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(RESEARCH ARTICLE)

Characters association and path coefficient analysis for quantitative traits of *Olitorius* jute

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Abstract

Fifty-two *olitorius* jute germplasm lines were evaluated to monitor genetic variability, heritability, genetic progress, correlation coefficient and path analysis for yield and yield attributes. Wide variation was maintained for days to flowering, days to 50% flowering, plant height, stick yield and fiber yield. Genotype JRO 524 and JRO 204 were promising for fiber yield and yield atributes. The best genotypic and phenotypic variance occurred for stick weight, plant height, days to flowering and days to 50% flowering. A better phenotypic coefficient of variation (PCV) than genotypic coefficient of variation (GCV) for all traits indicated that the traits were studied. Green weight, basal diameter, days to 50% flowering, fiber yield, days to initiation of flowering, plant height and cane yield recorded higher heritability accompanied by good amount of additive genetic action that can be used for additional crop improvement. Stick weight and plant height showed maximum and green weight showed minimum genetic advance. High heritability with moderate to high genetic advance over percent mean changed percent mean change in fiber yield, green weight, days to flowering, days to 50% flowering and stick yield. High heritability with low genetic evolution over the proportion of implied changes observed in plant height and basal diameter indicates a predominance of non-additive genetic action. Low heritability with low genetic improvement over percent mean fiber yield indicated the presence of both additive and non-additive gene effects. Yield-contributing traits were significantly associated with fiber yield per plant at both genotypic and phenotypic levels except percent fiber recovery. Days to flowering at the phenotypic and genotypic level and plant height and basal diameter at the genotypic level showed a negative direct effect on fiber yield. The significant positive correlation with fiber yield per plant indicates that bias selection can be made for high yielding jute olitorius genotypes through most of the positively correlated traits.

Keywords: GA; GCV; Heritability; PCV;*Tossa* Jute; Variability; Yield attributes

1. Introduction

India is the most important producer of jute, followed by Bangladesh. India is also the largest consumer of jute and jute goods and about 85% of the production is used to meet domestic demand, mainly for bagging (about 80%) under jute packaging materials. Jute is the second maximum critical natural fiber crop in India after cotton and occupies approximately 0.4% of the total area under agricultural vegetation. Jute is an important crop for employment and a source of income for thousands and thousands of poor farmers. Jute is a major crop grown for its bast fiber and there are two most important cultivars: white jute (*Corchorus capsularis* L.) and tossa jute (*Corchorus olitorius* L.). About 5 and 7% of the gross weight of harvested plants is fiber. One of the longest-lasting, yet extremely cheap herbal fibers seemed to be the fiber of destiny. The breeding success of this important crop species depends on the availability of germplasm with a wide range of key traits that influence fiber yield. To increase the yield and beautify the jute fiber, reasonable efforts should be made to improve the current varieties on the side of ensuring a hybridization program

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using extensive and diverse germplasm strains. Current research tries to evaluate this variability in germplasm lines of *olitorius* jute. Eight yield and yield contributors i.e. days to flowering, days to 50% flowering, plant top (cm), basal diameter (cm), green weight per plant (kg), cane yield per plant, fiber recovery percentage and fiber yield in accordance with the plant were taken into account for the evaluation of the germplasm.

2. Materials and methods

Plant material and field experiment: Fifty-two genotypes of tossa jute (*Chorchorus olitorius* L.) obtained from AINP JAF through ICAR-CRIJAF, Barrackpore (WB) evaluated in a randomized block design (RBD) with three replications in an area of 4.50 m x 0.60 m for each genotype on site experimental farm of Cotton Improvemt project, MPKV, Rahuri during kharif, 2023. Recommended package of practices adapted to achieve production potential of the crop.

Data recording: 10 plants of each genotype were randomly marked from each replication and observations were recorded on days to initiation of flowering, days to 50% flowering, plant height (cm), basal diameter (cm), green weight per plant (kg), stick yield per plant (g), fiber yield per plant (g) and fiber recovery percentage.

