean of 336.66 and the estimates of PCV and GCV were low (8.42 and 6.36) respectively. The fruit volume ranged from 346.66 to 376.66 with a mean of 360.83 in F_6 generation and the PCV and GCV were recorded low (4.10 and 3.51) respectively for this trait under study. Similar results are reported by Konyak *et al*. (2022) [8].

Low, moderate and high heritability (14.70, 57.00 and 73.40) coupled with low, low and low genetic advance as per cent of mean (3.31, 9.90 and 6.20) were observed in F_4, F_5 and F_6 generation for fruit volume. Genetic advance for this trait was 11.17 per cent in F_4, while genetic advance in F_5 was 31.31 per cent and it was 22.40 per cent in F_6 generation. The per cent genetic gain for this trait was 6.44 from F_4 to F_5 generation and 7.17 from F_5 to F_6 generation. Similar results are reported by Konyak *et al*. (2022) [8].

Number of fruits per plant

Number of fruits per plant ranged from 31.93 to 58.60 with a mean of 45.31 and it exhibited high PCV (23.54) and moderate GCV (15.09) in F_4 generation. Simililar results are observed by Prabhu *et al*. (2009) [17] and Shilpa *et al.* (2018) [22]. However, moderate heritability (41.10) coupled with low (9.03) genetic advance and moderate (19.94) genetic advance as per cent of mean was observed for this character in F_4 generation. This indicated that preponderance of additive gene action governing the inheritance offers possibility to improve through selection. Similar results are reported by Prabhu *et al*. (2009) [17] and Shilpa *et al.* (2018) [22].

In F_5 generation, number of fruits per plant ranged from 48.66 to 61.56 with a mean of 54.97 and it displayed low PCV and GCV (8.71 and 7.10) respectively. However, high heritability (66.40) coupled with low (9.03) genetic advance and moderate (11.92) genetic advance as per cent of mean was observed for this character. Low estimates of PCV and GCV recorded for this trait indicated the presence of less genetic variability. However, high heritability indicated that there was less influence of environmental factors on the expression of this character; hence the selection would be effective for improvement of this character. However, notable improvement can be achieved by repeating selection in the advanced generations because of moderate GAM in F_5 generation. The results are similar with findings of Prabhu *et al*. (2009) [17] and Ravali *et al*. (2017) [20].

Number of fruits per plant ranged from 54.70 to 71.90 with a mean of 61.97 and it exhibited moderate PCV and GCV (12.69 and 12.63) respectively. Similar results are observed by Prabhu *et al*. (2009) [17] and Shilpa *et al.* (2018) [22]. However, high heritability (99.10) coupled with moderate (16.05) and high (25.90) genetic advance as per cent of mean was observed for this character in F_6 generation. The per cent genetic gain for this trait was 21.31 from F_4 to F_5 generation and 12.73 from F_5 to F_6 generation. Moderate estimates of PCV and GCV values recorded for this trait indicating the presence of moderate genetic variability. High heritability and high GAM indicating a preponderance of additive gene action governing its inheritance. Hence selection is effective for this character. The results are in line with Prabhu *et al*. (2009) [17] and Jyothi *et al.* (2019) [12], Balasubramaniyam *et al*. (2021) [2].

Average fruit weight (g)

The average fruit weight ranged from 45.50 to 59.16 with a mean of 51.05 and the estimates of PCV and GCV were moderate (15.96) and low (3.71). Similar results are observed by Chitra *et al*. (2022), while low heritability (5.40) coupled with low (0.90) genetic advance and low (1.78) genetic advance as per cent of mean was observed for this character in F_4 generation.

In F_5 generation, it ranged from 51.06 to 72.86 with a mean of 59.49 and the estimates of PCV and GCV were moderate (12.59 and 12.07 respectively). Similar results was observed by Chitra *et al*. (2022). However, high heritability (92.00) coupled with moderate (14.65) GA and high (23.85) genetic advance as per cent of mean was observed for this character. The results are in line with Balas *et al.* (2019) [1], Surabhi *et al*. (2020) [25].

