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# Heterosis studies for fruit characters in Brinjal (*Solanum melongena* L.)

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**Abstract**
A study was conducted in brinjal to estimate the magnitude of heterosis for eight fruit characters. Significant heterosis exhibited by different crosses for different characters over the years *viz.*, fruit length (PRxWB-1, PB-66xPB-67 & PB-66xWB-1), fruit diameter (PB-66xPS &BARIxPS), average fruit weight (BARIxPR,BARIxPS& WB-1xPS), number of healthy fruits/plant (*S. aethiopicum*xBARI&BARIxPB-66), number of infested fruits/plant (*S. aethiopicum*xBARI, BARIxPS&BARIxPR), weight of healthy fruits/plant (BARIxPB-66, BARIxPR& PB-71xPS) and weight of infested fruits/plant (PB-67xPS, PB-66xPR & BARIxPB-67) for almost all types of heterosis.The crosses BARIxPB-66, BARIxPR and PB-71xPS exhibited highest and significant positive heterosis over better parent, mid parent and standard checks for fruit yield over the years. The present study reveals good scope for isolation of purelines from the progenies of heterotic $F_1$s as well as commercial exploitation of heterosis in brinjal.

**Key words:** Heterosis, diallel, brinjal, heterotic hybrid, fruit characters.

## Introduction

Brinjal (*Solanum melongena* L., 2n=24) is an important *Solanaceous* vegetable crop of India. It is also a popular vegetable in China, Japan, Egypt, Italy, USA, Syria, Philippines, Thailand, Indonesia, France and Turkey, and now cultivated worldwide. Its immature fruits are generally used as vegetable and other culinary preparations with locally preferred fruit characters. In respect of very high local preferences for colour, shape and taste, there are specific genotypes suited for specific localities. It is not possible to have one common cultivar to suit different localities and local preferences. It is therefore, required to improve the locally preferred cultivars with certain fruit charactersalong with high yield and adaptation. Now a day's development of new hybrid combinations with specific fruit characteristic is most desirable traits for the breeders of brinjal in India as well as in the world. For the development of an effective heterosis breeding programme in brinjal, one need to have information about genetic architecture and estimated prepotency of parents in hybrid combinations. In this investigation eight diverse genotypes of brinjal were taken up to estimate heterosis effect for important fruit characters in brinjal. Similar investigation were carried out in brinjal by various workers at different places *viz.*, Ansari*et al*. (2009), Chadha*et al*. (2001), Dhankar*et al.* (1979), Dubey*et al.* (1998), Gupta and Singh (2000), Hazra*et al.* (2010), Ingale and Patil (1996), Mandal*et al*. (1994), Patil*et al*. (2001), Prabhu*et al.* (2005), and Singh et al. (2004). The information generated in this process is used to understand the magnitude of heterosis of $F_1$ hybrids. This knowledge helps in exploiting heterosis for different fruit characters in brinjal.

## Materials and methods

The present investigation was undertaken at Vegetable Research Centre (VRC), GBPUA&T, Pantnagar-263145during 2009 to 2011. The VRC, Pantnagar is geographically situated at an altitude of 243.84 meters above mean sea level and at $29^0$ N latitude and $79.3^0$ E longitudes. This falls in the humid subtropical zone and situated in the *Tarai* belt in the foothills of *Shivalik* range of the great Himalayas. The climate is humid and sub-tropical with maximum temperature ranging from $32^0$ C to $43^0$ C in summer and minimum temperature ranging from $0^0$ C to $9^0$ C in winter. Frost can be expected from last week of December to first week of February. Soil of the field was clay-loam in nature.

The experimental materials consisted of seven promising genotypes *Solanum melongena* L.(2n=24),viz.BARI, PB-66, Pant Rituraj, WB-1, PB-67 (PB-6), PB-71, Pant Samrat and one genotype of *Solanum aethiopicum*L.(2n=24)which were selected for making crosses in diallel fashion (Griffing's

Method II, Model I, fixed effect) and generated a set of 28 $F_1$ hybrids. Crosses were made during 2009-10 and 2010-11 for the evaluation of $F_1$s during two subsequent years viz., 2010-11 and 2011-12, respectively. Evaluation of all 36 genotypes (8 parents + 28 $F_1$s) was done in both the years of experimentation. One month old seedlings were transplanted at the spacing of 75 cm x 60 cm in rows of 6 meter length consisting of 10 plants each row. Recommended package of practices were followed for raising the normal seedlings and crop.

The genotypes were evaluated for eight important characters viz. fruit length (cm), fruit diameter (cm), average fruit weight (g), number of healthy fruits per plant, number of infested fruits (damaged by *Leucinodes orbonalis*) per plant, weight of healthy fruits per plant (kg), weight of infested fruits (damaged by *Leucinodes orbonalis*) per plant (kg) and yield per plant (kg). The data were subjected to appropriate statistical analysis.

Estimation of heterosis:Heterosis, expressed as per cent increase or decrease in the performance of $F_1$ hybrid over the mid-parent (average or relative heterosis), better parent (heterobeltiosis) and standard (economic) heterosis was computed for each character as suggested by Hayes *et al. (*1965) and Fonesca and Paterson (1968).The differences in the magnitudes of heterosis, heterobeltiosis and standard heterosis were tested as per the method proposed by Panse and Sukhatme (1969).

**Results and Discussion**

The analysis of variance revealed significant variation due to parents for all eight characters studied indicating that parents possess good amount of genetic variability (Table 1). The variance due to hybrids was also significant for all the characters studied. Comparison of means of hybrids with mean of parents as a group was found to be significant for most of the characters which suggested that the hybrids differ considerably from the parents for most of the traits and also the existence of substantial heterosis for most of the characters studied. Moreover, the importance of non-additive genetic effects in determining these characters can also be revealed.

Almost all the characters had shown considerable amount of heterosis over mid parent (relative heterosis), better parent (heterobeltiosis) or over the check variety (standard or economic heterosis). The degree of heterosis however differed for different characters of twenty eight crosses studied.

The estimation of heterosis in per cent for all the characters is presented in table 2, for first year and in table 3, for second year. The coefficients of variations (CV) were below 20 per cent in all the characters in both the years. This indicates that the precision of the experiment was within the accepted normal limits. The results on estimates of relative heterosis, heterobeltiosis and standard heterosis are described as follows;

