RESEARCH ARTICLE

STUDIES ON CORRELATION AND PATH CO-EFFICIENTS ANALYSIS FOR YIELD AND YIELD ATTRIBUTES IN NIGER [(*GUIZOTIA ABYSSINICA* (L. F.) CASS.] GERMPLASM LINES

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Abstract: The present investigation was undertaken to study the interrelationship and path coefficient analysis for grain yield and its components in niger germplasm lines. The current experiment was carried out using 54 niger germplasm lines along with three standard checks at University of Agricultural Sciences, Bengaluru, GKVK, during *Kharif* 2017, material was sown by using augmented design with nine blocks. The character association analysis in niger germplasm lines revealed that plant height, number of primary and secondary branches, Days to 50 % flowering,number of capsule per plant, number of seeds per capsule, capsule diameter and test weight had significant and positive correlations with seed yield per plant. Path coefficient analysis revealed that plant height, number of secondary branches, number of capsule per plant, capsule diameter and test weight had a high positive direct effect on seed yield.

Keywords: Niger, Correlation coefficient, Path coefficient

INTRODUCTION

Niger (*Guizotia abyssinica* (L.f.) Cass) an oil bearing annual is an herbaceous plant belonging to the natural order compositae, sometimes referred to as Asteraceae, tribe heliantheae and sub-tribe coreopsidinae. It is originated in Ethiopia, niger is one of the old world archetype species which has retained its originality without undergoing any alteration in its genetic architecture throughout its history of evolution. Ethiopia and India are the two major niger growing countries in the world. It is an economically important edible oil seed crop with 30-50 per cent oil content. Direct selection for yield and yield attributing traits is not effective as they are complex quantitative characters, highly influenced by environment. High genotype and environment interaction will restrict improvement if selection is based on yield *per se*. The effective improvement in yield may be brought about through selection on yield component characters. The aim of correlation studies is primarily to know the suitability of various characters for indirect selection because any particular trait may bring about undesirable changes in other associated characters. Yield component characters show associations among themselves and also with yield. The unfavourable associations between the desired attributes under selection may limit genetic advance. Hence, knowledge of associations between the yield and yield components and also among the yield components is essential for planning a sound selection programme (Falconer, 1981).

MATERIALS AND METHODS

Description of the study site

The experiment was conducted at K block, University of Agricultural Sciences, GKVK, Bengaluru during *Kharif* 2017. The experimental site is located at a latitude of 13° 4′ 55.92″ North, longitude of 77° 34′ 34.57″ East and altitude of 899 meters above mean sea level. The average annual rainfall is 779.7mm.

Experimental materials and design

The experimental material consisting of 54 Niger germ plasm lines and 3 check varieties *viz.*, KBN-1, NO.71 and LOCAL was taken up during 2017 *Kharif* in augmented statistical design with nine blocks and three standard check varieties. Size of each block was 4×3m and each germplasm was grown in a row of 4m length which accommodates 30-40 plants per row. A spacing of 30×10cm was provided as recommended in package of practice.

Data collection

Morphological characters viz., Plant height (cm), Primary branches plant^{-1}, Secondary branches plant^{-1}, Days to 50 % flowering, Capsules plant^{-1}, Seeds capsule^{-1}, Capsule diameter, Seed yield plant^{-1} (g) ,1000 seed weight (g) and Oil content (%). Data recorded on 10 randomly selected plants from each germplasm line and oil content (%) was determined for each genotype from 5 g of seeds using destructive method of oil estimation.

Estimation of correlation coefficient

The simple correlation coefficients was calculated to determine the direction and magnitude of associations among different characters and tested against table ‘r’ values (Fisher and Yates, 1963) for

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(n-2) degrees of freedom both at 0.05 and 0.01 probability levels for their significance. Simple correlations were calculated by using the formula as given by Weber and Moorthy (1952). Path-coefficient analysis is partitioning of the correlation coefficients into the measures of direct and indirect effects of yield components on yield as suggested by Wright (1921) and illustrated by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Correlation studies among seed yield components in niger germplasm lines

The magnitude and direction of association among character would be measured by correlation coefficient. Yield is a complex trait governed by large number of genes and is the result of interaction of many interrelated attributes. Hence knowledge of correlations among niger traits is important for improvement in niger and also to identify and avoid characters that have little or no importance and use of some traits in the selection program, to define breeding target and cultivars model and to recognize impediments and benefits of a breeding process well in advance. With characters that exhibited positive correlations, simultaneous improvement in two or more characters is possible. The phenotypic correlation (rp) among traits reflects observed relationship between traits arising from the combined effects of genotype and environment, whereas genetic correlations (rg) estimate the association between traits resulting either from linkage or pleiotropy (Falconer, 1981).

