Original Research Article

Genetic analysis of yield traits in snake gourd (*Trichosanthesanguina* L.)genotypes

ABSTRACT

The present investigation was carried out with 32snake gourd genotypes during*late kharif* 2021-22. The investigation was conducted to study the variability, heritability and genetic advance expressed as per cent of mean for yield and yield attributing characters in snake gourd genotypes. The genotypes were significantly different for all the characters studied, which indicated scope for further genetic studies. High values of PCV with correspondingly high values of GCV were observed in averagefruitweight,fruityield pervine,numberofseedsperfruit, node to first female flower, fruit length, fibrecontent, acidity content andpotassium contentwhich indicated greater extent of variability that could be ascribed to genotype. High heritability coupled with high genetic advance as per cent of mean was recorded in days to first male flower opening, days to first female flower opening, node to first female flower, fruit set percentage, fruit length, average fruit weight, flesh thickness, number of seeds per fruit, number of fruits per vine, fruit yield per vine, acidity content and potassium content indicating heritability was mainly due to additive gene effect and hence selection was highly effective for these characters.

Key words: Snake gourd, Genetic advance, Heritability, Variability.

INTRODUCTION

Snake gourd (*Trichosanthesanguina*(L.) 2n=2x=22) is an annual, dayneutral,herbaceousandclimbingtypevegetablecrop.Itbelongstofamilycucurbitaceae, sub-family cucurbitoideae, tribe Trichosantheae. It is originated inIndo-Malayan region. The wild species of *Trichosanthes*is considered as theprogenitor of *Trichosanthesanguina*. It is widely distributed in Asia, extendingthrough Malaya to North Australia in one direction and through China and Japanin another. At present, snake gourd is also cultivated in Mauritius and in Centraland East Java. In India, it is most commonly cultivated in South India and also grown in Punjab, Delhi, Uttar Pradesh, Bihar, Gujarat and otherpartsofthecountry.

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It is agoodsourceof minerals, fibre andnutrientsto make the foodwholesome and healthy (Ahmed *et al*. 2000). It contains considerable amount ofprotein(0.5%),fat(0.3%),minerals(0.5%),fibre(0.5%)andcarbohydrates(3.3%). It possesses medicinal importance due to the abundance offlavonoids,carotenoids and phenolicacids*etc*.Thepredominantmineral elementsarepotassium(121.6mg/100g), phosphorus(135mg/100g),sodium,magnesium and zinc(OjiakoandIgwe,2008).Theplanthaspharmacologicalandtherapeuticalpropertiessucha santi-diabetic,hepatoprotective,cytotoxic and anti-inflammatoryand it is also used in Ayurvedaand Siddhamedicalpractices.

Generally, snake gourd fetches more yield per unit area, but the average yield of the crop is low in India when compared to other neighboring countries and its production is also restricted to only to 3-4 months of the year. Despite of economic and medicinal importance of the crop due attention was not given towards a need based crop improvement programme and also no serious attempts have so far been made to upgrade the productivity and acceptability of this crop. The productivity of vegetable can be increased to a greater extent through varietalimprovement. The improvement work should befocused on selectionof genotype for better yield and superior quality.Snake gourd is a monoecious and highly cross-pollinated crop. There are number of cultivars with wide range of variability in size, shape and colour of fruits are available in India. Besides its nutritional value, it is having good demand in the market. Considering the nutritional and medicinal importance of snake gourd, there is a prime need for its improvement. Identification of an improved variety with high yield and good quality characters with wider adaptability would be a great benefit to the farmers.

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The magnitude of variability present in a population is of utmost importance as it provides the basis for effective selection. The basic understanding of the magnitude of genetic variability and its genetic components is a prerequisite for the planning of breeding programme. Generally, genotypic coefficient of variability (GCV) and phenotypic coefficient of variability (PCV) are measured to study the variability. Since the observed variability in a population is the sum of variation arising due to the genotypic and environmental effects, knowledge on the nature and magnitude of genetic variation contributing to gain under selection is essential.

