IJBPAS, August, 2018, 7(8): 1643-1649

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

GENETIC VARIATION, CORRELATION AND GENE ACTION STUDY FOR YIELD AND OIL QUALITY PARAMETERS IN SESAME

AZMAT M*AND KHAN FA

Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad, Pakistan;

***Corresponding Author: E Mail: azmatguaf@yahoo.com**

Received 15th Feb. 2018; Revised 23rd March. 2018; Accepted 11th April 2018; Available online 1st August 2018

https://doi.org/10.31032/IJBPAS/2018/7.8.4529

ABSTRACT

The research work was carried out by selecting F_1 progenies of a 10×5 line into tester analysis to find out the genetic variation, correlation and gene action study for yield and oil quality traits in sesame. The experiment was undertaken in research area of PBG department, UAF during 2013-14. The genetic association for yield and oil quality parameters was analyzed. The germplasm contained variation for all the characters for which data were calculated. It showed that the effective selection can be made in the genetic material used in the experiment. The results predicted that the values for SCA were more than GCA values for all the parameters under consideration. This showed that all the quality characters had dominant type of gene action. The quality characters such as oil, protein and different valuable fatty acids such as oleic acid, palmitic acid, stearic acid and linoleic acid were all positively correlated with yield of the plant.

Keywords; **Genetic variance, correlation, breeding quality sesame, sesame yield**

INTRODUCTION

The sesame crop had export potential in Pakistan. There is need to raise its production (yield) and export. The demand of sesame is good throughout the world. There is need to produce the sesame of that quality which can meet the exporting standards. The qualities of standard sesame for export must be color sorted, well dried, washed, cleaned and having good oil content that ranged from forty to sixty percent. The other qualities

necessary to meet the demand standards are disease free, pest as well as drought resistant for the country like Pakistan which is facing the water shortage problem due to wrong policies from the government side by delaying the construction of different dams.

As the sesame is ranking down in area as well as production in Pakistan, it had given courage to the scientists especially breeders by having good export earnings among the other oil seed crops of Pakistan. The sesame seeds have good food quality from a long time. To increase the export of sesame the international market standards must be kept in mind during the breeding program planning. The breeders must have the knowhow about the correlation of different parameters of yield and production. [1]. The good knowledge of correlation could be helpful in selection criterion for breeding [2]. The correlation (association) analysis provides good and reliable method for selection [3].

The correlation (inter-relationship) study provides a tool of selection keeping both the direction and magnitude of selection under consideration [4].The knowledge of relation among different yield traits is necessary to have simultaneous selection for two or more variables. A correlation in positive direction between two variables makes it useful to increase both the variables under study [5].

The production of the crop depends upon its ability to accumulate its reserves and its adoption in varying and harsh environment [6-7]. For crop improvement, it is necessary thing to have the correlation knowledge of major yield parameters for effective response for selection [8]. For improvement purpose of major plant parameters, the correlation analysis is important to know [9-10].

MATERIALS AND METHODS

The material of research (i.e. lines of sesame) was obtained by requesting the different agriculture research centers of Pakistan. The experiment was done in the field of PBG Department, UAF. All the genotypes were being sown in the field adopting RCBD pattern using 3 repeats. The R×R and P×P separations were taken to be 45 cm and 15 cm respectively. The data for ten guarded plants were recorded and their mean was calculated for the different yield traits like days to germinate, germinating percentage, days to first flower seen, days to fifty percent flowers, days till maturity, plants heights, length of capsules, width of capsules, capsules number on one plant, grains in one capsule, 1000 grain wt and production per plant.

The oil percentage, protein %age, palmitic, stearic, linoleic and oleic acids were calculated by using Foss NIRS 6500 Systems (near-infrared reflectance spectroscopy) [11].

Analysis of variance was carried out following Steel [12]. For improvement in yield, study of yield contributing components in respect of their genetic mechanism is very important. Evidences related to phenotypic and genotypic correlations in quantitative characters and their indirect and direct effects on the grain yield as an outcome of the response of varieties was considered to be a valuable implement for improving yield per unit area by selection. Simple correlation study showed the degree of association among traits but it cannot give the reasons of this association. That's why; simple correlation coefficients are not always efficient to find out the actual association between traits. Hence there is a need for component analysis.

