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Research Article

Estimation of heterosis for earliness, yield and yield attributing traits in chilli (*Capsicum annuum* L.)

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Abstract

The present investigation was carried out to estimate the magnitude of heterosis over mid parent, better parent and standard checks (Tejaswini and Indam-5) for earliness, fruit yield and yield attributing traits in chilli (*Capsicum annuum* L.) and developed 54 F_1 hybrids by crossing nine lines with six testers using line x tester mating design. The 71 genotypes (54 F_1's hybrids along with their 15 parents and two standard checks) were evaluated in Randomized Block Design during *kharif* 2014 - 15 at HRS, Lam farm, Guntur. The analysis of variance for L x T revealed significant differences among the parents and crosses for all the 12 characters studied indicating the presence of wide range of variability among them. Among 54 F_1 hybrids, twenty seven, seventeen, two and four hybrids exhibited significant positive heterosis for fruit yield per plant over mid parent, better parent, and standard checks - Tejaswini and Indam-5 respectively and the hybrid LCA 607 x LCA 703-2 registered significant standard positive heterosis (20.99 per cent) followed by LCA 655 x LCA 703-2 (15.09 per cent) over best check Tejaswini. Among the 54 hybrids, the hybrid LCA 355 x LCA 703-2 was found to be superior for plant height, LCA 504 x LCA 703-2 for plant spread, LCA 466 x LCA 678 & LCA 466 x LCA 315 for no. of primary branches per plant and LCA 442 X G4 for days to fruit maturity recorded maximum standard heterosis in desirable direction over best check Tejaswini, while the hybrid LCA 655 x G4 recorded maximum positive heterosis for no. of fruits per plant but inferior to best check Tejaswini. The hybrid LCA 446 x LCA 453 for days to 50 % flowering, LCA 355 x LCA 315 for fruit length, LCA 466 x LCA 453 for fruit diameter, LCA 607 x LCA 453 for average dry fruit weight, LCA 615 x G4 for no. of seeds per fruit and LCA 607 x LCA 705-2 for seed weight registered maximum standard heterosis in desirable direction over best check Indam-5. The identified heterotic hybrids could be further evaluated to exploit the heterosis or utilized in future breeding programmes to obtain desirable segregates for development of superior genotypes.

Key words

Chilli, *Capsicum annuum,* Heterosis, Hybrids, Earliness and Yield

Introduction

Chilli (*Capsicum annuum* L.) is one of the most important commercial crops of India and it belongs to the family Solanaceae *(2n = 24)*. The primary centre of origin of chilli is said to be Mexico with secondary centre in Guatemala and Bulgaria (Salvador, 2002). Chilli has diverse uses as spice, condiment, culinary supplement, medicine, vegetable and ornamental plant. It is an indispensable spice due to its pungency, taste, appealing colour and flavour. India is the largest producer (1.492 million tonnes from 0.775 million hectares), consumer and exporter of chilli in the world (National Horticulture Board, 2014) with productivity of 1.9 metric t/ha. Eventhough India ranks first in area and production of chilli, its productivity is very low as compared to other countries like Japan (3.6 t/ha) and Korea (2 t/ha), USA and Indonesia (Patil *et al.,* 2012). The low yield potential in India is mainly due to poor yielding genotypes/varieties and high incidence of pests and diseases. One of the options to achieve quantum jump in yield is heterosis breeding.

Heterosis breeding is an important crop improvement method adopted in many crops all over the world due to popularity of F_1 hybrids in view of their vigour, high productivity, uniformity, improved quality, built in resistance, environmental adaptations, stress tolerance and good horticultural traits including earliness and long shelf life and therefore giving constant stable higher yields (Sood and Kumar, 2010). The term heterosis was first coined by Shull (1908) and in chilli it was first reported by Despande (1933). Keeping in view the major constraint *i.e.* low yield potential of chilli, the present study was undertaken to estimate the magnitude of heterosis for earliness, yield and it's component traits to develop and identify the best performing heterotic hybrids.

