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Combining Ability Studies in Different Cultivated Species of Tomato for Growth and Yield Attributing Traits

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ABSTRACT: An experiment was conducted with 13 genotypes (10 lines (*Solanum lycopersicum* var. *cerasiforme*) and 3 testers (*Solanum lycopersicum* var. *lycopersicum*)) and their 30 F_1 hybrid obtained from line × tester mating design during 2023. The experiment was laid out in the Randomized Complete Block Design with three replications at Vegetable Research Centre (V.R.C), Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, to estimate the combining ability of various growth and yield attributing traits for their genetic improvement and their effects in the population. Both GCA and SCA variances were highly significant for most of the characters indicating the importance of both additive and non-additive gene actions. CPCT-IARI Cherry-214 was found good general combiner for yield per plant among lines whereas PPT-2 was good general combiner among testers. The crosses identified as good specific combiner for yield per plant were CPCT-263×PBT-5 (0.59) followed by Punjab Red Cherry×PPT-2 (0.29) and CPCT-IARI Cherry-214×PPT-2 (0.25), they also showed SCA effects in desirable direction for more than one trait. Hence can be used in upcoming hybrid breeding programme after stability tests.

Keywords: line × tester, Combining Ability, GCA, SCA.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) (2n = 2x = 24) is the most popular and is the important member of Solanaceae family. It is widely grown vegetable crop in the world next to potato. The origin of tomato was Peru-Equador region (Rick and Holle 1990). Tomatoes were native to South America, but were brought to Europe in the 15th century, where they soon became popular and were exported around the world. Tomato is a self-pollinated, typical day neutral and warm season crop (Rick, 1965). It is highly nutritious with properties like blood purification and also rich in antioxidant like lycopene, β-carotene, ascorbic acid, folic acid and flavonoids (Freeman and Reimers 2011). Wide diversity prevailing in tomato can be used to harness yield and quality potential of the crop. On one hand where table tomato or cultivated tomato have high yield potential and larger fruit size, and on the other hand cherry tomatoes have small size clustered fruit. The breeding goals for improvement of tomato are high yield, more number of fruits, enhanced fruit shape and weight. Developing hybrids for both yields as well as quality is now essential for keeping the tomato production and supply sustainable for exponentially growing population. The hybrid performance depends upon the selection of parents. Per se performance, genetic diversity and combining ability etc are the basis of selection of parents. Selection of parents based on per se performance alone is not a sound procedure as superior lines identified on this basis may yield poor recombinants in the segregating generations (Garg *et al*., 2007). Therefore, to assess the genetic potential of parents in hybrid combination the combining ability analysis offers a powerful tool through general and specific combining abilities, to produce a superior heterotic hybrid. Among many available statistical tools to detect the combining ability and gene action governing various quantitative traits, line × tester analysis has been a very useful design (Kempthorne, 1957). Sound knowledge on the kind of gene action involved *i.e*., additive and dominance in the population, is required for genetic improvement of traits. Therefore, success in hybrid development with desired traits depends on the knowledge of combining ability, nature, and magnitude of gene action in different genetic backgrounds (Somraj *et al.,* 2018). High GCA was observed in days to 50 % flowering, plant height and

other related traits upon the study aimed to estimate the GCA and SCA variances including 10 lines and 5 testers (Singh *et al*., 2021). Further, after the study in 3 lines, 3 testers, and 9 hybrids to identify desirable parents and crosses. The lines contributed to most of hybrids variability than testers, Plant height had a higher degree of SCA variance as compared to GCA variance hence, governed by additive gene action. Whereas, number of branches, number of flowers/ clusters, number of fruits/cluster, and yield/plant were under the control of non-additive gene action (Pawan *et al.,* 2022). The information generated from line × tester analysis of quantitative traits helps plant breeders in planning the selection strategy and predicting the outcome of their breeding program (Mather and Jinks 1982).

With this objective, the present study was planned and executed with the objective of identification of desirable parents (combiners) and crosses (combinations) for the growth and yield traits through line × tester analysis in tomato, where lines were cherry tomatoes (*Solanum lycopersicum* var. *cerasiforme*) testers used were common table tomato (*Solanum lycopersicum* var. *lycopersicum*).

