Int.J.Curr.Microbiol.App.Sci (2019) *8*(7): 229-237

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 8 Number 07 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.807.029

Variability and Path Coefficient Analysis in Sesame (*Sesamum indicum* L.)

Labhya Rani Gogoi* and R.N. Sarma

Department of Plant Breeding and Genetics, Assam Agricultural University, Jorhat-785013, India

**Corresponding author*

Keywords

Correlation, Genetic variability, Heritability, Path analysis, Sesame

Article Info

Accepted:
04 June 2019
Available Online:
10 July 2019

A B S T R A C T

The present study was conducted with 33 sesame genotypes collected from different North East region of India with an objective to determine genetic variability and association among characters. Significant differences were observed for all the characters studied, except for number of branches per plant. High heritability coupled with high genetic advanced as % of mean was observed for yield per plant followed by 1000 grains weight indicating that these characters are controlled by additive gene effect. None of the characters showed significant association with yield per plant. Path analysis revealed that days to 50% flowering and 1000 grain weight found to have high direct effect on seed yield and high indirect effect via height of 1st capsule bearing node, branches per plant and seeds per capsule. The study highlighted the scope of path analysis to identify important yield attributes despite of no correlation with yield.

Introduction

Sesame (*Sesamum indicum* L.) is one of the most important oilseed crops belong to the family *Pedaliaceae*. India is very rich in diversity in cultivated sesame (Bisht *et al.*, 1998). India, Myanmar and China are the top three sesame producing countries in the world (Abate and Mekbib, 2015). 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. However, continuous flooding or severe drought adversely affects the crop resulting in low yield (Bharathi *et al.*, 2014). But despite the potentiality of this crop, sesame is still a minor crop of developing countries grown mostly in sub-marginal and marginal land under rainfed condition with little research activities.

Sesame has a wide range of genetic variability in its extensive germplasm collections. Traditional sesame landraces as well as related wild species are an important source of genetic diversity for breeders and form the backbone of agricultural production. The knowledge on the extent and pattern of genetic variability present in a specific breeding population will help in the selection and breeding of high yielding, good quality cultivars that will increase production. Seed yield is a complex character and is associated with numbers of component interrelated traits. Direct selection for traits as such could be misleading because of complex association among the yield attributing traits. Correlation and path coefficient analysis between different yield attributes and yield is invaluable to the breeders who aim to identify key traits for exploitation in breeding for yield improvement. Hence the objectives of the study were to gather information on variability, character association and path - coefficient analysis in few germplasm of sesame.

Materials and Methods

In the present study 33 genotypes were sown in randomized complete block design (RBD) with 3 replications (Table 1). Each genotype was raised in 3 row plots of 4 m length with spacing of 30 X 10 cm following recommended agronomic practices. Observations were recorded on height of first capsule bearing node (cm), plant height (cm), number of capsules per plant, number of branches per plant, capsule length (cm), capsule width (cm), number of seed per capsule, 1000 grain weight (g), days to 50% flowering, days to maturity and yield per plant (g). The mean values were used for analysis of variance. The coefficient of variation was calculated as per Burton and Devane (1953). Heritability in broad sense and genetic advance were calculated as per Johnson *et al.*, (1955). The mean data collected were subjected to simple correlation analysis as described by Singh and Choudhary (1979). The direct and indirect effects on and individual and combined (two factors) contributions of yield components to seed yield were determined using path analysis as described by Dewey and Lu (1959).

