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GENETIC POTENTIAL OF ARTIFICIALLY SYNTHESIZED *BRASSICA JUNCEA* FOR YIELD IMPROVEMENT

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ABSTRACT

A study was made to compare the potential of artificially synthesized *Brassica juncea* strains in inter-varietal crosses for basal branching characters and seed yield. Sixty four F3 families of synthetic x synthetic, synthetic x cultivar, and cultivar x cultivar crosses were studied and from among them thirty two superior F3 families were selected and advanced to F4 generation. Artificially synthesized materials generate more useful variability than those by usual inter-varietal crosses.

Keywords: Artificial *Brassica juncea*, basal branching, inter-varietal crosses, variability.

INTRODUCTION

Breeding for basal branching, non-lodging, compact plant type with high yield potential for improved agronomic situations has been suggested by several workers (Jain, 1984; Labana, 1984). However, in Indian Mustard, *Brassica juncea*, the genetic variability is limited for several characters (Rai, 1989), and particularly for seed yield (Uddin *et al,* 1983). Lack of physiologically efficient plant type in mustard has been one of the limiting factors in the productivity advance (Singh and Chauhan, 1984). Nevertheless, both the diploid parents of this amphlidiploid species exhibit enormous variability in morphology and physiology. A major advance was made by Prakash (1973a) when a large number of amphidiploids were synthesized for their practical utilization in the improvement of this crop.

Preliminary studies with resynthesized *B.juncea* (Olsson, 1960a; Frandson, 1943) showed that the direct products of such interspecific hybrids represented no improvement. However, the lodging resistance was better and there was greater variation for seed size and the seeds of artificial *B.juncea* were larger than those of natural species. The report of the Prakash (1973b) in *B.juncea* and the release of cultivar 'Norde' in *B.napus* (Olsson and Ellerstrom, 1980) demonstrated how successful was an appropriate introduction of resynthesized material.

Our investigations were designed to study the variability for basal branching and yield in F3 and F4 generations of three types of crosses; cultivar x cultivar, cultivar x synthetic and synthetic x synthetic.

MATERIALS AND METHODS

In the F2 of nine crosses listed below, 64 individual plants were selected on the visual basis for basal branching and other yield components.

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List of crosses and their pedigree

Cross	No.of Plants	Expanded pedigree
PBRN	10	PB = Pusa Bold
PBNN	6	RN = Synthetic *B. juncea*
PBYS	7	(*B. Campestris* ssp. *rapifera*
JNRN	6	x *B. nigra*)
JNNN	4	NN = Synthetic *B. juncea*
RNJN	8	(*B. campestris* ssp. narinossa
RNYS	8	x *B. nigra*)
NNRN	8	YS = Yellow seed *B. juncea* An accession from Poland
RNNN	6	JN = Synthetic *B. juncea* (*B. campestris* ssp. *japonica* x *B. nigra*)

The F3 of those selected individuals was raised during rabi 1989-90 on plant to progeny basis. Each F3 family was sown in four rows of 3m length with a row to row spacing of 75 cm and 10 cm between plants. Data were collected on seven traits. The traits defining basal branching were number of primary (PBI) and secondary branches (SBI) attributable to 30 cm height of plant from the ground level. Other traits measured were plant height (HT), seed yield (SY) and harvest index (HI) on per plant basis. Any entry with two third of the selected plants possessing basal branching within 30 cm from the ground were termed as basal branching entries, while others non-basal branching.

Data collected on five randomly selected plants was analysed using CRD on individual plant basis. Using the method suggested by Arunachalam and Bandyopadhyay (1984), the relative order of importance of 64 F3 families was obtained using all the seven traits. Based on the mean and standard deviation of the final scores 32 families were selected. The F4 progeny of the selects was raised during rabi 1990-91 in a RBD, where each family was sown in a single row of 5m length in two replications with a row to row spacing of 75 cm and 10 cm between plants. The seed yield (grammes) per plot of each family was noted.

RESULTS AND DISCUSSION

The ANOVA for seven traits studied is presented in Table 1. The differences between families were significant for all the traits. The variability for seven traits in the F3 of three types of crosses is presented in Table 2. It is seen from the table that the range of variability increases when cultivar is replaced by synthetic. For instance, the range and mean of synthetic x synthetic crosses was most desirable for almost all traits including seed yield. It was followed by cultivar x synthetic and cultivar x cultivar crosses in that order.

Table 1. Percentage success in hybridization (100 x number of pods set/number of pollinations made)

Tester Line (*jn*)	*jn*			*np*		
	BD	JN	MEAN	BO	BN	MEAN
YN	51.7	83.1	67.4	100	96.6	98.3
DR	91.0	77.4	84.2	93.4	86.2	89.8
PR	58.0	97.7	77.8	68.4	92.7	80.5
MEAN	66.9	86.1		87.3	91.8	

Jn = *B juncea*; *np* = *B napus*.

Table 2. Mean (M) and range (R) of seven traits in 64 F3 families of three crosses

Cross	Mean Range	Plant height (cm)	No. of primary branches	No. of secondary branches	Seed yield seed yield (g/plant)	Seed yield (g/plot)	Harvest Index (per plant basis)	Harvest index (per plant basis)
CC	M	210	0.8	2.3	1.1	17.1	0.8	14.8
	R	188-229	0-2.4	0-6.8	0-4.5	10-23	0-3.7	9-19.5
	Sd	14.1	1.9	2.5	1.5	4.8	1.2	3.6
CS	M	224	0.7	2.2	1.1	18.1	0.7	13.7
	R	190-264	0-2.6	0-8.8	0-5.5	11-27	0-2.4	8.8-19
	Sd	17.9	0.7	2.6	1.6	4.9	0.9	2.7
SS	M	217	0.8	2.4	1.3	16.6	0.8	13.8
	R	172-247	0-3	0-10.4	0-7.3	6.2-34	0-3.7	7.5-24.1
	Sd	18.0	1.0	3.1	1.7	6.7	1.1	3.8

Sd : Standard deviation

The variability for seed yield in the F3 and F4 of 32 selected families of three types of crosses is presented in Table 3. In the F3, the mean seed yield was similar in all crosses, however the variability in synthetic x synthetic crosses was most desirable followed by cultivar x synthetic and cultivar x cultivar. While, in the F4, the range of variation was low in cultivar x cultivar crosses and it increases when cultivar is replaced by synthetic strain. Interestingly, the mean seed yield of those families increased from 277g in cultivar x cultivar crosses to 364g in synthetic x synthetic crosses.

The potential of artificially synthesized material has been noted by many *Brassica* workers. Robbelen (1979) for example, observed that heterosis in synthetic x cultivar combinations was far higher than in cultivar x cultivar crosses. It is a general openion among the *Brassica* breeders dealing with inter-specific crosses at manogenomic level that synthetic populations provide good genetic stocks to breed better cultivars.

Our studies with F3 and F4 generations of three types of crosses clearly showed that intervarietal crosses made using artificially synthesized material generate useful variability for various traits including those of plant type and seed yield.

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Table 3. Variability for seed yield (g) in F3 and F4 of 32 families of three crosses

	Mean per plant (F3)			Mean per plot (F4)		
Cross	Mean	Range	Standard error	Mean	Range	Standard error
Cultivar x Cultivar	20.4	16.5-23.0	1.45	277.4	191.1-399	44.25
Cultivar x Synthetic	21.2	14.9-27.5	1.39	313.5	183.6-441	27.53
Synthetic x Synthetic	20.2	10.3-34.0	1.67	363.7	196.1-739	37.86

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