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**YR Pawar**

Senior Research Assistant,  
 AICRP on Vegetable Crops,  
 MPKV, Rahuri, Maharashtra,  
 India

**BT Patil**

Senior Vegetable Breeder,  
 AICRP on Vegetable Crops,  
 MPKV, Rahuri, Maharashtra,  
 India

**BV Kagane**

Senior Research Assistant,  
 AICRP on Vegetable Crops,  
 MPKV, Rahuri, Maharashtra,  
 India

## Combining ability and gene action studies in ridge gourd [*Luffa acutangula* (Roxb.) L.]

YR Pawar, BT Patil and BV Kagane

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**Abstract**

Present investigation was carried out at All India Coordinated Research Project on Vegetable crops, Mahatma Phule Krishi Vidyapeeth Rahuri during kharif season of 2021. Six promising parental lines of diverse origin of ridge gourd selected, crossing them in half diallel fashion (without reciprocals). The performance of the parents and 15  $F_{1s}$  hybrids with one standard check was assessed in a randomized block design with three replications. Distance between rows was kept 150 cm and plants were spaced at 100 cm apart within row. Observations were recorded of 5 selected plants in each replication for the characters like average fruit weight (g), average length of fruit (cm), diameter of fruit (cm), yield per plot (kg) and yield per hectare. All agronomical practices were followed to grow good crop. The plant protection measures were adopted as and when required to control pest and diseases. GCA, SCA and gene action were calculated. From the estimates, it is observed that, the parent Pusa Nasdar (6.53), Solani 5 (10.05) showed highly significant positive *gca* effects for characters i.e. average fruit weight (g), average length of fruit (cm), diameter of fruit (cm), yield per plot (kg) and yield per hectare. Hybrid Pusa Nasdar x Solani 5 showed significant positive *sca* effects for yield per hectare and parents found better specific combining. Among the cross combinations hybrid Pusa Nasdar x Solani 5 was found promising for obtaining highest yields. From this study, it is showed that SCA variance is greater than GCA variance indicating the preponderance of non-additive gene action for yield characters, hence the character should be improved through heterosis breeding.

**Keywords:** Combining ability, yield, ridge gourd. Half diallel, gene action

**Introduction**

Ridge gourd [*Luffa acutangula* (Roxb.) L.] is considered as one of the most important cucurbitaceous vegetable crops both nutritionally and economically. Its tender fruits are well known for culinary vegetable in India with good nutritive value and high yield potential, which are rich in vitamin A, vitamin C and iron (Yawalkar, 2004) <sup>[9]</sup> and have certain medicinal uses too. Hayes and Jones (1916) <sup>[1]</sup> were the earliest investigators to export heterosis in cucurbits. The different size of fruits indicates about its wide genetic variability. For its being a monoecious and essentially cross pollinated crop, it has ample scope for successful exploitation of hybrid vigour. Aiming, this present investigation was undertaken with an objective to select elite parental line which can be best utilized for hybridization programmes yielding best performing hybrids for commercial cultivation in India as there is still a least availability of varieties and hybrids of this crop.

**Material and Methods**

Six promising parental lines of diverse origin of ridge gourd selected, namely P1 (Pusa Nasdar), P2 (Arka Sumeet), P3 (Kokan Harita), P4 (Jaipur long), P5 (NRG 9), P6 (Solani 5) and 15  $F_{1s}$  hybrids obtained by crossing them in half diallel (without reciprocals), in Summer 2011. The performance of the parents and 15  $F_{1s}$  hybrids with one standard check was assessed in a randomized block design (RBD) with three replications at AICRP, Vegetable crops, Department of horticulture, M.P.K.V, Rahuri during Kharif 2021. Distance between rows was kept 150 cm and plants were spaced at 100 cm apart within row. Observations were recorded on ten (5) selected plants in each replication on average fruit weight (g), average length of fruit (cm), diameter of fruit (cm), yield per plot (kg) and yield per hectare. All agronomical practices were followed to grow good crop.

