

Studies on Variability, Heritability and Genetic Advance for Yield and It's Contributing Traits in Bottle Gourd (*Lagenaria siceraria* (Mol.) Standl.)

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ABSTRACT

Genetic variability, heritability and genetic advance were studied at genotypic and phenotypic levels in 100 treatments (10 parents + 45 F1s and 45 F2s) of bottle gourd for sixteen qualitative and quantitative traits during *zaid* 2021. The experimental design which is used to conduct the experiment was randomized block design. In F1, the mean sum of squares of genotypes were observed highly significant differences among the treatments for days to first staminate flower anthesis, days to first pistillate flower, node number to first staminate flower appears, node number to first pistillate flower appears, ratio of pistillate: staminate flowers, internodal length (cm), vine length at last picking stage (m), number of primary branches per plant, average weight per fruit (kg), number of fruits per plant, fruit length (cm), total soluble solids (TSS) °Brix, specific gravity of fruits (g/cc), dry matter content (%) and fruit yield per plant (kg). In case of F2, highly significant differences were recorded among the treatments, parents, F2s and parent vs F2 for all the characters except Specific gravity of fruits for the treatments and F2s while for days to first staminate flower anthesis, days to first pistillate flower, Internodal length, days to first fruit harvest and number of fruit /plant. The result of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters. In case of F¹, the highest genotypic as well as phenotypic coefficient of variation were observed in the ratio of pistillate : staminate flowers followed by number of fruits per plant, average weight per fruit, fruit yield per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in specific gravity of fruits (g/cc) In case of F2s, the highest genotypic as well as phenotypic coefficient of variation were observed in the fruit diameter followed by ratio of pistillate :staminate flowers followed by number of fruits per plant, average weight per fruit, fruit yield per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in days to first fruit harvest. Heritability result showed for different traits in the F1 high estimate of heritability in broad sense was recorded for ratio of pistillate: staminate flowers, number of fruits per plant, average weight per fruit (kg), fruit yield per plant and fruit length while in F2 for ratio of pistillate: staminate flowers, number of fruits per plant. High heritability coupled with high genetic advance in percent of mean were observed for Ratio of pistillate: staminate flower, No. of fruit/ plant, Average weight per fruit (kg), followed by Fruit yield /plant per plant(kg) while in F2 Ratio of pistillate: staminate flower, No. of fruit /plant, fruit length, Fruit yield /plant per plant(kg) showed high heritability coupled with high genetic advance in percent over mean.

Key words: Bottle gourd, Variability, Heritability, Genetic advance.

Introduction

Bottle gourd is one of the most nutritive vegetable crops for human and tone up for energy and vigour, because it contains valuable source of carbohydrates, proteins, vitamins and minerals. The edible 100g fresh fruits of bottle gourd contains fats (0.5%), proteins (0.20%), carbohydrates (2.9%), Vitamin C (11mg) and minerals (0.5%) such as calcium, iron, potassium and phosphorous. Tender fruits of Bottle gourd used as vegetable and for preparation of sweets (Halva, Kheer, Petha and Burfi) and Pickles. Kofta is most popular preparation by this. Bottle gourd has cooling effect and prevents constipation and has diuretic and cardio-tonic properties. Bottle gourd is also used in ayurvedic pharmacopoeia of India. Its fruits are traditionally used as a nutritive agent having cardio protective, cardio tonic, controlling blood pressure, general tonic, diuretic, aphrodisiac, antidote to certain poisons and scorpion stings, alternative purgative, and cooling effects. It cures pain, ulcers, and fever and used also for pectoral-cough, asthma, and other bronchial disorders. It has been used routinely as a source of rootstock for watermelon and other cucurbits in both Korea and Japan to reduce the incidence of soil-borne diseases and to promote the vigour of the root system of the crop in low temperature conditions (Lee and Oda, 2003). Selection of superior parents flaunting better heritability and genetic advance for numerous characters is an essential prerequisite for any yield enhancement programme. The knowledge of inheritable variability being within the different parameters contributing to the yield is an important creation for yield improvement. The efficacy of selection depends upon the magnitude of inheritable variability for yield and yield contributing traits in the parentage material. The knowledge of heritability and genetic advance harness the breeder to pick superior parents to initiate an effective and fruitful crossing programme.

