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National Academy of Agricultural Science (NAAS) Rating : 3.03

Quantitative characters studies of bitter gourd genotypes under Hisar conditions

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ABSTRACT: *Ten genotypes of bitter gourd were evaluated for quantitative characters related to earliness, growth parameter and fruit yield at Research Farm of the Department of Vegetable Science, CCS H.A.U., Hisar during 2013-14. All the genotypes differed significantly for all the characters under study. The minimum number of days taken to first female flowering (49.3 days) was recorded in genotype HK 168, followed by HK 164 (51.3 days). The check variety Pusa Do Mausami took more number of days to first female flowering (58.3 days). Among ten genotypes under study, the genotype HK 168 was earlier in first fruit picking (58.7 days) followed by HK 164 (60.5 days). Among the various growth characters like fruit length and girth and branches per plant, all the genotypes differed significantly. The number of fruits per plant (27.0), number of branches per plant (11.0), fruit length (13.8 cm) and average fruit weight (65.0 g) was recorded maximum in genotype HK 168 followed by HK 164 (25.7, 10.0, 12.3 and 60.0 g, respectively). The seven genotypes out of ten bitter gourd genotypes had no significant difference in fruit yield, except HK 164, HK 167 and HK 168 with fruit yield of 119.8, 113.2 and 121.7 q/ha, respectively. The fruit yield was recorded maximum in HK 168 (121.7 q/ha), followed by HK 164 (119.8 q/ha), which gave significantly higher yield as compared to rest of the genotypes. The lowest fruit yield was obtained from check variety Pusa Do Mausami (102.2 q/ha).*

Keyword: *Bitter gourd, genotypes, average fruit weight, number of fruits, yield*

Bitter gourd or Karela (*Momordica charantia* L.) belonging to the family cucurbitaceae is considered an old world species with native home in the tropical Africa and Asia. The importance of bitter gourd has been recognized due to its nutritive value and medicinal properties. Its fruits are used for curing diabetes, asthma, blood diseases and rheumatism. Its fruits are considered as a rich source of vitamins, especially of vitamin C (88 mg/100 g) and minerals. Its seed contains protein, which is used to inhibit the growth of immune deficiency virus (HIV-I) in human cell cultures [2]. The lipid oxidative enzyme present in bitter gourd reduces cholesterol deposition in the body [3, 4]. The anti-fertility property of bitter gourd extracts also makes it useful as an organic contraceptive [6]. Fruits are used after cooking and delicious preparations are made after stuffing and frying. It is also used for its anti-mutagenesis, antiviral and anti-bacterial properties [5, 7]. During periods of glut in the market, fruits are sliced, partially boiled with salt and dried under direct sunlight and stored for months. Drinking fresh bitter gourd juice is recommended by naturopaths. Roots and stem of wild bitter gourd are used in many ayurvedic medicines.

Being a monoecious and highly cross-pollinated crop, wide range of variability with respect to vegetative and fruit character is available. The assessment of variability present in any crop species is an essential prerequisite for formulating an effective breeding programme, as the existing variability can be used to enhance the yield level of cultivars following appropriate breeding strategies [12]. Diversity of germplasm provides an opportunity to increase the yield of vegetable crops. Bitter gourd is grown in semi-arid and arid regions that face water scarcity during critical crop growth periods, flowering and late fruit development stages, resulting in drastic yield loss. In bitter gourd, several researchers had already reported the presence of significantly high diversity for fruit yield and yield components. The understanding of nature and degree of variability among different lines is prerequisite for varietal improvement. Therefore, the present study was undertaken to analyze the genetic variability of a number of bitter gourd genotypes for selecting

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parents of diverse group for further breeding programme.

