



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2017; 6(5): 909-911
Received: 03-07-2017
Accepted: 04-08-2017

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Studies on heterosis over economic parents for seed yield and its contributing traits in Indian mustard (*Brassica juncea* L. Czern & Coss)

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Abstract

Analysis of variance revealed that the genotypes were genetically-differ to each for all the characters. Out of 21 Crosses the cross combinations namely; Varuna x RK-9101, Varuna x Pusa Jagannath, Varuna x RH-819, Varuna x Rohini and RK-9101 x Pusa Jagannath showed positive and significant heterosis over economic parents for seed yield per plant.

Keywords: *Brassica*, heterosis, Indian mustard and sca

1. Introduction

The seed and oil of Indian mustard (*Brassica juncea*) are used as condiments in the preparation of pickle and for flavour carrying out vegetables. The oil is utilized for human consumption throughout northern India in cooking and frying purposes. The oil cake is used as a cattle feed and manure. Green stems and leaves are a good source of green fodder for cattle. The theory of diallel analysis assumed that there is an independent distribution of genes showing no linkage or epistasis. However, significance of epistasis cannot be ignored. This must be estimated otherwise the estimated become biased and misleading.

2. Material & Methods

The present investigation was carried out at Oil Seed Research Farm, Kalyanpur of Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, during rabi season 2013-15. The experiment was conducted in Randomized Block Design (RBD) with three replications. 7 parents/strains (Varuna, RK-9101, Pusa jagannath, RH-9801, Pusa bahar, Rohini & Kanti) were crossed in diallel mating design (excluding reciprocal crosses). 28 genotypes (21 F₁ + 7 parents) were evaluated for six characters viz., Number of seeds per siliqua, Biological yield per plant (g), Harvest index (%), 1000-Seed weight (g), Oil content (%) and seed yield per plant (g). The parents and F₁s were growing in single row of five meter length spaced 45 cm apart. The distance of 15 cm between the plants in a row maintained by thinning. All the recommended agronomic practices were followed for raising the good crop. The components of variance in diallel cross were computed by the use of formula suggested by Hayman (1954a). Oil content was estimated with the help of NMR.

3. Results & Discussion

The estimates of heterosis over standard or economic variety (Varuna) for six characters were calculated and presented in table-2. Out of 21 crosses the best five cross combinations viz., Varuna x Pusa Jagannath, Varuna x Pusa Bahar, RK-9101 x Rohini, Pusa Jagannath x Kanti and Pusa Bahar x Kanti were showed significant heterosis for number of siliquae per plant, the cross combinations viz., crosses RH-819 x Kanti, Pusa Bahar x Kanti, Pusa Bahar x Rohini and Rohini x Kanti showed high positive and significant heterosis for harvest index, the top three crosses namely, Varuna x RK-9101, Varuna x Pusa Jagannath and RK-9101 x Pusa Jagannath were showed positive significant heterosis for oil content, the cross combinations viz., RK-9101 x Pusa Jagannath, RK-9101 x Pusa Bahar, RK-9101 x Rohini, Pusa Jagannath x Pusa Bahar and Pusa Jagannath x Kanti were showed positive and significant heterosis for 1000-seed weight and the cross combinations viz., Varuna x RK-9101, Varuna x Pusa Jagannath, Varuna x RH-819 and Varuna x Rohini exhibited significant and positive heterosis over standard variety (Varuna) for seed yield per plant. Similar findings were also observed by Kakroo *et al.* (2000) [9], Katiyar *et al.* (2000) [11], Kant *et al.* (2001) [10], Ghosh *et al.* (2002) [5], Parmar *et al.* (2004) [14], Goswami *et al.* (2005) [6], Monalisa *et al.* (2005) [13], Prajapati *et al.*

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(2009) [15], Singh *et al.* (2009b) [16], Gupta *et al.* (2010) [7], (2012) [4], Lal *et al.* (2013) [12], Dholu *et al.* (2014) [2], Chauhan *et al.* (2011) [1], Dond *et al.* (2012) [3], Frasad *et al.*

Table 1: ANOVA of parents, F₁'s and parents vs. F₁'s for six characters in a 7 x 7 parental diallel cross analysis in Indian mustard: mean sum of squares

Source of variation	d.f.	Number of seeds per siliqua	Biological yield per plant (g)	Harvest index (%)	1000-seed weight (g)	Oil content (%)	Seed yield per plant (g)
Replicates	2.00	0.15	18.37***	30.57**	0.00	0.28*	2.43
Treatments	27.00	4.84***	3.85*	22.85***	0.21***	3.59***	10.88***
Parents	6.00	7.87***	2.54	38.77***	0.17***	4.95***	25.37***
Hybrids	20.00	2.19	2.25	19.07***	0.16***	2.81***	4.94*
Parent Vs. F ₁ 's	1.00	39.68***	43.75***	2.83	1.55***	10.95***	42.74***
Error	54.00	1.48	2.15	4.43	0.00	0.09	2.21
Total	83.00	2.54	3.09	11.05	0.07	1.23	5.04

*, **Significant at 5% and 1% level of significance, respectively.

