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Original Research Article

Morphological Characterization in Sesame (*Sesamum indicum* L.) for Seed Yield and its Component Traits

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A B S T R A C T

Genetic variability and other related parameters in respect of eleven quantitative characters were studied by growing twenty eight genotypes of sesame, *Sesamum indicum* L. at Agricultural Research Station, Mandor-Jodhpur during *kharif*, 2018. Analysis of variance revealed highly significant differences among genotypes for all the eleven characters studied. High genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were recorded for seed yield per plant followed by harvest index, number of capsules per plant, test weight and number of primary branches per plant indicating greater scope for selection of these characters for further improvement programme due to presence of substantial variability in the genotypes while it was moderate for days to 50% flowering, oil content, plant height and protein content indicating the little influence of environment in the observed variability. High heritability and high genetic advance as percent of mean was observed for test weight, number of capsules per plant, seed yield per plant, days to 50% flowering, oil content, harvest index, protein content, number of primary branches per plant and plant height indicating lesser influence of environment in expression of these traits and may be governed by additive gene action, hence selection will be effective.

Keywords

Genetic advance, Genetic variability, Heritability, Sesame

Introduction

Sesame (*Sesamum indicum* L.), belonging to the family Pedaliaceae, is one of the most ancient and important oil seed crop (Mabberley, 1997). It is also known as *til*, *gingelly*, *benniseed* and *sinsim*. *Sesamum indicum*, the cultivated type, is originated in India (Ogasawara *et al.*, 1988). The genus *Sesamum* contains more than 30 species of which *Sesamum indicum* is the commonly cultivated (Nayar and Mehra, 1970). Sesame is a drought tolerant crop particularly at vegetative stage because of its extensive root system. The diploid chromosome number of sesame is 2n=26 and it is usually self-pollinated although cross- pollination reported ranging from 5 to over 50% (Pathirana, 1994).

India, China, Burma and Sudan are the major sesame producing countries that contribute to about 60% of the total world production. Sesame is one of the nine major oilseed crops of India. It is an important *kharif* crop mainly cultivated in states of Gujarat, Rajasthan, Andhra Pradesh, Tamil Nadu, Madhya Pradesh, Maharashtra, Karnataka, Uttar Pradesh, West Bengal, Orissa and Assam. In India, sesame is grown in an area of 13.98 lakh hectare with production of 4.18 lakh tonne with an average productivity of 291 kg/ha, while in Rajasthan it is grown over an area of 2.72 lakh ha with an annual production of 73.55 thousand tonne and productivity of 270 kg/ha (Anno. 2017).

Sesame is grown for its seeds and oil. It had earned a poetic label "Queen of Oilseeds" as its oil and protein are of very high in quality. Sesame is highly nutritive and also possesses high oil (38-54%) and protein content (18-25%). The seed is also used on burger, breads and cakes. Sesame seeds are digestive, rejuvenative, anti aging and rich in vitamins E, minerals like calcium, phosphorus, iron, copper, magnesium, zinc and potassium with this unique composition coupled with high-unsaturated fatty acid (linolinic and tocopherol) make the sesame nearly perfect food (Lokesha and Theertha Prasad, 2006). Sesame oil has long shelf-life due to presence of lignans (which have remarkable antioxidant function), sesamol, tocopherols, sesamolin and their derivatives prevent oxidation of the oil and give it long shelf life and stability (Brar and Ahuja, 1979). All these characters make it holds tremendous potential for export.

In spite of its good quality oil and health benefits, cultivation of sesame is not wide in India due to low yield potential to other crops. The low yield of sesame can be attributed to various factors such as its cultivation in un-irrigated areas, lack of improved varieties tolerant to abiotic and biotic stresses, low harvest index values, significant yield loss during threshing and uneven ripening of capsules. Furthermore, properties such as undefined growth habit, asynchronous capsule ripening and seed shattering are also some important factors which are limiting the production of sesame (Ashri, 1998).

The knowledge of genetic variability in germplasm will help in the selection and breeding of high yielding, good quality cultivars that will increase production. India is wealthy of sesame germplasm and some local cultivars provide raw material for improved varieties (Ali *et al.,* 2009). Amelioration of productivity necessitates us to detection or cataloguing of sesame genotypes along with the assessment of genetic variability in sesame germplasm.

Materials and Methods

A field experiment was conducted with 28 genotypes during *kharif*, 2018 at Agricultural Research Station, Mandor, Jodhpur (Raj.) in Randomized Block Design with three replications. Each genotype was grown in two rows of 0.6 x 4 m size adopting a row spacing of 30 cm. recommended cultural practices and plant protection measures were adopted to raise a good and healthy crop. The traits *viz.*, plant height (cm), number of primary branches per plant, number of capsule per plant, capsule length (cm), seed yield per plant (g), test weight (g), harvest index (%), oil content (%) and protein content (%) were recorded on ten randomly selected plants. However, observations were taken on whole plot basis for days to 50% flowering and days to maturity. The data was subjected to analysis of variance (Panse and Sukhatme, 1985), coefficients of variation (Burton, 1652 and Johnson *et al.*, 1955), heritability in broad sense and genetic

advance (Johnson *et al.,* 1955) as per the standard statistical methods. Statistical analysis was performed using Windo Stat version 9.1 software.

Results and Discussions

Analysis of variance revealed highly significant differences among the genotypes for all the eleven characters *viz.,* days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of capsule per plant, capsule length, seed yield per plant, test weight, harvest index, oil content and protein content indicating the presence of considerable variability among the experimental material of the present study (Table 1). Present results showed similar trend with earlier reports published by Chandra Mohan (2014), Abate *et al.,* (2015), Prithviraj and Parameshwarappa (2017), Singh *et al.,* (2018).

