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GENETIC VARIABILITY, CORRELATION AND PATH ANALYSIS IN TOSSA JUTE (*Corchorus olitorius* L.) GERMPLASM

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ABSTRACT

Genetic variability, correlation and path coefficient analysis for yield and yield attributing traits in 41 indigenous genotypes and three commercially cultivated varieties of tossa jute were studied at the Central Jute Agricultural Experiment Station, Manikganj of Bangladesh Jute Research Institute (BJRI) during April to September 2007. Considering genetic parameters, high genotypic coefficient of variation and high heritability coupled with high genetic advance over mean were recorded for the characters- number of nodes per plant, green weight with leaves per plant, green weight without leaves per plant, stick weight per plant and fibre weight per plant suggesting better opportunity for selecting high valued genotypes based on these characters. Fibre yield per plant was significantly and positively correlated with green weight without leaves per plant and stick weight per plant at both genotypic and phenotypic levels. Path coefficient analysis indicated maximum direct contribution of stick weight per plant towards fibre yield followed by internode length, green weight without leaves per plant, plant height and green weight with leaves per plant.

Key words: Tossa jute, *Corchorus olitorius* L., germplasm, genetic variability, correlation, path analysis

INTRODUCTION

Jute is the most important natural fibre crop next to cotton (Singh, 1976). It is an agricultural commodity that singly earns foreign exchange equivalent to 469 crore taka annually to the national economy of Bangladesh (BBS, 2005). Of the two cultivated species of jute, *Corchorus olitorius* (tossa pat) produce better quality fibres i.e., finer, softer, stronger and lustrous than those of *C. capsularis* (deshi pat) (Dahal, 1991). As a result, *C. olitorius* jute cultivation is increasing day by day for its higher market price, and has a great demand to the farmers of this country. The average yield of jute in our country is only 1.72 tons/ha, which is low as compared to other jute producing countries like India (FAO, 1997). There are many constraints to higher and stable yield of jute. Of them, limited number of jute varieties and narrow genetic bases of the existing varieties are the most important. Therefore, improvement in yield and other morphological and agronomical characters are important for increasing productivity of this species. Yield in jute is a complex character, which is not only polygenically controlled but also influenced by its component characters (Alam *et al.*, 1988). These yield contributing characters are related to fibre yield and also among themselves. The correlation studies can provide information about such relationship among the characters and the real contributor for yield may be searched by adopting path analysis. Therefore, the present investigation was designed to identify the traits that contribute much to fibre yield through study of genetic variability, correlation and path-coefficient analysis in some local germplasm of tossa jute.

MATERIALS AND METHODS

The experiment was carried out at Central Jute Agricultural Experiment Station of Bangladesh Jute Research Institute (BJRI), Manikganj during the period from April to September, 2007. Forty one

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indigenous germplasm accessions of tossa jute (*C. olitorius* L.) including three cultivated varieties namely var. O-9897, var. OM-1 and var. O-72 were collected from the gene bank of BJRI, Dhaka and were raised in a randomized complete block design (RCBD) with three replications. Unit plot had a single row of 3 m length. Space between rows was 0.30 m and block to block distance was 1 m. Standard agronomic practices were maintained to raise healthy crop. After 120 days, the plants were harvested and data on plant height, base diameter, number of nodes per plant, leaf area, green weight with leaves per plant, green weight without leaves per plant, stick weight per plant and fibre weight per plant were recorded from 10 randomly selected plants of each genotype from each replication. The data were statistically analyzed according to Panse and Shukhatme (1978), Steel and Torrie (1980) and Johnson *et al.* (1955). Genotypic and phenotypic coefficients of variation were calculated according to Burton (1952). The broad sense heritability and genetic advance were estimated by the formulae suggested by Johnson *et al.* (1955). Genetic advance as percentage of mean was calculated as suggested by Comstock and Robinson (1952). Genotypic and phenotypic correlation coefficients were calculated according to Al-Jibouri *et al.* (1958), Miller *et al.* (1958), Johnson *et al.* (1955) and Hanson *et al.* (1956). Path co-efficient analysis was performed according to the formula originally developed by Wright (1921) and later revised by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Genetic variability

The estimates of genotypic variance (σ^2_g), phenotypic variance (σ^2_p), genotypic coefficient of variation (GCV %), phenotypic coefficient of variation (PCV%), heritability (h^2_b%), genetic advance (GA) and genetic advance in percentage of mean (GA% mean) for 9 different characters are shown in Table 1.

