Induction of Genetic Variability for Quantitative Traits and Oil Content in Peanut (*Arachis hypogaea L.*) by Using Gamma Rays and Acriflavin Mutagens.

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Abstract: The present study aimed to induction of genetic variability for important characters in peanut. Different doses of gamma rays (200, 400 & 600 Gy) and different concentration of acriflavin solution (0.2%, 0.4% & 0.6%) were applied. Four varieties of Peanut (*Arachis hypogaea* L.) namely; Giza4, Giza5, Giza6 and Giza7 were used in this present study. The studied characters including: plant height, number of branches per plant, dry weight of pods per plant, number of pods per plant, number of seeds per plant, yield of plant, weight 100-seed, shelling percentage and oil percentage. Increase and decrease in mean values were recorded as a result of the irradiation and chemical treatments. Mutagenic effectiveness was found to be dependent upon dose and genotype concerned. Increases in genetic parameters of variation, heritability and genetic advance under mutagenic treatments indicated the possibility of evolving higher yield variants through proper crop selection. Thus, economic traits like plant height, number of pods per plant, dry weight of pods, and number of seeds per plant and 100-seed weight with high heritability and genetic advance in M2 and M3 generation offer good scope for the possibility of inducting desirable mutations for polygenic traits accompanied with effective selection and improvement.

Keywords: Peanut, gamma rays, Acriflavin, yield characters, genetic parameters.

INTRODUCTION

Mutations are the tools used by the geneticist to study the nature and function of genes which are the building blocks and the basis of plant growth and development, thereby producing raw materials for genetic improvement of economic crops (Adamu *et al.* 2004). Induced mutations have great potential and served as a complimentary approach in genetic improvement of crops. Moreover, variability in base population becomes essential when breeding objective is more complex. Main interests of geneticist and plant breeder are quantitative traits which are controlled by polygenic interactions. Many experiments carried out with various crops have established that radiation and chemical mutagens induce polygenic variability (Khan *et al,* 2004, Khan and Wani, 2006 and Tah, 2006). However, various mutagenic agents are used to induce favorable mutations at high frequency that include ionizing radiation and chemical mutagens. The mutants so produced facilitate the isolation, identification and cloning of genes used in designing crops with improved yield, increases stress and reduced agronomic input (Ahloowalia & Mlszynski 2001).

Since peanut is self-pollinating crop, available variability is limited for its improvement programs. Induced mutageneses thus seem to be an ideal methodology for induction of desirable genetic variability. In addition to mutation could confer increasing variability in plants, it could improve one or two characters without significantly altering its acceptable phenotype and without changing the rest of genotype (Mensah & Obadoni, 2007).

For increasing production of the peanut crop there is needed to have a better understanding of the genetic background. However, there is poor information on the locally cultivated varieties which lack variability because it considered self-pollination status. Therefore, the present study aimed to induction of genetic variability for important characters (qualitative) and oil content to measuring the effective of genetic improvement progenies.

MATERIALS AND METHODS

A field experiment was conducted during 2006, 2007 and 2008 seasons at the Experimental Farm, Faculty of Agriculture , Suez Canal University.

The experimental material was comprised of four varieties of Peanut (*Arachis hypogaea* L.) namely , Giza4 , Giza5 , Giza6 and Giza7 which were obtained from Oil crop Research Department , Institute of Field Crops, Giza, Egypt .

For physical mutagenesis, sample of 200 dry seeds of each variety were subjected to the acute well gamma doses (Co ^{60} source) 200, 400 and 600 Gy. Irradiation was achieved in season 2006 at the National Center for Research and Radiation Technology, Atomic Energy Agency. Cairo, Egypt.

For chemical mutagenesis, seeds of four varieties pre-soaked in distilled water for 6 hours, were treated 0.2, 0.4 and 0.6 % of Acriflavin solution for four hours. Seeds soaked in distilled water were used as control. After completion of treatment period of four hours, the treated seeds were washed thoroughly in running tap water to reduce the residual effect of the mutagen sticking to the seeds coat.

