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EVALUATION OF SNAKE GOURD [*TRICHOSANTHES CUCUMERINA* L.] GENOTYPES AND HYBRIDS

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ABSTRACT
The present investigation was conducted at the department of Horticulture, Agricultural College and Research Institute, Madurai, Tamil Nadu, to assess the performance of 36 hybrids and their parents for growth, earliness and yield in snake gourd. Significant variation in *per se* performance was noticed in plant growth, earliness and yield characters. Different hybrids and parents were found best for different traits. The best performing parents for different characters includes L_2 and L_6 for earliness and yield, L_8 for vine length T_3 for lowest internodal length. The hybrids of $L_2 \times T_3$, $L_9 \times T_3$, $L_6 \times T_1$, $L_7 \times T_2$ and $L_7 \times T_1$ were most promising for various traits which contribute to early and highest fruit yield per vine. The best performing parents can be used for further breeding programmes and hybrids could be exploited for cultivation.

INTRODUCTION

Snake gourd (*Trichosanthes cucumerina* L.) belongs to the family Cucurbitaceae and it's an important summer vegetable but it can be grown throughout the year except extreme winter. It is important as a good sources of minerals, fiber and nutrients to make the food wholesome and healthy (Ahmed *et al*., 2004). It is also one of the important vegetables which fetches more yield per unit area but the average yield of the crop is low. In addition it has tremendous export potential because of its excellent keeping quality and shelf life. There are a number of cultivars with wide range of variability in size, shape and color of fruits available in India. A large number of local lines are cultivated in this country but there is no recommended cultivar so far. There is no serious attempts have been made to upgrade the productivity of snake gourd. For developing superior varieties, it is necessary to improve the yield and its components in snake gourd. *Per se* performance is the primary criteria to evaluation of a hybrid and parents for particular traits. Identification of superior parents for growth, earliness and yield traits becomes imperative for promoting improvement in growth and yield traits of hybrids. The basic idea of hybridization programme is to combine favourable genes present in different parents into a single genotype. The hybrids thus obtained can be utilized directly as F_1 hybrid to exploit hybrid vigour or they can be advanced to further generations for other crop improvement programmes. The utilization of hybrid will depend upon its genetic constitution and its performance both at genotypic and phenotypic levels. Considering these points, the present investigation was undertaken to assess the *per se* performance of parents and hybrids for growth, earliness and yield for produce better hybrids of snake gourd.

MATERIALS AND METHODS

The present investigation was conducted in the Department of Horticulture, Agricultural College and Research Institute, Madurai during the period 2012-13. Study comprise of thirteen parents (nine lines and four testers) and 36 hybrids were obtained from those selected parents in a hybridization programme through LxT mating design. These 36 F_1 hybrids along with 13 parents were evaluated in randomized block design with three replications. These parents and hybrid seeds were sown at a spacing of 2m x 2m with recommended package of practices followed as per the state of Tamil Nadu. Observations were recorded on five randomly selected plants in each hybrids and parents on vine length, internodal length, days to first female flower appearance, days to first male flower appearance, node at which first female flower appeared and fruit yield per vine. The *per se* performance of selected 13 parents and 36 hybrids combinations obtained from line x tester mating design for all growth, earliness and yield characters.

RESULTS AND DISCUSSION

In any crop breeding programme, it is essential to eliminate the undesirable types, which would be achieved simply by studying the *per se* performance of parents and hybrids. The *per se* performance should also be given an equal importance while judging the hybrid combinations for exploitation of

Table 3 : Based on *per se* performance of top six parents and top five best performing hybrids

