Original Research Article

Studies on Genetic Variability in Ridge Gourd (*Luffa acutangula* L. Roxb.) under Prayagraj Agro-Climatic condition

ABSTRACT

A set of eleven genotypes of ridge gourd were evaluated for studying of **"Studies on Genetic Variability in Ridge Gourd (*Luffa acutangula* L. Roxb.) under Prayagraj Agro-Climatic condition".** The experiment was conducted in a Randomized Block Design with three replications during the *Kharif* season, 2021 at Sam Higginbottom university of Agriculture, Technology and Sciences, Prayagraj. The data were recorded from five randomly selected plants for each genotype in all the replications for twenty one characters. From the present investigation it is concluded that among 11 genotypes of ridge gourd on the basis of mean performance 3 genotypes namely; Dharidar, Anamika and Jaipur long had substantially higher yield and performed better for other desirable traits as compared to Pusa Nasdar **(Check).** Analysis of variance showed the presence of significant variation among different genotypes for all characters studied. Days to germination and plant height [30DAS] exhibited high estimates of GCV and PCV both. Genetic parameters revealed that high heritability (broad sense) was observed for fruit yield per hectare, plant height [30DAS], fruit length, plant height [60DAS], days to first harvest of fruits, days to germination, leaf length, sex ratio, fruit girth, fruit yield per plant, days to first male flowering, shelf life, leaf per plant [30DAS], Vitamin C content and number of primary branches per plant. Fruit yield per hectare, fruit yield per plant, fruit girth, fruit length, leaf length, plant height [60DAS], plant height [30DAS] and days to germination exhibited high heritability broad sense coupled with high values for genetic advance as percent of mean. This indicated that priority should be given to these characters during selection for improvement in ridge gourd.

Keywords: Ridge gourd, GCV, PCV, Variability, Heritability, Genetic Advance.

INTRODUCTION

Ridge Gourd (*Luffa acutangula* Roxb.) is a creeping vine plant in the *Cucurbitaceae* family that bears usually cylindrical fruits, which are used as vegetables. Ridge gourd is a cross pollinated diploid crop which is grown in all the parts of India. Gelatinous compound in ridge gourd is 'Luffein'. Most favourable temperature for Ridge gourd is 18°C-28°C. Flower colour is pale yellow and anthesis time is morning hours. Botanically, Ridge gourd is known as *Luffa acutangula* Roxb. belongs to family *Cucurbitaceae.* It is a diploid cross-pollinated species with chromosome number 2n=2x=26 (**Karpechenko, 1925**). Ridge gourd probably originated from India (**De Candole, 1967**). It is mainly cultivated in China, India, Turkey, Iran and other parts of south-east Asia. Progenitor of Ridge gourd is "*Luffa graveolens".*

The area under Ridge gourd production in India accounts to 10.03 thousand ha with production of 3.16 million tonnes in year 2018-19. (*Source: **NHB,*** **Ministry of Agriculture & Farmers Welfare, Government of India, 2019-20**). Bihar ranks first in area and production of Ridge gourd in year 2018-19 followed by Uttar Pradesh and Haryana. The production of Ridge gourd in Uttar Pradesh is 427.81 tonnes for year 2018-19. The ridge gourd is used as cooked vegetable. It has many uses in ayurvedic medicines. According to 'Ayurvedic' medicines, the oil from its seed is god for the liver and the body. Ridge gourd has moisture 95.2 g, magnesium 11 mg, sodium 2.9 mg, Vitamin C 5 mg, 3.5g Carbohydrates, Oxalic acid 27 mg, Calcium 40 mg, Phosphorous 40 mg, Potassium 50 mg, Chlorine 7 mg and many other nutrients out of 100 g of edible portion. (**Nutritional Research Laboratory, Coonoor**, **Choudhary, 1967**).

Germplasm serves as the basic material with a plant breeder to initiate any breeding programme. It consists of genetic variability for quantitative and qualitative traits. A proper understanding of classification of ridge gourd germplasm for qualitative and quantitative traits may serve as useful guidelines for plant breeders for selection and improvement of the crop. Genetic variability and their quantification for qualitative and quantitative characters of economic importance are prerequisite for any crop improvement programme. The knowledge of genetic advance and heritability guides the breeder to select superior parents to initiate fruitful breeding programme. Thus, for any yield improvement programme superior parent possessing better heritability and genetic advance for various traits is essential (**Khan *et al.*, 2005).**

