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Study of mutagenic effect of sodium azide on a germination and growth of brinjal [*Solanum melongena* L. (Solanaceae)]

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Abstract
The study investigates the mutagenic effect of sodium Azide, on a growth and development of *Solanum melongena* L. (eggplant), a widely grown vegetable in tropical and subtropical regions. Eggplant seeds from two varieties treated with mutagenic solution of sodium Azide at concentrations ranging from 0.1M to 0.5M, with control seeds soaked in distilled water. The findings revealed a concentration-dependent reduction in seed germination, plumule and radicle lengths, plant height, and branching. Germination rates decreased as sodium azide concentrations increased, with delayed germination at higher concentrations. Radicle Lenth and Plumule lengths were significantly reduced, especially at concentrations above 0.3M. After 70 and 90 days, growth measurements indicated that variety A showed slightly better tolerance to the mutagen compared to variety B. The study concludes that sodium azide negatively affects key growth parameters in eggplant, limiting its potential use in high concentrations for agronomic trait enhancement.

Keywords: *Solanum melongena* L, sodium azide, growth parameters

Introduction

Solanum melongena L. (egg plant) is belongs to a family solanaceae, commonly known as an egg plant and brinjal. *Solanum melongena* L is used as common vegetable all around the world. It is common in tropical and subtropical area (P. Nisha, *et al*,2009) [2]. In Asia, the area harvested by an eggplant is around a 1,728,691 ha and all over the world is 1,870,728 ha and the production in asia is 47,142,210 ton and all over the world is 50,193,116 ton (Medina *et al*., 2017) [3]. It can be stored up to 2-3 days in room temperature. Eggplants is growing in many countries such as an India China, Bulgaria, many African countries, Italy, France and USA (G. Kalloo,1993) [4].

Flavonoids are also isolated by a *Solanum melongena* L. and it shows potent antioxidant activity (S. Sudheesh *et al*.,1999) [5]. Vit-A, Vit-B, Vit-B3, Vit-B6, Vit-B9, Vit-C and Vit-E are present but Vit- A, Vit-C and Vit –E are present in greater amount (Affiong Edeke *et al*.,2021) [6]. *Solanum melongena* is originated in a india and the fruit colour is a mottled purple or green and the fruit weight is around a 101-102g (Peter M. Hanson *et al*.,2006) [7]. Glutamine amino acid is present in a higher amount followed by a histidine, lysine, and cysteine also the aspartic acid is present but in very small amount (Affiong Edke *et al*.,2021).

Mutation is a change the sequence of DNA of organism (Hugo De Vries). Sodium azide is a chemical mutagen which induced a mutation in organism (Sonavane 2020) [10]. It is used for enhance agronomic trait of a crop plants. Seed coat and the nature mutagen decide the effect of chemical mutation (Salim Khan *et al*.,2009) [21, 25]. Sodium azide mutagen is effective in a seed germination, root length. Shoot length, flowering time, and a fruit size (Adamu *et al*.,2007) [8].

Germination percentage are calculated by using this formula:

$$\frac{\text{Number of total germinated seeds} \times 100}{\text{Total no seed}}$$

Materials and methods

Research was conducted in Botanical Garden of Vidya Pratishthan's Supe ASC college supe Tal-Baramati, Dist-Pune Maharashtra (Lat.18.3326490Long.74.372150).

Source of Seeds: Seeds of Two Verity of Cultivated Brinjal (Variety A-Puneri Kater, Variety B- Panchganga.) were used for the research.

Preparation of Mutagenic Solution: For The experiment standard chemical mutagen such as a sodium Azide were used. Mutagenic solution was prepared in five level of concentration (0.1M,0.2.M,0.3M,0.4M and 0.5M) seeds were exposed in solution for 6 hrs. The seeds were carefully washed with tap water to eliminate any leftover mutagens.

Planting of Seeds: The treated seeds were placed in sterile Petri dishes with filter paper acting as an absorbent to promote germination. The seeds were then left in the Petri dishes for a period of 7 days.

Parameters Measured in the Experiment: Data were recorded on the time taken for the first germination. Germination Percentage, Plumule length in MM, Plant height, Radicle Length, Number of Branches.

