

X-RAY INDUCED MALE STERILITY WITH PHENOTYPIC MARKER TRAIT IN SESAME (*SESAMUM INDICUM* L.)

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A male sterile mutant (100 Gy – X- ray; mutation frequency 0.032%) with stem fasciation was identified in sesame (*Sesamum indicum* L.) at M_2 . Male sterility was characterized due to the formation of 100.0 % sterile pollen grains and the pollens were smaller (compared to fertile pollen grains of normal plants) and variable in sizes. Meiosis was normal ($2n = 26$) in the mutant 13II at MI and 13:13 separation at AI always). Male sterility seems to be controlled by single pair of alleles. Pleiotropic nature of the male sterile gene has been predicted.

Keywords : Male sterility; Meiosis; Monogenic inheritance; Phenotypic marker.; Sesame; Stem fasciation; X-ray.

Introduction

Stem fasciation is an easily scorable morphological trait and it can be exploited as genetic marker for efficient plant breeding. Concomitant association of male sterility with stem fasciation is therefore unique as it gives selective advantage for the identification of male sterile plants under field conditions. Further, development of male sterile system in a crop may be utilized for hybrid seed production. A male sterile plant with distinctive morphological marker (stem fasciation) was identified at M_2 from X-rays irradiated progenies of sesame (*Sesamum indicum* L.; family : Pedaliaceae; oil seed crop), which has been described in the text along with the cytogenetical behaviour.

Material and Methods

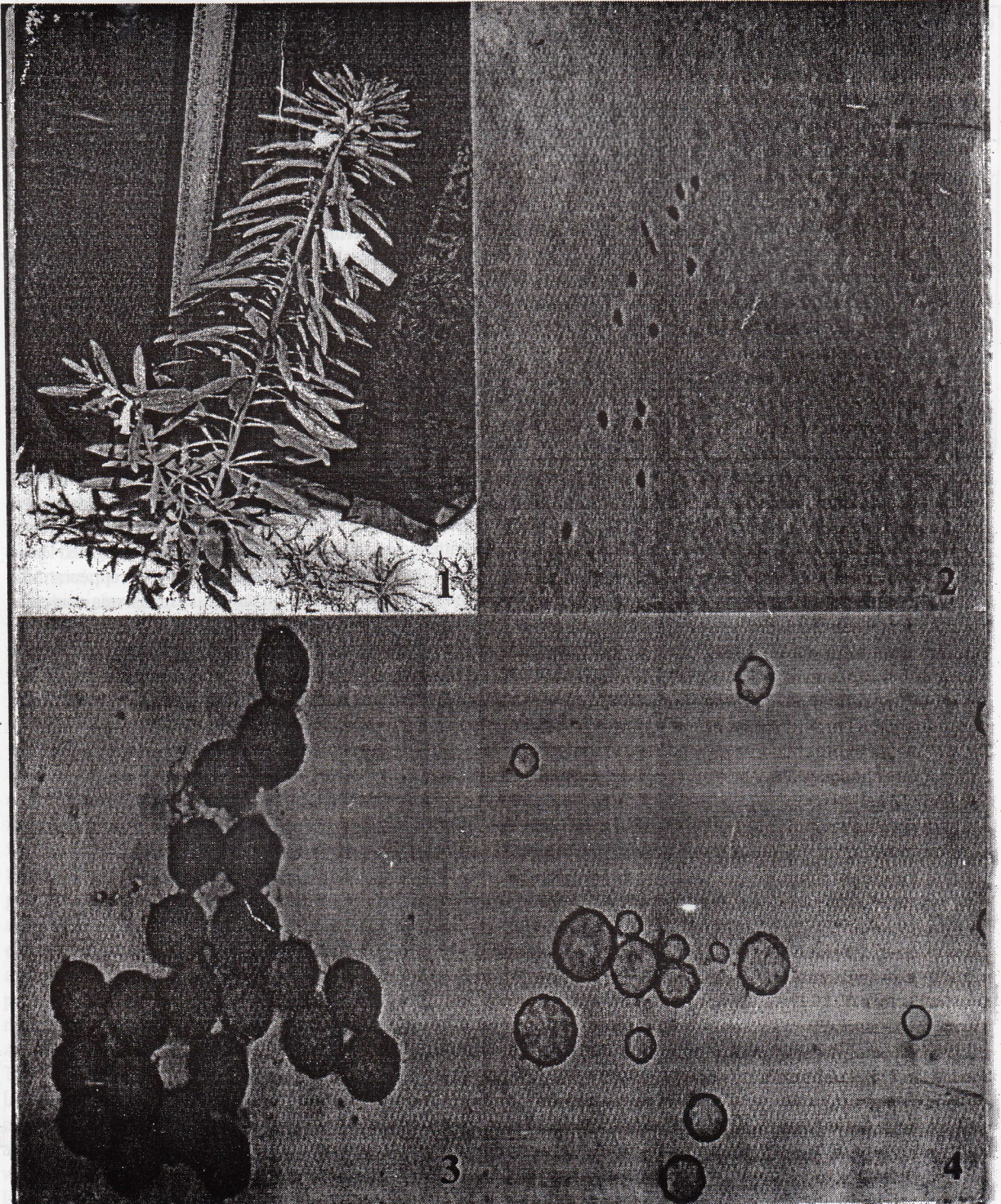
In the present study dry seeds of sesame (*Sesamum indicum* L. var. B-67 – moisture content : 9.56 %) were treated with 50 Gy, 100 Gy, 200 Gy and 300 Gy of gamma rays and X – rays and M_1 and M_2 generations were raised at Kalyani University research garden, during the irrigated seasons (February to May) of 2005 and 2006, respectively. A male sterile mutant with stem fasciation was spotted at M_2 from 3130 plants. Mutation frequency was estimated as per 100 M_2 plants.

