6. SUMMARY AND CONCLUSION

The present investigation entitled, "Development of quality hybrids in brinjal (Solanum melongena L.)" was carried out during *kharif* season of 2006 at the research farm of Janta Vedic College, Baraut, Baghpat, U.P. The objectives of investigation were (1) expression of important character association and path coefficient in F₁, (2) to analyse the basis of heterosis through estimates of components of genetic variance, (3) to identify the parents with good GCA and cross combination with good SCA (4) to identify better performing F₁ hybrids over standard checks along with good general combining ability and quality traits.

The experimental material for present study comprised a set of eight diverse parents of brinjal viz. Pusa Purple Long, Green Long, BB-44, Gulabi Long, Manjari Gota, Black Beauty, Pusa Purple Round and Surati Ravaiya. Choice of the parents was based on plant habit, calyx colour, calyx spininess, fruit colour, fruit shape, fruit size and diversity of their origin. The parents were crossed in diallel fashion excluding reciprocals. The experimental material consisting of eight parents and twenty-eight hybrids along with six checks viz., Ravaiya, PH-5, PH-6, MHB-80, Navkiran and Ajay. Trial was transplanted in randomized block design with three replications with twenty-one plants per entry in each replication. The observations were recorded in respect of morphological and qualitative characters viz. plant habit, leaves colour, flower colour, calyx colour, spininess of calyx and plant, fruit colour, fruit shape, fruit compactness, blossom end scar of fruit and keeping quality and quantitative traits viz. plant height at first flowering, plant height at last picking, number of primary...
branches per plant, number of secondary branches per plant, days to 50 per cent flowering, days to first fruit picking, fruit setting flowers, non-setting flowers, volume of fruit, moisture content in fruit, length of fruit, breadth of fruit, seed to pulp ratio, number of marketable fruits per plant, number of unmarketable fruits per plant, yield of marketable fruits per plant, yield of unmarketable fruits per plant and average weight of the single fruit. The data recorded were utilized for estimation of variability, heritability, genetic advance, correlation, path coefficient analysis, component and genetics variance, general and specific combining ability, relative heterosis, heterobeltiosis and standard heterosis.

The salient findings of investigation are summarized as follows:

1. Six parents had green calyx and two purplish green. In hybrids fourteen were green, eleven purplish green and three purple whereas in checks two were purplish green, one green and two purple. As for fruit colour in parents, three were purple, two variegated and one each in pink, black and green; in hybrids, twelve were purple, five purplish green, six pink, three black and two variegated; and in checks three were purple and one each in pink, black, and variegated with varied colour intensity. As regards the fruit shape in parents were two each in long and oblong, three oval and one round; in hybrids five were long, eight oblong, ten oval and five round; and in checks three oval, two round and one oblong.

2. Analysis of variance demonstrated significant variation among the genotypes for almost all the characters except yield of unmarketable fruits per plant.

3. The phenotypic and genotypic coefficient of variances were maximum for number of unmarketable fruits per plant followed by average weight of the single fruit and lowest for moisture content in fruits.
4. Higher value of PCV was observed for yield of unmarketable fruits per plant while high GCV was observed for number of marketable fruits per plant and yield of unmarketable fruits per plant.

5. High heritability accompanied with high genetic advance were observed for fruit setting flowers, length of fruit, breadth of fruit, volume of fruit, average weight of the single fruit and number of marketable fruits per plant suggested the role of additive gene action. Moderate heritability along with moderate genetic advance were for non-setting flowers, number of unmarketable fruits per plant and days to first fruit picking suggest the presence of additive and non-additive gene action. The traits namely days to 50 per cent flowering and plant height at last picking which showed low genetic advance along with, moderate to high heritability reflects the presence of non additive gene action and thus, heterosis breeding could be followed for effective improvement of these traits.

6. Correlation studies revealed yield of marketable fruits per plant had significant positive correlation with yield of unmarketable fruits per plant, volume of fruits per plant, number of unmarketable fruits per plant, breadth of fruit, average weight of single fruit, number of secondary branches per plant and plant height at last picking. Breadth of fruit had significant positive correlation with yield of marketable fruits per plant, yield of unmarketable fruits per plant and average weight of the single fruit while significant negative correlation with seed to pulp ratio, number of marketable fruits per plant and number of unmarketable fruits per plant.

7. The highest positive direct effect on yield of marketable fruits per plant was contributed by number of marketable fruits per plant followed by breadth of
the fruits. Further plant height at last picking, number of secondary branches per plant and average weight of the single fruit indirectly influenced the yield of marketable fruits per plant through breadth of fruit, number of marketable fruits per plant which is indicating that number of marketable fruits per plant and breath of the fruits are the important parameters in the selection programme.

