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INDUCED POLLEN STERILITY IN *BRASSICA JUNCEA* VAR. PUSA BOLD

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The effect of gamma-ray, ethyl-methane-sulphonate (EMS), streptomycin, acriflavin and ethidium bromide (EB) at various concentrations on pollen sterility in M1 and M2 generations of *Brassica juncea* var. Pusa bold was studied. The plants in M1 generation failed to show any significant change in their pollen sterility by various treatments except in streptomycin treated progeny which exhibited the presence of some plants with 26-50% pollen sterility. However, the extent of pollen sterility increased in M2 generation of the entire treated population and streptomycin caused maximum pollen sterility.

Keywords: Acriflavin; *Brassica juncea;* EMS; Ethidium bromide; Pollen sterility; Streptomycin

Introduction

Brassica juncea (Indian mustard or brown mustard) of Brassicaceae is an important oil yielding crop of India. The application of spontaneous male sterility in hybrid seed production and studies on mechanism of male sterility have received much attention for more than three decades. Several potential physical and chemical mutagens are known to cause severe breakdown of genetic system and induce pollen sterility in plants[1] Development of genetic variability in relation to growth rythm and biosynthesis of chemical constituents should be exploited for evolving better quality genotypes[2]. The present investigation deals with the evaluation of various doses of gamma-rays and different concentrations of some new potential chemical mutagens e.g. streptomycin, acriflavin, ethidium bromide (EB) including ethyl-methane-sulphonate to induce pollen sterility in *Brassica juncea* var. Pusa bold.

Materials and Methods

The experiment was carried out at R.B.S.College Agricultural Research Station, Bichpuri, Agra. The dry seeds of *Brassica juncea* var. Pusa bold were irradiated with 40,60 and 80 kR gamma-ray with the help of ^{60}Co at the Division of Genetics, I.A.R.I., New Delhi. Pre-soaked (12h) seeds at room temperature were treated with 500,750 and 1000ppm ethyl-methane-sulphonate (EMS) and 1000,1500 and 2000 ppm streptomycin, acriflavin and ethidium bromide (EB).

The irradiated, chemically treated and untreated seeds were sown in fields in randomized block design to obtain parental generation. The plants thus raised were selfed and the seeds of individual plants were collected and sown next year to obtain M1 generation. The plants of M1 generatrion were selfed and seeds obtained from these plants were used to obtain M2 generation. Pollen viability variously treated and untreated population was tested at regular intervals by the staining procedure[3]. The data in M1 and M2 generations thus collected was analysed statistically.

Results and Discussion

Plants in M1 and M2 generations of treated populations of *B.juncea* var.Pusa bold showed various degrees of pollen sterility and classified in four groups *viz:* The plants exhibited pollen sterility (0-25%) similar to those of untreated (C) plants were termed as normal (N), while those exhibited 26-50 per cent pollen sterility were of semi-sterile type a (SSa). The plants showing 51-95 per cent pollen sterility were called as semi-sterile type b (SSb).

The phenotypes of male sterility in M1 generation is given inTable 1. It is evident that entire irradiated and chemically treated M1 population. except streptomycin treatments consisted of only N type of plants. The streptomycin treated M1 population showed the presence of SSa type of plants also and their number was higher in higher concentrations of streptomycin.

The inheritance of male sterility from M1 to M2 lines shows that gamma-ray irradiated normal (N) M1 population inherited N, SSa and SSb types of plants in M2 generation (Table 2). However, the number of SSa type plants in M2 generation was considerably high and there were only a few SSb type of plants. More or less similar inheritance pattern of male sterility from M1 to M2 generation was exhibited by various treatments with chemical mutagens except streptomycin. The N and SSa type of streptomycin treated M1 plants inherited a higher number of SSb type (pollen sterility 51-95%) in M2 generation. However, N type of plants in 1000 ppm streptomycin treated M1 generation produced higher number of SSa type alongwith a limited number of N as well as SSb types. On the other hand, 2000 ppm streptomycin treated SSa type M1 plants produced a large population of SSb type in M2 generation and there were not a single N type of plant in this M2 treated progeny. Thus, among the entire M2 population of 1080 plants, there were 155 (14.3%) N, 538 (49.9%) SSa and 387 (35.8%) SSb type of plants.

Reduction in pollen fertility in gamma-ray and EMS treated M1 and M2 generations was observed in *Lens culinaris4* and a close association of M1 pollen fertility with higher frequency of chlorophyll mutation was also observed[5,6]. While studying the effect of gamma radiation on pollen fertility in M1 and M2 generations in castor three complete male sterile mutants in M2 generation of 150 kR gamma-ray irradiated population were recorded[7]. Cytoplasmic male sterility in sugar beets by gamma-ray irradiation and by EMS, ethidium bromide, acriflavin and streptomycin treatments was successfully induced[8-10].

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Table 1. Phenotype expression of male sterility in M_1 generation.

Treatments	Doses (KR) Conc.(ppm)	Phenotype of (M_1) lines No. & (%)			Total number observed
		N	SSa	SSb	
	40	60(100)	0(0)	0(0)	60
Gamma-ray	60	60(100)	0(0)	0(0)	60
	80	60(100)	0(0)	0(0)	60
	500	60(100)	0(0)	0(0)	60
EMS	750	60(100)	0(0)	0(0)	60
	1000	60(100)	0(0)	0(0)	60
	1000	48(80)	12(20)	0(0)	60
Streptomycin	1500	42(70)	18(30)	0(0)	60
	2000	33(55)	27(45)	0(0)	60
	1000	60(100)	0(0)	0(0)	60
Acriflavin	1500	60(100)	0(0)	0(0)	60
	2000	60(100)	0(0)	0(0)	60
	1000	60(100)	0(0)	0(0)	60
Ethidium bromide	1500	60(100)	0(0)	0(0)	60
	2000	60(100)	0(0)	0(0)	60
Total	-	843(93.6)	57(6.3)	0(0)	900
Control	-	60(100)	0(0)	0(0)	60

N = Normal; SS_a = Semi - sterile a; SSb = Semi - sterile b

Table 2. Inheritance of male sterility from M_1 to M_2 lines in Brassica juncea var.Pusa bold.

Treatments	Doses (kr) Conc. (ppm)	Phenotype of M_1 lines	Phenotype of M_2 lines No. & (%)			Total
			N	SSa	SSb	
	40	N	7(12)	50(83)	3(5)	60
Gamma-ray	60	N	15(25)	42(70)	3(5)	60
	80	N	8(13)	37(62)	15(25)	60
	500	N	12(20)	45(75)	3(5)	60
EMS	750	N	6(10)	36(60)	18(30)	60
	1000	N	4(7)	21(35)	35(58)	60
	1000	N	16(27)	24(40)	20(33)	60
		SSa	9(15)	15(25)	35(60)	60
Streptomycin	1500	N	4(7)	12(20)	44(73)	60
		SSa	3(5)	18(30)	39(65)	60
	2000	N	7(12)	6(10)	47(78)	60
		SSa	0(0)	12(20)	48(80)	60
	1000	N	9(15)	48(80)	3(5)	60
Acriflavin	1500	N	6(10)	45(75)	9(15)	60
	2000	N	3(5)	51(85)	6(10)	60
	1000	N	12(20)	20(33)	28(47)	60
Ethidium bromide	1500	N	18(30)	32(53)	10(17)	60
	2000	N	16(27)	24(40)	20(33)	60
Total	-	-	155(14.3)	538(49.9)	387(35.8)	1080
Control	-	N	60(100)	0(0)	0(0)	60

N = Normal SSa = Semi-sterile a; SSb = Semi-sterile b;

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