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Mohit Lal
Ph.D., Research Scholar, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Parades, India

CN Ram
Associate Professor, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Parades, India

Shiva Nath
Associate Professor, Department of Genetics and Plant Breeding, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Parades, India

Satish Kumar Gautam
Ph.D., Research Scholar, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Parades, India

Corresponding Author:
Mohit Lal
Ph.D., Research Scholar, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya, Uttar Parades, India

Estimation of heterosis in Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] for growth and earliness

Mohit Lal, CN Ram, Shiva Nath and Satish Kumar Gautam

Abstract
Twenty-seven F_1's developed from a line x tester involving twelve parents (check variety) in bottle gourd were evaluated in randomized block design with three replications during *Zaid* 2019 and 2020 at the Main Experiment Station, Achayra Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya. These studies were aimed to study the extent of heterosis over better parent and standard check Pusa Naveen. Analysis of variance indicated presence of considerable variability among genotypes all the characters under study. The exploitation of heterosis requires an intensive evaluation of germplasm to find out diverse donors with high nicking of genes and further identification of heterotic crosses. The cross combination BG132 x BG 619, N. Pooja sel-1 x N. Rashmi, BG 7 x N. Rashmi and Pb round x BG 619 were showed highly positive significant heterosis over standard check for fruit yield per plant, whereas, crosses BG 38-1 x N. Rashmi, BG132 x BG 0-2 and BG 7 x BG 0-2, for node number to first male flower anthesis and BG 7 x BG 0-2, BG132 x N. Rashmi and N. Pooja sel-1 x BG 0-2 showed significant negative heterosis over standard check for earliness.

Keywords: Heterosis, hybrids, bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

Introduction
Bottle gourd (*Lagenaria siceraria* (Mol.) Standl., 2n =2x= 22] is an important cultivated annual cucurbitaceous crop grown throughout the country. The wild forms are native to the northern part of Africa. Being warm season vegetable crop it thrives well in warm and humid climate but at present it's off season cultivation has progressively stretched throughout the year in northern Indian plains. According to De Candolle (1882) [2], bottle gourd has been found in wild form in South Africa and India. However, Cutler and Whitaker (1961) [3] are of the view that probably it is indigenous to tropical Africa on the basis of variability in seeds and fruits. A decoction made from the leaf is a very good medicine for jaundice. The fruit has cooling effect, it is a cardiotonic and diuretic, good for people suffering from biliousness, indigestion and convalescences *i.e.*, regain health after illness. The pulp is good for overcoming constipation, cough and night blindness and as an antidote against certain poisons. It is highly cross pollinated because of monoecious sex form and exhibits large amount of variation for its quantitative and qualitative traits. This crop is well suited for improvement through inbreeding followed by selection without significant loss in vigour.

Materials and Methods
The experimental materials comprised of twelve parents *viz.* NDBG 63, NDBG 65, NDBG 83, N. Pooja, BG 132, N. Pooja sel-1, BG 16, BG 18, Punjab Komal, Pusa Naveen, BG 169 and N. Rashmi. The crosses were made in line x tester fashion including check, during *Zaid* 2019 and 2020. The twenty-seven F1 hybrids along with their twelve parents including check Pusa Naveen were evaluated in randomized block design with three replications. The observations were recorded on seventeen characters in quantitative and two qualitative parameters. The experiment was move around at Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya. Geographically, experimental site falls under humid, sub-tropical climate and is located in between 24.47^0 and 26.56^0 N latitude and 82.12^0 and 83.98^0 E longitude at an altitude of 113m above the mean sea level in the Gangetic Alluvial Plains of Eastern Uttar Pradesh. The soil type of experimental site was sandy loam with average fertility level and pH in the range of 7.5-8.5. This area falls under the humid subtropical zone and received average annual precipitation of about 1200 mm. The maximum rainfall received during the period between March to the end of July. Sometimes, continuous cloudy weather with heavy rains for longer

period drastically affects the agricultural production. However, occasional showers are also very common in the month of mid-July to September. The winter months are usually cool and dry. The summer is hot and dry, western hot winds, start from April and end at onset of monsoon. The seedlings of all the parental genotypes and developed F_1's along with parents were brought up in the raised direct in field. Recommended cultural practices and appropriate plant protection measures were also taken up prior and after sowing of the seeds. Observations were recorded on five plants in each of parents and F_1s for each treatment in each replication, selected randomly for the following characters. The observations recorded on the five plants were averaged and got mean value. Magnitudes of heterosis were calculated as percentage of F_1 performance in favourable direction over better parent and standard check Pusa Naveen.

Result and Discussion

Significant differences were observed among hybrids for all the characters. The range of heterosis by F1's over their better parent and standard check Pusa Naveen and superior crosses based on estimates of heterobeltiosis and standard heterosis are presented in Table 1. The negative estimate of heterosis were considard desirable for earliness days to first male flower anthesis, days to first female flower anthesis, node number to first male flower appearance, node number to first female flower appearance and days to first fruit harvest whereas for remaining twelve characters, positive estimates of heterosis were considered favourable.

The extent and magnitude of heterosis differed for different traits and over seasons in various hybrid combinations. In case of total fruit yield per plant, in Y_1 the heterobeltiosis ranged from –14.76 (L_1xT_3) to 40.49 per cent (L_6xT_3) and standard heterosis from -15.04 (L_4xT_3) to 24.63 per cent (L_6xT_3), in Y_2, over better parent ranged from -18.59 (L_4xT_3) to 20.90 per cent (L_5xT_2) and standard variety ranged from -6.30 (L_1xT_3) to 35.30 per cent (L_5xT_2) and in pooled, over better parent ranged from -14.71 (L_1xT_3) to 26.22 per cent (L_5xT_2) and standard parent ranged from -10.43 (L_1xT_3) to 25.94 per cent (L_5xT_2). Out of twenty seven crosses, one cross showed positive and significant heterosis over better parent and standard variety for fruit yield per plant in both the years and over pooled. In Y_1, five crosses L_1 x T_1 (19.01 and 19.01), L_5 x T_2 (33.36 and 16.17), L_6 x T_3 (40.14 and 24.63), L_9 x T_2 (36.81 and 19.18) and L_9 x T_3 (28.24 and 14.49) were exhibited positive and highly significant heterbeltiosis and standard heterosis, respectively. In Y_2, three crosses L_2 x T_3 (17.80 and 31.03), L_5 x T_2 (20.90 and 35.30) and L_7 x T_3 (18.53 and 31.84) whereas, in pooled, eleven crosses L_1 x T_1 (13.05 and 18.72), L_2 x T_3 (13.47 and 20.83), L_3 x T_2 (13.29 and 13.04), L_4 x T_1 (16.72 and 18.70), L_5 x T_2 (26.22 and 25.94), L_6 x T_2 (11.95 and 11.71), L_6 x T_3 (24.66 and 25.08), L_7 x T_3 (18.66 and 19.06), L_8 x T_3 (10.64 and 11.01), L_5 x T_2 (20.13 and 19.86) and L_9 x T_3 (11.86 and 12.23) were exhibited positive and highly significant heterbeltiosis and standard heterosis respectively. The similar results were proposed by Kushwaha and Ram (2002) [7], Khot *et al*. (2018) [6] and Mishra *et al*. (2019) [8].

