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


## ABSTRACT

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.The present investigation was carried out with 32snake gourd genotypes during*late kharif* 2021-22. There was need for more genetic research because the genotypes for every character under study differed significantly. Average fruit weight, fruit yield per vine, number of seeds per fruit, node to first female flower, fruit length, fiber content, acidity content, and potassium content all showed high values of PCV with correspondingly high values of GCV, indicating a greater degree of variability that could be attributed to genotype. Selection was very successful for these characters because of their high heritability and high genetic advance as measured by the percentage of mean for the following traits: 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. Heritability was primarily caused by additive gene effect.



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


## INTRODUCTION

"Snake gourd (*Trichosanthesanguina* L.) 2n=2x=22) is an annual, day-neutral, climbing herbaceous vegetable crop belonging to the Cucurbitaceae family, sub-family Cucurbitoideae, and tribe Trichosantheae. Originating in the Indo-Malayan region, it is believed to have evolved from wild species of *Trichosanthes*. Its distribution spans widely across Asia, from Malaya to North Australia, and extends through China and Japan. Presently, snake gourd cultivation also occurs in Mauritius, as well as in Central and East Java. In India, it is predominantly cultivated in South India and is also grown in regions including Punjab, Delhi, Uttar Pradesh, Bihar, Gujarat, and other parts of the country" (Padmaraja, 2011).

"It serves as a valuable reservoir of minerals, fiber, and nutrients, contributing to the overall wholesomeness and healthfulness of food" (Ahmed *et al.*, 2000). "Notably, it contains significant proportions of protein (0.5%), fat (0.3%), minerals (0.5%), fiber (0.5%), and carbohydrates (3.3%). Its medicinal significance is attributed to its rich content of flavonoids, carotenoids, phenolic acids, and other compounds. Among its mineral constituents, potassium (121.6 mg/100 g), phosphorus (135 mg/100 g), sodium, magnesium, and zinc are prominently present" (Ojiako and Igwe, 2008). "The plant exhibits pharmacological and therapeutic properties, including anti-diabetic, hepatoprotective, cytotoxic, and anti-inflammatory effects, making it integral to Ayurveda and Siddha medical practices" (Warrior *et al.,* 1993).

Typically, snake gourd exhibits a higher yield per unit area, however, its average yield in India remains comparatively low compared to neighbouring countries, with production limited to a mere 3-4 months annually. Despite its economic and medicinal significance, there has been insufficient emphasis on implementing a tailored crop improvement program, and little effort has been made to enhance the productivity and acceptance of this crop. Varietal improvement holds promise for significantly enhancing vegetable productivity. “The focus of improvement efforts should centre on selecting genotypes that offer improved yield and superior quality. Snake gourd, being a monoecious and highly cross-pollinated crop, boasts numerous cultivars showcasing extensive variation in fruit size, shape, and colour within India. Beyond its nutritional value, there exists a substantial market demand for snake gourd. Given its nutritional and medicinal significance, there is a critical need for its improvement. The identification of an improved variety boasting high yield and superior quality traits, coupled with broader adaptability, would greatly benefit farmers”(Sivabhodh,2018).

“Understanding the extent of variability within a population is crucial as it forms the foundation for successful selection processes. A comprehensive grasp of genetic variability and its components is essential for planning breeding programs. Typically, the genotypic coefficient of variability (GCV) and phenotypic coefficient of variability (PCV) are assessed to analyse variability. Given that population variability results from both genotypic and environmental influences, understanding the nature and extent of genetic variation contributing to gains under selection is vital”(Singh *et al*., 1986).

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.

## 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”(Thamburaj and Singh, 2004).“Observations on growth parameters were recorded upto 4 months of planting.Data on yield and yield attributes were collected at appropriate stages”. [24]

## 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 show 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 influencewhich are in conformity with the finding were reported by 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 conformity 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

Significant values of PCV along with corresponding high GCV were observed across various parameters including average fruit weight, fruit yield per vine, number of seeds per fruit, node to first female flower, fruit length, fiber content, acidity content, and potassium content. These findings suggest a substantial degree of variability attributable to genotype, indicating that these traits are less influenced by environmental factors and are amenable to improvement through selective breeding. In particular, efforts to enhance fruit yield per vine in snake gourd should focus on traits such as days to first male and 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 content, as these traits exhibit high heritability and substantial genetic advance as a percentage of the mean. Breeding programs should aim to leverage both additive and non-additive gene effects, employing suitable techniques to facilitate varietal development and contribute to the advancement of snake gourd breeding initiatives.



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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 (°Brix) | 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