Original Research Article

Genetic Parameters and Character Association in Ridge Gourd (Luffa acutangula Roxb.)

Abstract

An experiment was conducted on Genetic variability and character association in eight genotypes of Ridge Gourd with three replications during summer season 2021-22 at the Research Field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. The observations were recorded on various yield and yield contributing characters of ridge gourd. The results from the present investigation revealed that on the basis of Based on mean performance for fruit yield per plant (2.17 kg) and fruit yield ((88.35 q/ha), genotypes IET 2021/RIGVAR-6 were considered suitable genotypes in Prayagraj climatic condition. Coefficient of variation revealed that high magnitude of GCV and PCV were recorded for Fruit yield/ ha (q) and Average fruit weight (g). The heritability estimates were found to be high (more than 60%). The genetic advance and genetic advance as percent of mean estimates were found to be high (more than 20%). Genotypic correlation coefficient analysis revealed that fruit yield /ha (kg) showed positive significant association with Fruit length (cm) (0.024**), Fruit diameter (cm) (0.971**), Number of fruit per plant (0.331**), Average fruit weight (g) (0.940**) at genotypic level. Whereas Phenotypic correlation coefficient analysis revealed that fruit yield /ha (kg) showed positive significant association with Fruit length (cm) (0.347**), Fruit diameter (cm) (0.999**), Number of fruit per plant (0.653**), Average fruit weight (g) (0.999**) at phenotypic level.

Key words: Ridge gourd, heritability, genotypic and phenotypic coefficient of variation, genetic advance, earliness.

INTRODUCTION

Crop improvement is largely depends on existence of genetic variability. To know the extent of variability present in a population, evaluation of large number of germplasm lines is the first line of work.This improvement in any crop is based on the extent of genetic variation and magnitude of available beneficial genetic variability. Some of the biometrical parameters include genotypic (GCV) and phenotypic (PCV) coefficients of variation. High value of these coefficients indicates wider diversity. Similarly, narrow difference between GCV and PCV reveals low sensitivity to the environmental effects.

Another indicator of variability is heritability, which is the ratio of genetic variance to total variance. This is broad sense heritability and gives an idea about that portion of observed variability which is attributable to genetic differences. Heritability estimates supplemented by genetic variance are more meaningful. Heritability is a component in the computation of expected progress which is most meaningful when accompanied by genetic advance. Genetic advance would be more in cases where the additive genetic variance is more than non-additive genetic variance (Lush, 1949). The present investigation was undertaken with ridge gourd genotypes with the objective of obtaining information on variability, heritability and genetic advance.

MATERIAL AND METHODS

The experiment was conducted during the summer seasons of 2021-22 at the Research Field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj using randomized block design with three replications. During the period of experimentation, the maximum temperature of the location reaches up to 46 ºC – 48 ºC and seldom falls as low as 4ºC – 5ºC. The relative humidity ranges between 20 to 94 per cent. The average rainfalls in this area is around 1013.4 mm annually. Treatment was in a plot of single row in each replication. Recommended cultural practices were followed as per the package of practices of horticultural crops of University of Agricultural Sciences, Dharawad (Anon., 2010). Five randomly selected plants from each genotype were subjected to made observation on Plant height, Primary branches at 30 & 60 DAS, Plant spread, Days to first flowering, Days of Emergence of first male & female flowers, No. of male & female flowers, Sex ratio, Nodes Number at which First Male & female Flower appears, Days to First Fruit setting, Days to First Fruit Picking, Fruit Weight, No. of Fruits Per Plant, Fruit Yield Per Plant, Fruit Length, Fruit Girth Yield per Hectare and Vine Length at Harvest. Variability for different qualitative characters and expected genetic advance at 5 per cent intensity were calculated as per Burton (1952) and Johnson et al., (1955), respectively.

RESULT AND DISCUSSION

Analysis of variance in these 8 genotypes of ridge gourd showed that highly significant differences for all the quantitative and qualitative traits studied indicating adequate genetic variability among the genotypes studied (Table-1).

