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Genetic variability in bitter gourd (*Momordica charantia* L.)

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ABSTRACT

The variance analysis for 17 plant characters showed significant differences. Maximum vine length was recorded in IC-85635A. Significantly higher number of primary branches per vine and internodal length were observed in IC-85639. Maximum number of nodes was observed in JMC-4. Significantly minimum number of days for first appearance of male flower and maximum fruit length, fruit width, yield per vine, yield per plot, yield/ha were recorded in MC-84. Highest number of fruits per vine was recorded in GY-I and minimum powdery mildew infestation was observed in JMC-22.

Key words : Genetic variability, germplasm, bittergourd

INTRODUCTION

Bitter gourd fruits are highly nutritious (Gopalan *et al*, 1982). The tender and immature fruit is a rich source of Calcium (20 mg/100 g), Phosphorus (55 mg/100 g), Iron (1.8 mg/100 g), vitamin A (219 IU/100 g) and vitamin C (88 mg/100 g). The roots, vines, leaves, flowers and seeds of bitter gourd are also used in medicinal preparations (Morton, 1967).

Success in plant breeding depends upon the existence of genetic variability present in the breeding materials. It is proved that larger the variability, greater is the scope for selection and improvement. It is the genotypic variability and more specifically the additive variances, which is most important for a plant breeder as, it determines the genetic gain through selection. Before aiming at an improvement in yield, it is necessary to have information on genetic variability and heritability, in respect of important characters associated with yield. Therefore, the present study was taken up to obtain information on the range of variability for different important economic traits.

MATERIAL AND METHODS

The experiment was conducted at Vegetable Research Farm, Deptt. of Horticulture, Allahabad Agricultural Institute-Deemed University, Allahabad during the year 2003 and 2004. Twenty eight accessions were grown in a Randomised Block Design with three replications at 1 x 1.5 m^2 spacing. Observations were recorded on five randomly selected plants for vine length (cm), number of primary branches per vine, number of nodes per vine, internodal length (cm), days to first appearance of female flower, days to appearance of male flower, first effective node, length of fruit (cm), width of fruit (cm), weight per fruit (g), number of fruits per vine, number of fruits per plot, yield per plant (Kg), and yield per plot (Kg), yield (q/ha). The data were analysed statistically.

RESULTS AND DISCUSSION

Significant differences were recorded among the genotypes for all the characters studied (Table 1). Highest vine length was recorded in IC-85635A followed by MC-84, JMC-4, CO-1 and minimum in TZA_1. Such variation in vine length of bitter gourd have also been reported earlier (Ramchandran and Gopalkrishnan, 1979; Mangal *et al*, 1981; Chaudhary *et al*, 1967; Reddy *et al*, 1995; Yadav *et al*, 2004), which might be due to the specific genetic constitution, inherent character and vigour of different genotypes. Highest number of primary branches per vine was noted in IC-85639 (37.67) followed by MC-84 (32.67), Improved Jaunpuri (37.67) and S-17 (31.00) whereas, the last number of primary branches per vine was recorded in DVBT-G-5 (10.67). Maximum internodal length was

observed in IC-85639 (10.00 cm) followed by BG-11 (9.33 cm), TZA (8.33 cm) and VRBT-14 (7.50 cm) and the minimum were recorded in VRBT-6-9 (4.50 cm). Highest number of nodes was recorded in JMC-4 (85.33) followed by IC-85639 (84.00) and MC-84 (72.00) and the minimum number of nodes were recorded in DVBT-G-5 (30.33). The number of days recorded for first appearance of male flower was maximum in IC-85612 and PDM (35.00 days), followed by VRBT-14 (34.67 days) JMC-22 (29.33 days) and S-17 (29.67 days) and the least in MC-84 and TZA_1 (27.00 days). The number of days taken for first appearance of male flower plays an important role in deciding the earliness of crops and the variation in this character might be due to internodal length, number of nodes and vigour of the crop. The number of days recorded for first appearance of female flower was the maximum in CO-1 (42.33 days) followed by PDM (38.67 days), Preethi (38.67 days) and minimum days in TZA_1 (25.33 days), VRBT-6-9 (29.00 days), JMC-22 (29.22 days) and Gy-I (30.00 days). The number of days from sowing to first appearance of female flower is an important character, which helps in the occurrence of early flush of the crop. Lower number of nodes was required for the formation of first effective node in VRBT-6-9 (5.33), JMC-22 (6.33), TZA (7.00) and higher number of node in CO-1 (35.00), IC-85648 (32.33) and IC-85612 (29.67). The first effective node plays an important role in determining the yield of the crop. Maximum fruit length was recorded in MC-84 (20.50 cm) followed by JMC-4 (19.33 cm), S-17 (19.00 cm) and minimum in TZA_1 and DVBT-G-5 (7.33 cm) and TZA (8.33 cm). Highest fruit width was found in MC-84 (9.91 cm) followed by IC-85639 (9.83 cm), S-17 (9.42 cm) and lower in IC-85648 (2.33 cm) and IC-85636 (3.08 cm) and IC-85612 (3.83 cm). These observed differences might be due to fruit length, number of fruits per vine and number of effective nodes. Highest weight per fruit was found in S-17 (175.00 g), followed by NDBT-15 (160.00 g), VRBT-94 (133.33 g), and minimum in TZA_1 (28.33 g), TZA (33.33 g) and Gy-I (42.33 g). The genotype

