International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(4): 1329-1333

Received: 10-05-2018
Accepted: 12-06-2018

Ramesh ND
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Praveen Choyal
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Radhelal Dewangan
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Pushpa S Gudadinni
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Priyanka P Ligade
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Correspondence
Ramesh ND
Department of Horticulture, SHUATS, Allahabad, Uttar Pradesh, India

Study on genetic variability, heritability and genetic advance in ridge gourd (*Luffa acutangula* (L.) Roxb.)

Ramesh ND, Praveen Choyal, Radhelal Dewangan, Pushpa S Gudadinni and Priyanka P Ligade

Abstract
An experiment was conducted to evaluate the genetic variability present in the fourteen genotype, in which one variety is the standard check (Arka Sumeet). Observation were recorded on various yield and yield contributing traits viz., days to 1st Male Flowering, days 1st female flowering, days to 50% Flowering, node to first male flower, node to first female flower Sex Ratio, vine length cm at 90 days, days to 1st harvest, days to last harvest, fruit length, flesh thickness, rind thickness, fruit set %, fruit diameter, fruits/ Plant, average fruit weight, fruit yield/plant, fruit yield per ha. Analysis of variance showed the significant variability for all the studied characters. High values of GCV and PCV were observed for characters viz., fruit yield per plant (45.09 and 45.92), fruit yield per ha (45.10 and 45.91), fruit diameter (29.74 and 30.00), number of fruits per plant (27.42 and 28.31), average fruit weight (26.10 and 26.62), sex ratio (24.84 and 25.15), rind thickness (22.11 and 22.65), fruit length (20.01 and 20.40) and which indicates the presence of high genetic variation. Were high heritability coupled with high genetic advance observed for the traits viz, fruit yield per hectare, Fruit yield per Plant, Fruit diameter, No. Fruits per Plant, average weight, node to first female flower, sex ratio, rind thickness, fruit length, vine length cm at 90 day, flesh thickness, node to first male flower, days to taken first female flower and fruit set percent which indicates presence of additive gene action and demands for population improvement by selection.

Keywords: Genetic variability, heritability, GCV, PCV and ridge gourd

Introduction
Ridge gourd (*Luffa acutangula* L.) (2n = 26) belongs to the family Cucurbitaceae is one of the most important cucurbitaceous vegetable crops and grown extensively throughout the tropical and subtropical regions of the world. The name "Luff" or "Loofah" is an Arabic origin and refers to the spongy characteristic of the mature fruit (Bose and Som) [5]. Its origin is not definitely known, although wild forms are available in India, the Sunda Island and Java (Yawalkar) [30]. Now, it is cultivated in Bangladesh, China and different region of India such as Asam, West Bengal, Uttar Pradesh and in some other countries (Bose and Som) [5]. Tender fruits are green in colour, which are used in soups and curries or as a cooked vegetable. Fruit contain edible protein (82%), moisture 92.5g, protein 0.5g, fat 0.5g, carbohydrate 3.4g, energy 17 k cal, calcium 18mg, vitamin C 5mg, riboflavin 0.01mg, phosphorous 26mg, iron 0.5mg and carotene 33µg (Sheshadri and Parthasarthy) [27] per 100 g of edible portion.

To improve the yield and other characters, information on genetic variability and inter-relationship among different traits is necessary. Genetic variability is a perquisite for the meaningful selection the heritability in conjunction with expected genetic advance determines its success. 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 these 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 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) [18]. Hence, the present investigation is carried out for various economic traits and to measure the extent of variability, heritability, genetic advance and their genetic makeup in ridge gourd.

Materials and Methods

The present investigation was undertaken during *kharif* 2016 at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad. The experimental material comprised of fourteen varieties, including one standard check viz, Arka sumeet which were collected from different source (Table 1). The varieties were grown in a randomized block design with three replicates, keep row to row distance of 1.2 m. and plant to plant distance of 0.90 m. Observation were recorded on five randomly selected plants per treatment for eighteen quantitative characters viz., days to taken 1st Male Flowering, days to taken 1st female flowering, days to 50% Flowering, node to first male flower, node to first female flower Sex Ratio, vine length cm at 90 days, days to 1st harvest, days to last harvest, fruit length, flesh thickness, rind thickness, fruit set % , fruit diameter, fruits/ Plant, average fruit weight, fruit yield/ plant, fruit yield.

