International Journal of Genetics
ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 11, Issue 8, 2019, pp.-629-631.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000226

Research Article

HETEROSIS AND INBREEDING DEPRESSION FOR YIELD AND YIELD COMPONENTS IN SESAME [*SESAMUM INDIUM* L.]

MISHRA A.K. AND NAPIT S.*[2]
[1]ICAR-Krishi Vigyan Kendra, Shajapur, 465001, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002, Madhya Pradesh, India
[2]Maharaja Chhatrasal Bundelkhand University, Chhatarpur, 471001, Madhya Pradesh, India
*Corresponding Author: Email - sudhir.s@live.in

Received: July 11, 2018; Revised: July 27, 2019; Accepted: August 20, 2019; Published: August 30, 2019

Abstract: Heterosis and inbreeding depression for yield and yield components were evaluated in 28 crosses of Sesame derived from 8x8 diallel. Heterosis was worked out over mid and better parent. Two cross combination TKG -22 X RT -54 and JTS-8X TKG 306 showing highly significant positive heterosis coupled with heterobeltiosis and non significant inbreeding depression in F2 can be exploited for developing superior verities. The best heterotic combination for seed yield was TKG-22 X RT-54 giving 183.72%, heterosis, heterobeltiosis 136.52% with 15.01gm F_1 mean. The crosses RT-54 X JLT-7 and RT-54 XN-32 which gave significant negative heterosis and hetrobeltiosis along with non significant inbreeding depression in F2 could be used for obtaining early maturing genotype.

Keywords: *Heterosis, Inbreeding depression, Yield component, Heterobeltiosis*
Citation: Mishra A.K. and Napit S. (2019) Heterosis and Inbreeding Depression for Yield and Yield Components in Sesame [*Sesamum indium* L.]. International Journal of Genetics, ISSN: 0975-2862 & E-ISSN: 0975-9158, Volume 11, Issue 8, pp.- 629-631.

Introduction

Sesame as a source of edible oil for human consumption, offers scope or commercial exploitation of heterosis. Studies on the extent and nature of heterosis are needed in any breeding programme to identify high yielding hybrid cultivars. The present investigation was undertaken to study heterosis and inbreeding depression in 28 cross combination involving genetically diverse parents.

Materials and Methods

The experimental material consisted of eight genetically divers genotypes of Sesame (TKG-22, JTS-8, TKG-306, RT-54, JLT-7, GT-2, N-32, and RT-125) obtained in a diallel matting system. The eight parents and 28 F_1 and F_2 families from this diallel were grown during 2015 in a complete randomized block design with three replications. Each plot consisted of single row of 6 m long. Row to row distance was 30 cm. and plant spacing within rows 10 cm. Observations were recorded on 10 plant from each replication, F_2 plots consisted of 4 rows, 6m long with spacing of 30 cm. between rows and 10 cm. between plants. Observation on 25 plants from each replication were recorded for days to flowering and maturity, plant height, number of branches, number of capsules per plant, 1000 seed weight, oil content and seed yield. For heterosis and heterobeltiosis were estimated as percentage increase or decrease in F_1 generation over mid and batter parent. The inbreeding from F_1 to F_2 were calculated as described [5].

Results and Discussion

For days to 50% flowering out of 28 crosses studied, 26 crosses exhibited significant negative values of heterosis and heterobeltiosis [Table-1]. The inbreeding depression of earliness crosses were TKG-22 X JTS-8, TKF-22 X JLT-7, TKG-22 X GT-2, JTS-8 X GT-2, TKG-306 X RT-54, TKG-306 X JLT-7, RT-54 X JLT-7, RT-54 X N-32, JLT-7 X GT-2, JLT-7 X N-32, JLT-7 X RT-125. The heterosis from these crosses TKG-22 X RT-125, TKG-22 X RT-54. JTS-8 X TKG-306, TKG-306 X RT-125 AND RT-54 X GT-2 had non-significant inbreeding depression fixable gene action in the crosses.

