Original Research Article

VARIABILITY AND CORRELATION STUDIES IN RIDGE GOURD (*Luffa acutangula* L. Ruxb.)

.

Abstract

A field experiment was conducted at All India Coordinated Research Project on Vegetable Crops, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.) in randomized block design with two replications during summer season, 2022. The evaluation of F_3 progenies in cross-III P_6 x P_8 (Saloni-5 x NRG-9) along with two parents of ridge gourd. The eighteen characters for variability along with heritability and genetic advance as percent of mean and correlation studied that, the high GCV and high PCV observed for the characters number of branches per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha indicating high variability available for these characters for further improvement and the high heritability coupled with high genetic advance as per cent of mean was observed for the characters number of branches per vine, node number at which first male flower appeared, number of pickings, weight of fruit, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha. The character fruit yield (q/ha) in F_3 generation at both genotypic and phenotypic levels the fruit yield (q/ha) showed high significant positive correlation with number of branches per vine, length of vine, number of pickings, days to last picking, diameter of fruit except genotypic level, weight of fruit and number of fruits per vine, in these characters were governed by additive gene action and least influenced by the environmental effects indicating better scope for improvement through selection.

Key words: Variability, GCV, PCV, Heritability, Genetic advance.

INTRODUCTION

Ridge gourd (*Luffa acutangula* L. Ruxb.) is one of the most important cucurbitaceous vegetable crop grown extensively throughout the tropical and sub-tropical regions of the world. It belongs to Cucurbitaceae family with 2n=26 chromosome number and widely cultivated in *kharif* and summer season in India. Tender fruits of ridge gourd are popular and well-known culinary vegetable in India with good nutritive value and high yield potentials (Seshadri, 1986). Yield is a complex character and is largely influenced by the genotype-environment interaction and understanding of the mode of inheritance of such complex quantitative character is essential for formulating effective selection procedures in order to improve the yield and its related characters. High heritability accompanied by a high genetic advance, indicate the predominance of additive gene action, whereas high heritability accompanied by low genetic advance indicate the predominance of epistasis and dominant gene action (Panse and Khargonkar, 1957). High

heritability along with high genetic advance is usually more useful in predicting gain under selection than the heritability estimates alone (Johnson *et al.* 1955). The genotypic and phenotypic coefficient of variation, heritability and genetic advance enable the breeders to study its genetic variability and potential progenies. Since, many economic traits are quantitative in nature and highly influenced by the environment, the progress of breeding is governed by the nature of genetic and non-genetic variations, it will be useful to partition the overall variability into its heritable and non-heritable components to know whether superiority of selection is inherited by the progenies.

MATERIAL AND METHODS

The experiment was conducted at All India Coordinated Research Project on Vegetable Crops), Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (M.S.) with randomized block design with two replications during summer season, 2022. The F_3 generation of five progenies in cross III P_6 x P_8 (Saloni-5 x NRG-9). The crop received timely management practices as per recommended package of practices. The crop was maintained properly till last harvest and observations on yield and yield contributing characters was noted on F_3 progenies along with two parents. From cross III 150 plants were studied and taken data from all the plants for eighteen characters *viz.*, number of branches per vine, length of vine (m), days to appearance of first male flower, days to appearance of first female flower, node number at which first male flower appeared and node number at which first female flower appeared, days to 50 percent flowering, sex ratio, days to first picking, number of pickings, days to last picking, length of fruit (cm), diameter of fruit (cm), weight of fruit (g), number of fruits per vine, fruit yield per vine (kg), fruit yield per plot (kg) and fruit yield (q/ha). Genotypic and phenotypic coefficient of variation were calculated as per the formula suggested by Burton and De Vane (1953). Heritability and expected genetic advance were calculated as per formula given by Johnson *et al.*, (1955a) and correlation coefficient was compared with statistical table value of correlation coefficient at 1% and 5% level of significance (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The results of variability, heritability and genetic advance are presented in the table 1. The phenotypic coefficient of variation (PCV) was higher than the respective genotypic coefficient of variation (GCV) for all the characters of generations of three crosses denoting environmental factors influencing their expression to some degree. Wide difference between PCV and GCV indicates the maximum role of environmental factors whereas, narrow difference between PCV and GCV suggested that these characters are least influenced by environment. Similar findings were observed by Kannan and Rajamanickam (2019) and Gautham and Balamohan (2018) in ridge gourd and Deepa *et al.* (2018) in cucumber and Maurya *et al.* (2018) and Alekar (2019) in bitter gourd.

