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HETEROSIS OF GROWTH CHARACTERS AND EARLINESS IN SNAKEGOURD (*TRICHOSANTHES ANGUINA* L.)

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Abstract: Heterosis of growth characters and earliness in snakegourd was worked out in a 13 x 13 analysis. Heterobeltiosis and standard heterosis were found for main vine length, primary branches per plant, days to first male flower anthesis, days to first female flower opening, fruiting nodes on main vine, days to fruit maturity and days to first fruit picking maturity. Days to first female flower opening showed high heterobeltiosis in parental combinations TA 102xTA 41, TA 77xTA 41 and TA 87x TA 30. The crosses TA 77 x TA 55, TA 89 x TA 19, TA 89 x TA 102 and TA 77 x TA 99 were highly heterobelliotic for days to first fruit pickig maturity and in crosses TA 100 x TA 82, TA 77 x TA 99, TA 77 x TA 41 and TA 30 x TA 99, standard helerosis was high for this trait.

INTRODUCTION

Sankegourd (*Trichosanthes anguina* L.) occupies a pride of place among the cucurbitaceous vegetables, particularly in South India, where it is commonly grown throughout the year. It is considered as a good source of minerals, fibre and other nutrients. Inspite of its economic importance as a common vegetable consumed by many people in the country, no serious attempt has so far been made to upgrade the productivity and acceptability of this crop. The types that are under cultivation at present are non-descript ones. This necessitates a need-based crop improvement programme for developing high yielding varieties with superior quality fruits. Exploitation of heterosis is a known technique of boosting up production and productivity of crop plants. Snakegourd being a cross pollinated crop, considerable scope exists for commercial exploitation of heterosis, and there exists considerable level of diversity among the snakegourd types in South India. The work was undertaken with the above objective.

MATERIALS AND METHODS

From the germplasm collection of 48 snakegourd accessions, 13 parents were selected based on generic variability and overall performance. The parents selected were TA 99 (P1), TA 90 (P2), TA 55 (P3), TA 41 (P4), TA 77 (P5), TA 19 (P6), TA 84 (P7), TA 30 (P8), TA 82 (P9), TA 102 (P10), TA 100 (P11), TA 87 (P12) and TA 89 (P13). The true breeding parents were sclfed for one generation. The selfed parents were crossed in a 13 x 13 diallel, excluding recriprocals, during September, 1989 to January, 1990. These parents along with their f_1 hybrids were evaluated during February-May 1990. The design used was randomised block design. There were three pits/replication and one plant/pit was retained. A spacing of 2.0 x 2.0 m was provided. The cultural practices, plant protection measures and fertilizer application were adopted according to the package of practices recommendations of the Kerala Agricultural University (Anon., 1986).

Magnitude of heterosis was calculated in terms of two parameters. Heterosis over better parent (heterobeltiosis) and overstandard variety (standard heterosis) were worked out as suggested by Briggle (1963) and Hayes *et al.* (1965)

Table 1. Mean performance of parents, F_1 hybrids and extent of heterosis for main vine length, primary branches per plant and days to first male flower anthesis

	Main vine length			Primary branches/plants			Days to first male flower anthesis		
	Mean (cm)	HB (%)	SH (%)	Mean	HB	SH	Mean (days)	HB (%)	SH
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
P_1	370.0			13.00			**34.5** ·		
P_2	800.0			16.50			37.5		
P_3	600.0			11.00			34.0		
P_4	490.0			9.00			36.5		
P_5	520.0			10.00			32.0		
P_6	570.0			12.00			31.0		
P_7	500.0			12.00			36.5		
P_8	490.0			8.60			40.0		
P_9	500.0			14.00			26.7		
P_{10}	500.0			11.00			37.0		
P_{11}	510.0			12.00			35.5		
P_{12}	760.0			8.50			35.0		
P_{13}	480.0			10.50			32.0		
$P_3 \times P_1$	520.0	-13.33	8.77	11.00	-1538	-8.33	29.0	**-14.71****	**-6.45****
$P_4 \times P_1$	500.0	-2.00	-1228	10.00	-23.00	-16.67	33.5	-2.90	8.06
$P_4 \times P_3$	570.0	5.00	0.00	7.00	-36.36	**-41.67**	31.5	7.35	1.61
$P_5 \times P_4$	855.0	**64.42****	**50.00****	16.00	**60.00****	**33.33****	28.0	**-12.50****	**-9.68****

Table 2. Mean performance of parents, F_1 hybrids and extent of heterosis for days to first female flower opening, days to fruit maturity and days to first fruit picking maturity

