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Research Note

Correlation and path analysis for seed yield and its components in sesame (*Sesamum indicum* L.)

S. Sasipriya[1*], K. Paimala[2], K.B. Eswari[3] and M. Balram[4]
[1,3]Departmentof genetics and plant breeding, College of Agriculture, PJTSAU, Hyderabad-030, Telangana, India
[2]Scientist, Seed Research and Technology centre, PJTSAU, Hyderabad-030, Telangana, India
[4]Department of Molecular Biology and Biotechnology, College of Agriculture, PJTSAU, Hyderabad-030, Telangana, India
E-Mail:* priyaskumar9@gmail.com

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Abstract
Sesame is one of the oldest cultivated crops, "known as queen of oilseed crops". The field experiment was carried out to know the character association and also for determining the cause and effect situation through the assessment of direct and indirect effects of various yield contributing traits by using 45 sesame genotypes. Analysis of variance indicated the presence of good amount of genetic variability among the genotypes under study.Seed yield showed positive significantcorrelation with number of branches per plant, number of capsules per plant, capsule length, number of seeds per capsule and 1000-seed weight both at genotypic as well as phenotypic levels revealing that selection made on the basis of these characters will assist in enhancing the seed yield. The trait number of capsules per plant showed the highest phenotypic and genotypic correlation with seed yield followed by 1000- seed weight.Path coefficient analysis revealed that 1000-seed weight recorded the highest positive direct effect on seed yield followed by number of capsules per plant and number of seeds per capsules both at phenotypic and genotypic levels. Number of seeds per capsules, capsule length and plant height are the other traits which showed positive direct effect on seed yield. From the study it was concluded that, 1000-seed weight, number of capsules per plant and number of seeds per capsule were determined as most critical ones as both the correlation coefficients and the direct effects were high with seed yield per plant.

Key words
Sesame, correlation, path analysis, yield components

Sesame (*Sesamum indicum* L.) is one of the important and oldest cultivated oilseeds crop known to mankind. It is an important source of edible oil (50-60%) and protein (25%) with antioxidants lignans such as sesamolin, sesamin, considerable amount of calcium, tryptophan, methionine and many minerals (Johnson *et al.* 1979) and it is widely used as one of the ingredients in food products especially in bakery foods and animal feed.

Myanmar, India and China are the world's largest producers of sesame followed by Sudan, Uganda and Ethiopia. In India, Gujarat is the leading sesame producing state contributing 22.3% of total production, followed by West Bengal (19.2%), Karnataka (13.5%), Rajasthan (9.8%), Madhya Pradesh (9.06%), Tamil Nadu (4.7%), Andhra Pradesh (4.52%) and Maharashtra (4.52%).

Correlation coefficient analysis helps to understand the mutual relationship between various characters and can also be used to determine the component character which accounts for yield improvement. Correlation analysis combined with path coefficient analysis, which further permits the partitioning of correlation coefficient into components of direct effect and indirect effect of independent variable on dependent variable (Wright, 1921) will give more valid estimates compared to the previous one. Keeping in view of the above, the present study was undertaken to assess the interrelationship and contribution of yield related component traits in sesame.

A total of forty five sesame germplasm lines were evaluated during late *kharif*, 2017-18 in the farm at Seed Research and Technology Centre, Rajendranagar, Hyderabad.The experiment was laid out in Randomised Block Design with three replications. The genotypes were sown with a spacing of 30 × 10 cm by dibbling at a depth of 2-3cm and thinning was done at 15 days after sowing. Recommended package of practices were carried out to raise a healthy crop. Each entry was sown in two rows four meter length. Observations were recorded for eight quantitative traits *viz.*, plant height (cm), number of branches per plant, number of capsules per plant, number of seeds per capsule, capsule length (cm), 1000-seed weight (g) and seed yield per plant (g) for each entry from each replication by selecting five plants at random from the central rows leaving corner plants to take care of boarder effects. The trait days to 50% flowering was recorded on plot basis. To determine the degree of association of yield components with

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seed yield and also among themselves, correlation coefficients were calculated as suggested by Falconer (1981). Path coefficient analysis was carried out to understand the direct and indirect effects off the yield contributing characters as given by Wright (1921) and Dewey and Lu (1959).

Analysis of variance revealed the presence of highly significant differences among the genotypes for all the traits studied suggesting existence of high amount of genetic variability among the genotypes (Table 1).Sabiel *et al.* (2015) and Abhijatha *et al*. (2017) were also observed similar results.

