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Short Communication

Isolation of genetic male sterile mutant in okra [*Abelmoschus esculentus* (L.) Moench]

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Okra [*Abelmoschus esculentus* (L.) Moench] is one of the important vegetable crops in India. The work on heterosis in okra has already been reviewed [1, 2]. A number of workers have reported heterosis for plant height, number of internodes, branches and seeds per fruit and fruit yield. Similarly negative heterosis has been reported for days to flowering and days for maturity [3-6]. In India seed companies are producing a number of F_1 hybrids of okra through emasculation and hand pollination. Use of malic hydrazide and FW-450 (Sodium 2, 3 dichloisbutrate) spray application has been proved successful for inducing pollen sterility on experimental scale; but has not been used in commercial F_1 okra seed production [1]. A method has been reported for F_1 seed production in okra, following the use of genetic male sterility [7]. However, there is no reference in the literature forthcoming regarding the presence of GMS okra lines and their commercial use for hybrid seed production.

Seed of three okra lines *i.e.*, AOL-63, AOL-64 and AOL-65 were irradiated with gamma rays doses of 100, 200 and 300 Gy in *kharif* 1997. M_0 generation were raised and M_1 progenies of selected plants from these lines were raised in summer 1998. In one line AOL-64, a single plant was observed which produced flowers with small whitish empty anthers. When observed under microscope these sterile anthers did not show presence of any normal fertile pollen grains. The flowers on this plant were pollinated with the pollen from the fertile plants of the same line. The crossed fruits, each had only 1 to 4 viable seeds, the rest being immature with red seed coat. The F_1 of these plants were found to be fertile. These plants were selfed and F_2 was raised in summer 1999. The F_2 showed the presence of about 25% sterile plants with small whitish empty anthers. Crosses made between selected F_2 sterile and fertile plants, showed few progenies with about 50% sterile and 50 % fertile plants; selected progenies from back crosses giving about 50% sterile and fertile plants were continued for two more generations as AGMS-28. Though these sib-mated progenies showed good segregation for sterile and fertile, the seed set in these AGMS-28 plants was only up to 30 seeds as against 50 to 55 seeds per fruit in normal okra inbred.

To overcome low seed set per fruit, fresh crosses were made between AGMS-28 and two promising inbreds AOL-58 and AOL-75. F_2 of both these crosses showed the presence of about 25% sterile plants. Selected F_2 plants when sib-mated showed few progenies which gave about 50 % sterile and fertile plants. The segregation data in F_2 and backcrosses in the two crosses is given in Table 1.

Table 1. Segregation for male sterility in F_2 and backcrosses in okra

Population	Number of plants			Ratio	X^2	P
	Fertile	Sterile	Total			
F_2 (AGMS-28) × AOL-58	157	41	198	3:1	2.12	0.5
F_2 (AGMS-28) × AOL-75	203	52	255	3:1	2.89	0.5
Pooled data	360	93	453	3:1	4.12	0.3
Heterogeneity						0.01
BC (AGMS-28) × AOL-58	82	68	150	1:1	1.37	0.5
BC (AGMS-28) × AOL-75	95	77	172	1:1	1.90	0.2
Pooled data	177	145	322	1:1	3.80	0.3
Heterogeneity						0.09

The segregation of sterile plants in F_2 and backcrosses in both these crosses showed that the male sterility in the above lines is monogenic and recessive. Two promising lines AGMS-253 and AGMS-172 were further selected and are being maintained since 2002. These two lines are semi-tall, produce about 50% sterile when maintained, are with short internodes and with 2-3 branches per plant. These lines have shown good resistance to YVM under field condition. Their flowering duration has increased by 7-8 days and produce 30-32 flowers per plant as against 20-22 flowers in normal okra inbreds. The seed set in the sterile line and its hybrids is about 45-50 seeds per fruit (Fig. 1). Styles with anthers in flowers