Statistical analysis: Analysis of variance for RBD was done according to Panse and Sukhatme (1985). Genotypic and phenotypic level deviations and genetic advance (GA) were calculated according to Comstock and Robinson (1952) and Johnson *et. al.* (1955), respectively Coefficients of variation at genotypic and phenotypic levels were analyzed by Singh and Choudhary (1985). Broad-sense heritability for fiber and yield traits was estimated by Hanson *et. al.* (1956). Genotypic and phenotypic correlations were calculated according to Dewey and Lu (1959).

3. Results and discussion

Crop Improvement mainly depends on generic variation and heritability (Dudley, 1967). Identification of desired genes can lead to crop improvement through hybridization programme. Crop yield is affected by mainly environment and genetic factors. Forsman (2014) stated that genetic characteristics are subject to change at the genotypic and phenotypic level and the importance of genetic variation for various seasons. Achieving the goal of increasing yield through breeding programme may depends on the selection of parental lines according to genetic differences and information on genotypic and phenotypic correlation coefficients are important. Information on GCV, PCV and heritability can help to estimate the genetic progression (GA). Therefore, in this study, important variable parameters such as coefficient of variation, heritability, genetic advance at genotypic and phenotypic level were calculated for fibre yield and it's attributes.

Analysis of variance (ANOVA): In this study, differences between genotypes for days to flowering, days to 50% flowering, plant height (cm), stick yield (g/plant) and fiber yield (g/plant) were statistically significant, revealing a wide range of variation between genotypes for these characters (Table 1). Higher magnitude of variance was recorded for cane weight followed by plant height, days to flowering and days to 50% flowering.

Table 1 Analysis of variance (ANOVA) for studied traits

Sources	**df**	**Days to initiation of flowering**	**Days to 50% flowering**	**Plant height (cm)**	**Basal Diameter (cm)**	**Green weight (kg/plant)**	**Stick yield (g/plant)**	**Fibre recovery (%)**	**Fibre yield (g/ plant)**
Replication	2	6.08	9.56	9,830.78	0.07	0.030	2,326.94	3.13	50.43
Treatment	51	120.83**	102.60**	690.66**	0.02	0.004	872.82**	0.64	7.40**
Error	102	11.18	7.30	73.08	0.001	0.000	130.33	0.42	0.65

Mean performance: Germplasm's genetic makeup and adapted research area create differences in agronomic traits (Zhao *et al.*, 2020). Effective selection would be done with respect to stalk weight, bark thickness, green weight, plant height and base diameter per plant to produce jute varieties with acceptable yield (Sawarkar *et al.*, 2014). In this study, JRO 204 (68.33) and OIN-269 (40.33) showed the highest and the lowest values for flower initiation flowering, while the genotypes, OIN-237 (75.00) and OIN-269 (47.67) showed the highest and the lowest values for days to 50% flowering, respectively (Table 2). JRO 524 maintained the highest plant height (310.89 cm), base diameter (1.79 cm), green weight per plant (0.447 kg), stick weight per plant (147.16 g) and fibre yield per plant (15.10 g), while the genotypes, OIN-264 (236.33 cm) and OIN-238 and OIN-239 (1.38 cm) recorded the lowest plant height and basal diameter, respectively. The genotype, OIN-280 showed minimum values for green weight per plant (0.239 kg), stick yield per plant (70.97 g) and fibre yield per plant (6.36 g). The maximum and minimum fibre recovery percentage was recorded by the genotypes OIN-286 (9.47) and OIN-271 (7.90), respectively.