The treated and control seeds were sown in the field in complete randomized block design with three replications. Seeds harvested from individual M1 plants were sown as M2 families in three replications in the field. Such 10 M2 progenies were selected for raising M3 generation. Seeds from each selected M2 progeny were bulked by taking an equal amount of seeds from all M2plants from a single M2 progeny and thoroughly mixed. A random sample of this bulk was sown to obtain M3 progeny per each treatment.

The parameter studies including: plant height, number of branches per plant, dry weight of pods per

plant, number of pods per plant, number of seeds per plant, grain yield per plant, weight 100-seed, shelling percentage. Oil parentage was measured by Soxhelt apparatus.

Since, variation in M1 generation, though less important in view obtaining stable gene mutations, are often considered as indicator in measuring efficiency of mutagen treatments (plesnik, 1993).These nine characters were evaluated during M2 and M3, further using the following genetic parameters: genetic variance, phenotypic variance, heritability in broad sense by the formulae outlined by Singh and Choudhary (1976) and genetic advance was according to Allard (1964).

RESULTS AND DISCUSSION

Mean performance of quantitative traits and oil content in peanut at M2 and M3 generation:

To create a new variation in plant population, the use of chemical and irradiation mutagens is an interesting method which has becomes an established technology. In this way many induced mutants have been released as cultivars (Maluszyonski *et al*, 1995). However, the mean performance of quantitative traits and oil content in peanut varieties at M2 and M3 (Table1-5) confirmed that the significant differences between varieties, gamma-ray and acriflavin treatments in almost characters, except plant height of gamma and Acraflivin at M3 generation.

Table 1 showed data for plant height and no of branches for four peanut varieties at M2 and M3. It is obviously that Giza4 possessed higher mean values for plant height at M2 and M3, and no. of branches per plant at M3 while Giza6 gave higher mean values at M2 generation.

In M2 generation, differences recorded for plant height were in the range of 47.58 cm & 43.82 cm; 27.43 cm & 26.7 cm; 40.40 cm &35.38 cm and 39.22 cm & 35.99 for Giza4, Giza5, Giza6 and Giza7 at radiation and chemical mutagens respectively. It is evident from Table 1, that increases in the mean values of Giza4, Giza6 and Giza7 for plant height (cm) were 20.15 & 17.12, 12.97 & 11.38 and 11.79 & 8.68% respectively as compared to the mean values of Giza5 (27.43 & 26.7 cm) for plant height at both mutagens.

Moreover, the data obtained from Table1 for effects of radiation doses and chemical concentrations on the varieties in M2 generation indicated that they responded to mutagens differently. Plant height was found to be reduced at higher mutagenic treatments but some plants at lower dose responded positively to the mutagen and recorded a slight increase in plant height in Giza4.The opposite trend was found in Giza5 which was responded positively to highest mutagenic treatment and recorded an increase in plant height. However, various radiation doses and acriflavin concentrations in increasing arrangement produced gradual reduction in plant height in Giza7. Giza6 showed increased for plant height through all different mutagenic treatments.

Table 1 showed the mean values for plant height due to different radiation doses and different chemical concentrations ranged between 31.92 cm to 40.32 cm. The maximum decreased in plant height due to 0.4% of Acriflavin was 6.38 cm by comparing the mean value due to 0.4% of Acriflavin (31.92 cm) to control (38.3 cm).

In M3 generation, plant height was found to be increase in Giza4, Giza6 and Giza7 but it was found to be reduced in Giza5. However, the selection of mutants with plant height reduction is particularly important in connection with high susceptibility of peanut to lodging. Using gamma rays and EMS (Waghmare and Mehra, 2000) the induced polygenic variability of plant height in M2 and M3 reached 26-120 and 37-118 cm, respectively.

Particularly wide variability was observed for number of branches and number of pods per plant, dry weigh of pod, number and weight of seed per plant as well as for 100 seed weight (Table1-5).There was an increase in the mean values of the number of branches per plant in M2 generation in Giza4 and Giza6 (Table1). The mean values were higher than the control. Whereas the mutagenesis effect on Giza5 and Giza7 was negative in M2. The minimum mean value of this trait was 6 for 400 Gy gamma rays in M2 plants of Giza5. M3 generation show very slight improvement for number of branches as comparison with control population. However, difference in effect of irradiation and chemical mutagens might be due to seeds metabolism and onset of DNA synthesis in each variety (Shah *et la.*, 2008).

