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Studies on genetic variability, heritability, genetic advance in F_4 generation of ridge gourd (*Luffa acutangula* (L.) Roxb.)

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Abstract
The magnitude of genetic variability was estimated by means of phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance as per cent of mean in F_4 generation of four crosses of ridge gourd *viz.*, VRG-24 x VRG-13, Swarna Manjari x Arka Prasan, Swarna Manjari x VRG-16, Arka Prasan x VRG-16 during Summer, 2021 at Horticultural Research Station, Chintapalli. High estimates of PCV, GCV were noticed for node of first male flower, sex ratio, fruit set percentage, fruit girth, average fruit weight, rind thickness, flesh thickness, number of fruits per vine, fruit yield per vine, number of seeds per fruit, fibre content and TSS indicating the presence of large variability and hence there is a great scope for selection. High heritability coupled with high genetic advance as per cent of mean were found for node of first male flower, node of first female flower, number of male flowers per vine, number of female flowers per vine, sex ratio, fruit set percentage, fruit length, fruit girth, average fruit weight, rind thickness, flesh thickness, number of fruits per vine, fruit yield per vine, number of seeds per fruit, 100 seed weight, fibre content and TSS indicating the existence of additive gene action and selection in these traits will be effective as they are less influenced by the environment.

Keywords: Genetic, variability, heritability, ridge gourd, *Luffa acutangula* L.

1. Introduction
Ridge gourd is the most important summer cucurbitaceous vegetable in India. Subtropical Asia and India are considered as primary centre of origin. It is an annual creeper and has a climbing or trailing habit. In India, cucurbits are usually cultivated in small areas for local consumption and hence reliable statistical data on area and production is lacking. Plants are usually monoecious in nature, but there are also several other sex forms. The fruits have 10 prominent longitudinal ridges; hence the plant is called ridged gourd. The tender fruits are rich in dietary fibre, which aids in weight loss. They are anti-inflammatory and antibiotic in nature hence prescribed for people suffering from malaria and other seasonal fevers. The luffaculin, a protein isolated from its seeds, exhibit abortifacient, antitumor, ribosome inactivating and immunomodulatory activities (Ng *et al.* 1992) [11].
Genetic variability is a prerequisite for the meaningful selection. Ridge gourd requires vast genetic studies for substantial improvement in yield and quality. There is a wide scope for the development of the superior varieties with high sex ratio (high female to male flowers per vine), earliness in fruiting, consumer preferred size, shape, colour, high yield and long shelf life. Understanding the inheritance of yield and quality traits in advance would be important to maximize the use of genetic potential in an effective breeding programme. Therefore, to introgress these traits, the F_4 progenies were assessed for variability (PCV, GCV), heritability, genetic advance for utilization in crop improvement programmes. PCV, GCV provides information about the total variability present within the population but they cannot explain the extent to which this variability can be heritable it is explained by heritability studies. Genetic advance provides the information about the gene action that is involved. Heritability in combination with genetic advance helps to predict the genetic gain under selection.

2. Materials and Methods
The experiment was conducted at Horticultural Research Station, Chintapalli, Alluri Sitaramaraju District, Andhra Pradesh, during Summer 2021 to assess the genetic variability in

F_4 generation of four crosses of ridge gourd *viz.*, cross-1 (VRG-24 x VRG-13), cross-2 (Swarna Manjari x Arka Prasan), cross-3 (Swarna Manjari x VRG-16), cross-4 (Arka Prasan x VRG-16). The plants were maintained with the spacing of 1m x 1m. A total of 100 plants were studied in each cross and the observations were recorded on various growth and quality characters like days to male flowering, days to female flowering, node of first male flower, node of first female flower, number of male flowers per vine, number of female flowers per vine, sex ratio, fruit set (%), fruit length (cm), fruit girth (cm), average fruit weight (g), rind thickness (mm), flesh thickness (cm), number of fruits per vine, fruit yield per vine (kg), number of seeds per fruit, 100 seed weight (g), fibre content (g/100g) and TSS (^{0}Brix). Estimation of Phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV) given by Burton and Devane (1952) [2], heritability given by Lush (1943) [10] and genetic advance as per cent of mean (GAM) suggested by Comstock and Robinson (1952) [3] were utilized.