Large variation among the genotypes found for the traits, Genetic variability estimates including mean, range, genotypic and phenotypic variances, genotypic and phenotypic coefficient of variances, broad sense heritability, genetic advance and genetic advance over mean for different characters are presented in Table-2.

Genotypic and Phenotypic coefficient of variation

Both High GCV% and PCV% are recorded highest at Days to 1st Male Flower (GCV % 27.71) (PVC%38.23) followed by Number of Male Flower, Number of Female Flower, Days to first fruit picking, Number of Fruits per Plant, Average Fruit Yield Per Plant and Fruit Length. Moderate GCV%and PCV% are recorded at Plant Spread, Days to First Flowering and Nodes number at which first Female flower appears. This also suggests that improvement in these characters might be gained to a reasonable extent therefore, selection for these characters would be effective because the response to selection is directly proportional to the variability present in the experimental material.

Both low GCV% and PCV% were recorded at Plant Height 30DAS, Plant Height 60DAS, Primary Branches 30DAS, Primary Branches 60DAS, Days to First Female Flower, Sex ratio, Days to First Fruit Setting, Fruit Girth, Yield per Hectare, Vine Length at Harvest, TSS and Vitamin C.

Heritability and Genetic Advance

The heritability estimate was foundto be high (>60%) for almost all thecharacters viz., Plant Height 30DAS, Plant Height 60DAS, Plant Spread, Days to First Flowering, Days to First Fruit Setting, Number of Fruits per Plant, Fruit Yield Per Plant, Fruit Length, Fruit Girth, Yield per

Hectare, Vine Length at Harvest, TSS and Vitamin C.

High genetic advance was observed for Plant Height 30DAS, Plant Height 60DAS, Plant Spread, Days to First Male Flowering, Days to first fruit setting, Days to first fruit picking, Fruit Length, Fruit Girth, Yield per Hectare and Vine Length at Harvest. While other characters had low estimates of genetic advance. The high or moderate value of genetic advance indicates additive gene action whereas low genetic advance value indicates non-additive gene action. The high or moderate value of genetic advance indicates additive gene action whereas low genetic advance value indicates non-additive gene action.

The estimation of genetic advance for all the characters are presented inGenetic advance as percent mean was categorized as low (0-10%), moderate (10-20% and (≥20%) as given by Johnson et al., (1955) and Falconer and Mackay (1996). The genetic advances as percent mean was highest in all characters and have moderate estimates for Sex Ratio character only. 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 geneeffects and direct selection for these traits would be fruitful. Thus, phenotypic selection may be effective for these characters. This also pointed out the fact thatthese characters have appreciable genetic potential and are comparably less influencedby 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.

Genotypic and Phenotypic Correlation

Genotypic correlation coefficient analysis revealed that fruit yield plant-1 (kg) showed positive significant association with Primary Branches 30 DAS, Primary Branches 60 DAS, Days to First Flowering, Nodes at which first male flower appears, Nodes at which first female flower appears, Number of fruit per plant, TSS and Vitamin C. While negative significant association was observed with Plant Height 30DAS, Plant Height 60DAS, Plant Spread, Days to first male flowering, Sex ratio, Days to first fruit setting, Days to first fruit picking, Fruit weight, Fruit Girth, Yield per hectare, Vine Length per hectare.

Phenotypic correlation coefficient analysis revealed that fruit yield plant-1 (kg) showed positive significant association with Plant Height 30DAS, Plant Height 60DAS, Primary Branches 30DAS, PrimaryBranches 60 DAS, Days to First Flowering, Days to first female flowering, Sex Ratio, Nodes at which first female flower appears, Days to first fruit setting, Fruit weight, Fruit Girth, Yield per Hectare, Vine Length at Harvest, TSS and Vitamin C. While negative significant association was observed with Days to first female flower appears and Days to first fruit picking.

