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THE EFFECT OF IONIZING RADIATION IN MUNG (*PHASEOLUS AUREUS* ROXB)

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Dry seeds of three mung varieties viz. AUM 65, AUM-233 and 6601 were exposed to gamma rays (cobalt 60) using 15 20, 25 and 30 Kr levels of irradiation. Variability for various characters was studied in M1 and M2 generations. All the three varieties had reduced germination under all doses of irradiation during both the generations. Various levels of irradiation adversely affected plant height in M1 but not in the M2 generation. Irradiated plants produced significantly lesser number of flowers and pods per plant in the M2 generation. Number of seeds per pod in the irradiated material was also reduced in both the generations. Lower grain yield per plant was obtained with all levels of irradiation.

INTRODUCTION

Mung is a highly self fertilized crop and most of the commercial varieties are pure lines, therefore, scope for improvement through conventional methods of selection is very meagre. Success in creating genetic variability through varietal crosses has been very limited due to the failure in seed setting even under controlled conditions. As the creation of genetic variability is imperative for all types of improvements, it looked appropriate to make use of ionizing radiation to bring about heritable changes in various economic characters of mung. Traub and Muller (1933) observed a progressive decrease in percentage germination of peanuts with the increase in X–ray dosage. Similary response in germination of peanuts was reported by Van Huystee and Cherry (1967). Mont and Donini (1968), investigated the response of 24 pea varieties to prolonged gamma irradiation, subjecting them to 34 different exposure rates ranging between 5 and 200 R/d. Two weeks after transplanting into gamma field, all lines under investigation clearly showed delay in flowering, decrease in plant height, reduction in the number of ovules and seeds per pod. The

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present study is an attempt to assess the role of gamma rays as a means inducing genetic variation in this important edible legume.

MATERIALS AND METHODS

Dry seeds of three varieties viz. AUM-65, AUM-233 and 6601 were exposed to gamma rays (Cobalt-60 source) using 15, 20, 25, and 30 Kr doses of irradiation. M1 and M2 generations were raised during July-September, 1973, and March-July, 1974 crop seasons respectively. Ten plants from each treatment and the control were randomly selected in M1 generation. Sixty seeds were taken at random from each selected M1 plant to raise M2 progeny. The data for the following characters were recorded in both generations on an individual plant basis.

1. *Germination.* The germination count started after five days of sowing and continued for six consecutive days. The germination percentage was then calculated.

Plant Height. The height of the main stem in each selected plant was measured in inches from the surface of soil to the tip of the mother shoot.

Number of Flowers per Plant. Daily flower count was taken starting from the opening of the first flower bud for each set of treated and control plants.

Number of Pods per Plant. All the pods of a single plant in each treatment and control were harvested separately at maturity and counted to compute the number of pods per plant.

Number of Seeds per Pod. All the pods of individual plant from each treatment were threshed separately and the number of seeds per pod was calculated.

Yield per Plant. Finally, grain yield of selected plants was separately estimated in grams using sartorious balance and single plant average was then computed.

RESULTS AND DISCUSSION

As is evident from Table 1, no significant differences in germination among the three varieties were observed during M1 generation. However,

significant varietal differences were noticed in M2 generation where AUM-233 and 6601 with a germination percentage of 46.12 and 46.16, respectively, were found to be more tolerant to irradiation as compared to AUM-65 with a germination of 28.38 per cent only. Germination percentage declined with a progressive increase in the irradiation doses during both the generations although differences observed during M1 were not significant. As a reduction in germination appeared in both the M1 and M2 generations, possibly a heritable change in the genetic material is involved. Traub and Muller (1933), and Van Huystee and Cherry (1966) also observed a deterioration in germination in the irradiated plant material.

