Original Research Article

GENETIC VARIABILITY IN BITTER GOURD GENOTYPES FOR YIELD AND YIELD ATTRIBUTING TRAITS

ABSTRACT

The present study was undertaken at the Department of Horticulture, University of Agricultural Sciences, GKVK Bengaluru,during the *Rabi* season of 2022 using a Randomized Complete Block Design (RCBD) with three replicationsto evaluate eighteen bitter gourd genotypes including check Pusa Hybrid 6. The Analysis of variance revealed significant difference among the genotypes for the traits studied. The genotype Pusa Purvi produced maximum number of fruits per vine (46.67), whereas, Pusa Rasdar produced least number of fruits (12.33) per vine. Longest fruits were recorded in Pant Karela 4 (24 cm) followed by Phule Green Gold (19.37) and Priya (19 cm)whereas, smallest fruits were found in Pusa Purvi (5.07 cm).Maximum fruit diameter was recorded in Pusa Rasdar (6.53 cm) in which highest fruit weight (148.14 gm) was also recorded. Minimum diameter was recorded in the smallest fruit Pusa Purvi (2.72 cm).The genotype Konkan Tara(1.96 kg) followed by Pusa Rasdar (1.79 kg) and Priya (1.60 kg) exhibited maximum fruit yield per vine. These genotypes may be selected as parents in further breeding programme to improve the crop in terms of yield traits.

Keyword: bitter gourd; genotypes; yield; traits

1. INTRODUCTION

Bitter gourd (*Momordica charantia* L.) holds a prominent position as a cucurbitaceous vegetable cultivated throughout India during the warm season for its tender fruits, which is commonly called as Balsam pear or bitter cucumber or bitter melon (English), Hagalakayi (Kannada), Karela (Hindi) etc. The genus *Momordica* encompasses several other species including *M. balsamina, M. cochinchinesis, M. dioca, M. denudate, M. macrocarpa, M. subangulata and M. tuberosa.* Bitter gourd is diploid having chromosome number 2n=22 and has its origin in the Indo-Burma region.

Leading countries in bitter gourd production include India, Indonesia, Malaysia, China and Tropical Africa. Major bitter gourd cultivating states in India are Madhya Pradesh, Chhattisgarh, Tamil Nadu, Andhra Pradesh, Odisha and Bihar. Its cultivation is widespread in India's tropical and sub-tropical regions, with a total area of 109.51 thousand hectares, production of 1375.82 thousand tonnes and a productivity of 12.56 MT (Anon., 2022).

Bitter gourd is known for its various health benefits, including its reported wormicidal effect and its role as a laxative and digestion stimulant. The bitter taste of bitter gourd is attributed to certain compounds, including the cucurbitacin-like alkaloid momordicine and triterpene glycosides such as momordicoside K and L (Jeffrey, 1980 and Okabe *et al.*, 1982).The antidiabetic properties of bitter gourd have garnered significant attention in recent years. Extensive research over the past decade has revealed the presence of a hypoglycemic compound called "charantin" (Yeh *et al.*, 2003). In terms of vitamins, it is a source of 126.0 mg of vitamin A and 96.0 mg of vitamin C (Gopalan *et al.*, 1993).

Bitter gourd, due to its monoecious nature and high degree of heterozygosity, is predominantly cross-pollinated. Its medicinal and nutritional value has raised its commercial significance, leading to consistent consumer demand throughout the year. There is a growing need for improved bitter gourd varieties that exhibit better quality traits and higher yield, benefiting both farmers and consumers. The objectives of the study were, therefore, to evaluate the bittergourd genotypes for their yield and yield attributing traits to identify the best genotypes which can be utilized for further breeding programme.

2. MATERIALS AND METHODS

The experiment was conducted at the Department of Horticulture, University of Agricultural Sciences, GKVK Bengaluru. Eighteen genotypes including check Pusa Hybrid 6 collected from various sources (Table 1.) for the experiment were evaluated during the *Rabi* season of 2022 using a Randomized Complete Block Design (RCBD) with three replications.Bitter gourd seeds which were presoaked for about 12 hrs were sowed in beds at a spacing of 2.0 x 2.0 meters under open field condition by adopting recommended package of practices(Plate 1). Data recorded on five randomly selected plants from each genotype for yield traits *viz.*, fruit length (cm), fruit diameter (cm), average fruit weight (g), number of fruits per vine and yield per vine were statistically analysed by following the method given by Panse and Sukhatme (1985).

