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Evaluation of various snake gourd (*Trichosanthes anguina* L.) genotypes under Konkan agro-climatic conditions

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Abstract
The present investigation was carried out to evaluate snake gourd genotypes for growth, yield and quality traits. The experiment was conducted at college of Horticulture Dapoli during 2023 with three replications in Randomized Block Design. Total fifteen snake gourd genotypes were evaluated for growth, yield and quality traits. Significant variation was observed among all the genotypes. Mean performance of genotypes for growth, yield and quality traits revealed that genotype Phule Vaibhav recorded highest fruit yield per plant due to the highest fruit weight and minimum days taken for opening of male and female flower. The fruit length varied from 51.01 to 117.47 cm while fruit diameter varied from 26.50 mm to 67.09 mm. Days to 1st female flower opening ranged between 47.97 and 62.97 days and nodal position 1st female flower appeared was between 8.62 and 10.51. The number of fruits/plants ranged from 14.69 to 17.05, whereas individual fruit weight varied from 260.32 g to 371.97 g. Fruit yield per plant ranged from 4.39 kg to 6.33 kg. Genotypes were Phule Vaibhav, Konakan Shweta, DPL-SG-2, PLR-1 and PKM-1 identified as the highest yield. The genotypes differed significantly in most of the parameters and offer a good scope for selection of parent for crop improvement programme.

Keywords: *Trichosanthes cucumerina* L., snake gourd, genotype evaluation, genetic variability, growth traits, yield, fruit quality, fruit yield, varietal performance, crop improvement

Introduction
Snake gourd (*Trichosanthes anguina* L.) is an underutilized tropical vegetable crop belonging to family cucurbitaceae with chromosome No 2n = 22. It is commonly known as Serpent gourd, Chichinda and popularly known as “Padwal” in Maharashtra. It is believed to have originated in the Indo-Malayan region. Snake gourd ia an annual, herbaceous, day neutral and climbing vegetable crop widely cultivated in tropical and subtropical regions. It is the with regards to Konkan region of Maharashtra. It is commercially grown mainly during rainy season and to some extent during summer, where, sufficient water availability exists.

Snake gourd is an important summer vegetable crop due to its adaptability and nutrional value. It is grown extensively during the warm season and contributes significantly to vegetable is limited. The crop possesses good keeping quality, making it suitable for transportation and marketing over long distances. The crop exhibits considerable variability in fruit size, shape, colour, length and yield. Being a monoecious and predominately cross pollinated species, it possesses a wide genetic diversity that can be exploited through selection and breeding. Numerous local cultivars and genotypes are available, offering substantial scope for crop improvement.

Despite its economic and nutritional importance, the productivity of snake gourd remains relatively low in many growing regions. The absence of high yielding varieties, limited characterization of available germplasm and inadequate information on agronomic and morphological traits are major constraints to crop improvement. Therefore systematic evaluation and characterization of snake gourd genotypes are essential for identifying superior genotypes with desirable yield and quality traits.

Hence, the present study was undertaken to characterize and evaluate different snake gourd genotypes and to identify promising genotypes for future breeding programmes and commercial cultivation.

Material and Method

The study was carried out during *Kharif* 2023 at College of Horticulture, Dapoli. The experiment comprised of fifteen genotypes of snake gourd *viz*, PKM-1, PLR-1, PLR-2, Manusree, DPL-SG-1, DPL-SG-2, DPL-SG-3, DPL-SG-4, DPL-SG-5, DPL-SG-6, DPL-SG-7, DPL-SG-8, DPL-SG-9, Phule Vaibhav and Konkan Shweta. The experiment was laid out in a Randomized Block Design with three replications with spacing 2m x 1m row to row and plant to plant. All the recommended cultural practices were followed to raise a healthy crop. Data were recorded from five randomly selected plants for the characters *viz*, days to 1st male flower, days to 1st female flower, nodal position to 1st male flower, nodal position to 1st female flower, fruit length, fruit diameter, fruit weight, number of fruits per plant, yield per plant and yield per hectare. Based on the evaluation of yield and yield attributing characters, the genotypes Phule Vaibhav, Konakn Shweta, DPL-SG-2, PLR-1 and PKM-1were recorded better performance with respect to growth, yield and yield attributing characters under Konkan agro-climatic conditions. Statistical analysis of the data was done by using the method as suggested by Panse and Sukhatme (1985).