Table 1. Estimation of genetic parameters of morphological characters of different genotypes of tossa jute

Characters	σ^2_g	σ^2_p	GCV (%)	PCV (%)	h^2_b (%)	GA	GA (% mean)
Plant height (m)	0.01	0.03	4.33	6.73	41.49	0.16	5.75
Base diameter (mm)	0.60	1.46	5.60	8.70	41.35	1.03	7.41
Number of nodes/plant	85.86	103.06	13.39	14.67	83.31	17.42	25.18
Internode length (cm)	0.03	0.29	4.17	11.12	14.03	0.14	3.21
Leaf area (sq. cm)	12.62	21.71	10.54	13.83	58.11	5.58	16.56
Green weight with leaves/plant (g)	142.57	155.45	19.49	20.35	91.12	23.56	38.45
Green weight without leaves/plant (g)	96.82	109.00	22.22	23.57	88.82	19.10	43.14
Stick weight/plant (g)	8.80	9.48	21.43	22.24	92.87	5.89	42.55
Fibre weight/plant (g)	1.12	1.28	17.55	18.80	87.08	2.03	33.73

The phenotypic variances (σ^2_p) were slightly higher for all the characters than their corresponding genotypic variances (σ^2_g) indicating the presence of environmental influence to some extent in the expression of those characters. Relatively higher value of genotypic (σ^2_g) and phenotypic (σ^2_p) variances were recorded for green weight with leaves per plant, green weight without leaves per plant and number of nodes per plant. The highest GCV was recorded for green weight without leaves per plant followed by stick weight per plant, green weight with leaves per plant, fibre weight per plant and number of nodes per plant indicating higher degree of genetic variability in these traits. These results showed close agreement with the findings of Akter *et al.* (2005). Besides, the narrow difference between PCV and GCV suggested that the environment had less effect on these characters under study, which also supported the findings of Islam *et al.* (2002).

Comparatively high heritability value coupled with high genetic advance over mean were recorded for the characters stick weight per plant, green weight with leaves per plant, green weight without leaves per plant, fibre weight per plant and number of nodes per plant, which suggested that these characters were mostly controlled by additive genes. These results supported the findings of Islam and Ahmed (2003) and Akter *et al.* (2005). Moderate heritability value with moderate genetic advance over mean were found for leaf area, base diameter and plant height indicating that these characters were under the control of non additive genes.

Correlation coefficient

Correlation study among fibre yield and yield attributing traits in tossa jute revealed that the genotypic correlation coefficients were higher in most cases than their corresponding phenotypic correlation coefficients (Table 2). Fibre weight per plant was significantly and positively correlated with green weight without leaves per plant and stick weight per plant at both genotypic and phenotypic level, where as it was significantly and positively correlated with base diameter, number of nodes per plant, internode length and leaf area at genotypic level and green weight with leaves per plant at phenotypic level. Therefore, selection based on these characters should get preference for identifying superior parental line(s) for future breeding programme. Highly significant and positive relationship at genotypic and phenotypic levels was obtained for plant height, base diameter, number of nodes per plant, leaf area and fibre weight per plant. Similar results were also reported by several authors with *Corchorus* species (Paul and Eunus, 1974; Maiti *et al.*, 1977; Ghosdastidar and Das, 1984; Das, 1987; Islam *et al.*, 2004; Akter *et al.*, 2005).