M2 generation showed a decrease in mean values for dry weight of pods per plant compared to its control in four varieties of peanut (Table2). Reduction in this trait may be attributing to chromosomal aberration or due to decline of assimilation mechanism (Larik *et al.*, 2009). Some plants in M3 observed slight increase in this trait as the case in Giz6 and Giza7 at irradiation mutagen and in Giza4 and Giza7 at chemical mutagen.

One of the most important traits influenced yielding ability is pods number per plant (Rybinski, 2003). The value of this trait for M2 plant Giza4, Giza5, Giza6 and Giza7 ranged respectively between, 10.28-21.96, 5.04-21, 13.44-23.04 and 9.8-20.92 (Table2). A comparison of number of pods in the treated and control plants showed the mean values decreased for four varieties in M2. M2 plants responded negatively to mutagenic treatments may be partly due to the fact that cells having relatively more chromosomal damage at mutagenic exposures, are disadvantage due to diplontic selection and cannot complete well with normal cells and are thus prevented from making any further contribution (Larik *et al.*, 2009). Similar depression effects of mutagenesis were also report by Cheema and Atta (2003). M3 plants showed some improvement for the mean values of Giza6 and Giza7 at gamma rays and in Giza4 and in Giza7 at chemical mutagen. The interaction between gamma- rays or acriflavin were recorded in many cases. For no. of pods per plant, Giza6 x 400 Gy –gamma ray gave extreme mean value (68.5) with comparison (31) at the average mean. 400 Gy -gamma ray might be simulated the plants to produced this high number of pods.

Table (1): Average mean for plant height and no. branches / plant of four peanut varieties in M2 and M3 generations.

Treat.	M2 Plant height (cm)					M3 Plant height (cm)					M2 No. branches /plant					M3 No. branches /plant				
	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean
Control	48.4	25.64	32.5	46.6	38.3	38.9	39	28	34	35	9.88	11	8.84	12.4	10.53	4.57	4.43	3.22	5	4.31
200Gy	53.3	22.44	39.6	38.8	38.55	42.8	38.3	32.5	36	37.34	8.12	10.7	14.3	13.9	11.76	4.08	4.13	4.46	5	4.42
400Gy	42.4	23.16	48.4	35.8	37.46	42.4	31.7	40	44	39.55	11.6	6	11.8	10.7	10.02	3.792	5.56	6.5	5.4	5.31
600Gy	46.1	38.48	41	35.6	40.32	42	33.5	33.1	26	33.57	17	13.4	15.5	10.6	14.1	5.4	5.1	4.36	2.6	4.37
Mean	47.6	27.43	40.4	39.2	38.66	41.5	35.6	33.4	35	36.37	11.7	10.3	12.6	11.9	11.6	4.46	4.81	4.64	4.5	4.6
Control	48.4	25.64	32.5	46.6	38.3	38.9	39	28	34	35	9.88	11	8.84	12.4	10.53	4.57	4.43	3.22	5	4.31
0.2%Acr	53.2	27	39	33.1	38.1	57.3	32.3	27.2	30	36.75	10.4	9.88	11.8	10.2	10.6	8.42	3.63	3.62	5.7	5.34
0.4%Acr	38.6	21.16	40.6	27.3	31.92	40.1	40	42.3	36	39.46	10.4	7.24	11.2	13.1	10.49	6.375	5.03	2.88	6	5.07
0.6%Acr	35	33	40.2	34.4	35.65	39.6	32.8	31.1	41	36.01	11	13.4	11.7	8.13	11.06	5.5	3.89	4.67	6	5.01
Mean	43.8	26.7	38.1	35.4	35.99	44	36	32.1	35	36.81	10.4	10.4	10.9	11	10.67	6.216	4.24	3.6	5.7	4.93
LSD 5%	Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)		
	4.9	1.97	1.57			4.23	4	3.5			0.88	1.02	1.02			1.57	1.26	1.4		
LSD 5%	V * R	V*Acr	V * R	V * Acr	V * R	V* Acr	V * R	V * Acr												
	4.07	3.25	8.05	7.01	2.1	2.08	2.479	2.65												

Table (2): Average mean for dry weight of pods/ plant and no. pods / plant of four peanut varieties in M2 and M3 generations.

