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EFFECTOF MUTAGENS (EMS, SA AND GAMMARADIATION) ON QUANTITATIVE PARAMETERS OF *VIGNA RADIATA* (L.) WILCZEK

Amol C. Vikhe[1] and Janardhan N. Nehul[2]
1. Department of Botany, New Arts, Commerce and Science College Ahmednagar, University of Pune, Maharashtra, India.
2. Department of Botany, Dadapatil Rajale College of Science Adinathnagar, Taluka-Pathardi, District- Ahmednagar (414505), University of Pune, Maharashtra, India,

Email- amolvikhe54@gmail.com, jnnehul@gmail.com

ABSTRACT:
Creation of genetic variability in crops for improvement in its Qualitative and Quantitative parameters; mutagens (Chemical and Physical) act as crucial role in the field of plant breeding. Using Ethyl methane Sulphonate (EMS), Sodium azide (SA) and Gamma radiation (GR) dominant and recessive qualitative as well as quantitative parameters were studied in this experiment. The research study was carried out on *Vigna radiata* Cultivar- Naval. The seeds of cultivar were exposed to treatments with EMS, SA and GR concentrations of mutagens. The selected concentrations were determined by LD_{50} Value i.e. 10, 15, 20 mM from EMS; 2, 3, 5 mM from SA and 250, 350, 450 Gy from Gamma radiation. These doses showed significant results on Quantitative parameters in M_2 generation. The yield contributing traits showed positive and negative correlation against the control. Among these treatments we found some dominant and recessive mutants in relation with yield contributing and morphological traits which are different than the control. These mutants were harvested and collected separately for sowing purpose in M_3 generation to study their performance in next generation.

Keywords: *Vigna radiata, Mutagens, M_2 generation, Quantitative parameters.*

INTRODUCTION:

Vigna radiata is leguminous crop belonging to the family Leguminosae. It is cultivated throughout the world and its demand is high. It is proteinous food and supplied vegetarian source of food for human being as well as food and fodder for animals. Mungbean is a short duration crop and it takes about minimum 58 to maximum 90 days to mature. Majorly of it is Kharif season crop, but in case availability of water it can be cultivated in rabi and summer season also. There are few varieties to cultivate in summer as compared to kharif and rabi season. Depending on the variety responsiveness to environmental situation, some varieties show good performance in kharif season.

In present situation, there is a need to develop high source nutritional cultivar with lower anti-nutritional factors, tolerance/ resistance to drought and salinity. The achievement in the field of plant mutation breeding for improvement in cultivars were studied by several workers, research scientists and research students.100 to 700 Gy treatment of Gamma radiation; resulted in more branches and number of pods per plant as compared to

control[6]. Synchronous maturity has been obtained in mungbean mutant[10].

In present experimental study; we have induced mutation in *Vigna radiata* in M_2 generation to find out more desirable mutants with morphologically different and yield contributing traits.

MATERIAL& METHODS:

Seeds of cultivar Naval were procured from Nirmal seeds, Jalgaon, Pachora. The doses were selected from determined LD_{50} Value of *Vigna radiata*. Ethyl Methane Sulphonate and Sodium Azide was purchased from Sigma Aldrich availed at New Arts, Commerce and Science College Ahmednagar. The seeds were treated with EMS- 10, 15, 20 mM; SA- 2, 3, 4 mM[4] and GR- 250, 350 and 450 Gy[1] dose. The source of Co^{60} Gamma radiation was provided by BARC Mumbai. The M_1 generation was obtained in academic year 2019-20 along with control at Research Center, Department of Botany, New Arts, Commerce and Science College Ahmednagar,MS,India. Seeds of M_1 generation were harvested separately and sowed in M_2 generation. All Qualitative traits of selected plants were observed and recorded.

RESULTS& DISCUSSION:

Quantitative traits in M_2 generation were studied and observed. Treatments with various concentrations showed positive and negative correlation showed in Table- 1, 2; Figure- 1, 2. The observations were carried out for plant height (cm.), number of primary branches, number of leaves per plant, number of days to flower, days to maturity, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length (cm.), seeds per pod, seed index, seed yield per plant (gm.), number of nodes per plant, internodal length (cm.) after mutagenic treatments. There was a variation in quantitative parameters among the mutagenic treatments in relation with plant height of control. The observations were made on fifty plants and the mean was taken for calculations.