8. Component of variance analysis of eighteen characters in F₁ revealed that the estimates of additive variance \( \hat{D} \) and dominant variance \( \hat{H}_1 \) and \( \hat{H}_2 \) were significant for all the characters, except \( \hat{D} \) for plant height at first flowering, number of primary branches per plant, number of secondary branches per plant, days to 50 per cent flowering, moisture content in fruit and number of unmarketable fruits per plant. The significance of additive (\( \hat{D} \)) and dominance (\( \hat{H}_1 \) and \( \hat{H}_2 \)) components suggested that both these gene actions were important in the expression of these characters.

9. The estimate of parameter \( \hat{F} \) was positive indicating preponderance of dominant alleles for plant height at last picking, number of primary branches per plant, number of secondary branches per plant, days to first fruit picking, fruit setting flowers, non-setting flowers, volume of fruits, moisture content of fruit, fruit length, breadth of fruit, seed to pulp ratio, number of unmarketable fruits per plant, yield of marketable fruits per plant, yield of unmarketable fruits per plant and average weight of the single fruit. Whereas negative for days to 50 per cent flowering and number of marketable fruits per plant indicating preponderance of recessive alleles.

10. The mean degree of dominance \( (\hat{H}_1/\hat{D})^{1/2} \) was found to be over dominance for plant height at first flowering, plant height at last picking, number of primary
branches per plant, number of secondary branches per plant, days to 50 per cent flowering, days to first fruit picking, fruit setting flowers, non-setting flowers, moisture content of fruits, seed to pulp ratio, number of unmarketable fruit per plant, yield of marketable fruits per plant and yield of unmarketable fruit per plant, whereas for volume of fruits and number of marketable fruits per plant complete dominance was recorded. These findings indicated the importance of additive and non-additive gene action. Therefore, both these types of gene actions should be taken into consideration while formulating appropriate breeding programme.

11. The symmetrical distribution of positive and negative genes among the parents were observed for fruit setting flowers and non-setting flowers, whereas asymmetry in the distribution of positive and negative alleles in majority of the cases were found.

12. The ratio between dominant and recessive alleles was more than unity for plant height at first flowering, plant height at last picking, number of secondary branches per plant, days to first fruit picking, fruit setting flowers, non-setting flowers, volume of fruits, moisture content of fruit, fruit length, breadth of fruit, seed to pulp ratio, number of unmarketable fruits per plant, yield of marketable fruits per plant, yield of unmarketable fruits per plant and average weight of the single fruit revealing almost symmetry in the gene distribution among the parents indicating the preponderance of dominant alleles among the parents. Whereas this ratio was less than unity for days to 50 per cent flowering and number of marketable fruit per plant suggested asymmetrical gene distribution among the parents.
13. The ratio of $h^2/H_2$ which is an important measure of group of genes showing dominance was more than unity for plant height at last picking indicating preponderance of dominant genes in the control of the characters.

14. The coefficient of correlation between the parental order of dominance and parental order of measurement was negative and significant for plant height at first flowering, number of marketable fruits per plant and number of unmarketable fruits per plant whereas, it was positive and significant for length of fruit, breadth of fruit and seed to pulp ratio confirm the association between dominance and recessive alleles.

15. Analysis of variance for GCA revealed that significant differences was observed for all the characters except the number of primary branches per plant and moisture content in the fruit. Results of SCA variance revealed that significant differences for all the characters except plant height at first flowering.

16. The results indicated that parent P 6 (Black Beauty) was the best general combiner for eleven characters. The P 1 (PPL) and P 7 (Pusa Purple Round) was next best general combiner for nine characters whereas on commercial point of view parent P 8 (Suraty Ravaiya) was the second best general combiner for eight characters.

17. In general the parents that have the best per se performance were also the best general combiners indicating a positive association between these two parameters. Majority of combination exhibiting desirable SCA effects having at least one of the parents as good or average general combiner. Desirable SCA effects for yield of marketable fruits per plant were observed in eleven crosses namely (P 1 x P 6, P 5 x P 8, P 3 x P 8, P 2 x P 6, P 6 x P 8, P1 x P 2,
P 4 x P 7, P 4 x P 6, P 1 x P 4, P 2 x P 7 and P 4 x P 8), two crosses for number of marketable fruits per plant (P 1 x P 6 and P 1 x P 2), eight crosses for breadth of fruit (P 1 x P 8, P 2 x P 3, P 6 x P 8, P 2 x P 4, P 3 x P 6, P 4 x P 6, P 1 x P 3 and P 4 x P 8). On the basis of per se performance and significant desirable sca effects for yield of marketable fruits per plant it was noted, high SCA effects were not always associated with high per se performance. Therefore, selected hybrids must have high per se performance for yield with superiority for quality traits like less moisture content in fruits, less seed to pulp ratio, uniform fruits colour with green calyx, high keeping quality, non bitter with firm fruits, small blossom end scar should be taken as selection criteria for finally hybrid promotion.

