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GENETIC VARIABILITY AND HERITABILITY STUDIES IN SNAKEGOURD (*TRICHOSANTHES ANGUINA* L.)

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Abstract: Genetic variability and heritability parameters were studied in 48 snakegourd accessions. The genotypic coefficient of variation was high for fruiting nodes on main vine, male flowers/plant, sex ratio, fruits/plant and crude fibre content. The heritability was high for total duration of the crop and crude protein content of the fruit. Male flowers/plant, sex ratio, fruiting nodes on main vine and fruits/plant exhibited high heritability and high genetic gain indicating additive gene action. Yield/plant, fruit length, total crop duration, days to first harvest and days to first male flower anthesis exhibited high heritability and low genetic gain which indicate nonadditive gene action including epistasis and dominance pointing towards heterosis breeding for high yields and earliness.

INTRODUCTION

Snakegourd (*Trichosanthes anguina* L.) is a common vegetable consumed and relished by many people of South India. It is important as a good source of minerals, fibres and other nutrients to make the food wholesome and healthy. It is one of the few vegetables which fetches more yield per unit area. The medicinal value of snakegourd is lately recognised. In spite of its economic importance as a common vegetable, no serious attempt has so far been made to upgrade the productivity and acceptability of this crop. The present study was undertaken to develop high yielding varieties which would be suited to different agro-climatic zones.

MATERIALS AND METHOD

The experitmental materials consisted of 48 snakegourd accessions consisting of the genotypes maintained in the Department of Olericulture, College of Horticulture, Vellanikkara, Kerala and others collected from various parts of South India. The 48 genotypes were grown in a randomised block design with two replications during December, 1988 to April 1989. There were three pits/replication and one plant/pit was retained. The spacing adopted was 2 x 2 m. The cultural practices, plant protection measures and fertilizer applications were adopted according to the Package of Practices Recommendations of the Kerala Agricultural University (Anon., 1986).

Analysis of variance for RBD in respect of various characters was done as per Panse and Sukhatme (1957). Variability that existed in the population for various characters was estimated by the method suggested by Burton (1952). Heritability in broad sense was estimated by the formula suggested by Burton(1952). The genetic advance of the genotypes at 5% selection pressure was calculated using the formula suggested by Lush (1949) and Johnson *et al.* (1955). Observations were recorded on 25 vegetative and yield characters.

RESULTS AND DISCUSSION

Variability among 48 snakegourd accessions for different characters are presented in Table 1. Genotypic, phenotypic and environmental coefficients of variation, heritability, genetic advance and genetic gain are given in Table 2.

The snakegourd genotypes exhibited significant differences for all the 25 quantitative characters studied. The accession TA 99 had the shortest vine (303.5 cm) and TA 70 had the longest vine (785.0 cm). The genotype TA 82 took 33.5 days from germination to the opening of first female flower and TA 84 took 65.0 days for the same. The genotype TA 82 took 43.5 days for first harvest after germination and TA 84 took 81.0 days for harvest after germination. The accession TA 96 yielded 7330.0 g and TA 94 recorded an yield of 20230.0 g. The lowest number of fruits was produced by TA 71 (11.0) and the highest by TA 94 (57.5). The minimum number of seeds/fruit was produced by TA 55 (30.0) and the maximum by TA 19 (72.5). The crude fibre content was minimum in TA 34 (25.0%) and maximum in genotype TA 94 (71.8%). Snakegourd being a cross pollinated crop and since the different genotypes included in the studies belonged to different regions, the present observation is quite rational which is also in line with the reports of Srivastava and Srivatava (1976) and Vahab (1989) in bittergourd, Tyagi (1972) in bottlegourd and Rajendran (1989) in watermelon.

The highest phenotypic coefficient of variation was found for fruiting nodes on main vine (70.05) followed by male flowers/plant (47.55), sex ratio (45.65), fruits/plant (39.39), fruit length (32.56), crude protein (33.69) and yield/plant (31.35). The pcv was the lowest for crop duration (9.25) followed by days to first male flower anthesis (10.13), days to first fruit picking maturity (11.93), days to fruit maturity (12.4), flesh thickness (13.09), and days to first female flower opening (15.01). These observations were in conformity with the reports of Reddy and Rao (1984) in ridgegourd, Arora *et al.* (1983) in spongegourd and Vahab (1989) in bittergourd.

