J. Phytol. Res. 17(1) : 13-16, 2004

MULTIVARIATE ANALYSIS IN SESAME (SESAMUM INDICUM L.) FOR SELECTION OF BETTER PARENTS

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Yield and 8 yield related components have been assessed in 22 plant types (control and 21 macromutant lines) of sesame (*Sesamum indicum* L.) for selection of better parents aiding to crop improvement following multivariate analysis. Results indicated that *cluster flower, broad leaf* and *diffused branching* mutants are promising parents and are distant from other plant types.

Keywords : Sesame; Macromutants; Multivariate analysis; Promising parents.

Introduction

Twentyone macromutant types have been evolved through induced chemical mutagenesis in sesame[1,2] (*Sesamum indicum* L.), important oilseed crop of the family Pedaliaceae, and were catagorized following qualitative and quantitative traits[3,4]. Important selection criteria have been identified in the plant types through genetic studies[5]. This investigation reports on the selection of better parent(s) among the plant types of sesame (control and 21 macromutants) following the use of multivariate analysis (discriminate function analysis, principal component analysis and cluster analysis) taking into consideration yield and 8 important yield related components.

Material and Methods

Genetic analysis was made on 9 quantitative characters (plant height, primary and total branches / plant, distance from base to first branching, capsules on the main axis, capsules/ plant, capsule length, seeds/ capsule and seed yield) from 22 plant types (1.Control - C, 2.*Viridis* - V, 3.*Broad leaf* - BL, 4.*Thick leaf* - TL, 5.*Narrow leaf* - NL, 6.*Dwarf* - D, 7.*Diffused branching* - DB, 8.*Funnel* - F, 9.*Cluster flower* - CF, 10.*Early flowering* - EF, 11.*Late flowering* - LF, 12.*Small flower* - SF, 13.*White flower* - WF, 14.*Globular fruit* - GF, 15.*Non-shattering capsule* - NS, 16.*Elongated fruit* - Efr, 17.*Reddish brown seed-coa*t I - RB1, 18. *Reddish brown seed-coat* II - RB2, 19.*Dark reddish brown seed-coat* I - DRB1, 20. *Dark reddish brown seed-coat* II - DRB2, 21.*Bold seeded* - BS and 22.*Large seeded* - LS; selfed control and true breeding M_4 and M_5 mutant lines were used) of sesame (*Sesamum indicum* L.var. B-67) following the use of index of the net merit of an individual constructed by taking together the scores of each characters as was proposed by Jain[6]. Based on correlation matrix, principal component analysis (PCA) as described by Dillon and Goldstein[7] has been performed to judge the factor score of each plant type due to two highest eigen values. Percentage variation explained by first eigen values was also calculated. Further, Hierarchical cluster using the single linkage and complete linkage methods[7] based on Euclidean distance matrix of Z transformed character scores of different plant types have been performed to group the plant types into homogenous sub-units. Respective dendrograms have been drawn based on agglomeration schedule.

Results and Discussion

Total branches / plant, capsules / plant, capsule length and seeds / capsule (Model I), and capsules / plant, capsule length and seeds / capsule (Model II) estimated as important selection criteria from correlation and path analysis and from stepwise regression analysis respectively[5] were given economic non zero weights (ai values) and the remaining all variables were zero values for selection index (Table 1). The calculated bi values as per Jain[6] has been displayed in Table 1 and the corresponding index scores for each plant type was analysed using mean data. Based on selection index (5% selection intensity) the plant types have been ranked and in both models ranking seems to be more or less same (Table 2), thereby offering scope for selection of better parents.

PCA based on mean values gave two sets of factor loadings (pc1 and pc2) corresponding to first two large eigen values (> 1) and explaining 78.06 % of total "accounted for variance" of the whole experiments (Table 3). The variables loading on component 1 (Table 4) indicated that except for distance from base to first branching all other variables are heavily loaded and comparing the factor score coefficients it seems that mutant CF followed by BL and DB are scoring maximum (Table 5). The component 1 explains about 64% of total variance. In component 2 it has been observed that distance from base to first branching, primary and total branches / plant and plant height were dominating (Table 4) and the mutants LF, CF and RB1 were having maximum factor scores and this component accounted for another 15% of total variance (Table 5). Although the factor scores due to component 1 and 2 are uncorrelated, CF, BL and DB are promising parents in both and this result of PCA validated

Table 1. Quantitative characters of Sesame and ai and bi values in Model I and Model II.

