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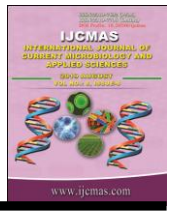

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Genetic Variability Parameters for Yield and Yield Related Traits in Sesame (*Sesamum indicum* L.)

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A B S T R A C T

The evaluation of phenotypic variability, heritability, genetic advance and diversity in germplasm collections is important for both plant breeders and germplasm curators to optimize the use of the variability available. In the present study, Thirteen sesame genotypes were grown during Rabi Summer'2019 at Agricultural College and Research Institute, Kudumiyanmalai (TNAU) taken to assess genotypic, phenotypic variability and heritability coupled with genetic advance. The biometrical and morphological traits such as days to fifty percent flowering, plant height, number of branches, number of capsules per plant, seeds per capsule, thousand seed weight, seed yield per plant and plot yield. The GCV and PCV estimates were found to be high for seed yield per plant, number of capsules per plant and number of branches per plant. High heritability coupled with high genetic advance was observed for the characters seed yield per plant, number of seeds per capsule, number of capsules per plant, number of primary branches per plant and plant height. This indicated the additive genes governed these traits and the improvement could be brought about by selection for these traits. Therefore, these characters can be considered as a criterion for improving seed yield in breeding programs of sesame.

Introduction

Sesame (*Sesamum indicum* L.) is the oldest indigenous oil crops with longest history of its cultivation in India. India is still the world leader with maximum (25.8 %) production from the largest (29.8 %) area and highest export (40 %) of seeds of sesame. In India, sesame is being grown over an area of 16.67 lakh hectares with production of 6.57 lakh tonnes and productivity of 460 kg/ha (Anon., 2014). It is cultivated extensively from tropical regions to the temperate zones in the world. It is fifth important edible oil crop in India after groundnut, rapeseed-mustard, sunflower and soybean. Sesame seed contains

50% oil, 23% protein and 15% carbohydrate (Ranganatha *et al.,* 2012). The crop is highly tolerant to drought, grows well in most of the well-drained soils and various agro climatic regions, and is well adapted to different rotations. It can set seed and yield well under fairlyhigh temperature and can grow in stored soil moisture without rainfall and irrigation. Sesame oil has highest antioxidant content and contains several fatty acids such as oleic acid (43%), linoleic acid (35%), palmitic acid (11%) and stearic acid (7%). It has high commercial attributes by virtue of it being a rich source of quality edible oil enriched with proteins, vitamins, amino acids and antioxidants like sesamin, sesamolin and sesamol (Brar and Ahuja, 1979). Genetic variability is essential for continued genetic improvement of any crop species. Biometrical techniques to assess the genetic variability and the extent of heritability of the economic characters serve as a useful tool in evaluating the segregating population. These techniques will provide an insight into their magnitude of variability available in a crop and are effective in reducing the environmental effects substantially to project the real genetic effects with discrimination of better genotype from the rest. Yield is the resultant product of various morphological, physiological and biological components. To formulate an effective selection technique for increasing the yield, the association analysis among yield and yield contributing characters are important. The magnitude and direction of the association of yield components with yield will help us to programme our selection technique. Phenotypic and genotypic correlation coefficient and the yield components and their contribution in path analysis provide information on their relative importance in determining the yield (Dewey and Lu, 1959). With this background, the present investigation is contemplated with the following objectives 1). To assess the variability parameters in the sesame genotypes. 2) To study the morphological, biometrical and leaf characters of the sesame genotypes.

Materials and Methods

The experimental materials for the present study involves thirteen sesame genotypes were selected including eleven advance sesame culture of Tamilnadu Agricultural University and two checks varieties TMV 7 and SVPR 1 (Table 1). The experiment was conducted in Agricultural College and Research Institute (Tamil Nadu Agricultural University), Kudumiyanmalai, Pudukkottai District of Tamil Nadu during Rabi Summer' 2019. The field experiment was conducted in a randomized block design with two replications. The eleven genotypes and two local checks were raised in a plot size of 4 m x 0.3 m x 4 rows (4.8 m^2). Seeds were sown on 29.01.2019 in ridges and furrows with a plant spacing of 30 x 30 cm. All agronomical practices like thinning, weeding was carried out at right time and irrigation was given at suitable interval. Five plants were randomly selected and biometrical observations were recorded on eight quantitative characters *viz.*, days to fifty per cent flowering, plant height, number of branches per plant, number of capsules per plant, number of seeds per capsule, thousand seed weight (gm), seed yield per plant (g) and plot yield (g). Observations on each character's contributed to the genetic diversity of the sesame genotypes were calculated using mean, variability, PCV and GCV, heritability and genetic advance for advanced cultures of sesame genotypes.

