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Identification of Heterotic Crosses in Sesamum (*Sesamum indicum* L.)

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ABSTRACT

A study was conducted in sesamum (*Sesamum indicum* L.) at Department of Genetics and Plant Breeding, Navsari Agricultural University, Navsari (Gujarat) to assess the extent of the heterosis for eleven quantitative traits including seed yield per plant. Ten lines and four testers were crossed in line x tester manner to develop 40 F_1 hybrids. Analysis of variance revealed the significant differences among the crosses for all the traits. Heterosis was worked out over better parent and standard variety *Guj.Til*-2. Among the crosses evaluated, *Timbi* 3 x *Guj. Til* 10, BAVJ 1 x RT 125 and ES 246 x RT 125 were found to be most heterotic hybrids for yield per plant in terms of heterobeltiosis. These hybrids may be tested in large scale trial to confirm the superiority in heterosis. Crosses BAVJ 1 x RT 125, BAVJ 1 x *Guj.Til* 1 and *Timbi* 3 x *Guj. Til* 10 were the best heterotic combinations for seed yield, which recorded 24.35, 23.31 and 22.27 per cent standard heterosis respectively and could be utilized for hybrid development.

Key words *Sesamum, heterosis, yield per plant, line x tester analysis*

Sesamum (*Sesamum indicum* L.) is an important oilseed crop and its seed contains 38-54% oil and 18-25% protein. It is sixth most important oilseed crop in India and has 1.94 mha area with 0.755 mt production and productivity of 389 kg/ha (Anonymous, 2012). The average productivity is very low as compared to other sesamum growing countries and almost stagnant during the last few years. In India, the yield plateau and poor productivity can be overcome by commercial exploitation of heterosis. However, being an autogamous crop, has not so far been amenable for heterosis breeding due to lack of economic methods for large scale seed production. In spite of this, epipetalous flower, easy emasculation and pollination, high number of seeds (40-50) produced per flower, low seed rate (2.0-2.5 kg/ha) and high multiplication ratio (1:300) for manual seed production increases the scope of heterosis breeding in sesamum. In sesamum, several researchers already reported the presence of significantly high heterosis for yield and yield components. Heterosis of small amount for individual yield contributing characters may have an additive or synergistic effect on the end product (Sasikumar and Sardana, 1990). Therefore, the present study was undertaken for identification of heterotic crosses in sesamum.

MATERIALS AND METHODS

The present study on sesamum was conducted at Department of Genetics and Plant Breeding, Navsari Agricultural University, Navsari (Gujarat). Ten lines *viz*., ES 246, AT 24, SPS 19, BAVJ 1, TNAU 2, *Kalyanpur* 2, *Mota Liliya* 1, *Ingorola* 7, SI 968, *Timbi* 3 and four testers *viz*., RT 125, *Guj.Til* 1, *Guj.Til* 2 (Check), *Guj.Til*-10 with varying morphological and agronomic characters were obtained from Main Oilseeds Research Station, Amreli (Gujarat). The selected ten lines and four testers were crossed in line x tester manner during summer 2011 to produce 40 hybrids. The spacing of 45 cm between rows and 15 cm between plants was adopted for the crossing programme. The resulting 40 hybrids along with14 parents including check variety *Guj. Til* 2 were evaluated during *rabi* 2011-2012 in randomized block design (RBD) with three replications and each plot consist of single row of 2 m length. All need based practices were followed during the crop growth period to maintain good crop stand. Observations were recorded on randomly selected five plants in each entry for all eleven quantitative traits including seed yield per plant for each replication. The mean values were used for estimation of heterosis over better parent and standard check as per the standard method.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) revealed significant differences among parents for almost all the traits. This indicates the presence of the significant variability in the experimental material for the traits. The crosses showed significant differences for all the traits, which indicate the variability among the crosses for most of the traits. The interaction between crosses and parents recorded significant differences for only days to 50 per cent flowering, plant height, no. of effective branches per plant, no. of capsules per plant, days to maturity, yield per plant (g), harvest index (%) and oil content (%). This indicates that with exception of few traits heterosis could be exploited for most of the traits. Similar results were reported by Kar, *et al.,* 2002, Thiyagu, *et al.,* 2007 for most of the characters except capsule length (cm), no. of seeds per capsule and 1000- seed weight.

