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CORRELATION AND PATH COEFFICIENT ANALYSIS OF YIELD AND ITS ATTRIBUTING TRAITS IN TOSSA JUTE (*CORCHORUS OLITORIUS* L.)

ASHUTOSH SAWARKAR[1*], SONIKA YUMNAM[1], S.G. PATIL[2] AND S. MUKHERJEE[1]
[1]Department of Genetics and Plant breeding,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur - 741 252, Nadia, West Bengal, INDIA
[2]Agricultural College and Research Institute,
Tamil Nadu Agricultural University, Killikulam - 628 252, Tamil Nadu, INDIA
e-mail: annu.sawarkar@gmail.com

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***Corresponding author**

ABSTRACT
The genetic variability, heritability, genetic advance, correlation coefficient and path analysis were estimated for yield and its attributing traits in thirty genotypes of tossa jute (*Corchorus olitorius* L.). The analysis of variance showed significant differences among the genotypes for all the characters. The highest genotypic variance was for plant height (680.97) followed by green weight (123.59), stick weight (49.33), days to 50% flowering (12.05), fibre weight (1.31), base diameter (0.02) and the lowest genotypic variance was that of bark thickness (0.03). High values of heritability(>90%) were recorded for almost all characters like plant height (93.01%), bark thickness(98.33%), base diameter(94.82%), green weight (91.64%), stick weight (99.20%) and fibre weight (96.48%). The high heritability with moderate to high genetic advance over percentage of mean was observed in bark thickness (98.33%, 38.86), stick weight (99.20%, 56.87) and fibre weight (96.48%, 25.02) which indicate preponderance of additive genetic action. Therefore, effective selection would be made considering the stick weight, bark thickness, green weight, plant height and base diameter per plant to produce jute varieties with acceptable yield.

INTRODUCTION

Jute is a natural fiber crop and is second in the world after cotton in terms of global production, consumption and availability. In India, West Bengal occupies foremost place both in respect of area (73.5%) and production (82.26%) of jute. The fibre (bast fibre) is obtaining from the bark of two cultivated species of the genus namely *Corchorus capsularis* L. and *Corchorus olitorius* L. which are widely cultivated throughout the tropical and sub-tropical regions of the world, particularly in Asia, Africa and Latin America (Hossain *et al.*, 2002). The bast fibres of jute are not only important to textile and paper industries but also make us free from being worried of population hazards as it is biodegradable. The present threatening of undegradable particle reminds us that there is no other alternative for fibre crops like jute. (Senapati *et al.*, 2006). Jute fibre has high tensile strength, low extensibility and ensures better breathability of fibre, therefore, it has proved its importance in packaging of agricultural commodity, textiles and non-textiles industries and construction work. Raw jute along with manufactured jute products formed an important source of earning for foreign exchange in India. Unfortunately, there is limited scope for further improvement of cultivated variety of jute in the absence of required variability and genetic diversity (Sinha *et al.*, 2004). The association of commercially important quantitative characters that are statistically determined by correlation coefficient has been quite helpful as a basis of selection. Selection pressure can be more easily exerted on any of the characters which reflect close association with yield. The yield by itself may not be the best criterion for selection (Yasin *et al.*, 1973). Correlation studies measure only mutual association between two traits and path analysis for the cause and effect of relationship. (Kumar *et al.,* 2013 a; Reddy *et al.,* 2013). Thus, the estimation of correlation and path analysis give 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 yield. (Pervin *et al.,* 2012) In this regards, a good number of research works in jute has been reported by many workers (Islam *et al.,* 2001; Alam *et al.,* 2011). Hence, present experiment was undertaken to study the correlation and path coefficient between yield and its attributing traits and to find out the extent of direct and indirect effects of fibre yield components.

