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ORIGINAL ARTICLE **OPEN ACCESS**

Effects of Ethyl Methane Sulphonate on yield parameters of groundnut (*Arachis hypogaea* L.)

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ABSTRACT
The mutagenic effects of different concentrations of EMS (0.05 – 0.20%) on groundnut (Arachis hypogaea L. JL-24, Phule Pragati) were investigated. The characters studied include; plant height, number of branches per plant, pods/plant, seeds/pod, seeds/plant and 100 seed weight in the M1 and M2 generations. Both negative and positive shifts in mean values were recorded as a result of the chemical treatment. The most effective dosage for inducing mutation/morphologicalaberration was established at 0.15% Increases in genetic parameters of variation, heritability and genetic gain under the chemical treatment indicate the possibility of evolving higher yield variants through proper crop selection. Thus, economic traits like pods/plant, seeds/plant with high heritability and genetic variation offers scope for selection and improvement of cultivar.
Key words: *Groundnut, mutagenic effects, EMS.*

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INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop and grain legume worldwide. However, it is self pollinating and possesses limited variability. Consequently, the extent to which groundnut cultivars may be improved through conventional breeding methods is limited. Mutation breeding supplement conventional plant breeding as a source of increasing variability and could confer specific improvement without significantly altering its acceptable phenotype [10]. The successful utilization of EMS to induce genetic variability in plant breeding has been reported in *Vicia faba* [12], in barley [6] and other crops [2, 9-15]. It has been demonstrated by many workers that genetic variability for several desired characters can be induced successfully through mutations and its practical value in plant improvement programmes has been well established. The main advantage of mutation breeding is the possibility of improving one or two characters without changing the rest of the genotype. The varieties of groundnut have remained relatively unimproved and little work has been carried out on them. The present investigation was undertaken to investigate the mutagenic effects of EMS as a means of increasing thevariability within the cultivars and hence improve its productivity.

MATERIAL AND METHODS

Seeds of groundnut (JL_24) were procured from MPKV Rahuri Dist-A.Nagar (Maharashtra). The 200 seeds were treated with 0.05, 0.10, 0.15, 0.20 % solutions of ethyl methane sulphonate at room temperature (25°C). A set of 200 seeds was kept in distilled water for soaking for 8 hours to serve as control. After 4 h of treatment, all seeds were washed in distilled water to remove toxic products, if any, and sown directly on field plots following a randomized block design and maintaining a spacing of 25 x 50 cm. The parameters studied included germination percentage, seedling survival at 21-26 days after planting, lethality percentage, and plant height at 21-26 days, number of days to maturity, branches/plant, pods/plant, seeds/pod, seeds/plant and 100 seed weight. The mutagenic effectiveness and efficiency were calculated following the methods of Sisikala and Kamala [13]. At maturity, M1 plants where individually harvestedand sown as M2 family. During the M3, five of the characters were evaluated further using the following genetic parameters: (a) genetic variance, (b) phenotypic variance, (c) heritability and genetic gain in accordance with Allard [3]. The selection pressure was 10% for the purposeof this investigation.

RESULTS AND DISCUSSION

The effect of the different concentrations of ethyl methane sulphonate on survival percentages, lethality percentage, percent seedling injury and mutagenic effectiveness is presented in Table 1. The survival percentages decreased progressively as the concentrations increased. The percentage lethality and seedling injury increased as the dosage increased, Mensah and Akomeah[7] have reported that the higher the mutagenic dose, the lower the survival percentage, and the present results confirm these earlier reports.Table.1. The decrease in survival percentage has been attributed to the physiological disturbance or chromosomal damage caused to the cells of the plant by the mutagen. Adegoke [1] reported that ethyl methane sulphonate induces chromosomal damages leading to bridge formation during mitotic division and hence increased phenotypic aberration.

Table 1. Effect of EMS on mutagenic effectiveness, efficiency and survival of groundnutsduring the M1 generation.

Treatment	Conc.(%) of Mutagen	Survival(%)	(%) lethality	% Seedling injury	Mutagenic effectiveness	Mutagenic efficiency
Control	Control	96.00	0.00	0.00	0.00	0.00
EMS	0.05	69.30	06.80	-2.83	0.010	0.28
	0.10	54.50	09.50	-5.56	0.062	**1.08**
	0.15	48.90	10.10	-6.51	**0.156**	1.04
	0.20	**30.75**	**10.22**	**-6.81**	0.00	0.00

The spectrum of chlorophyll mutants also considered in assessing the mutation frequency includes xantha (completely yellow), chlorina (variegated yellow and green) striata (green- yellow with white strips) and albino (whitish). Out of these, chlorina type was predominant inthe cultivar. Table 2**.**

The parameters of variation, heritability and genetic gain for five selected yield parameters are given in Table 3. The M2 population of EMS treated exhibited genetic variability for yield contributing traits. Statistical analysis of data indicated significant variations in yield contributing traits of the treated population as compared to control. The experimental result shown promontory effect on height of plant, number of branches/ plant, pods / plant, seeds/pod, and 100 seed weight (gm) as compared to control. Maximum number of branches (7.93), number of pods per plant (28.33), and number of seeds per pod (2.00) and 100 seed weight (56.26 gm) was recorded in 015% concentration of EMS. Plant height was increased in all conc. Of EMS as compared to control (43.66 cm) see Table 3 and Fig.1. Similar result was obtained by Tambe and Apparao [14] in soybean.

