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Studies on Genetic Variability among various Horticultural Traits of Bottle Gourd

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ABSTRACT

The present investigation was carried out with 18 genotypes of bottle gourd planted in Randomized Block Design with three replications to know the nature and magnitude of variability, heritability and genetic advance as percent of mean for various horticultural traits. The analysis of variance showed significant variation among different genotypes for all the traits under study. Genotype Chandra Long Special had maximum total yield followed by Sarita, G 2 Chandra, R K Cross 3, LC-6 and Gutkha G 2 Improved. Chandra Long Special took minimum days to first female flowering as well as produced maximum number of marketable fruits per plant. KGP Bottle Gourd produced maximum number of branches and nodes per plant however, maximum vine length was found in LC-5. Genetic analysis indicated that phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) in all of the attributes studied. High heritability (broad sense) estimates coupled with high genetic advance as percent of mean were observed for yield and other horticultural traits.

Key words: *Bottle gourd, Genetic variability, Genetic advance, Heritability.*

INTRODUCTION

Bottle gourd or Lauki [*Lagenaria siceraria* (Mol.) Standl. (2n = 2x = 22)] is an important vegetable crop belonging to the family Cucurbitaceae. It is a highly cross pollinated crop due to its monoecious and andromonecious nature[13].

It is originated in Africa[11] and from there by floating on the seas, it travelled to India, where it has evolved into numerous local varieties, and has spread to China, Indonesia and far to New Zealand. The fruits contain vitamin C, thiamine, riboflavin, niacin, mineral matters, carbohydrates, fats, protein and moisture and its different parts possess large number of medicinal properties[5].The tender fruits are used as vegetable and for preparing sweet dishes, rayta and pickles. India has wide variability in bottle gourd germplasm, consisting both wild and cultivated forms. Due to the continuous cultivation of this cross pollinated crop, variation has occurred for fruit and vegetative characters.

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It shows large variation for various economic trait like size, shape and color of fruits. The genetic parameters such as heritability, genetic advance, genotypic and phenotypic coefficients of variability provide an effective tool in the hands of a breeder to select a genotype having the most desirable traits for yield. Bottle gourd production can be increased by bringing extra area under its cultivation or by adopting superior varieties but it is difficult to increase the area due to the competition with other vegetable crops. Therefore the present research has been undertaken with the objective to study the relative magnitude of genetic variability, heritability, and genetic advance for various traits of horticultural importance in bottle gourd and to estimate phenotypic and genotypic correlation among yield and its component characters.

MATERIALS AND METHODS

The experiment was carried out in diverse collection of eighteen genotypes of bottle gourd, including check cultivar (Pusa Naveen) in Randomized Block Design with three replications of each genotype, at the Vegetable Production and Demonstration Block of College of Horticulture, VCSG Uttarakhand University Horticulture and Forestry, Bharsar, Pauri Garhwal (Uttarakhand) during the period from April to September 2016. There were 6 plants of each entry in each replication in a plot of 6 x 1 m^2. The plant to plant spacing was given 1m. The standard cultural practices were followed to raise the bottle gourd crop. The observations on days to first female flowering, node number bearing first female flower, days to first fruit edible maturity from transplanting, fruit length (cm), fruit diameter (cm), fruit weight (Kg), flesh thickness (cm), number of marketable fruits per plant, total number of pickings, harvest duration, marketable yield per plant (Kg), marketable yield per plot (Kg), total yield per plot (Kg), vine length (m), number of branches per vine, number of nodes per, TSS (^{0}B) and 100 seed weight (g) for each genotype were recorded from five randomly selected plants per replication. The analysis of variance was carried out as suggested by Panse and Sukhatme[15]. The data were analyzed to estimate genotypic and phenotypic co-efficient of variation[2] and heritability in broad sense and genetic advance[1].