The high values of GCV and PCV observed for characters number of branches per vine, sex ratio, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha indicating high variability available for these traits which is useful for further improvement Similar findings were observed by Kannan and Rajamanickam (2019) and Gautham and Balamohan (2018) in ridge gourd and Deepa *et al.* (2018) in cucumber. The moderate GCV and PCV values were observed for characters node number at which first male flower appeared, number of pickings, length of fruit and weight of fruit, similar findings were reported by Singh *et al.* (2002), Kumar *et al.* (2017), Ananthan and Krishnamoorthy (2017) in ridge gourd. Yadagiri *et al.* (2017) in bitter gourd that suggested considerable variability in the population. It implies that moderate amount of variability is present in the population and further selection would be possible up to some extent. Whereas, low GCV and PCV values for characters days to appearance of first male flower, days to appearance of first female flower, days to 50 percent flowering, days to first picking, number of pickings, days to last picking. This indicates limited scope for improvement of these traits due to low magnitude of variability and also it implies the population attained homozygosity for these traits and further selection will not alter them. Similar results were observed by Kanimozhi *et al.* (2014) in wax gourd.

In the present investigation, high heritability (bs) estimates observed for all studied yield and yield contributing characters. Results were on par with the findings of Doddamani *et al*. (2018) in cucumber and Kannan and Rajamanickam (2019) in ridge gourd. High heritability coupled with high genetic advance as per cent of mean was observed for the characters number of number of branches per vine, sex ratio, number of pickings, length of fruit, weight of fruit, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha, indicating these characters were least influenced by the environmental effects and governed by additive gene action, and better scope for improvement through selection. Similar findings were observed by Sharma and Sengupta (2012) in bottle gourd and Gautham and Balamohan (2018) in ridge gourd. Whereas, the characters are node number at which first male flower appeared, node number at which first female flower appeared and days to pickings exhibited high heritability coupled with moderate genetic advance as per cent of mean, and the high heritability coupled with low genetic advance as per cent of mean was observed for length of vine, days to appearance first male flower, days to appearance first female flower, days to 50 percent flowering and days to first picking. These results were revealed that, presence of certain degree of non-additive gene effect and selection may not effective. Similar findings were observed by Pathak *et al*. (2014) and Maurya *et al.* (2018) in bitter gourd.

The correlation studies revealed that (table 2) the character fruit yield (q/ha) in F_3 generation at both genotypic and phenotypic levels, the fruit yield (q/ha) showed high significant positive correlation with number of branches per vine, length of vine, number of pickings, days to last

picking, diameter of fruit except genotypic level, weight of fruit and number of fruits per vine. Similar findings reported by Mali (2015) in musk melon, Sharma and Sengupta (2012) and Chandramouli *et al. (*2021) in bottle gourd. Whereas, significant negative correlation with days to appearance first male flower, days to appearance first female flower, node number at which first male flower appeared, node number at which first female flower appeared, days to 50 percent flowering, sex ratio and days to first picking.

CONCLUSION

The high GCV and high PCV were observed for number of branches per vine, sex ratio, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha, which indicates wide range of variation and selection based on these characters provide ample scope for desirable plant types. The high heritability coupled with high genetic advance as per cent of mean was observed for number of number of branches per vine, sex ratio, number of pickings, length of fruit, weight of fruit, number of fruits per vine, fruit yield per vine, fruit yield per plot and fruit yield per ha, indicating that these characters were least influenced by the environmental effects and governed by additive gene action, and better scope for improvement through selection. The character fruit yield (q/ha) in F_3 generation at both genotypic and phenotypic levels the fruit yield (q/ha) showed high significant positive correlation with number of branches per vine, length of vine, number of pickings, days to last picking, diameter of fruit except genotypic level, weight of fruit and number of fruits per vine.

