In all vegetables including brinjal, quality parameters are of prime importance in addition to high productivity, spread over area and time. Prior to advent of hybrids in Indian vegetable market, only local land races in traditional vegetables including brinjal, improved open pollinated varieties and introduced vegetable like Brassica, tomato etc were cultivated.

With the introduction of F₁ hybrids in India commencing from 1973, the farmers of India have reaped rich harvest and profits. Many private seed companies both indigenous and multinational have jumped into vegetable F₁ seed business, seeing the vast scope and market of India offers: being second largest producers of vegetable in the world with an acreage of 0.51 million hectare.

Brinjal being a native crop of the India lot of variability exists. The vast variability has been maintained to this day mainly due to consumer preferences for brinjal types based on fruit shape, size, fruit color, calyx color, thorniness and fruit peduncle length, etc.

Besides, higher productivity, quality traits are prime objectives of any breeding programme. The amount of success in such programme depends on the availability of genetic information about yield and its contributing traits: quality and its expression under different genetic background. For overall improvement in any crop, it is necessary to accumulate an array of favorable genes or gene complexes in a single productive genotype. In accomplishing the synthesis of superior genotype, selection of appropriate parental material and breeding methodology are of prime
importance. Keeping in view this in mind the present series of investigations are
drawn out to get a clear picture of the genetic architecture of the important traits in
brinjal. The material constituted of a full diallel (excluding reciprocals) of eight
selected lines. Choice of parents and standard checks were based on plant habit, calyx
color, calyx spininess, fruit colors, fruit shape, fruit size, etc. The data was analyzed
for general combining ability effects of eight parents and specific combining ability
effects of F₁ crosses using the method proposed by Griffings (1956). Analysis of
variance revealed significant differences among genotypes for all the characters
indicating presence of adequate amount of variability among them. To assess the
hybrids, relative heterosis, heterobeltiosis and standard heterosis were estimated. To
estimate the standard heterosis different checks for comparison were used depending
on the group which experimental F₁ belongs small-fruited, Ravaiya, purple long
fruited PH-5, round fruited, PH-6 and Navkiran, black round fruited, MHB-80, and
variegated spiny fruited Ajay were used as check. Some of the salient features of the
results obtained are discussed below.

5.1 CHOICE OF PARENTS AND STANDARD CHECKS

Choice of parents and standard checks were based on plant habit, calyx color,
calyx spininess, fruit colors, fruit shape, fruit size and diversity of their origin etc. The
study based on morphological characters of all eight parents and six checks revealed
that plant in parents four were semi erect and four bushy and in checks four were semi
erect and two bushy. As regards the calyx colour in eight parents, six were green and
two purplish green and 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 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 ovals and one round and in checks three oval, two round and one oblong.

5.2 VARIABILITY

Analysis of variance indicates that there was significant variation among the genotypes for all the characters except yield of unmarketable fruits per plant.

In general the phenotypic variance was higher than the corresponding genotypic variance. This is because of the fact that phenotypic variance include genotypic and environmental variance (Sharma et al., 2000) indicating environmental influence on all the characters. The phenotypic and genotypic variances of traits were maximum for number of unmarketable fruits per plant followed by average weight of the single fruit and lowest for moisture content in fruits. A similar result for weight of fruit was also reported by Singh and Kumar (2005).

In the present investigation PCV was higher than GCV. The meager differences between PCV and GCV for all characters except plant height at first flowering, number of primary and secondary branches per plant, days to 50 per cent flowering, moisture content in fruit, number of unmarketable fruits per plant and yield of unmarketable fruits per plant indicated less effect of environment on the phenotypic expressions. These results were in conformity of earlier findings of Singh and Kumar (2005). Highest PCV was observed for number of unmarketable fruits per plant, yield of unmarketable fruits per plant, average weight of the single fruit and lowest for moisture content in fruit (Mohanty, 2001). The GCV was maximum for average weight of the single fruit followed by number of marketable fruits per plant; yield of unmarketable fruits per plant and was lowest for moisture content in fruits (Negi et al., 2000 and Sharma et al., 2000).
5.3 HERITABILITY AND GENETIC ADVANCE

Heritability in broad sense and genetic advance are important selection parameters in breeding and genetics. The heritability estimates along with genetic advance are important as either of these two parameters help in selecting the important traits. High heritability coupled with high genetic advance and high heritability along with low genetic advance might be due to additive and non-additive genetic components, respectively.

Highest heritability estimates were observed for average weight of the single fruit followed by yield of marketable fruits per plant, number of marketable fruits per plant, fruit setting flowers, non-setting flowers, breadth of fruit, length of fruit, volume of fruit, number of unmarketable fruits per plant, seed to pulp ratio, days to first fruit picking and yield of unmarketable fruits per plant. Similar results were also reported by Sharma et al. (2000), Chung et al. (2003) and Singh and Kumar (2005).

Plant height at last picking and days to 50% flowering had moderate heritability value whereas number of primary branches per plant, number of secondary branches per plant, plant height at first flowering and moisture content in fruit had low value. These results were in corroboration with the findings of Rai et al. (1998).

Genetic advance as percentage of mean was highest for average weight of the single fruit followed by number of unmarketable fruits per plant, yield of unmarketable fruits per plant, fruit setting flowers, length of fruit and breadth of fruit. Whereas non-setting flower, volume of fruit, days to first fruit picking and seed to pulp ratio had moderate value. The results of Mohanty (2001), Baswana et al. (2002), Singh and Kumar (2005) and Panda et al. (2005) also supported the present results.
Low genetic advance was observed for moisture content of fruit, plant height at first flowering, number of primary branches per plant and number of secondary branches per plant, days to 50 per cent flowering and plant height at last picking. These results were in corroboration with the findings of Rai et al. (1998) and Mohanty (1998).

In the present study, 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 unmarketable fruits per plant, suggested the role of additive gene action and thus, a high genetic gain is expected from selection of these traits. The results of Negi et al. (2000), Mohanty (2001), Baswana et al. (2002) and Singh and Kumar (2005) also supported the present result. Moderate heritability along with moderate genetic advance for non-setting flowers, number of unmarketable fruits per plant and days to first fruit picking suggested 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 were reported by Rai et al. (1998).

