Genetic variability of yield and yield components for segregating generations in sesame (*Sesamum indicum* L.)

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ABSTRACT:

The present investigation was conducted at Bahteem Agricultural Research Station ARC During 2018 and 2019 summer seasons. One cycle of pedigree selection method was applied on a segregation population of sesame in the F_3 and F_4 generations to improve seed yield. The aim of this study was to estimate the genetic parameters, genetic variability, heritability, phenotypic and genotypic coefficient of variation and genetic advance from selection. These results showed that the parent (2) was the earliest in flowering and physiological maturity. Also, plant height showed that the tallest plant in parent (5). Also, number of capsules per plant showed that the parent (5) was the heaviest. 1000 seed weight was recorded in parent (6), seed weight per plant. The highest oil content was obtained by parent (4). The population (3) was the earliest in flowering and physiological maturity in F_4, plant height showed that the tallest plant in population (4). Number of capsules per plant showed that the population (7) was the heaviest in 1000 seed weight in population (5), seed weight per plant showed that the highest value was obtained by population (4). The highest oil content was obtained by population (12). Highly heritability coupled with high genetic advance from selection was recorded from number of capsules/plants, and seed weight/plant. Indicated additive gene effects of these traits could be improved by selection. Hence selection for these traits in expected to be effective.

Keywords: Sesame; *(Sesamum Indicum L.*); Pedigree Selection; Genetic Parameters; Heritability; Genetic Advance; Segregation Generation.

INTRODUCTION

Sesame growing area in Egypt is decreasing due to low seed yield compared to the other competitive crops. There is about 95% shortage of edible vegetable oils in Egypt. The Egyptian strategy aimed to increase the edible oil production through increasing the areas devoted to oil crops and also increasing their seed yield productivities. Development of high seed yielding and oil yielding hybrids of sesame crop would meet the Egyptian strategy. Studying the genetic components for main agronomic characteristics is the goal of the breeding strategy for sesame. (Abo El-wafa and Ahmed, 2005) found that the observed gain in seed yield of two population was better when selection practiced for seed yield per se (25.24 and 15.22%) of the better parent than selection for weight of capsules per plant after two cycles of pedigree selection. (El-Shimy, 2005) through two cycles of pedigree selection increased seed yield by (49.12 and 45.78%) from the better parent in two populations.

Sesame has different development stages of capsules in a plant because plant growth is originally in determine. Capsules on middle low position of stem are ripen almost enough but those of late bloom high on the stem remain immature (Doo *et al*., 2003). When crosses are made, genetic parameters should be well defined. These parameters are very useful perceiving genotype and environmental interaction in crosses providing beneficial data for identification of genetic and agronomic potential. It also provides information the successive generations. Genetic information like heritability and genetic advance of several yield contributing characters would be of great value to enable development of new genotypes (Mangi *et al*., 2007). Although determinate sesame has agricultural advantages, and uniformity, it has reduced capsule production, plant height, and seed yield. As a part of the strategy to increase genetic variability in sesame and to make the desired changes in the mentioned quantitative characters. Heritability was estimated by parent off spring regression and date was collected from F_1, F_2 and F_3 generation (Bulent *et al.*, 2013). To assess the cross effect on indeterminate and determinate sibs in F_2 segregation.

The aims of the present work were to improve yielding ability of sesame through pedigree selection methods and to study the effect of direct and indirect selection for seed yield per plant on the other traits, and to estimate phenotypic coefficient of variability (PCV), Genotypic coefficient of variability (GCV), Heritability in Broad sense and narrow sense ($h^2_{b,n}$), genetic advance (Δ G) and Selection intensity.

MATERIALS AND METHODS

The present study was carried out at Bahteem Agricultural Research Station, ARC during two summer seasons of 2018 and 2019 respectively. They are comprised of six parents and fifteen segregation populations. The breeding material used in this study was 200 families traced back to random F_2 plants. The seed were conservation in (+5C^0 and -5C^0) in Genetic Resources Research Dept. Field Crop Research Institute (FCRI) ARC.

Genetic materials:

Twenty-one genotypes are under study One cycle of pedigree selection was achieved for seed weight per plant and percentage of oil content. One cycle of pedigree selection was achieved for seed weight per plant. The genetic materials were F_3 and F_4 generations of Sesame (*Sesamum indicum* L.).

