Environment and Ecology 40 (4A) : 2235—2238, October—December 2022
ISSN 0970-0420

Estimation of Genetic Variability, Heritability and Genetic Advance for the Phenotypic Traits in Sesame (*Sesamum indicum* L.)

Kartikey Sootrakar, S.K. Payasi, R.P. Joshi, Sudhanshu Pandey

Received 14 July 2022, Accepted 25 August 2022, Published on 4 November 2022

ABSTRACT

The evaluation of phenotypic variability, heritability and genetic advance of Forty-five crosses were made in a diallel manner with ten parents, during *kharif* 2019 conducted at Instructional Farm, College of Agriculture, Rewa (MP). High values for phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) was recorded for number of primary branches per plant followed by number of secondary branches per plant, number of seeds per capsules, capsule length, number of capsules per plant and 1000 seed weight hence improvement through selection could be possible. High heritability was recorded for seed yield per plant followed by biological yield per plant, oil content, capsule length, plant height, 1000 seed weight and number of seeds per capsules. High heritability combined with high genetic advance was recorded for number of secondary branches per plant followed by capsule length, number of seeds per capsules, number of primary branches per plant, seed yield per plant, number of capsules per plant, 1000 seed weight, oil content, plant height, harvest index, days to flower initiation, biological yield per plant, days to 50% flowering and days to maturity.

Keywords Variability, GCV, PCV, Heritability, Genetic advance.

INTRODUCTION

Sesame (*Sesamum indicum* L.), belongs to the family Pedaliaceae, it's chromosome number (2n= 26) a self-pollinated crop, it is an ancient cultivated oil crop and thought to have originated in Africa. Sesame is also known as the "Queen of Oil Seeds" in view of its oil and protein which are of very high property. Sesame is an important source of food globally and constitutes an inexpensive source of protein, fat, minerals and vitamins in the diets of rural populations, especially for children. Sesame is an vital source of high-quality edible oil. The seeds contain 50-60% oil. Which composed of linoleic acid (41%), oleic acid (39%), palmitic acid (8%), stearic acid (5%) and others in small amount. Sesame oil contains vitamin E and various important antioxidant constituents

Kartikey Sootrakar[1]*, S.K. Payasi[2], R.P. Joshi[3], Sudhanshu Pandey[4]
[1] PhD Research Scholar, [2,3] Principal Scientist, [4] Technical Assistant
Department of Genetics and Plant Breeding,
College of Agriculture Rewa, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur 482004, MP, India

Email: kartikeya1995@gmail.com
*Corresponding author

such as sesamol, sesamin and sesamolin, which are believed to promote the integrity of body tissues in the presence of oxidizing compounds.

Black seeded sesame has medicinal properties. Sesame cake is nutritious feed for dairy cattle and it can also be used as fertilizer (Ashri *et al*. 1998). Sesame seeds are peptic, rejuvenative, anti-aging and rich in vitamins E, A and B complex and minerals like calcium, phosphorus, iron, copper, magnesium, zinc, and potassium. This unique composition coupled with high-unsaturated fatty acid (linolenic and tochopherol) make the sesame nearly perfect food.

Though variations in climatic and soil conditions, affect sesame yields and performance, the major constraints identified in growing sesame in most countries are instability in yield, lack of wider adaptability, drought, non-synchronous maturity, poor plant stand, lack of response to fertilizer application, profuse branching, lack of seed retention, low harvest index and susceptibility to insect pests and pathogens. Genetic diversification in crop plants is essential to sustain level of high productivity. Genetic revulsion survives for agronomically important characters in sesame but its production is still very low in India. Conventional 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 characterization and conservation of sesame germplasm are necessary for both safe guarding and the future use of existent genetic resources of sesame. However, the development of modified plant cultivars is restricted mainly due to narrow genetic pool which results into limited possibility to restructure the sesame crop. The understanding of genetic variability in germplasm will help in the selection and breeding of high yielding, good quality cultivars that will increase production.

The study of high level of variability noticed in different sesame germplasm based on morphological traits. The heritability along with genetic advance supports the careful selection of starting material for breeding pro-grams. Success through hybridization followed by se-lection primarily depends on the choice of appropriate parents with high genetic variability for different characters.

A study of the manner in which a particular character behaves in relation to others contributing to seed yield will be great significance in planning successful breeding strategies in any crop improvement program. Yield being a complicated character is influenced by various component characters, which are polygenetically inherited and highly subjected to environmental variation.

Therefore, needs to be placed on the selection of yield attributes which are less effected by the environment. Expect, genotypic and phenotypic coefficient of variation, heritability and genetic advance, a study of correlation among yield and its components and their relative contribution to yield is of great value in the breeding programs.

