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Correlation and Path Analysis for Fiber Yield and its Constituent Component Characters in Jute Mallow (*Corchorus olitorius* L.)

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Abstract

The research work was conducted at the BCKV, research station in Mohanpur, Nadia, West Bengal in 2020, thirty jute genotypes were evaluated for fibre yield and related traits. It was revealed that 14 yield-related characters, such as basal diameter, bark thickness after 120 DAS, plant height, green weight plant^{-1}, node number plant^{-1}, and internodes length, showed moderate genetic advance and high heritability. These traits were found to be significantly different. Plant height, node number plant^{-1}, internode length, basal diameter, petiole length, leaf area, bark thickness, green weight plant^{-1}, chlorophylls 'a' and 'b', and total chlorophyll, as well as dry stick weight plant^{-1}, all displayed a significantly positive correlation with dry fibre weight at both the phenotypic and genotypic levels. The path coefficient analysis results showed that node number plant^{-1}, internode length, plant height, basal diameter, petiole length, bark thickness both at 90 DAS and 120 DAS, chlorophyll 'b' and total chlorophyll had significant direct effects on dry fibre yield. These characters should be taken into consideration as important selection criteria to increase the yield of fibre in tossa jute.

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Introduction

Jute is a significant crop grown for its bast fibre, and there are two major cultivars: white jute (*Corchorus capsulari*s L.) and tossa jute (*Corchorus olitorius* L.). Between 5 and 7 percent of the gross weight of harvested plants are made up of fibre. One of the most durable but also most affordable natural fibres, it is regarded as the fibre of the future. Breeding success for such a crucial crop depends on the availability of germplasm with a wide range of key characteristics that affect fibre yield. The current study seeks to evaluate this variability in a few chosen olitorius genotypes. Fourteen morpho-economic characters viz., plant height (cm), node number plant-1, internodes length (cm), basal diameter (cm), petiole length (cm), leaf area (cm2), bark thickness (cm) after 90 and 120 DAS, green weight (g) palnt-1, dry stick weight (g) plant-1, total chlorophyll in mg/g (chlorophyll 'a' and chlorophyll 'b') and dry fibre weight in mg/g palnt-1 were considered for evaluation of the germplasm.

Materials and Methods

The experimental material consisted of the thirty genotypes which were collected from ICAR- Central Research Institute for Jute and Allied Fibers, Barrack pore, Kolkata, West Bengal, India through All India Coordinated Research Project (AICRP) project on Jute and Allied Fibers, Kalyani research center of BCKV, Mohanpur, West Bengal, India. The seed of thirty selected olitorius strains were sown on 11 April, 2020. The experiment was conducted in a Randomized Block Design (RBD) with two replications following recommended agronomic practices. There were two rows of 3 m length and distances of 30 cm between rows and 10 cm between plants. The mean data were obtained in respect of all the characters and subjected to various statistical analysia. Genetic variability parameters like GCV and PCV was calculated as per the standard formula. For estimation of heritability and GA, the method of.[11] Leaf area was measured using the factors as proposed by.[1] Chlorophyll 'a' and chlorophyll 'b' were estimated following the method of Arnon. The path coefficient analysis was carried out at the genotypic level as recommended by the author[2] and discussed by.[3] The different characters considered in the present investigation were Plant height, node number plant^{-1}, internodes length, basal diameter, petiole length, leaf area, bark thickness after 90 and 120 DAS, green weight palnt^{-1}, dry stick weight plant^{-1}, total chlorophyll (chlorophyll 'a' and chlorophyll 'b') and dry fiber weight palnt^{-1}.

Results and Discussions

All the characters except weight of dry stick plant^{-1} had significant positive correlation with dry fiber weight plant^{-1} both at phenotypic and genotypic levels. (Table: 1) The similar results were also reported by earlier authors i.e.[4,5,6] Similarly, plant height and node number plant^{-1} showed significant association among themselves as well as with all the characters except dry stick weight at genotypic and phenotypic levels. The highest positive significant correlation was found between dry fiber weight plant^{-1} and green weight plant^{-1}.

Table 1: Mean, range and other genetic parameters in jute (*Corchorus olitorius* L.)

Sl. No.	Characters	Mean	SED	GCV	PCV	H^2 broad sense	Genetic advance %	Genetic advancement % of mean
1	Plant height (cm)	225.77	5.477	13.73	13.94	0.969	62.89	27.86
2	Node no/pl.	48.18	2.015	19.29	19.74	0.955	18.71	38.84
3	Internode length (cm)	5.273	0.265	21.96	22.52	0.950	2.32	44.09
4	Basal dia.(cm)	1.553	0.029	12.74	12.87	0.979	0.40	25.98
5	Petiole length (cm)	4.843	0.184	11.03	11.67	0.894	1.04	21.50
6	Leaf area(cm2)	52.379	1.868	17.26	17.63	0.959	18.24	34.83
7	Bark tk. 90 DAS	1.125	0.040	11.22	11.76	0.910	0.24	22.07
8	Bark tk.120 DAS	1.289	0.022	9.96	10.11	0.971	0.26	20.23
9	Green wt./pl.	227.10	6.254	13.95	14.22	0.962	64.04	28.20
10	Dry stick wt./pl.	23.928	2.260	25.53	27.22	0.879	11.80	49.32
11	Ch'a' mg/g	1.240	0.075	19.03	19.98	0.907	0.46	37.35

Table 2: Genotypic and phenotypic correlation among the fourteen characters of jute genotype (*Corchorus olitorius* L.)