For days to first male flower anthesis, negative heterosis is desirable. Since hybrids with heterosis for earliness produce first fruit earlier as compared to parents, thereby increasing their productivity per day per unit area and as a consequence fetch good prices in the market by early supply of produce. A close examination of heterosis value of days to first male flower anthesis revealed that five F_1 hybrids exhibited significant and desirable heterobeltiosis and standard heterosis in respect to better and standard parent Y_1, Y_2 and pooled respectively. Only one hybrid exhibited significant and desirable heterobeltiosis and standard heterosis in respect to better and standard parent both the seasons and pooled for days to first female flower anthesis. However, six, two and eight crosses in both the seasons and pooled showed highly significant heterosis in desirable direction in Y_1, Y_2 and pooled, respectively. The similar result was found by Adarsh *et al*. (2017) [1], Mishra *et al*. (2019) [8], Jayanth *et al*. (2019) [4, 5].

Table 1: Estimates of heterosis (%) over better parent (BP) and standard variety (SV) Pusa Naveen over two years (Y_1, Y_2) and pooled

S. No.	Crosses	Days to male flower anthesis						Days to female flower anthesis					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	$L_1 \times T_1$	-6.77	-6.77	-7.14 *	-12.75 **	-6.96 *	-9.93 **	-4.55	-11.89 **	5.38	5.38	0.38	-3.66
2	$L_1 \times T_2$	-3.1	-6.02	-2.92	-10.74 **	-3.01	-8.51 **	11.57 **	-5.59	-1.39	9.23 **	4.53 *	1.47
3	$L_1 \times T_3$	-5.26	-5.26	-3.57	-9.40 **	-4.40	-7.45 **	3.88	-6.29 *	1.36	14.62 **	1.43	3.66
4	$L_2 \times T_1$	-12.86 **	-8.27	-13.01 **	-14.77 **	-12.94 **	-11.70 **	-1.52	-9.09 **	6.92 *	6.92 *	2.67	-1.47
5	$L_2 \times T_2$	1.55	-1.5	-1.46	-9.40 **	0.01	-5.67 *	18.18 **	0.02	2.08	13.08 **	9.43 **	6.23 **
6	$L_2 \times T_3$	-3.70	-2.26	-0.70	-5.37	-2.17	-3.90	13.18 **	2.10	2.70	16.92 **	6.81 **	9.16 **
7	$L_3 \times T_1$	-11.89 *	-5.26	-15.44 **	-15.44 **	-13.70 **	-10.64 **	-20.45 **	-26.57 **	-0.77	-0.77	-10.69 **	-14.29 **
8	$L_3 \times T_2$	4.65	1.5	1.46	-6.71 *	3.01	-2.84	14.05 **	-3.50	2.78	13.85 **	7.92 **	4.76 *
9	$L_3 \times T_3$	-15.56 **	-14.29 **	-16.90 **	-20.81 **	-16.25 **	-17.73 **	-6.98 *	-16.08 **	-17.33 **	-4.62	-12.54 **	-10.62 **
10	$L_4 \times T_1$	-8.33	-9.02	-6.52	-13.42 **	-7.41 **	-11.35 **	-21.97 **	-27.97 **	5.38	5.38	-8.40 **	-12.09 **
11	$L_4 \times T_2$	-4.65	-7.52	-8.76 *	-16.11 **	-6.77 *	-12.06 **	-16.53 **	-29.37 **	-7.64 **	2.31	-11.70 **	-14.29 **
12	$L_4 \times T_3$	-9.85 *	-10.53 *	-17.39 **	-23.49 **	-13.70 **	-17.38 **	-4.65	-13.99 **	-15.86 **	-6.15	-11.55 **	-10.26 **
13	$L_5 \times T_1$	-18.25 **	-15.79 **	-15.38 **	-18.79 **	-16.79 **	-17.38 **	-16.00 **	-26.57 **	-6.92 *	-6.92 *	-13.74 **	-17.22 **
14	$L_5 \times T_2$	0.002	-3.01	-2.92	-10.74 **	-1.50	-7.09 **	14.88 **	-2.80	-2.78	7.69 *	5.28 *	2.2
15	$L_5 \times T_3$	-5.19	-3.76	-16.20 **	-20.13 **	-10.83 **	-12.41 **	8.00 *	-5.59	-20.00 **	-7.69 *	-7.94 **	-6.59 **
16	$L_6 \times T_1$	-15.63 **	-18.80 **	-7.46 *	-16.78 **	-11.45 **	-17.73 **	-16.39 **	-28.67 **	4.62	4.62	-8.11 **	-12.82 **
17	$L_6 \times T_2$	-0.78	-4.51	-2.24	-12.08 **	-1.53	-8.51 **	17.36 **	-0.70	-5.84	-0.77	4.63 *	-0.73
18	$L_6 \times T_3$	-3.13	-6.77	-8.21 *	-17.45 **	-5.73 *	-12.41 **	9.84 **	-6.29 *	-8.03 **	-3.08	0.39	-4.76 *
19	$L_7 \times T_1$	-25.00 **	-21.05 **	-15.86 **	-18.12 **	-20.35 **	-19.50 **	14.17 **	-4.20	-1.54	-1.54	1.15	-2.93
20	$L_7 \times T_2$	-1.55	-4.51	-0.73	-8.72 **	-1.13	-6.74 *	20.83 **	1.4	-13.89 **	-4.62	1.51	-1.47
21	$L_7 \times T_3$	-10.37 *	-9.02	-7.04 *	-11.41 **	-8.66 **	-10.28 **	9.17 *	-8.39 **	-9.33 **	4.62	-2.55	-2.2
22	$L_8 \times T_1$	-13.29 **	-6.77	-20.13 **	-20.13 **	-16.78 **	-13.83 **	12.90 **	-2.10	-2.31	-2.31	1.91	-2.2
23	$L_8 \times T_2$	0.001	-3.01	-1.46	-9.40 **	-0.75	-6.38 *	16.53 **	-1.40	-2.78	7.69 *	6.04 **	2.93
24	$L_8 \times T_3$	-12.59 *	-11.28 *	-1.41	-6.04	-6.86 *	-8.51 **	9.68 **	-4.90	-8.67 **	5.38	-2.15	0.03
25	$L_9 \times T_1$	-12.30 *	-19.55 **	-0.78	-14.77 **	-6.40 *	-17.02 **	5.34	-3.50	11.54 **	11.54 **	8.02 **	3.66

