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Genetic Variability Studies of Ridge Gourd Advanced Inbred Lines (*Luffa acutangula* (L.) Roxb.)

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ABSTRACT

Fourteen advanced inbred lines of ridge gourd were evaluated in RCBD with three replications. Analysis of variance revealed that highly significant variation among genotypes for the characters for the viz., characters such as node number for the first female flower appearance, days taken for the first male flower appearance, days taken for the first female flower appearance, vine length, leaf length, fruit length, ovary length, peduncle length, fruit girth, number of fruits per vine, fruit weight, fruit yield/vine and fruit yield/ha. High PCV, GCV, heritability, genetic advance were observed for fruit length (cm), number of fruits per vine, yield per vine (kg) and fruit yield (t/ha).

Key words: *Luffa acutangula, Genotypes, Fruit, Yield*

INTRODUCTION

Ridge gourd [*Luffa acutangula* (L.) Roxb.], originated in India and belongs to the family cucurbitaceae having chromosome number 2n = 26. Ridge gourd is cultivated throughout the year on a commercial scale and grown in homesteads as a popular vegetable both in spring summer and rainy season. Its immature fruits which are used as a vegetable, in many ways and are quite commonly used in cooked, fried and stuffed forms. Ridge gourd is monoecious in nature, which is considered as one of the fruit vegetables consumed and relished by most local people in India[5]. Crop improvement largely depends on the existence of variability and its exploitation by the plant breeders and has to identify sources of favorable genes, incorporating them into breeding population or lines. Knowledge of the amount of variability and heritability aids the crop breeder for effecting improvement in any crop by choosing suitable breeding technique. This necessitates the evaluation of the assemblage for various requirements in the single environment.

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Therefore, occurrence of adequate genetic variability is an essential pre-requisite for all crop improvement programmes. The source material for genetical improvement would be identified by studying the amount of variability available in the gene pool or germplasm.

MATERIALS AND METHODS

The present research was carried out in the block VIII, Division of Vegetable Crops, ICAR-IIHR, Bengaluru, India (12^0 58´ north latitude, 77^0 45´ east longitude and at an altitude of 930 meters above the mean sea level.). The soil of the experimental site is red loamy. Crop was raised following standard cultivation practices. The experimental material for present investigation consist of 14 advanced inbred lines of ridge gourd (Table 1). The experiment was laid out in a randomized complete block design (RCBD) with three replications in the field of Division of Vegetable Crops, ICAR-IIHR, Bengaluru, during August-November 2015. Ten plants per replication were transplanted on raised beds keeping a spacing of 1.5 m between rows and 50 cm within rows. The recommended NPK fertilizer doses and cultural practices along with plant protection measures were followed to raise an ideal crop. The observations were recorded from 5 randomly selected plants in each replication on 19 quantitative traits *viz*., node number for the first male flower appearance, node number for the first female flower appearance, days taken for the first male flower appearance, days taken for the first female flower appearance. vine length (cm), number of primary branches, leaf length (cm), leaf width (cm), petiole length (cm), fruit length (cm), ovary length (cm), peduncle length (cm), fruit girth (cm), number of fruits per vine, fruit weight (g), fruit yield/vine (kg), fruit yield/ha (t/ha), ToLCNDV Incidence (VI) and downy mildew incidence. Analysis of variance was carried out as per the procedure given by Panse and Sukhatme[9] using the mean values of five randomly selected plants in each replication from all inbreds to find out the significance of inbred effect. GCV and PCV were estimated according to Burton and Devane[1] based on estimate of genotypic and phenotypic variance, heritability (bs) were calculated as per formula given by Falconer[2] and GAM was calculated according to Johnson *et al*.[7].

