

Genetic variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Mol.) standl.]

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Abstract

Extent of variability, heritability and genetic advance of fruit yield and its contributing characters were estimated in twelve diverse genotypes of bottle gourd. The study indicates that there is considerable amount of genetic variability for all the characters studied. The length of edible green fruit exhibited highest value of genotypic and phenotypic coefficient of variations (GCV and PCV). High estimates of heritability, genotypic coefficient of variations and genetic advance as per cent of mean were observed for length of edible green fruit, number of fruits plant⁻¹ and weight of edible green fruit. This indicates that these characters in bottle gourd can effectively be improved through selection.

Keywords : Bottle gourd, heritability, genetic advance.

Introduction

Bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) is an important vegetable crop belonging to family cucurbitaceae and is commercially grown in almost all parts of India. It is a monoecious and highly cross-pollinated crop in which large amount of variations are observed in many economically important traits. The exploitation of genetic variability in the available genotypes is a prerequisite in a breeding programme for effective selection of superior genotypes. Since natural genetic variation for most of the yield attributes is considerably high in bottle gourd. There is an urgent need of information on the nature and magnitude of variation available in the material and part played by environment in expression of different characters. Keeping in view the above facts the present investigation was undertaken to estimate the magnitude of heritable and non-heritable components of variation and genetic parameters such as coefficient of variations, heritability and genetic advances in twelve diverse genotypes of bottle gourd.

Material and methods

Twelve diverse genotypes of bottle gourd having distinct diversity in morphology and performance were sown in randomized block design with three replication during rainy season at Vegetable Research Farm of the Department of Horticulture, Institute of Agricultural Sciences, Banaras

Hindu University, Varanasi. The spacing between row to row was kept at 2m and plant to plant was 1m in a 5m x 4m-plot size. The crop was maintained according to standard agronomic practices. Observations were recorded on five randomly selected plants for 14 different characters including vegetative as well as fruit characters such as days to germination, days to first staminate flower anthesis, days to first pistillate flower anthesis, number of primary branches plant⁻¹, vine length, node number bearing first staminate flower, node number bearing first pistillate flower, days to first fruit harvest, length of edible green fruit, number of fruits plant⁻¹, length of edible green fruit, number of fruits plant⁻¹, weight of edible green fruit, number of seeds fruit⁻¹, 100-seed weight and edible fruits yield plant⁻¹. The statistical analysis was carried out as per formula suggested by Panse and Sukhatme (6) and was used for calculating other genetic parameters. Genotypic and phenotypic coefficients of variations were calculated as per the formula suggested by Burton and Devane (2). Heritability in board sense and genetic advance were calculated as per the formula given by Allard (1) and Johnson *et.al.* (3), respectively.

Results and discussion

The extent of variability present in twelve diverse genotypes of bottle gourd was measured in terms of range, mean, variations (PCV and GCV), heritability (broad sense) and genetic advance (GA) and GA as per cent of mean [Table-1]. All the genotypes differed significantly with respect to different characters studied. Wide range of

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variation was observed in all the characters studied. Number of fruits plant⁻¹ varied from 3.83 (VRBG-40) to 7.20 (VRBG-101), length of edible green fruits from 28.97cm (PGOG-62) to 60.00cm (VRBG-110) and fruits yield plant⁻¹ from 5.33kg (PBOG-40) to 9.63kg (VRBG-110) (Table-2). Prakash *et al.* (7) also reported wide range of variation for most of the characters studied in this crop.

The GCV, which gives a picture of extent of genetic variability in the population ranged from 5.21 (days to first fruit harvest) to 23.68 (length of edible green fruit). The GCV values were considerably high for characters such as number of fruits plant⁻¹, weight of edible green fruit and fruits yield plant⁻¹. The characters having higher range of variation have a better scope for improvement through selection. This finding is in agreement with those reported by Tyagi (4). A perusal of data in table-1 shows that there was close relationship between PCV and GCV and was observed low for all the characters except vine length and fruits yield plant⁻¹ which indicated less influence of environment for most of the characters.

With the help of GCV alone, it is not possible to determine the amount of variation that is heritable. Heritable variation can be found out with greater degree of accuracy. The heritability estimates of 100-seed weight (98.90 %) was highest and was moderate for vine length (71.50%) and number of primary branches plant⁻¹ (71.00%) which suggest that the environmental effects constitute a major portion of total phenotypic variation and hence direct selection for this characters will be less effective. Expected genetic advance and its estimates as per cent of mean for various characters revealed that length of edible green fruit (48.21), weight of edible green fruit (43.60) and number of fruits plant⁻¹ had high GA. High heritability along with high expected GA were recorded for length of edible green fruit

and 100-seed weight which was also recorded by findings of Prasad and Prasad (5). If heritability was mainly due to non-additive gene action, the expected GA could be expected. It is clear from table-1 that the characters like length of edible green fruit and number of seeds fruit⁻¹ possessing high heritability along with GA could be effectively used for selection as it is also suggested by Johnson *et al.* (3). High heritability along with low GA was observed in characters namely number of seeds fruit⁻¹, days to first pistillate flower anthesis and days to first fruits harvest indicated that expression of these characters was governed by non-additive gene action.

