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Investigating The Impact Of Ethyl Methane Sulphonate (EMS) On Seed Sprouting And Plant Viability In *Brassica Campestris*.

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ABSTRACT

Dry seeds of Brassica campestris (2n=20) were irradiated with different doses (control, 0.05%, 0.10%, 0.15%, 0.20%, 0.25%) of Ethyl Methane Sulphonate (EMS). The aim of the study is to determine the induction of some physiological variations like seed germination and plant survival rate. Maximum reduction of seed germination was observed at 0.20% and 0.25%. Result showed that the Ethyl Methane Sulphonate (EMS) affected germination and plant survival rate. On 8th DAG 99% for control, 98% for 0.05% EMS, 92% for 0.10% EMS, 92% for 0.15% EMS, 89% for 0.20% EMS and lowest 85% for 0.25% EMS.No stimulating effect of Ethyl Methane Sulphonate (EMS) was observed at any dose.

Keywords: EMS (Ethyl Methane Sulphonate), Brassicaceae, Germination, Survival rate.

INTRODUCTION

Brassica is a genus of plants in the cabbage and mustard family (Brassicaceae). The genus is native to Western Europe, the Mediterranean and temperate regions of Asia. Many wild species grow as weeds, especially in North America, South America, and Australia. The members of the genus are informally known as cruciferous vegetables, cabbages, or mustard plants. The genus Brassica is known for its important agricultural and horticultural crops and also includes a number of weeds. Brassica plants have been the subject of much scientific interest for their agricultural and economic importance. The flowers, seeds, stalks, and tender leaves of many species of Brassica can be eaten raw or cooked. Brassica is the second largest oilseed crop after soybean (Glycine max) in world oilseed production. Of the 37 species in the Brassica genus, the 4 species are most widely cultivated species for oilseed and vegetables. Oleiferous brassicas are generally derived from two species, B. napus L. and B. campestris L. Brassica campestris is also referred to by such names as toria, sarson, summer turnip rape, and Polish rape. All rapeseed-contributing cultivated Brassica spp. are highly polymorphic including oilseed crops, root crops, and vegetables such as Chinese cabbage, broccoli, and Brussels sprouts. However, a few of them are cultivated

as salad, vegetable, and condiment crops as well. These Brassica species are cultivated to produce vegetables, vegetable oils, condiments, and fodders. They contribute to ~10% of the world's vegetable crop production and 12% of edible oil supplies . Brassica campestris, is one important crop which offers an exciting opportunity for quality improvement.

Ethyl methane sulfonate (EMS) is one of the most potent mutagenic and carcinogenic compounds. EMS is currently the most widely used chemical mutagen and is highly effective . The mutagenicity of this substance depends on factors such as plant genus and species, dose and time of use, and physiological conditions for these reasons, it is very important to be aware of the effects of EMS on different plants . In this experiment Ethyl methane sulphonate (EMS) dose was given to mustard seeds to study the growth rate and survival rate at various concentrations of EMS. Firstly, mustard seeds were soaked for a time period of twenty-four hours in a solution of EMS of concentrations such as control, 0.05%, 0.10%, 0.15%, 0.20%, 0.25% respectively.

MATERIALS AND METHODS

Material

Dry seeds of Brassica campestris was used as study material collected from horticulture department Sangam University.

Method

Physiologically similar seeds of *Brassica campestris* NL-360 were exposed to a chemical mutagen ethyl methane sulphonate (EMS). Seeds were treated with EMS concentrations of 0 (control), 0.05%, 0.10%, 0.15%, 0.20%, 0.25% for 24Hrs. After completion of treatment the seeds were thoroughly washed in running water 2-3 times to remove the excess mutagen stick to the seed coat. (4) 50 percent seeds of each dose along with control were kept in petridishes on blotting paper in triplicates. The emergence of radical was taken as indication for germination of seed. Total Germination percentage was calculated after eight days by counting the germinated seeds and total number of seeds sown. The experiment was established at the field of Basic and Applied Sciences, Sangam University, Bhilwara (Rajasthan). Germination percentage was recorded for each dose at 10 DAG, 20 DAG and 30 DAG.

Fig. A- Petridish showing seed germination at different doses of EMS

Fig. B- Plant survival rate at various doses of EMS

RESULT AND DISCUSSION

Effect on plant germination

The results of experiments on the effects of Ethyl Methane Sulphonate (EMS) on the seed germination of Brassica campestris is given in table- 1. It was shown that the exposure of seeds to various EMS dose such as 0.05%, 0.10%, 0.15%, 0.20% and 0.25% as compared with the control.

Data of seed germination were recorded on 0-8 DAG. It was observed that germination percentage decrease with increase of EMS doses. The percentage of germination of non- irradiated control group was 99% at 8th day, while for the treated group was 98% for 0.05% EMS, 92% for 0.10% EMS, 92% for 0.15% EMS, 89% for 0.20% and 85% for 0.25% EMS are decreased with increased intensity of doses.