Characters	Parents	Hybrids
Vine length (cm)	L_2, L_3, L_4, L_5 and T_4	$L_1 \times T_1$, $L_1 \times T_3$, $L_1 \times T_4$, $L_2 \times T_1$, $L_2 \times T_2$, $L_2 \times T_3$, $L_3 \times T_2$, $L_4 \times T_1$, $L_4 \times T_2$, $L_4 \times T_3$, $L_5 \times T_2$, $L_5 \times T_3$, $L_5 \times T_4$, $L_6 \times T_3$, $L_6 \times T_4$, $L_7 \times T_1$, $L_7 \times T_2$, $L_7 \times T_4$, $L_8 \times T_2$, $L_8 \times T_4$, $L_9 \times T_4$
Internodal length (cm)	L_1, L_2, T_1, T_2 and T_3	$L_1 \times T_3$, $L_1 \times T_4$, $L_2 \times T_3$, $L_2 \times T_4$, $L_3 \times T_1$, $L_3 \times T_3$, $L_4 \times T_3$, $L_5 \times T_1$, $L_5 \times T_2$, $L_5 \times T_3$, $L_6 \times T_1$, $L_7 \times T_1$, $L_7 \times T_2$, $L_8 \times T_1$, $L_8 \times T_3$, $L_9 \times T_3$, $L_9 \times T_4$
Days to first female flower anthesis	L_2, L_3, L_4, L_5 T_2, T_4	$L_1 \times T_2$, $L_2 \times T_3$, $L_3 \times T_1$, $L_3 \times T_3$, $L_4 \times T_2$, $L_4 \times T_3$, $L_5 \times T_1$, $L_5 \times T_2$, $L_6 \times T_1$, $L_6 \times T_3$, $L_6 \times T_4$, $L_7 \times T_2$, $L_7 \times T_3$, $L_8 \times T_1$, $L_8 \times T_2$, $L_9 \times T_2$, $L_9 \times T_3$, $L_9 \times T_4$
Days to first male flower anthesis	L_2, L_5, L_6, L_9, T_2 and T_3	$L_1 \times T_2$, $L_2 \times T_3$, $L_3 \times T_1$, $L_3 \times T_3$, $L_4 \times T_3$, $L_5 \times T_1$, $L_5 \times T_2$, $L_6 \times T_1$, $L_6 \times T_3$, $L_6 \times T_4$, $L_7 \times T_2$, $L_7 \times T_3$, $L_8 \times T_1$, $L_8 \times T_2$, $L_8 \times T_4$, $L_9 \times T_2$, $L_9 \times T_3$, $L_9 \times T_4$
Node at which first female flower appeared	L_2, L_3, L_7 and T_1	$L_1 \times T_2$, $L_2 \times T_3$, $L_3 \times T_1$, $L_3 \times T_3$, $L_4 \times T_2$, $L_5 \times T_1$, $L_5 \times T_2$, $L_6 \times T_1$, $L_6 \times T_2$, $L_6 \times T_3$, $L_6 \times T_4$, $L_7 \times T_2$, $L_7 \times T_3$, $L_8 \times T_1$, $L_8 \times T_2$, $L_8 \times T_4$, $L_9 \times T_2$, $L_9 \times T_3$, $L_9 \times T_4$
Yield per vine (kg)	L_2, L_3, T_1 and T_4	$L_1 \times T_1$, $L_1 \times T_3$, $L_1 \times T_4$, $L_2 \times T_1$, $L_2 \times T_2$, $L_2 \times T_3$, $L_3 \times T_2$, $L_4 \times T_1$, $L_4 \times T_2$, $L_4 \times T_3$, $L_5 \times T_2$, $L_5 \times T_3$, $L_5 \times T_4$, $L_6 \times T_3$, $L_6 \times T_4$, $L_7 \times T_1$, $L_7 \times T_2$, $L_7 \times T_4$, $L_8 \times T_2$, $L_8 \times T_4$, $L_9 \times T_4$
Overall	L_2, L_3, L_5, L_6, T_1 and T_4	$L_2 \times T_3$, $L_5 \times T_1$, $L_6 \times T_1$, $L_7 \times T_2$, and $L_8 \times T_4$

heterosis. Parents with high *per se* performance would be of much useful in producing better offsprings in any breeding programme (Gilbert, 1958). The potential of a variety could be assessed by comparing the *per se* performance and combining ability of the parents (Singh *et al*., 1996). *Per se* performance of parents and hybrids in Table 2 and top six parents and top five best performing promising hybrids in Table 3 are presented in this study.