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Material and Methods

The experiment was conducted at Horticulture Research Station, Dr. Y.S.R.H.U., Lam farm, Guntur**.** The experimental material and their characters used in this experiment were presented in Table 1. The experimental material comprised of nine lines *viz.* LCA 504, LCA 615, LCA 446, LCA 466, LCA 442, LCA 654, LCA 607, LCA 655 and LCA 355 and six testers *viz.* G4, LCA 678, LCA 453, LCA 703-2, LCA 705-2 and LCA 315. These parents were crossed in Line × Tester fashion during *Kharif*, 2013-14 and developed 54 F_1 hybrids. The resulting 54 F_1 hybrids along with their 15 parents and two commercial checks (Tejaswini and Indam-5) were evaluated during *Kharif*, 2014-15 in a Randomized Block Design with three replications in two rows (one row of 4 m length) of each genotype at a spacing of 75 cm x 30 cm. The recommended package of practices were followed for raising good crop. The observations were recorded on five randomly selected plants for twelve characters *viz.*, plant height (cm), plant spread (cm), number of primary branches, days to 50% flowering, days to fruit maturity, number of fruits per plant, fruit length (cm), fruit diameter (cm), average dry fruit weight (g), dry fruit yield per plant (g), number of seeds per fruit and seed weight (g/1000 seed). Heterosisis expressed as per cent increase or decrease in hybrid (F_1) over it's mid parent (MP), better parent (BP) and standard check (SC) values. The per cent heterosis of the derived F_1 over mid parent (Average heterosis, AH), better parent (Heterobeltiosis, HB) and commercial check (Standard heterosis, SH) was calculated using the following formulae's as per the Turner (1953) and Fonesca and Patterson (1968)

