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Genetic Variability and Character Association for Fruit Yield and Its Attributing Traits in Bottle Gourd (*Lagenaria siceraria* (Mol.) Standl.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Short Research Article

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Abstract

The present investigation was carried out during the summer season of the year 2024-25 in the experiment field of Department of Vegetable Science at Pt. KLS College of Horticulture and Research Station, Rajnandgaon (C.G.), under Mahatma Gandhi University of Horticulture & Forestry, Durg (C.G.). The

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experiment was laid under Randomized Block Design (RBD) with three replications and the experimental material consisting of eighteen genotypes of Bottle gourd. Eighteen bottle gourd genotypes were growth, flowering and yield traits. Analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all characters. Among eighteen genotypes, the genotype BOGVAR-10 was noted for 1st germination (5.16 days). The genotype BOGVAR-3 was noted for earliness in 50% germination (8.37 days). The maximum plant height (1.88 m) in 60 DAS was recorded in BOGVAR-8 and maximum plant height (6.03 m) in 90 DAS in the same genotype. The genotype BOGVAR-14 was also noted for early days taken to first male flower (27.14) and first female flower appears (30.00) DAT. The genotype BOGVAR-3 was also recorded the earliest node for first male flower (3.46) and first female flower (8.23). Maximum number of fruits per plant (14.42) was recorded in BOGVAR-3. The genotype BOGVAR-3 was noted for days taken to 1st fruit harvest 41.43 DAT. Maximum fruit length (57.42 cm) was recorded in BOGVAR-18. Maximum fruit diameter (13.24 cm) and average fruit weight (1784.26 g) was recorded in BOGVAR-4. Maximum fruit yield per plant (12.76 kg) and fruit yield per hac. (383.90 q) was recorded in BOGVAR-8.

Keywords: Bottle gourd; genotype; earliness; fruit yield.

1. Introduction

Traditional plant breeding has long served as an essential link between the exploitation of natural variation and the development of high-yielding cultivars. Conventionally, it focuses on the improvement of agronomic traits through phenotypic selection. The success of any crop improvement programme largely depends on the nature and extent of genetic diversity present in the breeding material. Both the genetic constitution of the plant and the surrounding environment play a crucial role in the phenotypic expression of traits. Consequently, investigations into genetic variability using relevant biometrical parameters—such as the coefficient of variability, heritability, and genetic advance—have become indispensable for plant breeders to achieve measurable gains in desired traits (Kumar *et al*., 2025).

Bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) is a member of the Cucurbitaceae family, with a diploid chromosome number of 2n = 22. The species is believed to have originated in Southern Africa and later dispersed to Asia and other tropical regions. It is commonly known by various names, including ghia, lauki, calabash, and white-flowered gourd. The genus and species names, *Lagenaria* and *siceraria*, are derived from the Latin words "lagena" (bottle) and "sicera" (drinking vessel) (Suman *et al*., 2023).

The tender fruits of bottle gourd are widely consumed as vegetables and are used in the preparation of sweet dishes, raita, and pickles. It is one of the most important cucurbitaceous vegetables cultivated in India. *Lagenaria siceraria* is a monoecious, diploid plant that exhibits climbing or prostrate growth habit and produces solitary flowers. Its strictly monoecious nature necessitates cross-pollination for fruit set. The crop is commonly cultivated during both the rainy and summer seasons in tropical regions, ensuring year-round availability of fruits in local markets.

Fruit morphology is highly variable, with shapes including pear-shaped, globular, cylindrical, lengthened cylindrical, and elongate, depending on the variety. Bottle gourd has been reported to provide multiple health benefits, including anticancer, cardioprotective, diuretic, and aphrodisiac effects. Its medicinal applications also encompass the management of pain, ulcers, fever, bronchial disorders, and the reduction of cholesterol, triglycerides, and low-density lipoproteins (Suman *et al*., 2023). In view of its economic and nutritional importance, the present study was undertaken to evaluate the genetic variability among bottle gourd genotypes with respect to yield and yield-related traits under field conditions.

2. Materials and Methods

The present investigation was carried out during the summer season of 2024–25 at the Vegetable Science field of Pt. KLS College of Horticulture and Research Station, Rajnandgaon (Chhattisgarh), affiliated with Mahatma Gandhi University of Horticulture & Forestry, Durg (Chhattisgarh). The experimental field soil was clayey in texture, with low nitrogen content, high phosphorus availability, medium potassium levels, and a soil pH of 7.1. The experiment comprised eighteen genotypes of bottle gourd (*Lagenaria siceraria*), namely BOGVAR-1 through BOGVAR-18. The trial was laid out in a Randomized Block Design (RBD) with three replications,

using a row-to-row spacing of 2 m and plant-to-plant spacing of 1.5 m. All recommended cultural practices were followed to ensure the establishment of a healthy crop. Data were recorded from three randomly selected plants per genotype for the following traits: Days taken to 1st germination, days taken to 50% germination, plant height (m), days taken to 1st male flower appears, days taken to 1st female flower appears, node at which 1st male flower appears, node at which 1st female flower appears, number of fruits per plant, days taken to 1st fruit harvest, fruit length (cm), fruit diameter (cm), average fruit weight (g), fruit yield /plant (kg) and fruit yield /hac. (q). The collected data were subjected to analysis of variance (ANOVA) following the procedures outlined by Gomez and Gomez (1984) for Randomized Block Design, to assess the significance of differences among genotypes for the measured characters.