MATERIALS AND METHODS

The investigation on combining ability was conducted at Vegetable Research Centre (V.R.C), Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, during 2022-23 (September-May) and 2023-24 (October-April). The experimental materials for this study comprised of 10 lines (*Solanum lycopersicum* var. *cerasiforme*) *viz.,* Pusa Cherry 1, Punjab Red Cherry, Pant Cherry Tomato-6, Pant Cherry Tomato-7, CPCT-IARI Cherry-214, Punjab Sona Cherry, CPCT-263, Pant Cherry Tomato-8, Pant Cherry Tomato-9, Pant Cherry Tomato-10 and 3 testers (*Solanum lycopersicum* var. *lycopersicum*) *viz.,* PPT-2, PBT-5, PBT-9, which are selected based on their diversity for various traits. From these 10 lines and 3 testers, 30 crosses were evolved in a line × tester mating design and further analysed. A tri-replicated experiment was laid out in the Randomized Complete Block Design with plots having row to row and plant to plant spacing of 60 and 45 cm, respectively, with 6 plants each plot. Treatments were randomly allotted in each block. Five plants were randomly selected and tagged from each unit plot for recording data of the following observations *i.e.,* days to 50% flowering, first fruit set, number of flowers per cluster, number of fruit set per cluster, number of primary branches, plant height (m), main stem diameter (mm), fruit yield per plant (kg). Combining ability analysis was carried out as per procedure suggested by Kempthrone (1957).

RESULT AND DISCUSSION

The analysis of variance due to general combining ability (GCA) and specific combining ability (SCA) are presented in (Table 1). From the data presented in the table it is evident that mean square due to GCA (lines) were highly significant for the characters *viz.,* days to 50% flowering, number of fruit set per cluster, number of primary branches, main stem diameter, fruit yield per plant. Whereas, mean square due to SCA were highly significant for all the eight characters. The parents/crosses which have shown significant negative or positive GCA/SCA effects were good and poor combiners, respectively. Whereas, parents/crosses that exhibited non-significant GCA/SCA effects were average combiners.

Table 1: Analysis of variance (mean squares) for combining ability.

	Df	D50%F	DFFF	NFPC	NFSPC	NPB	PH (m)	MSD(mm)	FYPP(kg)
GCA (Lines)	9	97.00*	76.23	85.61	93.49**	56.05*	0.44	43.61**	0.57**
GCA (Testers)	2	11.70	22.30	1.39	23.98	10.74	2.12	59.87	0.46
SCA	29	53.14**	51.16**	49.47**	42.66**	29.72**	0.78**	43.61**	0.57**
Error	58	2.23	5.27	5.34	8.58	7.21	0.25	3.18	0.013

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

General combining ability. Estimates of the general combining ability are presented in Table 2. For days to 50% flowering, days to first fruit set negative values are desirable and the parents having significant negative estimates are considered as good general combiners. 3 lines out of 10 lines, *viz.,* Punjab Red Cherry (-1.283), Pant Cherry Tomato-9 (-4.783) and Punjab Sona Cherry (-6.450) exhibited significant desirable negative GCA effect for days to 50% flowering, whereas Among 3 testers, only one tester PBT-9 (-0.70) was a good combiner as it exhibited significant negative GCA effects for days to 50% flowering. For days to first fruit set, out of 10 lines, only 1 line was good general combiner *viz.,* Punjab Sona Cherry (-7.84) as it exhibited significant desirable negative GCA effect, further, Among 3 testers, none of the parents exhibited significant negative GCA effects whereas, PBT-9 (0.989) exhibited significant positive GCA effect for days to first fruit set indicating delayed fruit set.

A critical examination of the Table 2 revealed that for number of flowers per cluster Among 10 lines, CPCT-263 (2.307), CPCT-IARI-214 (2.05), Pant Cherry Tomato-8 (1.762) and Pant Cherry Tomato-6 (1.628) exhibited significant positive GCA effects making them good general combiner, significant positive values are desirable for this trait. Among 3 testers, none of the parents exhibited significant positive and negative GCA effects for number of flowers per cluster, hence making them average combiner. For number of fruits set per cluster, out of 10 lines, 3 lines were good general combiners *viz.,* Pant Cherry Tomato-7 (3.68), Pusa Cherry 1 (3.32), and Pant Cherry Tomato-8 (2.32) as they exhibited significant positive GCA effects. Further, among 3 testers, none of the parents exhibited significant positive and negative GCA effects for number of fruit set per cluster indicating them as average general combiners.