Table 2 Mean performance of fibre yield and yield contributing characters

Accession No.	Days to initiation of flowering	Days to 50% flowering	Plant height (cm)	Basal Diameter (cm)	Green weight (kg/plant)	Stick yield (g/plants)	Fibre recovery (%)	Fibre yield (g/plant)
OIN-237	65.00	75.67	262.11	1.49	0.316	97.16	9.03	9.60
OIN-238	43.00	53.33	247.00	1.38	0.279	81.29	9.04	8.06
OIN-239	45.00	54.00	229.22	1.38	0.254	72.97	8.73	6.91
OIN-240	48.00	57.33	255.78	1.56	0.323	104.51	8.57	9.82
OIN-241	48.00	54.67	246.78	1.59	0.320	118.30	8.77	11.35
OIN-242	44.67	55.33	262.33	1.56	0.330	108.70	9.39	11.18
OIN-243	47.33	55.33	252.89	1.56	0.321	107.96	8.33	9.84
OIN-244	50.67	57.67	261.33	1.57	0.331	107.25	8.76	10.28
OIN-245	51.33	60.33	256.78	1.60	0.341	108.04	9.05	10.68
OIN-246	44.67	58.00	256.00	1.54	0.323	104.83	8.63	9.92
OIN-247	46.33	54.33	270.00	1.52	0.330	108.32	8.64	10.29
OIN-248	48.33	57.00	264.78	1.55	0.331	103.49	9.22	10.35
OIN-249	50.00	59.33	267.44	1.62	0.355	128.30	8.06	11.25
OIN-250	59.00	64.67	263.00	1.52	0.328	102.85	9.00	10.08
OIN-251	56.67	65.67	262.89	1.55	0.335	113.67	8.31	10.29
OIN-252	54.67	61.67	251.89	1.56	0.316	92.51	9.41	9.55
OIN-253	52.33	59.00	259.33	1.59	0.339	114.16	8.46	10.41
OIN-254	55.33	63.67	267.33	1.58	0.350	105.53	9.36	10.90
OIN-255	58.67	64.00	265.00	1.60	0.350	128.74	7.99	11.09
OIN-256	57.67	66.33	262.00	1.54	0.331	103.12	9.02	10.16
OIN-257	50.00	56.33	272.78	1.65	0.360	127.77	8.23	11.37
OIN-258	46.00	52.33	261.55	1.57	0.332	124.17	8.22	11.06
OIN-259	49.67	56.33	252.56	1.54	0.322	118.59	8.86	11.56
OIN-260	45.67	52.33	261.22	1.55	0.335	105.96	9.00	10.43
OIN-261	51.00	57.00	255.33	1.47	0.302	87.25	9.41	9.07
OIN-262	49.33	56.00	266.00	1.64	0.351	109.15	9.21	11.13
OIN-263	44.00	55.67	250.33	1.53	0.307	86.26	9.70	9.24
OIN-264	41.33	55.67	236.33	1.40	0.265	80.54	8.54	7.52
OIN-265	48.33	54.67	239.00	1.44	0.280	85.14	8.76	8.19
OIN-266	51.00	58.00	251.11	1.47	0.296	90.30	8.97	8.81

OIN-267	45.33	56.00	248.67	1.49	0.297	100.97	8.00	8.78
OIN-268	46.33	55.33	256.67	1.51	0.311	89.78	9.46	9.34
OIN-269	40.33	47.67	249.56	1.50	0.302	89.85	9.04	8.91
OIN-270	42.67	51.00	256.67	1.55	0.321	123.44	8.05	10.83
OIN-271	43.33	51.00	261.55	1.57	0.330	115.75	7.90	9.95
OIN-272	47.67	55.00	252.33	1.52	0.309	98.42	8.72	9.42
OIN-273	52.00	59.67	254.22	1.49	0.305	97.39	8.53	9.08
OIN-274	53.33	61.00	254.44	1.46	0.299	94.29	8.59	8.80
OIN-275	42.33	52.00	256.56	1.55	0.320	106.05	8.38	9.75
OIN-276	46.33	54.33	260.33	1.56	0.326	138.52	8.29	12.55
OIN-277	46.67	56.00	242.11	1.42	0.276	88.35	8.34	7.95
OIN-278	48.00	55.00	243.67	1.44	0.281	86.32	8.70	8.18
OIN-279	56.67	65.33	271.00	1.59	0.346	119.23	8.42	10.94
OIN-280	43.67	51.67	211.33	1.41	0.239	70.97	8.26	6.36
OIN-281	55.00	66.33	264.44	1.61	0.342	108.27	9.04	10.73
OIN-282	51.00	60.33	268.22	1.62	0.351	115.17	8.82	11.17
OIN-283	55.33	61.00	267.11	1.56	0.335	103.95	9.16	10.49
OIN-284	54.67	63.67	262.33	1.56	0.331	109.02	8.54	10.18
OIN-285	57.67	64.00	270.78	1.56	0.341	121.79	8.02	10.65
OIN-286	51.67	60.33	247.00	1.43	0.285	77.90	9.47	8.16
JRO 524	67.67	73.00	310.89	1.79	0.447	147.16	9.31	15.10
JRO 204	68.33	73.33	307.11	1.77	0.436	142.21	9.16	14.31

