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INTERRELATIONSHIP ANALYSIS AMONG DIFFERENT GROWTH AND YIELD ATTRIBUTES OF TOSSA JUTE

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ABSTRACT

The experiment was conducted on tossa jute (*Corchorus olitorius* L.) at Jute Agricultural Experimental Station, Jagir, Manikganj during the period from April to August, 2016. The experiment was laid out in a randomized complete block design with three replications. A total of 53 diverged genotypes were included to examine the interrelationships of eleven growth and yield characters viz. plant height (cm), base diameter (mm), green bark thickness (mm), leaf length (cm), leaf width (mm), leaf angle (^{0}), petiole length (cm), green weight with leaves (g), green weight without leaves (g), fibre weight (g) and stick weight (g) as well as their associations with fibre weight in Tossa. Fibre weight was highly positively correlated with plant height (0.677 and 0.962), base diameter (0.382 and 0.878), green bark thickness (0.614 and 0.744), leaf length (0.379 and 0.551), petiole length (0.170 and 0.217), green wt. with leaves (0.854 and 0.952), green wt. without leaves (0.801 and 0.945) and stick wt. (0.913 and 0.973) at both phenotypic and genotypic levels. The results of path coefficient analysis were shown that direct positive effects of plant height, (0.088), base diameter (0.099), green bark thickness (0.094), stick weight (0.486) on fiber yield/plant, green weight with leaves (0.424) and green wt. without leaves (0.012) suggested that these characters would be feasible to improve fiber yield potential in tossa jute.

Key words: Correlation coefficient, path analysis, tossa jute.

Introduction

Jute is an important traditional cash crop in Bangladesh. It is the second most important natural fiber in terms of global consumption after cotton (Basu, 2008). The associations of commercially important quantitative characters that are statistically determined by correlation coefficients have been quite helpful as basis of selection. Selection pressure could be more easily exerted on any of the characters which reflect close association with fiber yield. The fiber yield by itself may not be the best criterion alone for improving fibre yield of tossa jute. Correlation studies measured only mutual association between two in depended characters and path analysis measures the cause and effect of relationship. Thus, the estimation of correlation coefficients and path analysis gave a clear picture about the association between two characters and partitioning of the relationship into direct and indirect effects showing the relative contribution of each of the causal factors towards the fiber yield of tossa jute. Such study would also offer to know the suitability of various characters for indirect selection because selection of one or more character results in correlated response in several other traits.

Materials and Methods

A total of fifty three genotypes (tossa) consisting of 50 accessions and three cultivated varieties with different origin, were included for the study. The genetically pure and healthy seeds of those genotypes were collected from the Gene Bank of Bangladesh Jute Research Institute (BJRI), Dhaka. The experiment was conducted during the period from April to August, 2016. The seeds of the experimental materials were sown in well-prepared land RCBD with three replications. The seeds were sown on 06 April, 2016 and each genotype was allotted in 3 rows of 3m long. The rows were 30cm apart with planting space of 5-7 cm. The replications (blocks) were interspaced with 60cm. The genotypes were assigned randomly to each plot within each block. The agronomic practices with fertilizer application were in accordance with standard recommendation. The data on fibre yield and its attributes were recorded from five randomly selected

plants of each genotype from each replication after harvest (120 days crop age). The data were taken on plant height, base diameter, green bark thickness, leaf length, leaf width, leaf angle, petiole length, green weight with leaves, green weight without leaves, fibre yield and stick yield. The genotypic and phenotypic correlations were estimated by the formula suggested by Miller *et al*. (1958). The cause and effect relationship between yields and its components characters, were studied through path coefficient analysis, which was done according to the procedure stated by Singh and Choudhury (1985).

