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Estimation of heterosis for yield, yield attributes and quality parameters in brinjal (*Solanum melongena* L.)

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Abstract
An investigation on three kinds of heterosis was taken up in twenty one single crosses along with ten parents and two standard checks (Arka Anand and Mahy Hari) at PG Students research farm, College of Horticulture, Rajendranagar, Hyderabad. Studies revealed that appreciable amount of heterobeltiosis and standard heterosis in desirable direction were recorded in a good number of crosses for majority of yield and yield contributing characters. The hybrids, RCBG-1 x Bhagyamathi for eleven characters *viz*., number of branches per plant, number of flower clusters per plant, number of fruits per plant, number of marketable fruits per plant, average fruit weight(g), fruit yield per plant(kg), marketable yield per plant(kg), total yield per hectare(tons), total marketable yield per hectare(tons), ascorbic acid content(mg/100g) and total phenols content(mg/100g), RCBG-4 x Shyamala for number of flower clusters per plant, days to first flowering, days to 50% flowering, days to first harvest, number of marketable fruits per plant, average fruit weight(g), fruit yield per plant(kg), marketable yield per plant(kg), total yield per hectare(tons), total marketable yield per hectare(tons), and total phenols content(mg/100g), RCBG-2 x Bhagyamathi, RCBG-7 x Shyamala, RCBG-1 x Shyamala each for nine different yield and its contributing characters, were found superior and recorded significant standard heterosis and heterobeltiosis. The identified hybrids may be further tested over locations, seasons and years for commercial release for commercial cultivation.

Keywords: Estimation, heterosis, parameters, brinjal, *Solanum melongena* L.

Introduction
Egg plant or Brinjal (*Solanum melongena* L., 2n = 2x = 24) belonging to the family Solanaceae, is one of the most commonly grown, important and popular vegetable crops in India. It is often referred as poor man's crop (Sharma *et al*., 2004) [47], vegetable of masses (Patel and Sarnaik, 2003) [30] and king of vegetables. The cultivated brinjal is of Indian origin. The region across India and Indo-china is considered the centre of diversity for brinjal (Vavilov, 1951) [58].

India is major producer of brinjal in the world. In India, eggplant occupies an area of 0.73 million hectares with an annual production of 12.515 million tonnes and productivity stands at 18.9 MT/ha. The major brinjal growing states are West Benghal, Odisha, Gujarat, Madhya Pradesh, Bihar, Chhattisgarh, Andhra Pradesh, Maharashta, Karnataka and Telangana. In Telangana, it is grown over an area of 20,176 acres with a production of 2, 36,878 tonnes and productivity is 19.46 MT/ha (Dept. of Horticulture, Telangana, 2019-20). The unripe fruits of brinjal contain carbohydrate, protein, ascorbic acid, Ca, Mg, Fe, P, vitamin B_6, niacin, pantothenic acid, vitamin A and vitamin K. It is very low in calories and fats but rich in soluble fiber content. The peel has significant amounts of phenolic flavonoid phyto-chemicals called anthocyanins. They are also known to have alkaloid solanin in roots and leaves. Copper content, aminoacid content and polyphenol oxidase activity were highest in purple brinjal Where as Fe, potassium and chloride content were highest in green cultivars.

Brinjal is grown for its immature, tender and unripe fruits which are used in variety of ways as cooked vegetable in curries. It has got much potential as raw material in pickle making and dehydration industries (Singh *et al*., 1963) [53]. The fruit is employed as cure for toothache. It has also been employed as excellent remedy for those suffering from liver complaints.

Fruit is used as cardiotonic, laxative muturant and reliever of inflammation. White brinjals are good for diabetic patients (Singh *et al*., 1963) [53]. Other medicinal uses of brinjal include treatment of diabetes, asthma, cholera, bronchitis and dyspepsia. Fruits and leaves are administered to lower blood cholesterol levels.

The term Heterosis was coined by Shull (1914) [50]. Heterosis or average heterosis is measured as mean superiority of F_1 over the mid parent value, that is the average value of both the parents. The term Heterobeltiosis was proposed later to denote the expression of heterosis over better parent (Bitzer *et al*., 1968; Fonesca and Patterson, 1968) [7, 7]. Since the better parent may fall on either of the extreme sides, heterobeltiosis may manifest in any of the two directions positive or negative. In some causes the superior parent may be inferior to the best commercial variety or hybrid. In such cases it is desirable to estimate heterosis in relation to the commercial variety. The superiority of F_1 over the standard commercial check is called as useful / standard / economic heterosis. The expression of heterosis may be due to factors such as heterozygosity, allelic interaction such as dominance or over dominance, non allelic interaction or epistasis and maternal interactions. The degree of expression of heterosis depends upon the number of genes in heterozygous condition. The higher the number of heterozygous alleles, the more is the heterosis expected (East and Hayes, 1912) [14]. Heterosis breeding is the most successful approach amongst various technological options available for the improvement in crop productivity (Saidaiah *et al*., 2008, 2012, Raghu *et al*., 2012) [43, 44, 36]. The phenomenon has extensively been exploited in cross pollinated as well as self pollinated crops.

In Brinjal, the earliest recorded instances of artificial hybridization were evidently carried out by Bailey and Munson in the United States in 1889, however, none of the hybrids exhibited heterosis but were intermediate between the parents (Bailey and Munson, 1892) [3]. Rao (1934) [40] made the first report on hybridization of brinjal varieties in India and stated that the cross between two wide varieties, a high degree of partial sterility due to abortive pollen was observed. Venkataramani (1946) [59] reported that the early parent and yielded more than either parent. In the same year, Pal and Singh (1946) [28] reported that hybrid egg plants were taller, spread more and flowered earlier than the early parent had yielded more than either parent. In the same year, Pal and Singh reported that majority of the hybrids exhibited heterosis with respect to seed germination, plant height, plant spread, number of branches, early flowering, number of fruits per plant, fruit size and fruit yield. Heterosis breeding has become the widely used breeding method could enhance its quality and productivity without sacrificing the consumer's choice. Exploitation of hybrid vigour in brinjal is commercially possible (Bavage *et al*., 2005; Prabhu *et al*., 2005; Dharwad *et al*., 2011) [4, 32, 13] and in other crops (Saidaiah *et al*., 2008, 2012, Raghu *et al*., 2012) [43, 44, 36] due to manifestation of high heterosis and other important characters, ease of handling the flowers during artificial emasculation and pollination, and realization of high number of hybrid seed per effective pollination. The estimation of heterosis for yield and its component characters would therefore, useful to judge the best hybrid combination for exploitation of superior hybrids (Raghu *et al*., 2012) [36]. Keeping in view of the above discussed aspects, the present investigation was carried out with an objective of studying the heterosis of hybrids in field conditions.

Material and Methods

The seven genotypes *viz*., RCBG-1, RCBG-2, RCBG-3, RCBG-4, RCBG-5, RCBG-6 and RCBG-7 having high genetic divergence and desirable characters were selected as lines and three improved locally popular varieties *viz*., Bhagyamathi, Gulabi and Shyamala were selected as testers and were crossed in line x tester mating fashion during *rabi*, 2016. The resultant twenty one single crosses along with ten parents and two standard checks (Arka Anand and Mahy Hari) were evaluated in RBD following Panse and Sukatme, 1957 ANOVA for twenty yield and yield contributing traits at PG students research farm, College of Horticulture, Rajendranagar, Hyderabad in order to obtained information on the mean performance. Seeds of ten patents, twenty one hybrids and two commercial checks were sown on 25th January, 2017 in plug trays and thirty two days old seedlings were transplanted in the main field. In each replication each genotype was grown in a plot of 1.8 x 3.5 m2 consisting of three rows, accommodating 7 plants in each row. Row-to-row spacing of 60 cm and plant-to-plant spacing of 50 cm was maintained. The recommended package of practices was followed to raise a successful crop and necessary prophylactic plant protection measures were carried out to safeguard the crop from pests and diseases. Heterosis is measured as mean superiority of F_1 s over their mid parent or better parent or the best commercial variety and thus, it is rated to be an important parameter in such studies. In the present investigation, all the three types of heterosis *viz*., relative heterosis, heterobeltiosis and standard heterosis (over Arka Anand/Mahy Hari) was estimated for twenty characters.

