Research Article
Volume 10:S3, 2021
Molecular Pathogenesis and Treatment Strategies in Plants.

Molecular Biology

ISSN: 2168-9547 **Open Access**

Induced Mutations In *Vigna radiata* (L.) Wilczek

Amol Chandrakant Vikhe[1]* and Janardhan Nehul[2]

Department of Botany, New Arts, Commerce and Science College Ahmednagar (CAAA016160), Taluka-Ahmednagar, District-Ahmednagar, University of Pune, Maharashtra, India

Abstract

In present investigation an attempt was made to induce mutation with mutagens namely Ethyl Methane Sulphonate (EMS), Sodium azide (SA) and Gamma Radiation (GR) were studied in M2 generation of *Vigna radiata* (L.) Wilczek Cultivar-Naval to study different morphological mutations. The results indicated induction of a wide spectrum of morphological mutations in cultivar-Naval. The frequency of morphological mutations was variated and significant in mutagenic treatments. The cultivar-Naval was found to be more sensitive to EMS, SA and GR.

Keywords: EMS • GR • SA • Morphological mutations • Naval • *Vigna radiata*

Objectives

To study the functional, technological and physio-chemical analysis of FVR flour.

Introduction

Mutagenesis has played an important role in improvement of mungbean. So, far many cultivars have been developed following induced mutagenesis [1,2]. Different types of mutations reported in mungbean for high yield, biotic and abiotic stress tolerance and other agriculture importance. Mungbean is demandable crops which give rise more yields in short duration. The maturity and durability can be changed through mutation breeding. The growth phases of the plant from seedling, vegetative and reproductive to maturity stages can be altered or changed by mutagens. The mutations were also of academic interest and can be used in genetic study. Mutagenesis altered the desirable and undesirable changes [3,4].

In the present investigation an attempt was made to induce mutation in *Vigna radiata* (L.) Wilczek Cultivar-Naval and study the spectrum and frequency of morphological changes.

Materials and Methods

Seeds of *Vigna radiata* (L.) Wilczek Cultivar-Naval Mutants were obtained in M1 generation. The dry and healthy seeds were selected for the study with moisture content 9-10%. Seeds were selected from Ethyl Methane Sulphonate, Sodium Azide (Chemical Mutagens) and Gamma Radiation (Physical Mutagen) with different concentrations (10, 15 and 20 mM from the EMS; 2, 3 and 4mM from the SA and 250 Gy, 350 Gy and 450 Gy from Gamma Radiation. irradiated from BARC Mumbai [5]. The control in the form of untreated seeds was used for sowing for comparison. The 25-30 plant seeds in 3 replications were sowed to obtain M2 generation. The seeds were sowed with RBD method. Morphological mutants were isolated in M2 generation and classified on the basis of morphological parts affected and frequency was estimated (Figure 1).

***Address for Correspondence:** Vikhe AC, Department of Botany, New Arts, Commerce and Science College Ahmednagar (CAAA016160), Taluka-Ahmednagar, District-Ahmednagar, University of Pune, Maharashtra, India, Email-amolvikhe54@gmail.com*

Received 04 Septebmer, 2021; **Accepted** 21 Septebmer, 2021; **Published** 28 Septebmer, 2021

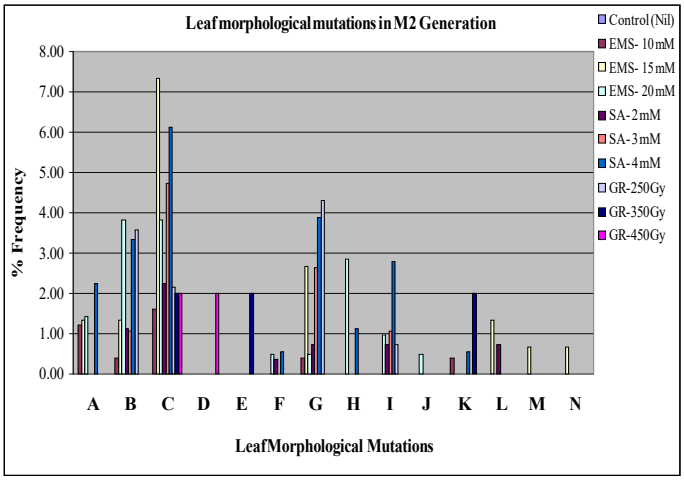

Figure 1. Support Breastfeeding.

