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ASSESSMENT OF GENETIC VARIABILITY AND CORRELATION STUDIES FOR YIELD IMPROVEMENT IN SESAME (*Sesamum indicum* L.)

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ABSTRACT

A study was conducted in 44 sesame accessions to analyze genetic variability and character association for yield improvement in sesame. Analysis of variance indicated the existence of significant genotypic differences among the genotypes. High GCV and PCV were observed for seed yield per plant, harvest index and number of capsules per plant. High heritability coupled with high genetic advance as percent of mean was observed for number of primary branches, seed yield per plant, number of capsules per plant, harvest index and height to first capsule indicating the influence of additive and gene action. Seed yield per plant showed positive association with number of capsules per plant, harvest index, oil content and number of primary branches.

KEYWORDS: Sesame, PCV, GCV, heritability, genetic advance as per cent mean, correlation.

INTRODUCTION

Sesame (*Sesamum indicum* L., 2n = 26), an ancient oilseed crop, a member of the Pedaliaceae family and also known as the "Queen of Oilseeds," is recognized for its nutritional value and diverse applications. The seeds are rich in proteins, lipids, and lignin-like compounds, offering health benefits such as antioxidant properties, cholesterol reduction, and protection against cardiovascular diseases (Wei *et al*., 2022). Sesame seeds enhance plasma g-tocopherol and vitamin E activity, which may prevent aging-related diseases, and are incorporated in foods like bread, cookies, and tahini (Elleuch *et al*., 2011).

In India, it occupied in an area of 10.39 lakh hectares with 4.29 lakh tonnes of production and productivity of 413 kg/ha (Indiastat,2024). Variation in climatic and edaphic conditions affects sesame yield, the major constraints identified in growing sesame are instability in yield, lack of wider adaptability and non-synchronous maturity etc. Therefore, there is a need to exploit the existing genetic variability in sesame for developing high yielding varieties. Besides this, for understanding the mode of inheritance of the yield components, the correlation among them and the association between each component and yield is necessary for intelligent choice of breeding procedures for evolving high yielding varieties. (Robinson *et al*., 1951 and Johnson *et al.,* 1955).

The present investigation was conducted to study the phenotypic and genotypic variability among the genotypes and to estimate genetic advance, correlation coefficient among the component characters on yield of sesame.

MATERIAL AND METHODS

The experiment was conducted with 44 accessions including 40 advanced breeding lines and four checks *viz.,* YLM 66, Swetha til, TKG 22 and G Til 10 in a randomized block design (RBD) with two replications at the Regional Agricultural Research Station (RARS), Tirupati during Rabi 2023-24. Each breeding line was sown in two rows of three meters length with a spacing of 30 cm between the rows and 15 cm distance between the plants within the row. List of forty advanced breeding lines along with four checks utilized are given in Table.1

(C): Check

Observations were recorded for all the characters separately on randomly chosen five competitive plants in each replication except days to 50% flowering and days to maturity which will be taken on plot basis. The characters studied are *viz.,* days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, SCMR (SPAD Chlorophyll meter reading), SLA (Specific Leaf Area) ($cm2g^{-1}$), height to the first capsule (cm), distance between the internodes (cm), number of capsules per plant, capsule length (cm),

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Table. 1: List of genotypes under study

S. No	Breeding Line	S. No	Breeding Line	S. No	Breeding Line	S. No	Breeding Line
1.	TPTS-4146	12.	TPTS-4201	23.	TPTS-4248	34.	TPTS-4278
2.	TPTS-4148	13.	TPTS-4204	24.	TPTS-4249	35.	TPTS-4280
3.	TPTS-4158	14.	TPTS-4208	25.	TPTS-4253	36.	TPTS-4281
4.	TPTS-4159	15.	TPTS-4211	26.	TPTS-4259	37.	TPTS-4283
5.	TPTS-4167	16.	TPTS-4223	27.	TPTS-4260	38.	TPTS-4284
6.	TPTS-4172	17.	TPTS-4232	28.	TPTS-4263	39.	TPTS-4285
7.	TPTS-4193	18.	TPTS-4233	29.	TPTS-4264	40.	TPTS-4299
8.	TPTS-4197	19.	TPTS-4234	30.	TPTS-4267	41.	YLM 66 (C)
9.	TPTS-4198	20.	TPTS-4238	31.	TPTS-4273	42.	Swetha Til(C)
10.	TPTS-4199	21.	TPTS-4239	32.	TPTS-4276	43.	TKG 22 (C)
11.	TPTS-4200	22.	TPTS-4243	33.	TPTS-4277	44.	G Til 10 (C)