MATERIALS AND METHODS

Thirty genotypes of tossa jute (*Corchorus olitorius* L.) were collected from AINP jute and allied fibres via Central Research Institute for Jute and Allied Fibres (CRIJAF), Barrackpore, West Bengal were sown in randomized block design (RBD) with three replications having plot size of 3 m × 1.5 m for each genotype, at the Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Jaguli, Nadia during pre-*kharif* season of

Table 1: Results of analysis of variance (ANOVA) for studied traits

Source of variation	DF	Mean sum of squares						
		Days to 50% flowering	Plant height(cm)	Bark thicknes (mm)	Base diameter (cm)	Green weight(g)	Stick weight(g)	Fibre weight(g)
Replication	2	34.20	319.03	0.00	0.00	70.43	2.76	0.30
Treatment	29	42.13**	2094.19**	0.107**	0.06**	382.04**	148.41**	3.984**
error	58	5.96	51.21	0.00	0.00	11.27	0.39	0.04

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

Table 2: Mean performance of 7 yield attributing traits

	Days to 50% flowering	Plant height(cm)	Bark thicknes (mm)	Base diameter (cm)	Green weight(g)	Stick weight (g)	Fibre weight (g)
OIJ 213	101.83	331.20	1.12	1.34	152.37	31.13	10.30
OIN 959	108.00	284.33	0.83	1.35	138.90	19.10	8.38
OIN 990	101.67	324.89	1.03	1.29	150.67	29.20	10.10
OIN 986	103.50	295.47	0.91	1.39	141.33	24.20	8.83
OIJ 054	104.17	272.83	0.80	1.64	132.67	17.70	7.98
OIN 124	103.33	341.58	1.28	1.44	160.67	36.20	10.69
OEX 05	106.33	337.58	1.32	1.60	158.18	32.97	10.52
OIN 981	103.83	270.89	0.79	1.53	128.67	16.20	7.84
OIN 976	103.33	309.67	0.97	1.39	143.68	26.50	9.27
OIN 082	108.17	308.97	0.93	1.41	142.99	26.20	9.15
OIJ 216	109.17	339.65	1.14	1.63	159.57	35.00	10.60
OIN 196	113.17	327.59	1.09	1.53	151.14	29.83	10.22
OIN 623	112.17	283.66	0.82	1.25	137.12	18.70	8.33
OIJ 937	110.00	332.55	1.12	1.37	152.67	32.50	10.30
OIN 533	107.17	266.45	0.78	1.43	120.85	15.80	7.56
OEX 014	107.83	282.33	0.81	1.44	136.11	18.50	8.31
OIN 937	112.83	260.00	0.78	1.33	117.67	11.23	7.05
OIJ 264	105.67	339.30	1.34	1.55	158.47	33.83	10.59
OIN 915	103.67	286.54	0.86	1.26	139.14	19.30	8.43
OIJ 168	104.17	329.58	1.11	1.49	151.28	30.40	10.29
OEX 019	106.33	290.36	0.85	1.35	140.41	21.00	8.60
OIN 791	106.83	350.67	1.39	1.59	164.67	37.00	11.89
OIN 666	112.50	280.67	0.81	1.53	135.50	18.40	8.20
OIJ 177	108.67	334.61	1.28	1.49	153.67	32.83	10.41
OIN 926	107.67	276.90	0.81	1.50	135.33	18.00	8.18
OEX 29	117.33	310.30	0.96	1.46	143.33	26.27	9.25
OIN 970	103.33	298.64	0.92	1.52	141.49	25.20	8.98
OIN 581	106.67	313.31	0.98	1.35	144.33	27.00	9.34
OIJ 257	105.33	292.71	0.86	1.22	140.54	21.20	8.63
OIN 378	106.00	316.99	0.99	1.94	147.00	28.83	9.61
Grand mean	107.02	306.34	0.99	1.45	144.01	25.34	9.26

