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Research Article

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

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Abstract
Sesame (*Sesamum indicum L.*) is one of the oldest cultivated crops in the world popularly referred as "Queen of Oilseeds" due to its high quality oil. A field study was undertaken at the Research farm of the Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai during the year 2015-16 to know the association among yield and its component traits in sesame. Thirty sesame hybrids obtained through Line x Tester analysis and their parents were evaluated for important quantitative traits such as days to 50 per cent flowering, plant height, height of first capsule, number of primary branches per plant, number of capsules on main stem, number of capsules per plant, capsule length, number of seeds per capsule, 1000 seed weight, oil content and seed yield per plant. Analysis of variance indicated the presence of genetic variability among the genotypes for all characters except days to 50 % flowering. Correlation analysis indicated that the characters *viz.,* number of capsules on main stem and number of capsules per plant had the highest positive correlation with seed yield per plant followed by plant height, number of seeds per capsule, number of primary branches per plant and height of first capsule. Path analysis exhibited that the trait number of capsules on main stem had very high direct effect on yield followed by capsule length, 1000 seed weight and number of seeds per capsule. Hence these traits are to be given due importance during selection programme for improving seed yield in sesame.

Key words
Sesame, yield and its components, correlation and path analysis

Introduction

Sesame (*Sesamum indicum L.*) is one of the oldest cultivated crops in the world and the most important ancient oilseed crop known to mankind. Sesame oil is characterized for its stability and quality; hence it is regarded as "Queen of the oilseeds." The crop is grown throughout the tropical and subtropical countries of the world (Ashri, 1994). The crop is highly tolerant to drought, grows well in well drained soils and various agro climatic regions, and well adapted to different crop rotations. It can set seed and yield well under fairly high temperature and can also grow well in rainfed areas. However, continuous flooding or severe droughts adversely affect the crop resulting in low yield (Mensah *et al*., 2006). The crop is cultivated in almost all parts of the country either as sole or mixed crop during *kharif*, *rabi* and summer seasons and cultivated over an area of about 17.75 lakh hectares with an annual production of about 8.28 lakh tones and productivity of 426 kg/ha (Indiastat,2015). However, the average productivity is very low as compared to China (1234 kg/ ha) and other sesame producing countries.

The ultimate expression of yield in crop plants usually depends upon the action and interaction of a number of important characters. Knowledge of association between quantitative traits is essential for formulating an effective breeding programme in any crop. Correlation analysis is helpful in determining the critical component characters of a complex trait like yield. With more variables in correlation studies, indirect associations become more complex and important. Consequently, a correlation study coupled with path analysis is more effective in the study of yield attributing characters. Taking the above factors into consideration, an attempt was made to study the association between yield and its contributing traits in sesame and suggest a suitable selection strategy.

Materials and Methods

The present investigation in sesame was carried out at the research farm of the Department of Plant Breeding and Genetics, Agricultural College and Research Institute, Madurai during 2015-2016. The experimental material comprised of 30 F_1 sesame hybrids generated by crossing six lines and five testers and its parents which were evaluated in Randomised Block Design with two replications. All standard agronomic package of practices were adopted to raise a healthy crop. Observations were recorded on five random plants in each replication for the characters *viz*., plant height (cm), height to

first capsule (cm), number of primary branches per plant, number of capsules on main stem, number of capsules per plant, capsule length (cm), number of seeds per capsule, 1000-seed weight (g), oil content (%) and seed yield per plant (g) and the trait days to 50 % flowering was recorded on plot basis.

Genotypic correlation between yield and its component traits and among themselves was worked out as per the method suggested by Johnson *et al.* (1955). The significance of genotypic correlation coefficient was tested by referring to the standard table given by Snedecor and Cochran (1967). Path coefficient analysis was carried out as suggested by Dewey and Lu (1959).

Results and Discussion

The analysis of variance (ANOVA) of RBD revealed that the genotypes taken for the study exhibited significant difference for all the traits except days to 50 per cent flowering (Table 1). Seed yield is a complex character and is considered as the ultimate product of its components. Hence, selection of superior genotypes based on seed yield is difficult due to the integrated structure of plant in which most of the characters are interrelated and being governed by more number of genes (Lule *et al.*, 2012). The inter relationship of component characters of yield provide an idea for the selection and simultaneous improvement of desirable yield attributing traits. Hence, correlation studies were undertaken to know the association of grain yield with its component traits.

