I J R B A T, Issue (IX), Vol. III, Sept 2021: 84-88
A Double-Blind Peer Reviewed & Refereed Journal

OPEN ACCESS

e-ISSN 2347 – 517X
Original Article

INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY

 www.ijrbat.in

EFFECTIVENESS AND RELATIVE EFFICIENCY OF MUTAGENS IN *LABLAB PURPUREUS* (L) SWEET.

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Communicated: 22.06.21	Revision : 23.07.21 & 30.08.2021 Accepted: 06.09.2021	Published: 30.09.2021

ABSTRACT:
Effectiveness is a measure of gene mutation in relation to dose, and efficiency is a phrase used to evaluate biological effects in plants such as mortality, damage, and sterility. The mutagenic effectiveness of the mutagens was shown to decrease as the dose/concentration of the mutagens was increased in the current study. Physical and combination mutagenic treatments are less effective than chemical mutagen therapy. For *Lablab purpureus* (L.) Sweet, mutagenic efficiency increased in relation to lethality and pollen sterility in response to mutagenic treatments. Combination EMS Gamma rays treatment was the order of the mutagens' mutagenic efficacy. The decreased in the effectiveness of the mutagens in the EMS and Gamma rays produced the biological damage like lethality and pollen sterility.
Key words: - *Effectiveness, efficiency, lethality and pollen sterility.*

INTRODUCTION:

Pulses are a valuable source of protein, vitamins, and minerals. Pulses by-products are fed to livestock as a dry and fresh feed. In Asia, Africa, and the Caribbean, *Lablab purpureus* is produced as a pulse crop. The immature seeds, pods, and young leaves can be eaten raw or cooked.Forage, hay, and silage are all produced from *Lablab purpureus*. It is planted as forage with sorghum and millet. (Maass et al; 2010) As a green manure, the nitrogen-fixing legume is quite beneficial. (Cook et al., 2005; Adebisis et al., 2004; Cook et al., 2005). It is also used as a stimulant to reduce fever flatulence to stimulate digestion and as an antispasmodic (Stuart, 2011), in Namibia the root has been used to treat heart conditions (Pinocchio et al., 2010) Mutation breeding is a novel technique to impart biochemical changes in plants. This method may bring out many positive results leading to crop improvement (RS Bhosale, 2013; Jagtap and More 2015).

MATERIALS AND METHODS:

Mode of the Mutagenic Treatment:

1. Gamma rays- Healthy and uniform size of dry seeds of the Dolichos bean variety *Phulesuruchi* were treated with CO^{60} irradiation. The seed samples were exposed to doses of 100Gy, 200Gy, 300Gy, and 400Gy of Gamma rays.
2. Ethyl Methanesulphonate (EMSmolecular weight 124.16 g/mol and its density 1.20g/cm^3) was used to determine the lethal dose (LD_{50}) at suitable concentration of mutagen for the further study. The different concentrations used for the chemical mutagenic treatment were 10mM, 20mM, 30mM, and 40mM.
3. Combination treatment- For the combination treatment Gamma rays irradiated seedswere treated by EMS. The concentration/ dose for combination treatment were 100Gy+40mM, 200Gy+30mM, 300Gy+20mM, and 400Gy+10mM. For each treatment 500 seeds were used.

Seeds of each treatment along with the control were sown in field as per Complete Randomized Block Design (CRBD) with three replications to raise the M_1 generation plants.Screened mutants of M_4 generation were tested for the Biochemical studies.

Estimation of Mutagenic effectiveness and efficiency:

Mutagenic effectiveness and efficiency of different mutagens were calculated according to the formulae suggested by (Konzac*et. al*; 1965).

$$\text{Mutagenic effectiveness} = \frac{\text{Mutation frequency (MF)}}{\text{Dose or (time} \times \text{Concentration)}}$$

$$\text{Mutagenic efficiency} = \frac{\text{Mutation frequency (MF)}}{\text{Biological damage}}$$

The effect of combined treatments on chlorophyll mutations frequency was analyzed following the method of (Sharma; 1970) Co- efficient of interaction k

$$k = \frac{(a+b)}{a+b}$$

Where,(a+b) = chlorophyll mutations frequency of combination treatment.

a+b = sum of chlorophyll mutations frequency of individual treatment.