In the present investigation, heterosis for yield per plant ranged from -33.39 to 56.49and -39.66 to 24.35 per

Table 1. Analysis of variance (mean squares) for eleven quantitative traits in sesamum

Source	Replication	Parents	Crosses	Parents *vs* Crosses	Error
d.f.	**2**	**13**	**39**	**1**	**106**
Days to 50 per cent flowering	2.49	13.63**	12.02**	77.29**	1.02
Plant height (cm)	103.44	89.43**	222.27**	181.45*	35.27
No. of effective branches per plant	0.28	0.48**	1.96**	1.38**	0.11
No. of capsules per plant	92.33	35.04	669.97**	428.35**	42.09
Capsule length (cm)	0.001	0.01	0.04**	0.0003	0.008
Days to maturity	3.52	368.79**	367.38**	9.82*	2.37
No. of Seeds per capsule	67.68	34.10	103.06**	17.71	22.48
1000-seed weight (g)	0.05	0.08	0.12**	0.007	0.06
Yield per plant (g)	0.16	2.69	10.07**	51.37**	1.91
Harvest index (%)	26.38	11.46	85.41**	454.37**	8.60
Oil content (%)	5.06	15.99**	8.79**	21.43**	1.84

*Significant at 5 % and **Significant at 1 % level

cent over better parent and standard variety respectively (Table 2). Ten cross combinations *viz*., ES 246 x RT 125, ES 246 x *Guj. Til* 1, BAVJ 1 x RT 125, BAVJ 1 x *Guj. Til* 1, *Kalyanpur* 2 x RT 125, *Kalyanpur* 2 x *Guj. Til* 1, *Ingorola* 7 x RT 125, *Ingorola* 7 x *Guj.Til* 1, *Timbi* 3 x *Guj. Til* 10 and *Kalyanpur* 2 x *Guj. Til* 10 depicted significant positive heterobeltiosis out of which six were highly significant. Highest significant positive heterobeltiosis was observed in *Timbi* 3 x *Guj. Til* 10 (56.49 per cent) followed by BAVJ 1 x RT 125 (40.26 per cent) and ES 246 x RT 125 (35.86 per cent). In case of standard heterosis, only three crosses described their importance for yield. The foremost among all crosses, BAVJ-1 x RT-125 depicted highest standard heterosis followed by BAVJ 1 x *Guj. Til* 1 and *Timbi* 3 x *Guj. Til* 10, which recorded 24.35, 23.31 and 22.27 per cent standard heterosis respectively. Similar extent of heterosis was also observed by Sankar and Kumar, 2001, Kar, *et al.* 2002, Kumar, *et al.,* 2003, Anuradha and Reddy, 2008, Sharmila and Ganesh, 2008, Yamanura, 2008 and Prajapati, *et al.,* 2009.

Table 2. Mean, heterobeltiosis and standard heterosis (per cent) for seed yield per plant in sesamum

Crosses	Mean (g/plant)	Heterobel-tiosis	Standard heterosis	Crosses	Mean (g/plant)	Heterobel-tiosis	Standard heterosis
ES 246 x RT125	12.34	35.86**	20.45	*Kalyanpur* 2 x RT 125	12.31	35.54**	20.16
ES 246 x *Guj.Til* 1	12.27	28.02*	19.77	*Kalyanpur* 2 x *Guj. Til* 1	12.23	27.58*	19.36
ES 246 x *Guj.Til* 2	12.23	19.36	19.36	*Kalyanpur* 2 x *Guj.Til* 2	9.66	-5.99	-5.99
ES 246 x *Guj. Til* 10	10.30	23.91	0.32	*Kalyanpur* 2 x *Guj.Til* 10	10.64	34.34*	3.65
AT 24 x RT125	9.53	4.60	-7.27	*Mota Liliya* 1 x RT 125	9.50	4.26	-7.57
AT 24 x *Guj.Til* 1	10.10	5.13	-1.65	*Mota Liliya* 1 x *Guj.Til* 1	10.55	9.91	2.83
AT 24 x *Guj.Til* 2	10.16	-1.02	-1.02	*Mota Liliya* 1 x *Guj.Til* 2	9.15	-11.05	-11.05
AT 24 x *Guj. Til* 10	8.04	-4.93	-21.97	*Mota Liliya* 1 x *Guj.Til* 10	9.91	25.09	-3.48
SPS 19 x RT 125	7.97	-22.21	-22.67*	*Ingorola* 7 x RT 125	12.23	34.64**	19.36
SPS 19 x *Guj. Til* 1	7.38	-28.06*	-28.48*	*Ingorola* 7 x *Guj.Til* 1	12.23	27.58*	19.36
SPS 19 x *Guj. Til* 2	7.90	-23.32*	-23.32*	*Ingorola* 7 x *Guj.Til* 2	9.02	-12.27	-12.27
SPS 19 x *Guj. Til* 10	6.84	-33.39**	-33.78**	*Ingorola* 7 x *Guj.Til* 10	10.17	28.32	-0.99
BAVJ 1 x RT 125	12.73	40.26**	24.35*	SI 968 x RT 125	7.40	-23.45	-28.27*
BAVJ 1 x *Guj. Til* 1	12.63	31.80**	23.31*	SI 968 x *Guj. Til* 1	8.30	-14.00	-19.41
BAVJ 1 x *Guj. Til* 2	10.28	0.10	0.10	SI 968 x *Guj.Til* 2	9.01	-12.44	-12.44
BAVJ 1 x *Guj. Til* 10	11.05	23.95	7.71	SI 968 x *Guj. Til* 10	7.40	-23.45	-28.27*
TNAU 2 x RT 125	6.25	-31.93*	-39.66**	*Timbi* 3 x RT125	9.85	8.15	-4.12
TNAU 2 x *Guj. Til* 1	9.95	3.51	-3.16	*Timbi* 3 x *Guj. Til* 1	9.02	-6.30	-12.34
TNAU 2 x *Guj. Til* 2	9.91	-3.46	-3.46	*Timbi* -3 x *Guj.Til* 2	7.14	-30.80**	-30.80**
TNAU 2 x *Guj. Til* 10	9.11	2.53	-11.45	*Timbi* 3 x *Guj.Til* 10	12.52	56.49**	22.27*

