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GENETIC STUDIES TO ASCERTAIN SELECTION CRITERIA FOR YIELD IMPROVEMENT IN SESAME

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Genetic variability, character association and path analysis have been computed for yield and 8 yield related traits in 22 plant types (control and 21 macromutant lines) of sesame (*Sesamum indicum* L.) for better understanding of the component maximizing yield. Further, stepwise regression analysis laid emphasis on simultaneous selection of traits for efficient breeding in sesame.

Keywords : Genetic analysis; Sesame; Step-wise regression.

Introduction

Twenty two genotypes (selfed control lines and 21 true breeding macromutant lines which were induced through chemical mutagenesis)[1-2] of sesame (*Sesamum indicum* L.,cultivar B-67, an important oilseed crop of the family Pedaliaceae) exhibited significant variations for the different agronomic traits studied[3], thereby offering scope for utilization and exploration of the genotypes for yield improvement through efficient breeding. For the purpose, it would be of utmost importance to understand the contribution of each yield related trait to yield and to select component maximizing yield. The present investigation, therefore, has been undertaken to study genetic variability, character association and path analysis in 22 genotypes of sesame considering 8 yield related traits and yield.

Material and Methods

Twenty two genotypes of sesame were grown in randomized block design with 3 replications (plot size – 3m X 1.5m, consisted of 4 rows, 250cm long with a spacing of 30cm between rows and 10cm between plants) at the experimental plot of Kalyani University during M4 and M5 generations (Kharif 2002 and 2003). Data have been estimated for 8 yield related traits and yield (Table 1) from 5 randomly selected plants from each plot in each generation over two years for studying genetic variability, character association and path analysis in 22 genotypes as per the method described by Burton[4], Johnson *et al.*[5] and Dewey and Lu[6] respectively.

Results and Discussion

The estimates of genetic parameters (Table 2) indicated that the magnitude of GCV (genotypic coefficient of variation) and PCV (phenotypic coefficient of variation) was of high order for all the traits and PCV was higher than the corresponding GCV values. The heritability estimated ranged from 19.32% to 91.00% among the traits. High degree of heritability was obtained for plant height, seeds/capsule, number of capsules/plant and distance from base to first branching; while, it was moderate to low for other traits. High heritability coupled with high genetic advance is being considered as effective criteria for selection for improvement in yield and has been noted for number of capsules/plant and distance from base to first branching.

Correlation studies (Table 3) showed that for all characters, genotypic and phenotypic associations were in the same direction and genotypic estimates were higher than the phenotypic ones indicating an inherited association between the traits. The yield showed a strong

Table 1. Analysis of variance for different traits in sesame genotypes.

Sources	DF	Mean sum of squares (MSS)								
		Plant height (cm)	No. of primary branches/ plant	No. of total branches/ plant	Distance from base to first branching (cm)	Capsules on main axis	Capsules/ plant	Capsule lenght (cm)	No. of seeds/ capsule	Seed yield/ plant (gm)
Genotypes	21	1301.9***	2.6**	5.8*	272.8***	116.4**	872.4***	0.2*	137.2***	6.0**
Replications	2	41.1	0.2	0.1	1.8	11.3	49.2	0.1	1.8	0.2
Error	32	41.6	1.0	3.4	43.1	34.8	114.2	0.1	15.3	1.8

*, ** and *** Significant at 5%, 1% and 0.1% level respectively.

Table 2. Estimates of parameters of variability, heritability and genetic advance for different characters in sesame genotypes.

Attributes	Population Mean ± S. E.	Coefficient of variability (%)		Heritability (%)	Genetic advance as % of mean
		GCV	PCV		
Plant height (cm)	83.31 ± 2.65	24.60	25.79	91.00	48.34
Primary branches / plant	2.63 ± 0.15	27.94	46.72	35.76	34.42
Total branches / plant	2.88 ± 0.25	31.06	70.65	19.32	27.65
Distance from base to first branching	23.94 ± 1.35	36.55	45.69	63.98	60.23
Capsules on main axis	17.77 ± 0.97	29.35	44.32	43.86	40.04
Capsule / plant	37.84 ± 2.36	42.01	50.62	68.87	71.82
Capsule length (cm)	2.10 ± 0.04	8.25	15.50	25.00	8.50
No. of seeds / capsule	38.95 ± 0.92	16.36	19.20	72.66	28.74
Seed yield / plant	2.86 ± 0.22	41.37	62.35	44.03	56.55

Table 3. The genotypic and phenotypic correlation coefficients of different characters in sesame.

