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Research Article

Studies on Heterosis, Inbreeding depression and Heritability in Ridge Gourd (*Luffa acutangula* L.)

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ABSTRACT

The present Investigation was carried out to study the extent of heterosis, inbreeding depression and heritability through six generation mean analysis (P_1, P_2, F_1, F_2, BC_1 and BC_2 derived) of three crosses for yield and yield contributing character in ridge gourd (Luffa acutangula L.). The material was evaluated in a Randomized Block Design with two replications during summer 2018. The magnitude of heterosis revealed that, the cross combinations Konkan Harita x Arka Sujat and Krishna-51 x Kranti-30 showed significant heterosis over better and mid parent. The inbreeding depression were positively and negatively lower significant indicate that the presence of vigour in F_2, Heritability was observed important for crop improvement of yield contributing character, high to low for different characters and play important role in selection of population for crop improvement in ridge gourd.

Key words: *Generation mean, Heterosis, Inbreeding depression, Heritability.*

INTRODUCTION

Ridge gourd (*Luffa acutungula* L., 2n=26) a member of Cucurbitaceae family, is grown almost every corner of the word because it's special nutritive value. It is extensively cultivated throughout India; due to suitability of the crop for growing under limited irrigation and high yield potential, it is widely cultivated in semi-arid area and north Konkan region of Maharashtra. Further in South India the fruits are extensively used in "Samber" preparation. Ridge gourd has good nutritive value, rich in carbohydrates and contains the minerals Ca, P and Fe. It is also a good source of vitamin A and vitamin B and a fair source of ascorbic acid. The fruit is rich in pectin and seed are source of protein. With regards to available data, in India Ridge gourd is cultivated 90 ha area with the production of 983 metric tons. For successful breeding and to boost productivity, the trend has been directed into evolving hybrids for exploiting heterosis. The exploitation of heterosis has become a potential tool in the improvement of the ridge guard yield.

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Information on the magnitude of heterosis in different cross combination is a basic requisite for identifying crosses that exhibit high degree of exploitable heterosis hence heterosis breeding one of the ways to improve the production and productivity is to harness the potential. Therefore the present investigation was carried out with an objective of extend the magnitude of heterosis in different crosses and its confirmation through inbreeding depression in F2 generation and then utilization in future crop improvement progammes.

MATERIAL AND METHOD

Plant material

Crosses viz., cross Konkan Harita X Arka Sujat, Pusa Nasdar X Swati Green, Krishana-51 and X Kranti-30 were made between six parents by manual emasculation and pollen transfer. F1 plants were selfed to obtain seed for the F2 generation and backcrossed with their respective parents to generate BC_1 and BC_2 generations. Thus, a total of six generations were obtained.

Field trial

The six generations (P1, P2, F1, F2, B1 and B2) for each population were planted during 2017. Six populations were planted in randomized block design with two replications. All cultural practices and preventive measures were adopted as per recommendation. Each plot had one row each of three for each set of experiment (P1, P2, F1, F2, B1 and B2). Each row consisted of 15 plants and having spacing 1.5m x 0.5m respectively. The observation were recorded on the randomly selected five plants from each replication and treatment for length of wine (cm), No of branches per wine, Days required first female flower, Node at which first female flower, days to 50% flowering, No of female flowers per wine, days required first harvest, length of fruit (cm), fruit diameter (cm), fruit wt (g), No of fruit per wine, Fruit yield per wine (kg), Fruit yield per ha (q), Incidence of pest and disease like leaf miner, downy mildew and powdery mildew.

Stastical analysis

Analysis of variance for RBD was carried out by panse sukhatme for all metric character under study, for estimation of relative heterosis and heterobeltiosis were computed as per Jinks and Jones and Mather. Whereas broad and narrow sense heritability was estimated using method proposed by Adeniji and Kehinde.