Table 1: List of ridge gourd advanced inbred lines

Sl. no	Advanced inbred lines	Sl. no	Advanced inbred lines
1	RV-1	8	RV-8
2	RV-2	9	RV-9
3	RV-3	10	RV-10
4	RV-4	11	RV-11
5	RV-5	12	SV-12
6	RV-6	13	RG-27
7	RV-7	14	RG-2

RESULTS AND DISCUSSION

Analysis of variance revealed that highly significant variation among advanced inbred lines for most of the characters *viz*., node number for the first female flower appearance, days taken for the first male flower appearance, days taken for the first female flower appearance, vine length, leaf length, fruit length, ovary length, peduncle length, fruit girth, number of fruits per vine, fruit weight, fruit yield/vine and fruit yield/ha. Similarly highly significant variation for all

characters studied were reported by Kadam and Kale[8], Sahni *et al.*[12], Rao *et al.*[10], Singh *et al.*[13] and Hegade *et al.*[6] in ridge gourd, Bharathi *et al.*[3] in sponge gourd, Dora *et al.*[4] in pointed gourd and Rathod[11] in bitter gourd. Sufficient genetic variability for many traits had been reported by Dubey *et al*.[5] in ridge gourd. It was revealed from Table 2 that the node number for the first male flower appearance was maximum in RG-2 (3.78) and minimum was recorded in RV-8 (2.67). Node number for the first female flower appearance was recorded maximum in RV-1 (10.87) and minimum was recorded in RV-9 (6.33). Inbred line RV-1 took minimum number of days (38.30) from sowing for producing the first male flower followed by RG-27 (38.47) and RV-10 (38.72 days) whereas, the genotype RG-2 took maximum number of days (53.06) from sowing for first male flower appearance. Inbred line RG-27 showed earliness in terms of days to first female flower appearances (41.28 days from sowing) and the genotype RV-1 took maximum number of days (56.17) from sowing for first female flower appearance. Maximum vine length was observed in RV-1 (363.28cm) followed by RV-3 (335.22cm) and RV-11 (325.83cm) whereas, minimum was observed in RV-9 (206.97cm). Maximum number of primary branches were observed in SV-12 (9.70) followed by RV-10 (8.98) and RV-4 (8.67) whereas, minimum was recorded in RV-5 (6.00). Maximum leaf length was recorded in RV-5 (12.15cm) and minimum in RV-8 (9.62cm) with a mean of 10.58cm. Maximum leaf width was recorded in RV-5 (15.10cm) and minimum in RV-8 (11.25cm) with a mean of 13.23cm. Maximum petiole length was recorded in RV-5 and RV-11 (6.58cm) and minimum in RV-8 (5.12cm). The inbred line, RG-2 had long fruits (32.28cm) whereas as, the inbred line RV-9 had shorter fruits (12.13cm) among all the advanced inbred lines (Fig). Mean ovary length was maximum in RV-11 (7.29cm) and minimum was recorded in RV-9 (3.80cm). Mean peduncle length was maximum in SV-12 (9.92cm) and minimum was recorded in RV-4 (5.85cm). Fruit girth was significantly higher in the genotype RV-9 (15.50cm) whereas, lowest was recorded in the line RG-2 (12.05cm). Mean number of fruits per vine was maximum in RG-27 (13.15) and minimum was recorded in RG-2 (4.09). Among the different inbreds, significantly higher fruit weight was recorded in the RG-2 (183g) whereas, lowest was recorded in the line RV-6 and RV-7 (90g). Fruit yield was maximum in SV-12 (1.64kg) and minimum was recorded in RV-7 (0.52kg). Average yield was maximum in SV-12 (21.91 t/ha) and minimum was recorded in RV-7 (6.90 t/ha). There was no incidence of Tomato Leaf Curl New Delhi Virus during the crop growth period. However, these inbred lines were found resistant under artificial inoculation condition during last year. Advanced inbred line RG-2 (38.23) recorded low level of downy mildew incidence and RV-8 recorded highest level of downy mildew incidence (49.22) (Table-2). High PCV and GCV was observed for fruit length, number of fruits per vine, fruit yield per vine and fruit yield per hectare indicating that maximum amount of variability present among the inbred lines for these characters. In general PCV was higher than GCV indicated higher influence of the environment on expression of the characters (Table 3).Heritability estimates were high for fruit length, ovary length, peduncle length, number of fruits per vine, fruit weight, fruit yield per vine, fruit yield per hectare. Node number for the first female flower appearance, fruit length, ovary length, peduncle length, number of fruits per vine, fruit weight, fruit yield per vine and fruit yield per hectare showed high genetic advance over per cent of mean (Table-3).

