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Exploitation of Hybrid Vigour and Combining Ability Studies for Yield and Its Attributing Traits in Ridge Gourd [*Luffa acutangula* (Roxb.) L.]

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ABSTRACT

Twelve parental lines (7 lines and 5 testers) were crossed in Line × Tester mating design and 35 F_1 hybrids of ridge gourd obtained and were studied to investigate the extent of heterosis and combining ability for yield and related traits. Result revealed that the crosses, COHB-1 × Deepthi (25.95 %), COHB-33 × Deepthi (11.07 %) and COHB-32 × Pusa Nutan (5.09 %) exhibited maximum and significant positive heterosis over the commercial check (Naga) for fruit yield per vine. Among the parents, maximum and significant gca effects was recorded in the line COHB-33 (0.66) followed by Pusa Nutan (0.60) and Deepthi (0.44) for fruit yield per vine. The maximum sca effects was observed in the cross COHB-1 × Deepthi (1.64) followed by COHB-32 × Arka Sumeet (1.12) and COHB-32 × Pusa Nutan (1.03).

Key words: *Heterosis, Combining ability, Ridge gourd, Yield and Line × Tester analysis.*

INTRODUCTION

Luffa acutangula (ridge gourd) is very popular vegetable in the tropical and subtropical regions. In India, they are eaten boiled or in curry (mixed with potato or sole). In Japan, the young fruits are sliced and dried and kept for future use. The young insipid leaves are consumed in Malaysia[15]. In African countries, leaves are used as leafy vegetable and seeds are used in several soup and sauce preparations[1]. Despite its health and dietary benefits, the production of ridge gourd in India is mostly done on a small scale for local consumption and hence exact area and production are unknown. Nevertheless, in Karnataka, the ridge gourd is cultivated over an area of 4,970 hectares with a production of 42,856 tonnes and productivity of 8.62 tonnes per hectare[4].

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A wide range of variability in fruit and vegetative characters is available in this crop, but the same has not been assessed and utilized. Heterosis breeding is one of the most efficient tools to exploit the genetic diversity in ridge gourd. Being monoecious in sex expression and cross pollinated, it provides ample scope for the utilization of hybrid vigor. The line × tester analysis[10] is one of the techniques, where large number of genotypes could be tested for combining ability. It is also necessary to assess the genetic potentialities of the parents in hybrid combination through systematic studies in relation to general and specific combining abilities which are due to additive and non-additive gene effects, respectively[6].

MATERIAL AND METHODS

Seven lines and five testers of diverse origin of ridge gourd were crossed in Line × Tester fashion[10] to obtain 35 F_1 Hybrids. The F_1 hybrids along with their parents were evaluated at Department of vegetable Science, College of Horticulture Science-Bengaluru, University of Horticultural Sciences-Bagalkot, India, during *Kharif* 2015 with two replication. Distance between rows was kept 120 cm and plants were spaced at 90 cm apart within row. All the recommended cultivation practices were followed to raise good crop[5]. A row consisting of 15 plants formed in each plot under each treatment. Observations were recorded on five randomly selected plants in each replication on fruit length (cm), fruit diameter (cm), flesh thickness (cm), rind thickness (mm), average fruit weight (g), number of fruits per vine and fruit yield per vine. Data thus recorded were analyzed as per the method of Kempthorne[10] to work out the general combining ability effect of the parents and specific combining ability effects of the crosses. Heterosis was calculated as percentage increase in F_1 over better parent and standard variety Naga (East West Seeds, Pvt. Ltd.).

RESULTS AND DISCUSSION

The analysis of variance for heterosis has been presented in Tables-1. Genotypes differences were found significant for all the characters studied. Parents differed significantly for all the characters except rind thickness. Crosses exhibited significant differences for all the parameters under the study. Heterosis was worked over better parent and the commercial check for yield and its attributing parameters. The hybrid "Naga'' was selected as the commercial check, since it is commercial grown F_1 hybrid in the Karnataka**.**

Yield components greatly influence the yield and expression of heterosis for fruit length, fruit diameter, average fruit weight, number of fruits per vine can greatly contribute for heterosis observed for total yield per vine. For these traits positive heterosis is desirable and result of estimates of heterosis over better and standard parent have been presented in Table 2. Out of 35 crosses, 17 crosses over better parent reported positive and significant heterosis for fruit length. None of the cross exhibited positive and significant heterosis over the commercial check. The cross COHB-1 × Deepthi (50.61 %) showed maximum and positive significant heterosis over better parent and it is very high compared to earlier reports of 6.92 per cent by Poshiya *et al.*[16] and 28.64 per cent by Karmakar *et al.*[9] in ridge gourd.