**Corresponding Author:****YR Pawar**

Senior Research Assistant,  
 AICRP on Vegetable Crops,  
 MPKV, Rahuri, Maharashtra,  
 India

The plant protection measures were adopted as and when required to control pest and diseases. GCA, SCA and gene action were calculated as per method suggested by Haymen and Jinks.

**Results and Discussion**

The analysis of variance for combining ability for 5 characters in ridge gourd has been given in Table 1. From the analysis of variance, it is observed that variance due to general combining ability and specific combining ability were highly significant for all the characters. From the estimates of gca effects for the average fruit weight, it is observed that (Table 2), the parent Pusa Nasdar (6.53), Solani 5 (10.05) showed highly significant positive gca effects. Negative and significant gca effect showed by Kokan Harita (-7.16) and Arka Sumeet. Among 6 parent, parent Solani 5 (0.119) showed significant positive gca effect for diameter of fruit. Pusa Nasdar (1.78) gave highly significant positive gca effect for yield per plot and yield per hectare. Among the cross combination (Table 3), four crosses viz. Hybrid Kokan Harita x Jaipur long (53.34), hybrid. Arka Sumeet x Jaipur long (31.68), hybrid. Pusa Nasdar x Solani 5 (17.63) and hybrid Arka Sumeet x Kokan Harita (15.49) showed significant positive sca effects for

average fruit weight. Whereas NRG 9 x Solani 5(4.24), Kokan Harita x Solani 5 (3.57) showed significant sca effects for the length of fruit. However, hybrid Pusa Nasdar x Solani 5 (2.80) Pusa Nasdar x Kokan Harita (1.28), and NRG 9 x Solani 5 (1.95) showed significant sca effects for yield per plot and hybrid Pusa Nasdar x Solani 5 (59.16), Kokan Harita x Jaipur long (43.51), hybrid NRG 9 x Solani 5 (36.28) Arka Sumeet x Kokan Harita (26.87), Arka Sumeet x Jaipur long (28.80), and Kokan Harita x NRG 9 (20.69) for yield per hectare. Similar results were reported by Narasannavar *et al.* (2014)<sup>[5]</sup>, Niyaria and Bhalala (2001)<sup>[6]</sup>, Mole *et al.* (2001)<sup>[4]</sup>, Sarkar *et al.* (2015)<sup>[7]</sup>, Lodam *et al.* (2009)<sup>[3]</sup> and Tyagi *et al.* (2010)<sup>[8]</sup>.

The ratio of the component of general combining ability variance to components of specific combining ability was lower than unity, which indicated preponderance of non-additive gene action for the all traits (Table 4). The magnitude of gca/sca for average fruit weight (0.15), Length of fruit (0.001), for diameter of fruit (0.26), yield per plot (0.70) and yield per hectare was (0.096). It is showed that there is preponderance of non-additive gene action and considered that these traits showed be improved through heterosis breeding. Similar finding was also reported by Tyagi *et al.* (2010)<sup>[8]</sup> in Luffa spp.

**Table 1:** Analysis of variance for combining ability in ridge gourd

Source	D.F.	Average fruit weight (g)	Length of fruit (cm)	Diameter of fruit (cm)	Yield per plot (kg)	Yield per hectare (qtl)
σ <sup>2</sup> gca	5	66.37	0.012	0.0088	0.80	102.097
σ <sup>2</sup> sca	15	414.86	6.87	0.033	1.13	1052.78
Error	20	67.31	0.93	0.016	0.63	96.02

**Table 2:** Estimates of general combining ability effects for different characters in 6 x 6 half diallel of ridge gourd

Sr. No	Parent	Source	Average fruit weight (g)	Length of fruit (cm)	Diameter of fruit (cm)	Yield per plot (kg)	Yield per hectare (qtl)
1	P <sub>1</sub>	Pusa Nasdar	6.53*	0.12	0.043	1.78***	12.97***
2	P <sub>2</sub>	Arka Sumeet	-12.00***	0.12	-0.11	-0.62*	-0.72
3	P <sub>3</sub>	Kokan Harita	-7.16*	-0.26	-0.12	-0.83**	-11.15**
4	P <sub>4</sub>	Jaipur long	5.24	-0.53	0.095	-0.35	-12.51***
5	P <sub>5</sub>	NRG 9	-2.66	0.51	-0.015	-0.030	0.446
6	P <sub>6</sub>	Solani 5	10.05**	0.035	0.119**	0.064	10.97**
		S.E. (gi) ±	2.64	0.31	0.041	0.25	3.16
		C.D. 5%	5.52	0.65	0.086	0.53	6.59