Parents and hybrids differed significantly among themselves for vine length. Among the lines, vine length ranged from 324.2 cm (L_8) to 575.5 cm (L_3). On the other hand, testers ranged from 392.5cm (T_1) to 475.7 cm (T_4). The parents L_2, L_3, L_4, L_5 and T_4 recorded significant mean value. Among the thirty six hybrids, $L_2 \times T_3$ recorded the maximum vine length of 585.3 cm, followed by $L_4 \times T_2$ (582.5 cm). Vine length is an important yield component by which growth and vigour of plants are measured. The variation of vine length might have been due to the specific genetic makeup of different hybrids and vigour of the crop. The same trend of results in their study was also reported by Sundaram (2006) in bitter gourd, Sachin *et al*. (2014), Alli Rani and Jansirani (2014) in ridge gourd and Sangeetha and Subramaniam 2015 in ginger.

The data on intermodal length showed significant variation among different parents and hybrids. Among the parents the lines L_1, L_2 and all the testers except T_4 showed significantly minimum internodal length. The hybrid $L_9 \times T_3$ registered the shortest internodal length of 19.70 cm and $L_9 \times T_2$ recorded the longest internodal length of 29.60 cm for the same trait. Among the thirty six hybrids, sixteen hybrids were found to shorter internodal length. The same results were also obtained by Alli Rani (2014) in ridge gourd.

Earliness is one of the main attribute which is measured in terms of days to first female flower appearance, days to first male flower appearance and node at which first female flower appeared in cucurbits. It is an essential criterion to select hybrids for earliness. In this study, the first female flower anthesis was recorded early by the parent L_2 (44.76 DAS), followed by L_3 (46.45 DAS) while, late flowering was observed in L_8 (51.47 DAS). Four lines *viz*., L_2, L_3, L_4, L_5 and two testers T_2 and T_4 recorded significant low mean values for this trait. The hybrid $L_6 \times T_1$ and $L_7 \times T_2$ registered the shortest period of 30.50 days for first female flowering and $L_1 \times T_3$ recorded the longest period of 46.23 days for the same trait. Among the 36 hybrids,18 hybrids were found to flower earlier than the grand mean of 40.27 days. The variation in the first female flower appearance might have been due to increase in the internodal length, number of internodes and vigour of the crop. Similar results were also obtained by Aravindakumar *et al*. (2005) in musk melon, Badgujar and More (2004), Bairagi *et al*. (2005) in cucumber and Alli Rani and Jansirani (2014) in ridge gourd.

Genotypes differed significantly among themselves for days to first male flower anthesis. Earliness in first male flowering was recorded by the parent L_6 (39.01 DAS), followed by L_5 (39.03 DAS) and T_3 (40.04 DAS) while late flowering was observed in L_1 (47.50 DAS). Among the parents L_2, L_5, L_6, L_9 T_2 and T_3 registered significantly minimum mean values for this trait. The hybrid $L_1 \times T_2$ registered the shortest period of 40.63 days for first male flowering and $L_1 \times T_3$ recorded the longest period of 50.10 days for the same trait. Among the 36 hybrids, 19 hybrids were found to flower earlier than the grand mean of 44.24 days. Similar results were also obtained by Sharma and Bhataarai (2006) Rastogi *et al*. (1990) in cucumber and Alli Rani and Jansirani (2014) in ridge gourd.

Yet another character *i.e.,* node number for first female flower appearance is also considered as one of the measures for earliness in cucurbits. Early appearance of female flower would indirectly lead to production of early fruits and early harvest. Genotypes differed significantly among themselves for node at which first female flower appeared and it varied from 15.61 (L_2) to 22.79 (L_6) and the testers it ranged from 19.56 (T_1) to 24.57 (T_3). Four parents *viz*., L_2, L_3, L_7 and T_1 registered significantly minimum mean values for node to first female flower. The node to first female flower appeared was registered in $L_5 \times T_1$, $L_6 \times T_3$ and $L_7 \times T_2$ with the values of 10.07, 10.15 and 10.18 respectively and $L_1 \times T_3$ hybrid recorded maximum mean value of 20.27 for the same trait. Similar results were recorded in ridge gourd by Rao *et al*. (2000) and Bairagi *et al*. (2005) in cucumber by Sharma and Bhataarai (2006), Hegde (2009), Reddy *et al*. (2013) in ridge gourd, Peerzada *et al*. (2014) in chickpea and Alli Rani and Jansirani (2014) in ridge gourd.

