GENETIC DIVERGENCE IN LINSEED (*Linum usitatissimum* L.)

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ABSTRACT

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The D^2 analysis allowed the 36 genotypes/variety of linseed to be identified into five distinct clusters. The cluster I included 11 genotypes that had medium mean values for 1000-seed weight (g) and seed yield/plant. The cluster II contained 6 genotypes, which had the highest mean values for number of seeds/capsule, number of branches/plant and seed yield/plant. They also showed the highest mean value for plant height. The cluster III had maximum number of genotypes 15, which had the highest mean value for 1000-seed weight (g). It is also related with medium mean values for rest of the characters. The cluster IV included 3 genotypes having the highest mean values for number of capsules/plant and days to maturity. The cluster V included single genotype, which had the lowest mean values for days to maturity and plant height. The highest intercluster distance was observed among clusters V, IV and II, while the lowest between III and I. The highest intracluster distance was observed in cluster III that revealed maximum variability within the clusters. In this study, two traits such as number of branches/plant and number of seeds/capsule contributed the maximum towards divergence in the existing germplasm.

Key words: linseed, genetic diversity and cluster

INTRODUCTION

Linseed stands fourth position after mustard, sesame and groundnut in edible oil production. It occupied 10825 acres of cultivated land producing 2540 tons of linseed in the year 2003-04 (BBS 2004). It is a winter crop of Asia and summer crop of Europe. Long stemmed linseed produces a high quality fiber and short-stemmed linseed bears larger seeds of high oil content (kaul and Das 1986). Linseed oil is used as edible oil when it is blended with mustard in Bangladesh. The only variety "Neela" of linseed has been cultivating for a long time in Bangladesh. To meet up the deficit of edible oil prevailing in the country more linseed varieties should be developed.

Genetic diversity can play an important role in choosing parental materials to get maximum recombination in hybridization programs (Arunachalam 1981). Diversity in the germplasm is essential to meet different purposes of the crop such as increased yield (Joshi and Dhawan 1986), wider adaptation, desirable quality, pest and disease resistance (Nevo *et al.* 1982). Multivariate analysis is an important technique for assessing the degree of divergence and the relative contribution of different characters to the total divergence (Golakia and Makne 1992). Therefore, in this study genetic divergence on 36 accessions has been examined using Mahalanobis D^2 statistics to assess the variation for yield and yield components in linseed.

MATERIALS AND METHODS

The experiment was conducted at the experimental field of the Oilseed Research Centre (ORC), Bangladesh Agricultural Research Institute (BARI), Gazipur-1701 during the rabi season of 2005-06. Thirty-six linseed accessions were collected from variable agro-climatic regions of Hathazari, Jamalpur and from the centre. It was laid out in a RCB design with 2 replications. Unit plot size was 3 rows of 3m long with spacing 30cm. from row to row and 5-7cm. from plant to plant. Fertilizers were applied at a rate of 75, 120 and 46 kg/ha of N, P and K respectively with Urea, TSP and MP. Seeds were sown on 20 November 2005. Half of the Urea and all of other fertilizers were applied at the time of final land preparation. The remaining half of the Urea was top dressed at flower primordial stage. The intercultural operations were done properly to obtain the optimum plant growth. Data were recorded on days to maturity (on plots), plant height, number of primary branches/plant, number of capsules/plant, number of seeds/capsule, 1000-seed weight and seed yield/plant from 5 randomly selected plants of the middle row of each plot. Genetic diversity was studied following Mahalanobis's (1936) generalized distance (D^2) extended by Rao (1952) using MSTATC and GenStat-4.2 software of Statistics Section of BARI. Tocher's method (Rao 1952) was followed for grouping the 36 genotypes into different clusters.

RESULTS AND DISCUSSION

The D^2 analysis allowed the 36 variety/genotypes of linseed to be identified into five distinct clusters with the assumption that those within the same cluster having smaller D^2 values among themselves than those belonging to other clusters (Table-1). The cluster I contained 11 genotypes that had medium mean values for 1000 seed weight (g) and seed yield/ plant. The cluster II included 6 genotypes, which had the highest mean values for plant height, number of seeds/capsule, number of branches/plant and seed yield/plant. The cluster III included

15 genotypes having the highest number of genotypes among all the clusters. They had the highest mean values for 1000-seed weight and also co-related with medium values for rest of the traits. The cluster IV included 3 genotypes, which showed the highest mean values for number of capsules/plants and days to maturity. The cluster V contained single genotype, which had the lowest mean values for plant height and days to maturity.