Results and Discussion

The analysis of variance of experimental material comprising 21 hybrids, 10 parents and 2 checks (Arka Anand and Mahy Hari) for twenty yield and yield contributing traits *revealed that* the replication mean sum of squares due to parents and hybrids were non significant for all the characters studied, which means there is no environmental error in controlling these characters. The treatment mean sum of squares due to parents and hybrids for all the characters under study were highly significant, indicating the presence of significant variation among the characters studied. The positive heterotic values are desirable for all the above characters except days to first flowering, days to 50% flowering and days to first harvest where negative heterosis indicates the earliness (Raghu *et al*., 2012) [36].

High fruit yield in plants is manifested through enhancement in the vegetative characters like plant height and number of branches per plant hence positive heterosis was desirable for this trait. An average heterosis of -12.89 (RCBG-3 x Bhagyamathi) to 24.77 (RCBG-6 x Gulabi) and heterobeltiosis of -16.07 (RCBG-3 x Bhagyamathi) to 20.20 (RCBG-7 x Bhagyamathi) was registered for plant height. Out of 21 hybrids, fifteen and thirteen hybrids exhibited significant positive heterosis and heterobeltiosis respectively (Table 1). Heterosis range of -22.16 (RCBG-3 x Bhagyamathi) to 11.07 (RCBG-4 x Bhagyamathi) over Arka Anand and -14.56 (RCBG-3 x Bhagyamathi) to 21.92(RCBG-7 x Bhagyamathi) over Mahy Hari was expressed for this trait. Significant positive standard heterosis was displayed by three hybrids *viz*., RCBG-4 x Bhagyamathi (11.07), RCBG-3 x Gulabi (10.76) and RCBG-7 x Gulabi (9.84) over Arka Anand and ten hybrids over Mahy Hari. These results are in close conformation with the findings of Prabhu *et al*. (2005) [32], Ajjappalavara and Dharmatti (2006) [1], Das *et al*. (2009)

[11], Sao and Mehta (2011) [45], Naresh *et al*. (2016) [26], Palli *et al*. (2016) [29], Patidar *et al*. (2017) [31], Pramila *et al.* (2017) [33] and Kumar *et al*. (2017) [20].

Number of branches per plant determines the fruit bearing surface and hence was considered as growth attribute. More number of branches per plant on the main stem, higher is the number of fruits per plant. Hence, positive heterosis is desirable for this character. The results are presented in Table 1. For number of branches per plant, heterosis range of -15.00 in RCBG-5 x Shyamala to 53.65 in RCBG-4 x Bhagyamathi over midparent and -18.19 in RCBG-5 x Shyamala to 50.55 in RCBG-4 x Bhagyamathi over better parent, with seven and six number of hybrids showing positive significant heterosis and heterobeltiosis respectively was observed. RCBG-4 x Bhagyamathi (50.69), RCBG-2 x Gulabi (43.69), RCBG-1 x Bhagyamathi (32.52), RCBG-6 x Gulabi (30.22) and RCBG-7 x Shyamala (27.80) were the five cross combinations which manifested significant positive standard heterosis over the check Mahy Hari and the range was varying from -23.60 (RCBG-5 x Shyamala) to 50.69(RCBG-4 x Bhagyamathi). Similar trends of results are also reported by Bavage (2002) [5], Singh *et al*. (2004) [51], Prabhu *et al.* (2005) [32], Gururaj *et al*. (2016) [17], Gharge *et al*. (2016) [16] and Pramila *et al.* (2017) [33].

The observed range of relative heterosis and heterobeltiosis for number of flower clusters per plant was -2.19 (RCBG-3 x Bhagyamathi) to 12.89 (RCBG-2 x Gulabi) and -6.52(RCBG-6 x Bhagyamathi) to 10.48 (RCBG-2 x Gulabi) respectively. Twelve hybrids exhibited positive significant heterosis over midparent and eight hybrids over their respective better parent. As many as fifteen and twelve hybrids registered significant standard heterosis over Arka anand and Mahy Hari respectively. Heterosis range over Mahy Hari was varied between -1.99(RCBG-5 x Gulabi) to 17.98(RCBG-2 x Bhagyamathi). Sharma (2010) [49] also reported similar results (Table 2).

With respect to number of flowers per cluster, seven and three were the number of hybrids recorded significant midparental heterosis and heterobeltiosis respectively. The extent of average heterosis was ranged from -23.63(RCBG-7 x Gulabi) to 79.77(RCBG-1 x Shyamala) and heterobeltiosis was varied from -42.56(RCBG-7 x Gulabi) to 54.70(RCBG-1 x Shyamala) for number of flowers per cluster. Among 21 hybrids, only one hybrid, RCBG-4 x Gulabi expressed significant positive heterosis over standard check Mahy Hari and it was ranged from -55.61 in RCBG-7 x Shyamala to 27.70 in RCBG-4 x Gulabi. Three hybrids shown significant positive heterosis over Arka Anand. These findings are in agreement with those of Singh and Maurya (2005) [52], Ajjappalavara and Dharmatti (2006) [1], Shafeeq *et al*. (2007) [46], Joshi *et al*. (2008) [18] and Ramireddy *et al*. (2011) [38].

The results obtained in the present study pertaining to days to first flowering are given in Table 3, which revealed that a midparental heterosis range varying from -12.55(RCBG-4 x Gulabi) to 15.55(RCBG-2 x Shyamala) with eight hybrids exhibiting significant negative heterosis(desired) was observed for this character. As many as fourteen hybrids recorded significant negative and superior heterosis over their respective better parent, with a range of -17.95(RCBG-4 x Shyamala) to 8.57(RCBG-2 x Shyamala).When compared to Arka Anand, 7 hybrids showed significant negative heterosis and it was ranged between -15.04 in RCBG-4 x Shyamala to 3.54 in RCBG-6 x Bhagyamathi and RCBG-6 x Gulabi. The above results are in accordance with the earlier findings of Das and Barua (2001) [10], Aswani and Khandelwal (2003) [2], Kumar and Pathania (2004) [22], Sao and Mehta (2011) [45] and Sharma *et al.* (2016) [48].

Negative heterosis over mid parent, better parent and standard check is desirable for days to 50% flowering (Saidaiah *et al*., 2008, 2012, Raghu *et al.*, 2012) [43, 44, 36]. Hybrids exhibited, relative heterosis having a range of -14.07 in RCBG-4 x Bhagyamathi to -0.39 in RCBG-5 x Gulabi for days to 50% flowering. None of the hybrids shown positive significant heterosis over both mid parent and better parent. Negative significant heterosis and heterobeltiosis was displayed by as many as fifteen and eighteen number of hybrids respectively. For this trait, heterosis over better parent was varied between -20.00(RCBG-5 x Bhagyamathi) to -2.86 (RCBG-3 x Gulabi). The earliness attribute is one of the prime criterions in any crop improvement programme. The present study also brought out certain hybrids with significant earliness in days to first flowering. The four cross combinarions *viz*., RCBG-5 x Shyamala (-8.20), RCBG-5 x Bhagyamathi (-8.20), RCBG-4 x Shyamala (-7.38), RCBG-1 x Shyamala (-7.38) were exhibited desired significant negative heterosis over the early flowering check Arka Anand (Table 3). Concurrent results are also reported by Bulgundi (2000) [8], Kumar and Pathania (2004) [22], Ajjappalavara and Dharmatti (2006) [1], Das *et al*. (2009) [11], Chowdhary *et al*. (2010) [9], Ramireddy *et al*. (2011) [38], Biswas *et al*. (2013) [6], Sharma *et al*. (2016) [48], Kumar *et al*. (2017) [20] and Patidar *et al*. (2017) [31].

