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COMBINING ABILITY STUDIES IN RIDGE GOURD [*LUFFA ACUTANGULA* (ROXB.) L.]

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ABSTRACT
Twenty eight hybrids were crossed in a diallel fashion excluding reciprocals and to estimate combining ability in ridge gourd for fruit yield and yield components. F_1's and parents were evaluated under four environments created by two different date(s) of sowing at two different locations. Three parents *viz.*, AHRG-1, Salumber Long and Jaipuri Long were found to be good general combiners in all over the environments. The cross Pusa Nasdar x Arka Sumeet was found significant specific combining ability in more than one environment while, Jaipuri Long x Arka Sujath in E_1, AHRG-1 X Jaipuri Long in E_2, AHRG-1 x Arka Sujath in E_3 and Jaipuri Long x Swarna Manjari in E_4 environment have been identified as good specific combiner for fruit yield per vine. Therefore, these crosses could be utilized for further selection of high yielding progenies to achieve a quantum jump in improvement of ridge gourd.

INTRODUCTION

Ridge gourd [*Luffa acutangula* (Roxb.) L.] is one of the important cucurbitaceous crop grown extensively throughout the tropical and subtropical region of India as well as world. It's tender fruits are popular and well known for culinary vegetable, preparations of chutneys and curries in India, which is easily digestible and prevent constipation with good nutritive value and high yield potential (Seshadri, 1986). However, concerted efforts towards its improvement and developing new varieties are lacking and only a few varieties have been developed. Thus, it necessitates, development of high yielding, better quality varieties through efficient breeding programmes. Thus, the GCA helps in selection of superior parents and SCA for superior hybrid to identifying the best combiner, which can be utilized for future hybridization programme or to accumulate fixable genes through selection. Diallel cross-designs are frequently used in plant breeding to obtain information on genetic effects for fixed set of parental lines or to estimate general combing ability and specific combining ability, which play an important role in control of yield related components (Virk, 1988). Tyagi *et al*. (2010), Reddy *et al*. (2013) and Koppad *et al*. (2015) reported that, the hybrids were early and give higher yields in ridge gourd which helps to bridge the gap between the availability and requirement therefore the crops is selected. Hence, the present investigation was undertaken to determine the mechanism of gene action involved in inheritance of yield components in ridge gourd.

MATERIALS AND METHODS

The experiment material consists of eight parental line/ genotype *viz*., Pusa Nasdar (P_1), Swarna Uphar (P_2), AHRG-1 (P_3), Salumber Long (P_4), Jaipuri Long (P_5), Swarna Manjari (P_6), Arka Sujath (P_7) and Arka Sumeet (P_8). These parents were crossed in all possible combinations (excluding reciprocals) during summer season of 2011 to produce F_1's seed by hand pollination. Hence, the experimental material consist eight parents and their 28 F_1's. The experimental materials were sown under four environments created by two different date(s) of sowing at two different locations *viz*., Bikaner during *Kharif* 5th July, 2011 (E_1) and 25th July, 2011 (E_3) and Fatehpur-Shekhawati location during *Kharif* 5th July, 2011 (E_2) and 25th July, 2011 (E_4) within a year. Seeds of all 28 resultant F_1's and their parents were sown in fields under randomized block design (RBD) using three replication. The data was subjected to the ANOVA for RBD as suggested by Panse and Sukhatme (1978). All the recommended package of practices was followed for raising the crop. Observations were recorded on five randomly selected plants from each treatment for yield and yield related traits. The estimates of general combining ability of parents and specific combining ability of crosses were calculated on the diallel fashion according to the method of Griffing's (1956) (Methods I and II).

