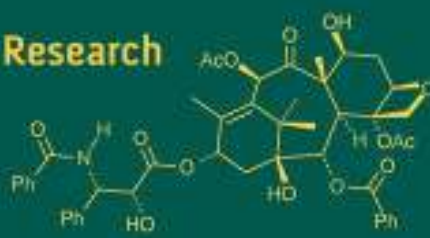
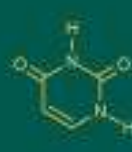


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Genetic variability studies in bottle gourd [*Lagenaria siceraria*]

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Abstract

The study titled "Genetic Variability Studies in Bottle Gourd [*Lagenaria siceraria*]" was conducted at the Experimental Department of Horticulture, Naini agricultural Institute (NAI), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, during kharif-2024-2025. The experiment was conducted in a Randomized Block Design (RBD) with three blocks and plant spacing of 2.5×0.50 m for 11 varieties. According to the experimental result from current study, bottle gourd varieties 2021/BOGVAR was found to be most suitable for Germination% 2021/BOGVAR-1(99.33). Day to first appearance of male flower in 2021/BOGVAR-5 (40.46), Days to first appearance of female flower in 2021/ BOGVAR-5 (46.67), Total no of male flower/ Plant 2021/BOGVAR-1 (48.67).Total no of female flower/ plant 2021/BOGVAR-1 (31.12) Days to first fruit harvest 2021/BOGVAR-9(15.67), Fruit diameter (mm) 2021/BOGVAR-4 (250.280) fruit length (cm) 2021/BOGVAR-2 (34.36).Vin length at last harvest2021/BOGVAR-1(4.80),Weight of individual fruit (g) 2021/BOGVAR-1(557.87).No. of fruits/plants 2021/BOGVAR-1 (8.00). Fruit yield/plant (kg) 2021/BOGVAR-1 (4.12).TSS (°BRIX) in 2021/BOGVAR-1 (3.60). Highest recorded Juice (pH) 2021/BOGVAR-1 (6.3). 2021/BOGVAR-1 Yield/ha best in term of Germination%, No. of fruit/plant, Weight of individual fruit, Vin length at last harvest and fruit yield t(ha) Prayagraj under agro climatic conditions.

Keywords: Bottle gourd, GCV, PCV, heritability, genetic advance

Introduction

The bottle gourd [*Lagenaria siceraria* (Mol) Standl.] is a well-known member of the "Cucurbitaceae" family and is likely one of the oldest crops grown during the warm season all over the world. Its somatic chromosome number is ($2n=2x=22$). The Latin word lagena, which means the bottle, is whence the genus *Lagenaria* gets its name. In various regions of India, it is also known as calabash, white flowered gourd, zucca melon, doodhi and lauki (Deore *et al.*, 2009) [6].

The bottle gourd is a widely produced, nutrient-dense vegetable that is part of the Cucurbitaceous family, which is the most important family economically and provides humans with palatable and nourishing fruits (Bisognin, 2002). Fruits are utilized as kofta, petha, halwa, kopoor kand, paratha, rayata, pickles (particularly on hills), and sweets. According to Desai and Musmade (1998) [7], the fruits' various portions have several therapeutic qualities. They include vitamin C (11 mg), thiamine (0.044 mg), riboflavin (0.023 mg), niacin (0.33 mg), mineral matters (0.05%), carbs (2.9%), lipids (0.5%), protein (0.2%), and moisture (96.3%). It is a widely utilized vegetable that is easy to digest. It is also advised for convalescence, and its juice is suggested for patients with diabetes and heart disease. With the exception of calcium, zinc, cobalt, and chromium, the seeds are triangular or rectangular in shape, gray to white in color, and contain more important amino acids and micronutrients than fruits.

To create high-yielding cultivars, genetic enhancement is desperately needed. The selection of certain valuable materials from the current population may benefit from the research of genetic diversity, heritability, and genetic advancement for yield and its components. The degree of genetic variability found in crop species is important because it gives the fundamental information for efficient selection. Heritability is the ratio of the total variation, or phenotypic variance, to the genetic variance in the population. However, by applying a certain level of selection intensity, the genetic advance forecasts the amount of gain anticipated. Therefore, knowledge of these criteria is crucial for choosing the approach to be

used. Individuals are chosen based on their phenotype in order to develop their traits in a desired way. The genetic advance, which is a measure of this anticipated improvement, is dependent on genetic variability, the extent of environmental influence, the interplay of genetic diversity and variability components, and the level of selection. The phenotypic heterogeneity across various plants or females in the base population, the heritability of the selected trait, and the selection intensity all influence genetic advancement under selection.