Genotypic and phenotypic variance and variability: The variance and coefficient of variation at the genotypic and phenotypic level shows the importance of genetic characteristics useful in supporting population importance for several reasons (Forsman, 2014). Genetic variability parameters showed a considerable degree of variability for all traits (Table 3). The highest genotypic variance was for stick weight per plant (247.50) followed by plant height (205.86), days to initiation of flowering (36.55) and days to 50% flowering (31.77) and the lowest genetic variability was weight of green per plant (0.00), basal diameter (0.01), fiber recovery percentage (0.07) and fiber yield per plant (2.25). Phenotypic variance was also highest for stick weight per plant (377.83) followed by plant height (278.94), days to flowering (47.73) and days to 50% flowering (39.07) and the lowest phenotypic variance was for plant green weight (0.00), basal diameter (0.01), fiber recovery percentage (0.49) and fiber yield per plant (2.90).

Genotypic and phenotypic coefficient of variation: the phenotypic coefficient of variation (PCV) was higher than the genotypic coefficient of variation (GCV) in all cases, showing that the traits were mainly influenced by the environment (Kumar et al., 2021)[11]. High values for GCV and PCV were recorded for stick yield per plant (14.95, 18.47), fiber yield per plant (14.95, 16.96), days to flowering (12.00, 13.72) , green weight per plant (10.71, 11.61) and days to 50% flowering (9.63, 10.68). Plant height (5.56, 6.47), basal diameter (5.13, 5.68) and fiber recovery percentage (3.09, 8.01) showed low values for GCV and PCV (Singh *et al.*, 2013; Quatadah *et al.*, 2012; Anandrao *et al.*, 2011; Paul *et al.*, 2011). A narrow range of variation between GCV and PCV for initiation of flowering, days to 50% flowering, basal diameter and green weight indicated that these traits were less influenced by environment, while a wider range for plant height, fiber recovery, stick yield and fiber yield showed a higher degree of environmental influences (Senapati et al., 2006)[17].

Heritability and genetic advance: Green weight per plant (85.20%) showed higher heritability followed by basal diameter (81.73%), days to 50% flowering (81.31%), fiber yield per plant (77.68%), days to flowering (76.59%), plant height (73.80%) and stick yield per plant (65.50%) showed good amount of additive genetic components which can be used for further crop improvement. Rod weight (26.23) and plant height (25.39) recorded the highest and green weight

(0.07) recorded the lowest genetic progress. High heritability with moderate to high genetic progress above the percent mean was observed for fiber yield per plant (77.68, 27.14), green weight per plant (85.20, 20.37), days to flowering (76.59 , 21.64), days to 50% flowering (81.31, 17.88) and cane yield per plant (65.50, 24.93), which indicates the predominance of additive genetic action (Senapati *et al.*, 2006).

High heritability with low genetic advance above mean percentage was observed for plant height (73.80, 9.83) and basal diameter (81.73, 9.55) indicating the predominance of non-additive genetic action. A low heritability with a low genetic advance above the mean observed fiber recovery percentage (14.86, 2.45) indicated the presence of both additive and non-additive gene effects. Selection based on the phenotypic performance of these traits appears to be reliable and effective (Mia et al, 2020). These traits contain a large number of additive genetic components that can be easily exploited for further crop improvement (Sawarkar *et al.*, 2014).