RESULTS AND DISCUSSION

Pooled analysis of variance was calculated over four environments for each trait is given in Table 1. The mean squares due to environment were found significant for fruit length. Mean squares due to genotypes were significant for days to first fruit harvest. The mean sum of square due to parent's number of node at which first female flower appears, days to first fruit harvest and fruit weight. The mean sum of

Table 1: Mean square for parents and F_1's pooled over the environments for different characters

Source of variance	d.f.	Days to opening of first female flower	No. of nodes at which female flowers appears	Days to first fruit harvest	No. of fruits/ vine	Fruit length (cm)	Fruit girth (cm)	Fruit weight(g)	Total fruit yield / vine(kg)
Environments	3	5441.03	169.24	4347.60	161.71	17.22**	12.87	1188.14	2.93
Replications/Environments	8	6.40**	12.77**	915.89**	1.07**	9.78**	3.47**	1394.29	0.10
Genotypes	35	217.98	36.40	1482.74**	43.56	30.63	4.82	506.92	0.82
Parents	7	411.99	9.58**	419.46**	70.20	37.26	8.42	527.07**	1.42
F_1's	27	175.67	40.87	1802.83	36.82	30.05	2.91**	497.62	0.68
Parents v/s F_1's	1	2.39**	103.53	283.23**	39.28	0.12**	31.26	617.04**	0.23**
Genotypes x Environments	105	57.64	20.32	964.15**	5.80	22.23	3.30**	399.83	0.12
Parents x Environments	21	79.66	13.52	68.08**	4.94	20.19	9.12	391.20	0.07
F_1's x Environments	81	52.93	20.81	1225.92**	4.99	22.63	1.83**	402.15	0.13
Parents v/s F_1's x Environments	3	30.55	54.84	168.94**	33.85	25.54**	2.11**	397.67**	0.34
Error	280	7.46	6.61	947.36	0.92	7.13	2.57	202.40	0.03

* and ** significant at 5 and 1 per cent level, respectively

Table 2: Estimates of general combining ability effects of parents for days to opening of first female flower, number of node at which first female flower appears by days to first fruit harvest and number of fruits/vine in ridge gourd under different environment

Parents ↓ Environment →	Days to opening of first female flower				No. of node at which first female flower appears				Days to first fruit harvest				No. of fruits/vine			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
Pusa Nasdar	-1.73*	0.04	-3.83**	-1.88**	0.40	-1.02**	-0.97 *	-0.73*	-2.28 **	0.31	-8.66	-1.76**	0.27	1.18**	0.46 *	0.29*
Swarna Uphar	-1.87**	-2.08**	0.26	1.66**	0.89	-0.63*	-0.38	0.51	-2.31**	-2.02**	-5.44	1.65**	0.41 *	0.08	-0.25	-0.42 **
AHRG-1	-4.39**	-0.49	-2.29**	-3.42**	-1.71**	-1.53**	-0.62	-1.51**	-2.69**	-0.39	-7.40	-3.62 **	0.90 **	1.37 **	1.00 **	0.45 **
Salumber Long	-0.79	1.85**	-0.59	-1.38**	-1.04	-0.21	0.45	0.73*	-0.61	1.55**	-6.08	-1.36 **	0.42 *	0.62 **	1.33 **	0.69**
Jaipuri Long	1.92**	0.19	-2.27**	-1.86**	-0.16	1.76**	0.17	0.69*	1.66**	-0.07	-7.47	-1.47 **	1.23 **	0.46 **	0.92 **	1.01 **
Swarna Manjari	2.07**	-0.60	1.10*	0.17	0.05	0.25	0.07	0.19	1.72**	-0.35	-4.12	0.16	0.45 *	-0.36 **	0.89 **	0.10
Arka Sujath	2.09**	-1.13**	2.15**	1.88**	1.39*	0.17*	1.17 **	0.61	1.66**	-1.23**	18.22	2.08**	-1.61 **	-1.48**	-2.18 **	-1.08 **
Arka Sumeet	2.72**	2.20**	5.46**	4.83**	0.18	0.62*	0.10	-0.49	2.85**	2.19**	20.93 *	4.32**	-2.07 **	-1.88 **	-2.17 **	-1.05 **
SE (gi)	0.67	0.96	0.44	0.85	0.63	0.79	0.41	0.90	0.59	0.33	10.48	0.38	0.19	0.13	0.20	0.12
CD 5%	1.33	1.91	0.88	1.70	1.25	1.57	0.83	1.80	1.18	0.66	20.91	0.76	0.37	0.26	0.41	0.24

E_1: Bikaner, 5 July 2011; E_2: Fatehpur, 5 July 2011; E_3: Bikaner, 25 July 2011and E_4: Fatehpur 25, July, 2011

