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GENETIC VARIABILITY STUDIES IN LINSEED (*LINUM USITATISSIMUM* L.)

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KEYWORDS

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ABSTRACT

Forty two linseed (*Linumusitatissimum* L.) genotypes were evaluated for eleven quantitative traits to examine the variability, heritability and genetic advance. Analysis of variance indicated significant differences for all the traits under study. The genotypic and phenotypic coefficients of variation were observed to be high for seed yield/ plant (25.45% and 30.36% respectively) followed by number of branches/ plant (25.08% and 29.61% respectively), number of capsules/ plant (21.87% and 23.8% respectively). It indicates significant variability for effective selection to identify potential genotypes. The heritability estimates (broad sense) were high for all characters on the basis of average. The highest heritability estimates were observed for volume weight/ plant (97.48%) followed by plant height (96.36%), 1000 seed weight (94.74%), oil content (93.29), number of days to maturity (86.86%), harvest index (84.08%), number of capsules/plant (83.79%), number of days to 50 % flowering (81.37%), number of branches/ plant (71.76%) and seed yield/plant (70.24%) this indicate that, simple selection could be effective for improving these characters.

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INTRODUCTION

Linseed (*Linum usitatissimum* L.), also called flax is an important oilseed crop grown for both seeds and fibers. Flaxseed is used for oil production and also in food industries because of its nutritional values, essential poly unsaturated fatty acids such as alpha-linolenic acid and rich supply of soluble dietary fiber. Linseed seed contains good percentage of oil which varies from 33-47 percent in different varieties. Various parts of the plant have been used to make fabric, dye, and paper, medicines, fishing nets, hair gels and soap.

Selection is an integral part of a breeding programme by which genotypes with high productivity in a given environment could be developed. However, selection for high yield is made difficult because of its complex nature. Genetic diversity in crop plants is essential to sustain level of high productivity (Azad Ahamed *et al*., 2014). Yield per unit area is the end product of components of several characters, which are polygenic in inheritance and thus are highly influenced by environment. Genetic parameters such as genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are useful in detecting the amount of variability present in the genotypes (Vardhan and Rao, 2012).Heritability coupled with high genetic advance would be more useful tool in predicting the resultant effect in selection of the best genotypes for yield and its attributing traits (Reddy *et al*., 2013). It helps in determining the influence of environment on the expression of the genotypic and reliability of characters.

With the above background information the present investigation was undertaken to study the genetic parameters among the forty two linseed genotypes to assess the genetic variability for yield and yield contributing characters.

MATERIALS AND METHODS

The present studywas undertaken at Oil Seed Research Station, Latur and College of Agriculture, Laterduring *Rabi*-2013. The experiment was laid out in randomized block design with three replications. Forty two genotypes including thirty nine lines and three checks were sown. The data were recorded on five randomly selected plants from each line for quantitative traits *viz*., days to 50 per cent flowering, days to maturity, plant height (cm), number of branches per plant, number of capsules per plant, number of seeds per capsule, 1000- seed weight (g), volume weight (g), oil content (%), harvest index (%) and seed yield per plant (g).

The mean data after computing for each character was subjected to standard method of analysis of variance following Panse and Sukhatme (1961), genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV), heritability in broad sense (h2) and genetic advance as per cent of mean were estimated by the formula as suggested by Burton (1953) and Johansson *al*., (1955).

RESULTS AND DISCUSSION

Mean performance of forty two genotypes for all characters are presented in Table

no.1. Analysis of variance (Table no. 2) showed that differences among the treatments with respect to all the characters were significant at both 5 percent and 1 percent level of significance. This indicated that wide range of variability among the genotypes. The characters studied in the present investigation exhibited low, moderate and high PCV and GCV values (Table no. 3). Genotypic coefficient of variation was observed to be high for seed yield per plant (25.45%) followed by number of branches per plant (25.08%) and number of capsules per plant (21.87%). The estimated values were least for oil content (3.54%).Phenotypic coefficient of variation was recorded to be high for seed yield per plant (30.36%) followed by number of branches per plant (29.61%) and number of capsules per plant (23.89%). The estimated value was least for oil content (3.42%). The phenotypic coefficient of variation was greater than genotypic coefficient of variation for most of the characters that indicates influence of environment on the traits under study, similar results reported by Singh *et* al. (1995b), Awash and Rae (2005), Tadesse *et al*. (2010), Vardhan and Rao (2012), Tahira*et al*. (2013),Tyagi*et al*. (2014), Rafiq*et al*. (2014).