For number of primary branches represented in Table 2, Among 10 lines, only 2 lines, *viz.,* CPCT-263 (3.92) and Pant Cherry Tomato-9 (3.81) exhibited significant positive GCA effects indicating them as good general combiners. Whereas, 4 lines *viz.,* Pant Cherry Tomato-7 (-2.86), Pant Cherry Tomato-6 (-2.52), Punjab Red Cherry (-2.078) and CPCT-IARI-214 (1.87) exhibited significant negative GCA effects making them poor combiners. Among 3 testers, significant positive and negative GCA effects for number of primary branches was shown by none of the tester hence they can be classified as average general combiners. Out 10 lines, only 1 line was good general combiner, *viz.,* Pusa Cherry 1 (0.476) which exhibited significant positive GCA effects for plant height, whereas among 3 testers, PBT-5 (0.251) was a good general combiner as it exhibited significant positive GCA effects and PPT-2 (-0.278) was a poor general combiner as it exhibited significant negative GCA effects. Further for main stem diameter 3 lines, *viz.,* Pusa Cherry 1 (3.12), Punjab Sona Cherry (4.03) and CPCT-263 (2.99) exhibited significant positive GCA effects which is desirable for this trait making them good general combiner. Whereas, 5 lines, *viz.,* Punjab Red Cherry (-2.52), Pant Cherry Tomato-6 (-2.07), CPCT-IARI Cherry- 214 (-1.35), Pant Cherry Tomato-8 (-1.49) and Pant Cherry Tomato-10 (-2.86) were poor general combiner as they exhibited significant negative GCA effects, whereas among testers PBT-5 (1.36) exhibited significant positive GCA effects. While, PPT-2 (-0.12) and PBT-9 (-1.24) exhibited significant negative GCA effects.

For fruit yield per plant, 3 lines were good general combiners *viz.,* Pusa Cherry 1 (0.117), CPCT-IARI-214 (0.507) and Pant Cherry Tomato-9 (0.18) exhibited significant positive GCA effects. Whereas, Punjab Red Cherry (-0.22), Pant Cherry Tomato-6 (-0.209), Pant Cherry Tomato-7 (-0.086) and Punjab Sona Cherry (-0.23) exhibited significant negative GCA effects. PPT-2 (0.396) exhibited significant positive GCA effects. While, PBT-5 (-0.103) and PBT-9 (-0.293) exhibited significant negative GCA effects among testers.

Table 2: Estimates of GCA effect of parents.

	D50%F	DFFF	NFPC	NFSPC	NPB	PH (m)	MSD(mm)	FYPP(kg)
Lines								
Pusa Cherry 1	1.550 **	-0.011	0.376	3.323 **	-0.30	0.476 **	3.120 **	0.117 **
Punjab Red Cherry	-1.283 **	0.489	-0.390	-4.941 **	-2.078 *	-0.111	-2.524 **	-0.217 **
Pant Cherry Tomato-6	2.383 **	1.156	1.628 *	1.506	-2.52 **	-0.148	-2.068 **	-0.209 **
Pant Cherry Tomato-7	3.217 **	1.156	1.273	3.677 **	-2.86 **	0.041	-0.951	-0.086 *
CPCT-IARI Cherry-214	2.050 **	2.989 **	2.053 **	0.460	-1.856 *	0.109	-1.346 *	0.507 **
Punjab Sona Cherry	-6.450 **	-7.844**	-8.235 **	-5.515 **	0.92	-0.098	4.032 **	-0.232 **
CPCT-263	0.883	1.656 *	2.307 **	0.862	3.92**	0.231	2.987 **	-0.010
Pant Cherry Tomato-8	-0.283	-0.011	1.762 *	2.316 *	1.589	-0.248	-1.491 **	-0.067
Pant Cherry Tomato-9	-4.783 **	0.322	-0.763	-2.273 *	3.81**	-0.176	1.098	0.177 **
Pant Cherry Tomato-10	2.717 **	0.100	-0.011	0.584	-0.633	-0.076	-2.857 **	0.020
Testers								
PPT-2	0.200	-0.594	-0.238	0.735	-0.222	-0.278 **	-0.117	0.396 **
PBT-5	0.500	-0.394	0.057	-0.995	-0.456	0.251 **	1.356*	-0.103 **
PBT-9	-0.700 **	0.989 *	0.181	0.261	0.678	0.027	-1.239*	-0.293 **
S.E. (GCA)±	0.26	0.37	0.39	0.57	0.45	0.08	0.30	0.02
S.E. (g_i-g_j) ±	0.37	0.53	0.55	0.80	0.63	0.12	0.43	0.03

