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Original Research Article

Estimates of Gene Action for Thirteen Characters in Half Diallel Cross of Bottle Gourd

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Keywords

Diallele, Additive components, Dominance components

A B S T R A C T

Diallel mating scheme was adopted to develop 21 hybrids in spring summer season of 2016 and the hybrids along with the seven parents and one checks were evaluated in RCBD with two replications in the autumn-winter season of 2016 to accomplish the objectives. The additive components (D) of genetic variance was found to be highly significant for average fruit weight and number of fruits per vine. The estimates of dominance components viz. $\hat{H}1$, $\hat{H}2$ and $\hat{h}2$ were evaluated which $\hat{H}1$ and $\hat{H}2$ were found to be highly significant for all the trait. Dominance components ($\hat{h}2$) was found in few characters viz. fruits per vine, fruit yield per vine and yield (q/ ha) suggested the role of dominance components for this trait. The estimated for E component for days to first fruit harvest, fruits per vine, average fruit weight showed significant value. The average degree of dominance was more than one for all the characters showed over dominance excluding fruit length.

Introduction

Bottle gourd (Lagenaria siceraria (Molina) Standl.) is a tropical and subtropical viny crops belongs to the Cucurbitaceae family having chromosome number 2n = 22 (Bose and Som, 1986). The Centre of origin of bottle gourd is tropical Africa (Cutler and Whitaker,1961). India is considered as a secondary Centre of diversity of bottle gourd and exhibits a great range of variability with respect to its morphological traits, maturity period and fruit yield etc. It contains considerable amount of water (96.1 g), carbohydrates (2.5 g), protein (0.2 g), fat (0.1 g), minerals (0.5g), fiber (0.6 g) and energy (12 kcal) per 100 g of edible fruit (Gopalan et al., 1982). India being the second largest producer of vegetable in the world, after China, shares about 15 per cent of the world output of vegetables from about 3 per cent of total cropped area in the country. In spite of such a large production, the per capita per day supply of vegetables could not rise above 175 g in the country, which is lower than the recommended dietary allowance (RDA) of 350 to 400 g per capita per day for a balanced diet (Rai and

Pandey, 2007). The vegetable requirement of our country is estimated to be 220 million tons by 2020 (Singh, 2004).

Materials and Methods

The present research work entitled 'Study of gene action in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]' was undertaken to study the gene action using diallel mating design at the Research farm area of the Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural College, Bihar Agricultural University, Sabour, Bhagalpur during winter season, 2016. The experimental materials for the present study comprised of seven promising and diverse inbred lines/varieties of bottle gourd selected on the basis of genetic variability from the germplasm stock maintained in the Department of Horticulture (Vegetable and Floriculture), Bihar Agricultural University, Sabour, Bhagalpur. The selected parental lines *i.e.* BRBG 51-2 (P_1), BRBG 21-2 (P_2), BRBG 65 (P_3), BRBG 190 (P_4), BRBG 42-2 (P_5), Pusa Naveen (P_6) and Punjab Komal (P_7) were crossed in the all possible combinations in diallel technique, excluding reciprocals to get 21 F_1 hybrids for the study of heterosis, combining ability and gene action for eighteen characters.

The experiment was conducted in Randomized Complete Block Design with two replications to assess the performance of 21 F_1 hybrids and their 7 parental lines. The crop was planted in rows spaced at 2.5 meters with plant to plant spacing of 0.5 meter apart. Distinguishing features of the parental lines are given in Table-01.

