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Correlation and Path Analysis for Different Characteristics in Germplasm of Niger (*Guizotia abyssinica* (L.f) Cass)

Shubhangi Patil, V. V. Bhavsar* and Sweta Deokar

Department of Agricultural Botany, College of Agriculture, Dhule-424 004 (MPKV), (M.S.), India

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A B S T R A C T

The present investigation entitled "Correlation and Path Analysis for Different Characteristics in Germplasm of Niger (*Guizotia abyssinica* (L.f) Cass.)" was undertaken during *Kharif* 2018. The experiment was carried out in Randomized block Design (RBD) with two replications to derive Correlation coefficient and Direct and Indirect effects in 45 germplasm of Niger. In 45 genotypes it has been revealed that, that number of primary branches per plant, number of secondary branches per plant, number of capitula per plant, number of seed per plant, diameter of capitula, 1000 seed weight were good indicators of seed yield per plant along with highly significant correlation in the desirable direction towards seed yield per plant indicated the true and perfect relationship between seed yield and these characters suggesting direct selection based on these character would help in selecting the high yielding genotypes in niger.

Introduction

Niger (*Guizotia abyssinica* (L.f) Cass) is named after the French historian Guizot. It belongs to the family Compositae/Asteraceae, tribe Helianthoides and subtribe Verbeninae. It is an oilseed crop cultivated in Indian subcontinents and East African Countries. It is self-incompatible crop having diploid chromosome 2n=30. It is minor crop grown mostly in India and Ethiopia where it is known as Ram til, Kala til, Karala, Gurellu, Tilangi and Neuk, Noog and Nug. Niger is the native of highlands of Ethiopia and originated from *G. scabre* subsp. *Schimperi*, where it is a common weed in fields with grown Niger. The wild form has oil content of 24 to 35%, while the cultivated Niger has 36 to 42% oil with fatty acid composition of 75 to 80% linoleic acid, 7 to 8 % palmitic and stearic acid and 5 to 8 % oleic acid. Indian Niger oil reported higher in oleic acid (25%) and lower in linoleic acid (55%). Niger has a 10-30% protein content. Niger is a dicotyledonous herb, moderately to well branched, grows up to two meter tall. Niger plant like other

compositae is highly cross pollinated oilseed crop mostly grown on marginal and sub marginal land.

In India the Niger is grown on an area of 2.61 lakh ha mainly during *Kharif,* and average productivity in India is 321 kg/ha with production 0.84 lakh tonnes. India is the largest exporter of Niger in the world to USA, Netherland, Italy, Germany, Belgium, and Spain are the regular buyer. Whereas, USA is the largest buyer in the world. The export of the Niger seed continuously increased. In Maharashtra, it is grown on an area of 0.141 lakh ha with the production of 0.023 lakh MT and productivity is 165 kg/ha (2016-17). India tops in area, production and total export for Niger in the world.

Correlation studies provide knowledge of association among different characters and grain yield. The study of association among various traits is useful for breeders in selecting genotypes possessing groups of desired traits.

The correlation coefficients become insufficient for using yield components as selection criteria to improve grain yields. It is reasonable to know whether any yield components has a direct or indirect effect on grain yield, so that selection studies can be carried out successfully.

Correlated response: Two characters say x and y, are correlated. A change in the mean of x through selection will cause an associated change in the mean of y also. This change in y brought about through indirect selection on an associated character x is known as correlated response (Singh and Chaudhary, 1977).

The path coefficient analysis provides a more realistic picture of the relationship as it considers direct as well as indirect effects of the variables by partitioning the correlation coefficients.

Correlation and path analysis estimates between yield and other characters are useful in selecting desired plant type in designing an effective breeding programme. When change in one variable causes the change on other variable, the variables are said to be correlated.

Keeping the above facts a view, the present investigation entitled, "Correlation and Path Analysis for Different Characteristics in Germplasm of Niger (*Guizotia abyssinica* (L.f) Cass.)" was proposed to gather information on the following objectives:

To better insight into the cause and effect relationship between pairs of characters, study of correlation in conjunction with path analysis is essential.