This character ranged from 55.30 to 64.10 with a mean of 61.42 and the estimates of PCV and GCV were low (6.34 and 6.01 respectively). However, high heritability (89.90) coupled with low (6.98) GA and high (11.74) genetic advance as per cent of mean was observed for this character in F_6 generation. The per cent genetic gain for this trait was 16.53 from F_4 to F_5 generation and 3.24 from F_5 to F_6 generation. The results are in line with Prabhu *et al*. (2009) [17].

Number of seeds per fruit

Number of seeds per fruit varied from 336.00 to 395.33 with a mean of 359.66 and the estimates of PCV (14.95) and GCV (9.60) were moderate and low for number of seeds per fruit. This trait recorded moderate heritability (41.20) coupled with moderate (41.15) GA and moderate (12.69) GAM in F_4 generation. Moderate to low estimates of PCV and GCV recorded for this trait indicating the presence of less genetic variability. However, moderate heritability indicated that there was less influence of environmental factors on the expression of this character; hence the selection would be effective for improvement of this character. However, notable improvement can be achieved by repeating selection in the advanced generations because of moderate GAM.

In F_5 generation, it varied from 310.00 to 389.33 with a mean of 347.22 and the estimates of PCV and GCV were low (9.52 and 5.72) respectively for number of seeds per fruit. This trait recorded moderate heritability (36.10) coupled with moderate GA (24.62) and low GAM (7.09).

Number of seeds per fruit varied from 263.33 to 388.00 with a mean of 324.11 and the estimates of PCV and GCV were low (7.77 and 7.11 respectively) for number of seeds per fruit. This trait recorded high heritability (83.80) coupled with moderate (41.15) GA and moderate GAM (13.42) in F_6 generation. The per cent genetic gain for this trait was -3.45 from F_4 to F_5 generation and -6.65 from F_5 to F_6 generation. Low estimates of PCV and GCV recorded for this trait indicating the presence of less genetic variability. However, high heritability indicating that there was less influence of environmental factors on the expression of this character; hence the selection would be effective for improvement of this character. However, notable improvement can be achieved by repeating selection in the advanced generations

because of moderate GAM. Similar results are reported by Mili *et al*. (2014) [10] and Balasubramaniyam *et al*. (2021) [2].

Seed weight per fruit (g)

The trait seed weight per fruit varied from 4.32 to 5.36 with a mean of 4.82 and the estimates of PCV (12.90) and GCV (5.79) were moderate and low for seed weight per fruit. This trait recorded low heritability (20.10) coupled with low GAM (5.35) and low (0.24) GA in F_4 generation. Moderate to low estimates of PCV and GCV recorded for this trait indicating the presence of less genetic variability.

In F_5 generation, it varied from 3.95 to 5.42 with mean of 4.50 and the estimates of PCV (14.66) and GCV (1.56) were moderate and low for seed weight per fruit. This trait recorded low heritability (1.10) coupled with low GAM (0.34) and low (0.01) GA. Moderate to low estimates of PCV and GCV recorded for this trait indicating the presence of less genetic variability.

The trait seed weight per fruit varied from 3.55 to 4.63 with a mean of 3.99 and the estimates of PCV (9.00) and GCV (8.76) were low and low for seed weight per fruit. This trait recorded high heritability (94.80) coupled with low GAM (17.58) and low GA (0.84) in F_6 generation. The per cent genetic gain for this trait was -6.63 from F_4 to F_5 generation and -11.33 from F_5 to F_6 generation. Moderate to low estimates of PCV and GCV recorded for this trait indicating the presence of less genetic variability. Similar results are reported by Mili *et al.* (2014) [10].

Firmness of the fruit (kg/cm^2)

Firmness of the fruit varied from 2.15 to 2.78 with a mean of 2.43 and it exhibited moderate PCV and GCV (19.18 and 10.03 respectively). However, low heritability (27.30) coupled with moderate genetic advance as per cent of mean (10.80) and low GA (0.31) was observed for this character in F_4 generation.

