RESEARCH ARTICLE

Effect of Gamma radiation on Seed Germination, Seedling Height and Seedling Injury in *Withania somnifera*, (L.) Dunal.

Bhosale RS*and More AD[1]

Post Graduate Research Station, Department of Botany, Fergusson College, Savitribai Phule Pune University, Pune – 04, (M.S.).

***Corresponding author:** Bhosale Rahul Suresh, 198 School Mohalla, Mahabaleshwar, Dist- Satara- 412 806 (MS)*
Email: rahul.bhosale3@gmail.com

Manuscript details:

Received: 28 June, 2014
Revised : 01 August, 2014
Revised received: 08 August, 2014
Accepted: 07 September, 2014
Published: 30 September, 2014.

Editor: Dr. Arvind Chavhan

Citation this article as:
Bhosale RS and More AD (2014) Effect of Gamma radiation on Seed Germination, Seedling Height and Seedling Injury in *Withania somnifera*, (L.) Dunal. *Int. J. of Life Sciences*, 2(3): 226-228.

ABSTRACT

The seeds of *Withania somnifera*, Dunal. Var. nagori were selected and used for following research. The healthy, dry and uniform seeds were treated with different doses of Gamma rays like 10kR, 20kR, 30kR and 40kR. Germination parameters like seed germination percentage, seedling height and seedling injury were studied. Germination percentage in control was 82 %. Germination percentage revealed gradual decrease from lower doses to higher doses in given treatments of Gamma rays. In case of seedling height there was dose dependent deduction after treatment of Gamma rays. In Gamma rays treated seeds seedling height was in the range 1.853 cm to 1.5743 cm and seedling injury varied from 2.4 % to 8.8%. In conclusion it can be said that use of chemical mutagens has succeeded in inducing M1 Biological parameters.

Key words: Ashwagandha, Mutation, seedling injury, Gamma ray.

INTRODUCTION

Withania somnifera Dunal or Ashwagandha is widely used in Ayurveda which is traditional medical system of India. It is an ingredient in many formulations prescribed for a variety of musculoskeletal conditions (e.g., arthritis, rheumatism), and as a general tonic to increase energy, improve overall health and longevity, and prevent disease in athletes. Many pharmacological studies have been conducted to investigate the properties of Ashwagandha in an attempt to authenticate its use as a multi-purpose medicinal agent (Bhosale and More, 2013a). Its importance and for development of interest amongst cultivators it is important to develop better varieties. Therefore mutagenesis has been carried out in recent paper. Any mutagen that induces single base pair mutations or small deletions/insertions is effective for genetic modifications (Bhosale and More, 2013b). Gamma radiation is the mutagen we have employed for the following reasons. Its effects have been well studied and it is known to generate point mutations. These mutations may lead to a complete or partial loss of gene function or,

less frequently, to some other alteration of normal gene function. Mutations are randomly distributed in the genome. A high degree of mutation saturation can be achieved with a mutagen like Gamma rays that does not cause a lot of collateral DNA damage (Bhosale and More, 2013b).

MATERIALS AND METHODS

The seeds material of *Withania somnifera* (L.) Dunal were collected from Mahatma Phule Agriculture University, Rahuri.

Mutagen used: (Physical) Gamma radiation.

Mode of treatment with mutagenic agents: The dose of Gamma rays were decided according to LD^{50} treatments.

Treatments: Dry seed material of *Withania somnifera* Dunal. were exposed to different doses of Gamma rays obtained from Co^{60}. Facility was provided by Department of Nuclear Chemistry, Department of Chemistry, University of Pune.

Seeds germination percentage: From each treatment 100 seeds material were kept in tray with sterile soil. After one week germination of seeds germination percentage was recorded.

Seedling height and seedling injury: The seedling height was recorded at the end of first week and the percentage seedling injury was calculated from the data of seedling height.