Result and discussion

Table 1: Effect of sodium azide on a germination Percentage of seeds of *Solanum melongena* L

Mutagen	Concentrations	Germination Percentage	
		Variety A	Variety B
Sodium Azide	Control	100%	90%
	0.1M	90%	90%
	0.2M	80%	80%
	0.3M	70%	60%
	0.4M	60%	40%
	0.5M	30%	20%

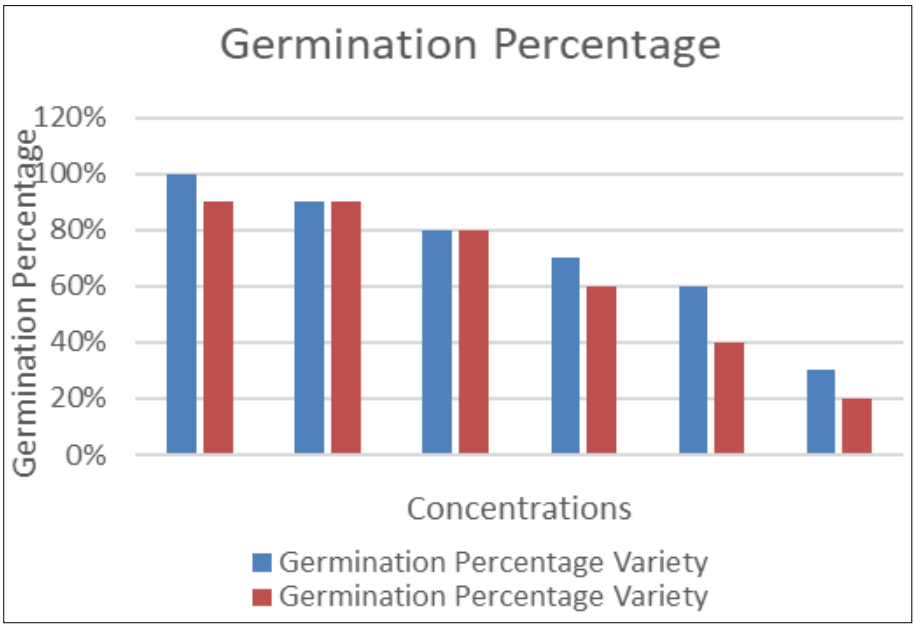

Fig 1: Effect of sodium azide on a germination Percentage of seeds of *Solanum melongena* L

Table 2: Effect of sodium azide on a plumule length (mm) at day 7th

Mutagen	Concentrations	Plumule length in MM	
		Variety A	Variety B
Sodium Azide	Control	21.30	21.20
	0.1M	20.40	19.40
	0.2M	18.50	18.40
	0.3M	0	0
	0.4M	0	0
	0.5M	0	0

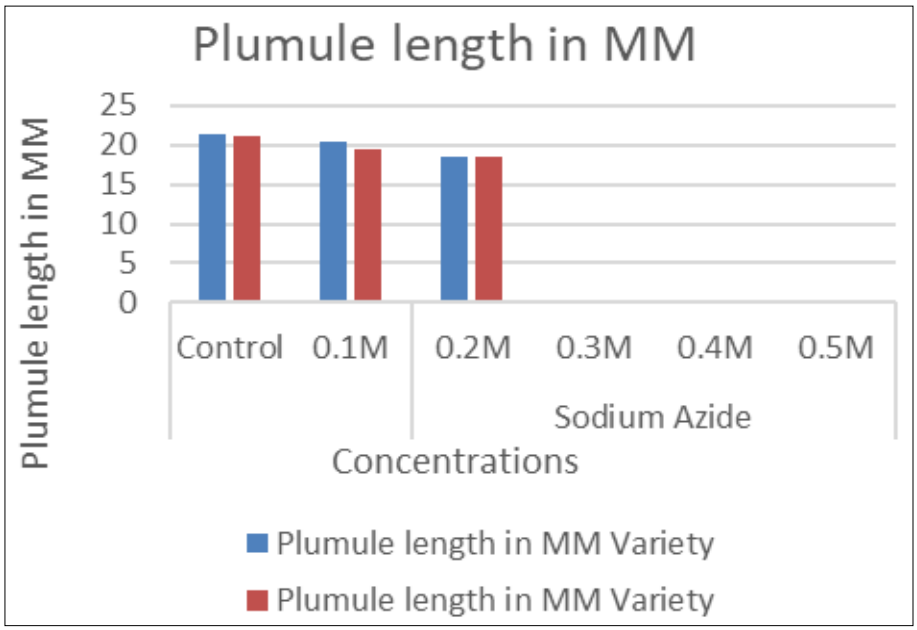

Fig 2: Effect of sodium azide on a plumule length (mm) at day 7th

Table 3: Effect of sodium azide on a radicle length(mm) at day 7th

Mutagen	Concentrations	Radicle Length	
		Variety A	Variety B
Sodium Azide	Control	22.20	21.30
	0.1M	21.40	20.20
	0.2M	20.30	19.80
	0.3M	0	0
	0.4M	0	0
	0.5M	0	0

