**SHORT COMMUNICATION**

# ASSESSMENT OF GENETIC COMPONENTS OF VARIATION IN $F_2$ GENERATION OF LINSEED (*LINUM USITATISSIMUM* L.)

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**Abstract:** 15 $F_1$, s and 6 parents were evaluated during *rabi* 2011-12 in randomized block design with three replications. The present study has been carried out to assess the genetic parameters through $F_2$ diallel populations along with the six parents. The estimates of components D was noted highly significant for number of primary branches per plant and plant height. The dominance components $H_1$ and $H_2$ were highly significant for days to maturity, number of primary branches per plant, number of capsules per plant , number of seeds per plant, 100 seed weight and seed yield per plant. Estimates of $H_1$ and $H_2$ were found to be significant for number of secondary branches per plant and number of seeds per capsule. Parameters of genetic variation in $F_2$ generation suggested that the characters viz. days to 50% flowering, plant height, number of secondary branches per plant, number of seeds per capsule and 100 seed weight were governed by over dominance. The ratio of KD/KR pertains to relative distribution of dominance and necessary genes appeared more than unity for days to 50% flowering, days to maturity and 100 seed weight. The ratio of $h_2/H_2$ was recorded more than 0.5 for number of primary branches per plant, number of capsules per plant, number of seeds per plant and seed yield per plant. The heritability estimates in this analysis recorded high for plant height followed by days to 50% flowering.

**Keywords:** Linseed, Diallel, Combining ability, Genetic components

## INTRODUCTION

Linseed, *Linum usitatissimum* L. is grown as a winter crop mostly in sub-marginal lands under un-irrigated 'utera' conditions. Chhattisgarh is one of the important linseed growing states of India, which accounts nearly 18.05% area and 15.21% production of country. In Chhattisgarh linseed is having 81.54 thousand ha. area with a productivity of 409 kg/ha (Anonymous, 2012). Advance in the development of crop varieties and hybrids greatly depend upon the diverse source of material. Improvement of genetic architecture of any crop depends upon the nature and extent of genetic variability required to effect selection in any breeding material. Yield is a complex trait and cannot be improved by direct selection as it is influenced by a number of independent characters. Thus association of various characters the yield and among themselves would provide criteria for indirect selection through components for improvement of yield.

Improvement of genetic architecture of any crop depends upon pattern of inheritance of traits under consideration. The assumed or expected statistics of genetic components is one of the useful measures to predict the pattern of inheritance of the trait under study. The assumed or expected statistics for $F_2$ generation are of the same as the estimates of $F_1$ generation except the contribution of 'h'.

## MATERIAL AND METHODS

The experiment was conducted at Research cum Instructional Farm, Department of Genetics and Plant Breeding, College of Agriculture, AICRP on Linseed, I.G.K.V., Raipur, Chhattisgarh during *rabi* 2011-12. The experimental materials comprised of 15 $F_2$ populations without reciprocals, derived from 6 parent diallel along with the parents (RLC-92, R-552, Kiran, Polf-22, LCK-88062 and T-397). The progeny of resultant populations of fifteen cross combinations along with six parents were sown in Randomized Complete Block Design with three replications. Each family consisted of a single row of the both parents and 6 rows each of $F_2$ population of that particular cross combination. The length of the row was of 5 m. Row-to-row distance of 30 cm and plant-to-plant distance of 10 cm was maintained. All recommended cultural practices were followed to raise a healthy crop. The observations were recorded on 5 randomly selected plants in the parental rows and 30 plants from $F_2$ population in each plot per replication for seed yield and its components. The genetic parameters measured were days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per capsule, number of seeds per plant, 100 seed weight and seed yield per plant.

The diallel analysis technique suggested by Hayman (1954) and Jinks (1956) was used to analyse the data for study of components of variation in $F_2$ generation. Combining ability analysis was done according to the Method-2, Model-1 of Griffing (1956).

## RESULT AND DISCUSSION

The estimates of genetic components are presented in Table 1. The estimates of component D was noted highly significant for number of primary branches per plant. It was significant for plant height in $F_2$ generation. The dominance components, $H_1$ and $H_2$ in $F_2$ were highly significant for days to maturity,

number of primary branches per plant, number of capsules per plant, number of seeds per plant, 100 seed weight and seed yield per plant. significant for number of secondary branches per plant, number of seeds per capsules and non-significant for days to 50 % flowering and plant height.

