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Efficiency of selection based on genetic variability in Ridge gourd [*Luffa acutangula* L. (Roxb.)]

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Abstract

The present experiment was conducted at Main Experiment Station of Department of Vegetable Science at Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during 2015-16. The Analysis of variance, mean performance of genotypes, coefficient of variability, heritability and genetic advance in percent of mean were studied in 29 diverse genotypes of ridge gourd. Considerable variation was recorded for all the characters. The GCV and PCV estimate were high for node no. to anthesis of first staminate flower per plant followed by node no. to anthesis of first pistillate flower, days to anthesis of first staminate flower, days to anthesis of first pistillate flower, average fruit length (cm), days to anthesis of first pistillate flower, days to first fruit harvest, vine length(m), no. of nodes per vine, no. of primary branches per plant, average fruit diameter (cm), no. of fruit per plant, average fruit weight (g) and marketable fruit yields per plant (kg).

Keywords: Analysis of variance, genotypes, heritability, genetic advance and ridge gourd

Introduction

Ridge gourd (*Luffa acutangula* L.) is one of the most popular cucurbitaceous vegetable both as spring summer and rainy season crop. The crop originated in India and cultivated in India, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka and Taiwan. Wide genetic variation for various morphological and fruit characteristics is observed in different parts of India. Among the cucurbitaceous vegetable grown in India, gourd vegetable occupy an area of 73273 ha with an annual production of 685224 tonnes. In India, it is largely grown in Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Uttar Pradesh, Madhya Pradesh and Maharashtra states. In Karnataka, it occupies an area of 2,753 ha with an annual production of 18,706 tonnes of fleshy marketable fruits (Anonymous, 2004). Ridge gourd belongs to genus *Luffa* of family Cucurbitaceae. The genus derives from the product loofah, which is used in bathing sponges, scrubber pads, door mats, pillows, matteressa and also for cleaning utensils. It contains a gelatinous compound called luffein and has medicinal use, commercial use of its by product in manufacturing household utensils, consumption of fleshy fruit as vegetable in daily food and its contribution to the welfare of people, there is a need to enhance the productivity level of this crop. It has great medicinal value. A glycoprotein was isolated from seeds of *L. acutangula* L., which was found to be immunologically distinct from abortifacient proteins isolated from other members of the Cucurbitaceae family (Yeung *et al.*, 1991) [8]. The luffaculin, a protein isolated from its seed, exhibited abortifacient, antitumor, ribosome inactivating and immunomodulatory activities (Ng *et al.*, 1992) [6]. Another ribosome inactivating peptide isolated from seeds of ridge gourd designated luffangulin inhibited cell-free translation (Wang and Ng, 2002). *L. acutangula* Linn contains trypsin inhibitors (Haldar *et al.*, 1996) [3].

Materials and Methods

The present experiment was conducted at Main Experiment Station of Department of Vegetable Science at Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during 2015-16. The experiment was conducted in a Randomized Block Design with Twenty nine treatments with three replications. The experiment comprises of different germplasms incorporated i.e. NDRG-1, NDRG-2, NDRG-3, NDRG-4, NDRG-5, NDRG-6, NDRG-7, NDRG-8, NDRG-9, NDRG-10, NDRG-11, NDRG-12, NDRG-13, NDRG-14, NDRG-15, NDRG-16, NDRG-17, NDRG-18, NDRG-19, NDRG-20, NDRG-21, NDRG-22, NDRG-23, NDRG-24, NDRG-25, NDRG-26, NDRG-27, NDRG-28 and Pusa Nasdar (National check).

The experiment comprises of different germplasm incorporated of selection based on genetic variability, path coefficient and genetic divergence in ridge gourd. The plant to plant and row to row spacing were maintained at 0.5m to 2.5 m during the trial period. The observations were recorded on 13 characters viz. Node no. to anthesis of first staminate flower per plant followed by Node no. to anthesis of first pistillate flower, days to anthesis of first staminate flower, days to anthesis of first pistillate flower, average fruit length (cm), days to anthesis of first pistillate flower, days to first fruit harvest, vine length(m), no. of nodes per vine, no. of primary branches per plant, average fruit diameter (cm), no.

of fruit per plant, average fruit weight (g) and marketable fruit yields per plant (kg). Performance, genetic variability, heritability, genetic advance, correlation and path analysis for yield and yield contributing characters namely total yield per vine (kg), number of fruits per vine, average weight of fruit (g), average length of fruit (cm), average diameter of fruit (cm), days to anthesis of first male flower, days to anthesis of first female flower, node number at which first female flower appeared, days to maturity, number of primary branches, vine length (cm), specific gravity (g/cc), number of seeds per fruit and total soluble solids (degrees Brix) of 20 genotypes of sponge gourd were studied.

