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Inheritance patterns of bottle gourd (*Lagenaria siceraria* (Molina) Standl.) in F_3 progenies

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Abstract

An experiment was carried out on F_3 progenies derived of the cross *Pusa Samrudhi* × *DHARWAD BOTTLE GOURD-5* in bottle gourd to evaluate genetic variability, genotypic and phenotypic coefficients of variation, heritability, genetic advance, and correlation among thirteen agronomic traits. Considerable genotypic and phenotypic variability, along with high heritability and substantial genetic advance expressed as a percentage of the mean, were observed for key traits including the number of primary branches per vine, number of fruits per vine, yield per vine, and average fruit weight. These findings suggest that these traits are largely controlled by additive gene action, making them amenable to improvement through simple selection methods. Additionally, yield per vine showed a strong and significant positive correlation at both phenotypic and genotypic levels with several important traits such as sex ratio, node of first female flower appearance, average fruit length, and fruit diameters measured at the pedicel, center, and stylar end, as well as the number of fruits per vine. Therefore, traits related to floral development and fruit morphology should be given priority in breeding programs aimed at enhancing yield potential in bottle gourd.

Keywords: Genetic variability, Correlation, bottle gourd, F_3 generation

Introduction

Calabash (*Lagenaria siceraria* [Molina] Standl.), belonging to the Cucurbitaceae family with chromosome number of $2n=22$, is widely cultivated and valued as a vegetable crop. Its flowering behavior, which includes both monoecious and andromonoecious types, facilitates a high degree of cross-pollination (Swiander and Maccollum, 1994) [24]. Originally domesticated in Africa (Singh, 1990) [20], bottle gourd is believed to have dispersed to the Indian subcontinent through oceanic drift. Over time, it's diversified into plenty indigenous landraces and further spread to regions including China, Indonesia, and as far as New Zealand.

Despite its widespread cultivation and increasing production, bottle gourd remains relatively underutilized in terms of systematic genetic improvement. There is an urgent need to develop improved cultivars possessing traits such as early fruit maturity, higher yield, an optimal female-to-male flower ratio, medium-sized cylindrical fruits with green coloration and pubescence, and resistance to common pests and diseases like fruit fly, downy mildew, powdery mildew, gummosis, and fusarium wilt. To address these challenges, the present study was undertaken to evaluate F_3 progenies for genetic variability, heritability, expected genetic advance, and trait correlations, with the aim of identifying promising genotypes for future breeding programs.

Materials and Methods

The study was carried out at the All India Coordinated Research Project on Vegetable Crops, AICRP-VC, Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahilyanagar, Maharashtra. A Randomized Block Design (RBD) with three replications was employed for the experiment. The plant material consisted of five F_3 progenies derived from the cross *Pusa Samrudhi* × *DHARWAD BOTTLE GOURD-5*, each comprising 20 plants & their parental lines. The crop was planted with a spacing of 3 meters between rows and 1 meter between plants within a row. Throughout the growing season, standard agronomic practices were maintained. Data were collected on various growth and yield-related traits from randomly selected plants within each progeny. The measured traits included vine length (m), number of primary

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branches per vine, days to first female flower appearance, sex ratio (male: female), node number at first female flower appearance, days to first fruit harvest, number of fruits per vine, yield per vine (kg), average fruit weight (g), average fruit length (cm), and fruit diameter measured at three positions—pedicel, center, and stylar end.

Genotypic and phenotypic components of variation, as well as genetic advance, were estimated using the procedure

outlined by Johnson *et al.* (1955) [7]. Coefficients of variation were calculated following Burton and De Vane (1953) [4], while broad-sense heritability was determined based on the formula provided by Lush (1949) [9]. Correlation coefficients among traits were computed according to the method described by Snedecor and Cochran (1967) [23].

Table 1: Mean, range, GCV, PCV, ECV, heritability, genetic advance and percent mean of genetic advance of two parents and F₃ population of cross Pusa Samrudhi x DHARWAD BOTTLE GOURD-5.

