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Correlation and Path-coefficient Analysis in Sesame (*Sesamum indicum* L.) Oil Content vs. Other Seed Characters

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ABSTRACT

Correlation and path-coefficient analysis was made on 40 varieties of sesame (*Sesamum indicum* L.) for 6 seed characters. Analysis of variance revealed highly significant differences among varieties for all characters. Oil percentage was positively and significantly correlated with seed length, seed thickness and 100 seed weight. Seed thickness was highly and positively correlated with seed length and seed width, seed length with seed width and 100 seed weight with seed thickness. Significant correlation did not exist between protein and rest of the characters. Non-significant negative correlation was found between protein and oil. Path-coefficient analysis revealed that the oil content was the resultant of direct effects of seed length and seed thickness 100, seed weight of the direct effect of seed thickness. Seed thickness and seed length were important for the improvement of oil in sesame.

INTRODUCTION

Studies on the quantity and quality of sesame oil have been conducted by various workers. Dhawan *et al.* (1972) studied 37 indigenous varieties and Yermanos *et al.* (1972) 712 varieties from a world wide sesame collection. The results of correlation coefficients for 6 seed characters and path-coefficient analysis for oil and 100-seed weight are presented.

MATERIALS AND METHODS

Twenty indigenous and 20 exotic varieties of sesame were grown under randomized block design with 4 replications during *Kharif* 1971 at the Regional Station of Agricultural Research, Vallabhnagar, Rajasthan. Each variety in a replication had one row 10 m in length and 30 cm apart. Five plants were selected at random and their seed was bulked to record observations on 6 seed characters, *viz.* length, width, thickness of seed, 100-seed weight, protein and oil content. Length, width and thickness of 25 seeds per replication selected at rondom were determined using a screw gauge; oil content was estimated by extracting in a soxhlet apparatus and the total nitrogen was determined by Kjeldahl method. The value obtained was multiplied by 6.25 to obtain the total crude protein. Analysis of variance for each character was done as suggested by Panse and Sukhatme (1967) and correlations by Fisher (1954) and Al-Jibouri *et al.* (1958). The path-coefficient analysis was done as suggested by Wright

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(1921) and later applied by Dewey and Lu (1959) to partition the genotypic correlation coefficients into measures of direct and indirect effects.

RESULTS AND DISCUSSION

Seed length ranged from 2.03–3.34 mm, width 1.30–2.06 mm, thickness 0.61–0.86 mm, 100-seed weight 170–370 mg, protein 22.8–31.5 per cent and oil 39.5–52.8 per cent (Table 1). Highly significant differences were observed among varieties for the characters studied.

Genotypic correlations were higher than the corresponding phenotypic correlations for all combinations except

TABLE 1. Range, mean, standard error of mean and critical difference at 5 and 1 per cent level in 40 varieties of sesame

Character	Range	Mean	SEm	CD 5%	CD 1%
Seed length (mm)	2.03–3.34	2.95	±0.0512	0.14	0.19
Seed width (mm)	1.30–2.06	1.72	±0.0408	0.11	0.15
Seed thickness (mm)	0.61–0.86	0.7321	±0.0203	0.0569	0.0753
100-seed weight (mg)	170–370	272.73	±7.69	21.53	28.49
Protein (per cent)	22.8–31.5	26.90	±0.2577	0.71	0.94
Oil (per cent)	39.5–52.8	46.49	±0.1408	0.39	0.52

seed length and seed width, 100-seed weight and protein content and 100 seed weight and oil content. This indicates a strong inherent association between various characters studied. Oil percentage was positively and significantly correlated with seed length, seed thickness and 100-seed weight. Oil percentage was negatively correlated with protein content but it was statistically not significant. The protein content did not show any significant correlation with other characters. The 100-seed weight was positively correlated with seed thickness. The seed thickness was highly and positively correlated with seed length and seed width, seed width with seed length (Table 2).

At genotypic level, high and positive correlations were observed between the seed width and seed length, seed thickness with seed length and width, 100-seed weight with seed length, width and thickness, oil percentage with seed length and thickness. Oil content was positively correlated with seed width and 100-seed weight.

