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Studies on genetic variability and association among seed yield and yield component characters (*Sesamum indicum* L.)

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Abstract
Twenty-five genotypes of sesame were evaluated in a field to study the magnitude of genetic variability, heritability and genetic advance for seed yield and yield contributing traits. The analysis of variance revealed that there were highly significant for all characters studied. Days to 50 percent flowering, plant height, number of primary branches per plant, number of capsules per plant, number of seeds per capsule, capsule length, capsule width, 1000 seed weight, days to maturity and seed yield per plant. The phenotypic coefficient of variation was greater than genotypic coefficient of variation for all the character studied which shows the influence of the environment effect on the characters. Moderate values for phenotypic coefficient and genotypic coefficient was recorded for the traits *viz*., number of primary branches per plant, number of capsule per plant and number of seeds per capsule. High heritability and high genetic advance was recorded for characters *viz*., number of primary branches per plant indicating that these characters were controlled by additive gene effects. High heritability with moderate genetic advance was shown for plant height, number of capsules per plant, number of seeds per capsule, capsule length, capsule width and 1000 seed weight. Moderate heritability coupled with moderate genetic advance was observed for seed yield per plant.

Keywords: *Sesamum indicum*, heritability, variability, genetic advance

Introduction
Sesame (*Sesamum indicum* L.) one of the oldest and most significant oilseed crops to have been cultivated is sesamum. It was domesticated and grown on the Indian Subcontinent around 4000 years ago, during the Harappan and Anatolian civilizations. Sesame seed contains a rich source of protein (18-25%), carbohydrates (13.5%), minerals and polyunsaturated fatty acids, sesame is regarded as a nutrient-dense oilseed crop. Africans and Indians both prefer to cook with sesame oil. It has been known as the "queen of oilseed crops" due to the presence of sesamol, a special antioxidant and higher polyunsaturated fatty acids like oleic acid (43%), linoleic acid (35%), palmitic acid (11%) and stearic acid (7%). Sesame seed yield is strongly associated with several other independent characters. Beside these, the effectiveness of selection for genetic improvement in yield and its contributing characters depends on genetic variability. The present study has been conducted to evaluate the genetic variability in different genotypes of sesame with following objectives. To study genetic variability association among seed yield and yield component characters.

Material and Methods
The present investigation was undertaken to study genetic variability and character associated studies in twenty-five genotypes of sesame (*Sesamum indicum* L.) including one check (Table 1). The experiment was conducted on experimental farm of AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra) during Summer, 2020-2021. The experimental material was evaluated in Randomized Block Design (RBD) with two replications under rainfed condition at experimental farm of AICRP on safflower, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra). Sowing was carried out at the spacing of 45 cm and 15 cm between the rows and plants, respectively. The method of sowing followed was dibbling. One plant per hill was maintained by thinning 15 days after sowing. The recommended dose of fertilizer 30 kg N + 60 kg P_2O_5 + 30 kg K_2O per hectare was applied at the time of sowing. All other cultural practices were undertaken to maintain healthy crop.

Table 1: List of twenty-five sesame genotypes with source of collection used in present investigation

Sr. No.	Genotype	Source
1.	VS-16-009	Vridhachalam
2.	PCS-20-1	Jabalpur
3.	VS-17-030	Vridhachalam
4.	PCS-20-2	Jabalpur
5.	VS-18-005	Vridhachalam
6.	JCS-3970	Jagtial
7.	YLM-146	Yellamanchili
8.	TBS-13	BARC, Mumbai
9.	JCS-1020	Jagtial
10.	AT-378	Areli
11.	TLT-07	Latur
12.	AT-383	Amreli
13.	SST-2	Sabour
14.	AT-429	Amreli
15.	JCS-3603	Jagtial
16.	BRT-04	Sabour
17.	PCUS-18-1	Jabalpur
18.	JCS-3202	Jagtial
19.	IIOS-1101	Hyderabad
20.	JCS RF-2	Jagtial
21.	CUMS-09A	Kolkata
22.	JCS RF-4	Jagtial
23.	GT-10	Amreli
24.	TKG-22	Tikamgarh
25.	Local Check	Pragati

Table 2: Analysis of variance (ANOVA) for ten characters in sesame

Sr. No.	Source of variation	df	Days to 50% flowering	Plant height	No. of primary branches/plant	No. of capsules/plant	No. of seeds/capsule	Capsule length	Capsule width	1000 Seed weight	Days to maturity	Seed yield/ plant
1.	Replication	1	3.790	34.789	0.023	0.037	6.175	0.033	0.001	0.025	3.204	0.468
2.	Genotypes	24	13.000**	218.630**	0.676**	53.629**	39.555**	0.145**	0.016**	0.209**	6.965**	2.368**
3.	Error	24	1.739	38.140	0.037	8.707	9.614	0.025	0.002	0.033	3.086	0.875

