

Genetic divergence analysis for seed classes of four popular linseed, *Linum usitatissimum* L varieties of Chhattisgarh

PREETI SINGH, NANDAN MEHTA, SUNIL KUMAR NAIR
and ABHINAV SAO*

Department of Genetics and Plant Breeding
Indira Gandhi Krishi Vishwavidyalaya, Raipur 492012 Chhattisgarh, India

*SG College of Agriculture and Research Station
Jagdalpur 494001 Chhattisgarh, India

Email for correspondence: saoabhi27@yahoo.co.in

ABSTRACT

The present investigations were undertaken at the Department of Genetics and Plant Breeding, IGKV, Raipur during Rabi 2012-13 and 2013-14 with three seed classes (certified, breeder, mixture) of four popular linseed varieties (Deepika, Indira Alsi-32, RLC-92, R552) using Mahalanobis's D^2 statistic for ten quantitative characters. On the basis of D^2 values 3 seed classes of 4 linseed varieties were grouped into 3 clusters. Maximum varieties appeared in cluster I which possessed 9 seed groups in selected varieties while cluster III possessed 2 seed groups and cluster II possessed only 1 seed group. The maximum intra-cluster distance was obtained for cluster II (2.751) followed by cluster III (2.530) while the minimum intra-cluster D^2 value was shown by cluster III (1.050). The highest inter cluster D^2 value was found between cluster I and II (5.094) followed by cluster II and III (4.426) while lowest inter-cluster distance D^2 value was found between cluster I and III (2.530).

Keywords: Linseed; genetic divergence; D^2 analysis

INTRODUCTION

Linseed, *Linum usitatissimum* L (2n= 30) also called as flax is an important oilseed crop which belongs to the family Linaceae having 14 genera and over 200 species. It is a dual purpose crop like soybean and cotton. It is called 'old world fibre'. In India it is used for oilseed. India is the second largest producer of linseed followed by Canada, China and USA whereas in production it stands at third

position. Linseed is widely grown and economically important species. Genetic improvement mainly depends on the amount of genetic variability present in the population. Genetic diversity can play an important role in choosing parental materials to get maximum recombination in hybridization programmes (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 and pest and disease resistance (Nevo et al 1982). Mahalanobis's D^2 statistic (Mahalanobis 1936) is an effective tool to quantify the degree of divergence at genetic level. 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). The parental diversity in optimum magnitude is required to obtain superior genotypes in the segregating generations (Moll et al 1962). Furthermore the evaluation of data obtained by any germplasm collection represents many duplicate accessions. These objects though desirable genetically create a difficult task in recognition from data tables. Such duplicate accessions which differ from each other in one or two characters significantly pose a difficult situation for resolving distinct types. Thus for characterization of any variety or germplasm for genetic diversity the genetic divergence analysis is very useful as it provides classification of material into different homogenous groups. Therefore in this study genetic divergence on 4 linseed varieties with three different seed classes of seeds viz certified, breeder and mixture has been examined using Mahalanobis's D^2 statistics to assess the variation for yield and its components in linseed.

MATERIAL and METHODS

The experimental material comprised of 80 plants of certified, breeder and mixture seed of four varieties

of linseed (Table 1) obtained from AICRP on linseed, Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidhyalaya, Raipur. The experiment was laid out in a randomized complete block design with three replications during Rabi 2012-13 and 2013-14. The entries were sown in one row each of 3 m length with spacing of 30 cm between rows and approximately 10 cm between the plants. The recommended packages of practices were followed for raising a healthy crop and all necessary plant protection measures were taken to control the pests and diseases. The observations were recorded for ten quantitative characters namely days to 50 per cent flowering, days to maturity, number of primary branches/plant, 100-seed weight (g), plant height, number of capsules/plant, number of seeds/capsule, seed yield/plant, harvest index (%) and oil content (%), (based on national guidelines for the conduct of tests for distinctness, uniformity and stability in linseed, India). The data were recorded on five randomly selected plants from all the three groups (breeder, certified and mixture). The analysis of genetic divergence among the genotypes was done by using Mahalanobis's D^2 statistic (Rao 1952).

