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AN ANALYTICAL STUDY OF GENETIC VARIABILITY IN INDUCED MUTATIONS WITH THE HELP OF SUNFLOWER

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Abstract

The present examination was gone for clarifying data principally on the genetic variability for yield and yield segments through induced mutagenesis and to confine self rich mutants with high oil content. Pre-sown Sunflower Hybrid (H1) and open pollinated populace composite (C1) were treated with the mutagen EMS at 0.06 percentage. There was increment in mean head distance across, seed yield, mean structure content in the mutants of DSF 15B and increment in mean for plant tallness, stem width and head measurement if there should arise an occurrence of mutants of Sunflower Hybrid in M2 generation. Investigation of change uncovered the predominance of noteworthy contrasts among the genotypes for every one of the characters considered in M2 generation. Further studies should be focused on testing new mutant lines in hybrid combinations, as well as the determination of inheritance of mutant traits.

Key words: sunflower, inbred lines, induced mutations, agronomic traits

1. INTRODUCTION

Genetic variability among plants in population is a basic prerequisite for successful plant breeding. Natural genetic variation *e.g.*, hybridization and spontaneous mutations have been used in plant breeding for a long time. Discovery that radiation can induce hereditary alterations in plant genome and thereby enhance the frequency of mutations allowed breeders to use induced mutagenesis to obtain more desirable mutations.

Prompted mutations have been effectively utilized as a part of sunflower breeding to increment hereditary inconstancy by changing plant qualities and profitability. Many creators have utilized initiated mutations in sun-blossom breeding and numerous mutants with changed attributes were produced. [1] Have made mutants with shorter developing season, which had more slender frame and lower plant stature. Mutants with short stature and bigger head width were produced by [2] utilizing gamma beams. Other sunflower mutants were likewise gotten: the expansion of 1000 seed mass [3], expanded leaf range and diminished plant stature [4], expanded oil content [5], imperviousness to rust and cytoplasmic male sterility. It has delivered mutants impervious to sweeper assault, races show in Bulgaria, by treating youthful incipient organisms with ultrasound. Utilization of mutagenic operators had extraordinarily added to

change of sunflower oil quality. Mutants having high centralization of palmitic [6] and [7] corrosive have been produced utilizing compound or physical mutagen medicines.

The principle destinations of this exploration were to increment hereditary variety inside the gathering of sunflower ingrained lines from Institute of Field and Vegetable Crops, Novi Sad by mutagenesis [8]. The exploration was coordinated to advancement of mutants with transformed one or couple of agronomic qualities and afterward to examine efficiency and strength of these mutants in relative trial [9].

2. MATERIALS AND METHODS

Material

The base material used in this study consisted of two sunflower genotypes, one open pollinated popular variety Sunflower Hybrid (H_1) and another inbred pollinated population composite (C_1) which is the female line of new hybrid DSH1. They were treated with chemical mutagen, ethyl-methane sulfonate (EMS) at optimum dose of 0.06% [10].

Method

M2 generation

The seeds from individual capitulum of each Mj plants were harvested separately that were planted during January 2010 in a plant to progeny row with wider spacing for better expression. M2 generation of EMS treated Sunflower Hybrid andC_1 was raised along with respective untreated check. The inter-row and intra-row spacing was 60 and 30 cm, respectively. Observations were recorded on plant height, stem diameter, head diameter, seed filling percentage, 100 seed weight, hull content, oil content and seed yield per plant on individual plant basis [11].

Table 1 description of parents used

PARTICULARS	SUNFLOWER HYBRID (H_1)	POLLINATED POPULATION COMPOSITE (C_1)
Duration (days)	14	12
Yield (kg/ha)	-	-
Rainfed	900	
Irrigated	1000	
Oil Percentage	36	35

Ray Floret	Light Yellow	Light Yellow
Height (cm)	90	120
Seed Size & Seed Color	Medium Black	Medium Black
1000 Seed Weight (g)	44	50

3. RESULTS AND DISCUSSION

The results pertaining to M2 generations are presented below.

M2 Generation results

Statistical parameters computed for M2 generation of Sunflower Hybrid and**C_1** are presented in Table 4 and 5 respectively.

