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

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Abstract

The research was conducted AICRP on Vegetable crops, Department of Horticulture, MPKV, Rahuri, Dist. Ahmednagar (M.S.) in RBD along with two replications evaluated that summer-2022. In F_3 progenies in Cross-III P_6 x P_8 (Saloni-5 x NRG-9) with two parents ridge gourd. In eighteen characters studied that variability and broad sense heritability (bs) with genetic advance over mean and correlation studied that, the high GCV and high PCV observed for the number of branches/vine, fruit yield/vine, fruit yield/plot and fruit yield/ha reported that highest variability indicated characters for further improvement and the highest broad sense heritability (bs) along with the highest genetic advance over mean were observed in number of branches/vine, number of nodes which first male flower appeared, number of picking, weight of fruit, number of fruits/vine, fruit yield/vine, fruit yield/plot and fruit yield/ha. The fruit yield (q/ha) in F_3 generation at genotypical and phenotypical of fruit yield indicated that highly significant positively correlated with number of branches/vine, length of vine, number of pickings, days to last pickings, diameter of fruit except genotypic level, weight of fruits and number of fruits/vine, in these characters was governed by additively gene action, the least influences by the environment effects indicating that better chance for the improve through the selections.

Key words: Variability, Fruit yield, Broad sense heritability, Genetic advance over mean, Gene action.

INTRODUCTION

One of the most significant cucurbitaceous vegetable crops is the ridge gourd (*Luffa acutangula* L. Ruxb.), which is widely cultivated in tropical and subtropical areas of the world. With a 2n=26 chromosomal number, it is a member of the Cucurbitaceae family and is commonly grown in India throughout the *kharif* and summer months. With good nutritional content and large yield potentials, ridge gourd's tender fruits are a well-known and popular culinary vegetable in India (Seshadri, 1986).

Understanding the method of inheritance of such a complicated quantitative character is crucial for devising efficient selection processes in order to improve yield and its related qualities. Yield is a complex character that is heavily influenced by the genotype-environment interaction**.** Highest broad sense heritability combined with the highest genetic advance over mean, reported that the of additively gene action, although highly heritability with lowest genetic advances reported that the epistasis, dominant gene action (Panse and Khargonkar,

1957). In Highest heritability combined with the highest genetic advances is usually greater useful in prediction achieve under selections than heritability estimation alone (Johnson *et al.* 1955). In genotypical and phenotypical coefficient of variations, heritability and genetically advances enable the breeders to studied that genetic variability and potential in progenies. Since many economic traits are quantitative in nature and heavily influenced by the environment, it will be helpful to divide the overall variability into its heritable and non-heritable components to determine whether selection is superior. Breeding progress is governed by the nature of genetic and non-genetic variations.

MATERIAL AND METHODS

The research was conducted AICRP on Vegetable crops, Department of Horticulture, MPKV, Rahuri, Dist. Ahmednagar (M.S.) in RBD along with two replications evaluated that summer-2022. F_3 generation of five progenies in the cross III P_6 x P_8 (Saloni-5 x NRG-9). The observations taken growth, flowering, fruit, yield characters were indicated that on F_3 progenies and with two parents. The data was taken from all the plants for eighteen characters *viz.*, number of branches/vine, length of vine (m), days to appearances of first male flower, days to appearances of first female flower, number of nodes at which first male flower appear and number of nodes at which first female flower appear, days to 50 percent flowering, sex ratio, days to first pickings, number of picking, days to last picking, length of fruit (cm), diameter of fruit (cm), weight of fruit (g), number of fruits/vine, fruit yield/vine (kg), fruit yield/plot (kg) and fruit yield/ha. The Genotypical and phenotypical coefficient of variations was evaluated as formula indicated by Burton and De Vane (1953).

Estimations of component of variations

In phenotypical and genotypical variance was indicated by respectively mean squared values (Johnson *et al.*, 1955a).

i. Environmental variance (σ^2e) = MSe

ii. Genotypic variance (σ^2g) = MSg-MSe/r

iii. Phenotypic variance (σ^2p) = (σ^2g)+ (σ^2e)

Where,

MSg is genotypic mean sum of square

MSe is an error mean sum of square

R is number of replications

Estimations coefficient of variation

In genotypical and phenotypical coefficient of variations was regarded that by Burton and De Vane (1953).

i. Phenotypic coefficient of variation (PCV)

$$PCV\ (\%) = \frac{\sqrt{\sigma^2 p}}{\text{------}} \times 100$$

$$\bar{X}$$

Where, $\sigma^2 p$ = Phenotypic variance

$\bar{X}$ = General mean of character

ii. Genotypic coefficient of variation (GCV)

$$GCV\ (\%) = \frac{\sqrt{\sigma^2 g}}{\bar{X}} \times 100$$

Estimations of the heritability (percentage)

The heritability is defined as ratio of genotypical to phenotypical variance. The percentages of heritability in a broad sense was calculated for a variety of characters, as shown below (Lush, 1949).

$$h^2\ (b.s.) = \frac{\sigma^2 g}{\sigma^2 p} \times 100$$

Where, $\sigma^2 g$ = Genotypic variance

$\sigma^2 p$ = Phenotypic variance

Genetic advances expressed as over mean were evaluated by the following formula.