MATERIALS AND METHODS

Experimental material for the present study consisted of forty-five crosses and ten parents of sesame genotypes grown during *kharif* 2019 at Instructional Farm, College of Agriculture, Rewa (MP) in a randomized complete block design with three replications. Each plot consisted of two rows of 2 m length spaced at 35 cm between rows and 10 cm between plants. Normal recommended agricultural practices and plant protection measures were followed. Three competitive plants were randomly selected for recording biometrical observations on days to flower initiation, days to 50% flowering, days to maturity, number of primary branches, number of secondary branches, number of capsules per plant, capsule length, plant height, number of seeds per capsules, 1000 seed weight, oil content, biological yield per plant, harvest index and seed yield per plant. The mean values were used for analysis of variance. The coefficient of variation was calculated as per Burton. Heritability in broad sense and genetic advance were calculated as per Lush (1949) and Burton and Devane (1953).

RESULTS AND DISCUSSION

High magnitude of genotypic coefficient of variation than phenotypic coefficient of variation indicates the presence of substantial amount of genetic variability in the population and there is little influence of the environment on the expression of the character are

Table 1. Estimates of genetic parameters for fourteen characters of sesame genotypes.

Characters	Grand mean	Range	Coefficient of variation		H^2 (BS)	GA as percent of mean
			GCV	PCV		
Days to flower initiation	39.75	37.0 – 43.0	1.815	2.562	50.2	2.647
Days to 50 % flowering	44.72	42.0-47.0	0.997	1.628	37.5	1.259
Days to maturity	88.22	86.0-92.0	0.511	0.876	34.0	0.614
Number of primary branches per plant	4.13	1.0-3.0	7.268	12.082	36.2	9.006
Number of secondary branches per plant	11.09	8.00-15.00	6.826	8.988	57.7	10.680
Number of capsules per plant	79.92	67.0-93.0	3.700	5.107	52.5	5.523
Capsule length (cm)	2.18	1.70 - 2.60	5.758	6.893	69.8	9.907
Plant height (cm)	86.71	78.20 – 97.40	2.628	3.224	66.5	4.414
Number of seeds per capsules	62.14	46.0 - 73.0	5.637	7.226	60.9	9.059
1000 seed weight (g)	3.45	3.00-3.700	2.945	3.670	64.4	4.867
Oil content %	48.81	45.0 – 54.0	2.702	3.140	74.0	4.789
Biological yield per plant (g)	23.68	22.85 - 24.23	0.787	0.910	74.7	1.400
Harvest index (%)	36.41	39.0 – 33.0	1.964	2.808	49.0	2.831
Seed yield per plant (g)	8.67	8.12 – 9.45	3.070	3.227	90.5	6.015

presented in Table 1. However, in the present study, the phenotypic coefficient of variation was greater than genotypic coefficient of variation for all the traits. The moderate magnitude of both coefficients were recorded for traits viz., number of primary branches per plant, number of secondary branches per plant, number of seeds per capsule and capsule length. This indicates that these characters are highly influenced by environmental effect. Similar findings for traits viz., seed yield per plant, oil content and seeds per capsule were recorded by Nayak *et al*. (2011), Gidey *et al*. (2013), Thirumalarao *et al*. (2013), Bharathi *et al*. (2014) and Abate and Mekbib (2015) for moderate GCV and PCV. For number of primary branches per plant reported by Solanki *et al*. (2003). Bharathi *et al*. (2014), Chandramohan (2014) and Hika *et al*. (2015).

The estimates of phenotypic and genotypic coefficient of variation was low for number of capsules per plant, 1000-seed weight, seed yield per plant, plant height, oil content, harvest index, days to flower initiation, days to 50 % flowering, biological yield per plant and days to maturity. Similar results for are in conformity with Thirumalarao *et al*. (2013), Bharathi *et al*. (2014), Chandramohan (2014), Hika *et al*. (2015) and Abate and Mekbib (2015) for days to 50% flowering; Shekhawat *et al*. (2013), Thirumalarao *et al*. (2013), Tripathi *et al*. (2013) and Bharathi *et al*. (2014) for capsule length; Gidey *et al*. (2012) and Hika *et al*. (2015) for harvest index.

High heritability coupled with moderate genetic advance as per cent of mean were recorded for seed yield per plant, biological yield per plant, oil content, capsule length and plant height indicating the expression of the character may be due to additive gene action. Similar results were reported by Vanishree *et al*. (2013) for seed yield per plant; Gidey *et al*. (2012), Bharathi *et al*. (2014) for harvest index; Ahmed and Ahmed (2013), Ismaila and Usman (2014) for days to 50% flowering.