Gaikwad and Lal (2011) [2], Jodon and Mehrotra (1988) [3], Karnade, *et al*., (2018) [4], Sasikumar and Sardana (1990) [6] have also reported significant negative heterosis for the traits. For days to maturity in the majority of the crosses heterosis and heterobeltiosis were significant negative, [Table-1] the values of (negative) heterosis range from -1.21 to -13.77% whereas the range for heterobeltiosis varied from -9.02 to 15.72 the inbreeding was non-significant in 6 crosses. These crosses are TKG-22 x RT-54, TKG-306 x GT-2, RT-54 x JLT-7, RT-54 x GT-2, RT-54 X N-32, GT-2 X N-32 and GT-2X RT-125. [Table-2]. In plant height in the majority of the crosses heterosis was significant positive [Table-1] and [Table-2] two crosses viz RT-54 X JLT-7 and TKG X JLT-8 gave significant positive heterosis (16.34, 17.64), heterobeltiosis for these crosses was (18.98, 17.28%) with non-significant in F_2 and highest F_1 mean. Therefore, the heterosis in the crosses is due to fixable gene effect and simple selection may be applied in segregation generation for a further improvement of the traits. [3,9] reported positive heterosis and [7,10] reported negative heterosis. In the case of number of branches per plant at most all the crosses showed positive heterosis and heterobeltiosis in [Table-1] and [Table-2]. Maximum heterosis of TKG-22 X RT-125 (270.554), JLT-7 X RT-125 (264.554), JTS-8 X RT-125 (182.794) was observed. Two crosses TKG-22 x TKG-306 and JLT-7 X RT-125 recorded significant positive value for heterosis and Heterobeltiosis with non-significant inbreeding depression in F_2. Positive heterosis has also been reported by Sodan and Bhatnagar (1990) [8], Yadav and Mishra (1991) [10] in the crop.

In case of number of capsules perplant the majority of the crosses show positive value of heterosis in Table 1 & 2. The maximum value of heterosis was obtained in TKG-22 X RT-54(286.524), RT-54 X JLT-7 (278.44) and GT-2 X RT-125 associated with significant positive heterosis and heterobeltiosis. These significant positive heterosis and heterobeltiosis has also been reported [1,6,8] by in the 1000 seed weight, positive heterosis was noticed in the majority of crosses in [Table-1] and [Table-2]. The best heterotic combination for the character was JLT-7 X RT-125 (45.63), TKG-306 X RT-125 (40.87).

Table-1 *Estimated of heterosis for various quantitative characters in Sesame*

Characters	No. of crosses significant superior to batter parent	Range of heterobeltiosis		No. of crosses significant superior to mid parent	Range of heterosis		Cross combination showing highest significant heterosis in desired direction over	
		Max	Mini		Max	Mini	Batter parent	Mid parent
Day to 50% flowering	25	-26.09	8.65	25	-46.11	-1.61	JLT-7 X GT-2	JLT-7 X N-32
Days to maturity	24	-15.72	-9.02	19	-13.77	-1.21	JLT-7 X GT-3	JLT-7 X N-32
Plant height (cm)	14	-18.98	6.90	14	24.37	7.90	JTS-8 X JLT-7	GT-2 X N-32
No. of branches/plant	27	149.96	39.35	20	270.554	21.27	RT-54 X JLT-7	TKG-22 X RT-125
No. of capsule/plant	15	266.674	20.51	22	286.524	23.45	TKG-22 X RT-54	TKG-22 X RT-125
1000 seed weight (g)	12	4.011	5.04	18	45.63	3.53	TKG-306 X RT-125	JLT-7 X RT-125
Oil content %	9	10.15	2.06	12	15.78	2.79	TKG-22 X RT-54	TKG-22 X JLT-7
Seed yield	20	137.83	9.04	22	183.72	20.13	RT-54 X JLT-7	TKG-22 X RT-54

Table-2 *Heterosis over best parent and inbreeding depression for various characters in sesame*