Specific combining ability. The estimates of SCA effects of 30 hybrid combination (produced by crossing 10 lines and 3 testers) were studied for 8 metric traits and results have been presented in Table 3. For maturity traits *viz.,* days to 50% flowering and days to first fruit set, SCA effects in negative directions was considered desirable. Out of 30 hybrids, 8 crosses *viz.,* Pusa Cherry 1× PPT-2 (-3.20), Punjab Red Cherry×PPT-2 (-1.87), Pant Cherry Tomato-6×PBT-9 (-2.13), Pant Cherry Tomato-7×PBT-5 (-3.17), Punjab Sona Cherry × PBT-9 (-5.80), CPCT-263 × PPT-2 (-3.53), Pant Cherry Tomato-8× PBT-5 (-5.17), Pant Cherry Tomato-9× PBT-5 (-4.17) exhibited significant negative SCA estimates depicting them as good specific combiners. Further for days to first fruit set 6 crosses *viz.,* Pant Cherry Tomato-6×PBT-5 (-3.11), Pant Cherry Tomato-7×PBT-5 (-3.11), CPCT-IARI Cherry-214×PPT-2 (-4.74), Punjab Sona Cherry × PBT-9 (-5.49), CPCT-263 × PBT-9 (-4.99) and Pant Cherry Tomato-8× PBT-5 (-3.44) out of 30 cross combinations exhibited significant negative SCA estimates proving them to be good specific combiners.

For number of flowers per cluster and number of fruit set per cluster SCA effects in positive direction are desirable presented in Table 3, 4 crosses out of 30 cross combinations *viz.,* Pant Cherry Tomato-6×PPT-2 (2.90), CPCT-IARI Cherry-214×PBT-9 (6.38), Punjab Sona Cherry × PBT-5 (3.07) and CPCT-263 × PBT-5 (6.03) exhibited significant positive SCA estimates for number of flowers per cluster indicating them as good specific combiners. Whereas, for number of fruit set per cluster only one hybrid combination *viz.,* Pant Cherry Tomato-6×PBT-5 (4.75) exhibited significant positive SCA effects, hence marking it as good specific combiner.

For growth parameters *viz.,* number of primary branches, plant height and main stem diameter SCA effects in positive direction are desirable. Out of 30 cross combinations, only 2 crosses were found good specific combiner for number of primary branches *viz.,* CPCT-IARI Cherry-214×PBT-9 (4.99) and Pant Cherry Tomato-9×PBT-5 (4.12) exhibited significant positive SCA effects. Further for plant height, only 3 crosses *viz.,* CPCT-IARI Cherry-214×PBT-9 (0.98), CPCT-263×PBT-5 (0.87) and Pant Cherry Tomato-8×PBT-9 (0.69) exhibiting significant positive SCA effects indicating them as good specific combiners. Punjab Sona Cherry × PBT-5 (6.82), CPCT-263×PBT-9 (3.89), Pant Cherry Tomato-9×PPT-2 (3.90) and Pant Cherry Tomato-9×PBT-5 (2.82) were found to be good specific

combiner for main stem diameter as they exhibited significant positive SCA effects the trait.

10 crosses *viz.,* Pusa Cherry 1× PBT-5 (0.18), Punjab Red Cherry × PPT-2 (0.29), Pant Cherry Tomato-6×PBT-5 (0.15), Pant Cherry Tomato-6×PBT-9 (0.27), Pant Cherry Tomato-7×PBT-5 (0.15), CPCT-IARI Cherry-214×PPT-2 (0.25), CPCT-IARI Cherry-214×PBT-9 (0.20), Punjab Sona Cherry × PPT-2 (0.15), CPCT-263×PBT-5 (0.59), Pant Cherry Tomato-9×PPT-2 (0.27) were found as good specific combiner, exhibiting significant positive SCA effects for fruit yield per plant with highest GCA effect shown by CPCT-263×PBT-5 (0.59).