Table 1. Performance of bitter gourd germplasm accessions

Genotype	Vine length (cm)	No. of primary branches/ vine	No. of nodes	Internodal length (cm)	Days to first appearance of male flower	Days to first appearance of female flower	First effective node	Fruit Length (cm)
IC-85635A	5.65	27.33	60.33	4.67	33.00	36.33	11.00	14.33
DVBT-G-5	2.74	10.67	30.33	5.67	33.67	36.00	7.33	7.33
VRBT-89	2.59	20.33	42.33	6.00	33.67	33.33	14.00	14.17
VRBT-94	3.03	23.67	40.33	6.17	34.33	34.67	11.33	14.17
S - 17	5.25	31.00	67.67	5.50	29.67	33.67	20.67	19.00
MC - 84	5.42	32.67	72.00	5.00	27.00	33.33	9.67	20.50
IC-85648	4.22	26.33	66.00	6.33	31.67	35.00	16.00	11.00
PDM	3.48	35.67	60.33	6.00	35.00	38.67	22.33	16.00
VRBT - 14	3.85	16.33	52.00	7.50	34.67	34.33	25.67	15.00
IC-85612	3.10	15.33	51.67	5.67	35.00	33.67	29.67	13.67
IC-85648A	2.62	16.00	40.00	6.67	33.00	36.00	32.33	11.67
IC-85636	4.12	22.00	46.33	7.00	34.67	36.33	17.33	14.33
MC - 56	3.07	19.33	46.00	6.30	32.67	36.33	15.00	11.00
CO - 1	4.95	22.00	62.67	6.00	40.00	42.33	35.00	10.33
JMC - 4	5.32	23.00	85.33	5.83	34.67	38.67	11.33	19.33
TZA	3.52	16.33	60.67	5.17	33.00	33.33	7.00	8.33
MC - 84 (1)	3.75	13.67	33.00	4.63	32.33	32.33	15.67	12.33
Gy - I	2.73	23.00	35.33	6.60	0.00	30.00	9.33	11.00
Gy - II	2.50	19.00	40.00	5.83	0.00	32.00	10.67	13.00
Preethi	4.72	20.33	55.33	6.50	34.67	38.67	17.33	15.67
JMC - 22	3.15	21.00	61.00	5.17	29.33	29.33	6.33	10.67
Immproved Jaunpuri	3.50	31.67	63.67	5.33	29.67	31.67	10.33	12.67
NDBT - 15	3.32	24.33	42.67	5.50	29.67	35.67	12.00	14.00
VRBT - 6 - 9	4.22	24.00	68.00	4.50	30.33	29.00	5.33	14.33
JMC - 21	3.37	26.00	66.67	6.00	31.00	35.00	8.67	11.00
BG - 11	1.92	18.00	32.00	9.33	31.00	33.33	13.00	9.67
IC-85639	4.78	37.67	84.00	10.00	31.67	35.33	15.67	16.67
TZA_1	1.12	17.33	20.67	8.33	27.00	25.33	9.67	7.33
S. Em. ±	0.95	0.71	1.54	0.44	0.49	1.37	1.10	0.29
C. D *(P=0.05)*	1.92	1.43	3.01	0.90	0.96	2.60	2.20	0.58