3. Results and Discussion

The analysis of variance in the four crosses of ridge gourd in the F_4 generation were presented in the tables 1, 2, 3, 4. The estimates of PCV were higher than GCV in the all the populations under study. Though the difference was very less which indicates the less influence of environment. The higher estimates of PCV and GCV were observed with average fruit weight, fruit yield per vine, number of seeds per fruit, fibre content in all the four crosses *i.e.*,(cross-1, cross-2, cross-3, cross-4), node of first male flower and sex ratio in cross-4, fruit set % (cross-1, cross 4), fruit girth (cross 2 and cross 3), rind thickness (cross-1, cross-3, cross-4), flesh thickness (cross-3, cross-4), number of fruits per vine (cross- 2) and TSS (cross-1, cross-2, cross-3). This indicates the presence of large variability and hence there is a great scope for selection in the above-mentioned traits for further crop improvement. The results were in conformity to the findings of Gautham and Balamohan (2018) [5] in F_2 and F_3 generations, Sravani *et al.* (2021) [13] in F_2 generation of ridge gourd and Vaidhya *et al.* (2020) in F_3 and F_4 generation of bottle gourd.

Traits like node of first female flower, fruit length in all the crosses *i.e.*, cross-1, cross-2, cross-3, cross-4, number of male flowers per vine (cross-3), number of female flowers per vine (cross-4), sex ratio (cross-1, cross-2, cross-3), fruit girth (cross-1, cross-4), number of fruits per vine (cross-1, cross-3, cross-4), 100 seed weight (cross-2, cross-3, cross-4) and TSS (cross-4) manifested with moderate range of variability *i.e.*, PCV and GCV. This indicates that these traits had not yet attained homozygosity and hence further improvement is possible to some extent. These findings were confirmed with Kannan *et al*. (2019) [9] in F_4 generation of ridge gourd; Kanal *et al.* (2019) [7] in F_4 generation of pumpkin, Ingole *et al.* (2021) [6] in F_4 generation of pumpkin Low variability was found for days to male flowering (cross-1, cross-2, cross-3, cross-4), days to female flowering (cross-1, cross-2, cross-3, cross-4). The results were similar to the findings of Vijaykumar *et al.* (2020) [16] in F_6 generation of ridge gourd, Pradhan *et al.* (2021) [12] in F_4 generation of bitter gourd. This indicates that these characters had attained homozygosity and further selection in these traits will not be effective which would be a constraint in genetic improvement.

High heritability coupled with high genetic advance as per cent of mean was observed for the traits like node of first male flower (cross-4), node of first female flower (cross-2, cross-4), number of male flowers per vine (cross-3), number of female flowers per vine (cross-4), sex ratio (cross-2, cross-3, cross-4), fruit set percentage (cross-1, cross-4), flesh thickness (cross-3, cross-4), number of fruits per vine (cross-1, cross-2, cross-3), 100 seed weight (cross-2, cross-3, cross-4), fruit length, fruit girth, average fruit weight, rind thickness, fruit yield per vine, number of seeds per fruit, fibre content and TSS in all the four crosses *i.e.*,(cross-1, cross-2, cross-3, cross-4). Selection of these traits will be effective as they are less influenced by the environment and confirms the presence of additive gene action. These results were in accordance to the findings of Kanimozhi *et al.* (2015) in F_2 population of wax gourd, Alekar *et al.* (2019) in F_4 generation of bitter gourd, Durga *et al.* (2021) [4] in F_3 generations of ridge gourd, Pradhan *et al.* (2021) [12] in F_4 generation of bitter gourd, Ingole *et al.* (2021) [6] in F_4 population of pumpkin.

High heritability along with moderate genetic advance as per cent of mean which might be due to the development of homozygous lines through continuous selection process were exhibited by the traits like days to male flowering (cross-1, cross-4), days to female flowering (cross-1), number of male flowers per vine (cross-2, cross-4) number of female flowers per vine (cross-1, cross-2, cross-3). The results were in confirmation with Kanimozhi *et al.* (2015) [8] in F_2 generation of wax gourd, Sravani *et al.* (2021) [13] in F_2 generation of ridge gourd where as sex ratio (cross-1) the results were contradictory to the findings of Kannan *et al.* (2019) [9] in F_4 generation of ridge gourd.