Total yield and consumer acceptance depends upon the fruit diameter, flesh thickness as well as rind thickness. With regard to fruit diameter, 27 over better parent and 24 over the commercial check was reported positive and significant heterosis. The cross COHB-1 × Pusa Nasdar showed maximum heterosis of 52.43% over better parent which is similar magnitude (36.31 %) as reported by Karmakar *et al.*[9] in ridge gourd. Maximum and significant positive heterosis over the commercial check was observed in the cross COHB-40 × Deepthi (48.54 %) and is very high compared to7.63 per cent as reported by Poshiya *et al.*[16] and it is attributed to use different genetic stocks and commercial check in the studies. For flesh thickness, the cross COHB-32 × Arka Sumeet exhibited positive and significant heterosis over better parent (54.15 %) and the commercial check (71.43 %). Similar observations were made by

Jhadav *et al*.[8] in bitter gourd. Among 35 crosses, 17 over better parent and 18 crosses over the commercial check was observed for rind thickness. Maximum and significant heterosis over the commercial check recorded in the cross COHB-1 × Pusa Nutan (103.09 %) and it is very high compared to earlier report of 15.23 per cent as reported by Angadi[3] in bitter gourd.

Total fruit yield per vine is dependent mainly on number if fruits per vine. Number of fruits per vine is negatively associated with size of the fruit. With regard to number of fruits per vine, out of 35 crosses, 29 over better parent and eight crosses over the commercial check exhibited positive and significant heterosis. The cross COHB-1 × Deepthi showed maximum and significant heterosis of 161.01 per cent over better parent and 29.66 per cent over the commercial check, which is very high compared to 57.13 per cent over better parent and low as compared 99.60 per cent over commercial check as reported by Poshiya *et al.*[16] in ridge gourd. Variance in the magnitude of heterosis in comparison to earlier reports is attributed to variance in genetic stock used in the different studies. Magnitude of heterosis over better parent and the commercial check was significant in both the directions for fruit yield per vine. Out of the 35 crosses, 28 over better parent and six over the commercial check was showed positive and significant heterosis. The maximum and significant positive heterosis over the better parent was reported in the cross COHB-33 × Deepthi (185.29 %) followed by COHB-1 × Deepthi (180.00 %) and COHB-32 × Pusa Nutan (155.73 %). Which is confirmed with earlier findings by Mole *et al*.[12] of 50.81 per cent, Niyaria and Bhalala[14] of 67.88 per cent, Hedau and Sirohi[7] of 93.09 per cent, Ahmed *et al*.[2] of 57.22 per cent and Neeraja[13] of 112.34 per cent, Poshiya *et al.*[16] of 67.46 per cent, Karmakar *et al.*[9] of 177.76 per cent, positive and significant heterosis was reported over better parent in ridge gourd. Maximum and significant positive heterosis over the commercial check was observed in the cross COHB-1 × Deepthi (25.95 %) followed by COHB-33 × Deepthi (11.07 %) and COHB-32 × Pusa Nutan (5.09 in order of merit. Heterosis for fruit yield over the commercial check was also reported by Niyaria and Bhalala[14] of 121.5 per cent, Hedau and Sirohi[7] of 93.09 per cent, Ahmed *et al*.[2] of 33.10 per cent, Lodam *et al*[11] of 63.81 per cent, Poshiya *et al.*[16] of 80.51 per cent, Neeraja[13] of 24.04 per cent and it is attributed to use of different varieties or hybrids as check in the studies.