Results and Discussion

Analysis of variation revealed highly significant differences among the genotypes for all the characters studied except number of branches per plant indicating sufficient genetic variation among the genotypes under study (Table 2). The comparison of characters as regards to the extent of genetic variation could be better judge by the estimation of genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV). The variation of different traits under this study revealed that the PCV were higher than GCV for all the characters studied indicating the role of environmental variance in the total variance (Table 3). GCV was found to be highest for number of capsules per plant followed by height of first capsule bearing nodes and yield per plant. The highest PCV was recorded for number of capsules per plant followed by number of branches per plant and height of first capsule bearing nodes. High GCV and PCV for seed yield per plant, number of branches per plant and number of capsules/plant was also reported by many authors (Gawali *et al.*, 2007; Gidey *et al.*, 2012; Bharathi *et al.*, 2014; Abate and Mekbib, 2015; Iqbal *et al.*, 2016). These suggested scope for selection for these traits in Sesame breeding. However, Burton (1952) suggested that GCV together with heritability estimates would give the best picture of the extent of the advance to be expected by selection. High broad sense heritability was observed for yield per plant followed by days to 50% flowering and 1000 grain weight, indicating limited influence of environment in expression of these traits. The present finding was in agreement with Ukaan and Ogbonna (2012), Tripathi *et al.*, (2014) and Ismaila and Usman (2014).

Table.1 Genotypes included in the present study

Sl.No.	Genotype Name	Source
1.	Nga Na	Arunachal Pradesh, local
2.	KolaTil_Tezpur	Tezpur, local
3.	AhuTil_Kalibor	Kalibor, local
4.	NeiIong_Umium	Umium, local
5.	AhuTil_Lakhimpur	Lakhimpur, local
6.	SaliTil_Biswanath	Biswanath,local
7.	SaliTil_Kaliabor	Kaliabor,local
8.	PahariaTilNagaon	Nagaon, local
9.	AhuTil_Sibsagar	Sibsagar,local
10.	CUHY 57	Calcutta University, mutant
11.	TKG 308	HYV, Madhya Pradesh
12.	CUMS 17	Calcutta University, mutant
13.	CUMS 04	Calcutta University, mutant
14.	Uma	Calcutta University, mutant
15.	AhuTil_Puranigudam	Puranigudam, local
16.	V 12	Calcutta University, local
17.	Rama	Calcutta University, selection from local ‘Khosla’
18.	V 15	Calcutta University, local
19.	SaliTil_Nagaon	Nagaon, local
20.	KolaTil_Nalbari	Nalbari, local
21.	SaliTil_Ghilamara	Ghilamara, local
22.	KolaTil_Majuli	Majuli, local
23.	SaliTil_Darrang	Darrang, local
24.	AST 1	RARS(Diphu),HYV (local X ST1683)
25.	NempoThepo	RARS(Diphu), local
26.	Punjab Til 1	HYV
27.	NempoLongnicklu	RARS(Diphu), local
28.	Nagaon Local	Nagaon, local
29.	NempoCharap	RARS(Diphu), local
30.	NempoSoksu	RARS(Diphu), local
31.	Kaliabor Local	Kaliabor, local
32.	Bahua Bheti	RARS(Diphu), local
33.	NempoChindon	RARS(Diphu), local

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

Sources of variation	d.f.	Mean Squares										
		Height of 1st capsule bearing node (cm)	Plant height (cm)	Capsules/ plant (no.)	Branches/ plant(no.)	Capsule length (cm)	Capsule width (cm)	Seeds/ capsule(no.)	1000 grain wt.(g)	Days to 50% flowering	Days to maturity	Yield/ plant (g)
Replication	2	61.193	906.789	429.330	2.368	0.086	0.020	41.886	0.122	31.121	43.727	0.952
Variety	32	130.866**	250.687**	369.801*	0.694	0.118**	0.033573**	139.943639**	0.450254**	36.710227**	72.967803**	5.183431**
Error	64	45.717	118.834	192.477	0.437	0.049	0.014	61.073	0.042	2.840	10.394	0.347

* Significant at 5% level, ** Significant at1 % level

Table.3 Estimates of variability parameters for different characters in some sesame genotypes