5.4 CORRELATION

The yield of marketable fruits is a complex and highly variable character, which is a result of cumulative effect of many contributing traits. Therefore, direct selection for yield of marketable fruits per plant may not be very effective. Thus, for bringing a rational improvement in desired direction the correlation between traits and their relative contribution to yield of marketable fruits per plant must be known. A positive correlation between characters is important to the plant breeder because it
helps in simultaneous improvement of both the characters. On the other hand a
negative correlation between desirable traits will hinder the simultaneous expression
of both the characters; hence, simultaneous selection for these traits becomes
difficult. In the present study, estimates of genetic correlation coefficient were higher
than the phenotypic correlation, indicating apparent association between two
characters is not only due to favourable influence of environment. These results have
support from the findings of Mohanty (1999) and Sharma et al. (2000).

Yield of marketable fruits per plant had significant positive correlation with
yield of unmarketable fruits per plant, volume of fruit, number of unmarketable fruits
per plant, breadth of fruit, average weight of single fruit, number of secondary
branches per plant, plant height at last picking. Similar findings have been reported by
Kabir et al. (1995), Shankaraiah and Rao (1990), Mishra and Mishra (1990), Mohanty
(1999), Singh et al. (2001), Singh et al. (2005) and Pathania et al. (2005) in the
characters studied. It had also significant positive correlation with seed to pulp ratio.
Thus, selection based on these traits either in combination or alone would be
beneficial to identify the genotypes having better yield potential.

Number of marketable fruits per plant had significant positive correlation with
number of unmarketable fruits per plant, yield of unmarketable fruits per plant while
significant negative correlation with average fruit weight of the single fruit. 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 (Kushwah and Bandhyopadhyya,
2005). Volume of the fruit had significant positive correlation with breadth of fruit,
yield of marketable fruits per plant, yield of unmarketable fruits per plant and average
fruit weight while significant negative correlation with length of the fruit. Number of secondary branches had significant positive correlation with number of marketable fruits per plant. The plant height at last picking had significant positive correlation with days to first fruit picking, volume of fruit, breadth of fruit, yield of marketable fruits per plant and yield of unmarketable fruits per plant while significant negative correlation with seed to pulp ratio (Shankaraiah and Rao, 1990, Mishra and Mishra, 1990).

5.5 PATH COEFFICIENT

Correlation study alone cannot ascertain clear association among the characters as more variables are involved. A path coefficient helps to understand the forces in building up the total correlation. 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 fruit yield of unmarketable fruits per plant. 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 and number of marketable fruits per plant indicating number of marketable fruits per plant and breadth of fruit as important parameters in the selection programme. The similar results were also reported by Chung et al. (2003) and Singh et al. (2005).

5.6 DIALLEL ANALYSIS

The effective use of genetic variability for crop improvement can be made if genetics of desirable characters is known. It is also important to know the relative magnitude of additive and non-additive genetic variances in order to formulate an effective breeding strategy. Several models have been developed for the estimation of these genetic parameters. In the present investigation the analysis of diallel mating
design as proposed by Hyman (1954) was used, as this analysis has proved to be quite efficient in the study of genetic architecture of quantitative traits. It helps in obtaining maximum genetic information in the shortest possible time as only the parental and F₁ generations are required.

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, whereas $\hat{H}_1$ and $\hat{H}_2$ for plant height at first flowering, number of primary branches per plant, days to 50 per cent flowering and moisture content in fruit.

The third measure of dominance effect, $\hat{h}^2$ was significant for plant height at last picking, fruit setting flowers, number of marketable fruits per plant, number of unmarketable fruits per plant 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. However, the magnitude of $\hat{D}$ was higher than $\hat{H}_1$ and $\hat{H}_2$ for length and breadth of fruit, yield of marketable fruit and average weight of the single fruit revealing that additive gene action had the major role in the expression of these traits while other fourteen characters were found largely governed by dominate gene action. Peter (1971), Choudhary (1999), Gulamuddin (1999) Chezhian et al. (2000), Choudhary and Malhotra (2000) and Panda (2005) reported non-additive components much higher than additive component in their material for days to 50 per cent flowering, plant height, number of primary branches, number of marketable fruits per
plant, total fruit yield per plant. The present results also in agreement with the findings of these workers.

The estimate of parameter $\hat{F}$ was positive for plant height at last picking, number of primary branches, 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 fruit per plant, yield of marketable fruits per plant, yield of unmarketable fruits per plant, average weight of the single fruit. It was negative for days to 50 per cent flowering and number of marketable fruits per plant. This indicated the preponderance of dominant alleles in the former set of sixteen characters and recessive in the later two characters.

The mean degree of dominance $(\hat{H}_1/\hat{D})^{\frac{1}{2}}$ was found to be over dominance (more than unity) 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 plant lowering, days to first fruit picking, fruit setting flowers, non-setting flowers, moisture content of fruit, seed to pulp ratio, number of unmarketable fruits per plant, yield of marketable fruits per plant, yield of unmarketable fruit per plant and yield of marketable fruits per plant whereas for volume of fruits and number of marketable fruits per plant complete dominance was recorded and partial dominance was for plant height at first flowering, number of primary branches per plant, length of fruit, breadth of fruit and average weight of the single fruit.

It is evident from the above findings that 12 characters exhibited over dominance, two for complete dominance while four had exhibited partial dominance. 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.

The ratio of $\hat{H}_2/4\hat{H}_1$ was found close to 0.25 (the theoretical value) for fruit setting flowers and non setting flowers, indicating symmetrical distribution of positive and negative genes among the parents, whereas in majority of the cases the ratio was not quite close to 0.25, except plant height at first flowering (0.28) showing slight asymmetry in the distribution of positive and negative alleles. The proportion of total number of dominant and recessive genes ($\hat{K}_D/\hat{K}_R$) among the parents determines the extent of genetic advance that can be made in a particular direction.

The ratio between dominant and recessive alleles was more than unity in 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, in case of days to 50 per cent flowering and number of marketable fruit per plant, it was less than unity, suggested asymmetrical gene distribution among the parents.

