Plant Archives

ESTIMATION OF HETEROSIS FOR YIELD AND ITS CONTRIBUTING TRAITS IN BRINJAL (*SOLANUM MELONGENA* L.)

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(Date of Receiving : 28-02-2025; Date of Acceptance : 08-05-2025)

ABSTRACT

In the present investigation, information on the magnitude of heterosis was obtained for fruit yield and yield attributing traits following Line x Tester design involving seven (5 females and 2 males) strains of brinjal (*Solanum melongena* L.). The seven parents and their ten resultant F_1 with one standard checks (Nav Kiran) were tested for fourteen characters in kharif during 2019-20 at Vegetable Research and Demonstration Block, College of Horticulture, Veer Chandra Singh Garhwali, Uttarakhand University of Horticulture and Forestry, Bharsar Uttarakhand in a randomized block design with three replications. Significant differences were observed among genotypes for all the traits studied. The cross Pusa Purple Round x Pusa Purple Cluster exhibited maximum heterosis over better parent (71.58%) and mid parent (89.46%) for yield per plant, the cross T-3 x Arka Nidhi exhibited maximum heterosis over better parent (39.03%) and mid parent (45.21%) for yield per plot while, Pant Samrat x Pusa Purple Cluster exhibited maximum heterosis over check (104.65% and 40.06%) for yield per plant and yield per plot. Some of the promising hybrids showed desirable heterosis for earliness, increased fruit number and yield.
Keywords **:** brinjal, Line × Tester analysis, heterosis, yield.

Introduction

Brinjal (*Solanum melongena* L.; 2n=2x=24) belongs to family Solanaceae, is an annual herbaceous versatile crop plant, which is well adapted to various agro-ecological zones and cultivated throughout the year. India is considered as the centre of origin/diversity of brinjal (Vavilov, 1931). In both temperate and tropical areas of the globe brinjal is extensively cultivated primarily for its immature fruits as vegetable (Rai *et al*., 1995). It is termed as poor man's vegetable based upon its highest production attainability and availability of the produce to consumers (Kumar *et al.*, 2014). It is a self-pollinated crop, however cross-pollination is occurred 30–40% and hence, it is classified as often cross pollinated crop (Kamalakkannan *et al.*, 2007). Eggplant is well known for its medicinal properties and has also been recommended as an excellent remedy for liver complaints and diabetic patients (Tiwari *et al*., 2009).

In 1914 Shull coined the term heterosis. Heterosis refers to the prevalence of F_1 hybrid in one or more characters over its parents. It can be relative heterosis, heterobeltiosis and economic heterosis.

Materials and Methods

The experiment study was carried out in Vegetable Research and Demonstration Block, College of Horticulture, Veer Chandra Singh Garhwali, Uttarakhand University of Horticulture and Forestry, Bharsar during 2019-2020. Five diverse brinjal lines *viz*., Pant Samrat, Pusa Purple Round, Pant Rituraj, Pusa Purple Long and T-3 and two testers *viz*., Pusa Purple Cluster and Arka Nidhi were chosen on the basis of their phenotypic performance and their diverse variation in fruit yield and its contributing traits, and were crossed in a line x tester mating design. The parents along with their F_1 hybrids and one standard check, (Nav Kiran) were grown in a randomized block design with three replications during Kharif 2020.

Each plot consisted of nine plants in a row at 60 x 45 cm inter and intra row spacing. All the recommended package of practices was adopted for raising a successful and healthy crop. The observations were recorded on five randomly selected plants per treatment per replication for 14 characters *viz.*, days to first flowering, days to 50% flowering, days to first harvesting, plant height, number of primary branches, fruit length, fruit girth, average fruit weight, rind thickness, number of fruits per plant, total soluble solids, shelf life, yield per plant and yield per plot.

Results and Discussion

The magnitude of heterosis was calculated as per cent increase or decrease of F_1 values over the mid parent (MP), better parent (BP) and standard check (SC) are presented in Table 1. The degree of heterosis varied from cross to cross for all the fourteen traits.

Days to first flowering (days)

For this trait, heterosis in negative direction is desirable as it imparts early flowering. Only one cross combination, Pant Samrat x Arka Nidhi (-11.96%) resulted in significant negative heterosis over mid parent. The standard heterosis over check ranged from -13.39% (Pant Samrat x Arka Nidhi) to 5.56% (Pusa Purple Long x Pusa Purple Cluster). Out of ten cross combinations only one cross Pant Samrat x Arka Nidhi (-13.39%) showed significant negative heterosis over standard check. Similar findings were also observed by Sao and Mehta (2010), Kalaiyarasi *et al*. (2018).

