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Research Note

Genetic variability analyses for economic traits in sesame (*Sesamum indicum* L.) germplasm

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Abstract
The present study aims to reveal the importance of some quantitative traits and genetic variability existing in the 40 sesame germplasm accessions. The analysis of variance revealed the significant differences among the genotypes for all the characters studied *viz.* days to maturity, capsule length, number of capsules per plant, number of seeds per capsule, leaf length, oil content, protein content, days to 50% flowering, number of branches per plant, number of leaves per plant, plant height, 1000-seed weight and seed yield per plant, which showed high heritability. The higher estimates of GCV were obtained for number of capsules per plant, number of branches per plant and seed yield per plant, while, it was moderate for capsule length, internode length, number of seeds per capsule and number of leaves per plant. Rest of the characters *viz.*, days to 50% flowering, days to maturity, plant height, 1000-seed weight, leaf length, oil content and protein content showed low GCV. The characters like; capsule length, number of branches per plant, number of leaves per plant, number of capsules per plant, number of seeds per capsule and seed yield per plant exhibited high genetic advance coupled with high heritability, indicating better scope for improvement of these traits by an effective selection programme also indicated the predominance of additive gene effects, in controlling these traits.

Key words
Sesame, Genetic variability, genotypic co-efficient of variation, phenotypic co-efficient of variation.

Sesame (*Sesamum indicum* L.) is the important oilseed crop of the world. It is important annual oilseed crop in the tropics and warm sub tropics, where it is usually grown in small patches. Sesame is described as the "Queen of oilseeds" because it contains Sesame seed contains 40-50% oil, 20-25% protein, 20-25% carbohydrate and 5-6% ash, calcium, phosphorous, oxalic acid and excellent qualities of seed oil and meal (Salunkhe *et al*., 1992). It is an annual plant which belongs to the Pedaliaceae family. India rank second in area (1.82 million ha) and production (0.62 million tones) (FAOSTAT, 2015). Among predominantly growing major states of the country, Gujarat secured first rank in area having (0.35 million ha), production of 0.14 million tones (Anon, 2012). Being the fourth important oilseed crop in Indian agriculture after groundnut, rapeseed and mustard, it is widely cultivated in the states like Gujarat, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Karnataka, West Bengal, Bihar and Assam. It is considered to be the oldest of the oilseed plants and has been under cultivation in Asia for over 5000 years (Bisht *et al.,* 1998). Despite being largely self-sufficient in production, sesame productivity is in decline (Anthony *et al*., 2015; FAOSTAT, 2015) and it is of great concerned that is caused mainly due to unavailability of high yielding varieties (Duhoon 2004; Ram *et al.* 2006).

In any crop improvement programme, existence of variability and selection with due selection pressure on yield components character is of prime importance. However, assessment of genetic variability in the base population is the first step in any breeding programme. Thus, the knowledge of existing genetic variability and estimation of heritability for yield and its components in an existing breeding material population is very important in determining the influence of environment for the expression of the character and extent of improvement is possible after selection. The yield is a complex character resulting from interplay of various yield contributing characters, which have positive or negative association with yield and among themselves. To assess the magnitude of correlation for various characters with yield would be immense help in the indirect selection for improvement of yield.

Though sesame genotypes in Indian subcontinent have been reported to represent a wide diversity but still no systematic efforts have been made to characterize and document the indigenous and exotic collections along with the local germplasms to reveal the genetic diversity (Kim *et al.* 2002).

The knowledge of genetic variation present between indigenous and exotic collection of sesame will provide critical information for better management strategy for crop improvement in adverse conditions. Therefore, the aims of the present study were to elucidate genetic variability exist among economic traits in 40 sesame accessions from different regions of India.

A field experiment was conducted during kharif 2013 at B. A. College of Agriculture, A.A.U., Anand. The experimental material comprised of 40 genotypes (Table 1) those were evaluated in RBD with three replications. Data were collected for a total of 14 characters *viz*., day to 50% flowering, days to maturity, plant height (cm), capsule length (cm), leaf length (cm), internode length (cm), number of branches per plant, number of leaves per plant, number of capsule per plant, number of seeds per capsule, 1000 – seed weight (g), oil content (%), protein content (%) and seed yield per plant (g).