The estimate of $\hat{H}_2$ was smaller than that of $\hat{H}_1$ for all the characters. This was not altogether unexpected. In fact, theoretically $\hat{H}_2$ should be equal to less than $\hat{H}_1$. Since $\hat{H}_1$ was greater than $\hat{D}$ in most of the characters this suggest that dominant genetic variance is more important than additive one.

The ratio of $\hat{H}_2^2/\hat{H}_1$, which is an important measures 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. It does not mean, however that the characters showing ratio less than one except plant height at last picking do not have dominant genes. Such situation may arise by canceling out the effects of positive and negative genes. Often, this ratio under-estimates the number of genes and provides no valid interpretation about gene groups exhibiting dominance. Complementary gene interaction, for example also depresses this ratio. Hence the number of gene groups recorded in this study for several attributes perhaps is lower than the actual number involved. Such low estimates of genes have also been reported by worker (Lal et al., 1971).

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.

5.7 COMBINING ABILITY

Proper choice of parents for producing hybrid is an important step in any hybridization programme. Combining ability analysis is an effective tool for identifying superior parents in breeding programme. Evaluation of parents for combining ability provides an indication of additive and non-additive variance for the characters under scrutiny. This information in turn, would help in determining the breeding strategy for developing the potential hybrid in brinjal. In the present investigation, the combining ability analysis of variance was done using half diallel mating design. The mean square due to GCA revealed significant differences for all the characters except the number of primary branches per plant and moisture content
in the fruit. Significant differences were observed for almost all the characters for
mean square due to sca variance except plant height at first flowering. The sum of
square due to GCA was higher than SCA for all the characters except number of
primary branches, fruit setting flowers non-setting flowers and moisture content in
fruit. This finding was in corroboration with (Choudhary et al., 1998) for all the
characters except marketable fruit yield per plant. Mean square due to GCA and SCA
were higher for all the characters including plant height at last picking, fruit length,
number of marketable fruits per plant and yield of marketable fruits per plant except
plant height at first flowering, number of primary branches per plant and moisture
content in fruit. The similar findings had also been reported by (Das and Varun, 2001
and Quamruzzaman et al., 2006). Earlier finding given by different scientist
mentioned in parenthesis with respective characters.

5.7.1 Combining ability effects

5.7.1.1 General Combining ability (GCA) effects

Based on GCA effects of the different characters no parent possessed
outstanding performance in desired direction for yield of marketable fruits per plant
and quality traits. It is suggested that the good general combiner parent should be used
in mating so that substantial improvement in the yield and quality parameters can be
achieved. The results indicated that parent P 6 i.e. Black Beauty (Biradar et al., 2005)
was the best general combiner for eleven characters out of eighteen characters studied
viz., yield of marketable fruits per plant, plant height at last picking, number of
primary branches per plant, fruit setting flowers, non-setting flowers, volume of fruits,
moisture content, breadth of fruit, seed to pulp ratio, number of unmarketable fruits
per plant, average weight of the single fruit. The P 1 i.e. PPL (Anonymous 1959,
Kumar and Ram, 1987) and P 7 was the next best general combiner parents for nine
characters viz., yield of marketable fruits per plant, plant height at first flowering, number of primary branches per plant, days to 50 per cent flowering, days to first fruit picking, volume of fruit, breadth of fruit, number of unmarketable fruits per plant, average weight of the single fruit in desired direction while commercial point of view parent P 8 i.e. Surati Ravaiya was the second best general combiner for eight characters viz., yield of marketable fruits per plant, number of secondary branches per plant, volume of fruit, breadth of fruit, seed to pulp ratio, number of marketable fruits per plant, number of unmarketable fruits per plant and average weight of the single fruit (Rajneeta and Maurya, 2003). Earlier finding given by different scientist mentioned in parenthesis with respective characters (Table 5.1).