The variance due to general combing ability (GCA), specific combining ability (SCA) and GCA to SCA ratio, contribution of lines, contribution of testers and interaction of lines and testers are presented in Table 3. Variance due to GCA is higher than variance due to SCA for all the characters under the study. Low GCA to SCA ratio was observed for the characters under the study *viz.,* fruit length (0.007), fruit diameter (0.024), flesh thickness (0.066), rind thickness (0.023), average fruit weight (0.006), number of fruits per plants (0.020) and fruit yield per plant (0.012). Similar findings were also made by Ahmed *et al.* (2006) in ridge gourd for yield per vine (0.10), number of fruits per vine (0.06), average fruit weight (0.22), fruit length (0.05) and fruit diameter (0.09). Per cent contribution of line × tester interaction was higher for the traits *viz.*, fruit length (59.94 %), fruit diameter (72.12 %), flesh thickness (65.83 %), rind thickness (68.04 %), average fruit weight (68.54 %), number of fruits per plant (39.03 %) and fruit yield per plant (52.74) compared to lines and testers. Hence, there is great scope for heterosis breeding to exploit the non-additive genetic variance observed for yield and yield components.

The estimate of gca effects of the parents and sca effects of the crosses have been presented in Tables 4 and 5, respectively. None of the parents showed good gca effects for all the characters. The best three parents possessing significant and high gca effect for fruit yield per vine were COHB-33 (0.66), Pusa Nutan (0.60) and Deepthi (0.44) in order of merit. COHB-33 and Pusa Nutan also showed significant gca effects for fruit length, flesh thickness and number of fruits per vine, whereas deepthi expressed significant gca effects for number of fruits per vine apart from fruit yield per vine.

Among the 35 crosses, nine crosses exhibited positive and significant sca effects for yield per vine. The maximum sca effects was observed in the cross COHB-1 × Deepthi (1.64) followed by COHB-32 × Arka Sumeet (1.12), COHB-32 × Pusa Nutan (1.04), COHB-28 × Pusa Nasdar (1.03), COHB-20 × Deepthi (0.93), COHB-33 × Pusa Nasdar (0.70), COHB-33 × Deepthi (0.63), COHB-35 × Deepthi (0.56) and COHB-40 × Pusa Nutan (0.55) in order of merit.

The hybrid COHB-1 × Deepthi was selected as the best hybrid for yield per vine and its total yield was 4.95 kg per vine as compared to 3.93 kg per vine of the commercial check (Naga) with 25.95 per cent standard heterosis. Performance of this hybrid with respect to total yield is attributed to its significant heterosis observed over the commercial check in the desirable direction fruit diameter, flesh thickness, rind thickness, number of fruits per vine, and fruit yield per vine. The hybrid COHB-1 × Deepthi also exhibited desirable significant sca effects for fruit length, flesh thickness, number of fruits per vine and fruit yield per vine. The parent COHB-1 involved in the development of this hybrid was found to be a poor general combiner for all the characters except rind thickness. The other parent Deepthi exhibited significant gca effects in the desirable direction for rind thickness, number of fruits per vine and fruit yield per vine. The next hybrid was COHB-33 × Deepthi exhibited 11.07 per cent standard heterosis for yield per plant which had yielding ability of 4.37 kg per vine as compared to 3.93kg per vine yield of commercial check. Performance of hybrids with respect to total yield is attributed to significant standard heterosis was observed in the desirable directions for fruit diameter, flesh thickness, number of fruits per vine and fruit yield per vine. The hybrid COHB-33 × Deepthi also exhibited desirable significant sca effects for number of fruits per vine and fruit yield per vine. The parent COHB-33 involved in the development of this hybrid was found to be a good general combiner for fruit length, flesh thickness, number of fruits per vine and fruit yield per vine. The other parent Deepthi exhibited significant gca effects in the desirable direction for rind thickness, number of fruits per vine and fruit yield per vine. The next best hybrid was COHB-32 × Pusa Nutan which exhibited 5.09 per cent standard heterosis for total yield per plant and its yield was 4.13 kg per vine as compared to 3.93kg per vine yield of commercial check. Its performance is attributed to significant standard heterosis in the desirable direction for fruit diameter, flesh thickness, rind thickness, number of fruits per vine and fruit yield per vine. The hybrid COHB-32 × Pusa Nutan also exhibited significant sca effects for number of fruits per vine and fruit yield per vine. Among the two parents involved in the development of this hybrid (COHB-32 × Pusa Nutan), COHB-32 was a poor general combiner for all the character under study and Pusa Nutan, the other parent was a good general combiner for fruit length, flesh thickness, number of fruits per vine and fruit yield per vine. As this hybrid (COHB-32 × Pusa Nutan) also possessed significant sca effects for yield possessing high standard heterosis, it can also be assessed for stability for commercial exploitation. In this cross also parents involved are low × high general combiners and this may be due to non-additive gene action.

