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Genetic Diversity and Stability in Linseed

Jay Lal Mahto and S. N. Singh

Department of Plant Breeding and Genetics, Birsa Agricultural University, Ranchi 834 006

ABSTRACT

Twenty strains of linseed (*Linum usitatissimum* L.) were grown over four environments. Pooled data of nine characters over environments were analysed for D^2 estimates. Mean sum of square for the most characters revealed highly significant differences due to strains environments and strain X environment interaction for all characters. Stability of individual strain was worked out on the basis of two stability parameters- regression coefficient (b_i) and deviation from regression (S^2d_i). Further 7 strains were selected with high seed yield/plant (higher than grand mean over environments) and stable for seed yield and for other yield contributing characters.

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INTRODUCTION

A stable variety for seed yield/plant with high mean value, is desirable for its commercial exploitation over a wide range of agroclimatic conditions. In self pollinated crops like linseed, development of hybrid varieties is costlier and unsuccessful. Therefore, it is important to choose divergent parent with stable performance for characters for hybridization and to achieve desirable segregant through selection in the advanced breeding generations. With this view, genetic diversity analysis was done to identify suitable parents on the basis of intra- and intercluster distances for desired recombinants and heterosis.

MATERIALS AND METHODS

The experiment was laid out in RBD with 3 replications with 6 rows plots of 4 m length during winter 1989-90 in two environments (irrigated and rainfed) and one row plots of 4 m length during winter (1990-91) in two environments (irrigated and rainfed) alongwith 25 x 10 cm spacing. Data were recorded on five plants chosen at random for 9 quantitative characters i.e. number of capsules/plant, plant height (cm), number of primary branches/plant, number of secondary branches/plant, number of seeds/capsule, 1000 seed weight, days to 50% flowering, days to maturity and seed yield/plant (g). Generalised distance was done by D^2 statistics and clusters of strains were formed by Tocher's method Rao (1952). Estimates of divergence were estimated bases on pooled data of nine characters over 4 environments. Further, stability parameters were computed using the method of Eberhart and Russell (1966).

RESULTS AND DISCUSSION

Genetic divergence on the basis of D^2 values of pooled data formed only three clusters. Cluster I had the maximum, 18 strains. Cluster II and III included only one strain each (Table 1). Clustering showed that strains RL 75-6-1 and LCK 88072 were distinct from the others, these formed different clusters. Maximum inter-cluster distance was observed between clusters I and III followed I and II and II and III (Table 2). Maximum intra-cluster distance was observed for cluster I. Cluster II and III had zero intra-cluster distance, since each of them was represented by single strain. On the basis of intra and intra-cluster distances, it is suggested that for creating maximum genetic variability, crossing between the strains of clusters I and III, I and II and II and III would be useful.

TABLE 1

Distribution of 20 strains in clusters in linseed.

Cluster	*No. of genotypes*	*Genotypes*
I	18	NL 40, NL 48, RLC 27, RL 33-5, RL 33-4, RL 58-3, RL 75-4-1, RL 75-6-2, LW 8286, LW 8289, LW 8281, LW 28-9-5, LCK 88061, LCK 88311, LCK 88512, Sweta, Shubhra, T 397
II	1	RL 75-6-1
III	1	LCK 88062

Stability analysis : The analysis of variance for strains x environments interaction is presented in Table 3. Mean squares for strains were significant for the most characters indicating the presence of variability among strains. The mean squares for S x E interaction was significant for the most characters, indicating that the strains showed differential response in different environments with respect to these characters. It is obvious from Table 3 that the linear components of S X E interaction were relatively greater than the non-linear components for all characters except days to 50% flowering and maturity where non-linear component, was greater indicating that the performance of strains for all the characters except 1000 seed weight, days to 50% flowering and days to maturity could be predicted. These results are accordance with the earlier reports of Finlay and Wilkinson (1963), Breese (1969), Yates and Cochram (1938), Rao and Singh (1984) and

TABLE 2

Mean intra and inter-cluster distances (D^2 values) in linseed over environments.

