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Interrelationship Analysis among Morphological and Seed Yield Contributing Traits in Yellow Seeded Genotypes of Linseed (*Linum usitatissimum* L.)

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A B S T R A C T

40 (forty) yellow seeded genotypes of linseed taken from AICRP on linseed, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) along with one check variety surabhi (yellow seeded check) were evaluated for estimation of seed yield and oil content. The high significant and positive correlation of oil yield per plant with 1000 seed weight suggested that heavy weight seed might have higher oil content. Therefore, selection based on 1000 seed weight could be depending on rich oil yield for the development of varieties. The branches/plant, Test weight and plant height identified as important traits for selection in linseed breeding program.

Introduction

Linseed (*Linum usitatissimum* L.) belongs to family Linaceae. It is the only economically important species of the family. It is a multipurpose rabi oilseed crop, cultivated for oil and fibre, which belongs to the family Linaceae having 14 genera. Linum has over 200 species with *Linum angustifolium* Huds (n=15) being its probable progenitor, native to Mediterranean region and Southwest Asia. The seed oil of linseed is utilized for fabrication of various biodegradable products such as drying oil, paints and varnishes, wood treatments, soap, linoleum, putty and pharmaceuticals while fibre from flax is used for valuable raw material for textiles, thread and packaging materials, and its straw is used to produce special types of papers for cigarettes, currency notes and the wooden part serves as biomass energy (ROWLAND, 1998).The main economic product of yellow seeded genotype of linseed i.e. oil is non-edible, drying in nature due to saturated fatty acids that include: palmitic acid (about 7%), acid (3.4 - 4.6%) unsaturated fatty acids like oleic acid (18.5-22.6%), linoleic acid (14.2-17%) and the omega-3 fatty acid α-linolenic acid (51.9-55.2 %) (Mirza *et al.*, 2011). High content of α-linolenic acid, high percentage of dietary fibre and high content of lignans are major components which makes linseed as an important crop for human health. Flaxseed is also used as animal feed to increase the level of α-linolenic acid in meat and eggs (Simmons *et al.,* 2011). Correlation coefficient estimates degree of association of different component characters of yield among themselves and with the yield. When there is positive correlation between major yield components, breeding strategies would be very effective but, on the reverse, selection becomes very difficult. A clear picture of contribution of each component in final expression of complex character would emerge through the study of correlations analysis revealing different ways in which component attributes influence the complex trait. Keeping this in view, the aim of present investigation was to develop a variety with high in yield and quality through correlation analysis studies.

Materials and Methods

An experiment was conducted with 40 genotypes (Table 1) of yellow seeded linseed along with one yellow seeded check variety viz., Surabhitaken from AICRP on linseed, during rabi crop season 2017-18at Experimental farm of the Department of genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India. The trail was laid out in Randomized Block Design with three replications in a single row of 3m length with spacing of 30cm between row to row and 7cm between plant to plant. The parameters taken at plant basis are days to flowering (50%), days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, total number of branches per plant, 1000 seed weight (g), oil yield per plant (g), harvest index (%), seed yield per plant (g)were taken on plot basis. The data on these traits is then subjected to statistical analysis. Statistical analysis of the data was subjected to analysis of variance (ANOVA). Calculations of ANOVA can be characterized as computing a number of means and variances, dividing two variances and comparing the ratio to a handbook value to determine statistical significance. Differences within and between treatments and their significance is best explained in the procedure suggested by Panse and Sukhatme (1984). Phenotypic and genotypic coefficients of correlation were worked out by the procedure of Al- Jibouri *et al.,* (1958) and Dewey and Lu (1959).

