J. Sher-e-Bangla Agric. Univ., 4(1): 39-42, January 2010 ISSN 1997-6038

GENETIC VARIABILITY, CHARACTER ASSOCIATION AND PATH ANALYSIS OF WHITE JUTE (*Corchorus capsularis* L.)

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ABSTRACT

Eighteen genotypes of white jute from different geographic origin were studied with a view to find out the variability and genetic association for fibre yield and its component characters. All the characters tested showed significant variation among the different genotypes. The highest genetic variability was obtained in green weight. High heritability together with high genetic advance in percentage of mean were observed in green weight, stick weight and fibre weight. Genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients in most of the traits. Base diameter, nodes per plant and stick weight showed significant positive correlations with fibre yield. Path analysis revealed maximum direct contribution towards yield through stick weight followed by nodes per plant and plant height.

Key words: White jute, genetic variability, correlation, path analysis

INTRODUCTION

Jute (*Corchorus capsularis L.*) is an important fibre crop of manifold utility. Its fibre yield and quality is dependent on component characters which are quantitatively inherited and considerably influenced by environment. In crop plants, most economical characters are controlled by many genes. Physiological and linkage relationship have been frequently observed in genes governing various quantitative characters (Dhillon and Gupta, 1975). Hence, knowledge on the phenotypic and genotypic correlations between important characters is considered useful in planning an efficient breeding programme. Besides, correlations between important and unimportant characters may reveal that some of the latter are useful as indication of one or more of the important characters (Johnson *et al.,* 1955 a). Thus, advancement through a breeding programme depends upon the extent of genetic variability in the population and the extent to which the desirable traits are heritable.

In this context, correlation and path-coefficient analysis assume special importance as they not only measure mutual association but also estimate the direct and indirect contributions of perspective traits. This investigation was, therefore, undertaken to measure the genetic variability, nature of association among different plant traits and the potential applicability of path analysis techniques in breeding white jute.

MATERIALS AND METHODS

The experiment was conducted at the Central Jute Agricultural Experiment Station of Bangladesh Jute Research Institute (BJRI), Jagir, Manikganj during the period from April to October, 2006. Three cultivated varieties CVL-1, BJC-7370 and CVE-3 with 15 genotypes namely accession numbers 864, 867, 875, 887, 944, 1512, 1801, 1923, 4374, 4482, 4617, 4700, 4706, 4951 and 5060 of white jute were collected from gene bank of BJRI, Dhaka. The experiment was laid out in a Randomized Complete Block Design with three replications. The seeds of each genotype were sown on 14 April, 2006 in a single row of 3 m length by adopting an inter and intra row spacing of 30 cm and 5 cm, respectively.

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From each replication 10 plants were randomly selected and harvested at mature fruit stage. Observations were recorded on plant height, base diameter, nodes per plant, green weight, stick weight and fibre weight. Genetic estimates and heritability in a broad sense were calculated following the procedure of Johnson *et al.* (1955b). The phenotypic and genotypic correlation coefficients were estimated according to Burton and De Vane (1953). Path coefficient analysis was estimated according to method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

All the genotypes varied significantly with each other for all the characters studied. The range of variation was wider and the highest for the character green weight followed by stick weight and fibre weight (Table 1). Phenotypic variance was higher than the genotypic and environmental variance in all the traits.

Table 1. Range, mean and variance for yield and yield contributing traits in white jute

Characters	Range	Mean	Variance		
			Phenotypic	Genotypic	Environmental
Plant height (m)	2.26-3.04	2.76	0.07	0.03	0.04
Base diameter (mm)	17.94-27.67	21.37	8.73	2.94	5.79
Nodes/plant (No.)	42.67-83.00	61.51	129.00	107.17	21.83
Green weight (g)	83.20-312.47	146.50	3822.85	3566.83	256.01
Stick weight (g)	23.87-91.67	44.13	244.02	230.37	13.66
Fibre yield (g)	9.73-34.67	17.63	40.44	36.64	3.80

The estimates of phenotypic coefficient of variation (PCV) were larger than those of genotypic coefficient of variation (GCV) for all the traits (Table 2). High genotypic coefficient of variation, high heritability value and high genetic advance were recorded for the characters - green weight, stick weight and fibre weight which suggested that those characters were under control of additive gene effects. Heritability values for green weight (93.30%), stick weight (94.40%) and fibre weight (90.61%) indicated that characters were less influenced by environmental factors.

