Plant Archives Vol. 24, No. 1, 2024 pp. 721-724 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.1.098

GENETIC VARIABILITY AND HERITABILITY STUDIES IN BITTER GOURD

M. Aishwarya, A. R, Kurubar, Ravi Pujari* and P. Shekargouda

Department of Horticulture, U.A.S., Raichur, Karnataka, India.

*Correspondence author E-mail : pujariravihort556@gmail.com

(Date of Receiving-07-11-2023; Date of Acceptance-16-02-2024)

ABSTRACT

Genetic variability, heritability, genetic advance and its per cent over mean for twenty three characters were assessed by field evaluation of eighteen bitter gourd genotypes at Main agricultural research station, Raichur, Karnataka, India during 2019-20. High degree of variation was observed for all characters. The difference between phenotypic co–efficient of variation (PCV) and genotypic co–efficient of variation (GCV) are found to be narrow for most of the traits. However, high GCV and PCV was observed for Internodal length at 90 DAT (cm), Number of branches per vine at 90 DAT, Vine length at 90 DAT (cm), Fruit length (cm), Rind thickness (mm), Node at which first male flower appeared, Node at which first female flower appeared, Number of female flowers per vine, Sex ratio (%), Average fruit weight (g), Total number of fruits per vine, Fruiting period (days, Fruiting period (days), Number of seeds per fruit, Seed weight per fruit (g/fruit), Fruit yield per vine (g/vine) are indicates the predominance of additive gene action. Hence, improvement of these traits through simple selection breeding method for improvement of wild melon would be rewarding.

Key words : Bitter gourd, Genetic advance, Heritability, Genotypic variance, Phenotypic variance.

Introduction

Bitter gourd (*Momordica charantia* L.; 2n = 22) is an economically important Cucurbitaceous vegetable, which has 90 genera and 750 species (Ram, 2006) and is widely cultivated in India, China, Malaysia, Africa and South America (Raj *et al*., 1993). It is also known as bitter melon, bitter gourd, bitter cucumber, bitter squash, balsam pear, Karela, cassilla and maiden apple (Morton, 1967). Indian bitter gourd has wide phenotypic variation with respect to growth habit, maturity, fruit shape, size, colour, surface texture and sex expression (Behera *et al*., 2006). For successful planning of breeding programme, the analysis of variability for important traits among genotypes and association with characters in relation to yield and yield attributing traits would be of great importance. The wild species offer great resource for breeding of cultivated bitter gourd varieties with desirable qualitative traits and tolerance to various biotic and abiotic stresses. It is possible to develop high-yielding open-pollinated varieties or hybrids, by utilizing existing variability and this technique could be used in improvement of bitter gourd. Improvement in any crop depends upon extent to which desired characters are heritable and magnitude of genetic variability. The role of genetic variability in crops is of paramount importance in selecting the best genotypes for making rapid improvement of yield and its related characters as well as to select the most potential parents for successful hybridization programme. With the limited variability, the interested traits cannot possible to incorporate and the breeder will have to enrich the greater variability of genetic resources namely germplasm by hybridization, mutation, polyploidy breeding and also by several other breeding procedure (Kumaran *et al*., 2000). In spite of many advantages bitter gourd, there were no research thrusts paid on genetic improvement wild melon. Henceforth, present study trialed to assess the genetic variability of local collections or land races based on morphological and physiological variation.

Materials and Methods

The present study was carried out at Main Agricultural Research Station, Raichur, Karnataka, India

during 2019-20 with 18 genotypes. The genotypes were assessed in a field experiment under a randomized block design with two replications. 10 plants maintained in each treatment with spacing of 2 m × 1 m between rows and plants, respectively. The data were recorded on five randomly selected plants from each treatment for 23 characters. Observations recorded on Internodal length at 90 DAT (cm), Number of branches per vine at 90 DAT, Vine length at 90 DAT (cm), Fruit length (cm), Rind thickness (mm), Node at which first male flower

Table 1 : Analysis of variance for growth, reproductive, yield and quality characters of various bitter gourd genotypes.