i)Per cent of Average Heterosis (AH) =

$$\frac{\overline{F_1}-\overline{MP}}{\overline{MP}} \times 100$$

Where, $\overline{MP}$ = Mean performance of mid parent =

$$P_1 + P_2 /2$$

F - MP

$\overline{F_1}$ = Mean performance of F_1 hybrid

ii) Per cent of Heterobeltiosis (HB) =

$$\frac{\overline{F_1}-\overline{BP}}{\overline{BP}} \times 100$$

Where, ($\overline{BP}$) = Mean performance of better parent

iii) Per cent of Standard Heterosis (SH) =

$$\frac{\overline{F_1}-\overline{CC}}{\overline{CC}} \times 100$$

Where, $\overline{CC}$ = Mean performance of commercial check

Results and Discussion

The analysis of variance for L x T in respect of yield and yield component characters was presented in Table 2. The analysis of variance revealed significant differences among the parents and crosses for all the 12 characters studied indicating the presence of wide variability among them. Significant differences were observed among the parents *vs*. Crosses for seven characters and the characters plant height, days to fruit maturity, fruit diameter, no. of seeds per fruit and seed weight recorded non-significant differences. All genotypes were partitioned into lines, testers and lines x testers and the significant differences were observed among lines and testers for all the characters studied. This indicates the existence of wide variability in the material studied and there is a good scope for identifying the promising hybrid combinations. These results are in accordance with the earlier findings of Kumar *et al*. (2013), Sharma *et al*. (2013), Savitha *et al*. (2015) and Spaldon *et al*. (2015). Exploitation of hybrid vigour in any crop depends on the magnitude and direction of heterosis. The main constituent of heterosis is the pronounced dominance gene action. In respect of days to 50 % flowering and days to fruit maturity negative heterosis is considered as desirable since early parent is treated as a better parent for comparison. However, for all the other attributes studied, positive heterosis is considered as desirable. Estimates of heterosis are expressed as percent increase (+) or decrease (-) in the average performance of hybrids over mid parent (average or relative heterosis) or over better parent (heterobeltiosis) or over standard checks (standard heterosis) in order to judge the potential of the crosses to be exploited on commercial scale through heterosis breeding. The range of relative heterosis, heterobeltiosis, standard heterosis and the identified best heterotic crosses for 12 yield and yield component characters are presented in Table 3. For plant height, the highest magnitude of significant positive heterosis was observed by the crosses LCA-655 x LCA-678 over mid parent (13.15%), LCA-355 x LCA-453 over better parent (11.21%) and LCA-355 x LCA-703-2 over standard checks Tejaswini (3.16%) and Indam-5 (32.89%). With respect to plant spread, the crosses LCA-504 x LCA-678 [mid parent heterosis (23.31%) and heterobeltiosis (16.12%)] and LCA-504 x LCA-703-2 [standard heterosis over Tejaswini (1.07%) and Indam-5 (24.36%)] were registered higher magnitude of significant desirable positive heerosis. In respect of no. of primary branches per plant, the cross LCA-466 x LCA-315 was recorded significant positive heterosis with higher values over mid parent (21.29%), better parent (12.69%), standard checks Tejaswini (6.34%) and Indam-5 (18.90%). Among the 54 hybrids; four, two and five hybrids registered desirable positive but non-significant standard heterosis over best check Tejaswini for plant height, plant spread and no. of primary branches per plant respectively. Similar findings have been reported by earlier workers Tembhurne and Rao (2012), Kumar *et al.* (2013), Suryakumari *et al*. (2014), Savitha *et al*. (2015) and Kranthi Rekha *et al.* (2016) in chilli.

Earliness is considered an important character in any crop improvement programme and is required for realizing the potential economic yield in as less time as possible. Thus, earliness is an important trait from the vegetable grower's point of view. The genotypes with high yield coupled with earliness are preferred for commercial cultivation and such F_1's are considered as superior. In the present study, days to 50 % flowering and days to fruit maturity were recorded to find out earliness of genotypes. For days to 50% flowering, the cross LCA-446 x LCA-453 was exhibited significant higher magnitude of negative relative heterosis, heterobeltiosis and standard heterosis over Tejaswini and Indam-5 to an extent of -38.46%, -38.74%, -32.00% and -27.66% respectively. Among 54 hybrids, 39 hybrids exhibited desirable negative heterosis over best check Indam-5 and out of those 39 crosses, 27 hybrids recorded significant negative standard heterosis. This indicates that, most of the hybrids evaluated were early compared to the best check Indam-5. Negative heterosis for this trait was in conformity with earlier reports of Kumar *et al*. (2013), Sharma *et al*. (2013), Suryakumari *et al*. (2014), Savitha *et al*. (2015) and Kranthi Rekha *et al.* (2016) in chilli. Whereas, for days to fruit maturity, the cross LCA-442 x G4 over mid parent and standard checks Tejaswini and Indam-5 and LCA-355 x LCA-703-2 over better parent registered higher magnitude of significant negative heterosis to an extent of -18.21%, -12.57%, -23.16% and -22.66% respectively. Ten crosses were recorded desirable negative heterosis over best check Tejaswini and only one hybrid LCA 442 x G4 was significantly earlier than best check Tejaswani with -12.57%. These findings were in inline with similar findings of Prajapati and Agalodia (2011), Patil *et al*. (2012) and Suryakumari *et al*. (2014) in chilli. As evident from the data on days to 50 % flowering and days to fruit maturity, though most of hybrids recorded early flowering over parents and checks, but very limited of them could attain maturity earlier than parents and checks. This obviously indicated longer period of fruit development which includes attainment of size as well as colour.

For no. of fruits per plant, the hybrid LCA-442 x LCA-453 was showed significantly superiority over mid parent and better parent by recording highest magnitude of positive relative heterosis (88.47%) and heterobeltiosis (70.45%). Whereas the cross LCA-655 x G4 was recorded highest standard heterosis over Indam-5 (92.54%) but lesser than best check Tejaswini (-16.44%). With respect to this trait, all 54 hybrids were showed significantly inferiority compared to best check Tejaswini. These results are in similarity with the earlier findings of Seneviratne and Kannangara (2004), Ganeshreddy *et al*. (2008), Kumar *et al*. (2013), Suryakumari *et al*. (2014), Savitha *et al*. (2015) and Kranthi Rekha *et al.* (2016) in chilli.