Statistical analysis

Phenotypic and genotypic co-efficient of variation (PCV and GCV) for each character were computed based on the methods given by Burton (1952). The co-efficient of variation

was categorized as proposed by Sivasubramanian and Madhava Menon (1973). The heritability was computed based on the methods given by Lush (1949). The heritability per cent was categorized as suggested by Robinson *et al.,* (1949). Genetic advance and genetic advance as percentage of mean were estimated according to the formula given by Johnson *et al.,* (1955). Statistical analysis was done by using INDOSTAT software.

Results and Discussion

Mean performance of sesame genotypes for yield and yield related traits

The mean for days to fifty percent flowering ranged from 32 days to 39 days. Among the genotypes, COS 16007 have recorded the highest number of days to fifty percent flowering ranging to 39 days (Table 2.) Other genotypes were significantly on par with each other. The mean plant height of 13 sesame genotypes ranged from 96 cm (COS 16007) to 148 cm (COS 14001). Among the genotypes, COS 14001 recorded the highest plant height ranged upto 148 cm. Among the parents, COS 14017 (W) had lowest number of branches (0) while SVPR1 CHECK recorded highest (8) number of branches.

Lowest number of capsules per plant observed in SVPR1 check (133) and highest in COS 13015 (W) (255.7) among 13 sesame genotypes (Table 2). Lowest number of seeds per capsules was observed in TMV7 (48.8) and highest in COS 13015 (W) (82) among 13 sesame genotypes. Lowest Thousand seed weight was observed in COS 14017(W), COS 16009 (2.75g) and highest in TMV7 (3.85g) (Table 2). The seed yield per plant in parents ranged from 11g (SVPR 1) to 21.68g (COS 14017 DW). The plot yield ranged from 229g [COS 13015 (W)] to 628g [COS 13006 (W)]. (Table 2).

Genetic variability for yield traits in sesame genotypes

In the present study, the highest phenotypic and genotypic variances recorded for the trait number of branches per plant and this was followed by the character single plant yield. The character days for fifty percent flowering have exhibited lowest phenotypic and genotypic variances. As the phenotypic and genotypic variances cannot be used for comparing the magnitude of variability directly, the coefficients of variation at phenotypic and genotypic levels have been used to compare the variability observed among the different characters. Since phenotypic and genotypic variances were associated with units of measurements, coefficient of variation was considered to make valid comparisons among the characters. The extent of variability measured by Phenotypic and genotypic co-efficient of variation provides information regarding the relative amount of variation for different characters. However it was not possible to assess the extent of heritable variance present in population. In this study, the GCV values were lower than PCV. In the present study, high GCV and PCV estimates were observed for seed yield per plant, number of capsules per plant, number of branches per plant. It was in accordance with the results obtained by Gidey *et al.,* (2013) and Ismaila and Usman (2014) for number of capsules alone. High coefficient of variation for seed yield per plant was also recorded by Sumathi and Murlidharan (2010) and Parameshwarappa *et al.,* (2009). Gangadhara *et al.,* (2012) and Parameshwarappa *et al.,* (2009) for seed yield/plant; Aristya *et al.,* (2017), Saxena and Bisen, (2016), Desawi *et al.,* (2014), Atul Singh *et al.,* (2018) for number of capsules/plant; Mustafa *et al.,* (2015), Rani (2014) for number of primary branches/plant and number of secondary branches/plant; Narayan and Murugan (2013) for number of seeds/capsule (Table 3).