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The success of improvement of characters through selection depends on the heritability coupled with its genetic advance. Once the relative amount of variability in population is assessed, it becomes necessary to partition the overall variability into heritable and non-heritable components. Magnitude of heritability indicates the effectiveness with which selection of genotypes can be based on phenotypic performance. Burton (1952) suggested that heritability along with GCV would provide a clear idea about the amount of genetic advance expected through selection. High value of heritability indicates that phenotype of the trait strongly reflects the genotype and suggests the major role of genotypic constitution in the expression of the character. Such traits are considered dependable from breeding point of view. Therefore, the present investigation was conducted to understand these parameters, which form an integral part of a programme for making improvements in snake gourd yield and its contributing characters.

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MATERIAL AND METHODS

The experiment was conducted at College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari District. It was conducted during late *kharif* season 2021-22 and laid out in Randomized Block design replicated twice. Total thirty-two snake gourd genotypeswere evaluated for growth yield and quality traits.Genotypes were collected from NBPGR regional station Thrissur. The experimental site was well prepared, cultural practices includetraining, pruning, weeding, irrigation, fertilizer application and plant protection measures were followed for the healthy growth of crop.Observations ongrowth parameters were recordedupto4 months of planting. Data on yield and yield attributes were collected at appropriate stages.

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RESULTS AND DISCUSSION

The analysis of variance showed that the genotypes differed significantly among themselves for all the characters indicating the presence of adequate variability (Table 1). In the present investigation, phenotypic coefficient of variation was higher than corresponding genotypic coefficient of variation indicating the influence of environmental factors in the expression of these characters (Rana and Pandit, 2011). Results were estimated and presented in Table 2.

HighPCVandGCVvalueswererecordedforaveragefruitweight (32.34%, 30.88%), fruityield pervine (42.24%, 40.54%),numberofseedsperfruit (43.33%, 42.94%),node to first female flower (27.24%, 21.94%), fruitlength (27.66%, 25.88%),fibrecontent (36.82%, 28.59%), acidity content (52.29%, 51.41%)andpotassium content(27.96%, 27.90%)inallgenotypes.Thisindicating the existence of more variability among all the traitsrecorded and ample scope for improvement of these characters through selection. These results are inconfirmationwith the findings of Rahman *et al*. (2002), Padmaraja (2011) and Rana and Pandit (2011) in snake gourd, Choudhary *et al*.(2011) andSravani *et al*. (2021) in ridge gourd, Akter *et al*. (2013) in pumpkin and Chakraborty *et al*. (2013) in bitter gourd.

High PCV and moderate GCV were observed for node to first male flower (22.14%, 14.14%),flesh thickness (22.56%, 18.35%) and number of fruits per vine (21.75%, 19.91%). Moderate PCV and moderate GCV were observed for days to first male flower opening (14.26%, 13.66%), days to first female flower opening (17.15%, 16.53%), fruit set percentage (17.24%, 15.41%), vitamin C content (12.73%, 10.69%) and TSS (12.47%, 10.48%)indicatingthe existence of variability. These results are confirmation with the findings of Rana and Pandit (2011) and Deepa and Mariappan (2013) in snake gourd, Choudhary *etal*.(2011) in ridge gourd, Tomar *et al*. (2008) and Reddy*et al*. (2013) in muskmelon and Chakraborty *et al*. (2013) in bitter gourd.

Moderate PCV and low GCV were recorded for sex ratio (11.22%, 7.14%) and fruit girth (11.95%, 8.85%). Similar results are reported by Sundaram *et al*. (2011) in watermelon and Kumar *et al*. (2013) in cucumber. Low PCV and GCV for number of male flowers per vine (1.04%, 0.87%) and number of female flowers per vine (9.70%, 7.80%).Thisindicatedthelowvariability for these characters which is the constraint for genetic improvementthrough selection. These results arecontradictory tothosereported byRana and Pandit (2011) in snake gourd and Karthick *et al*. (2019) in cucumber where the values of PCV (31.27%) and GCV (22.86 %) were recorded to be high.