Results and Discussion

Leaf variations observed

Variegated leaf mutations were observed in EMS- 10, 15 & 20 mM and SA- 4 mM. The frequency this mutation was 6.20%. These mutants showed the unequal length and size of leaf than normal trifoliate leaf. Terminal leaf different shape (oval) mutation was found in all mutagenic treatment except GR- 350 & 450 Gy. The frequency of these mutations was 14.65%. Irregular leaves with terminal leaf of plant was small, dissected or irregular curved shaped than normal trifoliate leaf. These leaf mutations were found in all mutagenic treatments. The frequency of these mutations was 31.99%. Highest frequency of these mutants was observed in EMS- 15 mM dose. Broad leaves with big in size and shaped than normal leaf. The colour of leaf was dark green. This mutation was very rare and found only in GR- 450 Gy. The frequency was 2%. Leaf of the mutant with dark purple leaf vein and also showed dark purple petiole. They showed different leaf characteristics than normal with green vein. The leaf was medium to broad in size and shape. The frequency was this mutant was 2%. This mutant was found in GR- 350 Gy. Dark Green leaf colour mutant was found in EMS- 20 mM, SA-2 mM and SA- 4 mM. The leaf colour of this mutant was dark green than normal trifoliate leaf colour. The few plants produced seeds, while few were without seeds and having normal flowering. The frequency of this mutant was 1.41%. Quadrafoliate mutant leaf was 15.11%. This mutant had four leaflets instead of three. The leaflets were different in shaped and arranged on irregular positions. This mutant was different in height and produced normal flowers and pods. This mutant was found in all mutagenic treatments except GR- 350 & GR- 450 Gy. Tiny leaves of mutants were small than normal trifoliate leaf. The mutant produced

more leaves with green colour. The plant height was dwarf and medium. The frequency of this mutant was 3.98%. EMS- 20 mM and SA- 4 mM were produced this mutant. Bifoliate leaf mutant has two leaflets instead of three and directly arised from main branch. The frequency of this mutant was 6.26%. This mutant was found in EMS- 20 mM, SA- 2, 3, 4 mM and GR- 250 Gy. Heart shape terminal leaflet mutant was found only in EMS- 20 mM. This mutant was medium growth, height and produced normal flowers and pods. The terminal leaflet of mutant was heart shaped and side leaflet were different shape or rounded shape. The frequency of this mutant was 0.48%. Unifoliate leaf was directly arised from main axis of cotyledonary leaf. This mutant was found in EMS- 10 mM, SA- 4 mM and GR- 350 Gy. The frequency of this mutant was 2.96%. Curly leaf mutant was found in EMS- 15 mM and SA- 2 mM. Frequency of this mutant was 2.08%. Leaf was green in colour and curly, rough surface of leaf. Margin of leaf was serrate. Pentafoliate leaf with five leaflets was arised from axis of cotyledonary leaf. The frequency of this mutant was 0.67% and found in EMS- 15 mM. This mutant was irregular mutant and some leaves were broad, leaflets were different shaped. Small narrow, medium lanceolate leaflets were found. The leaves were green to pale green in colour. Plants with normal flowering and pod formation. Dissected leaf mutant with dissected leaflet of terminal or side. Plant with green leaf, dwarf to medium height and less number of pods. Frequency of this mutant was 0.67% and found in EMS- 15 mM (Table 1).

