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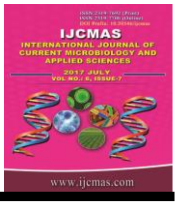

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Evaluation of Sesame (*Sesamum indicum* L.) Genotypes to the Shaded Uplands of Southern Region

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ABSTRACT

The sesame germplasm consisting of thirty three accessions were assessed for the extent of variability, degree and direction of character association among yield and its contributing traits and the direct and indirect effects of various components on yield. Analysis of variance showed significant differences among the genotypes for almost all the characters studied. High and moderate phenotypic and genotypic coefficients of variation (PCV and GCV) were noticed for most of the yield contributing characters. Highest and lowest PCV and GCV were recorded for number of capsules per unit length and 1000-seed weight respectively. High estimates of heritability coupled with high to moderate genetic advance as per cent over mean was recorded for all the yield associated traits except for days to maturity, oil content and 1000-seed weight. Yield had positive and significant association with the yield contributing characters such as plant height, number of primary branches, number of capsules per plant, length of capsule and number of seeds per capsule, signifying that selection based on these characters may improve yield. The highest genotypic and phenotypic correlation with yield was observed for number of capsules per plant. Path analysis revealed that number of capsules per plant had the highest positive direct effect on seed yield per plant followed by number of seeds per capsule. Number of primary branches per plant and days to maturity had the maximum positive indirect effect on seed yield per plant through number of capsules per plant.

Keywords

Sesame, Shade tolerance, Variability, GCV, Correlation analysis.

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Introduction

Sesame (*Sesamum indicum* L., 2n=2x=26) commonly known as *gingelly*, *til*, and *tila* in Sanskrit, is a member of the order Tubiflorae and family Pedaliaceae. Sesame is highly valued for its cooking quality, medicinal value of its oil, high seed oil content (50-60%), protein (18-25%), calcium, phosphorous, oxalic acid and excellent qualities of the seed oil and oil cake. Sesame crop has many agricultural advantages. It is grown on residual soil moisture with low inputs, and is a good crop for rotations with an extensive tap root system (Ashri, 1998). India is considered to be the major centre of genetic diversity even though the crop originated in Africa (Maiti *et al.*, 2012). In India, sesame is cultivated in an area of 1.94 m ha with 0.755 m ton production (Gayathri, 2011). However, the average productivity of sesame in India (453 kg ha^{-1}) is far below the average productivity in China (1127 kg ha^{-1}) and Egypt (1211 kg ha^{-1}). In Kerala, sesame is mainly cultivated in summer rice fallows. During 1990-91, 5.59 lakh hectares were under paddy; however during 2009-10 it was only 2.34 lakhs ha. Thus within two decades, there was a decline of 3.25 lakh hectares (Kumari, 2011).

Shrinking lowlands, shortage of labour and unprecedented summer showers resulting in crop failure, are the major reasons for the dwindling sesame cultivation in the state. Upland sesame cultivation is gaining importance in this scenario. Coconut gardens are the potential areas where we can intervene for upland sesame cultivation in the state since there has been a 28 per cent increased area under coconut over a period of twenty years (Govt. of Kerala, 2006). This highlights the need to enhance the productivity of the crop by developing high yielding genotypes. A thorough screening of the available germplasm for genetic variability for yield and its component traits will help in identifying elite genotypes.

Materials and Methods

The experiment was conducted in the field of Instructional Farm, College of Agriculture, Vellayani, during *rabi* season, 2012-13 in a Randomized Block Design in a coconut garden. A spacing of 30 cm×15 cm between plants was adopted. The material for study comprised of thirty three genotypes of sesame collected from various research stations including the varieties from Kerala Agricultural University. Observations were recorded on five random competitive plants in each replication for following traits viz., days to 50 per cent flowering, plant height, days to maturity, number of capsules per unit length, number of primary branches per plant, number of capsules per plant, length of the capsule, number of seeds per capsule, seed yield per plant, 1000-seed weight, root length and oil content.