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Table 1 Range, Mean, Variability, Heritability and Genetic Advance for 14 characters in bottle gourd

Table 1 Range, Mean, Variability, Heritability and Genetic Advance for 14 characters in bottle gourd									
S. No.	Characters	Range	Mean	Variability		Heritability (%) (Broad Sense)	Genetic Advance (GA)	GA as per cent of mean	
				*GCV	**PCV				
1	Days to germination (50%)	7.43-11.00	9.17	11.87	12.35	89.80	2.13	23.22	
2	Days to first male flower anthesis	42.97-53.83	47.82	7.24	7.34	97.50	7.05	14.74	
3	Days to first female flower anthesis	51.10-61.77	54.81	6.22	6.31	97.20	6.92	12.62	
4	No. of primary branches plant ⁻¹	3.83-6.30	4.85	14.28	16.96	71.00	1.20	24.74	
5	Vine length (m)	3.47-6.27	4.81	16.42	19.42	71.50	1.38	28.69	
6	Node no. to first male flower	5.50-7.97	6.86	9.91	12.03	67.90	1.15	16.76	
7	Node no. to first female flower	8.77-11.83	9.82	10.45	11.04	89.60	2.00	20.36	
8	Days to first fruit harvest	65.20-76.77	69.14	5.21	5.31	96.00	7.26	10.50	
9	Average length of edible green fruit (cm)	28.97-60.00	47.27	23.68	23.96	97.70	22.79	48.21	
10	Average no. of fruits plant ⁻¹	3.87-7.20	5.52	20.56	21.95	87.70	2.19	39.67	
11	Average weight of edible green fruit(kg)	0.87-1.87	1.33	22.34	23.87	87.60	0.58	43.60	
12	Average no. of seeds fruit ⁻¹	310-497.67	423.08	11.59	12.24	89.70	25.64	6.06	
13	100 seed weight(g)	11.57-15.33	13.69	8.22	8.27	98.90	2.31	16.87	
14	Average fruit yield plant ⁻¹ (kg)	5.33-9.63	7.03	18.15	23.36	60.40	2.04	29.01	

**PCV=Phenotypic coefficient of variability *GCV=Genotypic coefficient of variability

Table 2 Mean value of the twelve genotypes for fourteen characters in bottle gourd.

S. No.	Genotypes	Days to germination (50%)	Days to first male flower anthesis	Days to first female flower anthesis	No. of primary branches plant ⁻¹	Vine length (m)	Node no. to first male flower	Node no. to first female flower	Days to first fruit harvest	Average length of edible green fruit (cm)	Average no. of fruits plant ⁻¹	Average weight of edible green fruit (kg)	Average no. of seeds fruit ⁻¹	100 seed weight (g)	Average fruit yield plant ⁻¹ (kg)
1	VRBG-101	9.47	45.10	52.13	4.70	4.83	7.07	8.97	66.33	47.33	7.2	1.30	462.33	12.80	7.70
2	PBOG-40	8.80	47.67	54.57	5.37	3.47	7.43	10.73	70.33	43.93	4.83	1.10	400.00	12.57	5.33
3	NDBG-58	7.43	48.70	54.93	3.83	5.13	5.50	9.07	69.30	55.78	4.87	1.17	443.67	13.30	5.60
4	DVBG-1	8.63	44.83	51.83	4.77	5.53	6.53	9.90	65.20	57.97	4.83	1.43	479.00	14.60	6.87
5	PGOG-62	9.13	50.03	57.13	6.30	4.60	6.57	8.93	70.73	28.97	7.10	0.87	310.00	13.97	5.97
6	DVBG-2	8.87	45.03	51.67	3.93	4.07	7.97	10.83	65.73	30.37	6.07	1.00	396.67	14.13	6.07
7	PBOG-61	7.50	45.80	51.10	4.93	5.53	7.53	10.07	65.23	30.80	6.13	1.23	413.33	15.23	7.73
8	VRBG-110	8.87	50.87	57.03	5.03	4.00	5.97	8.93	66.53	60.00	6.83	1.43	497.67	12.87	9.63
9	PSPL	10.90	53.83	61.77	5.00	5.37	7.67	11.83	76.77	54.50	3.87	1.73	374.67	11.57	6.63
10	NDBG-56	11.00	53.07	58.63	4.80	6.27	6.77	8.77	73.80	52.20	5.10	1.87	429.33	14.33	9.60
11	VRBG-40	9.80	45.77	52.37	3.90	3.80	7.03	10.93	68.80	51.87	3.83	1.70	433.00	13.63	6.50
12	Pusa Naveen	9.73	42.97	53.63	5.73	5.17	6.30	8.90	71.00	53.67	5.63	1.23	457.33	15.33	6.77