Table 1: Analysis of variance (mean squares) for 13 characters in ridge gourd

S. No	Characters <i>d.f.</i>	Source of variation		
		Replication 2	Treatments / genotypes 28	Error 56
1.	Node no. to anthesis of 1 st staminate flower	0.315	51.34**	0.86
2.	Node no. to anthesis of 1 st pistillate flower	1.08	41.82**	1.32
3.	Days to anthesis of 1 st staminate flower	18.00	104.44**	12.27
4.	Days to anthesis of 1 st pistillate flower	3.20	76.61**	12.87
5.	Days to first fruit harvest	4.66	68.83**	18.91
6.	Vine length (m)	0.01	0.47**	0.10
7.	Number of nodes per vine	4.49	172.99**	23.36
8.	Number of primary branches per plant	0.008	0.33**	0.10
9.	Average fruit length (cm)	39.03	85.60**	13.13
10.	Average fruit diameter (cm)	0.09	0.78**	0.23
11.	Number of fruit per plant	1.79	10.34**	3.34
12.	Average fruit weight (g)	18.16	111.91**	24.58
13.	Marketable fruit yield per plant (kg)	0.09	0.83**	0.04

Table 2: Mean performance of 29 genotypes for 13 characters in ridge gourd.

S. No.	Character Genotypes	Node No. to Anthesis 1 st staminate flower	Node No. to Anthesis 1 st pistillate flower	Days to Anthesis 1 st staminate flower	Days to Anthesis 1 st pistillate flower	Days to 1 st fruit harvest	Vine Length (m)	No. of Nodes per vine	No. of Primary branches per plant	Average fruit length (cm)	Average fruit diameter (c)	No. m of fruit per Plant	Average fruit weight (g)	Marketable fruit yield per Plant (kg)
1	NDRG-1	5.76*	10.33	31.43*	38.96	52.93	3.01	46.90	3.83	29.80	2.36	19.06*	103.33	2.48*
2	NDRG-2	8.13	11.06	40.00	44.30	54.36	3.20	48.20	3.80	38.60	2.50	15.40	100.33	2.25
3	NDRG-3	18.30	15.20	34.86	41.53	53.10	2.89	61.60	3.93	34.16	3.16	16.06	118.33	1.85*
4	NDRG-4	4.00*	6.00*	30.43*	35.33*	48.83	3.43	50.50	3.60	25.26	2.86	15.30	117.00	2.04
5	NDRG-5	9.20	11.23	35.16	41.46	52.73	3.03	60.50	4.00	35.83	3.43	17.73	111.66	3.27
6	NDRG-6	5.56*	8.00*	31.76*	40.80	53.63	2.61	35.33	4.13	35.13	2.90	12.33	117.33	2.36
7	NDRG-7	7.86	12.06	43.33	44.50	56.00	2.70	53.56	4.50	34.03	3.56	13.00	107.33	2.27
8	NDRG-8	11.16	10.00	38.06	45.16	57.06	3.51	59.80	4.43	35.96	2.33	12.76	115.00	2.24
9	NDRG-9	9.03	9.00*	35.50	40.60	50.63	3.33	56.66	3.80	29.43	2.53	14.83	118.66	3.31
10	NDRG-10	8.36	11.00	35.33	41.10	52.80	2.63	44.73	4.56	34.20	3.06	16.16	115.00	2.20
11	NDRG-11	19.06	18.33	46.26	30.40*	60.13	3.38	46.73	4.06	37.83	2.73	15.10	119.00	1.42
12	NDRG-12	15.26	14.26	46.30	45.20	58.30	3.13	56.70	4.10	30.56	3.30	15.40	118.66	2.31
13	NDRG-13	3.70*	3.00*	25.66*	47.73	43.00*	2.43	58.33	3.76	29.96	3.03	13.43	106.66	1.21
14	NDRG-14	9.46	13.73	39.00	46.43	60.33	2.63	58.33	4.20	26.40	2.43	16.33	119.66	2.27
15	NDRG-15	8.73	13.73	35.70	43.53	57.10	3.71*	62.40*	3.73	38.50	2.80	12.56	105.00	2.19
16	NDRG-16	6.00*	10.00	35.80	41.46	52.70	3.19	58.30	4.30	34.23	2.76	12.46	110.00	1.44
17	NDRG-17	4.23*	7.66*	34.40	35.70*	47.56	3.23	48.33	4.33	29.96	2.43	15.30	116.00	1.29
18	NDRG-18	5.73*	10.00	40.63	44.30	53.90	3.15	60.33	4.53	37.13	3.26	16.36	121.00	2.32
19	NDRG-19	6.33*	11.76	42.03	48.50	60.76	2.69	47.76	3.63	29.90	3.83*	15.43	110.00	2.28
20	NDRG-20	17.23	14.03	42.40	46.60	59.96	3.56	40.63	4.46	33.50	2.83	17.10	121.00	2.29
21	NDRG-21	9.83	13.36	38.56	40.86	52.16	3.36	57.00	3.60	26.30	2.56	12.23	120.33	2.51*
22	NDRG-22	7.40*	15.00	49.10	51.60	59.66	3.51	54.33	4.46	30.46	3.13	16.46	110.00	1.22
23	NDRG-23	7.26*	7.06*	32.06*	40.80	48.03	3.29	55.53	4.33	40.73*	2.60	18.26*	124.00*	2.13
24	NDRG-24	13.16	17.33	49.46	53.46	56.26	2.43	58.16	4.30	40.83*	3.66	13.26	117.33	2.24
25	NDRG-25	6.00*	10.33	43.26	41.23	52.16	3.42	61.33	3.83	34.83	3.86*	15.76	112.66	1.47*
26	NDRG-26	11.53	11.66	38.23	45.70	54.00	3.68*	67.26*	4.20	35.63	2.76	14.20	119.33	2.33
27	NDRG-27	12.30	21.00	48.06	33.86*	59.00	2.51	45.53	4.23	34.50	2.86	14.23	122.00	2.27
28	NDRG-28	7.33*	12.00	37.06	38.80	50.70	3.58	62.60*	4.16	41.03*	2.66	14.36	120.00	1.37
29	Pusa Nasdar	8.43	10.56	40.80	46.66	56.83	3.55	62.30	4.93*	50.63*	4.20*	17.23	112.00	2.27
	Mean	9.18	11.68	38.64	42.64	54.61	3.13	54.47	4.13	34.32	3.01	15.11	114.78	2.11
	C.V.	10.12	9.83	9.06	8.41	7.96	10.11	8.87	7.81	10.55	16.11	12.10	4.31	10.23
	S.E.	0.53	0.66	2.02	2.07	5.51	0.18	2.79	0.18	2.09	0.28	1.05	2.86	0.12
	C.D. 5%	1.52	1.87	5.73	5.86	7.11	0.51	7.90	0.52	5.92	0.79	2.99	8.10	0.35
	Lowest	3.70	3.00	25.66	30.40	43.00	2.43	35.33	3.60	25.26	2.33	12.23	100.33	1.21
	Highest	19.06	21.00	49.46	53.46	56.26	3.71	67.26	4.93	50.63	4.20	19.06	124.00	3.31