RESULTS AND DISCUSSION

Analysis of variance for yield and yield component showed highly significant differences among the genotypes which indicated that the presence of substantial variability in the material under study and possibility of selection for fruit yield traits in ridge gourd. In the present study, the value of heterosis expressed as percentage increase or decrease over better and mid parent. The data for heterosis over better and mid parent are presented in (Table.1). The heterosis in favorable direction is only considered for the characters. For the trait length of vine the heterobeltiosis ranged was from -11.66 to 7.22 and 12.27 to 12.06 for heterobeltiosis and mid parent respectively. The crosses Konkan Harita x Arka Sujat (7.22, 12.06) and Krishna-51 x Kranti-30 (4.83, 11.29) were recorded positively significant over better and mid parent for length of vine. Similar result observed in Rao *et al*.[10] and Yadav *et al*.[16] and Wakle[15]. Heterobeltiosis ranged from -26.58 to 63.21 and mid parent ranged from -13.15 to 70.07. The crosses Konkan Harita x Arka Sujat (63.21, 70.07) and Krishna-51 x Kranti-30 (32.30, 40.83) were exhibited positively significant over better and mid parent for number of branches per vine. Yadav *et al.*[16], Verma *et al*.[14]. For days to first female flower, the crosses, Konkan Harita x Arka Sujat (-6.26, -9.62) and Krishna-51 x Kranti-30 (-4.31, -6.24) exhibited negatively significant heterosis over better and mid parent. For days required to first female flower. Narasannavar *et al*.[6] and Kandasamy[4] and Wakle[15]. However the crosses Konkan Harita x Arka Sujat (-35.68, -39.33) and Krishna-51 x Kranti- 30 (-20.31, -27.53) also observed negatively significant heterosis over better and mid parent for this trait. For node at which first female flower. The crosses Konkan Harita x Arka

Sujat (29.47, 30.95) exhibited positively significant over better and mid parent for number of female flowers per vine and Number of female flowers per vine Wakle[15]. For days to 50 per cent flowering and Days required to first harvest, negative significant value has immense value as it indicate earliness. Heterobeltiosis and mid parent heterosis was ranged from -14.00 to 5.88 and -15.68 to -5.26. The crosses Krishna-51 x Kranti-30 (-14.00, -15.68) and Konkan Harita x Arka Sujat (-11.00 and - 12.31) were observed negatively significant heterosis over better and mid parent. While heterobeltiosis and mid parent heterosis ranged from -7.07 to 8.59 and from -7.57 to -0.60. The crosses Konkan Harita x Arka Sujat (-7.07, -7.57) and Krishna-51 x Kranti-30 (-2.93, -5.56) were observed negatively significant over better and mid parent for initiation of first harvest. Similar result was in agreement with Singh and Ram[11] and Wakle *et al*.[15] for days to 50 per cent flowering and days required to first harvest. In respects to fruit length (cm), heterobeltiosis ranged from -5.98 (Pusa Nasdar x Swati Green) to 7.76 (Krishna-51 x Kranti-30) and mid parent ranged from -4.71 (Pusa Nasdar x Swati Green) to 14.70 (Krishna-51 x Kranti-30). The crosses Krishna-51 x Kranti-30 (7.76, 14.70) and Konkan Harita x Arka Sujat (4.07, 13.32) were observed positively significant heterosis over better and mid parent for fruit length. This result was in agreement to Jadhav *et al.*[2] and Wakle *et al*.[15]. Heterobeltiosis ranged from -18.02 (Pusa Nasdar x Swati Green) to 26.12 (Konkan Harita x Arka Sujat) and mid parent ranged from 13.16 (Pusa Nasdar x Swati Green) to 31.34 (Krishna-51 x Kranti-30) Number of fruits per vine, the crosses Konkan Harita x Arka Sujat (26.12, 26.38) and Krishna-51 x Kranti-30 (23.71, 31.34) were observed positively significant over better and mid parent Similar result was found in accordance to Wakle *et al*.[15]. Fruit yield per plot is and fruit yield per hectare is important traits. For both the traits the range was -26.52 to 28.45, -18.44 to 45.18 and -25.53 to 8.64, -17.81 to 18.54 for heterobeltiosis and mid parent respectively. The crosses, Konkan Harita x Arka Sujat (8.11, 18.54) and Krishna-51 x Kranti-30 (8.64, 13.24) for fruit yield per hectare (q) were observed positively significant over better and mid parent.

INBREEDING DEPRESSION

Estimate of inbreeding depression for all character presented in (Table.1) Highest inbreeding depression were observed in the crosses Konkan Harita x Arka Sujat for length of vine (24.39), number of branches per vine (62.49), number of female flowers per vine (45.12), fruit length (22.49), fruit diameter (17.89), fruit weight (20.09) and fruit yield per plot (38.85); Pusa Nasdar x Swati Green for days required to first female flower (-7.92), node at which first female flower (-15.81) and days required to first harvest (-1.29); Krishna-51 x Kranti-30 for number of fruits per vine (39.85), fruit yield per vine (28.10) and fruit yield per hectare (37.93) Similar result were obtained with agreement of Singh *et al*.[12], Yadagiri *et al*.[17] Wakle[15], Kamer *et al*., Tyagi *et al*.[13] Narasannavar *et al*.[6].