Season 2018 (F_3 generation):

The breeding materials were used in this study 200 F_3 families traced back to random F_2 seeds from the population. The aforementioned population in the F_3 generation with three-replication experiment was sown in 28/6/ 2018 in Genetic Resources Research Dept., at Bahteem Agriculture Research Station. ARC and executed as randomized complete block design with three replications. The experimental plot consisted of ten rows, 7 m long and 60 cm width (42.0 m^2) leaving one plant per hill the spacing between per hill in 20cm.The parents were sown each in five rows 4 m long and 60 cm width (12.0 m^2) each parent. Thinning was practiced after 17 days from planting, leaving one plant per hill. All other agronomic practices were applied according to recommended practices. At harvest time, the following traits were recorded on plants and twenty plants from each parent and discarded the guarded plants. The recorded traits were Days to 50% flowering (days), physiological maturity (days), plant height (cm), fruiting zone length (cm), amount of branches/plant. Number of capsules/plants, 1000-seed weight (gm), seed weight/plant (gm) and percentage of oil. The first cycle of pedigree selection was applied on the F_3 population for seed yield/plant as a selection criterion. Seed of the best one hundred of plants for seed yield/plant (10%) was selected based on seed yield/plant and saved to the next generation. The seed were conserved in (+5C^0 and -5C^0) in Genetic Resources Research Dept. Field Crop Research Institute (FCRI) ARC.

Season 2019 (F_4 generation), the first cycle of pedigree selection:

The 165 selected F_4 families along with the unselected bulk sample and the six parents were sown in RCBD with three replications. The plot size was ten rows. The space between rows and thills were as in the previous season. The characters were recorded as in the previous season. The best 65 plants from the best 65 families for seed yield/ plant were harvested separately for the next generation. Seeds of the Un-selected bulk sample were blended without selection. The seeds were conserved in (+5C^0 and -5C^0) in Genetic Research Resources Dept. Field Crop Research Institute (FCRI) ARC.

Statistical analysis:

The analysis of variance (Table 1) was performed following in F_3 and F_4 generations and six parents. Two analyses of variance were performed. The first was for all genotypes selected families in addition to parents and the second one was for the elected families to calculate heritability and coefficients of variance. The phenotypic (σ^2_{P}) and genotypic (σ^2_{g}), variance were calculated according to the following formulae as given by (Al-Jibori *et al.*, 1958).

The genotypic variation σ^2_{g}, =) $\sigma^2_{\mathrm{E}} = MS_E$

$\sigma^2_G = (MS_G - MS_E)/r$

$\sigma^2_{\mathrm{Ph}} = \sigma^2_G + \sigma^2_{\mathrm{E}}$=M2/ r

Heritability in broad sense was estimated as H= $\sigma^2_{\mathrm{g}}/\sigma^2_p$x 100.

The phenotypic (PCV) and genotypic (GCV) coefficient of variability were estimated using the formula developed by (Burton, 1952).

$$GCV\ \% = \frac{\sqrt{\sigma_g^2}}{\bar{x}} x100 PCV\ \% = \frac{\sqrt{\sigma_P^2}}{\bar{x}} x100 ECV\ \% = \frac{\sqrt{\sigma_E^2}}{\bar{x}} x100$$

Where: σ^2_{Ph} and σ^2_G are the phenotypic and genotypic standard deviations of the family mean, respectively and X is a family mean for a given trait.

Expected genetic gain AA=K $\sigma^2_P\ Ph2$ based on 10% selection intensity. KHb. σ^2_P. Where: K= selection intensity, Hb= broad sense heritability and σ^2_P= phenotypic standard deviation of the population significant of the selected families.

Seed oil percentage (%):

The oil content was determined from a seed sample of five grams (total lipids were determined in dried samples according to the method of (A.O.A.C., 1990). Two grams of dry weight of each sample was extracted by using a mixture of chloroform – methanol (2:1) for six hours at (45 – 50 C^0) in soxhelt apparatus. After extraction of total lipids, solvent was evaporated and the residue was dried to a constant weight.

RESULTS AND DISCISSION

It is apparent from the results presented in Table (1,1a and 1b) genotypes and its components (parents) and F_3, F_4. Data revealed highly significant mean squares due to genotypes, parents, crosses and parent versus crosses for all studied traits, this trait are less influenced by environmental effect. This material including the values of all studied characters for the sesame parents are presented in Table (2). These results showed that 50% flowering date in sesame on 2019 for the parents ranged from (51.63 to 60.07 days). Parent (2) was the earliest in flowering date. In contrast, parent 6 was the latest in flowering recorded in (60.0 7 days). These results are in agreement with (Fahmy *et al*., 2015). Physiological maturity in 2019, season ranged from (112.11 to 122.42 days), parent (2) was the earliest in physiological maturity. In contrast, parent (6) was the latest in physiological maturity recorded in (122.42 days).