Table 2. Genotypic (G) and phenotypic (P) correlation coefficients among nine characters of tossa jute

Characters		BD	NP	IL	LA	GWW	GWO	SW	FW
PH	G	0.710**	0.999**	0.280	0.595**	0.133	0.156	0.370*	0.201
	P	0.388**	0.736**	-0.040	0.376*	0.085	0.142	0.299	0.147
BD	G		0.687**	0.073	0.599**	0.145	0.162	0.407**	0.929**
	P		0.399**	0.085	0.368*	0.086	0.063	0.249	0.093
NP	G			0.108	0.494**	0.161	0.176	0.371**	0.623**
	P			0.028	0.383**	0.147	0.177	0.351**	0.099
IL	G				0.231	0.258	0.081	0.233	0.425**
	P				0.016	0.132	0.135	0.096	0.154
LA	G					0.028	0.022	0.026	0.657**
	P					0.028	0.036	0.031	0.008
GWW	G						0.946**	0.843**	0.164
	P						0.891**	0.781**	0.720**
GWO	G							0.861**	0.765**
	P							0.791**	0.693**
SW	G								0.825**
	P								0.765**

*Significant at 5% and ** Significant at 1% level of probability

PH= Plant height (m), BD = Base diameter (mm), NP = Number of nodes/plant, IL= Internode length (cm), LA = Leaf area (sq. cm), GWW =Green weight with leaves/plant (g), GWO = Green weight without leaves/plant (g), SW =Stick weight/plant (g) and FW = Fibre weight/plant

Path coefficient

In path coefficient analysis the stick weight per plant showed the highest positive direct effect on fibre weight per plant at genotypic level followed by internode length, green weight without leaves per

plant, plant height and green weight with leaves per plant (Table 3). Direct positive effect of plant height on fibre weight per plant was also reported by several authors (Mandal *et al.*, 1980; Chaudhury *et al.*, 1981; Bordoloi and Das, 1999). On the other hand, base diameter, number of nodes per plant and leaf area showed negative direct effect on fibre weight per plant. Chaudhury *et al.*, (1981) and Bordoloi and Das (1999) reported negative direct effect of base diameter at genotypic level. Biswas (1984) and Dahal (1991) observed negative direct effect of number of nodes per plant and Islam *et al.* (2004) found negative direct effect of leaf area on fibre weight per plant, which supported the present findings.

Table 3. Partitioning of genotypic correlation coefficient into direct (bold faced) and indirect effects by path analysis

Characters	PH	BD	NP	IL	LA	GWW	GWO	SW	FW
PH	**0.128**	-0.106	-0.270	0.090	-0.007	0.002	0.028	0.255	0.120
BD	0.091	**-0.149**	-0.174	0.023	-0.007	0.002	0.029	0.281	0.096
NP	0.136	-0.102	**-0.253**	0.035	-0.006	0.003	0.031	0.256	0.100
IL	0.036	-0.011	-0.027	**0.321**	-0.003	0.004	0.014	0.161	0.495**
LA	0.076	-0.089	-0.125	0.074	**-0.012**	0.000	0.004	0.018	-0.054
GWW	0.017	-0.022	-0.041	0.083	0.000	**0.016**	0.168	0.582	0.803**
GWO	0.020	-0.024	-0.045	0.026	0.000	0.015	**0.177**	0.595	0.765**
SW	0.047	-0.060	-0.094	0.075	0.000	0.014	0.153	**0.691**	0.825**

** Significant at 1% level of probability

PH= Plant height (m), BD = Base diameter (mm), NP = Number of nodes/plant, IL= Internode length (cm), LA = Leaf area (sq. cm), GWW =Green weight with leaves/plant (g), GWO = Green weight without leaves/plant (g), SW =Stick weight/plant (g) and FW = Fibre weight/plant

From correlation and path coefficient analysis it was revealed that stick weight per plant, green weight with leaves per plant and green weight without leaves per plant were the most important yield components in jute. These characters also showed high genotypic coefficient of variation and high heritability coupled with high genetic advance over mean. Therefore, the results suggested that these characters should get more preference by the jute breeders while selecting high valued genotypes to attain high fibre yield.

The residual effect (0.3824) indicated that the characters under study contributed 61.76% to the yield. It is suggested that more emphasis should be given on the characters studied for selecting tossa jute genotypes with higher fibre yield. The other characters which contributed to the yield might be included for further study.

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