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Correlation and Path Analysis for Yield and Yield Traits in Sesame (*Sesamum indicum* L.) Genotypes

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ABSTRACT

Correlation analysis is used to understand the relationships existing between yield and yield components. Path coefficient analysis has been suggested to separate correlation coefficient into direct and indirect effects. In sesame, path analysis has used to identify traits that have significant effects on seed yield. In the present experiment, Thirteen sesame genotypes were grown during Rabi Summer'2019 at Agricultural College and Research Institute, Kudumiyanmalai (Tamil Nadu Agricultural University) taken to assess genotypic, phenotypic correlation and direct and indirect effects of yield traits on yield. The biometrical and morphological traits such as days to fifty percent flowering, plant height, number of branches, number of capsules per plant, seeds per capsule, thousand seed weight, seed yield per plant and plot yield. The result showed significant differences among the accessions in most of the traits studied. This indicates that sufficient variability is present for most of the important characters among different genotypes. Correlation and path analysis revealed that the characters *viz*., number of seeds/capsule and plant height have positive direct effect along with significant positive correlation with seed yield whereas the character days to fifty flowering showed significant negative association with seed yield. Therefore, these characters can be considered as a criterion for improving seed yield in breeding programs of sesame.

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. 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. The crop is highly tolerant to drought, grows well in most of the well drained soils and various agro climatic regions, and is well adapted to different rotations. Sesame oil has highest antioxidant content and contains several fatty acids such as oleic acid (43%), linoleic acid (35%), palmitic acid (11%) and stearic acid (7%). It has high commercial attributes by virtue of it being a rich source of quality edible oil enriched with proteins, vitamins, amino acids and antioxidants like sesamin, sesamolin and sesamol (Brar and Ahuja, 1979). Yield is the resultant product of various morphological, physiological and biological components. To formulate an effective selection technique for increasing the yield, the association analysis among yield and yield contributing characters are important. The magnitude and direction of the association of yield components with yield will help us to programme our selection technique. Phenotypic and genotypic correlation coefficient and the yield components and their contribution in path analysis provide information on their relative importance in determining the yield (Dewey and Lu, 1959). With this background, the present investigation is contemplated with the following objectives 1)To assess the genotypic and phenotypic correlation in the sesame genotypes.

2) To separate the yield traits into direct and indirect effects of traits for selection in sesame.

Materials and Methods

The experimental materials for the present study involves thirteen sesame genotypes were selected including eleven advance sesame culture of Tamil Nadu Agricultural University and two checks varieties TMV 7 and SVPR 1 (Table 1). The experiment was conducted in Agricultural College and Research Institute (Tamil Nadu Agricultural University), Kudumiyanmalai, Pudukkottai District of Tamil Nadu, India during Rabi Summer' 2019. The field experiment was conducted in a randomized block design with two replications. The eleven sesame genotypes and two local checks varieties were raised in a plot size of 4 m x 0.3 m x 4 rows (4.8 m^2). Seeds were sown on 29.01.2019 in ridges and furrows with a plant spacing of 30 x 30 cm. All agronomical practices like thinning, weeding was carried out at right time and irrigation was given at suitable interval. Five plants were randomly selected and biometrical observations were recorded on eight quantitative characters *viz.*, days to fifty per cent flowering, plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, thousand seed weight(gm), seed yield per plant (g) and plot yield (g). Observations on each character's contributed to the genotypic correlation and path analysis of the sesame genotypes were calculated using mean for advanced cultures of sesame genotypes.

Statistical analysis

Genotypic and phenotypic correlation coefficients were calculated according to the formula suggested by Goulden (1952). Path coefficients were estimated by following (Dewey and Lu, 1959). The estimates of correlation coefficient and path coefficient analysis were calculated by analyzing data using INDOSTAT statistical package.

Results and Discussion

The analysis of variance revealed significant difference among the genotypes for all traits *viz.*, days to fifty per cent flowering, plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, thousand seed weight (gm), seed yield per plant (g) and plot yield (g) (Table 2) indicating the presence of sufficient variability among the evaluated genotype for the traits under consideration. This indicates that sufficient variability is present for most of the important characters among different genotypes. Similar results have been reported by Shekhawat *et al.,* (2013) for days to flowering, plant height, capsules/plant, seed yield/plant; Sabiel *et al.,* (2015) for plant height, flowering time and days to maturity; Atul Singh *et al.,* (2018) for days to fifty flowering, Plant height, number of seeds per capsule.

