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SHORT COMMUNICATION

Association analysis for quality attributes in ber (*Ziziphus mauritiana* L.)

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Yield being a complex character, is composed of several components, some of which affect the yield directly while, others contribute towards it indirectly. Correlation studies provide an opportunity to study the magnitude and direction of association of yield with direct and indirect quality parameters and also among these parameters. To accumulate optimum combination of quality characters in a single genotype, it is essential to know the implication of the inter-relationship of various characters. Linear correlations between yield and various quality characters, because of the interrelationship among the components themselves can present a confusing picture. For this reason standard partial correlation or regression (path coefficient) can give a more realistic interpretation of characters involved. Considering these points in view, the present study was conducted to understand inter-relationship of the quality traits in ber.

Ten year old plants of eleven genotypes of ber comprising eight commercial cultivars of *Ziziphus mauritiana* and three local selections of *Ziziphus rotundifolia* were used for this study. They were studied in randomized block design at Horticultural Research Farm, S.K.N. College of Agriculture, Jobner, during fruiting season of 1999-2000. Recommended agronomical practices were adopted under rainfed conditions. Observations were recorded on nine quality traits, *viz.*, pulp : stone ratio, TSS, acidity, ascorbic acid, total sugar, reducing sugars, non-reducing sugars, T.S.S. : acid ratio and yield per plant. Physico-chemical characteristics were recorded from twenty randomly selected mature fruits from each replication. The T.S.S. was estimated using a hand refractometer. Acidity and ascorbic acid were determined by titration methods (A.O.A.C., 1990). Total sugar content was determined by using anthrone reagent method (Dubois *et al.*, 1951). Reducing sugars was measured by following Nelson's modification of Somogyis method (Somogyi , 1952). Mean data were used for correlation and path coefficient analysis as per method of Dewey and Lu (1959).

Estimates of correlation coefficients at genotypic and phenotypic levels are presented in Table 1. The genotypic correlation coefficients were generally higher for all the combinations than their respective phenotypic correlation coefficients, thereby suggesting strong inherent association between various characters at genetic level. The phenotypic correlation decreased due to environmental effects. At the genotypic level correlation coefficients revealed that fruit yield had significantly positive correlation with pulp : stone ratio (0.644), T.S.S. (0.570), acidity (0.598), ascorbic acid (0.674), total sugar (0.461) and reducing sugars (0.905) which indicated that selection for these traits, would lead to an improvement in yield, while it was significantly and negatively associated with T.S.S. : acid ratio (-0.630). Positive association of total sugar content (Bisla and Daulta, 1986) and pulp : stone ratio (Prajapati *et al.*, 1996) with fruit yield in ber have been reported earlier and these results are in agreement with the present study. Pulp : stone ratio was significantly and positively associated with ascorbic acid, total sugar and reducing sugars. T.S.S. had significant positive correlation with T.S.S. : acid ratio, however, association with ascorbic acid and reducing sugars was found to be significant and negative. Acidity had high significant negative association with T.S.S. : acid ratio. Ascorbic acid showed significant positive interrelationship with total sugar and reducing sugars. Total sugar was significantly and positively associated with reducing and non-reducing sugars. These findings are in conformity with those of Gupta and Mehta (2000). Pant (1996) reported positive correlation of T.S.S. with total sugar in pomegranate. Estimates of phenotypic correlation coefficient revealed positive and highly significant correlation of fruit yield with T.S.S., acidity, ascorbic acid, total sugar and reducing sugars. Thus, we find consistency in the correlation both at genotypic as well as phenotypic levels.

Considering the fruit yield as the effect and eight quantitative traits as the causes, the path coefficient analysis was done to find out the direct and indirect contribution of these characters towards fruit yield in ber genotypes. The genotypic residual value was fairly low. The analysis of genotypic and phenotypic correlations into direct and indirect effects are presented in Table 2. T.S.S., reducing sugars and total sugar made appreciable direct

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positive contribution to fruit yield. It is interesting to note that reducing sugars which had highest correlation also exhibited highest direct path (1.378) towards fruit yield. T.S.S. contributed indirectly mostly through acidity and ascorbic acid. Reducing sugars exerted its influence mainly through pulp : stone ratio, total sugar and T.S.S. : acid ratio. Total sugar exhibited indirect effect via reducing sugars, T.S.S. : acid ratio and pulp : stone ratio. Low non-significant correlation and negative direct path non-reducing sugar with fruit yield indicated that much reliance cannot be placed on the selection of genotypes in enhancing the fruit yield, which confirmed the conclusion drawn from correlation. Ascorbic acid which had next to highest genotypic correlation exhibited negative direct path on fruit yield. Contrary to this acidity, which had significant positive correlation, exhibited high negative direct path towards fruit yield. The positive genotypic correlation of acidity was counter balanced by high negative direct path and negative indirect effect via T.S.S. and ascorbic acid. Non-reducing sugars and T.S.S. : acid ratio made negative direct contribution.

The results of phenotypic path coefficient analysis in the form of direct and indirect effects on fruit yield are presented in Table 2. The value of residual path after deducting the direct and indirect effects was not very high. Break-up of phenotypic correlations of fruit yield into its components showed that acidity, reducing sugars and non-reducing sugars directly contributed maximum towards fruit yield. T.S.S., ascorbic acid, total sugar and T.S.S. : acid ratio, made negative direct contributions. Similar conclusions were earlier reported by Bisla and Daulta (986; 1987) and Prajapati *et al.* (1996).