Results and Discussion

The comparative performance of various snake gourd genotypes grown under Konkan agro-climatic condition is presented in below the results revealed that differences due to various genotypes were highly significant for all the characters under study.

The genotypes significantly differed for days to 1st male flower, days to 1st female flower, nodal position to 1st male flower, nodal position to 1st female flower, fruit length, fruit diameter, fruit weight, number of fruits per plant, yield per plant and yield per hectare.

Flowering behaviour

1. Days to 1st male flower

The lowest number of days to appear first male flower was observed in the Phule Vaibhav (32.99 days) and was at par with Konkan Shweta (33.32 days), PKM-1 (34.85 days), PLR-1 (34.91 days), Manusree (34.92 days), DPL-SG-2 (35.37 days), PLR-2 (35.43 days) and DPL-SG-3 (36.47 days). The highest number of days to appear first male flower was observed in DPL-SG-9 (41.12 days). These variations might be occur due to the introduction and adaptation of new genotypes in alien environment and inherent patterns. Similar finding was also reported by Ara *et al*. (2013) [1] in snake gourd, Radha Rani (2014) [11] in bitter gourd, Varlakshmi *et al*. (2016) [13] in ridge gourd and Kumar *et al*. (2022) [8] in snake gourd.

2. Days to 1st female flower

The lowest number of days to appear first female flower was recorded in Phule Vaibhav (49.97 days) and was at par with Konkan Shweta (50.73 days), PLR-1 (51.63), PLR-2 (52.98 days), Manusree (52.90 days), DPL-SG-2 (53.57 days), PKM-1 (53.95 days), DPL-SG-4 (54.51 days) and DPL-SG-3 (54.71 days). The highest number of days for blooming first female flower was observed in DPL-SG-9 (62.97 days). Difference in days to first male flower and days to first female flower among the genotypes might be due to genetic makeup of different genotypes and response to the climatic conditions prevailing during the crop growth period. Similar studies have been reported by Ara *et al*. (2013) [1] in snake gourd, Radha Rani *et al*. (2014) [11] in bitter gourd, Uddin *et al*. (2014) [12] in bottle gourd, Duhan *et al*. (2015) [4] in bitter gourd and Kumar *et al*. (2022) [8] in snake gourd.

Table 1: Variation in flowering behaviour among snake gourd genotypes (*kharif* 2023)

Sr. No.	Genotypes	Days to 1st male flower	Days to 1st female flower	Nodal position of 1st male flower	Nodal position of 1st female flower
T_1	PKM-1	34.85	53.95	4.78	9.45
T_2	PLR-1	34.91	51.63	4.95	9.78
T_3	PLR-2	35.43	52.98	5.06	9.87
T_4	Manusree	34.92	52.90	4.43	8.96
T_5	DPL- SG-1	37.45	59.21	5.20	9.98
T_6	DPL -SG-2	35.37	53.57	4.34	8.94
T_7	DPL -SG-3	36.47	54.71	4.92	9.65
T_8	DPL -SG-4	36.82	54.51	5.23	9.72
T_9	DPL -SG-5	36.52	55.09	5.58	10.03
T_{10}	DPL -SG-6	39.06	55.09	5.84	10.07
T_{11}	DPL -SG-7	38.65	59.73	5.70	10.21
T_{12}	DPL -SG-8	37.51	59.96	6.02	10.46
T_{13}	DPL -SG-9	41.12	62.97	6.12	10.51
T_{14}	Phule Vaibhav	32.99	49.97	3.98	8.62
T_{15}	Konkan Shweta (Check)	33.32	50.73	4.74	8.87
	Mean	36.36	53.13	5.13	9.67
	Range	32.99-41.12	49.97-62.97	3.98-6.12	8.62-10.51
	Result	SIG	SIG	SIG	SIG
	SEm±	0.82	2.32	0.26	0.54
	CD@5%	2.39	6.71	0.76	1.56