In F_5 generation, firmness of the fruit varied from 2.31 to 3.82 with a mean of 2.43 and it showed moderate PCV (12.80) and low GCV (7.43). However, moderate heritability (33.70) coupled with low genetic advance as per cent of mean (8.88) and low GA (0.21) was observed for this character.

Firmness of the fruit varied from 3.01 to 3.38 with a mean of 3.22 and it recorded low PCV and GCV (9.55 and 3.12). However, low heritability (10.70) coupled with low genetic advance as per cent of mean (2.09) and low GA (0.06) was observed for this character in F_6 generation. The per cent genetic gain for this trait was 20.16 from F_4 to F_5 generation and 10.27 from F_5 to F_6 generation. Similar results are reported by Sunanda *et al*. (2019) [24] in tomato.

Phenols (mg 100 g^{-1})

The value for phenols ranged from 3.93 to 5.30 with a mean of 4.68 and moderate PCV (11.02) and low GCV (3.33) were recorded for this trait in F_4 generation. This trait recorded low heritability (9.20) coupled with low GAM (2.08) and low GA (0.09).

In F_5, the mean value for phenols ranged from 4.35 to 4.84 with a mean of 4.59 and it recorded low PCV and GCV (5.79 and 5.56) respectively. This trait recorded high heritability (89.10) coupled with high GAM (37.01) and low GA (1.17).

The phenols ranged from 2.41 to 4.02 with a mean of 3.16 and moderate PCV (20.16) and low GCV (19.30) were recorded for this trait in F_6 generation. This trait recorded high heritability (92.30) coupled with low GAM (11.01) and low GA (0.50) in F_6 generation. The per cent genetic gain for this trait was -1.92 from F_4 to F_5 generation and -31.15 from F_5 to F_6 generation. These results are in corroboration with the observations of Ramesh *et al.* (2013) [19], Ravali *et al.* (2017) [20] and Surabhi *et al*. (2020) [25].

Yield per plant (kg)

Yield per plant ranged from 1.76 to 3.27 with a mean of 2.31 and it noticed high PCV (29.37) and moderate GCV (13.96). Similar results are reported by Vidya and Kumar (2015). A low heritability (22.60) coupled with moderate GAM (13.68) and low GA (0.31) were observed for this character in F_4 generation. Similar results are reported by Parvati *et al.* (2018) [16].

In F_5 generation, yield per plant ranged from 2.78 to 4.27 with a mean of 3.37 and it recorded moderate PCV and GCV (15.24 and 13.48 respectively). Similar results are reported by Chitra *et al*. (2022). High heritability (78.30) coupled with high GAM (4.57) and low GA (0.83) was observed for this character. These results are in conformity with the findings of Neha *et al.* (2016) [13], Ravali *et al.* (2017) [20] and Divya and Sharma (2018) [6].

Yield per plant ranged from 3.28 to 3.97 with a mean of 3.66 and it recorded low PCV and GCV (8.18 and 7.87 respectively). High heritability (92.50) coupled with moderate GAM (15.60) and low GA (0.57) were observed for this character in F_6 generation. The per cent genetic gain for this trait was 45.88 from F_4 to F_5 generation and 8.60 from F_5 to F_6 generation. Similar results are reported by Prabhu *et al.* (2009) [17] and Das *et al.* (2010) [5].

Table 1: Genetic parameters for different characters in F_4, F_5 and F_6 generation of cross (Babajipet-1×EC-169084).

