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Heritability (narrow sense) and genetic advance of for growth, yield and quality traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

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Abstract

Carried out in two different seasons with aims to assess the extent of heritability and genetic advance [6] involving 10 parents namely, NDBG-49-2 (P_1), N. Rashmi (P_2), N. Prabha (P_3), N. Pooja (P_4), Pusa Naveen (P_5), Pb. Komal (P_6), NDBG S-1 (P_7), PBOG-3 (P_8), NDBG-11 (P_9) and Faizabadi Local (P_{10}) at MES, Vegetable Science, NDUA.&T, Narendra Nagar (Kumarganj), Faizabad (U.P.) India during *kharif* 2015 (E_1) and *Rabi*, 2015-16 (E_2). The experiments were laid out in RBD with three replications having each experimental unit of single row with spacing of 3.0 m × 0.5 m. The observations were recorded on parents and F_1's for eighteen quantitative traits including six quality traits *viz.*, days to first staminate flower anthesis, days to first pistillate flower anthesis, node number to first staminate flower, node number to first pistillate flower appearance, days to first fruit harvest, vine length (m), number of primary branches per plant, fruit length (cm), fruit circumference (cm), fruit weight (kg), number of fruits per plant, fruit yield per plant (kg), total soluble solids (°B), ascorbic acid (mg/100 g fresh fruit), reducing sugar (%), non-reducing sugar (%), total sugars (%) and dry matter content in fruit (%).The higher values of heritability (h^2n) estimates (> 30) were observed only for fruit length (52.20%, 37.50% and 35.17%) and fruit circumference (61.50%, 33.50% and 31.50%) during both the seasons and pooled. High genetic advance in per cent of mean were estimated for four traits, *viz.* number of fruit per plant (32.58%, 42.73% and 21.33%), fruit yield per plant (24.60%, 32.40% and 25.82%), reducing sugars (22.01%, 25.10% and 22.42%) and non- reducing sugar (27%, 38.96% and 28.01%) during both the seasons and pooled.

Keywords: bottle gourd, Heritability (narrow sense) and genetic advance, fruit yield per plant

Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl., 2n =2x= 22] is an important cultivated annual cucurbitaceous crop grown throughout the country. Being warm season vegetable crop it thrives well in warm and humid climate but at present it's off season cultivation has progressively stretched throughout the year in northern Indian plains. According to De Candolle (1882), Bottle gourd has been found in wild form in South Africa and India. However, Cutler and Whitaker (1961) [1] are of the view that probably it is indigenous to tropical Africa on the basis of variability in seeds and fruits. The tender fruits of bottle gourd can be used as a vegetable or for making sweets (e.g. *Halva, kheer, petha* and *burfi* etc.), kofta and pickles. The fruit is rich in pectin also, which showed good prospects for jelly preparation. A decoction made from the leaf is a very good medicine for jaundice. The fruit has cooling effect, it is a cardiotonic and diuretic, good for people suffering from biliousness, indigestion and convalescences *i.e.*, regain health after illness. The pulp is good for overcoming constipation, cough, night blindness and as an antidote against certain poisons. The plant extract is used as a cathartic and seeds are used in dropsy. In addition, the seeds and seed oil are edible. The fruits contain 96.3 per cent moisture, 2.9 per cent carbohydrate, 0.2 per cent protein, 0.1 per cent fat, 0.5 per cent mineral matter and 11 mg of vitamin C (Ascorbic acid) per 100 g fresh weight (Thamburaj and Singh, 2005) [6]. The exploitation of heterosis is much easier in cross-pollinated vegetable crops. Bottle gourd being monoecious provides ample scope for the utilization of the hybrid vigour for yield improvement of this crop. The selection of suitable parents for hybridization on the basis of phenotypic performance alone is not a sound procedure as phenotypically superior lines may yield poor recombinants in the segregating generations. It is, therefore, essential that parents should be selected on the basis of their genetic potential.

Materials and methods

The experimental materials consisted of 10 promising parental lines of bottle gourd and their

F_1 progenies. The selected parental lines *i.e*. NDBG-49-2 (P_1), N. Rashmi (P_2), N. Prabha (P_3), N. Pooja (P_4), Pusa Naveen (P_5), Pb. Komal (P_6), NDBG S-1 (P_7), PBOG-3 (P_8), NDBG-11 (P_9) and Faizabadi Local (P_{10}) were crossed in the all possible combinations, excluding reciprocals. at NDUA & T, Kumarganj, Faizabad (U.P.). These experimental materials were grown under Randomized Block Design (RBD) with three replications at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture and Technology, Narendra Nagar, Kumarganj, Faizabad (U.P.) India. The treatments were sown in rows spaced 3.0 meters apart with a plant to plant spacing of 0.5 meter. The experiments were laid out during the *Kharif* season of 2015-16 and and off season in winter 2015-16 seeds for the study of heterosis. All the recommended agronomic package of practices and protection measures were followed to raise a good crop. Fertilizers and manures were applied as per recommended dose. Observations were recorded on all the six plants maintained carefully in each plot for eighteen quantitative characters *viz*., days to first staminate flower anthesis, days to first pistillate flower anthesis, node number to first staminate flower, node number to first pistillate flower appearance, days to first fruit harvest, vine length at last picking stage (m), number of primary branches per plant, fruit length (cm), fruit circumference (cm), fruit weight (kg), number of fruits per plant, fruit yield per plant (kg), total soluble solids (°B), ascorbic acid (mg/100 g fresh fruit), reducing sugar (%), non-reducing sugar (%), total sugars (%) and dry matter content in fruit (%). Suggested by Mather and Jinks (1971) [2], narrow sense heritability.

