P: ISSN No. 2231-0045 RNI No. UPBIL/2012/55438 VOL.-IV, ISSUE-I, August-2015
E: ISSN No. 2349-9435 Periodic Research

Correlation and Path analysis in Lehsua (*Cordia myxa Roxb.)* in Thar Desert

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Abstract

The variability parameters, correlation and path coefficients were studied for physico-chemical characters in fifteen provenances of Lehsua at Department of Horticulture, S.K.N. College of Agriculture, Rajasthan University of Agriculture Bikaner (Rajasthan). The genotypic correlation was more than the phenotypic correlation for all the traits. High significant positive correlation coefficient of fruit weight was noticed with pulp: seed ratio and fruit size. The significant and negative correlation was observed between T.S.S. and acidity. Path coefficient analysis revealed that pulp: seed ratio had highest positive direct effect on fruit weight followed by leaf width and fruit size.

Keywords: Leshua (Gonda), Correlation Coefficient, Path Coefficient, Genotypic, Phenotypic.

Introduction

Cordia myxa L., locally called *Gonda/Lasora/lehsua*, family Boraginaceae, is traditional fruit tree found grown in arid and semi arid regions of north India, since it has great capacity to tolerate drought. The plant is perennial, medium sized, crooked tree, fruits are small appears in bunches. Plants have been associated with health, nutrition and overall care of mankind since time immemorial. The local populations of the area have inherited a rich traditional knowledge on the use of each and every part of gonda tree. The gonda is a priced fruit, used as traditional vegetable, pickled with mango and in the management of various ailments *viz*. skin diseases, dropsy, dysentery, dyspepsia, cholera and headache by local population of the region. Fruits are rich source of Carbohydrates (Chandra et al., 1999), phosphorus (Duhan et al., 1992) and contain 40mg/100g of ascorbic acid (Pareek and Sharma, 1993).

For improvement in this crop, the knowledge of magnitude of genetic variability and the extent of heritability of desirable characteristics is essentially important because the phenotypic selection depends upon the range of genetic diversity present in the population. For exploitation of such genetic variability, the knowledge of correlation between complex characters and its component characters is of considerable importance for a rational approach towards improvement in yield. The morphological and physiological traits exhibit a significant amount of genetic variation both within and between plant populations (Stebbins, 1950; Stern and Roche, 1974). Therefore, an attempt was made with the objective to assess the natural variation in lehusa and also to investigate the inter-relationship among important physico-chemical traits so as to select the best plant material for multiplication or for future use in breeding programme.

Materials and methods

Extensive survey of existing population of *Cordia myxa* Roxb. in Rajasthan was undertaken The sampling procedure includes delineation of the whole area, under the species into a number of sites depending upon the aspect variation in morphological characters. In this way fifteen sites were selected in five districts of Rajasthan viz, Ajmer, Jodhpur, Pali, Jalore and Barmer during two consecutive years. Three natural occurring trees of *Cordia myxa* having approximately the same age, height and diameter were selected within each site as per the methods adopted by Savnin (1967), Pozdnjakov (1969), Dumitriu-Tataranu (1970) and Pant (1996). These trees were marked for recording the observations on different physico-chemical characteristics (fruits cluster^{-1}, fruit weight, fruit diameter, pulp: seed, TSS & acidity) as per standard methodology (A.O.A.C., 1990).

The simple correlation coefficient (karl pearson's) were estimated by Panse and Sukhatme (1995) The estimate of direct and indirect effects were calculated by the path coefficient analysis as suggested by Wright (1921) and elaborated by Deway and Lu (1959) at both phenotypic and genotypic levels.

Results and discussion

Correlation coefficient among various morphological characters, fruit and fruit quality characteristics at genotypic and phenotypic levels has been presented in table. In general, the genotypic correlation coefficients were highly significant and positive for most of the character pairs (plant spread, pulp: seed ratio, fruit size and TSS). The direction of phenotypic and genotypic correlation coefficients was negative for most of the characters. The difference between genotypic and phenotypic correlation coefficients was negligible. Hence, environmental interfered less with the character expression. At genotypic level, fruit weight had significant positive correlation coefficient with pulp: seed ratio (r=0.843) and fruit size (r= 0.768) but leaf width showed significant and negative correlation coefficient (-0.531) with fruit weight. The correlation of fruit weight were non-significant and positive except leaf length which was negative.