RESULTS AND DISCUSSION

The analysis of variance for eighteen characters revealed highly significant differences for all the characters indicating the existence of enormous amount of genetic variability for growth and yield attributes. The extent of variability present in the genotypes was measured in terms of range, coefficient of variation, genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), broad sense heritability and genetic advance (GA). The mean performances of the different traits under study in 18 bottle gourd genotypes are shown in Table 1. Significant differences were observed among all the genotypes for all the characters under study. A wide range of variations existing for various quantitative traits has also been reported in bottle gourd by various workers[12,14,7,6,4,3]. Among the horticultural characters, node number bearing first female flower and days to first fruit edible maturity is the traits which determine the earliness of a variety.

The components of variance, coefficient of variation, heritability and genetic advance value for eighteen horticultural characters are presented in Table 2. The magnitude of phenotypic coefficient of variation (PCV) was significantly higher than the corresponding genotypic coefficient of variation (GCV) for all the characters under the study, indicating a considerable influence of environment on their expression. Higher magnitude of PCV and GCV (> 20%), respectively were recorded for marketable yield per plant and per plot, total yield per plot, total number of pickings, fruit weight, number of marketable fruit per plant, fruit length, fruit diameter and flesh thickness indicating the existence of wide range of genetic variability in the germplasm for these traits. This also indicated broad genetic base, less environmental influence and these traits are under the control of additive genes and hence there is a good scope for the further improvement of these characters through selection. Husan *et al.*[8], and Deepthi *et al.*[4], reported similar results in bottle gourd and

Islam *et al*.[9], in bitter gourd. Rest of the characters recorded moderate coefficient of variation except days to first female flowering and days to first fruit edible maturity from transplanting. However, the differences between phenotypic and genotypic coefficient of variation were quite low. The characters studied were influenced by environment to lesser extent, thus the selection based on phenotypic performance will be reliable. The genotypic coefficient of variation does not offer full scope to estimate the variation that is heritable or environmental and therefore, estimation of heritability becomes necessary. The magnitude of heritability ranged from 31.05 to 93.46. Heritability estimates were high (>60%) seed index (g), fruit diameter (cm), flesh thickness (cm), days to first fruit edible maturity from transplanting, marketable yield per plant (Kg), marketable yield per plot (Kg), fruit length (cm), total yield per plot (Kg), number of marketable fruit per plant, harvest duration, TSS (^{0}B) and total number of pickings which showed that selection in these characters would be effective. These findings were in accordance with Kumar *et al.*[10], Husan *et al*.[8], and Damor *et al*.[3], in bottle gourd. Moderate heritability (30-60%) for fruit weight (Kg), number of nodes per plant, days to first female flowering, vine length (m), number of branches per vine and node number bearing first female flower suggested that the environmental effects constitute a major portion of the total phenotypic variation and hence, direct selection for these traits will be less effective. The value of genetic advance as percentage of mean ranged from 10.26 – 68.41. The information on heritability alone may be misleading but when used in combination with genetic gain, the utility of heritability estimate increases. In present study, high heritability coupled with high genetic advance as percentage of mean was observed for marketable yield per plant and per plot (Kg), total yield per plot (Kg), fruit diameter (cm), flesh thickness (cm), fruit length (cm), number of marketable fruits per plant, total number of pickings, seed index (g), TSS (^{0}B) and harvest duration indicating that most likely the heritability is due to additive gene effects and thus the chances of fixing by selection will be more to improve such traits through pure line selection in the evaluated genotypes. Similar findings were recorded by Pandit *et al.*[14], Yadav *et al*.[16], in bottle gourd.