RESULTS AND DISCUSSION

1. Germination Percentage (Table 1)

In control maximum number of seeds germinated after one week of sowing. The percentage of germination was 82. Germination percentage showed gradual decrease from lower to higher doses of Gamma radiations which were 92%, 81%, 75%, and 68% for 10kR, 20kR, 30kR and 40kR respectively. In the present investigation, the germination percentage was decreased with increase in dose of Gamma rays. Relationship between mutagenic dose and germination percentage was inversely proportional. Same result has been recorded by Saba and Mirza (2002) in *Lycopersicon esculentum* L., (Ojiewo *et al.,* 2005) in *Solanum nigrum* L. ssp. Villosum., (Aruna *et al.* 2010) in *Solanum melongena* L., in Withania by Iqbal and Datta (2006) and Iqbal and Datta (2007b)., (Watanabe *et al.,* 2007) in *Solanum lycopersicum* L., Sri Devi and Mullainathan (2012) in *Capsicum annuum* L., (Bharathi *et al*., 2013) in Withania, (Sikder *et al.,* 2013) in *Solanum lycopersicum* L. and (Bhosale and More, 2014) in *Coriandrum sativum* L. (Sikder *et al.,* 2013) and in Isabgol (*Plantago ovate,* Forsk) Mishra and Singh (2014).

Table 1: Effect of mutagen on seed germination in *Withania somnifera* (L.) Dunal.

Mutagen	Dose	Seed Germination %	±SE
Control	**-**	82	± 0.12
Gamma Radiation	**10kR**	92.68	±0.14
	20kR	81.70	±0.18
	30kR	75.60	±0.22
	40kR	69.29	±0.35

2. Seedling Height and Seedling Injury (Table 2)

In the present investigation the results shows fluctuation in the seedling height and seedling injury in higher doses of gamma rays (40kR.) Seedling height was dose dependent. As the dose of Gamma rays increased from 10kR to 40kR there was gradual decrease in seedling height and increase in seedling injury. This indicated that with increase in dose of Gamma rays, damage in seedling increases similar reports were recorded in *Lycopersicon esculentum* L. by Saba and Mirza (2002), in Tomato by (Kostov *et al*., 2007) and Isabgol (*Plantago ovate,* Forsk) Mishra and Singh (2014).

Table 2: Effect of mutagen on Seedling Height and Seedling Injury in *Withania somnifera* (L.

Mutagen	Dose	Average Seedling Height	Seedling Injury (%)	±SE
Gamma Radiation	**10kR**	1.853	2.4	±1.6
	20kR	1.7403	5.6	±1.0
	30kR	1.6574	7.9	±1.3
	40kR	1.5743	8.8	±1.5

The parameter like seedling height and seedling injury in M1 generation was studied by Jabeen and Mirza (2002) in *Lycopersicon esculentum* L. and (Patil *et al*., 1997) in *Capsicum annum* L. where similar results were reported. The effect of mutagen was found inhibitory to the seedling height as reported by many researchers (Sikder *et al.,* 2013) in *Solanum lycopersicum* L. The reduction in seedling height was due to physiological processes. The frequency of seedling height and seedling injury decreased with increasing dose was reported by (Watanabe *et al*., 2007) in *Solanum lycopersicum* and (Salve and More, 2014) in *Coriandrum sativum* L.

CONCLUSION

From above investigations it is clear that gamma rays are capable in inducing damage to plants at molecular level and is capable of inducing mutation. Higher the dose of Gamma rays more will be the damage and chances of getting variables may increase. The present investigation clearly demonstrated that induced mutation can be successfully utilized to create genetic variability when it is desired to improve specific traits in plants. In conclusion, it can be said that physical mutagenic treatments employed in the present research work succeeded in inducing superior genotypes with significant alterations in growth and metabolism of the plant body.

REFERENCES

Aruna J, Prakash M and Kumar BS (2010) Study of effect of mutagens in M1 population of Brinjal (*Solanum melongena* L.) *Research Journal of Agriculturai Science*, 1 (4): 407-471.

