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VARIABILITY AND HERITABILITY STUDIES IN BOTTLE GOURD (*LAGENARIA SICERARIA* (MOL.) STANDL.)

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Abstract

An experiment was carried out to analyze genetic variability for yield and its contributing characters in 20 bottle gourd genotypes in Randomized Block Design (RBD) with three replication to assess the nature and magnitude of association among yield and its contributing traits in bottle gourd. Analysis of variance revealed that there were significant differences among the genotypes studied for all the characters except node number of first female flower. Moderate differences between phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) indicating the least role of environment on these traits. Among these characters, vine length, fruit girth, days to fruit harvest and node number of first female flower registered high genotypic variability suggesting their improvement through selection. High heritability was recorded for all the characters except average fruit weight. Traits like vine length, node number of first male flower, node number of first female flower, fruit length, fruit girth, number of fruits per vine, 100 seed weight and yield per vine shows high heritability along with high genetic gain which reveals the predominance of additive gene action of these traits.

Key words : Bottle gourd, variability, GCV, PCV, heritability, genetic advance.

Introduction

Bottle gourd (*Lagenaria siceraria* (Mol) Standl) is one of the most important cucurbitaceous vegetable crop in India grown in both rainy and summer seasons. It belongs to the family cucurbitaceae having chromosome number 2n = 22. It is highly cross pollinated crop due to its monoecious and andromonoecious nature (Swiander *et al.,* 1999). It has been found in wild form in India and Southern Africa. It is widely cultivated in tropics and subtropical region in India. Bottle gourd are known to lower cholesterol, triglyceride, low density lipoproteins, pain and inflammation (Ghule *et al.,* 2006). Hence, the estimates of variability and its heritable components for the yield contributing characters in the available germplasm are pre-requisite for a breeding programme for high yield. Improvement in bottle gourd is being made by exploiting the available source of variability.

Evolving superior genoytpes would be effective, only when the existing variability in the chosen material is wide. The observed variability for any character is the result of interaction of hereditary effects of concerned genes and the influence of environment. Hence it becomes necessary to partition the overall phenotypic variability into heritable and non-heritable components to have an effective selection for superior genotypes. Estimation of coefficient of variation helps to assess the variability in a population. Heritable variation can be effectively used with greater degree of accuracy when heritability is studied in conjunction with genetic advance. Gayen and Hossain (2006) studied genetic variability and heritability of bottle gourd and observed that magnitude of phenotypic coefficient of variation (GCV) for all characters suggesting the effect of environment on expression of these traits. Singh *et al.,* (2008) studied genetic variability in bottle gourd in both summer and rainy seasons and recorded the highest genotypic and phenotypic coefficients of variation for yield per vine. Therefore the present investigation was carried out to study variability, heritability and genetic advance for twelve quantitative characters in bottle gourd.

Materials and Methods

The basic material for the study included 20 accessions of various genotypes of bottle gourd. The experiment was conducted in Vegetable Unit, Department

of Horticulture, Faculty of Agriculture, Annamalai University. The experiment was laid out in Randomised Block Design with three replications. The cultural and management practices were adopted according to the package of practices. The observations were recorded on five randomly selected plants with respect to characters *viz.*, vine length (cm), days to first male flowering, days to first female flowering, node number of first male flower, node number of first female flower, days to first fruit harvest, fruit length (cm), fruit girth (cm), average fruit weight (kg), number of fruits per vine, 100 seed weight (g) and yield per vine (kg). The mean value of five plants in each genotype and in each replication was subjected to statistical analysis of variance (Panse and Sukhatme, 1961). The phenotypic and genotypic co-efficient of variation were calculated by Burton (1952) and Comstock and Robinson (1952), heritability and genetic advance as per adopting the formula suggested by Lush (1940) and Johnson *et al.,* (1955) respectively.

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all the characters studied, indicating presence of sufficient genetic variability among the genotypes for all the traits table 1. As expected, phenotypic coefficient of variation (PCV) was slightly higher than the genotypic coefficient of variation (GCV) for all the characters under study table 2. This indicates that the environmental influence is very low, hence selection for these characters would be made based on their genotypic performance. Greater magnitude of PCV and GCV was observed for average fruit weight, fruit length, fruit girth and number of fruits per vine. High GCV values for most of the characters reveal the presence of high magnitude of genetic variability in the population studied. This confirms the findings of Husna *et al*., (2011) and Deepa devi and Mariappan (2013) and Sultana *et al*., (2015) for average fruit weight. Deepthi *et al.,* (2016) for number of fruits per vine. Damor *et al*. (2016) and Sharma and Sengupta (2013) and Muralidharan *et al*., (2013) for fruit length and fruit girth. Very high magnitude of PCV and GCV for these characters indicates presence of very high degree of variability and better scope for improvement.