Table. 1 Mean Performance of eighteen genotypes for the characters under study in bottle gourd

S.No.	Genotypes	Days to I female flowering	Node No. bearing I female flower	Days to I fruit edible maturity	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (Kg)	No. of marke table fruits per plant	No. of pickings	Harvest duration	Market able yield per plant (kg)	Marke table yield per plot (kg)	Total yield per plot (kg)	Vine length (m)	No. of branc hes	No. of nodes	Flesh thickness (cm)	TSS (°B)	Seed Index (g)
1	Vidhan	54.07	12.07	65.40	38.29	6.79	1.10	6.73	4.27	40.67	7.47	42.51	48.04	5.28	22.03	93.66	6.36	2.58	16.21
2	Sarita	52.93	13.40	68.60	48.87	7.58	1.52	7.40	5.53	42.67	11.28	62.01	68.55	5.04	19.08	90.17	7.11	3.05	16.60
3	Gutkha G2 Improved	53.75	13.07	67.86	48.99	7.19	1.59	5.53	3.73	33.33	8.78	51.37	53.17	5.48	22.68	101.19	6.92	3.00	13.16
4	KGP Bottle Gourd	51.67	11.80	70.33	39.62	6.77	1.37	6.88	5.40	49.33	8.74	55.13	56.46	4.57	23.71	141.68	6.49	2.40	13.95
5	Chandra Long Special	47.00	9.47	68.17	47.41	7.62	1.69	8.06	6.00	51.33	12.41	75.43	82.43	4.85	22.97	119.58	7.16	2.53	13.44
6	PBC Launki	52.20	10.73	68.55	53.11	6.33	1.40	5.87	5.33	45.33	6.87	45.30	48.63	5.18	21.93	108.06	6.13	2.67	13.31
7	Arka Bahar	61.05	14.67	85.93	24.81	6.57	0.81	2.98	2.33	41.67	2.37	13.22	15.53	6.37	15.34	81.09	6.26	3.25	16.59
8	G2 Chandra	53.60	13.00	63.89	56.47	7.46	1.67	6.61	4.67	44.67	9.69	60.96	66.16	5.66	23.57	107.89	7.15	1.99	12.83
9	RK Cross 3	50.33	11.53	70.26	49.32	7.77	1.68	5.93	4.73	40.33	9.73	58.69	60.36	3.80	20.09	69.81	7.38	2.27	13.57
10	Aditi	51.73	9.27	69.69	43.01	5.87	1.06	6.93	4.80	48.33	6.68	43.49	44.08	4.62	18.20	84.39	5.62	2.07	13.17
11	LC-1	56.07	11.67	76.24	19.63	13.12	1.21	4.83	2.60	37.33	4.73	34.46	34.79	4.95	17.58	97.75	12.73	1.97	17.37
12	LC-2	52.73	10.53	67.10	37.13	6.68	1.03	5.34	3.20	52.33	5.51	32.39	33.71	4.72	19.99	106.4	6.41	3.01	13.61
13	LC-3	64.91	11.93	85.66	37.29	6.18	0.85	3.60	2.67	36.67	3.09	17.52	21.06	6.50	17.50	113.19	5.99	1.75	15.44
14	LC-4	53.27	12.47	73.75	41.38	6.69	1.10	6.27	3.93	44.67	6.18	40.05	41.08	6.39	18.24	114.24	6.54	3.37	17.90
15	LC-5	59.61	12.53	80.90	38.00	6.43	0.82	6.03	4.73	37.33	4.26	29.54	29.54	6.80	15.32	109.05	6.24	2.60	20.61
16	LC-6	53.60	10.40	77.69	41.03	8.82	1.84	5.20	4.20	45.33	8.51	55.71	57.04	5.80	16.76	112.84	8.49	2.11	12.36
17	LC-7	52.33	11.33	74.91	46.30	6.91	1.13	7.93	6.13	55.67	8.61	49.57	56.08	4.92	22.78	100.91	6.49	2.63	9.47
18	Pusa Naveen	59.07	12.93	72.67	40.97	6.58	0.94	5.71	2.67	30.33	5.44	31.66	34.31	5.53	17.59	95.29	6.06	3.02	14.34
SE (m)		1.94	0.88	1.22	1.90	0.24	0.14	0.31	0.45	1.76	0.96	5.48	3.69	0.45	1.66	6.93	0.25	0.15	0.37
CV%		4.96	12.29	3.01	8.12	5.81	19.89	9.15	18.76	7.26	22.94	21.39	23.62	14.86	14.94	19.02	6.33	10.32	4.54
CD(P=0.05)		5.73	2.61	3.62	5.62	0.71	0.42	0.91	1.33	5.19	2.76	15.83	10.93	1.32	4.89	20.49	0.73	0.44	1.10