The analysis of variance was done as suggested by Panse and Sukhatme [21]. The phenotypic and phenotypic coefficient of variation were work out according to the formula given by Singh *et al.* [28] and Robinson *et al.* [24]. Heritability in broad sense and expected genetic advance on the basis of percent of mean were work out according to the method advocated by Burton and Devane [6] and Johnson *et al.* [15], respectively.

Results and Discussion

The mean sum of squares in ANOVA revealed high variability among 14 varieties for all characters at 5 and 1 per cent probability levels (Table 2). The highly significant differences might be endorsed to their genetic makeup of germplasm lines and various regions from where they have been collected. Mean performance of various varieties has also showed good range of variability for various characters, which were studied in present investigation (Table 2). The range recorded for days to taken first male flower (33-44), days to taken first female flower (36-52), days to 50 per cent flowering (38-56), node first male flower (2.90-5.53), node to first female flower (8.00-22.00), sex ratio (5.54-22.53), vine length cm at 90 days (151.67-461), days to first harvest (45.00-58.33), days to last harvest (77.00-95.00), fruit length cm (14.73-34.67), flesh thickness cm (2.29-4.18), rind thickness (mm) (2.45-5.33), fruit set per cent (46.17-67.00), fruit diameter mm (32.60-74.53), no. of fruits per plant (8.67-20.67), average fruit weight (g) (81.67-277.67 g), fruit yield per plant (0.708-4.91 kg), fruit yield q/ha (68-472.20).

The characters under investigation were analyzed for genotypic variance (g), phenotypic variance (p), genotypic coefficient of variance (GCV), phenotypic coefficient of variation (PCV), heritability (broad sense) and genetic advance as percent mean (Table-3). In the present investigation, genotypic variances have low values than phenotypic variances as former is the component of the latter and phenotypic variance expresses by the combined effects of genotypic variances, environmental variances and gxe interactions.

Different traits have different means in different environments so phenotypic variance and genotypic variance are not able to reveal the degree of variability therefore their coefficients were calculated as suggested by Burton and Devane [5] classified (low < 10; Moderate 10-20%; High > 20%) as suggested by Sivasubramanian and Madhavamenon [27]. PCV was higher than GCV for all the studied characters which indicates the effect of environmental variation but it is also observed the low range between PCV and GCV so it reveals that these traits have low sensitivity to environmental effects and it is reducible. High values of GCV and PCV were observed for characters viz., fruit yield q/ha, fruit yield per plant, fruit diameter , number of fruits per plant, average fruit weight , node to first female flower, sex ratio, rind thickness, fruit length which indicates the wide spectrum of genotypic variation for these traits. Moderate GCV and PCV were observed for traits viz., vine length at 90 days after sowing, flesh thickness, node to first male flower, fruit set percent, days to taken first female flowering and low GCV and PCV revealed the characters viz., taken first male flower, days to 50% flowering, days to first harvest, days to last harvest. These results are in agreement with various scientist which are mentioned in table- 4. Similar finding were also reported by Gowda [13], Kadam and kale [16], Sahni *et al.* [25], Prasad and Singh [22], Rao *et al.* [31], chaudary and Sharma [8], Ananthan *et al.* [2].

GCV measures the amount of variation present in a particular character but it does not-provide an idea about the proportion of heritable variation present in total variation therefore, heritability estimates were calculated in the present study. In the present study heritability estimates were high for all the studied character as categorized (Low <30%; Moderate 30-60%; high>60%) by Johnson *et al.* [15]. The estimates of heritability (%) in broad sense for 18 characters studied, which range from 82% to 98% hence, high heritability (broad sense) was recorded for all the characters.