These genotypes which showed earliness in flowering date and physiological maturity. These genotypes which showed earliness in flowering and maturity in the parent research work are important for plant breeding programs in adapting, sesame genotypes to various ecological regions, as well as for search on photoperiod and thermo sensitivity (Sudihiyam *et al*., 1992). Plant height in 2019 season for the parents ranged from (224.62 to 263.20 cm); the tallest plant was recorded by parent (5), while parent (2) was the shortest recorded (224.62 cm). The results are in agreement with those reported by (Fahmy, 2015) found that plant height of the top yielder selections was narrower with shorter plants than the range of the parent selections Their range was from (146.0 to 175.3 cm).

Meanwhile fruiting zone length in 2019 season for the parent (5) ranged from (112.98 to 121.18 cm) the fruiting zone length parent 4 recoded (121.18 cm), while the lowest parent 1 recoded (112.98 cm). Regarding to the number of branches in 2019 season for the parents ranged from (3.00 to 5.35 No.) The highest number parent (2) recorded (5.35 No.), while the lowest number parent (4) recoded (3.00 No.). Concerning number of capsules per plant in 2019 season for the parents ranged from (195.91 to 250.8 No.). The heaviest amount of capsules/plant in parent (5) recorded (250.80) while the lowest one number of capsules parents (1 and 3) recoded (195.91 No.). These results are in accordance with (Fahmy, 2015). Also, weight of 1000- seed weight in 2019 season for the parents ranged from (4.25 to 5.01 gm). The heaviest 1000-seed was recorded for parent (6), while the lowest one was observed in parents (1 and 2) recorded (4.25 gm).

The range for seed weight per plant in 2019 was from (34.53 to 41.44 gm). The highest value was obtained by parent 5, while the lowest was by parents (1 and 2) recoded (34.53). The results are in agreement with (Fahmy, 2015), who found the seed weight per plant ranged from (17.52 to 42.61 gm). Seed weight per plot in 2019 was from (1319.56 to 1541.95 gm). The highest value was obtained by parent (6) recorded (1541.95 gm), while the lowest was by parents (1 and 2) recorded (1439.65 gm). Finally seed oil content in 2019 season ranged from (48.31 to 51.50 %). The highest oil content was obtained by parent (4) recoded (51.50 %) and the lowest value (48.31 %) was recorded by parent (1). These results are in accordance with (Fahmy, 2015). Found the seed oil content (41.29 to 58.89 %).

The means of all studied characters for each of the fifteen populations are presented in (Table 3). The results showed different responses of the nine agronomic characters in two generations (one cycle), in F_4 days to 50 % flowering ranged from (41.37 to 53.68 days) and the population (4) was the earliest. The population (12) was the latest in flowering date. Also, physiological maturity in F_4 ranged from (90.52 to 109.18 days) and the population (4) was the earliest. While the population (12) was the latest in physiological maturity. The variation in populations among F_3 and F_4 for flowering date depends on a minor gene complex. There are some valuable sources for earliness.

These results revealed that population (4) in F_3 and F_4 generations is the earliest in flowering date, physiological maturity and had high seed weight per plant. The population was the earliest in flowering date, physiological maturity and had high seed weight per plant that was the earliest in flowering in two generations and can help the Egyptian breeder in short aiming maturity duration earliness in around (12 days) at harvest. Plant height in F_4 ranged from (194.55 to 235.00 cm). The tallest plant height was recorded in population (11), while the population (8) was the shortest. The results are in agreement with (Fahmy, 2015). Number of branches per plant in F_4 ranged from (3.09 to 5.73No.)The highest number of branches was recorded in population (5), while the lowest number of branches was recorded in population (10). Regarding the number of capsules per plant in F_4 ranged from (201.97 to 310.85 No.). The number of capsules per plant of the heaviest population No. 7 recorded (310.85) number of capsules, while population (2) the lowest one recorded (201.97 No.).

Meanwhile weight of 1000- seed of population in F_4 ranged from (4.38 to 5.57 gm). The heaviest 1000-seed weight was recorded (5.57 gm) in population (5), while the lightest was for population (1) recorded (4.38 gm). Range for seed weight per plant is from (35.60 to 56.52 gm). The highest value was obtained by population (4) (56.52 gm), while the lowest was obtained population (1) recorded (30.34 gm). These results are in agreement with (Ismail *et al.*, 2013). Seed oil content of population in F_4 ranged from (49.96 to 63.12 %); the highest oil content was observed for population (12), while the lowest one by the population (4). The results are in agreement with those of (Ismail *et al.*, 2013) and (Fahmy, 2015). We found Seed oil content ranged from (44.82 to 56.30 %).