Character	Model I		Model II	
	ai value	bi value	ai value	bi value
Plant height	0	- 0.077	0	- 0.076
Primary branches/ plant	0	- 16.679	0	- 14.850
Total branches	1	10.168	0	8.656
Distance from base to first branching	0	0.148	0	0.130
Capsules on main axis	0	- 0.042	0	- 0.022
Capsules/ plant	1	0.836	1	0.803
Capsule length	1	28.590	1	28.065
Seeds / capsule	1	0.709	1	0.713
Seed weight	0	0.089	0	- 0.089

Table 2. Sesame plant types and their ranked scores due to selection index of different characters.

Plant types	**Plant no.**	**Score**	
		Model I	**Model II**
Viridis	2	57.793	128.673
Dwarf	6	71.031	157.987
Reddish brown seed-coat I	17	71.896	159.332
Dark reddish brown seed-coat II	20	81.998	182.530
Reddish brown seed-coat II	18	83.629	186.575
Dark reddish brown seed-coat I	19	89.146	199.770
Bold seeded	21	92.657	207.328
Non-shattering capsule	15	93.683	209.035
White flower	13	96.570	216.743
Large seeded	22	100.270	223.488
Globular fruit	14	100.803	223.748
Early flowering	10	102.275	227.608
Control	1	103.186	230.189
Late flowering	11	105.624	235.415
Thick leaf	4	109.896	245.757
Narrow leaf	5	110.127	247.533
Small flower	12	110.291	246.831
Funnel	8	113.946	255.863
Elongated fruit	16	122.201	272.302
Diffused branching	7	124.488	280.521
Broad leaf	3	130.866	296.690
Cluster flower	9	135.516	298.264

Table 3. *S. indicum* Mean values and " accounted for variance" under PCA.

Factor	Eigen value	Percentage of variance	Cumulative variance
1	5.72	63.55	63.55
2	1.31	14.51	78.06
3	0.86	9.57	87.63
4	0.44	4.86	92.49
5	0.30	3.30	95.78
6	0.19	2.14	97.92
7	0.12	1.33	99.25
8	0.05	0.54	99.79
9	0.02	0.21	100.00

Table 4. *S. indicum*- Component loadings of different traits for eigen values more than 1.

Character	Component	
	1	2
Plant height	0.825	0.240
Primary branches	0.863	0.306
Total branches	0.778	0.404
Distance from base to first branching	0.313	0.802
Capsules on main axis	0.831	- 0.340
Capsules / plant	0.907	- 0.094
Capsule length	0.802	- 0.323
Seeds / capsule	0.820	- 0.164
Seed yield	0.872	- 0.305

Table 5. *S. indicum* - Standardized factor score coefficients of different plant types due to PCA.

Plant no.	Plant types	pc1	pc2
1	Control	0.258	-0.106
2	*Viridis*	-2.629	-0.199
3	*Broad leaf*	1.324	-0.555
4	*Thick leaf*	0.660	-1.380
5	*Narrow leaf*	0.540	-1.074
6	*Dwarf*	-1.485	0.261
7	*Diffused branching*	1.137	-0.438
8	*Funnel*	0.238	-0.957
9	*Cluster flower*	1.786	2.016
10	*Early flowering*	0.393	-0.703
11	*Late flowering*	0.774	2.855
12	*Small flower*	0.392	-0.460
13	*White flower*	-0.086	0.118
14	*Globular fruit*	-0.345	-0.355
15	*Non-shattering capsule*	-0.306	0.201
16	*Elongated fruit*	0.902	-0.896
17	*Reddish brown seed-coat I*	-1.092	1.535
18	*Reddish brown seed-coat II*	-0.811	0.041
19	*Dark reddish brown seed-coat I*	-0.232	0.263
20	*Dark reddish brown seed-coat II*	-0.819	0.135
21	*Bold seeded*	-0.524	-0.235
22	*Large seeded*	-0.076	-0.066