5.7.2 Specific combining ability (SCA) effects

The SCA effects represent dominant and epistatic effects and can be used as an index to determine the usefulness of a particular cross combination in the expression of heterosis. In the present investigation, SCA effects were significant for all the characters except number of unmarketable fruits per plant and yield of unmarketable fruits per plant, which were in desired direction. Twenty-five out of twenty-eight crosses under study were showed significant SCA effects for thirteen characters out of eighteen characters under study. 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, P 1 x P 2, P 4 x P 7, P 4 x P 6, P 1 x P 4, P 1 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), six crosses for length of fruit (P 6 x P 8, P 5 x P 6, P 5 x P 8, P 1 x P 3, P 4 x P 5 and P 1 x P 2), three crosses for days to first fruit picking (P 1 x P 5, P 1 x P and P 4 x P 7); in quality traits one cross for moisture
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Character</th>
<th>Desired direction</th>
<th>Parents</th>
<th>Cross</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plant height at first flowering (cm)</td>
<td>Positive</td>
<td>P 1, P 7</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>Plant height at last picking (cm)</td>
<td>Positive</td>
<td>P 6</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>No. of primary branches/plant</td>
<td>Positive</td>
<td>P 2, P 6, P 7</td>
<td>P 3 x P 4, P 5 x P 8, P 2 x P 6, P 2 x P 7, P 2 x P 4, P 1 x P 5, P 4 x P 8, P 6 x P 7</td>
</tr>
<tr>
<td>4.</td>
<td>No. of Secondary branches/plant</td>
<td>Positive</td>
<td>P 8, P 1</td>
<td>P 1 x P 8, P 2 x P 4, P 2 x P 6, P 4 x P 6, P 4 x P 7, P 1 x P 5, P 1 x P 6, P 4 x P 7</td>
</tr>
<tr>
<td>5.</td>
<td>Days to 50% flowering</td>
<td>Negative</td>
<td>P 1, P 3, P 7</td>
<td>P 1 x P 8, P 2 x P 4, P 2 x P 6, P 4 x P 6, P 4 x P 7, P 1 x P 5, P 1 x P 6, P 4 x P 7</td>
</tr>
<tr>
<td>6.</td>
<td>Days to first fruit picking</td>
<td>Negative</td>
<td>P 1, P 3, P 7</td>
<td>P 1 x P 8, P 2 x P 4, P 2 x P 6, P 4 x P 6, P 4 x P 7, P 1 x P 5, P 1 x P 6, P 4 x P 7</td>
</tr>
<tr>
<td>7.</td>
<td>Fruit setting flowers</td>
<td>Positive</td>
<td>P 6, P 3, P 4, P 2</td>
<td>P 4 x P 6, P 1 x P 2, P 6 x P 7, P 4 x P 8</td>
</tr>
<tr>
<td>8.</td>
<td>Non-setting flowers</td>
<td>Negative</td>
<td>P 6, P 3, P 4, P 1</td>
<td>P 4 x P 6, P 1 x P 2, P 6 x P 7, P 4 x P 8</td>
</tr>
<tr>
<td>9.</td>
<td>Volume of fruits (ml)</td>
<td>Positive</td>
<td>P 6, P 5, P 7, P 8</td>
<td>-</td>
</tr>
<tr>
<td>10.</td>
<td>Moisture content in fruit (%)</td>
<td>Negative</td>
<td>P 5, P 6, P 4</td>
<td>P 6 x P 8, P 5 x P 6, P 5 x P 8, P 1 x P 3, P 4 x P 5, P 1 x P 2</td>
</tr>
<tr>
<td>11.</td>
<td>Length of fruit (cm)</td>
<td>Positive</td>
<td>P 1, P 4, P 2</td>
<td>P 6 x P 8, P 5 x P 6, P 5 x P 8, P 1 x P 3, P 4 x P 5, P 1 x P 2</td>
</tr>
<tr>
<td>12.</td>
<td>Breadth of fruit (cm)</td>
<td>Positive</td>
<td>P 6, P 7, P 3, P 5</td>
<td>P 4 x P 5, P 5 x P 8, P 1 x P 2, P 4 x P 6, P 6 x P 7, P 5 x P 6</td>
</tr>
<tr>
<td>13.</td>
<td>Seed to pulp ratio</td>
<td>Negative</td>
<td>P 6, P 1, P 8</td>
<td>P 4 x P 5, P 5 x P 8, P 1 x P 2, P 4 x P 6, P 6 x P 7, P 3 x P 4, P 3 x P 7, P 5 x P 6</td>
</tr>
<tr>
<td>14.</td>
<td>No. of marketable fruits/plant</td>
<td>Positive</td>
<td>P 1, P 4, P 8</td>
<td>P 1 x P 6, P 1 x P 2</td>
</tr>
<tr>
<td>15.</td>
<td>No. of unmarketable fruits/plant</td>
<td>Negative</td>
<td>P 5, P 6, P 8, P 7</td>
<td>P 2 x P 3, P 5 x P 6, P 1 x P 8, P 2 x P 4</td>
</tr>
<tr>
<td>16.</td>
<td>Yield of marketable fruits /plant (kg)</td>
<td>Positive</td>
<td>P 6, P 7, P 1, P 6</td>
<td>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, P 1 x P 2, P 4 x P 7, P 4 x P 6, P 1 x P 4, P 1 x P 7, P 4 x P 8</td>
</tr>
<tr>
<td>17.</td>
<td>Yield of unmarketable fruits /plant (kg)</td>
<td>Negative</td>
<td>P 4, P 5, P 1, P 3</td>
<td>P 2 x P 3, P 5 x P 6, P 5 x P 7, P 1 x P 8, P 2 x P 4, P 6 x P 8, P 6 x P 7, P 3 x P 7, P 5 x P 8, P 4 x P 5, P 3 x P 5</td>
</tr>
<tr>
<td>18.</td>
<td>Av. weight of the single fruit (g)</td>
<td>Positive</td>
<td>P 6, P 8, P 7, P 5</td>
<td>-</td>
</tr>
</tbody>
</table>
content (P 6 x P 8) and ten crosses for seed to pulp ratio (P 4 x P 5, P 5 x P 8, P 1 x P 2, P 4 x P 6, P 6 x P 7, P 2 x P 7, P 3 x P 8, P 1 x P 4, P 3 x P 7 and P 5 x P 6), four crosses each in fruit setting flowers and non-setting flowers, eight crosses for number of primary branches per plant, five crosses for days to 50% flowering, four crosses for number of unmarketable fruits per plant, eleven crosses for yield of unmarketable fruits per plant. These crosses involved all the six possible combination among the parent of high, medium and low per se performance i.e. high x high, high x medium, high x low and medium x medium, medium x low, low x low. Several crosses apparent from Table (5.2) with low x high yielding parents (P 6 x P 8) proved better than those, which involved the parents with reciprocal, low x low, medium x low, medium x high and high x high crosses. Crosses with low x low yielding parents (P 5 x P 6) proved second best than those which involved the parents with medium x high and medium x low. Crosses with medium x high (P 4 x P 8) yielding parents proved third best than those involved the parents with reciprocal, medium x low and high x high. In general the parents that have the best per se performance were also the best general combiners indicating a positive association between the two parameters. Majority of combinations exhibiting desirable SCA effects had at least one of the parents as good or average general combiner. The similar findings have also been reported by Pal and Singh (1946), Venketaramani (1946), Vijay and Premnath (1978), Randhawa et al. (1991) and Aswani and Khandelwal (2005).

On the basis of per se performance and significant desirable sea effects for marketable fruit yield per plant it was noted that high sea effects were not always associated with high per se performance. This indicated that the choice of the best combination on the basis of high SCA effects could not always necessarily be the one, which would give highest per se performance. Since per se performance is the
Table 5.2. Best Cross combination on the basis of high per se performance (mean), GCA effects, SCA effects, heterosis over Mid Parent, Better Parent and checks for fruit yield per plant