With respect to fruit length, twenty crosses exhibited significant heterosis over mid parental value, where thirteen were in negative direction, ranging from -81.48 (*S. aethiopicum* x BARI) to -13.46 (BARI x WB-1) and eight were in positive direction ranging from 6.74 (BARI x PB-66) to 42.01 (PR x WB-1) in the first year (2010-11). In the second year (2011-12), again twenty crosses showed significant values, ranging from -91.99 (*S. aethiopicum* x BARI) to 39.75 (PB-66 x WB-1), where twelve crosses were in negative direction and eight were on positive direction with highest value of 39.75 (PB-66 x WB-1) followed by 35.79 (PR x WB-1), 30.13 (WB-1 x PB-67), 24.86 (WB-1 x PB-71) and 24.60 (PB-66 x PB-67). Twenty one crosses exhibited significant heterobeltiosis, ranging from -89.85 (*S. aethiopicum* x BARI) to 36.43 (PR x WB-1), where nineteen crosses were in negative direction and only two crosses PR x WB-1 (36.43 %) and PB-66 x PB-67 (31.20 %) were in positive direction in the first year. In the second year second year twenty one crosses showed significant estimates, ranging from -90.14(*S. aethiopicum* x BARI) to 35.31 (PR x WB-1), where seventeen were in negative direction and three in positive direction i.e. PR x WB-1 (35.31 %), PB-66 x PB-67 (24.6 %) and PB-66 x WB-1 (9.52 %). In the first year, all twenty eight crosses exhibited significant estimates with respect to standard heterosis, ranging from -92.58 (*S. aethiopicum* x PB-71) to -22.56 (BARI x PB-66). In the second year, also all crosses exhibited significant values over standard parent, ranging from -92.30 (*S. aethiopicum* x PB-71) to -27.70 (BARI x PB-66). It revealed that all crosses in both the year showed negative heterosis over standard parent. Thus the crosses PR x WB-1, PB-66 x PB-67, and PB-66 x WB-1 were the best hybrids, which showed significant heterosis over mid parents and better parent. This is in agreement with the report of Prasath*et al.* (2000), Patil*et al*. (2001), Kumar and Pathania (2004), Singh *et al*. (2004), and Ansari *et al*. (2009) in brinjal.

Seven crosses exhibited significant estimates of relative heterosis for fruit diameter (cm) in the first year, ranging from -63.64 (*S. aethiopicum* x PR) to 18.57 (PB-66 x PS), where three were in positive direction i.e. PB-66 x PS (18.57 %), WB-1 x PS (17.85 %) and PB-71 x PS (12.97 %). In the second year, twenty two crosses exhibited significant estimates, ranging from -61.73 (*S. aethiopicum* x PB-71) to 25.93 (PB-66 x PS), where twenty one were in negative direction and only one was in the positive direction.Twenty four crosses showed significant estimates of heterosis over better parental value in the first year, ranging from -69.18 (*S. aethiopicum* x PB-71) to -9.60 (WB-1 x PB-71). All these were in negative directions. Only one cross BARI x PS (9.01 %) showed positive heterosis but with non-significant value. In the second year, twenty six crosses showed significant estimates, ranging from -67.31 (*S. aethiopicum* x PB-71) to -18.52 (PB-66 x PB-67), where all were in negative direction. The only cross with positive value was PB-66 x PS (4.94 %), but non-significant.Withrespectto standard heterosis in the first years, all twenty eight crosses exhibited significant values, ranging from -79.86 was (*S. aethiopicum* x PS) to -19.04 (PR x PB-71), all were in negative direction.In the second year, all crosses were significant as first year with negative values, ranging from -79.07 (*S. aethiopicum* x P) to -19.04 (PR x PB-71). Thus the cross PB-66 x PS showed significant heterosis over mid parent in both the years and that was identified as the best cross for the increase of fruit diameter. None of the crosses was found superior over better parent and standard parent. The heterosis for fruit diameter has been reported by Singh and Gautam (1991), Mandal *et al.* (1994), Ingale and Patil (1996), Dubey *et al.* (1998), Prasath*et al*. (2000) andAnsari *et al*. (2009).

Seventeen crosses exhibited significant relative heterosis for average fruit weight (g) in the first year, ranging from -78.18(*S. aethiopicum* x PB-71) to 70.21 (WB-1 x PS), where ten were in positive direction which is desirable for this trait. The other superior crosses were BARI x PS (46.74 %), BARI x PR (39.05 %), PB-66 x PR (26.83 %) and PB-66 x PS (26.58 %). In the second year, twenty two crosses exhibited significant values, ranging from -77.21 (*S. aethiopicum* x PB-71) to 63.24 (WB-1 x PS), where fifteen were in positive direction and rest seven were in negative direction, which were from *S. aethiopicum* combinations.Asregards heterosis over better parent, sixteen exhibited significant estimates, ranging from -87.80 (*S. aethiopicum* x PB-71) to 50.54 (WB-1 x PS), where four were in positive direction i.e. WB-1 x PS (50.54 %), BARI x PR (21.67 %), BARI x PS (20 %) and PB-66 x PB-67 (17.02 %) in the first year. In the second year, twenty one crosses exhibited significant estimates, ranging from -87.23 (*S. aethiopicum* x PB-71) to 44.16 (WB-1 x PS), where eight were in positive direction. Twenty one crosses showed significant standard heterosis, ranging from -88.00 (*S. aethiopicum* x PB-71) to 21.67 (BARI x PR).BARI x PR was the single cross with positive value in the first year. In the second year, twenty six crosses exhibited significant estimates, ranging from -87.23 (*S. aethiopicum* x PB-71) to 32.77 (BARI x PR), where three were in positive direction. Other crosses with positive values were PB-66 x PR (10.08 %) and PR x WB-1 (8.40 %). Thus BARI x PR, BARI x PS and WB-1 x PS appeared as significant heterotic combination in both the years in the desired direction for this trait. These findings are in agreement with the results of Randhawa and Sukhija (1973), Ingale and Patil (1996) Patil*et al*. (2001) and Ansari *et al*. (2009).

With respect to number of healthy fruits per plant in the first year, fourteen crosses exhibited significant estimates, ranging from-45-17 (PB-66 x PS) to 99.01 (*S. aethiopicum* x BARI), where eleven were in positive direction. Among the crosses derived from*S. melongena* genotypes highest value was recorded in the cross BARI x PR (69.88 %), closely followed by BARI x PB-66 (68.86 %) and PR x WB-1 (57.55 %). In the second year, fourteen crosses showed significant estimates, ranging from -44.12 (PB-66 x PS) to 102.19 (*S. aethiopicum* x BARI), where ten were in positive direction. Among the crosses between *S. melongena* genotypes highest value was in the cross BARI x PB-66 (77.74 %) followed by PR x WB-1 (56.51 %) and PR x PB-712 (53.55 %).Sixteen crosses showed significant heterobeltiosis in the first year, ranging from -60.35 (PB-66 x PS) to 57.54 (BARI x PB-66), where three were in positive direction i.e. BARI x PB-66 (57.54 %), BARI x PR (41.94 %) and *S. aethiopicum* x BARI (23.02%), which is desirable for this character. In the second year, twelve crosses showed significant values, ranging from -62.99 (PR x PS) to 72.39 (BARI x PB-66), where only two were in positive direction i.e. BARI x PB-66 (72.39 %) and *S. aethiopicum* x BARI (33.87 %).For the standard heterosis, twenty seven crosses exhibited significant estimates in the first year, ranging from -85.98 (PB-66 x PR) to 23.02 (*S. aethiopicum* x BARI), where all crosses were in negative direction except *S. aethiopicum* x BARI. In the second year, twenty four crosses showed significant values, ranging from -85.48 (PB-66 x PR) to 33.87 (*S. aethiopicum* x BARI), where all were in negative direction except *S. aethiopicum* x BARI. Thus with respect to number of healthy fruits per plant *S. aethiopicum* x BARI was the best cross followed by BARI x PB-66, which showed significant heterosis over mid parent and better parent in both the year. The cross *S. aethiopicum* x BARI showed significant value for all types of heterosis during both the years.

Similar reports were also quoted by Dhankar*et al*. (1979), Dubey*et al*. (1998), Biswajit*et al*. (2004) and Kumar and Pathania (2004).