Genotypic and phenotypic coefficients of variation were computed according to the formula given by Kown and Torrie [13].

$$\text{Genotypic coefficient of variation (GCV)} = \frac{\sqrt{Vg}}{\bar{X}} \times 100$$

$$\text{Phenotypic coefficient of variation (PCV)} = \frac{\sqrt{Vp}}{\bar{X}} \times 100$$

Where

Vg = Genotypic variance

Vp = Phenotypic variance

$\bar{X}$ = General mean of the character

Phenotypic (r_p) and genotypic (r_g) correlation coefficient was calculated according to the formula given by Kown and Torrie [13].

$$r_G = \frac{COV_G(x_1, x_2)}{\sqrt{V_{G.}(x_1).V_G(x_2)}}$$

Where

$COV_G(x_1, x_2)$ = Genetic covariance among x_1 and x_2

$V_G(x_1)$ = Genetic variance for trait x_1

$V_G(x_2)$ = Genetic variance for trait x_2

r_g = The estimate of genotypic correlation coefficient

$$r_p = \frac{COV_p(x_1, x_2)}{\sqrt{V_{p.}(x_1).V_p(x_2)}}$$

Where

$COV_p(x_1, x_2)$ = Phenotypic covariance among x_1 and x_2

$V_p(x_1)$ = Phenotypic variance for trait x_1

$V_p(x_2)$ = Phenotypic variance for trait x_2

r_p = The estimate of phenotypic correlation coefficient

RESULTS

The results showed that replication squares did not give significant results. This showed that there was no experimental error and experiment was conducted in uniform environment. All the variation was because of genetic material. The table 1 predicted that the treatment squares were all significant. As mentioned in the table 1, oleic acid showed significant and high value as 39.59. Similarly yield per plant, proteins percentage, oil percentage and linoleic acid also gave

significant values as 18.16, 16.20, 15.30, and 15.30 respectively. It was evident from the results that the genetic material had the genetic variation and can be very helpful for effective selection and valuable for further breeding program. The mean values for variance are given in table 1.

The results predicted that the values for SCA were more than GCA values for all the parameters under consideration. This showed that all the quality characters had dominant type of gene action. The maximum value for dominant gene action was showed by oleic acid content. The variance due to GCA, SCA and ratio of GCA to SCA were also presented in table 1.

The results showed that oil percentage showed positive and significant association with all the parameters studied but gave high values with protein percentage (0.40), palmitic acid (0.41), and yield per plant (0.44). Similarly protein percentage also gave significant and positive values with all the parameters calculated but gave high values oleic acid (0.80), stearic acid (0.77), and linoleic acid (0.84).Oleic acid also gave the similar results but gave high value with only stearic acid (0.94) and linoleic acid (0.73). Stearic acid also performed well giving high value for linoleic acid (0.72). linoleic acid was positively related with yield per plant. The results of correlation study were presented in table 2.

Table 1: Genetic variances and gene action for yield and oil quality traits

SOV	RSS	TSS	∂ GCA	∂ SCA	∂GCA/∂SCA	Additive	Dominance
OIL%	**0.02**	**15.30****	**-0.05**	**9.61**	**-0.01**	**-0.11**	**9.61**
PR%	**0.01**	**16.20****	**0.07**	**11.01**	**0.01**	**0.14**	**11.01**
OA	**0.09**	**39.59****	**-1.23**	**40.75**	**-0.03**	**-2.46**	**40.75**
PA	**0.002**	**0.22****	**0.01**	**0.14**	**0.06**	**0.02**	**0.14**
SA	**0.02**	**0.78****	**-0.02**	**0.73**	**-0.03**	**-0.04**	**0.73**
LA	**0.55**	**15.30****	**-0.05**	**9.61**	**-0.01**	**-0.11**	**9.61**
YLPP	**0.08**	**18.61****	**2.94**	**6.57**	**0.45**	**5.90**	**6.57**

***Significant (5%) ** Highly significant (1%)**
RSS: Replications sum of square , TSS: Treatment sum of square, OIL%: Oil Percentage, PR %: Protein Percentage, OA:Oleic Acid content, PA: Palmitic Acid content, SA: Stearic Acid content, LA: Linoleic Acid content.YPP:yield/plant

Table 2: Correlation for yield and oil quality parameters						
parameters	**Oil%**	**PR%**	**OA**	**PA**	**SA**	**LA**
PR%	**0.408****					
OA	**0.346****	**0.802****				
PA	**0.412****	**0.235****	**0.314****			
SA	**0.369****	**0.779****	**0.940****	**0.249****		
LA	**0.186***	**0.849****	**0.736****	**0.139***	**0.729****	
YPP	**0.440****	**0.700****	**0.0910****	**0.840****	**0..240****	**0.412****

DISCUSSION

As the experimental study showed that considerable variation had been shown by the genetic material. Similar results were found through morphological studies carried out in sesame by [14-17]. The phenotypic variation was given for all the parameters studied by Ahadu [18]. A considerable variability had been analyzed for sixteen quality and agronomic parameters presented by Akbar [19]. The dominant type of gene action was studied by Sharmila [20]. As most of the parameters had positive association with sesame yield, similar findings were presented by Akbar [21].

