

Sesame review

by aditya Dash

Submission date: 03-Oct-2024 04:35PM (UTC+0530)

Submission ID: 2309620988

File name: Ms_IJPSS_124782.docx (369.19K)

Word count: 2698

Character count: 14492

Extend of transgressive segregation¹ for yield related parameters in sesame (*Sesamum indicum* L.)

ABSTRACT

The experiment involved F₂ generation of three superior crosses of sesame: Thilak X Ayali 1, Thilathara X Ayali 2 and Thilak X Ayali 5, grown in a Compact Family Block Design. A total of 200 plants were grown⁴ with a spacing of 30 x 25 cm, and observations were recorded on yield related characters⁵. Significant variation was found among most traits, except for capsule length, capsule width, number of seeds per capsule and the number of primary branches. Plant height had the highest mean and range, showing considerable potential for selection. CV analysis revealed high variability for traits like the number of capsules per plant and seed yield per plant. In contrast, low variability and high stability was observed for traits like capsule length, number of seeds per capsule and days to maturity¹. Higher PCV and GCV⁷ were recorded for traits like days to first flowering, number of capsules per plant, and seed yield per plant, showing substantial genetic and environmental influences. Moderate PCV and GCV were found²⁴ for plant height and days to maturity, while traits like capsule length, number of seeds per capsule, and capsule width had the lowest PCV and GCV, indicating limited genetic variation. Days to first flowering and days to maturity showed high heritability¹⁶ combined with high genetic advance, suggesting the preponderance of additive gene action and are ideal for simple selection. Traits like capsule length, capsule width, and number of seeds per capsule¹¹ showed low heritability and genetic advance, making them less ideal for selection. The cross Thilathara X Ayali 2 exhibited³² a high frequency of transgressive segregants for multiple traits, particularly for seed yield per plant, making it highly promising for further

breeding efforts. This cross should be prioritized in future generations to recover desirable segregants, especially for economically important traits like seed yield.

Keywords: Sesame, F₂ segregants, GCV, PCV, Total transgressive segregants (TTS), Significantly transgressive segregants (STS)

INTRODUCTION

Sesamum (*Sesamum indicum* L.), one of the most ancient oil crops, has been referred to as the 'queen of oilseeds' by virtue of its high-quality oil. It has been under cultivation in Asia for over 5,000 years (Bisht *et al.*, 1998). India is very rich in diversity in cultivated sesame. Its domestication started from the wild progenitor *Sesamum malabaricum* in the Indian subcontinent about 5000 years ago.

Sesame is rich in oil (50%) and protein (18-20%). Nearly 78% of the sesame seed produced in India is used for oil extraction, 21.5% for sowing purpose and rest is used in confections and in religious Hindu ceremonies. Nearly 73% of the oil is used for edible purposes, 8.8% for hydrogenation and 4.2% for industrial purpose in the manufacture of paints, pharmaceuticals and insecticides. Seeds are eaten fried and mixed with sugar and in several forms in sweet meats. The oil is an important cooking oil in south India.

The success of any crop improvement program largely hinges on the nature and extent of genetic variability within the crop. In often-cross pollinated crops like sesame, the natural variability for yield and its component traits is quite limited. Therefore, assessing the genetic variation for yield and related traits, along with their heritability and genetic advance, is crucial for breeders. The F₂ generation is ideal for obtaining superior transgressive segregants, as the segregation pattern in a cross reveal the genetic diversity and assists breeders in identifying outstanding individual plants.

MATERIALS AND METHODS

The experimental material consists of F₂ segregants of three superior crosses of sesame derived from a LXT analysis including Thilak X Ayali 1, Thilathara X Ayali 2 and Thilak X Ayali 5. The segregating population was laid out in a Compact Family Block Design during February - May 2024 in the experimental plot of Department of Genetics and Plant Breeding, College of Agriculture, Vellayani. Altogether 200 plants were maintained. Seeds were sown in rows at a spacing of 30 X 25 cm. Biometric observations were recorded for nine characters viz, days to first flowering, number of primary branches, number of capsules per plant, capsule length (cm), capsule width (cm), number of seeds per capsule, days to maturity, plant height (cm) and seed yield per plant (g). The data were subjected to analysis of variance (ANOVA) and various genetic parameters were worked out using GRAPES software, version 1.1.0 (Gopinath *et al.*, 2020).

