HETEROSIS BREEDING IN MUSTARD (*BRASSICA JUNCEA*) AND RAPESEED (*B. NAPUS*) BY A COMBINATION OF MOLECULAR AND CONVENTIONAL METHODS

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ABSTRACT

Successful hybrid seed production requires identification of good combiners and a male sterility/ restorer system. Good combiners with high yield potential under Indian agronomic conditions have been identified for both *B. napus* AACC and *B. juncea* AABB. In both the crops, genetically divergent lines with compensatory characters provide maximum heterosis for yield. *B. napus* and *B. juncea* lines with *B. tournefortii* TT cytoplasm are male sterile. Using this CMS, a three line (A, B and R) system for hybrid seed production has been developed in *B. napus*. No restorer lines could be identified in mustard. To transfer restorer gene(s) from *B. tournefortii* to mustard, somatic hybrids with genomic configuration TABB and TBAA have been produced. Diploid species, *B. campestris* AA and *B. nigra* BB, containing unique marker genes were used as bridging materials.

INTRODUCTION AND RESULTS

Deployment of hybrids could lead to yield improvement in oilseed *Brassica* species. We report here our studies on finding (1) good combiners in *B. juncea* and *B. napus*, (2) development of a three line hybrid seed production in *B. napus*, (3) production of three genome somatic hybrids to transfer alien genes to the two allopolyploid crops and (4) genetic transformation of *B. juncea*.

Combiners in rapeseed and mustard

Significant heterosis for yield has been observed in both mustard and rapeseed by crossing genetically divergent lines. F_1 progeny of a synthetic *B. napus* ISN 706 with a dwarf bold seeded line HNS8 gave an average seed yield of 2290 kg/ha and ISN 706 X GSL1 recorded average seed yield of 2990 kg/ha as compared to national check cultivar GSL1 (1810 kg/ha) (Sodhi *et al.*, 1993).

In *B. juncea*, 25 accessions of Indian and exotic origin were studied for their divergence. Combining ability and heterosis were studied in ten accessions by diallele analysis. Two best yielding crosses (Skorospieka II x RH 30 and Donskaja IV x Varuna) were also studied in plot level trials over two growing seasons and were found to give 29.4 to 91.8% heterosis over the best yielding parent. F_1 of Skorospieka II x RH30 yielded upto 2869 kg/ha as compared to 2126 kg/ha of RH 30 (Pradhan *et al.*, 1993).

Three line hybrid seed production in *B. napus*

Alloplasmic lines of *B. napus* with *B. tournefortii* cytoplasm are male sterile (Pradhan *et al.*, 1991). A number of *B. napus* lines were tested for their ability to maintain or restore the sterility. A number of lines were maintainers but a few had restorer function. The restorer gene(s) were inherited as a single Mendelian locus (Sodhi *et al.*, 1994). Restorer genes and 'tour' cytoplasm have been transferred to the identified good combiners. The system is now ready for hybrid seed production in rapeseed.

Transfer of restorer gene(s) from *B. tournefortii* to *B. juncea*

B. juncea lines with *B. tournefortii* cytoplasm, besides being male sterile have other floral abnormalities. Under temperate conditions such lines also suffer from chlorosis. To transfer restorer gene(s) from *B. tournefortii* TT to *B. juncea* and to correct organelle influenced deficiencies of the lines, hybrids have been produced by a combination of sexual and somatic cell hybridization with genomic configuration TABB and TBAA. We earlier proposed that such configurations will facilitate introgression of alien genes into *B. juncea* (Mukhopadhyay *et al.*, 1994). *B. tournefortii* TT was first sexually crossed with *B. campestris* AA or *B. nigra* BB. Protoplasts isolated from TA and TB plants were fused with protoplasts of *B. nigra* and *B. campestris* respectively to produce TABB and TBAA hybrids. Selection of somatic hybrids has been based on the use of marker containing diploid stocks - *B. nigra* with *npt* gene (Gupta *et al.*, 1993) and *B. campestris* with *hpt* gene (Mukhopadhyay *et al.*, 1994 and unpublished). Backcross breeding is underway to transfer restorer gene(s) from T genome to *B. juncea*. Hybrids are being screened for organelle composition.

Genetic transformation of *B. juncea*

Twelve different cultivars of *B. juncea* grown in different agroclimate regions of the world were tested for their ability to regenerate *in vitro*. Efficient genetic transformation systems have been developed for all the cultivars including those that are good combiners for yield. These could be transformed now with barnase/barstar genes for developing transgenics for hybrid seed production in *B. juncea*.

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