The estimates of genetic advance for 18 characters studied, which range from 1.23% to 232.65% (Table 3). High genetic advance was recorded for fruit yield per hector (232.65%), vine length (153.61%), average fruit weight (102.40%), and fruit diameter (32.22%).The moderate genetic advances were recorded for the characters such fruit set per cent (13.14), and fruit length (10.53%). The low estimates of genetic advance were observed sex ratio (8.74%) days to taken first female flower (8.64%), node to first female flower, no. of fruit per plant (7.24%), days to last harvest (6.99), days to taken first male flower (6.77%), days to 50% flowering (6.47),days to first harvest (5.57%), fruit yield per plant (2.42%), rind thickness (1.61%), node first male flower (1.47%), flesh thickness (1.23%).

The high heritability estimates were observed for all the chacters under study. On the other hand the high heritability coupled with high genetic advance observed for the traits viz, fruit yield per hectare, Fruit yield per Plant, Fruit diameter, No. Fruits per plant, average weight, node to first female flower, sex ratio, rind thickness, fruit length, vine length cm at 90 day, flesh thickness, node to first male flower, days to taken first female flower and fruit set percent. Which indicates presence of additive gene action and offers the best possibility for improvement of these traits by various selection methods. Similar finding were also reported by Koppad *et al.* [17], Choudary B.R and Kumar suresh [9], Gowda

[13], Kadam and kale [16], Sahni *et al.* [25], Prasad and singh [22], Rao *et al.* [23], chaudary and Sarma [8], Ananthan *et al.* [2]

High heritability coupled with moderate genetics advance was observed for characters viz, days to taken first male flower, days to 50 percent and day to first harvest indicates the presence of both additive and non-additive gene action for these traits.

High heritability coupled with low genetic advance found for only one character days to days to last harvest. Which clearly states the presence of non-additive gene action and selection is not rewarding for this trait. Recombination breeding and recurrent selection may be used for such type of traits for population improvement.

Table 1: List of varieties and the source

S. No	Varieties	Source of Varieties
1	Malapur local	Nadakatti Seeds Pvt Ltd
2	Anjali	Keyonic Seeds Pvt Ltd
3	Rekha	Ankur Seeds Pvt Ltd
4	Solani-s	Sardar Seeds Pvt Ltd
5	NRG-9	Nirmal Seeds Pvt Ltd
6	Jaipur Long	Ashok Seeds Pvt Ltd
7	PusaNasdar	IARI Newdelhi
8	Deepti	KAU Thrissur
9	Arka Sujat	IIHR, Bangalore
10	Dharidan local	Allahabad
11	CO-2	TNAU Coimbatore
12	Barsat Local	West Bengal
13	Neelaganj Local	West Begal
14	Arka Sumeet (check variety)	IIHR, Bangalore

Table 2: Analysis of variance for various characters in Ridge gourd

		Mean Sum of square		
S. No	Character	Replication	Varieties	Error
1	Days to Taken 1st Male Flowering	0.3810	34.62**	0.5861
2	Days to Taken 1st Female Floweri	0.6429	55.35**	0.6685
3	Days to 50% Flowering	1.5000	32.12**	0.6538
4	Node to First Male Flower	0.0610	1.72**	0.0502
5	Node to First Female Flower	0.8045	52.2**	0.8322
6	Sex Ratio	0.3717	53.83**	0.4618
7	Vine Length cm At 90 Days	31.1429	17275.92**	151.5531
8	Days to 1st harvest	0.3810	25.97**	1.0989
9	Days to Last harvest	0.3095	44.89**	2.9762
10	Fruit Length cm	2.2484	82.52**	1.0636
11	Flesh Thickness cm	0.0067	1.17**	0.0287
12	Rind Thickness mm	0.0240	1.94**	0.0315
13	Fruit Set %	5.2033	142.89**	5.6682
14	Fruit Diameter	2.9257	751.15**	4.3294
15	Fruits/ Plant	0.212	40.38**	0.8706
16	Average Fruit Weight (g)	97.0714	7814.03**	103.4000
17	Fruit Yield/ Plant (Kg)	90.60	435.42**	535.41
18	Fruit Yield Q/ha	1651.7087	40128.6**	478.8900