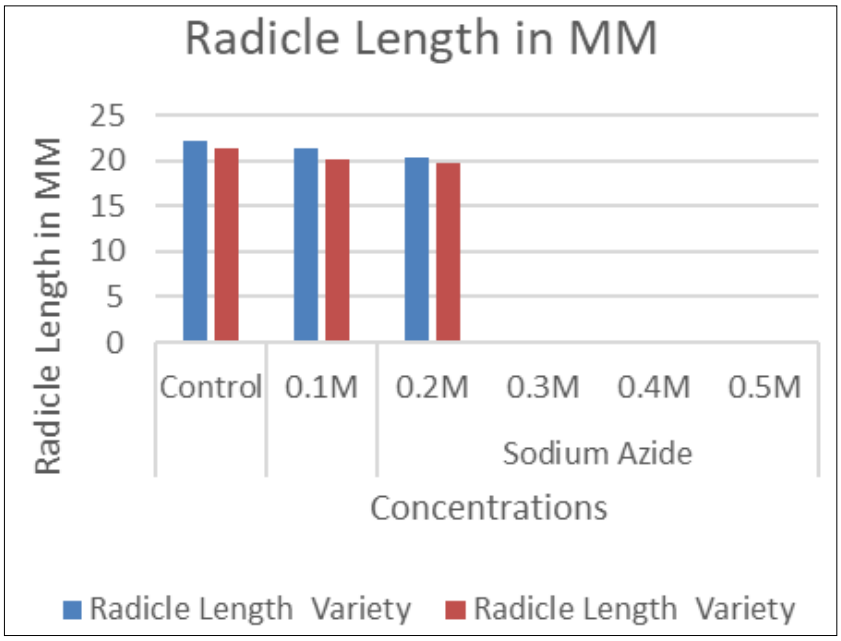

Fig 3: Effect of sodium azide on a radicle length(mm) at day 7th

Table 4: Effect of sodium azide mutagen on number of branches after 60 days

Mutagen	Concentrations	Number of Branches After 60 Days	
		Variety A	Variety B
Sodium Azide	Control	5	5
	0.1M	5	4
	0.2M	4	3
	0.3M	4	3
	0.4M	3	2
	0.5M	3	2