Table 3: Estimates of general combining ability effects of parents for fruit length, fruit girth in ridge gourd under different environment

Parents↓ Environments→	Fruit length (cm)				Fruit girth (cm)				Fruit weight (g)				Total fruit yield / vine (kg)			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
Pusa Nasdar	-2.08	-1.42 *	-0.16	0.20	0.03	-0.12	0.46	0.58	3.15	-9.69**	2.89	5.76*	0.08 *	0.09 **	0.049	0.07 **
Swarna Uphar	-1.15 *	0.04	0.23	1.37 **	0.15	0.00	-0.54	-0.48	-4.37	-1.50	-0.34	1.98	0.05	-0.01	-0.05	-0.05*
AHRG-1	-1.06 *	-1.21 *	-0.85	-0.18	-0.06	0.06	0.08	1.38 **	-2.71	-3.00	1.72	-3.98	0.11**	0.17 **	0.19 **	0.04 *
Salumber Long	1.65 **	0.88	0.72	0.57	-0.30	-0.19	-0.49	-0.71*	7.05**	3.19	0.77	2.20	0.12 **	0.13 **	0.19 **	0.08**
Jaipuri Long	2.52**	1.03	-0.70	0.05	-0.10	0.44	0.67*	-0.20	0.06	9.15**	1.55	7.26**	0.15**	0.12**	0.15**	0.18 **
Swarna Manjari	0.20	-0.13	-1.70**	-1.82 **	0.27	-0.03	-0.08	0.36	1.81	2.98	-0.07	1.12	0.05	-0.04	0.09	0.00
Arka Sujath	-0.45	0.30	0.36	-0.64	-0.25	0.25	-0.25	-0.52	-1.04	2.12	-5.35*	-4.94*	-0.24**	-0.18**	-0.24 **	-0.15**
Arka Sumeet	0.37	0.52	2.10 **	0.45	0.26	-0.42	0.16	-0.58	-3.96	-3.25	-1.18	-9.39**	-0.32**	-0.27**	-0.32**	-0.18 **
SE (gi)	0.44	0.54	0.44	0.39	0.20	0.30	0.27	0.31	2.32	2.76	2.25	2.36	0.03	0.027	0.04	0.02
CD 5%	0.87	1.09	0.88	0.77	0.39	0.61	0.54	0.62	4.62	5.51	4.48	4.71	0.06	0.05	0.087	0.04

E_1: Bikaner, 5 July 2011; E_2: Fatehpur, 5 July 2011; E_3: Bikaner, 25 July 2011and E_4: Fatehpur 25, July, 2011

square due to F_1's was significant for fruit girth. The mean sum of square due to parents v/s F_1's were significant for days to first fruit harvest, fruit length, fruit weight and total yield per vine. The mean sum of square due to genotype x environment interaction were significant for days to first fruit harvest and fruit girth, indicating differential responses of genotypes change in the environments for such characters. Replications were significant for all the traits (except for total fruit yield per vine) studied in all four environments. Significant difference among parents v/s F_1's in all four environments also found for most of the traits. The analysis of variance indicated significant difference among the genotypes for most of the traits studied in all four environments. Further, parents and F_1's partitioned from genotypes were also found significant for all the traits in all the four environments. The combining ability analysis revealed that GCA and SCA variances were significant for all the traits in most of the environments, indicating the importance of both additive and non-additive genetic control for all the character studied. However, the σ^2 GCA/σ^2 SCA ratio being less than the unity shows that the non-additive gene action was more important for all the character for environments. These results were conformity with the results of Purohit *et al*. (2007), Tyagi *et al*. (2010) and Koppad *et al*. (2015) in ridge gourd and Naliyadhara *et al*. (2010) in sponge gourd and Singh *et al*. (2014) in bitter gourd.