A pooled RBD Analysis of variance was performed using 3 families Thilak X Ayali 1, Thilathara X Ayali 2 and Thilak X Ayali 5 as treatments with 5 replications and 5 progeny lots as locations. These 3 crosses were used for studying transgressive segregation; 25 plants from each cross for each character were studied. Plants in the F₂ generation that exceeded the average mean values of the two parent plants were identified as total transgressive segregants (TTS). Among these, those with significantly higher values than the better parent was classified as significantly transgressive segregants (STS). The phenotypic and genotypic components of variance were calculated using the formula provided by Lush (1940). Heritability in the broad sense was determined following the formula outlined by Hanson *et al.* (1956), while genetic advance was estimated using the method suggested by Johnson *et al.* (1955).

RESULT AND DISCUSSION

The segregating population exhibited a wide range for all the characters studied (table 1). Maximum coefficient of variation was recorded for number of capsules per plant (41.091)

followed by seed yield per plant (40.163). The least coefficient of variation was recorded for capsule length (6.58) closely followed by number of seeds per capsule (6.774). The character number of capsules per plant exhibited a wide range of 78.96 to 109.94 indicating scope for selection for the character among the segregating generation. The number of primary branches also exhibited a wide range which can also be considered a selection criteria for higher yield since the character has been reported to be having a high positive correlation with seed yield (Parvathy, 2023). The characters capsule length and capsule width did not reveal a high variation in the segregating generation.

The PCV and GCV for the characters days to first flowering, number of primary branches and seed yield per plant was comparatively high indicating sufficient scope for selection. The GCV values were relatively low than the respective PCV values for the characters number of primary branches, number of capsules per plant, number of seeds per capsule and seed yield per plant suggesting the influence of environment on these characters. Highest PCV and GCV were recorded for characters seed yield per plant, number of capsules on secondary branches, number of capsules on primary branches and number of capsules per plant. High values of PCV and GCV in segregating populations of sesame were reported for number of branches per plant and seed yield per plant by Siva Prasad *et al.* (2013) and Bharathi and Reddy (2019) and Mahdy *et al.* (2021). The high estimates of PCV and GCV were also reported for number of branches per plant (Sundari *et al.*, 2022; Thouseem, 2022; Gedifew *et al.*, 2023), number of capsules per plant (Roy *et al.*, 2022; Akkiligunta *et al.*, 2024) and seed yield per plant (Mahla *et al.*, 2024, Takele and Dhabessa, 2024) in sesame.

The experiment revealed high heritability and high genetic advance for the characters days to first flowering, days to maturity and plant height suggesting preponderance of additive gene action and the scope of improvement through selection. High estimates of heritability and genetics advance for plant height was reported by Siva Prasad *et al.* (2013) F₂ and F₃

generations of sesame suggesting the possibilities of achieving high genetic progress through selection. Nazrul (2022), Gedifew ²⁸ *et al.* (2023), Mahla *et al.* (2024), Akkiligunta *et al.* (2024) and Takele and Dhabessa (2024) also reported high heritability and ³ high genetic advance for the characters seed yield per plant, number of branches per plant and number of capsules per plant in sesame.

² Genetic analysis for transgressive segregation in F₂ is helpful for determining prepotency of various crosses achieving efficiency in early generation selection. This can reduce the population size in later generation which helps in handling of the breeding material. ⁴ The transgressive segregants are produced by an accumulation of favourable genes affecting yield and yield governing characters. The percentage of total transgressive segregants (TTS) and significantly transgressive segregants (STS) in the F₂ generation across three cross combinations are represented in Table 2.