number of seeds per capsule, 1000 seed weight (g), seed yield per plant (g), harvest index (%) and oil content (%).

Mean, range and coefficient of variation were also estimated. Genotypic coefficients of variation (GCV) and phenotypic coefficients of variation (PCV) were estimated according to Burton (1952) while heritability in broad sense ($h_2$bs) was estimated according to Burton and Devane (1953); genetic advance (GA) and genetic advance as percent of mean (GAM) were calculated by Johnson *et al*., (1955a) and correlation coefficient analysis by Robinson *et al*., (1951).

RESULTS AND DISCUSSION

The numerical data collected on quantitative characters were statistically analyzed and analysis of variance (Table 2) showed highly significant differences among the genotypes under study for all the 15 traits indicating the presence of considerable genetic variability among the experimental material under study. The PCV was greater than GCV for all the characters suggesting that the performance of entries was influenced by the environment. The characters, seed yield per plant, harvest index and number of capsules per plant exhibited high GCV and PCV suggesting sufficient amount of variation among the advanced breeding lines and the selection would be effective for further improvement of the traits. The above results are in accordance with findings of Patil and Lokesha (2018), Kumar *et al*., (2022), Patel *et al*., (2022), and Kumari and Shah (2023). Estimates of genetic parameters for yield and yield attributing traits in forty-four accessions of sesame are given in Table. 3.

High heritability coupled with high genetic advance as per cent mean were recorded for number of primary branches ($h_2$bs: 94.40%; GAM: 40.02%), seed yield per plant ($h_2$bs: 92.50%; GAM: 55.02%), number of capsules per plant (h2bs: 86.86%; GAM: 47.49%), harvest index (h2bs: 85.79%; GAM: 50.27%) and height to first capsule (h2bs: 70.20%; GAM: 24.69%) indicating the preponderance of additive gene action. Therefore, phenotypic selection would be more effective for improvement of these characters. Patel *et al*., (2022) and Kumar *et al*., (2022) had reported similar results.

The traits number of capsules per plant (rp = 0.804**; rg = 0.910**), harvest index (rp = 0.754**; rg = 0.874**), oil content(rp = 0.31**; rg = 0.347**) and number of primary branches (rp = 0.220*; rg = 0.225*) recorded positive significant association with seed yield per plant at both phenotypic and genotypic levels indicating that these characters play an important role in selection for the improvement of seed yield per

Table 2. Analysis of variance for yield and yield attributing traits in forty four entries of sesame

S. No.	Characters	Mean sum of squares		
		Replications (df : 1)	Treatments (df : 43)	Error (df : 43)
1.	Days to 50% flowering	0.01	8.86**	3.85
2.	Days to maturity	25.10	20.59**	6.73
3.	Plant height (cm)	130.41	170.86**	35.06
4.	Number of primary branches	0.03	1.23**	0.03
5.	SCMR (SPAD Chlorophyll meter reading)	2.056	28.165**	10.248
6.	SLA (Specific Leaf Area) (cm^2 g^{-1})	555.16	679.15**	155.46
7.	Height to first capsule (cm)	26.73	38.56**	6.75
8.	Distance between the internodes (cm)	0.004	0.17**	0.05
9.	Number of capsules per plant	0.910	489.449**	34.48
10.	Capsule length (cm)	0.001	0.06**	0.02
11.	Number of seeds per capsule	55.682	49.71**	21.19
12.	1000 seed weight (g)	0.01	0.19**	0.014
13.	Seed yield per plant (g)	0.200	13.204	0.539
14.	Harvest index (%)	90.558**	103.976**	7.952
15.	Oil content (%)	4.98	34.53**	1.36

*Significant at 5% level; ** Significant at 1% level.

plant (Table 4). These results were in harmony with the findings of Abate et al. (2015), Saravanan *et al*., (2020) and Patel *et al*., (2022).

