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Genetic diversity and genetic advance in some cultivars of bitter gourd (*Momordica charantia* L.)

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Abstract

A field trial was conducted on fifteen cultivars of bitter gourd (*Momordica charantia* L.) to study the variability, correlation and path co-efficient analysis, and to determine the component characters on which selection can be based for improvement in yield. The experiment was conducted during the *kharif* 2018 at Rajaula Agriculture research field, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalay, Chitrakoot, Satna. The experiment was laid out in randomized block design with three replications. Observations were made for twelve characters *viz.*, number of branches/plant, days to 1st female flower appearance, days to 1st male flower appearance, node number to 1st female flower, node number to 1st male flower, days to 1st picking, number of marketable fruits/vine, average fruit length, average fruit width, average fruit weight (kg), fruit yield/plant (g), fruit yield/plot (kg) were studied. The results revealed that the phenotypic coefficient of variance was greater than genotypic coefficient of variance for all the traits. The highest value of genotypic coefficient of variation (GCV) was recorded for fruit yield/plant (g), number of branches/plant. High heritability was estimated for fruit yield (96.89 q/ha). Characters *viz.*, number of days to first picking (61) showed moderate heritability. The highest genetic advance as per cent of mean were recorded in for fruit yield (62.13 q/ha).

Keywords: genetic advance, genetic gain, genetic variability, heritability, *Momordica charantia*

Introduction

Bitter gourd (*Momordica charantia* L.) is a member of Cucurbitaceae family is an important vegetable among the cultivated cucurbits. The roots, vines, leaves, flowers and seeds of bitter gourd are also used in medicinal preparations. It has remarkable anti diabetic, antiviral, antibacterial and anti-cancerous properties (Samsam-Shariat, 1989) [1]. It is widely cultivated under tropical and sub-tropical conditions especially in India and China (Miniraj *et al.*, 1993) [2]. Bitter gourd contains carbohydrates (4.32g/100 g), protein (0.84g/100 g), vitamin C (33mg/100 g), calcium (9mg/100 g), iron (0.38mg/100 g) and water (93.95mg/100 g). In India with a greater seasonal availability it is grown in an area of 93 k ha with the production of 1063k MT (NHB 2017-18) with a productivity of 11.41 ton/ha. For a successful planning of breeding improvement program, the analysis of variability among the different traits and their association of a particular character in relation to yield and its attributing traits would be of greater importance (Mary and Gopalan, 2006) [3]. It also gives an estimation of genetic advance. A breeder can expect from selection applied to a population and help in deciding on what breeding method to choose (Idahosa *et al.*, 2010) [4]. High heritability and high genetic advance for a given trait indicates that it is governed by additive gene action and, therefore, provides the most effective condition for selection (Hamdi *et al.*, 2003) [5].

Material and Methods

The field experiment was carried out during *kharif* 2018 season at the main experiment station, Rajaula agriculture farm of the faculty of agriculture at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya Chitrakoot, Satna, Madhya Pradesh, India. The experiment was laid out in Randomized Block Design with three replications. The plot size kept as 3.0m × 3.0m. The distance maintained between row to row and plant to plant was 1.0m and 1.0m, respectively. All recommended agronomic practices for the region were adopted to raise a healthy crop. Three plants were selected randomly from each plot to record observations on 12 characters. Data were recorded on various parameters, *viz.* number of branches/plant, days to number 1st female flower appearance, days to 1st male flower appearance, node number to 1st female flower, node number to 1st male flower, days to 1st picking, number of marketable fruits/vine, average fruit length, average fruit width, average fruit weight (kg), fruit yield/plant and fruit yield/plot (kg).

Result and Discussion

Genetic variability

Genotypic and phenotypic coefficients of variation presented in Table 1 and 2. High magnitude of genotypic and phenotypic coefficient of variations were recorded for traits viz., fruit yield/plant (22.13g) to (23.73g) fruit yield/plot (30.6kg) to (32.05kg), fruit yield (30.59 q/ha) to (31.09 q/ha) suggested the substantial improvement on bitter gourd through selection for these traits. Moderate GCV and PCV were recorded for no of branches (10.31/plant) to (18.92/plant), days to first male flower(10.6)to(11.753), average fruit length(12.90cm) to (20.67cm), average fruit weight (13.23g) to (19.33g), no of marketable fruit per vine (7.71) to (14.88), node no of male flower (9.41) to (16.55), average fruit width (9.40cm) to (13.27cm), suggested existence of considerable variability in the population. Selection for these traits may also be given the importance for improvement programme.