Each genotype was sown in a plot with distance of 45 cm between the rows and 15 cm between the plants within the rows. Five plants in each row were selected at random and the data on fourteen characters were analysed based on the formula given by Lush (1940) for heritability. Heritability in the broad sense was derived based on the formula given by Hansan *et al.* (1956). Genetic advance was obtained by the formula prescribed by Johnson *et al*. (1955). The method adopted by Burton and Devane (1953) was used to calculate phenotypic and genotypic co-efficient of variation. The genotypic and phenotypic correlation coefficients were worked out by following Al-jibouri *et al*. (1958).

Considering overall results of the variance components (Table 2), the estimates of genotypic and phenotypic variances revealed that most of the characters studied showed predominance of genotypic variance in the total variance (Table 3). High GCV (>20%) was observed for number of capsules per plant, number of branches per plant and seed yield per plant. These results are in agreement with those of Patil and Sherif (1966) and Reddy *et al*. (2001). High GCV values with marginally high PCV values indicated that inter-accession variations were high and that the expression of these characters was not influenced by the environment. Low GCV (<10%) was recorded for characters like days to 50% flowering, days to maturity, plant height, 1000-seed weight, leaf length, oil content and protein content. Low PCV values with marginally low GCV values in these characters indicated less variability for these traits in the genotype studied and they were poor responsive to selection. Rest of the characters *viz.*, capsule length, internode length, number of seeds per capsule and number of leaves per plant showed moderate (10-20%) GCV and PCV values suggested considerable scope for improvement of the trait by selection. The results are in conformity with the findings of Chandrasekhar and Reddy (1993) and Reddy *et al*.(2001).

Very high heritability (>90%) was observed for days to maturity, capsule length, number of capsules per plant, number of seeds per capsule, 1000-seed weight, oil content and protein content. Whereas high heritability (60-90%) was observed for characters like days to 50% flowering, number of branches per plant, number of leaves per plant, plant height, leaf length and seed yield per plant. Moderate heritability (31-60%) obtained for internode length. Similar this way results were observed by Pawar *et al.* (2002). Significant and very high positive association between number of capsules per plant and seed yield/plant indicates that this characters were a reliable yield component characters. Tomar *et al.,* (1999) also found similar observations. Number of primary branches per plant, number of seeds per capsule and capsule length exhibited significant but moderate positive correlation with seed yield per plant.

The high heritability coupled with high genetic advance indicated that most likely heritability in genotypes was due to additive gene effects indicating better scope for improvement in the characters by effective selection of genotypes. Characters capsule length, number of branches per plant, number of leaves per plant number of capsules per plant, number of seeds per capsule and seed yield per plant exhibited high heritability with high genetic advance which could be effectively improved by selection. Johnson *et al.* (1955) have also suggested that characters with high heritability coupled with high genetic advance would respond better to selection than those with high heritability and low genetic advance. The characters like days to 50% flowering, days to maturity, plant height, internode length, leaf length, 1000-seed weight, oil content and protein content exhibited high to moderate heritability with low to moderate genetic advance indicating moderate scope of improvement in these traits through selection.

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Table 1. List of genotypes studied