Sr. No.	Character	Mean	Range	GCV (%)	PCV (%)	ECV (%)	h ² bs (%)	GA	GAM (%)
1.	Length of vine (m)	9.03	7.91-10.28	8.99	11.73	7.54	59	1.62	17.94
2.	Number of primary branches per vine	7.42	5.33-10.66	20.53	24.28	12.95	72	3.40	45.82
3.	Days required for appearance of first female flower	54.71	53.00-56.00	2.27	3.63	2.83	39	2.02	3.69
4.	Sex ratio (M: F)	14.97	14.63-15.30	12.46	13.13	4.14	90	1.72	11.38
5.	Node at which first female flower appeared	9.16	8.00-10.33	9.26	13.41	9.71	48	1.55	17.24
6.	Days required for first harvest of fruit	64.86	60.45-71.25	4.47	6.54	4.77	47	5.47	8.43
7.	Average weight of fruit (g)	720.23	634.66-772.33	10.70	11.60	4.48	85	193.91	26.92
8.	Average length of fruit (cm)	28.64	26.53-30.80	14.63	15.28	4.39	92	11.16	38.96
9.	Fruit diameter at pedicel (cm)	5.13	4.90-5.43	13.30	15.33	7.62	75	1.60	31.18
10.	Fruit diameter at center (cm)	5.52	4.96-6.06	12.69	16.42	10.43	60	1.52	27.53
11.	Fruit diameter at stylar end (cm)	5.75	5.06-6.28	8.49	10.19	5.63	69	1.04	18.08
12.	Number of fruits per vine	21.05	16.00-27.00	28.12	30.41	11.58	85	13.24	64.20
13.	Yield per vine (kg)	15.77	12.06-19.24	22.78	23.60	6.19	93	8.75	55.48

Table 2: Genotypic and Phenotypic Correlation co-efficient for yield and yield contributing characters in F₃ generation of cross Pusa Samrudhi x DHARWAD BOTTLE GOURD-5.

Sr. no.	Character		1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Length of vine (m)	G	1.000	0.475*	0.069	-0.619**	-0.857**	-0.213	0.989**	0.985**	-0.304	-0.612**	-0.741**	-0.644**	-0.528**
		P	1.000	0.137	0.085	-0.561**	-0.256	-0.091	0.732**	0.814**	-0.297	-0.429*	-0.438*	-0.476*	-0.376
2.	Number of primary branches per vine	G	-	1.000	-0.481*	-0.064	-0.411	-0.391	0.443*	0.336	-0.227	-0.151	-0.209	-0.01	0.121
		P	-	1.000	-0.389	0.021	-0.338	-0.439*	0.277	0.27	-0.141	-0.094	-0.198	-0.025	0.102
3.	Days required for appearance of first female flower	G	-	-	1.000	0.156	0.752**	0.766**	-0.179	0.12	0.485*	0.166	0.427*	0.065	0.115
		P	-	-	1.000	0.128	0.261	0.618**	0.061	0.067	0.325	0.112	0.203	0.141	0.103
4.	Sex ratio (M: F)	G	-	-	-	1.000	0.760**	-0.232	-0.849	-0.731	0.751**	0.934**	0.985**	0.930**	0.980**
		P	-	-	-	1.000	0.459*	-0.204	-0.726**	-0.695**	0.698**	0.861**	0.758**	0.825**	0.801**
5.	Node at which first female flower appeared	G	-	-	-	-	1.000	0.419*	-0.843**	-0.739**	0.301	0.396	0.451*	0.592*	0.681*
		P	-	-	-	-	1.000	-0.016	-0.491*	-0.468*	0.296	0.347	0.471*	0.315	0.621**
6.	Days required for first harvest of fruit	G	-	-	-	-	-	1.000	-0.091	-0.052	-0.055	-0.216	0.221	-0.226	-0.346
		P	-	-	-	-	-	1.000	0.013	-0.027	-0.112	-0.189	-0.026	-0.124	-0.389
7.	Average weight of fruit (g)	G	-	-	-	-	-	-	1.000	0.992**	-0.515	-0.750**	-0.915**	-0.785**	-0.779**
		P	-	-	-	-	-	-	1.000	0.892**	-0.408*	-0.639**	-0.632**	-0.597**	-0.562**
8.	Average length of fruit (cm)	G	-	-	-	-	-	-	-	1.000	0.275	0.607**	0.727**	0.721**	0.589**
		P	-	-	-	-	-	-	-	1.000	0.247	0.521**	0.603**	0.570**	0.497*
9.	Fruit diameter at pedicel (cm)	G	-	-	-	-	-	-	-	-	1.000	0.926**	0.938**	0.776**	0.657**
		P	-	-	-	-	-	-	-	-	1.000	0.885**	0.703**	0.734**	0.664**
10.	Fruit diameter at center (cm)	G	-	-	-	-	-	-	-	-	-	1.000	0.953**	0.980**	0.824**
		P	-	-	-	-	-	-	-	-	-	1.000	0.764**	0.848**	0.713
11.	Fruit diameter at stylar end (cm)	G	-	-	-	-	-	-	-	-	-	-	1.000	0.953**	0.734**
		P	-	-	-	-	-	-	-	-	-	-	1.000	0.665**	0.705**
12.	Number of fruits per vine	G	-	-	-	-	-	-	-	-	-	-	-	1.000	0.811**
		P	-	-	-	-	-	-	-	-	-	-	-	1.000	0.702**
13.	Yield per vine (kg)	G	-	-	-	-	-	-	-	-	-	-	-	-	1.000
		P	-	-	-	-	-	-	-	-	-	-	-	-	1.000

S: Symbol, G: Genotypic, P: Phenotypic

*, **: Significance at 5% and 1%, respectively.

