

## 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 replications to 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).

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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.

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## 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).

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**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 DISCUSSION

The mean values for all genotypes, including the check Pusa Hybrid 6, across yield attributing traits are summarized in Table 2. 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 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 in achieving 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),

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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.

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The highest number of fruits per vine was 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 might be due to fruit set percentage, sex ratio and vine length.

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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 variation in yield per vine might be due to fruit set percentage, sex-ratio, fruit length, number of fruits per vine, fruit weight and fruit width. These findings were supported by Yadav *et al.* (2004) in bitter gourd.

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Yield components such as fruit length, fruit diameter, fruit weight and 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.

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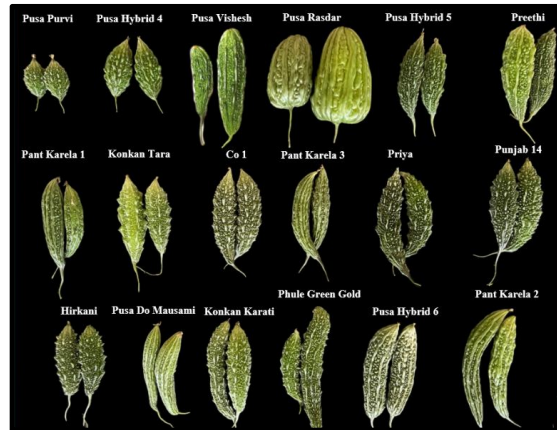
**Table 2. Mean performance of bitter gourd genotypes for yield and yield attributing traits**

| 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   |
|    | <b>C.V</b>            | <b>3.72</b> | -      | <b>2.98</b> | -      |
|    | <b>SE(m)</b>          | <b>0.32</b> | -      | <b>0.07</b> | -      |
|    | <b>C.D @ 5%</b>       | <b>0.92</b> | -      | <b>0.20</b> | -      |

**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                           |
|        | <b>C.V</b>            | <b>4.91</b>              | -                              | <b>5.08</b>            | -                              | <b>4.12</b>         | -                              |
|        | <b>SE(m)</b>          | <b>1.83</b>              | -                              | <b>0.57</b>            | -                              | <b>0.03</b>         | -                              |
|        | <b>C.D @ 5%</b>       | <b>5.26</b>              | -                              | <b>1.64</b>            | -                              | <b>0.08</b>         | -                              |



**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 and Pant 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.

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