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Genetic Variability, Correlations and Path Coefficient Analysis For Components of Seed Yield in Single Stemmed Sesame (*Sesamum indicum* L.)

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ABSTRACT

The genetic variability, correlations and path coefficients were worked out in 40 diverse single stemmed varieties of sesame for 11 characters. Analysis of variance revealed highly significant differencies for all the characters studied. Wide range of variability and high heritability were observed for all characters except capsule length, capsule girth and seeds per capsule. The genetic advance was observed to be highest for seed yield per plant followed by capsules per plant and fruiting length. The seed yield per plant was significantly and positively correlated with plant height, fruiting length and number of capsules per plant. The path coefficient analysis indicated that days to flowering, plant height, capsule length, seeds per capsule and 100 seed weight had the highest direct effect on seed yield per plant in that order.

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INTRODUCTION

Sesame is a popular and most ancient oilseed crop. The crop contains wide range of variability which can be exploited for varietal improvement. The crop is very important specifically under semi-arid and arid conditions of western Rajasthan where it is grown as a pure as well as intercrop. Single stemmed varieties of sesame may be a good proposition in western Rajasthan where rainfall is very low and irratic. For developing high yielding single stemmed varieties of sesame, it was thought worth-while to collect informations on genetic variability, and also to work-out correlations and path coefficients in 40 diverse entries of single stemmed sesame chosen from the germplasm maintained at RSAR, Sumerpur (Rajasthan) as this information is not available for single stemmed varieties of sesame.

MATERIALS AND METHODS

The materials for the present investigation consisted of 40 diverse entries of single stemmed varieties of sesame chosen out of a large collection of sesame germplasm maintained at Regional Station of Agricultural Research, Sumerpur (Rajasthan). The trial was conducted in a randomized block

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design with 4 replications during kharif 1974. Each plot comprised of one row (10 m in length and 30 cm apart). Five competitive plants from each plot were selected and observations were recorded on days to flowering, plant height (cm), height at first capsule (cm), fruiting length (cm), capsules per plant, 100-seed weight (mg), days to maturity and seed yield (g/plant). Mean values were statistically analyzed. Genetic coefficient of variation was calculated according to Burton (1951), heritability in broad sense (in percentage) according to Johnson *et al.* (1955a) and genetic advance according to Lush (1949). Correlation coeffcients both at genotypic and phenotypic level were computed according to Johnson *et al.* (1955b) whereas path coefficient analysis was done according to the method given by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among the varieties for all 11 characters studied. It was observed that wide range of variability existed for various characters studied except capsule length and capsule girth, as evidenced by ranges (Table 1). The highest genotypic coefficient of variability (GCV) was observed for seed yield (27.78 %) followed by capsules per plant (25.61 %), height at first capsule (20.94 %), 100-seed weight (14.68 %) and fruiting length (14.52 %). These characters also revealed high phenotypic coefficient of variation, heritability and high genetic advance expressed as percentage of mean (Table 1). High heritability with high genetic advance as percentage of mean shows the most effective condition for selection and was observed for plant height, height at first capsule, fruiting-length, capsules per plant, 100-seed weight and seed yield. This condition appears due to additive gene action. There are also few characters which showed high heritability but low genetic advance resulting due to non-additive gene action (Liang and Walter, 1968). Debral and Molkar (1971) reported high heritability for capsules per plant, yield per plant and 1000-seed weight. Sanjeevaiah and Joshi (1974) also reported little effect of environment on plant height and number of capsules. Murugesan *et al.* (1979)

TABLE 1

Genetic parameters of 11 characters in single stemmed sesame.

Character	*Range*	*Mean*	*G.C.V.*	*P.C.V.*	h^2	*G.A. as % of mean*
Days to flowering	44.7-58.2	52.9	5.74	7.64	56.4	8.89
Plant height (cm)	73.5-146.7	107.3	10.97	14.44	57.7	17.18
Height at first capsule (cm)	33.2-85.2	55.7	17.86	20.94	72.7	31.27
Fruiting length (cm)	31.8-71.2	45.9	14.52	19.59	55.0	22.68
Capsules/plant	17.1-39.3	27.1	18.08	25.61	49.8	26.30
Capsule length (cm)	2.51-2.84	2.68	2.20	4.46	24.2	2.23
Capsule girth (cm)	2.62-3.02	2.76	2.37	5.30	20.0	2.39
Seeds/capsule	62.6-76.9	71.3	3.80	5.83	42.5	5.11
100 seed weight (mg)	233.3-420.0	309.6	14.68	15.00	95.8	29.61
Days to maturity	85.4-103.3	95.7	4.82	6.04	63.8	7.93
Seed yield/plant(g)	1.574-5.148	3.40	23.17	29.78	60.6	37.17

observed high heritability followed by high genetic advance for plant height, height at first capsule, capsule per plant, 1000-seed weight and grain yield which are in conformity to the results obtained under the present investigation.

The results on correlation analysis indicated that the genotypic and phenotypic correlations followed the same trend and in general the genotypic correlations were higher than phenotypic correlations (Table 2). The seed yield was strongly and positively correlated with plant height, fruiting length and capsule per plant both at genotypic and phenotypic levels. Such correlations and high heritability coupled with high genetic advance as expressed in percentage of mean revealed that selection for higher plant height, fruiting length, capsules per plant and also 100-seed weight may result in higher yielding strains in single stemmed varieties of sesame (Table 2). It was further observed that days to flowering with height at first capsule and days to maturity; plant height with height at first capsule and fruiting length; height at first capsule with days to maturity; fruiting length with capsule per plant; capsule length with capsule girth; and capsule girth with seeds per capsule showed strong positive correlations both at genotypic and phenotypic levels, which are in conformity to those of Sanjeevaiah and Joshi (1974) and Shukla and Verma (1976).