The estimation of ² percentage of total transgressive segregants (TTS) and significantly transgressive segregants (STS) revealed a very high level of segregation with respect to most of the characters. The TTS and STS was very high ²³ for the character days to first flowering, days to maturity and plant height among the segregants for the cross Thilak x Ayali 1. The cross Thilathara x Ayali 2 exhibited maximum values of TTS and STS ⁴ for the characters number of primary branches, number of capsules per plant, number of seeds per capsule and seed yield per plant. Selection from the segregating population of the cross Thilathara x Ayali 2 will be advantageous for the yield related characters. ¹ The highest percentage of total transgressive segregants (TTS) and significantly transgressive segregants (STS) ¹⁸ for the character days to first flowering and days to maturity was observed in the cross Thilak X Ayali 1 (57.14% and 92.85% respectively). For the character ¹ number of primary branches per plant, all the three crosses have the highest percentage of total transgressive segregants (TTS) value (100%), while the cross Thilathara X Ayali 2 has highest significantly transgressive segregants (STS) value (100%).

High estimates of transgressive segregation were reported for various characters like plant height (Bharathi and Reddy (2019), days to 50% flowering (Kader ³ *et al.*, 2022) and seed yield per plant ((Mahdy *et al.*, 2021) in sesame.

CONCLUSION

Significant variation was observed among most traits, except for capsule length, capsule width, number of seeds per capsule, and the number of primary branches. Plant height had the highest mean and range, indicating significant variation and potential for selection. Coefficient of Variation (CV) analysis revealed that capsule length, number of seeds per capsule, and days to maturity had low CV values, implying greater trait stability. In contrast, the number of capsules per plant and seed yield per plant had higher CV, indicating greater environmental or genetic variability. Higher PCV and GCV were recorded for traits like days to first flowering, number of capsules per plant, and seed yield per plant, reflecting greater genetic and environmental influence. Moderate PCV and GCV were observed for plant height and days to maturity, while the lowest values were recorded for capsule length, number of seeds per capsule, and capsule width, indicating limited genetic variation for these traits. High heritability coupled with high genetic advance for days to first flowering and days to maturity suggests these traits are influenced by additive gene action, making them ideal for simple selection. The analysis suggests that while certain traits are more influenced by genetic factors and suitable for selection, others are heavily impacted by environmental variability. The cross Thilathara X Ayali 2, exhibited a high frequency of transgressive segregants for multiple traits, should be advanced for further breeding to recover desirable segregants, especially for economically important traits like seed yield and stands out for its breeding potential and should be prioritized in future generations for improved yield and related traits.

REFERENCES

- Abd EL-Kader M T, R M Fahmy, H F EL-Shaer, M A Abd EL-Rahman (2022) Genetic variability of yield and yield components for segregating generations in sesame (*Sesamum indicum* L.). Al-Azhar J. Agric. Res. 47(1): 99-108.
- Akkiligunta P, Jatothu J, Usha K B, S K C V (2024) Unveiling the Sesame Germplasm- A Study of Genetic Variability for Yield (*Sesamum indicum*. L). J. Exp. Agric. Int. 46(8): 693-699.
- Bharathi Y, K H Reddy (2019) Variability, heritability and transgressive segregation on yield and its components in F₂ progenies of sesame (*Sesamum indicum* L.) Electron. J. Plant Breed. 10(1): 312-317.
- 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(1): 325-335.
- Finker V C, Poneleit C G, Davis D L (1973) Heritability of rachis node number of *Avena sativa* L. Crop Sci.13(1):84-85.
- Gedifew S, Abate A, Abebe T (2023) Genetic variability in sesame (*Sesamum indicum* L.) for yield and yield related traits. Harran. J. Agric. Food Sci. 27(2): 153- 165.
- Gopinath P P, Parsad R, Joseph B, Adarsh V S (2020) GRAPES: General R shiny based analysis platform empowered by statistics. [https:// www.kaugrapes.com/home](https://www.kaugrapes.com/home).
- Hanson C H, Robinson H F, Comstock R E (1956) Biometrical studies of yield in segregating populations of Korean lespedza. Agron. J. 48(6): 268-272.