Table 3 Range, variability, heritability, coefficient of variation and other genetic parameter

Character	Range	GV	PV	GCV	PCV	H^2	GA	GA (%)
Days to initiation of flowering	40.33-68.33	36.55	47.73	12.00	13.72	76.59	10.90	21.64
Days to 50% flowering	47.67-73.33	31.77	39.07	9.63	10.68	81.31	10.47	17.88
Plant height (cm)	211.33-310.89	205.86	278.94	5.56	6.47	73.80	25.39	9.83
Basal Diameter (cm)	1.38-1.79	0.01	0.01	5.13	5.68	81.73	0.15	9.55
Green weight (kg/plant)	0.239-0.447	0.00	0.00	10.71	11.61	85.20	0.07	20.37
Stick yield (g/plant)	70.97-147.16	247.50	377.83	14.95	18.47	65.50	26.23	24.93
Fibre recovery (%)	7.90-9.47	0.07	0.49	3.09	8.01	14.86	0.21	2.45
Fibre yield (g/plants)	6.91-15.10	2.25	2.90	14.95	16.96	77.68	2.72	27.14

Phenotypic and genotypic correlation coefficients: Estimates of the phenotypic and genotypic correlation coefficients between each pair of traits showed that the magnitude of the genotypic correlation was higher than the phenotypic correlation, suggesting that exclusion of environmental effects led to a strengthening of the genetic association (Table 4). Correlation analysis revealed that all yield component traits except fiber recovery percentage in *olitorius* jute were significantly associated with fiber yield per plant at both genotypic and phenotypic levels. A non-significant correlation was observed between percentage fiber recovery with basal diameter at the genotypic level and percentage fiber recovery with all traits except stick yield per plant at the phenotypic level. Other traits of yield components showed highly significant correlation at both genotypic and phenotypic levels. It shows that direct selection of traits will be effective in ensuring seed and fiber yield of jute *olitorius* and this assumption is supported by various researchers (Faruq *et al.*, 2011).

Table 4 Genotypic (G) and phenotypic (P) correlations coefficient among different yield component characters

Characters		Days to initiation of flowering	Days to 50% flowering	Plant height (cm)	Basal Diameter (cm)	Green weight (kg/plants)	Stick yield (g/plants)	Fibre recovery (%)
Days to 50% flowering	G	0.971**						
	P	0.919**						
Plant height (cm)	G	0.734**	0.659**					
	P	0.564**	0.535**					
Basal Diameter (cm)	G	0.571**	0.480**	0.924**				
	P	0.440**	0.394**	0.759**				
	G	0.688**	0.602**	0.977**	0.982**			

Green weight (kg/plants)	P	0.561**	0.521**	0.936**	0.919**			
Stick yield (g/plants)	G	0.484**	0.377**	0.846**	0.949**	0.902**		
	P	0.357**	0.307**	0.725**	0.754**	0.805**		
Fibre recovery (%)	G	0.405**	0.439**	0.254**	0.019^{NS}	0.179*	-0.164*	
	P	0.088^{NS}	0.101^{NS}	0.080^{NS}	0.049^{NS}	0.053^{NS}	-0.426**	
Fibre yield (g/plants)	G	0.586**	0.487**	0.911**	0.971**	0.958**	0.971**	0.076^{NS}
	P	0.449**	0.404**	0.854**	0.859**	0.924**	0.878**	0.048^{NS}

Path coefficient analysis: Stick yield (0.964) at genotypic level had a positive direct effect on fiber yield per plant followed by green weight per plant (0.481), percent fiber recovery (0.228) and days to 50% flowering (0.024). At the phenotypic level, panicle yield (1.027), percent fiber recovery (0.480), plant height (0.043) and green weight (0.029), days to 50% flowering (0.019) and basal diameter (0.003) had a positive direct effect on fiber yield per plant (Senapati et al., 2006). Therefore, direct selection based on these characters would be feasible. Days to flowering at the phenotypic and genotypic level and plant height and basal diameter at the genotypic level showed negative direct effects on fiber yield. However, its significant positive correlation with fiber yield per plant suggests that indirect selection could be made for high-yielding jute *olitorius* genotypes through most of the traits that have positive indirect effects. The residual direct effect on the path coefficient was 0.00156 and 0.00981 of genotypic and phenotypic levels, respectively. This suggests that there were also some other traits that, although not studied, influenced the fiber yield per plant. Stick weight per plant had higher values of direct effects, even than their respective correlation coefficients, indicating their major importance in fiber yield. Thus, the result of this investigation indicated that cane weight, fiber regeneration, plant height, raw weight and basal diameter would be the selection parameters for the production of Jute olitorius varieties with acceptable production. A similar result was obtained by Singh *et al.* (2013) and Nayak *et al.* (2008).