Table.1 List of sesame genotypes

Sl. No.	Sesame Genotypes (11)
1	COS – 13006
2	COS -13015
3	COS – 14001
4	COS -14017(dw)
5	COS -14017 (w)
6	COS -14018
7	COS -14025
8	COS – 14026(b)
9	COS – 14026(w)
10	COS -16007
11	COS -16009
	Check Varieties (2)
12	TMV 7(b)
13	SVPR 1(w)
	(w) - white; (dw) - dull white ; (b) Brown

Table.2 Mean performance of yield and yield related traits of sesame genotypes

Genotype	Days to 50 % flowering	Plant height (cm)	Number of branches per plant	Number of capsules per plant	Number of seeds per capsule	1000 Seed weight (g)	Seed yield per plant (g)	Plot yield (g)
COS13006(W)	38.0	133.5	4.0	180.0	74.0	3.40	20.2	**628.0**
COS13015(W)	38.0	122.0	4.0	254.0	82.0	3.52	20.3	**605.0**
COS14026(B)	38.0	108.0	4.0	159.0	71.8	3.10	16.0	**426.5**
COS14017(W)	35.0	126.0	1.0	165.0	74.5	2.75	20.8	**551.0**
COS14017(DW)	35.0	125.5	6.5	148.5	74.4	3.15	21.7	**574.0**
COS14018	32.0	135.2	4.5	168.0	67.8	3.35	20.7	**615.0**
COS14025	37.0	141.6	6.0	199.5	65.1	3.52	20.9	**571.0**
COS14026(W)	37.0	100.0	2.5	152.0	74.0	2.85	14.3	**532.5**
COS16007	38.5	97.0	5.5	179.0	64.0	3.41	13.8	**574.0**
COS16009	35.5	133.0	5.0	221.0	64.8	2.75	13.1	**552.0**
COS14001	35.0	146.5	6.0	241.0	65.5	3.55	17.4	**514.0**
TMV 7	38.0	121.5	7.0	155.0	48.9	3.85	11.7	**541.0**
SVPR 1	**38.0**	**105.5**	**7.5**	**132.5**	**66.4**	**2.90**	**11.1**	**529.0**

Table.3 Parameters of genetic variability for yield and yield related traits in sesame genotypes

Characters	PCV (%)	GCV (%)	ECV (%)	Heritability h^2b (%)	GA as (%) of Mean (5%)
Days to fifty per cent flowering	5.206	4.86	1.852	87.3	**9.36**
Plant height	13.12	13.02	1.575	98.6	**26.64**
Number of branches per plant	47.63	44.73	16.365	88.2	**86.54**
Number of capsules per plant	20.86	20.49	3.899	96.5	**41.47**
Number of seeds per capsule	11.63	11.62	0.937	99.4	**23.87**
Thousand seed weight	10.95	10.66	2.497	94.8	**21.39**
Seed yield per plant	22.95	22.84	2.209	99.1	**46.84**
Plot yield	**8.908**	**8.65**	**2.091**	**94.5**	**17.34**

Classes of Heritability (%): High >60 %, Medium 30-60%, Low < 30 %
Classes of Genetic Advance (%): High >20%, Medium 10-20%, Low < 10 %

It indicated that there was greater diversity for these traits in sesame. Hence, direct selection based on these traits would be effective for the improvement of this crop. The PCV and GCV values for 1000 seed weight were medium. Days to maturity had low PCV and GCV estimates indicating low scope of selection for improvement. Similar results were obtained for Gidey *et al.,* (2013). Estimation of genotypic coefficient of variation gives the extent of variability present in the population, but the genotypic coefficient of variation alone does not give the heritable variation present in the population. Hence, heritability and genetic advance, the important selection parameters were worked out which help in understanding the mode of inheritance of quantitative traits. Relative comparison of heritability estimates and genetic advance as per cent of mean would give an idea about the nature of gene action governing a particular character. The estimates of heritability help the plant breeder in selection of elite genotypes from diverse populations. In the present study, high heritability was observed for the characters seed yield per plant, number of branches per plant, plant height, number of capsules per plant and seeds per capsule which was in accordance with the results obtained by Gidey *et al.,* (2013) and Ismaila and Usman (2014) for number of capsules alone. This indicates that selection for these characters would give the best results for selecting sesame genotypes with these traits with high heritability. Similarly high genetic advance as percentage of mean was observed in seed yield per plant and number of branches per plant, which was similar with the results obtained by Gidey *et al.,* (2013) and Menzir (2012) for seed yield per plant alone. But low genetic advance as percentage of mean was observed in case of days for fifty percent flowering. High heritability coupled with high genetic advance was observed for the characters seed yield per plant, number of seeds per capsule, number of capsules per plant, number of branches per plant, plant height. This showed that these characters were controlled by additive gene action and revealed better scope for improvement of these characters through direct selection.

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