26	L_9×T_2	-10.66 *	-18.05 **	7.03	-8.05 *	-1.60	-12.77 **	7.44 *	-9.09 **	-5.80	0.04	-1.89	-4.76 *
27	L_9×T_3	-4.10	-12.03 *	1.56	-12.75 **	-1.20	-12.41 **	-2.33	-11.89 **	4.35	10.77 **	0.37	-1.1
No. of crosses with significant +ve heterosis		0	0	0	0	0	0	15	0	2	10	8	3
No. of crosses with significant –ve heterosis		12	9	13	25	16	25	6	14	9	2	8	10
Range		-25.00 to 4.65	-21.05 to 1.05	-20.13 to 7.03	-23.49 to -5.37	-20.35 to 3.01	-19.50 to -2.84	-21.97 to 20.83	-29.37 to 2.10	-20.00 to 11.54	-7.69 to 16.92	-13.74 to 9.43	-17.22 to 9.16
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Node number to first male flower appearance						Node number to first female flower appearance					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	L_1×T_1	8.40	8.40	7.45	6.32	7.89 *	7.29 *	13.73 **	2.65	11.70 **	11.70 **	12.65 **	7.20 **
2	L_1×T_2	15.90 **	6.40	11.19	4.56	13.37 **	5.42	2.71	0.59	2.45	10.23 **	2.57	5.43 **
3	L_1×T_3	9.13 *	5.20	4.98	3.51	6.90	4.30	-1.55	-6.49 *	0.28	3.22	-0.59	-1.62
4	L_2×T_1	8.10	6.80	7.17	4.91	7.60 *	5.79	6.21	-4.13	4.68	4.68	5.40 **	0.29
5	L_2×T_2	21.57 **	11.60 **	16.04 **	9.12	18.59 **	10.28 **	7.72 *	-1.18	6.92 *	8.48 *	7.29 **	3.67 *
6	L_2×T_3	-22.82 **	-25.60 **	13.98 *	11.58 *	-3.45	-5.79	12.86 **	3.54	-21.33 **	-20.18 **	-5.17 **	-8.37 **
7	L_3×T_1	25.86 **	16.80 **	22.73 **	13.68 *	24.19 **	15.14 **	-21.90 **	-29.50 **	3.51	3.51	-8.49 **	-12.92 **
8	L_3×T_2	24.18 **	14.00 **	-17.05 **	-23.16 **	1.61	-5.79	17.14 **	8.85 **	-23.93 **	-21.93 **	-4.50 **	-6.61 **
9	L_3×T_3	-14.78 **	-20.92 **	7.20	-0.70	-3.08	-10.15 **	22.86 **	14.16 **	20.51 **	23.68 **	21.62 **	18.94 **
10	L_4×T_1	1.22	-0.40	2.16	-0.35	1.72	-0.37	-24.51 **	-31.86 **	6.14	6.14	-8.33 **	-12.78 **
11	L_4×T_2	25.05 **	14.80 **	-17.16 **	-22.11 **	2.31	-4.86	14.46 **	12.09 **	-26.63 **	-21.05 **	-7.14 **	-4.55 **
12	L_4×T_3	15.35 **	11.20 *	11.51 *	8.77	12.64 **	9.91 **	-29.19 **	-32.74 **	0.85	3.8	-13.50 **	-14.39 **
13	L_5×T_1	-21.98 **	-24.48 **	14.23 *	9.82	-2.75	-6.21	4.90	-5.31	-24.56 **	-24.56 **	-10.65 **	-14.98 **
14	L_5×T_2	18.95 **	9.20 *	-18.84 **	-23.68 **	-1.41	-8.32 *	16.03 **	6.78 *	14.37 **	16.37 **	15.15 **	11.60 **
15	L_5×T_3	-21.08 **	-23.92 **	9.49	5.26	-5.00	-8.37 *	-27.56 **	-33.33 **	8.62 **	10.53 **	-8.48 **	-11.31 **
16	L_6×T_1	26.07 **	18.00 **	22.93 **	14.74 **	24.40 **	16.26 **	1.31	-8.55 **	-22.81 **	-22.81 **	-11.42 **	-15.71 **
17	L_6×T_2	5.88	-2.80	-18.68 **	-24.11 **	-7.68 *	-14.15 **	8.28 *	0.29	7.43 *	9.94 **	7.83 **	5.14 **
18	L_6×T_3	-17.82 **	-23.08 **	2.26	-4.56	-7.14	-13.21 **	-25.48 **	-30.97 **	20.57 **	23.39 **	-1.20	-3.67 *
19	L_7×T_1	13.52 **	10.80 *	-18.48 **	-21.05 **	-3.46	-6.17	6.54	-3.83	5.85	5.85	6.17 **	1.03
20	L_7×T_2	11.11 *	2.00	7.09	0.70	8.94 *	1.31	-0.90	-2.95	-1.90	5.56	-1.43	1.32
21	L_7×T_3	7.47	3.60	2.17	-1.05	4.04	1.12	7.76 *	2.36	7.67 *	10.82 **	7.72 **	6.61 **
22	L_8×T_1	14.29 **	8.80 *	12.59 *	6.67	13.39 **	7.66 *	7.52 *	-2.95	6.73 *	6.73 *	7.10 **	1.91
23	L_8×T_2	25.49 **	15.20 **	19.40 **	12.28 *	22.21 **	13.64 **	19.81 **	10.62 **	17.77 **	20.18 **	18.73 **	15.42 **
24	L_8×T_3	23.11 **	17.20 **	21.48 **	15.09 **	22.24 **	16.07 **	9.58 **	1.18	9.74 **	11.99 **	9.67 **	6.61 **
25	L_9×T_1	14.47 **	7.60	12.73 *	5.61	13.55 **	6.54	14.83 **	-1.77	12.27 **	7.02 *	13.47 **	2.64
26	L_9×T_2	6.75	-2.00	3.75	-2.81	4.92	-2.43	16.55 **	-0.29	13.50 **	8.19 *	14.94 **	3.96 *
27	L_9×T_3	2.13	-4.00	7.12	0.35	4.78	-1.68	9.66 **	-6.19 *	9.20 **	4.09	9.42 **	-1.03
No. of crosses with significant +ve heterosis		15	11	10	5	12	8	15	7	14	14	14	9
No. of crosses with significant –ve heterosis		5	5	5	5	1	5	5	5	5	5	9	11
Range		-22.82 to 26.07	-25.60 to 18.00	-18.84 to 22.93	-24.11 to 15.09	-7.68 to 24.40	-14.15 to 16.26	-29.19 to 22.86	-33.33 to 14.16	-26.63 to 20.57	-24.56 to 23.68	-13.50 to 21.62	-15.71 to 18.94
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Days to first harvest						Vine length (m)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	L_1×T_1	-4.12	-4.12	-4.05	-5.68	-4.08	-4.91 *	-12.85 *	-12.85 *	-10.95	11.12	-11.82 **	-1.23
2	L_1×T_2	13.29 **	5.29	15.92 **	3.41	14.60 **	4.34	-12.47 *	-12.47 *	-11.49	10.45	-11.94 **	-1.36
3	L_1×T_3	6.63	4.12	2.96	-1.14	4.78 *	1.45	-24.24 **	-24.24 **	-20.67 **	-1	-22.31 **	-12.98 **
4	L_2×T_1	-0.62	-5.29	3.03	-3.41	1.22	-4.34	23.83 **	-1.51	19.57 *	23.17 **	21.49 **	10.45 *
5	L_2×T_2	14.56 **	6.47	16.56 **	3.98	15.56 **	5.20 *	-6.26	-18.89 **	-5.04	4.69	-5.6	-7.47
6	L_2×T_3	11.11 **	5.88	11.52 **	4.55	11.31 **	5.20 *	-38.24 **	-39.99 **	-5.45	15.14	-20.50 **	-13.27 **
7	L_3×T_1	-21.51 **	-20.59 **	-2.86	-3.41	-12.10 **	-11.85 **	3.85	-20.15 **	-20.52 **	-20.36 *	-9.57	-20.25 **
8	L_3×T_2	8.86 *	1.18	-12.10 **	-21.59 **	-1.59	-10.40 **	-1.31	-14.61 *	-0.91	9.24	-1.09	-3.05
9	L_3×T_3	-19.88 **	-21.76 **	1.18	-2.84	-9.25 **	-12.14 **	-38.63 **	-40.37 **	4.79	27.60 **	-15.14 **	-7.43
10	L_4×T_1	-4.62	-2.94	-19.19 **	-21.02 **	-11.88 **	-12.14 **	4.3	-9.95	-28.07 **	-20.70 **	-13.36 **	-15.16 **
11	L_4×T_2	6.96	-0.59	12.74 **	0.57	9.84 **	0.00	-31.22 **	-40.49 **	0.06	10.31	-14.17 **	-15.87 **
12	L_4×T_3	-20.48 **	-22.35 **	-4.73	-8.52 **	-12.54 **	-15.32 **	-10.82	-13.35 *	-36.19 **	-22.30 **	-24.55 **	-17.69 **
13	L_5×T_1	-10.92 **	-8.82 *	-22.16 **	-22.16 **	-16.57 **	-15.61 **	8.26	-9.26	6.85	14.94	7.49	2.47
14	L_5×T_2	-13.29 **	-19.41 **	17.83 **	5.11	2.22	-6.94 **	-5.39	-18.14 **	-33.90 **	-27.13 **	-20.93 **	-22.49 **
15	L_5×T_3	9.64 *	7.06	-20.12 **	-23.30 **	-5.37 *	-8.38 **	-5.18	-7.87	-4.40	16.41 *	-4.76	3.89
16	L_6×T_1	11.04 *	0.59	8.92 *	-2.84	9.97 **	-1.16	-31.02 **	-39.80 **	16.13 *	29.20 **	-5.32	-6.36

