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GENETIC PARAMETER, CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS OF SOME EXOTIC GERMPLASM OF TOSSA JUTE (*Corchorus olitorius* L.)

M. M. Rahman[1], M. A. Ali[2], M. S. R. Bhuiyan[3], M. M. Islam[4] and A. S. M. Yahiya[5]

ABSTRACT

Thirty exotic genotypes of tossa jute (*Corchorus olitorious* L.) from different geographic origins were evaluated in order to find out their genetic variability, correlation and path coefficient for 9 morphological characters. Significant variation was observed among the tested genotypes for different traits except base diameter. High Genotypic Coefficient of Variation (GCV) was observed for fibre weight, stick weight, green weight without leaves and green weight with leaves. High heritability values with high genetic advance in percentage of mean were obtained for green weight without leaves, green weight with leaves, stick weight and fibre weight. Highly significant and positive correlations were observed among the characters- plant height, node number, green weight with leaves, green weight without leaves and stick weight at both genotypic and phenotypic level. Fibre yield was significantly and positively correlated with green weight with leaves, green weight without leaves and stick weight at both levels. Path coefficient analysis indicated maximum direct contribution of stick weight per plant towards fibre yield followed by green weight without leaves, base diameter and leaf area.

Key words: Tossa jute (*Corchorus olitorius* L.), exotic germplasm, genetic variability, correlation and path coefficient analysis

INTRODUCTION

Jute is an important bast fibre crop in Bangladesh. It earns foreign exchange equivalent to 469 crore taka annually to our national economy (BBS, 2005). Presently, jute is growing in about 956 thousand acres of land and production is about 732 thousand metric tons annually (BBS, 2005). In Bangladesh two kinds of jute viz., white jute (*Corchorus capsularis*) and tossa jute (*Corchorus olitorius*) are mainly grown for commercial purpose. The fibre of tossa jute is finer and stronger. Its price in both national and international market is also high and the growers get better economic return from the cultivation of tossa jute. Bangladesh Jute Research Institute (BJRI) has got about 1540 germplasm of tossa jute. Of them, 554 germplasm are exotic and the rests are indigenous in origin. Study of the extent of variability and genetic estimates of these exotic germplasm is very important for utilizing them in hybridization program that has not yet been done completely. Dudley and Moll (1969) suggested partitioning the available variability in a population into its heritable and non heritable components. Swarup and Changale (1962) suggested studying the heritability and genetic gain to obtain better estimate about genetic variation. Fibre yield in jute is a complex character and is dependent on some component characters. The direct and indirect effects of these component characters on fibre yield and ultimately the real contributor for yield can be searched by adopting path analysis. Roy (1965) stated that plant height and base diameter should be considered for selection of genotype for higher fibre yield. Base diameter alone is also a good indicator of yield potential (Eunus and Salam, 1960). Therefore, the present investigation was carried out to estimate genetic parameters, correlation and path coefficient of some morphological and agronomical characteristics of some exotic tossa jute germplasm.

[1]Senior Scientific Officer, Breeding Division, Bangladesh Jute Research Institute (BJRI), Dhaka-1207, [2]Principal Scientific Officer, Breeding Division, BJRI, Dhaka-1207, [3]Professor, Department of Genetics and Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka-1207, [4]Scientific Officer, Breeding Division, BJRI, Dhaka-1207, [5]Scientific Officer, Genetic Resources and Seed Division, BJRI, Dhaka-1207.

MATERIALS AND METHODS

The experiment comprised of 30 germplasm accessions of tossa jute of exotic origin including 3 standard check varieties, namely var. O-9897, var. OM-1 and var. O-72 (Table 1). Genetically pure and physically healthy seeds of these genotypes were collected from the Gene Bank Department of BJRI, Dhaka and were raised in a randomized complete block design (RCBD) with three replications. The experiment was conducted at Central Jute Agricultural Experiment Station of Bangladesh Jute Research Institute (BJRI), Jagir, Manikganj during the period from April to September, 2007. Unit plot had a single row of 3m length. Space between rows was 30cm and block to block distance was 1m. 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. 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 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

Mean, range, 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 different characters are given in Table 1.