Estimation of correlation coefficients

For evaluating coefficient of phenotypic and genotypic association for all possible combination pair. Correlation coefficient analysis evaluate mutual relationship between various trait at phenotypic (g) and environment (E) with the aid of following formula given by Miller *et al.,* (1958), Hanson *et al.,* (1956) and Johnson *et al.,* (1955) was taken.

$$r_{xy(g)} = \frac{Cov_{(g)}X.Y}{\sqrt{\sigma^2_{(g)}X \times \sigma^2_{(g)}Y}}$$

Whereas,

$r_{xy(g)}$ = Genotypic correlation coefficient between x and y

Cov $_{(g)}$xy = Genotypic covariance between x and y

$\sigma^2 x_{(g)}$ = Genotypic variance of character x

$\sigma^2 y_{(g)}$ = Genotypic variance of character y

$$r_{xy(p)} = \frac{Cov_{(p)}X.Y}{\sqrt{\sigma^2_{(p)}X \times \sigma^2_{(p)}Y}}$$

Whereas,

$r_{xy(p)}$ = Phenotypic correlation coefficient between x and y

Cov $_{(p)}$xy = Phenotypic covariance between x and y

$\sigma^2 x_{(p)}$ = Phenotypic variance of character x
$\sigma^2 y_{(p)}$ = Phenotypic variance of character y

Results and Discussion

The analysis of variance (Table.2) revealed significant differences among the yellow seeded genotypes studied for all the characters studied viz., namely days to flowering (50%), days to maturity plant height (cm), number of primary branches per plant, number of secondary branches per plant, total number of branches per plant, 1000 seed weight (g), oil yield per plant (g), harvest index (%), seed yield per plant (g). The characters viz., harvest index, plant height, number of secondary branches per plant and seed yield per plant exhibiting high genotypic and phenotypic coefficient of variation showed the presence of considerable amount of variability for these characters for all genotypes. Hence, there is enough scope for enhancement of these characters. In order to achieve the goal of increased production by increasing the yield potential of the crop, knowledge of direction and magnitude of association between various traits is essential for plant breeders (Iqbal *et al.*, 2013). Earlier finding of Dubey *et al.*, (2006), Reddy *et al.*, (2013) were in agreement with present study.

Table.1

List of 40 yellow seeded germplasm of linseed with yellow seed check			
YLS-1	YLS-11	YLS-22	YLS-32
YLS-2	YLS-12	YLS-23	YLS-33
YLS-3	YLS-13	YLS-24	YLS-34
YLS-4	YLS-14	YLS-25	YLS-35
YLS-5	YLS-15	YLS-26	YLS-36
YLS-6	YLS-16	YLS-27	YLS-37
YLS-7	YLS-17	YLS-28	YLS-38
YLS-8	YLS-18	YLS-29	YLS-39
YLS-9	YLS-20	YLS-30	YLS-40
YLS-10	YLS-21	YLS-31	Surabhi

Table.2 Analysis of variance for different characters

S.No.	Source of variance	Mean sum of square		
		Replication	Genotype	Error
	Degree of freedom	2	39	78
1	days to flowering (50%)	3.06	39.3**	4.43
2	Days to maturity	17.18	97.2**	12.8
3	Plant height (cm)	11.1	24.3**	4.03
4	No. of primary branches/plant	1.59	4.89**	0.57
5	No. of secondary branches/ plant	4.01	12.74**	1.81
6	Total no. of branches/ plant	10.2	20.76**	2.25
7	1000 seed weight(g)	0.16	1.61**	0.07
8	Oil yield/ plant(g)	0.83	2.43**	0.31
9	Harvest index(%)	18.3	105.2**	6.2
10	Seed yield/ plant(g)	5.34	11.3**	2.22

Table.3 Genotypic correlation of seed yield and contributing traits in yellow seeded linseed during 2018-19 at Raipur (C.G.)