The phenotypic and genotypic correlations among the yield and yield component characters in sesame are presented in Table 2. The resultsrevealed that seed yield showed highest significant positive correlation with the trait number of capsules per plant(0.7765**/ 0.9434),followed by 1000-seed weight (0.7525**/ 0.8350**), number of seeds per capsule (0.7016**/ 0.8081**), number of branches per plant (0.3747**/ 0.4409**) and capsule length (0.2946**/ 0.3710**) at both phenotypic as well as genotypic levels indicating that selection made on the basis of these characters will assist in enhancing the seed yield. The trait plant height showed positive and significant correlation with seed yield at genotypic level only. Similar reports were also observed in the studies of Baraki *et al*. (2015), Abhijatha *et al*. (2017) and Agrawal *et al*. (2017) in their studies.

Positive significant correlationsof number of capsules per plant were observed with capsule length, number of seeds per capsule, 1000-seed weight and seed yield per plant at both phenotypic and genotypic levels. Positive significant association of the trait with seed yield per plant indicated that,number of capsules per plant would accommodate more number of seeds per capsule leading to an increase in the seed yield per plant.

These results are in agreement with the findings of Gangadhara *et al*. (2012) and Shekhawat *et al*. (2013) for capsule length, Shekhawat *et al.* (2013), Bharathi *et al.* (2015) and Kanak *et al*. (2016) for number of seeds per capsules, and1000-seed weight and seed yield per plant.

Positive significant phenotypic and genotypic correlations wereobserved for number of seeds per capsules with seed yield per plant and 1000-seed weight. Number of seeds per capsule had direct contribution to the seed yield per plant. Agrawal *et al*. (2017) and Ozcinar *et al*. (2017) for 1000-seed weight and seed yield and Fazal *et al*. (2015) for seed yield per plant also noticed the same in their studies.

The character 1000-seed weight expressed significant positive phenotypic and genotypic correlations with seed yield. Bharathi *et al*. (2015), Lal *et al*. (2016), Agrawal *et al*. (2017) and Ozcinar *et al*. (2017) observed similar results. The trait capsule length was found to possess positive significant phenotypic and genotypic correlations with number of seeds per capsules and seed yield per plant,whereas the trait number of seeds per capsule showed positive significant associationswith seed yield per plant and 1000-seed weight at both at phenotypic and genotypic levels. The character 1000-seed weight expressed significant positive phenotypic (0.7525) and genotypic (0.8350) correlationswith seed yield. Similar findings were also given by Bharathi *et al.* (2015), Kanak *et al*. (2016) and Lal *et al*. (2016).

Plant height contributed positive significant phenotypic and genotypic correlationswith number of branches per plant, capsule length and number of seeds per capsule. It exhibited positive non-significant associationswith number of capsules per plant and 1000-seed weight at both the levels. Studies of Agrawal *et al.*(2017) and Ozcinar *et al*.(2017) also found similar results. It was observed that number of branches per plant exhibited significant positive correlations with number of capsules per plant, capsule length, 1000-seed weight and number of seeds per capsule at both genotypic and phenotypic levels.

The association of different component characters among themselves and with yield is very important for devising an efficient criterion of selection for yield. Direct selection for yield as such could be misleading because successful selection criterion depends on the information on genetic variability and association of yield component traits with seed yield. The results of path coefficient analysis based on the genotypic and phenotypic correlation coefficients are presented in Table. 3.

Path coefficient analysis revealed that 1000-seed weight recorded the highest positive direct effect on seed yield followed by number of capsules per plant, number of seeds per capsules, capsule length and plant height at both phenotypic and genotypic levels.

The direct contribution of days to 50% flowering was negative on seed yield per plant at both phenotypic (-0.0954) level and genotypic (-0.1018) levels. Similar findings were observed by Sivaprasad and Yadavalli (2012), Shekhawat *et al*. (2013) and Bharathi *et al.* (2015). The direct contribution of number of branches per plant on

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seed yield per plant was found to be negative at phenotypic (-0.0860) and genotypic (-0.0317) levels. Vanishree *et al*. (2013) and Thirumalarao *et al*. (2013) were also noticed negative direct effect of this trait with seed yield per plant.

The trait number of capsules per plant showed positive indirect effects *via* plant height, number of branches per plant, capsule length, number of seeds per capsule and 1000-seed weight at both the levels,whereas positive significant indirect effects of capsule length on seed yield per plant was recorded through plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule and 1000-seed weight at both atgenotypic and phenotypic levels.

1000-seed weight had positive direct effect on seed yield per plant both phenotypic and genotypic levels. Similar reports were observed by Vanishree *et al.* (2013), Abate and Mekbib (2015), Bharathi *et al*. (2015) and Fazal *et al*. (2015).

A critical analysis of both character association and path analysis indicated that among the yield components investigated, 1000-seed weight, number of capsules per plant and number of seeds per capsule were determined as most critical ones as both the correlation coefficients and the direct effects were high with seed yield per plant. Other important traits for grain yield were capsule length and number of branches per plant. The traits *viz.*, days to 50% flowering and plant height contributed less to the seed yield.