With respect to fruit length, the hybrid LCA-355 x LCA-315 was exhibited highest magnitude of significant positive relative heterosis, heterobeltiosis and standard heterosis over Tejaswini and Indam-5 to an extent of 31.77%, 31.09%, 83.04% and 54.06% respectively. While for fruit diameter, the hybrids LCA-442 x LCA-705-2 over mid parent (24.60%), LCA-615 x LCA-678 over better parent (13.24%) and LCA-466 x LCA-453 over standard checks Tejaswini (89.76%) and Indam-5 (26.65%) have registered maximum significant desirable positive heterosis. In respect of average dry fruit weight, the crosses LCA-442 x LCA-703-2 over mid parent (35.17%), LCA-442 x LCA-705-2 over better parent (22.01%), LCA-607 x LCA-453 over standard checks Tejaswini (144.64%) and Indam-5 (33.66%) have exhibited highest magnitude of significant desirable positive heterosis. Among the 54 hybrids; 49, 22 and 14 hybrids recorded desirable positive standard heterosis over best check Indam-5 and among those identified desirable heterotic crosses; only 30, seven and three hybrids were significantly superiority over best check Indam-5 with respect to fruit length, fruit diameter and average dry fruit weight respectively. These results were in line with earlier reports of Ganeshreddy *et al*. (2008), Payakhapaab *et al*. (2012), Sharma *et al*. (2013), Dhaliwal *et al.* (2014), Khalil and Hatem (2014), Savitha *et al*. (2015) and Kranthi Rekha *et al.* (2016) in chilli.In respect of fruit yield per plant, the observed heterosis and heterobeltiosis was ranged from -22.38 (LCA 446 x LCA 705-2) to 53.61 % (LCA 655 x LCA 703-2) and from -34.83 (LCA 607 x LCA 678) to 47.71 % (LCA 655 x LCA 315) respectively. Standard heterosis over Tejaswini and Indam-5 was ranged from -42.19 (LCA 355 x LCA 315) to 20.99 % (LCA 607 x LCA 703-2) and from -35.18 (LCA 355 x LCA 315) to 35.66 % (LCA 607 x LCA 703-2) respectively. Out of 54 hybrids, only five hybrids were registered positive heterosis over best check Tejaswini and out of those five hybrids, the hybrids LCA 607 X LCA 703-2 (20.99%) and LCA 655 X LCA 703-2 (15.09%) were showed significantly superiority over best check Tejaswini. Fruit yield is the ultimate and most important trait. Heterosis for fruit yield is the product of simultaneous manifestation of heterosis for other yield attributing traits. Among the all hybrids, the hybrid LCA 607 x LCA 703-2 exhibited highest positive heterosis for fruit yield per plant which also expressed significant positive heterosis for fruit length, fruit diameter, average fruit weight and seed weight indicating that these quantitative traits contributed to high magnitude of heterosis for fruit yield in chilli. The significant positive standard heterosis for fruit yield per plant also exhibited by earlier findings of Sharma *et al*. (2013), Dhaliwal *et al.* (2014), Suryakumari *et al*. (2014) and Kranthi Rekha *et al.* (2016).The highest magnitude of significant positive average heterosis (51.46%) and heterobeltiosis (41.38%) for no. of seeds per fruit was observed by cross LCA-655 x LCA-315 whereas the cross LCA-615 x G4 registered maximum standard heterosis over Tejaswini (17.89%) and Indam-5 (5.49%). With respect to seed weight, the hybrids LCA-466 x LCA-703-2 over mid parent (20.17%), better parent (18.19%) and LCA-607 x LCA-705-2 over standard checks Tejaswini (53.07%) and Indam-5 (12.07%) have recorded higher values of significant positive heterosis. Among all hybrids, only seven and ten hybrids were exhibited significantly superiority over best check Indam-5 in respect of no. of seeds per fruit and seed weight respectively. The findings of earlier workers Tembhurne and Rao (2012), Kumar *et al*. (2013), Savitha *et al*. (2015) and Kranthi Rekha *et al.* (2016) support the reports of present investigation.

