Indian Res. J. Genet. & Biotech. 5(3) : 186-193 (2013)

Variation and character association in seed yield and related traits in sesame (*Sesamum indicum Linn.*)

R.S. Shekhawat, S.S. Rajput, S. K. Meena and Bhuri Singh

Department of Plant Breeding and Genetics, S.K.N. College of Agriculture (Swami Keshwanand Rajasthan Agricultural University) JOBNER 303 329 (Rajasthan), India

(Received : May, 2013 : Revised : June, 2013; Accepted : July, 2013)

Abstract

An evaluation of fifty five genotypes of sesame (Sesamum indicum Linn.) for seed yield and related characters in randomized block design revealed highly significant differences among the genotypes for days to flowering, plant height, capsule bearing length, capsule per plant, capsule length, capsule girth, seeds per capsule, seeds per capsule, test weight, seed yield per plant, days to maturity and oil content. Genotypic correlation coefficients were higher than the respective phenotypic correlation coefficients for all the characters. Broad sense heritability ranged from 10.20% (branches per plant) to 97.10% (days to flowering), confirming that genotypic variance has contributed substantially to the total variance. The association and path coefficient analysis revealed that capsules per plant, seeds per capsule, oil content and plant height were the important characters and may be selected to increase the seed yield ability. Based on means, considering together for various characters the genotype ES-111 was found to be superior for seed yield per plant, capsules per plant, capsule length, capsule girth, seeds per capsule and oil content; RT-127 for early flowering, plant height, capsule bearing length, branches per plant, capsules per plant, seed yield per plant and oil content; RT-244 for seed yield per plant, plant height, branches per plant, capsules per plant, capsule length and oil content; RT-46 for seed yield per plant, plant height, capsules per plant, seeds per capsule, test weight and oil content; AHT-37 for earliness, capsule bearing length, capsule length, capsule girth, test weight oil content and seed yield per plant. Therefore, these genotypes should be utilized in further breeding programme for developing superior varieties.

Key words:

Sesame, coefficient of variation, heritability, genetic advance, correlation and path coefficient

Introduction

Sesame (Sesamum indicum L.) is a member of family pedaliaceae and one of the important oilseed crop of kharif season grow in the country since antiquity. In India, it is mainly cultivated in the states of UP, Rajasthan, M.P., Gujrat, Tamil Nadu, Maharashtra, West Bengal, Andhra Pradesh and Orissa. In Rajasthan it is cultivated in 5,12,765 ha area with an annual production of 1,66,335 tones and productivity of 324.5 kgha-1 (Anonymous, 2012). Rajasthan is the largest state as far as the area is concerned, however, production and productivity is less as compared to other states. Obviously if productivity of the sesame has to be improved, high yielding varieties with better quality

Correspondance author's e-mail : rsshekabat@gmail.com, meenasureshmeena@gmail.com, bhurisingh@gmailc.com
Published by Indian Society of Genetics, Biotechnology Research and Development, 114, IInd floor Biotech Bhawan, Puspanjali Commercial Complex, Shastripuram Road, Sikandra 282007
Onlince management by www.isgbrd.co.in

will have to be developed. It is a well established fact that the progress in improvement of a crop depends on the degree of variability in the desired characters in base material. In the present study therefore, variability for seed yield and related attributes along with oil content was estimated in a collection of 55 genotypes.

Materials And Methods

The experimental material consisting of 55 genotypes of sesame (Sesamum indicum L.) representing various agro-climatic regions was grown in a randomized block design with three replications at research farm of S.K.N. College of Agriculture, Jobner (Rajasthan) during kharif 2011. Each plot consisted of 3 x 1.20 m2 Size, accommodating 4 rows spaced 30 cm apart maintaining plant to plant distance of 10 cm. All the recommended agronomic practices were followed to raise the experimental crop. Observations on days to flowering and days to maturity were recorded on whole plot basis while for rest of the characters data were recorded on 10 randomly selected plants from each plot and their mean was calculated and analysed to work out the variance (Panse and Sukhatme, 1967), coefficients of variability (Burton and Dewane, 1953), heritability in broad sense (Hanson *et al*., 1956), genetic advance and correlation coefficients (Robinson *et al*., 1951), path coefficients (Dewey and Lu, 1959).