Low heritability coupled with low genetic advance as per cent of mean was found for the trait number of female flowers per vine in cross-1 (VRG-24 x VRG-13). It confirms that the characters are in high influence of the environment and selection would not be effective. The results were contradictory to the findings of Sravani *et al.* (2021) [13] in F_2 generation, Durga *et al.* (2021) [4] in F_3 generation of ridge gourd.

Table 1: Estimates of mean, PCV, GCV, heritability, genetic advance and genetic advance as per cent of mean in F_4 population of Cross-1 (VRG-24 x VRG-13)

Parameters	General mean	Coefficient of variation (%)		Heritability (%) (Broad Sense)	Genetic advance	GAM @ 5%
		PCV	GCV			
Days to male flowering	29.80	7.42	7.02	89.50	4.08	13.67
Days to female flowering	39.58	6.72	6.00	79.92	4.38	11.06
Node of first male flower	2.09	32.76	12.76	15.17	0.21	10.24
Node of first female flower	13.11	13.76	10.11	54.05	2.01	15.32
Number of male flowers per vine	218.75	19.66	9.76	24.61	21.81	9.97
Number of female flowers per vine	25.75	10.15	8.21	65.48	3.53	13.69

Sex ratio	8.71	14.38	11.54	64.35	1.66	19.07
Fruit set (%)	54.07	25.42	24.65	94.01	26.62	49.23
Fruit length (cm)	22.96	14.13	11.78	69.60	4.65	20.25
Fruit girth (cm)	14.94	15.99	14.72	84.68	4.17	27.90
Average fruit weight (g)	317.66	35.42	35.34	99.59	230.81	72.66
Rind thickness (mm)	7.06	22.35	21.55	92.97	3.02	42.81
Flesh thickness (cm)	3.77	23.70	14.04	35.08	0.65	17.13
Number of fruits per vine	13.82	17.15	15.00	76.53	3.74	27.04
Fruit yield per vine (kg)	3.85	28.64	28.26	97.38	2.22	57.45
Number of seeds per fruit	150.12	32.52	32.21	98.05	98.62	65.70
100 seed weight (g)	11.24	12.04	9.53	62.62	1.75	15.53
Fibre content (g/100g)	1.68	41.28	38.77	88.21	1.27	75.01
TSS (^{0}Brix)	3.09	27.82	27.29	96.23	1.71	55.15

Table 2: Estimates of mean, PCV, GCV, heritability, genetic advance and genetic advance as per cent of mean in F_4 population of Cross-2 (Swarna Manjari x Arka Prasan)

Parameters	General mean	Coefficient of variation (%)		Heritability (%) (Broad Sense)	Genetic advance	GAM @ 5%
		PCV	GCV			
Days to male flowering	31.12	8.83	6.24	50.00	2.83	9.09
Days to female flowering	40.14	5.47	4.99	83.39	3.77	9.39
Node of first male flower	2.21	27.10	12.72	22.03	0.27	12.30
Node of first female flower	12.26	15.75	14.15	80.72	3.21	26.19
Number of male flowers per vine	265.34	10.28	8.10	62.12	34.87	13.15
Number of female flowers per vine	30.14	10.11	9.67	91.39	5.74	19.04
Sex ratio	8.98	18.70	14.69	61.71	2.41	23.77
Fruit set (%)	51.96	21.74	13.81	40.35	9.39	18.07
Fruit length (cm)	26.32	12.08	11.49	90.50	5.93	22.53
Fruit girth (cm)	13.91	27.17	26.40	94.40	7.35	52.84
Average fruit weight (g)	331.59	28.82	28.76	99.59	196.07	59.13
Rind thickness (mm)	8.22	20.22	19.93	97.15	3.33	40.47
Flesh thickness (cm)	3.58	25.70	19.83	59.53	1.13	31.52
Number of fruits per vine	14.74	23.87	21.44	80.62	5.84	39.65
Fruit yield per vine (kg)	4.69	26.03	25.40	95.22	2.40	51.06
Number of seeds per fruit	147.81	35.12	35.00	99.30	106.22	71.84
100 seed weight (g)	12.16	15.64	13.33	72.66	2.85	23.40
Fibre content (g/100g)	1.26	59.08	56.28	90.76	1.40	110.45
TSS (^{0}Brix)	2.23	28.15	27.50	95.46	1.24	55.35