Table 2: Mean performance of 14 advanced inbred lines of ridge gourd during *Kharif* 2015

Genotypes	Node number for the 1st male flower appearance	Node number for the 1st female flower appearance	Days taken for the 1st male flower appearance	Days taken for the 1st female flower appearance	Vine length (cm)	Number of Primary branches	Leaf length (cm)	Leaf width (cm)	Petiole length (cm)
RV-1	3.03	10.87	38.30	56.17	363.28	8.41	11.02	12.62	5.63
RV-2	3.42	8.92	41.32	50.83	277.13	6.87	10.15	13.03	5.57
RV-3	3.23	8.50	40.13	53.13	335.22	7.52	10.77	13.35	5.65
RV-4	3.31	8.42	41.33	50.57	282.44	8.67	10.67	14.22	6.01
RV-5	3.40	7.93	42.55	50.22	291.60	6.00	12.15	15.10	6.58
RV-6	2.95	6.57	39.30	43.72	299.73	7.33	10.82	12.82	5.60
RV-7	3.53	9.37	41.38	51.25	274.93	7.45	11.02	14.14	5.95
RV-8	2.67	6.58	40.73	46.80	210.82	7.40	9.62	11.25	5.12
RV-9	3.22	6.33	43.65	47.92	206.97	7.50	10.32	12.90	5.68
RV-10	3.60	7.30	38.72	44.13	297.87	8.98	11.13	13.95	5.97
RV-11	3.60	7.41	45.27	44.78	325.83	8.00	10.52	13.63	6.58
SV-12	3.64	9.83	48.97	53.58	293.89	9.70	9.75	13.40	5.95
RG-27	3.13	6.37	38.47	41.28	279.33	8.17	9.75	12.48	5.57
RG-2	3.78	7.95	53.06	52.63	280.43	6.98	10.42	12.37	6.28
Mean	3.32	8.02	42.37	49.07	287.11	7.78	10.58	13.23	5.87
Significance	NS	**	*	**	**	NS	*	NS	NS
C.D./SEm±	0.29	1.73	8.08	5.99	61.27	0.79	1.27	0.67	0.39
CV	15.36	12.82	11.36	7.27	12.72	17.61	7.14	8.82	11.59

Note: CV- Co-efficient of variation; CD- Critical difference at P = 0.05/ P = 0.01; SEm-Standard error of mean; * Significant at 5 % level of probability;** Significant at 1% level of probability; NS-Non-significant

Table 2: Continued.

Genotypes	Fruit Length (cm)	Ovary length (cm)	Peduncle length (cm)	Fruit girth (cm)	Number of Fruits per vine	Fruit weight (g)	Yield per vine (kg)	Fruit Yield (t/ha)	Downey mildew PDI
RV-1	16.37	4.97	6.14	12.78	9.58	103	0.98	13.06	47.41 (43.45)
RV-2	16.73	4.94	5.93	13.10	4.93	133	0.66	8.74	47.96 (43.83)
RV-3	17.47	4.80	6.41	13.57	5.67	113	0.66	8.70	50.19 (45.10)
RV-4	16.12	4.48	5.85	15.28	9.97	137	1.33	17.76	49.26 (44.58)
RV-5	15.25	4.81	6.60	13.50	7.92	113	0.92	12.19	49.63 (44.79)
RV-6	16.23	4.95	6.06	12.30	6.00	90	0.54	7.24	56.30 (48.62)
RV-7	16.93	5.06	6.13	13.00	5.98	90	0.52	6.90	44.88 (42.05)
RV-8	12.97	4.03	7.35	14.05	8.44	147	1.24	16.53	57.28 (49.22)
RV-9	12.13	3.80	7.72	15.50	8.58	113	0.99	13.15	48.70 (44.25)
RV-10	29.47	7.10	7.09	12.58	6.02	150	0.92	12.20	47.47 (43.54)
RV-11	29.17	7.29	6.75	12.98	6.12	133	0.82	10.97	41.48 (39.27)
SV-12	25.78	4.96	9.92	13.13	12.67	130	1.64	21.91	43.70 (41.30)
RG-27	16.33	4.90	6.65	13.45	13.15	113	1.50	20.05	44.81 (41.99)
RG-2	32.28	5.74	9.52	12.05	4.09	183	0.75	9.99	38.33 (38.23)
Mean	19.52	5.13	7.01	13.38	7.79	125	0.96	12.81	43.59
Significance	**	**	**	*	**	**	**	**	NS
C.D./SEm±	1.81	0.46	0.87	1.74	1.41	0.03	0.25	3.31	2.94
CV	5.53	5.32	7.42	7.75	10.80	11.71	15.32	15.38	11.68