Estimation of heritability (Narrow sense heritability)

Estimate of inbreeding depression is presented in (Table.2) Heritability is a good index of the transmission of characters from parents to their offspring Adeniji and Kehinde.

High estimates of heritability were recorded for length of vine and number of branches per vine in the cross Pusa Nasdar x Swati Green Krishna-51 x Kranti-30 (16.70), For required to first female flower in cross Krishna-51 x Kranti-30 (-0.80), Node at which first female flower in cross Krishna-51 x Kranti-30 (- 13.02), Days to 50 per cent flowering in cross Harita x Arka Sujat (-30.05). None of among three crosses showed negative significant heritability for number of female flower per vine however moderate level of heritability were observed in crosses Pusa Nasdar x Swati Green (-18.25), Konkan Harita x Arka Sujat (- 10.71) and Krishna-51 x Kranti-30. Low and moderate heritability was observed for Days required to first harvest in the cross Pusa Nasdar x Swati Green (-1.50) and Krishna-51 x Kranti-30 (-13.41). The

cross Krishna-51 x Kranti-30 (10.10) For Fruit length (cm), Konkan Harita x Arka Sujat (12.41) for fruit diameter (cm), Nasdar x Swati Green (14.24) for fruit weight (g) were showed positive high level of heritability however Konkan Harita x Arka Sujat (-99.90) for number of fruits per vine. The cross Krishna-51 x Kranti-30 (-14.72) for fruit yield per vine (kg) showed negative moderate level of heritability. negatively moderate level of heritability were observed in the crosses Konkan Harita x Arka Sujat (-13.24) for fruit yield per hectare. Similar result were obtained with agreement of Singh *et al*.[12], Yadagiri *et al*.[17] Wakle[15], Kamer *et al*.[3], Rani *et al*.[8], Rani *et al*.[9], Tyagi *et al*.[13] Narasannavar *et al*[6].

Table 1: Magnitude of Heterosis and inbreeding depression (%) for different characters in three crosses of ridge gourd

Crosses	Percent heterosis over		Inbreeding Depression %	Component of heterosis			
	BP %	MP %		(h)	(-i)	(-d)	$^1/_2$ j
Length of wine (cm)							
Konkan Harita x Arka Sujat	7.22**	12.06*	24.39**	203.86**	170.92**	-37.59**	-12.63*
Pusa Nasdar x Swati Green	-11.66**	-12.27**	-8.55**	-38.72	-1.56	8.98**	5.54**
Krishna-51 x Kranti-30	4.83**	11.29*	13.73**	76.99**	43.77**	35.79**	8.83**
No. of branches per vine							
Konkan Harita x Arka Sujat	63.21**	70.07**	62.49**	5.40**	2.48**	-0.13	-0.15
Pusa Nasdar x Swati Green	-26.58	-13.15	6.09**	0.96**	1.44**	0.31**	-0.17**
Krishna-51 x Kranti-30	32.30**	40.83**	57.89**	4.58**	2.97**	0.16**	-0.04
Days required to 1st female flower							
Konkan Harita x Arka Sujat	-6.26*	-9.62*	-12.94**	-5.09**	-0.65**	1.11**	-0.26
Pusa Nasdar x Swati Green	13.36	-3.90	7.92**	6.10**	8.10**	-3.85**	1.47**
Krishna-51 x Kranti-30	-4.31*	-6.24	-12.70**	-9.10**	-6.37**	1.23**	1.05**
Node at which 1st female flower							
Konkan Harita x Arka Sujat	-35.68**	-39.33**	-42.85**	-5.70**	0.20	-1.50**	-0.32**
Pusa Nasdar x Swati Green	16.58	3.68	-15.81**	-1.15	-1.60**	-2.10**	-0.37**
Krishna-51 x Kranti-30	-20.31**	-27.53**	-18.13**	-2.27**	-0.90	1.60**	0.18

Continue.