Materials and Methods

Eleven different bottle gourd genotypes were evaluated in an experiment conducted during the kharif of 2024 at the Experimental Department of Horticulture, Naini agricultural Institute (NAI), Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj. Two replications and a Randomized Block Design (RBD) were used to set up the experiment. Five randomly chosen plants of each genotype were observed for fifteen characters in each replication: vine length (cm), number of branches per

plant, node at which first female flower appears, number of days needed for first female flower appearance, number of male flowers, number of fruit per vine, number of days needed for first harvest, fruit length (cm), fruit diameter (cm), fruit weight (gm), fruit yield per vine (kg), fruit yield per plot (kg), fruit yield per hectare (q), and T.S.S (%). The generated data was averaged and then submitted to variability analysis. Coefficients of variation for genotype and phenotype were calculated using the equations proposed by Burton^[3] and DeVane (1953)^[4]. PCV and GCV levels were classified by Sivasubramanian and Menon (1973)^[19] as low (0-10%), moderate (10.1-20%), and high (>20%).

Heritability in broad sense was calculated by the formula as suggested by Allard (1960)^[11]. Heritability was classified as suggested Robinson *et al.*, (1949)^[15] into low (0-30%), moderate (30.1-60%) and high (>60%). The Genetic advance (GA) resulting from selection of five per cent superior individuals was worked out as suggested by Allard (1960)^[11]. The GAM% was categorized into low (0-10%), moderate (10.1-20%) and high (>20%) as suggested by Johnson *et al.* (1955)^[9].

Sr. no.	Varieties	Symbols	Sources
1.	2021/Bogvar-1	T ₁	IIVR, Varanasi
2.	2021/ Bogvar-2	T ₂	IIVR, Varanasi
3.	2021/ Bogvar-3	T ₃	IIVR, Varanasi
4.	2021/ Bogvar-4	T ₄	IIVR, Varanasi
5.	2021/ Bogvar-5	T ₅	IIVR, Varanasi
6.	2021/ Bogvar-6	T ₆	IIVR, Varanasi
7.	2021/ Bogvar-7	T ₇	IIVR, Varanasi
8.	2021/Bogvar-8	T ₈	IIVR, Varanasi
9.	2021/Bogvar-9	T ₉	IIVR, Varanasi
10.	2021/Bogvar-10	T ₁₀	IIVR, Varanasi
11.	Sharda	T ₁₁	TANDA SEEDS CO.

Results and Discussion

The analysis of variance indicated significance higher amount of variability among the genotype for fifteen character studies *viz.*, vine length, number of branches per plant, node at which first female flower appear, days required first female appear, number of male flower, fruit length, fruit diameter, fruit weight, fruit yield per vine, fruit yield per plant and fruit yield per hectare are given in Table 1. Similar findings reported by Singh *et al.*, (2015)^[18] in bitter gourd, Thakur *et al.*, (2015)^[21], Damor *et al.*, (2016)^[4], Detaba *et al.*, (2017)^[5] in pointed gourd, Rambhau *et al.*, (2017)^[13] and Thakur *et al.*, (2017)^[22].

The phenotypic coefficient of Wide range of variability was observed for the majority of traits under study. Germination% showed a mean value of 792.44 with a range of (80.66 - 99.33), respectively. Days to appearance of 1st male flower and days to appearance of 1st female flower exhibited a range of (24.00 - 40.46) and (30.00 - 46.67) with a mean value of 33.47 and 37.61, respectively. Total no of male flower/ Plant and Total no of female flower/ plant exhibited a range of (38.21 - 48.67) and (28.12 - 31.12) with a mean value of 44.85 and 29.45, respectively. Days to first fruit harvest and Fruit diameter (mm) exhibited a range of (12.24 - 15.67) and (51.00 - 250.28) with a mean value of 13.72 and 89.46, respectively.

The mean values of 28.30 and 4.14, were recorded for Fruit length (cm) and Vine length at last harvest (m) exhibited a range of (20.33 - 34.36) and (3.71 - 4.80), respectively.