Nine crosses exhibited significant heterosis over mid parental value for number of infested fruits per plant in the first year, ranging from -40.43 (PR x PS) to 41.54 (BARI x PB-66), where six were in desirable negative direction, other superior crosses were PB-66 XPB-67 (-36.11%) and PR X PB-71 (-35.00%). In the second year, twelve crosses showed significant estimates, ranging from -47.60 (PB-67 x PS) to 59.16 (BARI x PB-66), where nine were in negative direction, other superior crosses were PB-66 x PS (-44.99 %) and PR x PS (-43.06 %).Seventeen crosses exhibited significant estimates of heterosis over better parental value in the first year, ranging from -50.00 (PR x PS) to 37.31 (BARI x PB-66), where sixteen were in desirable negative direction, six from *S. aethiopicum* combinations and among the crosses derived from *S. melongena* genotypes best crosses were PR X PB-71 (-45.18%) and PB-66 XPB-67 (-43.21%). In the second year, eighteen crosses showed significant estimates, ranging from -91.30 (PR x PS) to 39.73 (BARI x PB-66), where all were in negative direction, except BARI x PB-66. Twenty seven crosses exhibited significant estimates of standard heterosis in the first year, ranging from -70.83 (PR x PS) to -20.83 (*S. aethiopicum* x PR), where all were in negative direction. Among the crosses between *S. melongena* genotypes best crosses were PR x PS (-70.83 %) closely followed by PR x PB-71 (68.40 %), PR x WB-1 (68.06%) and PB-66 x PB-67 (68.06 %). In the second year, twenty seven crosses exhibited significant effect, ranging from -78.62 (PB-66 x PR) to -27.36 (*S. aethiopicum* x PR), where all were in negative direction. Among the crosses derived from *S.melongena* genotypes the highest value was in the cross PB-66 x PR (-78.62 %), closely followed by PR x PS (-71.89 %), PR x PB-71 (-71.35 %) and PB-66 x PS 9-70.75 %). Thus best cross for this important trait was *S. aethiopicum* x BARI and among the crosses of*S. melongena* genotypes BARI x PS and PR x PS, which showed significant heterosis in desired negative direction for all three types of heterosis in both the years. These results are supported by the findings of Dhankar*et al*. (1979), Dubey*et al*. (1998), Chadha*et al*. (2001) and Kumar and Pathania (2004).

For weight of healthy fruits per plant (kg), twenty two crosses exhibited significant estimates of heterosis over mid parental value, ranging from -81.19 (*S. aethiopicum* x PB-67) to 96.31 (BARI x PR), where thirteen were in desirable positive direction. All seven crosses of *S. aethiopicum* combination were in negative direction, whereas a few crosses of*S. melongena* genotypes exhibited negative heterosis and highest value showed in the cross BARI x PR (96.31 %) followed by BARI x PB-66 (94.59 %) and PB-71 x PS 966.90 %) in the first year. In the second year, thirteen crosses revealed significant values, ranging from -84.87 (*S. aethiopicum* x PB-67 and *S. aethiopicum* x PS) to 79.99 (BARI x PB-66), where six were in positive direction i.e. BARI x PB-66 (79.99 %), BARI x PR (72.89 %), BARI x PB-71 (46.79 %), PB-71 x PS (42.07 %), etc. With respect to heterosis over better parent, twenty three crosses showed significant estimates, ranging from -89.76(*S. aethiopicum* x PB-67) to 90.99 (BARI x PB-66), where thirteen were in positive direction. In the second year, eleven crosses exhibited significant estimates, ranging from -91.84 (*S. aethiopicum* x PS) to 78.87 (BARI x PB-66), where four crosses were in positive direction i.e. BARI x PB-66 (78.87 %), BARI x PR (61.06 %), BARI x PB-71 (45.01 %) and PB-71 x PS (36.15 %).For heterosis over standard parent, twenty crosses exhibited significant estimates, ranging from -91.14 (*S. aethiopicum* x WB-1) to 62.80 (BARI x PB-66), where eight crosses were in positive direction, all seven crosses of *S. aethiopicum* combination were in negative direction in first year. In the second year, twelve crosses showed significant effect, ranging from -92.19 (*S. aethiopicum* x WB-1) to 59.98 (BARI x PB-66), where four were in positive direction i.e. BARI x PB-66 (59.98 %), BARI x PR (44.08 %), PB-67 x PS (36.15 %) and BARI x PB-71 (32.92 %). Thus regarding this trait best hybrid was BARI x PB-66, followed by BARI x PR, PB-71 x PS and BARI x PB-71, which showed significant estimates for all three types of heterosis in desired direction. This result is similar to the findings of Dubey*et al*. (1998), Sathya*et al*. (1998), Gupta and Singh (2000), Prasath*et al*. (2000), Chadha*et al*. (2001), Patil*et al*. (2001), Kumar and Pathania (2004) and Prabhu*et al.* (2005).

With respect to weight of infested fruits per plant, sixteen crosses exhibited significant effect over mid parental value in the first year, ranging from -85.16 (*S. aethiopicum* x PS) to 65.70 (BARI x PS), where eight crosses were in negative direction, which is desirable for this characters, all the seven crosses of *S. aethiopicum* combination showed negative heterosis with significant effect and only one cross of *S. melongena* genotypes was in negative direction with significant effect i.e. WB-1 x PS (-25.90 %). In the second year, twenty crosses exhibited significant heterosis, ranging from -81.10 (*S. aethiopicum* x PB-67) to 99.00 (BARI x PB-66), where ten crosses were in negative direction, all the seven crosses of *S. aethiopicum* combination were in negative direction and three crosses derived from *S. melongena* genotypes were in negative direction i.e. PB-66 x PR (-44.29 %), BARI x PB-67 (-22.94 %) and PB-67 x PS (-20.56 %). Sixteen crosses exhibited significant heterosis over better parental value in the first year, ranging from -91.75 (*S. aethiopicum* x PS) to 53.33 (BARI x WB-1), where nine crosses were in negative direction, all seven crosses of *S. aethiopicum* combination were in negative direction and among the crosses between *S. melongena* genotypes two were in negative direction i.e. WB-1 x PS (-36.60 %) and PB-67 x PS (-25.77 %). In the second year, twenty crosses exhibited significant estimates, ranging from -89.76 (*S. aethiopicum* x PB-67) to 98.44 (BARI x PB-66), where thirteen were in negative direction, seven from *S. aethiopicum* combination and six from crosses between *S. melongena* genotypes and highest values were in the crosses PB-66 x PR (-47.32 %), followed by BARI x PB-67 (-36.90 %) and PB-67 x PS (-35.18 %). Fifteen crosses showed significant heterosis over standard parental values in the first year, ranging from -92.27 (*S. aethiopicum* x PB-71) to 46.91 (BARI x PS), where twelve were in negative direction, all seven crosses of *S. aethiopicum* combination were in negative direction. Among the crosses derived from*S. melongena* genotypes five crosses were in desirable negative direction i.e. WB-1 x PS (-36.60 %), closely followed by PR x WB-1 (-34.54 %), PR x PB-71 (-27.32 %), WB-1 x PB-71 (-27.32 %) and PB-67 x PS (-25.77 %). In the second year, twenty three crosses exhibited significant estimates, ranging from -92.25 (*S. aethiopicum* x PS) to 26.56 (BARI x PB-66), where twenty two were in negative direction. Among the crosses derived from*S. melongena* genotypes highest negative heterosis were in the cross PB-66 x PR (-62.51 %) followed by BARI x PB-67 (-36.90 %) and PB-67 x PS (-35.18 %). Thus best hybrid was PB-67 x PS, PB-66 x PR and BARI x PB-67, which were significant heterosis over all three types of heterosis in both the years. For this trait and over all best cross was *S. aethiopicum* x PS. This is an agreement with the result of Prasath*et al*. (2000), Chadha*et al.* (2001), Kumar and Pathania (2004) and Prabhu*et al.* (2005).