Days to 50 % flowering

For this trait, heterosis over better parent ranged from -20.24% (Pant Rituraj x Arka Nidhi) to 16.80% (Pant Rituraj x Pusa Purple Cluster). Hybrid Pant Rituraj x Arka Nidhi (-20.24%) resulted in significant negative heterosis over better parent. The maximum negative relative heterosis was observed in Pant Rituraj x Arka Nidhi (-22.39%) followed by Pant Samrat x Arka Nidhi (-11.20%) and Pusa Purple Round x Pusa Purple Cluster (-7.75%). While, maximum significant negative heterosis over standard check was revealed in Pant Rituraj × Arka Nidhi (-21.28%) followed by Pusa Purple Round x Pusa Purple Cluster (-15.63%) and Pant Samrat x Arka Nidhi (-11.20%). The result achieved from this experiment are in agreement with Shafeeq *et al*. (2007), Joshi *et al*. (2008), Chowdhury *et al*. (2010), Biswas *et al*. (2013), Makani *et al*. (2013) and Reddy and Patel (2014).

Days to first harvesting

The heterosis over better parent for days to first harvesting ranged from -1.26% (Pant Samrat × Pusa Purple Cluster) to 26.60% (Pusa Purple Long x Arka Nidhi). The hybrid Pant Samrat × Pusa Purple Cluster exhibited both significant negative heterosis over mid parent (-4.29%) and over standard check (-11.74%). These findings are similar with the results of Chowdhury *et al*. (2010) and Makani *et al*. (2013).

Plant height

The hybrid Pusa Purple Long x Pusa Purple Cluster (11.05%) exhibited maximum significant positive heterosis over better parent followed by Pant Rituraj x Pusa Purple Cluster (10.02%) and Pusa Purple Long x Arka Nidhi (9.19%). The heterosis over mid parent ranged from 6.06% (Pant Samrat x Arka Nidhi) to 22.87% (Pusa Purple Round x Pusa Purple Cluster). All the ten cross combinations were found significant positive heterosis over mid parent. The best three superior hybrids viz., Pant Samrat x Pusa Purple Cluster (18.98%) followed by Pant Samrat x Arka Nidhi (14.71%) and Pusa Purple Long x Arka Nidhi (12.59%) registered significant and desirable standard heterosis over Nav Kiran. Positive heterosis for this trait has also been reported Makani *et al*. (2013), Reddy and Patel (2014) and Pramila *et al.* (2017).

Number of primary branches per plant

The hybrid Pant Samrat x Pusa Purple Cluster (48.23 %) exhibited significant positive heterosis over better parent followed by Pant Rituraj x Pusa Purple Cluster (47.84%) and T-3 x Arka Nidhi (26.39 %) respectively. Hybrid Pant Rituraj x Pusa Purple Cluster (66.29%) exhibited maximum significant positive heterosis over mid parent followed by Pant Samrat x Pusa Purple Cluster (55.65 %) and T-3 x Arka Nidhi (41.38 %). While maximum significant positive heterosis over the standard check was observed in Pant Rituraj x Pusa Purple Cluster (88.20%) followed by Pant Samrat x Pusa Purple Cluster (62.30%) and T-3 x Arka Nidhi (37.28 %) respectively. Similar findings were also reported by Prabhu *et al*. (2005), Shafeeq *et al*. (2007), Das *et al*. (2009) and Reddy and Patel (2014).

Fruit length

The hybrid Pusa Purple Long x Pusa Purple Cluster (26.61%) recorded significant positive heterobeltiosis followed by Pant Samrat x Arka Nidhi (18.27%) and Pant Samrat x Pusa Purple Cluster (7.11%). Relative heterosis varied from -12.87% (Pant Rituraj x Arka Nidhi) to 34.81% (Pusa Purple Long x Pusa Purple Cluster) and it was maximum with the hybrid Pusa Purple Long x Pusa Purple Cluster (34.81%) followed by Pant Samrat x Pusa Purple Cluster (22.33%) and Pant Samrat x Arka Nidhi (21.79%). The crosses recorded positive significant standard heterosis and it was ranging from from -

1.94% (Pusa Purple Round x Pusa Purple Cluster) to 70.02% (Pant Samrat x Arka Nidhi) and the cross of Pant Samrat x Arka Nidhi recorded maximum significant positive standard heterosis of (70.02%) followed by Pusa Purple Long x Pusa Purple Cluster (55.68%) and Pant Samrat x Pusa Purple Cluster (53.99%) for this trait. These results find support from Reddy and Patel (2014) and Ansari and Singh (2016).