Note: CV- Co-efficient of variation; CD- Critical difference at P = 0.05/ P = 0.01; SEm-Standard error of mean; * Significant at 5 % level of probability;** Significant at 1% level of probability; NS-Non-significant

Table 3: Mean, Range, GCV, PCV, Heritability and GA as % mean of ridge gourd advanced inbred lines

Sl. No	Characters	Mean	Range	GCV	PCV	Heritability (h^2) %	GA as % of mean
1	Node number for the 1st male flower appearance	3.32	2.67 - 3.78	2.64	15.58	2.87	0.92
2	Node number for the 1st female flower appearance	8.02	6.33 - 10.87	15.65	20.23	59.84	24.94
3	Days taken for 1st male flower appearance	42.37	38.30 - 53.06	7.55	13.64	30.63	8.60
4	Days taken for 1st female flower appearance	49.07	41.28 - 56.17	7.89	10.73	54.07	11.95
5	Vine length (cm)	287.11	206.97 - 363.28	12.52	17.85	49.23	18.10
6	Number of primary branches	7.78	6.00 - 9.70	6.75	18.86	12.82	4.98
7	Leaf length (cm)	10.58	9.62 - 12.15	4.81	8.61	31.22	5.54
8	Leaf width (cm)	13.23	11.25 - 15.10	5.15	10.22	25.40	5.35
9	Petiole length (cm)	5.87	5.12 - 6.58	2.09	11.77	3.16	0.77
10	Fruit length (cm)	19.52	12.13 - 32.28	33.81	34.26	97.40	68.74
11	Ovary length (cm)	5.13	3.80 - 7.29	19.01	19.74	92.74	37.71
12	Peduncle length (cm)	7.01	5.85 - 9.92	17.63	19.13	84.97	33.48
13	Fruit girth (cm)	13.38	12.05 - 15.50	5.98	9.79	37.36	7.53
14	Number of fruits per vine	7.79	4.09 - 13.15	35.09	36.72	91.35	69.09
15	Fruit weight (g)	0.13	90-183	19.00	22.32	72.49	33.33
16	Yield per vine (kg)	0.96	0.52 - 1.64	35.41	38.59	84.23	66.95
17	Fruit yield (t/ha)	12.81	6.90 - 21.91	35.45	38.65	84.17	67.01
18	Downey mildew PDI	43.59	38.33 - 57.28 (38.23-49.22)	1.75	11.81	2.19	0.53

Note: GCV- Genotypic co-efficient of variation; PCV- Phenotypic co-efficient of variation; GA-Genetic advance; Angular vales are given in parenthesis

Fig. Variability in fruit length, girth and peduncle length of 14 advanced inbred lines of ridge gourd

CONCLUSION

The genetic variability studies revealed that the material used in present investigation possessed variability which provides scope for selection by breeder. Wider genetic variability was observed for node number for the first female flower appearance, days taken for the first male flower appearance, days taken for the first female flower appearance, vine length, leaf length, fruit length, ovary length, peduncle length, fruit girth, number of fruits per vine, fruit weight, fruit yield/vine and fruit yield/ha. This indicated ample scope for genetic improvement of these traits through hybridization and subsequent directional selection. High PCV, GCV, heritability, genetic advance were observed for fruit length, number of fruits per vine, yield per vine and

fruit yield (t/ha) indicating that these characters were least influenced by the environmental effect and were effectively transmitted to progeny.

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