Materials and Methods

The experimental material comprising forty five genotypes of Niger were grown in Randomized Block Design with two replications at the research farm of Department of Genetics and plant breeding, College of Agriculture, Dhule, during Kharif season of 2018. Each entry was represented by single row of 4.5 m length with spacing of 30 cm between rows. Data were recorded on five randomly and competitive plants of each genotype from each replication for twelve quantitative characters viz., days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of capitula per plant, number of seeds per capitula, diameter of capitula (cm), 1000 seed weight (g), seed yield per plant (g), protein content (g), oil content (g). The mean of five plants was subjected to statistical analysis. The data for different characters were statistically analyzed for significance by using analysis of variance technique described by Panse and Sukhatme (1995). The significance

of mean sum of square for each character was tested against the corresponding error degrees of freedom using "F" Test (Fisher and Yates, 1967). Correlation between twelve characters was estimated according to the method given by Singh and Chaudhary (1977). Direct and indirect effects were estimated as described by Dewey and Lu (1959). Statistical analysis was done by using WINDOSTAT program.

Results and Discussion

Analysis of variance revealed significant differences among genotypes for all the characters (Table 1).

Analysis of variance for twelve characters indicated that the genotypes used in the present studies were significantly different. The correlation coefficients at both genotypic and phenotypic levels estimated between grain yields per plant with all other characters are presented in Table 2 and 3 respectively.

In the present investigation, the genotypic correlation coefficients were higher than the phenotypic correlation coefficients as observed by Johnson *et al.,* (1955). This might have occurred due to genes governing two traits were similar and the environmental conditions pertaining to the expression of these traits might have small and similar effects.

Seed yield exhibited highly significant positive correlation with plant height, number of primary branches per plant, number of secondary branches per plant, number of capitula per plant, number of seeds per capitula, diameter of capitula, 1000 seed weight suggesting dependency of yield on these characters (Table 2 and 3). The seed yield per plant (Table 4.) showed strong significantly positive genotypic correlation with number of capitula per plant (0.646) followed by 1000 seed weight (0.529), number of secondary branches per plant (0.514), number of seeds per capitula (0.452), diameter of capitula (0.338), number of primary branches per plant (0.335) and plant height (0.210).

Table.1 Analysis of variance for twelve characters in Niger

Sr. No	Characters	Mean sum of square		
		Replication	Genotype	Error
1	Days to 50 per cent flowering	0.100	95.622**	7.622
2	Days to maturity	5.877	65.018**	26.673
3	Plant height (cm)	740.173	11275.376**	8486.941
4	No. of primary branches / plant	2.116	20.370**	5.074
5	No. of secondary branches / plant	10.410	260.910**	12.331
6	No. of capitula / plant	105.408	1582.885**	94.286
7	No. of seeds / plant	1.534	49.349**	8.527
8	Diameter of capitula (cm)	0.009	0.011**	0.005
9	1000 seed weight (g)	0.047	0.462**	0.072
10	Seed yield/ plant (g)	0.065	1.108**	0.258
11	Protein content (%)	0.531	2.131**	0.707
12	Oil content (%)	4.513	4.954**	2.021

*, ** Indicates significance at 5% and 1% level, respectively.

Table.2 Genotypic correlation coefficient for twelve characters in Niger

	Characters	1	2	3	4	5	6	7	8	9	10	11	12
1.	Days to 50 per cent flowering	1	0.904**	0.459**	0.310**	0.284**	0.184	0.131	-0.086	0.252*	0.069	-0.386**	-0.081
2.	Days to maturity		1	0.073	0.474**	0.606**	0.456**	0.266*	0.211*	0.449**	-0.119	-0.465**	0.074
3.	Plant height			1	0.713**	0.381**	0.389**	-0.280**	-0.859**	0.223*	0.313**	-0.517**	0.210*
4.	No. of primary branches /plant				1	0.796**	0.647**	0.112	0.376**	0.244*	-0.242*	-0.356**	0.335**
5.	No. of secondary branches/plant					1	0.856**	0.199	0.644**	0.344**	-0.313**	-0.402**	0.514**
6.	No. of capitula / plant						1	0.222*	0.596**	0.507**	-0.467**	-0.204*	0.646**
7.	No. of seeds / capitula							1	0.008	0.327**	-0.126	0.082	0.452**
8.	Diameter of capitula								1	0.304**	-0.649**	-0.710**	0.338**
9.	1000 seed weight									1	-0.042	-0.013	0.529**
10.	Protein content										1	-0.001	-0.047
11.	Oil content											1	-0.128
12.	Seed yield /plant												1

