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Research Article

GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS STUDIES FOR YIELD AND YIELD COMPONENT TRAITS IN SESAMUM (*Sesamum indicum* L.)

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Abstract- Twenty six advanced varietal lines of sesame genotypes were grown during kharif 2015-16 at the Project Coordinating Unit Sesame and Niger, JNKVV, Jabalpur for the estimation of phenotypic and genotypic variances, heritability, genetic advances, correlation and path coefficient analysis for seed yield and yield related traits. High values for phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was recorded for seed yield per plant (g) followed by number of capsules per plant and hence improvement through selection could be possible. High heritability and genetic advance as per cent of mean were recorded for seed yield per plant followed by number of capsules per plant indicating that selection could be effective for improvement of these characters. Phenotypic and genotypic correlation analysis revealed strong positive association of seed yield per plant with number of secondary branches per plant and number of capsules per plant. Path coefficient analysis revealed high positive direct effect of number of secondary branches and number of capsules per plant on seed yield per plant. Hence number of secondary branches and number of capsules per plant may be good selection criteria for seed yield per plant.

Keywords- Sesame, Variability, Correlation, Path Coefficient Analysis, Yields components.

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Introduction

Sesame (*Sesamum indicum* L.) is one of the important oilseed crops. It is described as the "Queen of oil crops" because of its high oil content (38-54%). Although sesame is widely used for different purposes, the productivity has been miserably low compared to other oilseed crops. Sesame growing area is shrinking due to several reasons [1]. Ironically, the demand for sesame seed is increasing year after year. Selection for high yielding types with wider adaptability shall be not only very useful but shall help in increasing the production both locally and globally [2].

The determination of genetic variability and its partitioning into various components is essential for understanding the genetic nature of yield and its components. Yield is a complex quantitative character controlled by many genes interacting with the environment and is the product of many factors called yield components. Selection of parents based on yield alone is often misleading. Hence, the knowledge about relationship between yield and its contributing characters is needed for an efficient selection strategy for the plant breeders to evolve an economic variety.

The progress in breeding for yield and its contributing characters of any crop is polygenically controlled, environmentally influenced and determined by the magnitude and nature of their genetic variability. It is very difficult to judge whether observed variability is highly heritable or not. Moreover, knowledge of heritability is essential for selection based improvement, as it indicates the extent of transmissibility of a character into future generations. Genetic improvement of seed yield, alone, is not possible through phenotypic selection because of polygenic nature and low heritability. Hence, resorting to selection through correlated response entailing several contributing factors, which influence seed production both directly and indirectly shall be most appropriate [3].

Correlation between different characters is an important aspect required for better planning of selection programme. Pleiotropy and linkage are the major causes for the basic association of two traits. But it is not easy to determine the contribution of these causes to the association. Although the estimates of correlation coefficient are helpful in determining the components of complex traits such as yield they do not provide an exact picture of the relative importance of direct and indirect influence of each of them. But the techniques of path analysis appears to be helpful in elucidating pattern of association through direct and indirect effect. The understanding of the relationship between yield and its components is crucial for selection process and this relationship can be explained by means of correlation and path coefficient analyses. Keeping in view on significance of varietal improvement in sesame, the objective of the study is to determine the genetic variability, correlation and path analysis for yield components towards seed yield in sesame.

Material and Methods

Experimental material for the present study consisted of twenty six advanced varietal lines of sesame genotypes grown during kharif 2015-16 at the Project Coordinating Unit Sesame and Niger, Department of Plant Breeding and Genetics, in a randomized block design with three replications. Each plot consisted of three rows of 4m length spaced at 45 cm between rows and 30 cm between plants. Normal recommended cultural practices and plant protection measures were followed. Three competitive plants were randomly selected for recording biometrical observations on days to flower initiation, days to 50% flowering, days to maturity, plant height, number of primary branches, number of secondary branches, number of capsules per plant, capsule length, number of seeds per plant, 1000 seed weight, oil content, harvest index and seed yield per plant. The

data were subjected to statistical analysis.

Statistical analysis:
Mean values of the characters for each genotype per replication were used for analysis of variance and covariance as per [4]. Heritability estimates were calculated according to [5] and genetic advance according to [6]. Genotypic and phenotypic correlation coefficients were calculated according to the formula suggested by [4,6]. Path coefficients were estimated by following [7]. The estimates of correlation coefficient and path coefficient analysis were calculated by analyzing data using INDOSTAT statistical package.

