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GENETIC ENHANCMENT OF GROUNDNUT (*ARACHIS HYPOGAEA* L.)THROUGH INDUCED MUIATION.

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Abstract:

Groundnut (Arachis hypogaea L.) is a member of family Fabaceae grown for oilseed, food and animal feed. Groundnut contains 51% of monosaturated oil and 30% polyunsaturated and 19% saturated oil. India consumes over 10 million tonnes of edible oil per year. Present study was conducted for genetic enhancement of groundnut thorough induced mutation by gamma rays and EMS. For the purpose oil percentage, saponification, Iodine value and Protein percentage was observed after the different doses of gamma rays and EMS on two varieties of groundnut viz. TAG-24 and AK-159 and it was concluded that 10 kr dose induces good genetic variability in both varieties.

Keywords:*Groundnut; Gamma rays; EMS; Mutation.*

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INTRODUCTION:

Groundnut (Arachis hypogaea L.) is a member of family Fabaceae. It is mainly grown for oilseed, food and animal feed [1]. The plant is unusual because it flowers above ground and pods are produced underground. Seeds from the groundnut are the world's fourth largest edible oil seed crop just behind sunflower. The cultivated species was described by Linnaeus in 1753[2] as Arachis. Groundnut has recently attracted attention as functional food. It has been considered as energy dense food and a valuable food for long term health as evidenced by several beneficial components found in seed such as vitamin E, niacin, folate, arginine, copper, magnesium, potassium, calcium, phosphorus, flavonoids, resveratrol, β-sitosterol and phenolic acid [3]. Groundnut kernels are used for table purpose by frying, soaking, roasting and boiling and in different types of namkeens. Roasted groundnut is the most popular way of eating. Kernels are also used as a spice in vegetables and as sprouts for salad.

Mutation is useful in improving various quantitative characters of crops including yield. Induction of genetic variability by employing physical and chemical mutagens and improving the genotype of plants is known as mutation breeding. Mutation breeders believe that the desirable mutants in different oil crops would be able to contribute effectively towards oil and protein production besides in getting the induced genetic variability for the much sought after disease, pest, insect resistance [4].

MATERIALS AND METHODS:

For the present investigation two well known verities of groundnut from Vidharbha region i.e. TAG-24 and AK-159 was selected . The Germplasm was collected form Department of Crop Research Unit (Oil Seed), Dr. Panjabrao Deshmukh Krishi Vidhyapeeth, Akola-444001 (MS). Seed having moisture content 7% were irradiated Gamma rays at different doses viz. 10kr, 15kr, 20kr and 25kr. The chemical mutagenic treatments were performed at room temperature of 25 ± 2 ℃. The different concentrations of mutagenic solutions were 0.05%, 0.10% and 0.15% of EMS, used for the chemical treatments.

Treated seeds were sown in field (at Latitude 190 48' 23" N and longitude 750 50' 42" E at an altitude of 507 $\frac{1}{2}$ meter above sea level) following Randomized block design (RBD) with three replications of each dose/ concentration. Critical screening was done in M1, M2 and various morphological mutants were selected in M3 generation and subjected to following studies.

1) Seed oil percent (%):

The seed oil percentage was estimated by soxhlet method. 5 grams of well dried seeds was transferred to a Whatman thimble. Extraction with hexane was carried out for 8 hours.

2) Saponifiction value:

Saponification value of control and seed oil of selected mutants from M3 generation was determined according to the titration method [5]. 2 grams of oil sample was weighed into a conical flask and 25ml of alcoholic Potassium hydroxide was added. Solution was refluxed for 1 hour and titrated against 0.5 N HCL with 1ml of 1% phenolpthalein indicator. A blank was prepared alongside the oil samples. The values were calculated by the formula:

$$\text{Saponification value} = \frac{(B-S) \times N \times 56.1}{W}$$

Where, B = Vol. in ml of 0.5 N HCL required to blank.

S = Vol. in ml of 0.5 N HCL required for sample.

N = Normality of HCL (0.5N)

W = Weight of oil in gm (2 gm)

3) Iodine value:

Iodine value of selected viable mutants was calculated from fatty acid composition using the following formula [6].

$$\text{Iodine value} = \frac{\%\ \text{of linoleic} \times 173.2 + \%\ \text{oleic} \times 86.0}{100}$$

4) Protein estimation :

The protein estimation was carried out by Lowry's method [7]and values were expressed in percentage (%).

RESULT AND DISCUSSION:

The seed oil content in control of variety AK-159 was 51.08%. The majority of mutants in this variety revealed enhancement in seed oil percentage except in bold seeded (49.64%), tall mutants (49.64%), pink (49.12%) and faint (48.10%). The mutants showing maximum increase in oil content comprised the early maturing with dwarf (54.34%) and late flowered (52.92%). The seed oil content in variety AK159 ranged from 48.10% to 54.34%. In variety TAG-24 the seed oil content was 49.52%. The highest increased oil percentage (52.76%) could be noted in faint mutants, while the decreased oil percentage (47.20%) in bold seeded mutants. The seed oil content in variety TAG-24 ranged from 47.20% to 52.76%. The oil content in groundnut recorded low genotypic variability indicating the narrow range of variability induced for this character and restricting the scope of selection [8]. Such results are in

agreement with the earlier reports [9] [10] and [11].

Twelve macro mutants of variety AK-159 and TAG-24 each were screened for saponification value. It was observed that in variety AK-159 the 'GN-6', a tall mutants carried the lowest (237.02) saponification value whereas the 'GN-12', a faint mutants carried the highest (272.09) saponification value as compared to control (249.65).