Table 3: Estimates of SCA effect of hybrids.

Sr. No.	Hybrids	D50%F	DFFF	NFPC	NFSPC	NPB	PH (m)	MSD (mm)	FYPP(kg)
1.	Pusa Cherry 1× PPT-2	-3.20 **	-0.74	-0.39	-0.96	-0.33	0.21	-2.19 *	0.03
2.	Pusa Cherry 1×PBT-5	3.50 **	1.56	1.19	-0.91	2.57	0.29	0.20	0.18**
3.	Pusa Cherry 1×PBT-9	-0.30	-0.82	-0.80	1.87	-2.23	-0.50	1.99	-0.21 **
4.	Punjab Red Cherry× PPT-2	-1.87 *	-0.24	0.59	1.47	0.11	0.15	0.65	0.29 **
5.	Punjab Red Cherry× PBT-5	2.83 **	0.56	0.28	-3.86 *	-1.32	-0.20	-0.99	-0.25 **
6.	Punjab Red Cherry× PBT-9	-0.97	-0.32	-0.86	2.39	1.21	0.05	0.34	-0.05
7.	Pant Cherry Tomato-6× PPT-2	1.97 *	3.09 *	2.90 *	-3.74 *	-0.11	0.51	-2.24 *	-0.42 **
8.	Pant Cherry Tomato-6× PBT-5	0.17	-3.11 *	-0.81	4.75 **	-0.21	-0.40	1.02	0.15 *
9.	Pant Cherry Tomato-6× PBT-9	-2.13 *	0.01	-2.09	-1.02	0.32	-0.11	1.22	0.27 **
10	Pant Cherry Tomato-7× PPT-2	0.63	2.09	2.50	0.17	1.22	0.34	0.98	-0.13
11.	Pant Cherry Tomato-7× PBT-5	-3.17 **	-3.11 *	-3.39 *	-0.98	-0.88	-0.14	-0.83	0.15 *
12.	Pant Cherry Tomato-7× PBT-9	2.53 **	1.01	0.88	0.81	-0.34	-0.20	-0.15	-0.03
13.	CPCT-IARI Cherry-214 × PPT-2	-1.70	-4.74 **	-3.55 **	1.69	-1.78	-0.51	1.34	0.25 **
14.	CPCT-IARI Cherry-214 × PBT-5	0.50	-1.94	-2.84 *	-2.94	-3.21 *	-0.47	-2.57 *	-0.45 **
15.	CPCT-IARI Cherry-214 × PBT-9	1.20	6.68 **	6.38 **	1.25	4.99 **	0.98 **	1.23	0.20 **
16.	Punjab Sona Cherry × PPT-2	3.30 **	1.09	2.53	0.46	-0.22	-0.21	-4.30 **	0.15 *
17.	Punjab Sona Cherry ×PBT-5	2.50 **	4.39 **	3.07 *	0.61	-0.32	0.20	6.82 **	-0.15 *
18.	Punjab Sona Cherry ×PBT-9	-5.80 **	-5.49 **	-5.60 **	-1.06	0.54	0.01	-2.52 *	-0.00
19.	CPCT-263 × PPT-2	-3.53 **	0.09	-2.96 *	0.20	-0.56	-0.18	-1.43	-0.42 **
20.	CPCT-263 × PBT-5	4.17 **	4.89 **	6.03 **	2.17	2.68	0.87 **	-2.47 *	0.59 **
21	CPCT-263 × PBT-9	-0.63	-4.99 **	-3.07 *	-2.37	-2.12	-0.69 *	3.89 **	-0.18 **
22.	Pant Cherry Tomato-8× PPT-2	2.63 **	0.76	0.69	1.28	1.11	-0.35	1.62	-0.13 *
23.	Pant Cherry Tomato-8× PBT-5	-5.17 **	-3.44 *	-2.70 *	-0.49	-1.66	-0.33	-1.29	0.05
24.	Pant Cherry Tomato-8× PBT-9	2.53 **	2.68 *	2.00	-0.79	0.54	0.69 *	-0.33	0.09
25.	Pant Cherry Tomato-9 × PPT-2	1.63	-2.07	-1.65	1.43	-2.44	-0.11	3.90 **	0.27 **
26.	Pant Cherry Tomato-9 × PBT-5	-4.17 **	2.73 *	0.45	-1.62	4.12 **	0.36	2.82 **	-0.20 **
27.	Pant Cherry Tomato-9 × PBT-9	2.53 **	-0.66	1.20	0.19	-1.68	-0.25	-6.72 **	-0.07
28.	Pant Cherry Tomato-10 × PPT-2	0.13	0.65	-0.67	-2.00	3.00	0.16	1.68	0.12
29.	Pant Cherry Tomato-10 × PBT-5	-1.17	-2.55	-1.28	3.27	-1.77	-0.17	-2.72 **	-0.09
30.	Pant Cherry Tomato-10 × PBT-9	1.03	1.90	1.95	-1.27	-1.23	0.02	1.04	-0.03
	S.E. (SCA)±	0.82	1.18	1.24	1.79	1.41	0.27	0.96	0.07
	S.E. (g_{ij}-g_{kl}) ±	1.16	1.67	1.75	2.54	1.99	0.38	1.36	0.10