Genotypic and Phenotypic correlation coefficient was estimated in all character combinations with the objective to get information about the nature, extent and direction of selection pressure to achieve practical and usable results. In general, genotypic correlation coefficients were higher in magnitude than the phenotypic correlation coefficient. This indicated that although there is strong inherent association between the various pairs of characters studied the low phenotypic correlation would result from the masking and modifying effects of environment on the association of characters at gene level. Shekhawat *et al.,* (2013) also reported that genotypic correlation coefficients were higher than the respective phenotypic correlation coefficients for all the characters.

The present study revealed that seed yield per plant showed positive significant correlation with number of seeds per capsule followed by plant height and significant negative correlation with days to fifty per cent flowering at both genotypic and phenotypic level (Table 3) which indicates that these characters are reliable yield components. Similar results were reported by Fazal *et al.,* (2015), Bharathi *et al.,* (2015), Abate and Mekbib (2015) for number of seeds/capsule. Inter correlation among the traits showed that days to fifty flowering was negatively significant correlation with plant height and significant positive correlation with number of branches per plant. Significant positive correlation was observed between plant height and number of capsules per plant. Hence, seed yield can be increased to a substantial level through direct selection of plant height. Thus, indirect selection in favor of this trait can improve seed yield in sesame. The association analysis revealed that days to fifty flowering, plant height and number of seeds/ capsules were the important characters and may be selected to increase the seed yield. Present findings also revealed that by making selection for a particular character, simultaneous improvement in the associated character may be achieved.

Table.1 List of sesame genotypes used in the experiment

Sl. No.	Sesame Genotypes	Sl.No.	Sesame Genotypes
1	COS – 13006	8	**COS – 14026(b)**
2	COS -13015	9	**COS – 14026(w)**
3	COS – 14001	10	**COS -16007**
4	COS -14017(dw)	11	**COS -16009**
5	COS -14017 (w)		**Check Varieties**
6	COS -14018	12	**TMV 7(b)**
7	COS -14025	13	**SVPR 1(w)**
(w) - white; (dw) - dull white ; (b) Brown			

Table.2 Analysis of variance for yield and yield related traits in sesame genotypes

Sl. No.	Source of variation	df	Days to Fifty percent flowering	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	1000 Seed Weight (g)	Plot yield (g)	Seed yield per plant (g)
1	Replications	1	0.038	0.47	0.154	20.34	0.323	0.0015	172.65	0.32
2	Treatments	12	6.747**	516.25**	9.096**	2813.59**	127.99**	0.2451**	4643.1**	30.65**
3	Error	12	0.455	3.74	0.570	50.02	0.414	0.0065	131.48	0.14
4	SEm ±	-	0.458	1.31	0.513	4.80	0.437	0.0549	7.79	0.25
5	CD at 5%	-	0.998	2.86	1.118	10.46	0.952	0.1197	16.97	0.55
6	CD at 1%	-	1.400	4.01	1.567	14.67	1.335	0.1678	23.79	0.78

df –degrees of freedom *Significant at 5% **Significant at 1%

Table.3 Genotypic and phenotypic correlation analysis for yield and yield related traits in sesame genotypes

Character		Days to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	1000 Seed Weight (g)	Plot yield (g)	Seed yield per plant (g)
Days to fifty per cent flowering	**G**	**1.000**	-0.5719*	0.5615*	-0.2769	-0.2197	0.1079	-0.3564	-0.5318*
	P	**1.0000**	-0.5301*	0.5112*	-0.2183	-0.2068	0.1220	-0.2802	-0.4763*
Plant height	**G**	-0.5719	**1.0000**	-0.0019	0.5299 *	-0.0522	0.3105	0.3788	0.5682*
	P		**1.0000**	0.0008	0.5129*	-0.0493	0.3060	0.3631	0.5655*
Number of branches per plant	**G**			**1.0000**	0.0067	-0.5078*	0.3623	-0.0947	-0.4315
	P			**1.0000**	0.0061	-0.4790*	0.3510	-0.0559	-0.4041
Number of capsules per plant	**G**				**1.0000**	0.2088	0.3286	-0.0122	0.2626
	P				**1.0000**	0.1947	0.3246	-0.0029	0.2603
Number of seeds per capsule	**G**					**1.0000**	-0.3920	-0.0287	0.5953*
	P					**1.0000**	-0.3866	-0.0310	0.5924*
Thousand seed weight	**G**						**1.0000**	0.1522	0.1352
	P						**1.0000**	0.1637	0.1383
Plot yield (g)	**G**							**1.000**	0.3948
	P							**1.0000**	0.3773