\*\* Significant at 5% level

**Table 3:** Estimates of specific combining ability effects for various characters in 6 x 6 half diallel of ridge gourd

Sr. No.	Crosses	Average fruit weight (g)	Length of fruit (cm)	Diameter of fruit (cm)	Yield per plot (kg)	Yield per hectare (qtl)
1.	Pusa Nasdar x Arka Sumeet	-17.10**	1.88**	-0.22	-0.57	7.74
2.	Pusa Nasdar x Kokan Harita	-9.34	-3.02	0.039	1.28**	6.66
3.	Pusa Nasdar x Jaipur long	-18.95	-0.65	-0.083	0.10	-20.46
4.	Pusa Nasdar x NRG 9	-0.74	4.15	0.437	-0.55	23.81
5.	Pusa Nasdar x Solani 5	17.63**	1.27	-0.211	2.80**	59.16**
6.	Arka Sumeet x Kokan Harita	15.49**	-1.32	-0.152	-0.10	26.87**
7.	Arka Sumeet x Jaipur long	31.68**	0.84	0.271**	0.55	28.80**
8.	Arka Sumeet x NRG 9	4.99	1.10	-0.014	0.68	-3.05
9.	Arka Sumeet x Solani 5	-7.73	-3.17	0.303**	-1.70	-21.25
10.	Kokan Harita x Jaipur long	53.34**	-0.19	0.087	1.09	43.51**
11.	Kokan Harita x NRG 9	-2.64	0.99	0.047	-0.69	20.69**
12.	Kokan Harita x Solani 5	-14.16	3.57**	-0.037	0.19	-13.32
13.	Jaipur long x NRG 9	-12.25	-3.33	-0.025	-0.17	-3.93
14.	Jaipur long x Solani 5	-19.48	-1.26	-0.078	0.32	4.038
15.	NRG 9 x Solani 5	8.33	4.24**	0.287**	1.95**	36.28**
	S.E.±	6.00	0.70	0.094	0.58	7.17
	C.D.at5%	12.52	1.47	0.195	1.21	19.46

\*\* Significant at 5%

**Table 4:** Estimation of general combining ability and specific combining ability variance and gene action

Sr. No.	Characters	Season	$\sigma^2_{gca}$	$\sigma^2_{sca}$	$\sigma^2_{gca} \sigma^2_{sca} /$	Gene action.
1.	Average fruit weight (g)	K	66.32	414.86	<b>0.15</b>	Non-Additive
2.	Length of fruit (cm)	K	0.012	6.87	0.001	Non-Additive
3.	Diameter of fruit (cm)	K	0.0088	0.033	0.26	Non-Additive
4.	Yield per plot (kg)	K	0.80	1.13	0.70	Non-Additive
5.	Yield per hectare (qtl)	K	102.097	1052.78	0.096	Non-Additive

### Conclusion

The study assessed six parental lines and their 15 F1 hybrids of ridge gourd for various agronomic traits. Significant general combining ability (GCA) and specific combining ability (SCA) effects were observed, indicating the influence of both additive and non-additive gene actions. Particularly, parental lines like Pusa Nasdar and Solani 5 exhibited notable positive GCA effects on average fruit weight and diameter of fruit, with Pusa Nasdar also showing significant effects on yield parameters. Hybrid combinations such as Kokan Harita x Jaipur long and Arka Sumeet x Jaipur long displayed significant positive SCA effects, suggesting potential for heterosis breeding. Moreover, the predominance of non-additive gene action across traits underscores the importance of heterosis breeding strategies for trait improvement in ridge gourd. These findings echo previous research, indicating avenues for further breeding efforts to enhance ridge gourd cultivars for improved yield and quality traits.

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