17	L6×T2	-14.94 **	-22.94 **	17.20 **	4.55	1.29	-8.96 **	-15.01 *	-25.82 **	-30.76 **	-22.97 **	-23.60 **	-24.44 **
18	L6×T3	3.9	-5.88	-15.92 **	-25.00 **	-6.11 *	-15.61 **	-20.22 **	-22.48 **	-17.16 **	0.87	-18.57 **	-11.17 *
19	L7×T1	-2.87	-0.59	1.14	1.14	-0.86	0.29	-31.04 **	-40.68 **	7.62	18.29 *	-9.94	-12.11 *
20	L7×T2	15.82 **	7.65 *	14.01 **	1.70	14.92 **	4.62 *	12.88	-2.33	10.94	22.30 **	11.82 *	9.61
21	L7×T3	10.84 **	8.24 *	2.37	-1.70	6.57 **	3.18	-18.60 **	-20.91 **	-15.79 *	2.55	-17.08 **	-9.54
22	L8×T1	13.33 **	10.00 *	8.33 *	3.41	10.81 **	6.65 **	0.95	-13.04 *	0.49	10.72	0.70	-1.53
23	L8×T2	17.09 **	8.82 *	14.01 **	1.70	15.56 **	5.20 *	-7.13	-19.65 **	-5.77	3.88	-6.39	-8.24
24	L8×T3	12.73 **	9.41 *	2.38	-2.27	7.51 **	3.47	-11.08	-13.60 *	-8.25	11.72	-9.55 *	-1.33
25	L9×T1	8.05 *	10.59 **	2.27	2.27	5.14 *	6.36 **	18.11 *	-9.63	14.53	14.53	16.14 **	2.08
26	L9×T2	20.25 **	11.76 **	10.83 **	-1.14	15.56 **	5.20 *	-1.02	-14.36 *	-0.67	9.51	-0.83	-2.79
27	L9×T3	5.42	2.94	-2.96	-6.82 *	1.19	-2.02	-13.09 *	-15.55 *	-11.11	8.24	-12.02 **	-4.02
No. of crosses with significant +ve heterosis		13	7	11	0	13	11	2	0	2	6	3	1
No. of crosses with significant –ve heterosis		6	6	5	7	7	7	12	21	8	5	14	10
Range		-21.51 to 20.25	-22.94 to 11.76	- 22.16 to 17.83	-25.00 to 5.11	-16.57 to 15.56	-15.61 to 6.65	-38.63 to 23.83	-40.49 to -2.33	-36.19 to 19.57	-27.13 to 29.20	-24.55 to 21.49	-24.44 to 10.45
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Primary branches per plant						Fruits length (cm)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	L1×T1	-17.53 **	-17.53 **	-16.47 **	-9.27	-16.98 **	-13.44 **	0.93	0.93	0.87	9.55	0.9	5.2
2	L1×T2	-8.42	-8.42	-8.01	-0.07	-8.21 *	-4.29	6.00	6.00	5.63	14.71 *	5.81	10.32 *
3	L1×T3	-29.91 **	-24.35 **	-28.22 **	-16.22 **	-29.04 **	-20.33 **	4.5	4.5	4.22	13.19 *	4.36	8.81 *
4	L2×T1	-36.25 **	-26.61 **	-34.33 **	-18.53 **	-35.27 **	-22.61 **	13.79 *	6.14	12.87 *	14.85 *	13.31 **	10.46 *
5	L2×T2	-26.40 **	-15.27 *	-25.01 **	-6.96	-25.69 **	-11.16 **	20.02 **	14.88 *	18.71 **	23.75 **	19.34 **	19.28 **
6	L2×T3	2.60	18.12 **	2.46	27.12 **	2.53	22.58 **	-13.87 *	-19.66 **	-12.94 *	-11.41 *	-13.39 **	-15.57 **
7	L3×T1	-4.15	1.22	-3.91	9.87	-4.03	5.50	-1.33	-5.45	-1.24	3.05	-1.29	-1.24
8	L3×T2	8.53	14.61 *	8.04	23.54 **	8.28 **	19.03 **	7.74	3.24	7.23	11.90 *	7.48	7.53
9	L3×T3	-1.58	6.23	-2.19	14.16 *	-1.89	10.15 **	4.00	-0.34	3.74	8.25	3.87	3.92
10	L4×T1	0.17	19.51 **	0.72	29.25 **	0.45	24.33 **	20.39 **	17.29 **	19.08 **	26.20 **	19.71 **	21.70 **
11	L4×T2	-15.71 **	0.56	-11.12 **	14.06 *	-13.36 **	7.24 *	12.15 *	9.26	11.37 *	18.03 **	11.75 **	13.61 **
12	L4×T3	5.80	26.23 **	6.01	36.03 **	5.90 *	31.08 **	9.72	6.89	9.1	15.62 **	9.40 *	11.22 **
13	L5×T1	-15.83 **	-15.69 **	-14.75 **	-7.24	-15.27 **	-11.51 **	10.14	3.3	9.47	11.96 *	9.79 *	7.59
14	L5×T2	7.92	8.10	9.76	19.42 **	8.86 **	13.70 **	16.12 *	11.15	15.07 **	19.95 **	15.57 **	15.51 **
15	L5×T3	-20.37 **	-14.05 *	-22.26 **	-9.27	-21.34 **	-11.68 **	7.22	0.56	6.74	9.17	6.97	4.82
16	L6×T1	-27.30 **	-8.31	-23.43 **	3.59	-25.32 **	-2.42	3.01	-4.06	2.8	4.47	2.9	0.17
17	L6×T2	-39.88 **	-24.17 **	-34.87 **	-11.89 *	-37.31 **	-18.10 **	16.47 **	11.48	15.39 **	20.29 **	15.91 **	15.85 **
18	L6×T3	-41.67 **	-26.43 **	-39.44 **	-18.07 **	-40.53 **	-22.29 **	11.06	3.44	10.32	12.11 *	10.68 *	7.74
19	L7×T1	-7.18	-15.03 *	-5.18	-5.18	-6.15	-10.15 **	11.3	4.82	10.55	13.51 *	10.91 **	9.13 *
20	L7×T2	42.65 **	19.83 **	39.65 **	28.90 **	41.10 **	24.31 **	23.83 **	18.53 **	22.27 **	27.46 **	23.03 **	22.96 **
21	L7×T3	-5.99	1.46	-6.39	9.27	-6.20 *	5.32	16.71 **	9.91	15.60 **	18.70 **	16.14 **	14.27 **
22	L8×T1	25.91 **	15.27 *	24.78 **	24.78 **	25.33 **	19.98 **	-7.56	-11.58	-7.06	-3.19	-7.3	-7.42
23	L8×T2	25.80 **	5.67	24.77 **	15.16 **	25.26 **	10.37 **	35.44 **	29.64 **	33.13 **	38.78 **	34.24 **	34.17 **
24	L8×T3	10.86 *	19.65 **	11.28 *	29.89 **	11.08 **	24.72 **	17.48 **	12.36 *	16.34 **	21.19 **	16.89 **	16.74 **
25	L9×T1	9.76	0.49	12.28 *	12.28 *	11.07 **	6.32	-27.12 **	-29.01 **	-25.38 **	-20.93 **	-26.22 **	-25.00 **
26	L9×T2	44.91 **	26.37 **	41.94 **	35.64 **	43.37 **	30.96 **	-16.76 **	-18.92 **	-15.69 **	-10.66	-16.21 **	-14.83 **
27	L9×T3	-18.92 **	-12.49 *	-17.76 **	-4.01	-18.32 **	-8.29 *	-18.52 **	-20.63 **	-17.33 **	-12.40 *	-17.91 **	-16.56 **
No. of crosses with significant +ve heterosis		5	8	6	13	9	12	10	5	10	17	14	14
No. of crosses with significant –ve heterosis		11	10	11	4	13	10	4	4	4	3	4	4
Range		-41.67 to 44.91	-26.61 to 26.37	-39.44 to 41.94	-18.53 to 36.03	-40.53 to 43.37	-22.61 to 31.08	-27.12 To 35.44	-29.01 to 29.64	-25.38 to 33.13	-20.93 to 38.78	-26.22 to 34.24	-25.00 to 34.17
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Fruit Circumferance (cm)						Average fruit weight (kg)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	L1×T1	7.01	8.97	6.34	6.34	6.66	7.58	-7.8	-7.8	-2.42	-2.42	-2.89	-4.82
2	L1×T2	-1.16	5.02	-1.05	2.84	-1.1	3.87	-12.86 *	3.39	-9.69	6.18	-10.94 *	4.96
3	L1×T3	-3.77	3.09	-3.43	1.12	-3.59	2.04	-13.99 *	-2.03	-9.52	2.52	-11.47 *	0.57
4	L2×T1	0.55	6.70	2.76	6.67	1.71	6.68	-7.38	-6.44	-6.26	-2.41	-6.62	-4.11
5	L2×T2	6.35	13.00	5.76	9.92	6.04	11.36	-11.43	5.08	-8.33	7.79	-9.62 *	6.52