Days to first fruit harvest is a measure of earliness, as early picking gives better returns and also widen the fruiting period of the plant. Hence, heterosis in negative direction is desirable for this trait. The results of three kinds of heterosis for days to first harvest are given in Table 4. With respect to this character, five hybrids recorded significant desired negative heterosis with a range of -6.63(RCBG-4 x Gulabi) to 9.33(RCBG-2 x Shyamala) and heterobeltiosis was ranged from -13.83 in RCBG-7 x Shyamala to 4.46 in RCBG-2 x Shyamala with fifteen hybrids exhibiting earliness in harvest than their respective better parent. The magnitude of heterosis over standard check Arka Anand was varied from -11.45 to 4.22 and seven hybrids registered negative significant standard heterosis for days to first harvest. Similar results are also observed in the earlier studies conducted by Ashwani and khandelwal (2003) [2], Chowdhary *et al*. (2010) [9], Makani *et al*. (2013), Biswas *et al.* (2013) [6], Sharma *et al*. (2016) [48], Palli *et al*. (2016) [29], Triveni *et al*., 2017 [57] and Patidar *et al*. (2017) [31].

In case of days to last harvest, the range of average heterosis and heterobeltiosis among hybrids was -4.88(RCBG-5 x Gulabi) to 5.26(RCBG-2 x Shyamala) and -8.53(RCBG-5 x Gulabi) to 2.25(RCBG-4 x Bhagyamathi) respectively. Six hybrids were positively heterotic over midparent, while none of the hybrid shown significant positive heterosis over better parent (Table 4). Only two hybrids, RCBG-6 x Bhagyamathi (3.97) and RCBG-6 x Gulabi(3.75) manifested significant positive heterosis over best check Mahy Hari. The range of standard heterosis over Mahy Hari was -8.17 in RCBG-3 x Gulabi to 3.97 in RCBG-6 x Bhagyamathi.

Number of fruits per cluster is an important character for increasing the yielding ability in brinjal. More number of fruits per cluster means more number of long and medium styled flowers leads to more number of fruits per plant. Thus, positive heterosis was desirable for this trait and the results pertaining to this are presented in Table 5. Heterosis range varying from -42.59 in RCBG-5 x Gulabi to 75.75 in RCBG-1 x Shyamala was reported for number of fruits per cluster. For this character, heterobeltiosis was varied from -60.13(RCBG-

5 x Gulabi) to 42.89(RCBG-1 x Shyamala). Significant positive heterosis was displayed by four hybrids over mid parent and by only one hybrid RCBG-1 x Shyamala over respective better parent. Anologues kind of results are also reported by Singh and Maurya (2005) [52], Shafeeq *et al*. (2007) [46], Joshi *et al*. (2008) [18] and Palli *et al*. (2016) [29]. Out of 21 hybrids, only one hybrid registered significant positive heterosis over the check Mahy Hari and three hybrids shown significant and positive heterosis over second best check Arka Anad. The economic heterosis over Mahy Hari and Arka Anand was varied from -56.08(RCBG-7 x Shyamala) to 19.73(RCBG-4 x Bhagyamathi) and -50.35(RCBG-7 x Shyamala) to 35.34(RCBG-4 x Bhagyamathi) respectively. These results are in conformity with earlier reports of Singh and Maurya (2005) [52] and Magar *et al*. (2016) [23].

Number of fruits per plant is of great significance for the improvement of fruit yield in brinjal. Hybrids were in the range of -16.58 in RCBG-5 x Gulabi to 40.49 in RCBG-1 x Bhagyamathi for relative heterosis and -19.77 RCBG-5 x Gulabi in to 29.55 RCBG-1 x Bhagyamathi for heterobeltiosis. As many as fifteen and ten number of hybrids were positively and significantly heterotic over mid parent and better parent respectively. The above results are in consonance with the findings of Prabhu *et al*. (2005) [32], Joshi *et al*. (2008) [18], Ramireddy *et al.* (2011) [38] and Magar *et al*. (2016) [23] for average heterosis and Timmapur *et al*. (2008), Sharma (2010) [49] and Palli *et al*. (2016) [29] for heterobeltiosis. A standard heterosis range of -28.95 to 18.14 with three hybrids *viz*., RCBG-1 x Bhagyamathi (18.14), RCBG-4 x Bhagyamathi (17.87) and RCBG-2 x Bhagyamathi(13.56) showing significantly positive heterosis was reported for number of fruits per plant. Eight hybrids registered positive significant heterosis over next best check Arka Anand (Table 5). Similar trends of results are noticed by Sharma (2010) [49], Nalini *et al.* (2011), Ramireddy *et al.* (2011) [38], Dharwad *et al.* (2011) [13], Kumar *et al*. (2013) [21] and Triveni *et al*., 2017 [57].

For number of marketable fruits per plant, heterosis range of -9.69 (RCBG-5 x Gulabi) to 55.45 (RCBG-1 x Bhagyamathi) over midparent and -18.95 in RCBG-5 x Gulabi to 36.38 in RCBG-1 x Bhagyamathi over better parent, with as many as sixteen and eleven number of hybrids showing positive significant heterosis and heterobeltiosis respectively was observed (Table 6). RCBG-1 x Bhagyamathi (24.01) and RCBG-4 x Shyamala (15.48) were the only two cross combinations which manifested significant positive standard heterosis over the check Mahy Hari and the range was varying from -31.34 (RCBG-5 x Gulabi) to 24.01(RCBG-1 x Bhagyamathi). The present findings are in agreement with earlier findings of Bavage *et al*. (2002) [5], Kumar and Pathania (2004) [22], Joshi *et al*. (2008) [18], Sharma (2010) [49] Pachiyappan *et al*. (2012), Triveni *et al*., 2017 [57] and Pramila *et al.* (2017) [33].

Fruit length is a growth attribute directly associated with yield, for which positive heterosis is desirable and the results obtained in the present study are given in Table 6. An average heterosis of -22.41 (RCBG-7 x Gulabi) to 7.25 (RCBG-6 x Bhagyamathi) and heterobeltiosis of -33.48 (RCBG-6 x Gulabi) to 7.18 (RCBG-6 x Bhagyamathi) was reported for fruit length. Out of 21 hybrids, none of the hybrid expressed significant positive heterosis and heterobeltiosis. Heterosis range of -53.25(RCBG-5 x Shyamala) to -20.61 (RCBG-1 x Gulabi) over Arka Anand and -18.36 (RCBG-5 x Shyamala) to 38.61(RCBG-1 x Gulabi) over Mahy Hari was recorded for this trait. Significant positive standard heterosis was displayed by no hybrid over best check Arka Anand and by three hybrids *viz*., RCBG-1 x Gulabi, RCBG-3 x Gulabi and RCBG-4 x Gulabi over second best check Mahy Hari for fruit length, Timmapur *et al*. (2008), Das *et al*. (2009) [11], Makani *et al*. (2013), Biswas *et al.* (2013) [6], Magar *et al.* (2016) [23] and Gharge *et al*. (2016) [16] are also reported similar kind of results.

For fruit width (cm), a midparental heterosis range varying from -17.76(RCBG-1 x Shyamala) to 13.43(RCBG-2 x Bhagyamathi) with only one hybrid exhibiting significant positive heterosis. None of the hybrid recorded significant positive and superior heterosis over better parent and range was varied from -26.65(RCBG-6 x Gulabi) to 11.92(RCBG-2 x Bhagyamathi) (Table 7). When compared to Arka Anand, 16 hybrids showed significant positive heterosis and it was ranged between 3.89 in RCBG-5 x Gulabi to 40.48 in RCBG-6 x Shyamala. No hybrid was heterotic in performance over check Mahy Hari. The above findings are in close conformation with the earlier findings of Prathibha *et al*. (2004), Singh and Maurya (2005) [52], Suneetha and Kathiria (2005), Ajjappalavara and Dharmatti (2006) [1], Joshi *et al*. (2008) [18], Chowdhury *et al*. (2010) [9] and Pachiyappan *et al*. (2012).