2012. The recommended agronomic practices were followed to obtain optimum fibre yield. Except days to 50% flowering, which was studied on plot basis, observations on other five quantitative characters namely plant height (cm), bark thickness (mm), base diameter (cm), green weight (g/plant), stick weight (g/plant) and fibre weight (g/plant) were recorded from ten plants randomly selected from each genotype from each replication. The analysis of variance (ANOVA) for RBD was estimated according to Panse and Sukhtame (1989) (Table 1). The genotypic and phenotypic variances were calculated according to Johnson *et al.* (1955) and Comstock and Robinson (1952). Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were calculated by the method suggested by Singh and Chaudhary (1985) whereas heritability in broad sense for yield and its components were worked out by using formula suggested by Hanson *et al.* (1956). Genetic advance (GA) was calculated by the method suggested by Johnson *et al.* (1955). Genotypic and phenotypic correlations were partitioned using the technique outlined by Dewey and Lu (1959)

RESULTS AND DISCUSSION

The analysis of variance showed significant differences among the genotypes for all the characters studied is shown Table 1 indicating presence of considerable variability. Higher magnitude of variance was recorded in plant height followed by green weight, stick weight and days to 50% flowering.

The mean values shows in Table 2. Genotype OEX 29 showed highest values (117.33) while genotype OIN 990 showed lowest means (101.67) for days to 50% flowering. In case of plant height genotype OIN 791 showed the highest mean values (350.67) where OIN 937 was lowest (260.00) for plant

Table 3: Range, Mean, Variability, heritability and other genetic parameters

Characters	Range	GV	PV	GCV	PCV	H^2	GA	%GA
Days to 50% flowering	101.66-117.33	12.05	18.02	3.24	3.96	66.90	5.85	5.46
Plant height(cm)	260-350.66	680.97	732.21	8.51	8.83	93.01	51.84	16.92
Bark thickness(mm)	0.77-1.39	0.03	0.03	19.02	19.18	98.33	0.38	38.86
Base diameter(cm)	1.22-1.94	0.02	0.02	9.96	10.23	94.82	0.29	19.99
Green weight(g)	117.66-164.66	123.59	134.86	7.71	8.06	91.64	21.92	15.22
Stick weight(g)	11.23-37	49.33	49.73	27.71	27.83	99.20	14.41	56.87
Fibre weight(g)	7.04-11.89	1.31	1.36	12.36	12.59	96.48	2.31	25.02

GV-Genotypic Variance, PV-Phenotypic Variance., GCV-Genotypic Coefficient of Variation PCV-Phenotypic Coefficient of Variation, H^2- Heritability.,GA- Genetic Advance, %GA- Genetic Advance Over Percentage of Mean

Table 4: Phenotypic (P) and Genotypic (G) correlation coefficient among different yield component characters in jute

		Plant height (cm)	Bark thickness (mm)	Base diameter (cm)	Green weight(g)	Stick weight(g)	Fibre weight(g)
Days to 50% flowering	P	-0.01NS	-0.06NS	0.11NS	-0.04NS	-0.11NS	-0.06NS
	G	-0.20NS	-0.16NS	-0.02NS	-0.26*	-0.19NS	-0.21*
Plant height(cm)	P		0.93**	0.29**	0.96**	0.98**	0.98**
	G		0.94**	0.24*	0.96**	0.99**	0.98**
Bark thickness(mm)	P			0.31**	0.90**	0.93**	0.94**
	G			0.29**	0.91**	0.93**	0.94**
Base diameter(cm)	P				0.29**	0.31**	0.30**
	G				0.24*	0.30**	0.27**
Green weight(g)	P					0.95**	0.97**
	G					0.97**	0.97**
Stick weight(g)	P						0.97**
	G						0.98**

*, ** and NS: significant at 5% and 1%, Non significant respectively.