Results and Discussion

The study on correlation (Table 1) showed that all the correlation coefficients at genotypic level were greater than the corresponding phenotypic ones. The higher values of genotypic than those of phenotypic correlations suggested that the genotypic effects were more important than the environmental factors. In the present investigation fibre weight was highly positively correlated with plant height (0.677 and 0.962), base diameter (0.382 and 0.878), green bark thickness (0.614 and 0.744), leaf length (0.379 and 0.551), petiole length (0.170 and 0.217), green wt. with leaves (0.854 and 0.952), green wt. without leaves (0.801 and 0.945) and stick wt. (0.913 and 0.973) at both phenotypic and genotypic levels. Similar relationship was also reported by Khatun *et al.* (1992), Islam *et al.* (2001), Pullibai *et al.* (2005), Rani *et al.* (2006), and Hari *et al.* (2017). Only two characters, leaf width and leaf angle exhibited highly negative correlation with fibre weight. Significant highly positive correlations were observed from the relationships regarding i) five relations of plant height Vs green bark thickness, leaf length, green weight with leaves, green weight without leaves and stick weight; ii) four relations of base diameter Vs leaf length, green weight without leaves, green weight with leaves and stick weight; iii) five relations of green bark thickness Vs leaf length, petiole length, green weight with leaves, green weight without leaves and stick weight; iv) three relations of leaf length Vs green weight with leaves, green weight without leaves and stick weight; v) two relations of leaf width Vs leaf angle, petiole length; vi) three relations of petiole length Vs green weight with leaves, green weight without leaves and stick weight, vii) two relations of green weight with leaves Vs green weight without leaves and d stick weight as well as viii) green weight without leaves Vs stick weight. It therefore follows that selection for any of these four characters is likely to generate a correlated response over the remaining three characters. Such correlation may arise due to linkage or pleiotropy. But in this investigation it is not possible to conclude the cause of correlation. Highly significant but negative correlation was observed between base diameter Vs leaf width, base diameter Vs leaf angle, green bark thickness Vs leaf angle, leaf length Vs leaf angle, leaf width Vs green wt. with leaves, leaf width Vs green wt. without leaves, leaf width Vs stick wt., leaf width Vs fibre weight, leaf angle Vs green wt. with leaves, leaf angle Vs green wt. without leaves, leaf angle Vs stick wt., leaf angle Vs fibre weight.

Path analysis among different characters of Tossa jute: Since the genotypic correlation between the pairs of characters is the inherent property of the genotypes, therefore, cause and effect were analyzed both at genotypic and phenotypic levels. Estimates of correlation do not alone provide comprehensive pictures of the direct and indirect influences of each of the characters to the fibre weight as this trait is the resultant product of combined effect of various factors complementing and counter acting with each other. So the path coefficient analysis of fibre weight was carried out to assess the extent of relationship of fibre weight and its attributes, and establish the impact of the individual component on fibre yield of tossa jute. In the present genotypes, direct positive effects of plant height, base diameter, green bark thickness, green wt. with leaves, green wt. without leaves and stick wt. were observed on fibre weight (Table 2). These direct effects of plant height, base diameter, green bark thickness, green wt. with leaves, green wt. without leaves and stick wt. were mostly positive via other characters. This result corroborated with the finding of Islam *et al.*, 2001, Nayak *et al.* (2008) and Pervin and Haque (2012). However, significant positive correlation was obtained in plant height, base diameter, green bark thickness, green weight with leaves, green weight without leaves and stick weight with fibre weight. On the other hand leaf length, leaf width, petiole length, leaf angle produced negative direct effect with fibre weight. Thus plant height, base diameter, green bark thickness, green wt. with leaves, green wt. without leaves and stick wt. appeared to be most important fibre yield attributing characters in tossa jute.

Table 1. Phenotypic (P) and genotypic (G) correlation coefficient for eleven characters of tossa jute

Characters		Base diameter (mm)	Green bark thickness (mm)	Leaf length (cm)	Leaf width (cm)	Leaf angle (dg)	Petiole length (cm)	Green wt. with leaves (kg)m^2	Green wt. without leaves (kg)/m^2	Stick wt. (g)/m^2	Fibre wt. (g)/m^2
Plant height (m)	P	0.305**	0.506**	0.528**	-0.046	-0.507**	0.340**	0.708**	0.630**	0.711**	0.677**
	G	-0.074	0.779**	0.835**	-0.085	-0.955**	0.542	0.947**	0.969**	0.959**	0.962**
Base diameter (mm)	P		0.056	0.114	-0.472**	-0.393**	-0.034	0.301**	0.317**	0.314**	0.382**
	G		0.160	0.412**	-0.999**	-0.999**	-0.098	0.680**	0.795**	0.538**	0.878**
Green bark thickness (mm)	P			0.195**	0.070	-0.437**	0.337**	0.668**	0.558**	0.599**	0.614**
	G			0.237**	0.084	-0.514**	0.308**	0.774**	0.807**	0.709**	0.744**
Leaf length (cm)	P				-0.053	-0.356**	0.113	0.507**	0.455**	0.398**	0.379**
	G				-0.047	-0.468**	0.103	0.665**	0.742**	0.504**	0.551**
Leaf width (cm)	P					0.375**	0.301**	-0.183	-0.281**	-0.245**	-0.328**
	G					0.433**	0.287**	-0.241**	-0.436**	-0.311**	-0.424**
Leaf angle (dg)	P						-0.074	-0.618**	-0.598**	-0.582**	-0.587**
	G						-0.066	-0.812**	-0.986**	-0.790**	-0.795**
Petiole length (cm)	P							0.305**	0.235**	0.221**	0.170
	G							0.363**	0.329**	0.252**	0.217**
Green wt. with leaves (kg)/m^2	P								0.917**	0.833**	0.854**
	G								0.924**	0.949**	0.952**
Green wt. without leaves (kg)/m^2	P									0.768**	0.801**
	G									0.938**	0.945**
Stick wt.(g)m^2	P										0.913**
	G										0.973**