MATERIALS AND METHODS

The present experiment consisting of ten bitter gourd genotypes, *i.e.*, HK 160, HK 161, HK 162, HK 163, HK 164, HK 165, HK 166, HK 167, HK 168 and Pusa Do Mausami (check) was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during the year 2013-14 to evaluate for growth and yield parameters. The seeds were sown to a depth of 3-5 cm in the month of March 2013 and second crop in the same season in March 2014 on well-prepared moist flat seedbeds at an inter- and intra-row spacing of 2.5 and 1.5 m, respectively, accommodating five plants in a single row in randomized block design with three replications. A single row of non-experimental line was planted on either side of each block so as to avoid border effect. First light irrigation was applied 7-10 days after sowing, taking care to avoid over flooding. Subsequent irrigations were applied at an interval of 15-20 days as per the crop need. Necessary intercultural operations were followed during crop period to ensure normal plant growth and development. Control measures were taken against red pumpkin beetle at seedling stage and fruit fly at fruiting stage as per the package of practices adopted in Haryana state. The observations were recorded replication wise on five randomly selected plants for each genotype on nine quantitative characters *viz.*, days to first female flower, days to first picking, fruit length (cm), fruit diameter (cm), number of primary branches per vine, vine length (cm), average fruit weight (g), number of fruits per vine and yield of fruits per vine (g). The data recorded for different parameters were analyzed for analysis of variance in OPSTAT (http://14.139.232.166/opstat/index.asp) statistical software developed by CCS Haryana Agricultural University, Hisar, Haryana, India [17].

RESULTS AND DISCUSSION

Analysis of variance of 10 bitter gourd genotypes showed highly significant differences for all the quantitative traits, indicating adequate genetic variability present among the genotypes studied. The mean performance of all the genotypes for different growth, earliness and yield parameters are presented in Table 1. The mean sum of squares was significant for all characters, indicating the importance of selection method for improving these traits under study. Similar results were reported by Rao *et al*. [13] and Tyagi *et al*. [18] who also found significant results for the traits like fruits per vine, fruits length and diameter.

Significantly early female flowering (49.3 days) and first fruit picking (58.7 days) was noticed in genotype HK 168 closely followed by HK 164 (51.3 and 60.5 days), while Pusa Do Mausami (check) was found late in female flowering (58.3 days) and first fruit picking (68.7 days) among the genotypes. These attributes ranged from 49.3 to 58.3 and 58.7 to 68.7 days with mean range value 53.8 and 63.7 days for days to first female flowering and days to first fruit picking, respectively. The number of days taken to first female flower is an important character, which indicates early or lateness of the crop, as early and late female flowering helps in the occurrence of early or lateness of the crop. The earliness is a desirable character since the crop early in female flowering gives higher total yield and remunerative to the growers. These results are in line with the findings of other workers [14 and 19] in bitter gourd and [9 and 1] in ridge gourd crop. Some genotypes recorded lesser values for days to first female flowering and first fruit picking than those of checks, and negative values showed early maturity. Early appearance of female flowers is an indication of crop earliness. Similar findings were reported by Rao *et al*.[13] in ridge gourd, Rathod [14] in bitter gourd, Tyagi *et al*. [18] in luffa and Reddy *et al*. [16] in ridge gourd.

The mean value for number of branches per vine was 8.3 and ranged from 5.7 for HK 161 to 11.0 for HK 168 genotype. The genotype HK 164, HK 167 and HK 163 were next in order of more number of primary branches per vine. The check variety Pusa Do Mausami had 6.3 branches per vine, while the least number of branches was observed in HK 161 (5.7). The higher number of secondary branches might have led to the production of more number of fruits, resulting in higher fruit yield. Similar findings were reported by Yadav *et al*. [19] in bitter gourd.

The length of fruit ranged from 7.4 cm in HK 163, a short-fruited bitter gourd genotype, to 13.8 cm in HK 168, a long fruited genotype. The genotype HK 164, HK-160 and HK 165 were next in order with respect to fruit length (12.3, 11.7 and 11.3 cm, respectively). The genotype HK 162 produced the fruits with maximum diameter (4.0 cm), while HK 161 produced the fruits with least diameter (2.3 cm). The fruit diameter ranged from 2.3 cm in HK 161 to 4.0 cm in HK 162 cm with mean value 3.1 cm. The difference in fruits diameter could be attributed to inherent characteristics of the genotypes. The fruit

diameter increased with the increase in size of fruit. These results are similar to those obtained by Harika *et al*. [8] in bottle gourd.

The genotypes under study differed significantly from one another with respect to vine length, which varied from 146.7 to 200.3 cm. The minimum vine length was recorded in genotype HK 168 (146.7 cm) and maximum in check variety Pusa Do Mausami. The variation in vine length might be due to the specific genetic constitution, inherent character and vigour of different genotypes. The variation of vine length in bitter gourd has also been reported by Reddy *et al*. [15] and Yadav *et al*. [19] in bitter gourd.