Table 5: Path coefficient (genotypic) analysis showing direct (bold) and indirect effects of component traits in jute

	Days to 50% flowering	Plant height (cm)	Bark thickness (mm)	Base diameter (cm)	Green weight(g)	Stick weight(g)	Correlation with fibre yield
Days to 50% flowering	-0.06	0.56	-0.09	0.00	0.07	-0.70	-0.21*
Plant height(cm)	0.01	-2.74	0.52	-0.05	-0.26	3.51	0.98**
Bark thickness(mm)	0.01	-2.59	0.55	-0.06	-0.25	3.29	0.94**
Base diameter(mm)	0.00	-0.68	0.16	-0.22	-0.07	1.07	0.27**
Green weight(g)	0.02	-2.65	0.50	-0.05	-0.27	3.43	0.97**
Stick weight(g)	0.01	-2.73	0.51	-0.07	-0.26	3.52	0.98**

Residual effect = 0.19340., * , ** and NS : significant at 5% and 1%, Non significant respectively

height and accompanied with OIN 533 for bark thickness. While genotype OIN 791 showed highest mean values (1.39) for bark thickness. Highest base diameter (1.94) found in genotype OIN 378 followed by lowest base diameter (1.22) in OIJ 257. The genotype OIN 791 produced highest green weight per plant (164.67). The lowest mean values obtained for the character green weight (117.67), stick weight (11.23) and fibre weight per plant (7.05) OIN 937. The highest stick weight (37.00) produced by the genotype OIN 791 and fibre yield per plant (10.69) was produced by the genotype OIN 124.

Estimation of different genetic variability parameters are given in Table 3. There was substantial variability in terms of range for all the characters. Results showed that the highest genotypic variance was for plant height (680.97) followed by green weight (123.59), stick weight (49.33), days to 50% flowering (12.05), fibre weight (1.31), base diameter (0.02) and the lowest genotypic variance was that of bark thickness (0.03). Phenotypic variance was also the highest for plant height (732.21), followed green weight (134.86), stick weight (49.73), days to 50% flowering (18.02), fibre weight (1.36), base diameter (0.02) and the lowest phenotypic variance was that of bark thickness (0.03). The phenotypic coefficient of variability (PCV) was higher than genotypic coefficient of variability (GCV) in all the cases revealed the characters mainly influenced by environment. This result also get corroborated with Kumar *et al.* (2013 a.), Mehandi *et* al. (2013), Reddy *et al.* (2003) and Tejbir *et al.* (2009). But the difference between GCV and PCV was little in days to 50% flowering, plant height, bark thickness, stick weight and fibre weight. This finding was corroborated with Senapati *et al.* (2006). This indicated that these characters were less influenced by environment whereas the other characters, base diameter and green weight exhibited higher degree of environmental influences. High values for PCV and GCV were recorded for stick weight (27.71, 27.83), bark thickness (19.02, 19.18), fibre weight (12.36, 12.59). This was corroborated by Ghoshdastidar (2003). The days to 50% flowering exhibited low value for GCV (3.24) and PCV (3.96). Similar result were reported by Singh *et al.* (2013), Anandrao *et al.* (2011), Paul *et al.* (2011), Singh *et al.* (2011) and Quatadah *et al.* (2012). High values of heritability (>90%) were recorded for almost all characters like plant height

(93.01%), bark thickness(98.33%), base diameter(94.82%), green weight (91.64%), stick weight (99.20%) and fibre weight (96.48). Similar result were reported by Nayak *et al.* (2007) and Kumar *et al.* (2013 b.) except days to 50% flowering (66.90%). Thus, these characters contain good amount of additive genetic components which can be easily utilized for further crop improvement.

The high genetic advance was highest for plant height (51.84) and lowest for base diameter (0.29). Johnson *et al.* (1955) suggested that for a more reliable conclusion, heritability and genetic advance should be considered together. The high heritability with moderate to high genetic advance over percentage of mean was observed in bark thickness (98.33%, 38.86), stick weight (99.20%, 56.87) and fibre weight (96.48%, 25.02) which indicate preponderance of additive genetic action. Similar result was reported by Senapati *et al.* (2006). The high heritability with low genetic advance over percentage of mean was observed in plant height, base diameter and green weight. This result is corroborated by Nayak *et al.* (2007) and low heritability with low genetic advance over percentage of mean was observed in days to 50% flowering indicated the presence of both additive and non additive gene effects. Estimates of phenotypic and genotypic correlation coefficients between each pair of characters are given in Table 4. The results showed that the magnitude of genotypic correlation is higher than the phenotypic correlation indicating that elimination of environmental effects led to strengthen genetic association. The correlation analysis revealed that there was significant and negative association of days to 50% flowering with green weight, fibre weight at genotypic level only and rest of the characters were non significant. The plant height, bark thickness, base diameter, green weight and stick weight were positively significant with fibre weight at both phenotypic and genotypic level and also among themselves. Similar result was obtained by Singh *et al.* (2013), Nayak *et al.* (2008) and Mostofa *et al.* (2002).