References

- Alekar, A. N., Shinde, K. G., and Khamkar, M. B. 2019. Studies on genetic variability, heritability, genetic advance and correlation in bitter gourd (*Momordica charantia* L.) *Int. J. Chemical Studies.***7**(3):1155-1159.
- Ananthan, M. and Krishnamoorthy, V., 2017. Genetic variability, correlation and path analysis in ridge gourd (*Luffa acutangula* (Roxb) L.). *Int. J. Curr. Microbiol. App. Sci*, 6 (6): 3022-3026.
- Burton, G. W. and De Vane, E. H. (1953). Estimating heritability in tall fescus (*Festuce arundinaceae* L.) from replicated clonal material. *Agron. J.* 45 : 478-481.
- Chandramouli B, Reddy RVSK, Ravindra Babu M, Jyothi KU, Umakrishna K and Paratpara M.2021. Genetic variability studies for yield and yield attributing traits in F_2 generation of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.), *The Pharma Innovation Journal*, 10(5): 1484-1488.
- Deepa. S.K., Hadimani, H. P., Hanchinamani,C.N., Ratnakar Shet, Koulgi, S, and Ashok 2018. Estimation of genetic variability in cucumber (*Cucumis sativus* L). *Int. J. Chem.study*. **6**(6): 115-118.
- Doddamani M, Satish SD, Nishani S, Dileepkumar A, Masuthi SGK, Tataga MH. 2018 Assessment of genetic variability in local collections of cucumber (*Cucumis sativus* L.) genotypes for productivity traits. *International Journal of Genetics*., 8(1):01-05.
- Gautham SP, Balamohan TN. 2018. Genetic variability studies in F_2 and F_3 generations of ridge gourd for yield and yield components [(*Luffa acutangula* L.) Roxb]. *Annals of Plant Sciences* 7(8): 2385-2390.

- Johnson H. W., Robinson, H. F. and Fatokun, C. A. 1955.Genetic advance in pea (*Pisium sativum* L.). *Madras Agric*., 67: 387-390.
- Johnson, H. W., Robinson, H. F. and Comstock, R.W. 1955a.Estimation of genetic and environmental variability in soybeans. *Agron. J.,* 47:314-318
- Kanimozhi RG, Mohammed YS, Ramesh K, Kanthaswamy V, Thirumeni S. 2015. Genetic analysis in segregating generation of wax gourd. *International Journal of Vegetable Science* 21(3):281-296.
- Kannan A and Rajamanickam C. 2019. Genetic variability, correlation and path analysis of F_5 generation of ridge gourd (*Luffa acutangula* (L.) Roxb.) for yield and quality. *International Journal of Current Microbiology and Applied Sciences* 8(11):1153-1164.
- Amit Kumar Bhargava, VB Singh, Pradeep Kumar and Rakesh Kumar Meena. 2017. Efficiency of selection based on genetic variability in Ridge gourd [*Luffa acutangula* L. (Roxb.)]. *J Pharmacogn Phytochem.* 6(4):1651-1655.
- Mali, M. D. 2015. Genetic studies in F_3 and F_4 generations of musk melon (*Cucumis melo* L.). Ph. D. Thesis submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, M.S., India.
- Maurya, S.K., Ram, H.H. and Singh, O.K. 2009. Standrad heterosis for fruit yield and its components in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *Ann. Hort*. **2**: 72-76.
- Panse, V.G and Khargonkar, S.S., 1957, Genetics of quantitative characters in relation to plant breeding. *Indian J. Genet.,* 17: 318-327.
- Pathak M., Manpreet and Kanchan P. 2014. Genetic variability, correlation and path coefficient analysis in bitter gourd (*Momordica charantia* L.). *Int. J. Adv.Res.* 2 (8): 179-184.
- Seshadri, V. S. (1986). Cucurbits Vegetable crops in India, Ed. Bose T. K. and Som, M. G. Noya Prakash, Culcutta, India pp. 91-164.
- Sharma, A. and Sengupta, S. K. 2012. Evaluation of genetic variability in bottle gourd (*Lagenaria siceraria* (Molina) Standl.) genotypes. *Veg. Sci*., 39 (1): 83-85.
- Singh RP, Mohan J, Dharmendra S, 2002. Studies on genetic variability and heritability in ridge gourd (*Luffa acutangula* L.). *Agricultural Science Digest*, 22(4): 279-280.
- Snedecor, G.W. and Cochran, W.G. 1967. Statistical methods,6th Edn., Oxford and IBH, Publ. Co. Bombay.
- Yadagiri J, Gupta NK, Tembhre D, Verma S. 2017. Genetic variability, correlation studies and path coefficient analysis in bitter gourd (*Momordica charantia* L.). *Journal of Pharmacognosy and Phytochemistry*. 6(2):63-66.

