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Effect of radiomimetic agents on two varieties of *Trigonella* with emphasis on plant height and pod numbers

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ABSTRACT

The radiomimetic agents like, EMS (Ethyl Methane Sulphonate), MMS (Methyl Methane Sulphonate) and MES (Methyl Ethane Sulphonate) induce plant height and number of pods per plant in two varieties of *Trigonella foenum graecum* L. *i.e.*, Desi methi and Kasuri methi. Plant height at maturity increases by the treatment of 0.3% MMS in Desi and 0.1%MES in Kasuri methi. Number of pods per plant observed under the treatment of 0.3% EMS and 0.3% MMS in Desi methi and Kasuri methi, respectively. The mutants obtained from the treatments 0.3% MMS for height, 0.3% EMS for number of pods per plant in Desi methi and treatments 0.1% MES for height, 0.3% MMS for number of pods per plant in Kasuri methi give more yield as compared to control plants.

Keywords: *Trigonella*, EMS, MMS, MES, plants

INTRODUCTION

Two varieties of *Trigonella foenum-graecum* L. *i.e.* Desi methi and Kasuri methi are major crops in Central India. Radiomimetic agents have been introduced into plant breeding proving to be most effective in the development of high yielding crop cultivars. These agents modify bases or phosphates by alkylating them. In *Trigonella foenum graecum* L. Raghuvanshi and Singh (1974), studied the mutagenic effect of colchicines and gamma rays. Laxmi *et al*. (1983), studied a green seed coat colour of mutant in *Trigonella foenum-graecum* L., followed with treatment of 0.6% MMS. Jain and Agrawal (1987) treated the seeds of *Trigonella corniculata* and *Trigonella foenum graecum* L. with different concentration of EMS, MMS and SA (NaN_3) separately to study the effect on the level of ascorbic acid. Devi and Reddy (1990) studied sensitivity to chemical mutagens like, ethyl methane sulphonate (EMS), diethyl sulphonate (DES) and ethylene imine (EI) in *Trigonella foenum-graecum* L. Maximum percentage of seed germination was obtained at 1 and 10 ppm, 0.5 and 1 ppm IBA, 0.5 ppm NAA and 10 ppm GA_3. Lower doses of IAA (0.5 and 1 ppm) promoted shooting. Higher doses of GA_3 *i.e.*, 50 and 100 ppm significantly improved shooting. IAA induced maximum rooting while GA_3 induced maximum shooting. They also conclude that inorganic macronutrients (KNO_3 and NH_4NO_3) also increase growth and productivity of methi Gupta and Kumar (2003). A field experiment was conducted on loamy sand soil to study the effect of iron, molybdenum and *Rhizobium* inoculation of fenugreek (*Trigonella foenum-graecum* L.). Iron at 0.5 kg/ha and seed inoculation with *Rhizobium* significantly increased plant height, dry matter accumulation, metre row length, branches per plant, number and dry weight of root nodules per plant, pods per plant, straw and biological yields. Seed pod and test weight were also significantly higher with *Rhizobium* inoculation over no inoculation, Kumawat *et al*. (2003). The potential of chemical mutagens for creation of useful mutations in fenugreek quality attributes is yet to be further evaluated. The present study was aimed to explore the utility of EMS, MMS and MES in fenugreek genetic improvement based on analysis of the quality of several advanced breeding lines.

MATERIALS AND METHODS

Two varieties of *Trigonella foenum-graecum* L. *i.e.* Desi methi and Kasuri methi cultivated in Central India were utilized for the present study. The seeds presoaked in distilled water

for 12 hrs were selected for the study, and treated with freshly prepared aqueous solution of different concentrations of radiomimetic agents, EMS (Ethyl methane sulphonate), MMS (Methyl methane sulphonate and MES (Methyl ethane sulphonate) for 4 hrs. Intermittent shaking was done throughout the treatment. After the treatment, seeds thoroughly washed in running water for 15 minutes before sowing. The seeds were sown in randomized block design (RBD) at Safia Science College, Bhopal.