Table 4: Estimation of specific combining ability effects days to opening of first female flower and no. of node at which first female flower appears

Crosses	Days to opening of first female flower				No. of node at which first female flower appears			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
$P_1 \times P_2$	-2.32	1.91	-2.33	-1.26	-0.53	-5.39**	2.95*	-4.43**
$P_1 \times P_3$	3.80	2.12*	1.82	2.93**	-1.13	0.38	0.45	-0.28
$P_1 \times P_4$	2.74	-1.82	1.72	-2.15*	0.94	-1.47	0.59	2.66*
$P_1 \times P_5$	-5.71**	-3.36**	0.94	0.00	-1.88	0.03	-0.67	4.06**
$P_1 \times P_6$	0.14	5.73**	-1.07	2.97**	0.92	3.20**	0.73	1.00
$P_1 \times P_7$	6.06**	-3.24**	-1.35	0.96	3.77	0.08	-2.20	-2.73*
$P_1 \times P_8$	-2.84	-1.53	-4.86**	-6.02**	1.85	2.50**	-2.13	-1.63
$P_2 \times P_3$	-1.85	-3.56**	-1.28	-1.18	2.91	-4.14**	-4.40**	1.29
$P_2 \times P_4$	1.22	1.67	1.36	0.57	-6.62**	-3.56**	3.46**	0.12
$P_2 \times P_5$	-3.43	2.06*	0.95	5.02**	8.16**	8.10**	-1.06	0.89
$P_2 \times P_6$	2.69	0.22	3.77**	1.46	1.36	3.01**	0.31	0.26
$P_2 \times P_7$	5.07*	0.01	7.96**	11.24**	2.28	0.22	3.61**	1.74
$P_2 \times P_8$	-6.63**	-7.05**	-9.46**	-8.90**	-3.24	0.37	0.94	-2.40*
$P_3 \times P_4$	-2.66	6.04**	2.18	0.66	-0.29	1.07	-1.03	-3.06**
$P_3 \times P_5$	-2.38	9.67**	3.66**	0.07	0.09	-2.16*	-0.22	-0.56
$P_3 \times P_6$	-2.86	-1.50	-0.12	-3.16**	-2.31	2.31*	1.01	-2.66*
$P_3 \times P_7$	0.46	7.22**	0.04	-1.80	1.34	2.46**	4.05**	-0.48
$P_3 \times P_8$	-2.11	-3.84**	-3.91**	0.02	-0.18	-0.39	0.05	-0.85
$P_4 \times P_5$	3.42	-3.84**	4.36**	1.19	3.56	-1.32	-0.28	1.38
$P_4 \times P_6$	1.48	-3.11**	2.39	7.73**	-2.51	-3.68**	-0.39	-1.56
$P_4 \times P_7$	6.99**	-2.78*	-3.86**	0.28	-0.06	0.80	-0.62	-0.41
$P_4 \times P_8$	-4.51*	-9.04**	-3.11*	-1.03	2.76	-2.35*	1.65	1.33
$P_5 \times P_6$	0.56	-0.85	-2.86*	-3.46**	2.80	-0.51	0.29	-2.32*
$P_5 \times P_7$	4.54*	3.58**	4.49**	-3.70**	-1.08	-3.08**	4.33**	1.86
$P_5 \times P_8$	4.24*	-6.92**	-4.29**	4.75**	1.94	-1.55	2.66*	-2.84**
$P_6 \times P_7$	-19.00**	-9.10**	-3.02*	-4.26**	1.32	-1.79	1.43	2.86**
$P_6 \times P_8$	5.90**	5.24**	-1.03	2.76**	4.14*	4.16**	-3.11	3.00**
$P_7 \times P_8$	8.28**	7.37**	0.82	3.38**	0.46	0.34	-1.47	3.17**
Sij	2.05	1.10	1.35	0.98	1.93	0.91	1.27	1.04
Sii-Sjj	2.47	1.33	1.63	1.19	2.33	1.10	1.54	1.25
Sij-Sik	3.03	1.63	2.00	1.45	2.85	1.35	1.88	1.54
Sij-Skl	2.85	1.53	1.88	1.37	2.69	1.28	1.77	1.45