In contrast distance between the internodes (rp = -0.242*; rg = -0.315**) and SLA (Specific leaf area) (rp = -0.220*; rg = -0.277**) exhibited significant negative correlation with seed yield per plant indicating the role of these traits is important for improving seed yield per plant in sesame. Similar results were earlier reported by Hemanth *et al*., (2022) and Kumari and Shah (2023). Non-significant positive association of oil content (rp = 0.12; rg = 0.062) was observed with seed yield per plant. Similar results were earlier reported by Patel *et al*., (2022) in (Table. 4)

High heritability coupled with high genetic advance as per cent mean were recorded for number of primary branches, seed yield per plant, number of capsules per plant, harvest index and height to first capsule indicating the preponderance of additive gene action. In correlation studies, the traits *viz.,* number of capsules per plant, harvest index, oil content and number of primary branches recorded positive significant association with seed yield per plant indicating that these characters play an important role in selection for the improvement of seed yield per plant.

Table 3. Estimates of genetic parameters for yield and yield attributing traits in forty four accessions of sesame

S. No.	Character	Mean	Range		Variance		Coefficient of variation		Heritability (Broad sense) %	Genetic advance (GA)	Genetic advance as percent of mean (%)
			Min.	Max.	Genotypic	Phenotypic	Genotypic	Phenotypic			
1	Days to 50% flowering	37.83	33.00	41.00	2.51	6.35	4.18	6.66	39.43	2.05	5.41
2	Days to maturity	80.19	75.00	85.00	6.93	13.66	3.28	4.61	50.72	3.86	4.816
3	Plant height (cm)	92.87	62.80	108.50	67.90	102.96	8.87	10.93	65.95	13.78	14.84
4	Number of primary branches	3.86	1.00	5.20	0.60	0.63	19.99	20.57	94.50	1.55	40.03
5	SCMR(SPAD Chlorophyll meter reading)	38.08	31.50	46.70	8.96	19.21	7.86	11.51	46.64	4.21	11.06
6	Specific leaf area ($cm^2 g^{-1}$)	140.53	98.38	185.28	261.84	417.30	11.52	14.54	62.75	26.40	18.79
7	Height to first capsule (cm)	27.88	19.05	36.80	15.90	22.66	14.31	17.08	70.20	6.88	24.69
8	Distance between the internodes (cm)	2.60	2.16	3.51	0.06	0.11	9.60	12.65	57.70	0.39	15.01
9	Number of capsules per plant	60.98	38.80	91.30	227.52	261.93	24.74	26.54	86.86	28.96	47.49
10	Capsule length (cm)	2.84	2.50	3.20	0.02	0.04	5.40	7.00	60.51	0.25	8.58
11	Number of seeds per capsule	62.14	50.50	74.00	14.26	35.45	6.08	9.58	40.22	4.93	7.94
12	1000 seed weight (g)	3.08	2.43	4.10	0.08	0.10	9.45	10.20	85.97	0.56	18.03
13	Harvest index (%)	26.30	14.57	40.97	48.01	55.96	26.35	28.44	85.79	13.22	50.27
14	Oil content (%)	46.12	33.80	53.14	16.59	17.94	8.83	9.19	92.43	8.07	17.49
15	Seed yield per plant (g)	9.07	5.08	14.25	6.34	6.86	27.77	28.88	92.50	4.99	55.02

Table 4. Phenotypic (r_p) and genotypic (r_g) correlation coefficients among yield and yield attributing traits in forty four sesame accessions