	DF	DM	PH	PB	SB	TB	TWS	OY	HI	SY
DF	1.00	0.932**	0.209*	-0.251**	0.001	-0.148	0.071	0.082	-0.046	0.091
DM		1.00	0.176	-0.298**	0.06	-0.117	0.121	0.079	-0.038	0.098
PH			1.00	0.055	-0.1	-0.094	0.230*	0.290**	0.081	0.435**
PB				1.00	0.238**	0.669**	-0.074	-0.118	0.128	0.232*
SB					1.00	0.881**	-0.184*	-0.06	-0.175	-0.154
TB						1.00	-0.198*	-0.089	-0.059	0.208*
TWS							1.00	0.279**	-0.013	0.383**
OY								1.00	0.777**	0.769**
HI									1.00	0.793**
SY										1

*Significant at 5% level of significance ** Significant at 1% level of significance

DF – Days to 50% flowering
DM – Days to maturity
PH – Plant height (cm)
PB – Number of primary branches per plant
SB – Number of secondary branches per plant
TB – Total number of branches per plant
TWS – 1000 seed weight (gm)SY- Seed yield per plant (gm)
HI- Harvest index (%)
OY- Oil yield per plant (gm)

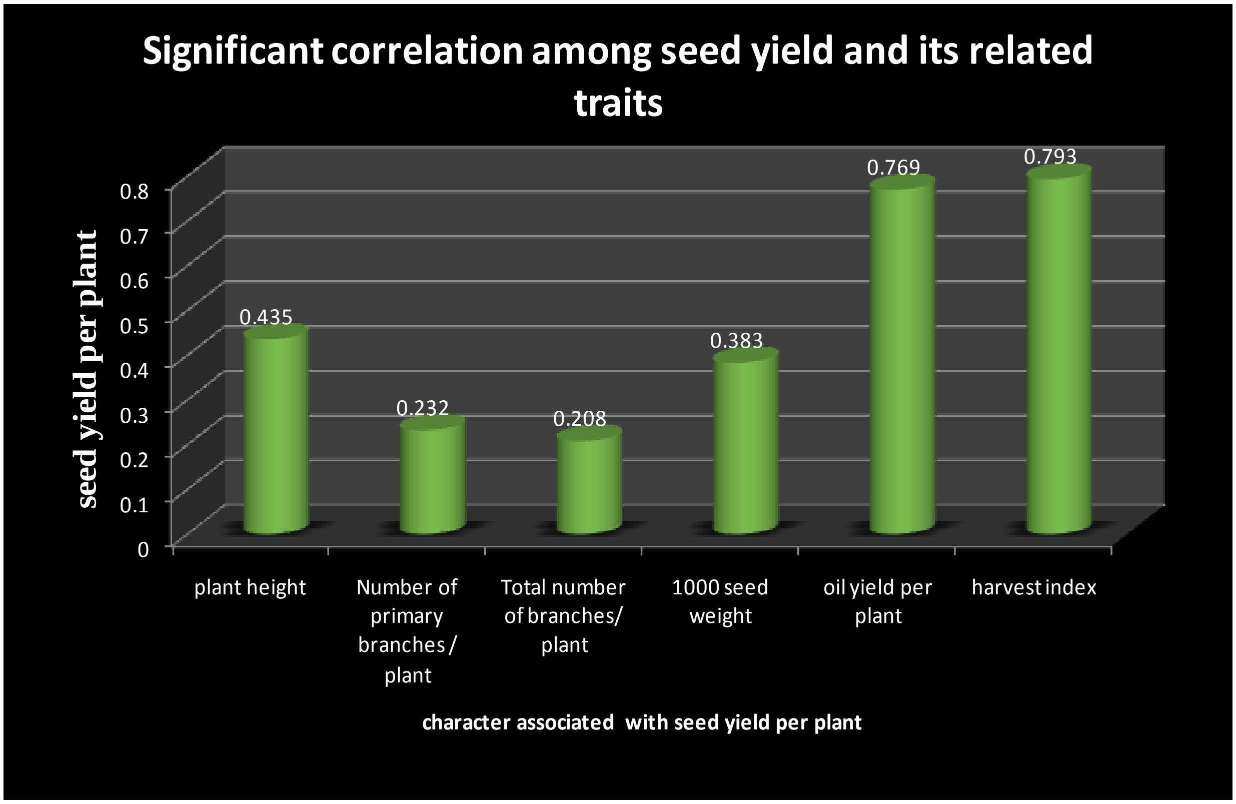
Table.4 Phenotypic correlation of seed yield and contributing traits in yellow seeded linseed during 2018-19 at Raipur (C.G.)