Table 3: Estimates of mean, PCV, GCV, heritability, genetic advance and genetic advance as per cent of mean in F_4 population of Cross-3 (Swarna Manjari x VRG-16)

Parameters	General mean	Coefficient of variation (%)		Heritability (%) (Broad Sense)	Genetic advance	GAM @ 5%
		PCV	GCV			
Days to male flowering	27.92	6.45	5.46	71.64	2.66	9.52
Days to female flowering	38.88	4.15	3.45	69.26	2.30	5.92
Node of first male flower	2.53	24.99	11.31	20.47	0.27	10.54
Node of first female flower	9.97	16.72	10.89	42.40	1.46	14.60
Number of male flowers per vine	243.04	13.87	12.77	84.66	58.81	24.20
Number of female flowers per vine	29.97	10.08	9.49	88.60	5.51	18.40
Sex ratio	8.26	18.88	16.03	72.08	2.55	28.04
Fruit set (%)	49.19	22.46	17.08	57.81	13.16	26.75
Fruit length (cm)	19.73	17.79	16.44	85.40	6.18	31.30
Fruit girth (cm)	17.52	26.26	25.96	97.72	9.27	52.87
Average fruit weight (g)	238.37	30.29	30.18	99.30	147.70	61.96
Rind thickness (mm)	6.98	22.21	21.69	95.40	3.05	43.64
Flesh thickness (cm)	4.62	24.89	24.23	94.76	2.25	48.59
Number of fruits per vine	12.85	19.84	17.23	75.42	3.96	30.83
Fruit yield per vine (kg)	3.62	30.58	29.96	95.96	2.19	60.46
Number of seeds per fruit	127.13	27.13	26.78	97.40	69.21	54.44
100 seed weight (g)	14.01	15.78	14.09	79.77	3.63	25.93
Fibre content (g/100g)	1.12	56.66	50.45	79.29	1.04	92.54
TSS (^{0}Brix)	2.57	21.77	20.62	89.71	1.03	40.24

Table 4: Estimates of mean, PCV, GCV, heritability, genetic advance and genetic advance as per cent of mean in F_4 population of Cross-4 (Arka Prasan x VRG-16)

Parameters	General mean	Coefficient of variation (%)		Heritability (%) (Broad Sense)	Genetic advance	GAM @ 5%
		PCV	GCV			
Days to male flowering	26.93	7.06	6.45	83.43	3.27	12.14
Days to female flowering	37.98	5.80	4.92	71.83	3.25	8.59
Node of first male flower	2.34	32.25	26.01	65.06	1.01	43.23
Node of first female flower	11.05	18.25	15.12	68.58	2.85	25.79
Number of male flowers per vine	254.56	11.70	9.82	70.43	43.21	16.98
Number of female flowers per vine	26.96	12.80	12.36	93.28	6.63	24.59
Sex ratio	9.32	22.97	21.32	86.19	4.54	40.78
Fruit set (%)	52.82	24.52	20.93	72.84	19.44	36.80
Fruit length (cm)	24.89	18.41	17.79	93.33	8.81	35.40
Fruit girth (cm)	16.11	18.46	17.69	91.83	5.63	34.93
Average fruit weight (g)	340.77	28.29	28.25	99.70	197.99	58.10
Rind thickness (mm)	5.92	23.64	23.09	95.43	2.75	46.47
Flesh thickness (cm)	4.28	27.79	24.83	79.86	1.96	45.72
Number of fruits per vine	15.12	18.12	13.34	54.21	3.06	20.24
Fruit yield per vine (kg)	4.29	28.35	27.73	95.66	2.40	55.86
Number of seeds per fruit	155.26	37.39	37.24	99.17	118.62	76.39
100 seed weight (g)	15.28	14.94	14.12	89.27	4.20	27.48
Fibre content (g/100g)	1.38	58.65	52.91	81.38	1.36	98.33
TSS (^{0}Brix)	2.81	17.38	16.48	89.96	0.91	32.20

4. Conclusion

High estimates of phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability and genetic advance as per cent of mean were observed for the traits like node of first male flower, sex ratio, fruit set (%), fruit girth, average fruit weight, rind thickness, flesh thickness, number of fruits per vine, fruit yield per vine, number of seeds per fruit, fibre content and TSS. High PCV, GCV indicates that the presence of larger amount of variability and high heritability coupled with high genetic advance as per cent of mean indicates the less environmental influence and also the presence of additive gene action. Therefore, selection with respect to these traits will be rewarding in the subsequent generations.