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Cross</th>
<th>Crosses and Parents Value</th>
<th>GCA Value</th>
<th>SCA effects</th>
<th>% Heterosis over</th>
<th>Number of characters showed superiority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Crosses</td>
<td>Female</td>
<td>Male</td>
<td>Mid parent value</td>
<td>Per se performance</td>
</tr>
<tr>
<td>1.</td>
<td>P1 x P6</td>
<td>4.30</td>
<td>3.10</td>
<td>1.90</td>
<td>2.51</td>
<td>H x L</td>
</tr>
<tr>
<td>2.</td>
<td>P4 x P8</td>
<td>4.10</td>
<td>2.60</td>
<td>3.10</td>
<td>2.80</td>
<td>M x H</td>
</tr>
<tr>
<td>3.</td>
<td>P1 x P4</td>
<td>3.03</td>
<td>3.12</td>
<td>2.63</td>
<td>2.87</td>
<td>H x H</td>
</tr>
<tr>
<td>4.</td>
<td>P1 x P2</td>
<td>3.42</td>
<td>3.10</td>
<td>2.50</td>
<td>2.85</td>
<td>H x M</td>
</tr>
<tr>
<td>5.</td>
<td>P6 x P8</td>
<td>4.90</td>
<td>1.90</td>
<td>3.10</td>
<td>2.50</td>
<td>L x H</td>
</tr>
<tr>
<td>6.</td>
<td>P3 x P6</td>
<td>3.33</td>
<td>2.50</td>
<td>1.90</td>
<td>2.24</td>
<td>M x L</td>
</tr>
</tbody>
</table>
realized value, while SCA effects are an estimated, the former should be given preferences while making selections for cross combinations. It should also be kept in view that SCA effect is a measure of deviation of F₁ performance over the parental performance and therefore, SCA effect of a hybrid performance may be high or low depending upon whether the performance of parent is low or high. Thus, high SCA would not necessarily reflect high performance of the hybrids. Since ultimate aim of brinjal breeder is to achieve high yield with high quality parameters. 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 fruit colour with green calyx, high keeping quality, non bitter fruit taste with firm fruit and small blossom end scar should be taken as selection criteria for finally hybrid promotion in segment wise.

In overall evaluation it was noted that six categories of hybrids showed promising performance for one to six characters. Hybrids were grouped on the basis of number of characters which showed high SCA effects i.e. for six characters in two crosses (P₁ x P₂ and P₄ x P₆); for five characters in five crosses (P₂ x P₄, P₄ x P₈, P₅ x P₈, P₆ x P₇ and P₆ x P₈); for four characters in five crosses (P₁ x P₈, P₅ x P₆, P₅ x P₈, P₆ x P₇ and P₆ x P₈); for three characters in five crosses (P₁ x P₆, P₂ x P₃, P₂ x P₆, P₄ x P₅ and P₄ x P₇); for two characters in five crosses (P₁ x P₃, P₁ x P₄, P₁ x P₅, P₂ x P₇ and P₃ x P₇) and for one characters in five crosses (P₁ x P₇, P₃ x P₄, P₃ x P₅, P₃ x P₆ and P₅ x P₇). On the other hand taking account of all parameters per se per performance, sca effects and quality attributes ten crosses (P₁ x P₆, P₄ x P₈, P₁ x P₂, P₆ x P₈, P₅ x P₆, P₁ x P₇, P₁ x P₄, P₂ x P₆, P₄ x P₆ and P₃ x P₆) were selected.
5.8 HETEROSIS

Heterosis can be interpreted as a complex genetic phenomenon depending upon the balance of the additive, dominance and epistasis gene action. Heterosis itself is not an indication of the gene action or interaction prevailing in the material. Combining ability meets the objective of spotting out the best combiners and cross combinations which would perform significantly better than their parents, whereas heterosis measures the mean superiority of $F_1$s over its superior parent, mid parent and the best commercial hybrids and thus, it is important parameter in such studies. Of these, standard heterosis is commercially important and not relative heterosis and heterobeltiosis (Table 5.3).

While analyzing the twenty eight crosses for manifestation of heterosis over better parent and standard parent, six checks were used segment wise [for small fruited check, Ravaiya; for purple long fruited check, PH-5 (NC); for purple round fruited check, PH-6 (NC), for big purple round fruited check, Navkiran for black round fruited check, MHB-80 and for spiny variegated checks, Ajay]. None of the crosses exhibited heterosis for all the characters.

All twenty-eight crosses were grouped on the basis of fruit shape, colour and size for evaluation of standard heterosis in respect of segment wise check, in small fruited segment, one cross (P 3 x P 6), in long fruited segment, twelve crosses (P 1 x P 2, P 1 x P 3, P 1 x P 4, P 1 x P 5, P 1 x P 6, P 1 x P 7, P 1 x P 8, P 2 x P 4, P 2 x P 6, P 2 x P 8, P 4 x P 6 and P 4 x P 8), in purple round fruited segment, five crosses (P 5 x P 6, P 5 x P 8, P 6 x P 7, P 6 x P 8 and P 7 x P 8), in black round segment three cross also used in purple round segment (P 5 x P 6, P 6 x P 8 + P 6 x P 7) and rest eleven non useful crosses (P 2 x P 3, P 2 x P 5, P 2 x P 7, P 3 x P 4, P 3 x P 5, P 3 x P 7, P 3
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Characters</th>
<th>P1 x P2</th>
<th>P1 x P4</th>
<th>P1 x P6</th>
<th>P3 x P6</th>
<th>P4 x P8</th>
<th>P6 x P8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plant height at first flowering (cm)</td>
<td>12.99</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.11</td>
</tr>
<tr>
<td>2.</td>
<td>Plant height at last picking (cm)</td>
<td>11.73</td>
<td>10.44</td>
<td>7.14</td>
<td>35.93</td>
<td></td>
<td>28.89</td>
</tr>
<tr>
<td>3.</td>
<td>No. of primary branches/plant</td>
<td></td>
<td></td>
<td>11.11</td>
<td></td>
<td>22.22</td>
<td>27.82</td>
</tr>
<tr>
<td>4.</td>
<td>No. of Secondary branches/plant</td>
<td></td>
<td></td>
<td>17.48</td>
<td></td>
<td>25.38</td>
<td>37.41</td>
</tr>
<tr>
<td>5.</td>
<td>Days to 50% flowering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.18</td>
<td>54.12</td>
</tr>
<tr>
<td>6.</td>
<td>Days to first fruit picking</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5.27</td>
</tr>
<tr>
<td>7.</td>
<td>Fruit setting flowers</td>
<td>29.97</td>
<td>22.06</td>
<td></td>
<td></td>
<td></td>
<td>48.47</td>
</tr>
<tr>
<td>8.</td>
<td>Non-setting flowers</td>
<td></td>
<td></td>
<td></td>
<td>23.56</td>
<td>42.35</td>
<td>23.16</td>
</tr>
<tr>
<td>9.</td>
<td>Volume of fruits (ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.77</td>
</tr>
<tr>
<td>10.</td>
<td>Moisture content in fruit (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.06</td>
</tr>
<tr>
<td>11.</td>
<td>Length of fruit (cm)</td>
<td>14.24</td>
<td>9.50</td>
<td></td>
<td></td>
<td></td>
<td>24.89</td>
</tr>
<tr>
<td>12.</td>
<td>Breadth of fruit (cm)</td>
<td></td>
<td></td>
<td>24.81</td>
<td></td>
<td>62.67</td>
<td>56.00</td>
</tr>
<tr>
<td>13.</td>
<td>Seed to pulp ratio</td>
<td>27.51</td>
<td>15.3</td>
<td>22.49</td>
<td>35.35</td>
<td>21.60</td>
<td>15.05</td>
</tr>
<tr>
<td>14.</td>
<td>No. of marketable fruits/plant</td>
<td>159.40</td>
<td>135.96</td>
<td>145.34</td>
<td></td>
<td></td>
<td>40.60</td>
</tr>
<tr>
<td>15.</td>
<td>No. of unmarketable fruits/plant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>64.79</td>
<td>18.04</td>
</tr>
<tr>
<td>16.</td>
<td>Yield of marketable fruits/plant (kg)</td>
<td>69.80</td>
<td>50.00</td>
<td>112.80</td>
<td>31.62</td>
<td>102.974</td>
<td>7.22</td>
</tr>
<tr>
<td>17.</td>
<td>Yield of unmarketable fruits/plant (kg)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13.64</td>
</tr>
<tr>
<td>18.</td>
<td>Av. weight of the single fruit (g)</td>
<td></td>
<td></td>
<td>97.57</td>
<td>63.64</td>
<td>117.08</td>
<td>17.95</td>
</tr>
</tbody>
</table>
x P 8, P 4 x P 5, P 4 x P 7, P 5 x P 7 and P 5 x P 8) were different types than the 
checks and not suitable for market requirement.