Moderate heritability with moderate genetic advance as per cent of mean was recorded for 1000 seed weight and harvest index, indicating lesser influence of environment in expression of these characters and may be governed by additive gene action, hence amenable for simple selection. Similar results were reported by Revathi *et al*. (2012), Kumhar *et al*. (2013), Ismaila and Usman (2014) for 1000 seed weight and harvest index. Low heritability with low genetic advance as percent of mean was observed for days to maturity and days to 50% flowering. This indicates the presence of non-additive gene action and hence selection would be ineffective. These results are in conformity with the finding of Suvarna *et al*. (2008) and Sivaprasad and Yadavalli (2013).

CONCLUSION

The phenotypic coefficient of variation was greater

than genotypic coefficient of variation for all the characters. The Moderate magnitude of both coefficients were recorded for traits viz., number of primary branches per plant, number of secondary branches per plant, number of seeds per capsule and capsule length. This indicates that these characters are highly influenced by environmental effect.

Heritability in broad sense and genetic advance are the important parameters for the selection. Low heritability coupled with high genetic advance as per cent of mean were recorded for number of secondary branches per plant and capsule length indicating higher influence of environment in expression of the character and may be governed by additive gene action, hence amenable for simple selection. High heritability coupled with moderate genetic advance as per cent of mean were recorded for seed yield per plant, biological yield per plant, oil content, capsule length and plant height indicating the expression of the character may be due to additive gene action. Moderate heritability with moderate genetic advance as per cent of mean was recorded for 1000 seed weight and harvest index, indicating lesser influence of environment in expression of these characters and may be governed by additive gene action, hence amenable for simple selection. Low heritability with low genetic advance as percent of mean was observed for days to 50% flowering and days to maturity. This represent the presence of non-additive gene action and hence selection would be ineffective.

REFERENCES

Ahmed BMS, Ahmed FA (2013) Variability of yield and some morphological traits in some sesame (*Sesamum indicum* L.) genotypes under rain-fed conditions. *Int J Agric Sci Res* 2(2): 54-59.

Ashri A (1998) Sesame breeding. Pl Breed Rev 16: 179-228.

Bharathi D, Thirumalarao V, Chandramohan Y, Bhadru D, Venkanna V (2014) Genetic variability studies in sesame (*Sesamum indicum* L.).

Burton GW (1952) Quantitative inheritance in grasses Proc. 6th Grassland Congr 1: 356- 363.

Chandramohan Y (2014) Variability and genetic divergence in sesame (*Sesamum indicum* L.). *Int J Appl Biol Pharmaceut Technol* 5(3): 222-225.

Gidey YT, Kebede SA, Gashawbeza GT (2013) Assessment of genetic variability, genetic advance, correlation and path analysis for morphological traits in sesame genotypes. *Int J Pl Breed Geneti* 7(1): 21-34.

Hika G, Geleta N, Jaleta Z (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(1): 20-26.

Ismaila A, Usman A (2014) Genetic variability for yield and yield components in sesame (*Sesamum indicum* L.). *Int J Sci Res* 3(9): 63-66.

Nayak PK, Mishra LD, Pradhan P, Mishra YK (2011) Genetic variability and heritability for seed yield and its components in sesame (*Sesamum indicum* L.). *Crop Res* 41(1-3): 206-209.

Revathi S, John JA, Manivannan N (2012) Genetic variability in sesame (*Sesamum indicum* L.). *Elect J Pl Breed* 3(1): 692-694.

Shekhawat RS, Rajput SS, Meena SK, Singh B (2013) Variation and character association in seed yield and related traits in sesame (*Sesamum indicum* L.). *Ind Res J Genet Biotechnol* 5(3): 186-193.

Siva Prasad YVN, Krishna MSR, Yadavalli V (2013) Correlation and path analysis in F^2 and F^3 generations of cross JLSV 4 x TC 25 in sesame (*Sesamum indicum* L.). *Advan Crop Sci* 3: 370-375.

Solanki ZS, Gupta D (2003) Variability and character association among quantitative characters of sesame. *J Oilseeds Res* 20: 276-277.

Suvarna MH, Manjunatha A, Manjunatha S, Bharathi, Shankar MA (2008) Studies on genetic variability, correlation and path coefficient analysis in sesame (*Sesamum indicum* L.) over locations during early *kharif*. *Crop Res* 35(1 and 2): 99-105.

Thirumalarao V, Bharathi D, Chandramohan Y, Venkanna V, Bhadru D (2013) Genetic variability and association analysis in sesame (*Sesamum indicum* L.). *Crop Res* 46(1-3): 122-125.

Vanishree L, Goudappagoudar Banakar RR (2013) Analysis of genetic variability for yield and its components in sesame (*Sesamum indicum* L.). *Int J Pl Sci* 8(1): 91-93.