Result and Discussion

The analysis of variance indicated that adequate variability was recorded in the genotypes for almost all the characters studied except branches per plant, which was further confirmed from the existence of significant differences among different entries based on pooled effect of all the characters as indicated in "genetic divergence" studies. Presence of significant variability in sesame was earlier reported by Trehan *et al*. (1975) and Yadava and Yadava (1980).

The data on mean, range, variability, heritability and genetic advance are presented in Table 1. The estimates of PCV and GCV were in close to each other for most of the characters, indicating that the environment had little influence on expression of these characters. Seed yield per plant, capsules per plant, capsule bearing length and plant height showed high PCV and GCV estimates. There is enough scope for selection based on these characters, and the diverse genotypes can provide material for a sound breeding programme.

Estimates of heritability and genetic advance in combination are important for selection than heritability alone (Lush, 1949). Heritability combined with high genetic advance (as percentage of mean) observed for seed yield per plant, capsules per plant, plant height and days to flowering showed that these characters were controlled by additive gene effects and phenotypic selection for these characters is likely to be effective. Days to maturity and oil content also had high heritability; but recorded low genetic advance. Low heritability along with low genetic advance was recorded for capsule bearing length, branches per plant, capsule length, capsule girth, seeds per capsule and test weight which shows that these characters are controlled by non-additive gene action. As some traits are governed by additive and others by non-additive genes, diallel selective mating or biparental mating may be adopted for improvement of yield and quality in sesame.

The genotypic and phenotypic correlation coefficients worked out among different characters including seed yield per plant revealed that in general the genotypic correlation coefficients were higher than respective phenotypic correlation coefficients (Table 2). Lower phenotypic correlations may result from the modifying effect of environment on the association of characters at genetic level. Genotypic correlation coefficient indicate a measure of genetic association between characters and therefore, help in identifying the characters which are important and

need to be considered for improvement of seed yield. As there is no suitable test of significance available for genotypic correlation, their main usefulness is in strengthening the interpretations based on phenotypic correlations (Pandey and Gritton, 1975). In present investigation, seed yield per plant was positively associated with plant height, capsule bearing length, capsules per plant, capsule length, capsule girth, seeds per capsule, test weight and oil content at genotypic as well as phenotypic level. Similar results were also recorded by Gupta and Labana (1983) indicating that seed yield was positively correlated with plant height, number of capsules per plant, length of the fruit bearing branches.

It is also noted that characters plant height, capsule bearing length, capsules per plant, capsule length, capsule girth, seeds per capsule, test weight and oil content exhibiting positive association with seed yield per plant have also shown positive association among themselves which shows consistency in association among the characters. Among these characters, plant height, capsules per plant and oil content also having high broad sense heritability and high expected genetic advance (expressed as % of mean) should be used in selection programme.

Furthermore, the path coefficient analysis based on genotypic correlation coefficient revealed that the highest positive correlation of seed yield was observed with seeds per capsule, oil content, capsules per plant and plant height, which exerted positive and high direct effects on seed yield per plant (Table 3). The highest direct effect was recorded in oil content followed by test weight, seeds per capsule, capsules per plant and plant height. Bhele *et al*. (1987) recorded that 1000-seed weight, number of capsules per plant and number of seeds per capsule had positive direct effect on seed yield. This confirms the role of these characters in determining the seed yield and therefore, their values in constructing the selection criterion.

The conclusion that can be reached from the variability, correlations and path coefficient is that capsule per plant is the most important component character for seed yield per plant. The other important characters are seeds per capsule, oil content and plant height which should be considered as selection criteria including seed yield per se in a selection programme.