The correlation among yield and yield components results obtained are presented in Table 1. Plant height had significantly positive correlation with traits like primary branches (0.97), secondary branches (0.97), days to flowering (0.45) number of capsule per plant (0.82), number of seeds per capsule (0.88), capsule diameter (0.80) and test weight (0.98). Whereas it showed non-significant negative correlation with the oil content (-0.19). Primary branches per plant showed significantly positive correlation with traits like secondary branches (0.98), days to flowering (0.40), number of capsule per plant (0.81), number of seeds per capsule (0.83), capsule diameter (0.75) and test weight (0.97). Whereas it showed non-significant negative correlation with the oil content (-0.18). Secondary branches per plant showed significantly positive correlation with traits like days to flowering (0.41) number of capsule per plant (0.81), number of seeds per capsule (0.86), capsule diameter (0.78) and test weight (0.97). Whereas it showed non-significant negative correlation with the oil content (-0.21). Days to flowering revealed significantly positive correlation with number of capsule per plant (0.40), number of seeds per capsule (0.45), capsule diameter (0.37) and test weight (0.44). Whereas it showed non-significant negative correlation with the oil content (-0.22). Number of capsule per plant exhibited significantly positive correlation with number of seeds per capsule (0.70), capsule diameter (0.63) and test weight (0.83). Whereas it showed non-significant negative correlation with the oil content (-0.15). Number of capsule per plant play a major role in yielding of plants, because if the plants having more number of capsule per plant means yielding of single plants also more. These findings are similar with the result and reported that yield was significantly and positively correlated with number of branches per plant and capitula per plant. Number of seeds per capsule recorded significantly positive correlation with capsule diameter (0.74) and test weight (0.86), whereas non-significant negative correlation was recorded with oil content (-0.24), similar results were found and reported that days to maturity and number of seeds per capitulam had strong correlation with yield in niger. The trait test weight was non-significant and negatively correlation with oil content (-0.19). Association of the character test weight was significant and positive at phenotypic level with seed yield per plant, seeds per capsule, capsule per plant, primary branches per plant, secondary branches per plant, Similar results were reported and that seed yield had significant and positive association with number of branches per plant and 1000 seed weight. The trait oil content was non-significant and negatively correlation with seed yield (-0.20).

Grain yield per plant exhibited significant positive correlationswith plant height (0.95) primary branches (0.90), secondary branches (0.93), days to flowering (0.45), number of capsule per plant (0.80), number of seeds per capsule (0.85), capsule diameter (0.81) and test weight (0.95). Grain yield was non-significant and negatively correlated with oil content (-0.20). Similar results were reported high positive correlation of seed yield with number of capitula followed by plant height, number of secondary branches and number of primary branches in niger. Lakshmi (1999) and observed a positive correlation of capsule plant^{-1}, secondary branches plant^{-1}, primary branches plant^{-1}, plant height, seeds capsule^{-1} and 1000 seed weight with seed yield plant^{-1} in niger. Based on phenotypic and genotypic association between yield and yield attributing characters, suggested that selection should be made for the characters, which are having positive significant association to improve the seed yield plant^{-1} in niger.

Path coefficient analysis for yield and yield attributing traits in niger germplasm lines

Seed yield is a polygenic trait, hence direct selection for this character may often be incorrect. The components that determine the yield are the best indices for selection. Therefore, knowledge of the association between important yield attributes and seed yield may help the breeder to identify suitable donors for any successful breeding. Path analysis can provide an effective means of partitioning the

correlation coefficient into direct and indirect effects. The results of phenotypic path-coefficients on seed yield calculated with respect to plant height, primary branches plant^{-1}, secondary branches plant$^{-1,}$ days to 50 % flowering, capsule plant^{-1}, seeds capsule^{-1}, capsule diameter, test weight (g), seed yield per plant (g) and oil content (%) are presented in Table 2.