** Significant at 1% level of probability

Table 3: Mean, Range, Coefficient of variations (GCV and PCV), Heritability, Genetic Advance and Genetic Advance as Per cent of mean for 18 Characters of ridge gourd

S. No	Characters	General Mean	Range		Variance		Coefficient of variance		h^2 (b.s.) (%)	Genetic Advance (5%)	Genetic Advance as % of mean (5%)
			Min	Max	GV	PV	Gcv (%)	Pcv (%)			
1	Days to Taken 1st Male Flowering	38.40	33.00	44.00	11.35	11.93	8.77	8.99	95.00	6.77	17.62
2	Days to Taken 1st Female Flowering	42.43	36.00	52.00	18.23	18.90	10.06	10.25	96.00	8.64	20.36
3	Days to 50% Flowering	46.36	38.00	56.00	10.49	11.14	7.65	7.88	94.00	6.47	15.28
4	Node to First Male Flower	4.18	2.90	5.53	0.56	0.61	17.84	18.63	92.00	1.47	35.20
5	Node to First Female Flower	16.43	8.00	22.00	17.13	17.96	25.18	25.79	95.00	8.33	50.66
6	Sex Ratio	17.30	5.54	22.53	18.46	18.92	24.84	25.15	98.00	8.74	50.54
7	Vine Length cm At 90 Days	397.64	151.67	461.00	5708.12	5859.68	19.00	19.25	97.00	153.61	38.63
8	Days to 1st harvest	50.69	45.00	58.33	8.29	9.39	5.68	6.05	88.00	5.57	11.00
9	Days to Last harvest	88.76	77.00	95.00	13.97	16.95	4.21	4.64	82.00	6.99	7.88
10	Fruit Length cm	26.04	14.73	34.67	27.15	28.22	20.01	20.40	96.00	10.53	40.44
11	Flesh Thickness cm	3.29	2.29	4.18	0.38	0.41	18.76	19.46	93.00	1.23	37.27
12	Rind Thickness mm	3.61	2.45	5.33	0.64	0.67	22.11	22.65	95.00	1.61	44.45
13	Fruit Set %	55.76	46.17	67.00	45.74	51.41	12.13	12.86	89.00	13.14	23.57
14	Fruit Diameter	53.05	32.60	74.53	248.94	253.27	29.74	30.00	98.00	32.22	60.75

15	Fruits/ Plant	13.24	8.67	20.67	13.17	14.04	27.42	28.31	94.00	7.24	54.70
16	Average Fruit Weight (g)	194.21	81.67	277.67	2570.21	267.36	26.10	26.62	96.0	102.40	52.72
17	Fruit Yield/ Plant (Kg)	2.65	0.708	4.91	143.35	148.70	45.09	45.92	96.00	2.422	91.20
18	Fruit Yield q/ha	254.93	68.03	472.20	13216.57	13695.49	45.10	45.91	97.00	232.65	91.26

Table 4: Summary of genotypic and phenotypic coefficient of variation with heritability and genetic advance as per cent of mean for yield and its components in ridge gourd