RESULTS AND DISCUSSION

Plant height

The data recorded on plant height of variety Desi methi at maturity with the treatment of three radiomimetic agents were given in (Table 1; Fig. 1). Mean plant height increased due to all the three treatments. The plant height ranged 22.0-37.0cm in control with mean height 25.7 ± 1.5cm, while increase height range 17.3-32.8cm with mean height 30.8 ± 1.7cm. In all the treatments of EMS, MMS and MES, a significant increase of height was observed (Table 1), which is also evident from the SD, CV and CD, analysis. In variety Kasuri methi effect of radiomimetic treatments showed highest plant height which range between 25-39cm with mean height 33.7 ± 1.7cm in comparison of control ranges 24-40 with mean height 35.5 ± 1.5cm. The plant height significantly increased under 0.2%, 0.3% of EMS, and 0.1%, 0.2% of MES, while in remaining all the treatments decrease in the mean height of plants was observed in comparison to control (Table 2; Fig. 2).

Number of pods per plant

Highest number of pods per plant in variety Desi methi was observed under 0.3% MMS treatment range between a 9-26, with mean 18.9 ± 1.1 in comparison of control where this parameter range between 13-23, with mean 16.2 ± 0.72. In all the treatments mean value increased except 0.1% MES, while 16.3 ± 1.2 more or less equal to control. SD, CV and CD analysis indicate that the effect of radiomimetic agents enhanced these parameters (Table 3; Fig. 3). In variety Kasuri methi, number of pods per plant was ranged between 10-19 where mean 17.34 ± 1.4, which was highest under 0.3% MMS, in comparison of control ranged between 12-20, mean value 14.98 ± 1.0. In this variety also the number of pods per plant significantly increases under all the treatments of three radiomimetic agents. The results were tested by using statistical analysis *i.e.* SD, CV and CD (Table 4; Fig. 4).

As per the results obtained from the statistical analysis it seems that all the treatments increase plant height and number of pods per plants. Same results were shown by Bandhopadhyay and Bose (1983) in urdbean. A linear dependency of seedling height on the dosage of physical and chemical mutagens have been reported by Mikaelsen *et al.* (1968) in rice; Siddiq and Swaminathan (1968) in *Oryza sativa*; Ando (1970) in rice; Katoch *et al.* (1992) in rice; Wang *et al.* (1995) in rice. In case of number of pods per plants same types of observation have been reported by Kumar and Gupta (2007) in *Nigella sativa.*

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Table 1. The effect of various doses of EMS, MMS and MES (Radiomimetic agents) on Plant height in *Trigonella foenum-graecum* L. (Desi methi) in M_1 generation

S. No.	Radiomimetic agents	Doses (%)	Plant Height Range (cm)	Plant Height Mean ± SE (cm)	SD	CV	CD
1.	—	Control	22.0-37.0	25.72±1.5	4.57	20.12	37.9
2.		0.1	21.1-36.0	27.9 ± 1.3	5.20	19.2	17.8
3.	EMS	0.2	20.2-35.0	29.5 ± 1.7	5.90	21.3	22.4
4.		0.3	18.3-34.0	29.6 ± 1.8	6.20	23.4	28.9
5.		0.1	21.0-35.0	29.9 ± 1.2	5.70	20.4	18.9
6.	MMS	0.2	20.3-34.0	30.8 ± 1.9	5.90	21.6	20.3
7.		0.3	17.3-32.8	33.3 ± 1.7	6.50	24.3	28.7
8.		0.1	21.7-35.5	27.8 ± 1.4	5.30	20.3	19.3
9.	MES	0.2	20.8-34.9	30.7 ± 1.6	5.40	22.3	24.3
10.		0.3	19.2-35.0	32.2 ± 1.8	6.20	24.3	27.3

Table 2 The effect of various doses of EMS, MMS and MES (Radiomimetic agents) on Plant height in *Trigonella foenum-graecum* L. (Kasuri methi) in M_1 generation