The parents involved in COHB-1 × Deepthi and COHB-32 × Pusa Nutan are low × high general combiners this may be due to intra allelic interactions. Similar results were also obtained by Niyaria and Bhalala[14] and Shaha *et al.*[17] in ridge gourd. The heterotic hybrids involving low x low and low x high or high x low also contributes to the non-additive gene effects. Hence, exploitation of heterosis appears to be an appropriate strategy for improvement of ridge gourd. In cross COHB-33 × Deepthi parents are high × high type of general combiners are involved. Among nine high heterotic crosses, four were products of both the parents are good combiners and governed by additive gene action which is fixable in nature. Therefore, following pedigree method or any other selection procedure or true breeding good progenies can be identified from the segregating population in succeeding generation. The similar findings were reported by Neeraja[13] in ridge gourd.

Table 1: Analysis of variance (mean sum of squares) of lines × tester analysis for yield and its attributes in ridge gourd

Source of variation	df	MSS						
		Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (mm)	Average fruit weight (g)	Number of fruits per plant	Fruit yield per vine (kg)
Replications	1	0.33	2.81	0.49	1.43	33.73	4.17	0.08
Genotypes	46	41.35**	0.87**	0.64**	9.98**	1112.49*	45.02**	2.07**
Parents	11	40.49**	0.48*	0.67**	1.27NS	1542.10*	28.42**	088**
Parents v/s Crosses	1	109.16**	10.49**	7.40**	26.93**	3732.87*	395.17**	25.28**
Crosses	34	39.63**	0.71**	0.43**	12.30**	896.43NS	40.09**	1.77**
Lines	6	24.07NS	0.90NS	0.76NS	14.79NS	975.31NS	85.29**	2.57NS
Testers	4	98.85*	0.33NS	0.11NS	11.21NS	933.63NS	79.86*	3.27NS
Line × Tester	24	33.65**	0.73**	0.14**	11.85**	870.52NS	22.16**	1.32**
Error	46	3.62	0.23	0.14	1.01	680.75	4.62	0.07

df=degrees of freedom, MSS=Mean Sum of Squares,
* and ** Significant at 5 and 1% level of significance, respectively

Table 3: Variance due to general combining ability and specific combining ability for yield characters in ridge gourd

Sl. No.	Characters	GCA	SCA	GCA/SCA	Contribution of lines	Contribution of testers	Contribution of lines × testers
1	Fruit length (cm)	0.18	23.58	0.007	10.72	29.34	59.94
2	Fruit diameter (cm)	0.01	0.21	0.024	22.41	5.47	72.12
3	Flesh thickness (cm)	0.01	0.14	0.066	31.08	3.09	65.83
4	Rind thickness (mm)	0.13	5.75	0.023	21.23	10.73	68.04
5	Average fruit weight (g)	0.76	119.82	0.006	19.19	12.25	68.54
6	Number of fruits per plant	0.53	26.8	0.02	37.54	23.43	39.03
7	Fruit yield per plant (kg)	0.01	1.11	0.012	25.59	21.67	52.74

GCA-General combining ability, SCA-Specific combining ability

Table 2: Heterosis (%) better parent and commercial check for fruit yield and its attributes in ridge gourd

