GENETIC PARAMETERS, CORRELATION COEFFICIENTS AND PATH COEFFICIENT ANALYSIS IN BITTER GOURD (*MOMORDICA CHARANTIA* L.)

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INTRODUCTION

For rational improvement of yield and its components, the understanding of the nature and magnitude of variation in the available material and association of characters with yield and among themselves and the extent of environmental influence on the characters has been very useful. Association of plant characters which is statistically determined by correlation coefficients is although useful in determining the relative influence of the various characters on yield they do not provide an exact picture of the relative importance of direct and indirect influences of each of the characters towards the yield. Path coefficient analysis developed by Wright (8) proves helpful in partitioning the correlation coefficient into direct and indirect effect. The results of estimates of genetic parameters, correlation coefficients and path coefficient analysis of components of yield in bitter gourd (*Momordica charantia* L.) are presented in this paper.

MATERIALS AND METHODS

The present study was conducted with ten lines of bittergourd. The trial was conducted in randomized block design with three replications at Horticulture Farm of Rajasthan College of Agriculture, University of Udaipur, Udaipur (India) during 1968 (February–June). The crop was planted in rows 2.75 cm apart and each row had twelve plant hills spaced 1.25 m apart. Three seeds were planted at each hills but only one seedling was retained thus a perfect stand was obtained. Three plants were selected at random from each plot for recording the observations on length of main vine (cm.), number of female flowers per plant, days taken to appear first female flower, number of fruits per plant, length of fruit (cm.), girth of fruit (cm.), weight of fruit (gm.) and yield per plant (kg.). The data were statistically analysed. Genotypic coefficient of variation were computed using the formula of Burton (1). Heritability in broad sense and genetic advance were estimated by the formula of Johnson *et al.* (4). The formula suggested by Miller *et al.* (6) were adopted for calculating correlation coefficients. Path-coefficient analysis were done using the formula of Dewey and Lu (2).

RESULTS AND DISCUSSION

Bittergourd lines showed significant difference for all the characters under study except for number of male flowers per plant. Genetic parameters like genotypic coefficient of variation, heritability per cent and genetic advance were estimated for all the characters which are summarised in Table 1. G.C.V. were computed to findout the amount of variation caused by genotype and environment. G.C.V. value was maximum for number of fruits per plant (37.45) and minimum for number of male flowers per plant (11.47). The characters showing low G.C.V. value indicate that they are more influenced by the environment. Heritability estimates are useful in selection on the basis of the phenotypic performance of the quantitative characters. And the characters with high

heritability value could be improved straight way through selection since they are less affected by environment. In the present study heritability per cent in broad sense was highest for number of fruits per plant (99.31) and lowest for number of male flowers per plant. Further Johnson *et al.* (4) have suggested that heritability and genetic advance when calculated together are more useful for predicting the resultant effect of selecting the best individual than heritability or genetic advance calculated alone. High heritability value along with high value of genetic advance as per cent of mean is most effective condition for selection (Gandhi *et al.*, 3) Characters like number of fruits per plant, weight of fruit and yield per plant have showed high heritability value as well as high value of genetic advance as per cent of mean. Such condition arises due to action of additive genes (Panse, 7). There are other characters like number of lateral branches per plant, number of female flowers per plant and days to first female flower, which showed high value of heritability but very low value of genetic advance as per cent of mean. This is because of non-additive gene action which includes dominance and epistasis (Liang and Walter, 5).

TABLE 1

Estimates of genotypic coefficient of variation (GCV), heritability (H) per cent and genetic advance (GA) in 10 characters of bittergourd.