Fruit girth

The hybrid Pant Samrat x Pusa Purple Cluster (29.20 %) recorded significant positive heterosis over better parent followed by T-3 x Arka Nidhi (26.62%) and Pusa Purple Long x Pusa Purple Cluster (26.10%) and the crosses T-3 x Arka Nidhi (62.12%) followed by Pusa Purple Round x Pusa Purple Cluster (48.19%) and Pusa Purple Round x Arka Nidhi (43.79%) recorded positive relative heterosis for this trait. The magnitude of standard heterosis ranged from -42.51% (Pusa Purple Long x Arka Nidhi) to 16.12% (Pusa Purple Round x Pusa Purple Cluster) and the crosses Pusa Purple Round x Pusa Purple Cluster (16.12%) and T-3 x Arka Nidhi (12.68%) recorded significant positive heterosis over standard check, which was in conformity with the study of Makani *et al.* (2013), Ansari and Singh (2016), Kalaiyarasi *et al.* (2018) and Mistry *et al.* (2018).

Average fruit weight

The range of heterobeltiosis from -19.78% (Pusa Purple Long x Arka Nidhi) to 36.30% (Pant Samrat x Pusa Purple Cluster) and hybrid Pant Samrat x Pusa Purple Cluster (36.30%) exhibited maximum significant positive heterobeltiosis followed by Pusa Purple Round x Pusa Purple Cluster (27.38%) and Pant Samrat x Arka Nidhi (26.29%) and crosses T-3 x Arka Nidhi (37.21%) showed maximum significant positive standard heterosis followed by Pant Rituraj x Arka Nidhi (22.14) and T-3 x Pusa Purple Cluster (16.65%) for this trait. These findings are in close association with the findings of Reddy and Patel (2014) and Ansari and Singh (2016) were reported the similar results.

Rind Thickness

The magnitude of heterosis over better parent ranged from -16.12% (Pusa Purple Long × Pusa Purple Cluster) to 53.56% (Pusa Purple Round x Pusa Purple Cluster) and six hybrids had significant positive heterosis over better parent. Hybrid Pusa Purple Round x Pusa Purple Cluster (82.08%) exhibited maximum significant positive relative heterosis followed by T-3 x Pusa Purple Cluster (73.02%) and Pant Rituraj x Pusa Purple Cluster (60.90%) for this trait. The magnitude of standard heterosis over check ranged from –32.70% (Pant Samrat x Arka Nidhi) to 61.19% (T-3 x Pusa

Purple Cluster) and the hybrids T-3 x Pusa Purple Cluster (61.19%) showed maximum significant positive standard heterosis followed by Pusa Purple Round x Pusa Purple Cluster (48.47%) and T-3 x Arka Nidhi (32.41%).

Number of fruits per plant

The magnitude of heterosis over better parent ranged from -40.34% in (Pusa Purple Round x Pusa Purple Cluster) to 36.26% in (Pant Samrat x Arka Nidhi). Two hybrids Pant Samrat x Arka Nidhi (36.26%) and Pant Samrat x Pusa Purple Cluster (31.79%) revealed significant positive heterosis over better parent. The hybrid Pant Samrat x Pusa Purple Cluster (46.46%) recorded maximum significant positive relative heterosis followed by Pant Samrat x Arka Nidhi (41.31%) and T-3 x Arka Nidhi (15.62%). The range of standard heterosis over check from -22.25% (Pusa Purple Round x Pusa Purple Cluster) to 71.76% (Pant Samrat x Pusa Purple Cluster) and four hybrids had significant positive standard heterosis over check. These findings are similar with the results of Prabhu (2005), Das *et al.* (2009), Sao and Mehta (2010) and Makani *et al.* (2013)