S. No.	Components	Status in present study	Characters	Supported by
	Genotypic Coefficient of Variation (GCV)	High	Fruit yield per ha, fruit yield per plant, fruit diameter, no. of fruits per plant, average fruit weight, node to first female flower, sex ratio, rind thickness, fruit length.	Gowda [13], Kadam and Kale [16], Sahni *et al*. [25], Prasad and Singh [22], Rao *et* al. [23], Chaudary and Sarma [8], Ananthan *et al.* [2]
		Medium	Vine length 90 days, Flesh thickness, node to first male flower, fruit set percent, days to taken first female flower	Koppad *et al.* [18], Choudary B.R and Kumar suresh [9]
		Low	Days to taken first male flowering, days to 50% flowering, days to first harvest, days to last harvest.	Koppad *et al.* [18]
	Phenotypic Coefficient of Variation (PCV)	High	Fruit yield per plant, fruit yield per ha, fruit diameter, no. of fruits per plant, average fruit weigth, node to first female flower, sex ratio, rind thickness, fruit length .	Choudary B.R and Kumar Suresh [9], Gowda [13], Kadam and Kale [16], Sahni *et al*. [25], Prasad and Singh [22], Rao *et al.* [23], Chaudary and Sarma [8]
		Medium	Vine length 90 days, Flesh thickness, node to first male flower, fruit set percent, days to taken first female flower	Koppad *et al.* [18]
		Low	Days to taken first male flowering, days to 50% flowering, days to first harvest, days to last harvest.	Koppad *et al.* [18], Choudary B.R and Kumar Suresh [9]
	Heritability (h^2in broad sense)	High	Days to taken 1st Male Flowering, days to taken 1st female flowering, days to 50% Flowering, node to first male flower, node to first female flower Sex Ratio, vine length cm at 90 days, days to 1st harvest, days to last harvest, fruit length, flesh thickness, rind thickness, fruit set %, fruit diameter, fruits/ Plant, average fruit weight, fruit yield/ plant, fruit yield.	Koppad *et al.* [18], Choudary B.R and Kumar Suresh [9], Gowda [13], Kadam and Kale [16], Sahni *et al*. [25], Prasad and Singh [22], Rao *et al.* [23], Chaudary and Sarma [8], Ananthan *et al.* [2]
		Medium	-	
		Low	-	
	Genetic advance	High	Fruit yield per ha, fruit yield per plant, fruit diameter, no.of fruits per plant, average fruit weight, node to first female flower, sex ratio, rind thickness, fruit length, vine length at 90 days, flesh thickness, node to first male flower, fruit set percent, days to taken first female flower.	Koppad *et al.* [18], Choudary B.R and Kumar Suresh [9], Gowda [13], Kadam and Kale [16], Sahni *et al*. [25], Prasad and Singh [22], Rao *et al.* [23], Chaudary and Sarma [8], Ananthan *et al.* [2]
		Medium	Days to taken first male flower, day to 50% flowering, days to first harvest	Koppad *et al.* [18]
		Low	Days to last harvest	Koppad *et al.* [18]

References

1. Akter Jasmin. Character association and genetic diversity analysis of sponge gourd (*Luffa cylindrica* L.). Asian J Bio. Sci. 2015; 6(1):119-120.
2. Ananthan M, Moorthy BG, Natarajan S. Genetic variability in ridge gourd (*Luffa acutangula* (L.) Roxb.). South Indian Hort. 2005; 53(1-6):326-328.
3. Bhardwaj DR, Singh A, Singh U. Genetic variability of bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] by multivariate analysis. Published in Proc of National Symposium on Abiotic and Biotic Stress management in Vegetable Crops. Ind. Soc. Veg. Sci., 2013, 370.
4. Bijalwan RK, Mishra JK. Selection parameters for fruit yield and related traits in ridge gourd *Luffa acutangula* (Roxb.) L. Bangladesh J bot. 2016; 45(1):75-84.
5. Bose TK, Som MC. Vegetables crops in India, 1st reprint. Good Association printers, Culcutta, 1990, 148-150.
6. Burton GW, Devane EH. Estimating heritability in tall fescue (*Festuca arundiancea*) from replicated clonal material. Agron. J, 1953; 45:478-81.
7. Choudhary BR, Pandey Sudhakar, Singh PK, Pandey V. Genetic Diversity Analysis in Hermaphrodite Ridge gourd. Indian J Hort. 2014; 71(2):284-287.
8. Chowdhury D, Sarma KC. Studies on variability, heritability, genetic advance and correlations in ridge gourd (*Luffa acutangula* Roxb.). Hort. J, 2002; 15(3):53-58.
9. Choudary BR, Kumar S. Studied on Genetic analysis in ridge gourd *Luffa acutangula* (Roxb.) under hot arid condition Indian J Arid Hort, 2011, 6(1-2):55-58.
10. Cochran WG, Cox GM. Experimental Design 1st *Ed.* Asia Publishing House, Bombay, 1959, 95-145.
11. Cockerham CC. Estimation of genetic variance, In Statistical Genetics and Plant Breeding, Hansan WD. and Robinson HF, Eds., National Academy of Science-National Research Council, Washington DC, 1963, 53.
12. Falconer DS. Introduction to quantitative Genetics 2nd Edition. Oliver and Boyd, Edinburg, London, 1981, 164-176.
13. Gowda. Studied the Variability Genetic variability in ridge gourd (*Luffa acutangula*) were undertaken by during the year 2010-2011 at Department of Vegetable Science, Karnataka, India, 2011.
14. Hegade VC, Pradeepkumar T, George TE. Variability and genetic diversity studies in ridge gourd (*Luffa acutangula* (Roxb) L.) Proceedings of the 21st Kerala Science Congress, Kerala State Council for Science Technology and Environment, Kollam. 2009, 28-31, 37-39.