Table 3: Estimates of range, grand mean, phenotypic and genotypic coefficient of variation (PCV, GCV) heritability in broad sense, genetic advance (GA) in percent of mean for the 13 characters in ridge gourd

S. No.	Characters	Range		Grand mean	Variability		Heritability in broad sense (%)	Genetic Advance
		Min.	Max.		PCV (%)	GCV (%)		
1	Node no. to anthesis of first staminate flower	3.70	19.06	9.18	45.78	44.64	95.1	8.24
2	Node no. to anthesis of first pistillate flower	3.00	21.00	11.68	32.95	31.45	91.1	7.22
3	Days to anthesis of first staminate flower	25.66	49.46	38.64	16.96	14.34	71.4	9.65
4	Days to anthesis of first pistillate flower	30.40	53.46	42.64	13.69	10.81	62.3	7.49
5	Days to first fruit harvest	43.00	65.26	54.61	10.91	7.47	46.8	5.74
6	Vine length(m)	2.43	3.71	3.13	15.12	11.25	55.3	0.54
7	No. of nodes per vine	35.33	67.26	54.47	15.71	12.96	68.1	12.00
8	No. of primary branches per plant.	3.60	4.93	4.13	10.34	6.77	42.9	3.37
9	Average fruit length (cm)	25.26	50.63	34.32	17.79	14.31	64.8	8.14
10	Average fruit diameter(cm)	2.33	4.20	3.01	21.42	14.11	43.4	0.57
11	No. of fruit per plant.	12.23	19.06	15.11	15.76	10.10	41.1	2.01
12	Average fruit weight (g)	100.33	124.00	114.78	6.38	4.70	54.2	8.18
13	Marketable fruit yields per plant (kg)	1.21	3.31	2.11	26.29	24.21	84.8	0.97

Results and Discussion

Analysis of variance, mean performance of genotypes, coefficient of variability, heritability and genetic advance for thirteen characters of thirty diverse genotypes of ridge gourd is given (Table-1). The variance of different characters was partitioned into replication, treatment and error. The mean sum of square due treatment was highly significant for all the characters under study.