High magnitudes of PCV and GCV were observed for the traits *viz.,* seed yield per plant followed by harvest index (41.96%, 40.73%), number of capsules per plant (39.11%, 38.72%), test weight (25.72%, 25.55%) and number of primary branches per plant (25.51%, 24.11%). These results indicated greater scope for selection of these characters for further improvement programme because of substantial variability present in germplasm lines for these traits. This finding is substantiated by similar results reported by Chandra Mohan (2014) and Tripathy *et al.,* (2016) for number of primary branches per plant; Chandra Mohan (2014), Saxena and Bisen (2016), Teklu *et al.,* (2017), Prithviraj and Parameshwarappa (2017) for number of capsules per plant and seed yield per plant.

Moderate values of PCV and GCV were noticed for characters *viz.,* days to 50% flowering, plant height, oil content and protein content indicating that there is little role of environmental component in the observed variation. Similar results have been reported by Singh *et al.,* (2018) for days to 50 flowering; Chandra Mohan (2014), Saxena and Bisen (2016), Teklu *et al.,* (2017) for plant height. Results contradictory to present findings reported by Saxena and Bisen (2016), Tripathy *et al.,* (2016), Prithviraj and Parameshwarappa (2017) and Singh *et al.,* (2018) for oil content and Saxena and Bisen (2016), Tripathy *et al.,* (2016), Prithviraj and Parameshwarappa (2017) for days to 50% flowering.

Low value of GCV and moderate value of PCV for capsule length were also reported by Abate *et al.,* (2015) and Prithviraj and Parameshwarappa (2017). PCV and GCV were low for days to maturity and which is in conformity to earlier findings of Chandra Mohan (2014), Saxena and Bisen (2016), Tripathy *et al.,* (2016), Teklu *et al., (*2017) and Singh *et al.,* (2018). Low values of PCV and GCV for capsule length and days to maturity indicated there is lesser variability and selection of these traits will be comparatively less effective.

In the present study, high heritability coupled with high genetic advance as per cent of mean were observed for days to 50% flowering, plant height, number of primary branches per plant, number of capsules per plant, seed yield per plant, test weight, harvest index, oil content and protein content indicating lesser influence of environment in expression of these characters and may be governed by additive gene action, hence effective for simple selection.

Table.1 Analysis of variance (ANOVA) for seed yield and its contributing traits

Source	DF	Mean sum of square										
		Day to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches	Number of capsules per plant	Capsule length (cm)	Seed yield per plant (g)	Test weight (g)	Harvest index (%)	Oil content (%)	Protein content (%)
Replication	2	7.30	3.89	129.22	0.26	9.48*	0.05	0.03	0.00	3.51	2.97	0.96
Genotype	27	271.79**	41.36*	413.09**	2.53**	391.36**	0.10*	5.09**	2.15**	470.04**	80.99**	12.00**
Error	54	2.74	20.42	46.41	0.10	2.67	0.05	0.03	0.01	6.30	0.98	0.38

*, ** significant at 5% and 1% levels, respectively

Table.2 Mean, range, variability, heritability (broad sense), genetic advance and genetic advance as per cent of mean for seed yield and its contributing traits

Character	Mean	Range		Coefficient of variation		Heritability (%) (broad sense)	Genetic advance at 5%	Genetic advance as per cent mean at 5%
		Min	Max	Genotypic	Phenotypic			
Day to 50% flowering	52.35	37.00	68.67	18.09	18.37	97.03	19.22	36.71
Days to maturity	84.64	77.33	90.67	3.12	6.18	25.46	2.75	3.24
Plant height (cm)	89.33	67.93	109.27	12.38	14.54	72.48	19.39	21.71
Number of primary branches	3.74	2.13	6.00	24.11	25.51	89.32	1.75	46.93
Number of capsules per plant	29.40	7.63	55.60	38.72	39.11	97.98	23.21	78.95
Capsule length (cm)	2.51	1.93	2.83	4.78	10.35	21.28	0.11	4.54
Seed yield per plant (g)	2.53	1.40	5.33	41.41	42.02	97.12	2.13	84.07
Test weight (g)	3.30	1.87	4.71	25.55	25.72	98.63	1.73	52.27
Harvest index (%)	25.71	8.06	44.56	40.73	41.96	94.22	20.94	81.45
Oil content (%)	35.01	25.99	43.92	14.75	15.02	96.47	10.45	29.84
Protein content (%)	18.65	13.42	20.68	10.55	11.06	91.04	3.87	20.75

Similar results were reported by Bindu *et al.*, (2014), Saxena and Bisen (2016) and Teklu *et al.*, (2017) for plant height; Bindu *et al.*, (2014), Hika *et al.*, (2015), Tripathy *et al.*, (2016) and Singh *et al.*, (2018) for number of branches per plant; Bindu *et al.*, (2014), Hika *et al.*, (2015), Saxena and Bisen (2016), Teklu *et al.*, (2017), Prithviraj and Parameshwarappa (2017) and Singh *et al.*, (2018) for number of capsules per plant; Bindu *et al.*, (2014), Tripathy *et al.*, (2016), Saxena and Bisen (2016), Teklu *et al.*, (2017), Prithviraj and Parameshwarappa (2017) and Singh *et al.*, (2018) for seed yield per plant; Hika *et al.*, (2015) for harvest index and Haibru *et al.*, (2018) for test weight.

Low heritability with low genetic advance as percent of mean was recorded for the characters *viz*, days to maturity and capsule length. This indicates the presence of non additive gene action and hence selection would be ineffective for these traits. These findings are in conformity with the results of Abate *et al.*, (2015) for days to maturity and Tripathi *et al.*, (2013), Teklu *et al.*, (2017) and Singh *et al.*, (2018) for capsule length (Table 2).

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