S. No.	Radiomimetic agents	Doses (%)	Plant Height Range (cm)	Plant Height Mean ± SE (cm)	SD	CV	CD
1.	—	Control	24-40	35.5 ± 1.5	5.0	15.2	40.6
2.		0.1	25-42	34.8 ± 1.4	4.9	17.3	41.1
3.	EMS	0.2	24-40	36.3 ± 1.6	4.7	18.9	43.2
4.		0.3	20-41	38.2 ± 1.7	4.7	19.7	43.7
5.		0.1	24-38	33.2 ± 1.8	4.9	17.3	43.9
6.	MMS	0.2	24-40	32.1 ± 1.5	4.9	18.4	44.1
7.		0.3	24-36	32.0 ± 1.8	4.8	20.5	44.5
8.		0.1	25-39	38.7 ± 1.9	5.0	17.3	41.0
9.	MES	0.2	24-43	37.3 ± 2.0	4.8	18.3	41.7
10.		0.3	24-41	33.4 ± 1.8	4.7	19.0	42.1

Table 3. The effect of various doses of EMS, MMS and MES (Radiomimetic agents) on Number of pods per plant in *Trigonella foenum-graecum* L. (Desi methi) in M_1 generation

S. No.	Radiomimetic agents	Doses (%)	Number of Pods per Plant				
			Range(cm)	Mean ± SE	SD	CV	CD
1.	—	Control	13-23	16.2 ± 0.72	3.24	14.83	11.45
2.		0.1	12-24	16.6 ± 1.2	3.11	14.23	10.87
3.	EMS	0.2	10-22	18.2 ± 1.3	2.98	12.50	10.01
4.		0.3	10-24	18.3 ± 1.0	2.87	11.20	9.92
5.		0.1	12-20	16.7 ± 1.2	3.10	13.90	10.14
6.	MMS	0.2	10-24	18.2 ± 1.3	2.89	12.78	10.10
7.		0.3	09-26	18.9 ± 1.1	2.81	12.00	9.27
8.		0.1	12-23	16.3 ± 1.2	3.20	14.10	10.89
9.	MES	0.2	11-22	18.1 ± 0.1	2.92	13.40	10.82
10.		0.3	10-22	18.8 ± 1.2	2.86	12.10	9.98

Table 4. The effect of various doses of EMS, MMS and MES (Radiomimetic agents) on Number of pods per plant in *Trigonella foenum-graecum* L. (Kasuri methi) in M_1 generation

S. No.	Radiomimetic agents	Doses (%)	Number of Pods per Plant				
			Range (cm)	Mean ± SE	SD	CV	CD
1.	—	Control	12-20	14.98 ± 1.0	3.42	14.24	11.79
2.		0.1	11-22	15.12 ± 1.2	3.30	14.12	11.10
3.	EMS	0.2	10-23	16.21 ± 1.5	3.10	13.89	10.92
4.		0.3	10-24	16.89 ± 1.4	2.98	13.24	10.24
5		0.1	12-22	16.24 ± 1.3	3.16	14.01	11.00
6.	MMS	0.2	10-23	16.64 ± 1.2	3.00	13.92	10.90
7.		0.3	10-19	17.34 ± 1.4	2.96	13.21	10.21
8.		0.1	12-22	16.92 ± 1.1	3.14	14.26	11.14
9.	MES	0.2	11-21	16.87 ± 0.9	2.99	13.04	11.09
10.		0.3	11-23	17.10 ± 1.1	2.89	12.96	10.72