The parameters of genetic components of variations were computed for all the 10 characters and depicted in Table 2. The mean degree of dominance $F_2$ is $¼(H_1/D)^{1/2}$ was recorded over dominance > 1 for characters days to 50% flowering (1.23), days to maturity (3.68), number of seed per capsule (3.06), number of seed per plant (1.65), number of secondary branches per plant (1.28), 100 seed weight (1.60) and partial dominance < 1 for characters *viz.* Plant height (0.56), number of capsules per plant (-4.13) and seed yield per plant (-4.35) whereas, the ration of $H_2/4H_1$ *i.e.* relative proportion of increasing (positive) or decreasing (negative) genes was found with unity (0.25) for number of primary branches per plant. It was noted that less than unity for all the traits indicating more proportion of genes with negative effects. The mean degree of dominance of F2, $¼(H_1/D)^{1/2}$ for these traits noted to be more than unity indicating the importance of both additive and non-additive gene actions. It was further confirmed by highly significant $H_1$, $H_2$ components in $F_2$ generation. Thus the case of over dominance for expression of this character was prevailed. Further, the proportion of dominant and recessive genes showed a asymmetrical distribution among common parents as the ratio between ($H_2/4H_1$) was below the unity and hence proportion of negative genes are preponderance for this traits (Singh and Chaudhary, 1977). These results were in agreement with Kumar and Chauhan (1980), Khorgade et al. (1990), Singh (2000) and Patel et al. (1999).

The ratio KD/KR pertains to relative distribution of dominance and necessary genes appered more than unity (1.0) for 100 seed weight (10.10), days to maturity (2.16) and days to 50% flowering (1.40). The ratio $h^2/H_2$ was recorded more than 0.5 for number of primary branches per plant, number of secondary branches per plant, number of capsules per plant, number of seeds per plant and seed yield per plant. Rest of the characters found low for this parameters. Similarly the heritability estimate was recorded high for plant height followed by days to 50% flowering, 100 seed weight, number of primary branches per plant and days to maturity and rest of the characters exhibited low heritability estimates. The correlation coefficient was also noted to be significant negative values except for plant height and number of seeds per capsule. The characters days to maturity indicated mean degree of dominance above unity indicating the case of over dominance, which is also evidenced by high $H_2$ value. The over dominance for days to 50 % flowering and 100 seed weight was also indicated by above unity (>1.0) value. For the characters, days to maturity, number of primary branches per plant, number of seeds per plant, 100 seed weight and seed yield per plant confirmed by highly significant values of $H_1$ and $H_2$. Mahto and Rahman (1998), Yadav et al. (2000), Tiwari et al. (2004) and Gauraha and Rao (2011) also reported similar findings. The characters governed by non-additive gene action, which could not be exploited by any classical breeding programme. Hence, these populations can be improved by following procedure of recurrent selection for specific combining ability in order to exploit the non-additive gene effect.

**Table 1**: Genetic components of variation for yield and its components in $F_2$ generation of linseed

| Characters | D | $H_1$ | $H_2$ | F | $h^2$ | E |
|---|---|---|---|---|---|---|
| Days to 50% flowering | 0.86<br>±0.90 | 21.05<br>±8.19 | 20.16<br>±8.96 | 2.53<br>±5.23 | -0.17<br>±1.54 | 0.28<br>±0.32 |
| Days to maturity | 0.46<br>±2.17 | 99.89**<br>±21.87 | 89.46**<br>±20.73 | 6.16<br>±11.07 | 21.58**<br>±3.90 | 0.94<br>±0.80 |
| Plant height (cm) | 35.32*<br>±9.71 | 178.26<br>±86.50 | 112.19<br>±78.11 | -65.04<br>±43.10 | -2.81<br>±13.69 | 6.08<br>±3.80 |
| No. of primary branches / plant | 3.50**<br>±0.08 | 3.50**<br>±0.72 | 3.73**<br>±0.64 | -0.09<br>±0.37 | 3.10**<br>±0.16 | 0.25**<br>±0.04 |
| No. of secondary branches / plant | 1.31<br>±0.95 | 34.61*<br>±9.94 | 33.10*<br>±8.58 | 2.00<br>±4.90 | 28.10**<br>±1.48 | 1.16*<br>±0.40 |
| No. of capsules / plant | -8.15<br>±33.09 | 2228.07**<br>±26.85 | 2075.36**<br>±293.14 | -37.34<br>±156.26 | 1712.73*<br>±48.39 | 13.23<br>±12.48 |
| No. of seeds / capsules | 0.002<br>±0.02 | 0.30*<br>±0.10 | 0.29*<br>±0.10 | -0.13*<br>±0.06 | 0.07<br>±0.03 | 0.04<br>±0.03 |
| No. of seeds / plant | 311.03<br>±2282.63 | 13587.98**<br>±23577.35 | 90544.21**<br>±20794.04 | 1288.40<br>±11175.68 | 61781.64**<br>±3780.26 | 643.02<br>±871.46 |
| 100 seed weight (g) | 0.28<br>±0.21 | 11.57**<br>±1.96 | 7.38**<br>±1.82 | 1.45<br>±0.90 | -0.10<br>±0.30 | 0.18<br>±0.09 |
| Seed yield (g) / plant | -0.02<br>±0.08 | 6.08**<br>±0.77 | 5.12**<br>±0.70 | 0.07<br>±0.33 | 3.14*<br>±0.10 | 0.06<br>±0.04 |