Materials and Methods

The research trial was conducted during *zaid*, 2021 at Main Experiment Station, Department of Vegetable Science, Kalyanpur, C. S. Azad University of

Agriculture and Technology, Kanpur in randomized block design with three replications. Sixteen qualitative and quantitative traits namely, 1. Days to first staminate flower anthesis, 2. Days to first pistillate flower, 3. Node number to first staminate flower appears, 4. Node number to first pistillate flower appears, 5. Ratio of pistillate : staminate flowers, 6. Internodal length (cm), 7. Vine length at last picking stage (m), 8. Number of primary branches per plant. 9. Days to first fruit harvest, 10. Average weight / fruit (kg), 11. Number of fruits per plant, 12. Fruit length (cm), 13. Total soluble solids (TSS)⁰ Brix, 14. Specific gravity of fruits (g/cc), 15. Dry matter content (%) and 16. Fruit yield per plant (kg) were studied for the estimation of genetic variability, heritability and genetic advance.

Results and Discussion

The mean sum of square of genotypes further divided into treatments parents, parents' *vs* F1 and parents' *vs* F2 population. In case of F1, highly significant differences were observed among the treatments for days to first staminate flower anthesis, days to first pistillate flower, node number to first staminate flower appears, node number to first pistillate flower appears, ratio of pistillate: staminate flowers, internodal length (cm), vine length at last picking stage (m), number of primary branches per plant, average weight per fruit (kg), number of fruits per plant, fruit length (cm), total soluble solids (TSS)⁰Brix, specific gravity of fruits (g/cc), dry matter content (%) and fruit yield per plant (kg) at 1% significance level. Variance due to parents were recorded highly significant for all the characters is found significantly different at 1% level of significance while variance due to F1's was found highly significant for all the characters. Variance due to parent *vs* F1, were highly significant for Node no. To first staminate flower appears, Ratio of pistillate: staminate flower, Internodal length (cm), vine length at last picking stage (m), No. Of primary branches per plant, number of primary branches per plant, Avg. fruit wt. (kg), No. of fruit /plant, fruit length (cm), total soluble solids (TSS)⁰ Brix, Dry matter content (%) and fruit yield per plant (kg) at 1% level of significance, Days to first fruit harvest and Specific

Table 1. Analysis of variance for parent and F₁

Sourced of variation	df	Days to first staminate flower anthesis	Days to first pistillate flower appears	Node No. to first staminate flower	Node no. to first pistillate flower	Ratio of pistillate: staminate flower	Internodal length (cm)	Vine length at last picking stage(m)	No.of primary branches per plant	Days to first fruit harvest	Avg. fruit wt (kg)	No. of fruit/plant	Fruit length (cm)	TSS	Specific-gravity of fruits (g/cc)	Dry Matter Content (%)	Fruit yield/plant per plant (kg)
Rep.	2	0.496	0.586	0.025	0.148	0.0005	0.282	0.043	0.074	7.985	0.008	0.007	5.194	0.007	0.002	0.011	0.005
Treat	54	4.108**	6.061**	6.083**	10.61**	0.0249**	3.700**	0.432**	1.725**	12.783**	0.084**	4.649**	91.468**	0.424**	0.001**	0.683**	1.936**
Error	108	0.470	0.471	0.252	0.384	0.0001	0.226	0.045	0.063	5.264	0.001	0.050	2.789	0.024	0.000	0.047	0.040
Total	164	1.668	2.313	2.169	3.749	0.0083	1.370	0.172	0.610	7.773	0.029	1.564	32.017	0.156	0.000	0.256	0.664

gravity of fruits showed significance at 5% level of significance while Days to first staminate flower anthesis, Days to first pistillate flower and Node no. To first pistillate flower appears were not found significant at any level of significance.

In case of F2 highly significant differences were recorded among the treatments, parents, F2s and parent vs F2 for all the characters except Specific gravity of fruits for treatments and F2s while for days to first staminate flower anthesis, days to first pistillate flower, Internodal length, days to first fruit harvest and no. Of fruit /plant similar finding were found by Pandit *et al.* (2008).