The data on yield per vine showed significant variation among different parents and hybrids. The range of 6.44 kg (L_8) to 7.78 kg (L_2) was observed in the lines and range of 6.72 kg (T_2) to 7.60 kg (T_4) was found among the testers. The line L_2 registered the highest yield(7.78 kg vine^{-1}) followed by L_3 (7.69 kg vine^{-1}), while the lowest yield (6.44 kg vine^{-1}) was noticed in L_8. Four out of 13 parents recorded significantly higher fruit yield per vine over the grand mean. The highest fruit yield of

Table 2: *Per se* performance of parents and hybrids of snake gourd genotypes for growth, earliness and yield

Parents Line	Vine length (cm)	Inter nodal length (cm)	Days to first female flower anthesis	Days to first male flower anthesis	Node at which first female flower appeared	Yield per vine (kg)
L_1	345.2	24.61*	52.25	47.50	20.54	6.81
L_2	512.5*	26.16*	44.76*	40.12*	15.61*	7.78*
L_3	575.5*	29.17	46.45*	43.00	18.72*	7.69*
L_4	555.1*	28.11	48.35*	45.00	19.82	6.94
L_5	515.6*	27.65	47.63*	39.03*	21.44	6.84
L_6	405.7	26.24	49.95	39.01*	22.79	6.65
L_7	385.5	28.84	50.49	45.00	18.77*	6.53
L_8	324.2	29.39	51.47	46.00	19.75	6.44
L_9	385.3	27.49	49.73	41.50	20.33	6.91
Mean	444.6	27.52	49.01	42.89	19.76	6.95
SEd	0.3294	0.0242	0.0842	0.5165	0.0876	0.1218
CD (at 5%)	0.6621	0.0487	0.1692	1.0382	0.1760	0.2449
Tester						
T_1	392.5	24.05*	50.52	43.50	19.56*	7.15*
T_2	415.1	25.18	47.59*	42.00	23.43	6.72
T_3	425.3	23.51*	49.14	40.04*	24.57	6.87
T_4	475.7*	28.20	48.83	45.00	22.50	7.60*
Mean	426.87	25.24	49.02	42.63	22.52	7.08
SEd	0.2196	0.0161	0.0561	0.3443	0.0584	0.2437
CD (at 5%)	0.4414	0.0325	0.1128	0.6921	0.1173	0.4898
Hybrids						
$L_1 \times T_1$	509.5*	24.35	44.22	40.71	14.28	6.06
$L_1 \times T_2$	424.1	25.39	40.63*	37.83*	10.49*	6.05
$L_1 \times T_3$	524.3*	23.66*	50.10	46.23	20.27	6.12
$L_1 \times T_4$	539.2*	23.74*	48.71	44.67	18.76	6.14
$L_2 \times T_1$	554.5*	25.03	49.68	45.75	19.45	6.34
$L_2 \times T_2$	569.5*	25.02	48.67	46.05	18.72	6.56
$L_2 \times T_3$	585.3*	22.56*	42.89*	39.70*	10.29*	6.24
$L_2 \times T_4$	475.6	22.24*	47.93	42.29	15.64	6.44
$L_3 \times T_1$	455.7	23.44*	41.54*	37.74*	10.85*	6.81*
$L_3 \times T_2$	505.7*	24.03	45.64	41.00	15.34	6.02
$L_3 \times T_3$	485.3	22.39*	43.61*	39.00*	13.35*	6.55
$L_3 \times T_4$	485.2	24.49	44.72	40.00	14.61	6.74*
$L_4 \times T_1$	565.1*	26.05	45.67	41.50	15.63	6.99*
$L_4 \times T_2$	582.5*	27.50	43.58*	41.00	13.61*	6.96
$L_4 \times T_3$	555.9*	20.84*	41.39*	39.00*	15.77	6.92*
$L_4 \times T_4$	465.9	26.80	45.58	41.50	14.41	7.14*
$L_5 \times T_1$	385.1	21.39*	42.39*	38.00*	10.07*	7.03*
$L_5 \times T_2$	525.1*	22.03*	43.61*	39.00*	13.61*	7.09*
$L_5 \times T_3$	505.3*	22.57*	44.87	40.00	14.69	6.99*
$L_5 \times T_4$	485.2	24.84	47.67	43.00	17.88	6.80*
$L_6 \times T_1$	445.4	23.17*	41.83*	37.50*	10.84*	6.69*
$L_6 \times T_2$	345.4	26.61	44.15	40.00	12.30*	6.40
$L_6 \times T_3$	535.5*	27.10	40.70*	38.00*	10.15*	7.21*
$L_6 \times T_4$	555.1*	24.11	43.42*	39.00*	13.61*	6.68*
$L_7 \times T_1$	515.7*	23.01*	44.90	40.00	14.45	7.24*
$L_7 \times T_2$	545.2*	20.16*	41.80*	37.50*	10.18*	6.57
$L_7 \times T_3$	455.8	24.03	40.77*	37.54*	11.67*	6.79*
$L_7 \times T_4$	515.3*	24.65	46.83	42.00	16.74	6.89*
$L_8 \times T_1$	425.2	22.93*	43.51*	39.00*	13.59*	6.23
$L_8 \times T_2$	555.5*	25.94	41.34*	38.50*	12.53*	6.39
$L_8 \times T_3$	405.7	23.47*	45.75	41.00	15.66	6.99*
$L_8 \times T_4$	575.8*	25.83	41.89*	39.50*	13.59*	6.88*
$L_9 \times T_1$	475.9	25.17	44.56	40.00	14.87	6.77*
$L_9 \times T_2$	385.1	29.60	43.50*	39.00*	13.20*	6.55
$L_9 \times T_3$	315.2	19.70*	41.78*	38.50*	11.48*	6.44
$L_9 \times T_4$	565.3*	25.65	42.67*	38.50*	12.34*	6.33
Mean	494.1	24.16	44.24	40.27	14.03	6.63
SEd	0.6588	0.0484	0.1684	1.0330	0.1751	0.2437
CD (at 5%)	1.3375	0.0984	0.3418	2.0972	0.3555	0.4898