Parent/Crosses	Days to first female flower opening			Days to fruit maturity			Days to first picking maturity		
	Mean (days)	HB (%)	SH (%)	Mean (days)	HB (%)	SH (%)	Mean (days)	HB (%)	SH
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
P_1	40.00			12.00			53.00		
P_2	47.00			10.00			57.50		
P_3	38.00			15.00			54.00		
P_4	38.00			12.00			51.50		
P_5	40.00			13.00			53.00		
Pa	45.00			12.00			58.00		
P_7	65.00			14.50			80.00		
P_8	45.00			13.00			57.00		
P_9	33.50			10.00			43.50		
P_{10}	44.00			11.50			58.00		
P_{11}	40.00			14.50			56.50		
PU	48.00			14.00			61.00		
P_{13}	40.00			13.00			56.00		
$P_3 \times P_1$	38.00	18.42	0.00	11.00	-8.33**	-8.33**	44.50	-16.04**	-23.28**
$P_4 \times P_1$	36.75	-8.12**	-18.33**	10.75	-10.41**	-10.41**	46.00	-10.68	-20.69**
$P_4 \times P_3$	37.00	-2.63	-17.78**	10.50	-12.5**	-12.5**	47.50	-7.77	-18.10**
$P_5 \times P_4$	33.75	-15.63**	-25.00**	10.00	-16.67**	-16.67**	45.00	-12.62	-22.41**

Table 1. Contd.

[illegible]	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$P_6 \times P_5$	480.0	-14.04	-14.04	12.00	0.00	0.00	32.0	3.23	[illegible]
$P_8 \times P_1$	800.0	14.28*	-1.[illegible]	12.00	-7.69	0.00	[illegible]	[illegible]	4.84
$P_8 \times P_4$	[illegible]	30.61**	12.28**	[illegible]	-5.55	-29.17	35.5	-2.74	14.52
$P_9 \times P_2$	550.0	-31.25	-3.51	15.50	-8.06	29.17**	36.0	34.83	16.13
$P_9 \times P_3$	775.0	[illegible]	35.98*	11.50	-17.86	-4.17	[illegible]	11.88	1.61
$P_{10} \times P_3$	670.0	[illegible]	17.54	11.00	20.00	-8.33	[illegible]	4.41	14.52
$P_{10} \times P_4$	855.0	[illegible]	50.00	13.50	12.73**	12.50**	33.5	8.22	8.06
$P_{10} \times P_7$	540.0	[illegible]	-5.26	13.50	-2.50**	12.50*	[illegible]	4.11	12.90
$P_{10} \times P_8$	722.5	[illegible]	26.73	13.75	15.00**	14.58**	[illegible]	-2.70	16.13
$P_{11} \times P_1$	725.0	[illegible]	27.19	10.25	-21.15	-14.58	31.5	8.70**	1.61
$P_{11} \times P_4$	560.0	9.80**	-1.70	6.50	-27.78	-45.83	41.0	15.82	[illegible]
$P_{11} \times P_6$	600.0	5.26	5.26	11.50	-4.17	-4.17	[illegible]	8.06	8.06
$P_{11} \times P_8$	670.0	81.87**	17.54	8.00	[illegible]	[illegible]	[illegible]	-9.60**	[illegible]
$P_{11} \times P_9$	500.0	-1.96	[illegible]	11.50	[illegible]	[illegible]	[illegible]	27.34	[illegible]
$P_{12} \times P_1$	510.0	-27.50	[illegible]	18.00	[illegible]	[illegible]	[illegible]	-2.90	[illegible]
$P_{12} \times P_2$	535.0	[illegible]	[illegible]	11.75	-28.79	[illegible]	36.5	4.29	17.74
$P_{12} \times P_3$	[illegible]	1.97	[illegible]	7.75	[illegible]	[illegible]	[illegible]	0.00	[illegible]
$P_{13} \times P_1$	[illegible]	4.16	[illegible]	12.50	[illegible]	[illegible]	28.5	-10.94**	[illegible]
$P_{13} \times P_4$	610.0	26.53	[illegible]	18.25	[illegible]	[illegible]	[illegible]	-6.25*	-3.26
$P_{13} \times P_5$	485.0	-14.91	-14.91	14.00	16.66*	16.66**	81.5	[illegible]	0.00
$P_{13} \times P_{10}$	480.0	[illegible]	-15.79	[illegible]	[illegible]	-18.75	[illegible]	[illegible]	[illegible]
[illegible] (0.05)		[illegible]	[illegible]		[illegible]	[illegible]		1.74	[illegible]
[illegible] (0.01)		49.96	49.56		[illegible]	[illegible]		[illegible]	2.82