Average fruit weight directly affects the total fruit yield, so this character is very important so far fruit yield is concerned. The results obtained in the present investigation for this character are presented in Table 7. Twelve and nine were the number of hybrids recorded significant midparental heterosis and heterobeltiosis respectively. Average heterosis was ranged from -15.18(RCBG-6 x Bhagyamathi) to 26.67(RCBG-7 x Shyamala) and heterobeltiosis was varied from -22.63(RCBG-6 x Bhagyamathi) to 25.95 (RCBG-7 x Shyamala) for average fruit weight. Singh *et al.* (2004) [51], Suneetha and kathiria (2005), Nalini *et al*. (2011), Ramireddy *et al*. (2011) [38], Biswas *et al.* (2013) [6], Sharma *et al*. (2016) [48] and Palli *et al*. (2016) [29] are also reported similar trends of results. Among 21 hybrids, eight hybrids expressed significant and positive heterosis over standard check Mahy Hari and it was ranged from -8.93 in RCBG-6 x Bhagyamathi to 23.51 in RCBG-1 x Bhagyamathi. Nine hybrids shown significant positive heterosis over second best check Arka Anand. These findings are in accordance with the earlier reports of Nalini *et al*. (2011), Reddy and Patel (2014), Gharge *et al*. (2016) [16], Triveni *et al*., 2017 [57] and Kumar *et al*. (2017) [20].

With respect to fruit yield per plant (kg), hybrids were in the range of -22.08 in RCBG-7 x Bhagyamathi to 91.87 in RCBG-7 x Shyamala for average heterosis and -28.74 in RCBG-7 x Bhagyamathi to 87.82 in RCBG-7 x Shyamala for heterobeltiosis. As many as sixteen and thirteen number of hybrids was positively and significantly heterotic over mid parent and better parent respectively. An economic heterosis range of -40.81 to 39.84 with six hybrids *viz.*, RCBG-2 x Bhagyamathi(39.84), RCBG-4 x Shyamala(36.94), RCBG-1 x Bhagyamathi(30.97), RCBG-7 x Shyamala(29.35), RCBG-1 x Shyamala(25.32) and RCBG-3 x Bhagyamathi(22.10) showing significantly positive heterosis was reported for number of fruits per plant. Eight hybrids, RCBG-2 x Bhagyamathi (54.82), RCBG-4 x Shyamala (51.61), RCBG-1 x Bhagyamathi (45.00), RCBG-7 x Shyamala (43.21), RCBG-1 x Shyamala (38.75), RCBG-3 x Bhagyamathi (35.18), RCBG-6 x Shyamala (30.89) and RCBG-2 x Gulabi (31.79) registered positive significant heterosis over next best check Arka Anand (Table 8). These results are in close conformity

with the earlier findings of Shafeeq *et al.* (2007) [46], Sharma *et al.* (2010) [49], Sao and Mehta (2011) [45], Pachiyappan *et al.* (2012), Makani *et al.* (2013), Biswas *et al.* (2013) [6], Gharge *et al.* (2016) [16], Gururaj *et al.* (2016) [17], Palli *et al.* (2016) [29], Pramila *et al.* (2017) [33] and Rani *et al.* (2018).

The wide range of relative heterosis and heterobeltiosis for marketable fruit yield per plant -20.60(RCBG-7 x Bhagyamathi) to 141.93(RCBG-7 x Shyamala) and -28.51(RCBG-7 x Bhagyamathi) to 105.71 (RCBG-7 x Shyamala) was observed respectively. As many as sixteen hybrids exhibited positive significant heterosis over midparent and also over respective better parent. From the Table 8, it was observed that among 21 hybrids, ten hybrids *viz*., RCBG-4 x Shyamala (58.72), RCBG-2 x Bhagyamathi (54.83), RCBG-1 x Bhagyamathi (53.06), RCBG-7 x Shyamala (41.12), RCBG-1 x Shyamala (40.87), RCBG-2 x Gulabi (35.06), RCBG-6 x Shyamala (33.68), RCBG-3 x Bhagyamathi (32.60), RCBG-3 x Shyamala (31.32) and RCBG-4 x Gulabi (26.36) and six hybrids, RCBG-4 x Shyamala (44.19), RCBG-2 x Bhagyamathi (40.65), RCBG-1 x Bhagyamathi (39.05), RCBG-7 x Shyamala (28.20), RCBG-1 x Shyamala (27.98) and RCBG-2 x Gulabi (22.69) registered significant standard heterosis over Arka Anand and Mahy Hari respectively. Heterosis range over Mahy Hari was varied between -44.37(RCBG-7 x Bhagyamathi) to 44.19(RCBG-4 x Shyamala). The present results are in concurrent with the findings of Prabhu *et al.* (2005) [32], Suneetha and Kathiria (2006), Shafeeq *et al.* (2007) [46], Joshi *et al.* (2008) [18], Chowdhury *et al.* (2010) [9], Sharma (2010) [49], Sao and Mehta (2011) [45], Praneetha *et al.* (2013) and Kumar *et al.* (2013) [21].

Heterosis range varying from -22.09 in RCBG-7 x Bhagyamathi to 91.87 in RCBG-7 x Shyamala was reported for fruit yield per hectare. For this character, heterobeltiosis was varied from -28.75(RCBG-7 x Bhagyamathi) to 87.84(RCBG-7 x Shyamala). Significant positive heterosis was displayed by sixteen hybrids over mid parent and by thirteen hybrids over respective better parent (Table 9). Out of 21 hybrids, six hybrids registered significant positive heterosis over the check Mahy Hari and nine hybrids shown significant and positive heterosis over second best check Arka Anand. The economic heterosis over Mahy Hari and Arka Anand was varied from -40.82(RCBG-7 x Bhagyamathi) to 39.83(RCBG-2 x Bhagyamathi) and -34.48 in RCBG-7 x Bhagyamathi to 54.81 in RCBG-2 x Bhagyamathi respectively. Similar results are also noticed by Joshi *et al.* (2008) [18], Magar *et al.* (2016) [23], Pramila *et al.* (2017) [33] and Rani *et al.* (2018).

For total marketable yield per hectare (tons), the observed range of average heterosis and heterobeltiosis among hybrids was -20.61(RCBG-7 x Bhagyamathi) to 145.97(RCBG-4 x Shyamala) and -28.51(RCBG-7 x Bhagyamathi) to 105.70(RCBG-7 x Shyamala) respectively. As many as sixteen hybrids were positively heterotic over midparent and over respective better parent. Six hybrids *viz*., RCBG-4 x Shyamala(44.18), RCBG-2 x Bhagyamathi (40.65), RCBG-1 x Bhagyamathi(39.04), RCBG-7 x Shyamala(28.20), RCBG-1 x Shyamala(27.97) and RCBG-2 x Gulabi(22.69) manifested significant positive heterosis over best check Mahy Hari. The range of standard heterosis over Mahy Hari was -44.38 in RCBG-7 x Bhagyamathi to 44.18 in RCBG-4 x Shyamala.

With respect to the ascorbic acid content, sixteen hybrids recorded significant positive heterosis with a range of -13.93(RCBG-6 x Gulabi) to 38.97(RCBG-4 x Gulabi) and heterobeltiosis was ranged from -20.93 in RCBG-6 x Gulabi to 36.17 in RCBG-4 x Gulabi with thirteen hybrids exhibiting significant and positive heterosis over respective better parent (Table 10). Heterosis over standard check Mahy Hari was varied from -34.35(RCBG-6 x Shyamala) to 20.77(RCBG-1 x Bhagyamathi) and four hybrids *viz*., RCBG-1 x Bhagyamathi (20.77), RCBG-4 x Gulabi (15.87), RCBG-2 x Gulabi (10.10) and RCBG-1 x Gulabi(5.60) registered positive significant standard heterosis for this character. Earlier reports of Kanthaswamy *et al.* (2003) and Rani *et al.* (2018) are in proportionate with the above results.