The results of path coefficient analysis are given in Table 5. Stick weight (3.52) had highest positive direct effect on fibre yield per plant followed by bark thickness (0.55). This findings is in agreement with Senapati *et al.* (2006). Therefore direct selection based on these characters would be feasible. Green weight, plant height and base diameter per plant exhibited high and negative direct effects towards fibre yield. Similar findings were reported by Pervin *et al.* (2012). But its significant positive correlations with fibre yield per plant indicated that the indirect selection could be made for high yielding jute genotypes through most of the characters having positive indirect effects. The residual effect (R) was 0.19340, indicating there was also some other characters which although not studied but influenced the yield of fibre per plant.

The stick weight per plant of the present study had higher values of direct effects even than their respective correlation coefficients indicating their prime importance in fibre yield. Roy (1965) also suggested that stick weight per plant would be an important parameter in predicting fibre yield in jute.

Thus, the result of this investigation suggested that stick weight, bark thickness, green weight, plant height and base diameter per plant would be the selection parameters to produce jute varieties with acceptable yield.

REFERENCES

Alam, M. J., Khatun, R., Hossain, M. S., Pervin, N. and Pramanik, M. E. A. 2011. Correlation and Path Analysis in White Jute Genotypes (*Corchorus capsularis*L.). *Int. J. Sustain. Agril. Tech.* **7**(**11**)**:** 7-10

Anandrao, S. D., Singh, C. M., Suresh, B. G. and Lavanya, G. R. 2011. Evaluation of rice (Oryza sativa L.) hybrids for yield and yield component characters under North East Plain Zone. *The Allahabad Farmer*. **67(1):** 63-68.

Comstock, R. E. and Rabinson, H. F. 1952. Genetic parameter, their estimation and significance. In: in proceed. *on 6th International Grassland Congress*. pp. 284 -291.

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.

GhoshDastidar, K. K. 2003. Genetic variability and association of leaf characters with fibre yield and its components in *Capsularis* jute (*Corchorus capsularis* L.). *J. Interacad.* **7:** 386-395.

Hanson, C. H., Robinson, H. F. And Comstock, R. E. 1956. Biometrical studies of yield in segregating population of Korean lespedeza. *Agron. J.* **48:** 268-272.

Hossain, M. B., Haque, S. and Khan, H. 2002. DNA Fingerprinting of jute germplasm by RAPD. *J. Biochem Mol. Biol.* **35:** 414-419.

Islam, M. S., Uddin, M. N., Haque, M. M. and Islam, M. N. 2001. Path coffiecient analysis for some fibre yield related traits in white jute (*Corchorus capsularis* L.). *Pakistan J. Bio. Sci.* **4(1):** 47-49.

Johnson, H. W., Robinson, H. F. and Comstock, R. E. 1955. Genotypic and phenotypic correlations in Soybeans and their implications in selection. *Agron. J.* **47:** 477-483.

Kumar, K., Prasad, Y., Mishra, S. B., Pandey, S. S. and Kumar, R. 2013a. Study on genetic variability, correlation and panalysis with grain yield and yield attributing traitin green gram [vigna radiata (l.) Wilczek]. *Bioscan.* **8(4):** 1551-1555.

Kumar, A., Rangare, N. R. and Vidyakar, V. 2013 b. Study of genetic variability of indian and exotic rice germplasm in allahabad agroclimate. *Bioscan.* **8(4):** 1445-1451.