The plant improvement programmes like selection and hybridization cannot be undertaken based on the phenotypic performance alone, since it is the sum total of genotypic and environmental effect. The highest gcv was found for fruiting nodes on main vine (62.99) followed by male flowers/plant (47.49), sex ratio (45.61), fruits/plant (38.93), crude fibre content (33.6) and fruit length (32.15). The lowest gcv was found for total crop duration (924) followed by days to first fruit picking maturity (11.19) and days to fruit maturity (12.09)

A character can be improved only if it is highly heritable. The magnitude of heritability indicates the effectiveness with which the selection of the genotypes can be made based on phenotypic performance (Johnson *et al.*, 1955). The heritability was maximum for total duration of the crop and crude protein content (99.8% each). The heritability was the lowest for female flowers/plant (62.0%). It was followed by seeds/fruit (78.7%). The other traits had values between 78.7 - 99.8%. The results were in conformity with the findings of Ramachandran (1978) in bittergourd.

Eventhough heritability values give indication of effeciveness of selection based on the phenotypic performance, it does not necessarily mean a high genetic advance for a particular character. Heritability along with estimates of expected genetic advance should be considered while making selection. In crop improvement, only the genetic component of variation is important since only this component is transmitted to the next generation. The estimates of heritability serves as a useful guide to the breeders. If the heritability of a character is high (0.8 or more), selection for this is very easy. This is because there would be close correspondence between genotype and

Table 1. Variability for different characters among 48 snakegourd genotypes

Sl. No.	Characters	Range				Means
		Minimum	Accession number (TA series)	Maximum	Accession number (TA series)	
1	Main vine length	303.5	99	785.5	70	511.3 ± 12.9
2	Primary branches/plant	7.50	87	17.60	19	10.89 ± 0.52
3	Days to first male flower anthesis	27.50	19,82	45.00	71	33.94 ± 0.91
4	Days to first female flower opening	33.50	82	65.00	84	42.52 ± 1.64
5	Node at which first female flower appeared	11.70	102	26.00	70	18.45 ± 0.55
6	Male flowers/plant	2440	41	15000	80	5624 ± 91.2
7	Female flowers/plant	63.00	45	130.0	94	85.53 ± 8.17
8	Sex ratio	30.00	83	150.0	80	67.29 ± 0.96
9	Nodes on main vein	31.00	83,99	66.00	70	40.82 ± 2.07
10	Fruiting nodes on main vine	0.00	43,70,91, 97,10	40.00	41	1.45 ± 0.31
11	Days to fruit maturity	10.00	70,73,82, 91,95,102	16.00	55,100	12.79 ± 0.28
12	Days to first fruit piking maturity	43.50	82	81.00	84	55.08 ± 1.61
13	Yield/plant (g)	7330	96	20230	94	10884 ± 680
14	Fruits/plant	11.00	71	57.50	94	24.43 ± 0.37
15	Fruit length (cm)	30.10	56	116.0	96	61.10 ± 2.22
16	Fruit girth (cm)	12.00	97	29.35	70	19.07 ± 0.85
17	Flesh thickness (cm)	0.60	32	1.00	71	0.76 ± 0.24
18	Seeds/fruit	30.00	55	72.50	19	46.88 ± 3.23
19	Seed weight/fruit (g)	7.50	82	18.86	82	14.12 ± 1.06
20	100 seed weight (g)	20.00	82	41.00	73	30.30 ± 0.48
21	Average fruit weight (g)	300.0	82	900.0	71	537.7 ± 20.0
22	Total crop duration (days)	95.00	77	140.0	32,71	118.9 ± 0.29
23	Vitamin C content of fruit (mg/100 g)	13.00	69	31.20	79,102	19.64 ± 0.25
24	Crude fibre content of fruit (%)	25.00	34	71.80	94	40.37 ± 0.52
25	Crude protein content of fruit (%)	8.75	80	48.12	55	26.98 ± 0.28

Table 2. Genotypic, phenotypic and environmental coefficient of variation, heritability, genetic advance and genetic gain