*Significant at 5 % and **Significant at 1 % level

Table 3. List of best promising hybrids showing heterosis for seed yield per plant along with heterotic effects for other characters in sesamum

Crosses	*per se* performance	Better Parent Heterosis	Standard Heterosis	Significant heterosis for other traits over better parent	Significant heterosis for other traits over standard check
BAVJ 1 x RT 125	12.73	40.26	24.35	Days to maturity	Days to maturity
BAVJ 1 x *Guj.Til* 1	12.63	31.80	23.31	Days to 50 per cent flowering, No. of effective branches per plant, No. of seeds per capsule	No. of capsules per plant, No. of seeds per capsule
Timbi 3 x *Guj.Til* 10	12.52	56.49	22.27	No. of effective branches per plant, No. of capsules per plant, Days to maturity	No. of effective branches per plant, No. of capsules per plant, 1000-seed weight (g)
ES 246 x RT 125	12.34	35.86	20.45	Days to 50 per cent flowering, Days to maturity, Oil content (%)	Days to 50 per cent flowering, Days to maturity, 1000-seed weight (g), Harvest index (%)
Kalyanpur 2 x RT 125	12.31	35.54	20.16	No. of effective branches per plant, Harvest index (%)	No. of effective branches per plant

In the present study, crosses showing the desirable heterosis for yield per plant along with other quantitative traits were identified (Table 3). The magnitude of the heterosis deviated from cross to cross. The crosses BAVJ 1x RT 125, BAVJ 1 x *Guj. Til* 1 and Timbi 3 x *Guj. Til* 10 showed significant positive heterosis over better parent and over standard check. The cross BAVJ 1 x RT 125 registered significant positive heterosis over better parent and over standard check for trait *viz.*, days to maturity, while cross BAVJ 1 x *Guj. Til* 1 recorded significant positive heterosis for days to 50 per cent flowering, no. of effective branches per plant and no. of seeds per capsule over better parent and no. of capsules per plant and no. of seeds per capsule over standard check. The cross *Timbi* 3 x *Guj. Til* 10 rendered significant and positive heterosis for no. of effective branches per plant, no. of capsules per plant and days to maturity over better parent and no. of effective branches per plant, no. of capsules per plant and 1000-seed weight over check variety which indicates that the heterosis for yield per plant was due to heterosis for other yield component characters. The *per se* performance of hybrids were, in general related to the heterotic response in majority of characters. This indicated that the selection of crosses on the basis of *per se* performance or heterotic response would be equally important (Table 3). Similar results were found by Ganesh, *et al.,* 1999, Sankar and Kumar, 2001, Kar, *et al.,* 2002 and Thiyagu, *et al.,* 2007. Therefore these cross combinations *viz.,* BAVJ 1 x RT 125, BAVJ 1 x *Guj. Til* 1 and *Timbi* 3 x *Guj. Til* 10 may be tested in large scale trial to confirm the superiority for heterosis and may be utilized for further breeding programme.

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