Table 1. Mean, range, GCV, PCV, ECV, heritability, genetic advance and per cent mean of genetic advance of two parents and F_3 population of cross-III Saloni-5 x NRG-9

Sr. No	Character	Mean		Range	GCV (%)	PCV (%)	ECV (%)	h^2 bs (%)	GA	GAM (%)
		2 Parents	F_3 progeny							
1	No. of branchesper vine	4.10	6.34	3.30-7.00	22.83	23.00	2.74	98.60	2.66	46.70
2	Length of vine (m)	3.69	3.92	3.59-4.09	4.43	5.10	2.52	75.50	0.30	7.94
3	Days to appearance firstmale flower	42.50	39.98	39.30-42.80	3.10	3.20	0.78	93.90	2.52	6.19
4	Days to appearance firstfemale flower	47.05	45.22	44.20-47.20	2.28	2.44	0.85	87.80	2.02	4.41
5	Node no. at whichfirst male flower appeared	3.85	3.22	2.80-3.90	10.53	11.45	4.50	84.60	0.67	19.95
6	Node no. at whichfirst female flower appeared	15.10	12.68	12.10-15.20	9.62	9.83	2.02	95.80	2.59	19.40
7	Days to 50%flowering	54.35	51.84	51.00-54.60	2.68	2.76	0.64	94.60	2.82	5.38
8	Sex ratio	25.30	17.28	16.06-26.58	21.16	21.4	3.18	97.80	8.43	43.10
9	Days to firstpicking	57.65	54.91	53.90-57.90	2.67	2.70	0.44	97.30	3.02	5.43
10	No. of pickings	12.41	18.38	12.05-19.23	17.86	17.90	3.79	99.61	6.10	36.70
11	Days to lastpicking	96.85	111.92	95.90-114.20	7.03	7.05	0.75	99.30	15.50	14.42
12	Length of fruit(cm)	21.65	25.20	21.00-29.40	12.84	13.44	3.98	91.20	6.11	25.26
13	Diameter of fruit(cm)	1.92	2.12	1.91-2.15	4.73	5.12	1.98	85.10	0.18	8.98
14	Weight of fruit (g)	112.45	142.42	108.10-156.40	13.75	13.8	1.13	99.30	37.80	28.24
15	No. of fruits pervine	13.50	25.24	12.90-28.10	28.41	28.48	1.95	99.50	12.78	58.39
16	Fruit yield per vine(kg)	1.52	3.62	1.39-4.39	39.28	39.38	2.81	99.50	2.44	80.72
17	Fruit yield /plot(kg)	7.61	18.12	6.95-21.98	39.33	39.42	2.75	99.50	12.21	80.82
18	Fruit yield (q/ha)	101.40	241.62	92.63-293.02	39.32	39.42	2.75	99.50	162.90	80.82

Table 2. Genotypic and phenotypic correlation coefficient for yield and yield contributing characters in F_3 generations of cross-3 P_6 X P_8