Sl. No.	Characters	gcv	pcv	ecv	h^2(b)	ga	gg
1	Main vine length	19.52	19.85	3.57	0.970	202.2	39.55
2	Primary branches/plant	20.95	22.01	6.75	0.910	4.470	41.07
3	Days to first male flower anthesis	9.39	10.13	3.80	0.860	6.090	17.93
4	Days to first female flower opening	13.93	15.01	5.59	0.860	11.06	26.64
5	Node at which first female flower appeared	20.41	20.84	4.20	0.960	7.600	41.18
6	Male flowers/plant	47.49	47.55	2.30	0.990	47.49	97.95
7	Female flowers/plant	17.12	21.81	13.51	0.620	23.67	27.67
8	Sex ratio	45.61	45.65	2.03	0.990	63.16	93.86
9	Nodes on main vine	15.93	17.47	7.18	0.830	12.22	29.95
10	Fruiting nodes on main vine	62.99	70.05	30.65	0.810	1.690	116.5
11	Days to fruit maturity	12.09	12.46	3.04	0.940	3.090	24.15
12	Days to first fruit picking maturity	11.19	11.93	4.14	0.880	11.91	21.62
13	Yield/plant	30.06	31.33	8.84	0.920	31.33	0.29
14	Fruits/plant	38.93	39.99	9.11	0.950	19.07	78.08
15	Fruit length	32.15	32.56	5.14	0.975	39.57	0.84
16	Fruit girth	20.26	21.23	6.34	0.910	7.600	39.84
17	Flesh thickness	13.09	13.73	4.14	0.909	0.196	25.71
18	Seeds/fruit	18.74	21.13	9.74	0.787	16.06	34.26
19	Seed weight/fruit	27.87	29.89	10.59	0.873	7.580	53.66
20	100 seed weight	15.25	15.92	2.24	0.978	0.420	31.10
21	Average fruit weight	24.62	25.05	5.28	0.954	259.1	48.19
22	Total crop duration	9.24	9.25	0.34	0.998	22.67	19.02
23	Vitamin C content of fruit	25.56	26.62	1.81	0.995	10.72	54.57
24	Crude firbe content of fruit	26.25	26.31	1.84	0.995	21.78	53.95
25	Crude protein content	33.66	33.69	1.49	0.998	18,69	69.26

phenotype due to a relatively smaller contribution of environment to the phenotype.

In the present investigation genetic advance was estimated in absolute values and also as percentage of mean. The characters that exhibited high heritability with high genetic gain were male flowers/plant (99.0 and 97.5), sex ratio (99.0 and 93.86), fruiting nodes on main vine (81.0 and 116.57) and fruits/plant (95.0 and 78.08). This indicates additive gene action. This suggests that these characters can be improved through selection. Similar observations were made by Srivastava and Srivatava (1976) in bittergourd and Arora *et al.* (1983) in spongegourd.

The characters that exhibited high heritability along with low genetic gain were yield/plant (92.0 and 0.20), fruit length (97.5 and 0.84), total crop duration (99.8 and 19.02), days to first harvest (88.0 and 21.62) and days to first male flower anthesis (86.0 and 17.93). The high heritability coupled with low genetic gain indicates good scope for developing F_1 hybrids for yield/plant and earliness. Similar observations were made by Krishnaprasad and Singh (1989) in ridgegourd.

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REFERENCES

Anonymous 1986. *Package of Practices Recommendations.* Directorate of Extension, Kerala Agric Univ., Thrissur

Arora, S.K., Pandita, M.L., Pratap, P.S. and Sidhu, A.S. 1983. Variability and correlation studies in spongegourd. *Haryana Agric. Univ. J. Res.* XIII : 146-149

Burton, G.W. 1952. Quantitative inheritance in grasses. *6th int. Grass Land Cong.* 1: 277-283

Johnson, H.W., Robinson, H.D. and Comstock, R.E. 1955. Estimates of genetical and environmental variability in soybeans. *Agron. J.* 47 : 314-318

Krishnaprasad, V.S.R. and Singh, D.P. 1989. Studies on heritability, genetic advance and correlation in ridgegourd. *Indian J. Hort.* 46: 390-394

tush, J.J. 1949. *Animal Breeding Plants.* Iowa State Univ. Press, Ames, Iowa, p 473

Panse, V.G. and Sukhatme, P.V. 1957. Genetics of quantitative characters in relation to plant breeding. *Indian J. Genet.* 17 : 318-329

Rajendran, P.C. 1989. Crop improvement in watermelon, Ph.D. thesis, Tamil Nadu Agricultural University, Coimbatore

Ramachandran, C. 1978. Genetic variability, correlation studies and path coefficient analysis in bittergourd (*Momordica charantia* L.) M.Sc. (Hort.) thesis, Kerala Agricultural University, Thrissur

Reddy, K.S.S. and Rao, M.R. 1984. Studies on heritability, genetic advance and characters association in ribbedgourd. *South Indian Hort.* 32 : 97-100

Srivaslava, V.K. and Srivastava, L.C. 1976. Genetic parameters, correlation coefficients and path analysis in bittergourd *(Momordica charantia* L.). *Indian J. Hort.* 33 : 66-70

Tyagi, I.D. 1972. Variability and correlation studies in bottlegourd (*Lagenaria siceraria*). *Indian J. Hort.* 29 : 219-222

Vahab, M.A. 1989. Homeostatic analysis of components of genetic variance and inheritance of fruit colour, fruit shape and bitterness in bittergourd *(Momordica charantia* L.). Ph.D. thesis, Kerala Agricultural University, Thrissur