*, ** Indicates significance at 5% and 1% level, respectively

Table.3 Phenotypic correlation for twelve characters in Niger

	Characters	1	2	3	4	5	6	7	8	9	10	11	12
1	Days to 50 per cent flowering	1	0.800**	0.331**	0.399**	0.325**	0.220*	0.204	0.060	0.321**	0.121	-0.120	0.051
2	Days to maturity		1	0.248**	0.463**	0.472**	0.356**	0.225*	0.205	0.373**	0.078	-0.125	0.117
3	Plant height			1	0.368**	0.230*	0.262*	0.025	-0.065	0.204	0.075	0.114	0.124
4	No. of primary branches /plant				1	0.725**	0.602**	0.280**	0.253*	0.323**	-0.024	-0.083	0.353**
5	No. of secondary branches/plant					1	0.813**	0.268*	0.424**	0.374**	-0.153	-0.154	0.471**
6	No. of capitula / plant						1	0.284**	0.372**	0.477**	-0.262**	-0.095	0.520**
7	No. of seeds /capitula							1	0.174	0.387**	0.068	0.153	0.433**
8	Diameter of capitula								1	0.370**	-0.141	-0.077	0.313**
9	1000 seed weight									1	0.098	0.175	0.563**
10	protein content										1	0.227*	0.187
11	Oil content											1	0.151
12	Seed yield per plant												1

*, ** Indicates significance at 5% and 1% level, respectively

Table.4 Genotypic path co-efficient for twelve characters in Niger

	Characters	1	2	3	4	5	6	7	8	9	10	11	12
1	Days to 50 per cent flowering	**-0.496**	-0.501	-0.227	-0.153	-0.141	-0.091	-0.065	0.042	-0.125	-0.034	0.191	-0.081
2	Days to maturity	0.126	**0.125**	0.009	0.059	0.075	0.057	0.033	0.026	0.056	-0.015	-0.058	0.074
3	Plant height	0.016	0.002	**0.034**	0.024	0.013	0.013	-0.009	-0.029	0.007	0.010	-0.018	0.210*
4	No. of primary branches / plant	-0.006	-0.010	-0.015	**-0.021**	-0.017	-0.014	-0.002	-0.008	-0.005	0.005	0.007	0.334**
5	No.of secondary branches / plant	-0.073	-0.156	-0.098	-0.205	**-0.25**	-0.220	-0.051	-0.166	-0.088	0.080	0.103	0.514**
6	No. of capitula/plant	0.163	0.405	0.346	0.576	0.761	**0.889**	0.197	0.530	0.451	-0.415	-0.181	0.646**
7	No. of seeds / capitula	0.048	0.098	-0.103	0.041	0.073	0.082	**0.370**	0.003	0.121	-0.046	0.030	0.451**
8	Diameter of capitula	0.001	-0.003	0.012	-0.005	-0.009	-0.008	-0.000	**-0.014**	-0.004	0.009	0.010	0.338**
9	1000 seed weight	0.032	0.058	0.028	0.031	0.044	0.065	0.042	0.039	**0.129**	-0.005	-0.001	0.529**
10	protein content	0.024	-0.043	0.113	-0.087	-0.113	-0.169	-0.045	-0.235	-0.015	**0.363**	-0.000	-0.047
11	Oil content	0.082	0.099	0.109	0.075	0.085	0.043	-0.017	0.150	0.002	0.0004	**-0.212**	-0.128

Residual effect = (0.5163) Bold values indicated direct effect

*, ** Indicates significance at 5% and 1% level, respectively.