15. Johnson HW, Robinson HF, Comstock RE. Estimates of genetic and environmental variability in soybean. Agron. J, 1955; 47(7):314-318.
16. Kadam PY, Kale PN. Genetic variability in ridge gourd. J Maharashtra Agric. Univ. 1987; 12:242-243.
17. Khatoon U, Dubey RK, Singh V, Upadyan V, Pandey AK. Selectio parameters fruit yield and related traits in *Luffa acutangula* (Roxb.) L. Bangladesh J Bot. 2016; 45(1):75-84.
18. Koppad Shivanand B, Mukesh Chavan L, Jagadeesha RC, Vijaykumar Rathod, Jayappa J, Sumangala Koulagi. Genetic variation and correlations among the physiological growth attributing characters in ridge gourd (*Luffa acutangula* Roxb.) with reference to yield. International J of Adv Res. 2015; 3(4):961.
19. Lush JL. Heritability of quantitative characters in farm animals. Proc. of 85th Congress Genetics Heredities, Supplement. 1949, 356-375.
20. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers (2nd Edn.), Indian Council of Agricultural Research, New Delhi, 1985, 381.
21. Prasad VSR, Singh DP. Studies on heritability, genetic advance and correlations in ridge gourd (*Luffa acutangula* Roxb.). Indian J Hort. 1989; 46(2):390-394.
22. Rao BN, Rao PV, Reddy TB. Genetic studies in ridge gourd (*Luffa acutangula* (L.) Roxb). South Indian Hort. 2000; 50(1-3):233-237.
23. Robinson HF, Comstock RE, Harvey VH. Estimates of heritability and degree of dominance in corm. Agron. J, 1949; 41:353-359.
24. Sahni GP, Singh RK, Saha BC. Genotypic and phenotypic variability in ridge gourd. Indian J Agric Sci. 1987; 57(9):666-668.
25. Sheshadri VS, Parthasarthy UA. Cucurbits in vegetable crops In: Bose TK, Kabir J, Maity TK, Parthasarthy VA. And Som MG. (eds.) veg. crops, 1980, 496-497.
26. Sivasubramanian J, Madhavamenon P. Genotypic and phenotypic variability in rice. Madras Agric. J, 1973; 12:15-16.
27. Singh RP, Mohan J, Singh D. Studies on genetic variability and heritability in ridge gourd (*Luffa acutangula*). Agric. Sci. Digest. 2002; 22(4):279-280.
28. Varalakshmi B, Rao PV, Reddy YN. Genetic variability and heritability in ridge gourd (*Luffa acutangula*). Indian J Agric. Sci. 1995; 65(8):608-610.
29. Yawalkar KS. Vegetable Crops of India. (3rd Edition). Agric. Horticultural Publishing House. Nagpur. 440010, 1985, 166-170.