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RESEARCH ARTICLE

MUTAGENIC EFFECT OF ETHYL METHANE SULPHONATE AND SODIUM AZIDE ON POLLEN STERILITY IN CHICKPEA (*CICER ARIETINUM* L.)

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ABSTRACT

The pollen sterility revealed an increasing trend with increasing concentrations of mutagen in both the cultivars of chickpea. Both the cultivars of chickpea namely BDN 9-3 and PG-5 demonstrated a more or less similar response as regards pollen sterility with increasing concentrations of the two mutagens. The maximum sterility could be seen at 0.15% EMS and 0.03% SA in both the cultivars of chickpea. The results in the present study demonstrated that the frequency of pollen sterility was more in EMS treatments in both cultivars of chickpea.

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INTRODUCTION

Chickpea, (*Cicer arietinum* L.) that belongs to family *Fabaceae*, comprised an important grain legume crop of our country. It is valued immensely as a food, fodder for its role in biological nitrogen fixation and as an industrial raw material. Among the pulse crops, it stands first and has a great biological value. It is cultivated all over the world due to its great nutritional components, especially the protein besides carbohydrates, fats, vitamins and minerals. Among the grain legumes, chickpea has great nutritional value, as it is rich in protein, carbohydrates, vitamins and minerals. It has great biological value (chemical score) about 52-78 %. Chickpea contains about 361 calories/10gm; 20.6 crude protein, 20. % fat; 61.2 % carbohydrates, 190 mg/100gm Ca; 9.8 mg/100gm Fe; 280mg/100gm P; 0.30 mg/100gm vitamin B1; 0.51 mg/100gm vitamin B2 and 2.6 mg/100gm niacin. Improvement of crops in regard to quality and economic traits can be achieved by hybridization and breeding programmes. But it has been thought that the improvement of crops is normally not achieved by hybridization within shortest possible time. This goal is however achievable within shortest period of time of restoring to induced mutations. Kalia *et al*, (1981) induced mutation through the combination treatment of physical and chemical mutagens in chickpea.

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Ayesha Khatoon and Bhalla (1986) studied the cytological effects of single and combination treatments of NMU and magnetic fields on *Cicer arietinum* L. mutagenic studies in chickpea have been carried out by Farook (1978).

MATERIAL AND METHODS

For the present mutation breeding programme, BDN 9-3 and PG-5 cultivars of chickpea were taken for induction of the mutations. Mutations were induced in chickpea by using different concentrations of two chemical mutagens like 0.05%, 0.10% and 0.15% of Ethyl methane sulphonate (EMS) and 0.01%, 0.02% and 0.03% of Sodium Azide (SA). The programme of mutation breeding was carried on research field of department. Pollen sterility was determined from 10 randomly selected plants in the field by staining the pollen grains with 2% acetocarmine. Stained pollen gains were considered as fertile, while empty, partially stained and shriveled ones were considered as sterile. The values were expressed as percentage.

RESULTS

In the present mutation breeding programme, both the cultivars of chickpea demonstrated a more or less similar response as regards pollen sterility with increasing concentrations of a two mutagens. The values ranged from 12.05% to 34.69% in case of EMS treatment in BDN 9-3, while the range was 11.20% to

32.10% in PG-5. In case of SA treatments, the values varied from 8.12% to 21.46% in BDN 9-3 and from 7.05% to 20.11% in PG-5.

Table 1. Effects of mutagens on pollen sterility in M1 generation of chickpea

Variety: BDN 9-3.

Treatment	Concentration %	pollen sterility %	±SE
Control	-	4.10	0.43
	0.05	12.05	0.69
EMS	0.10	23.26	0.77
	0.15	34.69	0.72
	0.01	8.12	0.54
SA	0.02	15.10	0.60
	0.03	21.46	0.63

Table 2. Effects of mutagens on pollen sterility in M1 generation of chickpea

Variety: PG-5.

Treatment	Concentration %	pollen sterility %	±SE
Control	-	4.05	0.54
	0.05	11.20	0.63
EMS	0.10	24.50	0.66
	0.15	32.10	0.60
	0.01	7.05	0.72
SA	0.02	13.10	0.69
	0.03	20.11	0.75

Among the two mutagens both the cultivars indicated better sensitivity towards the EMS treatments.

DISCUSSION

The pollen sterility revealed an increasing trend with increasing concentrations of mutagen in both the cultivars of chickpea. The results in the present study demonstrated that the frequency of pollen sterility was more in EMS treatments in both cultivars of chickpea. Kivi (1962) reported that the sterility in M2 generation is the first sign of genetic effectiveness of the mutagenic treatments. Konzak *et al.* (1961), Sparrow and Woodwell (1962), Gaul *et al.* (1966), Sudhakaran (1961) and Bhairawa Murthy and Venkatramana (1977), stated that pollen sterility induced by mutagens have been mainly due to chromosomal abnormalities. They advocated that ionizing radiations caused chromosomal rearrangements leading to sterility. Induction of pollen sterility through chemical mutagens has been reported by Gohal *et al,* (1972), Kothkar (1978), More (1992), Rayyan (1995), And Kulthe (2003) in different plant systems.