Hybrids exhibited, relative heterosis having a range of 4.80 in RCBG-6 x Gulabi to 53.74 in RCBG-1 x Shyamala for total phenols content (mg/100g). None of the hybrid shown desirable negative significant heterosis over mid parent and only four hybrids was negatively significant over better parent. For this trait, heterosis over better parent was varied between -12.32(RCBG-3 x Bhagyamathi) to 47.54(RCBG-1 x Shyamala). None of the hybrid exhibited desirable significant negative heterosis over both the checks (Table 10). Anologues kind of earlier findings are noticed by Suneetha *et al.* (2005) and Patidar *et al.* (2017) [31]. Marketable yield is the resultant manifest of its component traits, and heterosis observed for them contributes ultimately towards this complex character. The highest relative heterosis, heterobeltiosis were exhibited by crosses RCBG-7 x Shyamala, RCBG-3 x Shyamala, RCBG-4 x Shyamala, RCBG-1 x Shyamala, RCBG-2 x Bhagyamathi, RCBG-6 x Shyamala, RCBG-1 x Bhagyamathi, RCBG-2 x Gulabi, RCBG-2 x Shyamala, RCBG-4 x Gulabi, RCBG-3 x Bhagyamathi, RCBG-7 x Gulabi, RCBG-1 x Gulabi and standard heterosis by the crosses RCBG-4 x Shyamala, RCBG-2 x Bhagyamathi, RCBG-1 x Bhagyamathi, RCBG-7 x Shyamala, RCBG-1 x Shyamala, RCBG-2 x Gulabi for marketable yield per plant (Table 8). From study, it was concluding that the cross combinations RCBG-1 x Bhagyamathi, RCBG-4 x Shyamala, RCBG-2 x Bhagyamathi, RCBG-7 x Shyamala and RCBG-1 x Shyamala were identified as top standard heterotic crosses for marketable fruit yield per plant and its contributing characters. The identified hybrids may be further tested over locations, seasons and years for commercial release for commercial cultivation.

Table 1: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for plant height (cm) and number of branches in brinjal

Crosses	Plant height (cm)				Number of branches per plant			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	8.74**	3.43	-1.45	8.17*	39.31**	37.95**	55.34**	32.52**
RCBG-1 x Gulabi	-7.18*	-8.09*	-10.68**	-1.96	2.74	0.99	11.51	-4.88
RCBG-1 x Shyamala	18.27**	8.13*	3.03	13.08**	16.81	11.96	23.62	5.46
RCBG-2 x Bhagyamathi	-1.77	-2.49	-14.93**	-6.62	25.49*	24.97*	41.90**	21.05
RCBG-2 x Gulabi	10.74**	5.08	2.12	12.09**	52.97**	48.33**	68.43**	43.69**
RCBG-2 x Shyamala	13.43**	8.03*	-5.74	3.46	16.26	9.97	24.87	6.52

RCBG-3 x Bhagyamathi	-12.89**	-16.07**	-22.16**	-14.56**	-5.98	-5.98	5.87	-9.69
RCBG-3 x Gulabi	16.63**	13.97**	10.76**	21.57**	7.72	4.87	18.09	0.74
RCBG-3 x Shyamala	5.32	-2.52	-9.59**	-0.76	0.92	-4.17	7.91	-7.94
RCBG-4 x Bhagyamathi	21.91**	15.40**	11.07**	21.92**	53.65**	50.55**	76.65**	50.69**
RCBG-4 x Gulabi	9.55**	9.02*	5.95	16.30**	17.13	11.81	31.19*	11.91
RCBG-4 x Shyamala	2.03	-7.14*	-10.62**	-1.90	-5.04	-11.55	3.79	-11.46
RCBG-5 x Bhagyamathi	15.91**	12.74**	-3.08	6.39	1.24	-0.17	12.41	-4.10
RCBG-5 x Gulabi	19.01**	9.26*	6.18	16.55**	30.75**	29.08*	41.29**	20.54
RCBG-5 x Shyamala	3.47	1.99	-17.12**	-9.30*	-15.00	-18.19	-10.45	-23.60
RCBG-6 x Bhagyamathi	17.70**	8.60*	-6.64	2.48	-6.34	-12.61	-1.59	-16.05
RCBG-6 x Gulabi	24.77**	9.04*	5.97	16.31**	49.51**	43.12**	52.65**	30.22*
RCBG-6 x Shyamala	23.83**	18.92**	-6.12	3.04	2.63	0.75	2.01	-12.98
RCBG-7 x Bhagyamathi	21.91**	20.20**	3.33	13.42**	-5.38	-12.77	16.39	-0.71
RCBG-7 x Gulabi	21.55**	13.02**	9.84**	20.56**	-3.80	-13.45	15.48	-1.49
RCBG-7 x Shyamala	21.09**	17.76**	-1.62	7.99*	27.68**	12.28	49.81**	27.80*

****** Significant at 1% level and ***** Significant at 5% level

Table 2: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for number of flower clusters per plant and number of flowers per cluster in brinjal

Crosses	Number of flower clusters per plant				Number of flowers per cluster			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	12.69**	6.83*	17.83**	14.32**	18.68**	-4.84	7.68	5.36
RCBG-1 x Gulabi	10.32**	8.70*	10.67**	7.38*	-2.25	-20.65*	-13.05	-14.93
RCBG-1 x Shyamala	9.43**	4.90	13.03**	9.67**	79.77**	54.70**	5.68	3.40
RCBG-2 x Bhagyamathi	12.25**	10.25**	21.60**	17.98**	4.04	-2.98	9.79	7.42
RCBG-2 x Gulabi	12.89**	10.48**	17.50**	14.01**	3.60	-1.92	7.47	5.15
RCBG-2 x Shyamala	2.75	2.08	10.00**	6.73	57.51**	18.39	15.89	13.39
RCBG-3 x Bhagyamathi	-2.19	-5.75	3.96	0.86	39.74**	6.14	20.11**	17.51
RCBG-3 x Gulabi	4.05	3.82	6.18	3.02	-12.57	-32.85**	-26.42**	-28.01**
RCBG-3 x Shyamala	0.78	-1.78	5.84	2.69	5.07	-3.41	-43.26**	-44.49**
RCBG-4 x Bhagyamathi	-1.31	-2.64	7.38*	4.19	30.70**	6.33	20.32*	17.71
RCBG-4 x Gulabi	9.57**	6.77*	14.57**	11.17**	44.61**	19.12*	30.53**	27.70**
RCBG-4 x Shyamala	9.57**	9.35**	17.83**	14.32**	67.60**	41.99**	0.74	-1.44
RCBG-5 x Bhagyamathi	9.16**	4.07	14.78**	11.37**	-5.55	-17.67*	-6.84	-8.86
RCBG-5 x Gulabi	0.10	-0.79	1.01	-1.99	0.76	-10.95	-2.42	-4.53
RCBG-5 x Shyamala	11.17**	7.17*	15.48**	12.05**	0.24	-20.53	-33.16**	-34.60**
RCBG-6 x Bhagyamathi	-0.52	-6.52	3.10	0.03	-18.35*	-35.63**	-27.16**	-28.73**
RCBG-6 x Gulabi	5.19	2.69	4.56	1.45	-22.46*	-38.14**	-32.21**	-33.68**
RCBG-6 x Shyamala	9.58**	4.10	12.18**	8.84*	8.09	-5.16	-38.11**	-39.44**
RCBG-7 x Bhagyamathi	3.18	-0.02	10.28**	7.00	3.62	-22.88**	-12.74	-14.62
RCBG-7 x Gulabi	10.63**	9.75**	13.55**	10.17**	-23.63*	-42.56**	-37.05**	-38.41**
RCBG-7 x Shyamala	6.28*	4.16	12.25**	8.91*	-13.19	-17.90	-54.63**	-55.61**

****** Significant at 1% level and ***** Significant at 5% level

Table 3: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for days to first flowering and days to 50% flowering in brinjal