Table 1. Genetic parameters of nine morphological characters for different exotic genotypes of tossa jute

Characters	Mean	Range	σ^2_g	σ^2_p	h^2_b (%)	GA	GA (% mean)	GCV (%)	PCV (%)
PH	2.95	2.61-3.43	0.02	0.06	32.27	0.17	5.69	4.86	8.56
BD	14.90	12.50-17.70	0.12	1.81	39.73	1.10	7.37	5.68	9.01
NP	75.00	55.00-97.00	54.62	110.35	49.49	10.71	14.22	9.81	13.94
IL	4.26	3.80-5.69	0.07	0.20	33.88	0.31	7.34	6.12	10.52
LA	35.21	28.89-41.23	10.28	21.33	48.20	4.59	13.02	9.11	13.11
GWW	90.94	57.89-126.89	473.59	545.24	86.86	41.18	45.94	23.93	25.68
GWO	65.75	39.99-97.13	303.17	329.71	91.95	34.39	52.31	26.48	27.62
SW	18.97	10.25-33.30	34.23	35.90	95.34	11.77	62.05	30.85	31.59
FW	8.54	5.07-13.48	5.10	5.62	90.69	4.43	51.88	26.45	27.77

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

The range of variation was much pronounced for most of the characters. The lowest and highest ranges of variation were observed in plant height and green weight with leaves, respectively. The difference between genotypic and phenotypic variances was high for the characters base diameter, number of nodes per plant and leaf area indicating large environmental influence on the expression of these characters. The narrow difference between PCV and GCV for the characters- green weight with leaves, green weight without leaves, stick weight and fibre weight supported the idea that environment had less effect on these characters under present study. These characters also showed high heritability values

coupled with high genetic advance in percent of mean, which indicated that they were controlled by additive gene effects. Johnson *et al.* (1955) suggested that heritability estimates along with genetic gain were more useful in predicting the response of selection. Therefore, selection of superior genotypes based on these characters would be more effective and judicious. These results supported the findings of Islam and Ahmed (2003) and Akter *et al.* (2005).

Correlation co-efficient

Genotypic correlation co-efficients were higher than their corresponding phenotypic correlation co-efficients in most of the cases indicating a fairly strong inherent relationship among the characters (Table 2). In some of the cases phenotypic correlation co-efficients were higher than genotypic correlation co-efficients indicating suppressing effect of environment that modify the expression of the character at phenotypic level. Higher estimates of genotypic correlation co-efficients than their corresponding phenotypic correlation co-efficients in tossa jute were also reported by Islam and Ahmed (2003).

Table 2. Genotypic and phenotypic correlation co-efficient among nine morphological characters in tossa jute

		BD	NP	IL	LA	GWW	GWO	SW	FW
PH	G	0.441*	0.999**	-0.420*	0.690**	0.306	0.228	0.311	0.355
	P	0.342	0.548**	-0.810**	0.340	0.227	0.205	0.213	0.266
BD	G		0.521**	0.335	0.032	0.387*	0.370*	0.288	0.171
	P		0.374*	0.073	0.079	0.253	0.243	0.220	0.114
NP	G			-0.449*	0.587**	0.165	0.127	0.135	0.261
	P			-0.251	0.180	0.162	0.088	0.064	0.184
IL	G				-0.115	0.179	0.191	0.363*	-0.033
	P				0.035	0.093	0.131	0.191	0.015
LA	G					0.093	-0.002	0.093	-0.005
	P					0.099	0.051	0.096	0.009
GWW	G						0.992**	0.942**	0.767**
	P						0.931**	0.887**	0.878**
GWO	G							0.930**	0.767**
	P							0.886**	0.885**
SW	G								0.704**
	P								0.877**

*Significant at the 0.05 level, **Significant at the 0.01 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

Fibre yield was significantly and positively correlated with green weight with leaves, green weight without leaves and stick weight per plant at both genotypic and phenotypic level. Besides, these three characters were strongly inter-associated with each other at both levels. Therefore, selection of superior genotypes based on these characters should get preference in future breeding programs. Significant and positive relationship at genotypic and phenotypic levels was also obtained among plant height, base diameter and number of nodes per plant. About similar results were also obtained by Islam *et al.* (2004) and Akter *et al.* (2005).

Path co-efficient

The genotypic correlation co-efficients between fibre yield and other yield components partitioned into direct (bold value) and indirect effect through path co-efficient analysis is presented in Table 3.

Table 3. Path co-efficient showing direct (bold value) and indirect effects of eight morphological characters on fibre yield of tossa jute at genotypic level.

Characters	PH	BD	NP	IL	LA	GWW	GWO	SW	FW
PH	**-0.103**	0.111	-0.153	0.239	0.055	-0.306	0.202	0.311	0.3551**
BD	-0.045	**0.252**	-0.075	-0.190	0.003	-0.387	0.328	0.288	0.1714
NP	-0.109	0.131	**-0.145**	0.255	0.046	-0.165	0.113	0.135	0.2615
IL	0.043	0.084	0.065	**-0.569**	-0.009	-0.179	0.169	0.363	-0.0333
LA	-0.071	0.008	-0.085	0.006	**0.079**	-0.093	-0.002	0.093	-0.0051
GWW	-0.032	0.097	-0.024	-0.102	0.007	**-1.000**	0.879	0.942	0.7674**
GWO	-0.023	0.093	-0.018	-0.109	0.000	-0.992	**0.886**	0.930	0.7670**
SW	-0.032	0.072	-0.020	-0.206	0.007	-0.942	0.824	**1.000**	0.7042**