Results and Discussion

The estimates of D, Ĥ1, Ĥ2, F and E parameters along with its components obtained from diallel analysis (Hayman, 1954; Rai and Asati, 2011) are presented in Table 2. The additive components (D) of genetic variance was found to be highly significant for all the characters excluding node number of first pistllate flower, days to first fruit harvest, vine length, fruit yield per vine, yield (q/ ha) and total soluble solid content in fruit. (Table 2). The estimates of dominance components viz. Ĥ1, Ĥ2 and ĥ2 were evaluated which Ĥ1 and Ĥ2 were found to be highly significant for all the trait. Dominance component (ĥ2) was found in few characters viz. primary branches per vine, fruit length, pistillate flower per vine, fruits per vine, fruit yield per vine and yield (q/ ha) suggested the role of dominance components for this trait and other trait were showed non-significant.The estimated thireteen characters for E component for nodes on main vine, primary branches per vine, days to first fruit harvest, fruits per vine and average fruit weight were found significant and rest of the traits were non-significant (Table 2).The average degree of dominance (Ĥ1/ D)1/2 involve in the action of genes was found as over dominance for all the traits except for fruit length (cm) (Table 2). The proportion of (Ve) allele with positive and negative alleles (/) in the parents, If the ratio is (0.25) showed indicates symmetry of +Ve and –Ve alleles and less than (< 1) , it indicates asymmetry of +Ve and –Ve alleles. The evaluated data for the all trait was showed asymmetry allele (dominance) with positive and negative in the parents. (Table 2.).

The ratio of KD/KR or [(4DĤ1)1/2 +F/(4DĤ1)1/2 –F] was showed more than (> 1) indicates more of dominant alleles in the parents. If it is less than (<1), it indicates more of recessive alleles in the parents and if is equal to (1), it indicates equal proportion of dominant and recessive alleles in the parents. The estimated data were

showed more of dominance allele in parents for all the traits except and node number of first pistillate flower indicate value less than (<1) more of recessive alleles in parents (Table No 2). The ratio, (ĥ2/) indicates the number of groups of gene in the parents which control the character and exhibited dominance. The depicted that the number of major gene groups controlling the inheritance of characters in population was found to be one and negative for all the traits excluding primary branches per vine, fruits per vine, fruit yield per vine, yield in quintal per hectare. While, the estimated of (ĥ2/) was more than one which suggested that two major gene in single qualitative traits primary branches per vine, fruits per vine, fruit yield per vine, yield in quintal per hectare involve in inheritance for dominance (Table No.2).

The correlation coefficient (r) between parental order of dominance (Wr+Vr) and parental measurement (Yr) was positive for all the traits indicated excess of recessive gene for these characters in the parental population. For rest of the characters including days to first fruit harvest, vine length, this value of (r) was negative which indicated preponderance of dominant gene in the parents (Table No.2). The value of t2 for days to node number of first staminate flower, node number of first pistillate flower, days to first fruit harvest and vine length was found significant and rest of traits are non-significant indicated the validity of the hypothesis of assumption of diallel cross analysis. (Table No.2).The positive values of F for almost all the traits under study showed that there is an excess of dominance gene in the inheritance of these traits among the parents except node number of first pistillate flower this traits showed that there is an excess of recessive gene in the inheritance among the parents.
This suggested that heterosis breeding might be advantageous for improvement of yield and its component traits in bottle gourd. These findings are similar to that of Sirohi *et al*. (1986); Maurya *et al*. (1993); Dubey and Maurya (2003); Singh *et al*. (2005) and Sharma *et al*. (2010).

Table.1

S. No.	Parental Line	Source	Important characters
1	BRBG 51-2	BAU, Sabour	Long, bottle shape, late but higher yielder
2	BRBG 21-2	BAU, Sabour	Early, cylindrical, promising and higher yielder
3	BRBG 65	BAU, Sabour	Long, bottle shape, late but higher yielder.
4	BRBG 190	BAU, Sabour	Small, round, specific seed colour and size.
5	BRBG 42-2	BAU, Sabour	Club shaped, good for cooking, deep green, striped and higher yielder
6	Pusa Naveen	IARI, Pusa (N. Delhi)	Small, cylindrical, early with higher No. of fruits and yield/ vine
7	Punjab Komal	PAU, (Ludhiana)	Small, round, very early, higher No. of fruits/ vine