The various quality traits studied *i.e.*, Weight of individual fruit (g), No. of fruits/plant and Fruit yield/plant (kg)

exhibited a range of (1.00 - 11.00), (387.20 - 557.87) and (5.00 - 8.00) with a mean value of 6.00, 451.03 and 6.73, respectively. The various quality traits studied *i.e.*, TSS (°BRIX), Juice (pH) and Yield/ha (t) exhibited a range of (15.48 - 32.96) (2.20 - 3.60) and (1.93 - 4.12) with a mean value of 24.33, 2.81 and 3.04, respectively.

Estimates of phenotypic variances were observed to be higher than the corresponding genotypic variances for all the traits under study. Highest phenotypic and genotypic variances were recorded for Fruit diameter (mm) (5581.90, 5583.77), followed by Weight of individual fruit (g) (3526.04, 3550.39), and Yield/ha (t/ha) (32.68, 33.59). Rest of the characters recorded comparatively lower values of phenotypic and genotypic variances. The result is in confirmation with finding of Yadav^[22] and Kumar (2011)^[9], Sharma and Sengupta (2013)^[16], Mandal *et al.*, (2015)^[11] and Kumar *et al.*, (2018)^[9].

The genotypic coefficient variation ranged were categorized as low (0-10%), moderate (10-20%) and high (more than 20%) as suggested by Sivasubramanian^[19] and Madhavamenon (1973). Low PCV and GCV were noted for Juice (pH) (0.95), Total no of female flower/ plant (3.02), Germination% (5.71), Vine length at last harvest (m) (6.98), Total no of male flower/ Plant (7.42), Days to first fruit harvest (8.50), No. of fruits/plant (11.88), Days to first appearance of female flower (12.11), Weight of individual fruit (g) (13.17), Day to first appearance of male flower (15.58), TSS (°BRIX) (15.75), fruit length (cm) (16.09), were recorded in GCV however in PCV Juice (pH) (1.61), Total no of female flower/ plant (3.86), Germination%

(6.00), Total no of male flower/ Plant (7.96), Vine length at last harvest (m) (9.20), Days to first fruit harvest (10.78), Days to first appearance of female flower (12.46), Weight of individual fruit (g) (13.21), Day to first appearance of male flower (15.81), No. of fruits/plant (16.12), fruit length (cm) (16.58), TSS (°BRIX) (19.34), depicted moderate values of PCV and GCV. While as the Fruit yield/plant (kg) (19.99), Yield/ha (t/ha) (23.49), Fruit diameter (mm) (83.51) exhibited high in GCV, Fruit yield/plant (kg) (19.99), Yield/ha (t/ha) (23.49), Fruit diameter (mm) (83.51) exhibited high in PCV. The result is in confirmation with finding of Yadav [22] and Kumar (2011) [9], Sharma and Sengupta (2013) [16], Kumar *et al.*, (2014) [9] in Cucumber, Mandal *et al.*, (2015) [11] and Kumar *et al.*, (2018) [9].

Heritability in broad sense was found to be high for all traits (greater than 60 per cent). Highest genetic gain (genetic advance as percentage of mean) was recorded in Fruit diameter (mm) (99.97) followed by Weight of individual fruit (g) (99.31), Yield/ha (t) (97.29), Day to first appearance of male flower (97.17) and fruit length (cm) (94.17). While as lowest genetic gain (genetic advance as percentage of mean) was recorded for Juice (pH) (1.14).

Table 2. High heritability indicated that, through the character is least influenced by the environment effect. The selection for improvement of such character may not be useful because broad sense heritability is based on total genetic variance. The result is in confirmation with finding of Yadav [22] and Kumar (2011) [9], Sharma and Sengupta (2013) [16], Kumar *et al.*, (2014) [9] in Cucumber, Singh *et al.*, (2014) [17], Mandal *et al.*, (2015) [11], Rambabu *et al.*, (2017) [13] and Kumar *et al.*, (2018) [9].