Variability parameters	Height of 1st capsule bearing node (cm)	Plant height (cm)	Capsules/ plant (no.)	Branches/ plant (no.)	Capsule length (cm)	Capsule width (cm)	Seeds/ capsule (no.)	1000 grain wt. (g)	Days to 50% flowering	Days to maturity	Yield/ plant (g)
Genotypic variance (σ^2_g)	28.383	43.951	59.108	0.086	0.023	0.007	26.29	0.136	11.29	20.858	1.612
Genotypic variance (σ^2_p)	74.1	162.785	251.585	0.523	0.072	0.02	87.363	0.178	14.13	31.252	1.959
Genotypic coefficient of variation (GCV)	16.355	9.776	28.318	11.068	7.098	11.356	11.795	13.546	8.885	4.81	13.934
Phenotypic coefficient of variation (PCV)	26.425	18.813	58.423	27.358	12.552	20.02	21.5	15.475	9.94	5.888	15.359
Heritability broad Sense (h^2%)	38.304	26.999	23.494	16.444	31.944	32.200	30.093	76.404	79.901	66.741	82.287
Gen.Adv as % of Mean 5%	20.851	10.464	28.276	9.225	8.268	13.27	13.329	24.426	16.36	8.096	26.041

Table.4 Genotypic (above diagonal) and phenotypic (below diagonal) correlations among different characters in some Sesame genotypes

	Height of 1st capsule bearing node (cm)	Plant height (cm)	Capsules/ plant (no.)	Branches/ plant(no.)	Capsule length (cm)	Capsule width (cm)	Seeds/ capsule (no.)	1000 grain wt.(g)	Days to 50% flowering	Days to maturity	Yield/ plant(g)
Height of 1st capsule bearing node(cm)	1.000	**0.513****	0.138	**0.449****	**0.957****	**0.404***	-0.259	**-0.638****	**0.486****	0.023	0.013
Plant height (cm)	**0.489****	1.000	0.192	-0.234	-0.079	-0.141	-0.072	-0.073	-0.136	**-0.382***	-0.156
Capsules/ plant (no.)	**0.361***	**0.619****	1.000	**0.654****	-0.041	-0.401	-0.005	0.060	0.207	-0.094	-0.229
Branches/ plant(no.)	**0.419***	**0.399***	**0.648****	1.000	0.146	**-0.431***	**-0.493****	**-0.736****	**0.964****	**0.553****	-0.289
Capsule length (cm)	0.175	0.164	0.208	0.151	1.000	**0.618****	**-0.380***	-0.260	0.198	**0.462****	-0.166
Capsule width (cm)	-0.114	-0.059	-0.108	-0.058	**0.425***	1.000	-0.290	-0.176	0.049	**0.543****	0.069
Seeds/ capsule(no.)	0.001	0.061	0.066	-0.111	0.066	0.047	1.000	**0.476****	**-0.419***	-0.043	-0.175
1000 grain wt.(g)	-0.311	0.032	0.019	-0.259	-0.162	-0.088	0.191	1.000	**-0.855****	-0.267	0.114
Days to 50% flowering	0.194	-0.147	0.023	0.288	0.131	0.052	-0.140	**-0.700****	1.000	**0.466****	-0.015
Days to maturity	-0.150	-0.310	-0.232	0.000	0.168	**0.350***	-0.055	-0.182	**0.380***	1.000	-0.301
Yield/ plant(g)	0.009	-0.046	-0.077	-0.059	-0.106	0.001	-0.095	0.068	-0.016	-0.218	1.000

* Significant at 5% level, ** Significant at1 % level

Table.5 Genotypic path coefficients showing direct (diagonal) and indirect effects of different characters on yield per plant

