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INDUCED QUALITATIVE MUTATIONS IN GROUNDNUT (*Arachis hypoaea.* L.)

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Induced qualitative mutations in two groundnut cultivars, TMV 9 and Ah 7911. their frequency and spectrum are presented. Qualitative mutations in M_2 consisted. of chlorophyll and viable mutants. The spectum of chlorophyll mutations showed differential response of the two varieties to mutagenic treatments. Combination treatment in TMV 9 and higher dose of gamma rays in Ah 7911 resulted in less than additive values for chlorophyll mutation. Induced viable mutations included mutations for dwarffism, kernel size, testa colour and growth habit. Mutations for testa colour, consisted of brown, purple, red, white variegated end purple lining around micropyle as against rose testa in the control. Two mutants having semispreading growth habit possessed desirable features of short stature, higher pod and kernel yield, bold kernels and increased shelling percent compared to that of control.

Induced qualitative mutations are of two kinds, namely, chlorophyll mutations and viable mutations. Increasing the spectrum and frequency of mutations was among the objectives in the present study involving two well adapted groundnut cultivars, TMV 9 and Ah 7911. Three doses of physical mutagen, 20, 30 and 40 krad of gamma rays, three concentrations of chemical mutagen, 40, 60 and 80 m*M* of EMS and combination of 20 krad + 40 m*M* were the treatments with which the above mentioned varieties were subjected to. An account of the qualitative mutations are presented in this paper.

MATERIAL AND METHODS

Seeds harvested from fifty randomly selected M_1 plants in each treatment were advanced to raise M_2 generation in April, 1976 in randomised blocks with three replications. Control lines were raised from seeds obtained from randomly chosen plants in the parent varieties. The populations raised under varieties.

The M_2 generation was examined upto 15th day after germination for chlorophyll mutation. The mutation frequency was estimated and expressed as percentage on M_2 plant basis. The mutant and normal seedlings were counted separately to determine the segregation ratio, i. e., percentaoe of mutants to total progenies. The chlorophyll mutations were classified according to the system proposed by Gustafsson (1940) and Blixt (1961). Synergism was calculated to show synergistic or less than additive effect (Sharma and Swaminathan, 1969).

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The M_2 plants were observed periodically upto maturity for viable mutations and morphological deviants. Viable mutation frequency was estimated on the basis of 100 M_2 plants Progenies of the viable mutants were in M_3 generation in non-replicated rows along with the parents.

RESULTS AND DISCUSSION

1. *Chlorophyll mutations*: The chlorophyll mutation frequency was 1.44 at 40 krad of gamma irradiation treatment in Ah 7911 which was the maximum observed in the present study Earlier reports (Ashri and Levy, 1974) showed the low magnitude of occurrence of such mutation in the present study. Such differences could have arisen due to differential response of the genotypes besides differences in dose and treatment conditions of mutagenic treatments. The low frequency of chlorophyll mutation might have also been due to phenotypic buffering as reported in hexaploid wheat (Mackey, 1961). As groundnut is an amphiploid (Gregory *et al*, 1951) and Raman, 1959) and several traits are controlled by duplicate factors (Gregory *et al*. 1951 and Hammons, 1963), the masking effect would have reduced the expression of chlorophyll mutations.

The data on chlorophyll mutation frequency have shown that the varieties were identical in their response to gamma rays and EMS. Combination treatment in TMV 9 was found to induce chlorophyll mutation in greater frequency than single treatments. Synergism indicated less than additive effect in the combination treatment. Instances of increased mutation frequency in combination treatment have been reported in peas (Mehandjiev, 1969), French been (Marghittu, 1973) and *Vicia sativa* (Debelji and Ptaschenchuk, 1973).

The spectrum of chlorophyll mutations induced by mutagenic treatments was found to vary according to the mutagen, dose and variety (Table 2). While all the three concentrations of EMS have induced *albina* and *viridis* in Ah 7911, such mutants were observed in TMV 9 at 40 m*M* of EMS only. Gamma irradiation has induced *xantha* in Ah 7911 and not in TMV 9. EMS treatment was found to induce *chlorina* only in TMV 9. Earlier reports have shown the occurrence of *xantha* and *virescent* mutants after X-irradiation in groundnut (Bora, 1963). *Chlorina* was observed from a cross between X-ray induced *virescent* mutant and spontaneous krinkle leaf mutant (Patil, 1973). Individual treatments of gamma rays and EMS were known to induce *xantha*, *albina* and *virescent* mutants in groundnut (Ashri and Levy, 1974). Three major genes were reported to control chlorophyll development in groundnut (Patil, 1973).

2. *Viable mutations*: Data on viable mutation frequency on M_2 plant basis (Table-1) have shown its occurrence upto 0.66 percent in TMV 9 and 0.51 percent in Ah 7911 at 40 m*M* of EMS treatment. Lower frequency of viable mutations was observed at higher concentrations of EMS. A comparison of chlorophyll and viable mutations indicated the occurrence of the latter

at lower frequency than that of the former. EMS, particularly at lower concentration of 40 m*M* was found to induce higher frequency of viable mutation in the two varieties. Low frequency of viable mutation observed in the present study may be due to haplontic or diplontic selection (Swaminathan, 1977) or because the induced mutations may be semidominant or recessive. Mutants in M_3 are ordinarily considered homozygous for the selected trait. However, it cannot be assumed that all the variants should prove homozygous in progeny tests particularly since epistatic interactions among genes are common.

