Biotechnology in Muskmelon

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ABSTRACT

Musk Melon (*Cucumis melo* L.) is crop of Cucurbitaceae family. It is also known as Kharbuza. Musk melon is valued as a summer fruit. The chromosome no. of musk melon is 2n=24 and origin is Tropical Africa. It is stated to have a cooling effect on the body system. Further, it is a demulscent, diuretic and aphrodisiac. It is applied as a lotion in several skin conditions. The roots have emetic and purgative properties. Mature fruits of muskmelon are round in shape and 8-16 cm in diameter. Nevertheless some oblong, flat and oval fruit shaped varieties are also available. Immature fruits are used as vegetable and seeds are edible. The fruits of *C. angaria* (West Indian gherkin) is mostly used in pickles and also as a cooked vegetable. There is another form called snap melon (*Cucumis melo var. momordica*) found throughout India. It is consumed at full ripened stage.

INTRODUCTION

Improvement of Muskmelon using Conventional Breeding

Conventional selection breeding method in muskmelon has led to a considerable varietal improvement. Strong sexual incompatibility barriers at the interspecific and intergeneric levels have restricted the use of that genetic potential to develop new and enhanced muskmelon cultivars

- Muskmelon plant improvement by traditional hybridization is slow and limited to a restricted gene pool. It is possible to produce viable intraspecific muskmelon hybrids between wild type and commercial varieties, with the aim to transfer some particular muskmelon genetic traits, such as disease resistance to fungi, bacteria, virus and insects, or tolerance to environmental factors, such as salinity, flooding, drought, and high or low temperature, to commercial muskmelon varieties

Improvement of Muskmelon using Recombinant Technology

- Tissue culture techniques often depend upon the development of an efficient in vitro plant regeneration system, which are necessary for the breeding based on recombinant technology (Rubaiyat *et al*., 2013).
- However, many attentions have given to tissue culture of the muskmelon than the closely related cucumber.
- Buds and shoots have been obtained in vitro directly from muskmelon cotyledons and indirectly from callus derived from cotyledons, root, hypocotyls and leaves.
- Embryogenesis in muskmelon directly from cotyledonary explants has also been reported. Shoot multiplication from apical or lateral buds of muskmelon was reported as forms of axillary multiplication (Thakur *et al*., 2019).

Improvement of Muskmelon using by Polyploidization and Somaclonal Variation

- The ability of somatic embryos to develop into plantlets decreased in the following order: diploid>tetraploid>octaploid
- The tetraploid line of muskmelon production using somaclonal variation as well as colchicine treatment is important to production of a triploid muskmelon by hybridization a tetraploid and diploid although nowadays the triploid is not good hybrid cultivar for commercial production (Guis *et al*., 2013)
- Somaclonal variation could be used to obtain variants lines with low-temperature germinability in muskmelon. Changes in fatty acid patterns have been found in muskmelon callus tissue, as well changes in a repetitive DNA sequence during callus culture have been detected (Lin *et al*., 2012).
- However, somaclonal variation has to be avoided in research, where genetic transformation is involved because genomic stability in transgenic plants has to be maintained in order to express the inserted transgene (Rubaiyat *et al*., 2014).

Table 1: Genetic resources in muskmelon

Mass Selection	Arka Jeet (High TSS variety), Arka Rajhans (Tolerant to powdery mildew), Pusa Madhuras, MH-1 and Kashi Madhu (Long storage capacity)
Pedigree Method	Pusa Sharbati, Hisar Madhur
Resistance breeding	• **Powdery mildew**: PMR-6, PMR-5, PMR-45, FM 5 • **Downy mildew**: Budama types 1, 3 and 3, Annamalai • **Fusarium wilt**: Golden Gopher, Midget, Harvest Queen and Delicious 51 • **Cucumber Mosaic Virus**: Florida 67, PMR 6, Jacumba, PMR Honey Dew, Durgapur Madhu, Gulf Stream and Kabul Melon • **Cucumber green mottle mosaic virus**: VRM 5-10, VRM-29-1, VRM-31-1, VRM 42-4 and VRM 43-6 • **Red pumpkin beetle**: Cassba

Table 2: QTLs for important quality traits reported in melon

Sr. No.	Population Used	QTLs Reported
1.	Fruit shape	
	1. RILs	Ten QTLs
	2. NILs	Eleven QTLs: fruit length, 10 QTLs: fruit width
	3. RILs	Two QTLs for fruit length, 2 QTLs for fruit width
2.	Sugar content of fruit flesh in mature fruit	
	1. NILs	Nine QTLs for sweetness
	2. RILs	Six QTLs for sucrose, total soluble solids
3.	Ethylene production in fruit (climacteric crisis)	
	1. RILs	Four QTLs
	2. NILs	One QTL for ethylene production and climacteric response

Table 3: Transgenics developed in muskmelon for different traits

Transgene	Phenotypic trait	Cultivar
CMV-coat protein gene	Virus resistance	Prince
uidA gene	GUS Reporter gene	Galia
ZYMV-coat protein gene	Potyvirus resistance	Hale's Best Jumbo
CMV-white leaf coat protein gene	Virus resistance	Harvest Queen, Hearts of Gold and Topmark
Hal 1	Halotolerance	Pharo
Bar gene	Resistant against herbicides	Arava
HAL 1 and TPS 1	Salt and Drought tolerance	Pharo

CONCLUSION

The production of melon is top most level among fruits production by weight worldwide. In fruits including apple, strawberry, orange, grape, etc, the advanced technologies are applied very much for their improvement. Therefore, it is more urgent now to improve melon fruits production due to its yield at the highest level. A small-scale improvement in the melon production has achieved with the classical selection breeding technique

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