The biometric observations recorded were subjected to ANOVA (Panse and Sukhatme, 1985) for comparison among various treatments and to estimate variance components. The phenotypic and genotypic variances were calculated by utilizing the respective mean square values (Johnson *et al.*, 1955).

The genotypic and phenotypic coefficients of variation were calculated by following Burton (1952). Categorization of the range of variation was effected as proposed by Sivasubramanian and Menon (1973).

Both heritability percentage (h^2) in broad sense and genetic advance (GA) as percentage of mean was estimated and categorized for various characters as per the formulae suggested by Johnson *et al.*, (1955).

Results and Discussion

The analysis of variance revealed highly significant differences among the thirty three genotypes for all the traits studied except for 1000-seed weight, indicating the presence of substantial amount of variability and selection could be effective for improvement of those characters (Table 1).

Similar results have also been reported by Valarmathi *et al.*, (2004) and Raghuwanshi (2005).

Phenotypic and genotypic coefficients of variation

High GCV was shown by characters number of capsules per unit length, number of primary branches, seed yield per plant, root length and number of capsules per plant, clearly indicating that selection will be rewarding (Fig. 1). These results are in agreement with those of Valarmathi *et al.*, (2004). The estimates of PCV and GCV were high for the characters number of primary branches per plant, number of capsules per plant and seed yield per plant. Similar results were reported by Mandal *et al.*, (2010) and Gayathri (2011). Low estimates of GCV for days to 50 per cent flowering, days to maturity, number of seeds per capsule, oil content and 1000-seed weight indicated limited scope for improvement of these characters through selection due to low magnitude of heritable variation.

Thangavel *et al.,* (2000) published comparable results on estimates of GCV and PCV. The genotypes exhibited significant variation for oil content. The highest oil content noticed was 50.16 per cent and the lowest was 45.52 per cent with a mean of 48.59 per cent. Similar results were earlier reported by Shadakshri *et al.*, (1995).

Heritability and genetic advance

High heritability combined with high genetic advance (as per cent of mean) was observed for number of capsules per unit length, seed yield per plant, number of primary branches, plant height, root length and number of capsules per plant indicating these characters were controlled by additive gene effects and phenotypic selection for these characters is likely to be effective (Fig. 2).

Table.1 Analysis of variance for various characters of sesame genotypes

Characters	Mean sum of squares		
	Replication	Genotypes	Error
Days to 50% flowering	3.363	21.017**	0.645
Plant height (cm)	293.011	130.88**	5.364
Days to maturity	26.250	57.332**	1.420
No. primary branches	0.010	5.911**	0.020
No. capsules/plant	4.859	55.224**	0.120
No. capsules/unit length	0.007	0.041*	0.001
Length of capsule (cm)	0.023	0.185*	0.003
No. seeds/capsule	4.734	55.022**	0.977
Root length (cm)	1.149	13.704**	0.027
Oil content (%)	0.016	4.299**	0.001
1000-seed weight (g)	0.001	0.001	0.001
Seed yield/plant (g)	0.207	1.449*	0.004