Table-2: Estimation of Gene action of Morphological and yield characters

Components of variation	NNFSF	NNFPF	NMV	PB/V	DFFH	VL(m)	FL(m)
$\hat{D}$(Additive effect)	1.51*±0.54	0.32±0.60	25.20*±5.32	5.61*±1.11	6.81±5.71	0.45±0.295	52.45*±5.03
$\hat{H}_1$(Dominance effect)	6.28*±1.31	4.27*±1.45	51.66*±12.82	8.24*±2.66	59.98*±13.76	1.60*±0.711	44.34* ±12.109
$\hat{H}_2$	4.38*±1.161	3.88*±1.28	38.87*±11.30	-7.14*±2.34	45.94*±12.12	1.43*±0.63	30.90*±10.67
$\hat{F}$	3.31*± 1.31	-0.72±1.44	34.07*±12.77	3.80*±2.65	16.20±13.71	0.50±0.71	30.85*± 12.06
$\hat{h}^2$	-0.04±0.78	-0.136±0.86	11.71±11.30	7.20*±1.57	-2.59±12.13	0.30±0.42	26.83*±7.16
E	0.19±0.19	0.27±0.21	4.25*±1.88	1.01*±0.39	5.66*±2.02	0.11±.0.10	1.00±1.77
$(\hat{H}_1/\hat{D})^{1/2}$	2.03	3.62	1.432	1.21	2.97	1.87	0.92
$\hat{H}_2/4\hat{H}_1$	0.17	0.23	0.19	0.22	0.19	0.22	0.17
$(4\hat{D}\hat{H}_1)^{1/2}+\hat{F}/(4\hat{D}\hat{H}_1)^{1/2}-\hat{F})$	3.31	0.53	2.79	1.78	2.34	1.84	1.94
$(\hat{h}^2/\hat{H}_2)$	-0.01	-0.03	0.30	1.00	-0.05	0.22	0.87
r(correlation coefficient)	0.50	0.17	0.75	0.72	-0.02	- 0.46	0.75
t^2	3.00*	5.41*	0.22	0.14	9.01*	3.25*	0.26

***** - Significant at 5 per cent probability level ****** - Significant at 1 per cent probability level**, NNFSF**: Node No of First Staminate Flower, **NNFPF**: Node No of First Pistillate Flower, NMV: Nodes On Main Vine **PB/V**: Primary Branches/ Vine, **DFFH:** Days to first fruit harvest, **VL**: Vine length (m), **FL**: Fruit Length (cm)

Cont. Estimation of Gene action of Morphological and yield characters

Components of variation	FG(cm)	PF/V	F/V	AFW(Kg)	Fy/v	Y(q/ha)
$\hat{D}$(Additive effect)	8.30*±1.36	5.17*±0.75	0.46*±0.14	0.01*±0.001	0.10±0.194	665.35±1242.53
$\hat{H}_1$(Dominance effect)	13.83*±3.27	7.92*±1.82	2.70*±0.33	0.01*±0.004	3.90*±0.465	25017.55*±2991.36
$\hat{H}_2$	11.25*±2.88	6.26*±1.60	2.63*±0.29	0.01*±0.003	3.70*±0.411	23710.95*±2635.80
F	1.45±3.26	7.92*±1.81	0.18±0.330	0.005±0.004	0.17±0.465	1143.81±2980.80
$\hat{h}^2$	3.74±1.94	5.96*±1.07	2.71*±0.196	0.003±0.002	4.58*±0.276	29310.02*±1770.33
E	0.93±0.48	0.46±0.267	0.22*±0.048	0.001*±0.0006	0.12±.068	772.85±439.30
$(\hat{H}_1/\hat{D})^{1/2}$	1.29	1.24	2.40	1.17	6.13	6.13
$\hat{H}_2/4\hat{H}_1$	0.20	0.20	0.24	0.19	0.24	0.24
$(4\hat{D}\hat{H}_1)^{1/2}+F/(\hat{4}D\hat{H}_1)^{1/2}-F)$ ^	1.15	2.41	1.17	1.50	1.33	1.33
$(\hat{h}^2/\hat{H}_2)$	0.33	0.95	1.03	0.31	1.23	1.23
r(correlation coefficient)	0.74	0.60	0.93	0.86	0.74	0.74
t^2	0.03	0.18	0.89	1.79	2.61	2.62

* - Significant at 5 per cent probability level ** - Significant at 1 per cent probability level), FG: Fruit Girth (cm), PF/V: Pistillate Flowers per Vine, F/V: Fruits per Vine, AFW: Average fruit weight (kg), Fy/v: Fruit Yield perVine, Y: Yield (q/ha)

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