6	L_2×T_3	8.69	16.44 *	7.89	12.97	8.27	14.60 *	-2.38	11.19	-1.70	11.38	-2.12	11.19 *
7	L_3×T_1	-4.85	2.55	-4.40	0.64	-4.61	1.54	-18.90 **	-5.42	-8.86	5.05	-13.10 **	0.57
8	L_3×T_2	-0.51	7.22	-0.47	4.79	-0.49	5.93	-16.86 **	-1.36	-9.38	6.55	-12.50 **	3.12
9	L_3×T_3	-2.34	5.25	-2.12	3.04	-2.23	4.08	-12.21	2.37	-6.67	7.58	-9.06	5.24
10	L_4×T_1	15.09 *	17.19 *	13.64	13.64	14.33 *	15.31 *	-16.09 **	6.10	-10.89	8.99	-13.04 **	7.65
11	L_4×T_2	6.03	12.66	5.47	9.62	5.74	11.05	-16.62 **	5.42	-16.79 **	1.77	-16.59 **	3.26
12	L_4×T_3	1.52	8.76	1.38	6.15	1.45	7.38	-13.40 *	9.49	-9.61	10.55	-11.21 *	9.92
13	L_5×T_1	-9.96	-5.12	-9.03	-6.16	-9.47	-5.67	-22.41 **	-8.47	-14.74 *	-0.86	-18.06 **	-4.25
14	L_5×T_2	-5.33	0.58	-4.84	-1.10	-5.08	-0.31	-6.29	11.19	-4.04	12.82	-4.93	12.04 *
15	L_5×T_3	-13.36	-7.19	-12.14	-8.01	-12.72 *	-7.62	-29.89 **	-17.29 *	-22.00 **	-9.30	-25.33 **	-12.75 *
16	L_6×T_1	-4.34	0.18	-3.94	-1.46	-4.13	-0.69	-6.11	14.58	-2.04	16.82 *	-3.77	15.72 **
17	L_6×T_2	5.29	11.87	4.80	8.92	5.04	10.31	-21.39 **	-4.07	-7.73	10.04	-13.55 **	3.97
18	L_6×T_3	-4.7	2.09	-4.27	0.23	-4.48	1.11	-10.83	8.81	-6.30	11.75	-8.24	10.34
19	L_7×T_1	0.36	8.20	0.32	5.66	0.34	6.86	11.62	7.46	17.70 *	18.24 *	15.23 **	13.60 *
20	L_7×T_2	-2.21	5.44	-2.01	3.21	-2.10	4.26	-6.00	11.53	-3.11	13.92	-4.33	12.75 *
21	L_7×T_3	-0.51	7.27	-0.47	4.83	-0.49	5.97	5.65	20.34 **	6.11	20.24 **	5.74	20.11 **
22	L_8×T_1	36.34 **	51.21 **	49.50 **	61.55 **	43.23 **	56.69 **	15.61 *	17.97 *	15.55 *	21.26 **	15.44 **	19.69 **
23	L_8×T_2	-7.91	2.14	-7.26	0.22	-7.57	1.12	2.00	21.02 **	4.75	23.16 **	3.61	22.10 **
24	L_8×T_3	-8.78	1.17	-8.00	-0.59	-8.37	0.24	-1.19	12.54	-12.28	-0.60	-7.86	4.67
25	L_9×T_1	18.38 *	26.53 **	16.69 *	21.93 *	17.50 **	24.09 **	-21.87 **	-9.15	10.03	26.33 **	-3.44	11.33 *
26	L_9×T_2	12.62	20.37 **	11.46	16.46	12.01	18.30 **	-24.86 **	-10.85	6.62	25.36 **	-6.61	10.06
27	L_9×T_3	7.2	14.84	6.54	11.55	6.85	13.10 *	-24.49 **	-12.2	-17.69 **	-5.49	-20.64 **	-8.50
No. of crosses with significant +ve heterosis		3	5	2	2	3	6	1	3	2	7	2	9
No. of crosses with significant –ve heterosis		0	0	0	0	1	0	13	1	4	0	12	1
Range		-13.36 to 36.34	-7.19 to 51.21	-12.14 to 49.50	-13.64 to 61.55	-12.72 to 43.23	-7.62 to 56.69	-29.89 to 15.16	-17.29 to 21.02	-22.00 to 17.70	-9.30 to 26.33	-25.33 to 15.44	-12.75 to 22.10
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Number of fruits per plant						Total soluble solids (%)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	L_1×T_1	9.19	9.19	13.80 *	22.18 **	11.76 *	16.19 **	28.36 **	37.38 **	29.39 **	29.39 **	28.87 **	33.26 **
2	L_1×T_2	-8.65	-6.64	-4.68	2.34	-5.55	-1.81	-3.31	15.65 **	-3.09	9.00 **	-3.2	12.22 **
3	L_1×T_3	-20.24 **	-17.16 *	-11.75	-5.26	-14.14 **	-10.74 *	-7.18 **	19.81 **	-7.75 **	12.18 **	-7.46 **	15.87 **
4	L_2×T_1	4.05	5.31	5.47	15.32 *	4.84	10.69 *	11.70 **	34.19 **	11.66 **	26.39 **	11.68 **	30.17 **
5	L_2×T_2	-4.13	-2.02	-5.87	2.92	-4.68	0.64	15.69 **	38.98 **	15.63 **	30.89 **	15.66 **	34.81 **
6	L_2×T_3	17.96 *	22.53 **	10.78	21.12 **	15.31 **	21.75 **	-8.42 **	18.21 **	-8.39 **	11.40 **	-8.40 **	14.70 **
7	L_3×T_1	-6.2	-4.68	6.31	7.45	0.55	1.86	5.33 *	23.83 **	5.31	16.68 **	5.32 **	20.14 **
8	L_3×T_2	4.47	6.76	14.30 *	15.78 *	9.75 *	11.62 *	-1.44	17.89 **	-1.49	10.80 **	-1.47	14.23 **
9	L_3×T_3	-5.39	-1.73	6.13	8.43	0.77	3.75	-23.27 **	-0.96	-23.43 **	-6.90 *	-23.35 **	-4.02
10	L_4×T_1	8.72	17.45 *	17.32 **	19.68 **	13.25 **	18.64 **	-2.69	4.15	-1.80	-1.80	-2.24	1.08
11	L_4×T_2	-11.18	-4.04	1.67	3.71	-4.42	0.13	-0.37	19.17 **	-1.28	11.04 **	-0.83	14.98 **
12	L_4×T_3	-21.39 **	-15.08	-8.06	-6.07	-14.31 **	-10.24 *	4.21	34.50 **	4.19	26.69 **	4.20 *	30.48 **
13	L_5×T_1	-12.36	-13.17	-0.07	-0.07	-4.93	-6.12	29.55 **	38.66 **	30.59 **	30.59 **	30.07 **	34.50 **
14	L_5×T_2	19.05 *	21.66 **	23.09 **	24.68 **	21.20 **	23.27 **	-1.66	17.64 **	-1.12	11.22 **	-1.39	14.33 **
15	L_5×T_3	-17.80 *	-14.62	3.04	5.27	-6.66	-3.91	-9.41 **	16.93 **	-9.37 **	10.20 **	-9.39 **	13.46 **
16	L_6×T_1	-8.23	-6.01	-1.99	-1.99	-4.62	-3.86	-12.57 **	20.45 **	-13.18 **	12.66 **	-12.87 **	16.43 **
17	L_6×T_2	2.09	4.56	13.05	14.51 *	8.08	9.92 *	-0.51	37.06 **	-0.51	29.09 **	-0.51	32.95 **
18	L_6×T_3	12.35	16.70 *	24.33 **	27.02 **	18.75 **	22.25 **	-1.44	35.78 **	-1.43	27.89 **	-1.44	31.71 **
19	L_7×T_1	-3.94	-13.98	-4.40	-4.40	-4.22	-8.83	17.74 **	39.94 **	17.68 **	31.79 **	17.71 **	35.74 **
20	L_7×T_2	0.57	2.77	8.97	10.38	5.07	6.86	-0.91	18.53 **	-0.8	11.58 **	-0.85	14.94 **
21	L_7×T_3	18.85 *	23.45 **	15.41 *	17.91 **	16.99 **	20.45 **	-5.94 *	21.41 **	-6.66 *	13.50 **	-6.30 **	17.33 **
22	L_8×T_1	17.1	4.85	9.20	9.20	12.60 *	7.18	-3.91	20.96 **	-3.89	13.98 **	-3.90 *	17.36 **
23	L_8×T_2	4.24	6.53	8.41	9.81	6.48	8.30	-21.12 **	-0.7	-21.04 **	-6.36 *	-21.08 **	-3.62
24	L_8×T_3	-0.95	2.89	11.92	14.34 *	5.94	9.07	-23.51 **	-1.28	-23.24 **	-6.66 *	-23.38 **	-4.05
25	L_9×T_1	12	0.29	8.69	8.69	10.11 *	4.81	-25.94 **	1.98	-26.43 **	-3.84	-26.19 **	-1.02
26	L_9×T_2	8.99	11.38	19.07 **	20.61 **	14.41 **	16.35 **	-12.39 **	20.64 **	-13.03 **	13.68 **	-12.71 **	17.05 **
27	L_9×T_3	-3.56	0.17	13.19 *	15.64 *	5.4	8.51	-13.23 **	19.49 **	-13.86 **	12.60 **	-13.54 **	15.93 **
No. of crosses with significant +ve heterosis		3	5	8	12	10	10	6	22	5	25	7	22
No. of crosses with significant –ve heterosis		3	1	0	0	2	2	11	0	11	0	12	0
Range		-21.39 to 18.85	-17.16 to 23.45	-11.75 to 24.33	-6.07 to 27.02	-14.31 to 21.20	-10.74 to 23.27	- 25.94 to 29.55	-1.28 to 39.94	-26.43 to 30.59	-6.90 to 31.79	-26.19 to 30.07	-4.05 to 35.74
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Reducing sugar (%)						Non-Reducing sugar (%)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	$L_1 \times T_1$	-4.68	-4.68	-4.86	-0.61	-4.77	-2.67	24.10 **	24.10 **	19.58 **	22.16 **	21.69 **	23.08 **
2	$L_1 \times T_2$	-7.27	-7.27	-7.08	-2.94	-7.17	-5.12	28.18 **	39.76 **	22.55 **	35.14 **	25.19 **	37.32 **
3	$L_1 \times T_3$	-1.74	-1.74	-1.7	2.69	-1.72	0.45	-25.98 **	-9.04	-23.35 **	-5.95	-24.59 **	-7.41 **
4	$L_2 \times T_1$	-6.72	-10.81 *	-6.54	-6.54	-6.63	-8.70 *	20.30 **	42.77 **	17.27 **	39.46 **	18.71 **	41.03 **
5	$L_2 \times T_2$	1.56	-6.25	1.52	-1.9	1.54	-4.09	31.47 **	56.02 **	28.18 **	52.43 **	29.74 **	54.13 **
6	$L_2 \times T_3$	-5.00	-6.49	-4.88	-2.14	-4.94	-4.33	-1.47	21.08 **	-4.41	17.30 **	-3.02	19.09 **
7	$L_3 \times T_1$	1.13	-3.30	1.10	1.10	1.12	-1.12	14.88 **	48.80 **	13.45 **	45.95 **	14.13 **	47.29 **
8	$L_3 \times T_2$	5.29	-3.12	5.14	1.28	5.21	-0.94	11.16 **	43.98 **	5.46	35.68 **	8.17 **	39.60 **
9	$L_3 \times T_3$	4.88	3.24	4.76	7.77	4.82	5.48	1.86	31.93 **	0.84	29.73 **	1.32	30.77 **
10	$L_4 \times T_1$	2.01	-2.46	1.96	1.96	1.98	-0.27	31.18 **	46.99 **	27.75 **	44.32 **	29.37 **	45.58 **
11	$L_4 \times T_2$	-1.31	-9.19	-1.02	-4.65	-1.16	-6.94	21.51 **	36.14 **	18.66 **	34.05 **	20.00 **	35.04 **
12	$L_4 \times T_3$	-4.15	-5.65	-4.04	-1.28	-4.10	-3.48	-3.92	18.07 **	1.32	24.32 **	-1.16	21.37 **
13	$L_5 \times T_1$	-2.32	-6.61	-2.08	-2.08	-2.20	-4.36	24.16 **	33.13 **	20.90 **	31.35 **	22.43 **	32.19 **
14	$L_5 \times T_2$	7.90	-0.72	7.68	3.73	7.79	1.48	29.28 **	40.96 **	-15.69 **	-7.03	5.45 *	15.67 **
15	$L_5 \times T_3$	-0.73	-2.28	-0.71	2.14	-0.72	-0.09	-25.00 **	-7.83	8.37	32.97 **	-7.42 **	13.68 **
16	$L_6 \times T_1$	14.13 *	9.13	13.76 *	13.76 *	13.94 **	11.42 **	21.81 **	37.95 **	-21.13 **	-9.19	-1.00	13.11 **
17	$L_6 \times T_2$	3.00	-5.23	3.43	-0.37	3.22	-2.82	32.98 **	50.60 **	28.17 **	47.57 **	30.42 **	49.00 **
18	$L_6 \times T_3$	6.71	5.05	6.54	9.60	6.62	7.30	-24.02 **	-6.63	-29.52 **	-13.51 *	-26.91 **	-10.26 **
19	$L_7 \times T_1$	10.68	5.83	10.40	10.40	10.54 *	8.09 *	-13.47 **	0.6	10.86 *	32.43 **	-0.48	17.38 **
20	$L_7 \times T_2$	10.77	3.12	10.8	7.95	10.79 *	5.52	-10.88 *	3.61	19.46 **	42.70 **	5.31 *	24.22 **
21	$L_7 \times T_3$	7.87	6.19	7.67	10.76	7.77	8.45 *	-22.06 **	-4.22	7.49	31.89 **	-6.50 **	14.81 **
22	$L_8 \times T_1$	5.28	0.66	5.14	5.14	5.21	2.88	-23.83 **	-1.81	0.01	28.65 **	-11.28 **	14.25 **
23	$L_8 \times T_2$	3.35	-1.92	3.27	2.51	3.31	0.27	17.29 **	51.20 **	15.55 **	48.65 **	16.37 **	49.86 **
24	$L_8 \times T_3$	7.93	6.25	7.85	10.95 *	7.89 *	8.58 *	-2.34	25.90 **	-1.26	27.03 **	-1.77	26.50 **
25	$L_9 \times T_1$	8.48	3.72	8.26	8.26	8.37 *	5.97	9.87 **	54.22 **	8.98 *	50.81 **	9.41 **	52.42 **
26	$L_9 \times T_2$	16.38 **	7.09	15.94 **	11.68 *	16.16 **	9.36 *	-25.75 **	4.22	-10.16 *	24.32 **	-17.59 **	14.81 **
27	$L_9 \times T_3$	8.48	6.79	8.26	11.38 *	8.37 *	9.06 *	-23.18 **	7.83	1.95	41.08 **	-10.02 **	25.36 **
No. of crosses with significant +ve heterosis		2	0	2	4	7	6	14	18	13	23	14	25
No. of crosses with significant –ve heterosis		0	1	0	0	0	1	9	0	5	1	7	2
Range		-7.27 to 16.38	-10.81 to 9.13	-7.08 to 15.94	-6.54 to 13.76	-6.63 to 16.16	-8.70 to 11.42	-25.98 to 32.98	-9.04 to 54.22	-29.52 to 28.17	-13.51 to 52.43	-26.91 to 30.42	-10.26 to 54.13
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

