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Genetic Variation In Sesame (*Sesamum indicum* L.) Genotypes Under Foothill Condition Of Nagaland

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Abstract

A total of 16 genotypes of sesame were evaluated at SASRD, Medziphema during kharif season of 2018 in randomized block design with three replications. The analysis of variance revealed significant differences among genotypes for all the characters studied, indicating high degree of variability in the material. High GCV and PCV were recorded for number of branches per plant, stem height from base to first branch, days to 50% flowering, number of capsules per plant and seed yield per plant indicating influence of environment on their expression. High heritability coupled with high genetic advance as percent of mean was observed for days to 50 % flowering, 50 % flowering to maturity, number of branches per plant, number of seeds per capsule and harvest index indicating the influence of additive gene action, as such simple selection would be effective for improvement of these traits. Correlation studies indicate that plant height shows positive and significant association with seed yield per plant indicating relative utility of this trait. The path analysis revealed that the plant height contributed positive direct effect on yield per plant and also exhibited significant positive correlation with seed yield per plant. Thus it suggests that while selection, emphasis should be given on plant height for improvement of yield.

Key words Sesame, genotypes, genetic variability, heritability, correlation, path coefficient

Introduction

Sesame (*Sesamum indicum* L.) known as ‘benni seed’, ‘gingelly’, ‘simsim’, ‘til’ etc., is an important and perhaps the oldest and ancient oilseed crops known to man. It is cultivated extensively from tropical regions to the temperate zones in the world. It is fifth important edible oil crop in India after groundnut, rapeseed-mustard, sunflower and soybean. Sesame seed contains 50% oil, 23% protein and 15% carbohydrate (Ranganatha *et al.,* 2012). Sesame seed oil has long shelf life due to the presence of lignans (sesamin, sesamol, sesamolin), which have remarkable antioxidant function, resisting oxidation because this reason sesame regarded as a ‘’queen of oil seeds‘’. It can set seed and yield well under fairly high temperature and can grow in stored soil moisture without rainfall and irrigation. However, continuous flooding or severe drought adversely affects the crop resulting in low yield

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In spite of sesame possessing high nutritional value and resistance to abiotic stress like drought it has low yielding capacity compared to other oilseed crops. The low ranking of sesame among the oilseed crops may be attributed to several factors including its susceptibility to diseases, seed shattering, indeterminate growth habit and strong competition from other oil crops such as soybean, sunflower and peanut. Further, sesame has been given less attention by the farmers because of poor yield due to non availability of cultivars to suit the diverse agro climatic conditions. Hence, development of improved high yielding cultivars adapted to local conditions has become top priority.

Genetic variation exists for agronomically vital characters in sesame but its production is still very low in India. Traditional sesame landraces as well as related wild species are an important source of genetic diversity for breeders. However, the development of improved plant cultivars is restricted mainly due to narrow genetic pool which results in limited possibility to restructure the sesame crop. In general, diverse landraces traditionally are considered important for future food security due to their ability to sustain in changing climate (Huang *et al*., 2018). Therefore, the present study was undertaken to assess the nature and magnitude of genetic variability present in different genotypes of sesame. An attempt has also been made to study the correlation and path coefficient which are helpful in selecting the desirable traits.

Materials and Methods:

The present investigation was conducted with sixteen genotypes (Table- 1) during *kharif* 2018 at the experimental farm of department of genetics and plant breeding, School of Agricultural Sciences and Rural Development, Nagaland University, Medziphema, Nagaland. The experiment was carried out in randomized block design (RBD) with three replications. Sesame seeds are sowed on 10th august 2018. All the recommended agronomic practices were followed for raising a good crop. Data were recorded on five sampled plant in each plot on ten characters *viz.* days to 50 % flowering, days to 50 % flowering to maturity, plant height, stem height from base to first branch, number of branches per plant, number capsules per plant, capsule length, number seeds per capsule, harvest index and seed yield per plant. The mean values were subjected to statistical analysis to work out analysis of variance for all the characters as suggested Panse and Sukhatme (1957). The phenotypic, genotypic and environmental coefficients of variation were calculated according to Burton and De Vane (1953). Heritability (broad sense) was estimated according to Allard (1960). Genetic advance as per cent of mean was estimated according to Johnson *et al*. (1955). Phenotypic and genotypic correlation coefficients were worked out to study the interrelationship between various pairs of characters as suggested by Al-Jibouri *et al.* (1958). The path coefficient analysis was carried out by the formula apply by the Dewey and Lu (1959).