Crosses	Days to first flowering				Days to 50% flowering			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	-8.77**	-9.57*	-7.69*	-13.33**	-13.97**	-16.43**	-4.10	-11.36**
RCBG-1 x Gulabi	-7.76*	-13.08**	0.00	-5.83	-6.62**	-9.29**	4.10	-3.79
RCBG-1 x Shyamala	-0.96	-10.43**	-8.85*	-14.17**	-8.13**	-14.39**	-7.38*	-14.39**
RCBG-2 x Bhagyamathi	-3.67	-7.08	-7.08	-12.50**	-8.68**	-13.57**	-0.82	-8.33**
RCBG-2 x Gulabi	-3.83	-13.08**	0.00	-5.83	-6.42**	-11.43**	1.64	-6.06*
RCBG-2 x Shyamala	15.15**	8.57*	0.88	-5.00	-1.26	-5.60	-3.28	-10.61**
RCBG-3 x Bhagyamathi	2.22	1.77	1.77	-4.17	-4.35	-5.71*	8.20**	0.00
RCBG-3 x Gulabi	-9.09**	-15.38**	-2.65	-8.33*	-1.45	-2.86	11.48**	3.03
RCBG-3 x Shyamala	-4.39	-12.50**	-13.27**	-18.33**	-8.00**	-15.44**	-5.74	-12.88**
RCBG-4 x Bhagyamathi	-7.83*	-9.40*	-6.19	-11.67**	-14.07**	-17.44**	-4.92	-12.12**
RCBG-4 x Gulabi	-12.55**	-16.92**	-4.42	-10.00**	-11.11**	-14.29**	-1.64	-9.09**
RCBG-4 x Shyamala	-8.57*	-17.95**	-15.04**	-20.00**	-7.38**	-13.08**	-7.38*	-14.39**
RCBG-5 x Bhagyamathi	-10.50**	-13.27**	-13.27**	-18.33**	-12.84**	-20.00**	-8.20**	-15.15**
RCBG-5 x Gulabi	-4.24	-13.08**	0.00	-5.83	-0.39	-8.57**	4.92	-3.03
RCBG-5 x Shyamala	-2.51	-8.49*	-14.16**	-19.17**	-3.03	-4.27	-8.20**	-15.15**
RCBG-6 x Bhagyamathi	-5.26	-12.69**	3.54	-2.50	-7.42**	-8.39**	7.38*	-0.76
RCBG-6 x Gulabi	-11.36**	-12.69**	3.54	-2.50	-8.83**	-9.79**	5.74	-2.27

RCBG-6 x Shyamala	-6.61*	-20.90**	-6.19	-11.67**	-5.84*	-15.38**	-0.82	-8.33**
RCBG-7 x Bhagyamathi	2.68	1.77	1.77	-4.17	-5.26*	-10.00**	3.28	-4.55
RCBG-7 x Gulabi	-8.71**	-15.38**	-2.65	-8.33*	-6.77**	-11.43**	1.64	-6.06*
RCBG-7 x Shyamala	-1.96	-9.91*	-11.50**	-16.67**	-4.17	-8.73**	-5.74	-12.88**

****** Significant at 1% level and ***** Significant at 5% level

Table 4: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for days to first harvest and days to last harvest in brinjal

Crosses	Days to first harvest				Days to last harvest			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	-5.42*	-7.10*	-5.42	-7.65*	-0.21	-1.59	0.46	-4.45**
RCBG-1 x Gulabi	-5.14*	-8.29**	0.00	-2.35	-3.13**	-7.46**	0.70	-4.19**
RCBG-1 x Shyamala	-0.64	-8.28**	-6.63*	-8.82**	1.07	-0.47	-1.39	-6.18**
RCBG-2 x Bhagyamathi	-3.75	-5.52	-7.23*	-9.41**	1.93	1.81	4.18**	-0.88
RCBG-2 x Gulabi	-1.78	-8.29**	0.00	-2.35	0.44	-2.56*	6.03**	0.88
RCBG-2 x Shyamala	9.33**	4.46	-1.20	-3.53	5.26**	2.04	4.41**	-0.66
RCBG-3 x Bhagyamathi	2.44	1.82	1.20	-1.18	-0.12	-1.59	0.46	-4.42**
RCBG-3 x Gulabi	-5.78*	-9.94**	-1.81	-4.12	-4.02**	-8.32**	-0.23	-5.08**
RCBG-3 x Shyamala	-3.25	-9.70**	-10.24**	-12.35**	-1.07	-2.58*	-3.48**	-8.17**
RCBG-4 x Bhagyamathi	-3.95	-4.82	-4.82	-7.06*	2.82**	2.25	5.57**	0.44
RCBG-4 x Gulabi	-6.63*	-10.50**	-2.41	-4.71	0.44	-2.13	6.50**	1.32
RCBG-4 x Shyamala	-4.85	-11.45**	-11.45**	-13.53**	3.61**	0.00	3.25*	-1.77
RCBG-5 x Bhagyamathi	-5.00	-6.75*	-8.43**	-10.59**	-2.86**	-3.64**	-1.62	-6.40**
RCBG-5 x Gulabi	-1.78	-8.29**	0.00	-2.35	-4.88**	-8.53**	-0.46	-5.30**
RCBG-5 x Shyamala	0.67	-3.82	-9.04**	-11.18**	-1.06	-3.23*	-2.78*	-7.51**
RCBG-6 x Bhagyamathi	-1.99	-8.51**	3.61	1.18	3.86**	0.86	9.28**	3.97**
RCBG-6 x Gulabi	-6.23*	-7.98**	4.22	1.76	0.43	0.21	9.05**	3.75**
RCBG-6 x Shyamala	-2.11	-13.83**	-2.41	-4.71	3.97**	-1.93	6.26**	1.10
RCBG-7 x Bhagyamathi	3.98	3.66	2.41	0.00	0.57	0.45	2.55*	-2.43*
RCBG-7 x Gulabi	-4.93	-9.39**	-1.20	-3.53	-0.88	-4.05**	4.41**	-0.66
RCBG-7 x Shyamala	-0.33	-6.71*	-7.83*	-10.00**	4.34**	1.37	3.25*	-1.77

****** Significant at 1% level and ***** Significant at 5% level

Table 5: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for number of fruits per cluster and number of fruits per plant in brinjal

Crosses	Number of fruits per cluster				Number of fruits per plant			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	15.49*	-11.87	15.57	2.23	40.49**	29.55**	24.43**	18.14**
RCBG-1 x Gulabi	-3.80	-26.40**	-4.21	-15.26*	27.03**	18.74**	10.75	5.15
RCBG-1 x Shyamala	75.75**	42.89**	-1.40	-12.78	17.57*	13.01	-8.36	-12.99*
RCBG-2 x Bhagyamathi	1.55	-9.09	19.21*	5.46	31.54**	24.52**	19.60**	13.56*
RCBG-2 x Gulabi	-3.30	-13.15*	13.04	0.00	28.48**	23.33**	15.03*	9.22
RCBG-2 x Shyamala	33.72**	-5.28	-1.82	-13.15	28.12**	19.91**	2.88	-2.32
RCBG-3 x Bhagyamathi	10.79	-19.25**	5.89	-6.33	23.10**	11.59	7.19	1.77
RCBG-3 x Gulabi	-17.11*	-39.44**	-21.18**	-30.27**	17.45**	7.90	0.64	-4.45
RCBG-3 x Shyamala	8.42	-6.78	-44.04**	-50.50**	10.06	7.74	-15.86*	-20.11**
RCBG-4 x Bhagyamathi	26.81**	3.21	35.34**	19.73**	26.19**	23.29**	24.14**	17.87**
RCBG-4 x Gulabi	12.74	-7.97	19.78*	5.96	-3.83	-7.38	-6.74	-11.45*
RCBG-4 x Shyamala	-2.79	-25.89**	-38.99**	-46.03**	32.55**	15.51*	16.31**	10.43
RCBG-5 x Bhagyamathi	-29.48**	-51.12**	-35.90**	-43.30**	26.28**	19.78**	15.04*	9.23
RCBG-5 x Gulabi	-42.59**	-60.13**	-48.11**	-54.09**	-16.58**	-19.77**	-25.17**	-28.95**
RCBG-5 x Shyamala	9.42	1.39	-48.67**	-54.59**	13.31*	5.85	-8.81	-13.42*
RCBG-6 x Bhagyamathi	-30.25**	-45.88**	-29.03**	-37.22**	7.94	-0.23	-4.17	-9.01
RCBG-6 x Gulabi	-22.99**	-40.09**	-22.02**	-31.02**	30.84**	22.59**	14.34*	8.56
RCBG-6 x Shyamala	-6.31	-25.19*	-45.86**	-52.11**	-0.28	-4.38	-22.06**	-26.00**
RCBG-7 x Bhagyamathi	-23.98**	-46.95**	-30.43**	-38.46**	-3.73	-6.51	-10.20	-14.74*
RCBG-7 x Gulabi	-32.36**	-52.69**	-38.43**	-45.53**	25.93**	24.06**	15.72*	9.87
RCBG-7 x Shyamala	4.42	-4.32	-50.35**	-56.08**	16.39*	6.30	-3.80	-8.66