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Table 1. Analysis of variance for yield and yield component characters in Sesame

Sl. No.	Character	Mean sum of squares		
		Replications (df=2)	Treatments (df= 44)	Error (df= 88)
1	Days to 50% flowering	1.16	27.61**	1.57
2	Plant height (cm)	12.91	615.49**	64.53
3	Number of branches per plant	0.086	1.56**	0.060
4	Number of capsules per plant	17.95	394.10**	32.97
5	Capsule length (cm)	0.024	0.142**	0.01
6	Number of seeds per capsule	11.64	548.24**	13.50
7	Seed yield per plant (g)	0.12	2.99**	0.18
8	1000-seed weight(g)	0.014	0.59**	0.07

Table 2. Phenotypic (P) and Genotypic (G) correlation coefficients among yield attributes in 45 sesame genotypes

Character		DF50%	PH (cm)	NBP	NCP	CL (cm)	NSC	1000 SW (g)	SYP (g)
DF50%	**P G**	**1.0000**	0.1089	-0.0112	-0.0135	-0.0370	0.0482	0.0436	-0.0629
		1.0000	0.1681**	-0.0281	-0.0311	-0.0020	0.0510	0.0492	-0.0890
PH (cm)	**P G**		**1.0000**	0.3823**	0.0561	0.3674**	0.1696*	0.0724	0.1415
			1.0000	0.5249**	0.1485	0.4724**	0.2194**	0.0724	0.1831**
NBP	**P G**			**1.0000**	0.3422**	0.2810**	0.6148**	0.3155**	0.3747**
				1.0000	0.4117**	0.3380**	0.6684**	0.3361**	0.4409**
NCP	**P G**				**1.0000**	0.3047**	0.7221**	0.5960**	0.7765**
					1.0000	0.3600**	0.8679**	0.6686**	0.9434**
CL (cm)	**P G**					**1.0000**	0.2899**	0.1060	0.2946**
						1.0000	0.3275**	0.1168	0.3710**
NSC	**P G**						**1.0000**	0.5188**	0.7016**
							1.0000	0.5560**	0.8081**
1000 SW(g)	**P G**							**1.0000**	**0.7525****
								1.0000	**0.8350****

***** Significance at 5% level, ** significance at 1% level
Note: Diagonal values are direct effects
Residual effect for phenotypic path = 0.4762, Residual effect for genotypic path = 0.1350
DF 50%= Days to 50% flowering, PH= Plant height, NBP = Number of branches per plant, NCP= Number of capsules per plant, CL= Capsule length, NSC= Number of seeds per capsule, 1000 SW=1000-seed weight, SYP= Seed yield per plant

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Table 3. Phenotypic (P) and Genotypic (G) Path coefficients among yield attributes in 45 sesame genotypes

Character		DF50%	PH (cm)	NBP	NCP	CL (cm)	NSC	1000 SW (g)	SYP (g)
DF50%	P	-0.0954	-0.0104	0.0011	0.0013	0.0035	-0.0046	-0.0042	-0.0629
	G	-01018	-0.0171	0.0029	0.0032	0.0002	-0.0052	-0.0050	-0.0890
PH (cm)	P	0.0069	0.0633	0.0242	0.0036	0.0233	0.0107	0.0046	0.1415
	G	0.0086	0.0511	0.0268	0.0076	0.0241	0.0112	0.0030	0.1831
NBP	P	0.0009	-0.0308	-0.0806	-0.0276	-0.0227	-0.0496	-0.0254	0.3747**
	G	0.0009	-0.0166	-0.0317	-0.0130	-0.0107	-0.0212	-0.0106	0.4409**
NCP	P	-0.0045	0.0185	0.1126	0.3291	0.1003	0.2376	0.1961	0.7765**
	G	-0.0189	0.0900	0.2496	0.6061	0.2182	0.5261	0.4053	0.9434**
CL (cm)	P	-0.0025	0.0251	0.0192	0.0208	0.0683	0.0198	0.0072	0.2946**
	G	-0.0002	0.0362	0.0259	0.0276	0.0766	0.0251	0.0089	0.3710**
NSC	P	0.0125	0.0440	0.1596	0.1874	0.0752	0.2595	0.1346	0.7016**
	G	0.0023	0.0100	0.0305	0.0396	0.0149	0.0456	0.0253	0.8081**
1000 SW(g)	P	0.0192	0.0318	0.1318	0.2619	0.0466	0.2280	0.4395	0.7525**
	G	0.0200	0.0295	0.1370	0.2724	0.0476	0.2265	0.4074	0.8350**

***** Significance at 5% level, ** significance at 1% level

DF 50%= Days to 50% flowering, PH= Plant height, NBP = Number of branches per plant, NCP= Number of capsules per plant, CL= Capsule length, NSC= Number of seeds per capsule, 1000 SW=1000-seed weight, SYP= Seed yield per plant