The genotypic correlation coefficients between yield and its component characters and inter correlation among traits are presented in Table 2. Seed yield per plant had significant and positive association with plant height (0.779) , height of first capsule (0.296), number of primary branches per plant (0.507), number of capsules on main stem (0.857), number of capsules per plant (0.857) and number of seeds per capsule (0.625). Positive association between plant height and yield was reported by Khan *et al*. (2001), Yol *et al*. (2010) and Alake *et al*. (2010). Yingzhong and Yishou (2002) inferred that height of first capsule had significant and positive correlation with seed yield per plant. Sumathi and Muralidharan (2010) indicated that seed yield per plant was positively correlation with number of primary branches per plant. Subashini (2003) reported positive association between yield and capsules on main stem. Khairnar and Monopara (2013), Daniya *et al*. (2013), Sivaprasad *et al.* (2013), Rao *et al*. (2013) and Fazal *et al*. (2015) reported positive correlation between yield and number of capsules per plant. Positive correlation between number of seeds per capsule and seed yield per plant was reported by Ibrahim and Khidir (2012), Khairnar and Monopara (2013), Daniya *et al*. (2013) and Fazal *et al*. (2015).

Thus yield improvement in sesame can be achieved through the selection of plant type via yield contributing traits like tall plant with more number of primary branches, more number of capsules on main stem, more number of capsules per plant, more number of seeds per capsule. Height of the first capsule is also another important trait as plant height along with height of first capsule determines the length of the fruiting zone.

Inter association among the yield components shows the nature and the extent of relationship with each other and will help for simultaneous improvement of different characters along with seed yield in the breeding programme. The present study revealed that seed yield had positive association with plant height *via* height of first capsule (Yingzhong and Yishou, 2002), number of primary branches per plant (Teklu *et al*., 2014), number of capsules on main stem (Subashini, 2003), number of capsules per plant (Daniya *et al.*, 2013) and number of seeds per capsule (Daniya *et al*., 2013). Height of first capsule had positive significant correlation with number of primary branches per plant, number of capsules on main stem, number of capsules per plant and oil content. Sakila *et al.* (2000) found positive significant correlation between height of first capsule and number of capsules on main stem. Positive association between number of primary branches per plant and number of capsules on main stem was observed in the present study which is in accordance with the results reported by Meenakumari and Ganesamurthy (2015). Positive association between number of primary branches per plant with number of capsules per plant was observed which is in agreement with Azeez and Morakinyo (2011), Khairnar and Monopara (2013), Teklu *et al*. (2014). Number of capsules on main stem had positive significant correlation with number of capsules per plant and number of seeds per capsule which is in accordance with Meenakumari and Ganesamurthy (2015). Number of seeds per capsule had positive significant correlation with capsule length and oil content. Similar results were earlier observed by Sumathi and Muralidharan (2010), Kumar *et al*. (2012) and Khairnar and Monopara (2013).

From the aforesaid facts, it is clear that all the yield component traits *viz.*, number of capsules on main stem, number of capsules per plant, number of seeds per capsule, plant height, height of first capsule and number of primary branches per plant

were inter correlated among themselves. Therefore, these traits are to be given priority during selection programme to improve seed yield in sesame.

Genetic correlation of yield with its component characters can further be partitioned into direct and indirect effects through path analysis. A brief account on direct and indirect effects of different characters on seed yield per plant is given below (Table 3).

The present investigation revealed that the trait number of capsules on main stem exhibited very high positive direct effect on single plant yield (1.791). The trait capsule length had moderate and positive direct effect on seed yield per plant (0.278). The traits number of primary branches per plant (0.146), number of seeds per capsule (0.163) and 1000 seed weight (0.166) had low and positive direct effects; whereas other traits exhibited either negligible or negative effect. This is in agreement with Subashini (2003). Considering the indirect effects, number of capsules on main stem alone exhibited very high positive indirect association with seed yield through plant height, number of primary branches and number of capsules per plant.

Correlation analysis indicated that the characters *viz.*, number of capsules on main stem, number of capsules per plant, number of seeds per capsule, number of primary branches per plant, plant height and height of first capsule are inter correlated among themselves. Therefore these traits are to be given priority during selection for improvement of yield. Path analysis revealed that the trait number of capsules on main stem had very high direct effect on yield followed by capsule length and number of seeds per capsule. As far as indirect effects are considered, the trait number of capsules per plant had very high indirect effect on seed yield through number of capsules on main stem. The present study revealed that the trait number of capsules on main stem should be given more importance during selection programme for improving seed yield in sesame.

References

Alake, C.O., Ayo-Vaughan, M.A. and Ajani, O.O. 2010. Estimate for variability for yield and its characters in Nigerian sesame (*Sesamum indicum* L.) genotypes. J. Agric. Sci. Env., **10**:72-85.

Ashri, A. 1994. Genetic resources of sesame: present and future perspectives. In: Sesame Biodiversity in Asia: Conservation, Evaluation and Improvement. (Eds.): R.K. Arora and K.W. Riley. IPGRI Office for South Asia, New Delhi, India. pp. 25-39.