Economic heterosis in desired direction for yield of marketable fruits per plant 
were observed in small fruited segment for P 3 x P 6 (31.62) per cent, in purple long 
fruited segment ranged from 6.44 (P 4 x P 7) to 102.97 (P 4 x P 8) per cent. Other 
crosses showed economic heterosis in purple long fruited segment were P 1 x P 6 
(82.67), P 1 x P 2 (69.80), P 1 x P 7 (58.42), P 1 x P 4 (50.00) and P 2 x P 6 (38.61). 
These all crosses had positive heterobeltiosis ranged from 8.39 (P 2 x P 6) to 37.82 
(P 1 x P 6) per cent, except P 1 x P 4 (2.78) which was negative while in round fruited 
segment only one cross (P 6 x P 8) showed economic heterosis 3.52 per cent in each 
check (PH-6 and MHB-80) and 7.22 per cent in Navkiran. The findings of Pal and 
Singh (1946), Venketaramani (1946) Vijay and Premnath (1978), Sousa et al. (1998), 
Shaha et al. (1999), Gupta and Singh (2000), Prasath et al. (2000), Patil et al. (2001) 
and Babu and Thirumurugon (2001) also supported present result.

Earliness plays an important role in commercial vegetable cultivation fetching 
greater results due to higher market price. In the present study out of twenty-eight 
crosses, one hybrid (P 6 x P 8) showed desired negative standard heterosis (4.35 and 
5.27) per cent for earliness over checks MHB-80 and Navkiran respectively. Whereas 
three crosses, 1 x P6, P 1 x P 2, P 3 x P 6 expressed heterobeltiosis for earliness 10.45, 
6.67 and 5.47 per cent respectively. Heterosis for early maturity has also been 
reported by Venketaramani (1946) and Sousa et al. (1998).

Standard heterosis for average weight of the single fruit expressed by eight 
hybrids of which tree crosses (P 4 x P 8, P 1 x P 6, P 2 x P 4) in purple long segment 
117.08, 97.57, 39.04 per cent respectively and one cross (P 6 x P 8) in round fruited 
segment expressed 17.95 per cent. While heterobeltiosis showed by one cross P 2 x P
4 (26.67) per cent. This observation is in full agreement to that reported by Sousa et al. (1998), Patil et al. (2001) Babu and Thirumurugon (2001).

Standard heterosis for moisture content exhibited by four hybrid in negative and desired direction of which P 4 x P 8 in purple long segment highest 2.06 per cent, for seed to pulp ratio seven hybrid showed standard heterosis of which in purple long segment ranged from 10.67 (P 1 x P 8) to 29.42 (P 2 x P 6) while in purple round segment, one hybrid (P 6 x P 8) 15.05 per cent. Heterosis for seed to pulp ratio have also been reported by Patil et al., (2001).

Number of marketable fruits per plant expressed by six crosses of which in purple long segment ranged from 104.74 (P 1 x P 7) to 159.40 (P 1 x P 2) whereas in round fruited one hybrid P 6 x P 8 showed standard heterosis 48.60 and 31.14 per cent in MHB-80 and Navkiran segment respectively. Heterosis for number of marketable fruit has also been reported by Pal and Singh (1946), Prasad et al. (2000) and Babu and Thirumurugon (2001).

For plant height at last picking eight crosses expressed positive standard heterosis in desired direction of which in Ravaiya, one cross P 3 x P 6 (35.93) per cent; seven crosses in purple long segment with highest standard heterosis were in crosses P 4 x P 6 (24.36) and lowest in P 1 x P 7 (4.58) per cent followed by P 2 x P 6 (21.97), P 1 x P 3 (13.55), P 1 x P 2 (11.73), P 1 x P 4 (10.44), P 1 x P 6 (7.14) per cent and in purple round segment highest heterosis was observed in cross P 6 x P 8 (24.44) per cent. This observation is in full agreement to that reported by Benketaramni (1946), Pal and Singh (1946), Peter and Singh (1974), Shankraraiah and Rao (1990), Prasath et al. (2000) and Babu and Thirumurugon (2001).

For number of primary branches per plant, seven crosses expressed positive heterosis in desired direction of which in purple long segment high heterosis
expressed in crosses P 2 x P 8 (26.00 and 25.93) and P 2 x P 6 (25.00 and 16.60) P 4 x P 8 (22.22 and 22.22) and P 4 x P 6 (7.33) per cent for standard heterosis and heterobeltiosis respectively whereas in purple round segment one cross (P 6 x P 8) 27.82 per cent for Navkiran and PH-6 while 6.60 per cent in MHB-80. This finding is supported by the result of Peter and Singh (1974).