- Johnson H W, Robinson H F, Comstock R E (1955) Estimates of genetic and environmental variability in soybeans. *Agron. J.* 47(1): 314-318.
- Lush J L (1940) Intra - sire correlation and regression of offspring on dams as a method of estimating heritability of characters. *Proc. Amer. Soc. Anim. Prod.* 33(1): 293- 301.
- Mahdy R E (2021). Selection in two segregating populations of sesame under artificial infection of *Macrophomina phaseolina* (Tassi) Goid. *SVU-Int. J. Agri. Sci.* 3(4): 214-224.
- Mahla N U, P K Jagtap, H R Patel (2024) Genetic Variability and Association among Yield and Yield Related Traits of Sesame (*Sesamum indicum* L.) Genotype. *Int. J. Plant & Soil Sci.* 36(2): 197-206.
- Mohammed N I (2022) Genetic variability studies of sesame (*Sesamum indicum* L.) genotypes. M.Sc. Thesis. Sher-e-Bangla Agricultural University, Dhaka.
- Parvathy (2023) Potential of sesame (*Sesamum indicum* L.) genotypes with respect to yield and phyllody tolerance in Onattukara region. M.Sc. thesis. Kerala Agricultural University, Thrissur.
- Roy B, Pal A K, Basu A K (2022) The estimation of genetic variability and genetic divergence of some advance lines of sesame based on morphological traits. *Plant Sci. Today.* 9(2): 281-287.

Siva Prasad Y V N, M S R Krishna, Venkateswarlu Yadavalli (2013) Correlation and Path analysis in F₂ and F₃ generations of Cross JLSV 4 X TC 25 in sesamum (*Sesamum indicum* L.). *Advanced Crop Sci.* 3(5): 370-375.

Sundari K S, Vasline Y A, Saravanan K (2022) Selection of traits for seed yield improvement through variability parameters in sesame (*Sesamum indicum* L.) genotypes. *J. Appl. Nat. Sci.*14(3): 829-834.

Takele F, Dhabessa A (2024) Genetic Variability Study in Ethiopian Sesame (*Sesamum indicum* L) Genotypes at Western Oromia. *Asian J. Biol Sci.* 17(2): 221-227.

Thouseem N (2022) Development of superior varieties in white seeded sesame for seed yield and oil content. PhD. Thesis. Kerala Agricultural University, Thrissur

UNDER PEEK

Table 1. Mean, co-efficient of variation, heritability (broad sense) and genetic advance as percent of mean for yield related characters in F₂ progenies of sesame