* Significant at 5% level; **Significant at 1% level

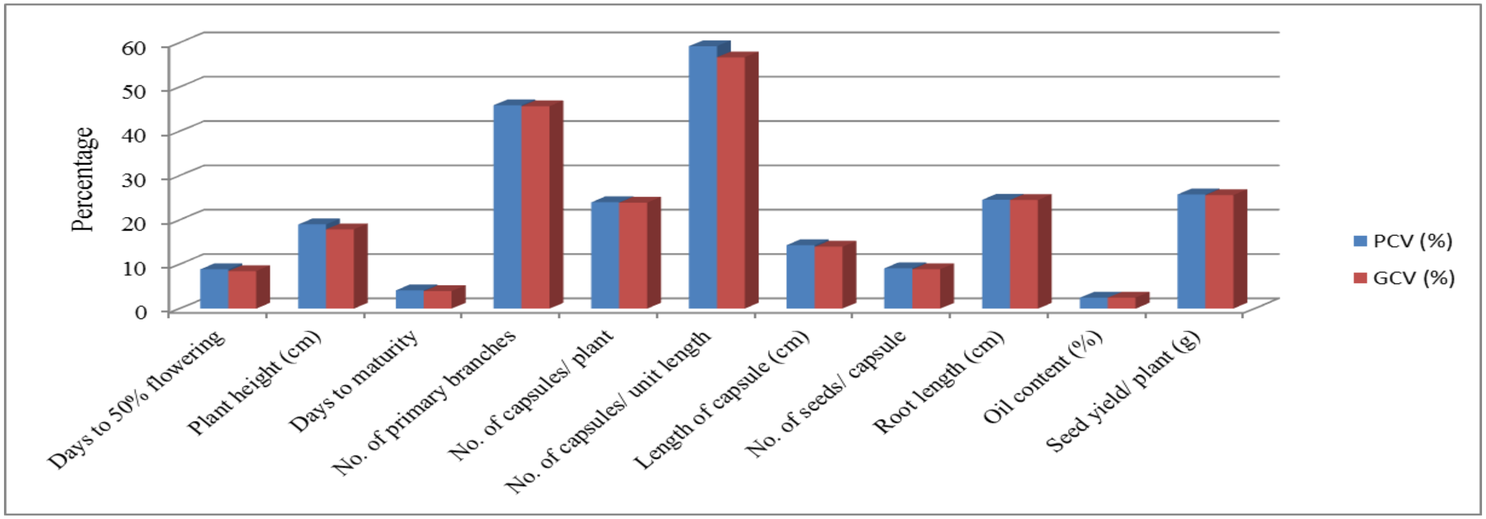
Table.2 Genotypic correlation among various characters of sesame

	DFF	PH	DM	NPB	NCP	LC	NSC	RL	OC	TSW	SYP	NCL
DFF	1.0000											
PH	-0.1199	1.0000										
DM	-0.0331	-0.0478	1.0000									
NPB	-0.3086*	-0.0122	0.1760	1.0000								
NCP	-0.0482	0.2308	0.3809**	0.3953**	1.0000							
LC	0.2117	0.1329	0.4481**	-0.1191	0.0911	1.0000						
NSC	0.2258	0.1583	0.4208**	-0.1730	0.0444	0.9847**	1.0000					
RL	0.1239	0.0231	-0.0327	-0.1896	0.1109	0.1465	0.2310	1.0000				
OC	0.1899	-0.1529	-0.0838	-0.2048	-0.2293	0.1196	0.1613	0.2073	1.0000			
TSW	0.1061	-0.0958	-0.2436*	0.0741	-0.3220**	-0.2233	-0.1867	-0.0534	0.0985	1.0000		
SYP	0.0357	0.2720*	0.4864**	0.2959*	0.9415**	0.4083**	0.3698**	0.1811	-0.1361	-0.3364**	1.0000	
NCL	0.3523**	-0.2855*	0.1052	-0.6837**	0.0499	0.1290	0.1414	0.2658*	0.1927	-0.1828	0.1042	1.0000

DFF- Days to first flowering
PH- Plant height (cm)
DM- Days to maturity
NPB- Number of primary branches/plant
NCP- Number of capsules/plant
LC- Length of capsule (cm)
NSC- Number of seeds/capsule
RL- Root length (cm)
OC- Oil content (%)
TSW- 1000 seed weight (g)
SYP- Seed yield/plant (g)
NCL- Number of capsules/unit length