Result and Discussions
Coefficient of variation truly provides a relative measure of variance among the different traits. Estimates of genetic parameters [Table-1] indicated that phenotypic coefficient of variation (PCV) was found to be highest for seed yield per plant followed by number of capsules per plant and number of secondary branches. Similar trend were observed for GCV (genotypic coefficient of variation). Close relationship between PCV and GCV was found in all the characters and PCV values were slightly greater than GCV, revealing very little influence of environment for their expression. Heritability plays a vital role in deciding the suitability and strategy for selection of a particular character. The traits under study exhibited high broad sense heritability (15.7% to 97.50%), and it was coupled with high genetic advance (index for selection criteria) for number of capsules per plant (31.71%), followed plant height (31.1%), and yield per hectare (53.51%) while other traits exhibited low genetic gain. Heritable variation is useful for permanent genetic improvement. The high values of genetic advance are indicative of additive gene action whereas low values are indicative of non-additive gene action [8].

Table-1 *Estimates of variability parameters for quantitative traits in twenty six advanced varietal lines of sesame genotypes*

Characters	Mean	$\sigma^2 e$	$\sigma^2 g$	$\sigma^2 p$	h^2(bs.) %	G.C.V(%)	P.C.V.(%)	G.A.	G.A. as % mean
Days to flower initiation	32.923	1.854	9.456	11.31	83.6	9.34	10.215	5.792	17.593
Days to 50 per cent flowering	38.128	0.911	10.204	11.115	91.8	8.378	8.744	6.305	16.536
Days to maturity	81.231	3.18	6.458	9.638	67.0	3.128	3.822	4.285	5.275
Plant height (cm)	143.42	22.078	248.23	270.31	91.8	10.985	11.463	31.102	21.686
Number of primary branches	3.564	0.47	0.179	0.649	27.6	11.87	22.607	0.458	12.838
Number of secondary branches	2.449	0.941	0.175	1.115	15.7	17.077	22.129	0.341	13.93
Number of capsules per plant	72.282	9.175	245.88	255.06	96.6	21.694	23.095	31.716	43.878
Capsule length (cm)	2.694	0.057	0.081	0.138	58.7	10.577	13.801	0.45	16.7
Number of seeds per capsule	52.679	6.854	27.613	34.467	80.1	9.975	11.145	9.689	18.392
1000 seed weight (g)	3.265	0.058	0.043	0.101	42.9	6.383	9.744	0.281	8.614
Oil content (%)	47.338	1.394	0.548	1.942	28.2	1.564	2.944	0.81	1.711
Harvest index (%)	23.619	0.164	4.657	4.821	96.4	9.137	9.296	4.369	18.499
Seed yield per plant (g)	14.563	0.291	11.276	11.567	97.5	23.058	23.354	6.83	46.898

Table-2 *Phenotypic (P) and Genotypic (G) correlation coefficients between seed yield and different traits in sesame genotypes*

Characters	Days to flower initiation	Days to 50 per cent flowering	Days to maturity	Plant height (cm)	Number of primary branches	Number of secondary branches	Number of capsules per plant	Capsule length (cm)	Number of seeds per capsule	1000 seed weight (g)	Oil content (%)	Harvest index (%)	Seed yield
Days to flower initiation	**1.000**	0.971	0.638 **	0.162	-0.036	0.3653**	0.571	-0.009	-0.064	-0.008	-0.023	0.536	0.459
Days to 50 per cent flowering	0.970**	**1.000**	0.635**	0.149	0.007	0.3589**	0.574**	0.001	-0.054	-0.032	-0.029	0.524	0.493
Days to maturity	0.638**	0.635***	**1.000**	0.192	0.020	0.2337*	0.442**	0.075	-0.051	-0.068	-0.006	0.426	0.319
Plant height (cm)	0.162	0.149	0.192	**1.000**	-0.098	-0.151	-0.072	-0.2943	-0.214	-0.126	-0.078	-0.149	-0.095
Number of primary branches	-0.036	0.007	0.020	-0.098	**1.000**	-0.201	0.234*	0.626**	0.638	0.458 **	0.075	0.218	0.322
Number of secondary branches	0.365**	0.359	0.233 *	-0.151	-0.201	**1.000**	0.499**	0.112	-0.008	-0.014	0.155	0.523	0.403
Number of capsules per plant	0.571**	0.574	0.442**	0.072	0.2344*	0.500	**1.000**	0.335**	0.226*	0.168	0.311**	0.945	0.913
Capsule length(cm)	-0.009	0.001	0.075	-0.2943 **	0.6263**	0.112	0.335**	**1.000**	0.803	0.442 **	0.228*	0.380	0.407
Number of seeds per capsule	-0.064	-0.054	-0.051	-0.214	0.6381**	0.0079	0.226*	0.8031**	**1.000**	0.621**	0.161	0.292	0.278
1000 seed weight (g)	-0.008	-0.032	-0.068	-0.126	0.4587**	0.0142	0.168	0.442**	0.621***	**1.000**	0.076	0.139	0.191
Oil content (%)	-0.023	-0.029	-0.006	-0.078	0.075	0.155	0.311**	0.228*	0.161	0.076	**1.000**	0.325	0.314
Harvest index (%)	0.535**	0.524	0.426 **	-0.149	0.218	0.523	0.944**	0.38**	0.291**	0.139	0.325**	**1.000**	0.800