Among all hybrids, the hybrid LCA 355 x LCA 703-2 for plant height, LCA 504 x LCA 703-2 for plant spread, LCA 466 x LCA 678 & LCA 466 x LCA 315 for no. of primary branches per plant and LCA 442 x G4 for days to fruit maturity recorded maximum standard heterosis in desirable direction over best check Tejaswini and the hybrid LCA 655 x G4 recorded maximum positive heterosis for no. of fruits per plant but inferior to best check Tejaswini. Whereas, the hybrid LCA 446 x LCA 453 for days to 50 % flowering, LCA 355 x LCA 315 for fruit length, LCA 466 x LCA 453 for fruit diameter, LCA 607 x LCA 453 for average dry fruit weight, LCA 615 x G4 for no. of seeds per fruit and LCA 607 x LCA 705-2 for seed weight recorded higher magnitude of standard heterosis in desirable direction over best check Indam-5. The top five heterotic crosses were LCA 607 x LCA 703-2 (20.99%), LCA 655 x LCA 703-2 (15.09%), LCA 446 x LCA 703-2, LCA 655 x LCA 315 and LCA 466 x LCA 705-2 as they have registered desirable positive standard heterosis over best check Tejaswini for fruit yield per plant. The hybrid LCA 607 x LCA 703-2 exhibited highest positive heterosis for fruit yield per plant which also expressed significant positive heterosis for fruit length, fruit diameter, average fruit weight and seed weight indicating that these quantitative traits contributed to high magnitude of heterosis for fruit yield in chilli. The identified heterotic hybrids could be further evaluated to exploit the heterosis or utilized in future breeding programmes to obtain desirable segregates for development of superior genotypes.

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Table 1. Salient features of parents used in Line x Tester analysis of chilli

S.No	Parents	Features
Lines		
1	LCA-504	Drought resistant, highly pungent
2	LCA-615	High yielding line with parrot green fruits
3	LCA-446	Bold pod, high colour and oleoresin
4	LCA-466	Bold and long pod, high colour and oleoresin
5	LCA-442	Bold and long pod, high colour and mild pungent
6	LCA-654	Medium bold, shiny fruit surface, light green in colour
7	LCA-607	Light green pod, profuse branching
8	LCA-655	Dual purpose variety, bold light green pod
9	LCA-355	High colour with wrinkled surface
Testers		
1	G4	Dark green (olive green) fruits, virus resistant
2	LCA-678	More primary branches, semi erect plant habit
3	LCA-453	Bold pod, erect growth habit
4	LCA-703-2	Virus resistant, dark green fruits
5	LCA-705-2	More no. of fruits, shiny dry pod
6	LCA-315	Virus resistant, fruits are long and dark green
Checks		
1	Indam-5	Indo-American Hybrid Seeds (India) Pvt.Ltd. (IAHS)
2	Tejaswini	Maharashta Hybrid Seeds Co.Ltd. (MAHYCO)

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Table 2. Analysis of variance for L x T in respect of yield and yield component characters in chilli