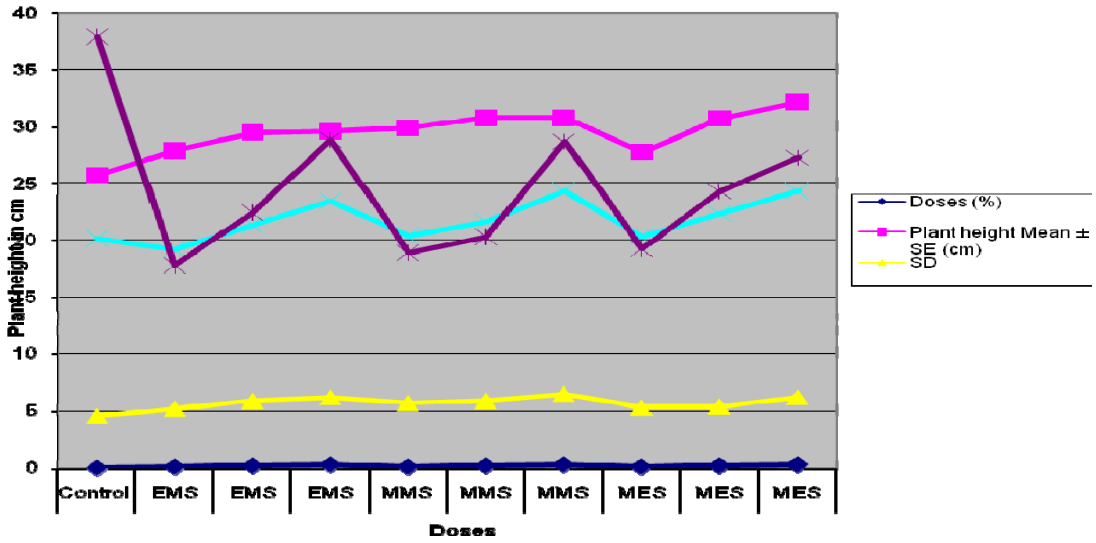

Fig.1 Plant height in *Trigonella foenum-graecum* L. (Desi methi)

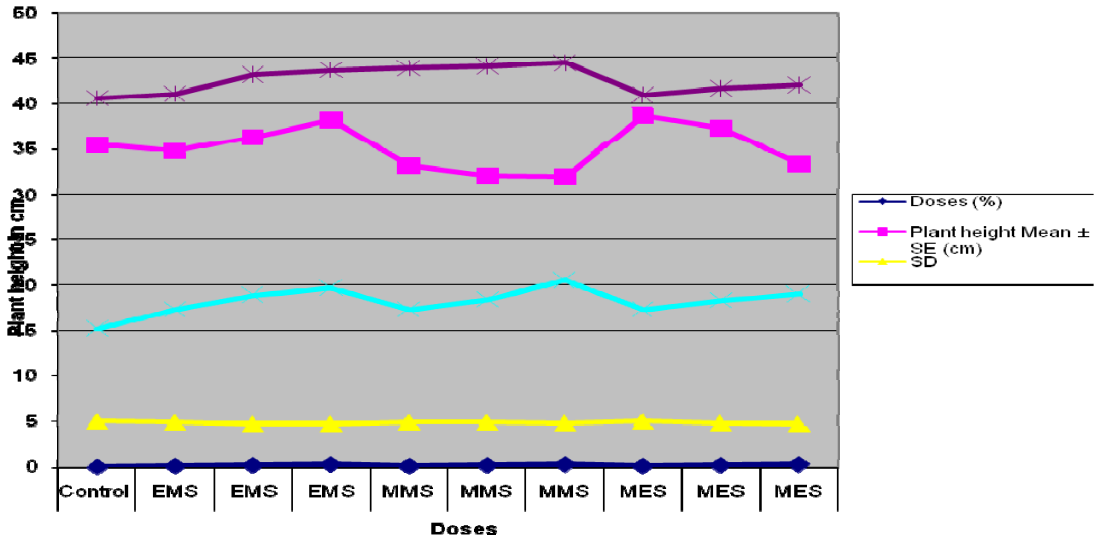

Fig.2 Plant height in *Trigonella foenum-graecum* L. (Kasuri methi)