The analysis of variance revealed the significance differences among genotypes for all the traits studied (Table- 1). Bharathi *et al.* (2006) [1] studied genetic variability for 10 characters in 32 genotypes of spine gourd. Analysis of variance revealed significant differences among the genotypes studied. High heritability coupled with high genetic advance was recorded for fruit weight, fruit volume and number of fruits per plant indicating the preponderance of additive gene effects for these characters. Mean performance of genotypes in respect to thirteen quantitative characters have been presented in (Table 2). The highest marketable fruit yield per plant was obtained in NDRG-9 and constituted the top significant group for high marketable fruit yield per plant. Most promising genotypes identified in order of merit were NDRG-25, NDRG-16, NDRG-28, NDRG-17 and NDRG-22. Node number to anthesis of first staminate flower were lowest in NDRG-22, NDRG-23, NDRG-28, NDRG-19, NDRG-16, NDRG-25, NDRG-1 and NDRG-18, NDRG-17, NDRG-4 and NDRG-13, in increasing order where the staminate flower appears at the earlier node which gives the sufficient pollen for pistillate flower. Node number to anthesis of first pistillate flower appears on earlier node in NDRG-1, NDRG-6, NDRG-17, NDRG-23, NDRG-4 and NDRG-13.

The high value of broad sense heritability and the genetic advanced in respect to thirteen quantitative characters have been presented in (Table- 3). Phenotypic coefficient of variation was higher for node no. to anthesis of first staminate flower (45.78%) followed by node no. to anthesis of first pistillate flower (32.95%), marketable fruit yields per plant (26.29%), average fruit diameter (21.42%), average fruit length (17.79%), days to anthesis of first staminate flower (16.96%), no. of fruit per plant (15.76%), no. of nodes per vine (15.71%), vine length(m) (15.12%), days to anthesis of first pistillate flower (13.69%), days to first fruit harvest (10.91%), no. of primary branches per plant (10.34%) and average fruit weight (g) (6.38%). Highest genotypic coefficient of variation was observed for node no. to anthesis of first staminate flower (44.64%) followed by node no. to

anthesis of first pistillate flower (31.45%), marketable fruit yields per plant (24.21%), average fruit length (14.31%), average fruit diameter (14.11%), no. of nodes per vine (12.96%), days to anthesis of first staminate flower (14.34%), vine length(m) (11.25%), days to anthesis of first pistillate flower (10.81%), no. of fruit per plant (10.10%), days to first fruit harvest (7.47%), no. of primary branches per plant (6.77%) and average fruit weight (g) (4.70%). Chowdhury and Sharma (2002) [2] studied 12 cultivars of ridge gourd (*Luffa acutangula L.*) and find that the genetic coefficient of variation (GCV) was higher than the phenotypic coefficient of variation (PCV) for all characters. High values of heritability, PCV, GCV and genetic advance were recorded for vine length, yield per hectare and fruit weight indicating that these traits were characterized by additive gene effects. The high value of broad sense heritability was recorded for all the characters except weight per fruit. Node no. to anthesis of first staminate flower (95.1%) followed by node no. to anthesis of first pistillate flower (91.1%), marketable fruit yields per plant (84.8%), days to anthesis of first staminate flower (71.4%), no. of nodes per vine (68.1%), average fruit length (64.8%), days to anthesis of first pistillate flower (62.3%), vine length(m) (55.3%), average fruit weight (54.2%), days to first fruit harvest (46.8%), average fruit diameter (43.4%), no. of primary branches per plant

(42.9%) and No. of fruit per plant (41.1%). Maharana *et al.* (1995) studied variability and heritability derived from data on internodal length, petiole length, leaf area, fruit weight, total number of fruits per plant and yield per plant in 34 spine gourd (*Momordica dioica L.*) genotypes.

The genetic advance is presented in Table-1. The highest genetic advance was recorded for no. of nodes per vine (12.00%) followed by days to anthesis of first staminate flower (9.65%), node no. to anthesis of first staminate flower (8.24%), average fruit weight (8.18%), average fruit length (8.14%), days to anthesis of first pistillate flower (7.49%), node no. to anthesis of first pistillate flower (7.22%), days to first fruit harvest (5.74%), no. of primary branches per plant (3.37%) and no. of fruit per plant (2.01%), marketable fruit yields per plant (0.97%), vine length(m) (0.54%), days and average fruit diameter (0.57%). Singh *et al.* (1977) [7] reported high heritability along with high genetic advance in sponge gourd for fruit length and days to flower, while characters like number of fruits per plant and fruit diameter showed lower estimates of heritability and genetic advance

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