Pollen sterility induced by ionizing relations also has been reported by many researchers like Lindstrom (1933) in tomato; Morris (1952) in maize, Deshpande (1980) in *momordica charantia*, Kothekar and Dnyansagar (1985) in *solanum nigrum*. According to Nilan *et al.* (1964), gross injury due to gene controlled biochemical processes or acute chromosomal aberration or both may be the reason for pollen sterility. Wanjari and Kutarekar (1977) stated that the major cryptic changes in meiosis due to mutagenic treatments can be implicated for pollen sterility. According to Sato and Gaul (1967), the radiation induced sterility in M1 might be due to the detectable chromosomal aberration cryptic deficiencies, while the sterility induced by EMS might be due to cryptic deficiencies and specific gene mutations. They have classified the pollen sterility induced by EMS into three categories namely, 1) chromosomal 2) genic and 3) purely physiological. Kaul (1970) has attributed the pollen sterility in *Tabernaemomtana cornaria* to the difference in environmental factors like photoperiod and temperature. Sudhakaran (1961) has concluded that the pollen sterility might represent the cumulative result of aberrant meiotic stages as well as physiological and genetic damage induced by breakage of chromosome through formation of antimetabolic agents in the cells. According to Sparrow (1951) the mutagenic treatment reduced the reproductive capacity causing severe stunting or inhibition of growth, sterile flowers, abortive pollens or embryo etc. these may be the consequences of chromosomal / gene mutations, cytoplasmic mutations and physiological effects which might together contribute to pollen sterility. It indicated various reasons like poor growth, chlorophyll deficiencies and chromosomal abnormalities etc. for enhanced pollen sterility.

REFERENCES

Ayesha Khatoon and Bhalla J.K. 1986. Cytological effects of single and combination treatments of NMU and magnetic fields on *Cicer arietinum* L. perspectives on cytology and genetics, 5: 433-439. Edt. By Manmo G.K. and Umakant sinha.

Bhairava Murthy, S. and Venkatraman, 1977. Effect of gamma ray on groundnut Curr.Sci.46: 45-46.

Deshpande, N.M. 1980. The effect of gamma rays and chemical mutagens a in Momordica charantia L. Ph. D. Thesis, University of Nagpur.

Farook, S.A.F. 1978. Mutagenic studies in *Cicer arietinum* L. Ph.D. Thesis, Osmania University Hyderabad.

Gaul, H., Ulonska, E. and Sato, M. 1966. EMS induced genetic variability in barley: "The problem of EMS-induced sterility, a method to increase the efficiency of EMS treatment", In: mutations in plant breeding" IAEA, Vienna, pp.63-64.

Gohal, M.S., Kalia, H.R., Dhillon, H.S. and Negi, K.S. 1972. effects of ethyl methansulphonate on the mutation spectrum in guar. Indian G. Heredity 2: 51-54.

Kalia, C.S., Singh, M.P. and Kundalia, S.K. 1981. Induced genetic variability in Bengal gram, cicer arietinum L. *J. Cytol. Genet*. 16: 155-162.

Kaul, C.L. 1970. Investigations into causes of sterility-II. *Tabernaemontana cornavia* wild. Cytologia, 51: 41-46.

Kivi, E. I. 1962. On sterility and other injuries in *Melandrium* irradiation with X-ray and gamma rays. *Ann. Acad. Sci. Enn. Ser.* A, IV, 56: 1-56.

Konzak, C. F., Nilan, R. A., Legualt, R.R. and Heiner, R.E. 1961. modification of induced genetic damage in seeds. In: symp, On effects of radiation on seeds, IAEA. *Karlsruhe*: 155-169.

Kothekar, V. S. 1978. Mutational studies in *Solanum nigrum* L. Ph.D. Thesis, University of Nagpur.

Kothekar, V. S. and Dnyansagar, V. R. 1985. Polyploidy and sensitivity to radiations in *Solanum nigrum* L. *J. Cytol. Genet*. 20: 79-88.

Kulthe, M.P. 2003. Induced mutational and biochemical studies in winged bean (psophophocarpous tetragnlobus L.

DC.). Ph.D. Thesis Dr. Babasaheb Ambedkar Marathwada University Aurangabad.

Lindstrom, E. W. 1933. Radium induced variations in the tomoto. *J. Hered.,* 24: 128-137.

More, A. D. 1992. Cytogenetical studies in *Medicago sativa* L. Ph. D. Thesis, Marathwada University, Aurangabad, India.

Morris, R. 1952. Transmitted pollen and chromosomal aberrations induced in maize by tassel exposure in a nuclear reactor. *Amer. J. Bot*., 39: 452-457.

Nilan, R. A., Konzak, C.F.., Heiner, R.E. and Froese-Gertzen, F.E. 1964. chemical mutagenesis in barley. Proc. Inter. Barley genetics Symp. Wageningen: 35-54.

Rayyan Asra, 1995. mutagenesis and tissue culture studies in *vigna mungo* L. Hepper. Ph.D. Thesis, Osmania University, Hyderabad.

Sato, L. and Gaul, H. 1967. Effect of ethyl methanesulfonate on fertility in barley, *Rad Bot.,* 7: 7-14.

Sparrow, A. H. 1961. Types of ionizing radiations and their cytogenetic effects. Mutations and plant breeding. NAS-NRC, 891: 55-119.

Sparrow, A. H. and Woodwell, G. M. 1962. Predication of the sensitivity of plants to chronic gamma irradiation. *Rad. Bot*., 2: 9-26.

Sudhakaran, I. V. 1961. Meiotic abnormalities induced by gamma rays in *Vinca rosea*. Linn. *Cytologia*. 36: 67-79.

Wanjari, K. B. and Kutarekar, D. R. 1977. Study of M_1 parameters in different treatments of gamma rays and chemical mutagens in Sorghum. *J. Cytol. Genet*., 12: 55-61.

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