In most top the crosses. The inbreeding depression was associated with heterobeltiosis. This indicated that most of the characters compromised higher magnitude of dominance gene action. For the population that revealed absence of inbreeding depression, they may be used for further selection programmes because in such crosses the additive and additive x additive gene interaction is of high magnitude.

The results in Table (4,a,b,c) indicated that for all studied trait in all generations, the phenotypic coefficient of variation (PCV)was generally higher than the genotypic coefficient of variation (GCV) for all characters in all generations, but in many cases, the two values differed only slightly in population (1). The highest values were shown, for number of capsules per plant, seed weight per plant, plant height and fruiting zone in population (1; 6; 11and 15), the highest values showed plant height, fruiting zone, number of capsules and seed weight per plant. Also, the high PCV and GCV for seed weight per plant, number of capsules per plant, plant height and fruiting zone were negligible indicating that selection based on phenotype may be useful for yield improvement. Therefore, it is essential to assess the relative effect of hybrid and environment and to have an estimate of the extent to which improvement is possible in the traits under consideration. Therefore, the relative effect is essential for hybrid and environment and for having an estimate of the extent to which improvement is possible in the traits under consideration.

The results showed highly significant variations for characters indicating the presence of sufficient genetic of variability for effective selection helping to identify the superior hybrid, for different characters as shown in Table (4, a, b, c). The phenotypic coefficient of variability value for number of capsules per plant, seed weight per plant and plant height indicated that these populations are pure lines and less than effect in breeding depression in these populations. The present data means that selection based on phenotype per for mace may be useful for yield improvement. Results of broad sense heritability estimates for all traits were high in F_4 except for, number of branches recorded in (26.85) and plant height (36.38) and Table (4a) number of branches (31.72) and (4c) (45.53) Heritability estimates for all traits except for number of branches per plant and plant height indicated that these traits are less influenced by environmental conditions. Heritability accompanied with high genetic advance is rather useful than heritability alone for predicting the selection effect. These results are in agreement with those, (Mahdy *et al.*, 2015) and (Abd-Elaziz, 2018).

The expected genetic advance, expressed as a percentage of the mean varied from (No. of branches recorded (0.60) and 1000-seed weight recorded (1.23), 4a (No. of branches recorded (048), percentage of oil recorded (1.16), 1000-seed weight recorded (1.55) and 50% flowering recorded (1.57), 4b 1000-seed weight recorded (1.36), (No. of branches recorded (1.41) and 50% flowering recoded (2.12) and percentage of oil recorded (4.35) Table (4c) showed that, No. of branches recorded (1.25), 1000-seed weight recorded (1.42) and 50% flowering recorded (3.71) and percentage of oil (5.24). Also, high expected genetic advance in Table (4 ,4a, 4b and 4c) was observed from seed weight per plant (91.76, 85.38, 97.37 and 97.19), and number of capsules per plant (83.25, 61.37, 56.26 and 68.28). Also studied traits in Table (4, 4a ,4b and 4c), showed high heritability coupled with high genetic advance for seed weight / plant recoded (97.80) (91.76), (98.37)(85.38), (98.07)(97.37) and (98.72)(97.19), number of capsules per plant recoded (99.32)(83.25), (97.81)(61.37), (97.62)(56.26) and (98.52)(68.28) indicated that these traits are less influenced by environmental conditions. Heritability accompanied with high genetic advance is rather useful than heritability alone for predicting the selection effect, indicated the percentage additive gene effects and that these traits could be improved by selection.

Therefore, genetic advance as percentage of mean was also computed in these studies. High heritability and moderate genetic advances were shown in some traits, fruiting zone length recoded (90.60)(31.78) and 1000-seed weight (97.59)(32.79), also Table (4a) fruiting zone length recoded (96.79)(40.93), 1000-seed weight recoded (97.38)(33.85) and plant height recoded (95.01)(35.66), Table (4b) plant height recoded (98.95)(33.26), fruiting zone length recoded (98.79)(33.38) and 1000-seed weight recoded (97.94)(30.70) and Table (4c) plant height recoded (98.03)(33.13), fruiting zone length recoded (97.52)(30.67) and 1000-seed weight recoded (98.36)(32.24) indicating moderate magnitude of additive gene effects. High heritability for the previous traits showed that two traits with moderate genetic advance and high genetic advance could be consisted indication that improvement can be done by selection.