	DF	DM	PH	PB	SB	TB	TWS	OY	HI	SY
DF	1.00	0.922**	0.167	-0.175	0.021	-0.108	0.063	0.080	-0.059	0.114
DM		1.00	0.173	-0.168	0.041	-0.066	0.102	0.098	-0.049	0.115
PH			1.00	0.071	0.013	0.002	0.181*	0.208*	0.055	0.247**
PB				1.00	0.143	0.594**	-0.044	-0.070	0.090	-0.142
SB					1.00	0.826**	-0.105	-0.020	-0.124	-0.094
TB						1.00	-0.119	-0.049	-0.046	-0.145
TWS							1.00	0.219*	-0.021	0.288**
OY								1.00	0.590**	0.728**
HI									1.00	0.560**
SY										1.00

*Significant at 5% level of significance ** Significant at 1% level of significance.

DF – Days to 50% flowering
DM – Days to maturity
PH – Plant height (cm)
PB – Number of primary branches per plant
SB – Number of secondary branches per plant
TB – Total number of branches per plant
TWS – 1000 seed weight (gm)SY- Seed yield per plant (gm)
HI- Harvest index (%)
OY- Oil yield per plant (gm)

Fig.1 Graphical representation of correlation among seed yield and its contributing traits in yellow seeded linseed genotypes at genotypic level during 2018-19 at Raipur (C.G.)



Correlation coefficient analysis

Correlation coefficient estimates degree of association of different component characters of yield among themselves and with the yield. The correlation studies between various yield attributes with yield, provides a basis for further breeding programs. Yield is a complex and highly variable character which is a result of cumulative effect of its component characters. The yield components may not always be independent in nature but interlinked. The selection practiced for one character may simultaneously bring change in other traits. Thus, association among yield and its attributing characters is must. The selection of traits with high expression and association (association being positive) considerably increase the rate of desirable genes. The results of experiment revealed that, genotypic and phenotypic correlation coefficient was similar in directions, while in magnitude, genotypic correlations were mostly higher than corresponding phenotypic correlations. Similarly, Nagaraja *et al.,* (2009) also reported that genotypic correlation coefficients were higher than their respective phenotypic correlation coefficients for most of the characters. Thus, the low phenotypic correlation could result due to the masking and modifying effect of environment on the association of characters at genotypic level.

The high significant and positive correlation of oil yield per plant with 1000 seed weight suggested that heavy weight seed might have higher oil content. Therefore, selection based on 1000 seed weight could be depend on rich oil yield for the development of varieties. Similar finding has also been reported by Diederichsen and Fu (2008) suggested that high 1000 seed weight affect oil yield. Tadesse *et al.,* (2010), Rahimi *et al.,* (2011) and Pali and Mehta (2014).

Correlation coefficients of seed yield and its component traits is shown in table 3.1.Correlation analysis in yellow seeded linseed revealed that seed yield per plant positively and significantly correlated with plant height (0.42), number of primary branches per plant (0.23), total number of branches per plant (0.21), oil yield per plant (0.72), harvest index (0.56) and 1000 seed weight (0.28) at genotypic level. Similar findings have also been reported by Gauraha *et al.,* (2011), Pali and Mehta (2013), Muhammad *et al.,* (2014), Paul *et al.,* (2015) and Chaudhary *et al.,* (2016), that plant height, oil yield per plant, number of primary branches per plant and 1000 seed weight had positive association with seed yield per plant.

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