3. Nodal position to 1st male flower

Significant differences were noticed among the different genotypes with regard to the node at which first male flower appear. The genotype Phule Vaibhav registered the lowest number of nodes (3.98) to first male flower appearance which was at par with Konkan Shweta (4.74), PKM-1

(4.78), PLR-1 (4.95), PLR-2 (5.06) and DPL-SG-1 (5.20). While, DPL-SG-9 (6.12) was noticed at which last male flower appeared. Variations in nodes number at which first male flower appeared among the genotypes might be due to genetic makeup of the genotype. It was observed that genotype with the various vegetative growth leads to the production of first male flower in the highest nodes. Similar difference in nodes number where first male flower appeared was also noticed by Radha Rani (2014) [11] in bitter gourd, Uddin *et al*. (2014) [12] in bottle gourd, Islam *et al*. (2020) [6] in snake gourd, Kumar *et al*. (2022) [8] in snake gourd and Moharana *et al*. (2022) [9] in bitter gourd.

4. Nodal position to 1st female flower

Among the fifteen different genotypes studied, significant differences were noticed with regard to the node at which first female flower appeared. The genotype Phule Vaibhav was recorded having minimum nodes to 1st female flower appearance (8.62) and was at par with Konkan Shweta (8.87), DPL-SG-2 (8.94), Manusree (8.96), PKM-1 (9.45), DPL-SG-3 (9.65), DPL-SG-4 (9.72), PLR-1 (9.78) and PLR-2 (9.87). Variations in nodes number at which first female flower appeared among the genotypes might due to the genetic potential of the genotype and genotype with the highest vegetative growth lead to the production of first female flower in the highest nodes. Similar results for nodes number where first pistillate flower appeared were also found by Radha Rani *et al*. (2014) [11] in bitter gourd, Islam *et al*. (2020) [6] in snake gourd, Kumar *et al*. (2022) [8] in snake gourd and Moharana *et al*. (2022) [9] in bitter gourd.

Fruit characters

1. Fruit length (cm)

The fruit length ranged from 51.01 cm to 117.47 cm and the overall mean value was 79.71 cm. The highest fruit length was observed in variety Phule Vaibhav (117.47 cm), which was at par with PKM-1 (112.43 cm) and DPL-SG-2 (103.01 cm). The lowest fruit length was recorded in PLR-2 (51.01). Variation in fruit length of different genotypes might be due to the inherent characteristics of genotype for different fruit shape. Similar results were also observed by Celine *et al*. (2010) [3] in snake gourd, Duhan *et al*. (2015) [4] in bitter gourd and Kumar *et al*. (2022) [8] in snake gourd.

6. Fruit diameter (mm)

The highest fruit diameter was recorded in PLR-2 (67.09 m). The lowest fruit diameter was observed in the accession DPL-SG-1 (26.50 mm). The check variety Konkan Shweta recorded (44.79 mm) fruit diameter. The observed variation in fruit diameter among different genotypes might be due to the genetic variability of the crop and inherent characteristics governing various fruit shapes. Notably, genotypes having a cylindrical fruit shape displayed wider fruit diameter. Similar results were also observed by Celine *et al*. (2010) [3] in snake gourd, Uddin *et al*. (2014) [12] in bottle gourd, Duhan *et al*. (2015) [4] in bitter gourd, Varlakshmi *et al*. (2016) [13] in ridge gourd and Kumar *et al*. (2022) [8] in snake gourd.