Characters	Height of 1st capsule bearing node(cm)	Plant height (cm)	Capsules/ plant (no.)	Branches/ plant(no.)	Capsule length (cm)	Capsule width (cm)	Seeds/ capsule(no.)	1000 grain wt.(g)	Days to 50% flowering	Days to maturity
Height of 1st capsule bearing node(cm)	-0.181	-0.093	-0.025	-0.081	-0.173	-0.073	0.047	0.115	-0.088	-0.004
Plant height (cm)	-0.013	-0.025	-0.005	0.006	0.002	0.004	0.002	0.002	0.003	0.009
Capsules/ plant (no.)	-0.053	-0.075	-0.388	-0.254	0.016	0.156	0.002	-0.023	-0.080	0.036
Branches/ plant(no.)	-0.240	0.125	-0.349	-0.535	-0.078	0.230	0.264	0.394	-0.515	-0.296
Capsule length (cm)	0.246	-0.020	-0.010	0.038	0.257	0.159	-0.098	-0.067	0.051	0.119
Capsule width (cm)	0.082	-0.028	-0.081	-0.087	0.125	0.202	-0.059	-0.036	0.010	0.109
Seeds/ capsule(no.)	0.034	0.009	0.001	0.064	0.050	0.038	-0.131	-0.062	0.055	0.006
1000 grain wt.(g)	-0.911	-0.105	0.086	-1.051	-0.371	-0.251	0.680	1.428	-1.221	-0.381
Days to 50% flowering	1.071	-0.299	0.456	2.122	0.436	0.109	-0.922	-1.883	2.202	1.026
Days to maturity	-0.021	0.353	0.087	-0.512	-0.428	-0.502	0.040	0.247	-0.431	-0.925
Correlation with Yield/ plant(g)	0.013	-0.156	-0.229	-0.289	-0.166	0.069	-0.175	0.114	-0.015	-0.301
Residual Effect: 0.593										

Again reliability of selection does not depend upon heritability alone, but on genetic advance as well (Bharathi *et al.,* 2014).High heritability coupled with high or moderate genetic advance was recorded for yield per plant, 1000 grain weight, days to 50% flowering. Similar observations were reported by Gangadhara *et al.,* (2012) for seed yield per plant and 1000 seed weight, Gawali *et al.,* (2007) and Hika *et al.,* (2015) for seed yield per plant, Desawi *et al.,* (2014) for seed yield and days to 50% flowering. These indicated involvement of additive gene action in the genetic control of these traits, suggesting the scope for improvement through simple selection in the present breeding materials. High heritability coupled with low genetic advance was recorded in days to maturity, and low heritability with high genetic advance was observed in number of capsule per plants. This result was inconsistent with other results of high heritability and high genetic advance for capsule per plant (Ismaila and Usman, 2014; Hika *et al.,* 2015). High heritability and low genetic advance indicated predominance of non-additive gene action suggesting that these two traits could be improved by pedigree method and population approach of breeding. Considering GCV, PCV, heritability coupled with genetic advance, yield per plant and 1000 grain weight were identified as prominent characters among the materials under study to consider in a breeding programme.

Genotypic and phenotypic correlation is presented in Table 4. This study revealed that none of the characters under study showed significant association with yield per plant which was not in conformity with the results obtained by different researchers (Parameshwarappa *et al.,* 2009; Goudappagoudra *et al.,* 2011; Gidey *et al.,* 2012; Daniya *et al.,* 2013). However, significant correlations among other trait combinations were observed in the present study. Similar correlation pattern among yield attributes were reported by Ganesh and Sakila (1999), Kumar *et al.,* (2009), Fazal *et al.,* (2015), Yol *et al.,* (2010) and Goudappagoudra *et al.,* (2011). It is most common to obtain significant correlation of yield per plant with yield attributes. But the lack of such correlation in the present investigation might be due to difference of the genotype used and environmental effect masking the true genetic correlation. Such estimation warrants use of path coefficient analysis for partitioning effect of yield contributing traits to yield.