However the PCV recorded in the present experiment was higher than GCV for all the characters, though closeness between PCV and GCV were recorded for some characters. These results shows that, there is an abundant scope of improvement through selection as it has been indicated that phenotypic expression of all genotypes is mostly under genetic control and environment has slight to moderate influence. Similar findings were reported by Rana and Pandit (2011).

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(Rana and Pandit ,2011).

In the present experiment high heritability coupled with high genetic advance as per cent of mean was recorded in days to first male flower opening (91.00%, 26.95%), days to first female flower opening (92.00%, 32.83%), node to first female flower (64.00%, 36.42%), fruit set percentage (79.00%, 28.39%), fruit length (87.00%, 49.90%), average fruit weight (91.00%, 60.75%), flesh thickness (66.00%, 30.76%), number of seeds per fruit(98.00%, 87.66%), number of fruits per vine (83.00%, 37.57%), fruit yield per vine (92.00%, 80.15%), acidity content (96.00%, 104.11%) and potassium content (99.00%, 57.37%) indicating heritability was mainly due to additive gene effect and hence selection was highly effective for these characters. These results are in line with the findings of and Rahman *et al*. (2002), Rana and Pandit (2011) and Deepa and

Mariappan (2013)in snake gourd, Choudhary *et al.* (2011) in ridge gourd,Chakraborty *et al*. (2013) in bitter gourd,Reddy *et al.* (2013) in muskmelon and Shah *et al*. (2017) in cucumber.

According to Panse and Sukhatme (1967), the characters with high heritability coupled with high genetic advance as per cent of mean were controlled by additive gene action and therefore amenable to improvement through selection. So the selection of phenotypically superior plants with respect to the discussed characters will result in significant improvement in the next generation.

High heritability along with moderate genetic advance was observed for number of female flowers per vine (64.00%, 12.94%), vitamin C content (70.00%, 18.49%) and TSS (70.00%, 18.16%) indicated the presence of additive gene action and selection may be effective for this character. High heritability along with low genetic advance was observed for number of male flowers per vine (69.00%, 1.49%). Similar results were obtained by Rana and Pandit (2011) in snake gourd and Reddy *et al.* (2013) in muskmelon.

Moderate heritability and high genetic advance were observed for fibre content (60.00%, 45.75%) indicated that these character was influenced by environmental factors. Moderate heritability and moderate genetic advance were observed for node to first male flower (40.00%, 18.61%) and fruit girth (54.00%, 13.51%). These results are in confirmity with the findings of Rana and Pandit (2011) in snake gourd, Veena *et al*. (2012) in cucumber and Pathak *et al*. (2014) in bitter gourd. The trait sex ratio (40.00%, 9.35%) exhibited moderate heritability and low genetic advance which indicates that it was influenced by environment and governed by non-additive gene action. Similar results were reported by Sundaram *et al*. (2011) in watermelon.

CONCLUSION

High values of PCV with correspondingly high values of GCV were observed inaverage fruit weight, fruit yield per vine, number of seeds per fruit, node to first female flower, fruit length, fibre content, acidity content and potassium contentwhich indicated greater extent of variability that could be ascribed to genotype. It showed that the traits are less affected by the environment and can be improved through selection. The crop improvement work in fruit yield per vine insnake gourd can be concentrated on the traits like days to first male flower opening, days to first female flower opening, node to first female flower, fruit set percentage, fruit length, average fruit weight, flesh thickness, number of seeds per fruit, number of fruits per vine,acidity content and potassium contentbeing controlled by additive gene effects since, they had recorded high heritability coupled with high genetic advance as per cent of mean. The breeder should adopt suitable breeding techniques to utilize both additive and non-additive gene effects simultaneously, since varietal development will go a long way in breeding programmes, especially in case of snake gourd.

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Table 1. Analysis of variance for different characters in 32 snake gourd genotypes.