7.24 kg vine^{-1} was recorded by $L_7 \times T_1$ followed by $L_6 \times T_3$ (7.21 kg vine^{-1}), $L_4 \times T_4$ (7.14 kg vine^{-1}) and the lowest (6.02 kg vine^{-}

Table 1: Details of the parents used in the present study

S. No. Lines	Name of the parents	Source	Symbol
1.	IC413017	NBPGR, New Delhi	L_1
2.	IC333314	NBPGR, New Delhi	L_2
3.	IC433526	NBPGR, New Delhi	L_3
4.	IC308557	NBPGR, New Delhi	L_4
5.	IC284753	NBPGR, New Delhi	L_5
6.	IC546083	NBPGR, New Delhi	L_6
7.	IC410160	NBPGR, New Delhi	L_7
8.	IC202159	NBPGR, New Delhi	L_8
9.	IC212527	NBPGR, New Delhi	L_9
Tester			
1.	Kulithalai Local	Tamil Nadu	T_1
2.	Jeyamkondam Local	Tamil Nadu	T_2
3.	Kumbakonam local	Tamil Nadu	T_3
4.	Palayajeyankondam Local	Tamil Nadu	T_4

[1]) in L_3 x T_2 for this trait. Sixteen hybrids recorded significantly superior performance than the grand mean. Fruit yield per vine showed a wide and appreciable range among the hybrids. Improvement of fruit yield per vine is the ultimate aim in any vegetable breeding programme. It is the most important character for any variety or hybrid. The mean performance in respect to fruit yield per vine in the parents showed a wide range. This was also supported by Singh *et al*. (1999) in bottle gourd, Bairagi *et al*. (2005) in cucumber, Hegde (2009) in ridge gourd,Yadav *et al*. (2012) in cucumber, Reddy *et al*. (2013) in ridge gourd, Peerzada *et al*. (2014) in chickpea and Alli Rani and Jansirani (2014) in ridge gourd.

Most of the hybrids exhibited superior *per se* performance than the parents involved with respect to growth, earliness and yield. The best three performing parents (Lines and Testers) and hybrids are presented in (Table 3) for different traits studied. In this study the parents $L_{2,}$ $L_{3,}$ L_5, L_6, T_1 and T_4 were good performers for various characters taken under study, in this perspective they could be exploited further in different breeding programmes. The promising hybrids like $L_{2\ x}$ T_3, L_5 $xT_{1,}$ L_6 x $T_{1,}$ L_7 xT_2, and $L_{8\ x}$ T_4 which are superior yielders than the checks can be further subjected to selection to isolate desirable transgressive segregants.

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