Path coefficient analysis based on genotypic correlation is presented in Table 5. The days to 50% flowering followed by 1000 grain weight exerted high direct effect on seed yield. Hence, the direct selection of these traits would be effective. Goudappagoudra *et al.,* (2011) and Ibrahim and Khidir (2012) reported positive direct effects of number of capsules/plant, 1000 seed weight and number of seeds/capsule on seed yield/plant, and Gidey *et al.,* (2012) reported positive direct effects of days to 50% flowering and 1000 grain weight on seed yield. The indirect effects of branches per plant, height of first capsule bearing node and days to maturity via days to 50% flowering were high, indicating the importance of these characters for consideration in the selection programme. High indirect effect of days to maturity via days to 50% flowering to seed yield was also reported by Gidey *et al.,* (2012). Number of seeds per capsule showed a high positive indirect effect through 1000 grain weight and number of branches per plant on seed yield. Present finding was in conformity with Fazal *et al.,* 2015. In case of days to 50% flowering, high direct effect might be nullified by its high negative effect via branches per plant, 1000 grain weight and days to maturity resulting in non-significant association with seed yield. Similarly in case of 1000 grain weight high negative indirect effect via days to 50% flowering has nullified high direct effect resulting in lack of its correlation with seed yield per plant. This path analysis suggested that despite lacking significant correlation of seed yield per plant with yield attributing traits, it was possible to identify important component traits to use in breeding programme. In the present study, the residual effect (0.593) was high in magnitude which showed that some other important yield contributing characters which contributed to yield had to be included. This was in accordance with Sumathi *et al.*, (2007) and Goudappagoudra *et al.*, (2011).

Variability and Path coefficient analysis identified days to 50% flowering and 1000 grain weight, height of 1st capsule bearing node, branches per plant and seeds per capsule as important traits to be considered in sesame improvement programme. The present study also highlighted the potentiality of path analysis to identify important yield attributing traits despite the lack of their direct correlation with yield.

References

Abate M and F Mekbib (2015) Study on genetic divergence in low-altitude sesame (*Sesamum indicum* L.) germplasm of Ethiopia based on agro morphological traits. *Sciences* 2: 78-90.

Bharathi D, VT Rao, YC Mohan, D Bhadru and V Venkanna (2014) Genetic variability studies in sesame (*Sesamum indicum* L.). *Intern. J. Appl. Biol. Pharmac. Technol.* 5: 31-33.

Bharathi D, VT Rao, YC Mohan, D Bhadru and V Venkanna (2014) Genetic variability studies in sesame (*Sesamum indicum* L.). *Intern. J. Appl. Biol. Pharmac. Technol.* 5: 31-33.

Bisht IS, RK. Mahajan, TR Loknathan, and RC Agrawal (1998) Diversity in Indian sesame collection and stratification of germplasm accessions in different diversity groups. *Gen. Res. Crop Evol.* 45: 325-335.

Burton GW (1952) Quantitative inheritance in grasses. *Proc. 6th Int. Grassland Cong*. 1: 227-285.

Burton GW and EH Devane (1953). Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. *Agron. J.* 45: 478-481.

Daniya E, SA Dadari, WB Ndahi, NC Kuchinda and BA Babaji (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. *J. Biol. Agri. Healthcare* 3: 12-16.

Desawi H, A Sentayehu and E Daniel (2014) Assessment of genetic variability, genetic advance, correlation and path coefficient analysis for morphological traits in sesame genotypes. *Asian J.* Agric. Res. 8:181-194.

Dewey DR and K Lu (1959) A correlation and path-coefficient analysis of components of crested wheatgrass seed production. *Agron. J*. 51:515-518.

Fazal A, HSB Mustafa, E Hasan, M Anwar, MHN Tahir and HA Sadaqat (2015) Interrelationship and path coefficient analysis among yield and yield related traits in sesame (*Sesamum indicum* L.).*Nature Sci.*13: 27-32.

Ganesh SK and M Sakila (1999).Association analysis of single plant yield and its yield contributing characters in sesame (*Sesamum indicum* L.). *Sesame Safflower Newsl.* 14: 16-19.