Pollen and pollen mother cells were studied in the mutant and control plants following single microsporophyll squash preparation in 1% acetocarmine solution. Fully stained pollens were considered fertile; while, partially and unstained pollen grains were designated sterile. The male sterile mutant was crossed with pollen grains from normal fertile plants and the progenies segregating at F_1 were computed following X^2 – test analysis.

Results and Discussion

A male sterile plant (Fig. 1) was isolated at M_2 (100 Gy – X - Ray) and the mutation frequency of which was estimated to be 0.032%. The mutant plant had broadened, flattened and ribbed stem with clustered, elongated leaves with smooth margins giving a bunchy top appearance at the apex. Stem fasciation and leaf cluster was evident at the very seedling stage of the plant. The width of the fasciation varied from 1.5 to 2.0 cm. The mutant plant attained a height of 46 cm at maturity (control : 100.4 ± 2.69 cm), showed delayed flowering (48 days from sowing; control 37 – 42 days), and possessed small sized flowers ($2.43 \pm 0.054 \times 1.53 \pm 0.03$ sq.cm; control : $4.0 \pm 0.01 \times 1.83 \pm 0.03$ sq.cm) and stamens (0.26 cm. ± 0.021 ; control : 0.34 cm. ± 0.021). Male sterility has been characterized due to the formation of 100.0% sterile pollen (Fig. 4) grains in (control : 60.0 to 85.0% pollen fertility – Fig. 3) and the pollens were smaller ($0.055 \pm 0.003 \times 0.051 \pm 0.003$ sq.mm; control : $0.079 \pm 0.001 \times 0.077 \pm 0.001$ sq.mm) and variable (0.032×0.032 sq.mm to 0.08×0.08 sq.mm) in sizes than normal fertile pollen grains. Male sterility induced by maleic hydrazide and dalapon¹; 2,2-dichloropropionic acid and trichlorobenzoic acid²; periodic acid³ and gamma irradiation⁴ have been reported in sesame. Associated phenotypic marker trait with male sterility has been documented in black cumin⁵.

Pod setting was not observed in the mutant on open pollination; however, fruiting was recorded on cross pollination. In F_1 15 male sterile plants with associated marker trait and 17 male fertile plants were noted ($X^2 = 0.124$ for 1:1 ratio at 1df, p value : 0.70 – 0.80). Both digenic⁶ and monogenic⁴ inheritance pattern have been reported



Figs.1-4. 1. Male sterile mutant showing stem fasciation (-->). 2. MI with 13II. 3. Fertile pollen grains in normal plants. 4. Sterile pollens in the mutant.

for male sterility in sesame. Meiosis was normal ($2n = 26$ – Fig. 2) in the mutant (13II always at MI – 52 cells scored; 13:13 segregation at AI – 24 cells studied).

Results indicated that the male sterile gene may be pleiotropic in nature. The male sterile female fertile plant described in the text has been non – structural nuclear type according to the classification given by Gottschalk and Kaul⁷ and Johns *et al*⁸. The mutant may further be exploited for improvement of sesame.

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