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Study on variability, heritability and correlation coefficient among linseed (*Linum usitatissimum* L.) genotypes

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ABSTRACT

Keeping in view the lack of information on genetic variability in the linseed germplasm and need to study variability, heritability and genetic advance in this crop, the present investigation was undertaken on 53 germplasm of linseed. These accessions were evaluated at field experimentation centre of Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad during Rabi 2011-12. Estimates of genotypic and phenotypic coefficients of variability indicated significant variability for all the quantitative traits under study. The low difference between GCV and PCV indicate the less influence of environment in the expression of characters studied. High heritability estimates were high for capsule per plant, plant height, biological yield per plant, seed yield per plant, harvest index, number of branches , test weight, days to maturity and number of seeds per capsule. These characters, therefore, may respond effectively to phenotypic selection. Further positive correlation of number of capsules per plant, test weight, number of seeds per capsules, biological yield per plant and plant height with grain yield proved that the genetic wroth of these characters in the indirect selection breeding for linseed improvement.

Keywords: Linseed, Variance, Heritability, Genetic Advance, GCV, PCV.

INTRODUCTION

Linseed (*Linum usitatissimum* L.) is one of the most important industrial oilseed crops of India. Every part of the linseed plant is utilized commercially either directly or after processing. Linseed contains about 33 to 45% oil and 24% crude protein. About 80% of the oil produced goes to industries for several innumerable by product and its used as drying oil for the manufacture of paints, varnish, linoleum, oilcloth, patent leather, printer ink, enamels, stickers, tarpaulins, soaps etc.

Keeping in view of increasing demand of linseed, there is consistent need to increase genetic seed yield potential. One way to increase seed yield potential and related traits is recombination of favorable genes. Genetic traits such as genotypic coefficient of variability, heritability and genetic advance provide precise estimates of genetic variation of quantitative traits (4-6, & 11). To achieve this goal, knowledge about extent of genetic variability of different traits and their correlation is very important, as the success of breeding program mostly hinge on the presence of genetic variability in the breeding material. Higher the genetic variability more will be the opportunities for improvement through appropriate selection procedure. Thus, there is a need to generate information on phenotypic and genotypic variances as well as heritability, Genetic advance and interrelationships of yield and yield related quantitative traits in the crop like linseed, where very little information is available. Therefore, the present investigation was under take in linseed.

MATERIALS AND METHODS

Fifty three diverse linseed genotypes were evaluated in randomized block design with three replications at field experimentation centre of Department of Genetics and Plant Breeding, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad during *Rabi* 2011-12. The distance between the rows and plant were 30 and 5 cm, respectively. Standard agronomic practices and plant protection measures were adopted to raise a healthy crop. Observations were record on five randomly selected plants per replication of plant *viz*. Days to 50% of flowering, plant height, number of capsule per plant, number of seeds per capsule, biological yield per plant, seed yield per plant, number of branches per plant, test weight, days to 50% flowering and days to maturity. Statistical measures of variability such as genotypic and phenotypic variances, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV), heritability (h^2), genetic advance (GA) as per cent of mean, genotypic and phenotypic correlations (rg & rp) were computed and path coefficient analysis was made (2-4).

RESULTS AND DISCUSSION

The analysis of variance for ten traits including grain yield and its related traits in the present set of linseed genotypes revealed significant differences for all of the traits. These suggested that these are an inherent genetic differences among the genotypes. Highly significance differences among genotypic mean square were recorded (Table-1) exhibited sufficient genetic variability which was necessary to check out an effective program of crop improvement. The estimates of range, mean, phenotypic coefficient of variation (PCV), genotypic coefficient of variation (GCV), heritability (broad sense) & genetic advance are presented in Table 1. Considerable range of variation was observed for all the traits under study indicating enough scope for bringing about improvement in desirable direction. In general estimates of PCV were higher than corresponding GCV. However good correspondence was observed between GCV and PCV for all characters. A wide range of phenotypic coefficient of variation (PCV) was observed for traits ranging from (3.22) for days to maturity to (44.08) for biological yield per plant. Higher magnitude of phenotypic coefficient of variation was recorded for biological yield per plant(44.08), economic yield per plant (37.23), Harvest index (34.74), number of capsules per plant (34.50), number of branches per plant (26.07)and plant height (18.86). Genotypic coefficient of variation (GCV) ranged from 2.91 for days to maturity to 43.96 for biological yield per plant. Higher magnitude of genetic coefficient of variation was recorded for biological yield per plant (43.96), economic yield per plant (39.87), number of capsules per plant (34.41) and harvest index (34.11) Similar finding were reported by Chaurasia *et al.,*(2012). Lush (1949) gave the concept of broad sense heritability (1 & 7). It determines the efficiency with which we can utilize the genotypic variability in a breeding program. High heritability was observed for traits *viz*.; number of capsule per plant (99.48) followed by biological yield per plant (99.43), plant height (99.46), and seed yield per plant (98.09%). High genetic advance as percent of mean was observed for biological yield (90.29%) whereas, number of capsules per plant (70.70%),harvest index(68.98%) number of branches per plant (50.77%). A moderate estimates were observed for plant height (38.65%) and test weight (37.04%). High estimates of PCV, GCV, heritability and genetic advance for grain yield component namely biological yield per plant, economic yield yield/plant, plant height and harvest index. Genetic advance is the improvement in the mean of selected families over the base population (Lush 1949, Johanson *et al.*, 1955). A character exhibiting high heritability may not necessarily give high genetic advance. Johnson *et al.*, (1955) suggested that heritability and genetic advance when calculated together would prove more useful result predicting the resultant effect of selection on phenotypic expression (2 & 7).