Table-1. List of genotypes used under investigation

S.NO.	Genotypes	Procurement Location
1	TKG – 21	JNKVV, Jabalpur
2	GT – 10	JNKVV, Jabalpur
3	GT – 3	JNKVV, Jabalpur
4	TKG – 22	JNKVV, Jabalpur
5	TKG – 53	JNKVV, Jabalpur
6	Nempo Karjung	AAU, Experimental centre, Diphu
7	Nempo Thepo	AAU, Experimental centre, Diphu
8	Nempo Soksu	AAU, Experimental centre, Diphu
9	Bahaubheti Local	AAU, Experimental centre, Diphu
10	ST-1683	AAU, Experimental centre, Diphu
11	Nempo Charap	AAU, Experimental centre, Diphu
12	Kensa	Ngaland
13	Youngyimsen	Ngaland
14	Meghalaya (Local)	Meghalaya
15	Chuchuyimlang	Naagaland
16	Yisemyong	Nagaland

Results and Discussion:

The analysis of variation revealed significant differences among the genotypes for all characters (Table- 2) studied indicating high degree of variability present in the material. Phenotypic coefficient of variation was found to be higher than those of genotypic coefficient of variance for all the characters under study (Table-3) indicating the role of environmental variance in the total variance. The highest GCV and PCV were recorded for number of branches per plant, stem height from base to first branch, days to 50% flowering, number of capsules per plant and seed yield per plant. Similar findings were reported by Soniasabanam (2019) and Zhimomi (2019) for seed yield per plant.

High heritability coupled with high genetic advance as percent of mean was observed for days to 50 % flowering, 50 % flowering to maturity, number of branches per plant, number of seeds per capsule and harvest index indicating the influence of additive gene action, as such simple selection would be effective for improvement of these traits. Similar findings were reported by Soniasabanam (2019) for days to 50% flowering, days to 50% flowering to maturity and Zhimomi (2019) for number of primary branches per plant. The traits plant height and capsule length were showing high heritability coupled with moderate genetic advance as percent of mean suggesting that the expression of these traits were mostly influenced by additive type of gene action hence these traits can be improved through selection. While traits stem height from base to first branch and seed yield per plant recorded moderate heritability and high genetic advance as percent of mean suggesting that these traits were governed by additive gene action, selection will be effective in improving these traits.

Table- 2. Analysis of Variance for 10 characters in sixteen genotypes of sesame

Sources of variation	DF	Sum of mean squares									
		Days to 50 per cent Flowering	Days to 50% flowering to maturity	Plant height	Number of branches per plant	Stem height from base to first branch	Number of capsules per plant	Capsule length (cm)	Number of Seeds per capsule	Harvest index (g)	Seed yield per plant (g)
Replication	2	33.83	18.52	6.31	0.25	65.60	153.17	0.02	4.11	18.27	1.95
Treatment	15	278.15*	107.26*	359.12*	1.51*	421.01*	124.69*	0.09*	331.44*	117.12*	1.41*
Error	30	23.19	8.43	25.31	0.20	81.54	50.77	0.002	13.15	17.71	0.53

** and * denotes 1 % and 5 % level of significance, respectively

Table- 3. Genetic parameters of yield and its related traits in sesame

Characters	Grand mean	range		Co-variance			Co-efficient of variation			Heritability (Broad sense)	Genetic advance as percent of mean
		Min.	Max.	$\sigma^2 g$	$\sigma^2 e$	$\sigma^2 p$	GCV	PCV	ECV		
Days to 50% flowering	46.35	30.00	79.00	84.98	23.19	108.18	18.88	22.43	10.38	78.55	36.05
Days to 50% flowering to maturity	49.64	40.00	65.00	32.944	8.43	41.37	11.56	12.95	5.84	79.62	21.08
Plant height (cm)	98.50	71.60	126.1	111.26	25.31	136.58	10.70	11.96	5.10	81.46	19.79
Number of branches per plant	2.45	1.20	4.20	0.43	0.20	0.64	26.87	32.57	18.25	68.09	45.71
Stem height from base to first branch (cm)	43.53	17.64	81.10	113.15	81.54	194.69	24.43	32.05	20.74	58.11	38.28
Number of capsules per plant	30.62	13.60	54.80	24.64	50.77	75.41	16.20	28.35	23.27	32.67	18.69
Capsule length (cm)	2.51	2.04	2.81	0.03	0.002	0.03	6.99	7.31	1.78	91.28	13.51
Number of Seeds per capsule	68.03	45.84	83.40	106.09	13.15	119.25	15.13	16.05	5.33	88.96	28.98
Harvest index (%)	40.266	25	56	33.13	17.71	50.85	14.29	17.70	10.45	65.20	23.71
Seed yield per plant (g)	3.45	1.57	3.45	0.32	0.52	0.85	16.36	26.69	20.90	37.50	20.61

Correlation studies (Table- 4 & 5) indicated that plant height shows positive significant association with seed yield per plant at both genotypic and phenotypic level hence simultaneous selection of this character will ultimately result in high yield. Zhimomi (2019) also reported significant positive association of plant height with seed yield per plant.