**Significant at 1% level of probability or level of significance

Table 3: Estimates of variability parameters for ten characters in sesame

Characters	Range	Genotypic variance (α^2g)	Phenotypic variance (α^2p)	GCV (%)	PCV (%)	Heritability (BS) (%)	Genetic advance	Genetic advance as % of Mean
Days to 50% flowering	32.50-41.50	3.75	5.49	5.34	6.47	68.34	3.29	9.10
Plant height (cm)	71.80-108.80	60.16	98.30	8.46	10.82	61.20	12.50	13.64
No. of primary branches/plant	2.9-5.1	0.21	0.25	11.15	12.09	85.10	0.87	21.19
No. of Capsule/Plant	24.5-44.3	14.97	23.68	10.83	13.62	63.23	6.34	17.75
No. of Seeds/Capsule	40.8-73.1	43.31	52.92	10.70	11.83	81.83	12.26	19.94
Capsule Length (cm)	2.2-3.2	0.04	0.06	7.29	9.29	61.69	0.32	11.81
Capsule Width (cm)	0.6-1.0	0.01	0.01	8.14	9.79	69.12	0.12	13.94
1000 Seed Weight (g)	2.8-4.0	0.06	0.09	7.18	8.99	64.01	0.39	11.85
Days to Maturity	79.0-92.5	7.95	11.04	3.31	3.90	72.06	4.93	5.79
Seed Yield/Plant (g)	6.1-10.2	0.49	1.37	8.48	14.10	36.22	0.87	10.52

Statistical analysis

Mean value of the characters for each genotype per replication were used for analysis of variance as per methodology advocated by Panse and Sukhatme (1985) [10]. Heritability in broad sense estimates were calculated according to formula suggested by Johnson *et al*. (1955) [7] and the estimates of genetic advance were obtained by the formula given by Johnson *et al*. (1955) [7].

Results and Discussion

1) Range of variability

Range of variability on the basis of mean values was more for the characters plant height (71.80-108.80 cm), number of seed per capsule (40.80-73.10 cm), number of capsules per plant (24.50-44.30) and days to 50 per cent flowering (32.50-41.50). Wide variation for different yield contributing characters in sesame have been reported by several workers including, Kumhar *et al*. (2008) [9], Jadhav and Mohrir (2012) [6], Revathi *et al*. (2012) [13] and Ismaila and Usman (2014) [5].

2) Genetic coefficient of variation

In general the estimates of PCV were high than those for GCV. Moderate GCV values were recorded for the traits *viz*., number of primary branches per plant (11.15%), number of capsules per plant (10.83%) and number of seed per capsule (10.70%). Low GCV values were recorded for the days to 50 per cent flowering (5.34%), days to maturity (3.31%), capsule length (7.29%), capsule width (8.14%), 1000 seed weight (7.18%) and seed yield per plant (8.48%).

3) Phenotypic coefficient of variation

Moderate estimates of PCV were observed for number of primary branches per plant (12.09%), number of capsules per plant (13.62%), number of seed per capsule (11.83%) and seed yield per plant (14.10%). Low PCV values were recorded for the days to 50 per cent flowering (6.47%), days to maturity (3.90%), capsule length (9.29%), capsule width (9.79%) and 1000 seed weight (8.99%).

Similar results were obtained by Pavani *et al*. (2020) [12] for days to maturity. Abhijatha *et al*. (2017) [1] for days to 50 per cent flowering, days to maturity, 1000 seed weight were low GCV, number of branches per plant were moderate. Jadhav and Mohrir (2012) [6] for number of primary branches, days to maturity, capsule length. Higher values of PCV than GCV were also reported by Kumhar *et al*. (2008) [9], Revathi *et al*. (2012) [13] for number of branches per plant and seed yield per plant.

4) Heritability and genetic advance as percent of mean

High estimates of heritability were observed for days to 50 percent flowering (68.34%), plant height (61.20%), number of primary branches per plant (85.10%), number of capsules per plant (63.23%), number of seeds per capsule (81.83%), capsule length (61.69%), capsule width (69.12%), 1000 seed weight (64.01%) and days to maturity (72.06%) whereas, moderate estimates of heritability was observed for seed yield per plant (36.22%).

The estimates of high genetic advance were observed for number of primary branches per plant (21.19%) while the values were medium for the character plant height (13.64%), number of capsules per plant (17.75%), number of seeds per capsule (19.94%), capsule length (11.81%), 1000 seed weight (11.85%), seed yield per plant (10.52%) low value estimates were observed for days to 50 percent flowering (9.10%) and days to maturity (5.79%).

Similar results were obtained by high heritability with moderate genetic advance were obtained by Tushar *et al*. (2020) [16], Kiruthika *et al*. (2018) [8] Sumathi and Murlidharan (2009) [14], Jadhav and Mohrir (2012) [6], Bharathi *et al*. (2014) [3] and Azeez *et al*. (2011) [2]. High heritability with high genetic advance per cent mean for is in accordance with the findings of Parmeshwarappa *et al*. (2009) [11] and Abhijatha *et al*. (2017) [1]. High heritability with low genetic advance for days to maturity is in accordance to Vanishree *et al*. (2011) [17], Chandramohan *et al*. (2014) [4] and Thirumala Rao *et al*. (2013) [15].

Conclusion

The present investigation concluded that, there is much scope for breeder in improvement of yield through selection of genotypes based on the traits viz., plant height (cm), number of capsules per plant, number of seeds per capsule, capsule length (cm), capsule width (cm) and 1000 seed weight (g), highly significant and positive association with seed yield per plant (g).

The traits which are exhibiting high GCV, PCV, Heritability along with high genetic advance and positive association with seed yield per plant could be considered as important traits and selection of these trait will be effective in improvement of yield in sesame. Based on the present studies the genotype viz., IIOS-1101, JCS-3202, PCUS-18-1 and JCS-1020 were exhibited the better performance for nearly most of the traits and were found to be superior for different yield contributing character among all the 25 genotypes including check. Hence, the genotypes could be advanced to next generation.

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