S. No.	Crosses	Total sugar (%)						Dry matter (%)					
		Y_1		Y_2		Pooled		Y_1		Y_2		Pooled	
		BP	SV	BP	SV	BP	SV	BP	SV	BP	SV	BP	SV
1	$L_1 \times T_1$	-2.57	1.71	-2.56	1.7	-2.56	1.71	9.15	9.15	9.09	9.09	9.12 **	9.12 **
2	$L_1 \times T_2$	-3	1.25	-2.99	1.25	-3	1.25	27.01 **	17.55 **	26.84 **	17.44 **	26.92 **	17.49 **
3	$L_1 \times T_3$	-3.04	1.88	-3.03	1.88	-3.03	1.88	-15.83 **	-3.12	-15.75 **	-3.1	-15.79 **	-3.11
4	$L_2 \times T_1$	-1.94	-1.94	-1.93	-1.93	-1.94	-1.94	-4.2	-4.2	-4.18	-4.18	-4.19	-4.19
5	$L_2 \times T_2$	4.96	3.76	4.94	3.75	4.95	3.76	7.28	4.81	7.24	4.78	7.26 *	4.8
6	$L_2 \times T_3$	-4.61	0.23	-4.60	0.23	-4.60	0.23	-14.89 **	-2.03	-14.81 **	-2.02	-14.85 **	-2.03
7	$L_3 \times T_1$	5.87	5.87	5.85	5.85	5.86	5.86	-24.94 **	-9.49 *	-24.82 **	-9.43 *	-24.88 **	-9.46 **
8	$L_3 \times T_2$	6.22	5.19	6.14	5.17	6.18	5.18	-4.44	15.24 **	-4.42	15.15 **	-4.43	15.20 **
9	$L_3 \times T_3$	5.05	10.38 *	5.03	10.34 *	5.04	10.36 **	-21.12 **	-4.88	-20.91 **	-4.71	-21.01 **	-4.8
10	$L_4 \times T_1$	6.50	6.50	6.48	6.48	6.49	6.49	12.50 **	15.85 **	12.43 **	15.76 **	12.46 **	15.81 **
11	$L_4 \times T_2$	1.81	-0.57	1.80	-0.57	1.81	-0.57	1.97	5.01	2.09	5.12	2.03	5.07
12	$L_4 \times T_3$	-3.47	1.43	-3.46	1.42	-3.47	1.42	-16.95 **	-4.4	-16.86 **	-4.38	-16.91 **	-4.39
13	$L_5 \times T_1$	1.54	1.54	1.53	1.53	1.54	1.54	-3.86	-3.86	-3.84	-3.84	-3.85	-3.85
14	$L_5 \times T_2$	10.16	7.58	10.12	7.56	10.14 *	7.57 *	26.13 **	16.73 **	25.96 **	16.63 **	26.05 **	16.68 **
15	$L_5 \times T_3$	0.38	5.47	0.38	5.45	0.38	5.46	-17.13 **	-4.61	-17.62 **	-5.25	-17.38 **	-4.93
16	$L_6 \times T_1$	16.65 **	16.65 **	16.59 **	16.59 **	16.62 **	16.62 **	-12.78 **	-6.64	-12.71 **	-6.6	-12.75 **	-6.62 *
17	$L_6 \times T_2$	6.95	4.45	6.92	4.43	6.93	4.44	5.32	12.74 **	5.29	12.66 **	5.30 *	12.70 **
18	$L_6 \times T_3$	7.98	13.45 *	7.95	13.41 *	7.96 *	13.43 **	-16.01 **	-3.32	-16.51 **	-3.97	-16.26 **	-3.65
19	$L_7 \times T_1$	13.80 **	13.80 **	13.75 **	13.75 **	13.77 **	13.77 **	12.13 *	12.13 *	12.05 *	12.05 *	12.09 **	12.09 **
20	$L_7 \times T_2$	12.08 *	11.63 *	12.04 *	11.59 *	12.06 **	11.61 **	-4.17	-11.31 *	-4.15	-11.25 *	-4.16	-11.28 **
21	$L_7 \times T_3$	8.46	13.97 **	8.33	13.81 **	8.40 *	13.89 **	-4.71	9.69 *	-4.68	9.63 *	-4.70 *	9.66 **
22	$L_8 \times T_1$	6.41	8.89	6.39	8.86	6.4	8.88 *	-7.38	-7.38	-7.34	-7.34	-7.36 **	-7.36 **
23	$L_8 \times T_2$	4.74	7.18	4.72	7.16	4.73	7.17	9.56	4.00	9.5	3.97	9.53 **	3.99