From the study it could be inferred that the parameters reducing sugars, T.S.S. and total sugar can be used as selection criteria for improvement of ber crop.

Table 1. Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients between quality attributes and fruit yield in ber

Character	Pulp: stone ratio	T.S.S.	Acidity	Ascorbic acid	Total sugar	Reducing sugar	Non-Reducing sugar	T.S.S.: acid ratio	Fruit yield
Pulp: stone ratio	-	-0.307	0.032	0.479*	0.486*	0.663**	0.250	-0.036	0.595**
T.S.S.	-0.313	-	-0.345	-0.701**	0.649**	0.484*	0.273	0.522*	0.555**
Acidity	0.003	-0.381	-	0.226	0.027	0.409	-0.154	-0.942**	0.541**
Ascorbic acid	0.495*	-0.705**	0.231	-	0.455*	0.717**	0.191	-0.377	0.657**
Total sugar	0.504*	0.049	0.034	0.456*	-	0.474*	0.918**	-0.062	0.451*
Reducing sugar	0.697**	-0.489*	0.437*	0.721**	0.477*	-	0.085	-0.382	0.891**
Non-Reducing sugar	0.258	0.275	-0.158	0.193	0.919**	0.091	-	0.102	0.108
T.S.S.: acid ratio	-0.003	0.575**	-0.954**	-0.396	0.073	-0.418	0.105	-	-0.542**
Fruit yield	0.644**	0.570**	0.598**	0.674**	0.461*	0.905**	0.116	-0.630**	-

* Significant at p-0.05 and ** Significant at p - 0.01

Table 2. Estimates of direct and indirect effects at phenotypic (p) and genotypic (g) levels for quality attributes

Character		Pulp: stone ratio	T.S.S.	Acidity	Ascorbic acid	Total sugar	Reducing sugar	Non-Reducing sugar	T.S.S.: acid ratio	Correlation with fruit yield
Pulp: stone ratio	P	0.040	0.086	0.005	-0.096	0.419	0.744	0.235	0.002	0.595**
	G	**0.408**	-0.383	-0.012	-0.358	0.256	0.961	-0.241	0.014	0.644**
T.S.S.	P	-0.073	-0.278	-0.054	0.140	0.042	0.543	0.257	-0.022	0.555**
	G	-0.128	**1.224**	1.704	0.511	0.025	0.674	-0.258	-3.082	0.570**
Acidity	P	0.001	0.096	0.158	-0.045	-0.023	0.459	-0.145	0.040	0.541**
	G	0.001	-0.466	**-4.473**	-0.168	0.017	0602	0.148	4.937	0.598**
Ascorbic acid	P	0.019	0.195	0.036	-0.200	-0.392	0.804	0.179	0.016	0.657**
	G	0.202	-0.863	-1.035	**-0.724**	0.232	0.993	-0.181	2.052	0.674**
Total sugar	P	0.019	-0.014	0.004	-0.091	-0.863	0.532	0.861	0.003	0.451*
	G	0.206	0.060	-0.154	-0.330	**0.507**	0.657	-0.861	0.376	0.461*
Reducing sugar	P	0.026	0.135	0.064	-0.143	-0.409	1.122	0.080	0.016	0.891**
	G	0.284	-0.598	-1.956	-0.522	0.242	**1.378**	0.085	2.162	0.905**
Non-Reducing sugar	P	0.010	-0.076	-0.024	-0.038	-0.792	0.095	0.938	-0.004	0.108
	G	0.105	0.337	0.705	-0.140	0.466	0.125	-0.937	-0.545	0.116
T.S.S.: acid ratio	P	-0.001	-0.145	-0.149	0.075	0.053	-0.429	0.096	-0.043	-0.542**
	G	-0.001	0.704	4.267	0.287	-0.037	-0.576	-0.099	**-5.175**	-0.630**

Diagonal values represent direct effects. * Significant at p=0.05 and ** Significant at p = 0.01

Residual effects : Phenotypic = 0.1327, Genotypic = -0.0327.

References

A.O.A.C. 1990. Official methods of analysis. Association of Official Analytical Chemists, Washington. D.C.

Bisla, S.S. and Daulta, B.S. 1986. Studies on variability, heritability, and genetic advance for quality traits in ber. *Haryana Journal of Horticultural Science.* 15: 175-178.

Bisla, S.S. and Daulta, B.S. 1987. Correlation and path analysis studies on fruit and seed characters in ber. *Agricultural Science Digest.* 7: 170-172.

Deway, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal.* 51: 515-518.

Dubois, M., Gilles, K., Hamitton, J.K., Robers, P.A. and Smith, F, 1951. A colorimetric method for determination of sugar. *Nature.* 16 : 167.

Gupta, N.K. and Mehta, A.K. 2000. Genetic variability and association of component characters for fruit yield in ber (*Zizyphus mauritiana* Lamk.). *Advances in Plant Sciences.* 13: 75-78.

Pant, K.S. 1996. Variation studies and provenance evaluation of wild pomegranate (*Punica granatum* L.). *Thesis Abstract.* CCSHAU, Hisar. 22: 43.

Prajapati, B.H., Goswami, D.G. and Prajapati, M.R. 1996. Cause and effect analysis for fruit yield in ber. *Gujarat Agricultural University Research Journal.* 21: 76-79.

Somogyi, M. 1952. Biochemcial Methods for Agricultural Sciences. Willey Eastern Limited, New Delhi. pp. 5-6.