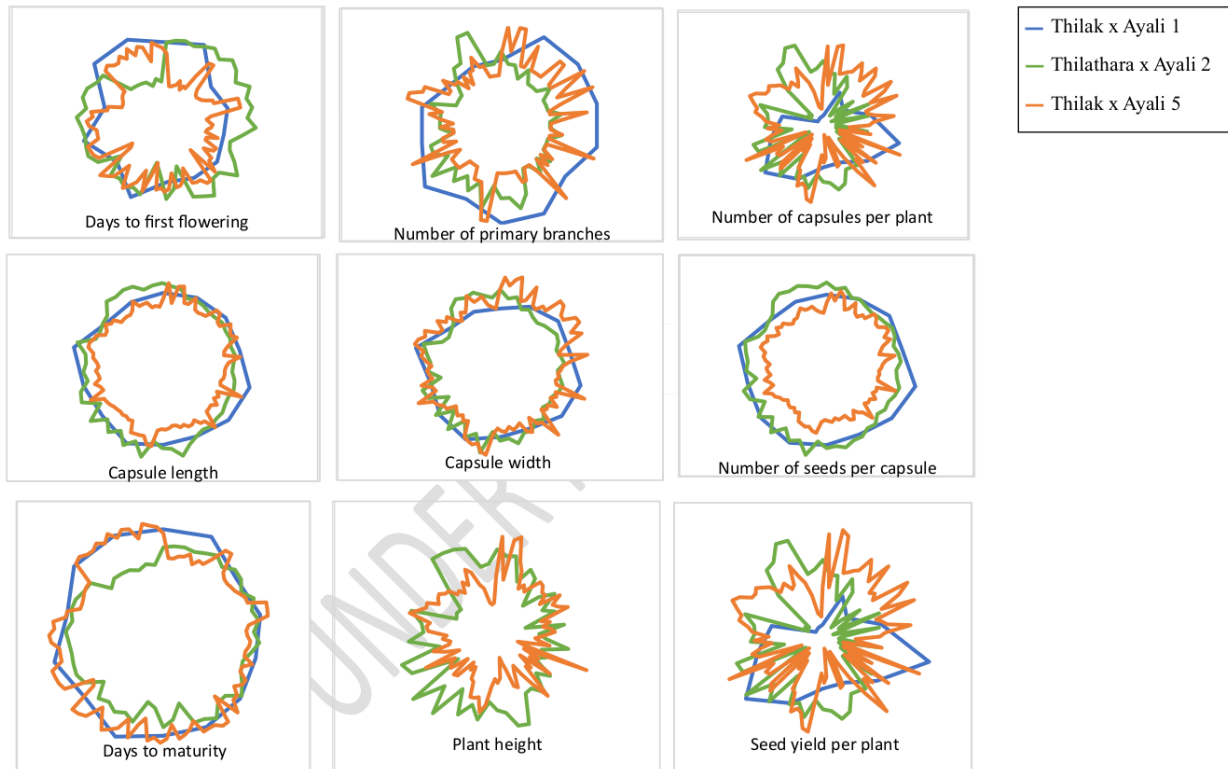
Sl.No.	Characters	Mean	Range	CV	PCV	GCV	H ²	GA
1.	Days to first flowering	49.66	45.78-53.55	19.598	55.424	51.843	87.5	99.898
2.	Number of primary branches	5.13	4.78-16.46	17.085	15.955	6.12	14.7	4.82
3.	Number of capsules per plant	94.45	78.96-109.94	41.091	45.701	20.002	19.2	18.034
4.	Capsule length (cm)	2.09	2.09-2.09	6.58	7.24	3.019	17.4	2.594
5.	Capsule width (cm)	0.74	0.73-0.75	10.379	11.369	4.642	16.7	3.903
6.	Number of seeds per capsule	51.41	50.95-51.87	6.774	7.257	2.605	12.9	1.927
7.	Days to maturity	100.56	97.99-103.12	8.647	27.258	25.85	89.9	50.499
8.	Plant height (cm)	100.73	97.47-104.06	20.456	33.222	26.177	62.1	42.49
9.	Seed yield per plant (g)	14.65	13.32-15.97	40.163	43.754	17.359	15.7	14.186

Table 2. Percentage of total transgressive segregants (TTS) significantly transgressive segregants (STS) in the F₂ generation

Characters	Thilak X Ayali 1		Thilathara X Ayali 2		Thilak X Ayali 5	
	TTS	STS	TTS	STS	TTS	STS
Days to first flowering	57.14	57.14	14.81	9.25	29.7	27.72
Number of primary branches	100	78.57	100	100	100	63.36
Number of capsules per plant	35.71	14.28	66.66	40.74	56.43	33.66
Capsule length (cm)	7.14	7.14	29.62	24.07	18.81	31.48
Capsule width (cm)	100	100	100	100	100	100
Number of seeds per capsule	7.14	0	29.62	22.22	14.85	7.92
Days to maturity	92.85	92.85	16.66	16.66	46.53	46.53
Plant height (cm)	64.28	28.57	40.74	1.85	11.88	11.88
Seed yield per plant (g)	35.71	14.28	61.11	31.48	49.5	14.85

UNDER PEER REVIEW

Fig 1. Variation for the yield related characters in the F₂ segregating populations of three crosses of sesame



Sesame review

ORIGINALITY REPORT

49%
SIMILARITY INDEX

45%
INTERNET SOURCES

47%
PUBLICATIONS

23%
STUDENT PAPERS

PRIMARY SOURCES

1 krishikosh.egranth.ac.in 8%
Internet Source

2 ejplantbreeding.org 6%
Internet Source

3 www.researchgate.net 6%
Internet Source

4 safflower.wsu.edu 5%
Internet Source

5 Madan Mohan Agrawal, Sangram Singh, Shenha Macwan, N Sasidharan, M.N. Wawge. " Genetic variability analyses for economic traits in sesame (L.) germplasm ", Electronic Journal of Plant Breeding, 2018 3%
Publication