Source of variation/Parameters	Mean sum of squares			S.Em ±	CD (5%)
Degrees of freedom	Replication	Genotypes	Error		
	2	18	36		
Growth Parameters					
Internodal length at 30 DAT (cm)	0.01	1.71**	0.01	0.06	0.18
Internodal length at 60 DAT (cm)	0.00	3.74**	0.01	0.04	0.13
Internodal length at 90 DAT (cm)	0.01	5.03**	0.00	0.03	0.10
Number of nodes per vine at 30 DAT	2.74	127.95**	5.83	1.39	4.00
Number of nodes per vine at 60 DAT	2.73	227.45**	3.81	1.13	3.23
Number of nodes per vine at 90 DAT	1.82	343.51**	1.02	0.58	1.67
Number of branches per vine at 30 DAT	0.89	58.32**	0.66	0.47	1.35
Number of branches per vine at 60 DAT	1.68	83.19**	1.10	0.60	1.73
Number of branches per vine at 90 DAT	0.59	97.98**	0.83	0.53	1.51
Vine length at 30 DAT (cm)	98.61	2497.96**	66.55	4.71	13.51
Vine length at 60 DAT (cm)	0.24	8165.90**	61.63	4.53	13.00
Vine length at 90 DAT (cm)	146.13*	14091.40**	40.04	3.65	10.48
Reproductive parameters					
Days to first male flower appeared (DAT)	3.77	49.11**	2.01	0.82	2.35
Days to first female flower appeared (DAT)	17.29	37.42**	14.53	2.20	6.31
Node at which first male flower appeared	3.19	20.43**	1.73	0.76	2.18
Node at which first female flower appeared	3.05	33.31**	2.98	1.00	2.86
Number of female flowers per vine	39.70*	93.22**	14.794	2.22	6.40
Number of male flowers per vine	5463.84*	73326.64**	2747.32	30.26	87.15
Sex ratio (%)	8.60*	50.31**	2.65	0.94	2.71
Yield parameters					
Average fruit weight (g)	8.79	2022.79**	15.52	2.21	4.49
Total number of fruits per vine	12.02*	63.55**	2.34	0.86	1.74
Fruit yield per vine (g/vine)	1115.7*	6833.33**	7948.70	87.43	177.31
Total fruit yield per hectare (kg/ha)	11157.21*	68339.92**	79487.03	874.27	1773.11
Days to first harvest (DAT)	0.51	13.06**	3.70	1.08	2.19
Days to last harvest (DAT)	3.07	147.15**	1.38	0.66	1.34
Fruiting period (days)	5.96	131.13**	4.75	1.22	2.48
Crop duration (days)	12.38	294.79**	9.64	1.75	3.54
Number of seeds per fruit	140.97**	164.72**	1.98	0.79	1.60
Seed weight per fruit (g/fruit)	1.93**	8.60**	0.06	0.14	0.28
Fruit fly infestation (%)	91.80	386.99**	37.72	3.45	7.00
Quality parameters					
Fruit length (cm)	155.7	548.58**	104.46	5.74	11.65
Fruit diameter (mm)	3.18	128.79**	1.61	0.71	1.45
Rind thickness (mm)	0.01	7.61**	0.03	0.10	0.21
Physiological loss in weight (g)	0.69	26.74**	0.31	0.32	0.64
Shelf life (days)	1.60*	1.53**	0.49	0.39	0.79
Ascorbic acid content (mg/100g)	1.72	1285**	13.68	2.08	4.21

** Significance at 1% probability * Significance at 5% probability.

appeared, Node at which first female flower appeared, Number of female flowers per vine, Sex ratio (%), Average fruit weight (g), Total number of fruits per vine, Fruiting period (days, Fruiting period (days), Number of seeds per fruit, Seed weight per fruit (g/fruit), Fruit yield per vine (g/vine) The variance components and co–efficients of variation (cv) were computed as per Burton (1952). The heritability in broad sense and genetic advance over a mean were determined by using the formula given by Johnson *et al*. (1955).