With respect to total fruit yield per plant (kg) in the first year, twenty four crosses exhibited significant estimates of heterosis over mid parental value, ranging from -81.29 (*S. aethiopicum* x PS) to 85.22 (BARI x PR), where fifteen were in desirable positive direction. All seven crosses of *S. aethiopicum* combination were in negative direction, whereas among the crosses derived from*S. melongena* genotypes other best crosses were BARI x PB-66 (84.63 %), BARI x PS (60.47 %) and PB-71 x PS (59.25 %). In the second year, fourteen crosses were significant, ranging from -83.79 (*S. aethiopicum* x PSB-67) to 84.20 (BARI x PB-66), where six crosses were in positive direction i.e. BARI x PB-66 (84.20 %), BARI x PR (70.83 %), PB-71 x PS (47.83 %), BARI x PB-71 (43.18 %), PB-66 x WB-1 (37.93 %) and BARI x PS (33.72 %). Twenty crosses exhibited significant estimates of heterosis over better parent in the first year, ranging from -89.60 (*S. aethiopicum* x PS) to 81.86 (BARI x PB-66), where twelve were in positive direction, other best crosses among crosses between *S. melongena* genotypes were BARI x PR (78.39 %), followed by PB-71 x PS (56.71 %) and BARI x PS (58.62 %). In the second year, fourteen crosses showed significant estimates, ranging from -91.23 (*S. aethiopicum* x PB-67) to 83.19 (BARI x PB-66), where six were in positive direction(all derived from *S. melongena* genotypes). Other superior crosses were BARI x PR (63.87 %) followed by PB-71 x PS (42.64 %) and BARI x PB-71 (42.22 %). Seventeen crosses exhibited significant estimates over standard parent in the first year, ranging from -90.71 (*S. aethiopicum* x PB-71) to 64.36 (BARI x PB-66), where seven were in positive direction (all derived from *S. melongena* genotypes). Other superior crosses were BARI x PR (56.339 %) followed by BARI x PS (42.26 %) and PB-71 x PS (40.45 %). In the second year, thirteen crosses exhibited significant estimates, ranging from –91.94 (*S. aethiopicum* x WB-1) to 53.20 (BARI x PB-66), where four were in positive direction i.e. BARI x PB-66 (53.20 %) followed by BARI x PR (37.05 %), PB-71 x PS (30.06 %) and BARI x PR (20.56 %). Thus with respect to this trait superior hybrids were BARI x PB-66 and BARI x PR showing significant values in positive direction in both the years for all three types of heterosis, which are in agreement with the findings of Dubey*et al.* (1998), Sathya *et al*. (1998), Gupta and Singh (2000), Prasath*et al.* (2000), Chadha*et al.* (2001), Patil*et al.* (2001), Kanthaswamy*et al*. (2003), Kumar and Pathania (2004), Prabhu*et al*. (2005), Ansari *et al*. (2009) and Hazra *et al.*(2010).

Most promising heterotic crosses with respect to each character in desired direction are presented in the table 4 based on the significance test of relative heterosis, heterobeltiosis and economic heterosis of the cross combinations over two years of experimentations.

The crosses PR x WB-1, PB-66 x PB-67 and PB-66 x WB-1 were found to be superior with respect to fruit length. The fruit diameter was also equally important while considering the shape of the fruits as fruit shape is one of the important characters for brinjal improvement. The crosses PB-66 x PS and BARI x PS emerged as superior for the increase of fruit diameter. In the crosses BARI x PR, BARI x PS and WB-1 x PS average fruit weight were increased significantly over both the years and *emerged as* crosses are promising with respect to average fruit weight. With respect to number of fruits *S. aethiopicum* x BARI was superior and total number fruits per plant BARI x PB-66, PB-66 x PS and PB-67 x PS were superior over both years. These three crosses could be utilized for number of fruits per plant. Weight of healthy fruits as well as total yield per plant were higher in the crosses BARI x PB-66, BARI x PR and PB-71 x PS whereas, weight of infested fruits per plant was minimum in the crosses PB-67 x PS, PB-66 x PR and BARI x PB-67. The yield per plant as well as healthy fruit yield per plant both are equally important, therefore both the characters could be considerable while improvement in the brinjal.

On the basis of economic heterosis, it can be concluded that the heterosis breeding could be advantageous for the improvement of brinjal genotypes for yield and fruit characters. The crosses BARI x PB-66, BARI x Pant Rituraj and PB-71 x Pant Samrat could be exploited as commercial hybrids as they exhibited highly significant heterosis, over standard parent. The cross BARI x PB-66 showed highest economic heterosis for most of the traits studied including the yield and fruit characters and can be utilized for commercial exploitation of heterosis for getting maximum yield.

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**Table 1:** Analysis of variance for different characters over the years

| S. No | Characters | Mean squares for source of variation | | | | | |
|---|---|---|---|---|---|---|---|
| | | Replication | | Treatment | | Error | |
| | | 2010-11 | 2011-12 | 2010-11 | 2011-12 | 2010-11 | 2011-12 |
| 1 | d.f. | 2 | 2 | 35 | 35 | 70 | 70 |
| 2 | Fruit length (cm) | 1.09 | 2.46 | 168.60** | 159.81** | 1.36 | 0.81 |
| 3 | Fruit diameter (cm) | 0.07 | 0.09 | 8.75** | 8.81** | 0.09 | 0.05 |
| 4 | Average fruit weight (g) | 28.68 | 21.95 | 13050.38** | 13475.99** | 194.04 | 64.38 |
| 5 | Number of healthy fruits/plant | 1.00 | 3.92 | 399.93** | 410.17** | 5.02 | 9.36 |
| 6 | Number of infested fruits/plant | 1.19 | 1.09 | 8.44** | 11.13** | 0.66 | 0.59 |
| 7 | Weight of healthy fruits/plant (kg) | 0.00 | 0.02 | 1.73** | 1.94** | 0.01 | 0.09 |
| 8 | Weight of infested fruits/plant (kg) | 0.00 | 0.01 | 0.20** | 0.18** | 0.01 | 0.00 |
| 9 | Yield/plant (kg) | 0.00 | 0.05 | 2.99** | 3.24** | 0.02 | 0.09 |

*Significant at 0.05 probability
**Significant at 0.01 probability

**Table2:** Mean values and percentage heterosis over mid parent (relative heterosis) better parent (heterobeltiosis), and standard or check parent (economic heterosis) for the year 2010-11.