Coefficient of Variation

The result of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters similar result obtained by Kumar *et al.* (2020) and Varalakshmi (2018).

In case of F1s, the highest genotypic as well as phenotypic coefficient of variation were observed in the ratio of pistillate : staminate flowers followed by number of fruits per plant, average weight per fruit, fruit yield per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in specific gravity of fruits (g/cc)

In case of F2s, the highest genotypic as well as phenotypic coefficient of variation were observed in the fruit length followed by node no. to first pistillate flower appears, Node no. To first staminate flower appears.

Heritability and Genetic Advance

The estimates of heritability in narrow sense of a character are important to the breeder since it indicates the possibility and extent to which improvement is possible by selection. It also indicates to direction of selection pressure to be applied for a trait during selection because it measures relationship between parent and their progeny, so widely used in determining the degree to which a character may be transmitted from parents to progeny. High heritability along with high genetic advance in per cent of mean provide good opportunity for further improvement in advance generations.

In F1 high heritability coupled with high genetic advance in percent of mean were observed for Ratio of pistillate: staminate flower, No. Of fruit /plant, Average weight per fruit (kg), followed by Fruit yield /plant per plant (kg) and all other characters

except Days to first fruit harvest, Fruit yield /plant per plant (kg), fruit length while high heritability coupled with moderate genetic advance as percent of mean internodal length, No. Of primary branches per plant similar result obtained by Chandra shekhar *et al.* (2018) for days to first male flower appearance, node at which first female flower appears, number of fruits per plant, weight of the fruit (g), fruit length (cm) and Singh *et al.* (2015) for fruit length. In F2 generation high heritability coupled

with high genetic advance in percent of mean were observed for Ratio of pistillate: staminate flower, No. of fruit /plant, fruit length, Fruit yield /plant per plant(kg) while high heritability coupled with moderate genetic advance as percent of mean T.S.S. & dry matter content (%) similar result obtained by Abhishek *et al.* (2020) for days of male flowering, days of female flowering, fruit yield/plot, number of fruits per plot, fruit yield per plant (Kg) and Deepthi *et al.* (2016) for node at first male appeared,

Table 2. Genetic variability-F₁

Genotypes	Mean	Min	Max	var (g)	var (p)	Heritability (%)	GA	GA% mean	GCV (%)	PCV (%)
Days to first staminate flower anthesis	46.79	44.93	50.06	1.21	1.68	72.08	1.93	4.12	2.47	5.28
Days to first pistillate flower	48.71	45.55	52.06	1.86	2.33	79.82	2.51	5.16	3.22	6.61
Node no. To first stiminate flower appears	12.19	8.90	14.93	1.94	2.20	88.52	2.70	22.16	3.46	28.40
Nodeno. To first pistillate flower appears	16.58	12.47	21.43	3.41	3.79	89.89	3.61	21.75	4.62	27.87
Ratio of pistillate: staminate flower	0.323	0.135	0.483	0.01	0.01	98.24	0.19	57.46	0.24	73.64
Internodal length (cm)	12.70	6.86	14.60	1.16	1.38	83.69	2.03	15.97	2.60	20.46
Vine length at last picking stage (m)	5.50	4.91	7.06	0.13	0.17	74.31	0.64	11.60	0.82	14.86
No. of primary branches per plant	6.51	4.46	8.20	0.55	0.62	89.83	1.45	22.32	1.86	28.60
Days to first fruit harvest	60.16	54.68	64.69	2.51	7.77	32.25	1.85	3.08	2.37	3.95
Avg fruit wt (kg)	1.00	0.66	1.37	0.03	0.03	94.90	0.33	33.38	0.43	42.78
No. Of fruit/plant	4.98	3.03	8.21	1.53	1.58	96.85	2.51	50.39	3.22	64.58
Fruit length (cm)	42.88	23.52	51.51	29.56	32.35	91.38	10.71	24.97	13.72	31.99
TSS	3.51	2.76	4.15	0.13	0.16	84.52	0.69	19.67	0.89	25.21
Specific gravity of fruits (g/cc)	0.923	0.907	0.967	0.00	0.00	39.36	0.01	1.50	0.02	1.92
Dry matter content (%)	5.01	4.18	5.95	0.21	0.26	81.92	0.86	17.14	1.10	21.97
Fruit yeild/plant per plant (kg)	4.93	3.78	6.88	0.63	0.67	94.07	1.59	32.24	2.04	41.32