Bharathi T, Gnanamurthy S, Dhanavel D, Murugan S and Ariraman M (2013) Induced Physical mutagenesis on seed germination, lethal dosage and morphological mutants of Ashwagandha (*Withania somnifera* (L.) Dunal) *International Journal of Advanced Research*, 1(5): 136-141.

Bhosale RS and More AD (2013a) Response of Withania somnifera, (L.) Dunal. to Soils from different locations in Satara district w.r.t Germination and Vegetative Growth, *Int. J. of Life Sciences*, 2013 Vol.1 (1): 76-78.

Bhosale RS and More AD (2013b) Effect of EMS (Ethyl Methane Sulfonate) on Seed Germination, Seedling Height and Seedling Injury in Withania somnifera, (L.) Dunal., *Int. J. of Life Sciences*, 1 (2):158-160.

Iqbal M and Datta AK (2006) Mutagenic effectiveness and efficiency of gamma-rays, hydroxylamine and EMS in *Withania somnifera* (L.) Dun. (Ashwagandha). *Plant Archives* 6: 533- 535.

Iqbal M and Datta AK (2007b) Cytogenetic Studies in *Withania somnifera* (L.) Dun. (Solanaceae), *Cytologia*; 72(1): 43–47.

Jabeen N and Mirza, B. (2002) Ethyl Methane Sulfonate enhances genetic variability in *Capsicum annuum* L., *Asian Journal of Plant Sciences*. 1(4): 425-428.

Kostov K, Batchvarova R and Slavov S (2007) Application of Chemical Mutagenesis to Increase the Resistance of Tomato to *Orobanche ramosa* L. Bulgarian. *Journal of Agricultural Science*, National Centre for Agrarian Sciences, 13: 505-513.

Mishra Monika and Khan Ainul Haq (2014) Mutagenic effectiveness and efficiency of individual and combination treatments of EMS and gamma rays in Isabgol (Plantago ovata Forsk., *Int. J. of Life Sciences,* (In Press).

Ojiewo CO, Agong SG, Murakami K, Tanaka A, Hase Y and Masuda M (2005) Male-sterility induced by gamma-ray irradiation of African nightshade (Solanum nigrum L. ssp. villosum) seed. *Journal of Horticultural Science & Biotechnology*, 80 (6): 699-704.

Patil AN, Meshram LD and Nandanwar RS. (1997) Induced quantitative variations in economical charaters by chemical mutagen in Chilli. *J. Soiols and Crop*s, 7: 15-18.

Saba N and Mirza B (2002) Ethyl Methane Sulfonate Induced Genetic Variability in *lycopersicon esculantum*. *Internation Journal of Agriculture and Biology*, (http://Www.Ijab.Org) 1560–8530.

Salve KM and More AD (2014) Effect of Gamma radiation on Seed Germination, Seedling Height and Seedling Injury in *Coriandrum sativum* Linn. *Int. J. of Life Sciences*, (In Press).

Sikder S, Biswas P, Hazra P, Akhtar S, Chattopadhyay A, Badigannavar AM and D'Souza SF (2013) Induction of mutation in tomato (Solanum lycopersicum L.) by gamma irradiation and EMS. *Indian Journal of Genetics*, 73(4): 392-399.

Sri Devi A and Mullainathan L (2012) The Use of Ethyl Methanesulfonate to Study the Flower Development in *Capsicum annuum* L. Mutants. *Botany Research International*; 5 (1): 04-09.

Watanabe S, Mizoguchi T, Koh Aoki K, Kubo Y, Mori H, Imanish S, Yamazak Y, Shibata D and Ezura H (2007) Ethyl methane sulfonate (EMS) mutagenesis of *Solanum lycopersicum* cv. Micro-Tom for large-scale mutant screens. *Plant Biotechnol*., 24: 33–38.