RESULT & DISCUSSION:

Mutagenic efficiency (Table No.1)

The mutagenic efficiency ratio of chlorophyll mutations induced in the M_2 generation to various biological damages induced in M_1 generation such as Lethality and pollen sterility.

Efficiency in relation to lethality:

The Lowest effect of the mutagen was observed at the 100Gy of Gamma rays radiation while the highest mutagenic efficiency was observed at the 30mM of EMS treatment and 300Gy+20mM Combination treatment. The efficiency was in the range of the 0.082-0.156% in EMS treatment, 0.055-0.113% in Gamma rays and 0.124-0.173% in Combination treatment.

Efficiency in relation to pollen sterility:

In EMS treatment the efficiency was in the range of the 0.412-0.4815. The lowest efficiency was observed in10Mm treatment while highest in 30mM treatment. In Gamma raysrange of efficiency was 0.167-0.260% .The lowest efficiency was observed in the 100Gy and highest in the 400Gy. In combination treatment the mutagenic efficiency was observed to be the highest in 300Gy+20mM treatment while lowest in the 100Gy+ 40mM treatment.

Mutagenic effectiveness: (Table No2and 3)

The lowest effectiveness of mutagens was calculated in the 400Gy Gamma rays radiation and highest in 400Gy+10mM treatment. The effectiveness of mutagens was highest in Combination followed by the EMS and Gamma rays radiation. Effectiveness of the mutagen was increased in the Combination treatment.In M_3 generations the effectiveness was in the range of the 0.138-0.347.In Gamma rays radiation the effectiveness was in the range of the 0.012-0.038 while in the Combination treatment was 0.131-0.692. In all the three generations it was found that the effectiveness of the mutagens was increased with the increases in the concentration/dose of the mutagens in the Combination treatment.

Lablab purpureus(L.)Sweet, that mutagenic effectiveness was decreased in the EMS treatment and Gamma rays radiation while it was increased in the combination treatment. The order of the mutagenic effectiveness of the mutagens was Combination > EMS> Gamma rays treatment. The decrease in the effectiveness of the mutagens in the EMS and Gamma rays may have produced the biological damage like lethality and pollen sterility.

The efficiency of treatment in combination (EMS +Gamma rays) was more effective than EMS and Gamma rays radiation similarly reported by (Singh and Singh, 2012) in Mungbean.(Bhosale and Kothekar, 2010) observed that effectiveness reduced with increase in concentrations in a

varieties of Cluster bean. (Waghmare and Mehra, 2001) reported that higher mutagenic effectiveness and efficiency was observed at lower concentration of EMS than in Gamma rays in *Lathyrussativus*. (Usharani and Kumar,2013) reported that mutagenic effectiveness in viable mutants was very high in Gamma rays than EMS and combination treatment shows more effective followed by Gamma rays and EMS in higher frequencies of mutations. EMS treatment was found to be most effective mutagen in Withania as compared to gamma rays. The order of effectiveness and efficiency of the mutagens was EMS > GR. (Bhosale R.S., 2013).Similar observations were reported by many researchers in different plants like (Kothekar in 1978) in *Solanum*, (Deshpande, 1980) in *Mormodica*, (Hakande, 1992) in Wingbean, (Salve,2014) in *Coriandrumsativum* Linn, (Ramezani , 2013) in *Lathyrussativus* Linn.