MATERIAL AND METHODS

The experimental material for present investigation comprised of 11 genotypes of ridge gourd [*Luffa acutangula* (L.)] were obtained from the different sources and sown at Horticultural Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The experiment was conducted in Randomized Block Design comprising 11 (10 genotypes +1 check) genotypes with three replications during *Kharif 2021-22*. The unit plot size would be 2 m^2. The plants will be planted with a spacing of 150 cm between the rows and 60 cm between the plants. There were six plants in each plot. The observations were recorded on randomly selected six plants on characters comprising Days to germination, Days to first male flowering, Days to first female flowering, Days to first harvest of fruits, Sex ratio (M:F), Plant height at 30 DAS (cm), Plant height at 60 DAS (cm), Leaf per plant 30 DAS, Leaf per plant 60 DAS, Number of primary branches per plant 60 DAS, Leaf length (cm), Leaf width (cm), Number of fruits per plant (Avg.), Fruit length (Avg.) (cm), Fruit girth (Avg.) (cm), Fruit weight (g), Fruit yield per plant (kg/plant), Fruit yield per hectare (t/ha), Number of seeds per fruit (Avg. of 5 fruits), Vitamin C content (mg/100gm), Shelf Life (in days). Analysis of Variance was calculated using the formula suggested by **Fisher, 1936;** Coefficient of variation including Genotypic coefficient of Variation and Phenotypic Coefficient of Variation was calculated using the formula suggested by **Burton, 1952;** Heritability (broad sense) was calculated using the formula suggested by **Allard, 1960;** Genetic advance was calculated using the formula suggested by **Johnson *et al.*, 1955.**

RESULTS AND DISCUSSION

The analysis of variance for all characters of ridge gourd genotypes revealed presence of good extant of significant differences among the genotypes for all traits. Henceforth, the data for all 21 characters that showed sufficient amount of significant differences were subjected to further statistical analysis. These results were in agreement with the studies conducted by Singh *et al.* (2002), Choudhary and Kumar (2011), Samadia (2011), Rabbani *et al.* (2012), Kumar *et al.* (2013), Koppad *et al.* (2015), Khan *et al.* (2016), Bhargav *et al.* (2017), Gautam and Balmohan (2018), Divyaraj *et al.* (2019), Akula and topono (2020) and Chinthalapudi *et al.* (2021). Both high GCV and PCV was recorded for fruit yield per hectare followed by days to germination and plant height [30DAS], While Both Moderate GCV and

PCV was recorded for plant height [60DAS], leaf length, fruit length, fruit girth, fruit yield per plant and shelf life in comparison to other characters indicating the presence of high amount of genetic variability for these characters. Similar results for high GCV and PCV were concluded earlier by was earlier reported by Singh *et al.* (2002), Samadia (2011), Rabbani *et al.* (2012), Khan *et al.* (2016), Ananthan and Krishnamoorthy (2017) while, for moderate GCV and PCV was earlier inferred by Rabbani *et al.* (2012), Kumar *et al.* (2013), Koppad *et al.* (2015), Bhargav *et al.* (2017), Manoj *et al.* (2018), Ramesh *et al.* (2018) and Kanan *et al.* (2019). This also suggests that improvement in these characters might be gained to a reasonable extent therefore, selection for these characters would be effective because response to selection is directly proportional to the variability present in the experimental material. In present study, heritability (broad sense) ranged from 30.99% for Days to first female flowering to 92.32% for Fruit yield per hectare. High heritability (broad sense) estimates (60% and above) had been observed for fruit yield per hectare, plant height [30DAS], fruit length, plant height [60DAS], days to first harvest of fruits, days to germination, leaf length, sex ratio, fruit girth, fruit yield per plant, days to first male flowering, shelf life, leaf per plant [30DAS], Vitamin C content and number of primary branches per plant Similar results for high heritability for fruit yield per hectare, plant height [30DAS], fruit length was reported earlier by Singh *et al.* (2002), Rabbani *et al.* (2012), Koppad *et al.* (2015), Ananthan and Krishnamoorthy (2017), Singh *et al.* (2017) and Pushpendra *et al.* (2018). High heritability for plant height [30DAS], days to germination was concluded earlier by Kumar *et al.* (2013), Harshitha *et al.* (2019), Kanan *et al.* (2019) and Akula and Topno (2020). Similar conclusion for high heritability for Days to first male flowering, sex ratio, fruit yield per plant and fruit girth was given by Divyaraj *et al.* (2019) and Chinthalpudi *et al.* (2021). Shelf life, leaf per plant [30DAS], Vitamin C content also had high heritability and similar results was concluded by Bhargav *et al.* (2017), Kartik *et al.* (2017) and Manoj *et al.* (2018) in their work. Days to first female flowering, leaf per plant [60DAS], leaf width, number of seeds per fruit showed moderate heritability which was similarly earlier concluded by Choudhary and Kumar (2011), Samadia (2011), Ananthan and Krishnamoorthy (2017), Singh *et al.* (2017) and Ramesh *et al.* (2018). Moderate heritability was also observed for number of fruits per plant, fruit girth. Similar results were concluded by Singh *et al.* (2002), Rabbani *et al.* (2012) and Chinthalpudi *et al.* (2017). Therefore, these characters are predominantly governed by additive gene action and could be improved through individual plant selection owing to their high heritability values. High genetic advance was observed for plant height [60DAS], plant height [30DAS] and fruit yield per hectare. Moderate genetic advance was observed for fruit weight only. While all other characters i.e. fruit length, leaf per