Characters		PH (cm)	ND no. Plant^{-1}	In ND length	BD (cm)	PL (cm)	LA (cm^2)	BT 90 DAS	BT 120 DAS	GW Plant^{-1} (g)	DSW Plant^{-1}	Ch 'a'	Ch 'b'	Tch	DFW Plant^{-1}
PH (cm)	G	1	0.934**	0.927**	0.867**	0.607**	0.844**	0.668**	0.730**	0.950**	0.245	0.890**	0.921**	0.954**	0.973**
	P	1	0.924**	0.891**	0.861**	0.582**	0.825**	0.641**	0.713**	0.943**	0.24**	0.855**	0.893**	0.763**	0.949**
Nd No. /Pl.	G		1	0.900**	0.846**	0.495**	0.820**	0.628**	0.651**	0.920**	0.333	0.820**	0.913**	0.922**	0.933**
	P		1	0.856**	0.827**	0.475**	0.794**	0.589**	0.635**	0.903**	0.323	0.773**	0.873**	0.725**	0.899**
In. Nd length	G			1	0.853**	0.571**	0.847**	0.509**	0.638**	0.920**	0.13	0.860**	0.895**	0.918**	0.922**
	P			1	0.834**	0.523**	0.832**	0.488**	0.610**	0.884**	0.153	0.827**	0.887**	0.737**	0.913**
B. Dia.	G				1	0.502**	0.824**	0.577**	0.633**	0.937**	0.329	0.827**	0.898**	0.905**	0.906**
	P				1	0.490**	0.810**	0.563**	0.622**	0.932**	0.33	0.800**	0.881**	0.738**	0.894**
Peti. length. (cm)	G					1	0.487**	0.317	0.374*	0.597**	0.327	0.429**	0.562**	0.480**	0.553**
	P					1	0.457**	0.297	0.362*	0.578**	0.306	0.413*	0.527**	0.383*	0.528**
Leaf area	G						1	0.457**	0.546**	0.887**	0.384*	0.935**	0.916**	1.022**	0.889**
	P						1	0.440*	0.528**	0.868**	0.365*	0.912**	0.904**	0.805**	0.881**
Bark th. 90 DAS	G							1	0.694**	0.666**	0.202	0.595**	0.588**	0.596**	0.643**
	P							1	0.675**	0.648**	0.209	0.563**	0.554**	0.451*	0.621**
Bark th.	G								1	0.738	0.154	0.549	0.686	0.610	0.757
Ch 'b' mg/g	G									1	0.432	0.050	53.30	54.54	0.955	0.81	107.31
Tch mg/g	G										1.639	0.286	23.51	29.30	0.644	0.35	38.87
Dry Fibre wt./pl.	G										12.064	0.184	21.95	22.43	0.958	3.44	44.27

120 DAS			**		**	**	**	**
	P	1	0.724**	0.153	0.523**	0.662**	0.490**	0.738**
Green Wt/pl. (g)	G		1	0.349	0.899**	0.985**	0.982**	0.988**
	P		1	0.352	0.860**	0.952**	0.791**	0.965**
Dry Stick)	G			1	0.273	0.429*	0.335	0.282
wt/p (g	P			1	0.267	0.414*	0.339	0.299
Ch 'a'	G				1	0.910**	0.987**	0.908**
	P				1	0.897**	0.826**	0.890**
Ch 'b'	G					1	0.995**	0.968**
	P					1	0.835**	0.963**
Tch.	G						1	0.963**
	P						1	0.797**
Dry Fibre	G							1
wt./pl.	P							1

The direct effects on dry fibre weight plant^{-1} were found positive by plant height, internodes length, basal diameter, petiole length, thickness of bark at 90 and 120 days after growth, context of chlorophyll 'b', total chlorophyll in leaves and these characters may be considering during selection to improve fibre yield.[7,8] observed these characters with high positive effect on yield of fibers. (Table: 2)

Table 3: Path coefficient at genotypic level of fourteen characters in (*Corchorus olitorius* L.)