Trait		DM	PH	NPB	SCMR	SLA	HFC	DBI	NCPP	CL	NSPC	TSW	HI	OC	SYP
DFF	r_p	0.19*	0.22*	0.324**	-0.109	-0.025	0.43**	0.005	0.098	0.194*	0.06	0.021	0.017	-0.124	0.024
	r_g	0.074	0.517**	0.508**	-0.146	-0.223*	0.892**	0.15	0.24*	0.258*	0.255*	0.019	0.151	-0.225*	-0.023
DM	r_p	1	0.161*	-0.327**	0.084	-0.334**	-0.158*	-0.086	0.21*	-0.097	0.098	0.046	0.234*	-0.005	0.106
	r_g	1	0.242*	-0.428**	0.272*	-0.514**	-0.16*	-0.288*	0.335**	-0.309**	-0.111	0.04	0.451**	0.065	0.128
PH	r_p		1	-0.003	-0.022	0.016	0.417**	0.071	0.227*	0.365**	0.132	0.107	0.194*	-0.162*	0.176
	r_g		1	-0.049	-0.102	0.068	0.539**	0.172*	0.225*	0.387**	-0.007	0.151	0.191*	-0.214*	0.218*
NPB	r_p			1	0.084	0.003	0.445**	-0.043	0.344**	0.137	0.134	0.133	0.072	-0.005	0.220*
	r_g			1	0.122	0.048	0.485**	-0.027	0.388**	0.161*	0.191*	0.152	0.08	-0.005	0.225*
SCMR	r_p				1	-0.22*	-0.169*	-0.128	0.559**	-0.109	0.011	0.467**	0.554**	0.137	0.656**
	r_g				1	-0.277*	-0.15	0.003	0.879**	-0.25*	-0.101	0.726**	0.845**	0.236*	0.731**
SLA	r_p					1	0.069	0.093	-0.278*	0.201*	-0.029	-0.009	-0.252*	-0.109	-0.184*
	r_g					1	0.23*	0.136	-0.358**	0.365**	-0.038	0.000	-0.289*	-0.174*	-0.237*
HFC	r_p						1	0.371**	-0.012	0.281*	0.11	-0.028	0.01	0.000	-0.002
	r_g						1	0.522**	0.025	0.411**	0.132	-0.061	0.049	0.012	-0.062
DBI	r_p							1	-0.255*	0.064	-0.03	-0.157*	-0.064	0.132	-0.242*
	r_g							1	-0.434**	0.287*	0.118	-0.284*	-0.149	0.133	-0.315**
NCPP	r_p								1	-0.048	-0.068	0.493**	0.632**	0.116	0.804**
	r_g								1	-0.057	-0.016	0.559**	0.706**	0.140	0.910**
CL	r_p									1	0.344**	-0.032	-0.107	0.008	-0.070
	r_g									1	0.529**	-0.067	-0.107	0.002	-0.079
NSPC	r_p										1	-0.173*	-0.169*	0.040	-0.086
	r_g										1	-0.236*	-0.288*	0.071	-0.177
TSW	r_p											1	0.55**	0.037	0.664**
	r_g											1	0.665**	0.062	0.727**
HI	r_p												1	0.191*	0.754**
	r_g												1	0.205*	0.874**
OC	r_p													1	0.120
	r_g													1	0.114

*Significant at 5% level; ** Significant at 1% level.

DFF : Days to 50% flowering; HFC : Height to first capsule (cm); CPP : Number of capsules per plant; TSW : 1000 seed weight; DM : Days to maturity; PH: Plant height (cm); CL : Capsule length (cm); OC : Oil content (%); SCMR : SPAD Chlorophyll meter reading; NPB : Number of primary branches; SPC : Number of seeds per capsule; SYP : Seed yield per plant (g); SLA : Specific Leaf Area ($cm^2\ g^{-1}$); DBI : Distance between the internodes (cm); HI : Harvest index (%)

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