plant [60DAS], days to first harvest of fruits, leaf per plant [30DAS], number of seeds per fruit, leaf length, days to germination, days to first male flowering, number of fruits per plant, sex ratio, days to first female flowering, leaf width, fruit girth, shelf life, number of primary branches per plant, vitamin C content and fruit yield per plant had low estimates of genetic advance Similar results were concluded by Rabbani *et al.* (2012), Khan *et al.* (2016), Pushpendra *et al.* (2018), Ramesh *et al.* (2018), Divyaraj *et al.* (2019), Akula and Topno (2020) and Chinthalpudi *et al.* (2021). The high or moderate value of genetic advance indicates additive gene action whereas low genetic advance value indicates non-additive gene action. High heritability coupled with high genetic advance as percent of mean was observed for fruit yield per hectare, fruit yield per plant, fruit girth, fruit length, leaf length, plant height [60DAS], plant height [30DAS] and days to germination. This indicates closeness of respective σ2p and σ2g value thereby low environmental effect on expression of these characters. Such values may be attributed to the additive gene effects and direct selection for these traits would be fruitful. Thus, phenotypic selection may be effective for these characters. High heritability coupled with moderate genetic advance as percent of mean was observed for leaf per plant [30DAS], number of primary branches, Vitamin C content and Shelf life. While moderate heritability coupled with moderate genetic advance as percent of mean was recorded for leaf per plant [60DAS], number of fruits per plant and fruit girth. This also pointed out the fact that these characters have appreciable genetic potential and are comparably less influenced by environment, hence desirable for simple selection in breeding programmes. High to moderate heritability coupled with low genetic advance as percent of mean was recorded for rest of the characters which indicated that these characters are highly influenced by environmental effects and selection would be ineffective Similar inferences were drawn by Singh *et al.* (2002), Choudhary and Kumar (2011), Samadia (2011), Rabbani *et al.* (2012), Kumar *et al.* (2013), Varalakshmi *et al.* (2015), Khan *et al.* (2016), Pushpendra *et al.* (2018), Ramesh *et al.* (2018), Divyaraj *et al.* (2019), Akula and Topno (2020) and Chinthalpudi *et al.* (2021).

CONCLUSION

From the present investigation it is concluded that among 11 genotypes of ridge gourd on the basis of mean performance 3 genotypes namely; Dharidar, Anamika and Jaipur long had substantially higher yield and performed better for other desirable traits as compared to Pusa Nasdar (Check). Genetic parameters also revealed that high heritability (broad sense) was observed for fruit yield per hectare, plant height [30DAS], fruit length, plant height [60DAS], days to first harvest of fruits, days to germination, leaf length, sex ratio, fruit girth, fruit yield

per plant, days to first male flowering, shelf life, leaf per plant [30DAS], Vitamin C content and number of primary branches per plant. Fruit yield per hectare, fruit yield per plant, fruit girth, fruit length, leaf length, plant height [60DAS], plant height [30DAS] and days to germination exhibited high heritability broad sense coupled with high values for genetic advance as percent of mean. This indicated that priority should be given to these characters during selection for improvement in ridge gourd.

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Table 1. Analysis of Variance (ANOVA) for 21 quantitative characters in Ridge gourd.