5. References

1. Alekar AN, Shinde KG, Khamkar MB. Studies on genetic variability, heritability, genetic advance and correlation in bitter gourd (*Momordica charantia* L.). International Journal of Chemical Studies. 2019;7(3):1155-59.
2. Burton GW, Devane EH. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. Agronomy Journal. 1952;45(2):478-81.
3. Comstock RE, Robinson. Estimation of average dominance of genes. Heterosis. Iowa state college press, Ames, Iowa, 1952, 494-516.
4. Durga PMC, Rekha GK, Kumari KU, Jyothi KU, Narasimharao S. Variability studies in F_3 population of ridge gourd (*Luffa acutangula* (L.) Roxb.) for yield and yield attributing traits. The Pharma Innovation Journal. 2021;10(7):612-15.
5. Gautham SP, Balamohan TN. 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. 2018;7(8):2385-90.
6. Ingole, Bhalekar MN, Kagane BV. Assessment of genetic variability in F_4 generation of pumpkin (*Cucurbita moschata* Duch ex. Poir). The Pharma Innovation Journal. 2021;10(12):1858-61.
7. Kanal T, Krishnamoorthy V, Beaulah A, Anand A. Genetic variability studies in F_4 generation of pumpkin (*Cucurbita moschata* Duch ex. Poir). International journal of chemical studies. 2019;7(3):1962-65.
8. Kanimozhi RG, Mohammed YS, Ramesh K, Kanthaswamy V, Thirumeni S. Genetic analysis in segregating generation of wax gourd. International Journal of Vegetable Science. 2015;21(3):281-96.
9. Kannan A, Rajamanickam C, Krishnamoorthy Arunachalam P. Genetic variability, correlation and path analysis in F_4 generation of ridge gourd (*Luffa acutangula* (Roxb) L.). International Journal of Chemical Studies. 2019;7(3):208-13.
10. Lush JL. Intro-site correlation and regression of off spring on corn as a method of estimating heritability of characters. Proceedings American Society of Animal Production. 1940;33:293-301.
11. Ng TB, Chan WY, Yeung HW. Proteins with abortifacient, ribosome inactivating, immunomodulatory, antitumor and anti-AIDS activities from Cucurbitaceae plants. General Pharmacology. 1992;23(4):579-90
12. Pradhan P, Tripathy P, Sahu GS, Tripathy B, Sourabh S. Assessment of genetic variability in F_4 segregating population of bitter gourd (*Momordica charantia* L.). Journal of Pharmacognosy and Phytochemistry. 2021;10(2):1452- 55.
13. Sravani Y, Rekha GK, Ramana CV, Naidu LN, Suneetha DS. Studies on genetic variability, heritability and genetic advance in F_2 generation of ridge gourd. The Pharma Innovation Journal. 2021;10(7):927-30.
14. Vaidya AV, Bhalekar MN, Damse DN. Genetic Studies in F_4 progenies of bottle gourd (*Lagenaria siceraria* (Molina) Standl.). International Journal of Current Microbiology and Applied Sciences. 2020;9(8):2616-22.
15. Vaidya AV, Bhalekar MN, Pawar PK. Genetic Studies in F_3 Progenies of bottle gourd (*Lagenaria siceraria* (Molina) Standl.). International Journal of Current Microbiology and Applied Sciences. 2020;9(7):714-19.
16. Vijaykumar R, Rajamanickam C, Beaulah A, Arunachalam P. Genetic variability, correlation and path analysis in F_6 generation of ridge gourd (*Luffa acutangula* (Roxb) L.) for yield and quality. International Journal of Current Microbiology and Applied Sciences. 2020;9(7):1012-19.