The selection is advocated for those traits because data indicated the presence of additive gene effects, hence their improvement can be done through selection. Also, Table (4a), moderate heritability, coupled with low genetic advance showed percentage of oil (50.94) (1.16) and 50% flowering (63.77) (1.57) and Table (4b) showed number of branches per plant recoded (53.90) (1.41). These results are in agreement with those of (Fahmy *et al*., 2014). This selection is advocated for those traits that indicate the presence of additive gene effect hence, their improvement can be done through selection. These results confirm the findings of (Fahmy *et al*., 2014). Table (4): Phenotypic coefficient of variance (PCV), genotypic coefficient of variance (GCV), broad and narrow sense heritability ($h^2_{b,n}$), selection index genetic advance (GA) and genetic advance % (of mean from selection for the studied traits in F_4 all crossing sesame.

Low heritability coupled with low genetic advance as shown in Table (4, a, b) for number of branches per plant (26.85) (0.60), (31.72) (0.48), indicated the influence of dominant and epistatic effect of inheritance these traits. On other words, non-additive gene effects are more important for inheritance These traits and selection on phenotypic value may not be much effective to improve this trait. These results confirm the (Fahmy *et al.,* 2013). It could be concluded that pedigree selection was an efficient method to improve seed yield productivity in the studied population selection for productivity that could be practiced in the early segregating generationoOe cycle of selection was enough to detect the families with high productivity away from significant selection accompanied with adverse effects on other traits.

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Table 1: The analysis of variance for 50% flowering, Physiological maturity, Plant height and Fruiting zone length in six parents and fifteen populations in two seasons:

S.O.V	df	50% flowering		Physiological maturity		Plant height		Fruiting zone length	
Generations		F_3	F_4	F_3	F_4	F_3	F_4	F_3	F_4
Replication	2	0.68	0.70	0.09	0.07	1.36	1.56	0.116	0.017
Genotypes	20	75.17**	63.64**	215.68**	186.74**	1852.57**	1270.17**	153.05**	257.92**
Parents	5	48.23**	32.37**	83.82**	46.98**	1529.82**	546.54**	10.709**	31.34**
CROSSES	14	48.83**	37.30**	75.24**	68.40**	937.3 1**	492.95**	116.097**	224.042**
PV cross	1	606.06**	588.62**	2841.15**	2542.37**	16280.01 **	15769. 41**	1382.11**	1865.05**
Error	40	0.63	0.44	0.25	0.18	3.59	2.70	1.244	1.019
Total	62	24.51	20.84	69.73	80.36	599.96	411.53	50.178	83.857

Table 1a: The analysis of variance for Number of branches. Number of capsules and 1000-seed weight in six parents fifteen populations in two seasons:

S.O.V	df	Number of branches		Number of capsules		1000-seed weight	
Generations		F_3	F_4	F_3	F_4	F_3	F_4
Replication	2	0.18**	0.14*	4.82	10.59	0.00	0.00
Genotypes	20	1.77**	1.83**	2291.71**	2857.2 6**	0.29**	0.43**
Parents	5	2.20**	2.31**	450.75**	1444.07**	0.22**	0.32**
Crosses	14	1.49**	1.61**	2039.36**	23.54.00**	0.17**	0.26**
PV cross	1	2.47**	2.66**	15029.45**	16968.9 3**	2.25**	3.33**
Error	40	0.03	0.04	8.76	6.60	0.01	0.01
Total	62	0.58	0.62	745.07	926.30	0.09	0.14

Table 1b: The analysis of variance for Seed weight / plant and % of oil in six parents and fifteen populations in two seasons:

S.O.V	df	Seed weight / plant		% of oil	
Generations		F_3	F_4	F_3	F_4
Replication	2	o.53	0.66	1.54	1.7 2
Genotypes	20	83.11**	117.93**	64.92**	57.06**
Parents	5	19.88**	28.66**	9.65**	4.45**
Crosses	14	70.73**	100.69**	55.26**	47.18**
PV cross	1	572.52**	05.60**	476.68**	458.31**
Error	40	0.28	0.37	0.53	0.55
Total	62	27.00	38.30	21.33	18.82

Table 2: mean value 50% Flowering, Physiological maturity, Plant height and Fruiting zone length of six parents evaluated at Bahteem in 2018 and 2019 seasons:

