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Induced Viable Mutants in *Vigna marina* (Burn) Merr.*

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In a study of induced mutagenesis in *Vigna marina*, a total of 88 viable mutants was isolated from 11693 M_2 seedlings derived from 280 M_1 plant progenies. Mutants affecting leaf shape were commonly induced by both gamma rays and EMS. Effectiveness and efficiency were higher in 10 krad of gamma rays and 25 m*M* of EMS.

Many viable mutants have been reported by several investigators in pulse crops. In the present study, the frequency, spectrum and description of the viable mutants obtained through induced mutagenesis in *Vigna marina* with gamma rays and ethyl methane sulphonate are discussed.

MATERIAL AND METHODS

Vigna marina (Burm.) Merr. is a short lived perennial forage legume. Self fertilised seeds were treated with 10 to 70 krad of gamma rays enhancing 10 krad between doses. Twelve hours presoaked seeds were treated with 25 to 150 m*M* of EMS enhancing 25 m*M* between concentration.

Twenty M_1 famalies were selected at random under each treatment and raised as individual progeny rows. The M_2 plants were observed periodically during their life period. All marphological deviants that survived upto maturity were classed as viable mutations in M_2 and confirmed by testing in M_3

RESULTS AND DISCUSSION

(1) Frequency:

In gamma rays, the percentage of viable mutations computed on M_1 plant basis ranged from 15.0 to 45.0, and on M_2 plant basis from 0.34 to 1 26 (Table I). There was a decreasing trend up to 30 krad and then the frequencies were high in the higher doses. In EMS, the viable mutation rate on M_1 plant basis ranged from 10.0 to 35 0 per cent and on M_2 plant basis from 0.22 to to 0.92. Viable mutations occured in all the doses of both the mutagens. The frequency was high in extreme doses and slightly low in middle doses of both the mutagens. There was no dose event relationship indicating the differential response of the doses. The potency of gamma rays in producing slightly higher frequency of viable mutations was evident as compared to that observed in EMS treatment. Rathnaswamy (1975) has also reported in lab-lab that gamma rays had greater potency in producing higher frequency of viable mutations than EMS,

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TABLE I Viable Mutations, Mutations rate, Effectiveness and Efficiency in M_2 Generation.

Mutagen Dose/ Conc.	Number of M_2 Plants scored	Mutation rate		Effectiveness M × 100	Effeciency		
		M_1 Plant basis	M_2 Plant basis	tc or krad	M × 100 / L	M × 100 / I	M × 100 / S
Gamma rays (Krad)							
10	975	30.0	1.01	10.10	101.00	4.95	7.54
20	960	25.0	0.51	2.55	15.55	2.07	3.25
30	875	15.0	0.34	1.13	5.98	1.20	1.53
40	973	30.0	0.82	2.05	8.07	2.34	2.71
50	904	45.0	1.00	2.00	4.56	1.67	3.03
60	950	45.0	1.05	1.75	2.70	1.42	3.03
70	715	45.0	1.26	1.80	2.28	1.53	3.21
Control	910	—	—	—	—	—	—
EMS (mM)							
25	945	35.0	0.92	0.92	4.26	8.85	9.48
50	896	20.0	0.78	0.39	1.45	4.04	4.73
75	880	15.0	0.32	0.11	0.28	1.32	1.05
100	840	15.0	0.33	0.08	0.13	1.01	0.84
125	890	10.0	0.22	0.04	0.06	0.52	0.51
150	885	30.0	0.66	0.11	0.14	1.25	1.55

M = Mutation rate, t = time, C = Concentration, Krad = Kilo rad, L = Percentage lethality, I = Percentage injury, S = Percentage survival.

(ii) Effectiveness and Efficiency:

Effectiveness was the highest in the lowest dose of 10 krad and 25mM of EMS. The efficiency based on lethality was the highest in 10 krad of gamma rays, whereas based on injury and sterility, 25 mM of EMS was more efficient. Efficiency, in general, was high in the lowest dose of both mutagens (10 krad and 25 mM). The greater efficiency of low doses of mutagens appeared to result from the fact that injury, lethality and sterility tended to increase with increase in dosage of the mutagen at faster rates than mutations themselves (Konzak *et. al.*, 1965). The usefulness of any mutagen depends upon the mutagenic effectiveness as well as efficiency. Gamma rays were found to be more effective than EMS with respect to the induction of viable mutations.

(iii) Spectrum :

The spectrum of mutations consisting of those affecting plant habit, leaf

TABLE II Viable Mutation Spectrum in M_2 Generation.