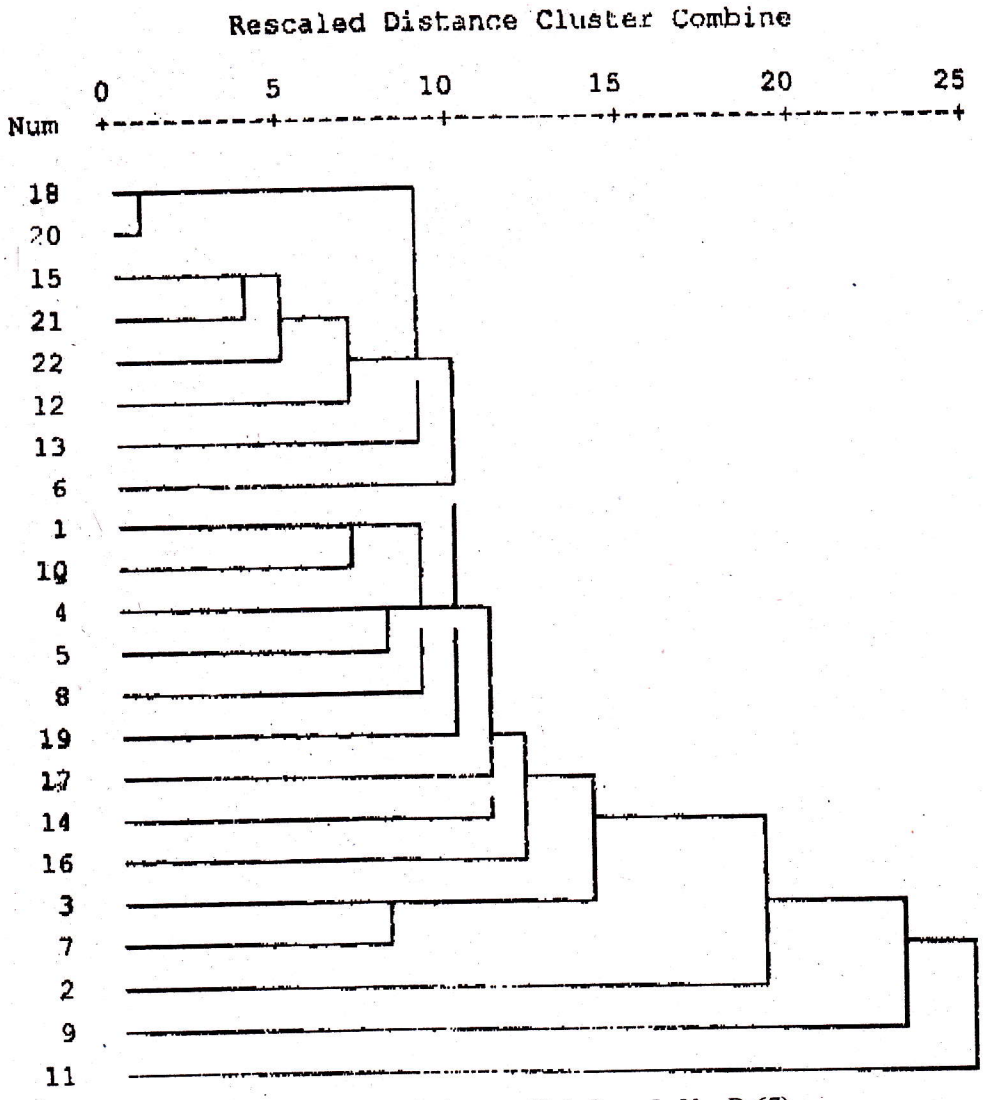

Fig. 1. Dendrogram showing clustering of the 22 plant types. (*S. indicum* L. Var. B-67)

that of discriminant function for selection of better parent. Further, dendrogram (Fig.1) prepared from cluster analysis revealed that the selected better parents have been distantly related than the remaining plant types.

Acknowledgement

The authors are thankful to CSIR for financial assistance.

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