Azeez, M.A. and Morakinyo, J.A. 2011. Path analysis of the relationships between single plant seed yield and some morphological traits in sesame (Genera Sesamum and Ceratotheca). Int. J. Plant Breed. Genet., **5**: 358-368.

Daniya, E., Dadari, S.A., Ndahi, W.B., Kuchinda, N.C. and Babaji, B.A. 2013. Correlation and Path analysis between seed yield and some weed and quantitative components in two sesame (*Sesamum indicum* L.) varieties as influenced by seed rate and nitrogen fertilizer. Journal of Bio. Agric. and Healthcare**, 3**:12-17.

Dewey, D.R. and Lu, K.H. 1959. Correlation and path coefficient analysis of component of crested wheat grass seed production. Agron., J., **51**: 515-518.

Fazal, A., Mustafa, H.S.B., Hasan, E., Anwar, M., Tahir, M.H.N., and Sadaqat, H.A. 2015. Inter relationship and path coefficient analysis among yield and yield related traits in sesame (*Sesamum indicum* L.). Nature and Sci., **13**:27-32.

Ibrahim, S.E. and Khidir, M.O. 2012. Genotypic correlation and path coefficient analysis of yield and some yield components in sesame (*Sesamum indicum* L.). Int. J. Agri. Sci., **2**: 664-670.

Indiastat, 2015. https://www.indiastat.com/

Johnson, H.W., Robinson, H.F. and Comstock, R.E. 1955. Estimation of genetic and environmental variability. Agron. J., **47**: 314-318.

Khairnar, S.S. and Monopara, B.A. 2013. Identification of potential traits and selection criteria for yield improvement in sesame (*Sesamum indicum* L). Electronic J. of Plt. Breed., **1:** 145-157.

Khan, N.I., Akbar, M., Sabir, K.M. and Iqbal S. 2001. Character association and path coefficient anlaysis in sesame (*Sesamum indicum* L.). Online J of Biol. Sci., **1:** 99-100.

Kumar, H., Kaur, G., and Banga, S. 2012. Application of GGE biplot analyses for characterizing diverse sesame (*Sesamum indicum*) germplasm for yield and yield contributing traits. Indian J. Agric. Sci., **82**: 759-767.

Lule, D., Tesfaye, K., Fetene, M. and deVilliers, S. 2012. Inheritance and association of quantitative traits in finger millet (*Eleusine coracana* subsp. *coracana*) landraces collected from eastern and south eastern Africa. Int. J. Genet., **2:** 12-21.

Meenakumari, B. and Ganesamurthy, K. 2015. Studies on variability, correlation and path analysis in sesame (*Sesamum indicum* L.). Adv. Appl. Res., **7:** 116-120.

Mensah, J.K. Obadoni, B.O., Eruotor, P.G. and Onome-Irieguna, F. 2006. Simulated flooding and drought effects on germination, growth and yield parameters of sesame (*Sesamum indicum* L.). Afr. J. Biotechnol., **5**: 1249-1253.

Rao, T., Bharathi, D., Chandramohan, V., Venkanna, V. and Bhadru, D. 2013. Genetic variability and association analysis in sesame (*Sesamum indicum* L). Crop Res., **46**: 122-125.

Sakila, M., Ibrahmim, S.M., Kalamani, A. And Backiyarani, S. 2000. Evaluation of sesame hybrids through Line x Tester analysis. Sesame Safflower Newslett., **15**:1-6.

Sivaprasad, Y.V.N., Krishna M.S.R., and Venkateshwara, Y. 2013. Correlation, path analysis and genetic variblility for economical characteristics in F_2 and F_3 generations of the cross AVT 3 x TC 25 in sesame (*Sesamum indicum* L.). J. Environ. Applied Biores., **1**: 14-18.

Snedecor, G.W. and Cochran, W.G. 1967. Statistical methods. Oxford and IBH, New Delhi, 381-488.

Subashini, G. 2003. Genetic analysis for yield and yield components in sesame (*Sesamum indicum* L.). M.Sc (Ag.) Thesis, AC&RI, Madurai.

Sumathi, P. and Muralidharan, V. 2010. Inheritance of branching and important biometrical traits in sesame (*Sesamum indicum* L). Indian J. Genet., **70**: 97-101.

Teklu, D.H., Kebele, S.A. and Gebremichael, D.E. 2014. Assessment of genetic variability, genetic advance, correlation and path analysis for morphological traits in sesame gentoypes. Asian J. Agric. Res., **8**:181-194.