Treat.	M2 Dry weight of pods /plant (g)					M3 Dry weight of pods /plant (g)					M2 No. pods /plant					M3 No. pods /plant				
	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean
Control	22.16	22.32	21.4	22.52	22.1	33.29	49.71	34	18.25	33.81	15.32	20.48	18.72	20.4	18.72	28.42	40.57	28	15.75	28.2
200Gy	15.68	8.224	13.89	10.48	12.07	38.46	40.16	27.36	16.41	30.6	12.32	9.2	14.8	10.7	11.75	29.54	39.42	31	17.25	29.3
400Gy	11.48	3.74	13.68	21.40	12.58	31.08	24.33	56	26.86	34.57	10.28	5.04	13.84	20.9	12.52	25.41	20.67	68.5	26.14	35.2
600Gy	20.55	16.15	22.97	15.30	18.75	27.18	27.74	19.52	15.78	22.56	21.96	21.28	21.20	15.6	20.02	27.3	31.2	20.4	15.96	23.7
Mean	17.46	12.60	17.98	17.42	16.38	32.5	35.49	34.22	19.33	30.38	14.97	14	17.14	16.9	15.75	27.67	32.96	37	18.77	29.1
Control	22.16	22.32	21.4	22.52	22.1	33.29	49.71	34	18.25	33.81	15.32	20.48	18.72	20.4	18.72	28.42	40.57	28	15.75	28.2
0.2%Acr	16.77	9.46	16.28	13.28	13.95	59.25	44.04	34.92	19.06	39.32	12.32	9.8	13.72	12.8	12.16	50.66	32.13	30.4	16.19	32.4
0.4%Acr	13.05	5.03	14.47	10.61	10.79	23.09	33.29	33.92	26.6	29.22	12.84	8.48	13.44	9.83	11.15	22	29.21	29.4	24.1	26.2
0.6%Acr	13.7	22.21	26.96	11.40	18.57	29.12	27.68	19.95	28.9	26.41	15.52	19.08	23.04	11.4	17.25	28.9	24.14	22.1	24	24.8
Mean	16.42	14.76	19.77	14.45	16.35	36.19	38.68	30.7	23.2	32.19	14	14.46	17.23	13.6	14.82	32.49	31.51	27.5	20.01	27.9
LSD 5%	Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)			Variety	Gamma rays (R)	Acriflavine (Acr)		
	2.9	2.97	2.65			12.17	8.78	9.52			2.037	2.64	2.15			9.39	10.69	6.52		
LSD 5%	V * R	V* Acr	V * R	V * Acr	V * R	V* Acr	V * R	V * Acr												
	6.1235	5.4536	16.46	18.69	5.4413	4.41807	20.313	12.8												

Number of seeds per plant and seed yield of gamma rays and acriflavin treated plants measured in M2 and M3 plants are present in Tables 3. The M2 and M3 plants were variable in spite of the fact M3 were selected for seed yield. Lower value for range of seed number and seed yield are higher in M3 compared to M2. This may be due to the selection practiced for higher seed yield in M3 generation. However, stability of seed yield performance in the mutants will most probably be visible in later generation (M4 or M5) for increasing recombination and elimination of cytological variants (Larik *et al.*, 1982 and Acharya *et al.*, 2006).

In many cases the M3 plants produced a high number of seeds per plant and increased seed yield which depended greatly on the genotype and the type and dose of mutagens used as the findings of M3 plants Giza4 and Giza5 (76 seeds & 56.3 g and 81.7 seeds & 46.3 g) respectively due to 200 Gy gamma rays. Giza6 at M3 generation as well as Giza7 200 Gy –gamma ray gave 94.35 seeds per plant by comparison 75 for average mean. Mean control results for seed yield per plant (g) were 28g to Giza5 by comparison 46.33g for this variety under 200 Gy-gamma rays at M3 generation. Thus, increases in a polygenic character like yield could result from changes in simply inherited traits (Micke *et al.*, 1990) or mutations at the structural loci (Evancs1987).

