

Cytoplasmic male sterility systems for the production of hybrid mustard



Flowers of Male sterile (left) and Fertility Restorer (right) lines of mustard

Name of the Institute: National Research Centre on Plant Biotechnology, New Delhi

Stage of Development: The CMS lines are ready for development of hybrids

IPR status: The lines have been registered with NBPGR and molecular markers are available to track the lines.

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Technology description: Commercial hybrid seed production requires controlled pollination systems. Non-availability of reliable pollination control system was a major bottleneck so far in developing hybrid cultivars of mustard. NRC on Plant Biotechnology has developed three perfect pollination control systems in mustard through somatic cell hybridization techniques involving wild alien species of Brassica. These include cytoplasmic male sterile (CMS) lines, and fertility restorer lines. All natural *Brassica juncea* (mustard) accessions serve as maintainer lines for propagating male sterile stocks. The three CMS lines carry cytoplasm from different wild species and confer cent percent male sterility. The fertility restorer stocks carrying genes transferred from the wild species confer male fertility to male sterile lines. Thus by selective mating between male sterile lines (A lines) and maintainer lines (B lines) or fertility restorer lines (R lines), one can generate male sterile or normal fertile progenies. By constructing A, B and R lines in specific nuclear backgrounds, one can develop heterotic hybrids. Thus these genetic stocks could be used to develop hybrid mustard.

Background: A high degree of heterosis has been found in experimental hybrids of mustard produced by hand emasculation and pollination. However, production of hybrid seeds through hand emasculation and pollination is not commercially viable. Worldwide, hybrid seed production in most grain crops is based on controlled pollination systems, and CMS systems are most widely used in crops such as rice, sorghum, pearl millet, sunflower, canola etc. We have developed for the first system stable and reliable CMS systems in India mustard comprising A, B and R lines. These lines have been thoroughly characterized at the morphological and molecular levels. Their performance has been assessed and verified over generations and at different locations. These genetic stocks are now ready for development of commercial hybrids.

Benefits and Utility: CMS systems offer opportunity to develop hybrid mustard. Since hybrids are propriety products and hybrid seeds can be used only once, developers of hybrids could reap benefits by marketing hybrid seeds to the farmers year after year. In fact, commercial seed industry is sustained by hybrid technology and availability of pollination control systems opens opportunity to hybrid varieties in mustard.

Country context: The genetic stocks are relevant for hybrid seed production in mustard in any country.

Scalability: The system is appropriate for commercial hybrid seed production on any scale.

Business and Commercial Potential: Considering that mustard is cultivated on >6 million ha in India, development of heterotic hybrids could fetch huge benefits to the developer.

Potential Investors to this technical innovation: Seed companies already working with mustard and other field crops such as pearl millet, sunflower, corn, rice.