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Analysis of variance and variability for seed yield and its contributing traits in Linseed (*Linum usitatissimum* L.)

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Abstract
The analysis of variance revealed highly significant differences among the genotypes for all the characters viz; days to 50% flowering, plant height, primary branches per plant, number of capsules per plant, number of seeds per capsule, days to maturity, biological yield per plant, seed yield per plant, harvest index and 1000-seed weight which showed wide spectrum of variation among present set of material. The number of capsules per plant varied from 84.20 (A-10-2-2) to 221.26 (A-404) with a mean value of 154.487.

Keywords: GCV, genetic variability, Linseed, PCV, variance

1. Introduction
The genetic improvement of linseed is expected through production breeding which requires precise information on the nature and degree of genetic variability present in linseed germplasm. Exploration from its principal areas of adaptation or cultivation which would help in understanding the evolutionary mechanism involved in intra-specific divergence and choice of desirable parents for evolving superior varieties are the major tasks before linseed breeders. Diverse germplasm is of digital importance and genetic improvement in yield and quality is possible only when there exists enough genetic variability which obviously reflects through phenotype of individual that have a sound base for the selection. Apart from it, the knowledge of most heritable traits and correlation among the traits are also helpful for increasing the yield. The identification of donor parent for important characters, assessment of genetic variation in the available germplasm and information about character association are required to device a successful breeding programme.

2. Materials & Methods
The present experiments were involving thirty-five genotypes of linseed was undertaken to examine the genetic variability, heritability, genetic advance, correlation coefficient, path coefficient analysis and genetic divergence. Thirty five genotypes of linseed were sown in a Randomized Complete Block Design with three replications during *rabi* season 2015-16 at Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP). Each genotype was sown in 3 rows plot of 3 meters length, spaced 20 cm apart with plant to plant distance of 5-6 cm. All recommended agronomic practices and plant protection measures were followed to raise the good crop. Observations were recorded for days to 50 per cent flowering, plant height (cm), number of primary branches per plant, number of capsules per plant, number of seeds per capsule, days to maturity, biological yield per plant (g), seed yield per plant (g), harvest index (%) and 1000 seed weight.

3. Results & Discussion
The results of analysis of variance are given in table-1. The analysis of variance revealed highly significant differences among the genotypes for all the characters viz; days to 50% flowering, plant height, primary branches per plant, number of capsules per plant, number of seeds per capsule, days to maturity, biological yield per plant, seed yield per plant, harvest index and 1000 seed weight which showed wide spectrum of variation among present set of material when it was tested against 'F' test. The mean performance of 35 genotypes of linseed for 10 characters revealed a wide range of variability. A brief account of the salient observation for variability is given below and the data are presented in Table-2. The days to 50 per cent flowering in 35 genotypes ranged from 63.00 (No-55) to 80.00(A-385) days with a grand mean value of 72.190.

The mean plant height of 35 genotypes ranged from 53.40 (191 RR 9/2) to 74.20 (NP-23K) cm with a grand mean value of 63.285 cm. The number of primary branches varied from 4.73 (191 RR 9/2) to 7.93(BR-1) with a mean value of 6.214. The number of capsules per plant varied from 84.20 (A-10-2-2) to 221.26 (A-404) with a mean value of 154.487. The number of seeds per capsule ranged from 8.26 (BR-1) to 10.00 (A-210) in 35 genotypes with a grand mean value of 9.183. Days to maturity varied from 132.00 (Banner) to 138.66 (No-11) with a grand mean of 135.36 days in 35 genotypes. Wide range of variation was also observed for biological yield per plant. It was noted to vary from 15.86 g (191 RR 9/2) to 34.40 g (LC-2063). The grand mean value for this character was 24.612 g. Wide range of variation was also observed for seed yield per plant. It was noted to vary from 6.00 g (A-10-2-2) to 12.06 g (Kiran). The grand mean value for this character was 8.770 g. Harvest index varied from 25.07 9 % (LC-2063) to 44.65 % (Kiran) with a grand mean 36.208 % in 35 genotypes. Wide range of variation for 1000-seeds weight was observed. It was noted to vary from 5.37 g (A-385) to 7.82 g (Karam banda) with a grand mean value of 6.150 g. These results were also observed by Wakjira *et al.* (2004) [9], Reddy *et al.* (2013) [6], Rafiq *et al.* (2014) [5], Choudhary *et al.* (2015) [1], Fida *et al.* (2015) [3], Kumar *et al.* (2015) [4], Dash *et al.* (2016) [2], Shalini *et al.* (2016) [7] and Siddiqui *et al.* (2016) [8].

Table 1: Analysis of variance for ten characters of 35 genotypes in Linseed (*Linum usitatissimum* L.).

Source of variation	D.F.	Days to 50%flowering	Days to maturity	Plant height (cm)	Primary branches per plant	Capsules per plant
Replication	2	2.866	26.866	7.408	0.559	163.936
Treatment	34	98.887**	7.419**	52.502**	1.941**	2855.421**
Error	68	1.327	1.650	2.635	0.422	146.183

Table 1: Continue……

Source of variation	D.F.	Seeds per capsule	Biological yield per plant (g)	Seed yield per plant (g)	Harvest index (%)	1000 seed weight (g)
Replication	2	1.804	3.076	1.398	5.479	0.118
Treatment	34	0.971**	70.068**	7.409**	61.889**	1.186**
Error	68	0.192	3.437	0.961	20.911	0.313

*,** Significant at 5% and 1% level of of significance, respectively**.**

Table 2: Estimate grand mean, range (lowest and highest) for ten characters of 35 genotypes in Linseed (*Linum usitatissimum* L.).

Characters	GM	Range	
		Lowest	highest
Days to 50% flowering	72.190	63.00	80.00
Plant height (cm)	63.285	53.40	74.20
Primary branches per plant	6.214	4.73	7.93
Capsules per plant	154.487	84.20	221.26
Seeds per capsule	9.183	8.26	10.00
Days to maturity	135.361	132.00	138.66
Biological yield per plant (g)	24.612	15.86	34.40
Seed yield per plant (g)	8.770	6.00	12.06
Harvest index (%)	36.208	25.07	44.65
1000 seed weight (g)	6.150	5.37	7.82

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