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GENETIC ANALYSIS IN LINSEED UNDER MOISTURE STRESS CONDITION

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ABSTRACT

In 10 x 10 diallel analysis in linseed, additive (D) and dominance (H1 and H2) components were found significant for days to flower, days to maturity, plant height, capsules per plant, 500-seeds weight, harvest index and seed oil content. Only dominance components (H1 and H2) were significant for number of seeds per capsule and biological yield. The degree of dominance indicated preponderance of additive genetic variance for days to flower and days to maturity, equal importance of both genetic components for 500-seeds weight and seed oil content and greater magnitude of dominance component for rest of the characters. Reciprocal recurrent selection or biparental mating is suggested for improvement of all the characters except seeds per capsule and biological yield.

KEY WORDS : Linseeds, genetic analysis, additive and dominance component, diallel analysis, biological yield

Linseed *Linum usitatissimum* L., is an important short duration, cold hardy and drought tolerant oilseed crop, mainly grown for seed oil. Developmental and yield contributing characters have considerable effect on seed yield. While improving seed yield, such characters must be kept in mind to develop genotype suited to the particular situation. The understanding of genetics of such characters is of prime importance to decide breeding methods in order to achieve desired improvement in them. Only meagre information on genetics of these traits is available in literature and hence an attempt has been made to generate information on quantitative inheritance of important developmental, yield contributing characters and seed oil content.

MATERIALS AND METHODS

All possible one way diallel crosses were attempted amongst ten parents *viz.*, LC 1048 (LC 36 x LC 54, Punjab), LCK 88062 (Mukta x Flax Purple, U.P.), LCK 88511 (Neelam x EC 1042, U.P.), LW 28-9 (BR 1 x Delta, W.Bengal), LCK 8605 (Neelam x LC-268, U.P.), AKL 79 (SPS 77-303 x LMH 327, Maharashtra), RLC 29 [(Bengal 64 x R 556) x Afg 14, M.P.)], RLC 35 [(No.55 x R-556) x Afg 14, M.P.)], Chambal (Sel.from 6971 A, Rajasthan) and Triveni [(Chambal x Neelam) Rajasthan)] to generate 45 hybrids. The parents and F1S were planted in a randomised block design with three replications at the Experimental Field, Rajasthan College of Agriculture, Udaipur during *rabi* 1994-95. Each genotype was represented by a single row plot of 2.5m length with a 25 x 10 cm spacing. The data were recorded on randomly selected ten competitive plants for all the characters (Table 1) except for phenological traits *viz.*, days to flower and days to maturity which were recorded on population basis. The mean values were used for statistical analysis by adopting standard procedure and subsequently diallel analysis as per the procedure suggested by Hayman (1954).

RESULTS AND DISCUSSION

Analysis of variance for various characters (Table 1) revealed significant differences among genotypes. The mean squares due to parents, F1S and parents vs hybrids were significant for all the characters except parents and parents vs hybrids for number of seeds per capsule. The non-significant t^2 test for all the characters except primary branches per plant, seed yield and oil yield per plant indicated validity of the assumptions underlying diallel analysis.

The estimates of genetic components of variation together with related genetic parameters for various characters (Table 2) indicated that additive (D) and dominance (H1 and H2) components of variance were significant for all the characters except number of seeds per capsule and biological yield per plant. For these two traits, only dominance components were significant, suggesting the importance of both additive and

Table 1. Analysis of variance and estimates of t^2 values for different characters in linseed

Source	d.f	Days to flower	Days to maturity	Plant height	Primary branches /plant	No.of caps./ plant	No.of seeds/ capsule	500-seeds weight	Seed yield/ plant	Biological yield/ plant	Harvest index	Seed oil content	Oil yield/ plant
Replication	2	0.56	1.87	3.76	0.97*	73.43	0.05	0.14	0.07	4.57	0.001	0.14	0.01
Genotypes	54	160.72**	143.02**	82.47**	1.89**	2472.08**	2.29**	0.81**	11.35**	26.30**	0.01**	5.19**	2.21**
Parents	9	420.76**	252.97**	75.27**	1.36*	2269.59**	0.80	1.10**	11.11**	17.61**	0.016**	8.96**	2.40**
Hybrids	44	92.58**	121.15**	82.20**	2.01**	2447.31**	2.61**	0.69**	11.02**	28.06**	0.010**	4.38**	2.11**
Parents Vs hybrids	1	700.12**	116.01**	159.93**	1.28*	5384.50**	1.37	3.30**	27.90**	26.77**	0.04**	7.20**	4.46**
Error	108	2.16	3.02	4.25	0.31	137.16	0.37	0.025	0.68	2.09	0.001	0.06	0.13
t^2t value		0.013	0.21	0.0004	10.12**	0.30	11.49	0.038	5.52**	2.07	0.04	0.91	5.19**

dominance variance for rest of the characters. However, the degree of dominance $(H1/D)^{0.5}$ revealed preponderance of additive genetic variance for days to flower and days to maturity. Equal importance of both additive and dominance variances for 500-seeds weight as well as seed oil content and over dominance for plant height, number of capsules per plant and harvest index. Preponderance of additive gene effect for days to flower and days to maturity was also observed by Kalia (1972), Singh *et al* (1981) and Dhakar (1994). The findings for plant height, capsules per plant and harvest index are in accordance with those obtained by Singh *et al.* (1983) and Singh *et al.* (1987). The complete dominance for 500-seeds weight and seed oil content was also reported by Nie *et al.* (1991). The results for biological yield per plant were in agreement with Singh *et al.* (1983) whereas for seeds per capsule Chandra (1978) and Thakur *et al.* (1987) reported simila results.