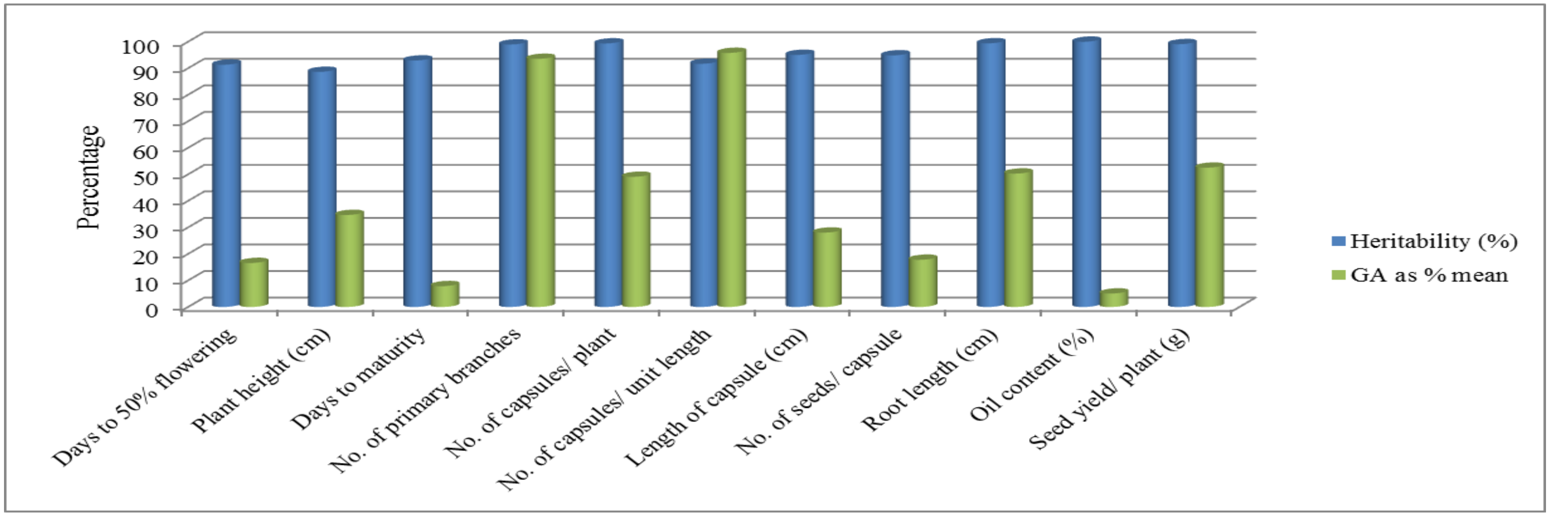
*- Significant at 5% level
*- Significant at 5% level

