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DEVELOPMENT OF GENETIC MALE STERILE LINES IN SAFFLOWER

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The scope of hybrid safflower to overcome current yield barriers is well known. The development of genetic male steriles [1] offers a feasible approach to hybrid seed production. However, certain inherent deficiencies of these recessive genetic male sterile lines limited their use in hybrid breeding programme [2]. The recently reported induced dominant male sterility [3] too has very limited application in safflower hybrid development. In this context, the present note reports the isolation of eight genetic male sterile lines with improved agronomic base and striped hull seed, giving about 38% oil on whole seed basis.

One of the crosses (BLY 616 x BLY 257) grown in F_2 generation during 1985-86 at the DOR Research Farm, Hyderabad, exhibited distinct 3:1 segregation for normal and pinched flower types. The latter with characteristic indehiscent anthers possessed very few pollen grains, with varying fertility levels from plant to plant. Nearly normal development of ovules in about 60% florets of each capitulum differentiated these partial male sterile plants from those of the female–male sterile system reported by Carapetian and Knowles [4]. Due to total failure of seed set under selfing, all partial male sterile plants were propagated by forced fertilization by repeated pollination with mixed pollen collected from all normal plants of the same cross. The seeds so obtained from the partial male sterile plants were bulked and advanced to F_3 and F_4 generations during 1986-87 and 1987-88 crop seasons, respectively. Selection among 250 individual plants for the presence of few or no fertile pollen grains in the anthers and other agronomic characters resulted in the isolation of 27 partial to total male sterile plants each of which was pollinated by mixed pollen collected from normal plants in F_4 generation. The partial male sterile plant progenies (sown November 7) started flowering by mid-January 1989. The progeny size varied from 10 to 35 plants. The analysis of all pinched flower types in each progeny revealed that 8 out of 27 progenies had empty anther sacs. Microscopic studies of later order flower heads of the male sterile plants showed total degeneration of meiocytes, followed by tapetal disintegration as in case of alfalfa genetic male steriles reported by Childers [5].

The segregation pattern of the confirmed male sterile progenies into 137 normal and 49 male sterile plants giving 3:1 ratio (χ^2 = 0.179) suggested single recessive gene control of male sterility. The improved agronomic base of these male sterile lines in combination with striped hull seed facilitate their direct use in hybrid breeding programmes.

Table 1. Extent of seed set in male sterile plants under sibbing and open pollination (1988–89)

Progeny	No. of male sterile plants	Sibbing		Open pollination	
		No. of capitula	seeds per capitulum	No. of capitula	seeds per capitulum
MSS 1	4	22	15.2	10	26.6
MSS 2	9	44	11.9	27	22.4
MSS 3	7	32	13.2	17	23.0
MSS 4	3	18	9.7	10	23.9
MSS 5	1	6	12.0	5	15.0
MSS 6	5	22	20.5	9	46.8
MSS 7	3	14	10.4	5	30.4
MSS 8	2	7	6.9	5	16.2

Variable number of capitula in each male sterile plant were bagged prior to anthesis and every capitulum was pollinated with pollen from normal plants within the progeny for 3–4 consecutive days. Preliminary observations on the extent of seed set (Table 1) revealed nearly normal seed development from the open pollinated capitula, while under sibbing it varied from 34 – 80% of open pollinated capitula. Individual male sterile progenies were nearly uniform but differed from each other for plant height, extent of branching, capitulum size and flower colour.

The exertion of florets and seed set in the later order capitula (beyond secondary order) of most male sterile plants were more or less normal, indicating either environmental sensitivity of incomplete exertion of florets, leading to pinched flower appearance, or ontogenic changes, or both.

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