Table 2. Phenotypic (PCV), Genotypic (GCV) and Environmental coefficients of variation (ECV) in white jute

Characters	PCV	GCV	ECV	h^2 (%)	GA	GA as % of mean
Plant height (m)	9.42	6.20	7.09	43.36	0.23	8.42
Base diameter (mm)	13.83	8.03	11.26	33.72	2.05	9.61
Nodes/plant (No)	18.47	16.83	7.60	83.08	19.44	31.60
Green weight (g)	42.20	40.77	10.92	93.30	118.84	81.12
Stick weight (g)	35.39	34.39	8.37	94.40	30.38	68.83
Fibre yield (g)	36.06	34.33	11.05	90.61	11.87	67.31

Heritability together with genetic gain was usually more useful than heritability estimates alone in predicting selection response (Johnson *et al.*, 1955b; Swarup and Chaugal, 1962). In the study green weight, stick weight and fibre yield showed high genetic gain along with high heritability values. The genotypic correlations were higher than the corresponding phenotypic correlations except correlation between plant height and base diameter (Table. 3).

Table 3. Correlation coefficients among six quantitative characters in white jute

Characters		BD	NP	GW	St W	Fibre yield
Plant height (PH)	P	0.310	0.541*	-0.236	0.188	0.307
	G	-0.062	0.678**	-0.284	0.287	0.346
Base diameter (BD)	P		0.280	0.399	0.598**	0.591**
	G		0.426	0.731**	1.045**	0.841**
Nodes/plant (NP)	P			0.199	0.520*	0.590**
	G			-0.203	0.603**	0.682**
Green weight (GW)	P				0.311	0.172
	G				0.356	0.190
Stick weight (StW)	P					0.790**
	G					0.856**

*and ** Significant at 5% and 1% level respectively.
(P) Phenotypic and (G) Genotypic correlation coefficients.

Table 4. Partitioning of genotypic correlation coefficient into direct (bold faced) and indirect effects of path analysis

Characters	PH	BD	NP	GW	St W	Genotypic Correlation with fibre yield
Plant height (PH)	**0.016**	0.005	0.105	0.056	0.256	0.346
Base diameter (BD)	-0.001	**-0.080**	0.066	-0.144	0.933	0.841**
Nodes/plant (NP)	0.011	-0.034	**0.155**	0.040	0.538	0.682**
Green weight (GW)	-0.005	-0.032	-0.032	**-0.198**	0.317	0.190
Stick weight (StW)	0.005	0.093	0.093	-0.070	**0.892**	0.856**

The lower estimates of phenotypic correlation coefficients suggested that the suppressive effect of the environment modified the phenotypic expression of these characters by reducing phenotypic correlation values. About similar results were reported by several workers in jute and mesta material (Shukla and Singh, 1967; Joseph, 1976; Aruna *et. al.* (1988). On the other hand, genotypic correlation coefficients were lower than the corresponding phenotypic correlation coefficients suggesting that the expression of these characters was appreciably enhanced by environmental influence. About similar results were reported by Chaudhury 1984; Sardana *et. al.*, 1990 and Shreshtha, 1991. The association between plant height and node per plant, base diameter and stick weight per plant, nodes per plant and stick weight per plant showed significant positive correlation at phenotypic and genotypic level. In case of base diameter vs. stick weight the value of genotypic correlation coefficient was greater than 1.00 because the estimation of genotypic variance and covariance by algebric manipulation led to unexpected high value. Similar results were also observed in eggplant (Salehuzzaman *et. al.*, 1979).

Path coefficient analysis revealed that stick weight had the highest positive direct effect on fibre yield (Table 4). The indirect effects on fibre yield via plant height and nodes per plant were also positive and resulted the highest positive association.

The plant height showed positive association with fibre yield because of positive direct effect, as well as indirect effect via base diameter, nodes per plant, green weight and stick weight. This suggests that the plant height contributed directly to fibre yield.

Base diameter showed positive correlation with fibre yield whereas path analysis revealed that the direct effect of base diameter was negative, the indirect effects via nodes per plant and stick weight were positive and nullified the direct effect of this trait but also resulted in a positive association and followed the highest association. Similar results have also been reported by Khatun and Sobhan (1992). The direct effect of nodes per plant was positive and the effects via plant height, green weight and stick weight were also positive, which counter balanced the negative effect via base diameter and resulted in a positive association. Green weight had positive association with fibre yield but its direct effect was negative (-0.198). The indirect effects via plant height, base diameter and node per plant were also negative. The positive association was entirely due to positive indirect effect through stick weight.

The correlation and path analysis showed that plant height, base diameter, nodes per plant and stick weight were the most important yield contributing characters. It is suggested that maximum emphasis should be given on the above characters in selecting jute genotype with higher yield.

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