3. Results and Discussions

The mean values of different growth and yield parameters with respect to genotypes are presented in table 1. The analysis of variance revealed that mean sum of squares due to genotypes were highly significant for all characters. Significant mean sum of squares due to fruit yield and attributing characters revealed existence of considerable variability in material studied for improvement for various traits. These findings are in general agreement with the findings of Kumar *et al*. (2012).

The first seed germination occurred in an average of 8.26 days, ranging from 5.16 to 11.19 days. BOGVAR-10 recorded the first seed germination after 5.16 days, while BOGVAR-6 recorded a delayed first seed germination after 11.19 days. The earliest days to 50% seed germination were recorded between 8.37 days and 17.69 days, with an overall mean of 12.20 days. BOGVAR-3 had the earliest 50% seed germination (8.37 days), whereas BOGVAR-6 had the delayed 50% seed germination (17.69 days). The average height of the 60 DAS plants is 1.52 meters, with a range of 1.15 to 1.88 meters. BOGVAR-8 had the highest plant height (1.88 m) at 60 DAS, while BOGVAR-1 had the lowest (1.15 m). BOGVAR-8 had the highest plant height at 90 DAS (6.03 m), whereas BOGVAR-6 had the lowest plant height (3.44 m). The 90 DAS plant height ranges from 3.44 m to 6.03 m, with an overall mean of 4.49 m. The time taken for the first male flowers to appear ranged from 27.14 DAT to 44.41 DAT. The genotype BOGVAR-14 had the earliest day to first male flower appearance (27.14 DAT), while the genotype BOGVAR-7 had the longest day to first male flower appearance (44.41 DAT). The range of days taken for the first female flower to appear was 30.00 DAT to 49.83 DAT. The significantly earliest days for the appearance of the 1st female flower were recorded in BOGVAR-14 (30.00 DAT), and the maximum days to the 1st female flower appearance was recorded in the genotype BOGVAR-7 (49.83 DAT). The first male flower appeared at nodes ranging from 3.46 to 4.86. The genotype BOGVAR-2 (4.86) had the highest node at which the first male flower appeared, while BOGVAR-3 (3.46) had the earliest node at which the first male flower appeared. The range of nodes at which the first female flower appears is 8.23 to 11.55. The genotype BOGVAR-13 (11.55) had the largest node at which the first female flower occurs, while BOGVAR-3 (8.23) had the earliest node at which the first female flower appears. The maximum number of fruits per plant ranged between 6.53 and 14.42, with an overall mean of 9.55 fruits per plant. The genotype BOGVAR-3 (14.42) had the greater number of fruits per plant, while the genotype BOGVAR-7 (6.53) had the lowest number of fruits per plant. The average number of days taken to the 1st fruit harvest was 52.17 DAT, with a range of 41.43 DAT to 67.69 DAT. The genotype BOGVAR-3 was recorded at the early harvesting (41.43 DAT), while the genotype BOGVAR-7 showed the longest time to 1st fruit harvest (67.69 DAT). The fruit lengths ranged from 15.31 to 57.42 cm, with a mean of 33.85 cm. The genotype BOGVAR-18 had the longest fruit length (57.42 cm), while the genotype BOGVAR-3 had the shortest fruit length (15.31 cm). The fruit diameters have varied from 5.36 to 13.24 cm, with an average of 7.38 cm. The genotype BOGVAR-4 had the largest fruit diameter (13.24 cm), whereas the genotype BOGVAR-18 had the smallest fruit diameter (5.36 cm). The average fruit weight ranged from 896.11 g to 1784.26 g, with an overall mean of 1097.90 g. The genotype BOGVAR-7 had the highest average fruit weight (1784.26 g), while BOGVAR-6 had the lowest average fruit weight (896.11 g). The fruit yield per plant ranged between 6.56 kg and 12.76 kg, with an overall mean of 9.23 kg. The genotype BOGVAR-8 had the highest fruit yield per plant (12.76 kg), while genotype BOGVAR-6 had the lowest fruit yield per plant (6.56 kg). The fruit yield per hectare has ranged between 196.80 q and 383.90 q, with an overall mean of 277.80 q. The genotype BOGVAR-8 (383.90 q) has the highest fruit yield per hectare, while the genotype BOGVAR-6 (196.80 q) has the lowest fruit yield per hectare.