RESULTS and DISCUSSION

The analysis of variance revealed significant differences among the genotypes for all characters indicating existence of variability among the genotypes. Diversity

Genetic divergence analysis of linseed

Table 1. Characteristic features of linseed varieties

Cultivar	Origin	Year of release	Parentage	Seed category	Special features
Deepika	IGKV, Raipur	2006	Kiran × Ayogi	1. Certified 2. Breeder 3. Mixture	Medium in height and early maturing, flowers blue, seeds brown, resistant to powdery mildew, oil content- 41.39%
Indira Alsi-32	IGKV, Raipur	2005	Kiran × RLC 29	4. Certified 5. Breeder 6. Mixture	Dwarf statured, flowers blue, seeds dark brown, resistant to powdery mildew, oilcontent- 39.18%.
R552 (Jawahar 552)	IGKV, Raipur	1984	No.55/R 67	7. Certified 8. Breeder 9. Mixture	Seeds brown medium to large, powdery mildew, tolerant to wilt, rust and
RLC-92	IGKV, Raipur	2008	Jeevan × LCK 9209	10. Certified 11. Breeder 12. Mixture	Tall in height, flowers with blue tinge, seeds brown, tolerant to bud fly and resistant to wilt, powdery mildew, oil content- 39%

analysis through D^2 analysis was carried out among three seed categories (certified, mixture and breeder) of four popular linseed varieties. These three seed categories were classified into 3 clusters. Maximum varieties appeared in cluster I which possessed 9 seed groups in selected varieties (Table 2). The maximum intra-cluster distance was obtained for cluster II (2.751) followed by cluster III (2.530) while the minimum intra-cluster D^2 value was shown by cluster III (1.050). The highest inter-cluster D^2 value was found between cluster I and II (5.094) followed by cluster II and III (4.426) while lowest inter-cluster distance D^2 value was found between cluster I and III (2.530) (Table 3).

Mahto and Singh (1996) reported that high contribution of days to maturity seed yield/plant and number of capsules per

plant contributed towards total genetic divergence. The cluster means for different characters are presented in Table 4. The genotypes from cluster I had better average for the characters harvest index and oil content.

The per cent contribution of 10 characters towards total genetic divergence (Table 5) showed that days to 50 per cent of flowering (35.02%) exhibited highest per cent contribution towards total genetic divergence followed by plant height (12.54%), oil content (12.0%), days to maturity (8.82%), number of primary branches (7.58%), seed yield/plant (7.50%), number of seeds/capsule (6.48%), 100-seed weight (4.5%), number of capsules/plant (2.14%) and harvest index (3.42 %).

Table 2. Genotypes included in different clusters based on D² analysis in 4 linseed varieties

Cluster #	Seed categories (#)	Varieties	Seed class
I	9	Indira Als-32, RLC-92, Deepika, R-552	1. Deepika Certified 2. Deepika Mixture 3. Deepika Breeder 5. IA-32 Mixture 6. IA-32 Breeder 7. R-552 Certified 9. R-552 Breeder 10. RLC-92 Certified 11. RLC-92 Mixture
II	1	R552	8. R-552 Mixture
III	2	Indira Als-32, RLC-92	4. IA-32 Certified 12. RLC-92 Breeder

Table 3. Average intra- and inter-clusters D² distance

Clusters	I	II	III
I	2.530	5.094	4.426
II		2.751	0.000
III			1.050

Main diagonal (bold)= intra-cluster D² value; upper= diagonal= inter-cluster D² value;
lower diagonal= inter-cluster D value

Table 4. Cluster means for yield and its components in 4 linseed varieties

Cluster no	I	II	III
# varieties	9	1	2
Days to 50% flowering	56.98	76.28	76.88
Days to maturity	110.14	131.10	129.59
# primary branches	2.81	4.07	3.90
Plant height at maturity	53.49	56.53	53.41
100-seed weight	0.63	0.60	0.57
# capsules/plant	40.88	48.23	45.81
# seeds/capsule	8.20	8.77	8.23
Seed yield/plant	12.73	11.99	11.65
Harvest index (%)	28.41	33.32	29.44
Oil content (%)	39.46	38.74	39.25

Table 5. Contribution of 12 characters towards total genetic divergence

Character	# times ranked first	% contribution
Days to 50% flowering	4	35.02
Days to maturity	3	8.82
Plant height (cm)	9	12.54
# primary branches	2	7.58
100-seed weight	2	4.5
# capsules/plant	0	2.14
# seeds/capsule	4	6.48
Seed yield/plant	7	7.50
Harvest index (%)	6	3.42
Oil content (%)	10	12.00

The highest value for number of primary branches per plant and plant height were observed in cluster III. The cluster V was characterized by highest value for number of seeds per capsule and 100-seed weight. The cluster IV genotypes which had highest mean values for the characters days to 50 per cent flowering, days to maturity, number of capsules per plant, biological yield and seed yield per plant may be used as parents in future hybridization programmes.

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Received: 2.2.2015

Accepted: 7.4.2015