

Effect of Mutagenic Treatments on Seed Germination, Seedling Growth, and Survival of *Capsicum annuum* L.

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Abstract: *Chili (Capsicum annuum L.) is an economically significant crop valued for its capsaicinoids, carotenoids, and essential vitamins, making it a staple in culinary and medicinal applications. Enhancing yield, nutritional composition, and secondary metabolite content are primary objectives in contemporary breeding programs to maximize crop profitability. The success of such programs relies on genetic diversity, which can be achieved through induced mutations. Chemical mutagens, such as sodium azide (NaN₃), are widely used to induce genetic variability by altering nucleotide sequences and generating novel alleles. This study investigates the effect of sodium azide on seed germination and plant growth in Capsicum annuum. The experiment aims to evaluate morphological variations induced by the mutagen, assess germination rates, and analyze subsequent growth responses*

Keywords: *Capsicum annuum*, Chili, Sodium azide, Germination percentage

I. INTRODUCTION

Capsicum (Capsicum annuum L.), commonly known as bell pepper, sweet pepper, hot pepper, or chili, is a popular vegetable crop. It is consumed in various forms, including as a spice, vegetable, pickle, condiment, and sauce. Internationally, chilies are widely used as a spice and serve as an ingredient in medicines and beverages (Khan et al., 2017).

A mutation is a sudden heritable change in the DNA in a living cell, not caused by genetic segregation or genetic recombination. Mutation breeding is the purposeful application of mutations in plant breeding. Unlike hybridization and selection, mutation breeding has the advantage of improving a defect in an otherwise elite cultivar, without losing its agronomic and quality characteristics.

Sodium azide, a widely used chemical mutagen, plays a crucial role in enhancing agronomic traits in crop plants. It is commonly utilized to develop resistance in vulnerable crops, thereby improving their yield and quality traits against harmful pathogens. Various mutagens are available for crop improvement, each exhibiting distinct effects, which can be either beneficial or detrimental to plant growth and development. (Khan et al., 2009). Varying the concentrations of sodium azide on seed germination, as well as plumule and radicle development, to determine the most effective dose for successful mutagenesis research (Singhet et al., 2022).

II. MATERIALS AND METHODS

Experimental materials:

The present study was carried out on a valuable seed of *Capsicum annuum* L. belonging to family Solanaceae, the seed material was collected from the Agricultural shop (Krushiseva Kendra) Murud (M.S.) India.

Mutagen:

The seeds of *Capsicum annuum* L. were treated with the mutagen sodium azide (SA). The experiment was conducted using six different treatment doses (0.02%, 0.04%, 0.06%, 0.08%, and 0.1%), along with a non-treated control.

Germination percentage:

“Germination Percentage = $\frac{\text{seeds germinated}}{\text{total seeds}} \times 100$ ”

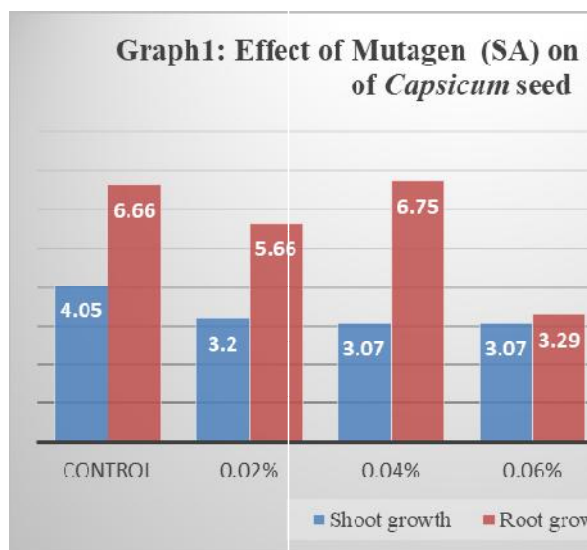


Plant height was measure with the help of measuring scale after 6 days interval of sowing seeds of *Capsicum annum*L.

Plant survival percentage:

After the maturity of *Capsicum annum*L. plants were be counted and survival percentage was calculated.

Mutagenic concentration	Table2: Effect of Mutagen (SA) on shoot and root growth of <i>Capsicum</i> seed							
	Shoot Growth (incm)				Root Growth (incm)			
	1	2	3	Mean	1	2	3	Mean
Control	4	5	5	4.66	8	7	5.5	6.83
	4.5	4	4	4.16	7	5.5	8.5	7
	3	4	3	3.33	7	6	5.5	6.16
0.02%	4	4	2.2	3.4	5	7	6	6
	2	5	3	3.33	3	5.5	8.5	5.66
	2	4	3.5	3.16	3	6	7	5.33
0.04%	3.5	2	4	3.16	8	6.4	8	7.46
	3.5	2.2	3.5	3.06	4.5	6	6.4	5.63
	3	3	3	3	7.5	7	7	7.16
0.06%	4	1.5	2.5	2.66	5	2	3.5	3.5
	3	2	3	2.66	4.5	2.5	4	3.66
	2	1.5	1.5	1.66	3.5	2	3	2.73
0.08%	2.1	1.5	0.5	1.36	3.6	2	1.5	2.36
	2.3	1	1	1.36	4.5	2.5	2	3
	2.5	2.5	0.5	1.83	4.5	3	1.5	3
0.1%	2	3	0.2	1.73	3	4.5	1	2.83
	3.5	2	0.5	2	5	3.5	1.5	3.33
	2.5	2.5	0.6	1.86	3.5	4	1.8	3.1



III. CONCLUSION

Capsicum annuum L. seed treatments with mutagenic concentrations reveal several important findings. This study examined the effects of sodium azide on seed germination, shoot and root growth. The analysis showed that the highest germination rates were observed in the control group, while the lowest germination observed at a 0.1% sodium azide concentration.

Overall, the results suggest that higher concentrations of sodium azide negatively affect germination, as well as shoot and root growth in *Capsicum annuum* L. It was concluded that different doses of sodium azide influence the growth performance of chili. Very low doses of sodium azide may be useful for studying and enhancing the genetic diversity of chili pepper.

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