Table 3. Genetic variability-F₂

Genotypes	Mean	Min	Max	var (g)	var (p)	Heritability (%)	GA	GA% mean	GCV (%)	PCV (%)
Days to first staminate flower anthesis	46.92	45.32	48.97	0.76	1.49	51.10	1.28	2.74	1.65	3.51
Days to first pistillate flower	48.83	46.60	51.41	1.03	1.83	56.29	1.57	3.21	2.01	4.12
Node no. To first stiminate flower appears	12.36	9.20	14.73	1.79	2.04	88.04	2.59	20.93	3.32	26.83
Nodeno. To first pistillate flower appears	16.79	13.60	20.20	3.85	4.37	88.20	3.80	22.61	4.87	28.98
Ratio of pistillate: staminate flower	0.276	0.153	0.383	0.01	0.01	97.72	0.16	57.27	0.20	73.40
Internodal length (cm)	12.41	11.19	14.32	1.12	1.38	81.39	1.97	15.84	2.52	20.30
Vine length at last picking stage(m)	5.32	4.91	6.12	0.14	0.18	74.32	0.65	12.32	0.84	15.78
No. of primary branches per plant	6.43	4.84	7.80	0.44	0.52	85.65	1.27	19.77	1.63	25.34
Days to first fruit harvest	61.47	56.22	64.76	1.81	7.61	23.72	1.35	2.19	1.73	2.81
Avg. fruit wt (kg)	1.01	0.76	1.32	0.02	0.02	93.26	0.28	28.35	0.37	36.33
No. Of fruit/plant	4.76	3.21	7.83	0.85	0.89	96.13	1.87	39.22	2.39	50.26
Fruit length (cm)	41.81	23.45	50.19	49.35	52.18	94.58	14.07	33.66	18.04	43.14
TSS	3.74	3.08	4.37	0.14	0.15	88.28	0.72	19.16	0.92	24.55
Specific gravity of fruits (g/cc)	0.917	0.900	0.953	0.00	0.00	45.62	0.06	6.59	0.08	8.44
Dry matter content (%)	5.14	4.24	5.95	0.25	0.29	87.05	0.97	18.81	1.24	24.11
Fruit yeild/plant per plant (kg)	4.87	3.67	7.00	0.51	0.54	93.44	1.42	29.15	1.82	37.36

number of fruits per vine, fruit weight (g), fruit length (cm), fruit diameter (cm).

Conclusion

The results of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters. In case of F_1 s, the highest genotypic as well as phenotypic coefficient of variation were observed in the ratio of pistillate : staminate flowers followed by number of fruits per plant, average weight per fruit, fruit yield per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in specific gravity of fruits (g/cc) In case of F_2 s, the highest genotypic as well as phenotypic coefficient of variation were observed in the fruit diameter followed by ratio of pistillate: staminate flowers followed by number of fruits per plant, average weight per fruit, fruit yield per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in days to first fruit harvest. Heritability result showed for different traits in the F_1 high estimate of heritability in broad sense was recorded for ratio of pistillate: staminate flowers, number of fruits per plant, average weight per fruit (kg), fruit yield per plant and fruit length while in F_2 for ratio of pistillate: staminate flowers, number of fruits per plant. High heritability coupled with high genetic advance in percent of mean were observed for Ratio of pistillate: staminate flower, No. of fruit/plant, Average weight per fruit (kg), followed by Fruit yield /plant per plant (kg) while in F_2 Ratio of pistillate: staminate flower, No. of fruit /plant, fruit length, Fruit yield /plant per plant (kg) showed high heritability coupled with high genetic advance in percent over mean.

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