| S. No. | $F_1$ | Fruit Length (cm) | | | Fruit Diameter (cm) | | | Average Fruit Weight (g) | | | Number of Healthy Fruits/ Plant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent |
| 1 | *S. aethiopicum* x BARI | -81.46** | -89.85** | -89.85** | -10.34 | -18.02** | -68.94** | -56.54** | -74.89** | -81.17** | 99.01** | 23.02** | 23.02** |
| 2 | *S. aethiopicum* x PB-66 | -52.50** | -71.25** | -87.03** | -40.48** | -53.13** | -74.40** | -60.40** | -76.94** | -83.67** | 44.07** | -8.31 | -8.31 |
| 3 | *S. aethiopicum* x PR | -27.03* | -50.36** | -86.94** | -63.64** | -76.11** | -76.11** | -75.82** | -86.50** | -86.50** | 51.84** | -12.04** | -12.04** |
| 4 | *S. aethiopicum* x WB-1 | -40.39** | -58.53** | -89.94** | -49.64** | -62.09** | -76.45** | -66.97** | -80.38** | -87.83** | 14.93* | -30.18** | -30.18** |
| 5 | *S. aethiopicum* x PB-67 | -66.72** | -80.00** | -90.60** | -43.70** | -54.11** | -77.13** | -66.67** | -80.85** | -85.00** | 19.45** | -20.43** | -20.43** |
| 6 | *S. aethiopicum* x PB-71 | -68.34** | -80.15** | -92.58** | -56.55** | -68.18** | -78.50** | -78.18** | -87.80** | -88.00** | 6.71 | -30.95** | -30.95** |
| 7 | *S. aethiopicum* x PS | -67.22** | -80.65** | -89.85** | -40.55** | -44.60** | -79.86** | -58.43** | -74.13** | -87.67** | -0.09 | -19.51** | -19.51** |
| 8 | BARI x PB-66 | 6.74* | -22.56** | -22.56** | -31.37** | -41.88** | -68.26** | 5.14 | 2.22 | -23.33** | 68.86** | 57.54** | -57.01** |
| 9 | BARI x PR | -18.75** | -48.68** | -48.68** | -5.45 | -34.81** | -34.81** | 39.05** | 21.67** | 21.67** | 69.88** | 41.94* | -66.46** |
| 10 | BARI x WB-1 | -13.46** | -46.24** | -46.24** | 0.20 | -19.34** | -49.90** | 24.09** | 13.33 | -15.00* | 22.30 | 16.77 | -72.41** |
| 11 | BARI x PB-67 | -15.35** | -37.78** | -37.78** | -7.39 | -18.49** | -59.39** | 8.70 | 6.38 | -16.67** | 12.33 | -3.90 | -68.06** |
| 12 | BARI x PB-71 | -14.09** | -40.98** | -40.98** | -11.33** | -30.81** | -53.24** | 15.38** | 1.69 | 0.00 | 28.45* | 15.80 | -65.93** |
| 13 | BARI x PS | -15.66** | -35.71** | -35.71** | 11.26 | 9.01 | -58.70** | 46.74** | 20.00* | -10.00 | 2.88 | -28.68** | -56.40** |
| 14 | PB-66 x PR | 0.00 | -20.83** | -64.29** | -24.06** | -41.30** | -41.30** | 26.83** | 8.33 | 8.33 | -34.98* | -48.60** | -85.98** |
| 15 | PB-66 x WB-1 | 41.46** | 8.75 | -50.94** | -7.60 | -13.19** | -46.08** | 10.41 | 3.53 | -26.67** | 24.06 | 10.89 | -69.74** |
| 16 | PB-66 x PB-67 | 33.88** | 31.20** | -38.35** | -15.69** | -19.38** | -55.97** | 22.91** | 17.02* | -8.33 | 38.04** | 25.69 | -58.23** |
| 17 | PB-66 x PB-71 | 12.98* | 3.33 | -53.38** | -3.91 | -13.13** | -41.30** | 2.46 | -11.86 | -13.33* | -24.73 | -27.46 | -78.66** |
| 18 | PB-66 x PS | -1.35 | -8.24 | -51.88** | 18.57** | -1.25 | -46.08** | 26.58** | 5.88 | -25.00** | -45.17** | -60.35** | -75.76** |
| 19 | PR x WB-1 | 42.01** | 36.43** | -64.10** | -24.63** | -38.91** | -38.91** | 7.00 | -13.33* | -13.33* | 57.55** | 36.88 | -70.58** |
| 20 | PR x PB-67 | 10.26 | -14.00* | -59.59** | -25.74** | -44.37** | -44.37** | 15.89** | 3.33 | 3.33 | 7.45 | -20.64 | -73.63** |
| 21 | PR x PB-71 | -14.45 | -27.14** | -72.74** | -12.02** | -26.28** | -26.28** | 9.24 | 8.33 | 8.33 | 14.48 | -11.92 | -74.09** |
| 22 | PR x PS | 11.22 | -16.49** | -56.20** | 1.63 | -30.72** | -30.72** | 4.97 | -22.50** | -22.50** | -5.74 | -40.65** | -63.72** |
| 23 | WB-1 x PB-67 | 28.76** | -2.40 | -54.14** | -1.22 | -10.99** | -44.71** | 6.89 | -4.26 | -25.00** | -11.98 | -27.52* | -75.91** |
| 24 | WB-1 x PB-71 | 37.20** | 13.07 | -57.71** | -5.79 | -9.60* | -38.91** | 6.03 | -13.56* | -15.00* | 33.23* | 15.28 | -66.08** |
| 25 | WB-1 x PS | 0.98 | -26.16** | -61.28** | 17.85** | -6.59 | -41.98** | 70.21** | 50.54** | -6.67 | -11.81 | -40.40** | -63.57** |
| 26 | PB-67 x PB-71 | -1.56 | -11.60 | -58.46** | -21.51** | -31.82** | -53.92** | -6.60 | -16.10** | -17.50** | 9.00 | 2.75 | -65.85** |
| 27 | PB-67 x PS | 10.40* | 4.66 | -45.11** | 4.55 | -9.59 | -54.95** | 19.05* | -4.26 | -25.00** | -28.59** | -44.89** | -66.31** |
| 28 | PB-71 x PS | -10.04 | -22.94** | -59.59** | 12.97** | -13.13** | -41.30** | -0.23 | -25.93** | -27.17** | 5.39 | -21.95** | -52.29** |
| | **S.E.D.** | **0.824** | **0.951** | **0.951** | **0.217** | **0.251** | **0.251** | **9.850** | **11.374** | **11.374** | **1.584** | **1.829** | **1.829** |
| | **C.D. 95%** | **1.690** | **1.951** | **1.951** | **0.445** | **0.514** | **0.514** | **20.210** | **23.337** | **23.337** | **3.250** | **3.752** | **3.752** |
| | **C.D. 99%** | **2.181** | **2.518** | **2.518** | **0.575** | **0.664** | **0.664** | **26.081** | **30.116** | **30.116** | **4.194** | **4.843** | **4.843** |
| | **CV (%)** | **8.236** | | | | **6.514** | | | **10.049** | | | **11.618** | |