The estimates of heritability (Table 3) act as predictive instrument in expressing the reliability of phenotypic value. The heritability estimates were high for all characters on the basis of average. The highest heritability estimates were observed for volume weight per plant (97.48%) followed by plant height (96.36%), 1000 seed weight (94.74%), oil content (93.29), number of days to maturity (86.86%), harvest index (84.08%), number of capsules per plant (83.79%), number of days to 50 per cent flowering (81.37%), number of branches per plant (71.76%) and seed yield per plant (70.24%).High heritability coupled with high genetic advance for a particular character indicates its applicability of being selected for further improvements. High heritability coupled with high genetic advance as a percent of means for days to 50% flowering

Table 1: Mean performance of 42 genotypes for yield and yield contributing characters

Genotype	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches/ plant	No. of capsules/ plant	No. of seeds/ capsules	1000 seed weight (g)	Volume weight/ 00 ml	Harvest index (%)	Oil content (%)	Seed yield/ plant (g)
RL 10193	38.33	90.00	50.66	2.66	33.66	7.33	5.34	73.56	15.66	38.52	1.39
RL 10135	56.00	98.00	63.00	3.00	35.33	8.33	6.20	73.33	17.33	39.58	1.64
RLC 133	39.33	91.00	58.33	2.00	43.33	8.00	6.21	68.33	13.66	38.14	1.85
PCL 62	44.00	95.00	53.00	4.00	43.33	7.66	6.27	67.40	19.33	40.92	1.49
T 397	60.00	95.66	52.66	3.66	39.66	7.66	4.76	72.26	18.33	38.24	1.12
RL 12014	52.66	95.00	50.66	3.66	53.66	7.00	5.90	66.73	19.00	38.99	2.00
LMS 2012-42	54.00	99.00	58.33	3.66	45.66	8.33	6.46	73.53	18.33	39.95	1.69
RLC 145	52.66	92.00	56.33	3.00	53.33	8.33	4.84	66.70	18.66	38.45	1.46
SLS 95	57.33	100.33	63.66	3.66	63.66	6.66	6.74	71.50	19.66	41.08	1.86
LCK 1307	53.33	101.33	69.33	2.66	58.00	6.33	7.04	66.43	18.00	40.98	2.13
NDL 2011-31	49.00	94.00	60.33	4.33	57.66	8.00	6.02	72.43	19.00	42.05	1.75
PCL 55	61.66	103.66	59.66	3.33	39.00	8.33	4.86	73.66	17.33	39.14	1.72
NL 261	47.33	98.33	60.66	3.33	46.33	7.66	6.18	72.60	17.33	40.02	1.53
SHARDA	41.00	97.33	48.00	3.66	60.00	7.00	6.96	70.63	19.00	41.01	2.59
LMS 2012-138	56.33	97.00	62.66	4.33	65.00	8.33	5.54	71.73	18.33	40.12	2.48
RLC 140	52.66	98.00	65.00	4.66	67.33	6.66	4.87	74.40	18.66	38.95	1.48
SLS 97	51.66	103.00	70.33	2.33	41.00	6.00	7.65	70.76	16.33	39.89	1.75
NDL 2006-12	53.00	99.66	57.66	2.66	39.00	6.33	4.52	72.73	17.33	36.88	1.00
PKDL 153	45.33	94.66	59.33	2.00	46.33	8.33	6.46	67.03	17.00	38.98	2.61
OL 08-2-7	45.66	99.33	59.00	3.00	52.66	7.66	6.60	74.53	18.33	39.76	2.38
PADMINI	45.33	93.66	69.66	2.33	48.00	8.66	6.94	70.50	15.33	38.95	1.60
BAV 2012-1	72.00	119.33	48.00	3.66	53.33	7.00	5.80	72.16	14.66	37.99	1.63
PKDL 154	54.66	94.66	72.00	3.33	63.33	7.66	5.31	69.23	17.00	37.72	1.45
NL-249	51.33	90.00	57.33	4.00	59.66	8.00	6.10	66.43	18.00	38.88	1.96
NL-258	40.33	84.66	55.66	3.33	42.00	8.00	5.66	72.20	17.33	37.95	1.33
NL-259	47.00	86.66	58.66	3.00	53.33	7.66	5.30	74.30	18.00	37.88	1.61
NL-261-1	40.33	87.33	55.66	2.66	51.00	7.66	7.70	68.50	17.33	38.81	1.75
NL-272	44.66	88.00	57.66	2.00	33.66	6.33	6.16	69.56	16.33	38.05	1.11
NL-276	44.00	91.00	52.33	2.33	40.33	7.00	7.60	69.46	14.66	41.15	1.76
NL-278	52.00	90.66	61.33	2.00	28.66	8.33	5.10	73.53	14.33	39.61	0.99
NL-280	45.66	92.00	60.66	4.00	67.33	7.33	7.63	69.40	17.00	41.89	2.18
NL-283	48.00	91.00	59.33	2.33	55.00	8.00	5.43	73.06	15.33	39.95	2.07
NL-286	45.00	91.00	50.66	2.00	48.00	8.00	6.20	75.20	14.00	41.02	1.53
NL-287	41.00	90.00	56.00	2.33	42.33	7.33	7.80	67.43	14.00	42.39	1.70
NL-303	45.66	88.00	60.33	2.33	26.00	6.66	7.23	72.80	13.00	39.02	1.10
NL-284	43.00	84.66	57.33	3.00	53.33	7.33	6.23	66.93	15.66	38.26	1.84
NL-288	51.00	96.66	64.00	2.66	38.33	7.33	7.53	63.00	15.00	40.25	1.34
NL-294	40.00	85.33	55.66	2.00	39.00	7.00	7.36	64.40	14.66	40.92	1.35
NL-302	49.33	88.00	64.66	2.33	48.00	7.00	6.43	73.03	16.00	39.15	1.42
NL-260(check)	44.00	89.00	64.33	2.00	37.66	7.66	7.26	70.06	14.66	39.98	1.15
RLC-4 (check)	43.66	88.00	64.66	2.33	42.00	7.33	6.16	68.46	15.66	39.08	1.57
NL-97 (check)	51.00	91.66	73.33	1.66	31.66	5.33	5.76	72.30	15.33	41.62	1.02
Lowest	38	85	48	2	26	5	4.52	63	13	36.88	0.99
Highest	72	119	73	4	67	9	7.8	75.2	20	42.39	2.61
Mean	48.81	93.89	59.47	2.84	47.28	7.44	6.24	70.53	16.66	39.57	1.63
S.E.	1.8374	1.4123	0.6887	0.1946	2.6270	0.2774	0.1233	0.2804	0.4335	0.2029	0.1089
C.V.	6.5189	2.6051	2.0055	11.8309	9.6227	6.4552	3.4214	0.6886	4.5055	0.8881	11.5631
C.D. 5%	5.1691	3.9732	1.9374	0.5394	7.3907	0.7806	0.3470	0.7889	1.2197	0.5709	0.3019