Crosses	Percent heterosis over		Inbreeding Depression %	Components of heterosis			
	BP %	MP %		(h)	(-i)	(-d)	$^1/_2$ j
Days to 50% flowering							
Konkan Harita x Arka Sujat	-11.00**	-12.31*	-22.47**	-16.25**	-10.00**	2.00**	0.62**
Pusa Nasdar x Swati Green	5.88	-5.26	-10.18**	-22.00**	-19.00**	-4.50**	0.75**
Krishna-51 x Kranti-30	-14.00**	-15.68**	-25.58**	-21.00**	-13.00**	0.50	-3.24
No. of female flower per vine							
Konkan Harita x Arka Sujat	29.47*	30.95*	45.12**	6.06**	1.49**	-0.43**	-0.30**
Pusa Nasdar x Swati Green	-10.18	-0.98	21.98**	2.69**	2.82**	1.05**	-0.14
Krishna-51 x Kranti-30	18.11**	23.75**	36.44**	10.91**	7.41**	-0.85**	-0.78**
Days required for 1st harvest							
Konkan Harita x Arka Sujat	-7.07*	-7.57*	-16.36**	-24.46**	-19.73**	-0.11	0.11
Pusa Nasdar x Swati Green	8.59	-0.60	-1.29*	-11.75**	-11.36**	3.28**	1.15**
Krishna-51 x Kranti-30	-2.93	-5.56	-12.98**	-10.53**	-7.34**	-0.35	0.60
Fruit length (cm)							
Konkan Harita x Arka Sujat	4.07**	13.32**	22.49**	6.42**	3.00	7.90**	2.81**
Pusa Nasdar x Swati Green	-5.98	-4.71	-5.54**	8.84**	9.74**	-2.47**	-1.10**
Krishna-51 x Kranti-30	7.76**	14.70**	10.51**	3.35**	0.17	-1.05**	-1.22**
Fruit diameter (cm)							
Konkan Harita x Arka Sujat	4.45*	9.57*	17.89**	0.38**	0.08	-0.32**	0.79**
Pusa Nasdar x Swati Green	-6.66	-5.56	4.46**	-0.04	0.12	0.29**	0.12**
Krishna-51 x Kranti-30	15.51**	17.95*	14.92**	0.78**	0.25**	0.11**	0.02

Continue.

Crosses	Percent heterosis over		Inbreeding Depression %	Components of heterosis			
	BP %	MP %		(h)	(-i)	(-d)	½ j
Fruit weight (gm)							
Konkan Harita x Arka Sujat	5.25**	14.14*	20.09**	18.89**	2.45	-2.46	-6.14**
Pusa Nasdar x Swati Green	-15.59*	-10.69*	-3.44**	-18.37**	-6.46	8.82**	1.17
Krishna-51 x Kranti-30	8.81**	11.62*	15.89**	2.94**	-9.74**	-9.26**	-6.04
No. of fruit per vine							
Konkan Harita x Arka Sujat	26.12*	26.38*	35.80**	7.14**	3.64**	1.17**	0.57**
Pusa Nasdar x Swati Green	-18.02*	13.16*	-0.15**	2.16**	3.66**	0.96**	0.14**
Krishna-51 x Kranti-30	23.71**	31.34**	39.85**	7.86**	3.62**	0.01	-0.41**
Fruit yield per vine (kg)							
Konkan Harita x Arka Sujat	13.79*	28.40**	26.36**	-0.29**	-0.66**	0.50**	0.16**
Pusa Nasdar x Swati Green	-26.71**	-19.75**	0.51**	0.61**	0.85**	0.26**	0.07**
Krishna-51 x Kranti-30	5.51**	17.46*	28.10**	0.32**	0.10**	0.25	0.04
Fruit yield per ha (q)							
Konkan Harita x Arka Sujat	8.11**	18.54**	29.95**	120.96**	85.74**	32.63**	7.15**
Pusa Nasdar x Swati Green	-25.53**	-17.81**	9.92**	48.25**	80.24**	20.79**	1.07**
Krishna-51 x Kranti-30	8.64**	13.24**	37.93**	153.26**	127.31**	1.02	-3.63

Table 2: Narrow sense heritability percentage of three crosses in ridge gourd

Sr.No	Characters	Konkan Harita x Arka Sujat	Pusa Nasdar x Swati Green	Krishna-51 x Kranti-30
1	Length of wine	-94.13	-26.70	16.70
2	No. of branches per wine	-11.40	-45.51	-0.80
3	Days required to 1st female flower	-10.44	-19.61	-0.80
4	Node at which 1st female flower	-26.21	15.50	-13.02
5	Days to 50% flowering	-30.05	14.01	-19.25
6	No. of female flower per vine	-10.71	-18.25	-10.05
7	Days required for 1st harvest	7.20	-15.03	-13.41
8	Fruit length (cm)	-12.41	-21.92	10.11
9	Fruit diameter (cm)	12.41	-8.72	5.25
10	Fruit weight (g)	-16.51	14.24	-42.02
11	No. of fruit per wine	-99.90	-51.54	-3.70
12	Fruit per wine (kg)	-7.61	-13.19	-14.72
13	Fruit yield per ha (q)	-13.24	-12.19	-8.23

CONCLUSION

The cross, Konkan Harita x Arka Sujat exhibited high heterosis over better parent, mid parent and inbreeding depression for most of the characters. Therefore these crosses may be useful for exploitation of heterosis at commercial scale. The narrow sense heritability played an important role for most of the economic traits. The high and moderate level of narrow sense heritability was observed on basis of phenotypic expression.