Table 4: Best tomato lines and testers with significant and high GCA effects in the desirable direction.

Characters	Lines	Testers
Days to 50% flowering	Punjab Sona Cherry	PBT-9
Days to first fruit set	Punjab Sona Cherry	-
Number of flowers per cluster	**CPCT-263**	-
Number of fruit set per cluster	**Pant Cherry Tomato-7**	-
Number of primary branches	**CPCT-263**	-
Plant height	**Pusa Cherry 1**	**PBT-5**
Main Stem Diameter	Punjab Sona Cherry	**PBT-5**
Fruit yield per plant (kg)	**CPCT-IARI Cherry-214**	**PPT-2**

The combining ability of lines differed based on the tester involved in the cross combination which was amply reflected by significant differences for crosses. The contrasting findings of additive gene action were cited for number of fruit/cluster (Mondal *et al.,* 2009; Reddy *et al.,* 2023). The additive and non-additive gene effects for fruit quality and yield traits were reported by Gaikwad and Cheema (2009); Akhtar and Hazra (2013). The predominance of non-additive gene action exhibited by number of branches, number of clusters and number of fruits/cluster Pavan *et al.* (2022). Similar results for days to 50% flowering was observed by Raj *et al.* (2017); Pattnaik *et al.* (2022), for number of primary branches, plant height, was reported by Pattnaik *et al.* (2022); Reddy *et al.* (2023), for number of flowers per cluster and number of fruit set per cluster (Reddy *et al.,* 2023) for main stem diameter was seen by (Zengin, 2015). The specific combining ability is used to designate those cases in which specific combinations do relatively better or worse than would be expected from the average performance of the lines involved. The SCA is controlled by dominance and non-allelic gene interactions. The high GCA effects of parents may producehybrids with low SCA effects and vice versa. Similar findings related to prevalent SCA effects were reported by Shakil *et al.* (2017; Umesh and Patil (2021); Pavan *et al.* (2022); Pattnaik *et al.* (2022); Reddy *et al.* (2023).

CONCLUSIONS

It was concluded that for all the growth and yield related traits highly significant variances were observed

for specific combining ability and for days to 50% flowering, number of fruit set per cluster, number of primary branches, main stem diameter, fruit yield per plant highly significant variances were observed for general combining ability indicating presence of additive and non-additive gene actions for these traits. Considering higher yield, CPCT-IARI-214 and PPT-2 were found as good general combiner. The three best hybrid combinations showing significant and desirable SCA effect for fruit yield per plant were CPCT-263×PBT-5 (0.59) followed by Punjab Red Cherry×PPT-2 (0.29) and CPCT-IARI Cherry-214×PPT-2 (0.25). The parent with high per se performance might or might not be the best specific cross. It is suggested that breeding techniques that can accumulate detectable genetic effects while maintaining substantial heterozygosity to take advantage of dominant gene effects have proven to be most beneficial for improving the population studied.

FUTURE SCOPE

As per the results of the present findings, it is suggested that parent CPCT-IARI-214 and PPT-2 may be used in upcoming breeding programme due to its high GCA effects in desirable direction for yield aspect. Whereas, cross combinations CPCT-263×PBT-5, Punjab Red Cherry×PPT-2 and CPCT-IARI Cherry-214×PPT-2 holds good prospects for serving as commercial hybrid for yield and yield related traits which may be used as a hybrid after their stability test.

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