* and ** significant at 5 and 1 per cent level, respectively

Days to opening of first female flower, appearance of female flowers at lower node number and early days to first fruit harvest are desirable in ridge gourd hence negative combining ability effects are desirable (Table 2). The parents Pusa Nasdar (except in E_2), AHRG-1 (except in E_2) in all the environment, Swarna Uphar in E_1 and E_2 Salumber Long in E_4, Jaipuri Long in E_3 and E_4, Arka Sujath in E_2 were good general combiners showing negative gca effects taking less number of days to first female flower. The parents Pusa Nasdar (except E_1) and AHRG-1 (except E_3) in all four environments, Swarna Uphar in E_2 exhibited significant negative effects hence, considered to be desirable for appearance of first female flower at lower node number. The parents Pusa Nasdar in E_1 and E_2, Swarna Uphar in E_1, E_2 and E_4, AHRG-1 in E_1 and E_4, Salumber Long and Jaipuri Long in E_4, Arka Sujath in E_2 were the best combiners as they had highly significant negative GCA effects, desirable for days to first fruit harvest. This might be attributed to the environmental influence on the expression of days to first fruit harvest. Maximum number of fruits per vine, fruit length, fruit girth, fruit weight and total fruit yield per vine are desirable trait, which is affected by the positive combining ability effect given in Table 2 and 3. The parents Pusa Nasdar (except E_1), AHRG-1, Salumber Long and Jaipuri Long in all four environments showing significantly positive GCA effects, having more number of fruit per vine (Table 2). The parents Swarna Uphar in E_4, Salumber Long in E_1, Jaipuri Long in E_1 and Arka Sumeet in E_4 showed significantly positive GCA effects, hence considered as suitable for fruit length. The parents AHRG-1 in E_4 and Jaipuri Long in E_3 exhibited highly significant GCA effects showing that these lines may be good general combiners for fruit girth. Table 3 revealed that the parents Pusa Nasdar in E_4, Salumber Long in E_1 and Jaipuri Long in E_1 and E_4 were the best general combiners as these parents had significantly positive gca effects, desirable for fruit weight. Parents namely Pusa Nasdar (except E_3), AHRG-1, Salumber Long and Jaipuri Long showed significantly positive GCA effects in all four environments for total fruit yield per vine. The results obtained in the present study are corroborative with the findings of Choudhary (2010), Tyagi *et al*. (2010), Reddy *et al*. (2013) and Koppad *et al*. (2015) in ridge gourd.

The estimated of SCA effects are given in Table 4-7. The best performing crosses showing lowest SCA effects in desirable direction were Swarna Uphar x Arka Sumeet, Salumber Long x Arka Sumeet and Swarna Manjari x Arka Sujath for days to opening of first female flower; Pusa Nasdar x Swarna Uphar in E_2 and E_4, Swarna Uphar x AHRG-1 in E_2 and E_3, Swarna Uphar x Salumber Long in E_1 and E_2, Jaipuri Long x Arka Sujath in E_2 for number of node at which first female flower appears and only one cross Swarna Manjari x Arka Sujath in all four environments for days to first fruit harvest. The SCA effect

Table 5: Estimation of specific combining ability effects days to first fruit harvest and no. of fruits/vine