TABLE 1. *Germintion Percentage in M1 and M2 Generations of three mung varieties exposed to different irradiation doses*

Varieties	M1 Germination percentage	Stat. Sign.	Varieties	M2 Germination percentage	Stat. Sign.
AUM-65	94.20	NS	6601	46.16	a
AUM-233	91.80	NS	AUM-233	46.12	a
6601	91.20	NS	AUM-65	28.38	b
S.E.	3.70		S.E.		
Treatments					
Control	96.00	NS	Control	57.90	a
15 Kr	94.67	NS	15 Kr	36.50	b
20 Kr	91.00	NS	20 Kr	37.33	b
25 Kr	90.67	NS	25 Kr	35.80	b
30 Kr	89.67	NS	30 Kr	33.63	b
S.E.	4.70		S.E.	0.38	

Ionizing radiation showed differential effects on plant height in various varieties. The data (Table 2) revealed significant varietal differences during both the years of study. Shortest height was recorded in variety 6601 for both the generations, the values being 19.20 and 19.85 inches for M1 and M2 generations, respectively. All of the irradiation doses had depressing effect on plant height during both the generations however,, the differences in the M2 generation were not significant. Since the height in most cases behaves as a quantitative character the observed variation can be attributed to many loci exposed to mutation. Somewhat similar reduction in plant height was observed

by Monti and Donini (1968) in soybeans. Variety treatment interaction for plant height was significant in M1 and non-significant in M2 generation.

TABLE 2. *Average plant height in M1 and M2 generations of three mung varieties exposed to different irradiation doses*

Varieties	Height (in inches) per plant	Stat. Sign.	Varieties	Height (in inches) per plant	Stat. Sign.
AUM-65	20.42	a	AUM-65	23.08	a
AUM-233	19.59	ab	AUM-233	20.94	b
6601	19.20	b	6601	19.85	b
S.E.	0.32		S.E.	0.56	
Treatments			*Treatments*		
Control	21.48	a	Control	22.49	NS
15 Kr	19.11	b	15 Kr	20.61	NS
20 Kr	19.11	b	20 Kr	20.05	NS
25 Kr	18.85	b	25 Kr	21.21	NS
30 Kr	20.11	b	30 Kr	22.09	NS
S.E.	0.41		S.E.	0.73	

Varieties and treatments having the same letter do not differ significantly at the 5 per cent level.

N.S. = Non significant

S.E. = Standard error

Different irradiation levels also had significant effect on the number of flowers produced by different varieties. As is evident from Table 3, varieties differed significantly during both the generations. Variety 6601 produced the least number (54.83 and 32.57) of flowers per plant during M1 and M2 generations, respectively. While maximum number of flowers was recorded in variety AUM-65 having 70.21 and 42.84 flowers per plant for first and second generation, respectively. Differences among various radiation levels were also significant for both the generations. Treated plants produced significantly lesser number of flowers as compared to control in M2 generation, although treatment differences were not significant. These results find support from Monti and Donini (1968) who also observed a decrease in flowering in their experiments on peas. Variety treatment interaction for flower number was significant for both the generations.

TABLE 3. *Average flower number per plant in M1 and M2 generations of three mung varieties exposed to different irradiation doses*

Varieties	M1 Mean Number of flowers per plant	Stat. Sign.	M2 Varieties	Mean Number of flowers per plant	Stat. Sign.
AUM-65	70.21	a	AUM-65	42.84	a
AUM-233	60.86	b	AUM-233	35.86	b
6601	54.83	c	6601	32.57	b
S.E.	1.90		S.E.	1.24	
Treatments			*Treatments*		
Control	57.18	a	Control	46.42	a
15 Kr	65.47	b	15 Kr	33.96	b
20 Kr	63.63	ab	20 Kr	35.48	b
25 Kr	57.63	a	25 Kr	34.36	b
30 Kr	65.92	b	30 Kr	35.26	b
S.E.	2.44		S.E.	1.60	

TABLE 4. *Average number of pods per plant in M1 and M2 generations of three mung varieties exposed to different irradiation doses*

Varieties	M1 Mean Number of pods per plant	Stat. Sign.	M2 Varieties	Mean Number of pods per plant	Stat. Sign.
AUM-65	58.79	a	AUM-65	23.35	a
AUM-233	48.88	b	AUM-233	19.66	ab
6601	43.74	a	6601	16.72	a
S.E.	1.80		S.E.	1.54	
Treatments			*Treatments*		
Control	45.25	a	Control	26.30	a
15 Kr	54.33	b	15 Kr	15.78	b
20 Kr	51.83	ab	20 Kr	18.27	b
25 Kr	45.27	a	25 Kr	18.92	b
30 Kr	55.67	b	30 Kr	20.29	b
S.E.	2.40		S.E.	1.98	

Varieties and treatments sharing the same letter do not differ significantly at the 5 per cent level.