		No. of Branches per Vine	Length of vine (m)	Days to appearan first male	Days to appearan first female	Node no.at Which first male	Node no.at Which first female	Days to 50% flowering	Sex ratio	Days to first picking	No. of picking	Days to last picking	Length o fruit (cm)	Diameter of fruit (cm)	Weight of fruit (g)	No. of fruits per vine	Fruit yield q/ha
No. of branches per vine	G	1.000	0.749*	-0.827**	-0.696**	-0.948**	-0.838**	-0.758**	-0.757**	-0.753**	0.826**	0.818**	0.223	0.915**	0.683**	0.805**	0.769**
	P	1.000	0.653*	-0.800**	-0.680**	-0.870**	-0.811**	-0.742**	-0.743**	-0.743**	0.819**	0.818**	0.240	0.817**	0.675**	0.801**	0.764**
Length of vine (m)	G		1.000	-0.788**	-0.411	-0.708**	-0.520	-0.462	-0.781**	-0.497	0.580*	0.681**	0.370	0.644*	0.866**	0.883**	0.913**
	P		1.000	-0.580*	-0.280	-0.688**	-0.404	-0.488	-0.697**	-0.382	0.458	0.576*	0.396	0.499	0.749**	0.785**	0.806**
Days to appearance first male flower appeared	G			1.000	0.806**	0.975**	0.920**	0.895**	0.975**	0.876**	-0.952**	-0.961**	-0.566*	-0.998**	-0.861**	-0.960**	-0.919**
	P			1.000	0.759**	0.824**	0.897**	0.809**	0.931**	0.844**	-0.944**	-0.936**	-0.502	-0.905**	-0.836**	-0.927**	-0.889**
Days to appearance first female flower appeared	G				1.000	0.836**	0.813**	1.023**	0.766**	1.011**	-0.754**	-0.675**	-0.094	-0.986**	-0.771**	-0.740**	-0.735**
	P				1.000	0.723**	0.736**	0.944**	0.693**	0.969**	-0.729**	-0.667**	-0.118	-0.790**	-0.708**	-0.694**	-0.686**
Node no. at Which first male flower appeared	G					1.000	0.898**	0.873**	0.853**	0.889**	-0.884**	-0.8345	-0.202	-0.985**	-0.865**	-0.885**	-0.887**
	P					1.000	0.798**	0.851**	0.749**	0.773**	-0.793**	-0.772**	-0.209	-0.785**	-0.773**	-0.816**	-0.813**
Node no. at Which female flower appeared	G						1.000	0.823**	0.784**	0.846**	-0.912**	-0.865**	-0.565*	-1.029**	-0.603*	-0.763**	-0.687**
	P						1.000	0.755**	0.744	0.801**	-0.891**	-0.844**	-0.518	-0.893**	-0.583*	-0.736**	-0.662**
Days to 50% flowering	G							1.000	0.821**	1.016**	-0.815**	-0.750**	-0.104	-0.961**	-0.854**	-0.817**	-0.823**
	P							1.000	0.794**	0.967**	-0.775**	-0.729**	-0.138	-0.847**	-0.822**	-0.803**	-0.805**
Sex ratio	G								1.000	0.825**	-0.913**	-0.959**	-0.512	-0.900**	-0.911**	-0.988**	-0.959**
	P								1.000	0.808**	-0.889**	-0.930**	-0.492	-0.852**	-0.908**	-0.981**	-0.954**
Days to first picking	G									1.000	-0.827**	-0.775**	-0.206	-0.971**	-0.805**	-0.810**	-0.796**
	P									1.000	-0.815**	-0.762**	-0.188	-0.891**	-0.793**	-0.797**	-0.784**
No. of pickings	G										1.000	0.983**	0.471	0.961**	0.719**	0.867**	0.799**
	P										1.000	0.977**	0.439	0.882**	0.715**	0.858**	0.791**
Days to last picking	G											1.000	0.542	0.955**	0.7607	0.9181	0.851**
	P											1.000	0.532	0.840**	0.745**	0.908**	0.841**
Length of fruit (cm)	G												1.000	0.531	0.2459	0.4589	0.361
	P												1.000	0.411	0.231	0.447	0.351
Diameter of fruit (cm)	G													1.000	0.7761	0.9001	0.841
	P													1.000	0.739**	0.837**	0.790**
Weight of fruit (g)	G														1.000	0.9447	0.981**
	P														1.000	0.942**	0.980**
No. of fruits per vine	G															1.0000	0.987**
	P															1.000	0.987**

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