Plant height (cm)

The mean values of plant height of mutant population (95.43) increased over theparent (79.85) in case of Sunflower Hybrid but in case of **C_1** mutants, decrease in mean plant height (111.13) was observed as against parent (123.11). Range increased in both positive and negative directions in the mutants of both Sunflower Hybrid (38.60-197.50) as against the parent (56.5-112.5) and **C_1**(71.5-165.50) as against the parent (103.50-140.00).

Values of coefficient of variation increased in the mutants of both Sunflower Hybrid and DSF 15B. Coefficient of variation was highest in the mutants of Sunflower Hybrid (23.43) as compared to **C_1**(15.59). Values of variance were increased in the mutants of both Sunflower Hybrid and**C_1** compared to their respective parent. Mutants of Sunflower Hybrid recorded highest variance (499.93).

Stem diameter (cm)

The mean values of stem diameter of mutant population (2.16) increased over the parent (1.96) in case of Sunflower Hybrid but mutants of DSF 15B showed decrease in mean stem diameter (2.07) as against parent (2.26). Range increased in both positive and negative directions in the mutants of both Sunflower Hybrid and**C_1**. But wider range was observed in the mutants of Sunflower Hybrid (3.50-0.5).

Values of coefficient of variation increased in the mutants of Sunflower Hybrid where as decrease in coefficient of variation was observed in **C_1**(18.85%) as against parent (19.96%). Values of variance were increased in the Mutants of Sunflower Hybrid where as there was decrease in variance in the mutants of **C_1**(0.15) as against parent (0.20).

Head diameter (cm)

The mean head diameter increased in the mutants of both Sunflower Hybrid (18.18) and **C_1** (15.40) against their respective

parents. Range was enlarged in both positive and negative directions in the mutants of both Sunflower Hybrid (36.50-9.30) and **C_1** (24.10-10.00) compared to their respective parents.

Estimates of coefficient of variation was high for the mutants of both Sunflower Hybrid (23.70) as against the parent (13.94) and DSF 15B (15.15) as against the parent (5.86). Variance increased in both the mutants of Sunflower Hybrid (18.56) and DSF 15B (5.45) as against the parents (4.79) and (0.78) respectively.

Hundred seed weight (g)

The mean hundred seed weight of mutants of Sunflower Hybrid (5.14) decreased as against the parent (5.19). But of DSF 15B (5.62) increased as against the parent (4.66). Range increased in both positive and negative directions in the mutants of Sunflower Hybrid (2.00-9.30) as against the parent (2.40-7.10), whereas range in the mutants of DSF 15B (2.80-9.30) increased in positive direction as against the parent (2.50-5.60).

Estimates of coefficient of variation was high for the mutants of Sunflower Hybrid (32.63) as against the parent (24.33) while for the mutants of **C_1**(21.13) was low as against the parent (21.70). Variance increased in both the mutants of Sunflower Hybrid (2.81) and DSF 15B (1.41) as against the parents (1.59) and (1.02) respectively.

Self fertility (%)

The mean self fertility of mutants of Sunflower Hybrid (64.71) decreased as against the parent (73.15), but of **C_1** (76.86) increased as against the parent (72.7).

Range increased in both positive and negative directions in the mutants of Sunflower Hybrid and**C_1**. But the extent of increase was more in Sunflower Hybrid (15.00-98.00) as against the parent (58.00-88.00) compared to DSF 15B (48.00-97.00) as against the parent (41.0081.80).

Estimates of coefficient of variation was high for the mutants of Sunflower Hybrid (27.77) as against the parent (15.11) while for the mutants of **C_1**(14.42), was low as against the parent (17.27). Variance was high for the mutants of Sunflower Hybrid (322.99) as against the parent (122.23) while for the mutants of **C_1** (122.87), was low as against the parent (157.63).

Hull content (%)

The mean hull content of mutants of Sunflower Hybrid (37.04) increased as against the parent (33.15), whereas mean hull content of mutants of **C_1** (28.27) decreased as against the parent (29.09). Range increased in both positive and negative directions in the mutants of both Sunflower Hybrid (24.50-70.50) against the parent (27.50-39.50) and **C_1**(18.40-49.60) as against the parent (25.80-31.50).