S.E. Standard error

As indicated by the data in Table 4, varieties differed significantly for the production of pods during both the generations. Variety 6601 with 43.74 and 16.72 pods per plant produced the maximum number in the first and second generations, respectively. Among the treatments, 25 Kr was at a par with control in pod number in M1, however, 15 Kr and 30 Kr significantly excelled the control producing 54.33 and 55.67 pods per plant as against 45.25 pods in control. However, in M2, differences among the various levels of irradiation were non-significant. Drastic reduction in pod number seems mainly due to large amounts of flower fall in treated plants. Variety treatment interaction for pod number was significant for M1 and non-significant in M2 generation.

The analysis of variance for number of seeds per pod (Table 5) revealed that differences between varieties were nonsignificant during both the years of study. Among the various irradiation levels applied, none could excel the control plants during both the generations. Smallest number of seeds per pod (7.51) was obtained in highest level of irradiation, i.e., 30 Kr during M1 generation. All the treatments showed tendency to reduce seed number as compared to control during both the generations. Whether the reduced seed setting resulted from reduced pollen viability or ovule abortion was not ascer-

TABLE 5. *Average number of seeds per pod in M1 and M2 generations of three mung varieties exposed to different doses of irradiation*

M1			M2		
Varieties	Mean number of seeds per pod	Stat. Sign.	Varieties	Mean number of seeds per pod	Stat. Sign.
6601	8.70	NS	AUM-233	6.57	NS
AUM-65	8.62	NS	AUM-65	6.30	NS
AUM-233	8.41	NS	6601	6.25	NS
S.E.	0.18		S.E.	0.13	
Treatments			*Treatments*		
Control	9.96	a	Control	7.59	a
15 Kr	8.30	b	15 Kr	5.89	b
20 Kr	8.51	b	20 Kr	6.12	b
25 Kr	7.51	b	25 Kr	6.28	b
30 Kr	7.51	c	30 Kr	6.00	b
S.E.	0.23		S.E.	0.16	

tained. There were significant differences for yield among the varieties during both the generations (Table 6). Variety 6601 was the lowest with 12.24 and 3.00 grams of yield per plant for the first and second generations, respectively. As for the various irradiation doses, the differences were nonsignificant during M1 but were significant during M2 generation. Treatment with 15 Kr and 20 Kr produced the minimum number of grains. From these findings it can be concluded that Phaseolus aureus does have the potential to respond to various irradiation doses and may yield beneficial mutants.

TABLE 6. *Average yield per plant in M1 and M2 generations of three mung varieties exposed to different levels of irradiation*

M1			M2		
Varieties	Mean Yield (in gms.) per plant	Stat. Sign.	Varieties	Mean Number of seeds per pod	Stat. Sign.
AUM-65	14.31	a	AUM-65	3.91	a
AUM-233	12.93	ab	AUM-233	3.91	a
6601	12.24	b	6601	3.00	b
S.E.	0.50		S.E.	0.17	
Treatments			*Treatments*		
Control	13.13	NS	Control	5.09	a
15 Kr	14.60	NS	15 Kr	2.67	c
20 Kr	13.27	NS	20 Kr	3.23	bc
25 Kr	12.70	NS	25 Kr	3.40	b
30 Kr	12.61	NS	30 Kr	3.64	b
S.E.	0.64		S.E.	0.24	

Varieties and treatments having the same letter do not differ significantly at the 5 per cent level.

N.S. = Non significant
S.E. = Standard error

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