The correlation among the character *per se* showed that leaf width had highest significant positive association with leaf length (r=0.949) while, significant negative with acidity (r=-0.598). The characters (plant spread, pulp:seed ratio, fruit size and TSS) exhibited negative non-significant association with leaf width, except total soluble solids (0.192) which showed positive non-significant correlation with leaf width plant spread had high positive significant correlation with plant height (r= 0.886). Its association with fruits per cluster (0.026), fruit size (0.194), and pulp: seed ratio (0.121) and acidity (0.231) were positive and non-significant. Plant spread showed non-significant and negative association with T.S.S. (-0.187) and leaf width (-0.163).

Acidity had significant negative correlation with T.S.S. (r= -0.863) while plant height (0.398), plant spread (0.500) and fruit size (0.291) showed non significant positive association with acidity.

From these associations it is indicated that higher fruit weight can be obtained by increasing the fruit size and pulp: seed ratio for improvement of this crop. Positive association among fruit weight, fruit size and pulp: stone ratio has been required. Same results were in conformity with Bisla and Daulta (1987); Prajapati *et al.* (1996); Gupta and Mehta (2000). Significant positive association exhibited of fruits weight and size of fruit at genotype level. These results are in agreement with Daware *et al.* (1985) in *Jamun* crop.

Table-1 Genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficient between various attributes and fruit weight in Lehsua (pooled basis)

Character	Plant height	Plant spread	Fruits/ cluster	Fruit size	Pulp: seed ratio	T.S.S.	Acidity	Leaf length	Leaf width	Fruit weight
Plant height	-	0.886	0.021	0.324	0.218	-0.252	0.398	-0.006	-0.268	0.348
Plant spread	0.815**	-	0.010	0.232	0.091	-0.431	0.500	-0.104	-0.319	0.243
Fruits/cluster	-0.20	0.026	-	-0.378	0.441	0.437	-0.451	-0.111	-0.124	0.140
Fruit size	-0.179	0.194	-0.190	-	0.322	-0.127	0.291	-0..62	-0.291	0.768**
Pulp : seed ratio	-0.176	0.121	0.235	0.234	-	0.608*	-0.071	-0.210	-0.490	0.843**
T.S.S.	0.233	-0.187	0.287	-0.142	0.428	-	-0.836**	0.257	0.192	0.335
Acidity	0.048	0.231	-0.258	0.123	-0.103	-0.550*	-0.314	-523*	-0.598*	0.152
Leaf length	0.110	0.008	-0.123	-0.031	-0.119	128	-0.384	-	0.949**	-0.154
Leaf width	0.157	-0.163	-0.066	-0.151	-0.282	0.093	0.056	0.662	-	-0.531*
Fruit weight		0.120	0.097	0.541*	0.386	0.246		-0.136	-0.230	-

* Significant at þ = 0.05
** Significant at þ = 0.01

T.S.S. had high positive correlation with pulp :seed ratio (0.608) while its non-significant correlation was observed with fruits per cluster (0.246).

Path Coefficient Analysis

The path coefficient analysis was performed at genotypic and phenotypic levels by utilizing genotypic and phenotypic correlation coefficients, respectively, to partition the correlation coefficient into direct and indirect effects. The fruit weight was taken as dependent variable. It becomes therefore essential partitions such association in to direct and indirect effect of components characters through path analysis.

In a breeding programmes, we are often concerned with the improvement in fruit weight as an overall product dependent on a number of morpho-physiological attributes. Such characters are often interrelated, hence their effect on fruit weight is also modified by others. Path coefficient analysis helps in separating the direct effect of a component character on fruit weight from indirect effects of other traits. The genotypic and phenotypic correlation coefficients of fruit weight with its contributing characters were partitioned into direct and indirect effects through path coefficient analysis and are presented in table-2.

The results of path coefficient analysis indicated that direct effects at genotypic and phenotypic levels were positive for the characters viz. plant height, fruit size and pulp: seed ratio while for leaf length. While direct effect was negative at genotypic and phenotypic levels. The signs of direct effect were differed at genotypic and phenotypic levels for plant spread, fruits per cluster, T.S.S., acidity and leaf width. The character, pulp : seed ratio (1.311) had highest direct effects followed by leaf width (1.032), fruit size (0.522), plant spread (0.140) and plant height (1.040) on fruit weight whereas highest negative effected was recorded for leaf length (-0.847 followed by T.S.S. (-0.485) acidity (-0.281) and fruits per cluster (-0.125) at genotypic level.