*, ** significant at 5% and 1%level, respectively

Table 2. Path coefficient at phenotypic (P) and genotypic (G) levels taking dependent variable (fibre weight) and direct effects in bold

Characters		Plant height (m)	Base diameter (mm)	Green bark thickness (mm)	Leaf length (cm)	Leaf width (cm)	Leaf angle (dg)	Petiole length (cm)	Green wt. with leaves (kg)/m^2	Green wt. without leaves (kg)/m^2	Stick wt. (g)/m^2	Correlation with fibre wt.
Characters Plant height(m)	P	**0.054**	0.045	0.047	0.009	0.031	0.027	0.021	0.136	0.022	0.265	0.677**
	G	**0.088**	0.079	0.081	0.043	0.065	0.061	0.055	0.171	0.056	0.299	0.962**
Base diameter (mm)	P	0.025	**0.051**	0.014	0.014	0.045	0.012	0.014	0.051	0.010	0.154	0.382**
	G	0.073	**0.099**	0.062	0.062	0.093	0.060	0.063	0.099	0.058	0.203	0.878**
Green bark thickness (mm)	P	0.024	0.016	**0.080**	0.002	0.004	0.015	0.005	0.206	0.005	0.222	0.614**
	G	0.037	0.030	**0.094**	0.016	0.018	0.029	0.019	0.220	0.019	0.235	0.744**
Leaf length (cm)	P	0.024	0.017	0.028	**-0.059**	0.022	0.017	0.014	0.135	0.011	0.146	0.379**
	G	0.041	0.034	0.045	**-0.043**	0.038	0.034	0.031	0.152	0.028	0.163	0.551**
Leaf width (cm)	P	-0.010	-0.018	-0.004	-0.006	**-0.145**	-0.009	-0.017	-0.056	-0.004	-0.077	-0.328**
	G	-0.018	-0.027	-0.012	-0.015	**-0.154**	-0.017	-0.026	-0.064	-0.013	-0.086	-0.424**
Leaf angle (dg)	P	-0.027	-0.028	-0.043	-0.003	-0.059	**-0.021**	-0.019	-0.173	-0.012	-0.191	-0.587**
	G	-0.048	-0.049	-0.065	-0.024	-0.080	**-0.042**	-0.040	-0.195	-0.033	-0.212	-0.795**
Petiole length (cm)	P	0.009	0.001	0.023	-0.003	-0.033	0.004	**-0.028**	0.109	-0.001	0.077	0.170
	G	0.012	0.004	0.026	0.001	-0.030	0.007	**-0.024**	0.113	0.002	0.080	0.217**
Green wt. with leaves(kg)/m^2	P	0.025	0.021	0.049	-0.006	0.034	0.017	0.009	**0.408**	-0.008	0.293	0.854**
	G	0.041	0.037	0.065	0.010	0.049	0.033	0.024	**0.424**	0.007	0.308	0.952**
Green wt. without leaves (kg)/m^2	P	0.024	0.022	0.042	0.005	0.041	0.019	0.013	0.383	**0.008**	0.253	0.801**
	G	0.045	0.043	0.063	0.021	0.062	0.040	0.034	0.404	**0.012**	0.274	0.945**
	P	0.031	0.028	0.045	-0.005	0.037	0.016	0.011	0.251	0.002	**0.475**	0.913**
	G	0.041	0.039	0.056	0.005	0.047	0.027	0.022	0.262	0.013	**0.486**	0.973**

Residual effect (G) = 0.1942 Residual effect (P) = 0.3473

Conclusion

The results of path coefficient analysis were shown that direct positive effects of plant height, (0.088), base diameter (0.099), green bark thickness (0.094), stick weight (0.486) on fiber yield/plant, green weight with leaves (0.424) and green wt. without leaves (0.012) suggested that these characters would be feasible to improve fiber yield potential in tossa jute. The direct negative effects exerting characters would not be suitable for improvement. The positive indirect effects of the characters imposed to develop ultimate positive correlation with fiber yield/plant. The negative correlation coefficients of fiber yield with some characters indicated that the indirect effects of the characters had not compensated the direct negative effect to build up correlation with fibre yield. From the association studies, it was revealed that plant height, green bark thickness, green weight without leaves and stick weight were the indispensable characters for improving fiber yield in tossa jute

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