Increase in plant height in EMS- 10 mM by 3.31 cm, 15 mM by 0.51 cm. and 20 mM by 3.06 cm. against control which showed plant height 34.00 cm. Similarly; SA and GR treatment also increased plant height. 2.41 &3.33 cm. increased plant height in SA- 2 mM and 4 mM respectively. The SA- 3 mM showed decreased plant height by -0.94 cm. with respect to control. Same results were found in GR treatment; 3.82, -0.29 and 4.71 cm plant height was recorded in GR- 250, 350 and 450 Gy respectively The negative sign in the treatment showed that; the plant height changed or variated in that particular mutagen. The treatment showed some plants with dwarf height and some with tall height. The major indication of negative sign of treatment with more population was dwarf in height.

The number of primary branches also increased and decreased among treatments as compared to control. The mean average primary branches per plant was 4.00 in control; EMS- 10, 15 and 20 mM showed 0.12, 0.13 and -0.29 increased and decreased in primary branches respectively; SA- 2 and 3 mM showed decreased primary branches by -0.30 and -0.48, SA- 4 mM increased primary branches with 0.05. GR- 250 with unchanged number of primary branches; while GR- 350 and 450 Gy showed 0.20 and 0.40 average increased primary branches. Same results were obtained for increased plant height and number of primary branches in *Glycine max* (L.) by Hanafiah et *al.* (2010).

Number of increased leaves per plant was observed only in EMS- 10 mM, SA- 4 mM, GR- 250 and 450 Gy (0.14, 0.17, 0.41 and 0.74 respectively). The average days to 50 % flowering of control was 39 days; while treatment population showed negative correlation to 50 % flowering except GR- 350 Gy (39 days). Negative sign indicates that among the population, the plant flowered early than the control. EMS- 10, 15, 20 mM showed -2.44, -1.20, -3.10 days early in 50 % of flowering respectively. SA- 2 mM showed -3.38 days early of 50 % flowering and GR- 250 Gy showed -3.58 days early of 50 % flowering. Days to early maturity were observed high in treatments of EMS- 20 mM, SA- 2 mM and GR- 250 Gy (-2.65, -3.44 and -4.03) days early respectively as compared to control (60.88 days). Similar results were obtained by Rashid (2001). Number of clusters per plant increased in EMS- 10 mM by 0.93, SA- 2 mM by 0.40 & GR- 450 Gy by 0.29 as compared to control. Pods per cluster were increased only in GR- 250 Gy & 350 Gy by 0.06 & 0.36 respectively. Number of pods per plant was observed increased in EMS- 10 mM by 4.43, which was higher among all the treatments. The average pods per plant were 28.33 in control. Decreased in pods per plant were recorded in EMS- 15 mM (-4.80), EMS- 20 mM (-1.81), SA- 3 mM (-4.70), GR- 450 Gy (-1.13). SA- 2 mM increased pods per plant with 1.37 and GR- 250 Gy with 2.24.

EMS- 10, 15 and 20 mM showed pod length 11.66, 11.06 & 11.33 cm respectively; SA- 2, 3 and 4 mM showed 11.94, 11.34 & 11.83 cm respectively; GR- 250, 350 and 450 Gy showed 11.82, 10.40 & 11.60 cm respectively; while in control it showed 11.27 cm. Seeds per pod not increased among the treatments of EMS, SA and GR; and correlated negatively. Seed index increased only in treatment SA- 3 mM & GR- 250 Gy by 0.01 & 0.03 gm. respectively. Seed yield per plant was observed increased only in lower doses of mutagens of EMS, SA & GR; similar, results were obtained by Singh and Kumar (2009). Seed yield per plant in EMS- 10 mM was 20.42 gm., SA- 2 mM 19.77 gm.& GR- 250 Gy showed 20.11 gm.; while control showed 19.60 gm. yield. The remaining treatments correlated negatively with respect to control. Nodes per plant were observed increased in SA- 4 mM (4.16), GR- 250 Gy (4.07) & in control it was 4.00. SA- 2 mM showed 4.00 nodes per plant that equal to control. Internodal length was increased only in GR- 450 Gy by 0.92 cm (4.80 cm); while in control it was 3.88 cm; similar Internodal length was found in SA- 4 mM. The remaining treatment showed negative correlation against control.

CONCLUSION

Qualitative and Quantitative traits in crop improvement along with yield contributing traits were studied in research experiment. We found that all mutagenic treatments showed significant variation in the quantitative and yield contributing traits in studied parameters. Few dominant plant populations have been observed among the treatments in plant height, early flowering, early as well as late matured, high yield plants Hence; the experimental study concluded that; the mutagenic treatments were more effective in increasing quantitative & yield contributing traits; that's the reason in future it could be applicable in various crop plants including cotton to increase crop yield.

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Table- 1. Morphological Characters in M_2 generation genotypes *Vigna radiata* (L.) Wilczek.

