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Genetic variability, heritability and genetic advance in bottle gourd [*Lagenaria siceraria* (molina) standl.] genotypes

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ABSTRACT

An experiment was carried out to analyze genetic variability for yield and its contributing characters in 35 bottle gourd genotypes in randomized block design with three replications to assess the nature and magnitude of association among yield and its contributing traits in bottle gourd (Lagenaria siceraria). Results indicated that PCV and GCV were high (more than 20%), sex ratio for PCV was 34.19 % and GCV registered as 24.79 per cent, respectively. Moderate PCV (14.28,16.10) and GCV (13.78,13.43) were recorded for vine length and primary branches, respectively. The high genetic advance as per cent of mean along with high heritability was obtained for vine length (0.93%), fruit length (0.87%), fruit width (0.76%), primary branches (0.69%), fruits per vine (0.59 %), sex ratio (0.52%), fruit yield (0.44%), days to first female flower anthesis (0.42%), node at first female flower appears (0.41%), days to first harvest (0.40%), fruit thickness (0.37%), days to first male flower anthesis (0.37%), fruit weight (0.35%) and node at first male flower appears (0.20%).

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

INTRODUCTION

Bottle gourd (*Lagenaria siceraria* (Mol) Standl) is one of the most important vegetable crop in India. It is a highly cross pollinated crop due to its monoecious and andromonoecious nature. It belongs to the family cucurbitaceae having chromosome number 2n = 22. It has a good amount of vitamins and minerals. Fruits are rich in 95.54% moisture, vitamin C (10.1 g), vitamin A (16 IU), thiamine (0.029 g), riboflavin (0.022 g), niacin (0.320 g), carbohydrates (3.39 g), fats (0.02 g) and potassium (150 mg)/100g. Being cross-pollinated crop; it exhibits wide range of variability for maturity, yield and fruit characters like shape and size. The fruit color varies from dark green to cream or yellow. Significant regional variability has been reported in India by Sivaraj and Pandravada (2005). The available diversity within the species for desired fruit enables a breeder in choosing elite genotypes. Parameters of genotypic and phenotypic coefficient of variation (GCV and PCV) are useful in detecting the amount of variability present in the available genotypes. Heritability and genetic advance help in determining the influence of environment in expression of the characters and the extent to which improvement is possible after selection. The present investigation was, therefore, taken under to ascertain magnitude and extent of genetic variability, heritability and genetic advance in thirty five varieties of bottle gourd. These genotypes represent released varieties (10), land races (7), accessions (7) and regional specific open pollinated varieties (11). The present study was conducted to analyze genetic variability for yield in bottle gourd.

MATERIALS AND METHODS

The study was carried out at vegetable unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Chidambaram during Jan-Mar 2020. Experimental site is situated at 11.24'N latitude and 79.41'E longitude at an altitude of 4m above mean sea level. The material for the present study consisted of thirty five diverse genotypes. The experiment was laid out in the randomized block design with three replications. Each treatment or a genotype in each replication was represented by two rows each accommodating 10 plants in a row. Row to row spacing was 1.8 m and 0.9 m

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was maintained between plants from within a row. Five plants were randomly selected in each genotype from each replication and labeled for recording observation on quantitative characters. All recommended cultural and management practices were followed to maintain the crop healthy. The mean values of the data recorded were analyzed statistically adopting the method suggested by Panse and Sukhatme (1985). The magnitude of phenotypic co-efficient of variation (PCV) and genotypic co-efficient of variation (GCV) existing in a trait was worked out by the formula given by Burton (1952). PCV and GCV were categorized as low, moderate and high by following Johnson *et al.* (1955) as (0 – 10%): Low, (10 –20%): Moderate, (Above 20%): High respectively. Heritability in broad sense was estimated as per the procedure presented by Burton and Devane (1953). The heritability percentage was categorized as low, moderate and high as suggested by Robinson *et al.* (1949) (0-30%): Low, (30-60%): Moderate and (60% and above): High respectively. Genetic advance at 5 per cent selection intensity was worked out by using the formula given by Johnson *et al.* (1955). The Genetic advance as per cent of mean was categorised as low, moderate and high by following Johnson *et al.* (1955) Low 0-10%, Moderate 10-20% and High 20% and above.

RESULTS AND DISCUSSION

The ANOVA revealed significant differences indicating that there are enough variation among all the germplasm, for all fifteen characters studied viz, vine length, primary branches, node at first male flower appears, node at first female flower appears, days to first male flower anthesis, day to first female flower anthesis, sex ratio, days to first harvest, fruit length, fruit width, fruit flesh thickness, fruit weight, fruits per vine and yield per vine. The range in the values reflect the amount of phenotypic variability. As this is not very reliable since it includes genotypic, environmental and genotype x environmental interaction components and does not reveal as to which characters is showing higher degree of variability. Further, the phenotype of crop is influenced by additive gene effect (heritable), dominance (non-heritable) and epistasis (no allelic interaction). Hence, it becomes necessary to split the observed variability into phenotypic coefficient of variation and genotypic coefficient of variation, which ultimately indicates the extent of variability existing for various traits.