24	$L_8 \times T_3$	7.76	13.23 *	7.73	13.18 *	7.75 *	13.20 **	-21.72 **	-9.89 *	-21.60 **	-9.83 *	-21.66 **	-9.86 **
25	$L_9 \times T_1$	13.06 *	13.06 *	13.01 *	13.01 *	13.03 **	13.03 **	-2.97	12.94 **	-2.95	12.86 **	-2.96	12.90 **
26	$L_9 \times T_2$	18.16 **	15.39 **	18.09 **	15.34 **	18.12 **	15.37 **	-20.20 **	-7.11	-20.15 **	-7.14	-20.17 **	-7.13 *
27	$L_9 \times T_3$	9.39	14.94 **	9.36	14.89 **	9.37 *	14.91 **	-15.37 **	-1.49	-15.29 **	-1.48	-15.33 **	-1.49
No. of crosses with significant +ve heterosis		5	9	5	10	10	12	4	8	4	8	8	9
No. of crosses with significant –ve heterosis		0	0	0	0	0	0	11	3	11	3	13	6
Range		-4.61 to 18.16	-1.94 to 16.65	-4.60 to 18.09	-1.93 to 16.59	-4.94 to 16.62	-1.94 to 16.62	-24.94 to 27.01	-11.31 to 17.55	-24.82 to 26.84	-11.25 to 17.44	-24.88 to 26.92	-11.28 to 17.49
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.													