Based on the results of the means some genotypes identified superior for different characters are RT-54, RT-256, TC-25 and 8/68 Local for early flowering; ES-111, RT-127, RT-46 and GRT-8327 for plant height; TKG-105, GRT-8327, RT-127 and OMT-34 for capsule bearing length; RT-127, RT-78, TC-25 and RT-244 for branches per plant; RT-127, RJS-141, ES-111 and 5/88 Local for capsules per plant; Guj Til-1, ES-2415, AHT-37 and RT-78 for capsule length; TNAU-64, ES-131-1-84A, C-50 and HT-20 for capsule girth; Guj. Til-1, ES-111, 5/88 Local and AHT-112 for seeds per capsule; ES-2415, RJS-5-2, TC-326 and RJS-165 for test weight; AHT-37, 8/68 Local, TC-25 and RT-256 for early maturity; ES-111, AHT-112, RT-46 and RT-244 for oil content; ES-111, RT-127, Pali Local, RT-244 and RT-46 had higher seed yield per plant. Considering together the various traits, the genotype ES-111 was found to be superior for seed yield per plant, capsules per plant, capsule length, capsule girth, seeds per capsule and oil content; RT-127 for early flowering, plant height, capsule bearing length, branches per plant, capsules per plant, seed yield per plant and oil content; RT-244 for seed yield per plant, plant height, branches per plant, capsules per plant, capsule length and oil content; RT-46 for seed yield per plant, plant height, capsules per plant, seeds per capsule, test weight and oil content; AHT-37 for earliness, capsule bearing length, capsule length, capsule girth, test weight oil content and seed yield per plant. Therefore, these genotypes should be utilized in further breeding programme for developing superior varieties.

Table 1: Range, mean, coefficient of variation, heritability and expected genetic advance for seed yield and related characters in sesame.

Character	Range	Mean	Genotypic coefficient of variation	Phenotypic coefficient of variation	Heritability (broad sense) %	Expected genetic advance % of mean
Days to flowering	35-63	47.04	12.05	12.23	97.10	24.44
Plant height	40.67-84.00	64.15	15.55	17.96	74.90	27.73
Capsule bearing length	11.86-33.93	25.32	11.75	25.06	22.00	11.33
Branches per plant	3.67-5.27	4.43	4.37	13.69	10.20	2.93
Capsule per plant	14.67-41.00	22.06	20.60	24.02	73.50	36.39
Capsule length	1.79-2.89	2.23	7.51	11.35	43.80	10.08
Capsule girth	2.49-3.31	2.87	4.42	8.88	24.80	4.53
Seeds per capsule	38.67-60.53	50.74	6.38	15.27	17.50	5.49
Test weight	0.68-1.00	0.80	6.27	13.37	22.00	6.20
Seed yield per plant	0.84-3.29	1.79	28.65	32.07	79.80	52.45
Days to maturity	75.67-93.00	82.02	5.41	5.52	96.10	10.93
Oil content	35.00-49.00	40.17	8.40	8.68	93.70	16.75

Table 2: Phenotypic (P) and genotypic (G) correlation coefficient among different characters in sesame.

Character		Plant height	Capsule bearing length	Branch per plant	Capsule per plant	Capsule length	Capsule girth	Seeds per capsule	Test weight	Seed yield per plant	Days to maturity
Days to flowering	**P**	**-0.046**	**-0.200**	**-0.212**	**-0.092**	**-0.159**	**0.128**	**-0.104**	**-0.112**	**-0.119**	**0.732****
	G	**-0.055**	**-0.441****	**-0.721****	**-0.124**	**-0.263***	**0.240**	**-0.246**	**-0.262***	**-0.134**	**0.753****
Plant height	**P**		**0.494****	**0.233**	**0.743****	**0.320***	**0.184**	**0.302***	**0.134**	**0.728****	**0.0758**
	G		**0.791****	**0.377****	**0.824****	**0.475****	**0.239**	**0.782****	**0.352****	**0.812****	**0.105**
Capsule bearing	**P**			**0.284***	**0.423****	**0.221**	**0.087**	**0.148**	**0.092**	0.357**	**-0.066**
Length	**G**			**0.931****	**0.631****	**0.428****	**-0.115**	**0.419****	**0.631****	0.591**	**-0.139**
Branches per plant	**P**				**0.333****	**0.272***	**0.203**	**0.123**	**0.019**	0.237	**-0.198**
	G				**0.420****	**0.388****	**-0.250***	**0.135**	**0.405****	0.322*	**-0.510****
Capsule per plant	**P**					**0.236**	**0.131**	**0.263***	**0.011**	0.796**	**0.045**
	G					**0.365****	**0.053**	**0.775****	**0.225**	0.863**	**0.050**
Capsule length	**P**						**0.287***	**0.449****	**0.068**	0.410**	**-0.259**
	G						**0.439****	**0.780****	**0.202**	0.522**	**-0.338****
Capsule girth	**P**							**0.369****	**0.132**	0.256*	**0.177**
	G							**0.509****	**0.519****	0.396**	**0.397****
Seeds per capsule	**P**								**-0.012**	0.508**	**-0.076**
	G								**0.492****	1.020**	**-0.159**
Test weight	**P**									0.328**	**0.043**
	G									0.596**	**0.046**
Seed yield per plant	**P**										**0.013**
	G										**0.027**
Days to maturity	**P**										
	G										