	Df	PH	PS	NPBPP	DFF	DFM	NFPP	FL	FD	ADFW	FYPP	NSPF	SW
Replications	2	35.36	35.31	0.11	3.27	16.71	233.40	0.47	0.00	0.03	50.82	285.78*	0.68
Treatments	68	247.43**	184.04**	0.72**	40.28**	61.11**	9776.15**	6.25**	0.13**	0.13**	4478.00**	539.91**	1.30**
Parents	14	272.38**	107.87**	0.71**	37.40**	55.51**	7290.72**	8.87**	0.28**	0.22**	4302.95**	577.65**	1.99**
Lines	8	219.22**	62.17*	0.38*	54.34**	39.01**	3414.52**	7.06**	0.24**	0.09**	4457.92**	457.92**	2.34**
Testers	5	402.36**	202.30**	1.39**	14.36**	87.29**	11844.51**	9.72**	0.38**	0.40**	4708.59**	691.03**	1.66**
Line x Tester	1	47.80	1.41	0.00	17.13**	28.68	15531.43**	19.17**	0.10**	0.31**	1034.96	968.63**	0.85
Parents *vs* Crosses	1	92.42	358.89**	1.65**	309.95**	0.41	29217.10**	41.66**	0.00	0.05*	24233.62**	96.68	0.13
Crosses	53	243.76**	200.86**	0.71**	35.95**	63.73**	10065.87**	4.89**	0.09**	0.11**	4151.50**	538.30**	1.14**
Error	136	23.79	27.19	0.17	2.14	13.18	860.72	0.46	0.01	0.01	602.37	89.20	0.37

*; Significant at 5% level; **; Significant at 1% level

PH - Plant Height (cm), PS - Plant Spread (cm), NPBPP - No. of Primary Branches Per Plant, DFF – Days to 50% Flowering, DFM – Days to Fruit Maturity, NFPP – No. of Fruits Per Plant, FL – Fruit Length (cm), FD – Fruit Diameter (cm), ADFW – Average Dry Fruit Weight (g), FYPP – Fruit Yield Per Plant (g), NSPF – No. of Seeds Per Fruit, SW – Seed Weight (g/1000 seed).

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Table 3. Range of heterosis and best heterotic crosses for yield and yield attributing characters in chilli