Table 1. Analysis of Variance for different traits in Ridge gourd

Characters	Mean Sum of Squares		
	Replication (df=2)	**Treatment / Genotypes (df=7)**	**Error (df=14)**
Plant Height 30DAS	112.87	70.07**	1.33
Plant Height 60DAS	198.12	63.39**	1.10
Primary Branches 30DAS	0.42	0.21**	0.08
Primary Branches 60DAS	18.07	0.16**	0.21
Plant Spread	35.88	50.89**	1.56
Days to First Flowering	0.005	0.47**	0.04
Days To Emergence Of First Male Flowers	132.92	83.39**	25.96
Days To Emergence Of First Female Flowers	0.075	8.39**	0.68
No. of Male Flowers	1.24	9.42**	1.59
No. of Female Flowers	0.26	0.30**	0.19
Sex Ratio	0.53	22.04**	2.45
Nodes Number at which First Male Flower Appears	0.37	2.87**	0.79
Nodes Number at which First Female Flower Appears	0.09	0.49**	0.17
Days to First Fruit Setting	1.84	8.72**	0.61
Day To First Fruit Picking	6.69	70.46**	22.936
Fruit Weight	0.03	122.79**	0.439
No. of Fruits Per Plant	0.36	10.31**	0.117
Fruit Yield Per Plant	0.005	0.41**	0.001
Fruit Length	0.36	39.63**	0.112
Fruit Girth	0.51	136.44**	0.095
Yield per Hectare	3.90	2060.46**	1.994
Vine Length at Harvest	0.51	454.64**	0.455
TSS	0.001	0.031**	0.006
Vit. C	0.013	0.051**	0.008

Table 2: Genetic parameters for different characters in Ridge gourd

Characters	**GCV (%)**	**PCV (%)**	**H2 (Heritability Broad Sense %)**	**GA (5% LOS)**	**GA as % Mean**
Plant Height 30DAS	4.53	4.61	96.28	109.55	84.58
Plant Height 60DAS	2.54	2.59	96.58	195.64	89.09
Primary Branches 30DAS	9.11	13.80	43.54	0.96	34.61
Primary Branches 60DAS	4.55	13.82	10.83	1.60	45.53
Plant Spread	12.53	12.92	94.04	39.69	100.13
Days to First Flowering	11.29	12.34	83.66	2.80	68.09
Days To Emergence Of First Male Flowers	27.71	38.23	52.52	49.57	256.32
Days To Emergence Of First Female Flowers	8.16	8.85	85.07	16.21	67.37
No. of Male Flowers	35.36	41.92	71.14	4.68	83.71
No. of Female Flowers	93.07	99.58	87.35	1.84	147.60
Sex Ratio	2.25	5.51	16.71	4.13	13.27
Nodes Number at which First Male Flower Appears	35.23	46.82	56.64	1.31	45.25
Nodes Number at which First Female Flower Appears	12.57	17.87	49.47	1.25	39.05
Days to First Fruit Setting	6.69	7.17	87.02	20.47	67.96
Day To First Fruit Picking	28.56	40.04	50.89	23.17	135.76
Fruit Weight	0.95	1.63	33.90	13.90	27.85
No. of Fruits Per Plant	30.57	30.92	97.76	8.82	119.39
Fruit Yield Per Plant	24.20	24.26	99.52	1.51	80.14
Fruit Length	22.64	22.70	99.44	32.91	167.58
Fruit Girth	1.84	2.05	80.81	22.12	64.36
Yield per Hectare	2.40	3.20	56.37	28.97	43.31
Vine Length at Harvest	0.72	0.79	82.17	138.62	68.56
TSS	7.66	9.32	67.57	0.82	56.39
Vit. C	8.46	9.91	72.88	1.05	60.59