****** Significant at 1% level and ***** Significant at 5% level

Table 6: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for number of marketable fruits per plant and fruit length (cm) in brinjal

Crosses	Number of marketable fruits per plant				Fruit length (cm)			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	55.45**	36.38**	30.43**	24.01**	-2.61	-19.24**	-39.84**	5.05
RCBG-1 x Gulabi	38.72**	25.55**	11.87	6.36	0.39	-5.11	-20.61**	38.61**
RCBG-1 x Shyamala	16.95**	11.33	-19.64**	-23.60**	-16.55**	-31.51**	-48.98**	-10.92*
RCBG-2 x Bhagyamathi	35.31**	19.93**	14.70*	9.05	5.28	-0.21	-45.36**	-4.60
RCBG-2 x Gulabi	43.06**	30.86**	16.60*	10.85	-10.93**	-26.32**	-38.35**	7.63
RCBG-2 x Shyamala	43.32**	34.92**	-0.29	-5.20	0.44	-5.97	-48.51**	-10.09
RCBG-3 x Bhagyamathi	20.25**	5.60	0.99	-3.98	4.62	-2.45	-44.68**	-3.41
RCBG-3 x Gulabi	24.75**	13.02	0.71	-4.26	-6.01	-21.15**	-34.03**	15.18**
RCBG-3 x Shyamala	24.97**	18.84*	-14.03*	-18.27**	-7.15	-14.46**	-51.49**	-15.31**
RCBG-4 x Bhagyamathi	22.71**	21.54**	16.24*	10.51	-0.04	-16.58**	-38.85**	6.77
RCBG-4 x Gulabi	5.01	2.37	-3.96	-8.69	-17.29**	-22.42**	-35.09**	13.34*
RCBG-4 x Shyamala	52.73**	29.47**	21.47**	15.48*	-8.27	-24.24**	-44.47**	-3.04
RCBG-5 x Bhagyamathi	31.76**	14.67*	9.67	4.27	-2.53	-4.71	-51.07**	-14.57**
RCBG-5 x Gulabi	-9.69	-18.95*	-27.78**	-31.34**	-13.84**	-30.48**	-41.83**	1.56
RCBG-5 x Shyamala	27.59**	22.55*	-13.20	-17.47**	-5.69	-8.97	-53.25**	-18.36**
RCBG-6 x Bhagyamathi	15.13*	3.37	-1.13	-6.00	7.25	7.18	-47.36**	-8.08
RCBG-6 x Gulabi	19.22**	10.53	-1.52	-6.37	-16.18**	-33.48**	-44.35**	-2.83
RCBG-6 x Shyamala	7.02	-0.62	-24.36**	-28.09**	0.27	-1.10	-51.42**	-15.18**
RCBG-7 x Bhagyamathi	-7.90	-10.85	-14.74*	-18.94**	-14.26**	-28.30**	-47.71**	-8.70
RCBG-7 x Gulabi	31.40**	31.11**	17.35*	11.57	-22.41**	-27.39**	-39.25**	6.07
RCBG-7 x Shyamala	14.85	-0.72	-11.14	-15.52*	-9.50*	-25.10**	-45.38**	-4.64

****** Significant at 1% level and ***** Significant at 5% level

Table 7: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for fruit width (cm) and average fruit weight (g) in brinjal

Crosses	Fruit width (cm)				Average fruit weight (g)			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	2.26	-8.12	31.44**	-12.87**	25.70**	24.16**	24.16**	23.51**
RCBG-1 x Gulabi	-10.33	-25.33**	6.57	-29.20**	12.39**	10.28*	10.28*	9.71
RCBG-1 x Shyamala	-17.76**	-19.33**	15.14*	-23.51**	10.88*	8.70	8.70	8.13
RCBG-2 x Bhagyamathi	13.43*	11.92	30.80**	-13.10**	17.58**	15.45**	12.62*	12.03*
RCBG-2 x Gulabi	5.27	-4.59	11.51	-25.92**	1.82	0.64	-3.13	-3.64
RCBG-2 x Shyamala	-1.29	-8.63	25.43**	-16.67**	16.57**	15.33**	10.79*	10.22*
RCBG-3 x Bhagyamathi	0.84	-3.09	19.55**	-20.57**	21.75**	20.94**	19.57**	18.94**
RCBG-3 x Gulabi	4.99	-7.08	14.62*	-23.85**	13.87**	12.37**	11.09*	10.51*
RCBG-3 x Shyamala	-4.75	-9.58	22.13**	-17.53**	11.20*	9.62	8.38	7.81
RCBG-4 x Bhagyamathi	0.27	-0.99	12.63	-25.17**	1.22	-0.27	-2.72	-3.22
RCBG-4 x Gulabi	6.22	-1.40	9.34	-27.36**	8.02	7.13	3.11	2.58
RCBG-4 x Shyamala	-2.06	-11.47*	21.54**	-19.25**	18.80**	17.94**	13.30*	12.71*
RCBG-5 x Bhagyamathi	0.48	-1.39	16.52*	-22.59**	10.61*	9.56	6.87	6.31
RCBG-5 x Gulabi	-2.52	-12.08	3.89	-30.98**	-0.24	-0.53	-4.26	-4.76
RCBG-5 x Shyamala	-4.10	-10.78*	22.49**	-18.62**	3.98	3.78	-0.30	-0.82
RCBG-6 x Bhagyamathi	1.09	-12.63**	36.42**	-9.37	-15.18**	-22.63**	-8.45	-8.93
RCBG-6 x Gulabi	-8.78	-26.65**	14.53*	-23.91**	-0.14	-9.45	7.14	6.58
RCBG-6 x Shyamala	-4.25	-10.03*	40.48**	-6.67	7.31	-2.78	15.03**	14.43**
RCBG-7 x Bhagyamathi	-5.12	-12.52*	17.91*	-21.67**	3.12	2.92	0.39	-0.13
RCBG-7 x Gulabi	4.29	-11.10*	19.81**	-20.40**	13.22**	12.69*	9.50	8.93
RCBG-7 x Shyamala	-0.60	-1.51	35.21**	-10.17*	26.67**	25.95**	22.39**	21.75**

****** Significant at 1% level and ***** Significant at 5% level

Table 8: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for fruit yield per plant (kg) and marketable yield per plant (kg) in brinjal

Crosses	Fruit yield per plant (kg)				Marketable yield per plant (kg)			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	64.87**	57.67**	45.00**	30.97**	89.17**	78.69**	53.06**	39.05**
RCBG-1 x Gulabi	32.65**	28.17*	15.36	4.19	51.77**	47.57**	18.97	8.08
RCBG-1 x Shyamala	76.79**	65.32**	38.75**	25.32*	126.80**	84.96**	40.87**	27.98*
RCBG-2 x Bhagyamathi	75.33**	68.35**	54.82**	39.84**	93.67**	80.75**	54.83**	40.65**
RCBG-2 x Gulabi	50.92**	46.43**	31.79**	19.03	74.44**	67.52**	35.06**	22.69*