Plant Morphology observed

Dwarf Mutant showed overall decrease in height of the plant as compared to control. Plant height ranged from 30 to 32 cm. as compared 40 to 45 cm. in control. Branches of such plants were shorter. The mutants showed decreased yield as compared to control. Dwarf mutants were observed in all mutagenic treatments. The frequency of this mutant was 23.48%. Spreading mutant was medium plant height ranged from 35 to 45 cm. plant branches were spread around main axis. Some plant showed more leaves and branches, few were less pods. The branches were shortened. Generally, the pods were small to medium in size. This type of mutant was found in all mutagenic treatments. The frequency of this mutant was 66.44%. Tall mutant was tall and showed increased height over the control. This type of mutant was observed in the M1 & M2 progeny of Mungbean Cultivar- Naval raised from all the treatments except 350 Gy from GR. The height of plants ranged from 46 to 60 or more than 60 cm. stem of plant thick, leaves were broad, more flowering and pods (Table 2). Highest frequency (0.2%) of tall mutant was observed in EMS- 15 mM & GR- 450 Gy dose while, lowest frequency was recorded in

Table 1: Spectrum and Frequency % of Leaf variations observed in M2 generation.

Sr. No	DOSE	Leaf morphological mutations													
		A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Control (Nil)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	EMS- 10 mM	1.20	0.40	1.60	0.00	0.00	0.00	0.40	0.00	0.00	0.00	0.40	0.00	0.00	0.00
3	EMS- 15 mM	1.34	1.34	7.34	0.00	0.00	0.00	2.67	0.00	0.00	0.00	0.00	1.34	0.67	0.67
4	EMS- 20 mM	1.43	3.81	3.81	0.00	0.00	0.48	0.48	2.86	0.96	0.48	0.00	0.00	0.00	0.00
5	SA- 2 mM	0.00	1.12	2.23	0.00	0.00	0.37	0.74	0.00	0.74	0.00	0.00	0.74	0.00	0.00
6	SA- 3 mM	0.00	1.06	4.74	0.00	0.00	0.00	2.64	0.00	1.06	0.00	0.00	0.00	0.00	0.00
7	SA- 4 mM	2.23	3.34	6.12	0.00	0.00	0.56	3.89	1.12	2.78	0.00	0.56	0.00	0.00	0.00
8	GR- 250 Gy	0.00	3.58	2.15	0.00	0.00	0.00	4.29	0.00	0.72	0.00	0.00	0.00	0.00	0.00
9	GR- 350 Gy	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00
10	GR- 450 Gy	0.00	0.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

A-Variegated leaf Mutant, B-Terminal Leaf Diff. Shape(Oval), C-Irregular Leaves, D-Broad Leaves, E-Leaf Vein Dark Purple, F-Dark Green Leaf Colour, G-Quadrafoliate Leaf, H-Tiny leaf Mutant, I-Bifoliate, J-Heart Shape Terminal Leaf, K-Unifoliate, L-Curly Leaf, M-Pentafoliate Leaf, N-Dissected Terminal Leaf.

Table 2: Spectrum and Frequency % of Plant Morphology observed in M_2 generation.

Sr. No	Plant habit	Treatments									
		EMS- 10 mM	EMS- 15 mM	EMS- 20 mM	SA- 2 mM	SA- 3 mM	SA- 4 mM	GR- 250 Gy	GR- 350 Gy	GR- 450 Gy	Total Frequency %
1	**Dwarf Mutants**	0.08	0.33	0.19	0.15	0.53	0.22	0.14	0.60	0.20	23.48
2	**Spreading Mutants**	0.80	0.50	0.70	0.70	0.40	0.70	0.80	0.40	0.60	66.44
3	**Tall Mutant**	0.10	0.20	0.10	0.10	0.10	0.10	0.10	0.00	0.20	9.39