Estimates of coefficient of variation were high for the mutants of both Sunflower Hybrid (23.12) as against the parent (13.82) and DSF 15B (6.56) as against the parent (15.02). Variance was very high for the mutants of Sunflower Hybrid (73.38) as against the

parent (21.00) as compared to the mutants of **C_1**(18.04) as against the parent (3.64).

Oil content (%)

The mean oil content decreased in the mutants of both Sunflower Hybrid (26.94) (parent 29.44) and **C_1**(27.91) (parent 31.94). Range increased in both positive and negative directions in the mutants of Sunflower Hybrid (10.00-38.50) against the parent (25.40-33.40), where as in the mutants of **C_1** increase in range (18.00-37.00) was in negative direction as against the parent (31.50-39.00).

Estimates of coefficient of variation were high for the mutants of Sunflower Hybrid (24.81) as against the parent (9.45), where as it decreased in the mutants of **C_1**(14.00) as against the parent (16.20). Variance increased for the mutants of Sunflower Hybrid (44.67) as against the parent (7.73) as compared to the mutants of **C_1**(15.28) decreased as against the parent (26.77).

Seed yield per plant (g)

The mean seed yield per plant of mutants of Sunflower Hybrid (21.48) decreased as against the parent (24.72), whereas mean seed yield per plant of mutants of **C_1**(19.31) increased as against the parent (16.77). Range increased in both positive and negative directions in the mutants of both Sunflower Hybrid (7.50-100.40) as against the parent (12.00-35.00) and **C_1** (8.40-63.50) as against the parent (9.80-26.80). However, increase in the range in the mutants of Sunflower Hybrid was more compared to **C_1**.

Estimates of coefficient of variation were high for the mutants of both Sunflower Hybrid (57.56) as against the parent (32.18) and **C_1**(53.67) as against the parent (16.20). Variance was very high for the mutants of both Sunflower Hybrid (152.80) as against the parent (63.29) and **C_1**(107.43) as against the parent (30.02).

Frequency distribution of mutants for important traits in M2 generation

The frequency distribution among the mutants in comparison with parents is given for the mutants of Sunflower Hybrid and**C_1** respectively. X-axis represents traits which are divided into equal class intervals and Y-axis represents the genotype frequencies and range of traits.

The distribution pattern was normal for all the productivity traits studied in M2 generation. Some of the mutants were falling within the range of parents; however, most mutants were superior to parents for all the traits.

Table 2 Range mean variance and coefficient of variation for different traits of sunflower variety modern in M_2 generation

Traits	Particular	Mean	Range		C.V.	Variance
			Minimum	maximum		
Plant height (cm)	Mutants	95.43	38.60	197.50	23.43	499.93
	parent	79.85	56.5	112.5	20.05	256.34
Stem diameter (cm)	Mutants	2.16	0.50	3.50	25.15	0.30
	parent	1.96	1.30	2.90	22.20	0.19
head diameter (cm)	mutuats	18.18	9.30	36.50	23.70	18.56
	parent	15.70	12.50	19.50	13.94	4.79
100seed weight (cm)	mutants	5.14	2.00	9.30	32.63	2.81
	parent	5.19	2.40	7.10	24.77	1.59
Seed filling (%)	mutants	64.71	15.00	98.00	27.77	322.99
	parent	73.15	58.00	88.00	15.11	122.23
Hull content (%)	mutants	37.04	24.50	70.50	23.12	73.38
	parent	33.15	27.5	39.5	13.82	21.00
Oil content (%)	mutants	26.94	10.00	38.50	24.81	44.67
	parent	29.44	25.4	33.4	9.45	7.73
Seed yield (g/Plant)	mutants	21.48	7.50	100.40	57.56	152.80
	parent	24.72	12.00	35.00	32.18	63.29

Table 3Range mean variance and coefficient of variation for different traits of sunflower variety DSF-158 in M_2 generation