RCBG-2 x Shyamala	54.93**	44.30**	22.14	10.32	97.97**	63.08**	21.05	9.96
RCBG-3 x Bhagyamathi	64.39**	46.99**	35.18**	22.10*	74.54**	54.80**	32.60**	20.46
RCBG-3 x Gulabi	30.99*	18.25	6.43	-3.87	45.17**	32.26*	6.63	-3.13
RCBG-3 x Shyamala	75.71**	75.06**	27.86*	15.48	129.69**	98.13**	31.32*	19.30
RCBG-4 x Bhagyamathi	-9.52	-11.46	-18.57	-26.45*	-13.67	-16.02	-28.06*	-34.65**
RCBG-4 x Gulabi	35.01**	33.53*	20.18	8.55	56.35**	55.98**	26.36*	14.79
RCBG-4 x Shyamala	88.25**	72.21**	51.61**	36.94**	145.95**	95.93**	58.72**	44.19**
RCBG-5 x Bhagyamathi	-3.17	-7.96	-15.36	-23.55*	-0.43	-10.00	-22.91	-29.96**
RCBG-5 x Gulabi	25.83*	20.83	8.75	-1.77	46.16**	35.79*	9.48	-0.55
RCBG-5 x Shyamala	27.15*	19.61	-0.89	-10.48	62.94**	38.07*	-4.48	-13.22
RCBG-6 x Bhagyamathi	-16.67	-22.33	-28.57*	-35.48**	-10.59	-16.56	-28.53*	-35.07**
RCBG-6 x Gulabi	12.96	6.35	-4.29	-13.55	4.13	0.00	-19.38	-26.76
RCBG-6 x Shyamala	71.66**	64.72**	30.89*	18.23	118.64**	80.10**	33.68**	21.44
RCBG-7 x Bhagyamathi	-22.08	-28.74*	-34.46**	-40.81**	-20.60	-28.51	-33.76**	-44.37**
RCBG-7 x Gulabi	45.65**	34.52*	21.07	9.35	66.13**	53.75**	23.95	12.61
RCBG-7 x Shyamala	91.87**	87.82**	43.21**	29.35**	141.93**	105.71**	41.12**	28.20*

****** Significant at 1% level and ***** Significant at 5% level

Table 9: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for fruit yield per hectare (tons) and marketable yield per hectare (tons) in brinjal

Crosses	Fruit yield per hectare (tons)				Marketable yield per hectare (tons)			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	64.88**	57.67**	45.99**	30.96**	89.20**	78.70**	53.07**	39.04**
RCBG-1 x Gulabi	32.64**	28.16*	15.36	4.18	51.78**	47.57**	18.97	8.07
RCBG-1 x Shyamala	76.79**	65.32**	38.74**	25.31*	126.84**	84.00**	40.88**	27.97*
RCBG-2 x Bhagyamathi	75.33**	68.35**	54.81**	39.83**	93.69**	80.77**	54.83**	40.65**
RCBG-2 x Gulabi	50.91**	46.42**	31.78**	19.02	74.45**	67.53**	35.06**	22.69*
RCBG-2 x Shyamala	54.93**	44.30**	22.13	10.31	97.99**	63.09**	21.05	9.96
RCBG-3 x Bhagyamathi	64.39**	46.99**	35.17**	22.09*	74.55**	54.81**	32.60**	20.45
RCBG-3 x Gulabi	30.99*	18.24	6.42	-3.88	45.17**	32.26*	6.63	-3.14
RCBG-3 x Shyamala	75.72**	75.06**	27.85*	15.48	129.71**	98.14**	31.32*	19.29
RCBG-4 x Bhagyamathi	-9.53	-11.46	-18.58	-26.46*	-13.67	-16.01	-28.06*	-34.65**
RCBG-4 x Gulabi	35.00**	33.52*	20.17	8.54	56.37**	56.00**	26.36*	14.79
RCBG-4 x Shyamala	88.26**	72.22**	51.60**	36.93**	145.97**	95.95**	58.73**	44.18**
RCBG-5 x Bhagyamathi	-3.16	-7.96	-15.36	-23.55*	-0.42	-9.99	-22.90	-29.97**
RCBG-5 x Gulabi	25.82*	20.82	8.74	-1.78	46.17**	35.80*	9.48	-0.55
RCBG-5 x Shyamala	27.15*	19.61	-0.90	-10.49	62.96**	38.08*	-4.47	-13.23
RCBG-6 x Bhagyamathi	-16.68	-22.34	-28.58*	-35.49**	-10.59	-16.56	-28.53*	-35.08**
RCBG-6 x Gulabi	12.95	6.34	-4.29	-13.56	4.12	-0.01	-19.39	-26.77
RCBG-6 x Shyamala	71.65**	64.71**	30.88*	18.22	118.66**	80.12**	33.69**	21.44
RCBG-7 x Bhagyamathi	-22.09	-28.75*	-34.48**	-40.82**	-20.61	-28.51	-33.77**	-44.38**
RCBG-7 x Gulabi	45.65**	34.51*	21.06	9.35	66.13**	53.75**	23.96	12.60
RCBG-7 x Shyamala	91.87**	87.84**	43.20**	29.35**	141.94**	105.70**	41.13**	28.20*

****** Significant at 1% level and ***** Significant at 5% level

Table 10: Average heterosis (%), heterobeltiosis (%) and standard heterosis (%) for ascorbic acid content (mg/100g) and total phenols content (mg/100g)

Crosses	Ascorbic acid content (mg/100g)				Total phenols content (mg/100g)			
	Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)		Average heterosis (%)	Heterobeltiosis (%)	Standard heterosis (%)	
			Arka Anand	Mahy Hari			Arka Anand	Mahy Hari
RCBG-1 x Bhagyamathi	35.13**	17.15**	34.79**	20.77**	11.49**	-8.73**	27.83**	52.00**
RCBG-1 x Gulabi	12.23**	2.44	17.86**	5.60**	20.33**	12.23**	15.74**	37.63**
RCBG-1 x Shyamala	8.39**	-8.81**	4.92*	-6.00**	53.74**	47.54**	43.23**	70.31**
RCBG-2 x Bhagyamathi	26.89**	19.05**	14.71**	2.78	27.99**	-5.14**	32.86**	57.98**
RCBG-2 x Gulabi	28.45**	27.53**	22.88**	10.10**	19.54**	-1.07	2.02	21.31**
RCBG-2 x Shyamala	18.18**	7.25**	3.35	-7.41**	35.41**	14.82**	11.47**	32.55**
RCBG-3 x Bhagyamathi	26.58**	21.97**	3.00	-7.72**	5.50**	-12.32**	22.80**	46.02**
RCBG-3 x Gulabi	7.24**	-2.18	-7.09**	-16.75**	40.84**	33.75**	37.93**	64.02**
RCBG-3 x Shyamala	11.70**	11.53**	-12.40**	-21.52**	16.71**	14.11**	10.78**	31.72**
RCBG-4 x Bhagyamathi	27.30**	22.62**	11.76**	0.13	27.35**	21.61**	70.32**	102.53**
RCBG-4 x Gulabi	38.97**	36.17**	29.33**	15.87**	48.52**	34.35**	71.22**	103.60**
RCBG-4 x Shyamala	18.56**	10.37**	0.59	-9.88**	41.61**	24.74**	58.97**	89.04**
RCBG-5 x Bhagyamathi	18.76**	15.44**	-2.51	-12.65**	13.14**	-1.79	37.55**	63.56**
RCBG-5 x Gulabi	3.27	-5.03*	-9.79**	-19.18**	24.47**	24.45**	28.34**	52.61**
RCBG-5 x Shyamala	28.17**	27.22**	1.43	-9.13**	20.32**	16.81**	20.42**	43.19**

RCBG-6 x Bhagyamathi	3.06	0.06	-15.50**	-24.29**	7.03**	-6.17**	31.41**	56.27**
RCBG-6 x Gulabi	-13.93**	-20.93**	-24.90**	-32.72**	4.80*	3.62	9.33**	30.01**
RCBG-6 x Shyamala	-7.29**	-7.86**	-26.72**	-34.35**	13.25**	8.72**	14.72**	36.41**
RCBG-7 x Bhagyamathi	23.00**	8.92**	-8.02**	-17.59**	21.78**	-2.85	36.06**	61.79**
RCBG-7 x Gulabi	1.88	-14.15**	-18.45**	-26.94**	22.02**	10.36**	13.81**	35.33**
RCBG-7 x Shyamala	12.92**	3.26	-18.90**	-27.34**	40.06**	30.20**	26.40**	50.30**

****** Significant at 1% level and ***** Significant at 5% level

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