Characters		Plant height (cm)	No. pr. Branches/ plant	Total branches/ plant	Distance from base to first branching	Capsules on main axis	Capsules/ palnt	Capsule length	Seeds/ capsule	Seed yield (gm)
Plant height (cm)	G		0.74***	0.68***	0.52***	0.79***	0.72***	0.67***	0.62***	0.57***
	P		0.54***	0.58***	0.43***	0.62***	0.68***	0.63***	0.59***	0.48***
No. pr. Branches /	G			0.96***	0.39**	0.80***	0.91***	0.59***	0.62***	0.78***
plant	P			0.93***	0.35**	0.25*	0.74***	0.52***	0.54***	0.65***
Total branches /	G				0.33**	0.15	0.76***	0.41***	0.48***	0.67***
plant	P				0.30*	0.22	0.68***	0.41***	0.47***	0.55***
Distance from base to	G					0.09	0.12	0.12	0.26*	0.03
first branching	P					0.08	0.09	0.10	0.25*	0.01
Capsules on main axis	G						0.91***	0.92***	0.88***	0.89***
	P						0.68***	0.53***	0.58***	0.62***
Capsules / plant	G							0.71***	0.67***	0.86***
	P							0.62***	0.60***	0.69***
Capsule length	G								0.78***	0.90***
	P								0.68***	0.69***
Seeds / capsule	G									0.81***
	P									0.68***

*, ** and *** Significant at 5%, 1% and 0.1% level respectively.

Table 4. Direct and indirect effects of contributing characters on seed yield of sesame.

Characters	Plant height (cm)	No. pr. Branches/ plant	Total branches/ plant	Distance from base to first branching	Capsules on main axis	Capsule/ plant	Capsule length	Seeds/ capsule	Correlation with seed yield
Plant height (cm)	**-0.406**	-0.719	0.538	0.027	-0.752	0.895	0.706	0.281	0.57***
No. pr. Branches / plant	-0.300	**-0.971**	0.759	0.020	-0.761	1.131	0.622	0.281	0.78***
Total branches / plant	-0.276	-0.933	**0.391**	0.017	-0.523	0.945	0.432	0.281	0.67***
Distance from base to first branching	-0.211	-0.379	0.261	**0.051**	-0.086	0.149	0.126	0.118	0.03
Capsules on main axis	-0.321	-0.777	0.435	0.005	**-0.952**	1.131	0.969	0.399	0.89***
Capsules / plant	-0.292	-0.884	0.601	0.006	-0.866	**1.243**	0.748	0.304	0.86***
Capsule length	-0.272	-0.573	0.324	0.006	-0.876	0.883	**1.054**	0.354	0.90***
Seeds / capsule	-0.252	-0.602	0.379	0.013	-0.837	0.833	0.822	**0.454**	0.81***

Residual effect = 0.0802; Figures in bold are the direct effects; *** Significant at 0.1% level.

positive association (0.001 probability level) with all yield related traits excepting distance from base to first branching. Similarly, correlation among the yield components was mostly positive and significant (excepting capsules on main axis, capsules/plant and capsule length with distance from base to first branching and capsules on main axis with total branches).

In addition to the degree of associations path coefficient analysis takes into account the cause and effect relationship and has been performed to partition the genotypic correlation into direct and indirect effects for understanding the relative importance of the component characters on yield. The perusal of path analysis (Table 4) revealed that capsules per plant (1.243) had maximum positive direct effect followed by capsule length (1.054), seeds/capsule (0.454) and total branches/plant (0.691).Further, indirect contribution via these traits on yield was also very high and positively significant. However, plant height, number of primary branches/plant and capsules on main axis demonstrated negative direct effects on yield and indirect effects via these traits were also found to be negative but these traits exhibited positive significant correlation with yield due to indirect contribution via total branches, capsules per plant, capsule length and seeds per capsule. Distance from base to first branching showed very low positive contribution to yield. Residual effect [0.0802] strengthened the reliability of the result. Thus, present genetic studies have led to the inference that number of total branches and capsules per plant, capsule length and seeds per capsule are the important selection criteria for yield improvement. Gupta and Gupta[7], Datta Roy *et al.*[8], Singh *et al.*[9] amongst others also emphasized the need for selecting capsules per plants as important selection index in sesame.

Further, stepwise regression analysis[10] performed with yield components as independent variables (Xi) and seed yield as dependent variable (Y) revealed that $Y = -4.67 + 0.03X_1 + 0.07X_2 + 1.71X_3$ as the best fitted equation (where X_1 = capsules per plant, X_2 = capsule length and X_3 = seeds per capsule; $R^2 = 0.62$, standard error of estimate- 1.06) and these three traits (X_1, X_2 and X_3) are explaining more than 62.0 per cent variations of the total variations. Thus, present investigation laid emphasis on simultaneous selection of capsules per plant, capsule length and seeds per capsule for efficient breeding in sesame.

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