Table 1. List of genotypes along with their source of collection

Sl.No.	Genotypes	Source of collection
1	Punjab 14	NSC, New Delhi
2	Hirkani	MPKV, Rahuri
3	Pusa Rasdar	IARI, New Delhi
4	Pusa Purvi	IARI, New Delhi
5	Priya	KAU, Thrissur
6	Konkan Tara	KKV, Dapoli
7	Konkan Karali	KKV, Dapoli
8	Pant Karela 3	GBPUAT, Pantnagar
9	Pant Karela 4	GBPUAT, Pantnagar

10	CO 1	TNAU, Coimbatore
11	Preethi	KAU, Thrissur
12	Phule Green Gold	MPKV, Rahuri
13	Pusa Do Mausami	IARI, New Delhi
14	Pusa Vishesh	IARI, New Delhi
15	Pant Karela 1	GBPUAT, Pantnagar
16	Pusa Hybrid 4	IARI, New Delhi
17	Pusa Hybrid 5	IARI, New Delhi
18	Pusa Hybrid 6 (Check)	IARI, New Delhi

Plate 1: General view of the experiment plot

3. RESULTS AND DISCUSION

The mean values for all genotypes, including the check Pusa Hybrid 6, across yield attributing traits are summarized in Table2. Significant variations were observed among the genotypes for all the traits studied (Plate 2). Genotype Pant Karela 4 (24.00 cm) exhibited the longest fruits, followed by Phule Green Gold (19.37 cm), Priya (19.00 cm), and Pusa Do Mausami (18.43 cm), all surpassing the check Pusa Hybrid 6 (18.33 cm). Conversely, Pusa Purvi (5.07 cm) produced the smallest fruits among the evaluated genotypes. As length of the fruit increases, the total yield is also expected to increase in a positive direction.The similar findings are reported by Yadav et al. (2018) in bitter gourd.

The trait fruit diameter also showed a positive correlation with total fruit yield. The maximum fruit diameter was recorded in Pusa Rasdar (6.53 cm), followed by Konkan Tara (5.24 cm) and Pusa Vishesh (4.68 cm), with percentage reductions over the control of 43.20%, 14.19%, and 2.63%, respectively. Whereas, Pusa Purvi (2.72 cm) exhibited the minimum fruit diameter with a reduction of -40.35% over the control. These findings align closely with those reported by Rani (2014) in bitter gourd.

Among the genotypes evaluated for average fruit weight, Pusa Rasdar succeeded inachieving a maximum fruit weight (148.14 g) which was significantly higher than all the other genotypes. Additionally, average fruit weight was observed in Pant Karela 4 (79.93 g), Konkan Tara (74.70 g), Phule Green Gold (70.42 g), Priya (66.69 g), and Konkan Karali (68.83 g). The genotypes such as Punjab 14 (66.10 g), Hirkani (64.62 g), CO 1 (65.00 g),

Preethi (65.00 g), Pusa Vishesh (60.00 g), and Pant Karela 1 (58.00 g) were on par with the control Pusa Hybrid 6 (61.40 g). In contrast Pusa Purvi (15.33 g) exhibited the smallest fruit weight, with a substantial reduction of -75.03% compared to the control. The significant variations in fruit weight might have been due to fruit length, fruit width and number of fruits per vine. The similar findings are reported by Mallikarjunarao*et al*. (2020) in bitter gourd.

The highest number of fruits per vinewas observed in Pusa Purvi (46.67) followed by Konkan Tara (26.33) and Priya (24.33) whereas,the lowest was recorded in Pusa Rasdar (12.33). The results revealed that the genotypes having smaller average fruit weight recorded highest number of fruits per vine and the variation in number of fruits per vine mightbe due to fruit set percentage, sex ratio and vine length.