Results and Discussion

Considerable variability was seen among F₃ progenies for

all traits under study. Vine length ranged from 7.91 - 10.28 meters, while the no. of prim. branches per vine varied

between 5.33 and 10.66. The days taken for the first female flower to appear ranged from 53.00 to 56.00, with the sex ratio (male: female) fluctuating between 14.63 and 15.30. The node at which the first female flower appeared was recorded between 8.00 and 10.33. The duration until the first fruit harvest spanned from 60.45 to 71.25 days. The number of fruits per vine ranged from 16 to 27, yield per vine ranged from 12.06 to 19.24 kilograms, and average fruit weight varied from 634.66 to 772.33 grams. Fruit length averaged between 26.53 and 30.80 cm, and diameters measured at the pedicel, center, and stylar end ranged from 4.90 to 5.43 cm, 4.96 to 6.06 cm, and 5.06 to 6.28 cm, respectively. Similar variability levels for yield and associated traits in bottle gourd have been documented by Pandit *et al.* (2009) [13], Arvindkumar *et al.* (2011) [2], and Yadav *et al.* (2008) [26].

Significant genotypic, phenotypic, and environmental coefficients of variation (GCV, PCV, and ECV) were evident for all evaluated traits. High GCV and PCV were observed for traits such as number of primary branches per vine (20.53% and 24.28%), number of fruits per vine (28.12% and 30.41%), and yield per vine (22.78% and 23.60%), indicating these traits exhibit substantial genetic variability primarily governed by additive gene effects and are thus suitable targets for improvement through simple selection methods.

Moderate GCV and PCV values were noted for sex ratio (12.46% and 13.13%), average fruit weight (10.70% and 11.60%), average fruit length (14.63% and 15.28%), and fruit diameter at the center (12.69% and 16.42%) and stylar end (8.49% and 10.19%). Traits such as days to first female flower appearance (2.27% and 3.63%) and days to first fruit harvest (4.47% and 6.54%) showed relatively lower variability. These results are in line with earlier reports by Reddy (1989) [18], Munshi *et al.* (2005) [11], and Singh *et al.* (2008) [21] in bottle gourd.

For all traits, PCV values were marginally higher than the corresponding GCV values, suggesting that environmental influence on trait expression was limited. This pattern concurs with observations by Rakhi and Rajamony (2005) [16], Torkadi and Musmade (2007) [25], and Mali (2015) [10] in muskmelon.

Heritability (broad sense) estimates ranged from 39% to 93%, with most traits exhibiting high heritability. Traits such as number of fruits per vine (85% heritability with 64.20% genetic advance), yield per vine (93% and 55.48%), average fruit length (92% and 38.96%), and number of primary branches per vine (72% and 45.82%) demonstrated high heritability combined with substantial genetic advance as a percentage of the mean, indicating these characters are predominantly controlled by additive genes and are amenable to improvement through simple selection.

Moderate genetic advance coupled with high heritability was recorded for fruit diameter at the pedicel (75% heritability with 31.18% genetic advance), center (60% and 27.53%), and stylar end (69% and 18.08%), suggesting moderate selection response. Similar patterns have been reported by Arvindkumar *et al.* (2011) [2], Yadav and Kumar (2012) [27] in bottle gourd, and Ibrahim (2012) [6], Reddy *et al.* (2013) [17], and Mali (2015) [10] in muskmelon.

Correlation analysis revealed that genotypic correlations generally exceeded phenotypic correlations in magnitude, highlighting the strong influence of genetic factors. Yield per vine showed significant and strong positive correlations,

both phenotypically and genotypically, with traits such as sex ratio, node of first female flower appearance, average fruit length, fruit diameters (pedicel, center, stylar end), and number of fruits per vine. These traits are key contributors to yield and should be prioritized in breeding and selection programs.

In contrast, vine length, days to first fruit harvest, and average fruit weight exhibited significant negative correlations with yield per vine. These findings suggest that shorter vine length and earlier fruiting may contribute to yield improvement. Comparable observations have been documented by Sharma and Dhankar (1993) [19], Badade *et al.* (2001) [3], Singh *et al.* (2002) [22], and Kumar *et al.* (2007) [8]. Gupta *et al.* (2015) [5] also emphasized the importance of yield component traits in influencing the marketable fruit yield in bitter gourd.