Sr. No.	Treatment	Dose	Plant Height (cm.)	Shift in Mean	Primary Branches	Shift in Mean	Number of Leaves	Shift in Mean	Days to Flowering	Shift in Mean	Days to Maturity	Shift in Mean	Number of Clusters	Shift in Mean	Pods Per Cluster	Shift in Mean
1	Control	Nil	34.89	0.00	4.00	0.00	6.66	0.00	39.00	0.00	60.88	0.00	5.11	0.00	5.44	0.00
2	Ethyl Methane Sulphonate	10 mM	38.20	3.31	4.12	0.12	6.80	0.14	36.56	-2.44	59.04	-1.84	6.04	0.93	5.28	-0.16
		15 mM	35.40	0.51	4.13	0.13	6.33	-0.33	37.80	-1.20	61.00	0.12	5.00	-0.11	4.66	-0.78
		20 mM	37.95	3.06	3.71	-0.29	6.04	-0.62	35.90	-3.10	58.23	-2.65	4.95	-0.16	5.23	-0.21
3	Sodium Azide	2 mM	37.30	2.41	3.70	-0.30	6.59	-0.07	35.62	-3.38	57.44	-3.44	5.51	0.40	5.00	-0.44
		3 mM	33.95	-0.94	3.52	-0.48	6.21	-0.45	37.63	-1.37	61.36	0.48	4.36	-0.75	5.10	-0.34
		4 mM	38.22	3.33	4.05	0.05	6.83	0.17	36.50	-2.50	59.44	-1.44	5.33	0.22	5.33	-0.11
4	Gamma Radiation	250 Gy	38.71	3.82	4.00	0.00	7.07	0.41	35.42	-3.58	56.85	-4.03	5.35	0.24	5.50	0.06
		350 Gy	34.60	-0.29	4.20	0.20	6.40	-0.26	39.00	0.00	59.80	-1.08	4.80	-0.31	5.80	0.36
		450 Gy	39.60	4.71	4.40	0.40	7.40	0.74	37.20	-1.80	57.60	-3.28	5.40	0.29	4.80	-0.64
SD±			**1.987**	**1.987**	**0.266**	**0.266**	**0.412**	**0.412**	**1.295**	**1.295**	**1.608**	**1.608**	**0.454**	**0.454**	**0.339**	**0.339**
SE±			**0.629**	**0.629**	**0.084**	**0.084**	**0.130**	**0.130**	**0.410**	**0.410**	**0.509**	**0.509**	**0.144**	**0.144**	**0.107**	**0.107**

Table- 2. Morphological Characters in M_2 generation genotypes *Vigna radiata* (L.) Wilczek.

Sr.	Treatment	Dose	Pods Per Plant	Shift in Mean	Pod Length (cm.)	Shift in Mean	Seeds Per Pod	Shift in Mean	Seed Index	Shift in Mean	Seed Yield Per Plant (gm.)	Shift in Mean	Nodes Per Plant	Shift in Mean	Internodal Length (cm.)	Shift in Mean
1	Control	Nil	28.33	0.00	11.27	0.00	12.11	0.00	5.62	0.00	19.60	0.00	4.00	0.00	3.88	0.00
2	Ethyl Methane Sulphonate	10 mM	32.76	4.43	11.66	0.39	11.72	-0.39	5.38	-0.24	20.42	0.82	3.96	-0.04	3.60	-0.28
		15 mM	23.53	-4.80	11.06	-0.21	11.73	-0.38	5.51	-0.11	15.41	-4.19	3.53	-0.47	3.80	-0.08
		20 mM	26.52	-1.81	11.33	0.06	11.62	-0.49	5.48	-0.14	16.63	-2.97	3.85	-0.15	3.76	-0.12
3	Sodium Azide	2 mM	29.70	1.37	11.94	0.67	11.52	-0.59	5.34	-0.28	19.77	0.17	4.00	0.00	3.25	-0.63
		3 mM	23.63	-4.70	11.34	0.07	11.68	-0.43	5.63	0.01	15.19	-4.41	3.63	-0.37	3.84	-0.04
		4 mM	29.33	1.00	11.83	0.56	11.61	-0.50	5.52	-0.10	18.68	-0.92	4.16	0.16	3.88	0.00
4	Gamma Radiation	250 Gy	30.57	2.24	11.82	0.55	11.64	-0.47	5.65	0.03	20.11	0.51	4.07	0.07	3.78	-0.10
		350 Gy	28.60	0.27	10.40	-0.87	11.60	-0.51	5.13	-0.49	16.79	-2.81	3.60	-0.40	3.80	-0.08
		450 Gy	27.20	-1.13	11.60	0.33	11.60	-0.51	5.30	-0.32	15.65	-3.95	3.80	-0.20	4.80	0.92
SD±			**2.912**	**2.912**	**0.459**	**0.459**	**0.162**	**0.162**	**0.167**	**0.167**	**2.098**	**2.098**	**0.215**	**0.215**	**0.386**	**0.386**
SE±			**0.921**	**0.921**	**0.145**	**0.145**	**0.051**	**0.051**	**0.053**	**0.053**	**0.664**	**0.664**	**0.068**	**0.068**	**0.122**	**0.122**

Fig.- 1. Morphological Characters in M_2 generation genotypes *Vigna radiata* (L.) Wilczek.