Type of Mutant	Number of mutants out of 11693 M_2 plants		Percentage of individual type/of mutants to the total number of mutants	
	Gamma rays	EMS.	Gamma rays.	EMS
PLANT HABIT				
a) Semi erect	8	3	14.55	9.09
b) Dwarf with small leaves	6	—	10.91	—
LEAF ARRANGEMENT				
a) Multifoliate leaf	1	3	1.82	9.09
b) Clustered leaf	5	—	9.09	—
LEAF SIZE				
a) Broad leaf	2	3	3.64	9.09
LEAF SHAPE				
a) Linear	4	2	7.27	6.06
b) Round	3	1	5.45	3.03
c) Long narrow	1	—	1.82	—
d) Lanceolate	14	11	25.45	33.33
e) Lobed leaf	2	1	3.64	3.03
MATURITY				
a) Early	3	1	5.44	3.03
b) Late	1	2	1.82	—
SEED SIZE				
a) Small	—	1	—	3.03
b) Bold	1	—	1.82	—
c) Elongated seed	1	—	1.82	—
SEED COLOUR				
a) Brown with black spots	1	—	1.82	—
b) Red with black spots	1	—	1.82	—
c) Black mosaic	—	1	—	3.03
d) Light red	—	1	—	3.03
CHIMERAS	1	3	1.82	9.09
Total	55	33	100.00	100.00

characters, duration, seed size and seed coat colours was observed. The percentages of different types of mutations were estimated from the total number of mutations induced by each mutagen over all the doses combined. The data are presented in Table II.

Among the gamma rays irradiated populations in M_2, 55 viable mutants were isloated. Of this, 14 were affecting plant habit, 32 were leaf mutants four were maturity mutants and four were seed mutants. Mutants affecting leaf characters were prodominant.

In the EMS treated populations, 33 viable mutants were isolated, out of which three were habit mutants, 21 were leaf mutants, three were maturity mutants and three were seed mutants. Among the leaf mutants, leaf shape mutants were predominant.

(iv) **Mutants for plant habit :**

The mutants for habit consisted of semi-erect and dwarf types with small leaves. In the semi-erect mutant, none of the branches had the tendency to spread on the ground. The mean vine length was 35.0 cm compared to 125.1 cm of the control. In the dwarf mutant with small leaves, vine length was a little higher (40.6 cm). But leaf size, vine thickness, petiole length and thickness were drastically reduced. The leaf length and breadth were 2.8 and 1.6 cm compared to 6.5 and 4.0 cm in control. Shakoor *et al.* (1978) observed upright mutant in chick pea. Dwarf mutants were reported in *Phaseolus vulgaris* by Mujeeb and Greig (1973) and in *Dolichos biflorus* by Kulkarni and Shivashankar (1978).

(v) **Leaf mutants :**

Mutants affecting leaf arrangements like multifoliate leaf and clustered leaves were observed. In multifoliate leaf mutants, either four or five leaflets were present instead of three leaflets of the original population. The presence of additional leaflets was observed throughout the plant and inherited to next generation. However, the size of the leaflets was reduced but the other characters like vine length and fodder yield were not affected. In the clustered leaf mutant, the three leaflets of the trifoliate leaves were clustered at the tip of the petiole, whereas those were spaceously arranged in control population. The length of the petiolules is only 0.4 cm compared to 2.0 cm of parental plant. The leaf size was also slightly reduced in those mutants. Multifoliate leaf mutants are of common occurrence in cowpea (Louis and Sundaram, 1973).

In the broad leaf mutant, the leaf size increased. The gigas character was observed in the case of vine thickness and petiole thickness also. The leaf length and breadth were 10.1 and 5.5 cm compared to 6.5 and 4.0 cm in control.

Different types of leaf shape mutants like linear, round, lanceolate and lobed leaves were observed. In the lobed and lanceolate leaf mutants other characters like vine length and fooder yield were not affected. The linear and round leaf mutants were stunted in growth and fodder yield was reduced (470.6 g and 485.6 g, respectively) whereas in control it was 529.7 g. Though flowering was profuse, pods were observed only sparsely in these mutants. Mutants affecting leaf shapes were reported by Saini *et al.*, (1974) in greengram and Rao and Jana (1976 b) in blackgram.

(vi) **Maturity mutants :**

The early mutants were 14 days earlier than the control. The plants were normal except for earliness. Early mutants flowered in 58 days and late mutants in 92 days compared to 72 days in control. The lateness may be due to the mitotic arrest in the flower primordia. Similar mutants were reported by Ramaswamy (1973) in blackgram and Rathnaswamy (1975) in lab-lab.

(vii) **Seed mutants:**

Mutants with small, bold and elongated seeds were isolated. Seed weight of 25 grains was 0.53 g, 1.13 g and 1.12 g in the case of small, bold and elongated seed mutants, respectively, compared to 0.91 g in control. The grain colour of the parental line was brown. Different seed coat colours like brown with black spots, red with black spots, black mosaic and red seeds were identified. Coat colour mutants were reported by Moh (1971) in french beans Krishnaswami *et al.* (1977) in greengram and Rao and Jana (1976 a) in blackgram.

Other types of mutants obtained included chimeras. Part of the branches and leaves were yellow, other characters not affected. These chimeras were segregated from the normal M_1 plants.

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