Table. 2 Estimates of phenotypic and genotypic coefficients of variation, heritability, genetic advance and genetic gain for different traits in bottle gourd

Sr. No.	Characters	Range	Mean	Coefficients of variation (%)		Heritability (%)	Expected genetic Advance	Genetic advance as percent of mean
				Phenotypic	Genotypic			
1	Days to first female flowering	47.00-64.91	54.44	9.39	6.93	54.38	5.73	10.52
2	Node No. bearing first female flower	9.27-14.67	11.82	16.04	8.94	31.05	1.21	10.26
3	Days to first fruit edible maturity from transplanting	63.89-85.93	72.65	9.26	8.75	89.46	12.39	17.06
4	Fruit Length (cm)	19.63-56.47	41.76	22.79	21.30	87.32	17.12	41.00
5	Fruit Diameter (cm)	5.87-13.12	7.29	22.59	21.84	93.39	3.17	43.45
6	Fruit weight (Kg)	0.81-1.84	1.27	30.94	23.77	59.02	0.48	37.62
7	Flesh thickness (cm)	5.62-12.73	6.97	23.22	22.34	92.57	3.09	44.28
8	No. of marketable fruits per plant	2.98-8.06	5.99	23.48	21.63	84.82	2.46	41.03
9	Total no. of pickings	2.33-6.13	4.27	32.03	25.96	65.70	1.85	43.35
10	Harvest Duration	30.33-55.67	43.19	16.71	15.05	81.15	12.06	27.93
11	Marketable yield per plant (Kg)	2.37-12.41	7.24	42.18	35.40	70.41	4.43	61.19
12	Marketable yield per plot (Kg)	13.22-75.43	44.39	40.29	34.14	71.80	26.45	59.59
13	Total yield per plot (Kg)	15.53-82.43	47.28	38.28	35.65	86.75	32.34	68.41
14	Vine Length (m)	3.80-6.80	5.36	19.07	11.94	39.22	0.83	15.40
15	No. of branches per vine	15.32-23.71	19.74	18.82	11.44	36.95	2.83	14.32
16	No. of nodes per plant/vine	69.81-141.68	102.62	18.60	14.19	58.17	22.88	22.29
17	TSS (^{0}B)	1.75-3.37	2.57	20.45	17.65	74.52	0.81	31.39
18	Seed Index(g)	9.47-20.61	14.66	17.74	17.15	93.46	5.01	34.16

CONCLUSION

Different bottle gourd genotypes exhibited marked variation in all the traits under study. The genotype KGP Bottle Gourd performed better for vegetative characters such as number of branches, number of nodes and vine length. Aditi produced first female flower at the lowermost node. Chandra Long Special produced highest number of marketable fruit per plant and had highest yield. Overall, Chandra Long Special, LC-6, RK Cross 3, Sarita and G 2 Chandra are best suited for cultivation in the hills of Uttarakhand. G 2 Chandra was earliest in maturity and genotype Chandra Long Special was earliest in producing female flower. PCV was higher than GCV in all of the attributes studied, which signified the presence of environmental influence to some degree in the phenotypic expression of characters. Highest PCV (42.18) and GCV (35.65) were obtained for marketable yield per plant and total yield per plot respectively. High heritability estimates coupled with high genetic advance as per cent of mean were observed for marketable yield per plant and per plot, total yield per plot, fruit diameter, flesh thickness, fruit length, number of marketable fruits per plant, total number of pickings, seed index, TSS and harvest duration, which indicated that these characters are under additive gene effects and these characters are more reliable for effective selection.