Table 2: Variation in fruit length (cm) and fruit diameter (mm) among snake gourd genotypes (*kharif* 2023)

Sr. No.	Genotypes	**Fruit length** (cm)	**Fruit diameter** (mm)
T_1	PKM-1	112.43	30.54
T_2	PLR-1	80.21	44.81
T_3	PLR-2	51.01	67.09
T_4	Manusree	56.40	47.96
T_5	DPL- SG-1	79.23	26.50
T_6	DPL -SG-2	103.01	44.16
T_7	DPL- SG-3	91.24	31.52
T_8	DPL- SG-4	90.62	36.00
T_9	DPL -SG-5	80.89	37.38
T_{10}	DPL -SG-6	87.46	29.57
T_{11}	DPL -SG-7	62.23	30.24
T_{12}	DPL -SG-8	70.38	28.67
T_{13}	DPL -SG-9	67.69	27.23
T_{14}	Phule Vaibhav	117.47	41.56
T_{15}	Konkan Shweta (Check)	81.94	44.79
	Mean	79.71	37.87
	Range	51.01-117.47	26.50-67.09
	Result	SIG	SIG
	SEm±	3.38	2.55
	CD@5%	9.78	7.39

Yield and yield attributing characters

1. Weight of fruit (g)

The data presented in Table. 3 it distinctly revealed that the fruit weight varied significantly in different genotypes. It was ranged from 260.32 g to 371.97 g with a mean weight of 316.46 g. Significantly, the highest fruit weight was observed in Phule Vaibhav (371.97 g) and was at par with Konkan Shweta (345.29 g), DPL-SG-2 (339.62 g), PLR-1 (337.34 g), PKM-1 (333.87 g) and PLR-2 (332.63 g) while, the lowest fruit weight was observed in DPL-SG-9 (260.32 g). Significant variation in fruit weight might be due to the inherent genetic characters of the genotypes specially result fruit shape and size. Genotypes exhibiting larger fruit size tend to record the higher fruit weight whereas as those with smaller fruits naturally exhibits the lower fruit weight. The variation in fruit weight among snake gourd genotypes might be due to genetic differences along with environmental conditions and their interaction with genetic makeup. Variability in fruit characteristics exhibited by snake gourd was also described by Celine *et al.* (2010) [3] in snake gourd, Ahamed *et al.* (2012) [2] in pumpkin, Harika *et al.* (2012) [5] in bottle gourd, Ara *et al*. (2013) [1] in snake

gourd, Varlakshmi *et al*. (2016) [13] in ridge gourd, Islam *et al.* (2020) [6] in snake gourd and Kumar *et al*. (2022) [8] in snake gourd.

2. Number of fruits plant^{-1}

The data regarding number of fruits per plant influenced significantly by various genotypes are presented in table 3. The check variety Konkan Shweta recorded significantly the highest number of fruits per plant (17.05) which was at par with DPL-SG-3 (17.01), DPL-SG-4 (16.99), DPL-SG-9 (16.92), DPL-SG-7 (16.88), DPL-SG-5 (16.86), PKM-1 (16.65), PLR-1 (16.60), Phule Vaibhav (16.58), DPL-SG-2 (16.57), Manusree (16.50), PLR-2 (16.47) and DPL-SG-8 (16.23) whereas, the lowest number of fruits per plant was recorded in DPL-SG-1(14.69).

The variation in number of fruits per plant among different genotypes might be due to production of more number of female flowers i.e., lower sex ratio (M:F), dissimilarities of intermodal characters, leaf characters, fruit length, fruit diameter had a greater number of fruits per plant is due to the lower sex ratio which is genetical character of that particular genotype. Similar results were also observed by Celine *et al.* (2010) [3] in snake gourd, Varlakshmi *et al*. (2016) [13] in ridge gourd, Islam *et al.* (2020) [6] in snake gourd and Kumar *et al*. (2022) [8] in snake gourd.

3. Yield plant^{-1} (kg)

The variety Phule Vaibhav recorded significantly highest fruit yield (6.33 kg) per plant and was at par with Konkan Shweta (5.82 kg), DPL-SG-2 (5.59 kg), PLR-1 (5.58 kg) and PKM-1 (5.54 kg). The lowest fruit yield per plant was recorded in DPL-SG-8 (4.39 kg) which was at par with DPL-SG-9 (4.41 kg), DPL-SG-6 (4.53 kg) and DPL-SG-1 (4.70 kg). Significant variation in fruit yield per plant might be due to the genetic potential of the genotype as which exhibited superior growth and yield contributing traits which lead to production of more number of fruits with the highest weight. These results are in line with the findings of Celine *et al.* (2010) [3] in snake gourd, Ahamed *et al.* (2012) [2] in pumpkin, Harika *et al.* (2012) [5] in bottle gourd, Ara *et al*. (2013) [1] in snake gourd, Islam *et al.* (2020) [6] in snake gourd and Kumar *et al*. (2022) [8] in snake gourd.