Table.5 Phenotypic path co-efficient for twelve characters in Niger

	Characters	1	2	3	4	5	6	7	8	9	10	11	12
1	Days to 50 per cent flowering	**-0.095**	-0.076	-0.031	-0.038	-0.031	-0.021	-0.019	-0.005	-0.030	-0.011	0.011	0.051
2	Days to maturity	-0.163	**-0.203**	-0.050	-0.094	-0.096	-0.072	-0.045	-0.041	-0.076	-0.015	0.025	0.117
3	Plant height	-0.003	-0.002	**-0.009**	-0.003	-0.002	-0.002	-0.0002	0.0006	-0.001	-0.0007	-0.001	0.124
4	No. of primary branches / plant	-0.006	-0.006	-0.005	**-0.014**	-0.010	-0.009	-0.004	-0.003	-0.004	0.0004	0.001	0.353**
5	No. of secondary branchea/ plant	0.077	0.112	0.055	0.173	**0.238**	0.194	0.064	0.101	0.089	-0.036	-0.036	0.471**
6	No. of capitula/ plant	0.060	0.098	0.072	0.165	0.224	**0.275**	0.078	0.102	0.131	-0.072	-0.026	0.520**
7	No. of seeds / capitula	0.041	0.045	0.005	0.056	0.054	0.057	**0.201**	0.035	0.078	0.013	0.030	0.433**
8	Diameter of capitula	0.002	0.009	-0.002	0.011	0.019	0.016	0.007	**0.044**	0.016	-0.006	-0.003	0.313**
9	1000 seed weight	0.106	0.123	0.067	0.106	0.123	0.157	0.127	0.121	**0.329**	0.032	0.057	0.563**
10	Protein content	0.033	0.021	0.020	-0.006	-0.042	-0.073	0.019	-0.039	0.027	**0.278**	0.063	0.187
11	Oil content	-0.003	-0.003	0.003	-0.002	-0.004	-0.002	0.004	-0.002	0.005	0.006	**0.028**	0.151

Residual effect = (0.6603) Bold values indicated direct effect*, **

Indicates significance at 5% and 1% level, respectively.

While seed yield per plant showed non-significant positive genotypic correlation with days to maturity (0.074). But, it showed non-significant negative genotypic correlation with protein content (-0.047), oil content (0-0.128) and days to 50 per cent flowering (-0.081).

Seed yield per plant showed positive association with the traits such as 1000 seed weight, number of capitula per plant, number of secondary branches per plant, number of seeds per plant and number of primary branches per plant. Similar results were reported by Reddy *et al.,* (1992), Lakshyadeep *et al.,* (2005), Dalvi *et al.,* (2005), Ali *et al.,* (2008), Khuntey and Kumar (2015) and Kumar and Bisen (2016).

The path coefficients at both genotypic and phenotypic levels estimated between seed yield per plant and yield contributing characters and qualitative characters were carried out by using correlation coefficient.

The results obtained are presented in Table 4 and 5, respectively. Path coefficient indicated that positive genotypic and phenotypic direct effects were observed for number of capitula per plant, number of seeds per plant, 1000 seed weight and protein content had higher positive direct effect on seed yield.

These traits having a positive direct effect on seed yield can be considered as a suitable selection criterion for evolving high yielding Niger genotype. The findings of Ghongade *et al.,* (1993), Kubsad *et al.,* (2000), Rani *et al.,* (2005), Dalvi *et al.,* (2005), Genet (2007) and Thakur and Reddy (2012) was similar to these results.

In general, correlation and path analysis carried concluded that the number of primary branches per plant, number of secondary branches per plant, number of capitula per plant, number of seeds per capitula, diameter of capitula, 1000 seed weight influenced the seed yield more than any of the other characters. Hence, it would be worthwhile to lay more emphasis on these characters in selection programme to improve the seed yield in niger.

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