Parents	50% Flowering		Physiological of maturity		Plant height		Fruiting zone length	
Seasons	2018	2019	2018	2019	2018	2019	2018	2019
P_1	56.42	52.62	126.47	116.o1	270.95	248.64	105.54	112.98
P_2	54.64	51.63	118.04	112.11	239. 90	224.62	106.86	112.98
P_3	60.52	56.39	126.39	119.02	258.00	242.82	109.32	117.84
P_4	60.35	55.96	129.33	120.62	270.95	248.64	110.18	121.18
P_5	63.38	58.61	131.23	121.87	299.13	263.20	106.11	114.03
P_6	65.20	60.0 7	133.04	122.42	296.22	258.29	106.41	116.27
LSD 5%	0.26	0.28	0.21	0. 18	0.81	0.70	0.48	0.43
X^-	60.09	55.88	127.42	118.68	272.53	297.70	107.46	115.88

Table 2a: Mean value, Number of branches, Number of capsules and 1000-seed weight of six parents evaluated at Bahteem in 2018 and 2019 seasons:

Parents	Number of branches		Number of capsules		1000- seed weight	
Seasons	2018	2019	2018	2019	2018	2019
P_1	4.40	4.89	174.85	195.91	3.90	4.25
P_2	4.92	5.35	193.95	225.91	3.90	4.25
P_3	4.66	5.01	174.85	195.91	4.39	4.83
P_4	2.77	3.00	188.49	230.00	4.37	4.85
P_5	3.17	3.80	205.51	250.80	4.36	4.77
P_6	3.77	4.27	196.32	233.68	4.54	5.01
LSD 5%	0.07	0.09	1.26	1.09	0.01	0.01
X^-	3.95	4.39	189.00	222.04	4.24	4.66

Table 2b: Mean value, Seed weight / plant and percentage of oil at six parents evaluated at Bahteem in 2018 and 2019 seasons:

Parents	Seed weight / plant		% of oil	
Seasons	2018	2019	2018	2019
P_1	30.13	34.53	44.93	48.31
P_2	30.13	34.53	47.80	49.54
P_3	31. 65	35.88	47.97	49.91
P_4	35.10	39.84	48.74	51.50
P_5	35.26	41.44	44.93	48.46
P_6	35.33	40.11	48.78	50.51
LSD 5%	0.23	0.26	0.31	0.32
X^-	32.93	37.72	47.19	49.71

Table 3: Mean values of agronomic traits 50% flowering, Physiological maturity, Plant height and Fruiting zone length for fifteen populations:

Characters	50% flowering		Physiological maturity		Plant height		Fruiting zone length	
Generation	F_3	F_4	F_3	F_4	F_3	F_4	F_3	F_4
1	48.79	46.10	105.39	100.10	214.20	200.55	110.16	116.46
2	47.74	44.20	110.26	103.40	228.08	203.25	112.7	121.4
3	50.37	46.98	112.92	103.57	241.92	222.00	113.59	127.08
4	45.20	41.37	98.85	90.52	221.75	195.22	109.39	127.2
5	49.28	45.32	111.35	102.72	232.6	204.30	109.7	119.86
6	54.03	50.35	112.85	106.27	229.93	216.80	121.73	128.96
7	58.87	49.97	114.92	107.67	233.13	211.35	124.6	131.37
8	56.08	52.10	110.9	104.63	208.85	194.5	113.62	117.56
9	56.12	52.20	114.95	108.08	223.0	209.22	118.0	123.02
10	53.67	49.40	115.47	107.58	238.32	203.55	119.0	124.92
11	55.01	50.17	112.94	102.82	267.0	235.00	129.80	145.4
12	58.22	53.63	116.74	109.1	247.1	221.77	119.2	130.3
13	56.59	51.68	117.17	108.82	240.76	213.3	116.0	125.94
14	56.82	52.00	118.78	108.9	264.25	230.62	124.06	133.88
15	56.45	51.27	114.75	104.9	263.10	228.70	127.2	145.2
LSD 5%	0.40	0.45	0.34	0.29	1.28	1.11	0.75	0.68
X^-	53.22	49.12	112.55	104.61	236.94	212.68	117.77	127.92

Table 3a: Mean values of agronomic traits No. of branches /plant, No. of capsules / plant, 1000-seed weight, Seed weight / plant and percentage of oil for fifteen populations:

Characters	No. of branches /plant		No. of capsules / plant		1000-seed weight		Seed yield / plant		% of oil	
Generation	F_3	F_4	F_3	F_4	F_3	F_4	F_3	F_4	F_3	F_4
1	5.07	5.51	199.95	232.90	4.03	4.38	31.06	35.60	49.28	51.07
2	4.80	5.36	180.26	201.97	4.52	4.98	32.63	36.99	49.46	51.45
3	5.03	5.73	194.32	239.69	4.67	5.17	36.18	41.07	52.05	53.09
4	4.64	5.12	253.99	297.24	4.74	5.33	49.08	56.52	46.32	49.96
5	4.61	5.13	202.39	246.60	5.11	5.57	36.42	41.35	50.52	52.07
6	5.05	5.25	241.50	263.29	4.81	5.51	38.78	44.77	56.07	57.53
7	4.97	5.36	283.70	310.58	4.73	5.26	43.53	50.34	55.67	58.04
8	4.13	4.07	259.53	270.91	4.50	4.91	41.30	47.70	58.59	59.75
9	5.27	5.61	218.98	240.91	4.75	5.38	36.54	44.78	58.99	60.80
10	2.86	3.09	204.40	237.54	4.50	5.00	38.25	44.11	50.24	55.60
11	3.91	4.56	227.50	261.15	4.79	5.21	40.48	46.84	50.85	53.61
12	3.89	4.45	208.21	247.67	4.72	5.20	41.26	46.71	60.29	63.12
13	3.27	3.91	211.87	259.64	4.50	5.01	36.35	42.72	58.15	59.58
14	4.14	4.77	252.73	292.78	4.86	5.46	45.43	52.92	51.54	54.84
15	4.17	4.60	228.87	272.62	4.68	5.16	44.79	52.16	51.18	54.58
LSD 5%	0.12	0.13	1.99	1.73	0.01	0.01	0.36	0.41	0.49	0.50
X^-	4.39	4.83	223.19	258.37	4.66	5.17	39.61	37.72	47.19	49.71

Table 4: Phenotypic coefficient of variance (PCV), genotypic coefficient of variance (GCV), Broad and narrow sense heritability ($h^2_{b,n}$), selection index genetic advance (GA) and genetic advance % (of mean from selection for the studied traits in F_4 population (1) in sesame:

Characters	50% Flowering	Physiological maturity	Plant height	Fruiting zone	No. of branches	No. of capsules	1000-seed weight	Seed weight / plant	% of oil
PCV	9.64	10.36	163.47	112.23	9.61	1284.62	3.87	245.45	12.24
GCV	8.88	9.88	157.55	101.68	2.58	1276.85	3.78	240.05	11.45
H^2 BS	92.08	95.35	36.38	90.60	26.85	99.32	97.59	97.80	93.60
H^2NS	30	30	30	34	34	37	35	39	33
SI 10%	6.43	9.82	55.20	34.85	2.22	165.60	1.26	28.50	7.77
GA	5.92	9.36	53.20	31.58	0.60	194.11	1.23	27.87	7.27
GA%	5.05	10.96	31.09	31.78	12.67	83.25	32.79	91.76	16.05

Table 4a: Phenotypic coefficient of variance (PCV), genotypic coefficient of variance (GCV), Broad and narrow sense heritability ($h^2_{b,n}$), selection index genetic advance (GA) and genetic advance % (of mean from selection for the studied traits in F_4 population (6) in sesame:

Characters	50% Flowering	Physiological maturity	Plant height	Fruiting zone	No. of branches	No. of capsules	1000-seed weight	Seed weight / plant	% of oil
PCV	1.30	3.95	239.21	180.63	4.79	811.87	5.08	268.62	0.98
GCV	0.83	3.64	227.28	174.83	1.52	794.10	4.94	263.99	0.50
H^2 BS	63.77	92.19	95.01	96.79	31.72	97.81	97.38	98.37	50.94
H^2NS	30	30	30	34	33	35	36	37	32
SI 10%	2.47	6.25	96.42	48.52	1.53	140.94	1.59	33.68	2.28
GA	1.57	5. 75	65.96	45.03	0.48	137.86	1.55	33.10	1.16
GA%	3.66	6.32	35.66	40.93	10.83	61.37	33.85	85.38	2.37

Table 4b: Phenotypic coefficient of variance (PCV), Genotypic coefficient of variance (GCV), Broad and narrow sense heritability ($h^2_{b,n}$), selection index genetic advance (GA) and genetic advance % (of mean from selection for the studied traits in F_4 population (11) in sesame:

Characters	50% Flowering	Physiological maturity	Plant height	Fruiting zone /plant	No. of branches /plant	No. of capsules /plant	1000-seed weight	Seed weight / plant	% of oil
PCV	1.51	4.28	246.70	130.09	16.08	728.39	4.01	361.62	4.97
GCV	1.19	3.85	244.12	128.62	8.67	711.08	3.93	354.63	4.34
H^2 BS	78.51	90.08	98.95	98.79	53.90	97.62	97.94	98.07	87.36
H^2NS	30	30	29	36	37	38	36	37	35
SI 10%	2.71	6.55	71.30	41.94	2.61	132.95	1.39	39.67	4.97
GA	2.12	5.90	70.56	41.43	1.41	129.80	1.36	38.91	4.35
GA%	4.76	6.40	33.26	33.38	36.17	56.26	30.70	97.37	9.50