In many case the M2 plants produced a high number of pods per plant and were characterized by a decrease in weight 100 seed. Weight 100 seed in M2 for Giza4, Giza5, Giza6 and Giza7 ranged respectively: 64 g, 56 g, 72.3 g, and 49 g for control treatment (Table4). After use gamma rays and acriflavin the 100 seed weight in M2 range was 28.3-72.3 g. The maximum reduction in the 100 seed weight was 49.4% by comparing value due to 0.4% of Acriflavin (28.3 g) to control (56 g) in M2 plants Giza5. The results presented in Table4 showed the mean values for the 100 seed weight due to gamma rays and acriflavin mutagen which did not show any improvement in the 100 seed weight but slight decreased was observed in this special case as to compare to its respective control. M3 generation showed negative trend to mutagen treatments for 100 seeds weight character. It could attribute to mutation of the pleiotropic gene, mutation of gene cluster or to chromosomal rearrangement which influenced the production of mutant plants (Wani and Anis, 2008).

The mean values of shelling percentage were responded negatively to mutagenic treatments in M2 and M3 generation except for Giza6 in M2 and Giza5 and Giza7 in M3 were positively as comparing with respective controls (Table4).

In general, at M3 generation, the differences between varieties and treatments were smaller than M2 generation in almost characters under study because self pollination occurred and it decreased heterozygosity and subsequently increasing of similarity. Therefore, the mean results showed that M3 generation possesses higher values than M2 generation which permit to selection for increasing of yield characters and its attributes.

Oil content is a primary and important component of peanut crop. The date in Table 5 showed that an increase in mean values for oil parentage in treated plants of Giza5 and Giza6 whereas a decrease in mean values in treated plants of Giza4 and Giza7 in M2 generation. Gamma rays treated plants in M3 showed lower of oil percentage than its respective controls. Chemical treated plants in M3 did not show any improvement but slight decreased was observed expect for treated plants Giza6 was recorded 32.1%.This special case was higher than its respective control. On other hand, the maximum increased in mean value by mutagen effect was recorded (50.9%) at 0.4% acriflavin in Giza7 in M3 that indicated that mutation does might improve the oil percentage at 0.4% acriflavin by inducting polygenic variability (Kumar, *et al.*,1993). However, Wang *et al.* (2007) found EMS treatment may increases oil content of peanut and may also decrease this trait. Thus, the oil content of peanut seeds is a polygenic and complex trait that is responsive to environment effects that occur during plant development.

From genetic point of view increased variation assume greater significant. Micke *et al.*, (1990) reported that mutagen derived variability for quantitative characters in crop plants are heritable and response to selection is good. Use of relative value of this scours of variability in crop improvement, therefore, depends almost entirely upon nature of phenotypic expression caused by mutations induced at polygenic loci. It is only necessary to know if such deviation from the mean is identical and unidirectional for all yield components. The results indicated that change in means is always unidirectional and is effective for all traits, supporting conclusion of Larik *et al.*, (2009) that induced genetic changes are unidirectional and highly selected bring a greater shift in mean and a greater asymmetry in distribution.

Genetic parameters for studied characters under gamma ray and acriflavin mutagens at M2 and M3 generation:

In the present study, phenotypic variance was higher than genotypic variance for all the characters in both chemical and physical mutagens in M2 and M3 generations (Table 6). This is indicating higher influence of environment on the expression of these characters and genetic factor had low expressivity on them.

However, high heritability estimates along with high genetic advance were recorded for plant height, number of pods per plant, dry weight of pods, and number of seeds per plant and 100-seed weight in M2 and M3 generation. Those partly mention results were in agreement with those of Phudenpa *et al.* (2004) who reported that the heritability estimates for pod number per plant; pod dry weight, seed number per plant and 100-seed weight were moderate. The discrepancy of the results is not unexpected because such quantitative traits are often affected by several environment factors. Assessment at differences times may be the main cause

Table (3): Average mean for seeds number/ plant and seed yield / plant of four peanut varieties in M2 and M3 generations.