Table 2. Contd.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$P_6 \times P_5$	4[illegible].00	2.22	2.22	10.00	-16.67**	-16.67**	54.00	1.89	[illegible]
$P_8 \times P$	35.00	-12.50**	-22.22**	12.00	0.00	-0.00	45.00	-15.00**	-22.41
$P_8 \times P_4$	40.50	1.25	-10.00**	10.00	-16.67**	-16.67**	53.75	4.36	-7.[illegible]3
$P_9 \times P_2$	37.00	10.44	-17.78**	10.00	0.00	-16.67	45.00	-3.45	-22.41
$P_9 \times P_5$	37.50	11.94	-19.89**	10.00	10.00	-16.67 *	47.75	-8.26	-17.67*
$P_{10} \times P_3$	39.50	3.95	-12.22	12.50	8.7	-4.17	52.00	-3.70	-10.34
$P_{10} \times P_4$	36.50	-16.85**	-18.89**	10.00	-3.04	-6.67	46.75	-9.22	-19.40*
$P_{10} \times P_7$	44.00	0.00	-2.22	12.50	8.70	14.17	56.50	-2.20	2.[illegible]
$P_{10} \times P_8$	39.00	-13.33*	-13.33**	12.00	14.35	10.00	53.50	-6.14	7.76
$P_{11} \times P_1$	38.00	-2.50	-15.55	13.00	8.33	8.33	48.00	-9.43	-17.24*
$P_{11} \times P_4$	38.00	-5.00	-15.56**	12.50	-6.67**	-16.67**	53.25	3.40	8.12
$P_{11} \times P_6$	42.50	6.25	-5.56*	12.50	16.[illegible]*	-16.67**	55.00	0.92	-5.17
$P_{11} \times P_8$	42.75	6.88	-5.00*	11.00	-15.28*	-8.83*	56.75	-0.44	-2.16
$P_{11} \times P_9$	37.00	10.45	-17.78	11.00	10.00	-8.83*	43.00	-1.15	-25.86
$P_{12} \times P_1$	37.50	-6.25**	-16.67**	12.00	0.00	0.00	46.00	-13.21	-20.69
$P_{12} \times P_2$	41.50	-13.54**	-7.78**	12.75	27.50	6.25	52.75	-8.26	-[illegible]05
$P_{12} \times P_8$	38.50	-3.75	-14.44**	13.00	0.00	8.33	51.50	9.65	-11.21
$P_{13} \times P_1$	38.50	-3.75	-14.44**	11.00	8.88*	8.38	48.00	-9.43	-17.24*
$P_{13} \times P_4$	37.50	-6.25*	-16.67**	11.00	8.88*	-8.33*	48.50	-5.83	-16.38*
$P_{13} \times P_6$	36.50	-8.75**	-18.81**	10.00	16.67*	-16.67**	46.50	-16.96*	19.83*
$P_{13} \times P_{10}$	36.50	-8.75**	-18.89**	11.00	4.[illegible]5	-8.33*	46.75	-16.51*	-1[illegible]40**
CD (0.05)		2.01	2.01		0.92	0.92		7.82	7.85
CD (0.01)		2.67	2.67		1.22	1.22		10.44	10.44

Heterobeltiosis (HB)

$$\frac{F_1 - BP}{BP} \times 100$$

where BP = average performance of better parent

Standard heterosis (SH)

$$\frac{F_1 - \text{check variety}}{\text{Check variety}} \times 100$$

The local cultivar TA 19 was used as the check variety.

RESULTS AND DISCUSSION

The analysis of variance showed highly significant difference among the parental lines and other crosses. The mean values of 13 parents and their best 25 F_1 hybrids are presented in Table 1 and 2. The extent of heterosis over the better parent and check variety has also been given in Table 1 and 2.

Heterobeltiosis was high for main vine length in crosses P10 x P4 (71.0%) and P5 x P4 (64.42%). They also showed high standard heterosis. Among the parents, main vine length was the highest in P2 and the lowest in P1. In the case of primary branches/plant, the crosses P5 x P4 (60.0%), P13 x P4 (32.5%) were highly heterobeltiotic whereas relative heterosis was high in P5 x P4 (33.33%) and P9 x P2 (29.17%). The F_1 hybrids which were highly heterobeltiotic for days to first male flower anthesis were P3 x P1 (-14.71%), P5 x P4 (-12.5%) and P13 x P1 (- 10.94%). The combinations which showed standard heterosis for this trait were P5 x P4 (-9.68%), P13 x P1 (-8.06%) and P3 x P1 (-6.45%). For days to first female flower opening, highly heterobeltiotic combinations were P10 x P4 (-16.82%), P5 x P4 (- 15.63%) and P12 x P8 (-14.44%). Standard heterosis was high in P5 x P4 (-25.0%), P8 x P1 (-2222%) and P10 x P4 (-18.89%). The F_1 hybrids possessing earliness are of paramount importance in crop improvement.

The combinations P11 x P1 (400.0%), P10 x P3 (200.0%) and P10 x P7 (166.63%) were highly heterobeltiotic for fruiting nodes on main vine. High standard heterosis for this trait was exhibited by P10 x P3, P4 x P3, P5 x P4 and P9 x P5. For days to fruit maturity, the combinations highly heterobeltiotic were P5 x P4, P6 x P5, P8 x P4 and P11 x P6, each with values of -16.67%. Standard heterosis was high in P11 x P9(-25.86%), P3 x P1 (- 2328%), P5 x P4 (-22.41 %), P4 x P1 (-20.69%) and P4 x P3 (-18.10%). The high heterosis registered for various characters are important for their exploitation in increasing the productivity of the crop. The parents involved in the crosses are drawn from genetically diverse situations and their diversity was perceptibly expressed in the hybrid combinations.

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