Fig .1 Genetic Parameter

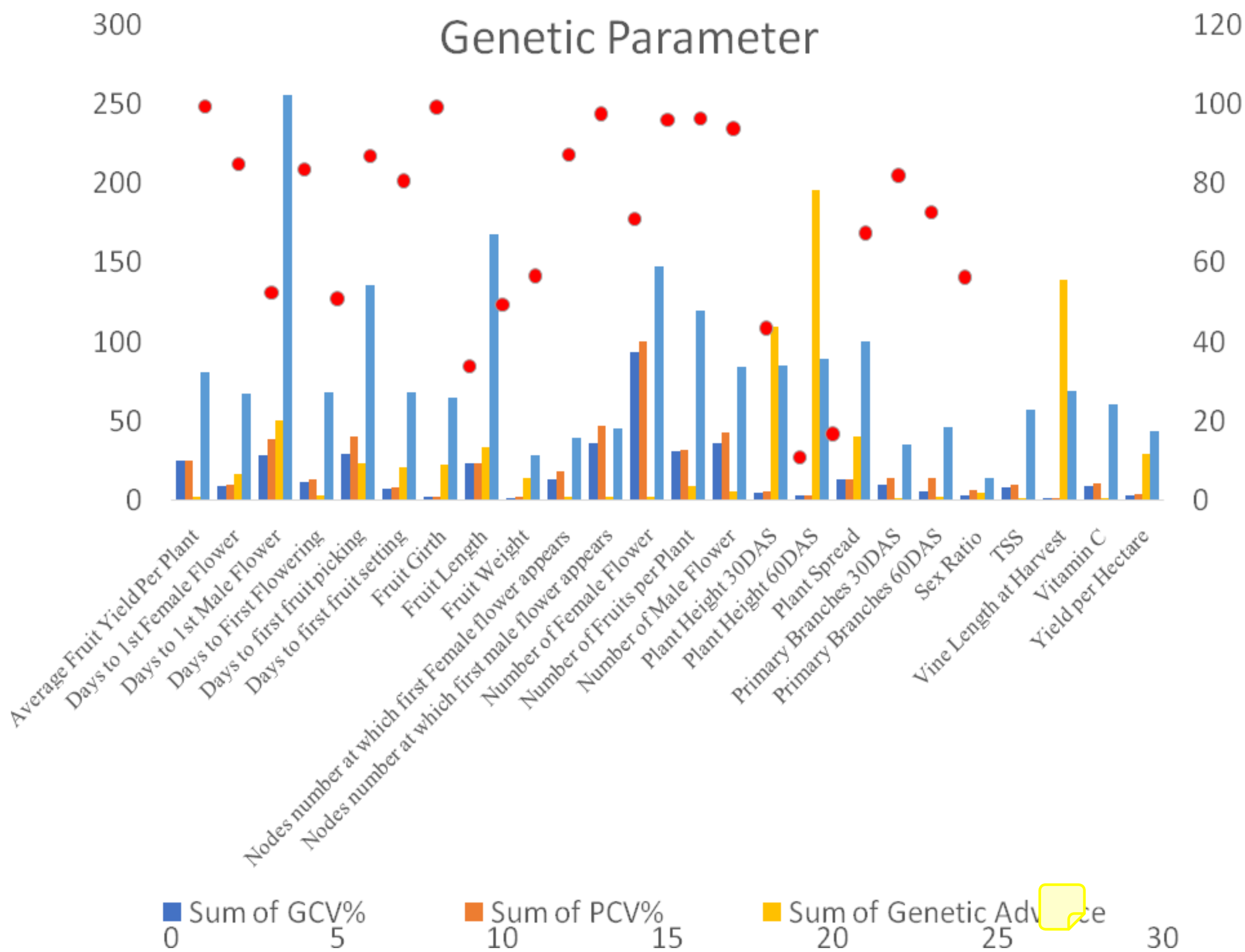

Table.3: Genotypic correlation for different characters in Ridge gourd.