CONCLUSION:

The relative effectiveness and efficiency of the three mutagenic treatments like Gamma rays, EMS and Combination treatment was calculated. The efficiency of the mutagens with respect to the lethality increased in all the treatments with the increase in the dose or concentration of the mutagens. The maximum efficiency with respect to lethality was observed in the combination treatment followed by the EMS and Gamma rays treatment. The efficiency of the mutagenic treatment with respect to pollen sterility was also observed to be increased with increase in dose or concentration. Finally itcan be concluded that the mutagenic effectiveness of the mutagens decreased as the dose/concentration of the mutagens increased. Physical and combination of mutagenic treatments are less effective than chemical mutagens. In*Lablab purpureus* (L.) Sweet, mutagenic efficiency increased in relation to lethality and pollen sterility.

ACKNOWLEDGEMENT

I acknowledgePrincipal, Waghire College, Saswad, Pune, SavitribaiPhule Pune University, Pune, for providing laboratory and cultivation facilities.

REFERENCES:

Adebisi, A.A., Bosch, C.H (2004) *Lablab purpureus* (L.) Sweet Record from PROTA4U, Grubben, G. J. H., Denton, O. A (Editor) PROTA (Plant Resource of Tropical Africa resource vegetable de l' Afriquetropicale).,Wageningen, Netherlands.

Bhosale, S.S and Kothekar, V.S. (2010) Mutagenic efficiency and effectiveness in Cluster bean (*Cyamopsistetragonoloba*(L.) Taub) *J.Phytol.*2 (6)21-27.

Bhosale, .R.S. (2013) Genetic improvement in*WithaniasomniferumDunal*,Ph.D Thesis, SPPU. Pune .

Cook, B. G ., Pengelly, B. C., Brown, S. D ., Donnelly, D. A. ,et. al., (2005) Tropical forages :an interactive selection tool. *Lablab purpureus*. CSIRO, DPI&F (Qld) , CIAT and ILRI,Brisbane,Australia

Deshpande, N.M. (1980) The effect of gamma rays and chemical mutagens in *MomordicacharantiaL*, Ph.D.Thesis, University of Nagpur.

Hakande, T.P. (1992) Cytogenetical Studies in *Psophocaroustetragonobolus*(L) DC.Ph.D.Thesis, BAMU, Aurangabad.

Jagtap,S.S., and More,A.D.(2015)Effect of chemical and physical mutagens on germination percentage, seedling height and seedling injury in *Lablab purpureus* (L).Sweet.*Ind.J.Adv.Plant Res.*2(1):30-32.

Konzac C.F., R.A.Nilan, J.Wagner and R.J.Foster.(1965).Efficient chemical Mutagenesis. The use of induced mutations in Plant breeding

(FAO/IAEAMeeting, Rome)*Radiat.Bot.* (Suppl.) 75:49-70.

Kothekar, V.S. (1978) Mutational studies in *Solanumnigrum*L.Ph.D Thesis, University of Nagpur.

Maass, B. L., M. R. Knox., S. C. Venkatesha, T. T. Angessa, S. Ramme and B. C. Pengelly (2010) *Lablab purpureus* –a crop lost for Africa? *Tropical Plant Biology* 3 (3):123-135.

Pennacchio,M., Jefferson,L.V.,andHavens,K,(2010)Uses and abuses of plant derived smoke:itsethnobotany as hallucinogen perfume, incense,and medicine. *Oxford Univ Press Inc.* New York.

Ramezani, P. and More, A. D (2013) Study of Biological damage in Grasspea (*Lathyrussativus*Linn) in M_1 generation.*Trends in Life Sciences*.2 (2):6-9.

Salve, K.M. (2014) Induction of mutation in*Coriandrumsativum* Linn. Ph.D. Thesis, SPPU. Pune

Sharma, R.P. (1970) Increased mutation frequency and wider mutation spectrum in barley influenced by combining gamma rays with EMS.*Indian.J.Genetics&Plant.Breeding.*

Singh, P.K.,Kumar,A.,Rai,N., and Singh,D.V.(2012)Identification of Host Plant Resistant to Dolichos Yellow Mosaic Virus(DYMV)in Dolichos bean *(Lablab purpureus* L.).*Plant pathology and Microbiology*.3:5.