*Significant at 0.05 probability
**Significant at 0.01 probability

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**Table 2: Cont……**

| S. No. | $F_1$ | Number of Infested Fruits/ Plant | | | Weight of Healthy Fruits/ Plant (kg) | | | Weight of Infested Fruits/ Plant (kg) | | | Yield/ Plant (kg) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent |
| 1 | *S. aethiopicum* x BARI | -21.33* | -42.36** | -42.36** | -74.90** | -86.14** | -88.19** | -75.52** | -86.00** | -89.18** | -75.06** | -86.11** | -87.82** |
| 2 | *S. aethiopicum* x PB-66 | 31.40** | -5.56 | -5.56 | -68.83** | -82.73** | -85.83** | -84.44** | -91.30** | -91.75** | -73.64** | -85.36** | -86.77** |
| 3 | *S. aethiopicum* x PR | 13.43 | -20.83** | -20.83** | -71.70** | -84.17** | -88.19** | -78.09** | -87.58** | -89.69** | -73.62** | -85.19** | -87.97** |
| 4 | *S. aethiopicum* x WB-1 | -4.00 | -33.33** | -33.33** | -78.47** | -87.94** | -91.14** | -74.94** | -85.51** | -89.69** | -77.49** | -87.28** | -90.23** |
| 5 | *S. aethiopicum* x PB-67 | -3.11 | -24.31** | -24.31** | -81.19** | -89.76** | -89.76** | -73.12** | -84.71** | -87.63** | -79.22** | -88.57** | -88.57** |
| 6 | *S. aethiopicum* x PB-71 | -19.82* | -36.81** | -36.81** | -80.86** | -89.46** | -90.79** | -80.60** | -88.72** | -92.27** | -80.80** | -89.29** | -90.71** |
| 7 | *S. aethiopicum* x PS | -14.04 | -31.94** | -31.94** | -79.42** | -88.56** | -90.94** | -85.16** | -91.75** | -91.75** | -81.29** | -89.60** | -90.68** |
| 8 | BARI x PB-66 | 41.54** | 37.31* | -36.11** | 94.59** | 90.99** | 62.80** | 59.28** | 44.57** | 37.11** | 84.63** | 81.86** | 64.36** |
| 9 | BARI x PR | 16.13 | 7.46 | -50.00** | 96.31** | 84.06** | 56.89** | 56.27** | 50.93** | 25.26* | 85.22** | 78.39** | 56.39** |
| 10 | BARI x WB-1 | 0.81 | -7.46 | -56.94** | 9.55 | 1.96 | -13.09* | 59.72** | 53.33** | 18.56 | 22.76** | 15.18* | 0.98 |
| 11 | BARI x PB-67 | -22.97 | -29.63* | -60.42** | 40.06** | 29.72** | 29.72** | 34.85** | 31.85* | 6.70 | 38.78** | 30.23** | 30.23** |
| 12 | BARI x PB-71 | -21.33 | -28.92* | -59.03** | 60.55** | 58.56** | 38.58** | 15.90 | 9.33 | -15.46 | 49.66** | 48.89** | 30.53** |
| 13 | BARI x PS | 31.13** | 17.86 | -31.25** | 58.32** | 52.66** | 30.12** | 65.70** | 46.91** | 46.91** | 60.47** | 58.72** | 42.26** |
| 14 | PB-66 x PR | -20.00 | -23.81 | -66.67** | -16.58** | -20.38** | -34.65** | -6.38 | -12.23 | -16.75 | -13.50* | -17.89** | -25.79** |
| 15 | PB-66 x WB-1 | 2.52 | -3.17 | -57.64** | 42.43** | 34.92** | 10.75* | 3.73 | -9.24 | -13.92 | 31.22** | 21.40** | 9.71 |
| 16 | PB-66 x PB-67 | -36.11** | -43.21** | -68.06** | 37.51** | 25.20** | 25.20** | 16.13 | 7.61 | 2.06 | 31.75** | 25.41** | 25.41** |
| 17 | PB-66 x PB-71 | -20.55 | -30.12* | -59.72** | -18.93** | -21.40** | -31.30** | 8.52 | -6.52 | -11.34 | -11.54* | -13.31* | -21.65** |
| 18 | PB-66 x PS | -23.81 | -33.33** | -61.11** | 20.05** | 17.89** | -3.23 | -15.34 | -17.53 | -17.53 | 8.87 | 8.42 | -2.02 |
| 19 | PR x WB-1 | -18.58 | -19.30 | -68.06** | 35.64** | 34.56** | 0.39 | -15.05 | -21.12 | -34.54** | 21.22** | 17.96** | -4.21 |
| 20 | PR x PB-67 | 0.00 | -14.81 | -52.08** | 10.26 | -3.74 | -3.74 | 41.51** | 39.75** | 15.98 | 18.51** | 7.37 | 7.37 |
| 21 | PR x PB-71 | -35.00** | -45.18** | -68.40** | 35.60** | 25.68** | 9.84 | -4.08 | -12.42 | -27.32* | 25.16** | 21.14** | 5.11 |
| 22 | PR x PS | -40.43** | -50.00** | -70.83** | 29.07** | 25.37** | -0.79 | -0.28 | -8.76 | -8.76 | 19.89** | 14.26* | 2.41 |
| 23 | WB-1 x PB-67 | -31.39* | -41.98** | -67.36** | -1.25 | -14.37** | -14.37** | 18.64 | 11.46 | -9.79 | 3.74 | -8.27 | -8.27 |
| 24 | WB-1 x PB-71 | -22.30 | -34.94** | -62.50** | -3.55 | -11.26 | -22.44** | 4.06 | 2.17 | -27.32* | -1.65 | -7.28 | -19.55** |
| 25 | WB-1 x PS | -11.43 | -26.19* | -56.94** | 28.00** | 23.38** | -2.36 | -25.90* | -36.60** | -36.60** | 11.83* | 3.86 | -6.92 |
| 26 | PB-67 x PB-71 | -12.20 | -13.25 | -50.00** | 6.93 | 0.20 | 0.20 | 52.41** | 40.76** | 13.92 | 17.55** | 9.77 | 9.77 |
| 27 | PB-67 x PS | -20.00 | -21.43 | -54.17** | 3.52 | -7.28 | -7.28 | -17.95 | -25.77* | -25.77* | -2.46 | -7.52 | -7.52 |
| 28 | PB-71 x PS | 10.18 | 9.52 | -36.11** | 66.90** | 59.01** | 38.98** | 39.45** | 17.53 | 17.53 | 59.25** | 56.71** | 40.45** |
| | **S.E.D.** | **0.575** | **0.664** | **0.664** | **0.074** | **0.086** | **0.086** | **0.061** | **0.071** | **0.071** | **0.104** | **0.120** | **0.120** |
| | **C.D. 95%** | **1.180** | **1.363** | **1.363** | **0.152** | **0.176** | **0.176** | **0.125** | **0.145** | **0.145** | **0.213** | **0.246** | **0.246** |
| | **C.D. 99%** | **1.523** | **1.759** | **1.759** | **0.196** | **0.227** | **0.227** | **0.162** | **0.187** | **0.187** | **0.275** | **0.318** | **0.318** |
| | **CV (%)** | **16.468** | | | **7.589** | | | **17.853** | | | **7.880** | | |

*Significant at 0.05 probability
**Significant at 0.01 probability

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**Table 3:** Mean values and percentage heterosis over mid parent (relative heterosis) better parent (heterobeltiosis), and standard or check parent (economic heterosis) for the year 2011-12.