The genetic advance were Fruit diameter (mm) (172.01), Yield/ha (t) (47.74), Fruit length (cm) (32.17), Day to first appearance of male flower (31.65), Fruit yield/plant (kg) (27.72), Weight of individual fruit (g) (27.03), TSS (°BRIX) (26.41) and Days to first appearance of female flower (24.25). This indicated that, genetic advance is high it shows that character is governed by additive genes and selection will be rewarding for improvement such traits. Similar finding reported by Yadav [22] and Kumar [9] (2011), Sharma and Sengupta (2013) [16], Kumar *et al.*, (2014) [9] in Cucumber, Singh *et al.*, (2014) [18], Manada *et al.*, (2015) [11], Rambabu *et al.*, (2017) [13] and Kumar *et al.*, (2018) [9].

Table 1: Analysis of variance for 15 characters of Bottle Gourd genotypes.

S.No.	Characters	Mean sum of squares		
		Replications (D.F=2)	Treatment (D.F=10)	Error (D.F=20)
1.	Germination%	6.415	86.485**	2.887
2.	Day to first appearance of male flower	1.760	82.393**	0.792
3.	Days to first appearance of female flower	2.69	63.45**	1.21
4.	Total no of male flower/ Plant	3.724	34.915**	1.676
5.	Total no of female flower/ plant	1.114	2.872*	0.501
6.	Days to first fruit harvest	1.841	4.908*	0.828
7.	Fruit diameter(mm)	3.724	16747.572**	1.876
8.	fruit length (cm)	2.851	63.492**	1.283
9.	Vine length at last harvest (m)	0.108	0.312*	0.062
10.	Weight of individual fruit (g)	54.124	10602.461**	24.356
11.	No. of fruits/plant	1.101	2.455*	0.538
12.	Fruit yield/plant (kg)	0.688	1.552*	0.446
13.	TSS (°BRIX)	0.221	0.687*	0.100
14.	Juice (pH)	0.015	0.017*	0.007
15.	Yield/ha (t)	2.0253	98.944**	0.911

Table 2: Estimation of components of variance and genetic parameters for different quantitative characters in Bottle Gourd.

Observation	Mean	Range	Vg	Vp	GCV	PCV	HERTI	GA	GA AS%
Germination%	92.44	80.66 - 99.33	27.87	30.75	5.71	6.00	90.61	10.35	11.20
Day to first appearance of male flower	33.47	24.00 - 40.46	27.20	27.99	15.58	15.81	97.17	10.59	31.65
Days to first appearance of female flower	37.61	30.00 - 46.67	20.75	21.96	12.11	12.46	94.49	9.12	24.25
Total no of male flower/ Plant	44.85	38.21 - 48.67	11.08	12.76	7.42	7.96	86.86	6.39	14.25
Total no of female flower/ plant	29.45	28.12 - 31.12	0.79	1.29	3.02	3.86	61.20	1.43	4.86
Days to first fruit harvest	13.72	12.24 - 15.67	1.36	2.19	8.50	10.78	62.14	1.89	13.80
Fruit diameter (mm)	89.46	51.00 - 250.28	5581.90	5583.77	83.51	83.53	99.97	153.88	172.01
Fruit length (cm)	28.30	20.33 - 34.36	20.74	22.02	16.09	16.58	94.17	9.10	32.17
Vine length at last harvest (m)	4.14	3.71 - 4.80	0.08	0.15	6.98	9.20	57.55	0.45	10.90
Weight of individual fruit (g)	6.00	1.00 - 11.00	3526.04	3550.39	13.17	13.21	99.31	121.90	27.03
No. of fruits/plant	451.03	387.20 - 557.87	0.64	1.18	11.88	16.12	54.30	1.21	18.04
Fruit yield/plant (kg)	6.73	5.00 - 8.00	0.37	0.81	19.99	29.70	45.29	0.84	27.72
TSS (°BRIX)	24.33	15.48 - 32.96	0.20	0.30	15.75	19.34	66.28	0.74	26.41
Juice (pH)	2.81	2.20 - 3.60	0.00	0.01	0.95	1.61	34.55	0.07	1.14
Yield/ha (t)	3.04	1.93 - 4.12	32.6776	33.5890	23.49	23.82	97.29	11.61	47.74

Conclusion

The study found that phenotypic coefficients of variation were slightly higher than genotypic coefficients of variation for all traits. High heritability and genetic gain were

observed in traits such as number of male flowers, vine length, number of primary branches, and number of fruits, fruit weight, fruit length, diameter, fruit yield, and fruit yield ha⁻¹.

