

Effect of Mutagen on Pollen Sterility in *Withania somnifera* Dunal. (Ashwagandha)

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ABSTRACT

M₁ generation of *Withania Somnifera* (L.) Dunal. was raised by treating the seeds with varied concentrations of chemical mutagens (EMS) and physical mutagen (Gamma rays). Effect of these mutagens on pollen sterility and plant survival at maturity was studied in M₁ generation. The maximum pollen sterility (10.40%) could be seen at 40 kR dose of gamma rays.

KEYWORDS

Withania Somnifera Dunal. EMS, Gamma radiation, pollen sterility

INTRODUCTION

Withania somnifera (L.) Dunal, also known as Indian ginseng and as Indian Winter Cherry is an important ancient plant, the roots of which have been employed in Indian traditional systems of medicine, Ayurveda and Unani. It grows in dry parts in sub-tropical regions. Rajasthan, Punjab, Haryana, Uttar Pradesh, Gujarat, Maharashtra and Madhya Pradesh are the major Ashwagandha producing states of the country. Plant breeding requires genetic variation of useful traits for crop improvement. Mutagenic agents, such as radiation and certain chemicals, can be used to induce mutations and generate genetic variations from which desired mutants could be selected. Mutation induction has become a proven way of creating variation within a crop variety. The induction of mutation in plant material can be achieved either through physical or chemical mutagens. Sangle et al., (2010) reported that mutation breeding may be an alternative to hybridization as a source of variability.

MATERIALS AND METHODS

Collection of Genotype

Seeds were collected from Mahatma Phule Agriculture University, Rahuri. Trials were taken

for germination in different conditions of soil, temperature and light.

Mutagens Used: Physical mutagen gamma ray, Chemical mutagen EMS were used for the treatment.

Gamma Rays Treatment: The seed material was irradiated at Nuclear Chemistry Division, Department of Chemistry, University of Pune 07. Sets of dry and healthy seeds were packed and irradiated with 10 kR, 20 kR, 30 kR and 40 kR gamma rays obtained from the source of Co⁶⁰

Chemical mutagenesis: The healthy, dry and uniform seeds were treated with EMS at different conc. like 0.05 %, 0.075 %, 0.10 % and 0.125 %. at Department of Botany, Fergusson College, Pune.

Test for pollen Sterility:

Pollen sterility was determined by smear test in 10 randomly selected plants of each treatment along with control by staining the pollen grains with 2% acetocarmine stain. Stained pollen grains were considered as fertile, while empty, partially stained and shriveled ones were considered as sterile. The values were expressed as percentage. Statistical analysis was done to know the standard error.

RESULTS AND DISCUSSION

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

Mutagen	Concentration/dose	Pollen sterility %	± SE
EMS	Control	0.616	±0.1
	0.05%	1.988	±0.6
	0.075%	6.128	±1.0
	0.1%	7.01	±1.1
	0.125%	8.398	±1.2
Gamma rays	Control	0.616	±0.1
	10 kR	2.3	±0.6
	20 kR	6.666	±1.1
	30 kR	8.058	±1.2
	40 kR	10.408	±1.4

All concentration showed pollen sterility in increasing order from lower concentrations/dose to higher concentration/dose of mutagens. Out of two mutagenic agents physical mutagen gamma radiation showed maximum pollen sterility at 40 kR which was 10.408% where as minimum sterility was induced by 0.05% EMS which was 1.988%.

CONCLUSION

The pollen grains are slightly sticky, tricolporate with reticulate exine sculpturing similarly reported by Singh, (2009). A general trend towards increased pollen sterility with increasing concentration/ dose of mutagens could be observed as reported by Maruthi and Tejavathi , (2011) in *Solanum viarum* and Muthusamy et al., (2011) in Cotton. In case of control 0.616 % pollen sterility was observed and maximum pollen sterility 10.40% could be seen at 40 kR dose of gamma rays. Of the two mutagens gamma rays revealed the maximum sterility than that of the EMS. The rate of pollen sterility was increased with an increase in the concentration/dose of mutagen.

The concentration/dose used in present study is effective in induction of wide range of mutants. Fruit development was pollination independent and could have led to male sterility as reported by Matsukura et al., (2007) in tomato, but fruit development was not affected as a result of heterostyly similarly reported by Singh (2009) in *Withania Somnifera* (L.) Dunal. Finally it can be concluded that mutagenic agent have successfully induced mutation by causing damage in *Withania Somnifera* (L.) Dunal. as reported by Bhosale et al., (2013) w.r.t morphological character

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