Results and Discussion

The analysis of variance revealed significant differences among genotypes for all the characters, which indicated the presence of variability among the lines evaluated and which indicated existence of ample scope for genetic improvement of wild melon by selection breeding methods. Estimates of genetic parameters and components of variance are presented in Table 1.

In general, the PCV values were higher than GCV values, indicating that the variation among the genotypes is due to the influence of environment. Both GCV and PCV were high Internodal length at 90 DAT (cm), number of branches per vine at 90 DAT, Vine length at 90 DAT (cm), Fruit length (cm), Rind thickness (mm), node at which first male flower appeared, Node at which first female flower appeared, number of female flowers per vine, Sex ratio (%), Average fruit weight (g), Total number of fruits per vine, Fruiting period (days), Fruiting period (days), Number of seeds per fruit, Seed weight per fruit (g/fruit), Fruit yield per vine (g/vine). The present findings are in agreement with Rani *et al*. (2015), Gupta *et al*. (2016) and Kumar *et al*. (2018) found similar findings for this character in bitter gourd. Mangal *et al*. (1981), Chakraborty *et al*. (2013), Rani *et al*. (2015), Gupta *et al*. (2016), Iqbal *et al*. (2016), Jatav and Singh (2016) and Yadagiri *et al*. (2017).

Table 2 : Estimates of genotypic and phenotypic coefficient of variation, heritability and genetic advances for different parameters in bitter gourd.

Variable	Range	Mean (%)	GCV	PCV (%)	h^2 BS (%)	GAM (%)
Internodal length at 90 DAT (cm)	1.15 to 5.36	2.73	47.47	47.52	99.80	97.69
Number of nodes per vine at 90 DAT	37.40 to 78.13	61.04	17.51	17.58	99.10	35.90
Number of branches per vine at 90 DAT	9.07 to 28.47	17.55	32.42	32.83	97.50	65.94
Vine length at 90 DAT (cm)	171.53 to 452.53	287.71	23.79	23.89	99.20	48.79
Fruit length (cm)	5.12 to 71.84	18.49	65.79	85.92	58.60	97.54
Fruit diameter (mm)	33.68 to 59.63	42.23	15.42	15.71	96.30	31.18
Rind thickness (mm)	4.35 to 10.66	6.64	23.95	24.12	98.70	49.01
Day to first male flower appeared (DAT)	17.78 to 31.07	25.26	15.69	16.66	88.70	30.43
Day to first female flower appeared (DAT)	24.28 to 38.73	30.72	8.99	15.32	34.40	10.87
Node at which first male flower appeared	6.72 to 16.73	10.78	23.16	26.17	78.30	42.20
Node at which first female flower appeared	13.27 to 25.47	17.52	18.24	20.71	77.60	33.09
Number of female flowers per vine	18.00 to 38.33	28.23	18.11	22.67	63.91	29.82
Number of male flowers per vine	100.33 to 724.00	365.05	42.06	44.40	89.58	81.90
Sex ratio (%)	4.33 to 20.65	9.16	43.53	47.03	85.75	83.01
Average fruit weight (g)	13.93 to 137.04	79.34	32.60	32.98	97.70	66.40
Total number of fruits per vine	9.72 to 28.54	18.67	24.19	25.54	89.70	47.21
Days to first harvest (DAT)	40.13 to 49.43	44.17	4.00	5.91	45.80	5.58
Days to last harvest (DAT)	84.4 to 107.73	98.89	7.05	7.15	97.20	14.32
Fruiting period (days)	38.93 to 64.47	54.73	11.86	12.51	89.90	23.16
Crop duration (days)	98.47 to 136.33	119.25	8.18	8.58	90.80	16.05
Number of seeds per fruit	9.33 to 42.23	29.04	25.37	25.82	96.50	51.33
Seed weight per fruit (g/fruit)	1.51 to 7.17	4.81	35.09	35.46	97.90	71.53
Fruit yield per vine (g/vine)	497.37 to 2509.03	1590.00	29.48	31.06	90.10	57.64