Sl. No	Crosses	Fruit length (cm)		Fruit diameter (cm)		Flesh thickness (cm)		Rind thickness (mm)		Average fruit weight (g)		Number of fruits per vine		Fruit yield per vine (kg)	
		BP	CC	BP	CC	BP	CC	BP	CC	BP	CC	BP	CC	BP	CC
1	COHB-1 × P. Nasdar	5.54**	-26.68**	52.43**	20.69**	8.31**	-3.81**	-6.15**	22.53**	-19.34	-12.15	-0.75	-41.31**	4.86**	-53.31**
2	COHB-1 × P. Nutan	11.95**	-14.42**	40.70**	11.41**	36.73**	21.43**	55.56**	103.09**	1.82	-21.17	122.22**	18.27**	124.15**	-7.89**
3	COHB-1 × Deepthi	50.61**	-10.58**	43.38**	13.53**	29.49**	15.00**	40.74**	83.75**	28.66	-2.45	161.01**	29.66**	180.00**	25.95**
4	COHB-1 × A. Sujat	-5.94**	-31.49**	-2.90**	-15.52**	-6.17**	-16.67**	3.70**	35.40**	-10.46	-21.93	1.15	-45.18**	-7.57**	-56.49**
5	COHB-1 × A. Sumeet	-2.00	-17.55**	11.49**	-0.93	23.11**	31.90**	-12.37**	14.41**	23.51	0.36	46.79**	-41.28**	74.32**	-43.00**
6	COHB-20 × P. Nasdar	9.66**	-23.56**	33.33**	16.71**	29.56**	55.48**	82.35**	49.90**	-15.93	-8.43	-20.00**	-17.21**	1.35**	-23.54**
7	COHB-20 × P. Nutan	19.81**	-8.41**	22.73**	7.43**	2.58**	23.10**	36.09**	27.27**	27.63	-1.20	-0.86	2.60	35.25***	2.04**
8	COHB-20 × Deepthi	-7.59**	-35.58**	17.12**	2.52**	11.91**	34.29**	-7.55**	-1.64	-1.12	-27.62	-11.43**	-8.34**	-16.19**	-36.77**
9	COHB-20 × A. Sujat	20.13**	-12.50**	20.15**	5.17**	7.74**	29.29**	-10.53**	-17.79**	-7.8	-19.61	-21.11**	-18.36**	-13.15**	-34.48**
10	COHB-20 × A. Sumeet	-8.86**	-23.32**	27.91**	13.66**	25.60**	50.71**	3.88**	-14.60**	12.17	-8.85	-28.57**	-26.08**	-8.94**	-31.30**
11	COHB-28 × P. Nasdar	-8.81**	-35.34**	6.71**	11.80**	11.58**	51.43**	1.66	-4.93**	-19.48	-12.3	46.15**	12.36*	51.94**	-0.25
12	COHB-28 × P. Nutan	1.89	-22.12**	-0.89	3.85**	1.75**	38.10**	22.34**	14.41**	8.86	-9.87	40.15**	7.75**	48.06**	-2.80**
13	COHB-28 × Deepthi	15.59**	-18.03**	12.28**	17.64**	-15.26**	15.00**	-1.46	4.84**	12.15	-7.15	6.58**	-18.07**	15.31**	-24.30**
14	COHB-28 × A. Sujat	9.57**	-20.19**	21.01**	26.79**	25.79**	70.71**	-3.41**	-9.67**	-1.52	-14.14	9.92**	-15.49**	10.27**	-27.61**
15	COHB-28 × A. Sumeet	-8.29**	-22.84**	15.19**	20.69**	2.46**	39.05**	1.66	-4.93**	19.34	-1.19	-16.92**	-36.13**	-2.91**	-36.26**
16	COHB-32 × P. Nasdar	-22.91**	-40.14**	-20.66**	-20.03**	-2.14**	8.81**	11.77**	-8.12**	-39.87	-34.51	-57.45**	-74.84**	-62.86**	-83.46**
17	COHB-32 × P. Nutan	4.03*	-19.23**	27.63**	28.65**	41.33**	57.14**	39.61**	30.56**	12.33	-13.04	106.06**	9.67**	155.73**	5.09**