Clusters	*I*	*II*	*III*
I	17.916	27.464	44.672
II		0.0	24.073
III			0.0

TABLE 3

Pooled analysis of variance for different characters in linseed.

Source	df	No. of capsules	Plant height	No. of primary branches	No. of secondary branches	No. of seeds/ capsule	1000 seed weight	Days to 50% flowering	Days to maturity	Seed yield / plant
Strains (S)	19	327.47**++	40.02**++	0.98**++	15.21**++	0.98**++	15.42**++	28.40**	39.34++	0.30*++
Environments (E)	3	4503.50**++	225.02**++	16.18**++	232.74**++	1.32**++	8.68**++	44.16**++	66.32++	3.24**++
S X E	57	156.97**++	18.96**++	0.49++	5.45	0.32++	3.47	12.52++	18.29++	0.07++
Env. (linear)	1	13510.51**++	675.05**++	18.54**++	698.29**++	0.369+	8.04	32.48**++	18.97++	9.71**++
S X E (linear)	19	258.73**++	38.89**++	0.55+	7.59*++	0.44++	2.72	11.48++	14.18++	0.09++
Pooled deviation	40	87.96	8.54+	0.32+	4.15	0.26++	3.66	12.38++	19.34++	0.06++
Pooled error	160	100.21	4.82	0.19	3.38	0.08	5.52	0.31	0.59	0.02

*. ** SIgnificant at 5% and 1% on pooled deviation.

+. ++ Significant at 5% and 1% on pooled error.

TABLE 4

High yielding strains stable for various characters.

Variance	Characters								
	Plant height	No. of capsules	No. of primary branches	No. of secondary branches	No. of seeds/ capsule	1000 seed weight	Days to 50% flowering	Days to maturity	Seed yield/ plant
Cluster I									
NL 40			+		+		+		+
NL 48					+		+		+
RLC 27		+	+	+	+	+			+
RL 33-5	+		+		+		+	+	+
RL 75-6-2		+			+	+			+
LCK 88061						+		+	+
LCK 88512	+	+		+			+	+	+
LCK 88311	+					+	+		+
Shubhra		+		+	+				+
Cluster II									
RL 75-6-1		+	+		+	+	+		+
Clusrer III									
LCK 88062		+		+	+	+	+	+	+

Singh and Singh (1989) in a wide range of plant materials. However, predictions of S x E interaction in individual line for 1000 seed weight, days to 50% flowering and days to maturity were also made on the basis of their b_1 and S^2d_i values. Stability parameters showed that out of 20 strains II were stable for seed yield/plant with high mean performance. These were NL 40, NL 48, RLC 27, RL 33-5, RL 75-6-2, LCK 88062, LCK 88311, LCK 88512, Shubhra, RL 75-6-1, and LCK 88061. Out of these 11 strains 7 were selected having higher yields and stable for most of the yield contributing characters, (Table 4).

D^2 and stability : The 7 strains sorted out on the basis of stability and higher mean for seed yield belong to different clusters i.e. 5 belong to cluster I, each to cluster II and III, respectively (Table 5). Therefore considering the D^2 analysis and stability of yield and yield contributing characters, making crosses among the selected strains of cluster I (RLC 27, Shubhra, LCK 88512, RL 75-6-2, and RL 33-5) with the strains of cluster II (RL 75-6-1) and cluster III (LCK 88062) is recommended. Crosses in the above combinations are expected to provide enough genetic variability to select for high yielding and stable segregants in the segregating generations.

TABLE 5

High yielding strains stable for seed yield/plant forming different clusters on the basis of D^2 analysis.

Cluster	*Strains*	*Mean*	b_1	S^2d_1	*No. of other stable characters*
I	RLC 27	0.95	1.13	–0.01	6
	RL 33-5	0.95	1.28	–0.01	6
	RL 75-6-2	0.91	1.26	–0.00	4
	LCK 88512	0.85	0.88	0.12	6
	Shubhra	0.89	0.86	0.02	6
II	RL 75-6-1	0.64	0.83	0.02	6
III	LCK 88062	0.86	1.10	0.01	7

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