S.No.	Character	Range				Best check	No. of hybrids registered heterosis in desirable direction over best check
		Mid Parent (%)	Better Parent (%)	Tejaswini (%)	Indam-5 (%)		
1	2	3	4	5	6	7	8
1	Plant height (cm)	-14.32 (LCA 446 x LCA 705-2) to 13.15 (LCA 655 x LCA 678)	-20.51 (LCA 615 x LCA 703-2) to 11.21 (LCA 355 x LCA 453)	-29.92 (LCA 446 x LCA 705-2) to 3.16 (LCA 355 x LCA 703-2)	-9.73 (LCA 446 x LCA 705-2) to 32.89 (LCA 355 x LCA 703-2)	Tejaswini	4 (0)
2	Plant spread (cm)	-12.91 (LCA 655 x LCA 705-2) to 23.31 (LCA 504 x LCA 678)	-18.57 (LCA 655 x LCA 315) to 16.12 (LCA 504 x LCA 678)	-32.8 (LCA 355 x LCA 315) to 1.07 (LCA 504 x LCA 703-2)	-17.33 (LCA 355 x LCA 315) to 24.36 (LCA 504 x LCA 703-2)	Tejaswini	2 (0)
3	No. of primary branches per plant	-26.61 (LCA 355 x LCA 705-2) to 21.29 (LCA 466 x LCA 315)	-28.03 (LCA 504 x LCA 703-2) to 12.69 (LCA 466 x LCA 315)	-35.92 (LCA 355 x LCA 705-2) to 6.34 (LCA 466 x LCA 315)	-28.35 (LCA 355 x LCA 705-2) to 18.90 (LCA 466 x LCA 315)	Tejaswini	5 (0)
4	Days to 50 % flowering	-38.46 (LCA 446 x LCA 453) to 14.00 (LCA 466 x LCA 315)	-38.74 (LCA 446 x LCA 453) to 10.68 (LCA 466 x LCA 315)	-32.00 (LCA 446 x LCA 453) to 14.00 (LCA 466 x LCA 315)	-27.66 (LCA 446 x LCA 453) to 21.28 (LCA 466 x LCA 315)	Indam-5	39 (27)
5	Days to fruit maturity	-18.21 (LCA 442 x G4) to 24.92 (LCA 615 x LCA 678)	-22.66 (LCA 442 x G4) to 20.93 (LCA 615 x LCA 678)	-12.57 (LCA 442 x G4) to 24.55 (LCA 615 x LCA 678)	-23.16 (LCA 442 x G4) to 9.47 (LCA 615 x LCA 678)	Tejaswini	10 (1)
6	No. of fruits per plant	-27.11 (LCA 355 x LCA 315) to 88.47 (LCA 442 x LCA 453)	-40.34 (LCA 466 x G4) to 70.45 (LCA 442 x LCA 453)	-69.61 (LCA 446 x LCA 453) to -16.44 (LCA 655 x G4)	-29.97 (LCA 446 x LCA 453) to 92.54 (LCA 655 x G4)	Tejaswini	0
7	Fruit length (cm)	-12.73 (LCA 607 x LCA 705-2) to 31.77 (LCA 355 x LCA 315)	-20.98 (LCA 466 x 705-2) to 31.09 (LCA 355 x LCA 315)	-4.58 (LCA 615 x LCA 703-2) to 83.04 (LCA 355 x LCA 315)	-11.98 (LCA 615 x LCA 703-2) to 54.06 (LCA 355 x LCA 315)	Indam-5	49 (30)
8	Fruit diameter (cm)	-32.33 ((LCA 655 x LCA 453) to 24.60 (LCA 442 x LCA 705-2)	-49.28 (LCA 655 x LCA 453) to 13.24 (LCA 615 x LCA 678)	-7.85 (LCA 655 x LCA 453) to 89.76 (LCA 466 x LCA 453)	-28.02 (LCA 655 x LCA 453) to 26.65 (LCA 466 x LCA 453)	Indam-5	22 (7)
9	Dry fruit weight (g)	-19.82 (LCA 655 x LCA 453) to 35.17 (LCA 442 x LCA 703-2)	-33.40 (LCA 607 x G4) to 22.01 (LCA 442 x LCA 705-2)	18.75 (LCA 615 x G4) to 144.64 (LCA 607 x LCA 453)	-35.12 (LCA 615 x G4) to 33.66 (LCA 607 x LCA 453)	Indam-5	14 (3)
10	Fruit yield per plant (g)	-22.38 (LCA 446 x LCA 705-2) to 53.61 (LCA 655 x LCA 703-2)	-34.83 (LCA 607 x LCA 678) to 47.71 (LCA 655 x LCA 315)	-42.19 (LCA 355 x LCA 315) to 20.99 (LCA 607 x LCA 703-2)	-35.18 (LCA 355 x LCA 315) to 35.66 (LCA 607 x LCA 703-2)	Tejaswini	5 (2)
11	No. of seeds per fruit	-43.31 (LCA 446 x G4) to 51.46 (LCA 655 x LCA 315)	-52.73(LCA 442 x LCA 453) to 41.38 (LCA 655 x LCA 315)	-45.00 (LCA 446 x G4) to 17.89 (LCA 615 x G4)	-50.78 (LCA 446 x G4) to 5.49 (LCA 615 x G4)	Indam-5	7 (0)
12	Seed weight (g/1000 seed)	-21.86 (LCA 442 x G4) to 20.17 (LCA 466 x LCA 703-2	-23.18 (LCA 607 x LCA 678) to 18.19 (LCA 466 x LCA 703-2)	0.13 (LCA 442 x G4) to 53.07 (LCA 607 x LCA 705-2)	-26.69 (LCA 442 x G4) to 12.07 (LCA 607 x LCA 705-2)	Indam-5	10 (0)

Note: In 8th column, the values in parenthesis indicated the no. of hybrids registered significant standard heterosis in desirable direction over best check