Moderate GCV and PCV for vine length, node number of first female flower, days to first fruit harvest indicated the existence of comparatively high variability, which could be exploited for improvement through selection in advanced generations table 2. These results coincide similar with the results obtained by Mandal *et al*., (2015) and Damor *et al*., (2016). The characters like days to first male flowering and days to first female flowering recorded low PCV and GCV values. It indicates the presence of narrow genetic base for these traits. This is in conformity with the finding of Sultana *et al*., (2015), Rahman Khan *et al*., (2016) and Damor *et al*., (2016). Improvement in these characters can be brought out by hybridisation to widen genetic base and then selecting in advanced generations.

The difference between PCV and GCV were wide for the characters node number of first male flowering, 100 seed weight and yield per vine suggesting the large influence of the environment in these traits. Existence of mere variability in the population may not serve the whole objective of breeding programme. To exercise an effective selection, it is important to know about the extent of variation that is heritable. Therefore, it is essential to partition the overall variability into its heritable and non-heritable components for predicting the genetic advance, which will enhance the precession of selection.

The heritability as a fact is often used to describe the heritable portion of total variation. It is a good index of the transmission of characters from parents to their offsprings. Selection will be effective when the heritable estimates for the different characters are high. High genotypic coefficient of variation is not sufficient for determination of the heritable variation, as it simply measures the extent of genetic variability present for a character. Hence, GCV together with heritability estimates would give the best picture of the extent of advance to be expected by selection. Improvement in mean genotypic value over the base population as per cent of mean is known as genetic advance as per cent of mean. It depends on the heritability of the trait, the genetic variability in the base population and the selection intensity. Hence, it is essential to combine both heritability and genetic advance as per cent of mean together with GCV will give a clear picture to select a better parent (Johnson *et al*., 1955).

In the present investigation, most of the characters studied had high heritability, while some of them have a moderate heritability table 3. The characters vine length, node number of first male flower, node number of first female flower, fruit length, fruit girth, number of fruits per vine, 100 seed weight and yield per vine recorded high heritability estimates above 60 per cent (Table1). Similar high heritability estimates were previously reported for vine length, node number of first male flower, fruit length, number of fruits per vine, 100 seed weight, yield per vine by Deepthi *et al*., (2016) and Kumar *et al*., (2007), whereas fruit girth, node number of first female flowering by Mandal *et al*., (2015) and Damor *et al*.,

Table 1: General analysis of variance for various characters of bottle gourd genotypes.

Source	Df	Mean sum of square (MSS)											
		Vine length (cm)	Days to first male flowe-ring	Days to first female flowe-ring	Node number of first male flower	Node number of first female flower	Days to first fruit harvest	Fruit length (cm)	Fruit girth (cm)	Average fruit weight (kg)	Number of fruits per vine	100 seed weight (g)	Yield per vine (lg)
Replication	2	20.21	17.17	19.00	30.28	50.86	4.90	4.09	2.18	1.32	5.69	6.70	8.75
Genotype	19	12935.40**	39.74**	79.68**	22.01	60.54**	187.51**	143.14**	298.20**	1.32*	42.80**	37.00**	25.14**
Error	38	21.07	5.94	5.32	136.51	2.10	6.24	5.76	6.79	0.59	5.47	6.04	7.06

** Significant at 1% level. * Significant at 5% level.

Table 2: Magnitude of variability for various characters in bottle gourd genotypes.

S.No.	Characters	PV	GV	PCV (%)	GCV (%)	ECV (%)
1.	Vine length (cm)	4325.94	4304.77	10.76	10.74	0.75
2.	Days to first male flowering	17.20	11.27	7.75	6.27	4.55
3.	Days to first female flowering	30.11	24.79	8.97	8.14	3.77
4.	Node number of first male flower	9.73	6.14	20.73	16.47	12.60
5.	Node number of first female flower	21.58	19.48	19.96	18.97	6.22
6.	Days to first fruit harvest	66.67	60.41	10.65	10.14	3.26
7.	Fruit length (cm)	51.56	45.79	24.85	23.42	8.31
8.	Fruit girth (cm)	103.92	97.13	25.79	24.93	6.59
9.	Average fruit weight (kg)	0.84	0.24	73.46	39.53	61.91
10.	Number of fruits per vine	17.91	12.44	32.91	27.43	18.19
11.	100 seed weight (g)	16.36	10.32	24.23	19.24	14.72
12.	Yield per vine (kg)	13.09	6.02	25.55	17.34	18.76

Table 3: Estimation of heritability, genetic advance and genetic advance as per cent of mean for various characters in bottle gourd genotypes.