Character	Generation	Mean	Range	PCV	GCV	Heritability (%)	GA at 5%	GAM at 5%	% GG
Plant height (cm)	F_4	94.22	80.60-107.92	7.14	3.24	20.60	2.98	3.03	
	F_5	98.20	91.43-100.80	7.40	6.71	82.30	11.82	12.55	4.22
	F_6	98.37	96.87-100.16	2.02	1.02	25.50	1.04	1.06	0.17
Plant spread N-S (cm)	F_4	63.77	49.40-75.43	15.51	9.11	34.50	7.03	11.02	
	F_5	78.33	76.13-85.20	5.07	3.23	40.50	3.42	4.23	22.83
	F_6	80.73	73.43-81.46	5.18	4.76	84.70	7.07	9.03	3.06
Plant spread E-W (cm)	F_4	67.40	51.16-78.50	15.86	3.20	4.10	0.89	1.32	
	F_5	79.19	74.86-85.33	6.12	3.63	35.20	3.51	4.44	17.49
	F_6	83.68	80.20-88.53	4.84	4.75	96.20	8.03	9.60	5.66
Number of primary branches	F_4	7.22	5.60-8.06	11.26	5.93	27.80	0.46	6.44	
	F_5	7.42	5.93-8.23	10.75	9.70	81.30	1.30	18.02	2.77
	F_6	7.70	7.26-8.06	4.48	4.22	88.60	0.63	8.19	3.77
Days to 50 % flowering	F_4	45.51	41.66-49.33	7.24	3.14	18.80	1.22	2.80	
	F_5	43.48	38.66-46.33	7.28	3.01	17.10	1.16	2.56	-4.46
	F_6	42.66	40.33-44.66	5.71	4.15	52.80	2.65	6.21	-1.88
Number of flowers per inflorescence	F_4	2.97	1.90-4.56	34.43	8.77	6.50	0.14	4.60	

	F_5	3.14	2.43-3.53	15.11	12.03	63.40	0.58	19.72	5.72
	F_6	3.40	3.16-5.46	32.67	32.45	98.70	2.92	66.40	8.28
Number of fruits per inflorescence	F_4	2.56	1.93-3.76	27.23	6.67	6.00	0.09	3.36	
	F_5	2.79	2.10-3.36	23.09	21.88	89.70	1.09	42.70	8.98
	F_6	2.97	2.30-3.53	17.98	16.93	88.70	0.97	32.85	6.45

Table 1: Cont….

Character	Generation	Mean	Range	PCV	GCV	Heritability (%)	GA at 5%	GAM at 5%	% GG
Days to first harvest	F_4	58.03	53.33-61.00	6.24	3.27	27.40	1.88	3.52	
	F_5	53.55	49.00-57.33	5.50	3.72	45.80	3.01	5.19	-7.72
	F_6	52.41	51.00-55.66	4.39	4.04	84.80	4.02	7.67	-2.12
Days to final harvest	F_4	163.33	150.00-174.33	4.63	3.75	65.70	10.52	6.27	
	F_5	167.62	150.66-175.33	6.49	6.00	85.30	18.66	11.42	2.62
	F_6	168.75	167.00-171.00	1.42	1.10	60.90	3.00	1.78	0.67
Fruit length (cm)	F_4	7.23	6.21-8.44	14.68	2.71	3.40	0.07	1.03	
	F_5	8.52	7.38-9.96	10.92	10.47	91.90	1.76	20.67	17.84
	F_6	8.96	8.65-9.51	4.27	4.16	95.00	0.75	8.36	5.16
Fruit girth (cm)	F_4	12.71	9.49-15.94	15.69	1.94	1.50	0.07	0.49	
	F_5	14.41	12.63-17.81	16.76	16.47	96.50	4.23	33.33	13.37
	F_6	15.39	13.18-17.29	11.39	11.09	94.70	3.42	22.24	6.80
Fruit length to girth ratio	F_4	0.70	0.40-1.22	47.97	45.03	88.10	0.61	89.08	
	F_5	0.68	0.55-0.78	13.07	12.17	86.70	0.15	23.35	-2.85
	F_6	0.58	0.51-0.65	11.61	11.13	91.90	0.12	21.98	-14.70
Fruit volume (cm^3)	F_4	316.29	290.00-350.00	10.96	4.20	14.70	11.17	3.31	
	F_5	336.66	296.66-366.66	8.42	6.36	57.00	31.31	9.90	6.44
	F_6	360.83	346.66-376.66	4.10	3.51	73.40	22.40	6.20	7.17
Number of fruits per plant	F_4	45.31	31.93-58.60	23.54	15.09	41.10	9.03	19.94	
	F_5	54.97	48.66-61.56	8.71	7.10	66.40	6.55	11.92	21.31
	F_6	61.97	54.70-71.90	12.69	12.63	99.10	16.05	25.90	12.73