CONCLUSION

The germplasm contained variation for all the characters for which data were calculated. It showed that the effective selection can be made in the genetic material used in the experiment. The results predicted that the values for SCA were more than GCA values for all the parameters under consideration. This showed that all the quality characters had dominant type of gene action. The quality characters such as oil, protein and different valuable fatty acids such as oleic acid, palmitic acid, stearic acid and linoleic acid were all positively correlated with yield of the plant.

ACKNOWLEDGEMENT

Authors acknowledges equally to all the authors of the research paper.

REFERENCES

[1] Pandey, S., and E. T. Gritton. 1975. Genotypic and phenotypic variances and correlations in peas. Crop Sci. 15 353-356.

[2] Yassin TE .1973.Genotypic and phenotypic variances and correlations in field beans (*Viciafaba*L.). J Agric Sci. Camb 81:445–448.

[3] Falconer, D.S.1981.Introduction to quantitative genetics. 2nd Ed.Long man,new york.

[4] Chandra, R., Kewalanand, Y.P. Jo and S. Singh. 2012. Correlation studies in multicut forage sorghum

grown under different environments. Forage Res.4:263-265.

[5] Khairwal IS, Rai KN, Andrew DJ Harinarayana G (1999). Pearl millet breeding.Oxford and IBH Publishing Co.New Delhi.p 511.

[6] Ikanovic, J., D. Glamoclija, R. Maletic, V. Popovic, D. Sokolovic, M. Spasic and S. Rakic.2011.Path analysis of the productive traits in *sorghum* species. Gene.2:253-262.

[7] Casler, M.D.2001.breeding forage crops for increased nutritional vaue. In Sparks, D.L. (ed.) Advances in Agronomy, Vol. 71. Academic Press , San Diego, CA.

[8] Ikanovic, S., S. Rakic, J Jankovic., J. Kuzevski, L. Zivanovic and Z. Lakic. 2010. Correlation coefficients of morphological-productive traits of species of sorghum genus. Biotechnol.Animal Husb. 3:585-593.

[9] Radivic J.2009.New Alfalfa cultivar.a periodical of scientific research on field and vegetable crops.44:143-149.

[10] Sokolovic D. 2006.Genetic variability of perennial Rhy grass.Autochthous populations. In: proceedings fo 26th EUCARPIA fodder crops and amenity grass s section, 3-7.253-256

[11] Anonymous, 1998.NIR calibration in practice. Available: http://dx.doi.org/1-:1051/analusis:199826040038.

[12] Steel, R.G.D., J.H. Torrie and D.A. Dickey. 1997. Principles and Procedures of Statistics: A biometrical approach. McGraw Hill Book Co. New York.

[13] Kwon, S.H. and J.H. Torrie. 1964. Heritability and inter-relationship among traits of two Soybean Populations. Crop Sci. 4:196-198.

[14] Bedigian, D and Harlon, J. R. 1986. Evidence for the cultivation of sesame in the ancient world. Econ. Bot.40: 137-154.

[15] Baydar, H., Marquard, R. & Turgut, I. (1999). Pure line selection for improved yield, oil content and different fatty acid composition of sesame, *Sesamum indicum*. Plant Breed. 118(5), 462-464.

[16] Bisht, I.S., Mahajan, R.K., Loknathan, T.R. & Agrawal, R.C. (1998). Diversity in Indian sesame collection and stratification of germplasm accessions in different diversity groups. Genet. Resour. Crop Evol. 45(4), 325-335.

[17] Xiurong, Z., Z. Yingzhong1, C. Yong, F. Xiangyun, G. Qingyuan1, Z. Mingdeand T. Hodgkin. 2000. Establishment of sesame germplasm core collection in China..Gen. Res. and Crop Evo. 47: 273–279.

[18] Ahadu and Menzir.2012. Phenotypic variability, divergence analysis and heritability of characters in sesame (*Sesamum indicum L.*) genotypes. Nat.&Sci. 10:117-126.

[19] Akbar, F., M.A. Rabbani, Z.K Shinwari and S.J. Khan. 2011. Genetic divergence in sesame (*Sesamum indicum* L.) landraces based on qualitative and quantitative traits. Pak. J. Bot.43: 2737-2744.

[20] Sharmila, V., S.K. Ganesh, M. Gunasekaran. 2007. Generation mean analysis for quantitative traits in sesame (*Sesamum indicum L.*) crosses. Genet. Mol. Biol.30: 80-84.

[21] Akbar, F., M.A. Rabbani, Z.K Shinwari and S.J. Khan. 2011. Genetic divergence in sesame (*Sesamum indicum* L.) landraces based on qualitative and quantitative traits. Pak. J. Bot.43: 2737-2744.