S. No.	Characters	Heritability h^2 (%)	Genetic advance	Genetic advance as per cent of mean
1.	Vine length (cm)	99.51	134.82	22.06
2.	Days to first male flowering	65.48	5.61	10.48
3.	Days to first female flowering	82.32	9.31	15.21
4.	Node number of first male flower	63.08	4.05	26.94
5.	Node number of first female flower	90.28	8.64	37.12
6.	Days to first fruit harvest	90.63	15.24	19.89
7.	Fruit length (cm)	88.82	13.14	45.47
8.	Fruit girth (cm)	93.47	19.63	49.65
9.	Average fruit weight (kg)	28.96	0.55	43.83
10.	Number of fruits per vine	69.45	6.06	47.09
11.	100 seed weight (g)	63.08	5.26	31.48
12.	Yield per vine (kg)	46.05	3.43	24.23

(2016). High heritability coupled with high genetic advance as per cent of mean were established by the traits vine length, node number of first male flower, node number of first female flower, fruit length, fruit girth, number of fruits per vine, 100 seed weight and yield per vine Table 3. Same trend of high heritability and high genetic advance was reported for vine length, node number of first male flower, node number of first female flower, fruit length, fruit girth, number of fruits per vine, 100 seed weight and fruit yield per vine by Damor *et al*., (2016) and Rahman Khan *et al*., (2016). These results indicated that the characters like vine length, number of fruits per vine, fruit length, node number of first male flower, node number of first female flower, fruit girth, 100 seed weight and yield per vine indicated the presence of additive genes and so these traits can be improved by a simple phenotypic selection. Among the characters studied, days to first male flowering, days to first female flowering and days to first fruit harvest registered high heritability coupled with moderate genetic advance indicating the action of non additive genes for expression of these characters indicating that these characters can be given considerable weightage by a simple phenotypic selection. A similar report on high heritability and moderate genetic advance was reported by Singh (2004), Munshi and Sirohi (2005) and Rana and Pandit (2011).

References

Damor, A.S., J.N. Patel, H.K. Parmar nad and N.D. Vyas (2016). Studies on genetic variability, heritability and genetic advance for yield and quality traits in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.) genotypes. *International J. Sci. Environ. Tech*., **5(4):** 2301-2307.

Deepa devi, N. and S. Mariyappan (2013). Genetic variability, heritability and genetic advance for yield and its components in snake gourd (*Trichosanthes anguina* L.). *African J. Agri. Res*., **8(28):** 3852.

Deepthi, B., P.S.S. Reddy, A.S. Kumar and A.R. Reddy (2016). Studies on PCV, GCV, heritability and genetic advance in bottle gourd genotypes for yield and yield components. *Plant Archives*, **16(2):** 597-601.

Johnson, H.W., H.F. Robinson and R.E. Comstock (1955). Estimates of genetic and environmental variability in soybean. *Agron. J.*, **47:** 314-318.

Kumar, S.A. Yadav, J.P. Srivastava, J.R. Yadav, J.N. Shukla, G. Mishra and N.S. Parihar (2007). Correlation and path coefficient analysis in bottle gourd (*Lagenaria siceraria* (Molina) Standl.). *Prog. Res*., **2(1/2):** 165-166.

Munshi, R. and P. Acharyya (2005). Varietal evaluation in bottle gourd genotypes. *Ind. Agric*., **49(3/4):** 213-221.

Muralidharan, B., V. Kanthaswamy and B. Sivakumar (2013). Correlation and path analysis studies in bottle gourd (*Lagenaria siceraria* (Mol.) Standl.). Published in Proc. of National Symposium on Abiotic and Biotic stress management in Vegetable crops. *Ind. Soc. Veg. Sci.,* 69.

Panse, V.G. and P.V. Sukhatme (1961). Statistical methods for agricultural workers. ICAR, New Delhi

Rana, N.P. and M.K. Pandit (2011). Studies on genetic variability, character association and path analysis in snake gourd (*Trichosanthes anguina* L.) genotypes. *J. Crop and Weeds*., **7(2):** 91-96.

Sharma, A. and S.K. Sengupta (2013). Genetic diversity, heritability and morphological characterization in bottle gourd (*Lagenaria siceraria* L.). *The Bioscan*, **8(4):** 1461-1465.

Sultana, S., M.A. Kawachar, S. Naznin, A. Sadhik and F. Mahmmud (2015). Variability, correlation and path analysis in pumpkin (*Cucurbita moschata* L.). *Bangladesh J. Agri. Res.,* **42(3):** 479-489.