Crosses		Days to 50% flowering	Days to maturity	Plant height	No. of branches/plant	No. of capsule/ plant	1000 seed weight (g)	Oil content %	Seed yield/plant (g)
TKG-22xJTS-8	H	-19.736**	-10.356**	6.904*	68.654**	73.454**	0.744	-0.286	43.154**
	ID	-6.636**	-3.575**	21.764**	37.084**	-2.146	5.544	-0.036	16.124**
TKG-22xTKG-306	H	-0.036	1.164	-8.465	27.464	24.214**	25.154**	1.004	46.864**
	ID	-3.106**	1.934*	6.764	19.564	4.294	13.254	2.524	11.004
TKG-22xRT-54	H	8.554**	-1.606	10.914**	129.294**	271.984**	-14.539**	10.154**	136.524**
	ID	6.434**	-0.036	3.264	2.284	12.534	3.444	0.274	17.074**
TKG-22xJLT-7	H	-18.346**	-14.636**	-23.466**	-27.116	16.934**	5.404*	5.854**	62.364**
	ID	-12.096**	-6.866**	14.164	-0.036	15.174	12.614**	2.214*	18.234
TKG-22xGT-2	H	-13.856**	-8.906**	-10.646**	38.064**	13.324**	11.304	4.174**	13.074**
	ID	2.794	1.284*	4.964	6.854	-6.256	8.444*	1.064	28.924**
TKG-22xN-32	H	-8.186**	-6.706**	13.896**	52.344**	22.494**	16.264**	3.924**	9.404*
	ID	-4.866**	-2.416**	11.454	3.864	-13.056	1.964	0.264**	38.964**
TKG-22xRT-125	H	-14.516**	-7.226**	-14.996**	85.254**	45.754**	0.274	2.064**	38.964**
	ID	6.414**	3.064**	1.074	0.754	3.854	1.344	0.414	9.904
JTS-8xTKG-306	H	1.484	6.314**	12.564**	106.024**	84.704**	0.584	-4.596**	57.084**
	ID	5.184**	3.694**	8.864	30.844**	-3.336	-0.646	0.094	4.424
JTS-8xRT-54	H	-6.096**	-0.036	7.164	39.354**	85.244**	3.084	-5.416**	35.894**
	ID	-8.096**	-6.326**	-0.036	28.944**	50.104**	5.614	1.294	25.074**
JTS-8xJLT-7	H	-6.376**	-4.416**	18.984**	60.574**	-31.196**	-44.416**	-9.216**	-44.626**
	ID	-1.536	-1.936	12.274	43.984**	16.194	12.884**	1.704	22.074
JTS-8xGT-2	H	-18.976**	-7.976**	6.904	55.524**	-14.946**	26.054**	-3.326**	11.274**
	ID	-14.986**	-4.346**	5.244	20.08	22.464**	24.744**	3.104	17.404**
JTS-8xN-32	H	-8.926**	-8.186**	5.904	12.084	-20.406**	26.514**	0.154	-7.786
	ID	-5.726**	-1.646*	1.824	10.774	19.784**	-1.016	2.734**	16.844
JTS-8xRT-125	H	-7.626**	-2196**	-2.886	41-374**	41.424**	12.044**	-4.276**	35.404**
	ID	0.704	1.064*	-0.516	1.384	34.904**	-4.986	0.564	30.974**
TKG-306XRT-54	H	-8.496**	-1.606*	-1.666	57.464**	6.354	-15.216**	2.634**	15.734**
	ID	-0.876	-1.236*	14.874*	29.324	4.204	-9.616*	1.294	17.294
TKG-30xJLT-7	H	-21.466**	-13.536**	-12.266**	-17.746	-14.886**	-14.966**	-19.726**	18.434**
	ID	-0.036	3.754**	-25.726**	-12.686	9.314	19.334**	2.234	31.354*
TKG-306xGT-2	H	-4.656**	0.044	-9.276	8.294	-2.406	-19.006**	-17.576**	-24.156**
	ID	-1.646	-0.426	5.344	-6.626	26.674**	39.884**	3.834**	41.134**
TKG-306xN-32	H	-8.186**	-10.036**	5.654	3.534	24.374**	-1.276	-1.506**	0.204
	ID	-0.836	-3.736**	1.594	-36.816**	4.684	-0.816	0.604	13.514
TKG-306xRT-125	H	-13.136**	-11.906**	-7.396*	24.964	30.694**	40.114**	3.814**	39.414**
	ID	3.924**	-0.846**	15.084**	6.964	1.554	10.824**	0.214	20.794**
RT-54xJLT-7	H	-19.046**	-10.986**	13.314**	149.964**	204.724**	-11.286**	-4.404	137.834**
	ID	-3.906**	-0.436	2.124	-0.866	35.644**	1.634	0.824	34.904**
RT-54xGT-2	H	-5.506**	-4.756**	-3.946	9.484	139.834**	-3.716	-12.736**	54.664**
	ID	8.224**	2.434**	6.644	-25.036	56.314**	11.074**	1.354	39.804**
RT-54xN-32	H	-20.776**	-14.106**	0.124	1.154	6.334	-14.396**	-12.226**	-9.516*
	ID	-5.636**	-0.466	19.714**	-23.556	12.504	-0.976	10.424**	19.734
RT-54xRT-125	H	-16.586**	-11.906**	-0.986	105.294**	110.414**	5.654**	-10.156**	113.644**
	ID	-0.856	-3.706**	-0.036	36.324**	-3.016	4.064	10.344**	27.944**
JLT-7xGT-2	H	-26.096**	-15.726**	2.414	60.384**	123.604**	-31.686**	-17.276**	58.594**
	ID	-18.126**	-6.096**	0.514	51.254**	53.694**	-34.596**	0.284	43.574**
JLT-7xN-32	H	-23.976**	-13.906**	-5.486	135.384**	152.284**	-7.796**	5.074**	55.084**
	ID	-8.366**	-3.416**	-1.076	-4.456	-3.066	14.774**	0.094	2.124
JLT-7xRT-125	H	-21.416**	-14.066**	4.474	82.254**	32.504**	11.344**	-11.666**	38.074**
	ID	-10.556**	-8.396**	-0.256	19.384	-0.346	10.734*	2.044	21.034**
GT-2xN-32	H	-5.226**	-6.336**	17.294**	96.394**	-21.036**	27.294**	-9.036**	15.964**
	ID	-2.376	-0.426	9.874	31.474**	7.334	22.274**	6.554	44.694**
GT-2xRT-125	H	-11.066**	-9.026**	-1.226	22.584	183.474**	29.194**	-0.826	132.254**
	ID	1.514	-0.426	7.414	-1.006	24.574**	14.604**	0.154	28.064**
N-32xRT-125	H	-13.826**	-8.666**	3.524	21.394	-8.786	8.584**	2.774**	-21.406**
	ID	0.764	1.924*	0.184	-9.836	17.284*	7.894	3.374	9.454