Character	GCV	H (%)	GA	GA as % of mean
Length of main vine	17.07	57.14	0.43	26.21
Number of lateral branches/plant	22.92	90.02	3.52	44.84
Number of male flowers/plant	11.47	49.93	99.60	16.73
Number of female flowers/plant	19.76	98.84	22.74	40.49
Days taken to appear first female flowers	12.01	95.48	14.21	25.11
Number of fruits/plant	37.45	99.31	21.38	76.93
Length of fruit	26.22	94.59	6.15	53.75
Girth of fruit	12.96	60.38	2.24	22.33
Weight of fruit	30.02	98.56	25.85	62.09
Yield/plant	32.13	97.61	7.15	65.71

Data on correlation coefficient (Table 2) indicates that days to first female flower have high negative correlation with number of fruits per plant and number of female flowers per plant but positive correlation with weight of fruit both at genotypic and phenotypic level. High positive correlation of number of lateral branches per plant with yield per plant at genotypic level and with number of fruits per plant both at genotypic and phenotypic level was also observed. Number of female flowers per plant were highly positively correlated with number of fruits per plant and yield per plant. Weight of fruits and number of fruits per plant were highly negatively correlated only at genotypic level. Number of fruits per plant was also having positive correlation with yield per plant. In all cases genotypic correlations were higher than phenotypic correlations. This is in agreement with the findings of many workers including Johnson *et al.* (4) in soybeans.

Path coefficient analysis (Table 3) revealed that number of female flowers per plant have maximum direct effect on yield (+2.7544) followed by number of fruits per plant (+0.9031) and number of lateral branches per plant (+0.8868) A critical study

TABLE 2

Phenotypic (P) and genotypic (G) correlation coefficients for different pairs of characters in bitter gourd

Character		Yield/ plant	Number of fruits/ plant	Weight of fruit	Number of female flowers/plant	No. of lateral branches/plant
Days to first female flower	P	—0.1575	—0.7013*	+0.6531*	—0.5919*	—0.1526
	G	—0.1587	—0.7185	+0.6790	—0.6071	—0.1642
Number of lateral branches/plant	P	+0.4626	+0.6180*	—0.4582	+0.4481	
	G	+0.5873	+0.6301	—0.5039	+0.4721	
Number of female flowers/plant	P	+0.8282**	+0.9504**	—0.5219		
	G	+0.8684	+0.9623	—0.6330		
Weight of fruit	P	+0.2170	—0.5323			
	G	+0.2186	—0.9645			
Number of fruits/plant	P	+0.7000*				
	G	+0.8611				

*Significant at 5% level of probability.
**Significant at 10% level of probability.

TABLE 3

Path coefficient analysis to determine the direct and indirect effect of five variables on yield of bitter gourd

Character	Number of lateral branches/ plant	Days to first female flower	Number of female flowers plant	Weight of fruit	Number of fruits/plant	Genotypic correlation with yield/ plant
Number of lateral branches/plant	+0.8868	+0.0246	+1.2994	—0.2410	+1.3834	0.5873
Days to first female flower	—0.1436	—0.1497	—1.6722	+0.3247	—1.5626	—0.1587
Number of female flowers/plant	++0.4187	+0.0909	+2.7544	—0.3017	+2.0928	+0.8684
Weight of fruit	—0.4469	—0.1016	—1.7325	+0.4782	—2.0976	+0.2186
Number of fruits/plant	+0.5641	+0.1075	—0.4612	+2.6506	+0.9031	+0.8611

Under line data shows direct effect while others are indirect effects.

of the Table 3 further revealed that the contribution of almost all the characters towards yield in through number of lateral branches per plant, number of female flowers per plant, and number of fruits per plant.

It clearly indicates that the number of lateral branches per plant, number of female flowers per plant and number of fruits per plant are the most important components of yield and so more weightage has to be given to these characters in bitter gourd breeding programme.

SUMMARY

Variability studies were made in ten lines of bitter gourd (*Momordica charantia* L.). Of the ten characters studied, genotypic coefficient of variation, heritability per cent in broad sense and genetic advance as per cent of mean were highest for number of fruits per plant and lowest for number of male flowers per plant. High heritability value in conjunction with high genetic advance as per cent of mean was observed for number of fruits per plant, weight of fruit and yield per plant. Yield per plant was highly positively correlated with number of fruits per plant. Number of fruits per plant was also having high positive correlation with number of lateral branches per plant and number of female flowers per plant. Number of female flowers was having maximum positive direct effect on yield and the indirect contribution of other characters on yield was mainly through number of lateral branches per plant, number of female flowers per plant and number of fruits per plant.

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