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Full Length Article

Studies of Mutagenic Sensitivity in Pigeonpea [*Cajanus Cajan* (L.) Mill sp.]

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ABSTRACT

The seeds of two varieties of pigeon pea [*Cajanus cajan* (L.) Millsp], (ICPL-87 and BDN-708) were used to study mutagenic sensitivity. The seeds of both the verities were treated with two different concentration /dose of EMS (10, 20, 30,40mM) and Gamma Radiation (100,200,300,400 Gy). Attempts were made to study mutagenic sensitivity in Pigeonpea through biological parameters such as percent germination, pollen Sterility and Survival of plant at maturity in M_1 generation. There was decrease in percent germination and survival at maturity, while pollen sterility increases in concentration of mutagens.

Key words: Mutagenic sensitivity, EMS, Gamma Rays**,** Pigeonpea.

INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp], belongs to family Fabaceae, is the most important food legume crop. Pigeonpea is an economic source of not only protein but of carbohydrate, minerals and B-complex vitamins particularly in vegetarian diet (Salunkhe *et al.,* 1985). The production of Pigeonpea in the past decade remains static. The available genetic variability in them has been almost utilized for improvement by conventional breeding methods. Mutation breeding technique is the best method to enhance the genetic variability of crop with in short time. Therefore it becomes necessary to create genetic variability through induced mutations. Micke (1988) showed that study of mutagenic sensitivity will be helpful for enhancement of genetic variability. Gaul (1964) showed that biological damage caused by mutation to germination; pollen sterility and survival at maturity may be considered as an indication of mutagenic sensitivity. The Mutagenic Sensitivity study was done by Bashir *et al*, 2013 in Fenugreek., Sangale *et al*, 2011 and Giri and Apparao, 2011 in Pigeonpea. Hence, present study was undertaken with an objective of mutagenic sensitivity in Pigeonpea var. ICPL-87 and BDN-708 employing ethyl methane sulphonate (EMS) and Gamma rays.

MATERIALS AND METHODS

The experimental plant material (seed) of two Pigeonpea cultivars i.e. ICPL-87 and BDN-708 selected. It was procured from Pulses improvement Division of Mahatma Phule Agricultural University, Rahuri (Ahmednagar district, Maharashtra state). Both cultivars are commonly cultivates in Maharashtra. Pilot experiments were conducted to determine the lethal dose (LD_{50}), suitable concentration of the mutagen and duration of treatment for both the cultivars. Seeds of both the verities were treated separately with chemical EMS and Physical Gamma rays. From such experiment it was finally established that concentration of 10, 20, 30 and 40 mm for duration 8 hrs is best suitable for chemical mutagenic treatments. Seeds are pre soaked in sterile distilled distilled water for 6 hrs and subjected to freshly prepared mutagen solutions for 8 hrs at 25 ± 3^{o}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 100, 200, 300, and 400 Gy from C^{60} source available in the department of Biophysics, Government institute of Science, Aurangabad, Maharashtra India.

Every treatment was carried out for 200 seeds. The treated seeds along with control were sown in the field in RBD in three replications at spacing 60 X 25 cm to raise M_1 generation during Kharif season of 2010-2011 in separate rows. The M_2 progeny was raised along with parental verities (Control) following randomized block design with three replications. Each treatment comprised of 20-21 M_1 plant in three replications. The cultural operation and application of FYM were done as per schedule. The treated as well as control seeds after germination were carefully screened for percent seed germination, plant survival and pollen Sterility for determining the mutagenic sensitivity for both the cultivars.

RESULTS AND DISCUSSION

Percent seed germination decreased with an increase in concentration/dose of mutagen in both cultivars in M_1 generation (Table-1). The decrease in germination was more conspicuous with EMS treatment than that of gamma radiation in both cultivars. The germination for control was 100%. The seed germination decreased from 96% to 48% in variety ICPL-87 and 95% to 48.24 % in variety BDN-708. The maximum decrease in seed germination was observed in with 40mM EMS treatment in both the varieties. The result also shows that 100Gy dose of gamma was less toxic to seed germination in both varieties. The differential sensitivity of these two varieties may be due to metabolic processes affected at embryonic level reported by Ashri and Herzog (1972).Similar inhibitory effects on seed germination observed by Mundhe & Borse (2012), and Khan & Wani (2006).

Table 1: Differential effects of mutagens on: Percent Seed germination, Pollen sterility and plant survival at maturity in M_1 generation of both variety: ICPL-87 and BDN-708 in Pigeonpea.

Cultivar	Treatments	Concentration/dose	% Germination	Plant survival %	Pollen Sterility %
Pigeonpea ICPL-87	Control	-------	96.00	95.20	00.00
	EMS	10 mM	68.00	89.30	05.40
		20 mM	60.00	82.32	10.24
		30 mM	56.00	68.00	09.37
		40 mM	48.00	46.36	16.61
	Gamma rays	100 Gy	84.00	90.14	04.61
		200 Gy	76.00	88.40	07.14
		300 Gy	68.00	86.18	09.04
		400 Gy	49.00	76.52	30.70
Pigeonpea BDN-708	Control	------	95.30	95.40	00.00
	EMS	10 mM	67.20	89.88	06.85
		20 mM	68.30	87.12	12.24
		30 mM	56.44	78.00	16.37
		40 mM	48.24	56.40	23.80
	Gamma rays	100 Gy	83.36	96.14	05.80
		200 Gy	76.20	93.50	09.24
		300 Gy	68.24	89.36	14.46
		400 Gy	48.50	78.12	37.80

Pollen sterility in M_1 generation is the first sign of genetic effectiveness of the treatment. Pollen sterility increased with increase in concentration /dose of the mutagens in both varieties. EMS treatment induced higher pollen sterility than the gamma radiation. The highest pollen sterility in present investigation was 16.61% in ICPL-87 and 23.80% in BDN-708 with 40mM treatment. Lowest pollen sterility was recorded at 10mM treatment in both cultivars. The result agreed to Barshile *et.al* (2006) in Chickpea employing SA, EMS and Gamma rays.

The percentage of survival a maturity decreased with increased concentration/dose of mutagens (Table-1).

The variety ICPL-87 was found more sensitive than that of BDN-708, With respect to percent survival at maturity. The lowest percent survivals in both cultivars were found in 40mM treatment of EMS (ICPL-87, 46.36%) and BDN-708, 56.40%).

The EMS was more effective than Gamma radiation. The decrease in survival of plant at maturity is due to rapid injection of chemical mutagen and their ability to produce chromosomal abstractions (Sharma *et.al,* 2005). Similar results were also obtained by Bashir *et al*, 2013 in Fenugreek. Kulkarni and Mogle, 2013 in Horse gram, Sangale *et al*, 2011 and Giri and Apparao, 2011 in Pigeonpea.

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