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Studies on variability, heritability and genetic advance for growth, yield, and quality traits in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]

Arun Kumar Verma, KP Singh, Lokendra Singh, PK Singh, Virendra Kumar, Bankey Lal and Satyendra Kumar

Abstract

An investigation was conducted with ten diverse bottle gourd (*L. siceraria*) strains/cultivars, including Pusa Naveen, Pusa Santusthi, Kalyanpur Long green, KBGL-20, KBGL-14, KBGL-22, KBGL-29, NDBG-1, NDBG-121 and H-22. The study was based on fifteen characters, namely 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, days to first fruit harvest, average weight per fruit (kg), number of fruits per plant, fruit diameter (cm), fruit length (cm), duration of crop (days), total soluble solids (TSS) ⁰Brix, specific gravity of fruits (g/cc) and fruit yield per plant (kg). The result of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters and high heritability coupled with high genetic advance in percent of mean for node number to first staminate and pistillate flower appears, ratio of pistillate: staminate flowers, average weight per fruit, number of fruits per plant, fruit length in both F₁ and F₂ generations and fruit yield per plant in F₂. Indicating that most likely that heritability is due to additive gene effects and selection may be effective.

Keywords: Variability, heritability, genetic advance, bottle gourd

Introduction

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] is an important vegetable crop which belongs to the family cucurbitaceae. The family consists of about 118 genera and 825 species. The status of vegetable production is over 184.39 million tonnes from an area of 10.26 million hectares, in which bottle gourd contribute 2.683 million tonnes production with area of 0.157 million hectares (NHB, 2017-18). 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 100 g fresh fruits of bottle gourd contain fats (0.5%), proteins (0.20%), carbohydrates (2.9%), Vitamin C (11mg) and minerals (0.5%) such as calcium, iron, potassium and phosphorous (Thamburaj and Narendra Singh-2013) [7]. Bottle gourd is highly cross-pollinated crops due to its monoecious and romonoecious nature (1). The amount of cross pollination ranges from 60 to 80 per cent (2). Due to cross-pollinated in nature; it has wide range of variability for maturity, yield and fruit characters like shape and size. Many of the quantitative traits such as number of fruits per plant and yield per plant are highly influenced by environmental conditions partitioning the overall variability into heritable components which will be immense help in any planned breeding programme. Heritability and genetic advance are important parameters in predicting the genetic gain under selection. These estimates help the breeder in selection of genotypes from diverse genetic populations. 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.

Material and Methods

The experiments of the present research work were conducted with ten diverse parents viz. Pusa Naveen, Pusa Santusthi, Kalyanpur Long green, KBGL-20, KBGL-14, KBGL-22, KBGL-29, NDBG-1, NDBG-121 and H-22. All the 10 genotypes have crossed in diallel mating design to produce 45 F₁s hybrids (excluded reciprocal crosses) during Zaid 2020.

Mature seeds of F₁s and parental selfed lines have to be harvested separately and procured for growing in the next crop season. Half seeds of all the F₁s will be grown and the plants so obtained will be selfed during Kharif 2020 to produce source seed of F₂s generation. Mature seeds will be harvested and procured for growing in final trial. During Zaid 2021 the final trial have been conducted taking total 100 treatments (10 parents + 45 F₁s and 45 F₂s) in Randomized Block Design with three replications at Vegetable Research Farm, Kalyanpur, C. S. Azad University of Agriculture and Technology, Kanpur. In the final trial the treatments were planted in rows spaced at 3.0 meters apart with a plant to plant spacing of 0.5 meter of Single row plot for Parents, F₁s

while for F₂s two rows plot four meter long. The observations were recorded on the five plants for parents and F₁s as well as 10 competitive plants of F₂'s were selected in each replication for fruit yield per plant and its components were summed up and divided by five to get mean value. The observation were recorded 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, days to first fruit harvest, average weight per fruit (kg), number of fruits per plant, fruit diameter (cm), fruit length (cm), duration of crop (days), total soluble solids (TSS) °Brix, specific gravity of fruits (g/cc) and fruit yield per plant (kg).