18	COHB-32 × Deepthi	-28.48**	-44.47**	-28.95**	-28.38**	-7.07**	3.33**	-12.09**	-6.48**	12.68	-19.18	36.91**	-31.99**	75.21**	-46.95**
19	COHB-32 × A. Sujat	5.26**	-18.27**	8.29**	9.15**	54.18**	71.43**	7.05**	-1.64	-4.89	-17.07	41.84**	-23.12**	30.54**	-38.55**
20	COHB-32 × A. Sumeet	11.71**	-6.01**	-1.84**	-1.06*	34.05**	49.05**	2.00	-16.15**	12.99	-8.18	117.74**	-12.89**	144.75**	-19.97**
21	COHB-33 × P. Nasdar	-18.78**	-26.20**	2.16**	0.27	6.45**	57.14**	-12.76**	-11.41**	-16.11	-8.63	81.05**	7.07**	127.14**	1.15**
22	COHB-33 × P. Nutan	5.29**	-4.33*	10.41**	8.36**	12.90**	66.67**	0.00	1.55	11.21	-13.91	70.89**	-9.05**	92.26**	-20.99**
23	COHB-33 × Deepthi	-29.37**	-35.82**	27.43**	25.07**	0.00	47.62**	-9.09**	3.29**	23.27	-5.64	137.82**	21.23**	185.29**	11.07**
24	COHB-33 × A. Sujat	-0.27	-9.38**	8.51**	6.50**	11.29**	64.29**	19.05**	20.89**	10.35	-3.78	86.91**	1.30	86.76**	-12.09**
25	COHB-33 × A. Sumeet	-11.91**	-19.95**	1.35**	-0.53	-19.36**	19.05**	-1.62	-0.10	0.50	-18.33	89.27**	-3.52	101.63**	-21.50**

Table 2: Contd...

Sl. No	Crosses	Fruit length (cm)		Fruit diameter (cm)		Flesh thickness (cm)		Rind thickness (mm)		Average fruit weight (g)		Number of fruits per vine		Fruit yield per vine (kg)	
		BP	CC	BP	CC	BP	CC	BP	CC	BP	CC	BP	CC	BP	CC
26	COHB-35 × P. Nasdar	21.80**	-15.38**	18.78**	8.22**	9.71**	53.33**	-6.09**	-0.10	-18.26	-10.97	4.10	-38.44**	22.29**	-45.55**
27	COHB-35 × P. Nutan	15.09**	-12.02**	0.00	-8.89**	-17.55**	15.24**	-5.46*	0.58	-28.6	-35.82	43.06**	-23.86**	30.03**	-46.56**
28	COHB-35 × Deepthi	10.25**	-35.34**	24.16**	13.13**	14.65**	60.24**	19.64**	27.27**	-3.70	-13.44	7.14**	-46.78**	103.28**	-21.12**
29	COHB-35 × A. Sujat	-3.63	-29.81**	-22.42**	-29.31**	-15.33**	18.33**	-20.90**	-15.80**	3.14	-7.29	20.02**	-34.95**	25.41**	-40.97**
30	COHB-35 × A. Sumeet	-31.43**	-42.31**	8.15**	-1.46**	4.43**	45.95**	-22.73**	-17.79**	1.85	-8.45	-43.02**	-75.37**	-42.62**	-77.74**
31	COHB-40 × P. Nasdar	-4.50*	-33.65**	17.16**	14.99**	19.11**	27.62**	23.26**	11.22**	-35.32	-29.55	4.30	-2.42	2.62**	-30.15**
32	COHB-40 × P. Nutan	-2.83	-25.72**	8.51**	6.50**	16.44**	24.76**	12.00**	4.74**	6.46	-17.59	31.70**	23.21**	48.04**	0.76**
33	COHB-40 × Deepthi	5.65**	-37.02**	51.35**	48.54**	17.78**	26.19**	24.27**	32.21**	1.26	-26.26	34.48**	25.81**	35.70**	-7.63**
34	COHB-40 × A. Sujat	9.57**	-20.19**	23.38**	21.09**	8.00**	15.71**	21.05**	11.22**	-5.65	-17.74	13.78**	6.45**	28.60**	-12.47**
35	COHB-40 × A. Sumeet	-14.00**	-27.64**	-6.35**	-8.09**	40.00**	50.00**	17.90**	6.38**	10.31	-10.37	-15.87**	-21.29**	2.80**	-30.03**
	C.D.@5%	3.83	3.83	0.96	0.96	0.75	0.75	2.02	2.02	52.5	52.5	4.32	4.32	0.53	0.53
	C.D.@1%	5.11	5.11	1.29	1.29	1.01	1.01	2.70	2.70	70.11	70.11	5.78	5.78	0.71	0.71
	S.Em±	1.35	1.35	0.34	0.34	0.26	0.26	0.71	0.71	18.45	18.45	1.52	1.52	0.19	0.19
	Heterosis range	-31.43 to 50.61	-44.47 to -4.33	-28.95 to 52.43	-29.31 to 26.79	-19.36 to 54.14	-16.63 to 71.43	-22.73 to 82.35	-17.79 to 103.90	-39.85 to 28.66	-35.82 to 0.36	-57.45 to161.01	-75.37 to 29.66	-62.86 to 180.00	-83.46 to 25.95