Crosses	Days to first fruit harvest				No. of fruits/ vine			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
$P_1 \times P_2$	-1.72	0.40	3.63	-1.21	0.69	-1.15**	-1.20	0.72
$P_1 \times P_3$	2.00	1.04	6.26	2.89*	-0.80	-1.24**	-3.86**	-1.08**
$P_1 \times P_4$	2.64	-2.50*	6.74	-2.34*	-4.13**	-3.32**	-2.58**	-0.65
$P_1 \times P_5$	-5.36**	-4.14**	6.13	-0.23	-4.37**	-2.29**	-1.34*	0.72
$P_1 \times P_6$	0.65	8.77**	2.69	2.14	-0.55	1.12**	0.23	0.36
$P_1 \times P_7$	6.31**	-4.25**	-18.09	1.32	-0.10	1.00*	2.89**	1.94**
$P_1 \times P_8$	-2.88	-1.34	-20.67	-5.89**	1.43*	1.17**	0.61	1.11**
$P_2 \times P_3$	-3.37	-1.77	3.97	-0.69	-0.20	0.82*	1.35*	0.73
$P_2 \times P_4$	1.21	0.70	4.85	0.08	0.31	0.34	-0.14	0.13
$P_2 \times P_5$	-3.06	2.35	5.31	7.63**	-0.77	0.00	-0.97	-1.10**
$P_2 \times P_6$	3.02	0.20	8.30	1.30	-1.39*	-0.58	-0.67	0.81*
$P_2 \times P_7$	5.14**	0.75	-8.58	10.51**	-0.73	-0.13	-0.41	0.09
$P_2 \times P_8$	-7.45**	-6.61**	-25.86	-8.50**	0.79	1.07**	-0.32	0.43
$P_3 \times P_4$	0.92	6.63**	6.75	1.32	0.19	1.62**	0.14	-0.04
$P_3 \times P_5$	-3.81*	9.09**	8.34	-0.17	0.95	2.68**	-0.12	0.80*
$P_3 \times P_6$	2.86	-1.63	4.79	-1.93	-2.61**	-1.57**	2.61**	1.21**
$P_3 \times P_7$	5.19**	6.95**	-16.95	-1.92	-2.09**	-1.89**	-2.36**	-1.54**
$P_3 \times P_8$	-4.73*	-3.24**	-21.03	-0.26	-1.93**	-1.55**	2.23**	0.99**
$P_4 \times P_5$	3.30	-2.98**	7.98	0.86	-2.28**	0.47	0.32	0.06
$P_4 \times P_6$	0.44	-2.84**	6.79	6.97**	1.03	-0.88*	1.42*	-0.70
$P_4 \times P_7$	6.64**	-2.02	-18.79	-0.02	0.99	1.00*	0.09	0.45
$P_4 \times P_8$	-5.29**	-8.58**	-19.45	-0.63	-1.49*	-0.53	-2.56**	0.72
$P_5 \times P_6$	0.38	-0.88	2.35	-3.68**	1.16	0.15	1.39*	2.84**
$P_5 \times P_7$	4.37*	3.90**	-12.33	-3.61**	2.08**	1.23**	2.66**	1.22**
$P_5 \times P_8$	3.98*	-5.96**	-21.13	4.38**	1.94**	0.03	2.15**	-0.87*
$P_6 \times P_7$	-19.43**	-8.79**	-19.89	-4.67**	0.63	-1.12**	-2.71**	-1.27**
$P_6 \times P_8$	4.66*	4.79**	-17.54	3.29**	-0.88	-1.99**	-2.86**	-1.16**
$P_7 \times P_8$	6.78**	7.94**	174.18**	3.43**	-1.73**	-0.61	-0.53	-0.45
Sij	1.81	1.02	32.14	1.17	0.57	0.40	0.62	0.37
Sii-Sjj	2.18	1.23	38.83	1.41	0.69	0.48	0.75	0.45
Sij-Sik	2.68	1.51	47.55	1.72	0.85	0.59	0.92	0.55
Sij-Skl	2.52	1.42	44.83	1.63	0.80	0.56	0.87	0.52

* and ** significant at 5 and 1 per cent level, respectively

Table 6: Estimation of specific combining ability effects fruit length and fruit girth