Table 1. (contd.) Performance of bitter gourd germplasm accessions

Genotypes	Fruit Width (cm)	Fruit Weight (g)	No. of fruits/ vine	No. of fruits / plot	Yield / vine (kg)	Yield/ plot (kg)	Yield (q/ha)	Vitamin C (mg/100 g)	Powdery mildew infestation (%)
IC-85635A	7.14	80.00	11.00	20.00	0.88	3.51	59.45	78.67	16.33
DVBT-G-5	6.97	47.67	15.33	61.33	0.74	2.98	49.67	107.67	27.33
VRBT-89	6.83	95.00	15.00	53.33	1.45	5.81	96.89	60.67	12.00
VRBT-94	7.17	133.33	14.33	50.67	1.86	7.45	124.22	95.33	42.67
S – 17	9.42	175.00	12.67	50.67	2.21	8.83	147.11	49.33	26.67
MC - 84	9.91	130.00	20.33	81.33	2.68	10.73	178.89	85.00	33.00
IC-85648	6.17	80.00	15.67	58.67	1.25	4.99	83.11	84.67	28.67
PDM	2.33	101.60	11.00	44.00	1.12	4.47	74.44	91.00	47.00
VRBT - 14	5.33	60.00	15.33	48.00	0.92	3.68	61.33	120.00	12.33
IC-85612	3.83	80.67	11.67	42.67	0.95	3.79	63.11	87.33	24.33
IC-85648A	6.93	85.00	10.33	41.33	0.88	3.52	58.67	170.00	45.00
IC-85636	3.08	98.33	11.33	42.67	1.11	4.45	74.22	80.00	33.00
MC - 56	5.67	58.33	24.00	96.00	1.39	5.57	92.89	86.00	22.67
CO – 1	5.50	93.33	6.00	24.00	0.57	2.28	38.00	71.67	48.33
JMC - 4	6.67	80.00	14.67	49.33	1.17	4.69	78.22	119.00	46.33
TZA	5.58	33.33	21.33	85.33	0.71	2.84	78.33	44.67	67.33
MC - 84 (1)	7.18	78.33	13.67	54.67	1.07	4.27	71.11	82.67	31.00
Gy – I	5.50	42.33	42.67	170.67	1.81	7.24	119.00	87.67	45.67
Gy – II	6.50	46.67	17.67	70.67	0.82	3.29	54.67	90.62	46.33
Preethi	4.83	118.33	11.00	48.00	1.30	5.20	87.33	70.00	32.67
JMC - 22	6.17	120.00	14.33	57.33	1.70	6.79	113.11	90.33	9.00
Immproved Jaunpuri	6.67	98.33	13.67	54.67	1.34	5.37	89.55	90.00	40.00
NDBT - 15	7.33	160.00	12.00	48.00	1.89	7.55	125.78	80.33	41.00
VRBT - 6 - 9	6.17	90.00	19.00	76.33	1.70	6.81	113.56	99.00	12.67
JMC - 21	6.67	126.67	15.33	61.00	1.95	7.80	130.00	81.00	46.33
BG – 11	7.33	130.00	11.00	44.00	1.43	5.73	95.55	87.67	41.67
IC-85639	9.83	133.33	9.00	36.00	1.28	5.13	85.55	89.33	38.67
TZA_1	5.67	28.33	25.33	101.33	0.72	2.88	47.56	79.33	27.67
S. Em. ±	13.29	1.90	1.50	1.50	2.63	12.52	1.10	0.75	1.89
C. D (*P=0.05*)	26.49	3.90	3.10	3.30	5.21	25.80	2.20	1.50	3.79

Gy-I had maximum number of fruits per vine (49.67) followed by TZA_1 (25.33), MC-56 (24.00), TZA (21.33), MC-84 (20.33) and minimum number of fruits per vine was recorded in CO-1 (6.00), IC-85639 (9.00) and IC-85648A (10.33). The variation in number of fruits per vine might be due to fruit set percentage, sex ratio and vine length. The highest number of fruits per plot were recorded in Gy-I (170.67) followed by TZA_1 (107.33), MC-56 (96.00), TZA (85.33) and MC-84 (84.33) and significantly less number of fruits per plot were noted in IC-85635A (20.00), CO-1 (24.00) and IC-85639 (36.00). Maximum yield per vine was recorded in MC-84 (2.68 kg) followed by S-17 (2.21 kg), VRBT-6-4 (1.95 kg) and NDBT-15 (1.89 kg). The yield per vine was lower in CO-1 (0.57 kg), TZA (0.71 kg), TZA_1 (0.72 kg) and DVBT-G-5 (0.74 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 Shrivastava and Shrivastava (1976), Singh *et al* (1977), Ramchandran and Gopal Krishnan (1979), Indiresh (1982) and Yadav *et al*(2004) in bitter gourd and Kadam and Kale (1987) in ridge gourd. Maximum yield per plot was recorded in MC-84 (10.73 kg) followed by S-17 (8.33 kg), JMC-21 (7.80 kg) and NDBT-15 (7.33 kg). Significantly lower yield per plot was recorded in CO-1 (2.28 kg), TZA (2.84 kg) and TZA_1 (2.88 kg). The variation in yield per plot might be due to variation in yield per plant, number of fruits per vine, fruit length, fruit width, fruit weight and fruit set percentage. Singh *et al* (1977), Parhi *et al* (1993), Thakur *et al* (1994), and Yadav *et al* (2004) also reported similar findings for yield per plot in bitter gourd. Maximum yield was recorded in MC-84 (178.89 q/ha) followed by S-17 (117.11 q/ha), JMC-21 (130.00 q/ha) and NDBT-15 (125.78 q/ha). Significantly lower yield was recorded in CO-1 (38 q/ha), TAZ (47.33 q/ha) and TZA_1 (47.56 q/ha). Maximum vitamin C was found in IC-85648A (170 mg/100 g) followed by VRBT-14 (120 mg/100 g), VRBT-6-9 (99 mg/100 g) and VRBT-94 (95.33 mg/100 g). Minimum vitamin C was found in TAZ (44.67 mg/100 g) S-17 (49.33 mg/100 g) and VRBT-89 (60.67 mg/100 g). Lower powdery mildew

infestation percentage was recorded in JMC-22, VRBT-89, VRBT-6-9, IC-85635A, MC-56, IC-85612, JMC-4, S-17 and maximum infestation was recorded in CO-1 showing that JMC-22 was least susceptible and CO-1 was most susceptible to powdery mildew infestation. Similar results were reported by Akram and Khan (1971), Khan and Khan (1992).

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