References

- Allard RW. Principles of plant breeding. New York: John Wiley and Sons; 1960.
- Bisognin AD. Origin and evolution of cultivated cucurbits. *Ciencia Rural*. 2002;31(4):715-723.
- Burton GW, DeVane EH. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. *Agronomy Journal*. 1953;45(10):478-481.
- Damor AS, Patel JN, Parmar HK, Vyas ND. Studies on genetic variability, heritability and genetic advance for yield and quality traits in bottle gourd (*Lagenaria siceraria* L.). *International Journal of Science, Environment and Technology*. 2016;5(4):2301-2307.
- Debata J, Maurya SK, Yadav Y, Bhat L. Assessment of heritability, genetic advance, and correlation and path analysis in pointed gourd (*Trichosanthes dioica* Roxb.). *International Journal of Chemical Studies*. 2017;5(5):705-709.
- Deore SL, Khadabadi SS, Patel QR. *In vitro* antioxidant activity and quantitative estimation of phenolic content of *Lagenaria siceraria*. *Rasayan Journal of Chemistry*. 2009;2(1):129-132.
- Desai UT, Musmade AM. Pumpkins, squashes and gourds. In: Salunkhe DK, Kadam SS, editors. *Handbook of vegetable science and technology: production, composition, storage and processing*. New York: Marcel Dekker; 1998. p. 273-297.
- Falconer DS. *Introduction to quantitative genetics*. England: Longman Group Limited; 1989.
- Johnson HW. Genetic advance analysis in pea (*Pisum sativum* L.). *Madras Agricultural Journal*. 1955;42(7):387-390.
- Kumar L, Trivedi J, Sharma D, Janghel AK, Ansari M. Genetic diversity, heritability and agromorphological characterization in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *International Journal of Current Microbiology and Applied Sciences*. 2018;6(12):264-271.
- Kumari M, Kumar J, Kumari A, Singh VK, Rani N, Kumar K. Genetic variability, correlation and path coefficient analysis for yield and yield attributing traits in bitter gourd (*Momordica charantia* L.). *Current Journal of Applied Science and Technology*. 2018;31(4):1-8.
- Mandal J, Tirumalesh M, Dhangra VK. Studies on genetic variability and trait interrelationship in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *HortFlora Research Spectrum*. 2015;4(1):34-38.
- Maurya D, Singh VB, Yadav GC, Kumar V. Studies on genetic variability, heritability and genetic advance in bitter gourd (*Momordica charantia* L.). *Journal of Pharmacognosy and Phytochemistry*. 2018;7(5):1925-1928.
- Rambhau E, Mandal AR, Hazra P, Senapati BK, Thapa U. Morphological characterization and genetic variability studies in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *International Journal of Current Microbiology and Applied Sciences*. 2017;6(9):3585-3592.
- Rastogi KB, Arora D. A note on inter relationship between yield and important plant characters in cucumber. *Vegetable Science*. 1990;17(1):102-104.
- Robinson HF, Comstock RE, Harvey PH. Estimates of heritability and the degree of dominance in corn. *Agronomy Journal*. 1949;41(8):353-359.
- Sharma A, Sengupta SK. Genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* L.). *The Bioscan*. 2013;8(4):1461-1465.
- Singh HK, Singh VB, Kumar R, Barnawal DK, Ray PK. Character association, heritability and path analysis for yield and its contributing traits in bitter gourd (*Momordica charantia* L.). *Progressive Agriculture*. 2015;15(1):41-47.
- Singh SP, Singh B, Mohan M, Rao S, Soni S. Genetic variability for some quantitative traits in bottle gourd (*Lagenaria siceraria* L.). *Annals of Horticulture*. 2014;8(1):113-115.
- Sivasubramanian S, Menon M. Heterosis and inbreeding depression in rice. *Madras Agricultural Journal*. 1973;60(8):1139-1144.
- Thakur P, Sharma D, Visen VK, Dash SP. Evaluation of bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) genotypes. *Plant Archives*. 2015;15(2):1037-1040.
- Thakur P, Singh J, Nair SK, Dash SP. Correlation and path analysis in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). *International Journal of Current Microbiology and Applied Sciences*. 2017;6(12):1478-1485.
- Yadav CY, Kumar S. Determination of variability for yield advancement in bottle gourd (*Lagenaria siceraria* (Molina) Standl.). *Annals of Horticulture*. 2011;4(2):151-164.