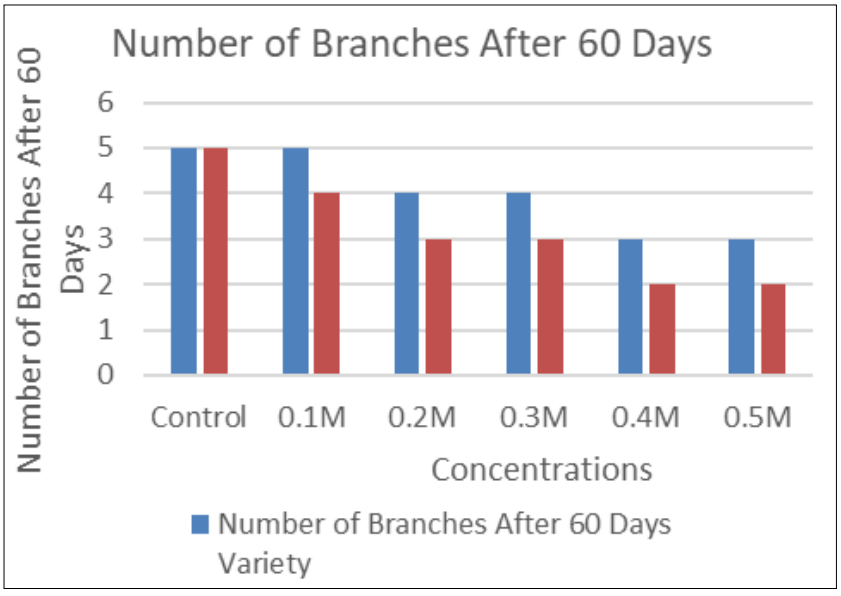

Fig 4: Effect of sodium azide mutagen on number of branches after 60 days

Table 5: Effect of sodium azide on a height of plants (in cm) after 90 days

Mutagen	Concentrations	Plant height after 90 days in cm	
		Variety A	Variety B
Sodium Azide	Control	42.2	40.5
	0.1M	37.3	39.5
	0.2M	32.8	31.8
	0.3M	28.6	28
	0.4M	27.8	25.4
	0.5M	26	23.8

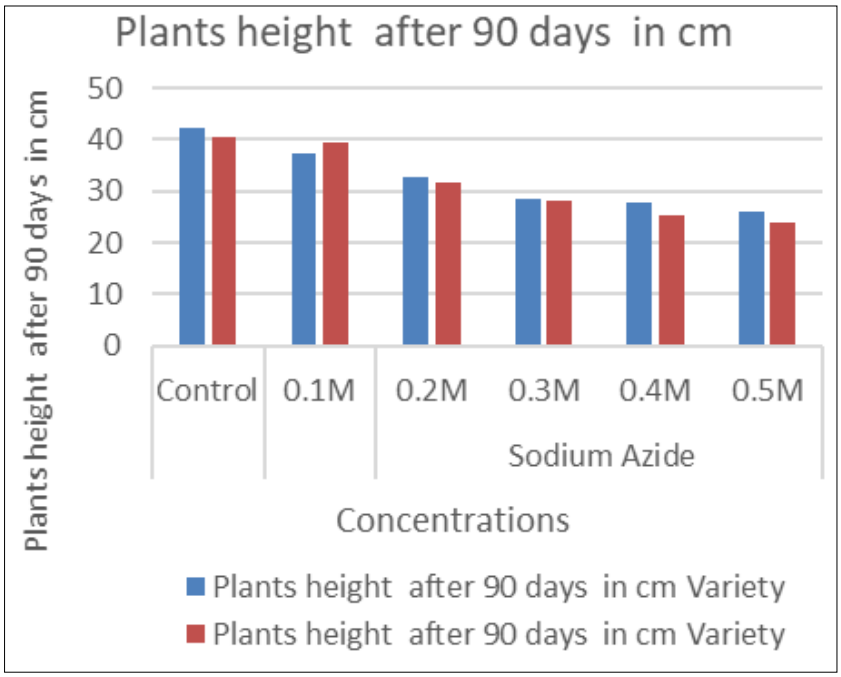

Fig 5: Effect of sodium azide on a height of plants (in cm) after 90 days

Germination percentage of *Solanum melongena* L. seeds are decreased when the concentration of sodium azide is increased. Germination percentage is higher in control seeds and it decreased in concentrating seeds of brinjal. Seeds of variety A and variety B starts germinate in 0.1M concentration after 6 days, in 0.2 M after 7 days, in 0.3 M concentration seed were germinate after 8 days, in 0.4 M germinate after 9 days and in 0.5 M germinate after 10 days was observed.

Plumule and radicle length after the treating seeds with sodium azide was also decresed with increased in concentration. After 7 day the plumule and radicle length was measured then it was observed that radicle length in variety A is along with control 0.1 M and 0.2 M is 22.20mm, 21.40mm and 20.30mm and in 0.3M,0.4 M and 0.5M and in variety B is along with control 0.1M and 0.2 M is a 21.30mm,20.20mm and 19.40mm there is no germination in 0.3M,0.4 M and 0.5M at day 7th. Plumule length along with control,0.1M and 0.2 M is in variety A is 21.30mm, 20.40mm and 18.50mm and in case of variety B plumule lenghth along with control, 0.1M and 0.2 M is 21.20mm, 19.40mm and 18.60mm.

No. of branches were counted after the 60 days; the number of branching are also decreased with increasing the concentration of sodium azide mutagen. Height of the plant is also measured in cm after 90 days but height is also decreased by incresing the concentration but in case of variety A height and no of branches are more as compared to variety B in all the concentrations.

Conclusion

From the study, the chemical mutagen sodium azide treatment decreases the germination percentage, plumule length, radicle length, number of branches and height of the plant with incresed in the concentration.

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