6 link.springer.com 2%
Internet Source

7 Submitted to Indira Gandhi Agricultural University 1%
Student Paper

8	archive.saulibrary.edu.bd:8080 Internet Source	1 %
9	Hotti, Avinalappa. "Study on Combining Ability in Early Maturing Chickpea (<i>Cicer arietinum</i> L.) With Special Reference to Terminal-Heat Stress.", Bidhan Chandra Krishi Viswavidyalaya University (India), 2020 Publication	1 %
10	Submitted to Kasetart University Student Paper	1 %
11	mafiadoc.com Internet Source	1 %
12	isor.in Internet Source	1 %
13	www.ejplantbreeding.org Internet Source	1 %
14	Submitted to Mansoura University Student Paper	1 %
15	journals.e-palli.com Internet Source	1 %
16	Sunil K. Yadav, Ashok K. Singh, Praveen Pandey, Smita Singh. "Genetic Variability and Direct Selection Criterion for Seed Yield in Segregating Generations of Barley	1 %

(<i>Hordeum vulgare</i> L.)", American
Journal of Plant Sciences, 2015

Publication

17

sasapjas.org

Internet Source

1 %

18

Submitted to Higher Education Commission
Pakistan

Student Paper

1 %

19

Rajesh Kumar Kar, Tapash Kumar Mishra,
Banshidhar Pradhan, Ahmed Gaber et al.
"Effectiveness of repeated mutagenesis of
sesame crosses for enhancing polygenic
variability in F2M2 generation", PLOS ONE,
2023

Publication

1 %

20

C. Appunu, G. Hemaprabha, V. Sreenivasa, A.
Anna Durai et al. "Evaluation of sugarcane
genotypes (*Saccharum* sp. hybrid) for multi-
trait stability analysis across diverse
environments", Industrial Crops and
Products, 2024

Publication

1 %

21

Submitted to Orissa University of Agriculture
& Technology

Student Paper

1 %

22

doi.org

Internet Source

1 %

23	jpds.co.in Internet Source	1 %
24	thebioscan.com Internet Source	1 %
25	Barman, Dharmeswar. "Studies on Intermutant Hybridization in Rice.", Gauhati University (India) Publication	<1 %
26	Khan, Imran Ahamad. "Study of Variability and Character Association in Linseed (<i>Linum usitatissimum</i> L.)", Veer Bahadur Singh Purvanchal University, Jaunpur (India), 2018 Publication	<1 %
27	Sathish, Vangaru. "Evaluation of Some Newly Developed Rice Genotypes Under Rainfed Shallow Low Land at New Alluvial Zone of West Bengal.", Bidhan Chandra Krishi Viswavidyalaya University (India), 2020 Publication	<1 %
28	V. K. Tiwari. " Morphological parameters in breeding for higher seed yield in Indian mustard [(<i>L.</i>) Czern. & Coss.] ", Electronic Journal of Plant Breeding, 2019 Publication	<1 %
29	krishi.icar.gov.in Internet Source	<1 %

30

www.thepharmajournal.com

Internet Source

<1 %

31

Priya, S. Shanthi. "Evaluation of Watermelon (*Citrullus lanatus* (Thumb) Matsum and Nakai) Genotypes for yield and Quality", Tamil Nadu Agricultural University (India), 2021

Publication

<1 %

32

Y. Bharathi, K. Hariprasad Reddy. " Variability, heritability and transgressive segregation on yield and its components in F progenies of sesame (*L.*) ", Electronic Journal of Plant Breeding, 2019

Publication

<1 %

33

V.R. Pandey, P.K. Singh, O.P. Verma, P. Pandey. "Inter-relationship and Path Coefficient Estimation in Rice under Salt Stress Environment", International Journal of Agricultural Research, 2012

Publication

<1 %

34

Yirgalem Tsehaye Gidey, Sentayehu Alamerew Kebede, Geremew Terefe Gashawbeza. "Assessment of Genetic Variability, Genetic Advance, Correlation and Path Analysis for Morphological Traits in Sesame Genotypes", International Journal of Plant Breeding and Genetics, 2013

Publication

<1 %

Exclude quotes On

Exclude matches Off

Exclude bibliography On