Yol, E., Karaman, E., Furat, S. and Uzun, B. 2010. Assessment of selection criteria in sesame by using correlation coefficients, path and factor analyses. Aust. J. Crop Sci., **4**:598-602.

Yingzhong, Z. and Yishou, W. 2002. Genotypic correlations and path coefficient analysis in sesame. Sesame and safflower Newslett., **17**:10-16.

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Table1. Analysis of variance of RBD for various quantitative traits

Source	df	Mean sum of squares										
		DF	PH	HFC	NPB	NCM	NCP	CL	NSC	1000SW	OC	SYP
Replication	1	2.52	15.80	10.59	0.32	9.97	18.54	0.00	0.98	0.08	3.08	3.12
Genotypes	40	4.56	558.17*	58.35*	0.88*	26.58*	401.57*	8.06*	53.10*	0.22*	41.12*	34.78*
Error	40	5.84	2.80	4.64	0.10	2.72	46.51	0.96	7.91	0.02	6.78	2.30

* **Significant at 5% level**

DF : Days to 50 % flowering
PH : Plant height
HFC : Height of first capsule
NPB : Number of primary branches per plant
NCM : Number of capsules on main stem
NCP : Number of capsules per plant
CL : Capsule length
NSC : Number of seeds per capsule
1000SW : 1000 seed weight
OC : Oil content
SYP : Seed yield per plant

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Table 2. Genotypic correlation coefficients of different characters with seed yield per plant

Character	PH	HFC	NPB	NCM	NCP	CL	NSC	1000SW	OC	SPY
DF	0.230	0.571**	-0.118	-0.020	-0.011	-0.648	-0.382	0.152	0.015	-0.354*
PH		0.654*	0.749**	0.877**	0.892**	0.000	0.295*	0.192	0.139	0.779**
HFC			0.397*	0.355*	0.346*	-0.117	0.074	0.101	0.405**	0.296*
NPB				0.564**	0.570**	-0.058	0.112	0.073	-0.139	0.507**
NCM					0.999**	-0.075	0.413**	0.072	0.075	0.857**
NCP						-0.064	0.366**	0.131	0.055	0.857**
CL							0.368**	-0.079	0.227	0.206
NSC								0.080	0.360**	0.625**
1000SW									0.105	0.151
OC										0.186

* **Significant at 5% level**

DF	:	Days to 50 % flowering	NCM	:	Number of capsules on main stem	1000 SW	:	1000 seed weight
PH	:	Plant height	NCP	:	Number of capsules per plant	OC	:	Oil content
HFC	:	Height at first capsule	CL	:	Capsule length	SPY	:	Seed yield per plant
NPB	:	Number of primary branches per plant	NSC	:	Number of seeds per capsule			

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Table 3. Direct and indirect effects of different characters on seed yield per plant

Character	DF	PH	HFC	NPB	NCM	NCP	CL	NSC	1000SW	OC	SPY
DF	**-0.056**	-0.040	0.003	-0.017	-0.036	0.010	-0.180	-0.062	0.025	0.000	-0.354
PH	0.013	**-0.172**	0.003	0.109	1.571	-0.825	0.000	0.048	0.032	0.001	0.779
HFC	0.032	-0.113	**0.005**	0.058	0.635	-0.320	-0.033	0.012	0.017	0.002	0.296
NPB	-0.007	-0.129	0.002	**0.146**	1.009	-0.528	-0.016	0.018	0.012	-0.001	0.507
NCM	-0.001	-0.151	0.002	0.082	**1.791**	-0.925	-0.021	0.067	0.012	0.000	0.857
NCP	-0.001	-0.154	0.002	0.083	1.789	**-0.926**	-0.018	0.060	0.022	0.000	0.857
CL	-0.036	0.000	-0.001	-0.008	-0.134	0.059	**0.278**	0.060	-0.013	0.001	0.206
NSC	-0.021	-0.051	0.000	0.016	0.740	-0.339	0.102	**0.163**	0.013	0.001	0.625
1000SW	0.009	-0.033	0.001	0.011	0.129	-0.121	-0.022	0.013	**0.166**	0.000	0.151
OC	0.001	-0.024	0.002	-0.020	0.135	-0.051	0.063	0.059	0.017	**0.004**	0.186

***Significant at 5% level** **Diagonal values denote the direct effects** **Residual effect = 0.39**

DF	:	Days to 50 % flowering	NCP	:	Number of capsules per plant	1000SW	:	1000 seed weight
PH	:	Plant height	CL	:	Capsule length	OC	:	Oil content
HFC	:	Height at first capsule	NSC	:	Number of seeds per capsule	SYP	:	Seed yield per plant
NPB	:	Number of primary branches per plant	NCM	:	Number of capsules on main stem			

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