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GENETIC VARIABILITY AND CORRELATION STUDIES IN BITTERGOURD

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Abstract: Eight collections of bittergourd (*Momordica charantia*) were studied for genetic variability and degrees of association of yield and yield components. Of eight characters studied, genotypic and phenotypic coefficient of variation and genetic advance in percentage of mean were the highest for leaf area followed by seeds per fruit, weight per fruit, yield per plant and the lowest for days to female flower. The highest heritability was found in seeds per fruit followed by leaf area, fruits per plant, weight per fruit and the lowest in fruit breadth. High heritability along with high genetic advance was observed in seeds per fruit, leaf area and weight per fruit. The correlations at genotypic level were higher than their corresponding phenotypic level. Yield per plant was highly positively correlated with weight per fruit and fruit length. These two characters were also positively significantly correlated with the leaf area.

Keywords: Genetic variability; Genetic advance; Correlation; Bittergourd.

Introduction

Yield is not only polygenically controlled but also subject to the effect of fluctuation of environmental components (Oluwatosin, 1997, Surlan *et al.,* 1997). Therefore, direct selection for yield is often misleading. Improvement of yield depends on genetic variability for the characters (Varalakshmi and Reddy, 1994; Pandey *et al.*, 1996; Sreekumar *et al.,* 1997; Wahid and Ahmed, 1999) and the association between the yield components and their relative contribution to yield (Desai *et al.,* 1996; Thakur *et al.*, 1997; Das *et al.*, 1998). Bittergourd is one of the vegetable belongs to the family cucurbitaceae and favorite to most of the peoples of Bangladesh. Its improvement is necessary to increase the yield for the increasing demand of ever increasing population of the country. Selection of improved germplasms on the basis of genetic variability, heritability, genetic advance and correlation among the yield components is an effective approach for its improvement like other crops (Singh *et al.*, 1996). Therefore, this experiment was conducted to estimate the genetic variability, heritability, genetic advance and correlation among the yield components in bittergourd.

Materials and Methods

The study was conducted at the Genetics and plant breeding farm of Bangladesh Agricultural University, Mymensingh, with eight germplasms of bittergourd collected by research project entitled "Development of high yielding cucurbits" from different parts of Bangladesh. The experiment was laid out in randomized complete block design with three replications. Seeds were dibbed in pit with the spacing 1.5m x 1.5m. One seedling was allowed in each pit. The vines were trained on bamboo 'Machas'. Out of 7 plants of a block, data were collected from middle 5 provided data for evaluation of following parameters viz., days to initiation of female flower, fruits per plant, fruit length (cm), fruit breadth (cm), weight per fruit g^{-1}, yield per plant g^{-1}, seeds $fruit^{-1}$ and leaf area (cm^2).

The methods suggested by Panse and Sukhatme (1967) were adopted for the analysis of variance. Variability existing in different characters was estimated using the method suggested by Burton (1952). Heritability in broad sense was estimated by the formula suggested by Burton and De Vane (1953). The expected genetic advance of the available germplasm at 5% intensity of selection was calculated as per Lush (1949) and Johnson *et al.*, (1955a) using the constant value of K 2.06. The formulae suggested by Singh and Choudhury (1979) were adopted for calculating correlation coefficients.

Results and Discussion

The analysis of variance revealed high significant (0.1%) differences among the genotypes for all the characters except fruit breath (significant at 1%). Yield per plant ranged from 875 g to 354 g indicating maximum variability present in this character. The range of phenotypic coefficient of variation (PCV) was

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from 5.734% (days to female flower) to 43.084% (leaf area). The genotypic coefficient of variation (GCV) ranged from 5.077% (days to female flower) to 41.739% (leaf area). Both PVP and GCV were the highest in leaf area in respect to other parameters. The seeds per fruit, weight per fruit and yield per plant also showed high GCV (37.027%, 29.032% and 22.545%, respectively). Higher GCV of these characters offer scope for the improvement of this crop as the environment affects them at minimum level.

The degree of success in a selection program also depends upon the magnitude of heritable variation. Heritability (in broad sense) estimates ranged from 62.473% (fruit breadth) to 97.375% (seeds per fruit). Heritability for leaf area (93.856%), fruits per plant (93.411) and weight per fruit (88.479%) were considerably high, which also substantiate the scope of genetic improvement for bittergourd. Both the percentage of GCV and heritability were very low regarding fruit breadth (Table 1). This suggested that the environment markedly influenced fruit breadth.

Table 1. Genetic and Phenotypic Coefficient of variation, heritability (H%) and genetic advance (GA%) in percentage of mean in eight genotypes of bittergourd.