Table 1: Contd…..

Crosses	Fruit yield/plant (kg)					
	Y_1		Y_2		Pooled	
	BP	SV	BP	SV	BP	SV
BG 63-1-1 x BG 0-2	19.01 **	19.01 **	7.82	18.43 *	13.05 **	18.72 **
BG 63-1-1 x BG 619	-8.4	-8.4	-7.43	3.6	-6.95	-2.27
BG 63-1-1 x N. Rashmi	-14.76 *	-14.76 *	-15.76 *	-6.3	-14.71 **	-10.43 *
BG 65-1 x BG 0-2	12.21	14.25 *	3.43	14.79 *	7.55	14.54 **
BG 65-1x BG 619	-9.7	-8.06	-7.28	3.77	-8	-2.02
BG 65-1 x N. Rashmi	8.25	10.22	17.80 **	31.03 **	13.47 **	20.83 **
BG 83-1x BG 0-2	9.23	2.78	-5.35	5.41	4.74	4.13
BG 83-1x BG 619	25.99 **	9.76	3.79	16.16 *	13.29 *	13.04 *
BG 83-1 x N. Rashmi	16.59 *	3.69	-2.88	8.16	5.64	5.99
BG 10 x BG 0-2	17.79 *	10.84	7.56	26.27 **	16.72 **	18.70 **
BG 10 x BG 619	12.77	-1.76	-9.64	6.07	0.52	2.22
BG 10 x N. Rashmi	-4.47	-15.04 *	-18.59 **	-4.43	-11.13 *	-9.63
BG 132 x BG 0-2	1.15	-4.82	-10.55	-2.5	-0.8	-3.66
BG 132 x BG 619	33.36 **	16.17 *	20.90 **	35.30 **	26.22 **	25.94 **
BG 132 x N. Rashmi	17.10 *	4.14	-13.62 *	-3.92	-0.3	0.03
N. POOJA Sel -1 x BG 0-2	-1.33	-7.15	-7.09	4.17	0.45	-1.36
N. POOJA Sel -1 x BG 619	25.34 **	9.19	1.76	14.09	11.95 *	11.71 *
N. POOJA Sel -1 x N. Rashmi	40.14 **	24.63 **	11.89	25.46 **	24.66 **	25.08 **
BG 7 x BG 0-2	-8.69	-14.07 *	-3.3	-3.3	-5.86	-8.57
BG 7 x BG 619	19.64 *	4.43	0.51	12.49	8.76	8.52
BG 7 x N. Rashmi	18.83 *	5.68	18.53 **	31.84 **	18.66 **	19.06 **
BG 18 x BG 0-2	8.02	1.65	14.44	14.44	11.37 *	8.16
BG 18 x BG 619	11.07	-3.23	3.61	15.96 *	6.81	6.57
BG 18 x N. Rashmi	22.40 **	8.85	1.7	13.12	10.64 *	11.01 *
Pb round x BG 0-2	9.23	2.78	9.06	9.06	9.14	5.99
Pb round X BG 619	36.81 **	19.18 **	7.72	20.56 **	20.13 **	19.86 **
Pb round x N. Rashmi	28.84 **	14.59 *	-1.12	9.98	11.86 *	12.23 *
No. of crosses with significant +ve heterosis	13	6	3	10	12	12
No. of crosses with significant -ve heterosis	1	3	3	0	2	1
Range	-14.76 to 40.14	-15.04 to 24.63	-18.59 to 20.90	-6.30 to 35.30	-14.71 to 26.22	10.43 to 25.94
*, ** Significant at 5 per cent and 1 per cent probability levels, respectively.						

Only one hybrid exhibited significant and desirable heterobeltiosis and standard heterosis in respect to better and standard parent both the seasons and pooled for node number to first male flower appearance. However, six, two and eight crosses in both the seasons and pooled showed highly significant heterosis in desirable direction in Y_1, Y_2 and pooled, respectively. five, crosses namely L_3xT_1, L_4xT_1, L_4xT_3, L_5xT_3 L_6xT_3 in Y_1 and five crosses namely L_2xT_3, L_3xT_2, L_4xT_2, L_5xT_1, L_6xT_1 in Y_2 and eight crosses namely L_3xT_1, L_3xT_2, L_4xT_1, L_4xT_2, L_4xT_3, L_5xT_1, L_5xT_3, L_6xT_1 in pooled showed highly significant heterosis in desirable direction for node number to first female flower appearance. The similar results were given Adarsh *et al.* (2017) [1], Mishra *et al.* (2019) [8].

Conclusion

A wide range of variation in the estimates of heterobeltiosis and standard heterosis in positive and negative direction were observed for all the traits studied. In case of total fruit yield per plant, in Y_1 the heterobeltiosis ranged from -14.76 to 40.14 per cent and standard heterosis from -15.04 to -24.63 per cent. In Y_2, over better parent from -18.59 to 20.90 per cent and standard parent from -6.30 to 35.30 per cent and in pooled, over better parent from -14.71 to 26.22 per cent and standard parent from -10.43 to 25.94 per cent. Out of twenty seven crosses, one cross showed positive and significant heterosis over better parent and standard variety for fruit yield per plant in both the years and over pooled. In Y_1, five crosses L_1 x T_1, L_5 x T_2, L_6 x T_3, L_9 x T_2 and L_9 x T_3 were exhibited positive and highly significant heterbeltiosis and standard heterosis, respectively. In Y_2, three crosses L_2 x T_3, L_5 x T_2 and L_7 x T_3 whereas, in pooled, eleven crosses L_1 x T_1, L_2 x T_3, L_3 x T_2, L_4 x T_1, L_5 x T_2, L_6 x T_2, L_6 x T_3, L_7 x T_3, L_8 x T_3, L_5 x T_2 and L_9 x T_3 were exhibited positive and highly significant heterbeltiosis and standard heterosis respectively. Out of 27 crosses exhibiting significant and negative estimates of heterosis for one or both types of heterosis for total fruit yield also exhibited significant and positive estimates of heterosis for other important yield attributing traits. In contrast, none of the crosses showed significant and desirable heterosis for all the traits.

Thus, there exists scope for development of desirable F_1/segregates as per consumer's choice to meet out the ever increasing demand of bottle gourd in future.

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