Mehandi, S., Singh, C. M. and Kushwaha, V. K. 2013. Estimates of genetic variability and heritability for yield and yield component traits in mungbean [vigna radiata (l.) Wilczek]. *Bioscan.* **8(4):** 1481-1484.

Mostofa, M. G., Islam, M. R., Morshed Alam, A. T. M., Mahbub Ali, S.M. and Mollah M.A.F. 2002. Genetic variability, heritability correlation studies in Kenaf (*Hibiscus cannabinus* L). *Onl. J. Biol. Sci.* **2(6):** 422-424.

Nayak, B. K. and Baisakh, B. 2007. Variability in tossa jute (Co*rchorus olitorius* L.). *Environ Ecol.* **25(A):** 916-918.

Nayak, B. K. and Baisakh, B. 2008. Character association and path analysis in tossa jute (Co*rchorus olitorius* L.). *Environ Ecol.* **26(1A):** 361-363.

Panse, V. G. and Sukhatme, P. V. 1989. Statistical Methods for Agricultural Workers. *Indian Council of Agricultural Research, New Delhi, India.*

Paul, A., Suresh, B. G., Lavanya, G. R. and Singh, C. M. 2011. Variation and association among yield and yield components in upland rice (*Oryza sativa* L.). *Envir. Eco.* **29(2):** 690-695.

Pervin, N. and Haque, G. K. M. N. 2012. Path coefficient analysis for fibre yield related traits in deshi jute (*Corchorus capsularis* L.). *IRJALS.* **1(3):** 72-77.

Quatadah, S. M., Singh, C. M., Babu, G. S. and Lavanya, G. R. 2012. Genetic variability studies in rice. *Environ. Ecol.* **30(3A):** 664-667.

Reddy, B. N. K., Lavanya, G. R. and Kumar, A. S. M. 2013.

Assessment of mungbean germplasm for genetic variability and cause effect interrelationship among yield and yield attributing traits. *The Allahabad Farmer*. **58(2):** 49-56.

Reddy, V. L. N., Reddi Sekhar, M., Reddy, K. R. and Reddy, K. H. 2003. Genetic variability for yield and its components in mungbean (*Vigna radiata* (L.) Wilczek). *Legume Res*. **26(4):** 300-302.

Roy, B. 1965. Studies on correlation and mean yield component in relation to jute breeding. *Indian agric*. **9:** 107-111.

Senapati, S., Nasim Ali, MD. and Sasmal, B. G. 2006. Genetic variability, heritability and genetic advance in *Corchorus* sp. *Environ. Ecol*. **24S(1):** 1-3.

Singh, C. M., Babu, G. S., Binod, K. and Mehandi, S. 2013. Analysis of quantitative variation and selection criteria for yield improvement in exotic germplasm of upland rice (*oryza sativa* l.). *Bioscan*. **8(2):** 485-492.

Singh, R. K. and Chaudhury, B. D. 1985. Biometrical methods of quantitative genetic analysis. Kalyani Publishers, New Delhi, India.

Singh, S. K., Singh, C. M. and Lal, G. M. 2011. Assessment of genetic variability for yield and its component characters in rice (*Oryza sativa* L.). *Res. Plant Bio*. **1(4):** 73-76.

Sinha, S. K., Mitra, S., Nandy, S., Dasgupta, D., Dutta, P., Das, F. and Chakraberty, S. C. 2004. Interspecific hybrid between two jute (*Corchorus*) species for textile quality fibre. *Indian J. Genet*. **64:** 310-314.

Tejbir, S., Amitesh, S. and Alie, F. A. 2009. Impact of environment on heritability and genetic gain for yield and its component traits in mung bean. *Legume Res*. **32(1):** 55-58.

Yassin, T. E. 1973. Genotypic andphenoyupic variances and correlation in field beans (*Vicia faba* L.). *Agric. Sci. Camb*. **81:**445-448.