Results and discussion

The knowledge of heritability of a character is important to the breeder since it indicates the possibility and extent to which improvement is possible through selection (Robinson *et al.*, 1949) [8]. Heritability, which denotes the proportion of additive genetic variance to the total variance, is a measure of genetic relationship between parents and progeny and has been widely used in determining the degree to which character may be transmitted from parent to offspring. Singh *et al.* (2005) [5] pointed out that the heritability in combination with intensity of selection and amount of variability present in the population influences the gains to be obtained from selection. Since the genetic gain is yet another important selection parameter which is although independent and represents the expected genetic gain under selection. It measures the differences between the mean genotypic values of the selected lines and mean genotypic value of base population from which these lines were selected. Thus, it is necessary to utilize the heritability in conjunction with selection differential, which would indicate the expected genetic gain. The estimate of heritability with genetic advance as per cent of mean provides a better picture to the breeders during the process of selection.

The findings of the present investigation revealed that high heritability (h^2n) coupled with high genetic advance as per cent of mean were observed fruit length fruit circumference during both the seasons and pooled. (Table-1), indicating thereby these traits were less influenced by environment and were mainly under control of additive genes. This suggested that these characters could be improved through appropriate selection procedures. High heritability along with high genetic advance of these traits are in close agreement with the findings of Maurya (1991) [4], Singh *et al.* (1996), Kumar (2000) [3] and Warner, J.N. (1952) [9].

High heritabilities (h^2n) coupled with moderate to low genetic advance were estimated for number of fruit per plants, fruit yield per plant, reducing sugar and non- reducing sugar during both season and pooled (Table-4.8). It indicated the less influence of non-additive gene action for these traits. The high heritability is being exhibited due to favourable influences of environment rather than genotype and selection for such traits may not be rewarding. Similar were the findings of Singh *et al.* (1996) for days to first harvest.

The estimate of moderate heritability accompanied with high genetic advance were found for ascorbic acid. While moderate genetic advance for

Table 1: Heritability (ns) and genetic advance in bottle gourd over two seasons (E_1, E_2) and pooled.

Characters	Seasons	Heritability in broad sense (%)	Heritability in narrow sense (%)	Genetic advance in per cent of mean
Days to first staminate flower anthesis	E_1	68.48	16.20	8.97
	E_2	32.00	4.20	2.52
	Pooled	18.00	2.90	1.73
Days to first pistillate flower anthesis	E_1	73.83	30.60	10.63
	E_2	56.00	24.50	5.38
	Pooled	21.00	8.34	2.40
Node number to first staminate flower appearance	E_1	89.00	40.70	34.48
	E_2	87.00	7.00	25.39
	Pooled	30.00	8.53	10.97
Node number to first pistillate flower appearance	E_1	93.32	54.20	45.36
	E_2	69.00	9.20	19.54
	Pooled	36.00	18.18	16.94
Days to first fruit harvest	E_1	62.37	28.80	6.63
	E_2	34.00	34.30	2.64
	Pooled	18.00	14.66	1.63
Vine length (m)	E_1	85.63	27.50	35.80
	E_2	96.00	35.10	53.99
	Pooled	32.00	12.40	15.17
Number of primary branches per plant	E_1	88.22	36.70	35.15
	E_2	88.00	23.30	42.58
	Pooled	43.00	13.44	18.85
Fruit length (cm)	E_1	91.11	52.20	29.72
	E_2	87.00	37.50	21.79
	Pooled	63.00	35.17	18.46
Fruit circumference (cm)	E_1	92.38	61.50	34.86
	E_2	53.00	33.30	31.56
	Pooled	93.00	31.82	18.94

Characters	Seasons	Heritability in broad sense (%)	Heritability in narrow sense (%)	Genetic advance in per cent of mean
Fruit weight (kg)	E_1	63.96	10.30	22.52
	E_2	88.00	15.10	48.44
	Pooled	35.00	2.71	16.09
Number of fruits per plant	E_1	76.53	13.20	32.58
	E_2	84.00	15.30	42.73
	Pooled	46.00	3.60	21.33
Fruit yield per plant (kg)	E_1	74.81	9.00	24.60
	E_2	86.00	3.30	32.40
	Pooled	74.00	1.76	25.82
Total soluble solids (TSS)	E_1	87.02	62.60	22.58
	E_2	81.00	21.60	22.53
	Pooled	52.00	24.58	14.04
Ascorbic acid (mg/100 g fresh fruit)	E_1	86.13	43.10	13.70
	E_2	83.00	25.90	11.86
	Pooled	59.00	25.27	8.90
Reducing sugar (%)	E_1	96.03	11.20	22.01
	E_2	95.00	8.00	25.10
	Pooled	91.00	5.16	22.42
Non-reducing sugar (%)	E_1	91.79	10.20	27.00
	E_2	95.00	6.10	38.96
	Pooled	80.00	3.88	28.01
Total sugar (%)	E_1	85.80	13.20	8.93
	E_2	93.00	4.90	15.57
	Pooled	83.00	4.09	11.34
Dry matter content in fruit	E_1	93.11	20.90	27.19
	E_2	89.00	9.70	25.58
	Pooled	63.00	7.61	18.42

node number to first pistillate flower appearance, node number to first staminate flower appearance, vine length, number of primary branches per plant, fruit length, fruit circumference, fruit weight, TSS and total sugars in pooled exhibited low heritability along with low genetic advance for days to first staminate flower anthesis and days first fruit harvest during both seasons (E_1 and E_2) and pooled. This indicates major contribution of non-additive genes and suggests heterosis breeding approach for improvement of these traits. Similar findings were also reported by Singh *et al.* (1996); Kumar (2000) [3]; Singh *et al.* (2005) [5] Warner, J.N. (1952) [9] and Sharma *et al.* (2010) [10].

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