$$\text{Genetic advance as over mean (GAM)} = \frac{GA}{\bar{X}} \times 100$$

Estimations of correlation coefficient

The genotypic and phenotypic correlation coefficient were estimated for the pooled data were derived by the following formula in order to explore the relationship between various features.

$$rg = \frac{\text{Co-variance XY (G)}}{\sqrt{\text{Variance X (G) x Variance Y (G)}}}$$

$$rph = \frac{\text{Co-variance XY (PH)}}{\sqrt{\text{Variance X (PH) x Variance Y (PH)}}}$$

The Heritability and expected genetic advances was indicated as per formula regards by Johnson *et al*., (1955a) and correlation coefficient were comparing with the statistical table value of correlation coefficients at 1% and 5% level of significances (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

The results revealed that variability, heritability and genetic advance in studied that. The phenotypical coefficient of variation (PCV) were greater than the respective genotypical coefficient of variation (GCV) for all the traits of cross denoted that environment factors

influenced their expressions to little degree. Wider differences between the PCV, GCV indicated that the greater role of their environment factors although, narrow differences between the GCV and PCV reported that these traits are less influences by the environment condition. Similarly was noted by Panda *et al*. (2022) and 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 highest values of GCV and PCV was showed in number of branches/vine, sex ratio, number of fruits/ vine, fruit yield/vine, fruit yield /plot and fruit yield/ha indicated that the highest variability for these traits which is useful that advance improvements Similarly reported that Kannan and Rajamanickam (2019) and Gautham and Balamohan (2018) of ridge gourd and Deepa *et al.* (2018) of Cucumber. The moderately GCV, PCV values were showed for traits number of nodes at which first male flower appear, number of picking, length of fruit, weight of fruit similarly noted that Singh *et al.* (2002), Kumar *et al.* (2017), Ananthan and Krishnamoorthy (2017) of ridge gourd. In bitter gourd Yadagiri *et al.* (2017) that suggested considerable variability in the population. Variability exists in the population, some allowed for further selection. although, lowest GCV, PCV for these days to appearance of first male flower, days to appearance of first female flower, days to 50 % flowering, days to 1st picking, number of picking, days to last pickings were showed. The indicated that less chance for improvements of their characters due to lowest magnitudes of the variability. Similarly was indicated that Kanimozhi *et al*. (2014) in wax gourd.

The estimates of highest heritability (bs) was showed for yield and yield related factors, similarly noted by Doddamani *et al*. (2018) of Cucumber, in ridge gourd Kannan and Rajamanickam (2019). Highest heritability along with the highest genetic advance over mean were showed for the number of branches/vine, sex ratio, number of picking, length of fruit, weight of fruit, number of fruits/vine, fruit yield/vine, fruit yield/plot and fruit yield/ha, indicated there traits was less influences by environment conditions and controlled by the additively gene actions, and greater chance for the improvements direct the selections. Similarly showed that in bottle gourd Sharma and Sengupta (2012), Gautham and Balamohan (2018) in ridge gourd. Although, these traits are number of nodes at which first male flower appeared, number of nodes at which first female flower appeared and days to picking revealed that highest heritability along with the moderated genetic advance over mean, and the highest heritability along with lowest genetic advance over mean were showed for length of vine, days to appearances of first male flower, days to appearances first of female flower, days to 50 % flowering and days to first pickings. The reported that, present to a certain extent of non-additively gene effects and not effective through the selection. Similarly showed that in bitter gourd noted Pathak *et al.* (2014) and Maurya *et al.* (2018).

The correlation studies reported that the character fruit yield in F_3 generation at both

genotypical and phenotypical, the fruit yield noted that high significant positively correlation with the number of branches/vine, length of vine, number of picking, days to last picking, diameter of fruit except genotypic level, weight of fruits and number of fruits/vine. Similar findings reported by Mali (2015) in musk melon, in bottle gourd Sharma and Sengupta (2012) and Chandramouli *et al. (*2021). Whereas, significant negatively correlation were observed that days to appearances of first male flower, days to appearances of first female flower, nodes number of at which first male flower appear, node number of at which first female flower appear, days to 50 % flowering, sex ratio and days to first pickings.

CONCLUSION

In highest genotypic coefficient of variations (GCV) and the high phenotypic coefficient of variations (PCV) was showed that number of branches/vine, sex ratio, number of fruits/vine, fruit yield/vine, fruit yield/plot and fruit yield/ha, which revealed that widely ranges of variations and the selective based on these traits provides grater scope for the selection. In highest heritability along with the highest genetic advance over mean were showed that number of branches/ vine, sex ratio, number of picking, length of fruits, weight of fruits, number of fruits/vine, fruit yield/ vine, fruit yield /plot and fruit yield/ha, reported that were less influences by environment conditions and controlled by additively gene actions, and greater amount scope for selection. The character fruit yield in F_3 generation at combined with genotypical and phenotypical the fruit yield noted high significant positively correlation with the number of branches/vine, length of vine, number of pickings, days to last pickings, diameter of fruit except genotypic level, weight of fruits and number of fruits /vine.

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Table 1. Mean performance , ranges, GCV, PCV, ECV, heritability (bs), genetic advances over mean and genetic advance of two parents along 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 branches/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 appearances first male 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