For number of secondary branches per plant six crosses exhibited positive heterosis in desired direction of which in purple long segment highest standard heterosis were in cross P 4 x P 8 (25.38) and lowest in P 1 x P 8, (14.29) per cent followed by P 1 x P 2 (23.81) and P 1 x P 6 (17.48) per cent whereas in purple round segment observed for P 6 x P 8 (37.41) in PH-6, 12.68 in Navkiran and 17.39 per cent in MHB-80. Heterobeltiosis of cross P 6 x P 8 was 37.40 per cent. This observation is in full agreement of result by Mandal and Dana (1993) and Babu and Thirumurugan (2001), which also supported present result.

For fruit setting flowers, five crosses expressed positive heterosis in desired direction of which in purple long segment high heterosis were recorded in crosses P 1 x P 2 (29.93 and 11.49) and P 1 x P 4 (22.06 and 15.67) per cent standard heterosis and heterobeltiosis, respectively whereas in purple round segment, highest standard heterosis was observed for P 6 x P 8 (48.47) in Navkiran and 6.67 per cent in PH-6.

For volume of fruit six crosses showed positive standard heterosis in desired direction of which in Ravaiya segment one cross P 3 x P 6 (42.35) per cent, in purple long segment four crosses P 2 x P 6 (36.12) P 1 x P 6 (23.56), P 1 x P 5 (23.02) and P 1 x P 7 (17.79) per cent whereas in purple round segment one cross P 6 x P 8 (8.77) over in both checks PH-6 and MHB-80.

For length of fruit, six crosses expressed positive standard heterosis in desired direction of which in Ravaiya segment, one cross P 3 x P 6 (55.73) per cent, in purple
long segment crosses P 1 x P 2 (14.29) and P 1 x P 4 (9.50) per cent whereas in purple round segment for two cross P 6 x P 8 (24.89) and P 7 x P 8 (22.49) per cent in PH-6 and in black round segment one crosses P 6 x P 7 (4.25) per cent. This finding is supported by Shaha et al. (1999), Prasath et al. (2000), Patel et al. (2001) and Babu and Thirumurugun (2001).

For breadih of fruit, seven crosses exhibited positive standard heterosis in desired direction of which in Ravaiya segment one cross P 3 x P 6 (62.67) per cent, in purple long segment, five cross P 4 x P 6 (49.10), P 2 x P 6 (39.53), P 1 x P 8 (37.73), P 1 x P 7 (29.97), P 2 x P 8 (29.20) whereas in purple round segment for one cross P 6 x P 8 (56.00) per cent in PH-6. This observation is in full agreement to that reported by Prasath et al. (2000).