Table 5 Genotypic (G) and phenotypic (P) path coefficient analysis showing direct (bold) and indirect effects for component traits in *olitorius* jute

Characters		**Days to initiation of flowering**	**Days to 50% flowering**	**Plant height (cm)**	**Basal Diameter (cm)**	**Green weight (kg/ plant)**	**Stick yield (g/plant)**	**Fibre recovery (%)**	**Fibre yield (g/plant)**
Days to initiation of flowering	G	**-0.025**	0.023	-0.223	-0.077	0.331	0.466	0.092	0.586**
	P	**-0.021**	0.018	0.024	0.001	0.016	0.367	0.042	0.449**
Days to 50% flowering	G	-0.025	**0.024**	-0.201	-0.065	0.289	0.364	0.100	0.487**
	P	-0.019	**0.019**	0.023	0.001	0.015	0.316	0.049	0.404**
Plant height (cm)	G	-0.019	0.016	**-0.304**	-0.125	0.470	0.815	0.058	0.911**
	P	-0.012	0.010	**0.043**	0.003	0.027	0.745	0.038	0.854**
Basal Dia-meter (cm)	G	-0.015	0.011	-0.281	**-0.135**	0.472	0.914	0.004	0.971**
	P	-0.009	0.008	0.033	**0.003**	0.027	0.774	0.024	0.859**
Green weight (kg/plant)	G	-0.018	0.014	-0.297	-0.133	**0.481**	0.869	0.041	0.958**
	P	-0.012	0.010	0.040	0.003	**0.029**	0.827	0.025	0.924**
Stick yield (g/plant)	G	-0.012	0.009	-0.257	-0.128	0.434	**0.964**	-0.037	0.971**
	P	-0.007	0.006	0.031	0.003	0.024	**1.027**	-0.205	0.878**
	G	-0.010	0.010	-0.077	-0.003	0.086	-0.158	**0.228**	0.076^{NS}

% Fibre recovery	P	-0.002	0.002	0.003	0.000	0.002	-0.438	**0.480**	0.048^{NS}

Residual effect (Genotypic): **0.00156** Residual effect (Phenotypic): **0.00981**

Quality parameters: The qualitative parameters studied among 52 germplasms of jute *olitorius* are shown in Table 6. Out of 52 germplasm lines, 49 lines were upright and 3 were medium growth. In terms of leaf type, 38 lines were lanceolate, 3 ovate and 11 broadly lanceolate. Twenty-two lines had predominantly primary and 30 lines had weekly branching. Green leaf petiole color was observed in 28 lines, while purple and pink color in 23 and only one line. Petiole hairiness and petiole hairs were absent in all lines. 36 lines had oblique sharp and 16 oblique very sharp type of leaf shape. All lines have yellow flowers. Green stem color was observed in 38 lines, while 13 lines were pink stem and 9 lines were purple stem color.