References

1. Arunkumar KH, Ramanjinappa V, Hugar A. Association of yield and yield components in F2 population of bottle gourd (*Lagenaria siceraria*). Plant Arch. 2011;11(1):457-459.
2. Arvindkumar N, Singh B, Kumar M, Naresh RK. Genetic variability, heritability and genetic advance for yield and its components in bottle gourd (*Lagenaria siceraria*). Ann Hortic. 2011;4(1):101-103.
3. Badade DS, Warade SD, Gaikwad SK. Correlation studies in bottle gourd. J Maharashtra Agric Univ. 2001;6(1):20-22.
4. Burton GW, De Vane EH. Estimating heritability in tall fescue (*Festuca arundinacea* L.) from replicated clonal material. Agron J. 1953;45:478-481.
5. Gupta N, Bhardwaj ML, Singh SP, Sood S. Correlation and path analysis of yield and yield components in some genetic stocks of bitter gourd (*Momordica charantia* L.). SABRAO J Breed Genet. 2015;47(4):475-481.
6. Ibrahim EA. Variability, heritability and genetic advance in Egyptian sweet melon (*Cucumis melo* var. *aegyptiacus* L.) under water stress conditions. Int J Plant Breed Genet. 2012;6(4):238-244.
7. Johnson HW, Robinson HF, Fatokun CA. Genetic advance in pea (*Pisum sativum* L.). Madras Agric J. 1955;67:387-390.
8. Kumar S, Yadav, Srivastava JP, Yadav JR, Shukla IN, Mishra G, *et al.* Correlation and path coefficient analysis in bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. Prog Res. 2007;2(1-2):165-166.
9. Lush RL. Heritability of quantitative characters in farm animals. Hereditas Suppl. 1949;35:365-387.
10. Mali MD. Genetic studies in F3 and F4 generations of muskmelon (*Cucumis melo* L.) [PhD thesis]. Rahuri (India): Mahatma Phule Krishi Vidyapeeth; 2015.
11. Munshi AD, Sirohi PS. Combining ability estimates in bottle gourd (*Lagenaria siceraria*). Veg Sci. 2005;21:132-136.
12. Narayan R, Singh SP, Sharma DK, Rastogi KB. Genetic variability and selection parameters in bottle gourd. Indian J Hortic. 1996;53(1):53-58.
13. Pandit MK, Mahato B, Sakar A. Genetic variability, heritability and genetic advance for some fruit characters and yield in bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. Acta Hortic.

- 2009;809:221-223.
14. Patil PD. Genetic variability studies in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) [MSc thesis]. Rahuri (India): Mahatma Phule Krishi Vidyapeeth; 2010.
 15. Prasad R, Prasad A. A note on the heritability and genetic advance in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). Indian J Hortic. 1979;36(4):446-448.
 16. Rakhi R, Rajamony L. Variability, heritability and genetic advance in landraces of melon (*Cucumis melo* L.). J Trop Agric. 2005;43(1-2):79-82.
 17. Reddy BP, Begum H, Reddy MT. Variance component analysis of quantitative traits in muskmelon (*Cucumis melo* L.). Trakia J Sci. 2013;2:118-124.
 18. Reddy LM. Variability, heritability and genetic advance in tomato (*Lycopersicon esculentum* Mill.). Andhra Agric J. 1989;36(2-3):123-124.
 19. Sharma NK, Dhankhar BS, Tewatia AS. Correlation and path analysis in bottle gourd [*Lagenaria siceraria* (Mol.) Standl.]. Haryana J Hortic Sci. 1993;22(1):62-66.
 20. Singh AK. Cytogenetics and evolution in the Cucurbitaceae. London: Cornell Univ.; 1990. p. 10-28.
 21. Singh KP, Choudhury DN, Mandal G, Saha BC. Genetic variability in bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. J Interacad. 2008;12(2):159-163.
 22. Singh KP, Panda PK, Singh AK. Variability, heritability and genetic advance in ash gourd (*Benincasa hispida*). Haryana J Hortic Sci. 2002;31(1-2):139-140.
 23. Snedecor GW, Cochran WG. Statistical methods. 6th ed. Bombay: Oxford and IBH Publishing Co.; 1967.
 24. Swiander JM, Ware GW, Maccollum JP. Vegetable crops. Danville (IL): Interstate Publishers; 1994. p. 323-340.
 25. Torkadi SS, Musmade AM. Genetic variability studies in muskmelon (*Cucumis melo* L.). J Soils Crops. 2007;17(2):308-311.
 26. Yadav JR, Yadav A, Srivastava JP, Mishra G, Parihar NS, Singh PB. Study on variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (Molina) Standl.]. Prog Res. 2008;3(1):70-72.
 27. Yadav YC, Kumar DS. Studies on genetic variability, correlation coefficient and path analysis in bottle gourd (*Lagenaria siceraria* (Molina) Standl.). Ann Hortic. 2012;5(1):80-89.