Treat.	M2 Seeds number/plant					M3 Seeds number/plant					M2 Seed yield /plant (g)					M3 Seed yield /plant (g)				
	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean
Control	54.67	46.67	48.33	52	50.4	75.33	56	56	65	63.1	33.03	38.33	37	23.63	33	49.3	28	33.67	50.67	40.4
200Gy	32.33	42	41.33	55	42.7	76	81.67	68.67	94.33	80.2	21.47	29.3	17.87	25.17	23.45	56.3	46.33	38.67	37	44.6
400Gy	32.33	17	53	49.67	38	66.33	41.67	60.67	91	64.9	20.23	7.753	23.83	34.57	21.6	42	26	30	36.67	33.7
600Gy	49.33	61	56	64.67	57.8	61.33	59	61.67	50	58	24.73	36	32.23	33	31.49	40.3	32	24.67	23	30
Mean	42.17	41.67	49.67	55.33	47.2	69.75	59.58	61.75	75.08	66.5	24.87	27.85	27.73	29.09	27.38	47	33.08	31.75	36.83	37.2
Control	54.67	46.67	48.33	52	50.4	75.33	56	56	65	63.1	33.03	38.33	37	23.63	33	49.3	28	33.67	50.67	40.4
0.2%Acr	41.33	32.67	50.33	48.67	43.3	38.67	40.33	67.67	34.33	45.3	28.67	18.67	33.19	23.57	26.02	22.7	25.33	44.33	19	27.8
0.4%Acr	28	13.33	42.67	33	29.3	46.67	37.33	55.33	46.33	46.4	17.17	3.75	31.37	13.3	16.4	26.3	22.33	35.67	33.33	29.4
0.6%Acr	42	60.67	58.67	30.33	47.9	40.33	53	83	81	64.3	22.6	33.27	34.07	15.87	26.45	21.7	30.33	41	65.33	39.6
Mean	41.5	38.33	50	41	42.7	50.25	46.67	65.5	56.67	54.8	25.37	23.5	33.91	19.09	25.47	30	26.5	38.67	42.08	34.3
LSD 5%	Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)	
	5.31	5.55		5.68		9.38	10		5.61		3.33	3.16		2.98		3.8	7.83		2.8	
LSD 5%	V * R		V* Acr			V * R		V * Acr			V * R		V* Acr			V * R		V * Acr		
	3.675		3.863			17		11.01			2.058		2.03			13.4		5.495		

Table (4): Average mean for weight 100-seed and shelling % of four peanut varieties in M2 and M3 generations.

Treat.	M2 weight 100-seed (g)					M3 weight 100-seed (g)					M2 Shelling%					M3 Shelling%				
	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean
Control	64	56	72.33	49	60.3	57.67	67	61	67	63.2	63	63	62	60.333	62.08	65.67	61	64.67	62.33	63.42
200Gy	61.3	58.33	47.67	49.7	54.3	56.33	49	44.67	49.33	49.8	61.67	59.67	56	55	58.08	57.67	56	57	59.67	57.58
400Gy	62	41.67	46.33	65.3	53.8	51	44.67	49.33	46	47.8	60	55.67	60	63.667	59.83	52.33	62.3	53	52.67	55.08
600Gy	63.3	57	60.33	56.3	59.3	77.33	45	32.67	52	51.8	58.67	64.33	64.67	59	61.67	66.67	60.7	60.67	58.33	61.58
Mean	62.7	53.25	56.67	55.1	56.9	60.58	51.42	46.92	53.58	53.1	60.83	60.67	60.67	59.5	60.42	60.58	60	58.83	58.25	59.415
Control	64	56	72.33	49	60.3	57.67	67	61	67	63.2	63	63	62	60.333	62.08	65.67	61	64.67	62.33	63.42
0.2%Acr	60.3	61	71	48.3	60.2	55.67	59.33	48	65	57	61.67	67.33	68.33	62.667	65	55.67	61.3	61.33	64.33	60.67
0.4%Acr	61.7	28.33	72.33	41.3	50.9	52.33	64.33	53.33	70	60	60	50.67	64.67	55.667	57.75	58	68	57.67	66	62.42
0.6%Acr	52.3	68	59	60.7	60	42.67	75	41.67	67.67	56.8	53	66	65	60.667	61.17	54	63	55.67	64	59.17
Mean	59.6	53.33	68.67	49.8	57.9	52.08	66.42	51	67.42	59.2	59.42	61.75	65	59.833	61.5	58.33	63.3	59.83	64.17	61.42
LSD 5%	Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)		Variety	Gamma rays (R)		Acriflavine (Acr)	
	4.33	4.52		5.64		8.9	10.36		10.65		4.17	4.38		2.58		7.55	5.88		4.21	
LSD 5%	V * R		V* Acr			V * R		V * Acr			V * R		V* Acr			V * R		V * Acr		
	3.78		2.945			19.31		17.71			3.116		2.052			10.88		12.98		