Table 3: Direct and indirect effects of different characters on seed yield in sesame at genotypic level.

Character	Days to flower.	Plant height	Capsule bearing length	Branches per plant	Capsule per plant	Capsule length	Capsule girth	Seeds per capsule	Test weight	Days to maturity	Oil content
Days to flowering	**-0.125**	**-0.015**	**-0.001**	**0.313**	**-0.002**	**-0.032**	**-0.112**	**-0.083**	**-0.099**	**0.160**	**-0.138**
Plant height	**0.007**	**0.278**	**0.001**	**-0.164**	**0.015**	**0.058**	**-0.111**	**0.264**	**0.133**	**0.022**	**0.308**
Capsule bearing Length	**0.055**	**0.220**	**0.001**	**-0.404**	**0.012**	**0.053**	**0.053**	**0.142**	**0.239**	**-0.030**	**0.249**
Branches per plant	**0.090**	**0.105**	**-0.001**	**-0.434**	**0.008**	**0.048**	**0.116**	**0.046**	**0.153**	**-0.108**	**0.297**
Capsule per plant	**0.015**	**0.229**	**0.001**	**-0.182**	**0.018**	**0.045**	**-0.025**	**0.262**	**0.085**	**0.011**	**0.404**
Capsule length	**0.033**	**0.132**	**0.001**	**-0.168**	**0.007**	**0.123**	**-0.204**	**0.263**	**0.077**	**-0.072**	**0.332**
Capsule girth	**-0.030**	**0.067**	**0.000**	**0.108**	**0.001**	**0.054**	**-0.465**	**0.172**	**0.196**	**0.080**	**0.214**
Seeds per capsule	**0.031**	**0.217**	**0.001**	**-0.059**	**0.014**	**0.096**	**-0.237**	**0.338**	**0.186**	**-0.33**	**0.465**
Test weight	**0.033**	**0.098**	**0.001**	**-0.176**	**0.004**	**0.025**	**-0.241**	**0.166**	**0.378**	**0.010**	**0.299**
Days to maturity	**-0.094**	**0.029**	**0.000**	**0.221**	**0.001**	**-0.042**	**-0.176**	**-0.053**	**0.018**	**0.212**	**-0.089**
Oil content	**0.031**	**0.154**	**0.001**	**-0.231**	**0.013**	**0.073**	**-0.179**	**0.282**	**0.202**	**-0.034**	**0.558**

Table 4: Top ranking genotypes selected on the basis of mean of different characters in sesame.