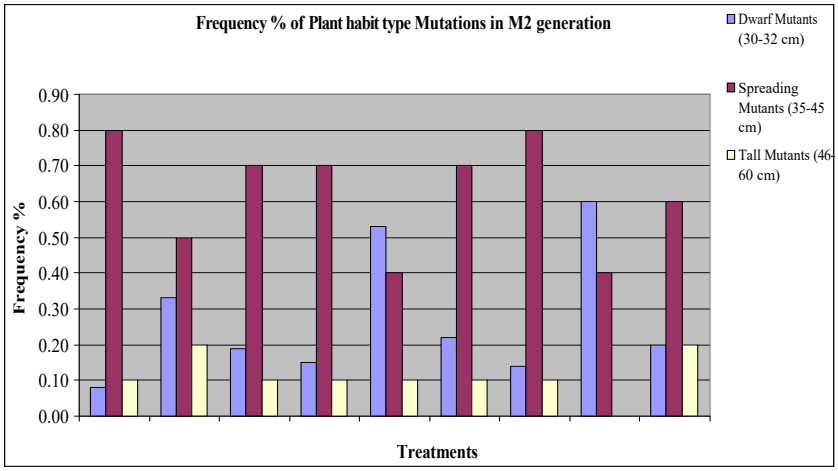

Figure 2. Treatments of plant habit.

other mutagenic treatments 0.1%. Similar kind of results were obtained by [6,7]. However, in present investigation some distinct morphological mutants affecting leaf, inflorescence and plant habit were noticed and the hereditary characters of mutants were noted as in M1 generation were observed in M_2 generation (Figure 2).

Conclusion

The experimental study showed significant variation in M2 family. Number of morphological and leaf mutation per 100 M2 plants and average frequency of mutants were lower as compared to number of morphological and leaf mutation per 100 M1 family and were segregating in M2 generation. It can be concluded that EMS and SA treatment were more effective in segregating leaf and morphological mutants in M2 generation as compared to GR.

Conflict of Interest

None

Acknowledgement

The facilities of New Arts, Commerce and Science College Ahmednagar were well acknowledged.

References

1. Gupta, P.K. “Recent advances in mungbean research.” (Ed. A.N. Asthana and Doo Hwan Kim), (1996): 124-126.
2. Lavanya, G. Roopa, Leena Yadav, G. Suresh Babu, and Pronob Jyoti Paul. "Sodium azide mutagenic effect on biological parameters and induced genetic variability in mungbean." *J Food Legumes 24*, no. 1 (2011): 46-49.
3. Konzak, C. F. "Efficient chemical mutagenesis, in: The use of induced mutations in plant breeding." In Report of the FAO/IAEA technical meeting organized by the food and agriculture organization of the United Nations and the International Atomic Energy Agency in cooperation with the European Association for Research on Plant Breeding, Rome, Italy, 25 May 1964, pp. 49-70. Pergamon Press, 1965.
4. Nerkar, Y. S. “Mutagenic effectiveness and efficiency of gamma rays, ethyl methane Sulphonate and nitroso methyl urea in *Lathyrus sativus*.” *Indian J Genet* 37 (1977): 137-141.
5. Gupta, P. K., and J. R. Bahl. "Cytogenetics and origin of some pulse crops." Cytogenetics of crop plants/editors: MS Swaminathan, PK Gupta, Umakant Sinha (1983).
6. Kashid, N.G., More, S. B. “Mutagenic effectiveness and efficiency of ethyl methane Sulphonate and sodium azide in chickpea (*Cicer arietinum* L.).” *Int J Adv Res Biological Sciences* 3 (2016):64-68.
7. Yadav, R.D.S. and Singh, V.P. “Pulse Crop Newsl.” 6(1986): 20-21.

How to cite this article: Vikhe, Amol Chandrakant, Nehul J. "Induced Mutations In *Vigna radiata* (L.) Wilczek". *Mol Biol* 10.S3 (2021): 300.