** 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 co-efficient analysis revealed that stick weight had the highest positive direct effect on fibre weight per plant followed by green weight without leaves, base diameter and leaf area, while plant height, number of nodes per plant, internode length and green weight with leaves showed negative direct effect on fibre weight per plant. Direct positive effect of green weight without leaves on fibre weight was reported by Akter *et al.* (2005). Besides, direct positive effect of base diameter and leaf area on fibre weight was reported by Das (1987) and Das and Rakshit (1988). However, Biswas (1984) reported that node number and intermodal length had negative direct effect on yield which supported the present findings.

The character green weight with leaves had highly significant and positive indirect effect on fibre weight per plant at genotypic level followed by green weight without leaves, stick weight and plant height. The residual effect (0.1643) indicated that the characters under study contributed 83.57% of the yield. Therefore, it is suggested that the breeder might concentrate more on the above characters in order to increase fibre yield of tossa jute.

The results of the present study indicated high heritability together with high genetic advance in percentage of mean for green weight without leaves, green weight with leaves, stick weight and fibre weight per plant. Therefore, selection based on these characters would be effective for the improvement of jute. Correlation and path coefficient analysis suggested that during selection more emphasis should be given on green weight without leaves and stick weight since these two characters have high positive correlation and high positive direct effect on fibre weight per plant.

REFERENCES

Akter, N., Mian, M. A. K., Islam, M. M., Alim, M. A. and Islam, M. N. 2005. Estimation of genetic parameters, character association and path analysis in jute (*C. olitorius* L.) germplasm. *Bangladesh J. Pl. Breed. Genet.* 18 (1): 35-38.

BBS, 2005. Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics, Planning Ministry, Dhaka.

Biswas, S. K. 1984. Genetic assessment of chemical mutagen treated population. Ph. D. Thesis, Bidhan Chandra Krishi Viswabidyalaya, Kalyani, West Bengal.

Burton, G. W. 1952. Quantitative inheritance in grasses. Proc. 6th Intl. Grassland Cong. 1: 277-283.

Comstock, R. E. and Robinson, H. F. 1952. Genetic parameters, their estimation and significance. Proc. 6th Intl. Grassland Cong. 1: 284-291.

Das, U. C. L. 1987. Genetic evaluation of jute germplasm under Indo-Nepal terai soil regions. Ph. D. Thesis, Bidhan Chandra Krishi Viswabidyalaya, Kalyani, West Bengal.

Das. U.C.L. and Rakshit, S. C. 1988. Character association and path analysis in *C. olitorius* jute. *Expt. Genet.* 4 (2): 48-52.

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

Dudley, J. W. and Moll, R. H. 1969. Heritability and genetic advances in plant Breeding. *Crop Sci.* 9: 257-261.

Eunus, A. M. and Salam, M. A. 1960. Epistasis in the inheritance of quantitative characters in jute. *Crop Sci.* 9 (2): 167-169.

Hanson, C.; Robinson, H. and Comstock, R. E. 1956. Biometrical studies of yield in segregating populations of Korean lespedza. *Agron. J.* 48: 268-272.

Islam, M. S. and Ahmed, S. 2003. Genetic variability and character association in *Corchorus olitorius* L. *Bangladesh J. Life Sci.* 15 (2): 133-136.

Islam, M. S., Nasreen, A., Begum, S. and Haque, S. 2004. Correlated response and path analysis in tossa jute (*C. olitorius* L.). *Bangladesh J. Bot.* 33 (2): 99-102.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. 1955. Estimates of genetic and environmental variability in soybean. *Agron. J.* 47: 314-318.

Miller, P. J., Williiiams, J. C., Robinson, H. F. and Comstock, R. E. 1958. Estimates of genotypic and environmental variances and covariances in upland cotton and their implications in selection. *Agron. J.* 50:126-131.

Panse, V. G. and Sukhatme, P. V. 1978. Statistical method for agricultural workers. 3rd Edition. Indian council of Agricultural Research , New Delhi. pp.258-268.

Roy, B. 1965. Studies on correlation and means of yield components in relation to jute breeding. *Indian J. Agric.* 9 (2): 107-111.

Steel, R. G. D. and Torrie, J. H. 1980. Principles and procedures of statistics. Mc Graw-Hill Book Co. Inc., New York.

Swarup, V. and Changale, D. S. 1962. Studies of genetic variability in Sorghum. *Indian J. Genet.* 22: 31-36.

Wright, S. 1921. Correlation and causation. *J. Agric. Res.* 20: 557-587.