S. No.	Days to flower.	Plant height	Capsule bearing length	Branches per plant	Capsule per plant	Capsule length	Capsule girth	Seeds per capsule	Test weight	Days to maturity
1	RT-54	ES-111	TKG-105	RT-127	RT-127	Guj. Til-1	TNAU-64	Guj.Til-1	ES-2415	AHT-37
	(35.00)	(84.00)	(33.93)	(5.27)	(41.00)	(2.89)	(3.78)	(58.07)	(1.00)	(65.67)
2	RT-256	RT-127	GRT-8327	RT-78	RJS-141	ES-2415	ES-131	ES-111	RJS-5-2	8/68 Local
	(36.00)	(84.00)	(33.67)	(5.20)	(32.33)	(2.86)	(3.31)	(57.47)	(0.98)	(75.67)
3	TC-25	5/88 Local	RT-127	TC-25	ES-111	AHT-37	C-50	5/88 Local	TC-326	TC-25
	(39.00)	(82.00)	(33.60)	(5.13)	(32.00)	(2.83)	(3.31)	(57.30)	(0.96)	(77.00)
4	8/68 Local	RT-46	OMT-34	RT-244	5/88 Local	RT-78	HT-20	AHT-112	RJS-165	RT-256
	(41.00)	(81.00)	(30.70)	(5.10)	(31.33)	(2.74)	(3.20)	(57.27)	(0.93)	(77.33)
5	TKG-105	GRT-8327	AHT-112	TKG-105	Guj. Til-1	RT-244	AHT-123	C-50	RT-256	TKG-84
	(41.00)	(80.33)	(30.60)	(5.00)	(31.00)	(2.72)	(3.16)	(57.17)	(0.92)	(77.33)
6	RT-78	ST-1639	TC-25	TC-326	RT-46	NP-6-3	AHT-37	RT-46	TKG-105	RT-54
	(41.00)	(80.07)	(30.20)	(4.97)	(27.67)	(2.70)	(3.14)	(56.93)	(0.91)	(77.67)
7	RT-127	RT-244	RT-103	TKG-97	AHT-112	5/88 Local	ES-111	ES-131	AHT-37	RT-103
	(41.67)	(76.33)	(29.87)	(4.93)	(27.33)	(2.70)	(3.10)	(56.53)	(0.89)	(77.67)
8	RT-244	ES-2415	AHT-37	ST-1639	RT-244	ES-111	AT-09	GRT-8327	RT-46	TKG-97
	(42.00)	(73.67)	(29.27)	(4.93)	(26.33)	(2.69)	(3.10)	(56.23)	(0.89)	(77.67)

References

1. **Anonymous** (2003). Vital agricultural statistics. Department of Agriculture, Govt. of Rajasthan, Jaipur (Rajasthan).

2. **Bhele O.S.; Khorgade P.W. and Narkhede M.S.** (1987). Estimates of genetic parameters, correlation coefficient and path analysis in sesame. *J. of PKV Research*, **11**(2): 118-122.

3. **Burton G.W. and Devane E.M.** (1953). Estimating heritability in tall fescue (Festuca arundinacea) from replicated colonial material. *J. of Agron.*, **45**: 478-481

4. **Chowdhury S. and Datta A.K.** (2008) Radiation induced macromutation in sesame (Sesamum indicum L.). J. Phytol. Res. **21** (2), 181-185.

5. **Chowdhury S., Datta A.K., Saha A. and Maity S.** (2009) Radiation induced two oil rich mutants in sesame (*Sesamum indicum L.*). Indian J. Sci. Technol. **2** (7), b.51-52.

6. **Dewey D.R. and Lu K.H.** (1959). A correlation and path coefficient analysis of components of erasted wheat grass seed production. *J. of Agron.,* 7: 179-188.

7. **Gupta T.R. and Labana K.S.** (1983). Correlation in sesame. Indian *J. of Agril. Sci.*, **53**(2): 96-100.

8. **Lush J.L.** (1988). A genetic analysis of the main characters in sesame. Oil crops in China, **4**:33-36.

9. **Pandey S. and Gritton E.T.** (1975). Genotypic and variance correlation in peas. Crop Sci., **15**: 1353-55.

10. **Panse V.G. and Sukhatme P.V.** (1967). Statistical methods of agricultural workers, ICAR publication, New Delhi. pp 44.

11. **Robinson H.F., Comstock R.E. and Harvey P.H.** (1951). Genotypic and phenotypic correlations in corn and their implication in selection. *J. of Agron.*, **43**: 262-267.

12. **Sengupta S. and Datta A.K.** (2004) Genetic studies to ascertain selection criteria for yield improvement in sesame. *J. of Phytol. Res.* **17**, 163-166.

13. **Trehan K.B., Rao A.V., Mehta S.K., Chand H., Sharma H.N. and Baijal S.K.** (1975). Genetic dicvergence in sesame. Indian *J. of Agril. Sci.,* **44** (4): 208-212.

14. **Yadav T.P. and Yadav S.K.** (1980). Association of yield and its components in sesame. Indian *J. of Agril. Sci.*, **50**(4): 317-319.

***