Table 1: Analysis of variance with respect to MSS for various characters in bottle gourd

Source of variation	d.f	Mean sum of squares							
		Vine length	Primary branches	Node at first male flower appears	Node at first male flower appears	Node at first male flower appears	Node at first male flower appears	Sex ratio	Days to first harvest
Replication	2	670.97	0.91	0.40	0.13	0.86	2.22	0.26	4.01
Genotypes	34	5421.82	4.01	1.08	1.96	6.94	2.01	0.05	3.21
Error	68	129.85	0.51	0.60	0.63	2.44	0.63	0.01	1.05
Source of variation	d.f	Mean sum of squares							
		Fruit length	Fruit width	Fruit cavity	Fruit flesh thickness	Fruit weight	Fruits per vine	Yield per vine	
Replication	2	2.06	0.23	0.28	0.00	0.11	0.12	5.39	
Genotypes	34	16.41	7.64	1.59	0.15	0.26	0.57	19.55	
Error	68	0.77	0.71	0.06	0.05	0.10	0.10	5.69	

Results from the present study indicated that PCV and GCV were high (more than 20%), sex ratio for PVC was 34.19 per cent and GCV was registered as 24.79 per cent, respectively. Moderate PCV (14.28,16.10) and GCV (13.78,13.43) were recorded for vine length and primary branches, respectively. High estimates of genotypic and phenotypic coefficient of variation for fruit length were also observed by Singh *et al.,* (2014). The difference among the genotypic coefficient of variance and phenotypic coefficient of variance value for different characters indicated that the influence of environment in expressing the variability with there traits. Hence the breeders are to select superior genotypes on the basis of phenotypic expression of quantitative traits as stated by Johnson *at el.,* (1955).

The high genetic advance as per cent of mean along with high heritability was obtained for vine length (0.93%), fruit cavity (0.88%), fruit length (0.87%), fruit width (0.76%), primary branches (0.69%), fruit per vine (0.59 %), sex ratio (0.52%), fruit yield (0.44%), days to first female flower anthesis (0.42%), node at first female flower appears (0.41%), days to first harvest (0.40%), fruit thickness (0.37%), days to first male flower anthesis (0.37%), fruit weight (0.35%) and node at first male flower appears (0.20%).

Table 2: Estimates of Genetic Variability parameters for various quantitative characters in bottle gourd

Sl.No	Mean	Range	Phenotypic variance (PV)	Genotypic variance (GV)	Genotypic coefficient of variation (GCV)	Phenotypic coefficient of variation (PCV)	Heritability h^2 (broad sense)	Genetic advance (as % of mean)
Vine length	304.69	202.33–401.12	1893.84	1763.99	13.78	14.28	0.93	27.40
Primary branches	8.04	5.86 – 11.17	1.67	1.16	13.43	16.10	0.69	23.07
Node at first male flower appears	8.46	7.23 – 9.30	0.76	0.16	4.73	10.33	0.20	4.46
Node at first female flower appears	13.20	11.48 – 14.98	1.08	0.44	5.04	7.87	0.41	6.65
Days to first male flower anthesis	42.95	40.56 – 46.47	3.94	1.49	2.84	4.62	0.37	3.61
Days to first female flower anthesis	48.90	47.58 – 51.29	1.09	0.46	1.38	2.13	0.42	1.85
Sex ratio	0.48	0.19 – 0.72	0.02	0.01	24.79	34.19	0.52	37.03
Days to first harvest	60.80	58.12 – 62.91	1.77	0.71	1.39	2.19	0.40	1.82
Fruit length	38.25	33.46 – 43.03	5.98	5.21	5.96	6.39	0.87	11.46
Fruit width	23.30	20.16 – 26.89	3.02	2.30	6.52	7.46	0.76	11.73
Fruit cavity	7.75	6.23 - 9.35	0.57	0.50	9.19	9.78	0.88	17.79
Fruit flesh thickness	1.62	1.23 – 2.33	0.08	0.03	11.07	18.09	0.37	13.97
Fruit weight	1.78	1.40 – 2.38	0.15	0.05	13.21	22.19	0.35	16.21
Number fruits per vine	2.53	1.96 – 3.58	0.26	0.15	15.51	20.20	0.59	24.55
Yield per vine	16.99	11.98 – 22.35	10.31	4.62	12.64	18.89	0.44	17.44

The presence of heritability and additive gene action in the present study were supported by the findings of Sanwal *et al.*, (2007) in sweet gourd, Kumar *et al.*, (2008), Hanchinamani *et al.*, (2011) and Kumar *et al.*, (2013) in cucumber, Samadia (2011), Jat *et al.*, (2014) in kakri, and by Singh *et al.*, (2014) in bitter gourd. From the present study, it is obvious that genotypes studied may provide good source of material for advance breeding programme. Therefore, information on the genetic parameters such as genetic correlation coefficient, coefficient of variation, heritability and genetic advance can help the breeder to develop suitable cultivars within a short time.

On the basis of results as summarized above, it is concluded that traits like vine length, primary branches, node at first male flower appears, node at first female flower appears, days to first male flower anthesis, day to first female flower anthesis, sex ratio, days to first harvest, fruit length, fruit width, fruit flesh thickness, fruit weight, number of fruits per vine and Yield per vine can be considered as suitable selection criteria for the improvement of high yielding bottle gourd varieties.

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