Levy and Ashri (1978) have isolated one true breeding trailing mutant, an extreme form of spreading type, from bunch cultivars, which has been interpreted as segregation of heteroplasmons arising from plasmon mutations. The observed semispreading types of mutants in the present study would have arisen as a result of probable plasmon mutation.

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TABLE—I: Chlorophyll and viable mutation frequency in M_2 generation

Variety/Treatment	Number of M_2 plants	M_1 families segregating for chlorophyll mutants %	Chlorophyll % mutants	Visble mutants %
		IMV 9		
Gamma 20 krad	2705	8	0.81	0.33
30	2692	10	1.07	0.38
40	2685	6	0.81	—
EMS 40 mM	2724	8	1.06	0.66
60	2675	4	0.44	0.17
80	2585	6	1.00	0.26
20 krad + 40 mM	2536	8	1.26	0.27
		Ah 7911		
Gamma 20 krad	2675	14	1.04	0.25
30	2663	6	1.01	0.21
40	2635	12	1.44	—
EMS 40 mM	2654	10	1.20	0.51
60	2595	8	1.04	0.04
80	2573	6	0.85	0.09
20 krad + 40 mM	2515	8	1.11	—

Number of M_1 plants studied under each treatment is 50

Table—2: Spectrum of chlorophyll mutations in M_2 generation

Treatment	Mutation spectrum (percent)					
	Albina	Alboviridis	Chlorina	Xantha	Viridis	number
TMV 9						
Gamma 20 krad	27.2	36.3	36.3	—	—	22
30	34.4	34.4	31.0	—	—	29
40	9 1	54.5	36.3	—	—	22
EMS 40	6.9	41.3	17.2	13 7	20.6	29
60	—	33.3	25.0	41.6	–	12
80	—	26.9	34.6	38 4	—	26
20 krad + 40 mM	18.7	34.3	21.8	18.7	6.2	32
Ah 7911						
Gamma 20 krad	–	25.0	42.8	32.1	—	28
30	7·4	22.2	29.6	22.2	18.5	27
40	10.5	23 6	34.2	31.5	–	38
EMS 40 mM	28.1	37.5	—	—	34.3	32
60	25.9	–	–	29.6	44.4	27
80	27.2	—	—	40.9	31·8	22
20 krad + 40 mM	14.2	17.8	42.8	25.0	—	28

Table—3 Spectrum of viable mutations in M_2 generation

Treatment	Mutant for %				Mutations for				Total number
	Dwarf ness	Growth habit	Leaf character	Sterility	Pod charac-ter mutatnts	Testa colour	Two* traits	Three traits	
TMV 9									
G mma 20 krad	—	–	50.0	25.0	12 5	12 5	—	—	8
30	11.1	—	11.1	11.1	44.4	22.2	–	–	9
40	—	—	—	—	—	—	—	—	1
EMS 40 mM	—	6.2	62.5	–	12.5	6.2	6.2	6.?	—
60	—	60.0	40.0	—	—	—	—	—	5
80	—	—	66.6	—	33.3	—	—	–	6
20 krad + 40 mM	–	—	33.3	—		33.3	33.3	—	6
Ah 7911									
Gamma 20 kard	—	—	66.6	—	33.3	—	—	—	6
30	20.0	—	—	40.0	—	40.0	—	—	5
40	—	—	—	—	—	—	—	—	—
EMS 40 mM	—	8.3	16.6	—	50.0	16.6	—	8.3	12
60	—	—	—	—	—	—	100.0	—	1
80	—	50.0	50 0	—	—	—	—	—	2
20 kard + 40mM	—	—	—	—	—	—	—	—	—

*Growth habit and pod size

+Growth habit, dod size and testa colour

Table—4 Quantitative Characters of viable mutants in M3 Generation. (Mean of 20 plants)

Characters	Mutant - 16 TMV 9, 20 Krad + 40 m*M* Mean ± S. E	Mutant - 17 TMV 9, 20 krad + 40 m*M* Mean ± S. E	TMV 9 (Control) Mean ± S.E.
Hight of main stem (cm)	10.3 ± 0.6	11.2 ± 0.8	20.3 ± 1.6
Length of primary branch (cm)	23.1 ± 1.0	22.8 ± 0.7	23.9 ± 2.3
Number of primaries	12.9 ± 0.8	12.4 ± 0.2	4.5 ± 0.8
Number of secondaries	10.0 ± 1.4	9.9 ± 1.1	3.3 ± 0.9
Number of pods/plant	23.4 ± 1.5	21.0 ± 1.5	20.8 ± 2.1
Number of kernels/plant	37.7 ± 2.1	34.0 ± 2.3	34.2 ± 2.5
Pod yield (g)/plant	26.2 ± 1.7	21.7 ± 1.6	16.4 ± 0.9
Kernel yield (g)/plant	19.4 ± 1.3	15.5 ± 0.8	10.8 ± 0.6
100 pod Weight (g)	114.6 ± 5.0	103.0 ± 2.0	67.4 ± 4.6
100 Kernel weight (g)	52.4 ± 2.0	50.3 ± 2.3	28.2 ± 1.5
Shelling percent	72.7 ± 4.2	74.2 ± 2.4	71.8 ± 2.7

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