Total Soluble Solids

The hybrid Pusa Purple Long x Pusa Purple Cluster (26.22%) exhibited maximum significant positive Heterobeltiosis followed by T-3 x Arka Nidhi (21.34%) and Pusa Purple Round x Arka Nidhi (18.39%) and the range of relative heterosis from -11.46% (Pant Rituraj x Pusa Purple Cluster) to 34.69% (T-3 x Arka Nidhi) and the hybrid T-3 x Arka Nidhi (34.69%) revealed maximum significant positive relative heterosis followed by Pusa Purple Long x Pusa Purple Cluster (30.58%) and Pant Samrat x Arka Nidhi (23.59%) respectively. The range of standard heterosis over check was -0.66% (Pant Samrat x Pusa Purple Cluster) to 39.13% (T-3 x Arka Nidhi) and hybrid T-3 x Arka Nidhi (39.13%) recorded maximum significant positive standard heterosis over check followed by Pusa Purple Round x Arka Nidhi (37.48%) and Pant Samrat x Arka Nidhi (34.45%). Similar findings were also reported by Biswas *et al.* (2013) and Vaddoria and Ramani (2015).

Shelf life

Heterosis over better parent ranged from -0.15% (Pusa Purple Round x Arka Nidhi) to 34.00% (Pant Rituraj x Arka Nidhi) and hybrid Pant Rituraj x Arka Nidhi (34.00%) revealed maximum significant positive heterosis over better parent followed by Pusa Purple Long x Arka Nidhi (31.41%) and Pant Rituraj x Pusa Purple Cluster (28.97%). The range of relative heterosis was 0.96% (Pant Samrat x Pusa Purple

Cluster) to 38.64% (Pant Rituraj x Pusa Purple Cluster) and nine hybrids had exhibited significant positive relative heterosis. The range of standard heterosis varied from -2.94% (Pant Samrat x Pusa Purple Cluster) to 24.76% (T-3 x Arka Nidhi) along with eight hybrids recorded significant positive standard heterosis over the standard check.

Yield per plant

The heterobeltiosis ranged from -1.15% (Pant Samrat x Arka Nidhi) to 71.58% (Pusa Purple Round x Pusa Purple Cluster) and hybrid Pusa Purple Round x Pusa Purple Cluster (71.58%) exhibited maximum significant positive heterobeltiosis followed by T-3 x Arka Nidhi (45.99%) and Pant Samrat x Pusa Purple Cluster (44.92%). All the hybrids revealed significant positive relative heterosis for this trait. The hybrid Pant Samrat x Pusa Purple Cluster (104.65 %) showed maximum positive significant standard heterosis over check followed by Pusa Purple Round x Pusa Purple Cluster (83.13%) and T-3 x Arka Nidhi (72.71%). These findings are in close agreement with the findings of Suneetha *et al*. (2008), Sao and Mehta (2011), Biswas *et al*. (2013), Dubey *et al*. (2014), Reddy and Patel (2014), Ansari and Singh (2016), Baraskar *et al*. (2016) and Desai *et al*. (2016).

Yield per plot

The heterosis over better parent varied from -23.04% (Pusa Purple Long x Pusa Purple Cluster) to 39.03% (T-3 x Arka Nidhi) and hybrid T-3 x Arka Nidhi (39.03) recorded maximum significant positive heterosis over better parent followed by Pant Samrat x Pusa Purple Cluster (31.70%) and Pant Rituraj x Arka Nidhi (28.99%). The hybrid T-3 x Arka Nidhi (45.21%) revealed maximum significant positive relative heterosis followed by Pant Samrat x Pusa Purple Cluster (41.14%) and Pant Rituraj x Arka Nidhi (31.47%) and the range standard heterosis varied from -29.10% (Pusa Purple Long x Pusa Purple Cluster) to 40.06% (Pant Samrat x Pusa Purple Cluster) along with hybrid Pant Samrat x Pusa Purple Cluster (40.06%) recorded maximum significant positive standard heterosis over check followed by T-3 x Arka Nidhi (23.74%) and Pant Rituraj x Arka Nidhi (19.30%). Similar findings were also reported by Suneetha *et al*. (2008) and Dubey *et al*. (2014).

Conclusion

On the basis of above results and discussion, it can be concluded that cross Pusa Purple Round x Pusa Purple Cluster exhibited highest heterobeltiosis (71.58%) and relative heterosis (89.46%) for yield per plant and T-3 x Arka Nidhi exhibited highest heterobeltiosis (39.03%) and relative heterosis (45.21%) for yield per plot while, Pant Samrat x Pusa Purple Cluster exhibited highest standard heterosis (104.65% and 40.06%) for yield per plant and yield per plot. The study revealed good scope for isolation of pure lines from the progenies of heterotic F1 hybrids as well as commercial exploitation of heterosis breeding in brinjal.