Effect on plant survival

Table-2 showed the effect of Ethyl Methane Sulphonate (EMS) on plant survival of *Brassica campestris*. Survival percentage was observed at 30 DAG in treated plants as well as control. In present investigation observed that the survival percentage decreased when doses increased. When frequency of chromosomal damage increased with increased doses of radiations may be responsible for less ability for the seeds to germinate and also reduction in plant survival and growth

Table 1:

Effect of various doses of EMS on percentage of seed germination on 0-8 DAG.

Sample EMS Dose	Germination Successful %							
	1st DAG	2nd DAG	3rd DAG	4th DAG	5th DAG	6th DAG	7th DAG	8th DAG
Control	71	78	94	97	98	99	99	99
0.05%	71	73	96	97	98	98	98	98
0.10%	75	83	87	89	92	92	92	92
0.15%	62	74	91	92	92	92	92	92
0.20%	63	73	87	88	89	89	89	89
0.25%	45	53	78	85	85	85	85	85

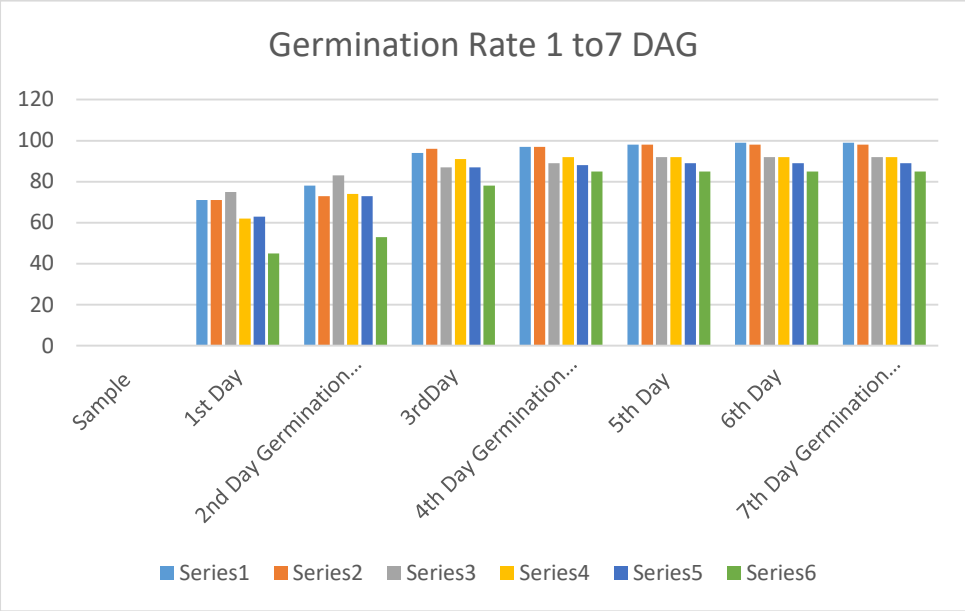

Table 2:

Effect of various doses of EMS on Plant survival % at 10th, 20th and 30th DAG.

Sample EMS Dose	Survival rate on 10th DAG	Survival rate on 20th DAG	Survival rate on 30th DAG
Control	38	49	39
0.05%	58	49	29
0.10%	44	34	32
0.15%	36	41	36
0.20%	42	46	38
0.25%	68	48	41

CONCLUSION

Based on the experimental data collected at 10, 20, and 30 days after germination, it is evident that the application of EMS (Ethyl Methanesulfonate) doses had varying effects on the germination rates of the tested samples .At 10 days after germination, the control group exhibited a germination rate of 38%. However, when subjected to EMS doses of 0.05% and 0.25%, the germination rates increased to 58% and 68%, respectively. This indicates that higher doses of EMS positively influenced germination rates within the initial phase of the experiment. Contrastingly, at 20 days after germination, the control group demonstrated a higher germination rate of 49% compared to the EMS-treated groups, where the rates were 48% for both 0.05% and 0.25% doses. This suggests that the EMS doses did not significantly enhance germination rates compared to the control group at this stage of growth. Further observations at 30 days

after germination revealed a decline in the control group's germination rate to 39%. Interestingly, the application of EMS at a dose of 0.05% did not alter the germination rate, remaining at 39%. However, a lower dose of 0.02% EMS resulted in a slight increase in the germination rate to 41%.

In conclusion, the research findings indicate that the effect of EMS doses on germination rates is dependent on the dosage and the stage of growth. While higher doses initially stimulated germination, lower doses and later stages of growth showed varied or minimal effects. These results provide valuable insights for further exploration into the optimal application of EMS in promoting crop germination and growth.

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