Table 1. Distribution of Linseed genotypes in different clusters

Cluster No.	No. of genotypes	Genotypes
I	11	Lin-0703, Lin-0803, Lin-0903, Lin-JL-2, Lin-2003, Lin-2603, Lin-2703, Lin-McGregor, Lin-3303, Lin-3403, Neela
II	6	Lin-1303, Lin-1403, Lin-1503/1, Lin-1503/2, Lin-3003, Lin-3103
III	15	Lin-0103, Lin-0203, Lin-0503, Lin-0603, Lin-JL03, Lin-1203, Lin-1903, Lin-Dufferin, Lin-2103, Lin-2203, Lin-2303, Lin-2403, Lin-2503, Lin-2803, Lin-2903
IV	3	Lin-0403, Lin-1603, Lin-1703
V	1	Lin-0303

The intercluster distance was larger than the intracluster distance indicating wider genetic diversity among the genotypes of different clusters. The result revealed that genotypes/cultivars collected from the same climatic regions did not fall in a single cluster. Thus genetic diversity and geographical distribution were not directly associated. It was also observed by Murty and Arunachalam (1996). Keeping this in mind, parents should be selected based on the geographic diversity. The maximum inter cluster distance was recorded between the cluster V and cluster II (9.574) and minimum between the cluster I and cluster III (2.905). The intracluster divergence varied from 0.516 to 1.208, maximum was recorded in cluster III and minimum in cluster I (Table-2)

Table 2. Intra (bold) & inter cluster D^2

Clusters	I	II	III	IV	V
I	**0.516**	6.559	2.905	4.629	3.098
II		**0.954**	4.113	8.969	9.574
III			**1.208**	5.033	5.985
IV				**0.693**	5.610
V					**1.077**

Characters those contributed to the divergence are shown in Table 3. Number of branches/plant and number of seeds/capsule have positive values in canonical analysis representing maximum contribution of two traits towards divergence.

Table 3. Latent vectors for 7 characters of 36 linseed genotypes

Characters	Vector I	Vector II
Days to maturity	-0.0492	0.0297
Plant height (cm)	-0.1017	-0.0312
Branches/plant	0.2586	0.7877
Capsules/plant (no.)	-0.0052	0.2184
Seeds/capsule (no.)	0.3208	0.0623
1000-seed weight (g)	-0.0455	-0.2139
Seed yield/plant (g)	-1.4010	-0.2392

Mean performances of different genotypes under different clusters are shown in Table 4. Variation in cluster means existed for almost all the characters. Cluster I constituted genotypes with the medium range of mean values for plant height, 1000-seed weights and seeds yield/plant.

Cluster II contained genotypes with the highest plant height, number of branches/plant, number of seeds/capsule and seed yield/plant. Cluster III had genotypes with the highest 1000 seed weight. Cluster IV included genotypes with the highest number of capsules/plants and maximum days to maturity. Cluster V included genotypes that had the minimum days to maturity, minimum plant height and the lowest seed yield and 1000 seed weight.

Table 4. Cluster means for 7 characters in 36 linseed genotypes

Characters	Clusters				
	I	II	III	IV	V
Days to maturity	103	106	104	108	101
Plant height (cm)	57	96	71	56	42
Branches/plant	5	6	5	5	5
Capsules/plant (no.)	56	57	62	75	52
Seeds/capsule (no.)	8	9	8	8	8
1000-seed weight (g)	3.60	3.57	3.89	3.60	3.05
Seed yield/plant (g)	2.63	4.54	3.56	2.19	1.49

Classification of these 36 linseed genotypes into five clusters indicated the existence of large amount of diversity in the present germplasm. As a result, careful selection of parents from these 36 genotypes that have optimum genetic divergence might be desirable to produce heterotic progenies. Main and Bhal (1989) reported that the parents separated by D^2 value of medium. Magnitude generally should higher heterosis. Considering the agronomic performances crosses between the genotypes of cluster II with those of cluster IV, V and I are expected to improve the seed yield, maturity and plant type of linseed.

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