S.No	Characters	Mean sum of squares		
		Replications Df= 1	**Treatments Df= 31**	**Error Df= 31**
1	Days to first male flower opening	26.21	1788.58**	77.27
2	Days to first female flower opening	66.54	6377.18**	234.35
3	Node to first male flower	1.24	51.69*	21.73
4	Node to first female flower	9.09	431.97**	92.00
5	Number of male flowers per vine	0.76	1069.65**	193.25
6	Number of female flowers per vine	0.52	340.33**	72.70
7	Sex ratio (%)	0.95	147.72*	62.62
8	Fruit set (%)	10.92	9151.98**	1019.70
9	Fruit length (cm)	75.97	7469.11**	494.41
10	Fruit girth (cm)	0.27	127.50**	37.15
11	Average fruit weight (g)	9713.08	465958.19**	21489.76
12	Flesh thickness (cm)	0.03	0.54**	0.11
13	Number of seeds per fruit	5.64	18580.25**	169.10
14	Number of fruits per vine	4.17	1044.15**	91.67
15	Fruit yield per vine (kg)	1.06	306.06**	12.56

16	Vitamin C content (mg/100 g)	0.03	14.36**	2.48
17	Acidity content (per cent)	0.0003	0.42**	0.007
18	Potassium (mg/100 g)	56.25	243215.93**	466.75
19	TSS (ºBrix)	0.03	9.40**	1.61
20	Fibre content (g/100 g)	0.0006	1.29**	0.31
*Significant at 5 % level of significance **Significant at 1 % level of significance				

Table 2. Estimates of genetic parameters in snake gourd genotypes.

Character	Range	Mean	GCV	PCV	h^2	GA	GAM (%)
Days to first male flower opening	28.43-46.63	38.44	13.66	14.26	91.00	10.36	26.95
Days to first female flower opening	44.30-77.63	60.19	16.53	17.15	92.00	19.76	32.83
Node to first male flower	3.00-7.00	4.91	14.14	22.14	40.00	0.91	18.61
Node to first female flower	7.25-14.67	10.67	21.94	27.24	64.00	3.88	36.42
Number of male flowers per vine	423.90-443.13	431.80	0.87	1.04	69.00	6.45	1.49
Number of female flowers per vine	24.00-34.18	26.61	7.80	9.70	64.00	3.44	12.94
Sex ratio (%)	12.38-19.10	16.41	7.14	11.22	40.00	1.53	9.35
Fruit set (%)	51.50-95.83	74.29	15.41	17.24	79.00	21.09	28.39
Fruit length (cm)	26.40-78.70	40.97	25.88	27.66	87.00	20.44	49.90
Fruit girth (cm)	10.93-17.15	13.62	8.85	11.95	54.00	1.84	13.51
Average fruit weight (g)	141.25-459.50	274.12	30.88	32.34	91.00	166.55	60.75
Flesh thickness (cm)	0.30-0.70	0.46	18.35	22.56	66.00	0.14	30.76
Number of seeds per fruit	14.00-78.25	40.13	42.94	43.33	98.00	35.17	87.66
Number of fruits per vine	13.48-32.65	19.68	19.91	21.75	83.00	7.39	37.57
Fruit yield per vine (kg)	2.82-13.11	5.37	40.54	42.24	92.00	4.30	80.15
Vitamin C content (mg/100 g)	3.35-4.89	4.09	10.69	12.73	70.00	0.75	18.49
Acidity content (per cent)	0.11-0.18	0.16	51.41	52.29	96.00	0.16	104.11
Potassium (mg/100 g)	120.50-350.50	224.22	27.90	27.96	99.00	128.65	57.37
TSS (ºBrix)	2.58-4.15	3.38	10.48	12.47	70.00	0.61	18.16
Fibre content (g/100 g)	0.15-0.75	0.44	28.59	36.82	60.00	0.20	45.75

GCV Genotypic coefficients of variation **PCV** Phenotypic coefficients of variation **h^2** Heritability
GA Genetic advance **GAM (%)** Genetic advance as per cent of mean