Table- 4. Genotypic correlation of 10 characters in sesame

Characters	Days to 50% flowering	Days to 50% flowering to maturity	Plant height	Number of branches per plant	Stem height from base to first branch	Number of capsules per plant	Capsule length	Number of Seeds per capsule	Harvest index (%)	Seed yield per plant
Days to 50% flowering	1.0000	-0.8385**	-0.4282*	0.7189**	0.7346**	0.3329*	0.0386	0.5011**	-0.0857	-0.4440*
Days to 50%flowering to maturity		1.0000	0.4196*	-0.4889*	-0.3280*	-0.0797	0.0212	-0.4026*	-0.0198	0.1252
Plant height (cm)			1.0000	-0.3202*	-0.2408	0.0617	0.1685	-0.4673*	-0.4091*	0.6154**
Number of branches per plant				1.0000	0.7974**	0.7662**	0.0507	0.0941	-0.2641	0.03014
Stem height from base to first branch (cm)					1.0000	0.7701**	0.2382*	0.2624*	-0.2741*	-0.2992*
Number of capsules per plant						1.0000	0.1978	-0.2983**	-0.5288**	0.1304
Capsule length (cm)							1.0000	0.2835*	0.2921*	-0.2984*
Number of seeds per capsule								1.0000	0.6861**	-0.0165
Harvest index (%)									1.0000	-0.6149**
Seed yield per plant (g)										1.0000

** and * denotes 1 % and 5 % level of significance, respectively

The path analysis (Table- 6) revealed that the plant height contributed positive direct effect on yield per plant and also exhibited significant positive correlation with seed yield per plant. Thus it suggests that while selection, emphasis should be given on plant height for improvement of yield. Shitiri et al. (2018) reported similar finding. The residual effect estimated was 0.44 indicating that the traits under the study are not sufficient to account for variability there may be few more pertaining characters other than those studying in the present investigation and thus solicits inclusion of some more characters. Inclusion of some physiological characters like leaf area index, chlorophyll content etc. could be considered important in order to derive a much clear picture of casual relationship. The present study suggest that while selection emphasis should be given on plant height for improving the yield

Table-5. Phenotypic correlation of 10 characters in sesame

Character	Days to 50% flowering	Days to 50% flowering to maturity	Plant height (cm)	Number of branches per plant	Stem height from base to first branch	Number of capsules per plant	Capsule length	Number of Seeds per capsule	Harvest index (%)	Seed yield per plant
Days to 50% flowering	1.0000	-0.7123**	-0.3285*	0.4927 *	0.5138**	0.1819	0.0590	0.4502*	-0.0852	-0.2497*
Days to 50%flowering to maturity		1.0000	0.3203*	-0.2577*	-0.1674	0.0550	0.0324	-0.3517*	-0.0651	0.1957
Plant height (cm)			1.0000	-0.2825*	-0.0747	0.0586	0.1593	-0.3753*	-0.2864*	0.3971*
Number of branches per plant				1.0000	0.6558**	0.6762**	0.0380	0.0843	-0.2561*	0.2323
Stem height from base to first branch					1.0000	0.3930*	0.1736	0.2626*	-0.1237	0.0432
Number of capsules per plant						1.0000	0.0802	-0.1306	-0.2792	0.4857*
Capsule length (cm)							1.0000	0.2834*	0.2621*	-0.1700
Number of Seeds per capsule								1.0000	0.5411**	-0.5564**
Harvest index (%)									1.0000	0.3816*
Seed yield per plant (g)										1.0000

** and * denotes 1 % and 5 % level of significance, respectively

Table- 6. Direct and Indirect effects of yield components on seed yield at genotypic level in sesame genotypes.

Character	Days to 50% flowering	Days to 50% flowering to maturity	Plant height (cm)	Number of branches per plant	Stem height from base to first branch	Number of capsules per plant	Capsule length	Number of Seeds per capsule	Harvest index (%)	Seed yield per plant
Days to 50% flowering	-0.7089	1.1640	-0.1251	-0.7969	0.5663	0.2475	-0.0061	-0.7197	-0.0652	-0.4441
Days to 50% flowering to maturity	0.5944	-1.3882	0.1226	0.5420	-0.2529	-0.0593	0.0034	0.5782	-0.0151	0.1252
Plant height (cm)	0.3036	-0.5826	0.2922	0.3550	-0.1857	0.0459	0.0268	0.6712	-0.3108	0.6154
Number of branches per plant	-0.5096	0.6787	-0.0936	-1.1085	0.6147	0.7761	0.0081	-0.1352	-0.2006	0.0301
Stem height from base to first branch (cm)	-0.5208	0.4553	-0.0704	-0.8839	0.7709	0.5725	-0.0378	-0.3768	-0.2082	-0.2992
Number of capsules per plant	-0.2360	0.1107	0.0180	-1.1573	0.5937	0.7434	0.314	0.4284	-0.4018	0.1305
Capsule length (cm)	-0.0274	0.0295	-0.0493	0.0562	0.1837	-0.1471	-0.1588	-0.4072	0.2219	-0.2984
Number of Seeds per capsule	-0.3553	0.5590	-0.1366	-0.1043	0.2023	-0.2218	-0.0450	-1.4360	0.5213	-0.0165
Harvest index (%)	0.0608	0.0276	-0.1196	0.2928	-0.2113	-0.3932	-0.0464	-0.9854	0.7596	-0.6150

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