S.N.	Genotypes	Pedigree / Source	S.N.	Genotypes	Pedigree / Source
1	RT-127	Si3500 X Patan-64	21	JR-25	Amreli, Gujarat
2	RT-125	Type13 X RT-1	22	Rama	West Bengal
3	RT-346	Rt-127 X Hy-24	23	SSM	Amreli, Gujarat
4	GT-1	Pure Line Selection	24	MRUG-1	Selection from local material
5	GT-2	Gt-1 X TC25	25	Nirmla	Mutant of B-67
6	GT-3	Gt Til X AHT85	26	T-4	T-10 X T-3
7	GT-4	GT1 X RT-127	27	TC-289	P.B. Til X E.C. 4619
8	VRI(SV)-1	Pureline Selction from Thirukkattappali	28	GP-238	Amreli, Gujarat
9	TKG-55	TC25 X TNAU-1	29	Patan-64	Amreli, Gujarat
10	TKG-306	CST785 X TKG-22	30	SVPR-1	Selection From Western Ghat
11	TKG-22	HT6 X JLT-3	31	T-12	Selection from local material
12	TMV-4	Mass Selection-from Local Satur Variety	32	AKT-101	Maharashtra
13	TMV-6	Pureline Selection	33	ES-274	Exotic
14	TMV-7	Si-250 X Es-22	34	Thilarani	Thilak X Kayamkulam -1
15	V-76-30	Amreli, Gujarat	35	Surya	Selection Culture 42-1
16	P.Zalawad	Amreli, Gujarat	36	AT-24	Selection from Local Material
17	JTS-8	Omt-10 X Tc-289	37	Thilak	Pure Line Selection
18	Bhavrodi-6	Amreli, Gujarat	38	Kayamkulam-1	Pure Line Selection
19	MT-75	Jlt-26 X Rt-127	39	VRI2	JL-24 X CO1
20	Shedvhar	Amreli, Gujarat	40	RSS-106	Amreli, Guajrat

Table 2. Analysis of variance for 14 characters in sesame

Sr. No.	Characters	Mean squares		
		Replication	Treatment	Error
1	Days to 50% flowering	23.86	25.96**	2.41
2	Days to maturity	47.91	65.45**	2.32
3	Plant height (cm)	26.52	140.02**	5.73
4	Capsule length (cm)	0.052	0.429**	0.011
5	Internode length (cm)	0.226	1.14**	0.226
6	Number of branches per plant	12.67	4.92**	0.428
7	Number of leaves per plant	50.94	279.45**	15.53
8	Number of capsules per plant	47.66	376.77**	6.12
9	Number of seed per capsules	35.47	209.61**	4.95
10	Leaf length (cm)	0.043	2.06**	0.271
11	1000-seed weight (g)	0.034	0.137**	0.002
12	Oil content (%)	0.781	21.91**	0.261
13	Protein content (%)	0.114	8.02**	0.054
14	Seed yield per plant (g)	23.23	9.28**	1.20

** Significant at 1% level of significance

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Table 3. The estimates of genotypic ($\hat{\sigma}^2_g$) and phenotypic ($\hat{\sigma}^2_p$) variance and other genetic parameters for different characters in sesame

S.N.	Characters	Mean	$\hat{\sigma}^2_g$	$\hat{\sigma}^2_p$	GCV (%)	PCV (%)	H^2 (b) (%)	GA (% of mean)
1	Days to 50% flowering	40.62	7.85	10.26	6.90	7.89	76.50	12.43
2	Days to maturity	82.97	21.05	23.35	5.53	5.82	90.10	10.81
3	Plant height (cm)	84.49	52.98	59.77	7.92	8.41	88.60	15.36
4	Capsule length (cm)	2.41	0.139	0.150	15.49	16.07	92.90	30.70
5	Internode length (cm)	4.72	0.305	0.531	11.70	15.44	57.50	18.22
6	Number of branches per plant	6.07	24.6	31.74	20.16	22.87	77.80	36.57
7	Number of leaves per plant	67.40	87.97	103.50	13.92	15.09	85.00	26.42
8	Number of capsules per plant	54.38	123.55	129.67	20.44	20.94	95.30	40.95
9	Number of seeds per capsule	49.47	68.22	73.17	16.70	17.29	93.20	33.21
10	Leaf length (cm)	10.12	0.598	0.869	7.64	9.20	68.80	12.94
11	1000-seed weight (g)	3.28	0.045	0.047	6.46	6.60	95.70	13.10
12	Oil content (%)	48.24	7.22	7.48	5.57	5.67	96.50	11.28
13	Protein content (%)	23.26	2.66	2.71	7.05	7.12	98.10	14.22
14	Seed yield per plant (g)	8.11	2.69	3.89	20.22	24.31	69.20	34.65