Crosses	Fruit length (cm)				Fruit girth (cm)			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
$P_1 \times P_2$	0.35	-0.29	1.73	-2.73*	0.15	0.40	0.40	0.15
$P_1 \times P_3$	0.17	1.72**	-0.82	0.36	-0.02	1.97*	-0.01	-1.40
$P_1 \times P_4$	0.14	1.27*	-1.03	2.75*	0.01	-1.23	0.47	0.22
$P_1 \times P_5$	-2.58	-3.70**	-1.73	1.28	-0.59	-1.87*	-0.64	0.47
$P_1 \times P_6$	-2.47	0.03	2.66	-0.02	-0.26	0.04	-0.47	0.74
$P_1 \times P_7$	0.52	0.15	4.88**	1.82	-0.22	0.76	-0.85	0.04
$P_1 \times P_8$	1.63	-1.54*	-2.90*	1.43	1.22*	0.15	0.29	-1.71
$P_2 \times P_3$	1.88	0.27	-2.55	0.83	-0.02	0.08	-0.20	-0.11
$P_2 \times P_4$	-1.36	-1.97**	0.05	0.84	0.01	0.30	0.43	0.09
$P_2 \times P_5$	-3.77**	0.56	-1.66	-3.64**	-0.72	-0.82	0.61	-1.68
$P_2 \times P_6$	1.93	2.09**	-0.31	-0.22	0.04	-1.08	0.54	0.50
$P_2 \times P_7$	1.90	2.34**	-1.82	0.23	-1.06	-0.18	0.50	-1.67
$P_2 \times P_8$	-1.99	2.70**	0.59	3.30**	0.77	-0.15	-0.23	1.97*
$P_3 \times P_4$	0.77	0.12	-1.71	0.27	-1.27*	-0.68	-0.13	-0.53
$P_3 \times P_5$	-0.16	-0.91	0.78	-1.57	1.12	-0.48	-0.02	-0.80
$P_3 \times P_6$	-3.41*	-0.67	0.75	-1.66	0.48	0.38	-0.58	-1.71
$P_3 \times P_7$	2.56	0.60	-0.42	0.37	-0.29	-0.35	-0.23	-0.79
$P_3 \times P_8$	0.62	-1.48*	1.22	3.65**	-0.70	0.80	0.15	-1.80
$P_4 \times P_5$	3.50*	1.91**	-0.07	-0.90	-0.75	0.32	-1.04	-0.62
$P_4 \times P_6$	-5.59**	-0.85	-3.98**	-3.46**	-0.75	0.68	0.36	-0.97
$P_4 \times P_7$	1.13	-1.31*	1.53	-0.77	-0.01	-1.79	0.42	-0.13
$P_4 \times P_8$	-2.39	-0.20	1.80	-0.59	-0.09	0.68	0.29	1.01
$P_5 \times P_6$	11.16**	-1.34*	0.05	-3.23**	1.09	-0.38	-0.66	1.41
$P_5 \times P_7$	-1.77	-2.64**	3.75**	-0.48	0.06	-1.61	-0.48	0.47
$P_5 \times P_8$	7.19**	0.97	-0.19	0.34	1.39*	-0.82	-0.89	1.63
$P_6 \times P_7$	0.19	-0.84	-0.22	1.03	-0.56	-0.36	-1.06	-1.19

Table 6: Cont....

Crosses	Fruit length (cm)				Fruit girth (cm)			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
$P_6 \times P_8$	1.00	0.83	-0.16	-0.88	-0.80	0.47	0.62	-0.25
$P_7 \times P_8$	-0.89	-5.01**	-1.54	0.86	-0.42	-0.07	-0.21	-0.08
Sij	1.34	1.67	1.36	1.18	0.60	0.93	0.84	0.95
Sii-Sjj	1.61	2.02	1.64	1.43	0.73	1.12	1.01	1.15
Sij-Sik	1.98	2.47	2.01	1.75	0.89	1.38	1.24	1.41
Sij-Skl	1.85	2.33	1.89	1.65	0.84	1.30	1.17	1.33

* and ** significant at 5 and 1 per cent level, respectively

Table 7: Estimation of specific combining ability effects for fruit weight and total fruit yield/vine