*and **-Significance level at 5 and 1 per cent level, respectively. A-Arka, P-Pusa

BP- Heterosis over better parent

CC- heterosis over the commercial check (Naga)

Table 4: Estimates of general combining ability (GCA) effects in ridge gourd for yield and its components

Sl. No.	Parents	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (mm)	Average fruit weight (g)	Number of fruits per vine	Fruit yield per vine (g)
				Lines				
1	COHB-1	1.43	-0.05	1.43	1.75**	5.71	-0.28	-0.06
2	COHB-20	1.21	0.08	1.21	-0.49	1.82	0.14	0.02
3	COHB-28	-0.05	0.34	-0.05	-0.94*	11.59	0.74	0.28*
4	COHB-32	-0.85	-0.36	-0.85	-0.95*	-10.37	-2.09*	-0.45**
5	COHB-33	1.85*	0.03	1.85*	-0.85	8.97	2.99**	0.66**
6	COHB-35	-1.41	-0.41	-1.41	1.74**	-2.93	-5.00**	-0.83**
7	COHB-40	-2.19*	0.36	-2.19*	-0.25	-14.78	3.49**	0.37**
	C.D. @5%	1.71	0.44	1.71	0.91	23.49	1.94	0.24
	C.D@1%	2.29	0.59	2.29	1.21	31.35	2.58	0.32
	S.Em±	0.6	0.15	0.6	0.32	8.25	0.68	0.08
				Testers				
1	P. Nasdar	-2.13**	0.02	-2.13**	-0.5	-6.31	-1.32	-0.32**
2	P.Nutan	3.50**	0.04	3.50**	0.41	-5.01	3.11**	0.60**
3	Deepthi	-3.07**	0.23	-3.07**	0.08*	-1.41	1.73*	0.44**
4	A. Sujat	1.38	-0.14	1.38	1.18**	-1.35	-0.71	-0.25*
5	A. Sumeet	0.33	-0.15	0.33	-1.18**	14.07	-2.81**	-0.46**
	C.D. @5%	1.45	0.37	1.5	0.77	19.85	1.64	0.2
	C.D@1%	1.93	0.5	1.93	1.02	26.5	2.18	0.27
	S.Em±	0.51	0.13	0.51	0.27	6.97	0.57	0.07

*and ** -Significance at 5 and 1 per cent, respectively A-Arka, P-Pusa,

Table 5: Estimates of specific combining ability (SCA) effects for yield and its attributes in ridge gourd