Table 6 Quality parameters influenced by olitorius jute germplasm lines

Character		Genotypes
Growth habit	Upright	OIN-237, OIN-241, OIN-242, OIN-243, OIN-244, OIN-245, OIN-246, OIN-247, OIN-248, OIN-249, OIN-250, OIN-251, OIN-252, OIN-253, OIN-254, OIN-255, OIN-256, OIN-257, OIN-258, OIN-259, OIN-260, OIN-261, OIN-262, OIN-263, OIN-264, OIN-265, OIN-266, OIN-267, OIN-268, OIN-269, OIN-270, OIN-271, OIN-272, OIN-273, OIN-274, OIN-275, OIN-276, OIN-277, OIN-278, OIN-279, OIN-280,OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, OIN-286, JRO 524, JRO 204 (49)
	Intermediate	OIN-238, OIN-239, OIN-240 (3)
Type of leaves	Lanceolate	OIN-237, OIN-238 OIN-242, OIN-243, OIN-244, OIN-246, OIN-247, OIN-248, OIN-249, OIN-250, OIN-252, OIN-255, OIN-256, OIN-257, OIN-258, OIN-259, OIN-260, OIN-261, OIN-262, OIN-263, OIN-264, OIN-265, OIN-269, OIN-270, OIN-271, OIN-272, OIN-273, OIN-274, OIN-276, OIN-278, OIN-279, OIN-280, OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, OIN-286 (38)
	Ovate	OIN-239, OIN-240, OIN-241 (3),
	Broad Lanceolate	OIN-245, OIN-251, OIN-253, OIN-254, OIN-266, OIN-267, OIN-268, OIN-275, OIN-277, JRO 524, JRO 204 (11)
Branching habit	Predominantly primary	OIN-237, OIN-238, OIN-239, OIN-240, OIN-241, OIN-242, OIN-243, OIN-244, OIN-245, OIN-246, OIN-249, OIN-254, OIN-255, OIN-256, OIN-257, OIN-259, OIN-262, OIN-263, OIN-265, OIN-276, OIN-277, OIN-278 (22)
	Weak	OIN-247, OIN-248, OIN-250, OIN-251, OIN-252, OIN-253, OIN-258, OIN-260, OIN-261, OIN-264, OIN-266, OIN-267, OIN-268, OIN-269, OIN-270, OIN-271, OIN-272, OIN-273, OIN-274, OIN-275, OIN-279, OIN-280, OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, OIN-286, JRO 524, JRO 204 (30)
Leaf petiole colour	Green	OIN-237, OIN-239, OIN-247, OIN-249, OIN-250, OIN-251, OIN-253, OIN-257, OIN-264, OIN-266, OIN-267, OIN-269, OIN-271, OIN-272, OIN-273, OIN-274, OIN-276, OIN-277, OIN-278, OIN-279, OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, OIN-286, JRO 524, JRO 204 (28)
	Purple	OIN-238, OIN-240, OIN-241, OIN-242, OIN-243, OIN-244, OIN-245, OIN-246, OIN-248, OIN-252, OIN-254, OIN-255, OIN-256, OIN-258, OIN-259, OIN-260, OIN-261, OIN-262, OIN-263, OIN-265, OIN-268, OIN-270, OIN-275 (23)
	Pink	OIN-280 (1)
Petiole hairiness	Absent	All (52)
Leaf shape	Oblique very acute	OIN-237, OIN-238, OIN-239, OIN-243, OIN-244, OIN-247, OIN-257, OIN-259, OIN-260, OIN-261, OIN-262, OIN-263, OIN-269, OIN-278, JRO 524, JRO 204 (16)
	Oblique acute	OIN-240, OIN-241, OIN-242, OIN-245, OIN-246, OIN-248, OIN-249, OIN-250, OIN-251, OIN-252, OIN-253, OIN-254, OIN-255, OIN-256, OIN-258, OIN-264, OIN-265,

		OIN-266, OIN-267, OIN-268, OIN-270, OIN-271, OIN-272, OIN-273, OIN-274, OIN-275, OIN-276, OIN-277, OIN-279, OIN-280, OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, OIN-286 (36)
Flower colour	Yellow	All (52)
Stem colour	Green	OIN-237, OIN-238, OIN-239, OIN-240, OIN-244, OIN-248, OIN-250, OIN-251, OIN-252, OIN-254, OIN-258, OIN-259, OIN-264, OIN-266, OIN-267, OIN-269, OIN-270, OIN-271, OIN-272,OIN-273, OIN-274, OIN-279, OIN-280, OIN-281, OIN-282, OIN-283, OIN-284, OIN-285, JRO 524, JRO 204 (30)
	Pink	OIN-242, OIN-255, OIN-256, OIN-257, OIN-260, OIN-261, OIN-263, OIN-268, OIN-275, OIN-276, OIN-277, OIN-278, OIN-286 (13)
	Purple	OIN-241, OIN-243, OIN-245, OIN-246, OIN-247, OIN-249, OIN-253, OIN-262, OIN-265 (9)
Stem hairs	Absent	All (52)

4. Conclusion

A study of genetic variability, trait association and path coefficient analysis in *olitorius* jute examines the relationships between genotypes that are needed for the production, conservation and utilization of this green resource. It will be very useful for varietal breeding of jute *olitorius* in tropical environment by selecting genotypes with different genetic background. This information will facilitate effective breeding programs for improved yield of adaptive vertices to support better crude fiber resource environments.

Compliance with ethical standards

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