18. On consideration of yield of marketable fruits per plant of twenty-eight crosses, thirteen expressed heterosis in desired direction of which one cross in Ravaiya, eleven crosses in purple long and one cross in round fruited. Besides yield of marketable fruits per plant two characters namely, number of marketable fruits per plant and average weight of the single fruit exhibited highest heterosis for maximum crosses. In addition to these three characters plant height at last picking had also showed heterosis for maximum crosses. Thus, these four characters viz., number of marketable fruits per plant, yield of marketable fruits per plant, average weight of the single fruit and plant height at last picking appear to be the most important yield contributing traits. Six crosses expressed maximum standard heterosis for these four characters:

a. In Ravaiya segment cross, P 3 x P 6 showed standard heterosis for yield of marketable fruits per plant (31.62), average weight of the single fruit (63.64) and plant height at last picking (35.93) per cent, plant height at first flowering
(76.22), plant height at last picking (35.93), volume of fruit (42.35), length of fruit (55.73), breadth of fruit (62.67), seed to pulp ratio (35.35) and number of unmarketable fruits per plant (64.79).

b. In purple long segment, four crosses expressed highest standard heterosis namely, cross P 1 x P 6 for number of marketable fruits per plant (145.34), yield of marketable fruits per plant (112.87) and average weight of the single fruit (97.57); cross P 4 x P 8 yield of marketable fruits per plant (102.97) and average weight of the single fruit (117.08); crosses P 1 x P 2 for number of marketable fruits per plant (159.40), yield of marketable fruits per plant (69.80), and plant height at last picking (11.73) and cross P 1 x P 4 for number of marketable fruits per plant (135.96), and plant height at last picking (10.44). These crosses (P 1 x P 6, P 4 x P 8, P 1 x P 2 and P 1 x P 4) had also expressed standard heterosis for six, four, six and one characters, respectively beside above characters.

c. In round fruited segment cross P 6 x P 8 showed highest standard heterosis for number of marketable fruits per plant (40.60), yield of marketable fruits per plant (7.22), average weight of the single fruit (17.95), plant height at last picking (28.89), plant height at first flowering (20.51), plant height at last picking (28.89), number of primary branches per plant (27.82), number of secondary branches per plant (37.41), days to 50 per cent flowering in desired negative direction (5.12), days to first fruit picking in desired negative direction (5.27), fruit setting flowers (48.47), none-setting flowers in desired negative direction (23.16), volume of fruits (8.77), length of fruit (24.89), breadth of fruit (56.00), seed to pulp ratio in desired negative direction (5.05), number of unmarketable fruits per plant in desired negative direction (18.04),
yield of marketable fruits per plant (7.23), yield of unmarketable fruits per plant in desired negative direction (13.64).

19. The cross P 1 x P 6, involving high x low combiners for yield showed higher heterosis than the cross derived from the high x high combiners.

CONCLUSION

On the basis of component of variance, per se performance, SCA effects, standard heterosis and quality traits, it can be concluded heterosis breeding would be advantageous for the improvement of yield and its yield component characters along with quality. Cross P 3 x P 6 can be exploited in small fruited Ravaiya with USP of increased marketable fruit yield per plant and average weight of the single fruit. In purple long fruited PH- 5 cross P 1 x P 4 can be exploited with USP of increased number of marketable fruits per plant, plant height at last picking with good uniform pinkish purple fruits colour, medium maturity and none spiny over cross P1 x P2 which posses increase number of marketable fruits per plant, yield of marketable fruits per plant and plant height at last picking with purplish green fruits and few spines on calyx. Cross P 1 x P 6 posses USP of increase number of marketable fruits per plant, yield of marketable fruits per plant, average weight of the single fruit with black fruit colour, oblong shape, sweet taste, less seed content, firm fruit and medium to good keeping quality while cross P 4 x P 8 posses USP for increase yield of marketable fruits per plant, average weight of the single fruit with pink fruit colour, oblong shape, sweet taste, firm fruit and good keeping quality. In round fruited segment (MHB-80), cross P 6 x P 8 posses USP of increase number of marketable fruits per plant, yield of marketable fruits per plant, average weight of the single fruit, plant height at last picking, number of primary branches per plant, number of secondary branches per plant, days to first fruit picking, fruit setting flower, volume of fruits with black fruits colour, round shape, pointed blossom end scar, firm fruit and good keeping quality.