** Significance at 1% probability
* Significance at 5% probability
GCV - Genetic co-efficient of variance
PCV - Phenotypic co-efficient of variance
h^2 BS - Broad sense heritability
GAM - Genetic Advances as *per cent* of Mean.

References

Behera, T.K., Dey S.S. and Sirohi P.S. (2006). DBGy-201and DBGy-202: two gynoecious lines in bitter gourd (*Momordica charantia* L.) isolated from indigenous source. *Indian J. Genet*., **66**, 61–62.

Chakraborty, L., Acharyya P. and Raychaudhuri S. (2013). Diversity analysis of *Momordica charantia* L. accessions from eastern and north eastern India based on morphological, yield related traits and molecular marker. *Proceedings of FVHH*, Thailand, 179-193

Gupta, N., Bhardwaj M.L., Singh S.P. and Sood S. (2016). Genetic diversity for growth and yield traits in bitter gourd. *Int. J. Veg. Sci.*, **22(5)**, 480-489.

Iqbal, M., Munawar M., Najeebullah M. and Din A. (2016). Assessment of genetic diversity in bitter gourd. *Int. J. Veg. Sci.*, **22(6)**, 578-584.

Jatav, V. and Singh D.K. (2016). Genetic Variability, Heritability and Genetic advance for yield and related traits in bitter gourd (*Momordica charantia* L.). *J. Env. Bio-Sci*., **30(2)**, 421-426.

Johnson, H.W., Robinson H.F. and Comstock R.S. (1955). Estimation of geneticnand environmental variability in soyabean. *Agron. J*., **41**, 314-318.

Kumaran, S.S., Natarajan S. and Thamburaj S. (2000). Genetic variability in pumpkin (*Cucurbita moschata* Duch. Ex. Poir.). *South Indian Hort*., **45**, 10-12.

Kumar, D., Kumar S., Meena R.K., Kumar M. and Vilas R. (2018). Genetic Variability, Heritability and Genetic advance for Yield and Quality attributes in Bitter Gourd (*Momordica charantia* L.). *Int. J. Pure App. Biosci.*, **6(2)**, 499-503.

Mangal, J.L., Pandita M.L. and Singh G.R. (1981) Effect of various chemicals on growth, flowering and yield of bitter gourd. *Indian J. Agric. Res*., **15**, 185–188.

Morton, J.F. (1967). The balsam pear-an edible medicinal and toxic plant. *Eco. Bot*., **212**, 57-68.

Ram, D., Kumar S., Singh M., Rai M. and KaIloo C. (2006). Inheritance ofgynoecism in bitter gourd *(Momordica charantia*). *U. J. Hered*., **97**, 294-295.

Rani, K.R., Raju C.S. and Reddy K.R. (2015). Variability, correlation and path analysis studies in bitter gourd (*Momordica charantia* L.). *Agric. Sci. Digest-A Res. J*., **35(2)**, 106-110.

Raj, M., Prasanna N.K. and Peter K.V. (1993). Bitter gourd (*Momordica ssp.)* In: Kalloo G. and Berg B.O. (eds) *Genetic Improvement of Vegetable Crops*, Pergmon Press, Oxford, UK. 239-246.

Yadagiri, J., Gupta N.K., Tembhire D. and Sheela V. (2017). Genetic variability, heritability and morphological characterization in bitter gourd (*Momordica charatia* L.). *Int. J. Pure Appl. Biosci.*, **5(4)**, 1322-1327.