REFERENCES

1. Ghuge, M. B., Syamal, M. M. and Karcho, S., Heterosis in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. *Indian J. Agric. Res.*, **50(5):** 466-470 (2016).
2. Jadhav, K. A., Garad, B. V., Dhumal, S. S., Kshirsagar, D. B., Patil, B. T. and Shinde, K. G., Heterosis in bitter gourd (*Momordica charantia* L.). *Agric. Sci. Digest*, **29(1):** 7-11 (2009).
3. Kamer, A., Mona, M. E., Yousry, M. and Gamal, A. M. E., Heterosis and Heritability Studies for Fruit Characters and Yield in Melon (*Cucumis melo,* L.). *Middle East J. of App. Sci.*; **5(1):** 262-273 (2015).
4. Kandasamy, R., Heterosis in bitter gourd (Momordica charantia L.). *The Asian J. of Hort.*, **10(1):** 158-160 (2015).
5. Muthaiah, K., Gasti, V. D., Mallesh, S. and Nagaraju, K., Heterosis Studies for Earliness and Yield Related Traits in Ridge Gourd (*Luffa Acutungula* L.) *Int. J. Curr. Microbiol. App. Sci*. **6(6):** 2656-2661 (2017).

6. Narasannavar, A., Gasti, V. D., Sridhar, Malghan, S., & Kumara, B. R., Gene Action and Combining Ability Analysis for Yield and Yield-Related Traits in Ridge Gourd [*Luffa Acutungula* (L.) Roxb.] *Global J of Sci Frontier Research* (2014).
7. Rani, R., Heterosis, combining ability and gene action studies in bitter gourd (*Momordica charantia* L.) Ph.D. Thesis, submitted to College of Horticulture, Dr. Y.S.R. Horticultural University Rajendranagar, Hyderabad – 500 030 (2012).
8. Rani, R., Reddy, R. and Raju, S., Study of gene effect for yield and its component traits in bitter gourd (*Momordica charantia* L.) by generation mean analysis. *Electronic J. of Plant breeding,* **4(3):** 1237-1241 (2013).
9. Rani, R., Raju, S. and Reddy. R., Variability, correlation and path analysis studies in bitter gourd (*Momordica charantia* L.*) Agric. Sci. Digest*., **35(2):** 106-110 (2015).
10. Rao, B. N., Rao, P. V. and Reddy, B. M., Heterosis in ridge gourd. *Haryana J, Hort. Sci*., **29(1-2):** 96-98 (2000).
11. Singh, A. and Ram, H. H., Standard heterosis for yield and its attributing characters in cucumber (*Cucumis sativus* L.). *Pantnagar Journal of Research.* **7(1):** 81-84 (2009).
12. Singh, V., Rana, D. K. and Shah, K. N., Genetic variability, heritability and genetic advance in some strains of bitter gourd (Momordica charantia L.) under subtropical conditions of garhwal Himalaya. *Plant Archives* **17(1):** 564-568 (2017).
13. Tyagi, N., Singh, V.B. and Maurya, P. K., Studies on Genetic Variability, Heritability and Genetic Advance in Bitter Gourd (Momordica charantia L.) for Yield and Yield Contributing Traits. *Int. J. Curr. Microbiol. App. Sci*. **7(3):** 1788-1794 (2018).
14. Verma, R. S., Narendra, P., Dubey, D. K. and Singh, S. S., Combining ability and gene action in indigenous bitter gourd (*momordica charantia* L.) *SAARC J. Agri.*, **11(2):** 117-127 (2013).
15. Wakle, D. G., Studies on heterosis and combining ability in ridge gourd (Luffa acutungula L.). M.Sc. Thesis, submitted to Department of Horticulture, VNMKV Parbhani - 431 402 (M.S.), India (2017).
16. Yadav, M., Chaudhary, R. and Singh, D. B., Heterosis in bitter gourd (*Momordica charantia* L.). *J. Hort. Sci.* **4(2):** 170-173 (2009).
17. Yadagiri, J., Gupta, N. K., Tembhire, D. and Verma, S., Genetic variability, heritability and morphological characterization in bitter gourd (*Momordica charantia* L.). *Int. J. Pure App. Biosci*. **5(4):** 1322-1327 (2017).