The fruit yield per vine ranged from 0.62 kg to 1.96 kg, with an average of 1.15 kg per vine across the genotypes. Konkan Tara exhibited the highest yield per vine (1.96 kg), followed by Pusa Rasdar (1.79 kg), Priya (1.60 kg), and Punjab 14 (1.54 kg). Genotypes such as Hirkani (1.26 kg), Konkan Karali (1.35 kg) and Pant Karela 4 (1.29 kg) showed yields per vine similar to that of control Pusa Hybrid 6 (1.26 kg). In contrast, Pusa Hybrid 5 recorded the lowest yield per vine (0.62 kg).The significant variationin yield per vine might be due to fruit set percentage, sex-ratio, fruit length, number of fruits per vine, fruit weightand fruit width. These findings were supported byYadav et al(2004) in bitter gourd.

Yield components such as fruit length, fruit diameter, fruit weightand number of fruits per vine are critical factors that significantly influence the total fruit yield per vine in bitter gourd. The evaluated bitter gourd genotypes shown significant genetic variability for fruit weight, fruit length, fruit diameter, number of fruits per vine and yield per vine. These differences in varietal characters could be due to genetic makeup of the plant as these are highly genetically governed traits.

Table 2. Mean performance of bitter gourd genotypes for yield and yield attributing traits

Sl. No.	Genotypes	Fruit length (cm)	Percent reduction over control	Fruit Diameter (cm)	Percent reduction over control
1	Punjab 14	14.60	-20.35	3.97	-12.94
2	Hirkani	14.00	-23.62	4.31	-5.48
3	Pusa Rasdar	13.50	-26.35	6.53	43.20
4	Pusa Purvi	5.07	-72.34	2.72	-40.35
5	Priya	19.00	3.66	4.16	-8.77
6	Konkan Tara	15.83	-13.64	5.24	14.91
7	Konkan Karali	12.83	-30.01	2.74	-39.91
8	Pant Karela 3	17.33	-5.46	3.26	-28.51
9	Pant Karela 4	24.00	30.93	3.26	-28.51
10	CO 1	10.33	-43.64	3.24	-28.95
11	Preethi	13.17	-28.15	3.97	-12.94

12	Phule Green Gold	19.37	5.67	3.98	-12.72
13	Pusa Do Mausami	18.43	0.55	3.01	-33.99
14	Pusa Vishesh	16.43	-10.37	4.68	2.63
15	Pant Karela 1	15.34	-16.31	3.53	-22.59
16	Pusa Hybrid 4	8.52	-53.52	3.62	-20.61
17	Pusa Hybrid 5	11.52	-37.15	4.20	-7.89
18	Pusa Hybrid 6 (Check)	18.33	0.00	4.56	0.00
	C.V	**3.72**	-	**2.98**	-
	SE(m)	**0.32**	-	**0.07**	-
	C.D @ 5%	**0.92**	-	**0.20**	-

Table 2. (contd.)Mean performance of bitter gourd genotypes for yield and yield attributing traits

Sl No.	**Genotypes**	**Average fruit weight (g)**	**Percent reduction over control**	**No. of fruits per vine**	**Percent reduction over control**	**Yield per vine (kg)**	**Percent reduction over control**
1	Punjab 14	66.10	7.65	23.33	14.76	1.54	22.22
2	Hirkani	64.62	5.24	19.33	-4.92	1.26	0.00
3	Pusa Rasdar	148.14	141.27	12.33	-39.35	1.79	42.06
4	Pusa Purvi	15.33	-75.03	46.67	129.56	0.70	-44.44
5	Priya	66.69	8.62	24.33	19.68	1.60	26.98
6	Konkan Tara	74.70	21.66	26.33	29.51	1.96	55.56
7	Konkan Karali	68.83	12.10	19.67	-3.25	1.35	7.14
8	Pant Karela 3	55.82	-9.09	16.33	-19.68	0.91	-27.78
9	Pant Karela 4	79.93	30.18	16.33	-19.68	1.29	2.38
10	CO 1	65.00	5.86	15.67	-22.92	1.00	-20.63
11	Preethi	65.00	5.86	14.67	-27.84	0.94	-25.40
12	Phule Green Gold	70.42	14.69	15.33	-24.59	1.05	-16.67
13	Pusa Do Mausami	57.50	-6.35	16.00	-21.30	0.94	-25.40
14	Pusa Vishesh	60.00	-2.28	13.67	-32.76	0.82	-34.92
15	Pant Karela 1	58.00	-5.54	14.33	-29.51	0.80	-36.51
16	Pusa Hybrid 4	40.20	-34.53	22.67	11.51	0.91	-27.78
17	Pusa Hybrid 5	45.70	-25.57	13.67	-32.76	0.62	-50.79
18	Pusa Hybrid 6 (Check)	61.40	0.00	20.33	0.00	1.26	0.00
	C.V	**4.91**	-	**5.08**	-	**4.12**	-
	SE(m)	**1.83**	-	**0.57**	-	**0.03**	-
	C.D @ 5%	**5.26**	-	**1.64**	-	**0.08**	-