Gangadhara K., JC Prakash, AM Rajesh, C Gireesh, J Somappa and KR Yathish (2012) Correlation and path coefficient analysis in sesame (*Sesamum indicum* L.). *BIOINFOLET-A Quart. J. Life Sci.* 9:303-310.

Gawali CW, KD Bhoite, SR Pardeshi, BM Mhaske and MP Wagh (2007) Study of genetic variability and correlation studies in sesame (*Sesamum indicum* L.). *Agril. Sci. Digest* 27: 282-284.

Gidey YT, SA Kebede and GT Gashawbeza (2012) Assessment of genetic variability, genetic advance, correlation and path analysis for morphological traits in sesame genotypes. *Intern. J. Plant Breed. Genet.* 7: 2-14.

Goudappagoudra R, R Lokesha and ARG Ranganatha (2011) Research note trait association and path coefficient analysis for yield and yield attributing traits in sesame (*Sesamum indicum* L.). *Electr. J. Plant Breed*. 2: 448-452.

Goudappagoudra R, R Lokesha and ARG Ranganatha (2011) Research note trait association and path coefficient analysis for yield and yield attributing traits in sesame (Sesamum indicum L.). *Electr. J. Plant Breed*. 2:448-452.

Hika G, N Geleta and Z Jaleta (2015) Genetic variability, heritability and genetic advance for the phenotypic traits in sesame (*Sesamum indicum* L.) populations from Ethiopia. *Sci. Technol. Arts Res. J.* 4: 20-26.

Ibrahim SE and MO Khidir (2012) Genotypic correlation and path coefficient analysis of yield and some yield components in sesame (*Sesamum indicum* L.). *Intern. J. Agri. Sci.* 2: 664-670.

Iqbal A, R Akhtar, T Begum and T Dasgupta (2016) Genetic estimates and diversity study in sesame (*Sesamum indicum* L.). *IOSR J. Agric. Veter. Sci.* 9: 01-05.

Ismaila A and AUsman (2014) Genetic variability for yield and yield components in sesame (*Sesamum indicum* L.). *Intern. J. Sci. Res.* 3: 63-68.

Johnson HW, HF Robinson and RE Comstock (1955) Estimates of genetic and environmental variability in soybeans. *Agron. J.* 47: 314-318.

Kumar V and SN Sharma (2009) Assessment of genetic diversity of sesame (*Sesamum indicum* L.) genotypes using morphological and RAPD markers. *Indian J. Genet. Plant Breed.* 69: 209-218.

Parameshwarappa SG, MG Palakshappa, PM Salimath and KG Parameshwarappa (2009) Studies on genetic variability and character association in germplasm collection of sesame (*Sesamum indicum* L.). *Karnataka J. Agril. Sci.* 22: 252-254.

Singh RK. And BD Choudhury (1979) Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi, India, pp. 211-215.

Sumathi P, V Muralidharan and N Manivannan (2007) Trait association and path coefficient analysis for yield and yield attributing traits in sesame (*Sesamum indicum* L.). *Madras Agric. J.* 94: 174-178.

Tripathi A, R Bisen, RP Ahirwal, S Paroha, R Sahu and A Ranganatha (2014) Study on genetic divergence in sesame (*Sesamum indicum* L.) germplasm based on morphological and quality traits. *The Bioscan* 8: 1387-1391.

Ukaan S and P Ogbonna (2012) Genetic variability and character association in sesame (*Sesamum indicum* L.) accessions. *Intern. J. Plant Breed.* 6: 139-143.

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

How to cite this article:

Labhya Rani Gogoi and Sarma, R.N. 2019. Variability and Path Coefficient Analysis in Sesame (*Sesamum indicum* L.). *Int.J.Curr.Microbiol.App.Sci.* 8(07): 229-237.
doi: https://doi.org/10.20546/ijcmas.2019.807.029