REFERENCES

1. Allard, R. W., *Principles of Plant Breeding*. John Wiley and Sons, New York. 485p (1960).
2. Burton, G. W. and De Vane, E. H., Estimating heritability in tall fescue (*Festuca arundiancea)* from replicated clonal material, *Agron. J.* **9(22):** 12-15(1953).
3. Damor, A. S., Patel, J. N., Parmar, H. K. and Vyas, N. D., Studies on Genetic variability, heritability and genetic advance for yield and quality traits in bottle gourd [*Lagenaria siceraria* (Mol.)

Standl.] Genotypes, *Int. J. Sci. Environ. and Tech*. **5(4):** 2301 – 2307 (2016).

4. Deepthi, B., Reddy, P. S. S., Kumar, A. S. and Reddy, A. R., Studies on PCV, GCV, heritability and genetic advance in bottle gourd genotypes for yield and yield components. *Plant Arch.* **16(2):** 597-601 (2016).
5. Desai, U. T. and Musmade, A. M., Pumpkins, Squashes and Gourds, *Handbook of Vegetable Science and Technology: Production, Composition, Storage and Processing* (Eds., Salunkhe D K and Kadam S S). New York, Marcel Dekker. 273-297 (1998).
6. Emina, M., Berenji, J., Ognjanov, V., Mirjana, J. and Jelena, C., Genetic variability of Bottle gourd and its morphological characterization by multivariate analysis, *Archaeol. Biol. Sci. Belgrade*. **64(2):** 573-583 (2012).
7. Harika, M., Gasti, V. D., Shantappa, T., Mulge, R., Shirol, A. M., Mastiholi, A. B. and Kolkarni, M. S., Evaluation of bottle gourd genotypes [*Lagenaria siceraria* (Mol.) Standl.] for various horticultural characters, *Karnataka J. Agric. Sci.* **25(2):** 241-244 (2012).
8. Husna, A., Mahmud, F., Islam, M. R., Mahmud, M. A. A. and Ratna, M., Genetic variability, correlation and path co-efficient analysis in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.], *Adv. Biol. Res*. **5(6):** 323-327 (2011).
9. Islam, M. R., Hossain, M. S., Bhuiyan, M. S. R., Husna, A. and Syed, M. A., Genetic Variability and Path-Coefficient Analysis of Bitter Gourd (*Momordica charantia* L.), *Int. J. Sustain. Agric*. **1(3):** 53-57 (2009).
10. Kumar, S., Singh, R. and Pal, A. K., Genetic variability, heritability, genetic advance, correlation co-efficient and path analysis in bottle gourd, *Indian J. Horti*. **64(2):** 163-168 (2007).
11. Singh, A. K., *Cytogenetics and Evolution in the Cucurbitaceae*. Cornell University. London. 10-28 (1990).
12. Singh, K. P., Choudhury, D. N., Mandal, G. and Saha, B. C., Genetic variability in bottle gourd [*Lagenaria siceraria* (Molina) Standl.], *J. of Interacademicia.* **12(2):** 159-163 (2008).
13. Swiander, J. M., Ware, G. W. and Maccollum, J. P., *Vegetable Crops*. *Interstate Publishers* 323-340 (1994).
14. Pandit, M. K., Mahato, B. and Sarkar, A., Genetic variability, heritability and genetic advance for some fruit character and yield in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.], *Acta Hortic.* **809:** 221-225 (2009).
15. Panse, V.G. and Sukhatm, P.V., Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi, 1-381 (1985).
16. Yadav, J. R., Yadav, A., Srivastava, J. P., Mishra, G., Parihar, N. S. and Singh, P. B., Study on variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Mol) Standl.], *Progressive Res.* **3(1):** 70-72 (2008).