Characters like days to first female flower (5.78) to (6.46), no of days to first picking (5.95) to (7.64), node no to female flower (5.26) to (7.80) had low genotypic and phenotypic coefficient of variation. Similar finding was also reported

earlier by Saha and Bhuyin *et al.*, (2015) [6], Singh *et al.*, (2017) [7], Ziaul *et al.*, (2019) [8].

Heritability and genetic advance

An attempt has been made in the present investigation to estimate heritability in broad sense and categorized as low (<50%), moderate (50%-70%) and high (>70%) as suggested by Robinson (1966). The highest heritability was observed for some characters fruit yield (96.82 q/ha) fruit yield/plot (91.12 kg) fruit yield/plant (86.92 g), days to first male flower (81.33), days to first female flower (80.07). The results are in line with the results of Mishra *et al.*, (2016) [9], Singh *et al.*, (2014) [10].

The expected genetic advance in per cent of mean ranged per cent for fruit yield/plot to fruit yield/plant. High estimated to expected genetic advance were found for fruit yield/plant, no. of branch/plant, days to no. 1st female flower appearance, days to 1st male flower appearance, node no. to 1st female flower, node no. to 1st male flower, days to 1st picking, no. of marketable fruit/vine, average fruit length, average fruit width, average fruit weight (kg) and low for fruit yield/plot (kg).

Table 1: Mean, range, genotypic and phenotypic coefficient of variation for 13 quantitative characters in bitter gourd

S. No.	Characters	Grand mean (SEm ±)	Range		GCV	PCV
			Min.	Max.		
1	No. of branches/plants	12.78(1.17)	10.00	16.33	10.313	18.92
2	Days to first female flower appearance	49.31(0.82)	46.00	56.55	5.789	6.469
3	Days to first male flower appearance	36.85(1.08)	28.33	42.67	10.6	11.753
4	Node no. to which 1 st female flower appearance	18.52(0.62)	17.33	22.00	5.263	7.801
5	Node no. to which 1 st male flower appearance	12.09(0.95)	9.00	14.00	9.414	16.551
6	Days to first picking	63.69(1.76)	56.00	71.00	5.959	7.643
7	No. of marketable fruits/ vine	10.29(0.76)	8.33	12.22	7.718	14.889
8	Average fruit length (cm)	9.98(0.93)	7.44	13.00	12.909	20.679
9	Average fruit width (cm)	8.12(0.44)	6.90	11.00	9.404	13.276
10	Average fruit weight (g)	37.18(3.02)	29.11	48.00	13.237	19.33
11	Fruit yield/plant(g)	349.95(17.35)	223.33	481.67	22.132	23.739
12	Fruit yield/plot(kg)	2.01(0.11)	0.90	3.00	30.6	32.056
13	Fruit yield (q/ha)	22.29(1.24)	10.00	33.33	30.59	31.09

Table 2: Heritability in broad sense and genetic advance in per cent of mean for 13 quantitative characters in bitter gourd

S. No.	Characters	Heritability (%)	Genetic advance	Genetic advance in per cent of mean
1	No. of branches/plants	29.712	1.48	11.58
2	Days to first female flower appearance	80.072	5.261	10.67
3	Days to first male flower appearance	81.337	7.257	19.693
4	Node no. to which 1 st female flower appearance	45.52	1.354	7.315
5	Node no. to which 1 st male flower appearance	32.355	1.334	11.031
6	Days to first picking	60.793	6.096	9.571
7	No. of marketable fruits/ vine	26.871	0.848	8.242
8	Average fruit length (cm)	38.969	1.657	16.6
9	Average fruit width (cm)	50.175	1.114	13.722
10	Average fruit weight (g)	46.892	6.943	18.673
11	Fruit yield/plant(g)	86.921	148.748	42.506
12	Fruit yield/plot(kg)	91.123	1.208	60.173
13	Fruit yield (q/ha)	96.82	13.85	62.13

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