Characters	GCV	PCV	H%	GA%
Days to female flower	5.077	5.734	87.391	9.260
Fruits per Plant	14.110	14.560	93.411	28.094
Fruit length (cm)	18.989	21.314	79.343	34.834
Fruit breadth (cm)	8.210	10.387	62.473	13.367
Weight per fruit (g)	29.030	30.844	88.479	56.219
Yield per Plant (g)	22.545	26.364	73.124	39.714
Seeds per fruit	37.027	37.523	97.375	75.269
Leaf area (cm^2)	41.739	43.084	93.856	82.299

The maximum genetic gain of 82.299% (expressed as percentage of mean) was expressed in leaf area, followed by seeds per fruit (75.269). Days to female flower and fruit breadth showed very low genetic advance (9.260 and 13.367% respectively). The remaining characters showed considerable amount of expected genetic advance (Table 1).

A very strong positive and significant correlation was observed between yield per plant and weight per fruit (0.937) at the genotypic level. Fruit length also showed strong positive and significant genotypic coefficient of correlation (0.856). For interrelationship between the yield components, a strong positive and significant association was observed between fruit length and leaf area (0. 970), weight per fruit and fruit length (0.959), and leaf area and weight per fruit (0.886). Days to female flower showed positive significant correlation with yield per plant (0.771) and weight per fruit (0.737). Negative but highly significant genotypic correlation was found in case of fruits per plant with weight per fruit (-0.893) and fruit breadth (-0.835) and fruit length (-0.834.). Fruits per plant also showed negative significant genotypic correlation with yield (-0.717) seeds per fruit (-0.768) and leaf area (-0.748). At the phenotypic level yield per plant showed very strong positive and significant correlation with weight per fruit (0.920), and strong positive correlation with fruit length (0.734). Fruit length also showed very strong positive and significant phenotypic correlation with weight per fruit (0.858). Leaf area showed positive and significant phenotypic association with fruit length (0.797) and weight per fruit (0.-88). Negative but significant phenotypic association was found only in case of fruits per plant with leaf area (-0.730) and seeds per fruit (-0.719). The remaining combination showed weak association among themselves (Table 2).

In general, genotypic correlation coefficients were higher than their corresponding phenotypic correlation coefficients indicating that there is a strong inherent association between the characters studied, the phenotypic expression of correlation reduced under the influence of the environment. Higher and wider genotypic correlation than phenotypic correlation have been reported by Johnson *et al.* (1955b), Mital *et al.* (1969), Sharma and Swarup (1964), Srivastava and Srivastava (1978) and singh *et al.* (1977). The strong positive and significant correlation at genotypic and phenotypic level of fruit length and fruit weight with yield per plant indicates that the later can be improved by selection of these characters. The correlation between fruit length and weight per fruit was also positive and significant. Although leaf area showed weak correlation with yield per plant but it showed strong positive significant correlation with fruit length and weight per fruit, which is the main contributing character of yield. So leaf area is also very important in this regard. The estimates of heritability, genetic coefficient of variation and the expected genetic advance was also higher for these characters. It is suggested that direct selection for theses three characters would be beneficial for the improvement of bittergourd's yield.

An expected genetic advance for leaf area, seed per fruit, weight per fruit and yield per plant was encouraging. These characters specially the leaf area had also high heritability value, which suggested additive gene effects (Panse, 1957). It therefore, appears that selection for these characters should be effective for all practical purposes. High heritability associated with low genetic advance observed incase of fruits per plant might be due to nonadditive gene action which includes epistasis and dominance (Linang and Walter, 1968).

Table 2. Phenotypic (P) and genotypic (G) correlation co-efficient for different pairs of characters in bittergourd

Characters		Yield per plant	Days to female flower	Fruits per plant	Fruit length	Fruit breadth	Weight per fruit	Seeds per fruit
Days to female flower	G	0.771*						
	P	0.544						
Fruits per Plant	G	-0.717*	-0.340					
	P	-0.500	-0.292					
Fruit length (cm)	G	0.856*	0.665	-0.834*				
	P	0.734*	0.550	-0.705				
Fruit breadth (cm)	G	0.600	0.139	-0.835*	0.375			
	P	0.484	0.106	-0.614	0.493			
Weight per fruit (g)	G	0.937*	0.737*	-0.893*	0.959**	0.628		
	P	0.920*	0.567	-0.772	0.858**	0.544		
Seeds per fruit	G	0.349	0.542	-0.768*	0.654	0.321	0.627	
	P	0.304	0.494	-0.719*	0.593	0.296	0.578	
Leaf area (cm^2)	G	0.701	0.701	-0.748*	0.970**	0.583	0.886*	0.575
	P	0.572	0.572	-0.730*	0.797*	0.442	0.788*	0.537

* and ** represent significant level at 1% and 0.1% respectively

Conclusion

From the study, it revealed that, like other horticultural crops yield contributing characters have immense importance to make improvement approaches in bittergourd. Leaf area, weight per fruit, and fruit lengths were found as the most important yield contributing characters in consideration of bittergourd breeding programme. Therefore, more emphasis has to be given to these characters in bittergourd breeding program.

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