Characters	PH (cm)	ND no. Plant^{-1}	In ND length	BD (cm)	PL (cm)	LA (cm^2)	BT 90 DAS	BT 120 DAS	GW Plant^{-1} (g)	DSW Plant^{-1}	Ch 'a'	Ch 'b'	Tch	DFW Plant^{-1}
PH (cm)	0.474	-0.101	0.221	0.774	0.125	-0.054	0.26	0.148	-3.646	-0.066	-0.207	2.866	0.177	0.973**
ND no.Plant^{-1}	0.442	-0.108	0.214	0.756	0.102	-0.053	0.245	0.132	-3.53	-0.089	-0.191	2.84	0.171	0.933**
In ND length	0.439	-0.097	0.238	0.761	0.18	-0.054	0.198	0.13	-3.531	-0.035	-0.2	2.784	0.17	0.922**
BD(cm)	0.41	-0.091	0.203	0.893	0.103	-0.053	0.225	0.129	-3.595	-0.088	-0.192	2.794	0.168	0.906**
PL(cm)	0.287	-0.053	0.136	0.448	0.207	-0.031	0.123	0.076	-2.289	-0.088	-0.1	1.747	0.089	0.553**
LA (cm^2)	0.399	-0.089	0.201	0.735	0.1	-0.064	0.178	0.111	-3.403	-0.103	-0.218	2.849	0.189	0.889**
BT 90 DAS	0.316	-0.068	0.121	0.515	0.065	-0.029	0.39	0.141	-2.556	-0.054	-0.138	1.828	0.11	0.643**
BT 120 DAS	0.346	-0.07	0.125	0.565	0.077	-0.035	0.271	0.204	-2.833	-0.041	-0.128	2.135	0.113	0.757**
GW Plant^{-1}(g)	0.45	-0.099	0.219	0.836	0.123	-0.057	0.26	0.15	-3.838	-0.094	-0.209	3.064	0.182	0.988**
DSW Plant^{-1}	0.116	-0.036	0.031	0.293	0.067	-0.024	0.079	0.031	-1.338	-0.27	-0.063	1.333	0.062	0.282
Ch 'a'	0.422	-0.088	0.205	0.738	0.088	-0.06	0.232	0.111	-3.45	-0.073	-0.233	2.832	0.183	0.908**
Ch 'b'	0.436	-0.099	0.213	0.802	0.116	-0.059	0.229	0.14	-3.779	-0.115	-0.212	3.111	0.184	0.968**
Tch	0.452	-0.1	0.218	0.808	0.099	-0.066	0.232	0.124	-3.768	0.09	-0.23	3.097	0.185	0.963**

Where, PH (cm): Plant height; ND no. Plant^{-1}: Node number plant^{-1}; In ND length (cm): Internodes length; BD (cm): Basal diameter; LA (cm2): Leaf area; PL (cm): Petiole length; BT (cm) 90 DAS: Bark thickness 90 DAS; BT (cm) 120 DAS: Bark thickness 120 DAS; GW (g) Plant^{-1}: Green weight plant-1; DSW Plant^{-1}: Dry stick weight plant^{-1}, Ch (mg/g) 'a': Chlorophyll 'a'; Ch (mg/g) 'b': Chlorophyll 'b'; Tch (mg/g): Total chlorophyll; DFW (g) Plant-1: Dry fibre weight plant^{-1}

Among different yield attributing characters the maximum positive direct effect on fibre yield was exerted by chlorophyll 'b' content in leaves followed by basal diameter and plant height.[9,10] reported a similar observation of high positive effect of this character on yield of fibers.

Green weight per plant had negative direct effect on dry fibre yield but showed high positive correlation with fibre yield, which might be due to indirect contribution via basal diameter, plant height and chlorophyll 'b' content in leaf.

Chlorophyll 'a' had the negative effect on yield of fiber but showed significant correlation with dry fiber weight plant^{-1} which may be via indirect influence by basal diameter, plant height and chlorophyll 'b' content in leaf. Node number per plant had negative direct effects on dry fibre weight plant^{-1}, which corroborates the findings of[8] Most of the characters had high heritability[12] with moderate level of genetic advance which predicted the influence of both non-additive and additive gene actions on the appearance of these characters with least influence of environment. (Table: 3)

Where, PH (cm): Plant height; ND no. Plant-1: Node number plant^{-1}; In ND length (cm): Internodes length; BD (cm): Basal diameter; LA (cm^2): Leaf area; PL (cm): Petiole length; BT (cm) 90 DAS: Bark thickness 90 DAS; BT (cm) 120 DAS: Bark thickness 120 DAS; GW (g) Plant^{-1}: Green weight plant^{-1}; DSW Plant^{-1}: Dry stick weight plant^{-1}, Ch (mg/g) 'a': Chlorophyll 'a'; Ch (mg/g) 'b': Chlorophyll 'b'; Tch (mg/g): Total chlorophyll; DFW (g) Plant-1: Dry fibre weight plant^{-1}

Conclusion

The investigation possess numerous heritable traits with a large variety of variations can be found in the inquiry. These traits are anticipated to respond favorably to selection and can be used further for crop development efforts. At both the phenotypic and genotypic levels, the most positive significant connection was discovered between fibre-weight plant-1 and green-weight plant^{-1} On the amount of dry fibre produced by each plant, there were positive direct impacts of plant height, internode length, basal diameter, petiole length, and bark thickness after 90 DAS, bark thickness after 120 DAS, chlorophyll 'b', and total chlorophyll. The population improvement method may be suggested as a breeding strategy to increase fibre yield because these traits, along with green weight plant-1, should be thought of as important criteria to improve field yield. Since these traits are primarily influenced by additive and non-additive gene action.

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Conflict of Interest

The authors declared no conflict of Interest.

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