The highest average fruit weight per plant was recorded in HK 168 (65.0 g) closely followed by HK 167 (61.7 g) and HK 164 (60.0 g). The minimum average fruit weight (46.7 g) and fruits per vine (18.0) were recorded in check variety Pusa Do Mausami, indicating that priority could be given to genotypes over others based on higher number of fruits per vine and average fruit weight if other parameters were also at optimum level. Significant variation in fruit weight might be due to fruit length, fruit width and number of fruits per vine. The present study was also supported by the finding of Yadav *et al*. [19] for the character weight per fruit in bitter gourd.

The maximum number of fruits per plant was recorded maximum in HK 168 (27.0) closely followed by HK 164 (25.7) and HK 167 (24.7). The minimum number of fruits per plant was recorded in check variety (18.0) Pusa Do Mausami. The number of fruits per plant ranged from 18.0 in Pusa Do Mausami (check) variety to 27.0 in HK 168 with mean value 22.5, indicating that priority could be given to genotypes while selecting them for further improvement programme with higher number of fruits per vine and more average fruit weight if other parameters were also at optimum level. A positive relationship between number of fruits per vine and total yield in luffa was also reported by Tyagi *et al*. [18].

Significantly higher fruit yield per hectare (121.7 q/ha) was recorded in genotype HK 168 with higher number of fruits per vine (27.0) and more average fruit weight of 60.0 g, which accounted for higher yield. The other genotypes HK 164, HK 167, HK 160 and HK 165 were next in order of fruit yield per hectare. The total yield of bitter gourd genotypes ranged from 102.2 to 119.8 q/ha with mean value of 111.0 q/ha. This variation in fruit yield per vine might be attributed to higher fruit set percentage, sex ratio, fruit length, number of fruits per vine, fruit weight and fruit width, which governed the total yield per plant. Yield is a complex character, which is determined by the interaction of many heritable characters with soil, climate and agronomic conditions [11]. The higher yield of HK 168 might be due to more number of secondary branches per plant, number of fruits per plant, average fruit weight and fruit length. The final yield and yield attributing characters are basically governed by vegetative growth as dry matter production and its partitioning. This finding was supported by many researchers [10, 14, 19] in bitter gourd, and [1, 16] in ridge gourd crop.

Based on the above results, it may be concluded that bitter gourd genotype HK 168 was superior in terms of total fruit yield per hectare, while HK 164 and HK 167 was next in order of number of branches per plant, average fruit weight and number of fruit per plant. Hence, the genotype HK 168 HK, 164 and

Table 1
Performance of bitter gourd genotypes for growth and yield (Pooled data)

Sr.No.	*Genotypes/ variety*	*Days to 1st female flower*	*Days to 1st picking*	*Fruit length (cm)*	*Fruit diameter (cm)*	*Branchesper plant*	*Vine length (cm)*	*Av. fruit weight (g)*	*Fruits per plant*	*Total yield (q/ha)*
1.	HK 160	52.3	59.7	11.7	2.5	8.0	175.3	57.2	21.3	110.3
2.	HK 161	52.7	61.0	10.8	2.3	5.7	165.7	55.0	21.0	108.4
3.	HK 162	56.0	64.7	7.9	4.0	6.3	199.0	50.0	20.3	104.9
4.	HK 163	53.7	63.3	7.4	3.9	9.3	185.3	51.7	23.7	107.5
5.	HK 164	51.3	60.5	12.3	3.1	10.0	170.7	60.0	25.7	119.8
6.	HK 165	52.0	61.3	11.3	3.5	7.0	203.7	55.0	24.3	109.5
7.	HK 166	55.0	63.7	7.8	3.0	9.0	153.7	50.0	22.3	105.3
8.	HK 167	52.3	61.7	8.4	3.1	10.0	110.7	61.7	24.7	113.2
9.	HK 168	49.3	58.7	13.8	3.2	11.0	146.7	65.0	27.0	121.7
10.	PDM (C)	58.3	68.7	9.8	2.5	6.3	200.3	46.7	18.0	102.2
C.D. at 5%		3.1	3.3	1.9	0.4	1.6	16.3	9.1	3.0	8.4

- PDM= Pusa Do Mausami, HK= Hisar Karela

HK 167 can be utilized to incorporate particular traits for tailoring high yielding bitter gourd hybrids/ selections in the coming future breeding programme.

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