Table 1: Cont….

Character	Generation	Mean	Range	PCV	GCV	Heritability (%)	GA at 5%	GAM at 5%	% GG
Average fruit weight (g)	F_4	51.05	45.50-59.16	15.96	3.71	5.40	0.90	1.78	
	F_5	59.49	51.06-72.86	12.59	12.07	92.00	14.65	23.85	16.53
	F_6	61.42	55.30-64.10	6.34	6.01	89.90	6.98	11.74	3.24
Number of seeds per fruit	F_4	359.66	336.00-395.33	14.95	9.60	41.20	41.15	12.69	
	F_5	347.22	310.00-389.33	9.52	5.72	36.1	24.62	7.09	-3.45
	F_6	324.11	263.33-388.00	7.77	7.11	83.80	48.27	13.42	-6.65
Seed weight per fruit (g)	F_4	4.82	4.32-5.36	12.90	5.79	20.10	0.24	5.35	
	F_5	4.50	3.95-5.42	14.66	1.56	1.10	0.01	0.34	-6.63
	F_6	3.99	3.55-4.63	9.00	8.76	94.80	0.84	17.58	-11.33
Firmness of the fruit (Kg/cm^2)	F_4	2.43	2.15-2.78	19.18	10.03	27.30	0.31	10.80	
	F_5	2.92	2.31-3.82	12.80	7.43	33.70	0.21	8.88	20.16
	F_6	3.22	3.01-3.38	9.55	3.12	10.70	0.06	2.09	10.27
Phenols (mg 100 g^{-1})	F_4	4.68	3.93-5.30	11.02	3.33	9.20	0.09	2.08	
	F_5	4.59	4.35-4.84	5.79	5.56	89.10	1.17	37.01	-1.92
	F_6	3.16	2.41-4.02	20.16	19.3	92.30	0.50	11.01	-31.15
Yield per plant (Kg)	F_4	2.31	1.76-3.27	29.37	13.96	22.60	0.31	13.68	
	F_5	3.37	2.78-4.27	15.24	13.48	78.30	0.83	24.57	45.88
	F_6	3.66	3.28-3.97	8.18	7.87	92.50	0.57	15.60	8.60

Conclusion

The pedigree of the cross (Babajipet-1 x EC-169084) recorded the genetic gain from F_4 to F_5 and F_5 to F_6 generation; for yield per plant (45.88 and 8.60), plant height (4.22 and 0.17), plant spread N-S (22.83 and 3.06), plant spread E-W (17.49 and 5.66), number of primary branches (2.77 and 3.77), number of flowers per inflorescence (5.72 and 8.28), number of fruits per inflorescence (8.98 and 6.45), days to final harvest (2.62 and 0.67), fruit length (17.84 and 5.16), number of fruits per plant (13.37 and 6.80), fruit volume (6.44 and 7.17), number of fruits per plant (21.31 and 12.73), average fruit weight (16.53 and 3.24) and fruit firmness (20.16 and 10.27) respectively. Two top performing plants were selected in F_6 generation as given below

Salient features of selected two promising lines in F_6 for further evaluation in Preliminary yield trials

1. Early maturing, oblong light green fruits with white stripes at stylar end, fruits borne in cluster and heavy yielder.

2. Green oblong large sized fruits with light green stripes at stylar end, heavy yielder and tolerant to little leaf.

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