	PH 30DAS	PH 60DAS	PB 30DAS	PB 60DAS	PS	DFF	DFMF	DFFF	NMF	NFM	SR	NFMFA	NFFFA	DFFS	DFFP	FW	NFPP	FYPP	FL	FG	YPH	VLAH	TSS	Vit. C
PH 30DAS	1																							
PH 60DAS	0.96571	1																						
PB 30DAS	-0.20342	-0.09154	1																					
PB 60DAS	0.185686	0.329992	0.903582	1																				
PS	0.801343	0.623929	-0.25755	-0.06277	1																			
DFF	-0.1459	-0.0329	0.998243	0.925601	-0.21747	1																		
DFMF	0.110317	-0.13014	-0.30787	-0.42614	0.633157	-0.31397	1																	
DFFF	0.89041	0.944501	0.23327	0.606218	0.574836	0.290069	-0.16124	1																
NMF	-0.33861	-0.30104	0.943143	0.736979	-0.1832	0.930062	-0.02882	0.028174	1															
NFM	-0.44622	-0.37184	0.95457	0.735011	-0.35434	0.936637	-0.17888	-0.04896	0.982852	1														
SR	0.863554	0.963093	0.052266	0.474714	0.410181	0.10759	-0.32582	0.942264	-0.21191	-0.24656	1													
NFMFA	-0.40221	-0.32827	0.96529	0.762011	-0.31813	0.949948	-0.16863	-0.00162	0.987863	0.99864	-0.20443	1												
NFFFA	-0.24934	-0.14572	0.99821	0.876862	-0.2717	0.993367	-0.27653	0.181593	0.959409	0.97047	-0.00581	0.979177	1											
DFFS	0.916775	0.975048	0.13133	0.529457	0.566345	0.189241	-0.18977	0.992572	-0.08858	-0.15763	0.970701	-0.11155	0.077125	1										
DFFP	0.068706	-0.1649	-0.21639	-0.35485	0.601064	-0.22432	0.995023	-0.16438	0.066476	-0.08339	-0.34669	-0.07266	-0.18345	-0.2036	1									
FW	0.862035	0.963456	0.028204	0.453695	0.399862	0.083506	-0.34607	0.932935	-0.24016	-0.2705	0.999113	-0.22955	-0.03032	0.965243	-0.37008	1								
NFPP	-0.22867	-0.20816	0.933256	0.756123	-0.06021	0.926362	0.015827	0.120195	0.990911	0.954649	-0.14482	0.964172	0.946417	0.001301	0.107305	-0.17345	1							
FYPP	-0.39518	-0.30974	0.97336	0.781295	-0.34034	0.959019	-0.21794	0.015818	0.980125	0.997425	-0.17775	0.998691	0.985088	-0.09174	-0.12272	-0.20169	0.955472	1						
FL	0.407585	0.201799	0.096645	0.071227	0.836473	0.114553	0.758401	0.291489	0.288528	0.114172	-0.00134	0.139388	0.108339	0.225133	0.770138	-0.02281	0.392258	0.104112	1					
FG	0.869127	0.961256	-0.01449	0.412977	0.421958	0.040049	-0.2766	0.920431	-0.27111	-0.30868	0.994915	-0.26624	-0.07178	0.95509	-0.30126	0.993572	-0.20769	-0.24173	-0.01315	1				
YPH	0.877841	0.934481	-0.17461	0.247462	0.490714	-0.12273	-0.102	0.85056	-0.39098	-0.44504	0.943657	-0.40212	-0.22713	0.895295	-0.13511	0.940446	-0.33121	-0.3858	0.024217	0.971527	1			
VLAH	0.863963	0.965027	0.039228	0.462903	0.403664	0.094964	-0.36142	0.937521	-0.23001	-0.25977	0.997066	-0.21935	-0.01945	0.968623	-0.38572	0.998837	-0.16042	-0.1907	-0.01287	0.987277	0.925453	1		
TSS	-0.30149	-0.19936	0.993864	0.850834	-0.30802	0.985873	-0.27621	0.127299	0.9651	0.981388	-0.05835	0.987308	0.998434	0.022581	-0.18246	-0.08221	0.947137	0.992626	0.0908	-0.12444	-0.27906	-0.07104	1	
Vit. C	-0.28909	-0.18573	0.995316	0.858087	-0.30154	0.988122	-0.28048	0.140922	0.963	0.978657	-0.0444	0.985183	0.999081	0.036474	-0.18699	-0.06828	0.946125	0.99086	0.091955	-0.11069	-0.26623	-0.05708	0.999901	1

