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ADDITIVE, DOMINANCE AND EPISTATIC VARIATION FOR YIELD AND ITS COMPONENTS IN LINSEED (*LINUM USITATISSIMUM* L.)

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ABSTRACT

Three testers, R-552, Garima and their hybrid R-552 x Garima, were crossed to 15 strains/varieties of linseed to estimate the epistatic, additive and dominance components of genetic variance. Modified triple test-cross analysis was done for nine metric traits. Epistasis was evident for all the characters under study except seeds/capsule. The i as well as j and l type epistasis were significant for most of the traits. Additive (D) component was important in all cases except capsules/plant, whereas dominance (H) was significant for seeds/capsule, days to maturity, 1000-seed weight, and oil content. All traits showed partial dominance, and directional element, F was nonsignificant for most of the traits, suggesting ambidirectional nature of dominance.

Key words: Modified triple test-cross, components of genetic variation, linseed.

The information about nature and magnitude of genetic components of variation for yield and its related characters is essential for planning an effective breeding programme in any crop. The modified triple test cross analysis of Ketata et al. [1] provides efficient detection and estimation of epistatic variation along with unbiased estimates of additive and dominance components of genetic variation. The present investigation aims to determine the role of various components of genetic variance in determining the inheritance of nine traits in linseed using modified triple test-cross (TTC) analysis.

MATERIALS AND METHODS

Two linseed pure lines, viz. R-552 and Garima, and their hybrid (R-552 x Garima) were crossed as testers with 15 lines of linseed to develop a set of 45 crosses. The experimental

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material consisting of 3 testers, 15 lines, 30 single crosses, and 15 three-way crosses were evaluated in randomized block design with three replications. Each entry was grown in a 3 m long single row plot with 10 cm spacing within and 30 cm between rows. Observations were recorded on five randomly selected competitive plants for nine quantitative traits (Table 1). Character means were used for modified triple test-cross analysis [1].

RESULTS AND DISCUSSION

The triple test-cross (TTC) analysis revealed that significant epistasis was present for all the characters except seeds/capsule (Table 1). The partitioning of epistasis into i and j and l types showed that additive x additive (i) interaction was significant for primary

Table 1. ANOVA (mean squares) of triple test-cross to test epistasis for nine characters in linseed

Parameter	d.f.	Days to maturity	Plant height	Primary branches per plant	Capsules per plant	Seeds per capsule	1000-seed weight	Seed yield per plant	Harvest index	Oil content
Epistasis	15	643.4**	181.7*	14.4**	10852.3**	9.8	2.70**	47.9*	157.5**	12.1**
i type	1	8.9	51.6	31.9*	55763.8**	2.5	8.06	250.4**	478.4**	50.8**
j + l type	14	689.0*	191.0*	15.7**	7644.3**	10.3	2.31*	33.4	134.6**	9.4**
Epistasis x replicates	30	292.1	77.3	4.4	1677.7	11.6	0.90	19.4	44.2	3.3
i type epistasis x replicates	2	87.6	33.3	9.0	430.9	3.1	0.08	5.0	26.7	4.0
j + l type epistasis x replicates	28	306.7	80.5	4.1	1766.8	12.2	0.96	20.4	45.5	3.2

*,**Significant at 5% and 1% levels, respectively.

branches/plant, capsules/plant, seed yield/plant, harvest index, and oil content. The j and l type epistasis was significant for all the characters except seeds/capsule and seed yield/plant. Existence of significant epistasis in inheritance of seed yield and some other yield components in linseed were reported by others also [2–5]. The relative contribution of i type epistasis was higher than that of j and l type for most of the traits. Therefore, this component of epistatic variance seems to be of greater significance for these traits. The i type epistasis was also found to be more important than j and l interactions for some characters by Chaudhary et al. [2].

The estimates of the components of genetic variance, additive (D), dominance (H) and F components and the degree of dominance $(H/D)^{0.5}$ are given in Table 2. The additive (D) component was significant in all cases except capsules/plant, whereas dominance (H) component was significant for days to maturity, seeds/capsule, 1000-seed weight and oil content. The estimates of D were higher than H for all the traits, which suggests partial dominance. The directional element of dominance, F was positive and significant for days to maturity and seed yield/plant which indicates that majority of alleles with increasing effect for these characters are dominant. The nonsignificant values of F for rest of the characters indicated presence of ambidirectional dominance and alleles with increasing and decreasing effects appear to be dominant and recessive to the same extent.

Table 2. Estimates of additive (D) and dominance (H) components of variance, parameter F, and degree of dominance $(H/D)^{0.5}$ for nine characters in linseed

Parameter	Days to maturity	Plant height	Primary branches per plant	Capsules per plant	Seeds per capsule	1000-seed weight	Seed yield per plant	Harvest index	Oil content
D	263.5**	120.8**	3.3*	636.5	3.9**	6.2**	14.6**	122.3**	9.6**
H	281.4**	29.3	1.5	265.5	3.0**	1.0*	5.8	23.5	1.9**
F	+0.7**	–0.1	+0.5	+0.1	–0.1	–0.1	+0.7**	+0.4	–0.1
$(H/D)^{0.5}$	1.0	0.5	0.7	0.6	0.9	0.4	0.6	0.4	0.4

*,**Significant at 5% and 1% levels, respectively.

The significance of additive component for seed yield and its component traits, except for capsules/plant, indicates that substantial improvement in yield status can still be achieved by following conventional breeding procedures in linseed. The significant contribution of additive x additive (i) type epistasis for yield and some important yield components suggests that this component should not be ignored while predicting the recombinants extractable from segregating generations. Further, results provided evidence of j and l type epistasis for most of the traits studied. However, in autogamous crop like linseed, where commercial exploitation of hybrids has not yet started, this type of epistasis is of little use.

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