Table 1: Extent of per cent heterosis for different characters in brinjal

S. No.	Crosses	Days to first flowering			Days to 50% flowering			Days to first harvesting			Plant height (cm)		
		BP	MP	SC	BP	MP	SC	BP	MP	SC	BP	MP	SC
1.	Pant Samrat x Pusa Purple Cluster	12.12**	10.89	1.39	8.07	6.52	0.67	-1.26	-4.29	-11.74**	5.11**	11.49**	18.98**
2.	Pant Samrat x Arka Nidhi	-4.22	-11.96 *	-13.39**	-7.36	-11.20**	-11.20**	12.74**	6.75**	0.77	1.34**	6.06**	14.71**
3	Pusa Purple Round x Pusa Purple Cluster	12.73**	10.10	-0.56	-6.01	-7.75 *	-15.63**	11.32**	10.95**	5.12	6.80**	22.87**	7.06
4.	Pusa Purple Round x Arka Nidhi	6.26	-3.64	-6.27	9.23*	1.13	-1.95	7.62**	4.85 *	1.63	-0.41	15.94**	2.69
5.	Pant Rituraj x Pusa Purple Cluster	8.92	5.79	0.68	16.80**	13.42**	8.80*	12.22**	7.35**	6.68*	10.02**	17.13**	10.28**
6.	Pant Rituraj x Arka Nidhi	-1.73	-5.79	-3.80	-20.24**	-22.39**	-21.28**	10.30**	7.98**	9.66**	4.66**	12.90**	7.92
7.	Pusa Purple Long x Pusa Purple Cluster	14.21**	6.85	5.56	15.65**	9.94**	7.73*	4.98	4.93 *	-0.31	11.05**	17.04**	11.32**
8.	Pusa Purple Long x Arka Nidhi	-7.18	-7.69	-2.38	-4.13	-4.75	-1.43	26.60**	23.70**	20.23**	9.19**	16.62**	12.59**
9.	T-3 x Pusa Purple Cluster	2.24	2.12	-5.50	0.18	-2.87	-6.68	21.20**	14.75**	15.21**	7.11**	9.48**	7.37**
10.	T-3 x Arka Nidhi	12.73**	4.98	4.45	4.08	1.44	3.03	9.87**	6.49**	9.23**	5.91**	9.74**	9.21**

*,** Significant at 5% and 1% level, respectively BP, MP and SC represent heterosis values over Better, mid and standard check, respectively.

Table 1: (*Continued…*)

S. No.	Crosses	Number of primary branches per plant			Fruit length (cm)			Fruit girth (cm)			Average fruit weight (g)		
		BP	MP	SC	BP	MP	SC	BP	MP	SC	BP	MP	SC
1.	Pant Samrat x Pusa Purple Cluster	48.23**	55.65**	62.30**	7.11 *	22.33**	53.99**	29.20**	35.90**	-28.04**	36.30**	39.20**	-5.17
2.	Pant Samrat x Arka Nidhi	8.99 *	9.43 *	19.34**	18.27**	21.79**	70.02**	18.08**	18.31 *	-40.71**	26.29 *	40.20**	-15.79**
3	Pusa Purple Round x Pusa Purple Cluster	0.24	15.28**	-0.70	-9.20 *	0.18	-1.94	14.95**	48.19**	16.12**	27.38**	41.33**	10.43
4.	Pusa Purple Round x Arka Nidhi	-11.12*	6.19	-3.46	-22.44**	-5.87	5.06	7.49	43.79**	8.58	-15.12	5.02	-26.41**
5.	Pant Rituraj x Pusa Purple Cluster	47.84**	66.29**	88.20**	-8.28	-0.02	-0.95	-12.83*	3.97	-28.26**	6.35	29.12**	14.32*
6.	Pant Rituraj x Arka Nidhi	-4.10	3.50	22.09**	-27.44**	-12.87**	-1.71	6.17	32.08**	-12.62*	13.63 *	51.78**	22.14**
7.	Pusa Purple Long x Pusa Purple Cluster	4.62	20.52**	3.62	26.61**	34.81**	55.68**	26.10**	29.02**	-26.43**	6.81	16.84 *	-10.29
8.	Pusa Purple Long x Arka Nidhi	-11.44*	5.97	-3.82	-6.00	-1.46	27.33**	-1.47	6.10	-42.51**	-19.78 *	-1.95	-32.62**
9.	T-3 x Pusa Purple Cluster	17.46**	26.03**	16.35**	-8.03	-4.76	-0.68	16.65**	43.48**	3.80	-0.39	24.97**	16.65**
10.	T-3 x Arka Nidhi	26.39**	41.38**		-23.50**	-12.21**	3.62	26.62**	62.12**	12.68*	17.17**	60.90**	37.21**

*,** Significant at 5% and 1% level, respectively BP, MP and SC represent heterosis values over Better, mid and standard check, respectively.