Table (5): Average mean for Oil % of four peanut varieties in M2 and M3 generations.

Treat.	M2 Oil%					M3 Oil%				
	Giza4	Giza5	Giza6	Giza7	Mean	Giza4	Giza5	Giza6	Giza7	Mean
Control	33.7426	24.2717	20.8208	41	29.9588	32.5328	33.3892	30.8344	40.448	34.3011
200Gy	44.1062	47.5435	24.8533	22.5891	34.773	30.8383	26.1819	28.7213	46.0678	32.9523
400Gy	21.6776	20.2891	24.362	16.8623	20.7978	24.7521	30.0026	24.9107	37.4441	29.2774
600Gy	22.3002	20.9807	24.8861	37.4759	26.4107	25.9131	36.0835	26.5132	27.2981	28.952
Mean	30.4567	28.2712	23.7306	29.4818	27.9851	28.5091	31.4143	27.7449	37.8145	31.3707
Control	33.7426	24.2717	20.8208	41	29.9588	32.5328	33.3892	30.8344	40.448	34.3011
0.2%Acr	16.7807	25.8885	24.4937	50	29.2907	21.8428	28.0205	29.843	26.7676	26.6185
0.4%Acr	29.5	56.3825	16.068	28.5757	32.6315	27.5626	34.3953	31.3708	52.9053	36.5585
0.6%Acr	25.6017	33.3856	42.9841	33.2974	33.8172	22.2301	40.1572	36.4673	41.4909	35.0864
Mean	26.4063	34.9821	26.0916	38.2183	31.4246	26.0421	33.9906	32.1289	40.403	33.1411
LSD 5 %	**Variety**	**Gamma rays(R)**	**Acriflavine (Acr)**			**Variety**	**Gamma rays(R)**	**Acriflavine (Acr)**		
	4.5	7.23	6.12			10.34	7.04	8.36		
LSD 5%	**V * R**	**V* Acr**				**V * R**	**V * Acr**			
	7.65687	3.94384				10.0149	12.6923			

Table (6): Genetic parameters for the studied traits of four peanut varieties in M2 and M3 generations.