A positive correlation was recorded between seed yield with all the characters except plant height. The magnitude of correlation with seed yield was highest in case of number of capsules per plant followed by harvest index [Table-2]. Similar results were reported by [9-15]. This clearly indicates that increased capsule number per plant will increase seed yield and hence while making selection for yield more emphasis should be given to this character.]16,17] reported similar results for number of seeds per capsules, while the characters *viz.*, days to 50% flowering, days to maturity, capsule length, exhibited positive non significant correlation.
Path coefficient analysis [Table-3] revealed that number of capsules per plant had maximum direct effect on seed yield per plant (1.00) followed by number of secondary branches (0.91) and number of primary branches (0.51). Negative direct effects were recorded for days to flower initiation, days to maturity, number of seeds per capsule and harvest index. Other character days to 50 per cent flowering had positive direct effect. Similar results have been reported by [18,19]. The indirect effect of number of capsules per plant via days to flower initiation, days to 50% flowering, days to maturity, number of secondary branches, oil content, harvest index on seed yield was high and positive, the indirect effect of number of capsules per plant via number of secondary branches shows highest value while it exerted a negative indirect effect via plant height. [16,18] also found similar observations.

Conclusion

In the present study, it could be concluded that seed yield per plant exhibited high positive correlation with number of capsules per plant followed by harvest index and high heritability, PCV, GCV, genetic advance and genetic advance as % mean were also recorded for number of capsules per plant this character which could be relied upon for selection. Selection of these genotypes on the basis of these yield attributes could certainly lead to genetic improvement in sesame especially for seed yield. However, the characters, days to 50% flowering, plant height, number of primary branches, number of secondary branches, number of capsules per plant, capsule length, 1000 seed weight and oil content should be given prime importance as they revealed a direct positive correlation coefficient and days to 50% flowering followed by number of capsules per plant shows high positive direct effect compared to other traits.

Table-3 *Direct (diagonal) and indirect effects of 12 characters on seed yield per plant at phenotypic level in sesame genotypes*

Characters	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	Correlation with seed yield
x1	**-2.787**	-0.9152	-0.7464	-0.2037	0.0352	-0.7587	-0.5816	0.0412	0.0668	0.0182	-0.0552	-0.5542	0.5052
x2	0.8988	**0.9053**	0.7323	0.1669	0.0294	0.7309	0.5559	0.0144	-0.0394	-0.0201	-0.0246	0.5072	0.524
x3	-0.1764	-0.0499	**-0.0616**	-0.015	0.0001	-0.0372	-0.0322	0.0034	0.0079	0.013	0.0047	-0.0311	0.3763
x4	0.0672	0.0561	0.0738	**0.3041**	-0.245	-0.1366	-0.026	-0.432	-0.0902	-0.0824	-0.0691	-0.0513	-0.1036
x5	-0.014	0.0118	-0.0006	-0.0989	**0.365**	0.146	0.1073	0.3023	0.3195	0.1338	0.1615	0.0991	0.5144
x6	0.1091	0.107	0.0801	-0.0595	0.053	**0.1325**	0.166	0.0384	-0.0047	-0.0214	0.0653	0.1733	1.0056
x7	0.4017	0.391	0.3329	-0.0544	0.1872	0.7975	**0.6366**	0.2024	0.1099	0.0449	0.3698	0.6032	0.9142
x8	-0.0258	0.0092	-0.032	-0.2641	0.4785	0.1673	0.1836	**0.5776**	0.4791	0.0987	0.2721	0.2277	0.4439
x9	0.0607	0.0365	0.108	0.2487	-0.734	0.0297	-0.1447	-2.3926	**-0.8385**	-0.456	-0.1873	-0.2153	0.2502
x10	-0.221	-0.0093	-0.0892	-0.1142	0.1545	-0.0679	0.0297	0.072	0.2291	**0.4213**	0.0133	0.0222	0.1511
x11	0.0048	-0.0022	-0.0062	-0.0184	0.0358	0.0399	0.047	0.0381	0.0181	0.0026	**0.0809**	0.0492	0.614
x12	-0.0174	-0.0162	-0.0146	0.0049	-0.0731	-0.0378	-0.0274	-0.0668	-0.0074	-0.0015	-0.0176	**-0.0289**	0.801

Where, X1- days to flower initiation, X2-days to 50% flowering, X3- days to maturity, X4- plant height, X5- number of primary branches, X6- number of secondary branches, X7- number of capsules per plant, X8- capsule length, X9- number of seeds per capsules, X10- 1000 seed weight, X11- oil content, X12- harvest index

Conflict of Interest: None declared

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