Table 1. Mean performance for fruit yield and its components in bottle gourd

Treatment	Days taken to 1st Germi-nation	Days taken to 50% Germi-nation	Plant height (m)		Days taken to 1st Male flower appears	Days taken to 1st Female flower appears	Node at which 1st Male flower appears	Node at which 1st Female flower appears	Number of fruits per plant	Days taken to 1st fruit harvest	Fruit length (cm)	Fruit diameter (cm)	Average fruit weight (g)	Fruit yield/ plant (kg)	Fruit yield /hac. (q)
			60 DAS	90 DAS											
BOGVAR - 1	7.79	12.03	1.15	4.23	32.67	36.67	4.27	9.06	9.09	53.23	21.80	10.83	1138.72	8.97	269.00
BOGVAR - 2	8.81	13.85	1.47	4.17	33.05	37.67	4.86	9.54	8.17	52.27	22.83	11.14	1163.01	8.36	250.70
BOGVAR - 3	5.18	8.37	1.73	5.96	27.29	30.11	3.46	8.23	14.42	41.43	15.31	12.12	897.00	10.80	324.00
BOGVAR - 4	8.58	12.10	1.27	4.05	38.29	41.33	4.27	8.92	8.09	54.21	19.23	13.24	1071.63	7.87	236.10
BOGVAR - 5	7.60	10.78	1.35	3.89	34.21	42.23	4.42	9.75	7.60	57.93	31.20	6.99	927.73	7.52	225.50
BOGVAR - 6	11.19	17.69	1.38	3.44	39.24	43.82	4.85	10.11	8.04	62.03	31.48	5.96	896.11	6.56	196.80
BOGVAR - 7	9.60	12.09	1.32	4.31	44.41	49.83	4.72	10.88	6.53	67.69	47.05	6.29	1784.26	9.53	286.00
BOGVAR - 8	6.74	10.15	1.88	6.03	29.50	32.56	4.22	9.77	13.24	49.48	37.85	5.93	1038.53	12.76	383.90
BOGVAR - 9	8.66	11.47	1.66	4.58	31.89	35.45	4.62	9.22	10.59	52.81	36.72	6.03	914.40	10.10	303.10
BOGVAR - 10	5.16	8.55	1.63	5.45	27.62	30.67	4.14	9.12	11.01	47.15	35.28	5.89	1083.40	10.85	328.17
BOGVAR - 11	7.44	9.92	1.54	4.16	30.34	33.00	4.83	10.65	9.84	53.57	33.50	6.76	992.49	8.23	247.00
BOGVAR - 12	7.38	13.33	1.81	4.91	29.23	32.55	4.53	9.66	11.12	50.40	34.08	6.39	1043.41	10.70	321.00
BOGVAR - 13	7.45	13.21	1.66	4.29	29.33	31.78	4.32	11.55	10.40	48.24	38.53	5.76	1039.96	9.10	276.57
BOGVAR - 14	7.55	13.56	1.43	5.08	27.14	30.00	3.77	8.70	9.89	43.72	42.28	5.65	1242.67	10.77	326.10
BOGVAR - 15	10.01	13.43	1.25	4.38	33.17	37.78	4.30	10.77	8.89	49.82	39.51	5.72	1151.20	9.85	299.67
BOGVAR - 16	11.08	15.45	1.64	3.64	27.95	30.67	3.78	9.54	8.08	49.62	31.19	6.32	1081.24	7.45	227.17
BOGVAR - 17	11.12	13.20	1.68	3.99	34.17	39.33	3.63	8.60	9.33	51.26	34.12	6.45	958.56	7.67	230.20
BOGVAR - 18	7.33	10.43	1.57	4.26	30.13	36.22	4.24	9.02	7.48	54.23	57.42	5.36	1337.88	8.98	269.50
GM	**8.26**	**12.20**	**1.52**	**4.49**	**32.20**	**36.20**	**4.29**	**9.62**	**9.55**	**52.17**	**33.85**	**7.38**	**1097.90**	**9.23**	**277.80**
CD (p=0.05)	**0.99**	**1.48**	**0.20**	**0.69**	**3.57**	**4.12**	**0.57**	**1.22**	**1.33**	**5.54**	**3.62**	**1.44**	**131.88**	**1.67**	**49.41**
SEm±	**0.35**	**0.52**	**0.07**	**0.24**	**1.24**	**1.43**	**0.20**	**0.42**	**0.46**	**1.93**	**1.26**	**0.50**	**45.89**	**0.58**	**17.19**
SEd	**0.49**	**0.73**	**0.10**	**0.34**	**1.76**	**2.03**	**0.28**	**0.60**	**0.65**	**2.73**	**1.78**	**0.71**	**64.89**	**0.82**	**24.31**
C.V. (%)	**7.24**	**7.32**	**7.92**	**9.20**	**6.68**	**6.85**	**7.96**	**7.64**	**8.39**	**6.40**	**6.45**	**11.72**	**7.24**	**10.93**	**10.72**

BOGVAR - 1

BOGVAR - 2

BOGVAR - 3

BOGVAR - 4

BOGVAR - 5

BOGVAR - 6

BOGVAR - 7

BOGVAR - 8

BOGVAR - 9

BOGVAR - 10

Fig. 1. Different genotypes of Bottle gourd

4. Conclusion

The results from the present investigation concluded that Bottle gourd Genotype BOGVAR-8 recorded maximum fruit yield/plant (12.76 kg) and fruit yield/hectare (383.90 q), was superior among all the genotypes.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

Competing Interests

Authors have declared that no competing interests exist.

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