Table 4C: Phenotypic coefficient of variance (PCV), genotypic coefficient of variance (GCV), Broad and narrow sense heritability ($h^2_{b,n}$), selection index genetic advance (GA) and genetic advance % (of mean from selection for the studied traits in F_4 population (15) in sesame:

Characters	50% Flowering	Physiological maturity	Plant height	Fruiting zone	No. of branches	No. of capsules	1000-seed weight	Seed weight / plant	% of oil
PCV	3.25	9.34	204.54	112.48	17.49	1024.81	4.34	395.92	6.54
GCV	2.62	8.93	200.50	109.69	7.96	1009.69	4.27	390.85	5.95
H^2 BS	80.62	95.68	98.03	97.52	45.53	98.52	98.36	98.72	91.03
H^2NS	29	29	28	36	35	38	37	38	33
SI 10%	3.93	9.54	65.93	38.96	2.73	161.13	1.44	34.81	5.76
GA	3.71	9.13	64.63	38.00	1.25	158.75	1.42	43.24	5.24
GA%	7.25	10.19	33.13	30.67	31.72	68.28	32.24	97.19	11.25

التباين الوراثى للمحصول ومكوناته للأجيال الانعزالية فى السمسم

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الملخص العربي:

أجريت هذه الدراسة بقسم بحوث الأصول الوراثية محطة بحوث بهتيم، معهد بحوث المحاصيل الحقلية، مركز البحوث الزراعية، وذلك خلال موسمين متتالين 2018&2019. فى الموسم الأول تمت زراعة ستة آباء معلمس عشرة عشيرة في الجيلين الثالث والرابع فى قطاعات كاملة العشوائية فى ثلاث مكرارات وأجرى الأنتخاب بناء على الصفات (50% تزهير، النضج الفسيولوجى، ارتفاع النبات، طول المنطقة الثمرية، عدد الأفرع لكل نبات، عدد الكبسولات لكل نبات، وزن الـ 1000 بذرة، وزن البذور لكل نبات وأيضا النسب المئوية لمحتوى الزيت). وسجلت البيانات بهدف تحسين القياسات الوراثية (درجة التوريث بالمعنى الواسع والضيق ($h^2_{B\&N}$)، معامل الاختلاف المظهري(PCV) والوراثى (GCV) ، التقدم الوراثى (ΔG) ، كفاءة الأنتخاب). ولقد أظهرت نتائج التحليل أن الأب (2) كان مبكراً فى صفتى 50% تزهير والنضج الفسيولوجى، والأب (5) كان الأعلى فى الصفات (ارتفاع النبات، عدد الكبسولات لكل نبات، محصول البذور لكل نبات)، كما أظهرت صفة وزن الـ 1000 بذرة أن الأب (6) كان الأثقل فى الوزن، كذلك أظهرت النسبة المئوية للزيت أن الأب (4) كان الأعلى فى الزيت. كما أظهرت النتائج أن العشيرة رقم (3) كانت الأعلى في صفتى (50% تزهير، النضج الفسيولوجى)، وكانت العشيرة (4) الأعلى فى صفتى (ارتفاع النبات، وزن البذور لكل نبات)، وكانت العشيرة (7) الأعلى في صفة عدد الكبسولات لكل نبات، والعشيرة (5) كانت الأثقل في صفة وزن الـ1000 بذرة. كما أظهر تحليل الزيت أن العشيرة (12) كانت الأعلى فى النسبة المئوية للزيت. كما أظهرت النتائج أن التباين المظهرى أعلى فى القيمة من التباين الوراثى لجميع الصفات المدروسة وأوضحت النتائج أن أعلى قيمة لكل من معاملى الاختلاف المظهرى والوراثى كانت في صفة عدد الكبسولات لكل نبات. كذلك أظهرت النتائج درجة توريث عالية مصحوبة بتقدم وراثى عالى لصفتى (عدد الكبسولات لكل نبات، وزن البذور لكل النبات)، وأن هذه الصفات يمكن تحسينها عن طريق الانتخاب وهذه التأثيرات ترجع الى الجينات المضيفة، بالتالى فإن الانتخاب لهذه الصفات كان له تأثير معنوى عالٍ وفعال.

الكلمات الاسترشادية: السمسم، انتخاب النسب، المقاييس الوراثية، درجة التوريث، التقدم الوراثى، الأجيال الانعزالية.