Characters	Mean sum of Squares		
	Replication (df=2)	Treatment/ Genotypes (df=10)	Error (df=20)
Days to Germination (DG)	0.99	5.53**	0.41
Days to first male flowering (DFMF)	1.56	6.06**	0.77
Days to first female flowering (DFFF)	10.43	8.17	3.48
Days to first harvest of fruits (DFH)	2.51	17.56**	1.25
Sex Ratio [M:F] (SR)	0.74	3.55**	0.37
Plant Height [30 DAS] (PH30)	19.53	2207.63**	80.47
Plant Height [60 DAS] (PH60)	66.54	3090.58**	200.71
Leaves per plant [30 DAS] (LPP30)	1.75	21.99**	3.16
Leaves per plant [60 DAS] (LPP60)	34.91	82.39**	22.74
Number of primary branches (NPB)	0.51	0.82**	0.14
Leaf length [cm] (LL)	0.06	8.21**	0.79
Leaf width [cm] (LW)	0.48	3.35**	0.97
Number of fruits per plant (NFPP)	0.01	5.87**	1.28
Fruit length [cm] (FL)	13.01	69.63**	4.36
Fruit girth [cm] (FG)	0.02	1.51**	0.16
Fruit weight [g] (FW)	3.06	286.43**	72.92
Fruit yield per plant [kg/plant] (FYPP)	0.01	0.33**	0.03
Fruit yield per hectare [t/ha] (FYPH)	18.12	415.64**	11.20
Number of seeds per fruit [avg] (NSPF)	14.16	29.17*	9.41
Vitamin C content [mg/100gm] (VCC)	0.03	0.39**	0.06
Shelf life [in days]	0.41	0.82**	0.11

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

Table 2. Range, Variability and Genetic Parameters for 21 quantitative characters of 11 Ridge gourd genotypes

Sl No	Characters	Range		Variability		Genetic Parameters		
		Minimum	Maximum	GCV (%)	PCV (%)	h2 (Heritability Broad Sense) (%)	GA (5% LOS)	GA as % Mean
1	Days to Germination (DG)	4.00	7.67	22.39	24.96	80.49	2.41	41.39
2	Days to first male flowering (DFMF)	34.66	39.58	3.53	4.24	69.38	2.27	6.06
3	Days to first female flowering (DFFF)	44.17	50.25	2.73	4.91	30.99	1.43	3.13
4	Days to first harvest of fruits (DFH)	59.67	68.09	3.79	4.20	81.26	4.33	7.04
5	Sex Ratio [M:F] (SR)	20.78	24.13	4.73	5.50	74.01	1.82	8.38
6	Plant Height [30 DAS] (PH30)	84.84	175.83	20.80	21.95	89.80	51.98	40.61
7	Plant Height [60 DAS] (PH60)	156.92	258.25	14.04	15.43	82.16	58.16	26.31
8	Leaves per plant [30 DAS] (LPP30)	22.42	30.08	9.56	11.73	66.46	4.20	16.07
9	Leaves per plant [60 DAS] (LPP60)	42.42	61.00	8.41	12.31	46.64	6.27	11.83
10	Number of primary branches (NPB)	4.17	6.08	9.80	12.64	60.08	0.75	15.65
11	Leaf length [cm] (LL)	7.98	13.99	15.59	17.91	75.77	2.82	27.96
12	Leaf width [cm] (LW)	11.56	14.67	6.75	10.09	44.79	1.22	9.31
13	Number of fruits per plant (NFPP)	14.42	18.75	7.64	10.37	54.28	1.87	11.59
14	Fruit length [cm] (FL)	21.35	35.14	16.03	17.86	83.27	8.76	30.65
15	Fruit girth [cm] (FG)	4.26	6.42	13.25	15.48	73.28	1.18	23.38
16	Fruit weight [g] (FW)	94.00	121.38	8.01	11.39	49.39	12.21	11.59
17	Fruit yield per plant [kg/plant] (FYPP)	1.54	2.61	14.43	17.01	71.95	0.55	25.22
18	Fruit yield per hectare [t/ha] (FYPH)	25.39	61.91	27.40	28.52	92.32	22.98	54.24

19	**Number of seeds per fruit [avg] (NSPF)**	31.71	40.69	7.03	10.96	41.16	3.39	9.29
20	**Vitamin C content [mg/100gm] (VCC)**	2.93	4.30	8.87	11.00	65.07	0.55	14.74
21	**Shelf life [in days]**	3.33	5.00	11.30	13.85	66.61	0.81	19.01