The path coefficient analysis revealed that the oil content was resultant of two seed characters *viz.* seed length and seed thickness. The direct effect of seed length on oil content was positive, whereas its indirect effect though 100-seed weight was negative. The seed thickness

TABLE 2. Estimates of phenotypic, genotypic and environmental correlation coefficients between different pairs of charactes in sesame

Character		Seed Width	Seed thickness	100-seed weight	Protein (%)	Oil (%)
Seed lengh	P	0.5215**	0.4602**	0.2035	0.1404	—0.3109*
	G	0.5036	0 6653	0.4015	0.2063	0.4867
	E	0.5435	0.3269	0.0797	—0.0610	0.1308
Seed width	P		0.4739**	0.2545	0.1953	0.2055
	G		0.7143	0.4175	0.2658	0.3068
	E		0.3203	—0.0522	0.0554	0.2368
Seed thickness	P			0.3577*	0.0453	0.3096*
	G			0.6550	0.0800	0.5509
	E			0.0703	0.0066	—0.0043
100-seed weight	P				0.0223	0.3758*
	G				0.0135	0.3272
	E				0.1001	0.6404
Protein (per cent)	P					—0.1758
	G					—0.1818
	E					0.0005

*, ** Significant at 5 at 1% levels of significance respectively

gave the highest positive direct effect (+0.4407) on oil content, whereas its indirect effect through seed length was low and through 100-seed weight was negative. The 100-seed weight has negative direct effect but it was low, its indirect effect through seed length was positive but low and the indirect effect through seed thickness was medium (Table 3). Therefore, oil content was found more reliant for seed thickness and seed length. Path-

TABLE 3. Path-coefficient analysis showing direct and indirect effects of three seed characters on oil

Character	Effects via			Genotypic correlation with oil content.
	Seed length	Seed thickness	100-seed weight	
Seed length	+0.2123	+0.2931	—0.0187	+0.4867
Seed thickness	+0.1412	+0.4407	—0.0305	+0.5509
100-seed weight	+0.0852	+0.2887	—0.0467	+0.3272

Underlined figures denote the direct effects. Residual effect = 0.8179 coefficient analysis for 100-seed weight revealed that the seed thickness has high positive direct effect (+0.7637). The indirect effect of seed thickness through seed length and seed width was negative and low. The direct effect of seed length and seed width on 100-seed weight was negative (Table 4) whereas indirect effect of seed length and seed width through thickness gave high positive effects (+0.5080 and +0.5455 respectively). Thus it was concluded that though seed length, width and thickness are highly correlated with oil percentage, seed length and thickness are more important as revealed by path-coefficient analysis. For 100-seed weight seed thickness should be given more weightage.

TABLE 4. Path-coefficient analysis showing direct and indirect effects of three seed characters on 100-seed weight

Character	Effects via			Genotypic correlation with 100-seed weight
	Seed length	Seed width	Seed thickness	
Seed length	<u>−0.0564</u>	−0.0501	+0.5080	+0.4015
Seed width	−0.0284	<u>−0.0996</u>	+0.5455	+0.4175
Seed thickness	−0.0375	−0.0711	<u>+0.7637</u>	+0.6550

Underlined figures denote the direct effects. Residual effect = 0.7119

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TABLE 3. Effect of treatments on shoot and root length - expressed in mm

T No.	Treatments	I 8		II 15		III 22		IV Stages 30 days	
		Shoot length	Root length	Shoot length	Root length	Shoot length	Root length	Shoot length	Root length
C	Control	92.4	133.2	168.4	141.2	213.6	142.3	238.6	154.4
T_1	Hardening	103.5	140.6	190.3	158.4	234.8	170.5	269.3	214.2
T_2	CCC - 5 ppm	112.7	162.4	190.8	173.8	243.8	197.6	260.2	251.5
T_3	Ethrel - 5 ppm	97.1	145.9	172.6	164.4	232.4	174.3	255.1	226.8
T_4	Kinetin - 5 ppm	125.1	158.2	198.1	172.5	245.9	190.6	263.6	247.3
T_5	Resistine - 10 ppm	95.1	157.2	170.1	165.3	219.0	185.3	246.1	243.1

second stages, kinetin and CCC were effective while hardening was the next best. At the third and fourth stages kinetin was better than CCC. Root length was also increased by pre-treatments although hardening had the minimum influence among the treatments. At all stages CCC and Kinetin were more effective than the other treatments.

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