Sl. No.	Crosses	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Rind thickness (mm)	Average fruit weight (g)	Number of fruits per plant	Fruit yield per plant (kg)
1	COHB-1 × P. Nasdar	-0.59	0.54	-0.59	-1.02	4.73	-2.96	-0.71*
2	COHB-1 × P. Nutan	-1.12	0.17	-1.12	2.24	-17.51	2.68	0.15
3	COHB-1 × Deepthi	7.05**	0.06	7.05**	1.57	22.33	5.98*	1.64**
4	COHB-1 × A. Sujat	-6.10**	-0.67	-6.10**	-2.03*	-22.91	-4.23	-0.91
5	COHB-1 × A. Sumeet	0.75	-0.11	0.75	-0.76	13.36	-1.47	-0.17
6	COHB-20 × P. Nasdar	0.93	0.27	0.93	2.63*	17.23	0.69	0.37
7	COHB-20 × P. Nutan	1.6	-0.1	1.6	0.55	32.71	-0.39	0.45
8	COHB-20 × Deepthi	-3.13	-0.48	-3.13	-0.61	-32.17	4.86*	0.91**
9	COHB-20 × A. Sujat	2.02	-0.01	2.02	-2.55*	-13.64	-0.12	-0.13
10	COHB-20 × A. Sumeet	-1.43	0.32	-1.43	-0.03	-4.13	0.68	0.21
11	COHB-28 × P. Nasdar	-2.71	-0.18	-2.71	0.24	-1.5	5.09*	1.03**
12	COHB-28 × P. Nutan	-2.84	-0.51	-2.84	0.34	2.82	-0.12	0.01
13	COHB-28 × Deepthi	5.43**	-0.17	5.43	0.18	5.54	-3.11	-0.67*
14	COHB-28 × A. Sujat	0.08	0.54	0.08	-1.68	-10.73	-0.24	-0.11
15	COHB-28 × A. Sumeet	0.03	0.32	0.03	0.92	3.87	-1.62	-0.25
16	COHB-32 × P. Nasdar	-3.91*	-0.68	-3.91*	0.1	-31.05	-6.83*	-1.51**
17	COHB-32 × P. Nutan	-0.84	1.13	-0.84	1.19	17.43	4.35*	1.04**
18	COHB-32 × Deepthi	-4.77*	-1.21	-4.77*	-0.39	-0.41	-2.64	-0.84**
19	COHB-32 × A. Sujat	1.68	0.57	1.68	-1.25	4.42	1.3	0.18
20	COHB-32 × A. Sumeet	7.83**	0.2	7.83**	0.36	9.61	5.14*	1.12**
21	COHB-33 × P. Nasdar	-0.81	-0.31	-0.81	-0.17	9.62	1.94	0.70*
22	COHB-33 × P. Nutan	2.66	-0.03	2.66	-0.41	-3.92	-5.22*	-1.09**
23	COHB-33 × Deepthi	-3.87*	0.42	-3.87*	-0.33	11.65	4.38*	0.63*
24	COHB-33 × A. Sujat	2.68	0.08	2.68	-0.18	15.9	0.35	0.11
25	COHB-33 × A. Sumeet	-0.67	-0.17	-0.67	1.09	-33.26	1.64	-0.05
26	COHB-35 × P. Nasdar	6.95**	0.43	6.95**	-2.18*	16.11	2.24	0.36
27	COHB-35 × P. Nutan	2.72	-0.24	2.72	-3.05**	-42.83	0.28	-0.61*
28	COHB-35 × Deepthi	-0.41	0.4	-0.41	-1.34	5.49	-2.22	0.56*
29	COHB-35 × A. Sujat	-2.56	-0.83	-2.56	8.98**	19.66	2.22	0.47
30	COHB-35 × A. Sumeet	-6.71**	0.23	-6.71**	-2.41*	1.57	-2.51	-0.77**
31	COHB-40 × P. Nasdar	0.13	-0.08	0.13	0.4	-15.14	-0.16	-0.24
32	COHB-40 × P. Nutan	-2.2	-0.42	-2.2	-0.85	11.29	-0.26	0.55*
33	COHB-40 × Deepthi	-0.33	0.98*	-0.33	0.91	-12.42	1.56	-0.11
34	COHB-40 × A. Sujat	2.22	0.31	2.22	-1.28	7.3	0.72	0.39
35	COHB-40× A. Sumeet	0.17	-0.78	0.17	0.83	8.97	-1.86	-0.09
	C.D. @5%	3.83	0.99	3.83	2.03	52.52	4.33	0.54
	C.D@1%	5.12	1.32	5.12	2.71	70.11	5.78	0.72
	S.Em±	1.35	0.35	1.35	0.71	18.45	1.52	0.19

*and **-Significance at 5 and1 per cent level, respectively, A-Arka, P-Pusa

CONCLUSION

The hybrids *viz.*, COHB-1 × Deepthi, COHB-33 × Deepthi and COHB-32 × Pusa Nutan qualified to be of commercial value as they have manifested significant heterosis over standard check (Naga) for fruit yield per plant.Hence, these crosses may be recommended for commercial exploitation.

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