Traits	Particular	Mean	Range		C.V.	Variance
			Minimum	maximum		
Plant height (cm)	Mutants	111.23	71.50	165.50	15.59	300.11
	parent	123.11	103.50	140.00	10.56	169.11
Stem diameter (cm)	Mutants	2.07	1.00	3.40	18.85	0.15
	parent	2.26	1.60	2.90	19.96	0.20
head diameter (cm)	mutuats	15.06	10.00	24.10	15.15	5.45
	parent	5.62	13.50	16.50	5.86	0.78
100seed weight (cm)	mutants	4.66	2.80	9.30	21.13	1.41
	parent	76.86	2.50	5.60	21.70	1.02
Seed filling (%)	mutants	72.70	48.00	97.00	14.42	12.87
	parent	29.09	41.00	81.80	17.27	157.63
Hull content (%)	mutants	27.91	18.40	49.60	15.02	18.04
	parent	31.94	25.80	31.50	6.56	3.64
Oil content (%)	mutants	19.31	18.00	37.00	14.00	15.28
	parent	16.77	31.50	39.00	16.62	26.77
Seed yield (g/Plant)	mutants	19.31	8.40	63.00	53.67	107.43
	parent	16.77	9.80	26.80	16.20	30.02

Morphological Mutants in M2 generation

Some of the morphological mutants were observed in M2 generation namely, vegetative head type and dwarf mutant are shown in Plate 1. The mutants with respect to seed coat colour variation are shown in Plate 2.

When the sunflowers sample collected from different locations tested with fatty acid then results obtain as explored in Table 4, 5, and 6.

Table 4 Descriptions of Test Results

S. No.	Test Parameters	Observed Results (per 100 gm)	Test Method/Instrument Used
1.	Total Fat, gm	23.42	By Soxhlet Method
2.	Saturated Fat ,gm	7.59	AOAC 996.06/GC-FID
3.	Monounsaturated Fat ,gm	0.06	AOAC 996.06/GC-FID
4.	Polyunsaturated Fat ,gm	15.77	AOAC 996.06/GC-FID

Standard results show that polyunsaturated fats should be 23g/100g.But sunflower when tested with fatty acid it is found that sample 1 consists total fat (23.42), in this amount saturated fat were (7.59). Monounsaturated fats were very less in amount (0.06), Polyunsaturated fats were (15.77). Polyunsaturated fats include omega-3 and omega-6 fats.

Table 5 Descriptions of Test Results

S. No.	Test Parameters	Observed Results (per 100 gm)	Test Method/Instrument Used
1.	Total Fat, gm	23.06	By Soxhlet Method
2.	Saturated Fat ,gm	10.77	AOAC 996.06/GC-FID
3.	Monounsaturated Fat ,gm	0.17	AOAC 996.06/GC-FID
4.	Polyunsaturated Fat ,gm	12.12	AOAC 996.06/GC-FID

Similarly, sunflower when tested with fatty acid it is found that sample 2 consists total fat (23.06), in this amount saturated fat were (10.77). Monounsaturated fats were very less in amount (0.17), Polyunsaturated fats were (12.12).

Table 6 Descriptions of Test Results

S. No.	Test Parameters	Observed Results (per 100 gm)	Test Method/Instrument Used
1.	Total Fat, gm	32.23	By Soxhlet Method
2.	Saturated Fat ,gm	14.43	AOAC 996.06/GC-FID
3.	Monounsaturated Fat ,gm	0.12	AOAC 996.06/GC-FID
4.	Polyunsaturated Fat ,gm	17.68	AOAC 996.06/GC-FID

Similarly when sample 3 was tested with fatty acid it is found that consists total fat (32.23), in this amount saturated fat were (14.43). Monounsaturated fats were very less in amount (0.12), Polyunsaturated fats were (17.68).

4. CONCLUSION

Actuated mutagenesis prompt hereditarily acquired changeability of sunflower ingrained lines, which is appropriate for use in breeding projects. Additionally studies ought to be centered on testing new mutant lines in half breed mixes, and in addition methods of legacy of mutant traits. Since created mutant lines vary in at least one trait, they can be utilized specifically in half breed generation rather than their unique lines. Tests with fatty acid it is found out that the sunflower consists fat, in that Polyunsaturated fats in huge amounts it is different sample-wise taken from different area.

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