Table 3: Variation in yield and yield attributing parameters of snake gourd genotypes (*Kharif* 2023)

Sr. No.	Genotypes	Fruit weight (g)	Number of fruits plant^{-1}	Yield plant^{-1} (kg)	Yield ha^{-1} (t)
T_1	PKM-1	333.87	16.65	5.54	27.69
T_2	PLR-1	337.34	16.60	5.58	27.86
T_3	PLR-2	332.63	16.47	5.44	27.21
T_4	Manusree	323.16	16.50	5.30	27.03
T_5	DPL -SG-1	320.08	14.69	4.70	23.51
T_6	DPL -SG-2	339.62	16.57	5.59	28.07
T_7	DPL -SG-3	306.94	17.01	5.18	26.10
T_8	DPL -SG-4	301.23	16.99	5.10	25.53
T_9	DPL -SG-5	306.59	16.86	5.20	25.49
T_{10}	DPL -SG-6	314.82	16.00	4.53	25.03
T_{11}	DPL -SG-7	282.55	16.88	4.71	23.56
T_{12}	DPL -SG-8	270.45	16.23	4.39	21.95
T_{13}	DPL -SG-9	260.32	16.92	4.41	22.03
T_{14}	Phule Vaibhav	371.97	16.58	6.33	30.77
T_{15}	Konkan Shweta (Check)	345.29	17.05	5.82	29.12
	Mean	316.46	16.51	5.20	26.06
	Range	260.32-371.97	14.69-17.05	4.39-6.33	21.95-30.77
	Result	SIG	SIG	SIG	SIG
	SEm±	13.96	0.40	0.30	1.07
	CD@5%	40.45	1.15	0.88	3.11

4. Yield hectare^{-1} (t)

Significantly the highest fruit yield per hectare was recorded in genotype Phule Vaibhav (30.77 t) and was at par with Konkan Shweta (29.12 t), DPL-SG-2 (28.07 t), PLR-1 (27.86 t) and PKM-1 (27.69 t). The lowest fruit yield per hectare was recorded in DPL-SG-8 (21.95 t) which was at par with DPL-SG-9 (22.03 t), DPL-SG-1 (23.51 t) and DPL-SG-7 (23.56 t).

Differences in yield and yield-related characteristics among the various genotypes might be due to variations in their morphological and physiological traits, which consequently affected the translocation of carbohydrates from source to sink. Significant variations in morpho-physiological attributes were observed among the varieties, likely stemming from their distinct genetic compositions. These observations aligns with the findings of Islam *et al*. (2020) [6], who revealed that genetic and environmental interactions influence morphological traits, and environmental factors contributing to linear effects. The increased fruit yield could potentially be attributed to the combined impact of a greater number of branches per plant, individual fruit weight, and an elevated quantity of fruits per plant. Similar results were also observed by Celine *et al.* (2010) [3] in snake gourd, Ahamed *et al.* (2012) [2] in pumpkin, Harika *et al.* (2012) [5] in bottle gourd, Ara *et al*. (2013) [1] in snake gourd, Radha Rani (2014) [11] in bitter gourd, Uddin *et al*. (2014) [12] in bottle gourd, Duhan *et al*. (2015) [4] in bitter gourd, Islam *et al.* (2020) [6] in snake gourd and Kumar *et al*. (2022) [8] in snake gourd.

Conclusion

The result for present investigation indicated that the snake gourd genotypes Phule Vaibhav, Konakn Shweta, DPL-SG-2, PLR-1 and PKM-1 recorded better performance in respect of days to 1st male flower, days to 1st female flower, nodal position to 1st male flower, nodal position to 1st female flower, fruit length, fruit diameter, fruit weight, number of fruits per plant, yield per plant and yield per hectare.

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