The direct effect of plant height was positive and high (0.6560). The indirect effect of plant height through primary branches, secondary branches, days 50 % flowering, number of capsule per plant and capsule diameter on seed yield was positive and high on seed yield. Primary branches plant^{-1} revealed a negative direct effect (-0.7410) on seed yield plant^{-1}. The indirect effect of all the traits *viz* secondary branches, days to flowering, number of capsule per plant, number of seeds per capsule and capsule diameter were negative and indirect effect on seed yield. The direct effect of secondary branches per plant was showed positive and higher effect (0.4502). The indirect effect of secondary branches per plant through days 50 % flowering, number of capsule per plant and capsule diameter on seed yield was positive and higher effect on seed yield. The direct effect of days to 50 % flowering on seed yield was positive and negligible (0.0126). The indirect effect of days to 50 % flowering through number of capsule per plant, capsule diameter, test weight (g) and oil content (%) on seed yield was positive and negligible. The direct effect of number of capsule plant^{-1} on seed yield was positive and negligible (0.0239). Capsule plant^{-1} showed negligible positive indirect effect on seed yield via plant height, number of primary branches per plant, number of secondary branches per plant, capsule diameter, test weight (g) and oil content (%). Trait number of seeds per capsule revealed a negative direct effect (-0.0374) on seed yield plant. The indirect effect of all the traits viz secondary branches, days to flowering, number of capsule per plant, number of seeds per capsule and capsule diameter was negative and indirect effect on seed yield. The direct effect of capsule diameter on seed yield was positive and negligible (0.0893). Capsule diameter had positive negligible indirect effect on secondary branches, days to 50% flowering, number of capsule per plant, capsule diameter, test weight and oil content. The direct effect test weight was showed positive and higher effect (0.5241). The indirect effect of test weight through days 50 % flowering, number of capsule per plant and capsule diameter on seed yield was positive and high on seed yield. Observations have been reported positive direct effect on seed yield with number of primary branches, number of secondary branches and capsules plant. Days to 50 % flowering had negligible positive direct effect on the seed yield per plant, while its indirect effect through plant height, number of primary branches, number of secondary branches, number of capitula, number of seeds per capsule and test weight was small and positive direct effect. Lakshmi (1999) observed seeds capsule and 1000 seed weight had the highest positive direct effect on seed yield. Number of seeds per capsule had small positive direct effect on the seed yield per plant, while its indirect effect through plant height, number of primary branches per plant, number of secondary branches, number of capitula and test weight was small negligible positive effect. Test weight had high positive direct effect on the seed yield per plant, while its indirect effect through plant height, number of primary branches per plant, number of secondary branches, number of capitula, number of seeds per capsule was high and positive effect. Results were reported and observed seed yield had high positive direct effect through plant height, number of primary branches and test weight.

Table 1. Estimates of phenotypic correlation coefficients for yield and yield attributing characters in Niger germ plasm lines

	X1	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**X9**	**X10**
X1	1.00	0.97 **	0.97 **	0.45**	0.82 **	0.88**	0.80 **	0.98 **	-0.19	0.95**
X2		1.00	0.98 **	0.40**	0.81 **	0.83 **	0.75 **	0.97 **	-0.18	0.90**
X3			1.00	0.41**	0.81 **	0.86**	0.78 **	0.97 **	-0.21	0.93**
X4				1.00	0.40 **	0.45**	0.37 **	0.44 **	-0.22	0.45**
X5					1.00	0.70 **	0.63 **	0.83 **	-0.15	0.80**
X6						1.00	0.74 **	0.86 **	-0.24	0.85**
X7							1.00	0.79 **	-0.19	0.81**
X8								1.00	-0.19	0.95**
X9									1.00	-0.20
X10										1.00

*Significance at 5% level of significance
**Significance at 1% level of significance
X1- Plant height (cm) X2- Primary branches
X3 - Secondary branches X4 - Days to 50% flowering
X5 - Number of capsule per plant X6 - Number of seeds per capsule

X7 - Capsule diameter (cm) X8 - Test weight (g)
X9 - Oil content (%). X10 - Seed yield per plant (g)

Table 2. Estimation of phenotypic path coefficient analysis for yield and yield attributes in Niger germplasm lines

	X1	X2	X3	X4	X5	X6	X7	X8	X9
X1	0.6560	0.6367	0.6408	0.2957	0.5434	0.5832	0.5280	0.6493	-0.1304
X2	-0.7192	-0.7410	-0.7295	-0.2966	-0.6029	-0.6224	-0.5623	-0.7211	0.1385
X3	0.4398	0.4432	0.4502	0.1860	0.3679	0.3894	0.3532	0.4409	-0.0983
X4	0.0057	0.0050	0.0052	0.0126	0.0051	0.0057	0.0047	0.0055	-0.0028
X5	0.0198	0.0194	0.0195	0.0096	0.0239	0.0169	0.0152	0.0200	-0.0038
X6	-0.0332	-0.0314	-0.0323	-0.0168	-0.0265	-0.0374	-0.0279	-0.0323	0.0093
X7	0.0719	0.0678	0.0701	0.0332	0.0570	0.0666	0.0893	0.0710	-0.0178
X8	0.5187	0.5100	0.5133	0.2308	0.4386	0.4526	0.4163	0.5241	-0.1041
X9	-0.0011	-0.0010	-0.0012	-0.0012	-0.0008	-0.0013	-0.0011	-0.0011	0.0053
R^2	0.6287	-0.6734	0.4215	0.0057	0.0192	-0.0319	0.0728	0.5012	-0.0011

X1- Trait plant height (cm) X2- Primary branches X3 - Secondary branches
X4 - Days to flowering X5 - Number of capsule per plant X6 - Number of seeds per capsule
X7 - Capsule diameter X8 - Test weight (g) X9 - Oil content (%)

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