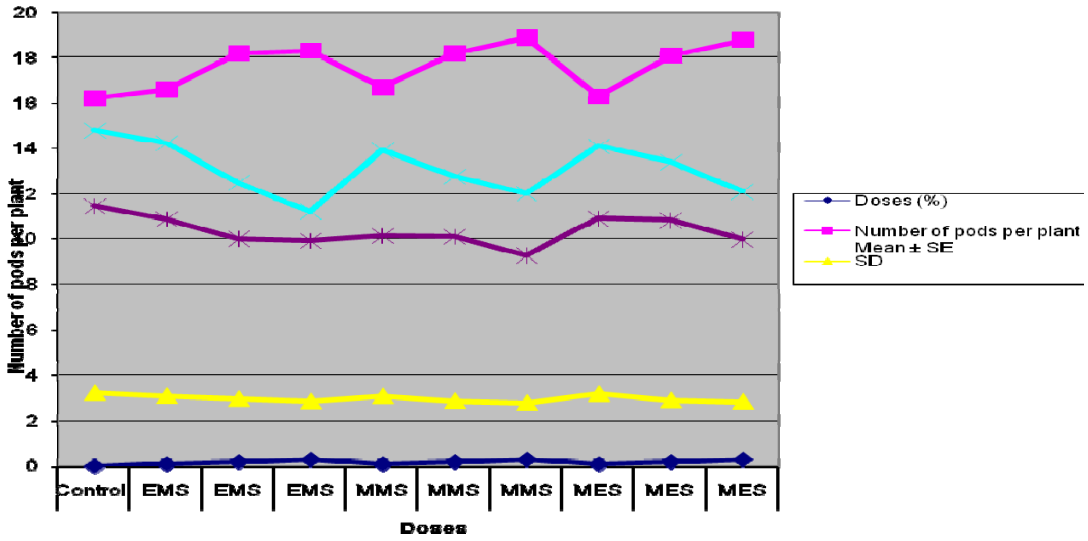

Fig. 3 Number of pods per plant in *Trigonella foenum-graecum* L. (Desi methi)

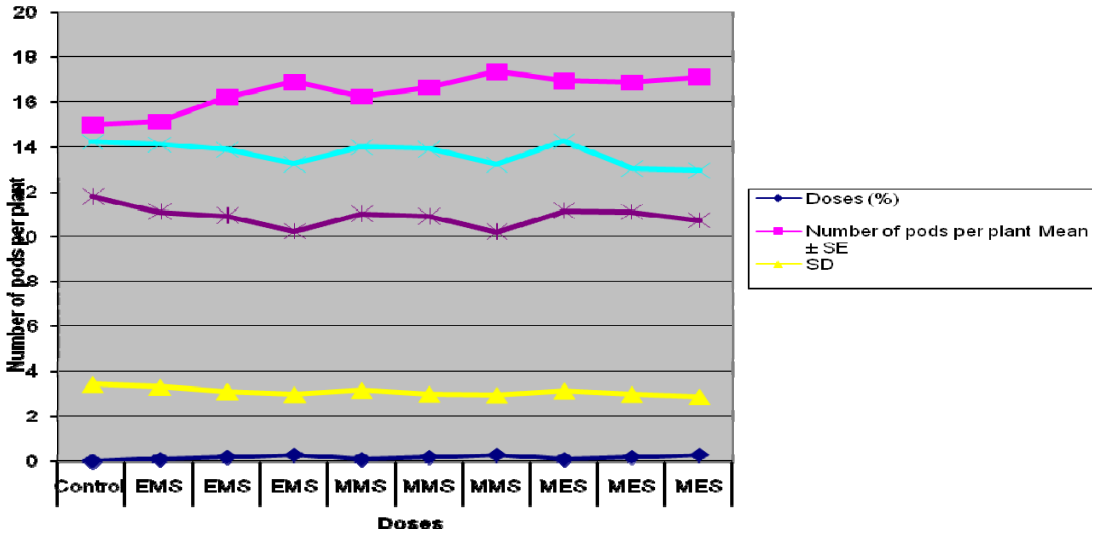

Fig. 4 Number of pods per plant in *Trigonella foenum-graecum* L. (Kasuri methi)