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STUDIES OF MUTAGENIC SENSITIVITY IN SOYBEAN *(GLYCINE MAX* L)

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The two soybean cultivars(JS-335 and DS-228) were used for study of mutagenic sensitivity. The seeds of both the varieties were treated with two different concentration/ dose of EMS (0.05,0.10, 0.15 and 0.20 % and gamma radiation 5,10,15 and 20KR. Attempts were made to study mutagenic sensitivity in soybean through biological parameters such as percentage germination, pollen sterility and survival of plants at maturity in M_1 generation. There was decrease in germination and survival at maturity, while pollen sterility increases in concentrations of mutagens.

Keywords: Chlorophyll mutation; EMS, Gamma Rays; Mutagenic sensitivity; Soybean.

Soybean *(Glycine max* L), belongs to family Fabaceae, is the most important crop with about 40% protein and 20% oil. Soybean has now become the largest source of vegetable oil and protein in the world. Production of soybean in the past decade remains static. Mutation techniques are the best methods to enlarge the genetically conditioned variability of a species within the short time. Micke[1] showed that study of mutagenic sensitivity will be helpful for enhancement of genetic variability. Gaul[2] showed that biological damage caused by mutation to germination, pollen sterility and survival at maturity may be considered as an indication of mutagenic sensitivity. Hence, present study was undertaken with an objective of mutagenic sensitivity in soybean employing ethyl methane sulphonate (EMS) and gamma rays radiations.

Seeds of two soybean cultivars, DS-228 and JS 335 were procured from Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra). Both the cultivars are widely cultivated in Maharashtra. Pilot experiments were conducted to determine the lethal dose (LD_{50}), suitable concentration of the mutagens and duration of treatment for both the cultivars. Both the varieties were treated separately with chemical EMS and physical mutagen (Gamma radiation). From such experiments it was finally established that concentration of 0.05, 10, 15 and 20mM for duration of 12 hrs and 18 hrs hours are best suitable for chemical mutagenic treatments. Seeds were presoaked in distilled water for 6 hours and subjected to freshly prepared mutagen solutions for 12 hrs and 18 hrs at 25± 2°C with intermediate shaking. The volume of mutagenic solutions was about 5 times to that of seeds. The seeds, treated with chemical mutagens were thoroughly washed for an hour.

For physical mutagen treatment, dry seeds with a moisture content of 10-12% were irradiated with 5, 10, 15 and 20KR from a C^{60} source available in the department of Biophysics, Government Institute of Science, Aurangabad (M.S.India).

Every treatment was carried out for 200 seeds. The treated seeds along with control were sown in the field in randomized block design (RBD) in three replications at spacing of 25 cm in rows and 50 cm between rows to raise M_1 generation during Kharif season of 2010-2011. The individually harvested M_1 plants were soon in the field to raise M_2 generation during Kharif season of 2011-2012 in separate rows. The M_2 progeny was raised along with parental varieties (Control) following randomized block design with 3 replications. Each treatment comprised of 20-21 M_1 plant progenies and each M_2 progeny row consisted of 10 to 25 plants in three replications. The cultural operation and application of FYM were done as per schedule.

Percent seed germination decreased with an increase in concentration for dose of mutagen in both cultivars in M_1 generation (Table 1, 2). The decrease in germination was more conspicuous with EMS treatment than that of gamma radiation in both the cultivars. The germination for control was 100%. The seed germination decreased from 96% to 64% in variety JS-335 and 89% to 73% in DS-228. The maximum decrease in seed germination was observed with 0.20mM EMS treatment in both the varieties. The result also shows that 5KR dose was less toxic to seed germination in both verities. The differential sensitivity of these two verities may be due to

Table 1. Differential effects of mutagens on plant seed germination percentage, pollen sterility and survival at maturity in M_1 generation of both varaity-JS-335 and DS-228 in soybean.

Cultivar	Treatments	Concentration %	Germination %	Plant survival %	Pollen sterility %
JS-335	Control T0	----------	96.43	91.73	8.39
	EMS(12hr)	0.05	89.95	86.81	11.77
		0.10	86.54	72.50	15.94
		0.15	82.64	67.66	29.65
		0.20	73.45	60.47	32.39
	EMS(18hr)	0.05	76.69	69.12	26.57
		0.10	73.62	64.84	29.75
		0.15	66.53	58.51	35.94
		0.20	64.44	52.85	42.17
	Gamma rays	5KR	91.36	65.63	7.94
		10KR	87.47	61.66	16.92
		15KR	84.36	57.61	22.62
		20KR	72.54	54.35	31.36
DS-228	Control	---------	96.33	92.44	10.03
	EMS(12hr)	0.05	89.00	87.88	11.85
		0.10	90.85	83.55	15.14
		0.15	82.97	79.83	28.47
		0.20	73.66	71.52	31.54
	EMS(18hr)	0.05	77.15	72.33	27.41
		0.10	73.08	69.67	31.13
		0.15	66.73	63.88	36.50
		0.20	64.42	57.39	41.69
	Gamma rays	5KR	91.25	85.51	8.38
		10KR	87.83	73.28	18.29
		15KR	84.78	64.66	23.46
		20KR	72.33	57.37	32.17

metabolic processes affected at embryonic level reported by Ashri and Herzog[4]. Similar inhibitory effect on seed germination by the mutagen was observedby Khan andWani[5].

Pollen sterility in M_1 generation is the first sign of genetic effectiveness of the treatment. Pollen sterility increased with increase in concentration of dose of the mutagens in both varieties.

EMS treatments induced higher pollen sterility then the gamma radiation. The highest pollen sterility in present investigation was 32.39 in JS-335 and 31.54% in DS- 228 with 0.20M treatment. Lowest pollen sterility was recorded at 0.05mM treatment in both the Cultivars. The results agreed to mutagenic sensitivity studies in chickpea employ SA, EMS and Gamma rays by Barshile *et al.*[3].

The percentage of survival at maturity decreased with increased concentration or dose of mutagens (Table 1). The variety DS- 228 was found more sensitive than that of JS-335 with respect to percent in survival at maturity. The lowest percent survivals in both cultivars were found in 0.20 mM treatment of EMS (JS-335, 60.47%) and DS-228 71.52%). The EMS was more effective than the gamma radiation. The decrease in survival of plants at maturity is due to rapid injection of chemical mutagen and their ability to produce chromosomal abstractions[6].

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