In variety TAG-24 the saponification value for control was 276.29. Majority of mutants showed decreased saponification value, among them the lowest saponification value was shown by 'GN-17', a multi branched mutant. The highest (281.90) saponification value was recorded in 'GN-20', a large leaf mutant. The high saponification values indicate the oxidation and its decrease suggest the unset of oxidation. [12]Rossel in 2004 reported similar observation. The high saponification value may be connected to the nature of the oils and the metallic ions present among other factors [13]. In present study the saponification values of different mutants revealed significant variation.

The iodine value in control of variety AK-159 was 97.08. The highest unsaturation was found in 'GN-12', a faint mutants with iodine value 99.33 whereas the lowest unsaturation could be recorded in 'GN-08', a pink mutants with iodine number 94.45. In case of variety TAG-24 the iodine value of control was 95.92. The highest saturation was observed in 'GN-20', large leaf mutants (94.61), whereas the highest unsaturaion was noted in 'GN-22', a faint mutants (97.77). As the PUFA value increases, the iodine value of oil also increases. Similar results were obtained [14] in sesame and [15] in camelina

The values for seed protein content in control were 23.92% and 25.93% in variety AK-159 and TAG-24, respectively. The highest (31.27%) value could be observed in 'GN-04', a bold seeded mutant, while the lowest value (22.37%) could be noted in 'GN-10', an early maturing, dwarf mutant. In variety TAG-24, the highest (32.63%) value for seed protein content was shown by 'GN-16', a tall mutant and the lowest value (24.93%) was observed in 'GN-19', an early maturing mutants. Increase in protein content of the mutants is in accordance with the results obtained [16] and [17]. An enhancement in protein content after gamma ray treatment has been recorded [18] in safflower and [19] in chickpea.

Table No. 01: ***Oli percentage, saponificatin value, Iodine content and Protein percentage of prominent mutants of Groundnut; Variety AK-159.***

Sr. No.	Code name*	Oil (%)	Saponification Value	Iodine value	Protein (%)
1	GN-01	51.08	249.645	97.08	23.9183
2	GN-02	52.44	256.6575	98.03	23.1837
3	GN-03	52.86	246.84	98.01	23.1020
4	GN-04	49.64	258.06	97.88	**31.2653**
5	GN-05	52.64	255.255	97.79	26.5306
6	GN-06	49.64	237.0225	96.90	27.9184
7	GN-07	51.52	252.45	98.50	24.2993
8	GN-08	49.12	265.0725	**94.45**	26.0952
9	GN-09	52.92	263.67	97.49	23.5374
10	GN-10	**54.34 ***	253.8525	98.82	**22.3674**
11	GN-11	50.48	248.2425	98.79	24.0816
12	GN-12	**48.10**	272.085	**99.33**	27.8912

* GN 1- Control, GN 2- Multi branched, GN 3- Dwarf, GN 4-Bold seeded, GN 5- Large leaf, GN 6- Tall, GN 7- High yielding GN 8- Pink, GN 9- Late flowered, GN 10-Early maturing with dwarf, GN 11- Late maturing with bold seeded and GN12- Faint.

Table No. 02: ***Oli percentage, saponificatin value, Iodine content and Protein percentage of prominent mutants of Groundnut; Variety TAG-24.***

Sr. No.	Code name*	Oil (%)	Saponification value	Iodine value	Protein Percentage (%)
13	GN-13	48.20	265.0725	96.98	27.1020
14	GN-14	50.58	272.085	97.06	29.0068
15	GN-15	50.24	273.4875	96.47	29.0884
16	GN-16	**47.20**	273.4875	97.65	**32.6258**
17	GN-17	47.94	264.37125	95.09	28.8980
18	GN-18	52.64	266.475	96.86	27.8911
19	GN-19	51.30	265.77375	96.20	**24.9252**
20	GN-20	51.24	281.9025	**94.61**	25.0884
21	GN-21	49.62	267.8775	97.64	25.2789
22	GN-22	**52.76 ***	279.0975	**97.77**	27.0204
23	GN-23	48.38	280.5	94.63	26.2585
24	GN-24	49.52	276.2925	95.92	25.9319

*GN 13- Dwarf, GN 14-Bold seeded, GN 15-Pink, GN 16-Tall, GN 17-Multi branched, GN 18-Late flowered, GN 19-Early maturing, GN 20-Large leaf, GN 21-High yielding, GN 22-Faint, GN 23-Tall with early maturing and GN 24-Control.

CONCLUSION:

Alternatively new aspect in applied mutagenesis is the quantitative and qualitative alteration of seed storage substances like oil, protein and carbohydrate. In present study different qualitative features of oil such as iodine number, saponification value and Oil percentage & protein percentage have been studied in the mutants of groundnut from M_3 generation. This work has enabled us to conclude that the oil content, protein content, saponification & iodine content could get alter in positive direction through the application of physical (Gamma rays) and chemical (EMS) mutagen. Pertaining to the oil quantity 20 kR and 10 kR doses of gamma rays is more effective in variety AK-159 and TAG-24 respectively. While in improving oil quality the 0.15% concentration of EMS and 0.10% concentration of EMS are more potent in variety AK-159 and TAG- 24 respectively. In conclusion, Induced mutation can enhance the oil yield, nutritional value and stability of groundnut (*Arachis hypogaea* L.)

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