Ding, *et al*., (1987) [1] Gaikwad and Lal (2011) [2], Karnade, *et al*., (2018) [4], Singh, *et al*., (1983) [7] also reported positive heterosis in further traits. In the case of oil content, heterosis was recorded in both positive and negative direction, the best heterotic combination was TKG-22 X JLT-7 (15.784%), TKG-22 X RT-54 (10.794%) and TKG -22 X N-32 (8.784%) heterosis and heterobeltiosis thus, these combination offered greater opportunities for further improvement of the trait. For seed yield the twenty-three crosses showed significant positive heterosis [Table-1]. Seven crosses TKG-22 X TKG-306, TKG-22 X JLT-7, TKG-22 X N-32, TKG-22 XRT-125, JTS-8 X TKG-306, TKG-306 X RT-54, and JLT-7 X N-32 emerged as best crosses and they possessed high heterosis, Heterobeltiosis and non-significant inbreeding depression in F_2.

Application of research: The majority of the heterotic combination for seed yield per plant also showed high heterosis for number of capsules per plant, number of branches per plant.

Research Category: Genetics and Plant breeding

Acknowledgement / Funding: Authors are thankful to ICAR-Krishi Vigyan Kendra, Shajapur, 465001, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002, Madhya Pradesh, India

***Research Guide or Chairperson of research: Dr Anil Kumar Mishra**
University: Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, 474002
Research project name or number: PhD Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: ICAR-Krishi Vigyan Kendra, Shajapur, 465001

Cultivar / Variety name: Sesame [*Sesamum indium* L.]- TKG-22, JTS-8, TKG-306, RT-54, JLT-7, GT-2, N-32, and RT-125

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Ding F.Y. Jiang J.P. and Zhand D.K. (1987) *Scientia Agricultural Sinica*, 20(4),70-76.
[2] Gaikwad K.B. and Lal J.P. (2011) *Current Advance in Agricultural Science*, 3(1) 5456.
[3] Jodon B.S. and Mehrotra H.N. (1988) *Indian J. Genet*., 48(7),2241-245.
[4] Karnade R.R., Yamgar S.V., Waghmade A.A. and Wadikar P.B. (2018) *In. J. Cum. Microbiol. App. Sci*., 7(2), 299-308.
[5] Mather K. and Jink J. (1971) *Biometrical Genetic, 2nd Edn. Chapman and Hall London.*
[6] Sasikumar B. and Sardana (1990) *Indian J. Genet*., 50(1), 45-49.
[7] Singh V.K., Singh H.G., Chauhan Y.S. (1983) *Farm Sci. J*., 1(1-2), 65-69.
[8] Sodan S.N. and Bhatnagar S.K. (1990) *Indian J. Genet*., 50(1), 87-88.
[9] Shivaprakash B. (1986) *Mysore J. Agric. Sci*., 20(2), 156.
[10] Yadav L.N. and Mishra A.K. (1991) *Sesame and Safflower Newsletter*, 5, 46-54.