Stuart,G,(2011)Stuartxchange – Philippine alternative medicine. http:// www.stuartxchange.org /AltMed. Html (accessed 26July2012)

Usharani, K. S and Anand Kumar, C.R(2013)Mutagenic effectiveness and efficiency of Gamma rays, EMS and their synergistic effects in Blackgram (*Vignamungo*(L.)Hepper. *IJAAS*.1 (2):31-39.

Waghmare, V.N. and R.B. Mehra. (2001). Induced chlorophyll mutations, mutagenic effectiveness and efficiency in *Lathyrussativus* L. *Indian J. Genet& Plant breeding,* 61(1): 53-56.

Table No.1.Relative efficiency of treatment of mutagens in M_2 generation of Lablab*purpureus*(L.)Sweet.

Mutagens	Dose/Conc.	% of chl. mutation	% of Lethality	Efficiency (MF/L)	% of Pollen sterility	Efficiency (MF/S)
Control		-	-	-	2.1	-
Ethyl Methane sulphonate	10mM	1.36	16.57	0.082	3.3	0.412
	20mM	2.09	18.37	0.113	4.84	0.431
	30mM	3.20	19.60	0.163	6.65	0.481
	40mM	3.64	23.30	0.156	8.80	0.413
Gamma Rays	100Gy	1.03	18.65	0.055	6.16	0.167
	200Gy	1.79	19.70	0.090	7.93	0.225
	300Gy	2.23	21.34	0.104	8.65	0.257
	400Gy	2.71	23.90	0.113	10.40	0.260
Combination Treatments	100Gy+40mM	2.42	19.47	0.124	6.33	0.382
	200Gy+30mM	3.23	20.36	0.158	7.35	0.439

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e-ISSN 2347 – 517X
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	300Gy+20mM	3.74	22.87	0.163	8.14	0.459
	400Gy+10mM	4.28	24.67	0.173	9.69	0.441

Table No. 2.Effectiveness of mutagens in M_2 generation of *Lablab purpureus*(L) Sweet.

Mutagens	Dose /Conc.	% of Chlorophyll Mutations	Effectiveness MF /Dose or MF /T+C	Interaction Co-efficient K
Control	-	-	-	-
Ethyl Methane Sulphonate	10mM	1.36	0.1360	-
	20mM	2.09	0.1045	-
	30mM	3.20	0.1066	-
	40mM	3.64	0.091	-
Gamma Rays	100Gy	1.03	0.013	-
	200Gy	1.79	0.0089	-
	300Gy	2.23	0.0074	-
	400Gy	2.71	0.0067	-
Combination Treatments	100Gy+40Mm	2.42	0.065	0.5
	200Gy+30mM	3.23	0.1076	0.6
	300Gy+20mM	3.74	0.187	0.8
	400Gy+10Mm	4.28	0.428	1.0

Table No. 3. Effectiveness of mutagens in M_3 generation of Lablab*purpureus* (L.)Sweet.

Mutagens	Dose /Conc.	% of Chlorophyll Mutations	Effectiveness MF /Dose or MF /T+C	Interaction Co-efficient K
Control		-	-	-
Ethyl Methane Sulphonate	10mM	3.47	0.347	-
	20mM	5.01	0.250	-
	30mM	5.07	0.169	-
	40mM	5.53	0.138	-
Gamma Rays	100Gy	3.85	0.038	-
	200Gy	4.28	0.021	-
	300Gy	5.05	0.016	-
	400Gy	5.16	0.012	-
Combination Treatments	100Gy+40Mm	5.24	0.131	0.5
	200Gy+30mM	5.79	0.193	0.6
	300Gy+20mM	6.31	0.315	0.6
	400Gy+10Mm	6.92	0.692	0.8