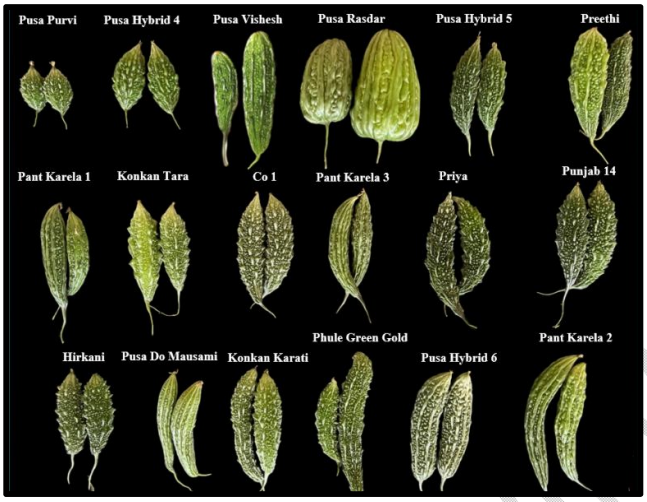

Plate 2: Phenotypic variability among bitter gourd genotypes

4. CONCLUSION

Identifying genotypes that excel in yield attributing components is crucial for future breeding program and enhancing bitter gourd production. Genotypes like Konkan Tara, Pusa Rasdar,Priya, Phule Green Gold andPant Karela 4 showed superior traits such as larger fruit length, fruit diameter and higher yields, making them promising for cultivation. Conversely, Pusa Purvi, despite smaller fruit size, produced the highest number of fruits per vine, indicating potential balance between fruit size and yield quantity.These findings contribute to the understanding of bitter gourd genetics and offer insights for breeding programs aimed at developing varieties with improved agronomic traits suited to diverse agricultural conditions.

REFERENCES

ANONYMOUS, 2022, Indiastatagri, www.indiastatagri.com/data/agriculture/bittergourd/data-year/all-years

Jeffrey C. A review of the cucurbitaceae. The Botanical Journal of the Linnean Society. 1980;81(3):233-247.

Okabe H, Miyahara Y, Yamauchi T. Studies on the constituents of Momordica charantia L. IV. Characterization of the new cucurbitacin glycosides of the immature fruits. (2) Structures of the bitter glycosides, momordicosides K and L. Chemical and Pharmaceutical Bulletin. 1982;30(12):4334-4340.

Yeh GY, Eisenberg DM, Kaptchuk TJ, Phillips RS. Systematic review of herbs and dietary supplements for glycemic control in diabetes. Diabetes Care. 2003;26(4): 1277-1294.

Gopalan C, Rama Sastri BV, Balalsubramanian SC. Nutritive value of Indian foods. 2nd Ed. Hyderabad. National Institute of Nutrition, IGMR. 1993.

Panse VG, Sukhatme PV. Statistical methods for agricultural workers. Statistical methods for agricultural workers.1954: 347.

Yadav, M., Singh, D.B., Chaudhary, R. and Singh, D., 2008. Genetic variability in bitter gourd (Momordica charantia L.). *Journal of Horticultural Sciences*, *3*(1), pp.35-38.

Rani, K.R., 2014. Performance of bitter gourd genotypes for yield and earliness. *Annals of Plant and Soil Research*, *16*(4), pp.330-333.

Mallikarjunarao, K., Pradhan, R. and Hari Ram, K.B., 2020. Varietal Evaluation of Bitter Gourd (*Momordica charantia* L.) In Paralakhemundi, Gajapati District. *Indian Journal of Natural Sciences*, *10*(60), pp.24152-24155.

Yadav, M., Chaudhary, R., Chandra, A. and Mehta, A. K.2004. Genetic variability of different genotypes ofbitter gourd (*Momordica charantia* L.). TheAllahabad Farmer, 2: 70-76.