Table 2: Estimate of heterosis over economic parent for seven characters in 21 F₁'s derived from a 7 x 7 diallel cross analysis in Indian mustard EP= Varuna

Hybrid combinations	Number of seed per siliquae		Biological yield per plant (g)		Harvest index (%)	
	EH	SCA	EH	SCA	EH	SCA
VARUNA X RK-9101	6.25	1.07	1.61	1.19	-3.36	0.13
VARUNA X PUSA JAGANNATH	2.08	-0.07	-1.20	0.16	-1.99	0.09
VARUNA X RH-819	6.25	0.63	-0.80	-0.18	-5.06	0.08
VARUNA X PUSA BAHAR	-14.58*		0.00	0.16	-11.96*	-0.30
VARUNA X ROHINI	6.25	0.96	0.00	0.08	-5.03	0.25
VARUNA X KANTI	0.00	0.74	-1.20	-0.55	-11.39*	0.77
RK-9101 X PUSA JAGANNATH	0.00	-0.30	0.80	1.12	-8.82	-0.58
RK-9101 X RH-819	6.25	0.74	0.00	-0.21	-9.99*	0.13
RK-9101 X PUSA BAHAR	0.00	1.19	0.40	-0.21	-16.09**	0.05
RK-9101 X ROHINI	2.08	0.41	1.20	0.38	-11.46*	-0.27
RK-9101 X KANTI	-6.25	-0.15	-0.40	-0.58	-18.21**	0.10
PUSA JAGANNATH X RH-819	6.25	0.26	-1.20	0.08	-9.03	-0.07
PUSA JAGANNATH X PUSA BAHAR	6.25	1.70*	0.40	1.08	-16.01**	-0.48
PUSA JAGANNATH X ROHINI	0.00	-0.41	-1.20	-0.32	-8.22	0.41
PUSA JAGANNATH X KANTI	0.00	0.37	-0.80	0.38	-17.73**	-0.28
RH-819 X PUSA BAHAR	-6.25	-0.26	0.00	0.08	-17.78**	0.00
RH-819 X ROHINI	0.00	-0.37	1.61	1.34	-13.80**	-0.56
RH-819 X KANTI	0.00	0.41	1.20	1.38	-21.35**	-0.50
PUSA BAHAR X ROHINI	0.00	1.07	1.20	0.68	-18.81**	-0.23
PUSA BAHAR X KANTI	0.00	1.85**	1.61	1.38	-26.94**	-0.38
ROHINI X KANTI	-6.25	-0.26	1.61	1.31	-22.04**	-0.60
SE(EP) ±	0.99		1.19		1.72	
SE (S _{ij}) ±		1.79		2.16		3.10
SE (S _{ij} - S _{ik}) ±		2.66		3.21		4.61

Table 9: Continue.....

Hybrid combinations	1000-Seed weight (g)		Oil content (%)		Seed yield per plant (g)	
	EP	SCA	EP	SCA	EP	SCA
VARUNA X RK-9101	-0.17**	0.19***	2.50**	0.97***	4.00**	1.20**
VARUNA X PUSA JAGANNATH	-5.34**	-0.10***	1.49*	0.81***	3.90**	1.04**
VARUNA X RH-819	-8.03**	-0.05***	-3.80**	-0.54**	3.45**	1.02**
VARUNA X PUSA BAHAR	-1.26**	0.18***	-3.53**	-0.37*	-11.04**	-0.70**
VARUNA X ROHINI	-3.79**	-0.04***	-3.59**	-0.52**	2.90**	1.24**
VARUNA X KANTI	-7.11**	-0.10***	1.21	0.39*	-10.51**	-0.25**
RK-9101 X PUSA JAGANNATH	2.07**	0.12***	2.97**	1.62***	2.98**	1.01**
RK-9101 X RH-819	-0.52**	0.18***	-4.62**	-0.66***	-9.01*	0.03
RK-9101 X PUSA BAHAR	6.20**	0.41***	-4.10**	-0.38*	-12.70**	-0.14
RK-9101 X ROHINI	3.61**	0.18***	-1.38*	0.59***	-9.44*	-0.14
RK-9101 X KANTI	0.34**	0.12***	-0.99	-0.29	-12.32**	0.25
PUSA JAGANNATH X RH-819	-5.85**	-0.11***	-2.13**	0.59***	-11.31**	-0.11
PUSA JAGANNATH X PUSA BAHAR	1.03**	0.12***	-3.41**	0.14	-10.51**	1.12**
PUSA JAGANNATH X ROHINI	-1.55**	-0.10***	-4.03**	-0.23	-10.51**	0.10
PUSA JAGANNATH X KANTI	4.30**	0.37***	-2.07**	-0.47**	-8.95*	1.88**
RH-819 X PUSA BAHAR	-1.55**	0.18***	-3.66**	0.82***	-13.66**	0.52
RH-819 X ROHINI	-3.27**	0.00	-1.13	1.71***	-11.47**	0.19

RH-819 X KANTI	-7.40**	-0.10***	-3.82**	-0.40*	-7.78	2.63**
PUSA BAHAR X ROHINI	2.58**	0.18***	-5.72**	-0.07	-11.58**	1.14
PUSA BAHAR X KANTI	-0.69**	0.12***	-1.46**	0.62***	-17.51**	0.58*
ROHINI X KANTI	-3.27**	-0.10***	-2.52**	0.06	-16.71**	-0.19
SE(EP) ±	0.00		0.23		1.21	
SE (s _{ij}) ±		0.00		0.43		2.19
SE (s _{ij} - s _{ik}) ±		0.01		0.64		3.26

*,**Significant at 5% and 1% level of significance, respectively.

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