The path coefficient analysis was carried out to estimate the direct and indirect effects of various components on seed yield to recommend reliable

TABLE 2

Genotypic (upper diagonal) and phenotypic (lower diagonal) correlation coefficients between different pairs of 11 characters in single stemmed sesame.

Characters	*Days to flowering*	*Plant height*	*Height at 1st capsule*	*Fruiting length*	*Capsules/plant*	*Capsule length*	*Capsule girth*	*Seeds/capsule*	*100-seed weight*	*Days to maturity*	*Seed yield plant*
Days to flowering		0.811	0.862	–0.169	0.008	0.058	0.040	0.024	0.023	0.818	–0.017
Plant height	0.305		0.926	0.315	0.133	0.278	–0.045	–0.076	0.171	0.537	0.435
Height at first capsule	0.447**	0.749**		–0.011	–0.046	0.271	–0.023	0.122	0.748	0.632	0.178
Fruiting length	–0.222	0.391*	–0.036		0.488	0.005	–0.124	–0.222	0.065	–0.394	0.574
Capsules/plant	–0.123	0.256	0.041	0.416**		–0.032	–0.220	–0.447	–0.391	–0.318	0.664
Capsule length	–0.003	0.132	0.097	0.125	–0.060		0.647	0.077	–0.036	0.062	0.063
Capsule girth	0.011	0.052	–0.040	0.092	–0.089	0.626**		0.330	0.282	0.068	0.121
Seeds/capsule	0.068	–0.046	–0.010	–0.060	–0.263	0.303	0.346*		0.062	0.255	–0.134
100-seed weight	0.014	0.137	0.070	0.051	–0.192	–0.027	0.113	0.045		0.211	0.278
Days to maturity	0.660**	0.288	0.369*	–0.248	–0.216	0.015	0.049	0.155	0.160		–0.210
Seed yield/plant	–0.016	0.371*	0.178	0.400*	0.579**	–0.054	–0.025	–0.169	0.238	–0.136	

* and ** significant at 5% and 1% levels of significance, respectively.

selection indices (Table 3). Days to flowering had the highest direct positive effect followed by plant height, capsule length, seeds per capsule and 100-seed weight. The direct effect of capsules per plant was low (0.330) though it was positively correlated with seed yield. The direct effect of height at first capsule, fruiting length, capsule girth and days to maturity were observed to be negative. It was interesting to note that days to flowering which had the highest direct effect was negatively correlated, with seed yield. On the contrary, fruiting length which was strongly correlated with seed yield revealed negative direct effect. The results further revealed that height at first capsule and days to maturity influenced seed yield through their indirect effects via days to flower, and plant height; fruiting length via plant height and days to maturity; and number of capsules via days to maturity.

In general, the plant height, fruiting length and number of capsules per plant had positive associations with seed yield per plant. Path coefficient analysis revealed days to flowering, plant height, capsule length, seeds per capsule and 100-seed weight as important yield contributing characters in single stemmed genotypes of sesame. Characters like height at first capsule and fruiting length having high heritability also contributed to seed yield indirectly and should be taken into consideration.

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TABLE 3

Path coefficient analysis showing direct and indirect effects of 10 yield components on seed yield in single stemmed sesame.

Character	*Effects via*										
	Days to flowering	*Plant height*	*Height at 1st capsule*	*Fruiting length*	*Capsules/ plant*	*Capsule length*	*Capsule girth*	*Seeds/ capsule*	*100 seed weight*	*Days to maturity*	*'rg' seed yield*
Days to flowering	**5.144**	3.256	–5.793	0.245	0.002	0.131	–0.102	0.054	0.037	–2.990	–0.017
Plant height	4.172	**4.014**	–6.227	–0.456	0.044	0.630	0.115	–0.158	0.276	–1.965	0.435
Height at 1st capsule	4.432	3.717	**–6.724**	–0.017	–0.015	0.615	0.058	0.270	0.121	–2.311	0.178
Fruiting length	–0.870	1.266	0.077	**–1.446**	0.161	0.011	0.319	–0.488	0.105	1.440	0.574
Capsules/plant	0.041	0.533	0.311	–0.706	**0.330**	–0.073	0.563	–0.984	–0.515	1.164	0.664
Capsule length	0.297	1.116	–0.825	–0.007	–0.011	**2.266**	–1.658	0.169	–0.576	–0.226	0.063
Capsule girth	0.204	–0.179	0.152	0.180	–0.073	1.466	**–2.563**	0.726	0.455	–0.248	0.121
Seeds/capsule	0.126	–0.306	–0.823	0.320	–0.148	0.174	–0.846	**2.201**	0.099	–0.931	–0.134
100-seed weight	0.119	0.687	**–0.503**	–0.094	–0.105	–0.081	–0.723	0.136	**1.615**	–0.773	0.278
Days to maturity	4.207	2.158	–4.250	0.570	–1.052	0.140	–0.174	0.561	0.341	**–3.656**	–0.210

Residual effect = 0.393

The underlined figures denote the direct effects.

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