The positive and significant correlation between numbers of branches, pods / plant, 100 seed weight (gm) and100 seed weight (gm) were observed in treated population. Promotory effects of chemical mutagen are known to induce a host of physiological changes in addition to genetic effects. Such effects were attributed to an increased enzymatic activity arising from depletion of an inhibitor or an effect on the enzyme itself. These results on induction of useful genetic variability for number of yield contributing traits can contribute to the high yielding genotypes, clearly indicate vital role of mutation breeding in crop improvement. In the present study, the values were generally higher in the treated plantsthan the control. This observation is similar to what was reported in *V. unguiculata* by Mensah and Eruotor [7] and Mensah *et al.* [8].

High heritability, coupled with high expected gains were observed for number of branches/plant, pods/plant and number of seeds / pod indicating that additive gene effects played an important role in the expression of such traits. Thus, these traits could be effective in the selection of high yielding cultivars/genotypes. The characters in which heritability has already been reported among legumes include plant height, pods/plant, 100 seed weight and seed yield [5, 15].

Table: 2. Effect of different conc. of EMS on frequency and spectrum of chlorophyll mutationsIn M2 generation of groundnut.

	Conc./dose	Frequency ofchlorophyll mutations (%)	Relative percentage (%)			
			Chlorina	Xantha	Striata	Albina
Control	--	0	0	0	0	0
EMS	0.05%	0.83	4	0	0.29	0
	0.10%	2.5	10	0	0	0
	0.15%	**4.16**	9.16	0	0.39	0
	0.20%	0	0	0.83	0	0

Table 3. Effect of different conc. of EMS on some yield parameters of groundnut in M2Generation.

Treatment	Conc. (%)	Plant height(cm)	Number of Branches/ plant	Number of Pods/Plant	Number of Seeds/pod	100seed weight(gm)
Control	Control	43.66	6.00	20.93	1.53	51.11
BMS	0.05	42.30	7.17	27.33	1.52	52.75
	0.05	42.30	7.17	27.33	1.52	52.75
	0.15	**53.80**	**7.93**	28.33	**2.00**	**56.26**
	0.20	49.60	7.76	**28.40**	1.94	54.75

REFERENCES

1. Adegoke JA (1984). Bridge induction by sodium azide in *Allium cepa* Nig. J. Genet. 5: 86. Allard RW (1999) Principles of Plant Breeding, John Wiley and Sons,New York.
2. Arvind Kumar., M.N. Mishra., and M.C. Kharakwal. (2007) Induced mutagenesis in blackgram (*Vigna mungo* (L.) Hepper) *Indian J. Genet.*, **67** (1)**:** 41-46.
3. Avila R, Murty, B. R. (1983). Cowpea and mungbean improvement by mutation induction Mutation Breeding Newsletter, 21: 9.
4. Barshile, J. D., S. G. Auti, S. C. Dalve And B. J. Apparao. (2006) Mutagenic sensitivity studies in chickpea employing SA, EMS and gamma rays. *Indian J. Pulses Res.,* **19** (1): 43-46.
5. Gregory WC (1955). X-ray breeding of peanuts *Arachis hypogaea* L., Agron. J. 47: 394-399. Gutafssan, A. (1940) The mutation system of the chlorophyll apparatus. Lund Univ. *Arskr;* **36:** 1-40.
6. Kleinhofs W, Sander C (1975). Azide mutagenesis in Barley. Third Barley Genetics Symp. Garching. Proceedings of Symp. Pp113-122.
7. Mensah JK, Akomeah PA (1992). Mutagenetic effects of hydroxxlamine and streptomycin onthe growth and yield of cowpea *Vigna unguiculata* (L.)Walp. Legume Res. 15:39 – 44
8. Mensah JK, Akomeah PA, Ekpekurede EO (2005). Gamma induced variation of yield parameters in cowpea (*Vigna unguiculata* (L.) Walp. Global J. Pure Appl. Sci. 11: 327- 330.
9. Micke A (1988). Improvement of Grain Legume Production using Induced mutations IAEA,Vienna pp. 1 – 51.
10. Ojomo AO, Omueti O, Raji JA, Omueti O (1979) Studies in induced mutation in cowpea, 5. Thevariation in protein content following ionizing radiation, Nig. J. Appl. Sci. 21 61-64
11. Reddy, P.S, Reddy M.V, Raju B.T, Ali S.M.(1977) Creation of genetic variability by recourse to irradiation in groundnut (*Arachis hypogaea* L.) *Oleagineux,* **32** (2)**:** 59- 62.
12. Rita Kumari, (1996) Effectiveness and efficiency of physical, chemical and physico- chemical mutagens in M_2 generation of *Vicia faba* L. var. VH 82-2. *J. Nuclear Agric. Biol.***, 25** (3)**:** 172-175.
13. Sisikala S and Kamala T. (1988). Mutagenic effectiveness and efficiency of gamma rays andfour gingerly cultivars. Indian Journal Bot. 11 : 118 – 122.
14. Tambe, A.B.,and Apparao, B.J. 2009.Gamma Ray Induced Mutations in Soybean [*Glycine max* (L.) Merrill] for Yield Contributing Traits Induced Plant Mutations in the Genomics Era.Ed.by Q.Y. Shu.Food and Agriculture Org.of United Nations, Rome, 95- 96.
15. Williams J H, Hanway DG (1961), Genetic variation in oil and protein content of soybeans induced by seed irradiation. Crop Sci. 1: 34 –36.

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