Table 2: Analysis of variance for yield and yield contributing characters in linseed.

Source of variation	d. f.	Days to 50% flowering	Days to maturity	Plant height (cm)	No. of branches /plant	No. of capsules /plant	No. of seeds/ capsule	1000-seed wt.(g)	Volume wt.	Harvest index	Oil content	Seed yield/ plant
		1	2	3	4	5	6	7	8	9	10	11
Replication	2	7.43	5.34	0.66	0.24	19.14	0.19	0.02	0.14	0.21	0.12	0.12
Treatment	41	142.81**	124.69**	114.47**	1.84**	341.70**	1.65**	2.51**	27.55**	9.49**	5.27**	0.59**
Error	82	10.12	5.98	1.42	0.21	20.70	0.23	0.04	0.23	0.56	0.12	0.07

* and ** indicates significance at 5 and 1 per cent level respectively

Table 3: Parameters of Genetic variability for yield and yield contributing characters in Linseed

Sr. No.	Character	Range	General Mean	Genotypic variance (σ^2 g)	Phenotypic variance (σ^2 p)	GCV	PCV	Heritability (%)	GA	EGA
1	Days to 50% flowering	38-72	48.817	44.229	54.357	13.623	15.102	81.37	12.358	25.314
2	Days to maturity	85-119	93.896	39.569	45.552	6.699	7.188	86.86	12.077	12.862
3	Plant height (cm)	48-73	59.476	37.683	39.106	10.321	10.514	96.36	12.413	20.871
4	No. of branches/plant	2-4	2.849	0.542	0.756	25.084	29.613	71.76	1.28	43.77
5	No. of capsules/plant	26-67	47.28	106.99	127.70	21.87	23.89	83.79	19.50	41.24
6	No. of seeds/capsule	5-9	7.44	0.47	0.70	9.24	11.278	67.24	1.163	15.623
7	1000 seed wt. (g)	4.52-7.8	6.243	0.821	0.867	14.51	14.917	94.74	1.817	29.112
8	Volume wt./100 ml	63-75.2	70.531	9.106	9.342	4.278	4.333	97.48	6.137	8.701
9	Harvest index	13-20	16.666	2.977	3.541	10.353	11.290	84.08	3.259	19.555
10	Oil content (%)	36.88-42.39	39.579	1.717	1.840	3.310	3.427	93.29	2.607	6.587
11	seed yield/ plant(g)	0.99-2.61	1.607	0.172	0.245	25.450	30.367	70.24	0.717	43.939

(81.37%, 25.31% respectively), number of branches per plant (71.76%, 43.77%respectively), number of capsule per plant (86.79%, 41.24% respectively), 1000 seed weight (94.74, 29.11 respectively) and seed yield per plant (70.24%, 43.93% respectively) indicating that simple selection could be effective for improving these characters. Similar, results observed by Rai *et al*. (1990), Murty and Anand (1966), Chandrashekhar*et al*. (1998b), Mishra and Yadav (1999), Vardhan and Rao (2012), Sanjiv *et al*. (2012), Tahira *et al*. (2013), Reddy *et al*. (2013) and Rafiq *et al*. (2014).

High heritability with low genetic advance for days to maturity, plant height, number of seeds per capsules, volume weight, harvest index and oil content indicating importance of non-additive gene action and therefore direct selection for these traits may not be effective.

Estimates of genotypic and phenotypic coefficient of variation indicated significant variability for all traits indicating good scope for genetic improvement of these traits. High heritability coupled with high genetic advance indicating prevalence of fixable type of genetic variation for these characters. Hence direct selection is highly rewarding in the material.

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