Traits	Treatments	M2				M3			
		GV	PV	H^2Bs	Gs	GV	PV	H^2Bs	Gs
plant height	**Gamma-rays**	6980	7030.5	99.282	146.51	127	149.6	84.893	18.275
	Acriflavine	5064	5096.2	99.368	124.85	325	342	95.029	30.93
No. branches /plant	**Gamma-rays**	95.6	109.08	87.642	16.11	28	30.25	92.562	8.96
	Acriflavine	9.19	22.59	40.682	3.4031	10.8	13.37	80.778	5.1984
No. pods/plant	**Gamma-rays**	272	362.34	75.0676	25.1492	612	773	79.1721	38.7413
	Acriflavine	276	335.5	82.2653	26.5201	467	526.9	88.6316	35.8068
Dry Weight of Pods/plant	**Gamma-rays**	675.6	790	85.519	42.3047	506	614	82.4104	35.9401
	Acriflavine	608	698.7	87.0187	40.4828	573	700	81.8571	38.117
No. seeds/ plant	**Gamma-rays**	512	553.2	92.5524	38.3126	795	924	86.039	46.0303
	Acriflavine	306	351.5	87.0555	28.7258	819	863	94.9015	49.0672
Seed yield/ plant	**Gamma-rays**	38.37	51.27	74.8391	9.43133	573	651.8	87.9104	39.5012
	Acriflavine	462	474.57	97.3513	37.3254	635	646	98.2972	43.9714
weight 100- seeds	**Gamma-rays**	199	242.5	82.0619	22.4911	389	494	78.7449	30.8034
	Acriflavine	940	966.47	97.2612	53.2165	949.9	1064.7	89.2176	51.2362
shelling %	**Gamma-rays**	4.5	34.1	13.1965	1.35628	13.6	62.3	21.8299	3.03255
	Acriflavine	77	101.5	75.8621	13.4515	93	154.7	60.1164	13.1598
oil %	**Gamma-rays**	202.3	282.44	71.6258	21.1858	17.49	59.29	29.4991	3.99771
	Acriflavine	161.5	208.9	77.3097	19.666	45.25	104.23	43.4136	7.80072

GV=Genetic Variance, PV=phenotypic Variance, H^2Bs = heritability in broad sense, Gs= genetic advance.

of difference in results during growth phase and at harvest. Peanuts are also different in maturity, disease resistance and tolerance to different kinds of stress.

Number of branches per plant showed high heritability but low genetic advance. It revealed non-additive gene action was involved for expression of this character. However, the high heritability was exhibited due to influenced of favorable environment rather than genotype and selection for such trait may not be rewarding.

At radiation mutagen, character of seed yield per plant showed high heritability (74.84%) and low genetic advance (9.43) in M2 but high heritability (87.91) with high genetic advance value (39.5) in M3. The increase heritability and genetic advance in M3 comparison to M2 generation (Table 6), may be due an increased homozygosis of the genes involves (Khan and Wani, 2006).

Also, at radiation mutagen, Low heritability with low genetic advance values were observed for shelling percentage whereas high and moderate heritability with low genetic advance in M2 and M3 generations at chemical mutagen. Although there were high heritability estimates for shelling percentage at chemical mutagen, they could not provide an indication for genetic advance through selection due to the difficulties since genetic variance values are low and also the narrow sense heritability is only included in the genetic gain equation.

High heritability accompanied by high genetic advance value were found for oil percentage in M2 generation but low heritability estimates with low genetic advance were found in M3. Thus, heritability is not a constant value and depends on the method of estimation and the procedures used by the breeder which influences its magnitude and genetic improvement obtain through selection. So, this feature suggestion that the environment influence on the phenotypic expression of this character was considerable and the phenotypic expression of this character was not true representation of the genetic make up in M3 generation. Therefore selection for oil percentage cloud not brings satisfactory improvement over the generation.

CONCLUSION

According to our results of induced polygenic variation of traits obtained for the our varieties of peanut, mutagenesis by using irradiation or chemical mutagen, is a particularly important tool in the case of species whose natural gene pool is very narrow. Moreover, Chemical mutagenesis has gained much popularity in recent years mainly due to its new uses in TILLING (Targeting Induced Local Lesions IN Genomes) for reverse genetics studies, rapid stabilization process of mutated characters, effectiveness in yield and quality improvement, no such limitation for management of the cultivars developed through the techniques as for GM (genetically modified) plants and no regulation for labeling related products. It is believed that it is possible to breed peanut chemical mutants with desirable quality traits through use of large population. Thus, from agronomic point of view, economic traits like plant height, number of pods per plant, dry weight of pods, and number of seeds per plant and 100-seed weight with high heritability and genetic advance in M2 and M3 generation offer good scope for the possibility of inducting desirable mutations for polygenic traits accompanied with effective selection and improvement. In addition to the increased heritability for yielding contorting traits, may lead to quick stability o the mutant plants. Currently work is undertaking directed towards the molecular characterization of these induced mutants and mutations.

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