Correlations explain the true interrelationship and suggest that a direct selection through these traits will be effective. Direct positive effects of fruit weight, stone weight and pulp: stone ratio (Bisla and Daulta, 1987) in *ber*.

Character		Plant height	Plant spread	Fruits/ cluster	Fruit size	Pulp: seed ratio	T.S.S.	Acidity	Leaf length	Leaf width	Correlation with fruit weight
Plant height	G	0.040	0.124	-0.003	0.169	0.279	0.122	-0.112	0.005	-0.277	0.348
	P	0.166	-0.091	-0.002	0.102	0.006	-0.070	0.044	-0.003	0.004	0.157
Plant spread	G	0.035	0.140	-0.001	0.121	0.120	0.209	-0.141	0.088	-0.329	0.243
	P	0.136	-0.111	0.003	0.111	0.006	-0.074	0.044	-0.001	0.007	0.120
Fruits per Cluster	G	0.001	0.001	-0.125	-0.197	0.578	-0.212	0.127	0.094	-0.128	0.140
	P	-0.003	-0.003	0.124	-0.108	0.011	0.114	-0.049	0.008	0.003	0.097
Fruit size	G	0.013	0.033	0.047	0.522	0.423	0.062	-0.082	0.052	-0.301	0.768**
	P	0.030	-0.022	-0.024	0.569	0.011	-0.056	0.023	0.002	0.006	0.541*
Pulp : seed ratio	G	0.008	0.013	-0.055	0.168	1.311	-0.295	0.020	0.178	-0.505	0.843**
	P	0.019	-0.013	0.029	0.133	0.049	0.169	-0.020	0.008	0.011	0.386
T.S.S.	G	-0.010	-0.061	-0.054	-0.066	0.797	-0.485	0.235	-0.218	0.198	0.335
	P	-0.029	0.021	0.036	-0.081	0.021	0.396	-0.105	-0.009	-0.004	0.246
Acidity	G	0.016	0.070	0.056	0.152	-0.093	0.406	-0.281	0.433	-0.617	0.152
	P	0.039	-0.026	-0.032	0.070	-0.005	-0.218	0.191	0.022	0.015	0.056
Leaf length	G	0.000	0.015	0.014	-0.032	-0.275	-0.125	0.147	-0.847	0.980	-0.154
	P	0.008	-0.001	-0.015	-0.017	-0.006	0.050	-0.060	-0.069	-0.027	-0.136
Leaf width	G	-0.011	-0.0145	0.015	-0.152	-0.642	0.093	0.168	-0.804	1.032	-0.531*
	P	-0.018	0.018	-0.008	-0.086	-0.014	0.037	-0.073	-0.046	-0.040	-0.230

*** Significant at þ = 0.05 and ** Significant at þ = 0.01Diagonal values represent direct effects Residual effect: Phenotypic = 0.5219, Genotypic = 0.0860**

Plant height (0.040) had positive direct effect but it also had indirect negative effects via fruits per cluster (-0.003), acidity (-0.112) and leaf width (-0.277). Plant spread (0.140) had positive direct effect but, it also had indirect negative effects via fruits per cluster (-0.001), acidity (-0.141) and leaf width (-0.329). Fruits per cluster (-0.125) had negative direct effect and it also had indirect negative effect via fruit size (-0.197), T.S.S. (-0.212) and leaf width (-0.128). Fruit size (0.522) had positive direct effect but it also had negative indirect effect via acidity (-0.082), and leaf width (-0.301). Pulp : seed ratio exerted highest direct effect and highest correlation coefficient with fruit weight but it also had indirect negative effect via fruits per cluster (-0.055), T.S.S. (-0.295) and leaf width (-0.505).

T.S.S. had negative direct effect but it also had positive indirect effect via. Pulp: seed ratio (0.797), acidity (0.235) and leaf width (0.198). Acidity had negative direct effect and it also had negative indirect effect via pulp: seed ratio (-0.093) and leaf width (-0.617). Leaf length had negative direct effect and it also had negative indirect effect via fruit size, pulp: seed ratio, T.S.S. and also had negative correlation coefficient with fruit weight. Leaf width had positive direct effect and it also had positive indirect effect via fruits per cluster, T.S.S. and acidity.

Among the various characters, fruit size (0.522) exerted highest positive direct effect followed by T.S.S., acidity, plant height, fruits per cluster and pulp : seed ratio. Whereas leaf width, leaf length and plant spread had positive direct effect but the values were very low at phenotypic level.

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