Significant label at 0.05 01 ; If correlation r = 0.476 0.634

Table.4 Genotypic and phenotypic path coefficient analysis of yield and yield related traits in sesame genotypes

Character		Days to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	1000 Seed weight (g)	Plot yield (g)	Seed yield per plant (g)
Days to fifty per cent flowering	**G**	**-0.0341**	0.0195	-0.0192	0.0095	0.0075	-0.0037	0.0122	-0.5318*
	P	**0.0151**	-0.0080	0.0077	-0.0033	-0.0031	0.0018	-0.0042	-0.4763*
Plant height	**G**	-0.3601	**0.6297**	-0.0012	0.3337	0.0329	-0.1955	0.2385	0.5682*
	P	-0.3296	**0.6217**	0.0005	0.3189	-0.0306	0.1903	0.2258	0.5655*
Number of branches per plant	**G**	-0.0851	0.0003	**-0.1516**	-0.0010	0.0770	-0.0549	0.0144	-0.4315
	P	-0.0964	-0.0002	**-0.1886**	-0.0012	0.0882	-0.0662	0.0105	-0.4041
Number of capsules per plant	**G**	0.1058	-0.2025	-0.0025	**-0.3821**	-0.0798	-0.1256	0.0046	0.2626
	P	0.0720	-0.1692	-0.0020	**-0.3300**	-0.0642	-0.1071	0.0009	0.2603
Number of seeds per capsule	**G**	-0.1738	-0.0413	-0.4017	0.1652	**0.7911**	-0.3101	-0.0227	0.5953*
	P	-0.1569	-0.0374	-0.3549	0.1476	**0.7584**	-0.2932	-0.0235	0.5924*
Thousand seed weight	**G**	0.0454	0.1308	0.1526	0.1384	-0.1651	**0.4212**	0.0641	0.1352
	P	0.0483	0.1211	0.1389	0.1285	-0.1530	**0.3959**	0.0648	0.1383
Plot yield (g)	**G**	-0.0299	0.0317	-0.0079	-0.0010	-0.0024	0.0127	**0.0838**	0.3948
	P	-0.0289	0.0374	-0.0058	-0.0003	-0.0032	0.0169	**0.1030**	0.3773

G - Genotypic path R Square = 0.9020 Residual Effect = 0.3131 P - Phenotypic path R Square = 0.8776 Residual Effect = 0.3498

Note: Diagonal bold figure are the direct effects and the off diagonal are indirect effects.

Path coefficient analysis was carried out using genotypic and phenotypic correlation coefficients and revealed that substantial positive direct effect on seed yield was exerted by number of seeds/ capsule and plant height followed by thousand seed weight at genotypic and phenotypic path matrix (Table 4). These traits are therefore considered as the principal traits while selecting for seed yield. Selection indices may be formed by considering all these characters for improvement of seed yield. Similar results have been reported by Shekhawat *et al.,* (2013) for plant height; Fazal *et al.,* (2015) and Bharathi *et al.,* (2015) for number of seeds/capsule; Mustafa *et al.,* (2015). Negative direct effect was exhibited by days to fifty flowering at genotypic level.

Similar result was reported by Saxena and Bisen (2016). The highest positive indirect effect via number of capsules per plant at both phenotypic and genotypic level was expressed by plant height followed by thousand seed weight phenotypic level and genotypic level.

Similar results had been observed by Abate *et al.,* (2015) for high indirect effect of biomass/plant via thousand seed weight. Thus, on the basis of above study the characters *viz*., number of seeds per capsule and plant height have positive direct association along with significant positive correlation with seed yield and significant negative correlation of days to fifty flowering with seed yield. Therefore, these characters can be considered as a criterion for improving seed yield in breeding programs of sesame. These traits especially number of seeds per capsules may be used as selection criteria in future breeding programs for the development of high seed yield sesame varieties/hybrids.

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