| S. No. | $F_1$ | Fruit Length (cm) | | | Fruit Diameter (cm) | | | Average Fruit Weight (g) | | | Number of Healthy Fruits/ Plant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent |
| 1 | *S. aethiopicum* x BARI | -81.99** | -90.14** | -90.14** | -7.00 | -15.45** | -68.10** | -60.89** | -77.42** | -82.35** | 102.19** | 33.87** | 33.87** |
| 2 | *S. aethiopicum* x PB-66 | -54.71** | -72.82** | -87.14** | -36.51** | -50.62** | -72.56** | -60.56** | -76.98** | -83.36** | 54.53** | 0.81 | 0.81 |
| 3 | *S. aethiopicum* x PR | -26.49** | -50.18** | -86.71** | -61.73** | -74.96** | -74.96** | -72.80** | -84.70** | -85.21** | 52.42** | -9.68 | -9.68 |
| 4 | *S. aethiopicum* x WB-1 | -44.19** | -62.24** | -89.86** | -46.67** | -61.03** | -73.93** | -66.30** | -80.00** | -87.06** | 24.51** | -22.58** | -22.58** |
| 5 | *S. aethiopicum* x PB-67 | -64.96** | -78.97** | -90.05** | -42.62** | -54.55** | -75.99** | -64.62** | -79.57** | -84.03** | 33.86** | -8.87 | -8.87 |
| 6 | *S. aethiopicum* x PB-71 | -67.65** | -79.80** | -92.30** | -54.36** | -67.31** | -76.67** | -77.21** | -87.23** | -87.23** | 11.85 | -25.81** | -25.81** |
| 7 | *S. aethiopicum* x PS | -64.16** | -78.63** | -89.48** | -38.38** | -43.52** | -79.07** | -58.04** | -73.90** | -87.06** | 10.63 | -6.45 | -6.45 |
| 8 | BARI x PB-66 | -1.85 | -27.70** | -27.70** | -19.12** | -32.10** | -62.26** | -5.03 | -8.60 | -28.57** | 77.74** | 72.39** | -44.11** |
| 9 | BARI x PR | -19.50** | -49.01** | -49.01** | -3.36 | -33.45** | -33.45** | 51.92** | 37.39** | 32.77** | 33.63 | 4.98 | -65.97** |
| 10 | BARI x WB-1 | -18.28** | -48.17** | -48.17** | -27.21** | -43.08** | -61.92** | 21.18** | 10.75* | -13.45** | 21.87 | 6.72 | -65.40** |
| 11 | BARI x PB-67 | -14.34** | -36.90** | -36.90** | -16.67** | -28.57** | -62.26** | 4.30 | 4.30 | -18.49** | 1.85 | -3.41 | -65.08** |
| 12 | BARI x PB-71 | -17.34** | -42.91** | -42.91** | -31.45** | -47.60** | -62.61** | 12.26** | 0.00 | 0.00 | 13.51 | 13.09 | -63.06** |
| 13 | BARI x PS | -16.17** | -37.46** | -37.46** | 0.00 | -0.91 | -62.61** | 44.21** | 17.85** | -7.90* | -10.09 | -33.96** | -54.35** |
| 14 | PB-66 x PR | 15.23** | -9.92* | -57.37** | -14.44** | -33.45** | -33.45** | 30.35** | 13.91** | 10.08** | -40.73 | -52.36* | -85.48** |
| 15 | PB-66 x WB-1 | 39.75** | 9.52* | -48.17** | -17.65** | -24.62** | -49.57** | 10.43* | 4.65 | -24.37** | 33.57 | 20.17 | -63.39** |
| 16 | PB-66 x PB-67 | 24.60** | 24.60** | -41.03** | -16.46** | -18.52** | -54.72** | 20.67** | 16.13** | -9.24** | 33.40* | 22.91 | -55.56** |
| 17 | PB-66 x PB-71 | 5.49 | -4.76 | -54.93** | -13.51** | -23.08** | -45.11** | 1.46 | -12.61** | -12.61** | -38.61* | -40.67* | -80.62** |
| 18 | PB-66 x PS | 3.70 | 1.72 | -49.95** | 25.93** | 4.94 | -41.68** | 25.52** | 5.81 | -23.53** | -44.12** | -59.74** | -72.18** |
| 19 | PR x WB-1 | 35.79** | 35.31** | -63.66** | -32.17** | -43.40** | -43.40** | 9.38* | -8.70* | -11.76** | 56.51* | 37.75 | -66.45** |
| 20 | PR x PB-67 | 17.26** | -8.33 | -56.62** | -29.97** | -46.48** | -46.48** | 24.04** | 12.17** | 8.40* | 3.88 | -21.46 | -71.60** |
| 21 | PR x PB-71 | -7.83 | -21.67** | -70.14** | -5.51** | -19.04** | -19.04** | 14.53** | 12.61** | 12.61** | 53.55* | 20.30 | -60.71** |
| 22 | PR x PS | 16.83** | -9.92* | -55.68** | -2.88 | -33.45** | -33.45** | 11.49** | -15.65** | -18.49** | -41.62** | -62.99** | -74.42** |
| 23 | WB-1 x PB-67 | 30.13** | 1.98 | -51.74** | -15.76** | -24.62** | -49.57** | 8.24* | -1.08 | -22.69** | 16.49 | -2.52 | -64.76** |
| 24 | WB-1 x PB-71 | 24.86** | 6.40 | -59.44** | -36.48** | -38.46** | -56.09** | 6.12 | -12.61** | -12.61** | 39.75* | 21.98 | -60.16** |
| 25 | WB-1 x PS | -0.25 | -22.90** | -62.07** | -20.79** | -38.46** | -58.83** | 63.24** | 44.16** | -6.72 | -10.47 | -39.46** | -58.16** |
| 26 | PB-67 x PB-71 | -6.37 | -15.48** | -60.00** | -25.97** | -35.58** | -54.03** | -4.72 | -15.13** | -15.13** | -6.29 | -10.82 | -67.76** |
| 27 | PB-67 x PS | 5.84 | 3.82 | -48.92** | -6.87 | -20.78** | -58.15** | 22.37** | 0.00 | -21.85** | -29.09** | -46.00** | -62.68** |
| 28 | PB-71 x PS | 6.02 | -5.92 | -53.71** | 3.16 | -21.63** | -44.08** | -3.37 | -27.73** | -27.73** | 10.30 | -18.79* | -43.87** |
| | **S.E.D.** | 0.636 | 0.734 | 0.734 | 0.160 | 0.184 | 0.184 | 5.674 | 6.551 | 6.551 | 2.163 | 2.497 | 2.497 |
| | **C.D. 95%** | 1.305 | 1.507 | 1.507 | 0.327 | 0.378 | 0.378 | 11.641 | 13.442 | 13.442 | 4.438 | 5.124 | 5.124 |
| | **C.D. 99%** | 1.684 | 1.944 | 1.944 | 0.423 | 0.488 | 0.488 | 15.023 | 17.348 | 17.348 | 5.727 | 6.613 | 6.613 |
| | **CV (%)** | | **6.317** | | | **4.357** | | | **5.725** | | | **13.739** | |