Crosses	Fruit weight (g)				Total fruit yield / vine (kg)			
	E_1	E_2	E_3	E_4	E_1	E_2	E_3	E_4
$P_1 \times P_2$	12.14	-9.51	-3.71	-4.21	0.13	-0.21*	-0.21	0.05
$P_1 \times P_3$	9.74	-0.42	-7.03	-4.91	0.23*	0.12	-0.48**	0.02
$P_1 \times P_4$	16.11*	-2.34	-5.28	-14.23	-0.58**	-0.47**	-0.36**	-0.17**
$P_1 \times P_5$	1.37	-13.50	15.28*	7.58	-0.61**	-0.40**	-0.02	0.14*
$P_1 \times P_6$	-20.72**	4.07	-4.44	11.99	-0.10	0.18*	-0.02	0.11
$P_1 \times P_7$	2.01	19.26*	4.38	-13.88	-0.04	0.25**	0.27*	0.14*
$P_1 \times P_8$	-19.88**	-1.70	-0.80	-5.84	0.01	0.13	0.07	0.09
$P_2 \times P_3$	13.72	-2.53	-12.27	-5.14	0.01	0.05	-0.05	0.03
$P_2 \times P_4$	-14.10	-9.79	6.27	10.21	0.22*	-0.05	0.03	0.09
$P_2 \times P_5$	-1.24	20.65*	8.83	-2.92	0.00	0.14	0.33*	-0.19**
$P_2 \times P_6$	2.20	11.69	-2.95	-4.37	-0.19	0.03	-0.13	0.08
$P_2 \times P_7$	-10.74	-1.19	0.67	16.56*	-0.19	0.00	-0.16	0.20**
$P_2 \times P_8$	-6.89	-11.12	-2.81	4.20	0.03	0.10	-0.06	0.05
$P_3 \times P_4$	-13.97	-12.43	-7.85	-1.82	-0.14	0.03	-0.13	-0.05
$P_3 \times P_5$	6.49	4.88	-1.62	-7.68	0.25*	0.38**	-0.15	0.04
$P_3 \times P_6$	7.14	23.78**	-1.48	-11.81	-0.32**	-0.07	0.24	0.07
$P_3 \times P_7$	2.39	3.84	6.41	2.79	-0.24*	-0.24**	0.42**	-0.15*
$P_3 \times P_8$	-3.63	0.41	7.43	4.24	-0.25*	-0.21*	0.29*	0.11
$P_4 \times P_5$	13.26	14.48	-5.81	14.67*	-0.21*	0.17*	-0.04	0.13*
$P_4 \times P_6$	11.11	-13.28	7.54	-14.36	0.22*	-0.25**	0.24	-0.18**
$P_4 \times P_7$	-14.70*	-10.55	-1.84	16.54*	-0.01	0.04	-0.09	0.12*
$P_4 \times P_8$	23.08**	8.22	-10.69	-8.21	-0.15	-0.07	-0.34	0.06
$P_5 \times P_6$	-3.76	-6.17	-3.64	3.75	0.09	0.00	0.10	0.44**
$P_5 \times P_7$	9.89	10.29	6.52	-5.59	0.36**	0.23**	0.22	0.09
$P_5 \times P_8$	6.01	10.33	-1.99	6.72	0.28**	0.00	0.38**	-0.13*
$P_6 \times P_7$	-2.26	3.33	-4.40	-4.25	0.09	-0.19*	-0.14	-0.19**
$P_6 \times P_8$	29.99**	11.10	7.69	0.20	0.10	-0.17*	-0.36**	-0.14*
$P_7 \times P_8$	-10.59	-11.11	-4.43	8.46	-0.26**	-0.10	-0.18	-0.06
Sij	7.11	8.47	6.88	7.23	0.10	0.08	0.13	0.06
Sii-Sjj	8.59	10.23	8.32	8.74	0.12	0.10	0.16	0.07
Sij-Sik	10.51	12.53	10.19	10.70	0.15	0.12	0.20	0.09
Sij-Skl	9.91	11.81	9.60	10.09	0.14	0.12	0.19	0.08

* and ** significant at 5 and 1 per cent level, respectively

showed that best specific combination were AHRG-1 x Swarna Manjari and AHRG-1 x Arka Sujath in E_3 and E_4 for number of fruits per vine; Jaipuri Long x Swarna Manjari in E_1, Pusa Nasdar x Swarna Manjari in E_3 and AHRG-1 x Arka Sumeet in E_4 for fruit length; Pusa Nasdar x Arka Sumeet and Jaipuri Long x Arka Sumeet in E_1, Pusa Nasdar x AHRG-1 in E_2 and Swarna Uphar x Arka Sumeet in E_4 for fruit girth; Salumber Long x Arka Sumeet in E_1, AHRG-1 x Swarna Manjari in E_2, Pusa Nasdar x Jaipuri Long in E_3 and Swarna Uphar x Arka Sujath in E_4 for fruit weight; Jaipuri Long x Arka Sujath in E_1, AHRG-1 x Jaipuri Long in E_2, AHRG-1 x Arka Sujath in E_3 and Jaipuri Long x Swarna Manjari in E_4 for total fruit yield per vine. These crosses could be of immense potential in ridge gourd for improvement programme. These findings are in accordance with results of earlier workers Acharya *et al*. (2005), Purohit *et al*. (2005), Choudhary (2010), Tyagi *et al*. (2010), Reddy *et al*. (2013) and Koppad *et al*. (2015) in ridge gourd.

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