The H2/4H1 ratio indicated the eq distribution of positive and negative genes parental lines for days to maturity, seeds capsule and seed oil content whereas for rest of t characters asymmetrical distribution of increasi and decreasing genes observed in paren population. The above unity proportion dominant and recessive loci estimated by th KD/KR ratio alongwith positive and significan value of F indicated preponderance of dominance genes for days to flower, capsules per plant and harvest index. The group of gene(s) controlling the character and exhibiting dominance (h^2/H2) was around one for most of the characters under study.

All the characters except seeds per capsule and biological yield were under influence of both

Table 2. Components of genetic variance and related parameters for different characters in linseed

Components / parameters	Days to flower	Days to maturity	Plant height	No.of caps./plant	No.of seeds/ capsule	500-seed weight	Biological yield/plant	Harvest index	Oil yield/plant
D	139.53**	83.32**	23.67**	710.81*	0.14	0.36**	5.17	47.76*	2.97**
	±11.25	±4.07	±5.72	±273.40	±0.22	±0.03	±4.15	±11.41	±0.44
H1	88.46**	53.98**	79.78**	3995.63**	2.72**	0.44**	42.99**	114.10**	3.59**
	±23.95	±8.67	±12.18	±581.95	±0.48	±0.07	±8.84	±24.30	±0.94
H2	64.53**	49.08**	45.94**	2878.72**	2.24**	0.29**	27.14**	107.66**	3.05*
	±20.35	±7.37	±10.35	±494.59	±0.41	±0.06	±7.51	±20.65	±0.80
h^2	92.16**	14.95**	20.60**	694.29**	0.14	0.43**	3.28	46.40*	0.94*
	±13.62	±4.93	±6.93	±331.06	±0.27	±0.004	±3.28	±13.82	±0.53
F	100.73**	17.18	22.28	1531.48**	0.13	0.12	15.75	71.52*	1.54
	±25.96	±9.40	±13.21	±630.80	±0.52	±0.07	±9.58	±26.34	±1.54
E	0.72	1.01	1.42	45.72	0.12	0.01	0.70	4.38	0.02
	±3.39	±1.23	±1.73	±82.43	±0.07	±0.01	±1.25	±3.44	±0.02
[H1/D]1/2	0.80	0.80	1.84	2.37	-	1.10	-	1.74	1.10
H2/4H1	0.18	0.23	0.14	0.18	0.21	0.16	0.16	0.19	0.21
Kd/KR	2.66	-	-	2.67	-	-	-	2.52	-
H^2/H2	1.43	0.30	0.45	0.24	-	1.51	-	0.43	0.31
r(Yr.Wr+Vr).	0.70	0.73	-0.03	0.29	-0.05	-0.25	0.11	-0.53	0.44
h^2(n)	107.21**	67.11**	27.26	21.17	44.48	50.39*	14.69	34.66	58.30**

additive and non-additive genetic variance and hence improvement in all these traits could be made through reciprocal recurrent selection or/and biparental mating as biparental mating accumulates additive and additive x additive genetic variance. Advancing segregating generations in single seed descent method as suggested by Brim (1966) with minimal selection pressure prior to F5 or F6 would also be effective for improvement of these characters.

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COMBINING ABILITY ANALYSIS OVER ENVIRONMENTS IN LINSEED

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ABSTRACT

Preponderance of additive gene effect was observed for days to flower, days to maturity, plant height, test weight, seed yield and oil yield. Additive genetic variation done was significant for primary branches, number of seeds per capsule, biological yield and seed oil content, whereas significant dominance genetic variation was seen for harvest index. However, none of the genetic variation was significant for number of capsules per plant. Both gca and sca were influenced by environments suggesting that to have unbiased estimate of gca and sca, the material may be tested over wide range of environments. The parental lines Chambal and Triveni were identified as a good general combiners for seed yield and oil content, earliness and other yield components. The cross combination LCK 88511 x Triveni exhibited high desired sca effects for seed yield, earliness, oil content and other yield contributing attributes. The additive and non-additive variance may be exploited following inter mating among the progenies within and between promising crosses in early segregating generations.

KEY WORDS : Linseed, combining ability, environmental effect, specific combining ability

Success of any crop improvement programme is mainly dependent upon the selection of parents together with the information regarding nature and magnitude of gene effect controlling quantitative traits of economic importance. The knowledge of combining ability provides a useful tool for selection of desirable parents and hybrids for further exploitation. Such information is more reliable when drawn over various environments. Linseed (*Linum usitatissimum* L.) is one of the important oil crop in India as well as in other countries of the world. However, such information is very meagre in this crop. Hence, in the present study, combining ability analysis under three different environments was undertaken.

MATERIALS AND METHODS

Ten diverse genotypes (Table 2) of linseed were selected for crossing in all possible combinations (excluding reciprocal). These 45 F1S