*Significant at 0.05 probability

**Significant at 0.01 probability

**Table 3:** Cont……

| S. No. | $F_1$ | Number of Infested Fruits/ Plant | | | Weight of Healthy Fruits/ Plant (kg) | | | Weight of Infested Fruits/ Plant (kg) | | | Yield/ Plant (kg) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent | Over Mid parent | Over Better parent | Over Standard parent |
| 1 | *S. aethiopicum* x BARI | -29.52* | -49.06** | -49.06** | -77.03** | -87.50** | -88.82** | -71.12** | -83.65** | -89.57** | -75.70** | -86.66** | -88.84** |
| 2 | *S. aethiopicum* x PB-66 | 34.56** | -10.06 | -10.06 | -73.81** | -85.73** | -87.40** | -77.79** | -87.42** | -92.02** | -74.71** | -86.10** | -88.51** |
| 3 | *S. aethiopicum* x PR | 15.21 | -27.36** | -27.36** | -77.49** | -87.59** | -90.42** | -79.16** | -88.34** | -91.70** | -77.93** | -87.79** | -90.62** |
| 4 | *S. aethiopicum* x WB-1 | -10.67 | -38.36** | -38.36** | -78.64* | -88.03** | -92.19** | -78.54** | -87.94** | -91.80** | -78.61** | -88.00** | -91.94** |
| 5 | *S. aethiopicum* x PB-67 | -13.78* | -30.82** | -30.82** | -84.87** | -91.82** | -92.01** | -81.10** | -89.76** | -89.76** | -83.79** | -91.23** | -91.23** |
| 6 | *S. aethiopicum* x PB-71 | -14.03 | -40.25** | -40.25** | -83.96** | -91.29** | -92.01** | -72.24** | -84.23** | -90.21** | -81.41** | -89.81** | -91.36** |
| 7 | *S. aethiopicum* x PS | -26.78** | -36.79** | -36.79** | -84.87** | -91.84** | -91.84** | -78.35** | -87.73** | -92.25** | -83.52** | -91.02** | -91.81** |
| 8 | BARI x PB-66 | 59.16** | 39.73** | -37.74** | 79.99** | 78.87** | 59.98** | 99.00** | 98.44** | 26.56** | 84.20** | 83.19** | 53.20** |
| 9 | BARI x PR | -9.21 | -28.02* | -67.92** | 72.89** | 61.09** | 44.08** | 64.33** | 55.80** | 10.88 | 70.83** | 63.87** | 37.05** |
| 10 | BARI x WB-1 | 22.67 | 13.62 | -49.37** | 16.12 | 0.40 | -10.20 | 10.73 | 7.26 | -27.02** | 14.77 | 3.46 | -13.48 |
| 11 | BARI x PB-67 | -20.96* | -31.36** | -58.49** | 20.97 | 15.88 | 13.17 | -22.94** | -36.90** | -36.90** | 9.76 | 0.78 | 0.78 |
| 12 | BARI x PB-71 | -2.90 | -8.96 | -59.43** | 46.79** | 45.01** | 32.92* | 29.92** | 28.22** | -18.22** | 43.18** | 42.22** | 20.56* |
| 13 | BARI x PS | -29.17** | -42.86** | -58.49** | 30.12* | 23.25 | 23.25 | 47.45** | 46.77** | -6.39 | 33.72** | 28.18* | 16.88 |
| 14 | PB-66 x PR | -28.46 | -36.51* | -78.62** | -22.44 | -27.31 | -35.79** | -44.29** | -47.32** | -62.51** | -27.71* | -30.29* | -42.34** |
| 15 | PB-66 x WB-1 | 1.80 | -3.97 | -63.52** | 34.84* | 17.20 | 3.51 | 47.17** | 42.17** | -3.26 | 37.93** | 24.95* | 3.35 |
| 16 | PB-66 x PB-67 | -10.49 | -30.32** | -57.86** | 15.84 | 10.30 | 7.72 | 1.53 | -17.04** | -17.04** | 12.18 | 2.48 | 2.48 |
| 17 | PB-66 x PB-71 | 7.83 | 0.48 | -60.82** | -15.42 | -16.96 | -23.89 | 21.34* | 20.09* | -23.84** | -7.54 | -8.66 | -22.57* |
| 18 | PB-66 x PS | -44.99** | -59.74** | -70.75** | -13.31 | -18.37 | -18.37 | 17.08* | 16.87 | -25.88** | -6.98 | -11.30 | -19.12 |
| 19 | PR x WB-1 | 9.91 | -7.28 | -64.78** | 25.45 | 15.69 | -10.65 | -1.01 | -3.18 | -31.10** | 18.13 | 10.69 | -14.97 |
| 20 | PR x PB-67 | -13.11 | -37.81** | -62.39** | 7.44 | -3.80 | -6.05 | -11.44 | -24.21** | -24.21** | 2.21 | -9.64 | -9.64 |
| 21 | PR x PB-71 | -11.98 | -26.53 | -71.35** | 22.50 | 12.86 | 3.44 | 1.97 | -4.52 | -32.05** | 17.65 | 12.13 | -4.94 |
| 22 | PR x PS | -43.06** | -61.30** | -71.89** | 0.79 | -10.68 | -10.68 | 7.42 | 1.40 | -27.83** | 2.31 | -5.75 | -14.06 |
| 23 | WB-1 x PB-67 | -16.77 | -32.24** | -59.03** | 2.96 | -14.14 | -16.15 | -11.14 | -25.34** | -25.34** | -1.09 | -17.34 | -17.34 |
| 24 | WB-1 x PB-71 | -19.04 | -20.08 | -68.84** | 14.57 | -1.96 | -10.13 | 22.68** | 17.32 | -20.17** | 16.56 | 4.44 | -11.47 |
| 25 | WB-1 x PS | -19.90* | -39.00** | -55.69** | 21.40 | 0.28 | 0.28 | 5.28 | 1.53 | -30.92** | 17.57 | 2.08 | -6.93 |
| 26 | PB-67 x PB-71 | -0.22 | -17.94 | -50.38** | -1.93 | -4.94 | -7.17 | 25.00** | 1.31 | 1.31 | 4.83 | -3.15 | -3.15 |
| 27 | PB-67 x PS | -47.60** | -51.99** | -65.13** | -9.16 | -10.22 | -10.22 | -20.56** | -35.18** | -35.18** | -11.94 | -15.83 | -15.83 |
| 28 | PB-71 x PS | 20.11* | -7.71 | -32.96** | 42.07** | 36.15** | 36.15** | 70.33** | 68.87** | 6.71 | 47.83** | 42.64** | 30.06** |
| | S.E.D. | 0.543 | 0.627 | 0.627 | 0.207 | 0.239 | 0.239 | 0.038 | 0.044 | 0.044 | 0.217 | 0.250 | 0.250 |
| | C.D. 95% | 1.114 | 1.286 | 1.286 | 0.426 | 0.491 | 0.491 | 0.078 | 0.090 | 0.090 | 0.445 | 0.513 | 0.513 |
| | C.D. 99% | 1.437 | 1.660 | 1.660 | 0.549 | 0.634 | 0.634 | 0.101 | 0.117 | 0.117 | 0.574 | 0.662 | 0.662 |
| | CV (%) | | 15.189 | | | 18.75 | | | 11.689 | | | 15.002 | |

*Significant at 0.05 probability
**Significant at 0.01 probability

**Table 4:** Summary table showing promising heterotic crosses with respect to each character in desired direction**.**

| S. No. | Characters | Promising crosses |
|---|---|---|
| 1 | Fruit length (cm) | PR x WB-1, PB-66 x PB-67, PB-66 x WB-1 |
| 2 | Fruit diameter (cm) | PB-66 x PS, BARI x PS |
| 3 | Average fruit weight (g) | BARI x PR, BARI x PS, WB-1 x PS |
| 4 | Number of healthy fruits per plant | *S. aethiopicum* x BARI, BARI x PB-66 |
| 5 | Number of infested fruits per plant | *S. aethiopicum* x BARI, BARI x PS, BARI x PR |
| 6 | Weight of healthy fruits per plant (kg) | BARI x PB-66, BARI x PR, PB-71 x PS |
| 7 | Weight of infested fruits per plant (kg) | PB-67 x PS, PB-66 x PR, BARI x PB-67 |
| 8 | Total yield per plant (kg) | BARI x PB-66, BARI x PR, PB-71 x PS |