Table.1 Genetic parameters of ten quantitative characters for fifty three-linseed genotype during *Rabi 2011-12*

S.N	Characters	Mean sum of square due to treatment	Mean	Range		σ^2g	σ^2p	GCV	PCV	h^2 (bs %)	GA	GA (M)
				Max.	Min.							
1.	Days to 50 % flowering	22.67*	82.47	95.00	77.00	6.81	9.05	3.16	3.65	75.28	4.66	5.66
2.	Plant height	622.83*	76.52	104.70	39.83	207.29	208.41	18.81	18.86	99.46	29.58	38.65
3.	No.of branches/Plant	10.83*	7.42	12.60	3.53	3.54	3.75	25.35	26.07	95.54	3.77	50.77
4.	No. of capsule per plant	5521.57*	124.58	250.33	52.06	1837.6	1847.32	34.41	34.50	99.48	88.08	70.70
5.	No. of seeds per capsule	1.09*	8.61	9.80	7.06	0.31	0.47	6.49	7.98	66.01	0.94	10.85
6.	Days to maturity	44.37*	127.37	135.66	120.33	13.77	16.83	2.91	3.22	82.82	6.91	5.43
7.	Biological yield per plant	486.08*	28.93	75.37	10.60	161.72	162.64	43.96	44.08	99.43	26.12	90.29
8.	Economical yield per plant	25.49*	7.88	16.50	4.21	8.44	8.61	39.87	37.23	98.09	5.93	75.22
9.	Test weight	4.52*	6.54	9.60	4.14	1.50	1.53	18.15	18.33	98.08	2.50	37.04
10.	Harvest index	314.78*	29.84	58.15	18.46	103.62	107.50	34.11	34.74	96.39	20.59	68.98

Legends- σ^2g = Genotypic variance, σ^2g = Phenotypic variance, GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation, GA = Genetic advance, GA%(μ) = Genetic advance as percent of mean.

In the present study, genotypic and phenotypic correlations among ten characters of linseed were computed. Correlation coefficient (Table-2) depicted that genotypic correlation were greater than phenotypic correlation coefficient for most of the parameter which have negative effect of environmental on an association development. This could be due to relative stability of the genotypes as majority of them have been subjected to certain amount of selection. Plant height at genotypic level showed positive and significant correlation with seed yield. Number of branches per plant had significantly positive correlation with number of capsule per plant, number of seed per capsule, test weight for majority of the cases, the genotypic and phenotypic correlations showed very close values. In all the cases, the margin of difference between phenotypic and genotypic correlations was very narrow. Plant height, capsules per plant, number of branches per plant, number of seeds per capsule were positively correlated with seed yield per plant except to days to 50% flowering and days to maturity at both genotypic and phenotypic levels. Similar results were findings of Pal *et al.,* (2000), Mishra and Yadav (1999). Thus it would be desirable to select plant type of linseed having more number of branches. Hence, selection for the plants having capsules with more number of seeds is likely to be effective in improving the seed yield per plant. The traits, test weight, established a positive and significant (8-9).

Table 2: Genotypic and Phenotypic correlation coefficient for ten quantitative characters of linseed germplasm

Characters		Days of 50% flowering	Plant height (cm)	branches/ Plant	capsules/ plant	seeds/ capsule	Days of maturity	Biological yield/ plant (gm)	seed yield/ plant (gm)	Test weight (gm)	Harvest index
Days of 50% flowering	rp	1.0000	0.2196	-0.0720	-0.0850	0.1458	0.0789	0.0236	-0.0937	0.0204	-0.1471
	rg	1.0000	0.1906	-0.0661	-.0679	0.0927	0.0688	0.0208	-0.0782	0.0161	-0.1309
Plant height(cm)	rp		1.0000	0.3543	0.1322	-0.0106	-0.4021	0.4004	0.1991	0.0067	-0.3060
	rg		1.0000	0.3399	0.1315	-0.0057	-0.3606	0.3989	0.1984	0.0075	-0.2998
branches/ Plant	rp			1.0000	-0.0048	0.0181	-0.3686	0.2096	0.2142	0.0237	0.0609
	rg			1.0000	-0.0061	-0.0027	-0.3300	0.2029	0.2040	0.0192	0.0594
capsules/ plant	rp				1.0000	-0.0597	0.0230	-0.0519	0.0941	-0.201	0.1658
	rg				1.0000	-0.0469	0.0183	-0.0521	0.0940	-0.198	0.1635
seeds/ capsule	rp					1.0000	0.0720	-0.0128	0.1116	-0.090	0.1012
	rg					1.0000	-0.0002	-0.0118	0.0933	-0.068	0.0841
Days of maturity	rp						1.0000	-0.0522	-0.0149	0.1011	0.0183
	rg						1.0000	-0.0493	-0.0198	0.0811	0.0124
Biological yield/ plant (gm)	rp							1.0000	0.7249	-0.042	-0.5873
	rg							1.0000	0.7174	-0.042	-0.5817
Economical yield/ plant (gm)	rp								1.0000	0.0946	0.0318
	rg								1.0000	0.0929	0.0469
Test weight (gm)	rp									1.0000	0.1952
	rg									1.0000	0.1926
Harvest index	rp										1.0000
	rg										1.0000

Legends- R_p-phenotypic correlation, R_g-genotypic correlation

CONCLUSION

It can be concluded from the present study showed the presence of considerable variations among linseed genotypes for all characters tested which gives an opportunity to plant breeders for the improvement of these characters through breeding. Genetic correlation coefficient analysis indicated that important agronomic characters are positively correlated with seed yield. It is suggested that common difference of genetically and physical basis among the characters. Therefore, simultaneous improvement of these characters would be possible to give substantiate results.

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