Table 4: Phenotypic Correlation for different characters in Ridge gourd

	PH 30DAS	PH 60DAS	PB 30DAS	PB 60DAS	PS	DFF	DFMF	DFFF	NMF	NFM	SR	NFMFA	NFFFA	DFFS	DFFP	FW	NFPP	FYPP	FL	FG	YPH	VLAH	TSS	Vit C
PH 30DAS	1																							
PH 60DAS	0.989143	1																						
PB 30DAS	0.959814	0.99046	1																					
PB 60DAS	0.95022	0.985034	0.999212	1																				
PS	0.876449	0.796208	0.707118	0.685792	1																			
DFF	0.970002	0.995177	0.999121	0.996743	0.733337	1																		
DFMF	-0.38386	-0.47387	-0.53038	-0.52658	-0.01822	-0.52287	1																	
DFFF	0.990704	0.999699	0.988993	0.983768	0.803925	0.993805	-0.45246	1																
NMF	0.721696	0.623441	0.528933	0.5135	0.933315	0.553025	0.328117	0.638951	1															
NFM	0.45313	0.317969	0.189732	0.163448	0.825089	0.22495	0.457846	0.331816	0.902767	1														
SR	0.948982	0.983862	0.998571	0.999848	0.684793	0.995765	-0.51478	0.982955	0.517903	0.164241	1													
NFMFA	0.941367	0.921882	0.894465	0.892582	0.860284	0.900394	-0.10061	0.931103	0.823291	0.514257	0.897157	1												
NFFFA	0.963995	0.99204	0.999653	0.998863	0.719436	0.999102	-0.50796	0.991204	0.548792	0.208898	0.998548	0.905916	1											
DFFS	0.986917	0.999804	0.992503	0.987856	0.787894	0.996445	-0.47237	0.999626	0.617919	0.306218	0.986937	0.923611	0.99411	1										
DFFP	-0.38069	-0.46546	-0.51641	-0.51072	-0.03223	-0.5108	0.998752	-0.44377	0.319267	0.430762	-0.49831	-0.08843	-0.49394	-0.46298	1									
FW	0.957701	0.989575	0.999807	0.99879	0.701055	0.998926	-0.54662	0.987629	0.516734	0.1798	0.997847	0.88608	0.998964	0.991485	-0.53297	1								
NFPP	0.83067	0.739852	0.641421	0.617723	0.995745	0.670411	0.029617	0.747874	0.938042	0.868528	0.616282	0.812953	0.654334	0.730228	0.011822	0.635318	1							
FYPP	0.983706	0.999443	0.994337	0.989794	0.775613	0.997852	-0.49468	0.998663	0.598438	0.286161	0.988592	0.91376	0.995269	0.999668	-0.48521	0.993782	0.71711	1						
FL	0.583655	0.458071	0.332671	0.303827	0.901631	0.368755	0.276116	0.468539	0.911015	0.98076	0.302296	0.590692	0.348644	0.445271	0.24778	0.32531	0.936871	0.428363	1					
FG	0.960409	0.990921	0.999734	0.998297	0.707718	0.999307	-0.54538	0.988981	0.522585	0.188559	0.997255	0.887439	0.998957	0.992625	-0.53223	0.999941	0.642685	0.994831	0.334413	1				
YPH	0.964015	0.992437	0.999881	0.998633	0.717925	0.999592	-0.52273	0.991155	0.540968	0.204733	0.997976	0.899235	0.999802	0.994264	-0.50929	0.999564	0.653162	0.995806	0.347158	0.999639	1			
VLAH	0.960133	0.990788	0.999725	0.998307	0.707012	0.999268	-0.54614	0.988828	0.521676	0.187551	0.997259	0.886989	0.998923	0.9925	-0.53298	0.999948	0.64193	0.994732	0.33349	0.999999	0.999615	1		
TSS	0.959414	0.990436	0.999759	0.998458	0.705231	0.999176	-0.54635	0.988477	0.520171	0.185219	0.99744	0.886698	0.998943	0.992205	-0.53304	0.999974	0.639954	0.994458	0.331042	0.999993	0.999609	0.999995	1	
Vit. C	0.960381	0.990905	0.999768	0.998375	0.707677	0.999311	-0.5444	0.988996	0.523003	0.188623	0.997359	0.887916	0.99902	0.992631	-0.5312	0.999949	0.642598	0.994812	0.334286	0.999999	0.999671	0.999998	0.999994	1

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