Table 1: Estimates of heritability (narrow sense), genetic advance, genetic advance in percent of mean, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) for 15 characters in bottle gourd

Sr. No.	Characters	F1					F2				
		Heritability in narrow sense (h ² _{ns})%	Genetic advance	Genetic advance in percent of mean	GCV	PCV	Heritability in narrow sense (h ² _{ns})%	Genetic advance	Genetic advance in percent of mean	GCV	PCV
1	Node number to first staminate flower appears	41.6	2.748	22.457	11.40	11.93	38.3	2.626	21.195	10.80	11.34
2	Node number to first pistillate flower appears	65.4	3.703	22.326	11.23	11.63	55.4	3.488	20.887	10.54	10.96
3	Ratio of pistillate: staminate flowers	48.8	0.175	58.919	29.22	29.85	39.2	0.142	49.733	25.06	26.02
4	Internodal length (cm)	63.0	1.850	14.58	8.28	9.69	66.2	1.792	14.465	8.33	9.89
5	Vine length at last picking stage (m)	54.8	0.448	8.144	5.78	8.46	52.5	0.524	9.764	6.49	8.90
6	Number of primary branches per plant	66.0	1.260	19.337	10.92	12.71	62.6	1.159	17.928	10.31	12.22
7	Days to first fruit harvest	58.0	1.146	1.904	2.17	5.10	48.4	0.477	0.777	1.39	5.13
8	Average weight / fruit (kg)	69.9	0.240	23.846	14.13	17.26	64.1	0.232	22.863	13.37	16.11
9	Number of fruits per plant	65.7	2.428	47.839	24.13	25.08	74.0	1.888	38.794	19.03	19.24
10	Fruit diameter (cm)	29.3	2.507	33.641	16.53	16.75	69.4	4.378	55.088	26.83	26.92
11	Fruit length (cm)	64.2	10.622	24.727	12.63	13.29	57.5	14.267	34.174	17.08	17.60
12	Duration of crop (days)	67.5	2.544	2.323	2.32	4.77	63.5	1.964	1.736	2.02	4.85
13	Total soluble solids (TSS) °Brix	56.7	0.727	20.733	10.35	10.65	44.2	0.678	18.723	9.43	9.80
14	Specific gravity of fruits (g/cc)	33.6	0.030	3.300	1.78	1.98	27.3	0.032	3.439	1.82	1.98
15	Fruit yield/ plant (kg)	58.4	1.406	28.298	15.41	17.30	54.7	1.146	23.612	13.10	14.97

Result and Discussion

The result of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters studies result showed in table 1. highest genotypic as well as phenotypic coefficient of variation were observed in the pistillate: staminate flowers, number of fruits per plant, fruit length, average weight per fruit, fruit yield per plant, node number to first staminate flower appears, node number to first pistillate flower appears, number of primary branches per plant, while lowest genotypic as well as phenotypic coefficient of variation were observed in specific gravity of fruits (g/cc) in both F₁ and F₂ generations, similar result obtained by Chandrashekhar *et al.* (2018) Varalakshmi (2018), Kumar *et al.* (2011). High heritability coupled with high genetic advance in percent of mean were observed for node number to first staminate flower appears, node number to first pistillate flower appears, ratio of pistillate: staminate flowers, average weight per fruit, number of fruits per plant, fruit length in both and fruit diameter, fruit yield per plant in F₂ generation, while high heritability coupled with moderate genetic advance as percent of mean internodal length, number of primary branches per plant in both and total soluble solids (TSS) °Brix in F₂ generation. moderate heritability coupled with low genetic advance in percent of mean were observed for Fruit diameter similar in F₁ and specific gravity of fruits (g/cc) in F₂. similar result obtained by Lal *et al.* (2021) [5], Abhishek *et al.* (2020) [1], Deepthi *et al.* (2016) [3]. Singh *et al.*

(2015) [8].

Conclusion

The result of phenotypic coefficient of variation (PCV) were higher than genotypic coefficient of variation (GCV) for all the characters. In case of F₁^s, the highest genotypic as well as phenotypic coefficient of variation were observed in the ratio of pistillate: staminate flowers and number of fruits per plant while In F₂^s, for fruit diameter followed by ratio of pistillate: staminate flowers and number of fruits per plant. High heritability coupled with high genetic advance in percent of mean were observed for node number to first staminate flower appears, node number to first pistillate flower appears, ratio of pistillate: staminate flowers, average weight per fruit, number of fruits per plant, fruit length in F₁ and F₂ while fruit yield per plant in F₂.

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