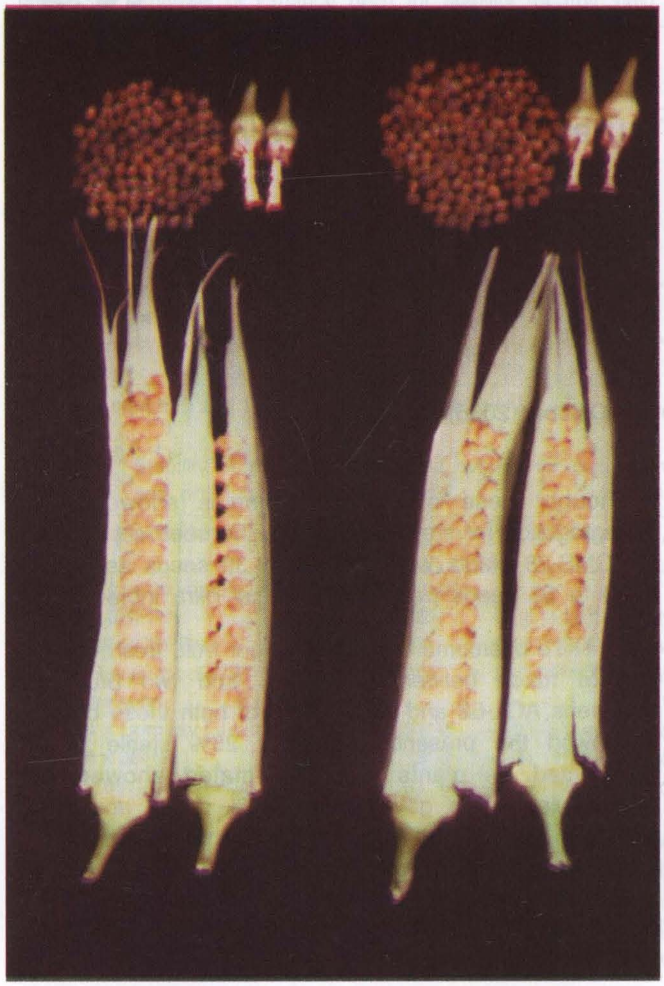

Fig. 1. Seed set in fruits, mature seeds and styles with anther in sterile AGMS-253 and fertile F_1 AGMS-253 × AOL-75 in okra

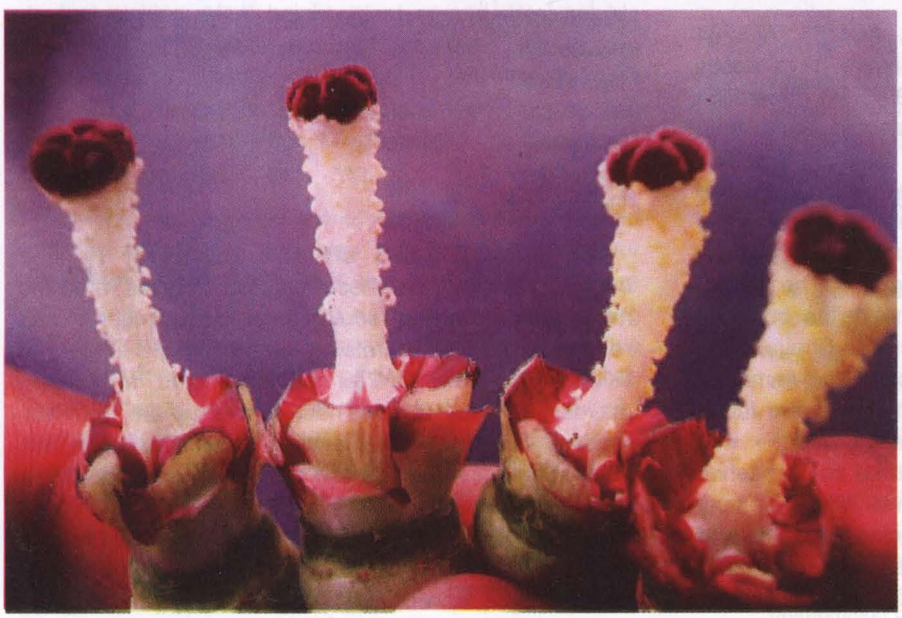

Fig. 2. Styles and anthers in flowers of male sterile and male fertile plants in okra AGMS-253

of male sterile and male fertile plants AGMS-253 (Fig. 2).

During large-scale F_1 seed production in okra, the emasculation work becomes rather slow due to production of slimy exudates adding to the cost of F_1 hybrid seed production and emasculation needs to be carried very often up to 4 pm thus adding to the cost of F_1 hybrid seed production. The use of male sterile lines AGMS-253 and AGMS-172 will make the F_1 hybrid seed production in okra easy and less costly compared to usual hand emasculation process. This will also compensate the loss of about 50% fertile plants in female plots which need to be uprooted.

We consider from the information available in literature on okra, that this may be the first report of GMS in okra which has reached to commercial F_1 hybrid seed production stage. These two lines AGMS-253 and AGMS-172 are under multiplication and testing of their F_1 hybrids for commercial hybrid seed production.

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