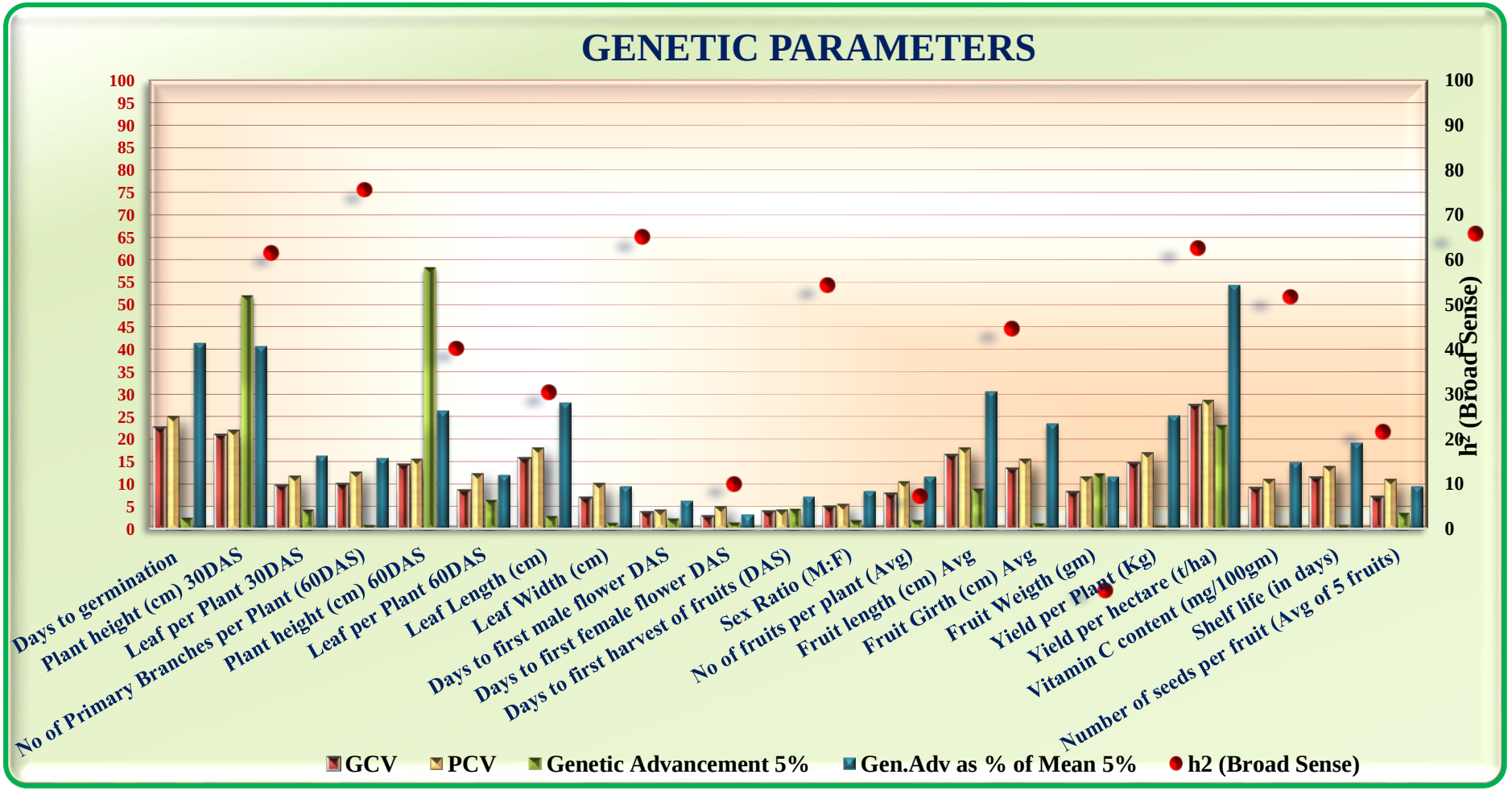

Figure 1. Histogram representing the relationship among the GCV, PCV, Heritability, Genetic Advance and Genetic Advance as percent of mean in Ridge gourd.

Table 3. List of sources of genotypes

Sl No	Genotypes List	Source
01	Jaipur long	Shankar seeds, Prayagraj, U.P.
02	Dharidar	Krishak hitashi seeds, Prayagraj, U.P.
03	Anamika	Right seeds, Prayagraj, U.P.
04	Sumitra	Ujjwal seeds, Prayagraj, U.P.
05	Latika	Ankur seeds, Nagpur, MH.
06	Riwaka	Winseed, Betul, M.P.
07	Aarti	VNR Seeds, C.G.
08	DS-4700	DSPL Seeds, Prayagraj, U.P.
09	Neha	Aadya Agricultures, Prayagraj, U.P.
10	Shamita	Sakata seeds, Indore, M.P.
11	**Pusa Nasdar (Check)**	VNR seeds, C.G.

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