On consideration of yield components, out of twenty-eight crosses thirteen crosses expressed standard heterosis, one cross in Ravaiya, eleven cross in purple long and one cross in round fruited segment in desired direction. On the consideration of number of characters (Table 5.4) for which heterosis is highest, thirteen crosses expressed standard heterosis for yield of marketable fruits per plant, ten crosses for average weight of the single fruit, eight crosses for plant height at last picking, seven crosses for six characters namely, plant height at first flowering, number of primary branches per plant, volume of fruit, breadth of fruit, seed to pulp ratio and number of marketable fruits per plant, five crosses for four characters namely, number of secondary branches per plant, fruit setting flowers, non setting flowers and yield of unmarketable fruits per plant, four crosses for two characters namely, days to 50 per cent flowering and number of unmarketable fruits per plant and one crosses for one character, days to first fruit picking. Out of eighteen characters studied only three character namely, number of marketable fruits per plant, yield of marketable fruits per
Plate 5. Promising hybrid ($P_3 \times P_6$) in purple oval fruited segment along with check (Ravaiya)
Plate 6. Promising hybrids (P1 x P2 and P1 x P4) in long (P4 x P8 and P1 x P6) in oblong fruited segment along with national check (PH-5)
Plate 7. Promising hybrids (P 6 x P 8) in black round, (P 7 x P 8) in purple round fruited segment along with check (MHB-80, Navkiran PH-6)
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Character</th>
<th>Character Importance</th>
<th>Heterobeltiosis</th>
<th>Relative Heterosis</th>
<th>Ravaiya (NC)</th>
<th>PH-5 (NC)</th>
<th>PH-6 (NC)</th>
<th>MHR-80</th>
<th>Navkiran</th>
<th>Ajay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Plant height at first flowering (cm)</td>
<td>Plant Height</td>
<td>P2 x P6</td>
<td>P1 x P7, P2 x P6, P2 x P5, P2 x P3, P3 x P8, P3 x P6</td>
<td>P3 x P6</td>
<td>P1 x P2, P4 x P6, P2 x P8, P2 x P6, P6 x P8</td>
<td>P5 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Plant height at last picking (cm)</td>
<td>Plant Height</td>
<td>P1 x P3</td>
<td>P1 x P5, P3 x P5, P2 x P5, P1 x P2, P1 x P5</td>
<td>P3 x P6</td>
<td>P4 x P6, P2 x P6, P1 x P3, P1 x P2, P1 x P7</td>
<td>P7 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>No. of primary branches/plant</td>
<td>Branches</td>
<td>P2 x P8</td>
<td>P2 x P6, P4 x P8, P2 x P3, P2 x P6</td>
<td>-</td>
<td>P2 x P8, P6 x P8, P1 x P5, P4 x P6, P1 x P7</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>No. of Secondary branches/plant</td>
<td>Branches</td>
<td>P6 x P8</td>
<td>P6 x P8, P4 x P8, P5 x P8</td>
<td>-</td>
<td>P4 x P8, P1 x P2, P1 x P6, P1 x P8</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Days to 50% flowering</td>
<td>Days to Flowering</td>
<td>P1 x P5</td>
<td>P1 x P5, P1 x P2, P1 x P6, P1 x P8</td>
<td>-</td>
<td>-</td>
<td>P7 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Days to first fruit picking</td>
<td>Days to Fruit</td>
<td>P1 x P6</td>
<td>P1 x P6, P1 x P2, P3 x P6</td>
<td>-</td>
<td>-</td>
<td>P7 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Fruit setting flowers</td>
<td>Flower Setting</td>
<td>P1 x P2</td>
<td>P1 x P4, P1 x P2</td>
<td>-</td>
<td>P1 x P2, P1 x P4, P1 x P3, P2 x P4</td>
<td>P6 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
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<tr>
<td>8.</td>
<td>Non-setting flowers</td>
<td>Flower Non-setting</td>
<td>P1 x P2</td>
<td>P3 x P8, P6 x P8, P1 x P2, P4 x P5</td>
<td>-</td>
<td>P1 x P3, P1 x P8, P2 x P6, P1 x P2</td>
<td>P6 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Volume of fruits (ml)</td>
<td>Fruit Volume</td>
<td>P3 x P7</td>
<td>P7 x P8, P1 x P8, P1 x P3</td>
<td>-</td>
<td>P2 x P6, P1 x P8, P1 x P6, P1 x P5, P1 x P7</td>
<td>P5 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Moisture content in fruit (%)</td>
<td>Fruit Moisture</td>
<td>P5 x P6</td>
<td>P5 x P6</td>
<td>-</td>
<td>P4 x P8, P2 x P4, P1 x P4, P1 x P7</td>
<td>P6 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Length of fruit (cm)</td>
<td>Fruit Length</td>
<td>P5 x P6</td>
<td>P3 x P7, P5 x P6, P5 x P7</td>
<td>P3 x P6</td>
<td>P4 x P6, P2 x P6, P1 x P8, P1 x P7</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Breadth of fruit (cm)</td>
<td>Fruit Breadth</td>
<td>P1 x P8</td>
<td>P3 x P4, P7 x P8, P3 x P8</td>
<td>P3 x P6</td>
<td>P1 x P2, P1 x P4</td>
<td>P7 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Seed to pulp ratio</td>
<td>Seed to Pulp</td>
<td>P3 x P7</td>
<td>P3 x P6, P3 x P8, P2 x P5, P2 x P3, P4 x P6, P4 x P8, P1 x P2, P3 x P5, P1 x P4, P1 x P3, P3 x P8</td>
<td>P3 x P6</td>
<td>P2 x P6, P1 x P2, P1 x P4, P4 x P6, P4 x P8, P1 x P4, P1 x P8</td>
<td>P5 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>No. of marketable fruits/plant</td>
<td>Marketable Fruits</td>
<td>P6 x P8</td>
<td>P6 x P8, P7 x P8, P1 x P2, P3 x P6</td>
<td>-</td>
<td>P1 x P2, P1 x P6, P1 x P4, P1 x P8, P1 x P3, P1 x P7</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td>P7 x P8</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>No. of unmarketable fruits/plant</td>
<td>Unmarketable Fruits</td>
<td>P4 x P6</td>
<td>P4 x P6, P6 x P7, P4 x P7, P3 x P5</td>
<td>P3 x P6</td>
<td>P4 x P6</td>
<td>P7 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Yield of marketable fruits/plant (kg)</td>
<td>Marketable Yield</td>
<td>P6 x P8</td>
<td>P3 x P6, P6 x P8, P5 x P6, P1 x P6, P4 x P8</td>
<td>P3 x P6</td>
<td>P1 x P6, P4 x P8, P1 x P7, P1 x P2, P1 x P4, P2 x P6, P5 x P8, P3 x P8, P1 x P8, P2 x P4</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Yield of unmarketable fruits/plant (kg)</td>
<td>Unmarketable Yield</td>
<td>P4 x P7</td>
<td>P4 x P7, P4 x P6, P2 x P3, P3 x P5, P5 x P6, P4 x P5</td>
<td>-</td>
<td>P4 x P6, P2 x P4, P1 x P4, P1 x P8</td>
<td>P7 x P8</td>
<td>P6 x P8</td>
<td>P6 x P8</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Av. weight of the single fruit (g)</td>
<td>Fruit Weight</td>
<td>P2 x P7</td>
<td>P2 x P4</td>
<td>P3 x P6</td>
<td>P4 x P8, P1 x P8, P1 x P6, P2 x P6, P1 x P7, P4 x P6, P1 x P5, P2 x P4</td>
<td>P6 x P8</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
plant and average weight of the single fruit had expressed highest heterosis in per cent for maximum number of crosses whereas in addition to these three characters, plant height at last picking had also expressed heterosis for maximum crosses. Thus, these four characters (number of marketable fruit 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.

For these four characters, six crosses expressed maximum standard heterosis of which in Ravaiya segment cross P 3 x P 6 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, in purple long segment, four crosses showed highest standard heterosis namely 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) per cent; cross P 4 x P 8 for yield of marketable fruits per plant (102.97) and average weight of the single fruits (117.08) per cent, 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) per cent and cross P 1 x P 4 for number of marketable fruits per plant (135.96), and plant height at last picking (10.44) per cent whereas in round fruited segment cross P 6 x P 8 exhibited 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) and plant height at last picking (28.89) per cent.

Above six crosses also expressed standard heterosis for various characters of which in Ravaiya segment cross P 3 x P 6 for six characters in desired direction namely, 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), in purple long segment promising four crosses (P 1 x P 6, P 4 x P 8, P 1 x P 2, P 1 x P 4) had expressed standard heterosis for six, five, four, six and one characters, respectively 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 in desired negative direction fruit setting flowers, non-setting flowers in desired negative direction, moisture content in fruits in desired negative direction, volume of fruit, fruit length, fruit breadth, seed to pulp ratio in desired negative direction, number of unmarketable fruits per plant in desired negative direction and yield of unmarketable fruits per plant in desired negative direction. The cross P 1 x P 6, involving high x low combiners for yield of marketable fruits per plant showed higher heterosis than the cross P 1 x P 4, P 1 x P 7, P 1 x P 8 and P 4 x P 7, derived from the high x high combiners. The similar observations were also recorded for other characters showing higher heterosis. This finding is supported by Biswas (1946).

In round segment cross P 6 x P 8 had also expressed standard heterosis for fourteen characters namely, 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), non-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 unmarketable fruits per plant in desired negative direction (13.64).