Table 1: (*Continued…*)

S. No.	Crosses	Rind thickness (mm)			Number of fruits per plant			Total soluble solids (°Brix)		
		BP	MP	SC	BP	MP	SC	BP	MP	SC
1.	Pant Samrat x Pusa Purple Cluster	19.61**	33.29**	-20.58**	31.79**	46.46**	71.76**	-5.90	-4.70	-0.66
2.	Pant Samrat x Arka Nidhi	-8.54	6.53	-32.70**	36.26**	41.31**	52.96**	17.27**	23.59**	34.45**
3	Pusa Purple Round x Pusa Purple Cluster	53.56**	82.08**	48.47**	-40.34**	-29.65**	-22.25**	-2.76	1.86	12.92*
4.	Pusa Purple Round x Arka Nidhi	-15.97**	-4.58	-18.76**	3.56	14.54 *	16.25*	18.39**	19.14**	37.48**
5.	Pant Rituraj x Pusa Purple Cluster	48.55**	60.90**	16.51*	-18.13**	5.24	6.70	-19.43**	-11.46 *	3.74
6.	Pant Rituraj x Arka Nidhi	52.32**	57.17**	19.46**	-16.73 *	1.22	-6.52	-8.97	-3.69	17.21**
7.	Pusa Purple Long x Pusa Purple Cluster	-16.12**	-5.58	-28.30**	-23.60**	-8.07	-0.43	26.22**	30.58**	33.27**
8.	Pusa Purple Long x Arka Nidhi	-12.75 *	-6.24	-25.44**	-1.80	11.05	10.24	-7.99	-1.03	5.50
9.	T-3 x Pusa Purple Cluster	34.41**	73.02**	61.19**	-29.22**	-16.78 *	-7.76	8.16	15.64**	14.19*
10.	T-3 x Arka Nidhi	10.42 *	36.85**	32.41**	4.85	15.62 *	17.70*	21.34**	34.69**	39.13**

*,** Significant at 5% and 1% level, respectively BP, MP and SC represent heterosis values over Better, mid and standard check, respectively.

Table 1: (*Continued…*)

S. No.	Crosses	Shelf life			Yield per plant (Kg)			Yield per plot (Kg)		
		BP	MP	SC	BP	MP	SC	BP	MP	SC
1.	Pant Samrat x Pusa Purple Cluster	0.07	0.96	-2.94	44.92**	79.67**	104.65**	31.70**	41.14**	40.06**
2.	Pant Samrat x Arka Nidhi	21.42**	27.86**	17.76**	-1.15	29.54**	39.58**	2.43	11.52**	8.93*
3	Pusa Purple Round x Pusa Purple Cluster	3.96	12.39**	16.53**	71.58**	89.46**	83.13**	6.77	17.89**	-1.64
4.	Pusa Purple Round x Arka Nidhi	-0.15	12.31**	11.92**	14.97**	35.55**	22.71**	0.70	9.47**	-10.38*
5.	Pant Rituraj x Pusa Purple Cluster	28.97**	38.64**	22.89**	16.63**	33.33**	34.72**	14.10**	14.33**	5.53
6.	Pant Rituraj x Arka Nidhi	34.00**	38.14**	16.87**	-0.20	21.46**	15.28**	28.99**	31.47**	19.30**
7.	Pusa Purple Long x Pusa Purple Cluster	5.16	8.25**	0.20	16.84 *	33.03**	1.18	-23.04**	-8.60 *	-29.01**
8.	Pusa Purple Long x Arka Nidhi	31.41**	33.36**	18.07**	17.13 *	24.50**	-12.99**	-13.53**	1.25	-23.03**
9.	T-3 x Pusa Purple Cluster	0.20	11.43**	19.58**	21.72**	40.56**	43.96**	10.59**	17.41**	1.88
10.	T-3 x Arka Nidhi	4.55	20.81**	24.76**	45.99**	79.33**	72.71**	39.03**	45.21**	23.74**

*,** Significant at 5% and 1% level, respectively BP, MP and SC represent heterosis values over Better, mid and standard check, respectively.

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