Fig.1 PCV (%) and GCV (%) for various characters of sesame genotypes



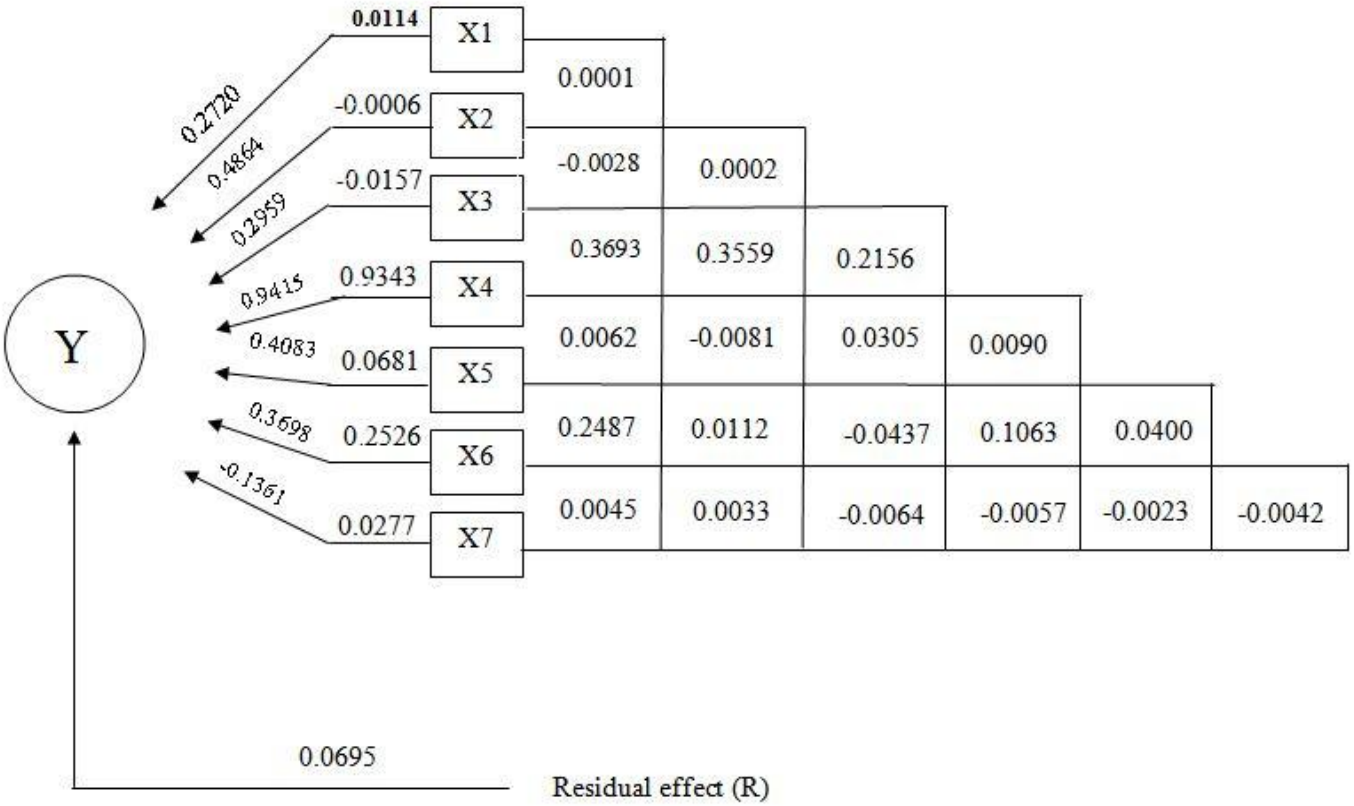
PCV: Phenotypic coefficient of variation
GCV: Genotypic coefficient of variation

Fig.2 Heritability (%) and genetic advance (%) for various characters of sesame genotypes



GA: Genetic advance

Fig.3 Path diagram



X1: Plant height (cm)
X2: Days to maturity
X3: Number of primary branches/plant
X4: Number of capsules/plant

X5: Length of capsule (cm)
X6: Number of seeds/capsule
X7: Oil content (%)

The path analysis revealed that seed yield per plant was positively and directly affected by the number of capsules per plant followed by number of seeds per capsule. All these had positive genotypic correlations with seed yield (Table 1 and Fig. 3). The greater influence of these traits reflects their importance as seed yield components. Similar results were reported by Mothilal (2005). Shajan (2002) and Kurdistani *et al.,* (2011) reported that number of capsules per plant had the highest positive direct effect on seed yield which is in conformity with the present observation. Plant height, number of capsules per plant, length of capsule, number of seeds per capsule and oil content showed positive direct effect on yield similar to the earlier report by Vidhyavati *et al.,* (2005) and Mohan (2011). The direct negative effect of days to maturity and number of primary branches per plant were in analogous to the reports of Siddiqui *et al.,* (2005). The indirect effect of number of capsules per plant on seed yield through plant height, days to maturity, number of primary branches, length of capsule and number of seeds per capsule. Sumathi *et al.,* (2007) and Georgiev *et al.,* (2012) confirmed equivalent outcomes for plant height, days to maturity and number of primary branches and Gnanasekaran *et al.,* (2008) for number of primary branches. Path analysis revealed that number of capsules per plant recorded the highest positive direct effect with seed yield per plant followed by number of seeds per capsule and plant height. However, number of primary branches per plant and days to maturity expressed negative direct effect. Similar reports have been given by Manjunatha *et al.,* (2008), Parameswarappa *et al.,* (2009) and Gayathri (2011).

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