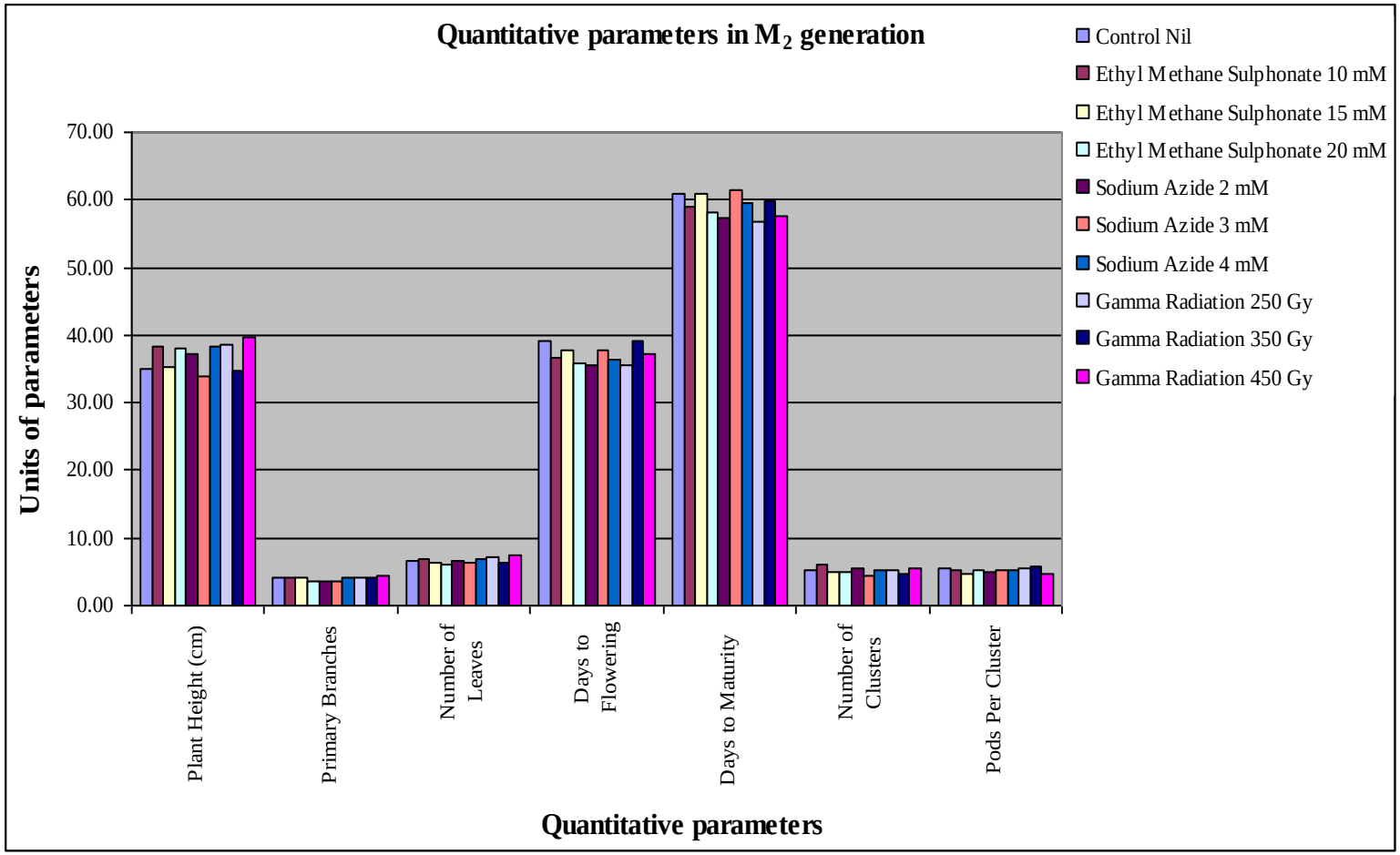

Fig.- 2. Morphological Characters in M_2