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

**Table 2:** Parameters of genetic variation for yield and its components in $F_2$ generation of linseed

| Characters | ¼$(H_1/D)^{1/2}$ | $H_2/4H_1$ | ¼$(H_1)^{1/2}$+ $(1/2)^F$ / ¼$(DH_1)^{1/2}$– $(1/2)^F$ | $h^2/H_2$ | Heritability (NS) | Values of wr with standard P and Wr + Vr |
|---|---|---|---|---|---|---|
| Days to 50% flowering | 1.23 | 0.23 | 1.40 | -0.008 | 11.34 | -0.240 |
| Days to maturity | 3.68 | 0.22 | 2.16 | 0.24 | 2.01 | -0.307 |
| Plant height (cm) | 0.56 | 0.15 | 0.03 | -0.02 | 24.61 | 0.333 |
| No. of primary branches / plant | 0.25 | 0.26 | 0.66 | 0.83 | 2.10 | -0.291 |
| No. of secondary branches / plant | 1.28 | 0.23 | 0.87 | 0.84 | -0.91 | -0.928 |
| No. of capsules / plant | -4.13 | 0.23 | -0.12 | 0.82 | -1.10 | -0.536 |
| No. of seeds / capsules | 3.06 | 0.24 | 0.30 | 0.24 | -1.22 | 0.530 |
| No. of seeds / plant | 1.65 | 1.66 | 0.02 | 0.68 | 1.35 | -0.615 |
| 100 seed weight (g) | 1.60 | 0.15 | 10.10 | -0.01 | 8.03 | -0.201 |
| Seed yield (g) / plant | -4.35 | 0.21 | -2.85 | 0.61 | -0.65 | -0.620 |

## REFERENCES


**Anonymous** (2012). Front line demonstration in oilseeds. Annual Report Directorate of oilseed Research, Hyderabad. pp.15-21.

**Gauraha, D. and Rao, S.S.** (2011). Studies on Gene Action for Yield and Yield Attributing Characters in linseed (*Linum usitatissimum L.*). *Journal of Agricultural Sciences*, **2**(1) : 44-48.

**Griffing, B.** (1956). Concept of general and specific combining ability in selection to diallel crossing system. *Australian Journal Biological Sciences*, **9**: 463-493.

**Hayman, J.L.** (1956). The theory and analysis of diallel crosses. *Genetics*, **39**: 789-809.

**Jinks, J.L.** (1956). The analysis of continuous variation in a diallel cross of *Nicotiana rustica* varieties. *Genetics*, **41**: 767-788.

**Khorgade, P.W.; Narkhede, M.N.; Ingle, W.S.; Raut, S.K. and Dakhare, S.R.** (1990). Combining ability for yield, oil content and related components in linseed. *Journal of Maharashtra Agricultural University*, **15**(3): 281-283.

**Kumar, S. and Chauhan, B.P.S.** (1980). Combining ability in linseed. *Indian Journal of Genetics and Plant Breeding*, **40**(1): 216-221.

**Mahto, C. and Rahman, M.H.** (1998). Line x tester analysis of seed yield and its components in linseed (*Linum usitatissimum* L.). *Journal of oilseeds Research*, **15**(2): 242-246.

**Patel, J.A.; Gupta Y.K.; Patel, S.B. and Patel J.N.** (1999) Genetic architecture of seed yield and yield components in linseed (*Linum usitatissimum* L.). *The Madras Agricultural. Journal*, **86**(4-6): 286-288.

**Singh, P.K** (2000). Gene action for seed yield and its components in linseed. *Indian Journal Genetics and Plant Breeding*, **60**(3): 407-410.

**Singh, R.K and Chaudhary, B.D** (1977). Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi, Ludhiana pp. 1-318.

**Tiwari, N.; Dixit R.K. and Singh, H.C.** (2004) Combining ability analysis for seed yield and its components in linseed ( *Linum usitatissimum* L.) *Journal of Oilseeds Research*, **21**(2): 343-345.

**Yadav, R.K.; Gupta, R.R. and Ram, K.** (2000) Heterosis and combining ability estimates in linseed (Linum usitatissimum L.). In: National Seminar on oilseed and oils Research and Development Needs in the Millennium. Feb 2-4, 2000. DOR, Hyderabad.